Getting Depreciation Right

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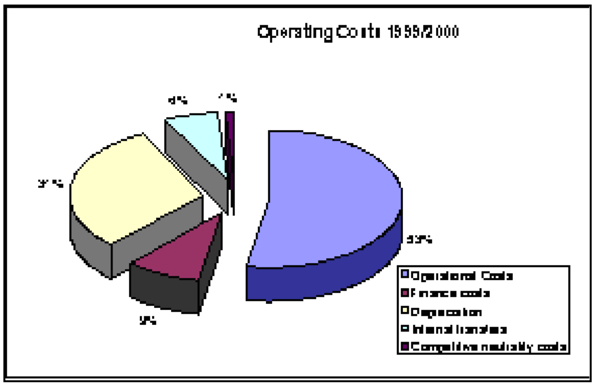
This paper is written form the perspective of utilities supplying services which require large infrastructure networks which typically have long lives.

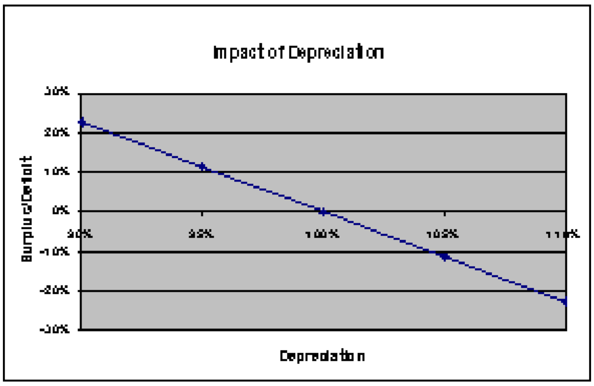
What have we learnt from the past?

The Bottom Line

- Depreciation expense can representative over 70% of the operating costs of utility businesses

The following example illustrates the impact on the bottom line of depreciation expense. As shown , after operating costs, depreciation expense is the next most significant business cost. Each percentage variation in depreciation expense has approximately double the impact on the operating surplus/deficit.





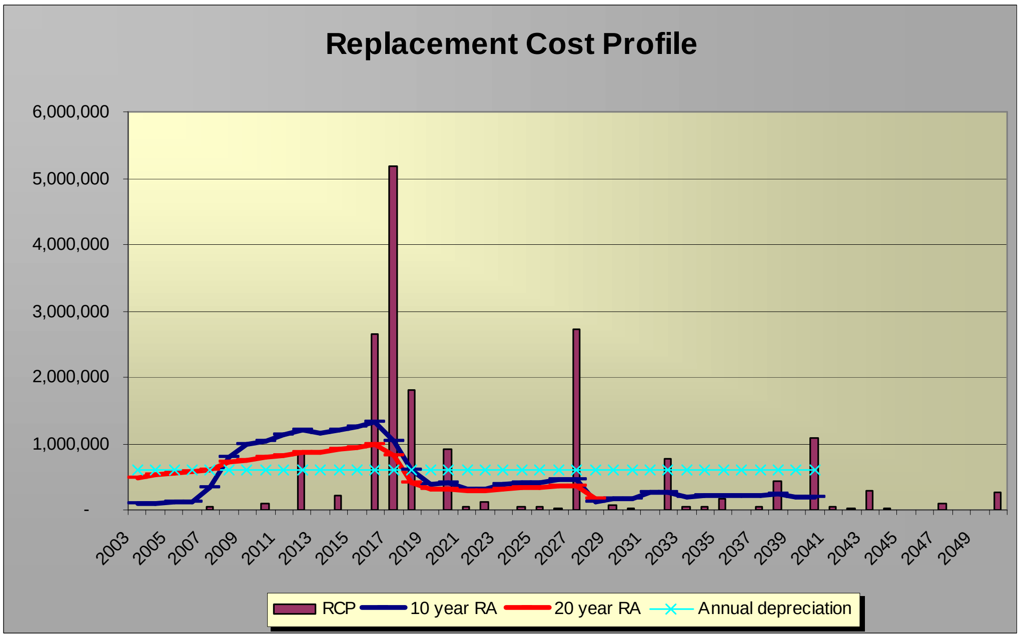
Example of Impact of Depreciation

- Variations in estimates useful lives, rates of consumption of service potential (depreciation) or residual value of infrastructure can have a major impact on the operating costs of an entity.

