حكومة دبي
GOVERNMENT OF DUBAI

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DUBAI MUNICIPALITY

BIM E-Submission Model Development Guideline

MODEL DEVELOPMENT PROCESS AND BEST PRACTICES FOR BIM E-SUBMISSIONS

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1. INTRODUCTION

1.1 Purpose of BIM Guidelines document

This document describes the necessary steps for public users (registered consultants and contractors) to develop the information models for upload to the Dubai BIM E-Submission platform as part of the building permit process.

The document describes the necessary tools, templates, and modelling practices required to develop a high-quality information model that can successfully utilize the automated code compliance checker and grant the building permit through the BIM E-Submission platform.

2. GLOSSARY

Term / Acronym	Definition
3D model	Graphical Data communicating the facility/assets height, width and depth (X, Y and Z coordinates) characteristics
BIM	The digitisation of construction information to be used and re-used throughout the project lifecycle to improve the quality and efficiency in the building permit process
Classification	A standardised structure for categorising and indexing data and information
Coordination	The linking of graphical information models to ensure there are no conflicts within the project information model
Data	Set of values, stored but not yet interpreted or analysed, in a form that is convenient to move or process
E-Submission (Model)	A model that complies with all the requirements for e-submission and is submitted to respective regulatory agencies.
Federated Model	A combined Building Information Model that has been compiled by linking or combining several different models into one

Geographic information system (GIS)	Database comprising layers of information relating to the position on Earth's surface
Information	Data which has been interpreted and processed (such as formatting and printing) to take on meaning in some context for its intended receiver
Information Model	Information models form the cornerstone of all digitisations of AEC information as it is the repository of data that are required for all intended uses and analyses. As such, the validity of the data inside information models should be dictated by its suitability for use.
Model	Generic term for a virtual representation of an asset
MEP	Mechanical, Electrical and Plumbing aspects of building design and construction
2D	
EPSG	Coordinate reference systems utilized all over the world for creating maps and geo data and for identifying geo-position
IFC	Industry Foundation Classes is a standardized, digital description of the built environment. It is an open, international standard (ISO 16739-1:2018), meant to be vendor-neutral, or agnostic, and usable across a wide range of hardware devices, and software platforms.
Spaces / rooms	In this instance either a space or a room is a defined area within a model file that has attributes and boundaries providing a basis for compliance checking.

3. MODEL DEVELOPMENT WORKFLOW

This section gives an overview of the workflow users should follow when developing information models for submission to the Dubai BIM E-Submission platform. .The subsequent sections describe the workflow steps during the model development in more detail.

1.2 Workflow Overview

The workflow does not depend on any particular software being used to produce the submitted BIM models. The model development workflow outlines 5 steps involved in developing models. By following these 5 steps, users can be confident of producing models that will meet the BIM E-Submission platform's requirements and standards.

It is important to note that this workflow is supported not only by the information in this document but also relies on information from associated documentation such as the **BIM Standards**, **Model Element Matrix,** and the **Model Attribute Matrix**.

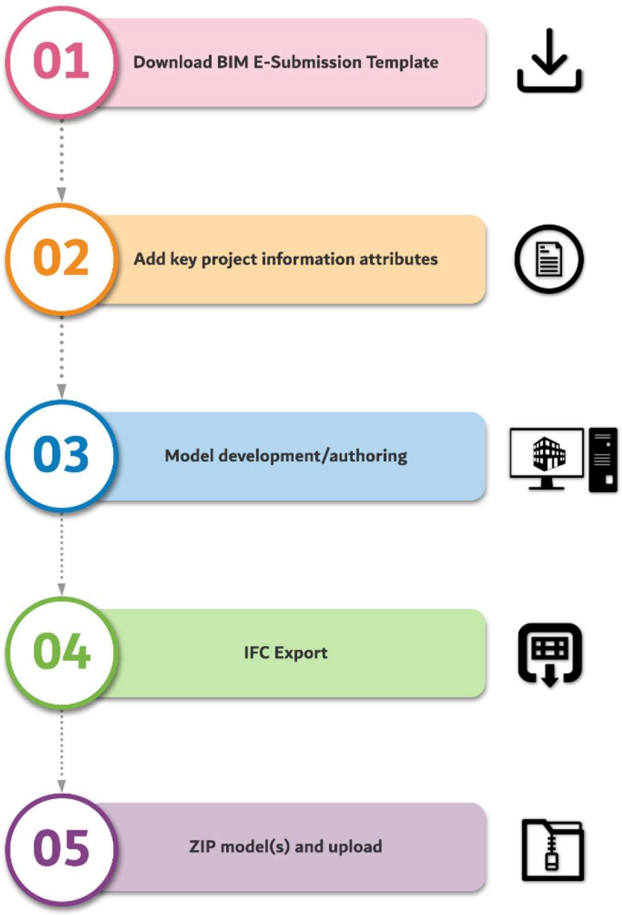

Figure 1- Model development workflow

1.2.1 Download BIM E-Submission Template

Before starting the model development, it is recommended to use the latest **BIM e-Submission Templates**. There are three main templates developed for each BIM software, those are:

