ElumTools™ 2014 Workshop

MP1975-L

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Class summary

Have you ever wanted to use Autodesk® Revit®-based software to produce point-by-point lighting calculations directly in the Revit model? ElumTools, an add-in for Revit, is the answer. In this hands-on lab, you learn how to use ElumTools in Revit to achieve point-by-point calculation by using the architectural model and lighting families.

Key learning objectives

At the end of this class, you will be able to:

- Describe ElumTools and its features and uses
- Produce point-by-point lighting calculations inside a BIM model
- Use lighting families in Revit
- Create fast and accurate lighting design using the “I” in BIM

Introduction to Elumtools

Benefits of Using Elumtools

- Point by Point calculations directly in the model
- Accurate lighting calculation due to specific reflectance values and accurate services/furniture layouts.
- Ability to render directly in Revit for presentation purposes
- No need to build a 3D model in AGI32 or DIALux.
- Multi-core processor support

Why can’t we use the lighting calculation built into Revit instead?

- Revit currently uses the Lumin Method to calculate the average illuminance in a space or room which is not a point by point calculation. The Lumin method is also known as the Zonal Cavity Method which is a way of calculating the average illuminance using the room index, utilization factor and a few other variables. This method has been used in the past in the absence of IES or LDT files using Utilization factors supplied by the lighting manufacturers.

- Today lighting manufacturers provide digital photometric web files in lieu of utilization tables due to the introduction of modelling software such as AGI32 and DIALux. Strangely enough, Revit calculates the Utilization Factor from the IES file for each fitting. It then uses the data from the Revit space or room to calculate the Average illuminance.

Are the calculated results using ElumTools the same as with AGi32?

Yes, if all things are equal. However, there are several considerations that may result in different calculated values, such as:

- Differences in Materials properties and reflectances (this will be covered in the material mapping section)
- Wall thickness and shape of room.
- Revit families and details not available in AGI32 which will obviously alter the calculations such as:
  - Accurate furniture layouts
  - Pipes, ducts, cable trays and other families that affect the spread of light in areas such as offices with exposed ceilings and plant rooms.

WSP used a typical Revit Project to compare between AGI32 and Revit (Elumtools). Two identical (as much as possible) models with the same reflective surfaces were created both in AGI32 and in Revit (Elumtools). The results of the project were very close, with Elumtools providing greater accuracy in very busy areas such as plantrooms.

Step 1 - Making your Revit Family MEP and Elumtools Friendly

Note: Previous Family creation skills will be required

You can adopt this to an existing family or if you're starting a new one follow instructions below:

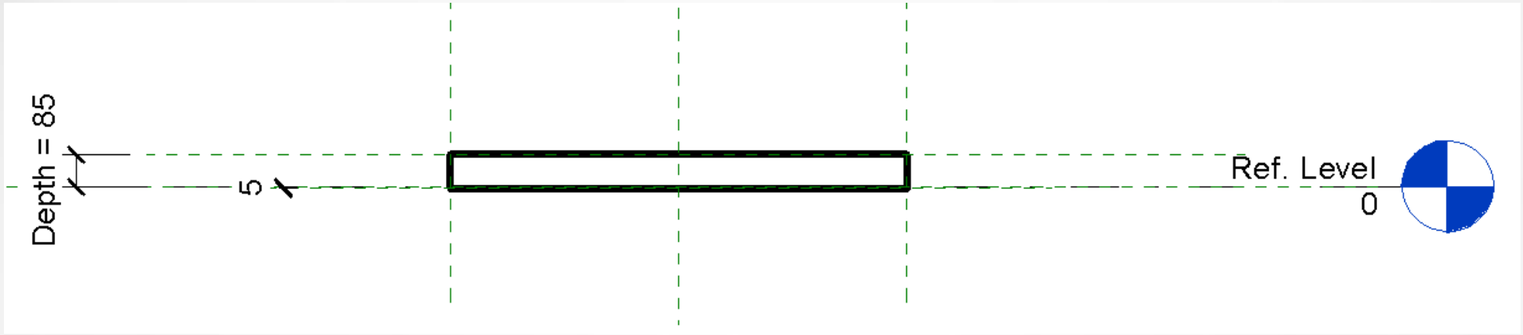
1. 

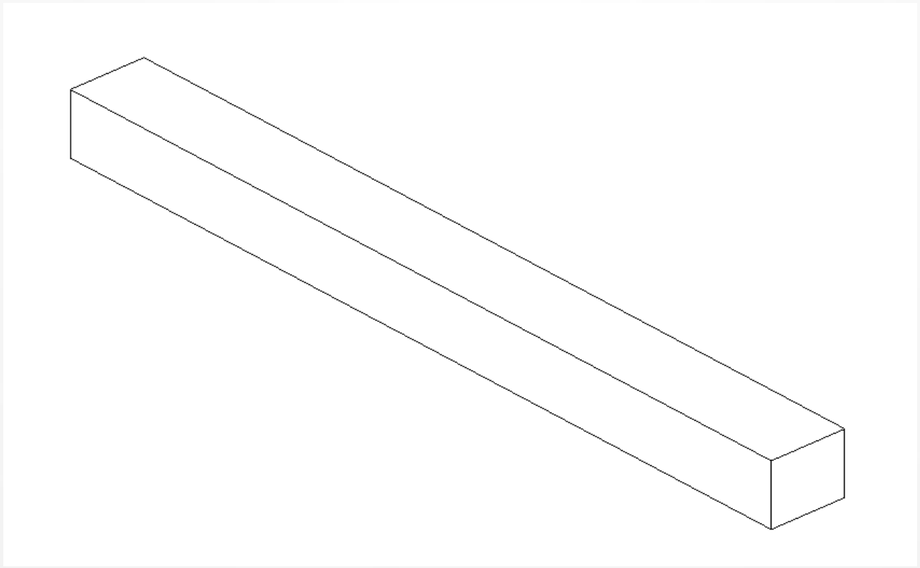
> New > Family > Metric Generic Model.rft

The reason we are selecting Metric Generic Model is because as we all know, there is no such thing as ceilings or walls in a linked model. We have not selected Face Based either as there are known issues with fittings appearing upside down on reference planes and disappearing when faces are deleted.

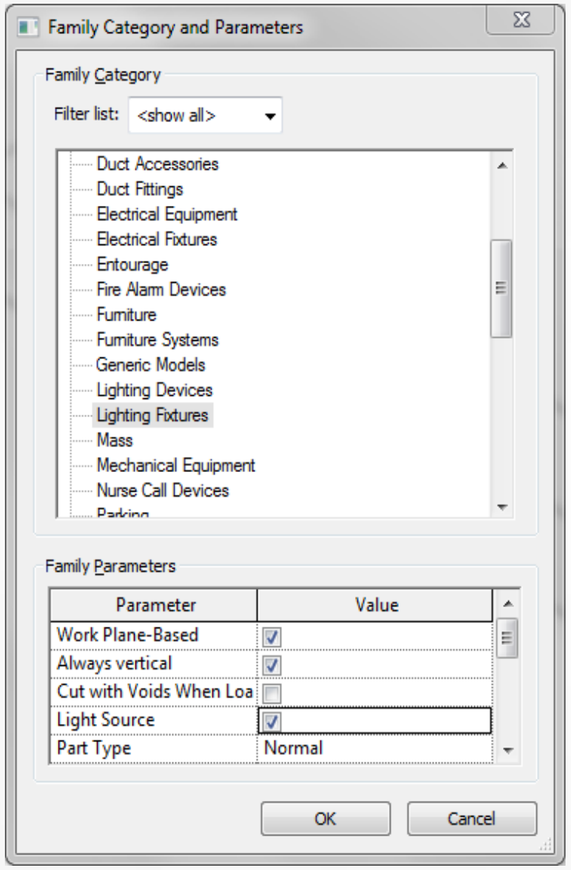
In this example we will be building the Zumtobel MIREL2 1x28 W (data available in the data sets).

