APPENDIX A
MODELLING AND DOCUMENTATION BEST PRACTICE

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CONSTRUCTION SECTOR ACCORD

BIM BETTER BUILDING PROCESS. BUILDING BETTER PERFORMANCE.

New Zealand Institute of Building

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1— PLANNING THE MODELLING PROCESS

Appendix A provides detailed guidance for modelling and documentation best practice.

The New Zealand BIM Handbook acknowledges the uniqueness of each project, with varying drivers and project owners implementing distinct modelling standards and protocols. Building information modelling enables greater design and time efficiencies, allowing for enhanced innovation and design quality. Applying a one-size-fits-all approach to projects and companies is not only impractical but also risks inhibiting the potential for creative advancements.

The project EIR will define the client's required BIM uses on a project, determining the extent of modelling required to deliver the final 2D/3D graphical output and non-graphical information. The BIM execution plan will specify the common modelling standards and workflows necessary to achieve the desired deliverables.

Parametric modelling should be used on all BIM projects. Parametric modelling designs objects with real-world behaviours and attributes. The approach uses parameters (numerical, text or formula-based characteristics) to determine the behaviour of a graphical entity and define relationships between model components.

Before modelling begins, the project team should take a collaborative approach to addressing the following requirements and document them in the BIM execution plans (BEPs):

- Modelling methodologies
- Define geo-spatial coordinates
- Define required discipline models
- Define items for inclusion in models
- Define information exchanges
- Assign Model Element Authoring (MEA) responsibilities
- Define non-graphical information necessary to achieve chosen BIM uses
- Define use of material properties
- Define model coordination processes, including the sequence of clash detection and model coordination precision
- Define requirements for model exchange and export of documents and information
- Audit and purge methodologies to maintain model performance and data integrity
- Define methodology for importing files

Refer to Appendix J for a BIM execution plan template.

2— QUALITY CONTROL

Apply quality control measures to all aspects of modelling, documentation, and data attribution to eliminate errors and achieve desired project outcomes. The principle underpinning these measures can be summarised as: model to a standard, check to a standard.

In addition to agreeing on standards as part of the development of the BIM execution plan, the project team should agree on protocols and procedures for checking compliance throughout the project.

The BIM execution plan describes quality control measures that should be applied at different times.

The ability to own, reuse, and properly manage project information throughout a facility's lifecycle benefits stakeholders. The accurate creation and management of building information is critical. Information created during design, and refined during the construction process, is a valuable resource for facilities management.

3— GENERAL MODELLING GUIDELINES

3.1 MODELLING STANDARDS

Each discipline in the delivery team should model to industry-proven best practice methodologies, and comply with in-house standards and protocols, as a bare minimum. The client may also have specific modelling and documentation requirements and standards to which the team must adhere. These conditions should be specified in the project EIR and documented in the project BIM execution plan.

Once the delivery team has agreed on the project modelling methodology, the BIM manager is responsible for ensuring its consistent application.

Consider the following points as part of the overall project modelling methodology:

- Model set-up, including project geo-location coordinates
- Use of in-place modelled objects or geometry
- Strategy for dividing large models
- Model file naming conventions
- Project templates (control 2D output appearance), including view templates
- System naming conventions (services, etc.)
- Element naming conventions (walls, partitions, doors, windows, columns, fan coil units, etc.)
- Object classification standards (Uniclass, Unformat, Omniclass, CBI, VDAS etc.)
- Materials' and finishes' naming conventions
- Properties/parameters for model objects
- Object property/parameter naming conventions

3.2 MODEL MANAGEMENT

Discipline BIM leads are responsible for managing the building information model(s) to maintain information integrity, manage file size, and ensure compliance with the MEA schedule, and agreed Levels of Development (LODs). The BIM leads are to regularly perform the following activities defined in the BIM execution plan:

