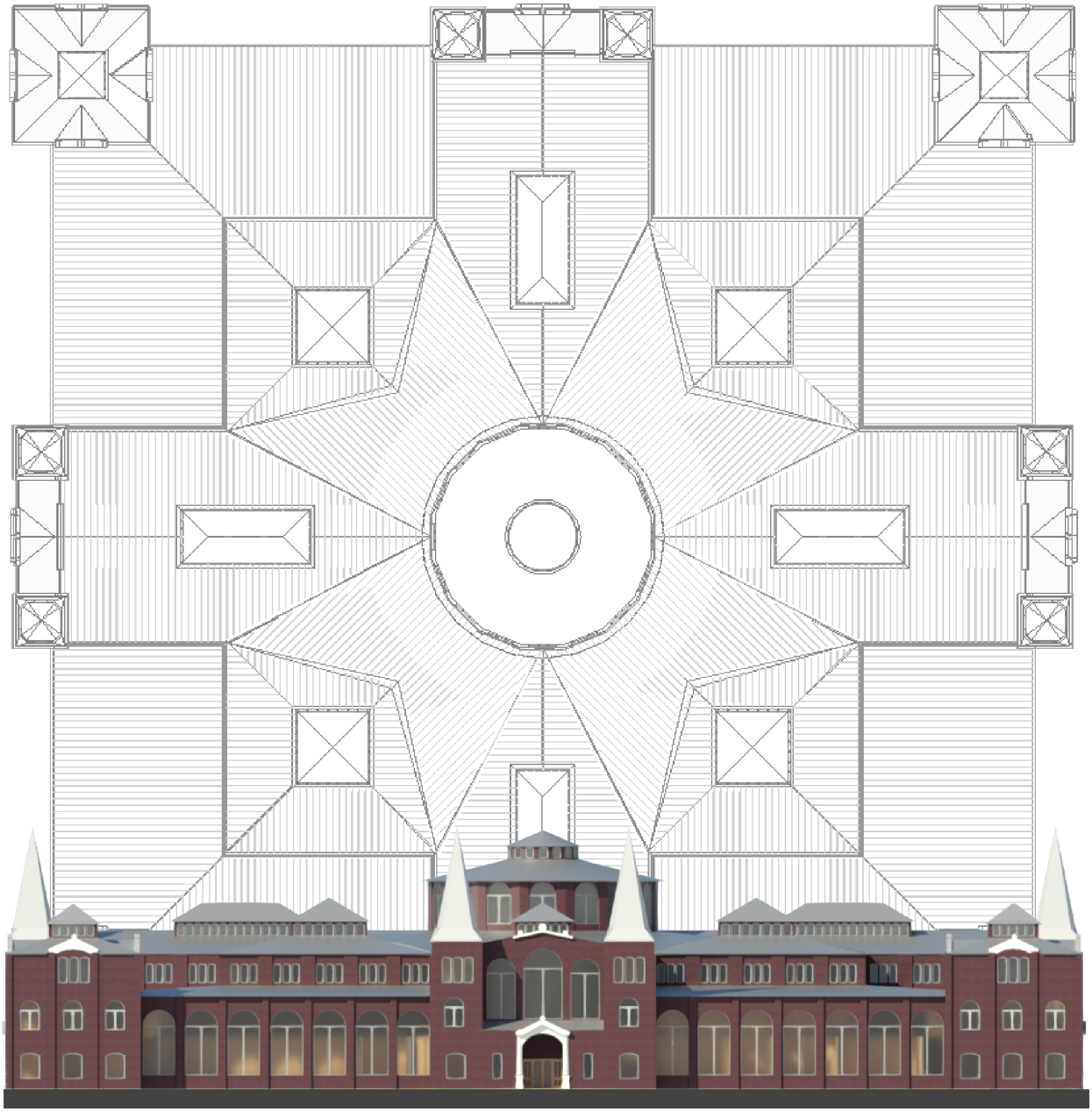
Smithsonian

Office of Planning, Design, and Construction

Revit Template User's Guide



November 2024

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Document Revision History

Rev	Date	Section	Description of Updates
	October 2018	5.3 Model Transmittal	Model Transmittal Requirements Added
	October 2018	Appendix B	Revised Asset Parameter Requirements
	April 2021	2.3 GIS Views	Updated Deliverable Requirements
	April 2021	3.8 IFC Export	Update IFC Export Format
	November 2024	Varies	Change Smithsonian Facilities (SF) to New Department

1. OVERVIEW OF THE OPDC REVIT TEMPLATES

Autodesk's Revit Building Information Modeling (BIM) software comes with the capability to configure, manage and save standard Revit work environments, as template files. Utilizing templates helps to standardize modeling practices throughout multiple projects for an organization, ensuring that graphic representations, data syntax, object and view taxonomies, and the overall software working environment is consistent, and that the end product aligns with industry and organizational standards.

The OPDC Revit templates have been developed to support the Smithsonian OPDC BIM requirements, project workflows and deliverables. The OPDC Revit Templates are a set of five (5) template files that support project separate project disciplines and BIM approaches: architecture, mechanical/plumbing, electrical, structural engineering, life safety, fire protection and security.

This guide is NOT intended to be a Revit tutorial. It does assume that the user has a sufficient level of proficiency with Revit, BIM processes, and template settings.

1.1. Revit Template Customization for the Smithsonian

This User's Guide details the features within the OPDC Revit templates that have been customized for SI, and how to use the templates when developing a BIM. The template files provide a starting point for a new project model. They also have defined settings for units, fill patterns, line styles, line weights, view scales, among others, that are aligned with OPDC standards. The templates provide drawing sheets (and sheet views) and title blocks with automated fields, customized for the SI.

Many template features follow the U. S. National CAD Standard (NCS) version 5, however, the template is not intended to comprehensively incorporate NCS v5. BIM developers may make modifications to components of the basic template as necessary to meet specific OPDC project requirements.

Documentation in this guide refers specifically to the OPDC Revit Architectural Template. The discipline templates (mechanical/plumbing, electrical, and structural engineering) are standard Revit engineering templates that have been modified to incorporate SI standard annotations, view templates, title blocks, etc. The discipline templates are discussed later in this document.

Template features that have been changed from the default Revit settings and customized for the SI have been given a "SI" prefix/suffix in their names. Changes to features having a "SI" prefix/suffix for a project BIM, need to be approved by Smithsonian Institution's project COTR (Contracting Officer's Technical Representative). All other features, not containing an "SI" prefix, can be modified to suit specific project requirements.

2. CONTENTS OF THE OPDC REVIT TEMPLATE

The OPDC Revit template is based on Autodesk Revit imperial default template that includes customized objects and views to reflect OPDC standards, notably:

Floor and area plan views customized to support data exports to SI Facility Center applications.

Basic schedule views for listing (and exporting) component data

Title blocks and sheet layouts customized with the standard SI logo, along with "smart labels", and graphic symbols in multiple, selectable scales

Pre-configured drawing sheets

Customized annotation families

2.1. SI Project Units, Fonts and Dimensions

Please refer to the ***Smithsonian OPDC BIM Guidelines*** document for current standards on:

- Default project units
- Conversion from imperial to metric units in Revit
- Text sizes and fonts
- Dimensions

2.2. SI Project Base Point

OPDC requires Revit projects to have a project base point (PBP) and a survey point (SP). The PBP and SP might not be visible in all views because of visibility settings and view clippings, and should not, in any case, be deleted.

The project base point defines the origin (0,0,0) of the project coordinate system. It can also be used to position the building on the site; and to locate design elements of a building during construction. Spot coordinates and spot elevations referencing the project coordinate system will be displayed relative to the project base point. The survey point represents a known point in the physical world, such as a geodetic survey marker. Survey Point should always refer to the State Plane coordinates system for that project. Please contact the COTR for the project if you have any questions.

SI Best Practices for Project Base Point

- The PBP and SP need to be the same to align models from different disciplines on the project, using the Revit origin-to-origin command.
- For SI projects, the PBP should be located at 0,0,0 and pinned, so that cannot be accidentally moved or deleted.
- The SP coordinates, elevation, and angle to true north must be shared with all disciplines. It must be located at the same point for all discipline model files.
- For SI BIMs, the insertion point must be at 0,0,0, and located at the lower left column grid intersection.
- For existing projects, the insertion point should be the same location as shown on drawings the A/E obtains from the SI archives for the building.

Insertion Point Symbol:

Note that all SI-GIS plan views must contain a SI insertion point symbol, located at the required location (0,0,0), before CAD drawings are exported from Revit to AutoCAD for all SI deliverables.

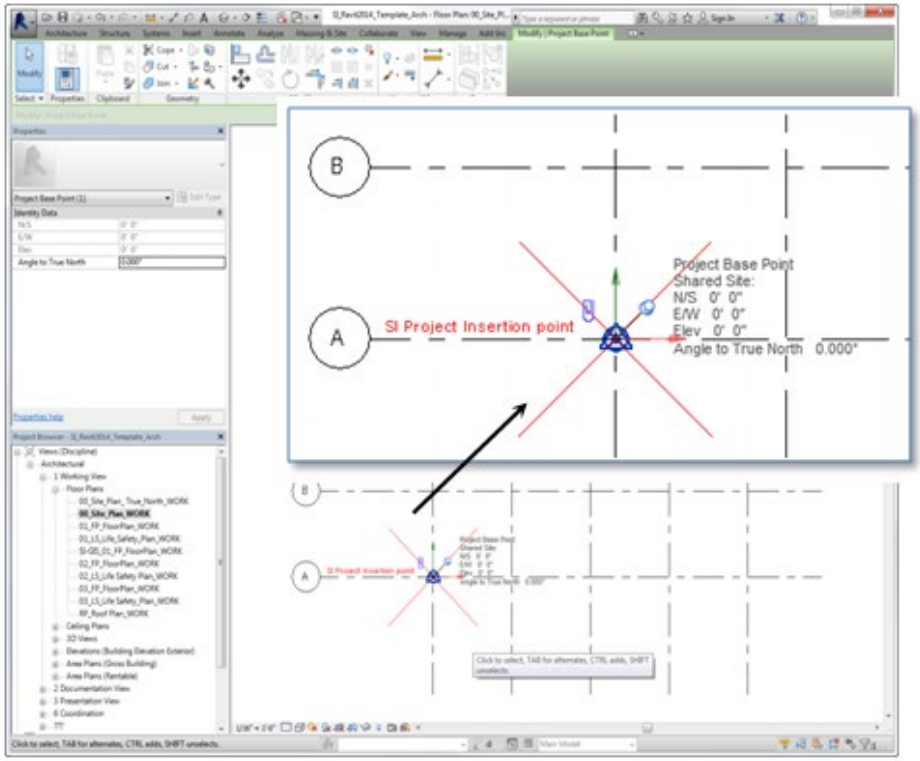


Figure 2.1: SI's Project Base Point instance located at the 0,0,0 coordinate

2.3. SI Area Plan and Floor Plan Views

The OPDC Revit templates contain basic Revit plan views as a starting point for developing the project model. Each basic view of the model (e.g. floor, reflected ceiling, elevation, section, etc.) should follow the view naming conventions provided in the template. Any deviations must be approved by SI project COTR in the initial stages of the project.

AEC project teams for SI projects can incorporate any additional view templates, view ranges, and general settings to support their practice requirements to produce construction documents.

To support spatial management, the OPDC Revit templates have been customized to expedite the export of spatial information from the Revit model.

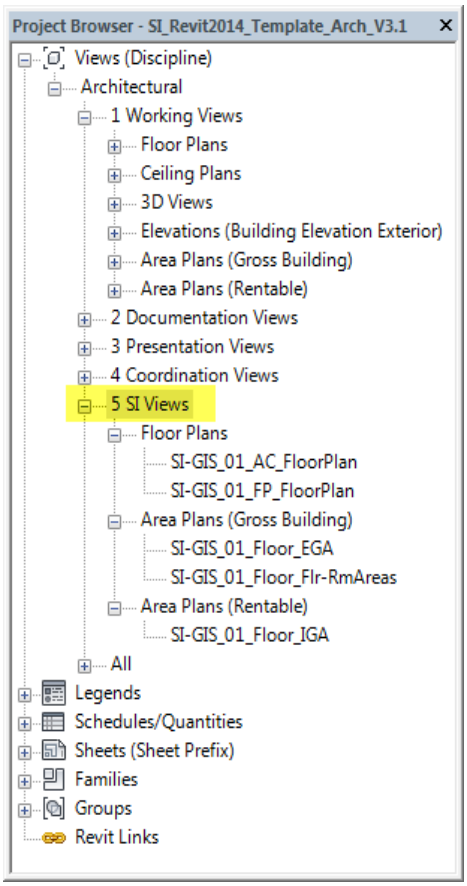


Figure 2-2: Project Browsers with SI-GIS custom views highlighted

2.3.1. Area and Floor Plan Views Customized for SI GIS Export

Table 2-1: Area and Floor Plan Views Customized to Support for SI Spatial Management

View	Description
Floor Plans - AC and FP Plans	The OPDC Revit template includes several floor plan and area plan views (labeled "SI"). These are formatted to hold data values that will be exported to SI's Facility Center Applications. These views are listed under "5 SI Views" in the template's Revit Project Browser. (Detailed instructions for these workflows follow later in this guide in the section "*Creating SI-GIS Area and Floor Plans Detailed Instructions*").
Area Calculation Plans (AC)	The SI-**GIS_*_AC_FloorPlan** view displays rooms objects. By default, in Revit, room objects added to a model will be displayed in those Revit views that have the display option for room objects set to on. Note that the room envelope (edge or boundary) is not visible in the view, since the color fill visibility is turned off (in order to export the information correctly into Facility Center). The Revit user will add room tags (including room name and number) to room objects in these views as part of the deliverable required by the SI.

View	Description
	All floor plan level views in the building must be created by duplicating the respective floor plan and applying the **SI_Rooms** view template to each floor.
Floor Plans (FP)	The Revit template's SI floor plan view follows the naming convention: **SI-GIS_*_FP_FloorPlan** (*= 2 digit floor number, i.e. 01). These customized views contain SI-required attributes and formatting, with no annotations, no unnecessary layers, no CAD underlays, etc., in order to export the CAD information correctly to Facility Center. Floor plan views for all levels in the building (within the project scope) must exist in the model. New floor plan views can be created by first duplicating the standard floor plan view, and then applying the **SI-FloorPlanLines** view template to the view just created.
Area Plans - Gross Building and Rentable Plans	The Revit template contains two types of SI area plans, *Gross Building* and *Rentable,* to support data transfer from the project BIM to Facility Center. These two views include: • **floor gross area** (calculating area bounded by the exterior side of the exterior wall) • **rentable area** (calculating area bounded by the interior side of the exterior wall) extractions
Gross Building - Exterior Gross Area Plans (EGA)	The template's **SI-GIS_*_Floor_EGA** (*= 2 digit floor number i.e. 01; EGA = Exterior Gross Area) view displays the gross floor areas (bounded by the exterior side of the exterior wall) of each level, and will be exported for intake into Facility Center. The project user must create gross building views for all floors in the building by duplicating the respective floor area plan (Gross Building) and applying the **SI_Floors** view template to each created.
Floor Room Areas - (Flr-RmAreas)	The **SI-GIS_*_Floor_Flr-RmAreas** (*= 2 digit floor number) view displays both floor and room areas for a floor. To generate these views, duplicate the respective floor area plans (Gross Building), and apply the **SI_Floors&Rooms** view template to each.
Rentable - Interior Gross Area Plans (IGA)	The OPDC Revit template's **SI-GIS_*_Floor_IGA** view (*= 2 digit floor number; IGA = Interior Gross Area) displays floor area information (bounded by the interior side of the exterior wall) to be exported for intake into Facility Center. The project BIM user must create views for all required floors in the building, by duplicating the respective floor area plan (Rentable) and then applying the **SI_Floors** view template to the new view(s).

2.3.2. Detailed Instructions for Creating SI-GIS Area and Floor Plans

At project delivery, spatial information developed in the model will be exported from Revit, and imported into the SI Facility Center Applications. The OPDC Revit template contains floor plan and area plan views that have been customized to extract room and area polylines. These views are located in the Revit Project Browser under "5 SI Views", in their respective categories.

SI-GIS_*_AC_FloorPlan

To create SI-GIS **Area Calculation** Floor Plan views for each level, the user must duplicate the standard floor plan view. To do so:

1. Right click on the view name in the Project Browser
2. Select Duplicate View > Duplicate with Detailing
3. Apply the view template named "SI _Rooms"

   This process will create CAD floor plans that appear to be empty. Although disconcerting, be aware that is because the customized Revit view settings display only Revit room elements and will not show other typical plan objects, such as walls, windows, doors, and annotations. Next:

4. Add the SI-Project Insertion Point Family at the project base point – this must be located at 0,0,0 coordinates) in each of the SI-GIS views

   Once all the rooms are added to the model the user must:

5. Add separate room tags - names and Numbers, for <u>all</u> room objects in the SI-GIS AC views. This will identify the room polylines within CAD, after exporting the floor plans from Revit.

Room Name Tags

To tag all room names, use the **Tag All Not Tagged** command:

> **Note:** If the visibility of either the tag category or its object type is turned off, a message will be displayed in Revit. Click OK to the message to direct Revit to turn on these visibility setting before the category is tagged. Revit will proceed to tag elements of the selected family categories.

1. Open the view in which you want to tag elements
2. (Optional) Select one or more elements to tag. If you do not select elements, the **Tag All Not Tagged** command will proceed to tag *<u>all</u>* untagged elements in the view
3. In the Revit menu's **Annotate** tab and **Tag** panel, click the **Tag All** icon. The **Tag All Not Tagged** dialog will be displayed
4. On the dialog menu, specify the objects to tag - in this case, select **Room Tags - SI-Room Tag: Room Tag - Name**. To tag:
   - all visible elements in the current view that do not have tags, select all objects in current view
   - only those elements you have selected in the view, select only selected objects in current view
   - elements in linked files, click the selection box for **Include elements from linked files**

5. (Optional) To attach a leader to each tag, select **Leader**. For **Leader Length**, enter a default leader length. For **Tag Orientation**, select Horizontal or Vertical. Click **OK** to proceed.

Room Number Tags

To create the *room number* tags positioned adjacent to the *name* tags:

1. Select all the elements in the current view by drawing an encompassing selection window around all the elements of the view. Use **Zoom All To Fit (ZA - keyboard shortcut)** command before selecting all the elements in the view
2. Keeping the elements selected, click on the **Filter** icon
3. In the **Filter** dialog, select **Check None** to unselect all the elements and then select just the **Room Tags** and click **OK**
4. In the **Modify** tab's **Clipboard** panel, select **Copy to Clipboard** icon or use Ctrl+C keyboard command to copy room tags
5. Now select **Aligned to Current View** from the **Paste** dropdown menu in the **Modify** tab's **Clipboard** panel to paste the tags in the same view
6. Keeping the tags selected from previous paste command, click on the room tag's **Properties** name and select **SI-Room Tag: Room Tag - Number** from the dropdown menu

OPDC Revit template only contains a *SI-GIS AC* floor plan view for first floor. For additional floors in the building room views must be created. This can be done by duplicating the respective (standard) floor plan view and then applying the "**SI_Rooms**" view template to the newly created floor plan(s).

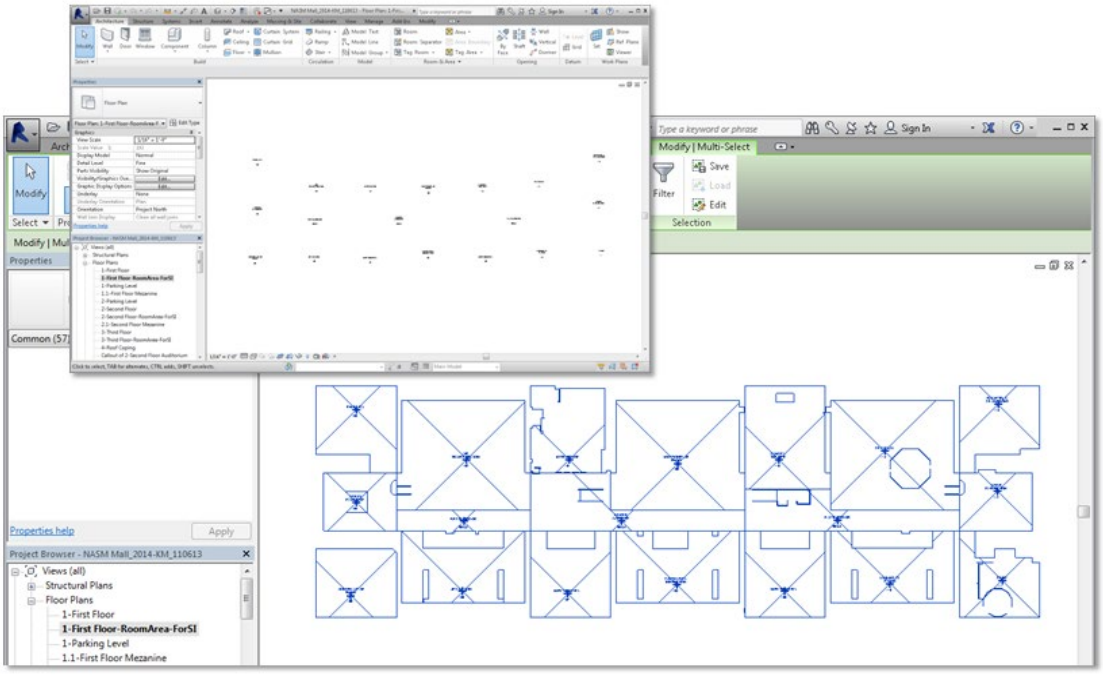


Figure 2-3: NASM First Floor Plan – Area Calculations (AC) view [View template applied: SI_Rooms]

SI-GIS_*_FP_FloorPlan

These views contain SI required attributes and formatting for each floor, with no annotations, no unnecessary layers, no CAD underlays, etc. To create SI-floor plan views for each level, the user must duplicate the standard floor plan view. To do so:

1. Right click on the view name in the Revit Project Browser
2. Select Duplicate View > Duplicate with Detailing
3. Apply the view template named *SI_FloorPlanLines*

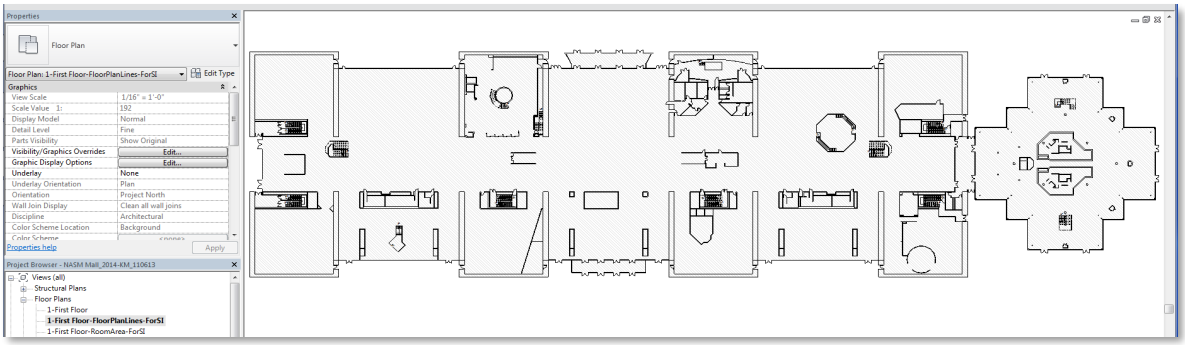


Figure 2-4: NASM First Floor Plan – Floor Plan Lines (FP) view [View template applied: SI_FloorPlanLines]

After the floor plans are created for a particular floor, duplicate the created view and name it appropriately with SI-GIS prefix. The following table lists the required views that need to be generated for SI-GIS use, from each of the floor plans:

Table 2-2: Required views to be generated for SI-GIS use from each floor plan

Floor Plans	SI-GIS Views	View Template Applied	Exported to CAD
Floor Plan for each floor (Duplicate each Floor Plan twice - one for each SI-GIS view)	SI-GIS_*_AC_FloorPlan	SI_Rooms	Yes
	SI-GIS_*_FP_FloorPlan	SI_FloorPlanLines	Yes

* = 2 digit Floor Number

SI-GIS_*_Floor_EGA and SI-GIS_*_Floor_IGA

The OPDC Revit template contains SI-GIS area plan views that track floor area information, including: gross area (as bounded by the exterior side of the exterior wall) and rentable area (calculating area bounded by the interior side of the exterior wall). This data, required from project delivery, is used for SI spatial management.

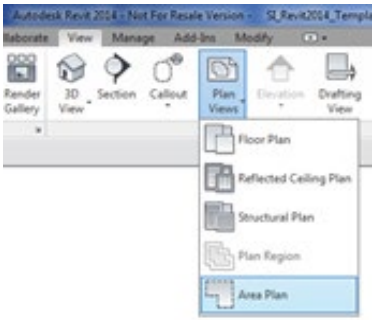
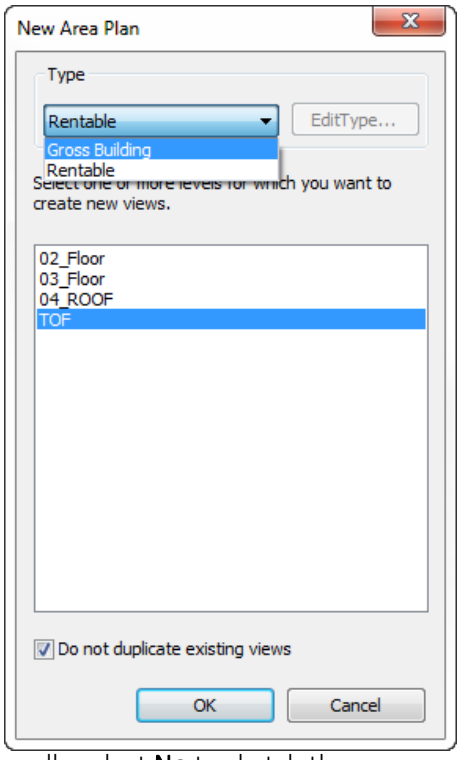


Figure 2-5: New Area Plan dialog

To create an area plan:

1. On Revit's **Architecture** tab in the **Room & Area** panel, click on the **Area** drop-down and select **Area Plan**
2. The **New Area Plan** dialog will appear, for **Type**, select an area scheme: Gross Building or Rentable
3. Select a level for the area plan view
4. If you select more than one level, Revit creates a separate area plan for each level and groups and displays them by area scheme in the Project Browser
5. To create copies of existing area plan views, clear **Do not duplicate existing views**. The levels for which area plans are created will appear
6. Select the level for the area plan view
7. Click **OK**
8. Revit prompts you to automatically create area boundary lines associated with all external walls - click **Yes**

   Revit places the boundary lines for the area calculation along the exterior walls of a closed loop. Optionally select **No** to sketch the area boundaries around curtain walls, semi-open spaces, etc.
9. Add the area by clicking the Architecture tab > Room & Area panel > Area drop-down > (Area)



After the area plans are created for a particular floor, duplicate the created view and name it appropriately with SI-GIS prefix. The following table lists the required views for SI-GIS from each of the area plans:

Table 2-3: Required views for SI-GIS from each area plan

Area Plans	SI-GIS Views	View Template Applied	Exported to CAD
Gross Building (Duplicate each area plan twice: one for each SI-GIS view)	SI-GIS_*_Floor _EGA	SI_Floors	Yes
	SI-GIS_*_Floor_ Flr-RmAreas	SI_Floors&Rooms	Yes
Rentable	SI-GIS_*_Floor_IGA	SI_Floors	Yes

* = 2 digit Floor Number

SI-GIS_*_Floor_ Flr-RmAreas

To create these views, go to the **SI-GIS_*_Floor_EGA** view for the corresponding floor and duplicate it, following these steps:

1. Right click on the view name in the Project Browser

2. Select Duplicate View > Duplicate with Detailing

This creates an identical view with a prefix "Copy of *<original view name>*"

3. Rename the copied view using the file naming format: *SI-GIS_ *_Floor_ Flr-RmAreas* (*=Floor number)
4. Apply the view template named "SI_Floors&Rooms"

The view displays both an exterior area boundary line and room boundary lines. When exported from Revit to CAD, the file will comply with SI-GIS requirements.

The user must add the area tags to each area object and name them appropriately, indicating gross area and room areas. This identifies the area polylines when the floor plans are exported to CAD (.dwg file).

Gross Area Tags

To tag the gross area:

1. Select the **Tag All Not Tagged** Revit command
2. In the Tag All Not Tagged dialog, select Area Tags – SI-Area Tag: Area Name with Area,
3. Click **OK** to complete the command

Room Area Tags

To tag room area:

1. Tag the area, as mentioned above, using **Area Tags** - **SI-Area Tag: Area Name with Area** tag
2. Open the previously tagged **SI-GIS_*_AC_FloorPlan** for that floor; select all the room tags and copy them to the clipboard. For instructions on selecting all room tags see **Room Number Tags** in the previous section.
3. Open the **SI-GIS_*_Floor_Flr-RmAreas** view for that floor and select **Aligned to Current View** from the **Paste** dropdown menu in the **Modify** tab's **Clipboard** panel to paste the tags in this view
4. Add the *SI-Project Insertion Point Family* at the project base point (which should be located at 0,0,0 coordinates) in each of the SI-GIS views.

This view contains tags for both floor area and room areas and is ready to export to CAD (dwg)

Create area plans for ALL levels (both gross building and rentable) and apply "**SI_Floors**" and "**SI_Floors&Rooms**" view templates.

