ABAB
AUSTRALASIAN BIM ADVISORY BOARD

Australasian BIM Benefits Reporting

GUIDE TO INFORMATION COLLECTION

VERSION ONE

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Australasian BIM Advisory Board (ABAB)

In May 2017, the Australasian BIM Advisory Board (ABAB) was established by the Australasian Procurement and Construction Council (APCC) and the Australian Construction Industry Forum (ACIF), together with NATSPEC, buildingSMART Australasia and Standards Australia. This partnership of national policy and key standard-setting bodies represents a common-sense approach that captures the synergies existing in, and between, each organisation's areas of responsibility in the built environment. It also supports a more consistent approach to the adoption of Building Information Modelling (BIM) across jurisdictional boundaries.

The establishment of ABAB is a first for the Australasian building sector with government, industry partnering to provide leadership to improve productivity and project outcomes through BIM adoption.

ABAB is committed to optimal delivery of outcomes that eliminate waste, maximise end-user benefits and increase the productivity of the Australasian economies. ABAB has evolved from a previous APCC–ACIF collaboration established in 2015 at a BIM Summit. This summit produced resource documentation to support BIM adoption (refer to www.apcc.gov.au for copies).

Members of ABAB have identified that, without central principal coordination, the fragmented development of protocols, guidelines and approaches form a significant risk that may lead to wasted effort and inefficiencies, including unnecessary costs and reduced competitiveness, across the built environment industry.

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What is Building Information Modelling (BIM)?

BIM is a digital form of construction and asset operations. It brings together technology process improvements and digital information to radically improve client and project outcomes and asset operations. BIM is a strategic enabler for improving decision-making for both buildings and public infrastructure assets across the whole life cycle. It applies to new build projects and crucially, BIM supports the renovation, refurbishment, and maintenance of the built environment – the largest share of the sector. [EU BIM Task group Handbook, 2018].

What is BIM process consistency?

BIM process consistency is the consistent use of proven methods, techniques, standards, templates, workflows, and tools within and across the public sector. BIM process consistency improves the performance of BIM adoption and implementation.

Australasian BIM Benefits Reporting

GUIDE TO INFORMATION COLLECTION

Acknowledgements

This Guide was developed by a small, dedicated Technical Working Group whose visions for BIM span beyond their usual domains. The Australasian BIM Advisory Board (ABAB) acknowledges the immense contribution given by the following individuals:

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David Heins, Senior Project Engineer, Transport for NSW

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Richard Choy, CEO, NATSPEC
Neil Greenstreet, Manager Digital Technologies, NATSPEC

Special Acknowledgements
Special acknowledgement is extended to two individuals who envisioned the importance to commence a national system to measure value and collect data on BIM usage in projects. Their support was instrumental in developing this benefits system, sharing their extensive knowledge from both government and industry sectors, and providing valuable insights from live projects to pilot the system.

Tim Mumford, General Manager, Transport & Infrastructure Digital and Innovation. Beca
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1. Introduction

1.1 Issue definition

Significant investment into Building Information Modelling (BIM) is ongoing for government projects across Australasia. This has influenced project funding and business cases, as well as increased the reliance on the return on investment from BIM.

Calculating the return on investment of BIM necessitates data on its benefits. Therefore, a data collection system must be applied across various projects over time. The importance of establishing data collection systems for key areas, and the problems arising from not applying one, has been demonstrated by recent national issues concerning poor data collection of major projects cost. The Grattan Institute reviewed national cost overruns in transport infrastructure delivery and reported: *"Current cost estimation guidance is inconsistent, omits valuable tools, and can't draw on previous projects because we don't collect the data."*[1]

This Guide, titled 'Australasian BIM Benefits Reporting (ABBR)' responds to the need to begin collecting BIM benefits data immediately, using a well-organised system. The data should be analysed using specific metrics and reported on a regular basis.

1.2 Background

Government delivery agencies and their major project teams are increasingly specifying BIM. The specifications should be written to target project-specific areas for improving efficiency and value in both delivery and asset management. However, even with the understanding that early investment in BIM will yield returns later on, quantifying the subjective benefits of this investment presents significant difficulties, Organisations face challenges in demonstrating that an early investment approach is correct, as the funding profile deviates from the common approach.

