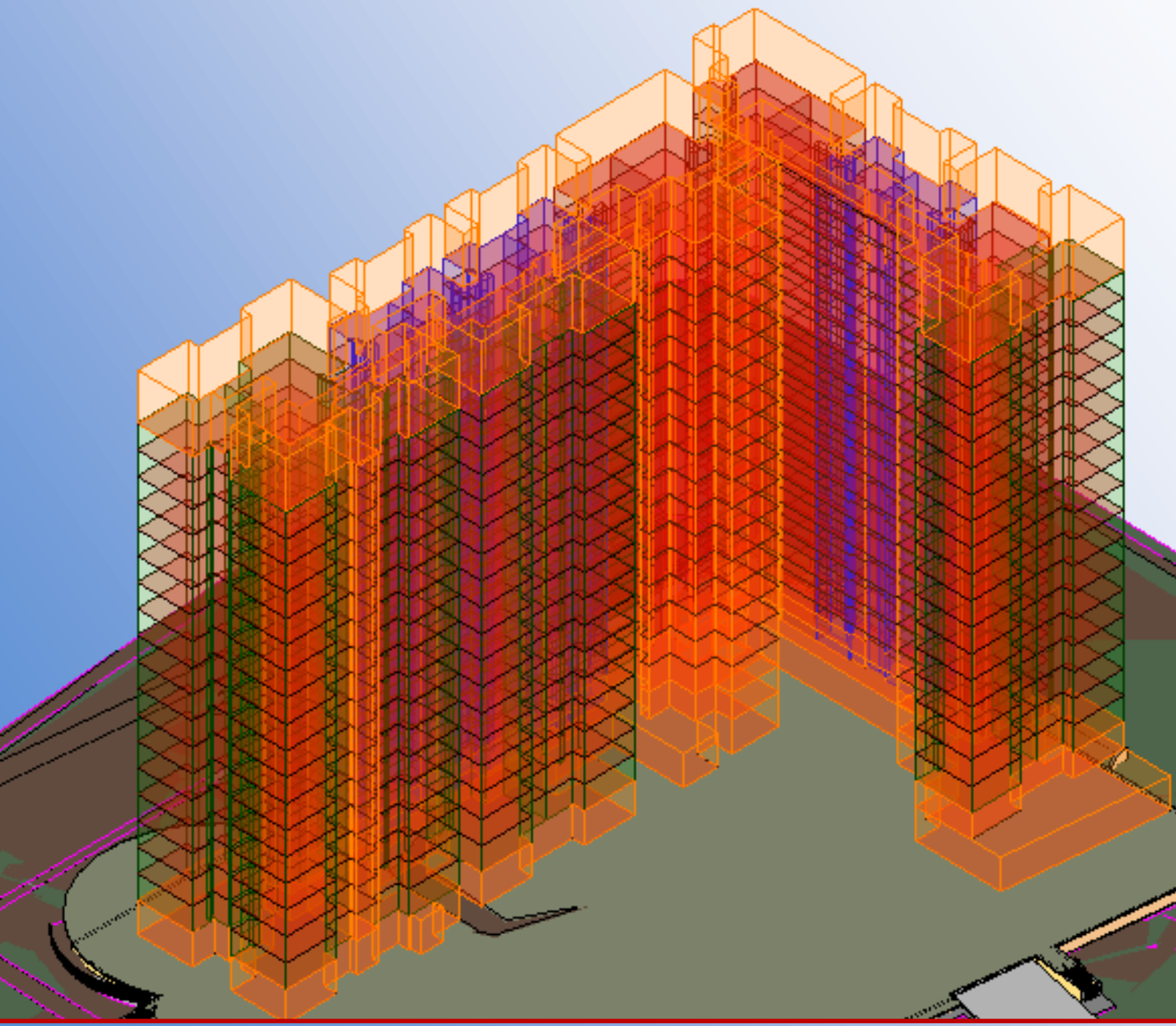
Step by Step BIM Guide

for

HDB Housing Projects

Version 1.0



HOUSING & DEVELOPMENT BOARD

Building and Construction Authority

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This Document is currently under provisional status and is available for public review and comment. As the provisional status denotes, however, it will continue to serve as the basis for further development, pilot validation, and professional editing. While HDB & BCA attempts to highlight major points to Building Information modelling requirements, HDB & BCA cannot take into account all exceptions and special cases. Updated versions to this document will continue to be issued, to address and incorporate on-going feedback in an open, collaborative process. All readers to this provisional guide are encouraged to submit feedback to HDB & BCA.

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Information and content set forth in this document are subjected to changes without notice, but will be released as updates in subsequent version. Readers, who wish to adopt this provisional document as a guide for their own purpose, are strongly advised to exercise discretionary judgment as HDB & BCA were not liable to any consequences arising from your adoption here.

Acknowledgements

HDB and BCA would like to acknowledge the contributions of the following organizations which had provided their valuable inputs in the development of this guide:

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P & T Consultants Pte Ltd

ADDP Architects LLP

Chapter 1
Introduction

Chapter 1 - Introduction

Introduction

The objective of this document is to assist Architects and Engineers to develop BIM model(s) collaboratively for HDB housing projects. It is a step-by-step guide for preparing the model(s), sharing them with project partners and submitting to HDB/Authorities as per the stages in the Singapore BIM Guide.

This is a general reference guide on how to develop a BIM model for a typical building and should not be regarded as an extensive document that covers all scenarios that may arise in a specific project. Users are encouraged to edit/change steps accordingly to suit their needs.

The following applications were used to develop this document:

Revit Architecture 2012, Revit Structure 2012 and Revit MEP 2012.

This document does not cover the explanation of Revit terms used. Please refer to Revit Help for the explanations of Revit terms.

This document does not cover the Engineering calculations, design and analyses.

It is recommended to read this guide together with Singapore BIM Guide and BIM e-Submission Guideline for additional information and Agencies requirements.

Chapter 6 - Mechanical and Plumbing covers the Water and Sanitary services. The concept for the rest of the MEP services is similar.

Chapter 2

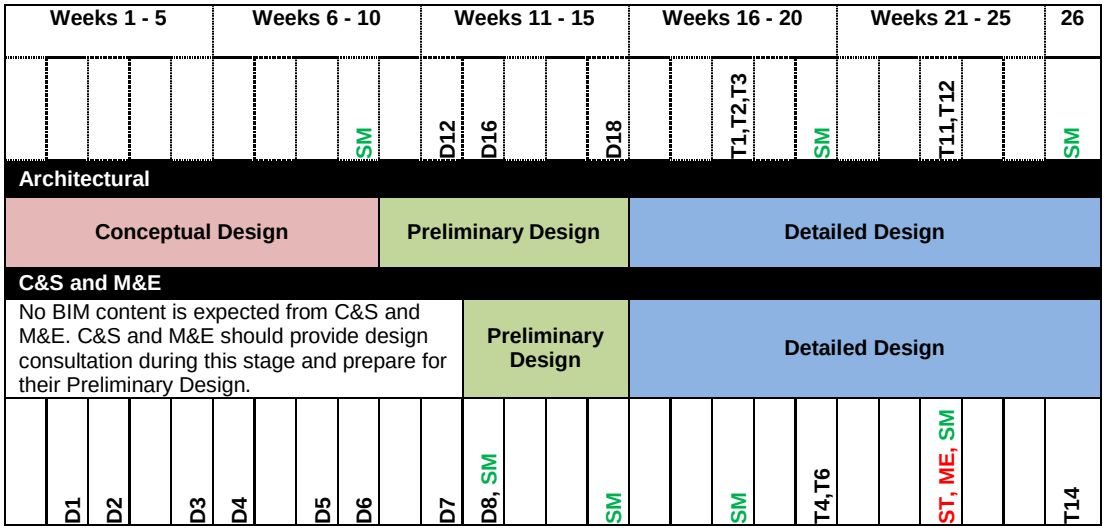
Getting Started

Chapter 2 – Getting Started

Getting Started covers the preparations required before starting the actual modelling for the project. In order to prepare for the modelling, the team should know the various stages of the project and their deliverables that is discussed in the next section.

Stages and Deliverables

This document focuses on the Design stages of the project up to tender. There are three Design stages - **Conceptual Design**, **Preliminary Design** and **Detailed Design**. The BIM content that needs to be prepared for each stage is shown in the respective chapters. The diagram below shows the mapping between the stages and major deliverables.

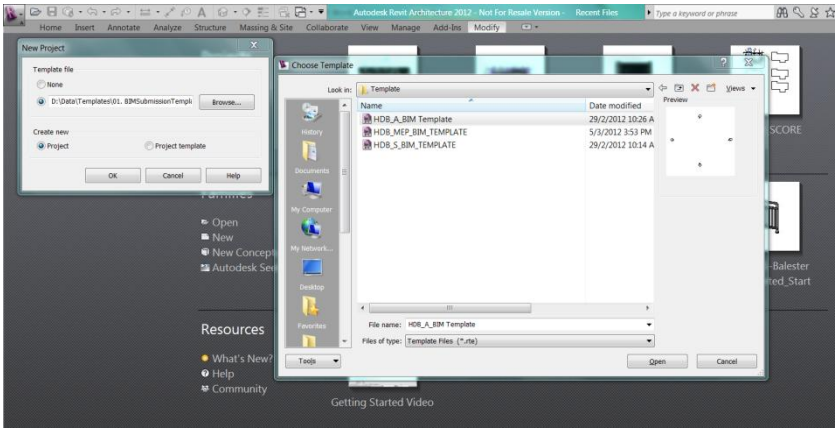


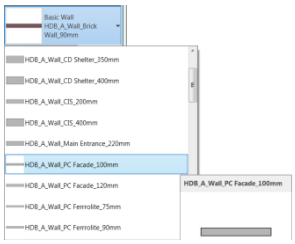
Code	Description	Code	Description
D1	Progress Review 1	T1	Submit Future Community Facilities drawings (if any) to BQG & PLG
D2	Management Review 1	T2	Submit landscape concept, hard landscape layout to DPD's Landscape Unit
D3	Progress Review 1A	T3	Submit Architectural drawings for BQG(PDMU) Technical Review
D4	Management Review 1A	T4	Submit M&E / C&S drawings for BQG(PDMU) Technical Review
D5	Progress Review 2	T6	Submit Architectural drawings to BQG(PDMU) via CORENET
D6	Management Review 2	T11	BP Submission
D7	Progress Review 2A	T12	FSSD Submission
D8	Management Review 2A	ST	ST Submission (C&S)
D12	Household Shelter Submission to BCA	ME	M&E Submission
D16	DC Submission to URA	SM	Share Model to other Consultants
D18	Cost Estimation & Cost Plan to HDB's CM in-charge	T14	Ready for BTO Tender

Chapter 2 – Getting Started

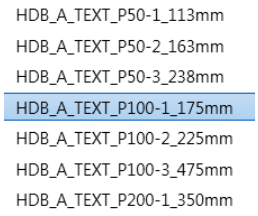
Template

A project template provides a starting point for new project. One can start a project with BCA's BIM e-Submission template(s) or customised BCA's BIM e-Submission template(s) that incorporates their office standards.





Example: Wall Types



Example: Text Types

The following settings can be customised in the template:

- Browser organization
- Views and View Template,
- System family types (Wall and Slab),
- Standard families (both 2D and 3D)
- Line types,
- Filters (for color override),
- Text types (3 sizes per type for both 1:50 and 1:100 scales)
- Units,
- Dimension types,
- Tags,
- Keynotes,
- Symbols,
- Groups,
- Parameters,
- Fill types (Floor and Wall tile patterns),
- Schedules and
- Sheets

The template can be refined and improved during the course of the project to use for future projects.

Note:
Setting up of the template is not in the scope of this document. Please refer to the software help file/manual to understand how to create the template file.

Chapter 2 – Getting Started

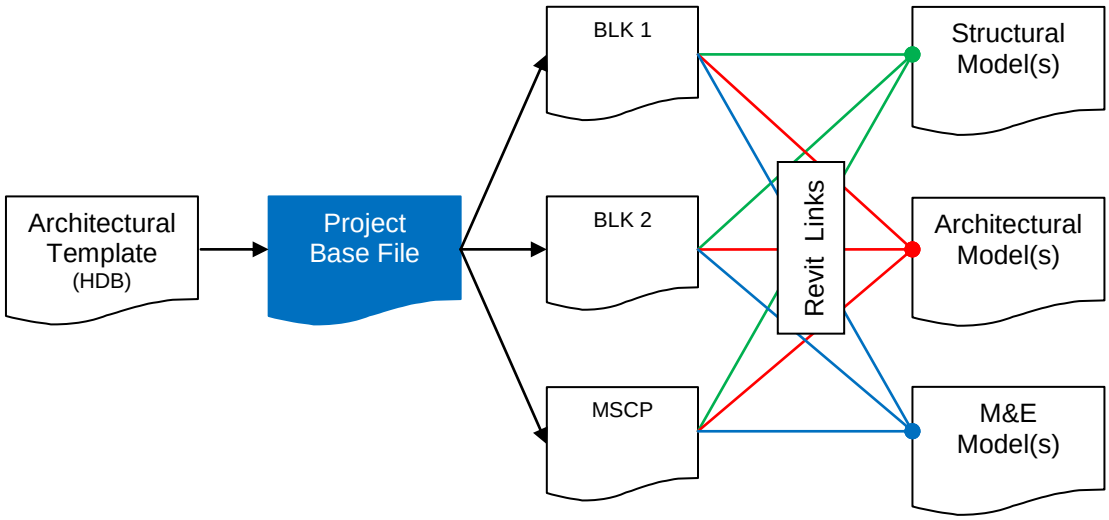
Project Base File

A project base file can be created with the BCA BIM eSubmission or the customised template, as discussed in the previously. This should be done before starting the project.

The project base file contains the location and orientation, which is set based on the Surveyor's drawing. If necessary, a common reference point can be marked using **Reference Planes**. Grids and Levels are optional at the moment as they can be drawn in the individual files later.

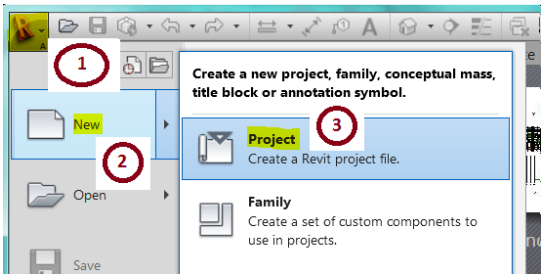
The project base file should be used by all the team members to create their assigned portion of the model. This allows them to link the individual portions of the model smoothly to the Master File that shows the complete assembly of the project.

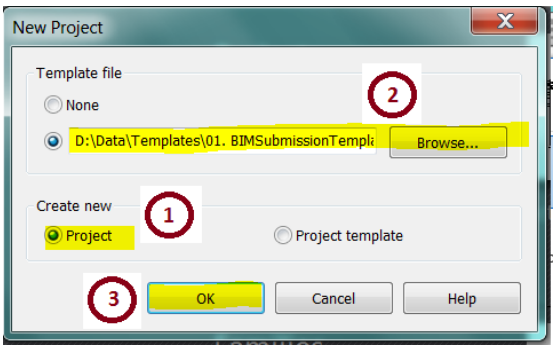
It is recommended that the Structural and M&E team use the Architectural Model(s) as a base. This will allow them to inherit the settings in the Project Base file.



Steps: Creating a Project Base File

1. Create a new project from the Project Template.
   a. From the **Application Menu** choose **New → Project**.
   b. In the **New Project** dialog box choose **Project** in the **Create new** section.
   c. Click the **Browse...** button and locate the template file using the file dialog box.
   d. Click **OK** to create the new project.

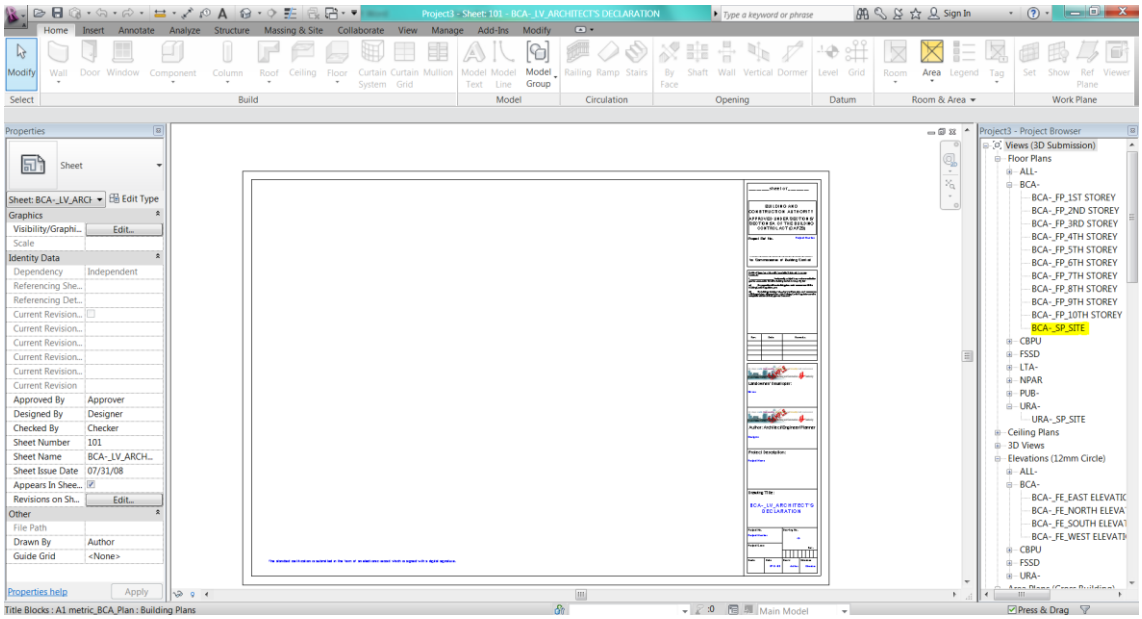




Chapter 2 – Getting Started

2. The new project created in **step 1** is shown in the image below. Next, set up the **Location** and **Orientation** for the project. This is done by inserting the **Surveyor's topography drawing** in DWG format into the **site plan view** and copying the settings from the file.

> **Note:**
> **Cleanup the topography drawing of unwanted layers and data. Keep only the necessary information.**

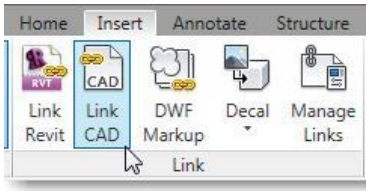


Chapter 2 – Getting Started

Setting up Location and Orientation

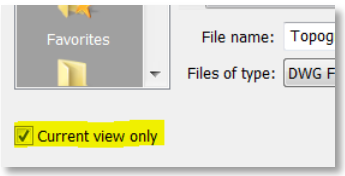
a. Double-click on the view **BCA-_SP_SITE** to open the site plan view.

b. From the **Insert Tab** choose **Link CAD**



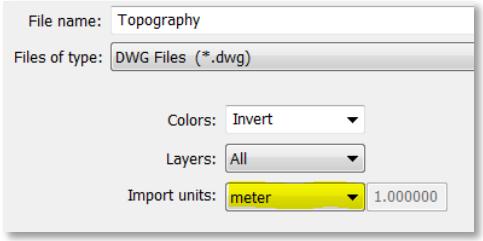
Note:
Link CAD is better as there is no need to explode the DWG after insertion.

c. In the file dialog box, browse and locate the topographical survey drawing file in DWG format.



Make sure **Current View Only** is checked as the survey drawing needs to be shown only in the site plan view and will be removed after the settings are captured.

d. Colors & Layers are user-specific but make sure **Import units:** is set to match the drawing (do not rely on the 'Auto' option).

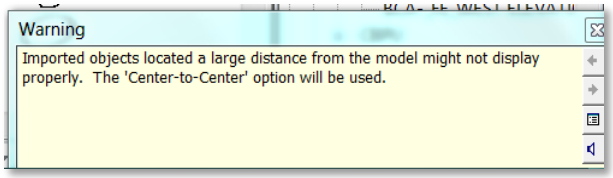


Note:
Most Surveyors prepare topography drawings in metres.

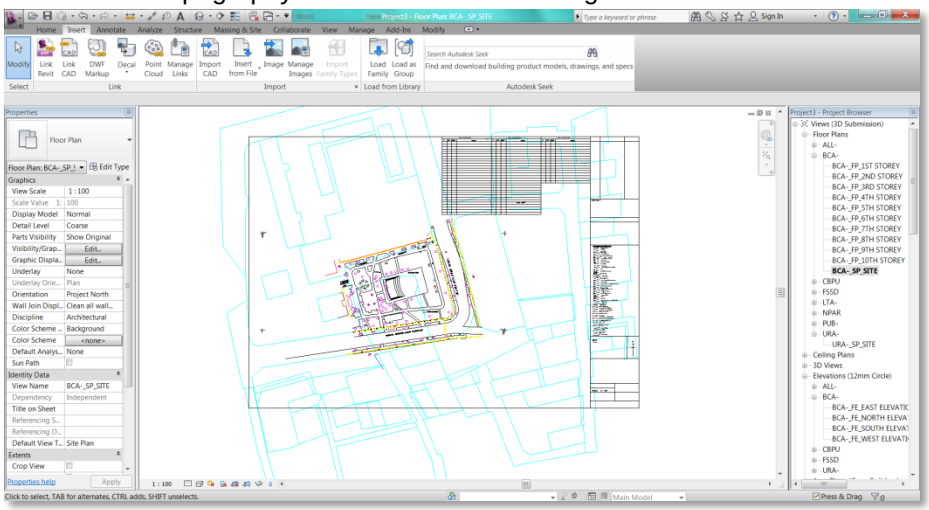
e. Set the Positioning to **Auto - Origin to Origin** and click **Open**. This will place the topography in the site plan view in the location and orientation set by the Surveyor.



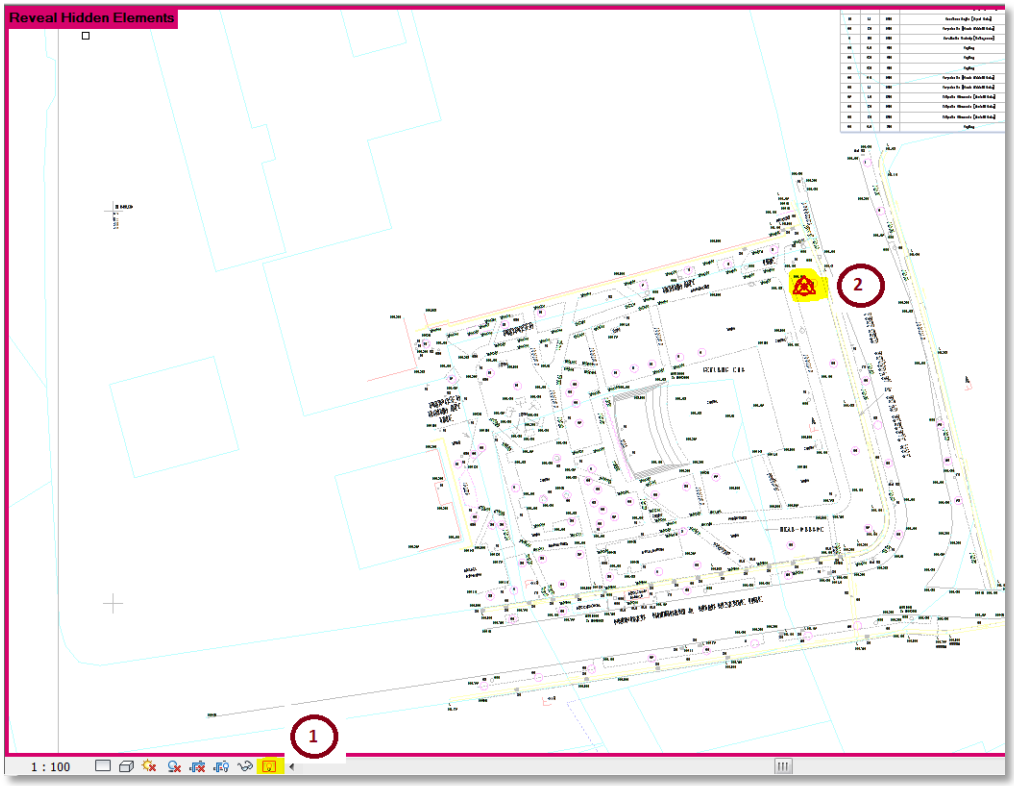
The following warning may appear. This is due to the limit set inside Revit. Zoom to fit, make sure the content is shown and continue.



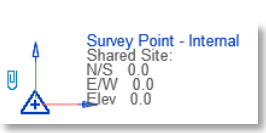
The inserted topography will be similar to the image shown below



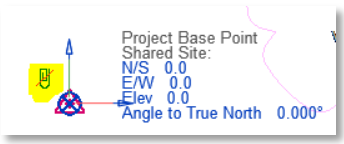
f. Click on **Reveal Hidden Elements** (1) in the **View Control Bar**. This will reveal the **Survey Point** and **Project Base Point** (2) as shown in the image below.



g. By default the Survey Point and Project Base Point will be in the same location.



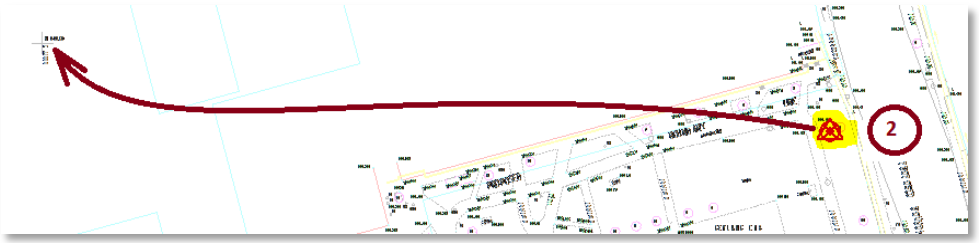




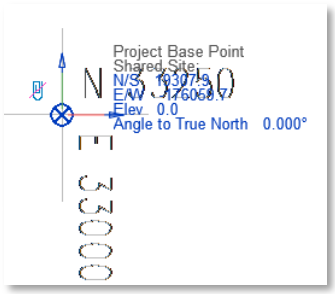
h. Select the **Project Base Point**.

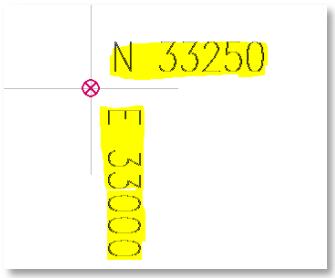
i. Click the icon shown like a **clip** next to **Project Base Point**. This will unclip the base point and allow the user to move the base point freely.

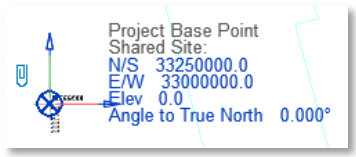
j. Move the **Project Base Point** to the nearest reference point marked by the Surveyor that has **North and East** co-ordinate value and Clip the base point.



Chapter 2 – Getting Started

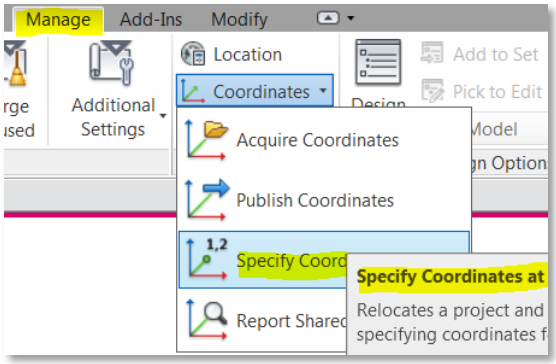






k. The co-ordinates shown in the Project Base Point and the co-ordinates given by the Surveyor will not be the same.

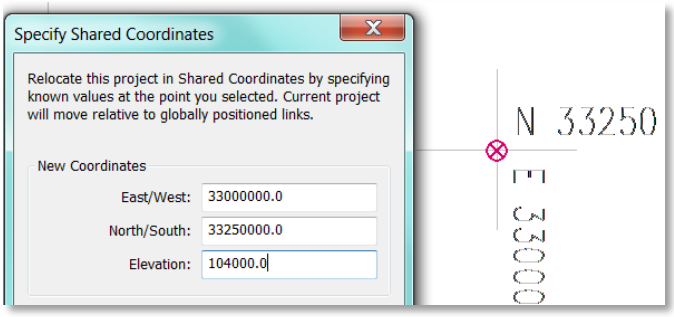
Go to the **Manage** tab, **Coordinates** and choose **Specify Coordinates at a point**.

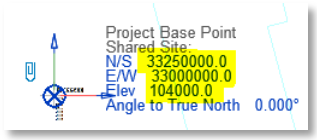


Click in the centre of the Project Base Point and enter the values for **North (N)** and **East (E)** in the dialog box as given by the Surveyor.

Cross-check the coordinates of other reference points provided by the Surveyor to make sure the values are correct. This can be done using **Report Shared Coordinates** in the **Manage tab - Coordinates** menu.

l. The default setting for the **Elevation** of **Project Base Point** is 0.0. It is recommended to set the Elevation to be the same as **1st Storey Finish Floor Elevation** or a value agreed between the project team members.





Next set the orientation. The survey drawing is normally based on the real world north (pointing upwards). Make sure that it is correct. However, it may not be convenient for the team to work in the real world north orientation. Revit offers **Project North** and **True North** as a solution.

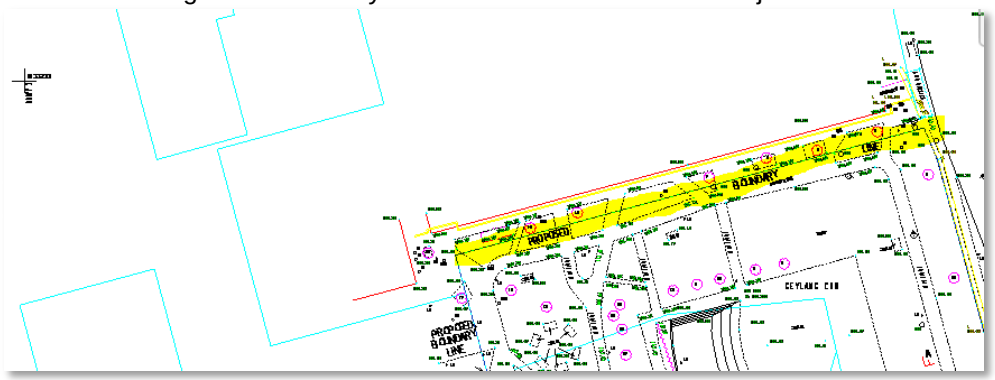
- **True North** in Revit represents real world north orientation and
- **Project North** is specified by the user, which can be set for convenience to work on the building model. It is like rotating a paper to a convenient position to draw.

Note:
In Revit there is only one Project North per file. If there are multiple blocks, either one of the options described below could be used.

Option 1: Create individual files for each block, in which the Project North can be set differently for each of them. Link the files (blocks) to form the overall model. In this option the documentation should be done in the individual files.

Option 2: This is done in the file containing the overall model. Set the Project North based on the key block in the project. For the rest of the blocks, create the plan views, enable the crop region, select and rotate the crop region to the convenient orientation.

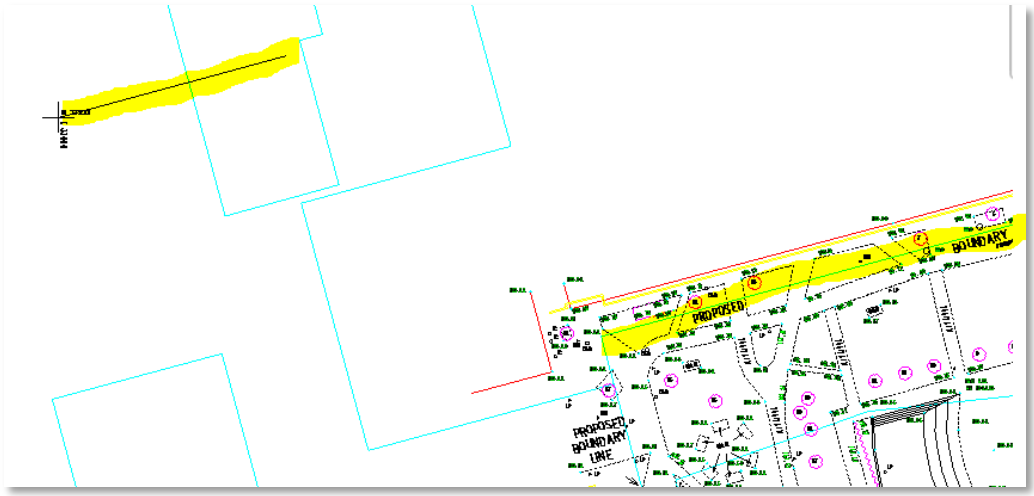
m. **Rotate** the topography drawing as required in the Project North. Select a boundary line that is parallel to the longitudinal side of the building as a base for orientation. At the end of the settings that boundary line will be horizontal in the Project North.



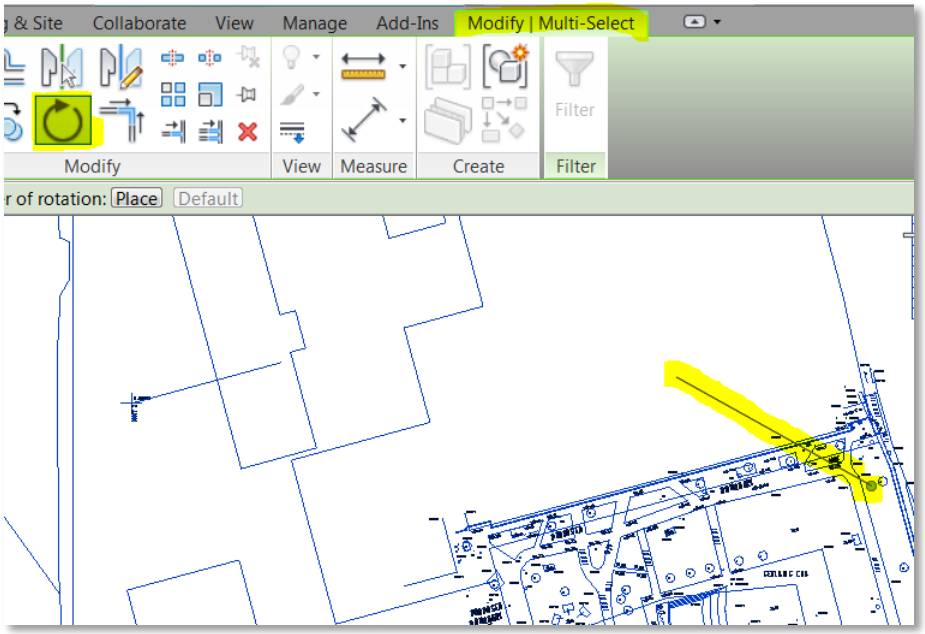
n. Make sure the **Orientation** parameter of the view is set to **Project North**.

Underlay	None
Underlay Orientation	Plan
Orientation	Project North
Wall Join Display	Clean all wall joins
Discipline	Architectural

o. Draw a line parallel to the site boundary that needs to be horizontal in the Project North. This line will be used as a reference to set the orentation.



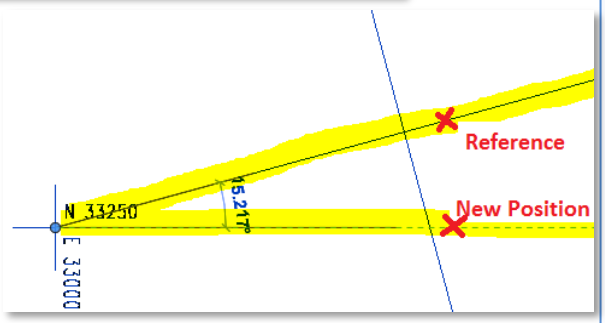
p. Select the **survey drawing** and the **line** just drawn. In the Modify | Multi-Select tab choose Rotate. A **basepoint** and **handle** will appear in the drawing area.



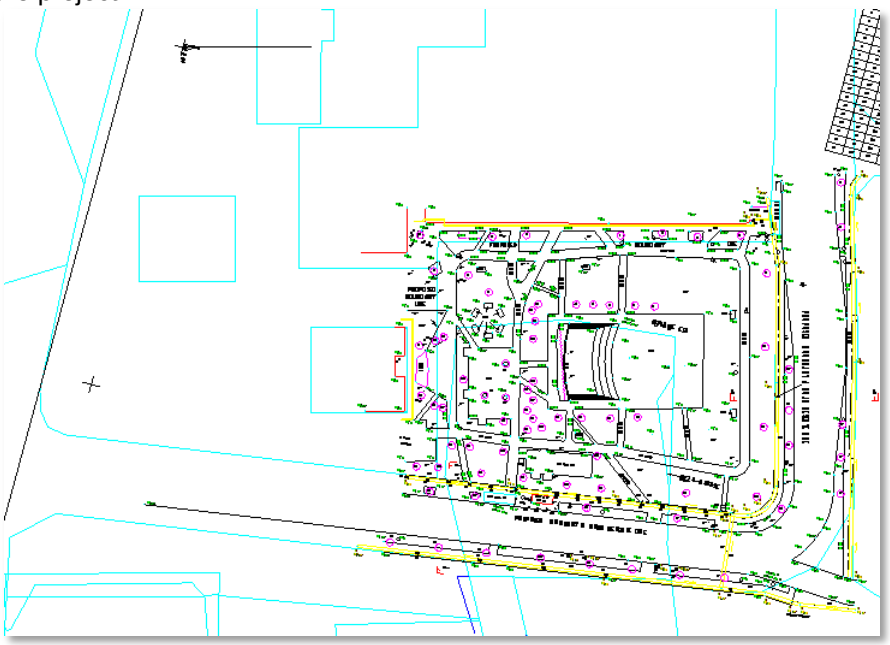
q. Click on the basepoint and move it to the Project Base Point.

