BUILDING INFORMATION MODELLING (BIM) STANDARDS

CIDB MALAYSIA

Building Information Modelling (BIM) Standards

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COMMITTEE REPRESENTATION

The Construction Industry Standard (CIS) was developed and reviewed by the Construction Industry Development Board Malaysia with the assistance of the Technical Committee, which comprises representatives from the following organisations:

BUILDING INFORMATION MODELLING (BIM) STANDARDS

1 SECTION 1: GENERAL

1.1 Introduction

The Malaysia Building Information Modelling (BIM) Standard aims to outline the processes of BIM implementation in construction project. The Malaysia BIM Standards will guide the project team to improve the process of design information production, management and exchange. This standard is intended to be used to:

- Define BIM deliverables in construction project
- Establish a process for adopting BIM in construction project
- Understand roles and responsibilities of project members

The standard can be used as reference by project team to implement BIM on a project when practical, however can be overridden during the preparation of the BIM Execution Plan (BEP). The documents listed below are supplementary advice, information and guidance note to this standard:

- BIM Guide 1: Awareness
- BIM Guide 2: Readiness
- BIM Guide 3: Adoption
- BIM Guide 4: BIM Execution Plan (BEP)
- BS 1192:2007 + A2: 2016, Collaborative production of architectural, engineering and construction information- Code of practice
- PAS 1192-2:2013, Specification for information management for the capital/ delivery phase of construction projects using building information modelling
- PAS 1192-5: 2015, Specification for security-minded building information modelling, digital built environments and smart asset management
- NBS BIM Object Standard, Version 2.0/ 2018

1.2 Definitions

For the purpose of this manual, the following definitions shall apply:

1.2.1 Building Information Modelling (BIM)

Modelling technology and associated set of process to produce, communicate, analyze and use of digital information models throughout construction project life-cycle.

1.2.2 BIM Execution Plan (BEP)

Plan prepared by the suppliers to explain how the information modelling aspects of a project will be carried out.

1.2.3 Employer's Information Requirement (EIR)

Pre-tender document setting out the information to be delivered, and the standards and processes to be adopted by the supplier as part of the project delivery process.

1.2.4 Common Data Environment (CDE)

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.

2 SECTION 2: PROJECT STANDARD

2.1 BIM Execution Plan

The BIM Execution Plan (BEP) is developed based on the project requirements and needs at the beginning of the project. The BEP outlines the project deliverables and provide implementation details for the for the project team to follow throughout the project. The BEP is developed both pre and post contract and is prepared to meet the Employer's Information Requirement (EIR).

The BEP assists the employer and project team to document the agreed BIM deliverables and processes for the project. It will be submitted to the employer and explain how the information modelling aspects of a project will be carried out. It usually details:

- Project goals and value
- Project team roles and responsibilities
- Strategy for key deliverables and information to be used
- Methods and procedures

For details information on the BEP, please refer to the CIDB BIM Guide Book 4: BIM Execution Plan. This guide is divided into three parts:

- Part 1: Introduction to BIM Execution Plan;
- Part 2: Case Study on BIM Implementation; and
- Part 3: Sample of BIM Execution Plan

2.2 Project BIM Strategy

The project BIM strategy shall be defined in the BEP. A project BIM strategy will incorporate process integration along with information interoperability throughout construction project life-cycle.

The project BIM strategy shall include the following key item:

a) Standards used in the project
b) Define software platform to be utilised and how interoperability issues will be addressed
c) Project Team Roles and Responsibilities Matrix
d) Define project deliverable and format in which it is delivered and exchanged
e) Project characteristic consist division of the work and schedule (Number of buildings, size, location etc.)
f) Define common coordinate system for all data
g) Addressing issues of data segregation due to multiple workset and linked filed to enable integration
h) Define checking/ validation process of drawings and data
i) Define communication protocols and form of data exchange
j) Set out key dates for reviews of the model

2.3 Collaborative BIM Data Sharing

Ability to communicate, re-use and shared data efficiently is major constituent of collaborative environment. This standard is aligned with BS 1192:2007 Collaborative working, which defines the process for design collaboration and efficient data sharing in Common Data Environment (CDE). A CDE approach allows verified and coordinated information to be shared efficiently and accurately between all members of the project team.

A set of possible modelling guidelines and collaboration procedures will assist the project members to work in systematic collaborative environment. The modelling guidelines need to be developed according to agreed deliverables stated in BEP. The BEP shall define the collaboration plan which consists of:

a) Software platform for collaboration
b) Project folder structure
c) Folder structure for WIP zone
d) Folder structure for shared zone
e) Folder structure for Published Zone
f) Information Exchange Protocol

The recommended data exchange diagram is shown in **Figure 1**.

