

BIM GUIDELINES FOR ASSET INFORMATION MODEL

CHENNAI METRO RAIL LIMITED



Issue History:

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Disclaimer

The document of BIM-AM standards and guidelines is a reference document for CMRL-managed projects and the handover of As-built BIM from contractors. Users should carefully consider the suitability of the recommendations given by these standards and guidelines before applying any methodology into their current project workflow.

PREFACE

What this guide is about:

BIM has the potential to provide significant benefits to the infrastructure sector. Many consultants and contractors have embraced the use of BIM for their projects. To maximize the use of BIM, building/facility owners can capitalize on the rich information developed in the process for operation and maintenance purposes. Increasingly, we have also seen more building/facility owners beginning to look at using BIM for asset management.

For BIM to be effective for life-cycle asset management, it is important at the start of the project to understand what information is important to capture upfront for use in later project lifecycle stages.

This guide provides a framework for contractors to define the information to be captured in BIM applications at design and construction stages and enables CMRL to use the information for operations and maintenance.

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1. Overview and Objectives:

1.1.1 What is BIM?

BIM stands for **B**uilding **I**nformation **M**odelling.

Building Smart International defines BIM as follows:

“BIM is a digital representation of physical and functional characteristics of a facility. A building information model is a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life cycle, defined as existing from earliest conception to demolition”.

BIM is all about data that is built up starting from the design to construction and finally to the operations and maintenance phase. Both geometry and non-geometrical data describing building elements are found in BIM.

1.1.2 WHY BIM FOR ASSET MANAGEMENT?

The goal of facility managers is primarily to manage the buildings and facilities effectively and efficiently in line with the owners' objectives, in compliance with the law and safety considerations, being energy-efficient, and ensuring the availability of building services to the occupiers with the aim of enhancing the asset values.

FM managers and technicians need building information to discharge their duties effectively and efficiently. Traditionally, FM managers depend on as-built drawings and operational & maintenance manual. Such a practice is no longer meeting the fast and demanding modern business world.

Building/facility owners should capitalize on BIM and its information available and move forward in adopting BIM for asset management (BIM-AM) that will gain substantial benefits in terms of cost, safety, productivity, and efficiency when the building or the facilities start operations.

To cross over from BIM to BIM-AM, it is important that information that is key to effective operations and maintenance is accurate and completely built into the BIM. A problem today at the handover stage is the inconsistency of handover information that makes it very challenging for the recipient to organize and subsequently use the information effectively for asset management.

With BIM, information can be captured and presented in a structured manner, and it can be digitally accessed and managed more conveniently compared to hardcopy documents. Manually entering asset data into AM systems will be a thing of the past. BIM data can also be integrated with smart building solutions in a seamless manner, facilitating the establishment of a predictive and preventive maintenance regime. BIM can help facility managers to access digital information within minutes as compared to possibly taking hours to retrieve the same information without BIM.

The Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines is based on the operation and maintenance requirements from CMRL. This standard provides the CMRL Building Information Modelling (BIM) modelling standard, coding standard, and the information requirement for structural, architectural, E&M, and wide model systems and assets from construction stage to handover for building operation.

During the design and construction stage, BIM is used as a design visualization and coordination tool. Meanwhile, asset information should be gradually built up in the BIM model so that by the end of the construction stage, the BIM model becomes an Asset Information Model (AIM) for handover to asset management. This standard focuses on AIM; it provides guidelines on what information should be included and how it is managed. It aims at providing a standard for as-built BIM and asset information at the handover stage conforming to the CMRL BIM-AM (Asset Management) System.

This BIM-AM Standards and Guidelines aims to achieve the goals:

1. Standardize E&M, systems, subsystems, and equipment coding.
2. Specify the information requirements for room/spaces, E&M, and systems equipment to be inputted in the BIM model.
3. Specify the modelling requirement for AM.

1.2. Reference Standards and Specifications

1.2.1 Codes and Standards

The below listed standards or guidelines have been used as reference documents for these standards and guidelines:

- 1) **ISO 19650:** An international standard that provides a framework for managing information throughout the life cycle of a built asset.
- 2) **BS EN ISO 19650-1:** Concepts and principles.
- 3) **BS EN ISO 19650-2:** Delivery phase of the assets.
- 4) **BS EN ISO 19650-3:2020:** Operational phase of the assets.
- 5) **BS EN ISO 19650-5:2020:** Security-minded approach to information management.
- 6) **BS PAS 1192:** A series of standards that outlines specific requirements for collaborative BIM processes.
- 7) **PAS 1192-2:2013:** Specification for information management for the capital/delivery phase of construction projects using building information modelling. Pioneering the Building Information Modelling Standard.
- 8) **PAS 1192-3:2014:** Specification for information management for the operational phase of assets using Building Information Modelling.
- 9) **PAS 1192-5:2015:** Specification for security-minded Building Information Modelling, digital built environments, and smart asset management.
- 10) **ISO 55000:2014:** Asset management—Overview, principles, and terminology.
- 11) **BS8536-1:2015:** Code of practice for facilities management (Buildings infrastructure).
- 12) **BS 8536-2:2016:** Design and construction: Code of practice for asset management (Linear and geographical infrastructure)

1.2.2 Guidelines and Specifications

- **Asset Information requirements (AIR)** – Outlines the information that the organization/contractors need to know about the assets they are responsible for.
- **Employer Information Requirements (EIR)** – Sets out the information to be delivered, the standards, and the processes to be adopted for a construction project.
- **BIM Execution Plan (BEP)** – Outlines the overall vision and implementation details for the project team to follow throughout the project.

Basically, there are 3 key elements in the data management framework for the BIM-enabled asset information delivery project, which will be discussed in the subsequent sub-sections:

1. **Information Requirements** (AIR, EIR) by the facility/building owner
2. **Information Delivery** (BEP, PIM, AIM) by the project team
3. **Information exchange** across the project lifecycle by all project stakeholders

1.3. Interpretations and Abbreviations

List of Abbreviations: -

ABAM	As-Built Asset Model
AFC	Automatic Fare Collection
AIM	Asset Information Model
AIR	Asset Information Requirements
ABS	Asset Breakdown Structure
BEP	BIM Execution Plan
BIM	Building Information Modelling
BMS	Building Management System
BMP	BIM Management Plan
BOM	Bill of materials
CAFM	Computer Aided Facilities Management
CCSM	Coordinated Combined Services Model
CCTV	Closed Circuit Television
CDE	Common Data Environment
CER	Central Equipment Room in OCC & BCC
CMMS	Computerized Maintenance Management System
CMRL	Chennai Metro Rail Limited
CoBie	Construction Operations Building Information exchange
EDMS	Electronic Document Management System
EIR	Employer's Information Requirements
FM	Facility Management
GIS	Geographic Information System
VAC	Heating Ventilation Air Conditioning
IFC	Industry Foundation Classes
LOD	Level of Development
LOI	Level of information (Attributes)

MIDP	Master Information Delivery Plan
MMS	Maintenance Management System
MPDT	Model Production Delivery Table
O&M	Operations and Maintenance
PIM	Project Information Model
SCADA	Supervisory Control And Data Acquisition
TBC	To Be Confirmed
TBD	To Be Defined
TIDP	Task Information Delivery Plan
WBS	Work Breakdown Structure

List of Interpretations: -

Attribute	It is a piece of data describing a BIM object.
Common Data Environment	An electronic platform to manage the collection, creation, sharing, and publishing of project information. This is the single source of all information relating to the project and should be set up to facilitate the spatial coordination and information exchange processes.
CoBie	Construction Operations Building Information Exchange (CoBie), an international standard to manage asset data information. CoBie may take several approved formats, including spreadsheet and IFC file formats.
Federated Model	A BIM model with links (does not merge) to several models. As opposed to the integrated Model, the Federated Model does not merge the properties of individual models into a single model.
Industry Foundation Class (IFC)	A platform-neutral, open, and object-based file format specification developed by Building SMART to facilitate interoperability in the architectural, engineering, and construction industries, and is a commonly used collaboration format in BIM-based projects.
Object	It is a building component in BIM software that can be inserted, moved, and rotated into the required location and orientation within models (e.g., MCB board, air diffuser, etc.).

1.4. Information Requirements

In this section, a step-by-step approach is proposed to assist O&M term in defining and translating the information requirements at the operational level (AIR) and how it could be specified in the tender specification (EIR). Figure 1 gives an illustration of this approach.

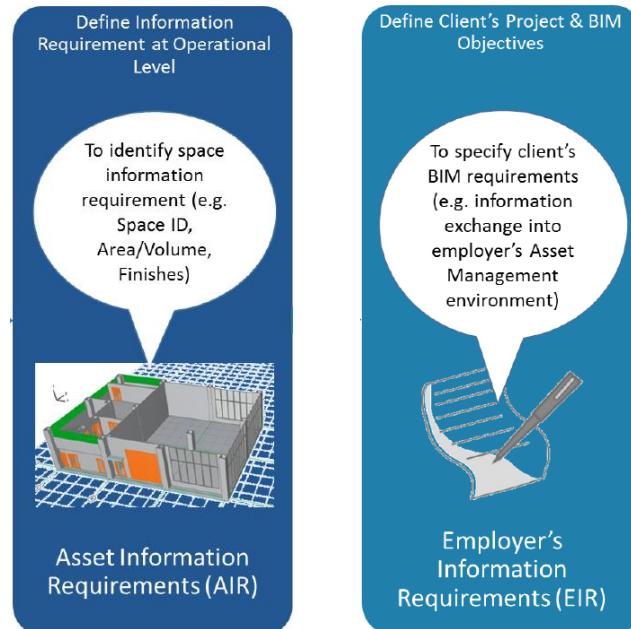


Figure 1

1.4.1. Asset Information Requirements (AIR)

Once the business needs are understood, more detailed asset information requirements (AIRs) can be defined. Based on a list of asset types that matter to the O&M, the initial requestor of the information should be able to define the specific asset information required to achieve the objective. Typically, the asset information would include the following:

- Physical asset data—name, description, and technical characteristics of the asset
- Location and spatial data—where the asset is and how it relates to other assets
- Performance data—how this asset contributes to the serviceability target
- Condition data—What is the life expectancy of the asset

For the operation and maintenance purposes, the key assets are usually those associated with the space and building services system. The following shows the asset systems to be captured for the deliverables.

- | | |
|---|-----------------------------|
| ➤ Architectural System | ➤ Telecom |
| ➤ Civil & Structural System | ➤ Signaling |
| ➤ PHE System | ➤ Platform Sliding Door |
| ➤ PS&OHE | ➤ Automatic Fare collection |
| ➤ Track | ➤ Lift |
| ➤ E&M | ➤ Escalator |
| ➤ Tunnel Ventilation System | ➤ Tetra |
| ➤ Ventilation and Air-conditioning System | |

To assist the facility management process in identifying which assets are important for the operation and maintenance, the following criteria could be used:

- Asset components with high-frequency usage and wear and tear that require a regular or unpredicted period of monitoring, maintenance, and replacement.
- Asset components that are linked directly to the basic and common services of a building, e.g., ventilation, air conditioning, and drainage system, etc.
- Asset components that require specific information, such as health and safety operation environment and procedure.

1.4.2. Employer's Information Requirements (EIR)

The Employer's Information Requirements (EIR) (also known as the client's BIM requirements) is a document that defines the client's project and BIM objectives. The EIR generally outlines the information to be delivered, together with any associated standard and process to be adopted by the project delivery teams. It will also establish the scope of work for the engaged project team to create the data in a structured manner (see Appendix 7B & Phase 2 BIM Management Plan for more information).

The detailed approach to be taken, including defining the roles and responsibilities of the key stakeholders in the value chain that need to create the asset data, should be spelled out in the BIM Execution Plan (BEP).

1.5. Information Delivery

Based on the information requirements specified in the EIR, the contractors shall collect, coordinate, and deliver the asset information. In this section, typical information deliverables will be discussed as summarized in Table 1.

Table 1: Information Deliverables

Deliverables	What it is and when to be delivered?
BIM Execution Plan (BEP)	<ul style="list-style-type: none"> • A document to explain in detail how the project team plans to meet the requirements specified by the building/facility owner. • To be delivered before the project started
Project Information Model (PIM)	<ul style="list-style-type: none"> • A progressively developed information model (BIM and non-BIM) across the project life cycle (e.g., Coordinated Design Model (CSD) ➡ Coordinated Combined Service Model (CCSM) ➡ As-built Model) • To be delivered at different project stages and to be completed during project handover
Asset Information Model (AIM)	<ul style="list-style-type: none"> • An information model (BIM and non-BIM) derived from PIM that supports the ongoing management of an asset. (As-Built Asset Model - ABAM) • To be delivered during project handover

1.5.1. BIM Execution Plan (BEP)

BIM Execution Plan (BEP) is a document prepared by the BIM Manager and maintained along with the project progress as a live document to explain in detail how the project team plans to meet the Employer's Information Requirement (EIR) specified by CMRL. In the Asset Information Delivery strategy, the consultants and contractors should propose:

- The roles and responsibilities of the parties and individuals for asset information modeling and management of the project
- The processes and procedures to collect, coordinate, and deliver asset information.
- The process for validating accuracy and submitting/applying corrections to the asset information model.
- The process and procedure to share the asset information model among project team members and cross parties.
- The process for updating the asset information model.
- The procedure on their quality assurance processes for data, models and documents.
- Response to the client's specific requirements, confirming the ability to comply on the timing, content, and format of information delivery.
- Comments where deliverables are impractical to deliver with alternative delivery proposals. If aftercare is required, the contractor must specify the period of aftercare (the number of years that the model should be managed for) following handover.

