

Review on Australian and International practices for Asset Management in Building Infrastructure

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PREFACE:

We have certainly been managing assets for years, and the financial services world has long used the term to mean, “getting the best return from the investments”. Nowadays, however, it is also being used to describe the professional management of physical infrastructure.

This report presents a review of current Australian & limited international practices and guidelines on buildings asset management. The work has been undertaken as a part of research project titled “Investment Decision Framework for Infrastructure Asset Management” at RMIT University, Melbourne. Australian Cooperative Research Center for Construction Innovation (CRC CI) funds the project in collaboration with leading industrial & research organizations in Australia.

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EXECUTIVE SUMMARY:

Background:

Both in developed and developing economies, major public funding is invested in civil infrastructure assets. Efficiency and comfort level of expected and demanded living standards are largely dependant on the management strategies of these assets. Buildings are one of the major & vital assets, which need to be maintained primarily to ensure its functionality by effective & efficient delivery of services and to optimize economic benefits.

Notwithstanding, public building infrastructure is not considered in Infrastructure report card published by Australian Infrastructure Report Card Alliance Partners (2001). The reason appears to be not having enough data to rate public building infrastructure. American Infrastructure Report Card (2001) gave "School Buildings" 'd-' rating, which is below 'poor'.

For effective asset management of building infrastructure, a need emerged to optimise the budget for managing assets, to cope up with increased user expectations, to response effectively to possible asset failures, to deal with ageing of assets and aging populations and to treat other scenarios including technology advancement and non-asset solutions.

John (Asset Management, 2001) suggests that in the area of asset management worldwide, UK, Australia and New Zealand are leading.

Objective:

This report presents a review of current Australian & limited international practices and guidelines on buildings asset management. The work has been undertaken as a part of research project titled "Investment Decision Framework for Infrastructure Asset Management" at RMIT University, Melbourne. The project is funded by Australian Cooperative Research Centre for Construction Innovation in collaboration with leading industrial & research organisations in Australia.

The purpose of the review was to obtain an appreciation of the asset management practices being used in infrastructure sectors other than roads with the intention of identifying superior techniques that may be used in the roads sector and as a basis for a long-term opportunity of the project to develop an investment decision framework for the building sector.

The objective of the study was to identify potential gaps in current practices & areas that need improvement including the use of advanced IT & GIS technologies in current practices. The main emphasis of the review is on asset management practices being used in public building infrastructure. Existing literature mostly from public domain via Internet, journals, research papers, workshop/seminar proceedings, government guidelines & asset management manuals have been analysed.

In Australia, federal government and several state government departments and councils publish and update the strategic asset management guidelines and manuals.

Findings:

Some Government organisations are facing problems within their existing "do as needed" approach for managing their assets. In some organisations, several stages/aspects of building asset management seem to be spread over different departments within organisations and integration of those needs attention.

By comparison of national & international practices in Asset management for Building infrastructure available in the public domain, considerable existence of advance technology

at different places and different stages is available, such as some software packages, GIS systems, Internet technology, relational databases. Few government organisations are likely to adopt/develop new reactive approach. Some countries are using such advance asset management practices.

The authors believe that the main areas needing improvement or further research include:

- Service life planning for capital works and residual service life prediction for existing buildings to assist optimising whole life cycle cost;
- Complete asset inventory using GIS, CADD (Computer Assisted Design and Drafting) and database technologies for management of data and its analysis;
- Cyclic inspection and condition assessment emphasizing performance improvement vs. maintenance expenditure;
- Asset performance trends for buildings incorporating financial, serviceability, environmental, safety and legal aspects;
- Qualitative and quantitative assessments to evaluate performance measures;
- Implementation of integrable CMMS (Computerized Maintenance Management System) to enhance overall management and better decision-making; and
- Optimisation of maintenance expenditure and effective budget planning at network and project level

Further research:

The following projects with theme 'Residual Service Life Prediction of Building Infrastructure', 'Service Life Planning for Building Infrastructure' and 'Optimisation of Maintenance Expenditure for Qld Department of Public Works' are proposed with industry partners' support for further research in the area through CRC for Construction Innovation, Australia.

