Preparing the Project for Performing an Energy Analysis

Heating and cooling loads analysis determines the heating and cooling demands of the building model. After spaces have been placed in all areas of the building model and zones have been created, and you have prepared the project for heating and cooling loads analysis, you can perform heating and cooling loads analysis using the following methods:

- Use the **integrated tool** within Revit MEP to calculate loads and create a report.
- Export the project information to create a gbXML (Green Building eXtensible Markup Language file). This method opens the Export gbXML dialog, which provides the same tools as those found in the Heating and Cooling Loads dialog, except that instead of calculating loads and producing a report, it allows exporting the heating and cooling information to a gbXML file.

The gbXML file contains all of the heating and cooling information including spaces and zones for a project. You can then import the gbXML file to a third-party load analysis software application that will perform a heating and cooling loads analysis.

The gbXML open schema was created to help building designers get information about the energy consumption characteristics of their building projects.

In order to perform an energy analysis, you must specify the project location, building type, building service, building construction, space types, space groupings by heating and cooling zone, design set points for heating and cooling, fresh air requirements, etc.

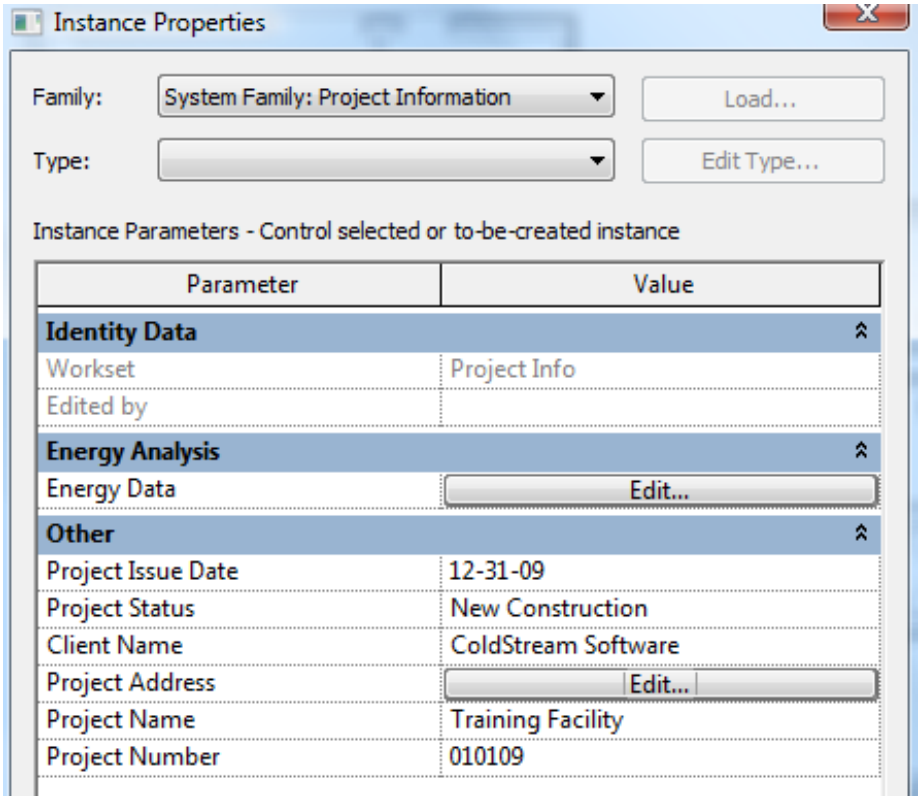
In this exercise, we will perform the following tasks:

- Set Project Information
- Specify energy data for our project
- Specify space parameters for energy analysis
- Specify space and area settings
- Define space components for energy analysis

Setting Project Information

1. Select the Manage Tab -> Project Settings Panel -> Project Information. Set the Instance Parameter values in the Project Information in accordance with the following example:

Note that some of the information you enter in the data fields in this dialog will be used to fill in tag fields in the Titleblock Sheets in a later exercise.



Click on the Edit Value button for the Energy Analysis Energy Data Parameter. You will be setting energy data for the integral tools to determine the heating and cooling loads for the project and you will be setting energy data for gbXML export.

gbXML settings specify the parameter values used by third-party software applications when calculating energy use. The following parameters must be specified prior to exporting the building model to a gbXML file for use with an energy analysis application or performing heating and cooling loads analysis:

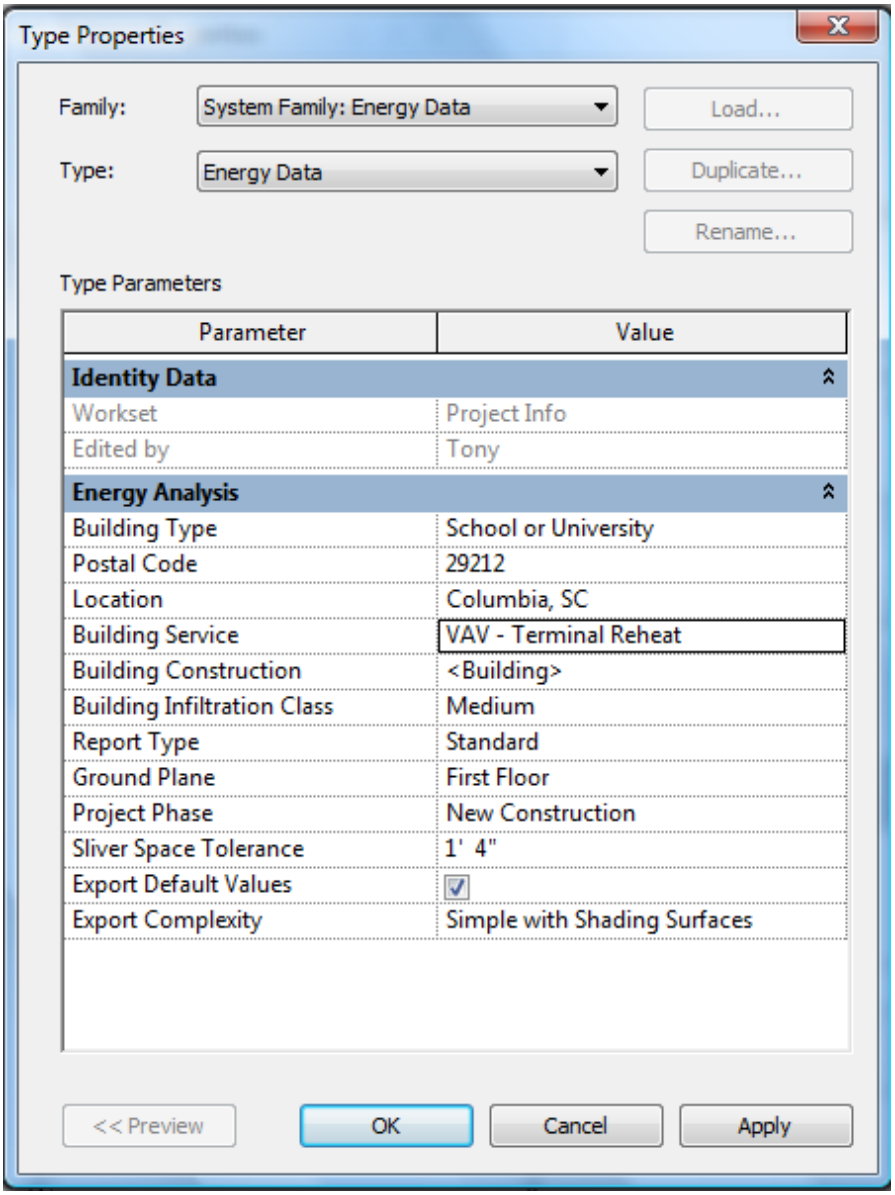
- Building Type - specifies the type of building according to the gbXML schema 0.37 (similar to ASHRAE).
- Postal Code - determinates the location of the building.
- Location - identifies the city, and longitude and latitude for the building.
- Building Service - specifies the heating and cooling systems for the building.
- Building Construction - specifies the type of construction, which determines the materials and insulation (U-values) for the building.
- *Building Infiltration Class*: Specifies an estimate of outdoor air that enters the building through leaks in the building envelope. **Note that Infiltration is used by the integral tool but is not exported to gbXML**. Infiltration can be specified as:
    - Loose - 0.076 cfm/sqft for tightly constructed walls.
    - Medium - 0.038 cfm/sqft for tightly constructed walls.
    - Tight - 0.019 cfm/sqft for tightly constructed walls.

    - None - infiltration is excluded from the calculation of loads.
- Report Type: Specifies the level of information provided in the heating and cooling loads report. You can specify Simple, Standard, or Detailed for Report Type.
- Ground Plane - specifies the level that serves as the ground level reference for the building. Surfaces below this level are considered to be underground. The default level is zero.

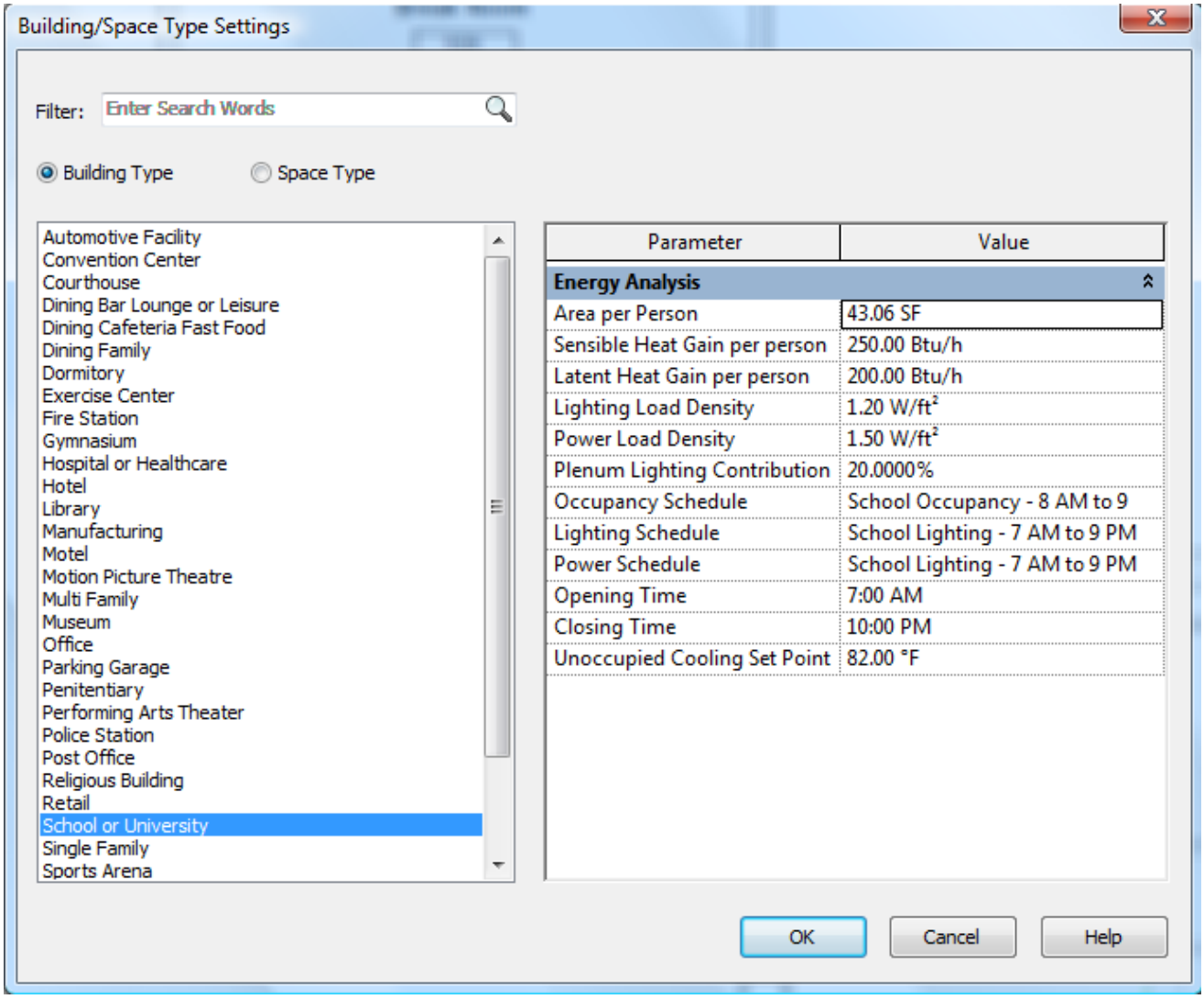
  Note: Ground plane does not affect the integral tool Heating and Cooling Loads calculations. It is used with gbXML export.

- Project Phase - specifies the stage of construction (Existing, New Construction).
- Sliver Space Tolerance - specifies the tolerance for areas that will be considered sliver spaces..
- Export Default Values - determines whether certain default values will be exported. When checked, the default values for People and Electrical Loads, Occupancy, Lighting, and Power Schedules, and building/space type Construction Types are exported together with all user specified values. When cleared, only user-specified values are exported. Only used with Export gbXML.
- Export Complexity - specifies the level of detail provided for openings, and whether shading surface information is exported. Shading surfaces are surfaces that are not adjacent to any space, and include surfaces that create a solar obstruction. Only used with Export gbXML. Simple complexity is used for heating and cooling loads analysis.
    - Simple - curtain walls and curtain systems are exported as a single opening (without individual panels). Simple is more appropriate for energy analysis.
    - Simple with shading surfaces - same as simple, but with shading surface information exported.
    - Complex - curtain walls and curtain systems are exported as multiple openings, panel by panel.
    - Complex with shading surfaces - same as complex, but with shading surface information exported.
    - Shading surfaces are not associated with any room/space (roof overhang, free-standing wall).
    - Complex with mullions and shading surfaces - same as complex, but with mullion and shading surface information exported.
    - Mullions in curtain walls are exported as shading surfaces. A simple analytical shading surface is produced from mullions, based on the centerline, thickness, and offset.

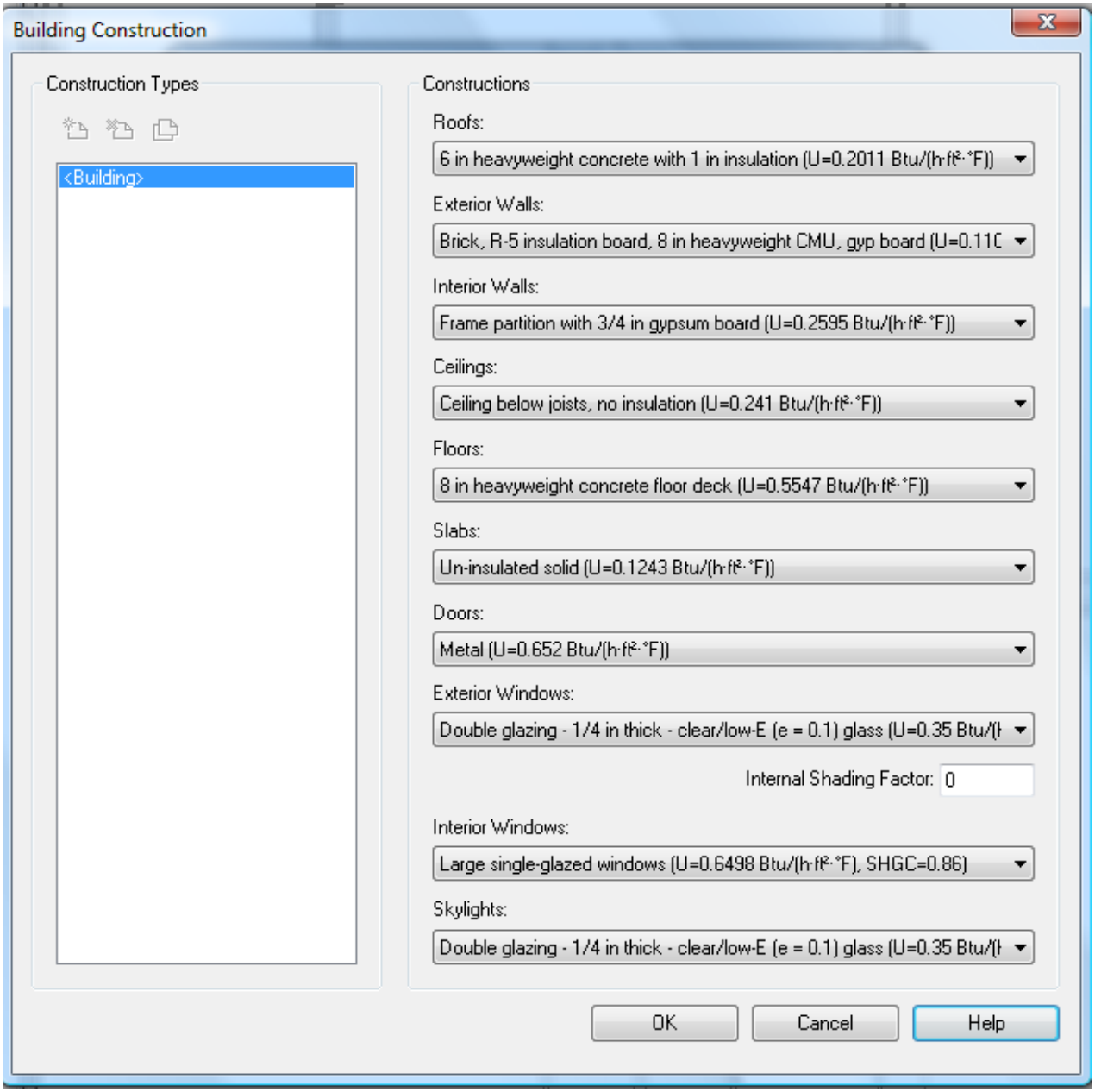
Set the Energy Data Type Properties in accordance with the following example:



Note that setting the Building Type to School or University creates a default set of energy analysis data for each space in accordance with the following dialog which can be accessed by clicking on the Manage Tab -> Project Settings Panel –> MEP Settings -> Building/Space Type Settings.