Once you have created a basic extrusion of what the family looks like you should get something like this:



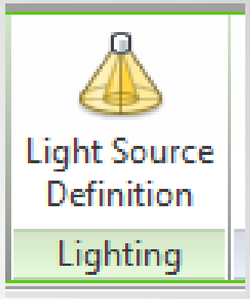


2. Select “**Family Category and Parameters**” in properties and change the Category to “**Lighting Fixtures**” and then check the “**light Source**” and “**Work Plane-Based**” boxes and select **OK**.

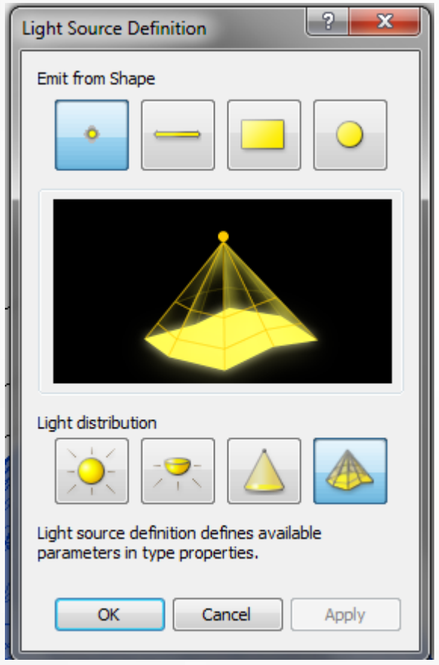


A default light source should come up; however we now need to change this to an IES file which we can use for our calculations.

3. Select the light source and then select “**Light Source Definition**”.



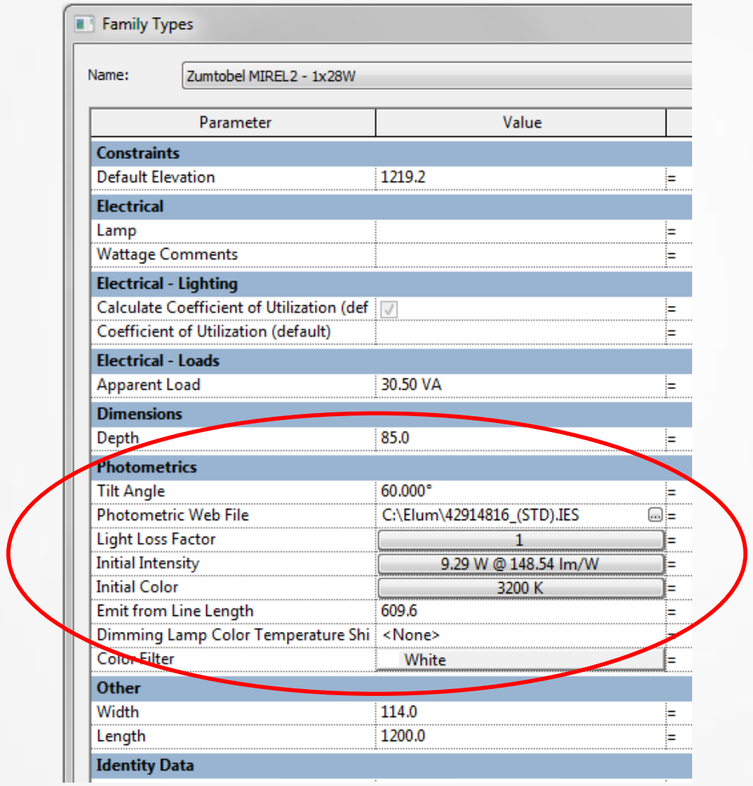
4. Now select “**Photometric Web**” under Light Distribution and select **OK**.



You should now see a light source shape however this is still a generic light source.

5. Now we must adjust this light source to use our desired IES file (Zumtobel MIREL2 1x28 W).

Select “**Family Types**” in properties.



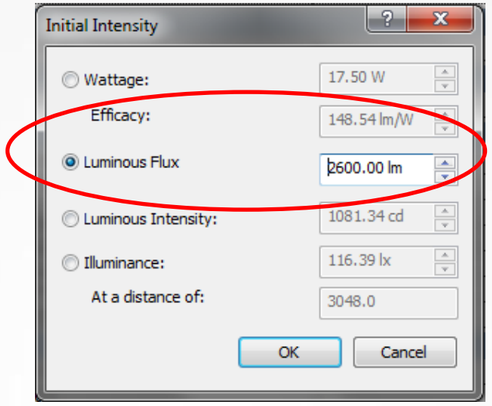
6. You should now see a new section appear called “**Photometrics**”. We must now go through and fill in each field first starting with the “**Photometric Web File**” first.

7. Select the tab on the right hand side and browse for the IES of your desired fitting. In this example we have inserted the Zumtobel MIREL2 IES file found in the Datasets.

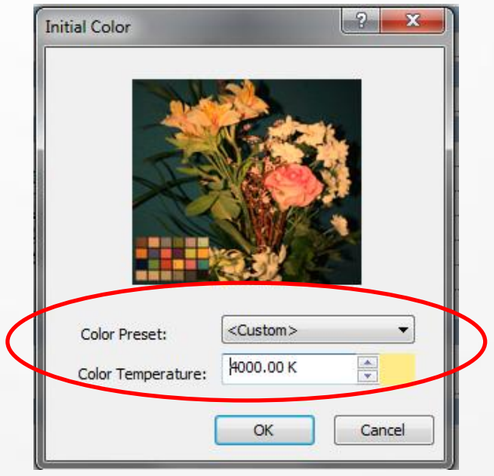
8. Change your “**Tilt Angle**” to the desired angle of your fitting. In this case it should be 90 Deg as this is a ceiling recessed fitting aiming down.

9. Adjust the “**Light Loss Factor**” to your desired value. This is generally your maintenance factor and in this case we are using 0.8 for a typical office.

10. Adjust your “**Initial Intensity**” to match the lamp you are using. We know that from a 1x28W T5 lamp we generally get 2600lm.

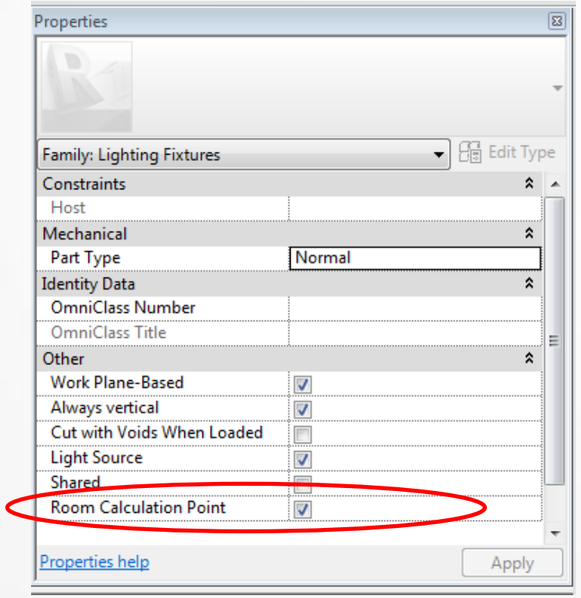


11. Change the “**Initial Color**” to suit your lamp type. In this example we are using a cool light of 4000K for a typical office. Select “**OK**” and you should now see the photometric web shape appear.