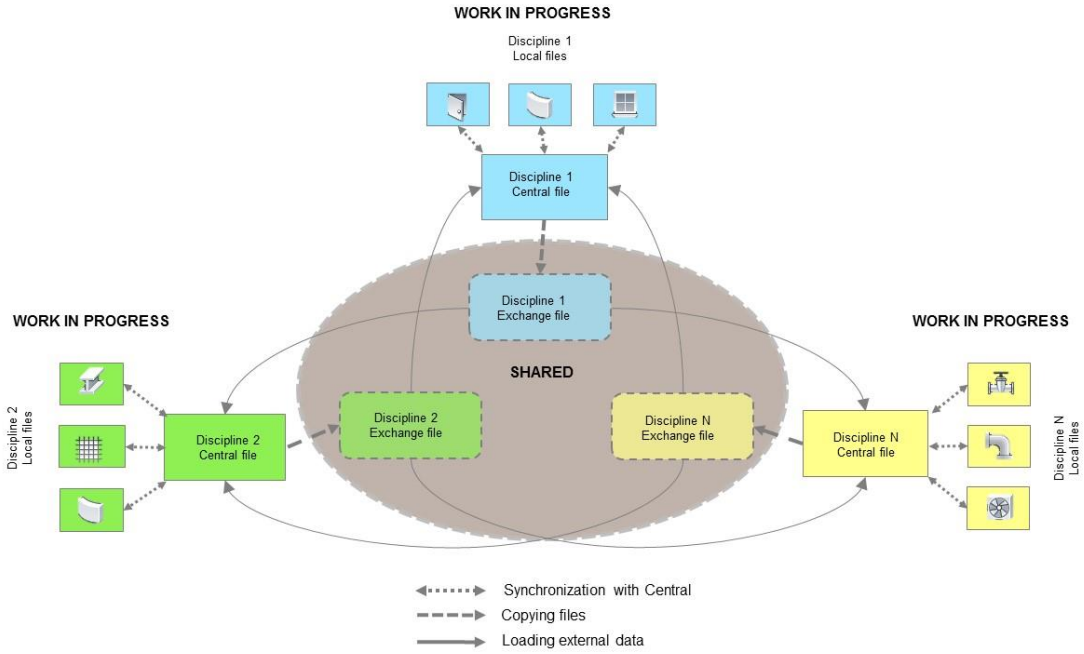


Figure 1: Data exchange diagram within multidisciplinary design participants

BS1192:2007 defines the outline of CDE as a process with four phases:

Work In-progress (WIP)	Non-verified design data used by discipline specific design teams. *Description: Authored, checked, reviewed and approved for use outside of the authoring team*
Shared	Verified design data by the Designer and BIM Quality approved by the BIM Manager shared with the project team for collaboration purpose. Data shall be checked, approved and validated as 'fit for coordination' in line with MS 2522 and PAS 1192-2: 2013 *Description: Shared with other disciplines to use as reference material for their own design development and authorized to publish*
Published	Design output for use by the project team coordinated and validated *Description: Published (in non-changeable formats) for use by the total project team (2D DWF or PDF)*
Archive	Project history maintained for knowledge and for regulatory and requirements *Description: Stored and maintained for knowledge, regulatory and legal requirements*

The phases of CDE is illustrated in **Figure 2:**

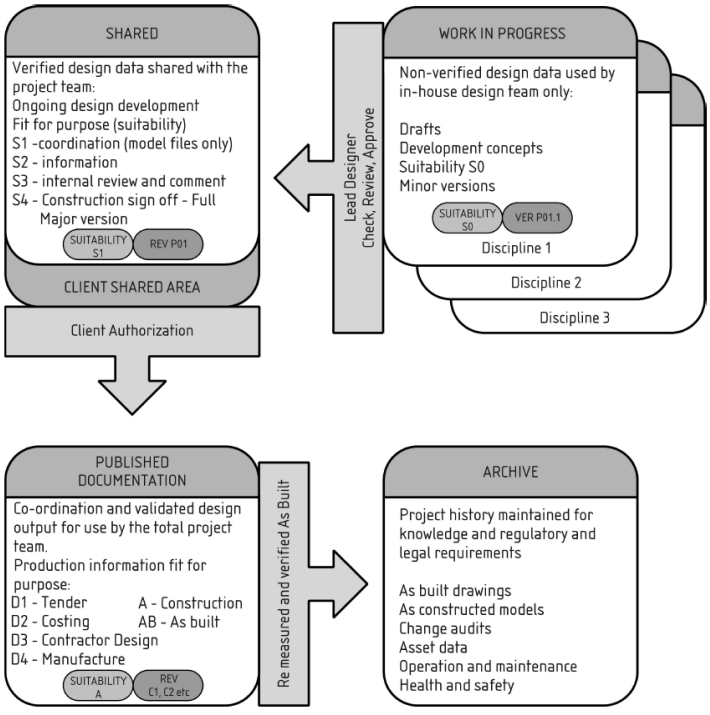


Figure 2: CDE structure extracted from BS 1192:2007

2.4 Interoperability

Interoperability between software products is a paramount importance for successful BIM working. Interoperability is where information is to be displayed or transferred between software applications through open data standards. Models created by the project members should be developed using suitable BIM authoring software applications that are compatible with the Industry Foundation Classes (IFC). The requirements of a project must be determined during early stage and reviewed on a case by case basis. Data exchange formats and rules shall be agreed by all BIM project participants and formalized in the BEP.

2.5 Planning the Work and Data Segregation (BIM uses and model breakdown)

The aim of segregation is to lay a basis for multi-user access to the model and to ensure effective teamwork. This section deals with the principles of subdividing a model for the purpose of:

a) multi-user access;
b) operational efficiency on large projects;
c) inter-disciplinary collaboration.

Planning the work and data segregation shall take into account, and be agreed by, all internal and external disciplines to be involved in the modeling. It must be fully documented within the BEP. Information should be managed in accordance with the processes described in PAS 1192-2:2013, PAS 1192-5: 2015 and BS 1192:2007.

The following practices are recommended during the information model development:

a) Model structure shall take into account all BIM-covered design discipline (Refer **Table 1**)

Table 1. Principle of data segregation

Discipline	Segregation principles
Architecture	By floor or floor group
Structural	By functional joints, grips of concrete and metal structures
HVAC - Mechanical	By system: air supply, air exhaust, air conditioning etc.
HVAC - Plumbing	By system: cold water supply, hot water supply, water waste

b) A model file shall contain data from one discipline / project stakeholder only (although exceptions may apply for Building Services where multiple disciplines converge).
c) Not more than one building shall be modeled in a single file.
d) Further segregation of the geometry may be required to ensure that model files remain workable on available hardware. Elements are included into worksets either individually or by category / location / task distribution etc.
e) In order to avoid duplication or coordination errors, clear definition of the data ownership throughout the life of the project shall be defined and documented.
f) Element ownership may transfer during the project time-line – this shall be explicitly identified in the BEP.
g) Where multiple models make up a single design, a container model should be considered, whose function is to link the various assemblies together for coordination/clash detection purposes.
h) Data segregation within a model may depend on planned ways of information transfer (export) as well as on model final delivery format.
i) Models shall initially be created as isolated, single-user files. The model will be sub-divided as additional members of the design team are introduced.

