

CONDITION BASED DEPRECIATION - THE QUESTIONS

by

Dr Penny Burns, Director, Infrastructure Economics
and Editor, *Asset Management Quarterly*

Why Condition Based Depreciation?

What do irrigation farmers in the Goulburn Murray, road engineers in Ipswich and building managers in Canberra have in common? The answer is that for all of these very practical people, condition based depreciation makes sense in a way that traditional formula depreciation does not.

The irrigation farmers distrust traditional formula depreciation because to their mind it is looking backwards and just an accounting device to put up prices. CBD, on the other hand, is demonstrably forward looking and designed to maintain the viability of the major asset on which their livelihood depends.

The road engineers daily witness the degrading effect that undermaintaining has on the road asset and depreciation formulas that ignore the level of maintenance make no sense to them. They recognise that condition based depreciation, linking maintenance and depreciation, makes depreciation a valuable tool in managing road services.

The building managers, faced with the necessity to reflect the value of buildings under new accrual accounting requirements, are concerned that traditional formula depreciation clearly understates asset values - and correspondingly overstates future requirements. Condition based depreciation adopts a systematic, replicable, auditable approach to reflecting written down valuations that are equivalent to the market based "depreciated values" of the Valuation Office.

Why CBD is recommended for Infrastructure Assets.

All of these users - and CBD is in use in the irrigation area in Victoria and the roads area in NSW, and pilot studies are being prepared for Canberra - are faced with the problem of depreciating *infrastructure* assets.

Infrastructure assets are assets which are not so much *replaced as renewed*. They may be *facilities* such as buildings and accompanying services, carparks, etc, or *utilities* such as power generation, water filtration, or *networks* such as roads, sewers, transmission lines.

There are two common features of all of infrastructure assets. One, they have long and indefinite lives and that, contrary to ordinary assets, they are generally not scrapped or sold off and replaced with a new asset, but rather their lives are continuously extended through judicious renewal of worn or obsolete elements. Two, the demand for infrastructure assets changes only very slowly. It is this second feature which makes it economical to renew (rather than scrap and replace with something else.)

Every now and then, an asset - say, a road - may be decommissioned. The effect of this is to change its indefinite life into a definite one. When this happens the asset ceases to be an infrastructure asset because it no longer has one of the two essential qualities - an indefinite life. The road is "written off" over the period of life remaining after the decision has been taken to decommission it. And similarly with other infrastructure assets which are given a definite end point by an administrative decision. Until such time as a decision is made, however, the management approach is to continuously extend life by renewal.

Applying traditional formula approaches which result in the asset being progressively written down until some point in its life in which it is replaced, misses the point with these infrastructure assets. They are not progressively written down. Periodically, some of the run-down in value that has occurred is made good and the written down value actually increases relative to the replacement value. Formula depreciation methods cannot cope with this. Rather we need a method of depreciation that reflects this change in the condition of the asset.

So What is CBD - and how does it fit with the accounting profession?

There is still some ambivalence in the accounting profession about the nature and purpose of depreciation. Is it an allocation of cost, or is it a decline in value?

CBD accepts the proposition that depreciation is a decline in value. This is in line with the move away from the old "stewardship" notion of accounting to the current "management" thinking. Stewardship is concerned with accountability for things past, management puts the emphasis on decisions to be made for the future.

Accrual accounting is part of the move towards management thinking, rather than stewardship. Assets really come into focus with accrual accounting. Assets may be defined as “a store of future services” (the accounting definition is longer but basically this). The value of the asset becomes the net present value of this future store of services. It is then natural to regard depreciation as the using up of services and a measure of the consequent reduction in value.

Condition based depreciation considers the most appropriate measure of this reduction in value is the cost of restoring it. Thus, the Road Traffic Authority in New South Wales has developed a policy - shortly to be adopted by all road authorities - that the cost of restoring a road to “almost” new condition shall be the measure of accumulated depreciation and deducted from the replacement cost to establish the writtendown value. Changes in the level of accumulated depreciation from year to year represent the annual depreciation figure.