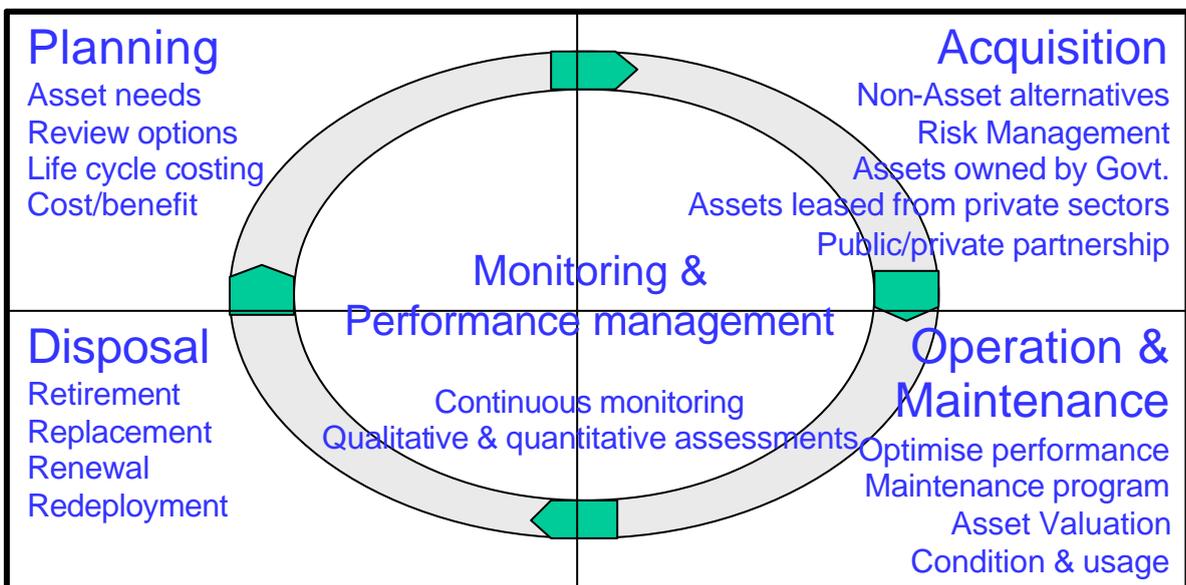
1 INTRODUCTION

All developed economies are based on huge infrastructures such as roads, bridges, railways, public structures, parks, public land, telecom networks, water supply, waste disposal, energy etc. The fixed assets of any government or organization make up the social and economic infrastructure, which enable the provision of services to the public and to the business. These assets play a vital role in the economy and in the quality of life of people. A key requirement is to secure a sustained and sustainable increase in public sector efficiency in the provision and management of infrastructure and other fixed assets.

The review emphasizes general asset management in the context of building as an infrastructure. Publications from several government authorities of Australia and several countries worldwide form the basis of the review.

The figure shows a typical asset life cycle, which can be applied to several types of physical infrastructures.

Figure 1.0 Typical Asset Life Cycle:



Compiled from:

- Asset Management Handbook (1996), © ANAO, Commonwealth of Australia
- Sustaining our assets (2000), © Department of Treasury & Finance, Victoria

As in the figure, any typical asset cycle consists of four phases, with ongoing monitoring and performance management. In PLANNING stage, asset needs are identified with help of review options, life cycle costing and cost/benefit analysis. Prioritization and other alternatives are examined in ACQUISTION stage. In phase of OPERATION AND MAINTENANCE, regular, preventive and do as needed maintenance work with focus on optimization of performance is carried out depending upon asset valuation, condition and usage. Retirement/replacement/renewal/redeployment of asset is decided in DISPOSAL phase.

Public building infrastructure is one of the major and vital assets of any economy. Local, federal governments and some other organizations publish general asset management policies and manuals to aid local organizations including departments of public works and local government councils in managing their assets.

Public buildings consist of several different types of structures, and the asset management of all different types is a challenging task. Major public buildings include government buildings,

monuments, libraries, schools, universities, hospitals, municipal halls, museums, railway stations etc. American Infrastructure Report Card (2001) gave "School Buildings" 'd-' rating, which is below 'poor'. Public buildings are not considered in the study by Australian Infrastructure Report Card Alliance Partners (2001), in the infrastructure report card, the reason appears to be not having enough data to rate public building infrastructure.

1.1 Building Asset Management

Among the several definitions available in the literature, the definition for Asset Management more relevant to public works (APWA, 1998) is given as,

"asset management is a methodology to efficiently and equitably allocate resource amongst valid and competing goals and objectives"

It should deal with competitive prioritization of investment choices with due consideration of social, economical, environmental and political factors associated. It should also match with Government or organizations' strategies and legislation.

Now, let's define "Building Infrastructure". The definition or categorization of a "Building" is more than just semantics. A uniform definition permits a standardized approach to data gathering and performance assessment. For purposes of simplification, definition of building is as follows:

"A Building is a fixed structure designed to protect an interior space from the exterior elements. A building is defined based on its conception, design and construction, and can be redefined when these change." (PWGSC, 2001)

Details such as categorization of the building usage, its location & significance (historic or otherwise) and design, construction, fit-up, operational and maintenance records are needed to manage building portfolio efficiently. The systems and serviceability of an individual building must be adequately described and preferably in user friendly format to best assist in matching the users' requirements to the capabilities of the building portfolio.

The role of Building Asset Management (BAM) has been defined as the integration of physical asset with the requirements of the market it is planned to serve and the availability of resources, exercised over the whole life cycle of the asset, including procurement, on-going support, rehabilitation and disposal activities. It also includes responsibility of fulfilling clients & tenants accommodation needs and striving to retain building integrity while achieving specific finance goals with due consideration of various environmental and policy driven requirements (Kyle, 2001; Bromilow, 1989).

1.2 Overview of current practices

Buildings are complex facilities. Buildings assets comprise of several components such as structure, services, internal fit-out and finish, external finish and external infrastructure which contribute to the overall functionality. These different components have varying service life, yet they are expected to perform satisfactorily throughout the anticipated service life of the buildings. Effective management of building infrastructure aims to optimise the budget for managing assets, to respond to increased user expectations, to provide early warning of asset failures, to deal with ageing of assets and ageing populations, and to treat other scenarios including technology advancement and non-asset solutions. The role of BAM has been defined as the integration of physical assets with the requirements of the market it is designed to serve and the availability of resources over the whole life cycle of the asset, including procurement, on-going support, rehabilitation and disposal activities

Efficient building management must be cost effective, and must amplify asset performance with due consideration of the significance of the building within the portfolio and the larger

picture. For example, a library building and a historic public building with tourist attraction within any council may have different significance and should be treated accordingly.

The prime goals and objectives of building asset management include:

The provision of functional requirements

An attempt should be to meet the functional needs of tenants and clients while considering the buildings' designs, existing conditions, environmental performance requirements, renovation/modification histories as well as the operations and maintenance procedures.