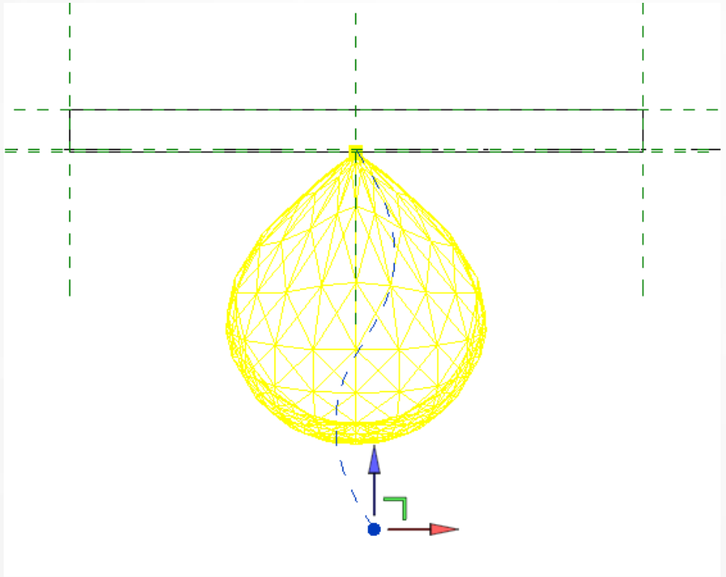
Now we must make sure that we have the “**Room Calculation Point**” option checked and shown the right direction. Without this the family will not be associated and recognised by the space or room and consequently none of your calculation will work.

13. In the Project Browser select a Front or Back **Elevation**. Now in your properties check the “**Room Calculation Point**” box.



14. You will now see a GREEN “S” shaped line appear. Now adjust this line by selecting the small green circle at the end of the line, and drag it to where your Revit Space or Room would be.

In this example we are using a ceiling recessed fitting and therefore the Room Calculation point should point down. However if this was an in ground up light then it would need to point upward as the space or room would be above ground.



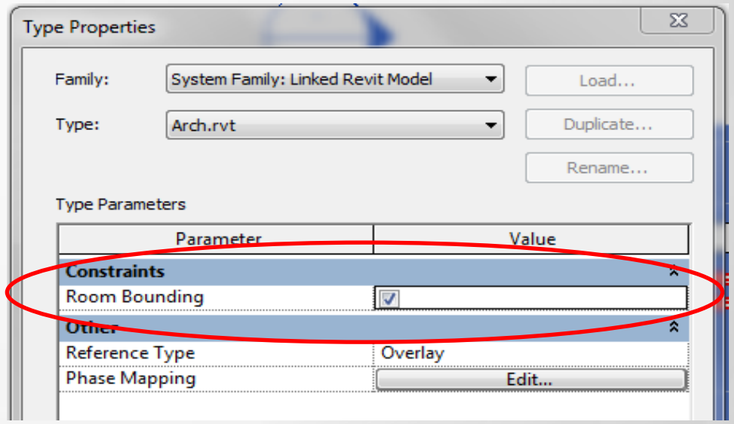
Now that we have created our family, we can simply duplicated and swap the IES files with similar fitting in the Revit project with ease.

Step 2 – Setting Up the Project Correctly

In this example we will be working with a linked model as most of the MEP projects currently operate this way.

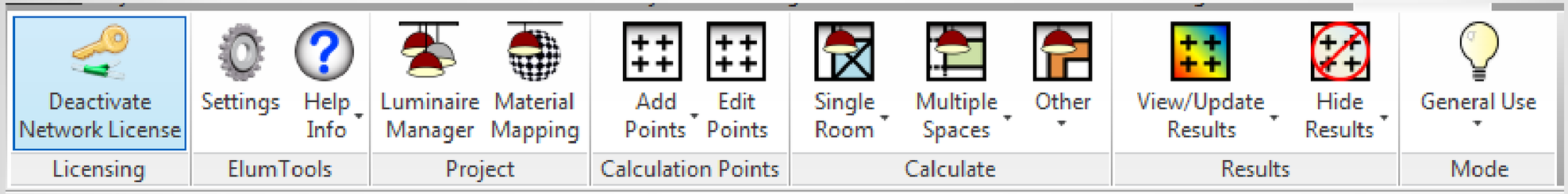
1. Once you have set-up your project using your template and inserted the Revit Architectural model (and have Elumtools installed of course we can begin).
2. It is highly recommended that you create Spaces as part of your standard project set-up as they have many uses with all services. If you do not have them created, you will need to for the areas you want to calculate.
3. You will need to ensure that your linked model is Room Bounding in order for your spaces to work. This can be set by selecting your linked model and then select "**Edit Type**" from the **Properties** menu.

4. Insert the Lighting family we have created and place the light fittings on the grid in an estimated spacing to achieve and Average Lux level of 320.



Step 3 – Using Elumtools

Select the Elumtools tab once the add-on has been installed. You will now see the Elumtools ribbon appear. We will follow the icons from Left to Right as this is the correct procedure when using Elumtools.



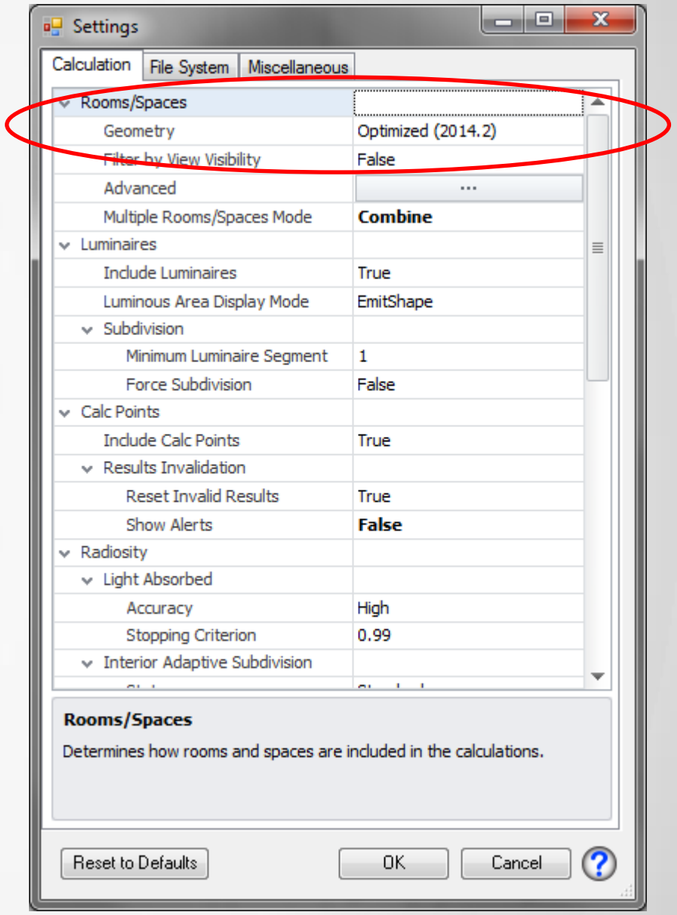
Settings

The majority of the calculations will be conducted with the above settings.

1. Set “**Geometry**” to “**Optimized (2014.2)**”
   This option uses the latest Elumtools engine to detect all MEP elements within the view i.e. Ducts, Pipes, Cable trays etc.

2. Set “**Filter by View Visibility**” to “**False**”
   This option allows you to calculate what is visible in the ElumTools_WorkingView automatically created by Elumtools. However this is not used due to Spaces and Rooms not being visible in a Revit 3D View.

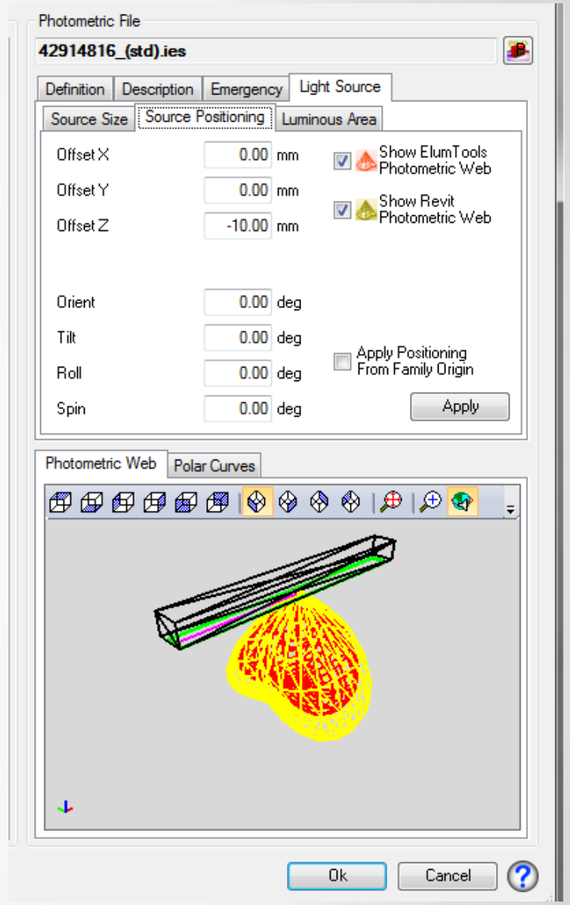
3. Select **OK**.