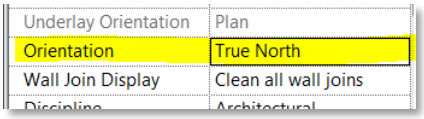


r. **Rotate** by piciking a point along the line (**Reference**) and click another point horizontal from the basepoint (**New Position**).

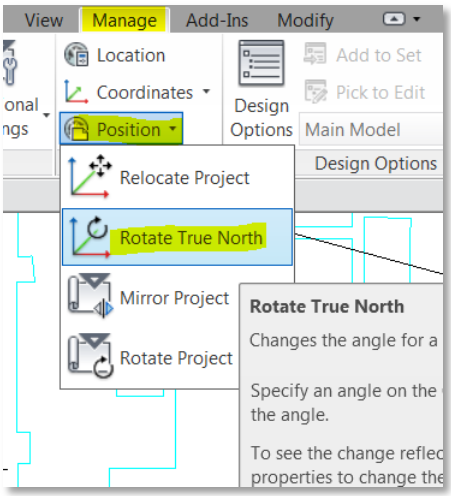


s. The rotated elements will be as shown below. Next the user need to set True North for the project.



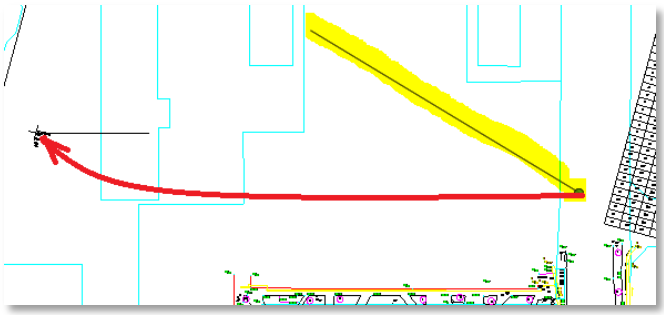


t. Set the **Orientation** parameter of the view to **True North**.

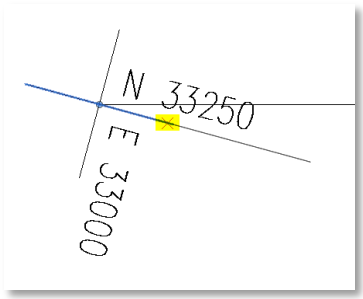


u. Go to **Manage** tab, **Position** and **Rotate True North**.

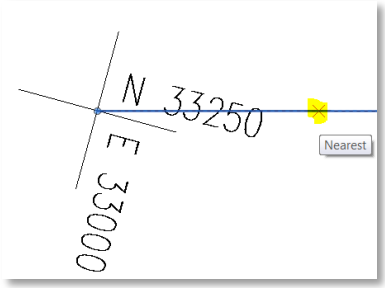
v. Basepoint and handle will appear on screen. Move the basepoint to **Project Base Point**.



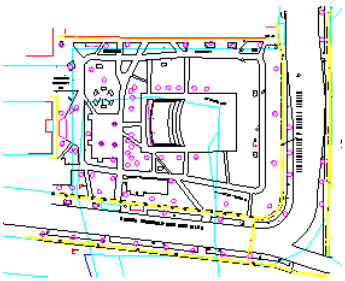
w. Pick the reference point along the line that is horizontal in True North.



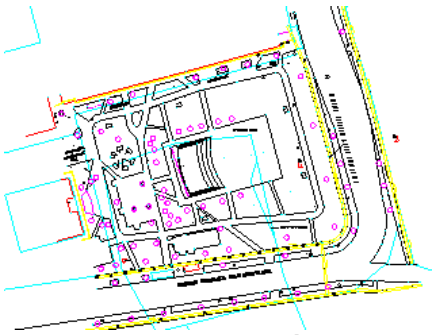
x. Pick the new point along the line that is horizontal in Project North.



y. Once both **Project North** and **True North** for the project are set, check that they are correctly set by changing the **Orientation** parameter of the view.

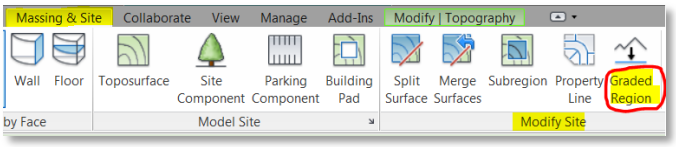


Project North



True North

3. Add the site boundary using the tool **Massing & Site tab → Modify Site → Property Line**

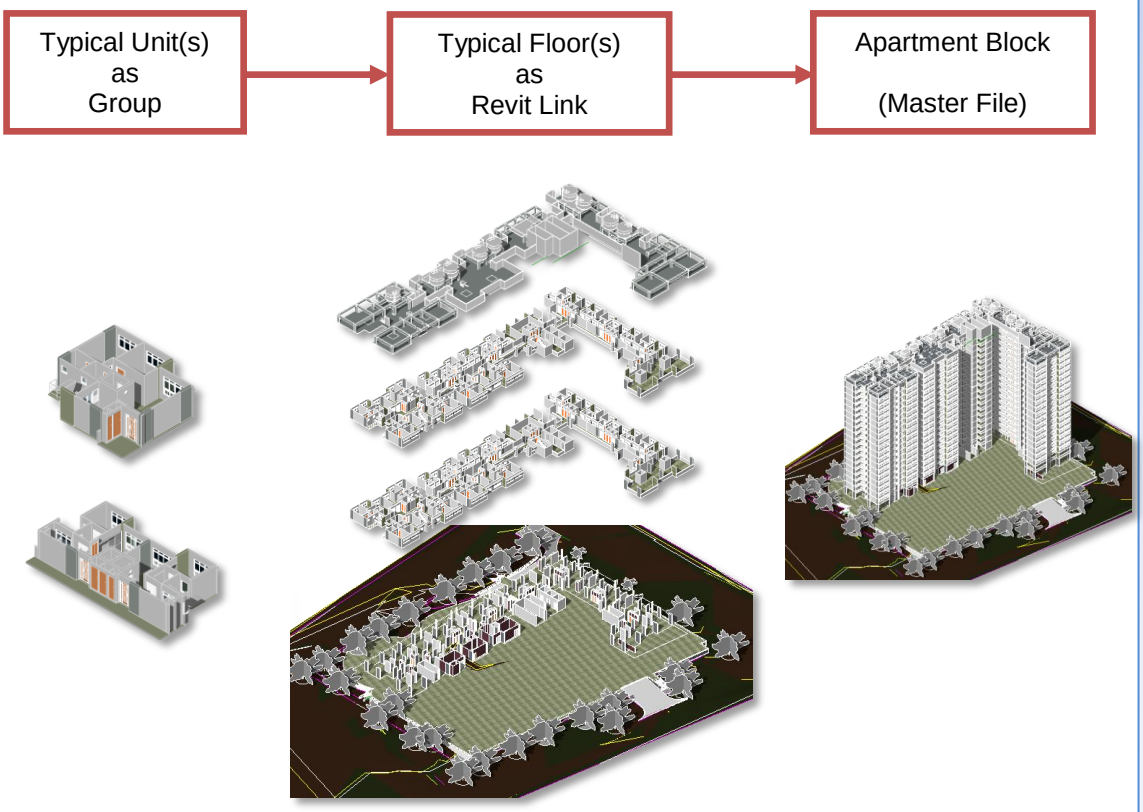


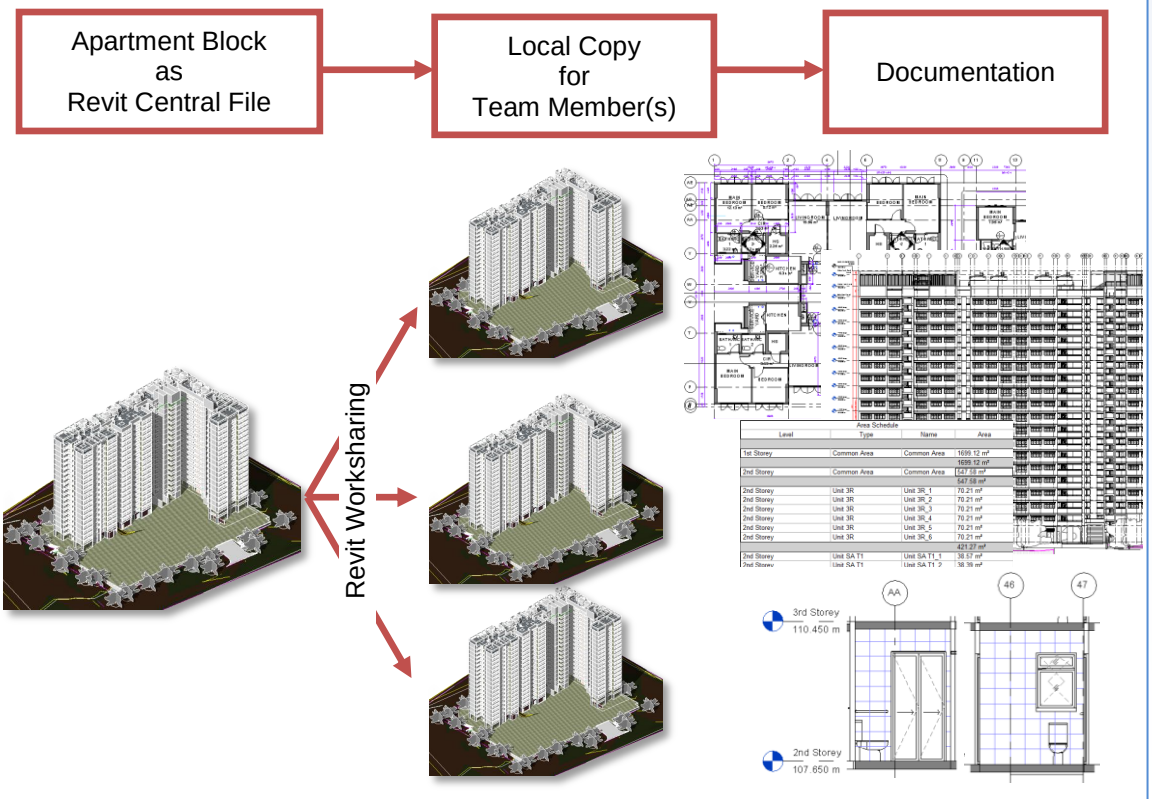
4. The project base file should be distributed to the team members to model the portion assigned to them. The assignment of model should be based on the modelling plan, which would be discussed in the next chapter.

Chapter 3
Modelling Plan

Chapter 2 – Getting Started

1. Modeling Plan is one which divides the project into manageable sizes to share among the team members. The example shown below is for the Architectural Model





a. **Revit Groups** are used mainly for repeating portions of the model. Groups helps to propagate changes quickly. Groups can be used for typical units and vertical shafts that may have one or more instances in the model. They should be used minimally.

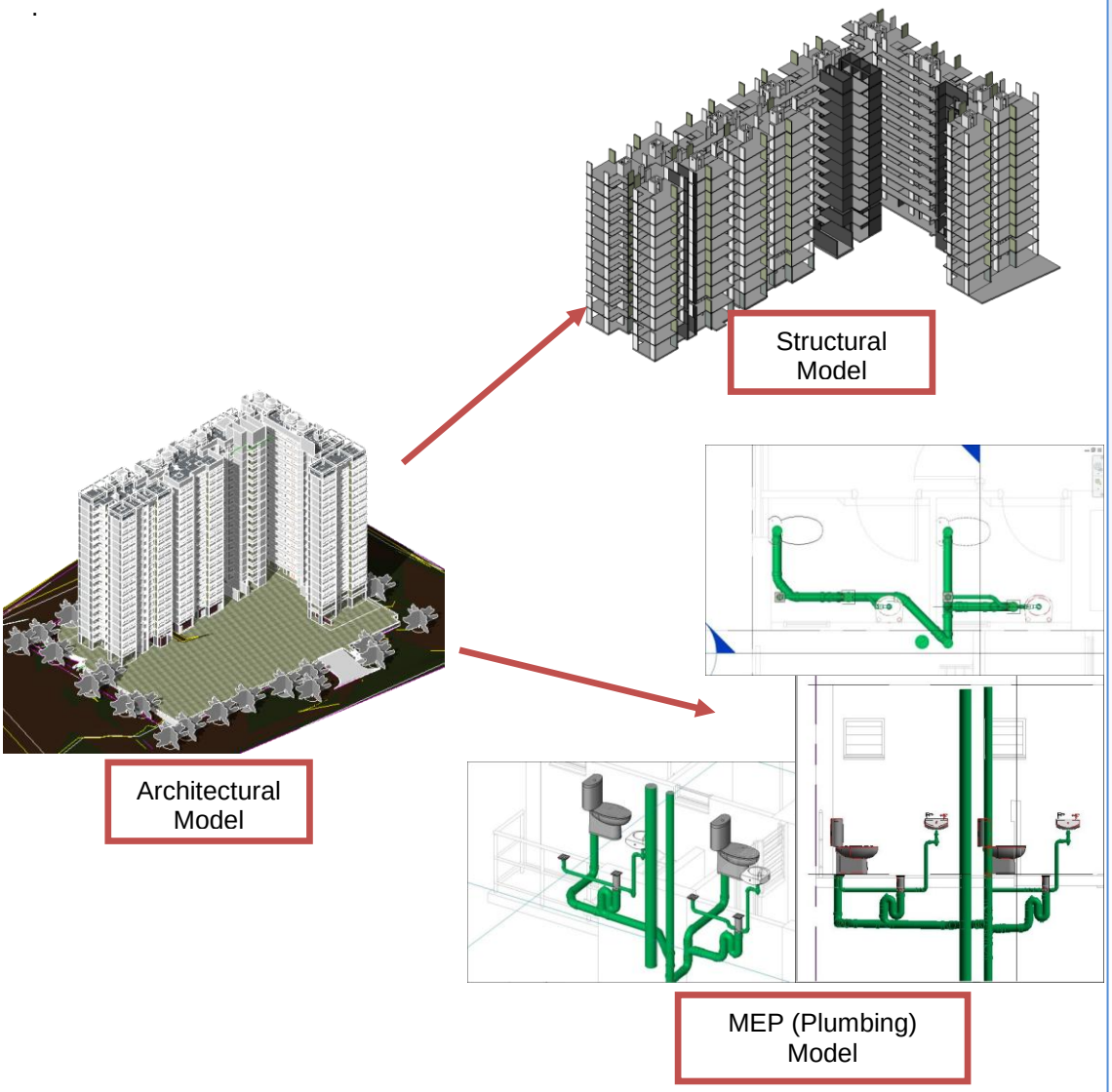
b. **Revit Links** will improve the model performance. Thye are especially good for propagating changes when the project has typical floors. Links allow team members to share their work.

c. **Worksharing** allows multiple modellers to work on a single model and share updates quickly. Worksharing can be used during the preparation of the documentation by all the team members in a single model.

2. It is recommended to share the Architectural Master and Link files with the Structural and MEP Engineers. The Structural and MEP Engineers can use the information in the Architectural model to prepare their models/documentation.

Note:
These steps will be explained in the later chapter of the document

.

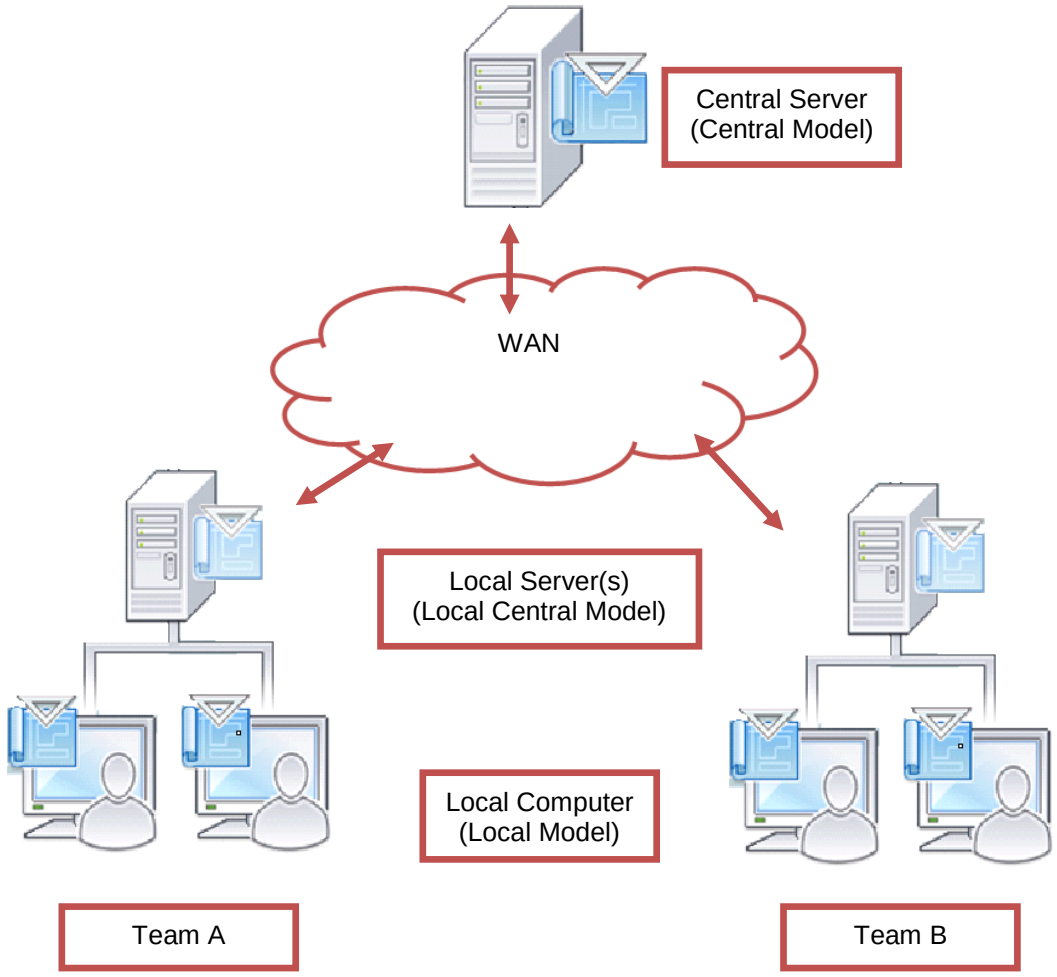


3. The next level of model sharing uses **Revit Server**. This is good for teams working remotely from different companies. **Revit Server** is a server application which is the foundation for server-based worksharing for Revit projects. The Revit Server uses a central server and multiple local servers for optimal project collaboration across a **wide area network** (WAN).

   a. The **Revit Server** consists of a **single central server** that connects with **multiple local servers**.

   b. When a team member opens the server-based workshared project, he will be working in a **local copy** of the **central model**. This local copy, called the local model, is stored on the team member's computer. The central model is stored on the central server.

   c. As a team member works, the local server silently requests updated information from the central model on the central server, using available network capacity to transfer data over the WAN. The updated version of the model is stored on the local server, so the updates are readily available when a team member requests them.



4. When the teams are working remotely, it is recommended some kind of **document management system** is in place to share large files. This system should allow the team members to share files on the Internet. Most of these systems have good security features for controlling access to files.

Chapter 4
Architecture

Chapter 4 – Architecture

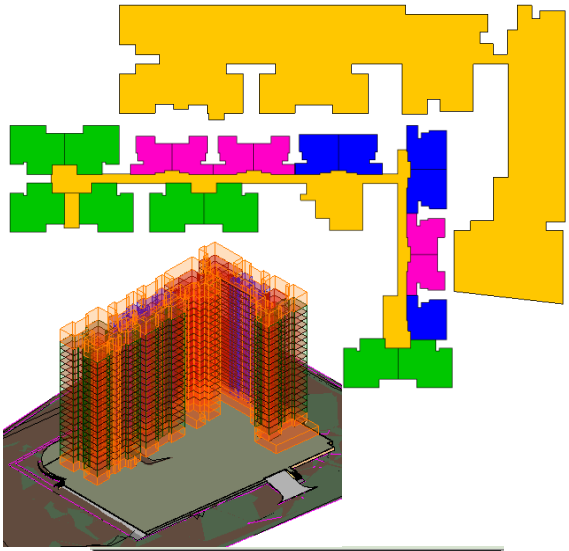
4.1 Conceptual Design

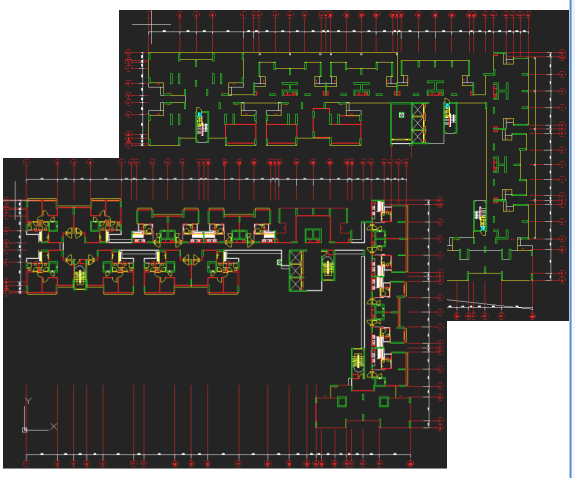
1. **Conceptual Design** is the first stage in the design process. The design team will prepare various design options based on HDB's design criteria and present them at the **Progress Reviews** (**PR**) and **Management Reviews** (**MR**). The design team can choose either one of the option described for the **Conceptual Design**.

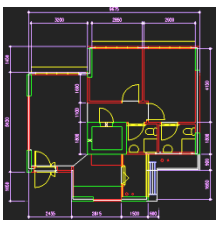
   Deliverable: Design Concepts that consists of the schematic representation of blocks, storeys, units and their arrangements on site.

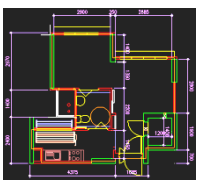
   Option 1: Use Revit to prepare the design options. This option is suitable for a design team which is familiar with Revit's conceptual design tools. The conceptual model can be used for further design development, which will saves time in the next stage.
   Option 1 consists of **Site BIM model(s)** for master plan site study and feasibility analysis. From this **massing model(s),** space areas and volumes can be extracted to check against HDB's requirements and compare between design options. The number of massing models depends on the number of conceptual design options produced. Additional information may need to be added based on the design requirements.

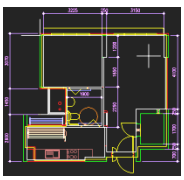
   Option 2: Use non-BIM tools to prepare the design options. Ex. AutoCAD, Sketch-up. This option is recommended if there are tight deadlines given for this stage, multiple design options that need to be prepared, or if the project is being carried out by a design team that just started with BIM. This option gives them necessary time to learn Revit before the next stage. Refer to **Appendix B** for steps on how to convert CAD drawings to BIM model in Architectural Preliminary Design stage.











Area Schedule

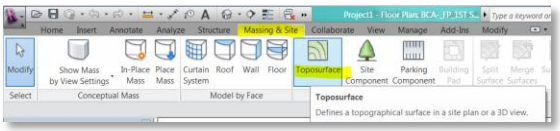
Level	Type	Name	Area
4th Storey	Common Area	Common Area	307.80 m²
Common Area			307.80 m²
4th Storey	Unit 3R	Unit 3R_1	70.21 m²
4th Storey	Unit 3R	Unit 3R_2	70.21 m²
4th Storey	Unit 3R	Unit 3R_3	70.21 m²
4th Storey	Unit 3R	Unit 3R_4	70.21 m²
4th Storey	Unit 3R	Unit 3R_5	70.21 m²
4th Storey	Unit 3R	Unit 3R_6	70.21 m²
4th Storey	Unit 3R	Unit 3R_7	69.31 m²
4th Storey	Unit 3R	Unit 3R_8	70.21 m²
Unit 3R			560.79 m²
4th Storey	Unit SA T1	Unit SA T1_1	38.57 m²
4th Storey	Unit SA T1	Unit SA T1_2	38.39 m²
4th Storey	Unit SA T1	Unit SA T1_3	38.39 m²
4th Storey	Unit SA T1	Unit SA T1_4	38.57 m²
4th Storey	Unit SA T1	Unit SA T1_5	38.39 m²
4th Storey	Unit SA T1	Unit SA T1_6	38.39 m²
Unit SA T1			230.70 m²
4th Storey	Unit SA T2	Unit SA T2_1	48.33 m²
4th Storey	Unit SA T2	Unit SA T2_2	48.13 m²
4th Storey	Unit SA T2	Unit SA T2_3	48.61 m²
4th Storey	Unit SA T2	Unit SA T2_4	48.13 m²
4th Storey	Unit SA T2	Unit SA T2_5	48.33 m²
Unit SA T2			241.54 m²

Option 1 **Option 2**

Chapter 4 – Architecture

2. The **Site model** can be created by following the steps below .
   a. Create a new project by duplicating the **Project Base File** created in the chapter "Getting Started".
   b. If the file does not contain the survey drawing then insert the drawing again following the same steps explained in the chapter "Getting Started".

   c. To create the 3D topography, activate the **Toposurface** from the **Massing & Site** tab → **Model Site** panel.

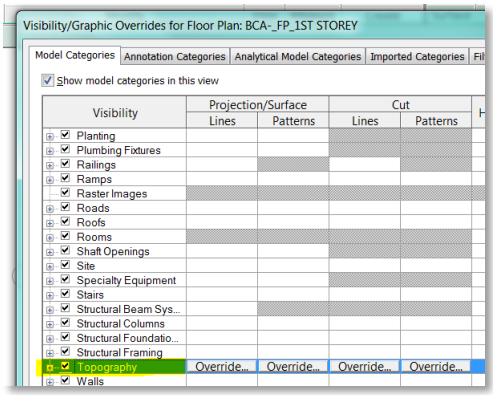


   d. If the topography visibility is not activated then the resulting toposurface will not be visible in the view.

      Type **VG** to activate the **Visibility/Graphic** dialog box.

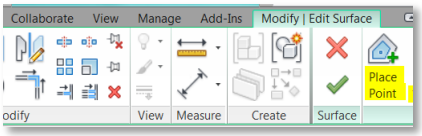
      Tick the box in front of **Topography**.

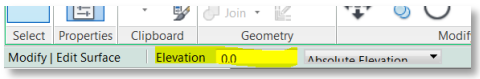
      Click **Apply** and **OK**.



   e. There are two options available to create the toposurface:

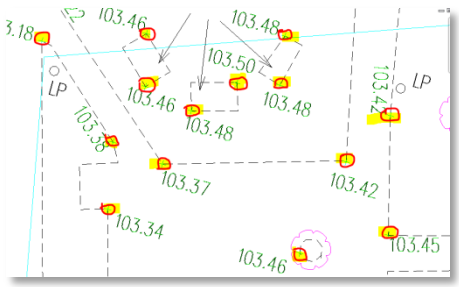
      Place Point: Place the points one by one using **Place Point** tool highlighted in the image on the right. Before placing each point specify the **Elevation** of the point in the option panel.





      Go to **Modify | Edit Surface** tab → **Tools** panel and click **Place Point**

      Select **Absolute Elevation** in the option panel. It is the project datum 0.0, which is equal to the **Elevation** of the **Project Base Point** set in the chapter “Getting Started” as **104.00 m.** It is also called shared co-ordinates.



      Set the **Elevation** in the option panel. e.g. The value for the point relative to the project datum, marked with a Z value of 103.37 m is 630mm.

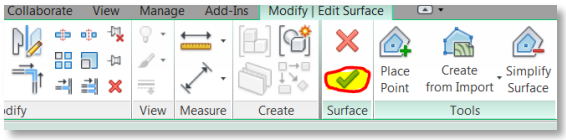
      104.00m - 103.37m = 0.63m
      0.63m = 630mm

      Place the point. Repeat the steps for the rest of the points.

Chapter 4 – Architecture

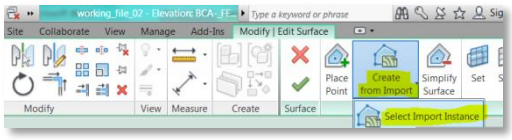
Set the visual style as wireframe to see the points below the toposurface.

Click **Finish Surface**.

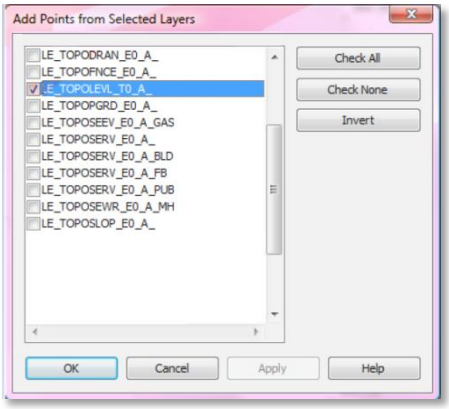


Create from Import: This option can be used if the points in the Surveyor's topography file have **Z** values.

Go to **Modify | Edit Surface** tab → **Tools** panel and click **Select Import Instance**.

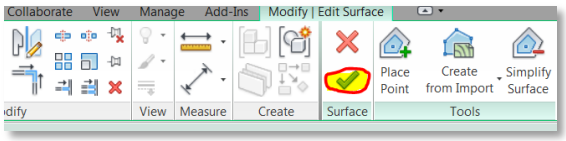


Select the imported topography drawing that contains the 3D contour data. The **Add Points from Selected Layers** dialog appears. Select the layer of the topography points specified by the Surveyor.

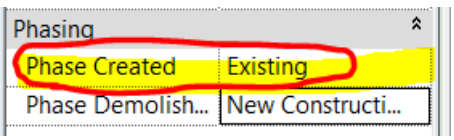


Revit Architecture analyses the imported 3D data and generates a toposurface based on the elevation of the points placed along the contour.

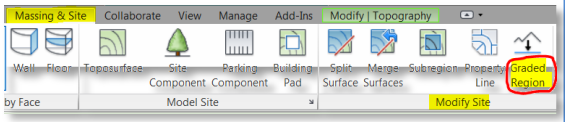
Click **Finish Surface**.



f. Select the toposurface completed in the previous step and set the parameter **Phase Created** as **Existing**.

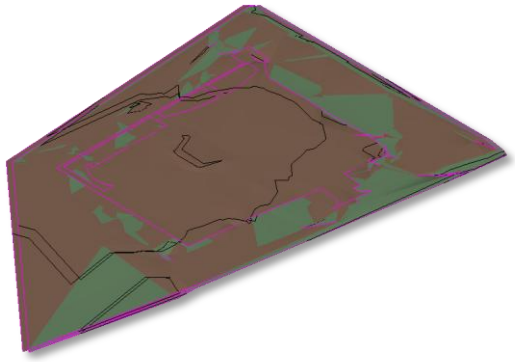


g. Go to **Massing & Site tab → Modify Site** panel and click **Graded Region**. **Edit Graded Region** dialog box appears**.**



In the dialog box, choose **Create a new toposurface exactly like the existing one**, if the change in the toposurface is minor. Otherwise, choose **Create a new toposurface based on the perimeter points only**.

Select the toposurface created in **step e**.

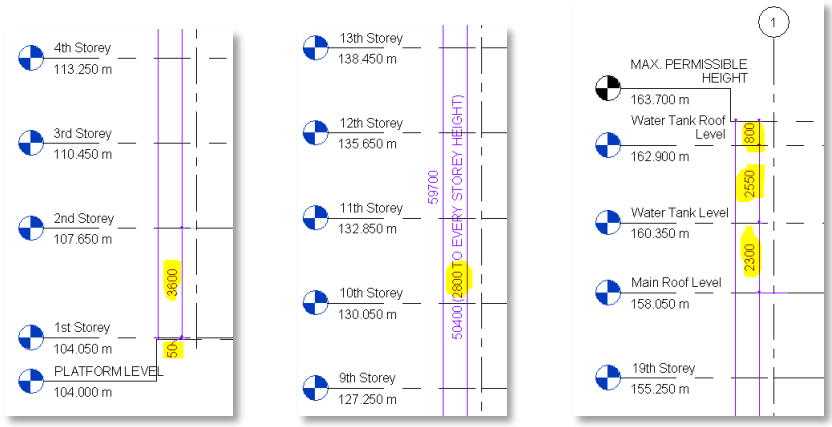


Modify the toposurface by adding new points, deleting points and changing elevations to the points.

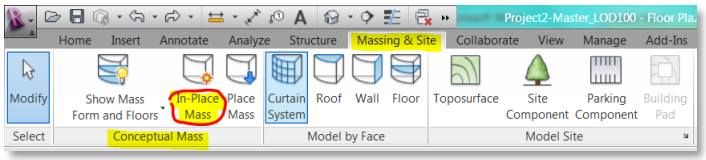
Click **Finish Surface**.

3. The **massing model** can be created by following the steps below.
   a. Open any one of the elevations and set the number of levels and floor to floor height as based on the design.

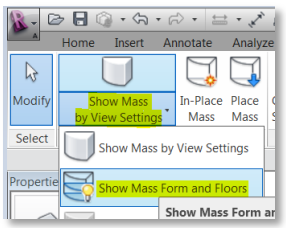
      e.g. 1st Storey level is 50mm higher from the platform,
      1st Storey to 2nd Storey is 3600mm,
      Typical Storey(s) height is 2800mm,
      Main Roof Level to Water Tank Level is 2300mm,
      Water Tank Level to Water Tank Roof Level is 2550mm and
      Water Tank Roof Level to the Max Permissible Height is 800mm.



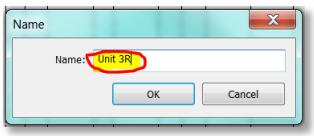
   b. It is recommended to prepare the massing model with the **In-Place Mass** tool individually for each unit and common area. This allows the floor area to be extracted for individual units, which can be checked against the requirement.



   c. Open the 2nd Storey Plan view as the residential units start from the 2nd Storey.

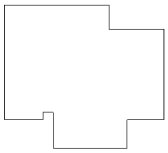


   d. Activate the visibility of the **Mass Form and Floors** from **Massing & Site** tab → **Conceptual Mass** panel → **Show Mass Form and Floors**.
   e. Click In-Place Mass in **Massing & Site** tab → **Conceptual Mass** panel.

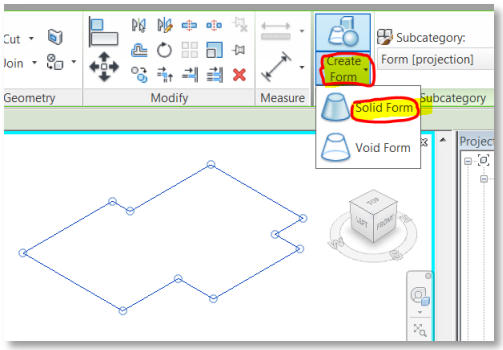


   f. Give a Name unique for the Unit type. e.g. **Unit 3R**.

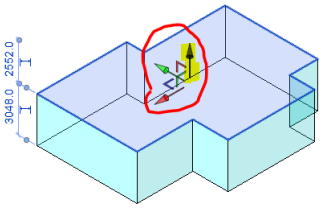
      Revit enters sketch mode
      Use the **Sketch Tools** available to create the Mass.

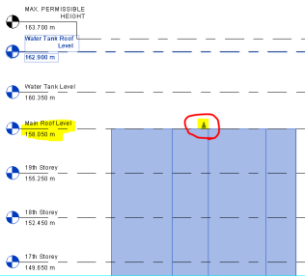


g. Draw the foot print of the unit as per the design requirement.



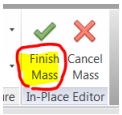
h. Switch to the 3D view window, select the sketch lines just drawn and click Solid Form from **Modify | Lines** tab → **Form** panel → **Create Form**. This will create an extrusion from the selected lines.





i. Select the top surface of the solid just created. The surface can be pulled up by holding the handle highlighted in the image on the left. It is recommended to do this step from the elevation view so that we can adjust exactly to the height we need.

