

March 2026
ISSUE
01
Volume 20

THE ASSET JOURNAL

ASSET MANAGEMENT COUNCIL

PRODUCTIVITY IMPROVEMENT THROUGH ASSET MANAGEMENT

Driving Real-Time Decision-Making: Leveraging Data and Reporting Tools to Transform Asset Management and Reliability

A Stochastic Model for Determining Optimal Asset Replacement Intervals

A Data-Driven Approach to Optimising Asset Performance on a Road Asset Performance Contract

Identifying Asset Performance Indicators for the NSW Government

CONTENTS

Editors Column 3

National Chair's Letter 4

Technical Article 1: Driving Real-Time Decision Making: Leveraging Data and Reporting Tools to Transform Asset Management and Reliability, Usama Fayyaz, Transdev 5

Technical Article 2: A Stochastic Model for Determining Optimal Asset Replacement Intervals, Alexandre Cesa and Jerome Lefebvre, Aurecon 16

Technical Article 3: A Data-Driven Approach to Optimising Asset Performance on a Road Asset Performance Contract, Jim Mahood and Conor Murphy, Ventia 29

Technical Article 4: Identifying Asset Performance Indicators for the NSW Government, Josh Milner, Infrastructure NSW, and Yahya Rased, NSW Dept of Communities and Justic 35

Member Article: The Capital Investment Playbook: Building Defensible Business Cases for Public Sector Assets, Shane Scriven 40

Star Profile: Tanya Nelson CPAM 46

Star Profile: Kate Ivicheva CSAM 48

Star Profile: Jeff Dusting CFAM 50

Chapter News 53

Member Application 56

Corporate Members 59

Publisher: The Asset Management Council
Chief Editor: Ernst Krauss
Publication Design: AMCouncil
ISSN: 1834-3864

For all enquires please contact:
publications@amcouncil.com.au
Asset Management Council
PO Box 2004 Oakleigh Vic 3166
Tel 03 9819 2515



ERNST KRAUSS

EDITOR IN CHIEF

This edition of "The Asset" centres about productivity improvements through Asset Management. Productivity, and its continuous improvement, is fundamental to a robust economy and remains a priority for governments, industry, and small businesses alike. In my mind, Government policy and polity play a key role in achieving productivity at all levels. But we explore here the possibility of improving productivity through Asset Management at the "micro level". Some examples in Government owned Asset and in Industry have already demonstrated that it is a distinct possibility to achieve greater productivity through application of an Asset Management framework.

Where I observed productivity improvement, there was always a strengthened understanding of purpose and direction across all levels in an organisation. That started with Leadership recognising the need to make a substantial change in operational and organisational strategies, and that resulted in implementing an Asset Management Framework. That suggests to me the observations of Behavioural Scientists, Management scholars and Leadership specialists, that leaders must do more than simply support individual growth or professional development. It is also crucial for leaders to actively foster a culture that motivates the pursuit of organisational objectives and creates a climate where employees experience a sense of fulfilment in their professional lives. Asset Management supports Leaders to encourage both personal and personnel growth and cultivate an environment that inspires achievement. This approach not only benefits individuals but also strengthens the overall performance and productivity of the organisation.

An effective Asset Management framework should embody these behaviours and promote a workforce that will be motivated, engaged, and committed to the organisation's long-term success. It is of course not an easy journey but a complex undertaking to turn around an organisation and improve productivity. Change Management must be carefully planned as the transformation may take many months and may not be concluded in a single year. Industry reports from Europe and the UK speak about productivity improvements though Asset Management of up to 15% and more but also claim employee engagement to be better suggesting by up to 20%. It is difficult to understand these figures as they may not reflect the entire organisational context or provide complete transparency regarding the transformation processes.

My own observations when implementing an Asset Management Framework are that there is a risk that the initial enthusiasm of having such a system implemented diminishes over time and then the gains are lost. Constant reinforcement of purpose, values and objectives across the organisation as well as adopting a dynamic, agile approach to managing the Asset Management framework are critical for long-term success. The synthesis of the Asset Management Council Asset Management Concept model and the Systems model and similar models into the Asset Management framework provides a solid foundation for advancing productivity and workforce satisfaction.

What is your experience with the productivity results by implementing an Asset Management framework? We value your feedback and experience.



WENDY MCPATE

NATIONAL CHAIR

As I step into the role of National Chair, I do so with both gratitude and a strong sense of responsibility. I would like to acknowledge Toby Horstead's leadership over the past four years. Under his stewardship, the AM Council has grown in reach and influence, and we are well positioned to build on that momentum.

This first edition focuses on productivity, a theme of growing national importance. Australia's productivity story is shifting. Average annual labour productivity growth has fallen from around 1.8% in the early 2000s to below 1% in recent years. Given that productivity has historically driven more than 70% of growth in income per person, this slowdown matters. It affects living standards, fiscal capacity and our ability to invest confidently in the future. Strengthening productivity is not abstract economics. It is about making better decisions across our organisations.

Research into the world's most productive firms shows clear patterns. Leading organisations capture value from digital transformation, invest in intangible assets such as research, intellectual property and workforce capability, and build future ready skills. Most importantly, they adopt a systems approach - connecting strategy, capital allocation and operations internally and across supply chains and value networks. They collaborate creatively with stakeholders and public sector partners to strengthen capability and infrastructure.

Asset management is inherently a systems discipline. At its core, it links purpose to performance. It aligns investment decisions with long term strategy. It integrates risk, lifecycle planning and governance. When applied well, asset management strengthens organisational capability, improves capital productivity and ensures that resources are directed to their highest value use. As a community, we also have an opportunity to contribute more actively to the national conversation on productivity that supports long term value creation.

At a time of energy transition, infrastructure renewal and fiscal constraint, we cannot afford fragmented decision making. Our assets, investments and services are deeply interconnected, and decisions in one part of the system inevitably influence outcomes elsewhere. Productivity depends on disciplined frameworks and whole of life thinking. Asset management provides both.

I would like to thank the contributors to this edition of the Asset Journal. Your insights will demonstrate how asset management can be applied to lift performance across sectors.

I look forward to connecting with many of you at AMPEAK in Perth, where we will explore how asset management can power productivity and prosperity, and continue advancing our profession together.



ARTICLE 1 – Driving Real-Time Decision-Making: Leveraging Data and Reporting Tools to Transform Asset Management and Reliability

Usama Fayyaz, Transdev Sydney Ferries

SUMMARY

Transdev Sydney Ferries (TDSF) has undertaken a significant digital transformation to enhance asset management and operational efficiency. This paper explores how TDSF transitioned from manual Excel-based reporting to an integrated, data-driven framework utilizing Power BI, a centralized Data Warehouse, and Power Automate. By leveraging data from the Enterprise Asset Management (EAM) system and real-time vessel monitoring via Grafana, TDSF has improved maintenance planning, labour utilization, and compliance tracking. Automated dashboards now provide real-time visibility into maintenance backlogs, planned maintenance schedules, and workforce performance, reducing reliance on static reports and enabling proactive decision-making.

Key benefits of this transformation include enhanced asset reliability, streamlined reporting workflows, and improved operational insights. The paper also discusses challenges encountered during implementation, such as data standardization, system integration, and change management. By adopting a structured data governance approach and investing in training, TDSF has successfully optimized its reporting and analytics capabilities. This paper provides insights into the role of automation and digital tools in asset management, highlighting how data-driven decision-making supports efficiency, compliance, and long-term sustainability.

Keywords: Digital Transformation, Asset Management, Power BI, Enterprise Asset Management (EAM), Data-Driven Decision-Making, Maintenance Planning, Resource Utilization, Automated Reporting, Grafana, Predictive Analytics, Data Governance, Maintenance Compliance, Workforce Efficiency, Operational Insights, Root Cause Analysis, Fleet Management, Real-Time Monitoring, Power Automate, Maintenance Backlog Analysis, Data Warehouse

1 INTRODUCTION

The Asset Management Policy for the NSW Public Sector (TPP19-07), released in November 2019, aims to enhance asset management by strengthening accountability, performance, and capability across the NSW public sector. The policy requires agencies to adopt core managynto a more flexible, efficient, and competiti

1.1 The Need for Digital Transformation in Asset Management

In today's data world, Asset Management is not just about managing physical assets, it is about it's about leveraging data and digital tools to optimise operations, improve reliability, and drive strategic decision-making with a data catered approach. Public transport industry which is considered an Asset-intensive industry is increasingly embracing data-driven decision-making to enhance operational efficiency, optimize maintenance strategies, and increase asset lifecycle. In the public transport sector, real-time data visibility and asset data insights have become critical for ensuring reliability, improving compliance, increasing safety and customer satisfaction and reducing operational inefficiencies.

At Transdev Sydney Ferries (TDSF), the transition to digital and enhanced asset management reporting was driven by the need to move away from manual, time consuming MS Excel-based reporting which was slow, inefficient, and provided minimal data insights for decision making. Historically, reporting was largely focused on contractual KPIs rather than in-depth asset performance analysis. Reports were created in Excel with no automation, required significant manual effort, leading to inefficiencies, backlog and a lack of real-time visibility of critical asset performance metrics. Reports were created out of necessity and using a reactive approach rather than proactive with limited utilisation of data for decision making.

Recognizing these challenges, TDSF embarked on a digital transformation journey as part of its business strategy to modernize asset management reporting, enhance maintenance planning, labor utilization, and reliability analytics, and automate reporting workflows. By integrating advanced data reporting and automation tools, TDSF aimed to move beyond compliance and contractual requirements, gain actionable insights, and leverage real-time asset data for improved decision-making. This shift not only aligned with industry best practices and client expectations but also addressed the evolving regulatory requirements in the public transport sector and asset management.

2 THEORETICAL BACKGROUND

2.1 Data-Driven Decision Making in Asset Management

Within Asset Management, the integration of data-driven decision-making processes have become very important This approach leverages data collection, integration, and analysis to enhance the reliability, efficiency, and longevity of assets. The transition from traditional maintenance strategies to data-centric methodologies, such as Predictive Maintenance, Reliability Cantered Maintenance exemplifies this shift. Utilising real-time data and advanced analytics to anticipate equipment failures and study trends with breakdowns before they occur, thereby minimizing downtime and optimizing operations. This proactive stance not only reduces operational disruptions but also extends the operational lifespan of assets. (Aboagye et al., 2023).

The importance of data collection, integration, and analysis in asset management cannot be overstated. Effective data governance ensures that information is accurate, consistent, and accessible, forming the foundation for informed decision-making. A study focusing on public asset management organizations demonstrated that robust data governance frameworks lead to improved decision-making capabilities. By establishing clear data requirements and quality standards, organizations can better assess asset conditions, predict future performance, and allocate resources more efficiently (van der Steen et al., 2023).

Digital tools play a pivotal role in improving asset reliability, reducing costs, and enhancing operations. With Industry 4.0, new technologies like the Internet of Things (IoT), Artificial Intelligence (AI), and advanced analytics allow organizations to continuously monitor and analyse asset parameters. These tools help shift from reactive maintenance to predictive



and preventive maintenance approaches. For example, data analytics and trend monitoring can identify early warning signs of deterioration or potential failure, allowing maintenance teams to intervene before a breakdown occurs. This proactive approach improves asset reliability, lowers maintenance costs, and extends asset life by preventing unexpected failures (Accenture, 2020).

A study on the impact of digital transformation highlighted that integrating advanced technologies into asset management practices leads to improved operational efficiency, better risk management, and enhanced decision-making processes. The study emphasized that organizations embracing digital tools are better positioned to respond to market dynamics and regulatory changes, thereby gaining a competitive advantage (KPMG, 2020).

2.2 Challenges in Traditional Asset Management Reporting

Traditional asset management reporting often relies on manual data collection and processing methods, which is full of inefficiencies, limitations, is time consuming, include human errors and can lead to inaccuracies which can compromise decision making. Moreover, the lack of automation means that reports are often outdated by the time they are generated, therefore not providing real time insights. This delay makes it harder for organizations to react quickly to issues, leading increased downtime and potentially higher maintenance costs.

The absence of real-time insights is a significant drawback in traditional reporting systems. Without access to up-to-date information, asset managers are unable to monitor the current health and performance of assets effectively. This limitation makes it challenging to anticipate failures or optimize maintenance schedules, often leading to a reactive approach to asset management. Such reactive strategies are less efficient and more costly compared to proactive, data-driven approaches.

Before digital transformation, organizations faced several challenges in asset management reporting. Information was isolated within departments, making it difficult to get a complete picture of asset performance. Traditional manual systems which had no integrated data, makes it hard to track maintenance activities, asset condition, resource allocation, and efficiency in one place. Reporting on asset performance, labor utilization, and operational efficiency was often manual, slow, and inconsistent, limiting real-time decision-making. These challenges highlight the need for digital tools that provide quick, automated, and real-time reporting. By integrating modern reporting systems and adopting a data-driven culture, organizations can improve asset reliability, workforce efficiency, and overall operational performance while reducing costs.

3 KEY DRIVERS FOR DIGITAL TRANSFORMATION AT TDSF

Several factors influenced the shift from manual to digital reporting.

1. Operational Inefficiencies in Manual Reporting

- Reporting was manual, time-consuming, and inconsistent across teams.
- Lack of automation meant significant delays in generating reports.
- Maintenance backlog and labor utilization data were not visible in real-time.

2. Strategic Business Priorities

- Digital transformation was identified as one of five key pillars in the annual business plan.
- A dedicated Fleet Performance Manager and Asset Management Analyst roles were created to lead the initiative.
- The goal was to shift from reactive reporting to a proactive, data-driven approach.

3. Industry Trends & Client Expectations

- Transport for NSW (TfNSW), TDSF's client, expects innovation and digitalization in asset management.
- The maritime sector is evolving, with other operators embracing data analytics
- Regulatory and industry best practices increasingly emphasize safety, efficiency, and data-driven maintenance.

4. Enhancing Safety, Reliability, and Root-Cause Analysis

- Vessel Data Recorder (VDR) data, integrated via Grafana, enables real-time insights into engine parameters, fuel consumption, and steering data.
- Improved failure investigation and root cause analysis contribute to enhanced fleet reliability.

4 TDSF'S DIGITAL TRANSFORMATION JOURNEY

4.1 From Manual to Automated Reporting

Prior to digital transformation, TDSF's asset management reporting was primarily based on Excel spreadsheets and manual data extraction from the Enterprise Asset Management (EAM) system. Reports were generated monthly, requiring significant effort from the asset management team. Data was manually extracted from the EAM system into Excel spreadsheets, where engineers and asset teams would input and modify data manually before compiling and formatting reports. This approach led to inefficiencies, including delays in reporting, lack of real-time visibility, and inconsistencies in data interpretation. Reports were often focused on contractual KPIs, rather than providing comprehensive insights into asset performance, workforce efficiency, and maintenance optimization. Once compiled, reports were emailed, leading to delayed distribution and outdated insights. The lack of automation resulted in time-consuming data entry, while reliance on static reports limited the ability to make timely, data-driven decisions. The absence of real-time tracking further slowed decision-making and reduced operational efficiency.

4.2 The Role of Digital Tools in Transformation

To address these challenges and align with industry advancements, TDSF adopted a **multiple of digital tools** to transform reporting and asset management. , TDSF developed a structured digital transformation strategy that focused on automating reporting, improving data accuracy, and enabling real-time insights

- **Enterprise Asset Management (EAM) System:** The foundation for asset data, work orders, maintenance schedules, TMPs , maintenance patterns and performance tracking. Data from the EAM is crucial for tracking asset health and identifying trends.
- **Data Warehouse:** A central repository where data from multiple sources, including the EAM and Vessel Data Recorder, is stored, structured, and made accessible for reporting and analytics.
- **Power BI:** Automated dashboards that provide real-time insights into maintenance tracking, Labor performance, asset condition, and KPI compliance.

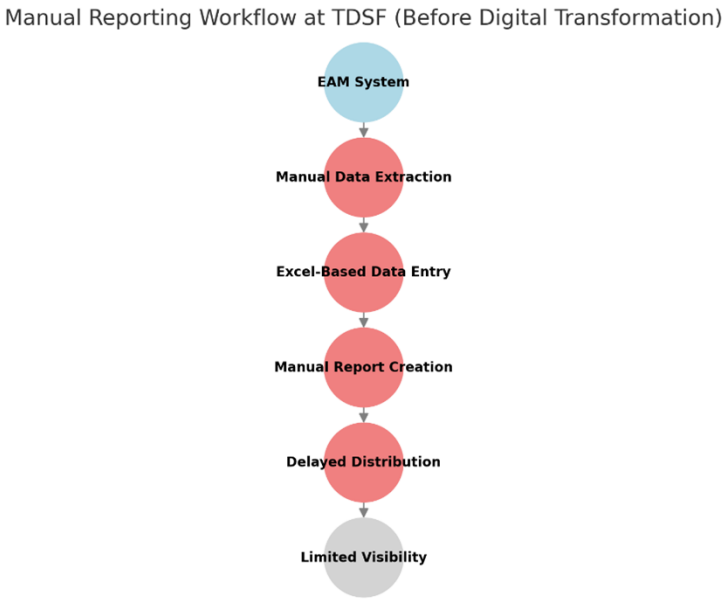


Figure 1: Manual Reporting Workflow at TDSF

- **Power Automate:** Automates report generation and distribution, significantly reducing manual effort and improving efficiency.
- **Grafana:** Monitors real-time vessel and engine data, enabling predictive maintenance and improving breakdown investigations.
- **API Integration:** APIs were developed to connect the EAM system with the Data Warehouse, allowing seamless data transfer and real-time updates for Power BI dashboards.

By integrating these digital tools, TDSF has built a connected, data-driven ecosystem that enhances operational visibility, improves decision-making, and drives efficiency across fleet management. This paper will explore the theoretical foundations of data-driven asset management, implementation strategies, TDSF case studies, and lessons learned.

4.3 Power BI Implementation

One of the most significant advancements in TDSF's digital transformation was the implementation of Power BI for automated asset management reporting. This platform replaced manual Excel-based reporting, significantly reducing the time required to generate reports while improving data accuracy and accessibility.

A key development was the introduction of a **Labor Performance and Efficiency dashboard.** The Labour Performance Dashboard provides real-time insights into workforce efficiency, booked hours, and task completion rates. It tracks the hours booked by each worker on various work orders, offering a clear picture of labor utilisation across maintenance activities. Furthermore, it monitors labor availability, including leave hours, ensuring that managers and supervisors have visibility into workforce capacity. The dashboard also records completed work order activities per trade staff, allowing leadership to assess employee productivity and efficiency trends. By leveraging this data, managers can identify inefficiencies, monitor workforce utilization patterns, and optimize resource allocation. Beyond tracking individual performance, the dashboard also monitors labor utilization across planned and corrective maintenance tasks, helping managers assess the balance between proactive and reactive maintenance efforts. Furthermore, it incorporates safety compliance tracking, such as the completion of Take 5 safety checklists on work orders, ensuring that safety protocols are being followed consistently.

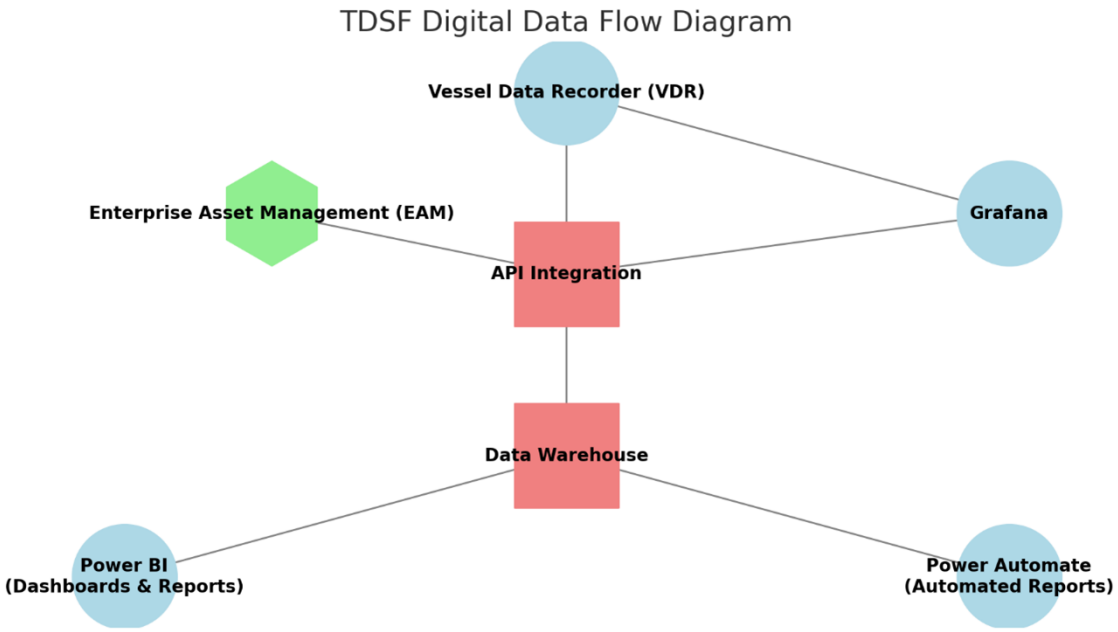


Figure 2: TDSF Data Flow Diagram - After Digitisation

This tool plays a critical role in supporting data-driven decision-making for workforce planning.

The **Maintenance Backlog Dashboard** is a important tool that provides real-time tracking of outstanding maintenance work across the fleet. It categorizes backlog tasks by priority (urgent, routine, docking), maintenance type (corrective or planned), and vessel class, ensuring that maintenance teams can effectively prioritize and allocate resources. Another essential feature of this system is the Maintenance Backlog Analysis Tool, which consolidates information on overdue and critical maintenance tasks. This tool enables maintenance teams to identify risk areas, reduce overdue tasks, and optimize scheduling. It also facilitates trend analysis, helping teams track how backlog levels change over time and assess the effectiveness of their maintenance strategies.

