



BIM Knowledge and Skills Framework

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ABOUT ACIF

The Australian Construction Industry Forum (ACIF) is the meeting place for leaders of the construction industry in Australia. ACIF facilitates and supports an active dialogue between the key players in residential and non-residential building, engineering construction, other industry groups, and government agencies.

Our members are among the most significant associations in the industry, spanning the entire asset creation process from feasibility through design, cost planning, construction, building and management.

ACIF also provides a number of resources for the industry, including twice yearly release of the ACIF Forecasts, the industry's 'compass' to the demand for work over the next decade.

ACIF is focused on creating a productive and efficient construction and property industry that is a leader in building Australia's prosperity. As well as facilitating communication between the different interests that make up the construction sector, ACIF provides governments and other agencies with a central and efficient industry liaison point.

ACIF seeks to develop a successful, strong and sustainable construction industry in Australia.

For more information about ACIF, visit:

www.acif.com.au

ABOUT APCC

The Australasian Procurement and Construction Council Inc (APCC) is the peak council whose members are responsible for procurement, construction, asset management, and property policy and delivery for Australian State and Territory Governments.

Over the past 50 years, the APCC has established itself as a leader in government procurement, construction, asset management, and property strategies and practice. The work of the APCC is committed to procurement innovation, solutions and efficiencies designed to create savings and maximise service delivery to the communities of Australia and New Zealand.

The APCC Council of Chief Executive Officers leads the direction of the APCC, supported by Special Interest Groups driving the overall work program.

The APCC promotes a cohesive government procurement environment and harnesses the benefits of nationally consistent approaches for its members.

The APCC community is made up of individuals with a wealth of skills and expertise. Collectively, it represents the hub for public sector procurement, construction, asset management, and property excellence.

For more information about APCC, visit:

www.apcc.gov.au

Strategic Forum for the Australasian Building and Construction Industry

An ACIF and APCC initiative

The Strategic Forum for Construction is a unique body that brings together key stakeholders in the Australasian construction industry. The Forum acts as an entry point and significant interface between government and the construction sector. It facilitates positive change and encourages greater productivity.

Above all, it acts as a national forum to network and discuss issues that affect the industry. This Forum is an entry point to facilitate joint pathways for improving building and construction industry productivity in Australasia. By working together to do this, we engender and encourage trust between the government and industry sectors.

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THANKS TO ACIF PRINCIPAL SPONSOR

As one of Australia's largest industry super funds, Cbus Super is the proud Principal Sponsor of ACIF.

Managing over \$30 billion, Cbus is the industry super fund for over 720,000 members in the building, construction, and related industries.

Cbus' support makes it possible for ACIF to create sources of information and develop knowledge tools to boost the productivity of the industry.



Construction & Building Industry Super

GLOSSARY OF TERMS

Where there is no definition source available, the definition has been developed to explain the term in the context of the Framework.

Alliance	<p>Alliance contracting is delivering major capital assets, where a public sector agency (the Owner) works collaboratively with private sector parties (Non-Owner Participants or NOPs). All Participants are required to work together in good faith, acting with integrity and making best-for-project decisions. Working as an integrated, collaborative team, they make unanimous decisions on all key project delivery issues. The alliance structure capitalises on the relationships between the Participants, removes organisational barriers and encourages effective integration with the Owner.</p> <p><i>Source: Alliances are defined in the National alliance contracting policy and guidelines (Department of Infrastructure and Transport 2011)</i></p>
Asset Information Model (AIM)	<p>Asset Information Model (AIM) is a sub-type of Information Models supporting the maintenance, management and operation of an asset throughout its lifecycle. An AIM is used (a) as a repository for all information about the asset; (b) as a means to access/link to enterprise systems (e.g. Computerised Maintenance Management System (CMMS)); and (c) as a means to receive and centralise information from other parties throughout project stages.</p> <p><i>Source: BIMdictionary.com</i></p>
As-Built Model	<p>A model most commonly maintained at the site for the Owner one copy of the Drawings (models), Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.</p> <p><i>Source: AIA Document A201-2007</i></p>
Asset Management	<p>“The life cycle management of physical assets to achieve the stated outputs of the enterprise”. This definition specifies a focus upon the delivery of a stated capability in which assets play a key role, and in which the business must manage its physical assets commensurate with the business need for that capability. Thus, the definition is concerned with short, medium and long-term considerations from the conception of the asset's need, through its complete operating life, all the way until its disposal phase.</p> <p><i>Source: The Asset Management Council</i></p>
Attribute	<p>Attribute Data element for the computer-sensible description of a property, a relation or a class. Note: An attribute describes only one single detail of a property, of a class or of a relation.</p> <p>Example: The names of a property, the code of a class, the measure unit in which values of a property are provided are examples of an attribute.</p> <p><i>Source: ISO/IEC Guide 77-1:2008: Guide for specification of product properties and classes</i></p>
Authorised Uses	<p>In addition to LODs, authorised (or warranted) use is often referred to. The premise of this is to specify who is allowed to do what with the BIM being authored. So that in addition to the degree of certainty of the BIM as implied by the LOD definitions there is a separate statement to quantify if the associated information is fit for the various purposes stated. i.e. construction documentation only, or including other uses like cost estimation, scheduling etc.</p> <p>Fundamental LOD definitions by themselves are not enough to define minimum requirements of the resulting BIM.</p> <p>Refer also to Legal Status and BIM Uses.</p> <p><i>Source: NATSPEC National BIM Guide</i></p>
Bill of Quantities (BoQ or BQ)	<p>A Bill of Quantities – BoQ or BQ is an itemised list of materials, parts, and labour that is established by a Quantity Surveyor to communicate the trades required in a construction project. BIM can assist in the delivery of BQ depending on the detail and accuracy agreed prior to modelling.</p> <p><i>Source: Australian Institute of Quantity Surveyors (AIQS)</i></p>

