

Comparative Study of Guidelines and Practices for Building Infrastructure Asset Management

Mr. Ashish SHAH
B.E. (Civil), M.E. (I.T.)
Researcher,
RMIT University, Australia

Research interests in Infrastructure Engineering and Management
Experience in Construction Technology, Project Management and Information Technology.
Email: ashish.shah@rmit.edu.au

Mr. TengHee TAN
Manager, Asset Management
Research Unit,
Queensland Department of Public Works, Australia

Expert in Asset Management especially in Public building infrastructure
Email:
tenghee.tan@publicworks.qld.gov.au

Professor Arun KUMAR
Professorial Fellow, Infrastructure
Director, Center for Infrastructure
Research and Management
RMIT University, Australia

Expert in Infrastructure Asset Management and road engineering and management
Email: arun.kumar@rmit.edu.au

Summary

This paper presents a comparative study of primarily Australian (and limited international) practices and guidelines on Buildings Asset Management (BAM). The objective of this study was to identify potential gaps in current practices and potential areas of research for further improvement. The paper starts with an overview of BAM. Later sections cover current BAM practices and guidelines across different states of Australia; give a limited overview of international practices and concludes with the authors' observations.

Keywords: Building Asset Management, Maintenance of Buildings, Building Infrastructure

1. Introduction

Both in developed and developing economies, major public funding is invested in civil infrastructure assets. Efficiency and comfort levels of expected and designed living standards are basically dependent on the management strategies of these assets. A prime necessity is to secure a continuous and sustainable increase in the efficiency for provision and management of such public infrastructure and assets. Buildings are major and vital assets, which need to be maintained primarily to ensure functionality by effective and efficient delivery of services, and to optimize economic benefits. The American Infrastructure Report Card [1] gave "School Buildings" 'd-' rating, which is below 'poor'. The Australian Infrastructure Report Card [2] had not considered public buildings in the study possibly due to lack of sufficient data to rate them.

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 ([3], [4]).

2. Australian Practices

Australian governments, at all levels, are now adopting accrual accounting practices and recording assets in their balance sheets [5]. 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 infrastructure needs and in the long-term management of infrastructure assets.

NPWC (1996) published Total Asset Management (TAM) guidelines which aims to provides a flexible service delivery approach driven by present and future needs using both asset and non-asset solutions. Major aims of TAM [6] guideline for total asset management are 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; and to supply assets suited to their functions.

2.2 State of Victoria

In Victoria, the Office of Building developed and published the guideline “Assessing the Condition of Constructed Assets, 1996” [7] to assist Asset Management Series (Government of Victoria, 1995) [8] 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 guideline [7], the procedure has been divided into three different phases named ‘Collect the Database’, ‘Analyse the Database’ and ‘Management Reporting’.

The Department of Treasury & Finance (2000) published Government Asset Management Policy Statement, “Sustaining Our Assets” [9]. 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 State of Queensland

In Queensland, the Department of Public Works (DPW) published Strategic Asset Management (SAM) guidelines [10], 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 [10], also found in [6] include:

- 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.

DPW 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.

Further in Queensland, 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.

2.4 Government of 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 [12], [13].

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 [12] 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) [14].

DPWS uses Life Cycle Assessment Design Aid (LCAid) [15] 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 [16] 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.

2.5 State of 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 [17] 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 [18] 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.

2.6 State of 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.

3. International practices

A limited overview of international perspective on building asset management strategies and practices is presented here. As reported by CarteGraph Systems, US, a leading provider of asset management/GIS software solutions to the public works industry [21][22], despite the wave of new and exciting technology, one of the most crucial aspects of any management system is still its data, which is used internally, or presented to citizens, city councils or state legislatures.

The amount of built assets in Canada is increasing at a rate of approximately C\$ 100 billion per year [23]. 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.

Recent newsletter [24] 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 USA

Vanier [23] 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 reported [25] “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 study by the Engineer Research and Development Centre, US Army Corps of Engineers, 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.

3.2 Canada

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 [27].

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 in 2000 [28], 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.

4. 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 authors believes 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; and
- Implementation of integrable CMMS (Computerized Maintenance Management System) to enhance overall management and better decision-making.

Acknowledgement:

The work has been undertaken as a part of research project titled “Investment Decision Framework for Infrastructure Asset Management” at RMIT University, Australia. The project is funded by *the Cooperative Research Center for Construction Innovation*, in collaboration with leading industrial, government and research organisations in Australia.