1. **Revit BIM e-Submission Template**
2. **Archicad BIM e-Submission Template**
3. **Bentley Open Building Designer BIM e-Submission Template**

Each of those templates includes predefined properties, settings, views, and objects which will aid consistency and efficiency of model creation. Using those templates is not mandatory, but it will support the successful and smooth development of the Model throughout the permit stages, and it will help to maintain the model in a shape that guarantees successful permit granting.

Please note that the existing templates are created for the implementation of 2019 software versions up to the latest version of the BIM software. Also, please note that the template may be updated in the future, so it is necessary to download the latest Template for each project.

Please visit https://bim.geodubai.ae to find and download all templates.

1.3 Add key Project information attributes

While developing the model, it is required to add and fill in all required key project information attributes for different model elements. Those attributes will be mapped to the appropriate IFC class or property set, which in return will result in a successful IFC export. It will also allow for a proper model code checking and eventually fast permit granting. Please refer to **Appendix B- Model Attribute Matrix**, which provides a breakdown of attributes that should be added to each model element, along with its IFC reference, Property Set, required data type to be added and a data sample. The table also provides the attributes which are needed for each of the building permit types.

1.3.1 Discipline Modeling guidelines

The BIM E-Submission system will recognize 3 different model disciplines that can be uploaded: Architectural, Structural, and MEP. Discipline models can be uploaded individually to the platform or combined to form a federated model and be uploaded.

To adhere to modelling best practices, only elements relevant to that particular discipline should be modelled in that specific model. For example, walls should never be modelled directly into an MEP discipline model, and likewise, MEP systems such as ductwork should never be modelled directly into an architectural model.

Whenever possible, model authors should model the actual details, in terms of shape, size, location, dimensions and orientation to produce an accurate element. The **Model Element Matrix** (Appendix A) defines different types of elements in detail with their associated disciplines.

The following guidelines recommend how BIM elements should be modelled in different disciplines. The general modelling guidelines below shall cover all modelling requirements for elements in general. Those guidelines should be followed by architecture, structure and MEP models. The list is followed by guidelines dedicated for each discipline in detail to demonstrate the best modelling practices.

General Modelling guidelines

- All components in the model space must be modeled on a scale of 1:1
- Sub-divide models between disciplines and within single disciplines to avoid file sizes becoming too big or slow to operate.
- The methods adopted for segregation must take into account and be agreed upon by all disciplines involved in the modelling.
- To avoid duplication or coordination errors, a clear definition of the data ownership throughout the life of the project must be defined and documented.
- Naming conventions are critical for each file. The BIM file name must not change for the duration of the project unless communicated to all involved parties.
- The model file naming should follow the **Section 7.1.3, BIM Standards**
- A model file must contain data from one discipline or project stakeholder only, although exceptions may apply for building services where multiple disciplines converge.
- To avoid duplication or coordination errors, a clear definition of the data ownership throughout the life of the project must be defined and documented.

- Where multiple models make up a single project, a federated model, whose function is to link the various assemblies together for coordination/clash detection purposes, must be considered.
- All models should use the EPSG coordinate system Dubai Local Transverse Mercator (DLTM)
- Make us of GIS to BIM dates for proper Geo location and for referring proper setback of the models
- All level should follow the level naming rules according the **Section 8.4, BIM Standards**
- The model space should contain components of only one design discipline, either architecture, or structure, or MEP.
- The building or feature elements should be created using the correct software tools and components. i.e., walls, slabs, doors, windows, roofs, ductwork, pipework, etc.
- Design coordination should be implemented between the Architectural, Structural and MEP Models.
- Elements should be modeled based on the information given by field specialists. e.g., Civil engineer, Architect, Electrical engineer, etc.
- Model space components should be modeled using their appropriate categories, for example, a wall should be modeled using the wall category.
- All objects should be assigned to their proper floor level.
- Components shall be modeled at true heights per each floor and shall not be one component spanning multiple floors. For example, walls and columns shall be split according to the construction intent rather than spanning the full height of the building.
- All required building elements should be geometrically accurate and correctly located.
- Use existing loaded objects embedded in the templates whenever possible. If objects do not exist in the template, it is preferable to create custom objects or edit the template objects.
- All inbuilt and loaded objects must have a standard object name convention according the **Section 8.2.2, BIM Standards**
- Components should not overlap with other components.
- Elements must not appear as detached or floating away from model space
- Duplicate objects should be prevented in the model space.
- Space gaps within the model space are not accepted. Spaces shall be contiguous.
- Rooms/Space Categorization should be added for each space within the model, including corridors, shafts, parking lots, and open spaces. In case of an existing false ceiling, room/space height should be adjusted to reach the lowest point of the ceiling, otherwise, it should reach the slab soffit.
- Rooms should be named properly, based on Space/ Room Naming. Rooms should be also classified based on the **Space/ Room Categorization List**. Refer to **Appendix E- Object Naming Abbreviation List,** and **Section 8.3.3, BIM Standards**.
- Each room, void, or cavity in the model should have a room/ space element associated with it and classified according to **Space/ Room Categorization List**, please refer to **appendix C- Space/ Room Categorization List.**

