Issues Paper

Queensland Rail – Draft Undertaking Asset Valuation, Depreciation and Rate of Return

May 1999

SUBMISSIONS

The Queensland Competition Authority (the Authority) considers public involvement to be an important element of its decision making processes. It therefore invites submissions from interested parties concerning the appropriate asset valuation and depreciation methods for Queensland Rail's physical assets and the appropriate approach to quantifying a rate of return to be earned on those assets.

Written submissions should be sent to the address below. While the Authority does not require submissions in any particular format, it would be appreciated if two printed copies are provided together with an electronic version on disk (Microsoft Word format) or by e-mail. Submissions, comments or inquiries regarding this paper should be directed to:

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The **closing date** for submissions is Friday 9 July, 1999.

Confidentiality

In the interests of transparency and to promote informed discussion, the Authority would prefer submissions to be made publicly available wherever this is reasonable. However, if a person making a submission does not want that submission to be public, that person should claim confidentiality in respect of the document (or any part of the document). Claims for confidentiality should be clearly noted on the front page of the submission and the relevant sections of the submission should be marked as confidential, so that the remainder of the document can be made publicly available. It would also be appreciated if two copies of each version of these submissions (ie the complete version and another excising confidential information) could be provided. Again, it would be appreciated if each version could be provided on disk. Where it is unclear why a submission has been marked "confidential", the status of the submission will be discussed with the person making the submission.

While the Authority will endeavour to identify and protect material claimed as confidential as well as exempt documents (within the meaning of the *Freedom of Information (FOI) Act 1989*), it cannot guarantee that submissions will not be made publicly available. As stated in s187 of the *Queensland Competition Authority Act 1997*, the Authority must take all reasonable steps to ensure the information is not disclosed without the person's consent, provided the Authority is satisfied that the person's belief is justified and that the disclosure of the information would not be in the public interest.

Public access to submissions

Subject to the above, submissions will normally be made available for public inspection at the Brisbane office of the Authority (see below), or on its website at *www.qca.org.au*.

Information about the role and current activities of the Authority, including copies of reports, papers and submissions can also be found on the Authority's website.

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1. INTRODUCTION

1.1 The Role of the Queensland Competition Authority

The Queensland Competition Authority (the QCA) is a statutory body established under the *Queensland Competition Authority Act 1997* (the Act). Its aim is to perform specified services associated with national competition policy in Queensland. Broadly, the QCA is responsible for:

- subject to reference or declaration by the Ministers (the Premier and the Treasurer), undertaking prices oversight of monopoly or near monopoly Government business activities;
- receiving and investigating competitive neutrality complaints against significant government and local government business activities;
- accrediting significant Government and local government business activities as complying with the principle of competitive neutrality;
- overseeing and arbitrating third party access infrastructure; and
- undertaking such other activities relating to national competition policy as the Ministers may direct.

Under the *Queensland Competition Authority Regulation 1997*, the Queensland Government declared certain services provided by Queensland Rail's (QR's) rail transport infrastructure under Part 5 of the Act.

QR has submitted for approval by the QCA a draft access undertaking covering certain services relating to the use of rail transportation infrastructure owned by QR. Accompanying the draft access undertaking is an explanatory guide which QR has produced to clarify the intent of selected provisions of the undertaking. These documents are available from the QCA (phone Natasha Bree on (07) 3222 0555) or can be downloaded from the QCA's website www.qca.org.au.

The draft access undertaking sets out the basis under which QR proposes to provide third party access to certain declared services. It is the role of the QCA, under Part 5 of the Act, to either approve or not approve the draft access undertaking.

As part of this process, the QCA considers that the value of QR's physical assets[1], allowing for depreciation on those assets and the determination of QR's accepted rate of return on its capital funds are central to the development of access prices. The QCA is therefore seeking the views of interested parties as to the appropriate asset valuation, depreciation and rate of return methods for this purpose.

1.2 Asset Valuation

Accurate asset valuation and capital cost allowances are central to generating appropriate prices which encourage efficient network usage in the short-term and efficient investment in the medium to long term. Inappropriate asset valuations of QR's rail transport infrastructure will tend to:

[1] It is recognised that apart from the value associated with physical assets, businesses also derive value from intangible assets. Intangible assets are those that have no physical substance, but are positive contributors to the success of a business. Such intangibles include among others, patents, trademarks, copyrights, software, intellectual capital, knowledge and know how, proprietary technology and formulae, and engineering designs and drawings.

- distort prices to end users of commodities delivered via the network (eg excessive prices will tend to undermine the competitiveness of Queensland industry in both domestic and international markets);

- distort competition between different transport modes; and

- alter the patterns of upstream and downstream development.

1.3 Depreciation

Depreciation seeks to measure the decline in service potential and ensure that it is matched against the revenue generated by the asset so as to give a fair estimate of the asset owner's return on investment.

In this sense depreciation takes on significant importance because it may form part of the assessment of asset valuation at a point in time as well as over time. Accordingly, inappropriate depreciation of QR's rail transport infrastructure will tend to produce similar effects to those that emerge from inappropriate asset valuations. In addition, inappropriate depreciation approaches may distort decisions relating to the maintenance and replacement of infrastructure.

1.4 Rate of Return

The rate of return is the return expected by investors in capital markets for investments of a given level of risk. The rate of return represents the opportunity cost to investors for expected returns on foregone investment opportunities (i.e. the expected return on the next best alternative project). In competitive capital markets, the rate of return is determined by the forces of supply and demand for capital. The establishment of an accurate rate of return on capital is central to generating appropriate prices which encourage efficient network usage in the short term and efficient investment in the medium to long term. An inappropriate rate of return on QR's rail transport infrastructure may:

- result in over or under investment in rail infrastructure. For example, if too high a rate of return is set, QR would be encouraged to invest in the network to an excessive extent and shippers would be required to pay too much for using the network. However, if too low a rate of return is set, QR would not be adequately compensated for its investment. Whilst this would lower prices in the short term, QR would be unlikely to undertake further investment in the network, leading to congestion and an inability of shippers to deliver their product to their market in the longer term; and

- distort prices to end users of commodities delivered via the network (eg excessive prices will tend to undermine the competitiveness of Queensland industry in both domestic and international markets).

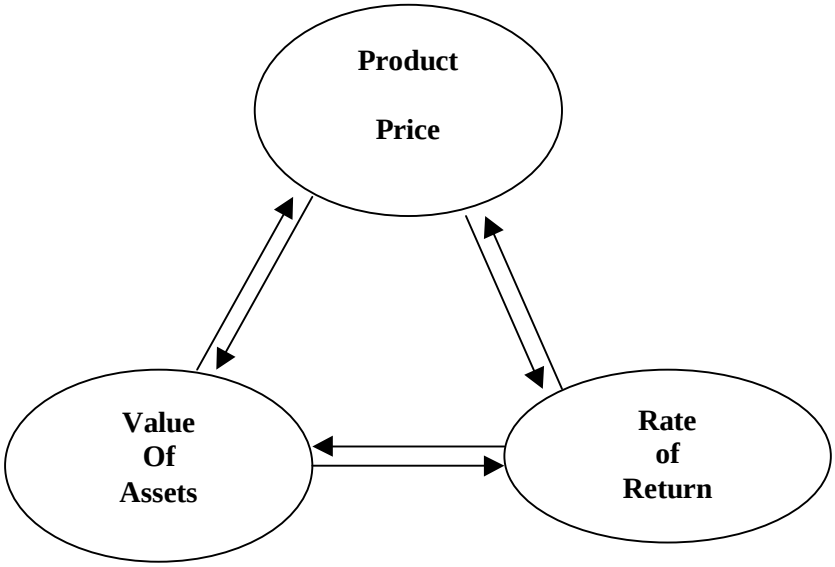
Consequently, the rate of return plays a critical role in not only compensating the network owner for its past investment, but also providing guidance as to the return on future investment in the network. In this sense, it is important to recognise that even small extensions to the network (that could be funded by debt) nevertheless should be considered as an investment by QR and remunerated appropriately (having regard to the overall mix of debt and equity funding for the enterprise).

In a competitive environment, market forces determine product prices which in turn determine, for a given asset value, the rate of return earned on debt and equity (capital) funds, associated with the provision of products (or for a given rate of return, the value of an asset, or bundle of assets). However, in monopoly markets, the incumbent company may have considerable discretion over the prices it sets. This can lead to a problem of circularity if price setting is

determined by the economic value of assets, as the economic value of assets might merely reflect (and thereby serve to legitimise) the prices charged by the monopolist.

Figure 1 illustrates the circularity problem and highlights the interdependency between product price, asset value and rate of return. For example, if prices increase whilst the rate of return (asset value) is held constant, then asset value (rate of return) will correspondingly increase and vice versa. Accordingly, for a given rate of return (asset value), the price charged for a product or service will determine the economic value of the assets (rate of return on the assets), used to produce the product or service.

Figure 1: Circularity of Prices, Rate of Return and Asset Value



Consequently, in monopoly markets there is a need to adopt a method that calculates both the value of assets and the rate of return independently of the prices that are set through the process. There are a number of approaches to both valuing physical assets and quantifying the rate of return. Each of these approaches is likely to provide different outcomes and, consequently, different prices and incentives.

At the same time, it is important to recognise that approaches to valuing assets and quantifying the accepted rate of return may not play a significant role in the calculation of access charges in many of the markets in which QR provides access. For example, in the markets in which QR is not a monopoly provider, intermodel transportation prices are likely to significantly influence actual access charges.

1.5 Queensland Rail's Draft Access Undertaking

Asset valuation, depreciation and the rate of return are addressed in Part 5 of QR's Draft Access Undertaking. Part 5 details that "QR's overriding objective is, over time, to achieve revenue adequacy". Revenue adequacy is defined as "revenue…that is sufficient to achieve full recovery of reasonable costs, including a commercial rate of return on the value of assets reasonably required for the long term sustainable provision of rail infrastructure".

QR proposes to pursue this objective by maximising the commercially viable utilisation of the network. QR also proposes to observe a constraint on price differentiation. These objectives are discussed in the Draft Access Undertaking Request for Comments Paper.

In pursuing revenue adequacy, QR intends to limit the access prices charged to users to Stand Alone Costs for the service (or a combination of services). QR further proposes a Revenue Limit be set for access charges for the coal haulage system and the Mt Isa line. The Revenue Limit seeks to ensure that access charges over the Evaluation Period cover all operational and maintenance costs and capital related costs (including return on assets and depreciation). In this environment QR has suggested, in its draft access undertaking, that:

- its assets be valued at depreciated replacement cost for the purpose of quantifying the Revenue Limit (although the draft undertaking does not mention the method by which depreciation is to be calculated); and

- the maximum allowable rate of return be expressed in nominal pre tax terms on the value of all assets reasonably required for the provision of third party access (QR has not identified a preferred approach to determining the rate of return).