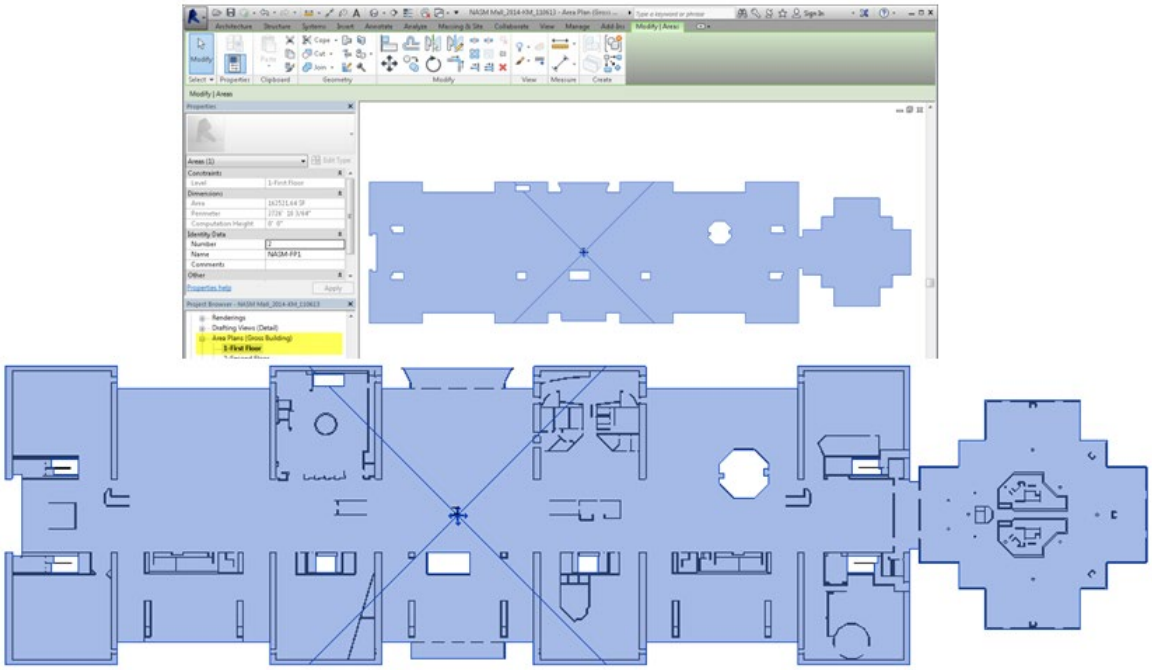


Figure 2-6: Gross Building AP (outer edge of the floor's ext. wall) [view template applied: Area Plan for SI Floors]

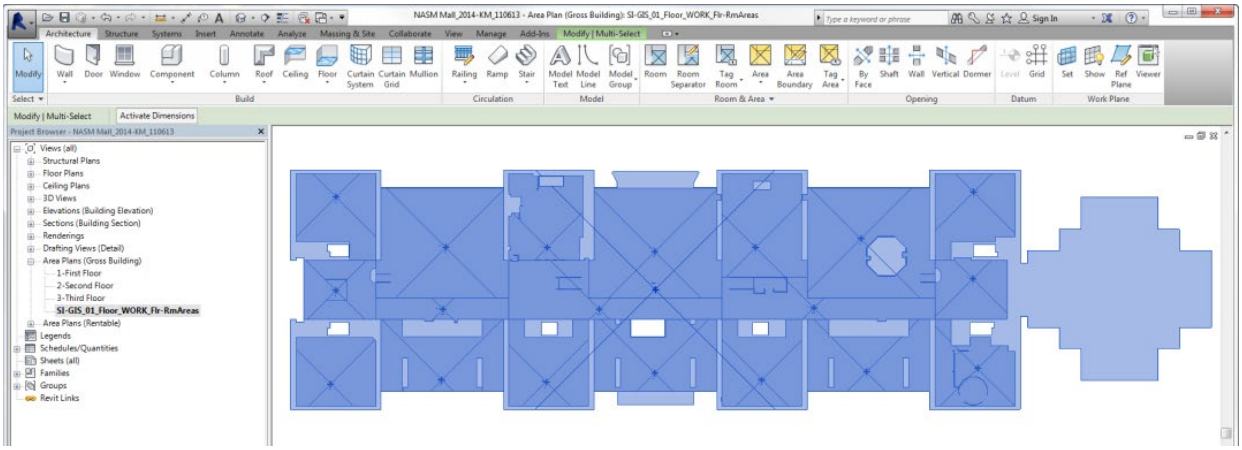


Figure 2-7: Gross Building AP - Floor and Rooms [view template applied: Floor & Room Areas for SI]

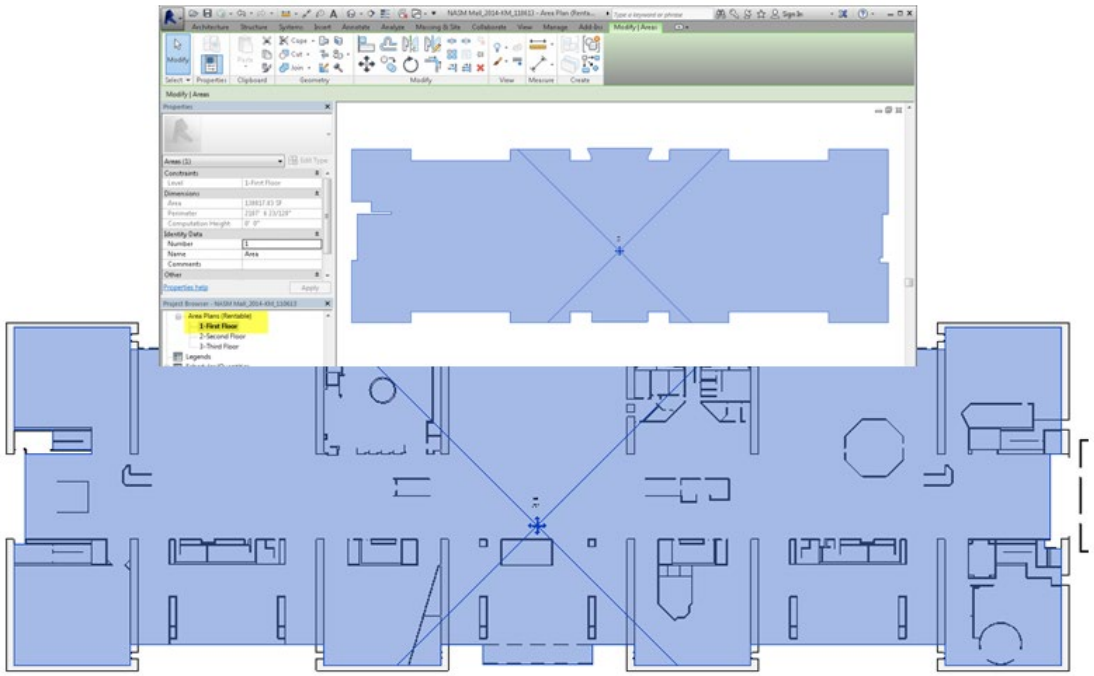


Figure 2-8: Rentable AP (the interior edge of the floor's ext. wall) [view template applied: AreaPlan for SI Floors]

2.3.3. Exporting SI-GIS Floor & Area Plans to AutoCAD

To export the above views to CAD:

1. Open the view to export
2. Click  ➤ Export ➤ CAD Formats ➤  (DWG)
3. In the DWG Export dialog box, select *SI_CADExportSetup* from the **Select Export Setup** drop down menu

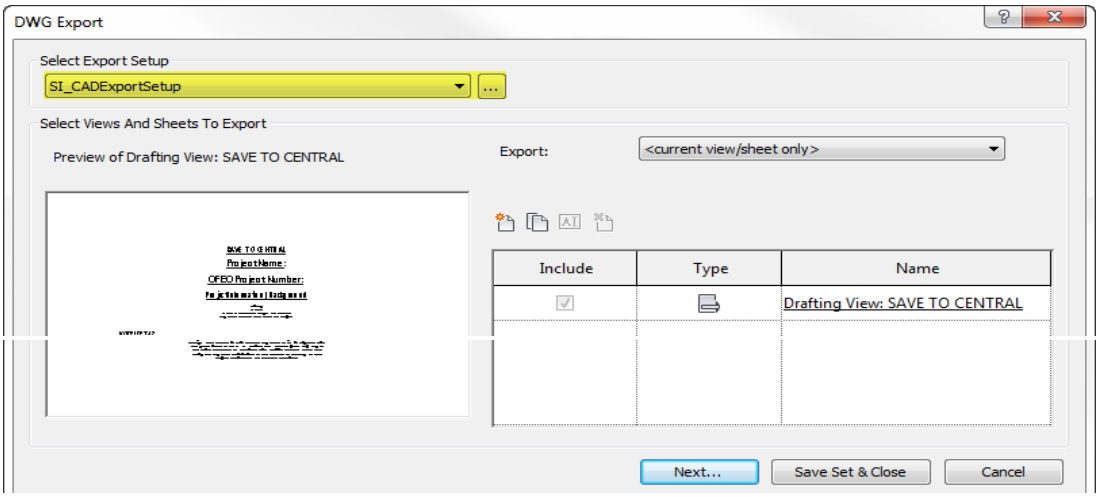


Figure 2-9: Select Export Setup in the DWG Export dialog

Table 2-4: Export options for Single and Multiple views

If you want to export:	Then:
a single view	for Export, select <Current View/Sheet Only>
multiple views	for Export, select **<In session view/sheet set>**, select views from the **Show in list** dropdown, and select the views to export

4. In the **DWG Export** dialog, specify which views to export to the DWG file:

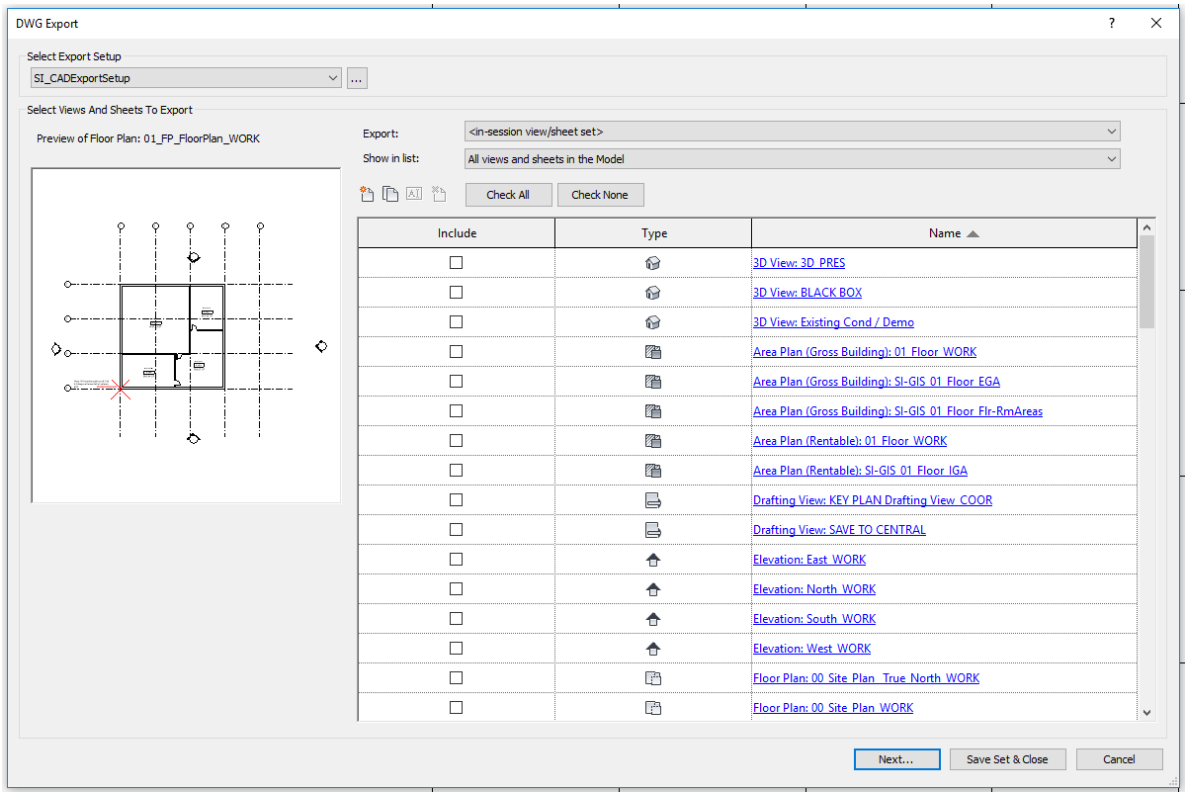


Figure 2-10: View selection in the DWG Export dialog

5. Click **Next**

6. In the **Export CAD Formats dialog**, navigate to the target folder for the exported files, enter the project name and click **OK**

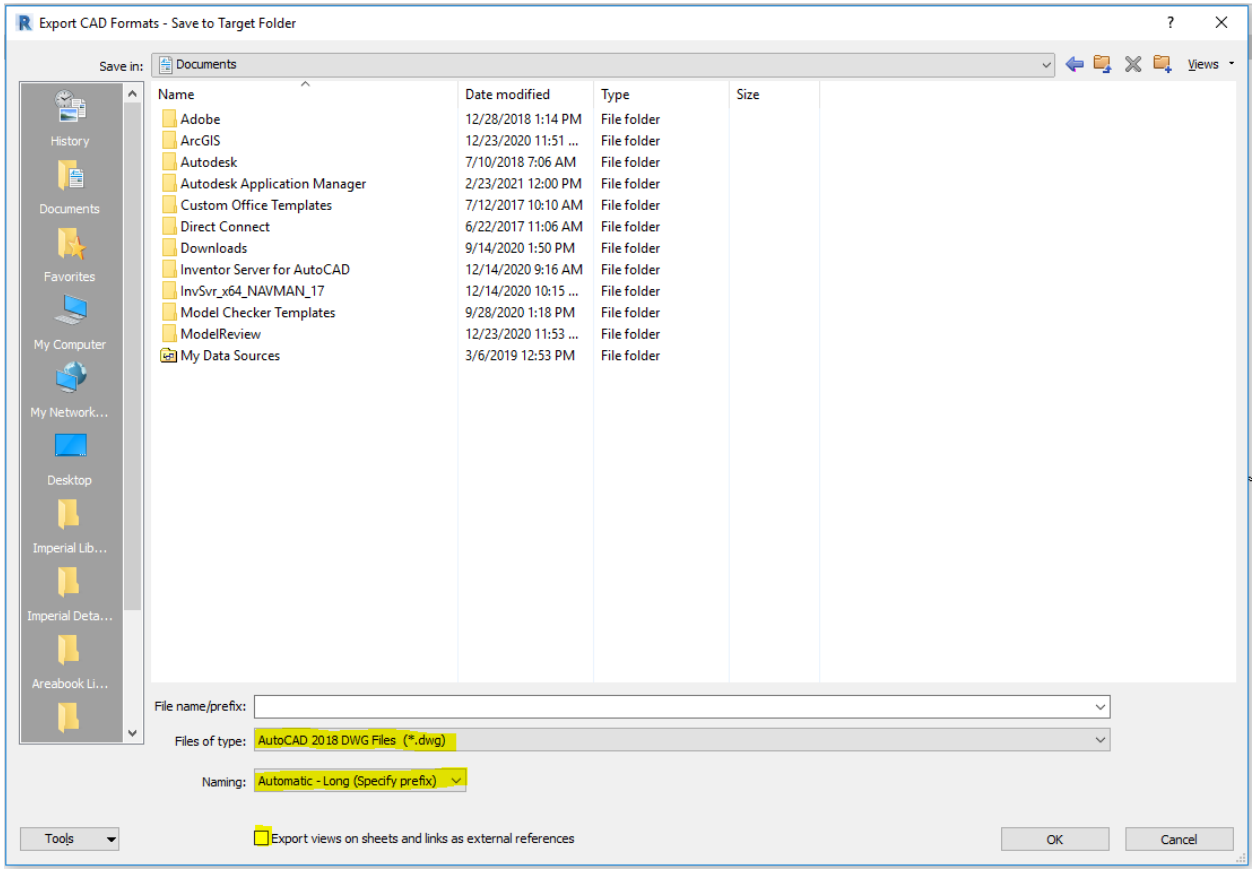


Figure 2-11: Export CAD Formats – Save to Target Folder dialog

7. Revit will export the selected views to DWG files, placing them in the target folder specified

   When the exported CAD files are opened in AutoCAD for the first time the A-FLOOR-OTLN & A-FLOOR-OTLN-RPRM layers (where the space and floor polylines are saved) are turned off. To view the polylines, turn on both layers and save the files for future use.

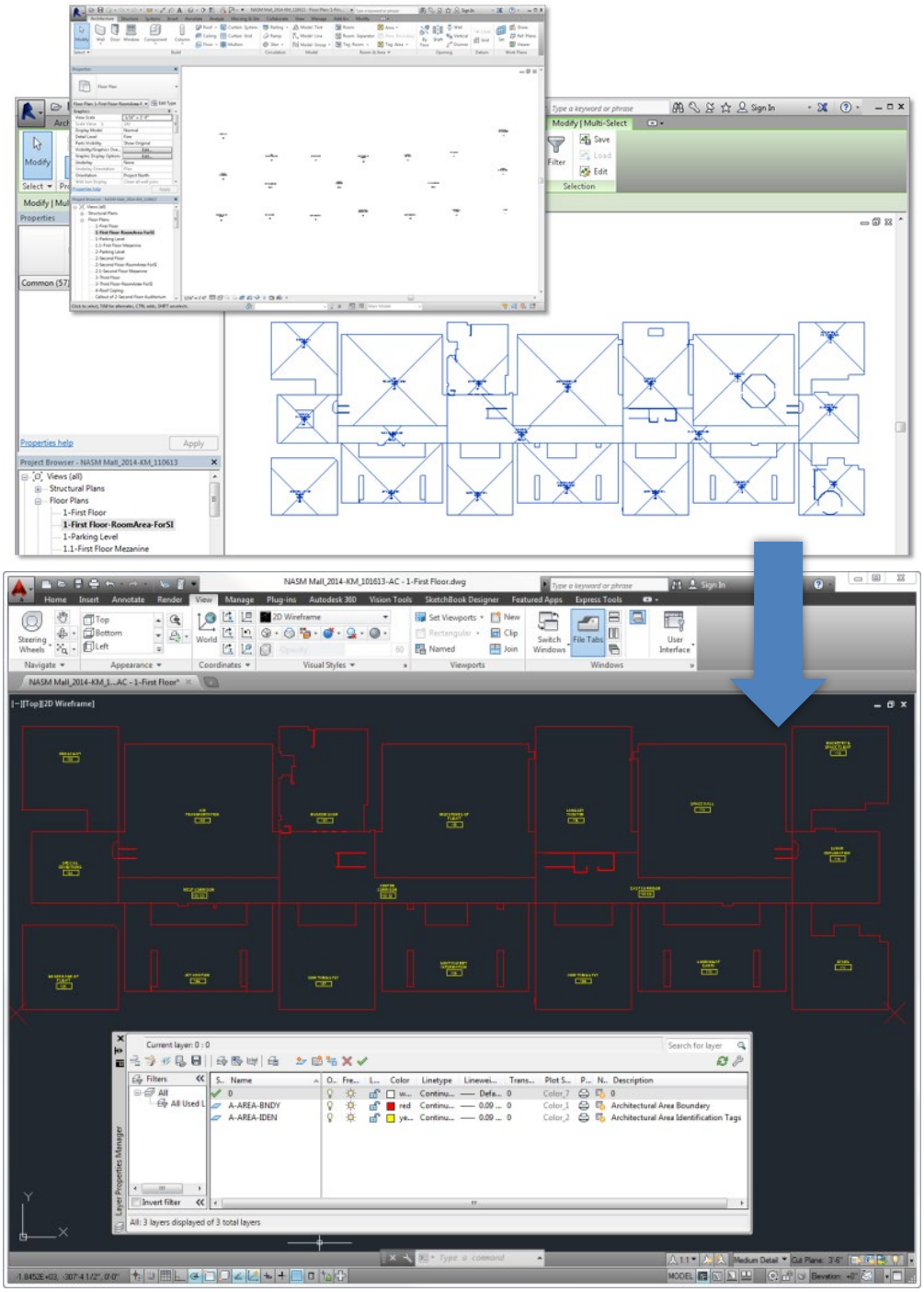


Figure 2-12: Exported Revit views in AutoCAD

2.4. SI Schedules

A set of schedules, labeled with the prefix "SI-GIS", are included in the OPDC Revit template to track room and floor data. This information is required as a part of the standard SI project BIM deliverables. These schedules provide a project data in a format that can be exported from Revit for eventual intake into the Facility Center applications.

Columns in the schedules represent custom parameters (data fields) created by the OPDC Revit templates. The parameter settings for these schedules cannot be modified. Any deviations in the format or content for these schedules must be approved by SI COTR.

Please refer to **Appendix A** in this document for a detailed list of space and floor custom spatial parameters for SI.

SI-GIS_Spaces Schedule

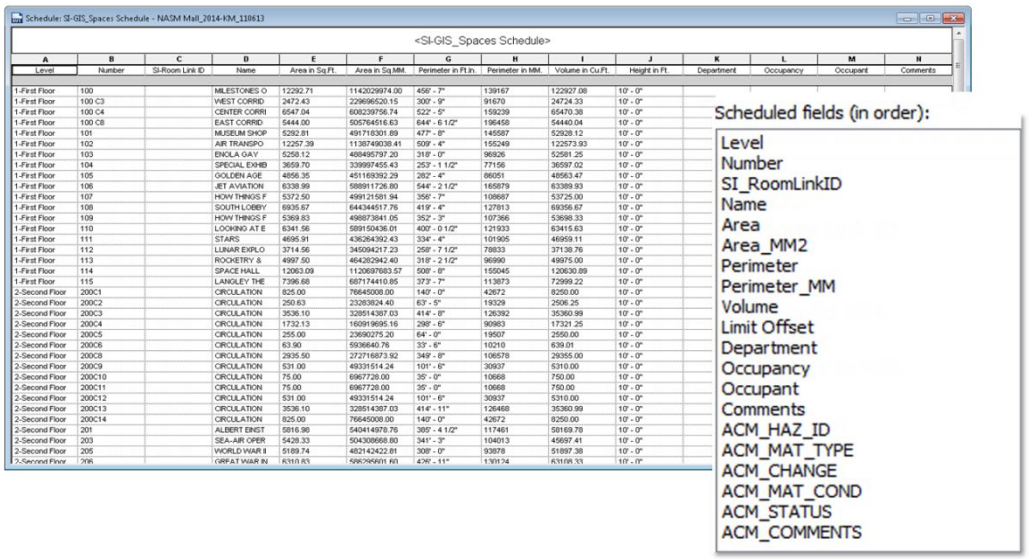


Figure 2-13: Customized Schedule Views for SI-GIS Space Data

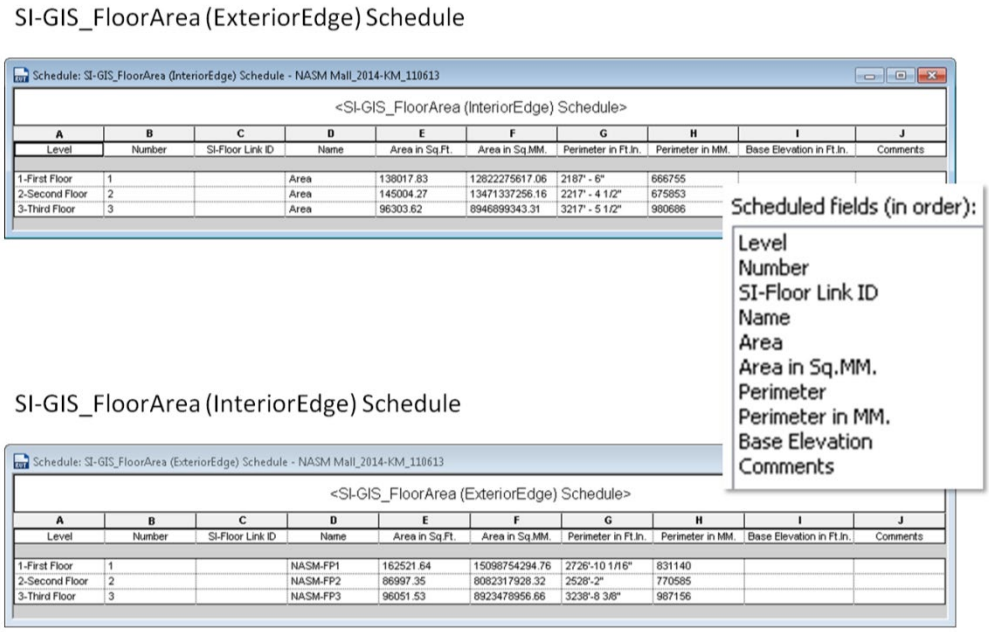


Figure 2-14: Customized Schedule Views for SI-GIS Floor Data

2.4.1. Exporting SI Schedules from Revit

To export a schedule:

1. In Revit, open the schedule view to be exported
2. Click ➤ Export ➤ Reports ➤ Schedule
3. The *Export Schedule* (file) dialog appears - specify a name and directory for the schedule, and click *Save*
4. The *Export Schedule* (options) dialog appears. Under *Schedule appearance*, select export options:
    - Export column headers: specifies whether Revit column headers export
        - One row: only the bottom column header exports
        - Multiple rows, as formatted: all column headers export, including grouped column header cells
    - Export group headers, footers, and blank lines: specifies whether sort group header rows, footers, and blank lines export
5. Under *Output* options, specify how you want to display the data in the output file:
    - *Field delimiter*: Specifies whether fields in the output file are separated by tabs, spaces, commas, or semi-colons
    - *Text qualifier*: Specifies whether the text in each field of the output file should be enclosed by a single or double quote, or no annotation
6. Click *OK*

Revit saves the file as delimited text, a format that can be opened in external programs, such as Microsoft Excel.

To save the exported .txt file as Excel file:

1. Click  ➤ *Open*
2. In the *Open* dialog box, select the .txt files exported from Revit, and then press the *open* button
3. Follow the instructions in the *Text Import Wizard*. When done with the steps in the wizard, click *Finish* to complete the import operation
4. Once the data is imported save the file as an Excel format file (.xlsx), with the appropriate file name

2.4.2. Additional/Optional Schedules

Additional schedule views have been included in the *OPDC Revit Templates* to assist project BIM development and data collection. These views can be modified by project teams.

Schedules in the OPDC Revit Template include:

1. Doors, Windows, Walls and Finishes
2. DIV* labeled component schedules - helpful for quantity take offs
3. Schedules for reference or documentation (labeled with the prefix Z-)
    - "Z-QAQC Programmed Area vs. Actual" Designed to contain the programmed spaces and area requirements and will track actual room areas in the model once the "Room" objects are assigned to the correct spaces.
    - "Z-QAQC Egress Route Distances" Contains fields to track the egress distances of labeled paths
    - Additional schedules labeled "Z-QAQC". Assists with Quality Assurance and Control. Refer to Appendix A for more information on program schedule

These are basic Revit schedules that track architectural elements. Project BIM consultants may also set up schedules to meet their practice requirements or specific project requirements.

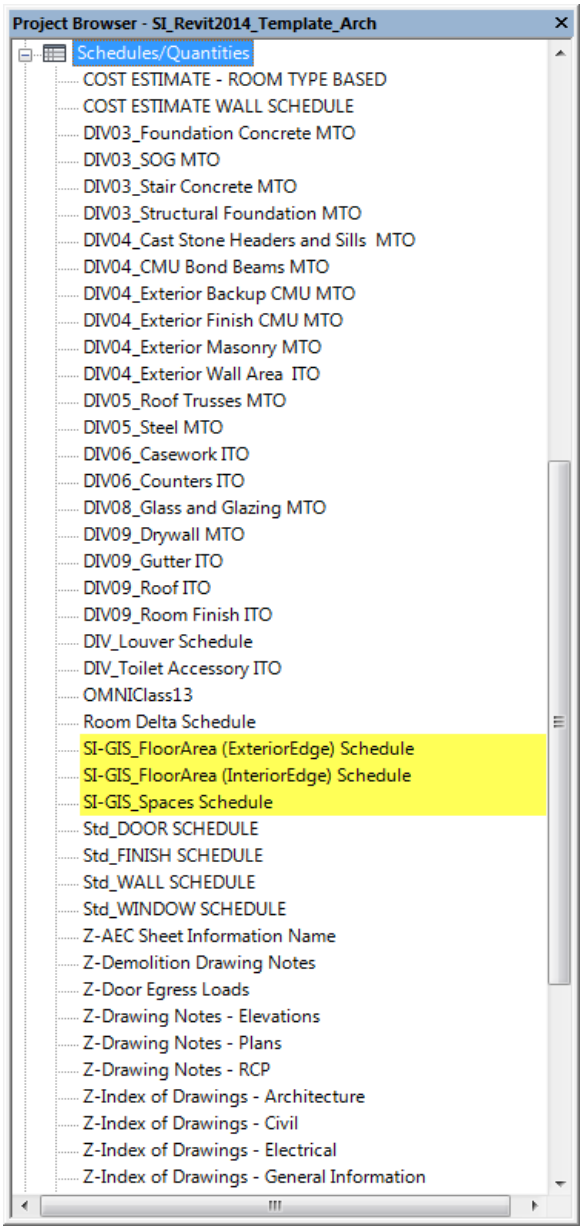


Figure 2-15: Revit Project Browser showing SI-GIS Schedule Views in yellow

2.4.3. Drawing Legends

The "*Legends*" view section contains legends referenced during drawing development. These may be changed during project production depending on specific project requirements. The "*ABBREVIATIONS*" legend uses a sample set of abbreviations that are derived from the National CAD Standards/Uniform Design System 5.0 list.

Table 2-5: Drawing Legends

Name	Description
ABBREVIATIONS & PROJECT INFORMATION	Sample - abbreviations (NCS compliant) and project information
CEILING LEGEND	Sample (Optional)
DOOR TYPES	Sample (Optional)
KEY PLAN	Sample to assist users with creation of a *Key Plan*
LIFE SAFETY CRITERIA	Sample
LIFE SAFETY LEGEND	Sample
LINE STYLE LEGEND	Sample (Optional)
PARTITION TYPES	Sample showing partitions, materials (Optional)
RCP LEGEND	Sample (Optional)
ROOF LEGEND	Sample (Optional)
SIGNAGE	Sample (Optional)
WALL TYPES	Sample (Optional)
WINDOW TYPES	Sample (Optional)

2.5. SI Workset Requirements

Worksets are a feature in Revit that can be used to organize elements into collections for worksharing, so that team members can display and work on selected worksets. Consider worksets as containers. Worksets are NOT layers as in CAD. Think of them as containers for major systems in a building (interior, exterior, roof, core, and so on). The Revit project contains a *Workset Table* which references all the worksets contained in that project. There may be one or many worksets in a project.

The SI requires the following to be essential worksets in a shared project for architectural models.

Table 2-6: Worksets for architectural models and their purposes

Workset Name	Purpose
Exterior Shell	Include all exterior shell elements of the building(s)
Interior	Include all interior elements of the building(s) except furniture and equipment
Core	Include core structure and core elements of the building(s)
Furniture	Include all interior furniture and equipment elements of the building(s)
Exhibits Walls	Include exhibit walls/partitions different from interior walls and exhibits
Exhibits	Include exhibits
Grid and Levels	Include grids and levels
Links	Include linked discipline Revit models (For large projects)
Worksets for separate disciplines	Include separate discipline worksets for Mechanical, Electrical, Plumbing, Fire Protection, Structural and Life Safety (For small projects)

Note: Small projects produced by a single A/E consultant, the project BIM will include all disciplines within a single Revit model. For these models, the separate discipline worksets should be used. For large projects, it is recommended to have separate Revit models for each discipline, linked to either the site model or architectural model, and associated with links workset.

During model development, Revit users should be aware of the active workset while creating datum, geometry, or rooms. Revit Architecture automatically manages the worksets for everything else (views, families, and project standards). These cannot be changed by the user.

2.6. SI Title Block, Cover Sheet and Save to Central View

The Smithsonian Institution's project title block contains parameters for project information compliant with the OPDC CAD guidelines. There are two sizes of SI title blocks included in the OPDC Revit Templates: SI-24x36In and SI-36x48In.

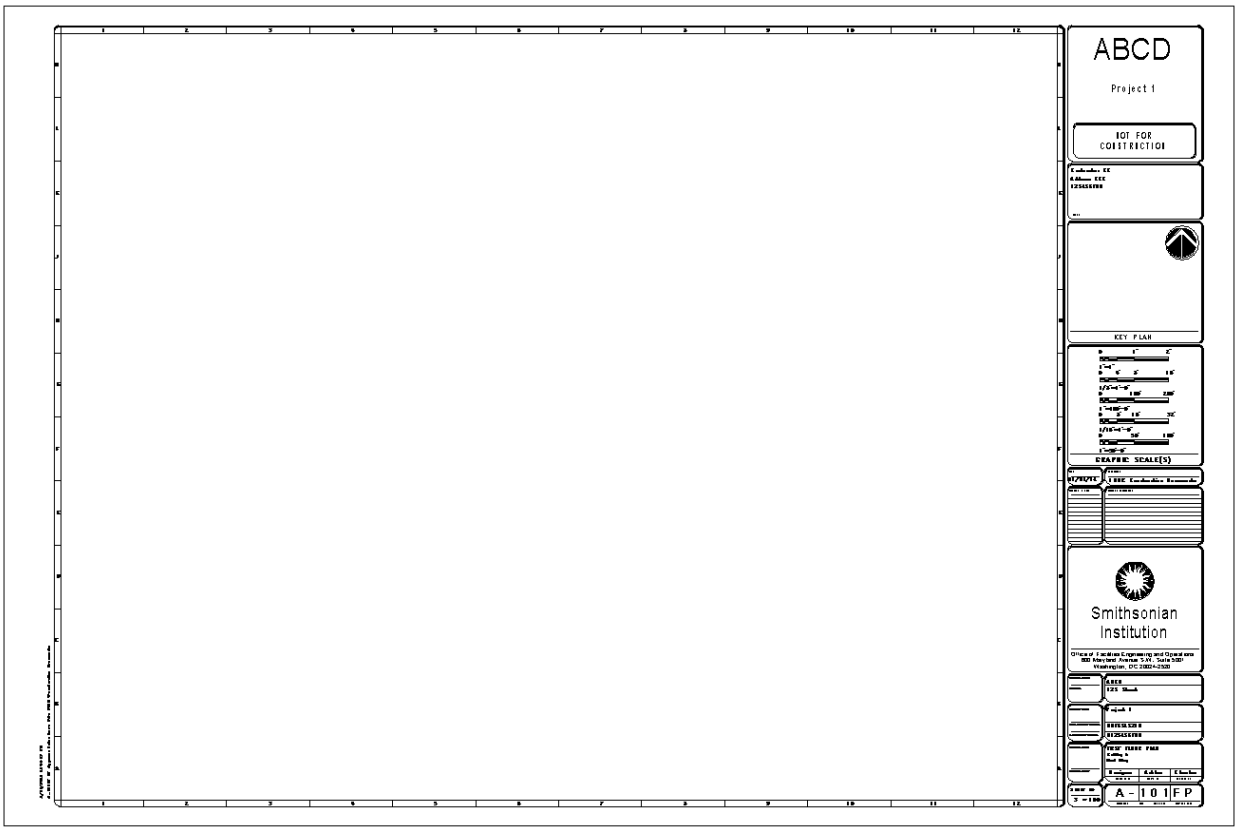


Figure 2-16: Standard Drawing Sheet with SI Title Block

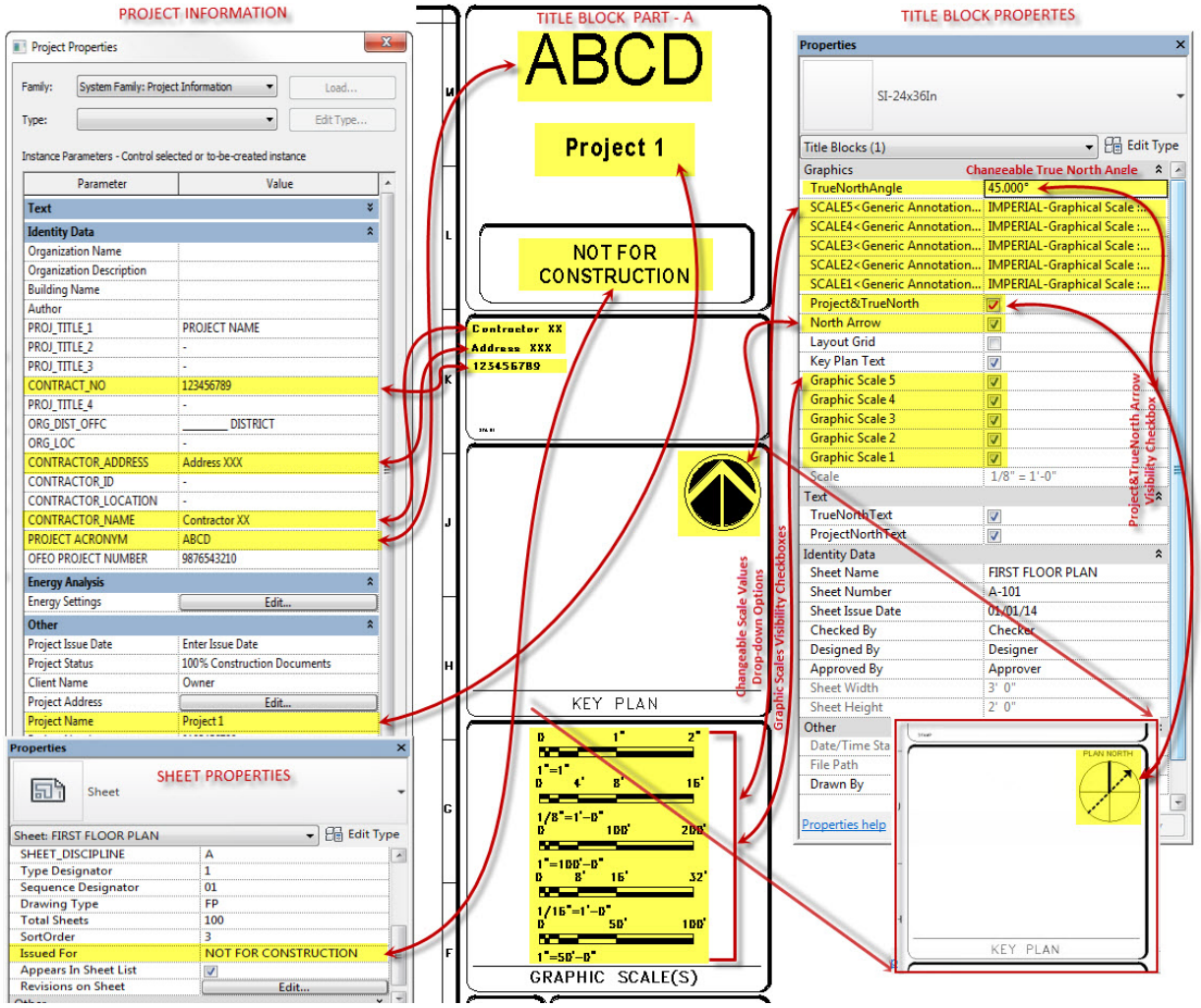


Figure 2-17: Detail of OPDC Revit Title Block and controlling parameters

The figure above shows the OPDC Revit sheet title block and links (in red) to its editable project specific parameters. Note that the north arrow can be changed to a *Project & True North* configurable arrow.

