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# Insight Lighting Analysis Help

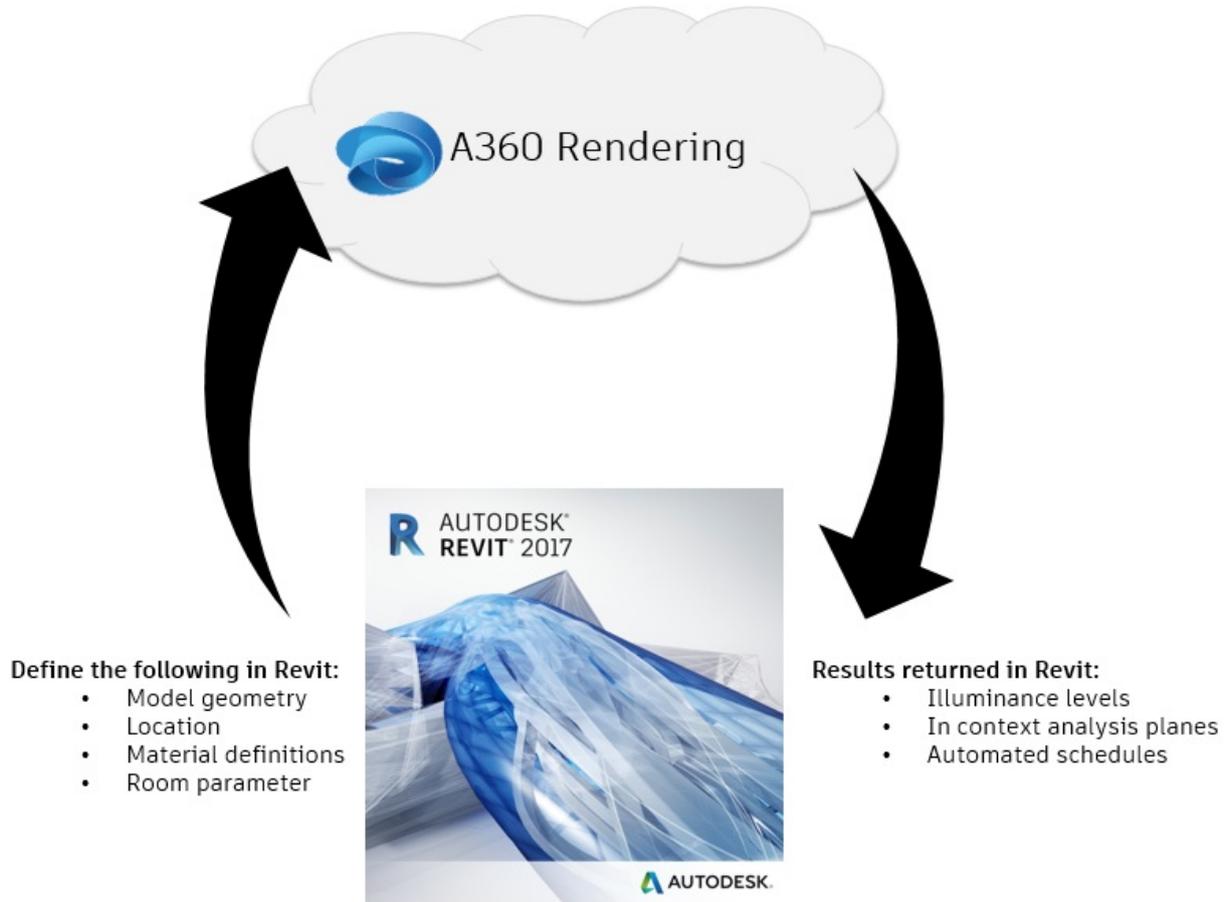This guide covers the Insight Lighting Analysis with Revit 2017 workflows available with Insight plugin v3.0.0.

Additional Revit support.