3 SECTION 3: TECHNICAL STANDARD

3.1 Modelling Methodology

This section explains the methodologies on model development and build-up which will facilitate the efficient use and re-use of BIM data.

3.1.1 Model Development Methodology

BIM model development methodology enables project team to specify the details and reliability of model elements at various stages in the project life cycle. Model development methodology shall be embedded in the BEP as it provides the basis for reliable structured project information, collaboration, coordination, and data use between participants. The following shall be taken into account during the BIM model development (refer **APPENDIX A**):

3.1.1.1 Level of Development (LOD)

Using elements with predetermined LOD allows determining the expected BIM content on the component level at different stages as shown in the following table:

Table 2: Level of Development (LOD) based on stages

Stage	Level of Development (LOD)
Pre-Design	LOD 100
Schematic Design	LOD 200
Design Development	LOD 300
Construction Documents	LOD 350
Construction Stage	LOD 400
As Built	LOD 500

3.1.1.2 Level of Detail (LoD)

LoD generally describes the properties that an object has at a given LOD level. Properties of a model element at a given LOD level are the described characteristics including the properties from the previous LOD level. Example of attributes contained in LoD are as follows:

a) Geometrical attributes: Size, volume, shape, height, orientation
b) Non-Geometrical attributes: System data, performance data, regulatory compliance, specifications and cost

Table 3: Interconnection between Level of Development (LOD) based and Level of Detail (LoD)

Level of Development (LOD)	**Level of Detail (LoD)**
LOD 100	Object (or structure) is graphically represented in the model by symbols (e.g. by a line or surface) or generic (i.e. dimensions and quantities are not defined). This represent the overall geometric expression of the object and the relations to its surroundings.
LOD 200	Object (or structure) is graphically represented as a generic object with approximate quantities, sizes, dimensions, location and orientation. The function of the objects are described and model will be divided into a number of discipline models.
LOD 300	Object (or structure) is graphically represented as a specific object representing quantities, sizes, dimensions, location and orientation. Objects overall function, performance and material are described.
LOD 350	Object (or structure) is graphically represented as a supplier-specific object with quantities, sizes, dimensions, location and orientation.

Level of Development (LOD)	Level of Detail (LoD)
	Objects are detailed at connections with other building components. Manufacturers or suppliers concerns information about the suppliers products including data sheet specification, colour codes, warranty period, intervals for maintenance and inspection, lifespan, etc.
LOD 400	Object (or structure) is graphically represented, possibly as a supplier-specific object with quantities, sizes, dimensions, location and orientation. Objects are detailed for fabrication, assembly, prefabrication, and contains also installation information.
LOD 500	Object (or structure) quantities, sizes, dimensions, location and orientation is confirmed on site (as built).

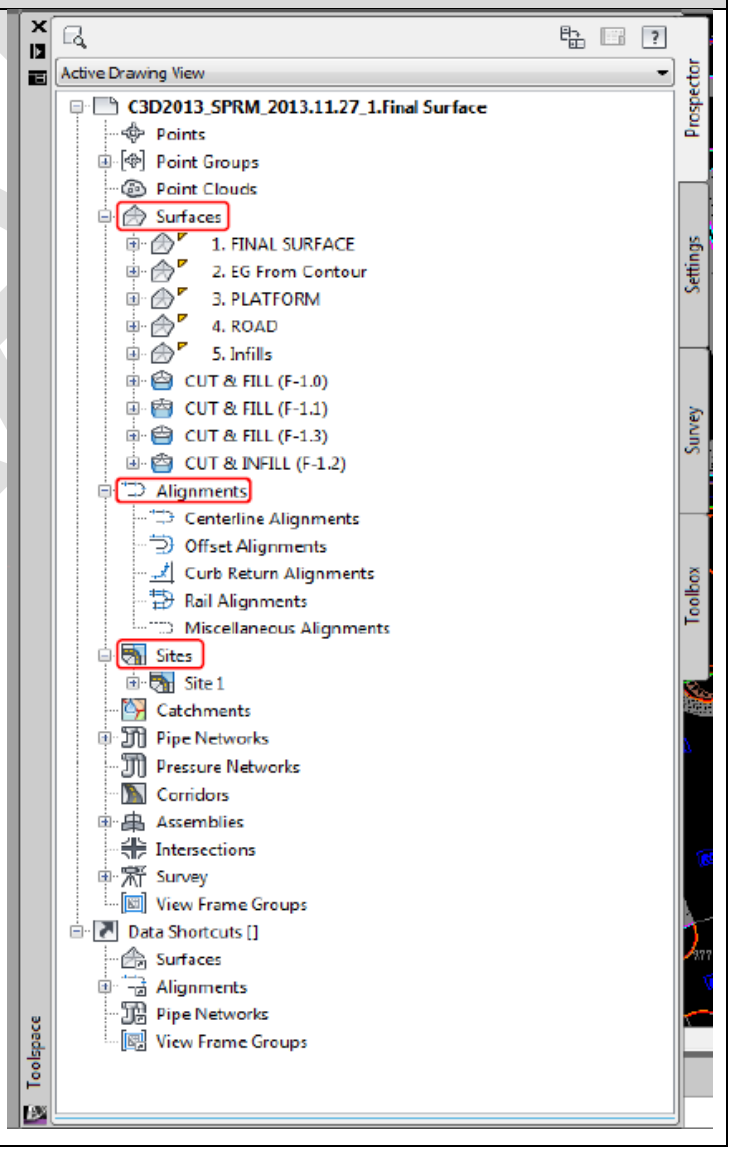
3.1.2 Discipline Modelling Guidelines

This section provides recommendation on how author will create the model elements based on agreed deliverables in the BEP at different stages.