The RTA have a provision for asset restoration which represents the cost of restoring the condition to “almost” new and a separate “provision for asset renewal” which takes into account the fact that whilst demand and technical changes occur only slowly so that obsolescence is not a major factor in road values, nevertheless it does occur. The Provision for Asset Renewal at this stage is by way of note only and is set at 1% of replacement value. The two provisions taken together constitute the depreciation element. The Victorian irrigation industry operates in a similar manner but there is no equivalent to the PMS (Pavement Management System) for irrigation assets and future cash flows for asset restoration are estimated over a reasonable period (say 15-20 years) using a combination of condition inspections and life cycle modelling and the annuity that would yield this cash flow is taken as the depreciation for the period. Annuities are recalculated on a forward rolling basis.

Because of the use of annuities to determine depreciation, this is sometimes referred to as the “infrastructure annuity” approach. Because it focuses on renewal rather than replacement, it is also sometimes called the “renewal accounting” approach - although it is important not to confuse the forward annuity approach with the older, and discredited, method of simply expensing all replacement activity as it occurs.

Advantages of CBD over Traditional Formula Depreciation

Applying traditional formula depreciation to infrastructure assets creates many problems. Formula depreciation requires a definite life estimate, not an indefinite one. Furthermore, the age of the asset has to be known in order for the calculations to be made. But what is the age of an asset where one part is, maybe a hundred years old, and another part was renewed yesterday? And where the overall life span may be so long that the date of many renewals will have been lost from the records?

Advantage 1. CBD does not need economic life estimates nor age.

Advantage 2. CBD does not overstate depreciation in the way that straight line methods do.

CBD can be applied even when age is not known, which is a great advantage. The reason it can do this is that CBD uses residual life calculations rather than economic life calculations. Residual life is an estimate of the remaining service potential. That this is generally not equivalent to some arbitrary economic life minus current age is well demonstrated by the work done by the Australian Valuation Office for the ACT estate.

Examples of AVO's Depreciated Replacement Estimates

school 1:	age: 30yrs:	current replacement:	\$5.68m:
		depreciated replacement:	\$2.58m
school 2:	age: 23yrs:	current replacement:	\$6.85m
		depreciated replacement:	\$4.0m
school 3:	age: 26yrs:	current replacement:	\$6.73m
		depreciated replacement:	\$3.62m
residence:	age: 50yrs:	current replacement:	\$100,000
		depreciated replacement:	\$54,000
city health building:			
	age: 18yrs:	current replacement:	\$23.5m
		depreciated replacement:	\$17.0m
childcare centre:			
	age: 20yrs:	current replacement:	\$690,000
		depreciated replacement:	\$500,000

If either of the standardised approaches (depreciation replacement cost (total life), or written down replacement cost (residual value)) were applied to the above examples, using a 40 year economic life, the amount of depreciation allowed would be far greater than the difference between the replacement value and the written down value.

Moreover CBD avoids problems associated with traditional methods of depreciation when age is unknown - or, in the case of major refurbishment, difficult to determine. Age is not necessary to a depreciated replacement estimate and it is not necessary for CBD.

In essence what CBD does for buildings is what the valuer does - it estimates the net present value of the cost of restoring the building to as new and deducts the amount from the as new replacement cost. The valuer does this by reference to other market sales and instinctively. CBD, with its use of asset management plans, does it in a way which is systematic, objective, replicable and auditable.

Advantage 3. CBD recognises the interlinkage between individual components of infrastructure assets and in doing so produces a depreciation figure that is more relevant, credible and useful.

Traditional formula based depreciation overstates by failing to recognise that value is “built back in again” by the process of component renewal. The reason why the valuer gives higher values than the straight line depreciation formulas is that the valuer recognises the value that has been built back in.

To try to overcome this, accountants have tried to treat each component as an asset in its own right, with its own depreciation schedule. This does overcome a lot of the problem - but at the expense of recognising the interlinkage between the individual components. The life of one component is frequently heavily dependent on the lives of the components with which it interacts. This means that determining the “life” of a component independently is an accounting fiction and management information is lost or distorted.

The component-as-asset approach is very common - and is highly resource intensive. It results in lists of assets and asset lives which have no purpose other than to produce a depreciation figure for the balance sheet.

