



CONSTRUCTION
INDUSTRY COUNCIL
建造業議會

Construction Industry Council Production of BIM Object Guide General Requirements

June 2018

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1 Introduction

1.1 Background

Building Information Modelling (BIM) is not just a three-dimensional drawing tool but a new tool to holistically manage information relating to construction projects from planning stage, to design, construction and operational stages. It is a new way of working using new technology to facilitate project management and execution, better construction process control, cross-disciplinary collaboration, internal coordination, external communication, problem solving, decision making support, productivity management, and risk management.

BIM is a way of working – it facilitates construction professionals to work together and communicate in one PLATFORM and all team members should be working to the same standards. BIM creates value from the combined efforts of people, process and technology.

Development Bureau of The Government of the Hong Kong Special Administrative Region issued Technical Circular (Works) No. 7/2017 **Adoption of Building Information Modelling for Capital Works Projects in Hong Kong** which takes effect from January 2018. The Circular sets out the policy and requirements on the adoption of Building Information Modelling (BIM) technology and applies to works to works either by in-house government staff, consultants or contractors.

The Circular has mandatory requirements for the BIM use of drawing production at design phase and construction phase. **Drawing production** is the most important and concerned deliverable of industry, both statutorily and contractually. A value driven BIM should be able to generate drawing production set for presentation, statutory and tender purpose.

A BIM project is made up of a lot of BIM objects such as walls, floors, columns, window, door, furniture or even a picture on the wall. To achieve the drawing production objective, a digital component that contains both geometry and non-geometry information of a product or element in the building needs to be standardised.

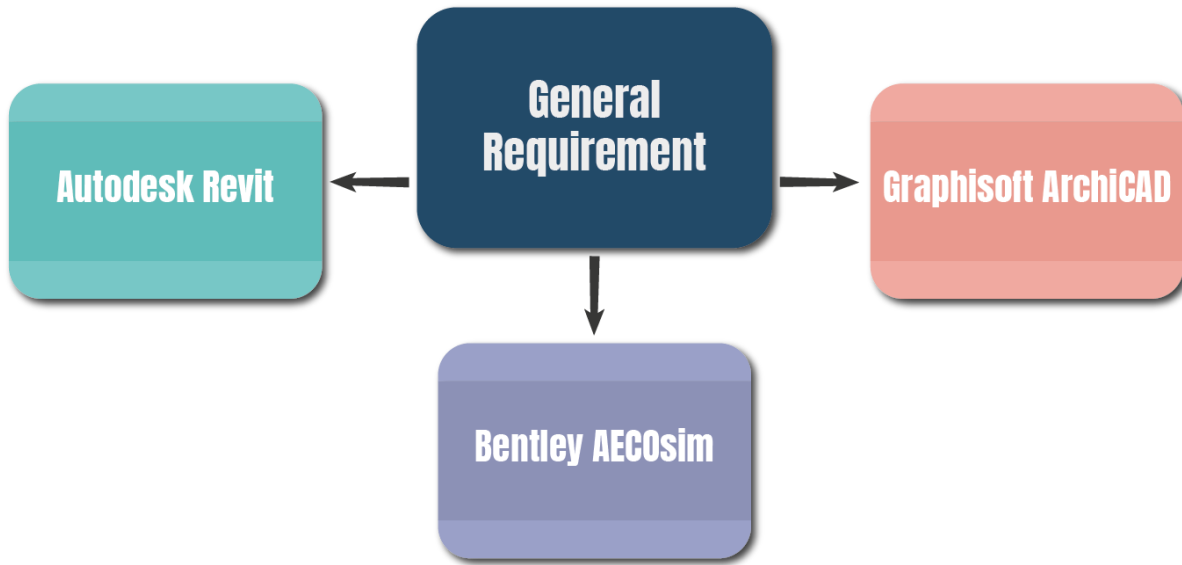
This guideline is intended to standardize the **minimum** requirement of BIM objects production for BIM object creators such as manufactures, construction industry and other BIM developers. Standardizing BIM object production is a pre-requisite to the compilation of a comprehensive and usable BIM object library to improve efficiency of whole construction industry in Hong Kong.

1.2 BIM Platforms

This guide aims to provide guidelines for the production of BIM objects for Hong Kong construction industry.

While BIM technology involves different software platforms, this guide specifies the general requirements in geometry, non-geometry and function to all BIM objects common for all BIM platforms. This guide considers the common intention for all BIM Objects, i.e. coordination, drawing production, and purposed to smoothen the geometry and information exchange among various BIM platforms and various phase of a project.

Specific Technical BIM Object Guide for widely used BIM platforms such as Autodesk Revit, Graphisoft ArchiCAD and Bentley AECOsims are to be published in future under separate cover.



2 General Requirements

This section describes the general requirements for BIM objects.

The scope of this section includes general requirements such as object categorisation and Level of Development (LOD).