3.1.2.1 Site Modelling Guidelines

The modelling of the site will include topography, land uses, site information, massing models of surrounding buildings, roads, infrastructure and other features. The site model elements involved and its function is shown in **Table 4.**

Table 4: Site model elements and its function

Bil.	Element and Function	Image
1.	Surface – Represents the surface level available (existing surface), sub-surface area and proposed shape surface level	
2.	Alignments- Soil profile data and heaps (cut and fill)	
3.	Sites- Information storage and data related to slope recommended (grading)	

3.1.2.2 Modelling Guidelines for BIM Elements

The modelling guidelines need to be developed according the requirements stated in the BEP. LOD of the BIM elements produced at each stage need to be specified in the BEP using tables provided in **APPENDIX B**. A set of modelling guidelines for key model elements at different stages of a project will assist the project team to model the elements.

The following are recommended guidelines to be produced by the project team:

a) Architectural Modelling Guidelines
b) Structural Modelling Guidelines
c) Mechanical, Electrical and Plumbing Modelling Guidelines

3.1.2.3 Modelling Guidelines for E-Submission

Modelling guidelines for Malaysia E-Submission for regulatory and approval purpose need to be considered. The requirements for E-submission can be found at: http://www.cidbec.com.my/

3.1.2.4 Model Orientation

The origin or base point of the project should be clearly defined and comply with True North and Project North.

3.1.2.5 Model Division and Structure

It may be necessary to divide the model into separate parts, zones, volumes or levels. This is depending on the size of the project. This should be agreed and documented by the project team as early as possible. How and when the model is split shall be defined in the BEP.

It is important to ensure that the BIM elements are aligned and reviewed across the model division interfaces to ensure continuity of the systems between the model division.

3.1.2.6 Revision Management

The model will evolve rapidly during each stage of the project. Any changes should be tracked and documented, especially when the model creation task is divided into a few smaller packages and handled by different people.

Various software of mechanisms are available to assist modellers to manage and monitor design change. Model author for each discipline should work with their respective BIM software vendor to familiarise themselves with the use of these software mechanisms so that design changes can be managed effectively. The BIM coordinator for each discipline could play the role of maintaining a register to record the latest information incorporated in the model. They should work closely with the BIM manager to coordinate the version of model shared or exchanged

3.1.3 Cross-Disciplinary Model Coordination

Project team should share their models with other project team at regular intervals for reference. Project team should agree on a schedule for the sharing and exchange of models. Each discipline model should be provided in native or neutral format (such as IFC- refer **section 1.6**) for other disciplines reference and use in relation to other project. It is recommended for the project team to map out a comprehensive coordination process flow (refer **APPENDIX C**), which shows the interactions between the client and project team.

Prior to model coordination, the respective models should be checked, approved and validated as “fit for coordination”.

3.1.3.1 Types of Model Coordination

Successful BIM coordination requires careful planning and a clear understanding of different types of coordination process (i.e. design coordination, clash detection space validation).

During early coordination processes, entire models can be run against other models to determine the scope of interference, i.e. objects, elements and selection criteria, for future testing. However, it is important to recognize that not all conflicts detected are problems. Certain conflicts may have been intentional during the modelling

process to simplify the modelling process. Proper elements grouping and clash rules should be set up before running the respective coordination processes, to:

- Reduce time and resources spent on detecting false positives
- Hide elements that unnecessary in the coordination process (i.e. known issues that are to be resolved in later project stages; elements that do not impact cost when changed on site, etc.)
- Group particular elements for specific type of coordination process, such as forming groups between the ceiling elements and a fire services model during a clash analysis

The BEP shall define clash detection software that will be used for the project. Clash results need to be judged in the context of the elements being analysed. For example, one issue that may occur are duplicate instances of the same clash – for example, a pipe hitting steel could represent 20 clashes when in reality it is only one single issue.

Responsibilities during the coordination process:

- Each party owns a discipline-specific model
- During coordination, different models can tap on appropriate software depending on the type of coordination needed
- To resolve clash conflicts, each party carries out agreed changes on their own discipline-specific model
- Liabilities of each discipline-specific model remain the same, before and after the analysis.

3.1.4 Model and Drawing Production

There is a need for the project team to agree on the standard for models and 2D drawings that form part of the contract documents. 2D drawings include plans, sections, elevations, details and RFIs, etc. All the drawing sheets produced by the project team shall comply with the current industry standards for drawings.

The project team shall create and publish drawings directly from BIM models (i.e. established through the linking of views, callouts and elevations). Drawings or documents which are not produced from BIM models should be clearly labelled.

The project team should agree and document the common naming convention and drawing numbering systems for model views, legends, schedules, drawing sheets and links that could provide a common reference to the corresponding design drawings, submission drawings, tender drawings, working drawings and as-built drawings.

3.1.5 Data Security and Saving

A data security protocol should be established to prevent any possible data corruption, virus “infections”, and data misuse or deliberate damage by project team members, other employees or outside sources. Listed are recommendations for data security and saving:

- Adequate user access right should be established to prevent data loss or damage during file exchange, maintenance, and archiving
- All BIM project data shall reside on network servers should be subjected to regular back-ups
- Staff access to BIM project data held on the network servers shall be through controlled access permissions
- Files shall be saved back to Central hourly. At the completion of work at the end of the day borrowed elements and worksets shall be released
- Save reminder interval shall be set to e.g. 30mins

3.1.6 Quality Assurance and Quality Control

A quality assurance plan for the models should be established by the BIM manager. The quality assurance plan will ensure appropriate checks on information and data security.

BIM coordinator for each discipline is also responsible to establish a quality control procedure to ensure that the discipline model is accurate and correct according to modelling guidelines (refer 2.7.2).

Each project team members should be responsible for performing quality control checks of their design, dataset and model properties before submitting their deliverables. Listed below is important consideration when creating a quality assurance plan:

- Modelling guidelines: Ensure model is created based on the modelling guidelines and CAD standards
- Dataset validation: Ensure dataset are produced with correct data
- Interference check: Detect any clashes between two building components using clash detection software
- Visual check: Ensure that the model is built according to the design and required characteristic
- Standard compliance: Ensure that the model is built according to specifications, standards and LoD requirements
- Integrity check - Ensure the integrity of the model is maintained throughout the duration of each project implementation
- Tolerance check- Ensure that the resulting model adheres to the tolerance limit set.

