

BIM eSubmission Guideline MEP

Template Training Guide

Bentley AECOsim Building Designer v8i



We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment.

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Revision #	Revision Date	Summary of Changes	Remarks
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1 Introduction

The objective of this document is to assist qualified persons (QPs) in developing Building Information Model (BIM) for MEP regulatory submission in Singapore. The BIM e-Submission template creates a basic structure to further assist the QPs in preparing the model. QPs are also advised to make reference to the training materials distributed or to consult Bentley for any enquiries on the application.

It describes the requirements and guidance for creating BIM with specific object types, associated properties and presentation format to the following regulatory agencies for visual processing:

- a) National Environment Agency (NEA), Central Building Plan Unit
- b) Public Utility Board (PUB), Water Reclamation (Network) Department
- c) Public Utility Board (PUB), Water Supply Network Department
- d) Fire Safety and Shelter Department (FSSD)
- e) Infocomm Development Authority (IDA)
- f) CityGas Pte Ltd

This training material is meant for Bentley MEP Users reference only.

1.1 Range of Requirements for BIM e-Submission

The Prescribed format covers a range of requirements based on a BIM e-Submission template that is downloadable from the regulatory authority covering:

- 1. Project Standards
- 2. Standardized File Naming
- 3. Project Basic Composition

2 Bentley Goal

The goal of Bentley Systems Pte Ltd Singapore is provide user with the necessary template and guidance to make BIM e-submission in Singapore.

This document is not to be used as a substitute for Bentley's regular training courses, available through Bentley's LEARN Server or On-site Training, for AECOSim Building Designer, Bentley Building Products or MicroStation.

This document is Bentley's BIM e-Submission Template Guide for BIM e-submission to BCA.

3 Deliverable Format

For deliverable format, please refer to the MEP BIM e-submission guideline by BCA. Below is a summary of requirements:

Regulatory Agencies	Accepted File Format for BIM Submission	Remarks
BIM submissions to other regulatory agencies: a. CBPU; b. PUB-WRN; c. PUB-WTR; d. FSSD; e. IDA-TFCC; and f. CityGas	a. A single light-weighted file format , as published from the similar BIM native file: i. DWF (.dwf); or ii. PDF (.pdf)	The respective regulatory agency reserves the right to request BIM native file for verification, ONLY if necessary.

3.1.1 Table 3.0.1

3.2 Light Weight File – PDF

Light-Weight PDF files can be generated with the Bentley application by publishing the project model, Floor Plans, Elevation and Sections into single PDF file. **PDF plotter configuration** (PDF.PLTCFG) for printing these documents is available by default in Bentley applications.

4 Bentley Templates

Bentley delivers a **BIM e-Submission.dgn** template document which incorporates the BIM e-Submission range of requirements:

- 5 Project model scale
- 6 Site Configuration / Layout
- 7 Project model orientation
- 8 Project model Datum

The template file **BIMe-Submission.dgn** must be selected as a **SEED FILE (Template)** during the creation of a new project design file.

Refer **Figure: 4.0.1** below.

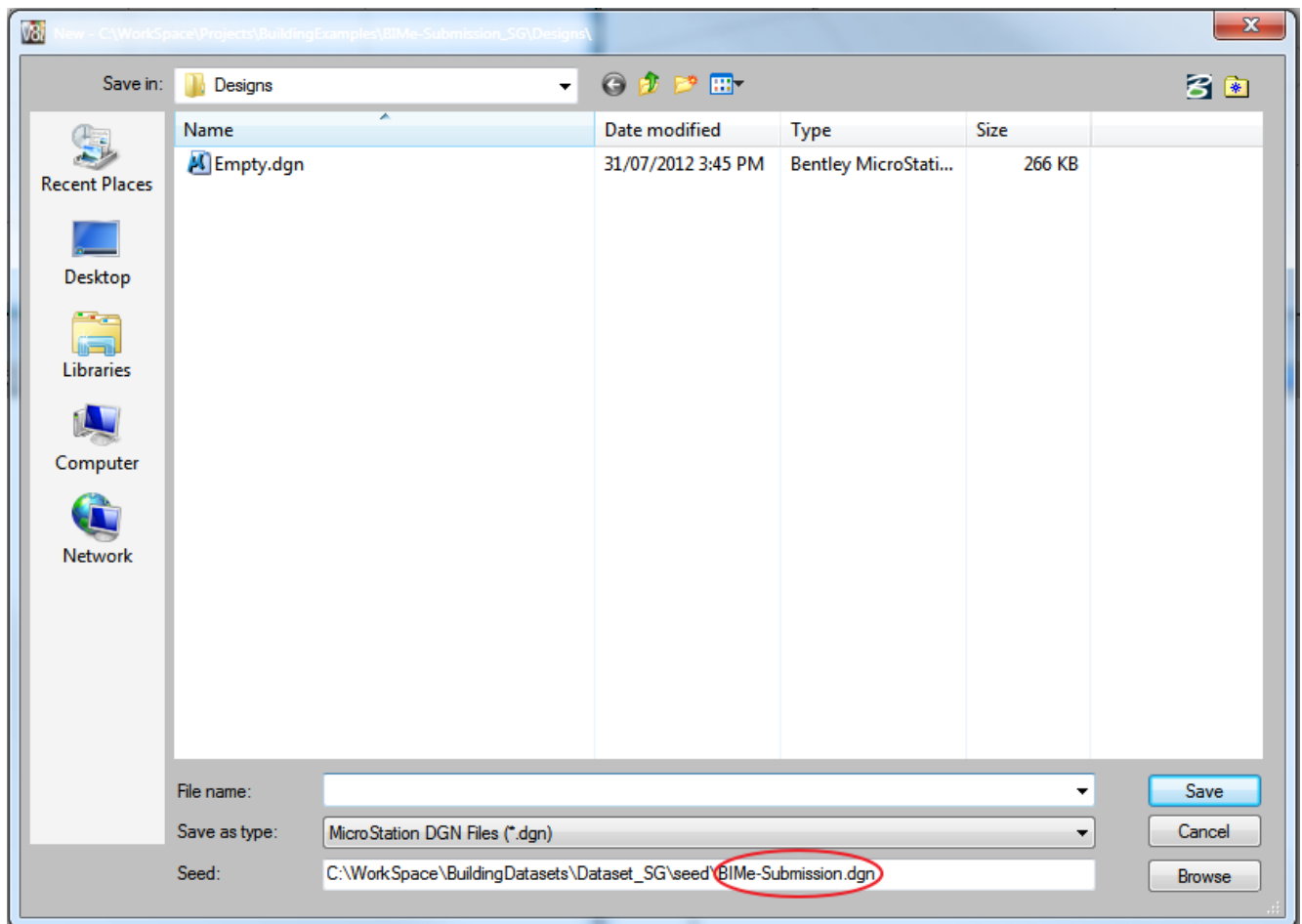


Figure: 4.0.1

4.1 Project Model Scale

It is recommended to use “**Real-World**” measurement for the project model scale for BIM e-Submission. In Bentley applications, Project model scale is presented in “Real-World” measurements via **SETTINGS MENU>DESIGN FILE** under the category **WORKING UNITS**. Metric units are configured by default in the BIM e-Submission.dgn template file.

Refer **Figure: 5.1.1** below

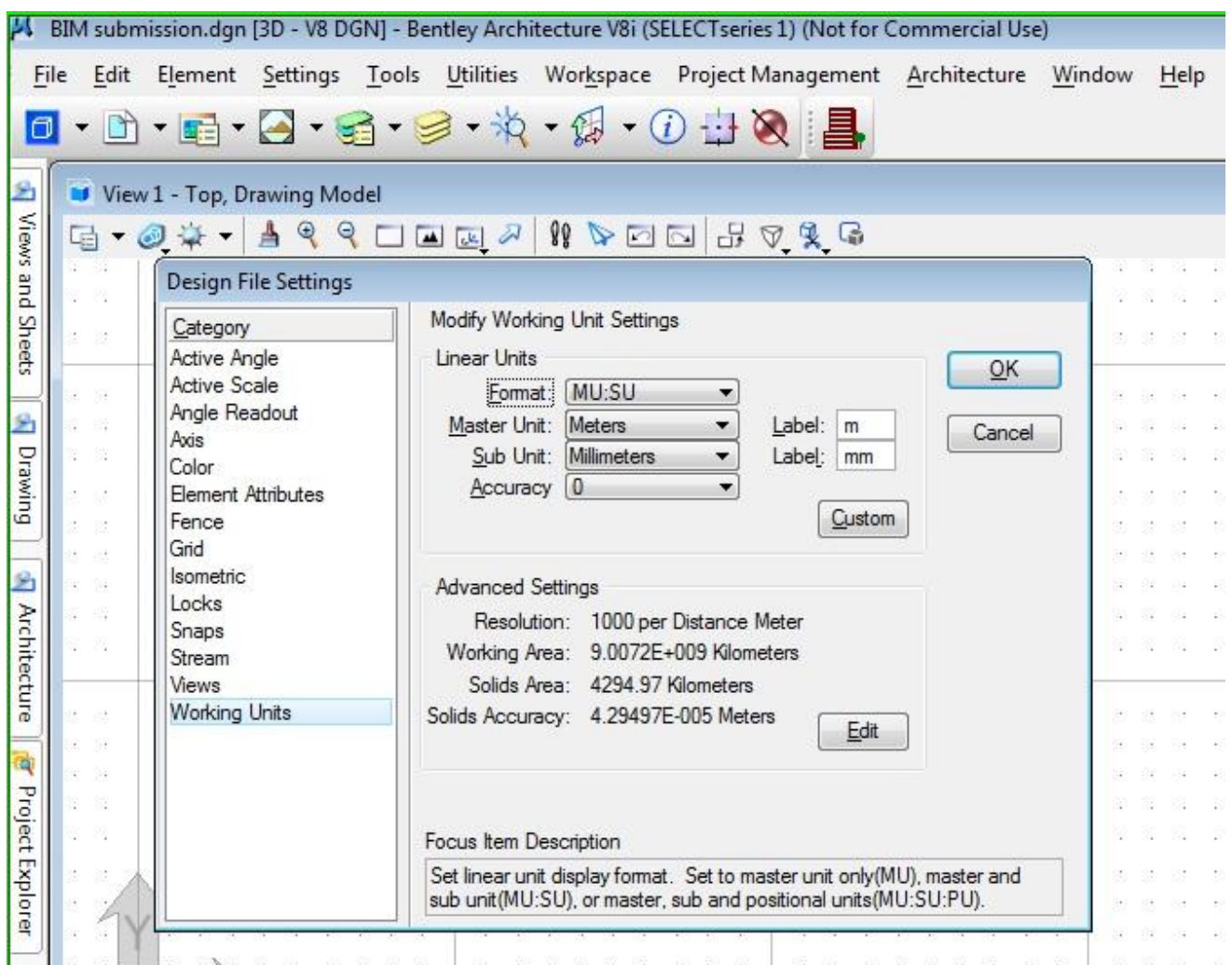


Figure: 4.1.1

4.2 Site Configuration / Layout

Real World coordinates for Singapore Zone **UTM84-48N** is configured in the template file. In Bentley applications, go to **TOOLS MENU> GEOGRAPHIC SELECT GEOGRAPHIC COORDINATE SYSTEM**.

Refer **Figure: 5.2.1** below

The Coordinate system in the design is accessed via **UTILITIES MENU>AUXILIARY COORDINATES**.

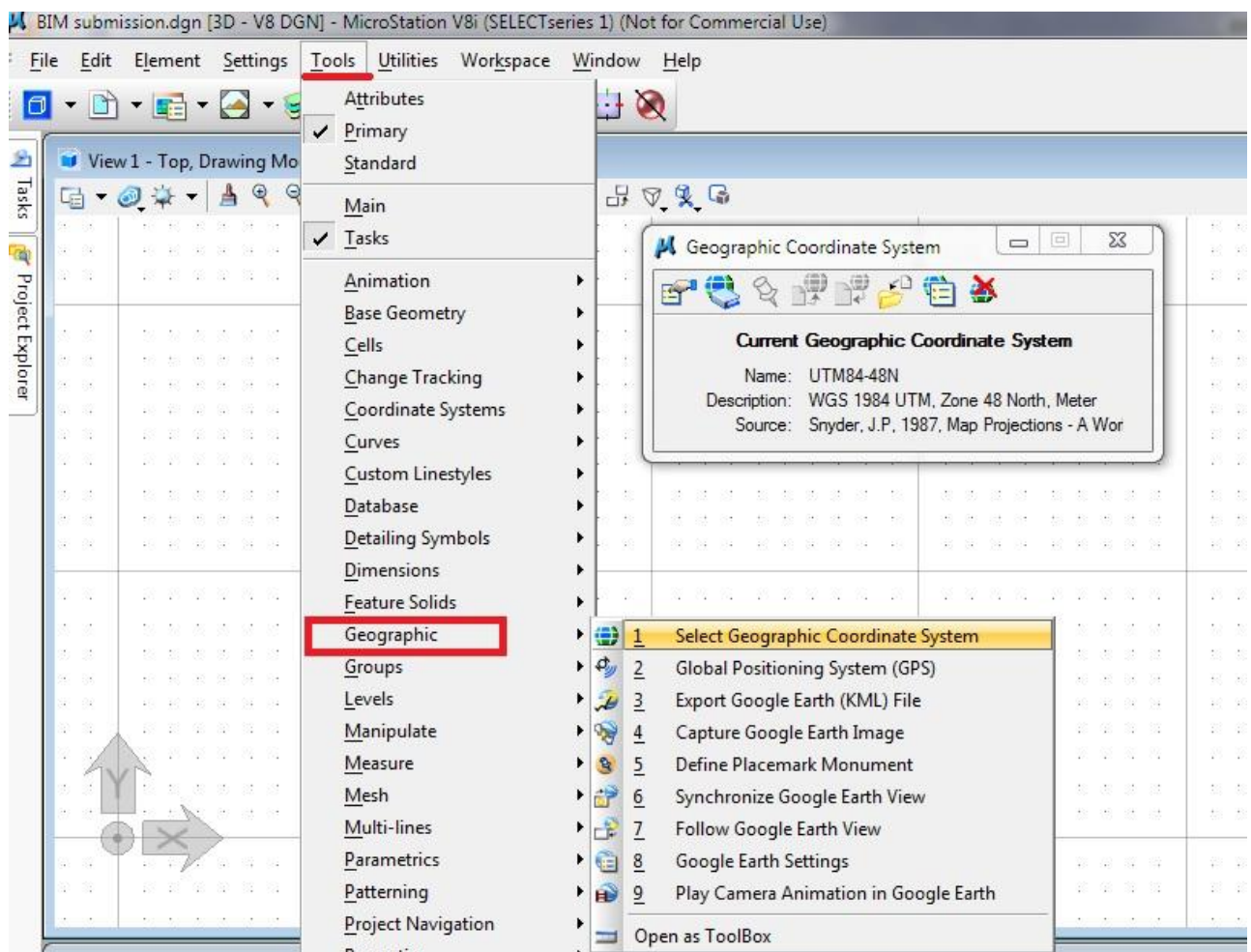


Figure: 4.2.1

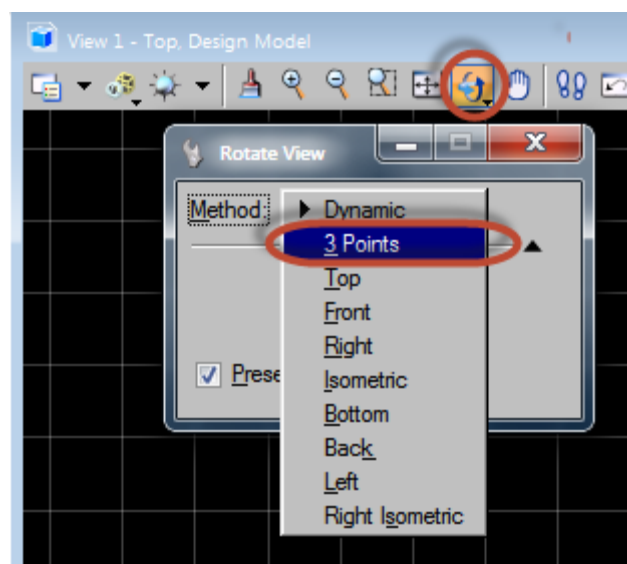
4.3 Project Model Orientation

Project North versus True North:

AECOSim Building Designer provides the ability to switch between “Project North” and “True North” allowing the user to create a model and detail a building orthogonally and yet display a site layout correctly i.e. with North pointing vertically upwards on the page.

