PROGRESS TOWARDS AN ASSET MANAGEMENT PLAN OF THE DRAINAGE SYSTEM FOR A LOCAL GOVERNMENT IN WESTERN AUSTRALIA

by

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Abstract

This presentation outlines the progress of a Local Government in Western Australia towards completing an asset management plan for stormwater drainage.

The paper examines the methods to complete an asset register and link it to Geographical Information System (GIS). It also looks at the depreciation of concrete pipes by condition rating instead of the accounting standards method of using straight-line depreciation.

Keywords: drainage, asset management, local government, Australia, useful life, depreciation, condition rating

1. Asset management

1.1 Introduction

A major component of Asset Management for drainage systems is preparing for the future. Asset Management is dealing with the challenges of today and not leaving it to the next generation. Asset Management is also a way of formalizing maintenance, replacement and renewal programmes for community infrastructure assets and showing in financial terms the depreciated value of the infrastructure. As drainage pipes have a life of approximately 80 to 100 years it has been easy to ignore them and let the future generations worry about their repair and replacement.

I was happy being part of the process that is producing kilometres and kilometres of greenfield development on which the expanding population of Perth is building and will soon be living. Beautiful new suburbs are being created with roads, parks, houses, schools and drainage. The participants in the team are all very proud of attaining the high standards required and having the plans approved for construction.

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Then along came the *Australian Accounting Standard 27* (AAS27, 1996) that obliges local governments to show the depreciation of infrastructure in their financial accounts. Or in the terminology outlined in the standards literature:

> *As local government is a highly capital intensive industry Australian Accounting Standard AAS27 applies accrual accounting to Local Government. It requires the value of infrastructure assets to be shown in the balance sheet and the consumption of the asset in the reporting period to be shown as depreciation expense in the operating statement.*

The impact of this standard still did not hit home. There was a three-year "phase-in" period and the accountants and their auditors seemed to be satisfied with the figures we supplied for the Perth greenfield developments.

To meet this requirement for the drainage systems, the City of Cockburn selected a typical small catchment area, measured up the drainage system, gave it a value and then said the drainage costs were $x per kilometre per road and then multiplied this by the number of kilometres. However in the second year of the "phase-in" period the City of Cockburn was advised that the auditors would be more rigorous in their assessment of the method used for valuation.

So the day finally arrived when we, the City of Cockburn, would have to embrace asset management formally. There was also the realization that the figures being supplied were of no practical value to us, the accountants or the auditors. It is not that we had not been aware of asset preservation for we had maintenance and upgrade programmes for our drainage systems and we used informal visual inspections for prioritizing maintenance.

The full impact came when we looked at our latest residential subdivisions and realised we had just constructed 2400 metres of 1200 mm to 1800 mm pipe all beneath the ground water table and in the greenfield development. This is major work and the protection of homes in the area relies on continuing maintenance and inspection programmes of the drainage network.

Also if this system deteriorates and needs replacing in 80 year's time, how will it be done and what will the costs be for doing this in a built-up area. These issues need to be addressed.

1.2 Planning

A meeting was arranged with staff from the City of Cockburn Works Division to discuss how we would proceed. It was agreed that:

- All components of the drainage system had to be identified and recorded.
- A formal maintenance programme would be introduced
- Information had to be readily accessed from the field and office.
- Information had to be easily updated by field staff.

The Works Division recognised that this was an ideal opportunity to have all its records updated and collated into a comprehensive and consolidated format. And most importantly, as the accountants of the organisation required the information to comply with their accountancy regulations, it was possible to access funds (with their support) for the compilation of the asset inventory.

1.3 Decision

It was agreed that all assets needed to be recorded into a consolidated assets register and the following priority list was agreed upon:

1. Roads
2. Footpaths
3. Drainage
4. Parks
5. Buildings (Council owned)

All of the information was available in one form or another within the organisation, the majority of it on the 1500 road and drainage drawings either hanging in cabinets or on microfiche. It was realized that this information on the drawings was not related to a standard grid. The only way the information could be consolidated was by scanning the plans and drawings. Unfortunately, this would not allow the information to be defined in accordance with the national grid co-ordinates.