3.2 Folder Structure and Naming Conventions

3.2.1 Introduction

This section provides information on storage of BIM data within the project filing system along with the naming conventions associated with aspects of BIM working.

3.2.2 Project Folder Structure

The defined structure shall follow the principles of BS1192:2007's 'Work In Progress (WIP)', 'Shared', 'Published' and 'Archived' segregation of data within a designated set of folders (refer **section 2.5**). An example is provided in **APPENDIX D**.

3.2.2.1 Central Resource Library Folder Structure

Standard templates, drawing borders, families and other non-project-specific data (**Figure 3**) shall be held within the server based Central Resource Library, with restricted write access.

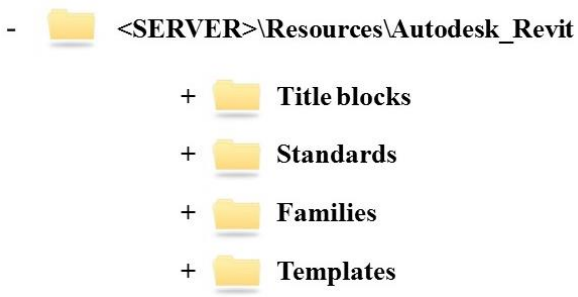


Figure 3: Central Resource Library Folder Structure

3.2.2.2 Local Project Folder Structure

Local copies of central project models do not need to be backed up as changes are regularly synchronized with the central file(s).

They shall be stored on the user's hard drive – not in "My Documents"– according to the folder structure below in **Figure 4**.

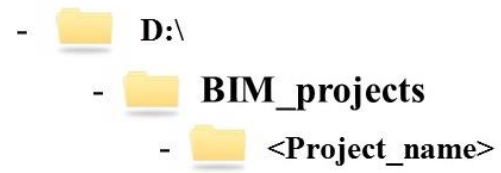


Figure 4: Local Project Folder Structure

3.2.3 General Naming Conventions

This section describes the method of the naming convention system. General rules for model files naming:

- Use only uppercase character A-Z, followed by lowercase character a-z, and number 0-9 for all fields
- All fields shall be separated by a hyphen character "-". Using spaces is not recommended
- Within a field, CamelCase or "_" shall be used instead of a space to separate words.
- Abbreviations and codes shall be written in uppercase.
- The file extension shall not be amended or deleted
- AN "XX" shall be used if the file does not refer a single specific zone or level
- The scheme for zone and level sub-division shall be agreed with the other project professionals at the outset and defined in the BEP document.
- For code examples for discipline, zone and level refer to **APPENDIX E**.

3.2.4 Model File Naming

Naming of information model files shall be based on BS1192:2007.

1	2	3	4	5	6	7
Project	Originator	Zone/ System	Level	Type	Role	Description

Field 1: Project	An abbreviated code or number identifying the project.
Field 2: Originator Code	An abbreviated code identifying the originating stakeholder. (Recommended 3 characters)
Field 3: Zone/System	Identifier of which building, area, phase or zone of the project the model file relates to if the project is sub-divided by zones. (Recommended 2 characters)
Field 4: Level	Identifier of which level, or group of levels, the model file relates to if the project is sub-divided by levels. (Recommended 2 characters)
Field 5: Type	Document type, e.g. M3 for 3D model files. (Recommended 2 characters)
Field 6: Role	Discipline identifier code. Refer to APPENDIX E. (Recommended 2 characters)
Field 7: Description	Descriptive field to define the type of data portrayed in the file, or a unique file number.

Examples:

Model File Name	Description
20-ABC-BE-L2-M3-S-Akedemi_Binaan_Malaysia.rvt	Job No. 20, ABC structure model for Akedemi Binaan Malaysia at Block E, Level 2

3.2.5 Division Naming

The division should be named in a consistent and logical manner to aid navigation through the project.

3.2.6 Library Object Naming

Library object naming provides a unified approach to the identification of objects across the dataset and associated tools. The object names shall be composed of the fields defined in **Table 5**, in the following arrangement:

<originator >_<source>_<type>_<Subtype/Product code>_<Differentiator[1]>

[1]*The differentiator filed is optional and may be included as needed*

Table 5: Object Naming Fields

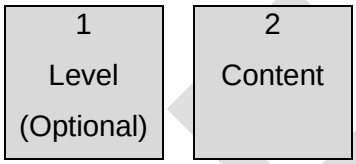
Type	Description	Example
Originator	Used to convey the object provider by a 3- 6-character code. Where an object is provided through an object library but developed by another party, include a code to convey the library provider.	NSWPH
Source	Used to identify the library object manufacturer. The manufacturer name shall not be abbreviated. For a generic object, this field may be omitted.	BettaWindows
Type	Used to identify the object type.	Window
Material	Used to identify the material type.	Plastic
Subtype/ Product Code	Used to convey additional information to further define the construction product such as the product range. The manufacturer product range shall not be abbreviated. This field can also be used to identify the predefined (Sub) type.	Skylight
Differentiator	Used to convey additional information required to adequately identify the object, or not otherwise captured in the attribute data.	600x900mm
Image type	Used to convey the image type, e.g. bump, cut-out, render	Bump

3.2.7 Object Property Naming

Parameters, or object properties, should be named in a consistent and logical manner to aid clarity and usability. Unique names should always be used.

3.2.8 View Naming

Conventions in the naming and use of views are necessary to coordinate team activity and prevent inadvertent changes in the output documents. View naming shall be consistent across all references to that view. Renaming of views shall be carried out with care as any changes will be automatically reflected across all documentation.