Five optional graphic scales are also included in the sheet customized for the SI, along with several additional title block parameters.

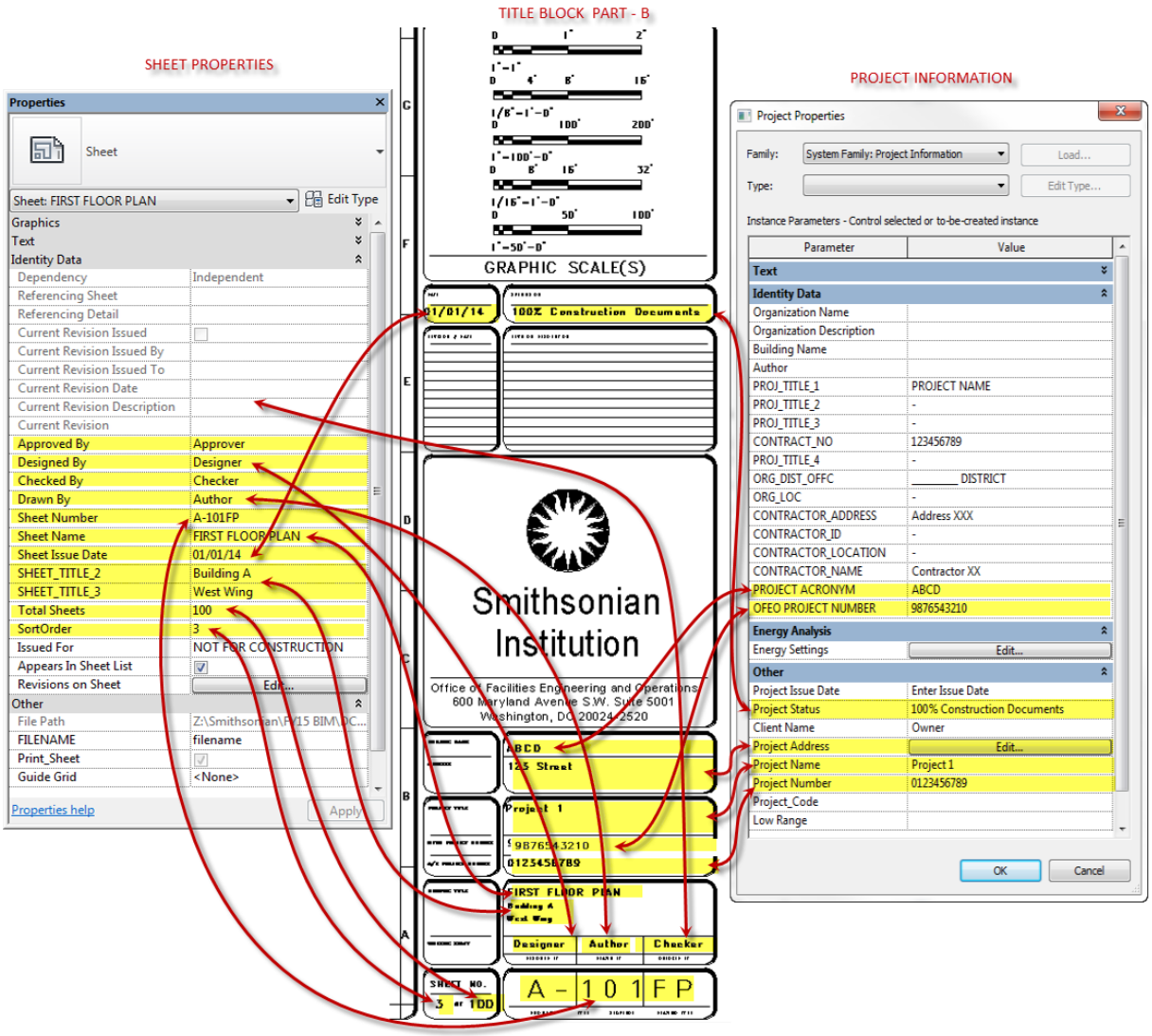


Figure 2-18: Detail of OPDC Revit Template title block displaying Project Information parameters

Standard SI Cover Sheets are included in two sizes; SI-CVR-24x36In and SI-CVR-36x48In.

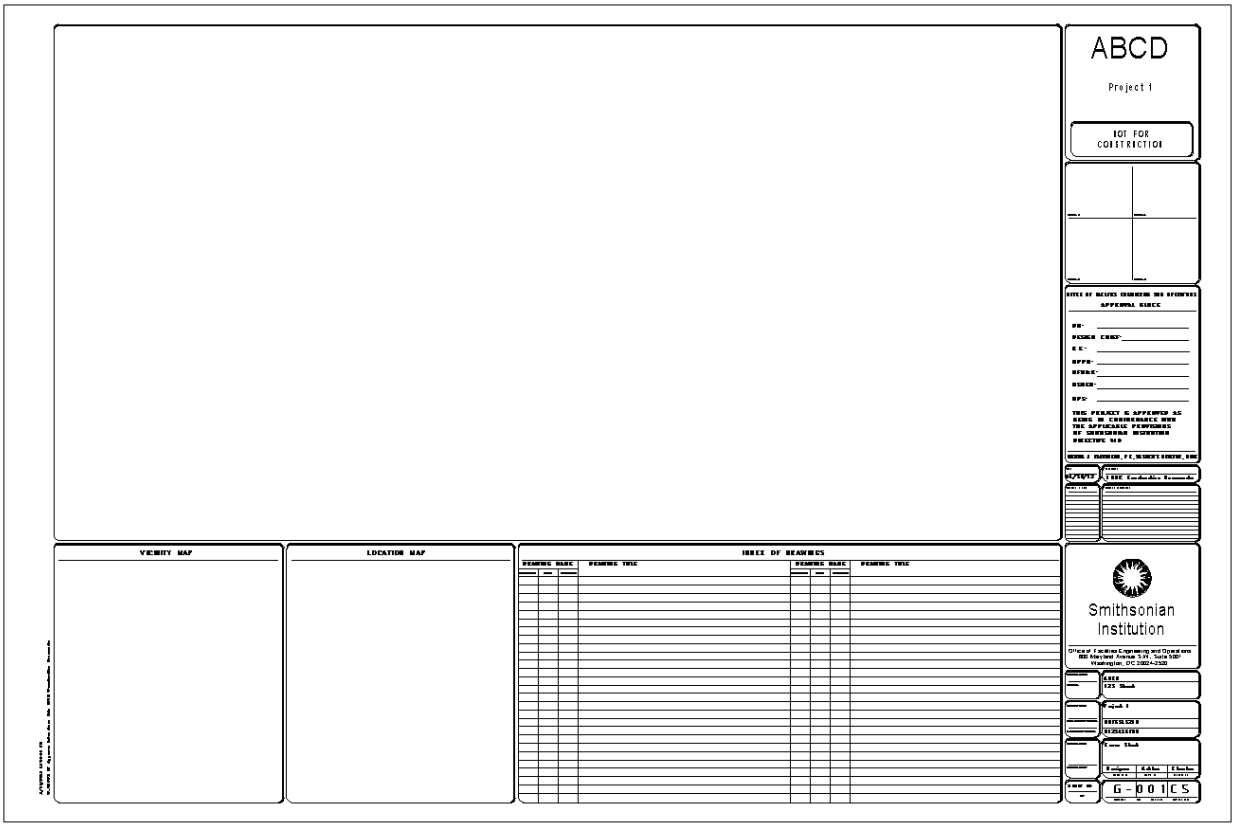


Figure 2-19: Standard SI Cover Sheet

2.6.1. Save to Central View

The OPDC Revit Template is configured to display a SAVE TO CENTRAL view. This is classified as a "Drafting View" in Revit. It will be the default view displayed when opening a OPDC Revit model. This view contains project information such as project name, Smithsonian OPDC' project number, and some additional details about the project.

Before saving, synchronizing the files to central and closing the model -- users should open this view and close all others. The project BIM manager must populate all the pertinent information in this view and update it as the project progresses. This view is located under the "All" view purpose in Drafting Views (Default) category in the Project Browser.

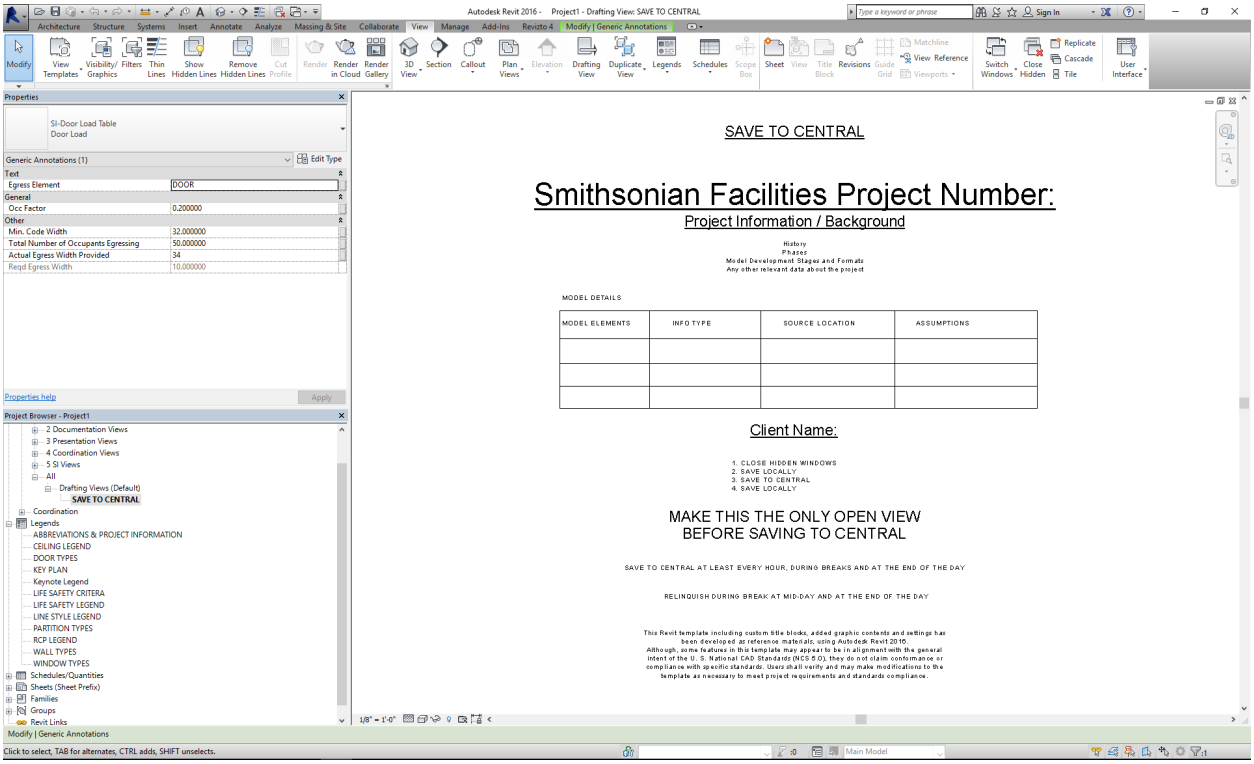


Figure 2-20: Standard SI Cover Sheet

2.7. SI Annotation Families

SI Annotation Symbols: Symbols included in the template have been set up to comply with the Smithsonian OPDC CAD Standards. Refer to **Appendix B CAD standard symbols**, in this document

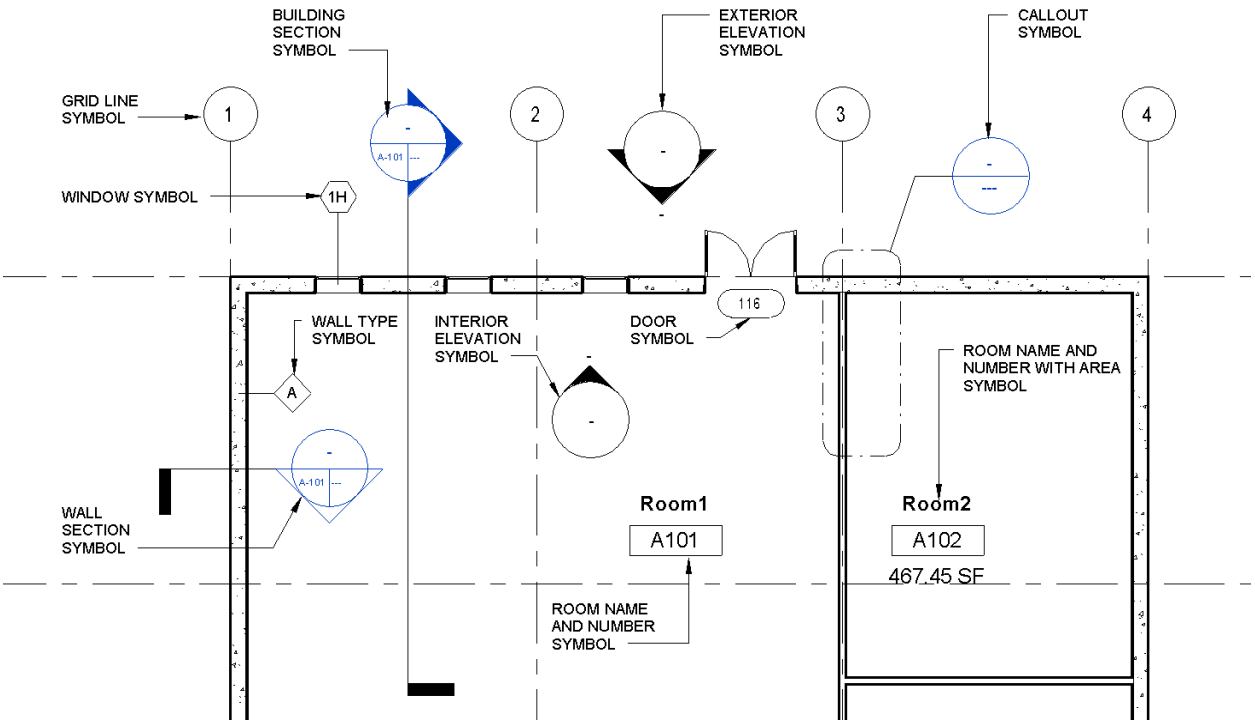


Figure 2-21: Custom SI Annotation Symbols

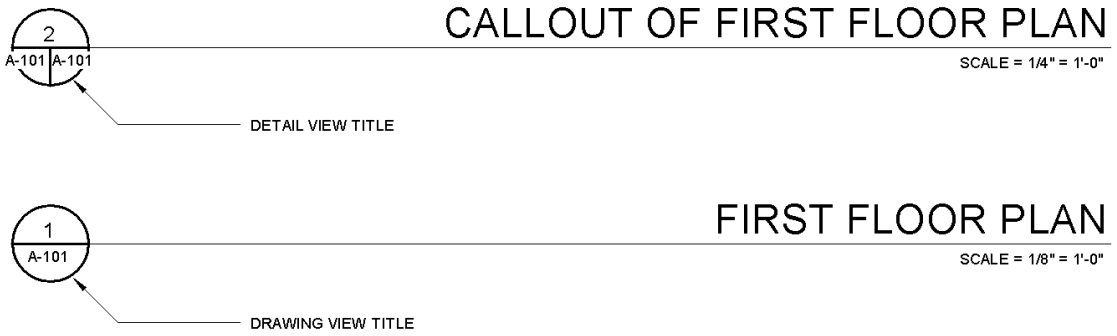


Figure 2-22: Custom SI View Title Symbols

Table 2-7: Custom Annotation Families within the OPDC Revit Architectural Template		
Family Type	**Family Name**	**NCS 5 Compliant**
Annotation		
SI	SI-24x36In	Y
	SI-36x48In	Y
	SI-Area Tag	Y
	SI-CVR-24x36In	Y
	SI-Door Load Table	Y
	SI-Door Tag	Y
	SI-ProjectInsertionPoint	Y
	SI-Revision Tag	Y
	SI-Room_Hazard_Occupancy_Tag	Y
	SI-View Title w RefSheet	Y
	SI-View Title w Sheet	Y
	SI-Wall Tag	Y
	SI-Window Tag	Y
	SI_North Arrow	Y
	SI_Room Tag	Y
Standard	Callout Head_NCS5	Y
	Door Tag NCS5	Y
	Elevation Mark Body_Circle Exterior NCS5	Y
	Elevation Mark Pointer_Circle Exterior NCS5	Y
	Elevation Mark Body_Circle NCS5	Y
	Elevation Mark Pointer_Circle NCS5	Y
	Electrical Fixture Tag	Y
	Furniture Tag NCS5	Y
	Graphic Scales_Arch NCS5	Y
	Grid Head - Circle NCS5	Y
	Level Head - Circle NCS5	Y
	Revision Tag NCS5	Y
	Room Tag NCS5	Y
	Section Head - Filled NCS5	Y
	Section Tail - Filled NSC5	Y
	Section Head - Filled w Sheet-Ref Sheet	Y
	Std Wall Tag - Square NCS5	Y
	Std Window Tag NCS5	Y
Generic Model		
	Std_Egress_Route	NA

2.8. SI Browser View and Sheet Organization Settings

The default view browser setting in the template is organized by **Discipline**, **View Purpose**, **Family and Type** and sorted by **Associated Level**.

There are no pre-defined sub-categories within the disciplines in the architectural template.

View Purposes

Pre-defined *view purposes* are:

- 1 Working Views (**WORK**)
- 2 Documentation Views (**DOC**)
- 3 Presentation Views (**PRES**)
- 4 Coordination Views (**COORD**)
- 5 SI Views (**SI-GIS** as Suffix)

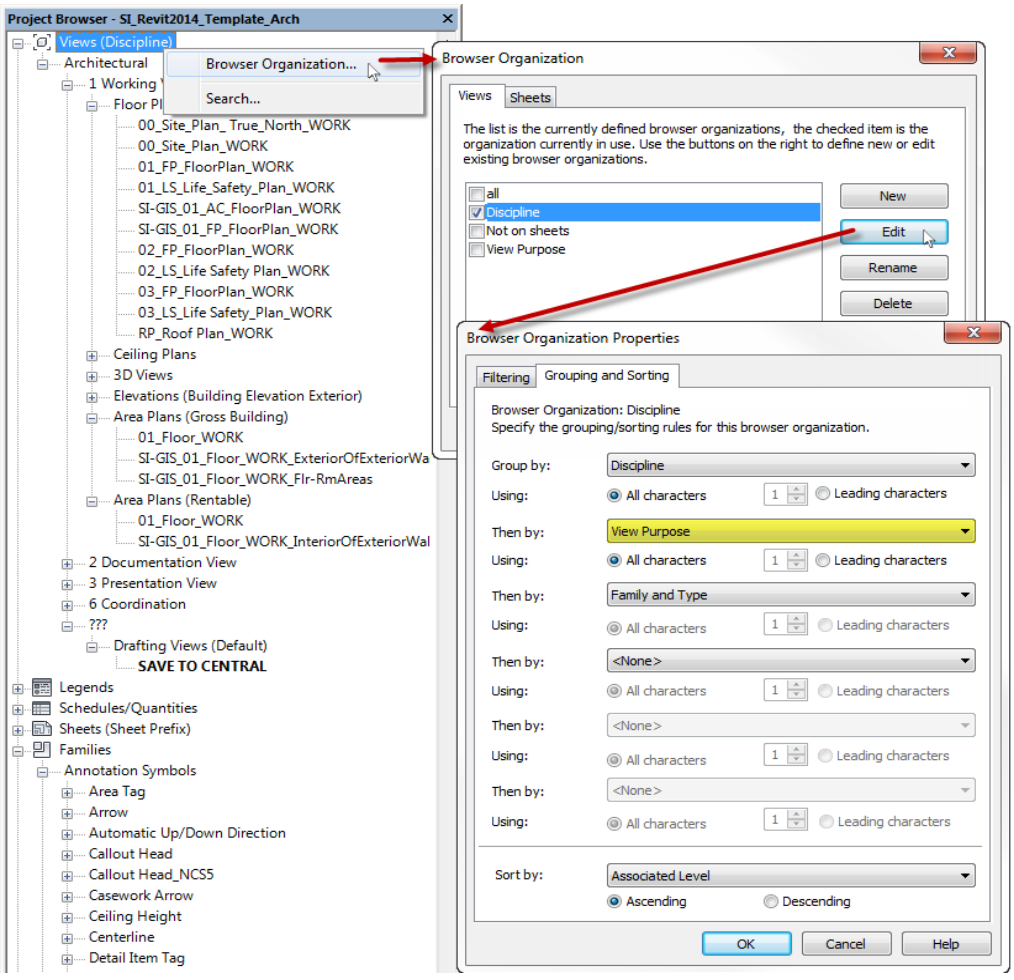


Figure 2-23: Revit Project Browser and its Organization Settings

View purpose is a Revit project parameter, providing a means for users to organize the many views that may exist in a BIM.

Within the OPDC Revit Templates, view names have these customizations applied:

- For SI-customized views, the uppercase **"SI-GIS"** abbreviation is appended to the start of the view names to more clearly connote SI-customized views.
- The uppercase abbreviation of the "*view purpose*" is appended to the end of the view names to help SI users clearly recognize and distinguish between the many views in the model.

The default sheet browser setting in the OPDC Revit Template is organized by:

- the *Sheet Prefix* setting
- Ordered by the first character of the Sheet Number, sorted in the ascending order.

Table 2-8: OPDCRevit Template Browser View Organization

Browser View Type	Grouping	Filter
All	Default	<None>
Discipline	Group by: • Discipline(all characters) • View Purpose(all characters) • Family & Type Sort by: • Associated Level, ascending	<None>
Not on Sheets	Group by: • Family and Type • Then by: <None> • Then by: <None> Sort by: • View Name, ascending	Filter by: Sheet Name = <None>
View Purpose	Group By: • View Purpose (all characters) • Discipline (all characters) • Family and Type Sort By: • Associated Level, ascending	<None>

2.8.1. View Types and View Templates

1. **View Types:** Typical Revit views (such as floor plan, area plan, elevation, and section views) are assigned a default Revit *View Template* with standard *View Properties* settings.
2. **View Template Settings**: The OPDC Revit Template has been set up with several customized **view templates** to enforce consistency and appropriate visibility of objects for certain types of views.

   Each "view template" includes specific settings that control how BIM objects appear. These settings include view properties such as *View Scale*, *Overrides*, *Model Display*, *Shadows*, Lighting, *View Range* and others. In the figure below, the highlighted view templates are applied to SI-GIS views. These view templates are for initial guidance only. They can be modified by A/E as required, except for *SI view templates*.

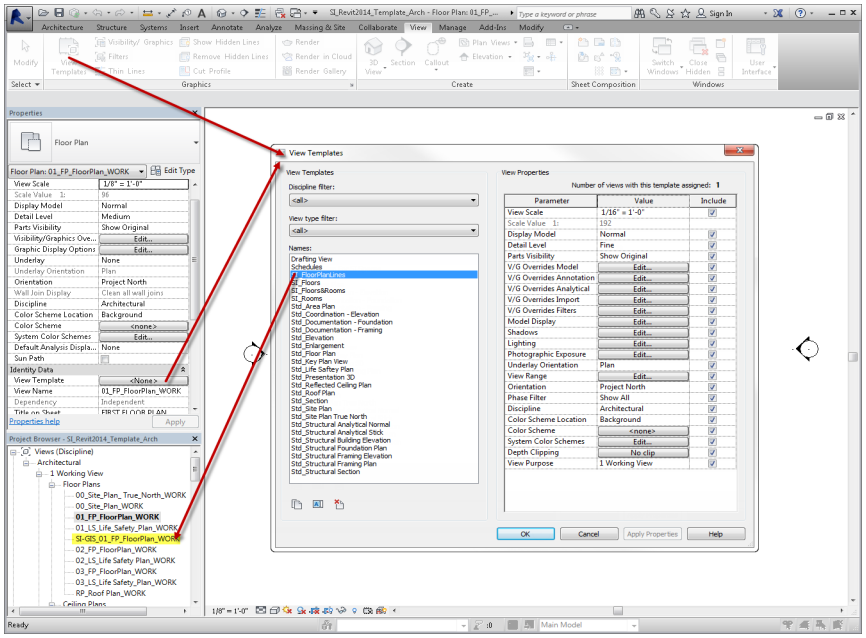


Figure 2-24: Revit worksession showing Default View templates that control views in the model

3. The *OPDC Revit View Templates* provide floor plan and area plan views customized for SI-GIS purposes. Applying these view templates to the default Revit views will also eliminate annotations, dimensions and other non-required Revit elements from the SI-GIS views, and facilitate easier export to CAD format files. The project team can edit and modify the view templates except for the view templates with the "SI" prefix, as needed to meet project requirements. The SI view templates should be applied to all the SI-GIS views (as detailed within this Users Guide).
4. 3D Views and View Templates are to be created in the Federated Model to Display
   - Existing Construction / Demo
     - This View should show Conditions prior to start of the renovations.
   - Final Construction / As Built "Black Box"
     - This View will should show the condition of the space / building at the end of the renovations. All demolished and duplicate elements should be turned offed.

Note that since the element visibility requirements will differ from project to project, the view settings for these 3D views are not created in the Revit Template. The AEC BIM managers should come to consensus with SI COTR and decide on what elements and disciplines are to be included in the 3D PDF views. And accordingly create view templates for those views.

To apply *View Template* settings on the drawings at any time, prior to printing or project delivery:

1. Select the view or multiple views in the browser window
2. Right click and select Apply Default View Template

To make changes to the default settings:

1. Go to the **View** tab, **Graphics** panel
2. Select the **View Templates** option to open the **View Templates** dialog box.
3. Make the necessary changes and click the **Apply** button

Reference the following table for SI "view template" types.

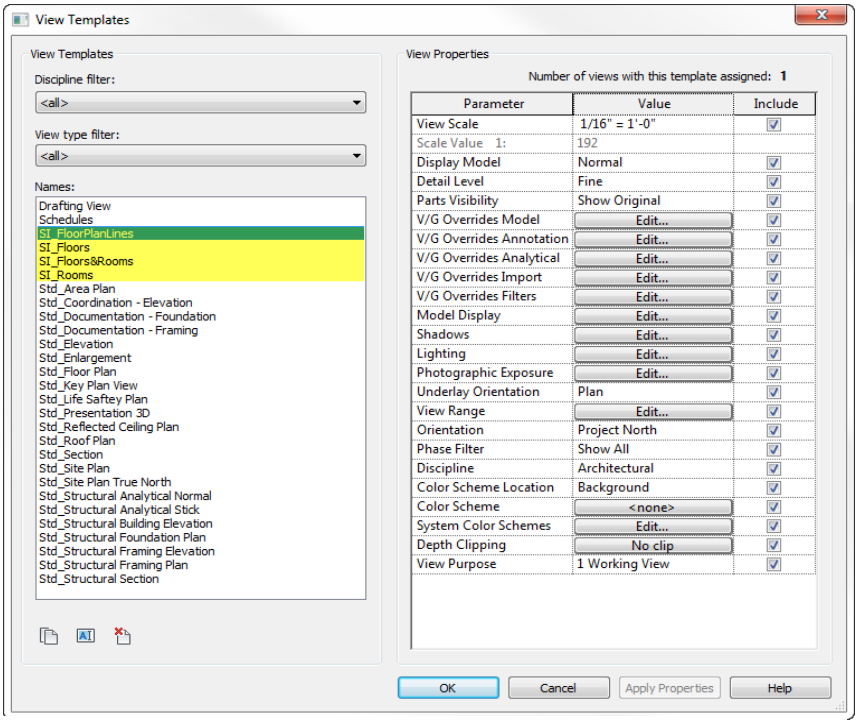


Figure 2-25: Revit View Template menu with SI View Templates highlighted

Table 2-9: View Template Types		
View Type Classification	View Template Name	Notes
SI Floor Plans	SI_Rooms	Typical floor plan with settings to just extract room areas for SI's GIS space elements. Note that these views do not contain any visible elements, since the room elements are not visible in plan views without color fill. For SI purposes, color fills are not set to visible. Also, users will need to add room tags to the rooms in this view to meet SI room area plan requirements.

Table 2-9: View Template Types		
View Type Classification	View Template Name	Notes
	SI_FloorPlanLines	This view template formats a typical floor plan to exclude information not necessary for SI-GIS floor plan line views (annotations, unnecessary Revit elements such as mechanical elements, electrical elements, etc., and imported CAD drawings)
SI Area Plans	SI_Floors	Typical Area Plan with settings to just extract building gross and rental areas for each floor Note that these views do not contain any visible elements as the areas are not visible in plan views unless color fill is applied For SI purposes color fills are not applied and users are required to add area tags to the gross area and rental area to fulfill the SI area plan requirements before exporting the views to CAD
	SI_Floors&Rooms	Gross Area Plan view settings that will isolate the building gross and room areas for each floor. This view template should be applied to *Gross Building Area Plans* for each floor, in order that the floor and space/room areas will be extracted for SI-GIS purposes
Schedules	Schedules	Format for schedule views
Floor, Structural, **Area Plans**	Std_ Area Plan	For showing overall building area
	Std_ Floor Plan	Typical floor plan settings for visibility
	Std_ Life Safety Plan	Uses "filters" to identify fire-rated and smoke-rated walls. Separate symbols may be applied using the "Std_ Fire Smoke Symbol" family (based on the NFPA symbols). A color scheme may be applied to the plan to identify the "Room_Occupancy_Hazard" classification. Egress paths can be created using the "Egress_Route" family. An **Egress ID** is assigned by the user, and the "Z-QAQC Egress Route Distances" schedule tracks the total length of path for each path
	Std_ Site Plan	
	Std_ Enlargement	
	Std_ Key Plan View	Used only for creating a **key plan** from the model.
	Std_ Roof Plan	

Table 2-9: View Template Types		
View Type Classification	View Template Name	Notes
	Std_ Site Plan True North	This site plan will display the **True North** orientation of the project. (The correct geospatial Lat/Long location should be set for this to display properly).
Ceiling Plans	Std_ Reflected Ceiling Plan	
3D Views, Walkthroughs	Std_ Presentation 3D Existing Cond. / Demo Final Construction "Black Box"	
Renderings, Drafting Views	Std_ Drafting View	
Ceiling Plans	Std_ Reflected Ceiling Plan	
Elevations, Sections, Area Plans	Std_ Coordination - Elevation	
	Std_ Elevation	
	Std_ Section	

2.8.2. View Filters

View Filters are used in the Life Safety plans to show color and patterns for walls that have a Fire and /or Smoke rating in the Fire Rating parameter under Identity Data section of the Wall Family (this is a default "Type" parameter and is built into the standard version of Revit Architecture "Wall" families). Refer to Appendix "D" for details.