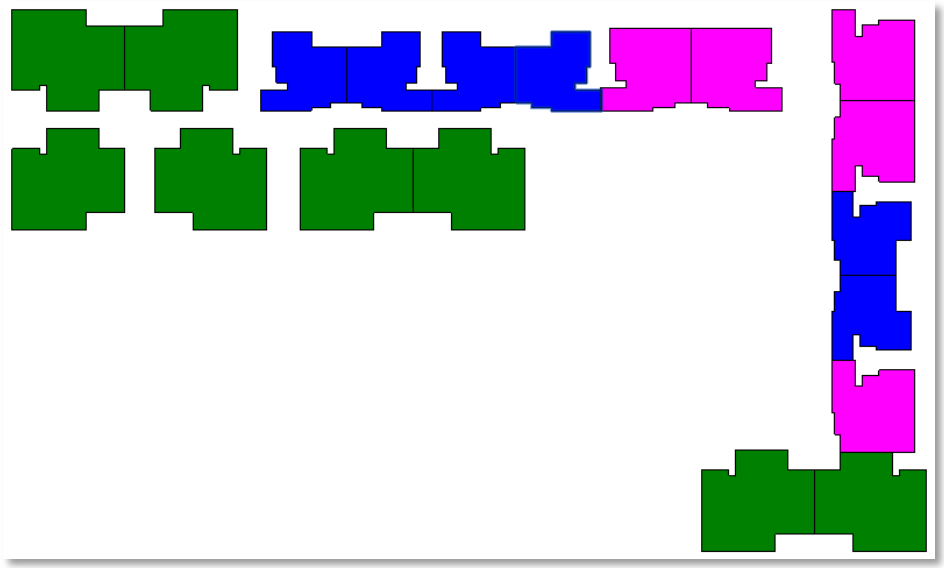
Click Finish Mass and switch to one of the elevations.



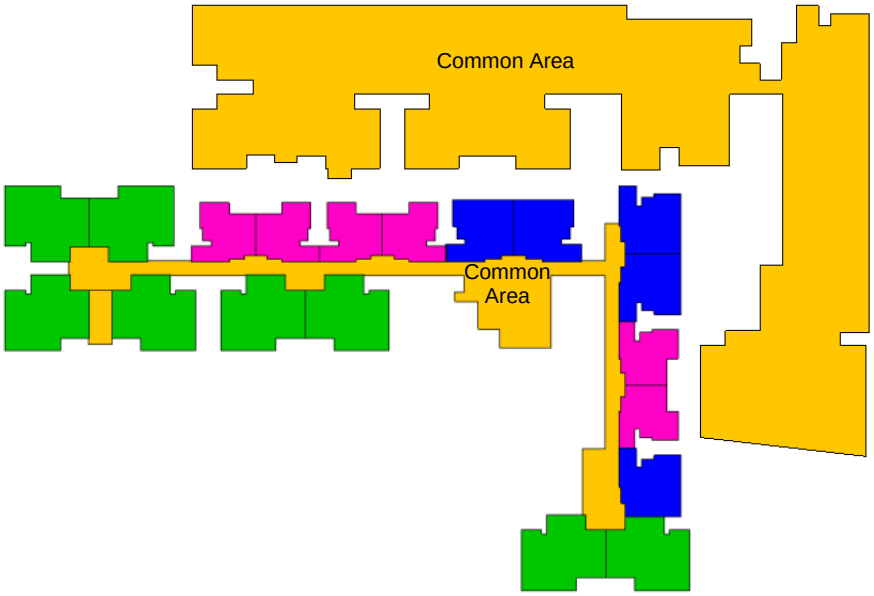
Extend the extrusion up to the Main Roof Level by holding the handle.

j. Repeat the steps **e** to **i** for the rest of the unit types.

k. Arrange the units as per the design option.



l. Similarly create In-Place Mass for the common area. The common area consists of all the rooms for services, ducts, stairs, lifts, refuse bin centre and access balcony that connects the units with the rest of the areas in the building. The foot-print of the common area starts from the 1st Storey (including the area below the residential units). It will be different from the 2nd Storey and Typical Storey. There will be a minimum 3 solid forms in the mass created for the common area.



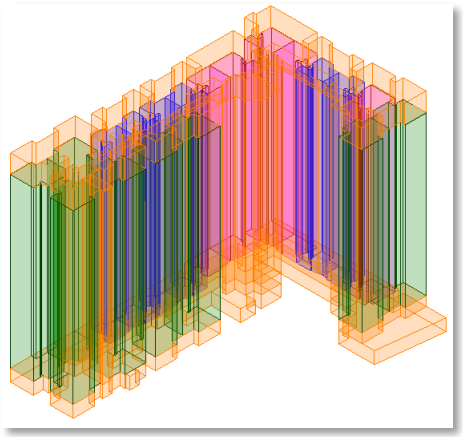
m. Next create Mass Floors to extract floor area/mass.

Select the Mass objects one by one.

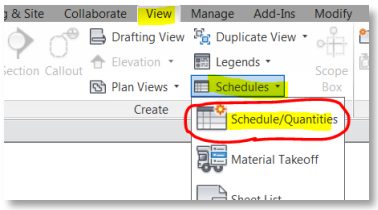
Click on **Modify | Mass** tab → **Mass Floors**

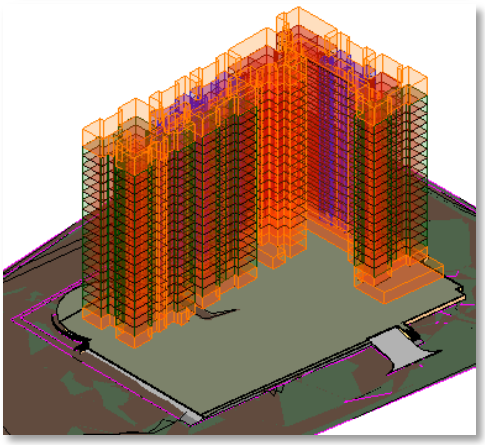
Select all the **Levels** shown in the dialog box.

Click “OK” to complete the Mass floor.

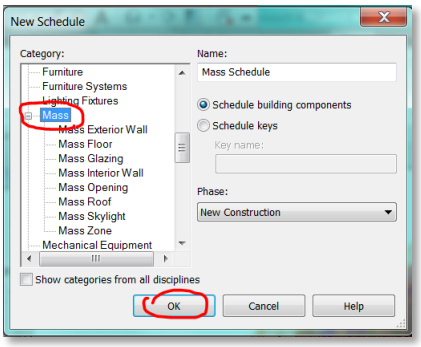


n. Create a schedule for the Mass Floor from the View tab

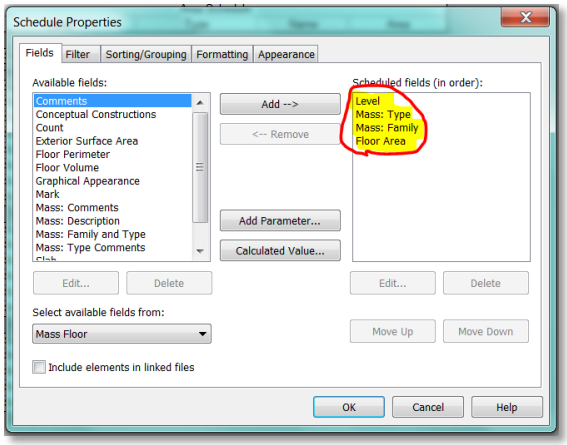




o. Select Mass in the **New Schedule** dialog box that just appeared.



p. Add the fields highlighted in the image on the right. Do the necessary settings in the Filter and Formatting tabs and click **OK** to see the schedule similar to the one shown below.



Area Schedule

Level	Type	Name	Area
4th Storey	Common Area	Common Area	307.80 m²
Common Area			307.80 m²
4th Storey	Unit 3R	Unit 3R_1	70.21 m²
4th Storey	Unit 3R	Unit 3R_2	70.21 m²
4th Storey	Unit 3R	Unit 3R_3	70.21 m²
4th Storey	Unit 3R	Unit 3R_4	70.21 m²
4th Storey	Unit 3R	Unit 3R_5	70.21 m²
4th Storey	Unit 3R	Unit 3R_6	70.21 m²
4th Storey	Unit 3R	Unit 3R_7	69.31 m²
4th Storey	Unit 3R	Unit 3R_8	70.21 m²
Unit 3R			560.79 m²
4th Storey	Unit SA T1	Unit SA T1_1	38.57 m²
4th Storey	Unit SA T1	Unit SA T1_2	38.39 m²
4th Storey	Unit SA T1	Unit SA T1_3	38.39 m²
4th Storey	Unit SA T1	Unit SA T1_4	38.57 m²
4th Storey	Unit SA T1	Unit SA T1_5	38.39 m²
4th Storey	Unit SA T1	Unit SA T1_6	38.39 m²
Unit SA T1			230.70 m²
4th Storey	Unit SA T2	Unit SA T2_1	48.33 m²
4th Storey	Unit SA T2	Unit SA T2_2	48.13 m²
4th Storey	Unit SA T2	Unit SA T2_3	48.61 m²
4th Storey	Unit SA T2	Unit SA T2_4	48.13 m²
4th Storey	Unit SA T2	Unit SA T2_5	48.33 m²
Unit SA T2			241.54 m²

4. The two key components for the conceptual design using BIM have been explained in the previous two points. Prepare the rest of the contents as per the design requirements. Grids, Annotations and Sheets can be used to complete the task.

5. Once a design option is selected, archive the contents and move on to the **Preliminary Design** stage. Use the contents of the selected design option as a base for the preliminary stage.

Chapter 4 – Architecture

4.2 Preliminary Design

1. Preliminary design is the second stage in the process. In this stage the selected conceptual design option will be further developed into a proper BIM model using BIM elements like Wall, Column, Slab, Door, Window and other objects. Refer to **Appendix A** for list of BIM elements that need to be modelled. Implement the modelling plan discussed earlier in this document.
   a. Create link files for floors. e.g. Site, 1st Storey, 2nd Storey, Typical Storey and Roof.
   b. Create typical units as groups inside the link files.
   c. Create a Master File and set-up the necessary views for each block.
   d. Create an overall Master File that links all the blocks together into the site.

2. Refer to **Appendix B** for the steps on how to convert CAD drawings to BIM model when Option 2 (using non-BIM tools) is selected in Conceptual Design.

   Deliverables:
   a. Architectural BIM model for design coordination with Structural and M&E Engineers.

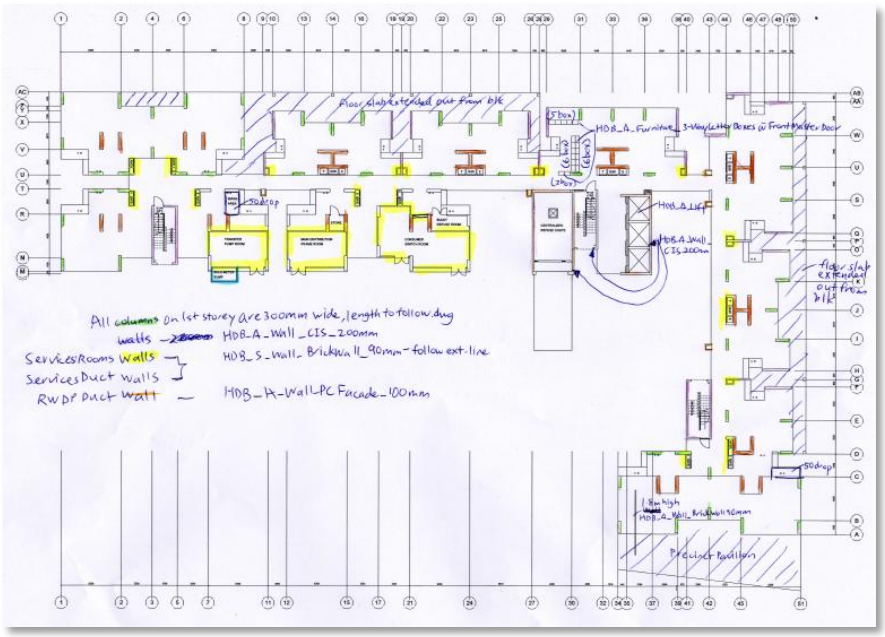
   b. Architectural BIM model for URA Submission

   Please refer to Architectural BIM e-Submission guides for Specific Requirements of the Agencies

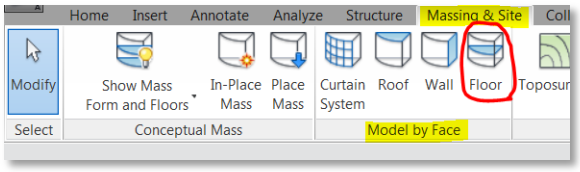
3. This chapter explains the steps on how to develop the Preliminary Design Model(s) from the **Mass Model** created in Conceptual Design (Option 1).
   a. The **Site Model** created in the Conceptual Design can be used as it is.

   b. The 1st Storey Model can be created by first duplicating the Mass Model project file.

   c. Choose the families and types to be used for the Floor, Column, Wall, Door, Window, CRC, Stairs and Lifts. If the families are not available then they will have to be created. Elements can be placed with approximate sizes and at approximate locations as there may not be enough information at this stage.

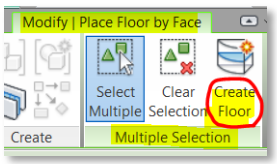


d. Convert the Mass floor of 1st Storey to Slab. Go to **Massing & Site** → **Model by Face** and click **Floor**.



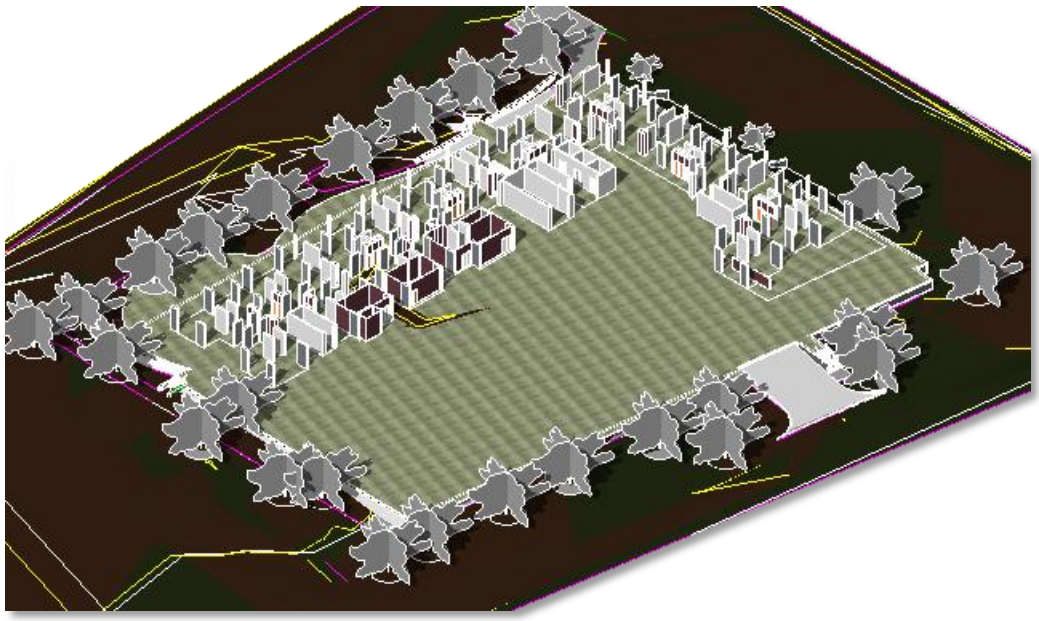
Select the **Floor type** from the type selector.

Pick the mass floor of the 1st Storey and click create floor in **Modify | Place Floor by Face** tab. This will create the Slab for the entire floor. Create openings and fill with separate slabs for areas with level difference. Ex. **Bath**.

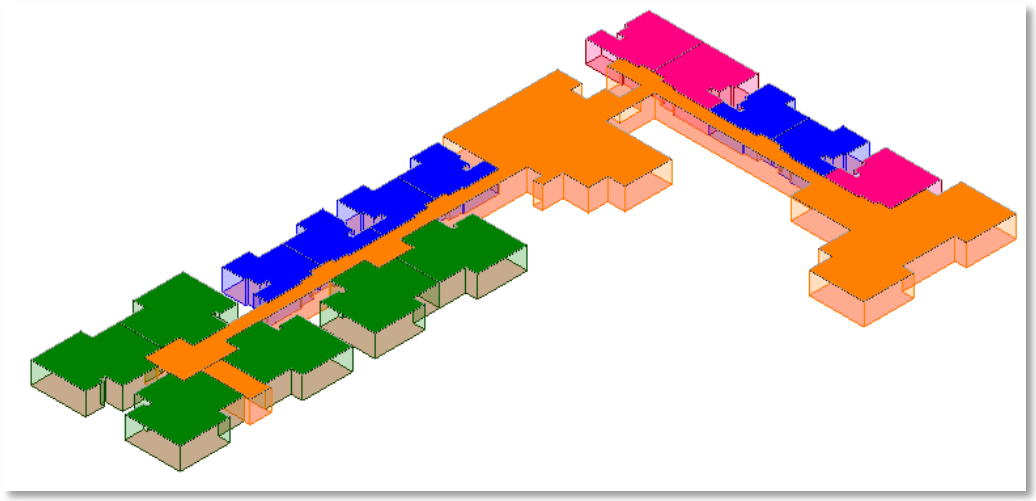


e. Model the Columns, Walls, Doors and Windows. Add rooms like Pump Room, MDF Room, Bulky Refuse Room, Consumer Switch Room, Store, Refuse Bin Centre, Lift/Lift Lobby and Stairs. **Home** Tab → **Room & Area** Panel → **Room**

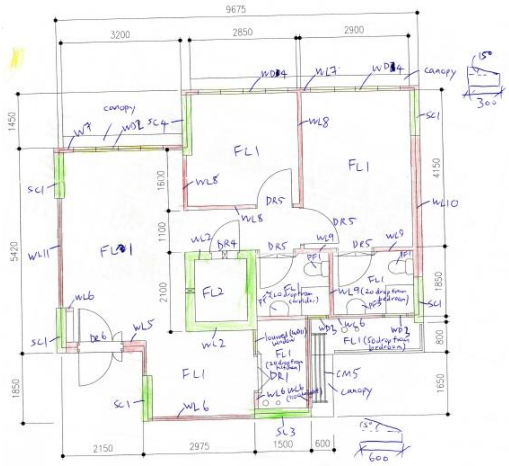
f. Duplicate the Project Base File to create a **Master File**. Link the **Site Model** and the **1st Storey Model**.



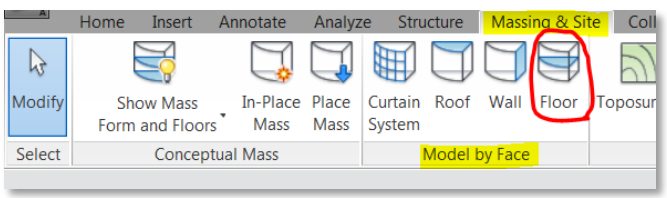
g. The **2nd Storey Model** can be created by duplicating the Mass Model project file. Edit the Mass Model, reduce the extrusion height of the 3rd Storey as shown below. Preserve Level 2 and Level 3 and remove the rest of the levels. This is to avoid confusion when the model is linked to the Master File.



h. Choose the families and types for the Slab, Column, Wall, Door, Window, CRC, Stairs and Lifts. If these families are not available, they will have to be created. Elements can be placed with approximate sizes and at approximate locations as there may not be enough information at this stage.

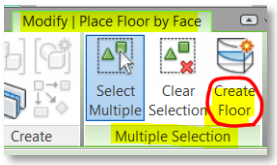


i. Convert the Mass floor of typical unit mass to Slab. Go to **Massing & Site → Model by Face** and click **Floor**.

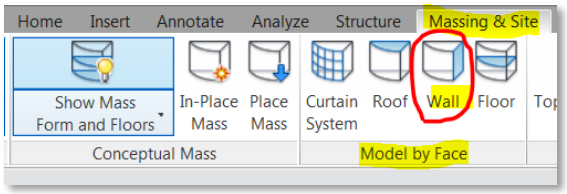


Select the **Floor type** from the type selector.

Pick the mass floor of the typical unit and click create floor in **Modify | Place Floor by Face** tab. This will create the Slab for the entire unit.



j. Convert the external face(s) of the typical unit mass to Wall(s). Go to **Massing & Site** → **Model by Face** and click **Wall**.



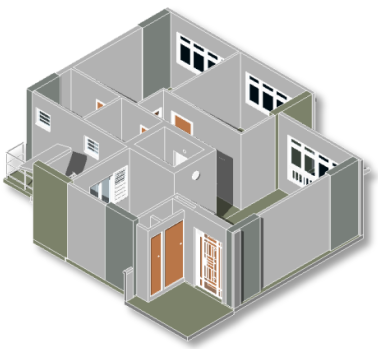
Select the **Wall type** from the type selector and **Location Line** from the Option panel.

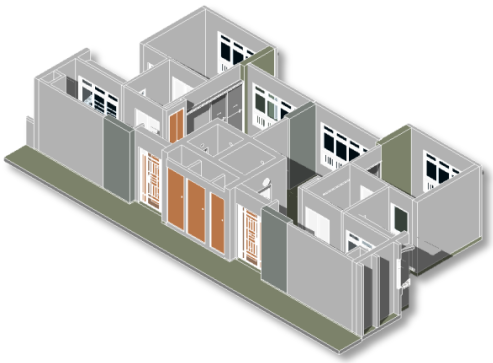


Pick the desired vertical face of the typical unit mass. This will create the wall attached to that face. These walls will form the External facade and common walls of the unit.

k. Model columns and walls to create the unit layout. Place doors, windows and other objects necessary at this stage. Create different slabs for areas with differences in levels (e.g. Bath/WC) or thickness (e.g. Household Shelters).

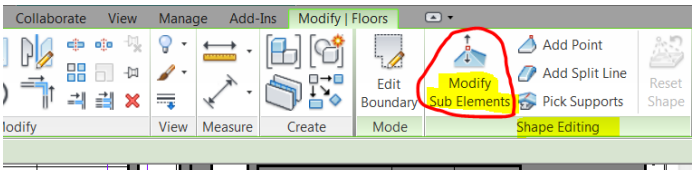
l. Select the unit and make it as a group. Repeat this for the rest of the typical units. These units can be un-grouped when the unit design is confirmed to reduce the file size.



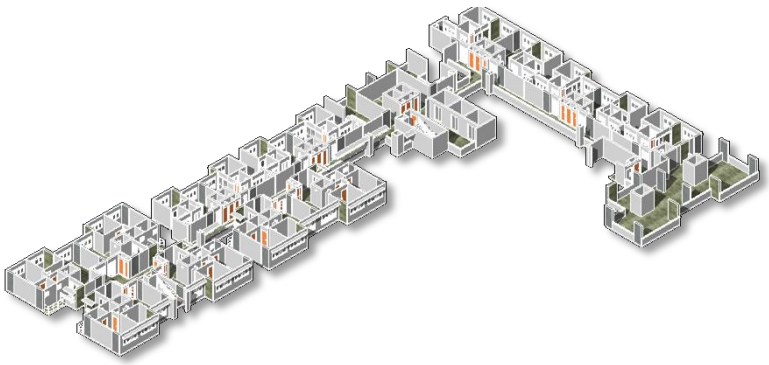


m. Place the Units (Groups) in the plan, add the rest of the Slabs, Columns, and Walls in the common area and complete the 2nd Storey Model. Link to the Master File created in **step 3.d**.

Create Ramps at required areas (e.g. Entrance to the Units, Entrance to the Bath/WC etc)
This can be done by editing the slab. Select the Slab, Go to **Modify | Floors** tab → **Shape Editing** Panel and Click on **Modify Sub Elements**. Click on the node that need to be changed in the slab profile and set the elevation as required.



Doors of the service ducts should be 100mm above the finished floor level of the Access Balcony. Set the Sill Height parameter of the doors to 50mm as the floor level of the Access Balcony is already -50mm.



n. Duplicate the 2nd Storey Model file to create the **Typical Storey Model**. Move the contents of the duplicated model to the 3rd Storey (**BCA-_FP_3rd Storey** Plan View). Make the necessary changes to the layout and Link to the Master File created in **step 3.d**. Copy the link to the rest of the Typical Floors, by **Copy to Clipboard** and **Paste Aligned to Selected Levels**, until the level below the top most Residential Level.

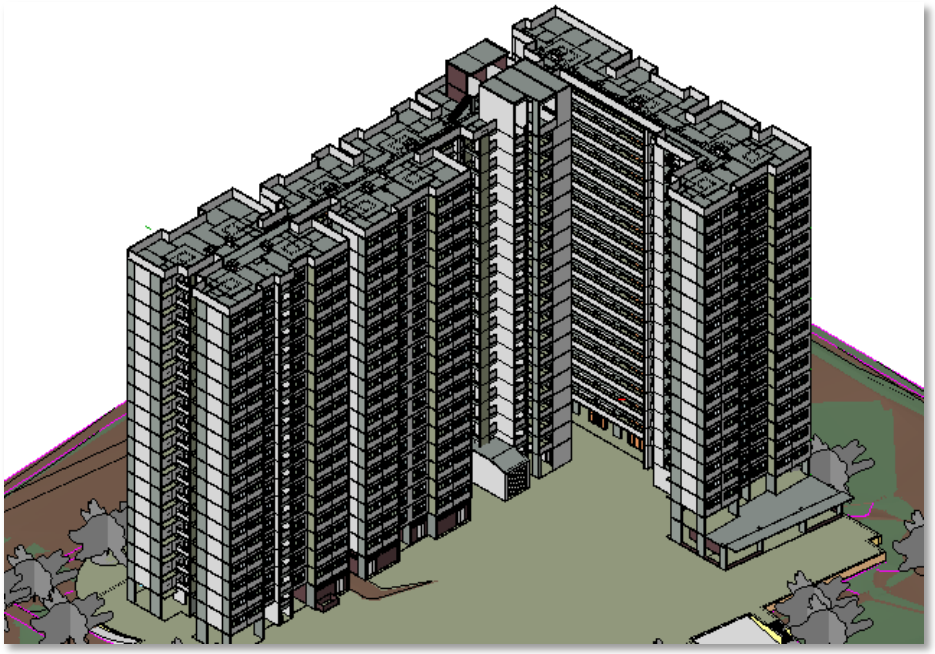
o. Duplicate the Typical Storey Model and create the **Roof Model** that contains the top most **Residential Level**, **Main Roof Level** and **Water Tank Level**. Some key items to be modeled:

- Water Tanks,
- Access Platforms,
- Lift Motor Rooms,
- Slab thickening for House Hold Shelter and
- Vents for the service duct coming from the units.

Complete the Roof Model and link to the Master File created in **step 3.d**.

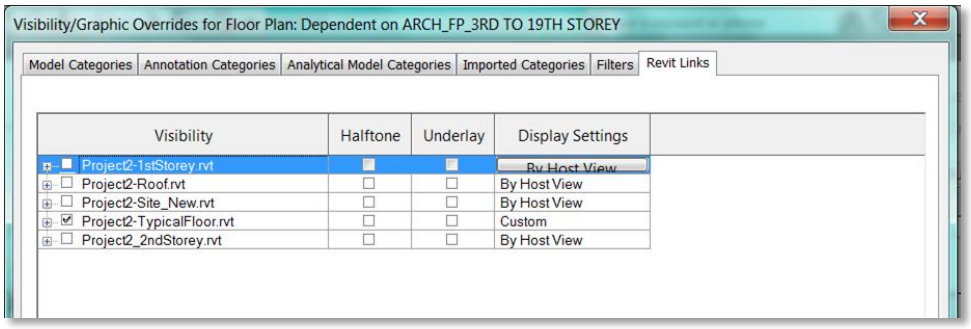
p. Add the basic dimensions in the Master File, clean up the Plans and Elevations. As part of the documentation prepare the 1:100 scale Plan, Elevations and Sections. The model is ready for the next stage.

Note:
The model at this stage should be sufficient for URA submission. Please refer to Architectural BIM e-Submission Guideline for detail requirements.



Note:
A clean-up is required for the links. In the clean-up, user need to hide the Grids and Levels that comes from the link files and reveal the visibility of correct floors in the levels. E.g. Display only the 1st Storey model and hide the rest of the links in the 1st Storey plan view.

All these can be done in the **Visibility/Graphics → Revit Link** Panel. Type **VG** to activate the **Visibility/Graphics** dialog box.



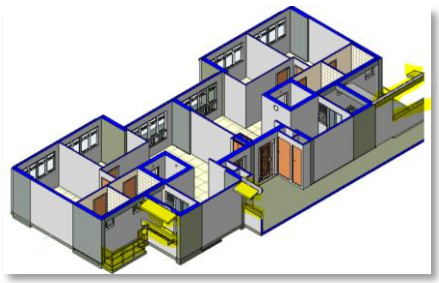
4. **Share the Preliminary Design model with the Engineers to prepare their part of the model.**

Chapter 4 – Architecture

4.3 Detailed Design

1. Detailed Design is the third stage in the process. In this stage the Preliminary Design model will be further developed with more accurate BIM elements based on the feedback from the other disciplines and Technical Departments. Additional BIM elements need to be added to complete the model as well. Refer to **Appendix A** for list of BIM elements that need to be modeled.

   Examples of the additional elements were given below and highlighted on the model (right)

   - Railing for Aircon ledge,
   - Clothes Drying Racks
   - Canopies with the connecting Beam,
   - Railing on the parapet walls and
   - Handrail along the Access Balcony

   Deliverables:

   a. Architectural BIM model for Tender with drawings highlighted in the next section.

   b. Architectural BIM model for Regulatory Approvals
   Please refer to Architectural BIM e-Submission guides for Specific Requirements of the Agencies

2D information can be used to complement the BIM model to improve the detail of the model. e.g. Hatch patterns can be used to represent the Tile Finishes either in the 2D views or as part of the material.

The following are usually additional documentation to be done in this stage:
1:50 scale Layout Plans and Sections of key areas like the Typical Unit, Lift Lobby and Central Refuse Chute.

1:50 scale Finishes Plans and Sections for the Typical Unit, Lift Lobby, Central Refuse Chute, Bath and Kitchen.

1:50 scale Ceiling Plan for the Lift Lobby if required by the design specification.

Note:
It is not necessary to produce the entire set of documentation from the BIM model. 2D detail drawings (e.g. extrusion of window frame) could be used to supplement the drawings from the BIM model.

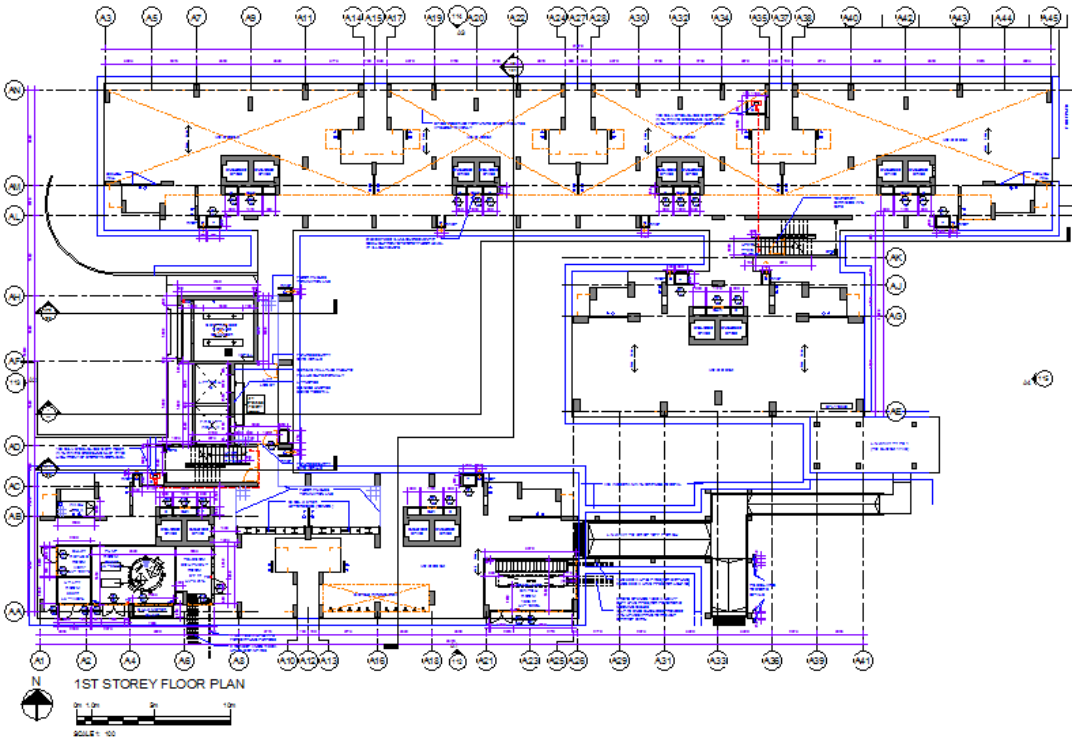
2. The following are some of the drawings to be produced from the model in the **Detailed Design** stage:

Drawings	Scale
1. LAYOUT & KEY PLAN	1:500
2. 1ST STOREY FLOOR PLAN	1:100
3. 2ND STOREY FLOOR PLAN	1:100
4. TYPICAL FLOOR PLAN	1:100
5. MAIN ROOF PLAN	1:100
6. FLOOR PLAN OF WATER TANK & PUMP ROOM	1:100
7. ROOF PLAN OF LIFT WELL & STAIRCASE	1:100
8. ELEVATIONS	1:100
9. SECTIONS	1:100
10. TYPICAL UNIT PLANS	1:50
11. PLANS OF LIFT LOBBY & STAIRCASE	1:50
12. TYPICAL UNIT FINISHES LAYOUT	1:50
13. FINISHES LAYOUT OF LIFT LOBBY, CENTRALISED REFUSE CHAMBER & WASH AREA	1:50
14. ELEVATIONS OF KITCHEN & BATH/WC	1:50
15. ELEVATIONS OF LIFT LOBBY, CENTRALISED REFUSE CHAMBER AND REFUSE CHUTE AT WASH AREA	1:50
16. REFLECTED CEILING PLANS OF LIFT LOBBY	1:50
17. TYPICAL PLANS OF HOUSEHOLD SHELTER	1:50
18. SECTIONS OF HOUSEHOLD SHELTER & STOREY SHELTER	1:50

Additional drawings may need to be produced, depending on the requirements of the project.

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3. A sample of a 1st Storey Floor Plan is shown below.

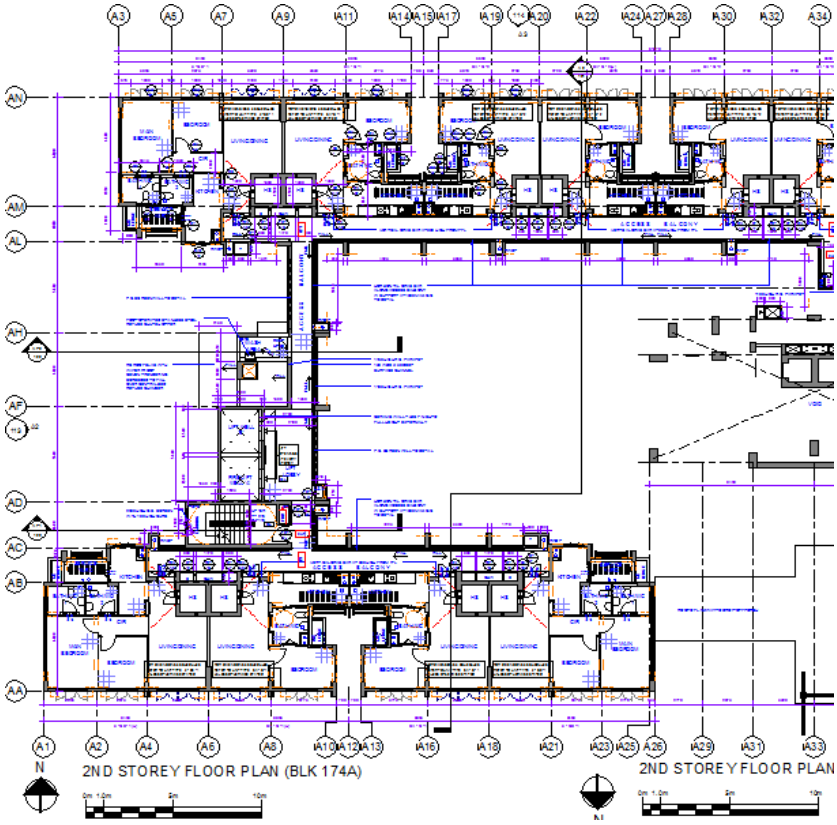


Add the following annotations to the plan view:

- Grid dimensions,
- Setting out for the Room(s),
- Indication of Room Name(s),
- Indication of Finishes and Fall,
- Annotations of Typical Elements,
- Door and Window tags,
- Section line marking,
- Elevation markings and
- Indication of surface drains

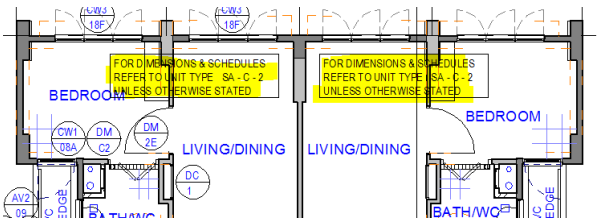
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4. A Sample of a 2nd Storey Plan is shown below. Typical Floor Plan(s) will look similar to this.



