

Whole-life infrastructure asset management: good practice guide for civil infrastructure

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Executive summary

This good practice guide:

- identifies the principles of effective whole-life infrastructure asset management (WLIAM) for long-life civil engineering infrastructure assets, particularly in the transport and distribution industries
- describes the important steps required to successfully carry out such whole-life infrastructure asset management
- highlights existing good practice in whole-life infrastructure asset management
- provides examples and case studies of carrying out asset management in practice.

The primary audience for this guide is engineering or other technical and professional managers who are new to the principles and uses of asset management. It may also be useful to experienced asset managers who are interested in reviewing the good practice examples and case studies from UK infrastructure organisations.

This guide is not intended to be an all encompassing asset management manual, or to provide comprehensive coverage of all associated subjects, but enable readers to apply the basic principles of asset management and to locate more detailed information if necessary. This guide complements the *International infrastructure management manual (IIMM)* (INGENIUM, 2006), which is a widely known guidance document primarily focused on experience in Australia and New Zealand, but also drawing relevant practice from the UK, South Africa and the United States of America. This guide is not as comprehensive as the *IIMM*, but is specifically relevant to the UK. The guide draws on the experiences of the steering group involved in its development, and exemplifies the asset management context for civil engineering infrastructure in the UK.

The guide has been designed to cross-relate to Publicly Available Specification 55 *Part 1 Specification for the optimized management of physical assets* (PAS 55-1:2008a). This specification is a step in the process of developing a full standard and organisations can seek approval of their asset management systems against this specification. In following the clauses contained in PAS 55-1, the information in this guide can be used without affecting such approval processes.

This guide provides a focus on the strategic and tactical aspects of asset management, including setting asset management policy and strategy, and developing and carrying out asset management plans. The guide does not focus on the operational aspects of asset management, such as inspection, maintenance and repair strategies for specific asset types. This type of information is contained in the broader suite of guidance available from CIRIA (see Section 1.1.1).

In discussing asset management strategy and policy, the importance of stakeholder views is highlighted. Extensive contracts for asset management, such as design, build, finance and operate (DBFO), are also discussed. It discusses the importance of information management for long-life civil engineering infrastructure assets, and briefly describes systems to manage this information.

Risk management is a fundamental part of good asset management and there is considerable information provided within this guide. The guidance highlights the continuing importance of risks to reputation even where other risks have been contractually transferred. This guide is mindful of other requirements that may be placed on asset owners and/or operators by legislation, regulation or by the adoption of voluntary agreements.

The guide has chapters considering the development of asset management objectives and performance and condition targets, and using comparison of current performance and condition to optimise and prioritise asset management activities. A brief review of financial considerations used when making optimised decisions is included in the guide. Chapter 8 discusses the operation of asset management systems, including delivery structures, training to meet asset management competency requirements, stakeholder consultation, and operational control. Chapters

9 and 10 respectively consider actions necessary when monitoring and maintaining assets (not from an operational point of view), and in the review and continuous improvement of the asset management system.

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This guide was produced as part of CIRIA's continuing work in developing a suite of documents for infrastructure asset management, following a two phase research project: RP737 *Whole-life infrastructure asset management across industries*. Phase 2 was carried out under contract to CIRIA by Scott Wilson.

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Glossary

This glossary contains several terms that are used within this guide or by other documents referenced by this guide such as the *IIMM* and *PAS 55*, or which readers interested in whole-life asset management may find useful in developing a broad understanding of the subject.

Several of the quoted definitions are taken from other contexts (such as project management) or related industries (such as buildings) and are not specifically related to infrastructure asset management. Rather than amend the original definitions, where the definition is marked with an asterisk (*) the term should be taken to refer to the constructed parts of an infrastructure network, system or facility, rather than the original context. For example, the definition for backlog is taken from *Best practice advice – establishing and managing backlog* (NHS Estates, 2004). This definition makes reference to “estate assets”, “mandatory fire safety requirements” and “the built environment”. These terms are marked with an asterisk and the reader should apply the definition in the context of the assets they are managing.

Asset	<p>“A physical component of a facility which has value enables services to be provided and has an economic life greater than 12 months. Dynamic assets have some moving parts, while passive assets have none”</p> <p>“Assets are plant, machinery, property, buildings, vehicles and other items that have a distinct value to the organisation”</p> <p>There are many other uses of the word “asset” with other definitions. This guide relates only to constructed infrastructure assets</p>
Asset hierarchy	<p>“A framework for segmenting an asset base into appropriate classifications. The asset hierarchy can be based on asset function, asset type, or a combination of the two”</p> <p>The concept of asset hierarchy goes beyond asset classification, to organise the assets into a family tree, showing the dependency relationships between the assets in terms of their functional roles within a system, network or organisation</p>
Asset management	<p>“Asset management is the systematic and co-ordinated activities and practices through which an organisation optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organisational strategic plan”</p> <p>“The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost-effective manner”</p>
Asset management objective(s)	<p>“Asset management objectives are:</p> <ul style="list-style-type: none">➤ specific and measurable outcome or achievement required of asset systems(s) in order to carry out the asset management policy or asset management strategy, and/or➤ detailed and measurable level of performance or condition required of the assets, and/or specific and measurable outcome or achievement of the asset management system”
Asset management plan	<p>“A plan developed for the management of one or more infrastructure assets that combines multi-disciplinary management techniques (including technical and financial) over the life cycle of the asset in the most cost effective manner to provide a specified level of service. A</p>