- Rooms that represent certain types should be precisely named: Ablution, Waste Storage Room, Emergency Command Centre, etc.
- All the IFC parameters should be assigned to the correct elements. Please refer to **Appendix B- Model Attribute Matrix.**
- All required attributes/ parameters of model elements should be filled in properly based on the **Model Element Attribute Matrix.**
- All schedules should be derived from the model and should not be generated independently using a spreadsheet or other tools.
- All objects in the 3D model of the modeling space must be made visible
- Unnecessary models or linked files should be removed from the model space before exporting to IFC
- The model space should not contain any annotations, text, or dimensions within it
- Any 2D objects within the model space should be deleted
- Outstanding warnings should be reviewed regularly, and important issues resolved.
- BIM Models should be detached from the central file where applicable.
- All models should be purged before exporting to IFC.
- Model quality should be checked before exporting to IFC. It is recommended to use the **QA/ QC Checklist** for this task. Please refer to **Appendix D- QA/ QC checklist.**

Architectural Modelling guidelines

- An architect should use the structural model as a reference within the architectural model to avoid duplication of building elements.
- Internal walls must not clash with structural elements
- All architectural objects should be modeled from slab to slab.
- Walls should be modeled with all wall components, including finishes.
- Composite walls should be divided into different layers. Every layer should be indicated in the structure with a unique function, material, and thickness.
- Walls should be modeled separately for each building floor levels.
- All Walls should be modeled as constructed, from the structural slab level to the bottom of the connecting element.
- The top constraint for free-standing walls should be unconnected, (such as toilet partitions, offices. etc.). Height should be unified as much as possible.
- Architectural components should have cut out voids to accommodate intersecting components.
- If the design has a precast or prefab design, then those elements can be placed as Objects.
- Internal details such as doors, partitions, panels, must be modeled as independent components and not embedded as part of a wall component.

- Door and Window objects should be created using the door and window tools, respectively, in the BIM-authoring application
- Windows and doors should be modeled as 'contained' in a wall and make sure that doors and windows don't extend outside the wall area.
- Walls that form rooms should have their boundary property defined, properly connected, and enclosed at the edges to prevent non-bounding rooms.
- Floor finishes should be created for each room separately
- Floor finishes should correctly mapped to IFc otherwise it will export as a Ifcslab
- Floor Shaft opening should be used to create opening through multiple floors
- Internal/external Claddings should be modeled as a separate wall, constrained from the FFL to the bottom of the connecting element.
- For all architectural objects that represent physical products or physical construction, model elements should include all product information as properties of the model element to the maximum extent practicable.
- The material name should be included as a property in the relevant BIM elements.
- All components should be assigned the correct building element types so that they are exported as the correct types to an IFC file.

Structural Modelling guidelines

- A Structural BIM may include all load-bearing concrete, wood, and steel structures, as well as non-load-bearing concrete structures.
- Piles and pile caps should be coordinated with services
- Structural components should have cut out voids to accommodate intersecting components.
- Structural concrete components should be modeled accurately
- Structural steel components should be modeled accurately.
- Every element that has a unique construction specification should be modeled individually
- Expansion joints should be presented in the model as a gap between two different slabs (each slab should be a separate sketch)
- Slabs, beams, and columns should be created using their respective tools in the BIM authoring software. If a specific tool is not available or is insufficient, generic model objects can be used. However, these generic objects must be properly mapped to the appropriate IFC object type so that the model object is exported properly to the IFC file format.
- Slabs should be properly joined to walls and bound spaces to ensure model integrity. For model consistency, it is essential that the floors are modeled as slab objects and that the joints between walls and slabs are modeled as accurately as possible, with the information known at that time.
- Stairs should be modeled using the stair tool with assigned base and top levels.