- Audit, purge, and compress the model(s) at key deliverable milestones
- Interrogate the model(s) to ensure it complies with agreed modelling standards, project LODs and the MEA schedule
- Review the views within the model, removing any that do not convey project requirements

3.3 MODEL SHARING

The model sharing methodology should be agreed between the project BIM manager and discipline BIM leads. The methodology should be documented in the BIM execution plan at the start of a project. As a minimum, the methodology should cover the following points:

- Intended Common Data Environment for collaboration/data sharing
- Frequency of model exchanges
- File formats required for exchange, including .rvt, .pln, .ifc, .dwg, .nwc, etc
- Protocols for issuing models – i.e., maintenance required prior to sharing

When issuing a model, the discipline BIM lead should include a Model Description Document (MDD) that includes crucial information about the approved use of the model. The format and content of the MDD should be agreed and documented as the BIM execution plan is developed.

Find an example in Appendix K.

4— MODEL SET-UP AND AUTHORING

4.1 GOOD MODELLING PRACTICE

A company participating in a BIM project should have a solid set of internal modelling standards, and follow the practices outlined in this handbook.

Discipline BIM leads are responsible for implementing best-practice methodologies across their teams. They should regularly audit models to ensure consistency in the application of these methodologies. Consider the following best practices:

- Common coordinate system
- Gridlines, reference points, survey markers and chainages, in all models, as appropriate for the project typology
- Modelled elements must be used for their purpose – i.e., floors should not be used for benchtops
- Check for inconsistent modelled objects (duplicate objects; one object on top of another; open or leaky rooms and spaces)
- Consistent BIM object naming

4.2 CREATING MODEL OBJECTS

Create model objects to meet in-house company standards, templates, and good industry practice methodologies, as a bare minimum – except in cases where clients have specific requirements for object creation, or object naming conventions.

Model objects can also be derived from the following sources:

- BIM object resources online
- A national BIM object library – a consistently formatted library of generic and proprietary model elements. As at publication no such library exists in New Zealand. However, there is a national object library hosted by NBS in the United Kingdom
- Manufacturer-specific content: as BIM matures in New Zealand, product manufacturers and suppliers should develop their own libraries of information-rich BIM objects (similar to how manufacturers currently supply 2D CAD details of their objects). This will also assist in the transition from design building information models to As-built facilities management-ready building information models
- Software developer libraries

There are multiple software-specific object-creation standards to guide best-practice methodology.

4.3 NAMING CONVENTIONS AND STRUCTURES

Reusing information efficiently throughout the life of the model and the related asset is one of the greatest benefits of BIM. Discuss and agree definitions and naming conventions with the client and other stakeholders as the BIM execution plan is written:

- How spaces are defined and named
- Granularity and naming conventions for objects
- Specific parametric requirements for objects
- Specific model naming conventions

Information should be structured to align with the end-user's asset information management system – even when the end-use of the model/information has not been confirmed. Information must be created in a way that is structured and consistent for future translation.

4.4 MODEL LOCATION AND ORIENTATION

All BIM projects should use real-world coordinate systems. New Zealand has several geodetic and vertical datum. The chosen system could vary, depending on the project location and client.

The chosen datum should be specified in the BIM execution plan.

When real-world coordinates are unavailable at the start of a project, the project should be located, with an agreed reference point and orientation, at 0,0,0. Once the coordinates become available, agree which discipline BIM lead is responsible for establishing the real-world coordinate system inside the model(s). Each discipline BIM lead is responsible for ensuring they acquire the coordinate system within their respective BIM. Once the coordinate system has been established, it should only be changed with the mutual consent of all stakeholders.

On top of ensuring that the model(s) is set to the correct northing and easting points, discipline BIM leads are also responsible for making sure the model(s) is set to the true height above local vertical datum heights.