2.8.3. View Purpose (for Architecture)

Separate "View Purposes" have been created in the OPDC Revit template for:

1. **Working Views** Where the BIM is created, modified, viewed
2. **Documentation Views** For project drawings/documents – Sheet views
3. **Presentation Views** For rendered or presentation views of the building
4. **Coordination Views** Displaying linked models generally to coordinate different disciplines
5. **SI Views** SI-GIS views

All Views that are common to all the above purposes

Revit's capability to set up distinct "View Purposes" helps to tailor model information to support distinct work tasks (or purposes).

Table 2-10: View Purposes (working, documentation and coordination views)

Working Views	Documentation Views	Coordination Views
This set of views is for the main design and layout of the building. These views are not intended for the final documents and are used to support the modeling process (although a View Purpose may be changed to a Documentation view). There are two site Views (*Site_Plan* and *Site_Plan_True_North*). The True North View is set with the orientation of True North. The user should change the orientation of the building to the actual orientation of the project in this view. The correct location coordinates should also be set in this view.	These views are finished and are intended to be placed on sheets. Documentation Views may contain scope box views for larger projects. Appropriate visibility and/or filter settings are applied to display only relevant categories and objects. These may need to be adjusted for specific needs. There may be additional standards required by the owner or organization that is responsible for review of documentation. These should be followed in lieu of these standards.	These views are for coordination and collaboration with separate disciplines: civil, interior design, structural, MEP, landscaping. Collision detection between disciplines would be done here.

2.8.4. View Naming

Additional views created in the model must follow the naming standards used in the example views included in the template.

Follow the file naming conventions as detailed in the ***Smithsonian OPDC BIM Guidelines*** document under **View Naming.**

2.9. SI Model File Naming

The project BIM team should follow the file naming conventions as detailed in the ***Smithsonian OPDC BIM Guidelines*** document under the **Model File Naming** section.

2.10. SI Sheet Naming

The OPDC Revit Template contains several pre-configured sheets which serves as a starting point for CD sheet generation.

Please refer to the **SI Sheet Naming** section in the ***Smithsonian OPDC BIM Guidelines*** document for SI sheet naming standards, including:

- Sheet naming:
  - Revit Sheet Views and
  - Sheet Views exported to CAD
- Sheet numbering system and file naming system
- Discipline code abbreviations
- Drawing type codes

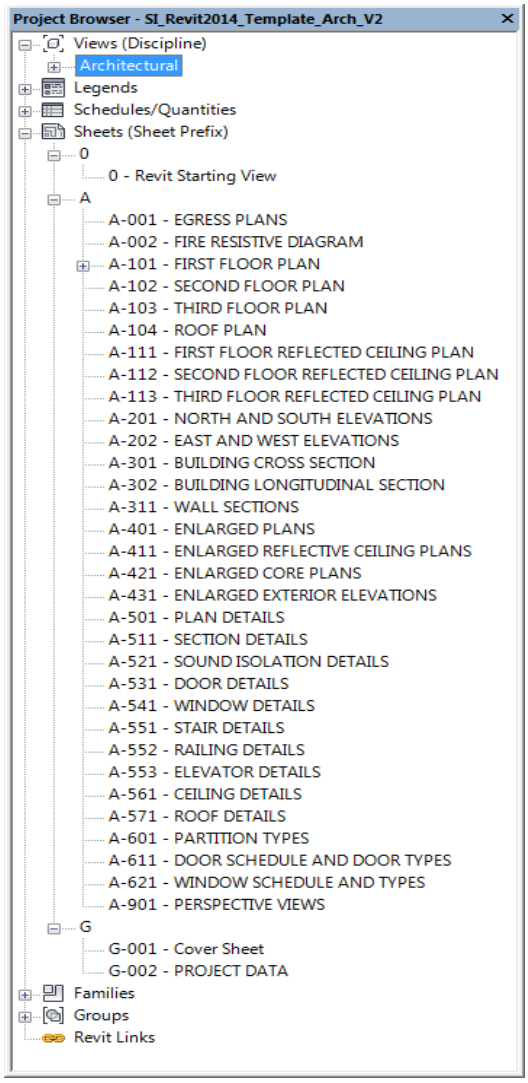


Figure 2-26: The pre-configured Sheet Set included in the SI Revit Template

Template Starting View - Sheet

The OPDC Revit Template includes a sheet labeled "**0 – SI Revit Starting View**" to serve as the initial view when the project model is opened. The sheet displays general project information that has been entered into the Revit *Project Information Attributes.* These data fields can be accessed within the Revit menu's "Manage" tab, with the "Project Information" icon. The sheet can be customized further to display additional information that might be helpful for project users.

Template Cover Sheet

The OPDC Revit Template includes a standard cover sheet (numbered G-001). This sheet contains labels that are linked to the Revit *Project Information* parameters in the model. These fields include the: Project Name, Owner, Project Status, Solicitation, and Contract Number fields, and will automatically be displayed on the sheet if the data has been entered the *Project Information* section's parameter fields.

Since project and contract requirement vary, a project team may need to modify all or parts of the sheet set, along with titles and numbering contained in the base template.

Additional Sheet Attributes

Sheet views contain attributes that can be employed by users to customize an ordered list of sheets for export from Revit. Some of these useful settings include:

- Attributes that can be used for making a custom ordered list that will control the order of sheets exported from Revit

- A checkbox for the sheet attribute "**Appears in Sheet List**" that can control whether the sheet appears in a sheet schedule (this is a default Revit parameter)

3. USING THE OPDC REVIT TEMPLATE

Save a copy of the OPDC Revit Template file in the project folder. Secure the folder so that only authorized users can modify the template file. The template file is typically only used once, during the initial creation of the project Revit file, at the start of the project BIM development. It is generally retained with other reference files in the project folder.

3.1. Starting a New Revit Model

1 In the Revit work session, select "New…", browse to the directory containing the OPDC Revit Template, select the OPDC Revit Template, and click open

2 Once opened, save as a new Revit project file (.rvt) with the appropriate SI naming convention (discussed previously in this guide) before continuing work on the project

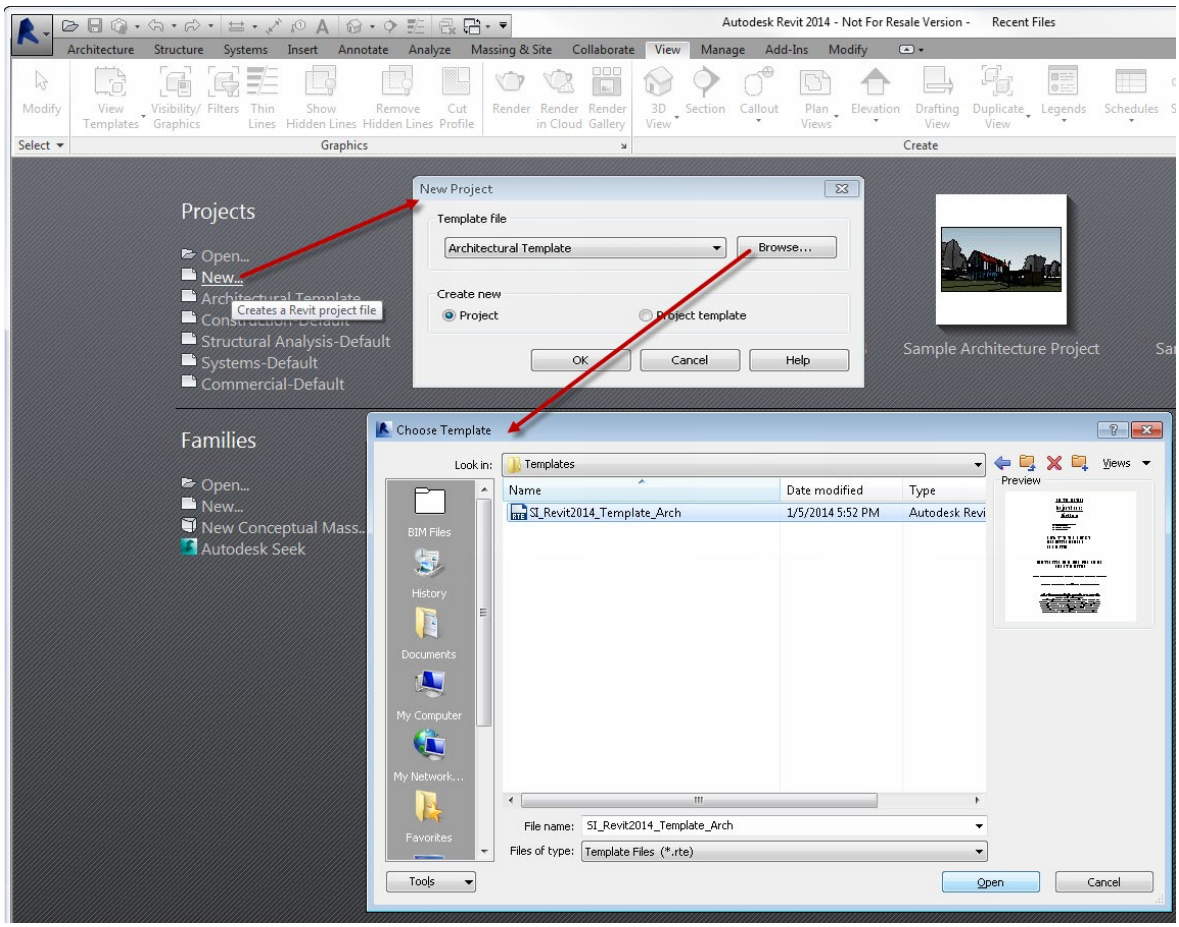


Figure 3-1: Revit New Project menu which brings up the Choose Template dialog

3.2. OPDC Revit Template File Default View

Once the user has created a new Revit project using the OPDC Revit Template, Revit workspace is opened with the initial "default view" displayed, summarizing general best practice instructions (see *Figure 29*). The text should be edited to display specific instructions for the project, as necessary.

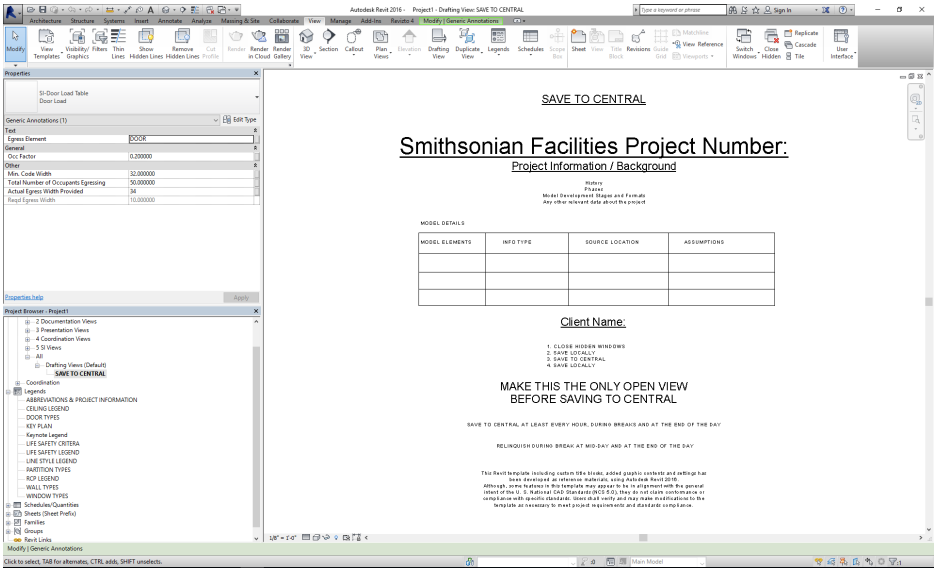


Figure 3-2: Default view for the OPDC Revit Template

3.3. Creating SI-GIS Floor Plans, Area Plans and SI-GIS Schedules

Follow the instructions mentioned in the "*Area and Floor Plan Views Customized for SI GIS Export*" section in this guide, and create the required SI plans for all floors in the project.

For SI-GIS schedules, custom SI GIS parameters will be automatically populated with data, as rooms are added to the project model. During project development, periodically check that the schedules are being completely populated and enter any data that is missing.

3.4. Export SI-GIS Floor and Area Plans to AutoCAD Format Files

To export SI-GIS floor and area plans to AutoCAD DWG format files, please follow the steps listed under the "Creating Floor and Area Plans - Export SI-GIS Floor and Area Plans to AutoCAD" section of this guide.

3.5. Life Safety Plan

The Life Safety Plans *View Template* has been created with *View Filters,* based on the Fire Rating parameter of the wall families. Since this is a type parameter from the default wall family, it will apply to all wall types that are given a fire rating (refer to "Type Properties" box below).

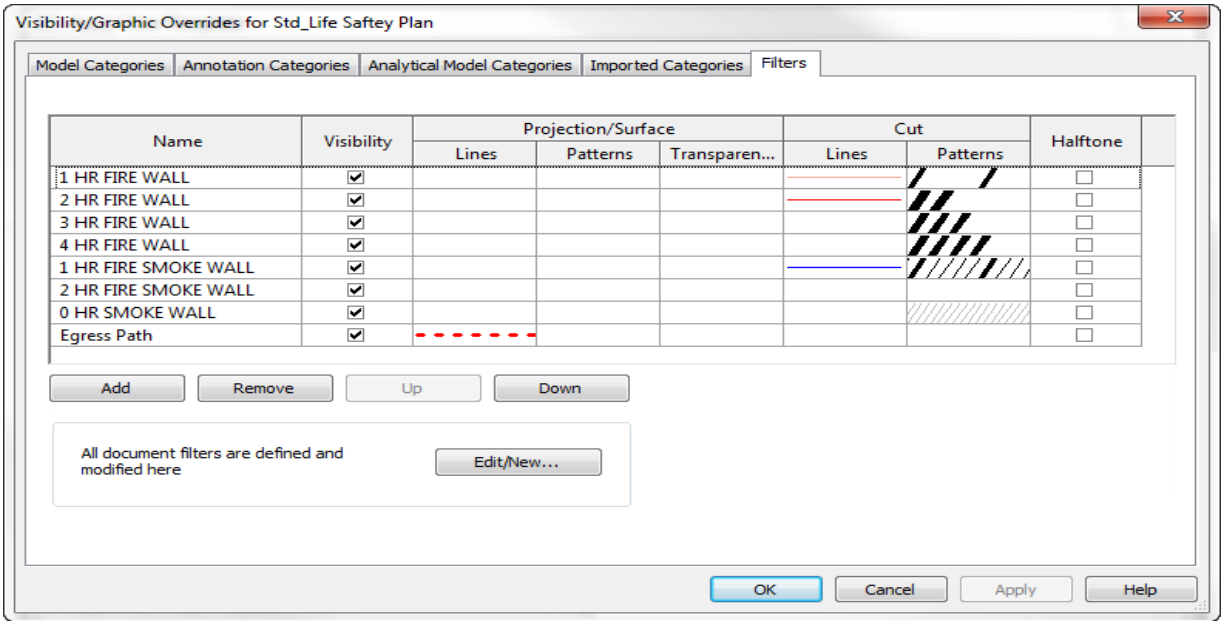


Figure 3.5-3: Fire Wall Filter Settings

The National Fire Protection Association (NFPA) Fire wall symbols (See Figure: NFPA Fire Rating Symbol Family) are just generic objects that must be inserted onto walls manually if these are used.

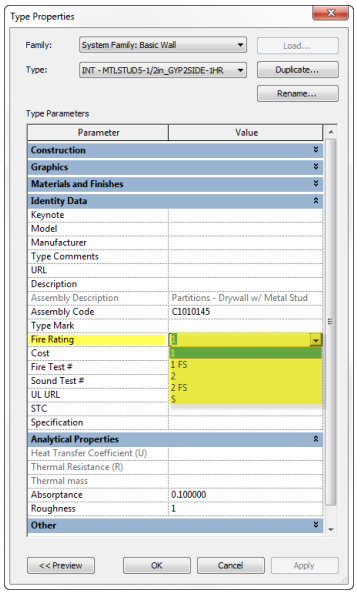


Figure 3.5-4: Wall Family - Fire Rating Parameter

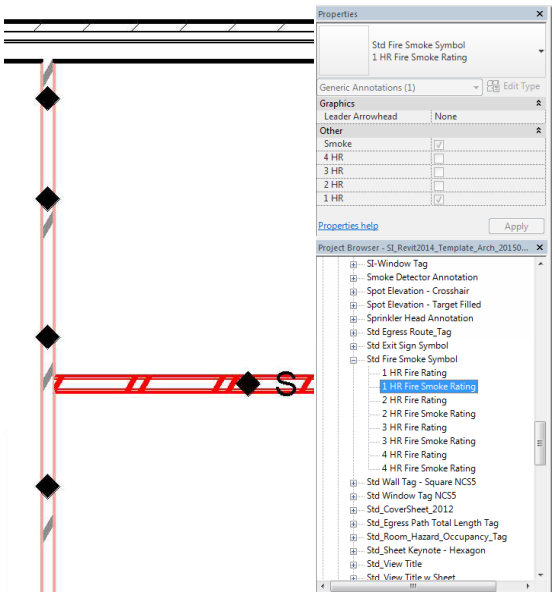


Figure 3.5-5: NFPA Fire Rating Symbol Family

3.6. Egress Routes

- The symbols used are based upon the requirements of the National CAD Standard (NCS) 5.0.
- The View Template uses Filters to identify fire rated and smoke rated walls. Separate symbols may be applied using the "Std Fire Smoke Symbol" family that is based on the NFPA symbols.
- A color scheme may be applied to the plan identifying the "Room_Occupancy_Hazard" classification.
- Egress paths may be created using the "Egress_Route" Family. An Egress ID is assigned by the user and the "Z-QAQC Egress Route Distances" schedule tracks the total length of path

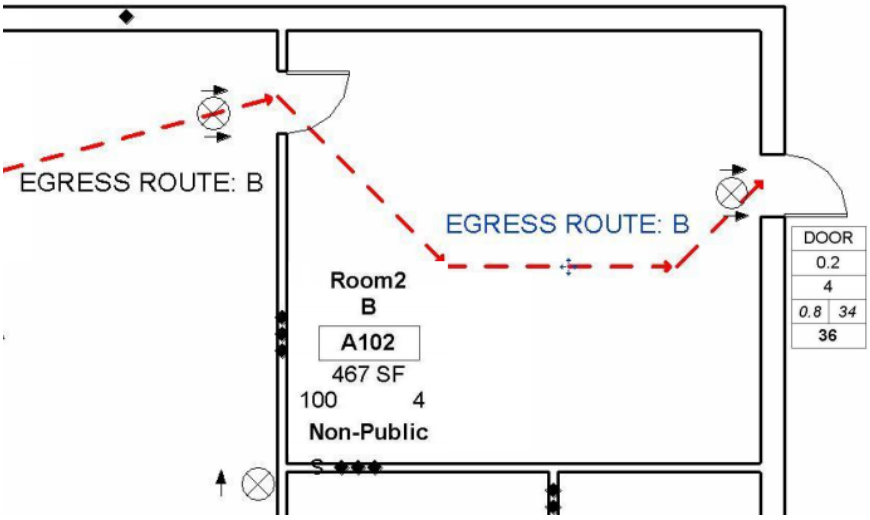


Figure 3.6-6: Example of an Egress Route (plan)

3.6.1. Egress Route Placement Details

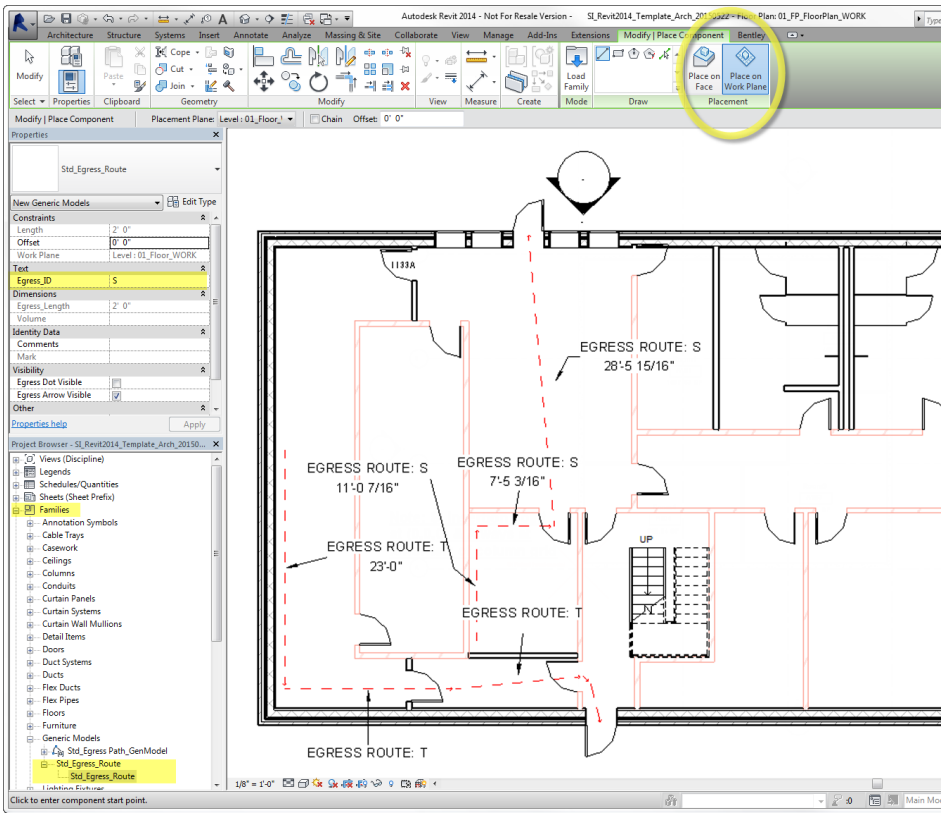


Figure 3.6-7: Egress Route Placement (Revit screenshot)

To create a new egress path:

- Select the Families list, Generic Models and expand to show the *Std_Egress_Route* object
- Create an instance of this object to be placed, and
- Select *Placement: Place on Work Plane*
- Set an Egress Path ID (Egress_ID) parameter.

  The Egress_ID corresponds to the entire path from start to finish and should be unique from all other path IDs.

Using the existing schedule "*Z-QAQC Egress Route Distances*", the component lengths and the entire path length is calculated to determine the actual total length of travel for each path as shown in the figure below.

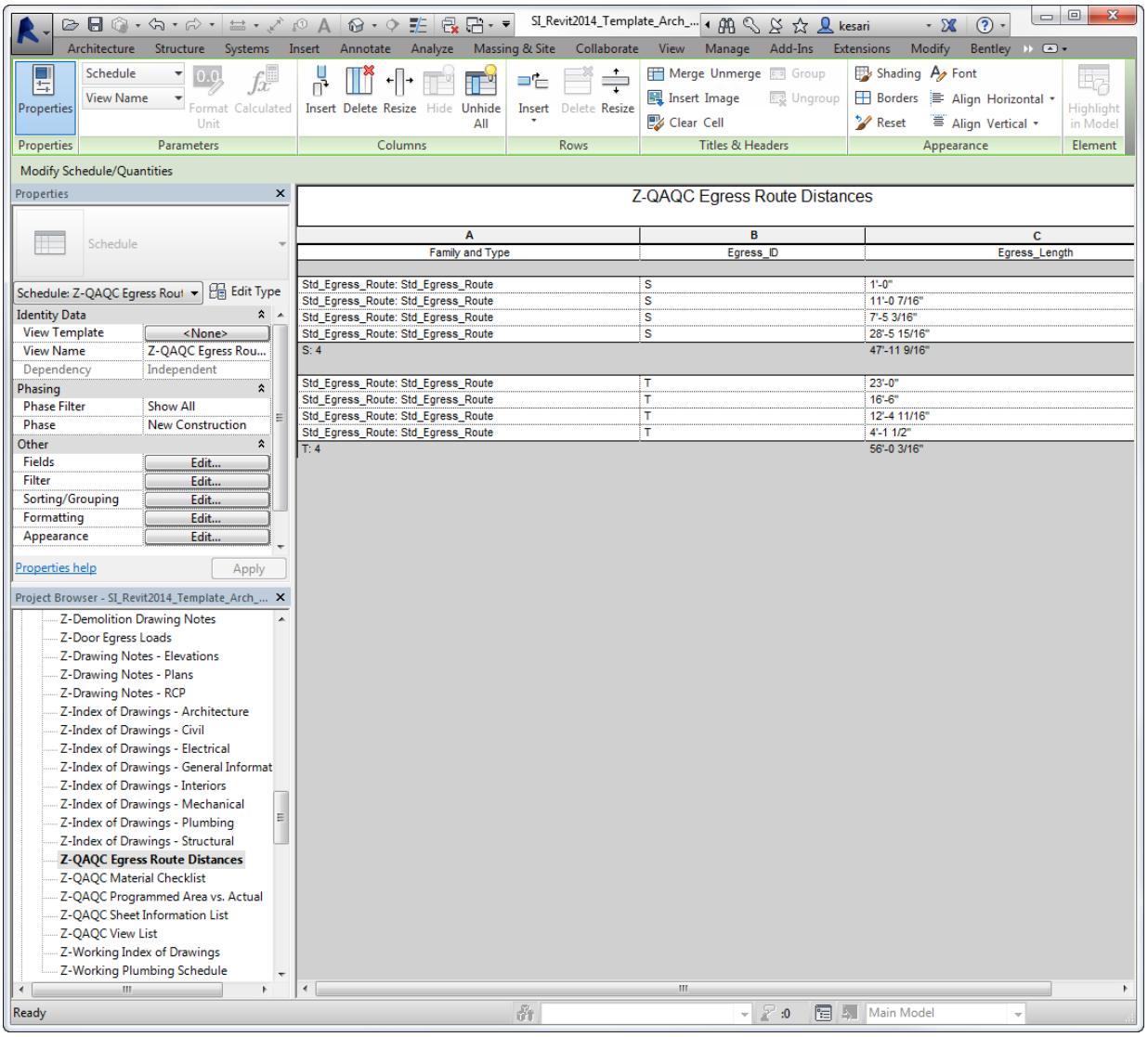


Figure 3.6-8: Revit screen showing Z-QAQC Egress Route Distances schedule (OPDC Revit template)

To label the line segments:

- Select the Annotate Tab and the "Tag by Category" button, and
- Select the egress line segment to be labeled.

  There are two different tags available - the "Egress Route ID" tag and the "Egress Route ID & Length" tag, which will display either the route ID alone, or the ID and segment length.

Unfortunately, there is not an automated way to display the total length, therefore the calculated length in the schedule would need to be manually placed by the user.

3.6.2. Egress Route Objects Alternate Method

Comments on the workflow:

1. This method represents one way of creating an Egress Path for modeling. It is not required but is provided to assist the user in showing the Egress Route and tracking the total distance of the Path.
2. When creating new paths, it may be easier to right-click on the family type and selecting "create instance" or right-click on an existing instance and selecting "create similar" as opposed to copying an existing path.
3. The tag uses family type mark to append to the distance.
4. Note that what is shown here is for demonstration purposes only. Users are responsible for ensuring code and documentation compliance in actual project design.

Families used:

- Std_Egress Path_GenModel: Creates the path object. The user must manually orient the path and adjust the route by altering the "Number of Segments" attribute, as needed for the individual path. This object is a *Generic Family* type of object.
- Std_Egress Path Total Length Tag: A tag which displays the egress path's total length
- SI_Room_Hazard_Occupancy_Tag: Tag containing the Room Number, Room Name, Occupant Type, Occupant Load Factor, Occupant Load, & Access Type
- SI-Door Load Table: Tag containing the Egress Element, Occupant Factor, Total # Occupants, Required / Min. Code Widths and Width Provided.

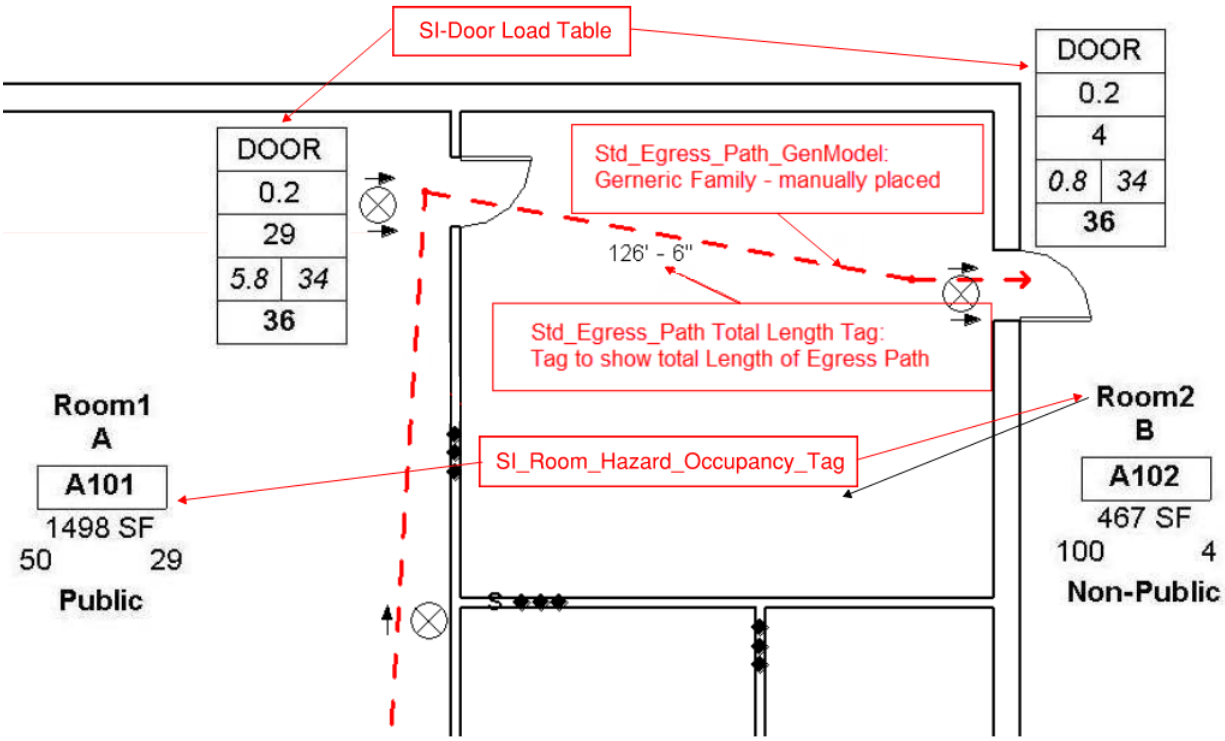


Figure 3.6-9: Plan on which an egress path will be calculated

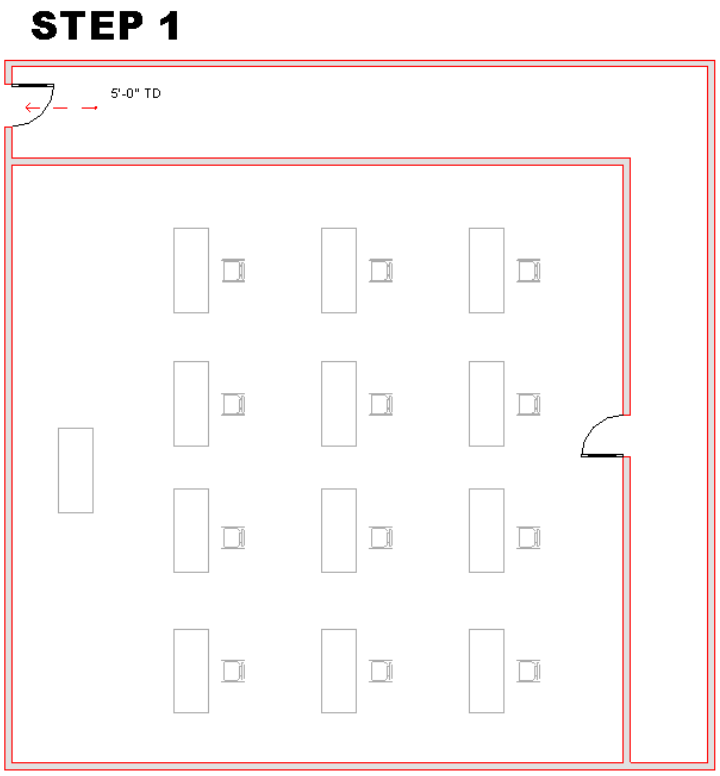


Figure 3.6-10: Step 1 for adding an egress path on a floor plan view

STEP 1: Place an instance of an egress path. The insertion point is the head of the arrow. The default number of segments is 3.

Hovering over the egress path will show that there can be up to six segments in the family.

The number of segments is an *instance parameter*.

Adding a segment will add to the tail of the path.