The use of CBD results not only in a more relevant figure, but also a more useful calculation process - one that generates a tool (not a list) that is useful for guiding and/or monitoring maintenance processes. Because it is a spinoff from management information and not separately calculated, CBD also produces a more credible result.

Advantage 4. With CBD, depreciation is linked to maintenance and an optimised renewal program.

The asset management plan that underpins CBD, is not merely a list of renewal activities, it is an *optimised* list of renewal activities. The AMP considers a range of maintenance/replace/modify options and chooses the set of options that provides the lowest life cycle cost option. If maintenance is not carried out at the appropriate level - say, because of funding constraints - the impact of the lack of maintenance is reflected in higher costs elsewhere in the system in order to maintain the same level of service output (or else a reduction of service output itself which also has costs).

The RTA's Pavement Management System (PMS) is basically an engineering tool. The RTA's Engineers, on an annual basis, provide estimates of current costs to reconstruct each road and through the technical and financial modelling capabilities of the PMS are able to assess the amount of expenditure necessary to restore each road segment to “almost” new condition. The PMS modelling capability considers a variety of options and optimises.

During 1990/91, the first year the RTA actually accounted for and disclosed network depreciation, the Authority expended an amount of \$444 million in connection with the maintenance of the Classified Road Network. In addition, and in recognition of the future outlays required, the Authority made provision of \$351 million in the accounts for the deterioration of roads which occurred during 1990/91 and which was expected to be restored in the due course of future maintenance programmes. This amount represented the extent of deterioration in the Road Network condition over that 12 month period.

With the irrigation farmers, depreciation based on a stated, justified and optimised future renewal program calculated to maintain the viability of the asset, is more acceptable as part of a charging regime for they can not only see what the money is for - but monitor that it is actually being used for that purpose, using the asset management plan.

Advantage 5. CBD provides a tool - and an incentive - for addressing asset deterioration

RTA reports that there is a clear link between road condition and the level of maintenance expenditure. In the period 1990/91 to 1993/94 annual maintenance expenditure increased substantially. During the same period the annual Provision for Asset Restoration expense decreased from \$351 million (1990/91) to \$23 million (1992/93) to a condition improvement of \$320 million (1993/94). The 1993/94 result indicated that for the first time some of the accumulated deterioration from previous years has been reversed. As at 30 June 1994 the Provision was estimated at \$570 million which represents the total decrease in the road condition since 1989/90 when Authority infrastructure was first capitalised.

What would the cost to consumers have been had the road network continued to decline at its previous \$350 million per annum rate? And what incentive would the powers that be have had to correct the situation if (a) they were unable to measure it and (b) unable to measure the extent of their intervention? "What gets measured, gets managed" applies to depreciation and the management of assets just as much as it does to other areas of management. It also follows that if the measures respond to management actions, they are meaningful measures. Measures that do not, such as formula based depreciation, are ignored.

So what are the disadvantages/ problems of CBD?

Ok, you say. So what are the disadvantages? The major disadvantages at this stage are problems that have yet to be resolved. Most of these can be overcome in some satisfactory way but will take a bit of time, or effort. The effort will be worthwhile but cannot be shortcircuited.

Some problems are concerns that can reasonably readily be accommodated. For example, the following issues have been identified:

Recognition of technical or commercial obsolescence - the failure to recognise the impending technical or commercial obsolescence of an infrastructure asset may give rise to much larger write-offs of asset values than might be the case under traditional methodologies. This is true and can be handled in one of several ways:

- a separate provision for asset renewal can be established to cover the obsolescence aspect, as has been done in the RTA
- where assets can be valued "at market", obsolescence of both a technical or a commercial nature, will be picked up in a reduction of the market price. To deduct a provision for asset renewal from this market price would be to double count. Thus obsolescence provisions are not need, nor should be provided, for assets which are market valued (as, for example, buildings).
- or, technical and commercial obsolescence can be ignored until it becomes clear that the asset has a limited life because of obsolescence and then the value of the asset can be written down over the remaining years of the asset's life. This may result in higher depreciation over this period than would otherwise be the case but this could well be preferable to overstating depreciation all the time which is the result of traditional formula depreciation.

