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Course Topics

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Topic		Theme and target audience
Title slide and topics page		Target: Management and practitioners Theme: Fundamentals
Some thoughts about change and excellence		
1. SA Context	Day 1	
2. Overview of Asset Management	Day 1	
3. Managing Asset Management	Day 2	
4. Scope of Asset Management	Day 2	
5. Case Study: AM & the Climate Emergency	Day 2	
About – sources, acronyms, course presenter		

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Managing Asset Management

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- **Overview**
  - This section describes the 'management of asset management'
  - AM should be regarded as one of the most important functions of a road agency
    - It is vital to have commitment and direction from directors, senior management and staff throughout the organisation
    - Governance of AM should not be left to practitioners and those charged with service delivery; it should be a joint responsibility of senior management and the corporate governance levels of the organisation
  - Two cases studies are provided

Topics

- **Managing the fundamentals of AM**
  - Leadership and culture
  - Value
  - Alignment
  - Assurance
- **Change management**
- **Understanding the strategic context**
- **Introducing SANS/ ISO 55000/1/2**
- **The AM System**
- **Whole of asset lifecycle activities**
- **AM Framework planning & implementation elements**
- **AM Policy, Objectives, Strategy, Plans, draft TMH 22 template for the Road AM Plan**
- **Achieving effective AM**
- **Organisational & individual AM Journeys**
- **Performance management**
- **Reporting organisational performance**

Features of AM which differentiate it from other management systems

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- **Approach to decision making**
  - Competent, consistent, optimal decision-making is a vital element underpinning successful AM
  - In making AM decisions, it is important to find the right compromise between competing interests, such as asset utilisation/ performance vs operating expenditures, or short-term benefits vs long-term sustainability
    - The approach applied should be proportionate
  - AM decisions vary greatly in complexity and criticality, so it's inappropriate to apply the same level of sophistication to all decisions
    - Simple, non-critical decisions can & should be made with common sense
    - Higher impact decisions with multiple influences, options, timings or inter-dependencies require systematic, multi-disciplined & auditable decision-making processes
  - AM also involves organisations choosing & using appropriate combination of tools & techniques, e.g., Lean, 6-Sigma, Total Productive Maintenance, Reliability Centred Maintenance, to support decision-making & improve AM activities
    - This also includes Operational Excellence, which builds on continuous improvement methodologies, such as Lean and 6-Sigma, bringing a workplace focus on problem solving, teamwork & leadership to continually improve activities to meet customer needs
    - The term 'optimising' is often used in relation to AM decision-making
      - It describes the process of establishing the best value compromise between a set of competing factors, in order to support AM decision-making
      - This can range from a subjective, quantitative judgement to more sophisticated techniques that can demonstrate that the best value is being obtained

Whole of asset lifecycle activities

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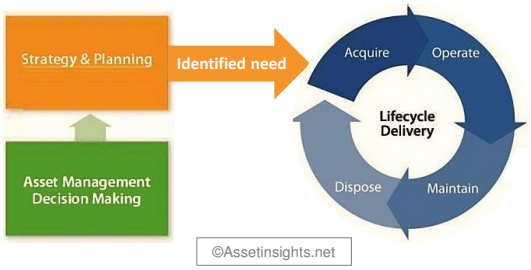
- **Lifecycle activities**
  - Assets usually contribute value in a systems context
  - The lifecycle includes all aspects of managing assets from the initial concept through to disposal as shown in the diagram
    - **Identify the need** – emanates from strategy & planning
    - **Acquire** – covers everything that goes into designing and procuring an asset. Proper application of these activities ensures that the asset is fit for purpose
    - **Operate** – normally the bulk of the lifecycle for an asset during which it provides the function for which it was designed
    - **Maintain** – maintenance, refurbishment and potential upgrade to meet any change in condition or operational requirement. This phase can be decades, even centuries
    - **Dispose** – this is often the most overlooked phase



- The concept of the lifecycle can become more challenging where more complex systems are considered
- AM requires integration of activities across the whole lifecycle, not just consideration of individual lifecycle stages
  - The focus on integration particularly affects the design phase, which can determine as much as 80% of the total lifecycle costs and a large proportion of its environmental and social impact

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Expanded view on Asset Lifecycle Activities

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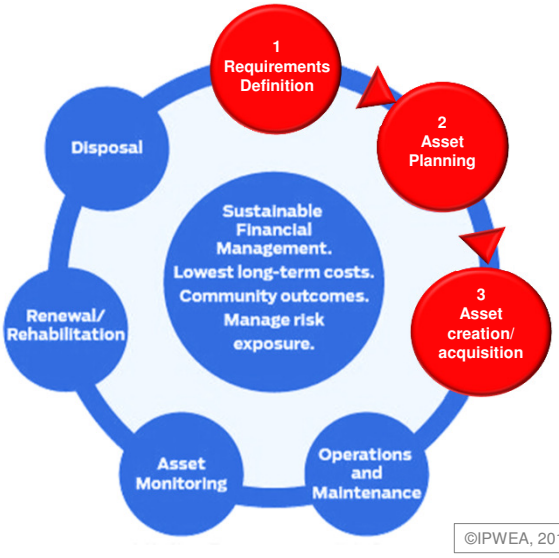
- **Requirements definition**
  - The need for the service provided by the assets is defined by an analysis of
    - The organisation's strategic/ business goals
    - The customer's level of service requirements, both now and in the future
    - Legislative and regulatory requirements
- **Asset planning**
  - Involves confirming the service required from the customer and ensuring the most effective solution is used – asset-based, demand management, or a combination
- **Asset creation/ acquisition**
  - The provision of, improvement to, an asset where the outlay can reasonably be expected to provided benefits beyond the year of outlay



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Expanded view on Asset Lifecycle Activities

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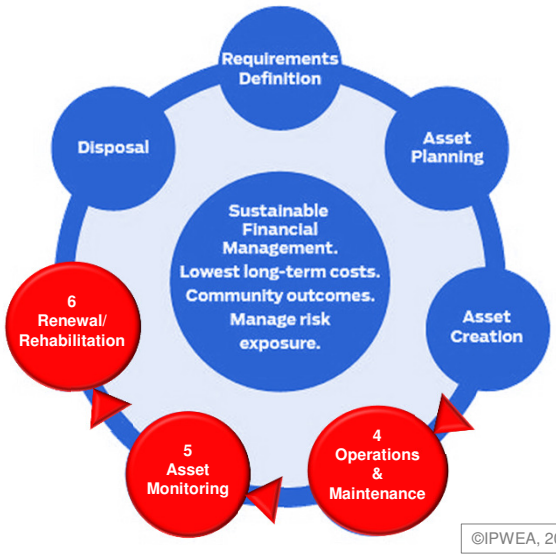
- **Asset operations and maintenance**
  - Relates to day-to-day running and upkeep of assets
  - Costs are particularly significant for dynamic/short-lived assets
- **Monitoring asset condition/ performance**
  - Performance relates to the ability of the asset to meet target LoS
  - Condition reflects the physical state of the asset
  - Condition & performance information drives future programmes
- **Asset rehabilitation/renewal**
  - Required to restore the asset to its required functional condition and performance



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Expanded view on Asset Lifecycle Activities

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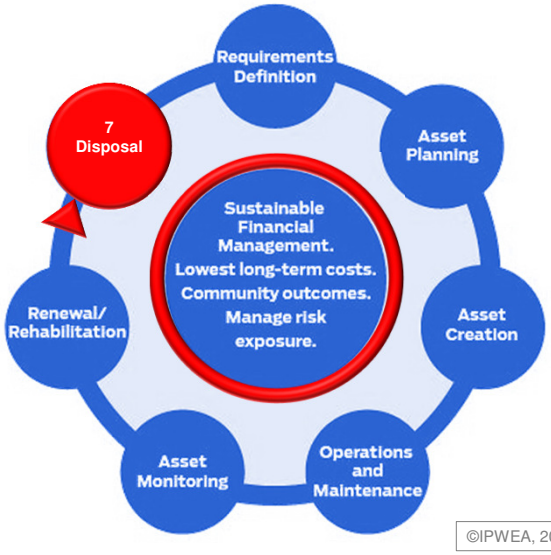
- **Asset disposal**
  - When the service is no longer required or is uneconomical compared with other methods
- **Financial management**
  - Requires the recognition of all lifecycle costs associated with asset ownership and supports cost-effective decision-making



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Background to AM Framework

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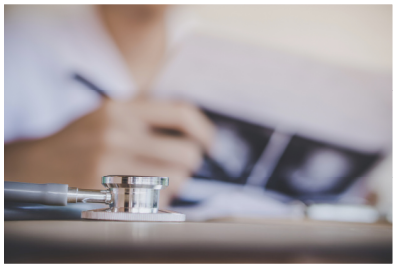
- **It is good practice to establish an overall organisational AM framework that connects to all levels of the organisation**
  - This should range from governance through to operational levels, including contract providers
- **This framework should tie the organisation's strategic direction to what is expected through the AM policy**
- **Business components, such as the AM system and its attendant parts (policy, strategy, plans, business processes, accountability and reporting mechanisms) support the implementation of AM and help to ensure alignment and good governance**
- **Good governance of AM means**
  - Ensuring that the organisation's service delivery objectives and obligations are being met prudently, effectively and efficiently.
  - The scope and principles of AM must be well defined, with clear accountabilities specified at all levels
- **AM should be one of the primary focal points for corporate governance or elected members of a Council, as appropriate**



AM Framework Artefacts

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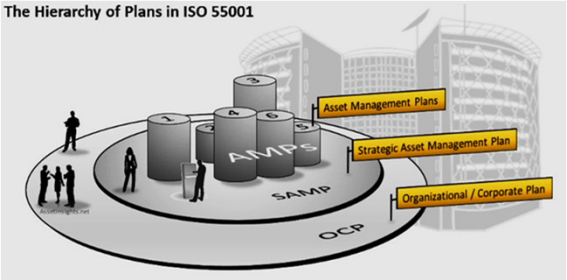
- **An AM framework typically includes the ISO 55001 artefacts – policy, objectives, strategic AM plan, AM plans (lifecycle plans)**
- **These drive the implementation of AM and ensure its alignment with the organisation's strategic objectives**
- **A good AM framework sets, directs &, where appropriate, controls and monitors all the components of the AM system to ensure they work together, firmly linking the organisation's strategic & AM objectives and practices, procedures, processes & systems**
- **It does this by**
  - Linking organisational strategic objectives with the policies and objectives needed to deliver them
  - Linking organisational strategic objectives with the levels of service that the assets should deliver
  - Guiding priorities, the work required on the assets to achieve those objectives, and the finances needed to support that work
- **The framework is not the sole driver of an organisation: it is part of a wider hierarchy of plans**
  - The clearer and more consistent this hierarchy is the greater the probability will be of the organisational objectives being delivered in the most cost-effective manner



©Assetinsights.net

GFMAM Asset Management Landscape Subjects

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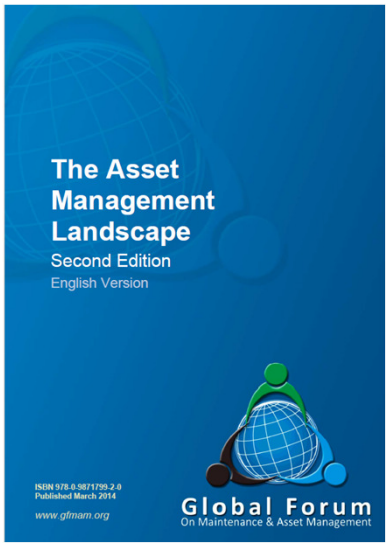
- **The Asset Management Landscape is a publication of the Global Forum on Maintenance & Asset Management**
  - The core of AM is the Asset Management Fundamentals described in the 39 AM Subjects
  - **Subject Group Strategy and Planning**: Subjects in the yellow highlights indicate ISO 55001 artifacts are derived from these subjects relevant to this course
    - Asset Management Policy
    - Asset Management Strategy & Objectives
    - Asset Management Planning
    - Demand Analysis
  - **Subject Group AM Decision-Making**: Subjects
    - Capital Investment Decision-Making
    - Operations & Maintenance Decision-Making
    - Lifecycle Value Realisation
    - Resourcing Strategy
    - Shutdowns & Outage Strategy



GFMAM Asset Management Landscape Subjects

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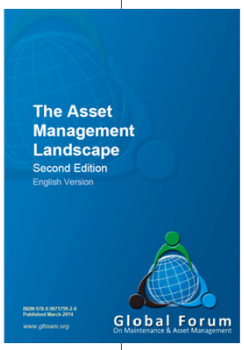
- **Subject Group Lifecycle Delivery**: Subjects
  - Technical Standards & Legislation
  - Asset Creation & Acquisition
  - Systems Engineering
  - Configuration Management
  - Maintenance Delivery
  - Reliability Engineering
  - Asset Operations
  - Resource Management
  - Shutdown & Outage Management
  - Fault & Incident Response
  - Asset Decommissioning & Disposal
- **Asset Information**: Subjects
  - Asset Information Strategy
  - Asset Information Standards
  - Asset Information Systems
  - Data & Information Management



- **Subject Group Organisation & People**: Subjects
  - Procurement & Supply Chain Management
  - Asset Management Leadership
  - Organisational Structure
  - Competence Management
- **Subject Group Risk & Review**: Subjects
  - Risk Assessment & Management
  - Contingency Planning & Resilience Analysis
  - Sustainable Development
  - Management of Change
  - Assets Performance & Health Monitoring
  - Asset Management System Monitoring
  - Management Review, Audit and Assurance
  - Asset Costing & Valuation
  - Stakeholder Engagement

GFMAM Asset Management Landscape Subjects

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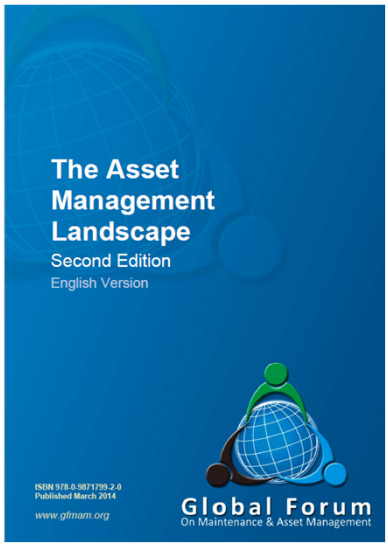
- **For each Subject Group 'The AM Landscape' provides**
  - Definition
  - Context
  - Artifacts
  - Related Subjects
  - Relevant Standards – e.g. clauses in ISO 55001 and other ISO standards



AM Framework

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- **Plan hierarchy and AM framework**

Adapted from IPWEA, 2015

Planning & implementation elements of an AM system

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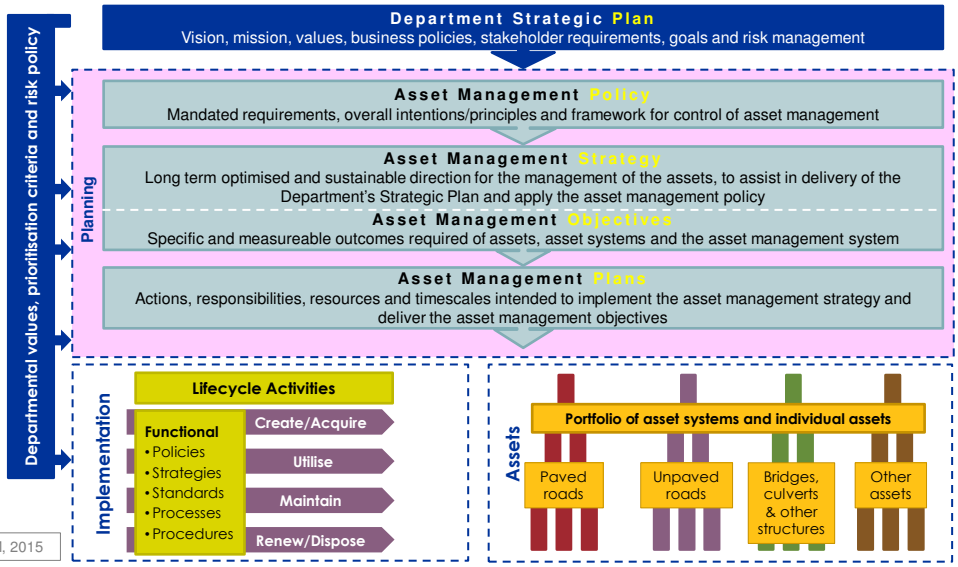
- The integration of planning and implementation elements of an AM system and illustrates the 'line of sight' of the strategic plan through to the AM plans for implementation of lifecycle activities on the asset systems and individual assets



Adapted from ©IAM, 2015

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AM Policy

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- **AM policy is the cornerstone of an organisation's approach to AM**
- **Purpose of AM Policy**
  - To outline broadly the principles & requirements—the rules of engagement—for undertaking all AM activities across the organisation in a structured & co-ordinated way consistent with the organisation's strategic plan
  - To provide direction to development & implementation of the AM Strategy and setting AM Objectives, and it should provide clear direction on the appropriate focus and levels of maturity expected
- **It works at two main levels**
  - It provides direction for the development of strategies & objectives & provides asset managers with statements of the organisation's requirements & management's expectations with respect to the outcomes
  - It requires senior management to consider its role in AM, recognise that it is an issue that affects the whole organisation, and to manage those effects

- **The policy should be a short, clear, concise, and easy-to-read document that describes the principles adopted in applying AM to achieve the agency's strategic objectives**
- **It should state the high-level principles by which the organisation manages its assets and sets out the intentions and direction of the organisation, as formally expressed by its top management**
- **It should be formally agreed and signed by an appropriate executive officer and approved at the governance level, thereby demonstrating the organisation's commitment to AM**

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ISO 55001 AM Policy requirements

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- **ISO55001 requires top management to establish an AM policy that**
  - Is appropriate to the purpose of the organisation
  - Provides a framework for setting objectives
  - Includes a commitment to satisfy applicable requirements
  - Includes a commitment to continual improvement of the system
- **ISO55001 requires that the AM policy be**
  - Consistent with the organisational plan
  - Consistent with other relevant organisational policies
  - Appropriate to the nature and scale of the organisation's assets and operations
  - Available as documented information
  - Communicated within the organisation
  - Available to stakeholders, as appropriate
  - Implemented & periodically reviewed & updated
- **Typical content of an AM policy**
  - Organisational context and the importance of AM
  - Overall vision, mission, strategic goals, plans, objectives and policies
  - Supporting vision and goals
  - Mandatory requirements, laws, legislation & regulations
  - Policies underpinning the strategic goals
  - Principles guiding activities in achieving the objectives
  - Resources and responsibilities, including organisational structure
  - Integration into the organisation's business practices and processes
  - Reporting on performance
  - Audit, review and updating procedures for the policy

Good AM Policy

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- **A good AM policy may also cover or refer to**
  - A commitment to abide by the principles of good or best practice in pursuing the achievement of the objectives
  - Decision-making criteria, including evaluation methodology spanning lifecycle costs, benefits, and asset risks
  - A commitment to continual improvement of the system
- **There is no right answer as to what should be contained in a policy document compared to the strategy document – they may well be in the same document**
- **The important point is to ensure that all requirements are robustly addressed and that it is shared widely within the organisation**
- **The policy should be reviewed regularly so that it remains relevant to the changing business environment of the organisation**
- **Examples of AM Policy**
  - Department of Transport and Main Roads, Queensland at https://www.tmr.qld.gov.au/-/media/busind/techstdpubs/Asset-management/TIAM-Policy/TIAMPolicy.pdf?la=en
  - City of Sydney, Australia at https://www.cityofsydney.nsw.gov.au/policies/asset-management-policy
  - Scottish Trunk Road Network Asset Management Policy at https://www.transport.gov.scot/publication/scottish-trunk-road-network-asset-management-policy/
  - NSW Treasury Asset Management Policy for the NSW Public Sector at https://www.treasury.nsw.gov.au/finance-resource/asset-management-policy

Example of a concise AM Policy of Highways England

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1 page: Top part

highways england

Highways England
Asset Management Policy

Highways England's asset management approach aligns our asset related activities to deliver the vision defined in the Department for Transport's Road Investment Strategy. This Asset Management Policy supports the new governance structure and associated ways of working within Highways England. We will periodically review and update it to remain aligned with the strategic business objectives.

The Asset Management Policy links with our three imperatives as well as the Strategic Business and Delivery Plans. It defines the principles by which we will develop our asset management capability - ensuring we understand the asset needs and develop effective solutions. We will successfully deliver these to drive the required service and value from our assets, meeting or exceeding customer expectations.

The scope of this Policy covers the management of the strategic road network and other assets owned by Highways England for the purposes of operating, managing and improving that network. The principles outlined below have been established in line with industry leading practices and are consistent with the requirements of the asset management standard ISO55000 as well as applicable laws, legislation and regulation.

Our Three Imperatives

Safety	Customer Service	Delivery
making the roads safer for everyone	improving the experience of road users	strengthening our capability to deliver the Government's five-year road investment plan

Example of a concise AM Policy from Highways England

©Mervyn Henderson Consulting

1 page: Bottom part

Our Asset Management Principles

Strategy and Planning
We will establish and continuously improve an asset management system linking our strategic business objectives to our everyday asset management activities.

Asset Information
Having determined the right asset information first, we will collect, collate, control and circulate that information at the right time informing the right asset management decision-making.

Decision Making
We will base our decision-making on the health and performance of our assets, measured throughout their lifecycle and informing our future asset management activities.

Lifecycle Delivery
We will utilise technology, tools and processes as enablers for the effective and efficient utilisation of our assets.

Risk and Review
We will embed a risk-based framework to deliver a resilient and reliable asset operational portfolio.

Organisation and People
We will recruit, train and retain the right staff to deliver a capable organisation.

"On behalf of Highways England, I endorse this Asset Management Policy. I believe a strong asset management capability is fundamental to our business. It will help us to deliver our commitments and improve our safety, efficiency and reputation. We need to go beyond just satisfying our licence requirements. Proactive and high capability asset management will help save lives, save money and bring a better understanding of our assets to our staff."