Impact on Pricing

- In regulated industries, depreciation expense can have a significant impact on pricing.

Regulated utilities have to justify price increases to industry regulators. Renewal annuities are increasingly being used in lieu straight line depreciation as the measure of asset consumption utilized in pricing models.



Example Replacement Profile and Replacement Annuity

Strategic Asset Management

- Asset accounting should support a strategic asset management approach.

The approach is based upon two key principles:

1. specifying the services required and the service delivery standards in consultation with the customer which meet financial, environmental and stakeholder needs; and
2. cost-effective provision and maintenance of appropriate infrastructure to deliver these requirements documented in an asset management strategy.

Development of an asset management strategy involves:

- identification of the customer's needs and expectations with respect to services required;
- translation of these needs and expectations into performance requirements;
- identification of the capacity, condition and operational characteristics of the infrastructure which will achieve and sustain these performance requirements; and

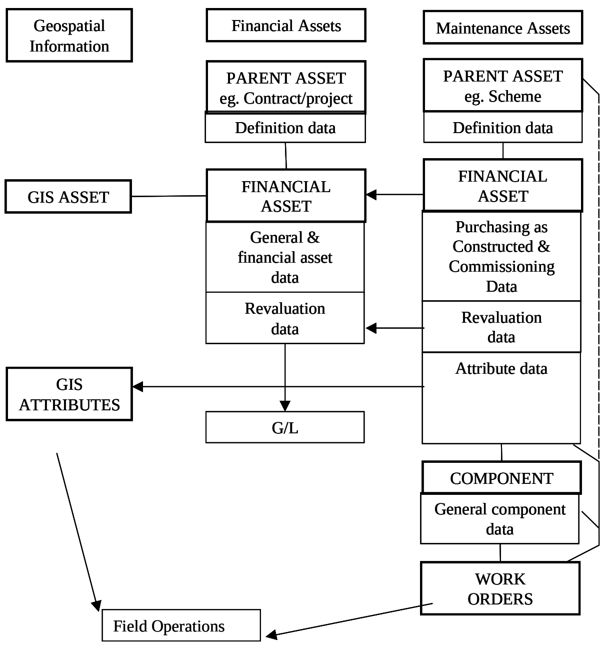
- supply, management and disposal of this infrastructure throughout its economic life, recognising the implications for current and future resources, people and the environment.

Operations

- Asset accounting should align with company operations.

Financial asset registers and engineering asset registers should align to ensure that any changes made during operations are reflected in the financial accounts.

Alignment of Financial and Maintenance Asset Registers



Example Alignment Financial and Maintenance Asset Registers

Financial asset registers do not need to be disaggregated to the same level as registers used to maintain and operate assets. The optimum level of disaggregation is the minimum level that recognizes the different service potential of different classes of assets.

For example a pump station, the minimum level of disaggregation would be:

- Civil structure
- Mechanical equipment
- Electrical equipment
- Communications equipment
- Siteworks

Each of these asset classes have different asset lives.

Changing Accounting Standards

- Drivers of change
  - Alignment public and private sectors
  - Alignment with international accounting standards

- New Australian Accounting Standards

The Australian Accounting profession is in the process of adopting the International Financial and Reporting Standards (IFRS) for all reporting periods commencing on or after 1 January 2005. For the valuation of infrastructure assets for ‘not for profit’ entities the appropriate IFRS standards are:

- AASB 116 “Property Plant and Equipment”
- AASB 136 “Impairment of Assets”

- **AASB 116 Property, Plant and Equipment** is the current standard applicable for the recognition and depreciation of infrastructure assets.

