Why there is no such thing as Maintenance Backlog

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/ DESIGN FOR A BETTER FUTURE

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Abstract

The aim of this paper is to challenge the legacy paradigm of 'maintenance backlog' in the public sector and propose a methodology in line with modern asset management standards.

The premise is that traditional approaches to (historic) maintenance expenditure backlog are not useful as a mechanism to provide the evidence necessary to balance cost, risk and performance. Hence, maintenance "backlog" is not relevant to support long term sustainable decision making for a Government's asset portfolio. This paper will outline a more effective approach to prospectively identify the optimal asset maintenance regime and expenditure required with consideration to risk and improve how public sector organisations can respond to the growing future challenges they face, including fiscal constraints, aging profile of existing assets, impacts of population growth, demands for higher quality or changing service needs and response to climate change impacts.

1. Introduction

This paper will propose a more effective approach to prospectively identify the optimal asset maintenance expenditure needed (above current maintenance funding) with consideration to risk and organisational objectives. The proposed approach aims to improve how public sector organisations can respond to the growing future challenges facing their asset portfolios and the services they provide.

Traditional approaches to maintenance expenditure backlog, that focus on the past, cannot help an organisation address any of these future challenges. A paradigm shift is required where the conversation (and evidence base) is about quantifying the uncertainties of the future and the outcomes (including level of service) to be achieved, rather than how much maintenance funding is required based on assessment of the past or the needs of the "asset". The focus should be on the most optimal maintenance program to meet the future service needs of customers and the community.

2. Why should the focus shift away from maintenance 'backlog'?

I have had the pleasure of working across a number of states in Australia and the USA. There is a very clear recognition by most jurisdictions on improving their asset management capability, particularly in line with modern asset management standards (ISO5500X).

For example, I led the development of the NSW Asset Management Policy (NSW Treasury, 2019) that is focused on building and sustaining a level of asset management capability that is critical to extract the maximum benefit from the State's physical assets portfolio and to ensure that the State's infrastructure spending remains sustainable to meet future service demand.

Asset maintenance has also been identified as a critical area for reform by many jurisdictions (Infrastructure Australia, 2021; Infrastructure NSW, 2018; World Economic Forum, 2014; Infrastructure Western Australia, 2021) resulting from the recognition of the role existing assets, through sustainable investment, can have in providing economic and social outcomes. Many states and countries are facing significant strategic challenges that will impact on the future needs of infrastructure and services, including:

- Increasing size of asset portfolios due to large infrastructure investment pipelines
- Aging profile of existing assets
- Impacts of population growth on asset use and productivity
- Demands for higher quality services
- Rapidly changing customer service requirements
- Risks associated with climate change including infrastructure resilience

While there is now a recognition by most governments that they can't continue to 'build their way' out of mitigating these strategic risks, many governments have neglected their existing assets due to the political bias towards funding new assets (World Economic Forum, 2014). The recent natural disaster events that have been experienced in Australia, which are forecast to become more common due to climate change (Infrastructure Australia, 2021), has exposed some of the limitations with asset management practices in demonstrating a strong case for improved resilience measures through adequate maintenance investment.

Historically, the focus by many government organisations is to use maintenance 'backlog' to inform an effective response to the required level of maintenance investment (NSW Audit Office, 2016; ASCE, 2017; CCA, CPWA, CSCE, FCM, 2016) which has had limited success. A new methodology is required that can provide organisations a more effective case for investment to governments where maintenance investment can demonstrate a viable response to addressing future challenges.

The following are the key learnings from the use of traditional maintenance backlog approaches (Infrastructure NSW, 2018; World Economic Forum, 2014; NSW Government, 2012)that a new methodology will need to consider to support a sustainable long term maintenance investment:

- Providing maintenance programs greater political visibility based on measurable outcomes (benefits) to customers and communities
- Long-term maintenance requirements to consider operating (opex) and capital expenditure (capex) which, historically, have been separated within budget management processes
- Ability to substantiate required levels of maintenance investment has been hampered by low asset management organisational maturity such as leadership, governance, frameworks, management systems, tools and data.