The lack of data of quantifiable benefits hampers approval at the organisation level and from project funders, resulting in broad level delays to BIM adoption. A system to collect national historical data on BIM benefits, along with comparable and standardised metrics for easily understood reporting is urgently needed. This will support project teams, whole of agency, and whole of jurisdiction decision-making. A recurring problem arises when delivery stage divisions are asked to finance BIM asset data for the benefit of asset divisions. This issue should be resolved at the organisational level, rather than through division-to-division negotiations.

The benefits of BIM cannot be simply demonstrated by collecting data feedback from projects, rather it needs to rely on meaningful comparison between projects. Further, comparing a BIM project to another will not achieve meaningful comparison of benefits because of the vast differences in project characteristics and maturity of BIM implementation parties. To overcome these issues, a data collection system needs project categories and ratings of BIM maturity such as project type, purpose, size, engineering disciplines, BIM contractor maturity and delivery systems. Historical information through a structured system will enable tracking of benefits as BIM implementation occurs. The historical BIM information will also enable effective benchmarking and comparison.

The demonstration of return on investment and the tracking of project costs of BIM is within the context of a significant increase in expenditure on infrastructure in Australasia. This increase in spend is placing demands on project managers, for example in project controls and justification of all costs. Like other cost items, BIM implementation is subject to detailed scrutiny and justification. BIM investment is unique in its highly focussed method of justification through early investment. This presents a challenge for project teams to justify BIM and to overcome a mindset of up-front cost.

Benefits measurements are needed, commencing at strategic options stage through to handover to asset management groups.

1 Cost overruns in transport infrastructure, Australia, Grattan Institute, October 2016.

1.3 Clarify the need

BIM can only be justified if it is approached on a proper return on investment basis. This includes not only on the justification of the broad concept of BIM but also in the details such as scope, specification and contracts. To support these detailed justification areas, it is essential that the needs of end users are properly understood. This will require consultation and checking of processes. By clarifying the need, we can identify the areas that BIM will provide most value. By maximising these value areas, the most benefit will be gained.

The method to clarify the need and value, and to develop BIM specifications requires major project experience. This means team members must be experienced in major project delivery and maintenance who, by definition, have worked on sites and managed contracts to develop a proper understanding of the interaction of design and its physical execution. Some examples of obtaining end user needs are given below:

- **Request for tender process:** Consult with end users to justify BIM implementation during the design and construction stages.
- **Quality assurance:** Assurance is needed for the BIM data structure and quality to be delivered to the specified information requirements in a form that it is compatible with client systems. Construction stage contract management requires easy access to digital quality records.
- **Design:** BIM designs need to support practical methods to address construction risks including the investigation and analysis of complex issues. For example, examine the temporary excavation and clearance of a pile cap to be executed next to traffic and pedestrians. A core responsibility of Transport for NSW roads project teams is to ensure safe and efficient operation of the network in temporary traffic arrangements. The staging is to be developed in 3D.
- **Project management:** An intelligent project model, with an appropriate level of detail, is essential for effective project management, construction contracting, and any future modifications. This model should allow for easy and quick access to information.
- **Construction:** The model information from the design stage needs continual updating to ensure an appropriate level of information is maintained during construction, facilitating handover of an as-constructed model and accurate ‘works as executed’ information.
- **Asset data and operation:** Handover data is specified in the Asset Information Requirements (AIR). However, before the AIR details are finalised for the Request for Tender, it needs to be tested against the organisation asset management system through confirmation with asset owners and facility managers.

1.4 Development of a system

ABAB has developed a system of data collection of BIM benefits reporting. The system is Australasian BIM Benefits Reporting (ABBR) which enables benefits measurement and meaningful comparison of projects. It has been developed to a maturity of phase 1 for piloting on a selected set of projects. The analysis of BIM benefits will be presented regularly through the ABBR which has been developed to support use for business intelligence.

The ABBR system will provide meaningful comparison, however it also respects the confidentiality of government agencies in their management of contracts and public funds. The reporting has been developed to maximise the use of publicly available information. This is also combined with relative changes of contract performance rather than absolute changes that are generally confidential (e.g., percent changes in time and cost to the original contract requirements rather than actual cost increase from claims). The ABBR results will be publicly available through ABAB.