1.6 Purpose of the Paper

The purpose of this paper is to seek comments on the appropriateness of various approaches to determining the asset valuation and depreciation of QR's physical assets and rate of return on its capital funds, which in turn will become important inputs into the quantification of QR's Revenue Limit.

In this regard, the Authority is mindful of a general trend amongst regulatory bodies in Australia to adopt:

- the depreciated optimised replacement cost as the appropriate method to determine asset values for the purpose of setting maximum revenue streams for monopoly infrastructure providers; and

- the Capital Asset Pricing Model (CAPM) for determining an appropriate rate of return on capital.

2. ASSET VALUATION[2]

Particular usages generate different values for similar assets. It is important that the appropriate valuation method be selected for the particular assets under consideration.

A variety of methods of asset valuation are available. However, these methods can be characterised under two main approaches, *value based* and *cost based:*

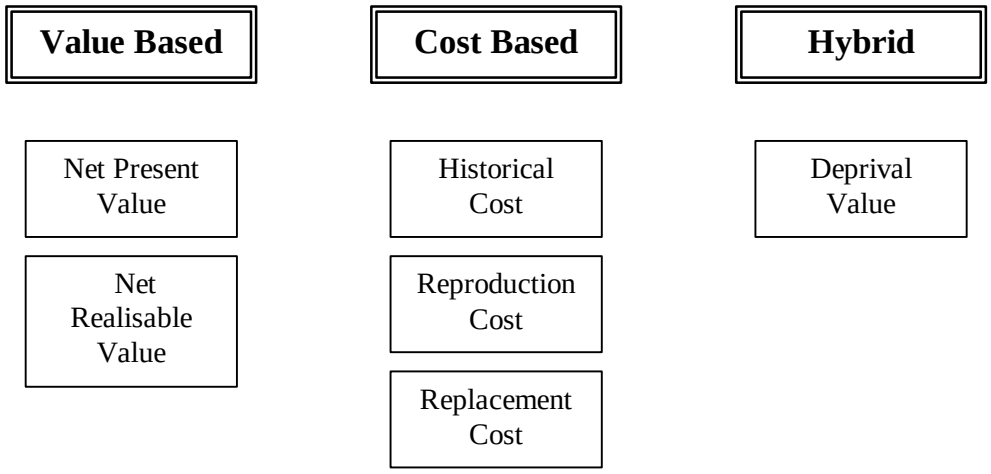
- *Value based* approaches determine the value of an asset largely from its cash generating capacity. This can be measured by the net present value of future cashflows (Net Present Value) or the cash generated by selling the asset (Net Realisable Value).

- *Cost based* approaches relate the value of an asset to the cost of purchasing the asset or the service potential embodied in the asset either at the original cost or the original cost adjusted to reflect its current cost.

A third *hybrid* approach considers both value and cost based approaches to arrive at an asset value.

The following figure depicts each approach and the various accompanying valuation methods.

Figure 2: Overview of Valuation Methods



2.1 Value Based Approaches

Net Present Value

The *Net Present Value* approach values an asset as the present value of the predicted cash flows generated from the use of the asset. This involves estimating the future income generated from an asset and then discounting the income streams at a predetermined rate based on the risk profile of the activity. The present value of the predicted future income stream then becomes the current value of the asset. This method is widely used in valuation for investment purposes.

Asset values based on discounted cash flows represent the economic value of the asset. This approach overcomes the distortions of valuing rail assets based on their best alternative use[3].

[2] The issue of the possible recognition of past capital contributions will be separately addressed.

[3] Rail networks have considerable value only when employed in delivering rail services. The next best alternative use is reflected in the opportunity for the asset to be used elsewhere in QR's or another rail system, or at a minimum in the scrap value of the assets (assuming that it is worth dismantling the line).

The application of present value approaches does however require a significant degree of information in regard to future cash flows.

As previously mentioned, the principal problem with the application of economic value (or Discounted Cash Flows) in monopoly markets is that of circularity. Given that monopolists are price setters in respect of their monopoly services, they thereby directly influence future revenue streams and subsequently asset values.[4]

Net Realisable Value

Realisable or *fair market value* can be defined as the current price that a seller of an asset would accept from a buyer of an asset, each having pertinent knowledge of the facts, in an arm's length transaction where both the buyer and seller are 'willing but not anxious'. This method is often cited as an alternative economic valuation approach to that of Discounted Cash Flows. However, Realisable Value and Discounted Cash Flow, when applied in the same context and circumstances generally result in the same values.

2.2 Cost Based Approaches

Historical Cost

Historical or *Actual Cost* uses the dollar cost of acquiring the asset, including the relevant financing cost during construction and installation, as the value of the asset.

Depreciated Actual Cost (DAC) or Depreciated Historical Cost represents the original cost of acquiring the asset reduced by the proportion of the asset service which has expired (which recognises that an asset's remaining service life may be less than the life which would normally be expected from a new asset). DAC or Historical Cost has been a widely accepted method for public reporting purposes amongst competitive industries and the private sector.

Historical cost valuation has a number of advantages for pricing purposes including:

- being relatively inexpensive to establish and simple to administer so long as asset registers are complete;
- reducing the risk for asset owners of the impact of technological change. When an investment is made, the schedule of allowed returns under Historic Cost depends solely on the depreciation schedule set by the price setting body. In contrast, the allowed returns under other cost based methods will vary whenever relevant input prices or the prices of alternative technology change.
- for assets with a relatively brief useful life, Historical Cost provides the advantage that it is consistent with a real measure of current cost and also represents the basis on which the owner assessed the potential returns and expended capital.

However, there are significant problems associated with this approach which diminishes its ability to provide relevant information for current and future economic decision making:

- Historic Cost values, especially in the case of long-lived assets, have little or no relationship with market values or replacement costs. For example, persistent inflation causes capital valuation and capital costs to be underestimated relative to current values.

[4] It should be noted that QR is not a monopolist for many of the services it provides.

Conversely, Historical Cost based valuation takes no account of the service potential of an asset or technological obsolescence; and

- valuations on Historic Cost would make tariffs dependent on asset age and could lead to price shocks when assets are replaced.

A variant of the historical cost approach, *inflation adjusted actual cost*, attempts to adjust the asset value for inflation. This can be done by revaluing assets according to some broad indicator of the price level (e.g. CPI). However, inflation adjusted estimates still fail to capture the impacts of technological change in the market for infrastructure.

Reproduction Cost

Reproduction Costs are those costs required to reproduce the existing plant in substantially its present form using the production technology and specifications of the original asset. This approach is most relevant where a similar asset is available and the existing asset still represents significantly unchanged technology.

Replacement Cost

The *Replacement Cost* of an asset is an estimate of the current cost of replacing the asset with similar assets (not necessarily the same) which can provide equivalent services and capacity to the asset being valued. That is, it measures what it would cost today to provide an asset to deliver the same service potential as the asset being valued.

The efficient use of resources requires pricing and investment decisions based on the real economic costs of usage in alternative activities. In this regard, current cost valuation systems are regarded as providing more relevant measures of value for the purposes of decision making than are historic costs.

The major advantage of replacement cost is that it addresses a major problem of historical cost valuation, namely, the incompatibility between historical values of capital assets (and capital costs) and current values for other expenses and revenues.

The main disadvantage of this approach is that asset valuation will usually be a costly exercise because it involves expert advice from professional valuers and/or engineers, in addition to considerable estimation and judgement.

Depreciated Replacement Cost is an estimate of the value of an asset in use which is equivalent to the net current cost of replacement of the asset in its current (partly worn out) state with an asset which has a similar service potential. Asset replacement costs need to be depreciated in situations where the existing asset's remaining service life is less than the life that would normally be expected from a new asset. The depreciation effectively recognises the limited remaining life.

Optimisation Process

Under replacement cost, the relevance of information is limited by the fact that there is no consideration of whether the services provided by the asset could be delivered more efficiently by a different asset configuration. For example, assets may have excess capacity, be over-engineered, be sub-optimally designed (eg having regard to technological advancements) or be poorly located. Consequently, a valuation system may incorporate an optimisation process to evaluate whether assets are in excess of current requirements.

Optimisation is a particularly complex issue in the case of QR's network. Rail transport involves a complex interaction between track infrastructure and rollingstock assets. The capacity of a rail system depends upon the capacity of trains operating, the number of movements the infrastructure can accommodate, and cycle times. In turn, the capacity of a train is determined by factors such as the gauge of the track, the length of passing loops, grades, curves, topography and so on. A further issue relates to potential cost penalties that may result from the fact that Queensland's gauge is unusual by world standards, which potentially imposes upon haulers and in turn shippers an additional cost from the need to acquire non-standard equipment. The consideration of the potential optimisation of assets is complicated by QR's past investment decisions made in good faith – optimisation potentially results in some reduction in the value of its asset base.[5]

Optimisation is implemented in asset valuation to take into consideration the most efficient modern form of facilities for either:

- the same capacity as the existing asset, known as the *Modern Equivalent Asset* (MEA) method; or

- a specified level of output or services (ie not necessarily the same capacity as the existing asset but rather a level of output based on, for example, expected demand). This is commonly termed *Optimised Replacement Cost* valuation.

Modern Equivalent Asset Method

The *MEA* approach recognises that the modern substitute for an existing asset may have altered markedly in respect of initial capital cost, operating costs, and output. Where the modern equivalent asset has a different service potential from the original asset, the MEA needs to be adjusted to account for that difference in the service potential.

Optimised Replacement Cost

Optimised Replacement Cost (ORC) measures, from an engineering perspective, the cost of replicating the system in the most efficient way possible. That is, it does not factor in the cost of replacing inefficient excess capacity, redundant services provided by the asset, inefficient scale or obsolescence.

Depreciated Optimised Replacement Cost (DORC) represents the unconsumed portion of an asset (ie that value which reflects its remaining service life) based on an optimal network.

The application of the DORC approach involves the following steps:

- network system optimisation;

- optimised replacement cost of the asset base; and

- asset depreciation.

[5] A further issue relates to whether an optimisation process should be undertaken on a greenfields (where construction is assumed to exist across an area free of any development) or brownfields (where all existing infrastructure is assumed to exist) basis.

The rationale for using DORC to value assets, in preference to other valuation systems, is based on the belief that it provides a greater indication of the opportunity cost to the owner of the assets. It is therefore considered more consistent with the value that would be ascribed to an asset in a competitive market (assuming there is an issue of monopoly pricing for the use of the asset).[6] For example, when an asset such as a computer is superseded, it is quickly devalued in the (competitive) secondary market, irrespective of the original cost of its acquisition.