By leveraging this data-driven approach, TDSF ensures that maintenance activities are proactively managed, reducing downtime, improving asset reliability, and supporting efficient fleet operations.

The **PMS Activities Monitoring Dashboard** is a very important tool for tracking Planned Maintenance System (PMS) activities on each vessel in real-time. The dashboard provides supervisors, managers, and crew members with up-to-date visibility on completed tasks, outstanding work, and due dates. This dashboard updates every 1-hour reflecting the latest task completions and pending maintenance requirements. Crew members update the status of tasks directly from their tablets using the Enterprise Asset Management (EAM) system app, where they mark work orders

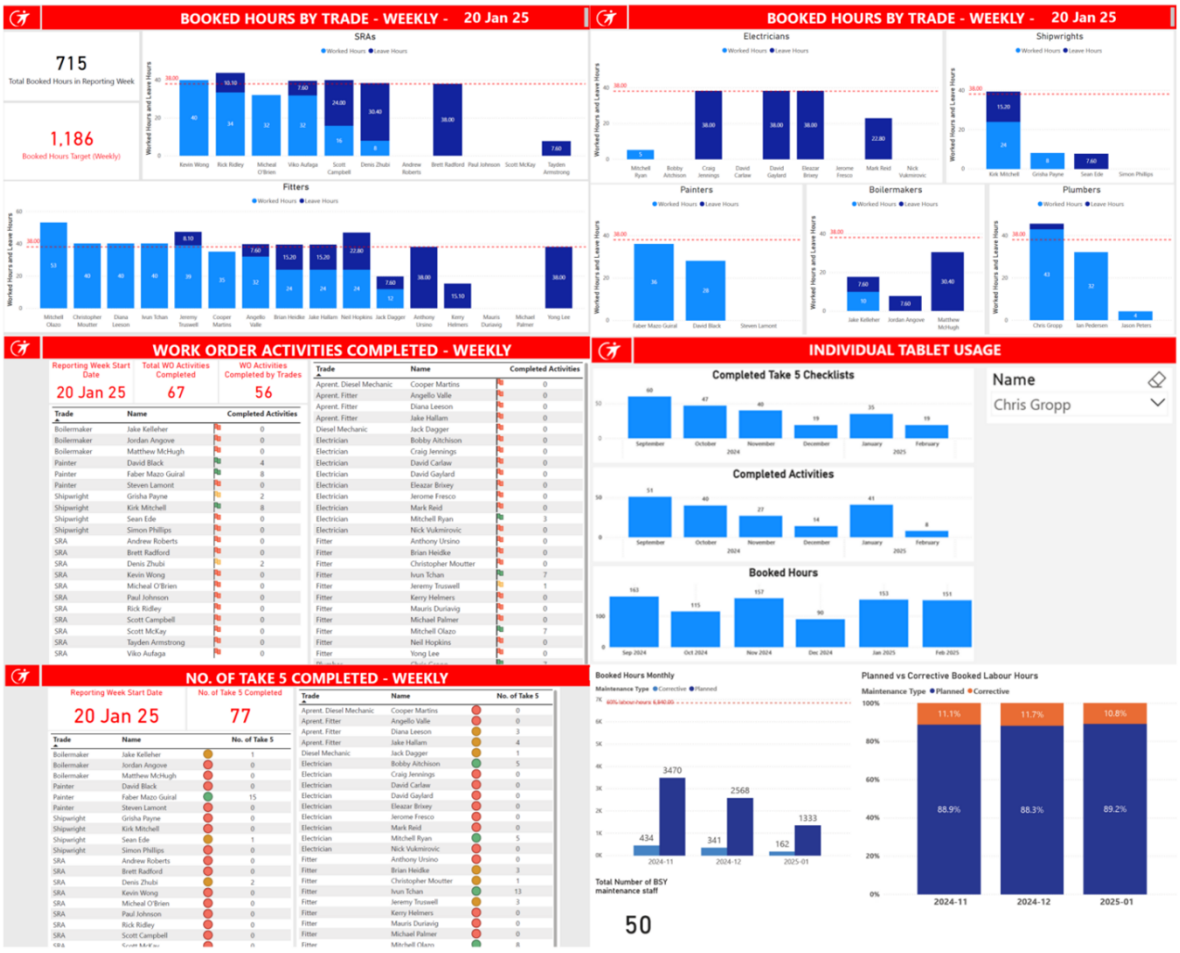


Figure 3: Labour Performance Dashboard Snapshot

as complete and add necessary comments. These updates flow into the EAM system, which then transfers data to the Data Warehouse every hour. Power BI retrieves this data, generating interactive reports that provide near real-time insights into maintenance progress.

This real-time monitoring system enhances operational efficiency by ensuring that maintenance teams have instant access to the latest data. It enables data-driven decision-making, allowing managers to identify backlogs, allocate resources efficiently, and prioritize overdue tasks. By integrating this dashboard into daily workflows, TDSF has significantly improved compliance with maintenance strategies, ensuring that planned maintenance activities align with asset reliability goals. The automation of reporting has also reduced manual efforts, leading to better workforce utilization and improved tracking of maintenance performance.

TDSF has developed a **Maintenance Forecast Model** that provides a projection of upcoming maintenance activities for the vessel fleet based on running profiles and predefined maintenance schedules. This model is built using EAM data, TMPs, and Maintenance Patterns, processed and visualized through Power BI reports using data from Data Warehouse. By consolidating planned maintenance schedules, asset usage, and work order history, the model enables supervisors, engineers, and operational teams to anticipate future maintenance needs, track planned activities, and optimize resource allocation. The system offers a comprehensive view of scheduled services over the next six months, detailing vessel availability, expected downtime, and maintenance requirements.

This forecasting tool is particularly valuable for planning and resource utilization, ensuring that maintenance activities are scheduled efficiently with minimal disruption to operations. The dashboard allows the operations team to assess vessel availability and align maintenance activities with vessel requirements for trips. By identifying vessels that will be out of service for maintenance, the team can adjust schedules, allocate replacement vessels, and ensure continuity of ferry operations. This data-driven approach enhances operational efficiency, reduces unexpected disruptions, and supports proactive decision-making in fleet deployment plan.

4.4 Power Automate for Process Automation

In addition to Power BI, TDSF implemented Power Automate to further streamline reporting workflows and automate data

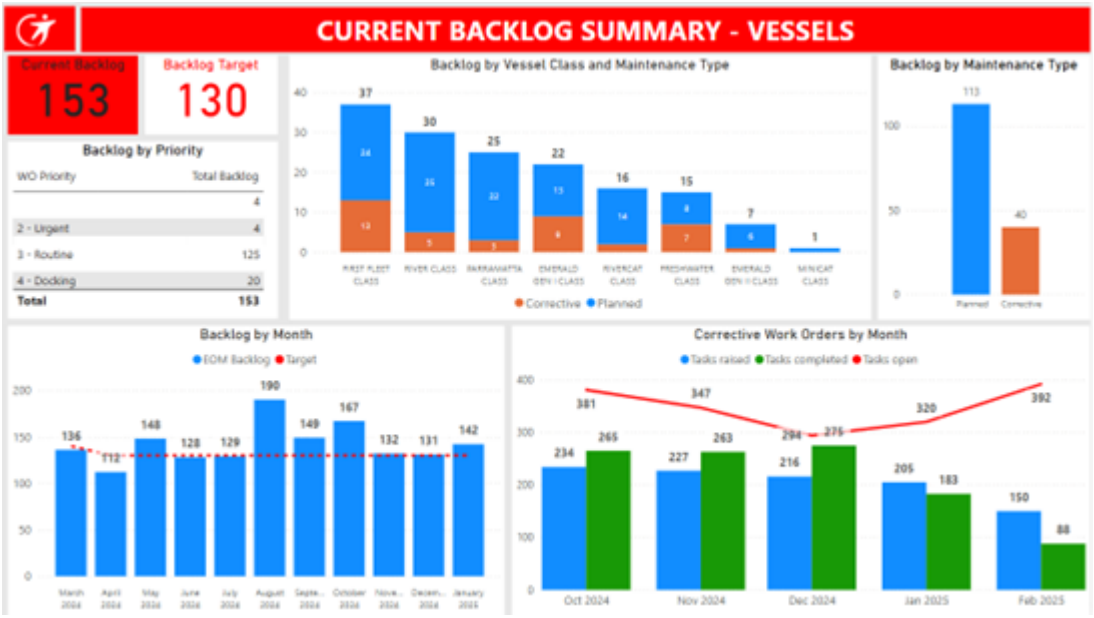


Figure 4: Maintenance Backlog Dashboard Snapshot

distribution. Previously, reports such as Running Hours were manually compiled each month, consuming significant time and effort. Now, data flows from the EAM system to the Data Warehouse, where it is structured and processed for Power BI reports. Within Power BI, sorting, calculations, and data aggregation occur, transforming raw data into meaningful insights. Power Automate then extracts relevant tables from these reports, processes the data as needed, and distributes the reports to relevant stakeholders automatically. This ensures that accurate, real-time insights reach decision-makers without manual intervention.

4.5 Vessel Data Recorder (VDR) and Grafana for Real-Time Vessel Data

TDSF utilizes Grafana as a powerful telematics visualization tool to monitor and analyse vessel performance in real-time. The system collects sensor data through a Vessel Data Recorder (VDR), which continuously captures critical parameters from the vessel, including engine performance, fuel consumption, steering inputs, transmission data, and hydraulic system pressures. This data is then stored in the cloud and updated every five seconds, with a granularity of one-second intervals, ensuring high-resolution monitoring of vessel

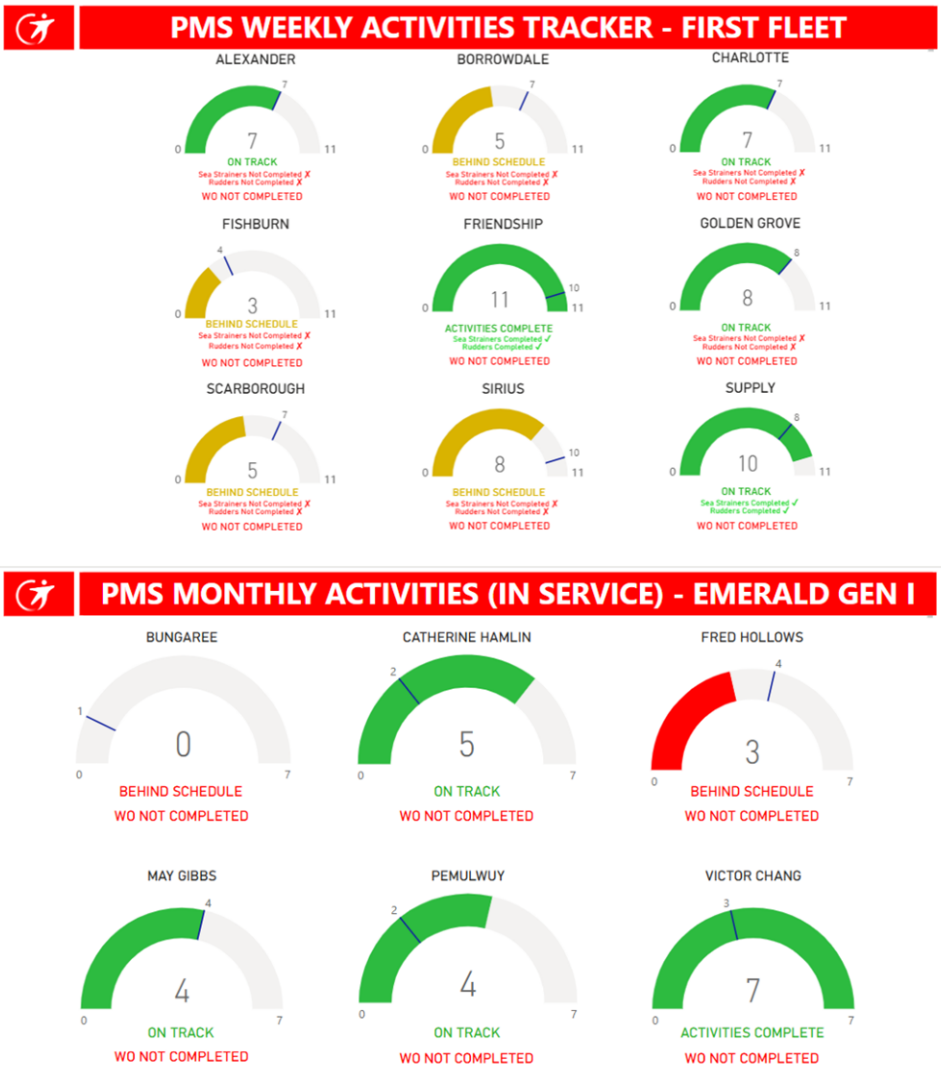
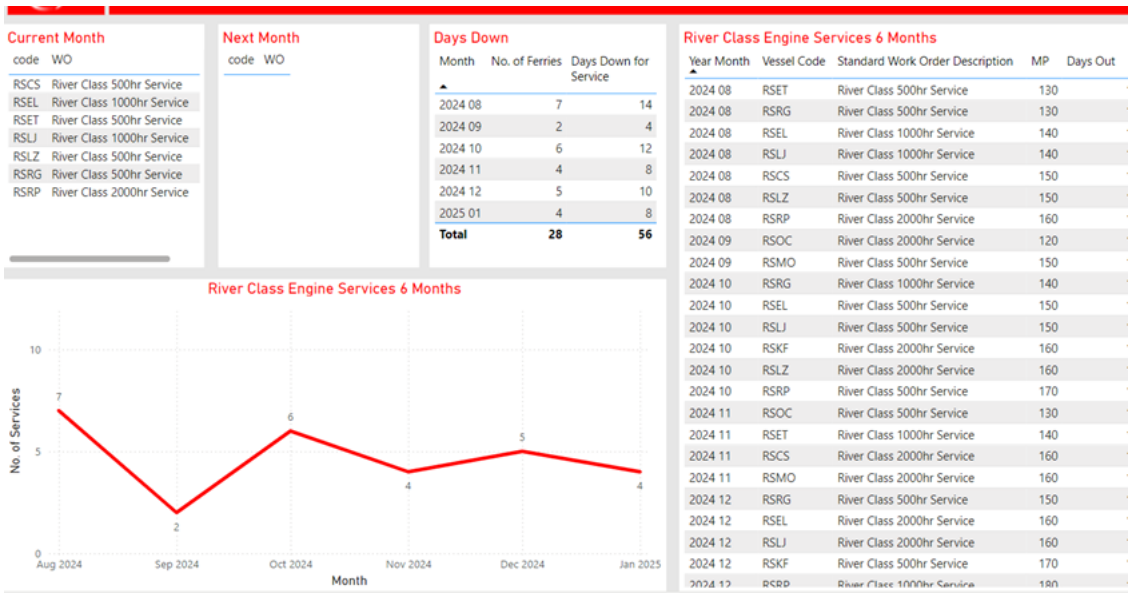


Figure 5: PMS Activities Monitoring Dashboard



Current Month

code	WO
RSCS	River Class 500hr Service
RSEL	River Class 1000hr Service
RSET	River Class 500hr Service
RSLJ	River Class 1000hr Service
RSLZ	River Class 500hr Service
RSRG	River Class 500hr Service
RSRP	River Class 2000hr Service

Next Month

code	WO

Days Down

Month	No. of Ferries	Days Down for Service
2024 08	7	14
2024 09	2	4
2024 10	6	12
2024 11	4	8
2024 12	5	10
2025 01	4	8
Total	**28**	**56**

River Class Engine Services 6 Months

River Class Engine Services 6 Months

Year Month	Vessel Code	Standard Work Order Description	MP	Days Out
2024 08	RSET	River Class 500hr Service	130	
2024 08	RSRG	River Class 500hr Service	130	
2024 08	RSEL	River Class 1000hr Service	140	
2024 08	RSLJ	River Class 1000hr Service	140	
2024 08	RSCS	River Class 500hr Service	150	
2024 08	RSLZ	River Class 500hr Service	150	
2024 08	RSRP	River Class 2000hr Service	160	
2024 09	RSOC	River Class 2000hr Service	120	
2024 09	RSMO	River Class 500hr Service	150	
2024 10	RSRG	River Class 1000hr Service	140	
2024 10	RSEL	River Class 500hr Service	150	
2024 10	RSLJ	River Class 500hr Service	150	
2024 10	RSKF	River Class 2000hr Service	160	
2024 10	RSLZ	River Class 2000hr Service	160	
2024 10	RSRP	River Class 500hr Service	170	
2024 11	RSOC	River Class 500hr Service	130	
2024 11	RSET	River Class 1000hr Service	140	
2024 11	RSCS	River Class 2000hr Service	160	
2024 11	RSMO	River Class 2000hr Service	160	
2024 12	RSRG	River Class 500hr Service	150	
2024 12	RSEL	River Class 2000hr Service	160	
2024 12	RSLJ	River Class 2000hr Service	160	
2024 12	RSKF	River Class 500hr Service	170	
2024 12	RSRP	River Class 1000hr Service	180	

Figure 6: Maintenance Forecast Model Snapshot



Figure 7: Power Automate Workflow Example

operations. Grafana dashboards enable engineers and operators to visualize trends, detect anomalies, and investigate vessel behaviour with detailed historical and real-time insights.

The real-time data visualization and reporting in Grafana provide invaluable support for breakdown analysis, incident investigations, and root cause identification. By monitoring key metrics such as engine temperature, boost pressure, load, and fuel consumption, maintenance teams can quickly identify potential issues before they escalate into failures. This data can also be leveraged for predictive maintenance models, helping to proactively schedule maintenance based on operational conditions rather than fixed intervals. By integrating real-time vessel data into decision-making processes, Grafana significantly enhances operational efficiency, improves asset reliability, and supports data-driven maintenance strategies.

5 CONCLUSION AND LESSONS LEARNED

TDSF's digital transformation has redefined its approach to asset management reporting, replacing manual, spreadsheet-based processes with an automated, real-time reporting framework. The integration of Power BI, Power Automate, and Grafana has enabled improved maintenance planning, workforce efficiency, and fleet reliability. This transformation has provided greater visibility into asset performance while streamlining reporting workflows and reducing administrative burdens.

While the transition to digital reporting at TDSF has significantly improved efficiency and decision-making, the journey was not without its challenges. One of the primary obstacles was overcoming resistance to change. Employees were accustomed to traditional Excel-based reporting, and some were hesitant to adopt automated dashboards and real-time reporting tools. However, this resistance was relatively minimal, as many staff members quickly recognized the benefits of digital reporting once they saw how it streamlined their workflow. To facilitate a smooth transition, TDSF implemented training programs to ensure that all employees, from engineers to managers, were comfortable using Power BI, Power Automate, and Grafana. Hands-on workshops and continuous support helped in easing the learning curve.

Another major challenge was data standardization and integration. Since data was coming from multiple sources—including the Enterprise Asset Management (EAM) system, the Data Warehouse, and the Vessel Data Recorder (VDR)—it was essential to align data formats, reporting structures, and processing methodologies. Standardizing these data streams required careful planning and coordination



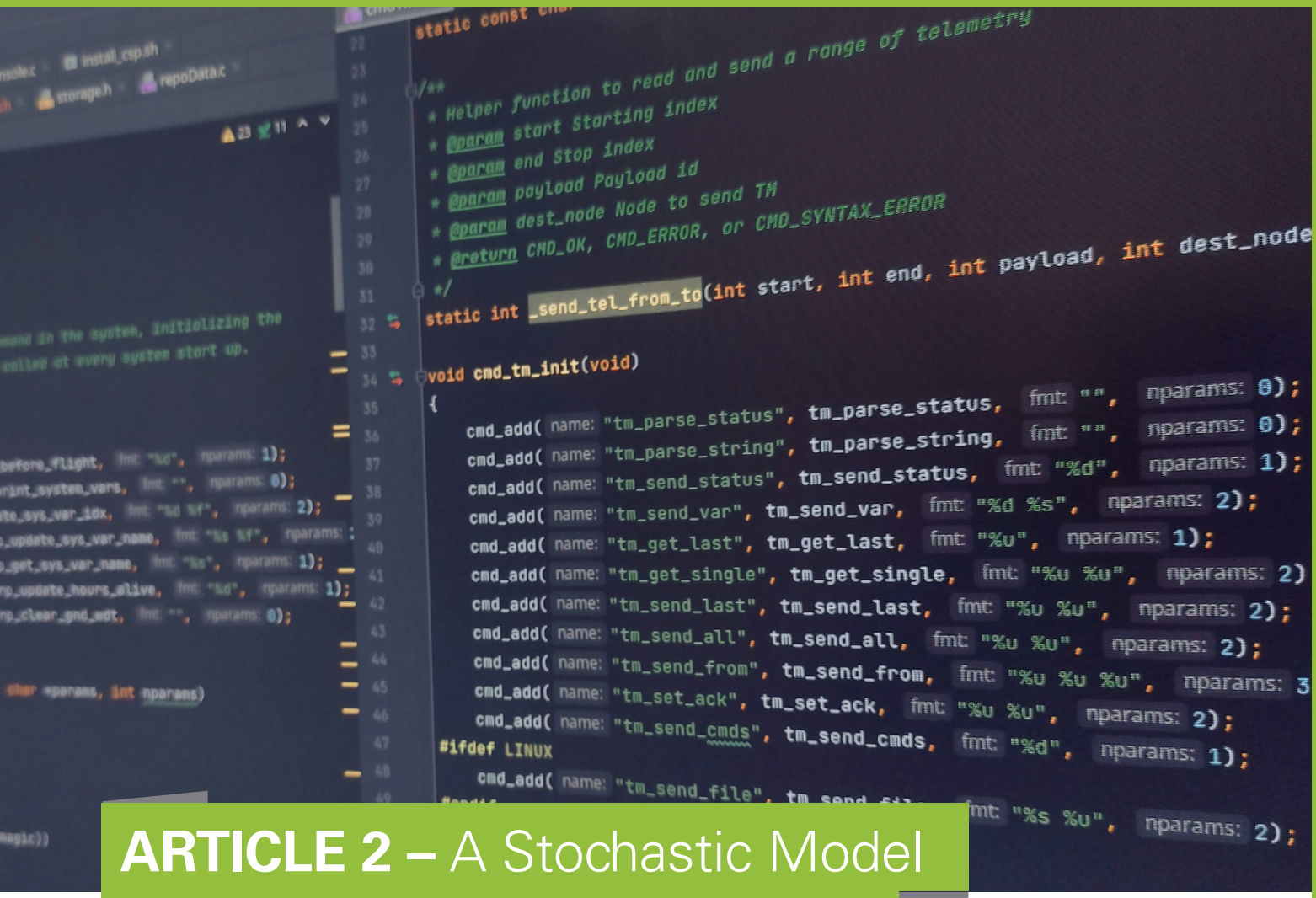
Figure 8: Grafana Dashboard Example

between asset managers, engineers, and IT teams. Right resources also played a key role in building dashboards and automating data flows. Additionally, APIs were developed to ensure seamless integration between EAM, the Data Warehouse, and reporting tools, reducing manual interventions, and improving data accuracy.