	significant component of the plan is a long-term cash-flow projection for the activities”
	“The asset management plan is the document specifying activities and resources, responsibilities and timescales for implementing the asset management strategy and delivering the asset management objectives”
Asset management policy	“Asset management policy is the principles and mandated requirements derived from, and consistent with, the organisational strategic plan, providing a framework for the development and implementation of the asset management strategy and the setting of asset management objectives”
Asset management strategy	<p>“Asset management strategy is the long-term optimised approach to management of the assets, derived from and consistent with the organisational strategic plan and the asset management policy”</p> <p>“A strategy for asset management covering the development and implementation of plans and programmes for asset creation, operation, maintenance, rehabilitation/replacement, disposal and performance monitoring to ensure that the desired levels of service and other operational objectives are achieved at optimum cost”</p>
Asset management system	“The asset management system is the organisation’s asset management policy, asset management strategy, asset management objectives, asset management plan(s) and the activities, processes and organisational structures necessary for their development, implementation and continual improvement”
Asset register	“A record of asset information considered worthy of separate identification including inventory, historical, financial, condition, construction, technical and financial information about each”
Asset system(s)	<p>“Asset systems are a set of assets that interact and/or are interrelated so as to deliver a required business function or service”</p> <p>This guide particularly relates to the constructed infrastructure assets of the transport and distribution industries. That is the road, rail, sea and water transport industries, the distribution and supply networks of the water, power and gas supply industries, and flood defence and natural waterway control systems</p>
Backlog	“Backlog is the cost to bring estate assets* that are below acceptable standards in terms of their physical condition or do not comply with mandatory fire safety requirements* and statutory safety legislation (as they apply to the built environment*) up to an acceptable condition. Backlog relates to assets that are in need of some investment at the date of assessment”
Benefit/cost ratio	<p>“The sum of the present values of all benefits (including residual value, if any) over a specified period, or the life cycle, of the asset or facility, divided by the sum of the present value of all costs”</p> <p>See also <i>Cost-benefit analysis</i></p>
Business plan	<p>“A plan produced by an organisation (or business units within it) which translates the objectives contained in an annual plan into detailed work plans for a particular, or range of, business activities. Activities may include marketing, development, operations, management, personnel, technology and financial planning”</p> <p>See also <i>Organisational strategic plan and Strategic plan</i></p>
Components	“Specific parts of an asset having independent physical or functional

	identity and having specific attributes such as different life expectancy, maintenance regimes, risk or criticality”
Condition based preventive maintenance	“Preventive maintenance initiated as a result of knowledge of an item’s condition from routine or continuous monitoring”
Condition monitoring	“Continuous or periodic inspection, assessment, measurement and interpretation of the resultant data, to indicate the condition of the specific component so as to determine the need for some preventive or remedial action”
Corrective maintenance	“The remedial actions performed as a result of failure, to restore an item to a specified condition. Corrective maintenance may or may not be programmed” The concept of failure is about failure to be in the specified condition, rather than collapse
Cost-benefit analysis	Analysis which quantifies in monetary terms as many of the costs and benefits of a proposal as feasible, including items for which the market does not provide a satisfactory measure of economic value See also <i>Benefit/cost ratio</i>
Critical assets/asset systems	“Critical assets asset systems are assets and/or asset systems that are identified as having the greatest potential to impact on the achievement of the organisational strategic plan” “Assets for which the financial, business or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than non critical assets”
Deferred maintenance	“The shortfall in rehabilitation work required to maintain the service potential of an asset”
Demand management	“The active intervention in the market to influence demand for services and assets with forecast consequences, usually to avoid or defer capital expenditure. Demand management is based on the notion that as needs are satisfied expectations rise automatically and almost every action taken to satisfy demand will stimulate further demand”
Design life	“Service life intended by the designer”
Disposal	“Activities necessary to dispose of decommissioned assets”
Economic life	“The period from the acquisition of the asset to the time when the asset, while physically able to provide a service, ceases to be the lowest cost alternative to satisfy a particular level of service. The economic life is at the maximum when equal to the physical life; however obsolescence will often ensure that the economic life is less than the physical life”
Facility	“A complex comprising many assets (eg a hospital, water treatment plant, recreation complex) which represents a single management unit for financial, operational, maintenance or other purposes”
Failure modes, effects and criticality analysis (FMECA)	“A technique for analysing and evaluating a maintenance strategy or life cycle strategy to ensure that the application has the desired reliability characteristics by obviating those critical failure modes through employment of redundancy, providing alternate modes of operation, de-rating, or any other means”
Gap analysis	“A method of assessing the gap between a business’s current asset management practices and the future desirable asset management