1.5.2. PROJECT INFORMATION MODEL (PIM)

Project Information Model (PIM) is an information model developed during the design and construction stage of a project. Using BEP as a standard and procedure guideline, the PIM will evolve from the most initial concept design to the virtual construction model to support construction stage activities and be delivered as an Asset Information Model (AIM) during project handover.

Project information (e.g., BIM data) usually evolves when the project progresses from the conceptual design stage to the O&M stage. Some data that is specific to a particular stage (e.g., alternative design options in the design development stage) will not be brought over to the next stage, as it may not be relevant or useful for the following stage to work on it. On another hand, lifecycle data, such as asset information, will continue to grow along with the progress of the project when the design and selection of assets become more certain. The evolution of the Project Information Model will generally go through the following phases as shown below.

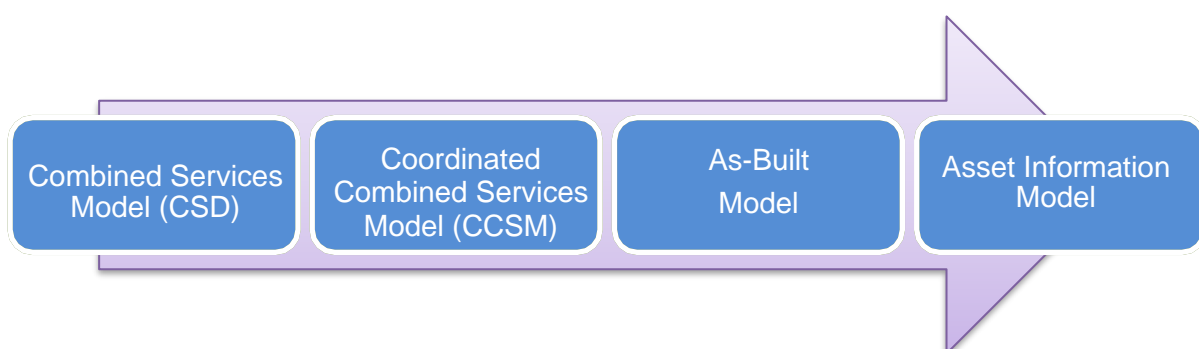


Figure 2 Evolution of Data

Combined Services Model: The Design Model is created by the design team that captures the intended design. (LOD 300)

Coordinated Combined Services Model: The Construction Model is developed from the Design Model and is used by contractors for fabrication and construction coordination. (LOD 350)

As-Built Model: This model should capture the condition and relevant information at the end of the construction stage. The building/facility owner should retain the As-Built model as the authoritative source and a reference for the building as constructed. (LOD 500)

Asset Information Model: The Asset Information Model (AIM) is derived from the As-Built BIM model, where only information specified in the AIR is to be retained.

The Table below shows an example of a deliverable schedule and milestones on asset information deliveries.

Table 2 Asset Information Deliverables

Milestone	Asset Information Deliverable	Format
Contract Award	BIM Execution Plan that includes asset information delivery plan	PDF
Construction	<ul style="list-style-type: none"> Designed Performance of Managed Asset (e.g., cooling capacity of the chillers) Location of Managed Asset All other asset information as specified 	Native BIM Format +Excel

The final details for contractor deliverables are to be included in the agreed project BIM Execution Plan (BEP), and this could also inform the production and delivery of the Asset Information Model that meets the CMRL requirements.

1.5.3. ASSET INFORMATION MODEL (AIM)

As asset information is essential for business operations, it is important to have a process to ensure the collection and management of good quality and accurate data. Therefore, this section defines the deliverables (either documents, graphical models, or drawings) to be produced by the contractors during construction till the end of the project, named as Asset Information Model (AIM).

The AIM deliverables usually comprise BIM and non-BIM deliverables. The BIM deliverables consist of a set of BIM models (e.g., architectural model, structural model, plumbing model, fire protection model, TVS & VAC model, electrical model, etc.), where each of the models contains a geometric representation of the BIM elements and their selected non-geometric attributes. The non-BIM deliverables usually consist of other asset information documents (files in PDF, JPEG, XLS, databases, etc.) that are linked to and referred to by the BIM deliverables. The figure below shows the structure of the Asset Information Model.

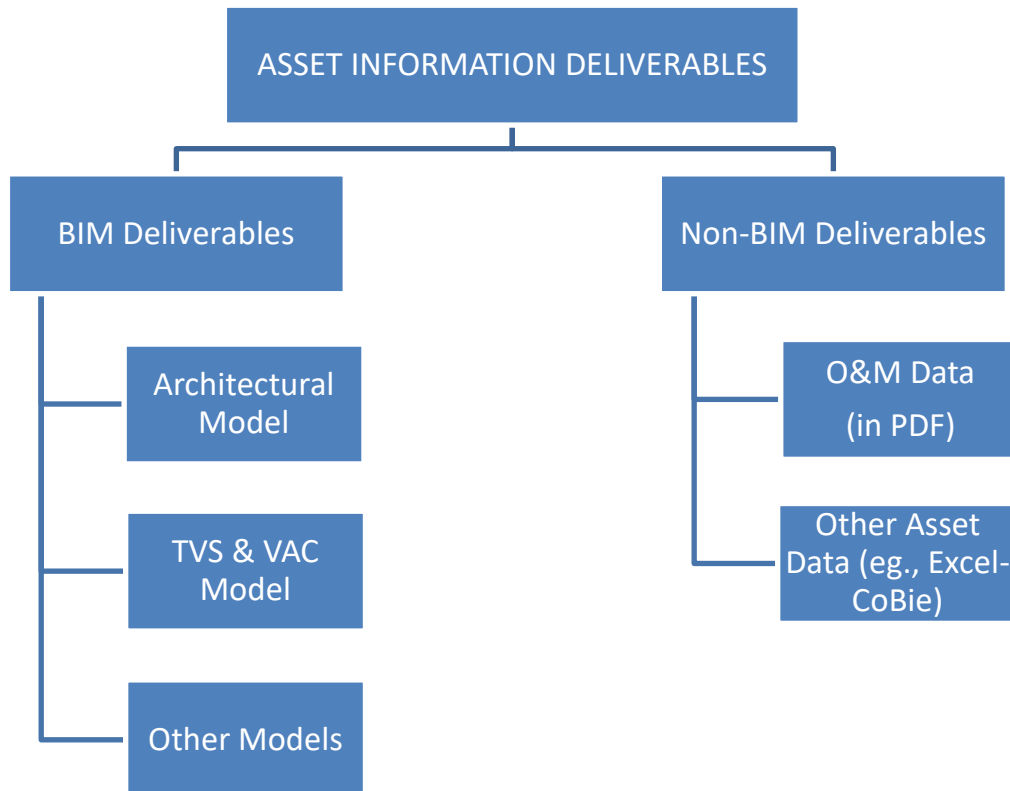


Figure 3 Asset Information Model

1.5.3.1 BIM Deliverables

The BIM deliverables usually consist of the geometric elements (e.g., assets to be modeled) and the non-geometric data (e.g., asset information to be tagged as a parameter in the geometric elements). Not all information about a facility needs to be captured within a BIM model. Contractors must consider the purpose of having certain objects in a BIM model (e.g., whether that particular asset is actually managed) before adding those details/requirements into the model.

The quality and completeness of the BIM deliverables are vital for the development of a useful Asset Information Model. It is essential for the contractors to ensure that all geometric elements in a model are classified (using a standard such as Omniclass) and mapped to a client/project-specific table of assets that need to be tracked for operations and maintenance, as determined by the CMRL. As the attributes vary by asset type, it is critical that elements are assigned specific classification in greater detail than that offered by BIM authoring platforms in order to meet the needs of operations and maintenance.

1.5.3.2 NON-BIM DELIVERABLES

Non-BIM deliverables refer to additional asset information such as documents, databases, or cloud storages to be handed over to CMRL as specified in the contract. This information is not part of the BIM model, but it is essential for the FM practitioners. For example, T&C or O&M documents are usually not embedded in the BIM element, but the link to those particular documents could be provided.

Similarly, information provided on databases and cloud storage will be 'tagged' in the BIM model to be machine-readable such that software solutions are able to read and relate them.

This type of information usually will be consumed later by a Computerized Maintenance Management System (CMMS) / Computer Aided Facilities Management (CAFM) / Building Management System (BMS). CMRL is in the process of consulting with CMMS/CAFM/BMS vendors on the preferred way of consuming Asset Information Deliverables.

1.6. Information Exchange

The smoothness of the information exchange process is essential to the overall success of construction projects. For information to be successfully exchanged, it is necessary for all contractors to understand what they need to provide and what others will be providing and how this information will be presented and used. This section will discuss some fundamental technology for the information exchange process.

1.6.1. Common Data Environment

To improve the information exchange and issuing of information that supports the delivery of a project, a common data environment (CDE) or a collaboration platform is recommended. The CDE is a central repository where construction project information is stored and shared. It keeps not only assets created in a BIM environment but also documentation related to the assets. CMRL is using BIM360/ACC as its CDE.

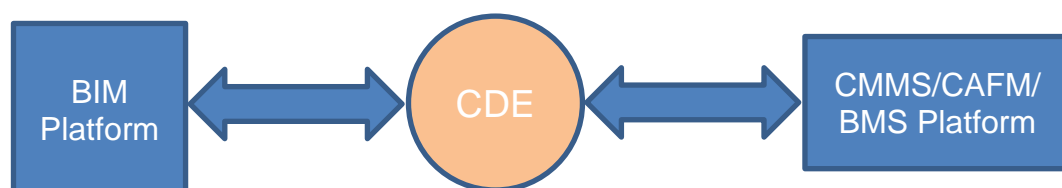


Figure 4: Common Data Environment

1.6.2.Information Exchange Format

Contractors to ensure the data exchange formats and protocol shall be required in a format defined in the BIM Execution Plan (BEP), which may include (but not be limited to) any of the following outputs:

- Native–3D discipline model files
- Common file format–Navisworks model files, IFC model files, per discipline and federated.
- CoBie

The asset information handover from the contractor to CMRL shall be in CoBie format. Construction-Operations Building information exchange (CoBie) is an open standard format that aims to eventually replace the current paper-based documents with an electronic format. The standard was developed for the exchange of information of managed assets that covers equipment, products, and spaces.

1.6.3.Information Exchange with Facility Management (FM) Solutions

Most BIM applications could export (and most CMMS/CAFM/BMS platforms can import) information in spreadsheet format; however, each solution may have a specific spreadsheet layout or data structure that conforms to its proprietary data model. In general, there are two ways to exchange asset information deliverables into facility management solutions, e.g., the CMMS/CAFM/BMS platform:

- Direct mapping from BIM platform to CMMS/CAFM/BMS platform (**Figure 5**):

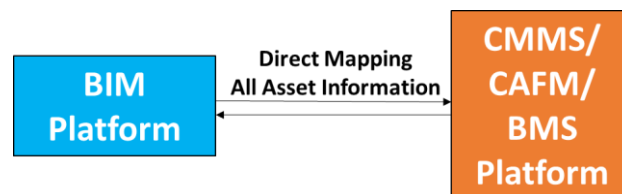


Figure 5 Asset Information Exchange into CMMS/CAFM/BMS

- Only mapping key asset information (**Figure 6**):

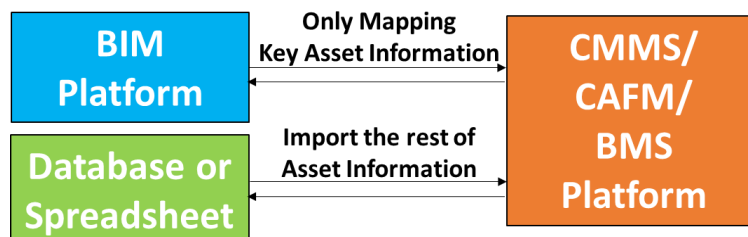


Figure 6 Asset Information Mapping

CMRL is in the process of consultation with CMMS/CAFM/BMS service providers to determine the asset information mapping approach. This will be informed in an upcoming revision. It is recommended that the BIM platform supports open APIs for the various FM solutions to have bi-directional communication, both for reading data and writing data back. The ability to visualize the 3D/2D graphics served by the BIM platform within the facility management applications would be a substantial added benefit to bring the power of BIM into every facility management solution. CMRL recommends that O&M manuals are submitted as electronic documents linked to BIM as a minimum requirement.