Moving forward, continuous improvement will be necessary as technology evolves. The Author recognizes that system optimization and skills development will remain an ongoing effort. As more advanced automation capabilities become available, further enhancements to reporting processes will be required to maintain efficiency, compliance, and industry best practices.

6 REFERENCES

1. Aboagye, I., et al. (2023). Asset Management Decision-Making Through Data-Driven Predictive Maintenance: An Overview of Techniques, Benefits, and Challenges. Retrieved from ResearchGate
2. van der Steen, M., et al. (2023). Coordinating Data-Driven Decision-Making in Public Asset Management Organizations. Retrieved from ResearchGate
3. Accenture. (2020). The Power of Data-Driven Asset Management. Retrieved from Accenture
4. KPMG. (2020). Digital Transformation in Asset Management. Retrieved from KPMG



ARTICLE 2 – A Stochastic Model for Determining Optimal Asset Replacement Intervals

Alexandre Cesa and Jerome Lefebvre, Aurecon

SUMMARY

The optimal frequency to recurrently replace a physical asset is a problem all asset-heavy organisations face. A scheduled replacement frequency interval is often devised from a combination of heuristics such as original equipment manufacturer guidance, subject matter experts' input, maintenance constraints, etc. Such an approach is likely to be sub-optimal from a whole-of-lifecycle cost perspective. We developed a simulation model in Python and MS Excel formats that can identify the optimal replacement interval that minimises the asset equivalent annual cost (EAC) of ownership. The model articulates current and future assets' stochastic behaviour of the probability and consequence of failure (PoF, CoF), monetisation of risks, time-value of money and other parameters, and should satisfy the Australian Energy Regulator (AER) requirement for an operator to demonstrate prudent replacement expenditure (REPEX) investment. Our code is made available as open-source software.

Keywords: Risk Modelling, Simulation, Optimisation, Maintenance, Weibull

1 INTRODUCTION

The optimal frequency of replacing an asset is a problem faced by all organisations that manage physical assets. Part of the challenge, to begin with, is the interpretation of what the different stakeholders mean by "optimal". As assets' costs and performance trade-off, it is not surprising that various interpretations of optimality typically exist, depending on the stakeholder and its incentives. Moreover, the concatenation of somewhat related drivers that are usually described subjectively (or, at best, with a simple scoring system), such as (e.g.) "risk", "criticality", "priority", "ease to replace/procure", and others supports making the goal seeking objective of "optimality" somewhat elusive. Given these issues, maintenance engineers often devise a scheduled replacement frequency interval as a combination of heuristics involving the original equipment manufacturer's guidance, subject matter expertise (SME) elicitation, the organisation's maintenance budget constraints and others. At best, such an approach is likely to be sub-optimal from a whole-of-lifecycle cost perspective, as it ignores the asset's specific operational circumstances, asset failure risks, future demands, etc. For the instances in which the asset under consideration is a single unit (e.g. a piece of equipment, machinery), cost performance sub-optimality may not be of great concern, and an SME's subjective guidance may be fit-for-purpose. However, for the instances in which the asset is made of a fleet of similar units operating under the same context, the cost opportunity presented could quickly become big and a more diligent assessment effort on the subject is granted.

More digitally mature users with access to off-the-shelf Asset Performance Management (APM) software tools can better estimate replacement intervals based on pre-determined software inputs, such as unit replacement costs, probability and consequence of failures (PoF, CoF) and others (Gartner, n.d.). Despite their overall appeal of "value for money", APM tools are typically expensive and present a high entry-cost barrier to many organisations. Moreover, APM's normally pre-determined set of inputs constrains one from finding optimal replacement intervals in real-life cases. For instance, limitations found in different APM platforms include the inability to model assets with different reliability performances (e.g. due to technology) during replacements, inability to truncate asset operational life (they usually implicitly assume operation in perpetuity), not being able to accommodate multiple consequences of failure outcomes to a failure event (i.e. they usually consider a "1:1 CoF-to-PoF" and cannot do "1:many"), and other nuances of relevance.

In this paper, we propose a method for determining the optimal replacement frequency of an asset using the Equivalent Annual Cost as a decision criterion. Despite this and similar approaches not being novel (Andrew K. S. Jardine, 2021) (Benjamin S. Blanchard, 2004), our contribution to the field involves the following elements:

- Incorporating in a single model input parameters that are typically not found on off-the-self APM software tools,
- Demonstrating the model application for a hypothetical asset example relevant to a Distribution Network Service Provider,
- Demonstrating how the additional modelling parameters we incorporate are relevant by showing their sensitivities to model outcomes.
- Sharing the model developed in both Python and Excel file formats as open-source software.

2 MODELLING CONSIDERATIONS

According to (ISO, 2024), *"Asset management involves balancing costs, opportunities and risks against the desired performance of assets to achieve the organisational objectives. The balancing might need to be considered over different timeframes"* and "*Assets exist to provide value to the organisation and its stakeholders*." In the context of physical asset replacement, a possible way of interpreting and implementing such a balancing act exercise to least erode organisational value is to evaluate the lowest maintenance EAC that could be achieved given the asset's risk, cost and performance profiles. This is the approach we adopted as the optimisation objective criteria in our model – i.e. to seek the scheduled replacement interval that yields the lowest average EAC, contingent on the interdependency of several input parameters.

Given our intent of making the model available as open source, it is presented in both MS Excel and Python to facilitate ease of access to potentially different users. A brief video demonstration of model is presented here (Lefebvre, 2025) and the source code is made available here (Alexandre Cesa, 2025).

The model inputs are described as follows:

- The probability of failure (PoF) is the probability of an asset failing within a defined period of time (intuitively, the longer the period, the more likely the asset is to fail). PoF is modelled using a Weibull distribution, parametrised with a characteristic life (η_1) and shape (β_1). The following considerations to the PoF were made in our model:An asset already installed may have an age (A), so the asset's PoF is contingent on that (i.e., it has a conditional probability of failure).

- Once an initially installed asset fails or is replaced on a scheduled basis, the operator may decide to use a different asset with a different performance (e.g., replacing a pole cross arm made of wood with one made of composite material). Such different asset technologies/construction may have different reliability performances. Our model enables the user to define a different reliability performance by changing the initially installed Weibull parametersη_1 and β_1 to new parameters η_2 and β_2. This (possibly different) asset performance will then be used for all subsequent future replacements, be these arising from either scheduled or failure events.

- A Consequence on Failure (CoF) assignment follows once an asset failure event occurs. CoF often commingle impacts concerning operation, safety, environment, reputation, etc. These comingled consequence outcomes are monetised and attributed a probability of occurrence. The probability (p_i) and associated costs (Cf_i) of these CoF typically range from (e.g.) "likely fails safe with no operational, reputation or environmental damages" & "cheap" to "extremely unlikely causing extensive disruption, fire event, causalities" & "major expense". The spectrum of CoF outcomes is modelled as p_i and Cf_i pairs, with as many outcomes (i) the user sees as required (with the restrictions that the sum of all p_i is 1 and $p_i > 0$). Typically, these multiple CoF scenarios are summed up and aggregated for calculations (Endeavour Energy, 2022). In our model, however, instead of aggregating Cf_i and p_i potential outcomes in an "equivalent" average weighted CoF, we use them as pairs and let the model draw a possible CoF outcome during the simulation based on their probabilities. More explicitly, our approach enables sampling the space of CoF possibilities "as they arise in time" rather than assuming a weighted average case throughout. This subtle difference may be relevant in affecting an optimal average EAC outcome, contingent on the input set used on the model (see "Scenarios Analysis" section below for more details).

- The schedule cost C_s is the cost associated with a scheduled replacement and typically includes parts replacement cost, labour, mobilisations, etc. Scheduled replacement costs tend to be constant over time and are usually a fraction of what it costs to reinstate a failed asset.

- The simulation period T_{sim} is the duration for which the asset is assumed to be operational – i.e. if an asset is planned to be retired in 10 or 100 years. Lowering this parameter truncates the "project life" and conversely, making it large means sustaining asset operation "in perpetuity". [1]

- The discount rate *r* is the annual discount rate used in the model. It adjusts the cost of an event when it happens to the present value of money.

- The replacement interval *RI* is the recurrent scheduled replacement frequency in years the asset may be replaced in a range defined by the user – e.g. (1, 2, 3, …, 50). For instance, if *RI* is set at "8" (and should the asset not fail before), it will be replaced recurrently after "8 years", until the end of the simulation period T_{sim}.[2]

- The number of trials *nt* is the number of times that each replacement interval *RI* is tested to obtain an EAC result. For instance, if nt is set to 1000, each replacement interval in the range of (1, 2, 3, …, 50) will be tested 1000 times, resulting in 50,000 EAC outputs for a "model run". [3]

- The equivalent annual cost (EAC) is the sum of discounted cost cash flows divided by an annuity for the simulation period T_{sim}. EAC is used instead of Net Present Value (NPV), as it is normalised

[1] *If cashflows are discounted, the cost of future replacements approaches zero. Thus, the EAC will not vary significantly past a certain point. See the scenarios below for situations in which extending the time range from 30 to 100 years has little impact on the result.*

and independent of the simulation period T_{sim} selected. We use EAC as it enables comparing projects of different durations. A lower EAC is preferred to a higher EAC.

These model parameters are summarised in Table 1. Other overarching modelling assumptions include the following:

- The asset has a finite life and cannot be repaired or serviced; it can only be replaced.
- Asset replacement or repair, once failed, is conducted instantaneously (i.e. there is no downtime).
- The probability of failure is a random variable, encompassing all different failure modes together.
- Cashflows are only outflows (as costs); there are no cash inflows (e.g. monetised benefits of doing maintenance, asset uptime, etc).

Table 1: Model Parameters Summary

Parameter	Unit (*)	Typical values	Variable Types	Comments
Time to failure (t)	years	Simulation dependent	Input, Random, Continuous	Time to failure following a Weibull distribution with parameters β_1 and η_1 for the life of the first asset (i.e. asset installed during the start of simulation) and parameters β_2 and η_2 for all subsequent replacements that take place.
Initial Age (A)	years	0-50	Input, Constant	The age of the asset when the simulation starts.
Scheduled Cost (C_s)	$	1	Input, Constant	Cost of a scheduled/planned replacement event.
Failure Cost (C_{f_i})	[$]	[2, 10, 100]	Input, Random, Discrete	List of possible unscheduled replacement costs that may take place (for instance, assuming three possible outcomes like "cheap" = $2, "moderate" = $10, "expensive" = $100, etc); pairwise associated with a probability p_i. The number of cost outcomes is user-defined. Only the ratio between C_s and C_{f_i} matter for the model (and not the cost values themselves).
Probability of failure cost (p_i)	[%]	[70, 29, 1]	Input, Random, Discrete	List of possible unscheduled event outcomes that may take place ("benign" = 70%, "moderate" = 29%, "catastrophic" = 1%). Each possible outcome p_i is pairwise associated with a C_{f_i}.
Discount rate r	$/year	3.0	Input, Constant	Annual discount rate (e.g., 0.030 = 3.0%). Used to compute the present value of costs for when events take place.
Simulation period (T_{sim})	years	100	Input, Constant	The duration of time which the sequence of scheduled replacement and failure events will be tallied for during the simulation.
Number of trials (nt)	N/A	1000	Input, Constant	Number of Monte Carlo simulation trials the model conduct for each replacement interval.
Replacement Interval (RI)	[years]	[1, 2, …, 50]	Input, Discrete	Array of possible replacement intervals (e.g., from 1 to 50 years) to be considered during the simulation, user defined.
Equivalent Annual Cost, (EAC)	$/year	Simulation dependent	Output	Each Monte Carlo simulation trial will result in an EAC. The (nt x EACs) ensemble for each RI candidate are averaged and later compared, where the lowest one is the $RI_{optimal}$.

(*) [] denotes an array

[2] While we use years in the paper and accompanying tool, other units that parametrise the Weibull distribution can be used, such as quarters, machine cycles, etc.

[3] Computer processing time increases with an increase in the number of trials. Therefore, one typically looks for a compromise between "convergence to a stable response" and "fast enough simulation" by conducting some testing. For reference, the Python code executes the model with 1000 iterations in approximately 10 seconds and with 10000 iterations in approximately 1 minute when using a computer with a 2.6GHz Intel I5 Processor and 16Gb of RAM. 10000 trials per RI generated the Scenarios showcased in this paper.

2 MODEL EQUATIONS AND ALGORITHM

The equations and background mathematics used in the model are described below.

3.1 Weibull Failure Distribution

The probability density function (PDF) of a Weibull random variable, failure time F(*t*), where *t* represents time and with shape parameter β and characteristic life η is as follows (ReliaSoft, n.d.):

$$\mathrm{F}(t) = 1 - e^{-(t/\eta)^{\beta}}, \quad t \geq 0 \qquad \text{(Equation 1)}$$

More generically, for an asset with age A, the conditional probability of failure time F (*t* | A) is as follows:

$$\mathrm{F}(t \mid A) = 1 - \frac{e^{-((A+t)/\eta)^{\beta}}}{e^{-(A/\eta)^{\beta}}} \qquad \text{(Equation 2)}$$

To simulate a failure time from this conditional distribution, we set:

$$U = \mathrm{F}(t \mid A) \qquad \text{(Equation 3)}$$

Where $U \sim U(0,1)$ is a uniform random variable with an equal chance of presenting any numerical value between 0 and 1. To generate failure times in a Monte Carlo simulation, we must use the inverse transform of the equation above – i.e. its Cumulative Distribution Function (CDF). Rearranging the equation above and solving for *t* give us:

$$t = \eta\left(-\ln(1-U) + (A/\eta)^{\beta}\right)^{1/\beta} - \mathrm{A} \qquad \text{(Equation 4)}$$

Equation 4 provides the time to failure t given that the asset has already survived up to age A. In more detail, when a sequence of random values *U* are generated (i.e. "draw") in a computer simulation, Equation 4 outputs a sequence of possible times-to-failure that follows a Weibull distribution parametrised by β and η.

3.2 Cost Model

The model considers two types of costs as follows:

- Scheduled Cost: A fixed cost C_s, incurred at planned replacement intervals and
- Failure Cost: A random cost Cf_i, drawn from a predefined probability distribution:

$$\mathrm{P}\left(C_{f_i} = c_i\right) = p_i, \quad i = 1,2,\ldots,\mathrm{N} \qquad \text{(Equation 5)}$$

where each c_i represents a possible Failure Cost with a probability p_i. As cost occurrences take place at different times, they need to be discounted (adjusted) for the preset value of money. The discounted cost for an event (i.e. either a scheduled or failure cost) occurring at time t_{event} is:

$$\mathrm{C}(t_{\mathrm{event}}) = \frac{C_{\mathrm{event}}}{(1+r)^{t_{event}}} \qquad \text{(Equation 6)}$$

Where r ≥ 0 note if r > 0, then as t_{event} gets large, $C(t_{event})$ approaches 0.

3.3 Equivalent Annual Cost (EAC)

The discounted cost events accumulated over a simulation period T_{sim} are summed up and then converted into an equivalent annual cost EAC using the annuity factor (J. Berk, 2011):

$$\mathrm{EAC} = \frac{\sum_{t=0}^{T_{\mathrm{sim}}} C_{\mathrm{event}}}{A(T_{\mathrm{sim}})} \qquad \text{(Equation 7)}$$

The annuity factor $A(T_{sim})$ when r=0 (as $\lim_{r\to 0} A(T_{sim}) = T_{sim} = T_{sim}$).

$$\mathrm{A}(T_{\mathrm{sim}}) = \frac{1-(1+r)^{-T_{\mathrm{sim}}}}{r} \qquad \text{(Equation 8)}$$

3.4 Optimisation

The optimal replacement interval is obtained by finding the *RI* value that give the lowest expected EAC (S. Boyd, 2004):

$$RI_{optimal} = \arg\min_{RI} EAC\,(RI) \qquad \text{(Equation 9)}$$

where *EAC* is calculated for a range of replacement intervals. There is typically only a single *RI* value that minimises EAC, and we call this value $RI_{optimal}$.

3.5 Monte Carlo Simulation

The Monte Carlo (MC) simulation method (Metropolis, 1949) enables one to test how the interplay of constants and random variables affects a mathematical outcome. Our model uses MC simulation to test the different EAC outcomes that could unfold for each scheduled replacement interval of interest (e.g., between 1 and 50 years). For instance, failure events of an expensive nature taking place early in the simulation period T_{sim} will lead to a comparatively higher EAC than if failure events were not expensive or if they took place at a relatively later time (refer to Table 4 and Table 5 that illustrate this point). By running several MC simulations, one can observe the distribution of EACs that each scheduled replacement interval scenario is likely to present. A simplified pseudocode for the MC simulation of our code is presented in Figure 1.

*For each schedule replacement interval (RI), test the number of trials (nt):
*For each trial:
*Assignment: An asset starts at A years old, β_1 and η_1 Weibull parameters, cost is set to zero.
*While time elapsed is less than simulation period τ_{sim}:
*Draw a possible asset time to failure (t) using equation (4).
*If (t) is less than RI, a failure cost C_f is drawn as per equation (5).
*Else, a scheduled cost c_s is assigned
(For subsequent asset, update equation (4) with β_2 and η_2)
*Update simulation time elapsed,
*Calculate cost $C(t_{event})$ as per equation (6) and tally
*Compute EAC for the MC run using equation (7) and tally.
*End for
*Average the EACs found for each schedule replacement RI over the nt iterations and tally.
*End for

Figure 1: Model MC simulation algorithm

2 MODEL TESTING SCENARIOS

To demonstrate the functionality of our model, we propose using a hypothetical scenario in which the asset being modelled is a distribution power pole cross arm. Our case is inspired by the typical replacement expenditure modelling the Australian Energy Regulator expects Transmission and Distribution Networks Service Provides (TNSPs & DNSPs) to conduct to justify their future maintenance costs budgetary requirements (AER, 2019). In addition to a base case, nine alternative scenarios were devised with the objective of investigating the model inputs' sensitivities and how the outputs produced conform with a "first-principles" logical reasoning, discussed on next section.

4.1 The base case scenario

Australian DNSPs typically must manage in the order of hundreds of thousands of cross-arms in their network. Cross arms are usually made of wood, but more reliable alternatives, such as composite material construction, are also available. Cross-arms present different failure modes (cracked, rot, etc). We assume a cross arm is 30 years old and made of wood, with PoF behaving like a Weibull distribution, with parameters η_1 = 41.5 and β_1 = 4.0 being typical representations of fleets in Australia (Ergon Energy, 2024). The asset operator decides to no longer use wood on future replacements but to use a more reliable composite cross-arms alternative with PoF following a Weibull distribution with parameters η_2 =70 and β_1 = 4.0.

Once a cross-arm functional failure event occurs, failure recovery costs/probability pairs are as follows: [($2.0, 50%), ($10.0, 49%), ($500.0, 1%)]. A scheduled replacement or the new composite cross arms cost $1.0. The operator anticipates the required asset for service over the next 100 years. The business uses a discount rate of 5% (this is a reasonable approximation for a DNSP in Australia - see (AER, 2020)). The operator wants the lowest EAC performance for replacement intervals between 1 and 100 years.

4.2 Alternative scenarios

Nine alternative scenarios were devised to assess the model performance under different input sets, as detailed on Table 2.

The scenario inputs summary and simulation results are presented in Table 3. The specific scenario changes made in relation to the base case are indicated in red text, and optimal replacement intervals are shown in blue at the bottom of the Table 3.

Table 2: Summary of alternative scenarios to the base case

Scenario	Difference(s) to the Base Case Scenario
1	Subsequent asset replacements have the same reliability performance as the asset initially installed, i.e. $\eta_1 = \eta_2 = 41.5$ and $\beta_1 = \beta_2 = 4.0$.
2	A weighted average CoF value of $10.9 replaces the costs/probability pairs set of [($2, 50%), ($10, 49%), ($500, 1%)].
3	The asset initially installed is new (i.e. its age is zero instead of 30 years).
4	The discount rate is set as 0.0% (instead of 5.0%)
5	The simulation period is reduced from 100 to 30 years.
6	The reliability performance of the asset installed initially is poor (for instance, may be of a low-quality wood, different operating environment, etc). Characteristic life parameter η_1 set at 20, instead of 41.5.
7	The failures are three times more expensive, from [$2, $10, $500] to [$6, $30, $1500].
8	The failures' costs are three times cheaper, from [$2, $10, $500] to [$1, $3, $150].
9	Two changes were made to the base case as follows: (1) assumed the assets subsequently replaced are of bad quality ($\beta_2 = 4$, $\eta_2 = 15$); (2) and the simulation period is reduced from 100 to 15 years.