Jim O'Sullivan,
Chief Executive

For further information please contact the Asset Management inbox: AssetManagementProgramme@highwaysengland.co.uk

Issue date: May 2017

AM Objectives

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- **AM objectives define what the organisation intends to achieve from its AM activities & by when**
- **ISO 55001 very clearly places the objectives at the centre**
  - They are a key element in the strategy and are usually incorporated in, & published with it
  - The organisation must retain documented information on the objectives, which should be established and updated as part of the SAMP
- **The objectives are set within the framework provided by and developed in the policy**
- **The objectives describe what the organisation intends to achieve with the particular assets within its planning horizon**
- **AM objectives are neither statements of the organisation's commitment to the services provided nor its long-term strategy, but are the goals of long-term strategies**
- **Considerations in developing AM objectives**
  - The purpose of the assets—what services are to be delivered to roads customers?
  - What is the current and future intended performance of the network?
  - What are the key risks and risk management processes, including the risk of service failure(s) and the consequences of such failure(s)?
  - What performance areas will be used for mapping to the objectives & monitoring their achievement/ progress?
  - The alignment and consistency with the other organisational objectives
  - The maturity of the organisation should be considered & include those objectives that can be used to encourage improvement

AM Objectives

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- **AM Objectives are normally developed alongside the strategy & are equally applicable to plans**
  - They should be **SMART** – Specific, Measurable, Achievable, Relevant, Time-related – milestones that set out **what** must be delivered and by **when**
  - Objectives may also be in organisational business plans and can be used to measure the success of the strategy or plan
  - Objectives within a strategy will enable specific AM plans ('lifecycle plans') to be developed

Case Study: Developing AM Objectives at NZTA

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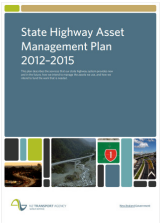
- **Every three years the New Zealand government produces a Government Policy Statement on Land Transport (GPS)**
  - It sets out its priorities for expenditure from the National Land Transport Fund over the next ten years.
  - All road agencies receiving funds, NZTA and territorial local agencies, must recognise these priorities and align their land transport strategies and AM plans with the intent of the GPS
  - With a strategic focus on economic growth and productivity, road safety and value for money, the draft GPS 2018 defines a number of national land transport objectives; such as
    - 'a land transport system that is resilient',
    - 'a land transport system that is a Safe System, increasingly free of death and serious injury', and
    - 'a land transport system that delivers the right infrastructure and services to the right level at the best cost'

- NZTA's role gives effect to the GPS, with its Investment and Revenue Strategy providing the framework and the 2016–2017 Statement of Performance Expectations (SPE) providing strategic input to defining NZTA's strategy, desired outcomes, goals and objectives
- These goals and objectives are cascaded from the SPE to service targets and investment proposals, which to date have been documented in the State Highway Asset Management Plan (SHAMP), in future becoming the State Highway Investment Proposal (SHIP)



OUR STRATEGY

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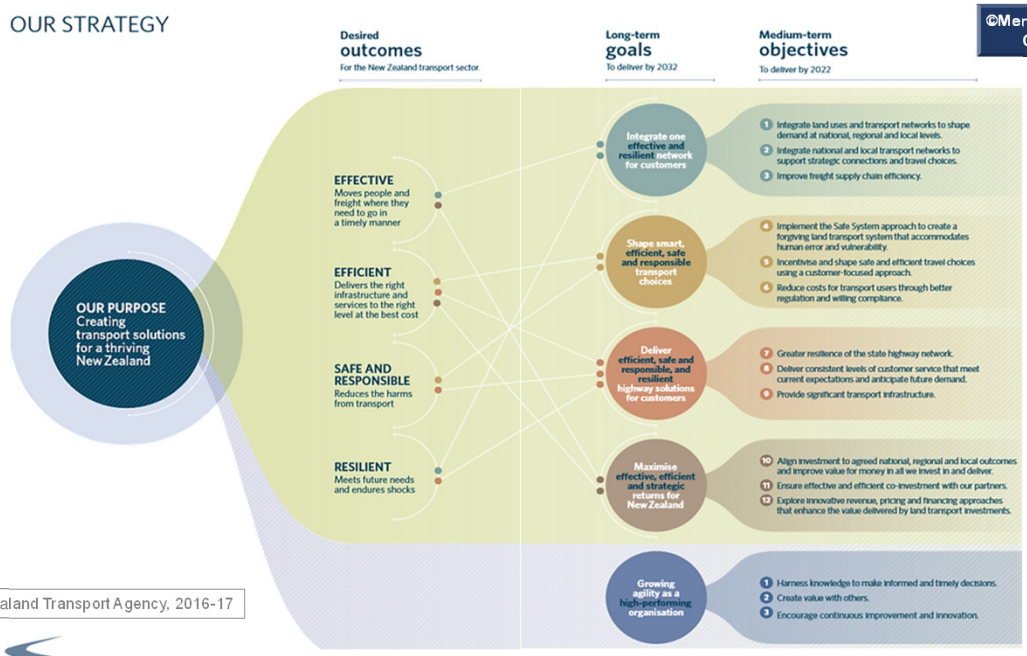

New Zealand Transport Agency, 2016-17

Case Study: Developing AM Objectives at NZTA

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- **Key performance measures relating to the objectives in the 2015–2018 SHAMP**
  - Efficiency in maintenance and operations
  - Better utilisation of existing capacity
  - Improved reliability
  - Reduced travel time
  - Reduction in deaths and serious injuries
  - Reduction in collective risk
- **These measures are aligned with the higher-level GPS objectives**
- **Levels of service provide another perspective of alignment with the GPS**
- **The Maintenance & Operations programme is linked to the customer-led One Network Road Classification (ONRC) levels of service, to be achieved at least cost**

SHAMP PERFORMANCE MEASURES

SHAMP KPI	Performance measure
Efficiency in maintenance & operations	ONRC performance measures
	$/lane km (by classification)
Better utilisation of existing capacity	Total HPMV network added (km)
	Network productivity in Auckland, Wellington & Christchurch
Improved reliability	Number of journeys impacted by an unplanned event(s)
	The variability of state highway travel times on key journeys
Reduced travel time	NPV of travel time and VOC savings by classification
Reduction in deaths and serious injuries	No. of serious and fatal crashes on state highway network each year as part of a five year trend
	NPV of safety savings
Reduction in Collective Risk	Annualised state highway serious and fatal crashes per km by classification and risk rating

New Zealand Transport Agency, 2015-2018 State Highways AMP

AM Strategy or Plan?

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- **Different names for the same thing?**
  - PAS 55 – AM Strategy
  - SANS/ ISO 55000 – AM Plan
- **Strategy or Plan?**
  - By convention, strategy describes the required activities for the long term approach based on uncertain knowledge and supported by available evidence, rationale and modelling
  - More detailed plans are derived from the strategy & would be aligned to it & are then used for the controlled delivery of the agreed activities
  - In some organisations the strategy document is fully developed down to the detail required to deliver activities, blurring the boundary between strategy and plan, making it difficult to draw a line between them
  - Each organisation should design its own approach to suit the nature and context of the assets managed
  - Irrespective of terminology & design choice, it is important that those within the organisation and their stakeholders have an unambiguous and common understanding of how strategy and plans are developed and documented
- **ISO 55000 defines an AM strategy/ SAMP as**
  - 'Documented information that specifies
    - how organisational objectives are to be converted into AM objectives,
    - the approach for developing AM plans, and
    - the role of the AM system in supporting the achievement of the objectives'

AM Strategy

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- **AM Strategy is a stakeholder facing statement describing the strategic approach**
  - It is a high level plan—single or multiple documents—for converting the AM Policy into specific AM objectives & the coordinating mechanism for ensuring that activities carried out on physical assets are aligned to optimally achieve the organisational strategic plan
- **Purpose of AM Strategy/Strategies**
  - Describe the strategic context & medium to long term organisational requirements of assets taking account of cost, performance and risk
  - Communicate clear rationale & objectives internally &/or externally providing line of sight between asset related organisational strategic objectives & AM objectives and plans
  - Provide internal stakeholders with direction, alignment & prioritisation for developing the long term management of the assets and their supply chain
  - Demonstrate due diligence to external stakeholders, increasing confidence & supporting the case for investment
  - Continue the line of sight from organisational strategy through AM Policy and pass it down to AM Plans
- **Expectations of an AM strategy**
  - Identifies the principles by which greater efficiency & value-for-money can be achieved
  - Describes the social & economic benefits of investing in road infrastructure
  - Sets clear directions, providing links with other relevant documents, corporate objectives, business planning, risk management & transport objectives
  - Provides direction for AM plans
  - Describes the structures, roles & responsibilities necessary to establish the AM system & to operate it effectively

AM Strategy

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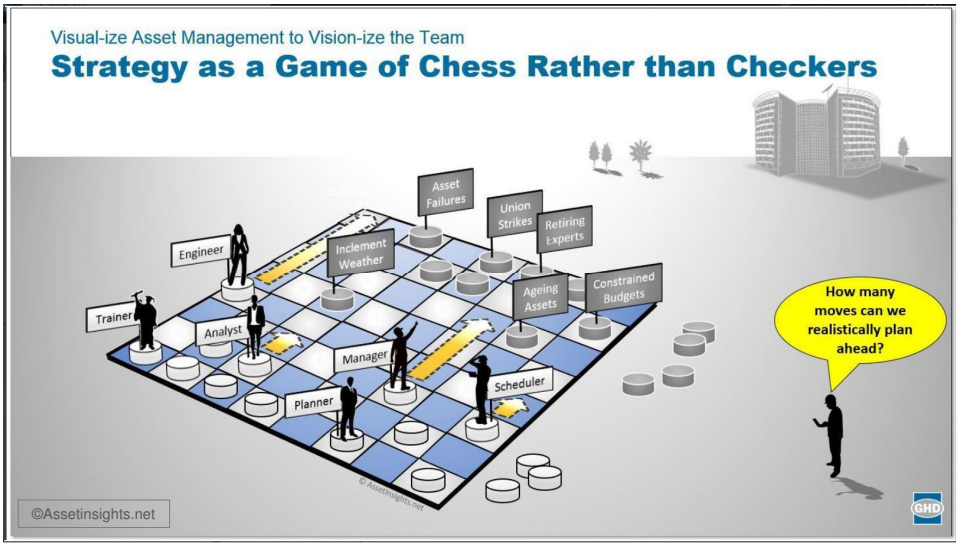

AM Strategy

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- **The AM Strategy**
  - Considers both capital & revenue work programmes
  - Normally has a time horizon well beyond detailed AM Plans
  - Should be regularly reviewed and updated as improved information becomes available and in response to changes
  - Should describe the long term approach to developing AM capabilities, i.e. improving the process by which the AM and asset systems are managed
    - AM capability strategy may be recorded separately from other strategies for e.g. asset investment, etc.
- **Commonly, there are multiple asset specific strategies by, e.g. asset type, operational function, service provision geography, location or interconnection**
- **Scope of the strategy should reflect the context of the organisation & consider key elements**
  - Define the key stakeholders
  - Clear statement of intent through strategic objectives
    - Set out the relevant requirements, objectives & organisational commitments
    - Describe the strategic context within which strategic requirements have been drawn, e.g. predictive modelling, asset condition, risk management, legal & regulatory obligations
    - Demonstrate the asset contribution (value) against organisational objectives
  - Scope of AM Strategy
  - Resource and organisational capacity
  - Risk
  - Gap definition
  - Scenarios
  - Asset approach
  - AM approach
  - Implementation and monitoring
  - Continual improvement opportunities

AM Strategy – Good practice

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- **Line of sight/ alignment**
  - To be effective the AM Strategy must provide the clear line of sight between organisational strategic plan, AM Policy, plans & the organisational processes & activities
  - The (vertical) line of sight provides the consistency between all levels
  - AM Strategy must set out how the assets contribute to organisational objectives
- **Ownership, Authorisation & Communication**
  - Involve the correct stakeholders & incorporate the authorisation of Senior Management
  - A clear owner should be accountable for development
  - AM Strategy should be endorsed and supported by the whole Senior Management Team/ Board
- **Length and Style**
  - Ensure communication & presentation of the AM Strategy is appropriate for the organisation & engages the relevant stakeholders
- **Continual development & improvement**
  - The AM Strategy must remain relevant and continue to drive improvements in organisational performance
  - Strategy should not be changing constantly, but it should be reviewed to take account of changing strategic context and organisational priorities
- **Development of AM Capabilities**
  - The AM system should be subject to continual improvement of processes, information systems, modelling tools, and resources utilised to develop and deliver the asset strategy & plans
  - The development programme for the AM System needs to be generated alongside that for the physical assets and similarly linked to delivering the AM objectives
    - The programme may be published within the AM Strategy or separately

AM Strategy & draft TMH 22 Template

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- **ISO 55001 requirements for the SAMP are included in TMH 22 Appendix J-10, Guide and format for preparation of a Road Asset Management Plan (RAMP) (template 2013)**
  - It provides the format to be used by South African road authorities for preparing their annual RAMPs
  - It is based on a template made available by the Department of Transport
- **TMH 22 template for a RAMP**

Executive Summary

Section 1: Introduction

1.1 Statement

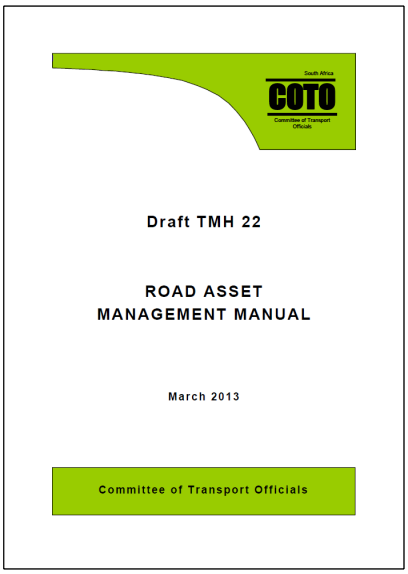
1.2 Background

1.3 Goals and Objectives of the RAMP

1.4 RAMP Framework

1.5 Planning Approach and Methodology

Section 2: Road Network



Draft TMH 22 template *continued*

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Section 3: Level of Service

Section 4: Situational Analysis (current asset condition and performance)

4.1 Inventory Data

4.2 Usage of the Assets

4.3 Engineering Condition of the Assets

4.4 Functional Condition of the Assets

4.5 Comparative Conditions

4.6 Vehicle Operating Costs & Excess User Costs

4.7 Asset Valuation

4.8 Remaining Useful Lives of Assets

4.9 Risks

4.10 Trend Analysis

4.11 Performance Gap Analysis (Problem Statements)

4.12 Summarising of Indices / Determining Composite Indices

Section 5: Demand or Need Determination

5.1 Need Determination for Current Assets

5.2 Demand for new assets

Section 6: Asset Management (multi-year tactical plans based on an approved budget)

Section 7: Financial Summary

Section 8: Organisational and Support Plan Structure

Section 9: Plan Improvement and Monitoring

Section 10: Job Creation and Skills Development

Section 11: SWOT Analysis

Section 12: References and Appendices

Appendix B: Declaration

AM 'Lifecycle' Plans

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- **AM 'Lifecycle' Plans (AM Plans) may be contained in a single document or a family of documents or a formalised AM system, depending on the scale of the business**
- **AM Plans specify the activities, resources & timescales required for an individual asset, or a grouping of assets, to achieve the organisation's objectives**
  - AM Plans are developed from AM Strategy & Objectives & must remain aligned to enable efficient & effective delivery
- **ISO 55001**
  - States that the organisation shall establish, document and maintain AM plan(s) to achieve the objectives
  - Requires that an organisation AM planning is integrated with other activities—financial, human resources & support functions
  - Requires that the plans take into account relevant requirements coming from outside the system
- **AM Plans describe in detail the activities which are carried out on the assets during their lifecycle ('lifecycle plans') and need to**
  - Have adequate detail to enable delivery of specific solutions for achieving the AM objectives, including customer benefits
  - Be aligned with financial requirements
  - Enable monitoring and management of delivery
  - Include the planning of capital investment, operations and maintenance requirements
  - Be optimised and prioritised
  - Include the costs, remaining risks and predicted improvement resulting from the plan, such as the forecast performance return in terms of key performance indicators and objectives
- **Time horizons for the AM Plan should be aligned with the needs of the assets, often leading to long time horizons for some asset replacement programmes**

AM Plans

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- **Good AM plans should help an agency to**
  - Meet its goals and objectives in a way that best serves its customers
  - Communicate with customers and other parties on different funding scenarios and impacts on service levels and risk
  - Develop detailed objectives and performance measures for its assets
  - Provide direction to its operating plans & business plans
- **ISO 55001 Clause 6.2.2 describes the minimum contents of a plan, by linking how to achieve the objectives to determining & documenting the following**
  - The method and criteria for decision-making & prioritising the activities & resources needed
  - The processes and methods to be employed in managing its assets over their lifecycles
  - What will be done?
  - What resources will be required?
  - Who will be responsible?
  - When it will be completed?
  - How the results will be evaluated?
  - The appropriate time horizons for the plans
  - The financial & non-financial implications of the plans
  - The review period
  - Actions to address risks and opportunities associated with managing the assets, taking into account how these risks and opportunities can change with time, by establishing processes for the
    - Identification of risks and opportunities
    - Assessment of risks and opportunities – determining the significance of assets in achieving the objectives
    - Implementation of the appropriate treatment and the monitoring of risks and opportunities
  - Ensure that the related risks are considered in the organisation's risk management approach, including contingency planning

AM Plans

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- **It is important to note that the production of plans is not the purpose of AM**
- **Rather, the plans are an important tool for coordinating, managing and uniting the wide range of individual activities to identify all organisational requirements and the steps to take to achieve them**

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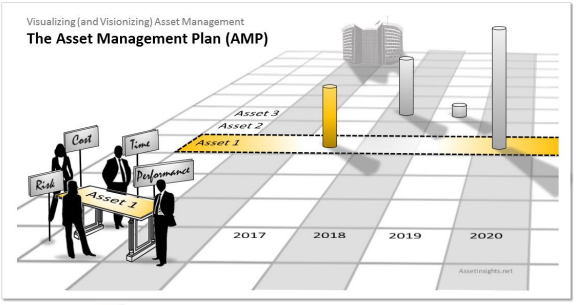

- **Example AM Plan content**
  - Introduction
    - Goal & purpose, scope, audience, definitions, planning process overview, treatments & activities, process timing & accountability, assumptions & constraints
  - 20 year vision, performance measures, targets, key performance indicators
  - Data
  - Demand, gap & budget analysis, prioritisation
  - Validation, final prioritisation, packaging & scheduling
  - Sourcing of materials
  - Risk management
  - Delivery of works
  - Project & programme performance review
  - Work element performance review
  - Interventions and other issues
  - Appendices

The Organisational AM improvement Journey

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- **What does it feel like to be on the Asset Management journey?**
  - Video produced by the Institute of Asset Management, UK shows the AM journey to creating value with implications for
    - Connecting the value derived from assets with the objectives & purpose of the organisation
    - The type of decision-making required – moving from reactive decision-making to optimised decision-making
    - Developing consensus and common terminology around cost, performance and risk
    - Organisational structure – moving away from silos (de-siloing)
    - Building a culture of continuous improvement
    - Visible and consistent leadership

- The IAM | The Big Picture - The Journey – YouTube

© 2014 the Institute of Asset Management

What can we take from this video?

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- **Reactive decision making is a consequence of**
  - Lack of engagement of senior management?
  - Silos (tribes) talking past each other?
  - A pecking order?
  - Decisions not made from the perspective of the overall system?

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What can we take from this video?

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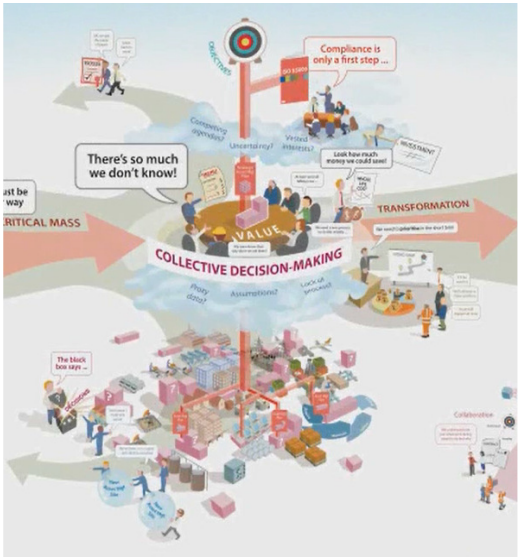
- **Impetus for change comes from the top down or the bottom up?**
- **Breaking down barriers?**
- **Certification?**
- **ISO 55000 only a start?**
- **Collective decision-making started?**
- **How much is missing?**
- **What's getting in the way?**
- **Processes are not implemented?**
- **Blame games?**
- **New AM silos?**
- **Having a system promotes quick wins?**
- **Teams working together to get optimal AM decisions?**



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What can we take from this video?

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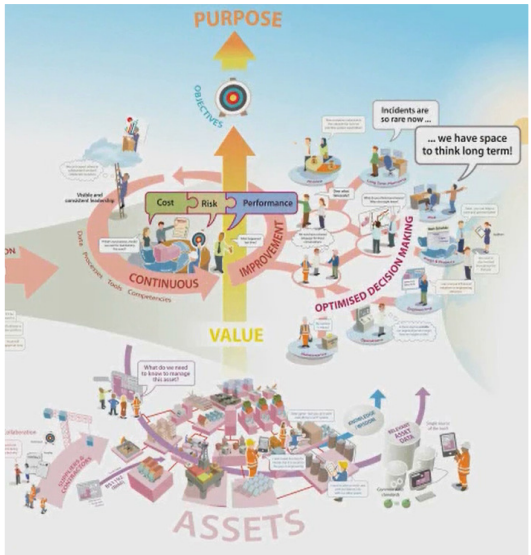
- Are leaders walking the talk?
- Is there continuous improvement?
- Is everyone is playing their part?
- Is there a framework for integrated decision-making?
- Are organisations very fluid?
- What does it feel like?
- Is there greater innovation?
- Are the right conversations taking place?