The advantages of DORC include:

- the optimisation process ensures that obsolete, poorly sized or poorly located assets are not included in the capital base and consequently are not paid for by users;
- as past inflation greatly alters the historical values of similar assets it simplifies the comparison of asset values by valuing assets at current costs; and
- it establishes asset values that will minimise incentives for 'inefficient' by-pass of the network[7].

The disadvantages of this approach include:

- costly examination and assessment procedures and more subjective judgement in determining the optimal network configuration and the degree of excess capacity deemed to be 'efficient'. Additional complexity is added to the process due to the need to reconcile the existing asset's service capacity and cost profile with that of the optimised configuration;
- the complexity of implementing a DORC valuation method can exacerbate a price setting body's informational disadvantage relative to the network owner.

2.3 Hybrid Approach

The hybrid approach combines aspects of each of the two preceding approaches.

Deprival Value

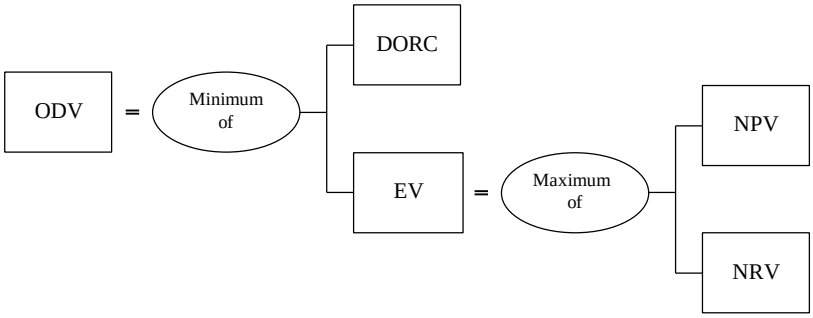
Deprival Value can be defined as the loss that might be expected if the entity was deprived of the future economic benefits of an asset. Consequently, assets are valued at an amount that represents the loss of the service potential flowing from the asset.

As illustrated in Figure 3, *Optimised Deprival Value* (ODV) is the lesser of the DORC and the Economic Value (EV) of the asset, where the latter is the maximum of the assets' net present value or net realisable value. A strict application of ODV approach would require a comparison of DORC and EV for each part of the network.

[6] For the reasons described in this Issues Paper, economic value is not a good basis for establishing the value of QR's monopoly assets.

[7] By-pass occurs when it is cheaper for current purchasers of network services to construct and operate an alternative service (either rail or non-rail) themselves than use the existing network.

Figure 3: ODV Valuation



Advocates of the deprival method argue that this approach better aligns asset valuations with those produced in a competitive market. In practice, if DORC exceeds EV, an owner would not replace the asset because the present value of future earnings would be less than the cost of replacing the asset. Alternatively, if EV exceeded DORC, the present value of future earnings would exceed the cost of replacing the asset and consequently the asset would be replaced. However, caution must be exercised when seeking to apply this rule to individual assets that form an essential part of a larger system (ie regard should also be had to the valuation of the system as a whole).

As ODV applies either EV or DORC, it is subject to similar benefits and criticism as these methods.

The Council of Australian Governments (COAG) has agreed that deprival value should be the preferred approach to valuing network assets for **public reporting purposes**.

2.4 Request For Comments

The Authority seeks comment on:

- **which asset value method represents the most appropriate method for determining the value of QR's network/infrastructure assets for the purposes of establishing access prices in relation to services for which QR is a monopoly provider;**
- **whether an optimisation process is appropriate and, if so, the framework within which an optimisation process should be implemented and the elements that should be considered in the optimisation process for example gauge, route, and train or wagon capacity;**
- **are there any classes of asset (eg land) which might warrant a particular treatment;**
- **are there any identifiable groups of assets (eg coal corridors) which might warrant a particular treatment;**
- **other issues which should be considered as part of the asset valuation process.**

3. DEPRECIATION

3.1 What is Depreciation?

The service potential of many assets diminishes over time [through use, obsolescence etc] and it is essential that the owners of the asset receive appropriate compensation for this through the return of capital.[8]

Depreciation seeks to measure the decline in service potential and ensure that it is matched against the revenue generated by the asset so as to give a fair estimate of the asset owners return on investment.

Depreciation is inextricably linked with asset valuation, the treatment of maintenance expenditure and the allowed return on an entity's asset base.[9] This is highlighted by QR's draft undertaking, which proposes that its Revenue Limit over an Evaluation Period be based upon, amongst other things, a depreciated asset value at the beginning and at end of the Evaluation Period (although the basis for determining depreciation is not specified).

Accordingly, depreciation calculations will form an element of financial modelling exercises and consequently the determination of access prices. The three stages of financial modelling which will require consideration of depreciation calculations are:

- the initial value of the asset base (if the approach to initial asset valuation includes allowances for depreciation as QR has proposed);
- the terminal value of the asset base (ie at the end of the modelling period, as QR has proposed); and
- the method of allocating the change in value across this period.

Broadly, there are two approaches to dealing with asset consumption:

- adopting a renewals annuity type approach; and
- through depreciation charges.

3.2 Renewals Annuity

An alternative to assessing a depreciation charge for assets with long lives is the development and implementation of a renewals annuity approach. Under this approach, a network of assets is viewed as a single system, the service potential of which is to be maintained in perpetuity, rather than a collection of individual assets each with its own asset life and maintenance requirements.

The renewals annuity approach assumes that, through regularly planned maintenance and renewals programs, the system as a whole does not lose service potential and therefore does not need to be depreciated.

[8] In its recent decision on the NSW Rail Access Regime, IPART noted that there is a distinction between accounting and economic approaches to depreciation. It is difficult to apply an economic approach to depreciation of QR's below rail assets for its coal and minerals corridors on account of the circularity that is involved.

[9] Depreciation is related to the rate of return as, in a given period, depreciation provides a return of capital, whereas the rate of return relates to the undepreciated value of the asset (ie that part of the value of the asset that has not already been returned to the customer through depreciation charges).

An essential element of the renewals annuity approach is an Asset Management Plan which attempts to determine the expenditure needed to maintain the service potential of the system over the period of the plan.

In principle, the asset management plan should cover the full life of the asset. Obviously, given the assumption of an infinite life this is not possible. Typically, though, asset management plans have a 25 year plus time horizon, with the limiting factor being the capacity to make realistic engineering and financial estimates into the future. In effect, uncertainty about asset life is replaced by uncertainty about future engineering and financial estimates.

This system is generally considered to be valid only for infrastructure assets satisfying the following characteristics:

- the asset system is renewable rather than replaceable. In other words, the components of the system will be replaced according to their own useful lives, but the operating capacity of the system as a whole will be maintained; and

- for the foreseeable future, demand is such as to warrant continual extension of the asset system life by this renewal so that the assumption of an infinite asset life is warranted.

Water supply is typical of the service for which a renewals annuity approach has been suggested. So far as QR's below rail coal and minerals infrastructure is concerned, it is unlikely to have an infinite life, as the mines it currently serves and is likely to serve are unlikely to have an infinite life. In this regard, it is noted that none of the submissions into IPART's recent review of the NSW access regime supported the use of a renewals annuity approach for asset consumption.

3.3 Depreciation

As mentioned above, depreciation represents the loss in asset service potential over the relevant period. It represents asset consumption as opposed to asset maintenance. Maintenance is a separate item and there is a need to ensure that such expenditure is either expensed, or is added to asset value and then depreciated. One of the strengths of the renewals annuity approach is that asset maintenance and replacement are considered together.

A number of central issues need to be addressed in determining depreciation, including:

- an assessment of the useful life of the asset, to establish an appropriate period of time over which the reduction in service potential for an asset should be charged (whether this be on a time or output unit basis);

- the pattern or method of the depreciation – straight line, units of production or accelerated depreciation; and

- an estimate of the salvage value that may be realised at the end of an asset's useful life.

QR's below rail infrastructure consists of numerous individual assets, which not only have different asset lives, but whose asset lives are affected by different factors – eg rail substructure and tunnels are unlikely to be affected by use, whereas rail life is typically tonnage related.

A number of alternative methods are identified below for allocating depreciation. Central to the choice of an allocation method is consideration of the elements of consumption that drive changes or reductions to the service potential of assets, eg whether they are time or usage related. It is quite conceivable that different approaches may be appropriate to different assets.

Straight Line Depreciation

Straight-line depreciation determines the capital consumption charge for a period by dividing the cost of the asset (less the estimated salvage value) by its expected life. The straight-line method therefore allocates an equal amount of depreciation each year until the asset has been written down to its estimated scrap value at the end of its useful life

This approach is simple, well understood and transparent.[10] Where the consumption of the service potential of assets is similar through time or where the deterioration of assets is time related, this approach is a reasonable method for allocating depreciation. However, where consumption is not consistent between years, or where the deterioration of the asset is due to circumstances other than time, alternative methods such as units of production may be more appropriate.

Units of Production

Under the unit of production method, the allocation of depreciation is based on the total number of units estimated to be produced or used over the life of the asset. Under this method, the quantification of annual depreciation is based on the number of units produced or used in that year. Consequently, the depreciation charge in any year will change (increase or decrease) according to the asset's use or productive output.

To the extent that deterioration arises from usage rather than the passage of time, this approach may be advantageous. The physical consumption or decline in value of an asset, such as rail lines subject to significant traffic levels, is largely dependent upon the number of units (eg gross ton km's) hauled rather than the length of time the infrastructure has been in place[11]. Consequently, calculating depreciation costs on a per unit basis may be advantageous and reflective of the actual decline in value. That is, recognition of the consumption of service potential may be better aligned with the actual consumption of service potential under this approach.

Accelerated Depreciation

Some assets lose their value, or are at risk of losing their value, much earlier than their physical asset life would otherwise indicate, with technological obsolescence often a factor.

For such assets, accelerated depreciation may be appropriate. The most common approach is the reducing balance or diminishing value method. Under this method, a fixed percentage is written off each year, calculated on the reducing balance at the beginning of each period. This method concentrates a large proportion of depreciation in the early years of the asset's life, with the annual depreciation charge reducing in each successive period.

A variant of this approach is double-declining balance depreciation, which is calculated by using twice the annual rate of straight line depreciation, based on the undepreciated value of the asset at the beginning of the period.

The Useful Life of the Asset

Establishing the useful life of QR's network assets is essential to the calculation of depreciation and to the valuation of QR's network. There appear to be two main methods available for assessing the useful life of QR's network assets:

[10] These factors persuaded the NSW Independent Pricing and Regulatory Tribunal that straight line depreciation was the most appropriate for rail assets in its recent final report on *Aspects of the NSW Rail Access Regime*.
[11] Although aspects of rail infrastructure such as earthworks may be time dependent rather then usage dependent.