Add the following annotations to the plan view:

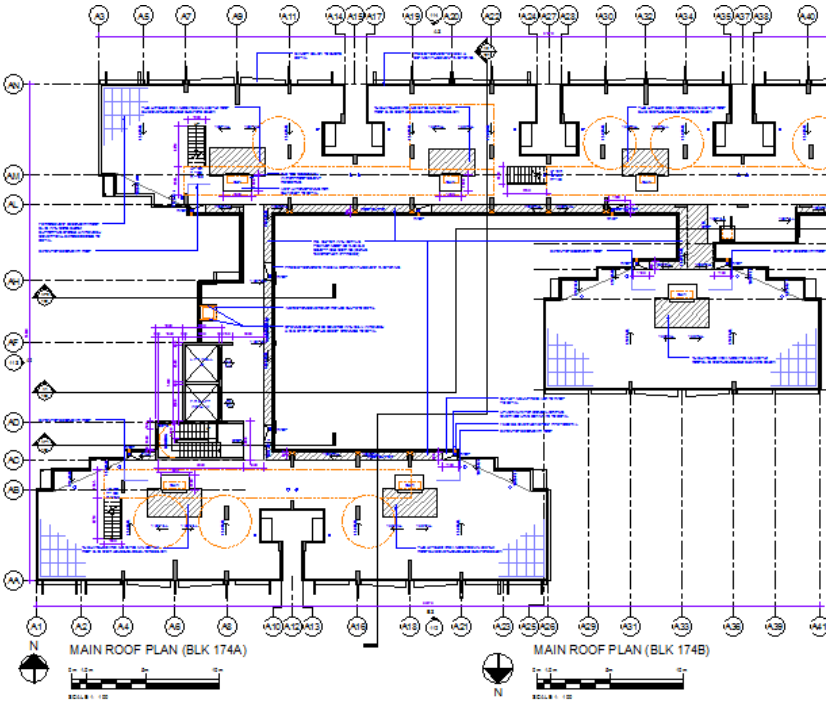
- Grid dimensions,
- Setting out for Typical Unit(s). It is not necessary to repeat the setting out for similar/mirrored units. Indications should be made, referring to the unit that has the setting out.



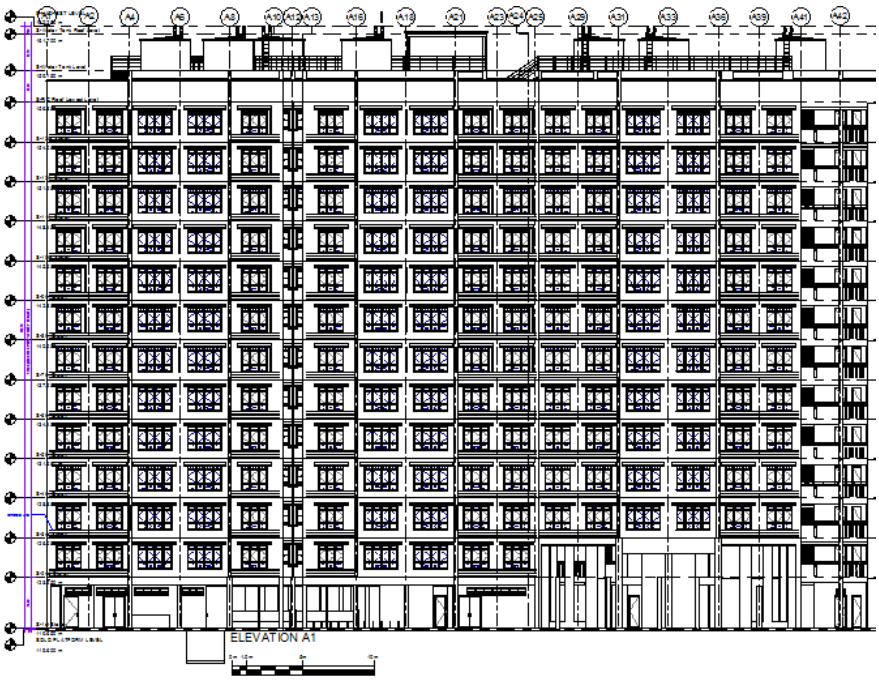
- Setting out for the Common Area
- Indication of Room Name(s),
- Indication of finishes and Fall,
- Annotations of Typical Elements,
- Door and Window tags,
- Section line marking and
- Elevation markings

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5. A sample of a Roof Plan is shown below. (Annotations are similar to the Floor Plans mentioned earlier)



6. A sample of an Elevation is shown below.

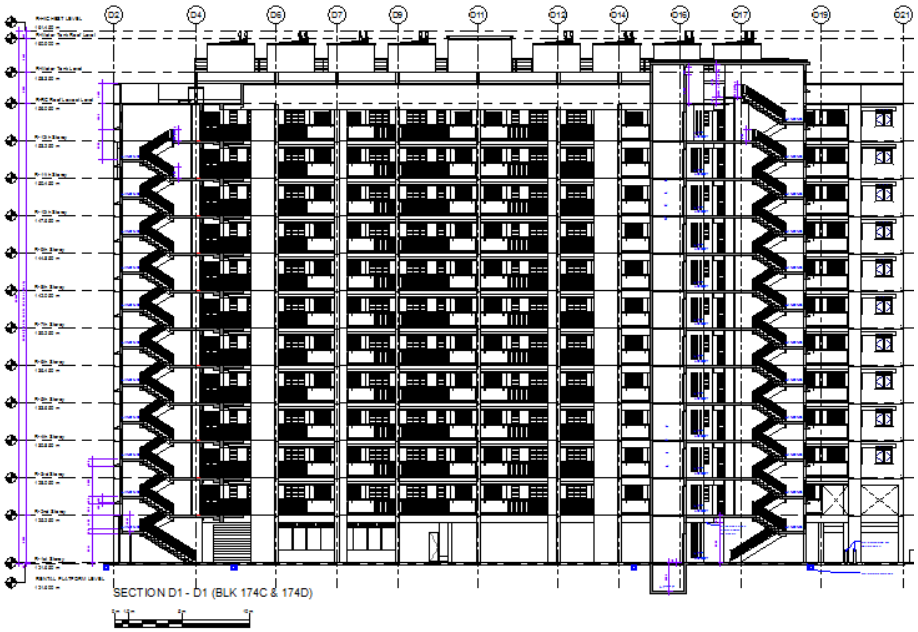


Add the following annotations to the elevation view:

- Grid dimensions,
- Floor to Floor height,
- Indication of levels and
- Annotations of Typical Elements

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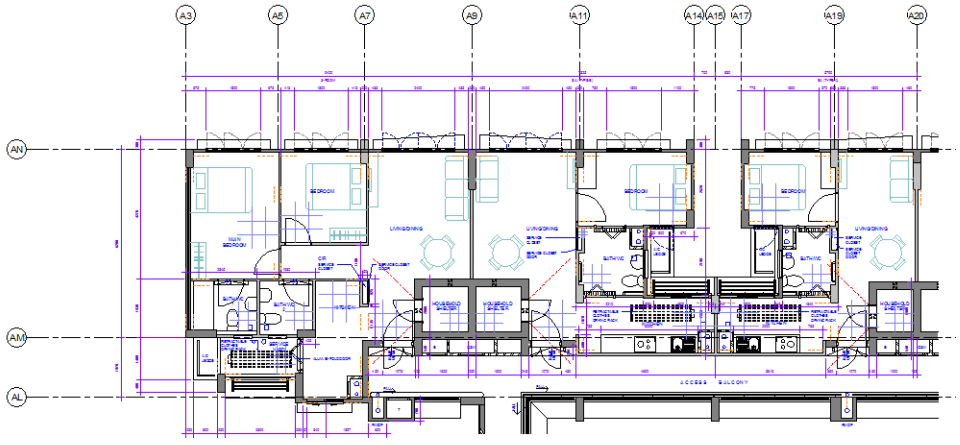
7. A sample of a Section is shown below.



Add the following annotations to the section view:

- Grid dimensions,
- Floor to Floor height,
- Indication of levels
- Height indication of Typical Areas and
- Annotations of Typical Elements

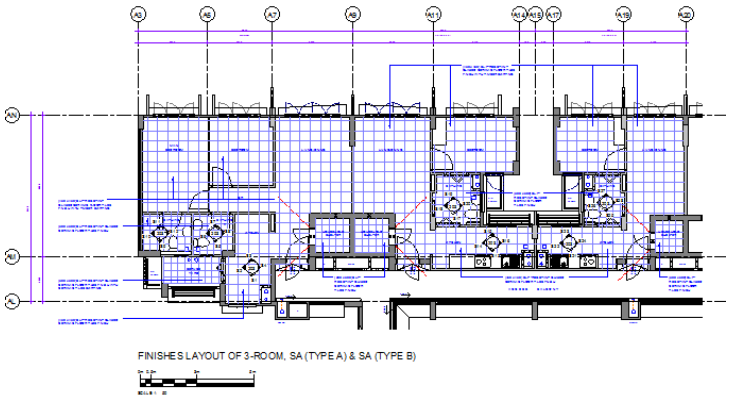
8. A sample of 1:50 a Typical Unit Plan is shown below.



Add the following annotations:

- Grid dimensions,
- Setting out of Room(s),
- Indication of Room Name,
- Indication of finishes,
- Annotations of Typical Elements and
- Indication of Furniture/Fittings

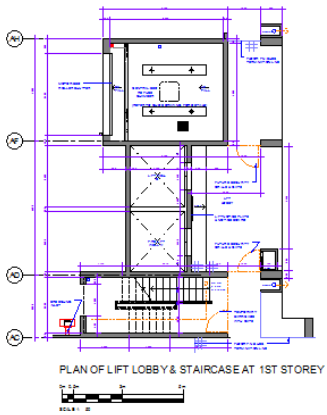
9. A sample of 1:50 a Typical Unit Finishes Layout is shown below.

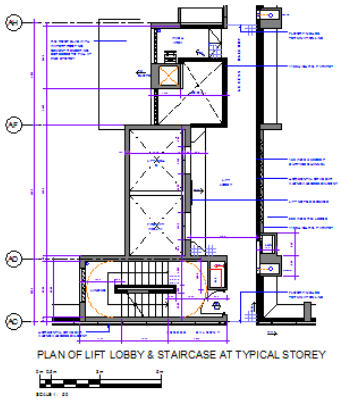


Add the following annotations:

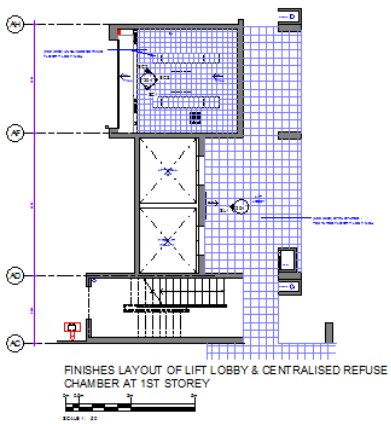
- Indication of the tiles using Fill pattern. Room(s) 300X 300 and Bath/WC 200 X 200.
- Annotate the finishes.

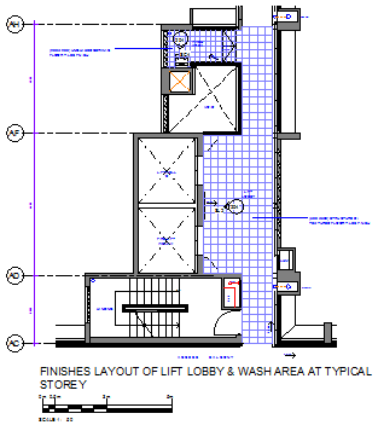
10. Samples of 1:50 drawings (1st Storey and 2nd Storey) of Lift Lobby and Refuse Chute areas are shown below.



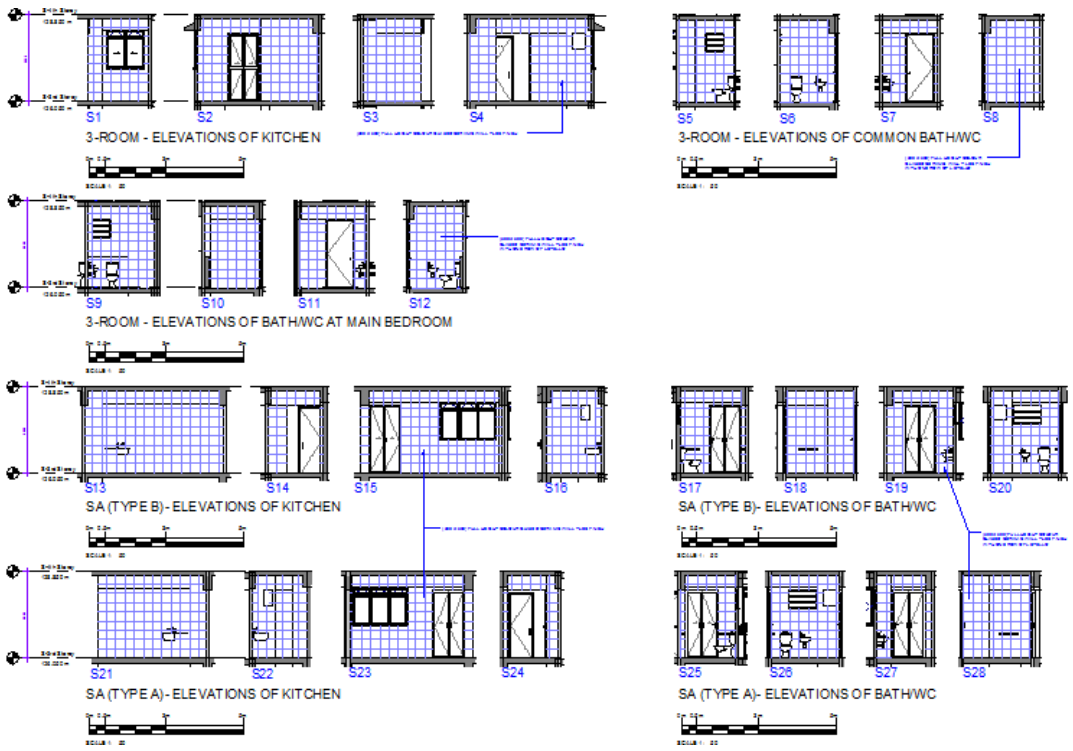


11. Samples of 1:50 Finishes drawings (1st Storey and 2nd Storey) of Lift Lobby and Refuse Chute areas are shown below.

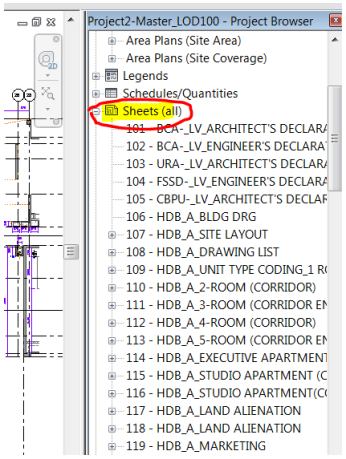


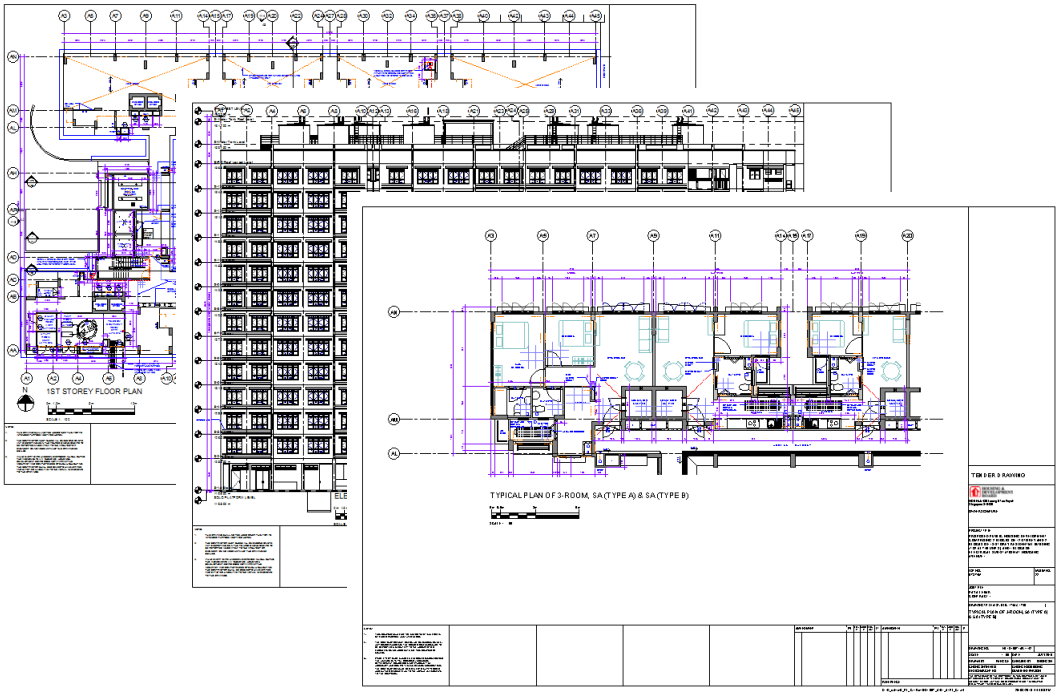


12. Samples of 1:50 Elevations of Kitchen and Bath/WC are shown below.



13. Once the views are ready, create the Sheets, drag the views into the sheets and complete the documentation process.





14. **Publishing Model and Drawings to Non-editable File Format**
Refer to Appendix C of Architectural BIM e-Submission Guideline for step-by-step guide to export/ publish to DWF/PDF for regulatory submission.

Note:
The drawings produced from the BIM model during the Detailed Design stage can form part of the tender documents together with other 2D detail drawings.

Chapter 5
Structural

Chapter 5 - Structural

5.1 Preliminary Design

1. The preliminary Structural BIM Model could be created from the Architectural BIM Model. The Grids, Levels, Slabs, Columns and Structural Walls could be copied from the Architectural Model to create the base Structural Model, while the Beams (Structural Framing) need to be added to complete the Structural BIM Model. Refer to **Appendix A** for list of BIM elements that need to be modeled.

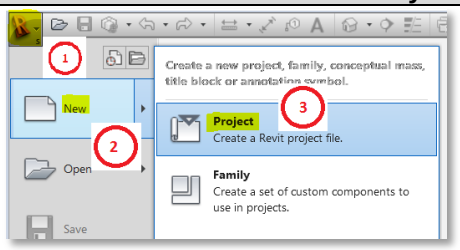
   Note:
   It is not necessary for the elements to be modeled as Precast Elements.

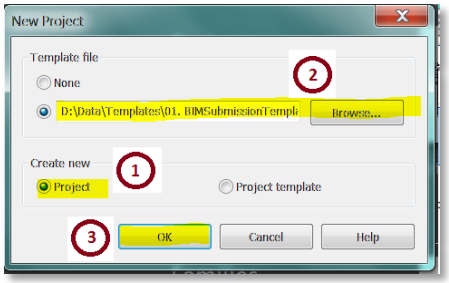
   Deliverables:
   - Structural BIM model for design coordination with the Architect and M&E Engineer.

   The Structural BIM model can be created in the following ways. depending on the Design/Analysis tool to be used:
   a. Using the Structural BIM authoring tool, before being transferred to the Design/Analysis tool to perform Design/Analysis;
   b. Using the Design/Analysis tool, before being transferred back to the Structural BIM authoring tool.

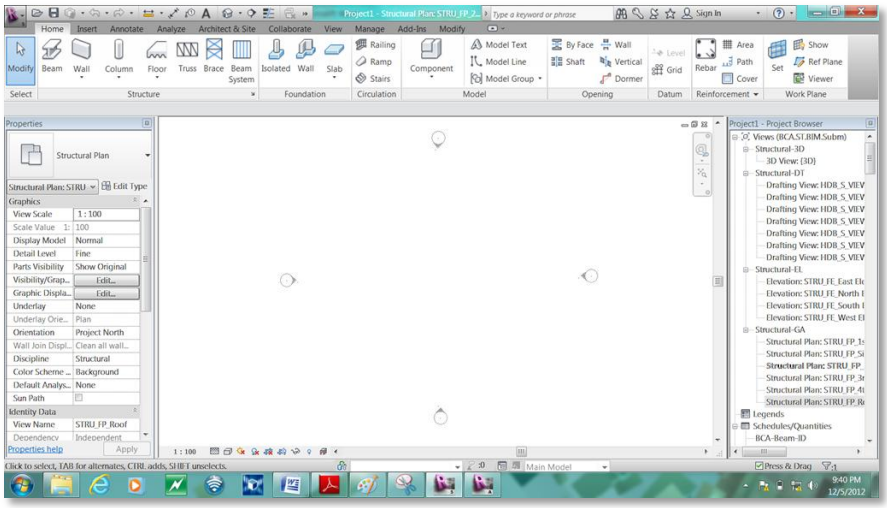
   Note:
   Some of the design analysis tools support the transfer of data bi-directionally.

2. Create a new project from the Project Template.
   a. From the **Application Menu** choose **New → Project**.
   b. In the New Project dialog box choose Project in the Create new section.
   c. Click the Browse... button and locate the template file using the file dialog box.
   d. Click OK to create the new project.

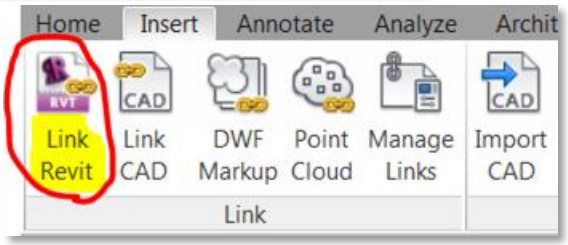




3. The new project created in **step 2** is shown in the image below. Link the Architectural BIM Model and copy the settings and content necessary for the Structural BIM Model.

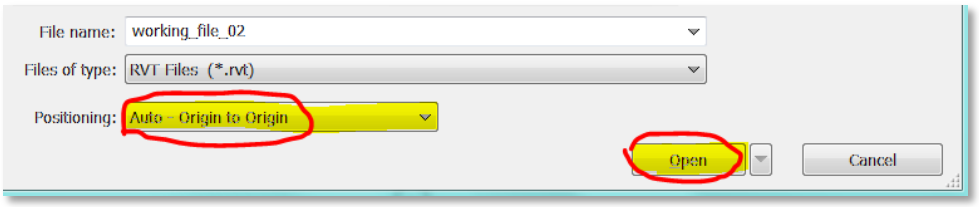


a. From the **Insert Tab** choose **Link Revit.**



Note:
It is good to link the individual storeys one by one rather than the entire block (Master File). This will be helpful later when using the Copy/Monitor tool to copy the Architectural elements.

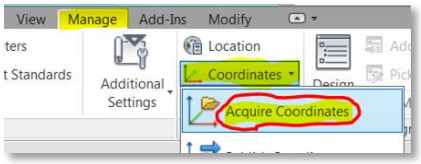
b. Select the Architectural BIM Model using the file dialog box. Choose **Origin to Origin** for the **Positioning** and click **Open**.



c. After the Architectural model is linked, the content may not be visible. It is necessary to **copy settings like Shared Co-ordinates, Levels, Grids and Visibility**.

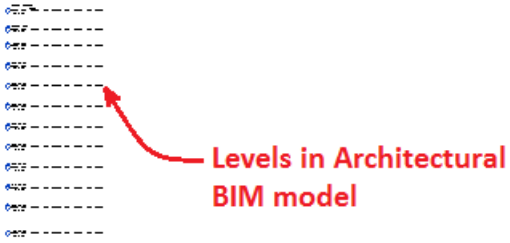
4. **Copying Shared Coordinates, Levels, Grids and Visibility**
   a. Copy the shared co-ordinate settings from the Architectural Model. Switch to one of the **Elevation** and **Zoom extent**. The levels of the Structural BIM Model and Architectural BIM Model may not be in the same place.

b. Go to **Manage** tab → **Project Location** panel → **Coordinates** and choose **Acquire Coordinates**.





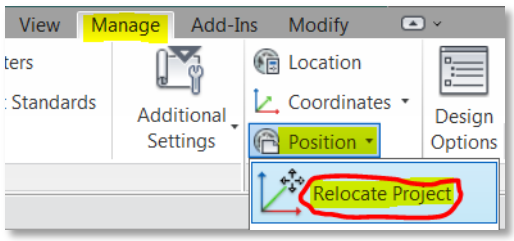
c. Select the Architectural Model link. This will copy the shared coordinates from the link to the project.



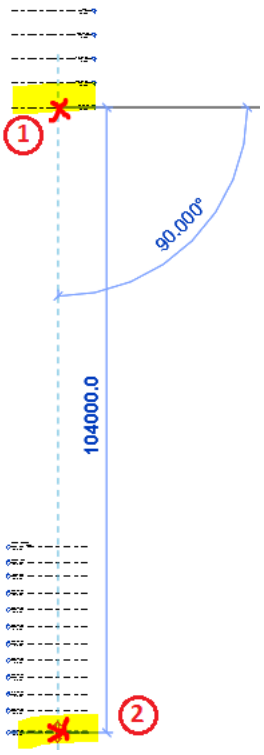
d. Move the project down to match the current 1st Storey to Architectural Model's 1st storey.

e. Go to **Manage** tab → **Project Location** panel → **Position** and choose **Relocate Project**.

Note:
There may be a need to relocate the Project in the plan view as well.



f. Click the base point on the **1st Storey (1)** level and move down to click the new location on the Architectural Model's **1st Storey (2)** level. Now both 1st Storey levels will show the same value. Ex. 104.00mm.
Move the rest of the levels in project to match with levels in the Architectural Model.



Create or delete levels depending on the project requirements.

Create Additional Level for Pile Layout Plan view.

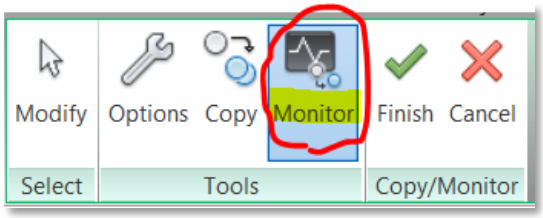
Rename the newly created levels.

Check whether there are plan views for 1st Storey, 2nd Storey, Typical Storey, Main Roof Level, Water Tank Level and Water Tank Roof Level. If it is not there then **Create** plan views (the menu is in **View** tab) for the missing levels and rename them as per the standard.

g. Link/associate the levels to the Architectural BIM model to make sure that changes to the levels in the Architectural BIM model's level are reflected. This can be done using the tool **Copy/Monitor** in the **Collaborate** tab.

> **Note:**
> **This needs to be done in an elevation view.**

Go to **Copy/Monitor** tool and choose **Select Link**. Pick the Architectural model just linked in the previous steps. This will open up a specific tab for **Copy/Monitor**.



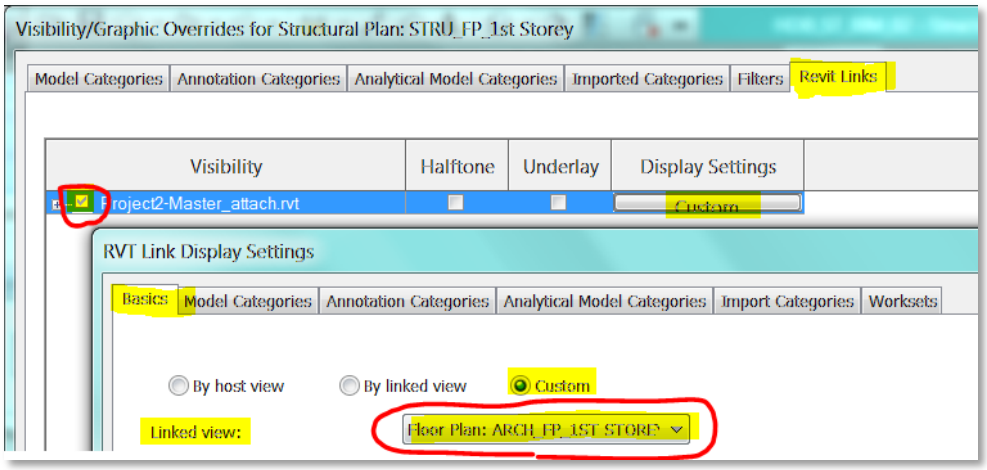
Choose the **Monitor** tool, pick the 1st Storey level and pick the 1st Storey level of the Architectural BIM model. This will link the levels together and a Monitor icon will appear. Repeat this for the rest of the levels and click **Finish**. From now on any changes in the Architectural levels will be highlighted.



h. Copy and monitor the grids from the Architectural Model.

i. Switch to the 1st Storey plan view.

j. To show the corresponding Architectural plan, Right click on the view in the **Project Browser**. Duplicate the view and Type **VG** to activate the Visibility/Graphics dialog box.

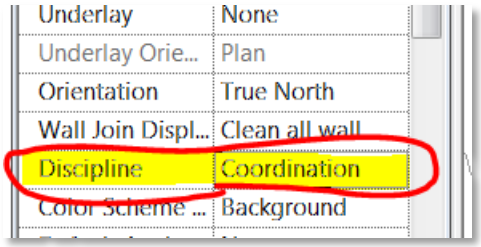


Choose the **Revit Links** tab, make sure the Architectural Model link is selected in the **Visibility**. Click on the **Custom** button under **Display Settings**. This will activate the **RVT Link Display Settings** dialog box.

Choose **Custom** radio button in the **Basics** tab. Choose the corresponding view in the **Linked view** and click **Apply** twice. This will display the correct plan.

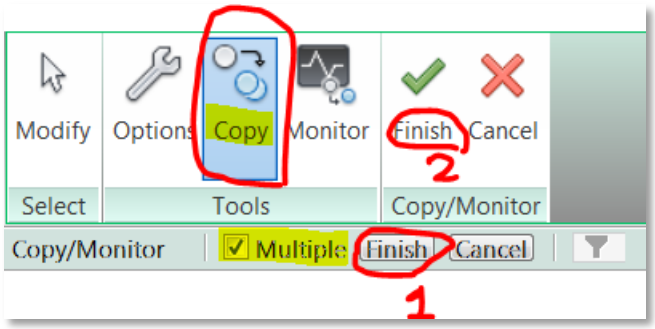
To see all Architectural elements, change the **Discipline** parameter in the **View's**

Properties palette either to **Architecture** or **Coordination**.



Repeat this for the rest of the views.

k. Choose **Copy/Monitor** again. This time choose the **Copy** tool as there are no existing grids in the plan.



Choose **Multiple** in the **options bar**, select all grids, click **Finish(1)** in the options bar and then **Finish(2)** in the **Copy/Monitor** tab.

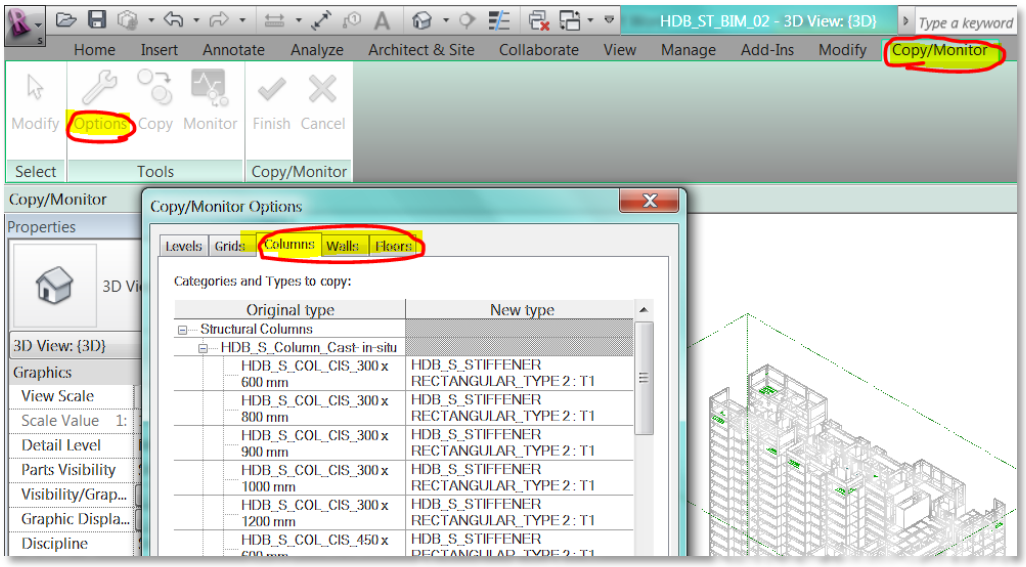
The grids will be created and associated to the Architectural grids and a Monitor icon will appear. From now on any changes in the Architectural grids will be highlighted.

5. Next, copy Structural elements like Slab (Floor), Column and Wall from the Architectural Model.
   a. Switch to 3D view, Duplicate and do the necessary visibility settings for the Coordination view (similar to steps done in the plan view).

   b. Choose Copy/Monitor again, choose the Options in the tab to set the correct family type mapping for Columns, Walls and Floors. The **Original type** refers to the family and type from the Architectural Model, while the **New type** refers to the family and type that is going to be created. If the family is not found, it is recommended to create the family before carrying out this step.

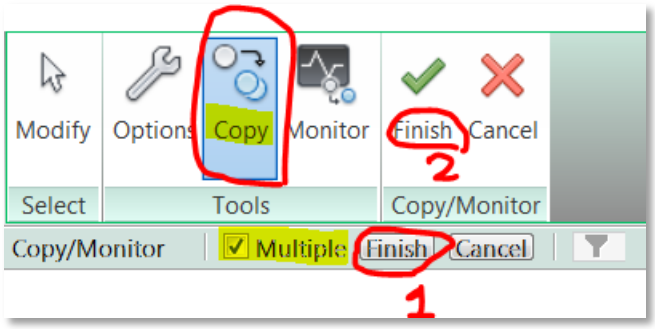
   In the options dialog box there may be an option **Copy Original Type**. This allows the user to create a **New type** from the **Original type**.

> **Note:**
> **If this option is used, there will be some redundant types of families that need to be cleaned up.**



Note:
Choose "Don't Copy This Type" for families/types that are not required in the project.

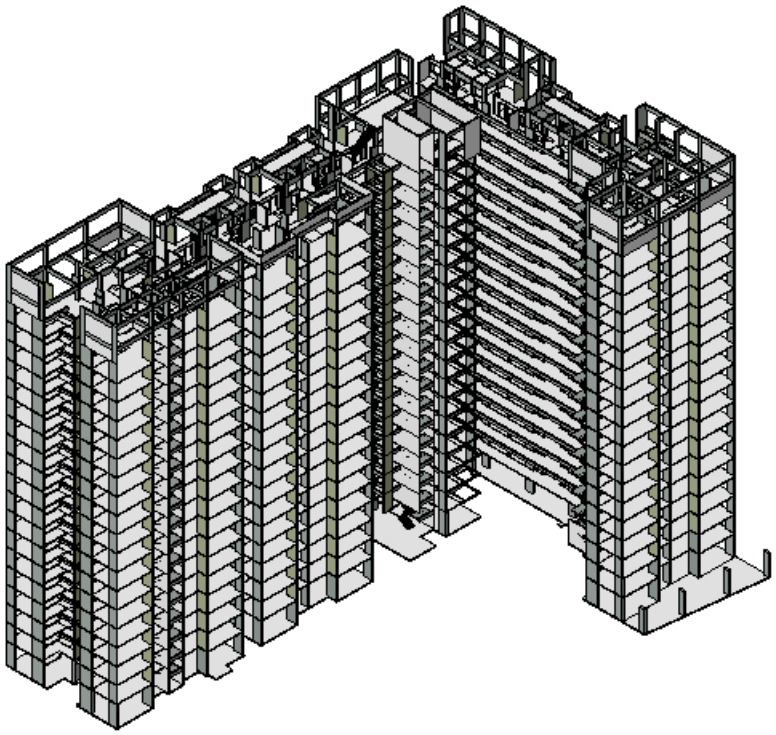
c. After the options are set correctly, Choose the **Copy** tool.

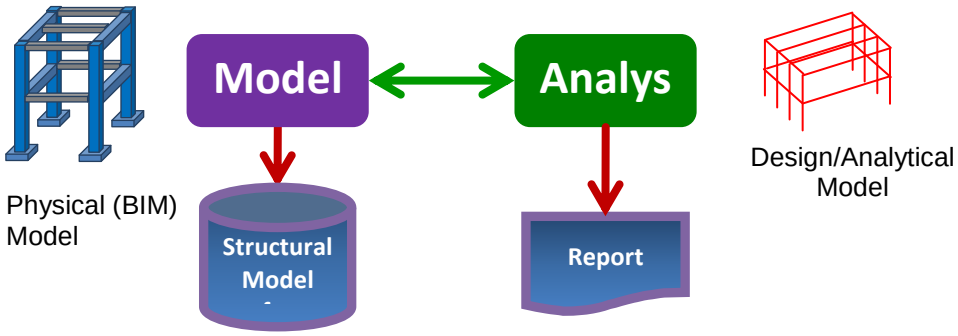


d. Choose **Multiple** in the **Options bar**, and select all the columns, structural walls and slabs in the link. Click **Finish (1)** in the options bar and then **Finish (2)** in the **Copy/Monitor** tab. This will create the equivalent elements and associate them to the Architectural Model.

e. Repeat **Steps 5b to 5d** for the rest of the floors.

f. Add the Beams with approximate size for each floor. After the model is completed it is ready to be exported into Design/Analysis tools.

