A Brief Comparison of the WA Rail Access Code approach to calculating ceiling cost with the conventional Depreciated Optimised Replacement Cost methodology

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1. Purpose Of Paper

The objective of this paper is to compare the determination of a tariff ceiling under the Gross Replacement Value ("GRV") annuity approach, as prescribed in the Western Australian *Railways (Access) Code 2000* ("the Code"), with that of determining a tariff ceiling using Depreciated Optimised Replacement Cost ("DORC") as an asset value with straight line depreciation. The latter approach to calculating the cost of service is used in some Australian jurisdictions. The paper's overall purpose is to inform interested parties of the potential outcomes under both approaches.

2. Background

In a competitive environment the value of an asset is determined by the market based on its future estimated economic return. If however the provision of access to that asset is not contestable in the market, then there is a need to look at alternate means to assess its value so that an appropriate and fair return on capital can be calculated.

To compensate the asset owners for the cost of capital, regulators permit a:

- Return on capital (ie. applying a Weighted Average Cost of Capital (WACC) to the asset base) consistent with prevailing capital markets conditions adjusted for the relative non-diversifiable risks involved in their business.
- Return of Capital (or depreciation) to compensate for any consumption of the asset value due to physical or economic loss.

GRV and DORC are two asset valuation methods among several used by regulators. The GRV using an annuity approach provides compensation for the return of and return on capital within the one revenue stream. The DORC approach typically (although not necessarily) involves the explicit separate determination of a return on capital and a return of capital.

GRV is defined in the Code as:

> *"… the gross replacement value of the railway infrastructure, calculated as the lowest current cost to replace existing assets with assets that have the capacity to provide the level of service that meets the actual and reasonably projected demand and are, if appropriate, modern equivalent assets."*

An analogy of the GRV annuity approach to capital cost recovery is the standard household mortgage where a constant annual payment is determined which will provide for the gradual increasing repayment of the principal over the term of the loan. The calculation of the capital cost annuity is made by applying the GRV of the railway infrastructure as the principal, the WACC[1] as the interest rate, and the economic life as the number of periods.

In practice the calculation is completed using the payment (or PMT) function available in spreadsheet software packages.[2]

DORC is defined as:

> *"…the replacement cost of an 'optimised' system, less accumulated depreciation. An optimised system is a reconfigured system using modern technology designed to serve the current load with current technology, with some allowances for growth. This method*

[1] As at 30 June 2002, the WACC is 7.8% (pre-tax real) for WestNet Rail and 4.9% pre-tax real for the WA Government Railways Commission.

[2] The MS Excel terminology for the PMT function inputs and the relevant inputs for the WA Code are:
"Rate of interest": should be set at the relevant WACC as defined by the Code.
"Nper": the Code stipulates that this should be expressed in years and based on the relevant average economic life of the track section(s).
"Pv": is the present value of the asset or in this instance the GRV of the relevant track sectors.
"Fv": is the future value at the end of the economic life or in this case the salvage value if any which remains. A zero salvage value assumption was used.
"Type": payments set at the end of period by inputting '0' or set at the beginning of period by inputting '1'.

excludes any unused or under utilised assets and allows for potential cost savings that may have resulted from technological improvement."[3]

The conventional DORC approach to assessing capital cost utilises a "building block" methodology involving the addition of two items - return on capital (eg. WACC multiplied by opening asset value in that year), and return of capital (eg. straight-line depreciation over the economic life).

Calculating the cost of service using a DORC value requires the explicit estimation of accumulated historical depreciation. This depreciation of assets is typically assessed by either measurement of the extent of physical asset deterioration from new condition or by assessment of consumption of economic benefits to date (eg. using straight line, economic (annuity), units of production or other recognised depreciation methodology).[4]

Both DORC and GRV use a current cost approach which is usually justified on the basis that it results in prices which more closely reflect the cost of replacing capacity or providing additional capacity. The optimisation test present in both DORC and GRV with Modern Equivalent Assets ("MEA") methodologies may also result in very similar deductions for any asset gold plating, inefficient routes or under-utilised capacity outcomes.