2.1 General

1. The word 'shall' is used to indicate requirements of this standard. The word 'should' is used to indicate recommendations. The word 'may' is used to indicate alternative recommendations.
2. Terms in bold and red font are presented similar concept or term used in different BIM platform, e.g. **category / classification / catalog** (Revit / ArchiCAD / AECOsim).
3. The BIM object shall be delivered as either a design phase object, construction phase object or facility management phase object.
4. The BIM object shall be intended to use in drawing production with easily control.
5. The BIM object shall not be modelled too detail. The BIM object is not suitable and necessary to be modelled in 100% of reality based on hardware, software limitation and purpose of BIM use. Refer to Level of Development (LOD) to decide minimum component of the BIM object.

2.2 Level of Development (LOD)

1. The BIM object shall be referred LOD as a minimum requirement for geometry and non-geometry component. The LOD specification as defined by CIC Building Information Modelling Standards (Phase One).
2. The BIM object shall be decided a suitable LOD based on client requirement, project demand, BIM platform limitation and realistic modelling practice.

2.3 Object Category / Classification / Catalog

1. In different BIM platforms, the **category / classification / catalog** system might be dissimilar to each other. Nevertheless, any BIM object shall be assigned with suitable **category / classification / catalog** based on its platform system, e.g. a door BIM object must be assigned to "Door" **category / classification / catalog**.
2. The BIM object may also be assigned with a **category / classification / catalog** based on another classification system, such as The *OmniClass Construction Classification System*, if that is available on the BIM platform or state as additional property.
3. The BIM object might be assigned with appropriate IFC parameters to identify in various BIM platforms.

3 Geometry Requirements

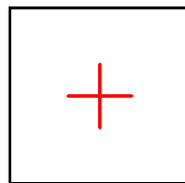
This section defines the minimum geometry requirements of the BIM object.

The scope of this section includes general requirements such as shape, symbolic, space and material.

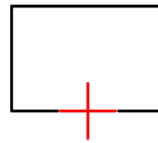
3.1 General

1. The BIM object shall be modelled geometry at scale 1:1.
2. The BIM object shall be included a suitable insertion point for its intended use.
 - Normally, the insertion point shall be located at centre of the geometry on plan view (as known as XY plane on three-dimensions coordinate system) and bottom of the geometry on elevation view (XZ plane or YZ plane). Following figure is indicated insertion point of simple curb geometry by red lines.

Plan View



Elevation View



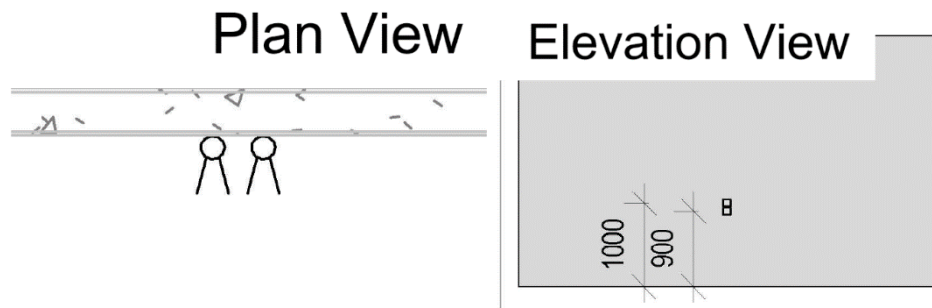
- The insertion point can be located at other point if reasonable, e.g. lighting switch always aligned on wall surface, the insertion point on plan view (XY plane) should be located at the back side of the switch surface.
3. The BIM object shall not be contained temporary modelling information such as construction lines and reference material. The BIM object shall be purged before submission.
 4. The BIM object shall be used metric geometry with units of millimetres.
 5. The BIM object shall be assigned suitable dimensions and labels.
 6. The BIM object shall be controlled its visibility of geometry and symbolic component for drawing production.
 7. The BIM object of design phase shall be provided parametric geometry for various size demand for design purpose.
 8. The BIM object of construction phase shall be provided appropriate parametric geometry to satisfy design requirement.
 9. The BIM object of facility management phase shall be provided actual geometry based on product catalogue and had not intended to modifiable.

3.2 3D-Geometry

1. The BIM object shall be modelled parametric geometry where supported by the BIM platform and appropriate.
2. The BIM object shall be modelled fixed geometry where the facility management phase object had fixed shape or not intended to be modifiable.
3. The BIM object shall be modelled suitable geometry which have reasonable size, major component of the product for design phase object, construction phase object and actual size for the facility management phase object.

3.3 2D-Symbolic

1. The 2D-symbolic item of BIM object is including symbol and **tag / label / annotation**.
2. The BIM object shall be included, where appropriate, a set of symbolic items of symbol at scale 1:20 and 1:100.
3. The **tag / label / annotation** shall be created as separate BIM object if available on BIM platform system. The information of **tag / label / annotation** shall be extracted from **property / parameter** of the BIM object.
4. The BIM object symbol shall be followed with the geometry, i.e. if the BIM object had a movement in project, its symbolic item will follow that change automatically.
5. The BIM object symbol shall be modelled, where appropriate, size-dependent with 3D geometry.
6. The BIM object symbol shall be intended to use for drawing production. That shall be included:
 - Symbol is orthogonal to the BIM object geometry;
 - Controllable offset(s) for overlapping object in the BIM model.
 - Following figure is shown lighting switches sample of orthogonal and offset:



7. The BIM object symbolic item shall be satisfied local practice.
8. The BIM object symbolic item shall be readable on the drawing production.