BIM Addendum or Protocol	<p>A contractual arrangement to modify the terms of a standard form agreement to which it is attached to address BIM-related issues that were beyond the original scope of the standard form agreement.</p> <p>Examples of forms that exist: <i>AIA E202 – 2008</i>, and <i>Consensus DOCS C301 BEP (Or PXP) CIC BIM Protocol</i></p>
BIM Coordinator	<p>A person who performs an intermediary role between the BIM Manager and the modelling team. The BIM Coordinator implements the BIM Manager's modelling standards and protocols and deals with the day-to-day coordination of team members to achieve project goals.</p> <p>Source: <i>NATSPEC National BIM Guide</i></p>
Building Information Management (Data Definition)	<p>Building Information Management supports the data standards and data requirements for BIM use. Data continuity allows for the reliable exchange of information in a context where both sender and receiver understand the information.</p>
BIM Dimension	<p>Information in a model or the properties about the objects beyond the graphical representation. A term which refers to the intelligent linking of individual 3D CAD components or assemblies with all aspects of project life-cycle management information. Commonly known for example as acronyms 4D (time), 5D (cost), 6D (life cycle management).</p> <p>Source: <i>Building and Construction Procurement Guide Principals and Options, (Austroads & APCC)</i></p>
BIM Manager	<p>An individual responsible for the administration and management of processes associated with Building Information Modelling on a project. The appointment process may vary but the BIM Manager is still effectively an agent of the project sponsor. While the scope of management may vary, to include activities such as organising, planning, scheduling, directing, controlling, monitoring and evaluating BIM processes, the objective is to ensure that those processes are aligned with the project objectives.</p> <p>Source: <i>NATSPEC National BIM Guide</i></p>
BIM Management Plan (BMP)	<p>A formal document that defines how the project will be executed monitored and controlled with regard to BIM. A BMP is developed at project initiation to provide a master information / data management plan and assignment of roles and responsibilities for model creation and data integration throughout the project</p> <p>Note: In some regions, a BMP is referred to as a BIM Execution Plan.</p> <p>Source: <i>NATSPEC National BIM Guide</i></p>
BIM - Product	<p>An object-based digital representation of the physical and functional characteristics of a facility. The Building Information Model serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its lifecycle from inception onward.</p>
BIM Maturity	<p>The range of levels that form the gradual implementation of collaborative BIM into the industry is described as 'maturity levels'. In Australia, this is described in the <i>CRC National Guidelines for Digital Modelling</i> and noted below.</p> <ul style="list-style-type: none"> • Stage 0 – 2D documents <ul style="list-style-type: none"> ○ 0A Manual drafting ○ 0B CAD 2D drafting • Stage 1 – Modelling <ul style="list-style-type: none"> ○ 1A 3D CAD modelling ○ 1B Intelligent 3D modelling • Stage 2 – Collaboration <ul style="list-style-type: none"> ○ 2A One-way collaboration ○ 2B Two-way collaboration • Stage 3 – Integration <ul style="list-style-type: none"> ○ 3A Local server ○ 3B Web-based server <p>Source: <i>CRC National Guidelines for Digital Modelling</i></p>
BIM Process	<p>A collection of defined model uses, workflows, and modelling methods used to achieve specific, repeatable, and reliable information results from the model. Modelling methods affect the quality of the information generated from the model. When and why a model is used and shared impacts the effective and efficient use of BIM for desired project outcomes and decision support.</p>

BIM Quality Plan	<p>A BIM Quality Plan refers to the stages of quality checking or assurance carried out on models. There are generally four grades or levels of checking. Following are the common methods:</p> <ul style="list-style-type: none"> • Visual and Performance Checks - software and model • Interference Checks – clash, segregation, deflection • Standards Check – compliance • Element Validation – asset compliance
BIM Uses	<p>Project Specific outcomes arising through the use of BIM processes. <i>Source: APCC & ACIF Building and Construction Guide PTI and BIM, June 2015</i></p>
Build–Own–Operate–Transfer	<p>A project delivery model, where the contractor assumes the risk of financing till the end of the contract period. For example, a private sector entity builds a project, operates it and eventually transfers ownership of the project to the government.</p>
buildingSMART	<p>The name given to the International Alliance for Interoperability (IAI), the pre-eminent organisation promoting interoperability in the construction industry. Promotion of IFC (Industry Foundation Classes), IFD (International Framework for Dictionaries) and IDM (Information Delivery Manual).</p>
CAD	<p>Computer Aided Design. A geometric / symbol based computer drawing system that replicates hand drawing techniques.</p>
2D CAD	<p>The use of CAD software to prepare 2D lines suitable for presentation on hard copy plots of drawings and/or as background data to other 2D lines.</p>
3D CAD	<p>The use of CAD software to prepare 3D lines, surfaces or solids which are suitable for presentation on hard copy plots of drawings, and / or as background data for other 3D data or BIM</p>
Capability	<p>The ability to perform a task or deliver a service or product. In this context it is generally taken to mean capability with regard to BIM.</p>
Change Register	<p>A Change Register or Change Log provides a central place for storing all the information relating to changes within a BIM project. Some processes are automated indicating visual changes whilst others require more formal approaches with an itemised list.</p>
Code Validation	<p>A process in which code validation software is utilised to check the compliance of model parameters against design codes.</p>
Collaboration	<p>Collaborative practices on building design and construction projects bring together large number of diverse disciplines (many of whom will not have worked together before). It also involves the co-ordination and integration of information, procedures and systems. For example: Project structures have evolved from straight-forward client - consultant - contractor relationships to more integrated structures with complex financing arrangements, early engagement of the supply chain and the introduction of sub-contractor and supplier design. <i>Source:</i> http://www.designingbuildings.co.uk/wiki/Collaborative_practices_for_building_design_and_construction</p>
Common Data Environment (CDE)	<p>Single source of information for any given project, used to collect, manage and disseminate all relevant approved project documents for multi-disciplinary teams in a managed process NOTE: A CDE may use a project server, an extranet, a file-based retrieval system or another suitable toolset. <i>Source: PAS 1192- 2:2013 The British Standards Institution 2013</i></p>
Conceptual Design	<p>The phase of the design process in which the overall scope and nature of the project is determined in response to the site, planning considerations and the client’s brief, budget and program.</p>
Construction Management (CM)	<p>A delivery model that involves the appointment of a construction manager to oversee and coordinate the work of a range of individual trade contractors and designers engaged directly by the project sponsor to deliver a specific construction project.</p>