Table 3: Scenario inputs summary and simulation model restuls

Parameter, [Unit]	Base Case	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
PoF, installed asset [β_1, η_1]	[4, 41.5]	[4, 41.5]	[4, 41.5]	[4, 41.5]	[4, 41.5]	[4, 41.5]	[4, 15]	[4, 41.5]	[4, 41.5]	[4, 41.5]
Initial Age (A), [years]	30	30	30	0	30	30	30	30	30	30
PoF, subsequent assets [β_2, η_2]	[4, 70]	[4, 41.5]	[4, 70]	[4, 70]	[4, 70]	[4, 70]	[4, 70]	[4, 70]	[4, 70]	[4, 15]
Scheduled Cost (C_s), [$]	1	1	1	1	1	1	1	1	1	0.7
Failure Cost (C_f), [$, array]	[2, 10, 500]	[2, 10, 500]	[10.9]	[2, 10, 500]	[2, 10, 500]	[2, 10, 500]	[2, 10, 500]	[6, 30, 1500]	[1, 3, 150]	[2, 10, 500]
Probability of failure cost (p_i), [%, array]	[50, 49, 1]	[50, 49, 1]	[1.0]	[50, 49, 1]	[50, 49, 1]	[50, 49, 1]	[50, 49, 1]	[50, 49, 1]	[50, 49, 1]	[50, 49, 1]
Discount rate r, [%]	5	5	5	5	0	5	5	5	5	5
Simulation period (T_{sim}), [years]	100	100	100	100	100	30	100	100	100	15
Number of trials (nt), [#]	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Replacement Interval (RI), [years, array]	[1, 2, …, 100]	[1, 2, …, 100]	[1, 2, …, 100]	[1, 2, …, 100]	[1, 2, …, 100]	[1, 2, …, 30]	[1, 2, …, 100]	[1, 2, …, 100]	[1, 2, …, 100]	[1, 2, …, 100]
Optimal replacement interval ($RI_{optimal}$) [years]	**8**	**8**	**8**	**22**	**36**	**9**	**27**	**4**	**66**	**5**

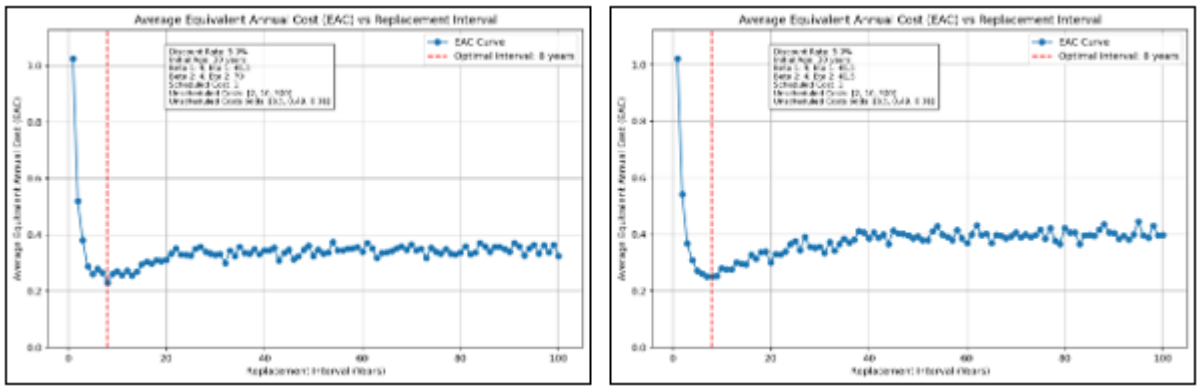


Figure 2: Base Case (left), Scenario 1 (right)

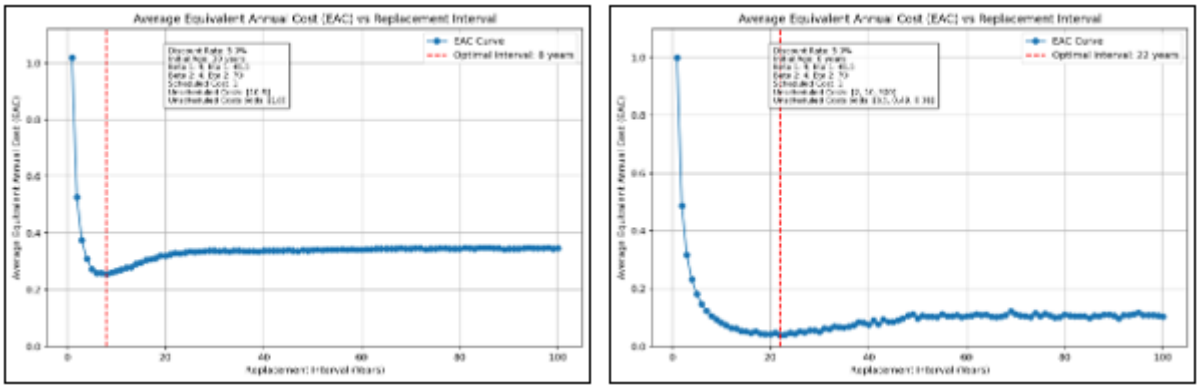


Figure 3: Scenario 2 (left), Scenario 3 (right)

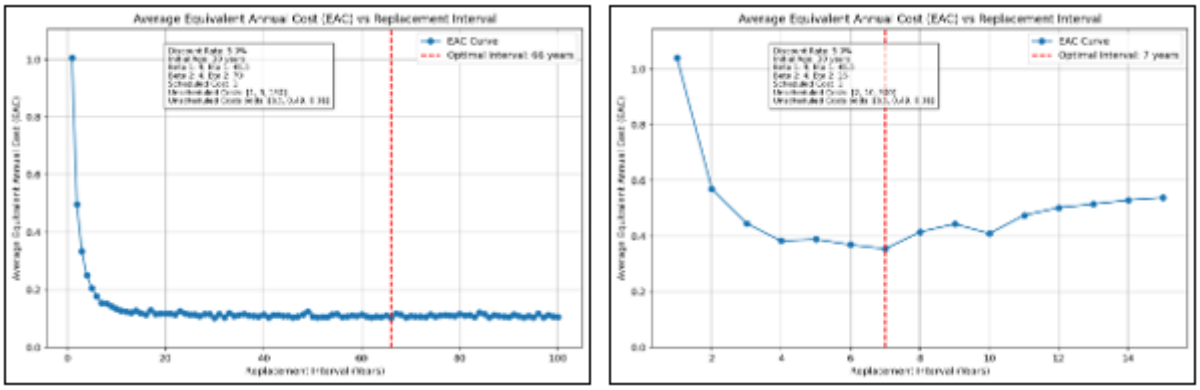


Figure 4: Scenario 4 (left), Scenario 5 (right)

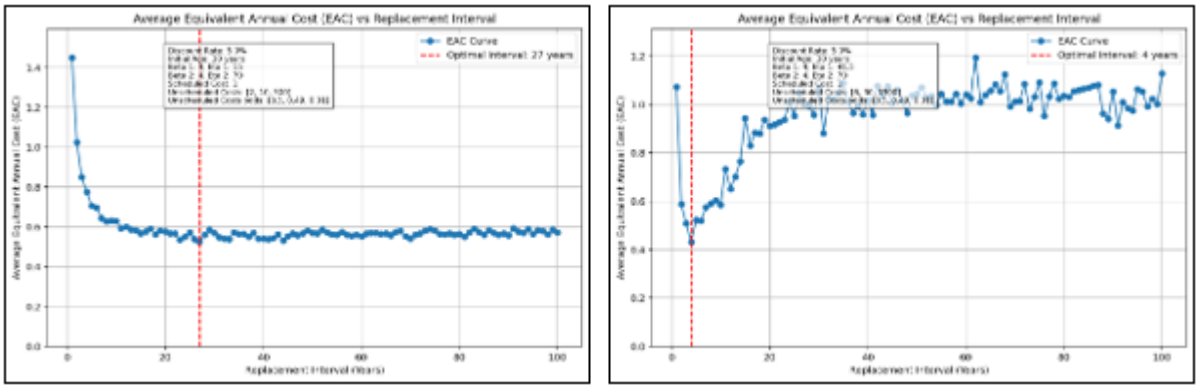


Figure 5: Scenario 6 (left), Scenario 7 (right)

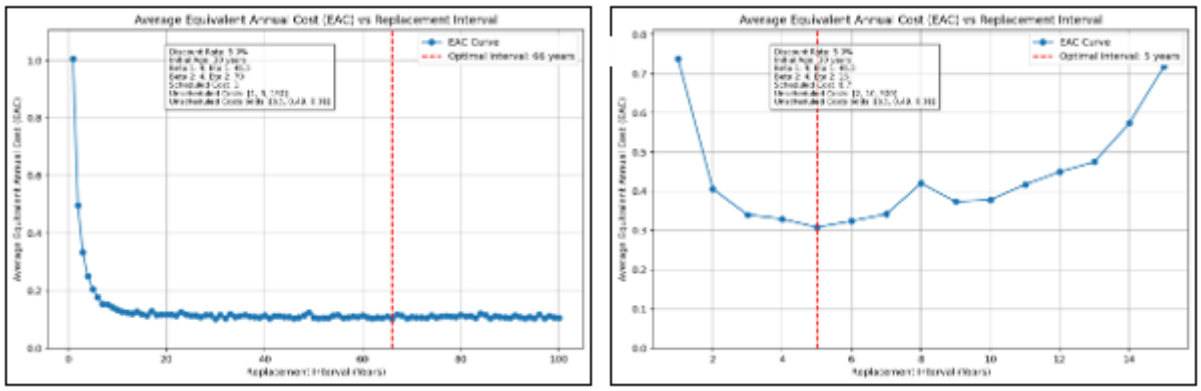


Figure 6: Scenario 8 (left), Scenario 9 (right)

5 MODEL RESULTS DISCUSSION

Below, we discuss the insights provided by the model outcomes, as illustrated by Figures 2-6, by contrasting the results of each scenario against the base case.

- Base Case

The base case graph shown in Figure 2 presents the typical convex curve behaviour expected from this type of optimisation problem setting (S. Boyd, 2004). The curve illustrates the inherent intuition that *"replacing assets early in their life or too frequently gets expensive"* and similarly, *"not replacing assets frequently enough and letting a large proportion of them fail also gets expensive".* This means that an optimal compromise frequency must exist to minimise costs that neither replaces assets too frequently nor lets them fail in large proportion. Despite the curve connecting the replacement intervals *RI* tested (i.e. the 1, 2, …, 100 range) not appearing "smooth", repeated tests with varying number of trials nt were used to assess the $RI_{optimal}$ results convergence to the same range. Note that despite the optimal replacement interval $RI_{optimal}$ found to be "8 years", there is not much difference in EACs for RI values in the 7-9 years range. Should one rerun the same model, it may generate a new $RI_{optimal}$ result in the 7-9 year range. This is not an abnormal behaviour but expected due to the inherent randomness in the sampling process, pseudo-random number generation "seed", and potentially other nuances. Refer to the following reference (Oracle Corporation, 2023) for some further practical explanation on this subject, which are particularly relevant to the *Oracle Crystal Ball ®* Excel add-in that we used in our Excel file development to run the optimisation.

- Scenario 1

$RI_{optimal}$ result remained the same at 8 years, as a result of using the same a replacement asset type with similar reliability performance to the one originally installed. This suggests that a more reliable alternative

would not change $RI_{optimal}$, given the other inputs set used.

- Scenario 2

$RI_{optimal}$ result remained the same at 8 years, as a result of aggregating the CoF as a single estimator. This particular result suggests (but does not guarantee) that "aggregating CoF costs/probabilities in a single estimator" may be a benign modelling simplification. However, it comes with caveats, as averaging can obscure the true range of possible outcomes (Savage, 2009). Moreover, one should consider "black swan events" as described by (Taleb, 2007), as these may (and frequently do) lead to disproportional impacts on model outcomes. As CoF is not probabilistic in Scenario 2, it is possible to observe the graph curve being smoother than the one shown in the base case.

- Scenario 3

$RI_{optimal}$ result increased from 8 to 20 years. This makes sense, as the asset is new at the beginning of the simulation and it should last much longer than if it was 30 years old to begin with, as in the base case. By the time the first installed asset fails in a relatively long distant future, the cashflows are getting relatively heavily discounted, to the extent of not significantly impacting the EAC result anymore.

- Scenario 4

$RI_{optimal}$ result increased from 8 to 36 years. In this scenario, cost cashflows were not discounted, meaning (e.g.) a $10 event taking place in year one or year one hundred would equally contribute to the calc of EAC. This result indicates that the $RI_{optimal}$ is quite sensitive to the discount rate, given the other inputs used.

- Scenario 5

$RI_{optimal}$ result increased from 8 to 9 years, by truncating the "project" life from 100 to 30 years. Scenario 5 $RI_{optimal}$ result is similar to the base case because cashflows get heavily discounts at the 30-year mark and onwards by a factor ranging between (Equation 6, denominator) of $(1+0.05)^{30}=4.32$ and $(1+0.05)^{100}=131.50$. This means changing the project tenure from 100 to 30 years should not affect the $RI_{optimal}$, given the other inputs set used.

- Scenario 6

$RI_{optimal}$ result increased from 8 to 27 years by assuming that the installed asset reliability is worse than the base case – i.e. it has a characteristic life reduced from 41.5 to 15 years. This change largely increases the chance of the initially installed asset failing almost immediately, regardless. This is reflected in the much higher average EAC shown on the graph (above ~ $0.50/year), compared to all previous scenarios (typically below the ~ $0.40/year), as an imminent failure event and cost takes place early in the simulation. It can be observed on the graph the curve is much flatter (it somewhat "plateau") between the RI range of 25-100 years than other previous scenarios, suggesting that other SI options would not present a significantly different performance from the $RI_{optimal}$.

- Scenario 7

$RI_{optimal}$ result decreased from 8 to 4 years, by making the consequence of failure costs three times more expensive than the base case. The graph's convex curve clearly illustrates that, in this scenario, the $RI_{optimal}$ quite decidedly is 4 years and that other SI alternatives (even in close range, say 3 or 5 years) would be significantly more expensive options to pursue.

- Scenario 8

$RI_{optimal}$ result increased from 8 to 66 years, by making the consequence of failure costs being significantly less expensive than the base case. This result is expected, as now "it does not cost much to let it fail" as in the base case. Note the graph curve flatten between *RI* 15 and 100 years, indicating that any of these values present an EAC with similar performance and may be considered equally suitable.

- Scenario 9

This scenario serves to illustrates a possible business context and likely upfront reasoning as *"cross arms will be retired in the next 15 years given upcoming standalone power systems deployments and plans for future underground installations - so let's replace current fleet as required, with a much cheaper (but also less reliable) alternative".* $RI_{optimal}$ result reduced from 8 to 5 years, meaning three replacements will be required for the project tenure - the last one at year 15 (when asset is close to retirement). This scenario indicates it may not be a good idea to change the asset type for a cheaper and more less reliable one, if the operator could (e.g.) replace asset only once with a better quality one and/or other combinations. The model encoded in both Python and Excel enables one testing various of these "what-if" scenario articulations quickly.

The scenarios presented provide some insights on the model performance for a hypothetical cross arm asset example and problem sensitivities. Overall, the scenarios illustrate the point that an optimal replacement interval is heavily dependent on several variables that interplay with each other. The model presented could be used to test and drive fact-based decisions, when the asset owner is interested in assessing typical asset management questions such as *"should the business invest in more expensive and reliable assets, when is appropriate to invest in light of asset retirement expectations, what are the risks of delaying asset replacements, what if …, etc".*

6 CONCLUSION

We developed a simulation model that informs the optimal replacement interval for an asset given its reliability characteristics, monetised risks of failure, anticipated operation tenure and other variables of relevance to the problem. A test case illustrating the model applicability in the context of replacing cross-arm assets was presented, together with nine scenarios used to check for model sensitivities to varying input sets. Input sensitivities model results suggest the model agrees with subjective first-principles intuition, indicating it performs as expected.

Our open-source model is developed in both MS Excel and Python code scripts to cater for different audiences. It addresses the AER's requirements outlined on its industry practice application note (AER, 2019), and could be used by TNSP and DNSP operators in Australia to support them demonstrating due diligence on REPEX investment decisions with their regulator. The potential cost-saving benefits this tool could unlock are significantly large when considering that (e.g.) T/DNSPs manage multiple aged asset fleets (e.g. transmission/distribution poles, insulators, conductors, etc) composed of hundreds of thousands of discrete assets each. Other asset types are equally suitable for using this model, such as (e.g.) heavy mobile plant, building infrastructures, etc.

Further developments of the model presented on this paper are possible and desirable. The authors are currently working on model augmentation improvements to consider (e.g.): repairable systems with varying levels of repair quality, "inspection regimes" (i.e. cost to inspect, prognostics assertiveness, detectability of failure, etc), the monetisation of maintenance benefits as cash inflows, system of assets dependency modelling (to address e.g. emergence of systemic risks that do not exist on discrete assets) and other aspects.

Table 4: Illustrative sample run (1oo2) from "Scenario 1" using the optimal replacement interval of 8-years

Event	Year	Asset Life (years)	Event type	Event Cost ($)	Discounted Cost ($)	Accumulative Cost ($)
1	8	8	Scheduled	1	0.67	0.67
2	16	8	Scheduled	1	0.45	1.13
3	24	8	Scheduled	1	0.31	1.44
4	32	8	Scheduled	1	0.20	1.65
5	40	8	Scheduled	1	0.14	1.79
6	48	8	Scheduled	1	0.09	1.89
7	56	8	Scheduled	1	0.06	1.95
8	64	8	Scheduled	1	0.04	2.00
9	72	8	Scheduled	1	0.02	2.03
10	80	8	Scheduled	1	0.02	2.05
11	86.09	6.09	Unscheduled	10	0.14	2.20
12	94.09	8	Scheduled	1	0.01	2.21
					EAC($/year)	**0.11**

Table 5: Illustrative sample run (2oo2) from "Scenario 1" using optimal replacement interval of 8-years

Event	Year	Asset Life (years)	Event type	Event Cost ($)	Discounted Cost ($)	Accumulative Cost ($)
1	7.90	7.90	Unscheduled	10	6.79	6.79
2	15.90	8	Scheduled	1	0.46	7.25
3	23.90	8	Scheduled	1	0.31	7.57
4	31.90	8	Scheduled	1	0.21	7.78
5	39.90	8	Scheduled	1	0.14	7.92
6	47.90	8	Scheduled	1	0.09	8.02
7	55.90	8	Scheduled	1	0.06	8.08
8	59.46	3.56	Unscheduled	2	0.10	8.19
9	67.46	8	Scheduled	1	0.03	8.23
10	75.46	8	Scheduled	1	0.02	8.25
11	83.46	8	Scheduled	1	0.01	8.27
12	91.46	8	Scheduled	1	0.01	8.28
13	99.46	8	Scheduled	1	0.01	8.29
					EAC($/year)	**0.415**

7 ACKNOWLEDGEMENTS

The authors thank Aurecon for its support of this development and welcome comments from interested parties on future ongoing model developments. The authors have no conflicts of interest to disclose.

8 REFERENCES

AER, 2019. Industry practice application note - Asset replacement planning, Melbourne: Autralian Energy Regulator.

AER, 2020. Final Decision - Ergon Energy Distribution Determination 2020 to 2025 - Overview, Melbourne: AER.

Alexandre Cesa, J. L., 2025. Github. [Online] Available at: https://gitlab.com/aurecon-oss/stochastic-model-for-determining-optimal-asset-replacement-intervals

Andrew K. S. Jardine, A. H. C. T., 2021. Maintenance, Replacement, and Reliability - Theory and Applications. 3rd ed. Boca Raton: CRC Press.

Benjamin S. Blanchard, J. E. B., 2004. System Engineering Management. 3rd ed. s.l.:John Wiley & Sons.

Endeavour Energy, 2022. Asset Risk Model Framework (REPEX), s.l.: AER, https://www.aer.gov.au/system/files/Endeavour%20Energy%20-%2010.22%20Asset%20Risk%20Model%20Framework%20-%20November%202022%20-%20Public.pdf

Ergon Energy, 2024. Pole Top Structure Replacements - Business Case, s.l.: AER, https://www.aer.gov.au/system/files/2024-02/Ergon%20-%205.4.02%20-%20Business%20Case%20Pole%20Top%20Structure%20Replacements%20-%20January%202024%20-%20public.pdf.

Gartner, n.d. Asset Performance Management Software Reviews and Ratings. [Online] Available at: https://www.gartner.com/reviews/market/asset-performance-management [Accessed 23 February 2025].

ISO, 2024. ISO 55000:2024 - Asset management - Overview, principles and terminology, s.l.: ISO.

J. Berk, P. D., 2011. Corporate Finance: Global Edition. 2nd ed. s.l.:Pearson.

Lefebvre, J., 2025. AMPEAK 2025 - A Stochastic Model for Determining Optimal Asset Replacement Intervals. [Online] Available at: https://www.youtube.com/watch?v=OGKEps3qoEQ

Metropolis, N. &. U. S., 1949. The Monte Carlo Method. Journal of the American Statistical Association, 44(247), pp. 335-341.

OpenAI, 2023. ChatGTP. [Online] Available at: https://chatgpt.com/ [Accessed 23 February 2025].

Oracle Corporation, 2023. Oracle Crystal Ball, Fusion Edition - User Manual: Version 11.1.2. [Online] Available at: https://docs.oracle.com/cd/E36352_01/epm.1112/cb_user.pdf [Accessed 23 February 2025].