Equally, the calculation of operating costs is different between the conventional DORC approach and the Code's approach using GRV. Under DORC, assuming that operating costs are prudent and reflect best practice, all such expenditures are usually allowed. On the other hand, the Code's approach to valuing assets using GRV that is regularly reset requires an operating cost profile that is consistent with that required for a permanently new network.

The following table presents the calculation of both approaches.

Ceiling Revenue =	**Operating Costs +**	**Return on Capital +**	**Return of Capital**
DORC	Operating costs	(WACC x opening asset value in that year)	Depreciation
GRV	Operating costs of new MEA	Annuity (PMT function: int = WACC, PV=GRV, life)	

Increasingly, estimating the cost of service using a DORC asset valuation method with straight line depreciation has become a conventional approach of valuing existing infrastructure assets and it is utilised by most Australian and overseas regulators in industries such as gas, electricity, telecommunications and rail. On the other hand, the GRV annuity approach is utilised by some water utilities for financial reporting and its only current regulatory application in Australia is in the Western Australia Railways Access Regime.

3. The Western Australian Railways Access Regime

Under the Western Australian Railways Access Regime, the negotiation of access prices takes place within a range bounded by a floor price and ceiling price. The "floor price" is defined as a price not less than the incremental costs resulting from the access seeker's operations on that route and use of that infrastructure. The "ceiling price" is defined as a price not more than the total costs attributable to that route and that infrastructure.

For the purpose of calculating the ceiling, the Code defines "total costs" to include all operating costs, capital costs and overheads attributable to providing the access-related function.

Clause 2 of Schedule 4 of the Code defines "capital costs" as:

[3] IPART, Aspects of the NSW Rail Access Regime, Final Report, April 1999, p. 34.
[4] For example if 53kg rail is 10 years old and has carried 200 million GTK should it be 20% depreciated based on a 50 year life or 44% depreciated based on a 460 million GTK life.

- Comprising both the depreciation and risk adjusted return on the relevant infrastructure not including land.
- Being determined as the equivalent annual cost or annuity for the provision of the railway infrastructure, and by applying the GRV as the principal, the WACC as the interest rate and the economic life as the number of periods.

The GRV is to be calculated as the lowest current costs to replace existing assets with assets that will provide the level of service that meets the actual and reasonably projected demand and are, if appropriate, MEA.

Following two rounds of public submissions and some amendments to the Code, the National Competition Council (NCC) in its September 1999 Draft Recommendations concluded that GRV with an annuity approach as proposed by the Western Australian Access Regime could be acceptable if:

- Perpetual structures (ie. mainly land) are excluded from the GRV value; and
- The revenue ceiling was reduced coincident with the lower value attributable to operating and maintenance costs associated due to the use of MEA.

In addition, the NCC noted that the Regulator's monitoring powers would need to be directed to preventing the asset owner from securing a capital return in excess of that needed to fund prospective investment requirements and to check that the owner does not earn monopoly profits from the below rail infrastructure to advantage its above rail business.

The NCC concluded that the GRV annuity approach forms an acceptable approach for ceiling test prices because it can broadly prevent monopoly rents being captured by the railway owner.

While it would seem that GRV can provide a valuation method for constraining the maximum pricing of monopoly services so that the constrained maximum approximates the maximum values that would prevail in a competitive market, it should be noted that the comments of the NCC did not portray an expectation that returns under the GRV with annuity framework would equate to returns under a conventional DORC framework.

4. Assumptions Of Major Periodic Maintenance Under A GRV Annuity Approach

Since the commencement of the Regime, there has been extensive debate on the issue of what (if any) depreciation is warranted if assets are to be maintained using a cyclical maintenance program as specified by the Code, and if cyclical maintenance includes major periodic maintenance ("MPM")[5].