3.4 Space

1. The BIM object shall be included 2D and 3D space indication for construction phase object and facility management phase object. The BIM object of design phase should include suitable space indication. The following list is the common space requirement sample:
 - Maintenance space
 - Clearance space
 - Installation space
 - Access space

3.5 Material

1. The BIM object shall be included suitable colours, surface patterns or texture images.
2. The BIM object of design phase and construction phase should be used representative colours, surface patterns for appearance in the relevant graphical view.
3. The BIM object of facility management phase shall be reflected the product material, colour and surface.
4. The BIM object may be applied default materials provided by the BIM software.

4 Non-Geometry Requirements

This section defines the requirements for the non-geometry (information) contained within a BIM object.

The scope of this section includes general requirements such as property, value, units and property naming convention.

4.1 General

1. The BIM object shall be contained properties that are suitably assigned as **type** or **instant / component**. All instant of the BIM object in the project will be affected by **type** property. **Instant / component** property can be customized for each instant of the BIM object in the project.
2. The BIM object shall be contained minimum information for purpose of phase, e.g. placeholder (space occupation) at design phase, coordination at construction phase and reality reflection at facility management phase.
3. The BIM object shall not be included undefined values. Every additional property shall be completed and shall not include unset or undefined values.
4. The BIM object may be contained additional information which assists to describe the product.
5. The BIM object shall be used appropriate units of measurements. Basically, millimetre (mm) is used in local practice. The units of measurements shall refer to EMSD Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines. The units of measurements do not state on the document shall use the International System of Units (SI).

4.2 Property / Parameter

1. The BIM object property shall be provided accurate information.
2. The BIM object property shall be indicated unambiguously definition to contribute BIM object selection and submission between different stage of phase. Beside of default property provided by BIM platform, additional BIM object property shall follow the selection order to obtain unified definition, property name and unit. This selection order is valid to all BIM developer to increase information exchange of stage-to-stage in project.

Selection Order	Reference
1	EMSD Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines
2	IFC
3	User defined

3. The BIM object property assist to descript its geometry or non-geometry characteristic. The value might present to single value, list value and range value, however, the BIM platform system might have restriction on property value, such as only single value is allowed of each numerical data or only numerical data is allowed add in arithmetic formula. Additional BIM object property can refer to following table to choose suitable data type and present format:

Present Format	Usage	Data Type	Example	Remark
Single Value	Description Only	Text / Numerical	Creator Name (Mr. Chan) Net Weight (40 kg)	
Single Value	Calculation	Numerical	Dimension (200 mm)	
List Value	Description Only	Text	Colour Option (Black, White) Optional Wattage / Lumen (13/1055, 33/4000)	
List Value	Calculation	Numerical	Optional Size (3000mm 3500mm 4000mm)	If restricted by system, consider breaking to separate property or BIM object type.
Range Value	Description Only	Text	Allowable Setting Value (-4°C ~ 0°C)	
Range Value	Calculation	Numerical	Input Voltage (100V~230V)	Range value shall be separated into two properties to represent its lower bound and upper bound values.

4.3 Property Naming

1. The BIM object property shall be used Camel Case and title casing for parameter naming, e.g. Coefficient of Performance; Point of Shipment.
2. The BIM object property shall be used descriptive naming. The name shall describe the property's meaning or definition rather than describe the product component.
3. The BIM object property shall not be end of space or footstep.
4. The BIM object property should be named as short as possible.
5. The BIM object property should be avoided abbreviation and truncation when no unambiguously definition or industrial consensus.
6. The BIM object property should be used the most common descriptor for a group of property as the first part of the name so that the property is sorted logically (e.g., Filter Face Area; Filter Efficiency).
7. The BIM object property shall be avoided using symbols in property naming.
8. The BIM object property naming of boolean (YES/NO) data types shall be named so that they clearly imply that they return a YES/NO value, e.g. Is Energy Efficient, Show Hoods.

5 Functional Requirements

This section defines functional requirements of the BIM object to describe the BIM object naming conventions and expected behaviour.

5.1 Naming Conventions

1. The BIM object shall be named systematically and logically for the understanding of the users and for easy BIM objects management.
2. All BIM developer shall apply this methodology of naming conventions including Format, Field Definition and Limitation to their own BIM object library.
3. The naming conventions include abbreviations of category, sub-type, originator and descriptor fields.
4. The category field shall be indicated the BIM object **category / classification / catalog** based on the BIM platform system. Another classification system shall use descriptor if necessary.
5. The sub-type field shall be indicated sub-category / functional type under its category, e.g. Category "Door" can classify sub-category by door panel quantity "Single Door" or "Double Door".
6. The originator field shall be indicated who own or create the BIM object.
7. The descriptor fields shall be indicated the critical characteristic of the BIM object.
8. The abbreviation shall be unique of each other. The abbreviation can make reference to F.L.I.P Master Type List (<http://www.aiab.org/index.php/flip-guideline>).
9. All BIM developer shall refer the abbreviation defined by F.L.I.P.