Organisational AM improvement journey

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- **AM Maturity**
  - The intention of the AM improvement process is to establish permanent, repeatable processes for continuously improving practices, procedures, tools and activities so that organisations can achieve their desired maturity goals in a planned and timely way and maintain that position or advance to a different level if desired
  - There are many reasons why the appropriate level of practice varies between and within organisations, e.g.
    - Varying levels of skills, knowledge, experience, political and physical environment, and resources
    - Some aspects, such as consultation with customers over levels of service, may be new to an agency
    - The characteristics of different transport networks vary considerably, city, town, and rural networks
  - Maturity implies certain requirements for systems integration, information architecture, data structure, system selection and development, and data quality

- **Maturity concept**
  - The concept of maturity is therefore important in determining the current and desired future state of AM practice. With the publishing of ISO 55001, two distinct but parallel approaches are available in assessing maturity
    - The 1st approach addresses the 'AM system' and identifies the business processes and key documents needed for good management
      - The IAM self-assessment process for ISO 55001
      - IPWEA's (2017) ISO 55001 AM maturity assessment tool
    - The 2nd approach addresses the practices that should follow the AM cycle, or 'how the activities are conducted'
      - The IAM model, which uses 39 AM subjects
      - Gap analysis tools based on the principles in the IIMM
      - IPWEA's maturity assessment tool based on the National Asset Management Assessment Framework
      - AASHTO Transportation Asset Management maturity model
  - The level of maturity required will depend on the scale and type of assets the organisation manages and the complete business context

Organisational AM improvement journey

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- **Maturity concept *continued***
  - For every road agency aiming to improve its AM practice, the maturity scale provides an indication of progress towards that improvement
  - It also simplifies discussion of some aspects of AM, allowing management, corporate governance and other decisions to be set out in relatively self-explanatory terms
  - The concept of maturity helps understand that
    - The appropriate level of AM practice is not always the most advanced
    - All areas of practice may not need to be developed to the same levels of excellence to
      - Meet the needs of the organisation, or
      - Provide the required services at the lowest lifecycle costs

- **Maturity assessment**
  - There is a variety of maturity assessment scales in use throughout the world
  - Many have a nominal 5-point scale including 'innocence' as an initial 'Level Zero'
  - The ultimate best practice score is typically 100% in quantitative scales
  - IAM maturity scale for ISO 55001

Maturity Level	Description
0	Innocent
1	Aware
2	Developing
3	Competent - Conformance with ISO 55001
4	Optimising
5	Excellent

Organisational AM improvement journey

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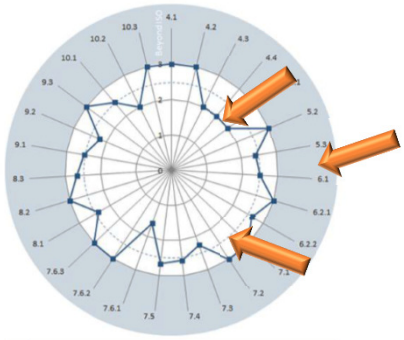
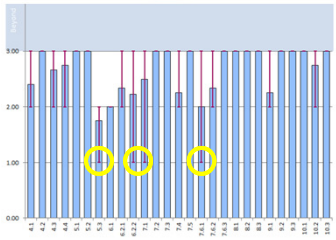
- **Assessment for ISO 55001:2014**
  - The average score for each clause of ISO 55001:2014 is shown on the Radar Chart against the five-point maturity scale
  - The maturity Levels 4 and 5 are combined into 'beyond' and indicated by the blue band
  - A dotted line has been entered at a score of 2,5 as the assessors may wish to use their discretion as to conformance if the average score is between 2,5 & 3
  - Within any element, a significant deficiency or weakness may be masked in the Radar Chart by other questions that have scored highly
  - The Bar Chart is included to display the average score per clause in 'blue' and the score range in 'red'.
    - This enables the assessor to easily tell whether a poor score has been masked due to the calculation of average scores





© IAM, 2015

Organisational AM improvement journey

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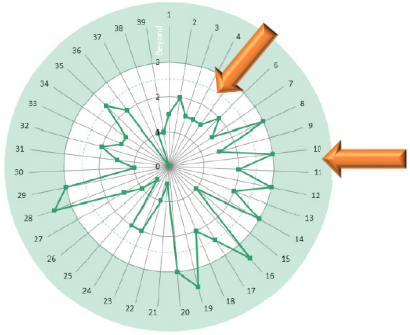
- **Assessment for the AM Landscape**
  - The average score for each subject is shown on the Radar Chart against the 5-point maturity scale and maturity Levels 4 and 5 are combined into 'beyond'. This is indicated by the green band
  - A dotted line has been entered at a score of 2,5. This is to allow the assessor the ability to use their discretion as to conformance if the average score is between 2,5 and 3
  - Within any element, a significant deficiency or weakness may be masked in the Radar Chart by other questions that have scored highly. Similarly, if the two areas on either side are scored 0 then the middle one will also appear as 0
  - The Bar Chart is included to display the average score per clause in 'green' and the score range in 'red'
    - This enables the assessor to easily tell whether a poor score has been masked due to the calculation of average scores



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Case study: Organisation Review of AM Practices – RMS

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- **Roads & Maritime Services (RMS) AM review**
  - RMS embarked on a significant AM improvement journey involving a strategy that included
    - An AM transformation programme involving cultural change
    - A staged approach to the consolidation of existing systems
    - An organisation-wide systems implementation
  - An important step was to ensure a clear, high level, shared understanding of business processes within RMS. RMS decided to carry out an independent whole-of-organisation review using the IAM competency framework and maturity assessment tool
  - Some of the benefits from this process have been
    - Profile of AM raised
    - Senior executive buy-in
    - A clear AM strategy, versus an asset maintenance strategy
    - An informed direction for future effort in AM
    - Increased openness & communication within RMS
    - Reduction of risk in relation to future systems implementation through a clearer view of business needs
    - Identification of anticipated financial savings
  - The output of the maturity assessment was correlated with the requirements of ISO 55001 to obtain a picture of how RMS compared against the Standard
  - Documents produced included
    - Current status as assessed by the review
    - A description of desired future status, an important 'stake in the ground' which required wider buy-in
    - An implementation plan, setting out actions and timelines
  - Important to getting the programme off to a good start, a key part of the plan was establishing a governance structure, setting out a programme and allocating resources to it. Governance arrangements included
    - An Executive Management Team sponsor and
    - A Steering Committee involving key stakeholders
  - Key outcomes so far have included
    - Internal stakeholder engagement and education were critical in helping to achieve wider buy-in
    - Ownership & commitment by the Exec. Management Team
    - Significant change was expected – effective change management is critical to the success of the programme

Achieving effective AM

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- **Determining the right level of maturity for an organisation is an important early step in determining and implementing the appropriate improvement paths, and in ensuring the appropriate levels of skill are available throughout the organisation**
  - Effective AM is an organisation-wide process of continuous improvement and not an independent specialist activity undertaken only by engineers or practitioners
    - Its strategic direction & the goals it seeks to deliver are elements of corporate policy, so approaches to AM improvement should be policy driven
  - The implementation and improvement of AM can be thought of as an organisational change project, with a starting point followed by a continuous series of objectives over multi-year time scales

The Individual AM Journey

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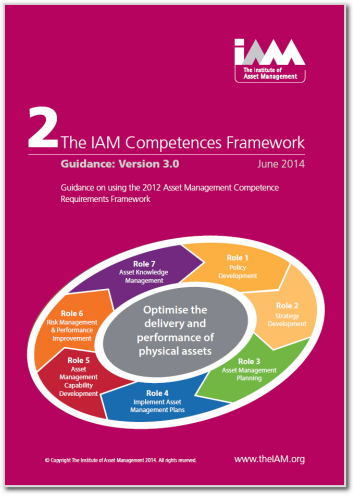
- **Challenges for individuals considering their own AM journey include determining**
  - What competences they need to develop
  - Finding the training and learning materials they require to achieve this
- **The Institute of Asset Management Competences Framework provides a good starting point to understand the competences required for generic AM roles (www.theIAM.org)**
  - The key purpose of the framework for people working in AM is: '*To optimise the delivery and performance of physical assets*'
  - The key roles are shown in the table below (colours relate to IAM Concept Model, which is dealt with later)

Key Roles	
1	Policy development
2	Strategy development
3	Asset management planning
4	Implement asset management plans
5	Asset management capability development
6	Risk management and performance improvement
7	Asset knowledge management



©The Institute of Asset Management 2014

The Individual AM Journey

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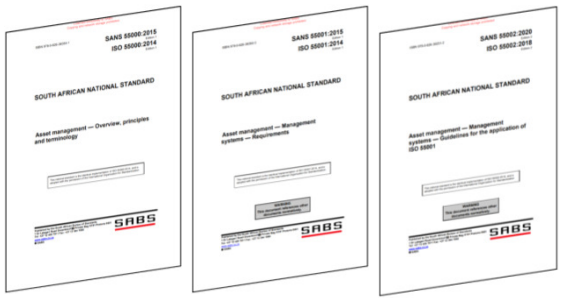
- **Once individuals have established the competences they wish to develop, they can proceed to**
  - AM training courses
  - Publications and on-line resources, such as SANS/ ISO 55000/1/2
  - AM conferences
  - Working on projects which will enable development of AM knowledge in specific areas



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Planning for improvement

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- **Improvement Plan**
  - An improvement plan should be based on a long-term goal, i.e. a target level of maturity, supported by self-assessment and gap analysis to define the starting point and reasonable expectations, in terms of time and finance, as to what can be accomplished in achieving intermediate goals
    - It is also important never to overlook the small, work-based improvements identified on a day-to-day basis by practitioners, especially when preparing plans and asset valuations
  - Self-assessment provides a high-level view of the organisation's current position and organisational perspective
  - A detailed gap analysis extends the self-assessment into individual business processes as maturity develops
    - This helps to provide insights into detailed practices that need to be improved to meet the agreed goals
  - Benefits of a gap analysis include
    - It builds consensus among the organisation's managers
    - It assists the organisation to identify strengths, weaknesses, constraints and opportunities for improvement
    - It recognises and prioritises critical areas that need short-term attention
    - It provides robust, auditable & substantially repeatable foundations for the development of an improvement

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Performance Management Framework

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- **'Performance' is defined in various ways, all of which are relevant, e.g., ISO 55001 (Clause 3 Terms and Definitions) defines 'performance' as a measurable result, one which can relate to the management of activities, processes, products, services, & systems or organisations**
- **The performance framework for AM provides bi-directional 'line of sight' between high-level and operational goals, objectives, needs, activities and actions**
- **While objectives and goals cascade down, performance measures enable upward reporting and aggregation of results**
- **The importance of performance management was recently recognised by law in the United States: MAP-21 – 'Moving Ahead for Progress in the 21st Century'**

- **Principles & Drivers of performance-based AM**
  - Every organisation has a reason to exist, whether by legislation, to carry out a legislative function, or to meet a perceived need by delivering services or products & seeking payment from customers or users
    - These reasons are usually highlighted in a mission statement, strategic objectives, strategic outcomes or organisational outcomes
  - Key points to note include
    - Being able to measure performance against outcomes and objectives is a critical business activity for any organisation, and asset management is no exception
    - Understanding performance is important in demonstrating that the organisation is delivering the agreed levels of service
    - The measurement processes should be practical, reliable and cost-effective
    - Service delivery performance should be monitored at both the organisation and asset levels

Performance from an ISO 55001 perspective

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- **ISO 55001 refers to three dimensions – performance of the**
  - Organisation in carrying out its activities
  - AM system in delivering the objectives
  - Assets in delivering the levels of service agreed with customers
- **The Standard is clear in terms of requiring a performance-based approach which recognises the organisation's purpose and objectives**
- **Clauses 4.1, 4.4 and 6.2.1 require that**
  - The organisation shall determine external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended outcome(s) of its asset management system.
  - The objectives included in the SAMP, shall be aligned to, and consistent with, the organisational objectives
  - The organisation shall establish, implement, maintain and continually improve an AM system, including the processes needed and their interactions in supporting achievement of the organisation's AM objectives
- **As ISO 55001 is a Standard focussed on requirements, it does not specifically detail the means of managing AM or its performance**

ISO 55000 Statements on performance

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- **Clause 2.5.3.7 Performance evaluation**
  - *'The organisation should evaluate the performance of its assets, its AM and its AM system. Performance measures can be direct, indirect, financial or non-financial.*
  - *Performance should be evaluated against whether the objectives have been achieved, and if not, why not. Where applicable, any opportunities that arose from having exceeded the objectives should also be examined, as well as any failure to realise them. The adequacy of the decision-making process should be carefully examined.*
  - *The performance of the AM system should be evaluated against any objectives set specifically for the system itself (either when it was established or following previous evaluations).*
  - *The primary purpose of evaluating the system should be to determine whether it is effective and efficient in supporting the organisation's AM. Periodic audits should be used to evaluate the performance of the system; these must be complemented by self-assessments.*
  - *The results of performance evaluations should be used as inputs into management reviews.'*
- **The role of the AM objectives is apparent – a key principle of performance management is to measure delivery of organisational and AM objectives**

Performance management

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- **Performance management is a systematic and cyclical process of**
  - Identifying objectives
  - Collating transparent information on the achievement, or otherwise, of these objectives
  - Reporting this information in ways that are meaningful to the intended audience
  - Using the information to manage and improve the organisation's delivery of services to its customers, such as improving resilience and making sound asset investment decisions
- **Alignment**
  - A key part of the performance management framework is alignment of the agency's goals and objectives with the levels of service being delivered to customers and road users, and to cascade these to the operational management of work programme delivery
  - The organisation's AM policy is the starting point for good AM; and is aligned with the organisation's vision and higher level goals.
    - In many respects, an agency's published goals and objectives can be taken as high-level directions from the governance/top management level to the agency's management and staff

Performance management – line of sight

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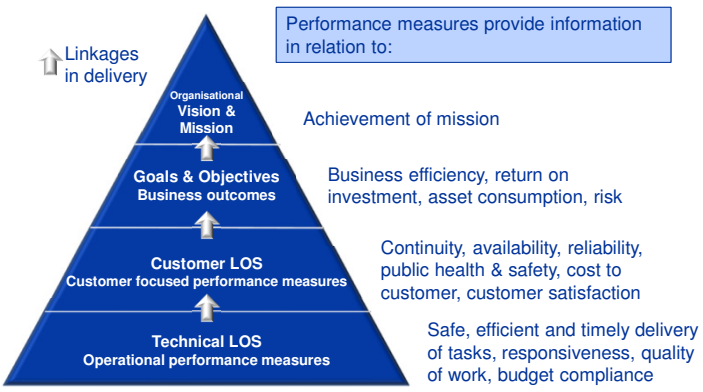
- The figure illustrates this 'line of sight' alignment - hierarchy of performance measures between the top level (achievement of mission) and the middle (customer levels of service) and lower (technical levels of service) levels ▶▶▶
- Performance information should be aggregated upwards, providing summary information at higher levels for governance level and public reporting
- As the shape suggests, there will typically be many more performance measures at the lower levels, given the number of activities and sub-activities being managed



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Linking AM Plans to Strategic Plan Outcomes

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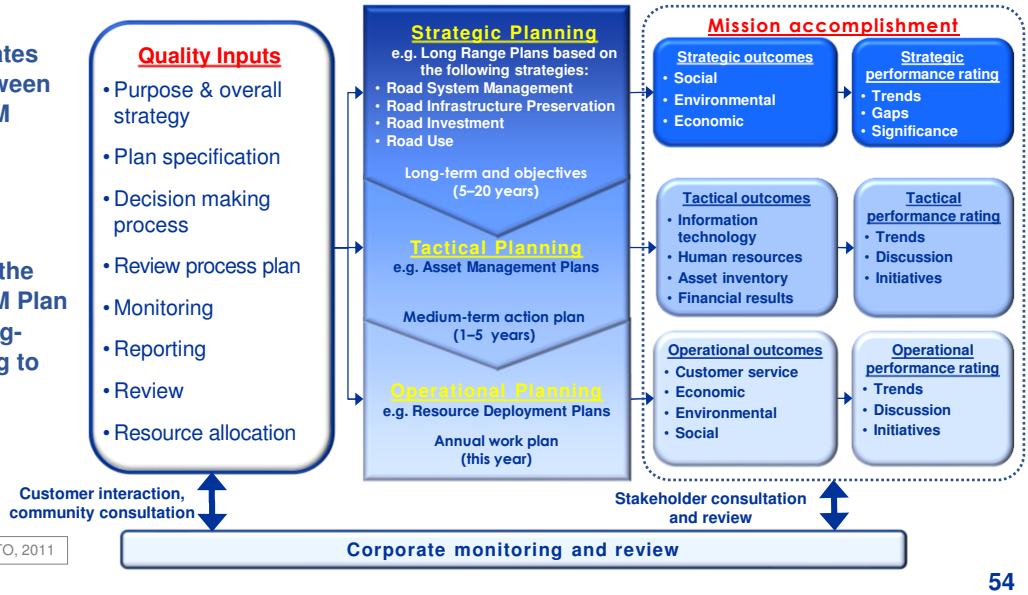
- The AASHTO figure illustrates linkages between enterprise AM objectives & outcomes of specific AM practice
- Emphasises the role of the AM Plan in linking long-term planning to operational delivery



Adapted from AASHTO, 2011

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Performance measures

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- **A linked hierarchy of performance measures, covers**
  - **Vision or mission**: how the agency knows whether, and to what degree, it is successful in delivering on its mission effectively and efficiently
  - **Goals and objectives**: has the agency achieved key business outcomes, such as ROI and managed risk?
  - **Customer levels of service**: describe road user expectations and needs such as safety and availability
  - **Technical levels of service**: the operational aspects such as responsiveness, timeliness and cost-efficiency of works carried out
  - Performance measures should help answer questions such as how good was the work and how good was our procurement of the work?
  - Typically, performance measures are reported to the level above to provide information and to support decision-making at that level

- At management reporting levels, they are often referred to as Key Performance Indicators (KPI), reflecting their importance to the business, e.g., did the agency perform across multiple dimensions, such as finance, procurement, and people?
- There is a progression of maturity in organisations as they develop and use performance measures, both for internal purposes and public reporting, as described in AASHTO (2011) and shown in the table in the next slide
- It is important to note that all of the performance measures relating to AM described above are part of an organisation's AM system, as defined in ISO 55001

AASHTO Maturity levels relating to AM performance measures

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Basic	Improved	State of the Art
• Performance understood in engineering terms: asset condition, work output • Measures are a mix of quantitative and qualitative indicators • Track customer comments and complaints	• Add economic and customer-oriented level of service considerations to the definition of asset performance • May supplement consideration of customer-oriented outcomes with customer surveys • Increased use of quantitative measures, establishment of target values, and application of predictive models to evaluate investment options against targets	• Performance measures fully integrated into business and decision processes – used as the basis for accountability reporting internally and externally • Performance measures used for policy development, trade-off analysis, and resource allocation • Communication becomes a focus – presenting performance measures in various forms for different audiences – reports, trend lines, dashboards, maps, etc.

© AASHTO, 2011

Outcomes and Objectives

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- **It is important to distinguish between outcomes and objectives**
  - 'Outcomes' are descriptive statements of a desired future state or a result, which are articulated elements of vision, often described in terms of 'key result areas' or 'key customer areas'
    - Outcomes may relate to aspects such as safety, efficiency, resilience, reliability, mobility and value
    - They are an important starting point for a performance management framework
  - 'Objectives', as defined in ISO 55001 Clause 3.1.12, reflect the results or outcomes to be achieved and are often tied to time and resources; they can be strategic, tactical or operational
  - Objectives can relate to different disciplines, such as finance, health and safety, environment, and AM
  - There is a close relationship between an 'objective' and a 'performance measure', with an objective being a means of linking an outcome to a performance target

- Higher order objectives should consider societal and whole of government outcomes and desires
  - To reflect community and stakeholder values, AM objectives need to resonate with community needs; they need to cover attributes that are important to road users and stakeholders

Why Outcomes Matter

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- **IAM 2022 Why Outcomes Matter - full program subbed – YouTube**
  - 5'38"

- **IAM 2022 Royal BAM - Why Outcomes Matter – YouTube**
  - 4'31"

Reporting of the performance of an organisation

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- **Public reporting of performance information**
  - Traditionally, public reporting of agency performance has mostly focussed on financial statements and achievement of work programmes
  - With the development of AM, this has changed and is continuing to evolve
    - Many organisations now report publicly about the state of their asset portfolios to demonstrate that they are good stewards of those assets
  - Reporting should include performance information covering the desired outcomes, objectives and customer levels of service, with technical and operational levels of service typically being managed and reported internally
  - Different levels of performance information are relevant at different levels in an organisation, its key stakeholders and among its customers, and it is important to ensure that reporting at these levels is well linked and they do not 'stand-alone'
  - It is important for consistency and robustness that all public reporting be coordinated
  - Good reporting must encompass the whole performance, good and bad, allowing readers to assess the asset performance, AM performance, financial and non-financial performance and the effectiveness of AM practices
    - Well-designed charts are good tools for presenting both current data and historical data, allowing both current performance and trends to be seen
- **Alignment with investment evaluation**
  - Agency reporting is important for aligning future investment priorities with what the public actually needs and expects of the transport network
  - Evaluation of investment options should address how well the programme & the projects within the programme deliver against the organisation's goals & objectives
  - Evaluation should address the key performance attributes which are the subject of KPI reporting, including safety, reliability, resilience, etc.