Life-cycle analysis experience - it has been suggested that many infrastructure assets will outlive the working lives of their creators and, potentially, a number of their maintainers. This must also give rise to the ability of those people to accurately assess the life-cycle of the asset, and its maintenance requirements, being called into question. Is there empirical evidence to support the adoption of a methodology which has life cycle analysis as an essential part of the computation? This will be particularly significant to auditors, who often have to rely on the work of experts to satisfy themselves about the nature of the material they have been asked to audit. Although an auditor may rely on experts employed by the business he/she must assess the objectivity of such experts and their level of skills and expertise. The availability of alternative experts may be a problem.

This problem too has several parts to the solution.

- Estimating the requirements for maintaining an asset twenty years out is, in fact, a far less demanding exercise than estimating the time at which the asset will no longer be capable of functioning economically, which may be 80 or more years out!
- Demanding accuracy in the assessment of life cycle analysis is to demand more accuracy than is presently required in the very broad life estimates which are assigned to infrastructure assets.

- Nevertheless there is empirical evidence to suggest that the CBD method, which uses both condition inspection and life cycle analysis for its development, is an appropriate tool - and that is the relationship of depreciated value to replacement value, which indicates that the current SL depreciation methods are not only inaccurate, but biased towards overstating depreciation and understating asset value. CBD figures, by building back in the restoration work carried out on an asset, are automatically closer to the valuers estimates than the traditional depreciation formulas. They may not be "100% accurate", however that may be defined, but they are better than what we have at present.
- Engineering consultants can be used as technical auditors. What needs to be checked in an AMP are the life assumptions and maintenance consequences and these are engineering functions. A class of technical experts would develop if there was a demand for them and they would be drawn from the engineering field.

Lumpiness of expenditure. Even though a 20 year time frame may be used for assessing the maintenance and capital renewal requirements of infrastructure assets, there is the potential for significant errors to be part of the assessment, either under or over assessment of funding requirements. The use of a rolling annualised present value does mitigate the potential to a certain extent, but both accountants and auditors will need to ensure that the estimates are relatively sound. This problem will be more pronounced for emerging technologies.

Again, a true statement with a range of solutions:

- Even if the maintenance and capital renewal requirements are perfectly accurately assessed, there may well be scope for changing the predictions as further information comes to hand or technology and opportunities change. With the rolling annualised methods adopted, these changes will automatically be built into the depreciation calculation. However, with a 20 year period the impact of even a very large alteration will naturally be muted. With the alternative of traditional formula depreciation, however, any error made in assessing economic life is likely to remain in the system and not be adjusted simply because the processes for adjustment are not institutionalised as they are with CBD.
- It is true that accountants and auditors will need to ensure that the estimates are relatively sound. And this can be done by (a) ensuring by way of a technical audit that the assumptions made are reasonable ones (ie if the assumption says the life of a component is 10 years, is this reasonable?) and (b) ensuring that the costs and benefits of all activities are recorded and correctly modelled.

There are two further issues that are particularly a problem with current accounting standards and methodologies:

Provision for asset restoration - it is proposed that where maintenance and renewal capital expenditures in a particular year is less than the assessed annualised present value of condition based depreciation that the difference should be set aside as a provision for future asset restoration. Such a provision, which portends to be a liability for future asset restoration, does not meet the test which is currently applied to determine a liability. One leg of the test is that there must be an obligation to another entity to sacrifice future economic benefits (pay money!) as a result of some past transaction. There is no obligation to anyone to carry out what are potential future works. The thinking behind the existing accounting standards is that liabilities should only be shown in the statement of financial position where they are crystallised, to prevent management of businesses making provisions for expenditures which are unlikely to occur. A secondary consideration is the aspect of reliable measurement of the quantum - how accurate is a 21 year present value calculation.

- This is a issue that really needs resolution. Until it is done, accrual accounting fails in the basic “matching principle” that expenses in one period should be matched with the benefits of those expenses regardless of whether the benefits occur then or later.
- If it is accepted that managers of infrastructure assets are required to maintain the viability of their assets indefinitely (and remember that if the asset has a stated definite life it is not an infrastructure asset attracting CBD for the purposes of this exercise) then preventing the run down of assets is a liability (or responsibility) of management regardless of whether the potential recipient of the expenditures has been identified and regardless of whether the contract has yet been written which makes it an obligation under current accounting rules.
- Maybe we need a change in the rules?
- As for accuracy of a 21 year present value calculation - how accurate are life estimates and values now? I would suggest that they are not any more accurate.