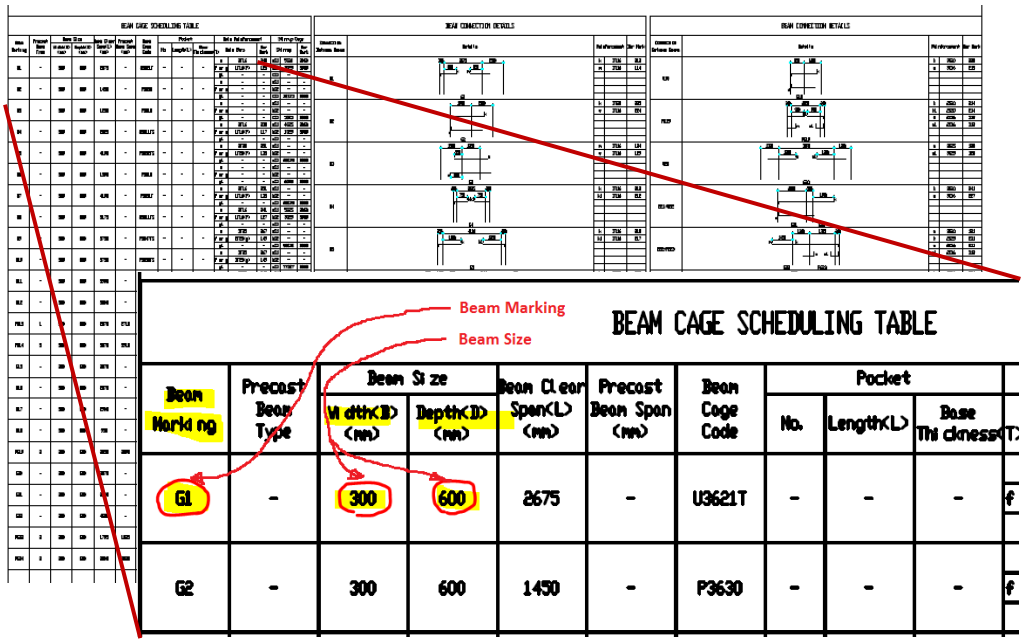




g. Alternatively, use the Design/Analysis tool to determine the size and design of the members, and produce the member detail drawings from the design tool.

h. Update the Structural BIM model with the member sizes and markings generated from the Design/Analysis tool. A sample is shown below.

Chapter 5 - Structural



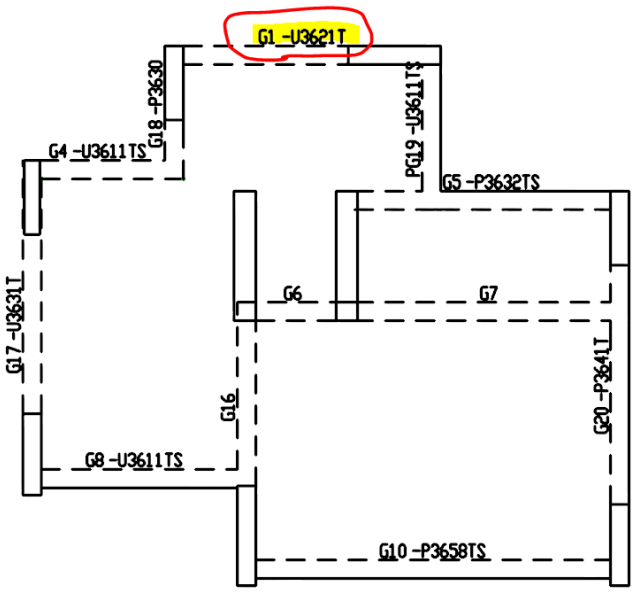
Beam Marking

Beam Size

BEAM CAGE SCHEDULING TABLE

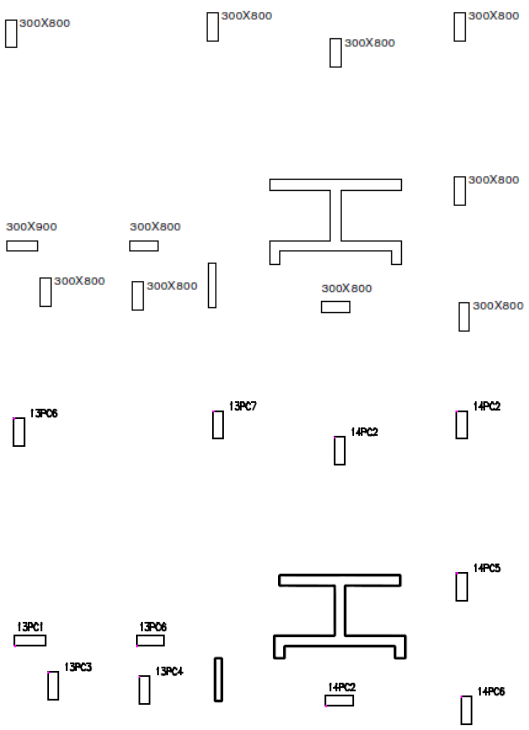
Beam Marking	Precast Beam Type	Beam Size Width(B) (mm)	Beam Size Depth(D) (mm)	Beam Clear Span(L) (mm)	Precast Beam Span (mm)	Beam Cage Code	Pocket No.	Pocket Length(L)	Pocket Base Thickness(T)
G1	-	300	600	2675	-	U3621T	-	-	-
G2	-	300	600	1450	-	P3630	-	-	-

The plans generated from the Design/Analysis tool shows the location of the beam. A part of the plan is shown below.



Chapter 5 - Structural

The Column sizes and markings can be obtained from the plans generated from the Design/Analysis tool.



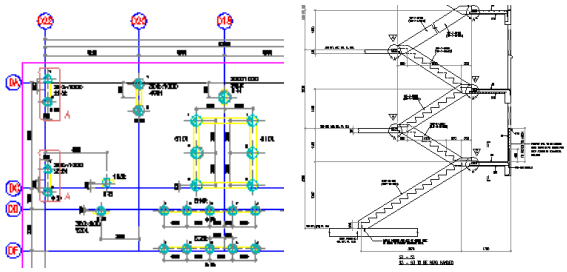
i. **Once the model is completed, the model can be shared with other disciplines for design coordination.**

5.2 Detailed Design

1. In the Detailed Design stage, the Preliminary Design model will be further developed with more accurate BIM elements. Additional BIM elements need to be added to complete the model as well. Refer to **Appendix A** for a list of typical BIM elements that need to be modelled.

Some examples of the additional elements are listed below.

- Stairs (not the complete detail),
- Precast parapet for the details
- Piles and Pile caps

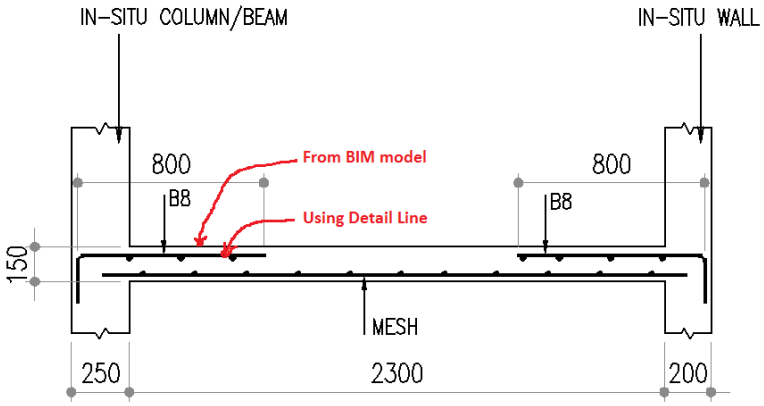


Deliverables:

c. Structural BIM model for Tender with drawings highlighted in the next section.

d. Structural BIM model for Regulatory Approval
Please refer to Structural BIM e-Submission guides for Specific Requirements of the Agencies

2D information can be used to complement the BIM model to improve the detail of the model. Ex. Detail lines can be drawn to represent the **Rebar** in a section cut from the BIM model.



CASE 1

Note:
Column Schedule, Beam Schedule, Member Details and Reinforcement arrangement plans can be produced from the Design/Analysis tools as 2D DWG/DXF and inserted into the BIM model file.

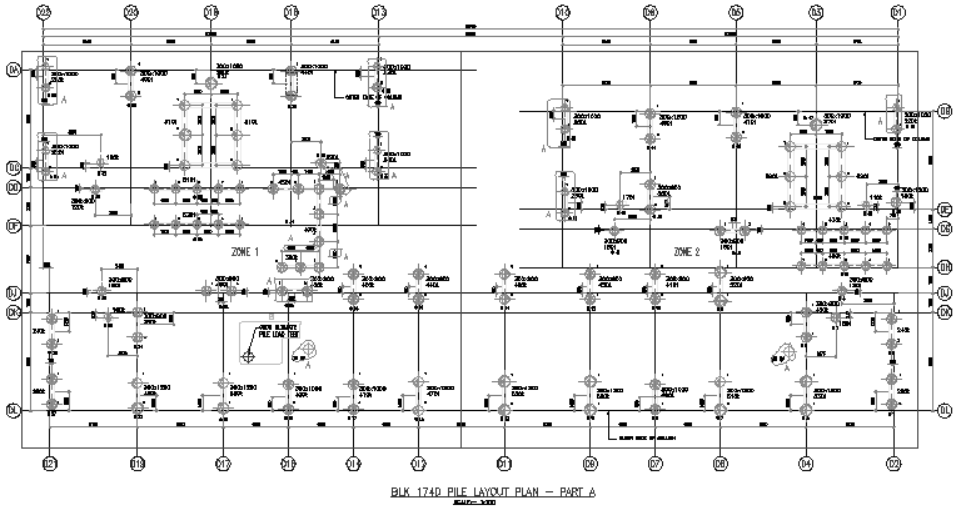
Chapter 5 - Structural

2. The following are some of the drawings to be produced from the model in the **Detailed Design** stage:

Drawings		Scale
a.	PILING LAYOUT PLAN	1:100
b.	1ST STOREY GENERAL ARRANGEMENT PLAN	1:100
c.	2ND STOREY GENERAL ARRANGEMENT PLAN	1:100
d.	TYPICAL FLOOR GENERAL ARRANGEMENT PLAN	1:100
e.	MAIN ROOF GENERAL ARRANGEMENT PLAN	1:100
f.	GENERAL ARRANGEMENT PLAN OF WATER TANK & PUMP ROOM	1:100
g.	GENERAL ARRANGEMENT PLAN OF LIFT WELL & STAIRCASE ROOF	1:100
h.	ELEVATIONS	1:100
i.	SECTIONS	1:100
j.	TYPICAL DETAIL SECTIONS (ACCROSS THE BUILDING IN SELECTED LOCATIONS)	VARIES

Additional drawings may need to be produced, depending on the requirements of the project.

2. A sample of a Pile Layout Plan is shown below.

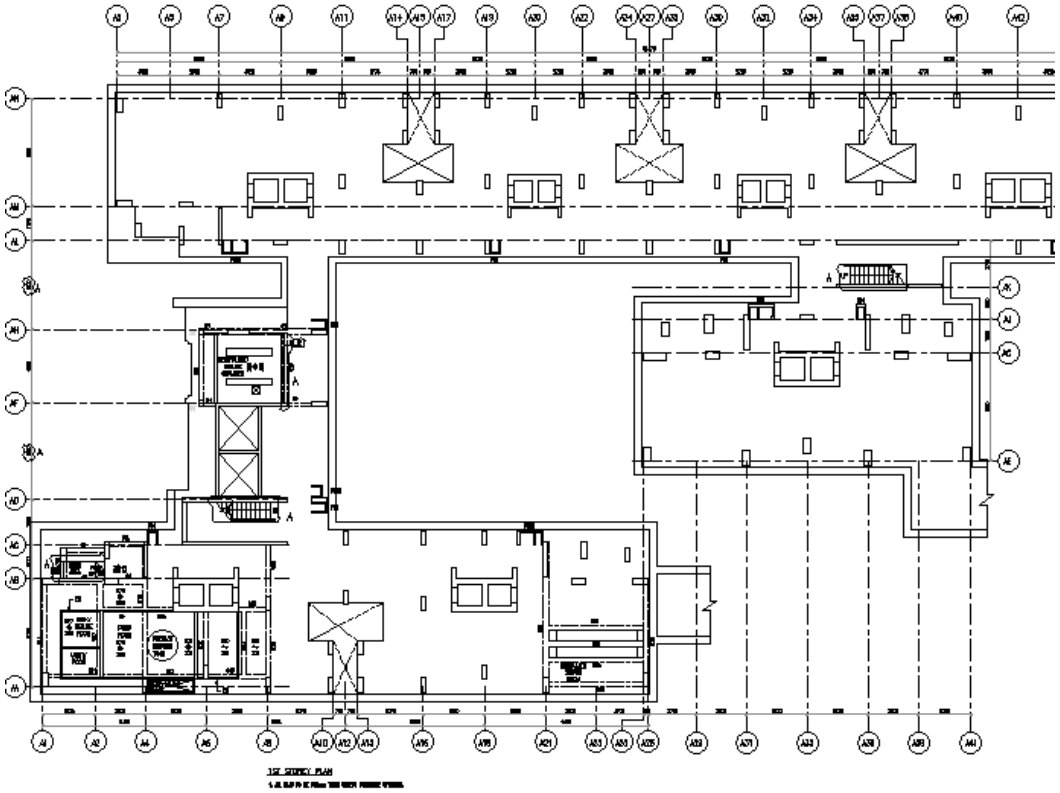


Add the following annotations to the plan view:

- Grid dimensions,
- Markings,
- Size,
- Load,
- Setting outs and
- Zones

Chapter 5 - Structural

3. A sample of a 1st Storey General Arrangement Plan is shown below.

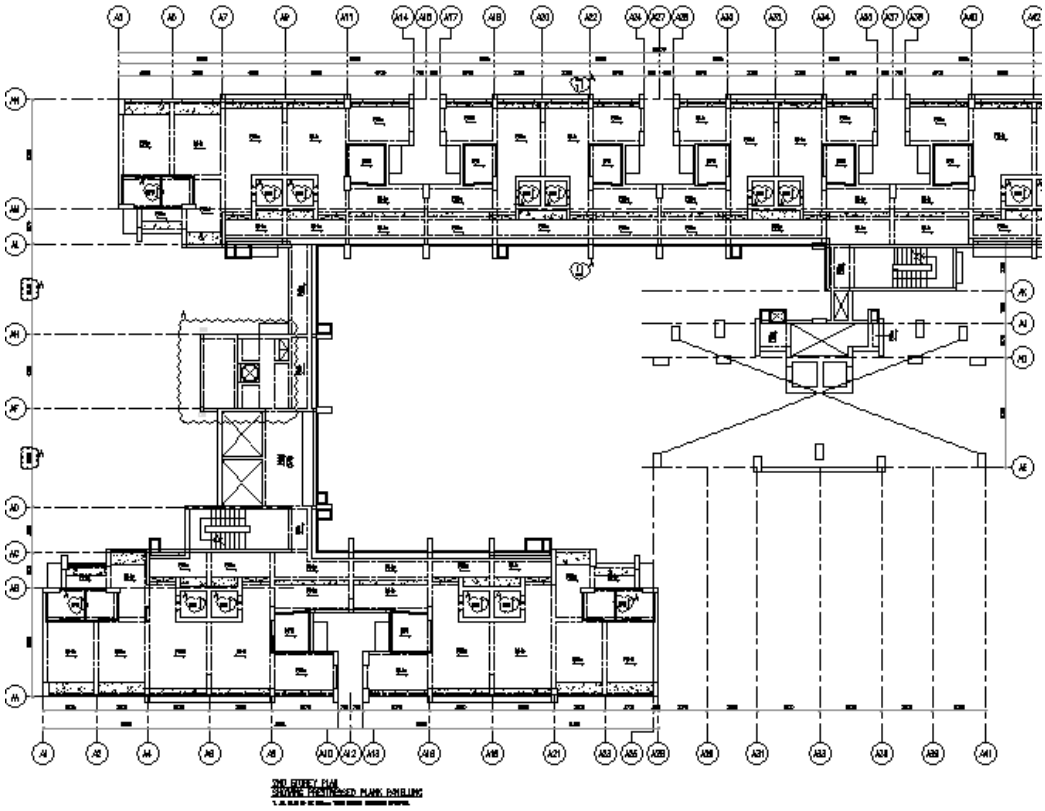


Add the following annotations to the plan view:

- Grid dimensions,
- Markings and
- Size

Chapter 5 - Structural

4. A sample of a 2nd Storey General Arrangement Plan is shown below. Typical Floor Plan(s) will look similar to this.

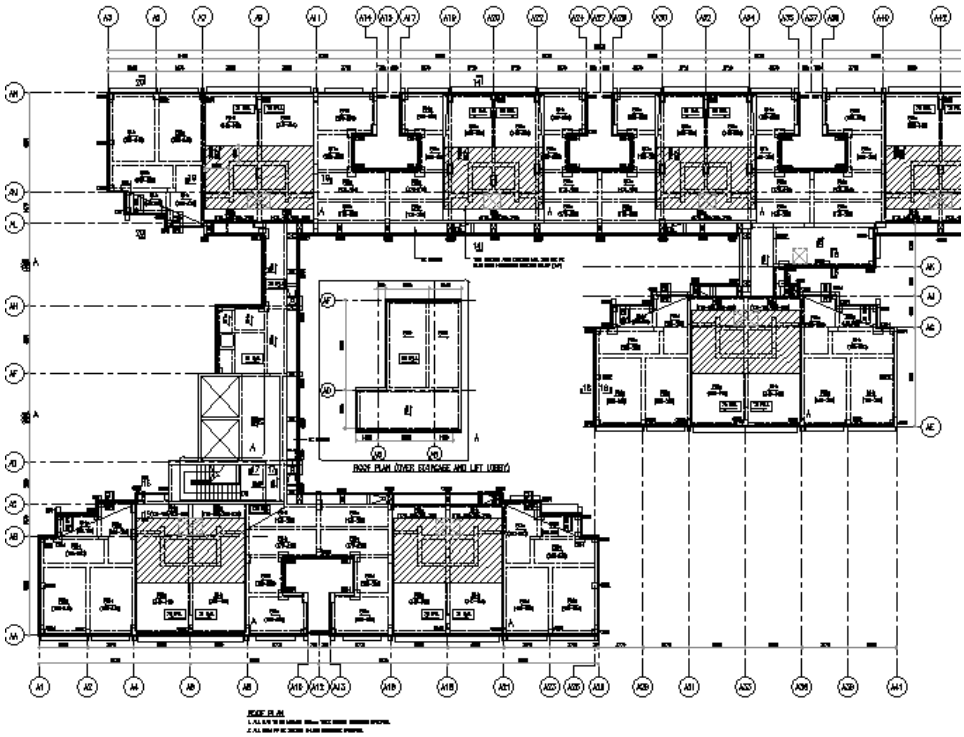


Add the following annotations to the plan view:

- Grid dimensions,
- Markings and
- Size

Chapter 5 - Structural

5. A sample of a Roof General Arrangement Plan is shown below.



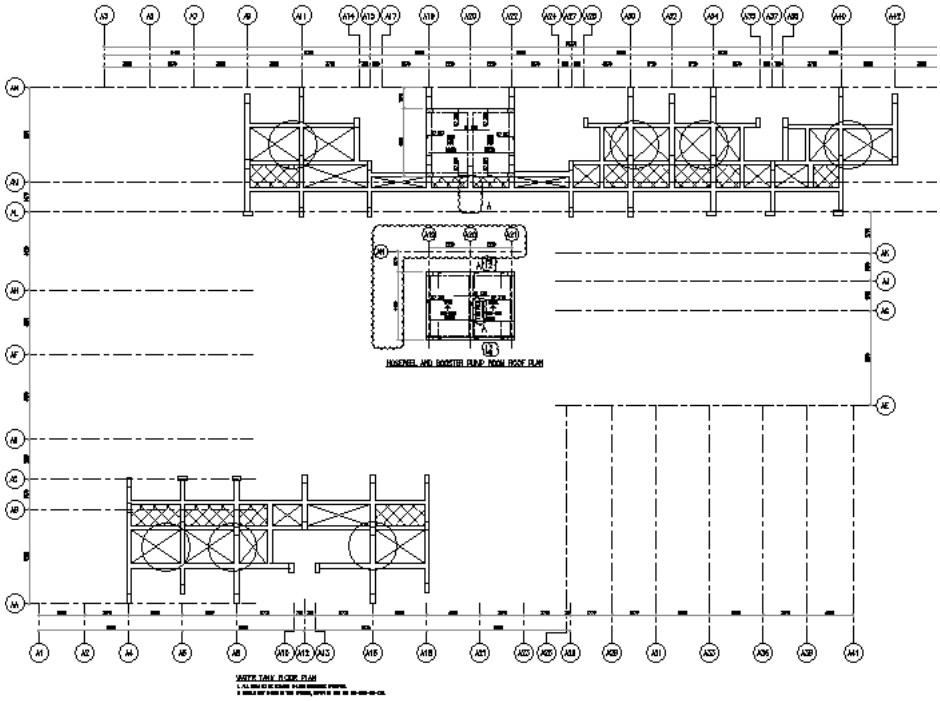
Add the following annotations to the plan view:

- Grid dimensions,
- Markings and
- Size

Additional indication of Slab thickening above the **House Hold Shelter** is shown with a hatch pattern.

Chapter 5 - Structural

6. A sample of a Water Tank General Arrangement Plan is shown below.

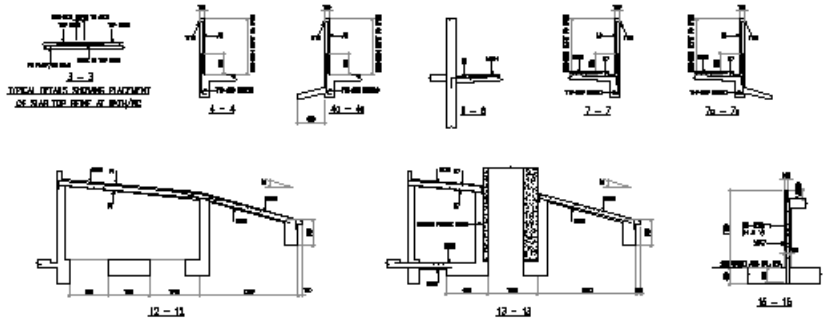


Add the following annotations to the plan view:

- Grid dimensions,
- Markings and
- Size

Chapter 5 - Structural

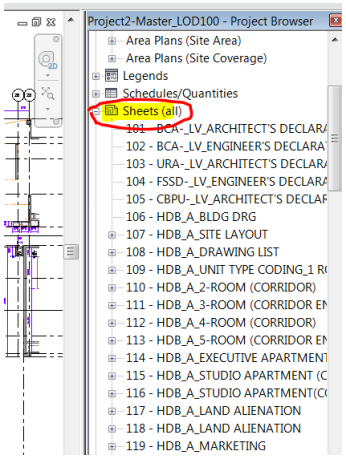
7. Samples of some Details are shown below.

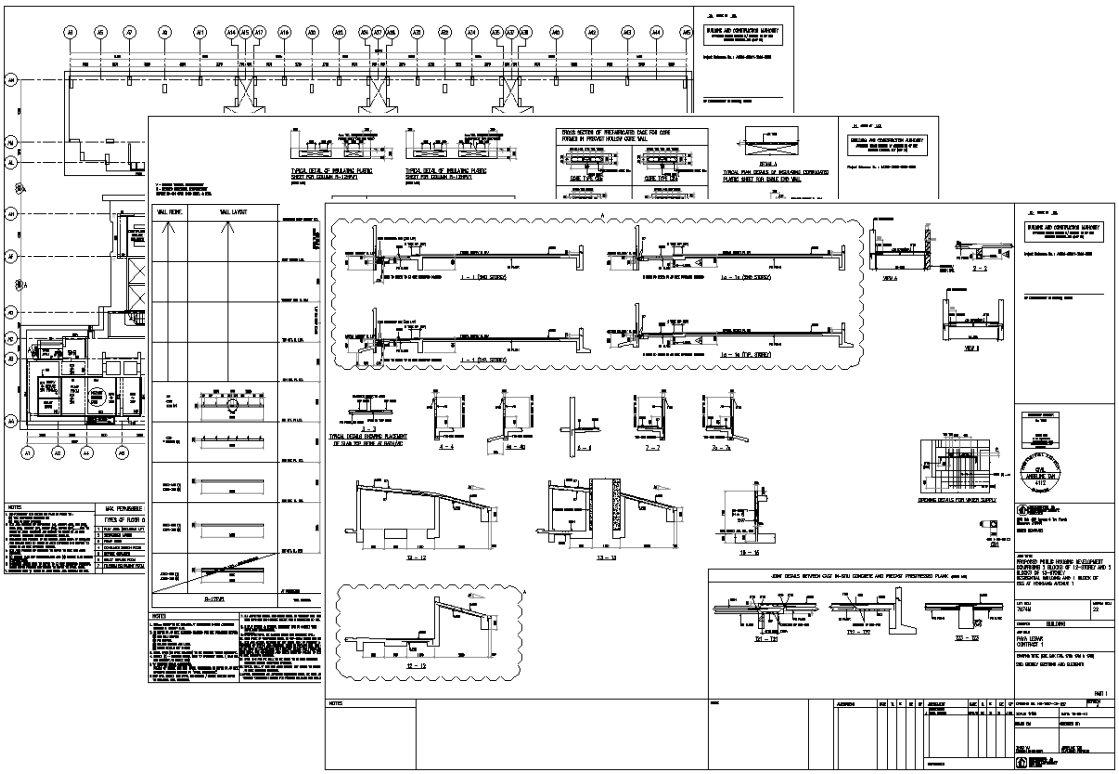


Add the following annotations:

- Dimensions,
- Member Markings,
- Rebar Annotations and
- Slopes.

8. After the views are ready create the Sheets, drag the views into the sheets and complete the documentation process.





9. **Publishing Model and Drawings to Non-editable File Format**
Refer to Annex 1a - Section 8 of Structural BIM e-Submission Guideline for step-by-step guide to export/ publish to DWF/PDF for regulatory submission.

Note:
The drawings produced from the BIM model during the Detailed Design stage can form part of the tender documents together with other 2D detail drawings.

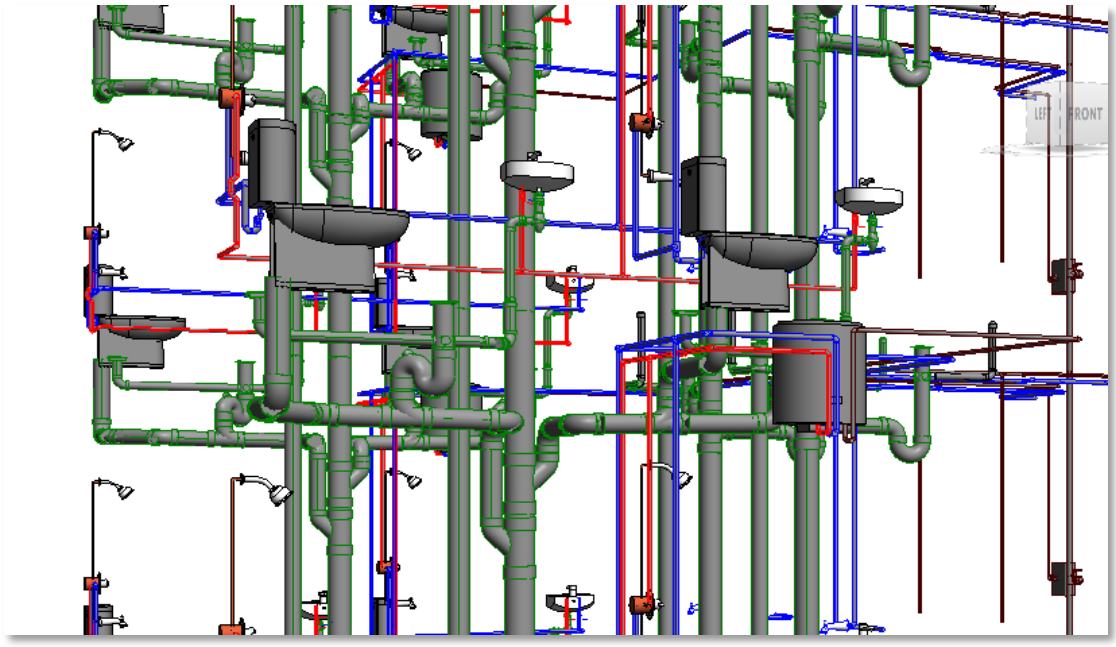
Chapter 6

Mechanical and Plumbing

Chapter 6 – Mechanical and Plumbing

6.1. Conceptual Design

Conceptual Design for Mechanical and Plumbing covers basically the steps required for creating the Schematics. BIM modelling is not required.



A Sample M&P model for a HDB residential block is shown below.

Schematics

Objective: Create a single line diagram that shows the distribution of the system into the HDB block.

Deliverable: Schematic Diagrams

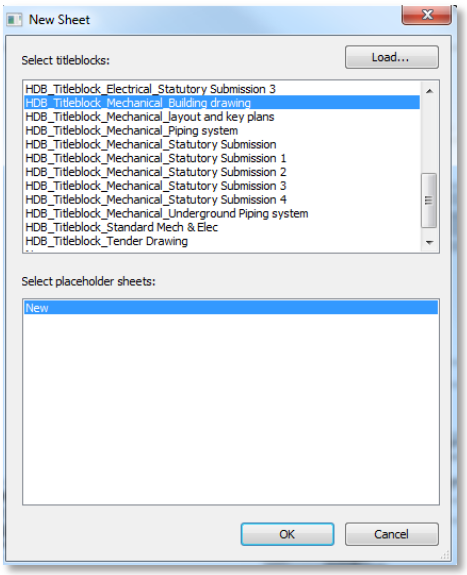
Procedures:
BIM authoring tools do not have the capability to generate schematic diagram automatically from the model at this moment. It is recommended to follow either one of the options below to generate Schematic Diagrams.

- Schematic Diagram using traditional 2D method in AutoCAD
- Schematic Diagram using BIM tool

Chapter 6 – Mechanical and Plumbing

Schematic Diagram using Traditional 2D Method in AutoCAD Application

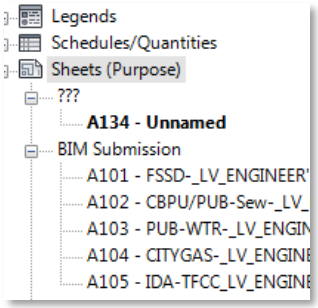
Schematics created in AutoCAD can be loaded directly to Revit through the following steps:

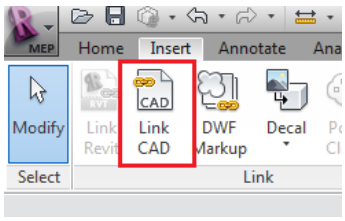


1. Create a new Sheet from the **View** Tab of Revit.
   View → Sheet

2. Select the title block based on the system from the list of the title blocks shown in the **New Sheet** dialog box.

3. The created new sheet for the schematic diagram will be placed under the non-category **(???)** views on the project browser. Right click on the created sheet and rename it based on the BIM eSubmission requirements.





4. Insert the pre-created 2D cad drawing through **Insert** tab → **Link Cad** then choose the intended file as shown in the image on left.

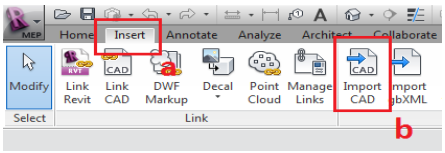
Chapter 6 – Mechanical and Plumbing

Schematic Diagram using BIM Tool

It is advisable to import the symbols and typical details that already created in CAD. This is to save time in creating the schematic diagram. Below steps are need to follow to finish the schematics.

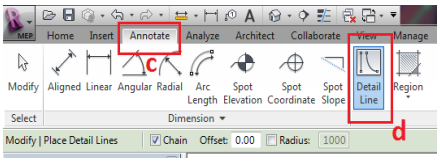
1. Create a new Sheet from the View Tab.
   View → Sheet

   Note:
   Drafting view can be used to create the schematic as well.

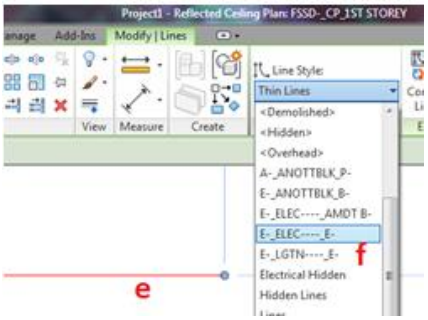


2. Select the Mechanical Building drawing from the list of the title blocks of the template

3. Import the 2D symbols through **Insert** Tab → **Import CAD** (**a** and **b** from the figure on left)



4. Place the imported 2D symbols into the drawing and connect it using the **Detail Lines**. Use **Annotate (c)** Tab →**Detail Line (d)** tool to draw the Detail Lines. The steps to draw the Detail Lines are similar to creating lines in AutoCAD.



5. Select the created lines **(e)** (shown in image on left) and change the **Line Style** properties to its representing system (**f**).

Chapter 6 – Mechanical and Plumbing

A Sample Schematic Diagram created using 2D lines and Texts is shown below.

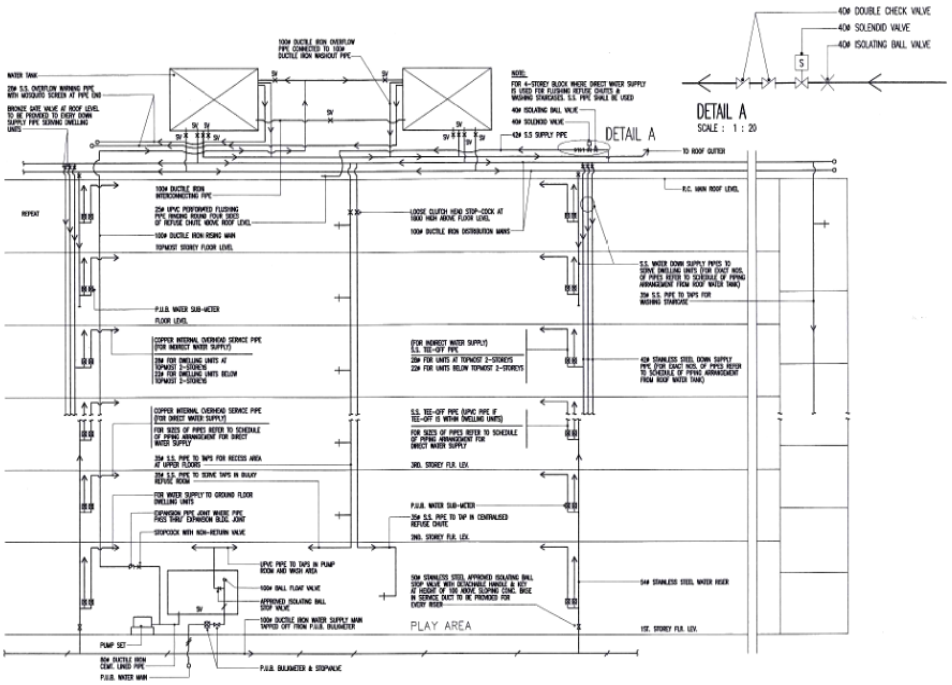


DIAGRAM SHOWING POTABLE WATER DISTRIBUTION SYSTEM

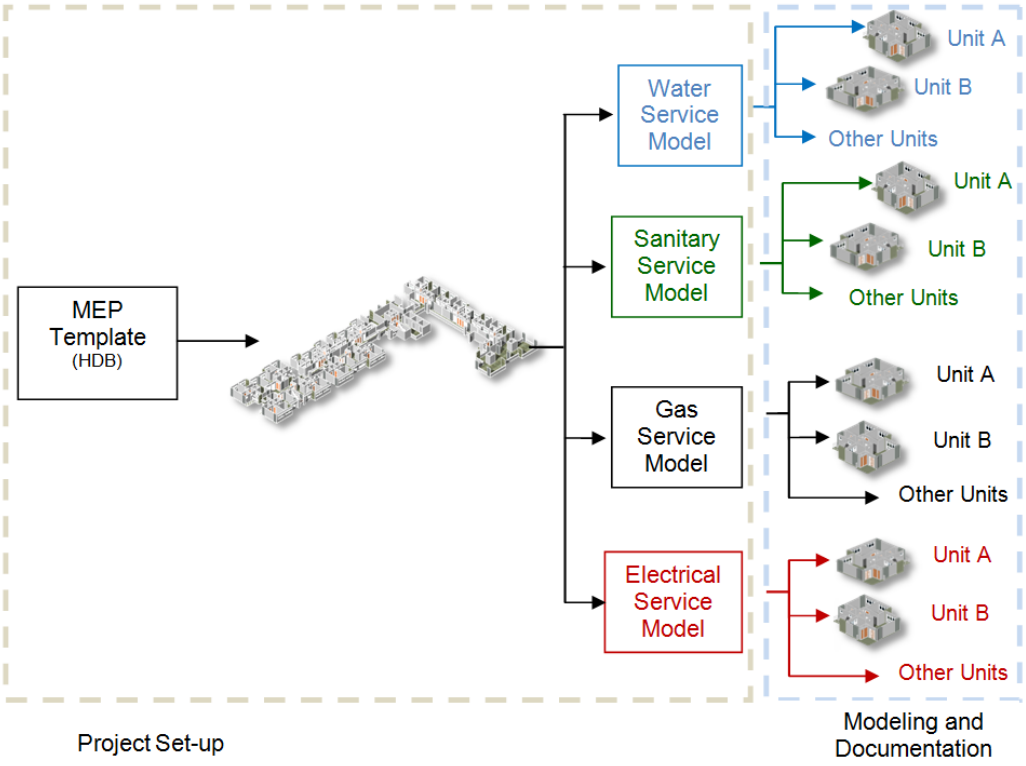
Chapter 6 – Mechanical and Plumbing

6.2. Preliminary Design

1. The preliminary Mechanical and Plumbing (M&P) BIM Model could be created from the Architectural BIM Model and serves as a preparation for the Detailed Design stage.