- the useful physical life of the assets; or
- the remaining life of existing and expected mines (eg coal) served by the network.

In assessing the appropriateness of the alternative methods, regard needs to be had to factors such as:

- whether difficulties arise from applying different depreciation approaches to individual components of essentially integrated assets; and
- ensuring that the depreciation approach appropriately compensates the infrastructure owner for the use of assets whose life is expected to exceed the life of the mines/resource they are to serve and that current users are attributed an appropriate consumption charge.

3.4 Request For Comments

The Authority seeks comment on:

- **whether asset consumption should be recognised through a renewals annuity type approach or via depreciation charges;**
- **if a renewals annuity approach is adopted, what should be the period of the asset management plan;**
- **if a depreciation approach is adopted:**
  - **the most appropriate method of recognising asset consumption for each asset class or group of assets (e.g. straight line, units of production etc)**
  - **whether there are difficulties in applying different methods of depreciation to individual assets of the network**
  - **the expected life of the current and expected mines which QR's below rail coal infrastructure serves**
  - **for an asset whose physical life may extend beyond the expected life of the specific purpose for which it was built, how depreciation charges should be based (e.g. physical asset life, life of the mines etc)**
- **any other issues which should be considered in the context of depreciation.**

4. THE RATE OF RETURN ON CAPITAL

One of the most significant issues to be addressed in any process to set maximum prices for the products or services provided by a business activity involves the determination of the allowed rate of return for the assets involved in that activity. An allowed rate of return for a company or for a group of assets owned by a company used in a particular business activity can be derived by calculating the appropriate weighted average cost of capital (WACC). This WACC should depend on the risk characteristics of the cash flows generated by the assets rather than the ownership of those assets.

A company's WACC recognises that its funds are provided by two direct sources, namely lenders and equity investors (i.e. owners or shareholders), and is equivalent to the weighted average cost of servicing the various classes of financial claims on the company. Each source of capital or financial claim will involve different risks and hence different costs. A company's WACC is calculated by adding the cost of its debt, weighted by the proportion of debt to total capital (ie debt plus equity), to the cost of equity funds weighted by the proportion of equity funds to total capital. The method requires estimates of the current market values of the company's debt and equity and market rates for both sources of funds.

4.1 Cost of Debt

The required return on debt is usually defined as the marginal rate at which a company can raise debt financing. This rate will vary depending on the default risk of the borrower, which, in turn, will be affected by the gearing of the company, volatility of its cash flows and the long term security of its revenue and profit flows. High gearing means a high level of debt relative to the cash flows available to service it with a commensurate higher risk of default. The lender charges a premium on loans corresponding to the degree of default risk associated with the loan.

4.2 Cost of Equity

Unlike the cost of debt, the cost of retaining and attracting equity funds is not observable for a Government Owned Corporation such as QR because it is not listed on the stock exchange. Consequently, a fair assessment of the cost of equity for an equivalent operation needs to be estimated using data from security markets. A number of alternative models have been developed to estimate the cost of equity funds, including the Capital Asset Pricing Model (CAPM), Dividend Growth Model (DGM), Price/Earnings ratio and the Arbitrage Pricing model.

In considering these alternatives, the QCA is mindful of a trend amongst regulatory bodies in Australia to utilise the CAPM to estimate a utility's cost of equity. The following discussions briefly describe each model and outlines key strengths and weaknesses of each.

Capital Asset Pricing Model (CAPM)

CAPM determines the return on equity using a single risk factor related to market return and may be represented as follows:

$$r_e = r_f + \beta_e \bullet (r_m - r_f)$$

Where:
r_e= Expected after tax return on equity
r_f = Risk free rate of return
r_m= Market risk premium
β_e= Equity beta

The central concept of CAPM is that of undiversifiable risk (known as beta (β)). Basically, the total risk of a business activity can be separated into diversifiable and undiversifiable risk. Diversifiable risk is that risk that is effectively removed from holding a security as part of a wide (diversified) portfolio of assets. The remaining risk is known as undiversifiable risk which relates the correlation between the riskiness of a company compared to the market as a whole and is estimated by a linear regression based on historic data. The CAPM assumes that investors are only compensated for the undiversifiable risk associated with an investment.

Since the beta of the market portfolio is 1, then all assets can be identified as being more or less risky than the market as a whole. For example, an enterprise with a beta of 1 has undiversifiable risk that is perfectly correlated with the expected return for the market as a whole. A higher value is generally associated with a more risky investment relative to a lower one.

CAPM asserts that the market risk premium required per unit of undiversifiable risk is the same across all assets. Therefore, given the risk free rate, the beta of an asset and the overall market return, the CAPM estimates the expected cost of equity funds for those assets. The after tax WACC for a company (assuming that dividend imputation credits are <u>not</u> included in the company's cash flows) is calculated as follows:

$$WACC_{\text{after tax}} = (1-t)\left[r_e / (1-t(1-\gamma)) \bullet E/(E+D) + r_d \bullet D/(E+D)\right]$$

Where:

r_e = Expected after tax return on equity
r_d = Before tax cost of debt
r_f = Risk free rate of return
r_m = Market risk premium
β_e = Equity beta
D = Market value of debt
E = Market value of equity
t = Corporate tax rate
γ = Assumed utilisation of franking credits by shareholders.

Source: adapted from Officer, R, "The cost of capital of a company under a dividend imputation tax system", Accounting and Finance, 34 1, May 1994

The CAPM is more widely used and accepted by practitioners in calculating the cost of capital for companies in both the public and private sector. It is also widely adopted by regulatory bodies in Australia because CAPM is more objective than alternative models, conceptually simple in terms of defining and measuring β_e and may be applied across industries while other approaches may only be used in some industries.

The CAPM remains subject to theoretical controversy. There are also practical difficulties in implementing CAPM, especially in respect of a business activity which is undertaken by a Government owned corporation such as QR and for which there are no directly comparable companies listed on a stock exchange. For example, the estimation of the equity beta (β_e) is not entirely objective and judgement is required in practice. In QR's case directly comparable companies do not exist in Australia or, to a lesser extent, overseas. Accordingly, there is considerable judgement involved in applying the CAPM approach.

Nevertheless, regulators in the United Kingdom and other Australian States such as New South Wales have adopted this method. In contrast, rail regulators in the United States of America utilise the Dividend Growth Model.[12] It is worth observing that virtually all enterprise valuations which cannot rely on direct market comparison must involve the subjective evaluation of risk in whatever way it is attempted.

Dividend Growth Model

Dividend Growth Model (DGM) is a variation of the discounted cashflow model. DCF models are based on the projection of future cash flows (dividends and expected growth in dividends), which would be generated by a company's assets. A discounted cash flow applied to express these cash flows in present value terms may represent some measure of shareholder expectation of return on investment.

DGM is conceptually sound where key assumptions may be predicted with a reasonable degree of accuracy although it assumes that dividend growth is to continue in perpetuity at a constant rate. However, in practice, DGM may only be applied to companies listed on the stock exchange. As QR is not listed, this approach can not be used to determine QR's rate of return.

Price Earnings Ratio

The price earnings (PE) ratio method involves capitalising the estimated future maintainable earnings of the business at a price/earning multiple appropriate to the risks and prospects of the business.[13]

PE ratios are easily calculated and are commonly used in practice for established businesses with a financial track record and smooth earnings flows. The main weakness of PE ratios is that it relies heavily on book earnings, which are poor measures of true earnings especially in period of high inflation. Further, there are no rail companies listed on the Australian stock exchange and no listed rail companies in the world with a current and future expected risk and earnings profile like QR's. However, more useful comparators could emerge in the future with the increasing number of listed infrastructure providers.

Arbitrage Pricing Theory (APT)

APT is a multi-factor equivalent of CAPM and requires:

- identification of risk factors (typically macro economic factors) affecting the stock;
- measurement of the risk premium for each of these factors; and
- measurement of the sensitivity of the company's shares to each of these factors.

[12] See Attachment B for more details.

[13] The comparable earnings method is similar to PE ratio method. It is a benchmarking process, which involves deriving a company's cost of equity capital based on the return on equity for a sample of comparable entities. For each company in the sample, return on equity is calculated as the accounting return on the company's book value of equity.

APT may be expressed as:

$$\underline{R}_i = E(\underline{R}_i) + b_{i1}\underline{F}_1 + \ldots. + b_{ik}\underline{F}_k + \underline{e}_i$$

Where:
$\underline{R}_i$ = rate of return on asset i
$E(\underline{R}_i)$ = expected rate of return on asset i
b_{ik}= sensitivity of asset i to factor k
$\underline{F}_k$= factor k common to the returns of all assets under consideration
$\underline{e}_i$ = noise term for asset i

In theory, APT provides a more accurate estimate of return on equity than CAPM for reasons which include the following:

- returns on assets are estimated from many factors, not just one (e.g. beta) which provide an explanation for stock return movements;
- unlike CAPM, APT does not require the market portfolio to be efficient; and
- APT is easily extended to a multi period framework.

APT is rarely used in practice because despite its complexity the method generally does not significantly improve the results compared with CAPM. In addition, there is no consensus about the identity of risk factors. Also, where there are more risk factors involved, there are more risk factor sensitivities to be estimated with greater potential for statistical error.

4.3 Issues in the Quantification of the Rate of Return

In its draft undertaking, QR proposes its rate of return be based on a nominal pre-tax WACC. The Authority notes the debate that has already occurred in Australia in other regulatory exercises on this issue. The Authority is aware that there is another approach which involves treating QR's tax expense in the same manner as any other cost it incurs (and hence to model QR's cash flows on a nominal post tax basis). It is conceivable that relying on a nominal pre-tax WACC (grossed up from its post-tax WACC at the statutory tax rate) could compensate QR for tax it is not required to pay for some time in the future. However, the QCA has not yet received data from QR to enable it to assess the materiality of the issue.

It is important to note at the outset that many issues associated with the implementation of CAPM are intertwined and should not be considered in isolation. For example, as the proportion of debt increases in a company's capital structure, the risk (and hence the cost) of both debt and equity increase. However, because debt is a cheaper source of funding than equity, the overall effect on that company's rate of return may be to reduce the WACC overall.[14]

There is also an issue as to whether the rate of return should be calculated for QR's business as a whole or separately for general lines and specifically for indentifiable segments eg coal and minerals traffics. QR's draft undertaking proposes that reference tariffs will only be developed for its coal and minerals services (at least initially) as these are the services for which it is a monopoly provider.