Abbreviations, acronyms and contractions

AHB	Aberdeen Harbour Board
AIRMIC	Association of Insurance and Risk Managers
ALARM	National Forum for Risk Management in the Public Sector
ALARP	As low as reasonably practical
ALWC	Accelerated low water corrosion
AMCL	Asset Management Consulting Limited
AMEM	Asset management excellence model
AMP	Asset management programme
AMPAP	Asset management planning assessment process
AMSE	American Society of Mechanical Engineers
AST	Appraisal summary table
BRE	Building Research Establishment
BSI	British Standards Institution
CBA	Cost benefit analysis
CDM	Construction (Design and Management)
CECASE	Civil engineering cost and strategy evaluation
CETANS	Civil engineers' technical advice notes
CICE	Centre for Innovative and Collaborative Engineering
CMPCF	Capital maintenance planning common framework
CSS	County Surveyors' Society
CP	Control period
CR	Corrosion rate
DBFO	Design, build, finance and operate
DCF	Discounted cash flow
DCLG	Department for Communities and Local Government
DCSF	Department for Children Schools and Families (formerly DfES)
Defra	Department for Environment, Food and Rural Affairs
DfEE	Department for Education and Employment
DfES	Department for Education and Skills (now DCSF)
DfT	Department for Transport
DNV	Det Norske Veritas
EV	Expected values
FMEA	Failure modes and effect analysis
FMECA	Failure modes, effects, and criticality analysis
GIS	Geographic information system
HAUC	Highway Authorities and Utilities Committee (England and Wales)
HAZAN	Hazard analysis
HAZCON	Hazards in construction
HAZOP	Hazard and operability studies
HGV	Heavy goods vehicle
HSC	Health and Safety Commission

HSE	Health and Safety Executive
IAM	Institute of Asset Management
IASB	International Accounting Standards Board
ICAEW	Institute of Chartered Accountants in England & Wales
IIMM	International infrastructure management manual
IRM	Institute of Risk Management
ISO	International Standards Organisation
L&SE	London and South East
LCC	Lancashire County Council
LEQS	Local environmental quality survey
LUL	London Underground Limited
MCS	Monte Carlo simulation
MIC	Microbially influenced corrosion
NATA	National approach to transport appraisal
NHS	UK National Health Service
NPV	Net present value
ODM	Optimised decision making
ORR	Office of Rail Regulation
PAS	Publicly available specification
PCIS	Pavement Condition Information System
PESTLE	Political, economic, societal, technological, legal /regulatory, environmental
PFI	Private Finance Initiative
PPP	Private Public Partnership
RAMP	Risk analysis and management for projects
RAUC	Roads Authorities and Utilities Committee (Scotland and Northern Ireland)
RPB	Risk profile bulletin
RSSB	Rail Safety and Standards Board
RUS	Route utilisation strategy
SCANNER	Surface conditions assessment for the national network of roads
SCRIM	Sideways force coefficient routine investigation machine
SMART	Specific, measurable, achievable, relevant, timebound (objectives)
SMIS	Safety management information system
SRM	Safety risk model
STAMP	Structures asset management process
SWIMS	Scott Wilson Internal Management System
SWOT	Strengths, weaknesses, opportunities, threats
TAG	The Asset Management Working Group
TRACS	Traffic-speed condition surveys
TRADA	Timber Research and Development Association
TWI	Formerly The Welding Institute
UKPMS	UK pavement management system
UK RLG	UK Roads Liaison Group
UKWIR	UK Water Industry Research
WLIAM	Whole-life infrastructure asset management
WRAP	Waste & Resources Action Programme

1 Introduction

1.1 THE AIMS OF THIS GUIDE

Whole-life infrastructure asset management balances maintenance, repair, refurbishment, renewal, replacement, and upgrade activities to optimise the long-term value of an asset. Whole-life is an important ingredient to the asset management principles contained within the body of this guide. Section 7.4 specifically addresses optimised decision making (ODM) processes including whole-life cost/benefit analyses and multi criteria analyses as part of an asset management process.

1.1.1 Vision for this guide

This good practice guide:

- identifies the principles of effective whole-life asset management for infrastructure assets
- describes the important steps required to successfully carry out such whole-life infrastructure asset management
- highlights existing good practice in whole-life infrastructure asset management
- provides examples and case studies of carrying out asset management in practice.