2. Before starting the actual modelling, it is recommended to go through proper planning and preparation.

3. **Recommended Workflow**
   Below is the graphical sequence of connected steps to be carried throughout the development of the model.



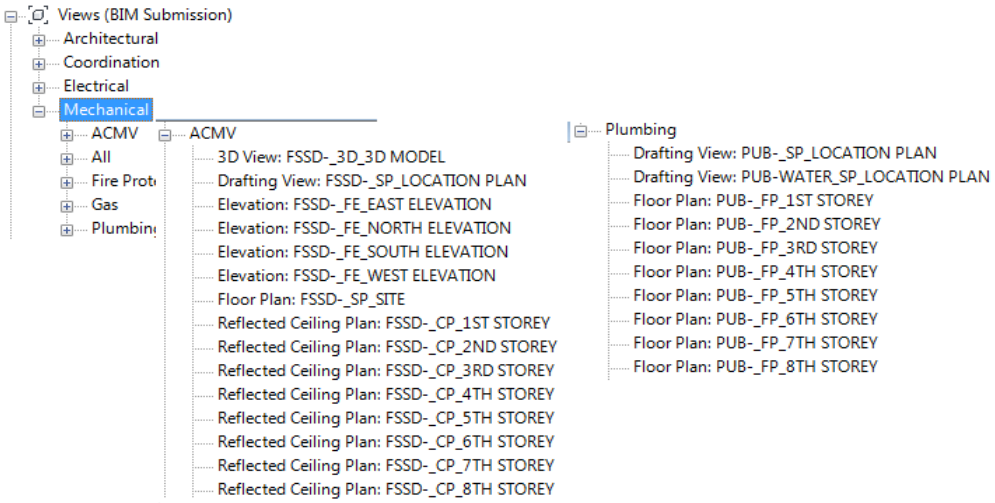
It is recommended to divide the project into different files for different services in order to manage file size and to delegate the task to the team members. After completion of each service, the models can then be linked together for services coordination.

Chapter 6 – Mechanical and Plumbing

4. **Understanding the MEP BIM eSubmission Template**
The template files provide initial conditions to a project. A new project inherits all settings, families and title blocks from the template file.

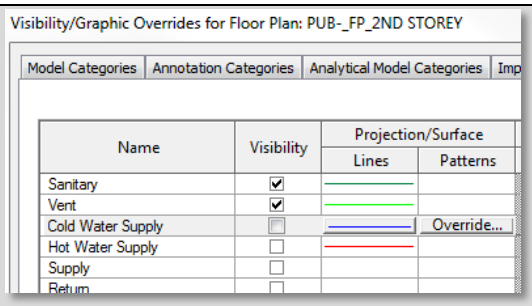
Settings

- The Project Browser of the template is organised by the different Regulatory Agencies.
- The views were enabled with **Visibility Graphics→Filter** (by System) as shown below.



Visibility Graphics (VG):

- **This is set to manage graphical display of the elements in the view.**
- **Systems that are not necessary in the view were properly turned off.**
- **Colors for the system are as per CP83 Standard.**
- **The modelers can go directly to the views specific for each agency/service/system and start the modelling.**

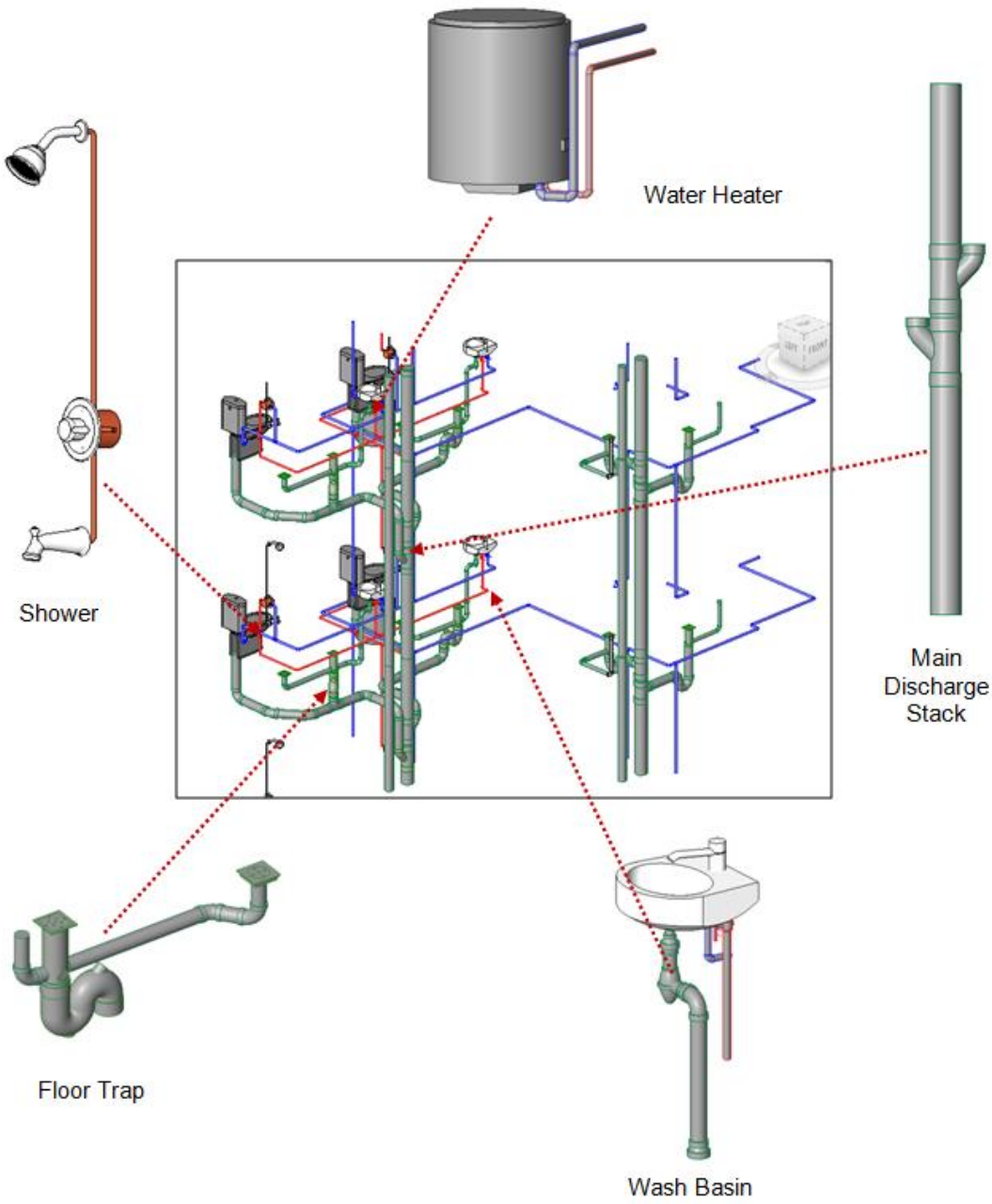


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Families and Groups
The default families available inside the template can be used for the modeling. Additional objects can be downloaded from the web and loaded into the project through Insert tab of Revit.

In addition, some groups of interconnected families as shown in the figure below can be created inside the template. These pre-loaded objects can be placed as one and adjusted to fit the projects requirement.

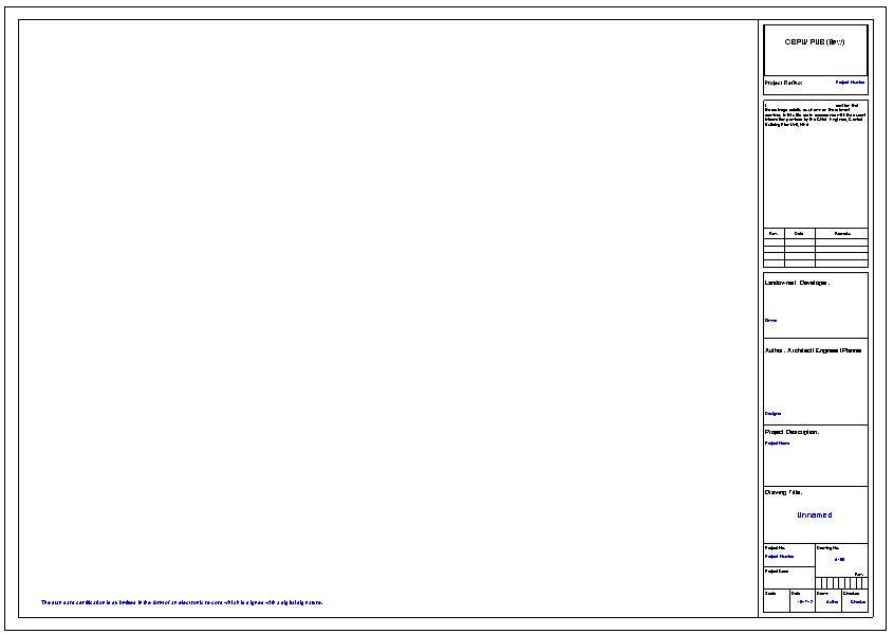
Note:
Create separate groups for families that need to be mirrored instead of mirroring the same group as the connections (hot and cold water) location will be mirrored as well.



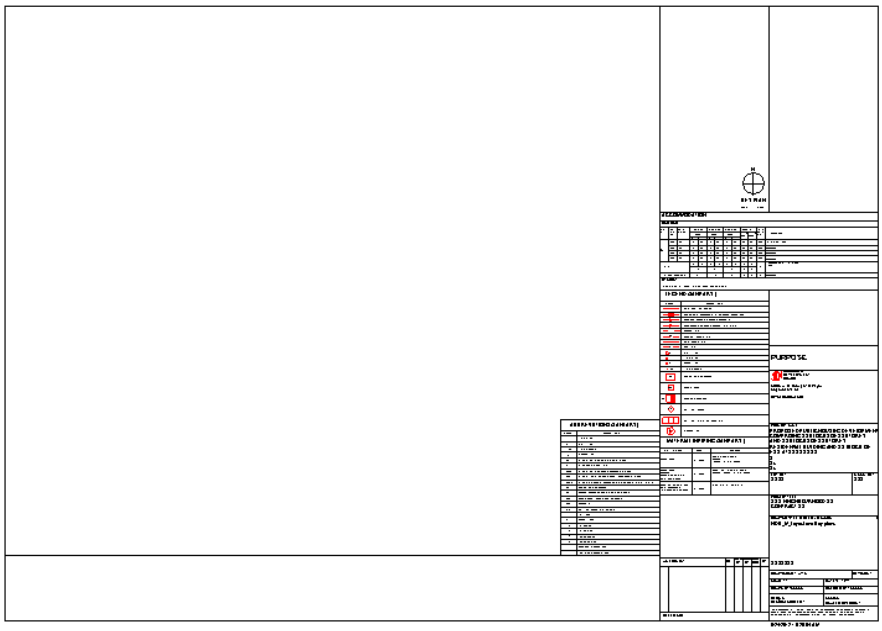
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Title Block

- Template comes with the standard title block as shown below, customise it as a company standard title block with HDB's requirements incorporated.



Standard Title Block

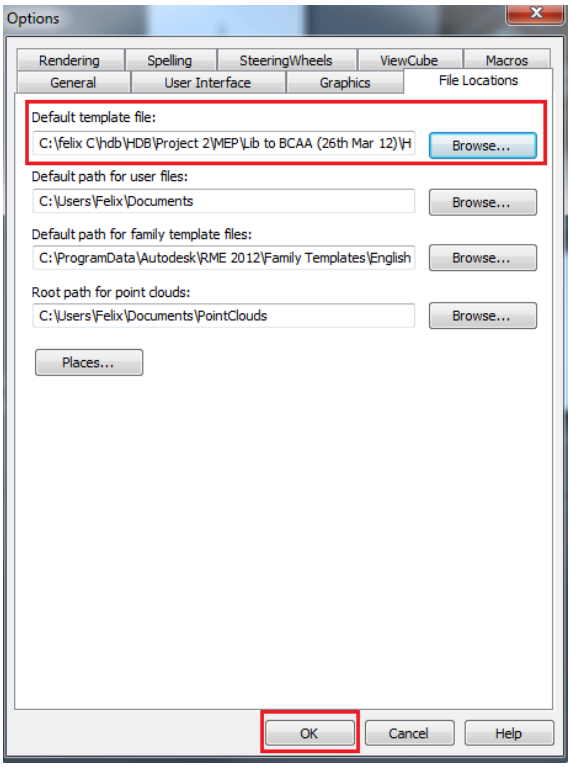


Customised Company Standard Title Block

Chapter 6 – Mechanical and Plumbing

5. **Project Setup**
   Files needed: Architectural Model and the Project template.

   Loading the Project Template .

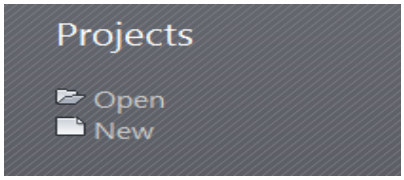


a. From the **Application Menu** 

, click on the **Options** button.

b. Under the File Location, browse for the Project template. Click **OK** once done. And;

c. Click on **New Project** to start.

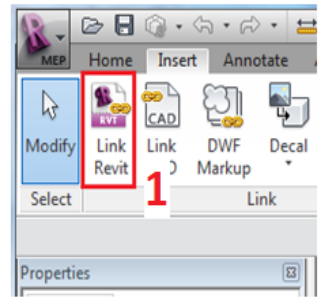


6. **Architectural Model Validation**
   The basic elements required from the Architectural BIM Model for the M&P BIM model are as listed.
   - Plumbing Fixtures
   - Water tanks
   - Ceiling
   - Floors
   - Riser's location
   - Inspection Chamber
   - Grids
   - Levels

   The elements, especially MEP fixtures, should be placed realistically on the architectural plan for proper modelling of required MEP systems.

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7. Linking Architectural Model





a. Go to **Insert Tab** and choose **Link Revit**

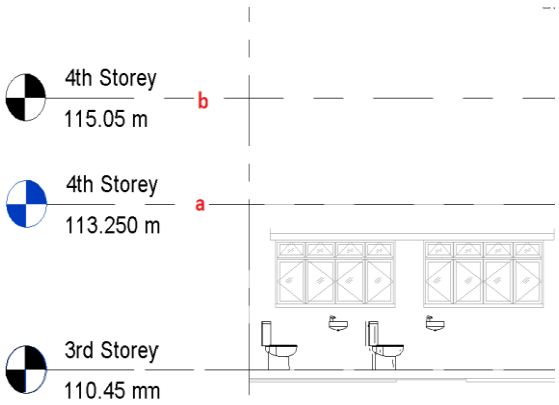
Note:
It is good to link the individual storeys one by one rather than the entire block (Master File). This is to manage the file size and prevent system lag during modeling process. Combining the M&P model can be done once typical floor is completed. The steps will be discussed in the later chapter.

b. Link the model using Origin to Origin Positioning in order to place in the same position as Architectural model.

Note:
If the Central Architecture Model will be used, all nested links must be set as OVERLAY in the Reference Type under Manage Links dialog box. This is to properly see the model in your working window.

8. Adjusting MEP Levels and Creating Grids

Adjusting MEP Levels with the Architectural Model



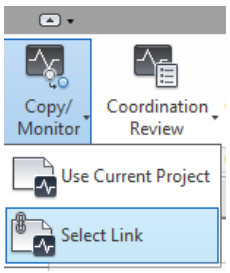
a. On the project browser, open one of the Elevation views.
b. In the Elevation view, click the **Align** tool  under the **Modify tab**.
c. Select the Level of the linked architecture model, (**a** in the left figure) then select the MEP Level that intended to move (**b**). Grid will be aligned accordingly.

Repeat for the rest of the levels and rename them if necessary.

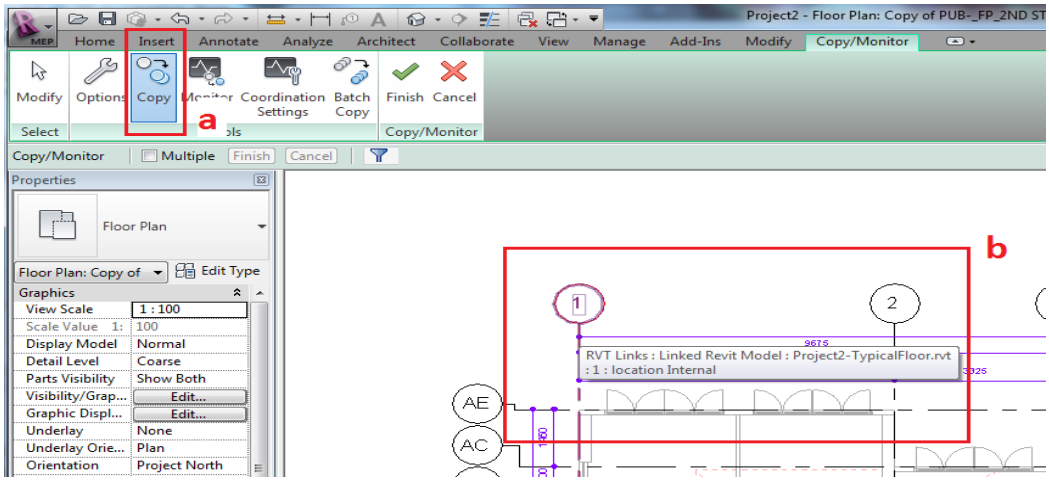
Creating Gridlines

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Copying and monitoring the project gridlines is the one of the best practices in modelling services of the project. The grids would be updated to reflect the changes made in the Architectural BIM model.



a. From the **Collaborate Tab**, click **Copy/Monitor** Tool then choose **Select Link** from the 2 given options.
b. Select the linked architecture model.
c. Select Copy tool from the ribbon**(a)** from below figure and click the Grids in the linked model**(b)**.



9. **Creating Base File for MEP Services**
   The separate project base file should be created for MEP services and used to model different portions of the project. This allows linking the individual portions of the model smoothly to the central file that shows the complete assembly of the project.

   Copy the project file that was set based on the number of services to be modeled.

10. **Preliminary Design Modelling**: Create a copy of the Project Base File discussed in the previous item. Copy the fittings from the Architectural Model and model only the main distributions of the project.

11. Choose the families/types for the MEP components. Components can be placed with approximate sizes and in approximate location as there may not be enough information at this stage. Refer to **Appendix A** for the list of BIM elements to be modeled by the MEP discipline. Users shall follow a standard naming convention.

12. **Share the Preliminary Design model with the Design Team for co-ordination.**

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6.3. Detailed Design

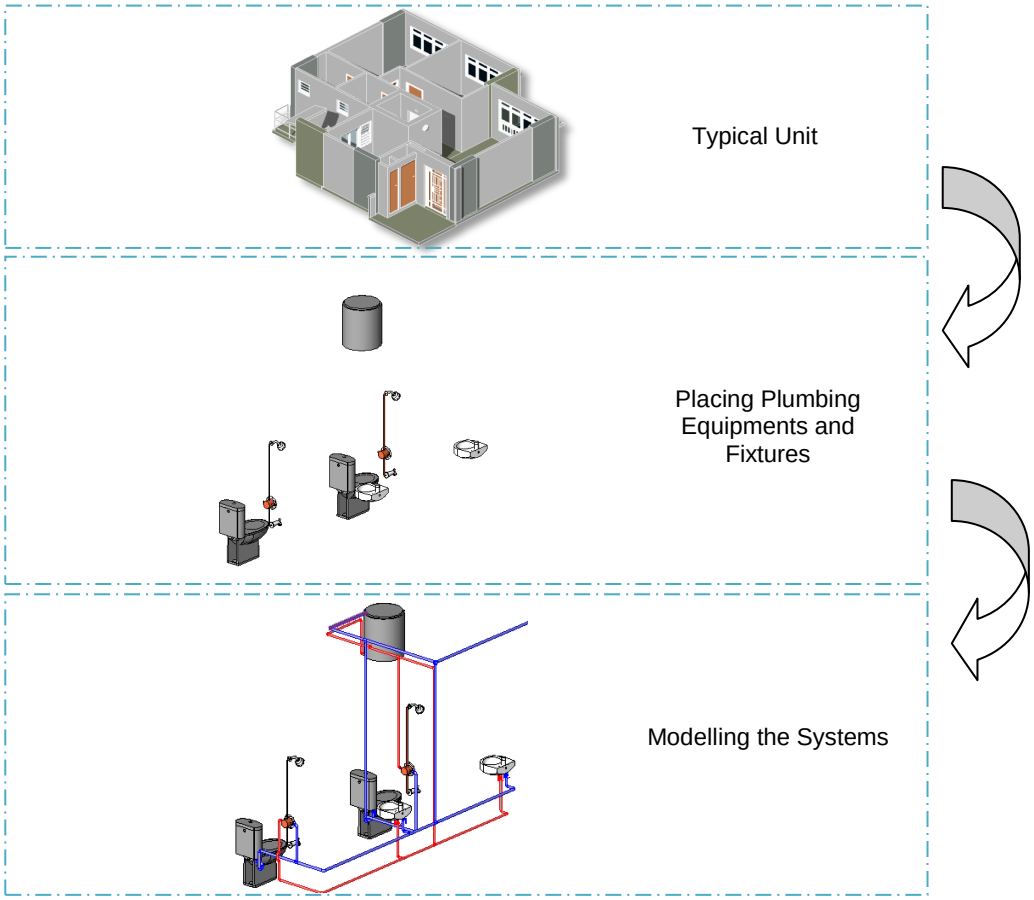
1. In the Detailed Design stage, the Preliminary Design model will be further developed with more accurate BIM elements, based on feedbacks from the Technical Departments and other disciplines. Additional BIM elements need to be added to complete the model as well. Refer to **Appendix A** for a list of typical BIM elements that need to be modelled. Elements should be with an accurate dimensions, shape and location. Non-geometric properties should be provided.

   Deliverables:
   a. Tender BIM Model with drawings
      Content:
      - Layout and Key Plans
      - Site Plans
      - Floor Plans

   b. Submission BIM Model for Regulatory Approval
      Please refer to MEP BIM e-Submission guides for Specific Requirements of the Agencies

   This sub-chapter will be divided into different services namely:
   a. Water and Gas Services
   b. Sanitary Service and
   c. Electrical Service

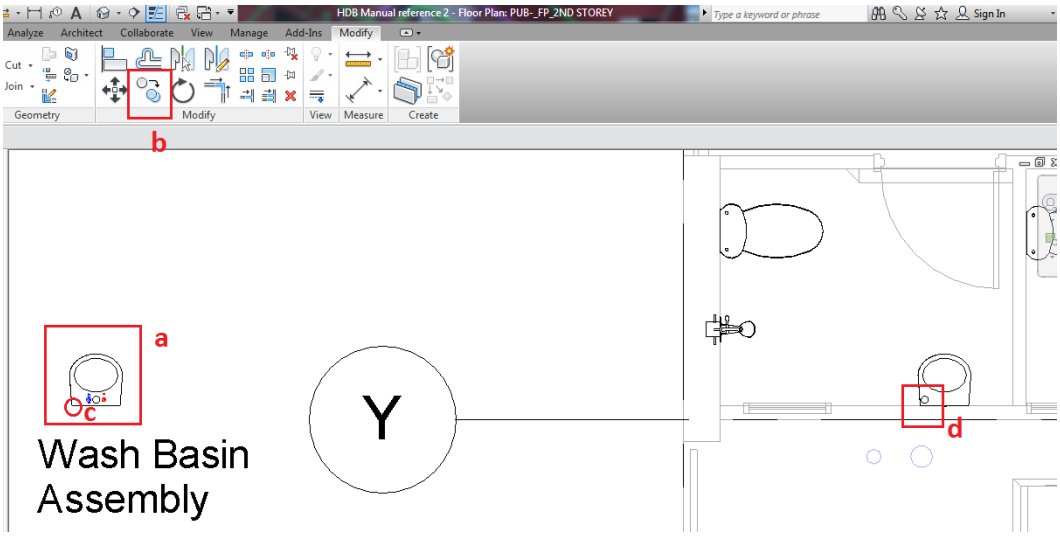
2. **Modelling Water and Gas Services**
   After the project has been set up, the water and gas services can be modelled in the manner illustrated below.



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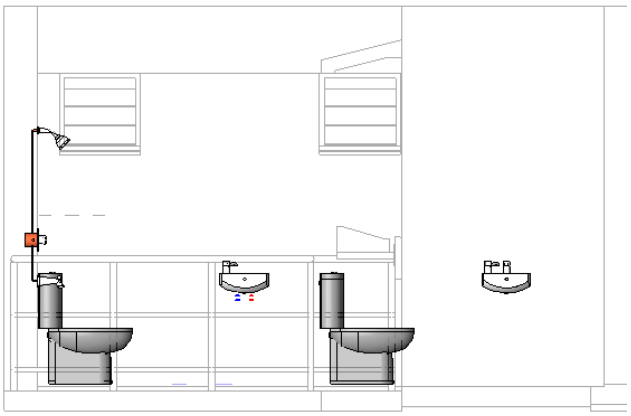
Modelling Plumbing Fixtures
Open the base file that was created for Water and Gas services.

a. Choose Wash Basin Assembly from the list of preloaded assemblies in the template (letter **a** from the figure below) and copy **(b)**
b. Pick the start point of copying. **(c)**
c. Place the copied assembly to the same position of the fixtures of the architectural model. **(d)**
d. Parts of the groups should be adjusted if necessary to fit the required clearances.



Load other plumbing fixtures from the library folder if necessary and do the above steps.

After the above step is done, the model will look like the image below.



Note:
In detail design stage, elements should be placed into the ideal position. Therefore, offset or level of the elements with reference to the finish floor level is one of the factors should be considered in modelling.

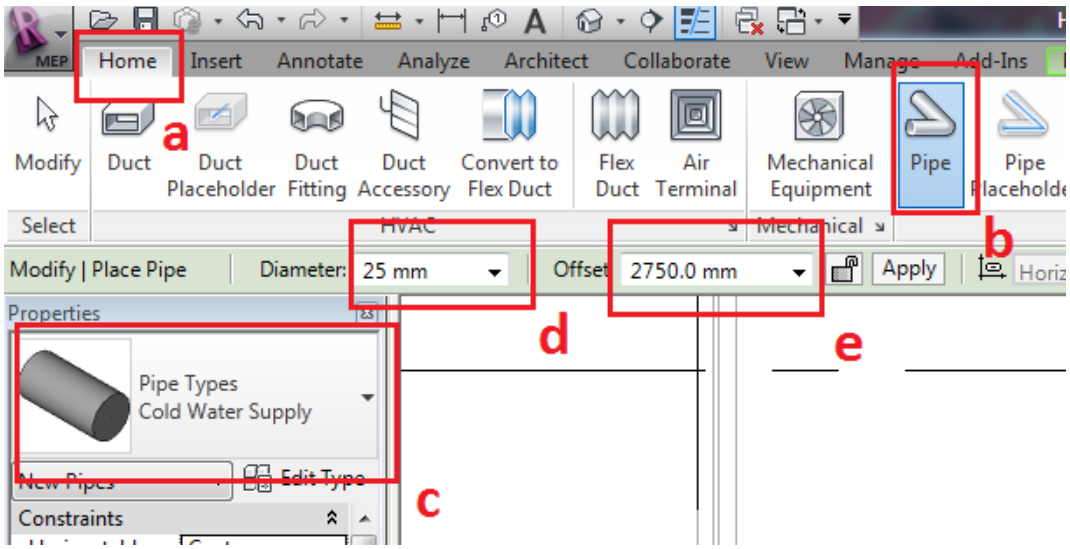
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Modelling Connections
When all plumbing fixtures necessary for the water and gas services of the unit were placed, modelling connections with piping will then be the next. In modelling piping systems, below are the settings to be considered:

- Pipe Materials
- Pipe System
- Size (please refer to HDB standard pipe sizes)
- Level or Offset from finish floor level

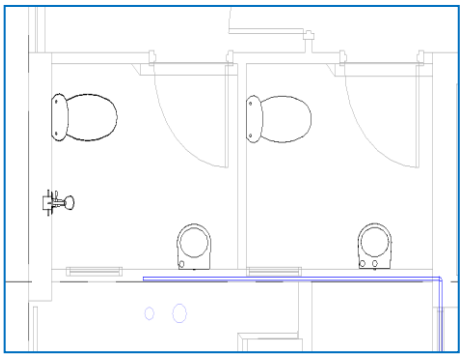
The following steps will lead the modelers to get this done.

a. Choose pipe tool from the Home tab of Revit. (Letter **a** & **b** from figure below)
b. Select the type of pipe to be used from the Property tab of Revit. **(c)**
c. Choose the required diameter of the pipe for the pipe specified. **(d)**
d. Set the required offset from the finish floor level of the model. **(e)**

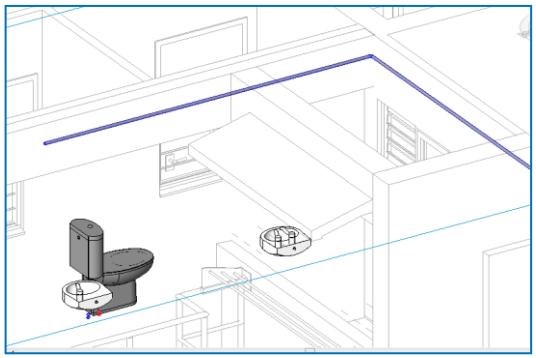


Model and place the pipe into its ideal location. The modeler should verify the design whether the pipe should be embedded or exposed to the wall.

Plan View



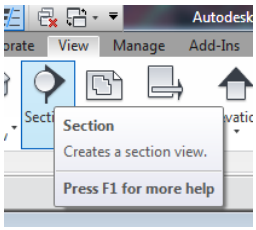
3D View



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Connecting Water Fixtures with Pipe System
It is advisable not to create all elements in one view (e.g. plans) as some elements are much easier to model and connect properly in other views (e.g. elevations and sections).

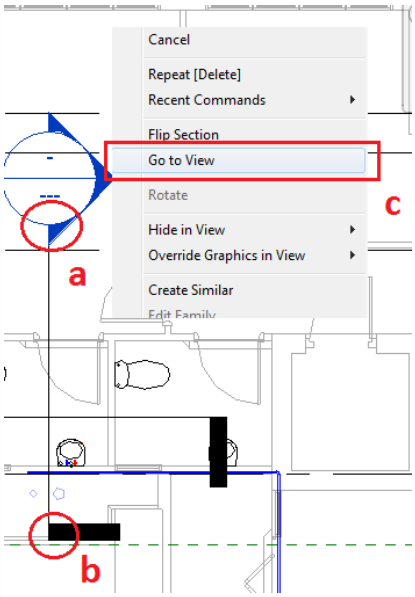
In the following steps, the pipe will be connected to the wash basin in section view.

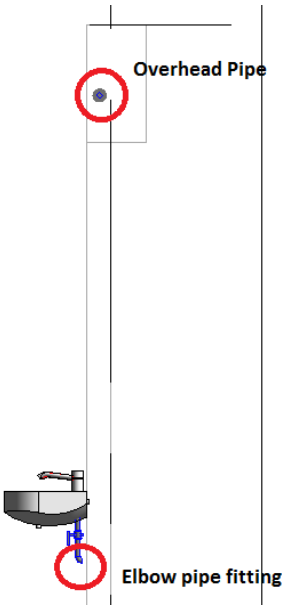


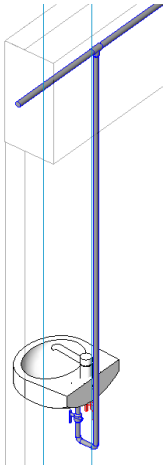
a. Cut a section into the floor plan.
View tab → Section.

b. Draw a section line from point **a** to point **b**, as shown in the left figure.

c. Once the section is created, **right click** on it and choose **Go to View.** (**c**) The Section created will be displayed.







d. On the Section View, select the elbow fitting and select the **Connect Into** (

)tool on modify tab of Revit.

e. Then choose the overhead pipe to connect.

f. Repeat the above steps to the other fixtures.

Connecting Pipe Directly to the Fixtures

Before the pipe is connected to a particular plumbing fixture, there should be a basic understanding of the properties of the fixture or equipment. . The properties of components may vary based on the category. The wash basin is used as an example here.

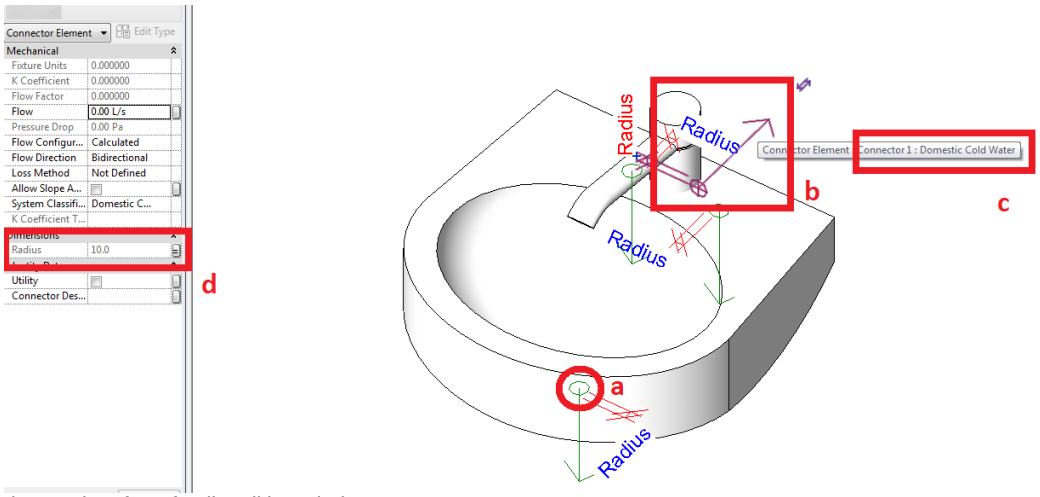


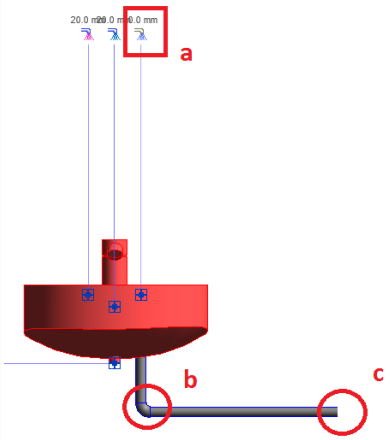
Figure taken from family editing window

Where:

a = point of connection
b = direction of the pipe to be connected
c = name and the system property (ex. Cold water, hot water, etc.)
d = dimension of the connection port

Note:
Warning might appear during modelling due the above properties.

The steps below can be applied to the fixture or equipment that is not connected to any system yet.



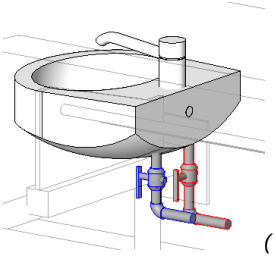
a. **Cut sections** in the model showing the connection point of the fixtures and the preferred route of the pipe.

b. **Select** the fixtures, Revit will show you the different connection points of the fixture. **Pick the system** (**a** from the left figure) to be created and move the mouse to the preferred route. (**b & c**) On the other hand, **right click** to the connection point and choose **Draw pipe.**

c. Repeat the above steps for the other fixtures if necessary.

