AUSTRALIA AND NEW ZEALAND
GUIDE TO ISO 19650

ISO 19650 – Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling.

ACKNOWLEDGEMENTS

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FOREWORD

In the ANZ region and across the world, BIM is being actively implemented by organisations seeking to improve information management practices. The main focus has been on improving design and construction processes, however, collectively the industry has failed to exploit BIM's key value proposition, namely how to enhance information management practices for the ultimate asset owner.

Since the early 2000's, the ANZ construction industry has adopted and adapted many BIM principles from elsewhere, developing their own approaches. Whilst these approaches have supported the early adopters of BIM they have also caused some confusion with different terminology and techniques. To accelerate the adoption of BIM and better information management practices in ANZ, simple guidance for practitioners is essential - hence this Guide.

PAS1192-2 and ISO 19650 - How do they differ?
No attempt has been made to compare ISO 19650 with PAS 1192-2 as the document PD 19650-0:2019 Transition guidance to BS EN ISO 19650, available from the BSI Group covers this transition. Those more familiar with either ISO 19650 or the UK PAS 1192 series of documents, may still find this Guide useful.

The volunteer authors of this Guide are passionate about information management using BIM processes. Our goal in creating this Guide is to support the adoption of the ISO 19650 series. However, by their very nature, International Standards distil content on their subject matter down to the bare essentials. They state the requirements as succinctly and unambiguously as possible in a strictly defined format to facilitate international adoption. As many countries have to agree on the terminology used, this can lead to the inclusion of terms for some items that appear unfamiliar in a local context. This typically makes them more difficult to read, particularly for a reader new to the subject. This Guide aims to reduce some of that confusion by highlighting in italics where a term is taken from ISO 19650, as demonstrated in the following sentence.

"Information requirements must support the organisational business decision-making process (*key decision points*) in step with project stages and align to operational uses of asset information at critical asset *trigger events* (commissioning, planned maintenance, failure, decommissioning etc)."

Our goal is to pique your interest in ISO 19650, so you can continue to expand your knowledge in the subject matter, can collaborate with others using the same terms and approaches and so that, collectively, we can improve the ANZ construction industry we enjoy working in. The purpose of this Guide is to explain the high-level concepts and principles found in ISO 19650 in terms more readily understood by people in our region. The central section of this Guide follows the same parts, section headings and subheadings structure as the Standards.

DOCUMENT COLOUR LEGEND

| ANZ GUIDE | ISO 19650-1 | ISO 19650-2 | IN DEVELOPMENT | ISO 19650-5 |
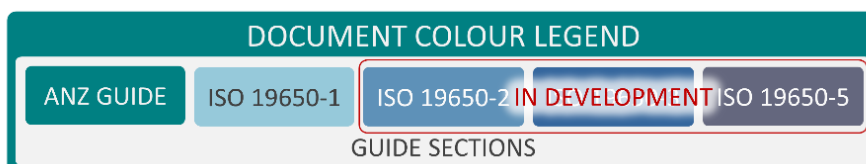
GUIDE SECTIONS

This format allows this Guide to act as a companion document to ISO 19650-1. As such, sections can be easily referenced between the two documents. Our goal is to continue to develop this Guide when future parts to the ISO 19650 series are released.

It should be noted that this Guide is not intended to be a replacement for the Standards. ISO 19650-2 in particular describes the requirements and approach for implementing ISO 19650-1 concepts and principles on a project in a "step by step" fashion, aligned to project delivery stages.

The authors have purposely developed this Guide as a section by section companion document to enable the ANZ construction industry to become more familiar with the approaches, processes and terminology described, predominately in ISO 19650-1. We strongly encourage readers to purchase ISO 19650, as this Guide does not attempt to recreate all the detail found in these Standards.

Our aim is to make it easier to understand (at a high level) the benefits of using ISO 19650 and how it relates to other Standards such as ISO 9001, ISO 41000, ISO 55000, ISO 21500, ISO 16739-1:2018 and ISO 22263.

One of the core elements in the BIM value proposition is defining the operator/ owner's *Asset Information Requirements*, allowing the project delivery team to align their efforts. Information can then be effectively planned and managed to enable collaborative project delivery practices and so that it can then be structured to support ongoing asset management practices.

HOW TO ACCESS ISO 19650-1 AND ISO 19650-2

SAI Global distributes all ISO Standards in ANZ, with access generally on an organisational basis:

ISO 19650 - Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling

Part 1: Concepts and principles
Part 2: Delivery phase of the assets

Please check with your standards coordinator as it will be essential to read this Guide as a companion to the Standard.

A NOTE ON EXISTING ANZ BIM DOCUMENTS AND APPROACHES

To assist the reader, we have included links embedded within this Guide to the many previously developed ANZ BIM documents. We note that many of these documents need to be "brought up to speed" with the ISO 19650 series in terms of the language and terms used. We hope with the introduction of the ISO 19650 series, authors of those existing ANZ documents will realign them to the ISO 19650 approach in the near term.

BS 1192:2007+A2:2016 and PAS 1192-2 (which some ANZ projects and clients have adopted) have now been withdrawn. *Appointing parties* need to consider the impact of applying the ISO 19650 series to their existing and future projects. All projects that are transitioning from the PAS 1192 suite to the ISO 19650 series should refer to PD 19650-0:2019 Transition Guidance to BS EN ISO 19650.

CONTENTS

THE ANZ GUIDE TO ISO 19650

INTRODUCTION

Built assets are a key part of modern life; from your home, to your work and to your transportation networks. When creating, extending or refurbishing built assets, the whole project (delivery) team has the core responsibility of delivering them on time, within budget, and to the required level of quality.

The built environment is a fundamental expression of civilisation. It is founded on the effective management of asset and project information. Across the asset's lifecycle, many stakeholders (referred to in the Standards as *actors*) will contribute to its creation and maintenance. *Actors* have an obligation to understand where the asset is located within its lifecycle, alongside the data, decisions, objectives, and operating context that created the need for the asset in the first place.

The scale of potential benefits offered by the adoption of ISO 19650 should not be underestimated. The current level of infrastructure spending in ANZ is significant and the built environment is becoming increasingly sophisticated, involving automation, the Internet of Things and smart, integrated cities. Projects are becoming increasingly more complex and demanding.

Reliable information and effective information management have always been fundamental to the success of construction projects. Clients expect professional service providers to manage this information appropriately prior to its handover back to the operator. Digital technology-based practices such as BIM and, more broadly, Digital Engineering (DE), are powerful collaborative processes that can facilitate information management, with the potential to revolutionise the procurement and management of the built environment.

The construction process usually involves very large and often fluctuating groups of people working together over extended periods of time. Regardless of how wonderful the technologies are that are at their disposal, social and cultural factors will typically determine how smoothly and effectively this process runs in practice. This includes, for example, everyone having a clear understanding of the overall information management process over the lifecycle of the asset, and the part they play in that process. This is the real value of ISO 19650 – it provides a common framework for collaboration, communication and managing the exchange of all information between all actors over the project delivery lifecycle whilst facilitating good information handover practices.
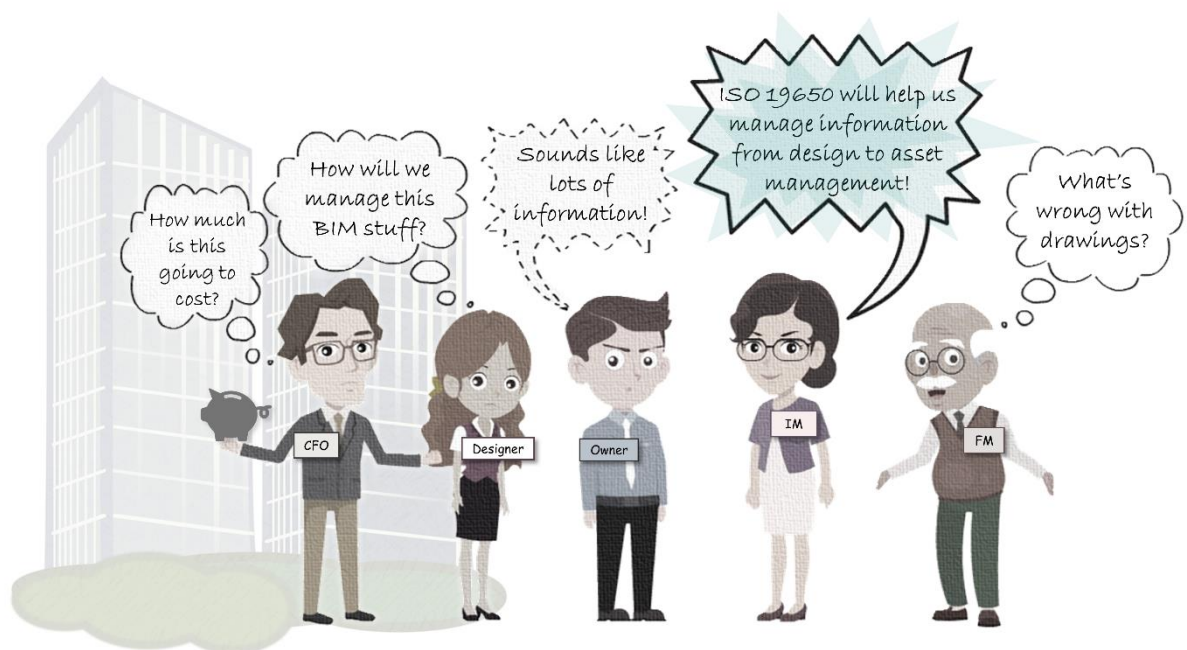