2. In a later exercise, each individual space will be adjusted based on type of occupancy, usage, and occupancy schedules.
3. Click on the Building Construction <Building> Value in the Type Properties dialog for Project Data and set the values for Building Construction in accordance with the following illustration:



The following settings (from the dialog) are provided for clarity:

Roof: 6 in. heavyweight concrete with 1 in insulation (U=0.2011 Btu/(h-ft² °F)

Exterior Walls: Brick, R-5 Insulation Board, 8 in. heavyweight CMU, gyp board (U=0.1106 Btu/(h-ft² °F)

Exterior Windows: Double-glazed – ¼ in thick – clear/lowE (e=0.2) glass (U=0.35 Btu/(h-ft² °F), SHGC=0.39)

Skylights: Double-glazed – ¼ in thick – clear/lowE (e=0.2) glass (U=0.35 Btu/(h-ft² °F), SHGC=0.39)

4. From the Collaborate Tab -> Synchronize Panel -> Synchronize With Central Drop-down, select Synchronize and Modify Settings.
5. Select to Compact the Central File, relinquish any worksets that are not greyed out, and Save the local file before and after Synchronization with central.

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Zones and Spaces

Zones and spaces are independent components but are used together to achieve a common result. Spaces contain information about the areas that they have been placed in. This space information is used to calculate the volume of the area and to help determine heating and cooling loads.

Zones consist of one or more spaces that are controlled by equipment that maintain a common environment (temperature, humidity, and so on). Each zone contains zone information, such as heating and cooling temperature and outside air load. An effective energy analysis can only be accomplished if

- All the spaces in your model are defined by space components in the building model.
- The entire volume of the building model is included in load calculations.

For Revit MEP, spaces that are not typically considered as rooms in an architectural model must be assigned space components. This includes spaces such as attic spaces and the spaces between a ceiling and the floor above. The spaces in the building model should be defined to the center line of bounding walls and from floor height to floor height, so that there are no gaps between the spaces in a building. You can examine a shaded 3D analytical model in the Heating and Cooling Loads Dialog to detect gaps. However, when you find gaps in the analytical model, you must adjust the space properties to correct the volume.

Computing Space Volumes

1. Click Architect Tab -> Room & Area Panel -> Click down on drop-down arrow in the Panel next to Room & Area.
2. Select Area and Volume Computations. An Area and Volume Computations dialog will display.

Make sure that the radio button for Areas and Volumes is turned on. *NOTE: The calculations performed to compute space volumes can adversely affect Revit MEP performance. You should clear this parameter when not preparing for energy analysis.*

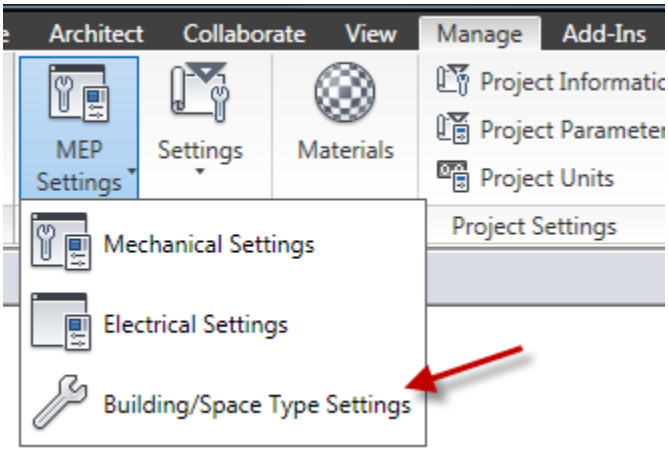
3. Make sure that Room Area Computations are taken “At Wall Center”.
4. Select OK.

Specify Individual Space Parameters For Energy Analysis

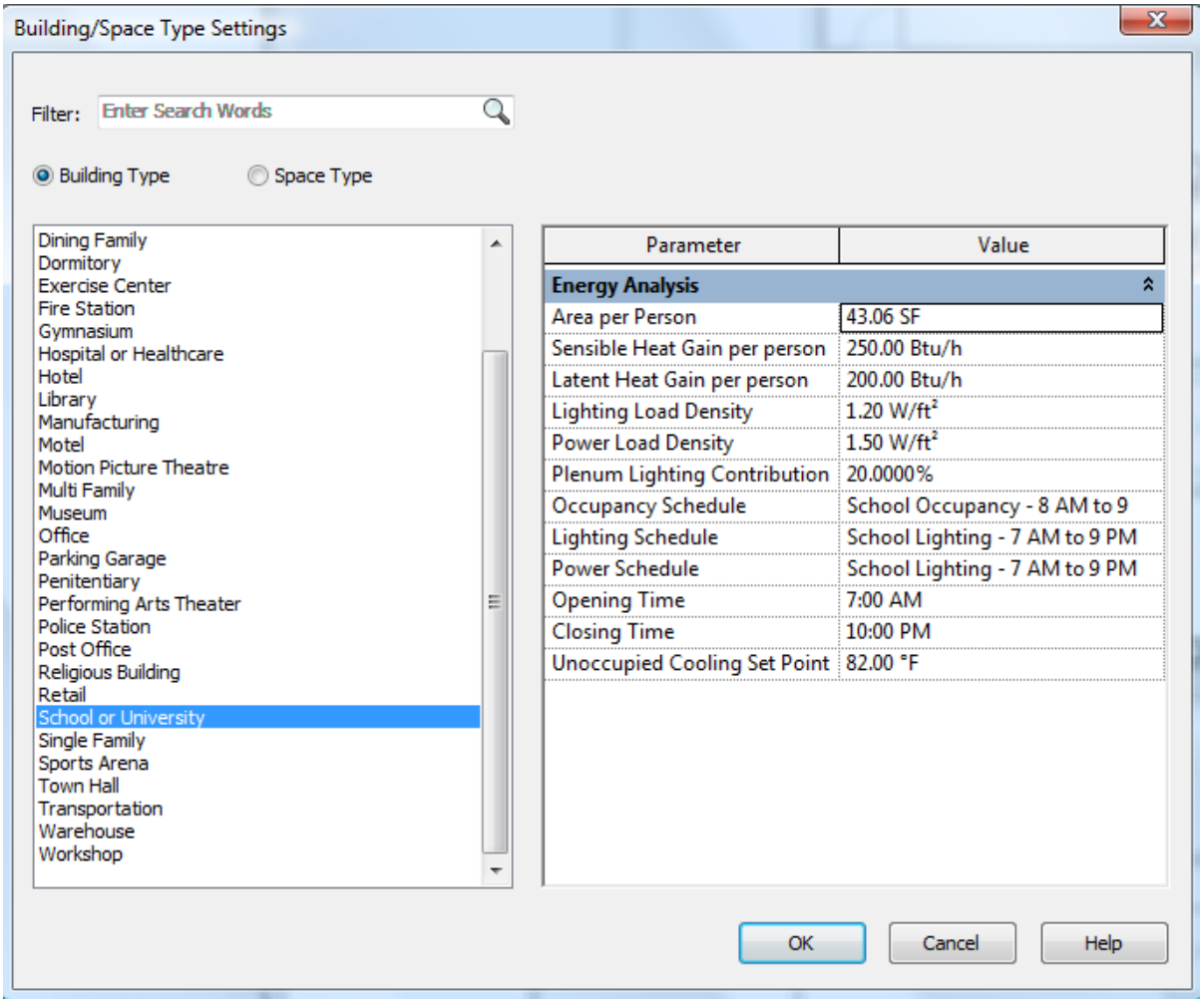
Revit MEP 2010 provides tools for controlling the settings for individual space parameters such as number of people, lighting loads, etc.

Building/Space Type Settings

1. Select the Manage Tab -> Project Settings Frame -> MEP Settings drop-down -> Building/Space Type Settings.



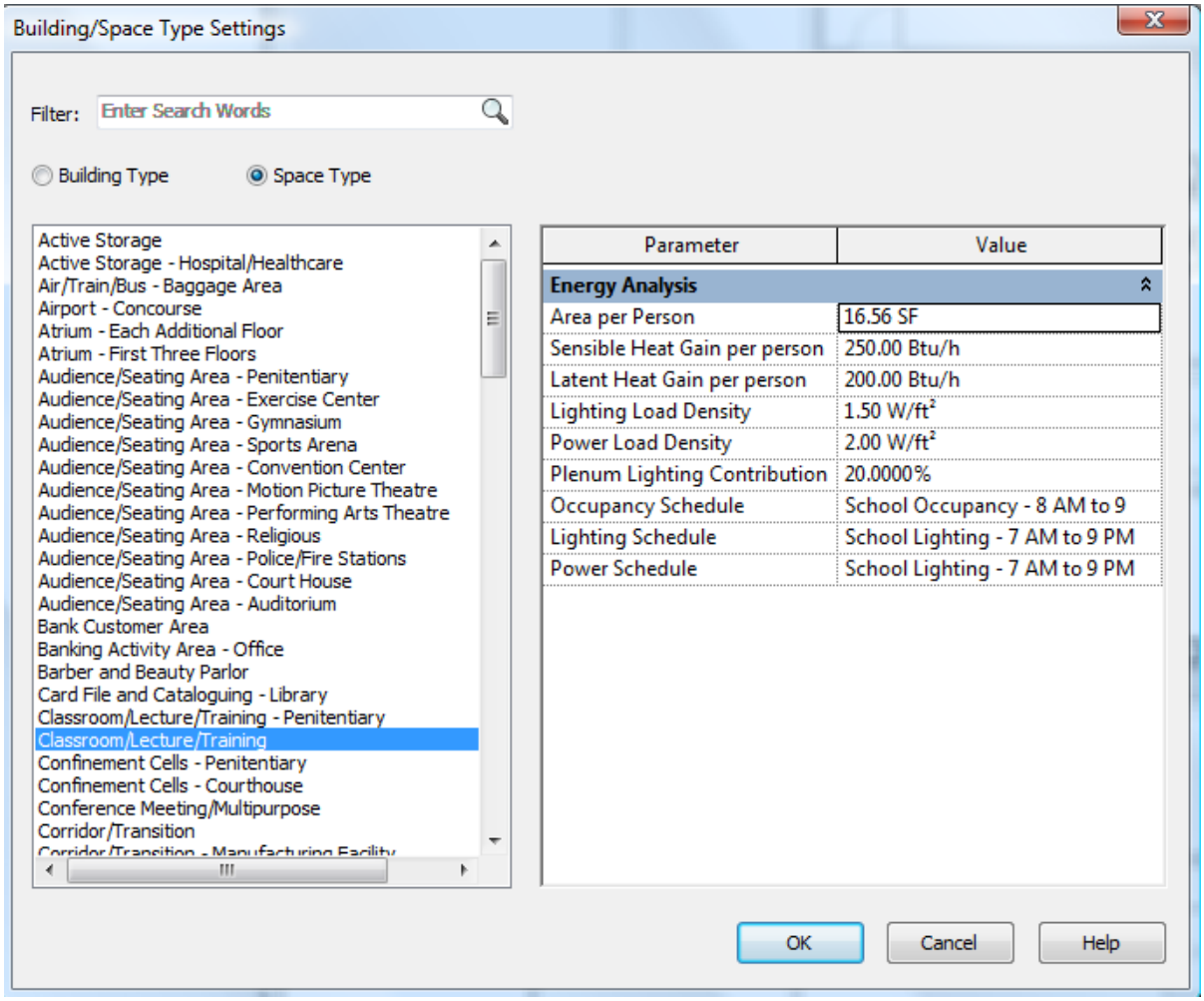
A Building/Space Type Settings dialog will display.



Note that there are Building Type settings and Space Type settings. The first display is base on Building Type categories.

You can adjust these settings to change the default values used for heating and cooling loads analysis. This allows you to establish parameters for the overall building model, then modify individual spaces to create an accurate analysis for heating and cooling loads.

2. Select the School or University type since this is the type we will be using for this training project. There are default setting for various parameters in this category and they will be used to set the parameters for all of the spaces that are defaulted to the building type settings and are not assigned a specific space type from the listed categories.
3. Select the Space Type radio button at the top of the dialog. The categories change to individual space categories and parameter values for each type of space are displayed.



4. Select Classroom/Lecture/Training for space category. Note the parameter values for the specific space type. All of the values listed for each space type can be changed by the user to meet their specific load requirements.

The Building Type and Space Type categories cannot be modified by deleting or adding additional building types or space types to the list. You must select one of the pre-defined categories.

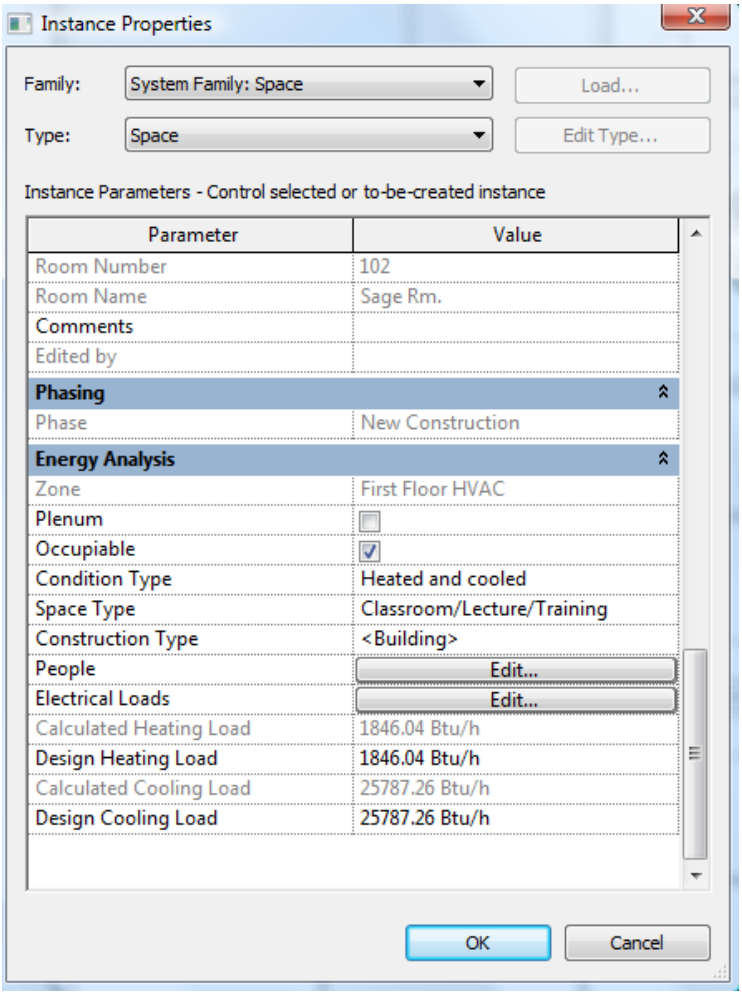
The values represented for each category in these Building/Space Type Settings are based on current industry standards. They do not represent the actual loads for each space since that can vary by region, client requirements, and individual Architectural and Engineering preference.

Note in the next exercise that individual values can be changed on a per-space basis and the loading values for people, lighting, and general power can be set to specified values. Lighting and power can also be set to actual installed values.