CHAPTER 2

ASSET BIM MODELLING STANDARDS

2. Asset BIM Modelling Standard

2.1. Asset BIM Model Management

For ease of file management and optimal model loading and display performance, contractors should maintain the BIM models according to the following criteria:

1. BIM models shall be separately constructed by disciplines and clusters as specified in the Phase 2 BIM management plan.
2. A model file size shall be controlled to not more than 500MB.
3. A federated model file named “Master” shall be created to link all the architectural, structural, and E&M and system models for the operation of the BIM-AM system. Binding models shall not be adopted.
4. All work sets shall be removed for the handover of as-built asset models.
5. Before model submission, all irrelevant parameters (e.g., those parameters not required by CMRL) of the objects shall be deleted, and unused BIM objects in the as-built BIM models shall also be purged.
6. Before model submission, all irrelevant objects, views, schedules, and linkages in the as-built BIM models shall be purged.
7. In addition to the BIM project files for the BIM models, all loadable objects (e.g., *.rfa) that are used in the BIM models shall be separately submitted and saved in the “model” folder.

2.2. Browser Organization

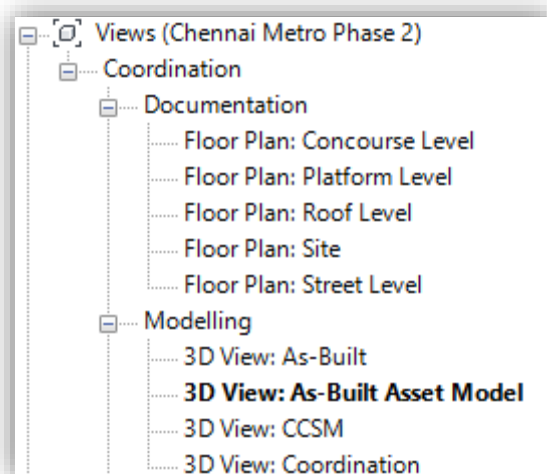


Figure 7 Browser Organization.

Project Browser should be designed by the Project BIM Manager so that views can be organized according to their purpose, their viewing details, and types of view.

2.3. Room and Space creation in Revit

Creating rooms and spaces in Autodesk Revit is essential for defining interior areas, performing spatial analysis, and documenting building designs. The methodology and requirements of architectural, structural & MEP modelling shall follow the guidelines below.

Room or Space shall be created with Room Name & ID: When establishing a room or space in an architectural model, it is important to include elevated floor and ceiling gaps so that the AM system can automatically fill in the "zone tag number" parameter for each E&M item.

Reflected ceiling plans showing the location of access panels for MEP services shall also be included in the architectural models.

An accurate systems analysis can only be accomplished if spaces are placed (created) in all areas to account for the entire volume of your building model. Contractors shall ensure spaces are bounded.

- ❖ Bounded areas are areas that are bounded by room-bounding components such as walls, curtain walls, curtain systems, columns, roofs, floors, and room and space separation lines.

Creating Rooms for Architecture Model: (By Civil Contractors)

- ✓ Ensure that walls or other elements form closed boundaries around the intended room area.
- ✓ Confirm that the "Room Bounding" property is enabled for all relevant elements in the **Properties Palette**.
- ✓ Navigate to the floor plan or ceiling plan view of the level where you want to place rooms.
- ✓ Go to the **Architecture** tab and select **Room** in the "Room & Area" panel.
- ✓ Click inside a bounded area to place the room. Revit will detect the enclosed space automatically.
- ✓ After placing a room, modify its properties in the **Properties Palette**. Assign a **Room Name**, **Room Number**. Refer to the below image for reference.

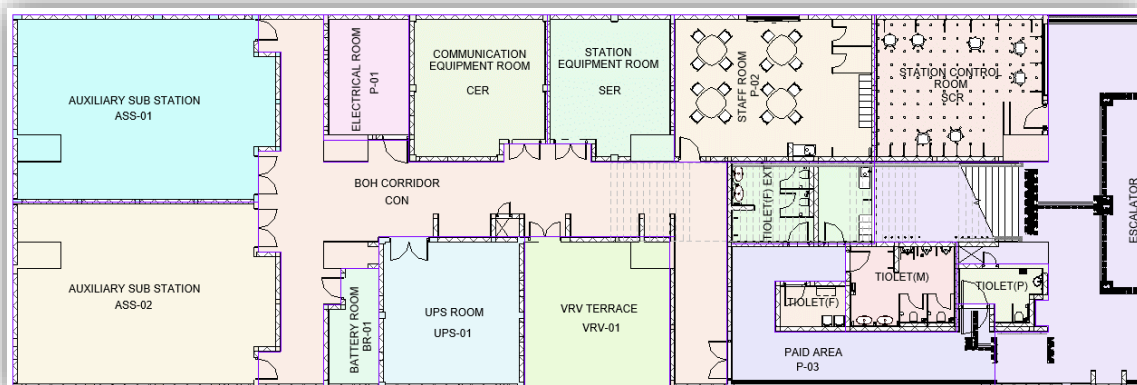


Figure 8 Rooms created with labels.

In a federated model within Revit, where different disciplines (such as architecture, structure, and MEP) collaborate, it's important to ensure that architectural levels are consistent and well-coordinated across all models. Following standard levels helps to avoid conflicts and ensures that elements from different disciplines align correctly. The architectural levels in such a model typically follow these guidelines. Contractors should align their designs using the same level system to avoid misalignment in the model.

- | | |
|--------------------------------|---|
| ➤ Top of Pile Cap Level | ➤ Platform Level |
| ➤ Top of Foundation Slab Level | ➤ Rail Level |
| ➤ Pump Room Level | ➤ Upper Platform & Lower Platform Level |
| ➤ Street Level | ➤ Undercroft Level |
| ➤ Concourse Level | ➤ Roof Level |

Creating space for E&M Model: (By E&M Contractors)

- ✓ Ensure that architectural model is linked in place. Confirm that the "Room Bounding" property is enabled.
- ✓ Switch to a mechanical or electrical plan view of the relevant level.
- ✓ Navigate to the **Analyze** tab and select **Space** from the "Spaces & Zones" panel.
- ✓ Click within a bounded area to place the space. Revit will detect the geometry of the enclosed area.
- ✓ Modify properties in the **Properties Palette**, such as **Space Name**, **Number**. Refer to the below image.

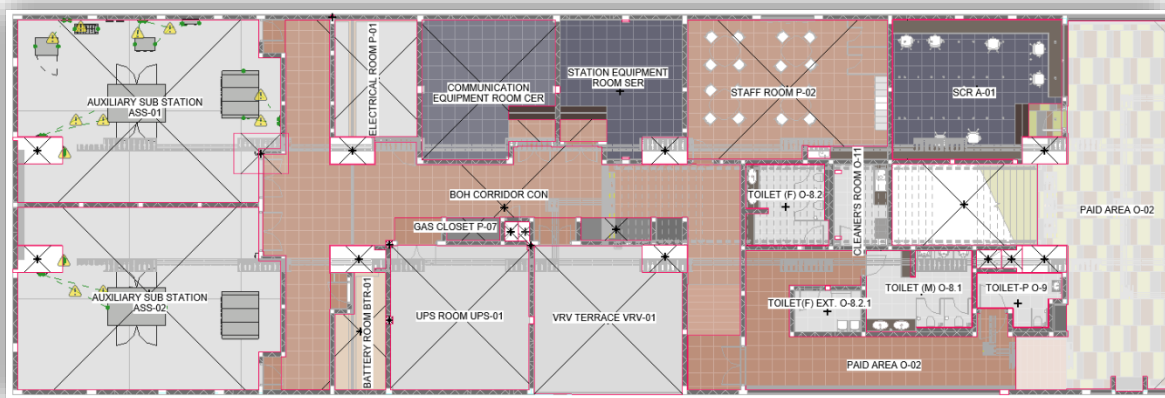


Figure 9 Spaces created with labels.

2.4. Asset Breakdown Structure/Location Information

The Asset Breakdown Structure known as the ABS - is a structure made up of:

- ❖ Facilities e.g., Station, Tunnel & Viaduct
 - ❖ Primary Functional Units (PFUs) e.g., System
 - ❖ Functional Units (FUs) e.g., Sub-system

This is used to logically group Assets and align classifications and definitions. It's important to know as O&M information is often collated at PFU level with respect to geographic location/linear locations. The standard applies to all Facility types and their assets.

- ❖ Station
- ❖ Tunnel/Viaduct
- ❖ Shaft
- ❖ Cross Passage
- ❖ Depots
- ❖ Rolling Stock

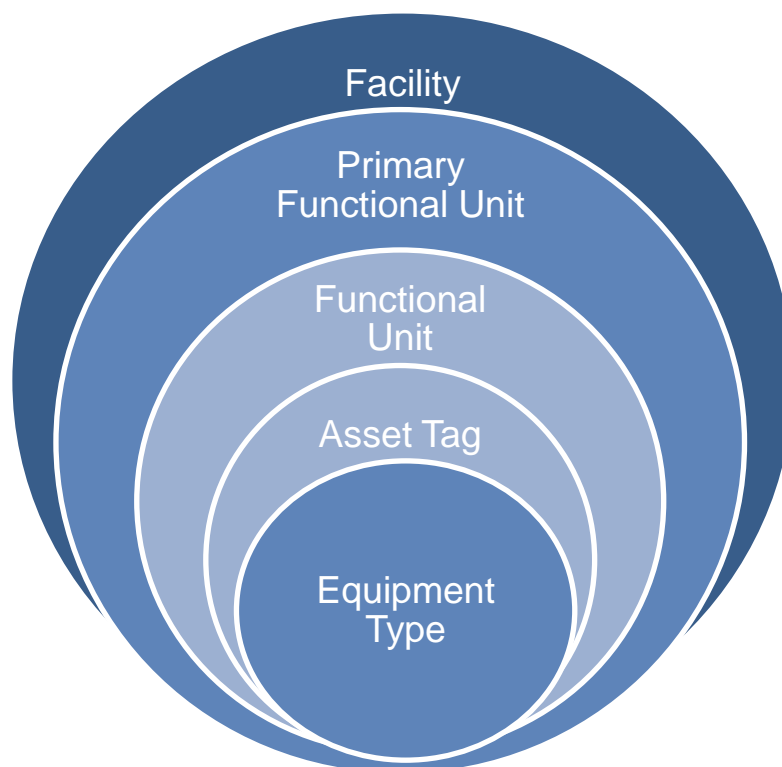


Figure 10 Asset Breakdown Structure.

2.4.1. Primary Functional Unit (PFUs)

A primary functional unit location describes an item in which other assets are operated, stored, or repaired. A primary functional location has a one-to-many relationship with assets, i.e., a primary functional location may contain multiple assets (Functional units), but an asset can only be in one functional location.

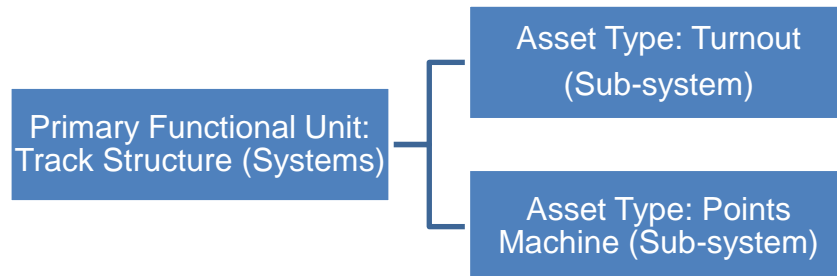


Figure 11: Example Primary Functional Unit (PFUs)

2.4.2. Linear Asset reference


Linear referencing describes the position of an asset, event, or other asset information in relation to a linear asset. It may also be referred to as 'chainage,' 'meterage,' or 'kilometerage.' A linear reference can be expressed as an absolute measure (a distance along the linear asset from its origin) or as a relative reference (a distance along the linear asset from a reference point, whose position is also related to the origin of the linear asset).

The relative reference form is similar to a street address for metro tracks and is the most commonly used form. There are four components of a relative linear reference:

- Line refers to the named rail corridors and is often abbreviated, e.g., Phase 2 Corridor 4 is abbreviated to the code P2C4.
- Track chainages is used, where required, to position the asset or object relative to a specific track where there are two or more tracks running parallel.
- Reference Point is the known point from which the distance to the position of interest is measured.
- Offset is the measured distance, in meters, from the reference point to the position of interest.

Cables, pipes, ducts and other linear assets shall be clearly labelled to ensure correct identification. Multiple labels shall be required for linear assets:

- At each end of the asset.
- At linear intervals as per the table below.

Linear Asset Type	Station / Depot Label Spacing	Tunnel / Viaduct Label Spacing	
Generic, HV, LV, Earth wire Cables, Cable trays, Data, Control, Fire Cables and Pipes	15m	100m	

At points where linear assets pass through walls/floor where they will be labelled on each side of the wall/floor within 500mm of its entry into / exit from a space and within 500mm of each termination. Where linear assets cross over/under each other or over/under other assets they will be labelled within 500mm of each side of the crossing.

contractor's may further create other system/sub-system types for their respective disciplines those are not listed. Example of geographic/linear asset reference for each discipline are given below.