- Material and material properties should be included for each structural model element.
- All components of the foundation, including but not limited to isolated pads, bearing and retaining footings, stem walls, structural slabs, and piles, should be fully modeled.
- All beams, joists, slabs, and precast slabs should be fully modeled. The model should show slab perimeters and structural edges; penetrations for shafts, holes, or other slab discontinuities; and cantilevered sections.
- All columns, walls, and cross-bracing should be fully modeled. All connections and start/endpoints of such elements must be modeled to allow load continuity.

MEP Modelling guidelines

- Maintain and update the MEP Model, based on the latest Architectural and Structural Models
- All components must be fully connected.
- All components should be individually selectable.
- System models must include all equipment necessary for operations, such as; boilers, chillers, pumps and piping distribution systems, water-side terminal units; fans, air handlers, air distribution, and evacuation systems, etc.
- All diagrams of Risers must be based on the model.
- Air terminals should be placed at the correct elevation and be properly connected to the duct.
- Main duct/pipe runs should be modeled in their respective locations and elevation with adequate clearances around them (for insulations, supporting, and accessibility).
- A slope to drainage pipes should be considered while modeling to allow for more appropriate special coordination.
- Electrical equipment placed on walls should be at the correct elevation.
- The MEP systems in the model should be properly split to show which equipment is serving which spaces or floors, and that system assignments made in the native authoring software should be properly reflected in the IFC deliverable.
- For all products in MEP models, the model elements should include all appropriate data and properties to store schedule information traditionally embedded in a 2D drawing schedule.

1.4 Checking model QA/ QC

Running a BIM QA/ QC check is an essential step to maintain compliance with the Dubai BIM standards, and to ensure that the model is in a good condition with no errors and no missing information. Also, a well-modeled 3D BIM will allow for smooth and successful code checking within the Platform, which in return will lead to a faster process of issuing the building permit.

After completing the modeling part and adding all required project IFC attributes based on the **Model Element Attribute Matrix,** the user is required to check the model QA/ QC before moving to the next step. Please refer to the **Appendix D - QAQC Checklist.** This Checklist was developed for the use of all consultants/ contractors who are submitting for a building permit through the BIM e-Submission platform.

The purpose of this checklist is to ensure that the quality of each uploaded BIM model meets the minimum requirements set out by the permitting authority concerning BIM E-Submissions. It will also allow the user to check and confirm that the BIM model is clean and properly developed in terms of its modeling quality, coordination, availability of required information, naming convention, and finally its IFC property settings.

The user should answer all the questions within the checklist concerning the BIM model being submitted. The answers to all questions are expected to be "yes", (except if the point was not applicable at that stage). If this is the case, the user can move to the next step which is **Exporting to IFC.**

1.5 IFC Export

IFC (Industry Foundation Classes) file format is the only file format considered to be globally identified as a standard for information exchange between different BIM software applications in the building industry. IFC allows data sharing of both graphical and nongraphical information between all project parties. It also promotes freedom of collaboration and communication between multiple design disciplines developed using different BIM software applications.

The BIM E-Submission platform will be completely dependent on the IFC file format. This will allow for a highly flexible workflow between permit authorities and the construction industry. It will also provide a chance for any BIM software application in the market to be used for developing the building information model and applying for a building permit.

Exporting the model to IFC is one of the most significant and critical steps that should take place before uploading the model to the BIM E-Submission platform. If the model is not exported properly following the given instructions and using the correct settings, it can lead to an unsuccessful experience of model upload and checking using the platform. Accordingly, it is important to follow the steps provided in each BIM software appendix. Refer to **Section 3, Appendix A, B and C.** Before exporting to IFC, make sure you are using the latest

IFC export Setup release for the used BIM software version. More details will be provided in the BIM software appendices.

1.6 ZIP and Upload Models

The BIM E-Submission platform provides the option for users to upload as many BIM Models as required through one step only. This step can take place after zipping all the models/ documents planned to be submitted to the BIM E-Submission platform, but before this step, the user should make sure that all the files are named as per the file naming convention provided in **Section 1, BIM Standards.** Also, there should be a separate IFC model for each discipline; architectural, Structural and MEP.

The user should zip all the models and the documents that he wants to share before uploading them to the platform, by following the steps below:

1. Select all the IFC models and the documents (which may include PDF and DWG files).
2. Right-click and select the option **Send to** and choose **Compressed (Zipped) Folder**.
3. Open the BIM E-Submission platform, and follow the steps mentioned in the **BIM E-Submission platform Public User Manual Document, section 6.1.4 file/s Upload.**