Lastly, there is no consistent industry definition for backlog maintenance (even within one jurisdiction) and measurement methods can vary significantly as shown in Table 1 (NSW Audit Office, 2016; Infrastructure NSW, 2018; Infrastructure Western Australia, 2021; IPWEA, 2019; IPART, 2015; APPA, 2015; NHS Estates, 2004; Department of Infrastructure, Local Government and Planning, 2013). This means that it is difficult to determine the actual levels of future maintenance expenditure required, risks to service delivery and quantum of impact to social, economic and financial outcomes.

METHODOLOGY	MEASURE	APPLICATION
Total Cost of Fully Sustainable Asset Portfolio	Total Cost of Fully Sustainable Asset Portfolio = No. of assets by class in "poor" condition (based on useful life) x unit rate cost of replacement	The measure is dependent on condition assessment. Backlog value is current total replacement value of assets past useful life.
Infrastructure Backlog Ratio based on Written Down Value	Infrastructure Backlog Ratio = Cost to Bring to Satisfactory Standard / Total Written Down Value of Asset Portfolio	Values greater than 2% represent that the annual renewal rate is not sustainable to achieve desired condition/standard.
Facilities Condition Index (FCI)	The facilities Condition Index (FCI) = deferred capital renewal and deferred maintenance / Current asset replacement value	Applies to facility assets (built environment) and considers historic deferred costs for CAPEX and OPEX maintenance.
Asset Renewal Funding Ratio	Asset Renewal Funding Ratio = NPV of asset renewal funding over a 10-year period expressed as a percentage of the NPV of required asset renewal identified in an asset management plan for the same period	This ratio is a forward-looking indicator to provide the renewal and service levels defined in asset management plans as required in a 5 to 10 period based on available funding.
Steady state annual replacement of Major Periodic Maintenance	Annual Steady State replacement target = Count of asset population for a specific asset type / Average asset life expectancy	Maintenance backlog is determined for a population of assets based on how far behind/ ahead the steady state replacement on a cumulative basis.

Table 1 *Selection of maintenance backlog methodologies across industry*

3. Defining maintenance

To determine the most appropriate methodology to calculate maintenance funding needs to meet current and future objectives for an organisation, it is critical that there is a common understanding and definition of 'maintenance'. To my surprise, across many organisation (at a practitioner level), the term 'maintenance' is defined very differently. For example, if you were to review the list of typical "myths" below about 'what maintenance is', how many would you say are true?

- Maintenance is asset management
- Maintenance is a post design and acquisition activity
- Maintenance needs are based on the asset
- Maintenance requirements are based on available budgets
- Maintenance requirements are not objectively based
- Maintenance requirements are all fixed time based
- Maintenance is a business overhead
- Maintenance requirements do not change with the business
- Maintenance requirements are not assessed for effectiveness and efficiency

None of these are true. Yet, in my experience, organisations would often say many of these are true. While this may be reflective of organisations being at the start of their asset management capability development journey, the need to have a consistent methodology for 'maintenance' backlog stems from having a consistent understanding of maintenance.

The Asset Management Council of Australia, through its Asset Management Body of Knowledge, defines maintenance as "all actions intended to retain an item in, or restore it to, a state in which it can perform as required" (Asset Managenent Council of Australia, 2020). The scope of maintenance activities in line with the definition is outlined in Figure 1.