Construction Operations Building Information Exchange (COBie)	<p>A system for capturing information during the design and construction of projects that can be used for Facility Management purposes including operation and maintenance. A key element of the system is a preformatted Excel spreadsheet used for recording this information. COBie eliminates the current process of transferring massive amounts of paper documents to facility operators after construction has been completed. COBie eliminates the need for as-built data capture after building handover and helps to reduce operational costs.</p> <p>Source: <i>NATSPEC National BIM Guide</i></p>
Container Files	<p>A Container File is a term used to describe a file that contains multiple elements of models, data and metadata within it. It is often used to describe the BIM that other models will be federated into.</p>
Communication Methods	<p>Communication methods when working with BIM is: Graphical model requirements (colours, detail etc.), Data requirements (information to communicate intention e.g. work breakdown packages, costing etc.). This also includes responsibility or decision making mapping, similar to a communication tree.</p>
Data Drop	<p>Data Drops are produced at set stages of a project, through the design, construction and operation phases. A Data Drop provides the capability to analyse and check the proposed design at set stages. • ie. use of COBie is a flat (static) dump of the data information within a BIM to a structured format (COBie).</p> <p>Source: <i>UK Government BIM Maturity</i></p>
Datum Files	<p>A Datum File or also referred to as a Project Base File, is a model file that a project uses to establish the datum elements of all stakeholder models. Datum elements include coordinates, levels, grids and other items such as export standards.</p>
Deliverables	<p>The product of engineering and design efforts to be delivered to the client as digital files and/or printed documents. Typically, this would be the concept submittal and the corrected final design. A deliverable may have multiple phases.</p>
Delivery Model	<p>An approach to the delivery of a construction works or services project. Often noted as Delivery model or method, this system establishes the legal agreements for the contract formation.</p> <p>Source: <i>Building and Construction Procurement Guide Principals and Options, (Austroads & APCC)</i></p>
Design-Build-Operate (DBO)	<p>A project delivery model is a system used by an agency or owner for organizing and financing design, construction, operations, and maintenance services for a structure or facility by entering into legal agreements with one or more entities or parties.</p>
Design-Build-Finance-Operate (DBFO)	<p>Is a project delivery model very similar to Build-Own-Operate-Transfer (BOOT) except that there is no actual ownership transfer. Moreover, the contractor assumes the risk of financing till the end of the contract period. The owner then assumes the responsibility for maintenance and operation. This model is extensively used in specific infrastructure projects such as toll roads. The private construction company is responsible for the design and construction of a piece of infrastructure for the government, which is the true owner. Moreover, the private entity has the responsibility to raise finance during the construction and the exploitation period.</p>
Design and Construct (D&C)	<p>A delivery model (which includes variants such as novated design and construct, and design development and construct) under which a project owner selects a single contractor to deliver both the design services and construction works for a specific project. Following completion of the construction works, the project owner assumes responsibility for the ongoing maintenance and/or operation of the asset, except in cases where such responsibilities are appended to the D&C model under such variants as design, construct and maintain; design, construct and operate; or design, construct, maintain and operate.</p>
Design-Bid-Build (DBB)	<p>A delivery model in which the client enters into separate contracts for the design and construction of a building or project. Design and documentation services are generally provided by a professional design consultancy, the documents are used for bidding (tendering) purposes and the successful bidder, generally a building company, enters into a contract with the client to build the project. Often referred to as the 'traditional' method of procurement.</p>

Design Development	The phase of the design process in which the general relationships represented in the schematic design phase are resolved in more detail. During this phase the dimensions of all major elements are defined and forms of construction finalised.
Discipline Models	Individual design discipline or trade sub-contractor models – aggregate models. <i>Source: Building and Construction Procurement Guide Principals and Options, (Austroads & APCC)</i>
Early Contractor Involvement (ECI)	A two-stage relationship-style delivery model, generally structured to resemble a project alliance model during the first stage and a D&C model during the second. This delivery model is specifically designed to achieve good relationship, cost and constructability outcomes by fostering the involvement of construction contractors during the preliminary (design and development) stages of project delivery. <i>Source: Building and Construction Procurement Guide Principals and Options, (Austroads & APCC)</i>
EIR (Employers Information Requirement)	A template setting out the information needed to define information and other client requirements for a project delivered using BIM. It includes guidance and pre-qualification documentation for consultants and contractors. The EIR form part of the appointment and tender documents on a BIM Project. The EIR define which models need to be produced at each project stage – together with the required level of detail and definition. These models are key deliverables in the ‘data drops’ – contributing to effective decision making at key stages of the project. The content of the EIR covers three areas: <ul style="list-style-type: none"> Technical – details of software platforms, definitions of levels of detail, etc. Management – details of management processes to be adopted in connection with BIM. Commercial – details of BIM Model deliverables, timing of data drops and definitions of information purposes. <i>Source: NATSPEC BIM Resources</i>
Earned Value	A project management technique which has three criteria: Planned Value (PV), Earned Value (EV and Actual Cost (AC). Earned Value Management thus combines the measurements of scope, schedule, and cost in a single integrated system. BIM with additional software applications can be utilised to determine a BIM projects earned value. <i>Source: BIM Dictionary</i>
Facilities Management (FM)	Facilities Management - the process of managing and maintaining the efficient operation of facilities including buildings, properties and infrastructure. The term is also applied to the discipline concerned with this process.
Federated Model	A model consisting of linked but distinct component Models, drawings derived from the Models, texts, and other data sources that do not lose their identity or integrity by being so linked, so that a change to one component Model in a Federated Model does not create a change in another component Model in that federated Model.
Federated IFC Model	One or more aggregate models brought together in non-authoring software, using Industry Foundation Class (IFC) reading, for the purposes of virtual construction and data manipulation.
Federated Open Standard Model	Refer Federated IFC Model
Federated VC Review Model	One or more aggregate models brought together in non-authoring software for the purposes of virtual construction review.
FF&E	Furniture, Fixtures & Equipment.
File Transfer Protocol (FTP)	The protocol for exchanging files over the Internet. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server (e.g. uploading a Web page file to a server).

Industry Scope	The Industry Scope and the application of definition in BIM Uses may differ, for example from Building (commercial and residential), Sectors (health and education) to Infrastructure (civil, roads and bridges, transport, water, energy and telecommunications); to Mining, (resources, gas and oil) to Manufacturing including supply chains and other large assets (such as plant, treatment and extrusion). Industries and relevant sectors develop BIM Uses to their specialisation and requirements.
IFC (Industry Foundation Classes)	A specification for a neutral data format to describe, exchange and share information typically used within the building and facility management industry sectors. The IFC data model consists of definitions, rules, and protocols that uniquely define data sets which describe capital facilities throughout their lifecycles. IFC is the only non-proprietary, open global data model specification available. <i>Source: buildingSMART</i>
Informational	See Legal Status
Integrated Project Delivery (IPD)	The project procurement method in which the client enters into a contract with a number of organisations including design consultants and building contractors at the earliest stages of the project to create an integrated team. It is characterised by an expectation that the team will work collaboratively to deliver a product that meets the client's requirements. <i>Source: NATSPEC National BIM Guide</i>
Legal Status	Legal status of the Design Model to construction: Binding: Imposing a legal (contractual) obligation between the author/s and recipient/s. Used in this context to mean a Design Model that represents what has to be constructed under the terms of the contract. Informational: A Design Model that conveys non-binding information relevant to the project that may be useful to its recipient/s. No formal claims are made about its accuracy and it is provided on an 'as is' basis. Reference: A Design Model that is intended to be used for 'read-only' purposes such as recording model development at different stages of the project or clash detection. Once Design Models are designated 'Reference', they shall not be edited further. Reference Design Models can be used as the basis for bid preparation but cannot form part of the contract documents. A model has to be designated 'Binding' for this purpose. Reference models shall be sufficiently accurate for their intended purpose. Reuse: A Design Model authorised by its authors for modification or further development by its recipients. <i>Source: NATSPEC National BIM Guide</i>
Level of Development (LOD)	"The level(s) of Development (LOD) describes the level of completeness to which a Model Element is developed". It describes the steps through which a BIM element can logically progress from the lowest level of conceptual approximation to the highest level of representational precision The document defines 5 LODs. Each subsequent level builds on the previous level and includes all the characteristics of the previous levels. <i>Source: The American Institute of Architects Document E202 – 2008 Building Information Modelling Protocol Exhibit - Level of Development.</i>
Level of Information (LOI)	Level of Information is the different types of information that are required to be embedded into the BIM for tiered levels of requirement, such as importance, decision making, clarity etc. A BIM may require the information level to be high on particular elements as they will assist in determining the type of element that is modelled. <i>Source: NBS - National Building Specification toolkit definitions</i>
Master Format®	Master Format® is a master list of numbers and titles classified by work results or construction practices, used throughout the North American construction industry to organise project manuals, detailed cost information, and relate drawing notations to specifications. <i>Source: Master Format®</i>
Model	A three-dimensional representation in electronic format of building elements representing solid objects with true-to-scale spatial relationships and dimensions. A Model may include additional information or data <i>Source: ConsensusDocs 301 BIM Addendum, 2008</i>