However, this information from the plans allows the construction date to be established. This has to be known for depreciation calculations required by AAS27. It was decided to collect all the data in the field and to record it in electronic format so it could be linked to GIS A five-year programme was agreed upon, supported by the necessary funding.

1.4 Implementation

To implement the plan, an Asset Information Services Manager was employed together with two other support staff members. One staff member would develop the GIS so the drainage module could be added, and the other would coordinate the collection of the data and design the formats for inputting the data as well as design a system so the data can be shown on GIS.

A real-time global positioning system (GPS) and vehicle were purchased and two casual field staff were employed to collect the data.

GPS has emerged as an essential tool for collecting data. It provides the information in national grid coordinates so it can be accurately located on the plans. The equipment used in the field is a Hewlett Packard Jornada running the Starpal HGIS software. The Jornada is connected to a realtime GPS unit.

For the drainage component of the project, the municipality has been broken into eighteen suburbs. The following information is recorded:

(1) Manhole position to 0.1 metre using GPS
(2) Drainage gully and side entry pits to 0.1 metre using GPS
(3) Type of lid
(4) Diameter of manhole
(5) Diameter of pipes, and
(6) Depth of pipes (using tape measure)

Each component is given a unique number (e.g. AT C1-MH 1) where:

AT = Atwell name of suburb
C1 = Catchment 1

MH = Manhole
1 = unique identifying number for asset

For example, for the suburb of Atwell, the following totals were recorded:

• Number of manholes	295
• Number of gullies	430
• Length of pipes < 450 mm	15326 metres
• Length of pipes > 450 mm	7561 metres
• Number of individual components	1503

The lid from every manhole and gully was lifted and the depth to every pipe measured. The man-hours taken for collecting and recording all this data was approximately 1000 hours.

The subdivision of Atwell is located on sandy soil and flat terrain. The groundwater table is approximately 2 metres below the ground level. It is a suburb with house lots of 500 to 600 square metres in area, with bungalow type houses, containing typically 4 bedrooms and 2 bathrooms. The suburb of Atwell has 1700 building lots and 27 kilometres of road.

1.5 Progress on plan

The City of Cockburn is using the Institute of Municipal Engineers of Australia National Asset Management Manual 1994 and the International Infrastructure Management Manual Australia/ New Zealand edition 2000 as our reference.

We looked at the list compiled in these documents as best practice and it mirrors the questions identified by other speakers in this session that need to be addressed in asset management, namely:

- Knowledge of assets owned
- Knowledge of physical condition of asset
- Knowledge of levels of service required by customer
- Knowledge of asset performance and reliability
- Knowledge of asset utilization and capacity
- Knowledge of asset value
- Ability to predict failure modes and estimated time of failure for asset
- Ability to determine the likelihood and consequences (risk) associated with the different failure modes.
- Ability to analyze alternative treatment options
- Ability to rank the treatment options available
- Ability to prioritize treatment options based on risk.
- Ability to optimise maintenance and operations activities.

The above items can be summarised into the following short list:

- Asset inventory techniques
- Condition assessment surveys
- Service life predictions

- Asset valuation methods
- Deferred maintenance classification
- Maintenance planning

The area where the City of Cockburn has progressed so far is "asset inventory techniques". The next area will be "condition assessment surveys".

Regarding condition assessment surveys, we obtained a copy of the publication *Australian Conduit Condition Evaluation Manual Sydney Water Board 1991*. This outlines a procedure for rating the condition of drainage pipes. This procedure is oriented towards using video cameras for the collection of the data. The manual has an accompanying computer programme for the storage of the data and for producing condition rating scores.