Translating real-world coordinates between certain authoring software platforms and IFC can be problematic. Consequently, the use of a site cube to facilitate the location of files when shared coordinates are unavailable is recommended. The site cube is a 1m cube placed at an agreed grid intersection with the cube base at a specified floor RL and on its own dedicated workset, or layer. The decision to use a site cube should be made by consultants prior to initiation. The site cube should not be used as a replacement for any software inbuilt geo-coordinates capability. It is advised that all parties involved in this process test and review that the information exported is able to be referenced appropriately in their design spaces.

4.5 REQUIREMENTS FOR MODELLING SPACE

To maximise opportunities for reusing information within the BIM, ensure spaces are consistently defined and named. The importance of space modelling varies according to BIM uses. Defined spaces, and elements within them, can be used for analyses of sustainable design, heat loads, lighting levels etc. This information can be exported to gbXML, where it can be used by third-party software. Concept massing is also exportable to gbXML and ripe for analysis.

The client area brief can be provided in multiple formats (usually in Word tables or Excel spreadsheets). By correctly modelling spaces, BIM can be used to generate space/area schedules, which can be dynamically updated from the model geometry.

Confirm the method used to measure areas. The commonly accepted standard for New Zealand commercial buildings is the BOMA/PMI Guide to the Measurement of Rentable Areas 2013.

All areas above an agreed size (e.g., 1m2) should be tracked and identified by name. A physical space may contain several areas that have different functional space classifications. They should be modelled and identified as separate spaces.

4.6 MODEL DEVELOPMENT AND LEVEL OF DEVELOPMENT (LOD)

The use and importance of LODs is one of the least understood aspects of the BIM process. There are numerous documents on the subject, the most complete being the LOD Specification, produced by the BIM Forum (https://bimforum.org/lod/).

LOD is a scale used to show the reliability of content likely to be included for specific model objects, at different times, during model development. It covers specific model elements at different times, during model development.

The main purpose of LOD, when incorporated in MEA schedules and BIM execution plans, is to make it clear what each member of a design/construction team is required to author in their models, at each stage, and to what extent others can rely on them.

LOD applies to elements within a model – not the overall model. Critically, as the LOD progresses, other information associated with the elements also progresses – not just the geometry. This is referred to as non-graphical information.

It is important to get the required LOD for each element confirmed at the completion of the design phase, before the model is transferred to the contractor.

Refer Appendix C for a summary definition of LODs.

4.7 MODELLING REQUIREMENTS FOR QUANTITY SURVEYORS

BIM is an effective digital tool for quantity surveyors seeking to assess and influence design and delivery processes to provide better commercial outcomes. Quantity surveyors should be involved in the planning of the modelling process. They should define specific modelling requirements to allow compliance with quantity surveying fundamentals. Leveraging information generated within the model allows a quantity surveyor to focus on verification and validation processes.

When cost estimation is selected as a BIM use for a project, the consultant quantity surveyor, or pre-construction estimator, should provide input to the design BIM execution plan. Their input can help in the development of design models that meet quantity surveyor or pre-construction estimator requirements. Refer to AIQS and NZIQS Australia and New Zealand BIM Best Practice Guidelines (2018) "click here" and its sections on key modelling principles relating to:

- Model location
- Model setup
- Object placement
- Object geometry
- Object metadata
- Model output procedures

Key model object points:

- Model as you would physically construct the building, with a greater emphasis in the later design phases i.e., columns modelled floor to floor
- Exterior modelling vs. interior modelling: objects must be clearly identified in the naming and attributes, should they be used in exterior envelope vs. interior construction i.e., windows and doors
- Use common and logical object descriptions
- Add material and finish coding parameters to objects where appropriate. For architecture, insert a parameter code into an object, which can be reported through a schedule, or linked to a specification
- Minimise the use of generic model category objects, as they often do not contain usable information
- Inform the quantity surveyor discipline BIM lead when in-place or placeholder objects are used at design phase milestones. These items should be discussed in BIM coordination meetings

Any object(s) likely to be modelled as design progresses should be identified at each design phase milestone. A gap register is a useful tool alongside a Model Content Plan.