It should be achieved by

- Keeping the building assets tuned to the needs of the market that the buildings are supposed to satisfy, for eg. Different needs of community will require to be satisfied by different buildings like library or hospital and tourism attracted heritage buildings/structures
- Knowing exactly what building assets are there in the portfolio, and what components are in them to the degree that they can be managed effectively both technically and financially. This means keeping database of assets owned by agencies in the form either of sophisticated GIS system with age, location and capacity of the asset or may be simple asset register with the similar details.
- Ensuring that all the monitoring and controlling of the all the necessary support activities are being undertaken efficiently, which includes condition assessment and minimum level of condition being maintained.
- Providing integrated decision-making machinery so that the right levels of maintenance will be applied, rehabilitation undertaken in the right way and at the right time.

Maximising economic benefit

Economic benefit of any given building is relative to all incurred costs and anticipated revenue throughout service life of the asset. Primary focus tends to be upon reducing costs. It needs the provision of adequate finance, skills, materials and equipment in order to secure the above objectives economically.

Implementation of Asset Management is based and dependable on the organisation's Assets database, Assets Valuation, Assets Condition Assessment, Assets Maintenance, Assets Life and Prioritisation of Assets as a whole.

2 AUSTRALIAN PRACTICES

Australia has a high ratio of infrastructure to population, much of it constructed in a peak period after the end of the Second World War (Asset Management Handbook, 1996). This infrastructure is aging and becoming due for renewal. However the growth and relatively easy finance conditions that gave rise to its initial development no longer exist and the costs of renewal need to be found in a more difficult economic climate. There is growing anecdotal evidence that some communities may face difficulty in funding renewal of their inherited infrastructure and there is the possibility that the high ratio of infrastructure to population may, in some cases, be unsustainable.

As per Australian National Audit Office (ANAO), Commonwealth Govt of Australia (1998), Sound principles of asset management dealing with strategic planning, acquisition, operation and disposal are not being applied in most agencies and, where they are, they can be significantly improved; and in relation to management control and monitoring of assets, agencies have generally developed basic asset policies and procedures and implemented adequate asset accounting systems.

Australian governments, at all levels, are now adopting accrual accounting practices and recording assets in their balance sheets. This has resulted in the need for large-scale asset data capture and large-scale investment in information technology, but it seems, these are being carried out by individual agencies with little or no co-ordination regionally or across the whole of government. In Australia federal government organisations such as the Australian National Audit Office (ANAO), the National Public Works Council Inc, and state government departments (State of Victoria, State of Queensland, State of New South Wales, State of South Australia, State of Western Australia, State of Northern Territory and State of Tasmania) are major organisations that publish and maintain asset management guidelines and/or manuals.

There is considerable usage of latest technologies e.g. Internet (web technology), (Geographical Information System) GIS and others in BAM practices in Australia.

2.1 National Public Works Council Inc, Australia

The National Public Works Council Inc (NPWC) is the peak council of the public works authorities of the Australian Commonwealth, State and Territory governments. It assists in the provision of policy advice to government on best practice and best value procurement of country's infrastructure needs and in the long-term management of infrastructure assets. It took a leadership role in the reform of Australian building and construction industry through development of best practice and continuous development. (Total Asset Management, 1996)

NPWC (1996) published, Total Asset Management (TAM) which aims to provides a flexible service delivery approach, driven by present and future needs, and using both asset and non-asset solutions.

Major aims of Total Asset Management are: (TAM, 1996)

- To reduce demand for new assets by managing demands for services
- To ensure existing assets are properly used and maintained
- To consider non-asset solutions to meet demand of services
- To identify opportunities to share government, private and community assets
- To improve capital and recurrent works budget processes and accountability
- To give agencies greater control of, and financial responsibility for, their assets
- To consider use of private sector to provide services and infrastructure
- To supply assets suited to their functions

2.2 Office of Building, Victoria

In Victoria, the Office of Building developed and published the guideline “Assessing the Condition of Constructed Assets, 1996” to assist Asset Management Series (Government of Victoria, 1995) to help agencies fulfil their budgeting, planning and reporting responsibilities.

The guideline emphasizes improved management techniques, greater accountability and reductions in the costs and liabilities. It makes the agencies responsible for using assets effectively; maintaining assets to appropriate standards; ensuring that assets has capacity to meet service demands; and budgeting for costs associated with the acquisition, use and disposal of assets. These help agencies to regularly assess whatever assets meet service delivery needs and base decisions on this assessment.

In the guidelines, the procedure has been divided in three different phases. First, collect the database, second, analyse the database and third, management reporting.

Phase 1: Collect the database

This is information gathering and collating stage that establishes the database for the next two stage:

- Phase 1a: Identify Asset Category
- Phase 1b: Identify Required Condition
- Phase 1c: Identify Actual Condition

Phase 2: Analyse the database

The database is analysed during this stage. Assessments are made of the gap between actual and required condition and impact of the gap. These assessments are then used to decide the nature, timing and priority of actions needed to close the gap:

- Phase 2a: Establish Relative Condition Level
- Phase 2b: Establish Condition Impacts
- Phase 2c: Identify Appropriate Action

Phase 3: Management reporting

In this stage information is gathered and indicators of asset management effectiveness developed. Information at this level provides an internal management tool and assists reporting to senior management:

- Phase 3a: Calculate Condition Index
- Phase 3b: Determine Condition Trend

The Department of Treasury & Finance (2000) published Government Asset Management Policy Statement, “Sustaining Our Assets”. Its central principle indicates that “service delivery needs” (comprise the social, economical and environmental needs) form the basis of asset management practices and decisions. The policy suggested integrated asset management approach incorporating a whole of government policy framework; informed decision-making; an integrated approach to planning; accountability and responsibility; and sustainability. It also suggested quantitative and qualitative management measures to evaluate performance of assets.