[14] This effect is more pronounced if low levels of dividend imputation are adopted. Dividend imputation is discussed below. It is conceivable that other issues to be addressed in the regulatory process, such as the form of incentive regulation, may also impact on the rate of return.

In practice, given the limitations of any risk pricing model (including the CAPM), it may not be practically possible to substantiate any difference between the undiversifiable risk of QR's below rail business generally and that of its below rail coal and minerals business. For example, it is difficult to distinguish between the additional risk a diversified shareholder assumes by investing in a business involved in the provision of access generally as opposed to provision of access for coal and minerals traffics.

The following provides an outline of issues to be considered in the estimation of QR's expected rate of return if the CAPM is the method to be applied.

Quantification of R_f

The derivation of a return on equity under CAPM requires the estimation of a risk free rate. There are two issues which arise in this context:

- whether it is appropriate to rely upon the prevailing interest rate at a point in time or an average over time; and
- what maturity period of bonds should be used to identify the interest rate (e.g. 5 year, 10 year, etc).

In quantifying the risk free rate, it is important to note that the rate of return provides compensation for a network owner's past investment and an indication of the rate at which future investment will be compensated. It is in this context that the risk free rate needs to be considered.

The ten year Australian Commonwealth bond yield is a commonly used proxy for the risk free rate as it is a liquid instrument and provides a better reflection of the market risk free rate than bonds with a longer duration which are less well traded. The ten year term is also consistent with the Authority's proposed ten year financial modelling of QR's cash flows.[15]

The following table summarises the approaches adopted by other jurisdictions.

	Approach Adopted to Estimate the Risk Free Rate
IPART (1999)[16]	Average 10 year Commonwealth bond rate over the 20 business day period preceding the determination date.
ORG/ACCC (1998)[17]	Average 10 year Commonwealth Bond rate over an eight week period preceding the determination date.
Office of the Rail Regulator (1998)[18]	Risk free rate based on a forward looking range of rates of 5 year index linked UK Government bonds (bondholders receive an interest rate which is indexed to take into account inflation). This is in line with the Office of the Rail Regulator's adoption of a post-tax real rate of return.

[15] The model provides for a terminal value of QR's asset base at end of this 10 year period. It is also proposed that a nominal WACC be used in the modelling with explicit inflation assumptions incorporated into the cash flows.

[16] Independent Pricing and Regulatory Tribunal of NSW (IPART) Final Report, Aspects of the NSW Rail Access Regime (April 1999)

[17] ORG/ACCC, Final decision on the Victorian Gas Access Arrangements for Multinet, Westar and Stratus, October 1998, page 201. Also see Office of the Regulator General, Victoria, Weighted Average Cost of Capital for Revenue Determination: Gas Distribution, Staff Paper Number 1, 28 May 1998, page 52.

[18] Office of the Rail Regulator, The Periodic Review of Railtrack's Access Charges: The Regulator's Conclusions on the Financial Framework (Paper Three), December 1998.

Quantification of Market Risk Premium

The market risk premium is based on the difference between the return on the market as a whole (r_m) and the risk free rate, both of which vary considerably over time. This may be attributed mainly to short term business cycles and the fact that measures of risk premia are influenced by the measurement period. However, over longer periods, the results are fairly stable.

In theory the CAPM requires that a forward looking r_m be based on a time frame corresponding to the period of the analysis (eg 10 years). However, in practice this data does not exist. Accordingly, it is proposed to extrapolate from historical data. The findings of the Australian studies suggest that the market risk premium ranges from 6 to 8% (refer Attachment B).

Quantification of R_d

Quantification of the required return on debt will usually be based on actual rates of interest charged on specific debt instruments used by the company. For most government business activities, the perception of some implicit guarantee provided by the Crown may result in lower borrowing rates for those businesses than if they were privately owned. There is therefore the issue as to whether or not this implicit debt guarantee (assuming it exists) should be taken into account by adjusting actual borrowing rates and, if so, how the adjustment ought to be quantified. Certainly, one difficulty centres around the isolation of the implicit debt guarantee component in any observed interest rate differences between comparable government and private businesses.

Where problems exist in observing the actual cost of part or all of an entity's debt, an alternative approach is to assess the entity's credit rating based on its interest cover, debt payback period and internal financing ratio. This credit rating can be used to estimate a premium over the risk free rate that, which when added to the risk free rate, is a measure of the cost of debt for the entity. In this instance, lower credit ratings are associated with higher premia. The relationship between credit rating and risk premium is not straight forward and care must be exercised in applying this method to estimate the cost of debt for an entity.

It would seem satisfactory to determine QR's actual cost of debt and determine whether an adjustment is required in light of the cost of debt for comparable companies.

Equity and asset betas

For entities with no traded equity, like most government business activities, it is necessary to use judgement in determining the appropriate equity betas to be used in the estimation of the required return on equity funds. As is the case for companies with traded equity, equity betas used in calculating WACCs for government businesses should reflect the perceived undiversifiable risk involved in that business.

Ultimately, the QCA will have little option but to estimate betas on a case by case basis. In this respect, it is important to distinguish equity betas from asset betas. Equity betas incorporate the financial risk associated with an entity's capital structure as well as risk associated with holding the assets used in the business (which is reflected in the asset beta).

This raises the issue of QR's current gearing level and its effect on the WACC. It is not clear if there is a material difference between the WACC based on QR's current gearing and the WACC that would emerge if QR was financed under an "optimal" capital structure.

To assist in estimating QR's beta (whether equity or asset), the following may be considered as reference points:

- comparable Australian companies listed on the Australian Stock Exchange, as well as relevant ASX wide indices (eg infrastructure providers);

- listed companies that have a similar risk profile;

- overseas listed transport companies (although considerable caution needs to be exercised); and

- views expressed by regulatory bodies such as IPART on comparable entities (eg the Rail Access Corporation).

Dividend imputation and rates of return

Prior to the introduction of dividend imputation, equity returns observed in the market place represented rates of return after all corporate taxes had been paid (but before shareholder taxes were paid) and therefore could be used in determining the post-tax cost of equity funds for a company, leaving aside timing issues (such as those associated with accelerated depreciation).

To accommodate dividend imputation, the definition of risk premium in the CAPM requires an adjustment for the capitalised value of personal tax credits to maintain consistency between the cost of capital and cash flows which are defined on an after company tax but before personal tax basis. This is because, under an imputation tax system, credit is given to shareholders for the company tax implicitly levied on their dividend receipts at the company level. Therefore, the tax collected at the company level may be considered as a mixture of personal tax and company tax.

There are three key events in the life of an imputation credit which determines its value to a shareholder. Imputation credits are created when company tax is paid, distributed when franked dividends are paid to shareholders and redeemed or utilised when shareholders lodge their personal tax returns.

(a) Creation of imputation credits

An imputation credit is created when a company pays a franked dividend out of its Australian based after tax profits. The value of imputation credits is therefore dependent on the extent to which a dividend is franked, which in turn depends on a company's effective Australian tax rate.

(b) Distribution of imputation credits

A company's dividend policy affects the value of imputation credits. Low payout ratios effectively defer the benefit of the imputation credits to shareholders and consequently make them less valuable. Shareholders are unable to access imputation credits relating to tax paid by the company until that company pays dividends to its shareholders.

One issue in the context of assessing the level of imputation credits is whether profits earned on the coal and mineral traffics which are retained by QR for investment elsewhere in the network should effectively be allowed to reduce the value of imputation credits overall (because of the deferral of the payment of dividends) and hence increase QR's rate of return. In other words, if the rate of return is to be based on an identifiable segment of QR's business (such as its coal and minerals traffics), there is an issue as to the way in which allowance should be made for QR's rate of return on account of major investments in the network not referable to that identifiable segment.

(c) Redemption or utilisation of imputation credits

The value of imputation credits to a particular shareholder depends on whether a shareholder is able to both access and utilise those credits. For example, the gamma (which represents the aggregate value of franking credits) for an investor who is unable to utilise those credits (e.g. a foreign investor or non-taxable entity) currently is zero.[19]

The issue of shareholder status also arises in the content of QR's undertaking. QR and its shareholder, being the Queensland Government, are both exempt from Commonwealth tax (QR instead is subject to a State based tax equivalent regime). Given that the State Government retains all of QR's tax payments, is it appropriate to assume a relatively high level of redemption of imputation credits in respect of QR's notional tax payments.

The following table outlines the available research[20] on the issue of market value of a franking credit. Direct comparison between the results of these studies is difficult as they cover different time periods and different methods. The "gamma" referred to in the table reflects that valuation of imputation credits. For example, a "gamma" of 1 reflects full imputation, which means that shareholders receive the full benefit of tax paid at the company level (so that the company's pre-tax rate of return is the same as its post-tax rate of return). Conversely a "gamma" of 0 reflects no imputation, which means that shareholders receive no benefit whatsoever from dividend imputation.

	Gamma
Australia	
ORG[21]	0.35-0.9 (preferred 0.5)
ORG/ACCC (1998)[22]	0.50
IPART (1998)[23]	0.30-0.50
NSW Treasury[24]	0.40
Davies/ACCC (1998)[25]	0.40-0.70 (adopted value = 0.50)
Hathaway and Officer (1995)[26]	0.60
Bruckner, Dews and White (1994)[27]	0.48-0.88 (most likely value = 0.68)

[19] Imputation credits have very little value to tax exempt and non-resident investors, who hold a significant proportion of Australian equities. Tax credits only provide a timing benefit on taxable non-resident investors through a reduction in Australian withholding taxes. They cannot be used to offset the non-resident's tax liability in their own country. While a high proportion of tax credits appear to be wasted, there is some trading in tax credits (through the use of futures) between investors who place a low value on the credits and investors who place a high value on the credits. As a result, the market value of tax credits will be influenced by the cost and risk of trading tax credits.

[20] The market value of franking credits may be estimated by analysing the ex dividend share price movements. Company share prices can be considered as a bundle of expected future dividends and franking credits. The decline in share price following distribution of a dividend should represent the market's valuation of the dividend and any associated franking credit. The average value attached to franking credits by shareholders may be determined by comparing the share price fall of companies paying franked dividends to the share price fall of companies paying unfranked dividend, on the day that the books close for dividend entitlements.

[21] Office of the Regulator General, Victoria, Weighted Average Cost of Capital for Revenue Determination: Gas Distribution, Staff Paper Number 1, 28 May 1998, page 52.

[22] ORG/ACCC, Victorian Gas Transmission Access Arrangements for Multinet, Westar and Stratus (Final Decision), October 1998, page 207.