Figure 1: How ISO 19650 can help align project parties differing expectations

Operating in a silo, with disregard to future actors and long-term asset information management, results in a waste of valuable resources. This is also true when working in a project *delivery team*. Collaborative production of information is at the core of BIM and facilitates a shared knowledge resource for the entire delivery team, which ultimately supports the asset owner/operator. The result is greater confidence in the information, reduced risk and better project outcomes. However, we are regularly presented with news of large projects running massively over time and over budget – we have a responsibility to future generations to do better!

Whilst applying ISO 19650 on individual projects would certainly be beneficial, the most substantial benefits will only be realised when embraced and widely adopted by clients and industry alike. The effort individuals or organisations need to invest, changing their current ways of working and aligning with ISO 19650, is easier to justify if the bigger picture is appreciated. Whilst there could be some costs involved to implement the processes defined in the ISO 19650 series, the benefits of having ready access to information, reducing rework, can be significant.

ISO 19650 series focuses the scope of responsibility for information management processes for project delivery and handover back to the asset owner and/or operator. On ANZ projects to date, this has been a challenge as the information management scope is not typically defined clearly. This leads to assumptions as to who manages the information management processes and often results in unstructured data and missed opportunities to efficiently design, construct and operate a built asset.

Information management as a defined function is typically overlooked as part of a specific contract. ISO 19650 highlights the need for the *appointing parties* to eliminate these issues and fulfil the potential benefits BIM has promised for all *actors* through the entire lifecycle of a built asset.

ADVANTAGES OF WIDESPREAD UNDERSTANDING AND IMPLEMENTATION OF ISO 19650

INDUSTRY

- There are still wide variations in knowledge of BIM, particularly about implementing it on projects – ISO 19650 provides a valuable overall framework for BIM practice.
- ISO 19650, being developed through consensus by international experts, and representing current best practice, gives *actors* greater confidence to invest in industry initiatives such as education, training and accreditation programs based on it.

PROJECTS

- Less time spent at project inception on reinventing the wheel: agreeing information management approaches, procedures, standards, roles and responsibilities, etc.
- Everyone can get on with the job quicker and with greater certainty.

CLIENTS

- The ability to define the asset information requirements for their assets prior to engaging any delivery team.
- Improved briefing of those generating information (the delivery team) to suit the organisational needs of their business.
- Reduced risks, as the most appropriate party is charged with capturing and managing the information aligned to their role on the project (e.g. contractors providing as-built information).

ORGANISATIONS

- Accreditation programs based on ISO 19650 will give *actors* a consistent means of assessing the capabilities of candidates for employment and projects, giving fairer, more reliable results.
- The stability and certainty International Standards represent give owners the confidence to invest in office systems and staff training programs based on them.
- Less time required by new staff to familiarise themselves with information management processes and procedures based on ISO 19650 than unique internal Standards. Less time and effort will need to be devoted to induction procedures, allowing them to become productive sooner.

ISO 19650-1 AND ISO 19650-2 – WHERE DID THEY COME FROM?

ISO 19650-1 introduces the underlying concepts and principles for ISO 19650-2, which is an adaptation of the British Publicly Available Standard (PAS 1192-2). However, the Standard's evolution can be traced much further back than this.as shown in Figure 2.
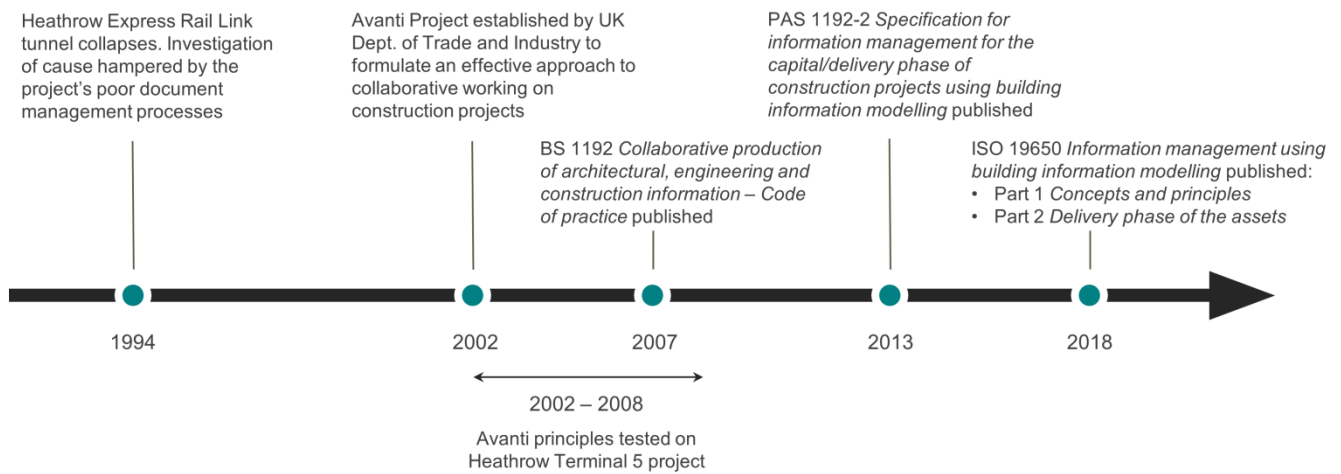
Heathrow Express Rail Link tunnel collapses. Investigation of cause hampered by the project's poor document management processes

Avanti Project established by UK Dept. of Trade and Industry to formulate an effective approach to collaborative working on construction projects

PAS 1192-2 *Specification for information management for the capital/delivery phase of construction projects using building information modelling* published

BS 1192 *Collaborative production of architectural, engineering and construction information – Code of practice* published

ISO 19650 *Information management using building information modelling* published:
• Part 1 *Concepts and principles*
• Part 2 *Delivery phase of the assets*

1994   2002   2007   2013   2018

2002 – 2008
Avanti principles tested on Heathrow Terminal 5 project

Figure 2: Timeline

Locally, there have been numerous studies going back decades, including the Queensland chapter of Engineers Australia - Getting it Right the First Time[1]. These have identified the significant costs incurred by poor documentation, coordination and information management practices. The use of BIM and other information management tools and processes aims to improve these issues.

APPLYING ISO 19650 TO PROJECTS AND ASSETS

In an industry that has long become used to working without a unifying framework for specifying information management requirements, adoption of ISO 19650 could well be seen as an imposition. These concerns should be put in perspective.

ISO 19650 requirements are very general and by nature aren't normative. Within the framework, ISO 19650-2 describes the considerable latitude available for accommodating the specific requirements of individual projects and organisations alike. The Standard itself recognises this and in fact calls on those applying it to tailor their information requirements approach to suit their organisational information needs and the information requirements of each project.

ISO 19650 (nor this Guide) is not a one-size-fits-all solution to information management on projects and assets. It requires all *actors* to take responsibility for their part in the process. One party is not able to specify "this project is to be delivered in BIM to LOD 300" or "information management is to be in conformance with ISO 19650" and expect that that is the end of their involvement. In fact, these types of approaches are unhelpful and often cause more confusion for the delivery team and asset operators alike.

SUMMARY AND NEXT STEPS

ISO 19650 is transforming the global construction industry by providing a unified framework to enable regional and cross border collaboration. It provides an internationally recognised way of developing and managing asset information through project delivery to support operational needs.