This ABBR system is the first release (version 1) and is subject to continual improvement. The standing up of the ABBR has been carefully prepared but it is also recognised there is an imperative to the timely commencement of the collection of historical BIM benefits data.

Given the importance of data integrity and reporting, the first stage of the ABBR implementation consisted of a controlled set of targetted projects. The projects spanned jurisdictions in a range of project types. They required ownership and support by designated persons managed through ABAB.

1.5 The role of metrics in information collection and reporting

Metrics are part of the process of gathering and reflecting data back to an organisation to manage issues and improve the business. Key Performance Indicators (KPIs) are key areas that determine the success of an organisation and these need to be supported by measured data and metrics.

Some metrics may be a simple statistic and others may be a combination of data and information that gives further important insight. For example, comparison of design issues on site of projects using BIM/Digital Engineering (DE) to other projects that do not have BIM.

2. Data collection details for project teams

Australasian BIM benefits reporting elements and timeline

The system applies to projects from:

- Strategic options (alignment, location, outline).
- Concept (general arrangement, footprint, environmental assessment and public consultation).
- Detailed design.
- Construction.
- Handover to asset management group.

The data collection and processing consist of three corresponding system and timeline elements:

1. Project Registration (includes categories and rating for meaningful comparison) (Refer to Appendix 1).
2. Metrics and Survey (Refer to Appendix 2).
3. Processing and Report (Refer to Appendix 3).

Information is collected and recorded in the following templates:

Template No.	Title	Reference Section
1	Project registration.	1
2	Project type and procurement.	1
3	BIM/DE maturity assessment for ABBR system.	1
4	Execution on site. Partnering survey.	2
5	Construction productivity indicators.	2
6	Value for money of BIM and of the project	2

Section 1

Template 1: Project registration

Project criteria	Project details
Title	
Project number	
Description (maximum 10 words)	
Purpose (maximum 10 words)	
Jurisdiction	
Location (local government, street address, MGA, chainage)	
Announced cost-total project estimate	
Announced timing of construction (include duration and completion month)	
Funding source (federal, state, other)	
Client organisation (government agency, division)	
Delivery organisation (government agency, division)	
Project manager (name, email, mobile)	
ABBR coordinator person (at jurisdiction or agency level) and contact information (name, email, mobile)	

Template 2: Project type and procurement

Project criteria	Answer Options
Project generic type	Building medical
	Building non-medical
	Rail
	Road and structures
	Bridge
	Light rail
	Maritime
	Airport
	Utility-water
	Utility-Communication
	Utility-electricity
	Utility-gas
Project cost range $ (publicly available information).	$1-5m
	$5-20m
	$20-100m
	$100-500m
	$500m-1b
	$1b +
Project construction duration (years)	0-1
	1-2
	2-3
	3-4
	5+
Construction delivery system	Concept design and EA
	Detailed design
	Construct only (Principal design)
	Design and Construct
	Alliance Design and Construct
	Design and Construct and Maintain
	Design Construct Maintain Operate
	Public Private Partnership (PPP)
	Build own operate transfer (BOOT)
	Integrated project delivery (IPD)
	Asset management contract

Project criteria	Answer Options
Engineering major construction disciplines (this will include multiple disciplines)	Building medical
	Building non-medical
	Building up to 2 story
	Building multi story
	Building public space
	Rail
	Rail bridges
	Rail tunnel
	Rail station
	Rail structures (e.g. station and carpark)
	Rail signals
	Rail utilities
	Rail general civil works
	Road
	Road bridges
	Road tunnel
	Road property adjust
	Road structures
	Traffic management
	Temporary works structures
	Temporary works civil
	Utility-water new
	Utility-water adjust existing
	Utility-communication new
	Utility-communication adjust existing
	Utility-electricity new
	Utility-electricity adjust existing
	Utility-gas new
	Utility-electricity adjust existing
	Landscape
Physical context and adjacent areas	Urban
	Rural
	Brownfields
	Greenfield
Design contractor (or government agency)	
Construction contractor	
Asset Maintenance contractor	
Operator	