Figure 4.3.1.1 below shows two diagrams:

1. Drawing according to **True** North – Model is based on True North (North Arrow shown in this case as being vertical up/down page). Note that the Model is rotated, so also the elevations if viewed without ‘View’ rotation.
2. Drawing according to **Project** North – ‘View’ has been rotated (not Model/graphics or North Arrow), so as to present the model as being orthogonal to the computer screen. This rotated view is used for creation of Plans, Sections and Elevations.



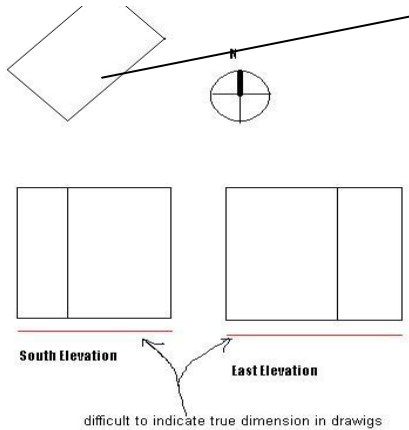
Rotate view functionality in AECOSim Building Designer

Figure: 4.3.1.1

Both methods may easily be recalled at any time via the Saved View functionality within the software.

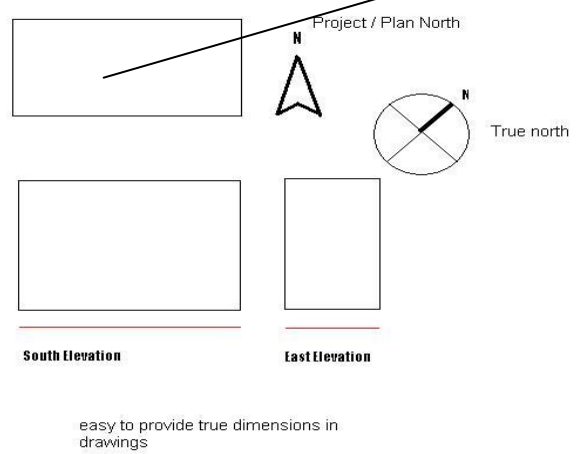
Project orientation is **aligned orthogonal to the computer screen** (North – South), as the building industry in Singapore has adopted “Project-North” as a default for delivery of all drawing documents. The setting between Project-North and True-North (refer **Figure: 5.3.1.2**) can be configured within project setup. This setup can be configured in Bentley Building applications using the tool **ROTATE VIEW>3 POINTS** (as shown in the **Figure: 5.3.1.3**)

Building Model (top view shown) orientation based



Drawing according to True North

Building oriented based on Project North. View rotated



1. Drawing according to **True** North

2. Drawing according to **Project** North

Figure: 4.3.1.2

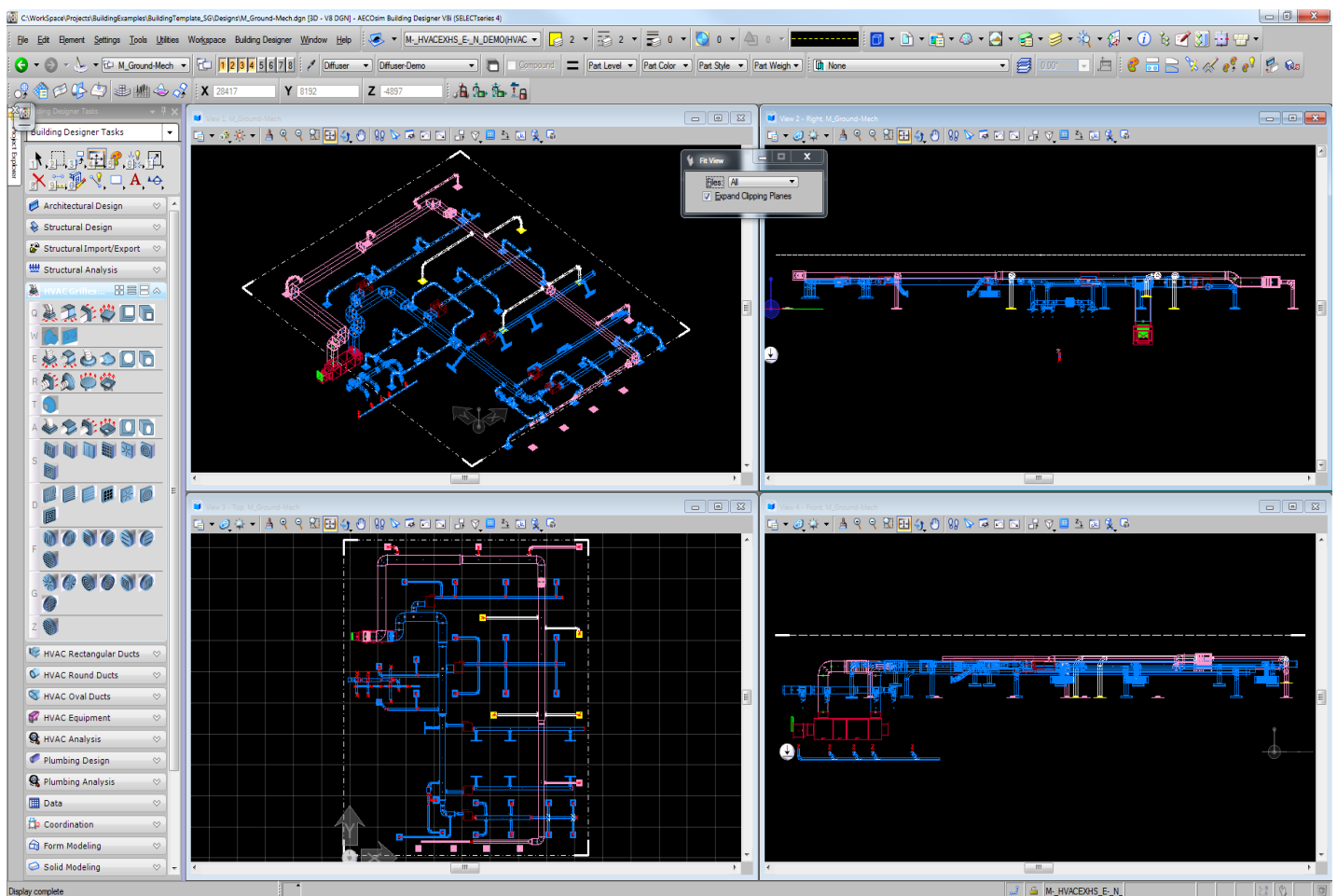


Figure: 4.3.1.3

4.4 Project Model Datum

Project Datum must be aligned to **Above Mean Sea Level or AMSL** (>100meters) and is configured in BIM e-Submission.dgn template file whereby the settings move the project to actual datum. This can be done in Bentley Building applications using **UTILITIES MENU>AUXILIARY COORDINATES**.

Refer **Figure: 4.4.1** below.

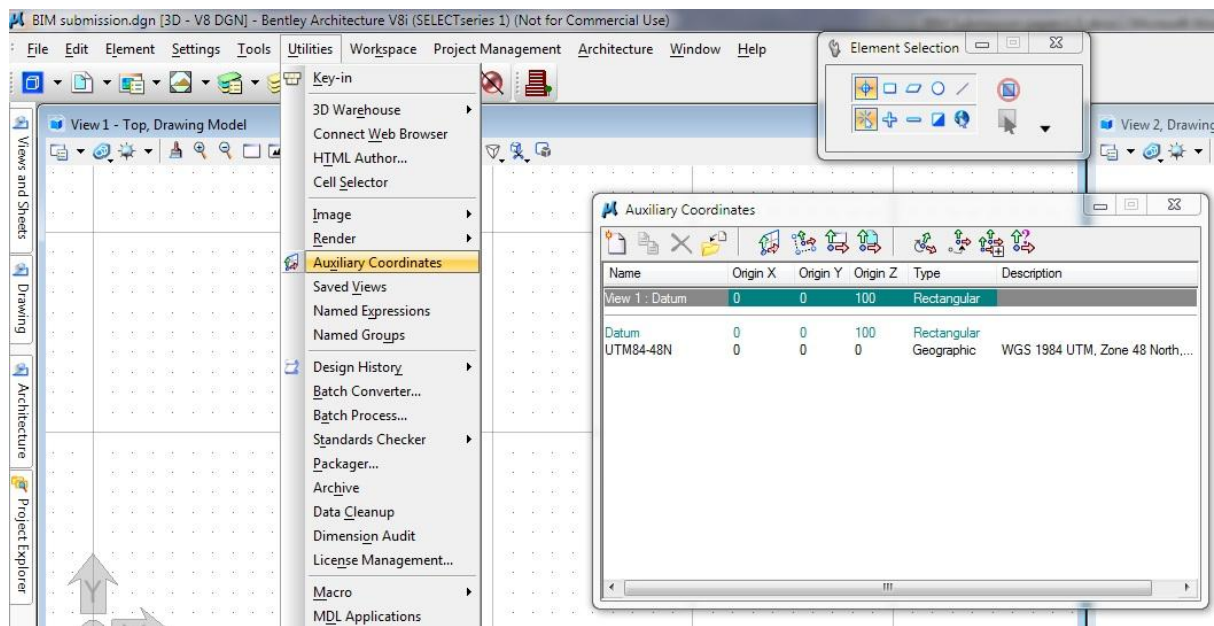


Figure: 4.4.1

5 Standard File Naming

To facilitate BIM e-Submission and to avoid ambiguity in understanding the BIM Native File, Building & Construction Authority standardized the File Naming. The convention to naming these files follows a pattern modified from **SS-CP83, Part 3**.

Bentley has developed a utility which will automate the process of **Standardized File** and **View Naming**. **BIMFileNaming.mdl** requires to be loaded within Bentley Building applications via **UTILITIES MENU>MDL APPLICATION** - MDL Loaded by default when the appropriate project is selected..

Refer **Figure: 5.0.1** below.

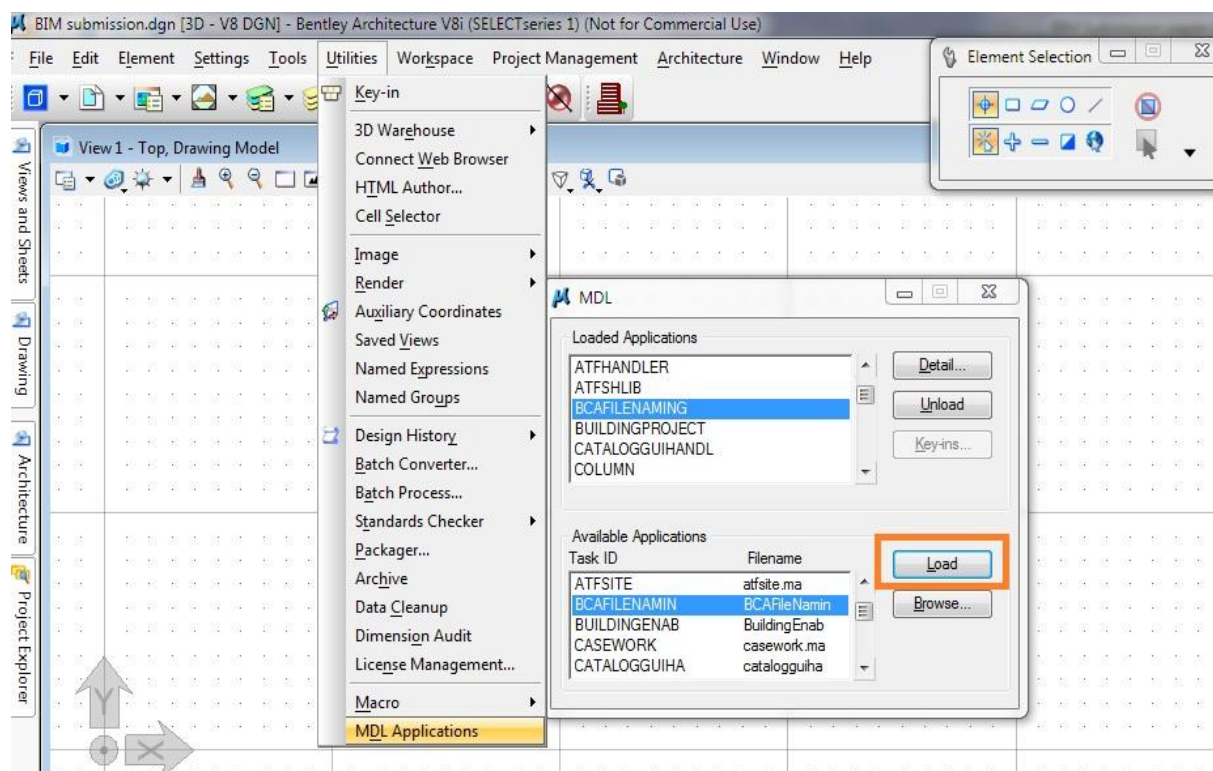
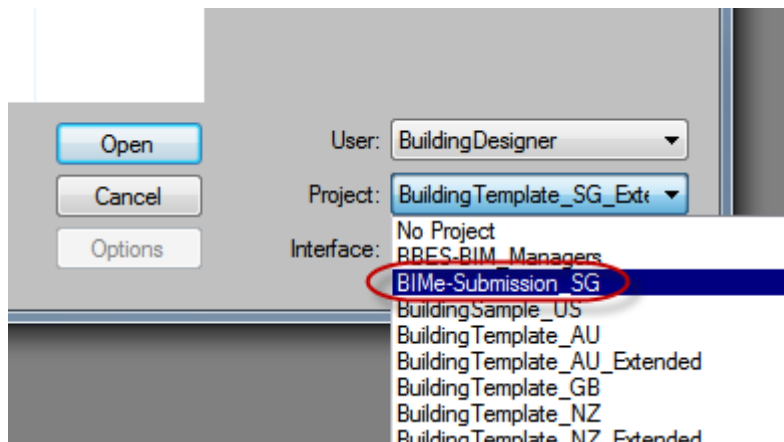


Figure: 5.0.1

6 New MEP File Creation

Start AECOsim Building Designer by selecting the appropriate project:



This ensure that all new files created within this environment will use **BIME-Submission.dgn** as a seed file, thereby loading all the required pre requisites for BIME-Submission.