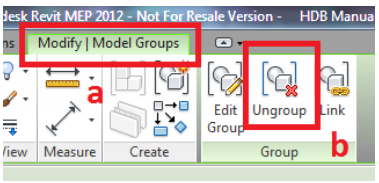
Modifying Groups
Group of interconnected families that are pre-loaded could be modified in order to suite the design requirements.

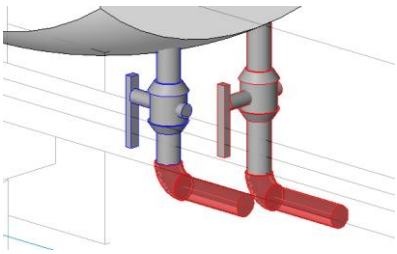
Below are the steps to get this done.



(back direction)

On the left example, the pipe connection will be changed from back direction to side.

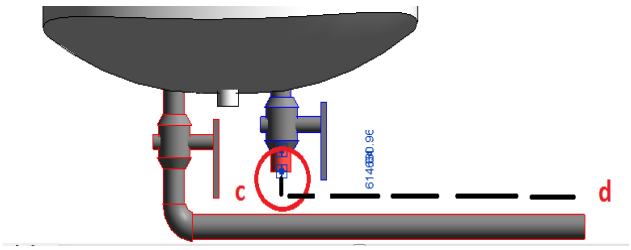


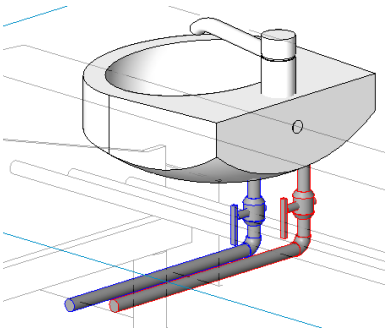


a. **Select the group** and click **Ungroup** from the Modify tab. (**a** & **b** from the left figure) Select and edit each element from group.

b. Choose a convenient view to **select** the elbows together with the pipes that need to be re-routed. Press **Delete** key on the keyboard.

c. **Select the pipe** and **right click** to its end point (**c**) and choose **draw pipe** from the options. Move the mouse to the prefer direction. (**d**)



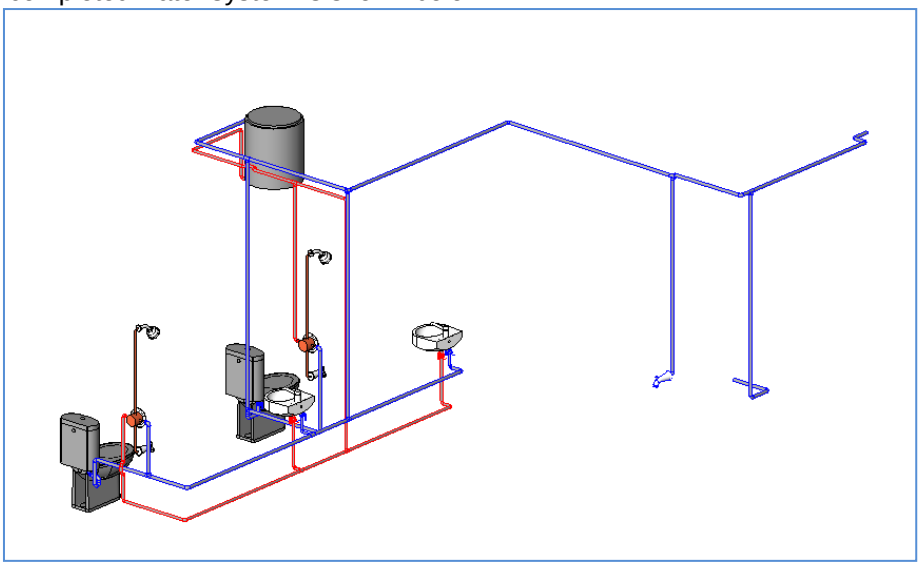


Re-routed Pipe (side direction)

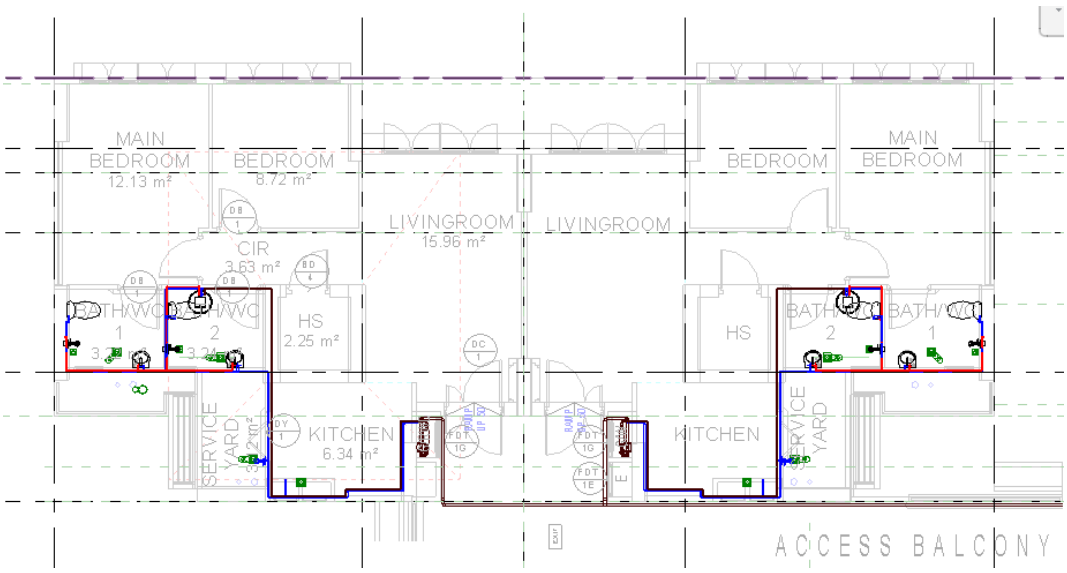
Modelling tip:
Risers and other vertical parts of the system are much easier to create in section or elevation view of the model.

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The completed water system is shown below.



The unit can then be mirrored or copied to complete the whole floor.



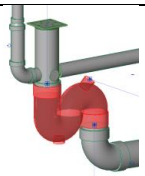
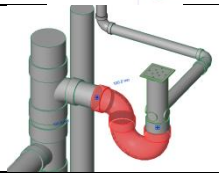
Now the model is ready for documentation.

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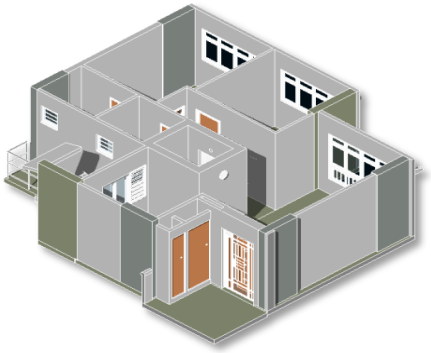
3. **Modelling Sanitary System**
The settings listed below should be considered when modeling the sanitary system of a residential block. References should be made to the prevailing statutory regulations and HDB standards:

- Pipe Materials and Fitting to be used in the systems
- Pipe System
- Size
- Level or Offset from finish floor level
- Slope

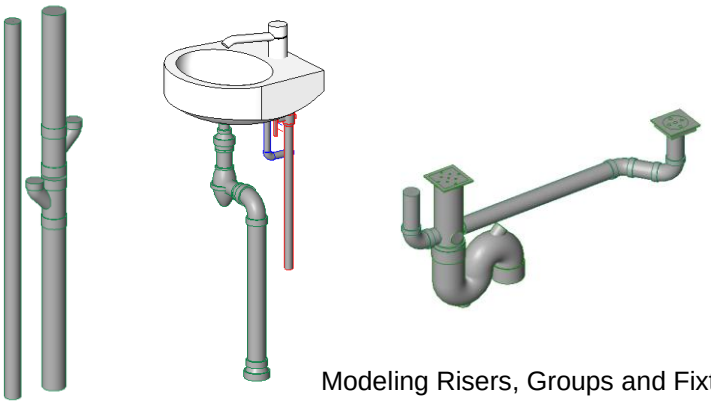
Recommended fittings for the sanitary system in a HDB residential block:

	Floor Trap for toilet
	P-Trap for kitchen area

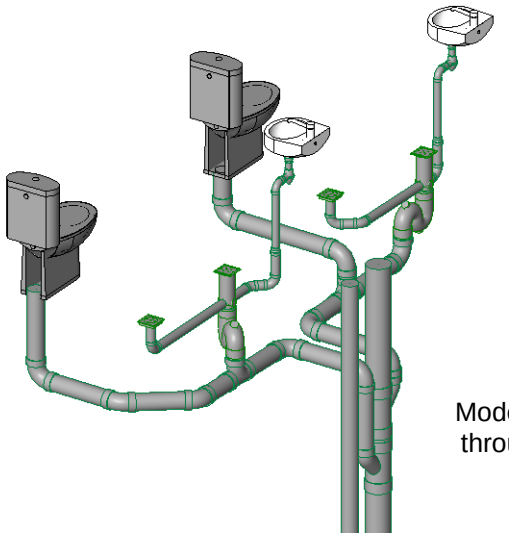
Recommended Workflow for modelling Sanitary System of a HDB residential block



Typical Unit



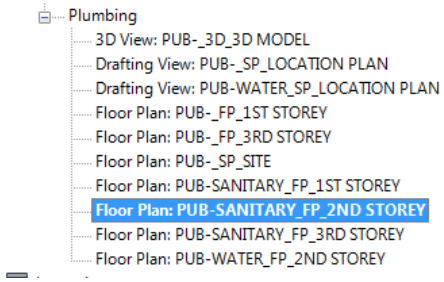
Modeling Risers, Groups and Fixtures



Modeling Sanitary Service through pipe connections

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Modelling Main and Secondary Discharge Stack
Modelling the risers for Main Discharge Stack (MDS) and Secondary Discharge Stack (SDS) can be modelled with the following steps.

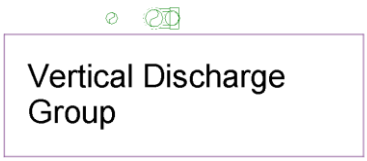


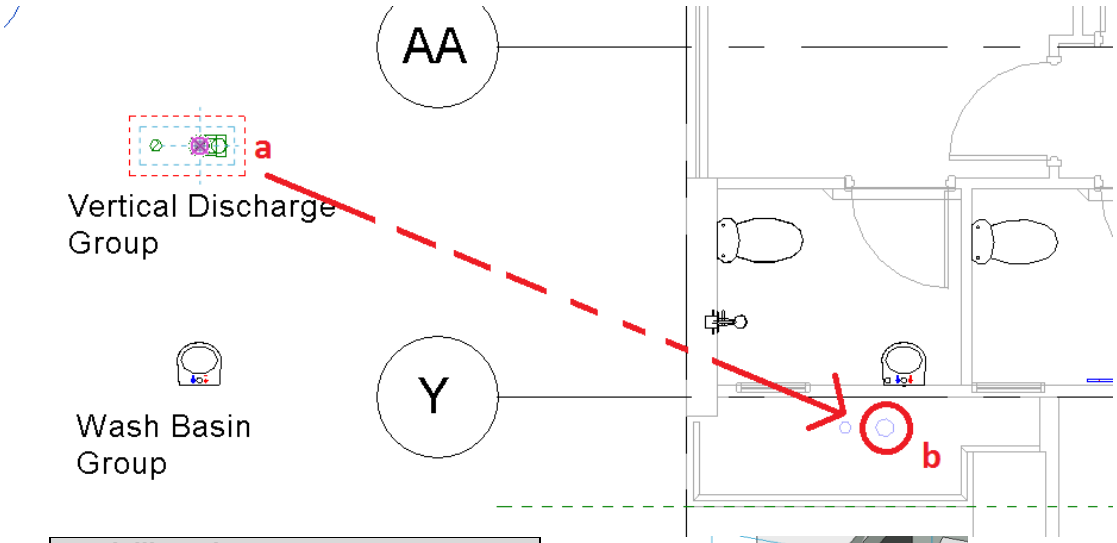
a. Extend the Plumbing Category on the project browser and double click ***PUB-SANITARY_FP_2ND STOREY.***

b. Create a group for the Vertical Discharge Stack.

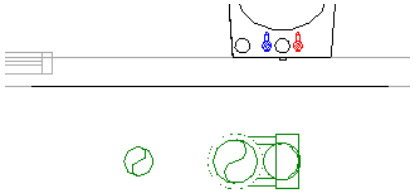
Select the Group → Modify tab, Copy

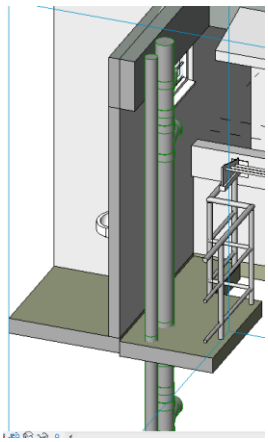
c. Pick the center of the MDS pipe as a Start point of placing (**a** from the figure below) and put it at the center of the circle mark (**b**) provided in the architectural model. Please refer to the below figure.





Modelling Tips:
To get a perfect center snapping, while moving the element to the intended location, right click on the reference point and choose Center. When the center of the circle is highlighted, click once more.

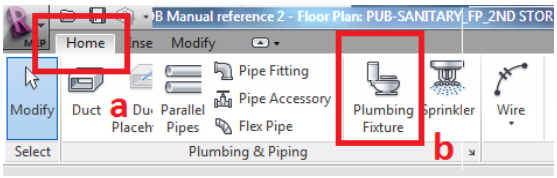




Chapter 6 – Mechanical and Plumbing

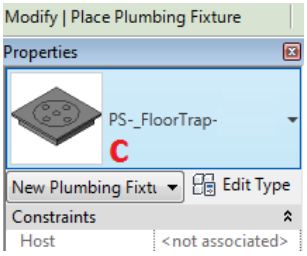
Modelling Floor Traps

Floor traps and floor drains cannot be placed without the hosting elements such as floors or slab. Placing of these elements in the model can be done through following the steps below.

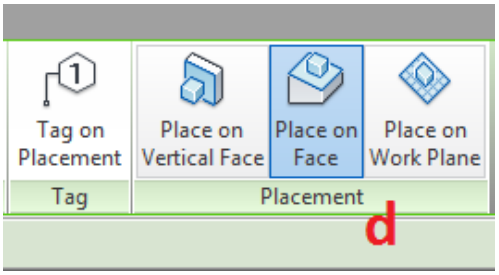


a. From the Home tab, (**a** from the left figure) choose Plumbing Fixtures. (**b**)

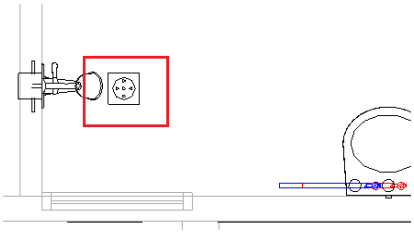
b. From the Property panel, pick the required floor trap type in the project. (**c**)



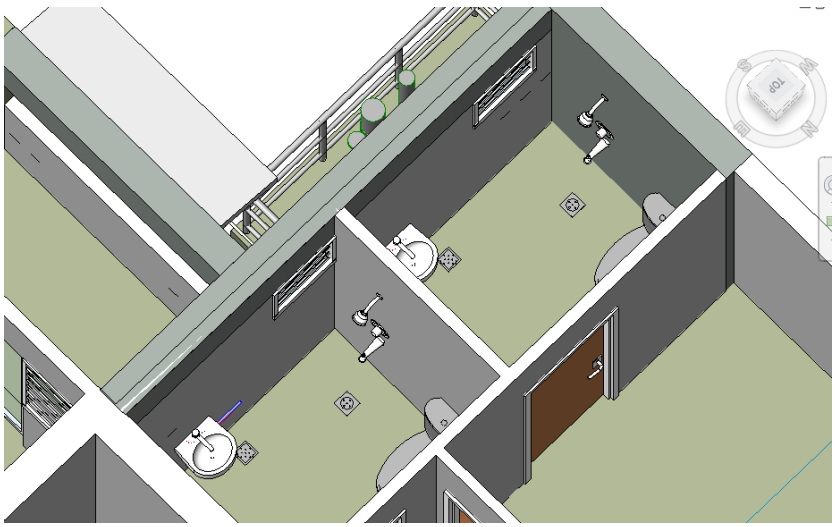
c. Choose the Place on Face as a placement method. (**d**)



Once placement method has been set, move the cursor and Click into desire place.



When all the required plumbing fixtures were placed, the model will look like (figure xx). The plumbing fixtures can now be connected by the piping system.

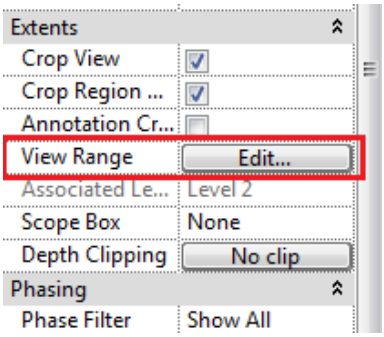


Model showing the modeled layout of the HDB typical bathroom.

Chapter 6 – Mechanical and Plumbing

Modelling Sanitary Pipe System

Note:
The slope of the pipe should be considered in modelling the sanitary system. The View Range could be modified to see all the elements into their model.

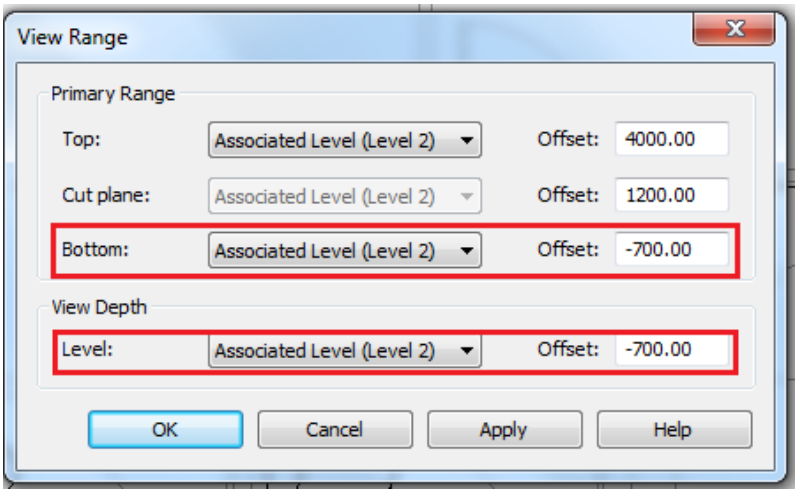


a. Go to the **Floor Plan view** of the model by double clicking on the Project Browser.

b. Open the View Range setting from the Property Box

c. Adjust the **View Range** of the model view and assign **negatives values** into the **Bottom and View Depth; Level**. Please refer to the below figure.

Click **OK** once done.



This will allow the modelers to see and pick the elements below the slabs.

Modelling Tip:

Model in the Wireframe visual style, which will allow each component of the model to be picked and connected easily.

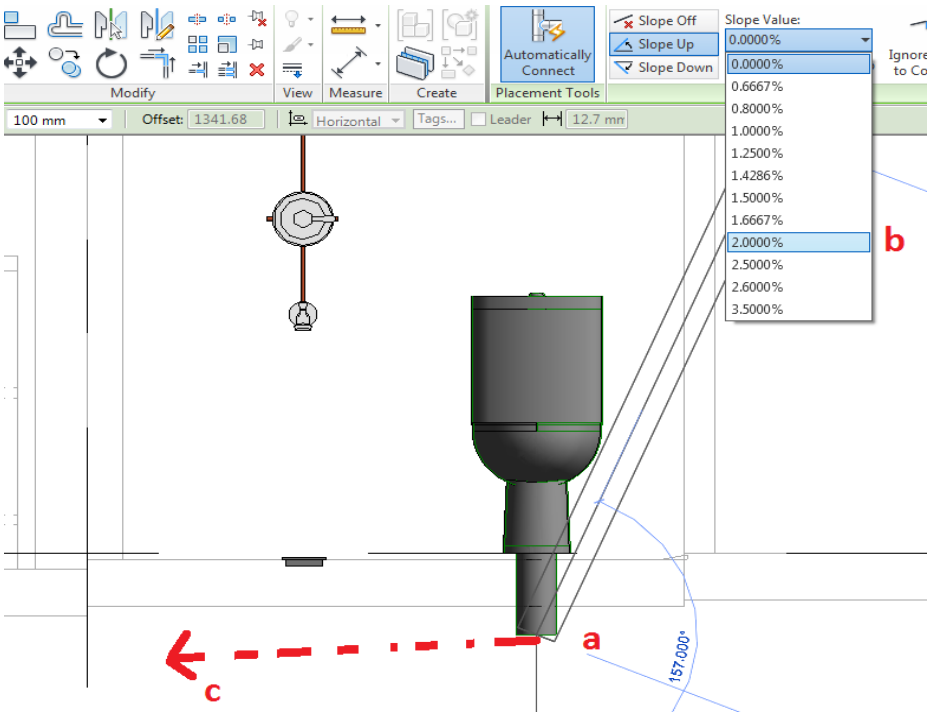
Start the pipe modelling at the furthest fixture from the riser so that the the clearance and slope of the pipe can be easily controlled.

d. Cut and open a section with the furthest fixtures on the toilet layout.

e. Select it and click the System Icon (

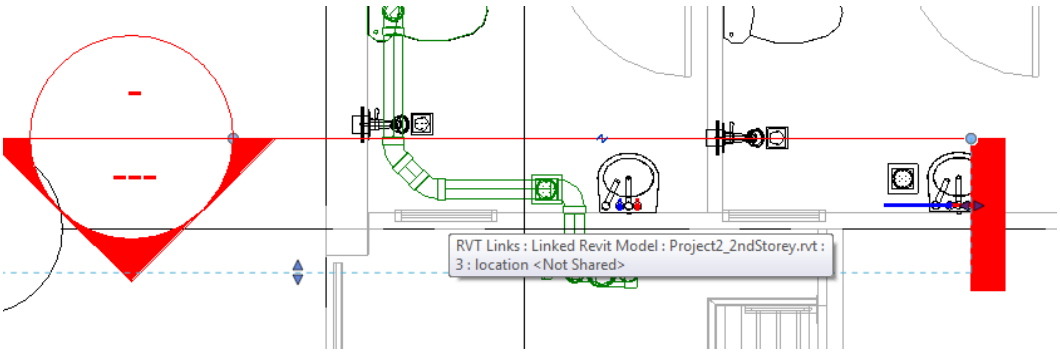
) and draw a pipe moving from the bottom of the water closet. See the figure below. Stop at point a and assign the slope of the pipe (b) and move the cursor to the left going to MDS direction. (c)

f. Repeat the same steps until all the water closets are connected to the Riser.



Connecting Floor Trap

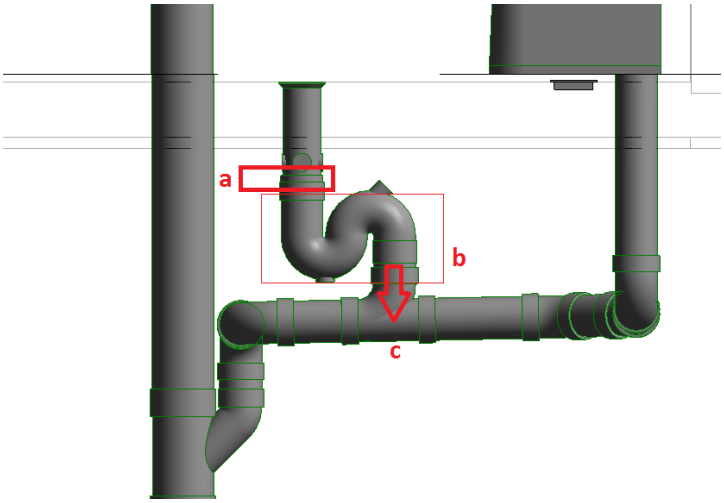
a. Cut a section in the floor plan showing the floor trap.



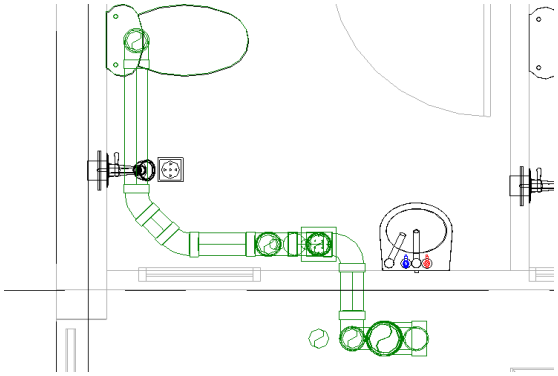
b. **Create a down pipe** as shown in the below figure. This step is the same as the procedure of connecting the water closet.

c. Stop at point **a** then **attach the S –trap**. The S-trap family can be loaded by selecting it from the list in the Property Panel of the **Home tab → Pipe Fitting** (**b**). Once the S-Trap had been placed, adjust if necessary to fit the required overhead clearance.

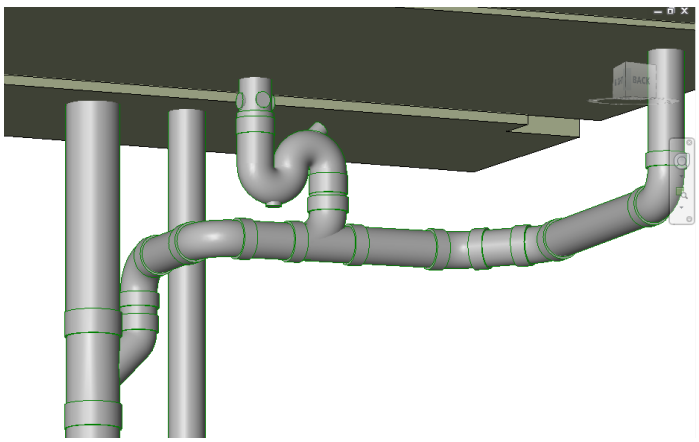
d. Finally, connect the S-trap to the nearby horizontal pipe. (**c**) See below figure after all the steps have been done.



Repeat the steps until the rest of the floor traps are connected.



Floor Plan



3D Model

Chapter 6 – Mechanical and Plumbing

Modelling Overall Floor Layout
To complete the layout for the whole floors and building, modelers should familiarize themselves to the following commands in Revit.

	*Group* This is to group all the different elements comprising 1 typical unit to allow reuse or repetition.
	*Mirror* To create an adjacent copy of the unit

Grouping Typical Unit Layout

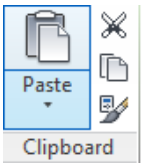
- Select the all the elements that belongs to the unit.
- From the modify, click the group

Copying MEP Layout to Adjacent Unit

a. **Select the grouped unit** and **Click the Mirror** tool from the modify tab.
b. **Pick the Mirror Axis**. Elements will then be mirror and place in an adjacent unit.

Modelling and Placing Layout into the Different Floors

a. Select the Group that you want to copy and place into a different floors.

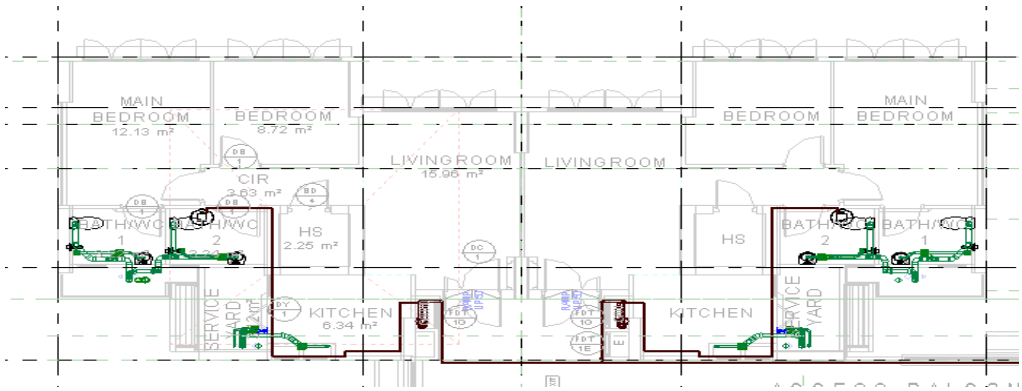


b. From the clipboard panel, select Copy to Clipboard.

c. Then click the **Paste**, from the list, click **Paste to Selected Level** and **tick** the level you intended to place the grouped unit.

Modelling Tips:
The more model Group you copy and paste, the more times it will generate.

Once done, the model will be like the figures below.



Chapter 6 – Mechanical and Plumbing



The MEP Model is ready for documentation.

Chapter 6 – Mechanical and Plumbing

4. **Documentation**

This is the last step of the Detailed Stage where the model will be prepared for regulatory submission and tendering.

Objectives:
To extend the information of the model by putting additional properties such as 2D details and attributes.

Deliverables:

- Model for Tendering
- Model for BIM e-Submission

5. **Preparing BIM model for Tendering and e-Submission**

The floor plans, sections and other drawings required for tendering can be generated directly from the BIM model. Reference should be made to the MEP BIM e-submission Guidelines in preparing drawings for regulatory approvals.

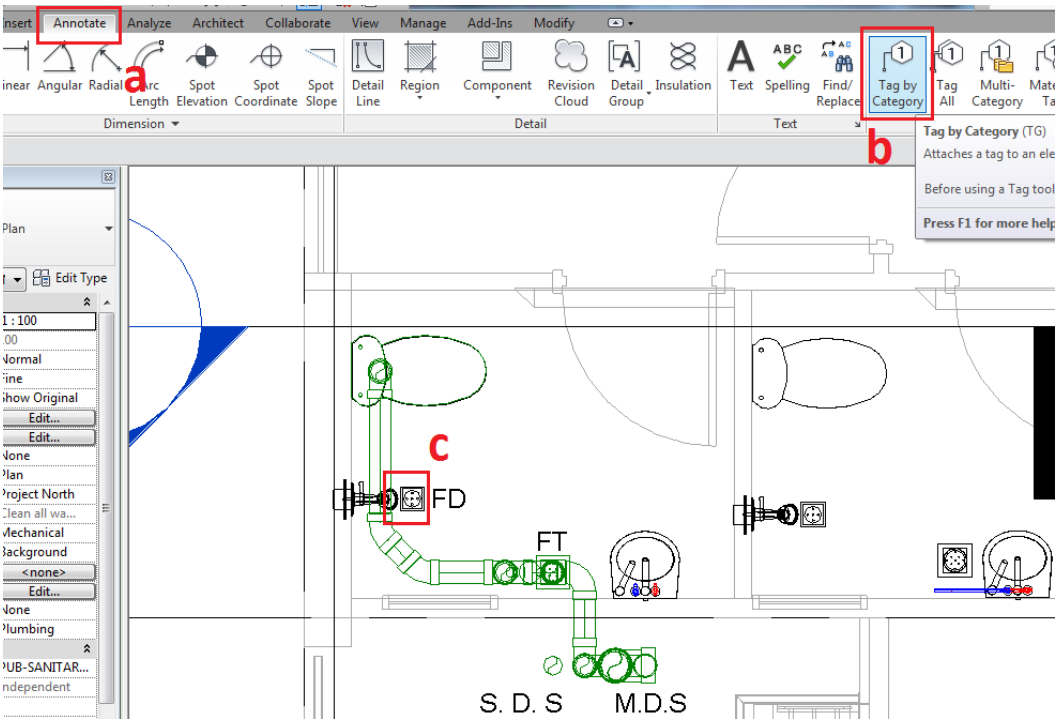
The steps below can be applied to both Mechanical and Plumbing trades of the project.

Preparing Typical Floor Plans

Open the typical floors of the created model. Zoom-in to one of the typical units and do the following steps.

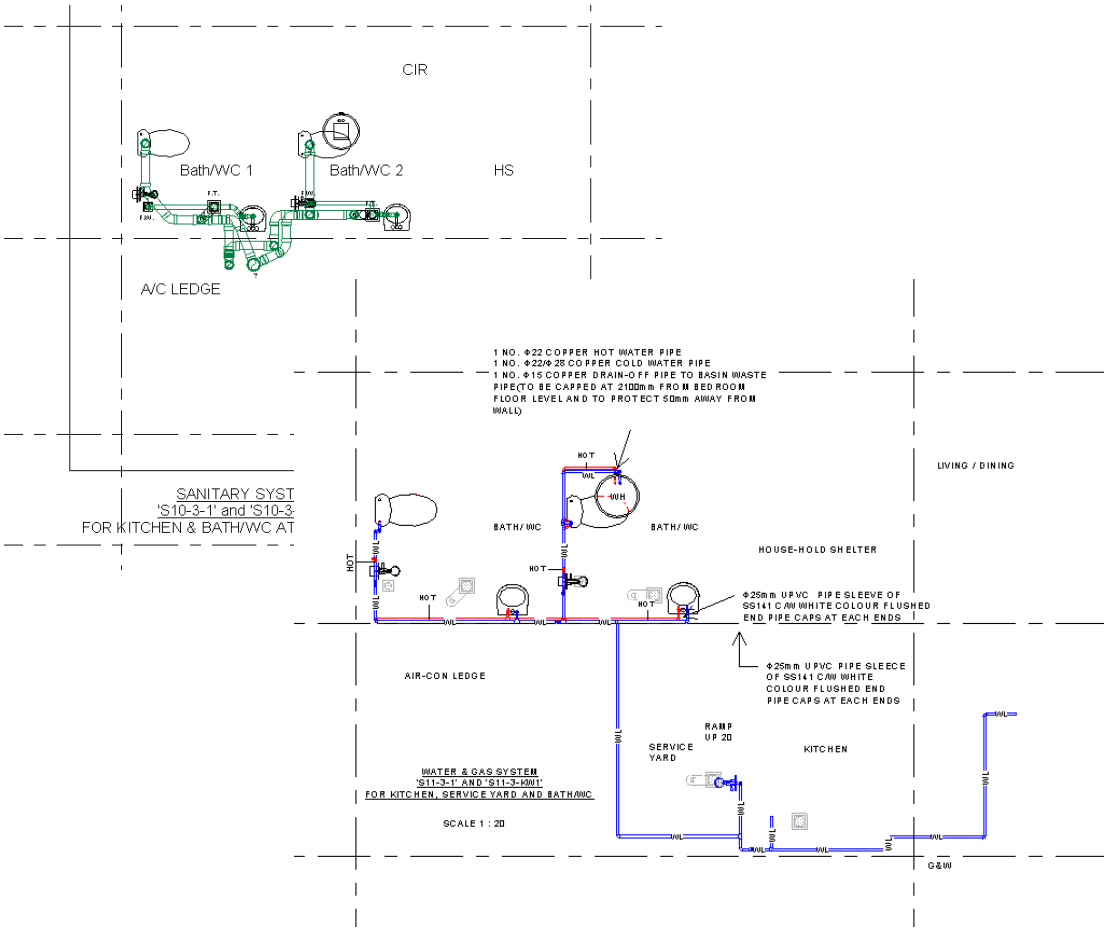
a. From view tab, select **Callout**. **Right click** to the selected Callout and **Open the View**

b. From the **Annotate** tab, click **Tag by Category** and select the elements in the model.



Standard annotation/tags available in the software can be used to annotate the model. If required load other annotation and customise them. Refer to Revit help for family creation.

c. Complete the annotation in the model by using Text tool and other detailing tool if necessary. See the figures below.