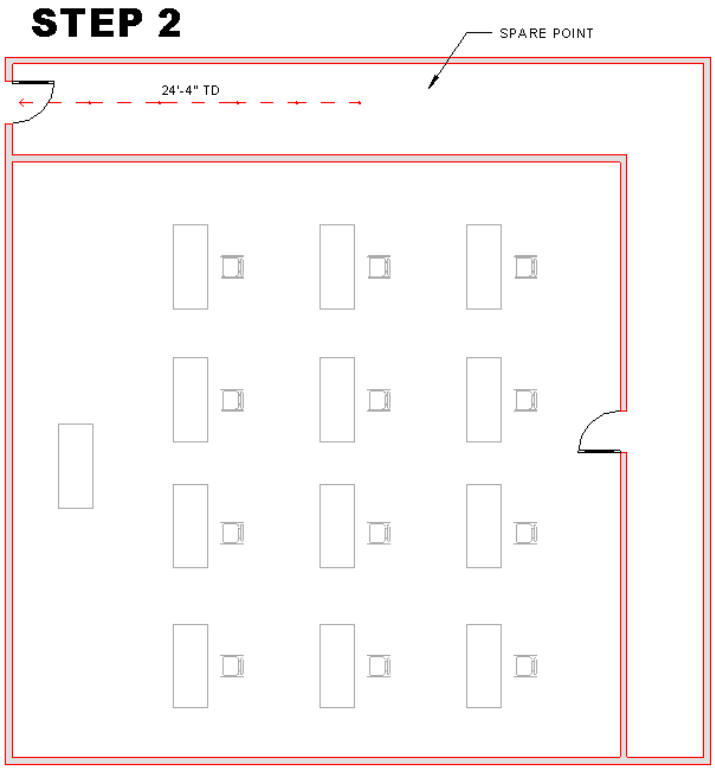
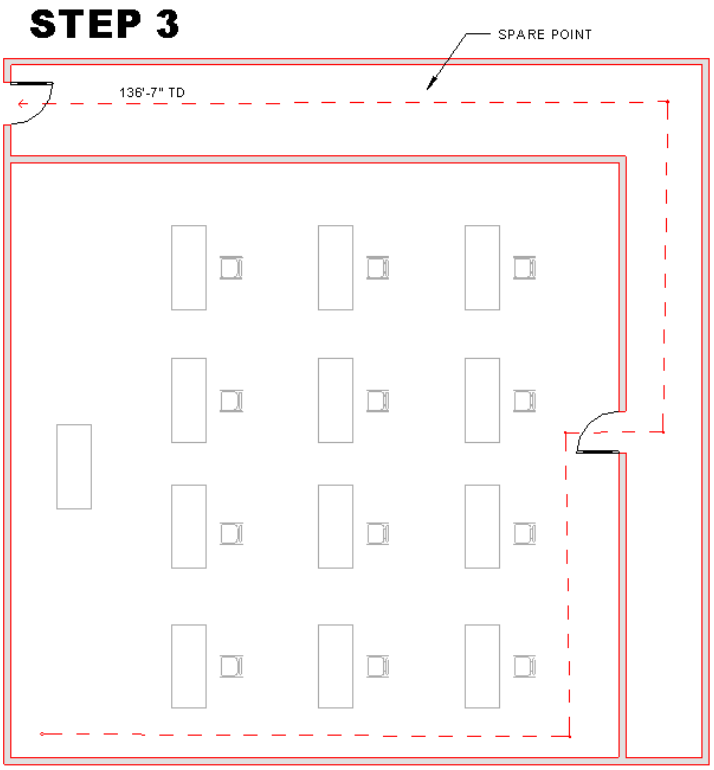


Figure 3.6-11: Step 2 for placing an egress path – specify segments

STEP 2: Determine the number of segments required and update the instance. In this case, we'll try five.

Hover over the egress path - you will see that there is one "spare" point at the end.

Note that, unused points may end up seeming to be "arbitrary" (unless the user has intentionally moved them to be close to the "used" ones.)



STEP 3: To move the points, hover over one of the points so that only one point is highlighted, click to select it.

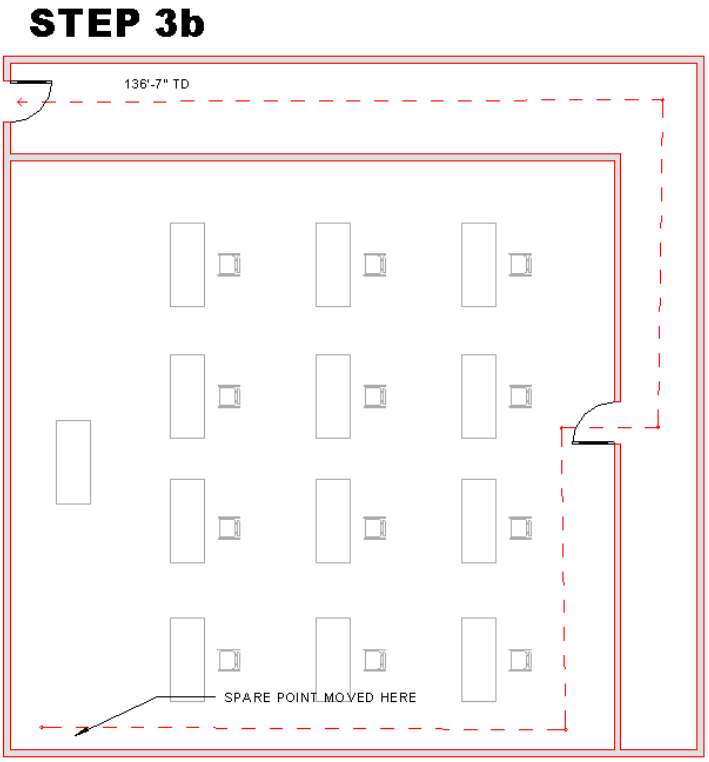
Move the cursor away and the point should be now selected and ready to be moved.

Move the points to the proper locations using the move tool or using the arrow keys to nudge.

Notice that the "spare" point has not been moved.

It should be moved closer to the last point so later, if needed, it can be more easily found.

Figure 3.6-12: Step 3 for placing an egress path – moving control points



STEP 3B: Optionally, the spare point has been moved.

Figure 3.6-13: (Optional) step 3B - placing an egress path, moving the spare point

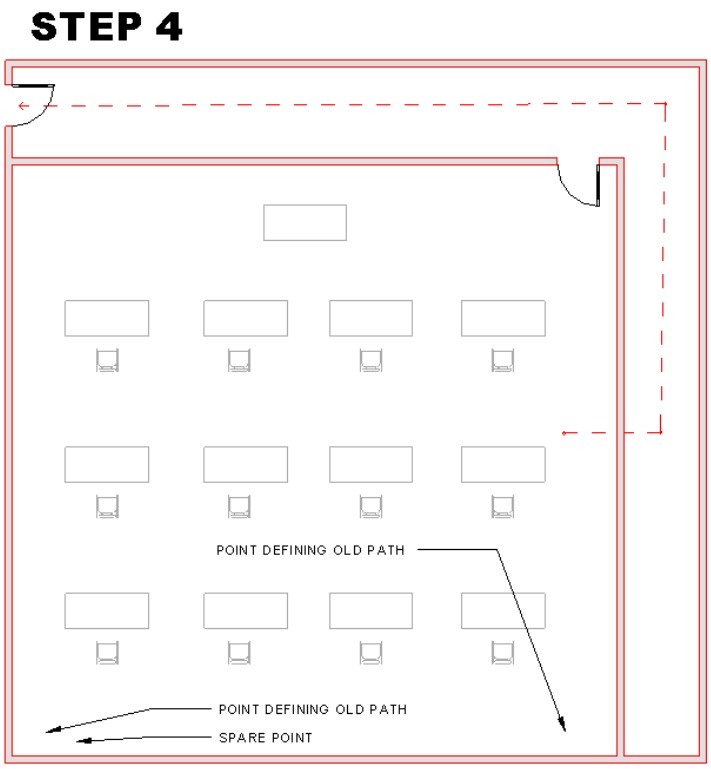


Figure 3.6-14: Step 4 for placing an egress path – how to update

STEP 4: Assume that the furniture has been re-arranged and the door has moved.

The egress path needs updating. There are only 3 segments needed, number of segments for the egress path instance parameter is changed to 3.

Notice that two of the segments have been removed, but the defining points remain. Hover over the egress path to see the points.

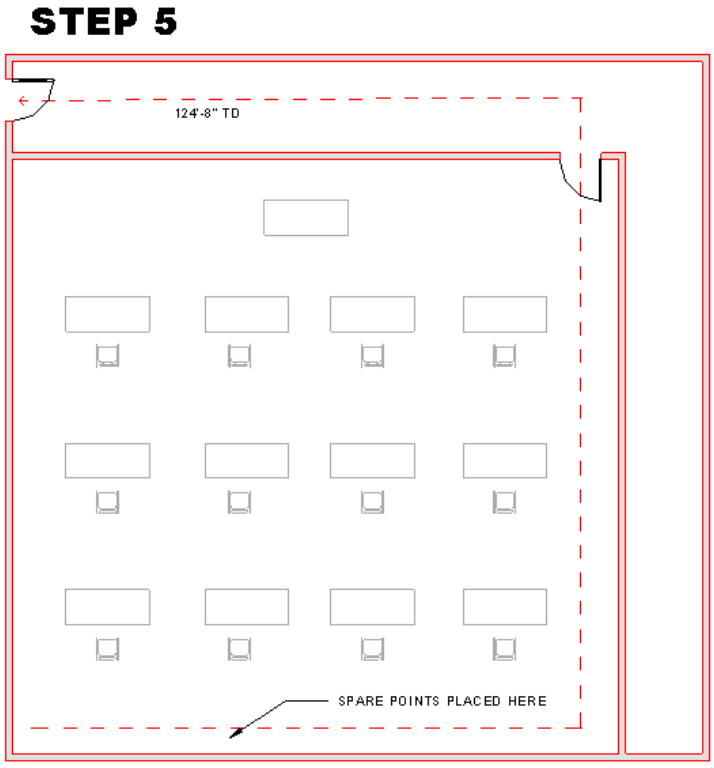


Figure 3.6-15: Step 5 for placing an egress path – adjusting for a new path, updating distance

STEP 5: The points are then adjusted for the new path and the distance is updated.

3.7. Creating a New Sheet with a Title Block

To create a new sheet:

1 Select the **View** tab on the Revit menu

On the **Sheet Composition** panel, click on the **Sheet** icon,

Or select and right click on the **Sheets** in the Project Browser and select **New Sheet…**

The **New Sheet** dialog box will appear - select the appropriate title block from the different sheet size options listed

Click **OK** to create a new sheet

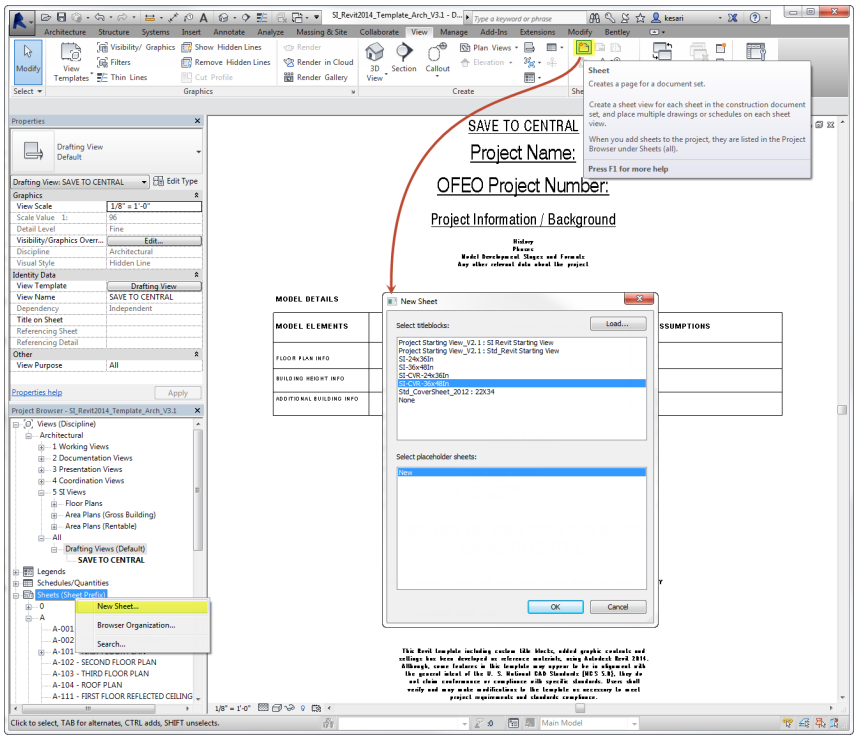


Figure 3-16: Create a New Sheet with a Title Block in Revit

3.7.1. Applying Sheet Properties

In the Revit **Properties** palette, scroll down to the parameter **SHEET_DISCIPLINE** and type the appropriate discipline code. (Table 8 lists discipline codes)

3.7.2. Adding Sheet and Project Information

Complete the information for the fields in the **Properties** window. These parameter fields populate sheet-specific information displayed on the sheet title block. Alternatively, title block labels can be edited directly in the graphic window.

On the **Manage** tab, **Settings** panel, select the **Project Information** tool to open the **Instance Properties** palette. On the form, fill in project specific data – this information will be displayed in the title block.

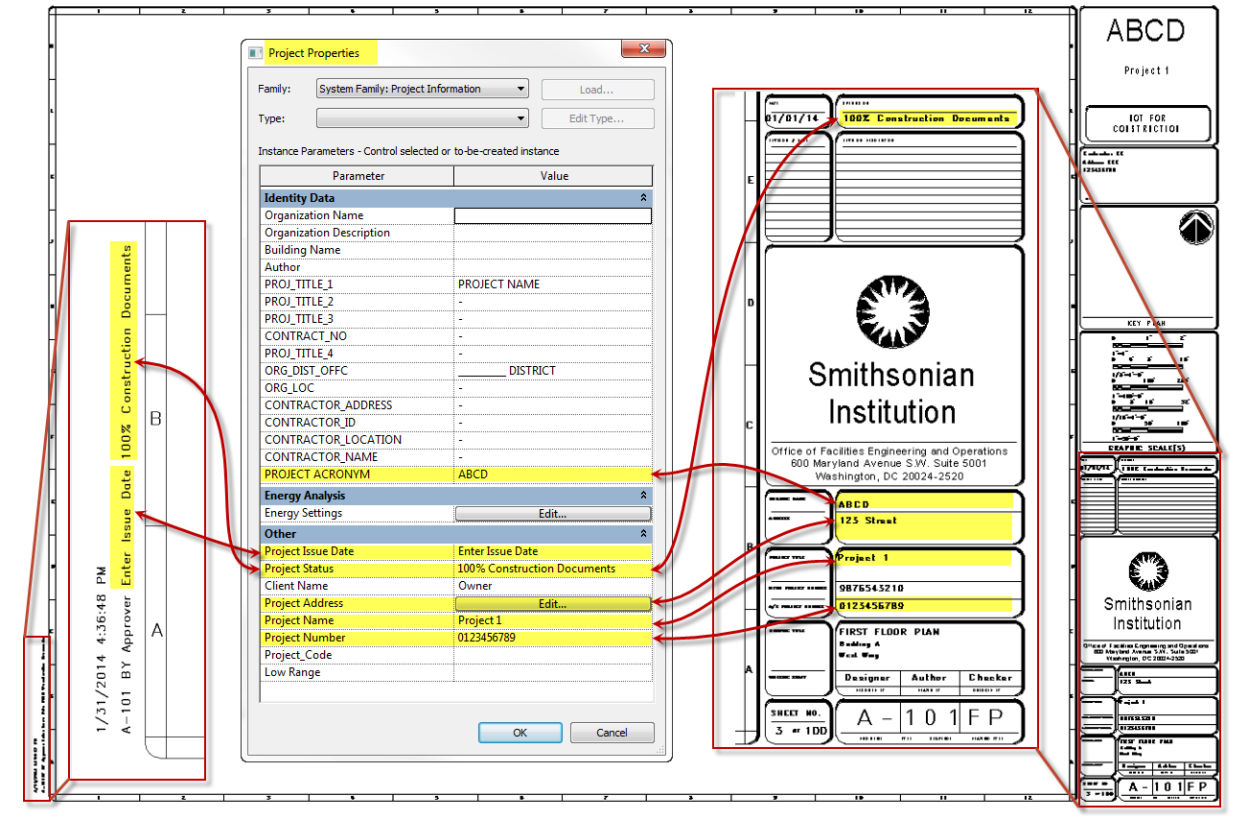


Figure 3-17: Revit Project Properties tied to Title Blocks

3.8. Exporting the Project to IFC

Smithsonian OPDC require IFC files as project deliverables. To export an IFC file from the Revit model:

1. Click ➤ Export ➤ (IFC)
2. In the *Export IFC dialog*, select the *IFC 2x3 Coordination View 2.0 (*.ifc)* from the drop down menu

   IFC 2x3 file type is the default, certified version for IFC exports, and is a format generally supported by other BIM applications.

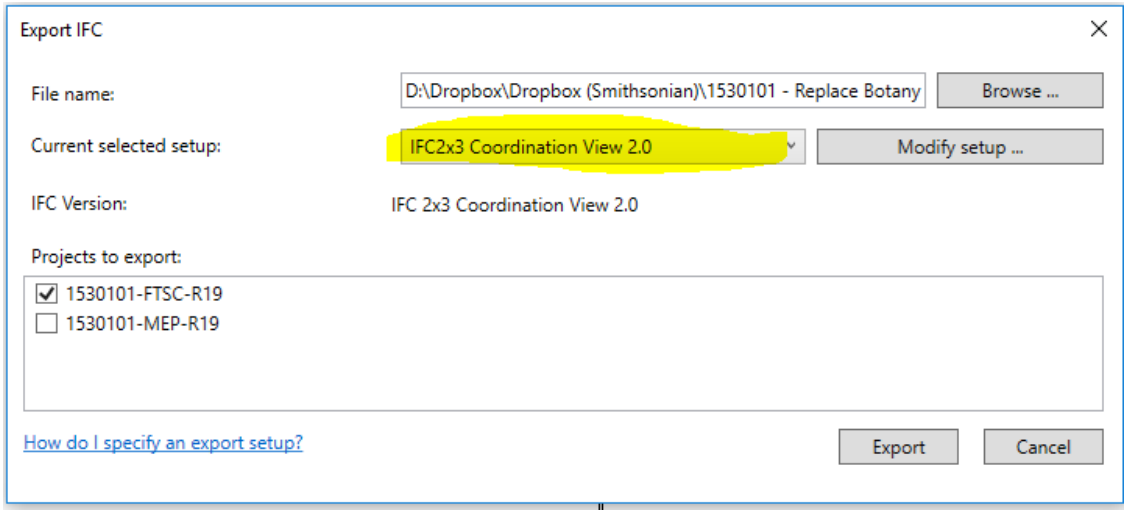


Figure 3-18: Export IFC Settings

3. Click **Export**
4. Navigate to the target folder to save the IFC file and enter a project specific file name
5. Click **Save**
6. The resulting IFC file and a log file for the export process are placed in the target folder

4. APPLYING THE OPDC REVIT TEMPLATE TO THE EXISTING OPDC REVIT PROJECTS

To apply the OPDC Revit template to the existing Revit project models, do the following:

4.1. Transfer Project Parameters from the Revit Template to the Model File

Transferring project standards from one Revit project model to another will copy the following items to the recipient/target model:

- Family types (including system families, but not loaded families)
- Line weights, materials, view templates, and object styles
- Mechanical settings, electrical settings, structural settings, etc.
- Annotation styles, color fill schemes, and fill patterns
- Print settings

Users can specify which standards to copy.

Objects that are copied will also bring along any object parameter settings that are referenced to it. For example, when a wall type is copied, the material affiliated with that wall type will be copied as well.

To transfer the project parameters from the Revit Template to an existing Revit model, follow the steps below:

- Open both the source (Revit Template) and target (existing Revit model)
- In the target model, click Manage tab ➤ Settings panel ➤ (Transfer Project Standards)

- In the *Select Items to Copy* dialog, select the source project to *copy from*
- Select the desired project standards. To select all project standards, click *Check All*
- Click *OK*
- If the *Duplicate Types* dialog displays, select one of the following options:
    - *Overwrite*: Transfers all new project standards and overrides duplicate types
    - *New Only*: Transfers all new project standards and ignores duplicate types
    - *Cancel*: Cancels the operation

The following items do not transfer between projects:

- Elevation view types
- Section view types
- Visibility settings for Revit links

Caution: Delete any view templates and filters from the target Revit model before performing the copy, especially if the target project contains view templates and filters with the same names as the source project view templates and filters. This precaution will avoid potential issues with the view template settings.

4.2. Inserting Revit Template Schedules Views from Revit Template to the Model File

Note that the project template file will need to be open along with the project BIM during before inserting views.

To insert schedule view(s) from the Revit template to an existing Revit model:

- In the template worksession, click: Insert tab ➤ Import panel ➤ Insert from File drop-down ➤ Insert Views from File
- Navigate to select a Revit template file and select *Open*. The *Insert Views* dialog will then list views contained within the template file
- On the list displayed, select schedule views
- Check the views to be inserted, and click *OK*

A new schedule view(s) is created in the Project Browser with all the saved formatting of the original schedule and all the parameter fields that may have been customized for that schedule.

4.3. Upload Revit Template Annotation Families into the Model File

To save all families loaded in the OPDC Revit Template to a location on your file system, do either option below:

- Option 1:
    - Click:  Save As ➤ Library ➤ Family
    - Navigate to a file system folder to save the files and folder structure
- Option 2:

- Right-click the *Families* category in the Project Browser, and click *Save*
- Select *<All Families>*, and click *Save*

Each family will be saved to an ".rfa" file. Note that all family types will be saved with the .rfa family file. Note that only "loadable" families are saved. In-place families and system families, such as walls, duct systems, and patterns, will not be saved.

Note: It is a good practice to separate and save annotation families from other families for ongoing Revit projects. Once saved and sorted, families saved to an organization's file repository can be available for all ongoing Revit projects.

To load families:

- Click Insert tab ➤ Load from Library panel ➤ (Load Family)
- In the *Load Family* dialog, navigate to the location where annotation families from the Revit template are saved
- Select all the annotation families and click *Open*

OPDC Revit Template annotation families will now be available in the **Annotations** category under **Families** in the **Project Browser**

4.4. Generate SI-GIS Floor and Area Plans for Each Floor

To generate SI-GIS floor and area plans for each floor in existing projects, please follow the steps listed under the "Detailed Instructions for Creating SI-GIS Area and Floor Plans" section of this Users Guide.

4.5. Export SI-GIS Floor and Area Plans to AutoCAD

To export SI-GIS floor and area plans to AutoCAD files, please follow the steps listed under the "Exporting SI-GIS Floor & Area Plans to AutoCAD" section of this Users Guide.

5. REVIT MODEL OPTIMIZATION AND BEST PRACTICES

5.1. Revit Minimum Modeling Requirements for Documentation Purposes

This section provides some general guidance and best practices to the Revit users. This section should not be considered as a requirement for SI. Its sole purpose is to advice SI BIM staff and A/E's on the best practices in using Revit to its highest potential.

Table **5-1**: Architectural Modeling Requirements		
3D Model Elements	Walls/Curtain Walls	Walls should be modeled as per their overall thickness. Studs and individual layers of drywall are **NOT** required to be modeled separately, but as part of a wall or wall partition type. Note that wallpaper or paint will not be part of the wall assembly.
	Wall partitions	All types of partitions including interior and exterior fences should be modeled with appropriate metadata.

Table 5-1: Architectural Modeling Requirements		
	Column/Pilasters	Columns should be modeled either as part of architectural model or structural model as coordinated between architect and structural engineer for size and location.
	Doors, Openings & Grilles/Gates	Doors, window louvers, and frames should be modeled. It is NOT required to model door and window hardware; it should be added as metadata. King studs should be modeled as part of door and window families. Door families should indicate the door swings.
	Windows & Louvers	
	Stairs, Steps and Ramps	Treads and risers should be modeled as per the design of stairs. Ramps should be modeled so that accurate slope is modeled, as per the design.
	Railings	Intermediate railing members are NOT to be modeled.
	Elevator Shafts	Elevator shaft clear space should be modeled to the worst-case clear width, depth and height only, from preferred possible vendors. Detailed elevator cabs, equipment, and similar components need not be modeled. Nominal elevator cab size and overrun shall be modeled, including hoist beam within an elevator family.
	Escalators	Nominal escalator size and opening clearances shall be modeled within an escalator family.
	Slabs, Floors and Raised floors	Floors should be modeled in such a way that they contain slopes as per the design specs. Floor size and structure should be coordinated with a structural engineer.
	Ceilings	Overall thickness for ceilings and soffits should be determined by their actual total composite assembly thicknesses.
	Soffits/ Bulkheads	
	Casework	Casework will be modeled with detail sufficient to appear in the 2D drawings and to communicate with consultants. These items will contain the metadata relevant to scheduling.
	Roofs	Roofs should be modeled reflecting the designed slopes and thickness, along with material and other metadata. Roof access, doors/hatches, gratings, removable slabs, etc., should be indicated on the roof, but need not to be modeled.
	Roof Gutters and Drains	Can be either 2D or 3D
	Furniture	Base requirements for Furniture, Fixtures and Equipment (FF&E) are accurate 2D representation of these components along with metadata sufficiently detailed to schedule the components, as required during design and construction.
	Plumbing Fixtures	Lavatories, water closets, urinals, showers, tubs, sinks, floor drains, drinking fountains, etc., should be modeled to show the location and size for the plumbing fixtures (LOD appropriate for the project phase).

Table 5-1: Architectural Modeling Requirements		
	Other Custom Elements	Fenestrations, ledges, sills, overhangs, sun control devices, canopies, docks, and fireplaces should be modeled to illustrate the design intent. These might be 2D, depending on the required project LOD.
2D model elements	Grids and Levels	To be coordinated between architect and structural engineer. Once finalized, these elements should be locked to avoid accidental moving and deletion.
	Rooms	Room elements with metadata, including room names and numbers, finishes and materials, occupancy type, etc. as noted in the BIM PxP.
	Lighting and Ceiling Fixtures	Access doors, catwalks, air terminal locations, light fixture locations (3D components in electrical models).
Note: Any further modeling questions will be addressed as needed by the architectural design team using the stated goals and requirements as a baseline.		

5.2. Modeling Level of Development

The BIM Level of Development Specification for Building Information Models will be specific to the projects and will be detailed in the BIM project execution plan PxP for every project. The AIA Document G202 TM – 2013 Project Building Information Modeling Protocol Form provides an industry recognized framework as a means of defining the detailed modeling requirements for a project. SI LOD definitions are defined from the BIM Forum's Level of Development Specification (ref http://bimforum.org/lod).

To help further the standardization and consistent use of the LOD concept, and to increase its usefulness as a foundation for collaboration, the AIA agreed to allow the BIMForum to utilize its latest LOD definitions in their Specification. The LOD definitions that are used in BIMForum's Specification are identical to those published in the AIA's updated Digital Practice Documents, with an exception of addition of LOD 350.

The working group identified the need for an LOD that would define model elements sufficiently developed to enable coordination between disciplines – e.g. clash detection/avoidance, layout, etc. The requirements for this level are higher than those for 300, but not as high as those for 400, thus it was designated as LOD 350. The AIA documents do not include LOD 350, but the associated Guide and Instructions references it. The table below summarizes those levels of development as defined by the BIM Forum.

Table 5-2: Summary of the BIM Forum Level of Development Definitions	
LOD 100	The model element may be graphically represented in the Model with a symbol or other generic representation, but does not satisfy the requirements for LOD 200. Information related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other Model Elements.

Table 5-2: Summary of the BIM Forum Level of Development Definitions	
LOD 200	The model element is graphically represented within the Model as a generic system, object, or assembly with approximate quantities, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.
LOD 300	The model element is graphically represented within the Model as a specific system, object or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element.
LOD 350	The model element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, orientation, and interfaces with other building systems. Non-graphic information may also be attached to the Model Element.
LOD 400	The model element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly, and installation information. Non-graphic information may also be attached to the Model Element.
LOD 500	The model element is a field verified representation in terms of size, shape, location, quantity, and orientation. Non-graphic information may also be attached to the Model Elements.

For every SI project a BIM Model Content LOD matrix must be filled out and submitted utilizing the template provided along with the BIM PXP's Appendix B in a Microsoft Excel format.

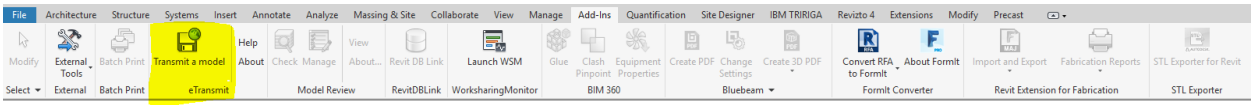
5.3. Transmitting the Model

This section provides best practices for transmitting the Revit Model(s). When transmitting the model for submission please utilize the eTransmit tool within Revit. Please refer to the steps below for this process.

Step 1: Open Revit (do not open the model)

Step 2: Go Add-Ins ribbon

Step 3: Click on "Transmit a Model" under "eTransmit"

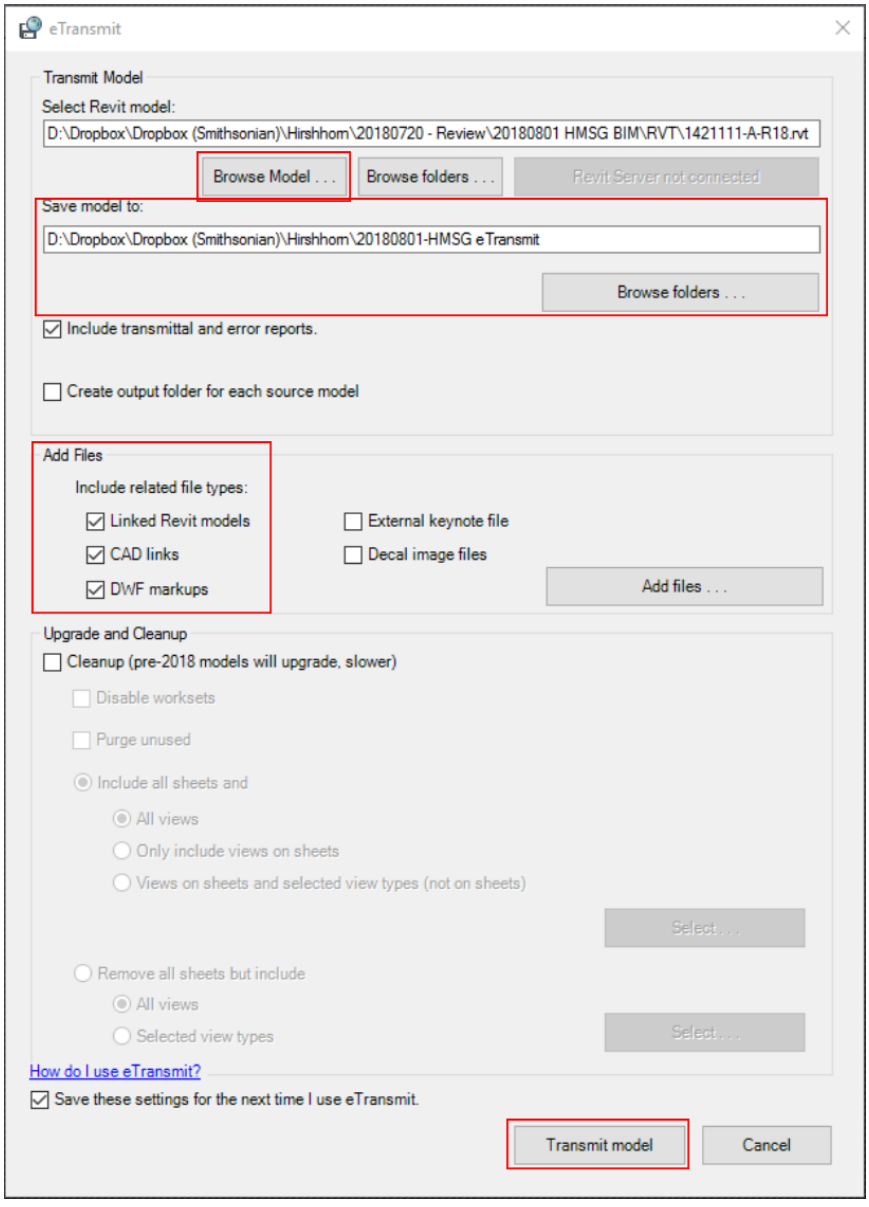


Step 4: (Below window will open) Click on Browse Model and navigate to model location.

Step 5: Click Browse folder under the "Save Model to:" and choose a location where transmitted folder will be located

Step 6: Under "Add Files", check boxes for: Linked Revit Models, CAD links, DWF Markups.

Step 7: Click "Transmit Model"



5.4. Autodesk Revit BIM Model Deliverables Checklist

Table 5-3: BIM Model Deliverable Checklist

Description	☑/☒
Check model file name conforms to standards	☐
Check if all the annotations and title blocks are as per the SI standards	☐
Check if all the custom SI floor plans and area plan views are created for all floors in the project	☐
Check if all the custom SI schedules are populated with all the relevant data	☐
Check model is correctly assembled through visual inspection	☐
Check if all the model contents are correctly placed per their element categorization in the correct workset and conform to standards	☐
Check if all non-transmittal linked-in files (CAD/Revit) are removed	☐
Check if all non-required views / legends / schedules / sheets / images are removed	☐
Check if unwanted **Design Options** are removed	☐
Check if all unnecessary groups are removed. Check if all the groups used to model the building are ungrouped and those groups are purged from the deliverables. This reduces the file size	☐
After all the checks are done, purge model (repeat process three times as materials are only removed after the parent object has been removed). This will reduce the file size.	☐
Update **Save to Central** view with any relevant model notes	☐

6. REVIT MODEL OPTIMIZATION AND BEST PRACTICES

6.1. Starting a Project

After creating a new project using the OPDC Revit Template, a basic set of tasks should be performed to provide direction for the design team. These tasks include:

6.1.1. Model Position/Extents

- Define the project's position in space by locating the project base point at (0, 0, 0) origin. Locate the survey point coordinates based on survey data, using survey base point
- Enter location data to establish sun and shadow information
- Define true north and project north
- Add levels and grids to represent the expected scale of the project

6.1.2. Model Organization

- Add worksets as suggested in "Setting Up Worksharing and Worksets" section of this Guide
- Define phases appropriate to the project
- If known, set up Design Options for the project
- Adjust browser organization to reflect the needs of the project
- Create Shared Parameters if applicable
- Load the appropriate Keynote file if applicable

6.2. Modeling Efficiencies

In general, the following characteristics of a Revit-based application model can affect performance:

1. Multiple constraints
2. Imported and Linked files
3. Complex geometry
4. Multiple parametric relationships

6.2.1. Constraints

- Minimal constraints will help prevent *"Can't keep joined"* errors when moving objects
- Workset sharing issues where a user may unknowingly take ownership of an object can be avoided by the project manager checking out the workset that need to be constrained

6.2.2. Imported and Linked Files

- Unload links of all types, if not in use.
- Temporarily unload links if they are not needed in a view (reload them, as required). This will help to maximize workstation memory resources for opening Revit files.