- AASB 116 defines depreciation as:
    - Depreciation is the systematic allocation of the depreciable amount of an asset over its useful life.
- AASB 116 requires that each significant part of an item of property, plant and equipment is depreciated separately.
    - Infrastructure assets are broken down into significant components with similar physical and operating characteristics.
    - A separate useful life is applied to each component and they are depreciated separately.
    - The depreciable amount of an asset is allocated on a systematic basis over its useful life.
    - The residual value and the useful life of an asset are to be reviewed at least at the end of each annual reporting period and, if expectations differ from previous estimates, and if impacts on the carrying amount are significant, appropriate adjustments to accounts are made.
    - The depreciable amount of an asset is determined after deducting its residual value. In practice, the residual value of long-lived infrastructure assets is difficult to forecast with any confidence and is usually set as zero. An exception are road assets where the pavement will have significant residual value.

- **AASB 136 Impairment of Assets** is concerned with ensuring that assets are not carried in the accounts at more than their recoverable amount.
- **On an annual basis**, each entity needs to review the current recoverable amount of its assets in accordance with AASB 136 “ Impairment of Assets”. That Standard explains how an entity reviews the carrying amount of its assets, how it determines the recoverable amount of an asset, and when it recognises, or reverses the recognition of, an impairment loss.

Role of the Valuer

- The role of the valuer in undertaking infrastructure valuation for ‘not for profit’ entities consist primarily of three roles:

1. estimation of ‘fair value’;
2. review of useful lives for each asset class; and
3. review of remaining useful life for each asset

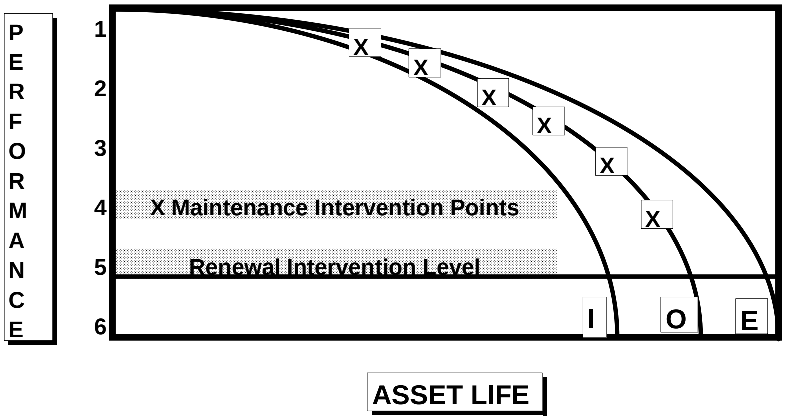
- Fair value is the amount for which an asset could be exchanged between knowledgeable, willing parties in an arm's length transaction.
- For infrastructure assets where no market exists, 'fair value' is estimated at depreciated replacement cost.
- For infrastructure assets, useful life is defined in terms of the asset's expected utility to the entity.
- The estimation of the useful life of the asset is a matter of judgement based on the experience of the valuer and the entity with similar assets.
- Determination of remaining useful life is a critical input in the determination of depreciated replacement value.

How is service potential actually consumed?

Asset Manager's Perspective

- One of the main objectives of Strategic Asset Management is to minimise the whole of life cost of an asset while maintaining service standards.
    - To achieve this objective, intervention points need to be determined for maintenance and renewal activities.
    - It is not possible to define the economic useful life of an infrastructure asset without reference to the adopted maintenance strategy (including both routine and repairs/renewals)
    - The concepts are illustrated below. Maintenance ensures that the asset service capacity continues to be available for users.
    - In practice this requires ensuring that the performance or service level provided by the asset is at least above the minimum standard required by the user.
    - Note however, that maintenance cannot prevent the inexorable underlying decline of assets and eventually when the performance falls below what the user requires, asset renewal is required. For example, any physical asset will deteriorate even without any use. Cars for example need to be operated regularly to stop them seizing up and the battery going flat.
    - Infrastructure assets (unless they become commercially or technically obsolete) are not so much replaced as renewed. For example, bitumen reseals renew the running surface of roads by replacing the existing bitumen which oxidises over time.