The concern is that recovery of both depreciation as a component of the capital cost annuity and MPM is double counting as MPM enables the network to be retained in a fit for purpose condition in perpetuity.

In the case of track maintenance, which is completed via a combination of MPM and routine maintenance, MPM refers to activities which renovate the network to retain it in a functional condition and it is completed on track sectors at intervals of more than one year. MPM can be categorised into variable MPM which includes programs mainly driven by the extent of volume, and fixed MPM where the programs are scheduled more on the time elapsed since previous work than on usage.

In the case of the WA operating environment, the GRV annuity approach, as contemplated when the Code was established, provides the requisite return on capital and return of capital to fund the costs of keeping the railway infrastructure in a fit-for-purpose condition. The GRV

[5] Refer to definitions and discussions of routine, cyclical, and major periodic maintenance in the Costing Principles Determination (issued as a Draft as at 28 June 2002).

approach also assumes that the network is permanently new. As such, it would be an over-recovery and unreasonable for the inclusion of MPM as an operating cost under the regime.

5. Comparability Of Revenue Ceilings Under GRV And DORC Approaches

The following is an illustration of the relative ceilings under GRV and DORC for new assets[6] using the following assumptions:

- All calculations are in real terms.
- No MPM provisions have been allowed under GRV. MPM under DORC is treated as operating expenditure, rather than capital expenditure.
- For both GRV and DORC, routine maintenance and other operating costs are allowed.
- No consideration has been given to reduce any of the costs under DORC as a result of allowing MPM.
- All allowable operating costs are averaged out over the life of the asset.
- Depreciation method for GRV is based on an annuity approach and for DORC a straight-line approach.
- The annuity formula for the GRV calculation has been set for an end of period payment[7].

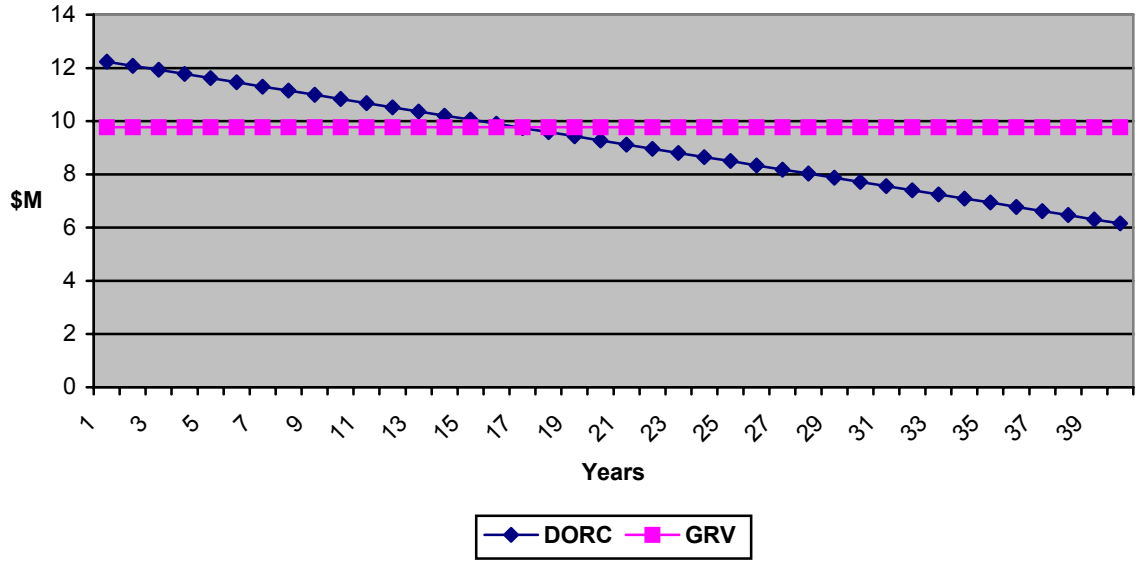
Input Parameters	GRV	DORC
WACC (pre-tax real) / Discount rate	7.8%	7.8%
Route kilometre	100 km	100 km
Opening value of asset	$80 M	$80 M
Economic life[8]	40 years	40 years
MPM expenses per annum ($8,000 per km)[9]	$0	$0.8 M
Routine maintenance per annum ($9,000 per km)[8]	$0.9 M	$0.9 M
Other operating costs per annum ($23,000 per km)[8]	$2.3M	$2.3 M
Opening accumulated depreciation	Not Applicable	$0
Inflation rate	0%	0%
PV over 40 years	**$119.0M**	**$128.8M**
Percent difference [(DORC/GRV)x100]-100	**8.2%**	