Field 1: Level (Optional)	Concise description of the content and purpose of the view Field
Field 2: Content	Where appropriate, further clarification of the location of information shown

Examples:

Name	**Description**
01- Plan	First floor plan
01-CeilingPlan	First floor reflected ceiling plan
Level3-DetailPlanElevator1	Third floor detail plan at elevator 1
AA	Section A-A along gridline 4
BB	Section B-B along gridline 7 North-South
NS-BuildingSection	North-South full building section
EdgeSection	Typical edge section showing slab, beam and wal
SouthElevation	South Elevation

3.2.9 Sheet Naming

Sheet naming shall be based on the document and drawing numbering protocols established for the project. These names automatically match the text as it appears in the title block and any schedules.

3.3 Presentation Styles

This section defines the criteria which ensure the plotted appearance of drawing output from the BIM is consistent and of the highest quality. It is not the remit of this standard to dictate aspects covered by existing CAD standards. Most of the aspects covered in this section are software- specific and further information should be obtained from the relevant software providers.

Where client requirements deviate from those expressed in this standard, project-specific template files shall be created. These shall be stored within the Project BIM Resources Library (refer APPENDIX D)

3.3.1 Annotation

Where no pre-defined text standards exist, the Text Style shall be ARIAL NARROW. Listed are recommendations for annotation:

- The appearance of text shall be consistent across a set of drawings
- Annotation shall be legible, clear and concise
- An opaque background should be considered as an aid to clarity
- Text shall remain legible when drawings are plotted at reduced size. Wherever practical lettering shall not be placed directly on top of lines or symbols
- Dot style arrowheads shall be used instead of closed filled arrowheads when calling up hatched/shaded areas.

3.3.2 Text Assignment

All text shall be restricted to the following sizes:

Text height (mm) Plotted full size	Usage
1.8	General text, dimensions, notes – used on A3 & A4 size drawings
2.5	General text, Dimensions notes
3.5	Sub-headings,
3.5	General text, dimensions, notes – A0 drawings
5.0	Normal titles, drawing numbers
7.0	Major titles

Alternative text sizes shall not be used without clarification in the Project BIM Execution Plan.

3.3.3 Line Weights

Line weights control the graphical display of on-screen data as well as all published output.

- The plotted appearance of modelled components shall be consistent across the project
- The plotted appearance of modelled components shall be represented in a manner that provides ‘depth’ to the drawing and allows for adequate differentiation of elements cut in section, profile view and priority elements.
- For Line Patterns, Line Styles, Hatching and Filled Regions and View Templates, the modellers will need to refer to software-specific supplements

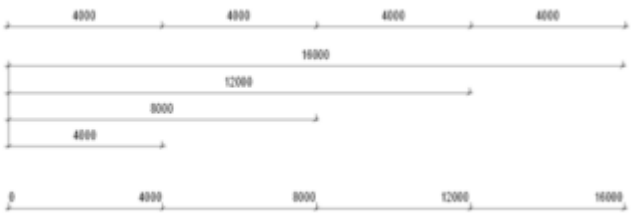
3.3.4 Dimensioning

Default dimension styles should be provided for the consistent appearance of dimensions across all project documentation. New styles shall be added only if authorised.

- Where practical, all dimensioning shall be created using relevant software dimensioning tools. The dimension text shall not be exploded or overridden
- Where practical avoid duplicate dimensioning either within a drawing or within a set of drawings. Where practical, dimension lines shall not be broken and shall not cross other dimension lines.
- Dimensions shall be placed on a drawing, so they may be read from the bottom or right-hand side of the drawing
- Dimension text shall be placed above the dimension line and shall be clear of other lines so that they are legible. The default dimension styles shall not be overridden

3.3.4.1 Dimensioning Style Naming Convention

1 Text Size	2 String Type	3 Tick Mark	4 Units	5 Description

Field 1: Text Size	Size of text used on the dimension in the appropriate units. By default this shall be 2.5mm Arial Narrow
Field 2: String Type (Optional)	Dimension String Type **CON** Continuous **BAS** Baseline **ORD** Ordinate 
Field 3: Tick Mark	Description of the tick mark used on the dimension style such as Dot, Arrow or Diagonal tick marks
Field 4: Units	The reporting units of the dimension style

Field 5: Description (optional)	Provision for distinguishing specifi c dimension styles

Examples:

- 1 .8-Con-Arrow-(mm)
- 2.5-Con-Di agonal-(mm)-Centreline
- 2.5-Arrow-(deg)

3.3.5 Drawing borders and Title blocks

Project-specific title blocks shall be created and stored in the Project BIM Resources folder

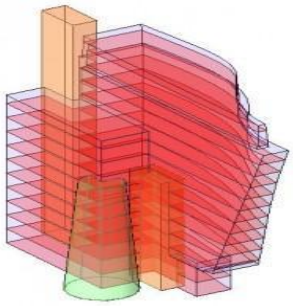
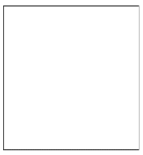
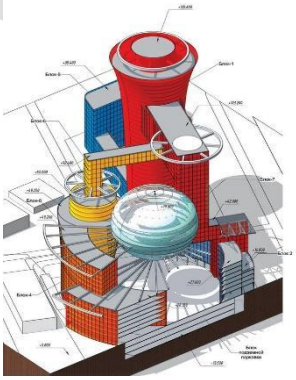
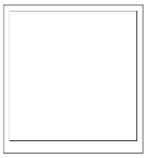
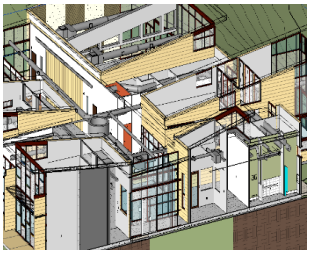
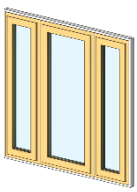
3.3.6 Symbols

Standard symbols such as North point, section marks and call-ups shall be made available from within the project or central Resource folder.

3.3.7 Section and Detail Marks

- All Sections shall be numerically labelled.
- All Details shall be alphabetically label led.
- Where practical, sections shall be listed consecutively, from left to right and from top to bottom on the drawing on which they are drawn.
- All sections and details shall be correctly cross-referenced in both directions i.e. Cross reference to where the section/detail is actually drawn.
- Drawing cross referencing shall not include the revision code.

