Victorian Digital Asset Strategy
Guidance

Appendix 2: Asset information requirements template

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Appendix 2 contents

Introduction

Most organisations have assets, whether physical, virtual or data related, and the information that supports them is valuable. Often those assets are managed by external organisations on behalf of the owner.

This means that asset information needs to be managed effectively to support business needs.

Asset information supports decision-making processes and it enables many other business functions, such as financial, analytics, safety, planning, capital delivery and operations.

Asset information must be well structured and available to the right people, at the right time, to make informed decisions. It also needs to be articulated to the entity responsible for creating it, at specific asset lifecycle stages, and in line with organisational key decision points.

When this is done well, the task of asset management and capital delivery becomes much easier.

Purpose

The purpose of this template is to assist organisations' clients and their consultants to define specific asset information requirements (AIR) as set out in the VDAS and ISO19650. The secondary purpose of this document is to facilitate the standardised production of asset information and to take advantage of digital engineering processes.

Defining, then capturing and delivering asset information at the right time in design and construction will support operational uses. Ideally, as an organisation matures, asset information can be progressively delivered to operations through a soft landings approach. See Parts B and C of this document for more detail.

Audience

The primary audience for this template comprises:

- clients, their facilities and asset management agents with relatively limited experience in using digital engineering to deliver asset-related information for operational purposes; and
- clients who do not have well-developed statements of AIR, asset management strategies, digital engineering and other standards for specifying how asset information needs to be created in design and construction to support operations.

Focus and scope

Decision support

The AIR focuses on decision making about the asset information required and on providing detailed coverage about that information.

Handover deliverables

The AIR defines the information deliverables required, typically at the handover between the 'build and commissioning' and 'operation and maintenance' phases of an asset, rather than on the requirements at each stage of a project.

The intention, first and foremost, is to focus the attention of the primary audience on the outcomes of the AIR definition process without becoming distracted by the multiple considerations associated with information delivery. Once this is accomplished, the work-breakdown structure necessary for its delivery can be developed.

Process of defining asset information requirements (AIR)

This section provides an overview of the process for defining AIR before examining the steps involved in the process in more detail.

- Prior to defining the AIR, the OIR should be well defined and endorsed for the organisation approach to the VDAS and digital engineering.
- Define the roles, individuals and functional areas of the organisation that are stakeholders in developing the AIR.
- Clearly define what constitutes an 'asset' to ensure whole of organisation alignment.
- Identify which assets will be managed by the AIR.
- Define the asset information requirements to meet only relevant business needs, remembering that asset data requires capture, maintenance and quality checks – this can be a costly exercise
- Identify potential 'trigger' events and key decisions points that may require asset information. This includes potential future needs, e.g. identifying age/use related defects/ wear.
- Establish standards for how asset information will be exchanged. For example, the AIR could hold all the asset information requirements for the organisation, but only a subset of this is specified for the delivery team on a project (through an EIR).
- How will asset information be captured (process, people, technologies and data formats)?
- How will the organisation federate information from different silos into a common data environment?
- Can an existing asset information model be mined? Where is it deficient? What are the common complaints?
- How will asset information from project delivery (PIM) be integrated with operations (AIM)?
- How will the AIM be updated over time? How will refurbishment projects of the facility/ infrastructure be integrated in the future?
- What asset information will be shared with the project delivery team at project commencement (stage 1) and how will asset information be returned in subsequent stages?

Managing and delivering asset information

Asset information requirements (AIR)

Define AIR.

Define AIR

For example, the AIR are a subset of the overall project brief. Just as the functional design brief describes the client's requirements for the finished built asset, the AIR describe the client's requirements for asset data. The processes of delivering the assets and the associated data and information are parallel and connected.

Benefits of early definition of AIR

Brief descriptions of how defining AIR prior to the commencement of design has significant benefits at different stages of a project.