Linked Revit Files

Revit project files on different networks: Importing the files into the master model, rather than linking to them, may improve performance (if possible)

Revit version upgrades: Perform version upgrades first on linked files, before upgrading the host file, or if necessary, unload all .rvt links before upgrading the host file. (Host models that reference files authored under older Revit versions will consume additional memory.)

DWG Files

- Minimize the number of linked or imported DWG files
- Link only essential DWG files into views they are necessary
- Avoid importing unnecessary data, such as hatching or AutoCAD-specific line work, such as construction lines
- Delete unnecessary parts and layers of the DWG file within AutoCAD, and import only a cleaned, smaller-sized DWG file
- Avoid exploding the geometry imported from DWG files. The exploding operation within a Revit-based application can change a DWG from a single managed element to hundreds or thousands of additional elements, depending on the number of entities in the imported DWG.
- Switch-off visibility of 2D AutoCAD (plan view) DWGs in views such as elevations and sections, or else click the "Current View Only" check box on while linking to the CAD file. 2D AutoCAD files linked into a plan view will show as collinear lines in elevation or section, causing a significant degradation in performance.

6.2.3. Complex Geometry and Multiple Parametric Relationships

General Guidance

- Regularly review and fix warnings
- Promptly resolve warnings about room boundaries overlapping.
- Avoid coincident room separation lines that overlap each other, and overlapping walls
- When creating detail views, model *hatches* to fill regions -- do not use lines
- Limit joined geometry wherever possible
- Remove unneeded area schemes
- Regularly purge unused objects. Since purged objects cannot be recovered, you may wish to make a backup of the project before performing a purge

Arrays

- Arrays can be used to copy and associate objects together. After the array is modeled, Revit performance may be improved by ungrouping the array, and removing the parametric associations of the copied objects.
- The *Group and Associate* checkbox can also be cleared before creating the array, to attain the same result (see Revit array options below)

Figure 6-1: Revit menu - array options

Design Options

- Utilize design options to quickly compare alternatives. Once the final design has been determined, delete unused options to reduce model overhead. For large-scale options (e.g. entire sections of a building), use separate models instead of design options

Detail Lines vs. Model Lines:

- Detail and Model lines may be used to add information that cannot be modeled efficiently. Use detail lines to represent information that appears in only one view and model lines for information that appears in multiple views

Joined Geometry:

- Limit joined geometry to necessities

Levels in Elevation:

- Avoid using levels to indicate every vertical reference in elevation (e.g. window head and sill elevations); such a technique will require a user to hide irrelevant levels in every elevation and section view. Develop and use Spot Elevation tools to label these items

Railings:

- Avoid use of railings for extensive fences or separation systems and limit the visibility of such elements. There is no warning offered by Revit, but performance is impacted because of the number of lines required to generate each railing element
- If a lengthy railing element is desired, consider modeling a simplified railing representation, relying on railing details to fully describe the design
- Stairs are complex elements, but may not be easily simplified. Confine stair visibility to essential views

Parts and Assemblies:

- Limit the creation of parts and assemblies to necessary elements, to avoid overloading models with unneeded detail
- Consider creating parts in a separate model and linking in the original

Raster Images:

- Remove unneeded raster images and renderings. Raster images represent a performance and file size cost which should be minimized
- Monochrome raster images are smaller than color images. Save black and white raster images as 1 bit per pixel format instead of JPG or TIF. MS Paint refers to this format as Monochrome Bitmap
- Large raster images such as logos scaled down to fit into title blocks will still retain the original file size. Consider creating a smaller, simplified image for import into Revit

Groups

Avoid maintaining unnecessary groups. Delete unused groups from the project browser

Family Creation

- Families require fewer resources than groups. Use families instead of groups, where possible. Groups are a useful Revit capability, however updating large numbers of group instances will consume significant computing resources

- Because families are optimized for repetition, create a family component instead of in-place families when components are going to be repeated. When an in-place family is copied (which it may already be problematic), it makes an entirely new entity each time, as opposed to referencing the information from the first instance
- Limit the use of detailed/nested/parameterized families to necessities
- Where possible, avoid widespread use of voids in family geometry
- Where possible, avoid arrays and formulas
- Use symbolic lines and masking regions instead of geometry in plan views to show simple geometric representations. This allows Revit to avoid processing complex geometry when it is not necessary
- Parametric families place a greater computational burden on the model than static families. Consider carefully whether a family needs parametric flexibility and confine that flexibility to necessary adjustments
- Families that cut their hosts consume significant computing resources on regeneration as compared to families that reside on a given surface without cutting the host. Consider modeling building components such as HVAC registers as 2D ceiling-based or face-based families to reduce penetration calculation

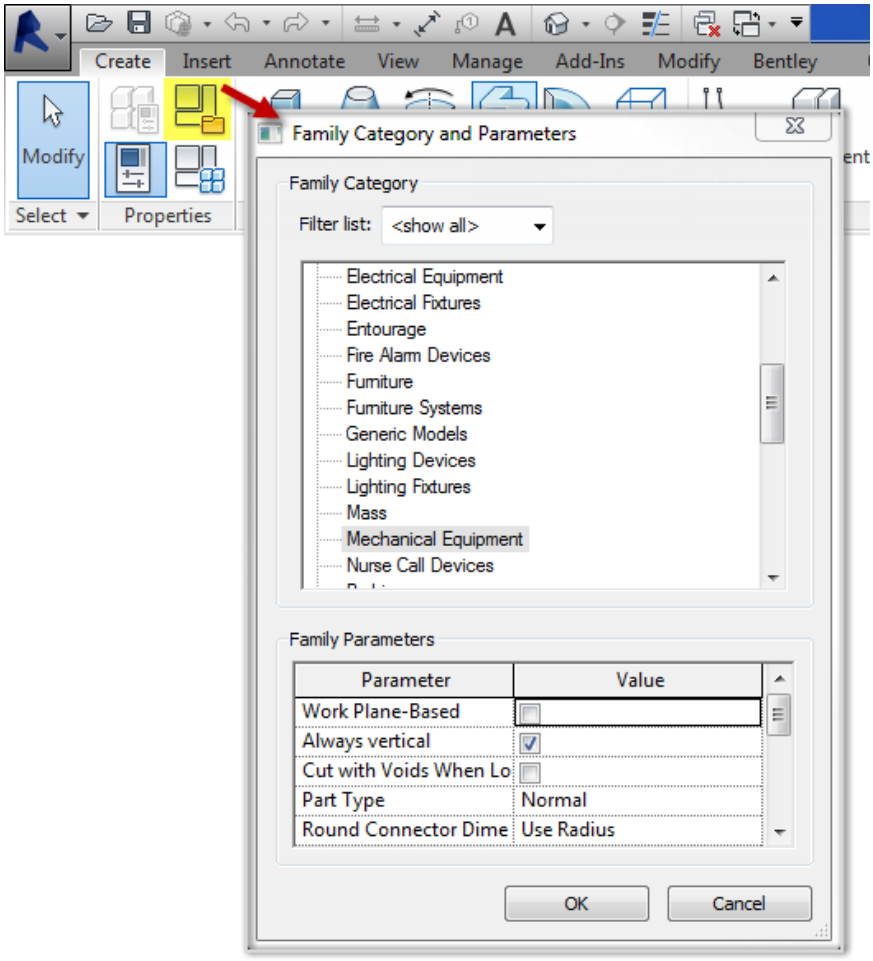


Figure 6-2: Revit Family Category and Parameter Menu

- Note: When using families for elements, equipment and fixtures from 3rd party web portals or manufacturer websites, always check the *Family Category* and *Parameters* in the Revit Family file for correct mapping of the elements into their respective categories. Most of the families might be modeled as generic models. It is easier to edit the Family Category and Parameters to their respective category before using the families in the model.

6.3. Setting Up Worksharing and Worksets

Worksharing: A Revit-based design method that allows multiple team members to work on the same project model at the same time. When worksharing is enabled, a Revit document can be subdivided into worksets, which are collections of elements in the project.

Worksets: Worksets are a way to divide a set of elements in the Revit project into subsets for worksharing. There may be one or many worksets in a project. The Revit project contains a Workset Table which is a table containing references to all the worksets contained in that project.

In a shared project, one of the worksets is specified as an active workset. Each new model element added to the project will be placed in the active workset. View-specific elements, such as annotations and dimensions, are placed in the workset for the current view.

Worksharing Best Practices: Consider worksets as containers. Worksets are **NOT** layers as in CAD. Think of them as containers for major systems in your building (interior, exterior, roof, core, and so on). For any project it is important to determine how the Revit elements will be divided into the user-created worksets, such as the following:

- Datum (levels and grids)
- Geometry (building elements that show up in multiple views)
- Rooms (the spaces that can be tagged)

For SI workset requirements refer to *Chapter 2.5 - SI Workset Requirements*, in this document.

Note: Although it is possible to create a large number of worksets, doing so will make model management tedious.

During model development, Revit users should be aware of the active workset while creating datum, geometry, or rooms. Revit Architecture automatically manages the worksets for everything else (views, families, and project standards). These cannot be changed by the user. Note that it is a best practice to lock the datum (levels and grids) once they are finalized. This can be done by the BIM project manager (BIM PM) by making the workset editable to him/her and not relinquishing it.

Listed below are some additional best practices for worksharing:

- The copy monitor tool (**Copy / Monitor**) may be employed to synchronize elements such as levels and grids among the design team. Excessive copy/monitor usage (e.g. all walls) may prove to be inefficient. However, copy monitoring elements and fixtures from other disciplines (MEP-F) to the architectural model will be an ideal way to avoid redundant modeling of those elements in the architectural model.

- Consistent customer practice is to break up a large model into multiple files of about 160 MB each for 32-bit Revit or 200 MB for 64-bit Revit, then link together the resulting project files. Such a procedure will work best if the user can work on one file while the other links are unloaded for a majority of the time. Engineering consumers of architectural models may have to maintain one or more constantly loaded links, which may affect model size estimation and thresholds for those disciplines.
- The decision to split a model should be made early in the design process, ideally in the pre-design or schematic design phase with all consultants aware of this decision and its ramifications. Splitting the model later in the design process (e.g. DD, CD phases) adds significant time and cost. Specific conditions that may trigger a multiple-model project include:
    - Separate buildings (a "campus" project where each building would be a separate model, linked together on a "master site plan" project)
    - Collaboration between geographically disperse project teams (a single building being worked on by offices that are not on the same WAN)
    - Unusually large files (after all other model management practices have failed, because of the particular needs or scope of a project, it may still not be possible to keep the model to a reasonable size)**; and
    - Phased projects where there is a natural and specific split of the design and/or construction

**Where file size is the primary factor, model splitting should be considered a last resort and is not to be undertaken lightly. All model management and modeling best practices methods and procedures should be exhausted before model splitting is undertaken. If a firm encounters project types and sizes that require this approach on a consistent basis, we strongly recommend working in a 64-bit environment with appropriate hardware specifications (e.g. minimum of 8 GB RAM).

6.3.1. How Worksharing Works

The basic process of worksharing is outlined in these steps:

1. A single user creates a project and begins creating the initial geometry and information. The building information model is developed to a certain point.
2. Then, additional users are required and worksharing is enabled in the project.
3. Revit automatically assigns the various elements of the project to logical worksets.
4. The file is then saved as the central file to the network appending the project file name with "-central" for clarification.
5. Team members will then save the central file as a Local file to their local hard drive or on the network and append the file name with an identifier such as "-user initials" for clarification.
6. Additional worksets can be created in a user's local file to group the building elements into logical groupings.
7. Users make modifications by using "element borrowing" or checking out a workset through their local file. Element borrowing in a workset checked out by another team member can be made through "editing requests".
8. Each team member makes regular local file saves and saves to the central file throughout the day.

9. Each team member makes regular reloads from the central file to synchronize their own local file.
10. Users with checked out worksets can relinquish ownership at any time.

6.3.2. Benefits of Worksets

- Efficiency: Workset may be selectively loaded to reduce memory use:
    - Improved performance and large projects can be broken down into manageable areas
    - Disciplines can work independently from one another by creating discipline specific worksets within the same project (typical in an AE firm)
    - Visibility of a workset can be controlled per view
- Security: Access to worksets may be individually controlled
- Management: Use of worksets facilitates division of tasks among team members by assigning each team member a Workset will give them sole responsibility of that portion of the work, and
- Remote Use: Worksets may be employed to complete work offline

6.4. File Maintenance

The following are recommendations for file maintenance mirroring those provided by a client with significant Revit project experience. For small projects, this file maintenance schedule may be largely unnecessary, while it may need to be accelerated to keep a very large model manageable. Also note that these maintenance procedures may be applied to files received from consultants to ensure optimal performance.

- Periodic File Maintenance (e.g. every sheet set issue): In addition to weekly maintenance tasks, perform the following steps:
    - Audit the central file
    - Create a backup of the central file
    - Create a new central file
    - Have all users create new local files from this central file
- Every Two Weeks: In addition to weekly maintenance tasks, perform the following step:
    - Create a backup of the central file
- Weekly
    - Audit the central file
    - Perform a Coordination Review, if using Revit to maintain coordination with consultants
    - Perform an Interference Check, if using Revit to detect collisions
    - Review and resolve warnings
    - Delete unused or redundant views
    - Purge unused elements that will not potentially be used in later phases of the project
    - Compact the central and local files
- Daily
    - Audit local files upon opening them
    - Compact local files when closing them for the day

- Backups and Archives
    - At each issue date, or as required, use the Detach from Central option to create an independent, archive-ready central file
    - Backups can be generated via the same process, but this is generally unnecessary, as each user's local file can be considered a backup file. If a central file becomes corrupt, it is often most efficient to convert the most-recently-saved local file for that project into a new central file, rather than attempting to recover a backup file that may be obsolete.

7. OPDC REVIT MECHANICAL TEMPLATE DOCUMENTATION

All OPDC BIM Templates are based on Autodesk Revit default templates with OPDC BIM standards applied to them.

7.1. Overview of the Mechanical Template

The intent of the mechanical template is to provide a framework to facilitate mechanical design using Revit. It is intended to include but not be limited to HVAC and plumbing, fire suppression, and other mechanical systems as appropriate.

This section is NOT intended to be a Revit tutorial, but rather assumes that the user has a sufficient level of proficiency to comprehend the template descriptions outlined in this guide.

7.2. Browser and View Organization

The default browser setting in the template is organized by View Purpose, Discipline, and Sub-Category within the Discipline, and sorted by associated level.

Pre-defined sub-categories within the Discipline in the templates are HVAC, Plumbing, and Fire Suppression. The other examples for sub-categories within Mechanical Discipline can be mechanical piping, ducts, etc.

Pre-defined view purposes are COORD (coordination views), WORK (working views), and DOC (documentation). View purpose is defined as a project parameter and the uppercase abbreviation is also appended to the end of the view names to facilitate user recognition of the views.

Table 7-1: View Purpose [MEP]

Browser View Type	Grouping	Filter
View Purpose	Group by: View Purpose, Using All Characters Then by: Discipline, Using All Characters Then by: Sub-Category within the Discipline, Using All Characters Sort by: Associated Level, Ascending	<None>
Discipline	Group by: Discipline, Using All Characters Then by: Sub-Category within the Discipline, Using All Characters Then by: View Purpose, Using All Characters Sort by: Associated Level, Ascending	<None>

Table 7-1: View Purpose [MEP]		
Not on Sheets	Group by: Family and Type Then by: <None> Then by: <None> Sort by: View Name, Ascending	Filter by: Sheet Name = <None> And: View Purpose = Documentation

7.3. Working Views

These views are intended to be used for laying out mechanical components allowing collaboration between the sub-categories within mechanical disciplines and other disciplines.

Table 7-2: Working View - Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
HVAC 3D	All Annotation Categories All Analytical Categories Areas Detail Items Entourage Parking Raster Images Site Structural Area Reinforcement Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Wires	
Plumbing 3D	All Annotation Categories All Analytical Categories Areas Detail Items Entourage Parking Raster Images Site Structural Area Reinforcement Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Wires	
Fire Suppression 3D	All Annotation Categories All Analytical Categories Areas Detail Items Entourage	

Table 7-2: Working View - Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
	Parking Raster Images Site Structural Area Reinforcement Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Wires	
HVAC Plan	All Analytical Categories Areas Detail Items Entourage HVAC Zones Parking Raster Images Roads Site Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Wires	**All Annotation Categories hidden EXCEPT:** Air Terminal Tags Duct Color Fill Duct Color Fill Legends Duct Tags Pipe Tags Reference Lines Reference Planes Reference Points Room Tags Sections Space Tags
Plumbing Plan	All Analytical Categories Areas Detail Items Entourage HVAC Zones Parking Planting Raster Images Roads Rooms Site Spaces Structural Area Reinforcement Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Wires	**All Annotation Categories hidden EXCEPT:** Pipe Tags Reference Lines Reference Planes Reference Points Room Tags Sections Space Tags

Table 7-2: Working View - Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
Fire Suppression Plan	All Analytical Categories Areas Detail Items Entourage HVAC Zones Parking Planting Raster Images Roads Rooms Site Spaces Structural Area Reinforcement Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Topography Wires	**All Annotation Categories are hidden EXCEPT:** Generic Annotations Pipe Tags Reference Lines Reference Planes Reference Points Room Tags Sections Space Tags Sprinkler Tags
HVAC Zones	**All Model Categories Hidden EXCEPT:** Columns Curtain Panels Duct Fittings Duct Placeholders Ducts Generic Models HVAC Zones Lines Shaft Openings Spaces Structural Columns Walls Windows **All Analytical Categories Hidden**	Color scheme = HVAC Zones **All Annotation Categories are Hidden EXCEPT:** Space Tags Zone Tags
Mechanical – Solar Study-Sun Path	All Annotation Categories All Analytical Categories Air Terminal Area Cable Tray Fittings Cable Trays Casework Ceilings Communication Devices Conduit Fittings	

Table 7-2: Working View - Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
	Conduits Curtain Systems Data Devices ALL Duct Categories Fire Alarm Devices Flex Ducts Flex Pipes Furniture Furniture Systems Nurse Call Devices ALL Pipe Categories Plumbing Fixtures Security Devices Sprinklers Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Telephone Devices Wires	

Table 7-3: Working Views - View Filters [MEP]		
Discipline	**View Filters**	**View Filter Overrides**
HVAC	Piping – ALL Domestic Water Piping – ALL Fire Protection Piping – Sanitary Piping – Sanitary Vent Piping – Natural Gas Equipment – Domestic Plumbing Equipment – Fire Protection	Line Color = Gray Halftone = True
Plumbing	Piping – ALL Fire Protection Piping – ALL Hydronic Duct – ALL Equipment – Fire Protection Equipment – Hydronic	Line Color = Gray Halftone = True
Fire Suppression	Piping – ALL Fire Protection Equipment – Fire Protection	Line Color = Red
	Piping – ALL Domestic Water Piping – ALL Hydronic Piping – Sanitary	Line Color = Gray Halftone = True

Table 7-3: Working Views - View Filters [MEP]		
	Piping – Sanitary Vent Piping – Natural Gas Duct – ALL Equipment – Hydronic Equipment – Domestic Plumbing	

7.4. Documentation Views

These views are intended to be placed on sheets. Depending on workflow in many, if not, most cases, mechanical design is done directly in the documentation views. Appropriate visibility and/or filter settings are applied to display only relevant categories and objects.

Table 7-4: Documentation Views - Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	View Overrides
HVAC	Areas Cable Tray Fittings Cable Trays Communication Devices Conduit Fittings Conduits Curtain Panels Curtain Systems Curtain Wall Mullions Data Devices Entourage Fire Alarm Devices HVAC Zones Lighting Devices Light Fixtures Nurse Call Devices Parking Parts Planting Plumbing Fixtures Raster Images Roads Roofs Security Devices Site Sprinklers Structural Area Reinforcement Structural Beam Systems Structural Connections	All pipe categories have their detail level set to coarse

Table 7-4: Documentation Views - Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	View Overrides
	Structural Foundations Structural Path Reinforcement Structural Rebar Structural Stiffeners Telephone Devices Topography Wires	
Plumbing	Air Terminals Areas Cable Tray Fittings Cable Trays Ceilings Communication Devices Conduit Fittings Conduits Curtain Panels Curtain Systems Curtain Wall Mullions Data Devices Duct Accessories Duct Fittings Duct Insulation Duct Linings Duct Placeholders Ducts Electrical Equipment Electrical Fixtures Entourage Fire Alarm Devices Flex Ducts Furniture Furniture Systems HVAC Zones Lighting Devices Lighting Fixtures Nurse Call Devices Parking Parts Planting Raster Images Roads Rooms Security Devices	All pipe categories have their detail level set to coarse

Table 7-4: Documentation Views - Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	View Overrides
	Site Spaces Sprinklers Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Telephone Devices Topography Wires	
3D Plumbing Isometric	**All Model Categories Hidden EXCEPT:** Flex Pipes Generic Models Lines Mechanical Equipment Pipe Accessories Pipe Fittings Pipe Placeholders Pipes Plumbing Fixtures	Plumbing fixtures set to Halftone and Transparent. Projection lines set to gray View set to coarse and hidden line
Fire Suppression	Air Terminals Areas Cable Tray Fittings Cable Trays Ceilings Communication Devices Conduit Fittings Conduits Curtain Panels Curtain Systems Curtain Wall Mullions Data Devices Duct Accessories Duct Fittings Duct Insulation Duct Linings Duct Placeholders Ducts Electrical Equipment Electrical Fixtures	

Table 7-4: Documentation Views - Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	View Overrides
	Entourage Fire Alarm Devices Flex Ducts Furniture Furniture Systems HVAC Zones Lighting Devices Lighting Fixtures Nurse Call Devices Parking Parts Planting Raster Images Roads Rooms Roofs Security Devices Site Spaces Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Telephone Devices Topography Wires	

Table 7-5: Documentation Views - View Filters [MEP]		
Discipline	View Filters	View Filter Overrides
HVAC	Piping – ALL Domestic Water Piping – ALL Fire Protection Piping – Sanitary Piping – Sanitary Vent Piping – Natural Gas Equipment – Domestic Plumbing Equipment – Fire Protection	Visibility OFF
Plumbing	Piping – Sanitary Vent	Visibility ON Override line pattern with DASH

Table 7-5: Documentation Views - View Filters [MEP]		
Discipline	View Filters	View Filter Overrides
	Piping – Domestic Cold Water Piping – Domestic Hot Water Piping – Domestic Hot Water Return	Visibility ON Override line patterns with AEC CAD standard compliant patterns
	Piping – Natural Gas Piping – ALL Fire Protection Piping – ALL Hydronic	Visibility OFF
3D Plumbing Isometric	Piping – Sanitary Vent Piping – Domestic Cold Water Piping – Domestic Hot Water Piping – Domestic Hot Water Return	Override Linetype – Dashed Override Linetype – CLDWTR Override Linetype – HWTR Override Linetype – HWTRR
	Piping – ALL Fire Protection Piping – ALL Hydronic Piping – Natural Gas Equipment – Fire Protection Equipment – Hydronic	Visibility OFF
Fire Suppression	Piping – ALL Domestic Water Piping – Sanitary Piping – Sanitary Vent Piping – Natural Gas Piping – ALL Hydronic Equipment – Hydronic Equipment – Domestic Plumbing	Visibility OFF

7.5. Coordination Views

Due to the unique workflow for MEP design, there are only a few times where there is a need for a coordination view separate and distinct from the working views. In the template, only one 3D_ALL _COORD view is provided. In this view, most categories' visibility settings are turned ON and section box is enabled.

Table 7-6: Coordination Views - Model Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
Mechanical 3D	Areas Curtain System Detail Items Mass Wires	**All categories detail level set to Coarse except for:** Air Terminals All Duct categories All Pipe categories Generic models Mechanical equipment Plumbing fixtures Sprinklers **Categories with surface patterns hidden:**

Table 7-6: Coordination Views - Model Categories Visibility [MEP]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
		Floors Roofs Walls
Mechanical Elevations	Areas HVAC Zones Mass Nurse Call Devices Rooms Spaces Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Wires	

7.6. View Filters

View filters on 3D views are intended to serve as an aid to viewing mechanical systems more clearly via color overrides. With Documentation Views, the purpose of view filters is to facilitate the use of overrides for proper generation of printed drawing sheets. For filter rules, preference is first given to System Classification. When multiple system types are defined for one system classification, then System Type is used as the filter rule.

Note *that the view filters list in Revit cannot be sorted. They are listed in the order they were created.*

Table 7-7: View Filters [MEP]		
View Filter	Categories	Filter Rules
Duct - Supply	All Duct, Duct Placeholders and Flex Duct categories	System Type = Supply Air
Duct – Return	All Duct, Duct Placeholders and Flex Duct categories	System Classification = Return Air
Duct – Exhaust	All Duct, Duct Placeholders and Flex Duct categories	System Classification = Exhaust Air
Duct – Outside Air	All Duct, Duct Placeholders and Flex Duct categories	System Type = Outside Air
Piping – Sanitary	All Pipe, Pipe Placeholders and Flex Pipe categories	System Classification = Sanitary

Table 7-7: View Filters [MEP]		
View Filter	Categories	Filter Rules
Piping – Sanitary Vent	All Pipe, Pipe Placeholders and Flex Pipe categories	System Classification = Vent
Piping – Domestic Cold Water	All Pipe, Pipe Placeholders and Flex Pipe categories	System Classification = Domestic Cold Water
Piping – Domestic Hot Water	All Pipe, Pipe Placeholders and Flex Pipe categories	System Classification = Domestic Hot Water
Piping – Domestic Hot Water Return	All Pipe, Pipe Placeholders and Flex Pipe categories	System Type = Domestic Hot Water Return
Piping – Natural Gas	All Pipe, Pipe Placeholders and Flex Pipe categories	System Type = Natural Gas
Piping – Fire Protection Dry	All Pipe, Pipe Placeholders and Flex Pipe categories	System Type = Fire Protection Dry
Piping – Fire Protection Wet	All Pipe, Pipe Placeholders and Flex Pipe categories	System Type = Fire Protection Wet
Piping - ALL Domestic Water	All Pipe, Pipe Placeholders and Flex Pipe categories	System Classification contains Domestic
Piping - ALL Fire Protection	All Pipe, Pipe Placeholders and Flex Pipe categories	System Classification contains Fire Protection
Piping - ALL Hydronic	All Pipe, Pipe Placeholders and Flex Pipe categories	System Classification contains Hydronic
Equipment – Hydronic	Mechanical Equipment	System Classification contains Hydronic
Equipment – Domestic Plumbing	Mechanical Equipment	System Classification contains Domestic
Equipment – Fire Protection	Mechanical Equipment	System Classification contains Fire

7.7. Piping Systems

Table 7-8: Piping Systems [MEP]				
System Type	System Classification	Abbreviation	Color	Pattern*
Condensate	Other	C	-	-
Domestic Cold Water	Domestic Cold Water	CW	Blue	CLDWTR
Domestic Hot Water	Domestic Hot Water	HW	Red	HWTR
Domestic Hot Water Return	Domestic Hot Water	HWR	Light Red	HWTRR
Fire Protection Dry	Fire Protection Dry	FPD	-	-
Fire Protection Other	Fire Protection Other	FPO	-	-
Fire Protection Pre-Action	Fire Protection Pre-Action	FPPA	-	-
Fire Protection Wet	Fire Protection Wet	FPW	-	-
Natural Gas	Gas	G	Orange	
Hydronic Chilled Water Return	Hydronic Return	CHWR	RGB 82,103,165	-

Table 7-8: Piping Systems [MEP]				
System Type	System Classification	Abbreviation	Color	Pattern*
Hydronic Chilled Water Supply	Hydronic Supply	CHWS	Cyan	-
Hydronic Hot Water Return	Hydronic Return	HWR	Light Red	-
Hydronic Hot Water Supply	Hydronic Supply	HWS	Red	-
Other	Other	-	-	-
Sanitary	Sanitary	SS	Purple RGB 145,82,165	-
Vent	Vent	V	Green	DASHED

** Pattern Override for Documentation views, AEC CADD Standard compliant line pattern where applicable.*

7.8. Duct Systems

Table 7-9: Duct Systems [MEP]				
System Type	System Classification	Abbreviation	Color	Pattern
Exhaust Air	Exhaust Air	EA	Green	-
Outside Air	Supply Air	SA	Yellow	-
Return Air	Return Air	RA	Orange	-
Supply Air	Supply Air	SA	Cyan	-
Supply Air – High Pressure	Supply Air	SA-HP	Blue	-

7.9. Schedule Views

The following schedule views have been included in the Revit template to assist project mechanical data collection.

Table 7-10: Schedules [MEP]			
Schedule	Fields	Heading	Filter Rules
Circulating Pump	Mark Type Comments Flow Head --- Pump HP Voltage Phase Electrical Hertz	SYMBOL TYPE CAPACITY HEAD ELECTRICAL HP VOLTAGE PHASE HZ	Mark begins with CP-

Table 7-10: Schedules [MEP]			
Schedule	Fields	Heading	Filter Rules
Diffuser and Register	Type Mark Type Description Family Type Comments Max Flow Min Flow Count Count	MARK FACE/NECK SIZE DESCRIPTION TYPE TYPE COMMENTS MAX. FLOW MIN. FLOW COUNT	
Plumbing Fixture	Type Mark Description CW_DIAMETER HW_DIAMETER W_DIAMETER Count Comments	SYM DESCRIPTION CW HW W COUNT REMARKS	
VAV	Mark Type Type Comments MINIMUM_AIRFLOW MAXIMUM_AIRFLOW PRESSURE INLET_SIZE System Name kW LEAVING _DB HEATING_AIRFLOW Level Current	MARK SIZE/TYPE TYPE MIN. AIRFLOW MAX. AIRFLOW MAX. INLET DESIGN AIR S.D. – IN.W.G. INLET SIZE – IN. SYSTEM kW LEAVING DB HEATING AIRFLOW LEVEL CURRENT	Mark begins with VAV-
Elec Water Heater	Mark Type Comments Description Voltage kW Electrical Hertz Comments	MARK TYPE DESCRIPTION VOLTAGE kW Hz NOTES	Mark begins with EWH-
zHVAC Spaces	Level Zone Name Room: Name Number Room: Number Area Volume		

Table 7-10: Schedules [MEP]			
Schedule	Fields	Heading	Filter Rules
	Number of People Occupiable Plenum Actual HVAC Load Space Type Design Cooling Load Calculated Cooling Load Design Heating Load Calculated Heating Load Calculated Supply Airflow Specified Supply Airflow Actual Supply Airflow Return Airflow Airflow Differential		
zHVAC Zones	Name Level Gross Area Gross Volume Occupied Area Occupied Volume Service Type Calculated Cooling Load Calculated Supply Airflow Calculated Supply Airflow per Area		
zSheet List	Sheet Number SHEET_TITLE_1 SHEET_TITLE_2 SHEET_TITLE_3 Current Revision Publish Order SHEET_NO Approved By Checked By Designed By Drawn By FILE_NO FILENAME Sheet Issue Date Sheet Name		

7.10. SI Asset Schedule View and Customized Parameters

In addition to the schedules above, a customized SI Asset schedule has been created to hold asset data information based on SI requirements. The schedule has SI asset related fields that are added to the project as custom parameters. See Appendix B Table A-3 for SI Asset Schedule. Please refer to Smithsonian OPDC BIM Guidelines for additional SI Asset Management requirements.

7.11. Steel Pipe Fitting Lookup Table

Included with the mechanical template is a "Pipe Fitting – Steel.csv" file for use in defining steel pipes. The .csv file should be copied to the Revit MEP lookup table location. (see Revit documentation for the Lookup Tables\Pipe location.

7.12. Plumbing Schematic Isometric Risers

The preferred method of presenting isometric risers is to embellish locked, 3D views. For situations where this is not practical, due to various reasons including complexity of the models or congested areas, additional tools for hand drafting isometric risers are available to facilitate such drafting within Revit.

The drafting view entitled Plumbing Riser Template DOC provides an optional method to layout plumbing isometric risers within Revit using detail components. A background ISO GRID GUIDE helps in aligning to the proper isometric angle.

Special detail component families for pipes, crossings, and tees with filled regions allow for the proper display of overlapping lines without manually breaking linework. This also allows for fast editing and moving of components.