5— MODEL COORDINATION

Successful model coordination relies on different BIM disciplines understanding their role – and only modelling what they are responsible for (typically following an MEA schedule). Coordination is much more than just clash detection. Consider buildability as part of this process. Regular communication between all parties is the key to successful coordination.

General coordination should take place during early design phases (preliminary and developed), via visual inspections of the model. It includes single discipline coordination and coordination of other discipline models and is the responsibility of all discipline BIM leads.

A managed approach to 3D model coordination will not be applicable to all projects. Where it is applicable it is the responsibility of the BIM manager and should centre on the federated model. At intervals, as agreed in the project BIM execution plan, the BIM manager should create a federated model and undertake clash detection according to the agreed model coordination matrix and coordination model tolerances per design stage.

Refer Appendix B for more detail on model coordination.

6— MODEL HANDOVER AND SIGN-OFF PROCEDURES

There are two types of model handover during a project: work in progress or iterative model exchanges, and end-of-phase (preliminary, developed, detailed design, construction and as-built) model exchange. In both cases it is important to ensure there is a process in place to communicate change and models' fit-for-purpose status.

For iterative model exchanges, keep each design discipline aware of changes within the models. However, with frequent exchanges, communicating change is problematic because the models are constantly evolving. It is critical to identify model changes that will affect other design discipline workstreams, for example ceiling heights, grid spacing, and floor-level changes. The BIM manager should consider the level of change that should be communicated, and whether the use of an MDD is appropriate during the early design phases. As a bare minimum, the issuer of a model must clearly define what it can be used for. For example:

- Issued for information – issued for information only
- Work in progress – issued for ongoing coordination

Prior to designated handovers, check all models are using agreed procedures, and use publishing formats defined in the project BIM execution plan.

Each modelling team should include an MDD and sign-off that confirm it complies with the agreed specification. Name the MDD so that it can be readily associated with the correct model. The document should describe the contents of the model and explain its purpose and limitations.

The specific format of the MDD should be documented in the BIM execution plan. The sender of a model is responsible for communicating change and the model's fit-for-purpose status.

7— TRANSITION OF MODEL OWNERSHIP

In this context, ownership refers to the party responsible for the model.

Refer to New Zealand BIM Handbook, Section 3 – Legal implications of BIM for guidance on legal ownership.

As a project progresses, information (both graphical and non-graphical) contained in fabrication and trade models supersedes information contained in the design models.

The ownership of each building information model rests with the model author for the project stage. During the construction phase, the contractor will own the federated model, which comprises a mixture of design models (owned by the design team) and fabrication and trade models (owned by the subcontractors).

8— FINAL PROJECT DELIVERABLES

One of the primary benefits of building information modelling for a client or building operator is BIM's application to asset management when the building is occupied. Information that matures during the design and construction process is captured in the appropriate models.

The project EIR should clearly outline deliverables. Today, most contracts continue to require 2D paper documents (drawings, schedules, and specifications), but the industry is maturing, with models becoming contractual deliverables. This information should be included in the Consultants Scope of Services, EIR and BIM execution plan.

When the model has an agreed handover requirement – either from the design team to the contractor, or from the contractor to the client/operator – the following must be confirmed:

- Separate or combined models
- Format/File type
- Model inclusions – what is in and what is out

2D deliverables generated from the model should accurately represent the view of the model. Do not modify models in their 2D format.

The project BIM execution plan should define client deliverables, required file formats, and the people responsible for providing them.

Potential deliverables include:

- 3D geometric deliverables, construction coordination model and as-record model(s) for all building systems. The model(s) should be fully coordinated. Include the required instructions on file/folder setup
- Information deliverables: asset management spreadsheet or database file, and room/space data in an agreed format
- 2D deliverables: as-record drawings

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The New Zealand BIM handbook.

This document is one of a suite of documents forming the New Zealand BIM Handbook. You can download or view the remaining documents here:
http://www.biminnz.co.nz/nz-bim-handbook