[23] Independent Pricing and Regulatory Tribunal of NSW (IPART) draft decision, Access Arrangement for the Great Southern Energy Gas Networks Pty Limited (October 1998). Independent Pricing and Regulatory Tribunal of NSW, Aspects of the NSW Rail Access Regime (Final Report), April 1999.

[24] NSW Treasury response to IPART draft decision on Access Arrangement for the Great Southern Energy Gas Networks Pty Limited (October 1998)

[25] Davis, K., The Weighted Average Cost of Capital for the Gas Industry – Report Prepared for the Australian Competition and Consumer Commission and Office of the Regulator General, 18 March 1998.

[26] Hathaway, N., and Officer, R. (1995), "The Value of Imputation Tax Credits", Finance and Research Group, Graduate School of Management, unpublished manuscript first presented at a Pacific Basin Finance Conference in New York in December 1991. Subsequently presented at seminars in Sydney, Brisbane and Melbourne during 1992, 1993 and 1995 respectively.

[27] Brucker, K., Dews, N., and White, D. (1994), *Capturing Value from Dividend Imputation*, McKinsey and Company, Sydney. This paper based the research on 88 of the Top 100 Australian companies over the six years to 1993. The paper:

- found that imputation credits were valued between zero and 97% of face value;
- estimated that with a statistical confidence of 90% probability, an average market valuation of a franking credit is between 48% and 88% of face value; and

	Gamma
McKinsey & Company (1994)[28]	0.68
Brown and Clarke (1993)[29]	0.72
Steering Committee on National Performance Monitoring of Government Trading Enterprises (1996)[30]	1.00

In assessing the level of imputation credits (if any) that should be implied for QR there are perhaps two broad approaches that may be considered:

- "QR specific", where the value of imputation credits is based on the 3 factors described above in the context of the specific services for which Reference Tariffs are to be established; or

- an average approach, where the value of imputation credits is estimated on the basis of the average valuation of imputation credits for listed companies generally, or for a specific sector of the market (eg infrastructure providers).

Tax rates

In striking the tax rate to be applied to QR, there are broadly two alternatives – the statutory rate (36%) or an "effective rate", which adjusts the statutory rate for both timing and permanent differences. In practice, if a relatively high value of imputation credits (gamma) is adopted, then the issue of the tax rate (whether statutory or effective) assumes considerably less significance.

The owner of infrastructure assets with a long life may claim a higher tax deduction in the early years of the asset's life, thus bringing forward the tax deductions and increasing the value of these tax benefits in net present value terms. Thus, allowing for the time value of money, the effective tax rate for a major infrastructure provider may be below the statutory rate of 36%. As outlined in the following table, studies have found that the effective tax rate ranges from 15% to 36%.

	Effective Tax Rate (%)
Australia	
IPART (1998)[31] and (1999)[32]	36
ORG/ACCC (1998)[33]	36
Industry Commission (1991)[34]	15
NSW Treasury (1988)[35]	36

- considered that 68% is a reasonable estimate.

[28] McKinsey & Company (1994), Capturing Value from Dividend Imputation.

[29] Brown and Clarke (1993), "The Ex Dividend Day Behaviour of Australian Share Price Before and After Imputation", unpublished manuscript, University of Western Australia.

[30] Steering Committee on National Performance Monitoring of Government Trading Enterprises, An Economic Framework for Assessing the Financial Performance of Government Trading Enterprises, July 1996, pages 38-41.

[31] Independent Pricing and Regulatory Tribunal of NSW, Access Arrangement for the Great Southern Energy Gas Networks Pty Limited (Draft Decision), October 1998.

[32] Independent Pricing and Regulatory Tribunal of NSW, Aspects of the NSW Rail Access Regime (Final Report), April 1999.

[33] ORG/ACCC, Victorian Gas Transmission Access Arrangements (Final Decision), October 1998, page 57.

[34] Industry Commission (1991), Choosing the Appropriate Rate of Return for Coal Rail Investment (Appendix J of Rail Transport Report page 125).

[35] NSW Treasury response to IPART draft decision on Access Arrangement for the Great Southern Energy Gas Networks Pty Limited (October 1998)

In practice, the more significant issue is whether to explicitly address taxation liability in the cash flows or whether to "gross up" the post tax WACC by a factor to account for tax to arrive at a "pre-tax" WACC. QR's undertaking refers to a pre-tax (ie grossed up) WACC, but does not indicate the factor by which it proposes to "gross up" the post-tax WACC.

Another approach is to address taxation liability in the same manner as any other cash flow item (and instead rely on a post-tax WACC for the rate of return). This approach explicitly addresses tax expense through the cash flows so that users only pay for the tax expense actually incurred by QR in the provision of its below rail services.

Again, the issues arises as to how tax expense related to QR's coal and minerals traffics should be treated in the context of the remainder of QR's below rail business. In this regard, the Authority notes the desirability of adopting a consistent approach with related issues (eg the treatment of imputation credits).

It is noted that a debate is currently underway that could have significant ramifications for Australia's corporate taxation system. This raises the issue of whether, in light of any change that occurs to the tax system, it is appropriate that QR's accepted rate of return be reviewed.

Other factors

Recently, submissions to IPART's review of the NSW Rail Access Regime suggested that Rail Access Corporation's WACC should be multiplied by a factor of 1.2 to take account of the additional risks imposed on an infrastructure owner by the regulatory environment.

In this context, it has been argued that a maximum rate of return multiple or uplift factor over the WACC is necessary because the ceiling test prevents the company subject to it from averaging returns:

- between separate line sectors; and
- over time in respect of particular line sectors.

There are many mechanisms which could be used to address this issue, including uplift factors, unders and overs accounts and, in a forward looking sense, contractual arrangements.[36]

4.4 Request For Comments

The Authority seeks comments on:

- **what is the most appropriate method for estimating the rate of return for QR's network/infrastructure assets for the purposes of establishing maximum access prices in relation to services for which QR is a monopoly provider;**
- **whether segment specific (eg. a coal and minerals specific) or QR wide WACC should be utilised;**

[36] The issue of unders and overs accounts will be addressed in a separate paper dealing with incentive regulation.

- **if the CAPM is to be applied, the appropriate assumptions in estimation of QR's WACC, in terms of the:**
  - **risk free rate;**
  - **market risk premium;**
  - **beta;**
  - **valuation of imputation credits (ie "gamma" or "?"). In particular, if imputation credits are to be recognised, should their value be quantified according to QR's specific circumstances or an average approach, based upon, for example, the average valuation of imputation credits for listed companies generally or for a specific sector of the market; and**
  - **tax rate;**
- **the use of QR's actual cost of debt and whether this should be adjusted to reflect the impact of the benefit (if any) derived by QR by virtue of the implicit government guarantee. If an adjustment is to be made, how should it be effected;**
- **if QR's estimated WACC based on its current capital structure is materially different to that which would emerge if it were financed under an optimal or tax effective capital structure, which figure should be taken to quantifying QR's accepted rate of return;**
- **given the uncertainty associated with the review of Australia's taxation system, what events, if any, should trigger a review of QR's rate of return for the purposes of quantifying Reference Tariffs;**
- **whether the WACC should be based upon pre or post tax cash flows;**
- **what mechanisms are appropriate to deal with the unanticipated variations in returns for investments between line sectors and in respect of particular line sectors over time; and**
- **any other issues which should be considered in the context of the allowed rate of return.**

ATTACHMENT A

ASSET VALUATION IN OTHER REGIMES

Great Britain

In 1993, the UK Government introduced the *Railways Act 1993,* the aim of which was to "create a better railway for passengers and freight customers, and better value for public funding authorities, through effective regulation in the public interest". The result of the reform was privatisation of the industry after extensive vertical and horizontal separation. To oversee the industry and provide economic regulation, a Rail Regulator and Franchise Director have been established.

Train operating companies, both passenger and freight, can gain access to the network through commercial access agreements with Railtrack. Access Agreements and the charges contained within them are subject to approval by the Rail Regulator.

In determining access charges, the Rail Regulator has considered asset valuation issues in two distinct phases. First, asset valuation procedures where developed and adopted for an industry characterised by Government ownership of rail infrastructure. Under this system:

> "The principles of Modern Equivalent Asset (MEA) valuation should be followed. This requires the valuation of assets by reference to the expected replacement cost to an enterprise of assets with similar operational capabilities. It may be that the modern equivalent assets valued actually provide different operational capabilities from Railtrack's existing assets, either in terms of revenue earning capabilities or operating costs. In such cases, the Regulator would then expect to see some adjustment made either to asset values or to projections of operating expenditure."[37]

Second, following the privatisation of Railtrack and the advent of the 'periodic review of access charges', the Office of the Rail Regulator has expressed the view that, for price setting purposes under a privatised ownership regime, a market-based indicator of value (such as initial market capitalisation) is appropriate. In this sense, the Rail Regulator has concluded that the approach to asset valuation in the current review should be based on the money which shareholders paid for the company plus net debt owed on the close of the first day's trading.[38]

United States of America

The US rail industry is characterised by numerous vertically integrated private rail companies. Rail transport in the US is highly deregulated and competitive, although economic regulation is instituted by the Surface Transportation Board (STB) for the purpose of (a) ensuring rate reasonableness in the presence of 'captive shippers' and/or 'market dominance' and (b) to address 'bottleneck' complaint (or competitive access) cases.

All carriers are obliged under common carrier obligations to provide rail services upon request subject to commercial negotiation and appeal to the STB. Further, it is common for US railroads to enter into voluntary unregulated agreements to run trains over each other's track, known as 'trackage rights', and to establish 'interlining services' where one railroad hands over its traffic to another at the point at which the two railroads meet.

[37] Office of the Rail Regulator (1994*) Framework for the Approval of Railtrack's Access Charges for Franchised Passenger Services*, ORR: London

[38] Office of the Rail Regulator (1998) *The Periodic Review of Railtracks's Access Charges: The Regulator's Conclusions on the Financial framework*, ORR: London.

The framework for establishing rate reasonableness by the STB is that of 'Constrained Market Pricing' (CMP). This framework applies to the transportation of captive coal traffic and was set out under the Interstate Commerce Commission's (ICC) *Coal Rate Guidelines: Nationwide (Ex Parte No 347) (1985*) and adopted by the STB[39].