Discipline	System	Location
ARC	Door System	Geographic
ARC	Floor System	Geographic
ARC	Furniture System	Geographic
STR	Roof System	Geographic
ARC	Wall Cladding System	Geographic
ARC	Signage (SGN)	Geographic
ARC	Non-Structural Walls	Geographic
STR	Cross Passage	Geographic
STR	Concourse	Geographic
STR	Shaft	Geographic
STR	Tunnel System	Linear/Functional
STR	Linear Structural Staircase	Geographic
STR	Structural Foundation System	Geographic
STR	Platform Structure	Geographic
PHE	Sanitary Equipment System	Geographic
PHE	Water Distribution System	Geographic
E&M	Building Management System (BMS)	Geographic
E&M	Central Management System SCADA	Linear/Functional
E&M	Fire Detection/Protection System	Geographic
E&M	Lighting (LGT)	Geographic
E&M	Uninterruptible Power Supply (UPS)	Geographic
E&M	Equipment Cabinets	Geographic
E&M	Earthing System (Facility)	Geographic
TEL	Closed Circuit Television (CCTV)	Linear/Functional
TEL	Optical Fibre Network	Linear/Functional
TEL	GSM-R Radio System	Linear/Functional
TEL	Telephone System	Linear/Functional
VAC	Ventilation and Air Condition System (VAC)	Geographic
TVS	Tunnel Ventilation System (TVS)	Linear/Functional

OHE	Overhead Line Equipment (OLE)	Linear/Functional
OHE	Traction Power System	Linear/Functional
SIG	Switches & Crossings (S&C)	Linear/Functional
SIG	S&CS - Automatic Train Control (ATC)	Linear/Functional
SIG	S&CS - Interlocking (IXL)	Linear/Functional
ESL	Escalator	Geographic
LFT	Lift	Geographic
PSD	Platform Screen Doors (PSD)	Geographic

2.5. Asset BIM Parameter Requirement

Parameter Setup and Modelling

The CMRL Asset BIM model parameters are described below. For each asset/equipment, the required parameters consist of two parts:

❖ Common parameters

These attributes are applicable to all assets/equipment. Contractors are advised to propose additional attributes for other common parameters with supporting documentation.

- Critical Common Parameters
- Other Common Parameters

❖ Equipment-specific parameters

The specific parameters of each electrical, mechanical, and other system equipment should be referred to those attributes with the naming of sub-systems or equipment codes. For example: "LV," "EMG," "VAC," "CCTV," and so on. Contractors should liaise with the subject officers of CMRL to acquire and input the correct content into the specific parameter fields. All acronyms/short forms for the equipment shall be submitted to BIM team before populating into the model.

2.5.1. Critical Common Parameters

Contractors to ensure the parameter listed in the section below must be created/filled in the model for each asset. Each parameter shall be with the following settings.

1. LOD
2. Item Type
3. Description
4. Assembly Code
5. Omniclass Classification

S. No	Attributes Type	BIM Model Parameter	Setting
1	Critical Common Parameter (Applicable to all Elements / discipline)	LOD	Stage of LOD
2		Item Type	Define Item Type by descriptive value
3		Description	Descriptive name for an asset to be entered in the name field
4		Assembly Code	Assign uniformat code to related elements that belong to the same group
5		Omniclass Classification	Assign Logical code from omniclass table

Working Procedure for critical common parameters in Revit are shown below.

1. Steps to Create and Use **LOD** Parameter

- Start by opening your project where you want to track **LOD**.
- Navigate to the **Manage** tab in the Revit ribbon. In the setting panel, select **Project Parameters**. Click **Add** to create a new parameter. In the dialog box, enter the following:
 - **Parameter name:** A descriptive name, such as “LOD” or “Level of Development.”
 - **Type of Parameter:** Choose the type, typically **Text** or **Integer**. Text is used if you want to define LOD by description (e.g., "LOD 300," "LOD 350").
 - **Group Parameter under:** Select the appropriate category, such as **Identity Data**.
 - **Apply to:** Select the categories of elements (e.g., Walls, Doors, Structural Elements) you want this parameter to apply to.
- Click OK.
- **Edit Properties:** In the **Properties** palette, you will now see the new "LOD" parameter. Enter the appropriate LOD value based on the stage of development.

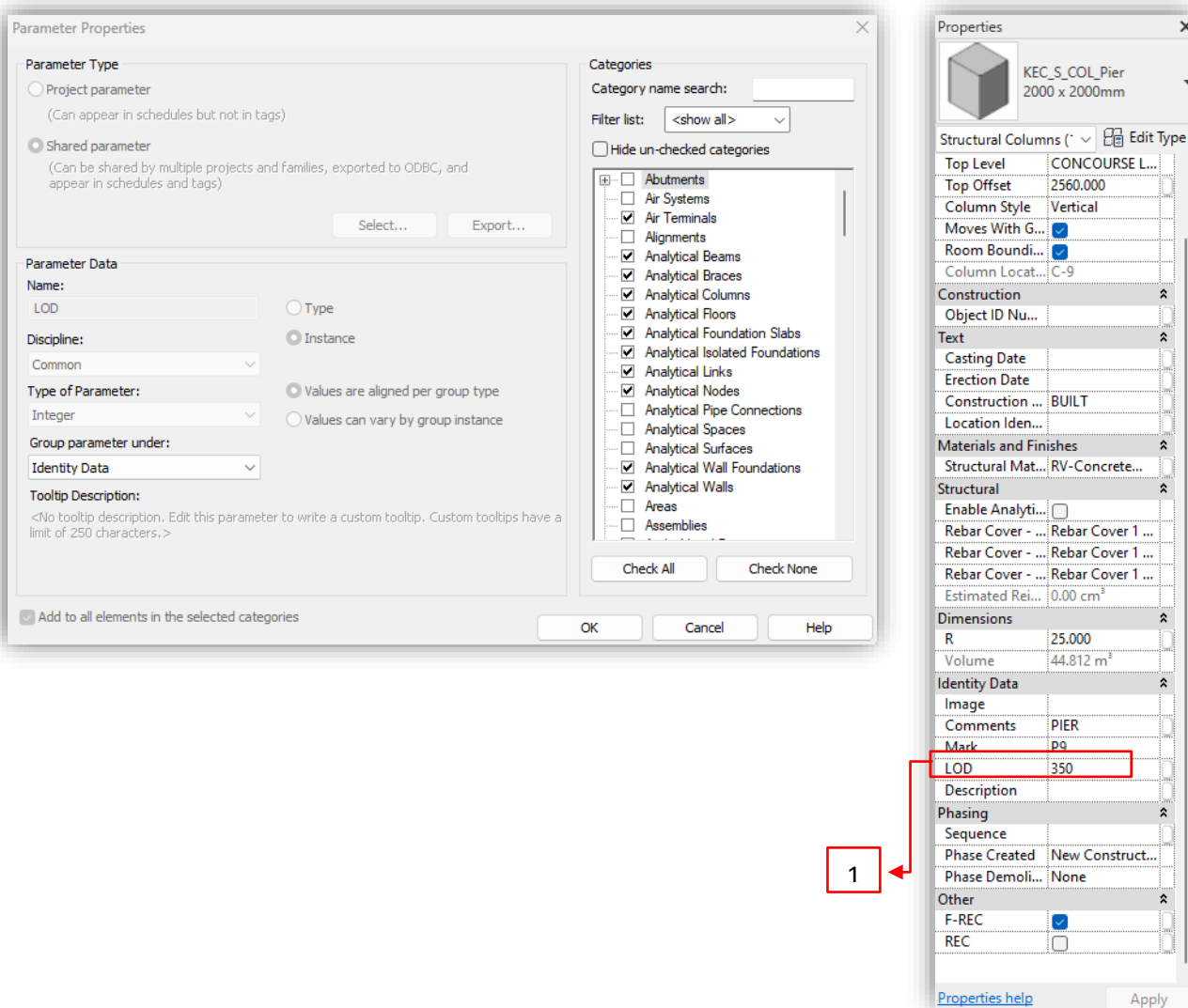


Figure 12 LOD creation

2. Steps to Create an **Item Type** Parameter

- Open the Revit project where you need to create the **Item Type** parameter.
- Navigate to the **Manage** tab in the Revit ribbon. In the setting panel, select **Project Parameters**. Click **Add** to create a new parameter. In the dialog box, enter the following:
 - **Parameter name:** Enter a name that clearly describes the parameter, such as "Item Type".
 - **Type of Parameter:** Choose the type, typically **Text**. Text is used if you want to define Item Type by descriptive value (e.g., "Structural Steel", "VAC Equipment")
 - **Group Parameter under:** Select the appropriate category, such as **Identity Data**.
 - **Type:** Choose if this parameter should be a **Type** parameter (shared among all instances of a family) or an **Instance** parameter (specific to each element).
 - **Assign parameters to categories:** Under **Categories**, choose which categories this parameter should be applied to. You can apply it to multiple categories, such as **Walls, Doors, Windows, Structural Elements**, etc.
- Once the parameter is defined, click **OK** to save your changes.
- After creating the **Item Type** parameter, you can assign it to specific elements within your project.

3. Steps to Create a **Description** Parameter

- Open the Revit project where you need to create the **Description** parameter.
- Navigate to the **Manage** tab in the Revit ribbon. In the setting panel, select **Project Parameters**. Click **Add** to create a new parameter. In the dialog box, enter the following:
 - **Parameter name:** Enter a name that clearly describes the parameter, such as "Description".
 - **Type of Parameter:** Choose the type, typically Text, as it allows you to enter descriptive text. (e.g., "Load-bearing wall", "Fire-rated door", "VAC air handler").
 - **Group Parameter under:** Select the appropriate category, such as **Identity Data**.
 - **Type:** Choose if this parameter should be a **Type** parameter (shared among all instances of a family) or an **Instance** parameter (specific to each element).
 - **Assign parameters to categories:** Under **Categories**, choose which categories this parameter should be applied to. You can apply it to multiple categories, such as **walls, doors, windows, structural elements**, etc.
- Once the parameter is defined, click **OK** to save your changes.
- After creating the **Description** parameter, you can assign it to specific elements within your project.

4. **Assembly code** Parameter

The **Assembly Code** in Revit is a key parameter used to group related elements, typically for construction, fabrication, or project management purposes. It allows you to assign a code to multiple elements (like walls, windows, doors, structural components, etc.) that belong to a larger assembly or system. This grouping simplifies scheduling, cost estimation, and managing the elements within the model. Revit has a built-in parameter for **assembly code**, but you may need to enable or customize how it is used.

- Click on any element in your model that you want to assign an **assembly code** to (e.g., walls, doors, windows).
- In the **Properties** palette, locate the **assembly code** field.
- Enter the appropriate code.
- The same **assembly code** can be assigned to multiple elements that belong to the same assembly or group.

Contractors should assign **assembly codes** to related elements that will be grouped together for management purposes. By applying and managing assembly codes effectively, you ensure that all components are organized and can be tracked and managed in a unified way across the project.

5. **Omniclass Classification** Parameter

OmniClass is a classification system designed to organize and categorize building information across various stages of a construction project. In Revit, the integration of **OmniClass** allows users to categorize elements in their model based on a standardized system, which helps in project documentation, asset management, cost estimation, and reporting.

The **OmniClass** classification system is broken into different tables, such as **Product Classification**, **Element Classification**, **Activity Classification**, and others. This system enables better organization, coordination, and data exchange across various platforms and disciplines. OmniClass in Revit can be used to classify various elements in the model, such as walls, windows, doors, mechanical systems, etc. OmniClass classifications provide a standardized method for organizing these elements based on their type, function, and other relevant properties.

OmniClass Tables: In Revit, you can use specific OmniClass tables to assign classifications to elements in your model. The main ones include:

- OmniClass Table 23: Classification for Construction Products.
- OmniClass Table 25: Classification for Elements (e.g., walls, doors).
- OmniClass Table 33: Classification for Construction Activities.

Here's a working procedure for using OmniClass in Revit:

To integrate **OmniClass** classifications into your Revit project, you need to add it as a **shared parameter** or use **Revit's built-in parameters** (if available) for elements.

A. Add OmniClass as shared parameters (if not pre-defined)

1. **Create a Shared Parameter File:**

- Open **Revit** and go to the **Manage** tab.
- In the **Settings** panel, click **Shared Parameters**.
- If you don't have a shared parameter file, click **Create** to create one, and specify the location for saving it.

2. **Define OmniClass Parameters:**

- In the **Shared Parameters** dialog, click **New** to create a new parameter.
- Name the parameter (e.g., **OmniClass Classification**, **OmniClass Code**).
- Set the **type of parameter** to **text** or **integer** (depending on the type of OmniClass code).
- Choose **Instance** or **Type** based on your project needs.
- Add this parameter to relevant **categories** of elements (e.g., **walls**, **doors**, **windows**, etc.).

3. **Load Shared Parameters:**

- After defining the parameters, load them into your project.
- Go to **Manage** → **Project Parameters** → **Add**.
- Select **Shared Parameter** and choose the OmniClass parameters you created.

B. Use Built-in OmniClass Parameters (If Available)

Revit has some built-in parameters for **OmniClass**, especially for certain categories. You can directly use these parameters in the **Properties** palette to classify your elements.

For example:

- Product Classification (Table 23) can be assigned to materials or construction products.
- Element Classification (Table 25) can be assigned to structural or architectural elements.

Assign OmniClass to Model Elements

- Select an element (e.g., a door, wall, or equipment) in your model.
- In the Properties palette, locate the OmniClass classification parameter. Assign the relevant Omniclass code.
- For complex elements or custom categories, you can create a **custom OmniClass classification** by entering the appropriate **code** manually based on your needs or project specifications.

Type Properties

Family: Load...

Type: Duplicate... Rename...