Benefits of early definition of AIR

- *During project planning and design*
- *At team engagement and tender stage*
- *During project delivery and handover*

Value of asset management/ facilities management

Strategic approach to asset management/facilities management

Strategic approach to asset management/facilities management

For example:

Strategic planning for asset management/ facilities management should start at the very beginning of a project, if not before. Members of the project team need to know what data and information they are expected to provide, and for which they will be held contractually accountable. Thus, the client's AIR must be defined.

Value of digital asset data

Value of digital asset data

Effective asset management/facilities management depends on reliable information. General expectations about information deliverables for asset management/facilities management purposes are well established and documented. The NATSPEC 0171 General requirements worksection, for example, specifies general requirements, such as quantities, formats and contents for as-built drawings, product information, O&M manuals, warranties, etc. that the contractor must submit. Other worksections specify requirements for their subject system under the 'Submissions' clause.

These expectations still stand, but simply delivering these items in digital form, for example, with computer-aided design (CAD) or PDF files instead of printed drawings, does not capitalise on the potential value offered by digital technologies such as BIM or digital engineering. The biggest difference between traditional deliverables and BIM/digital engineering deliverables is structured data.

Digital deliverables for asset management

Models, documents and data etc.

The digital deliverables for asset management/ facilities management are virtual 3D models, documents including drawings and tabulated data. Collectively, these deliverables are referred to as the asset information model (AIM).

Models, documents and data etc.

Models, drawings, text-based documents and non-graphical data – usually stored in spreadsheets or databases – each have their strengths and weaknesses as information sources, depending on the circumstances in which they are used. Instead of relying on only one as a primary source, it is more sensible to explore how to obtain the best result by linking them and using them collectively.

Structured data and information

To obtain the most value from asset data and information, it needs to be well structured and understood by all parties.

Structured data and information

The features of structured data are that they use a 'single source of truth', are linked in a useful way, are object based, are based on a schema leverage metadata.

Single source of truth

One of the key principles of digital information management is to maintain a single location for data, thus avoiding the duplication that results from storing the same data in different locations.

A digital system allows multiple locations to link to a single source of data. Advantage should be taken of this capability to maintain the integrity of data and minimise data maintenance overheads.

Single source of truth

Provide strategic decisions about where particular types of data are to be located.

Linked data

One great advantage of digital data is the ability to link the data in useful ways (e.g. links between database tables, hyperlinks etc.). For example, on one hand, information about an asset can be linked to information about the room or space where it is located while, on the other hand, information about the space can include all assets found in that space. The asset record can be linked to O&M manuals, models and drawings showing its location in a system or assembly, as well as being linked to product data, manufacturer data, contact data for service and maintenance contractors, performance logs, etc.

Linked data

Specify how links will be manually created and maintained.

Asset classification

The VDAS approach recommends the use of Uniclass 2015 if no existing asset classification system is in use by the asset owner / Appointing Party. If an existing asset classification system is being used, it should be mapped to Uniclass 2015 and reviewed to align with digital engineering tools and processes. That is, it should support object-based modelling, connected systems, use type of and part of approaches and have a hierarchical structure. It should conform to ISO12006.

Asset location referencing

A common pitfall of existing asset information management approaches is combining location referencing with asset classification. These need to be separated to enable the same asset to reside in two different locations. This can greatly simplify asset registers and asset management practices.

Object-based organisation of information

An object-based approach to organising information is one in which objects act as a unifying point on reference.

Asset no.	Description

Data schema

Data must be consistently formatted and based on a highly structured data schema.

Data schema
For example, schemas for architecture, engineering and construction (AEC) and asset management/facilities management data can range from the very broad and comprehensive, such as industry foundation classes (IFCs), to the small scale and single purpose, such as categories of assets used by a computer maintenance and management system (CMMS).

Metadata

Metadata in this context is data about an asset record, rather than about the asset itself. This type of data is key to data discoverability, access, appropriate usage, auditing and quality control.