[6] Asset values represent new assets, hence DORC = ORC
[7] For a beginning of period payment an allowance for the net working capital position of the infrastructure owner would be required.
[8] The above analysis has been based on a weighted economic life assumption of 40 years for the rail assets. It is made for comparative purposes with that of IPART for the Hunter Valley rail assets. Further details on economic life assumptions can be found in the Regulator's "Draft of the Determination on the Costing Principles to Apply to WestNet Rail', 28 June 2002. In relation to the Hunter Valley, the economic life assumption was consistent with the mine life of the customer the rail is servicing.
[9] The estimated levels of MPM, routine maintenance and other operating costs were based on independent engineering advice.

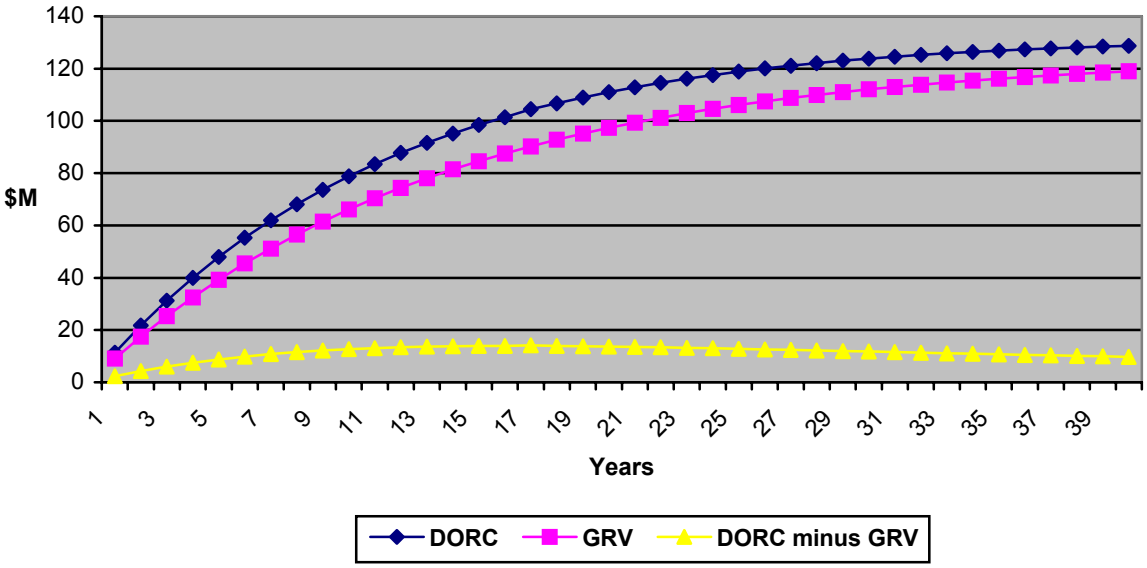
Utilising the parameters in the above table, the cumulative ceiling level for DORC is 8.2 percent higher than that attained for GRV in PV terms.

The results are provided in the following graphs.