Type Parameters

Parameter	Value	
Construction		
Commodity Code		
Product Code		
Structural		
Section Shape	Not Defined	
Dimensions		
b	2000.000	
h	2000.000	
Identity Data		
Type Image		
Keynote		
Model		
Manufacturer		
Type Comments		
URL		
Description	Pier	3
Assembly Code	B1010200	4
Cost		
Section Name Key		
Assembly Description	Upper Floor Framing - Vertical Elements	
Type Mark		
Item Type	Structural Column	2
OmniClass Number	23.25.30.11.14.11	
OmniClass Title	Columns	5
Code Name		
Data		

[What do these properties do?](#)

<< Preview OK Cancel Apply

Figure 13 Type Properties palette

2.5.2. Other Common Parameters

Contractors shall create other common parameters for all the elements in the model under the **Identity Data** tab.

Attributes Type	Civil/Architectural Parameter	Electrical, Mechanical and other system parameter
Identity Data	Facility Name (Station/Depot)	Asset/System Name
	Facility Abbreviation	Asset/System Type
	Building Type (Underground/Elevated)	Asset/System ID
	Floor Name	Asset/System Description
	Floor Number	Sub-System Name
	Floor Elevation	Sub-System Location
	Floor Height	Make
	Room Name	Model Name
	Room Number	Model Number
	Room Function	Serial Number
	Room Area	Manufacturer Name
	Room Volume	Manufacturer Website
	Room Capacity	Manufacturer Address
		Manufacturer Phone
		Manufacturer Email
		Manufacturer Contact Information
		Warranty
		Warranty Expiration Date
		Warranty Link
		WBS
		Alternate Manufacturer Name
		Alternate Manufacturer Website
		Alternate Manufacturer Email
		Manuals Link
		Specifications Link
		Construction Documents Link

2.5.3. Equipment-Specific Parameters

- Contractors shall create equipment-specific parameters for all the elements in the model under the **Identity Data** tab.
- Each contractor's BIM manager may further create equipment-specific parameter of other system types for their respective disciplines.
- Contractors shall submit equipment-specific parameters to CMRL for the approval of each asset before filling it into the BIM model.

Example of Asset Data Template for Ventilation and Air-Conditioning (VAC)

Attributes Type	Attributes	Parameter naming in BIM Model	Example
Specific Parameters for Equipment (VAC)	Equipment Location	VAC.Equipment Location	AHUR
	First Filter	VAC.1st Filter	Gas Filter
	Second Filter	VAC.2nd Filter	NONE
	Equipment Type	VAC.Equipment Type	Air Handling Unit
	Made by which company	VAC.Make	ABC Company
	Contain UV Sterilizing	VAC. UV Sterilizing Light	Y
	Contain VSD or not	VAC.VSD	Y
	Air Flow	VAC.Air Flow	6100
	Cooling Capacity	VAC.Cooling Capacity	214.6
	Rated Power Input	VAC.Rated Power Input	30

2.6. Maintainability

The equipment objects are created with clearance space in the BIM model. The clearance space should be reflected in the BIM model for operation and maintenance purposes.

Clearance space is modeled in BIM equipment objects so that it will be taken into consideration during construction, and maintenance of the equipment.

Examples of clearance space with visibility on and off are shown in the figure below.

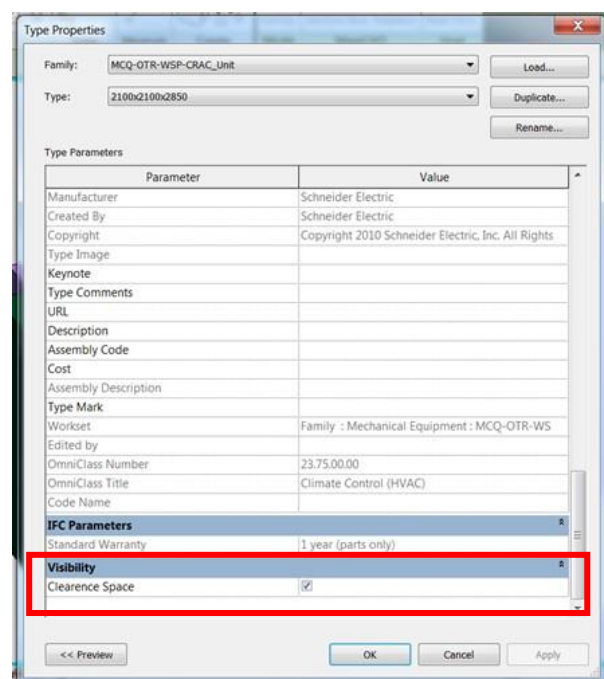
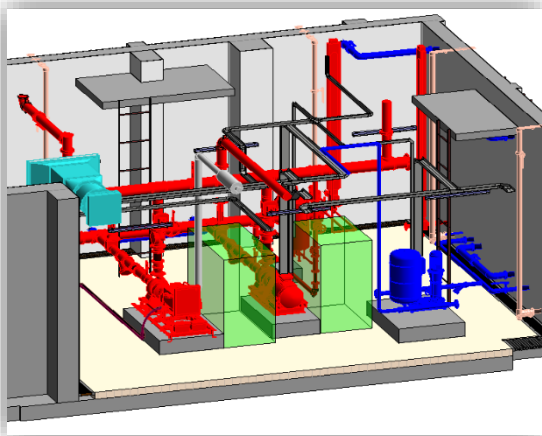
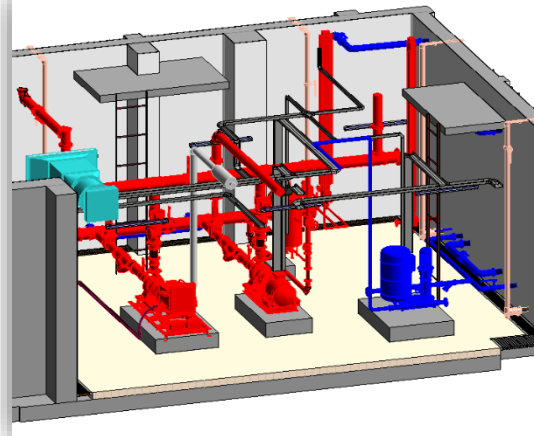


Figure 14



**Fig.15 Clearance space with visibility
“ON”**



**Fig.16 Clearance space with visibility
“OFF”**

CHAPTER 3

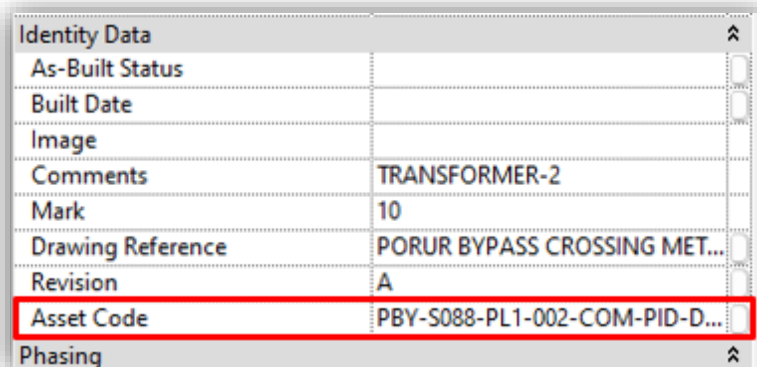
Coding and Numbering System

3. Coding and Numbering System

Unified conventions in BIM-Asset model naming are essential to standardize the assets/equipment coding structure for modeling & coordination activity in the project life cycle. The naming convention as stated in this chapter is for the implementation of the BIM-AM system.

3.1. Asset Coding

Asset coding must be created and filled for all the elements in the model under the Identity Data tab. Asset code consists of 8 parts; it shall be in the form as shown below and separated by a hyphen “-” between fields.



Identity Data	
As-Built Status	
Built Date	
Image	
Comments	TRANSFORMER-2
Mark	10
Drawing Reference	PORUR BYPASS CROSSING MET...
Revision	A
Asset Code	PBY-S088-PL1-002-COM-PID-D...
Phasing	

Asset code consists of all 8 parts as stated below with a **maximum 35 characters**, including hyphens.

Requirement of Asset Coding							
1	2	3	4	5	6	7	8
Station Name (Refer to P2BMP)	Cluster No. (Refer to P2BMP)	Room No.	Building level	Discipline Code	Sub-System Code	Equipment Code	Number
3 characters	4 characters	3 to 4 characters	3 characters	3 characters	3 to 4 characters	3 to 4 characters	3 characters
PBY	S088	PLT	P01	COM	PID	DSD	001

- PBY- Porur Bypass Metro Station
- S088- Cluster Number
- PLT- Platform Level
- P01- Platform No 1
- COM- Telecom
- PID- Public Information Display System
- DSD- Double side Display
- 001- Equipment Number

Note:

- ❖ The sequence should be restarted per each type of equipment on different floor.

Examples: STATION NAME-CLUSTER NUMBER-ROOM ID-BUILDING LEVEL-
DISCIPLINE/SYSTEM CODE-SUB_SYSTEM CODE-EQUIPMENT CODE-NUMBER

1. PIDS Equipment on Platform Level:

Asset Code	PBY-S088-PLT-P01-COM-PID-DSD-001
------------	---

2. Telephone System on Platform Level:

Asset Code	PBY-S088-PLT-P02-COM-TEL-HPP-001
------------	---

3.1.1.Room No.

Below are the Room designation to be followed for the common area other than the equipment/control/system rooms.

S. No	Room No	Code
1	Entry & Exit	ENE
2	Concourse Level	CON
3	Lobby	LOB
4	Platform Level	PLT

3.1.2.Building Level

Below are the building level code followed for Asset coding.

S. No	Building Level	Code
1	Street Level	S01
2	Concourse Level	C01,C02
3	Platform Level	P01,P02,P03,P04

3.1.3.Discipline Codes

Alphabetical characters represent the class of disciplines. This is applicable to the naming convention of discipline for each asset as specified.

Discipline	Code
Architecture	ARC
Civil & Structural	STR
Plumbing and Sanitary	PHE
OHE	OHE
Track	ATR
E&M	E&M
Tunnel Ventilation System	TVS
Ventilation and Air-Conditioning System	VAC
Telecom	COM
Signaling	SIG
Platform Sliding Door	PSD
Automatic Fare Collection	AFC
Lift	LFT
Escalator	ESR
Tetra	SYS

3.1.4.Sub-System Codes

- The names and codes of some Electrical, Mechanical & other systems and corresponding routing list based on operation and maintenance requirements are given below. The list below does not exhaustively cover all the E&M equipment.
- Each contractor's BIM manager may further create other sub-system types for their respective disciplines those are not listed.
- Contractors shall submit their system name and coding to CMRL for the approval of each asset before filling it into the BIM model.

No	System Name	System Code	Routing Name	Routing Code
1	Lift	LFT	Trunking for Lift	LFT
			Cable Tray for Lift	
2	Escalator	ESR	Trunking for Escalator	ESR
			Cable Tray for Escalator	
3	LV Switchboard	LVS	Trunking for LV Switchboards	LVS
			Cable Tray for LV Switchboards	
4	Emergency Generator	EMG	Trunking for Emergency Generator	EMG
			Cable Tray for Emergency Generator	
5	VAC	VAC	Primary Air Duct	PAD
			Exhaust Air Duct	EAD
			Fresh Air Duct	FAD
			Supply Air Duct	SAD
			Return Air Duct	RAD
			Transfer Air Duct	TAD
			Smoke Extraction Duct	SED
			Pressure Relief Duct	PRD
			Condensate Drainpipe	CDP
			Condensing Water Supply Pipe	CDWR
			Condensing Water Return Pipe	CDWS
			Chemical Dosing Pipe	CHDP
			Make-up Water Pipe	MWP
			Heating Hot Water Supply Pipe	HHSP
			Heating Hot Water Return Pipe	HHRP
6	Fire Services Installation	FS	Chimney Pipe	CHP
			Sprinkler Pipe	SPR
			Hose Reel / Fire Hydrant Pipe	FSP
			Trunking for Automatic Fire Detection and Alarm System	AFA
7	Uninterrupted Power Supply	UPS	Gas Suppression System Pipe	GSS
			Trunking for UPS	UPS
			Cable Tray for UPS	
8	Lighting	LTG	Cable Tray for Microwave Link System	LTG
			Trunking for Lighting Control	
			Cable Tray for Lighting	

No	System Name	System Code	Routing Name	Routing Code
9	Electrical Distribution	EL	Cable Containment for Low Voltage	LV
			Cable Containment for High Voltage	HV
			Trunking for Normal Power	TR-N
			Trunking for Emergency Power	TR-E
			Trunking for ELV Systems	TR-ELV
10	Plumbing	PL	Cleansing Water Pipe	CLWP
			Cold Water Pipe	CWP
			Flushing Water Pipe	FLWP
			Fresh Water Pipe	FWP
11	Drainage	DR	Waste Pipe	WP
			Soil and Waste Pipe	SWP
			Vent Pipe	VP
			Rainwater Pipe	RWP
			Pumped Soil & Waste Pipe	PSWP
			Pumped Waste Pipe	PWP

3.1.5. Equipment Codes

The principle for equipment coding is for easy identification of assets and drawing production. The list below does not exhaustively cover all the E&M/System equipment. Below are some of the equipment types & codes.