Template 3: BIM/DE maturity assessment for ABBR system

Client BIM/DE maturity	
Level	**Required information**
0	No specifications, contract requirements, organisation objectives. No Executive direct KPIs.
1	No client led organisation level system. No Common Data Environment (CDE). No consistent naming system for documents and objects linked to metadata and Computer Aided Facility Management (CAFM) for Project Information Model (PIM) and Asset Information Model (AIM). Not driven from organisation lead. No minimum set of mandated project BIM requirements. No organisation KPIs for BIM/DE.
2	Client led organisation level system. CDE. Consistent naming system for documents and objects linked to metadata and CAFM for PIM and AIM. Driven from organisation lead. Minimum set of mandated project BIM requirements. Organisation KPIs for BIM/DE. Change management training, resources and processes.
3	Organisation level CDE. Client led system with document and BIM models integrated with string, legal and contract issues resolved. System and information requirements agreed with Executive Directors of development, delivery, commercial and asset management. Consulted with PMs and industry and built from the work execution point upwards.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

Contractor BIM/DE maturity	
Level	**Required information**
0	N/A
1	No organisation level system. No CDE. No consistent naming system for documents and objects linked to metadata and CAFM for PIM and AIM. Not driven from organisation lead. No minimum mandated project BIM requirements. No organisation KPIs for BIM/DE.
2	Company organisation level system. CDE. Consistent naming system for documents and objects linked to metadata and CAFM for PIM and AIM. Driven from organisation lead. Minimum set of mandated project BIM requirements. Organisation KPIs for BIM/DE. Change management training, resources and processes. Compatible with client requirements.
3	Fully compliant to AS ISO 19650 and international leading practice. Tested and proven on multiple sites.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

3.1	Information management
Level	**Specified and verified complete**
0	No system. E.g. various spreadsheet based local approach.
1	Available specification for use by projects.
2	Organisation level sponsored.
3	Specified requirements match the needs of users, agreement Exec directors of development, delivery, commercial and asset management branches and justification demonstrating return on investment. Compliant with relevant ISO standards.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

Project BIM/DE specified requirements

3.2	GIS
Level	**Specified and verified complete**
0	No Geographic Information Systems (GIS).
1	No GIS uniform system. Sporadic project-based use.
2	Program level requirement and use of GIS and trained users at project level.
3	Organisation GIS system with specific objectives and connectivity into program of works and business as usual.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

3.3	BIM/DE for design and construction
Level	**Specified and verified complete**
0	No BIM systems and tools specified or applied.
1	Generic systems and tools applied through specification without analysis of delivery stage risk and addressing complex issues with the assistance of BIM.
2	Delivery stage risk and issues clarified and analysed using BIM approach and systems. E.g., complex earthworks, staging analysis of utilities and investigation of scenarios where the original program sequence and timing not done at execution. Workshops with delivery teams to identify and partner solution to issues and demonstrated return on investment.
3	Advanced integrated project delivery (IPD) with managed controls.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

3.4	Asset management
Level	**Specified and verified complete**
0	N/A
1	Asset data and system not defined. Some asset data is required in contracts based on knowledge of leading practice or estimated use.
2	End to end system. CDE. CAFM.
3	Advanced end to end system with predictive maintenance system including Internet of Things (IoT) and some Artifical Intelligence (AI). Designed and built with full consultation and agreement. System to continually confirm alignment with asset management and measure return on investment.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

Average of 3.1 to 3.4
Specification and design of system: Project BIM/DE specified requirements.
ABBR assessed level of maturity for meaningful comparison. (0-3)

BIM/DE status of verified successful implementation

4.1	Information management
Level	**Specified and verified complete**
0	No system. E.g., various spreadsheet based local approach.
1	Available specification for use by projects.
2	Organisation level sponsored.
3	Specified requirements match the needs of users, agreement Exec directors of development, delivery, commercial and asset management branches and justification demonstrating return on investment. Compliant with relevant ISO standards.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

4.2	GIS
Level	**Specified and verified complete**
0	No GIS.
1	No GIS uniform system. Sporadic project-based use.
2	Program level requirement and use of GIS and trained users at project level.
3	Organisation GIS system with specific objectives and connectivity into program of works and business as usual.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