The objectives of CMP have been stated simply as:

> "A captive shipper should not be required to pay more than is necessary for the carrier(s) involved to earn adequate revenues. Nor should it pay more than is necessary for efficient service. A captive shipper should not bear the costs of facilities or services from which it derives no benefit. Responsibility for payment for facilities and services which are shared (to its benefit) by other shippers should be apportioned according to the demand elasticities of the various shippers"[40]

Central to any price setting framework is an appropriate mechanism for determining the value of assets. This is recognised in the ICC's *Coal Rate Guidelines: Nationwide,* where it is indicated that:

> "An important step in the SAC computation is the valuation of the assets comprising the investment base. The depreciation expense and return on investment are significantly affected by the choice of valuation methods … we proposed valuing assets at their depreciated current cost and applying the current nominal cost of capital to the investment base to compute the return on investment."[41]

The ICC's Guidelines highlight that this approach has had its critics, but contends that:

> "under the theory of SAC, which assumes that a new entrant can potentially enter the market today, asset value must be based on the cost of acquiring assets today (at there current value). Using the railroad's historical cost of the assets … would not be consistent with the theory of SAC"[42]

Railroads also objected to the use of depreciated current costs on the basis that asset values should reflect the current cost of acquiring all new plant and equipment. The ICC maintained however that "… a new entrant would not necessarily purchase all new assets".

The ICC in its Guidelines has, however, acknowledged acceptance of an Economic Value approach, proposed by railroads and supported by shippers, as a reasonable alternative to depreciated current cost. Under this approach railroads and shippers considered that:

> "… one would project the stream of earnings which can be expected (based on the economic life of the assets in the investment base and the demand for service), then discount it at the current cost of capital to derive the present value of the stand-alone system."[43]

In this context is useful to note that the ICC has not attempted to prescribe a hard and fast formula for developing and applying its price setting principles but has indicated its preference for the adoption and application of depreciated current cost. This asset valuation approach has also been adopted for competitive access pricing.

[39] As identified in the STB's first annual report 1996-97 (STB, 1998) "To assess whether rates are reasonable, the Board uses a concept known as 'constrained market pricing' (CMP) whenever possible. See Coal Rate Guidelines, Nationwide" (STB, 1998, p18).
[40] Interstate Commerce Commission's (1985) Coal Rate Guidelines: Nationwide (Ex Parte No 347) p 523.
[41] Interstate Commerce Commission's (1985) Coal Rate Guidelines: Nationwide (Ex Parte No 347) p 544.
[42] Interstate Commerce Commission's (1985) Coal Rate Guidelines: Nationwide (Ex Parte No 347) p 545.
[43] Interstate Commerce Commission's (1985) Coal Rate Guidelines: Nationwide (Ex Parte No 347) p 545.

Canada

Two vertically integrated private companies - Canadian National Railways (CN) and Canadian Pacific Railways (CPR) - dominate freight and mineral haulage in the Canadian rail industry.

Regulatory oversight of the rail industry in Canada, performed by the Canadian Transportation Agency, is based on the premise of enhancing the negotiating leverage of shippers and to provide them with a wide range of regulatory remedies to resolve rate and service disputes with railway companies. Central to this process are a number of policy options grouped under the title of 'competitive access provisions' and include:

- Regulated Interswitching;
- Competitive Line Rates; and
- Running Rights.

Regulated Interswitching: Interswitching is the transfer of rail traffic by one railway between a shipper's siding and an interchange with another connecting or line-haul carrier, where the siding is located within a radius of 30 km of the interchange. That is, Interswitching requires the movement of rollingstock by one above rail carrier to an interchange or connection point with another carrier. Interswitching occurs under regulated interswitching rates, where rates are set by the Agency on the basis of average variable cost plus a set contribution to average fixed costs.

Competitive Line Rates: As with interswitching, Competitive Lines Rates (CLRs) provide for shippers located further from an interchange to be able to require the owner of the railroad to carry the shipper's traffic from its origin to the interchange with another the shipper's railroad. CLRs are established at the request of a shipper and are set either by the local carrier or the Agency.

Running Rights: A running right is the Canadian version of 'third party access rights'. Running rights allow railway operators to provide services over a railway line it does not own. Running rights can be voluntary or, if both railways fall under federal jurisdiction, they can be imposed on the railway owning the line by an order of the Agency. This process allows a federal railway to use or occupy land belonging to another federal railway, use all or part of the railway's tracks, terminals and stations, and operate its trains over the other railway's lines. The ability to do all of this is contingent upon the approval of the Agency, having regard to the public interest and commercial injury. If the Agency does grant an application for running rights, the two railways have the opportunity to negotiate compensation for the running rights. If the negotiations fail, the Agency may determine the compensation to be paid. However, given the commercial nature of running right contracts evidence on how compensation or access charges are determined is not readily obtainable.

Information provided to the QCA by the Canadian Transportation Agency indicates that the Agency has not clearly stated what elements would be considered in a request for running rights (such as asset valuation, capacity etc) given that the Agency has to date not had to make a determination on running rights.

South Africa

In 1990, South African Transport Services was corporatised to form Transnet Ltd. Transnet is organised on the basis of seven operational divisions, including Spoornet – South Africa's national rail carrier and infrastructure owner. There is no economic regulation of the rail industry in South Africa.

NSW Rail Access Regime

The NSW Rail Access Regime asserts that "…full stand alone economic costs include a rate of return on the asset value of the relevant line section (or group of line sections) and on assets which are in the nature of corporate overheads". In this context the Regime expresses that "…below rail general assets

which require future expenditures to retain the current Capacity of the NSW Rail Network, will be valued at equal to the current cost depreciated replacement value of the asset or group of assets".[44]

Depreciated current replacement cost, as applied in the NSW Rail Access Regime, is also supported by the NCC sponsored KPMG 'Report on the Pricing Principles contained in the NSW Rail Access Regime'. The Report contends that "in the context of determining a ceiling price based on the stand alone economic cost concept … there is a strong argument to support the use of current cost depreciated replacement cost valuations."[45] However, IPART's recent report on *Aspects of the NSW Rail Access Regime* advocates the use of Depreciated Optimised Replacement Cost as the appropriate asset valuation methodology. The Depreciation method recommended by IPART is the straight-line approach over the remaining life of the mines.

Australian Rail Track Corporation

Discussions with the ARTC have highlighted the fact that, in valuing its asset base, the ARTC has taken into consideration a number of methods, including: Optimised Deprival Value, Depreciated Optimised Replacement Cost and Market Value elements.

These have been combined in ARTC's asset valuation processes with preference being given to the adoption of value based, rather then cost based, valuation techniques.

[44] NSW Government (1996) *NSW Rail Access Regime*.
[45] KPMG (1997) *Report in the Pricing Principles in the NSW Rail Access Regime*, NCC: Canberra.

General Information Pertaining to Rail Regimes

Jurisdiction	Gauge	Average Net Coal Wagon Tonnage	Typical # of Wagons	Asset Valuation	Depreciation	Regulator
Great Britain	Standard (1.435m)	N/A	N/A	Modern Equivalent Asset (pre-privatisation) and Economic Value (company value upon flotation).		Office of the Rail Regulator
United States	Standard (1.435m)	96[46]	84	Depreciated Current Cost	Units of Use.[47]	Surface Transportation Board
Canada	Standard (1.435m)	105[48]	106-110[49]	N/A[50]	N/A	Canadian Transportation Agency
South Africa	Narrow (1.067m)	Various: 92,84,71,58	Various: 100 and 200	N/A	N/A	N/A
New South Wales	Standard (1.435m)	Three types: 95,75,56	Large–91 Medium–64 Small–34[51]	Depreciated Optimised Replacement Cost[52]	Straight Line[49]	Independent Pricing and Regulatory Tribunal (IPART)
Australian Rail Track Corp	Standard (1.435)	N/A	N/A	Optimised Deprival Value[53]		Australia Competition and Consumer Commission (ACCC)
QR	Narrow (1.067m)	Various types: 56,57,58,62, 63,70,81	Various Ranging from 39 to 140	N/A	N/A	Queensland Competition Authority (QCA)

Australian regulatory experience in both gas and electricity has reflected an acceptance of the application of either Optimised Deprival Value or Depreciated Optimised Replacement Cost as the means best suited to establishing asset values for the purpose of price regulation of natural monopolies.

[46] Information provided by the American Association of Railroads.
[47] Information provided by Surface Transportation Board.
[48] Information provided by the Canadian Transportation Agency.
[49] Information provided by the Canadian Transportation Agency.
[50] Running rights (ie third party access) is determined on a confidential and commercial basis between rail companies. The Canadian Transportation Agency has had no involvement to date, consequently information on asset valuation for the purpose of regulating price setting is not available.
[51] Large Train – 91*95 (net tonnes) wagons hauled; Medium Train – 72*75(nt) wagons hauled, 66*75(nt) wagons hauled, and 56*95(nt) wagons hauled; Small Train – 42*75(nt) wagons hauled, 33*75(nt) wagons hauled, 24*56(nt) wagons hauled, 38*56(nt) wagons hauled.
[52] This has been recommended by IPART in its recent review into rail access pricing issues. However, the current asset valuation approach for regulated access prices is current replacement cost.
[53] ARTC indicated that its asset valuation process was based on a number of elements including:

- Deprival Value
- Depreciated Optimised Replacement Cost; &
- Market Value elements

Asset Valuation and Depreciation under Australia Access Codes

Regulation	**Asset Valuation**	**Depreciation**
National Gas Access Code	Valuation is set with respect to the boundaries imposed by: • Depreciated Actual Cost; and • Depreciated Optimised Replacement Cost.	As determined by jurisdictional regulator. Code stipulates a number of guiding principles for consideration by regulators and requires either a cost of service or Net Present Value perspective to depreciation.
National Electricity Code	Optimised Deprival Value	Not strictly defined subject to determination by jurisdictional regulator.

ATTACHMENT B

APPROACHES TO RATE OF RETURN IN OTHER REGIMES

Great Britain

The Privatisation Act was introduced in the UK to address problems with limited competition in the rail sector and inefficiencies of monopoly behaviour. It was recognised that below rail infrastructure assets were a natural monopoly and effective competition was difficult to achieve in a vertically integrated network. Accordingly, the ownership of above and below rail assets was separated with the establishment of Railtrack assuming ownership of almost all of the below rail infrastructure in the UK, including track, signalling, bridges, tunnels, stations and depots. Railtrack supplies access to train operators (passenger and freight), train planning and signalling.