In that context, if ISO 19650 goes some way in assisting the organisations that request BIM within the ANZ construction industry, it will be a great step forward for information management and more broadly for BIM in the region.

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1   https://mqia.com/wp-content/uploads/2017/06/Getting-it-Right-First-Time.pdf

Below are some salient points to consider as you or your organisation starts to implement the principles and approaches of ISO 19650 on projects:

- **Get familiar with the terminology used, then try to incorporate those terms in your approach/documentation. The more we can collective "speak" the same language the better.**
- **Comprehend and implement the management and flow of information in ISO 19650-2.**
- **Consider how ISO 19650 can complement current practices within your organisation.**
- **Consider how ISO 19650 may scale, appropriate to your projects.**
- **Information management is a key function of project delivery. Once a capital solution is preferred, the *appointing party* needs to include a specialist Information Manager as soon as possible.**
- **The use of a structured *Common Data Environment* which allows automation of processes is a key tenet of ISO 19650.**

CONSIDER THE IMPACT OF ISO 19650 BEYOND YOUR ORGANISATION

Does your *appointing party* include ISO 19650 in their requirements?

- No, your *appointing party* is not yet working to ISO 19650:
  - Can your organisation highlight some previous benefits you've had using ISO 19650 approaches to the *appointing party*?
  - Suggest some elements that could be implemented (for example, BIM, CDE, an information management function) to improve information quality.
  - Can 2D documentation be reduced and more emphasis placed on using BIM and associated data for decision making?
- Yes, your *appointing party* is working to ISO 19650:
  - What are the information management processes for the project?
  - Are the appropriate *delivery team* members creating the right information applicable to their function?
  - Who will federate the information containers and provide the information management function on the *appointing party* side?
  - How will third party reliance and intellectual property issues be actioned?

With an international standard such as ISO 19650, it is up to your organisation's leadership to determine the applicability and implementation timeline for the business.

With ISO 19650, the onus is on the ANZ construction industry and its clients to undertake better information management through accountability, trust and collaboration. The use of BIM and more broadly Digital Engineering approaches, are just some of the means to support that collaboration.

We hope you will find the following section by section guidance to ISO 19650 useful.

AUSTRALIA AND NEW ZEALAND
GUIDE TO ISO 19650
PART 1

ISO 19650 – Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling.

Part 1: Concepts and principles

ISO 19650-1 GUIDANCE

1. SCOPE

This section addresses ISO 19650-1's outline of relevant concepts and principles, and provides a framework for information management. It applies to all phases of the asset lifecycle and can be adapted to projects of any scale and complexity. It accounts for a range of procurement, contracting, and contextual situations.

2. NORMATIVE REFERENCES

This section is intentionally blank.

3. TERMS AND DEFINITIONS

ISO 19650 introduces a series of new terms, not typically used in the ANZ construction or asset management sectors. The terms and definitions are clearly defined in the Standards and may also be searched online at the ISO Online Browsing Platform (OBP) – https://www.iso.org/obp/ui.

4. ASSET AND PROJECT INFORMATION, PERSPECTIVES AND COLLABORATIVE WORKING

Defining the when, why, who, and how is critical

The purpose of a project is to create an asset of value. To create that value, it is imperative to understand what is valued and the information to support the value creation. This is a key tenet of ISO 55000 series and the ISO 19650 series. Across the asset lifecycle, asset information and project information are inextricably linked. ISO 55000 sets out key factors to consider to enable organisational success, namely:

- the nature and purpose of the organisation;
- the operating context;
- financial constraints and regulatory requirements; and
- the needs and expectations of the organisation and its *actors*.

All of these factors are best defined, articulated, and managed by the 'asset owner'. It is the asset owner's responsibility to ensure that this information is correctly managed in an *Asset Information Model* and appropriately conveyed to *actors* when they are engaged to create a *Project Information Model*. This includes those that are contracted or subcontracted by the asset owner or *appointing party*.

For example, the Victorian Government is the 'ultimate' asset owner for transport assets. Metro Trains Melbourne (MTM), on behalf of Metro Trains, is contracted by the State to operate, maintain, define, run, invest, deal with complaints, etc. by the State. In this case, MTM has been allocated the responsibility to define *Organisational Information Requirements, Project Information Requirements* and *Exchange Information Requirements*, for these State-owned assets.
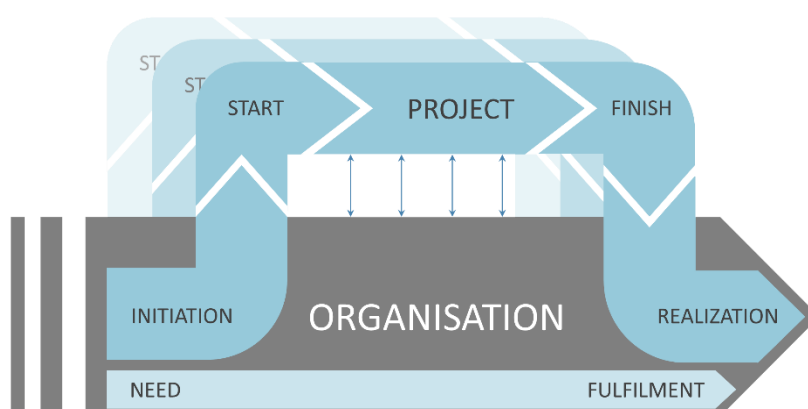
The Asset-Project bond

Figure 3: The asset – project bond
(Based on Figure 1.1 from the Guide to ISO 21500:2012)

The relationship between a project, an organisation's assets, and the organisational information needs is critical. It is a tripartite relationship that must be understood, as without:

- Clear direction to a capital project investment, an organisation cannot grow or deliver value;
- A clear understanding of what function the project is attempting to serve, a project will have ambiguous objectives and scope; and
- Functioning and valuable assets, an organisation fails to remain relevant.

As seen above, the Asset-Project bond is interdependent - one cannot survive without the other. This emphasises the value and importance of correctly specifying the *Level of Information Need* and the relevant information requirements for both project delivery and asset management purposes. This will ensure information management throughout the project and asset lifecycle is achieved by both project *actors* (designers and contractors) and asset *actors* (operators and maintainers).

The *appointing party*, *lead appointed party* and all *appointed parties* need to work collaboratively with the ultimate asset owner to create, manage and produce information to suit the long-term operation of the asset.

Project information, received early, is valuable

Figure 4: Information need

Information needed to operate the future asset is created throughout the project lifecycle - one value of BIM is the integrity of *information container* transfers.

Existing information and data is critical at early phases of a project's life cycle. Aggregated data is the basis of information, and information underpins effective decision making.

> "*It is the absence of information at an early stage that often causes large changes during project delivery, which drive variations and contract changes.*"

In practice it can be difficult when an *appointing party*, such as a developer, may have little long term interest in the operation of the asset or when the operational *actors* are not engaged at the beginning of the project information creation. To mitigate some of these risks, information should be developed by the *Delivery Team* to satisfy the *Project Information Requirements* described at project inception. If, during the course of delivery, a greater level of information is then sought, a commercial decision can be made about the cost/benefit of generating information to a new requirement.

Things change - allow for it, adapt to it and understand it

The information that is needed now may not be the same information that is needed in the future. Further, it is likely the information that is needed in the future will be required by someone else other than you. In some circumstances, this means you'll be making decisions about requirements of information for a task that may not exist yet on behalf of someone you don't know.