It is designed to guide the reader through the principles of infrastructure asset management. It is supported and complemented by examples of good practice, which explain the context and illustrate the practical application of the principles, and by more substantial case studies, which demonstrate carrying out infrastructure asset management. The examples included in this guide are in boxes and are intended to exemplify some aspects of the text they follow. The case studies in Chapter 11 provide more substantial information on asset management in general and may cover several aspects of the text.

This guide covers the whole-life of constructed infrastructure assets, particularly in transport and distribution industries. This includes the road, rail, sea and water transport industries, the distribution and supply networks of the water, power and gas supply industries, and flood defence engineering.

This guide is part of the suite of asset management guidance produced by CIRIA. Other existing asset management guidance is discussed in Section 1.4 and summarised in the box:

O'Reilly, M P and Perry, J (2009) *Drystone retaining walls and their modifications – condition appraisal and remedial treatment* (C676)

Perry, J, Pedley, M and Brady, K (2003) *Infrastructure cuttings – condition appraisal and remedial treatment* (C591)

Perry, J (updater), Pedley, M, and Reid, M (2003) *Infrastructure embankments – condition appraisal and remedial treatment. 2nd edition* (C592)

Tilly, G P, De Voy, J, Jackson, P A, Oakhill, A C, Matthews, S J, Slade, G, and Deacon, D (2007) *Iron and steel bridges: condition appraisal and remedial treatment* (C664)

Breakell, J E, Foster, K, Siegwart M, Marshal, D, Hodgson, M, Cottis, R, and Lyon, S (2005) *Management of accelerated low water corrosion in steel maritime structures* (C634)

May, R, Ackers, J and Kirby, A (2002) *Manual on scour at bridges and other hydraulic structures* (C551)

McKibbins, L D, Melbourne, C, Sawar, N and Gaillard, C S (2006) *Masonry arch bridges: condition appraisal and remedial treatment* (C656)

McKibbins, L D, Elmer, R and Roberts, K (forthcoming) *Tunnels: inspection, assessment and maintenance* (C671)

Further details on these guidance documents can be found on the CIRIA website: <www.ciria.org>

1.1.2 Intended audience

The audience for this guide will have a diverse range of knowledge about infrastructure asset management. Although there will be some common knowledge, there is a breadth of approaches to asset management within the construction industry, depending on the types of assets, the existing systems in place, and the level of experience of an asset management approach. Also, readers will be from a range of disciplines, including financial and business management.

The primary audience for this guide is engineering or other technical and professional managers who are new to the principles of asset management and of carrying it out. For example, readers who are:

- carrying out asset management principles to prioritise local budgets for local works, without corporate support
- working in organisations where there is a corporate asset management policy, but few systems in place to support asset management
- developing asset management systems based on existing management systems as a requirement of new regulation, legislation or policy

- aware that many current activities are asset management, even though the organisation does not describe them as such
- new to infrastructure asset management, but are recent recruits to organisations with established asset management systems and procedures
- commercial and contract specialists that may benefit from the basic understanding and linked principles that this guide embodies.

The guide may also be of value to experienced asset managers who are interested in reviewing the good practice examples and case studies from UK infrastructure organisations.

1.2 INFRASTRUCTURE ASSETS

This guide focuses on the management of long-life civil engineering infrastructure assets, particularly in the transport and distribution industries, as exemplified in Table 1.1. The *IIMM* defines infrastructure assets as:

“Stationary systems forming a network and serving whole communities, where the system as a whole is intended to be maintained indefinitely at a particular level of service potential by the continuing replacement and refurbishment of its components. The network may include normally recognised ordinary assets as components”.

Table 1.1
Types of infrastructure assets considered by this guide

Industry sector	Examples of assets
Electricity utilities	➤ towers, transmission lines, transformer stations
Flood defences	➤ embankments, barriers, coastal defences
Gas utilities	➤ pipelines, gas holders (or gasometers), distribution centres
Highways	➤ roads, bridges, tunnels, earthworks
Ports and harbours	➤ docking berths, hardstandings, breakwaters
Rail	➤ tunnels, bridges, earthworks, escalators, large buildings such as stations
Water utilities	➤ water mains, sewers, sewage treatment works
Other civil engineering structures	➤ waste management facilities, dams, reservoirs

In this guide, infrastructure assets are assumed to be physical assets with a fixed location, for example, highways, water mains or docking berths. They are not moveable, such as rail carriages or maintenance equipment. Other types of assets (for example, skilled staff, financial information and intangible assets such as intellectual property or good will) and their relationship to physical assets are discussed in PAS 55-2, and the relevant diagram showing this relationship is reproduced in Figure 1.1.