The Office of Rail Regulation (ORR) determines Railtrack's rate of return based on the company's Weighted Average Cost of Capital and an optimal capital structure. The cost of equity is estimated by the Capital Asset Pricing Model (CAPM). In a recent review, ORR concluded that Railtrack's real post tax rate of return would be in the range of 5% to 6% (although it should be noted that Railtrack's traffic mix is dramatically different to QR's).[54] This is based on the parameters outlined in the following table:

CAPM parameter	**Low**	**High**
Real risk free rate	2.25%	3.0%
Debt premium	1.0%	1.5%
Equity risk premium	3.0%	4.0%
Equity beta	7.5	8.5
Asset beta	7.0	8.0
Debt to value	40.0%	50.0%
Effective tax rate	Tax payments to be forecast	
Cost of equity nominal	8.7%	12.2%
Real post tax WACC	5.0%	6.0%

United States of America

The US is a prime example of a privately owned rail industry which is primarily vertically integrated with track operators owning the above and below rail assets. The market for rail freight transport in the US is entirely deregulated and highly competitive and there is limited government oversight over rates charged on freight, conditions of access and mergers.[55]

[54] Office of Rail Regulation, The Periodic Review of Railtrack's Access Charges: The Regulator's Conclusions on the Financial Framework (Paper Three), December 1998.

[55] Organisation for Economic Co-operation and Development (OECD), Proceedings of the OECD/World Bank Conference on Competition and Regulation in Network Infrastructure Industries, Paris 1995, OECD/GD(95)87, pages 256 and 276.

The US Government regulatory body, the Surface Transport Board[56] determined the overall railroad industry cost of capital rate using a "composite railroad" comprised of six major Class 1 carriers. These six companies account for over 86% of total operating revenues and over 87% of railroad assets of all Class 1 railroads[57].

The rate of return (on equity and debt) is primarily set with reference to the Dividend Growth Model, since the depth of the US capital markets makes it relatively straightforward to obtain unbiased estimates of dividend growth. Under this approach, the return on equity estimates are derived from the dividend yield of a company plus the average expected dividend growth rate. This approach is the most widely used alternative to CAPM in assessing a company's cost of equity. The US Surface Transport Board concluded in July 1998 that the railroad industry has a nominal post-tax composite cost of capital of 11.8% based on:

- current cost of debt of 7.2%;
- current cost of common equity of 13.8%;
- cost of preferred equity capital of 6.1%; and
- capital structure mix of 29.67% debt, 70.28% common equity and 0.05% preferred equity capital.

New South Wales (NSW)

The Rail Access Corporation (RAC) was born out of the former State Rail Authority when the NSW Government vertically separated the ownership of rail infrastructure from freight and passenger operations. RAC owns all the essential public rail infrastructure assets in NSW, including track, overhead wiring, signals and support systems.

The Independent Pricing and Regulatory Tribunal of NSW (IPART) has proposed setting a maximum rate of return based on RAC's Weighted Average Cost of Capital, with the cost of equity estimated by the method of the Capital Asset Pricing Model. In a recent final report, IPART concluded that RAC's real pre-tax WACC was in the range between 5.3% and 8.8% and 8.0% was an appropriate maximum for RAC under the NSW Rail Access Regime.[58] This was based on parameters outlined in the following table:

Parameter	**Low**	**Mid-point**	**High**
Risk free rate			
Nominal[59]	5.37%	5.37%	5.37%
Real[60]	3.52%	3.52%	3.52%
CPI	1.79%	1.79%	1.79%
Market risk premium	5.0%	5.5%	6.0%

[56] Surface Transportation Board (1998), "Railroad Cost of Capital – 1997 (STB Ex Parte No. 558 (Sub-No. 1)".
[57] Class 1 railroads are railroad companies with an annual gross operating revenue in excess of $250 million based on 1991 dollars.
[58] Independent Pricing and Regulatory Tribunal of New South Wales, Aspects of the NSW Rail Access regime (Final Report), April 1999, Pages 49-75.
[59] 20 day average yield of 10 year Commonwealth bond rate prior to 19 April 1999.
[60] 20 day average yield of 2010 Capital Indexed Bonds prior to 19 April 1999.

Parameter	**Low**	**Mid-point**	**High**
Debt margin	1.0%	1.0%	1.0%
Cost of debt	6.37%	6.37%	6.37%
Equity beta	0.7	0.85	1.0
Asset beta	0.29	0.41	0.55
Debt beta	0.10	0.09	0.08
Debt/value (optimal capital structure)[61]	50.0%	55.0%	60.0%
Franking credit (gamma)[62]	0.5	0.4	0.3
Effective tax rate	36%	36%	36%
Cost of equity nominal post tax	8.90%	10.06%	11.39%
Nominal post tax WACC	5.23%	5.94%	6.91%
Nominal pre-tax WACC	8.17%	9.28%	10.80%
Real pre tax WACC	5.3%	7.1%	8.8%

[61] IPART adopted a forward looking optimal capital structure rather than RAC's actual gearing level.

[62] IPART considers that ownership is irrelevant for the determination of gamma. This is because when valuing an asset, governments apply the same discount rate as that which would be used by the private sector. This principle may be applied in the determination of an appropriate gamma assumption.

ATTACHMENT C

MARKET RISK PREMIUM IN AUSTRALIA, UK AND THE USA[63]

	Market Risk Premium pa (%)
Australia	
Officer (1985): 1882-1987[64]	7.9
AGSM:	
1974-1983[65]	6.3
1977-1983[66]	11.7
1964-1995[67]: Arithmetic average (including October 1987) .[68]	6.2
Arithmetic average (excluding October 1987)	8.1
Department of Finance (1987)[69]	7.0-8.0
Bowers and Ball (1988)[70]	8.0
Reserve Bank of Australia[71]	>6.0
Irvine (1991)[72]	6.0
Department of Finance (1991)[73]	6.0
Hathaway and Dodd (1995)[74]	6.6
Davis (1998)[75]	4.5-7.0
QERU (1998)[76]	6.0-8.0
NSW Treasury (1988)[77]	6.5
IPART (1998)[78]	5.5-7.0
IPART (1999)[79]	5.0-6.0
ORG/ACCC (1998)[80]	6.0
United Kingdom	
Office of the Rail Regulator (1998): 1919-1996[81] Arithmetic average	7.1
Office of the Rail Regulator (1998)[82]	3.0-4.0
United States Of America	
Brealey & Myers (1926-1988)[83]	8.4
Federal Reserve Bank of Minneapolis[84]	
1926-91	8.3
1981-91	7.7
Ibbotson and Associates[85]	
1926-29	17.6
1930s	2.3
1940s	8.0
1950s	17.9
1960s	4.2
1970s	0.3
1980s	7.9
1990s	7.9
1987-96	8.3
Overall average 1920s to 1990s[86]	7.0

[63] Some studies have suggested that equity risk premium has reduced significantly in recent years due to the effect of dividend imputation and stable inflationary environment. It may be argued that whilst the mix of the components of expected returns may have altered, the aggregate corporate rate of return has not. This argument is based on the assumption that the corporate rate of return is a function of the risk of the equity and the imputation tax system has not changed this underlying risk. The Authority is not aware of robust empirical evidence to suggest that dividend imputation has had a systematic effect on the market risk premium.

[64] Officer, R. (1985), "Rates of Return to Shares, Bond Yields and Inflation Rates: An Historical Perspective", Chapter 14 in Brown, R., Ball, R., Finn, F. and Officer, R. (editors), *Share Markets and Portfolio Theory*, 2nd Edition, UQ Press, Brisbane Australia.

[65] Centre for Research in Finance, Risk Management Service, AGSM, 1989. (Equity returns exclude property trusts and the premium is measured from the rate on short term Treasury notes. Property trust returns were higher).

[66] Ibid. (Equity returns exclude property trusts and the premium is measured from the rate on long term government bonds. Property trust returns were higher).

[67] Independent Pricing & Regulatory Tribunal of NSW, The Rate of Return for Electricity Distribution Networks, November 1998.

[68] R. Brealey and S. Myers, *Principles of Corporate Finance*, McGraw-Hill, 1972

[69] Department of Finance (1987), "The Choice of Discount Rate for Evaluating Public Sector Investment Projects", Discussion Paper.

[70] Bowers, J. and Ball, R. (1988), "The Cost of Equity Capital Under the New Imputation Tax System", AGSM.

[71] Richards, A. (1991) "The Cost of Equity Capital in Australia: What can we Learn from International Equity Returns?" Reserve Bank of Australia Research Discussion Paper 9107.

[72] Irvine, M. (1991), *Clarifying the Link Between the Cost of Capital and Australia's Competitiveness*, McKinsey and Company, Sydney.

[73] Department of Finance (1991), *Handbook of Cost-Benefit Analysis*, AGPS, Canberra.

[74] Hathaway, N. and Dodd, P. (1995), "Government Cost of Capital – A Critical Look at the Treasury Model", draft paper Melbourne Business School seminar entitled Valuation and the Cost of Capital Under an Imputation System, Melbourne, 14 June.

[75] Davis, K., The Weighted Average Cost of Capital for the Gas Industry, report Prepared for ACCC and the Office of the Regulator-General, March 1998, pages 13-14.

[76] QERU referred to a study by Hathaway (1995) on the equity risk premium of Australian equity market and world capital markets found that the appropriate figures was between 6% to 7%, with the most likely estimate being 6.6%. US estimates of market risk premium (based on bonds of similar duration to those used for the Australian study) are around 7%, which is consistent with the Australian results.

[77] NSW Treasury response to IPART draft decision on Access Arrangement for the Great Southern Energy Gas Networks Pty Limited (October 1998)

[78] Independent Pricing and Regulatory Tribunal of NSW, Access Arrangement for the Great Southern Energy Gas Networks Pty Limited, (Draft Decision), October 1998.

[79] Independent Pricing and Regulatory Tribunal of NSW, Aspects of the NSW Rail Access Regime (Final Report), April 1999, page 63.

[80] ORG/ACCC final decision on the Victorian Gas Access Arrangements for Multinet, Westar and Stratus

[81] UK Office of the Rail Regulator (1998), The Periodic Review of Railtrack's Access Charges: The Framework and Timetable and Further Consultation on Financial Issues (Second Consultation Paper).

[82] Office of Rail Regulator, The Periodic Review of Railtrack's Access Charges: The Regulator's Conclusions on the Financial Framework (Paper Three), December 1998.

[83] Brealey and Myers advocated the use of arithmetic mean is advocated as estimates of discount rate are closer to the arithmetic mean than the geometrical mean. Brealey, R. and Myers, S. (1988), *Principles of Corporate Finance*, McGraw-Hill, page 136.

[84] Jagannathan, R., and McGrattan, E. (1995), "The CAPM Debate", Federal Reserve Bank of Minneapolis Quarterly Review, Vol. 19 No. 4 Fall, pages 2-17.

[85] Annin, M. and Falaschetti, D. (Ibbotson Associates), "Equity Risk Premium Article", Valuation Strategies, January/February 1998 issue.

[86] Ibbotson Associates, "Stocks, Bonds, Bills and Inflation Yearbook, 1996", quoted in Black, A., Wright, P. and Bachman, J., "In Search of Shareholder Value – Managing the Drivers of Performance", Price Waterhouse.