Format

<Category> - <Sub-Type> - <Originator> - <Descriptor 1> - <Descriptor 2>.<File Format Extension>

Limitation on Number of Characters

- 3 characters for Category, Sub-Type and Originator field
- 25 characters for entire name including hyphen mark

Example

Field	DOR-SGL-AEC-Wood-w_Louver.xxx	Description
Category	DOR-SGL-AEC-Wood-w_Louver.xxx	A Door, DOR is the short form of the category / classification / catalog "door".
Sub-Type	DOR-SGL-AEC-Wood-w_Louver.xxx	A Single Door, SGL is the short form of the sub-type "single".
Originator	DOR-SGL-AEC-Wood-w_Louver.xxx	AEC is the short form of the Architecture, Engineering and Construction . It is to represent a common standard of the industry. This can be replaced by the name of the creator in short form.
Descriptor 1	DOR-SGL-AEC-Wood-w_Louver.xxx	A door is made of Wood (Material). An optional descriptive text.
Descriptor 2	DOR-SGL-AEC-Wood-w_Louver.xxx	A door is built with Louver . This text further describes the BIM object.
File Extension	DOR-SGL-AEC-Wood-w_Louver.xxx	File Format Extension

5.2 BIM Object Behaviour

1. BIM object shall not be compromised the performance of project model in which it is placed, it shall not be over modelled than it is required for its intended purpose. Exact replication of all life details is NOT recommended and not necessary.
2. BIM object shall be modelled so that its behaviour can be easily controlled by different users.
3. BIM object shall be modelled so that it can be associated and connected with other objects where the association is appropriate to the project model and its analysis.
4. BIM object shall be available to be scheduled in the project.
5. BIM object shall be intended to use for drawing production, thus it must contain appropriate symbolic items and their visibility can be controlled to suit for 2D/ 3D purposes.

6 Purpose Driven BIM Objects

The BIM object needs to be of the purpose and value driven. A right quality BIM object should satisfy this guideline requirements including suitable geometry, non-geometry information, functional in project and able to generate drawing production.

Drawing production is the most important purpose of all BIM object due to drawing is the only accepted tool of submission and communication in local practice nowadays. The BIM object shall be designed and modelled to enable to generate drawing production without extra handling or modifying. The value of BIM object is created on its proper information including geometry and non-geometry component. Hence, the BIM object can coordination in BIM model and generate schedule production.