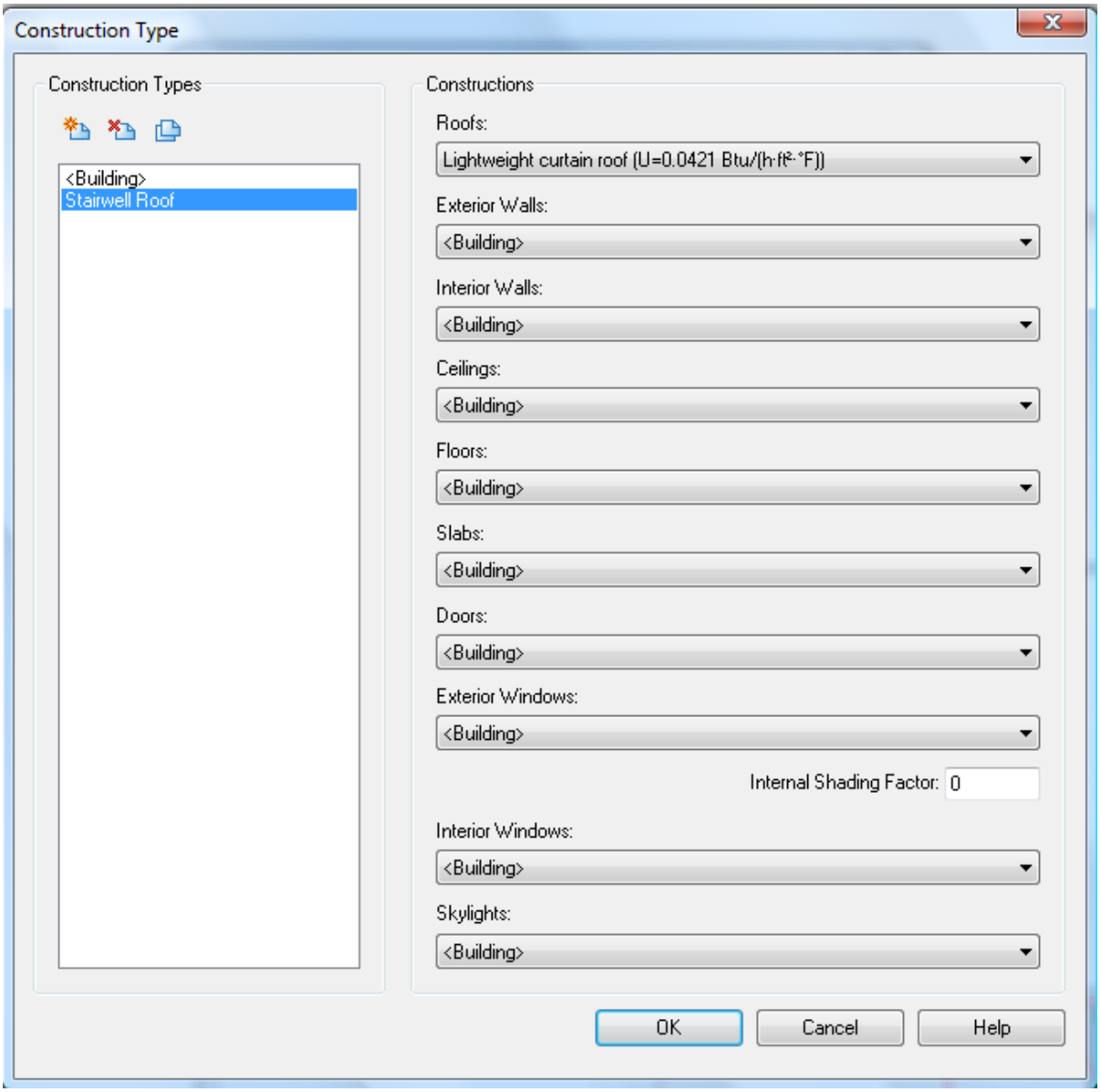
Loads can be run based on estimated values, then adjusted later based on actual values.

Setting Individual Space Parameters

1. Double-click on the First Floor View under Project Browser Views.
2. The First Floor View will display in the graphics screen. Move the cursor to a point inside Space 102, the Sage Rm, upper left corner. When the Space Element highlights, right click and pick Element Properties. The Instance Properties dialog will display.



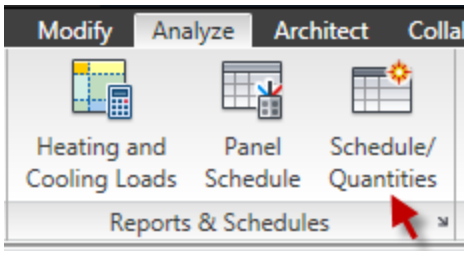
3. Scroll down to the Energy Analysis Category and set the Space Type for the Sage Rm to Classroom/Lecture/Training. Note that setting a space type will setup all the other parameters for Heating and Cooling calculations including people and electrical loads. These default values are based on typical building load values for a space of this type. The values can be changed for each individual space however, for the purpose of this exercise, we will use the pre-defined default values for each space type.
4. Double-click on the Second Floor Plan View in the Project Browser. Click on the space object for the 2nd Fl Lobby-1 Space number 201-1. Right-click, pick Element Properties and scroll down to the Energy Analysis category. Pick <Building> in the value field for Construction Type.
5. Pick on the small button on the right corner of the value field and the Construction Type dialog will display.
6. Click on the New button and create a new construction type named “Stairwell Roof”. Set the Roof Construction Type to the Lightweight Curtain Roof (U=0.0421 Btuh-ft² °F). Pick OK



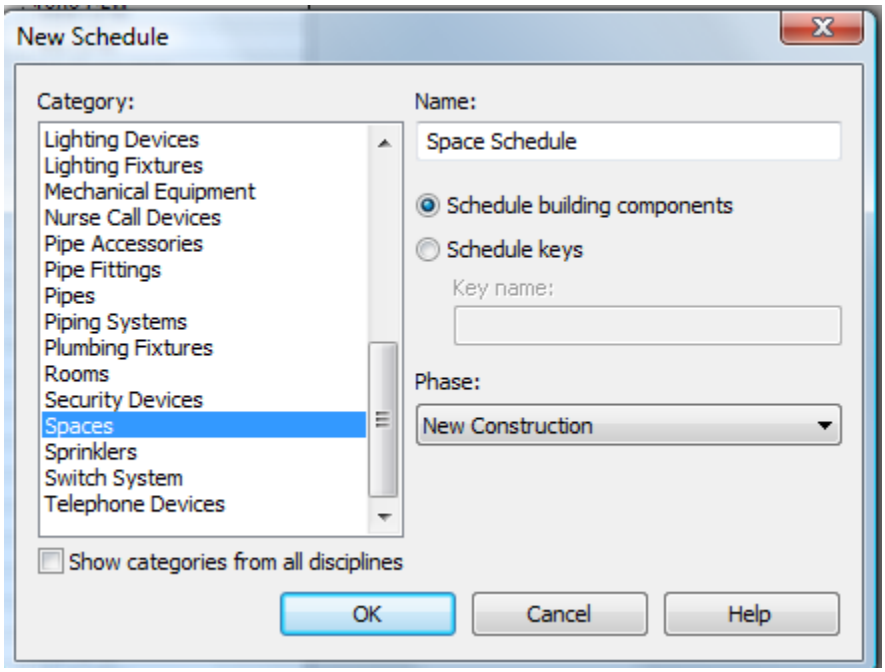
Picking OK will apply this roof type to the stairwell space on the second floor. All other construction settings for this particular space will be based on the default building settings for a Stair space type.

You may choose to select each space in turn for the first and second floors and set a space type or you may choose to create a Space Schedule and set the values from the table. Note that a table of space names and numbers with areas was created in the previous exercise (chapter 7). You may choose to select the schedule and modify the Fields Properties to create the new table.

7. Select the Analyze Tab -> Reports & Schedules -> Schedule/Quantities.

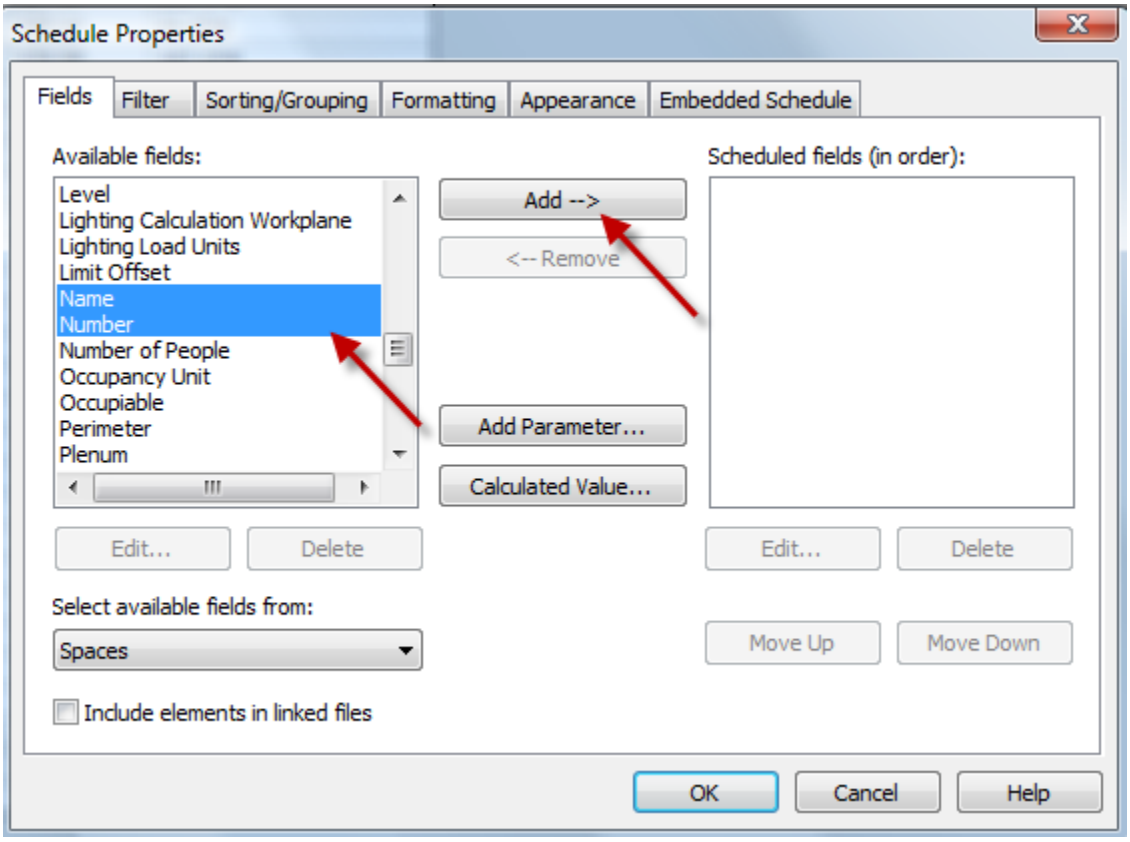


The New Schedule Dialog will display.



8. Select Spaces in the Category List Box. The name for this schedule can be Space Schedule. Pick OK.

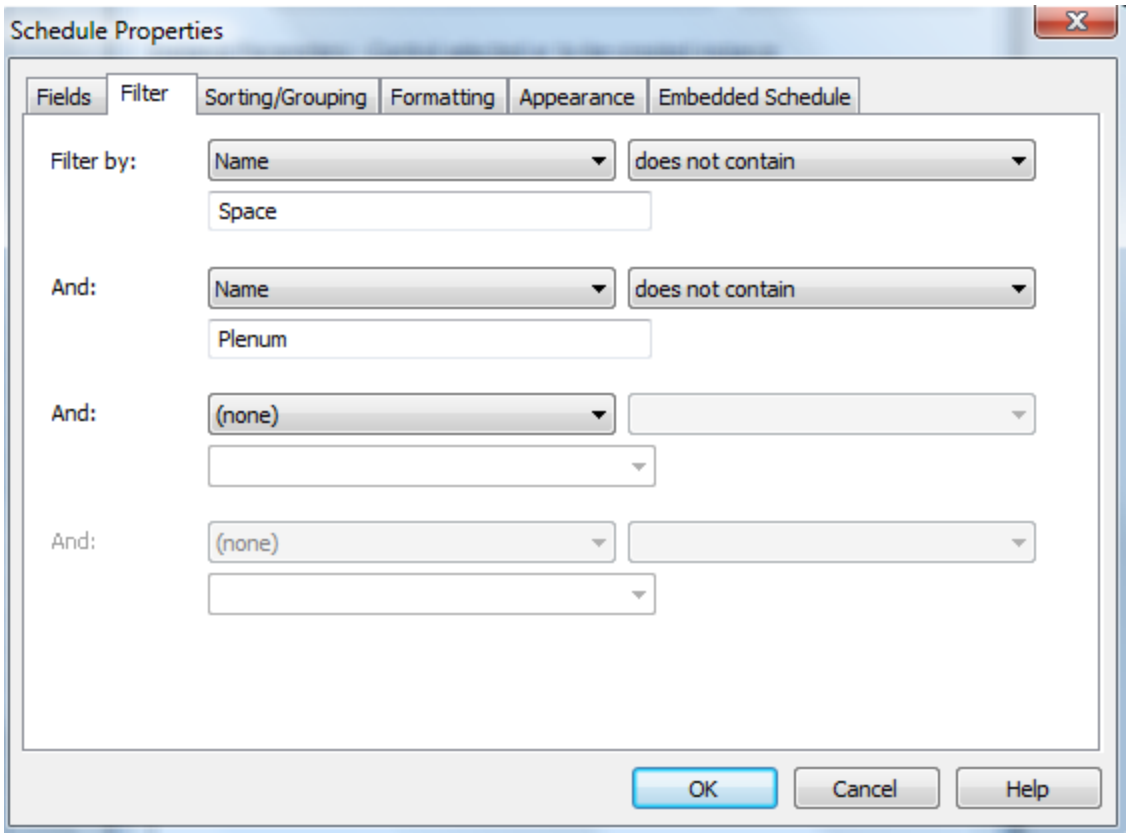
The Schedule Properties Dialog will display for the Spaces Category.



9. Select Name and Number from the Available fields. Select the Add→ button and the Name and Number fields will appear in the listbox named Scheduled Fields (in order).
10. Scroll down the Available fields and find Space Type. Add it to the Scheduled fields.
11. Scroll down in the Available fields list and find Conxtruction Type. Add it to the Scheduled fields. Pick OK.
12. Scroll down in the Available fields list and find Condition Type. Add it to the Scheduled fields. Pick OK.

A Space Schedule View will display in the graphics screen area. Note that all spaces display including plenum spaces and spaces that were not assigned to a specific category. We will “clean up” the table by filtering out these spaces from the display.

13. Click on Schedule/Quantities -> Spaces Schedule in the Project Browser. Right-click and select Properties. An Instance Properties dialog will display. Select to Edit the value of the Filter Parameter.
14. Set the values in accordance with the following illustration.



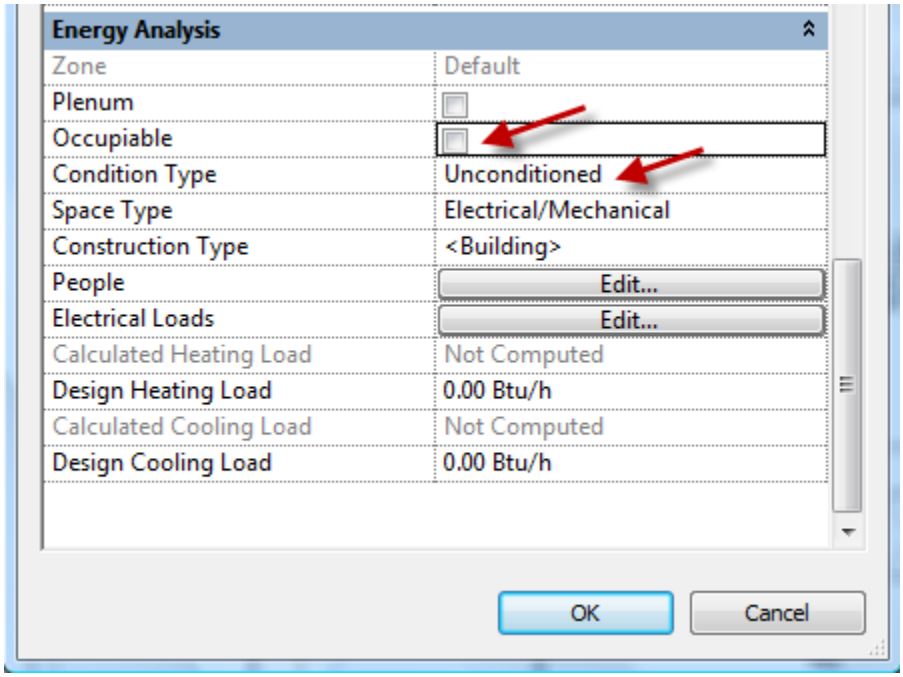
15. Pick OK twice.

The new schedule with filter applied will display. Click on the value in the Space Type column on the row for each Space Name and set the Space Type values in accordance with the following table.