Graph 1 – New Assets – Revenue Ceiling in real terms



Graph 2 – New Assets – Cumulative Ceiling Revenue Stream @ 7.8% Discount Rate



The Regulator is aware of the stakeholders' view that the rail assets of the railway owners are not new, and valuing such assets under the Western Australian Railways Access Regime provides railway owners with a much higher discounted ceiling than that which would be attained under DORC.

When analysing this issue, it is recognised that there may be some classes of rail assets where MPM cannot maintain that asset in a "state of perpetuity". For example, assets associated with formation works fall into this category and invariably must be replaced at the

end of their economic life. Under DORC in the example cited above, it has been assumed that some additional capital expenditures, over and above the MPM levels stated, would be required at the end of the economic life of the assets (ie. in year 41). It should also be noted that the accumulated value of MPM at the end of the 40-year assessment period is less than the initial capital investment in the above analysis.

To accurately model a scenario for a DORC approach where the assets are not new at the start requires detailed identification and quantification of the additional expenditures required at the end of the economic life of the asset. However, for consistency with the GRV approach, any reset of economic life under a DORC approach will need to assume that the asset commences as new.

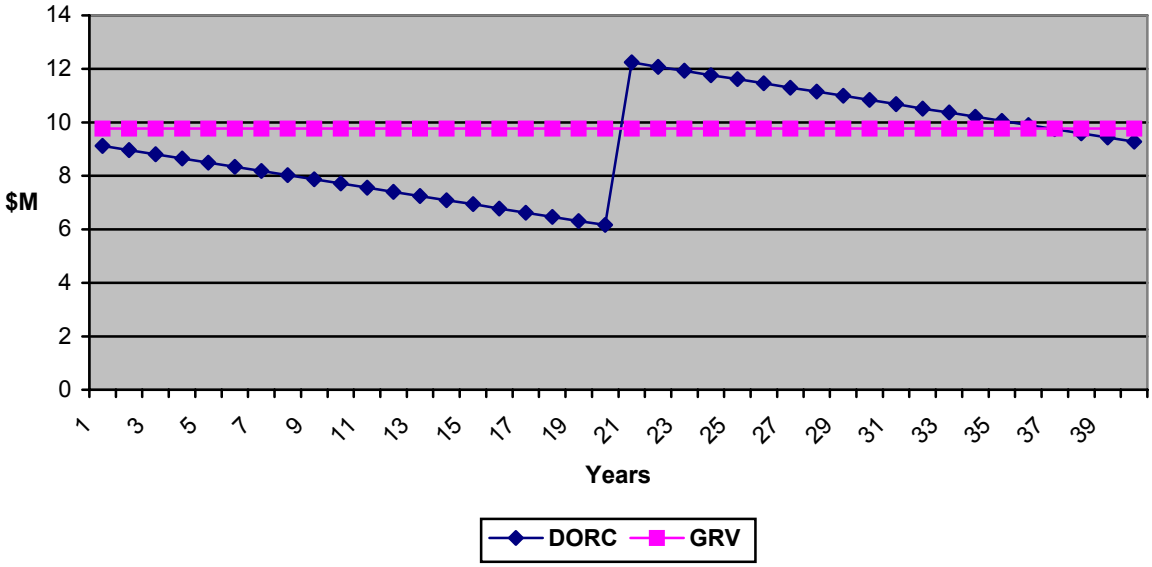
Accordingly, the capital base in the following analysis has been reset to the initial value of the asset (ie. $80 million) at the end of its economic life[10].

The following graphs suggest that when the assets are assumed to have been depreciated for 20 years and the value of the assets is reset (or set to be equal to the initial investment value) in year 21, then the cumulative ceiling level for DORC is 12.1 percent less than that attained under GRV in PV terms.