Similarly, fixtures are designed for easy manipulation with flip controls, type marks, and visibility settings.

Tip: Use Revit's Bring to Front and Send to Back tools to achieve the appropriate line work breaking.

Table 7-11: Special Detail Component Families [MEP]

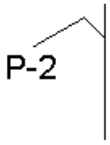
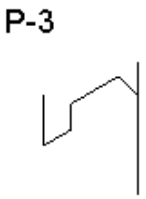
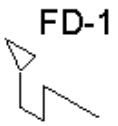
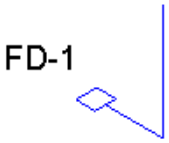
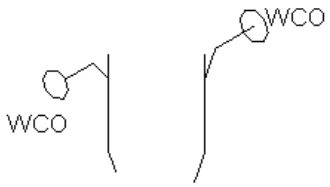
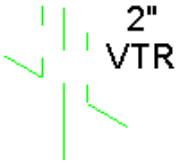
Detail Component Family	Graphics		Notes
DetailComp_PlumbingIsometric_WC.rfa	 Sanitary = OFF	 Sanitary = ON	Water Closet detail component family with 'Sanitary' visibility parameter OFF and ON. The P-1 label is a type mark tag.
DetailComp_PlumbingIsometric_Urinal.rfa	 Sanitary = OFF	 Sanitary = ON	Urinal detail component family with 'Sanitary' visibility parameter OFF and ON. The P-2 label is a type mark tag.

Table 7-11: Special Detail Component Families [MEP]			
Detail Component Family	**Graphics**		**Notes**
DetailComp_PlumbingIsometric_Lavatory.rfa	 Sanitary = OFF	 Sanitary = ON	Lavatory detail component family with 'Sanitary' visibility parameter OFF and ON. The P-3 label is a type mark tag. The lavatory component detail family also has an additional FLIP_HOTCOLD parameter to rectify the hot-cold piping when mirroring the fixture.
DetailComp_PlumbingIsometric_FD.rfa	 Sanitary = OFF	 Sanitary = ON	Floor Drain detail component family with 'Sanitary' visibility parameter OFF and ON. Water connection is intended as a trap primer. The FD-1 label is a type mark tag.
DetailComp_PlumbingIsometric_WCO.rfa			Wall Clean Out detail component family with RIGHT and LEFT parameters. The WCO label is a type mark tag.
DetailComp_PlumbingIsometric_VTR.rfa			Vent Through Roof detail component family. The 2" VTR label is a type mark tag.
DetailComp_PlumbingIsometric_WHA.rfa			Water Hammer Arrester detail component family. DCW/DHW representation is a type parameter. The WHA label is a type mark tag.

7.13. Sample Revit Plumbing Isometric 3D View

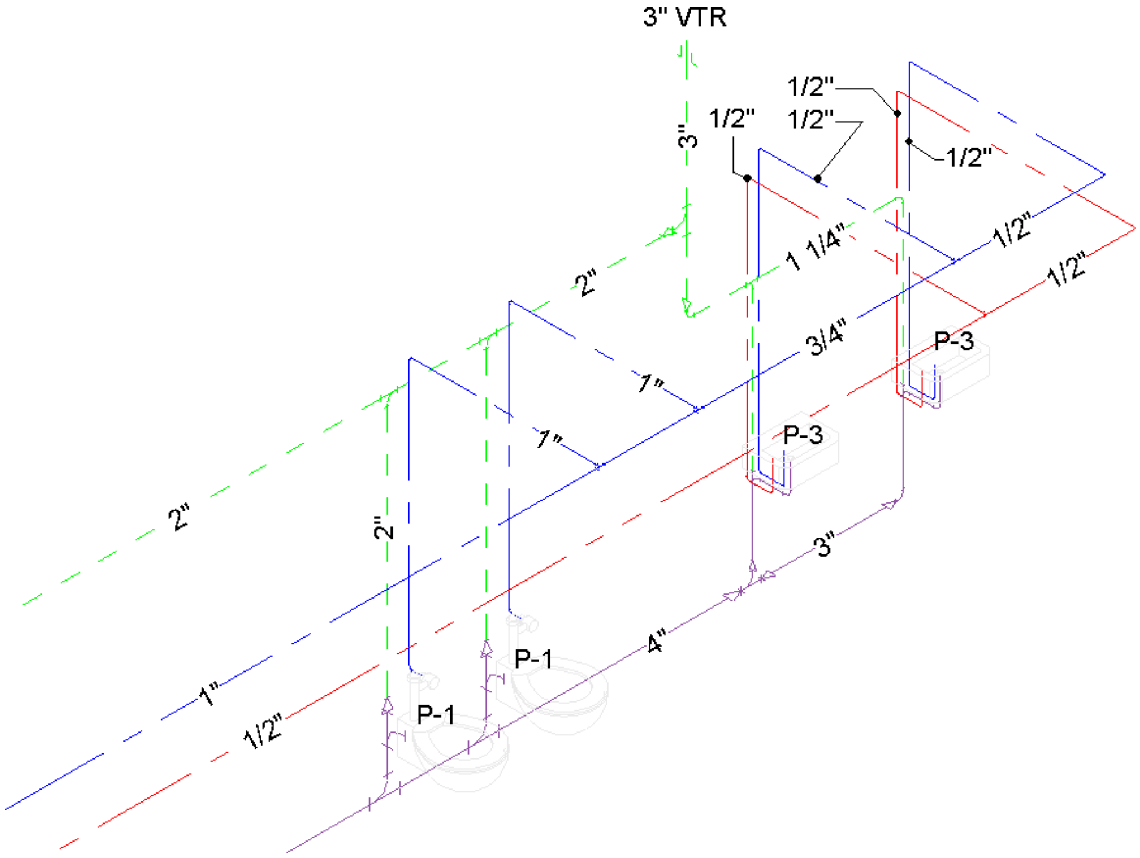


Figure 7-1: Sample 3D plumbing isometric based on the template 3D view "Plumbing Isometric_DOC"

7.14. Sample Revit Plumbing Isometric Using Drafting Views

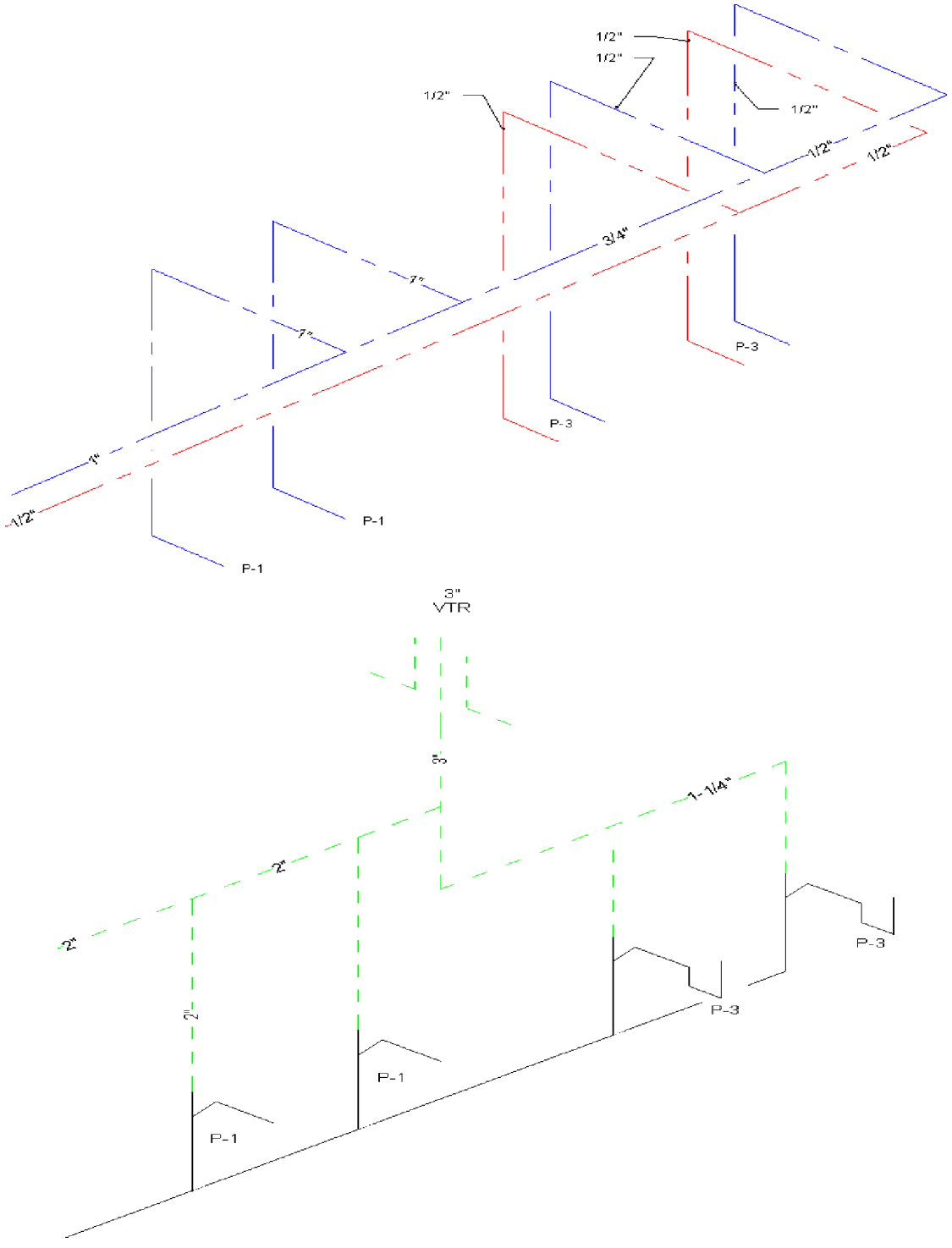


Figure 7-2: Two Sample Revit Plumbing Isometrics Using Drafting Views

8. OPDC REVIT ELECTRICAL & FIRE ALARM / SECURITY TEMPLATES DOCUMENTATION

All OPDC BIM Templates are based on Autodesk Revit default templates with OPDC BIM standards applied to them.

8.1. Overview

The intent of the Electrical & Fire Alarm / Security templates is to provide a framework to facilitate Electrical, Fire Alarm & Security design using Revit MEP. It is intended to include, but not be limited to power, lighting systems, and other electrical systems as appropriate.

This section is NOT intended to be a Revit tutorial, but rather assumes that the user has a sufficient level of proficiency to comprehend the template descriptions outlined in this guide.

8.2. Browser and View Organization

The default browser setting in the template is organized by View Purpose, Discipline, Sub-Category within the Discipline, and sorted by Associated Level.

Pre-defined Sub-Category within the Discipline in the templates are Power, Lighting, Systems (data, communication, alarms), Lightning Protection, and Electrical Site.

Pre-defined view purposes are COORD (coordination views), WORK (working views), and DOC (documentation). View purpose is defined as a project parameter and the uppercase abbreviation is also appended to the end of the view names to facilitate user recognition of the views.

Table 8-1: View Purpose [Electrical]

Browser View Type	Grouping	Filter
View Purpose	Group by: View Purpose, Using All Characters Then by: Discipline, Using All Characters Then by: Sub-Category within the Discipline, Using All Characters Sort by: Associated Level, Ascending	<None>
Discipline	Group by: Discipline, Using All Characters Then by: Sub-Category within the Discipline, Using All Characters Then by: View Purpose, Using All Characters Sort by: Associated Level, Ascending	<None>
Not on Sheets	Group by: Family and Type Then by: <None> Then by: <None> Sort by: View Name, Ascending	Filter by: Sheet Name = <None> And: View Purpose = Documentation

8.3. Documentation Views

These views are intended to be placed on sheets. Depending on workflow in many, if not, most cases, electrical design is done directly in the documentation views. Appropriate visibility and/or filter settings are applied to display only relevant categories and objects.

Table 8-2: Documentation Views - Categories Visibility [Electrical]

Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
Power	All Analytical Categories Air Terminals Areas Cable Tray Fittings Cable Trays Ceilings Communication Devices Conduit Fittings Conduits Data Devices All Ducts Entourage Fire Alarm Devices Flex Ducts Flex Pipes HVAC Zones Lighting Devices Lighting Fixtures Mass Nurse Call Devices Parking All Pipes Planting Plumbing Fixtures Raster Images Roads Roofs Rooms Security Devices Shaft Openings Site Sprinklers Structural Area Reinforcement Structural Connections Structural Foundations Structural Path Reinforcement Structural Rebar Structural Stiffeners	Floors Surface Patterns Hidden

Table 8-2: Documentation Views - Categories Visibility [Electrical]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
	Telephone Devices Topography	
Lighting	All Analytical Categories Air Terminals Areas Cable Tray Fittings Cable Trays Casework Communication Devices Conduit Fittings Conduits Data Devices All Ducts Electrical Equipment Electrical Fixtures Entourages Fire Alarm Devices Flex Ducts Flex Pipes Generic Models HVAC Zones Mass Mechanical Equipment Nurse Call Devices Parking Parts All Pipes Planting Plumbing Fixtures Railings Ramps Raster Images Roads Roofs Rooms Security Devices Shaft Openings Site Specialty Equipment	Furniture Categories set to Halftone

Table 8-2: Documentation Views - Categories Visibility [Electrical]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
	Sprinklers All Structural except Columns Telephone Devices Topography	
Systems	All Analytical Categories Air Terminals Areas Communication Devices Conduit Fittings Conduits All Ducts Electrical Equipment Electrical Fixtures Entourages Flex Ducts Flex Pipes Generic Models HVAC Zones Lighting Devices Lighting Fixtures Mass Mechanical Equipment Parking Parts All Pipes Raster Images Rooms Sprinklers All Structural except Columns Topography Wires	Furniture Categories set to Halftone
Lighting Protection	All Analytical Categories --- All Model Categories hidden **EXCEPT** Electrical Equipment Electrical Fixtures Generic Models Roofs Walls Wires	Wires Category Projection Line set to Dash Home Run Arrows and Wire Tick Marks hidden View Filters: Components – non-Grounding_ Visibility off

Table 8-2: Documentation Views - Categories Visibility [Electrical]		
Sub-Category within the Discipline	Hidden Categories	Overrides/Settings/Comments
Electrical Site	All Analytical Categories Air Terminals Areas Casework Ceilings ALL Curtain Categories Detail Items Doors ALL Duct Categories Entourage Furniture Furniture Systems HVAC Zones Nurse Call Devices Plumbing Fixtures Rooms Shaft Openings Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Windows	

8.4. Coordination Views

These views are intended to be used for interference checks and design collaboration between electrical and other disciplines as well as between the electrical sub-categories within the discipline.

Table 8-3: Coordination Views - Categories Visibility [Electrical]		
Sub-Category within the Discipline	**Hidden Categories**	**Overrides/Settings/Comments**
Electrical	All Analytical Categories Areas Duct Lining Entourage HVAC Zones Mass Nurse Call Devices Parking Planting Raster Images Roads	Floors Surface Patterns Hidden

Table 8-3: Coordination Views - Categories Visibility [Electrical]		
Sub-Category within the Discipline	**Hidden Categories**	**Overrides/Settings/Comments**
	Rooms Shaft Openings Site Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Topography Wires	
3D Electrical	All Analytical Categories All Annotation Categories Areas Detail Items Duct Lining Entourage Mass Parking Parts Planting Raster Images Site Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Wires	Floors Surface Patterns Hidden
Electrical Elevations	All Analytical Categories Air Terminals Areas Duct Linings HVAC Zones Mass Nurse Call Devices Parking Parts Raster Images Rooms Spaces Structural Area Reinforcement	

Table 8-3: Coordination Views - Categories Visibility [Electrical]		
Sub-Category within the Discipline	**Hidden Categories**	**Overrides/Settings/Comments**
	Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Wires	
Electrical Site	All Analytical Categories Air Terminals Areas Casework Ceilings Curtain Panels Curtain Systems Curtain Wall Mullions Detail Items Doors All Ducts Entourage Furniture Furniture Systems HVAC Zones Nurse Call Devices Parts Plumbing Fixtures Rooms Spaces Sprinklers Structural Area Reinforcement Structural Beam Systems Structural Connections Structural Path Reinforcement Structural Rebar Structural Stiffeners Windows	
Lightning Protection	All Analytical Categories --- All Model Categories hidden **EXCEPT** Duct Accessories Duct Fittings Duct Placeholders Ducts Electrical Equipment	View Filters: Components – Grounding System set to RED and Lineweight 6

Table 8-3: Coordination Views - Categories Visibility [Electrical]		
Sub-Category within the Discipline	**Hidden Categories**	**Overrides/Settings/Comments**
	Electrical Fixtures Flex Ducts Flex Pipes Generic Models Lighting Devices Lighting Fixtures Pipe Accessories Pipe Fittings Pipe Placeholders Pipes Roofs Security Devices	

8.5. View Filters

View filters on 3D views are intended to serve as an aid to viewing mechanical systems more clearly via color overrides. On Documentation views, the purpose of view filters is to facilitate the use of overrides for proper generation of printed drawing sheets. For filter rules, preference is first given to System Classification. When multiple system types are defined for one system classification, then System Type is used as the filter rule.

Tip: Note that the view filters list in Revit cannot be sorted. They are listed in the order they were created.

Table 8-4: View Filters [Electrical]		
View Filter	Categories	Filter Rules
Wires – Grounding	Wires	Number of Conductors = 1 and Ground Conductors = 1
Components - Interior	Cable Tray Fittings Cable Trays Communication Devices Conduit Fittings Conduits Data Devices Electrical Equipment Electrical Fixtures Fire Alarm Devices Lighting Devices Lighting Fixtures Nurse Call Devices Security Devices Specialty Equipment Switch System	ELECTRICAL SITE COMPONENT does not equal Yes (This setting is preferred over "=No" so that components not specifically set to Site Component would be displayed)

Table 8-4: View Filters [Electrical]		
View Filter	Categories	Filter Rules
	Telephone Devices Wires	
Components - Site	Cable Tray Fittings Cable Trays Communication Devices Conduit Fittings Conduits Data Devices Electrical Equipment Electrical Fixtures Fire Alarm Devices Lighting Devices Lighting Fixtures Nurse Call Devices Security Devices Specialty Equipment Switch System Telephone Devices Wires	ELECTRICAL SITE COMPONENT = Yes
Components – GroundSystem	Cable Tray Fittings Cable Trays Conduit Fittings Conduits Electrical Equipment Electrical Fixtures Wires	ELECTRICAL GROUNDING SYSTEM = Yes
Components – non-Grounding	Cable Tray Fittings Cable Trays Conduit Fittings Conduits Electrical Equipment Electrical Fixtures Wires	ELECTRICAL GROUNDING SYSTEM does not equal= Yes (This setting is preferred over "=No" so that components not specifically set to Grounding would be displayed.)

8.6. SI Asset Schedule View and Customized Parameters

A customized SI Asset Schedule has been created in the template to hold asset data information based on SI requirements. The schedule has SI asset related fields that are added to the project as custom parameters. See Appendix B Table A-3 for SI Asset Schedule. Please refer to Smithsonian OPDC BIM Guidelines for additional SI Asset Management requirements.

8.7. Electrical Site Design

A project instance parameter called "ELECTRICAL SITE COMPONENT" is used to designate specific electrical components as items to be shown on the electrical site plan. Note that this is an instance parameter, so it requires setting this value as needed for each object as needed.

There are two view filters: *Components – Site and Components- Interior,* associated with this workflow. The *Components – Interior filter* is used to select and filter out electrical components that are not intended to be shown on the electrical site documentation plan, such as interior lighting. Setting the project parameter "ELECTRICAL SITE COMPONENT" for each site electrical component is a manual process. As a visual aid, the view 00_Electrical Site COORD is set up to display all electrical components, with site electrical components displaying in red. In this view, the user can easily see if any objects intended for the electrical site plan were missed.

8.8. Lightning Protection Design

A project type parameter called "ELECTRICAL GROUNDING SYSTEM" is used to designate electrical fixtures and equipment types as being part of the grounding system. Note that this is a type parameter and needs to be set for each family type as necessary.

There are three view filters, *Components - Grounding System*, *Components – non-Grounding*, and *Wires – Grounding* associated with this workflow. The *Components –non-Grounding filter* is used to select and filter out electrical components that are not intended to be shown on the lightning protection documentation plan. The *Wires – Grounding filter* looks for wire annotation with one conductor, and that one conductor is a ground conductor. The filter overrides the lightning protection ground wires to display dashed. As a visual aid, the view Roof LightningProt COORD is set up to display all electrical components with lightning protection components displaying in red. In this view, the user can easily see if any object types intended lightning protection were missed.

8.9. Security Camera Design

Security Camera shall be accurately modeled in 3D and show the proper Field of View (FOV) per the camera type specified. Cameras shall be placed to optimize Field of View and eliminate blind spots.

Office of Protection Services (OPS) utilizes a variety of camera types including:

Axis - https://www.axis.com/us/en
Arecont - https://www.arecontvision.com/index.php

Revit Families can be downloaded from the websites listed above and can be utilized on SI projects.

9. OPDC REVIT STRUCTURAL TEMPLATE DOCUMENTATION

All OPDC BIM Templates are based on Autodesk Revit default templates with OPDC BIM standards applied to them.

9.1. Overview

The OPDC Revit Structural Template is employed to format a project's structural BIM with Smithsonian standards.

This section is NOT intended to be a Revit tutorial, but rather assumes that the user has a sufficient level of proficiency to comprehend the template descriptions outlined in this guide.

9.2. Browser and View Organization

The default browser organization in the template is 'View Purpose'. Itis organized by View Purpose, Family and Type, and sorted by the associated level.

There are no pre-defined Sub-Category within the Discipline in the structural template.

Pre-defined view purposes within the Structural Template are COORD (coordination views), WORK (working views), DOC (documentation), and Analytical (Anl). Note that there is also a Z-Detail Component Palette. (Please refer to the Appendix in this document for information on the palette.)

View purpose is defined as a project parameter. The uppercase abbreviation is also appended to the end of the view names to facilitate user recognition of the views.

Table 9-1: View Purpose [Structural]

Browser View Type	Grouping	Filter
View Purpose	Group by: View Purpose, Using All Characters Then by: Discipline, Using All Characters Then by: Sub-Category within the Discipline, Using All Characters Sort by: Associated Level, Ascending	<None>
Discipline	Group by: Discipline, Using All Characters Then by: Sub-Category within the Discipline, Using All Characters Then by: View Purpose, Using All Characters Sort by: Associated Level, Ascending	<None>
Not on Sheets	Group by: Family and Type Then by: <None> Then by: <None> Sort by: View Name, Ascending	Filter by: Sheet Name = <None> And: View Purpose = Documentation

9.3. View Types

To separate the purposes of the views and to make creating the sheets simpler, separate view purposes have been created for Working Views (where the main modeling is done), Documentation Views (the views are specifically added to sheets for official model documents), Presentation Views (for required or accessory presentation views) and Coordination Views (used to coordinate model in the structural and other linked disciplines).

9.4. View Naming

Naming of views is to follow the standard set in the template and is divided into categories by: Floor Level View Type Region (use *all* if building 'NOT' divided) _Function (depends on view purpose) _View Purpose

Structural Example: 00_North Elevation All Framing Work

Note: Abbreviations can be used to keep the length of the view name short if the abbreviations are listed in the general notes and abbreviations list. For example, "ELEV" can be used instead of "Elevations".

9.5. Working Views

These views are intended to be used for laying out all structural components and structural modeling elements in the structural discipline.

Table 9-2: List of Working Views in the OPDC Revit Template [Structural]

Name of View	Hidden Structural Categories	Reason for View
Structural Plans:		
00_Foundation Plan_All_WORK	Parts Mass	The view is intended to be the location where you would begin modeling your foundation elements (footings, slabs, foundation walls, etc.).
01_Framing Plan_All _WORK	Parts Mass	This view is intended to be the location where you would model any structural framing elements on level 1.
02_Framing Plan_All _WORK	Parts Mass	This view is intended to be the location where you would model any structural framing elements on level 2. If structure is only 1 story then the view may be deleted, or renamed to Roof Framing. The structural template was designed with 3 levels as a default.
03_Roof Framing Plan_All _WORK	Parts Mass	This view is intended to be the location where you would model any structural roof elements such as rafter, joists, trusses, etc. The structural template was designed with 3 levels as a default.

Table 9-2: List of Working Views in the OPDC Revit Template [Structural]		
Name of View	Hidden Structural Categories	Reason for View
Elevations (Framing Elevation):		
EAST _WORK	Parts	This view is intended to be the location where you would view your model from an East Framing elevation perspective. Modeling can be done in this view (ex. Cross brace framing and connection components).
NORTH _WORK	Parts	This view is intended to be the location where you would view your model from a North Framing elevation perspective. Modeling can be done in this view (ex. Cross brace framing and connection components).
SOUTH_WORK	Parts	This view is intended to be the location where you would view your model from a South Framing elevation perspective. Modeling can be done in this view (ex. Cross brace framing and connection components).
WEST _WORK	Parts	This view is intended to be the location where you would view your model from a West Framing elevation perspective. Modeling can be done in this view (ex. Cross brace framing and connection components).

9.6. Coordination Views

Coordination views are used for interference checks and design collaboration between project disciplines. The collaboration purpose can also be used as a temporary area to store quickly created plans, sections, and elevations for visual reference inside own discipline and linked Revit models. Modeling is to take place in the views associated with the working view purpose.

Table 9-3: List of Coordination Views in Template: 3D Views [Structural]		
Name of View	Hidden Structural Categories	Reason for View
3D - Structural and Architectural_COORD	Parts	This view is intended to be a view only showing the models from Structural and Architectural. After linking of all Revit model files, then visibility of models will be turned off except the Architectural model in Revit links.
3D - Structural and MEP_COORD	Parts	This view is intended to be a view only showing the models from Structural and MEP. After linking of all Revit model files, then visibility of models will be turned off except the MEP model in Revit links.

Table 9-3: List of Coordination Views in Template: 3D Views [Structural]		
Name of View	Hidden Structural Categories	Reason for View
3D - Structural Only_COORD	Parts	All view links to be turned off and the model visible is Structural.
3D - Structural, Architectural, and MEP_COORD	Parts	This view is intended to be a view showing all major disciplines: Structural, Architectural, and MEP.
3D - Working	Parts	This view is to be used for coordinating all models across disciplines and is the main view where categories will be hidden, and visibility turned on/ off for 3D collaboration.

9.7. Documentation Views

These views are intended to be placed on sheets. Depending on workflow in many, if not most cases, structural tags, notes, etc. are done directly in the documentation views, while the modeling is done in the working view purpose. Appropriate visibility and/or filter settings are applied to display only relevant categories and objects.

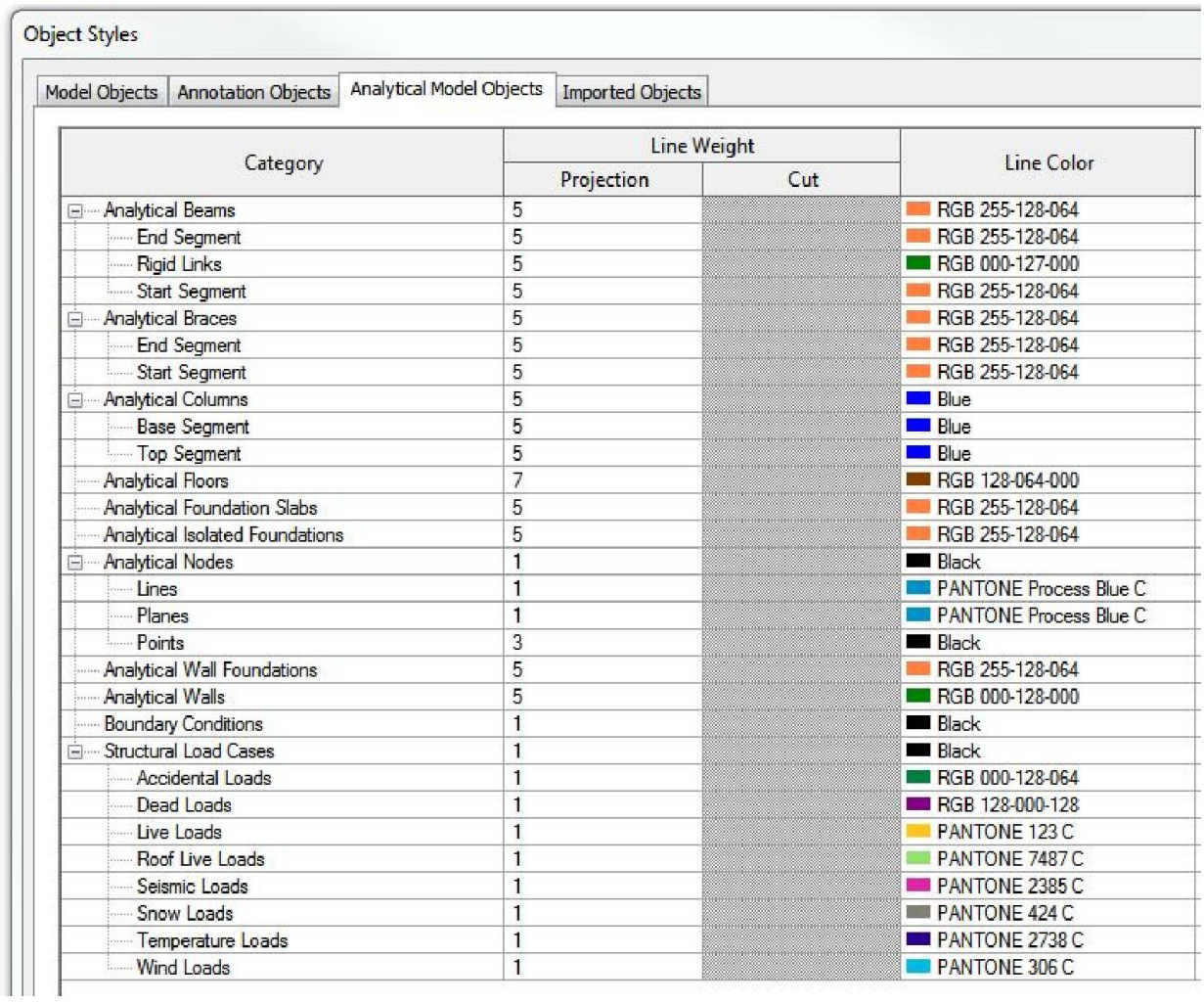
Table 9-4: Documentation Views in the Template [Structural]		
Name of View	Hidden Structural Categories	Reason for View
Structural Plans:		
00_Foundation Plan_All_DOC	Mass Parts	The view is intended to be the location where you would begin documenting your model for construction purposes (notes, tags, keynoting, etc.). This view would be added to the appropriate sheet.
01_Framing Plan_All _DOC	Mass Parts	The view is intended to be the location where you would begin documenting your model for construction purposes (notes, tags, keynoting, etc.). This view would be added to the appropriate sheet.
02_Framing Plan_All _ DOC	Mass Parts	The view is intended to be the location where you would begin documenting your model for construction purposes (notes, tags, keynoting, etc.). This view would be added to the appropriate sheet.

Table 9-4: Documentation Views in the Template [Structural]		
Name of View	Hidden Structural Categories	Reason for View
03_Framing Plan_All _ DOC	Mass Parts	The view is intended to be the location where you would begin documenting your model for construction purposes (notes, tags, keynoting, etc.). This view would be added to the appropriate sheet.
Elevations (Framing Elevation):		
EAST _ DOC	Parts	This view is intended to be the location where you would view your model from an East Framing elevation perspective. This view is specifically for documenting with tags, notes, legends, etc. which will be added to a sheet.
NORTH _ DOC	Parts	This view is intended to be the location where you would view your model from a North Framing elevation perspective. This view is specifically for documenting with tags, notes, legends, etc. which will be added to a sheet.
SOUTH_ DOC	Parts	This view is intended to be the location where you would view your model from a South Framing elevation perspective. This view is specifically for documenting with tags, notes, legends, etc. which will be added to a sheet.
WEST _ DOC	Parts	This view is intended to be the location where you would view your model from a West Framing elevation perspective. This view is specifically for documenting with tags, notes, legends, etc. which will be added to a sheet.
Drafting Views (Detail) *Additional views can be created for new details of the model*		
TYPICAL CONNECTION DETAILS	NA	This view is intended strictly for 2D drafting views only.
TYPICAL FOUNDATION DETAILS	NA	This view is intended strictly for 2D drafting views only.
TYPICAL FRAMING DETAILS	NA	This view is intended strictly for 2D drafting views only.

9.8. Analytical Views

The analytical views are used to demonstrate the analytical model and are depicted differently in these views by the visibility overrides of the elements being modeled. The depiction of these colors can be seen in the object styles for analytical model objects. The lateral and horizontal loads are depicted in orange, while the blue depicts vertical loads. Different structural load cases and their associated weights and colors are also listed in the image below.

Engineering the model for structural integrity can be performed natively in Revit or can be exported out to the compatible structural package (RAM, STAAD, RISA, Robot, etc.).