2.3 Department of Public Works & Services, New South Wales

In New South Wales (NSW), the Department of Public Works and Services (DPWS) is responsible for building and infrastructure services for the state. DPWS introduced Total Asset Management (TAM) through TAM 2000 policy, Total Asset Management System (TAMS) software (1994), Manual and Asset Management guidelines.

The TAM approach requires asset managers to assess what assets are needed to support successful service delivery with constant reference to Whole of Government planning, the

agency's Corporate Plan, and its Service Delivery Strategy. It then leads to detailed plans for the management of those assets that are to be acquired, maintained or disposed of.

TAMS is an asset register and management tool to provide a "whole of life" approach to the management of assets, from construction through operation, maintenance, refurbishment and eventual replacement or disposal. It uses GIS tool (MapInfo) in the building and maintenance module. TAMS supports integrated management of all of the agency's assets and assist agency to plan and budget for their assets, to manage asset maintenance, to monitor performance against established targets and to satisfy accrual accounting requirements (AAS 27).

DPWS uses Life Cycle Assessment Design Aid (LCAid) software package to help make life cycle assessment. LCAid™ is a tool for evaluating the environmental performance of buildings.

In NSW, Government agencies are now required to incorporate the requirements of the Environmental Performance Guide for Buildings in their Asset Strategies and in subsequent project delivery briefs for buildings. The guide aimed at establishing high environmental performance outcomes and deliver lower operating costs for NSW Government buildings.

2.4 Building Division, Department of Public Works, Queensland

In Queensland, the Department of Public Works (QDPW) published Strategic Asset Management (SAM) guidelines, which describe all activities for managing building assets for optimal outcomes. It documents the responsibilities of public sector asset owners, users and managers, and provides information and direction on all aspects of physical assets throughout their life cycle.

The principles of Strategic Asset Management suggested also found in Total Asset Management by NPWC (1996) include those listed below:

- Assets exist only to support the delivery of services and SAM within agencies must reflect the whole-of-government asset policy framework;
- Asset planning is a key corporate activity that must be undertaken along with planning for human resources, information and finances;
- Non-asset solutions, full life-cycle costs, risks and existing alternatives must be considered before investing in built assets, and
- Responsibility for assets should reside with the agencies that control them and the full cost of providing; operating and maintaining assets should be reflected in agency budgets.

QDPW has developed a range of following asset management support tools to assist departments with the implementation of asset management policies and guidelines [14], risk management, value management, life cycle planning, management of projects, post occupancy evaluation, condition assessment, functionality assessment, asset management system (Queensland Building Information System- QBIS), ecologically sustainable development, continuous improvement matrix, capital investment strategic plan, Capital Works Management Framework (CWMF) tools, Maintenance Management Framework (MMF) tools and MMF Implementation Assessment System (MMFIAS). DPW uses QBIS, which will be upgraded into "Building Queensland" (an asset register (GIS) and management tool) with advancement in near future. Some of the tools are described below.

Continuous Improvement Matrix:

- The Continuous Improvement Matrix (CIM) is a computer aided self-assessment tool which is designed to assist agencies to understand Asset Strategic Planning by allowing the user to determine their level of competency in physical asset strategic planning, and measure the gap between the existing performance and best practice.

Capital Investment Strategic plan:

- Capital investment strategic planning is the asset component of the agency strategic planning process. It focuses on the asset implications of the agency strategic plan. Agency strategic planning concerns identifying output requirements and service needs, and developing strategies to meet those needs; and asset strategic planning involves establishing what assets are required to support service and output strategies identified in the agency strategic plan, compares this to existing available assets and develops a strategy for acquisitions, disposal, funding, maintenance and management of the asset base. It also considers the recurrent cost implications of capital investment.

Capital Works Management Framework (CWMF) tools

- A number of tools are being developed to assist departments with the implementation of the CWMF. These tools include process flowcharts, templates, checklists, sample documents, website links, slideshows and analysis tools.

Maintenance Management Framework (MMF) tools

- The following tools have been developed to assist departments with the implementation of the MMF.
 - Strategic Maintenance Policy template
 - Strategic Maintenance Planning template

MMF Implementation Assessment System (MMFIAS)

- This assessment system is a valuable tool that can be used by agencies to identify any areas of deficiency in the implementation of the MMF and provide the basis for the development of agency specific implementation action plans.
- A series of screens prompt the user to answer a number of questions that have been developed to reflect the core requirements for implementation of each element. These questions relate to intent, process, responsibility, implementation and objective evidence for each element.
- A set of criteria relating to progress of implementation for each element has also been developed to ascertain a score, which represents the level of implementation achieved. An overall implementation score is recorded and displayed at the completion of the assessment.

2.5 Government Asset Management System (GAMS), Queensland

Again in Queensland, many departments, statutory authorities and government owned corporations manage Queensland's asset portfolio. Its current depreciated accrual value is estimated at \$60 Billion.

The Property Management Committee (1998) published a report which has identified a number of excellent asset management related policies, procedures, better practice guidelines, decision support tools, and information systems. This committee notified that these were at times inconsistent, and fragmented across a number of central and lead agencies. These resulted in development of the Government Asset Management System (2001) [11], a web-based knowledge management system with over 1,550 web pages and in excess of 34,500 hyperlinks to legislation, policies, better practice guidelines and information systems.