5. References:

- [1] 2001 Report Card for American’s Infrastructure, 2001, American Society of Civil Engineers, Available online <http://www.asce.org/reportcard/pdf/reportcard.pdf> (Accessed Sept’02)
- [2] 2001 Australian Infrastructure Report Card, 2001, Australian Infrastructure Report Card Alliance, Available online <http://www.infrastructurereportcard.org.au/2001/2001Reportcard.pdf> (Accessed Sept’02)
- [3] Bromilow F.J., “Building Asset Management – Approaches and Solutions”; *Building Asset Management- Don’t wait until 2000*, Building Science Forum Of Australia Seminar, 1990.
- [4] Kyle B.R., “Toward effective decision making for building management”, APWA International Public Works Congress NRCC/CPWA Seminar Series *Innovations in Urban Infrastructure*, 2001, Available online <http://www.nrc.ca/irc/fulltext/apwa/2001kyle.pdf> (download: September, 2002)
- [5] Asset Management Handbook, Australian National Audit Office, 1996 Available online <http://www.anao.gov.au/WebSite.nsf/Publications/4A256AE90015F69B4A256911008379C8> (Accessed Sept’02)
- [6] Total Asset Management, National Public Works Council Inc, Australia, 1996
- [7] Government of Victoria, “Assessing Condition of Constructed Assets”, 1996 Available online: <http://www.buildingcommission.com.au/CVICWeb/knowledge/Guide-Assessing Condition of Constructed Assets Final.PDF>. (download: Jul’02)
- [8] Government of Victoria, “Asset Management Series (1995)”, Available online: <http://home.vicnet.net.au/~assetman/> (download: July, 2002)
- [9] Government of Victoria, Department of Treasury & Finance, “Government Asset Management Policy Statement – Sustaining Our Assets”, Information available online [http://www.dtf.vic.gov.au/dtf/RWP323.nsf/bdbe2670498cb2314a2565f5002cc1b7/7676b730bfd425ed4a2569de00261615/\\$FILE/ampolicy.pdf](http://www.dtf.vic.gov.au/dtf/RWP323.nsf/bdbe2670498cb2314a2565f5002cc1b7/7676b730bfd425ed4a2569de00261615/$FILE/ampolicy.pdf) (Accessed Sept’03)
- [10] Government of Queensland, Department of Public works, “Strategic Asset Management”, Available online http://www.build.qld.gov.au/sam/sam_web/frames/guidelin.htm (Download: August, 2002)
- [11] Government of Queensland, “Government Asset Management System”, 2001, Available online <http://www.gams.qld.gov.au/default.htm> (Available online: August, 2002)
- [12] Department of Public Works and Services, NSW, “TAMS”, Available online <http://www.tams.nsw.gov.au/home.asp> (Accessed May’03)

- [13] Government of New South Wales, "Total Asset Management", 2001 Available Online <http://www.gamc.nsw.gov.au> (download August, 2002)
- [14] Australian Accounting Standard Board, "Financial Reporting by Local Government (AAS 27)", 1996, Available online <http://www.aasb.com.au/> (Accessed May'03)
- [15] Government of New South Wales, Department of Public Works and Services, "Life Cycle Assessment Design Aid", Information Available online <http://asset.gov.com.au/dataweb/lcaid/> (Accessed Mar'03)
- [16] Government of New South Wales, "Environmental Performance Guide for Buildings (the Performance Guide)", 2003 Available online <http://www.asset.gov.com.au/EnvironmentGuide> (Accessed May'03)
- [17] Government of South Australia, "Strategic Asset Management Framework", Second edition, 1999
- [18] Government of South Australia, "Building and Land Asset Management System", 1989 Available online http://www.blams.dais.sa.gov.au/support/b_intro.htm (Accessed April'03)
- [19] Government of Western Australia, "Western Property", 2002, Information available online http://www.dhw.wa.gov.au/index_IE.cfm (Accessed April'03)
- [20] Government of Western Australia, "CAMS Building Condition Assessment Methodology" (unpublished), 1998
- [21] A guide to selecting, implementing and maintaining an asset management system, "Getting Started in Public Works Asset Management", CarteGraph Systems, USA, 2000, Available online <http://www.apwa.net/documents/resourcecenter/ampaper.rtf> (download Oct, 2002)
- [22] Asset Management for the public works Manager – Challenges and Strategies, "Findings of the APWA Task Force on Asset Management", American public works Association, USA, 1998, Available online <http://www.apwa.net/resourcecenter/index.asp?Section=asset - Asset Management for the Public Works Manager> (download Sept, 2002)
- [23] Vanier, D. J., "Asset management 101: A Primer", APWA International Public Works Congress NRCC/CPWA Seminar Series: *Innovations in Urban Infrastructure*, 2000 Available online <http://www.nrc.ca/irc/fulltext/nrcc44300.pdf> (download: September, 2002)
- [24] NILIM Newsletter no.4, National Institute of Land and Infrastructure Management, Japan, 2003 Available online <http://www.nilim.go.jp/english/eindex.htm> (Accessed April'03)
- [25] National Research Council (NRC), "Research agenda for test methods and models to simulate the accelerated aging of infrastructure materials", *Board on Infrastructure and the constructed environment NRC*, National Academy Press, USA, 1999
- [26] US Army Corps of Engineers Champaign, Fact Sheet: "BUILDER Engineering Management System", Engineer Research and Development Centre, USA, 2002, Available online <http://www.cecer.army.mil/td/tips/product/details.cfm?ID=64andTOP=1> (Download Oct'02)
- [27] Department of Public Works and Government Services, Canada, Information Available online http://www.pwgsc.gc.ca/rps/inac/content/about_whatwedo-e.html (Accessed May'03)
- [28] Department of Public Works and Government Services, Canada, "Maintenance Management System", 2000

Disclaimer: The views expressed in the paper are of authors and not of organisations.