Figure: 6.0.1

Figure: 6.0.2

By selecting **File>New** the user is presented with a dialog box requesting input to various fields. Example: Project ID, Author, Zone/Block etc.

Completion of this task opens a new dialog box with the File Name already populated based on input previously entered by the user. The correct seed file is also highlighted.

Seed file location:

Drive:\WorkSpace\Projects\BuildingExamples\BIME-Submission_SG\support\dataset\seed\BIME-Submission.dgn"

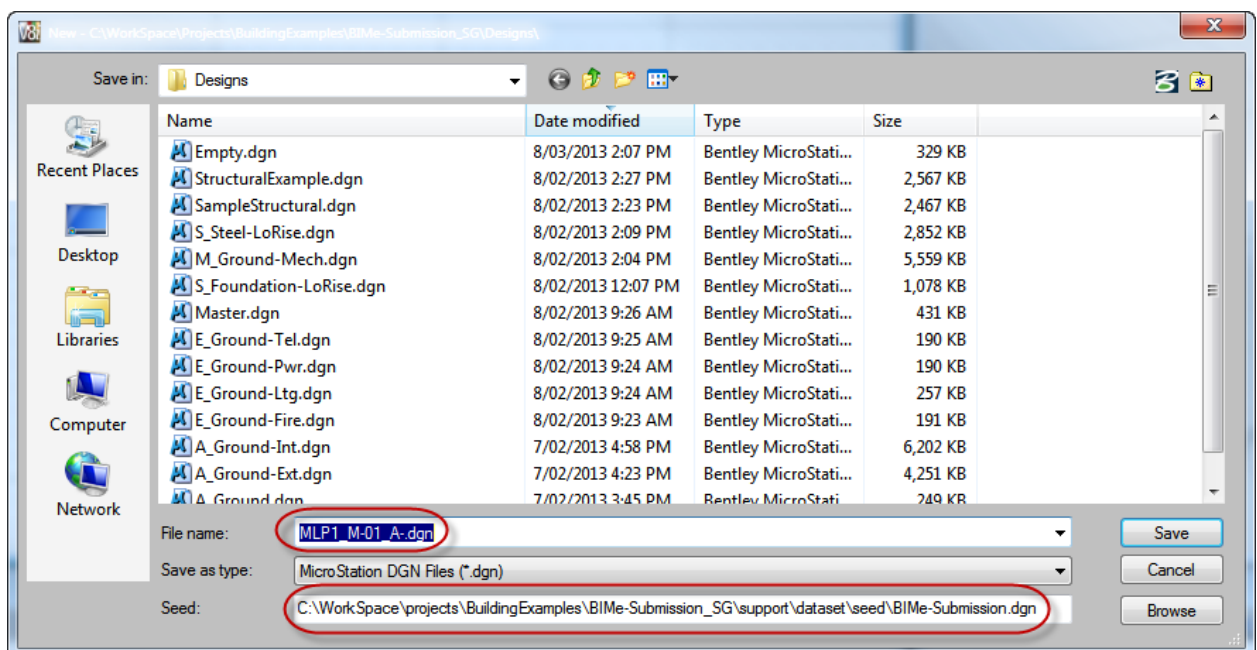
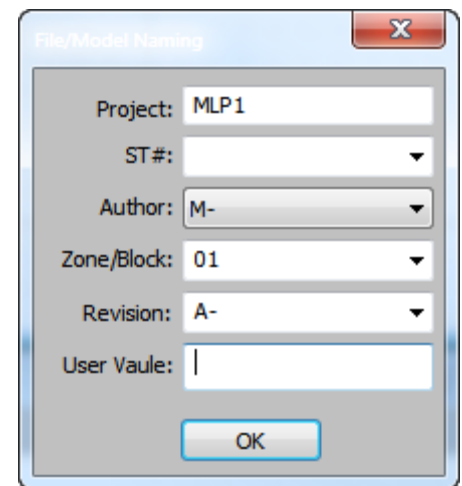


Figure: 6.0.3

6.1 Project Design MODEL Naming

Filename Fields:

Mechanical File naming requires **4 mandatory** fields and an optional user-defined field. To enhance readability the project field should be separated from the remaining fields by an **underscore** “_”.

Table 6.1.1.1

Project ID					Author				Zone			Version			User-Defined
M	L	P	1	_	M	-	_	0	1	_	A	-	_		

Naming convention for each 3D model or BIM file submitted. See Table 6.1.1.2 below.

Table 6.1.1.2

Name of Field	Indicators	Description of Field
Project ID	MLP1	Represent files of the same project - User defined
Author	M-	Mechanical Engineer
	E-	Electrical Engineer
	A-	Architect
Zone (or Block)	NN	Where N: zone or Block Number
	--	E.g. 01 for Block 1, A1 for Zone A1
Version Revision Submission	A-	1st Submission (original)
	B-	2nd Submission (revision or resubmission)
	C-	3rd Submission(revision or resubmission)
User-defined	-----	User defined code (optional field)

In Bentley applications, the loaded (BIMFileNameing.ma) utility will automate the process of File Naming for Models and Sheets. This can be achieved by activating the Building Designer Task **Create a New Design Model Container** from the **Drawing Composition** TAB.

The **File/Model Naming** dialog box will popup the utility dialog box to select/enter standard file naming as defined by Building and Construction Authority.

Create New Design Model tools will popup the utility dialog box to select/enter standard file naming as defined by Building and construction authority. Refer **Figure: 7.1.1.1** below.

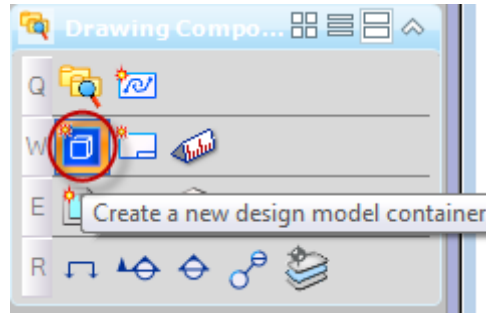


Figure: 6.1.1.1

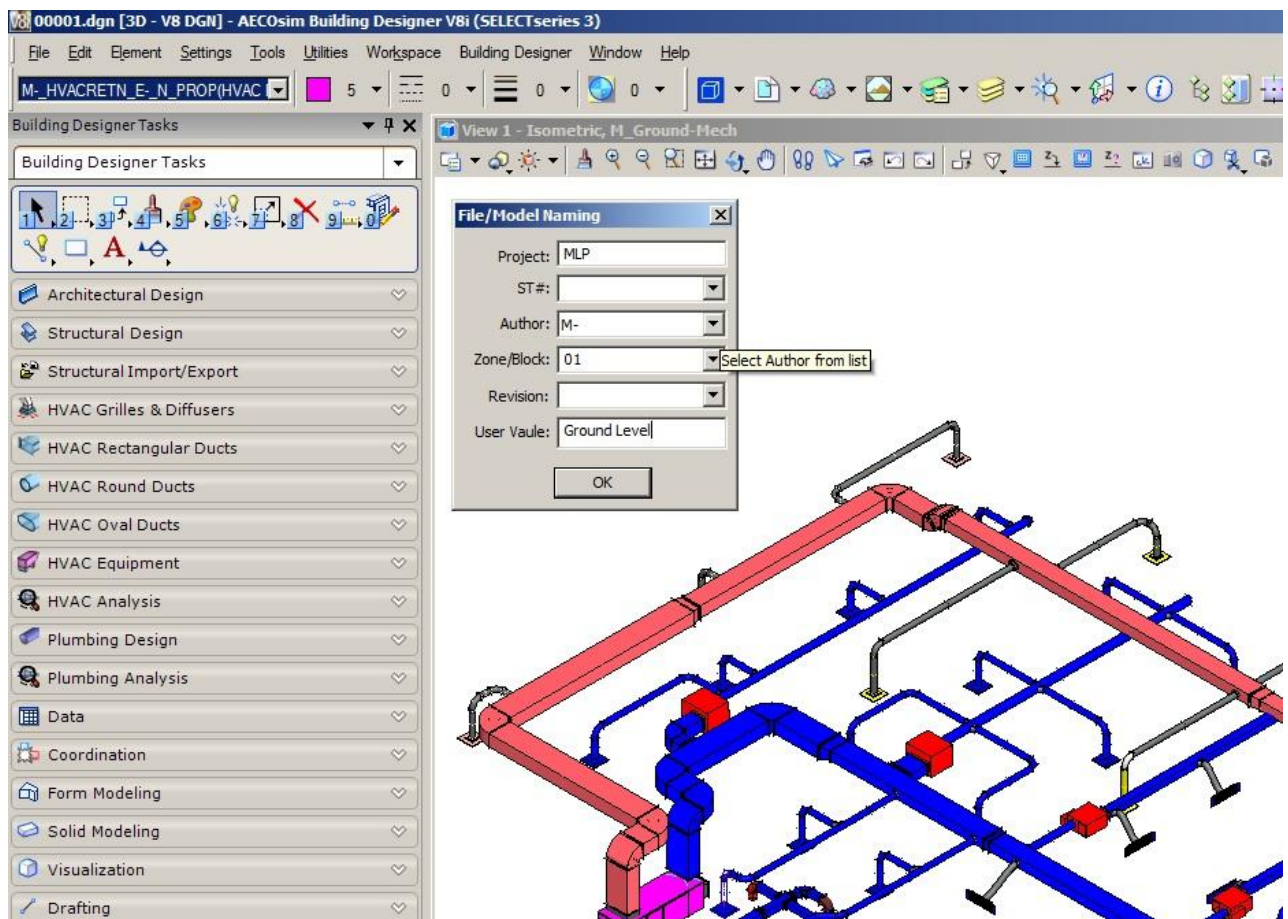


Figure: 6.1.1.2

Once entered the information, **Create Model** dialog box appears with Sheet name as (specified in the Mechanical BIM e-Submission Guideline, by BCA).

Refer Figure: 6.1.1.3 below for details.

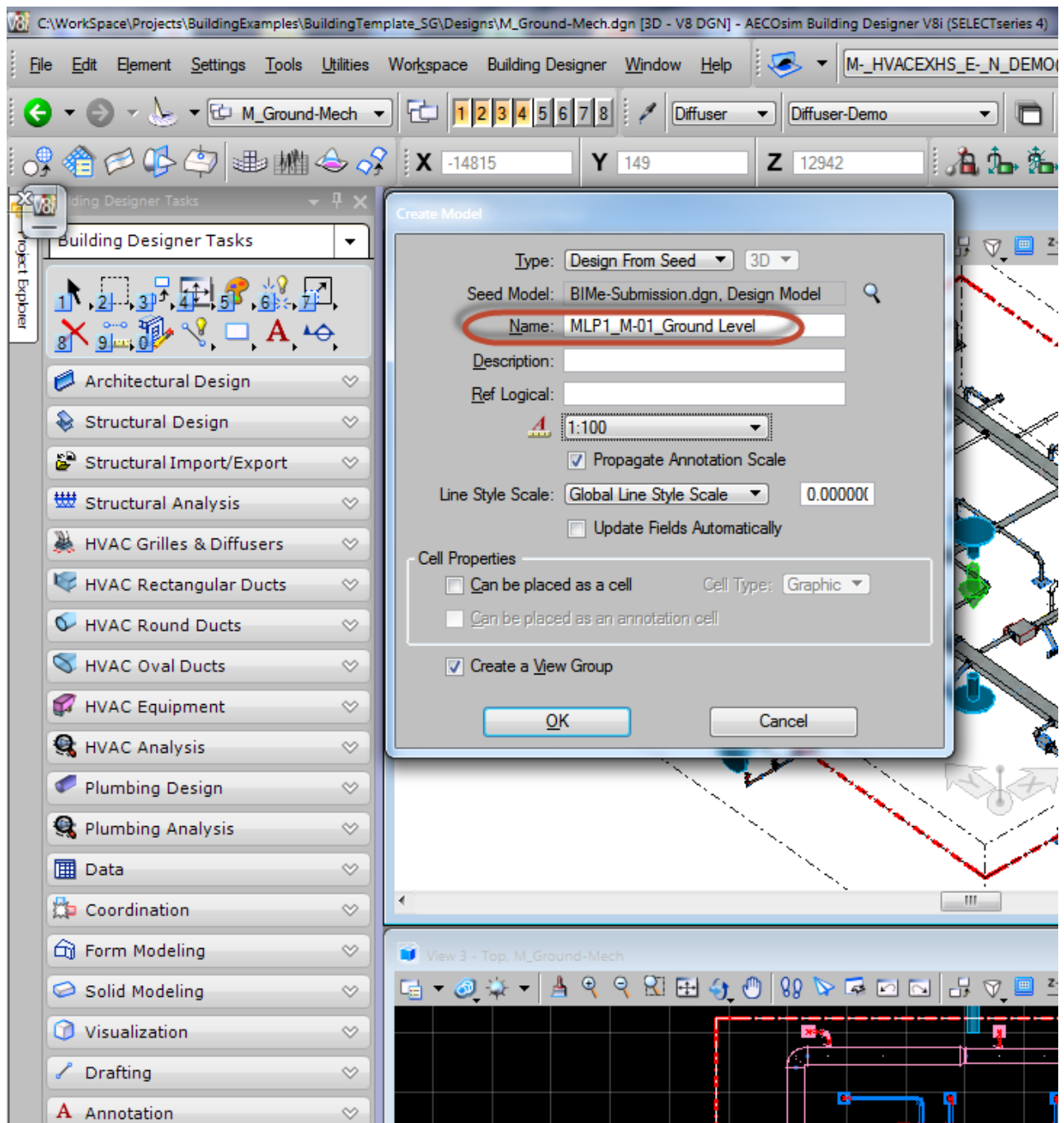


Figure: 6.1.1.3

Create New Sheet Model Container tool will popup the utility dialog box similar to Figure: 6.1.1.3 above. See **Figure: 6.1.1.4**

Figure: 6.1.1.4

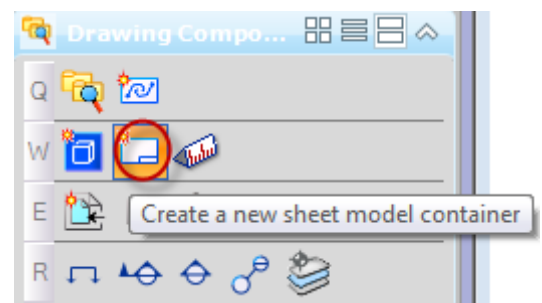


Figure: 6.1.1.5 below shows that user input at the previous stage pre-populates the 'Create Model' for Sheet files dialog box.