Space Schedule				
Name	Number	Space Type	Construction Type	Condition Type
Parsley Rm.	101	Classroom/Lecture/Training	<Building>	Heated and cooled
Sage Rm.	102	Classroom/Lecture/Training	<Building>	Heated and cooled
Rosemary Rm.	103	Classroom/Lecture/Training	<Building>	Heated and cooled
Thyme Rm.	104	Classroom/Lecture/Training	<Building>	Heated and cooled
Janitor's Closet	105	Electrical/Mechanical	<Building>	Vented
Male Toilet	106	Restrooms	<Building>	Heated and cooled
Female Toilet	107	Restrooms	<Building>	Heated and cooled
Break Room	108	Dining Area - Lounge/Leisure Dining	<Building>	Heated and cooled
Break Room	109	Dining Area - Lounge/Leisure Dining	<Building>	Heated and cooled
Director	110	Office - Enclosed	<Building>	Heated and cooled
Secretary	111	Office - Enclosed	<Building>	Heated and cooled
Conference	112	Conference Meeting/Multipurpose	<Building>	Heated and cooled
Lobby-1	113-1	Lobby	<Building>	Heated and cooled
Lobby-2	113-2	Lobby	<Building>	Heated and cooled
Corridor	114	Corridor/Transition	<Building>	Heated and cooled
Mechanical	115	Electrical/Mechanical	<Building>	Unconditioned
Electrical	116	Electrical/Mechanical	<Building>	Unconditioned
Storage	117	Active Storage	<Building>	Unconditioned
Storage	118	Active Storage	<Building>	Unconditioned
2nd Floor Lobby-1	201-1	Stairway	Stairwell Roof	Heated and cooled
2nd Floor Lobby-2	201-2	Lobby	<Building>	Heated and cooled
Cloves Rm.-1	202-1	Classroom/Lecture/Training	<Building>	Heated and cooled
Cloves Rm.-2	202-2	Classroom/Lecture/Training	<Building>	Heated and cooled
Cinnamon Rm.	203	Classroom/Lecture/Training	<Building>	Heated and cooled
Nutmeg Rm.	204	Classroom/Lecture/Training	<Building>	Heated and cooled
Marjoram Rm.	205	Classroom/Lecture/Training	<Building>	Heated and cooled
Male Toilet	206	Restrooms	<Building>	Heated and cooled
Female Toilet	207	Restrooms	<Building>	Heated and cooled
Janitor	208	Electrical/Mechanical	<Building>	Vented
Corridor	209	Corridor/Transition	<Building>	Heated and cooled
Break Room	210	Dining Area - Lounge/Leisure Dining	<Building>	Heated and cooled
Break Room	211	Dining Area - Lounge/Leisure Dining	<Building>	Heated and cooled
Storage	212	Active Storage	<Building>	Unconditioned
Air Shaft	213	Electrical/Mechanical	<Building>	Unconditioned
Chase	229	Electrical/Mechanical	<Building>	Unconditioned
Chase	267	Electrical/Mechanical	<Building>	Unconditioned

Note that setting a value in the schedule also sets the value in the project database so that if you return to the floor plan view, select the space and view the instance properties, the value is in agreement with the table. This is a great example of BIM in action.

16. Return to the First Floor Plan view in the Project Navigator. Select the Electrical and Mechanical Room space elements. Right-click and select Element Properties. Scroll down to the Energy Analysis category and un-check the Occupiable setting.



17. This same procedure must be performed on each of the following spaces:

Janitor's Closet	105	Mechanical	115
Electrical	116	Storage	117
Storage	118	Janitor	208
Storage	212	Air Shaft	213
Chase	229	Chase	267

The following step is not necessary if you will be using gbXML to export the space data to Trane Trace.

18. Select each of the plenum spaces and verify the following:
- Check the Plenum checkbox.
- Note that checking the plenum checkbox will automatically set the space to unoccupied and unconditioned and these two settings will be "greyed out".

Specify Zones

Group spaces in zones representing the air conditioned regions of the building. We will divide our building into three zones.

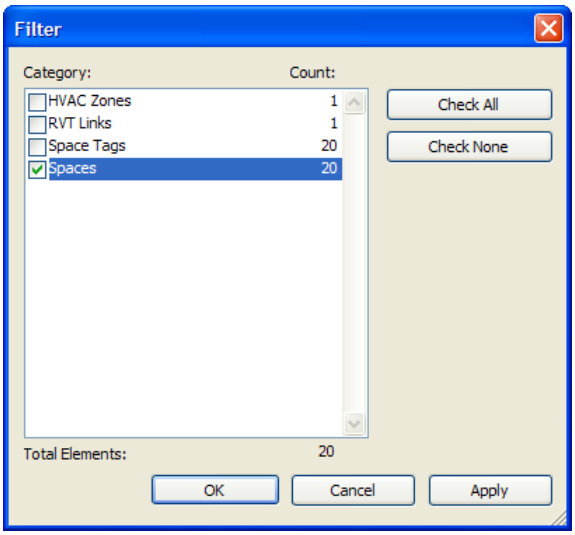
- First Floor HVAC Zone
- Second Floor HVAC Zone
- Unconditioned Spaces
- Plenum Zone (not required for Trane Trace)

The Unconditioned Spaces zone is required because conditioned and unconditioned spaces must not be mixed within a particular zone.

Note that no spaces should be unzoned. If any spaces are in the default zone, create a zone for them and move them to that zone.

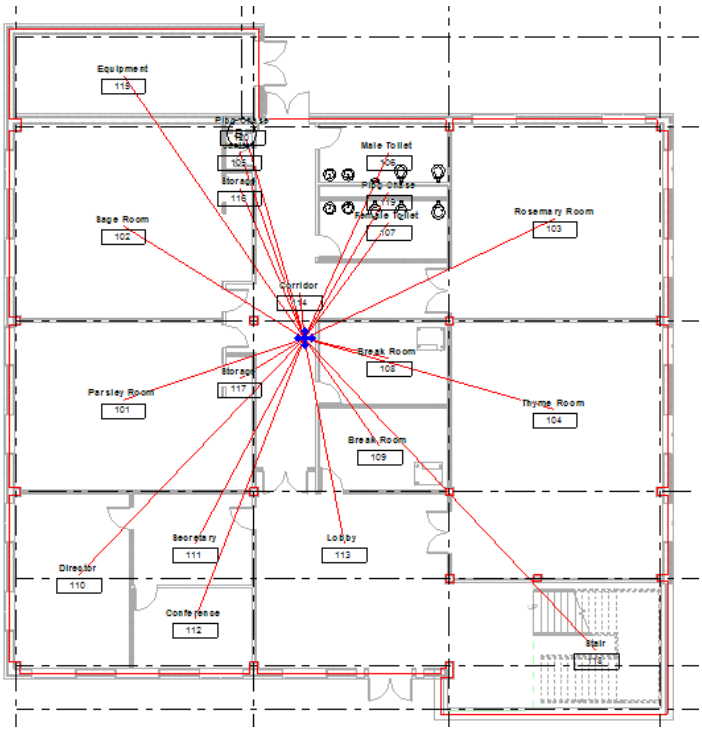
The building will be served by two Roof Mounted A/C Units, one for each floor.

1. Use a crossing window to select all elements on the First Floor.
2. Click on the Filter button. 
3. Uncheck all elements except spaces in the dialog



4. Click on the OK button.
5. While all spaces are selected, click on the Zone Tool in the Analyze Tab -> Spaces & Zones Frame.

All spaces on the first floor will be assigned to a Zone element.



6. Click on the Element Properties button and change the Workset to HVAC Zones.
7. Change the Zone Name to First Floor HVAC.
8. Scroll down to the Energy Analysis Category.
9. Click on the Service Type drop-down and select VAV Terminal Reheat.
10. Click on the Outdoor Air Information button and set Outdoor Air to 10 CFM/Person.
11. Perform the same functions to create a Second Floor HVAC Zone.
12. Perform the same functions to create an Unconditioned Spaces zone.
13. Group all the Plenum Spaces in a separate Zone named Plenum. As an alternative, the plenum spaces could be grouped in the Unconditioned Spaces zone.

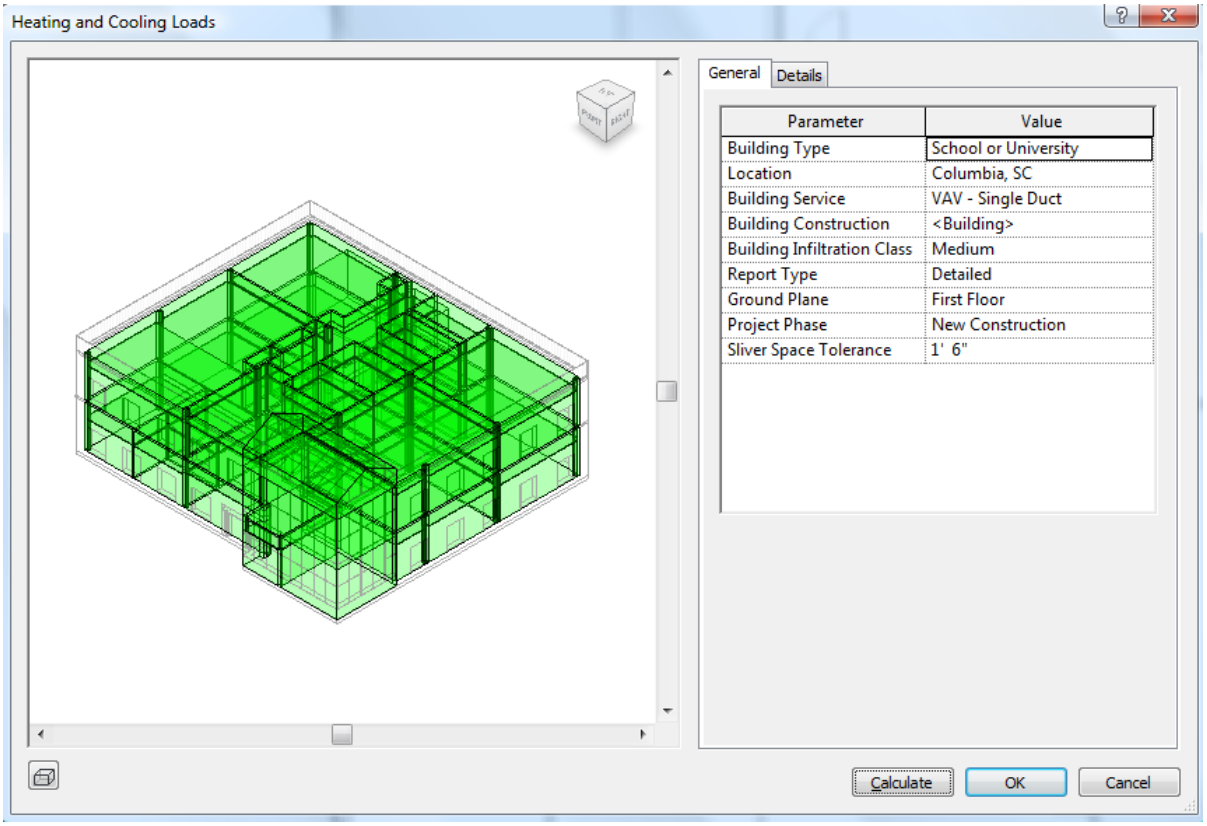
Performing an Energy Analysis using the Revit MEP Integral Tools

Revit MEP provides an integral tool for use in performing heating and cooling load calculations on the project.

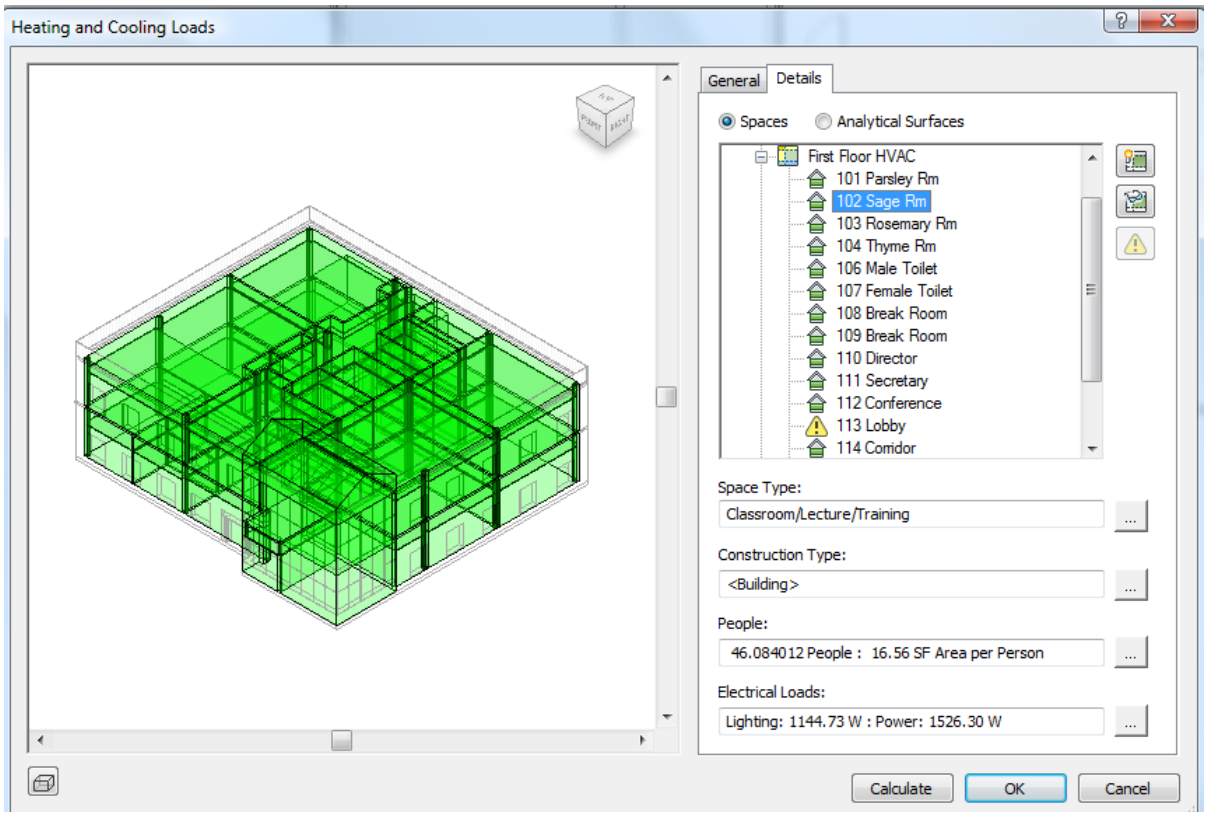
The integral tool for Heating and Cooling Loads Analysis provided by Autodesk in Revit MEP 2010 uses the Radiant Time Series Method (RTS). The tool was designed following the specifications of the ASHRAE Handbook of Fundamentals. This method takes into account the time delay effect as heat is transferred from the outside, through envelopes, and into spaces.

1. Enter LO at the keyboard

The Heating and Cooling Loads dialog will display.



2. Examine the analytical building model
3. Select the Details Tab to view the settings for each individual space and make further adjustments as needed.



The Heating and Cooling loads individual space details.

4. Click on the … button next to each detail category to change the current values for that category.
5. Clicking on the Calculate button will run an integrated loads report
6. Examine the results, refine adjustments to the analytical building model and re-run the loads report. Summary results taken from the load report are provided in the next 4 charts.
7. Once the internal load analysis has been run, the instance properties for each space have been updated with the calculated air flow, heating load value and cooling load values. See the following table for a summary of the results.

Note: The values in the following report were base on calculation for Columbia, SC and will differ slightly from the values derived from data in your area of the country.

Space Analysis Schedule – From Internal Loads Tool

Name	Number	Cooling BTUH	Heating BTUH	Supply CFM	Design Heating BTUH
Parsley Rm.	101	25634.9	9536.6	875	9536.6
Sage Rm.	102	25854.6	3663.5	883	3663.5
Rosemary Rm.	103	28527.9	6528	898	6528
Thyme Rm.	104	34971.9	4799.2	1067	4799.2
Janitor's Closet	105	136.7	23.3	7	23.3
Male Toilet	106	1981.7	1327.7	65	1327.7
Female Toilet	107	1308.3	164.9	43	164.9
Break Room	108	6219.7	227.1	144	227.1
Break Room	109	6075.1	224	139	224
Director	110	11643.7	4051.3	313	4051.3
Secretary	111	2329.2	232.9	77	232.9
Conference	112	11801.9	2416.2	276	2416.2
Lobby-1	113-1	66438.5	7584.1	2110	7584.1
Lobby-2	113-2	41986.6	8450.3	1129	8450.3
Corridor	114	4874.8	1673.3	160	1673.3
2nd Floor Lobby-1	201-1	77687.2	23639.1	2939	23639.1
2nd Floor Lobby-2	201-2	45777.1	8998.4	1631	8998.4
Cloves Rm.-1	202-1	24672.9	8993.7	873	8993.7
Cloves Rm.-2	202-2	32449.7	13951.1	1154	13951.1
Cinnamon Rm.	203	32432	13961.7	1157	13961.7
Nutmeg Rm.	204	30876.2	13455.6	1093	13455.6
Marjoram Rm.	205	37314.4	13283.4	1275	13283.4
Male Toilet	206	3050	2684.4	98	2684.4
Female Toilet	207	2293.3	1463.7	71	1463.7
Janitor	208	271.9	202.1	13	202.1
Corridor	209	9170.5	6088.6	260	6088.6
Break Room	210	6962.5	2016.5	250	2016.5
Break Room	211	6823.2	1988.8	245	1988.8

Note: The design heating BTUH in this schedule does not include reheat.