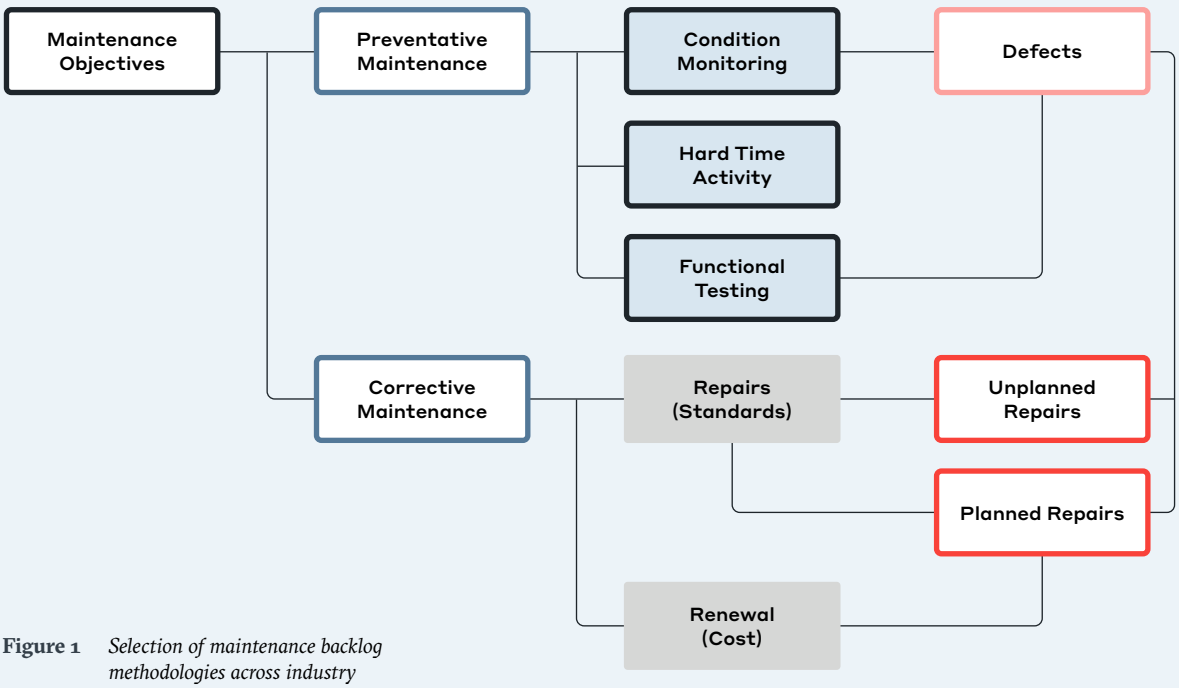

Figure 1 *Selection of maintenance backlog methodologies across industry*

The types of maintenance activities identified above are categorised based on their intent to prevent the functional failure of assets or to correct defects (conditional or functional) by restoring assets to a serviceable state in line with customer or service requirements/ standards. The inclusion of the terms 'standards' and 'cost' within the 'repairs' and 'renewal' categories are meant to signify that repairs (typically operating expenditure) return an asset to the agreed level of service and renewal (typically capital expenditure) is based on cost / benefit assessment for achieving organisational objectives.

This is critical in moving away from a 'backlog' methodology to one that considers future business objectives based on customer/ community needs. How assets were maintained in the past should not inform how assets should be maintained in the future. Changes to service requirements, customer standards, regulatory requirements and environmental sustainability objectives are all factors that influence the performance expected from assets and their maintenance regime. This is also reflective of leading maintenance management practice as shown in Figure 2.

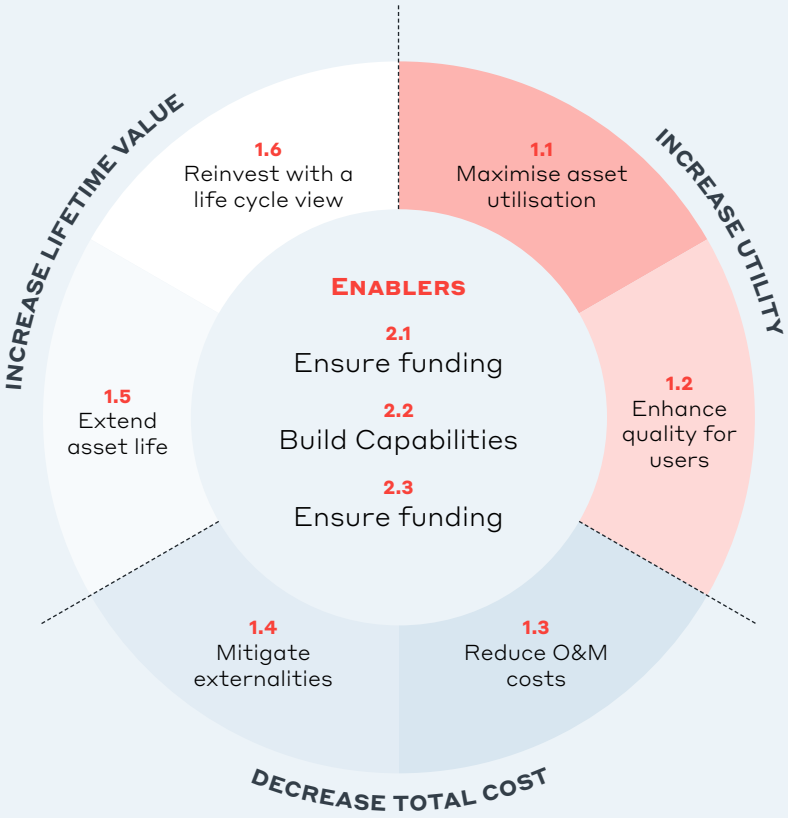

Figure 2 *Best practice maintenance management framework (World Economic Forum, 2014)*