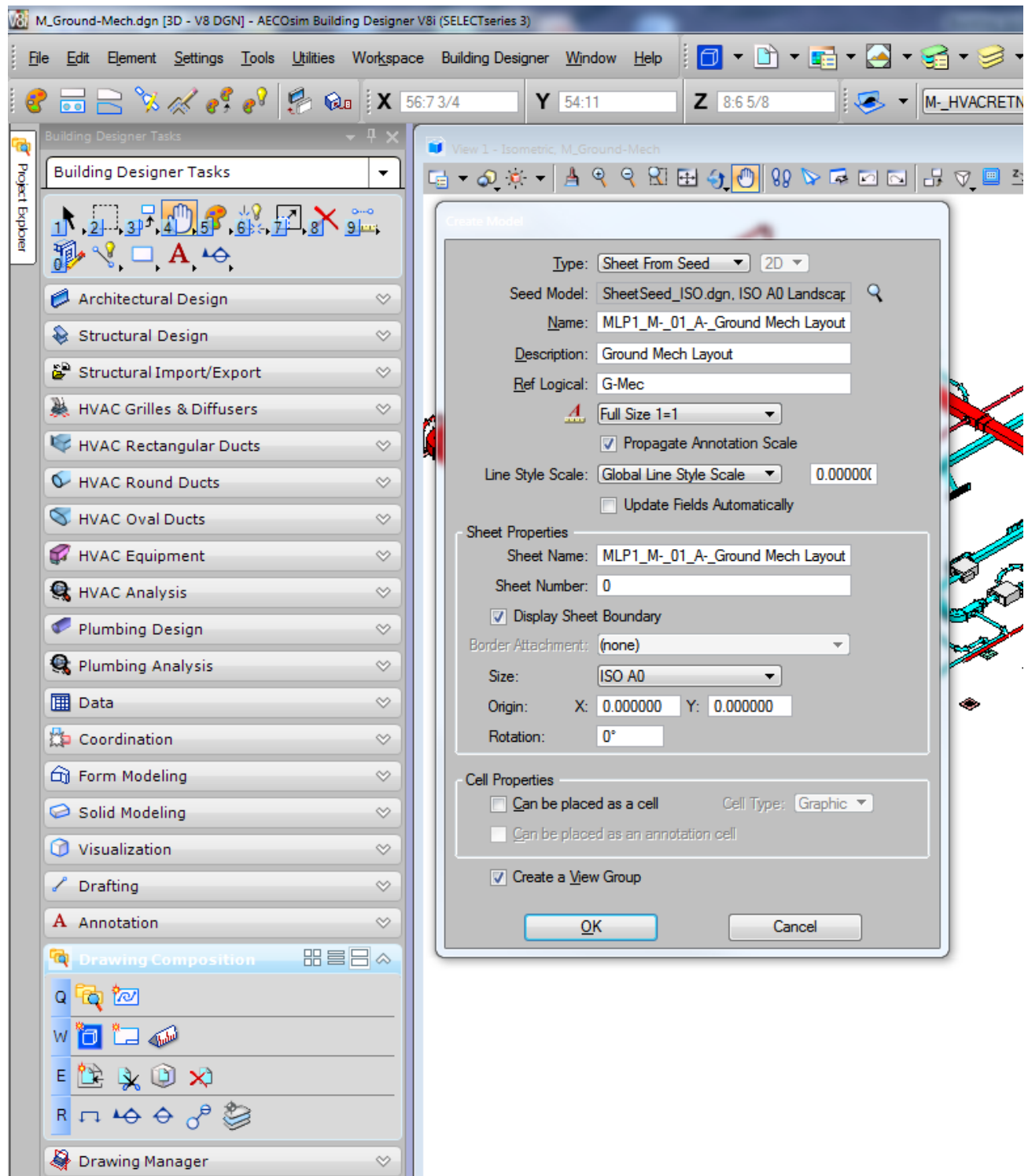


Figure: 6.1.1.5

6.2 Standardized Naming of Views

For every BIM Native file and Light-weight file submitted to regulatory agencies, there will be **"Views"** and **"Sheets"** within these files:

- **"Views"** are a representation of the project model presented in several viewing angles and horizontal / vertical planes, such as Plans and Elevations
- **"Sheets"** are generally supplementary information represented in textual form.

View Naming

Similar in purpose to file naming conventions, views must also adopt standardized naming conventions to convey a meaningful definition of the project.

View naming is divided into **3 parts**, each part is delineated by an underscore "_". All parts of this naming convention **are mandatory** and require to be strictly adhered to. The figure shown below is a sample in naming a view.

Table 6.2.1

Agency					View			View Name									
F	S	S	D	–	F	P	–	1	S	T		S	T	O	R	E	Y

For more detail refer Table 2 - Naming Convention for each Drawing View in the **09MEP_BIMPilot_Submission Guidelines_v3.pdf** guideline by BCA.

6.2.3 Naming convention for each drawing view

Table 7.2.2.1 below is broadly based on SS CP83 Standards for CAD File Naming. It will be noted that similarities in naming of files, views and sheets exist between all disciplines.

For Naming conventions for each drawing view, refer to Table 7.2.2.1 below:

6.2.4 Table 6.2.2.1

Name of Field	Indicators	Description of Field
Agency	CBPU	Central Building Plan Unit
	PUB-WRN	Public Utility Board, Water Reclamation (Network)
	PUB-WTR	Public Utility Board, Water Supply Network
	FSSD	Fire Safety and Shelter Department
	IDA-TFCC	Infocomm Development Authority, Telecommunication Facility Co
	CITYGAS	CityGas Pte Ltd
Type of View	SP	Site Plans
	FR	Roof Plans
	FP	Floor Plans
	FE	Elevations
	FX	Cross Section Views
	3D	3D Views
	DG	Schematic Diagram
	LG	Legend
View Name	1st STOREY	where N : Storey's number
	2nd STOREY	
	3rd STOREY	
	Nth STOREY	
	ROOF	Roof Level
	MEZZANINE N	where N : Mezzanine's number
	BASEMENT 1	where N : Basement's number
	ELEVATION N	where N : Directions (e.g.: East, West, North, South; or 1, 2, 3, 4)
	SECTION N	Where N : Section's Number
	SUMMARY OF GFA; or SUMMARY OF INCENTIVE GFA; or SUMMARY OF X	Where, X: Schedule's Name

6.2.5 OPTION 1: Saved Views

A '**Saved View**' is a view definition, which includes the level display for both the active model and references, the clip volume, and other view attributes. A saved view can be applied to a destination view window.

BIMFileNaming.ma loaded in Bentley Building applications are configured with standardized naming for (saved) views. Access **SAVED VIEWS** task from the **PRIMARY TASKS MENU**. Refer **Figure: 6.2.2.1** below.

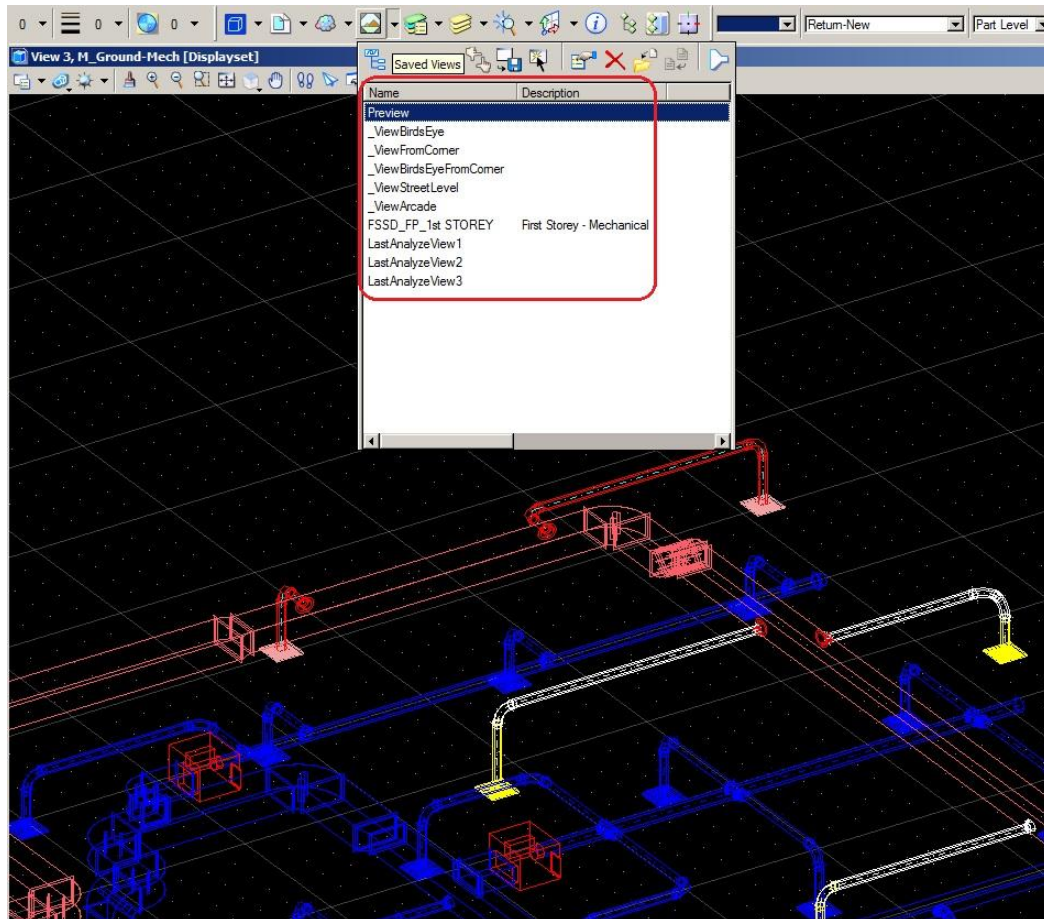


Figure: 6.2.5.1

Clicking on **CREATE SAVED VIEW** will pop up a utility **DRAWING VIEW FILE NAMING** to select / enter view name as per **BCA** standard.

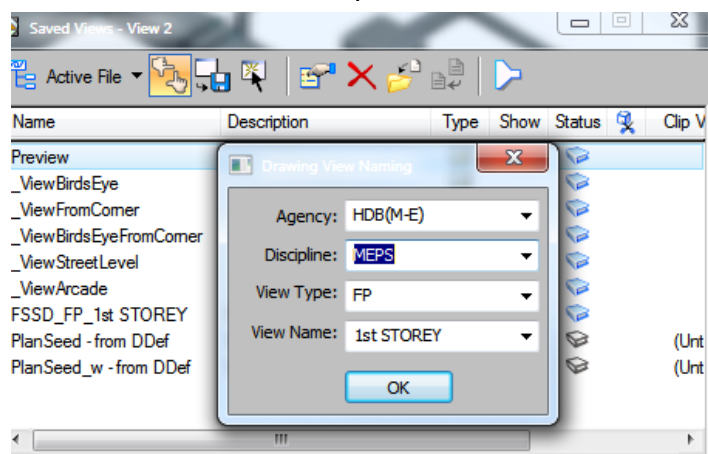


Figure: 6.2.5.2

Select the appropriate field from the drop down list for each of the above options relating to Agency, View Type and View Name and click **OK** to open the **CREATE SAVED VIEW** dialog box below which is automatically populated with data keyed-in from the previous step.

Two data points that define the extent of the plan are required as input to define extents of plan as **From 2-Points** was selected as method of input (From View is the other option available for selection).

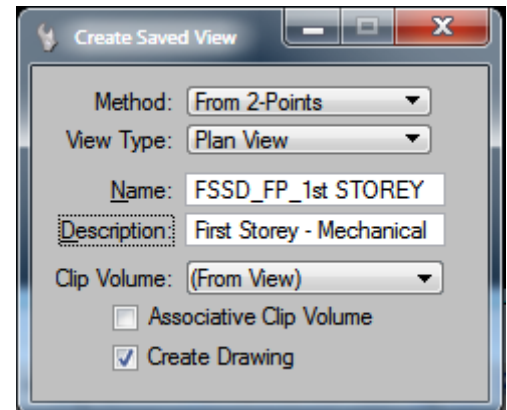


Figure: 6.2.5.3

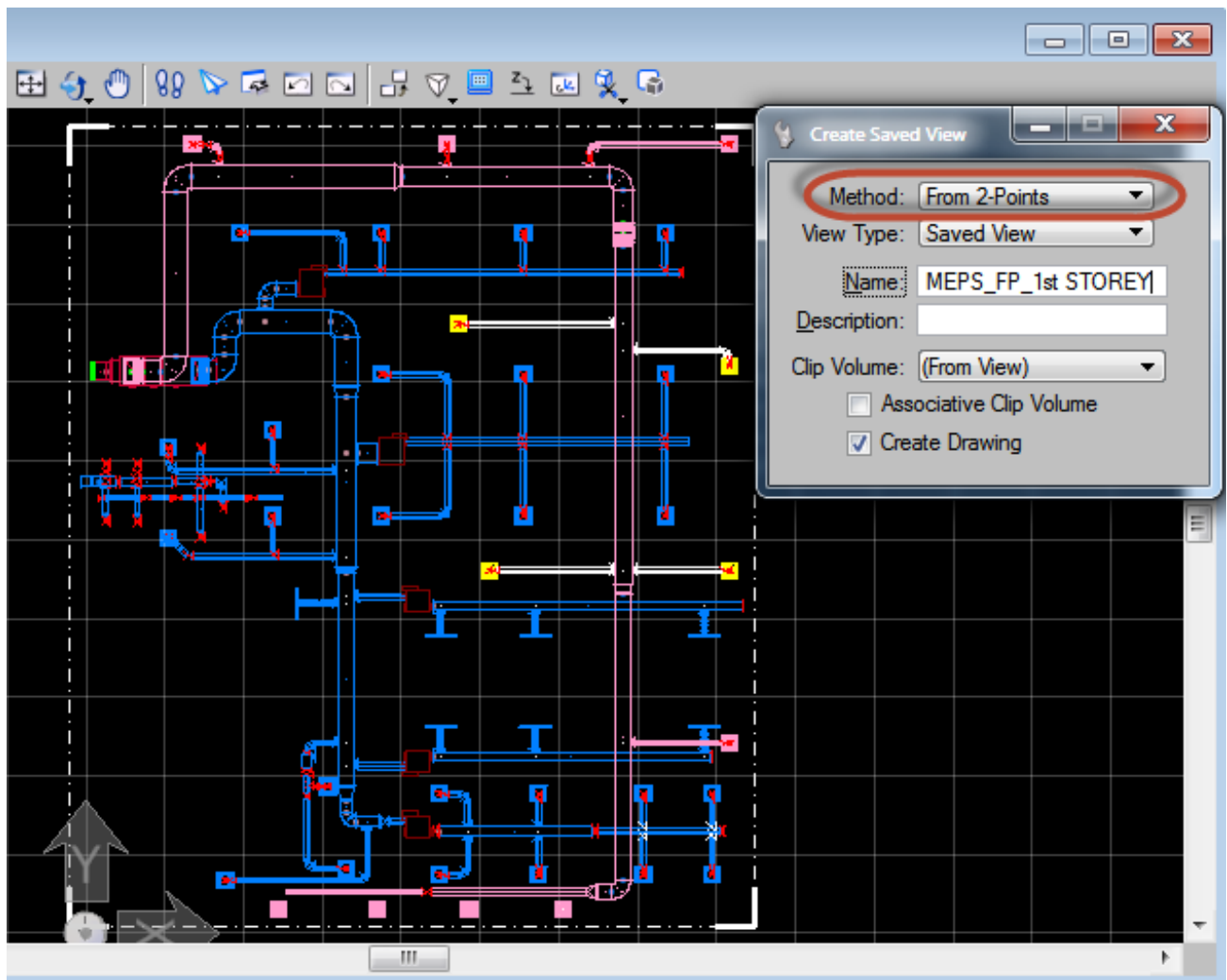


Figure: 6.2.5.4

Create Drawing dialog box opens with Name '**grayed**' out as this is derived from the previous step.