APPENDIX A: LEVEL OF DEVELOPMENT

LOD	Definition	Possible use	Examples	
LOD 100	Object (or structure) is graphically represented in the model by symbols (e.g. by a line or surface) or generic (i.e. dimensions and quantities are not defined). This represents the overall geometric expression of the object and the relations to its surroundings.	Preliminary Design stage		
LOD 200	Object (or structure) is graphically represented as a generic object with approximate quantities, sizes, dimensions, position, orientation and described functions. At this point, the model will be divided into discipline models.			
LOD 300	Object (or structure) is graphically represented as a specific object of quantities, sizes, dimensions, position and orientation. Object's overall function, performance and material are described.	Design stage		

LOD 400	Object (or structure) is graphically represented, possibly as a vendor-specific object with quantities, sizes, dimensions, position and orientation. Objects are detailed for fabrication, assembly, prefabrication and also contain installation information.	Detailed Design stage	 	
LOD 500	Object's (or structure's) quantities, sizes, dimensions, position and orientation is confirmed on site (as built).	OPEX phase		

APPENDIX B: LOD OF THE BIM ELEMENTS

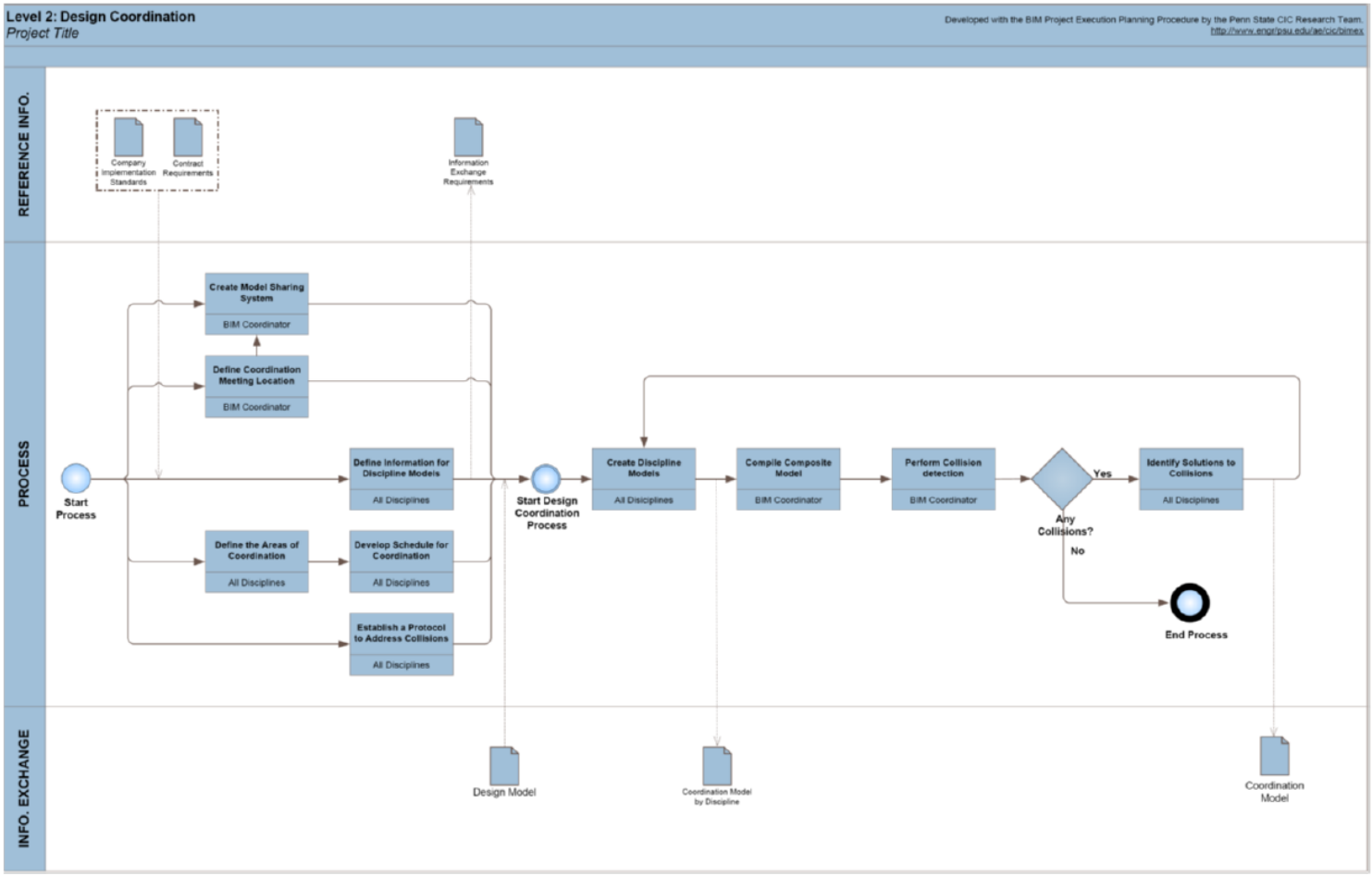
This table indicate LOD expected for each model element at different project stage. The BIM manager is responsible to amend each of the cells and is allowed to add or remove elements required from the list to suit a project requirement.