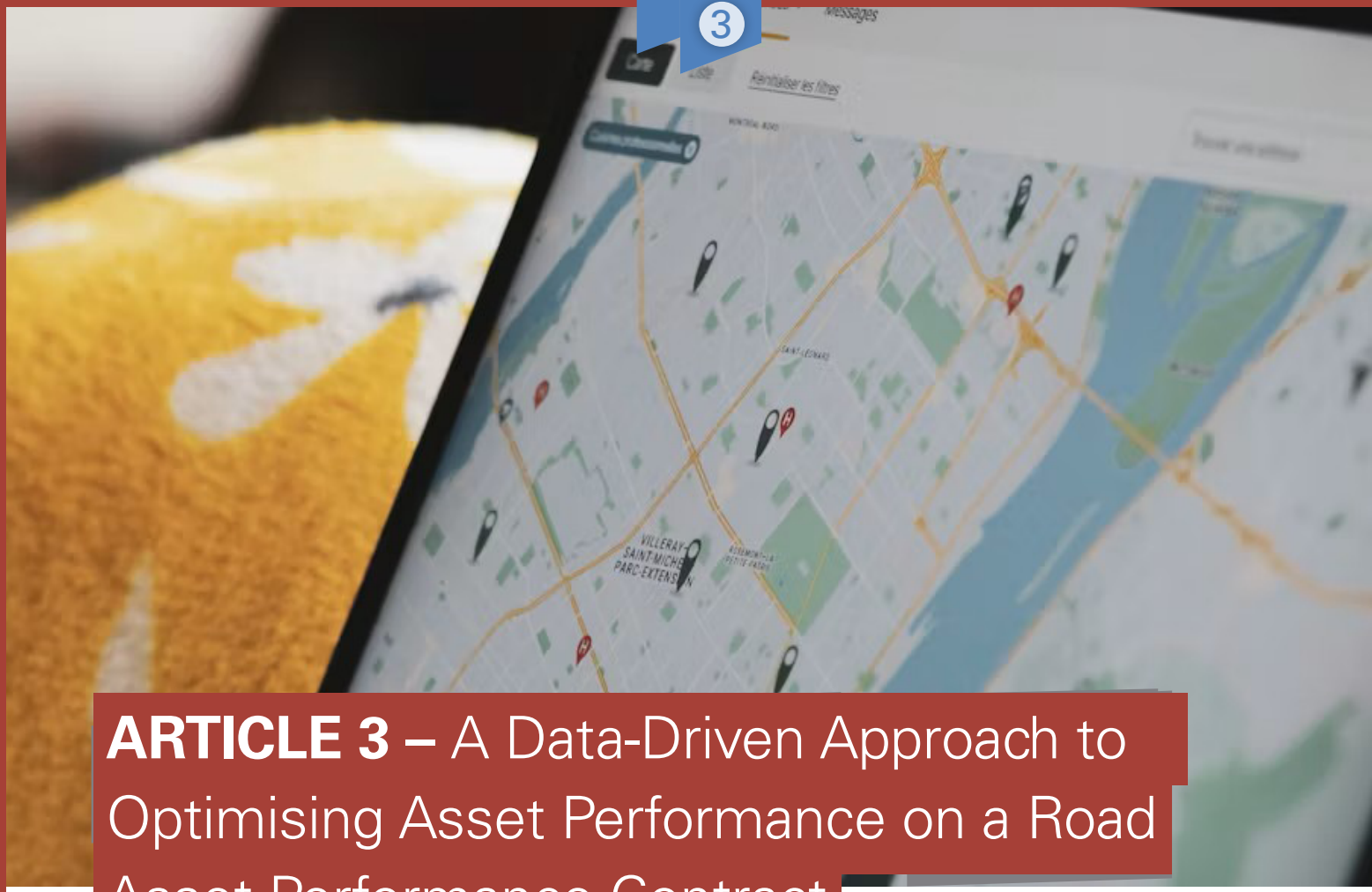
ReliaSoft, n.d. The Weibull Distribution. [Online] Available at: https://www.reliawiki.com/index.php/The_Weibull_Distribution [Accessed 23rd February 2025].

S. Boyd, L. V., 2004. Convex Optimization. 1st ed. New York: Cambridge University Press.

Savage, S. L., 2009. The Flaw of Averages: Why We Underestimate Risk in the Face of Uncertainty. 1st ed. s.l.:Wiley.

Taleb, N., 2007. The Black Swan: The Impact of the Highly Improbable. 1st ed. New York: Random House.

TECH 3



ARTICLE 3 – A Data-Driven Approach to Optimising Asset Performance on a Road Asset Performance Contract

Jim Mahood and Connor Murphy, Ventia

SUMMARY

In the fast-evolving world of Asset Management, data-driven insights are essential for optimal investment planning, maintenance scheduling, and performance review of asset management. This paper reviews some applications of spatial data science techniques in practice, where density-based clustering (DBC), Machine Learning (ML), and emerging hot spotting techniques are used to improve maintenance programs while allowing for effective root cause analysis. We also explore using Artificial Intelligence (AI) with computer vision to accurately detect defects and track deterioration over time to revise inspection frequencies and Technical Maintenance Plans (TMP). The paper explores some practical applications of asset management performance and planning dashboards to enable more informed decision-making in planning by developing a weighted suitability scoring of defects.

Keywords: Data Science, Density-Based Clustering, Data-Driven Decisions, Root Cause, TMP, Dashboard

1 INTRODUCTION

Ventia (Australia) Pty Ltd is responsible for managing road assets under a Road Asset Performance Contract for the Western Parkland Region of Greater Sydney. Additionally, we oversee Intelligent Transport Systems (ITS) in regional areas throughout the state. The replacement value of the road assets covered by this contract exceeds $8 billion.

The Western Parkland Region of Greater Sydney and Regional NSW includes major road transport routes within the Cumberland Plain and Blue Mountains. This area features a diverse range of geological and climatic zones, along with a wide variety of assets. With a projected population of approximately 6.6 million people by 2036, the road network in Greater Western Sydney is expected to expand to meet the demands of growth and regional development over the next decade. This includes developments associated with the new Western Sydney Aerotropolis.

Significant population growth and associated infrastructure development provide many challenges to maintaining the end-of-life and inadequate infrastructure. In Many cases, the asset can no longer cope with what is being asked of it. This paper outlines how Ventia uses data to optimise targeted maintenance to get the best performance from these assets.

By way of example, infrastructure investment projects include The Northern Road Upgrade, the M4 Smart Motorway, the Spring Farm Parkway, and the M12 Motorway accessing Western Sydney Airport and the Airport along with associated private developments, all of which must utilise the existing network assets during construction.

2 DENSITY-BASED CLUSTERING FOR ROOT CAUSE ANALYSIS

In a road asset performance contract with a wide range of asset infrastructure ages, we identify defects daily. Over the last 3 years, approximately 100,000 defects have been recorded on our contract. The location, type, and severity of these defects provide valuable data for density-based clustering analysis. This unsupervised machine-learning technique identifies distinct groups or clusters based on defined spatial proximity.

Density-based clustering is especially useful for spotting recurring issues, such as potholes or drainage blockages, in high-density areas. For instance, this method enabled us to identify locations where we frequently needed to return for pothole operational expenditure (OPEX) repairs within a small radius. By recognising these patterns early, we can transition to more cost-effective capital expenditure (CAPEX) solutions, such as full

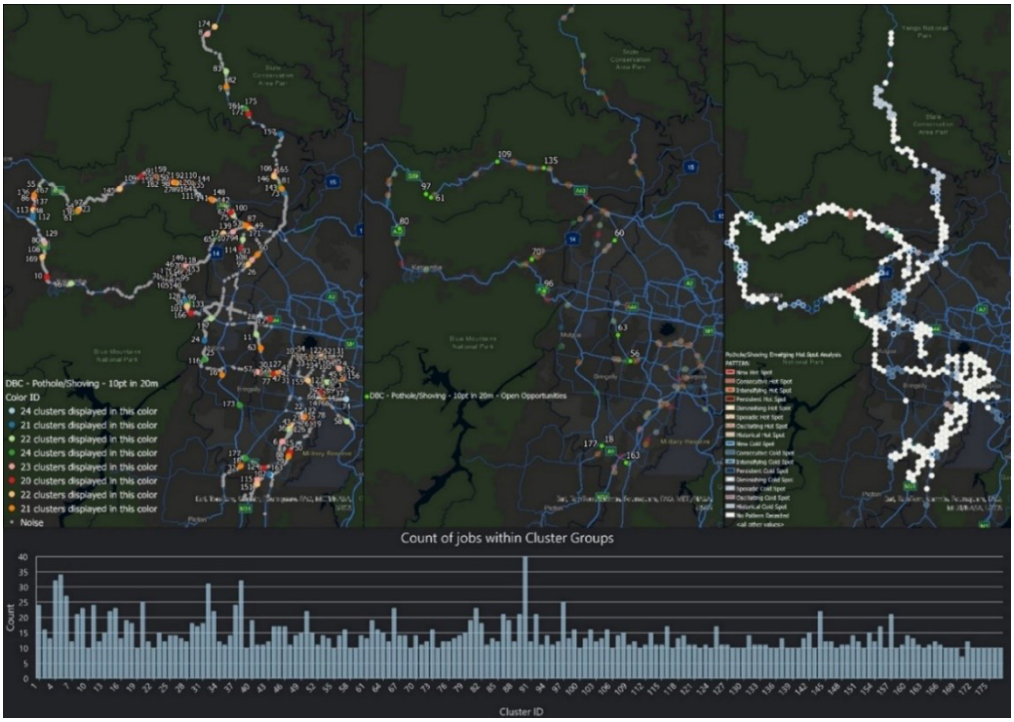


Figure 1: DBC of pavement failures with temporary repair (left map) with open opportunities for permanent repair (middle map) and emerging hot spots and remediated cold spots (right map)

road patching, resurfacing, or drainage redesigns. This approach ultimately helps reduce our total expenditure (TOTEX) in the long term. In many cases due to budget constraints, a full redesign might not be practical, so by following the RCM process, we implement a control measure such as an IOT (Internet Of Things) sensor in a pit to monitor water level and blockage. The expenses associated with reactive callouts may outweigh those of the sensor and any preventative maintenance. This is why it is critical to use this style of analysis to identify areas where we should look to identify the root cause.

A specific example relates to a road over rail bridge within the Network. Through clustering analysis, we noticed multiple recurring pavement defects on the bridge deck. This prompted an in-depth investigation that determined that a post-tensioning cable on one part of the bridge superstructure had relaxed causing a section of the bridge deck to crack. As a result, we were able to fund a capital project focused on bridge remediation.

3 AI (COMPUTER VISION) DEFECT DETECTION FOR TMP REFINEMENT

The utilisation of Artificial Intelligence, specifically computer vision ML models, is changing the approach to the visual road asset condition assessment process. There are many solutions in development across the globe in this area but we have been exploring a system that utilises stereoscopic cameras to measure size in addition to the identification and classification of defects such as cracks, potholes, and cracking with greater accuracy than manual inspections. A critical feature to enable this refinement is the remembering defects and reclassifying the condition and attributes them when identified again which ensuring no duplicates are created. These algorithms continuously learn from incoming data, allowing them to detect even minor defects that might go unnoticed by human inspectors with a 'Mark One Eyeball'.

This technology also tracks the change in the condition of defects over time, providing precise measurements that are invaluable for refining Technical Maintenance Plans (TMPs). If we can calculate that a pothole deteriorates from 'fair' to 'poor' within six months, we can use this information to predict future deterioration patterns. This helps optimise the timing and cost-effectiveness of inspections to achieving higher contractual levels of service.

4 PAVEMENT MODELLING FOR OPTIMISATION OF OPEX / CAPEX

Ventia utilise optimisation pavement modelling techniques with predictive analytics to develop tactical road pavement works, allowing us to develop programs that optimise the strategies. Optimisation modelling aims to manage pavement conditions by ensuring that funds are allocated

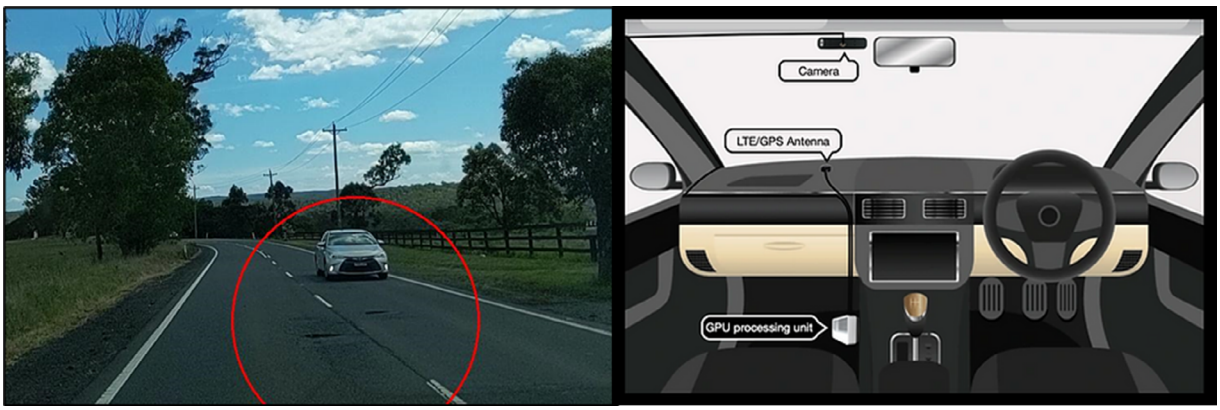


Figure 2: Pothole identified using artificial intelligence (computer vision) on left and equipment set up on the right

efficiently.

Pavement optimisation modelling is a large-scale data predictive exercise that utilises road surface and structural condition data to run multiple treatment scenarios on a section of the road to determine the most optimal treatment type and time to implement. For example, the model may look at a range of treatment types for a section of road that may be $1 per square meter or $10 per square meter and may determine that early intervention with multiple $1 treatments is the best approach. We also can change intervention criteria for different classes of road depending on posted speed limit and traffic type and volume, e.g. a multi-lane high-speed motorway will have a completely different analysis set to semi-rural road with 60-80km/h limits. This road network comprises approximately 2100 kilometres of lane each assigned 5 parameters that are used in the optimisation.

We utilise this data to inform our client of the impact of varying expenditure profiles and how it impacts overall Pavement Health. Examples are shown in Figure 3 below on two different funding scenarios and how they impact pavement conditions over time.

5 MACHINE LEARNING SPATIOTEMPORAL ANALYSIS FOR PREDICTIONS

On a large-scale variable condition road network, the ability to forecast where and when defects are likely to occur using machine learning and spatiotemporal analysis allows us to accurately allocate resources. By applying time series analysis, we can identify patterns and trends over time, pinpointing emerging 'hotspots' that may require more frequent maintenance. Conversely, we can also identify 'cold spots,' where the likelihood of defects is low, this also paints a good news story if we have completed a CAPEX treatment in that area which has reduced the reactive OPEX. These predictions are instrumental in proactive decision-making, helping asset managers allocate resources effectively before issues become critical.

This analysis was critical to showcase to the client the impact of flooding events on the condition of the road network, particularly on low-strength roads such as Darling Causeway, Bells Line of Road, Putty Road, and Elizabeth Drive. Post-flood these roads trended up in pavement defects and based on the spatiotemporal analysis we could showcase they were emerging hot spots. Combining this with video evidence before and after we successfully secured investment to remediate these roads. The OPEX in pavement defects on these roads is now minimal since rehabilitation. When selecting treatment options, we took sustainability into consideration to develop solutions that considered the climate resilience of these roads for potential future weather events.

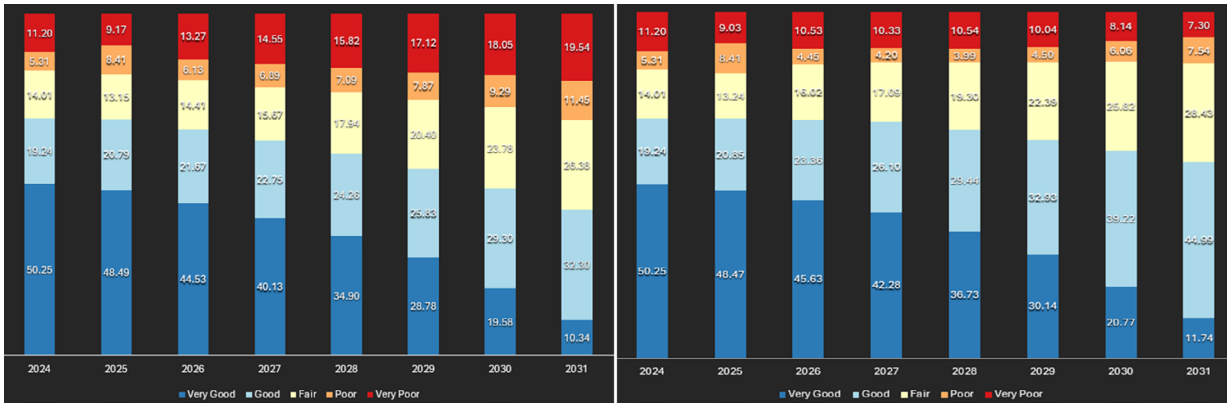


Figure 3: Modelled Pavement Health Index condition graphs with different funding scenarios, low funding on the left with unsatisfactory condition and ideal funding scenario on the right with recommended condition

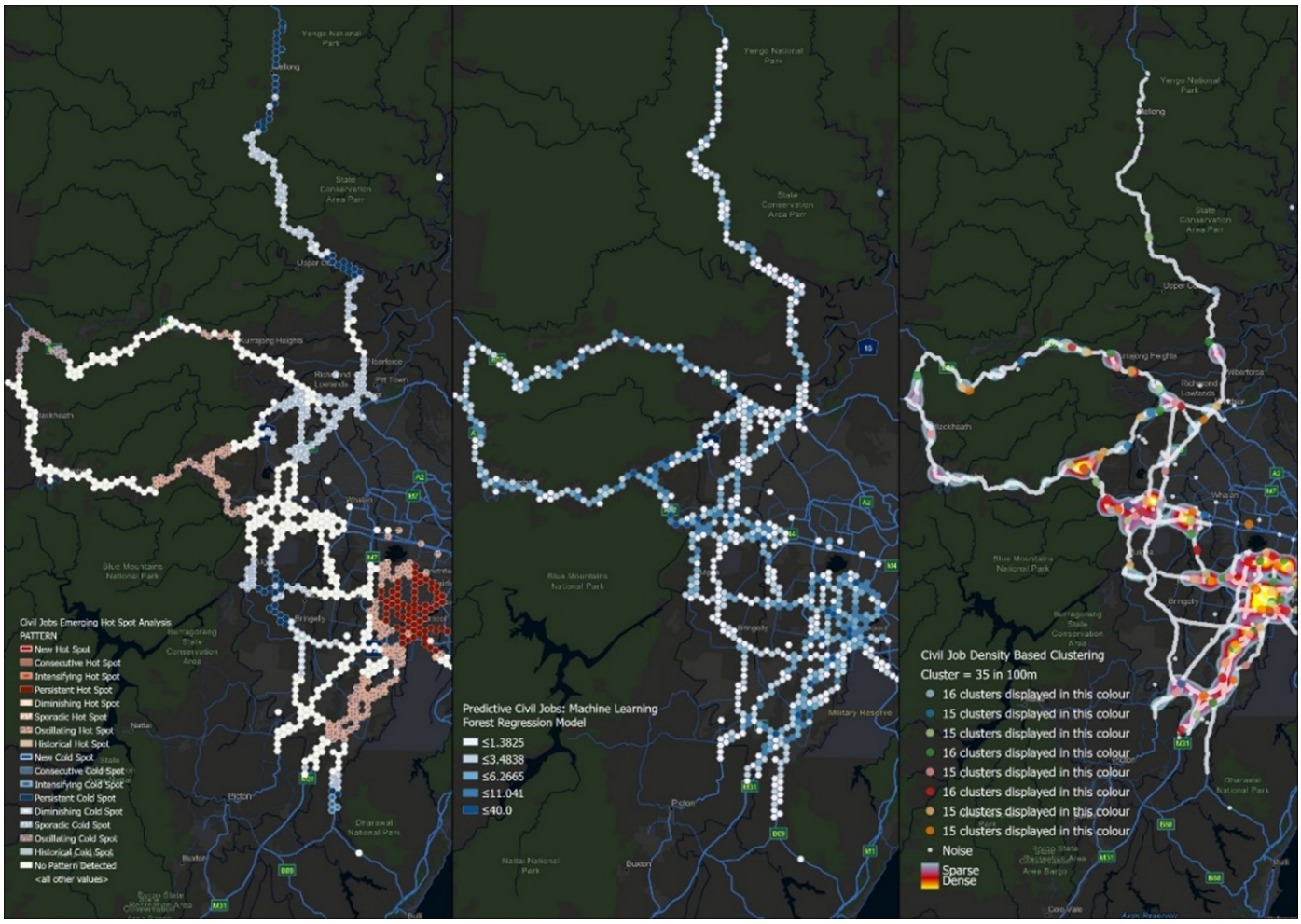
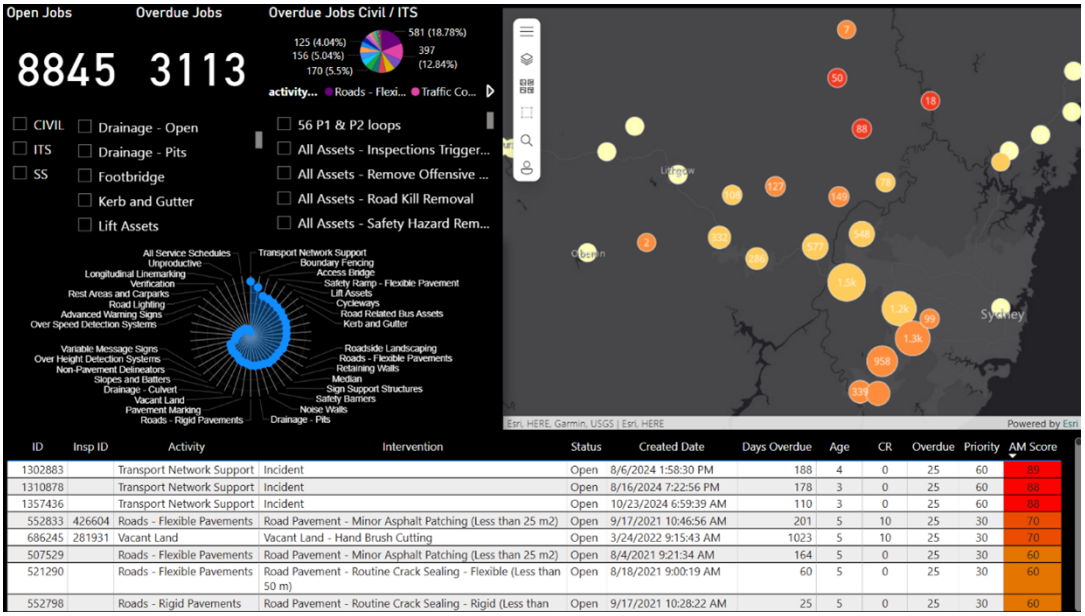


Figure 4: Spatiotemporal analysis to predict focus areas of OPEX in the near future

6 PERFORMANCE AND PLANNING DASHBOARDS – AM WEIGHTED SCORING

Developing performance and planning dashboards enables asset managers to understand the current status of their assets while also allowing for a combination of multiple data sources and calculations to be visualised to enhance decision-making in the planning process. It is important to standardise all available data into one Data Lakehouse such as Databricks to enable the development of these dashboards. One dashboard we developed includes a weighted suitability score of all identified defects, which is calculated by taking into account multiple variables such as defect priority, customer complaints, technical maintenance plan due dates, and density-based clustering. Taking these defect priorities into consideration when planning helps to ensure that jobs with a high impact on road safety and performance are not lost in the overwhelming big data available. As a result, this approach streamlines road asset management, allowing for quicker response times and more accurate resource allocation. This approach also allows asset manager's to balance the expectations of the public against our contractual KPIs (Key Performance Indicators) and APMs (Asset Performance Measures).