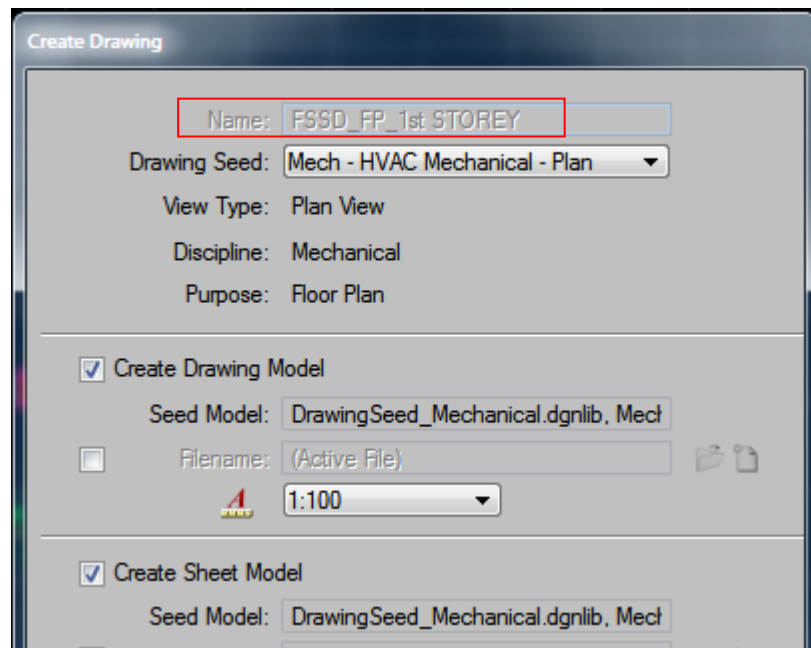


Figure: 6.2.5.5

The **Saved View** as well as the **Model** files is created with name based on BCA Standards.

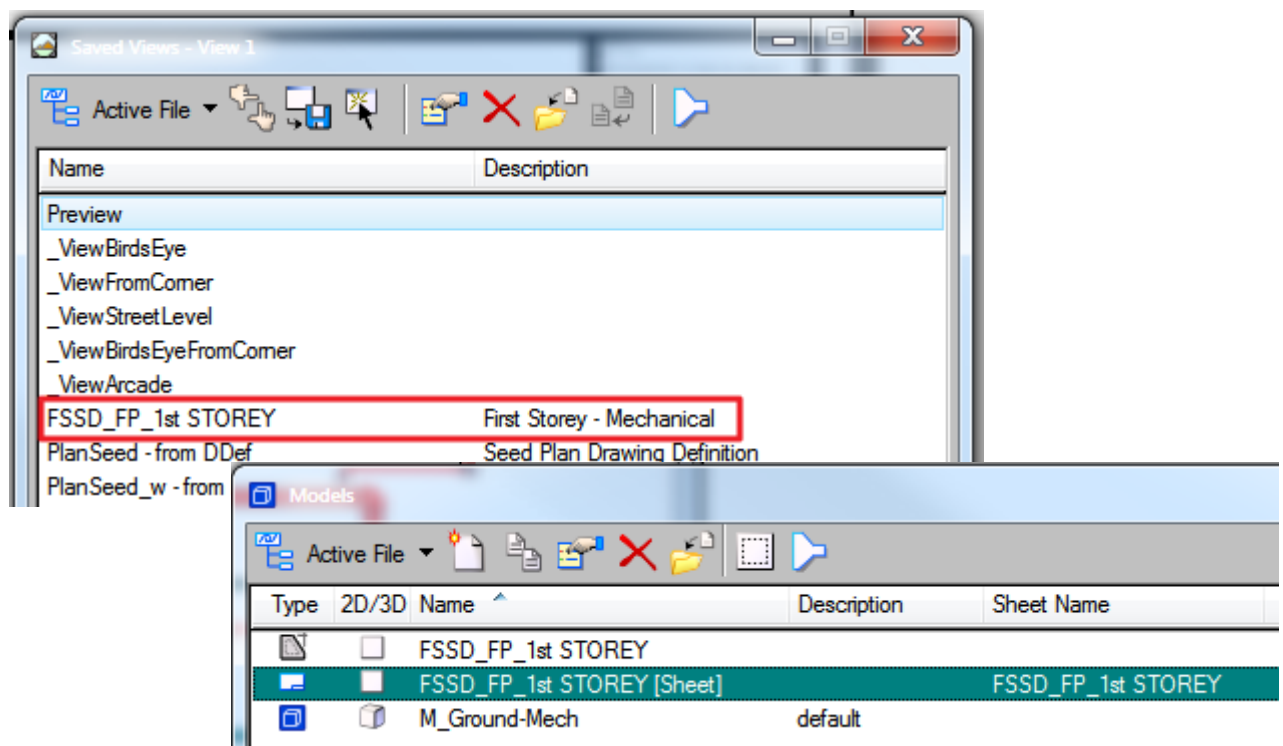


Figure: 6.2.5.6

Right click on the Saved View **BCA_FP_STOREY** opens the **CREATE DRAWING** dialog box. See Figure 6.2.2.7 below

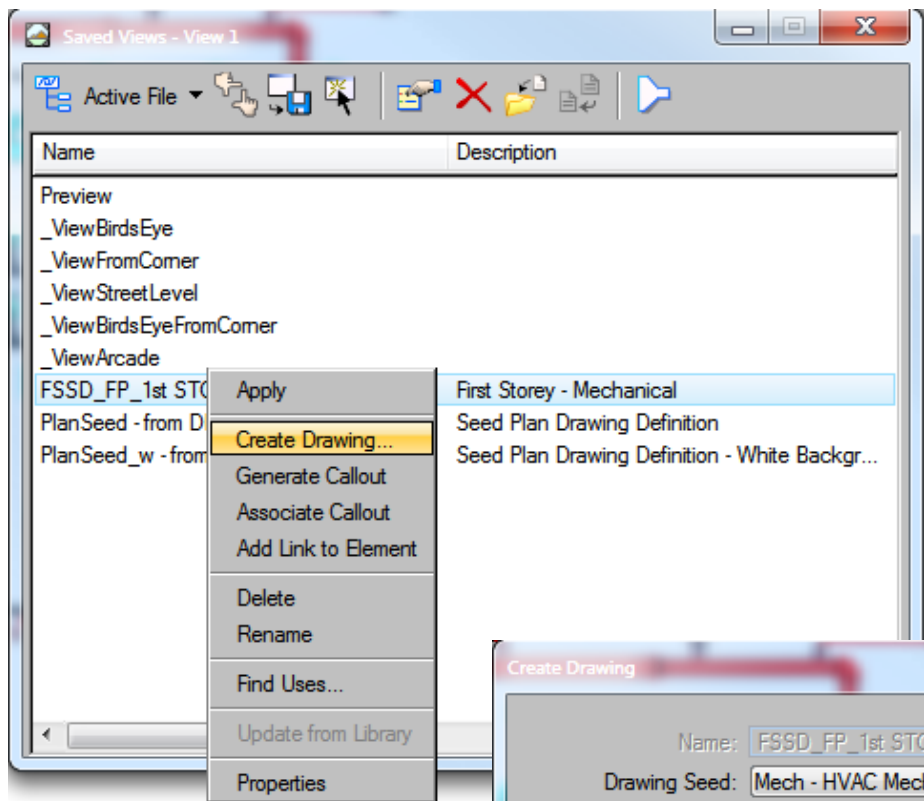


Figure: 6.2.5.7

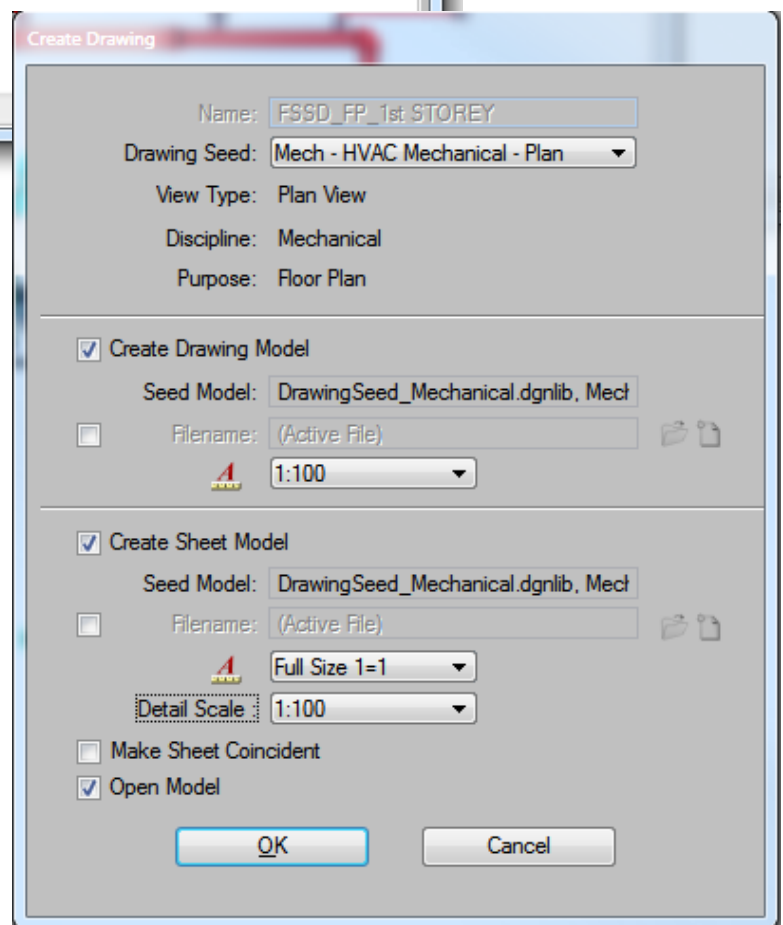


Figure: 6.2.5.8

A new **SHEET MODEL** with the appropriate naming convention is added once the user clicks OK.

6.2.6 OPTION 2: Dynamic Views

'**Dynamic Views**' is a general name that encompasses several related technologies which share a common goal of making model analysis and documentation more interactive and intuitive. One of these **technologies allows clipping of models and generating section graphics on the fly**. Section views, detail views, and elevation views are types of dynamic views. Gone are the days when designs are just static views, replaced by the ability to create live, intelligent sections of a design composition that update automatically (through the use of detailing symbols with fields and links) as the design evolves.

'**Building Dynamic Views**' are created using a host of Drawing Composition tools and Annotation tools, and they are managed using the Project Explorer. Building Dynamic Views are used to create dynamic view floor plans and drawings. The Create Floor Plan tool reads floor definitions from the Building Designer Floor Manager, the IFC i-model, and from named ACS definitions and shapes. Floor plans are created based on user defined settings and Floor Manager floor definitions. Designers can use single floor definitions or floor definition sets to create floor plans. Shapes, defining an area within the model, can also be used to create floor plans. Floor plan properties include Building and floor definitions, story and level data, floor elevations, and distances between floors.

Creation of 'Views' may also be performed by **DYNAMIC** Views. Dynamic Views allows clipping of models and generating section graphics on the fly. Section views, detail views, and elevation views are types of dynamic views. A **BUILDING DYNAMIC VIEW** is a Saved View that incorporates the parameters of both the Active View and the Dynamic View. The Building Dynamic View applies additional information such as Forward, Cut, and Back view drawing symbols, sensitive distances, and patterning. Mechanical drawing rules are applied in this view using tabs in the Building panel. Building Dynamic Views are also used to create drawings for construction documents.