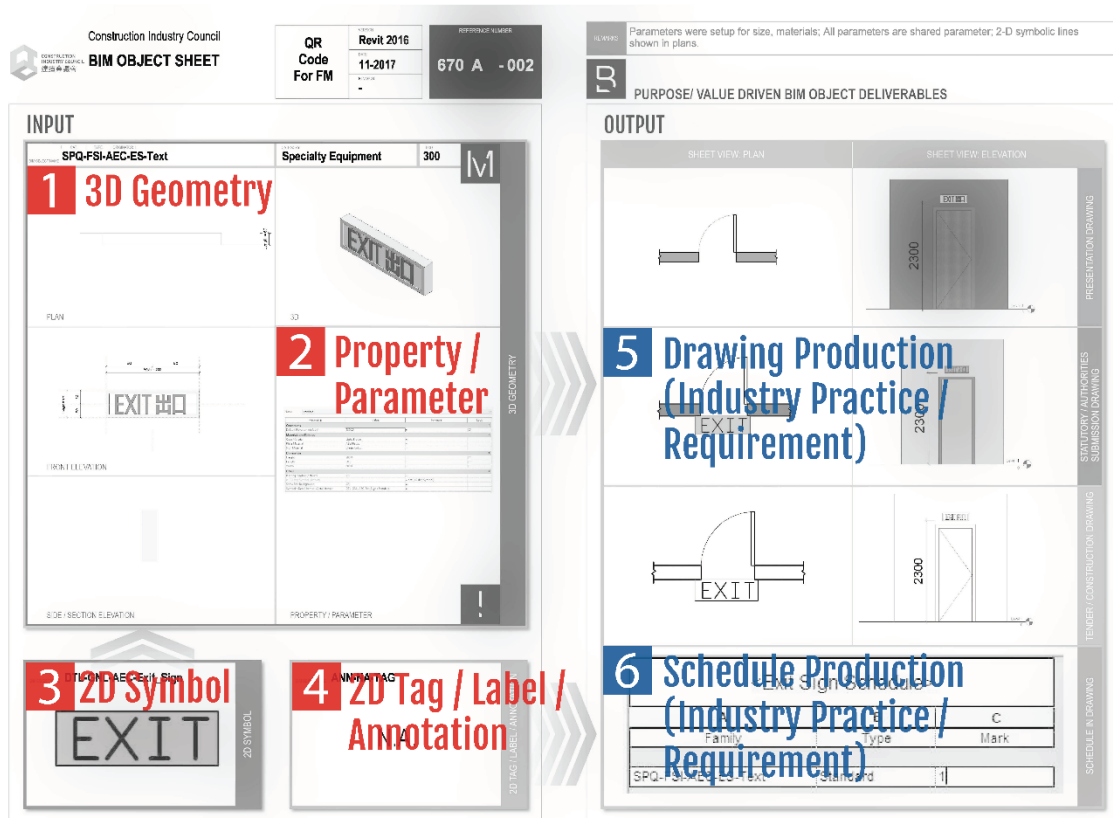
6.1 BIM Object Sheet

The BIM object shall contain 3D component of geometry, 2D component of symbol and **tag / label / annotation**. All of these contents are intended for drawing production of presentation drawing, statutory / authorities submission drawing and tender / construction drawing. In addition, the BIM object shall be able to schedule in project environment with proper information. The drawing production and schedule production shall follow industry practice and requirement of project and client.

The BIM object shall be provided a comprehensive sheet to convince client, receiver and user of the BIM object is complete, satisfy requirement and functional of drawing production.

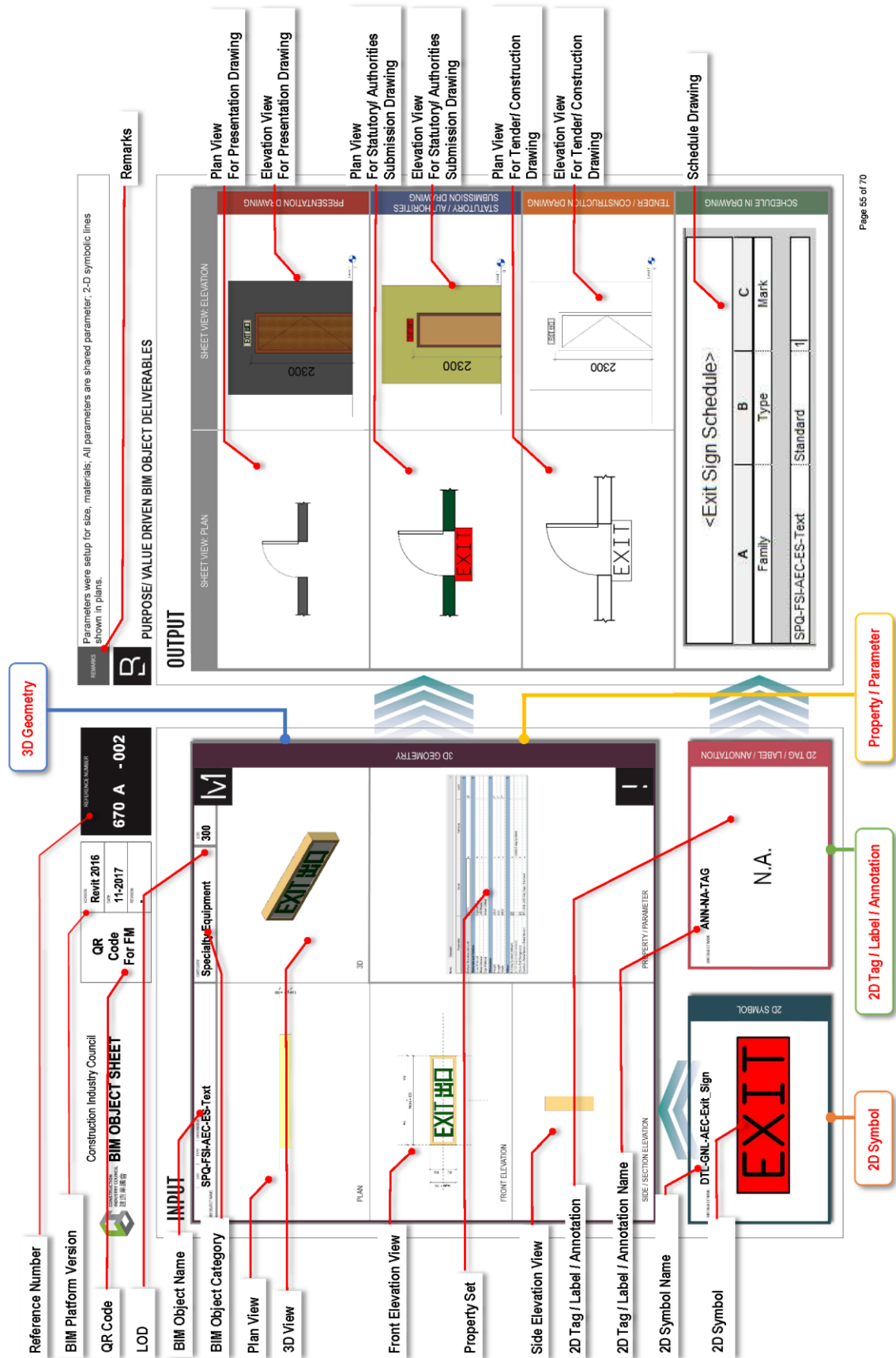
The BIM object sheet shall contain following items:

Item	Description
1. 3D Geometry	- Views to be shown in the sheet (plan view, front and side elevation view, 3D view) - (2D symbolic items do not show in this part)
2. Property / Parameter	- Property / Parameter set and value
3. 2D – Symbol	- 2D symbolic item for drawing production
4. 2D – Tag / Label / Annotation	- 2D symbolic item for drawing production
5. Drawing Production	- Plan view and elevation view for presentation purpose - Plan view and elevation view for statutory / authority submission purpose - Plan view and elevation view for tender / construction purpose
6. Schedule Production	- Schedule with appropriate property / parameter



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The BIM Object Sheet shall follow the following layout:



6.2 Quality Assurance

The BIM object shall be checked by a comprehensive check form and had endorsement by the inspector to verify the BIM object functions and behaviour. This quality assurance check form is provided to self-checking for BIM object creators and inspection for client or receiver.

The check form shall include following items:

Major Item	Content	Description
3D Geometry	File Size	Is it too large?
	Visibility Control	Suitable setting? Hide unnecessary geometry on plan and elevation?
	Category	Is the BIM object of correct category?
	Insertion Point	Is the insertion point appropriate?
	Unit	Is unit of measurements correct?
	Maintenance Space	Does it require maintenance space? Is space conformed to local practice?
	Parametric Properties	Is it necessary to be parametric? Is parametric behavior as expected?
Property / Parameter	Management	Are property classified in suitable grouping and naming?
	Information	Is all information necessary or exhaustive for the user?
2D-Symbolic Item (Symbol)	Symbol	Is the symbol conformed to local practice or client requirement?
	Size Dependency	Can the symbol follow the change of the 3D geometry?
	Symbol Offset	If necessary, can the symbol offset adjustable for overlapping in BIM model?
	Symbol Orientation	Is the symbol orthogonal to the BIM object geometry? If necessary, can the symbol orientation be controlled?
	Drawing Production	Is it readable when printing out?
2D-Symbolic Item (Tag / Label / Annotation)	Tag / Label / Annotation	Is the tag / label / annotation conformed to local practice or client requirement?
	Drawing Production	Is it readable when printing out in appropriate scale?

Item might be inapplicable based on unnecessary, client requirement or BIM object purpose.

The check form shall follow the following layout:

BIM Object Check Form

Acceptable
☐ A

Reject
☐ R

Outstanding
☐ O

Inapplicable
☐ N

3D Geometry
☐ 3D

Property / Parameter
☐ P

2D Symbol
☐ 2D

2D Tag / Label / Annotation
☐ T

INPUT

Category
Is the BIM object of correct category?
☐

Insertion Point
Is the insertion point appropriate?
☐

Parametric
Is it necessary to be parametric?
Is parametric behavior as expected?
☐

Property Management
Are properties classified in suitable grouping and naming?
☐

Property Information
Is all information necessary or exhaustive for the user?
☐

OUTPUT

Visibility Control
Suitable setting?
Hide unnecessary geometry on plan and elevation?
☐

Symbol Drawing Production
Is symbol readable when printing out in appropriate scale?
☐

Symbol Orientation
Is the symbol orthogonal to the BIM object geometry?
If necessary, can the symbol orientation be controlled?
☐

Symbol Size Dependency
Can the symbol follow the change of the 3D geometry?
☐

Symbol Offset
If necessary, can the symbol offset be adjustable?
☐

Symbol Drawing Production
Is it readable when printing out in appropriate scale?
☐

Tag / Label / Annotation Drawing Production
Is it readable when printing out in appropriate scale?
☐

Symbol
Is the symbol conformed to local practice or client requirement?
☐

Tag / Label / Annotation
Is the tag / label / annotation conformed to local practice or client requirement?
☐

File Size
Is it too large?
☐

Unit
Is unit of measurements correct?
☐

Comment:

BIM Object Name

Date

Inspector

Ref. No.