Category	Line Weight		Line Color
	Projection	Cut	
Analytical Beams	5		RGB 255-128-064
End Segment	5		RGB 255-128-064
Rigid Links	5		RGB 000-127-000
Start Segment	5		RGB 255-128-064
Analytical Braces	5		RGB 255-128-064
End Segment	5		RGB 255-128-064
Start Segment	5		RGB 255-128-064
Analytical Columns	5		Blue
Base Segment	5		Blue
Top Segment	5		Blue
Analytical Floors	7		RGB 128-064-000
Analytical Foundation Slabs	5		RGB 255-128-064
Analytical Isolated Foundations	5		RGB 255-128-064
Analytical Nodes	1		Black
Lines	1		PANTONE Process Blue C
Planes	1		PANTONE Process Blue C
Points	3		Black
Analytical Wall Foundations	5		RGB 255-128-064
Analytical Walls	5		RGB 000-128-000
Boundary Conditions	1		Black
Structural Load Cases	1		Black
Accidental Loads	1		RGB 000-128-064
Dead Loads	1		RGB 128-000-128
Live Loads	1		PANTONE 123 C
Roof Live Loads	1		PANTONE 7487 C
Seismic Loads	1		PANTONE 2385 C
Snow Loads	1		PANTONE 424 C
Temperature Loads	1		PANTONE 2738 C
Wind Loads	1		PANTONE 306 C

Figure 9-1: Revit object styles for Analytical Model Objects [OPDC Revit Structural template]

Table 9-5: Analytical Views in the OPDC Revit Structural Template [Structural]		
Name of View	Hidden Structural Categories	Reason for View
Plan Views:		
01_LoadDiagram_All_ANL	Columns, Detail Items, Mass, Parts, Ramps, Raster Images, Roofs, Stairs, Structural Framing subcategories	Displays a plan view showing the analytical model for Level 01, and its load combinations
02_LoadDiagram_ALL_ANL	Columns, Detail Items, Mass, Parts, Ramps, Raster Images, Roofs, Stairs, Structural Framing subcategories	Displays a plan view of the analytical model for Level 02 and its load combinations
03_RoofLoadDiagram_All_ANL	Columns, Detail Items, Mass, Parts, Ramps, Raster Images, Roofs, Stairs, Structural Framing subcategories	Displays a plan view of the analytical model for the roof level and its load combinations
3D Views:		
Dead Loads Visible	Columns, Detail Items, Mass, Parts, Ramps, Raster Images, Roofs, Stairs, Structural Framing subcategories	Displays a 3D view of the analytical model with dead load combinations visible
Live Loads Visible	Columns, Detail Items, Mass, Parts, Ramps, Raster Images, Roofs, Stairs, Structural Framing subcategories	Displays a 3D view of the analytical model with live load combinations visible
Loads NOT Visible	Columns, Detail Items, Mass, Parts, Ramps, Raster Images, Roofs, Stairs, Structural Framing subcategories	Displays a 3D view of the analytical model with no load combinations visible
Snow Loads Visible	Columns, Detail Items, Mass, Parts, Ramps, Raster Images, Roofs, Stairs, Structural Framing subcategories	Displays a 3D view of the analytical model with snow load combinations visible
Wind Loads Visible	Columns, Detail Items, Mass, Parts, Ramps, Raster Images, Roofs, Stairs, Structural Framing subcategories	To display a 3D view that displays the analytical model with wind load combinations visible

Further structural settings have been included in the template and can be accessed under the analyze tab:

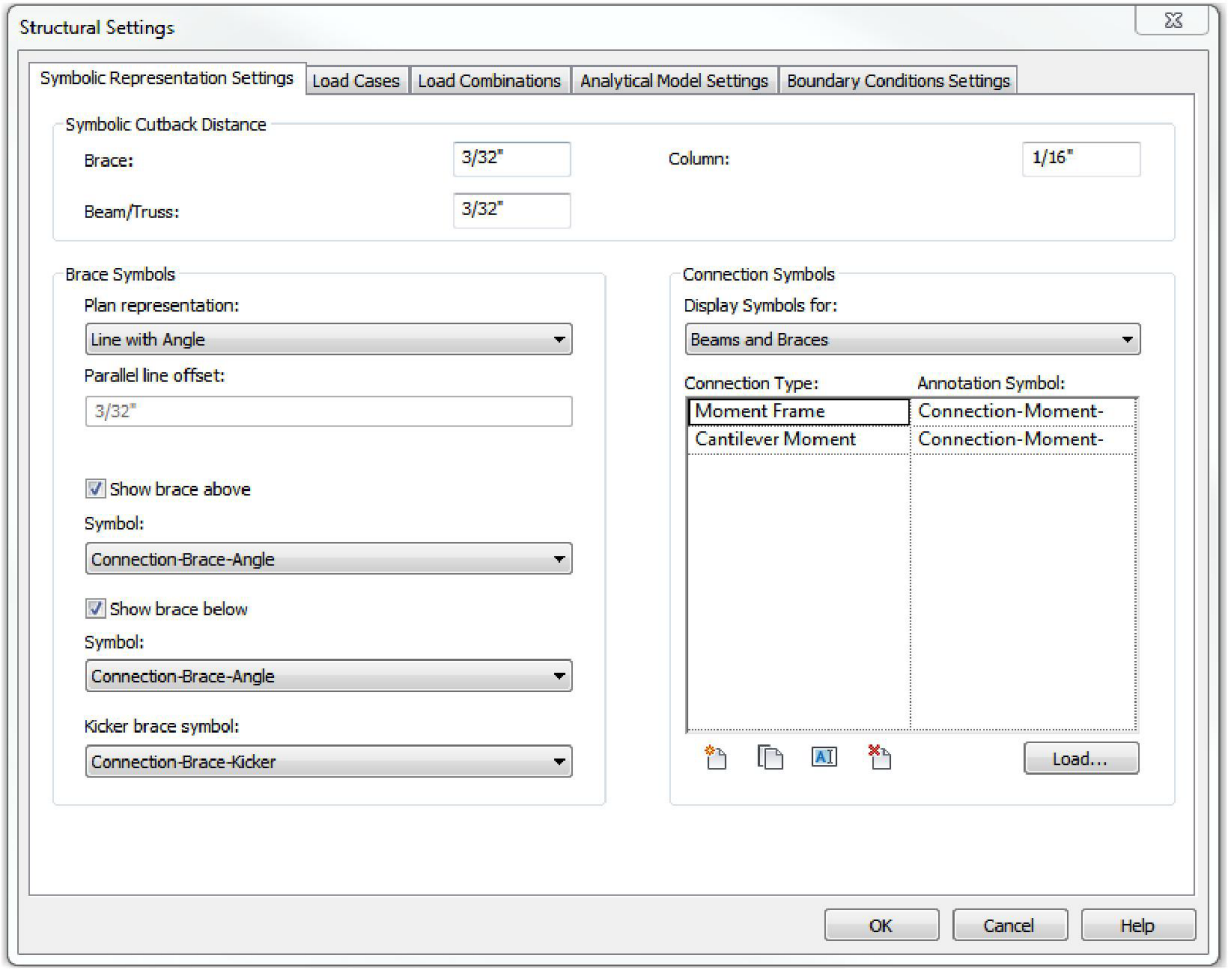


Figure 9-2: Revit Structural Settings dialog

9.9. View Template Settings

Typical view templates have been created to provide a consistent modeling visibility environment for certain types of views. These templates control view scales, phase filters, visibility, view purposes, analytical and import overrides, model display, and view ranges.

Table 9-6: View Template Settings [Structural]

View Type Classification	View Type Name	Purpose
Elevations	Std_Coordination – Elevation	This template is used for the coordination of an elevation with another linked model
Plans	Std_Documentation – Foundation	This template is used for the documentation views for the foundation plan
Plans	Std_Documentation – Framing	This template is used for the framing plans on documentation framing views
Analytical Views	Std_Structural Analytical Normal	This template can be applied to view only the analytical stick view of model
Analytical Views	Std_Structural Analytical Stick	This template can be applied to view only the analytical stick view of model
Elevations	Std_Structural Building Elevation	This template can be applied to a structural building elevation view
Plan	Std_Structural Foundation Plan	This template can be applied to a working foundation view
Elevations	Std_Structural Framing Elevation	This template can be applied to a working framing elevation
Plan	Std_Structural Framing Plan	This template can be applied for a working framing plan
Sections	Std_Structural Sections	This template can be applied for a working section view

9.10. Structural Schedules

As seen in the template, there are many structural schedules that can be used, but that doesn't mean they will all be used. Many might not be needed and whether it will be needed depends on the project and type of design.

If it is determined that a schedule will not be needed, then it may be deleted to help eliminate unneeded schedules in the browser. Any schedule name that is capitalized indicates it is a document schedule and is to be added to a sheet. Any working schedules preceded by a 'Z' indicates it's a working schedule and never to be added to a sheet.

Table 9-7: List of Document Schedules in the Template [Structural]			
Schedule	**Fields**	**Heading**	**Filter Rules**
COLUMN SCHEDULE	Family and Type Assembly Description Level Offset Elevation at Bottom Type Width Length Thickness Reinforcing A Bar Qty Reinforcing A Bar Size Reinforcing B Bar Qty Reinforcing B Bar Size Type Comments Volume Reinforcing Quantity	Mark Dimensions– Width, Length, Depth Reinforcing – A Bars (Qty and Size) B Bars (Qty and Size) Remarks:	Assembly Description - Equals (Spread Footings)
CONCRETE BEAM SCHEDULE	Family and Type Assembly Description Reference Level Z-Direction Offset Value Start Level Offset Type Concrete Beam Width Concrete Beam Depth Reinforcing A Bar Qty Reinforcing A Bar Size Reinforcing B Bar Qty Reinforcing B Bar Size Reinforcing C Bar Qty Reinforcing C Bar Size Reinforcing D Bar Qty Reinforcing D Bar Size Reinforcing E Bar Qty Reinforcing E Bar Size Reinforcing Stirrup Size Reinforcing Stirrup Spacing Reinforcing Type Type Comments Length Volume Longitudinal Qty PLF Quantity Longitudinal Stirrup Qty EACH	Mark Dimensions – Width, Depth Reinforcing – A – Bars-Qty, Size B – Bars-Qty, Size C – Bars-Qty, Size D – Bars-Qty, Size E– Bars-Qty, Size Stirrups – Size, Spacing, Type Remarks:	Assembly Description = Beams CIP

Table 9-7: List of Document Schedules in the Template [Structural]			
Schedule	**Fields**	**Heading**	**Filter Rules**
	Quantity Stirrups		
DRILLED PIER SCHEDULE	Family Assembly Description Type Shaft Diameter Bell Diameter Bell Height Longitudinal Qty Longitudinal Size Transverse Size Transverse Spacing Volume Offset Shaft Length Elevation at Bottom	Mark Dimensions – Shaft Diameter, Bell Diameter Bell Height Reinforcing– Longitudinal Qty Longitudinal Size Ties – Size, Spacing	Assembly Description = Caissons
FLOOR FRAMING PLAN NOTES	Note Number Description Usage	Number Description	Usage = Framing Floor
FOUNDATION PLAN NOTES	Note Number Description Usage	Number Description	Usage = Foundation
GRADE BEAM SCHEDULE	Family and Type Assembly Description Reference Level Z-Direction Offset Value Start Level Offset Type Concrete Beam Width Concrete Beam Depth Reinforcing A Bar Qty Reinforcing A Bar Size Reinforcing B Bar Qty Reinforcing B Bar Size Reinforcing C Bar Qty Reinforcing C Bar Size Reinforcing D Bar Qty Reinforcing D Bar Size Reinforcing E Bar Qty Reinforcing E Bar Size Reinforcing Stirrup Size Reinforcing Stirrup Spacing Reinforcing Type Type Comments Length	Mark Dimensions – Width, Depth Reinforcing A – Bars-Qty, Size B – Bars-Qty, Size C – Bars-Qty, Size D – Bars-Qty, Size E – Bars-Qty, Size Stirrups – Size, Spacing, Type Remarks:	Assembly Description = Grade Beams - CIP

Table 9-7: List of Document Schedules in the Template [Structural]			
Schedule	**Fields**	**Heading**	**Filter Rules**
	Volume Longitudinal Qty PLF Quantity Longitudinal Stirrup Qty EACH Quantity Stirrups		
INDEX OF DRAWINGS - Structural	Sheet Number Sheet Name Sheet Issue Date Drawn By Designed By Checked By Approved By	Sheet Number Sheet Name	
PILE CAP SCHEDULE	Family Assembly Description Level Offset Type Thickness Reinforcing A Bar Qty Reinforcing A Bar Size Reinforcing B Bar Qty Reinforcing B Bar Size Pile Type Pile Length Pile Capacity Compression Pile Capacity Tension Pile Capacity Lateral Count Number of Piles Volume Reinforcing Quantity	Mark Depth Reinforcing – A Bars – Qty, Size B Bars – Qty, Size Pile Properties– Type Length Capacity – Compression, Tension, Lateral	Assembly Description = Pile Caps

Table 9-7: List of Document Schedules in the Template [Structural]			
Schedule	**Fields**	**Heading**	**Filter Rules**
RECTANGULAR CONCRETE COLUMN SCHEDULE	Family Assembly Description Base Level Base Offset Top Level Top Offset Type Concrete Column Width Concrete Column Depth Longitudinal Qty Longitudinal Size Stirrup Qty EACH Quantity Ties	Mark Dimension – Width, Depth Reinforcing – Longitudinal, Qty, Size Ties – Size, Spacing Remarks	Assembly Description = Columns - CIP
REVIEW COMMENTS	Comment Number Reviewer Date Comment Status	Comment Number Reviewer Date Comment Status	
ROUND CONCRETE COLUMN SCHEDULE	Usage Family Assembly Description Base Level Base Offset Top Level Top Offset Type Concrete Column Diameter Longitudinal Qty Longitudinal Size Reinforcing Tie Size Reinforcing Tie Spacing Type Comments Length Volume Longitudinal Qty PLF	Mark Diameter Reinforcing – Longitudinal, Qty, Size Ties - Qty, Size Remarks:	Assembly Description = Columns - CIP

Table 9-7: List of Document Schedules in the Template [Structural]			
Schedule	**Fields**	**Heading**	**Filter Rules**
WALL FOOTING SCHEDULE	Family Assembly Description Description Structural Usage Type Width Foundation Thickness Longitudinal Qty Longitudinal Size Transverse Size Transverse Spacing Comments Elevation at Bottom Volume	Mark Dimensions – Width, Depth Reinforcing – Longitudinal, Qty, Size Transverse, Size, Space Notes:	Assembly Description = Strip Footings And Description does not = Stepped Footing And Structural Usage does not = Retaining

9.11. Custom Structural Families

Additional structural families have been included in the SI Structural Template. These families were created in conjunction with structural designers, technicians, and 3rd party consultants. The below list is intended to be a guide to determine what additional families have been loaded in the template, separate from what is included by Autodesk OTB (out of the box) structural families. There is a brief description of the family. Any families that have been modified or created as new includes: '_Std' at the end of the family name.

Table 9-8: List of Custom Structural Families [Structural]	
Name of Family	**Description**
Anchor Bolts-Side w-Nut and Thread Only_Std	Parametric 2D family for detailing anchor bolts and nuts. Parameters Include Washer Height, Bolt Length, Head Height, Head Width, Diameter, and Embedment.
Concrete Grade Beam_Std	Parametric 3D family for concrete grade beam. Parameters include Stirrup Types, Rebar Sizes and Quantities, Widths, Depths, etc.
Concrete-Rectangular Beam_Std	Parametric 3D family for concrete beam. Parameters include Stirrup Types, Rebar Sizes and Quantities, Widths, Depths, etc.
Concrete-Rectangular-Column_Std	Parametric 3D family for square concrete column. Parameters include Stirrup Types, Rebar Sizes and Quantities, Widths, Depths, etc.
Concrete-Round-Column_Std	Parametric 3D family for round concrete column. Parameters include Stirrup types, Rebar Sizes and Quantities, Diameters, etc.
Drilled Pier Cap-Rectangular_Std	Parametric 3D family to add additional CAP to a drilled pier. Parameters include Width, Length, and Thickness.

Table 9-8: List of Custom Structural Families [Structural]	
Name of Family	**Description**
Footing-Rectangular-(2000PSF)_Std	Parametric 3D family for footing that requires 2000 PSF. Parameters include Rebar Sizes and Quantities, Widths, Lengths and Depths.
Masonry Bond Beam Unit_Std	Parametric 3D family for a masonry block that includes bonding element. Parameters include Mortar Visibility, Core Visibility, Joint Thickness, Height, Length, and Depth.
Masonry CMU Grouted_Std	Parametric 3D family for grouted CMU block. Parameters include Mortar Visibility, Core Visibility, Joint Thickness, Height, Length, and Depth.
Masonry CMU UnGrouted_Std	Parametric 3D family for un-grouted CMU block. Parameters include Mortar Visibility, Core Visibility, Joint Thickness, Height, Length, and Depth.
Masonry Lintel Units_Std	Parametric 3D family for lintel unit. Can adjust Web Dimensions, Height, Thickness, and Length.
Masonry Mortar-Section_Std	Parametric 2D family for only the mortar as part of a CMU wall. Parameters to adjust Length and Thickness and Hatch Display.
Metal Floor Deck-Composite_Std	2D family for one rib of composite floor decking.
Metal Floor Deck-Non- Composite_Std.rfa	2D family for one rib of non-composite floor decking. 100 mm (4") length.
Metal Floor Deck-Non-Composite (9-16)_Std.rfa	2D family for one rib of non-composite floor decking. 50 mm (2") length.
Metal Roof Deck_Std.rfa	Parametric 2D family for one rib of a metal roof deck. Parameters include Cell Width and Depth.
Pile Cap-P-1 (with Piles)_Std.rfa	Parametric 3D family for one pre-cast concrete piles with cap. Parameters include Pile Tension, Lateral and Compression, Materials, Reinforcing Bar Size and Quantity, Widths, Lengths, Thickness and Embedment.
Pile Cap-P-2 (with Piles)_Std.rfa	Parametric 3D family for two precast concrete piles with cap. Parameters include Pile Tension, Lateral and Compression, Materials, Reinforcing Bar Size and Quantity, Widths, Lengths, Thickness and Embedment.
Pile Cap-P-3 (with Piles)_Std.rfa	Parametric 3D family for three precast concrete piles with cap. Parameters include Pile Tension, Lateral and Compression, Materials, Reinforcing Bar Size and Quantity, Widths, Lengths, Thickness, Embedment.
Pile Cap-P-4 (with Piles)_Std.rfa	Parametric 3d family for four precast concrete piles with cap. Parameters include Pile Tension, Lateral and Compression, Materials, Reinforcing Bar Size and Quantity, Widths, Lengths, Thickness, Embedment.

Table 9-8: List of Custom Structural Families [Structural]	
Name of Family	**Description**
Pile Cap-P-5 (with Piles)_Std.rfa	Parametric 3D family for five precast concrete piles with cap. Parameters include Pile Tension, Lateral and Compression, Materials, Reinforcing Bar Size and Quantity, Widths, Lengths, Thickness, Embedment.
Pile Cap-P-6 (with Piles)_Std.rfa	Parametric 3D family for six precast concrete piles with cap. Parameters include Pile Tension, Lateral and Compression, Materials, Reinforcing Bar Size and Quantity, Widths, Lengths, Thickness, Embedment.
Pile Cap-P-12 (with Piles)_Std.rfa	Parametric 3D family for 12 precast concrete piles with cap. Parameters include Pile Tension, Lateral and Compression, Materials, Reinforcing Bar Size and Quantity, Widths, Lengths, Thickness, Embedment.
Pile-Drilled Pier with Bell_Std.rfa	Parametric 3D family for one pile with enlarged bearing base capacity (bell). Parameters include Shaft Width, Length, Diameter, and Bell Diameter and Heights.
Pile-Drilled Pier without Bell _Std.rfa	Parametric 3D family for one pile with no bell or cap. Parameters include Width, Length, and Diameter.
Reinf Bar Bend 3-8 - 90 Degrees Each End_Std.rfa	Parametric 2D family for Rebar with 3-8 bend w/90 degree ends. Parameters include Bar Diameter, Length, and Height of both ends
Reinf Bar Bend 3-8_Std.rfa	Parametric 2D family for Rebar with 3-8 bends w/ (1) 90 degree end. Parameters include Bar Diameter, Length, and Height.
Reinf Bar Bend 9-11_Std.rfa	Parametric 2D family for Rebar with 9-11 bends w/ (1) 90 degree end. Parameters include Bar Diameter, Length, and Height.
Reinf Bar Elevation - with 180-degree Hooks_Std.rfa	Parametric 2D family for Rebar with 180 degree hooks at each end. Parameters include Bar Diameter, Length, and Outside/Inside Bend Radius.
Reinf Bar Elevation_Std.rfa	Parametric 2D family for elevation for one piece of rebar. Parameters include Length and Rebar Size.
Reinf Bar Stirrup Edge_Std.rfa	Parametric 2D family for a stirrup edge. Parameters include Length and Rebar Size.
Reinforcing Bar Section_Std.rfa	Parametric 2D family for a section cut of rebar. Parameter is Radius of Rebar.
Reinforcing Bend Type S3_Std.rfa	Parametric 2D family for fabricated rebar standard S3. Parameters include Bend Radius, Extension Length, Diameter, Stirrup Depth and Width.
Reinforcing Bend Type T1_Std.rfa	Parametric 2D family for fabricated rebar standard T1. Parameters include Bend Radius, Extension Length, Diameter, Stirrup Depth and Width.

Table 9-8: List of Custom Structural Families [Structural]	
Name of Family	**Description**
Reinforcing Bend Type T2_Std.rfa	Parametric 2D family for fabricated rebar standard T2. Parameters include Bend Radius, Extension Length, Diameter, Stirrup Depth and Width.
Reinforcing Bend Type T3_Std.rfa	Parametric 2D family for fabricated rebar standard T3. Parameters include Bend Radius, Extension Length, Diameter, Stirrup Depth and Width.
Reinforcing Bend Type T6_Std.rfa	Parametric 2D family for fabricated rebar standard T6. Parameters include Bend Radius, Extension Length, Diameter, Stirrup Depth and Width.
Reinforcing Bend Type T9_Std.rfa	Parametric 2D family for fabricated rebar standard T9. Parameters include Bend Radius, Extension Length, Diameter, Stirrup Depth and Width.
Slab Edge-Thickened_Std.rfa	Profile family that provides for thickened slab edge.
Reinforcing Concrete Beam Stirrup_Std.rfa	Parametric 2D family for stirrup tie used in a concrete beam. Parameters include Top Bar Location, Diameter, Stirrup Width, Depth, Diameter, Bottom Bar Location, and Diameter.
Reinforcing Stirrup Tie_Std.rfa	Parametric 2D family for reinforcing stirrup tie. Parameter includes Tie Length.
Steel Base Plate-Side-Length wo-Holes_Std.rfa	Parametric 2D family for a steel shear plate from a side view which does not display holes. Parameters include Width, Length, Thickness, Hole Spacing and Diameter (hole spacing and diameter do not display as they are a side view only).
Steel Shear Plate-Face_Std.rfa	Parametric 2D family for a steel shear plate face that has bolts. Parameters include Number of Holes, Visibility of Bolts, Thickness, Length, Width, and Hole Diameter.
Stepped Footing - Sloped Bottom_Std.rfa	Parametric 3D family for a stepped footing design with sloped bottom. Parameters include Width, Step Run, Step Rise, Length, and Footing Depth.
Stepped Footing - Stepped Bottom_Std.rfa	Parametric 3D family for stepped footing design with a stepped bottom. Parameters include Width, Step Run, Step Rise, Length, and Footing Depth.
Structural Beam System Tag_Std.rfa	Tag for a structural beam system with line and arrow beam type and a parameter to offset text from center of arrow line.
Structural Column Tag-45_Std.rfa	Tag for structural columns which includes the Type Name as a label to display the member type following NCS5 and allows for a 45 degree angle to tag.
Structural Column Tag_Std.rfa	Tag for structural columns which include the Type Name as a label to display the member type following NCS v5.

Table 9-8: List of Custom Structural Families [Structural]	
Name of Family	**Description**
Structural Foundation Tag_Std.rfa	Tag for structural foundations which include the Type Name as a label to display the member type following NCSv 5.
Structural Framing Tag-End Reactions_Std.rfa	Tag for structural framing for analytical model to display the end reaction forces of a member that only includes the total kips.
Structural Framing Tag-Joist Girder_Std.rfa	Tag for structural framing that does not include a box and displays the Depth, Girder type, Space number, and point load.
Structural Framing Tag-Start Reactions_Std.rfa	Tag for Structural Framing for analytical model to display the start reaction forces of member that only includes the total kips.
Structural Framing Tag_PRELIMINARY SIZE_Std.rfa	Default tag on placement of member. This tag has been colored and given two ** to indicate just a placeholder for the member and indicates that it might not meet requirements for type and size and still needs further engineering. After the member size and type has been engineered, then the tag can be changed to Structural Framing Tag_Std.rfa.
Structural Framing Tag_Std.rfa	Tag for Structural Framing Tag which is compliant with AEC CAD Standards.
Structural Truss Tag_Std.rfa	Tag for Structural Truss Tag which is compliant with AEC CAD Standards.
Thickened Slab_Std.rfa	Profile family that allows for Thickened Slab Edge. Duplicate Slab Edge-Thickened. Can be deleted in a future release.
Welded Wire Fabric_Std.rfa	2D family for displaying Welded Wire Fabric following AEC CAD Standards.

9.12. Detail Component Palette

Part of the detail component palette is shown below, and the purpose of this palette is to aid the structural engineer and technician to add common components together in a created Palette (a Revit Drafting View). During additional detailing of the model, it is suggested to have the Palette open and to copy and paste these components from the Palette over to the view that you are detailing.

Shown below is a component Palette (on left) and view of footing (on right). Both connections were copied and pasted from the component Palette on left and pasted specifically to that detailed view of the connection. Additional common components used at A/E's firm can be copied into the project Palette for ease of detailing.

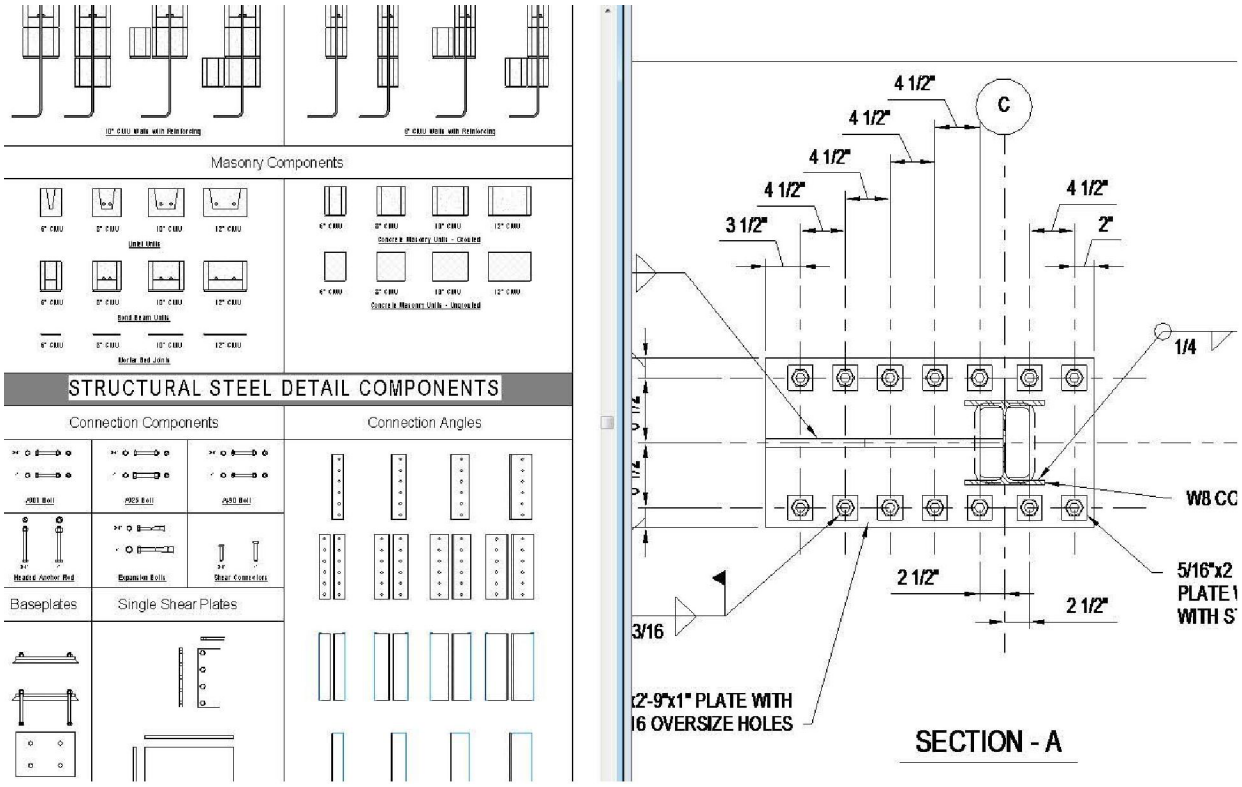


Figure 9-3: Partial Component Palette (left) and View of the Footing (right) from Revit

APPENDICES

Appendix A: Customized OPDC Revit Parameters

Table A-1: SI Parameter Fields for Spaces and ACM in Revit Models			
Revit Field/Parameter	**Description**	**Parameter Type**	**Data Input Type**
Level	Floor of the building	Revit default	Automatic
Number	Room number	Revit default	Manual
SI_RoomLinkID	Key identifier for SI space database	Custom	Manual
Name	Room name	Revit default	Manual
Area (Area_Ft-In)	Area of room (in square feet)	Revit default	Automatic
Area_MM2	Area of room (in square millimeters)	Calculated	Automatic
Perimeter (Perimeter_Ft-In)	Perimeter of room (in feet-inches)	Revit default	Automatic
Perimeter_MM	Perimeter of room (in millimeters)	Calculated	Automatic
Volume (Volume_Cu-Ft)	Room volume (in cubic feet)	Revit default	Automatic
Limit Offset (Height_Ft)	Room height (in feet-inches)	Revit default	Automatic
Department	Room type	Revit default	Manual
Occupancy	Number of people in the room	Revit default	Manual
Occupant	Occupants name	Revit default	Manual
Comments	Additional notes	Revit default	Manual
ACM_HAZ_ID		Custom	Manual
ACM_MAT_TYPE		Custom	Manual
ACM_CHANGE		Custom	Manual
ACM_MAT_COND		Custom	Manual
ACM_COMMENTS		Custom	Manual
ACM_STATUS		Custom	Manual
Room_Occupancy_Hazard	Code Occupancy Type	Custom	Manual
Public / Non-Public / Public View	Public Access Type	Custom	Manual
Occupant Load Factor	Occupant Load Factor by Code	Custom	Manual
Occupant Load	Occupant Load by Code	Custom	Manual

Table A-2: SI Spatial Data Fields for Floors in Revit Models			
Revit Field/Parameter	**Description**	**Parameter Type**	**Data Input Type**
Level	Floor of the building	Revit default	Automatic
Number	Floor number	Revit default	Manual
SI_FloorLinkID	Key identifier for SI floor database	Custom	Manual
Name	Floor name	Revit default	Manual
Area (Area_Ft-In)	Area of floor (in square feet)	Revit default	Automatic

Area_MM2	Area of floor (in square millimeters)	Calculated	Automatic
Perimeter (Perimeter_Ft-In)	Perimeter of floor (in feet-inches)	Revit default	Automatic
Perimeter_MM	Perimeter of floor (in millimeters)	Calculated	Automatic
BaseElevation_Ft-In	Floor elevation (in feet-inches)	Custom	Manual
Comments	Additional Notes	Revit default	Manual

Appendix B: OPDC Revit Asset Parameter MEP

Table A-3: OPDC Revit Asset Parameters [MEP]					
Information Type	Field / Parameter	Description	Example	Revit Custom Parameter	Data format
General Asset Information	Asset ID	Unique identifying number	(assigned in Facility Center)	SI_AssetID	Text
	Asset Name	Commonly known name of the component	Storm Water Pump (Chiller Plant)	SI_AssetName	Text
	Specification ID	2016 CSI/MasterFormat code (select from a picklist)	22 11 23 Pump-water	SI_SpecID	Text
	Brand	Brand name	General Electric	SI_Brand	Text
	Description	Description of the item	Pump, Circulating	SI_Description	Text
Asset Location Information (Default Revit Parameters)	Floor	Level on which the asset is located	First Floor	Room: Level (Floor)	Text
	Room Number	Room in which the asset is located	101A	Room: Number (Room Number)	Text

Schedules can be exported to a delimited text file, which can be opened in a spreadsheet programs, such as MS Excel. If the schedule is to be exported to CAD, it should be added to a drawing sheet view and exported to a DWG format file. See section 2.4.1 for instructions on how to export a schedule from Revit as a delimited text file, and the process to import a delimited text file into Excel.

Appendix C: References

National CAD Standard Version 5.0 http://www.nationalcadstandard.org/ncs5/

National BIM Standard-US Version 2 http://www.nationalbimstandard.org/references.php

USACE CAD and BIM Drawing Standards https://cadbim.usace.army.mil/BIM

Autodesk Revit Help Wiki http://help.autodesk.com/view/RVT/2014/ENU/

Autodesk Model Performance Technical Note White Paper
http://images.autodesk.com/adsk/files/autodesk_revit_2014_model_performance_technical_note.pdf

Construction Industry Institute https://www.construction-institute.org/scriptcontent/more/res_cpf_2010_2_v2_more.cfm

Pennsylvania State Computer Integrated Construction http://bim.psu.edu/