Government Asset Management System (GAMS) aims to achieve following goals or objectives

- Align all asset management processes with the government's "Managing for Outcomes" accrual output budgeting initiative
- Identify and address any apparent gaps in the asset management knowledge base, focussed upon better practice world-wide
- Provide a single point of access to the asset knowledge base and related information systems

- Devise and seamlessly integrate within all asset management processes a generic system to monitor, manage and continuously improve both the asset and the asset management system performance

2.6 Department of Administrative and Information Services, South Australia

In South Australia, the Department of Administrative and Information Services (DAIS) and the Department of Treasury and Finance published Strategic Asset Management Framework for all public assets or groups of public assets as a part of Asset Management Policy Series. The Framework primarily focuses on benefits for customers and informed decision-making.

The strategy has considered management level issues like government strategies, agency strategies, facility management and conduct of works with due consideration to life cycle functions at planning, procurement, maintenance and divestment stages. DAIS use tools such as asset management plans, demand management strategies, risk management, life cycle costing, agency asset register/data bases and reporting. It has also published strategic asset management policies; processes and guidelines, which include project initiation process for capital works, works policy and procedures manual and others.

DAIS is also responsible for the construction, management and conservation of public buildings in South Australia. It uses Building and Land Asset Management System (BLAMS) as a database containing information on selected land and buildings.

The BLAMS database operates with seven levels of data, which are inter-related. Those are the asset register, the base data, historic financial details, lifecycle costs of site and building elements, hazardous materials register, annual maintenance plans, asset management plans and reports. BLAMS provides owners and managers with information that will help them:

- Plan and review the allocation of building resources and the acquisition and disposal of land and buildings,
- Maintain an asset register of land and buildings, create annual budgets and project future anticipated maintenance expenditure; and
- Produce comprehensive maintenance agreement tender documents, associated contractual documentation and the technical data sheets for each item covered by the maintenance contract.

2.7 The South Australian Local Government Infrastructure Study, South Australia

In South Australia (SA), study of South Australian Infrastructure managed by Local Government was carried out in 2000-01. The study was a joint project involving all SA Councils and a steering committee representing the range of stakeholders involved in Local Government in South Australia. The initial idea for the study came from the SA Metropolitan CEO's group who were interested in developing advanced asset management techniques for South Australian Local Government and a more consistent method to monitor and predict infrastructure sustainability for SA local government.

2.8 Department of Housing and Works, Western Australia

In Western Australia, the Department of Housing and Works delivers and manages non-residential buildings and infrastructure assets through Asset Management Services (AMS). AMS contracts and manages projects for buildings and infrastructure assets valued at \$300 million annually, and manages over \$80 million of maintenance works. AMS [19] has published guidelines for Asset and Maintenance Planning, Building Skills Policy, Contract

Development, Contract Management, Heritage and Precincts, Western Property, Commercial Property and others.

Asset and maintenance planning processes assist agencies to identify their optimum building needs, secure appropriate funds, and achieve best performance from their building assets to support their service delivery. In 1998, the Department of Contract and Management Services developed methodology for Building Condition Assessment [20].

In July 2002, AMS launched an innovative, in-house property and facilities management system, "Western Property". Western Property [19] has been designed to:

- Establish and manage a competitive market of capable, pre-qualified service arrangers and a single point of pre-qualification for service providers;
- Make use of the competitive and public nature of the Government Electronic Market (GEM) and enable clients to package and bid work such as routine maintenance, general restoration and minor works through GEM; and
- Achieve efficiencies by using a common works management and data warehouse reporting systems.

2.9 Melbourne City Council, Victoria

In Victoria, The Facilities Management work group at Melbourne city council is responsible for managing assets for Melbourne city council's asset portfolio. It is made up of four distinct areas, each looking after specific interests of Council.

These areas are

- Real Estate Services (who manage property, engage in sales and purchases of land, and also manage off-street car parking),
- Facilities Maintenance (who conduct repairs and replacement equipment in Council owned and operated properties),
- Security Services (who provide personal security for staff as required, building security etc) and
- Strategic Accommodation (who look after the requirements of staff regarding internal fittings and furniture etc).

Practice at Melbourne city council: Case study

Facilities maintenance (FM) is responsible for managing the maintenance and repair of all elements of Council buildings. FM does this by using council staff as contract managers and outsourcing the work of electricians, plumbers, painters etc to the private sector. The outsourcing contract generally runs into the hundreds of thousands of dollars over the period of the contract. The basic process is when a problem is recognised, the contractor is notified and they then replace/repair as required and in turn collects a payment for their services in line with the agreement struck in the contract between Council and the contractor.

As part of providing maintenance services, the contractor is also required to develop *product life cycle costing*, which involved the contractor identifying works of a capital nature that will need to be performed during the duration of the contract (say 5 years) but are not maintenance works. Identified capital works are then bundled together and ranked in urgency by the Coordinator of FM, who then applies for fund via Council's budgeting processes to perform works. Works are then allocated on an urgency basis, and any capital works that remain unallocated are then incorporated into the following years bid - meaning all works get done eventually, with the most urgent getting priority. The problem council faces in allocating budget for capital works is that numerous groups in council compete for a finite pool of money, the panel assessing the priorities for works and programs must seek to understand the importance of each task and hope to rank them correctly in accordance with economic, environmental and social objectives as identified by the Councillors.