Selecting **CLIP VOLUME: APPLY or MODIFY CLIP VOLUME** from the 'View' tool bar across the top (or bottom) of the view (or via Tools>View>View Control>Clip Volume>Apply or Modify Clip Volume)

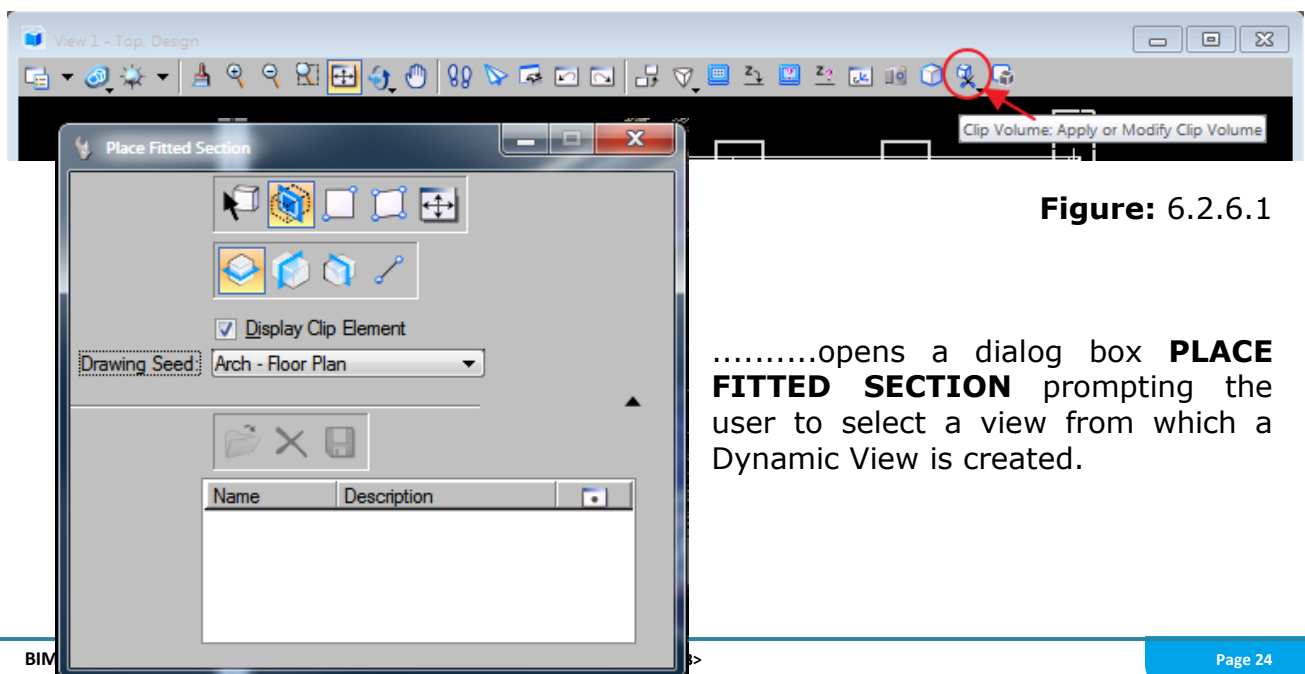
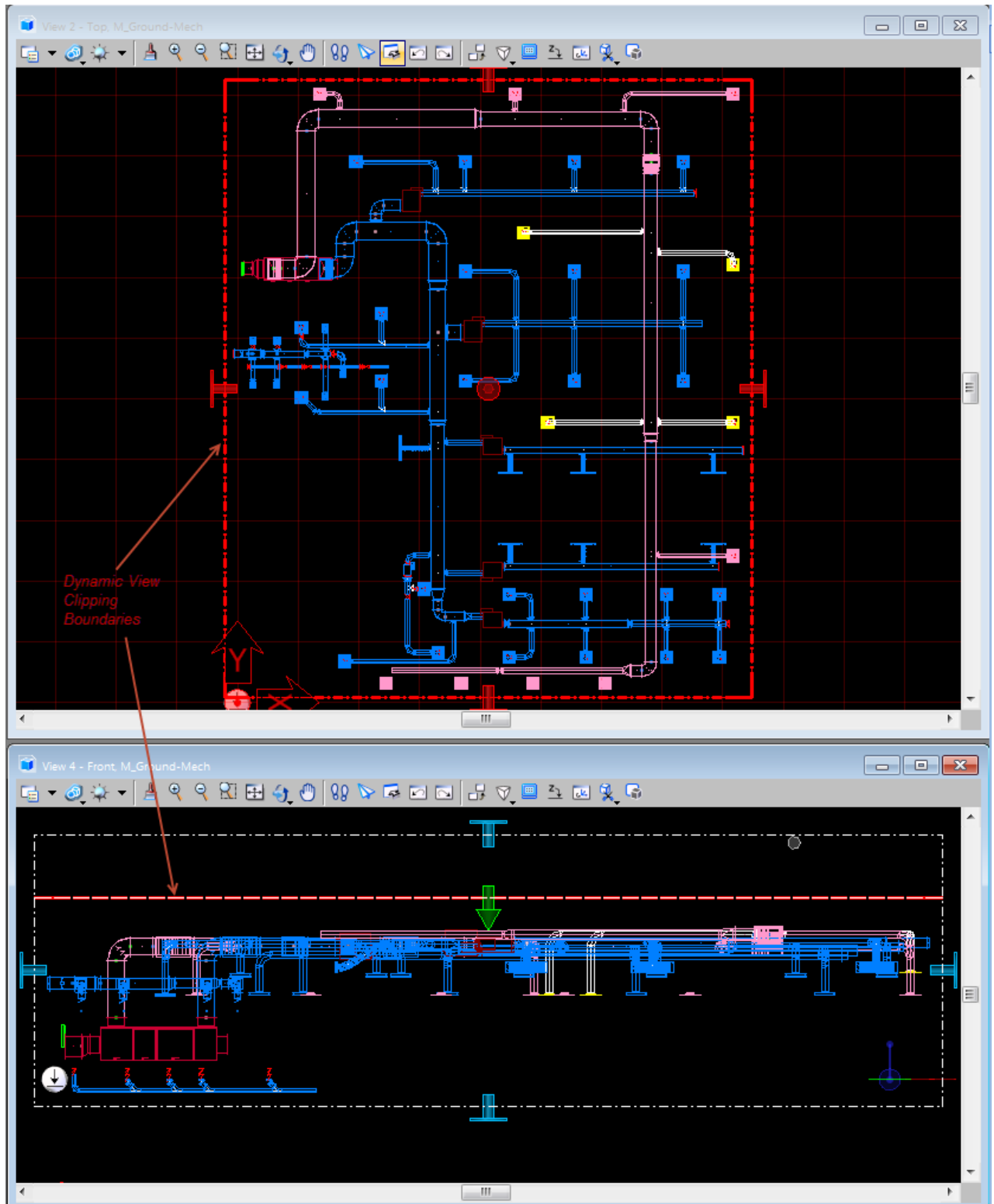


Figure: 6.2.6.1

.....opens a dialog box **PLACE FITTED SECTION** prompting the user to select a view from which a Dynamic View is created.

Figure: 6.2.6.2

Upon selecting an appropriate view the graphics are immediately clipped at the centre of the model. The clip boundary displays 'grips' that help define the **cut plane - Forward** and **Reflected** plane location. Once the plane is defined, **right clicking** on the **CLIP BOUNDARY** and selecting **CREATE DYNAMIC VIEW** will create a Floor plan. Refer **Figure: 6.2.6.3** below.

**Figure: 6.2.6.3**

From this point on the process and creation of Saved Views is similar to those that have already been outlined on Pages 22 through to 25.

6.2.7 OPTION 3: Hypermodels

Dynamic views features may be used to create sheet compositions. Previously in a 3D design, a model could be viewed in all its planes. However, dimensions, annotations and other details that were placed on the sheet models could not be seen. To view these details, the sheet models had to be navigated manually. Callouts could not be placed in a 3D design model. AECOSim Building Designer now provides the ability to not only place callouts in a 3D design model but also view these callouts in the sheet graphics in a 3D design model, in place, automatically. This capability of AECOSim Building Designer is called '**hypermodels**'

'**Hypermodels**' are therefore a combination of:

- dynamic views
- markers and
- mini toolbar features

.....that automatically contextualise in 3D all project documentation, so that both the drawings in sheets or drawing models as well as the 3D design model are easily understood, interpreted and updated.

Hypermodels:

- Link documents within the spatial context of 3D models
- Automatically coordinate models and drawings
- Slice and filter models interactively
- Update drawings automatically
- Update annotation dynamically

Some of the benefits of using callouts in 3D are:

- Callouts make drawings easier to understand and interpret.
- The effectiveness of project communication is increased, leading to better informed decisions.
- Project quality is improved by the increase in speed to insight. This is beneficial through all phases of project: design, review, construction, operation.
- Callouts make 3D design models more reliable, effective and easy to use for construction, operation and so on.

Following is a generic workflow for using the callouts in a project.

6.2.7.1 General Procedure — Using Callouts in a Project

1. Place a Callout in a 3D design model or in a drawing or sheet model.

The callout is automatically detected in the target design composition model.

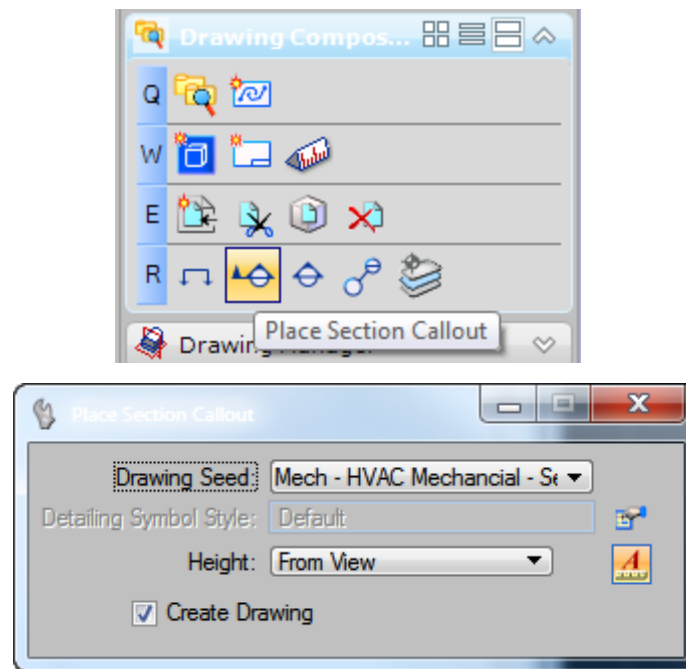


Figure: 6.2.5.1.1

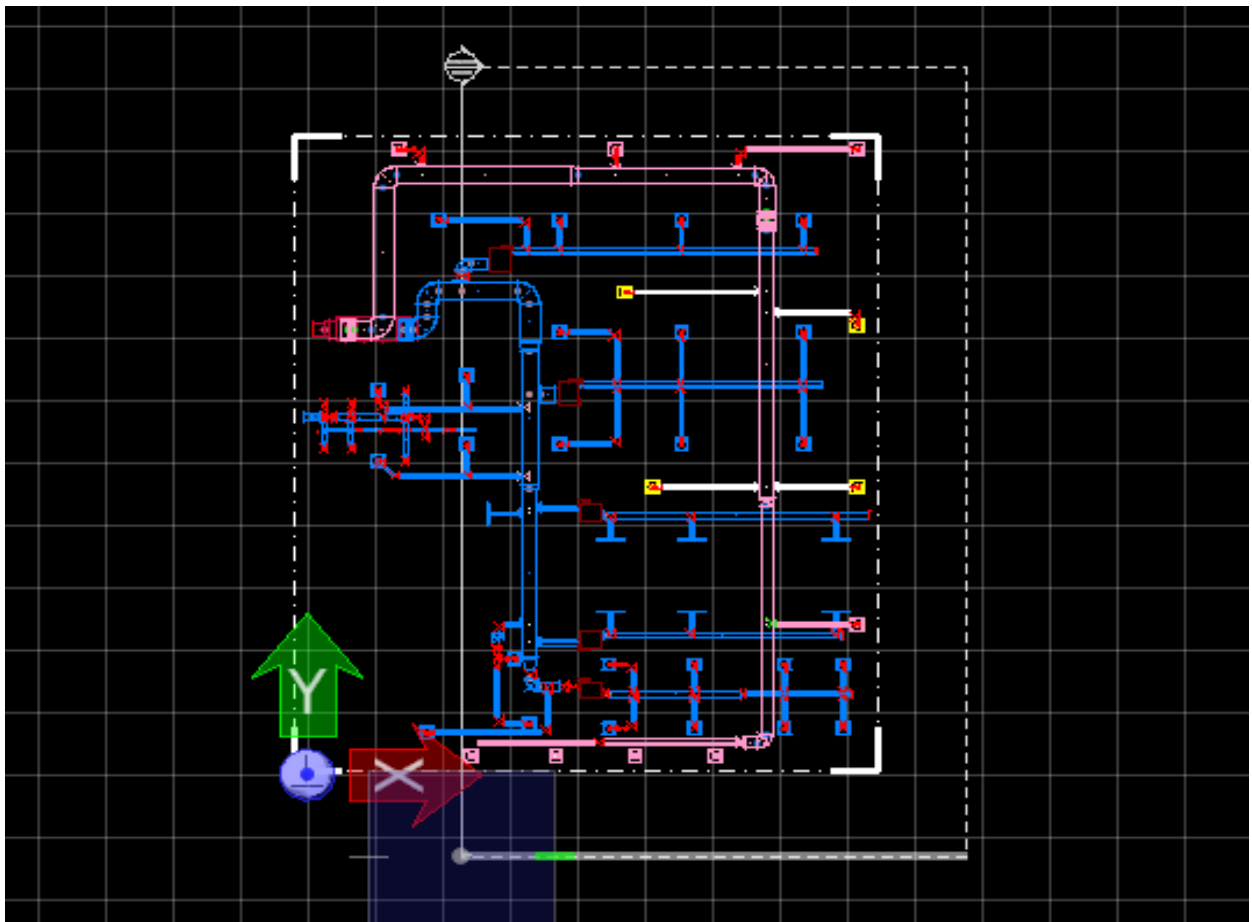
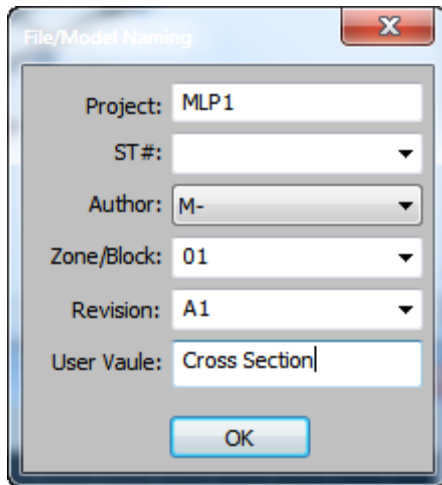


Figure: 6.2.5.1.2

- From the Links tab of the Project Explorer dialog, drag the callout's saved view onto another sheet.