# About Insight Lighting Analysis

Insight Lighting Analysis with Revit provides in context daylighting and lighting analysis results and automated scheduling to help you document light levels throughout your design. The plugin provides automated settings for specific study types, as well as customizable options. The following analysis types are currently available:

| Analysis Type | Description |
|---|---|
| *Illuminance Analysis* | Full custom control over date, time, threshold, and analysis plane height |
| *Daylight Autonomy (sDA preview)* | Sample calculation for LEED v4 EQc7 opt1 (sDA & ASE)Reduced cost & calculation time |
| *LEED 2009 IEQc8 opt1* | Automated settings for LEED 2009 IEQc8 opt1 settings |
| *LEED v4 EQc7 opt1* | Automated settings for LEED v4 EQc7 opt1 (sDA & ASE) settings |
| *LEED v4 EQc7 opt2* | Automated settings for LEED v4 EQc7 opt2 settings |
| *Solar Access* | Customizable hours of sun study |

Insight Lighting Analysis with Revit leverages the A360 Rendering service, a cloud based rendering service, to provide quick and accurate lighting analysis results. The diagram below represents how Insight Lighting Analysis with Revit works.

**Define the following in Revit:**
- Model geometry
- Location
- Material definitions
- Room parameter

**Results returned in Revit:**
- Illuminance levels
- In context analysis planes
- Automated schedules

# Requirements

Insight Lighting Analysis is supported for Revit 2016 and above. More recent versions of Revit will often feature more functionality. Refer to the Insight Lighting & Solar Analysis Forum for available versions and functionalities.

Access requirements for using Insight Lighting Analysis with Revit:

- Autodesk Revit 2016 or above
- Most recent Insight plugin
- Access to a Revit, Building Design Suite, or AEC Collections subscription
- Cloud Credits if conducting larger analyses

Learn about model requirements here.

# Workflows

Regardless of the type of analysis you wish to do, to get started with Insight Lighting Analysis with Revit, you should:

1. Install the most recent version of the Insight plugin. Find out which versions are available here.

2. Prepare your model: Set the project location and select a weather station. Define surface reflectivity and glazing material properties.

From there you will be prepared to complete any of the workflows outlined.

# Overview

Open a building element model in Revit. Note that for lighting analysis studies you must use a building element Revit model. A conceptual mass model will not work. Also be sure to login to your A360 account. Lighting analysis consumes Cloud Credits, so Revit will need to be able to access your A360 account to complete the analysis.

For new projects, make sure that your location is set and a weather station is selected.

From the **Analyze** tab, select **Lighting** from within the Insight panel. The Lighting command is a separate plugin you can download from here.
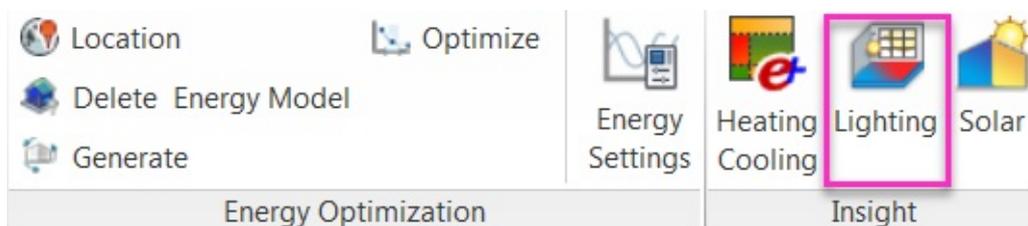


The first dialog that appears provides resources and best practices for conducting a lighting analysis study. These best practices are not required, but will help you achieve more accurate results. Select **Continue**.