In recognition of this flawed system, Council is now in the process of developing an all encompassing Asset Management System that will incorporate the development of product life cycle costing for all council assets (not just buildings), condition reporting and development of a subsequent priority ranking system that assesses projects in accordance with Councillor's initiatives and a triple bottom line (economic, environmental & social) returns/costs to council. It is hoped such a system will create equities in allocation of monies and also provide council with the data it requires to accurately budget to maintain infrastructure services to the city, and subsequently determine the amount of monies available for provision of services to constituents. Such a system of course is complicated by changing values of constituents and Councillors, but council believe it can be done.

One of the potential problems may be because Council relies on contractors; those contractors hold the bulk of information and database data though it remains the property of Council. As part of developing a new Asset Management Program, Council will be implementing a new software system to store and analyse all data collected by contractors. Such a process is anticipated to produce synergies within council through improved information sharing - the flow of pertinent information at present is an identified problem as work groups in an organisation as large as council (900+ staff) work independent of each other and occasionally the information flow breaks down eg: One group lay a new footpath, then another group goes and digs it up and lays new drains. While not a too common occurrence, the new Asset Management System should be designed to rectify instances such as this.

(Source & Acknowledgement: Email conversations with Luke Walker, senior property management officer, Melbourne city council)

3 INTERNATIONAL PRACTICES

A limited overview of international perspective on building asset management strategies and practices is presented here. In the 'Getting Started In Public Works Asset Management, A guide to selecting, implementing and maintaining an asset management system' (CarteGraph Systems, Inc 2000); it has been discovered that despite the wave of new and exciting technology, one of the most crucial aspects of any management system is still its data. Data is the driving force for implementing successful high-end technologies such as GIS.

Recent newsletter from National Institute of Land and Infrastructure Management, Japan reported, "In Japan, housing and infrastructure have been constructed as the basis of people's lives. However, the condition of such housing and infrastructure still remains room for improvement for all people to enjoy a safe and active life, and for proudly passing on to the future generations. Technological development needed for constructing infrastructure and using existing stock more efficiently are also our major assignment".

3.1 Asset Management of Built Assets; US perspective

Vanier (2000) identifies the asset management market in North America, addresses the need for decision-support tools for municipal-type organizations and identifies the challenges for maintenance, repair and renewal planning faced by asset managers and owners.

The National Research Council (1999) reported "The United states spends an enormous amount of money annually to replace or repair deteriorated equipment, machines and other components of infrastructure. In the next several decades, a significant percentage of the country's transportation, communications, environmental and power system infrastructure, as well as public buildings and facilities, will have to be renewed or replaced".

The graph shows an increasing trend in the annual value of new built assets in US.

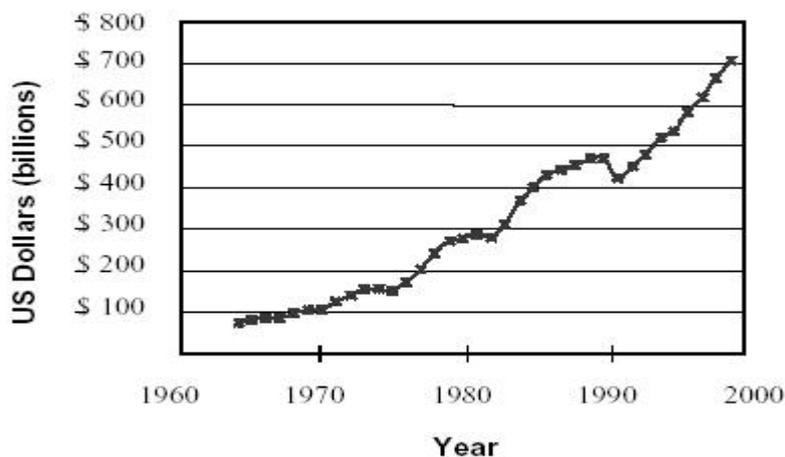


Figure 3.1.1 New Assets USA (US \$Billon)

(Source: Vanier, 2000)

A public works asset management system should provide the whole of life cycle coverage of the asset covering planning, design, construction, maintenance, operation, reconstruction or replacement.

The system should (CarteGraph Systems Inc, 2000),

- Provide data to predict asset performance
- Track estimated and actual costs
- Help manage maintenance activities
- Produce reports on completed activities and costs incurred
- Improve communication between public work organizations and their stakeholders/end users
- Help achieve Government Accounting Standard Board (GASB) compliance and help with other government mandates
- Help reducing liability and exposure
- Optimize existing budget dollars and helps plan future budgets
- Improve community safety
- Extend the life of infrastructure
- Reduce the labor required to plan and carry out maintenance activities
- Provide appropriate information for disaster relief or other federal funding

US Army Corps of Engineers; Engineer Research & Development Centre

The study by the Engineer Research and Development Centre, US Army Corps of Engineers (2002), states that the US army devotes about 55% of its installation real property maintenance funds into maintenance and repair of the buildings. It found that optimised fund allocation is difficult without structured, objective condition rating and functionality procedures, component remaining service life deteriorations, and easily developed short and long-range work plans based on a sound investment strategy and prioritisation criteria [26].

Construction Engineering Research Laboratory (CERL) developed Engineering Management System (EMS) named BUILDER. EMS provides the engineer a decision support tool to decide when, where, and how to best maintain facilities and their key components. BUILDER, an EMS for buildings is being enhanced into a network-based multi-user system with increased capabilities.