Placing Drawings into Sheets

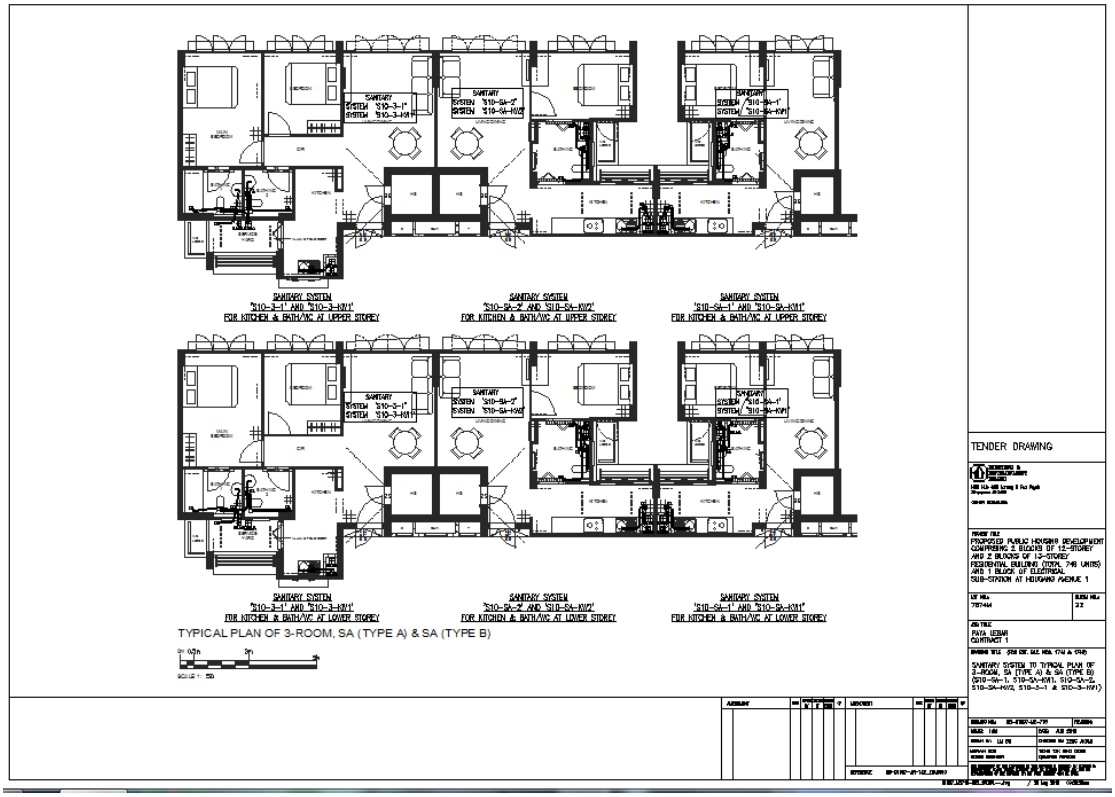
Once the drawing views (plans, schematics etc) are clearly annotated, they can be organized and placed in sheets with the steps below:.

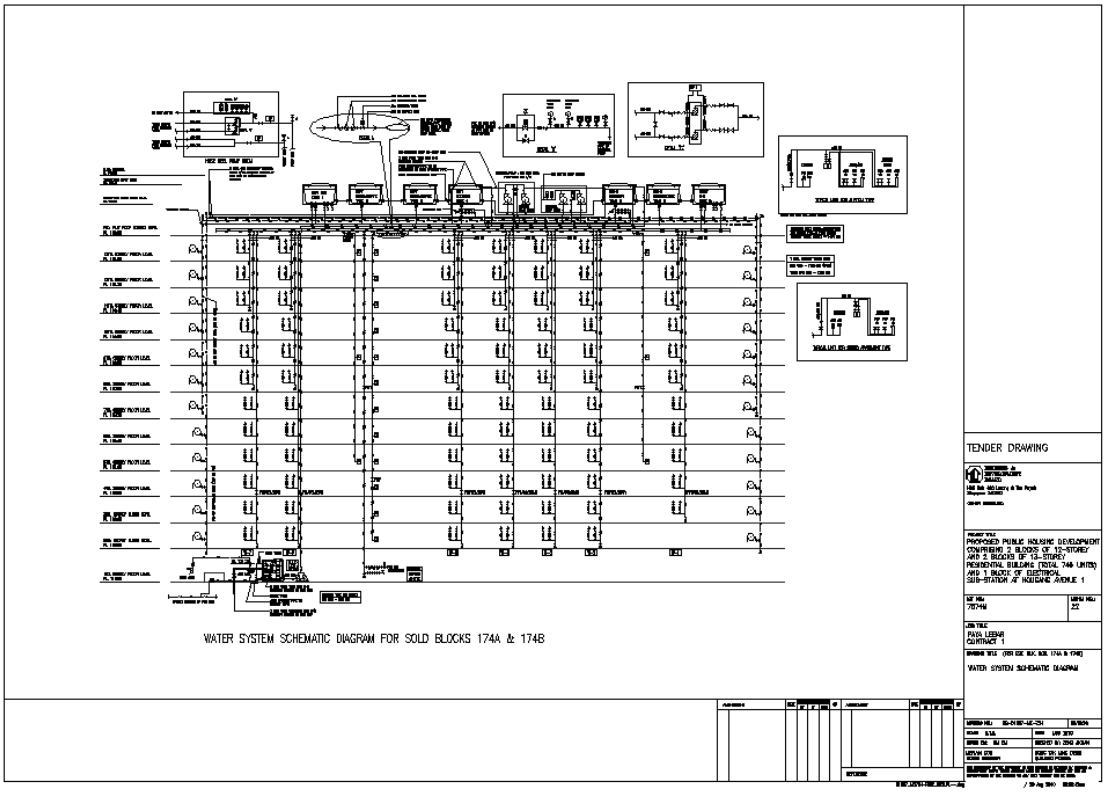
a. Create a sheet for the intended tender drawing. HDB has standards title block loaded into the template. Select the appropriate one.

b. From the project browser, drag and drop the drawing to be placed.

c. Once done, the drawing will be the same as the figure on the next page.

Chapter 6 – Mechanical and Plumbing





Repeat the same procedures to produce the documents listed below:

- Content of Contract Drawing
- Layout and Key Plans
- Site Plans
- Floor Plans

6. **Publishing Model and Drawings to Non-editable File Format**

Refer to Appendix C of Architectural BIM e-Submission Guideline for step-by-step guide to export/ publish to DWF for regulatory submission.

Note:
The drawings produced from the BIM model during the Detailed Design stage can form part of the tender documents together with other 2D detail drawings.

Chapter 7

Design Coordination

Chapter 7 – Design Coordination

1. Project members should share their models with one another at regular intervals for reference when they are developing the model for their own discipline. At certain milestones, models from different disciplines should be subjected to various coordination processes to allow the project team to resolve potential conflicts upfront and avoid costly abortive works and delays at the construction stage.

2. It is recommended for the project team to map out a high level coordination plan and agree on the intervals for Model sharing. An example is shown below.

3. The project base file discussed in the **Getting Started** chapter should be prepared and distributed to the team members to model their portion.

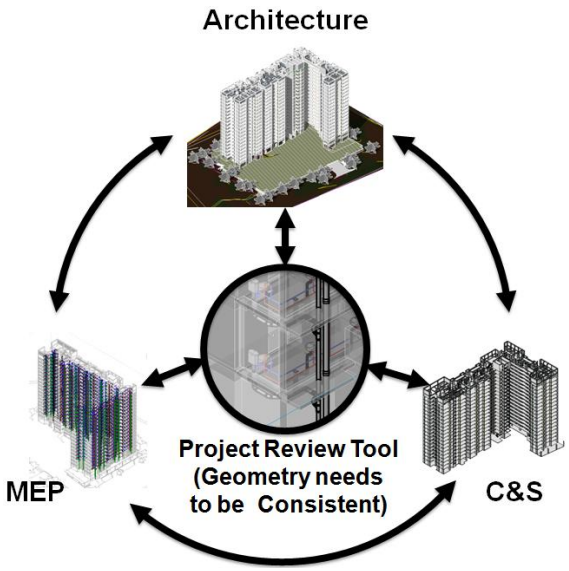
Architectural					
Conceptual Design		**Preliminary Design**		**Detailed Design**	
Model	Model	Model	Model	Model	Model
Weeks 1 - 5	**Weeks 6 - 10**	**Weeks 11 - 15**	**Weeks 16 - 20**	**Weeks 21 - 25**	**26**
Share	Share	Share	Share	Share	Share
No BIM content is expected from C&S and M&E. C&S and M&E should provide design consultation during this stage and prepare for their Preliminary Design.		**Preliminary Design**	**Detailed Design**		
C&S and M&E					

4. Successful BIM coordination needs proper management of workflow and team.

   Note:
   Coordination is not done automatically by the computer.

5. Prior to sharing, the data should be checked, approved and validated as "fit for coordination". It is recommended to use a common (software) platform to reduce possibilities of data loss or errors when sharing different models.

6. After the first set of models are received, they should be checked with the Project Review tool to ensure that they are placed in a common location and orientation.



7. It is recommended to discuss and decide the following in the **BIM Kick Off Meeting** before starting any modelling.
   - Schedule,
   - File naming convention,
   - Location, orientation and reference points,
   - File transfer methods,
   - File formats and
   - BIM tools and versions

8. Effective Modelling Plan helps better coordination. The Modelling plan has been discussed earlier in this document. It is recommended to export these part models as individual files for coordination.

   Example:
   - Each MEP trade as an individual file.
   - Each storey as an individual file.
   - A storey can be further divided into zones and exported as an individual file for big projects.

   Issues could be identified quickly as false issues are minimized. Ex. If a clash checking is done between the electrical system and the ceiling, there will be many false issues between ceiling and flush lights. These clashes can be ignored by not performing the clash between the lights and the ceiling.

9. Decide the color codes for each trade and assign them accordingly when they were combined together in a **Project Review Tool**. Color coding allows users to indentify issues visually.

   Note:
   Avoid colors that were used for highlighting or error by the Project Review Tool.

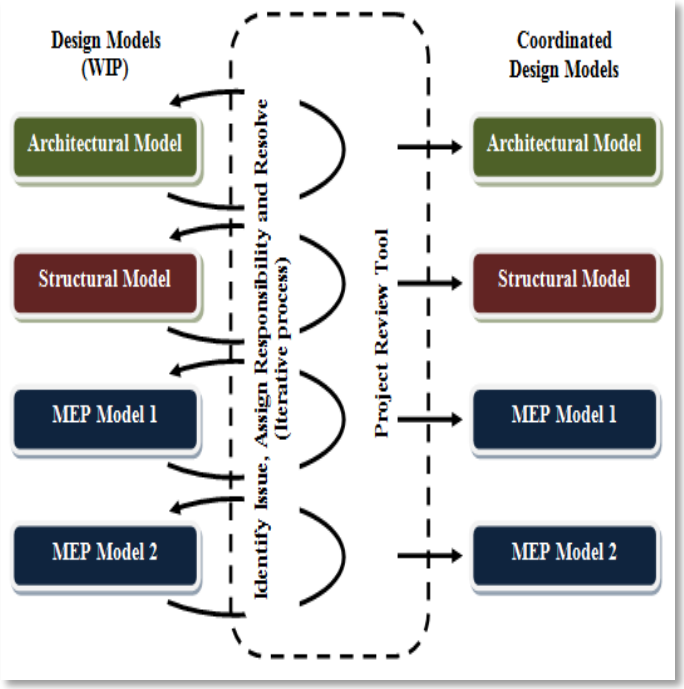
   Example:
   Architectural = Dark Green
   Structural = Dark Brown
   Fire Protection = Dark Red
   Plumbing = Light Green
   Sewerage = Yellow

10. Perform the coordination check before every coordination meeting, identify clashes, quality issues and geometry inconsistency. Record it for discussion in the meeting. This step is necessary for a effective design coordination meeting.

    It is important to recognise that not all conflicts detected are problems. Certain conflicts may have been intentional during the modelling process for the sake of simplifying the modelling process. Proper search sets 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 are unnecessary in the coordination process, for example, known issues that are to be resolved in later project stages; elements that do not impact the cost when changed on site, etc
    - Group particular elements for a specific type of coordination process, such as forming groups between a ceiling search set and an MEP model only during a clash analysis

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

Chapter 7 – Design Coordination



11. It is suggested, the project partners arrange for a meeting to discuss the issues and resolutions. The meeting is to identify and assign responsibility to each project partner.

Note:
Good practice is to record these issues, responsibility as a report for follow-up.

Image	Clash Name	Status	Distance	Description	Date Found	Assigned To	Clash Point
	**New Clash Group**	**New**	**-0.30**	**Hard**	**2012/6/11 04:20.38**		**x:-28.86, y:-34.11, z:3.20**
	Clash5	New	-0.03	Hard	2012/6/11 04:20.38	Archi Team	x:108.36, y:-32.74, z:3.30
	Clash6	New	-0.03	Hard	2012/6/11 04:20.38		x:-26.66, y:-31.93, z:2.51
	Clash7	New	-0.03	Hard	2012/6/11 04:20.38		x:-26.86, y:-31.73, z:2.50

Item 1				Item 2				
Item ID	Layer	Item Name	Item Type	Item ID	Layer	Item Name	Item Type	Comments
Element ID: **720998**	**B4**	**Internal_RC_300mm**	**Solid**	***Element ID:*** **503280**	**<No level>**	**Radius Elbows / Tees**	**Solid**	
Element ID: 721010	B4	Internal_RC_300mm	Solid	*Element ID:* 645265	Level 1	300 x 200	Composite Part	*#2 - chidam - 2012/6/11 05:45.38* Assigned to: Archi Team _____ Please create opening on the wall for the Diffuser
Element ID: 721018	B4	Internal_BK_200mm	Solid	*Element ID:* 533312	<No level>	Radius Elbows / Tees	Solid	
Element ID: 721018	B4	Internal_BK_200mm	Solid	*Element ID:* 518138	<No level>	Radius Elbows / Tees	Solid	

Appendix A

Appendix A

Appendix A: Typical Model Elements by Discipline

1. Architectural BIM Elements

	Element
Site Model	Site infrastructure within site boundary (roads, pavements, car park spaces, access and parking arrangements and surrounding land use)
	Surface drainage (only indication of locations necessary)
	External drainage & underground drainage
	Hard landscaped areas within site boundary
	Planter boxes including sub-soil drainage systems
	Massing of adjacent buildings relevant to project
Rooms / Spaces	Room spaces, corridors, other spaces, plant and equipment rooms (including designated use)
Walls and Curtain Walls	Interior / Exterior walls / Non-structural walls / Blockwork walls *(Including finishes to identify if tiled / painted / plastered)*
	Curtain wall with mullions and transoms with true profile and window glazing units including shading devices
Doors, Windows and Louvers	Interior / Exterior doors
	Interior / Exterior windows
	Louvers
	Ironmongery (handles, locks*, hinges* etc) *Typically in component family*
Basic structure	Beams where necessary
	Columns
Roofs	Roofs with overall thickness (including finishes & insulation)
Ceilings	Ceilings (without support sub-frames) including module arrangement, material choices and finishes.
Floors	Horizontal floors
	Sloped floors and ramps
	Floor finishes details including tiling and screed only
Vertical Circulation	Steps & stairs including risers, threads and railings including headroom clearance requirements
	Elevator shafts (without fit-out installations by lift contractor)
	Escalators & moving walkways, not including motorized equipments inside.
	Access ladders and catwalks
Architectural Specialties and Casework	Precast / GRC / Fibreglass facades
	Fixed Building Maintenance Units in their overall bulk form
Schedules	Schedules allowing information to be extracted from elements
Fixtures and Equipment *	Loose furniture including tables, sofas, desks and cloth hangers. Casework (carpentry), including upper and lower cabinets.
	Toilet fixtures, plumbing faucets

* these elements may cause BIM models to become too big and unmanageable.

2. Structural BIM Elements

Element
Foundations including piles, pile caps, tie / ground beams & footings
Diaphragm walls & retaining walls
Beams
Columns
Walls
Slabs, including slab on grade and floating slab, recesses, curbs, pads and major penetrations
Transfer Structure
Stairs (steps, risers, threads, landings): all framing members and openings
Shafts and Pits (and openings)
Precast & Prestressed concrete systems: all primary and secondary elements *
Temporary structures and platforms
Concrete reinforcement details (Rebar), imbeds and cast-ins *
Steel frame structures including bracing systems *
Base plates, bolts, clip angles, fixings, etc.*
Connection details of structural steel members *

* these elements may cause BIM models to become too big and unmanageable.

Appendix A

3. Civil Model

	Element
Digital Terrain Model ☼	3D surface based on topography that shows site conditions and building locations and utilities connections Include existing walkways, roads, curbs, ramps and parking lots etc
Geology report ☼	Soil investigation report
Utilities Model	All points of connection for existing and new utilities within site boundary
Rainwater & storm water pipe work	Includes outlets, surface channels, slot channels and manholes

☼ Data of existing conditions to be provided by surveyors and geotechnical engineers

4. ACMV BIM Elements

	Element
ACMV Equipment	Air Handling unit
	Chiller unit
	Variable refrigerant unit
	Cooling Tower
	Split-type indoor & outdoor air conditioning units
	Exhaust or extract air fans
	Fresh air fans
	Other fans such as jet fans
ACMV Distribution	Exhaust air ducts (excluding hangars)
	Fresh air ducts (excluding hangars)
	Supply air ducts (excluding hangars)
	Return air ducts (excluding hangars)
	Transfer air ducts (excluding hangars)
	Diffusers, air-boots, air grilles, air filters, registers
	Fire dampers, motorized dampers, volume control dampers
Mechanical Piping	Chilled water supply pipes including connections, fittings & valves
	Chilled water return pipes including connections, fittings & valves
	Condensate drain pipes including connections, fittings & valves
Others	Switch boards, control, BMS & DDC panels, BMS control & monitoring modules
	Fan Coil unit
	Engineering Smoke Extract System (e.g. smoke curtains, ductless fans)

5. Plumbing BIM Elements

	Element
General	Pipe supports and brackets *
	Pumps
	Control panels, monitoring and control sensors
Plumbing System	Fresh water piping, fittings, valves including hot & cold water pipe work with all plumbing equipment, sinks, toilet fixtures, plumbing faucets
	Water meters
	Storage, water holding tanks, pressure vessels
	Underground Public Utilities for water supply
	Underground Public Utilities for drainage
Sanitary System	Foul drainage, kitchen waste pipe work including floor drains, open trapped gullies, sealed trapped gullies and clean outs, vents and manholes
	Grease and sand traps
	Sump and sewage pits

* these elements may cause BIM models to become too big and unmanageable.

Appendix A

6. Fire Protection BIM Elements

Element
System piping, droppers, fittings, valves and sprinkler heads, sprinkler inlets, sprinkler control valve set, subsidiary valves, flow switches
Pipe supports and brackets *
Fire alarm gongs & break glass unit
Fire sprinkler pumps
Sprinkler tanks
Hydrants and hose reels, including street fire hydrant system
Gas piping for suppression systems
Heat or smoke detectors, control panels, monitoring and control sensors, pump panels, check meter positions
Fire extinguishers
Fire shutters & hoods above

* these elements may cause BIM models to become too big and unmanageable.

7. Electrical BIM Elements

Element
Cable trays, trunking & cable containment, Electrical risers, conduit, Busduct, power feeds,
Concealed and cast-in place conduits
Outlets, panels, wall switches, circuiting to devices, security devices, card access and “plug moulds” (socket points)
HV & LV switch boards, switchgear, MCCB boards, MCB boards
Transformers
Light fittings & fixtures & housings for light fixtures
Conduit associated with access, data communication, security systems and electrical equipment
Telecom equipment and computer racks
Generators and exhaust flues incl acoustic treatments
Diesel tanks & fuel pipes
Security system including CCTV camera, smart card system, door monitoring system
Car park control system, barrier gates
Equipment and associated installations maintained by public utility companies

Appendix B

Appendix B

Appendix B: 2D CAD to Architectural Preliminary Design BIM Model

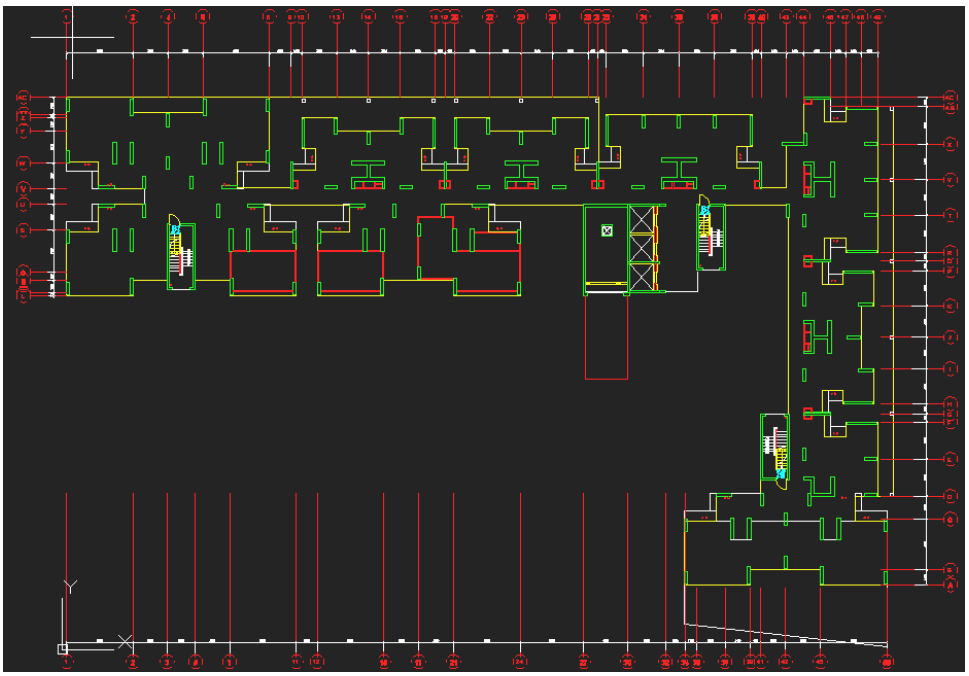
1. This appendix explains the steps on how to convert CAD drawings to a BIM model when **Option 2** (using non-BIM tools) is selected in Conceptual Design stage using BIM elements like Wall, Column, Slab, Door, Window and other objects. Refer to **Appendix A** for list of BIM elements that need to be modelled. Implement the modelling plan discussed earlier in this document.
   a. Create link files for floors. Ex. Site, 1st Storey, 2nd Storey, Typical Storey and Roof.
   b. Create typical units as groups inside the link files.
   c. Create a Master File and set-up the necessary views for each block.
   d. Create an overall Master File that links all the blocks together into the site.

   Deliverables:
   a. Architectural BIM model for design coordination with Structural and M&E Engineers.

   b. Architectural BIM model for URA Submission
   Please refer to Architectural BIM e-Submission guides for Specific Requirements of the Agencies

2. Create a BIM **Site Model** as per the steps discussed in **Point 2** of the Conceptual Design chapter. Next, to create the **1st Storey Model**, create a new project by duplicating the **Project Base File** created in the **Chapter 2 - Getting Started**.

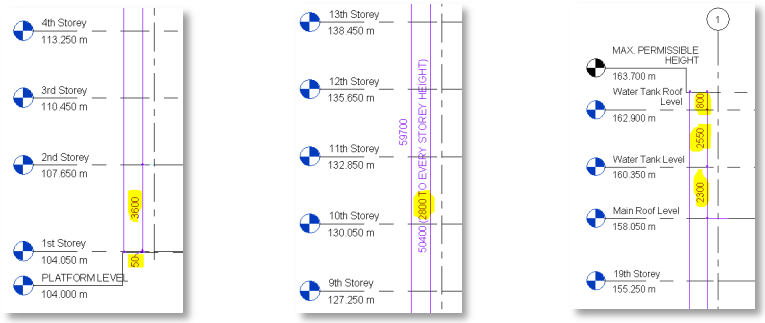
   a. Go to **Insert** tab → **Link** panel and click on the **Link CAD** to insert the 1st Storey DWG into the **BCA-_FP_1st Storey** plan view. Move the link to the correct location and orientation.



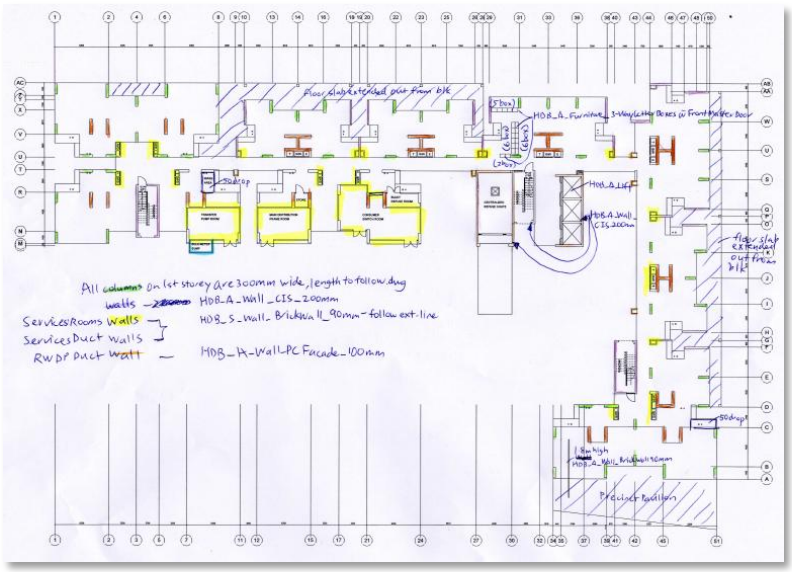
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b. Trace **the** grids from the inserted DWG file. If the Project Base File does not have the levels then set the number of levels and floor to floor height as per the requirement.

e.g. 1st Storey level is 50mm higher from the platform,
1st Storey to 2nd Storey is 3600mm,
Typical Storey(s) height is 2800mm,
Main Roof Level to Water Tank Level is 2300mm,
Water Tank Level to Water Tank Roof Level is 2550mm and
Water Tank Roof Level to the Max Permissible Height is 800mm.



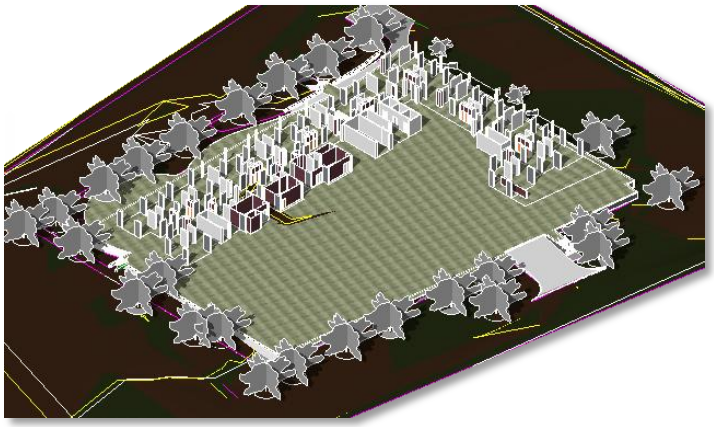
c. Choose the families and types to be used for the Floor, Column, Wall, Door, Window, CRC, Stairs and Lifts. If the families are not available then they will have to be created. Elements can be placed with approximate sizes and at approximate locations as there may not be enough information at this stage.



d. Model the Slabs, Columns, Walls, Doors and Windows. Add rooms like Pump Room, MDF Room, Bulky Refuse Room, Consumer Switch Room, Store, Refuse Bin Centre, Lift/Lift Lobby and Stairs. **Home** Tab → **Room & Area** Panel → **Room**

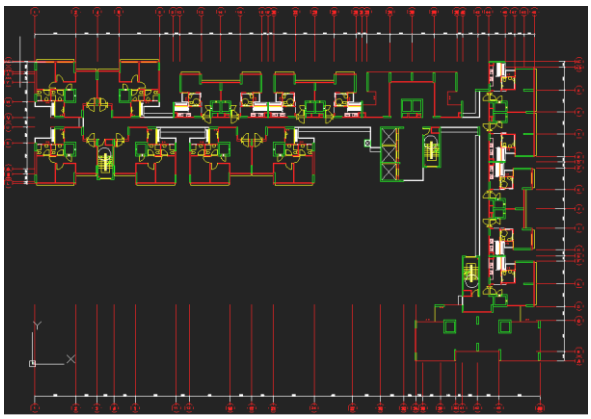
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e. Duplicate the Project Base File to create a **Master File**. Link the **Site Model** and the **1st Storey Model**.

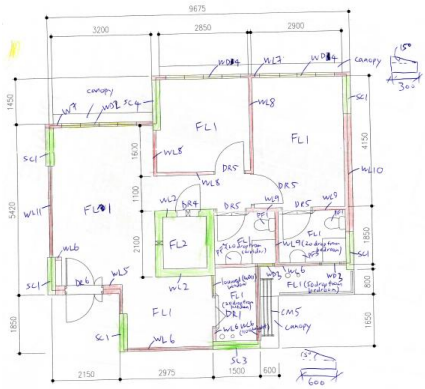


f. The **2nd Storey Model** can be created by duplicating the 1st Storey Model. Preserve Level 2 and Level 3, remove the rest of the levels. This is to avoid confusion when the model is linked to the Master File.

g. Go to **Insert** tab → **Link** panel and click on **Link CAD** to insert the 2nd Storey DWG into the BCA-_FP_2nd Storey plan view. Move the link to the correct location and orientation.

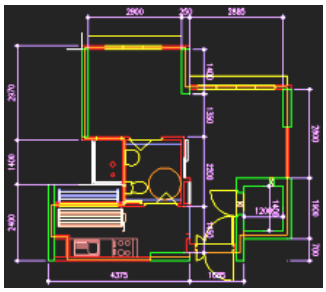


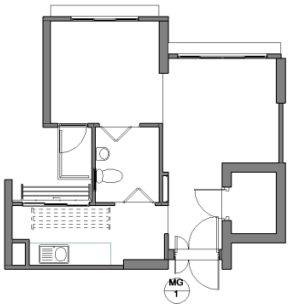
h. Choose the families and types for the Slab, Column, Wall, Door, Window, CRC, Stairs and Lifts. If these families are not available then they will have to be created. Elements can be placed with approximate sizes and at approximate locations as there may not be enough information at this stage.

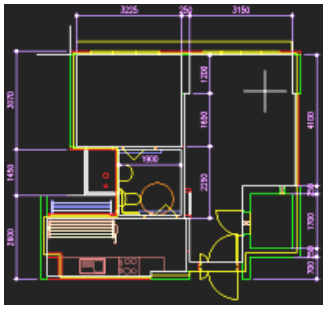


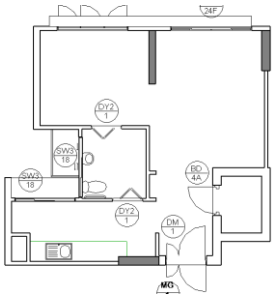
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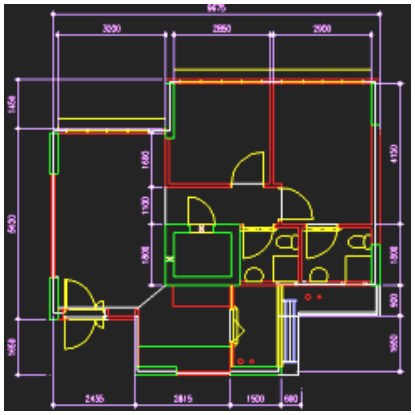
i. Trace the DWG file and model the typical units. Skip the Columns and Walls that are common with the adjacent units. Select the unit and make it as a group. These units can be un-grouped when the unit design is firm to reduce the file size.

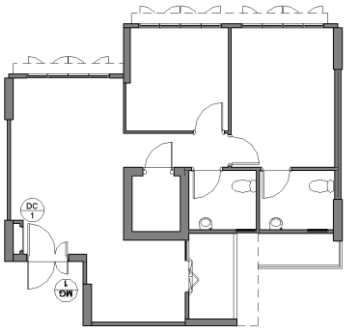


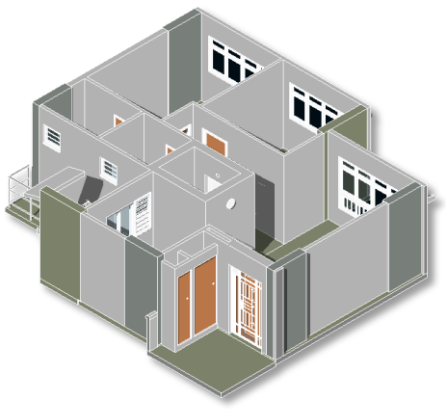


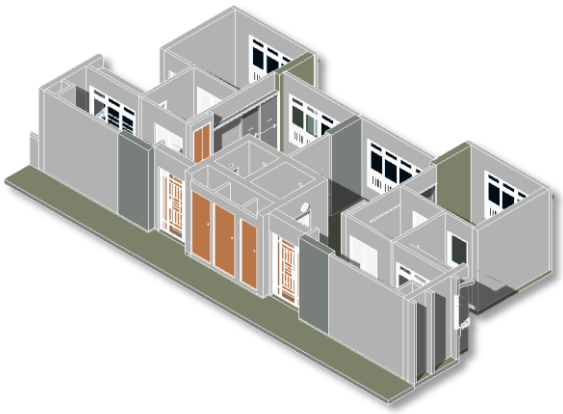








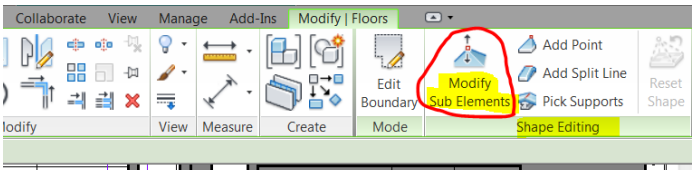




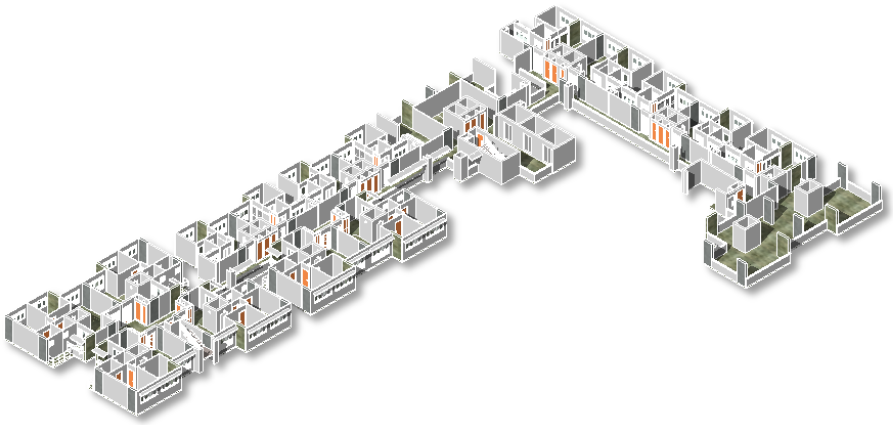
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j. Place the Units (Groups) in the plan, add the rest of the Slabs, Columns, and Walls in the common area and complete the 2nd Storey Model. Link to the Master File created in **step 2.e**.

Create Ramps at required areas (e.g. Entrance to the Units, Entrance to the Bath/WC etc)
This can be done by editing the slab. Select the Slab, Go to **Modify | Floors** tab → **Shape Editing** Panel and Click on **Modify Sub Elements**. Click on the node that need to be changed in the slab profile and set the elevation as required.



Doors of the service ducts should be 100mm above the finished floor level of the Access Balcony. Set the **Sill Height** parameter of the doors to 50mm as the floor level of the Access Corridor is already -50mm.



k. Duplicate the 2nd Storey Model and create the **Typical Storey Model**, Move the contents of the duplicated model to the 3rd Storey (**BCA-_FP_3rd Storey** Plan View), Make the necessary changes to the layout and Link to the Master File created in **step 2.e**. Copy the link to the rest of the typical Floors, by **Copy to Clipboard** and **Paste Aligned to Selected Levels**, until the level below the top most Residential Level.

l. Duplicate the Typical Storey Model and create the **Roof Model** that contains the top most **Residential Level**, **Main Roof Level** and **Water Tank Level**. Some key items to be modeled:

- Water Tanks,
- Access Platforms,
- Lift Motor Rooms,
- Slab thickening for House Hold Shelter and
- Vents for the service duct coming from the units.

Complete the Roof Model and link to the Master File created in **step 3.d**.

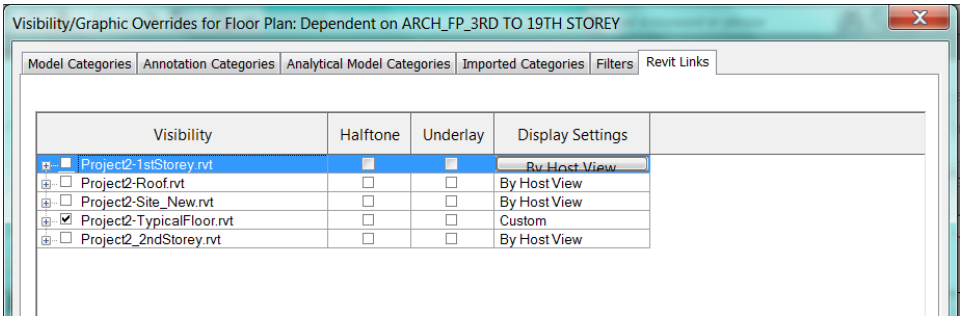
m. Add the basic dimensions in the Master File, clean up the Plans and Elevations. As part of the documentation prepare the 1:100 scale Plan, Elevations and Sections. The model is ready for the next stage.

Note:
The model at this stage should be sufficient for URA submission. Please refer to Architectural BIM e-Submission Guideline for detail requirements.



Note:
A clean-up is required for the links. In the clean-up, user need to hide the Grids and Levels that comes from the link files and reveal the visibility of correct floors in the levels. E.g. Display only the 1st Storey model and hide the rest of the links in the 1st Storey plan view.

All these can be done in the **Visibility/Graphics → Revit Link** Panel. Type **VG** to activate the **Visibility/Graphics** dialog box.



3. **Share the Preliminary Design model with the Engineers to prepare their part of the model.**