Model Collaboration Matrix	See Model Progression Specification. The difference in title simply reflects an emphasis on the collaborative nature of managing the modelling process.
Model Element	A portion of the Building Information Model, representing a component, system or assembly within the building or building site (American Institute of Architects).
Model Element Author (MEA)	The authorised person who inputs data into a Building Information Model.
Model Progression Specification	A document, usually a drawn matrix, which summarises how the significant Model Elements that comprise a model are to be progressively developed by reference to the Level of Development required for each element at different phases of the project. It also shows who is responsible for this development (the Model Element Author) at each phase. For project team members, whose ability to fulfil their roles is interdependent, it provides a framework for coordinating their activities. <i>Source: NATSPEC National BIM Guide</i>
Mechanical Electrical Plumbing (MEP)	Referring to this group of building services or the engineering disciplines associated with them.
Model Production and Delivery Table	The Model Production and Delivery Table (MPDT) is a key document as it both allocates responsibility for preparation of the Models and identifies the Level of Detail (“LOD”) that Models need to meet at the project stages or data drops stated in the table. <i>Source: CIC BIM Protocol</i>
Model View Definition (MVD)	An IFC View Definition, or Model View Definition, defines a subset of the IFC schema that is needed to satisfy one or many Exchange Requirements of the AEC industry. A MVD defines a subset of the IFC Schema providing implementation guidance for all IFC concepts (classes, attributes, relationships, property sets, quantity definitions, etc.) used within this subset. It thereby represents the software requirement specification for the implementation of an IFC interface to satisfy the exchange requirements. <i>Source: NATSPEC National BIM Guide</i>
Native Applications	Native applications are software applications that the system supports with minimal work-arounds or additional components, such as additional software or steps. They are generally built by the same vendor and within the same series of the vendors’ products.
NATSPEC	The Australian National Building Specification system. Used in this document to describe the work section classification system used to organise it, or the name of the organisation that produces it.
Non Native Applications	Non Native Applications is the opposite to ‘Native Applications’.
OmniClass™	The OmniClass™ <i>Construction Classification System</i> is a classification system for the construction industry, developed by the <i>Construction Standards Institute</i> (CSI) and is used as a classification structure for electronic databases. As the basis of its tables, OmniClass™ incorporates other existing systems currently in use, including Master Format® for work results, UniFormat™ for elements, and EPIC (Electronic Product Information Cooperation) for structuring products.
Open Standard Specification	An open standard specification describing the data needed to support operational management, building and system alterations or additions, and asset maintenance scheduling.
Operational Management	A process in which the data outlined in the open standard specification is used to allocate, manage, and monitor assigned workspaces and related resources.
Project Alliancing (PA)	Refer to Alliance

Project Charter	<p>The Project Charter is a brief document containing the statement of the scope, objectives, and participants in a project. It references back to the SOR/SOW and is utilised to outline key objectives to large teams.</p> <p>Some Project Sponsors will develop the charter whilst individual groups or businesses may establish their own.</p> <p>Source: <i>Project Management Body of Knowledge (PMBOK)</i></p>
Project Manager	<p>An individual or organisation contracted to administer and manage a project on behalf of the owner. While the scope of project management may vary, to include activities such as organising, planning, scheduling, directing, controlling, monitoring and evaluating, the objective is to ensure that the objectives of the project, manufactured product, or service, are achieved.</p> <p>Source: <i>Standards Australia, SAA HB50, 2004</i></p>
Project Management Plan (PMP)	<p>A Project Management Plan, according to the <i>Project Management Body of Knowledge (PMBOK)</i>, is: "...a formal, approved document used to guide both project execution and project control. The primary uses of the project plan are to document planning assumptions and decisions, facilitate communication among project stakeholders, and document approved scope, cost, and schedule baselines. A Project Management Plan – PMP, may be linked to a Project BIM Management Plan (BMP) or reference to the BMP.</p> <p>Source: <i>Project Management Body of Knowledge (PMBOK)</i></p>
Project Roles and Responsibilities	<p>Project roles and responsibilities (whole of and or at project stages) to enable BIM performance. Forms part of the BMP and Contractual hierarchy: The definition of the Project structure, roles, responsibilities and stakeholders.</p>
Procurement Method	<p>The form of contract and procurement process to be used with respect to the selected delivery model, as documented in the procurement strategy. Refer to Delivery Model</p>
Procurement Strategy	<p>A document that represents the outcome of the procurement options analysis process and identifies the recommended delivery model and procurement method for a project, based on the project's individual characteristics and circumstances.</p> <p>Source: <i>APCC Building and Construction Procurement Guide – Principles and Options</i></p>
Project Team Integration (PTI)	<p>PTI is a project delivery approach that encourages all project team members (including design consultants and building contractors) at the earliest stages of a project to enhance the level of integration between them. This is to encourage collaborative behaviour and harness the talents and insights of all participants. And also to reduce waste and optimise project outcomes through all phases of design, fabrication, construction and project handover.</p> <p>Source: <i>ACIF & APCC, Framework for the Adoption of Project Team Integration and Building Information Modelling</i></p>
Progress BIMs	<p>BIM models other than those specified in Final BIM Deliverables to be provided at specified milestones in the project program to demonstrate or record progress. They can be used as a design tool by the design or construction teams only or form part of the deliverables for the client. If Progress BIMs are required, they shall be specified in the BIM Management Plan (BMP) and the following details for each included:</p> <ul style="list-style-type: none"> ▪ Program milestone ▪ Level of Development ▪ Features to be modelled ▪ Recipient, e.g. Design Team only, client. <p>The same delivery requirements for 3D Geometric Deliverables specified in Final BIM Deliverables apply to Progress BIMs unless otherwise noted in the BMP.</p> <p>Refer to Work in Progress (WIP) for informal progress sharing.</p>
Project Sponsors	<p>Project sponsors are the client, financiers, and end users who, individually or jointly, determine the risk allocations and terms of the head contract offered to the head contractor. Whilst during design and construction there will usually be only one organisation acting as the client under a contract with a head contractor, its ability to determine all relevant commercial and technical conditions may have been influenced or even controlled by providers of finance, or the requirements of end users.</p>