Performing an Energy Analysis using gbXML

It is not necessary to perform this exercise unless you intend to use a third-party application such as Trane TRACE®, Carrier HAP, or IES to analyze and calculate the heating and cooling loads for the building.

Trane TRACE® and IES provide for importing the raw analysis data and exporting the results of the heating and cooling loads analysis back to the Revit model thru the use of a post processed neutral file using gbXML.

Carrier HAP provides for importing a gbXML file but does not provide for exporting the results of the heating and cooling loads analysis back to the Revit model.

The gbXML file contains all of the heating and cooling information for a project according to the gbXML file structure which is based on a gbXML schema. The gbXML schema was created to help building designers get information about the energy consumption characteristics of their building projects.

Removing Plenums

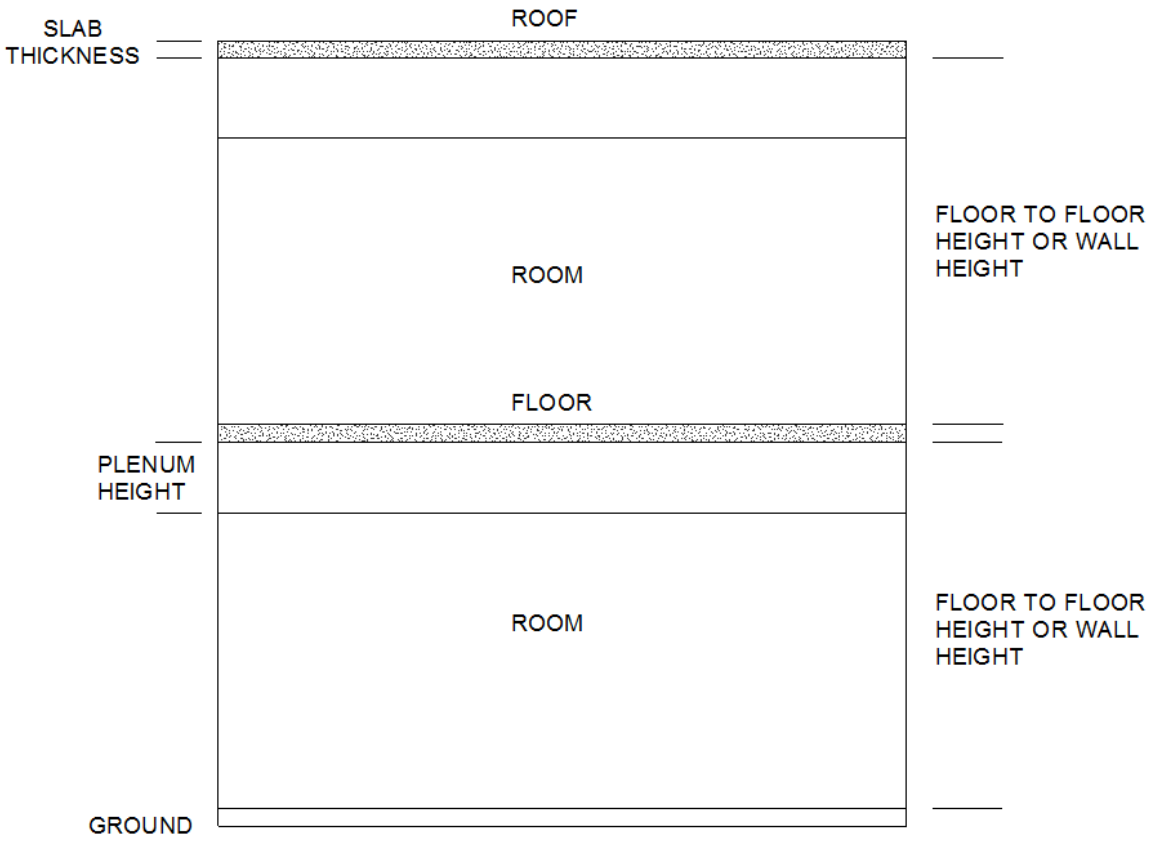
Prior to exporting the model to gbXML, remove all plenum spaces from the model. Plenum spaces in the Revit model are exported to gbXML and imported into Trane Trace as rooms (not as plenums).

A plenum is defined by plenum height for each individual space in Trace. The plenum is not extracted from the gbXML inport data.
The Plenum Height is the vertical distance between the ceiling and the floor slab surface of the floor above. If no plenum exists, you should enter a value of zero.

This value is used in conjunction with the entered Floor to Floor Height to calculate:

- The percent of non-glass wall conduction load that is assigned to the return air path.
- The volume of the room - used to calculate any airflows entered with the units of air changes per hour.

The plenum height is also used to decide if the roof conduction and solar heat gain loads are to be directed into the plenum or directly into the room. For example, if the plenum height is entered as zero, all the plenum loads are re-assigned to the room unless the Return Air Path has been entered as "Ducted".



Note: The gbXML export file does not contain the following information related to the building components. This information is necessary to perform room heating and cooling load calculations for system design and layout purposes:

Wall types

Window types

Roof types

Floor types

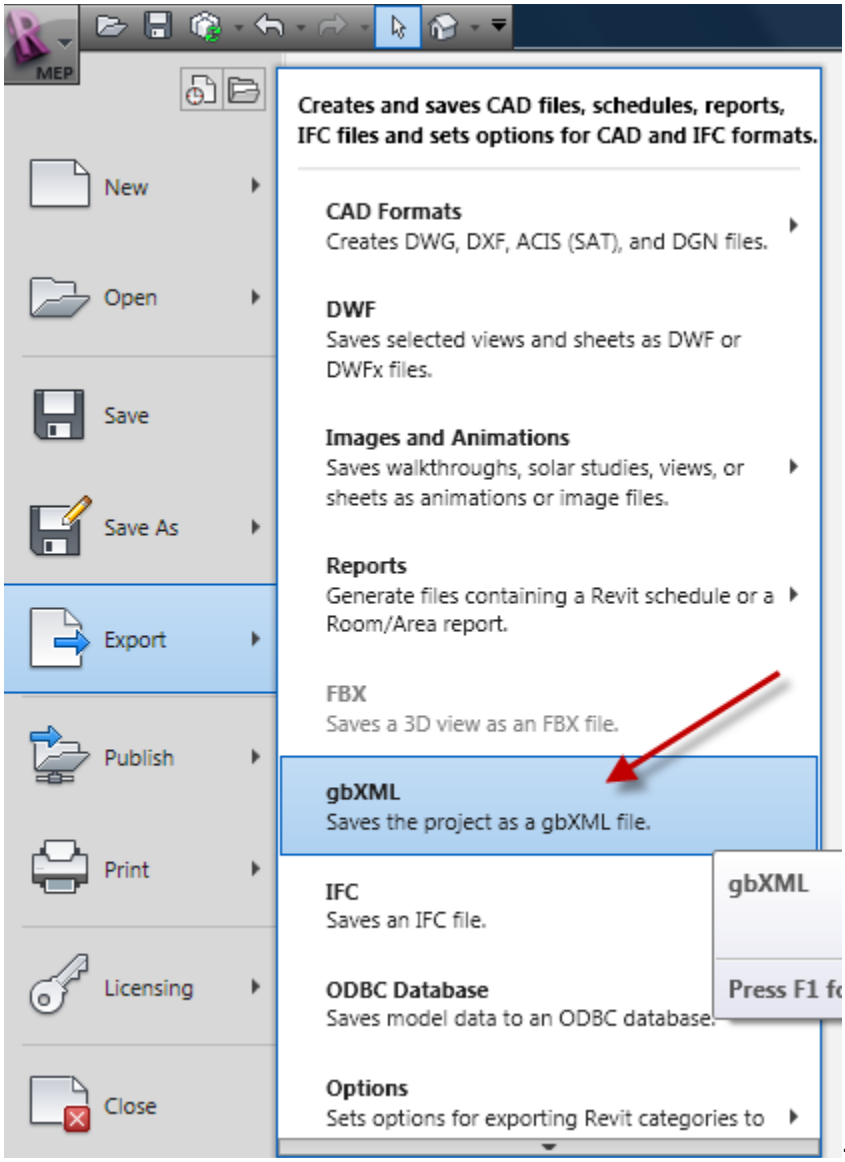
Geographic Location

North orientation

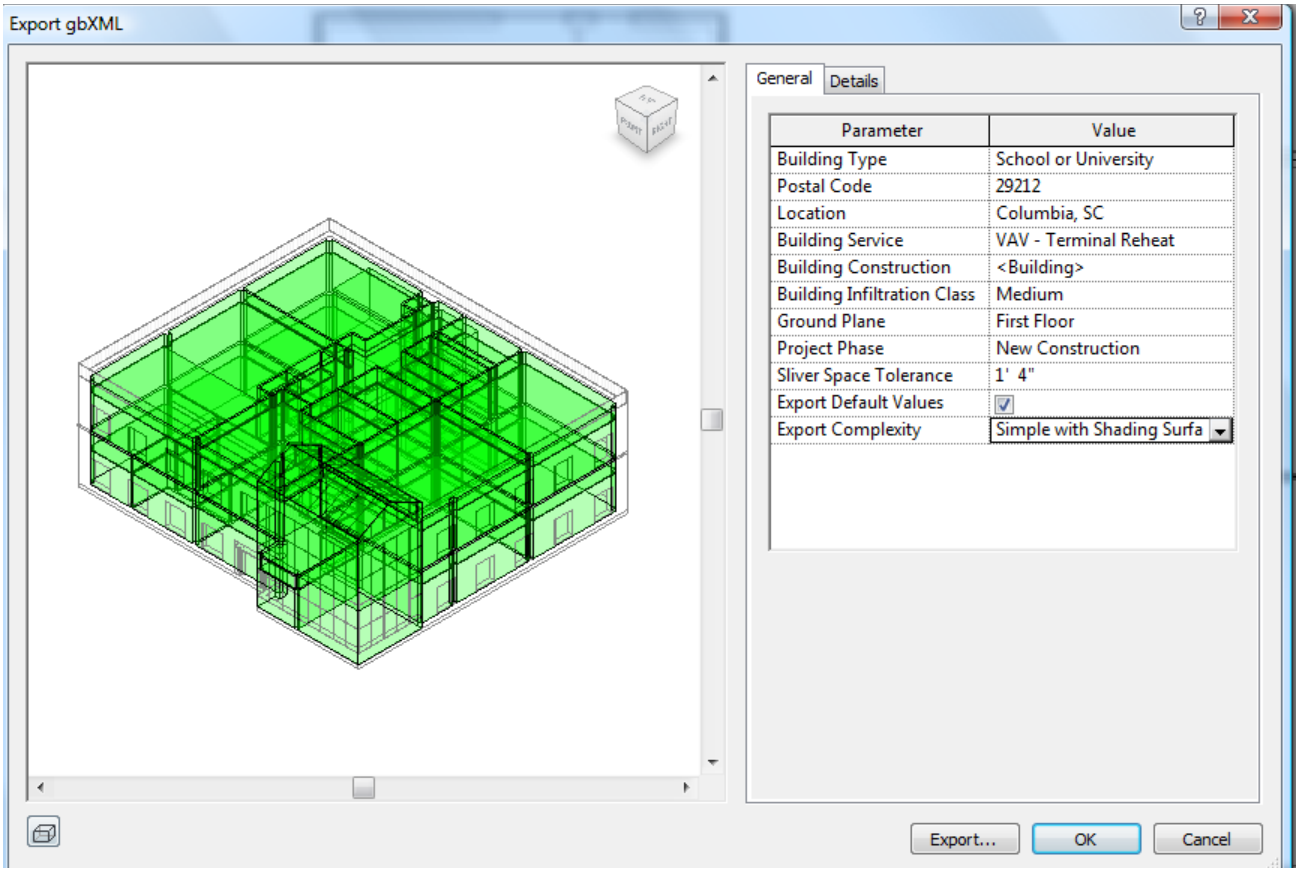
Partitions

The user must validate the data that is imported by gbXML into the third party application and supplement the data to make a complete and accurate model suitable for analysis Use the tools that are provided with the third party application to validate and update any missing or erroneous data prior to running the analysis.

1. Click  -> Export -> gbXML



2. The Export GbXML dialog will display.



3. You may modify any of the General settings or Detail settings for individual spaces prior to performing the export to gbXML.
4. When you are ready to export the file, click on the Export… button at the bottom of the dialog. In the Export gbXML Save As dialog, navigate to the target folder for the gbXML file. *For this exercise, the folder is C:\Revit MEP 2010 Training\gbXML*
5. Enter a name for the gbXML file *(Training – HVAC.xml)* and click Save.

Working with Trane Trace

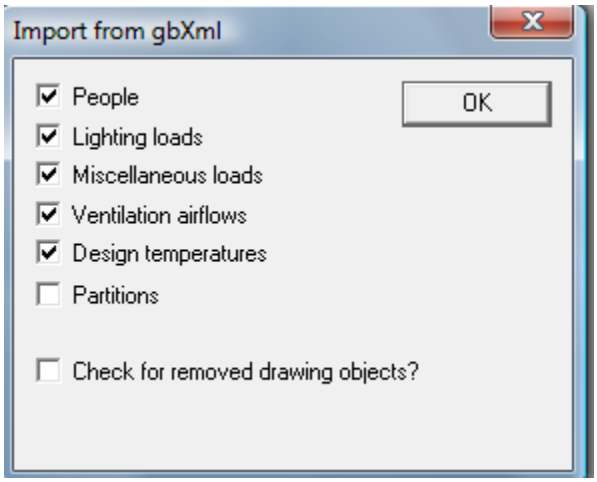
The Trane TRACE® program provides a number of choices for load calculation methodology. Choices include the following:

TETD-TA1
CLTD-CLF (ASHRAE TFM)
TETD-TA2
TETD-PO
RP359
UATD
RTS (ASHRAE Tables)
RTS (Heat Balance)
CEC-DOE2

We will be using the RTS (ASHRAE Tables) method for calculating the loads. This is the same method that is used by the integral load calculation tool that is provided with Revit MEP.

1. Start up Trane Trace™ 700.
2. At the start-up dialog, pick the New button to create a new project.
3. Enter Training – HVAC for a file name and locate the file in the Trace 700 Projects folder.
4. Pick Open. The Trace 700 Project Navigator will display.
5. Pick File -> Import gbXML…
6. Browse to C:\Revit MEP 2010 Training\gbXML\Training – HVAC.xml
7. Pick the file and select Open.

8. In the Import from gbXML dialog, verify that everything is checked except Partitions and Check for removed drawing objects ?



Note: Partions exported from Revit and imported into third party applications such as Trane Trace are treated as outside walls. In the event that you should import partitions, use the tools provided by Trane Trace (or other applications as appropriate) to delete all partitions that have conditioned spaces on both sides of the partition in order to obtain more accurate heating and cooling load results.

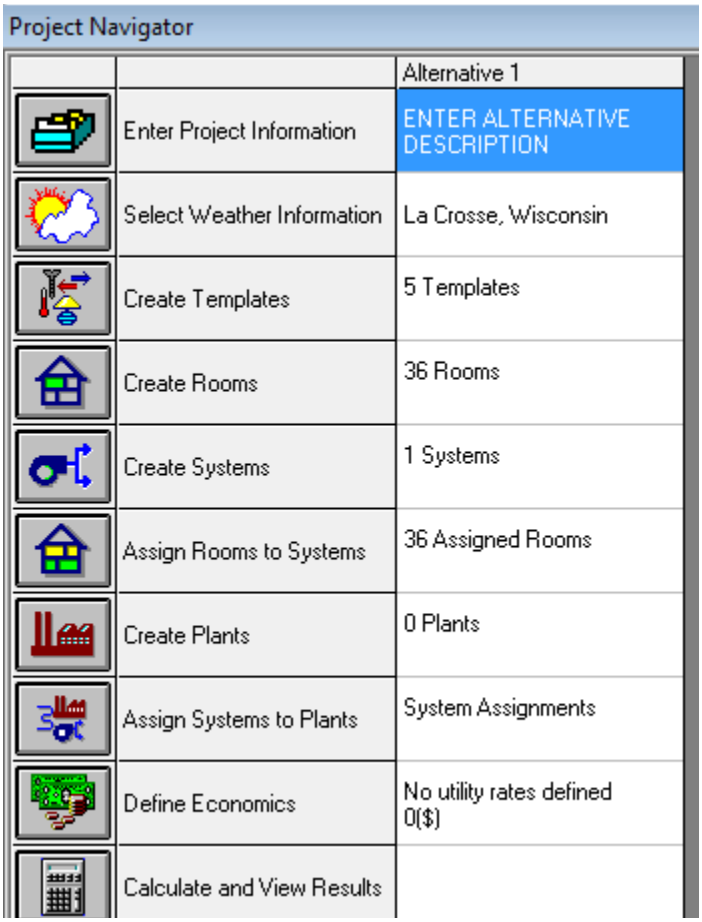
1. Select OK

An error dialog will display and report that The roof tilt of 180.0 entered for roof ???? is outside the typical range. For a flat roof, the tilt angle should be set to 90 degrees.