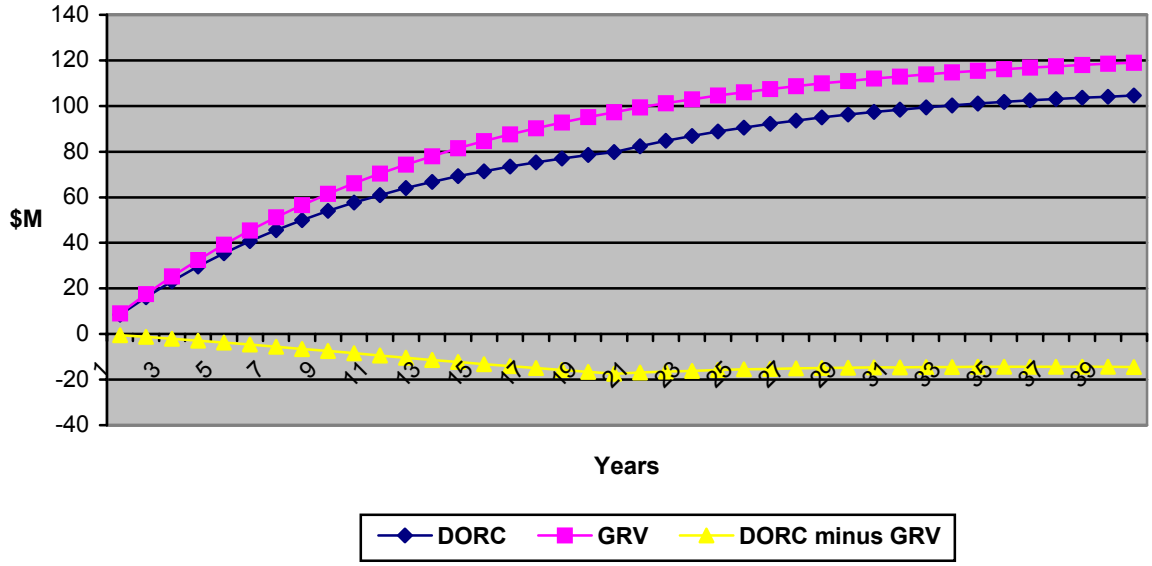
Input Parameters	GRV	DORC
WACC (pre-tax real) / Discounted rate	7.8%	7.8%
Route kilometre	100 km	100 km
Opening value of asset	$80 M	$40 M
Economic life	40 years	40 years
MPM expenses per annum ($8,000 per km)	$0	$0.8 M
Routine maintenance per annum ($9,000 per km)	$0.9 M	$0.9 M
Other operating costs per annum ($23,000 per km)	$2.3M	$2.3 M
Opening accumulated depreciation	Not applicable	$40 M
Inflation rate	0%	0%
PV over 40 years	**$119.0M**	**$104.6M**
Percent difference [(DORC/GRV)x100]-100	**-12.1%**	

[10] It is recognised that a more appropriate approach to resetting the capital base would be to deduct the accumulated MPM expenditures at the end of economic life from the opening value of the capital investment (ie. $80 million less $32 million in this analysis) and then using this value as the opening value at the beginning of the second asset life. An alternative approach would be to have a MPM profile consistent with that required for equating the accumulated MPM at the end of economic life with the initial value of the capital investment. This means that should the asset be further required after, in this example, 40 years that a capital injection is not needed in year 41.

Graph 3 – 50% Depreciated Assets – Revenue Ceiling in real terms



Graph 4 – 50% Depreciated Assets – Cumulative Ceiling Revenue Stream @ 7.8% Discount Rate



What if the annuity formula is used for DORC?

As indicated previously Australian jurisdictions regulating infrastructure assets calculate cost of service using a DORC approach to value assets and straight-line depreciation.

When using a DORC methodology for estimating the cost of service, the capital costs can be estimated using two different approaches. One approach is to apply a WACC to the asset value to calculate the return on capital and calculate depreciation using a straight-line approach. The other approach is to calculate an annuity which implicitly includes a return on capital and return of capital

It is important to note that while annual revenue streams differ when using the two approaches, the PV of costs over the economic life of the assets for both approaches is the

same. This assumes that MPM is included in both approaches and is treated as operating expenditure.