Asset Deterioration



Maintenance Level I (inadequate) O (Optimal) E (excessive)

Example Asset Deterioration

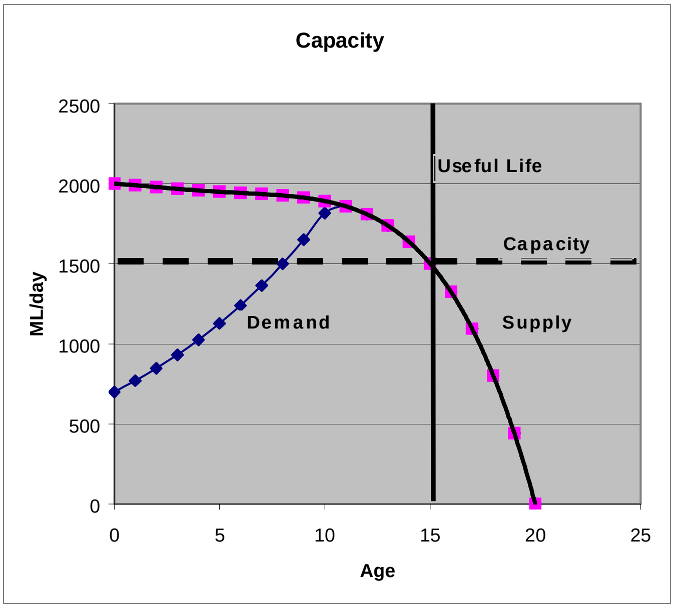
- Infrastructure assets deteriorate gradually over time and ultimately "fail".
  - Failure in asset management terminology does not necessarily mea physical failure.
  - Failure means, that the asset can no longer deliver the services required either physically, economically, safely or reliably.
    - With respect to physical deterioration, the rate of deterioration or "expected wear and tear" is determined by the various environmental factors under which the infrastructure asset operates.
    - The impact of these factors may cause the rate of deterioration over time to be non uniform and to vary from the expected.
  - There are many ways that an asset can fail.
  - The Asset Manager needs to know the likely failure modes and the indicators of each failure mode.
  - Failure modes can be broadly grouped into:
    - failures that occur because demand and standards have risen
    - failures that occur because asset performance has fallen.; and
    - failures that occur as a consequence of failure of another asset.

- An asset represents stored service potential.

As illustrated below , the performance of an asset gradually declines over time. The rate of decline is generally non-uniform. Although age is an important factor, environmental factors such as design, construction, maintenance, climate and loading also have a major influence.

Service Potential = Rate of service delivery (capacity)*adopted useful life

When an asset is designed, a design standard commensurate with the anticipated service demands is adopted. For example for an irrigation channel, the required capacity is estimated from current or predicted demand.
The resulting asset represents a service potential to be consumed over the life of the asset. The demand for the services of most assets will grow over a period of time. However, because of wear and tear and asset deterioration, the capacity to supply services will decline over time. Demand is effectively limited by the ability of the asset to deliver at a point in time. Note that capacity not used at a point in time is gone forever. For the example, the effective useful life of the asset is 15 years.



Example Consumption of Service Potential

Accountant's Perspective

- The future economic benefits embodied in an asset are consumed by an entity principally through its use. However, other factors, such as technical or commercial obsolescence and wear and tear while an asset remains idle, often result in the diminution of the economic benefits that might have been obtained from the asset.
- To account for the service potential provided by the existing asset used up to the balance date, the current cost needs to be written down to reflect the service potential available at the balance date.
- A forward estimate is also required of the projected decline in service potential over the following accounting period. This estimate is called depreciation.
- These calculations require estimates of remaining useful life and useful life.
- The determination of written down current cost and projected depreciation is dependent on the depreciation model, which has been adopted.
- To date the straight line depreciation model has been almost universally adopted.

Are there better ways to calculate depreciation?

What is Depreciation

- Under accrual accounting, the cost of a non-current asset is allocated on a systematic basis over the useful life of the asset. The process needs to account expected wear and tear, obsolescence and legal or other limits on the use of the asset. This process is call depreciation.