ID	Insp ID	Activity	Intervention	Status	Created Date	Days Overdue	Age	CR	Overdue	Priority	AM Score
1302883		Transport Network Support	Incident	Open	8/6/2024 1:58:30 PM	188	4	0	25	60	89
1310878		Transport Network Support	Incident	Open	8/16/2024 7:22:56 PM	178	3	0	25	60	88
1357436		Transport Network Support	Incident	Open	10/23/2024 6:59:39 AM	110	3	0	25	60	88
552833	426604	Roads - Flexible Pavements	Road Pavement - Minor Asphalt Patching (Less than 25 m2)	Open	9/17/2021 10:46:56 AM	201	5	10	25	30	70
686245	281931	Vacant Land	Vacant Land - Hand Brush Cutting	Open	3/24/2022 9:15:43 AM	1023	5	10	25	30	70
507529		Roads - Flexible Pavements	Road Pavement - Minor Asphalt Patching (Less than 25 m2)	Open	8/4/2021 9:21:34 AM	164	5	0	25	30	60
521290		Roads - Flexible Pavements	Road Pavement - Routine Crack Sealing - Flexible (Less than 50 m)	Open	8/18/2021 9:00:19 AM	60	5	0	25	30	60
552798		Roads - Rigid Pavements	Road Pavement - Routine Crack Sealing - Rigid (Less than	Open	9/17/2021 10:28:22 AM	25	5	0	25	30	60

Figure 5: Asset management weighted suitability planning dashboard

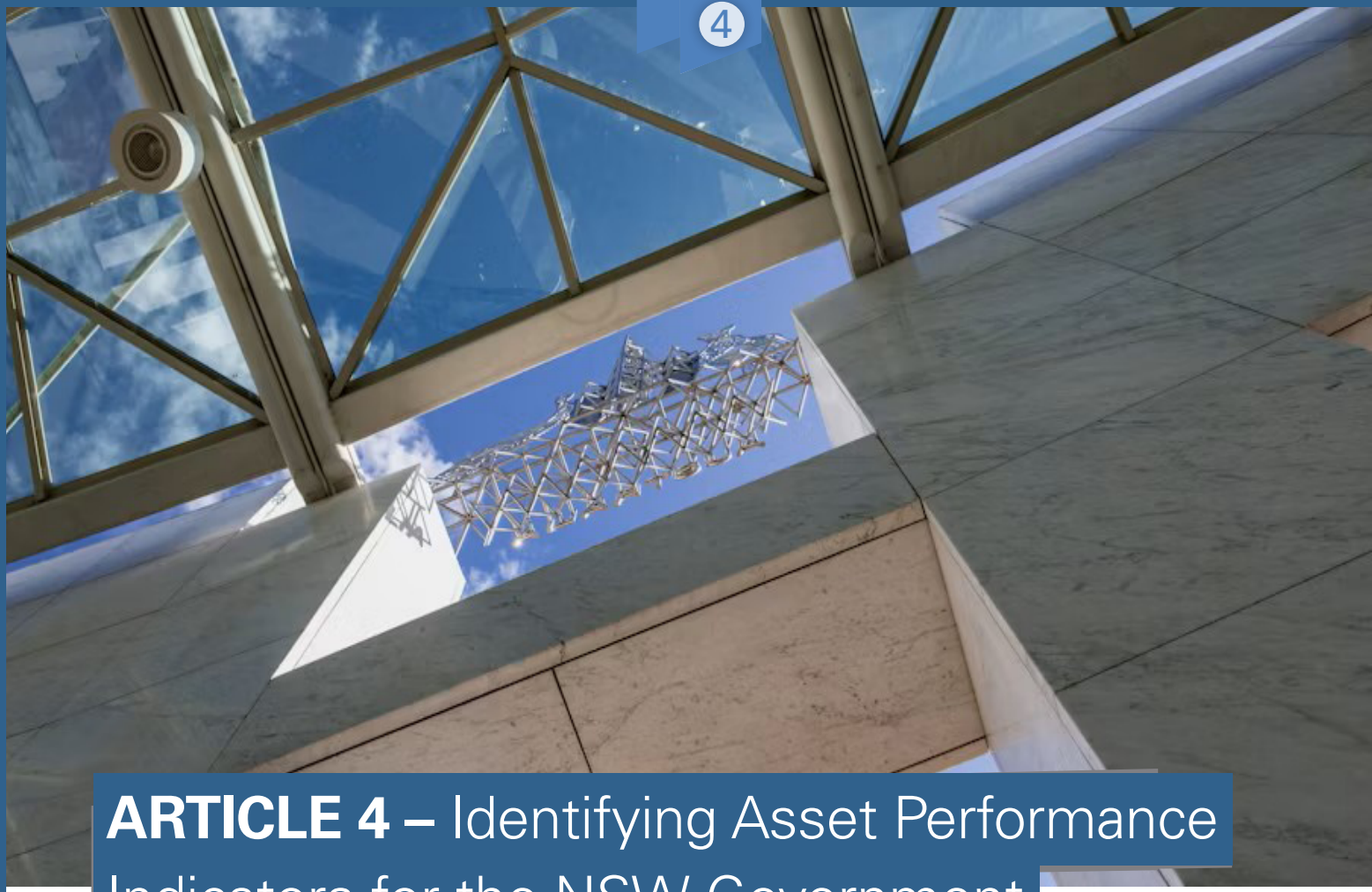
7 SUSTAINABILITY

A major benefit of the data-driven approach is the management of project sustainability. Data-driven maintenance decisions optimise costs and use of materials and hence optimise sustainability. The Infrastructure Sustainability Council ISC) recognise this important facet when considering the sustainability rating of our contract which is a contractual KPI.

8 CONCLUSION

This paper demonstrates how a data-driven approach is critical to shift road asset management from reactive to proactive/predictive interventions. Using spatial data science techniques like density-based clustering, we can identify recurring defect patterns earlier, enabling targeted interventions that shift maintenance strategies from costly reactive treatments to more effective capital solutions. AI defect detection improves inspection quality and maintenance scheduling optimisation by capturing data used for deterioration calculations. Predictive pavement modelling and machine learning-based analysis also provide valuable insight into forecasting future network conditions, enabling optimal resource allocation for both OPEX and CAPEX. Development of performance dashboards with weighted scoring enhances decision-making by including several sources of data, ensuring compliance with contractual KPIs and APMs and promoting sustainability by extending the life of our assets and intervening at the most optimal time.

TECH 4



ARTICLE 4 – Identifying Asset Performance Indicators for the NSW Government

Josh Millner, Infrastructure NSW &
Yahya Rased, NSW Department of Communities and Justice

SUMMARY

The NSW Government's physical asset portfolio is forecast to grow from $488.6 billion in 2022-23 to $620.5 billion in 2027-28. Agencies are operating in an increasingly challenging external environment and the ability to make optimal decisions on this large and diverse portfolio is becoming more and more complex for government. Each year, under the requirements of the NSW Government's *Asset Management Policy for the NSW Public Sector TPP19-07* (NSW Asset Management Policy), budget material agencies in scope of the policy provide Infrastructure NSW (as the administrator of the policy) with a snapshot of their asset performance, using a suite of indicators and metrics prescribed by Infrastructure NSW. Under its Asset Management Strategy program, and in conjunction with NSW Government agencies, Infrastructure NSW has recently revised this suite of indicators. The primary driver behind the revision was a need to provide better information to support NSW Government budget prioritisation and investment decision-making processes and enable the achievement of government priorities. As such, the indicators are closely tied to assets' abilities to deliver on service outcomes.

Keywords: Asset performance, asset reporting, asset management decision-making

1 INTRODUCTION

The NSW Government asset portfolio is large and complex, with a wide variety of asset types across a diverse range of service areas, including transport, health, education, emergency management, justice, housing and energy. Asset performance data provides decision-makers with key insights and information about where the risks and opportunities are across these different portfolios. Understanding how assets are performing is also essential for planning and prioritising investments to ensure the government's limited resources are being allocated where they are needed most.

The data points used to assess asset performance can vary wildly depending on the agency and the type of assets they manage. To ensure that government can make informed and cost-effective decisions across the NSW Government asset portfolio, it needs access to consistent and comparable asset performance data. This was also a key recommendation made in the 2022-23 State of Infrastructure Report, to help government prepare for the expected challenges of the next decade.

Infrastructure NSW has worked with several agencies to develop a set of whole-of-government asset performance indicators for agency-wide reporting. These indicators can be applied to a variety of asset portfolios and have been designed to provide more consistent and comparable data that can be used to inform government decision-making processes. The new indicators are focussed on not just the assets themselves but on describing the potential flow on impact(s) to service delivery outcomes and the overarching priorities of the NSW Government.

This new approach to asset performance reporting aims to drive further alignment between asset management and investment planning processes across government to support informed, objective, and evidence-based decision- making.

2 BACKGROUND AND CONTEXT

All budget material agencies in scope of the NSW Asset Management Policy are required to provide annual asset planning submissions to Infrastructure NSW, as the assurance lead and administrator of the policy. These asset planning submissions include a range of agency specific asset management artefacts, including:

- an asset management policy
- a strategic asset management plan (SAMP)
- asset management plan(s) (AMPs)
- asset performance data.

Asset performance data is a key component of asset planning submissions. This data allows the government to understand how an agency's assets are contributing to existing and planned service delivery needs, as well as for planning and prioritising investment proposals across agencies.

Asset performance indicators

The new approach for asset performance reporting requires agencies to provide information on service performance and financial performance, as well as 4 aspects of asset performance, including demand, capability, dependability and resilience.

These metrics were selected to give agencies and government a wholistic view of the performance of their asset base in terms of service outcomes, cost and risk. Service performance indicators and metrics provide the link between the assets and the service outcome. Financial performance indicators provide data on the constraints, funding gaps, and evolving financial risks affecting the asset portfolio. The asset performance indicators were selected to provide a comprehensive picture of the performance of the assets themselves as well as any emerging asset risks.

Agencies now also have the flexibility to identify and nominate the most appropriate metrics for reporting against each asset performance indicator. This ensures that the information provided by agencies best reflects the unique nature of their asset portfolios.

2.1 Service Performance

The service performance indicators describe the link between an agency's assets and the services and outcomes they are required to support and enable (in line with the indicators and metrics set by the NSW Government in the new NSW Performance and Wellbeing Framework). These indicators help identify critical asset-to-service dependencies across agencies and the potential impact(s) of

asset performance on service delivery outcomes and government priorities.

For example, a priority service outcome for the NSW Government is to ensure that vulnerable people have access to suitable housing. The service performance indicator to measure this outcome is the number of applicants on the social housing waiting list. The associated asset-related metric is the total number of dwellings available for use by social housing type.

In this context, demand asset performance indicators will highlight where there are underutilised properties that could be upgraded or redeveloped to help create additional capacity and reduce the number of applicants on the social housing waiting list. Resilience indicators on the other hand will highlight where there are properties that are highly exposed to natural hazards that could become unusable in the future, placing further strain on social housing waiting list.

2.2 Financial Performance

The financial performance indicators describe the link between an agency's assets, budget allocations and priorities, and any funding gaps (including the agency's maintenance and renewals liability). These indicators are important to understand how agencies plan to manage risks across their asset portfolio that are associated with any funding gaps.

An agency's maintenance and renewals liability is a key financial performance metric. It is described in detail in another AMPEAK paper (The NSW Government's Maintenance and Renewals Liability Funding Methodology). It requires agencies to set out projected costs associated with maintaining the asset portfolio, and the associated risk to asset performance, over 10 years under a range of funding scenarios. Understanding and reporting on the extent of this maintenance and renewals liability for each agency provides government with an understanding of the level of risk, and the cost of resolving any risks, allowing government to prioritise funding.

2.3 Asset Performance

Demand

Demand indicators describe the extent to which an agency's assets can meet current and future service demands by considering both utilisation and reserve capacity indicators. These indicators identify issues relating to the under (or over) use of assets that could pose a risk or opportunity for government.

Looking at both the utilisation rates of an asset and the reserve capacity is important to understand where government needs to prioritise investment to address demand constraints. This includes weighing up options to allocate investment towards delivering new assets vs improving the capability of existing assets to unlock value and increase utilisation rates.

Some examples of demand metrics might include bed utilisation rates in hospitals, courtroom waiting times, or the number of applicants waiting for social housing.

Capability

Capability indicators describe the ability of an agency's assets to meet customer and stakeholder needs, and satisfy safety and compliance requirements. These indicators aim to identify whether an agency's assets are fit-for- purpose for existing and future uses.

Understanding the capability gaps across an asset portfolio will help identify where there are opportunities to improve existing assets to increase utilisation rates and improve service outcomes. This is becoming increasingly important as customer expectations for technology, convenience and quality of services continue to change over time.

Some examples of capability metrics might include the number of hospitals that can provide children's and paediatric services, the number of schools that have sport and recreation facilities, or the number of social housing properties that are suitable for older people or people living with a disability.

Dependability

Dependability indicators describe the extent to which an agency's assets can be relied upon to perform as and when required. These include availability, reliability, maintainability and supportability indicators, all of which provide a level of confidence that an agency's assets can operate, as intended, with minimal disruption.

Focusing on dependability as a measure of asset performance has become increasingly important in recent years due to the growing risks of more

frequent disruptions and outages from external factors such as extreme weather events. Understanding the reliability of an asset portfolio can help maximise productivity, prevent downtime, reduce operating costs, minimise safety risks, and improve customer satisfaction.

Some examples of dependability metrics might include unplanned downtime, percentage of reactive maintenance, meantime between failure, and overall equipment effectiveness.

Resilience

Resilience indicators describe the extent to which an agency's assets can resist, absorb, accommodate, adapt, transform, and recover from the effects of hazards. Specifically, they relate to service disruption and business continuity. The resulting metrics identify the assets most vulnerable to shocks and stresses.

Natural and human hazards, such as extreme weather events and cyber-attacks, have damaged assets, driven up costs, degraded service delivery, and increased risk. Understanding how vulnerable assets are to shocks and stresses will help inform more effective lifecycle management of assets, enabling more accurate maintenance scheduling, cost-effective resource allocation, and ultimately, more informed decision-making.

Some examples of resilience metrics might include the number of disruptions or outages due to shocks and stresses, the duration of outage(s) or lost productivity.

3 REPORTING SCENARIOS

Agencies are required to nominate one or more quantitative metrics for each asset performance indicator. These metrics can be provided either at the portfolio or asset class level. In some instances, multiple metrics may be necessary to adequately satisfy the intent of the indicator.

For each of the nominated metrics, agencies are asked to report on 3 different performance scenarios: target performance (based on the metric's timeframe), current performance (for the previous year), and future forecast performance (based on the metric's timeframe). Together, these 3 scenarios provide visibility of existing and emerging risks and issues:

1. **Target Performance:** This scenario requires agencies to set a benchmark for the performance of an asset or asset class based on a set timeframe. It is used to understand the desired state of performance based on the agency's service requirements. Agencies should consider historical data, industry standards, and strategic objectives while defining target performance.
2. **Current Performance:** This scenario requires agencies to capture the actual performance of an asset or asset class over the reporting period. It is used to demonstrate any deviations from the target performance and helps proactively identify any potential risks or issues which may impact the agency's services. Agencies should use the most reliable and up-to-date data to report current performance.
3. **Forecast Performance:** This scenario requires agencies to project the performance of an asset or asset class into the future. It is used to support more long-term asset planning activities to address any identified risks or issues. Agencies should consider factors such as expected changes in demand, budget constraints and potential disruptions while forecasting future performance.

Reporting on these 3 scenarios provides Infrastructure NSW with a full picture of each agency's asset performance. It enables better government decision-making and resource allocation to address existing and emerging challenges impacting the performance of the NSW Government asset portfolio. This includes an increasing maintenance and renewals liability, greater exposure to extreme weather events, and issues associated with the management of ageing and legacy assets that are no longer fit-for-purpose.

4 IMPLEMENTATION APPROACH

A description of the revised asset performance indicators and agency requirements are contained in a guidance document developed by Infrastructure NSW. This guidance document is part of the asset management assurance document suite available to all agencies in scope of the NSW Asset Management Policy. A reporting template is also available for agencies to complete. The guidelines were developed in consultation with a wide range of delivery agencies and tested to ensure they could

be easily adopted and applied across different asset classes. Agencies will report on the revised set of asset performance indicators in 2025.

5 REFERENCES

ISO (2014). ISO 55001:2014 *Asset management – Management systems – Requirements.* International Organization for Standardization.

NSW Government. (2019). *TPP19-07 Policy and Guidelines Paper - Asset Management Policy for the NSW Public Sector.* [online] NSW Treasury. Available at: https://www.treasury.nsw.gov.au/finance-resource/asset- management-policy.

NSW Government (2023). *State of Infrastructure Report – 2022-23 review of the NSW Government asset portfolio.* [online] Infrastructure NSW. Available at: https://www.infrastructure.nsw.gov.au/news/insw-releases- 2022-23-soir/

NSW Government (2024). N*SW Budget 2024-25 - Performance and Wellbeing - Consultation Paper.* [online] NSW Treasury. Available at: https://www.treasury.nsw.gov.au/nsw-performance-and-wellbeing-framework.

Standards Australia and Standards New Zealand (2015). *AS/NZS IEC 60300.1:2015 Dependability Management, Part 1: Guidance for management and application.* Standards Australia.



MEMBER ARTICLE – The Capital Investment Playbook: Building Defensible Business Cases for Public Sector Assets

Shane Scriven

"We need data-driven decisions. Gone are the days of going cap in hand."

If you've worked in public sector asset management, you've heard some version of this. From department heads, from ministers, from treasury. The message is clear: prove it with evidence or don't bother asking.

Here's the uncomfortable reality: most asset managers can't.

Not because they're incompetent. Because the systems, data, and analytical capabilities required to build genuinely defensible investment cases simply don't exist in most organisations. The expectation has outpaced the capability.

The result? A predictable cycle. Asset managers know infrastructure is deteriorating. They raise concerns. Those concerns get deprioritised against competing demands with stronger evidence bases. Nothing happens. Then an incident occurs—a bridge fails, equipment malfunctions, a service is disrupted—and suddenly funding appears. Decisions get made in the heat of emotion rather than the calm of analysis.

We've seen this pattern play out. Emergency services restructures have surfaced long-standing asset investment gaps. Health infrastructure debates intensify after failures. Transport funding arrives after incidents make headlines. The conversations only gain traction when operational failures become public.

This cycle can be broken. It requires asset managers to build the evidence base before it's needed, not after—and to know what to do when the answer is still no.

This playbook covers both.

1 PART ONE: BUILDING THE IRREFUTABLE CASE

Step 1: Know Your Assets Before You're Asked

You cannot build a compelling investment case for assets you don't understand. This sounds obvious, but the reality in many public sector organisations is sobering: asset registers are incomplete, condition data is patchy, and criticality frameworks exist on paper but aren't applied consistently.

When treasury asks "why do you need $40 million for fleet renewal?" and your answer relies on assumptions rather than evidence, you've already lost.

Start with the basics:

- **Asset inventory accuracy.** Can you account for every asset you're responsible for? Do you know where they are, what condition they're in, and when they were acquired? Gaps here undermine everything that follows.
- **Condition assessment coverage.** What percentage of your assets have been formally assessed in the last five years? Condition data doesn't need to be perfect, but it needs to exist and be defensible.
- **Criticality and consequence.** Which assets matter most? Not in general terms, but specifically: which failures would cause service disruption, safety incidents, or reputational damage? If you can't articulate this clearly, decision-makers will make their own assumptions.

This foundation takes time to build. Start now, not when the budget submission is due.

Step 2: Quantify the Consequence of Inaction

Executive and political decision-makers are not asset management specialists. They think in terms of service outcomes, risk, and public impact. Your job is to translate asset condition into language they understand and care about.

"The HVAC system is at end of life" means nothing to a minister.