ISO 55001 reporting requirements & Benchmarking

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- **ISO 55001 Clause 9.1 states that**
  - *'The organisation shall evaluate and report on the following:*
    - *Asset performance*
    - *Asset management performance, including financial and non-financial performance*
    - *Effectiveness of the asset management system.*
  - *The organisation shall evaluate and report on the effectiveness of the processes for managing risks and opportunities.*
  - *The organisation shall ensure that it's monitoring and measurement enables it to meet the requirements of ISO 55001 Clause 4.2'* (the stakeholder requirements for recording financial and non-financial information relevant to AM, & for reporting on it both internally & externally)
- **Benchmarking**
  - Benchmarking is the practice of using quantitative measures to compare performance with peer organisations
    - It can be a powerful tool in finding out how well they are doing in terms of improving performance
  - Benchmarking performance provides a means of sharing best practices and a method of self-evaluation
  - Comparing important performance measures across agencies can motivate an organisation; such a comparison demonstrates what is possible by presenting what an agency's peers have been able to achieve and, to some degree, how it is achieved
- **National performance indicators**
  - The Department of Transport collects data from each province, metro and SANRAL. However, no national performance indicators are currently available for AM

Scope of AM

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- **Overview**
  - This section is important for those seeking to understand the business processes and enablers of effective practice, but not to a high level of detail
  - It provides an overview of the AM process, linking the business processes and enablers to decision-making
  - Gain a better understanding of
    - How to decide on the scope of the asset portfolio in relation to ISO 55001
    - The fundamental building blocks which comprise an AM framework
    - How the various processes and enablers of the AM cycle are connected
  - Case Study

Topics

- **Scope of ISO 55001**
- **Core elements of an AM process**
- **AM concept models/ frameworks, and enablers**
- **The Asset Management Framework in SA**
- **Steps in the AM process for roads - a strategic model**
- **Define objectives**
- **Formation of asset strategies**
- **Understand what is expected of the assets & their future behaviour**
- **Develop investment programmes**
- **Implement Works Programme**
- **Audit**
- **Reviews**
- **Risk and AM**
- **The Circular Economy**

Scope of ISO 55001

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- **For organisations pursuing certification or alignment with ISO 55001 one of the first steps is to define the scope**
- **ISO 55001 Clause 4.3 requires an organisation to**
  - 'determine the boundaries and applicability of the asset management system to establish its scope' & to
  - 'define the asset portfolio covered by the scope of the asset management system'.
  - In practice, this means deciding whether all assets are to be covered or just particular groups of assets
    - ISO 55001 is not restricted to road infrastructural assets – an asset may be anything that has potential or actual value to the agency
    - The value may be tangible or intangible, financial or non-financial
    - Assets may be managed as a group or individually (depending on needs), and grouped according to asset type, asset system or asset portfolio. For example, a road agency might consider groupings such as
      - Assets of significant financial worth – such as pavements and bridges
      - Assets which deliver significant benefits to customers – such as signage, road information, lighting and traffic controls
      - Assets which provide services to different customer groups – such as freight users, pedestrians and cyclists
      - Assets which are used indirectly by the agency in delivering services – such as fleets, computer systems and administration buildings
    - Any combination of these, or other groupings, may define the 'scope of the asset portfolio' for the purposes of ISO 55001 & for the implementation of AM generally

The hierarchy of assets in SANS/ ISO 55001

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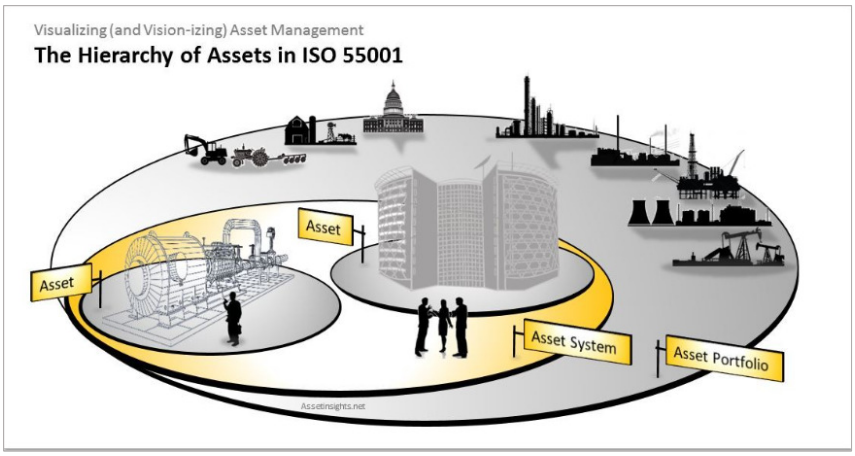
- **ISO 55001 contemplates a hierarchy of assets**
  - The detailed classification scheme and appropriate granularity is determined by the organisation's objectives and the nature of the assets in its portfolio



Core elements of AM process

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- **The three core elements summarise the overall AM process**

Core elements of AM process

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- **Organisational strategic direction**
  - Direction, strategic plans and objectives of an agency are influenced and shaped by external factors, such as legislation, Government policy, customer expectations, investors, funders, and commercial issues. In turn, these shape how AM will be directed and implemented within the organisation
- **Cycle of AM business processes**
  - The cycle of the AM business processes should always commerce from a customer-centric view
  - These customers are many and varied
    - Road users such as pedestrians, cyclists, car drivers, freight vehicle operators
    - The industries and communities these customers serve or are connected to
  - Asset managers have to decide on the levels of service for these customers and forecast future expectations of the service
  - The assets needed to provide the services, their condition, performance and risk characteristics all need to be described and categorised
  - Tools and techniques are used to carry out analysis and to optimise and prioritise work programmes
  - These are funded through budgetary processes, typically as operations, maintenance, rehabilitation, replacement and capital works programmes, until asset disposal occurs at the end of the lifecycle
- **Supporting enabler functions**
  - The cycle cannot be completed efficiently and effectively without supporting resources and functions, i.e. people, information systems, procurement and delivery mechanisms, and processes for continuous improvement

Background to AM Framework

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- **It is good practice to establish an overall organisational AM framework that connects to all levels of the organisation**
  - This should range from governance through to operational levels, including contract providers
- **This framework should tie the organisation's strategic direction to what is expected by the AM policy**
- **Business components, such as the AM system and its attendant parts (policy, strategy, plans, business processes, accountability and reporting mechanisms) support the implementation of AM and help to ensure alignment and good governance**
- **Good governance of AM means**
  - Ensuring that the organisation's service delivery objectives and obligations are being met prudently, effectively and efficiently
  - The scope and principles of AM must be well defined, with clear accountabilities specified at all levels
- **AM should be one of the primary focal points for corporate governance or elected members of a Council, as appropriate**

AM Concept Models/ Frameworks

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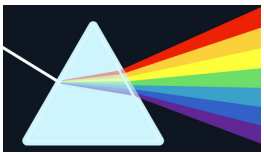
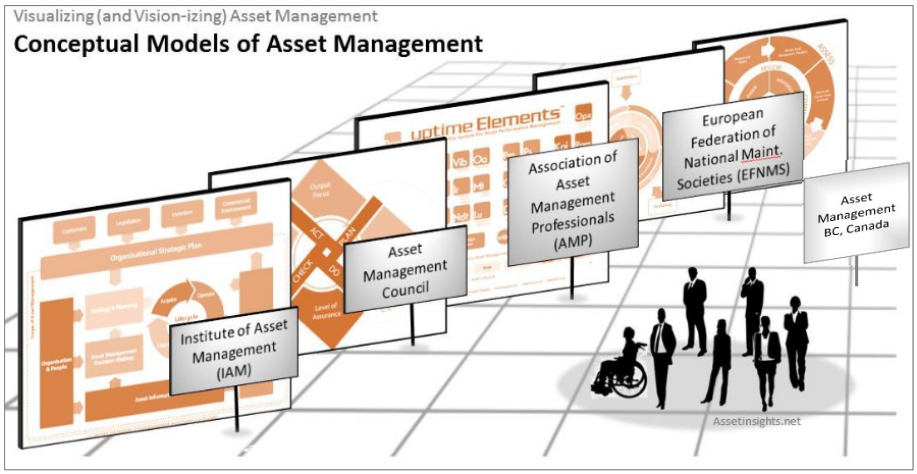
- **Many views of AM processes**
  - Each view has its own strengths and provides different insights



Adapted from Assetinsights ©Assetinsights.net



AM Framework Artefacts

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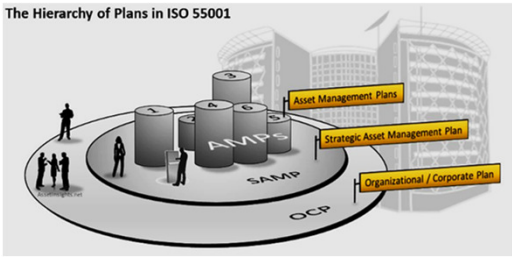
- **An AM framework typically includes the ISO 55001 artefacts – policy, objectives, strategic AM plan, AM plans (lifecycle plans)**
- **These drive the implementation of AM and ensure its alignment with the organisation's strategic objectives**
- **A good AM framework sets, directs, and where appropriate, controls and monitors all the components of the AM system to ensure they work together, firmly linking the organisation's strategic and AM objectives and practices, procedures, processes & systems**
- **It does this by**
  - Linking organisational strategic objectives with the policies and objectives needed to deliver them
  - Linking organisational strategic objectives with the levels of service that the assets should deliver
  - Guiding priorities, the work required on the assets to achieve those objectives, and the finances needed to support that work
- **The framework is not the sole driver of an organisation and it is part of a wider hierarchy of plans**
  - The clearer and more consistent this hierarchy is the greater the probability will be of the organisational objectives being delivered in the most cost-effective manner



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AM Framework

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➢ Plan hierarchy and AM framework

Adapted from IPWEA, 2015

IIMM Asset Management Process (2015)

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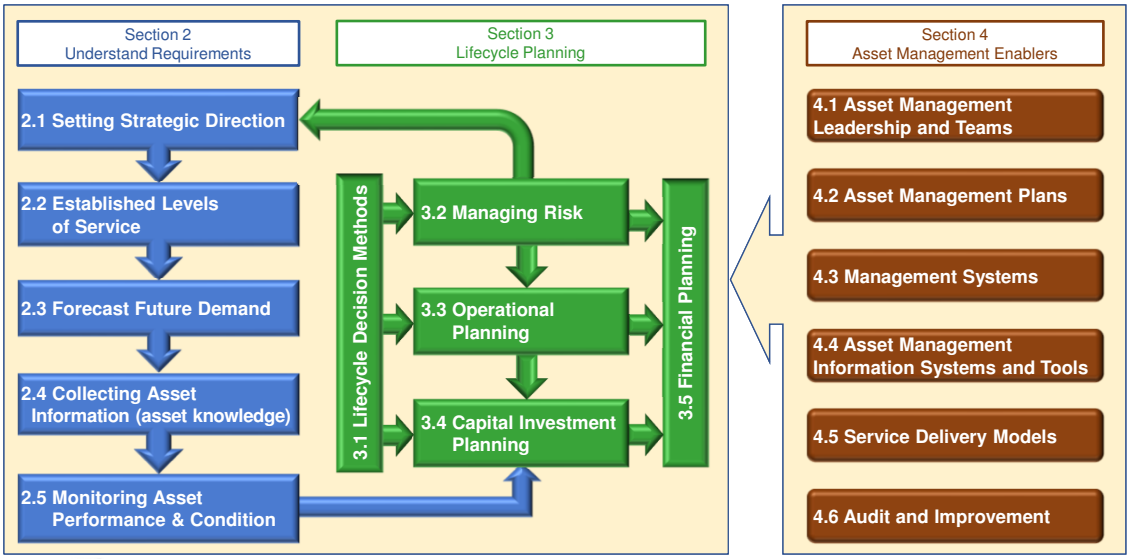

IAM AM concept model (2016)

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- **The IAM concept model has many similarities to the IIMM, but the arrangement of the 'boxes' and activities are structured differently, and some are not explicitly described in the IIMM**
  - It was developed to align with The Asset Management Landscape (Global Forum on Maintenance and Asset Management 2014)

Group 1 - Strategy & Planning

1. Asset Management Policy
2. Asset Management Strategy & Objectives
3. Demand Analysis
4. Strategic Planning
5. Asset Management Planning

Group 2 - Asset Management Decision-Making

6. Capital Investment Decision-Making
7. Operations & Maintenance Decision-Making
8. Lifecycle Value Realisation
9. Resourcing Strategy
10. Shutdowns & Outage Strategy

Group 3 - Life Cycle Delivery

11. Technical Standards & Legislation
12. Asset Creation & Acquisition
13. Systems Engineering
14. Configuration Management
15. Maintenance Delivery
16. Reliability Engineering
17. Asset Operations
18. Resource Management
19. Shutdown & Outage Management
20. Fault & Incident Response
21. Asset Decommissioning & Disposal

Group 4 - Asset Information

22. Asset Information Strategy
23. Asset Information Standards
24. Asset Information Systems
25. Data & Information Management

Group 5 - Organisation & People

26. Procurement & Supply Chain Management
27. Asset Management Leadership
28. Organisational Structure
29. Organisational Culture
30. Competence Management

Group 6 - Risk & Review

31. Risk Assessment & Management
32. Contingency Planning & Resilience Analysis
33. Sustainable Development
34. Management of Change
35. Asset Performance & Health Monitoring
36. Asset Management System Monitoring
37. Management Review, Audit & Assurance
38. Asset Costing & Valuation
39. Stakeholder Engagement

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IAM AM concept model (2016)

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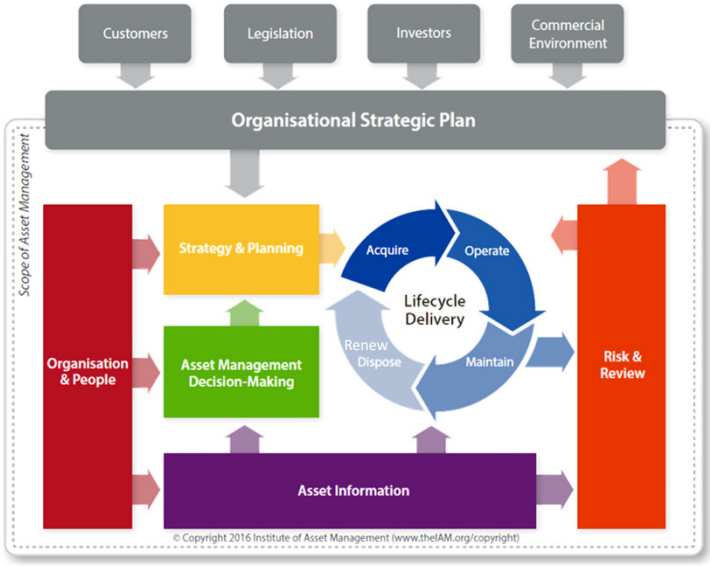
- **Subject groups**
  - The Organisational Strategic Plan feeds into Strategy & planning
  - Asset Information - enabler
  - Organisation & people - enabler
  - AM decision-making
  - Lifecycle delivery, which includes the processes of
    - acquisition
    - operation
    - maintenance
    - disposal of assets
  - Risk and review



Asset Management Landscape 39 Subject Groups

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Group 1 – Strategy & Planning
1. Asset Management Policy
2. Asset Management Strategy & Objectives
3. Demand Analysis
4. Strategic Planning
5. Asset Management Planning

Refer to '*The Asset Management Landscape*' for the definition of each subject https://gfmam.org/

Group 2 – AM Decision Making
6. Capital Investment Decision-Making
7. Operations & Maintenance Decision-Making
8. Life-Cycle Value Realisation
9. Resourcing Strategy
10. Shutdown & Outage Strategy

Group 3 – Life Cycle Delivery
11. Technical Standards & Legislation
12. Asset Creation & Acquisition
13. Systems Engineering
14. Configuration Management
15. Maintenance Delivery
16. Reliability Engineering
17. Asset Operations
18. Resource Management
19. Shutdown & Outage Management
20. Fault & Incident Response
21. Asset Decommissioning & Disposal

Group 4 – Asset Information
22. Asset Information Strategy
23. Asset Information Standards
24. Asset Information Systems
25. Data & Information Management

Group 5 – Organisation & People
26. Procurement & Supply Chain Management
27. AM Leadership
28. Organisational Structure
29. Organisational Culture
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31. Risk Assessment & Management
32. Contingency Planning & Resilience Analysis
33. Sustainable Development
34. Management of Change
35. Asset Performance & Health Monitoring
36. AM System Monitoring
37. Management Review, Audit & Assurance
38. Asset Costing & Valuation
39. Stakeholder Engagement

Adapted from © IAM 2015

South African elements of a Road AM System (TMH 22)

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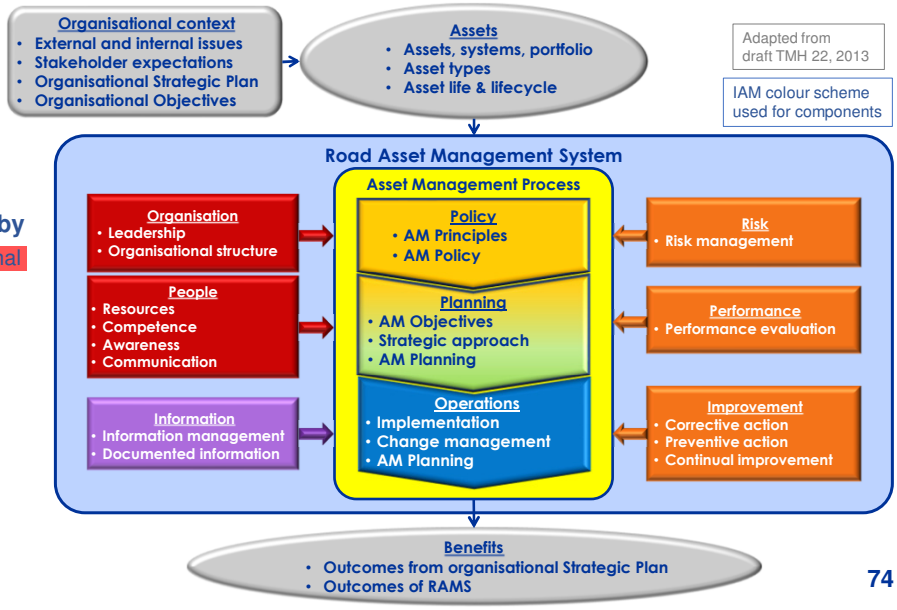
- Organisational context
- Assets
- AM processes
  - Policy formulation
  - Planning
  - Operations
- AM processes enabled by
  - Leadership & organisational structure
  - People
  - Information
- AM processes are influenced by
  - Risk management
  - Performance evaluation
  - Improvement actions
- Benefits derived



Adapted from draft TMH 22, 2013

IAM colour scheme used for components

Bridge Asset Management Framework

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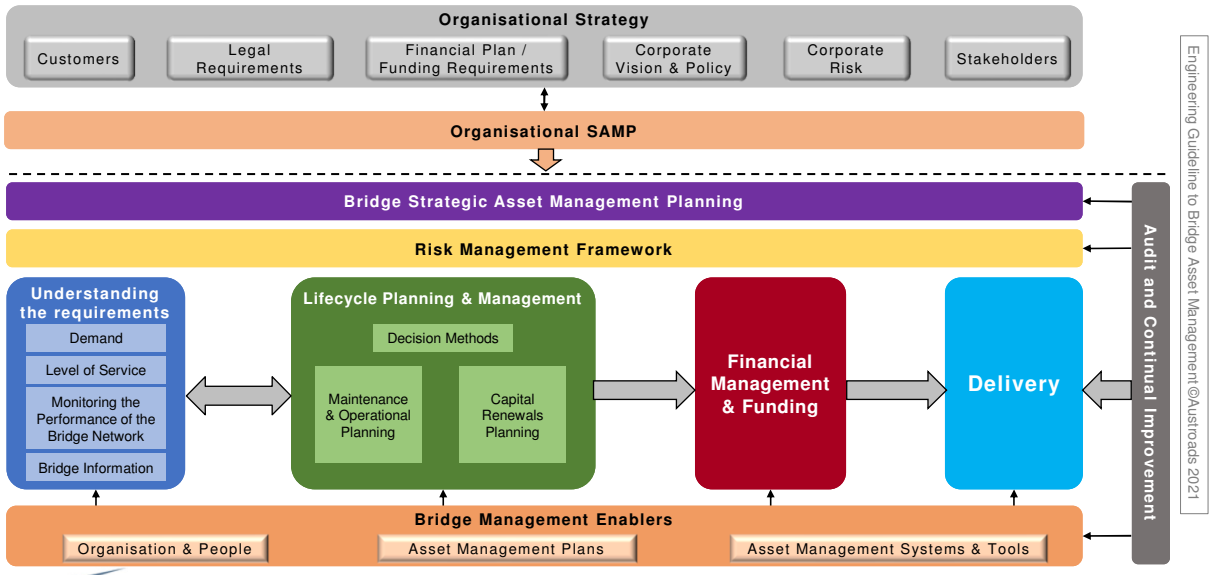

Engineering Guideline to Bridge Asset Management ©Austroads 2021

Some observations on the frameworks/ models

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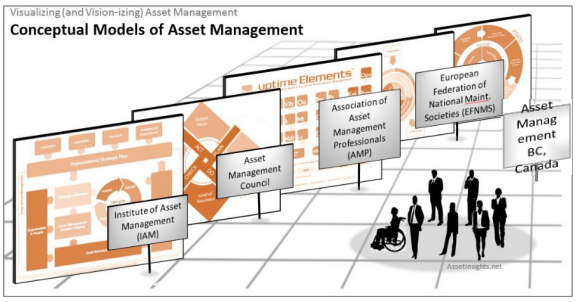
- Each framework/ model helps to provide a basis for understanding AM
- The frameworks/ models vary widely in their formulation
- The content of the frameworks/ models has a lot in common but the emphasis varies
- Some frameworks/ models depict the concept whereas others show the business process and relationships between components in more detail



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AM enablers

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- **AM is an organisation-wide business process that needs to be supported by cross-organisational boundary 'enablers'**
  - AM efforts are more likely to fail if these are ineffective or not present
- **Leadership and teams**
  - Important features of an 'AM capable' organisation include
    - Senior management commitment
    - Strong, highly visible AM leadership
    - Well-defined, clear structure and role definition which encompass all functions
    - Well-defined capability and competence needs that are matched by training and development provision
    - Effective coordination, collaboration and cooperation within the agency

- Ways in which an organisation can structure roles and responsibilities
  - In large organisations, it may be appropriate to provide clear separation between strategic and operational levels but with strong linkages to all departments or teams with a role
  - In smaller organisations, roles may be combined in single positions or teams, however, this often blurs responsibilities and leads to a short term, problem-solving focus rather than a strategic long-term approach
    - The urgent often takes precedence over the important

AM enablers

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- **Asset Management Plans**
  - AM plans bring all elements of lifecycle AM together into a coherent & coordinated form
  - They are important in 'telling the story' about the service, the assets involved & the costs associated with providing satisfactory & sustainable services on an ongoing basis
  - AM plans are also important requirements of ISO 55001

- **Management Systems**
  - Different management systems can be used by agencies, of which ISO 55001 is but one
  - These systems are typically developed to describe how business processes are to be followed and maintained
  - There are other formal management systems, such as quality management, environmental management and risk management
  - A **Technology Management System** has become a very important enabler as technology developments support all 6 subject groups in terms of innovation, efficiency and effectiveness

AM enablers

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- **Information Systems & Analysis tools**
  - AM information systems and analysis tools are used to capture & interpret data, enabling the agency to monitor assets, gather intelligence & make optimal decisions
  - An AM information system (AIMS) is 'a combination of processes, data, software and hardware applied to provide the essential outputs for effective AM, such as reduced risk & optimum infrastructure investment'
  - Two primary functions, which may be contained in one system or across multiple applications requiring integration or interfacing are
    - Databases that store and report data relating to the assets
    - 'Intelligence' applications that analyse and transform raw data, creating information & knowledge which is used in developing asset strategies and making decisions

- **Service Delivery Models**
  - Decision-making should consider the best means of procurement and retirement of physical works and professional services to deliver the programmes, whether using external or in-house resources and, if external, the contractual means
  - Mechanisms may include service level agreements or a range of different contract forms. The two primary objectives are to
    - Embed robust, effective & efficient processes for determining how activities should be procured & managed
    - Ensure that appropriate resources and contract methodologies are used to deliver the required levels of service, on time, at the lowest lifecycle costs, at an appropriate level of risk

AM enablers

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- **Audit**
  - An organisation's processes for auditing the effectiveness of its AM processes and AM system
  - It describes policies & processes for internal assurance processes, audit policies & procedures, internal & third party findings, & corrective actions & use of external benchmarking
- **Improvement**
  - A continuous improvement in culture is a very important contributor to
    - Enhancing and maintaining maturity levels
    - Growing commitment throughout the agency
    - Meeting the requirements of ISO55001
    - Meeting the requirements of other relevant management systems

- Continuous improvement should address data, processes and systems using audits, status assessments and gap analyses, together with human resource capability and competence needs analyses
- Agencies can use the maturity assessment tools in either the IIMM, IAM or other appropriate frameworks to assess the current state and identify change management initiatives
- The continuous improvement cycle typically includes the key steps in the AM process for roads
- An improvement plan includes lists of actions which should be documented in AM plans, defining financial costs, resources required & the timelines for implementing the actions