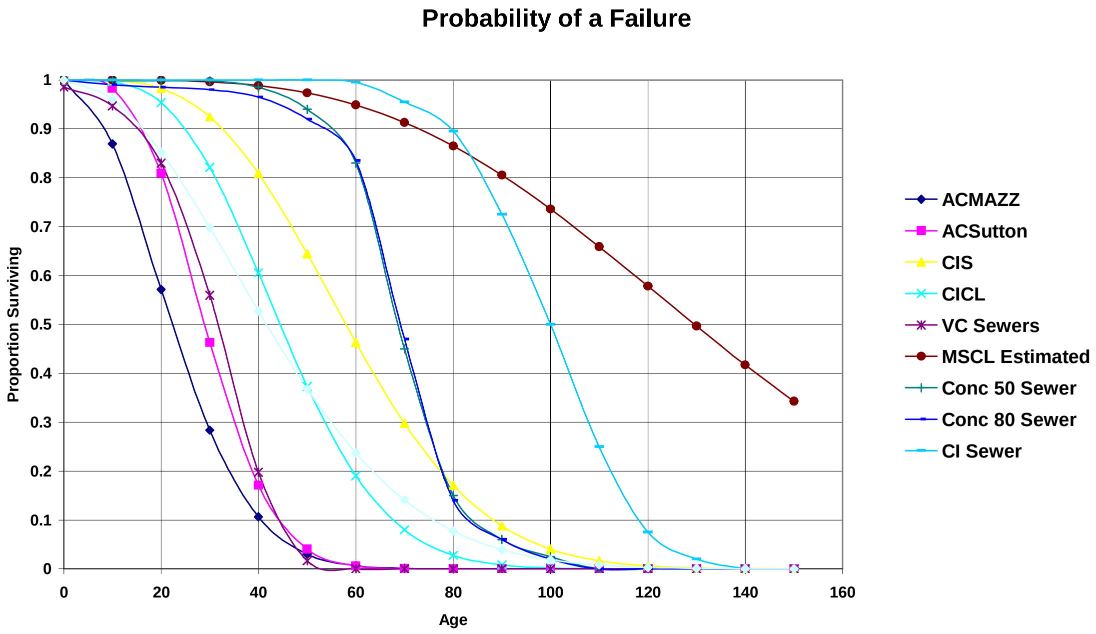
- AASB 116 defines depreciation as the systematic allocation of the depreciable amount of an asset over its useful life. Depreciable amount is the cost of an asset, or other amount substituted for cost, less its residual value.

- To be able to calculate depreciation, estimates are required of cost ("fair value"), useful life and remaining useful life

Useful Life

- A key component in the estimation of depreciation based on AASB 116 are estimates of useful life. There are many ways that an asset can fail. That is, there is a different useful life for each mode of failure.
- In practice, the total life of an asset is the shorter of:
    - The physical life of the asset, given normal maintenance.
    - The economic life of the asset – that is, where the cost of retaining the asset exceeds the cost of renewal/replacement.
    - The technological life of the asset.
    - The life determined by the adopted customer service standards
- Estimates of economic useful life are usually made for assets of the same type, which are subject to the same environmental conditions. When assessing individual assets, this life should be adjusted to reflect local factors.
- Estimates of remaining useful life are undertaken based on an assessment of individual assets.
- Estimates of economic useful life for different asset classes are traditionally based on a consensus of 'expert' opinion. In determining the useful life for a particular infrastructure asset, the valuer needs to assess the likely impact of expected physical wear and tear (and maintenance program to be adopted) and other factors on that particular asset.
- Other factors, which need to be considered by the valuer in assessing useful and remaining useful life, include:
    - Expected changes in regulatory and or environmental requirements;
    - Expected changes in technology;
    - Expected changes in demand for the services; and/or
    - Expected changes in operating conditions.
- Any changes needs to be "reasonably likely" to be taken into consideration by the valuer in the estimation of useful life and remaining useful life and the reasons should be documented in the valuation report. For example, if it is known that a water main will be decommissioned in 5 years, remaining useful life is 5 years regardless of the condition of the asset.
- Having old assets is not a problem in itself. However, as shown below as assets age, the probability of failure increases. The graph gives pipe survivor curves for

various water and sewerage pipeline materials based on literature research. It is the interaction between the pipe survival characteristics, pipe age and the customer



service standards (in terms of pipe breaks and chokes) which determines the intervention point and the "life" of the asset.