Metadata

Include data about the asset record, for example file creation date, last modified date, author and file size.

Elements of structured data

Elements of structured data

Provide descriptions of structured data elements such as single source of truth, linked data, object-based organisation, data schema, metadata.

Asset register organisation

Asset register organisation

For example, an asset register – whether in the form of spreadsheets, a database or part of a computer maintenance and management system (CMMS) – is the platform used to host asset data. It plays a central role in the asset information model (AIM). Apart from being a repository of asset data, an asset register can act as a 'switchboard' that links each asset to relevant information sources.

Designations for coordinating information

While databases use numerical identifiers (keys) or global unique identifiers (GUIDs) to link data in their constituent tables, human-readable designations are still necessary to make it easier for people coordinating or using the information.

Designations for coordinating information

Designation codes, or 'tags', are used to coordinate and cross-reference information about items in construction documents familiar to many in the industry, e.g. a door should appear in the asset register, schedules, specifications, models and drawings, and should correspond to the signage on the actual door in the completed building.

Business asset identifiers

Applications typically create a GUID to manage objects within the native application. It is important to use an identifier that is consistent across all applications. Ideally, this should be in human-readable form to be easily understood by all business functions, without having to ask a specific functional area to decode it.

Process overview

Process overview

The process of defining AIR focuses on defining the content of the asset register, the repository of generally non-graphical asset data. It is the core element of any asset management system as it is best suited to:

- *searching, filtering and sorting information about assets;*
- *handling the ever-changing data associated with asset management;*
- *aggregating data to provide insights into patterns and trends useful for strategic decision-making; and*
- *linking to the other elements of the AIM: documents, virtual 3D models and 'in-use' data.*

Process outcome

Applications typically create a GUID to manage objects within the native application. It is important to use an identifier that is consistent across all applications. Ideally, this should be in human-readable form to be easily understood by all business functions, without having to ask a specific functional area to decode it.

Process outcome

The requirements comprise:

- *a well-structured asset register, including asset data appropriate to the organisation's needs;*
- *a well-organised repository of drawings, documents and files, including a building manual;*
- *an accurate as-built model/s (with minimum non-graphic data); and*
- *all above components coordinated and consistently cross-referenced, with minimal duplication of data, and all presented in a format appropriate to the organisation's systems and management capabilities.*

Process participants

The early involvement of the asset operator is key to the success of the AIR definition process. The following parties should be involved in defining the AIR: VDAS Champion, DE Project Champion, client asset management / facilities management and finance supported by the technology functional area.

Title	Role and responsibility
Client AM/FM Manager	
Finance	
VDAS Champion	
DE Project Champion	

Information management prespectives

Although the process participants identified above automatically bring different perspectives to the AIR definition process, the conscious application of the perspectives shown in the table below throughout the process is useful to prompt comprehensive consideration of the information requirements and as a tool for assessing proposals.

Perspective	Information management purpose
Asset owners	
Asset users	
Project delivery and asset management/ facilities management teams	
Society	

Projects involving alteration, upgrade or extension of an existing asset

The types of projects involving alteration, upgrade or extension of an existing asset entail tasks and responsibilities additional to those undertaken in new-build projects.

Projects involving alteration, upgrade or extension of an existing asset

This may include:

- *extracting historical data on retained assets from existing systems;*
- *updating and linking new and old data sources to new and old assets; and*
- *ensuring that data and information formats are compatible with existing information management systems used by the client.*

Definition of asset information requirements (AIR)

The AIR definition process described in this section is concerned with decision making about the asset register's content and structure, and how it links to the other elements of the AIM: virtual 3D models and documents.

Strategic considerations

When defining the AIR, the overall organisational information requirements (OIR) need to be taken into consideration to provide a broader context for decision-making about the AIR.