No.	System Name	Equipment Type	Equipment Code
1	Lift (LFT)	Lift	LFT
		Electric Lifts	ELL
		Hydraulic Lifts	HYL
2	Escalator (ESR)	Escalators	ESR
3	LV Switchboard (LAS)	LV Switchboard	LVS
		Battery (Including battery charger)	BAT
		Harmonic filter	HAR
		Switchgear (Including ACB, MCCB, F/S, Contactor)	SWG
		Relay	REL
		Capacitor	CAP
4	VAC (Air Side)	Air Side	AS
		DX Unit	DXU
		VRV-IDU	IDU
		Air Handling Unit	AHU
		Primary Air Handling Unit	PAU
		Heat Wheel	HW
		Fan Coil Unit	FCU
		Fire Damper	FD
		Fresh Air Fan	FAF
		Exhaust Air Fan	EAF

No.	System Name	Equipment Type	Equipment Code
	VAC (Air Side)	VAV Box	VAV
		Local Control Panel	LMCP
	VAC (Water Side)	Water Side	WS
		Chiller	CHR
		Heat Pump Type Chiller	HPC
		Cooling Tower	COT
		Heat Exchanger	HEX
		Pump	PMP
		Pressurized Water Sys	PWS
		Water Treatment Sys	WTS
		Auto-strainer	ASR
		Travelling Band Screen	TBS
5	Fire Services Installation (FS)	Wet System	WTS
		Pump (Including FH/HR water pump, sprinkler water pump, jockey pump and fireservice up feed pump)	PMP
		Sprinkler control valve set & accessories	SCV
		Sprinkler Heads	SPR
		Fire Hydrant	FH
		Street Fire Hydrant	SFH
		Hose Reel	HR
		Pressure Reducing Valve	PRV
		Fire Service Inlet	FSI
		Sprinkler Inlet	SPI
		Local Control Panel	LMCP
		Automatic Fire Detection and Alarm System	AFA
		Fire Alarm equipment	FAE
		Exit sign & Directional sign	EXS
6	Uninterrupted Power Supply (UPS)	UPS System	UPS
		Battery System	BATS
		Static Transfer Switch	STS
7	Lighting System(LTG)	Lighting System	LTG
		Luminaire (Including external and exterior lighting and signs)	LUM
		Lighting Control System	LCS

No.	System Name	Equipment Type	Equipment Code
8	Electrical Distribution System (EL)	Electrical Distribution System	EL
		Busbar Trunking / Main Distribution Cable	BBT
		Isolating switch	ISW
		Distribution Board	DTB
		ACB	ACB
		MCCB	MCCB
		Fuse switch & Switch fuse	FSW
		MCB	MCB
		PV panels	PV
9	Plumbing System(PL)	Plumbing System	PL
		Sump Tank	SUT
		Booster pump	BPMP
		Pressure vessel	PVES
		Pressure Reducing Valve	PRV
		Local Motor Control Panel	LMCP
10	Drainage System(DR)	Drainage System	DR
		Wastewater sump pump	WWSP
		Local motor control panel	LMCP

Note:

- Each contractor's BIM manager may further create other system types for their respective disciplines / systems those are not listed above.
- Contractors shall submit their system name and coding to CMRL for the approval of each asset before filling it into the BIM model.

CHAPTER 4

CoBie and BIM-AM Deliverables Checklist

4. CoBie

4.1. Introduction of CoBie

CoBie (Construction Operations Building Information Exchange) is a data format and process designed to capture and exchange key information about a building during its construction and operational lifecycle. It was developed to facilitate the transfer of essential asset and facilities management data from the design and construction phases to the operational phase of a building.

CoBie in Revit involves the process of capturing and exporting critical building information for facility management purposes, particularly focusing on asset data, equipment details, and other essential elements once the design and construction are complete.

The CoBie extension for Revit is a software add-on that allows users to export data from a Revit model in the Construction Operations Building Information Exchange (CoBie) format. By exporting a Revit model in CoBie format, users can ensure that critical data is captured and shared with stakeholders in a standardized and structured manner.

4.2. CoBie Extension for Revit

❖ Prepare Your Revit Model:

- Contractors need to define and assign appropriate **CoBie parameters** to the relevant elements in the model.
- The CoBie Extension will be used to populate the CoBie parameters in your Revit model with the proper data.
- Ensure your Revit model is complete and contains all the necessary building information, including assets, spaces, systems, and components.
- The following setting contractors should follow to fill in data information required for an element.
 - ❖ Settings - General
 - ❖ Settings - Spaces
 - ❖ Settings - Type
 - ❖ Settings - Components
 - ❖ Settings - Systems
 - ❖ Settings - Attributes
 - ❖ Settings - Coordinates
 - ❖ Settings - Schedules
 - ❖ Settings - Parameter Mapping
 - ❖ Select
 - ❖ Create Spreadsheet

❖ Settings – General

First, we select **General** setup inside menu. The General dialog box allows you to decide how the data for the Locality, Identification, units, and area measurement standards are to be filled for CoBie data. Within these areas, the following options are available:

- **Locality:** Select the Locality, as **United Kingdom (UK)** for Choosing this option will instruct the CoBie Extension to apply the UK template during export.
- **Identification:** The Identifier item allows only a choice between three options. Choosing "Revit Element ID" means every CoBie element in the model will use its Revit Element ID as its CoBie External Identifier value. If "GUID" is selected, then the CoBie Extension will generate a unique Globally Unique Identifier (GUID) for each CoBie element in the model. Selecting "Mapped Parameter" will use the parameter assigned in the Parameter Mappings dialog box. Select the identification, as Global Unique Identifier. It's used to generate the GUID for each CoBie element in model.
- **Units:** The dropdown under Units allows you to override the Revit unit settings for the Facility CoBie worksheet. Changing these settings has no impact on your Revit model; it simply affects the exported field that is documented in the worksheet. Units shall be "Millimetre" or "Metre". Here dropdown units and select the meter, square meter and cubic meter for following measurement of Linear, area and volume unit.
- **Area Measurement Standard:** Choose the standard used for area measurements in this project. If the standard you are using is not in the list, choose the "Other" option and type in your own value. Changing this setting does not affect the exported values; it simply documents the method of measurement you are using. Select the Revit default area calculation method for area Measurement standard.

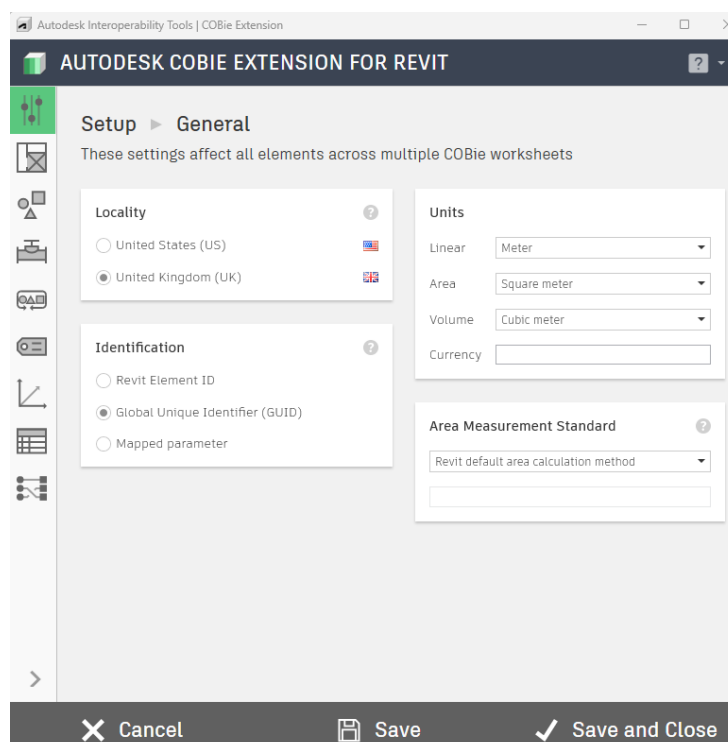


Figure 17: Setting - General

❖ Settings - Space

The Spaces dialog allows you to configure whether Revit elements remember the Room or the Space in which they are located referring to the space column (column E) of the "Component" CoBie worksheet. There is a list of all the pertinent Revit categories with a toggle to designate whether the room or space data is used to track their location. The buttons on the right will change the toggles based on their descriptions.

- Room for all = select Room for all categories.
- Space for all = select Space for all categories.
- Space for MEP elements = any category that is considered MEP.
- Space for MEP runs = just MEP categories that are used as carrying paths (duct, pipe, conduit, cable tray).
- Reset defaults = Same as all MEP elements, except anything that is considered more MEP equipment is assigned to spaces and MEP devices and fixtures are assigned to rooms (as an architect will often initially place these).

Space Name Builder: Using the Name Builder, you can configure how the CoBie.Name field is constructed for exported spaces in your model.

Spaces in Zones: This area lets you decide whether the spaces listed for each zone on the CoBie Zone worksheet are listed in one cell, comma-separated, or listed as a separate row for each space.

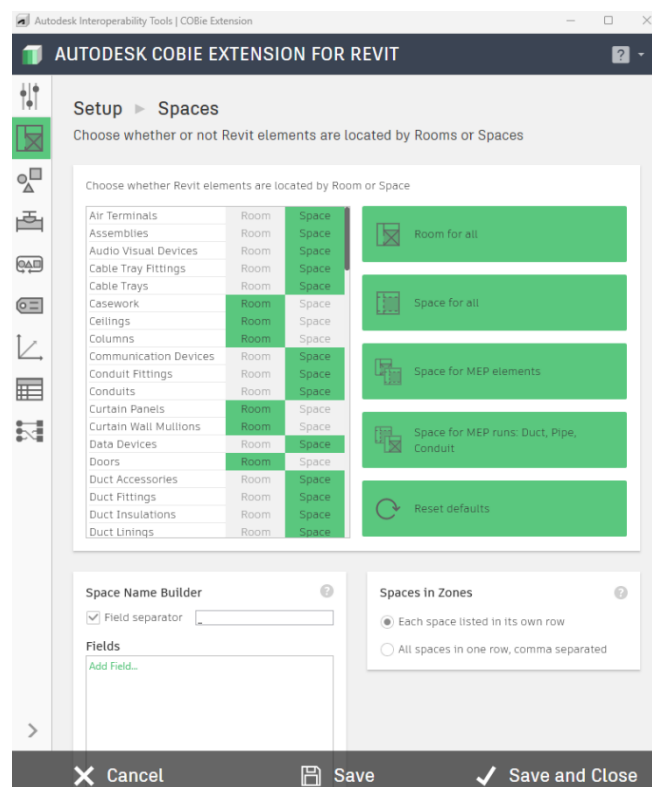


Figure 18: Setting – Space

Note: If you get error as same room and number with multi time, then go to add one more field to differentiate the space.

❖ Settings - Type

The Type dialog box helps you configure settings needed to fill in the data collected for and exported to the CoBie Type spreadsheet.

Name: Using the Name Builder, you can configure how the CoBie.Type.Name field is constructed for family types in your model. You can add, remove, and reorder fields, include manual text, and have a field separator to build the name.

Category: The category items contain drop-down lists with varying options, organized by priority; meaning the CoBie Extension will attempt to find a value in your first priority, and if no data is found in that field, it will look for data in the second priority, and so on, ultimately ending with "n/a" if no appropriate data is found in the model's parameters.

Description: The Description item also allows only a choice between two options:

- **Family:Type:** This setting is selected, and then the family name of the element will be concatenated with the name of the Type within that family (with an underscore in between) as its CoBie Description value.
- **Description Parameter from Type Properties Default:** This setting will take the value from the Description parameter in the Type properties of the element to use for its CoBie Description value.

Select the second choice of Description parameter form Type properties, which will take the value from the Description parameter in the Type properties of the element to use for its CoBie Description value.

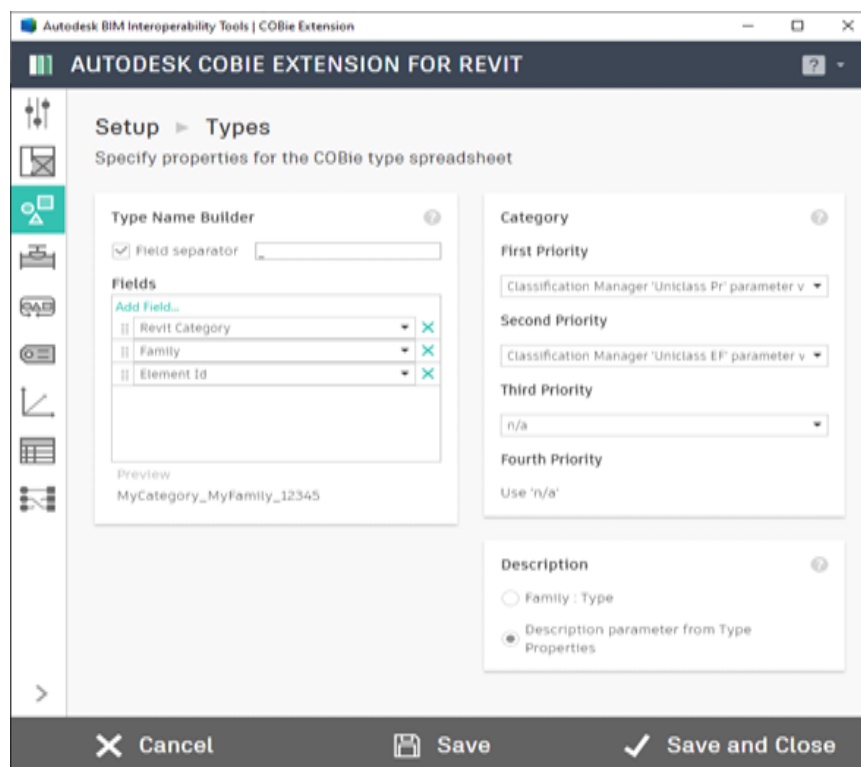


Figure 19: Settings - Type

❖ Settings – Components

The Component dialog box helps you configure settings needed to fill in the data collected for and exported to the CoBie Component spreadsheet.