4.3	BIM/DE for design and construction
Level	**Specified and verified complete**
0	No BIM systems and tools specified or applied.
1	Generic systems and tools applied through specification without analysis of delivery stage risk and addressing complex issues with the assistance of BIM.
2	Delivery stage risk and issues clarified and analysed using BIM approach and systems. E.g., complex earthworks, staging analysis of utilities and investigation of scenarios where the original program sequence and timing not done at execution. Workshops with delivery teams to identify and partner solution to issues and demonstrated return on investment.
3	Advanced integrated project delivery (IPD) with managed controls.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

4.4	Asset management
Level	**Specified and verified complete**
0	N/A
1	Asset data and system not defined. Some asset data is required in contracts based on knowledge of leading practice or estimated use.
2	End to end system. CDE. CAFM.
3	Advanced end to end system with predictive maintenance system including IoT and some AI. Designed and built with full consultation and agreement. System to continually confirm alignment with asset management and measure return on investment.
ABBR assessed level of maturity for meaningful comparison. (0-3)	

Average of 4.1 to 4.4
Completed work done to requirements and demonstrates value: BIM/DE status of verified successful implementation.
ABBR assessed level of maturity for meaningful comparison. (0-3)

Section 2: Value measurement during implementation

Template 4: Execution on site and partnering survey

Qualitative survey. (0-50 rating). Done by the client, construction contractor and designer. Rate this monthly at the coordination/partnering meetings.

0	Non existent. Unacceptable. Very poor.	
1	Only just acceptable. Some sporadic evidence of indirect benefits.	
2	Some evidence of DE benefits. Examples of collaboration. Broad qualitative benefit areas.	
3	Collaboration and some key areas where DE provides quantifiable benefits.	
4	High level of value and benefits. Good collaboration with asset management and the project team. Use of digital twin and virtual reality to head off issues and build safe and efficiently virtually. KPIs established and satisfied.	
5	Fully structured well thought out system. Exemplary. Excellent value. Easily demonstrated benefits with return on investment exceeding 10x. Efficient information management. Fully integrated. IoT. Artificial intelligence.	

Criteria	Score (0-5)
Safer design to build.	
Reduced design issues.	
Better coordinated design.	
Less construction stages through digital planning.	
Better organising of physical site work through use of 3D for toolbox and construction planning. Better engagement of tradespersons into issues identification and better ways to build.	
Information management: Single source of truth and easily obtained.	
Simpler subcontractor packaging.	
Ability to manage and have direct vision of cost, time and completion of zones.	

Template 5: Construction productivity indicators

Progressive execution on site. Quantitative metrics. Done by the client.

Criteria	Score (0-5)
Final project cost is managed well and within contingency.	
Construction contract duration % increase.	
Construction contract duration % increase minus wet weather delays.	
Construction contract cost % increase to original contract sum.	
RFIs: total.	
RFIs: due to clashes.	
RFIs: turnaround time (days).	
Number of variations paid.	

Template 6: Value for money of BIM and of the project (qualitative and quantitative)

Post completion review by the client PM and Asset Manager. Within 2 months after opening.

Criteria	Score (0-5)
Meets original functional project need and adapts to the current need.	
Appropriate, fit for purpose, urban design and way finding outcomes.	
Value for money (cross check standard rates. E.g. $/lane km).	
Did BIM/DE provide good value in optioneering.	
Public consultation for the environmental assessment and community confidence.	
Safe and efficient in operation.	
Visualisation for effective property adjustment consultation.	
Accessible in operation.	
Support broader network/masterplan.	
Asset data compatibility with client current and future forecast system.	
Provides immediate information and intelligence.	
End user positive feedback.	
Value for money in next stage asset management contract (this mainly applies to metropolitan network after a D&C contract).	
Project cost % increase.	
Project construction duration % increase.	
Design delivery cost % of construction. Concept design.	
Design delivery cost % of construction. Detailed design.	