File/Model Naming

Project: MLP1

ST#:

Author: M-

Zone/Block: 01

Revision: A1

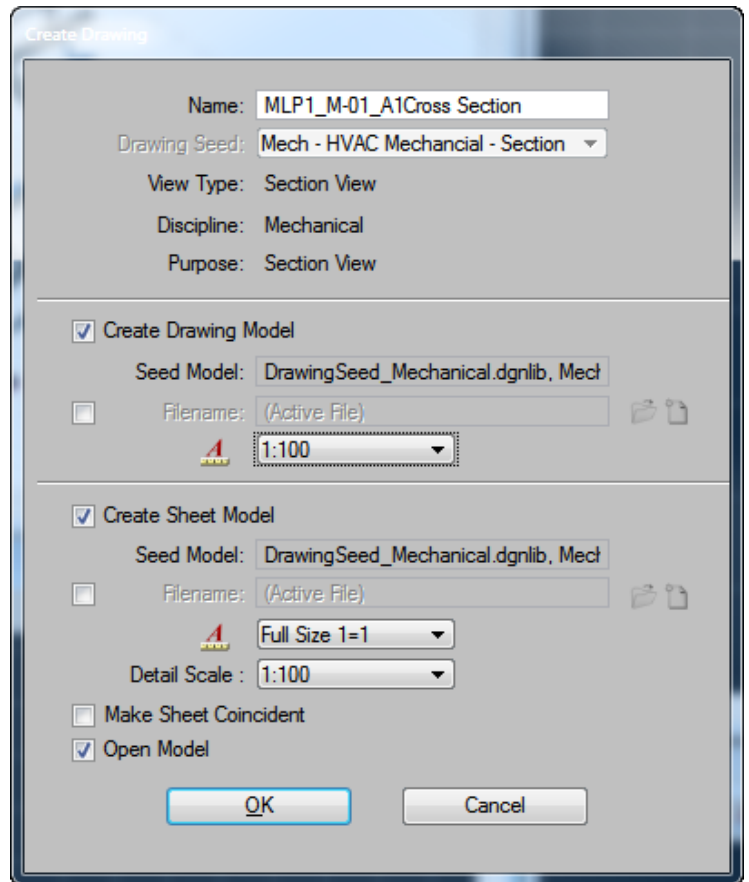
User Vaule: Cross Section

OK

- Add annotations, dimensions and other embellishments on the sheet.

Figure: 6.2.5.1.3

BCA File Naming Utility is automatically fired up for user input and model/sheet names automatically generated based on this input.



Create Drawing

Name: MLP1_M-01_A1Cross Section

Drawing Seed: Mech - HVAC Mechanical - Section

View Type: Section View

Discipline: Mechanical

Purpose: Section View

☒ Create Drawing Model

Seed Model: DrawingSeed_Mechanical.dgnlib, Mecl

☐ Filename: (Active File)

1:100

☒ Create Sheet Model

Seed Model: DrawingSeed_Mechanical.dgnlib, Mecl

☐ Filename: (Active File)

Full Size 1=1

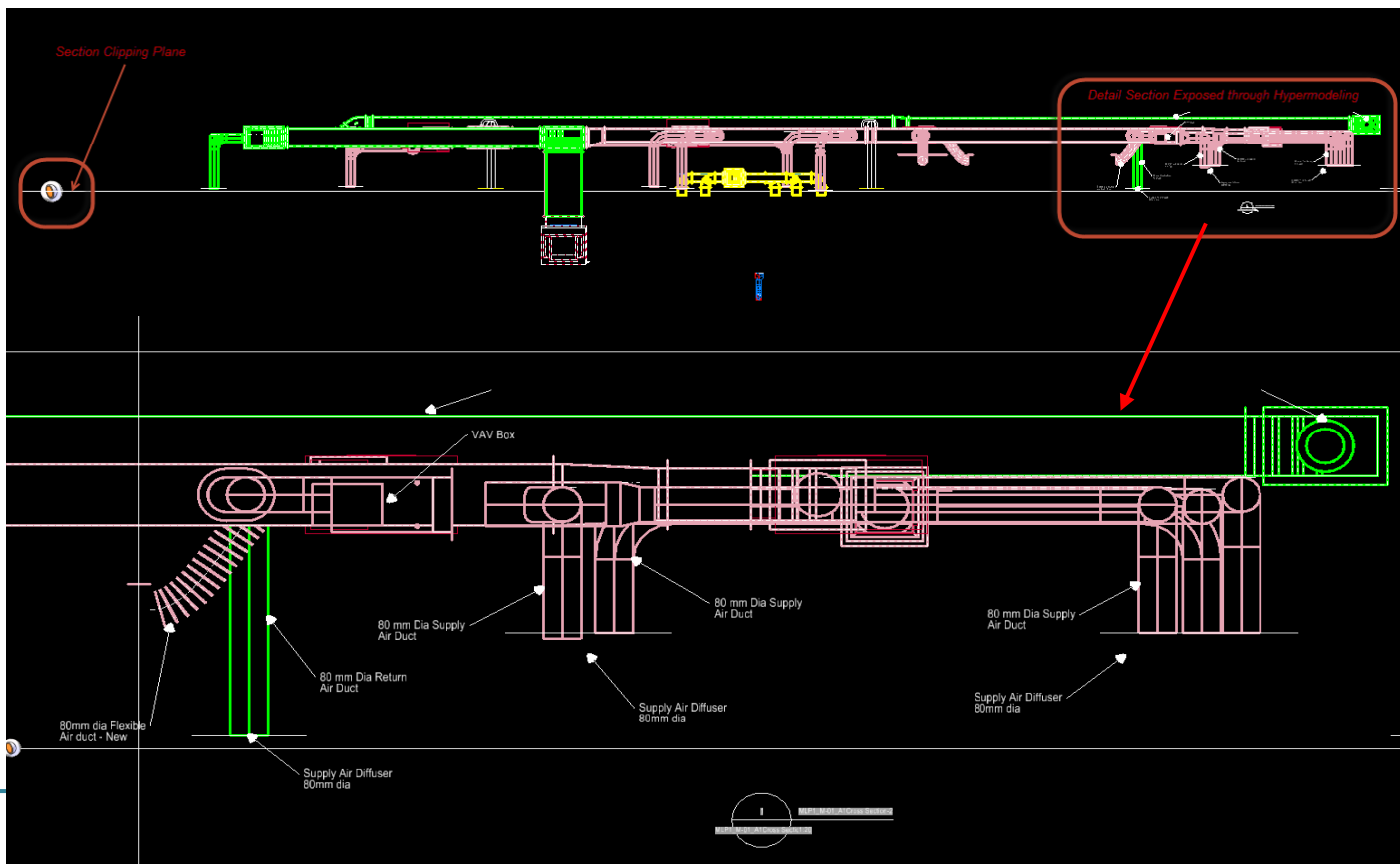
Detail Scale: 1:100

☐ Make Sheet Coincident

☒ Open Model

OK Cancel

Figure: 6.2.5.1.4



4. In the 3D design model, turn on the Markers icon from the View Attributes dialog to view the markers of the saved views in the project.
5. Hold the pointer on a marker and select the Apply View tool. The saved view linked to the callout is applied in the 3D model.

The model is automatically clipped at the location of the callout with the given Apply View settings. It also displays the sheet annotations, dimensions and other embellishments, in the 3D model, in place.

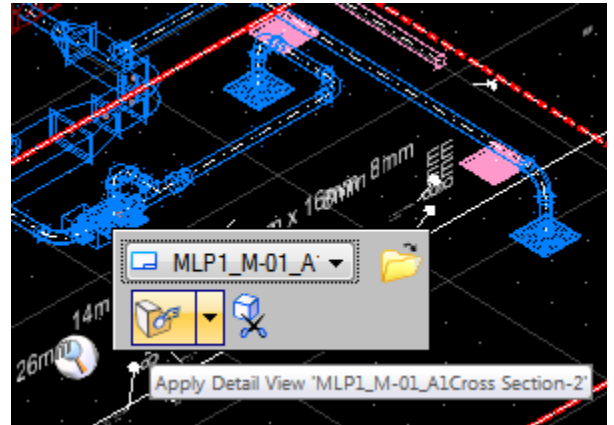


Figure: 6.2.5.1.5

6. To make changes in the annotations, select the Open Sheet Model tool on the Mini toolbar to open the sheet model.
7. Make the desired changes in the sheet model and select the Open Design Model tool in the Mini toolbar of the callout in sheet model to switch back to the 3D design model.
8. Select the next marker to view the next callout location. The result is that all of your project documentation is contextualized in 3D, at your control, automatically so that both the drawings in the sheet or drawing models and the 3D design model are easy to understand, interpret and update.

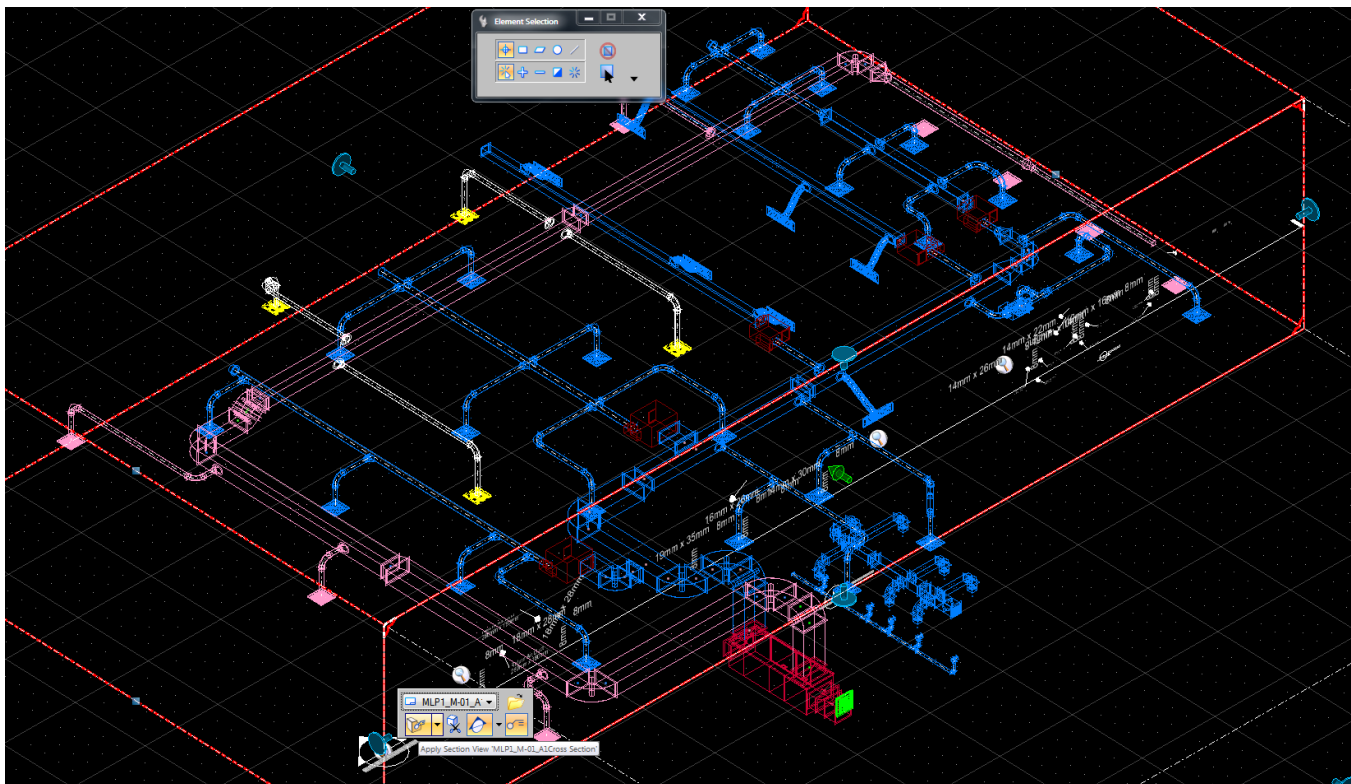


Figure: 6.2.5.1.6

NOTE: The workflow for the creation of new models and Sheets is exactly the same as those described under Option 1: Saver Views.

Note: BIM e-Submission standard Naming Sheet / Model / View attributes can be modified or appended via SETTING.XML file which is located in the Installer path of AECOsim Building Designer.

By default the location is:

Drive:\WorkSpace\Projects\BuildingExamples\BIMe-Submission_SG\BCAFileNamingBCAFileNamingsetting.xml.

The regulatory agencies check and approve the saved views of a project model and all its peripheral information such as Site Plans, Floor Plans, Elevation and Section. Care should be taken to ensure that the following actions are exercised before exporting to the Light-Weight File for doing BIM e-Submission:

1. Maximum extent to each drawing views are set and saved
2. No hidden objects or annotation exist
3. Any external links such as attached 2D drawings, 3D model and project segment saved in other files, which are part of the submission must be bound into a single integrated model
4. All other external and internal reference object, regardless of drawing layers, annotations, draft work and construction lines, that are inside the project model having no bearing to the submission, must be removed or purged before doing BIM e-Submission
5. The use propriety fonts for annotation are unacceptable. All the fonts must be legible
6. All objects and annotation for each phases must be displayed in the last saved view
7. Ensure all "Project Basic Composition" views are available in the project. BIM native files may contain more than what is needed for the submission but the Light-Weight File must contain only the listed composition

6.3 Addition and Alteration Projects

"Addition and Alteration" (A and A) projects are required to comply with **SS-CP83, Part 5** in the project model. **Colour Identifier** (Refer Table 7.3.1) has to apply to all the objects in the model before doing BIM e-Submission.

Table 6.3.1

Colour	Usage
Magenta	Proposed Elements
Cyan	Existing Elements
Yellow	Deleted Elements

NOTE: All DGNlibs have now been updated to conform to **Singapore CP83: Part 5 2001 – Colour & Line Type**.

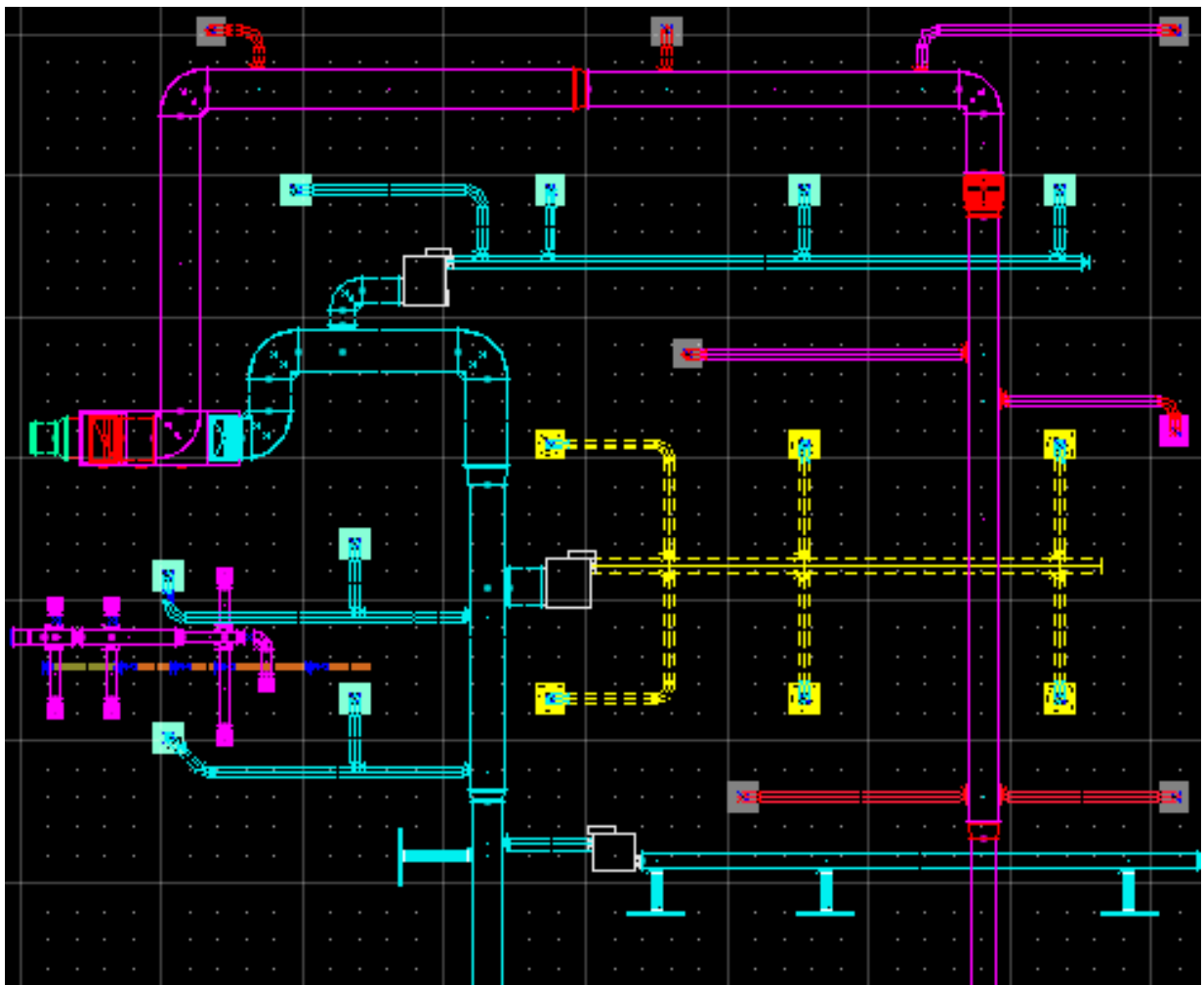


Figure: 6.3.1

Object properties such as colour identifier, line styles can be configured in Bentley Building applications via **Families and Parts**. In **PROJECT MANAGEMENT MENU**, FAMILIES AND PARTS select single parts to open **DATAGROUP EXPLORER** which stores the CAD standard data of objects in the project model.