Assessment

Signature

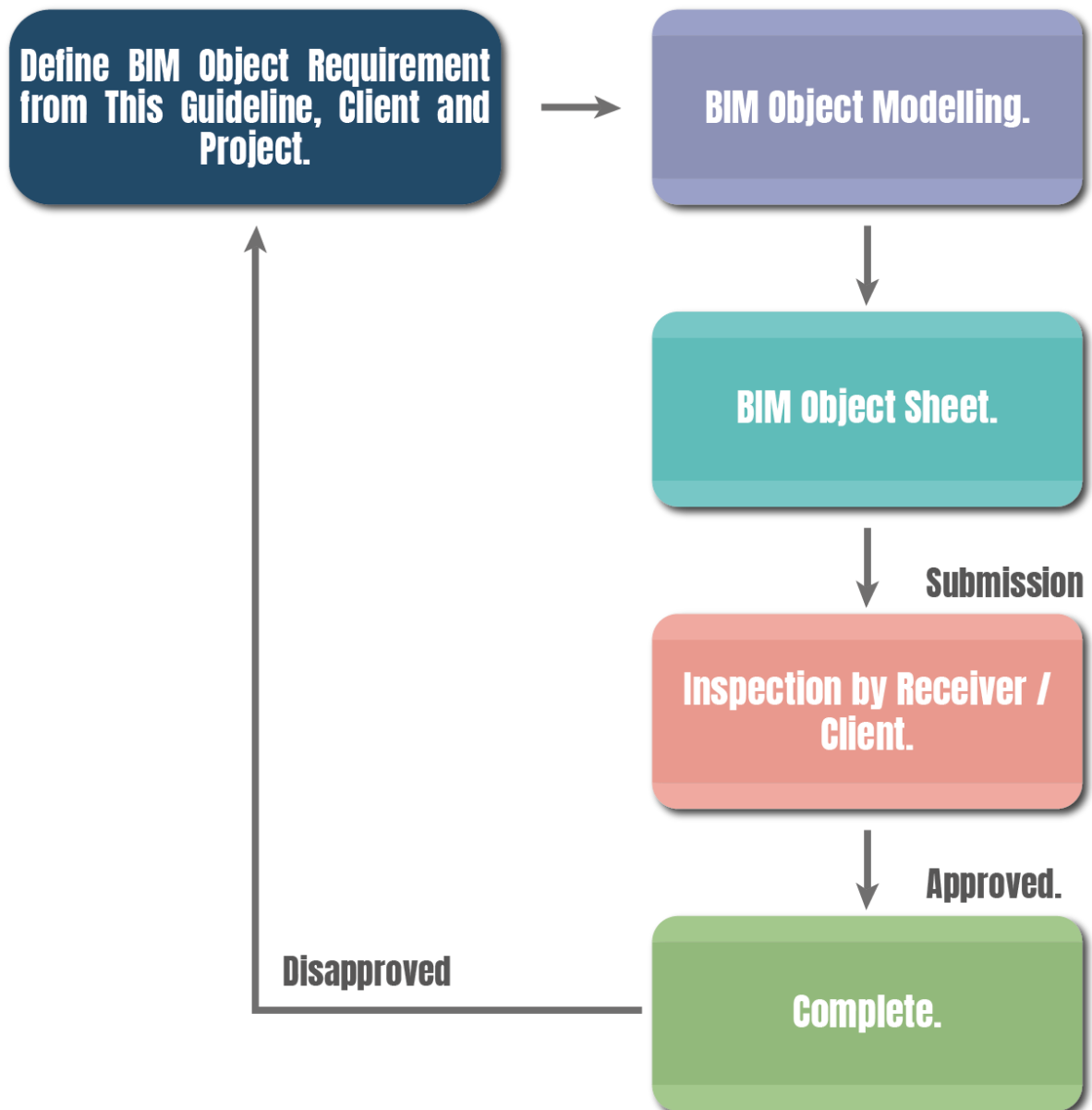
APPROVED/

DISAPPROVED/

RESUBMIT

6.3 Workflow

The BIM object shall follow this workflow to create, inspect and submit to verify it satisfy this guideline requirement and client requirement.



7 BIM Object Library (Tentative)

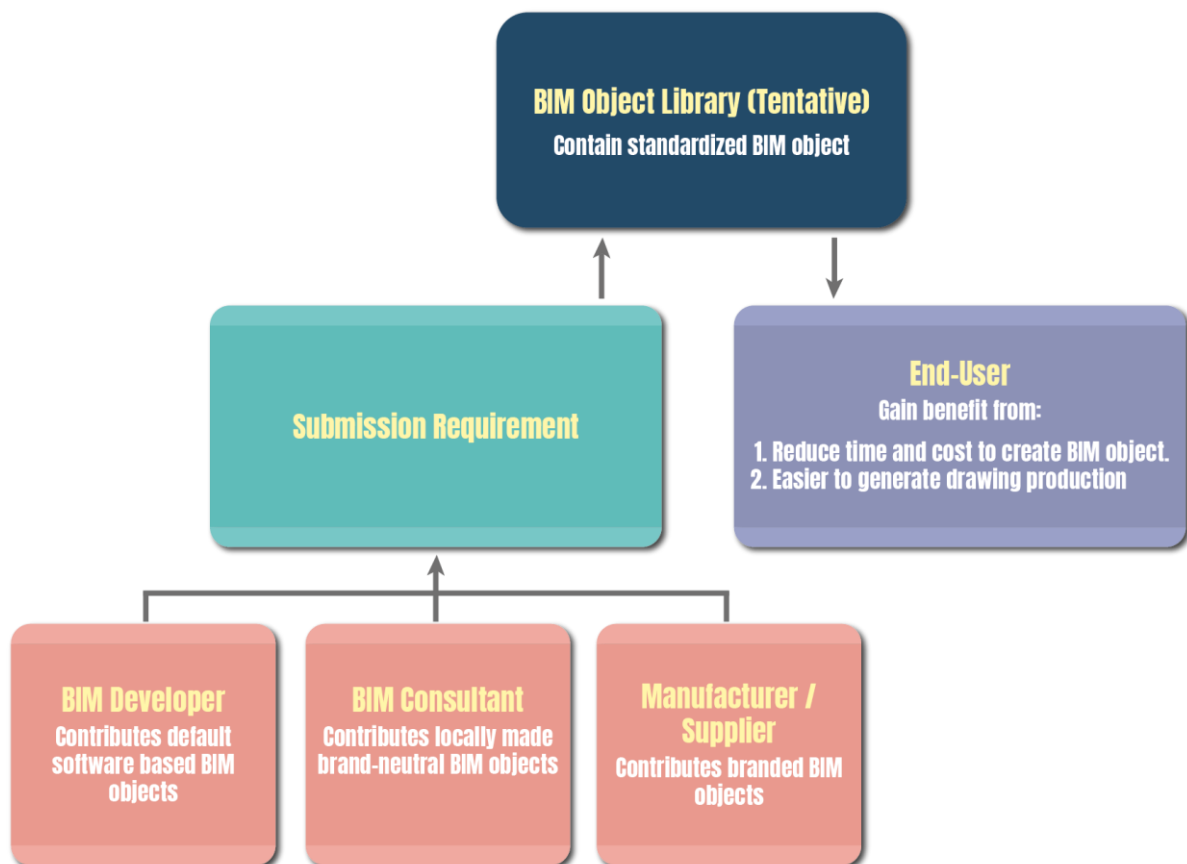
This section is prepared to contribute a comprehensive and open source CIC BIM object library for all construction industry and BIM developer. The BIM object library also purposes to provide a platform for whole BIM industry submit their BIM object and share to each other.