It is for this reason, that clarity should be provided at an organisational level by way of the *organisational information requirements (OIR)* and *asset information requirements (AIR)*. ISO 19650-1 sets out a framework for how that organisational alignment is reached. More information on this is provided below.
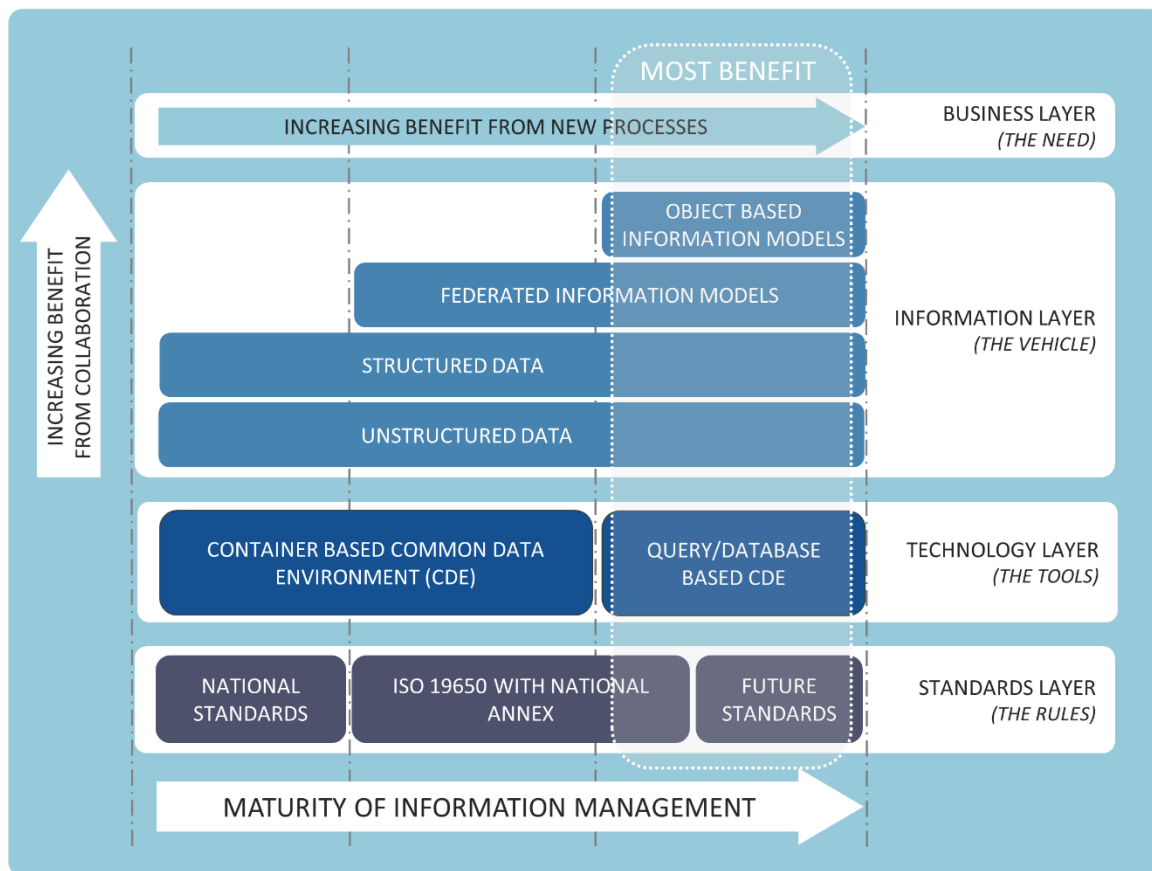

Figure 5: Maturity of information management
(Based on Figure 1 from ISO 19650-1:2018)

When considering the maturity of information management, many different information management perspectives are required, namely:

- **Business layer** = the "need";
- **Information layer** = the "vehicle", the conduits that solve the "need";
- **Technology layer** = tools, frameworks, systems, IT, to produce, capture and audit the quality of the information later;
- **Standards layer** = "the ways of working" the "rules" as to how the technology layer will operate;
- X-axis is a function of maturity, whereby new entrants to 19650 are looking towards enhanced organisational maturity in business, information, technology, and standards; and
- The more layers that integrate/coexist/are managed and can communicate, the more benefits for the business.

To increase collaboration and clarify the information requirements early on in the project lifecycle, ISO 19650-1 recommends a suite of key documents, which are further explained in Section 5.

5.   DEFINITION OF INFORMATION REQUIREMENTS AND RESULTING INFORMATION MODELS

By starting with the end in mind, such as the organisational and asset information management requirements, and considering the intended uses of information during project creation, will improve each *appointed party's* understanding of the information they are responsible for and what information other parties will be leveraging and creating.

Prior to engaging external parties, the *appointing party* shall understand:
- the *Level of Information Need* for each information deliverable,
- the value of it (and the likely costs to create it),
- when information is to be developed,
- who and how information will be managed;
- when it is to be delivered,
- by whom, and
- in what formats

Typically, this is documented in the *Organisational Information Requirements* (or business requirements) and will include a series of internally facing documents enabling effective business operations and management. The *Asset Information Requirements* (e.g. asset register), *Project Information Requirements* (defined by project stages) and *Exchange Information Requirements* (at defined trigger events) need to support these overall *Organisational Information Requirements*.

This means that when a specific *Project Information Model* is created, it will conform to the *Level of Information Need* of the organisation at defined project stages and that it will ultimately suit integration with the overall *Asset Information Model* (see Figure 6).
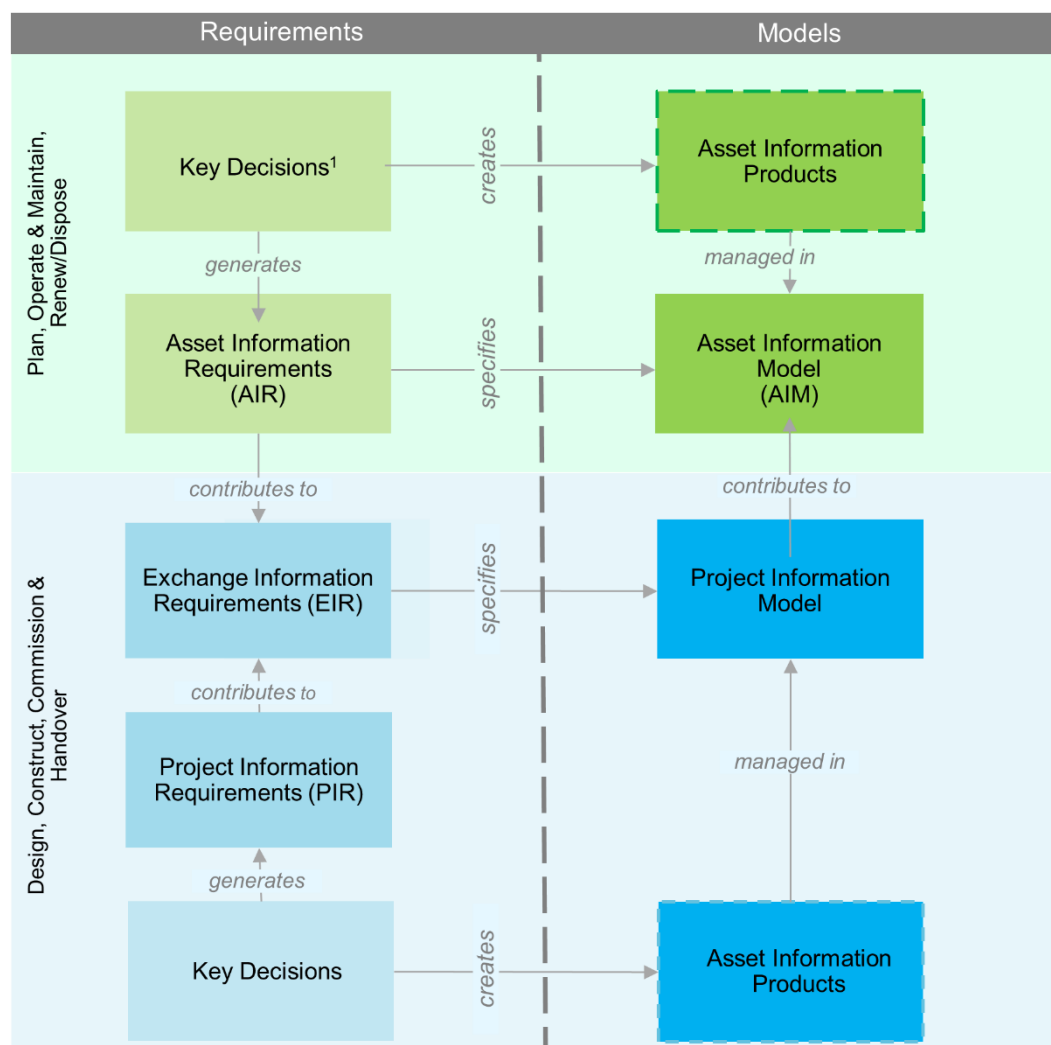

Figure 6: Information flows
(Supplied by Better AIM - https://www.betteraim.com.au/)

INFORMATION REQUIREMENTS AND INFORMATION MODELS

OIR
Key Decisions represent the **Organisations Information Requirements** and help in prioritising information improvements

AIR
Asset Information Requirements represent the Asset Information Products needed for Key Decision making in the O&M phase

PIR
Project Information Requirements represent the Asset Information Products required by Key Decisions making in the Acquisition phase

EIR
Exchange Information Requirements represent the Asset Information Products required by Key Decisions in the both the acquisition & O&M phase

It is critical that these information requirements form part of the appointment documentation when appointing external parties (see Figure 6). Information requirements can (and should) cascade to the most appropriate *appointed party* within a *delivery team* that has the domain expertise to produce the information.