4. Key principles for a new methodology

The starting point for proposing a new methodology to determine maintenance investment needs should be based on a set of principles. Drawing on the themes outlined earlier in the paper and leading maintenance management practice (World Economic Forum, 2014; NSW Government, 2012; IPART, 2015; Asset Managenent Council of Australia, 2020), the following design principles are proposed.

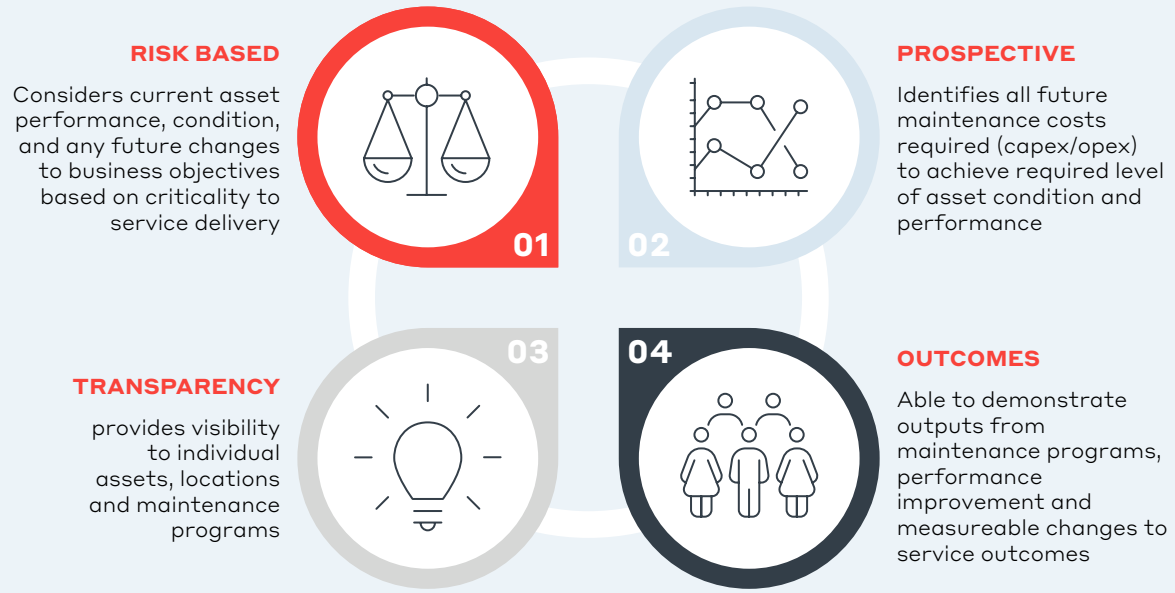

Figure 3 *Proposed principles for new methodology*

5. Designing the new methodology

In consideration of the design principles, the new methodology must ultimately be expressed as the level of future maintenance investment needed demonstrating the benefits to service outcomes for customers and the community. This paper proposes that the new methodology must prospectively identify additional maintenance investment required (forward five-years as a minimum) based on:

- Current and future maintenance requirements to support safety and service delivery
- Anticipated changes to asset portfolio performance requirements and rate of asset deterioration
- Current and anticipated changes to organisational objectives, legislative requirements, regulations and standards (technical, service and customer)
- Expressed in financial (capex/opex), program deliverables and economic benefits