Example Pipe Survivor Curves

Remaining Useful Lives

- Determining remaining useful life for each identified asset is a key step in the valuation process.

- Factors to be considered by the valuer include:

  - Asset age (if known);
  - Asset current and projected condition;
  - Adopted customer service standards;
  - Expected maintenance programs;
  - Legal, regulatory, or environmental constraints;
  - Change in demand patterns; and
  - Impact from other assets

- Age has been widely used to date with little assessment of the other factors because of its simplicity. Age alone should only be used in the absence of asset condition and performance data. There are many other factors such as design, construction, maintenance, load and environment that will affect how an asset deteriorates and the ultimate life achieved. Advanced asset management utilises knowledge of deterioration modelling to assess asset factors.

Levels of Service

- Customer charters are increasingly being adopted which set out the performance standards of service to be provided by utility organisations to their customers. Performance standards define the expected standard of service in terms or reliability, availability, quantity, quality, safety, risk and pressure. For example, road management plans which specifiy service level targets are mandated under State legislation in Victoria. In Queensland, all water service providers have customer service charters and Strategic Asset Management Plans.

- Standard of service or performance standards describe what the asset users want it to do and are used to describe the service level target adopted. The standard of service adopted needs to anticipate and allow for the natural deterioration processes and represents a minimum performance standard over the life of the asset When an asset deteriorates below the designated standard of service it needs to be renewed. The life of the asset is effectively over at this point, even though it has not totally physically failed.

Key Service Characteristic	Customer Service Indicators	Target	Current
Water *Reliability of Supply*	• Main breaks per 100km of mains per year • No. of days temporary water restrictions applied per year • Response time to Priority 1 events within 1 hour • Priority 1 events when service restored within 5 hours	<25 <15 >95% >95%	14
Quality of Water	Compliance with NHMRC guidelines • Microbiological • Turbidity < INTU • Colour < 5 CU	99% 99%	84% 100% 50%
Quantity of Water	• Available household supply • Minimum flow available at boundary (L/min)	1500 L/household/day 30L/min	1278 L/household/day
Customer Satisfaction	• Quality complaints per 1000 connections per year • Confirmed urban pressure complaints (outside 22-80m) per 1000 services per year • Positive external customer survey returns	<5 <10 85%	

Example Service Standards for Water Service Provider

- Before setting any customer standard, it is important that the full financial implications on the utility and its customers are clearly understood. Higher standards will require earlier intervention and effectively reduce asset lives.
- Customers need to understand the tradeoff between standards and delivery costs. In the longer term, increases in prices may change community opinion on the appropriateness of customer service standards and trade-off may eventuate between maintaining the pricing of the service and relaxing customer service standards

Depreciation Methods

- Straight-line
  - Simplest and most commonly used for infrastructure assets
- Reducing balance
  - Not widely used for infrastructure assets.
- Units of use
  - Alterative method for determining useful life. For example, for road pavements it is common to define pavement life in terms of Equivalent Axles. An equivalent axle is defined by a standard truck. Other trucks are then compared to calculate their impact in 'standard axles'.
- Modified straight line
  - This method combines the simplicity of straight-line with asset management practice.
  - It recognises that infrastructure assets are subject to renewal through periodic maintenance when they degrade past defined intervention points. For example, reseals of roads are often undertaken based on time intervals eg 15 years. The service potential of the road surface is renewed by the reseal and the asset life is extended.
- Condition based
  - In this method, the condition of assets is assessed by visual inspection or by use of mechanical aids.
  - Using a simple model, the condition score can be used to determine where the asset is in the life cycle.