Inclusion of maintenance expenditure - the inclusion of maintenance expenditure as part of the ‘value’ of the asset needs to be carefully assessed. The principle for including expenditure as part of an asset is that the expenditure has increased the service potential of the asset. Some maintenance may not meet that test, although there is potential to argue that not carrying out the maintenance will decrease the service potential of the asset.

In response to this, it may be said that maintenance expenditure is not included as part of the value of the asset. When the maintenance is expended it is simply that the asset value fails to decline, as it would without it.

There is one aspect of CBD that could be regarded as a disadvantage and that is CBD gives rise to non-constant depreciation figures. Because depreciation is linked to condition degradation it will vary according to the level of maintenance applied or any particular heavy use or abuse. Thus depreciation will not be constant. This, however, is only a problem if depreciation is interpreted as an allocation of costs rather than a representation of the decline in value of the asset, and CBD does not do this.

Where to now, or issues for resolution.

Because CBD is relatively new, there are a number of issues that do require resolution and not the least of these is the treatment of depreciation in the accounting standards.

These include:

- applicability of the concept outside the roads area and the water industry where it has already been applied
- authorities with large future expenditures may accumulate large cash reserves in intervening years creating a management problem - while CBD, because it does not overstate depreciation, creates less of cash reserve than would the charging of traditional depreciation, this could be a problem for agencies which have not previously recovered depreciation as a charge. Whilst it is not, primarily, an issue to do with CBD as such, since it would apply to any depreciation charge recovery mechanism, nevertheless it will need to be addressed.
- taxation implications - as more and more agencies become subject to tax or taxation equivalents, the issue of the taxing of depreciation provisions becomes important
- there will be continued pressure (particularly from a pricing and performance aspect) for all forms of reporting of "depreciation" to be consistent. Recognition of the difference between infrastructure assets and non-infrastructure assets will thus be important to establishing a sound basis for depreciation charges that is consistent over agencies. However one needs to query whether consistency should take priority over relevance for sound decision making.
- improvements are required in development of asset management plans, particularly involving the optimisation of maintenance levels and in training personnel in their development and use.
- there will continue to be short term financial performance and pricing pressures with accompanying implications on provisions for maintaining longer term service delivery capability - pressures that will be easier to address with CBD than without it.
- there will be continued debate over the accuracy and applicability of both the conventional method of determining depreciation, especially for assets with

long lives and associated lumpy expenditure, and the newer CBD. This debate will be a healthy one if it focuses on measures for improving the accuracy of CBD rather than the finer and finer division of components of long living assets which has been the practice with traditional depreciation, generating much work but little of real managerial significance.

- acceptance by the Office of the Regulator General, Department of Finance and Auditor General's office. In this respect it is worth noting that the Government Pricing Tribunal in NSW has favourably viewed CBD and the Auditor-General's Department in New Zealand is actively endorsing it. This could, therefore, be resolved by increasing the exposure and debate.

In summary, Condition Based Depreciation is a viable, and preferable, alternative to Traditional Formula based depreciation for infrastructure assets.

It has numerous advantages, viz:

- *CBD does not need economic life estimates nor age.*
- *CBD does not overstate depreciation in the way that straight line methods do.*
- *CBD recognises the interlinkage between individual components of infrastructure assets and in doing so produces a depreciation figure that is more relevant, credible and useful.*
- *With CBD, depreciation is linked to maintenance and an optimised renewal program.*
- *CBD provides a tool - and an incentive - for addressing asset deterioration*

It has been successfully applied so far in the roads area and in the water industry both here and overseas, and it is being considered for application by the ACT for its building estate.

A number of objections have been raised. None cannot be resolved. Some, particularly those involved in the way in which the accounting profession currently treats depreciation provisions, may take a little time and effort - but the end result would be so far superior to that which we currently have that the effort has to be worth making.