Strategic considerations

In this part of the process, organisational objectives, policies, systems, resources and constraints regarding asset management should be analysed. The purpose of this analysis is to provide a consistent framework for setting priorities and assessing the relative merits of options. Organisations must ensure that a strategic asset management plan (SAMP) has been developed.

Initial scope and structure

Roughly sketch the overall scope and structure of the AIM at the outset to reduce the risk of excess detail and losing sight of what is important in the next parts of the process.

Initial scope and structure

- *Project scope*
- *Organisational properties*
- *Organisational resources and constraints*

Asset selection

The selection of the assets to be included in an asset register is one of the most fundamental decisions to be made. This section outlines factors that need to be considered.

Information purposes

Information purposes

Thinking about the main purposes for asset information in relation to OIR can help to clarify requirements at a broad level. Another approach that can help define requirements is to think about the main questions that the client needs answered for each purpose.

State the main purposes for asset information. These can include:

- *capacity and utilisation – information to identify the capacity and utilisation of spaces and building services for operational and strategic planning purposes;*
- *risk management – information required (or required to be suppressed) to support risk management, especially for identifying and reviewing risks to which an asset could be exposed, for example, natural hazards, extreme weather events or fire. This can include financial information such as replacement value for insurance purposes;*
- *impacts – information for monitoring impacts such as sustainability, energy efficiency, water usage and waste;*
- *operations – information needed to operate systems, equipment and products;*
- *maintenance and repair – information needed to maintain and repair systems, products and finishes; and*
- *replacement/upgrade – information needed to replace or upgrade key systems and products.*

Asset priorities

The assets in an asset register are best included in an order that approximates the order in which the data purpose categories are listed in '5.3.1 Information purposes'.

Asset group *List asset groups, in order of priority*	**Description**	**Elements**
E.g. Mission-critical systems	Elements or systems which, if they fail or inadequately perform, severely disrupt or compromise the core business functions of an asset	Electrical, communication, security and mechanical services, and back-up systems in buildings such as hospitals and airports

Criteria for assessing asset priorities

It is important to identify critical assets as well as critical failure modes. It is then possible to target and refine maintenance plans, capital expenditure plans and investigative activities in these critical areas. Critical assets are those where there are high consequences if they fail. The overall risk depends on both the probability and consequences of the event. To estimate the level of risk, organisations should determine:

- the consequences of the failure caused by the event;
- the probability of the failure of the asset; and
- the probability of the event occurring.

Criteria for assessing asset priorities

Establish the criteria and metrics to determine the criticality of the assets. Several methodologies – based on these metrics and other criteria – have been developed for setting priorities and making decisions about asset data. Documents describing these methodologies include:

- *AP-R577-18: Minimum levels of componentisation for road infrastructure assets –Austroads 2018;*
- *IPWEA PN3 Building and performance assessment guidelines; and*
- *Optimum decision making in asset management.*

Asset property selection

Once you have determined which assets will appear in the asset register, decide which data to include for each asset.

Asset property selection

Each asset in a register has several properties for which data can be provided, for example, manufacturer, model number, etc. For data to be meaningful, some properties must be included before others. Basic identification and location properties must be included before more detailed information is added.

Asset property types

Asset property types

Understanding the types of properties associated with assets provides an insight into their significance and helps to identify those that are most useful for a project or an organisation. The types of properties can be arranged roughly in order of precedence and specialisation.

Core data

Core data properties provide an essential foundation or framework for all other data. More detailed information about an asset cannot realistically be added until these data are in place. Core data can generally be entered early in the project, for example, in the design development stage.

General identification	Location	Parent system or assembly data	Classification data
Asset name	Floor ID (i.e. floor level), space ID or space name. The location data in the models and documents need to be updated to reflect the names and numbers shown on signage on site	Describes 'part-of' relationships between assets (e.g. a pump that is part of a chiller)	Describes 'type-of' relationships (e.g. a fan is a type of mechanical services product)

Product data

Product data properties provide basic product information about the asset. They are typically entered during the project's contract documentation and construction phases when the asset is specified and installed. These properties generally constitute record data that does not require frequent amendment or updating but which forms the foundation for more dynamic data needed for asset management/ facilities management activities after handover.