Public Private Partnership (PPP)	A delivery model under which the project owner selects a private sector partner to finance, design and construct the project works, and assume responsibility for operations and/or maintenance over a long-term period.
Record Model	A Record delivery as documented by <i>AIA Document B101-2007</i> states: that the preparation of post-construction documents is an additional service, and that these documents can be provided in two forms: As-Designed Record Documents (models) and As-Constructed Record Documents (models). The former is a consolidation of all documents involving the architects design, including addenda and contract modifications; the latter is the preparation of record documents based on contractor-provided record information required by <i>AIA Document A201</i> . Sign - off or seals of the changes to design whilst out on site are established in the As-Constructed Record documents / models. <i>Source: AIA, Documents A201 and B101</i>
Reference	See Legal Status
Request for Expression of Interest (EOI)	A documented request for information on a matter from one party to another. They are usually managed through formal procedures agreed by members of the project team.
Request for Information (RFI)	A documented request for information on a matter from one party to another. They are usually managed through formal procedures agreed by members of the project team.
Request for Tender (RFT)	A documented request for tender on a matter from one party to another. They are managed through formal procedures.
Scope Creep	Scope creep is the uncontrolled or continuous growth in a projects scope due to changes or undefined detail in the requirements, function and features of a BIM and project BIM Uses. This can occur when the scope of a project is not properly defined, documented, or controlled. If budget, resources, and schedule are increased along with the scope, the change is usually considered an acceptable addition to the project, and the term "scope creep" is not used. <i>Source: Wikipedia and modified with BIM context</i>
Soft Landings	Soft landings reflect the framework utilised for a smooth transition from the design and construction phase to the operational phase of a built asset. Combined with the concept of Post Occupancy Evaluation (POE) it seeks to compare the required performance outcomes with actual performance outcomes. BIM is utilised to assist in this delivery via simulations and data validation. <i>Source: CIBSE, Soft landings Framework Australia and New Zealand and modified with a BIM context</i>
Stage Gate	Division of a standardised process map for the acquisition of a facility, at some of which the requirements can be delivered. NOTE: The stages at which information exchanges are required should be specified in the EIR by reference to the agreed stage and gate names. <i>Source: CIC Scope of Services</i>
Statement of Requirement and Statement of Works	The Statement of Requirement is a detailed description of the Goods and or Services to be provided by the successful tenderer including technical specification, service levels and performance framework. Taken together with the accepted parts of the tenderer's response, it will form part of the Agreement.
UniClass TM	A UK classification system. UniClass TM is a classification scheme for the construction industry. It is intended for organising library materials and for structuring product literature and project information. UniClass TM comprises 15 tables, each of which represents a different broad facet of construction information. Each table can be used as a "stand alone" table for the classification of a particular type of information, but, in addition, terms from different tables can be combined to classify complex subjects. <i>Source: UniClassTM</i>

UniFormat™	<p>Is a common elemental classification for the description, economic analysis and management of a building for its life-cycle. Elements often referred to as systems or assemblies, are major components common to most buildings that are identified as performing a given function regardless of the design specification, construction method, or materials used.</p> <p>UniFormat™ is most often used by estimators and design teams, who use it as a cost analysis format or arrangement for early project design documentation. Because it breaks a facility into the systems that perform distinct functions – shell, foundation, interiors, etc. The elements are major components common to most buildings. The system can be used to provide consistency in the economic evaluation of building projects. It was developed through an industry and government consensus and has been widely accepted as an ASTM standard.</p> <p>Source: UniFormat™</p>
Validation Procedures	<p>The procedures are carried out generally by software applications that utilise the BIM (elements and data) to check for compliance ranging from structural integrity and energy performance through to standards in areas such as safety and design.</p> <p>Refer also to: Code Validation</p>
Value Engineering (VE)	<p>Value engineering (VE) is using BIM with the project stakeholders to improve the "value" of project and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost. It is a primary rule of value engineering that basic functions be preserved and not be reduced as a consequence of pursuing value improvements. BIM assists to drive this process due to the ability to assess and test options quickly using validation procedures.</p> <p>Source: <i>Construction Work Zone modified with a BIM context</i></p>
Value-for-money	<p>Value-for-money is an essential determinant in the procurement of goods, services and works by Government agencies. It does not necessarily represent lowest cost; rather the achievement of the best available outcome for money spent on the procurement, considering whole-of-life considerations such as:</p> <ul style="list-style-type: none"> ▪ fitness-for-purpose and other considerations of quality ▪ performance ▪ price ▪ delivery ▪ accessories and consumables ▪ service support ▪ disposal <p>Source: <i>Building and Construction Procurement Guide: Principles and Options. APCC and Austroads</i></p>
Virtual Construction (VC)	<p>The interrogation of federated models to test geometrical and spatial fit in a rehearsal of the physical construction process.</p>
View – Model Views	<p>A representation of model from a defined vantage point. This can be outside or inside the model, or when seen from one side of a cutting plane intersecting the model.</p>
Work in Progress (WIP)	<p>Work in progress (WIP), is the production process of creating models that are partially completed. Models that are shared 'not issued' during the production process are done so for information purposes only.</p> <p>Source: <i>Wikipedia and modified in a BIM context</i></p>

Foreword

The building and construction industry is an important part of the economy and society more broadly, contributing around 9% to GDP and employing around one million people. It creates high-skill jobs and investment in other industries that leads to further social and economic benefits.

Due to the current growth in BIM adoption in Australasia, by both the public and private sectors, it is critical for government and the construction industry to work together to maximise the value of BIM to deliver improved efficiencies and productivity, and increase innovation in the management, design, construction and operation phases of a construction activity.

The positive impact that efficiency improvements can have on the competitiveness of the building and construction industry are estimated in the billions. Building Information Modelling (BIM) is a revolutionary technology that is becoming more common across Australia. It offers a means to revolutionise the industry, rapidly transforming the way buildings are constructed.¹

As the adoption of BIM accelerates in Australia, it is critical for governments and industries in the built environment to work together to maximise the value of BIM to deliver improved efficiencies and productivity and increased innovation in the management, design, construct and operation phases of a built asset.

With an estimated construction spend in Australia of \$207 billion in 2016-17 it is critical that efficient and effective processes are utilised. For example, a 15% productivity improvement driven by BIM would result in a \$31 billion saving. The potential for monetary savings through the use of BIM is estimated at 15-20% per project.²

The Australasian Procurement and Construction Council (APCC) and Australian Construction Industry Forum (ACIF) together represent the Strategic Forum for the building and construction industry. It is a unique body that brings together key stakeholders in the Australasian construction industry. The Forum acts as an entry point and significant interface between government and the construction sector facilitating positive change and encourage greater productivity.

This Framework is the third in a series of national important initiatives designed to drive improvement productivity and a consistent approach to the adoption of BIM.

1. Framework

This Framework is designed to guide and assist industry stakeholders in the adoption and implementation of BIM. Designed for the uninitiated to BIM to explain in simple terms the necessary elements to prepare and adopt BIM. It demystifies the perceived complexities and provides a 'reality check'.

2. Building and Construction Procurement Guide: PTI and BIM

This Guide is the 'how to' for integration of BIM into each procurement model. The Guide also assists to promote a consistent approach to tendering and contracting across Australia.