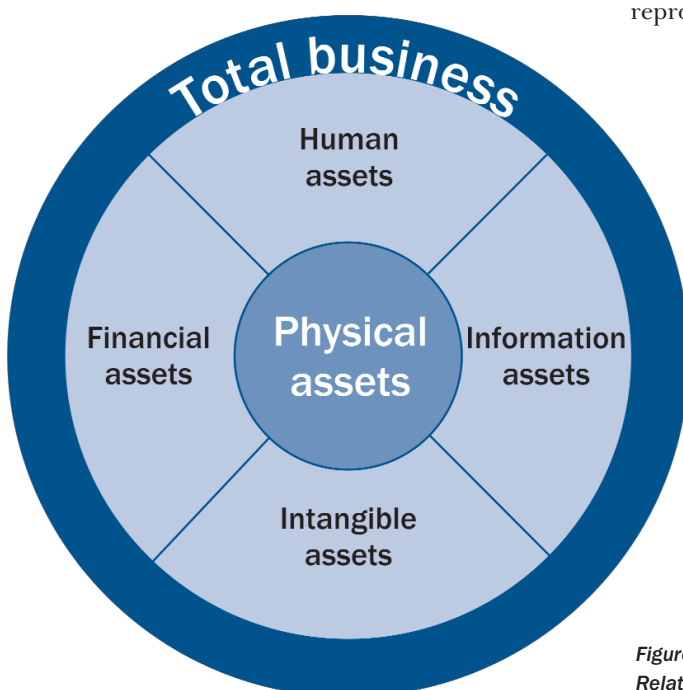


Figure 1.1
Relationship of physical assets to other assets

This guide does not cover other types of asset except where they overlap with the delivery of infrastructure asset management, for example, discussing the types of information system used in asset management. This guide does not cover property assets such as land and associated development (although infrastructure assets occupy land and may require the use of property assets). Nor does it cover production and manufacturing assets, or facilities or facility assets (such as air conditioning plant or heating and lighting systems).

As highlighted by the definition from the *IIMM*, important aspects of these infrastructure assets is their role in a systematic network which is maintained for an indefinite life span. Also, infrastructure assets can be characterised by:

- long design and service life
- extensive infrastructure corridors
- difficult or limited accessibility
- importance to the business of the asset owner
- limited flexibility within a context of changing and evolving use of the systems and assets
- high renewal or replacement costs
- direct public involvement in the operation and use of the assets
- maintenance that can result in loss of service and significant disruption, particularly if there is little or no redundancy (spare capacity) or links to re-route the service
- maintenance resulting in disruption incurring significant direct costs and significant indirect costs due to loss of service and associated loss of revenue.

Infrastructure assets are typically owned by asset-dependent businesses. For example, without its infrastructure assets (such as water mains) a water utility company cannot distribute water to customers. Contrast this with a manufacturing business, where the necessary plant can be moved to any location where there are the human resources and raw materials to manufacture the product.

In some instances, asset owners will transfer some of their asset management responsibilities to contractors, for example, by performance based maintenance specifications for contractors, or through strategic partnership arrangements.

1.3 THE WHOLE-LIFE CYCLE

Understanding the whole-life cycle of an asset enables owners and managers to maximise the benefits, and minimise the costs and risks, of ownership over its lifetime. Table 1.2 (derived from Bourke *et al*, 2005) shows the whole-life cycle of an asset.

It is very common for infrastructure assets to be in the operate-and-maintain phase of their life cycle, with no likelihood of closure, decommissioning, deconstruction or demolition. However, many infrastructure assets undergo some form of improvement or upgrade to maintain or improve the level of service they deliver or their performance. The long service life of infrastructure assets can mean that conventional concepts of whole-life costing (also known as life cycle costing) need careful consideration before they are applied. In the UK, much of the infrastructure asset stock may already have been in service for longer than the modern design life of equivalent assets.

PAS 55-1 recognises the importance of the whole-life cycle, requiring organisations to control activities through the whole asset life cycle. This includes considering the costs, risks and asset system performance across its life cycle.

1.4 EXISTING ASSET MANAGEMENT GUIDANCE

This guide seeks to build on existing guidance for asset management and linked subjects, such as risk management guidance. It does not aim to be an all encompassing asset management manual, or to provide comprehensive coverage of all associated subjects. It does aim to provide the reader with sufficient information to grasp and apply the basic concepts and principles of asset management, and to locate more detailed guidance and information where necessary. All information in this guide is fully referenced, and there is also an annotated Bibliography.

Two of the important reference documents for those responsible for managing infrastructure assets are:

- Publicly Available Specification 55 *Asset management*¹
Part 1: *Specification for the optimized management of physical assets* (BSI, 2008a), referred to as PAS 55-1 in this guide

1 A Publicly Available Specification (PAS) is often the first step in the standardisation process and is used to provide practical information quickly to users (BSI, 2007).