Revit outputs a roof area for each first floor space even though this is a multi-floor structure and there is no first floor roof. We will delete the roof from all first floor spaces and correct the roof tilt for the second floor spaces.

2. Select OK.

The Project Navigator will display.



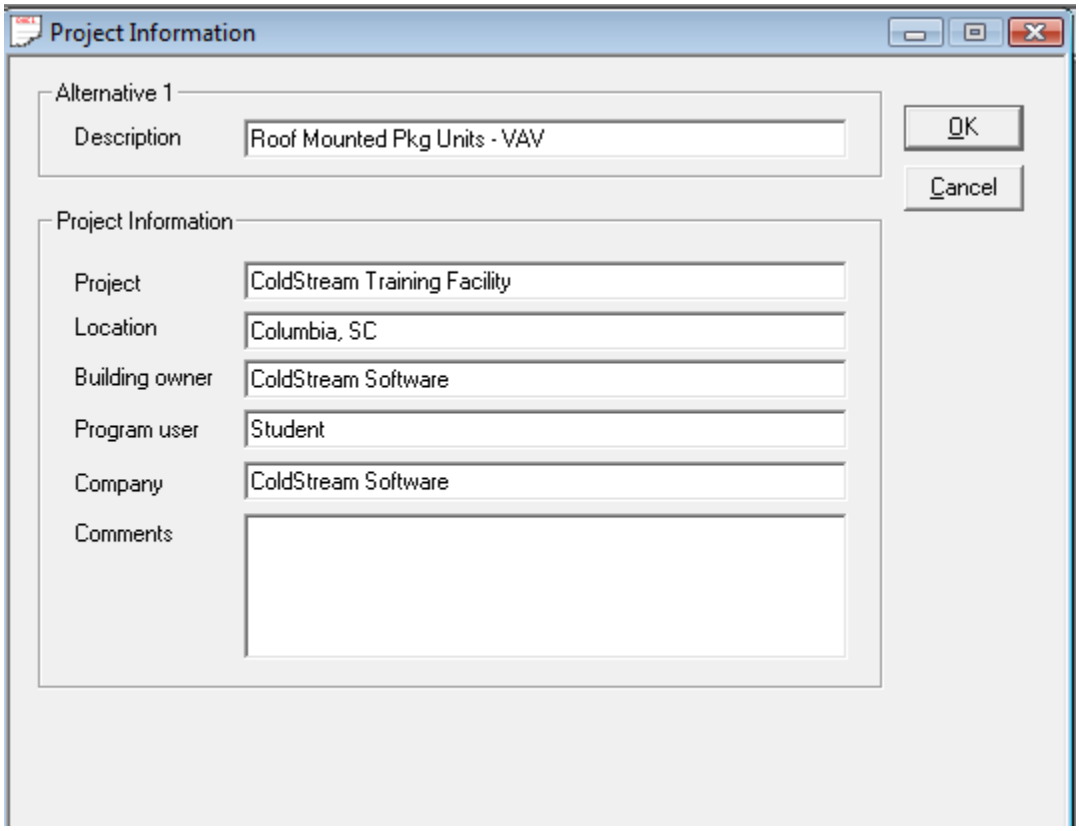
Note that 36 Rooms have been created in the navigator.

In order to perform a calculation of heating and cooling loads, you must do the following:

- Enter Project Information
- Select Weather Information
- Create Templates
- Create Rooms
- Create Systems
- Assign Rooms to Systems

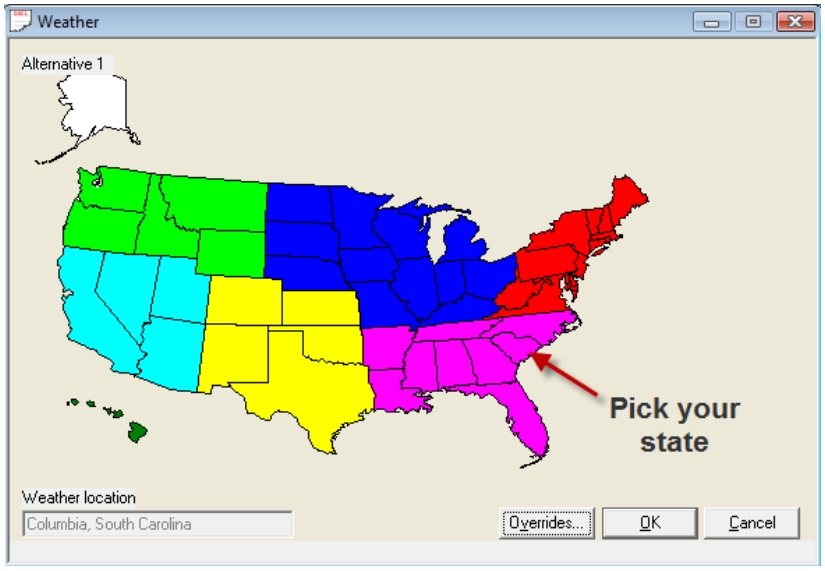
Entering Project Information

1. Enter the information in the Project Information Dialog in accordance with the following illustration.



Hint: Clear the comments field or you will get an error when you attempt to OK the Project Information Dialog.

2. Select the Weather Information button in Project Navigator. Select your state in the weather information dialog.



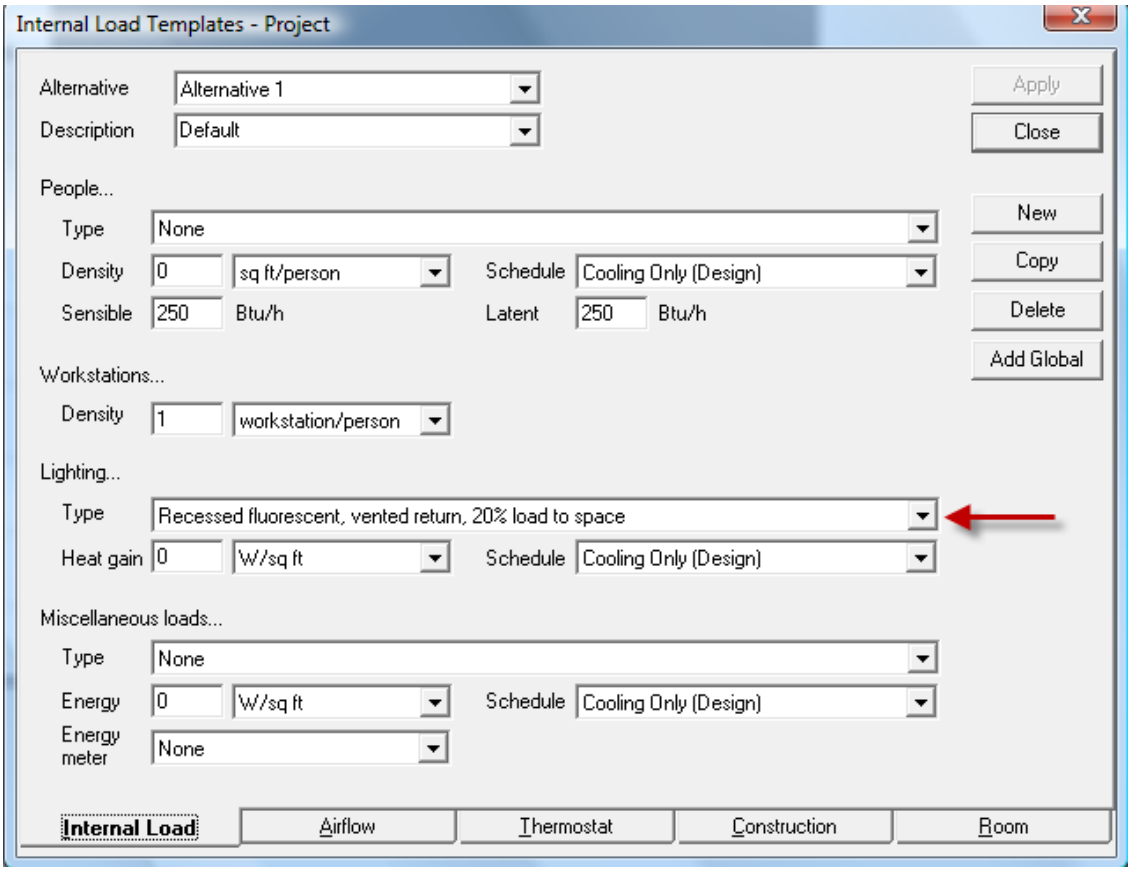
Note that the default weather location will display LaCrosse, Wisconsin and not the location that you selected in the energy data type properties dialog in Revit prior to exporting the data to gbXML.

3. A pop-up list box will display a list of cities in the state you selected. Select the city nearest to your location. When the Weather location text box displays your selected city, select the OK button in the Weather dialog.
4. Select the Overrides… button if you must alter the weather data for the selected area.

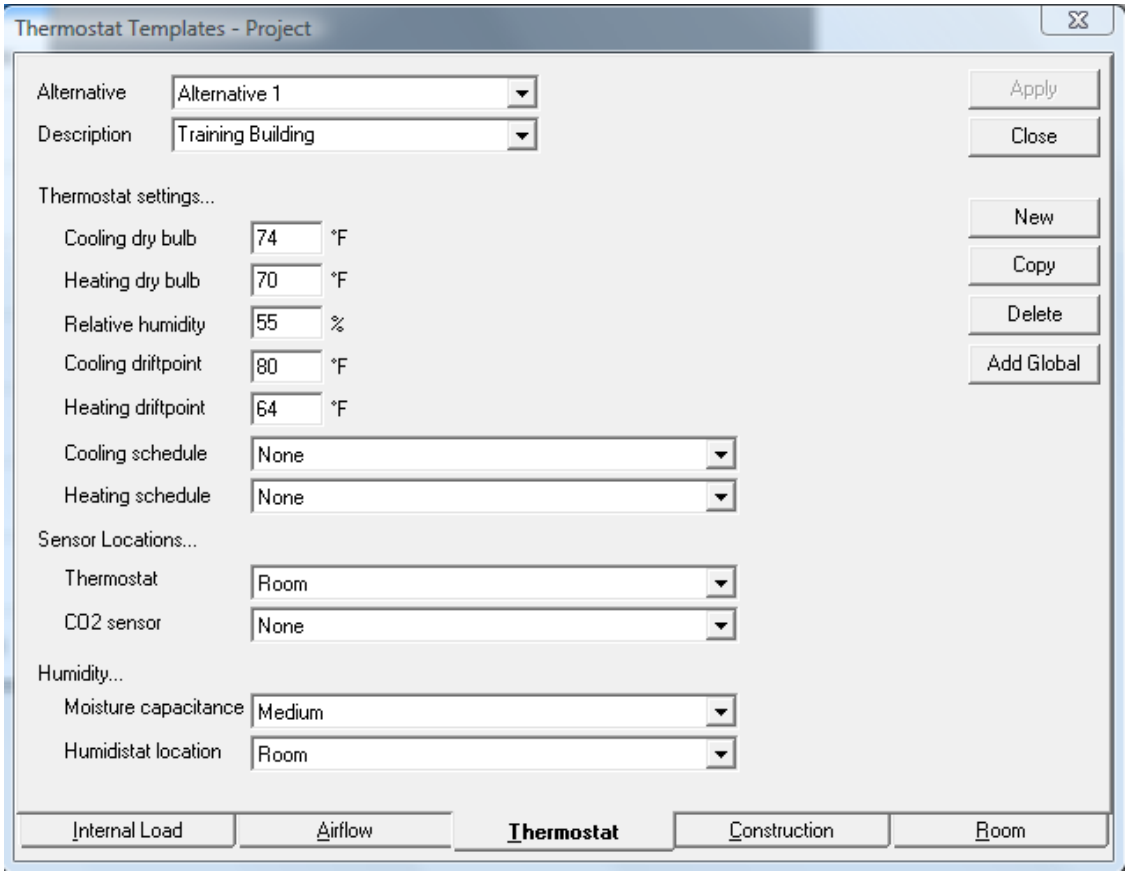
Creating Templates

Templates are intended to help simplify and speed up the process of entering and changing room information. They are based on the idea that several rooms in a building have information in common. Examples of this type of similar information include: design thermostat setpoints, wall/roof/floor construction types, amount and type of lighting, and many more.

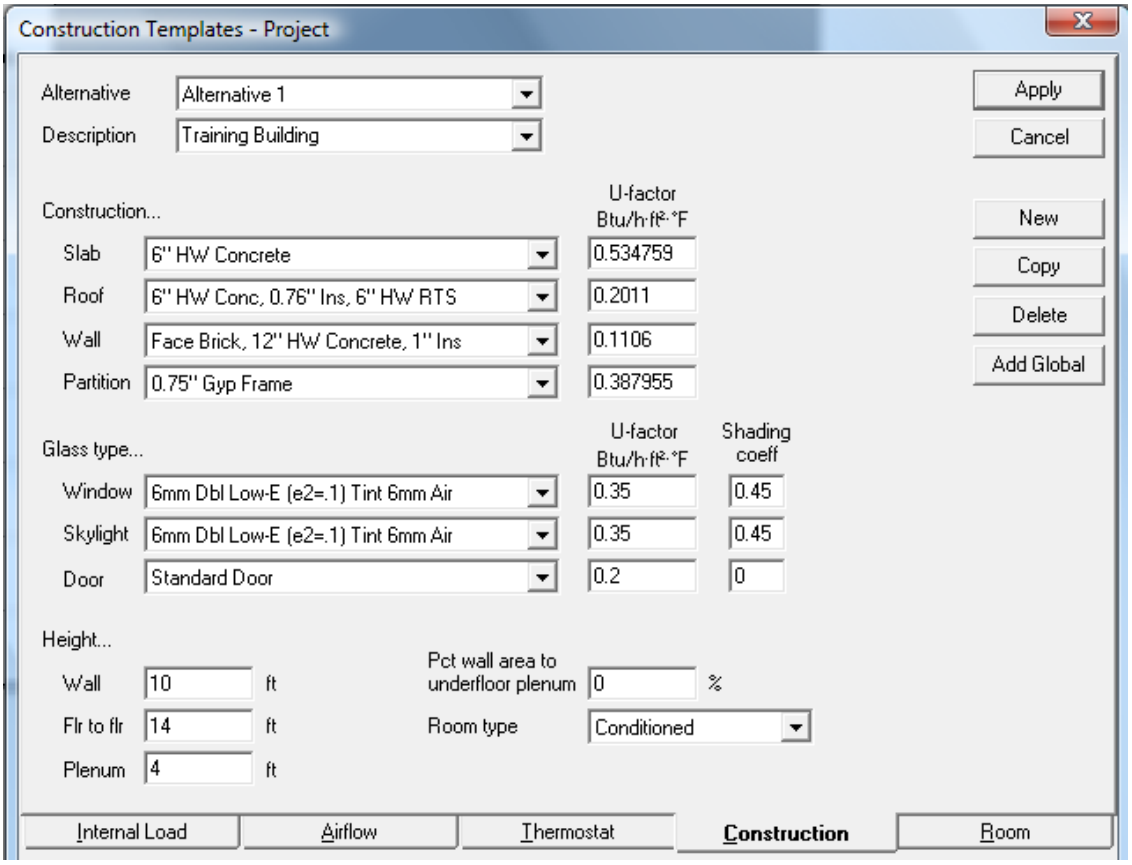
1. Select the Create Template button in Project Navigator. There are 5 tabs along the bottom of the Create Template Dialog. Each tab represents one of five templates that can be created. The templates can be applied to elements of the project to change settings as required. We will be creating a Thermostat Template, a Construction Template and a Rooms Template.
2. Select the Internal Loads template.
3. Change the Lighting Type setting in accordance with the following illustration:



4. Select the Thermostat Template Tab.
5. Pick the New Button.
6. Enter the new description as **Training Building**
7. Set the values in the Thermostat Template in accordance with th following illustration.



8. Select Apply.
9. Select the Construction Template Tab.
10. Pick the New button enter the description “Training Building”.
11. Set the values in the Construction Template in accordance with the following illustration.