The Asset Management Framework in SA

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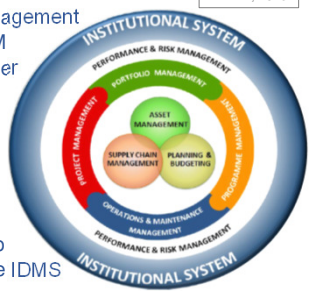
- **South African Treasury guidelines**
  - The Framework for Infrastructure Delivery & Procurement (FIDPM) prescribes minimum requirements for implementation of the Infrastructure Delivery Management System (IDMS) through the FIDPM for all departments, constitutional institutions and public entities at national & provincial levels and took effect on 1 October 2019
    - https://cdn.ymaws.com/www.safcec.org.za/resource/resmgr/construction_legislation/fipdm/fipdm_2019.pdf
    - The Framework for Infrastructure Delivery comprises
      - Portfolio, Programme, Operations & Maintenance processes
      - Gateway reviews
    - Framework for Infrastructure Procurement comprises
      - Infrastructure procurement requirements and gates
      - Procurement documentation
    - The FIDPM specifies the allocation of clear responsibilities for performing activities and making decisions at control points, stages & procurement gates

- The IDMS Diagram shown below depicts the structure & relationships between the different elements of the IDMS
- The inner interconnected circles represent the core legislative requirements of the IDMS, namely, asset management, planning and budgeting, and supply chain management
- Infrastructure Delivery Management (IDM) comprises portfolio, programme, operations, maintenance and project management processes
  - Performance & risk management are integrated in the IDM processes, while the outer circle represents the institutional system that provides organisations with guidance on a generic approach towards building an institutional system to effectively implement the IDMS

FIDPM, 2019



Infrastructure Delivery Management Process diagram

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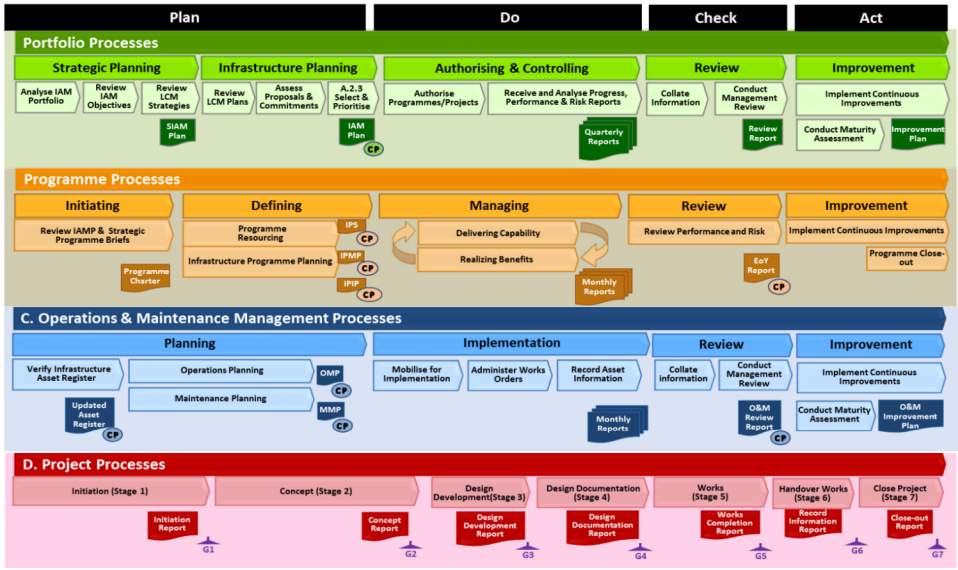
FIDPM, 2019



Cyclical phases are applicable to Portfolio, Programme and Operations and Maintenance

Linear stages are applicable to Projects

The Asset Management Framework in SA

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- **South African Treasury guidelines *continued***
  - The Cities Infrastructure Delivery Management Toolkit (CIDMT) was created in 2018 (https://cidms.co.za/)
    - The CIDMS comprises all key elements dictated by ISO 55001, including strategy and planning, asset information, decision-making, capability development, lifecycle delivery, and risk and performance management
    - The CIDMS Toolkit creates a common AM dictionary for officials, and aligns the paradigms and methodologies of engineers, urban planners, finance practitioners and other relevant stakeholders within and across cities
    - It presents scalable best practice techniques, multiple new innovations, and a platform for leveraging further innovations across the cities
    - Some of these include asset data models, spatially-based customer profiling, demand analysis and future allocation techniques, a spatially-based capital development cost premium atlas, aligning the AM risk management system with the broader corporate risk management framework, advances in investment planning, and a fit-for-purpose programme delivery system
    - The Toolkit not only presents systems, processes and techniques, it also showcases case studies of advances in best practice AM in several South African cities
  - CIDMS was initially to be piloted in the larger cities of eThekwini, Johannesburg and Cape Town, and then rolled out to the remainder of metros

The Asset Management Framework in SA

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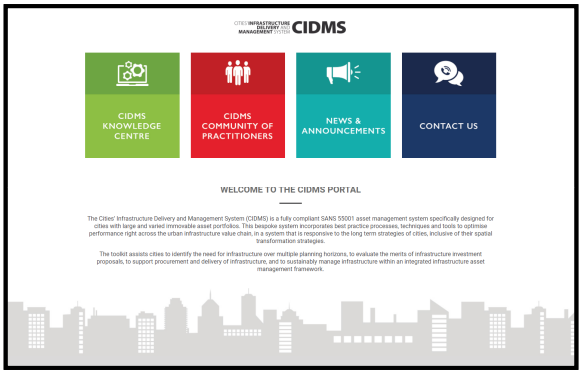
- **South African Treasury guidelines *continued***
  - Implementation would be staggered over the course of a five-year period, with the training and the establishment of AM policy and strategy in year 1, determining consolidated 30-year lifecycle needs in year 2, the production of AM plans and project pipelines in year 3, prioritised city investment plans and infrastructure delivery plans in year 4, & consolidation, review & improvement planning in yr 5
  - The Local Government Framework Infrastructure Delivery & Procurement (LGFIDPM) provides for minimum requirements for effective governance of infrastructure delivery and procurement management and took effect on 1 July 2021
    - A scaled-down version of the CIDMS will be developed for the remainder of local government



The Cities Infrastructure Delivery & Management System

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Source: Urban Infrastructure Asset Management: The Cities Infrastructure Delivery and Management System Toolkit, Boshoff, L & Childs, R, SAAMA Conference 2016, Somerset West, Cape Town, 16 – 18 May 2016

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South African Road Federation

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Case study of an AM Framework

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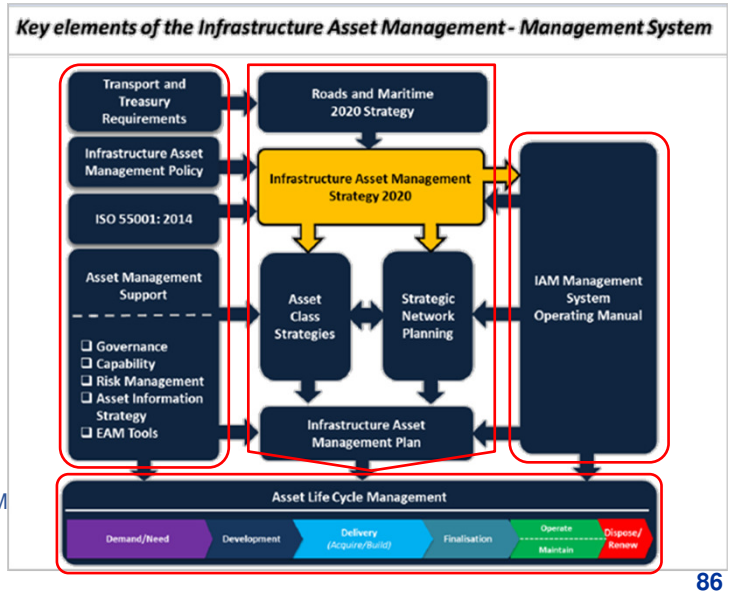
- **Roads & Maritime Services, NSW**
  - The diagram provides a frame of reference designed to ensure decisions & actions are relevant to the AM process. It provides a graphic expression of the
    - Hierarchy of planning elements and decision leading provision and operation of assets
    - Directional flows of information and decisions
    - Standardised procedures, manuals and resources available and their interrelationships
    - Way these elements sit above and interact with the sequence of actions which make up the AM process
  - The diagram provides an effective way to depict the drivers of the AM system
  - It needs to be understood & accepted by senior managers & is designed to aid understanding the key drivers behind the AM how divisions are impacted, & relationships between elements of the AM system



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Steps in the AM process for roads – a strategic model

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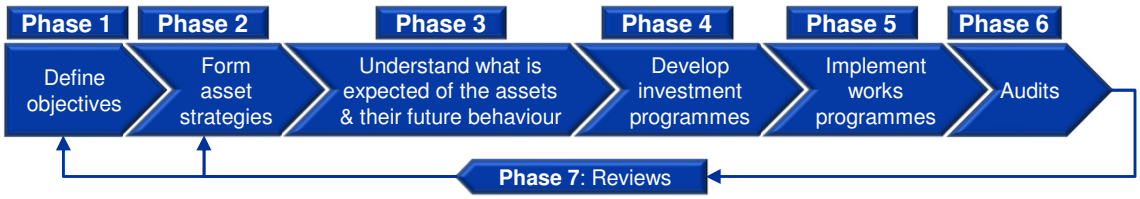

Adapted from Austroads Integrated AM Framework, ©Austroads, 2002

Phase 1: Define objectives

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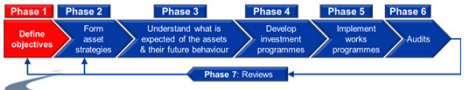
- **Part 1: Organisation & Stakeholder Requirements**
  - Road agencies define high-level outcomes, objectives and key result areas from
    - Stated desired outcomes of government
    - Strategic or corporate planning initiatives involving key stakeholders and customer groups
    - Stakeholder needs, both internally and externally, identified during involvement or consultation with the agency or in other forums
  - A discussion on AM objectives is also covered under 'AM Objectives' & road agency requirements are also covered in 'Understanding the strategic context'
  - There are many sources of information, including demographics, statistics and economic data
  - Stakeholder consultation, should be an open and accountable process whereby individuals and groups have structured opportunities to influence decisions



- Effective stakeholder consultation helps identify potential issues, social impact, opportunities, alternatives and solutions to problems
- It is important to understand communities so that road assets can be provided that meet expectations and serve transport needs within a specific region
- Identify those outcomes and levels of service that the community is prepared to pay for
- Feedback and information needs to be provided to the community, such as budget constraints and trade-offs that may need to be made between different levels of service, exploring the impact of decisions on agency and road user costs in the longer term
- Consultation gives decision-makers the best information available and allows for the best possible decisions
- A feedback loop that enables the measure of benefits gained as a result of the outcomes achieved from previous investments should be incorporated into the planning process

Phase 1: Define objectives

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- **Part 2: Key Result Areas & Key Performance Indicators**
  - Key Result Areas (KRAs) are the outcomes of the stakeholder consultation process and should be integrated into the objectives of the organisation
  - Examples of KRAs are
    - Safety
    - Efficient and effective transport
    - Accessibility
    - Fit for purpose
    - Security
    - Social equity
    - Sustainability
  - A number of Key Performance Indicators (KPIs) should be set to monitor the effectiveness of the AM process towards achieving the KRAs
    - The organisation will deliver the maximum benefits to the community by satisfying the KRAs
  - The performance measures relating to AM are part of an organisation's AM system (ISO 55001), including
    - Asset condition and asset performance measures
    - Performance measures applying to the AM system and associated tools
    - Financial and non-financial performance measures, for which terminology must be aligned
- **Part 3: Public Report & Information Dissemination**
  - This is part of the information & communication process
  - The purpose of this is to inform the road agency, stakeholders, and customers of the requirements, expectations and constraints for the purpose of public relations and opportunity for comment and feedback

Phase 2: Formation of asset strategies

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- **ISO 55001 requirements**
  - AM plans are the mechanism for demonstrating how the AM objectives will be achieved utilising road assets
  - Plans to achieve the AM objectives must be established, documented and maintained, aligning the plans with the AM policy and SAMP and taking into account relevant requirements external to the AM system
  - AM plans need to cover all road services and assets defined within the scope of the AM system
- **Road networks should be managed in an integrated and holistic manner**
  - Deciding on the most appropriate strategic approach is a key starting point

- Agencies aligning with ISO 55001 also need to consider the relationship between the strategic AM plan (SAMP) & the Austroads model which allows for all the competing issues and demands to be coordinated and addressed together & provides a foundation for developing customer levels of service
- There are many aspects to consider, including road safety and interactions with land use
- **Part 1: Road System (Network) Management Strategy**
  - Road system management strategy (RSMS) – the overarching approach to managing all aspects relating to the road network

Phase 2: Formation of asset strategies

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- The Road System Management Strategy
  - Is a strategic document to demonstrate the relationship between the directions of the development of the road system and the community's expectations of economic development, social development and environmental management
  - Examines the community needs and expectations for the performance of the road system
  - Demonstrates to government & key stakeholders the synergies of targeted investments in the management and development of the road system, together with other initiatives to achieve government policy outcomes
  - Defines & presents the rationale behind fit-for-purpose performance targets & corresponding standards for the capacity, condition & use of various components of the road system
  - Focuses on establishing an over-arching hierarchy of performance-based standards for the capacity, use and condition of the various components of the road network which reflect the strategic function and level of use of different routes

➢ **Part 2: Other perspectives**

- To give effect to the RSMS the following perspectives are used
  - Road investment strategy (RIS) – new capital investment strategies in assets associated with the expansion and upgrading of the asset base
  - Infrastructure preservation strategy (IPS) – strategies focussed on preserving existing assets in an optimised and cost effective manner over their lifecycle
  - Road use management strategies (RUMS) – strategies associated with the management of traffic of all forms and modes on the road network
  - Corridor management – planning for and ensuring protection of the road corridor for its intended functions

Phase 2: Formation of asset strategies

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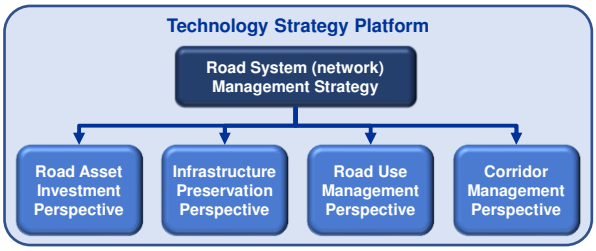

- The important role of technology is not explicitly dealt with in AM manuals
  - A Technology Strategy is the platform for encouraging innovation, and driving efficiency & effectiveness throughout the Value Chain

➢ **Agencies may choose to have separately-documented strategies or perhaps combine strategies in a single document**

- The approach to aligning these strategies with ISO 55001 and the SAMP should be made explicit

Phase 2: Formation asset strategies

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- **Part 3: Asset Management Plans**
  - Both the Strategic AM Plan and Lifecyle AM Plans have been covered previously
  - The Asset Plans may be a single set of plans or a hierarchy of plans that are consistent with the total AM policies of the government.
  - For an agency such as a local government council, a single set of plans may suffice, whereas for a provincial agency, a hierarchy of plans such as regional asset plans and individual asset plans may be required
  - AM Strategies are transformed into standards defining the Level of Service
  - These standards define the type and quality of road-related asset that should be provided in a given set of operational circumstances, e.g., for a given demand

- Using the standards, the current performance of an existing road-related asset can be compared with the target asset performance to identify performance gaps that are to be addressed by the Works Programme and road use policy interventions

Phase 3: Understand what is expected of the assets & their future behaviour

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- **Clearly describing the services provided to customers & road users is an important task**
  - They should be appropriate to the agency's organisational goals and resource constraints, and consistent with the perceived needs of the community
  - Access is fundamental – it promotes productivity and is an essential catalyst to economic and social growth
- **Part 1: Level of Service Framework**
  - Level of Service is a term used to describe the quality of services provided by the asset under consideration
  - Road agencies usually define LoS in terms of the convenience of travel and safety performance of the road network
  - Depending upon various factors such as demand or importance, a higher level of service may be required for some parts of the network compared to others

- Customer-focussed level of service (CLoS) typically varies depending on the role and importance of the asset within the road system
  - They are best based on a hierarchy related to road function and overall use
  - In turn, they will directly link to technical maintenance or intervention standards and engineering design guidelines with respect to the safety, speed and comfort of travel
  - In general, heavily-trafficked roads warrant investment in a higher level of service because this increases overall transport efficiency through increased ride comfort, improved reliability and more consistent travel speeds helps reduce road user costs

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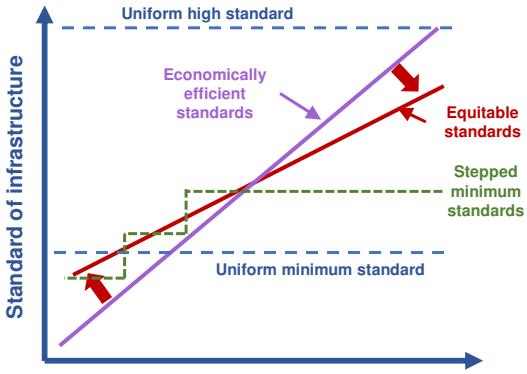
- **Part 1: Level of Service Framework *continued***
  - Lightly-trafficked roads provide fewer investment opportunities resulting in road user savings, & therefore
    - The associated service levels are generally lower, although minimum levels of service are still important to ensure basic levels of safety and accessibility to essential services, and to minimise agency costs
    - However, traffic volumes alone should not determine investment decisions as these roads are often the 'first and/or last mile' connections
- In practice, setting levels of service which strike a balance between being uniform across a network and economically efficient changes the slope of the line illustrated in the figure
  - The flatter the gradient of this line, the less that standards are economically efficient and the more they are uniform or equitable
  - 'Stepped minimum standards' can often achieve a comparable result forming an 'economic base case' for investment programmes

- A long term financial plan together with the use of accrual accounting for reporting and decision-making, are crucial for effectively and equitably managing service level



Equitable vs economically efficient standards

Department of Infrastructure & Regional Development, Australia

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- **Part 2: Road Asset Hierarchy**
  - To implement an AM strategy, a Level of Service Hierarchy is developed to define what class of asset is required
  - The LoS Hierarchy may be based on route function and demand or usage parameters such as traffic volumes and freight tonnage
- **Part 3: Target Road Asset Performance Standards**
  - For each LoS (or road asset class), target road asset condition and configuration requirements should be defined
  - The use of these Target Road Asset Performance Standards provides tangible measurements to determine road asset configuration and condition requirements in terms of capital investment and the upgrading of the existing road infrastructure
  - Targets for other aspects such as delineation can also be aligned to a range of LoS classes

- In South Africa, there is a national approach to route identity described in TRH 26 South African Road Classification and Access Management Manual
  - TRH 26 does not link the hierarchical classification scheme with driving condition standards, such as roughness, width, delineation, overtaking opportunities, etc.
- Standards may also be used to establish maintenance intervention levels.
  - For each class of road, minimum (or maximum) acceptable configuration and condition parameters may be established.
- Standards for operational performance may also be appropriate, using parameters based on performance criteria such as safety, reliability of travel times, and congestion
- Each road agency will determine its own sets of performance standards, based on community consultation, economic analysis, existing road standards, and budgetary expectations

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- **Part 4: Asset performance gap analysis steps**
  1. Determine the LoS Class required (assuming a road asset hierarchy has been developed) of each road-related asset by assessing the demand for or usage of the asset
     - Future demand from all users (e.g., motor cyclists, cars, buses and freight vehicles) for the service should estimated when planning ahead to identify the best way to meet demand
     - Demand can be met through a combination of asset solutions (such as new roads or better signs) and demand management strategies to influence demand (such as parking charges)
     - Demand forecasting requires consideration of the likely effects of
       - Changes in population (growth or decline)
       - Changes in land use (e.g. agricultural to residential)
       - Changes in consumption patterns (e.g. changes in vehicle occupancy)
     - The end results are changes in the number and/or size of the agency's assets & facilities or in the levels of service it delivers
  2. Using the Target Road Performance Standards, determine the required condition and configuration for each road asset
  3. Determine the current configuration and condition of each road asset
     - The actual current service level of an asset is usually determined by the existing state of attributes such as those describing condition and configuration
  4. Compare the actual road asset condition and configuration with the required condition and configuration (as specified in the Target Road Asset Performance Standards) to identify the gaps

Phase 3: Understand what is expected of the assets & their future behaviour

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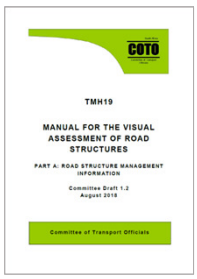
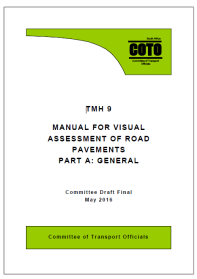
- **When planning future lifecycle strategies and programmes, the current and future ability of the assets to respond to demand needs to be understood**
- **Asset knowledge**
  - One of the basic AM requirements is knowledge of what assets the organisation is responsible for along with key supporting information, such as inventory, asset value, age, condition, performance, criticality & risk
  - It is important that the data is stored in a way that allows the information to be assembled, reported and programmed as necessary
- **Asset condition**
  - Asset condition is a measure of the asset's physical integrity and condition information

- It is used in the development of proactive maintenance and rehabilitation programmes
- Asset condition is also critical for risk management due to its linkage to likelihood of failure
- Not all assets in a network need to have their condition monitored, recorded & understood because the assessment process is labour intensive and costly
  - The level of investment in monitoring should depend on the type, scale & criticality of the assets





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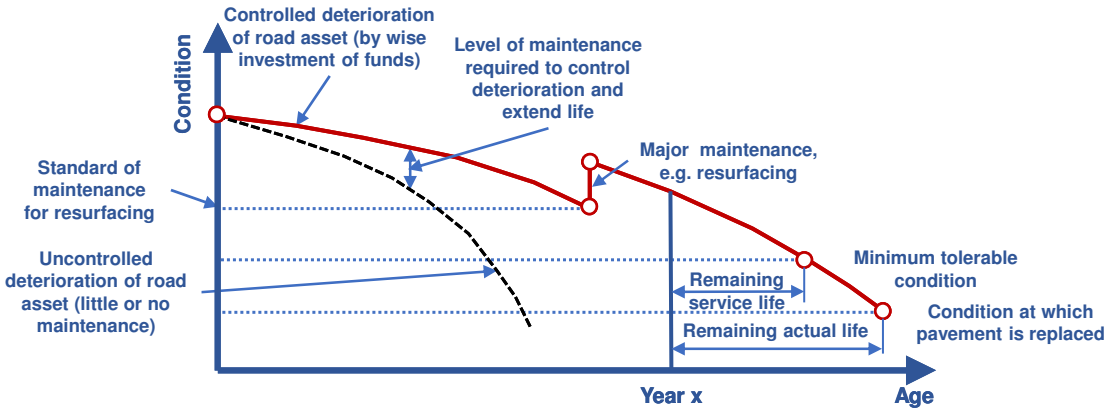
- The typical condition deterioration of a pavement asset from good to poor given a planned maintenance approach, and the typical condition triggers for interventions such as resurfacing or replacement, is shown in the figure