Condition Score		**%Remaining Life**
As new	1	100
Good	2	75
Fair	3	50
Poor	4	25
Failed	5	0

Example Condition Score

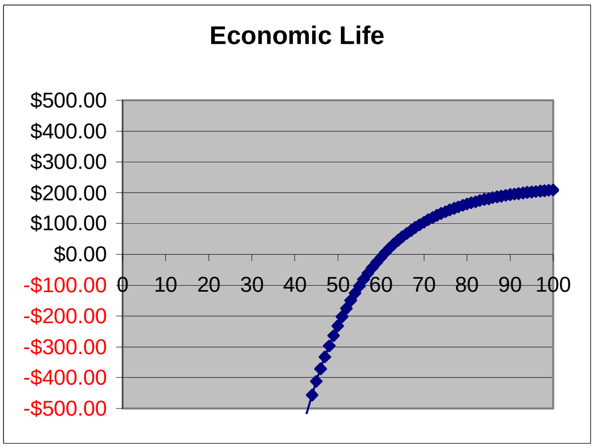
  - Adjustments are made to the estimate of remaining useful life for obsolescence or legal factors
  - AASB UIG 30 Directive, states that condition based methods with any of the following characteristics **do not comply** with AASB 116:
    - The depreciation expense is not determined by reference to the depreciable amount of the asset;
    - The depreciation expense is determined without consideration of technical obsolescence, potential changes in consumer demand and related factors which can influence the consumption or loss of future economic benefits during the reporting period;
    - Expenditure on maintenance and on enhancement of future economic benefits are not separately identified where reliable measures of these amounts can be determined, and are not recognised as an expense of the reporting period in which the

expenditure was incurred in the case of maintenance expenditure or as an asset in respect of asset enhancement expenditure;

- The asset is presumed to be in a steady state and a “renewals accounting” approach is adopted whereby all expenditure on the asset is recognised as an expense in the period in which it is incurred without consideration of whether that expenditure enhances the future economic benefits of the asset beyond that originally assessed; and
- The major components of complex assets are not separately identified and are not accounted for as separate assets where this is necessary to reliably determine the depreciation expense of the reporting period.

- Modelling
  - Models developed to predict optimum intervention intervals for the renewal/replacement of infrastructure can be used to predict remaining life of assets. Examples of models include pavement management systems for roads and failure models for pipe assets.
  - Using calibrated local decay curves, replacement models can be developed to assist with the prediction of useful life and remaining useful life for each asset group. The replacement model assesses when a main should be replaced based on factors such as repair costs and historical frequency of breaks, commercial loss of water (based on the number of customers affected), replacement cost, discount rate, the likely rate of increase in breaks in the future (defined by the decay curve) and the social cost to the community through loss of water caused by asset deterioration.
  - Customer service standards specifying limits on pipe breakages directly impact on asset lives by requiring asset replacement before physical failure occurs.
  - The economic life of a section of pipeline is reached when the cost of replacement is less than the cost of continuing to repair it. The following provides an example applied to Asbestos Cement water mains.

Example Methodologies for Calculation of Depreciation



- On the assumption that a 100 m of main costs $12,500 to replace and assuming that each breakage costs $1,000, economic theory suggests a useful life of 60 years. However, as Figure 4.02, shows, the flattening of the net present value curve suggests that there is little economic penalty from delaying replacement a few years when repair costs (and external costs) are relatively low. As repair costs (and external costs) increase, as would occur for the more significant trunk mains, there is significant penalty for delaying replacement. However, delay may also breach adopted customer service standards.

What methods work best and for what assets?

- As asset management practices and data becomes available within organisations, there is scope to utilise this data to facilitate the estimation of depreciation. Which method works best and is appropriate will vary for different asset groups.
- Data for all of these methodologies will not always be available. In this case, the 'fall-back' methodology can be used.
- Typical examples are provided below:

Example Methodologies for Calculation of Depreciation

Asset Group	Preferred Methodology	Fall-back Methodology
Water and Sewerage		
Water Mains Sewer Mains Water connections Sewer connections	• Deterioration modelling based on main breaks/100km with assets grouped by various factors such as age, pipe material, ground conditions, operating pressure, pipe size, traffic loading. • Economic life and remaining useful life determined from model incorporating customer service standards • Straight line depreciation	• Straight-line depreciation • Remaining useful life estimated from pipe condition records and operational history or if not available, age.
Reservoirs, Valves, Hydrants and Manholes Drainage pipes Active assets including pump stations and treatment plants	• Straight-line depreciation • Remaining useful life estimated from pipe condition records and operational history	• Straight-line depreciation • Remaining useful life based on age
Roads		
Road surface Road pavement Structures	• Straight-line depreciation • Remaining useful life estimated from condition.	• Straight-line depreciation • Remaining useful life estimated from age.
Road formation (earthworks)	• Not normally depreciated	

Is there any answer for cyclical maintenance assets?