Note that some of the construction components available in Trane Trace do not match the construction components in Revit MEP. Pick components that match by mass and materials as closely as possible and manually enter U-factors to match.

The glass types can be matched by U-factor but shading coefficients cannot be changed to match exactly the values in Revit MEP.

Values for Height are set to default. Individual room plenum height will be set based on the ceiling height of the room.

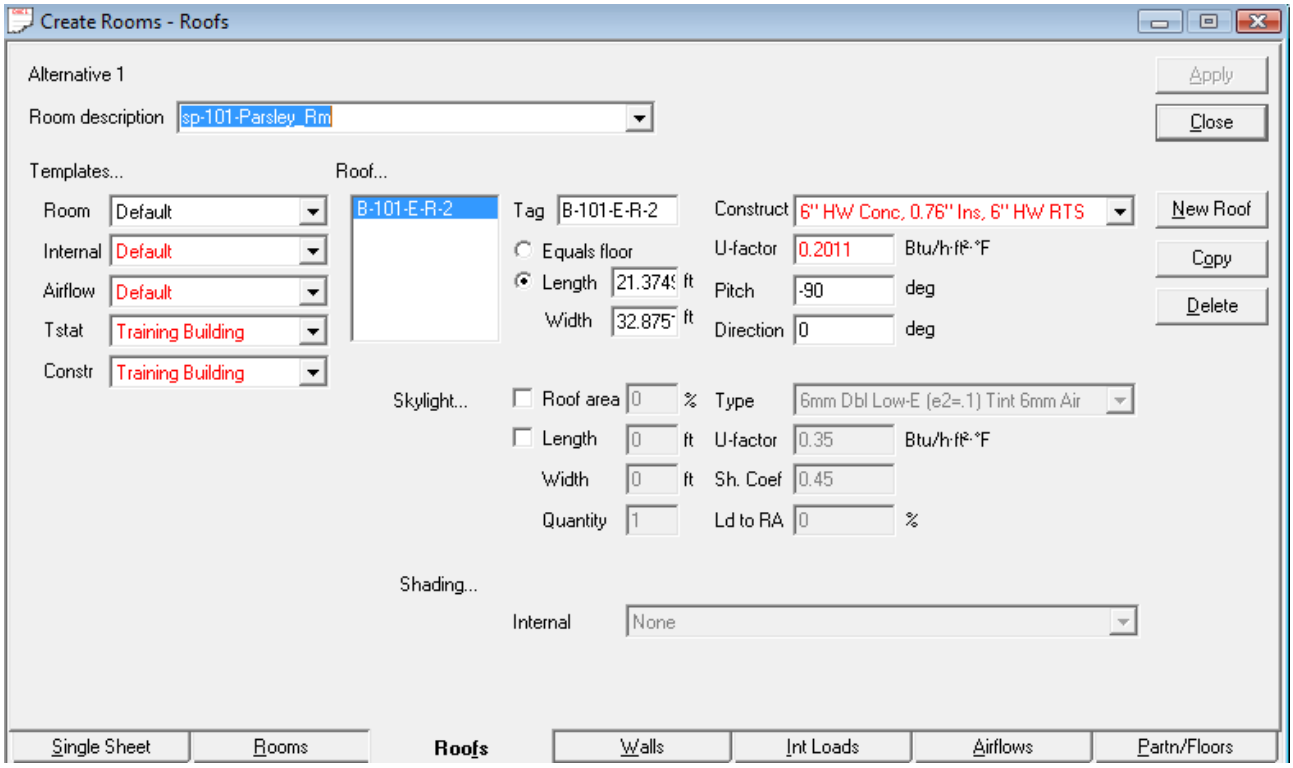
12. Select Apply.
13. Select the Room Template Tab. The description should remain as “default”.
14. Set the Construction Template and Thermostat Template to Training Building.
15. Pick the Apply button, then Close.

Working With Rooms

1. Pick the Create Rooms button in Project Navigator. The Create Rooms - Single Worksheet will display.

   The first room to display is the Parsley Room on the first floor. Note that the Parsley Room is showing roof dimensions. The Parsley Room is on the first floor and does not have a roof.

2. Click on the Roofs Tab at the bottom of the Create Rooms Worksheet. The Create Rooms – Roofs dialog will display.



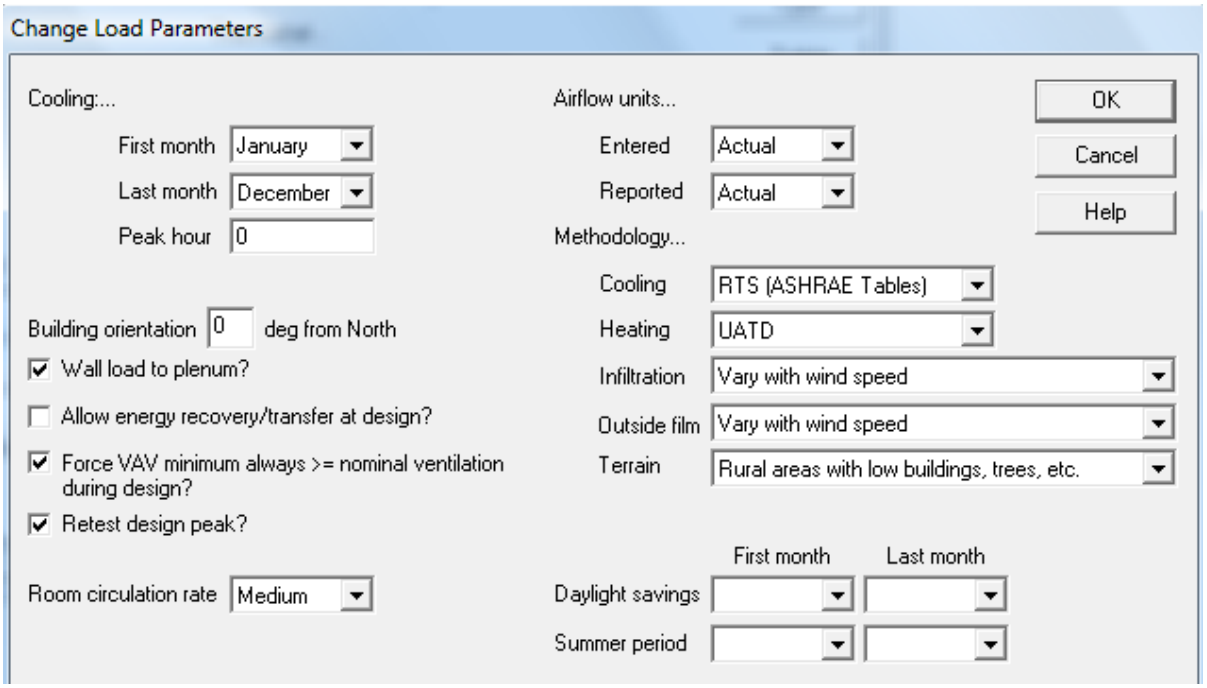
3. Select Roof B-101-E-R-2. Select the Delete button on the right side of the dialog. You will be prompted to be sure you want to delete the roof, answer Yes and the roof will be deleted.
4. Note that in the Create Rooms – Single Worksheet, one West exposure window has been created from the gbXML input data. The window is 5'-4: x 6'-8" and that is the correct size, however; there are two windows on the West exposure for this space. Change the value for Qty to 2. Click Apply.
5. Click on the Room description down arrow (right side of text box). Pick the Sage Room and delete the roof just like you did for the Parsley Room. Delete all roof elements for all spaces on the First Floor with the exception of the Mechanical and Electrical rooms. Note that the first floor Corridor and Lobby have many roof elements. Each element must be deleted.
6. Click on the Rooms Tab (bottom of dialog) and set the plenum height for each space to the appropriate value (5'-0" for 9' clgs and 4'-0" for 10' clgs).
7. Set the room type to Conditioned or Unconditioned as appropriate for each space.

Verify all data for each space and make certain that all of the elements from the project building have been transferred to the Trace Project in accordance with your requirements. Make adjustments as necessary.

Setting Load Parameters

1. From the Pull-down menu select Actions -> Change Load Parameters…

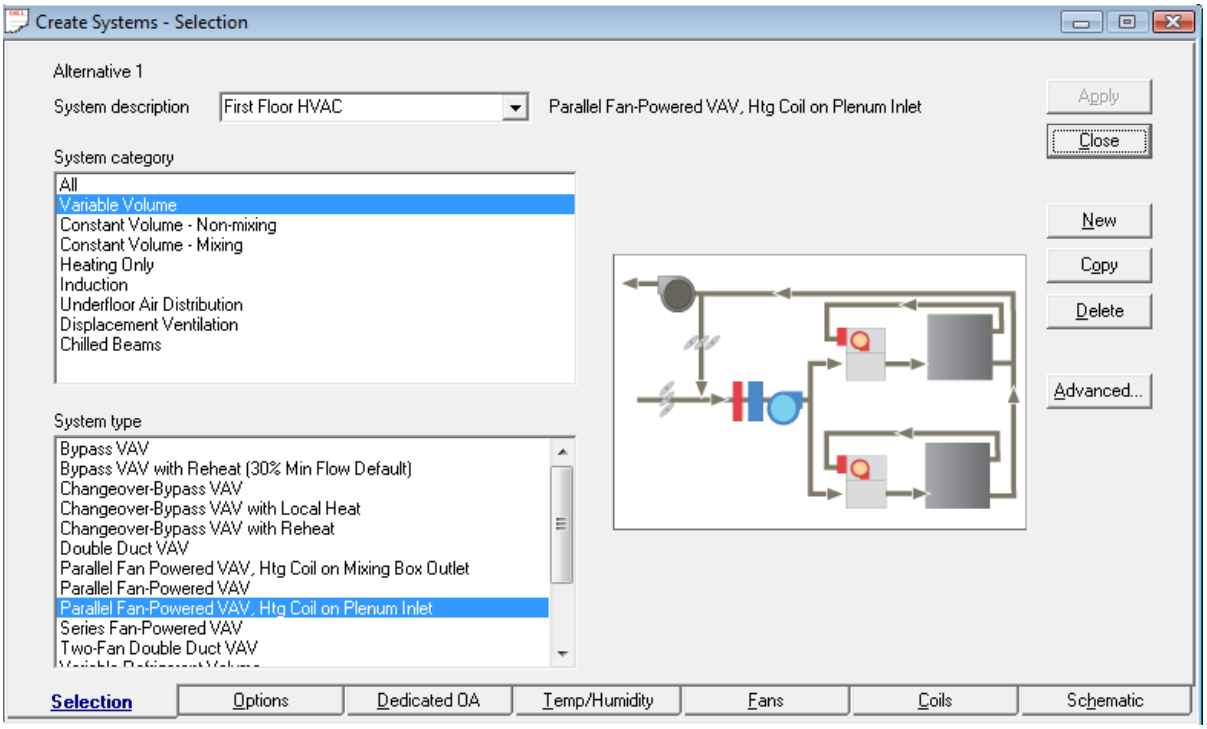
The Change Load Parameters dialog will display.



2. Set the values as shown in this example.

Creating Systems

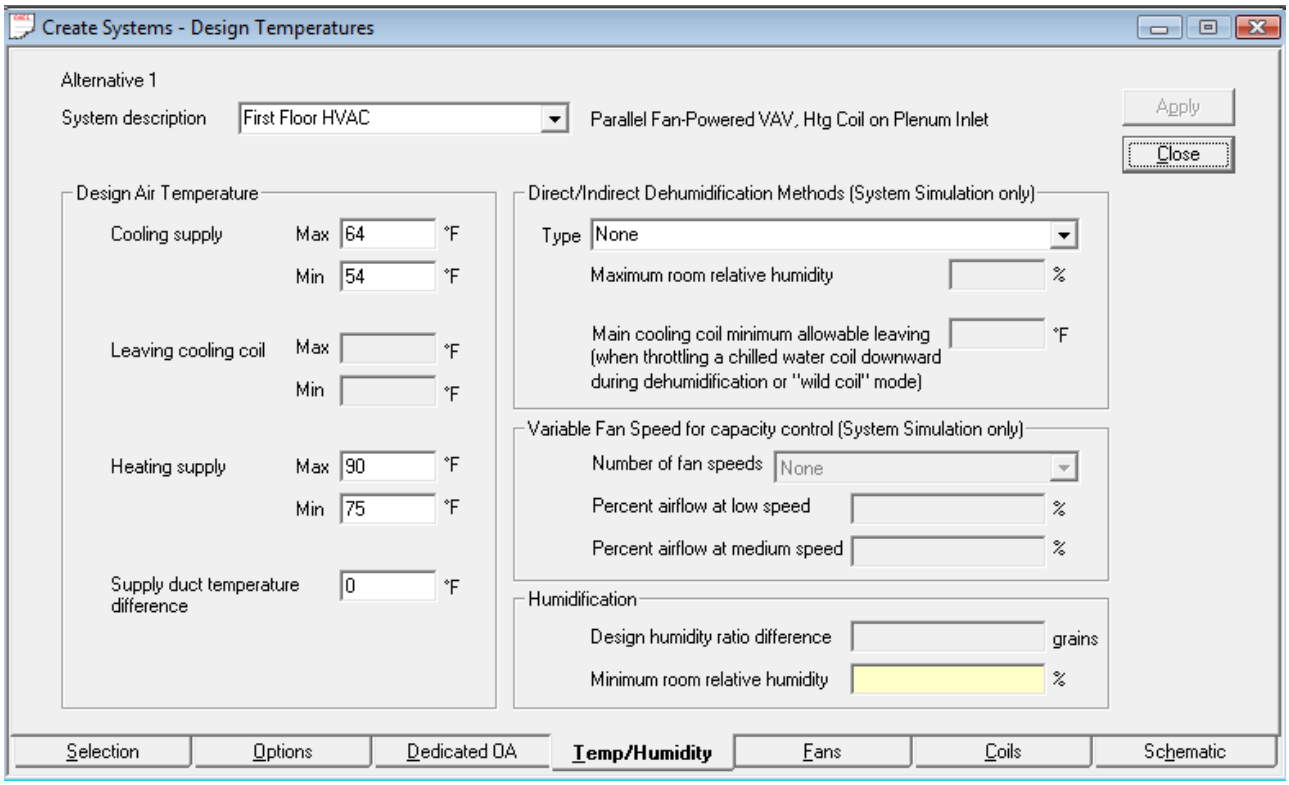
1. Pick the Create Systems button.



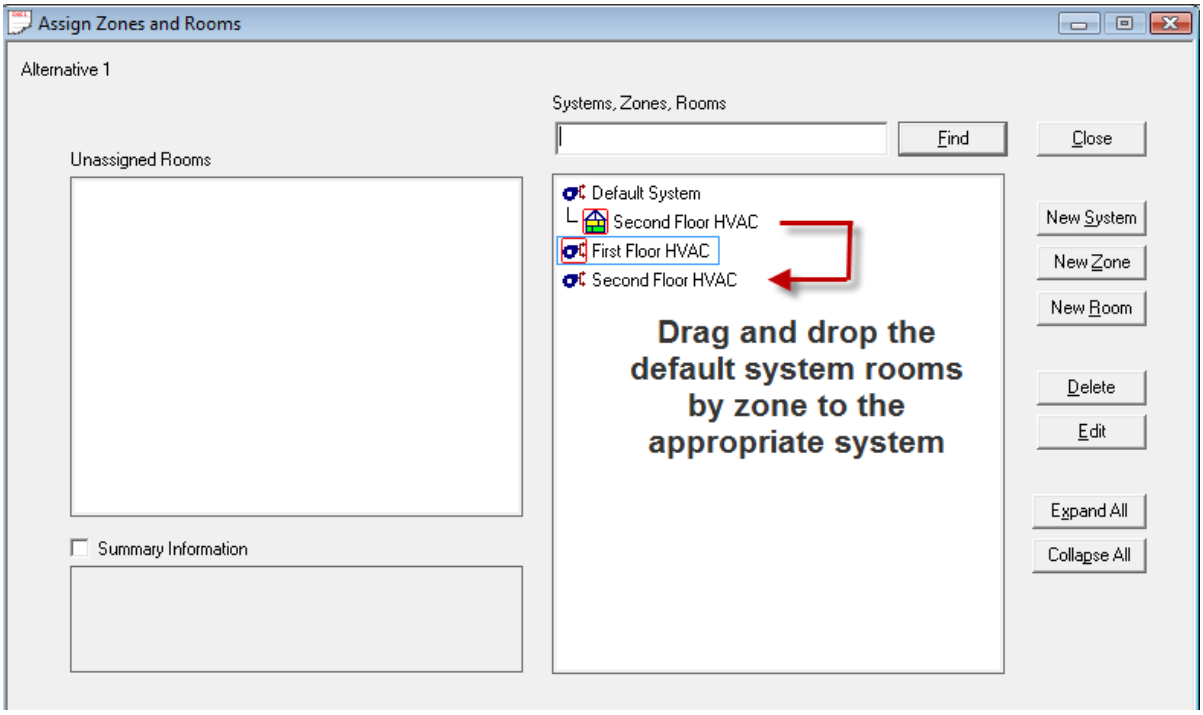
2. Pick New.
3. Enter First Floor HVAC for the System Description

4. Select Variable Volume in the System Category listbox.
5. Select Parallel Fan Powered VAV Htg Coil on Plenum Inlet.
6. Pick Apply
7. Pick New
8. Enter Second Floor HVAC for the System Description
9. Select Variable Volume in the System Category listbox.
10. Select Parallel Fan Powered VAV Htg Coil on Plenum Inlet.
11. Pick Apply
12. Pick Close
13. Pick the Temp/Humidity Tab

The Create Systems – Design Temperatures dialog will display.