Information requirements must support the organisational business decision-making process (*key decision points*) in step with project stages. They must also align to operational uses of asset information at critical *asset trigger* events (commissioning, planned maintenance, failure, decommissioning etc). This information will support asset selection, operational performance, security, environmental impacts, risk management and the broader regulatory requirements governing the organisation.

This gives the *delivery team* a significantly greater understanding of the responsibilities for information management and enables the appropriate *appointed party* to create and manage information related to their scope of the project.
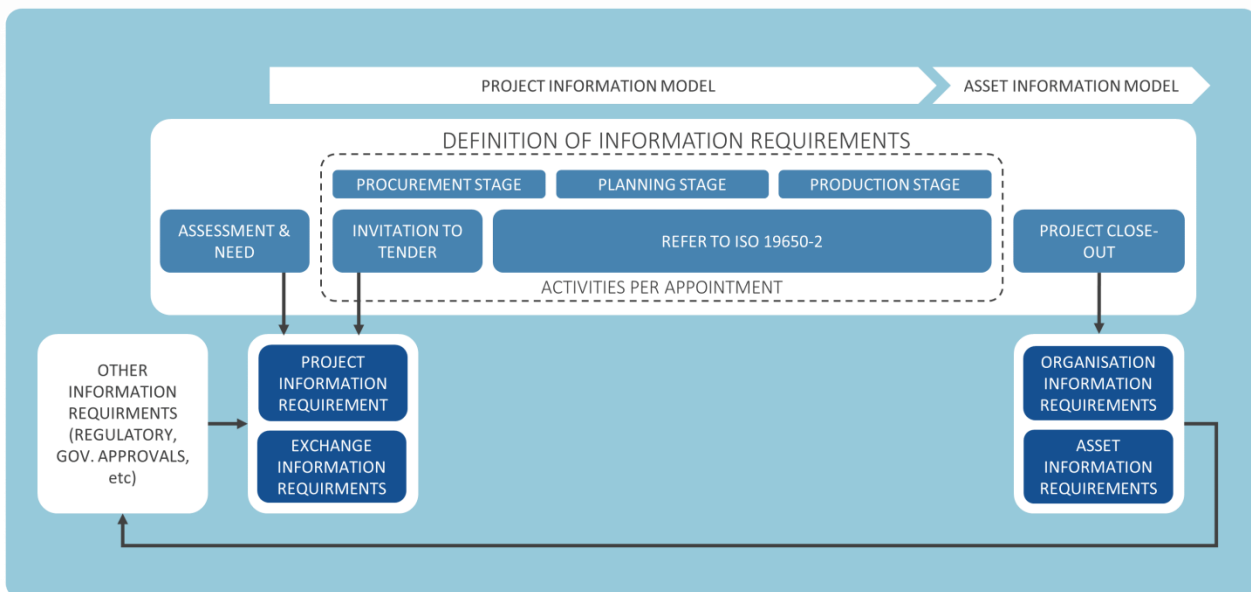

Figure 7: Information requirements informing the PIM and AIM

6. THE INFORMATION DELIVERY CYCLE

This section outlines four key principles for the specification and delivery of project and asset information:
- Information is used throughout all stages of the asset life cycle to inform decision making;
- Information is specified, produced, and delivered progressively;
- The most relevant party should be responsible for creating and managing the information related to their scope and should have access to the information requirements;
- Information will be subject to collaboration and be exchanged in open formats through the use of a *Common Data Environment*.
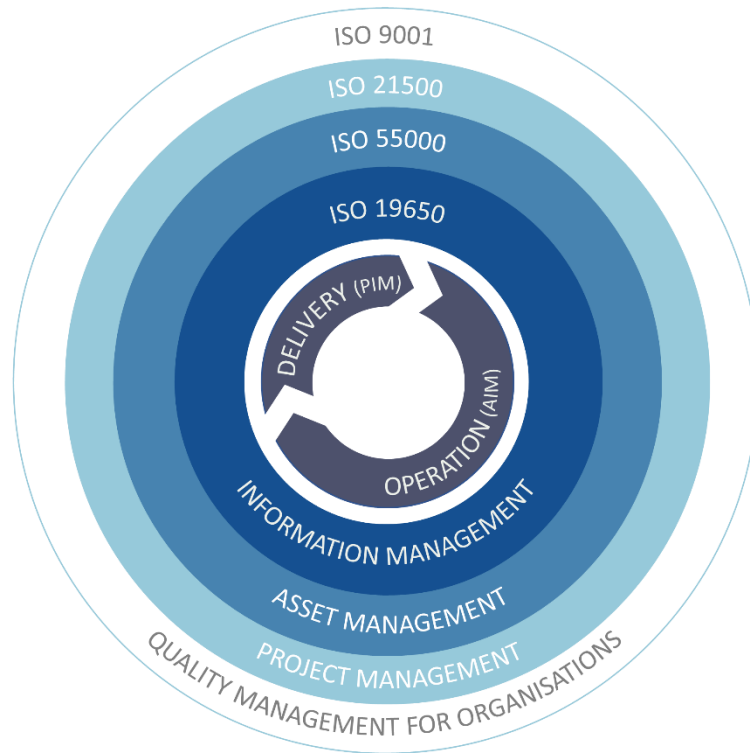
Alignment with the asset life cycle

Figure 8: Context of Standards

ISO 19650 operates within the wider context of an asset management system, such as the one described in the ISO 55000 Asset Management Standard. ISO 19650-1 Section 6.2 highlights key principles from both ISO 55000 and ISO 9001 and clarifies the relationship with other standards, as shown in the figure above.

Note: *The Asset Information Model* and *Project Information Model* progressively develop as information is produced. The *Project Information Model* may contain extra engineering or differing information than what is needed to efficiently operate and maintain the asset (i.e. not specified as a requirement in the *Project Information Requirements* or *Exchange Information Requirements*). In that case, some of the delivery phase information may be archived as the *Project Information Model* transfers information into the *Asset Information Model*. For example, fabrication models may be useful for future renovation use but would be inappropriate in an *Asset Information Model* or in asset management systems.

Setting information requirements and planning for information delivery
In Australia and New Zealand, documents such as the NATSPEC BIM Brief and NZ BIM Handbook Project BIM Brief give good guidance to *appointing parties* as to the types of information needed to support the implementation of BIM for a project (i.e. *Project Information Requirements*). ISO 19650 also reiterates these points below.
- The *appointing party* specifies their information requirements within a brief – the *Project Information Requirements*.
- A potential *lead appointed party* is required to respond. Their response should include how they (and any other proposed *delivery team members*) agree to meet the information requirements, developing a draft *BIM Execution Plan* (pre-award) document.
- The *appointing party* would then validate and confirm acceptance of the proposed approach, engaging the preferred *lead appointing party* and finalising the *BIM Execution Plan*.

These information delivery plans should be created every time a new *lead appointed party* is proposed for a new project. The planning to create a *Project Information Model* for integration with an *Asset Information Model* broadly follows these steps.
- State what you want, (i.e. the *Asset Information Requirements* and *Project Information Requirements*).
- Plan how to deliver, (i.e. the delivery plans - *BIM Execution Plan* etc).
- Deliver it (i.e. design, construct or acquire it).
- Approve it (i.e. approve the project and asset information).