The scope of this section includes the platform operation structure and submission structure.

All content of this section is primary draft and will be further modify.

7.1 Platform Operation Structure

The platform consists of BIM object library, end-user and contribution from industry and BIM developer. The library is open source and allow end-user to review, download and use any BIM object in the library. The library allows industry and BIM developer to submit their own BIM objects to contribute the entire value of the library and industry.



7.2 Submission Requirements

The BIM object shall provide the filled BIM object sheet and check form to prove the BIM object is complete and satisfy this guideline requirement.

The BIM object and relevant document shall submit as a package and follow a standardized folder structure.

Folder Name (The BIM object name without file format extension)

- └ The BIM object file
- └ Image Folder (Storage the BIM object geometry and property images)
- └ Symbol Folder (Storage the symbol object file(s) and its image(s)) If Applicable
- └ Tag Folder (Storage the tag object file(s) and its image(s)) If Applicable
- └ Document Folder (Storage the filled sheet and check form)

8 References

The following referenced documents apply to this guideline, however, this guideline is based on local industry principle and following document for reference only except annotated in content.

General:

- NBS BIM Object Standard (<https://www.nationalbimlibrary.com/nbs-bim-object-standard>)
- BIM-MEP^{AUS} (<http://www.bimmepaus.com.au/initiative/>)

Autodesk Revit:

- Family Library Interchange Program (F.L.I.P.) (<http://aiab.org/index.php/background>)
- International Revit User Group (www.revitcity.com)

GRAPHISOFT ArchiCAD:

- GDL Object Description (<http://gdl.graphisoft.com/>)
- BIM Classification Systems (https://www.graphisoft.com/downloads/archicad/BIM_Data.html)
- Overview of Creating Custom Objects (<https://helpcenter.graphisoft.com/guides/archicad-21/archicad-21-reference-guide/elements-of-the-virtual-building/parametric-objects/create-custom-library-parts-and-components/>)
- Expression Defined Property Values – Overview (<https://youtu.be/SnDYdbUAww0?list=PLnXY6vLUwIWUv8rM2RYu5RQnXVIZ-xxd7>)

Bentley AECOsim:

- AECOsim speedikon (https://communities.bentley.com/products/building/building_analysis_design/w/)

The BIM Object standard are based on the following referenced library and documents from major BIM capable organizations, both local and global in the industry:

- ASD (Architectural Services Department)
- CEDD (Civil Engineering and Development Department)
- DSD (Drainage Services Department)
- EMSD (Electrical and Mechanical Services Department)
- HA (Hong Kong Housing Authority)
- WSD (Water Supplies Department)
- HyD (Highways Department)
- Other Works Departments

9 Acknowledgement

In order to achieve a standardized technical BIM approach for the industry, it is inevitably that certain portion of this guide share similar approach by other organizations. CIC acknowledges that some methodologies are originated from the Housing Authority Building Information Modelling Standards and Guidelines (HABIMSG) study to be published by Hong Kong Housing Authority and Housing Department.

The CIC would also like to acknowledge the following organisations for providing valuable graphics, information and comment for this guideline:

- Development Bureau
- ASD (Architectural Services Department)
- CEDD (Civil Engineering and Development Department)
- DSD (Drainage Services Department)
- EMSD (Electrical and Mechanical Services Department)
- HA (Hong Kong Housing Authority)
- WSD (Water Supplies Department)
- HyD (Highways Department)

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- Bentley Systems Hong Kong Limited