Luminaire Manager

In order to use the Luminaire with Elumtools we will need to validate the IES file and make sure it is doing exactly what we want it to do. If the Family has been set-up correctly it should automatically validate and all you need to do is check each fitting.

1. As we can see the IES Definition is as per our family IES file. If this is not the case you will need to adjust accordingly.
2. The Red IES file(from Elumtools) should match the Yellow IES file (from our Revit Family)
3. If the Red and Yellow IES files do not match you will need to select:
4. Light Source > Source Positioning and adjust the settings accordingly.

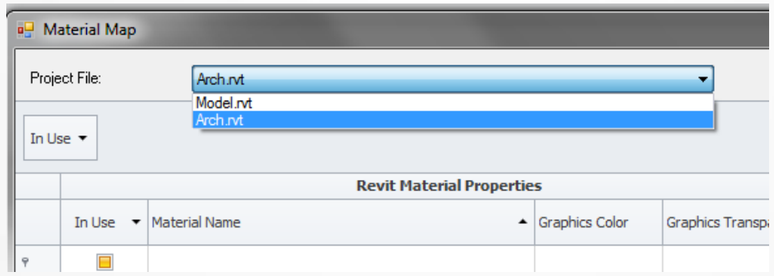


Material Mapping

Material Mapping is used to validate and override (if necessary) any surface reflectance value. As a default Elumtools will set the reflectances based on the colours and surfaces from the architectural model. If you are working on a true BIM project then it would be somewhat safe to leave in the default values.

However in the event you need to override the values follow the instruction below:

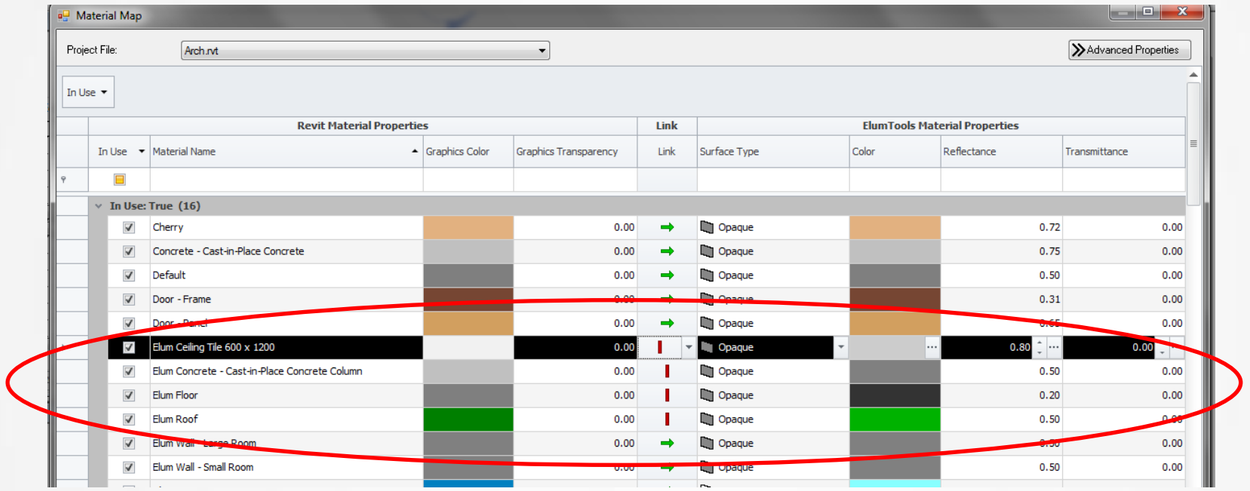
1. You will need to switch the project file to the architectural model as this is where our surfaces and objects are.



2. Now we can see all the materials that are coming through from the architectural model under materials “In Use”. The surfaces that we are using in these spaces have been re-named to include the word “elum”. This is simply to make things easier for this tutorial and help us located the desired surfaces.

Material Mapping

3. Below you can see the surfaces that have been altered to match our desired reflectances. Once the reflectances are overridden you will see the “Link” change to a vertical red bar. This represents a disconnection from the model and a user override has been inputted.

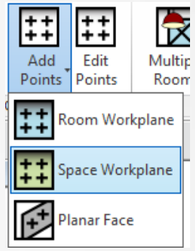


4. For the purpose of this example we have entered the default settings of ceiling 0.8, walls/columns 0.5 and floors as 0.2 reflectance.

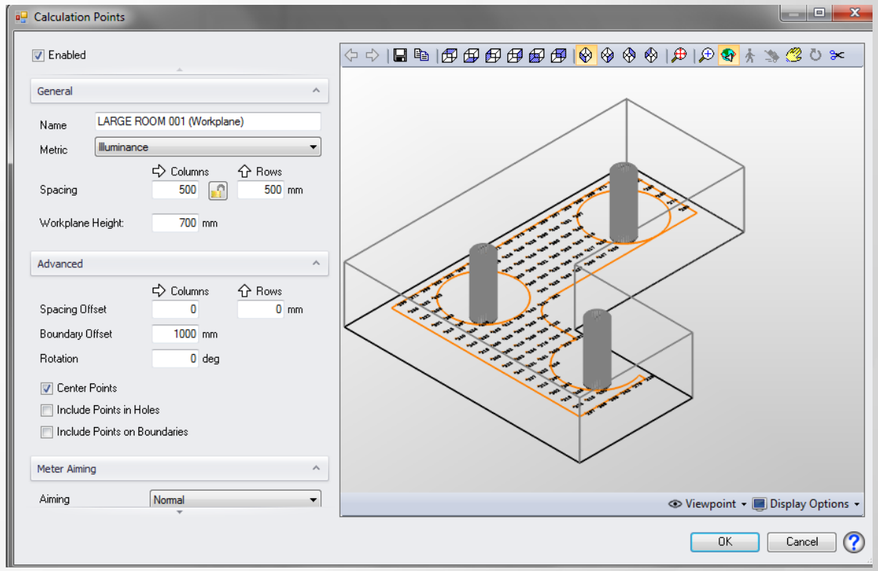
Add points

Now we must add calculation points to each space as we normally do in AGI32.

1. Select “**Space Workplane**” from the “**Add Points**” drop down. Select the space you want to add the points to and you should now see the calculation points window.



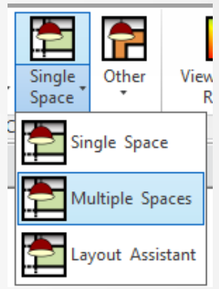
2. In this example we are using a working plane of 700mm and a calculation spacing of 500mm x 500mm and an offset of 1000mm from walls and columns. Be sure to uncheck the lock symbol as this tends to cause issues when selected.



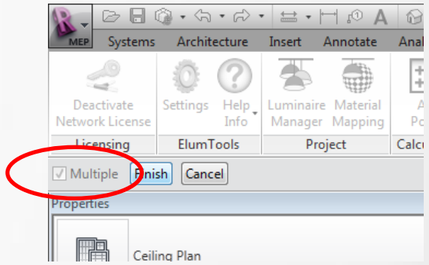
Calculating

Now that we have set everything up, it's now time to run our calculation.