The delivery cycle happens multiple times. It is an iterative information delivery process. ISO 19650-1 and 2 provide mechanisms for information updates throughout delivery, with feedback loops to review and revise the information

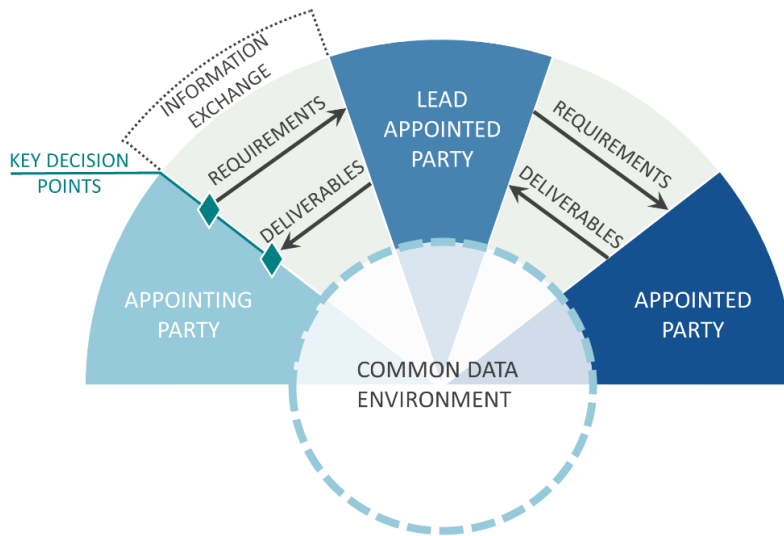## Delivery team provides information for asset owner/operator or client decisions

Figure 9: Information flow between parties

The iterative information delivery process occurs throughout delivery stages and is performed by some or all of the *appointed parties*. What is important is that the key decision points are documented by the *appointing party* in the *Project Information Requirements*, and the *delivery team* is aware of the level of information needed to support these key decisions. This enables the *delivery team* to appropriately scope and cost the project.

Historically this has been a problem in ANZ when the *appointing party* has not adequately defined the information requirements to a detailed level i.e. "The project is to be delivered in BIM, to LOD 500"

> **The importance of information: ISO 19650 is providing a framework that allows for the delivery of the right information, at the right time, to the right *actors*.**

Information verification and validation at start and end of project stages
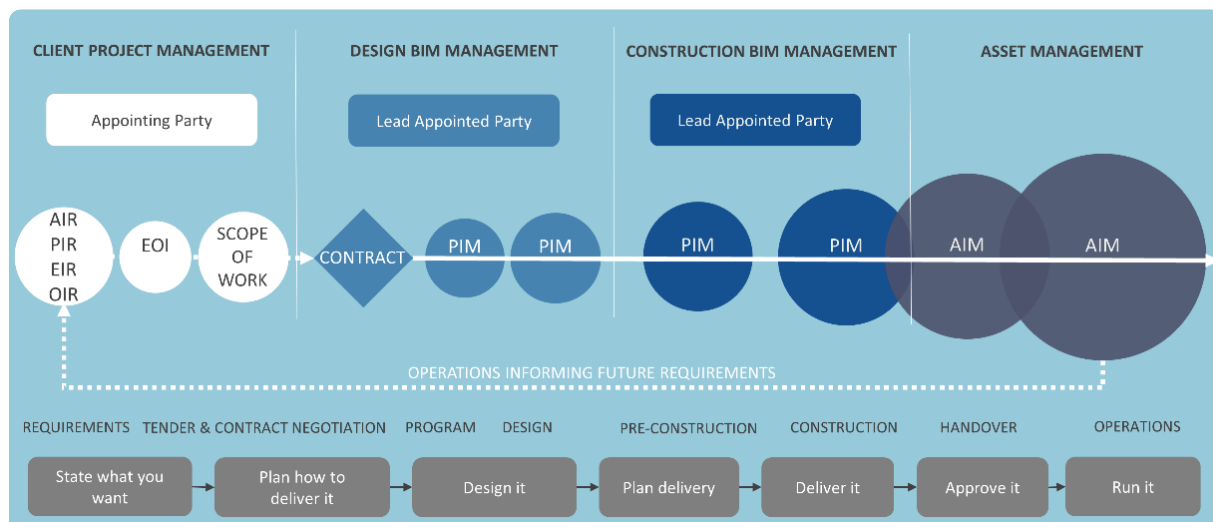

Figure 10: The progressive development of the PIM into the AIM using the ISO 19650 approach

It is critical to have strong knowledge of asset management operations and that this information flows into the *Organisation Information Requirements* and *Asset Information Requirements*, which in turn inform *the Project Information Requirements* and *Exchange Information Requirements*. Failure to define and express these requirements will most certainly result in change orders, delays in handover, delays in commissioning, inefficiency in operations and maintenance.

As soon as a capital solution to the asset is agreed, these requirements need to be included within the EOI/Tender stage and prior to any new parties joining the delivery team. Equally the *delivery team* needs to define their approach to these documents in delivery plans. In ANZ the following documents provide guidance on this:

- Australia NATSPEC BIM Guide
- New Zealand the BIM Handbook
- AIQS and NZIQS

Information is drawn from the whole delivery team
It is important that the most appropriate party within the delivery team creates a *Task Information Delivery Plan* for their tasks. This collectively should be rolled up into a *Master Information Delivery Plan* and all the proposed *delivery team* contributes to the creation of the other information delivery plans (particularly the *BIM Execution Plan* and *Model Content Plan*) This is especially true when new parties join the delivery team once the project has begun. ISO 19650-2 Section 5.4.4, 5.4.5 and 5.4.6 cover this detail.

Summary of information delivery from project and asset delivery teams
The procurement approach plays a major role in determining how information flows (i.e. how it is cyclically specified, captured, delivered and updated) both in project delivery and operational phases. ISO 19650-1 Figure 9 explains this in detail.

The asset information handover process needs to be well documented and represented in contractual terms to minimise the risk of poor information delivery at this crucial stage. The delivery phase is nested within the confines of asset and project management. If the *Project Information Requirements* or project management is lacking, it will be problematic to deliver the *Project Information Model* in a valuable and meaningful way.

7. PROJECT AND ASSET INFORMATION MANAGEMENT FUNCTIONS
The principles of this section aim to provide clarification of functions and responsibilities, in relation to effective information management. Functions should be embedded into appointments (e.g. model responsibility matrix (LOD) and/or Model Content Plan) and are not to be confused with job titles or design/construction/project management etc. responsibilities. Information management functions should be assigned proportionally to the scale and complexity of a project. ISO 19650-2 Section 4 & 5 go into great detail on the functions, responsibilities and processes that can be employed for many of the asset lifecycle stages.

This section of the standard also defines three information management functions, relating to:
- Asset information management functions
- Project information management functions
- Task information management functions

Asset Information Requirements will vary in complexity based on the asset's operational requirements. It is almost certain that information requirements will need to be addressed by a variety of organisations and individuals at different stages of project delivery. Therefore, succession and handover planning are to be properly addressed at the start of the project, especially if it is known that parties will change during delivery.

Project information management should be clearly defined as soon as practical as a part of the procurement method and be driven by the *appointing party*. Large delivery teams will need to subdivide information management functions and tasks to those most appropriate to manage/deliver them. It is critical to clearly define tasks in detail at the time of appointment to avoid dispute and cost overruns.

8.   DELIVERY TEAM CAPABILITY AND CAPACITY

Competency refers to the fulfillment of information requirement obligations in the production of deliverables, with regard to the ability to perform and complete tasks.

This section highlights the importance of reviews by one of three groups: the *appointing party*, the *delivery team* or a nominated third party. Setting the parameters for these reviews under specific contractual arrangements is encouraged to ensure these are done only when necessary. In the context of procurement, implementation of reviews under framework agreements is advised only when they are considered appropriate, i.e. at specific phases/intervals of projects and operations/maintenance.

Typically, the competency of a team would be assessed at prequalification and would require service providers / the supply chain to demonstrate capability and capacity to deliver to the *appointing party's* requirements. A useful supply chain assessment template is provided by The Construction Project Information Committee.

In terms of improving BIM competency across all parties and levels (strategic, managerial, technical), the Australian Construction Industry Forum and Australasian Procurement and Construction Council developed the BIM Knowledge and Skills Framework and associated xls template. This underpins the buildingSMART - BIM Creds exam for the recognition of BIM competence in an individual. Many ANZ educational institutions also offer BIM courses and for those new to BIM in New Zealand, 101 series and insight document BIM101 – An Insight seminar booklet are great resources.