This method of evaluation is not considered appropriate for our drainage system at this early stage in its life cycle. As there is no documented evidence in Western Australia of structural pipe failures for reinforced concrete pipes it is not necessary at this stage to inspect the pipes in detail. However, it has been possible to check the condition of the manholes easily when the data is being collected for the asset inventory. For the pipes only obvious faults such as blockages are being identified at this stage: mirrors have been used to carry this out.

A method of inspecting the pipes that are under water for most of the year has not been resolved. The need to carry out a more formal condition assessment will be looked into every 10 years and will be dependant on the reports of the maintenance programme showing an increase in failures or major problems. The major trunk drainage lines will be checked and cleaned on an annual basis.

1.6 Useful Life

The determination of useful life of an asset is essentially a matter of judgement. Publications from the Australian Concrete Pipe Association state that the design life standard of reinforced concrete pipe under normal conditions of installation and service can be conservatively taken as 100 years (CPAA, 1995).

At Cockburn a useful life of 80 years has been adopted. It is not appropriate to adopt a longer period until pipes have been in use for that period of time.

Asbestos and steel fibre pipes were also used in earlier years. Further work will be required to look at their deterioration curves.

1.7 Knowledge of asset performance and reliability

There is currently no monitoring being undertaken to assess the performance of the drainage system. It is assumed it is performing as it was designed.

The experiences in Western Australia so far indicate that limited capacity has been the principal reason for pipe replacement. This has mainly been due to inadequate planning at the initial stages and subsequent development has resulted in the pipe system not having sufficient capacity to cater for the increased flows. Flooding of roads on properties will also be an indication of the under-performance of the drainage network.

2. Asset valuation methods

2.1 Depreciation

As required by legislation all non current assets with limited useful lives must be depreciated. In determining the depreciation of these types of assets, there are three variables required:

- useful life,
- value of the asset, and
- residual value.

Using straight-line depreciation a sample calculation of valuation would be:

$$\text{Written down value} = \frac{(\text{effective life - life to date}) \times \text{replacement value}}{\text{Effective life}}$$

For municipal assets depreciation is calculated using one of the following methods:

- Condition rating
- Straight-line where assets are assumed to be used up at a constant rate.

The *National Asset Management Manual* (IMEA, 1994), as the predecessor to the *International Infrastructure Management Manual* (IMEA, 2000), explains that:

> *No depreciation formula (e.g. declining balance, increasing balance, straight line) matches the residual pattern of infrastructure because depreciation formulae cannot cope with major maintenance which keeps infrastructure assets close to full service value for most of their existence.*

Formula depreciation tends to: (1) understate the real residual asset value; (2) overstate the future asset liability, or (3) cumulatively understate the rate of return. But most critically it does not reflect the real decline in the value of the asset when maintenance fails to be carried out.

Unlike the traditional depreciation that is based on predetermined formula, hopefully, approximating the true rate of value decline will provide the true remaining value of the asset. Condition based depreciation (CBD) is a direct measure of the rundown in asset value.

In the past, it has only been possible to depreciate reinforced concrete pipes by straight-line method. However, a process and programme is being developed using the condition rating. This is required if meaningful results are to be provided. A method for having sufficient funds to be able to replace the drainage system at the end of its useful life has still not been established.

2.2 Degradation Curve.

There are no authoritative degradation or decay curves for reinforced concrete pipe in Australia. Based on observation and discussions with colleagues and experts, a degradation curve for steel reinforced concrete pipe has been identified and is shown in Figure 1:

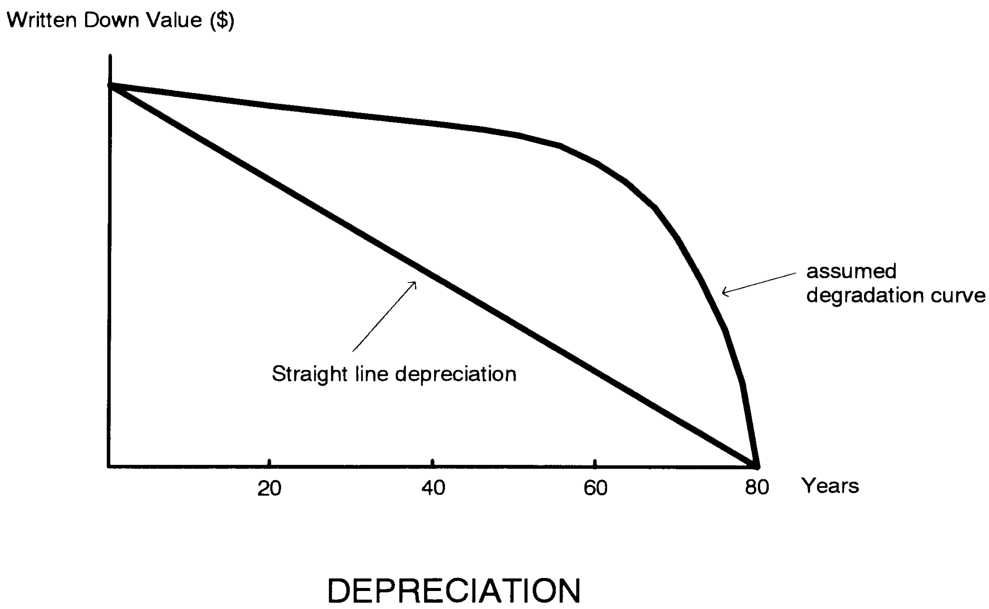

Figure 1: Straight-line depreciation versus normal degradation curve

If research confirms this, the difference for depreciation between straight line and an actual degradation curve based on condition rating is illustrated in Table 1 below:

Table 1: Degradation Curves for $1.0 Million Asset

Years	Degradation	Depreciation	Straight Line	Depreciation	Difference
20	5%	$50,000	20%	$200,000	$150,000
40	10%	$100,000	40%	$400,000	$300,000
60	20%	$200,000	60%	$600,000	$400,000
70	40%	$400,000	70%	$700,000	$300,000
80	100%	$1,000,000	100%	$1,000,000	0

Table 1 illustrates that different depreciation methods can show major differences in valuations over the life of the asset.

2.3 Maintenance

A maintenance management system module is being developed in-house for the City of Cockburn. This is part of the overall objective of the project to allow users to perform graphically the following functions:

- inputting and retrieving asset information
- recording maintenance and rehabilitation works
- generating financial and statistical reports in both written and graphical forms.

The maintenance management module will allow the field staff to proceed with the planned and unplanned maintenance work that can be connected to the assets register module and valuation module from the other programmes used.

3. Conclusion

The City of Cockburn is progressing towards an asset management system. It has completed the assets register for roads and footpaths and has completed 50% of the asset register for drainage. For a local government with a population of 75,000 (and increasing), it is going to be a four-year project for collecting data for the drainage systems for the four-member staff. Resources will be required on a continuing basis.

The AAS27 financial regulations have been the catalyst for a complete up-to-date listing of the drainage assets. This step was essential to allow the replacement value of the assets to be calculated and it was essential in calculating the future cost of replacing the system.

It is also extremely important that the information is correct and up-to-date. One of the principal reasons we have found that a system is not utilised is when there is no confidence in the data being used to make decisions. Collecting the data as we did has also allowed the drainage system to be displayed in graphical form as one module in the organisation's GIS. This will also assist the maintenance staff to be able to locate, schedule, carry out and record their work in a formal and retrievable process.

Because the life of a reinforced concrete drainage pipe is estimated to be in excess of 80 years and because our pipes were relatively new, condition assessment of the pipes by physical inspection is not being undertaken. However, they will be reassessed every 10 years in the future. The depreciation of the system will be carried out using the assumed degradation curves; this method approximates the true life and deterioration of a pipe better than the straight line method detailed in the accounting standards.

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