Name: Using the Name Builder, you can configure how the CoBie.Name field is constructed for family types in your model. You can add, remove, and reorder fields, include manual text, and have a field separator to build the name.

Once you have your settings configured properly, use the save button in the action bar to save your settings. If you are done setting up your model for the CoBie Extension, you can use Save and Close to update settings and close this dialog.

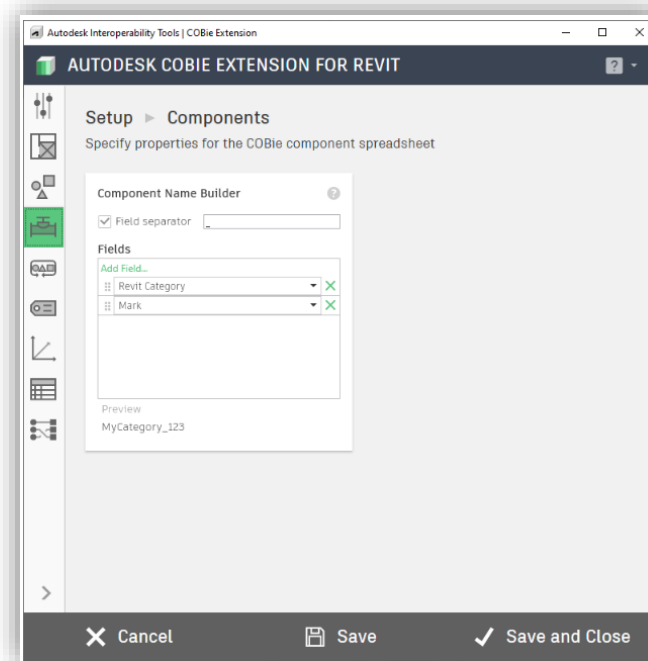


Figure 20: Settings – Components

❖ Settings – Systems

The System dialog box helps you configure settings needed to fill in the data collected for and exported to the CoBie System spreadsheet.

Name: Using the Name Builder, you can configure how the CoBie.Name field is constructed for family types in your model.

Category: You can use the values from the corresponding Autodesk Standardized Data Tool for Revit fields to populate the Category. Here we select the classification manager “omniclass table 21” parameter value.

Components in Systems: This toggle will export each component of a system either in a single row per system or each component will get its own row.

Include Components: Checking this box will automatically add each element of an exported System and its corresponding type to the Component and Type worksheets. If you do not check this option, your exported CoBie spreadsheet may not be valid, as components may be referenced on the System worksheet that are not listed on the Component and Type worksheets.

Once you have your settings configured properly, use the save button in the action bar to save your settings. If you are done setting up your model for the CoBie Extension, you can use Save and Close to update settings and close this dialog.

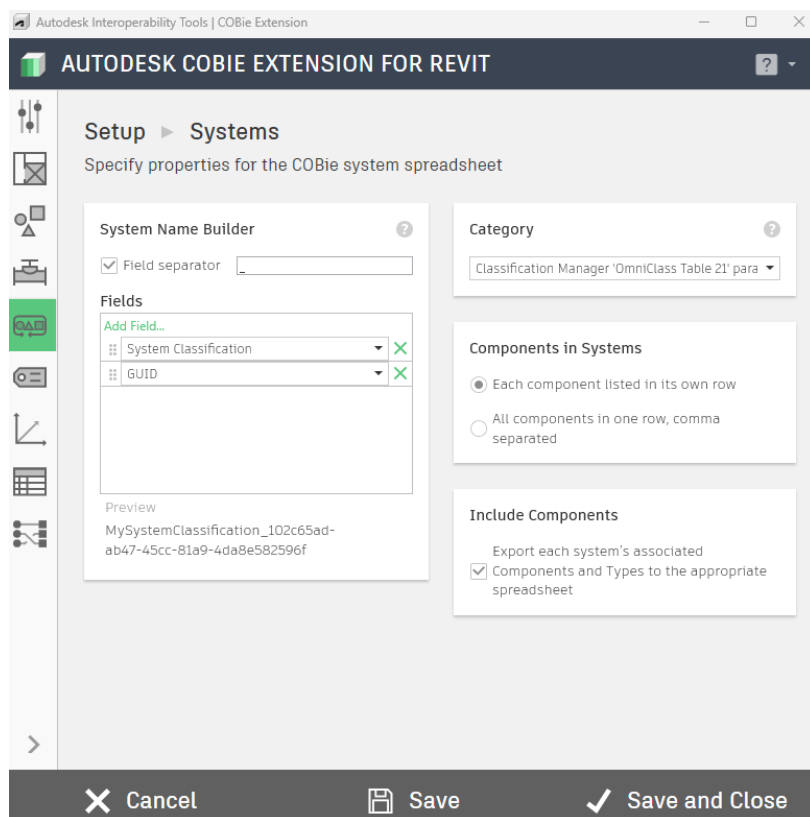


Figure 21: Settings - Systems

❖ Settings – Attributes

The Attributes dialog box gives you the ability to select other type and instance parameters from families to be exported to the Attribute worksheet in the CoBie spreadsheet. It includes all the Revit family categories as the top level, followed by “Type Parameters” and “Instance Parameters” as the second level, and all the pertinent parameters for each as the third level. This list will include all the parameters of the current model—both Revit standard parameters and those added to the model (project and shared). This includes the parameters from linked models when selected.

Note: Do NOT simply select every parameter to add to the attributes list. This can quickly cause issues with the spreadsheet export as you have too many items for export. Be deliberate and specific about what data you want to include in your CoBie spreadsheet.

Once you have your settings configured properly, use the save button in the action bar to save your settings. If you are done setting up your model for the CoBie Extension, you can use Save and Close to update settings and close this dialog.

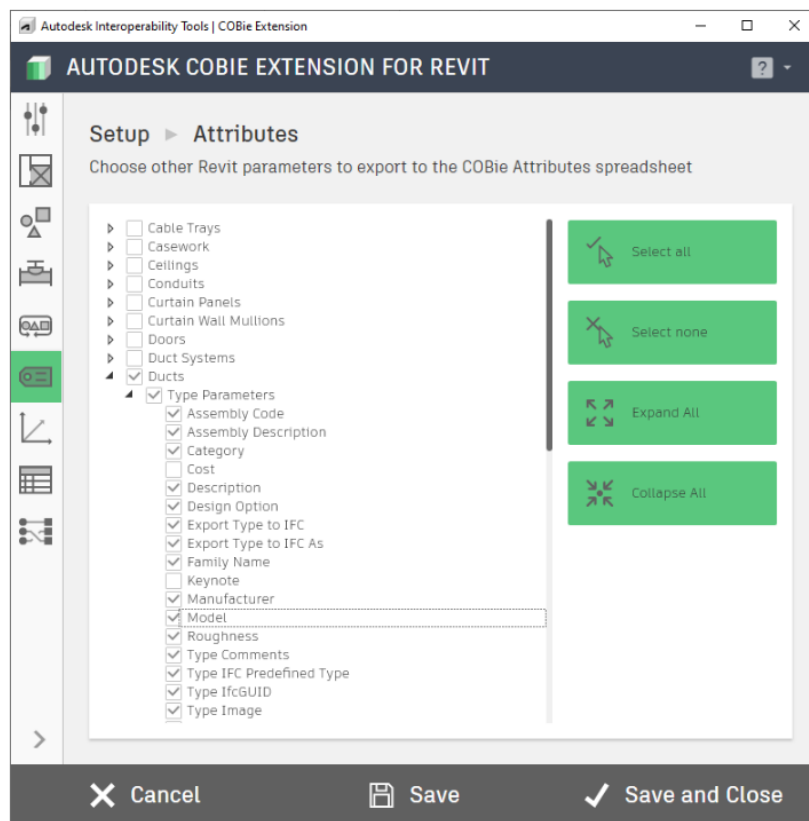


Figure 22: Settings – Attributes

❖ Settings – Coordinates

In CoBie, coordinate settings refer to the process of defining the spatial and geometric location of assets, spaces, and components within a facility. The Coordinates dialog controls what data is used from Revit to populate certain fields on the “Coordinate” CoBie worksheet.

The default option for each coordinate type is “Bounding Box.” The tool automatically reads the X, Y, Z coordinates of elements from the Revit model. Coordinates are derived from the shared or project coordinate system, depending on your setup.

Once you have your settings configured properly, use the save button in the action bar to save your settings. If you are done setting up your model for the CoBie Extension, you can use Save and Close to update settings and close this dialog.

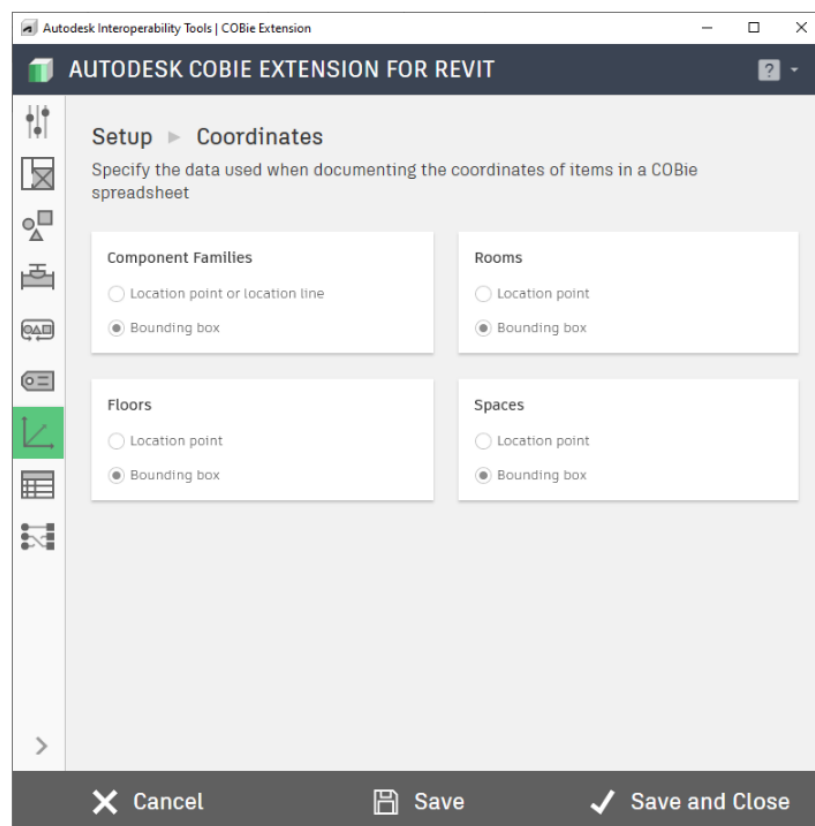


Figure 23: Settings - Coordinates

❖ Settings – Schedules

After configured the Coordinates setup, move and click the schedules setup which represents the standard Revit schedules and key schedules that will be imported from the Revit Resource Model. Here select the Revit schedule setup of Floor, Spaces, Family Types, Multi-category and piping system for plumbing Discipline. Contractors may select the appropriate category for their respective discipline.

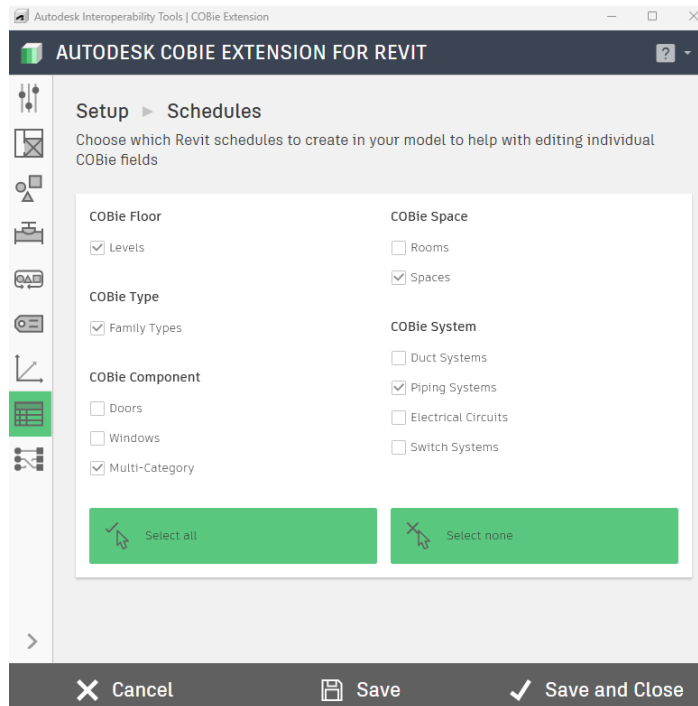


Figure 24: Settings – Schedules

❖ Settings – Parameter Mapping

The CoBie Extension has functionality to create and manage its own parameters in your Revit model. However, you might have already created your own parameters to store some CoBie or related data. The Parameter Mapping function allows you to bypass the default CoBie Extension parameters and use your own. The extension will then use these mapped parameters for data storage and exporting to your final CoBie spreadsheet.