Table 1.2
Whole-life cycle of an asset

Life cycle phase	Example activities in phase
Inception	<ul style="list-style-type: none"> ➤ building the business case for action ➤ demand forecasting ➤ defining requirements ➤ stakeholder involvement.
Feasibility appraisals for whole-life options	<ul style="list-style-type: none"> ➤ evaluating different solutions and associated risks/benefits ➤ selecting of procurement route (such as private finance initiative, framework contract, design and build, separate design and construction contracts) ➤ producing the project brief.
Plan and design	<ul style="list-style-type: none"> ➤ planning applications ➤ public inquiries ➤ tendering ➤ appointment ➤ outline and detailed designs ➤ whole-life costing ➤ specifying materials ➤ environmental assessment
Construct and handover	<ul style="list-style-type: none"> ➤ construction scheduling ➤ supply chain analysis ➤ waste management and other environmental management ➤ subcontractor management ➤ commissioning ➤ post-commissioning evaluation.
Operate and maintain	<ul style="list-style-type: none"> ➤ service delivery ➤ performance monitoring ➤ planned maintenance ➤ unplanned repairs ➤ condition monitoring ➤ demand forecasting ➤ deterioration modelling ➤ supply chain requirements
Renew or dispose	<ul style="list-style-type: none"> ➤ performance audit ➤ improvement and upgrade ➤ replacement ➤ closure ➤ decommissioning ➤ deconstruction, demolition and recycling ➤ sale ➤ transfer or end of liabilities

Part 2: *Guidelines for the application of PAS 55-1* (BSI, 2008b), referred to as PAS 55-2 and as PAS 55 collectively in this guide

- *International infrastructure management manual (IIMM)* (INGENIUM, 2006), referred to as IIMM in this guide.

In addition to these publications, other asset management publications that may be of value to readers include:

- *Framework for highway asset management* (CSS, 2004)

- *Guidance document for highway infrastructure asset valuation* (CCS/TAG, 2005)

- *Asset management planning assessment process – a methodology for self-assessment, volume I: project report* (UKWIR, 2007)

- *Assets in action – an asset management guide for non-technical managers* (NHS Estates, 2003)

- *Asset management plans* (DfEE, 2000)

- *The IAM competences framework* (Institute of Asset Management, 2008a and b).

This good practice guide complements these documents, and refers to them extensively, showing how the principles of effective asset management may be applied in the context of UK infrastructure. A schematic diagram of this relationship is given in Figure 1.2.

PAS 55-1 identifies 23 separate elements within an asset management system, shown in Table 1.3. The *IIMM* offers more detail on asset management systems, but covers broadly the same elements as *PAS 55*, as shown in Table 1.4. Example 1.1 (National Grid, 2005) describes the benefits of carrying out a *PAS 55* system and achieving accreditation to this specification.

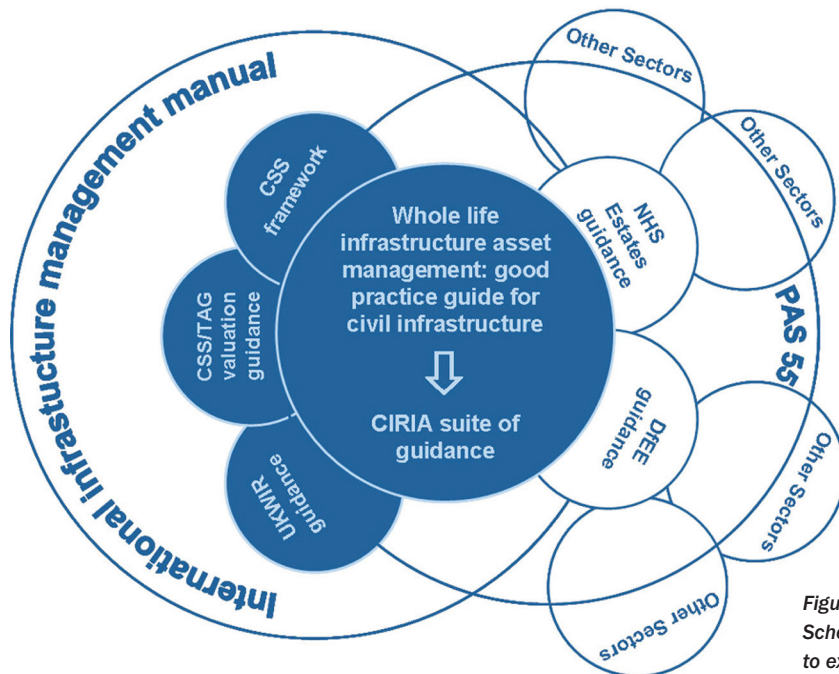


Figure 1.2
Schematic diagram showing relationship to existing guidance

Table 1.3
Asset management system elements

Elements	Including
Policy, strategy, objectives and plans	<ul style="list-style-type: none"> ➤ asset management policy ➤ asset management strategy ➤ asset management objectives ➤ asset management plans ➤ contingency planning.
Enablers and controls	<ul style="list-style-type: none"> ➤ structure, authority and responsibility ➤ outsourcing asset management activities ➤ training, awareness and competence ➤ communication, participation and consultation ➤ asset management system documentation ➤ information management ➤ risk management ➤ legal and other requirements ➤ management of change ➤ financial parameters.
Implementation of asset management plans	<ul style="list-style-type: none"> ➤ life cycle activities ➤ tools, faculties and equipment.
Performance assessment and improvement	<ul style="list-style-type: none"> ➤ performance and condition monitoring ➤ investigation of asset-related failures, incidents and nonconformities ➤ evaluation of compliance ➤ audit ➤ improvement actions ➤ records.
Management review	

2 Policy and strategy

- in risk assessment and control, in investigation of asset-related incidents
- in continuous improvement of the asset management system.