14. Set the Cooling supply and Heating supply temperatures for both the First Floor HVAC and Second Floor HVAC systems to the values illustrated. Close the dialog.
15. Click the Assign Rooms to Systems button.
16. The two systems will be displayed in the large listbox below Systems, Zones, Rooms.
17. Double-click on Defaults. The defaults folder will open to display the First Floor HVAC Zone rooms and the Second Floor HVAC Zone rooms.
18. Pick and Drag the First Floor HVAC zone and drop it on the First Floor HVAC System.

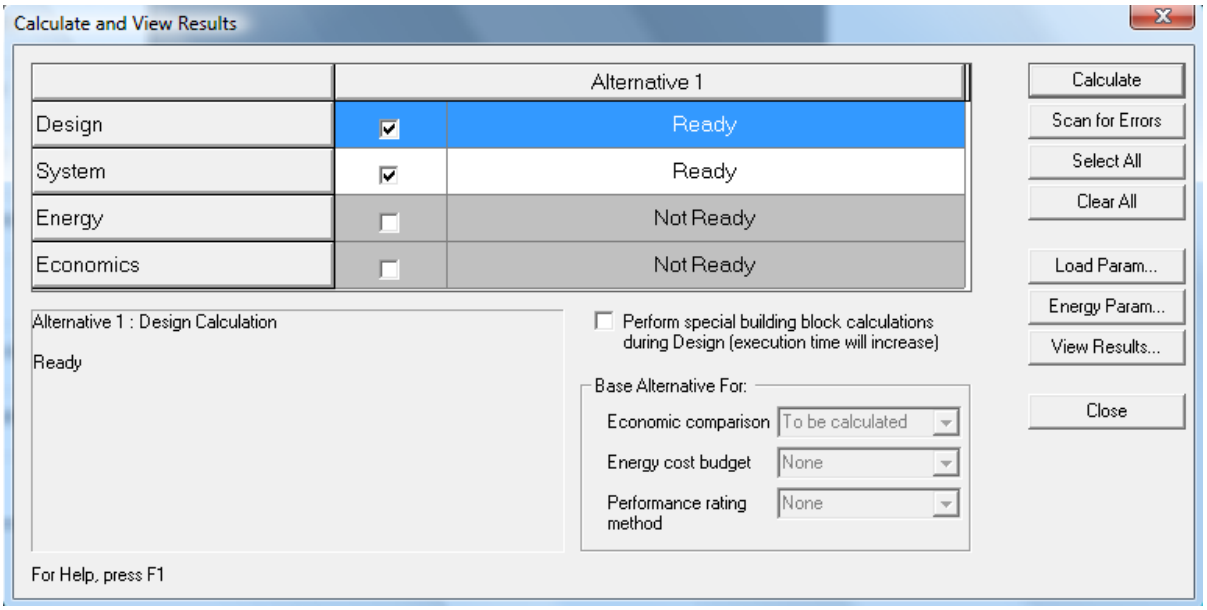


19. Pick and Drag the Second Floor HVAC zone and drop it on the Second Floor HVAC System.
20. Click on the Default System after the first and second floor zones have been assigned to the first and second floor systems. Pick the Delete button and delete the default system.
21. Select Close.

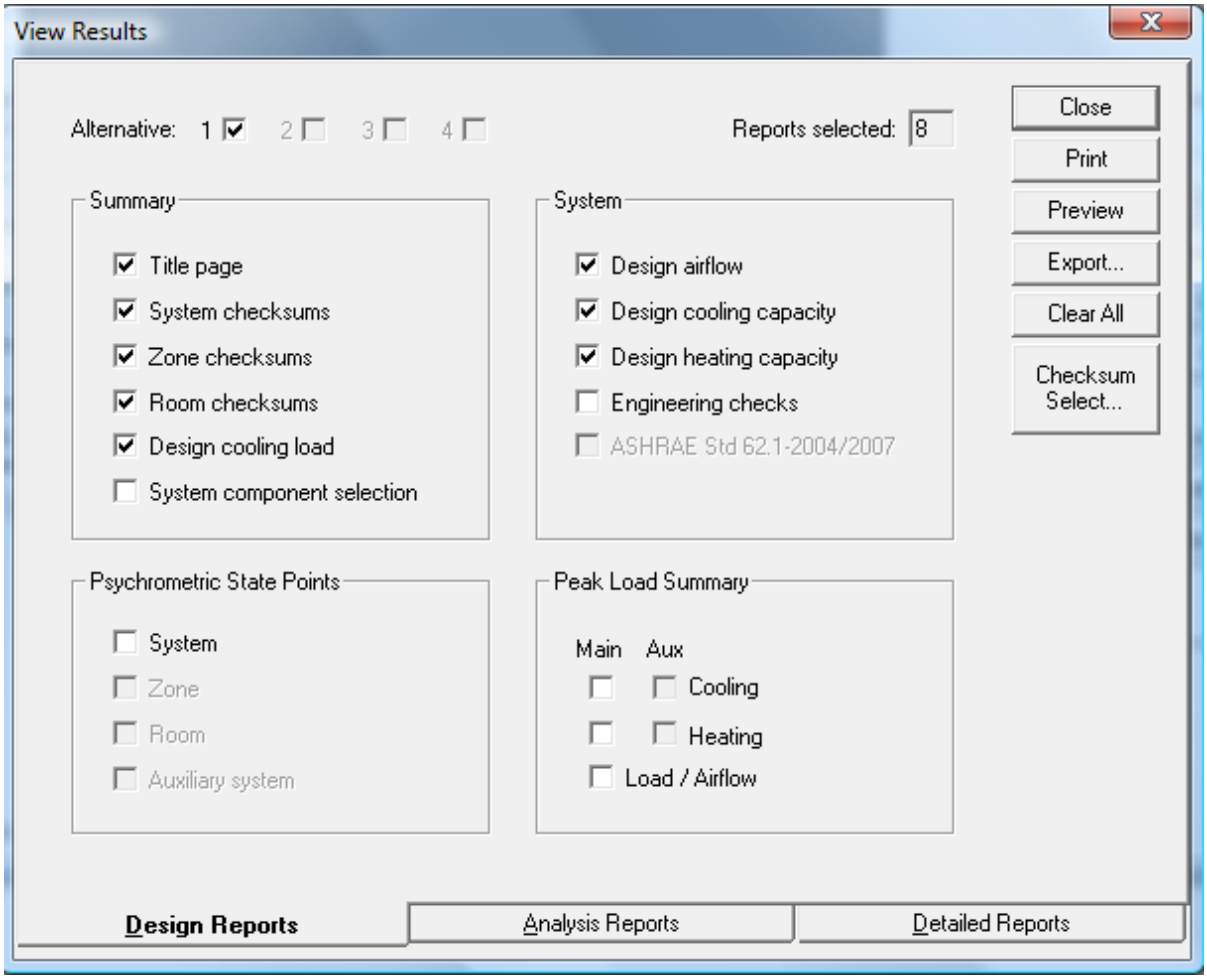
Calculating Results

22. Click on Calculate and View Results.

The Calculate and View Results dialog will display.

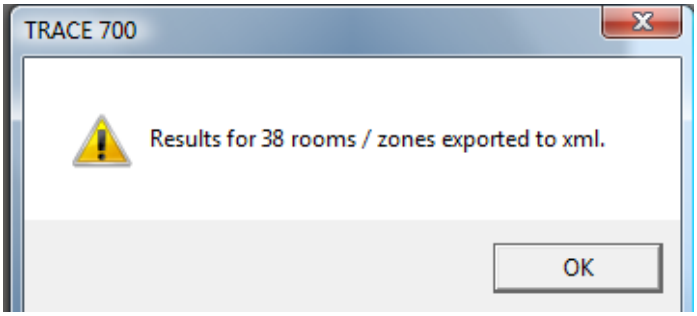


23. Note that the Design and System calculations for Alternative 1 are ready for calculation.
24. Select the Calculate button.
25. Ignore the warnings and pick continue.
26. The View Results Dialog will display. Check the data that will be viewed in accordance with the following illustration.

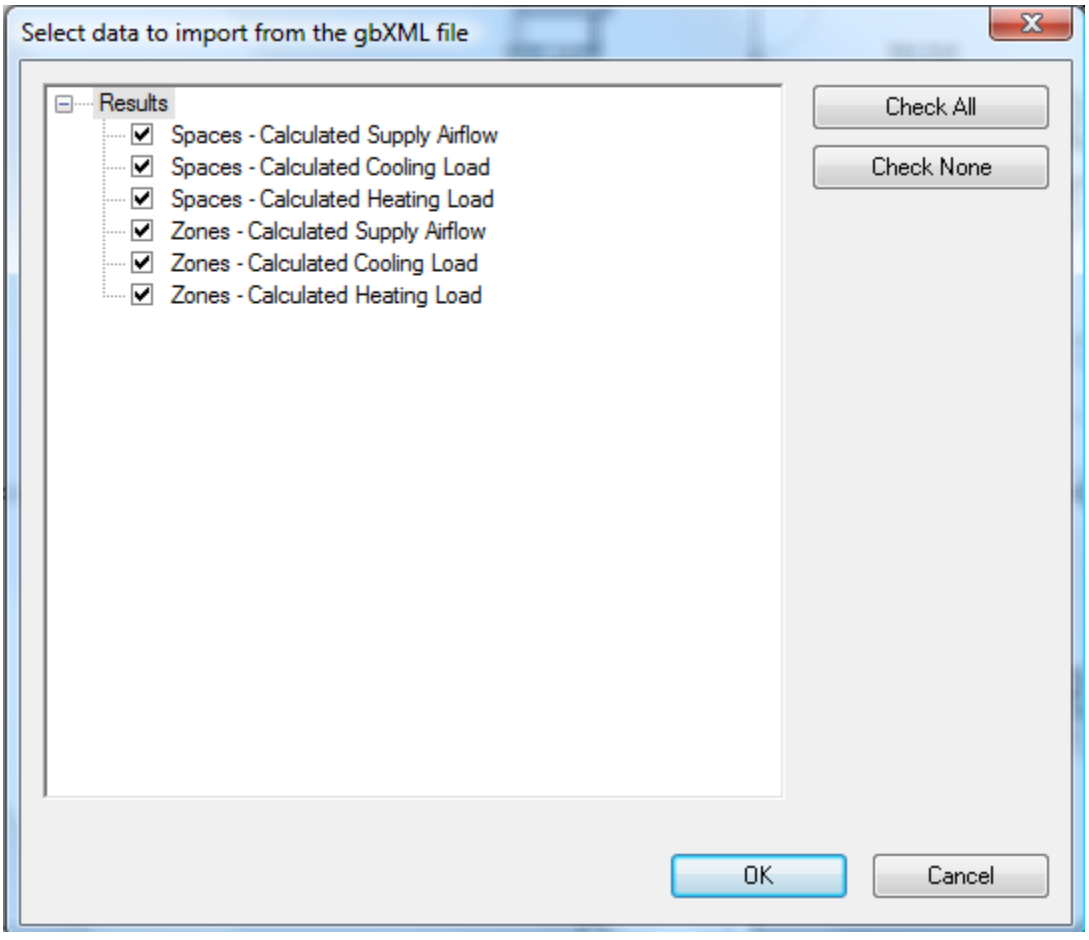


Previewing the Results

27. Pick Preview.
28. Preview the data that is displayed.
29. Close the dialogs back to the Project Navigator view.
30. Select File -> Export gbXML. Browse to the file that you imported prior to running the Trace Analysis.
31. C:\Revit MEP 2010 Training\gbXML\Training - HVAC.xml.
32. Pick Open. If the data is exported successfully, a dialog will display the results.



33. Return to Revit MEP 2010.
34. Select the Insert Tab -> Import Panel -> Import gbXML.
35. Select the C:\Revit MEP 2010 Training\gbXML\Training – HVAC.xml file.
36. Pick Open.
37. Check all data to import in the Data to Import Dialog.



38. Pick OK.

Results of the Trace Analysis:

Space Analysis Schedule – Trane Trace

Name	Number	Cooling BTUH	Heating BTUH	Supply Air	Heating Coil BTUH
Parsley Rm.	101	18838.8	1740.7	852	22700
Sage Rm.	102	21792.9	2260.1	985	26000
Rosemary Rm.	103	22179.3	3661.7	1003	26700
Thyme Rm.	104	27397.1	2793.4	1239	31600
Male Toilet	106	911.9	526.9	46	1200
Female Toilet	107	652.4	20	29	700
Break Room	108	3772.4	28.1	223	6300
Break Room	109	3772.5	28.1	223	6300
Director	110	9869.4	2336.2	446	5300
Secretary	111	1538.2	28.9	70	700
Conference	112	10325.5	1484.4	467	7100
Lobby-1	113-1	46839.3	4916.1	2344	66500
Lobby-2	113-2	34023.5	6307	1538	31600
Corridor	114	2529.5	230.2	114	2800
2nd Floor Lobby-1	201-1	56482	9797.4	2553	31300
2nd Floor Lobby-2	201-2	28963.8	2757.8	1673	31600
Cloves Rm.-1	202-1	18884.8	2697.4	854	26200
Cloves Rm.-2	202-2	24801.9	5261.3	1121	31300
Cinnamon Rm.	203	23627.1	4874.3	1074	32600
Nutmeg Rm.	204	21815.5	4794.8	1022	30900
Marjoram Rm.	205	27009.3	4215.8	1221	36700
Male Toilet	206	1018.6	731.7	58	1700
Female Toilet	207	759.8	226.4	34	1000
Corridor	209	2984	1132.4	140	4200
Break Room	210	3923	317.6	236	7200
Break Room	211	3923.1	317.6	236	7200

Notes:

1. *The design heating BTUH column is taken from the Trane Trace Room Checksums and includes reheat. Those values will be used in Chapter 9 to size the heating coils on the VAV boxes.*
2. *When the results of the load analysis are imported into Revit MEP, the calculated parameters from the gbXML file are automatically added to the Revit MEP spaces (as space properties) in the project.*

Creating an HVAC System

If you will be using the Internal Load Analysis Program results to create your HVAC System then:

- Delete the C:\Revit MEP 2010 Training folder.
- Install Revit MEP 2010 Training Dataset 4.
- Launch Revit MEP 2010 from the Desktop Icon.

If you will be using the Trane TRACE® Analysis Program results to create your HVAC System then:

- Delete the C:\Revit MEP 2010 Training folder.
- Install Revit MEP 2010 Training Dataset 5.
- Launch Revit MEP 2010 from the Desktop Icon.

This exercise is based on using Dataset 5.

At this point, the rooms all have calculated air flows. Actual airflow values will display once air terminals are placed in the rooms.

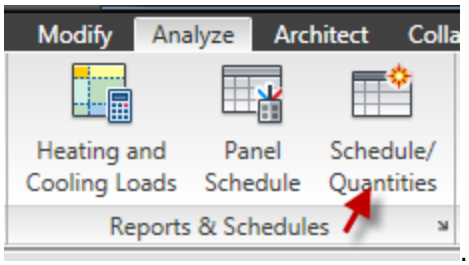
1. Once the file is opened, pick the Collaborate Tab -> Synchronize Panel -> Synchronize with Central tool. This is necessary in order to confirm the relationship between the central file and the local copy that you are working with.
2. Pick the Sage Room Space Element.
3. Right click and pick Element Properties
4. Scroll down to the Mechanical- Airflow Parameter in the Element Properties Dialog
5. Observe the value field for Calculated and Specified Supply Airflow

Creating a room supply air schedule

Schedules can be useful for displaying a listing of equipment for material takeoffs, etc. Schedules can also be used during the design and layout process to view and/or change values for elements in the project. The following schedule will list the space name and number along with the calculated air supply and actual supply air quantities. This schedule will be useful for determining when the room design conditions have been met during the placement of air terminal elements.

Note: You may duplicate the existing Space Analysis Schedule and modify it or you may create a new schedule in accordance with the following example:

1. Select the Analyze Tab -> Reports & Schedules panel -> Schedule/Quantities tool.



The New Schedule dialog will display.