Working from left to right, the Parameters table has columns that show you which CoBie spreadsheet that data shows up on, the field on the CoBie spreadsheet, the actual Parameter Mapping that you can modify, if the parameter needs to be an Instance or Type parameter, and what the data type is.

The "Parameter Mapping" column starts with the actual parameter name or piece of text; the default settings are all mapped to the default CoBie Extension parameters. To fill in a parameter field, either type in the parameter name or click the ellipsis button to bring up a list of all the parameters in your model that you can select from.

The green "+" allows you to add more fields for concatenation. If you are using more than one field, you get the ability to change the order of the fields by using the grabber to the left of the parameter name/text and dragging the order of elements. Finally, each field has a reset button that will return the parameter setting to the default CoBie Extension parameter.

If you use your own parameters, they **MUST** match all the settings outlined in the Parameters table, and the parameter name must be typed exactly as it is in the model.

It is possible for each contractor to map their own equipment parameter to the appropriate parameter field.

Once you have your parameters mapped properly, use the save button in the action bar to save your settings. If you are done setting up your model for the CoBie Extension, you can use Save and Close to update settings and close this dialog.

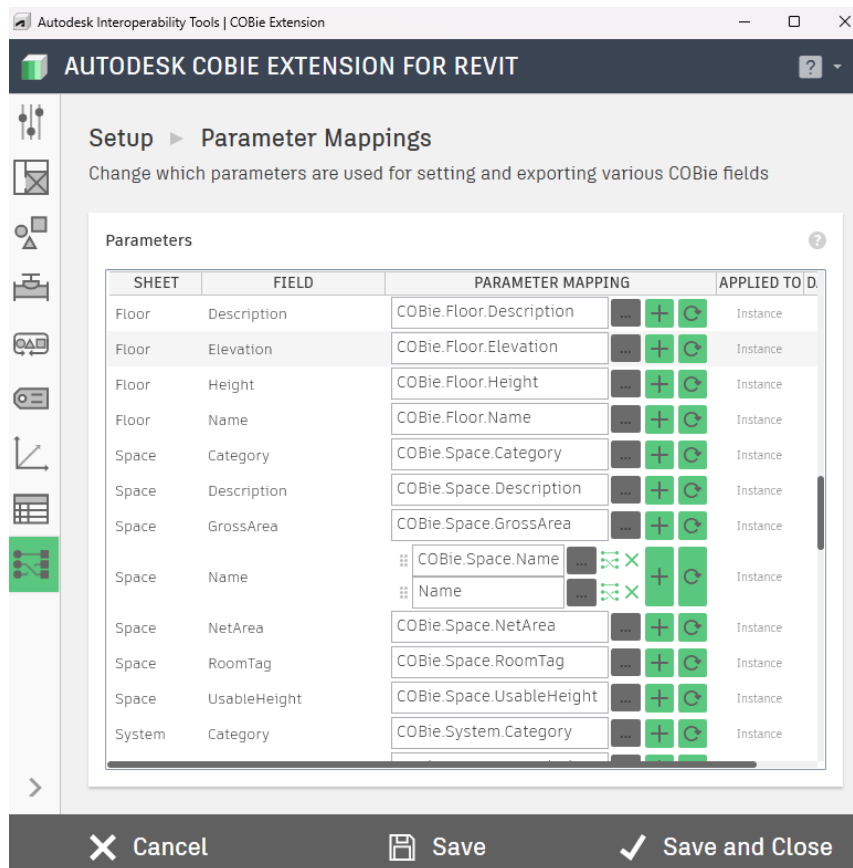


Figure 25: Settings - Parameter Mapping

❖ Select

Which elements the CoBie Extension exports are determined by the Select dialog. At its highest level, the tree view list within this dialog lists each of the Revit Family Types available for export. Below each of these primary headers are the individual families, types, and elements present within the current model.

Use the Select All button to export all possible model elements, or the Select None button to clear all checkboxes. By default, selecting a higher-level parent in the tree view list will also select all child entries below it. Override this behavior by unchecking any family, type, or element you wish to omit from the CoBie export.

Once done, click Apply and Close in the Action Bar to save your settings and update the elements in your model.

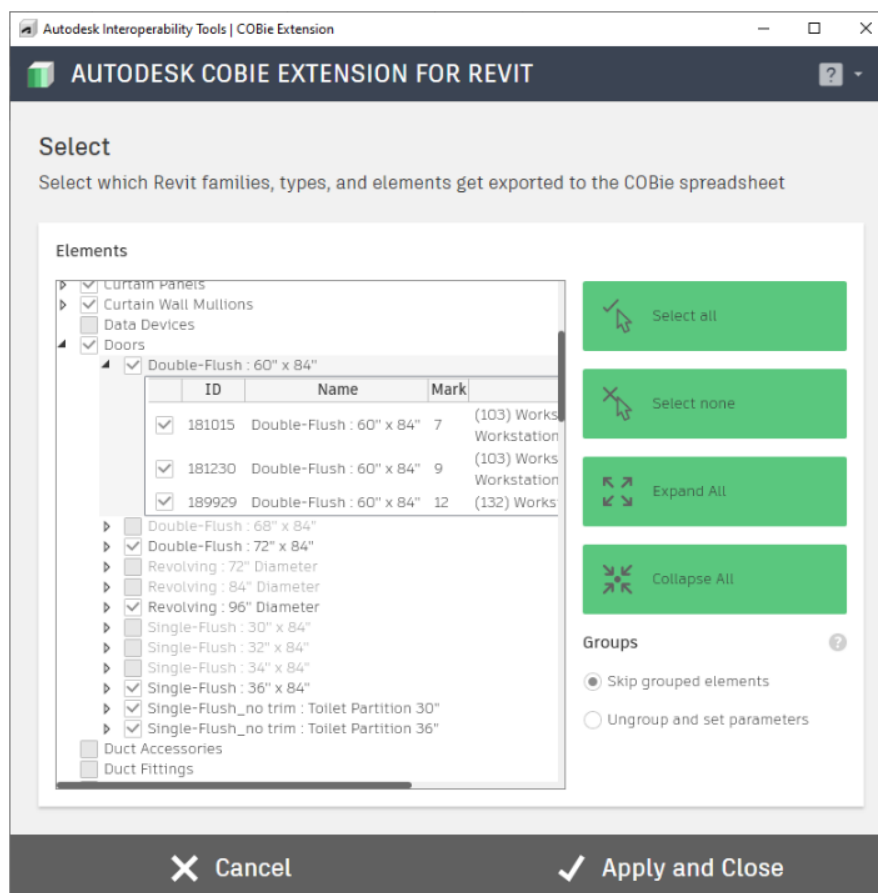


Figure 26: Select

❖ Create Spreadsheet

The export step will generate the necessary CoBie spreadsheets as a Microsoft Excel document. The Create Spreadsheet dialog allows you to specify which parts of the standard CoBie data exchange format is exported from the current Revit model. Spreadsheet creation is organized into two columns, the left column lists the standard CoBie workbooks that are each checked by default. Unchecking a workbook will omit it from the final export.

New file: This will generate a new Excel spreadsheet using the built-in CoBie template.

Append: This option will utilize an existing CoBie spreadsheet generated by the CoBie extension and append any new information to it.

Select Links to Export: You have the option to select any linked Revit model and include that model's CoBie export information during your export. If a model has not gone through the CoBie Extension setup, it will not be available to select. Data from exported models will use the settings for mapped parameters and attributes to export from that model, not the current active host model.

File: The CoBie Extension will generate an Excel spreadsheet containing the data specified in the preceding steps. Using this interface, the resulting Excel spreadsheet may be saved in a location of your choice. Once configured, the Create Spreadsheet button will begin the export process, whereas the Cancel button will close the dialog.

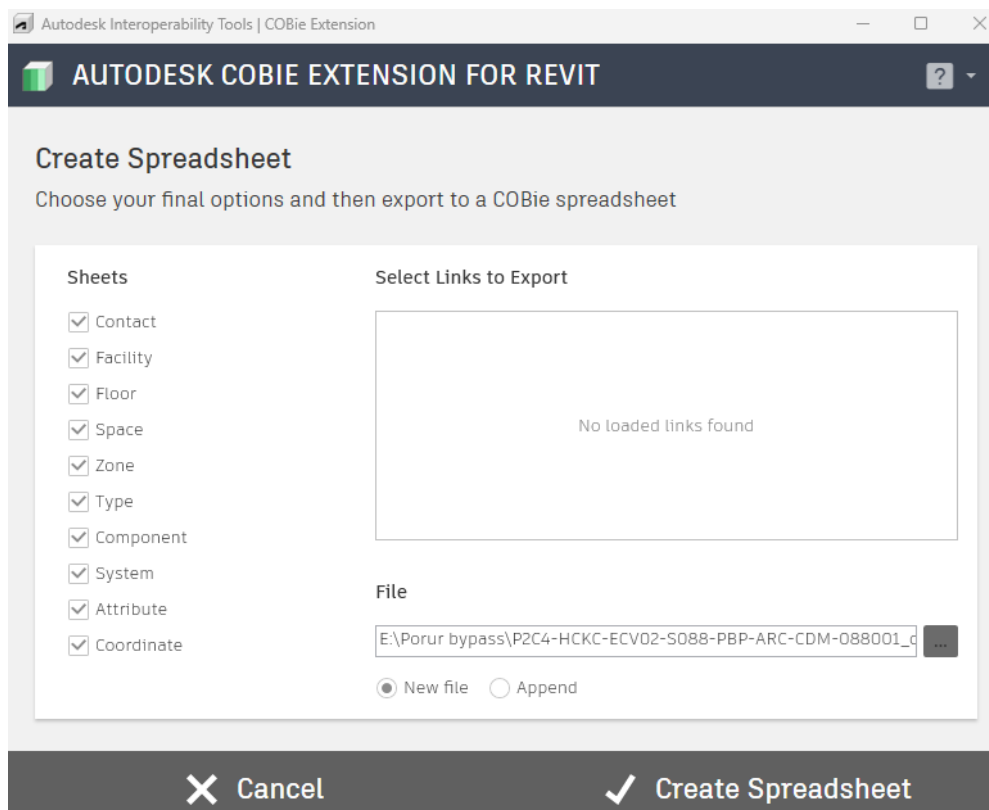


Figure 27: Spreadsheet Creation

4.3. BIM-AM Deliverable Checklist

To ensure the completeness of BIM asset model submission and streamline the handover process, the deliverable checklist serves to assist contractors to check and provide necessary information as specified.

BIM-AM Deliverable Checklist			
Deliverables	Items		Comments /Remarks
BIM Asset Model			
1. BIM ProjectModel	1.1 Model Management		
	(a) Separated Models by disciplines and systems as specified in Section 2.1	<input type="checkbox"/>	
	(b) Each model file size is around 500MB	<input type="checkbox"/>	
	(c) “Master” federated model with a link to all system models	<input type="checkbox"/>	
	(d) Hand over the file structure	<input type="checkbox"/>	
	(e) Central models instead of local models shall be submitted.	<input type="checkbox"/>	
	1.2 Naming Convention		
	(a) Model naming	<input type="checkbox"/>	
	(b) Family naming	<input type="checkbox"/>	
	(c) Asset Code	<input type="checkbox"/>	
	1.3 Model Setup		
	(a) Editable BIM project files in native formats	<input type="checkbox"/>	
	(b) Units	<input type="checkbox"/>	
	(c) Location and geo-coordination	<input type="checkbox"/>	
	(d) Delete all the worksets for handover	<input type="checkbox"/>	
	(e) Set “Fine” view and “Consistent color” for handover	<input type="checkbox"/>	
	1.4 Architectural & Structural Model		
	(a) Architectural model with reflected ceiling plans	<input type="checkbox"/>	
	(b) Rooms should be created in the architectural model for asset tagging	<input type="checkbox"/>	
	(c) Critical Common Parameters	<input type="checkbox"/>	
	(d) Other Common Parameters	<input type="checkbox"/>	

BIM-AM Deliverable Checklist			
Deliverables	Items		Comments / Remarks
BIM Asset Model			
	1.5 E&M System		
	(a) Modelling with system standard	<input type="checkbox"/>	
	(b) Space should be created in E&M model for the asset tagging	<input type="checkbox"/>	
	(c) Critical Common Parameters	<input type="checkbox"/>	
	(d) Other Common Parameters	<input type="checkbox"/>	
	(e) Equipment Specific Parameters	<input type="checkbox"/>	
	1.6 Maintainability		
	(a) Clearance spacing	<input type="checkbox"/>	
2. BIM-AM File Formats Checklist	(a) One Federated model with linked models	<input type="checkbox"/>	
	(b) NWC & IFC	<input type="checkbox"/>	
	(c) CoBie	<input type="checkbox"/>	