The *IIMM* defines and tabulates the differences between asset management policies, strategies and plans, as detailed in Table 2.1.

It is important to recognise that involved and intermediary stakeholders influence the weighting of factors taken into account when decision making, the drivers for asset management, communication policies, and information sharing and storage policies. PAS 55-1 sets requirements for consultations with stakeholders to ensure that their input, as appropriate, is used:

- in the development of the asset management strategy, objectives and plan(s)
- in developing policies and standards related to specific types of assets or asset management processes

2.1 ASSET MANAGEMENT POLICY

Policies set out the rules and structure that an organisation will work within, whether they are imposed externally or developed internally. They are generally agreed at board level (see Example 2.1) and can include naming a board member to be responsible for reviewing and updating each policy, as well as ensuring its adoption across the organisation. Policies can be established to embody legal obligations (for example, health and safety at work policies) or can be set to meet the expectations of the organisation's marketplace (for example, an environment or sustainability policy). For an organisation that depends on infrastructure assets to deliver its business, an asset management policy, which is endorsed by the board and disseminated to staff and stakeholders is essential (see Example 2.2).

Table 2.1
Asset management policies, strategies and plans

	Asset management policy	Asset management strategy	Asset management plans
What is it?	Broadly outlines how and why asset management will be undertaken across the organisation as a whole.	Specific actions to be undertaken by an organisation to improve asset management capability and achieve specific strategic objectives.	Long-term plans (usually 20 years or more for infrastructure assets) that outline the asset activities for each service area.
Objectives	Sets the broad framework undertaking asset management in a structured and co-ordinated way.	Develops a structured set of actions aimed at enabling improved asset management by the organisation.	Outlines actions and resources to provide a defined level of service in the most cost effective way.
Typical contents	<ul style="list-style-type: none"> ➤ organisational context and importance of asset management ➤ organisation's overall vision and goals, and supporting asset management vision and goals ➤ asset management policies underpinning the strategic goals ➤ key performance measures for policies, including broad timeframes and deadlines (eg frequency of asset management plan reviews, timing of community consultation inputs) ➤ asset management responsibilities and relationships ➤ how asset management integrates into the organisations' business processes. 	<ul style="list-style-type: none"> ➤ a description of the current status of asset management practices (processes, asset data, and information systems) ➤ organisation's future vision of asset management ➤ a description of the required status of asset management practices to achieve the future vision ➤ identification of the gap between current status and the future vision (a gap analysis) ➤ identification of strategies and actions required to close the gaps, including resource requirements and timeframes. 	<ul style="list-style-type: none"> ➤ a summary of an organisation's strategic goals and key asset management policies ➤ definition of levels of service and performance standards ➤ demand forecasts and management techniques ➤ a description of the asset portfolio ➤ a broad description of the life cycle management activities for operating, maintaining, renewing, developing or disposing of assets ➤ a cash flow forecast ➤ key asset management improvement actions including resources/ timeframes.

Example 2.1

Board review of asset management functions

Aberdeen harbour is a trust status port whose profits are re-invested in the port through capital and maintenance expenditure. Based on projected business a five year expenditure plan is compiled and reviewed/approved by the board on an annual basis. The business plan comprises all items of major maintenance and capital expenditure on the port infrastructure and includes a substantial sum dedicated to proactive and reactive asset management functions, particularly in respect of monitoring, repair and protection of its 6 km of steel piled berthing structures – literally the foundations of the port itself.

Stakeholder views may be sought as part of the business planning process. However, it may be appropriate for specific consultation to be undertaken with stakeholders when developing an asset management policy, as for Islington Council in Case study 11.1. It is important that infrastructure organisations identify who their stakeholders are and the degree of input they should have in the development of an asset management policy.

Example 2.2

Engagement with stakeholders in developing a business plan (derived from Network Rail 2007a)

Network Rail engaged extensively with stakeholders in delivering its Strategic business plan control period 4 in October 2007. The organisation realises that its visions for the future can only be achieved by consulting with stakeholders, aligning plans to meet their requirements, and surveying satisfaction. Network Rail has identified five main stakeholder groups:

- passengers and freight users
- customers (train and freight operators)
- industry stakeholders (including funders, regulators, the two governments (England & Wales, and Scotland), Transport for London, local authorities and communities)
- suppliers
- our people.