Appendix

Appendix 1: BIM Maturity Levels and example calculation

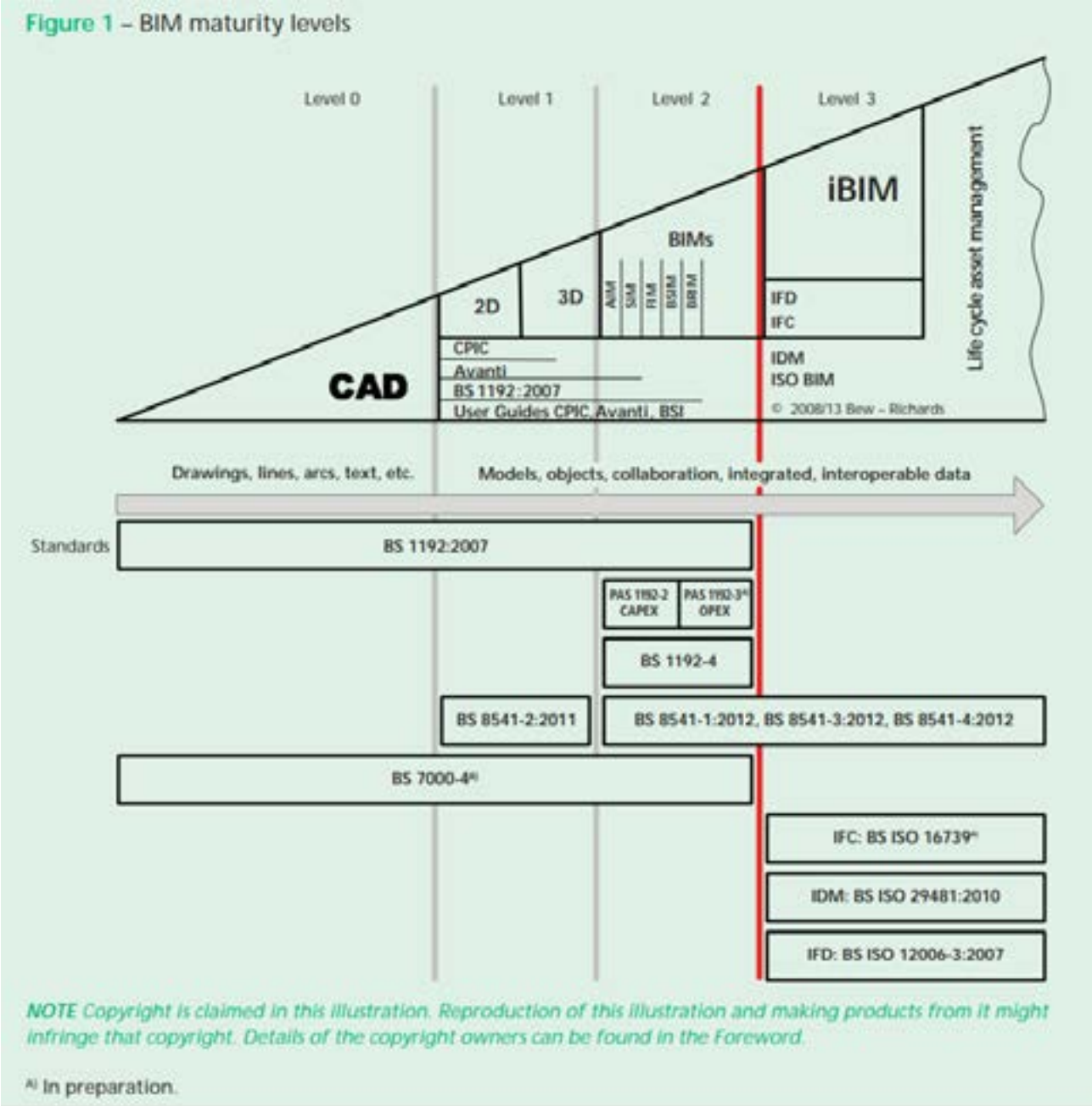

Figure 1 (PAS 1192.2 and AS ISO 19650 part 1).