9.   INFORMATION CONTAINER-BASED COLLABORATIVE

To work collaboratively in the way described in ISO 19650, parties need to work according to some fundamental principles. The figure below indicates these building blocks to successfully achieve information container based collaborative working.
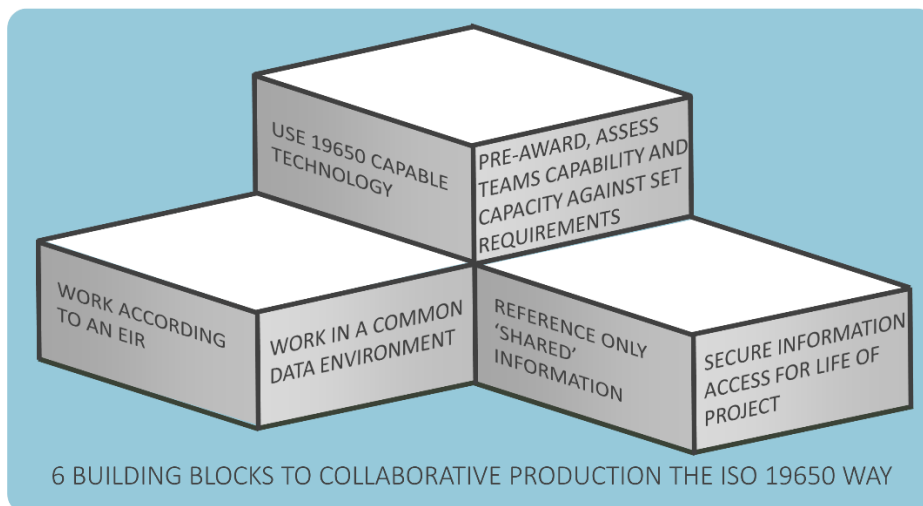

6 BUILDING BLOCKS TO COLLABORATIVE PRODUCTION THE ISO 19650 WAY

Figure 11: Container based collaborative working

10. INFORMATION DELIVERY PLANNING

The *Asset Information Requirements* and *Exchange Information Requirements* set out what the *appointing party* requires from each *lead appointed party* and may require solutions that involve complex workflows and interactions that rely on other parties in the *delivery team*. This will apply to work in progress and final deliverables. Without adequate planning, not only will the *appointed party* be at risk of not performing, but the *delivery team* can also be put at risk.
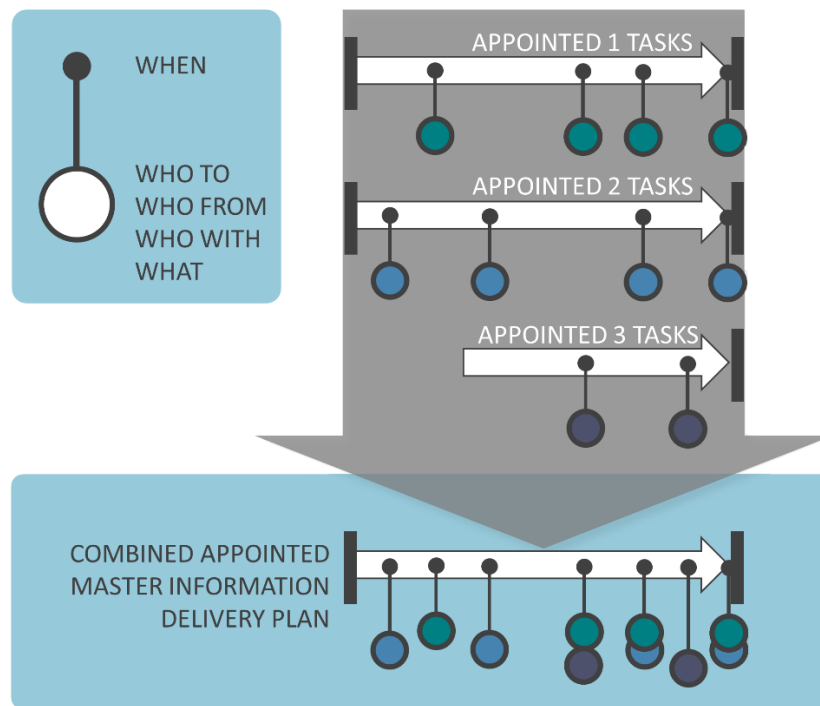
Figure 12: Task Planning

To improve collaboration and reduce this risk, each *appointed party* and *task team* must consider their own responsibilities to deliver as well as what relationships exist with the rest of the *delivery team*. If documented in a consistent format, information on tasks and dependencies can then be consolidated and managed by the *lead appointed party* throughout the project.

In ANZ, the following approach has been advocated for some time and it's great to see ISO 19650 recommends, prior to engagement, a summary version of how and when tasks are proposed to be delivered is required for assessment by the appointing party (i.e. the *Task Information Delivery Plan* (TIDP) and *Master Information Delivery Plan* (MIDP)). Once contracted to the project, the *appointed party* provides the necessary detail in a format managed by the *lead appointed party*, who in turn keeps this recorded and coordinated with the *delivery team* using the *BIM Execution Plan*.

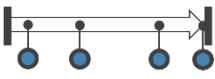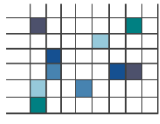**Timing of information delivery and responsibility matrix**

	TASK PLANNING	RESPONSIBILITY PLANNING	MODEL PLANNING
BEFORE APPOINTMENT	HIGH LEVEL SUMMARY	NOT APPLICABLE	IF NECESSARY
COMMENCE APPOINTMENT	TEAM ASSESSMENT AND CAPABILITY	RESPONSIBILITY MATRIX	FEDERATION STRATEGY DEFINE CONTAINERS
ON PROJECT	DETAILED PLANNING COMBINED PLANNING MAINTAIN/UPDATE	MAINTAIN/UPDATE	MAINTAIN/UPDATE

Figure 13: Planning information delivery

Identifying tasks and responsibilities is essential to effective project planning and avoiding ambiguity, therefore planning information delivery tasks and producing a concise responsibility matrix is essential. Depending on the complexity of the project, it may be possible to combine responsibilities effectively within the schedule of delivery tasks. However it may also be more beneficial to provide greater clarity by providing detail on which parties are affected, such as using a responsibility assignment matrix (RACI). There are some specific timings of when and how these planning tools are used.

Therefore, the *lead appointed party* is responsible for creating a *master information delivery plan* that takes into account the individual *task information delivery plans* if and when they are created for complex projects. A responsibility matrix can be used to clearly state which *appointed party* is responsible, accountable, consulted or informed and a quality reviewer (or a similar and consistently applied set of criteria). This is also created and maintained by the *lead appointed party*.

Defining the federation strategy and breakdown structure for information containers

There are many issues that make it unlikely and impractical that all *appointed parties* will produce project information in one central file or container. Typically in ANZ, when creating discipline or trade BIM files, each *task team* will most likely work separately and agree on pragmatic solutions to workflows, ensuring models are kept secure, manageable and coordinated. The size of the project and composition of *task teams* working are other examples that affect these delivery strategies.
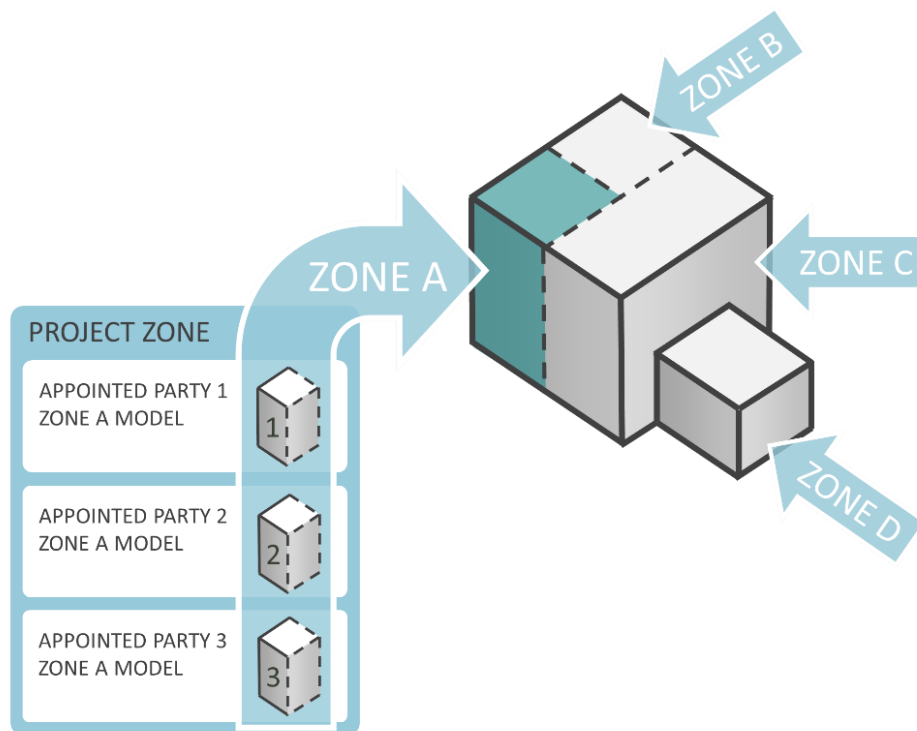

Figure 14: Model planning

To ensure efficient production of large or complex BIM projects, there will be a need to divide the project into separable parts based on appropriate criteria. The criteria might include each *task team's* discipline (engineer, designer, etc), separate built asset functions (core, façade, platform etc), and the size and complexity of the project (zoning, levels etc). How these parts are brought back together forms the federation and overall strategy.