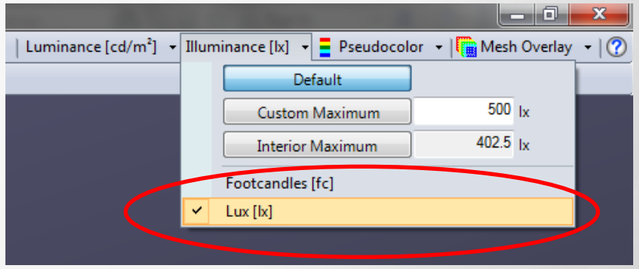
1. Select "**Multiple Rooms**" from the **Calculate** menu bar, as we have 2 spaces we would like to calculate.



2. Now select the 2 spaces we have in the model and click on finish on the top left hand side.

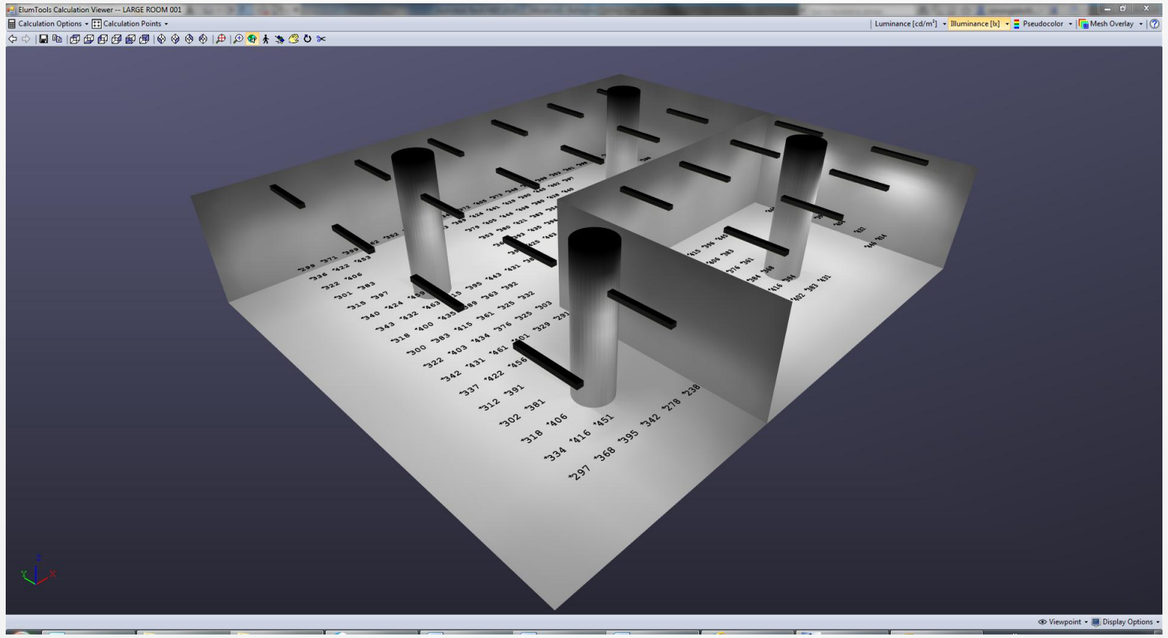


3. Now you will see a separate window which resembles AGI32 in render mode. You should also see the calculation points appear in cd/m². This can easily be changed to Lux by using the drop down menu adjacent cd/m² (if required).



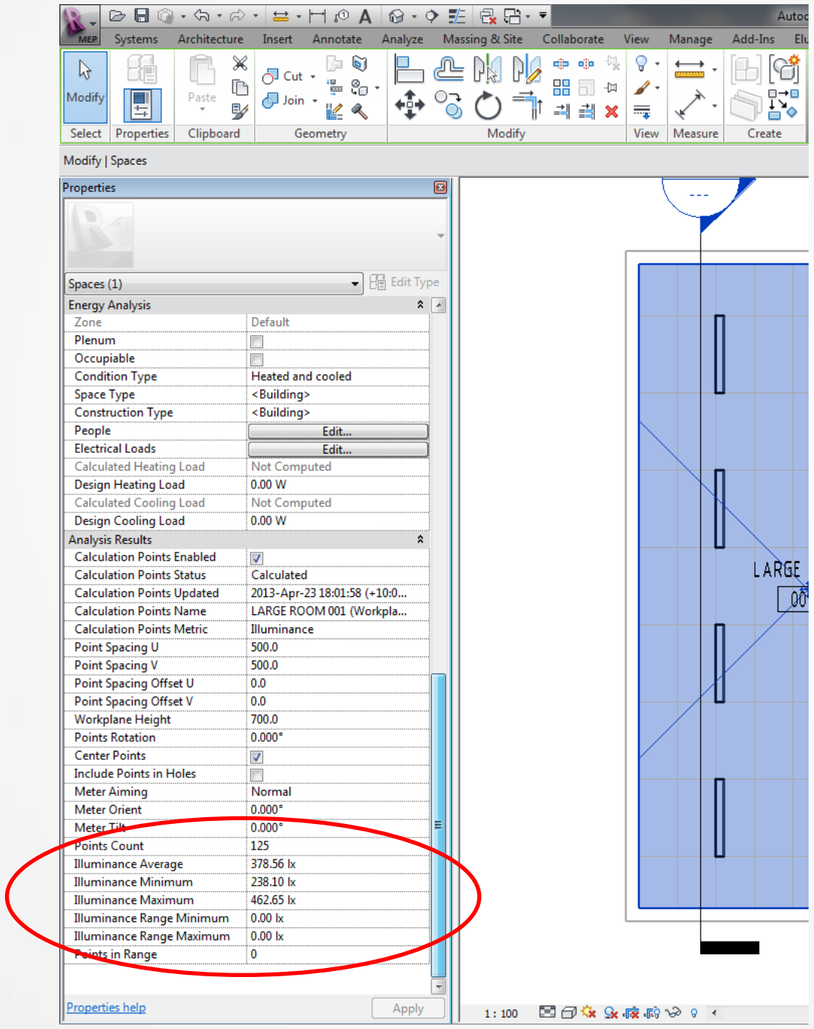
In this window there are a number of settings and functions to view your results. Some main ones are mesh overlay and Pseudocolor. You can also perform a walk through and rotate as per AGI32.

Once you have calculated the results you can now close this window as all of the information is available back in your Revit Model.



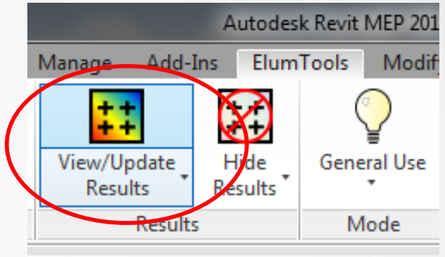
Step 3 – Using and Displaying the Results in Revit

Once you are back in your Revit Model you can quickly view your results by selecting the desired space and scrolling down the properties until you see the sub heading "**Analysis Results**". Under this heading are the parameters that Elumtools produces and will be used for scheduling purposes.