Example maturity calculation

BIM/DE maturity assessment for ABBR system

	Required information	ABBR assessed level of maturity for meaningful comparison. (0-3)	Table below. Ref	Example level of maturity.
BM1	Client BIM/DE maturity.		B1	0.5
BM2	Contractor BIM/DE maturity.		B2	1.5
BM3	Specification and design of system: Project BIM/DE specified requirements.			0.75 (Average of BM3.1 to BM3.4)
BM3.1	Information management.		B3	1
BM3.2	GIS.		B3	1
BM3.3	BIM/DE for design and construction.		B3	1
BM3.4	Asset management.		B3	0
BM4	Completed work done to requirements and demonstrates value: BIM/DE status of verified successful implementation.			0.75 (Average of BM4.1 to BM4.4)
BM4.1	Information management.		B3	1
BM4.2	GIS.		B3	1
BM4.3	BIM/DE for design and construction.		B3	1
BM4.4	Asset management.		B3	0

BIM summarised maturity for comparison (subject to review)

Item No.	Project party and stage	BIM maturity (0-3) (Refer above)	Weighting. (%) (Fixed for ABBR)	ABBR Weighted score (0-3)	Example
BM1	Client organisation.		10		0.5 x 10%
BM2	Contractor.		30		1.5 x 30%
BM3	Documentation and process: Specification, tender (RFT and assessment), contract/deed, client contract admin and audit, check and completed work.		20		0.75 x 20%
BM4	Completed work meets specified requirements and demonstrates value.		40		0.75 x 40%
	Total ABBR system estimated BIM maturity (0-3).				0.95

Appendix 2: Australasian BIM Benefits Reporting

The details of the standard measurement, comparison and dashboard reports are under development.

Typical generic examples:

Some examples of visual representation of metrics and a combined dashboard from the Pacific Highway upgrade project are below:

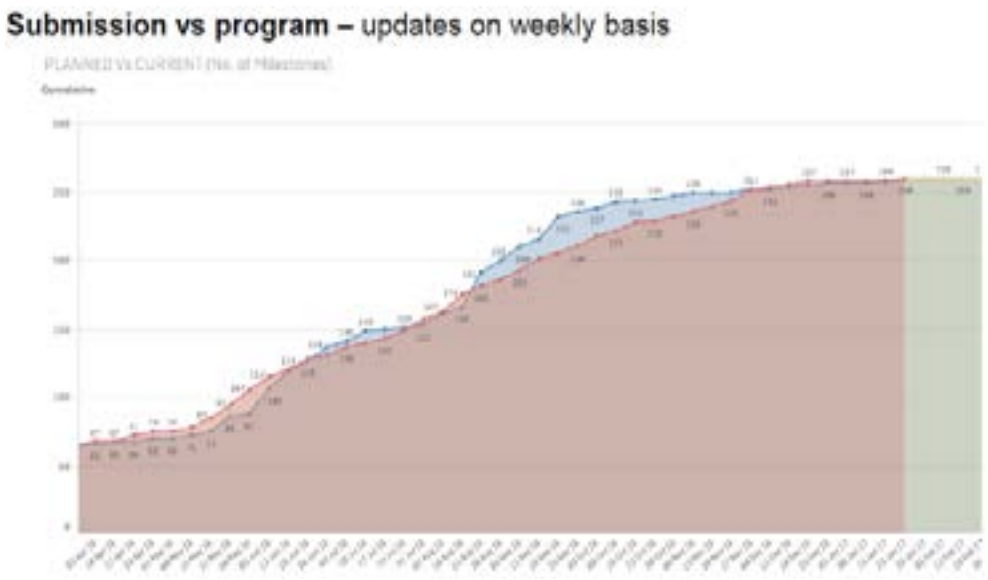

Figure 2: Example reporting output - Submission vs program.

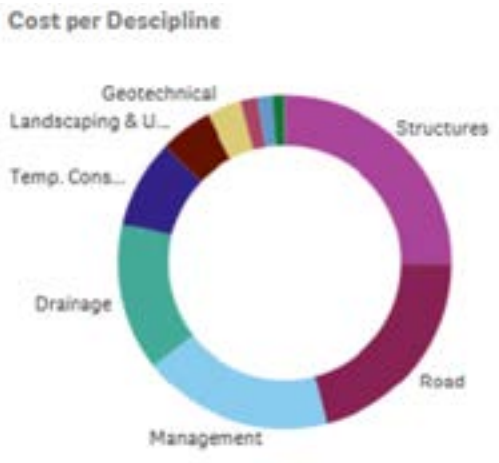

Figure 3: Example reporting output - Cost per discipline.

Appendix 3: Data Analysis

Figure 4: Example reporting output - Data Analysis board

NOTE: Metrics form only part of the combination of information and steps that enables decision-making.

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