"*The HVAC system has a 60% probability of failure within 24 months. Failure during summer would force facility closure for 2-3 weeks, affecting 12,000 service users and likely generating significant media coverage"* gets attention.

This requires connecting asset data to consequence models:

- **Service impact.** What happens to service delivery when this asset fails? Be specific about duration, affected users, and workarounds (or lack thereof).
- **Safety and compliance.** Does failure create safety risks or regulatory breaches? Quantify where possible.
- **Financial consequence.** What does reactive replacement cost versus planned renewal? Include emergency procurement premiums, overtime, and flow-on effects.
- **Reputational and political cost.** This is harder to quantify but often the most persuasive. Decision-makers understand headlines.

The goal isn't to be alarmist. It's to be accurate about consequences that are currently invisible in budget discussions.

Step 3: Connect Assets to Strategic Outcomes

Every government department has strategic priorities. Your capital investment case needs to connect directly to them—not as an afterthought, but as a central argument.

If the department's priority is service accessibility, show how asset investment improves access. If it's sustainability, quantify the emissions reduction. If it's regional equity, demonstrate the geographic distribution of benefits.

This isn't spin. It's relevance.

Too many business cases read as technical documents written for technical audiences. They detail asset specifications, maintenance histories, and engineering assessments. All necessary, but not sufficient.

The executives approving funding don't evaluate technical merit. They evaluate strategic alignment, risk, and political defensibility. Your case needs to work on their terms, not yours.

Ask yourself: if the minister had to defend this investment in question time, what would they say? Build your case to give them that answer.

Step 4: Present Options, Not Ultimatums

"We need $40 million or the system will fail" is not a compelling business case. It's a demand that invites scepticism.

Sophisticated investment cases present options with clearly articulated trade-offs:

Option	Cost	Outcome
Option A: Full renewal program	$40M over 4 years	Fleet availability above 95%, risk reduced to acceptable levels, 15-year asset life extension
Option B: Targeted critical replacement	$18M over 2 years	Addresses highest-risk assets only, availability maintained at 88%, residual risk remains for Tier 2 assets
Option C: Maintain current approach	$6M annually (reactive)	Continued deterioration, availability projected to decline to 75% within 3 years, increasing probability of service-affecting failure

This approach does several things. It demonstrates analytical rigour. It acknowledges budget constraints. It gives decision-makers genuine choices. And it makes the consequences of under-investment explicit without appearing to hold them hostage.

Decision-makers appreciate options. They resent being told there's only one acceptable answer.

Step 5: Build the Narrative Before You Need It

The worst time to build your investment case is when you need it.

Budget cycles have fixed deadlines. Incidents create pressure for immediate responses. Neither environment supports careful, evidence-based analysis.

The organisations that secure appropriate asset investment do the work continuously, not episodically.

This means:

- **Maintaining living documentation.** Asset condition reports, risk assessments, and consequence models that are updated regularly, not created from scratch each budget cycle.
- **Building relationships before the ask.** Treasury and finance teams are more receptive when they understand your asset challenges before you're requesting funds. Invest in education and engagement outside budget season.
- **Creating decision audit trails.** When you raise risks and they're accepted or deferred, document it. Not to assign blame, but to demonstrate that consequences were foreseeable and communicated. This becomes important when incidents occur.
- **Developing scenarios proactively.** What happens if funding is cut by 20%? What would you do with an additional $10 million? Having these answers ready demonstrates strategic thinking and makes you a more credible partner in budget discussions.

The goal is to shift from reactive justification to proactive stewardship. Asset managers who are seen as credible, prepared, and strategically aligned get more traction than those who only appear when they need something.

PART TWO: WHEN THE ANSWER IS STILL NO

Let's be honest: sometimes you do everything right and the funding still doesn't come. You:

- build the evidence base.
- quantify the consequences.
- present options.
- align to strategic priorities.

And the answer is still no—or worse, "not this year," which becomes not next year either.

This is the reality of public sector asset management. Competing priorities, constrained budgets, and political considerations mean that sound business cases don't always translate to approved funding.

The health system needs money.

The schools need money.

Emergency services need money.

Everyone has a defensible case, and the pool is finite.

What then?

Document the Decision, Not Just the Request

When funding is declined or deferred, ensure the decision and its rationale are formally recorded within the Asset Management System. Not as a gotcha for later, but as an honest organisational record.

"Funding for X was requested. The following risks were identified. The decision was made to defer due to Y."

This creates accountability and institutional memory. It also protects you professionally. When questions arise later there's a clear record of what was communicated and when.

Quantify the Residual Risk and Get It Accepted

If you can't eliminate risk through investment, ensure the residual risk is explicitly acknowledged at the appropriate level.

"Given current funding, we accept a Z% probability of service-affecting failure over the next three years."

Make the implicit explicit. Executives and ministers can accept risk—that's their prerogative—but they should do so knowingly. Risk accepted in writing looks very different to risk that was never raised.

This isn't about covering yourself. It's about ensuring organisational decisions are made with full information.

Optimise Within Constraints

If you have $5 million instead of $20 million, what's the smartest way to spend it?

Prioritise ruthlessly based on criticality and consequence.

Partial investment in the right places beats spread-too-thin investment everywhere.

The options framework from Step 4 helps here—you've already thought through what targeted investment looks like.

This is also where analytical capability pays dividends. Organisations that can model different investment scenarios can extract maximum value from constrained budgets. Those that can't end up making gut-feel decisions that often miss the mark.

Maintain the Evidence Base Anyway

The business case you build this year becomes the foundation for next year's submission. Conditions worsen, near-misses occur, and political priorities shift. When the window opens, you need to be ready.

Organisations that abandon rigour after rejection find themselves starting from scratch when the opportunity returns. Those that maintain their evidence base can move quickly when circumstances change.

Keep condition assessments current. Update consequence models. Track leading indicators of deterioration. The work isn't wasted—it's preparation.

Know When to Escalate

There are situations where asset condition creates genuine safety risks that cannot be managed through operational controls.

If you've raised concerns through normal channels and they've been dismissed, you need to consider formal escalation either through audit committees, risk registers that reach board level, or other governance mechanisms.

This isn't about being difficult. It's about professional responsibility.

Some risks shouldn't be quietly accepted. If an asset failure could injure someone, and you've identified that risk, and it's been deprioritised without adequate mitigation, that's not a situation you should silently absorb. Escalate through appropriate channels. Document that you did.

The goal isn't to create conflict. It's to ensure that significant risks receive appropriate attention and that decisions about them are made at the right level.

Separate Professional Obligation from Political Reality

Your job is to provide the best possible advice. The decision-maker's job is to weigh competing demands and make a call.

When funding doesn't come despite your best efforts, that's not a personal failure. It's the system working as designed—imperfectly, but with legitimate trade-offs. What matters is that you've discharged your professional duty by making the situation clear.

This distinction matters for your own wellbeing. Asset managers who take every funding rejection personally burn out. Those who understand the difference between advice and decision can maintain perspective while continuing to advocate effectively.

2 BREAKING THE CYCLE

The current pattern—under-investment followed by incident-driven funding—serves no one well. It costs more in the long run, creates unnecessary risk, and forces decisions in exactly the wrong conditions.

Breaking the cycle requires asset managers to build capabilities that many organisations currently lack:

- robust data foundations,
- consequence-based risk quantification,
- strategic narrative skills, and
- continuous rather than episodic engagement.

It also requires honesty about what happens when the system doesn't respond.

Good process doesn't guarantee good outcomes.

But it does ensure that when something goes wrong, the record shows you did your job.

The ministers and executives demanding data-driven decisions aren't wrong to ask. They're wrong to assume the capability already exists.

Building that capability is the work. And it starts before the next incident makes it urgent.

The hardest question in public sector asset management isn't "how do I build a better business case?"

It's "did we do everything we could with the information and resources we had?"

Make sure your answer is yes.

Need help building your capital investment capability?

SAS-AM works with public sector organisations to develop the data foundations, analytical tools, and strategic frameworks that support defensible investment decisions. From maturity assessments to business case development, we can help you break the cycle.

Asset Management Mentor Match

Exclusive to Asset Management Council Members!

- Be connected with seasoned asset management professionals.
- Gain insights and knowledge to fuel your career growth.
- Tailored match suggestions to meet your career goals.
- Mentoring tips and tricks provided to help you on your way.

Ready to advance in asset management?

Visit **www.amcouncil.com.au** to explore the possibility of finding your ideal match!

Are you looking for a **MENTOR**?

www.amcouncil.com.au/individual-mentoring

ASSET MANAGEMENT COUNCIL

ASSET MANAGEMENT FUNDAMENTALS COURSE

Run online in a live interactive session over two consecutive mornings offers a thorough overview of asset management. The purpose of the Asset Management Fundamentals program is to understand the fundamentals of asset management and how they can provide benefits to the organisation. Please click here to register.
Course learning objectives:

- Define asset management within the context of ISO 5500x suite, the Asset Management Landscape and AMBoK
- Identify the principles that underpin asset management
- Identify available asset management tools and techniques that are applicable within organisational context
- Identify opportunities to apply these learnings to improve individual and organisational performance.

JANUARY 19 & 20

FEBRUARY 16 & 17

MARCH 16 & 17

APRIL 20 & 21

MAY 14 & 15

JUNE 15 & 16

Register at www.amcouncil.com.au

STAR PROFILE – Tanya Nelson CPAM



What is your specialty?

My career has historically been within transport infrastructure- bridges, major culverts, etc. Recently, I've had the opportunity to apply my asset management skills beyond transport, into sectors like water, buildings and properties, and even cultural institutions.

What I've learned is that while the assets may differ, the principles of good asset management (optimizing performance, managing risk, and delivering value) remain universal. Exploring these new domains has been both challenging and rewarding, and it's reinforced the importance of adaptability in our profession.

What's the best career advice you've ever received and who gave it to you?

"Learn to be comfortable in the uncomfortable" – Sylvia Darwin, Delivery Manager

The moments of greatest growth in my career (and personal life) have come from situations where I felt the most uncomfortable. Discomfort forces us to pause, reflect, and ask:

"Why does this feel challenging? What's really behind it?" For me, that process has been transformative. By understanding the root cause, I've been able to turn discomfort into solutions, and solutions into progress. If you're feeling uncomfortable right now, lean into it. It might just be the start of your next big leap!

What makes a great asset manager?

A great asset manager doesn't just provide answers, rather they ask the right questions:

" What is trying to be achieved? Why is it being pursued? How can it be achieved? Who is responsible for achieving it?"

By asking these questions, asset managers uncover the real challenges, identify the root cause, and make recommendations that address the cause (not just the symptoms). Asset management isn't about quick fixes; it's about creating sustainable solutions that deliver long-term value.

What is the most exciting trend that you've noticed in asset management today?

One thing I've noticed is the passion and enthusiasm young professionals are bringing to asset management.

They're not just focused on maintaining assets; they're driven by a bigger purpose; Ensuring assets are sustainable, building resilience into infrastructure and meeting the evolving needs of society

This mindset is shaping the future of our industry. It's about more than technical excellence; it's about creating long-term value for communities and the environment.

What advice would you give to an up-and-coming asset manager today?

"We've always done it this way" is not a strategy.

In asset management, that mindset can lead to stagnation. Our role is about continuous improvement which means we need to be

challenging assumptions, finding better ways, and ensuring assets deliver value over time even as the way those assets are used changes.

Every process, every decision should be open to review. If the only justification is tradition, it's time to ask- "Is this still the best way?", "Does it align with our objectives?" or "Can we improve efficiency, sustainability, or resilience?" Asset management thrives on innovation, not inertia.

What is the biggest challenge facing the asset management sector today/your particular field of asset management today?

One of the biggest challenges I see today is the disparity between rapid technological advancements and an organization's ability to keep pace.

Government agencies, for example, often rely on legacy systems that will be around for years to come. While innovation moves fast, these systems hold critical data and processes that can't simply be replaced overnight.

That's why information transfer and integration is so important. It's not just about adopting new tools but also about managing change responsibly, ensuring continuity, and protecting the integrity of the data that underpins our decisions.

Asset management plays a key role here: bridging the gap between old and new, and making sure progress doesn't come at the cost of reliability. It can also help provide organisational knowledge transfer and capturing this personnel knowledge that isn't necessarily present in legacy systems.

What is your proudest career achievement?

I'm honored to have represented the Department of Transport and Main Roads (TMR) on the Austroads Bridge Task Force and to have contributed to the development of the Austroads Engineering Guideline for Bridge Asset Management.

Working alongside industry leaders from across Australia and New Zealand was a privilege. Together, we took this important document from concept through to publication, helping shape best practice for bridge asset management.

Collaboration like this strengthens our profession and ensures we deliver safe, sustainable, and resilient infrastructure for the communities we serve.

When you're not busy at work, what do you enjoying doing to unwind/relax/explore?

I have just started running. I don't know if I would say I enjoy it (or find it relaxing), but I am embracing trying to get better at it. For me, it's not about speed or distance right now. It's about consistency, resilience, and proving to myself that improvement comes from persistence. Sometimes growth isn't comfortable, and that's okay. It's the effort that counts

STAR PROFILE – Kate Ivicheva CSAM



Why asset management?

I have always been driven by curiosity about how things work and why certain solutions are judged effective while others are not. Early in my career, working as an engineer in energy efficiency, reliability and safety, I became interested in how technical choices shape real outcomes, not only in performance but also in value, safety and sustainability. As I took on more projects, I wanted to understand what information decision-makers rely on and how that information can support better, longer-term results. That thinking naturally evolved into a focus on asset management. It brought together the disciplines I cared about: technical reasoning, logic, financial understanding and structured decision-making. Together they provide a framework for improving how organisations plan, invest and deliver reliable and efficient services.

How long have you been working in the asset management sector?

My experience in asset management spans more than ten years. I began in the oil and gas sector, where precision, reliability and financial acumen were critical to every decision. After moving to New Zealand, I worked in manufacturing and later in the water sector. Much of what I learned about reliability and efficiency transferred naturally, but these roles also brought new dimensions: cross-disciplinary coordination, people management and a longer planning horizon. Each step added context and depth, gradually shaping the way I approach improvement and investment. Those experiences continue to influence how I look at performance, value and long-term sustainability in asset management today.

What makes a great asset manager?

I believe a great asset manager is genuinely curious and seeks to understand how things work, why they work that way, and how they can be improved. Curiosity drives you to look closer, ask better questions, and see patterns that others might miss. Being open-minded is equally important, because asset management brings together people from many disciplines, each viewing the same matter through a different lens. It shows up in how you listen, weigh different perspectives, and adapt your view when new information emerges is what keeps thinking fair and grounded. From that openness comes the courage to question existing practices and to guide teams while keeping trust and collaboration intact. A great asset manager unites people around a shared purpose, communicates clearly, and creates space for others to contribute and grow. For me, it comes down to staying grounded, learning continuously, and fostering confidence and shared ownership with those you work alongside.

What is the most exciting trend that you've noticed in asset management today?

One of the most visible trends is that asset management is now being recognised as an enterprise capability, rather than a narrow focus on maintenance or renewal planning. It is increasingly treated as part of how the business is run, shaping priorities, investment intent and the way services are sustained over time. The refreshed ISO 55000 series supports this shift by placing more weight on capability, culture and the conditions that enable good practice, alongside fit-for-purpose systems. The conversation is moving from "what is the next work order" to "how do our assets support our purpose and long-term outcomes".

What excites me most is the impact this has on how people work together. When asset management sits with strategy and governance, teams develop a common view of value and risk, and choices become more consistent across portfolios. It signals maturity and a more confident way of running the organisation.

What is the biggest challenge facing up-and-coming asset managers today?

In New Zealand, many emerging asset managers are entering the field at a time when core infrastructure is moving towards the end of its useful life. Renewal

needs are rising faster than available funding, while expectations for reliable services remain high. In the water sector, the establishment of new entities and evolving delivery models are changing how planning and management responsibilities are organised. While the transition is ongoing and moving to a broader scale, maintaining steady service for the public remains essential. The result is an operating environment where change is fast-moving, information is incomplete and choices carry greater pressure than before.

Succeeding in this setting depends on forming sound judgement when the full picture is not always visible. It means tracing longer-term effects, resetting priorities when conditions shift, and reasoning across competing demands and expectations. Decisions should withstand uncertainty and scrutiny, plans should remain adaptable, with the rationale recorded for review and improvement. Ultimately, the task is to practise disciplined judgement when certainty is not available and decisions have lasting consequences.

What advice would you give to an up-and-coming asset manager today?

I would encourage you to give yourself time to grow into the work. Asset management asks you to make sense of situations where not everything is clear at once. Instead of waiting for complete information, start by understanding what you do know, what is still emerging, and what really matters for the decision at hand. Being transparent about your reasoning and stating the assumptions you are relying on are more important than having every detail, as it helps others see how you reached your conclusion.

Secondly, try to step back and look at how things connect. An asset is never just a single item to be maintained or replaced. It sits within a network of people, places, systems and outcomes. When you understand those connections, your choices become more thoughtful and grounded. And when priorities change, as they often do, see it as a response to new insight rather than a setback. Reprioritising is part of doing this work well.

Remember, you do not develop judgement alone. Discuss things with colleagues, ask questions, and share what you are working to understand. Learning from others' experience helps you see more of the picture. Over time, these conversations will shape how you approach new situations and support your confidence in making decisions.

What's next for you?

I am deepening my work at the point where governance and asset management meet. In practice, that means helping boards and executive teams strengthen decision-making frameworks, test business models, and align asset management planning with intent and risk appetite. My aim is to make conversations, information and choices coherent so organisations can act with confidence and consistency.

I will continue contributing internationally through ISO/TC 251 "Asset Management" and ISO/TC 268 "Sustainable Cities and Communities", with a focus on advancing standards that connect resilience, finance and sustainability. This is how I share experience and perspective, stay close to expert thinking, and bring global insight back into application in New Zealand.

This year I founded my own company, as I felt ready to support more than one organisation. Working independently is simply an extension of the same practice, applied where it is most needed. I am taking a steady, selective approach, focusing on work that strengthens capability and leaves organisations better equipped to carry the work forward.

When you're not busy at work, what do you enjoying doing to unwind/relax/explore?

Outside of work, most of my time is spent with family and friends. They are the base that keeps everything in perspective. We often play board games together or spend time outdoors, and I value the mix of focus, laughter and connection. I also like chess especially rapid and bullet formats for the challenge of quick thinking and reading the next move. When time allows, I go hiking or fishing, which helps clear the mind and slow the pace. Pilates, yoga and the occasional return to karate add a different rhythm and discipline. These are simple things, but they give shape to life outside work and remind me to appreciate it as it happens.

STAR PROFILE – Jeff Dusting CFAM



Jeff is a Chartered Aerospace Engineer and Certified Fellow in Asset Management (CFAM) who serves as Director and COO of CBS Group and Strategic Advisor to Transport for NSW. With experience spanning aviation, rail, banking and startups, Jeff brings a unique cross-sector perspective to infrastructure asset management. At CBS Group, he's led the development of the CAPITAL framework, delivering over $180 million in direct savings on the Western Harbour Tunnel alone. His approach challenges traditional procurement models by integrating value-based pricing with whole-of-life asset thinking. Leading teams across CBS Group (12 core specialists) and Transport for NSW (18 staff), Jeff specialises in transforming how governments and blue-chip companies manage critical infrastructure - always seeking to deliver greater value for less investment.

What makes a great asset manager?

A great asset manager has the courage to challenge precedents and constantly asks 'why' - why do we accept this risk allocation, why does maintenance cost this much, why can't we incentivise better outcomes? They think like an owner, not a maintainer. They combine technical rigour with commercial acumen - understanding that every engineering decision has a 30-year financial consequence. Critically, they're master communicators who can translate complex technical realities into language that resonates with Treasury officials, community groups, Ministers, contractors and engineers alike. They build genuine collaboration across these diverse stakeholders, recognising that sustainable asset performance requires everyone pulling in the same direction. Great asset managers quantify everything that matters: the true cost of unavailability, the value of reliability, the price of risk transfer. They see beyond the asset to its role in the broader system. At CBS Group, we've proven that this combination of courage, curiosity and collaboration can save hundreds of millions while actually improving performance - but it requires the confidence to respectfully challenge how things have always been done.

What is the most exciting trend that you've noticed in asset management today?

The shift from reactive maintenance contracts to genuine whole-of-life partnerships, now supercharged by AI's ability to validate and optimise these approaches. We're finally seeing governments recognise that the cheapest tender rarely delivers the best value over 30 years. AI is transforming how we substantiate this - analysing millions of data points to prove that preventative interventions at year 5 save millions at year 20, or demonstrating how different design choices impact 30-year lifecycle costs. The CAPITAL framework's success, combined with AI-driven analysis, helps us quantify previously unmeasured impacts like the $26,000 per lane per day cost of tunnel closures - making the business case for better upfront investment crystal clear. We're using AI at CBS Group not just for predictive maintenance, but to model complex commercial scenarios that prove why spending more now delivers exponentially better infrastructure outcomes. This convergence of innovative commercial frameworks with AI's analytical power is finally giving us the evidence base to challenge decades of short-term thinking. It's not about better spreadsheets - it's about irrefutable data that transforms how public infrastructure serves communities over generations.