BUILDER technologies and methods includes (or will include)

- An inventory of building major components;
- Photo imaging; checklist-style, pen-based inspections;
- Condition indexes; functionality ratings;
- Condition prediction capabilities;
- Revised remaining life based upon the condition,
- Seismic and other building compliance ratings;
- Budget planning procedures;
- Prioritized long-range work-planning procedures;
- Presentation graphics;
- Linkages to AutoCAD[™]; Microstation and other building drawings;
- Linkages to MAXIMO^{1™} and other CMMS (Computerized Maintenance Management System)
- A built-in Geographical Information System (GIS) viewing capability;
- An ability interface to an external GIS

BUILDER allows users to manage buildings individually or in groups. Historic, housing, health/environment, and safety/code issues can be effectively managed. Projects can be BUILDER-generated or initiated externally from customer requests.

¹ MRO Software's [MAXIMO](http://www.mro.com/corporate/products/maximo.htm) helps companies in asset intensive industries increase their return on assets while decreasing their operational costs, including the costs of transacting with their suppliers (<http://www.mro.com/corporate/products/maximo.htm>)

Terrorism risk in Built Assets: US perspective

More common issue in US (after 11Sept'01) is to consider terrorism risk in each and every part of their government/organisation planning. Brief criteria that should be adopted are as follows (Schmidlt, 2002).

- Asset Manager must be prepared to promptly recognize a threat, decide quickly how to respond & then effectively execute predetermined procedures to safeguard employees and protect both physical assets & business operations.
- It can be measured by the probability of attack, vulnerability of people, assets and operations, and the magnitude of consequences
- Assess the vulnerability of people, buildings and operations to attack, and identify opportunities to mitigate the exposure.
- Site selection, placement of buildings on site, space management, physical barriers, operational security, and protection of critical utilities can all help mitigate exposure.

3.2 Asset Management of Built Assets; Canada perspective:

The amount of built assets in Canada is increasing at a rate of approximately C\$ 100 billion per year, as shown in Fig. 5.3.1 (Statistics Canada 1994, 1996, 1999; Vanier 2000). As a result of the growth in Canada, the country has an established total stock of buildings and constructed infrastructure with an estimated value of more than C\$ 2.94 trillion, as shown in Fig. 5.1.2 (Statistics Canada 1994, 1996, 1999). This could have a value of approximately \$ 5.5 trillion if calculated in constant dollars.

These values are significant and frightening; however, the magnitude of these numbers does establish the extent of the asset management challenge. The operation, maintenance, repair, and eventual renewal of this “built environment” therefore represent a major, and rapidly growing, cost to Canada and other developed countries.

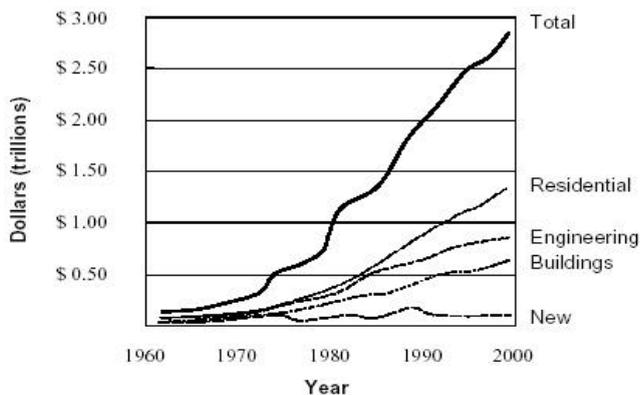


Figure 3.2.1 New Assets Canada (Can \$Billion)

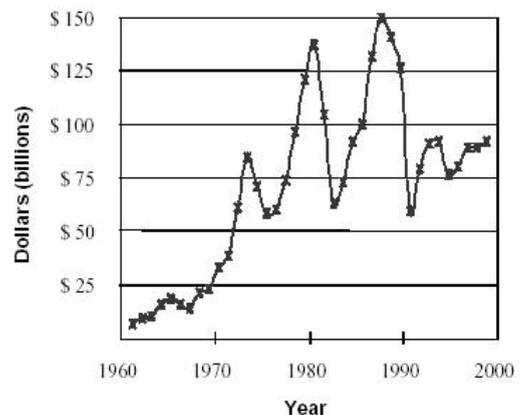


Figure 3.2.2 Total Assets Canada (Can \$Trillion)

(Source: Vanier, 2000)

In Canada, Department of Public Works and Government Services (PWGSC) provides Indian and Northern Affairs Canada (INAC) with strategic advice and real property services associated with INAC's programs; especially, the housing and community infrastructure and asset management on reserves across the country and in northern communities (PWGSC 2003).

PWGSC uses Capital Asset Management System comprising of Capital Assets Inventory System, Asset Condition Reporting System and Capital Management Database. It is an

automated system that provides information for the operation and maintenance of infrastructure. The Asset Condition Reporting System is a computerized system, which holds all the data on current physical condition of assets, which is used for planning and budgeting. The tool “Cost Reference Manual” is used for developing estimates for capital, maintenance and operations.

PWGSC published guidelines for Maintenance Management System (Maintenance Management System, 2000), which describes a system framework and helps in implementation from the initial step of data collection to preparation of maintenance budgets for asset maintenance planning and monitoring.