Model Element List : Determine model element (e.g. Door, Foundation, Slab, Ductwork etc.)
Required : Define if a group element need to be modelled for a project
Quantity Measurement : Data required for quantity take off
AUT : Model author
LOD : Level of Development required

Model Element List	Required	Quantity Measurement	Category Code	Project Stages											
				Concept Design		Developed Design		Technical Design		Submission for Approval		Construction		As- Built	
				AUT	LOD	AUT	LOD	AUT	LOD	AUT	LOD	AUT	LOD	AUT	LOD
Room space	Yes/ No	m^2	RS												
Floor	Yes/ No	m^2	FLR												
Door	Yes/ No	Nos.	DOR												

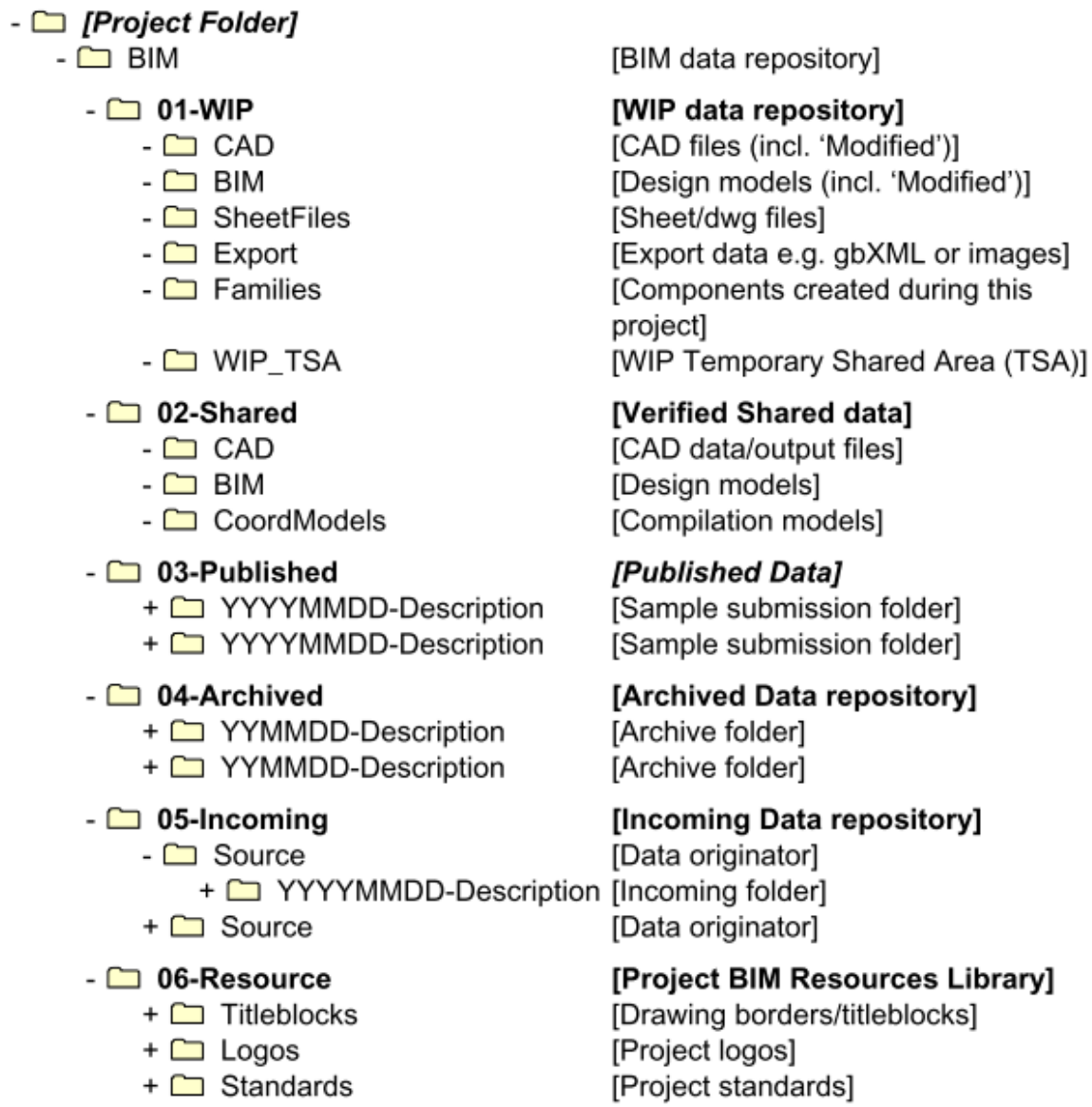
APPENDIX C: BIM COORDINATION PROCESS FLOW

Example of BIM coordination process flow (Penn State, 2010)



APPENDIX D: PROJECT FOLDER STRUCUTRE

This is provided as an example only and should not be used in preference to or replace any internal company quality assured standard folder structures.



Source: AEC (UK) Committee, 2012

APPENDIX E: MODEL FILE NAMING CODES

Discipline Codes BS1192:2007 codes shown in **bold** Additions shown feint	
A	**Architects**
B	**Building surveyors**
C	**Civil engineers**
CB	Bridge engineers
CR	Road / highway engineers
CW	Water / dam engineers
D	**Drainage**
E	**Electrical engineers**
EC	Cable Containment
EF	Fire Alarms
EL	Lighting
EP	Protection
ES	Security
F	**Facilities Manager**
G	**GIS, land surveyors**
GA	Aerial surveyors
H	**Heating and Ventilation**
I	**Interior designers**
K	**Client**
L	**Landscape architects**
M	**Mechanical engineers**
ME	Combined Services
MW	Chilled Water
MH	Heating
MV	Ventilation
P	**Public health**
PD	Drainage
PF	Fire Services
PH	Public Health Services
PS	Sanitation and Rainwater
PW	Water Services
Q	**Quantity surveyors**
R	Rail
RS	Railways signaling
RT	Railways track
S	Structural engineers
SF	Façade engineers
SR	Reinforcement detailers
T	**Town & country planners**

Project Zone Code Examples	
01	Building or zone 1
ZA	Zone A
B1	Building 1
CP	Car park
A2	Area Designation 2

Project Level Code Examples	
RF	Roof
01	Level 1
00	Ground floor
B2	Basement 2
M1	Mezzanine 1
PL	Piling
FN	Foundation

Discipline Codes cont…	
W	**Contractors**
X	**Sub-contractors**
Y	**Specialist designers**
YA	Acoustic engineers
YE	Environmental engineers
YF	Fire engineers
YL	Lighting engineers (non-building services)
Z	**General (non-specific)**

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ACKNOWLEDGEMENT