Manufacturer and supply data	Warranty data	Geometric and spatial data	Composition data	External reference data
Manufacturer name, product reference number or supplier name	Warranty end date, warranty duration (parts) or warranty duration (labour)	Spatial, area (for spaces/rooms), height, length, width or thickness (for products	Material, colour or finish	References to product data sheets or warranties included in a digital repository

Basic operation and maintenance (O&M) data

These properties support basic operation and maintenance (O&M) activities. They generally represent the initial data sets for systems and products entered after they have been installed and commissioned. They provide benchmarks or baselines for dynamic data that is routinely monitored and updated during an asset's operational phase.

Certification/ compliance data	Life cycle and maintenance data	Performance data	External reference data
Next certification inspection date or certificate identifier	Maintenance frequency, expected life or spares identification	Performance properties such as energy consumption, primary outputs, for example, litres/second flow or baseline commissioning properties	References to O&M manuals, etc. Included in a digital repository

Extended asset management/ facilities management use case data

These properties support extended asset management/facilities management use cases. This includes uses that require more extensive organisational resources and specialist expertise than are needed for basic O&M activities. They therefore need more careful evaluation.

Condition data	Financial data	Sustainability data	Logistics data
Condition assessment date, condition grade or defects	Such as replacement cost (actual cost may be different to insured value), asset accounting category or asset tax type. The date that cost values are assigned to assets should also be included.	Embodied carbon or post-consumer recycled content	Gross weight or shipping weight

Asset information model (AIM) structural integration

After selecting the assets and properties for inclusion in the asset register, finalise the structure of the AIM.

Decisions about the location, linking, formatting and hosting of asset data must be made. All of these must be considered together to optimise the system as a whole.

Data locations

Data locations

Criteria for assessing the appropriate location for data include the following:

- *the frequency the data will be accessed for reference and reporting purposes;*
- *the frequency the data will be updated;*
- *the speed at which the data will need to be accessed, particularly in emergency situations; and*
- *the data's criticality with reference to the main purposes identified for the data.*

Linking data

Linking data

After deciding to reference an item of information, various implementation options are available, depending on the platform and data format selected, including:

- *live links – when a user clicks on the link in the asset register, the relevant document or model view opens directly;*
- *addresses – the file path to the file that includes the required information is displayed in the asset register. The user must navigate to the location and open the file themselves; and*
- *no link/implicit link only – no link is displayed in the asset register; however, sufficient documentation (e.g. a user guide or an index) is provided elsewhere in the asset management system so the user can find the information when required. This option is only appropriate for very simple sets of asset information, or where it is expected that the user/s will quickly become sufficiently familiar with the locations of information to retrieve it readily when needed.*

Data schema selection

The schema selected for organising the asset data collected throughout the project will depend on how end users intend to use the data for everyday work tasks and what platforms they will use to host the data (e.g. CAFM system, spreadsheet). A data schema includes data standards, file formats, file types, naming conventions, relational linkages and units of measure.

The options, in order of preference, are listed below:

- to suit the CAFM system to be used – this reduces the need to translate data from other schemas (native/proprietary formats); and
- conforming to an open standard, such as IFC or COBie – this is preferred if a CAFM system has not been selected or if the client plans to outsource asset management to several service providers who may, or may not, have different systems. This option also makes sense if service providers are required to return updated data at a future date. Open standards have the advantage of being the product of expert collaboration over a period of time. They are usually well documented, readily available, supported by a community of users, and embodied in some applications, including those for automatically checking and validating data submissions.

Hosting platform

Some options to consider for a platform to host asset data include:

- the organisation's common data environment (CDE) maintained by the client after the completion of construction;
- the project's CDE developed and managed by the project delivery team (not preferred);
- an existing computer-aided facility management (CAFM) system;
- a CAFM system established for the project;
- a database of a type used by the client; and
- spreadsheets of varying degrees of sophistication.