3. BIM Knowledge and Skills Framework

The Framework is a critical part of the construction sector's approach to improvement. It is a Framework of principles, practices, and outcomes with which to build an education curriculum, professional development and business BIM requirements.

¹ Hardin, B (2009), BIM and Construction Management, Indianapolis: Wiley Publishing, IN.

² Bimplus.co.uk (2014), Chartered Institute.

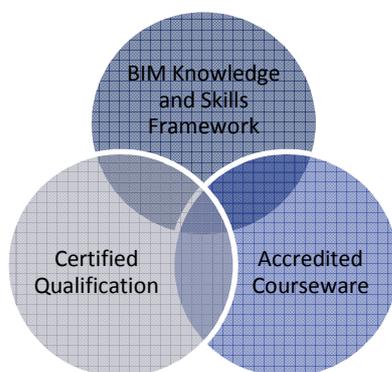
INTRODUCTION

A BIM KNOWLEDGE AND SKILLS VISION FOR AUSTRALASIA

The BIM Knowledge and Skills Framework (Framework) is an important and timely resource for the Australasian construction market sector. It provides guidance about the required skills and education relevant to BIM³ for a broad range of industry stakeholders. The intention of mapping the Framework in this wide-ranging manner is **to enable a consistent approach to the upskilling of the construction market sector**. This is to be achieved by increasing the level of knowledge and skills required to improve productivity through collaborative and integrated project delivery. It embraces a vision for the future of Australasian projects,

- a future that embraces all industries and the supply chain within the construction market sector
- a future where value for money encapsulates whole-of-life cost performance
- a future based on good working relationships through mutual respect, mutual resolve, and mutual responsibility
- a future that brings better functional design and environmental outcomes, and
- a future where all stakeholders have an equal share in shaping the next chapter in the history of their industry.

To achieve this, the Framework is a critical key part of the construction sector's approach to improvement. The focus revolves around a three-part model, linking the Framework with Accredited Courseware and a Certified Qualification procedure. This relies heavily on embedding a consistent message through each of the model parts, reflecting how market improvement can be achieved.



The Framework is developed with key concepts and principles which span across project management workflows. This is defined specifically to integrate with the many industries that BIM spans across and within. The desired outcome is to have educators establish courseware using this Framework as guidance and establish a national standard for BIM knowledge and skills. It is expected that due to the project management workflows, the integration can be developed into existing business requirements courseware. This is due to the ideal of BIM modifying and realigning project delivery workflows. **This Framework will assist businesses and educators to do this in their customised approaches, yet following and creating the same industry message.**

A major feature that distinguishes Australasia from all other countries implementing BIM is the flexibility of the approach. It is driven to integrate completely into all industries within the construction market sector. This is achieved by establishing groupings of stakeholders that exist across all or majority of project delivery types. The groupings are noted as follows:

- Client / Client Representative,
- Design (Architects and Engineers),
- Construction (Managing, Sub-contractors and Trades),
- Manufacturing (Suppliers and Fabricators), and (not included in this Framework)
- Site, Facility, and Asset Management. (not included in this Framework)

The stakeholders listed above indicate a general grouping noticed on all projects, whether it be a site, facility, or asset. The stakeholders' differentiation is established as each group interacts differently with the requirements of BIM. This is dependent on their speciality, such as Quantity Surveying (QS) and how the role and responsibility changes when the QS is within each of the stakeholder groups.

³ This also encompasses Digital Engineering, Digital Delivery, Virtual Digital Construction and Digital Technology which are terms commonly used in infrastructure construction.

The release of the three grouping in this Framework is the start of the journey to enable a consistent approach to the upskilling of the construction market sector. Other groups are encouraged to utilise the Framework to develop their own guidance about their required skills and education relevant to BIM.

The responsibility levels recognised for each stakeholder group follows the traditional hierarchical business pyramid of Strategic, Managerial (Tactical) and Technical. This has allowed for further integration into project workflows and decision making processes. This became a necessity in establishing the Framework as BIM tasks vary depending on the position within the stakeholder grouping. This is most notable from project delivery phases where strategic tasks are more prominent in feasibility, and managerial and technical roles in the execution or delivery.

Whilst the prime purpose of the Framework is to have BIM embedded into delivery of construction related education, there are benefits for businesses wishing to use BIM in construction projects.

The Framework provides an opportunity for businesses and educators across Australasia to work towards:

- a clear focus on BIM requirements
- a shared language for curriculum in the construction market sector
- a base for planning, promoting and assessing the industries learning progress
- improved quality in project delivery and productivity.

When starting to use the Framework, remember that it is just that – a framework. It is not a syllabus, not a program, not a curriculum, not an assessment tool, and not a detailed description of everything people will learn. **It is a Framework of principles, practices, and outcomes with which to build a curriculum, professional development and your business requirements and learning and development plans.**

It is based on best available evidence to how the construction market sector works and what it finds important. As such, some ideas will be consistent with some of your practices and knowledge, and some will be challenging, new, and very particular to BIM. This provides excellent opportunities for all educators to build on their current knowledge and experience, so that their curriculum decision making is consistent with current thinking and market expectations.

READING THE BIM KNOWLEDGE AND SKILLS FRAMEWORK

As noted in the introduction, the Framework comprises a variety of models and processes that link together. This section will outline how to read the BIM Knowledge and Skills Framework Matrix (the Matrix) whilst denoting how each of the models and processes are utilised. This will give you an understanding of why each method was chosen and how the model can be utilised across the industry. The Framework is not complete in the stakeholder groupings. These will be further developed when acceptance of the Framework is established within industry.

Organisation of the Matrix

The Knowledge Areas described in the Matrix are organised across two axes:

The horizontal axis is organised by Stakeholder Groups:

- Client / Client Representative,
- Design (Architects and Engineers),
- Construction (Managing, Sub-contractors and Trades)

These groups are further subdivided by a hierarchy of roles: Strategic, Management and Technical.

The vertical axis is organised by project phases plus some introductory material.

1.0 KNOWLEDGE AREAS

Establishing project management Knowledge Areas for the Framework: During the state consultations with government departments, education, and industry, a pattern in the Framework was recognised by some of our specialists. This pattern reflected the Project Managers Body of Knowledge – PMBOK. Although there is a slight variation to the structure, the Framework tends to replicate the system. It also connects with the **purpose of being a body of knowledge – standard terminology and guidelines**. This is noted as a necessity to establish understanding in BIM and therefore an appropriate fit for the Framework structure.

The Framework is developed with each of the Knowledge Areas listed within the first and second columns. They are broken down into:

- 1.000 INTRODUCTION
- 2.000 START UP
- 3.000 INITIATION
- 4.000 PLANNING
- 5.000 EXECUTION / OPERATION
- 6.000 MONITORING AND CONTROLLING
- 7.000 CLOSEOUT / HANDOVER / COMMISSIONING

The introduction section is included to give an overview of BIM. The close relationship to the PMBOK Knowledge Areas follows i.e. 2.000 START UP.