Next, you will have the option to run a new analysis type or recall previously saved results. Select **Run New Analysis** and then **Go**.
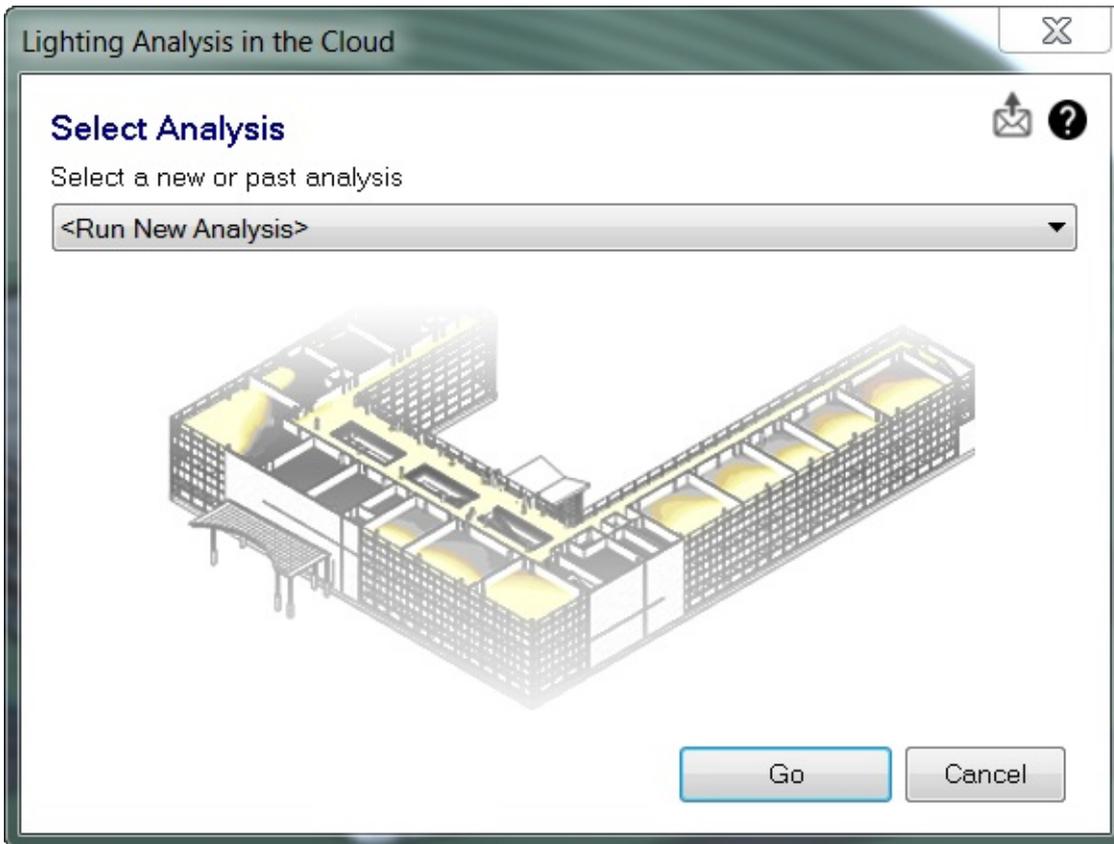
The *Lighting Analysis in the Cloud* dialog box will allow you to control your study settings.
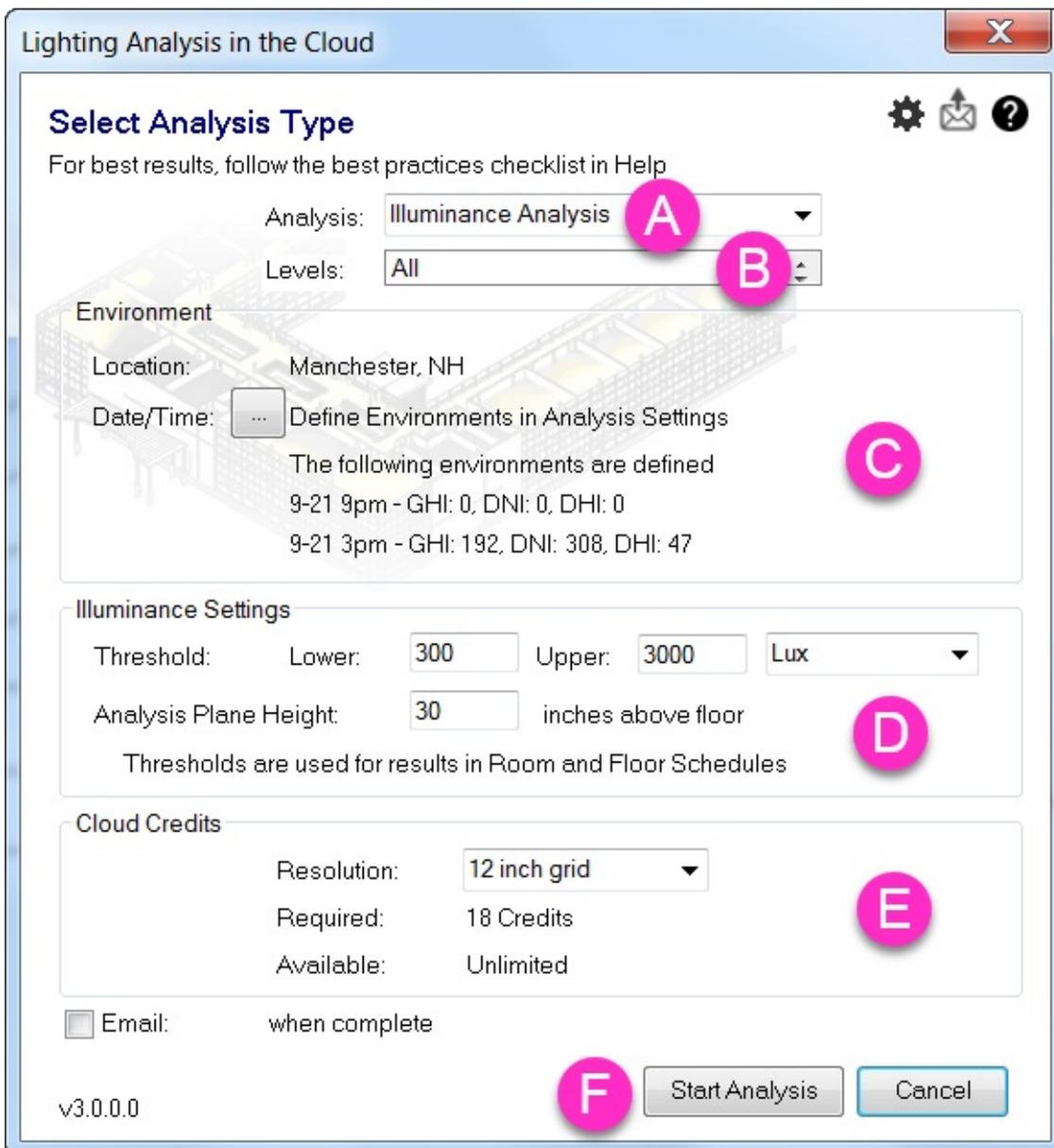
**A.** *Analysis* allows you to select between different study types including:

| Analysis Type | Description |
|---|---|
| *Illuminance Analysis* | Full custom control over date, time, threshold, and analysis plane height |
| *Daylight Autonomy (sDA preview)* | Sample calculation for LEED v4 EQc7 opt1 (sDA & ASE), Reduced cost & calculation time |
| *LEED 2009 IEQc8 opt1* | Automated settings for LEED 2009 IEQc8 opt1 settings |
| *LEED v4 EQc7 opt1* | Automated settings for LEED v4 EQc7 opt1 (sDA & ASE) settings |
| *LEED v4 EQc7 opt2* | Automated settings for LEED v4 EQc7 opt2 settings |
| *Solar Access* | Customizable hours of sun study |

**B.** Select which *Levels* you would like to visualize results for. Drop down the menu, and double click on your selection. To select multiple levels, hold down SHIFT, select the levels, then click outside of the drop down menu.

Note that Cloud Credit costs are tied to floor area included in the analysis. Learn more about Cloud Credit costs.

**C.** The *Environment* settings include Location and analysis time or range. The *Location* specified for the Revit project is what will be used for the analysis. The date and time settings are automatically populated for LEED analysis types, however if you select *Illuminance Analysis* or *Solar Access*, you have the ability control your settings.

**D.** *Illuminance Settings* are also automatically populated based on LEED criteria, but can be manually controlled for *Illuminance Analysis* and *Solar Access* studies.

**E.** *Resolution* includes two analysis grid sizes; a 72 inch grid and 12 inch grid and also drives cloud credit costs. For some analysis types, these grid sizes are preset and cannot be edited.

Note that Cloud Credit costs are tied to analysis resolution. Learn more about Cloud Credit costs.

**F.** Select **Start Analysis** to begin the simulation. Cloud credits will not be charged until the analysis is complete.

After selecting **Start Analysis**, the model geometry will be uploaded to the cloud rendering engine. Do not close the project or Revit during this process.

Once the model is successfully uploaded to the cloud and the project is saved, it is okay to close the project or continue working in Revit. Note that any changes you make to the model geometry or material settings will not be reflected in your analysis results, as the model has already been uploaded for analysis.