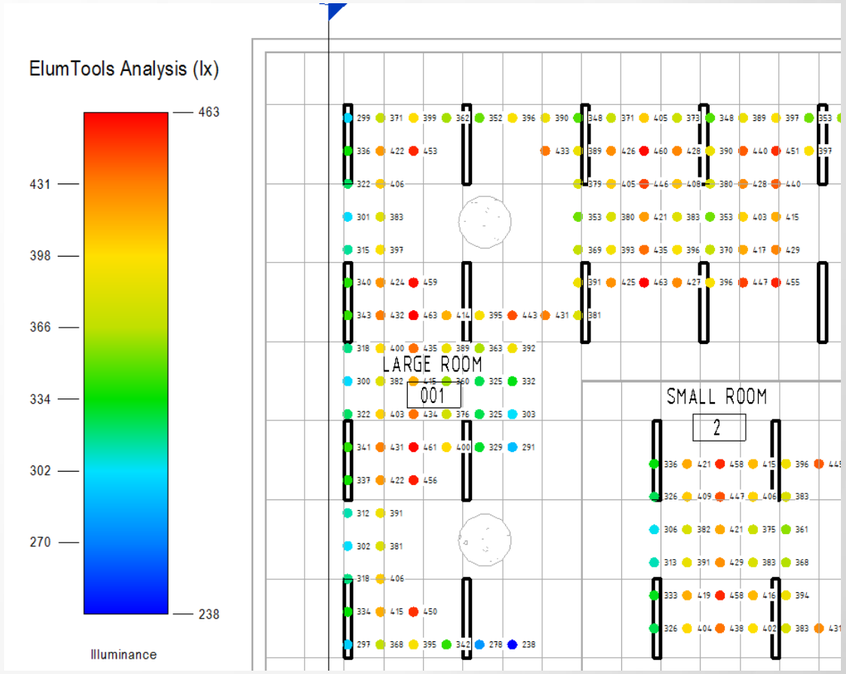


Once we are happy with the results there are a number of ways to view them:

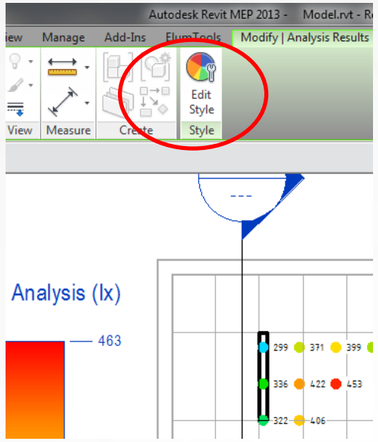
1. On the actual floor plan as per AGI32 by selecting “**View/Update Results**” from the **Results** menu bar.



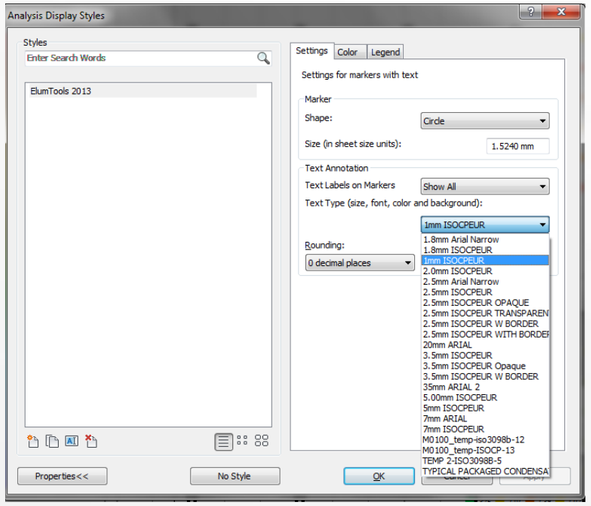
This will display the points as per our set-up previously.



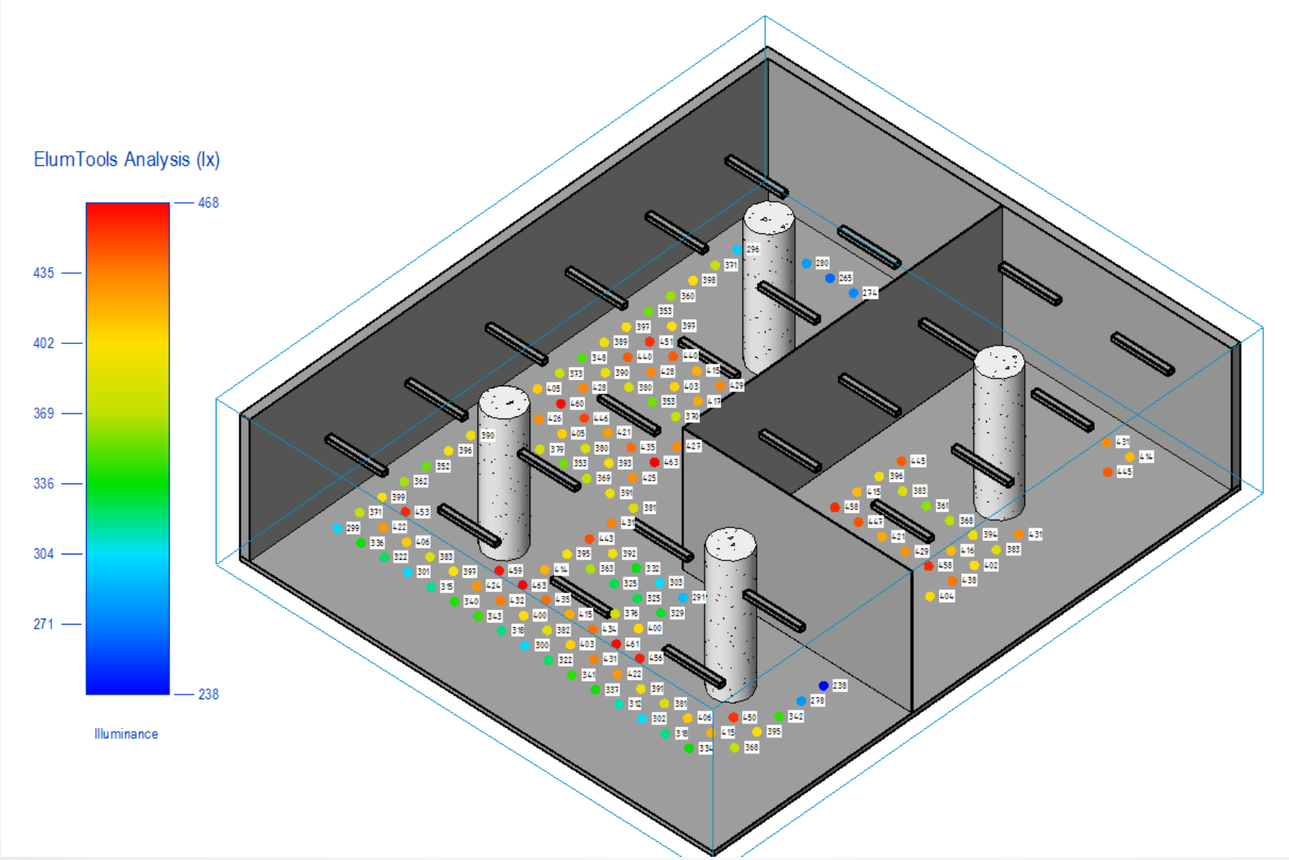
You may also choose to edit the way these points are displayed such as colours, font, text size etc. This can be achieved by selecting the calculation points and then selecting “**Edit Style**” from the ribbon:



In this dialog you adjust many variables and display the calculation points to your choosing.



2. You may also choose to view the calculation points in a Revit 3D View. This is done the same way as the floor plan method above.



3. The third and possibly most useful way is using schedules. This method also allows you to perform basic calculation using Revit Formulas:

As shown in the Elumtools help guide:

a)  > View Tab > Schedules > Schedules/Quantities
b) In the New Schedule dialog, select Rooms or Spaces from the category list.
c) Name the schedule "Lighting Calculation Schedule."
d) In the Schedule Properties dialog, select the Fields to be included in the schedule.
e) For this example we selected:
    i. Level
    ii. Calculation Points Name (Room Name)
    iii. Illuminance Average
    iv. Illuminance Maximum
    v. Illuminance Minimum
    vi. Workplane Height
    vii. Calculation Points Metric
f) We also want to add Minimum to Average ratio in order to see the uniformity result, so select the Calculated Value button. In the Calculated Value dialog enter the following:
    i. Name = Min/Avg
    ii. Formula (select button)
    iii. Discipline = Common
    iv. Type = Number
    v. Formula: select Illuminance Minimum, enter a "/" and then select Illuminance Average
g) Arrange the Fields as shown in the schedule shown below.
h) Select the Filter tab. Filter by "Calculation points metric," "equals," "Illuminance." This will ensure that we do not include all the Rooms that do not contain calculation points in the schedule.

i. Select the Formatting tab to enforce rounding rules on the ratio calculations.
   i. Select the field Min/Avg.
   ii. Select the Field Format button
   iii. Remove the checkmark for "Default Settings"
   iv. Change Units to "Fixed"
   v. Set Rounding to 2 decimal places
   vi. Repeat this for the Max/Min field
   vii. Change the field "Calculation Points Metric" to a hidden field

j. Change the column heading for "Illuminance Average" to simply "Average," and then do the same for Maximum and Minimum fields.