Guideline: low-volume sealed roads, SADC, 2003

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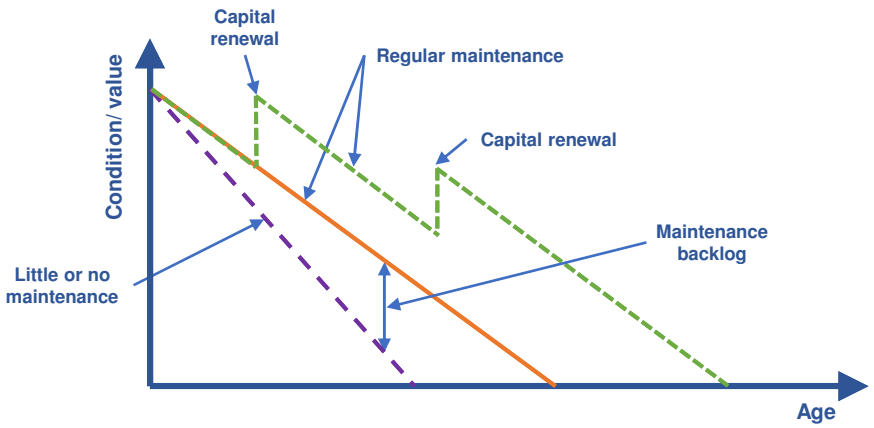
- The typical condition/ value deterioration of a bridge given a planned maintenance approach and capital interventions is shown in the figure



Engineering Guideline to Bridge Asset Management ©Austroads 2021

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- **Asset performance**
  - Asset performance relates to the functional performance of an asset when compared to its intended service level
  - Performance factors may relate to capacity, safety, reliability or other characteristics of a road network. Performance is not the same as condition, although the two are often linked, e.g.
    - A pavement which is very rough and in poor condition is likely to slow traffic and could pose a safety hazard
    - A road sign may be in excellent condition, but conveys a poorly-interpreted message
    - A street light might be in very poor condition but still provides an adequate level of light
  - It is important in deciding what work needs to be carried out to firstly understand whether the behaviour of the asset is affected by its physical condition or its ability to deliver the service expected of it

Phase 3: Understand what is expected of the assets & their future behaviour

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- **Asset criticality and risk**
  - An asset exists to provide a service to all customers and road users & those assets which customers depend on the most for service continuity are the most critical, e.g. critical assets might include
    - Bridges on important routes where there are limited, if any, alternative routes
    - Computers which control city-wide traffic management systems or life-safety systems such as those used in a tunnel
  - The most critical assets are often too important to fail, given the high or extreme consequences of service loss that could occur
  - Responses, such as early intervention or proactive monitoring, need to be given priority
  - Risks affecting assets which are least important may simply be monitored or the assets repaired or replaced should they fail
  - The types of risk and how such events could affect both the services and the assets need to be understood in order to determine and prioritise mitigation actions and works programmes
  - Risk events can include
    - Financial risks
    - Operational risks
    - Natural hazards or disaster events
    - Physical asset failure risks

Phase 3: Understand what is expected of the assets & their future behaviour

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- **Understanding risk**
  - Risk defined as "(Exposure to) the possibility of loss, injury, or other adverse or unwelcome circumstance; a chance or situation involving such a possibility"
    - The management of risk within AM is critical
    - Why? Because asset managers are responsible for optimising outcomes for the good of their organisation, and therefore need to make judgements about which actions best achieve the right blend of outcomes based on organisational objectives
    - To make judgements, they need to predict how their actions will impact on the future performance of the assets
    - They need to quantify both the probability of their actions (or inactions) causing a change in performance & then they need to determine the impact or consequences of that change in performance

$$Risk = Probability\ of\ failure \times Consequence\ of\ failure$$

- In the real world, we tend to focus on one solution to manage risk: either manage the probability or manage the consequences
  - These solutions often rest with different departments, different budgets or even different organisations
- The optimum reduction in risk comes when we identify where the risk is coming from and invest in and manage both the probability and the consequences accordingly
- **Correctly addressing this challenge is at the heart of AM discipline**

Phase 3: Understand what is expected of the assets & their future behaviour

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- **Phase 5: Community Consultation**
  - The identification of asset requirements is obviously fundamental to successful AM
  - It is important that the LoS Framework that is used as the basis for identifying asset requirements incorporates the informed view of the community
  - This is best achieved through a process of formal community consultation that continues throughout the whole AM process in the form of the information and communication sub-process

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Phase 4: Develop Investment Programmes

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- **The purpose of Phase 4 is to identify intervention options to close the asset performance gaps**
- **These intervention options will comprise the Total Needs Programme**
- **Owing to resource constraints, only a portion of the Total Needs Programme can be funded**
  - To ensure an equitable allocation of resources and to achieve the organisation's objectives, prioritisation of the Total Needs Programme is required
  - Prioritisation and various funding scenarios should act interdependently through this and the previous phases
  - The result of prioritisation & funding scenarios will lead to the identification of the funded Works Programme

- **Part 1: Total Needs Programme**
  - The Total Needs Programme is made up of three types of projects arranged in different programmes
  - The final list of projects is created from an integrated process that combines the three programmes into a single Total Needs Programme
- **Infrastructure preservation programmes**
  - Maintenance and asset renewal need to be planned and carried out efficiently and effectively over the whole of the asset lifecycle
  - There are typically many opportunities to optimise total lifecycle costs, sustain service provision, and manage risk through prudent maintenance & renewal analysis & planning.
    - Failure to carry out maintenance activities may reduce performance, lower reliability, increase overall lifecycle costs or result in safety issues
  - Infrastructure preservation programmes typically include activities such as OPEX & CAPEX

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- OPEX
  - Routine maintenance, both planned and unplanned, or preventative, corrective and reactive, & covering the entire network portfolio of assets
  - Minor replacements which are not 'capitalised'
  - Operational costs such as electricity for street lighting, street cleaning, vegetation control, etc.
  - Emergency works, such as the response to climatic or natural disaster events
- CAPEX
  - Resurfacing
  - Pavement rehabilitation
  - Reconstruction of existing roads
  - Bridge replacement
  - Renewal programmes for other asset groups

- Infrastructure preservation projects are identified by
  - Determining the performance gap
  - Investigating intervention options
  - Defining and broadly costing phases of potential projects
  - Identifying the optimal intervention option to close the gap
- **Capital investment programmes**
  - The objective is to ensure that the asset base is developed in a way that is appropriate to the needs of customers & addresses the agency's objectives
  - Capital investment programmes include
    - Construction of new roads and highways
    - Expansion of existing road, such as adding lanes or providing grade separation to existing intersections
    - New infrastructure, such as new ITS technology, new destination signs, new structures, etc.
  - Capital investment projects are identified by the same method as for preservation projects

Phase 4: Develop Investment Programmes

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- **Road use & corridor management programmes**
  - Good strategies and programmes can mitigate risk and defer the need for asset renewals or upgrade works, ensuring that road corridors retain the functionality intended
  - Managing road space, traffic and vehicle loadings is vital to capturing the most value out of the asset base
  - Addressing growth in demand does not always require the construction of new assets
    - It is important that alternative solutions to construction be explored, even if only to defer CAPEX for a period
  - These solutions are 'non-asset' solutions as they typically involve changes in customer or road user behaviour that have the effect of reducing demand
  - The focus of demand management programmes is usually to reduce peak demand or overall average demand
    - Peak demand typically drives asset-sizing and capacity planning, while average demand influences outcomes such as long term pavement deterioration & transport energy use
  - Controlling the interaction between land use & roads is important to preserving & balancing accessibility against the performance of the road
    - Busy roads with high levels of property interaction, such as strip shopping, tend to become congested quickly & should be avoided when planning new roads or improvements for through traffic efficiency

Phase 4: Develop Investment Programmes

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- **Part 2: Optimisation and/or Prioritisation**
  - The purpose of optimisation and/or prioritisation is to select the 'best' option to close each gap and also choose the gaps that will be filled in the final Works Programme
  - In a generic sense, the option that minimises the Agency and Road User Costs, in a lifecycle context, is considered to be optimal
  - An optimisation and/or prioritisation model is required to aid in the ranking of capital and maintenance projects to enable the optimum allocation of resources
  - In reality, this model will be indicative only and a number of iterations through the model may be required to achieve the final funding scenarios
  - As well as minimising lifecycle costs, the process of optimising and prioritising should include consideration of strategic network requirements and the accumulation of benefits from strategic corridor improvements compared with individual projects
  - Decision-making techniques
    - Various decision-making tools and techniques are used to bring together and analyse information from the preceding processes in developing strategies and formulating work programmes
    - These programmes encompass operational expenditure (OPEX) and capital expenditure (CAPEX), optimised across financial, service and risk criteria to ensure an economically efficient and prudent set of overall actions
    - Decision-making techniques cover a range of analytical procedures and tools, which may be spreadsheet based, part of a comprehensive information management system, or drawn from other agency business processes

Phase 4: Develop Investment Programmes

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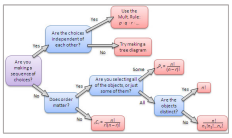
- Important financial and economic considerations in decision-making include
  - Taking a whole of life approach in making investment or preservation choices, which includes agency costs, road user costs & other social & environmental costs
  - When to incorporate both agency and community costs and benefits (total transport costs)
  - Recognising and accounting for the economic value embodied in existing assets – noting that the timing of renewals has a significant economic impact
  - Addressing intergenerational equity, the question of who should pay for investments and how – considering both current and future users and their patterns of asset 'consumption'
  - Decision-making techniques and frameworks



- **Part 3: Funding scenarios**
  - After the Total Needs Programme has been subjected to an optimisation and/or prioritisation process, a number of funding scenarios can be generated to reflect a number of possible funding levels
  - These scenarios should be supported by a summary of the benefits and costs of each level of funding
  - Ideally all projects should be considered equally and compete for the same funds but in reality, there are different funds available for road assets under different jurisdictions, programmes and projects

Phase 4: Develop Investment Programmes

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- **A long term financial plan (LTFP) is needed by every organisation with long-lived assets and significant AM responsibilities relative to their income base**
- **A LTFP is for generating, spending and investing future income and raising and repaying borrowings as appropriate**
  - It highlights the financial implications of the organisation's proposed activities & anticipated events
  - It includes a projection of financial performance and position
- **The purpose of a LTFP is to express, in financial terms, the activities that an organisation proposes to undertake over the medium to longer term to**
  - Give effect to strategies proposed in the organisation's other strategic planning documents including its Strategic AM Plan and achieve its stated objectives

- **Relationship between the LTFP and the SAMP**
  - The relationship between AM planning and financial management and sustainability is essentially a two-way relationship
  - AM planning is focused on asset requirements to maintain and expand the organisation's current road network taking into account future demand, while the LTFP and the financial strategy underpinning it involves assessment of these needs in terms of their financial implications which are fed back to the asset managers
  - The AMP provides projections of road needs and expenditure requirements that are used as input for the LTFP
  - The LTFP must incorporate the cash flow needs, enabling it to undertake maintenance, renewal and replacement works in line with the timing indicated by the AMP

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- The LTFP should accommodate the organisation's cashflow need to enable it to carry out the asset maintenance activities and renewal and replacement of assets, as set out in the SAMP, providing the SAMP is based on financially sustainable service levels
- Affordable service levels cannot be determined by considering historic AM outlays or projected available budget cashflow capacity for AM
- The only simple, practical way to determine affordable service levels is by looking at an underlying trend accrual accounting projected operating result, and other financial results, over at least 5 to 10 years

➢ **The preparation of a LTFP generates improved information to guide decisions about the mix and timing of outlays on operating activities and additional assets and the funding implications of these outlays**

➢ **A LTFP, together with the use of accrual accounting for reporting and decision-making, are crucial for**

- Effectively and equitably managing service level
- AM and revenue raising decisions
- Ensuring financial sustainability
- Efficiently and equitably accommodating ongoing funding of
  - Existing services – operations, maintenance, asset renewal and upgrade
  - New services and assets, as required

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➢ **Any judgement of the affordability of future LoS needs to include the implications arising from expected future non-cash related financial events and changes in their level**

- Various options should be evaluated before ultimately settling on a LTFP and a range of Levels of Service that best meets needs and preferences

➢ **Depreciation expense recognised in accrual accounting is calculated to reflect the rate of consumption of the service potential of assets**

- Depreciation expense is typically 25% to 35% of local government annual operating costs

➢ **Balancing a LTFP requires the fulfilment of an organisation's service level responsibilities and objectives within the constraints of its Financial Strategy**

- **It is not sufficient to simply ensure cash inflows match cash outflows each year**

➢ **The use of financial indicators can facilitate assessment of the compatibility of service level proposals included in a LTFP and achievement of an organisation's financial strategy**

- A LTFP should highlight projected financial performance against appropriately determined targets for financial indicators that are suited to the organisation's circumstances
- If a LTFP suggests that trying to achieve desired service levels will jeopardise ongoing financial sustainability, then the organisation needs to consider various alternative strategies to overcome this problem

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- **The core approach to a basic LTFP is**
  - It is under-pinned by a sound financial strategy that ensures that the organisation's financial sustainability is protected or improved as necessary
  - It accommodates asset maintenance, renewal and replacement activity at levels and at points in time that minimises whole-of-life economic costs relative to required service levels
  - It accommodates service levels proposed in the organisation's strategic plans
- **An enhanced LTFP has additional features**
  - It is based on achievement of and discloses projected performance against carefully developed financial sustainability targets
  - It fully accommodates, in quantum and timing, outlays consistent with activities identified as warranted in the SAMP and other strategic planning documents
- **A LTFP should cover a period of at least 10 years with an initial 5 year planning horizon generating substantially better information for financial decision-making compared with a traditional annual budget**
- **A LTFP should include a description of the financial strategy on which the plan is based, including financial targets and their rationale**

'…the decision whether or not to create an asset is typically the time where there is the most opportunity to impact on the potential cost and level of service impact. Once the asset is already in place, the decision of when and how to renew assets is the next greatest opportunity. Good infrastructure planning provides time to make good decisions and plan and coordinate activities in an effective and timely manner'.

IIMM (IPWEA 2015)

Phase 4: Develop Investment Programmes

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- **Funding and implementing programmes**
  - Programmes are typically developed at different levels, and aggregation and prioritisation processes are needed to produce robust budgets and achieve funding approval
  - For large agencies with multiple geographic areas, programmes might be built up layer-by-layer as follows
    - A road link, or project
    - A road corridor
    - A region
    - The entire road network
  - Results are incorporated in forward budgets, ready for consideration by the agency's senior executive and funders, often using AM plans

- Ideally, a long-term approach should be taken to develop multi-year programmes which are optimised & prioritised in line with the agency's objectives & strategies
- Short-term financial projections, typically covering a three to five-year period, should be reliable, while projections from 5 –10 years and beyond will usually be progressively less reliable
- Once programmes and funding have been approved, efficient programme and project management processes are needed to ensure that all work can be delivered within the timeframes and budgets established

Phase 4: Develop Investment Programmes

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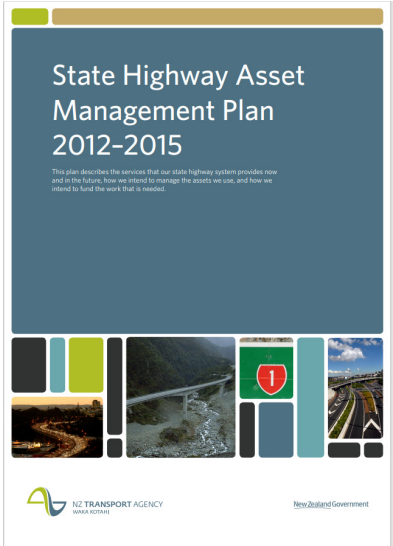
- **Part 4: Works Programme**
  - The final Works Programme should show the funding available for routine, preventative and periodic maintenance, as well as rehabilitation and construction, together with details of specific works
- **The Works Programme is published as part of the Strategic Asset Management Plan**
  - The SAMP was covered previously under 'Managing Asset Management'
  - The SAMP is an important requirement of ISO 55001



Phase 5: Implement Works Programme

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- **Phase 5 involves performing the projects and tasks defined in the Works Programme**
- **However, community consultation is a most desirable part of implementing a Works Programme, and so the Information and Communication Sub-Process is again emphasised**
- **Part 1: Information & Communication Process**
  - Public Report and Information Dissemination should be performed at this stage to inform the public of the final Works Programme
  - This may take the form of a document outlining major projects, timeframes and funding levels
  - Regular publication by Queensland of the 5 year rolling Roads Implementation Program is an example of outstanding practice (https://www.tmr.qld.gov.au/QTRIPonline)
  - At the project level, other media such as project specific newsletters and focus groups are used
- **Part 2: Service delivery models**
  - This topic is covered briefly in 'AM Enablers'

Source: The Citizen

Phase 6: Audit

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- **ISO 55001 requirements**
  - Define audit criteria and their scope, plan, establish and maintain an internal audit programme
  - The purpose of internal audits is to test conformance, implementation and maintenance of the AM system
  - This may lead to the identification of changes or improvements
- **An audit process should be implemented to ensure work activities reflect the Works Programme and satisfy the Asset and Organisational Strategies (and in turn stakeholder requirements)**
- **In this phase information should be provided to external stakeholders and other customers by means of public reports and other media**

- **Part 1: Audit of Work Carried out**
  - This audit can begin as the implementation of the Work Programme begins and can be integrated into an organisation's quality assurance systems
- **Part 2: Audit of the Asset Management Systems**
  - Audits should be performed to ensure that the AM cycle has been carried out as documented in the agency specific guidelines

Phase 7: Reviews

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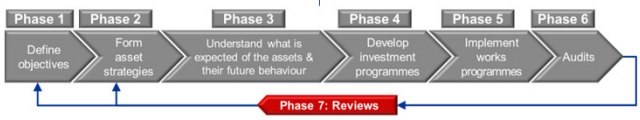
- **ISO 55001 requirements**
  - Plan and carry out regular top-management reviews of the AM system to ensure its continuing suitability, adequacy and effectiveness
  - Identify opportunities for continual improvement and retain documented evidence of the audits and the opportunities
- **A number of feedback cycles should be used to give the AM Process its cyclic, continual nature**
- **Implementation of works programmes can influence stakeholder requirements, asset strategies and future asset performance**
- **The outcomes of the Works Programme should be used to influence various parts of the planning process**

- **Part 1: Review Asset Performance**
  - This should be a review of the requirements defined in the Road System Management Strategy to confirm that gaps in the network have been filled as initially intended
  - Review the levels of service agreed with customers
- **Part 2: Review Infrastructure Strategies**
  - The purpose of this review is to cross check that the implementation of the Works Programme has satisfied all the objectives as specified in the Infrastructure Preservation and Road investment strategies, and if not, to trigger action to generate improved processes for future use



Phase 7: Reviews

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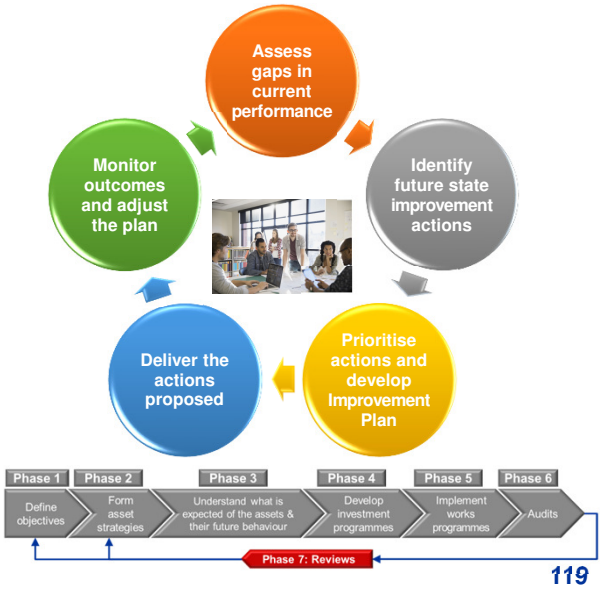
- **Part 3: Review AM system performance**
  - A maturity assessment (previously covered) provides information on how well the AMS is performing
  - The status of AM implementation is evaluated using the self-assessment method was covered in 'Organisational AM improvement journey'
  - After new AMS performance targets are set, an Improvement Plan is prepared for implementation, previously covered under 'Planning for improvement'
  - The continuous improvement cycle is show in the figure
- **Part 4: Review Agency and Stakeholder Requirements**
  - The implementation of the Works Programme may affect stakeholders' perceptions and thus their requirements and expectations
  - This feedback process highlights the necessity to gauge stakeholders' requirements on an ongoing basis



Risk and Asset Management

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- **Risk management is an integral part of AM from strategy through tactics to operational management**
- **Risk is integral to decision-making at each of these levels where it is addressed in different ways**
- **Risk is one factor in achieving the best total value approach – the optimal combination of costs, risks, performance and sustainability**
- **The outputs of a risk management framework should be referenced or integrated throughout the Asset Management Plan**

- **Risk management complements other management frameworks**

From yesterday: Optimisation - Risk-Cost-Service balance

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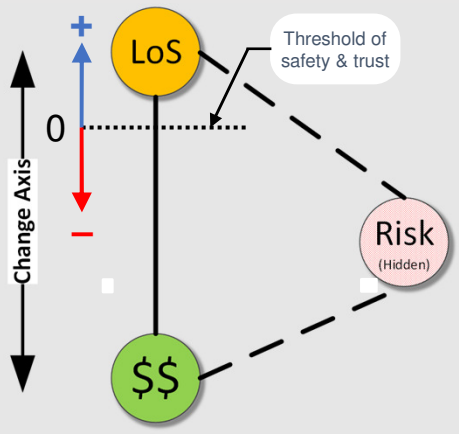
- **Asset managers may choose to optimise against 1, 2 or all 3 criteria simultaneously, with increasing levels of analytical sophistication required**
- **Ideally, the optimisation process should address all three: ISO 55001 and the IIMM emphasise the importance of balancing the competing elements of service level-cost-risk diagram ▶▶▶**
- **There is a threshold level of safety and trust below which it becomes dangerous and expensive to reinstate the safety**
- **It is difficult to restore trust once it has been lost**

Service level-cost-risk diagram



Ross Waugh, Deighton User Conference 2016

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Risk management and types

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- **Risk management**
  - At the most basic level, risk is about awareness and reaction to potential circumstances that could impede an entity's ability to achieve its goals and objectives
  - The broad-risk areas could be labelled 'planning risks', 'management risks', 'delivery risks' and 'physical asset risks' ▶▶▶
  - An alternative classification of kinds of risk is
    - **Enterprise Risk** – all levels of risks in the agency
    - **Agency Risk** – highest level of risk that affect the ability to accomplish its mission and achieve strategic goals and objectives
    - **Programme Risk** – affecting the achievement of programme objectives
    - **Project Risk** – affecting accomplishment of project objectives

Planning risks	• Strategic planning risks • Asset management planning risks • Levels of service risks • Natural event & environmental risks
Management risks	• Systems/ information risks • People risks • Financial risks
Delivery risks	• Procurement risks • Project management risks • Contract management risks • Communication risks
Physical Asset risks	• Risks common to all assets • Risks associated with specific assets

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Risk management in South Africa?