3.3 Asset Management Decision Making; UK perspective

The decisions about project investments, operating, maintenance and resource strategies are at the core of Asset Management. Guideline outlines that decision criteria should include following aspects of potential benefit for investment or expenditure:

- Reliability/Risk (specific events, such as equipment failures or safety incidents, comprising frequencies/probabilities x consequences)
- Operational Efficiency (performance while operating, such as energy/materials consumption and volumes or quality of output)
- Life Expectancy (deferment of capital expenditure, ‘cost of money’ etc.)
- Compliance (regulatory, safety, environmental)
- ‘Shine’ factors (public and customer impression, employee morale etc)

Optimal Asset management; should be achieved by

- Defining desired levels of services in consultation with the community, and matching these with assets that enable the services to be delivered
- Adopting a life cycle approach to planning asset investment and management decisions
- Balancing competing needs across all government functions and selecting options which best meet desired government outcomes
- Monitoring, evaluating and improving service delivery
- Managing the risks of asset ownership and operation to ensure continuity of service
- Providing for present needs while sustaining resources for future generations
- Adopting a *continuous improvement* approach to asset management policies and practices

4 SUMMARY:

The table shows the comparison about practices in Building asset management in Australia with some international perspectives.

Organisation	Current Practices	Models and tools
Queensland (2002) Department of Public Works	<ul style="list-style-type: none"> • Strategic Asset Management Guidelines • AMS: QBIS (Queensland Building Information System) <ul style="list-style-type: none"> ○ On-line data collection and query assistance ○ Capability to analyse all asset data, from lot plans to maintenance, from a reliable and current source of information 	<ul style="list-style-type: none"> • Risk management, Value management, Life cycle planning, Management of projects • Asset Management Policies and Support tools <ul style="list-style-type: none"> ○ Capital works management framework tools ○ Maintenance management framework tools ○ Use of Internet technology ○ Post occupancy evaluation, Condition assessment, Functionality assessment ○ Ecological Sustainable Development
Queensland (2002)	<ul style="list-style-type: none"> • Government Asset Management System (GAMS) (a web-based knowledge management system with over 1,550 web pages and in excess of 34,500 hyperlinks to legislation, policies, better practice guidelines and information systems) 	<ul style="list-style-type: none"> • Database of Asset Information • Online community involvement • Use of Internet technology
Victoria (1996)	<ul style="list-style-type: none"> • Asset Management series and guidelines • Assessing condition of constructed assets 	<ul style="list-style-type: none"> • Guidelines and tools to abet Asset Management Series with examples
New South Wales (2002) Department of Public Works and Services	<ul style="list-style-type: none"> • Asset.gov (online tools for management of Government assets "from cradle to grave," including support for planning, project delivery maintenance and disposal) 	<ul style="list-style-type: none"> • Online data monitoring • Life cycle assessment tool (LcAid – Life cycle Design Aid) • Use of Internet Technology
NSW Government Asset Management Committee (2000)	<ul style="list-style-type: none"> • Total Asset Management (TAM) <ul style="list-style-type: none"> ○ The asset strategy plan ○ The capital investment asset strategy plan ○ The asset maintenance strategy plan ○ The asset disposal strategy plan 	<ul style="list-style-type: none"> • Sustainable Development, Heritage Assets, Demand Management • Life-Cycle Costing, Economic Appraisal • Performance Evaluation, Post Implementation Review • Asset Information, Private Sector Participation • Value Management, Risk Management
South Australia (1999)	<ul style="list-style-type: none"> • Strategic Asset Management Framework (Asset Management Policy Series) 	<ul style="list-style-type: none"> • BLAMS (Building and Land Asset Management System)
Western Australia (1998)	<ul style="list-style-type: none"> • Asset Management Services 	<ul style="list-style-type: none"> • Building Condition Assessment Methodology • Western Property
U.S. ACE (1998)	<ul style="list-style-type: none"> • Engineering management system (EMS) 	<ul style="list-style-type: none"> • BUILDER package • Condition Index
PWGSC, Canada	<ul style="list-style-type: none"> • Capital Asset Management System <ul style="list-style-type: none"> ○ Capital Assets Inventory System ○ Asset Condition Monitoring System ○ Capital Management Database 	<ul style="list-style-type: none"> • Cost Reference manual • Maintenance management system

Table A: Summary of Australian and International practices in Building Asset Management

Observation and Conclusion:

Asset management of the building infrastructure is a complex process, fundamentally involving several stages. Adequate methods and tools exist in BAM practices and guidelines for cyclic and reasonable decision-making. However, in some organisations, several aspects of these are spread among different departments within organisations and there is room for an effective and efficient integrated approach.

Although some agencies distinguish different categories of buildings based on significance, there is room for a strong alignment between asset performance and category. For example, a library building or a historic public building, which is tourist attraction, should have different significance and should be controlled accordingly. It is observed from most BAM practices that a better comprehensive balance among social, economical, environmental, political and legal issues is required.

There is a pressing need for effective BAM. A few government organisations are on the way and some are likely to adopt a new proactive approach rather than a reactive approach. There is considerable advanced technology at different places and different stages, such as some software packages, GIS, Internet technology, relational databases and other IT usage.

The main areas needing improvement or further research include:

- Service life planning for capital works and residual service life prediction for existing buildings to assist optimising whole life cycle cost;
- Complete asset inventory using GIS, CADD (Computer Assisted Design and Drafting) and database technologies for management of data and its analysis;
- Cyclic inspection and condition assessment emphasizing performance improvement vs. maintenance expenditure;
- Asset performance trends for buildings incorporating financial, serviceability, environmental, safety and legal aspects;
- Qualitative and quantitative assessments to evaluate performance measures; and
- Implementation of integrable CMMS (Computerized Maintenance Management System) to enhance overall management and better decision-making.
- Optimisation of maintenance expenditure and effective budget planning at network and project level

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