Lighting Calculation Schedule						
Level	Calculation Points Name	Workplane Height	Illuminance Average	Illuminance Maximum	Illuminance Minimum	Min/Avg
Level 1	LARGE ROOM 001 (Workpl	700	379 lx	463 lx	238 lx	0.63
Level 1	SMALL ROOM 2 (Workplan	700	399 lx	468 lx	306 lx	0.77

Handy Tips

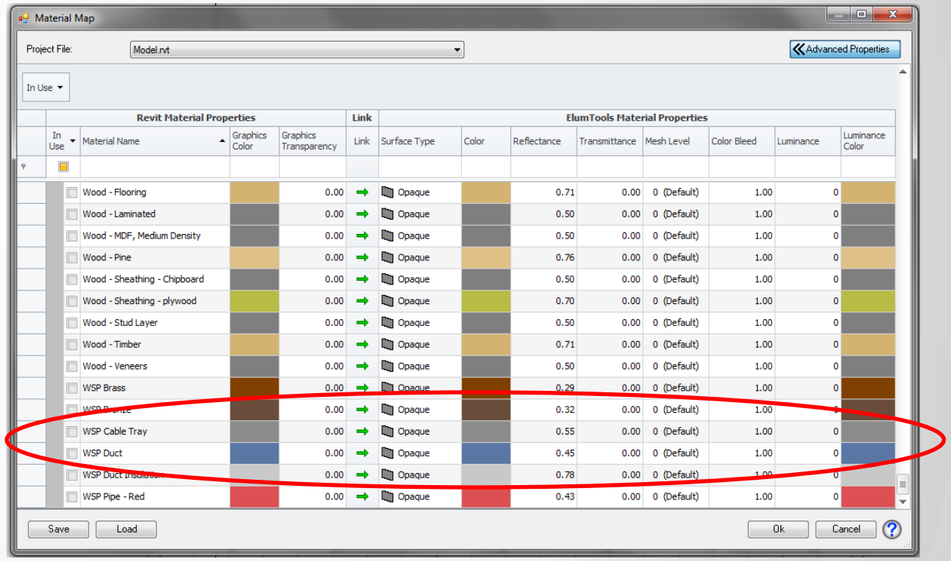
Include MEP Families in your Calculations

To utilize the full extent of Elumtools with MEP services such as plant rooms and exposed ceiling designs, you may use the "**Calculate Selected Elements**" option. This allows the inclusion of Revit Ducts, Pipes, and Cable Trays etc.

The following must be completed for this to work:

1. Apply a material to the Revit Families and System families in your project. Elumtools will not recognise the default material and therefore you will need to apply a different material. For this example we have used WSP_Duct, WSP_Pipe and WSP_Cable Tray for our materials. This should be set-up in the object styles of the project.

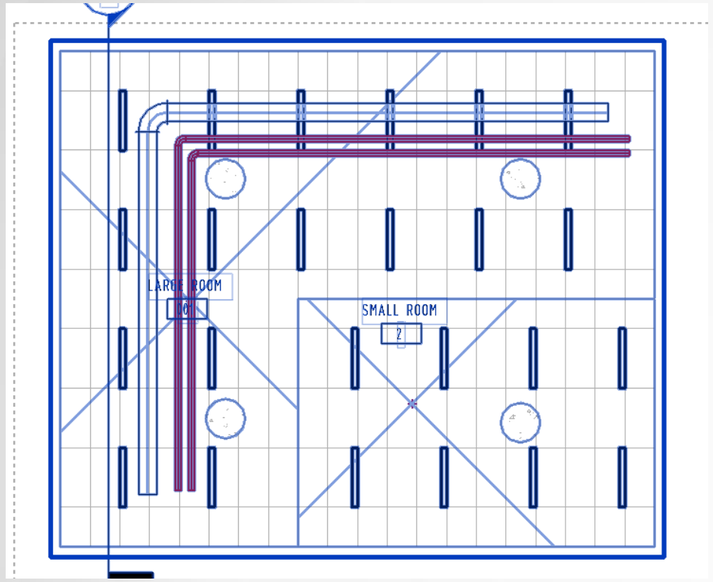
2. You should now select "**Material Mapping**" in Elumtools and review the reflectance of your chosen material. You can either choose to use the reflectance in the material you have chosen or override it.



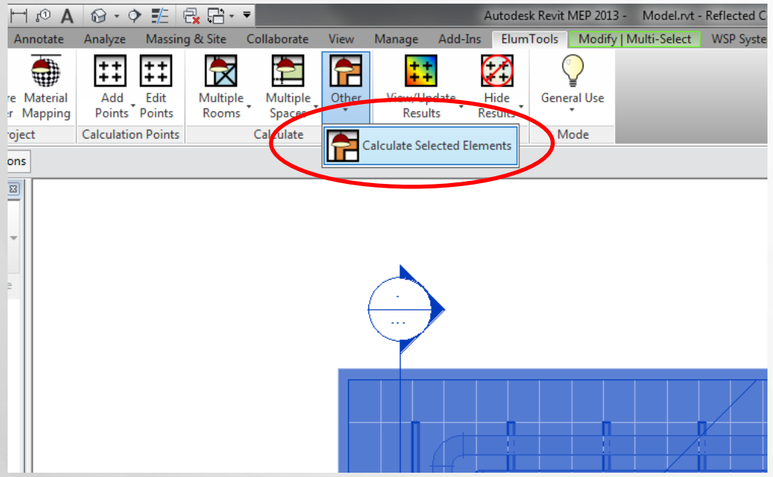
It is also worth mentioning that these materials will NOT show up in the "**In Use**" section. However they will still work and have a bearing on your lighting calculation.

3. Now simply select all the elements relating to that space and then select Elumtools > Other > Calculate Selected Elements. For this example we have drawn in some ducts and pipes in order to show how this will work.

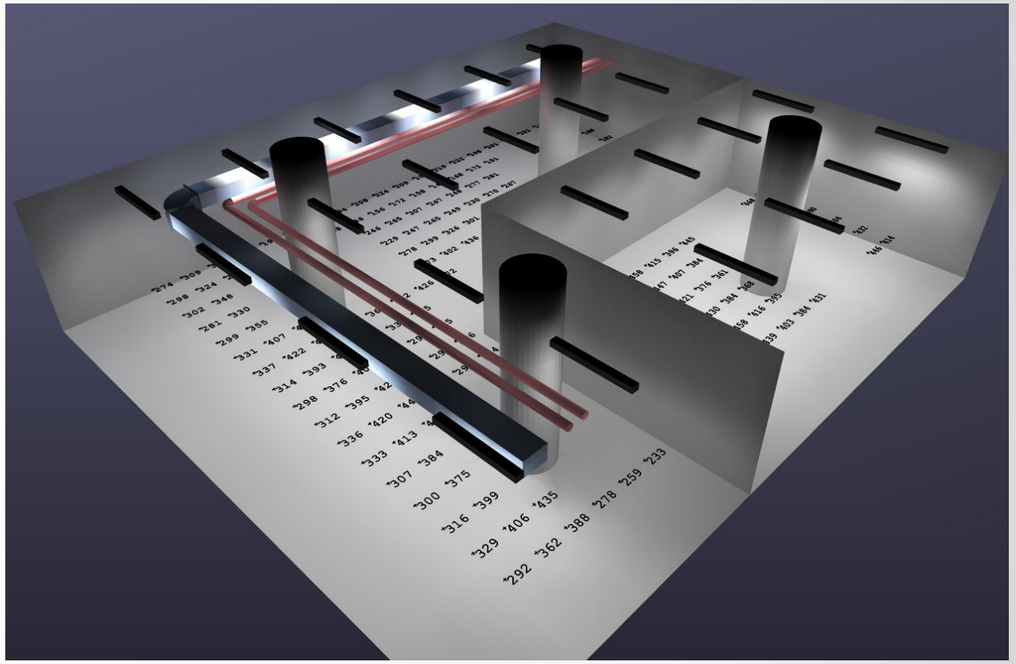
a.



b.



c.