METHODOLOGY ELEMENT	EXPLANATION / EXAMPLE	DESIGN PRINCIPLES			
		1	2	3	4
Cost of additional maintenance required over the next 5 to 10 years (capital and recurrent) to bring assets...	Cost will include future maintenance costs above current maintenance funding (capex and opex), and the optimal mix between preventative, repair and renewals activity/outputs. For example, $1 billion of additional maintenance over the next 5 years is required ($800 million capex and $200 million opex) for 700km of pavement rebuilding, 4 bridge renewals and repair 150 culverts on a road corridor...		●		●
...to acceptable performance to deliver required service outcomes...	Maintenance requirements are expressed in line with measurable performance results against service requirements, levels of service and target outcomes (by criticality). For example, ...to enable the organisation to meet road operational service requirements through: Reducing number of speed restrictions from landslides and load limits on bridges. Reduce safety incidents through reducing risk of rock falls/landslides. Reduce cost to government and customer operating costs through reduction in pavement failures and smoother ride quality.	●		●	
...and provides the following economic and financial benefits.	Maintenance requirements are expressed as measurable benefits to the organisation and customers/community in economic and financial terms. For example, ...that provides $2.5 billion of economic benefit and $60 million of financial benefits each year.			●	

Table 2 *Maintenance backlog expression and alignment to design principles*

6. Conclusion

The proposed methodology outlined in this paper is aimed to be the starting point for further refinement and improvement by public sector organisations and asset management practitioners. The proposed methodology is dependent of organisations having a sound level of asset management maturity. However, most state and local governments across Australia have started this maturity journey which makes this methodology very achievable. My experience in NSW Government alone can attest to its successful use to influence significant investment in maintenance, with $1.54 billion of additional maintenance funding of roads and bridges on state and council owned networks (NSW Treasury, 2013).

The asset management industry should consider moving away from the 'backlog' term as it has not been an effective tool for proving a robust case for additional maintenance investment within government. It is not a real or useful measure of the required level of additional maintenance investment needed to sustainably allow a public sector organisation to meet its service requirements to customers and communities.

A paradigm shift is required where the focus is on quantifying the uncertainties of the future and the level of service to be achieved as aligned to government target outcomes, rather than how much maintenance funding is required based on assessment of the past and the needs of the "asset". The proposed new methodology can help improve how public sector organisations and governments prioritise investment in response to the growing future challenges facing their asset portfolios and the services.

It is time to start looking forward to the outcomes we want to deliver, not look at the past for what we think we should have done for the asset. There should be "no such thing as maintenance backlog".

References

APPA, 2015.
Capital Renewal and Deferred Maintenance
Virginia: s.n.

ASCE, 2017.
2017 Infrastructure Report Card (USA)
USA: s.n.

ASSET MANAGEMENT COUNCIL OF AUSTRALIA, 2014.
Framework for Asset Management
Australia: s.n.

ASSET MANAGEMENT COUNCIL OF AUSTRALIA, 2020.
Asset Management Body of Knowledge
Australia: s.n.

CCA, CPWA, CSCE, FCM, 2016.
Canadian Infrastructure Report Card
Canada: s.n.

DEPARTMENT OF INFRASTRUCTURE, LOCAL GOVERNMENT AND PLANNING, 2013.
Financial Management (Sustainability)
Queensland: s.n.

INFRASTRUCTURE AUSTRALIA, 2021.
2021 Australian Infrastructure Plan
Australia: s.n.

INFRASTRUCTURE NSW, 2018.
State Infrastructure Strategy 2018-2038
NSW: s.n.

INFRASTRUCTURE WESTERN AUSTRALIA, 2021.
2021 State Infrastructure Strategy
WA: s.n.

IPART, 2015.
Fit for the Future Infrastructure Ratios
NSW: s.n.

IPWEA, 2019.
Asset Renewal Backlog
Australia: s.n.

NHS ESTATES, 2004.
A risk-based methodology for establishing and managing backlog
United Kingdom: s.n.

NSW AUDIT OFFICE, 2016.
An Overview
NSW: s.n.

NSW GOVERNMENT, 2012.
NSW Commission of Audit (Interim Report)
NSW: s.n.

NSW TREASURY, 2017.
2017-18 NSW Budget Paper 2
NSW: s.n.

NSW TREASURY, 2019.
Asset Management Policy for the NSW Public Sector (TPP19-07)
NSW: s.n.

WORLD ECONOMIC FORUM, 2014.
Strategic Infrastructure - Steps to Operate and Maintenance Infrastructure Efficiently and Effectively
Switzerland: s.n.

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