As noted the Knowledge Areas - when generalised, are utilised in every type of project across the entire market sector. This is regardless of discipline, speciality, or phase of the project delivery.

Below is an example of how the Knowledge Areas appear in the spreadsheet of the Framework.

PROCESS GROUP	CONCEPT	DESCRIPTOR
Groups loosely based on PMBOK process groups and knowledge areas	Key area that BIM has added functionality to or enabled sound process	
1.000 INTRODUCTION		
1.100 MARKET & INDUSTRY CONTEXT BIM Introduction	1.101 What is BIM?	Principles of Building Information Modelling. Including its application to the whole-of-life design, construction, management and operation.

Figure 1: Example of the Knowledge Areas within the BIM Knowledge and Skills Framework.

2.0 PROCESS GROUPS

The linking of PMBOK Process Groups to the Framework: The Process Groups in PMBOK range over 44 different items that fit into each of the Knowledge Areas. The BIM Knowledge and Skills Framework aligns to the Process Groups that suit how BIM will be approached in a project. To denote further understanding we have added another level to the Process Groups – in the example below this is highlighted ‘Planning’.

PROCESS GROUP	CONCEPT	DESCRIPTOR
Groups loosely based on PMBOK process groups and knowledge areas	Key area that BIM has added functionality to or enabled sound process	
2.000 START UP		
2.100 PROJECT INITIALISATION		
Planning	2.101 Project Performance Requirements: BIM Uses Additional Information: 2.205 BIM Uses	Identification of the Performance Requirements of the project where BIM Uses will assist in delivery such as: <ul style="list-style-type: none"> • Financial: Sustainability, Operation & Maintenance, Waste reduction, Asset and Facility Management • Business: Functional site, asset requirements, Safety, Quality and Environmental Assurance requirements. • Project Sponsor (Employer/Client): Community impacts, visualisations, noise studies . • Human Capital: Quality of work, productivity.

Figure 2: Example of the Process Groups within the BIM Knowledge and Skills Framework.

3.0 CONCEPTS

Concepts are used to explain the benefits BIM brings to the Process Group. The Framework covers the Process Groups that BIM add specific benefit. It is expected that not all projects will require every Concept listed within the Framework. A broad spectrum of concepts has been added to assist those that have not had exposure to this level of BIM.

Highlighted below is an example of the Concepts.

PROCESS GROUP	CONCEPT	DESCRIPTOR
Groups loosely based on PMBOK process groups and knowledge areas	Key area that BIM has added functionality to or enabled sound process	
2.000 START UP		
2.100 PROJECT INITIALISATION		
Planning	2.101 Project Performance Requirements: BIM Uses Additional Information: 2.205 BIM Uses	Identification of the Performance Requirements of the project where BIM Uses will assist in delivery such as: <ul style="list-style-type: none"> • Financial: Sustainability, Operation & Maintenance, Waste reduction, Asset and Facility Management • Business: Functional site, asset requirements, Safety, Quality and Environmental Assurance requirements. • Project Sponsor (Employer/Client): Community impacts, visualisations, noise studies . • Human Capital: Quality of work, productivity. Other supportive data used to confirm project viability during the feasibility stage.

Figure 3: Example of Concepts in the BIM Knowledge and Skills Framework.

4.0 DESCRIPTORS

Descriptors define the Concepts in broad detail to trigger specific tasks. The descriptors have been added to the Framework to further emphasise how to address the Concept for each of the hierarchical areas (noted in the hierarchy section). The detail varies depending on the explanation level required. Those that are difficult to explain have specific examples written within the cell in *italics*.

Below is an example of the Descriptor highlighted.

PROCESS GROUP	CONCEPT	DESCRIPTOR
Groups loosely based on PMBOK process groups and knowledge areas	Key area that BIM has added functionality to or enabled sound process	
2.000 START UP		
2.100 PROJECT INITIALISATION		
Planning		
	2.101 Project Performance Requirements: BIM Uses Additional Information: 2.205 BIM Uses	Identification of the Performance Requirements of the project where BIM Uses will assist in delivery such as: <ul style="list-style-type: none"> • Financial: Sustainability, Operation & Maintenance, Waste reduction, Asset and Facility Management • Business: Functional site, asset requirements, Safety, Quality and Environmental Assurance requirements. • Project Sponsor (Employer/Client): Community impacts, visualisations, noise studies. • Human Capital: Quality of work, productivity. Other supportive data used to confirm project viability during the feasibility stage.

Figure 4: Example of Descriptors in the BIM Knowledge and Skills Framework.

5.0 STAKEHOLDER GROUPS

Stakeholder Groups are utilised to understand the roles within the construction market sector. The differentiation of the groups is established as generally each project would share a similar stakeholder formation. Within this review there are only three of the five stakeholder areas covered:

- Client / Client Representative,
- Designers (Architects and Engineers)
- Construction (Managing contractors, sub-contractors, and trades)

Below is an example of the Stakeholder highlighted.

STAKEHOLDER GROUPS							
CLIENT / EMPLOYER REPRESENTATIVE							
Strategic (S)	Managerial (M)	Technical (T)	S: Procurement / Contract Officer	S: BIM Procurement Advisor / Contract Specialist	SM: Project Director	M: Project Manager	MT: BIM Manager
Identify and define the Project Performance requirements mapping BIM Uses to those requirements. <i>E.g. Financial: Reduced Energy Performance - BIM energy modelling concept to operation.</i>	Map the Project Performance requirements, linking the BIM Uses. Further define the BIM performance requirements. <i>E.g. Business: Quality Assurance - Laser Scanning pre, post and during engagements.</i>	Map BIM technical needs to assist in defining the BIM performance requirements. <i>E.g. Financial: Cl&M - Technical handover requirements for integration into Cl&M systems.</i>	3	5	3	4	4

Figure 5: Example of Stakeholder Groups within the BIM Knowledge and Skills Framework.

6.0 HIERARCHICAL ORGANISATION OF ROLES

The hierarchy structure defines how each stakeholder level interacts with the Concepts. The structure is based on the traditional business model hierarchy of Strategic, Managerial (Tactical) and Technical. Strategic is aimed at those that are in a high level within their business or project structure. They are generally external sales teams and those that are selling the business capabilities to market. Managerial is the tactical level which drives projects, project teams and discipline teams. They generally create a project management plan and are responsible for the project running on time and within budget. The final level is the technical level. People within this level define and manage the technical needs of projects, ranging from IT through to application workflows etc.

This level of definition in the Framework helps to address the different levels of understanding, and needs of those in each role. The objective is to ensure that all levels of leadership understand how their role interacts with BIM, and what they should be looking for at each Knowledge Area of the project life-cycle.

Expanding on the Concepts and Descriptors is an example for each of the hierarchical levels. These examples are just that; the framework is not stating that courseware should define this particular task in the same manner. The detail has been added so that educators can understand the Concept in further detail relevant to the person's level within business. It is expected that courseware will be created based on the audience (discipline). Therefore, the examples may not be suitable for all.