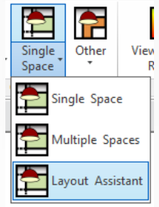


You should now see the MEP elements being included as part of the calculation.

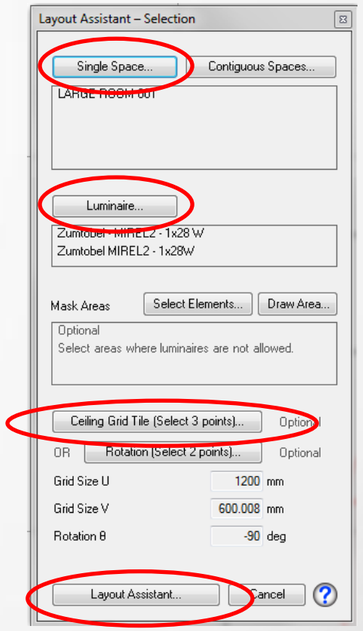
Layout Assistant (Room Estimator)

This is a handy tool in Elumtools to perform a quick calculation. This also allows you to play around with the lighting levels and luminaire locations before importing the layout into Revit.

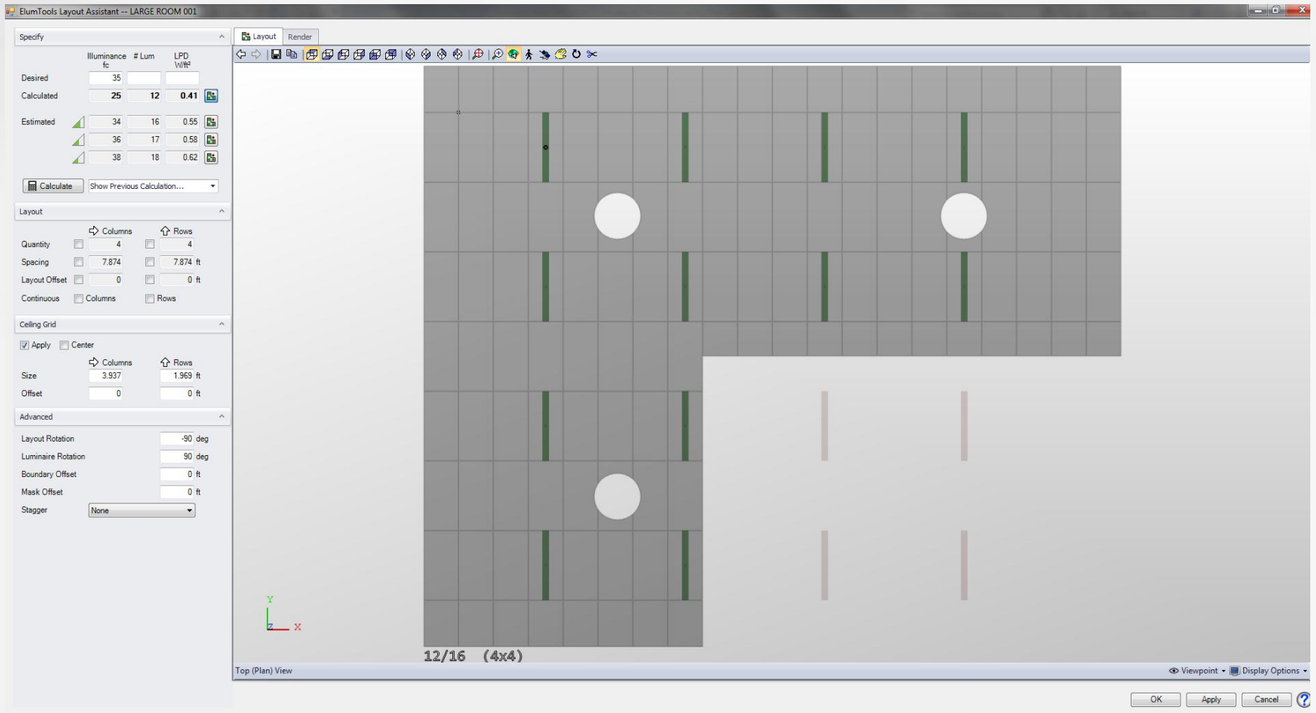
1. Select “**Layout Assistant**” from the **Calculation** menu bar.



2. You should now see the window bellow.
   a. Select “**Single Space**” and then select the space you need calculated from the model.
   b. Select “**Luminaire**” and then select the Luminaire you want to use for your calculation.
   c. And finally select the “**Ceiling Grid Tile**” and specify the 3 points in the model.
   d. Now you should be able to select “**Layout Assistant**”.



3. You should now see the layout assistant window appear as shown below.

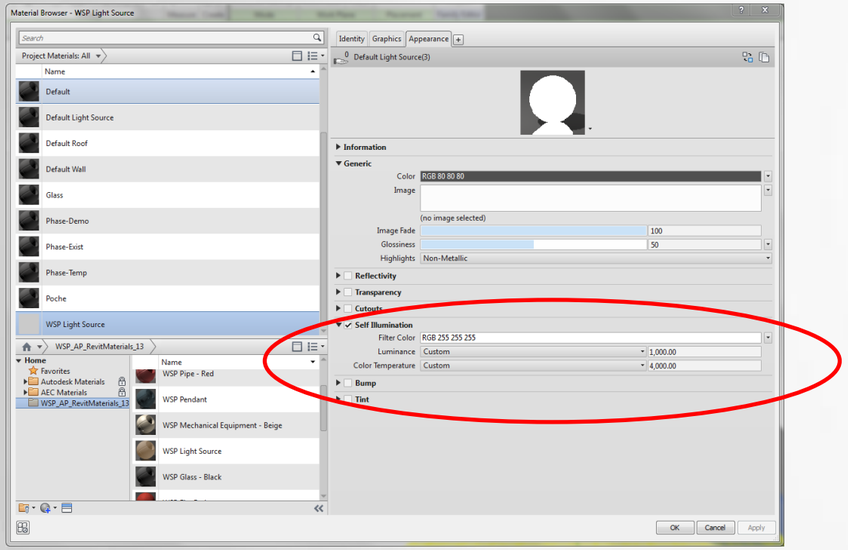


Once you have calculated and happy with the result. You can now select **OK** which will past the desired lighting layout into the Revit Model. Now you can simple calculate using the regular Elumtools method allowing the calculation points to appear and your schedules to be populated.

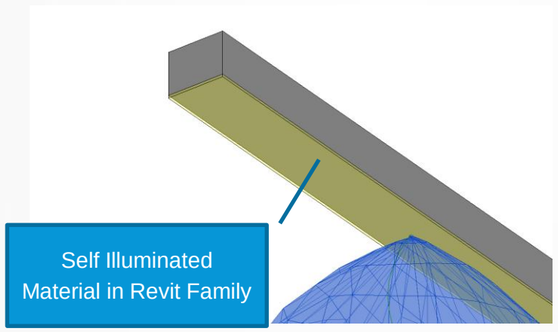
Using Self-Illuminated Material

When creating a Lighting Family it is handy to use a material with a “**Self Illumination**” property. This allows your light fittings to appear as if they are switched on when performing a render for presentation purposes.
This can be edited using the **Materials Browser** located under **Manage**.

a.



b.



c.