All of the above options may be used by different members of the project team at different stages of the project. Provided the format of the data and the ultimate destination are decided at the outset (stage 1), it is relatively straightforward to transfer the data between platforms if sound classification and data schemas are known and used.

AIM accessibility

As well as optimising the integration of the AIM, it is important to make it readily accessible to its intended users. The VDAS recommends a simple 3D GIS interface as a useful resource to access asset data. Again, factors such as the organisational systems and resources available and the experience and expertise of asset management/facilities management personnel will determine the AIM's sophistication and the systems used to access it.

Integration of the AIM with the enterprise systems

Some types of information included within the AIM can be found in other enterprise systems (information management systems used by organisations). These include:

- financial management systems;
- supplier or customer relationship management (SRM or CRM) systems/contact databases;
- file or document management systems; and
- enterprise resource planning (ERP) systems.

Review and finalisation

After completion of the initial round of the asset information requirements (AIR) definition process, all decisions should be reviewed together and any necessary adjustments made. If necessary, the process should be repeated to produce a clear statement of requirements.

As-built models

Just as the physical asset is verified against the contract documentation, the AIM should also accurately mirror (to the defined level of information need) the physical asset delivered.

Although it is important that as-built models are accurate geometric representations of their real-world counterparts, the data that is accumulated during the design and construction phases of the project is probably excessive for asset management purposes.

This is why it is important to specify the actual asset information requirements to the delivery team in stage 1. The models produced by the design team and the models produced by the construction team should be verified and coordinated.

Creating as-built models

Various options are available for documenting a project in its final built form, each with different levels of accuracy, resourcing requirements and costs.

Creating as-built models

Specify the aspects of the documentation process that need to be considered, for example recording methods, processes for updating models, verification methods.

Recording as-built conditions

Recording as-built models

The options for including as-built conditions include the following methods:

- *visual confirmation only – photographs taken of building elements on site are visually compared to the construction BIM. This is used only when the exact position of the as-built elements is not critical or the return on investment (ROI) does not warrant anything additional;*
- *manual measurements are used to mark up the installation drawings which provide a reference for a CAD operator to manually update a construction model;*
- *progressive photographs of the construction site taken with a 360° digital camera are used as a reference to update a construction model, and*
- *progressive capture of 3D data (point clouds) of the construction site generated by a laser scanner is loaded into BIM authoring tools and is used to update a construction model. Laser scanners can range from inexpensive hand-held devices through to expensive tripod-mounted professional surveying equipment. The accuracy of scanners generally increases with cost.*

Updating as-built conditions

Regardless of the method used to capture as-built conditions, the process of using the information to update a model is usually a manual one. Even high-accuracy point clouds generated by laser scanners require a BIM modeller to model/update forms to match them. Some applications automate this process for some forms, such as uniform pipework runs, but, in most instances, the process is largely manual.

Updating as-built models

Owing to the effort involved, a clear business case for an as-built model needs to be established at the outset, and decisions need to be made about how closely this model must reflect the recorded information.

Verifying as-built models

Verifying as-built models

To be certain that a virtual model truly reflects the real-world reality after it has been updated with the information recorded, the two need to be compared. This process can range from a simple visual check by the person who has updated the model through to a formal reporting and review process by independent parties.

Deciding on as-built modelling requirements

A calibrated approach to modelling as-built conditions is required, not only as project requirements vary, but because millimetre accuracy is not required for every aspect of most projects.

Deciding on as-built modelling requirements

The following categories, arranged roughly in order of priority, may assist decision-making about where efforts are best directed:

- *in-ground items;*
- *embedded items;*
- *built-in items;*
- *items in difficult-to-access areas;*
- *complex intersections of elements;*
- *emergency or service-critical items; and*
- *business-crucial items.*

Arrangements for delivering as-built information

Arrangements for delivering as-built information must be agreed before construction work starts. Lack of accurate information can cause costly delays on future projects. Roles, responsibilities and procedures should be agreed and adequately resourced.