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- **Public Sector Risk Management Framework is based on the draft ISO 31000: Risk Management (2008) … which is out of date**
  - A new version was published in 2018

The consequences of not keeping up …

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"If the rate of change on the outside exceeds the rate of change in the inside, the end is near."

— *Jack Welch* —

Risk management & ISO 31000

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- Risk management does not exist for its own sake
- The core work of leaders is to make and implement effective decisions and risk management only has value if it contributes to their ability to do so
- However, every person in an organisation makes decisions every day that can make the difference between success and disaster
- Risk management is the daily work of every person in the organisation
- Risk management should never be regarded as a separate activity and should be embedded in how all decisions are made and implemented
- ISO 31000: Risk management – Guidelines, provides principles, a framework and a process for managing risk

- Unfortunately, ISO 31000 is based upon thinking from the 1970s & 80s
  - The current Public Sector Risk Management Framework was published in 2010 by National Treasury
- The application of **systems thinking** indicates that the current approaches to risk management are **deeply flawed**
- The management of organisational risk is a difficult challenge for senior leaders
  - For many organisations, **crisis management** is the norm
  - Could the situation in many parts of South Africa be a reflection of crisis management? 🤔
- The ISO 31000 approach relies on the ability to manage individual risks
  - Many critical organisational risks are complex and inter-related and cannot be safely worked on one at a time and responses are inappropriate

Risk management and ISO 31000

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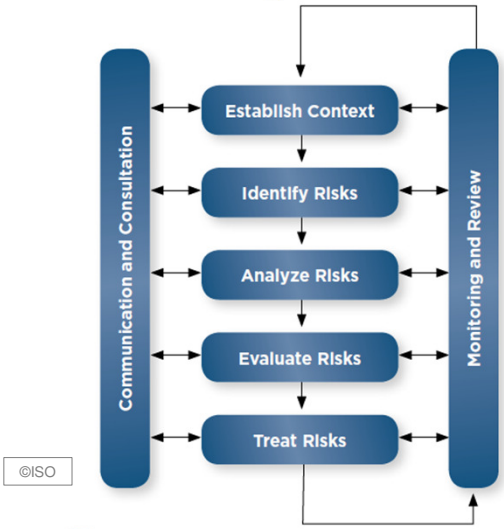
- ISO 31000 Risk Management Framework



- No matter how sophisticated they are and no matter how well they are applied, risk management approaches based on ISO 31000 are simply not able to deal with risks that are complex, inter-related, intangible and often sensitive
- Consequently, they
  - Fail to identify and manage important risks
  - Cause suboptimal or even perverse outcomes because risks are prioritised and treated one by one
  - Fail to recognise and to manage underlying systemic root causes of organisational risk as a whole
  - Lead to over-confidence & decisions based on poor assessment of the risks involved

Risk management and ISO 31000

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- **The definition of the term 'risk' in ISO 31000 is misleading – in all societies the term 'risk' is universally taken to mean 'threat', and not 'opportunity'**
- **The ISO 31000 approach is systematic, relying on an assumption that success could be ensured through effective preparation and planning**
- **The challenge for risk leaders does not lie in technical, routine, quantifiable or tangible, which can be managed by the ISO 31000 approach**
  - The real challenge is to ensure that the complex, hidden, sensitive risks that tend to be the root cause of organisational disasters are seen, understood and managed
  - In this context, ISO 31000 is not fully adequate as a standard or guide for risk management

- **Systematic vs systemic risk**
  - **Systematic risk** is the overall, day-to-day, ongoing risk that can be caused by a combination of factors, including the economy, interest rates, geopolitical issues, corporate health, and other factors
  - **Systemic risk** describes an event that can spark a major collapse in a specific industry or economy
    - All systematic approaches have major limitations when applied to complex human organisations, where the systems within them are mostly not tangible, predictable or measurable
    - Human involvement brings, culture, values, character, emotions and non-rational thoughts and behaviours into the management mix
    - The systematic approach simply does not work

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Systems Thinking & Systemic Risk Management

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- **Powerful tools derived from Systems Thinking exist that would help to deal with systemic risk, however…**
  - These measures require **time, effort & resources**
  - Systems thinking methods involve acceptance of and dealing with uncertainty, usually not a comfortable place for many leaders
  - Immediate solutions are desired, and leaders do not relate well to approaches where the essence is to learn your way forward without ever having an 'answer'
  - The **management culture** of many organisations is outdated, e.g., leaders are supposed to 'know the answer', to 'act decisively' and to 'be ahead of the game', inhibiting systemic inquiry, learning & analysis

- **Systemic Risk Management (SRM)**
  - With the systems thinking response to risk management, it is possible to manage previously hidden risks and to prioritise and optimise risk effort as a systemic whole rather than risk-by-risk
  - SRM requires a mind-set change by leaders who have been focussed on the '**red**' risks of the risk matrix.
  - SRM requires additional analysis to understand the suite of risks as a whole in order to respond accordingly
  - The most important strategic risk management work is to build organisational awareness, responsiveness, agility and resilience
  - Since these characteristics are driven by complex, subtle factors including the way in which the leaders themselves operate, they must be personally capable of recognising and accepting complexity and of applying action-learning principles
  - It also requires courage and determination to deal with root-causes that are difficult for them and others

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Systemic Risk Management Principles

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- **Systematic Risk Management Principles**
  - Risk Management should be embedded in business decision making, not separate and then integrated
  - Building an effective understanding of organisational risks requires inquiry and an active, shared dialogue with stakeholders
  - The tools used for assessing, analysing & representing risks must be capable of dealing with the kinds of complexity experienced in organisations
  - A key objective of Risk Management is to understand what is going on as a whole, and to find leverage points that enable sustainable, effective risk responses
  - Quantitative/ technical approaches to risk analysis and management are powerful in specific case and should be used when appropriate
  - A focus on prioritising risk responses is inherently more powerful and effective than prioritising risks
  - The key risk work of leaders is to create an organisation that is alert, responsive, proactive and resilient in the face of uncertainty and change

Internally Generated Risks

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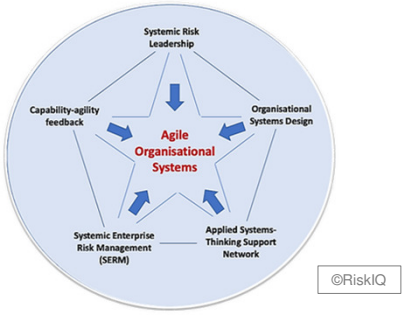
- **Internally generated risks (IGR) in organisations**
  - IGR is a risk to success where the majority of the potential impact of the risk results from sources of risk that arise **inside** the organisation
    - E.g., risks arising from decisions made when setting up and managing an organisation, or from the capabilities, behaviour, culture beliefs and relationships with the organisation
    - An inept manager is a source of IGR as is an ineffective process
  - IGRs are important because they are
    - A major source of both operational and strategic risk, and are almost always a major factor when an avoidable disaster occurs
    - Risks are often sensitive, complex, subtle and or interrelated and hence many not appear in the risk register
    - They are very difficult to manage or reduce, if only because of the characteristics noted above

- **Bearing in mind the exposé of the state of most State-Owned Enterprises in South Africa, one might expect that IGRs have a lot to answer for concerning the poor state of the road network**
  - For more information on Systemic Enterprise Risk Management (SERM) refer to
    - https://www.riskiq.com.au/framework

Proactive-agility Framework



AM and the Circular Economy

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- The circular economy is an economic and societal shift towards sustainability and regeneration
- It does this by maintaining and rebuilding natural and social capital stocks
- The maintenance and rebuilding of these stocks can be greatly accelerated through the deployment of systems thinking, where sustainability and regeneration are the product of the interaction of the circular economy parts
- Within an AM context, organisations can make existing assets last longer, design products that can be refurbished over multiple life cycles, shift operations to service models, create syndicates, networks, or value chains that offer greater sustainability and regenerative outcomes

- The adoption of circular economy strategies and principles can be seen as a response to Climate Change Action Planning
- There is a clear opportunity for AM used as one of the key enablers in significantly reducing the impacts of climate change, supply chain delays, and creating regeneration through the deployment of circular economy principles

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AM and the Circular Economy

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- Many existing AM practices focus on a continuous cycle of procuring assets that are used to maximise their performance
  - When they reach the end of their useful life, they are often scrapped or recycled because this is historically the cheapest, easiest, & quickest method of disposal
  - **This practice contradicts the sustainability goals, such as cutting the use of natural resources, minimising carbon, and reducing waste**
  - By moving away from the linear asset life cycles of take-make-waste & working towards an economy that is regenerative & circular by design, asset managers can become champions of environmentally sustainable systems & overarching asset sustainability in their organisations
  - Asset managers can develop the circular economy to address the organisation's sustainability, carbon reduction, and long term economic challenges

- Circular economy principles eliminate the notion that an asset has an 'end-of-life'
- This shift from a linear economy challenges asset managers to adapt their products, operations, and services toward opportunities for new types of businesses and changes to business models
- This can include the development of new partnerships, reducing, reusing, remanufacturing, repurposing, and recycling, to name a few
- This way of thinking and working moves away from linear asset life cycles into a closed-loop system where fewer new resources are needed, and little waste is generated

AM and the Circular Economy

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- **The emerging circular economy will call upon AM to**
  - Design & deploy asset systems that are regenerative by design
  - Innovate to increase asset resilience
  - Reduce reliance on global supply chains
  - Create the need to grow strategic, local, and regional capabilities, whilst also meeting or exceeding organisational and global sustainability targets
- **The circular economy is a strategy that engages systems thinking, enabling organisations to link important drivers and networks of actors, stakeholders, & value chains that, when combined, create greater value than the sum of its parts**
  - In so doing, it delivers regeneration, seeking to accelerate the reduction of carbon & is sustainable by definition
- **Developing Circular Economy Systems Thinking**
  - The vision is an AM system that is restorative and regenerative by design and aims to keep products, components, & materials near their highest utility & value always
  - The asset life cycle is a continuous positive development cycle that preserves and enhances natural capital, optimises resource yields, and minimises system risks by managing finite stocks and renewable flows such as in a closed-loop asset management system

Closed Loop Circular Economic Model

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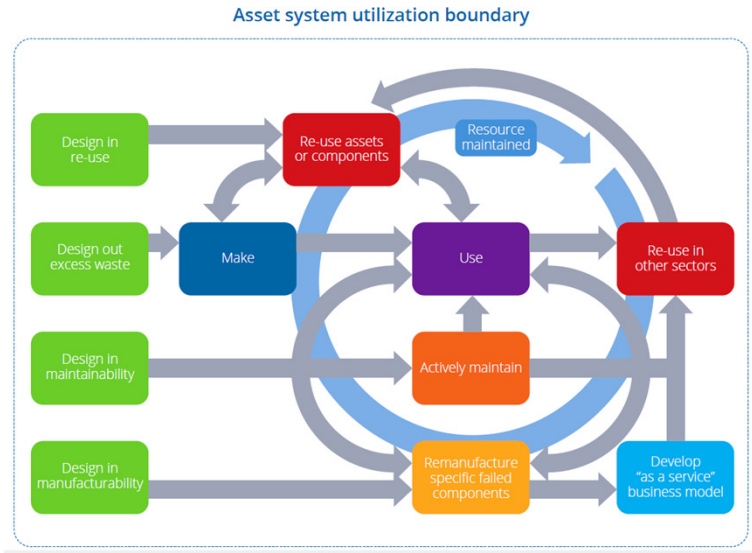

How Asset Management can enable the Circular Economy Version 1 ©IAM 2022

Creating Value through the Circular Economy

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- **The figure illustrates 3 entry points to understand where to start creating value for the circular economy within AM systems and where asset managers need to work continuously**
  - Starting with the assets at the centre, the first viewpoint is the '**here & now**', where assets that are in everyday operation can be positively affected
  - In general, an effective way of minimising the environmental impact of assets may be to extend the asset's life
  - Next, considering the asset lifecycle boundary more widely, we have the '**before & after**', where we can intervene on how the assets are initially designed or renewed
  - Finally, the widest boundary to consider are the '**overarching practices**', which influence how assets are used, and the value, e.g., the externalities that the assets enable
  - **Value management** needs to be applied, but its application should extend beyond the asset and the asset creation project
    - What matters is the externalities the asset enables, which must be tied back to the organisation's purpose and the value that organisations create

A systems-based approach to creating value through the circular economy

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Creating Value from the Circular Economy with Systems Thinking

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- **The IAM's AM conceptual model provides a good starting point to develop an approach to creating value from a circular economy using systems thinking**
  - The figure highlights how organisations can respond to, and create value from, the circular economy across and beyond the AM spectrum
- **Further reading**
  - Our Shared Understanding: a circular economy in the built environment, DOI: https://doi.org/10.17863/CAM.96973
    Website: www.circularbuiltenvironment.com

Circular Economy Alignment with the IAM's Asset Management concept model

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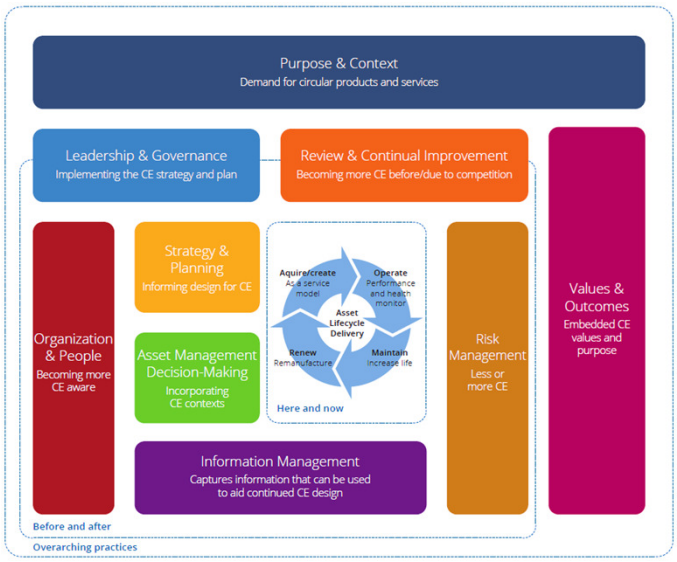

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Case Study: Using AM to address the Climate Emergency

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- **Overview**
  - This case study is based on the IAM publication '*Climate Emergency Action Planning: Guidance for asset owning organisations*', October 2021
  - The infrastructure continues to get older, posing a risk to life and safety, with reducing resilience to the effects of the environment, particularly the effects of climate change and natural disasters
  - The use of IAM concept model to provide guidance for addressing the climate change emergency is described

Topics

- **Role of asset management**
- **Building on good AM practice**
  - Strategy and planning
  - Lifecycle delivery
  - Risk and review
  - AM decision making
  - Asset information
  - Organisation and people
- **Developing Climate Emergency Action Plans**
- **Developing Climate Change Adaptation Plans**

Role of AM in addressing the climate emergency challenge

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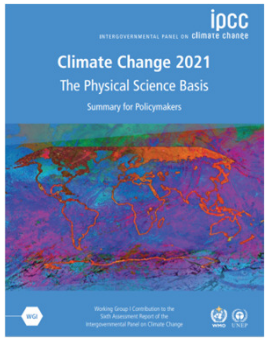
- **The Secretary-General of the United Nations describes the Intergovernmental Panel for Climate Change (IPCC)'s Sixth Assessment Report as '*code red for humanity*'**
- **Rapid action is required across sectors and globally to mitigate climate change and build climate change resilience**
- **The world faces a major climate emergency, unprecedented in human history and this is resulting in sustainability and resilience issues across society**



Source: Daily Maverick

Source: IOL

Role of AM in addressing the climate emergency challenge

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- **The Institute of Asset Management UK notes that in combination with implementing actions to mitigate climate change through reduced GHG emissions, organisations must introduce measures to adapt their systems and infrastructure to be resilient to changes in the climate, e.g.**
  - Addressing increased asset degradation/ failure risks due to exposure to extremes of temperature, drought, and flooding
- **Organisations must also consider the broader issues of environmental, social and economic sustainability, by reducing their detrimental environmental impacts and using resources sustainably**
  - Producing change requires urgent and clear leadership from these organisations
- **Increasingly governments throughout the world are mandating organisations to demonstrate that the impact of their actions on the environment is a core part of their decision-making processes**
  - Making sustainable and climate conscious investment decisions is essential if we are to be effective in tackling the climate emergency
  - The aim should be to embed the UN Sustainable Development Goals and other environmental and social drivers into an enhanced AM approach

Building on good AM practice to address the climate emergency

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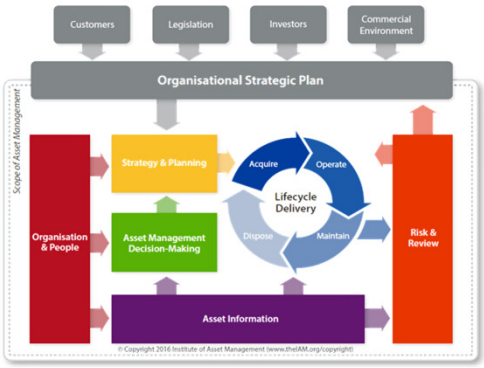
- **The foundation of good AM is the delivery of long term sustainable value & this is achieved using a**
  - Whole-life, whole system approach that is guided by stakeholder expectations
  - Optimises the use of resources
  - Has clearly defined targets based on transparent processes and evidenced-based methodologies
- **The whole-life approach also supports the concept of a circular economy, where the longevity and durability of material selection, and end-of-life repurposing opportunities are encouraged**
- **Avoidance of functional, organisational and technical boundaries that can lead to sub-optimal solutions is central to this approach**
- **These characteristics are required for the development of climate emergency action plans**
- **IAM Conceptual AM Model**
  - The IAM's conceptual model for AM identifies the six key subject groups that together enable an organisation to ensure that its approach to AM effectively, efficiently and sustainably supports the delivery of the organisational strategic plan & objectives



Building on good AM practice to address the climate emergency

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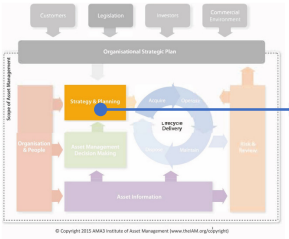
- **Strategy and planning**
  - This is the most critical group of activities within an organisation's AM system, identifying the asset and asset-system related activities that are necessary to deliver long-term value to the organisation and its stakeholders, and to support the delivery of the organisation's strategy and objectives
  - Reviewing the activities included in this subject group should be a priority for an organisation addressing the climate emergency challenge
  - It is not necessary, and probably highly ineffective, to develop a strategy and plan for addressing climate emergency separately from that necessary to deliver other organisational objectives
  - Climate-related risks pose new challenges to achieving corporate objectives and changes which address those risks should be identified as part of an AM Strategy

- Existing AM Strategies and plans, including the Technology Strategy, should be broadened in scope to address the additional climate emergency requirements
- To achieve this the senior team within the organisation must determine and communicate its requirements for addressing the climate emergency challenge, both in terms of scope and timescales



Group 1 – Strategy & Planning
1. Asset Management Policy
2. Asset Management Strategy & Objectives
3. Demand Analysis
4. Strategic Planning
5. Asset Management Planning

Building on good AM practice to address the climate emergency

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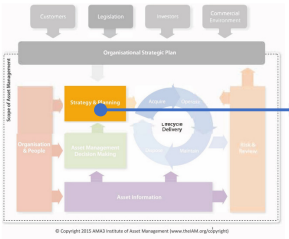
- **Strategy and planning *continued***
  - This should be based on a detailed understanding of stakeholder needs and expectations, and an understanding of the capability of the organisation, its assets and its supply chain partners to meet these requirements
  - The AM Policy should be updated to reflect these requirements and its value criteria, and decision support tools enhanced to evaluate strategic options
  - Based upon the outcome of this analysis – and after agreement with the senior team and key stakeholders which may involve adjustments to the organisation's strategy and goals – a revised set of AM Objectives will be produced containing explicit reference to the delivery of the climate emergency goals

- The existing AM Strategy, the Strategic AM Plan (SAMP) and supporting AM Plans should then be updated, budgets adjusted and delivery and monitoring regimes put in place
- These plans must include consideration of GHG emissions and other environmental outcomes, such as bio-diversity, as well as whole-life cost, if the planning and delivery of asset maintenance and operations is to be sustainable and climate resilient



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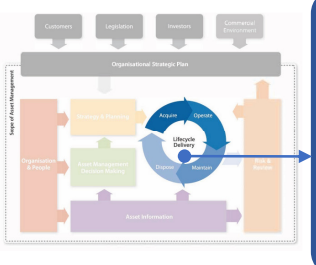
- **Lifecycle Delivery**
  - Organisations incur the majority of their asset related expenditure during the Lifecycle Delivery stage
  - We need to adjust the focus from the avoidance of cost, and recognise that mitigating environmental impact and remaining adaptable and sustainable are equally, if not more, valuable to the organisation and its stakeholders
  - Asset investment appraisal criteria must reflect this broader understanding of value and must include consideration over the whole-life of the asset
  - With capital assets often having a lifespan of many decades, the decisions and actions taken within the Lifecycle Delivery stage have long lasting consequences from an environmental and sustainability perspective, and organisations' assets must operate within the context of a rapidly changing environment

- It is imperative that asset managers ensure that all activities across the entire asset life (including asset disposal and repurposing opportunities) mitigate the impact of current and future assets on the environment; and that they can adapt to rapid and unprecedented changes to operating environments while still remaining a sustainable solution



Group 3 – Life Cycle Delivery
11. Technical Standards & Legislation
12. Asset Creation & Acquisition
13. Systems Engineering
14. Configuration Management
15. Maintenance Delivery
16. Reliability Engineering
17. Asset Operations
18. Resource Management
19. Shutdown & Outage Management
20. Fault & Incident Response
21. Asset Decommissioning & Disposal

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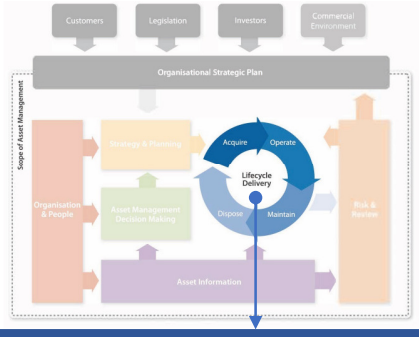
- **Lifecycle Delivery *continued***
  - Addressing climate emergency best practice and strategies, the Lifecycle stages will need to reflect an asset's vulnerability to climate effects and facilitate adaptation measures over the lifetime of an asset, e.g. to accommodate changes in technology and resources
  - A vital component of this consideration will be addressing environmental requirements within systems engineering
  - The Lifecycle stages will need to allow for mitigation opportunities throughout the life of an asset and minimise the asset's GHG footprint while still achieving the organisations objectives
    - This requires an understanding of the overall GHG contribution (embodied, operational and maintenance, and during disposal) as well as the environmental impacts