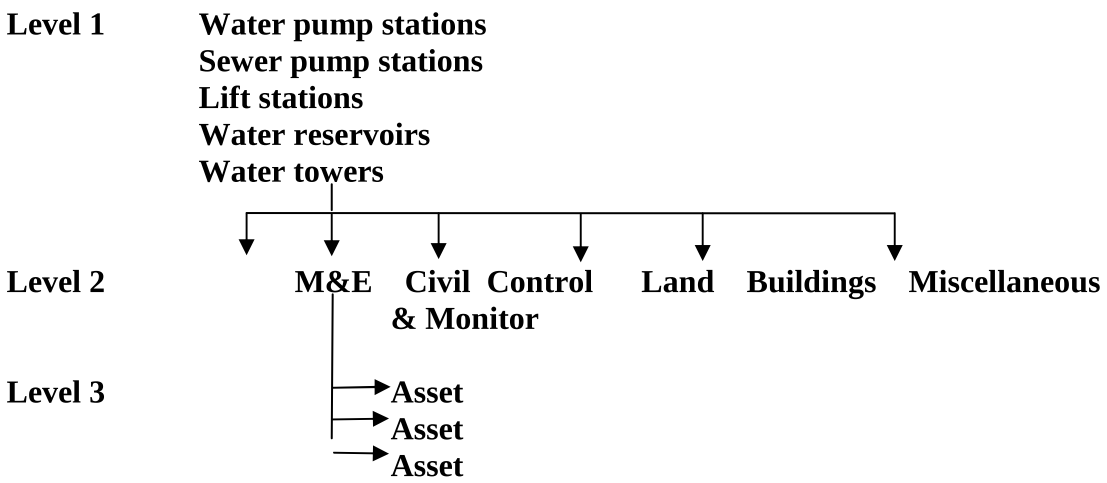
- Selection of the appropriate disaggregation level, is the most important decision in the establishment of the financial asset register (FAR).
- The appropriate level is determined by identifying those elements within complex infrastructure facilities that have a shorter useful life than the facility as a

whole. For example a major water pump station could be expected to be in service for 100 years. However during that 100 year life, the pumps could be expected to be replaced 4 times, the switchboard 3 times and the control equipment 10 times. The civil structure will most likely be unchanged.

- These complex assets need to be disaggregated to the appropriate level where each component can be allocated a useful life which is characteristic of that component. The example below provides an illustration of the concept.

Example Asset Hierarchy to Facilitate Calculation of Depreciation

Water /Sewerage Pump Stations
Lift Stations
Reservoirs
Towers



<u>LEVEL 1</u>

- A total value for each pump station, lift station, reservoir and tower is required.

<u>LEVEL 2</u>

- The value for each of station/reservoir/tower is to be broken up into the following categories:
    - Mechanical and Electrical
    - Civil
    - Control and Monitor
    - Buildings
    - Land
    - Miscellaneous

- “Control and Monitor” is electronic control and monitoring systems and includes
    - telemetry
    - switchboards
    - flowmeters

- pressure sensors
- SCADA
- analysers

LEVEL 3

- The categories are broken down into the following components for depreciation calculations:
-

M & E	Civil	Control and Monitor
▪ Pressure vessel	▪ Pipework	▪ Switchboard
▪ Generator	▪ Structures	▪ Flowmeters
▪ Pumps (excl sump pumps)	▪ Reservoir	▪ Variable speed drive
▪ Valves (>225mm dia)	▪ Tower	
▪ Compressors		