Below is an example of the structure being used for the Client / Client Representative area.

STAKEHOLDER GROUPS							
CLIENT / EMPLOYER REPRESENTATIVE							
Strategic (S)	Managerial (M)	Technical (T)	S: Procurement / Contract Officer	S: BIM Procurement Advisor / Contract Specialist	SM: Project Director	M: Project Manager	MT: BIM Manager
Identify and define the Project Performance requirements mapping BIM Uses to those requirements. <i>E.g. Financial: Reduced Energy Performance - BIM energy modelling concept to operation.</i>	Map the Project Performance requirements, linking the BIM Uses. Further define the BIM performance requirements. <i>E.g. Business: Quality Assurance - Laser Scanning pre, post and during engagements.</i>	Map BIM technical needs to assist in defining the BIM performance requirements. <i>E.g. Financial: O&M - Technical handover requirements for integration into O&M systems.</i>	3	5	3	4	4

Figure 6: Example of Hierarchical Levels in the BIM Knowledge and Skills Framework.

7.0 ROLES

Defining a base level of roles to structure stakeholder groups. Stakeholder groups each have roles that have been nominated to represent the difference between each groups' responsibility. The roles are a guide to what will fall under each group. There are many more, and at times less, roles depending on the project type and the level of BIM being explored.

The Framework has roles that define each hierarchical level. This is denoted with a S, M or T in front of the roles. In some cases, there will be a reference to two levels. This is due to some roles expanding beyond the traditional tasks.

Below is an example of the roles for the Client / Employer Representative.

STAKEHOLDER GROUPS							
CLIENT / EMPLOYER REPRESENTATIVE							
Strategic (S)	Managerial (M)	Technical (T)	S: Procurement / Contract Officer	S: BIM Procurement Advisor / Contract Specialist	SM: Project Director	M: Project Manager	MT: BIM Manager
Identify and define the Project Performance requirements mapping BIM Uses to those requirements. <i>E.g. Financial: Reduced Energy Performance - BIM energy modelling concept to operation.</i>	Map the Project Performance requirements, linking the BIM Uses. Further define the BIM performance requirements. <i>E.g. Business: Quality Assurance - Laser Scanning pre, post and during engagements.</i>	Map BIM technical needs to assist in defining the BIM performance requirements. <i>E.g. Financial: O&M - Technical handover requirements for integration into O&M systems.</i>	3	5	3	4	4

Figure 7: Example of roles within the BIM Knowledge and Skills Framework.

8.0 KNOWLEDGE AND SKILL LEVELS

Defining the levels of knowledge or skill required for each role. The levels of knowledge or skill required for each role can differ based on the size of the project, discipline team or business. The Framework aims to add these levels to each role. The levels are defined as follows:

Proficiency Level	Description
1 Fundamental Awareness (basic knowledge)	<p>You have a common knowledge or an understanding of basic techniques and concepts.</p> <ul style="list-style-type: none"> • Focus is on learning. • Limited or no use of competency required for the job. • Competency has been minimally demonstrated. • May have had limited opportunities to apply the competencies. • May have limited understanding of the competency.
2 Novice (limited experience/ Basic Level of Competency)	<p>You have the level of experience gained in a classroom and/or experimental scenarios or as a trainee on-the-job. You are expected to need help when performing this skill.</p> <ul style="list-style-type: none"> • Focus is on developing through on-the-job experience; • You understand and can discuss terminology, concepts, principles, and issues related to this competency; • You utilize the full range of reference and resource materials in this competency. • Basic Understanding or knowledge needed for the job. • Basic understanding and knowledge sufficient enough to handle routing tasks. • Requires some guidance or supervision when applying the competency. • Understands and can discuss terminology and concepts related to the competency.
3 Intermediate (practical application/Proficient)	<p>You can successfully complete tasks in this competency as requested. Help from an expert may be required from time to time, but you can usually perform the skill independently.</p> <ul style="list-style-type: none"> • Focus is on applying and enhancing knowledge or skill; • You have applied this competency to situations occasionally while needing minimal guidance to perform successfully; • You understand and can discuss the application and implications of changes to processes, policies, and procedures in this area. • Detailed knowledge, understanding and application of the competency required to be successful in the job. • Ability to handle none routing problems and Situations. • Required minimum guidance or supervision /works independently. • Consistently demonstrates success in the competency. • Capability of assisting others in the application of the Competency.
4 Advanced (applied theory)	<p>You can perform the actions associated with this skill without assistance. You are certainly recognized within your immediate organization as "a person to ask" when difficult questions arise regarding this skill.</p> <ul style="list-style-type: none"> • Focus is on broad organizational/professional issues; • You have consistently provided practical/relevant ideas and perspectives on process or practice improvements which may easily be implemented; • You are capable of coaching others in the application of this competency by translating complex nuances relating to this competency into easy to understand terms; • You participate in senior level discussions regarding this competency; • You assist in the development of reference and resource materials in this competency. • Highly developed Knowledge, Understanding and application of the competency required to be successful in the job and organization. • Can apply knowledge outside the scope of the one's position. • Have a long term perspective.

5 Expert (recognized authority)	<p>You are known as an expert in this area. You can provide guidance, troubleshoot and answer questions related to this area of expertise and the field where the skill is used.</p> <ul style="list-style-type: none"> • Focus is strategic; • Specialist /Authority level knowledge, understanding and application of the competency required to be successful in the job. • Recognizes by others as an expert in the competency and it sought out by others throughout the Organization. • You have demonstrated consistent excellence in applying this competency across multiple projects and/or organizations; • You create new applications for and/or lead the development of reference and resource materials for this competency; • You can diagram or explain the relevant process elements and issues in relation to organizational issues and trends in sufficient detail during discussions and presentations, to foster a greater understanding among internal and external colleagues and constituents. • Works across team, department and across the organization. • Applies skills across multiple projects or functions. • Able to explain issues in relation to broader organizational Issues. • Creates new applications and Processes.
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Below is an example of where the levels of knowledge and skill are shown within the Framework.

STAKEHOLDER GROUPS

CLIENT / EMPLOYER REPRESENTATIVE							
Strategic (S)	Managerial (M)	Technical (T)	S: Procurement / Contract Officer	S: BIM Procurement Advisor / Contract Specialist	SM: Project Director	M: Project Manager	MT: BIM Manager
Identify and define the Project Performance requirements mapping BIM Uses to those requirements. <i>E.g. Financial: Reduced Energy Performance - BIM energy modelling concept to operation.</i>	Map the Project Performance requirements, linking the BIM Uses. Further define the BIM performance requirements. <i>E.g. Business: Quality Assurance - Laser Scanning pre, post and during engagements.</i>	Map BIM technical needs to assist in defining the BIM performance requirements. <i>E.g. Financial: Cl@M - Technical handover requirements for integration into Cl@M systems.</i>	3	5	3	4	4

Figure 8: Example of the Knowledge and Skill Levels within the BIM Knowledge and Skills Framework.