Maintaining as-built information

Accurate as-built information has little ongoing value if it is not updated as changes are inevitably made to an asset, so resources and systems need to be put in place for its management and maintenance. This is a common failing among asset-owning organisations.

Maintaining as-built information

For example, to ensure long-term access to as-built information, models should be saved as IFC files.

Models for asset management/facilities management (AM/FM)

Models created during the design and construction phases of a project contain much information that is not particularly relevant to an asset or facility manager, but which presents an obstacle to finding required information. A purpose-made asset management/facilities management model is derived primarily from the as-built model with only the relevant asset information either retained or transferred into the CMMS.

Asset information model (AIM) documents

This section provides a broad outline of requirements for project documents and examines some options for linking them to the other elements of the asset information requirements (AIM): asset data and virtual 3D models.

Existing handover documentation expectations

Several established documentation deliverables relevant to asset management should be part of any construction contract.

Existing handover documentation expectations

Most NATSPEC worksections specify documents that must be submitted as part of the work that they cover. The types of documents covered include:

- *record drawings;*
- *operation and maintenance (O&M) manuals; and*
- *emergency information manuals.*

Additional handover documentation for asset management/facilities management

The NATSPEC National BIM guide, 'Section 10.10: Final BIM deliverables' outlines requirements for models and files, as well as for documents. It includes requirements for files in several formats and printed copies of documents.

Additional handover documentation for asset management/facilities management

Specify additional requirements that should be considered to be effective for asset management/facilities management purposes, for example authority approvals, basis for design information, user guide, technical guide.

Delivery format

All documents outlined must be delivered in an organised, integrated form. They should be incorporated in a digital information container, such as a cloud-based or compressed file folder.

Information container structure

Information container structure

A typical information container structure comprises the following components:

- *guide to container contents including an index and explanation of any classification systems or file-naming and document-naming conventions used;*
- *user guide;*
- *technical guide; and*
- *hierarchically arranged folders holding documents, drawings and models.*

Conventions for file and document naming

To assist with document retrieval, a naming standard for files and documents should be specified at the beginning of the project for adoption by all members of the project team. If the client does not specify a standard, use an international or national standard.

Linking to other elements of the asset information requirements (AIM)

Linking data can significantly increase their value. However, linking also requires a more considered approach to assembling the data and more sophisticated management afterwards. Decisions need to be made about what data should be linked and the nature of the links.

Next steps

When the AIR has been defined, decisions need to be made about the requirements for its delivery, which lie beyond the scope of this guide.

Useful references

Further information that will assist in the implementation of effective AM/FM practices can be found in the following documents:

ISO 55000:2014 *Asset management – overview, principles and terminology*

ISO 55001:2014 *Asset management – management systems – requirements*

ISO 55002:2014 *Asset management – management systems – guidelines for the application of ISO 55001*

ASTM *Standards for asset management*: Standards on a wide range of asset management topics from the American Society for Testing and Materials (ASTM)

AMBoK Publication 000: *Framework for asset management* – Asset Management Council (AMC) 2014

AMBoK Publication 001: *Companion guide to ISO 55001* – Asset Management Council (AMC) 2014

AGAM01-18: *Guide to asset management* – Austroads 2018

International infrastructure management manual (IIMM) – Institute of Public Works Engineering, Australasia (IPWEA) 2015

The asset management landscape – Global Forum on Maintenance and Asset Management

Asset management maturity scale and guidance, Version 1.1 – Institute of Asset Management

Asset management accountability framework – State of Victoria, Department of Treasury and Finance

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Australasian BIM Advisory Board – *Asset information requirements guide* www.abab.net.au/projects/

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Accessibility
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