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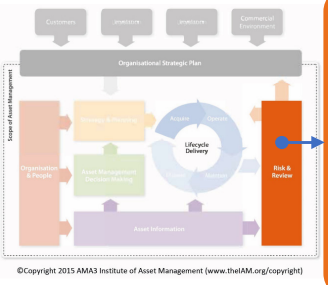
- **Risk and review**
  - ISO defines risk as the '*effect of uncertainty on objectives*'
  - Although it is understood that climate change will have significant impacts on assets, products and services, the degree or extent of various climate-related impacts across different time horizons remains uncertain
  - The impact of this climate risk or uncertainty upon organisations is that sustainability and GHG emissions targets must be managed within thresholds of variation
  - Climate change effects, both in terms of frequency and severity, could have an impact on the performance of assets and therefore on the delivery of organisational objectives
  - It is essential therefore that climate emergency uncertainties (both adverse and opportune) are thoroughly explored and levels of risk appetite and tolerance re-examined
  - An understanding of stakeholder expectations is a vital part of these considerations

- Risk models and lists of priority/critical assets should be reviewed and updated to reflect these uncertainties & to facilitate the development of robust climate change plans
- Monitoring and review are essential components of an effective AM system, primarily to ensure that the actions necessary to support the implementation of the AM Strategy have been executed effectively and ensuring that desired outputs are achieved and that processes are subject to continuous improvement



Group 6 – Risk & Review
31. Risk Assessment & Management
32. Contingency Planning & Resilience Analysis
33. Sustainable Development
34. Management of Change
35. Asset Performance & Health Monitoring
36. AM System Monitoring
37. Management Review, Audit & Assurance
38. Asset Costing & Valuation
39. Stakeholder Engagement

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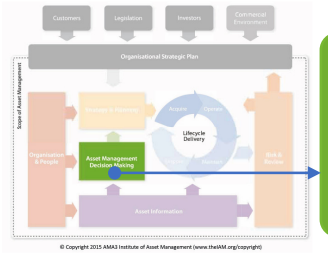
- **Risk and review *continued***
  - Consideration should also be given to the risks associated with supply chain disruption, especially considering reliance on resources, parts and materials that are difficult to source or need to be transported over long distances
- **Asset Management Decision Making**
  - To ensure the most effective management of assets in line with climate change causes and risks, targeted risk-based decisions need to be made at each asset lifecycle stage
  - Organisations need to consider sustainability, effect on the environment and output requirements to ensure greater asset resilience from climate changes
  - It is vital to understand the climate and environmental impact from an organisation's assets and then to ensure robust and timely mitigations are in place, minimising GHG emissions and climate change causes as much as possible

- The AM System should ensure that robust decision-making processes and criteria are defined and recorded and that regular reviews take place to learn lessons of previous decisions
- All processes within the AM system that increase associated GHG emissions should be considered, e.g., construction methodologies, operations and maintenance provision, and resourcing strategies



Group 2 – AM Decision Making
6. Capital Investment Decision-Making
7. Operations & Maintenance Decision-Making
8. Life-Cycle Value Realisation
9. Resourcing Strategy
10. Shutdown & Outage Strategy

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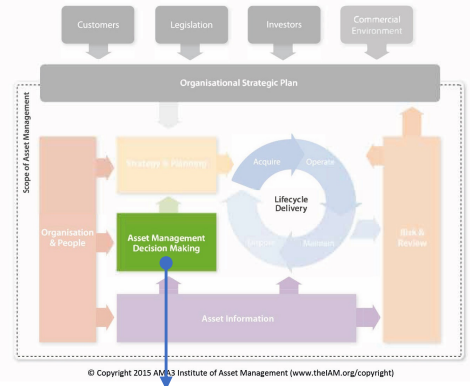
- **Asset Management Decision Making *continued***
  - Developing value-based analysis and lifecycle costing tools which take into account the impact on the organisation's triple bottom line (financial, societal and environmental) will be essential in providing the organisation with the information needed to make informed decisions at each lifecycle stage
  - Develop risk models that consider the local and global effect of climate change which is increasing adverse weather effects, such as flooding, drought, higher atmospheric temperatures, and increased wind speed, that will then enable decisions to be made to keep, change or modify existing assets to further support or maintain asset resilience



Group 2 – AM Decision Making
6. Capital Investment Decision-Making
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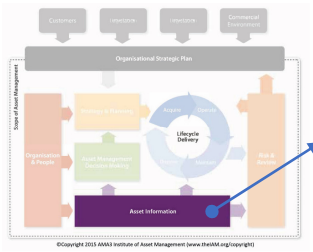
- **Asset Information**
  - Good practice approaches to asset information broadly support the delivery of climate change objectives
  - However, more complex questions and analysis are likely to be required to address the climate emergency
    - To support long term decision making when selecting optimum future strategies and
    - To undertake enhanced reporting to demonstrate the effectiveness of actions and plans
  - New information sources, different data types and greater data volumes are likely to be used, increasing the data management challenge for organisations
  - The challenges arising from climate change will sometimes not have been experienced in the past
  - Extremes of impact and frequency of events will most likely increase; therefore, data and information need to be considered with these factors in mind
  - Leading indicators and near misses will become ever more important, as will extrapolating past data with 'what if' scenarios
  - Innovation & emerging technologies are an important component of climate change resilience and mitigation
  - Specifically, asset innovations, including
    - Enhancement to existing technologies, as well as
    - Applications of emerging technologies may also present challenges to asset managers due to e.g. a lack of asset knowledge and data on performance



Group 4 – Asset Information
22. Asset Information Strategy
23. Asset Information Standards
24. Asset Information Systems
25. Data & Information Management

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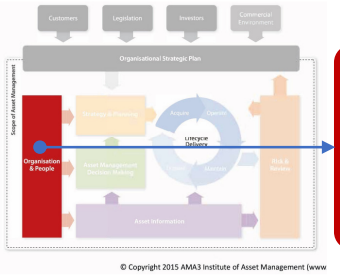
- **Organisation and people**
  - Effective leadership is critical
  - Developing and implementing a climate emergency action plan will be a challenge for most organisations and it is essential that the senior team within an organisation fully demonstrate in both words and actions their commitment to the plan
    - **Strategy** – the management team must ensure that
      - The strategy is clearly articulated & regularly communicated
      - The necessary funds and resources are made available
      - Describe the consequences of failing to deliver the strategy
    - **Structure** – the organisational structure and performance monitoring regime may need to be modified to reinforce the delivery of this strategy
      - People within the organisation must have the competence required to enable them to address the climate emergency challenge
      - This may necessitate changes to staff training programmes and the creation of new roles, potentially requiring the recruitment of new staff with specific expertise in key tasks e.g., expertise in low carbon technologies, legislative and regulatory knowledge



Group 5 – Organisation & People
26. Procurement & Supply Chain Management
27. AM Leadership
28. Organisational Structure
29. Organisational Culture
30. Competence Management

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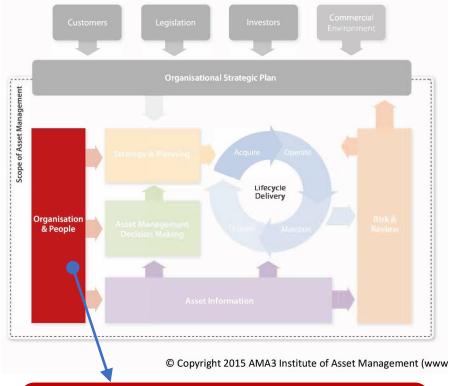
- **Organisation and people *continued***
  - **Culture** – the management team must ensure that the culture of the organisation underpins this approach
    - Encouraging an environment where challenge, innovation and cross-team working is supported
    - Progress is not delayed by competing team goals, local priorities or a blame culture where an innovation has not delivered everything expected
  - Organisations need to identify the suppliers that are key to their success and work closely with them to ensure that their actions are fully aligned with the delivery of the strategy
  - This may require changes in the supply chain, in interactions with suppliers and moving away from organisations that do not share the organisation's commitments in preference to suppliers that have aligned values



Group 5 – Organisation & People
26. Procurement & Supply Chain Management
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28. Organisational Structure
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30. Competence Management

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Developing Climate Emergency Action Plans

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- **Scope and prioritisation**
  - Addressing the climate emergency challenge requires action on two key issues
    - Reducing and removing GHG emissions
    - Improving the resilience of the organisation's infrastructure to expected climate changes
  - Critically, achieving both of these must be achieved in a sustainable manner
  - These actions are known respectively as climate change mitigation and climate change adaptation
  - Prioritisation is essential
  - Before embarking on extensive plans organisations are recommended to assess the scale of the climate challenge and how this might vary in different parts of the organisation, particularly for those whose operations are geographically dispersed
  - It is also considered worthwhile carrying out a high-level assessment of the relative importance of mitigation and adaptation plans

- Organisations must consider the vulnerability of their asset base in terms of exposure to climate change factors, such as extremes of heat or flooding
- They must determine what needs to be addressed in terms of adaptation to improve resilience and mitigation to reduce emissions, and prioritise their investment accordingly
- The purpose of effective AM is not simply supporting the delivery of the organisation's goals, but it is also about helping the organisation formulate and shape these goals, providing the decision-makers within the organisation with an understanding of what is possible and over what timescale

Developing Climate Emergency Action Plans

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- **Scope and prioritisation *continued***
  - These appraisal and planning processes should invariably identify choices for the organisation, presented in a format that allows the management team to make effective decisions
  - It is likely there will be significant interrelation between an organisation's climate change mitigation and adaptation strategies; this may generate both conflicts and opportunities, e.g. early replacement for resilience vs life extension for mitigation of GHG emissions
  - It is essential that organisations use multi-criteria assessments in their option appraisal tools, to reflect the fact that the value calculations must include
    - Consideration of GHG emissions
    - Environmental impact
    - Water and energy usage
    - Costs
    - Any other criteria that represent what the organisation values

- Understanding changes in climate and potential impact on assets
  - The IAM recommends addressing this challenge by the use of risk-based models, considering the increasing likelihood and consequence of asset failure/ degradation due to climate change and the impact this might have on the delivery of the organisation's goals, and this necessitates
    - Understanding the expected changes in the climate in which the assets operate
    - Assessing the likely impact of these changes on the performance of the assets and the ability to manage the assets
    - Assessing the consequences of this impact in terms of the delivery of the organisation's objectives
    - Developing strategies and plans to manage this impact
    - Monitoring the effectiveness of these plans and making adjustments as required

Developing Climate Emergency Action Plans

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- **Scope and prioritisation *continued***
  - Developing a climate change model
    - Developing an adaptation model requires an understanding of how the climate may change over the life of the assets, the extent of this change and the potential impact on the assets
      - The framework in the table below provides an illustration of how this assessment can be carried out, and it is against such a framework that adaptation strategies can be considered

- In assessing the potential climate change impact, it is important that the approach adopted is not limited solely to the physical impact on the assets: the processes for managing the assets and potential changes in demand for the organisation's products and services should also be considered, e.g.
  - Adverse weather conditions could severely impede the ability of the organisation to carry out routine or corrective maintenance activities, potentially leading to further degradation to the asset

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- **A framework for assessing the impact of climate change**

Factor	Climate changes	Metrics	Potential impact
Water	• Heavy rain, causing damage and/or leading to localised flooding • General rises in sea and river levels and flow rates • Ground movement and landslides • Increase in frequency and intensity of lightning, hail, snow or ice storms	• Annual rainfall • Peak rates and duration	• Transport disruption / delays • Supply chain interruptions • Damage to bridge foundations • Increased loading on bridge supports • Water ingress damage
Drought	• Reduced rainfall • Lowering of river and lake levels • Ground movement	• Annual rainfall • River and lake water levels	• Shortage of potable water for road construction • Lack of drinking water, reduction in water quality • Veld & forest fires • Habitat degradation • Food shortages • Dust storms

Developing Climate Emergency Action Plans

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➢ **A framework for assessing the impact of climate change *continued***

Factor	Climate changes	Metrics	Potential impact
Temperature	• Changes in duration and timing of seasons (reduced predictability) • Periods of intense heat • Less frequent cold periods, but perhaps more intense • Drought and fires • Invasive species causing damage to assets (or harm to employees) • Biodiversity crisis	• Daily, weekly, monthly temperatures	• Impact on asset specifications • Overheating of buildings/ assets • Transport disruption/ delays • UV degradation • Equipment failure
Wind	• Speed • Dust storms	• Mean wind speeds • Gust wind speeds	• Impact of storm damage • Impacts of increased cooling on assets • Impact on design specifications

Developing Climate Change Adaptation Plans

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➢ **Scope and prioritisation *continued***

- Developing Climate Change Adaptation Plans
  - The table on the following three slides provides an overview of how existing AM strategy, planning and implementation processes provide the platform for developing robust, risk-based adaptation action plans
  - In line with the prioritisation recommendations in the 'Scope and Prioritisation' section, critical assets, processes and supply chains should be considered first, extending the approach as necessary.
  - This further consideration may include connected assets in systems/ networks to identify single points of failure for less critical individual assets that would have a whole system/ network failure impact

➢ **Understanding the mitigation challenge and Developing a Climate Change Mitigation Strategy and Plans**

- Refer to the IAM '*Climate Emergency Action Planning – Guidance for asset owning organisations*', version 1, October 2021, for more information

Source: Oudtshoorn Courant

Developing Climate Change Adaptation Plans

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Subject group	Actions
Risk	• Agree and document climate change assumptions using the type of framework outlined in 'Developing a climate change model' for a planning horizon relevant to the expected life of the organisation's assets • Identify assets (including networks of connected assets) that are critical to the operation of the organisation. Repeat this planning process as considered necessary for other assets • Assess the likely impact of the climate change scenario(s) on these assets and the resulting business impacts using multivariate analysis techniques and expressing these impacts wherever possible in both financial & organisational value terms • Update risk models and logs
Asset Management Decision Making	• Ensure decision criteria and whole-life cost and performance models are modified as necessary to take into consideration impacts arising from expected climate changes • Identify and cost options to alleviate this impact. Develop business cases for potentially viable options. Note adaptation options may include: ○ Improving resilience of existing assets ○ Immediate replacement of an asset with one with a revised but more resilient specification ○ Waiting until an asset is due for renewal, then replace with a more resilient asset ○ Making the asset redundant by innovation

Developing Climate Change Adaptation Plans

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Subject group	Actions
Strategy and Planning	• The senior team should provide clear leadership on adaptation, ensuring that its importance is fully understood throughout the organisation • Ensure the Asset Management Policy is updated to reflect the organisation's approach to adaptation • Agree a climate change adaptation strategy, targets, timelines and monitoring regime • Update the Asset Management Strategy to reflect the requirements of the climate change adaptation strategy, providing details of: ○ Climate change adaptation strategy implementation costs and expected benefits ○ How the implementation of the strategy will be monitored ○ Identify expected asset performance as a result of these plans ○ Residual risks, key enablers and key assumptions • Update the organisation's Asset Management Plan to reflect the revised Asset Management Strategy
Organisation and People	• Update organisational roles, responsibilities & team objectives to reflect the climate change adaptation strategy • Ensure that adequate resources are made available to deliver the climate change adaptation plan • Review employee capabilities and implement a training programme as required • Ensure the procurement strategy reflects the climate change adaptation strategy requirements, e.g. asset resilience requirements, asset life-expectancy

Developing Climate Change Adaptation Plans

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Subject group	Actions
Asset Information	• Identify and source information required to develop and implement climate change adaptation plans • Identify information required to monitor the delivery and impact of the climate change adaptation plans • Update data collection processes, systems, training, communication etc. to ensure availability of the required information
Lifecycle Delivery	• Ensure investment approval processes and criteria reflects the climate change adaptation strategy requirements • Ensure each asset has a dynamic environmental standards register that is updated with changes to legislation and standards relevant to the asset • Document and implement revised asset specifications and/or operating and maintenance regimes with updated climate change adaptation strategy requirements • Collect required information relating to asset costs and performance, including GHG emissions and environmental impact, to assist with the review process and with further strategy development
Review	• Monitor the implementation of the climate change adaptation plans as defined within the organisation's Asset Management Plan • Monitor the expected level of performance of the assets • Identify improvement opportunities

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End of Day 2

About sources

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➢ **Major reference materials used**

- Guide to Asset Management, Austroads, 2018
- Draft TMH 22, COTO 2013
- Capital Planning Guidelines, National Treasury 2018
- Framework for Infrastructure Delivery and Procurement Management, National Treasury 2019
- ISO 55000/1/2: Asset Management, International Organization for Standardization 2014
- ISO/TC 251 WG4 resources (https://committee.iso.org/tc251)
- Asset Management – an anatomy, version 3, Institute of Asset Management (IAM) 2015/2018
- Asset Management Policy, Strategy and Plans, IAM, 2015
- Climate Emergency Action Planning – Guidance for asset owning organisations IAM 2021
- Asset Management Leadership – A White Paper, IAM 2022
- Value–the Apex of Asset Management version 1, IAM 2023
- How Asset Management Can Enable the Circular Economy version 1, IAM 2022
- International Infrastructure Management Manual, IPWEA 2011 & 2015
- Highway Infrastructure Asset Management Guidance Document, Department for Transport UK 2013
- Asset Management Landscape 2nd Edition, Global Forum on Maintenance & Asset Management 2014
- AASHTO Transportation Asset Management Guide, American Association of State Highway and Transportation Officials 2002
- AASHTO Transportation Asset Management Guide—A Focus on Implementation, American Association of State Highway and Transportation Officials 2011
- Ask the experts Asset Management Webinar June 2016 - Levels of Service-Cost-Risk and Asset Management Plan, Inframanage, accessed July 2021 at https://inframanage.com/inframanage-blog/,
- Asset Management: Whole-life management of physical assets, Editor Chris Lloyd 2010

About acronyms for organisations

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- AASHTO – American Association of State Highway and Transportation Officials
- BS – British Standard
- BSI – British Standards Institution
- CNAM – Canadian Network of Asset Managers
- FHWA – Federal Highway Administration (USA)
- GFMAM – Global Forum on Maintenance and Asset Management
- IAM – Institute of Asset Management UK
- IPCC – Intergovernmental Panel for Climate Change
- IPWEA – Institute of Public Works Engineering Australasia
- ISO – International Organization for Standardization
- NDOT – National Department of Transport, South Africa
- NRCC – National Research Council of Canada
- NZ – New Zealand
- NZTA – New Zealand Transport Authority
- OECD – Organisation for Economic Co-operation and Development
- PIARC – World Road Association
- PSAB – Canadian Public Sector Accounting Handbook
- RMS – Roads & Maritime Services (New South Wales)
- SA – South Africa
- TRB – Transportation Research Board (USA)
- TRL – Transport Research Laboratory (UK)
- UK – United Kingdom
- UN – United Nations
- US – United States
- US DoT – United States Department of Transportation

About acronyms for asset management & other

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- AM – Asset Management
- AMP – Asset Management Plan
- AMS – Asset management system
- BS – British Standard
- BSI – British Standards Institution
- CAPEX – Capital expenditure
- CIDMT – Cities Infrastructure Delivery Management Toolkit KPI – Key Performance Indicator
- CLoS – Customer-focussed level of service
- CNAM – Canadian Network of Asset Managers
- FWP – Forward work programme
- GHG – Green house gases
- GIAM – Government-wide immovable asset management
- GIAM – Government-wide immovable asset management act

- GPS – Government Policy Statement (NZ)
- HMEP – Highways Maintenance Efficiency Programme
- HR – Human resources
- IT – Information technology
- KRA – Key Result Area
- LoS – Level of Service
- LTFP – Long Term Financial Plan
- MAP-21 – Moving Ahead for Progress in the 21st Century
- ONRC – One Network Road Classification (NZTA)
- OPEX – Operational expenditure
- PAS – Publicly available standard
- PDCA – Plan-Do-Check-Act
- PRMG – Provincial Road Maintenance Grant
- PSAB – Canadian Public Sector Accounting Handbook
- RAMP – Road Asset Management Plan

About acronyms for asset management & other

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- SAMP – Strategic Asset Management Plan
- SHAMP – State Highway Activity Management Plan (NZTA)
- SHIP – State Highway Investment Proposal (NZTA)
- SPE – Statement of Performance Expectations (NZ)
- TAM – Transportation Asset Management
- TIP – Transportation Improvement Plan
- TMH – Technical Methods for Highways

About Synonyms

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- **'Agency' is used synonymously with 'authority' and are used in a generic sense and not to designate a particular organisational type**
-

About the course compiler

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- Mervyn Henderson Pr Eng
- Career - 44 years in the roads industry, South Africa & Australia
  - Consultant – Asset Management Services, Western Cape
  - Specialist Engineer, Roads Branch, Western Cape (RBWC)
  - Team Leader Asset Management, ARRB Group, Queensland, Australia
  - Program Manager – Strategic Investment and Network Performance, Brisbane Office, Metropolitan Region, Assets & Operations, Queensland Department of Transport and Main Roads, Australia (TMR)
  - Acting Director: Road System Governance, Engineering & Technology Division, TMR
  - Head: Pavement Materials and Rehabilitation. Roads and Stormwater Department, City of Cape Town
  - Chief Engineer: Pavement Engineering, Roads Branch, Western Cape
- Qualifications
  - MSc Engineering (Civil)
  - (Post) Graduate Diploma in Engineering (Civil)
  - Graduate Diploma of Management (Technology Management)
- Some achievements in asset management
  - Compiled the Western Cape Road Asset Management Plan (RBWC)
  - Compilation of an AM policy, AM strategies & AM plans (RBWC)
  - Development of integrated business processes all road projects and routine maintenance (RBWC)
  - Best Practical Paper Award for the paper "*Management of unpaved roads: Developing a strategy and refining models*", South African Transportation Conference, Pretoria, July 2017
  - Coordination of the implementation of Asset Management Elements in the Metropolitan Region of TMR
  - Implementation of dTIMS in 2012/13 for the $300 million 5 year TMR Road Asset Management Contract for Southeast Queensland (ARRB)
  - Development and establishment of new management systems: Gravel Management System, Pavement Quality Management System, Project Management System (RPM), the Seal Planning & Design System (RBWC)
  - Implementation of the Deighton Total Infrastructure Management System (dTIMS) (RBWC)
  - Development of programmes for rehabilitation, programmed maintenance, upgrading and regravel in the Western Cape and co-author of *'A Strategic analysis for optimal fund allocation and budget level'* (RBWC)
  - Planning and leading strategic planning sessions for the Western Cape Roads Branch and development of the 1st Business Plan (RBWC)
  - Editor and coordinator for Materials Manual (RBWC)