The Asset Management

CAREER PLANNING TOOL

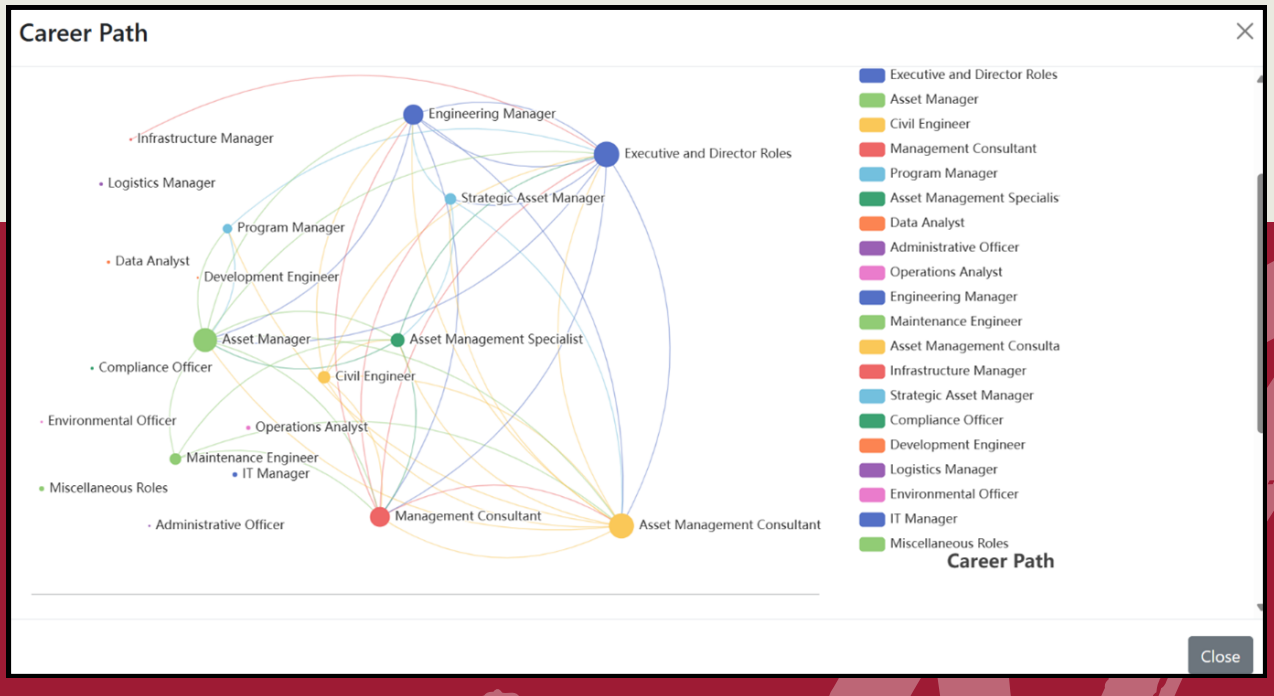
- **Wondering what asset management competencies you still need in your asset management journey?**
- **Looking for a Personalised Asset Management Career Mapping Tool?**
- **Wanting an asset management competency profile?**

Use the online tool to Create your Asset Management Individualised profile. Use your self assessment to map your future career and work on any gaps in asset management competencies.

Available to everyone from the AM Council website. Just login to the AM Council website and navigate to certification pages and AM GFMAM landscape or use this shortcut link to get started: www.amcouncil.com.au/career

There is no particular defined career path in Asset Management, but more a personal journey in collecting Asset Management competencies together with other competencies in your particular chosen field that allows one to get to the position to which you aspire.

Use the career path tool to compare your asset management competencies against those most common for various job roles and plan your future today!



ASSET MANAGEMENT

AMPEAK

PROMOTE EDUCATE ASSIST KNOWLEDGE

12 - 15 April 2026

Crown Perth, Western Australia

ASSET MANAGEMENT: POWERING PRODUCTIVITY AND PROSPERITY

Exploring how strategic asset management drives performance, resilience and value

Join AMPEAK26, a world-leading asset management conference featuring exhibits, case studies, and technical insights from across industries. It's the ultimate meeting place for asset managers to explore emerging trends, share knowledge, and find practical solutions to use in the workplace.

Come and hear from asset management experts covering lifecycle issues for all assets, take part in interactive sessions, chat to exhibitors and networks with professionals across all sectors and industries.

The theme for **AMPEAK26** is **Powering Productivity and Prosperity,** and there are five key topics that will be of interest to academia, directors, CEO's, executive managers across asset rich organisations, asset management and maintenance practitioners, including:

Workforce Transformation and Knowledge Retention:

Empowering people to drive performance - leadership and capability for the future

This theme explores how asset-intensive organisations are addressing critical workforce challenges — from skills shortages and an ageing workforce to knowledge loss and evolving expectations of new generations.

- Leadership and change management in asset management
- Capability frameworks, competency standards, and continuous upskilling
- Mentoring, knowledge transfer, and strategies to prevent knowledge loss
- Workforce diversity, inclusion, and wellbeing (including mental health)
- Inspiring the next generation of asset management professionals – career pathways and competency development

Data-Driven Decision Making and Digital Innovation:

Harnessing technology, information, and analytics for smarter decisions

This theme shows how data and digital tools are being leveraged to drive better maintenance decisions, optimise asset performance, and reduce costs.

- Data governance, integration, and assurance of data quality
- Predictive analytics, AI, machine learning, IoT, and condition monitoring
- Digital twins, BIM, and smart/connected assets
- Cybersecurity and protecting digital asset information
- Digital engineering and advanced information management systems
- Closing the digital ROI gap: from investment to realised business value

Strategic Alignment and Value-Focused Asset Management:

Embedding asset management into enterprise strategy and governance

This theme focuses on how organisations are aligning asset strategies with enterprise and societal goals to drive productivity, resilience, and stakeholder value.

- Asset management planning and risk-based decision-making
- Governance, compliance, and integration with ISO 55001:2024
- Communicating asset management value to executives and boards
- Investment prioritisation and lifecycle costing
- Policy, standards, and regulation for improved productivity
- Measuring and demonstrating asset management's contribution to organisational, national and societal outcomes

Operational Excellence, Reliability and Safety:

Driving performance, assurance, and resilience in operations

This theme seeks insights into how organisations are improving their planning, scheduling, reliability engineering, and execution disciplines to maximise asset availability and safety

- Reliability-centred maintenance and asset strategies, assurance frameworks, and performance metrics
- Improving planning, scheduling, work management processes and tools-in-hand/field time workforce productivity
- Resilient operations for aging and critical infrastructure
- Failure analysis and condition monitoring
- Integrating safety and risk management into reliability and maintenance

Sustainable Asset Management and Societal Value:

Embedding sustainability and resilience in asset decision-making

Delivering resilience, decarbonisation, and long-term prosperity

This theme focuses on how asset management supports decarbonisation, climate adaptation, circular economy practices, and broader social outcomes.

- Decarbonisation strategies and managing the energy transition
- Circular economy and asset reuse, refurbishment, and sustainable procurement
- Embedding climate risk and resilience in asset strategies
- Financing models and mechanisms for sustainable infrastructure
- Nature-based solutions and innovative practices for resilience
- Measuring and reporting ESG and societal outcomes of asset management

PERTH LOCATION

This year's conference is being held at Crown Perth, with various social events such as our welcome reception, and you won't want to miss our Gala Awards night. The prestigious dinner and 2026 awards ceremony will be held on the Tuesday evening.

NOMINATE YOUR ORGANISATION FOR AN AWARD

Nominations for asset management excellence are available in a range of categories. Awards will be presented at the gala dinner.

HOSTED BY: ASSET MANAGEMENT COUNCIL

SUPPORTED BY: ENGINEERS AUSTRALIA

www.ampeak.com.au

CHAPTER **NEWS**

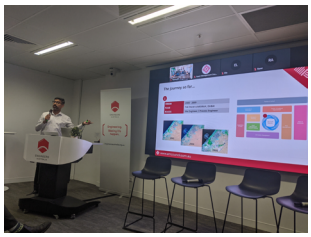
BRISBANE

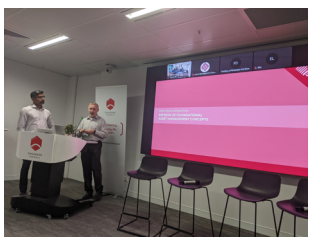
The Brisbane Chapter welcomed members and guests to *Navigating Asset Management: Concepts, Careers and Connections* on 11 March at Engineers Australia in Brisbane. Designed for early-career professionals, those transitioning into asset management, and practitioners looking to refresh their knowledge, the event explored core asset management concepts, recent updates to Asset Management Council models, and emerging trends shaping the profession.

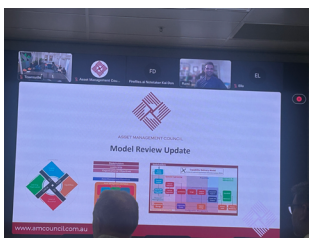
Presentations and panel discussions highlighted the many pathways into asset management, with speakers sharing their career journeys, key mindset shifts, and the skills that remain valuable across operations, project delivery, and asset management roles. The chapter was pleased to feature insights from Matthew Bower, Rajesh Kumar, Susan Chamberlain and Lalyn Masangcay, whose combined experience provided attendees with both practical guidance and broader industry perspective.

A notable feature of the evening was the involvement of the Townsville hub, whose local attendees gathered in Townsville and dialled in to the Brisbane event for the technical component. Their participation added a valuable regional connection to the event and reflected the chapter's commitment to making knowledge-sharing more accessible across Queensland.









MELBOURNE

The Melbourne Chapter held its recent technical meet on 3 March at the Grand Hotel in Docklands, welcoming members for an engaging presentation on the future of data-driven asset management. In F*rom Worthless Data to Intelligent Assets: Edge Federated Machine Learning in Real Work Asset Management,* attendees explored how asset-intensive organisations can unlock greater value from operational data that is often collected but underutilised.

Presented by Shane Scriven, Founder and Managing Director of SAS Asset Management, the session challenged traditional centralised analytics models and introduced edge federated machine learning as a practical and transformative approach for physical asset management. Drawing on real-world examples from Australian transport, ports and heavy industry, the presentation examined how this approach can help overcome common barriers including isolated asset knowledge, data silos, cloud analytics latency and privacy concerns.

The event provided valuable insight into the growing importance of data governance, data quality and data utilisation in enabling more intelligent maintenance and better-informed decision-making across asset-intensive sectors.









CHAPTER **NEWS**

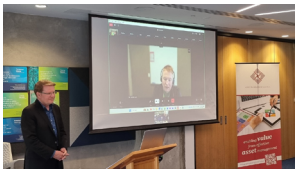
NEW ZEALAND

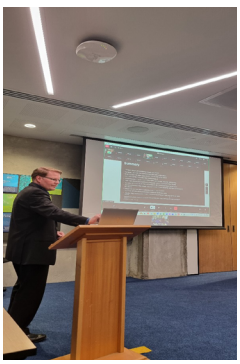
The New Zealand Chapter recently brought members together in Wellington for *Strengthening Asset Management Practice,* hosted at the Transpower office, with participants also dialling in from across both the North and South Islands. The hybrid format enabled asset management professionals from around the country to join the conversation and share in a strong program focused on current practice and capability development.

The event featured three presentations aligned to the theme of strengthening asset management practice. Rochelle Leach of NZTA presented *PlanRight – what are we focusing on right now,* offering insight into current priorities and direction. Obinna Akaa of KiwiRail explored *A Systems Approach to Asset Risk, Investment Timing, and Service Performance in Metro Rail,* highlighting the value of integrated thinking in complex transport environments. Matt Spooner of Transpower then spoke on D*eveloping an asset management competency framework and organisational training curriculums,* focusing on the importance of capability building to support long-term organisational success.

Together, the presentations provided attendees with a practical and thoughtful look at how asset management organisations are improving decision-making, building capability and strengthening practice across the sector.









PERTH

Perth was the setting for a highly successful national symposium on 20 February at the DoubleTree by Hilton Perth Waterfront, bringing together a full house of attendees for a one-day program on asset management in the nuclear sector. The symposium explored asset management in high-consequence, highly regulated environments, with a strong emphasis on safety, security, governance and workforce capability, while drawing out lessons that are transferable across a wide range of industries.

The program featured an impressive line-up of speakers covering the full nuclear asset lifecycle, from siting and regulation through to operations, decommissioning and long-term waste management. Presentations included whole-of-lifecycle nuclear safety regulation from Kirsty Braybon, hazardous waste facility management from Nate Smith, and hazardous materials risk and safety perspectives from Assistant Commissioner Jon Broomhall. Attendees also heard practical insights from ANSTO's David Vittorio and Alec Kimber on the role of asset management in supporting the reliability of the OPAL Multipurpose Reactor and the challenges of decommissioning nuclear facilities.

A panel discussion on managing and operating complex assets further examined the importance of









risk, reliability, work control, spares and future workforce capability, with contributions from David Vittorio, Alec Kimber, Ben Foster and Mark Schneider. The afternoon program continued this focus with presentations on navy submarines and aircraft, safe and sustainable nuclear supply chains, health and radiation safety considerations, and lessons from the UK nuclear industry.

Overall, the symposium provided a valuable forum for sharing practical approaches to safe, secure and sustainable asset management, while highlighting how lessons from the nuclear sector can inform asset management practice more broadly.

SYDNEY

The Sydney Chapter recently brought members together at Connect Sydney's offices for *Connect Sydney's Asset Management Maturity Uplift in Sydney Roads Asset Performance Contract,* an insightful session focused on strengthening asset management practice in a live operational environment. A notable feature of the event was the involvement of the Canberra Chapter, whose local attendees gathered as a hub in Canberra and dialled in to listen to the technical component, extending the reach of the session beyond Sydney.

The presentation explored ConnectSydney's asset management maturity journey under the Sydney Roads Asset Performance Contract (SRAPC), where the organisation assumed stewardship of a complex and highly visible road network within the Sydney Eastern Harbour Zone. The session examined a number of common industry challenges, including reactive planning, fragmented prioritisation, limited assurance confidence and siloed decision-making, before outlining the practical steps taken to address them.

Speakers Max Dallarmi, Network Needs Manager, and Syed Kazmi, Strategic Asset Manager, shared how ConnectSydney strengthened capability, assurance, prioritisation and cross-functional alignment through targeted improvements to roles, governance, decision frameworks and ways of working. By focusing on asset-need-led planning, balanced cost–risk–performance prioritisation and embedded assurance, the presentation demonstrated how these principles were translated into day-to-day business-as-usual practices, delivering improved decision quality, clearer traceability and greater client confidence.







How Much KNOWLEDGE & EXPERIENCE Protects Your Assets?



CFAM
Certified Fellow in Asset Management

CSAM
Certified Senior Practitioner in Asset Management

CPAM
Certified Practitioner in Asset Management

CAAM
Certified Associate in Asset Management

ARE YOUR EMPLOYEES ASSET MANAGEMENT COUNCIL CERTIFIED?

Improve Retention ▪ Enhance Recruitment ▪ Increase Portability

Get the facts: www.amcouncil.com.au/certification

Membership Application

ASSET MANAGEMENT COUNCIL

ASSET MANAGEMENT COUNCIL LTD

A Technical Society of Engineers Australia

ABN: 15 141 532 747 www.amcouncil.com.au
Phone: +613 9819 2515 Email: accounts@amcouncil.com.au

Thank you for joining the Asset Management Council. Please complete all sections. Phone or email with any queries.

PERSONAL DETAILS (Please print in BLOCK CAPITALS)

Title (Please circle) Dr Mr Mrs Ms Miss Other (Please specify) Sex (Please circle) F M

Family Name Given Names (in full)

Date of Birth Engineers Australia Membership No

CONTACT DETAILS (Please print in BLOCK CAPITALS)

Preferred Address: ☐ Private Address or ☐ Business Address

Position

Organisation

Postal Address

City State

Country Postcode

Phone Fax

Mobile

E-mail

AREAS OF INTEREST (Please tick)

Technical Topics

- ☐ Reliability
- ☐ Availability
- ☐ Maintainability
- ☐ Performance
- ☐ Spares Planning
- ☐ Maintenance Planning and Scheduling
- ☐ Maintenance Plan development and implementation
- ☐ Maintenance Policy/Strategy development
- ☐ Logistics
- ☐ Shutdown planning and the maintenance interface
- ☐ Asset Management
- ☐ Other:

Issues

- ☐ Skills development
- ☐ Training
- ☐ Other:

Industries

- ☐ Facility Management
- ☐ Consulting
- ☐ Power
- ☐ Transport
- ☐ Defence
- ☐ Oil and Gas
- ☐ Mining and Industry
- ☐ Water and Utilities
- ☐ Infrastructure
- ☐ Other:

Return completed Membership Application with payment to:
Asset Management Council
PO Box 2004, Oakleigh Vic 3166

GROUP AFFILIATION

☐ Young Asset Management Practitioners (18-35 year olds)

CHAPTER AFFILIATION (Please tick one)

☐ Newcastle ☐ Canberra ☐ Sydney ☐ Illawarra ☐ Mackay
☐ Melbourne ☐ Adelaide ☐ Brisbane ☐ Hobart
☐ Darwin ☐ Overseas ☐ Gippsland ☐ Perth

MEMBERSHIP FEES Effective Jan 2015 (Please tick one membership type only)

Individual Annual Fee (including GST)

☐ Member $190.00
☐ Student $35.00

Corporate Band Annual Fee (including GST)

☐ Unlimited $11,500.00 ☐ 11-20 $3,950.00
☐ 6-10 $2,100.00 ☐ 0-5 $1,100.00

GST (10%) does not apply to overseas memberships.

CORPORATE MEMBER NOMINEES

Gold – 10 nominees, Silver – 10 nominees, Bronze – 5 nominees

	Name	Email	Date of Birth (Mandatory)	AM Council Chapter
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Contact Asset Management Council to provide more corporate nominee details.

PAYMENT

Method of Payment (please tick one and enclose payment)

☐ Cash

☐ Money Order or Cheque drawn in AUD from an Australian bank) payable to **Asset Management Council Ltd**

☐ International Money Order

☐ Credit Card
(Australian or New Zealand Bankcard only acceptable)

Credit Card Details Please charge my card (tick one card type)

☐ Visa ☐ Bankcard ☐ Mastercard
☐ Diners ☐ American Express

Card no _____ CCV no _____

Expiry _____ Amount $ _____

Name on card _____

Signature _____ Date _____

Corporate Partners and Corporate Members

INDUSTRY PARTNER

ASC
Newmont
Rio Tinto

SUPPORTING PARTNER

Ausgrid
AusNet
BAE Systems
BGIS
Council of the City of Gold Coast
Department of Transport and Planning (VIC)
Programmed Facility Management
Serco AsPac
Service Stream
Transdev
Transport for NSW
Transpower NZ
Ventia

GOLD

Airservices Australia
Alstom
Aureco
Babcock
Brightly Software
Department of Families, Fairness and Housing
Department Of Health
Department of Housing and Works
Essential Energy
Evoenergy
Evolve FM
Flinders Port Holdings
GHD Advisory
Infrastructure NSW
Jacobs Group
KiwiRail
KPMG
Lucid Consulting
MTM
Pacific National
Parks Victoria
Port of Newcastle
QBuild
Spotless Facility Services
Stanwell
Sydney Water
TAFE Infrastructure NSW
Territory Generation
Transgrid
Transurban
V/Line
Western Power
Wood Plc (Australia)
WSP
Xenco

SILVER

ACEREZ M&L Contractor
AECOM Australia
AMCL
APA Group
Aurizon Network
BetterAIM
Campbelltown City Council
Comfort Delgro NSW
Court Services Victoria
Defence Equipment Management Organisation (NZDF)
Defence Estate Infrastructure, NZDF
Downer Rail & Transit Systems (RTS)
Fire and Rescue NSW
GHD Limited
Gladstone Ports Corporation
Greater Western Water
IBM
Infrastructure Advisory Group
ISS Facility Services
Jemena
KordaMentha
Mackay Regional Council
Napier Port
Norship
NSW Public Works
NSW Telco Authority
Origin Energy
Port Botany Operations
Public Transport Authority
SEQWATER
Sodexo
Southern Ports
Stantec
SunWater
Sutherland Shire Council
Sydney Opera House
Tasports
TasWater
Unitywater
VicTrack
Water Corporation
WA Police Force

BRONZE

Altrac Light Rail
ANSTO
APP Corporation
Asset Management Associates
Assetivity
Austal Australia
Australian Institute of Marine Science
Balance Agri-Nutrients
Beca Limited
Beyond Asset Management
Brisbane Airport Corporation
Bureau Veritas Australia
BWE Waterwell
CBC Facilities Maintenance
Covaris
Cushman and Wakefield
DAS Consulting
Department of Jobs, Skills, Industry and Regions
Department of Planning, Industry & Environment
Egis
Fire Rescue Victoria
Fraser Coast Regional Council
Fremantle Ports
Fresh Hope Communities
Gladstone Area Water Board
Gladstone Regional Council
Goulburn Valley Water
Hardcat
Horizon Power
Hunter Water Corporation
Infrastructure SA
Infrastructure WA
Invercargill City Council
IPS-ENERGY AUSTRALIA PACIFIC
Kepa Software
LYB Operations & Maintenance
Melbourne & Olympic Parks
Melbourne Water
Metrix Assets
Metro Trains Sydney
Minset
Monash University
Murray Irrigation
North East Water
Northern Territory Government Dept. of Infrastructure, Planning & Logistics
Northrop Grumman Integrated Defence Services
NRG Gladstone Operating Services
Ontoit Global
Osmose Australia
Pacific Hydro
Percept Systems
Placemaking NSW
Port of Melbourne
Powerlink Queensland
Quarterbac
Qubist
Queensland Rail
Raytheon Australia
Reeves Group Services
Rockfield Technologies Australia
SA Water Corporation
SAAB Australia
Shoalhaven Water
Silver Edge Technologies
SPM Assets
STRUCTURED CHANGE
SUSTECH ENGINEERING
Taronga Conservation Society Australia
TATWEER MIDDLE EAST AND AFRICA L.L.C.
Terotek (NZ) Limited
The Asset Management College
The Exchange Collective
Townsville City Council
Unison Networks
United Energy Services
Verbrec
Verosoft
Wagners Composite Fibre Technologies
Wannon Water
WaterNSW
Wesfarmers Chemical Energy and Fertilisers
Worley



ASSET MANAGEMENT COUNCIL

THE ASSET JOURNAL

Asset Management Council
PO Box 2004
Oakleigh Vic 3166
Tel 03 9819 2515
www.amcouncil.com.au