An asset management policy is a requirement of PAS 55-1, which states that the policy shall:

- be derived from and consistent with the organisational strategic plan, be appropriate to the organisation's assets and operations, and be consistent with other organisational policies and the organisation's risk management framework
- state any principles to be applied (such as sustainable development or corporate social responsibility principles)
- provide the framework for the production and carrying out of the asset management strategy, targets and plans

- commit to continuous improvement of its asset management and to comply with current legislation, regulation, statutory requirements and any voluntary requirements relevant to the organisation (for example, voluntary agreements such as the WRAP utility industry agreement – see Example 5.1)
- be visibly authorised and endorsed by the organisation's senior management with clear procedures for documentation, carrying out and maintenance, including periodic review
- be communicated to relevant stakeholders (such as employees and contractors).

For infrastructure organisations, the business of the organisation will be dependent on the assets that it owns or manages and will quite frequently be externally regulated, or subject to specific legislation, so it is important that the asset management policy:

- is fully integrated with other policies and any overarching regulation and legislation, but is flexible enough to accommodate changes in regulation and legislation
- is realistic, such that its broad objectives can be done and also developed, and its targets and milestones achieved
- considers and possibly defines whole-life. Because infrastructure assets are expected to operate indefinitely, the organisation can benefit from defining the period over which whole-life asset management should occur.

2.2 ASSET MANAGEMENT STRATEGY

The asset management strategy provides details of how the assets will be managed for the long-term and to deliver the organisational strategic plan. It needs to be carefully considered initially and reviewed from time to time, to ensure that it meets the needs of the business. It is important to consult with individuals and teams with an interest in the performance of the assets, including internal departments and external stakeholders such as regulators, owners (where asset management is subcontracted), investors and customers. The asset management strategy will need to balance the views of stakeholders, but should seek to account for these views to ensure it is aligned with business objectives and is advocating the correct actions to meet stakeholder needs.

To ensure effective asset management when responsibility has been contracted to an external agency, it is important that the contract is sufficiently flexible to be able to respond appropriately to the changing requirements and expectations of the ultimate asset owner and their main stakeholders.

PAS 55-1 requires that the long-term asset management strategy shall:

- be derived from, and consistent with, the asset management policy, the organisational strategic plan, and other policies and strategies (including alignment with timescales)
- be visibly authorised and endorsed by the organisation's senior management
- identify the functions, performance and condition of existing assets, asset types, or asset systems (networks) and their criticalities and state the function, performance or condition aspirations
- consider the risk management and life cycle management of assets, asset types or asset systems (networks)
- enable the development of asset management objectives, targets and plans and set criteria for optimising and prioritising asset management objectives, targets and plans
- provide the necessary information and direction (including time and responsibilities) to allow asset management objectives, targets and plans to be produced
- take into account the requirements of relevant stakeholders and be communicated to stakeholders as appropriate
- be periodically reviewed and amended as necessary.

Example 2.3 explains the strategic drivers behind the asset management approach adopted by Aberdeen Harbour Board (AHB), and Case study 11.3 provides the background to Network Rail's asset management policy and approach, which operates at a corporate level and is then further subdivided by asset type.

Example 2.3

Aims of asset management at Aberdeen harbour

The aims of asset management by AHB are safety and fitness for purpose of the structures in question. This is assisted by capability planning on the berths to successfully meet the demands of shipping and other industries relying on their performance.

For whole-life infrastructure asset management, the strategy should pay particular attention to areas such as:

- taking a long-term view, over several decades – as infrastructure assets have an indefinite life span
- asset performance and (customer) service metrics – reflecting legislative, regulatory and stakeholders' requirements
- the potential impact of high risk failures – to ensure critical assets are identified and treated accordingly
- the maintenance approach – such as run to failure, time-based, risk-based or condition based intervention,
- how asset condition data will be collected and information stored – as many infrastructure organisations already collect such data, but may not store it in a way that supports asset management
- how activities will be planned and delivered – including identifying the responsibilities and competencies required to deliver asset management projects
- identifying the management responsibility for monitoring, review and improvement.

It is important that the strategy to be adopted for the assets under consideration starts by viewing them as a system and that care is taken not to unwittingly put in place a sub-optimal strategy reinforced by subsequent plans. When an organisation intends to carry out asset management for the first time, it is important to review the strategy soon after its introduction, perhaps within a year or two. Good practice in asset management is based on continuous improvement, rather than aiming for perfection from a single improvement project. Regular reviews that include carrying out of identified improvements, allow organisations to integrate asset management effectively with changes in stakeholder requirements, technology and other existing systems in the organisation and operating environment.

A longer-term view is essential for effective management of those infrastructure assets which have long service lives and which may already have been in service for a long time. This means that a strategic view may need to accommodate longer-term variations in circumstances, such as climate change, legislative change, changes in national government and its policies and possible changes in the type and level of use of the asset. The level of service delivered by an asset may also vary in the long-term, because of changes in demand,