Once the *lead appointed party* is engaged on the project, a model breakdown strategy should be developed and recorded in the *BIM Execution Plan*. As the project develops, and newly *appointed parties* join, the strategy should be first tested and then amended to minimise any potential risks to the performance of the project delivery and operational teams. This is the responsibility of the *lead appointed party* in collaboration with the *delivery team*.

PART 1

11. MANAGING THE COLLABORATIVE PRODUCTION OF INFORMATION

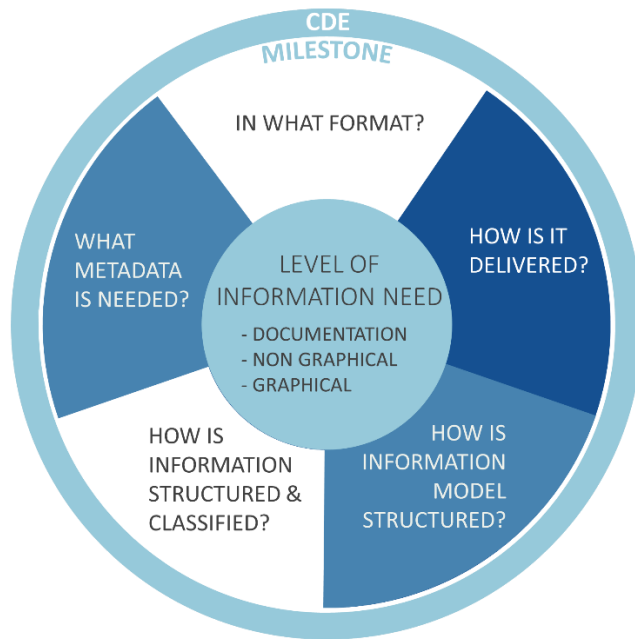The following represents the general workflow for collaborative information production:

Figure 15: Managing the collaborative production of information

- Ensure a comprehensive system is implemented to manage project information, using the *Common Data Environment (CDE)* principles outlined in ISO 19650-1 Section 12.

- Establish appropriate collaboration systems and processes, which requires careful consideration. Time and resources should be allocated for this effort before work commences. The systems and processes for delivery (and operations) must be documented and communicated to the delivery team for their buy-in and feedback.

- Consider how the project is composed and scoped to minimise spatial or functional issues during production. Refer to ISO 19650-1 Section 10.4 for details.

- Ensure information sharing agreements are put in place to govern ownership, security and usage rights

Level of Information Need

Level of Information Need is a conceptual indication of the required level of quality, quantity and granularity of information for both geometric and alphanumeric content.

Australia and New Zealand have not yet developed common approaches for *Level of Information Need*. It is up to *appointing parties* to make their preferred information needs clear (aligned to the key decision points) and document these in the *Organisation Information Requirements*, *Project Information Requirements, Asset Information Requirements* or *Exchange Information Requirements*. Other information may be required by other appointed parties, but not by the appointing party. (i.e. as a requirement of the contractor to a designer). Typically in ANZ, these "extra" information requirements are documented in the *BIM Execution Plan* to provide clarity to all parties.

The production of information containers/models should be designed to meet the information requirements but not exceed them - any information beyond the requirement is considered an unnecessary waste of effort. It is therefore important that appropriate methods to measure the level of information produced against the information requirement be agreed from the outset and applied across the delivery team and asset lifecycle.

Information Quality

The *Common Data Environment* outlined in ISO 19650-1 Section 12 must be logically organised. *Task teams* must be diligent in producing information that complies with the information requirements and ensure it is useful and is understood by all parties. *Information containers*/models should be produced using common standards for geometry and structured information and exchange formats such as Industry Foundation Classes (IFC). Information should be regularly audited by the *lead appointed party* and by the *appointing party* to ensure information integrity.

12. COMMON DATA ENVIRONMENT (CDE) SOLUTION AND WORKFLOW

A *Common Data Environment* solution and workflow is the means to manage project and/or asset information. It functions as a digital hub for project *actors* to collect, manage, and disseminate relevant approved *information containers* (or simply "information") in a managed environment. The ISO 19650 series applies the *Common Data Environment* principle across the entire project/asset lifecycle, encompassing both *appointing* and *appointed parties*.

Information containers include *Building Information Models*, documentation, reports, cost plans, specifications and other project/asset-related information.
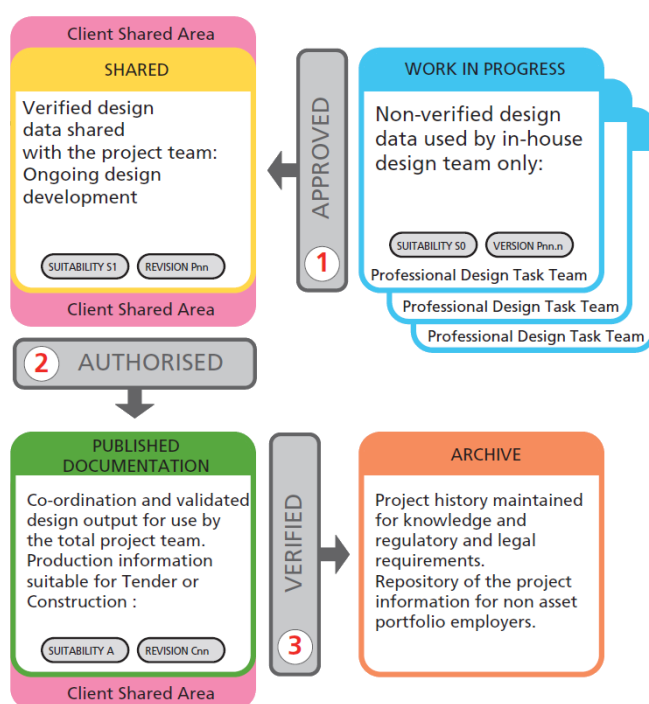

Figure 16: The Common Data Environment
(Figure 15 from PAS 1192-2:2013)

The processes by which the information is managed is known as the "workflow" and information will be in one of these *states*:

- **Work in Progress** - Information being developed.
- **Shared** - Information approved for sharing.
- **Published** - Information authorised by appointing party for a use.
- **Archive** - History of transactions of information.

Transition from one state to another is subject to checking, review, approval and authorisation. Understanding which authority is doing the authorising is important to ensure the distinction between '*shared*' and '*published*'.

Three fundamental principles are managed systematically across the *Common Data Environment* for each information container:

1. **State** - as described above (WIP, shared etc.).
2. **Status** - indicates the purpose or permitted use of an information container.
3. **Revision** - tracks information version.

ISO 19650 does not set out a revision numbering schema or standardised *status* codes. In ANZ there is great variance in the descriptions used to convey status (i.e. for construction, for information, for tender etc). The critical element is that the *delivery team* and appointing party agree early on the terminology to be used and apply this to project delivery and operational uses of the *information containers*.

13. SUMMARY OF "BUILDING INFORMATION MODELLING (BIM) ACCORDING TO THE ISO 19650 SERIES"

Section 13 summarises ISO 19650-1 and reinforces the importance of Information Management versus production or delivery. It outlines the information management processes (which must be considered at each appointment phase) that support the information management tasks and the responsible parties involved across the full lifecycle of an asset.

While the Standard uses some terms that are familiar to the ANZ audience, such as *Common Data Environment*, it also introduces newer terms such as "*appointing party, lead appointed parties, appointed parties*". These terms relate to the information *delivery team* of which there can be many on a project, depending on the procurement strategy.

The Standard also highlights the importance of being flexible in applying the process in a local context, appropriate to the scale and complexity of the project, in-line with the capability and capacity of the *delivery team.*

The use of a *Common Data Environment*, where all *appointed parties* can contribute to and be made aware of the changes to the *Project Information Model*, associated to their function and permissions, is a critical aspect of collaborative information management using the ISO 19650 series. ISO 19650-1 Figure 11 explains these concepts and principles.