Refer **Figure: 6.3.2** below.

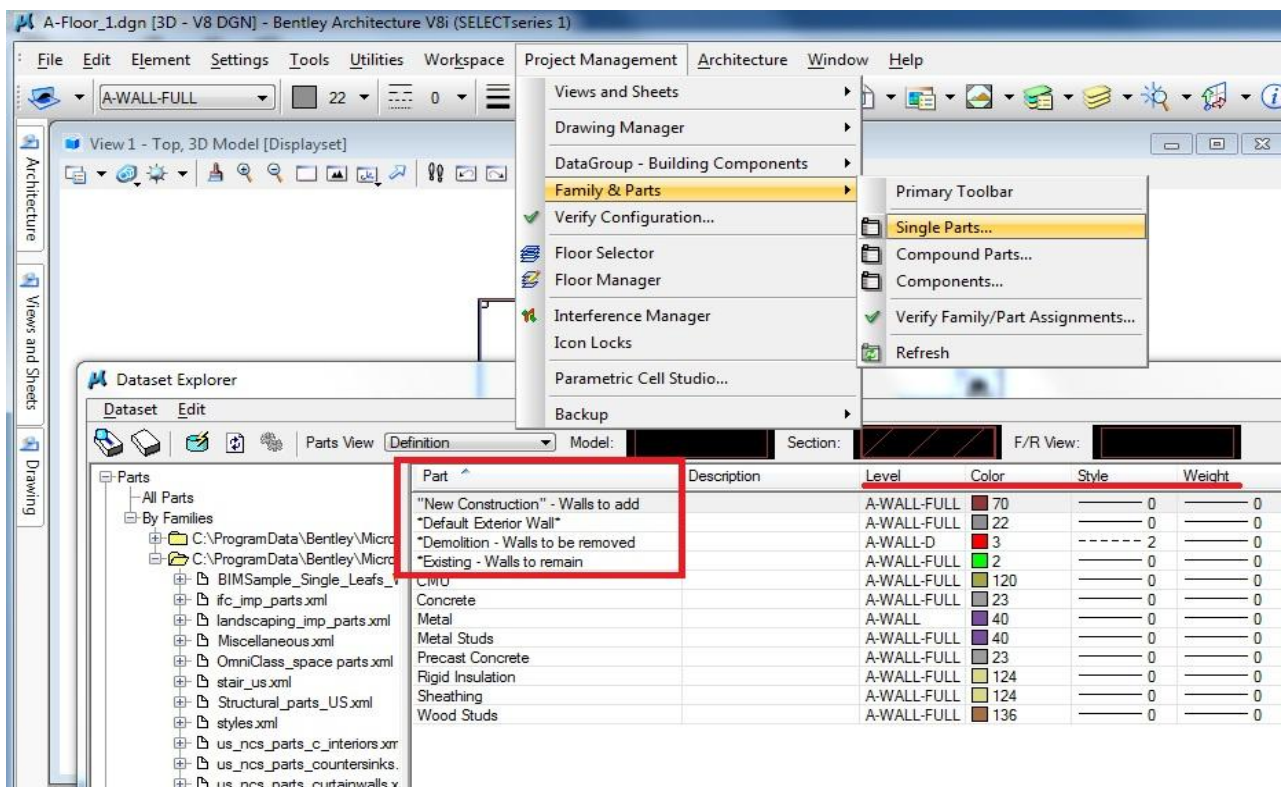


Figure: 6.3.2

6.4 Project Basic Composition

For BIM e-Submission purpose, project models should have fundamental composition in explorer view which must be exported to the Light-Weight file. **Table 5** of the BIM e-Submission template document from BCA outlines the fundamental composition.

In Bentley Building applications, Project Explorer comprising the aforesaid composition can be accessed through **FILE MENU>PROJECT EXPLORER**. Refer **Figure: 6.4.1** below.

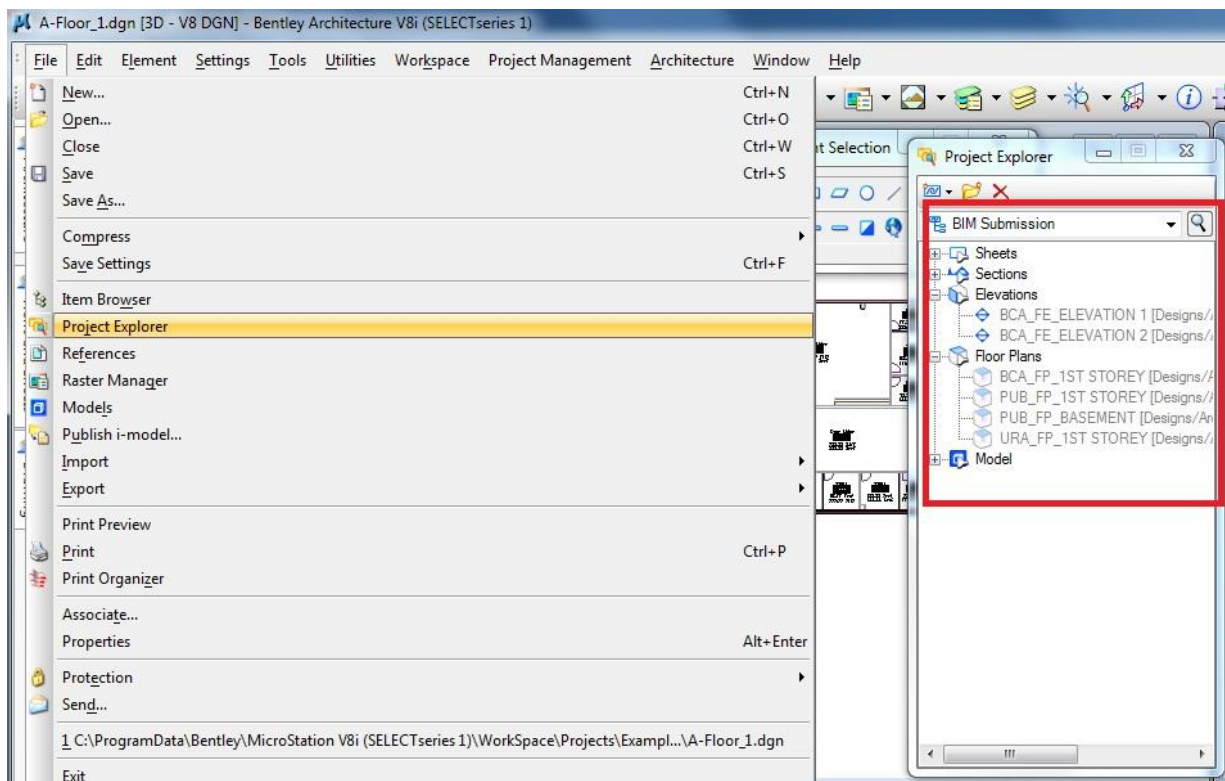


Figure: 6.4.1

By default the project explorer has configured with fundamental project composition defined by BCA.

6.5 3D PDF Example

Creating a **3D PDF** in AECOsim Building Designer v8i can be done using the same print tool provided that some parameters are as follows.

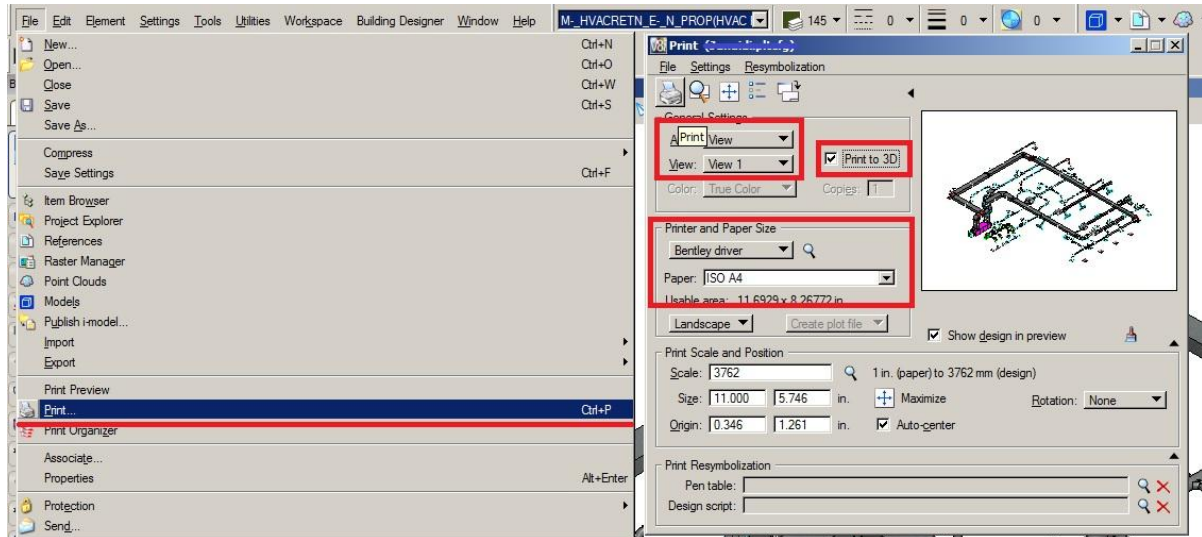


Figure: 6.5.1

The output is a PDF file that can be read by free downloadable Adobe Readers.

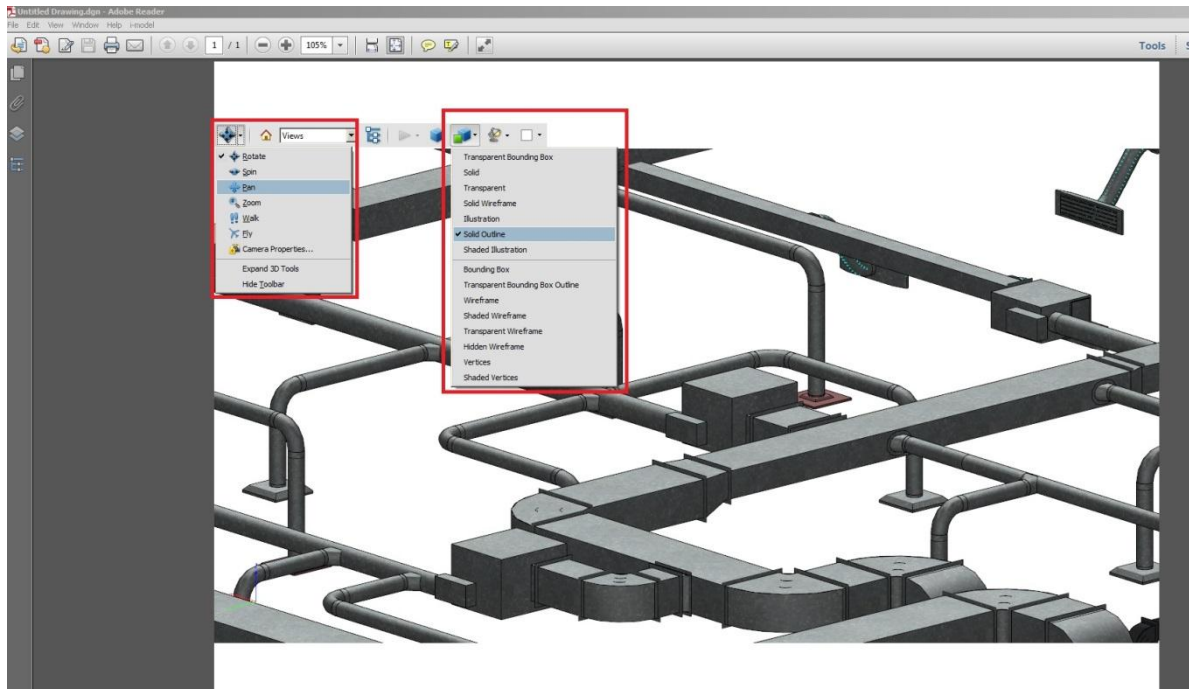


Figure: 6.5.2

Models can be easily rotated and viewed in different angles.

7 BIM e-Submission Benefits

Benefits of using Bentley's templates and processes to achieve BIM enabled software approval status in Singapore include:

1. MEP BIM e-Submission is configured in Bentley Building applications via BIM e-Submission.DGN template file and BIMFileNameing.mdl
2. Users have the advantage of appending their Company CAD standards and project standards in the BIM e-Submission.dgn file. Care should be taken to ensure that the configuration does not violate the MEP BIM e-Submission requirements
3. Bentley BIM applications will strictly be in compliance and formatted to the Singapore MEP BIM e-submission standards. Users can focus on the main task of design and delivery of the Project

8 Conclusions

The Methodology described above fulfils the Singapore MEP BIM e-Submission requirements and also provides the building and construction firms registered in Singapore with BIM e-Submission.dgn template file and BIMFileNameing.mdl installer. Thus local firms could use the template for MEP BIM e-Submission for regulatory approval.