6. The Comparative Stability Of Revenue Ceilings Under GRV And DORC Approaches

During the development of the WA Rail Access Regime, it is understood that ceiling stability was viewed as a desirable feature for access seekers as it enables better budgeting and reduces business risks. It was felt that ceiling stability would also reduce the administrative costs for regulators and simplify management of the Over-payment system.

The degree of ceiling stability is impacted by factors such as proposed CPI indexation, volume fluctuations and revaluations. The cost of service calculation as prescribed in the Code is considered by some to have the advantage of price stability, as the annuity component of the assets[11], and annualised operating expenditures is constant for the life of the asset[12]. While operating cost are likely to rise broadly in line with movements in wages and rail material costs, capital costs are the largest part of the ceiling cost and hence price stability is theoretically better.

However, in comparative terms the stability of the ceiling price calculated using the Code's GRV annuity approach over the DORC approach as used in other jurisdictions is minimal as:

- Customers pay the prices specified in their access agreements and prices change in accordance with the escalation and efficiency gain sharing provisions of any agreement. Thus if a customer seeks zero price volatility this could be accommodated regardless of the movement in ceiling costs. The ceiling test price is likely to be referenced only periodically as part of the contract re-negotiation for existing volumes and for new volumes.
- Under both the GRV and DORC approaches, ceiling costs are likely to require resetting following any material volume fluctuations.
- If relatively few customers are paying at the ceiling then the relative stability of the ceiling is not likely to be a tangible benefit.
- The Regulator has proposed that ceiling costs be adjusted by CPI-X at the first and second anniversary prior to completing a full evaluation and re-estimation of operating costs every three years.
- MPM expenditures under DORC when annualised will reduce the anticipated fluctuations from year to year.
- "Smoothing" can be undertaken under the DORC approach to provide a desirable price path over the economic life of the asset.

Overall, the Code's GRV annuity approach is likely to have some theoretical modest ceiling stability benefits over the DORC approach, however in practice the comparative stability benefits will be minimal.

7. Conclusions

This paper is an attempt to compare:

- the prescribed GRV asset valuation methodology with capital costs calculated using an annuity as specified in the ceiling test of Schedule 4, clause 8 of the WA *Railways (Access) Code 2000*; and
- a DORC valuation method with capital costs calculated by straight-line depreciation and a rate of return on the DORC value.

[11] An annuity can be described as levelising the cost of an asset over the life of the asset taking the time value of money into account.

[12] The Code also requires that allowable operating costs be evenly spread over the maintenance cycle.

The paper is not intended to question the use of GRV in the Western Australian Railways Access Regime. The GRV system is provided for in legislation and the Regulator does not have the power to use an alternate valuation method for setting the revenue ceiling. Every endeavour has been used to ensure that the data incorporated in the model is appropriate.

The underlying model to this analysis is available on the WA Rail Access Regulator's website (www.railaccess.gov.au) and stakeholders may test the model by varying the assumptions used.

The key overall conclusions of this paper are:

- The cost of service calculated on the basis of a GRV for assets using an annuity approach (maintaining perpetually new assets) to compensate asset owners for capital costs can provide a reasonable methodology that can be used in a ceiling test to restrict the ability of the owner to extract monopoly rents.
- Comparability between the cost of service calculated using the Code's GRV annuity approach and a DORC approach, as used in other jurisdictions, will be dependent on the extent to which the existing rail assets are depreciated and the assumptions used (ie. discount rate, components of operating expenditures, economic life of the rail assets).
- The GRV approach, in theory, is likely to have some modest ceiling stability benefits over the DORC approach, however in practice the comparative stability benefits will be minimal.
- Comparable outcomes do not mean that the results attained under the Code's GRV approach and a DORC approach are exactly equal.

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