You can check the progress of the analysis by initiating the plugin again, and using the drop down menu to find in progress analyses.
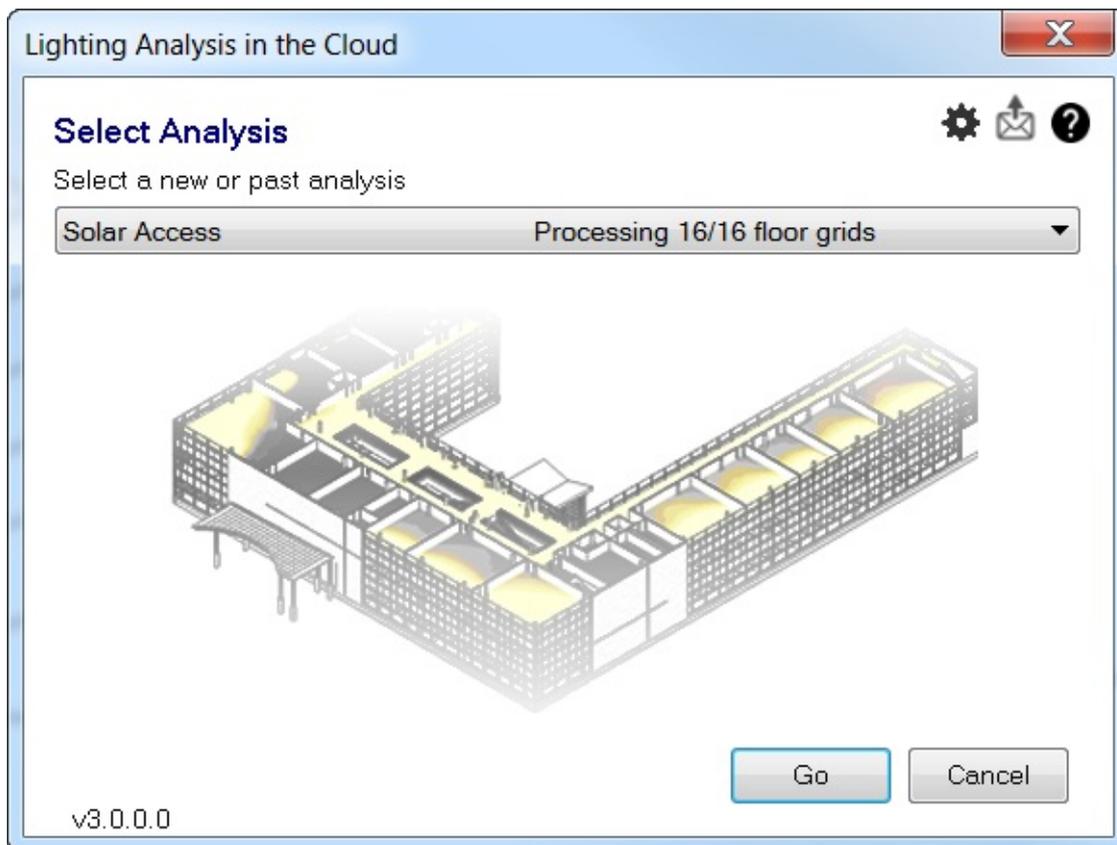
Revit will notify you once the results are ready. **Accept** or **Decline** the cloud credit charges at this point. It is recommended you also save the project after accepting the charges, so you will be able to recall the lighting analysis results after exiting Revit.

Lighting Analysis in the Cloud

The LEED v4 EQc7 opt 2 run submitted 12-Dec-16 2:41 PM
    is complete for project:
    AdvancedSample_17.rvt
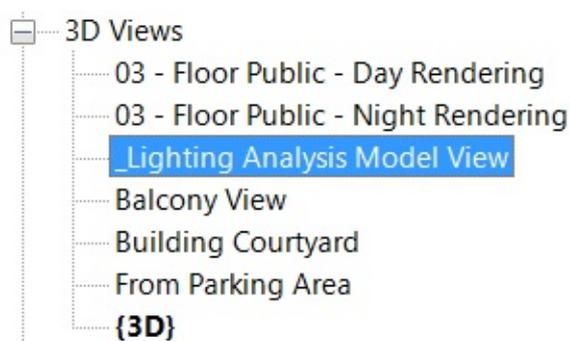
    16/16 floor grids succeeded

    Cloud Credits Required: 5
    Cloud Credits Available: Unlimited

➔ Accept, Update and Save Project
    Account will be debited the required credits and Project saved.
    Results will be available to generate from the Analysis List.

➔ Accept and Update
    Account will be debited the required credits.
    Results will be available to generate from the Analysis List.

➔ Decline
    Results will not be available until account is charged.
    This dialog can be accessed from the Analysis List.

Open the **_Lighting Analysis Model View** under 3D Views (or any other 3D view). Note that any "*_Lighting…*" views are automatically created to easily access results in plan, 3D, and as a schedule. Analysis results will populate in whatever 3D view is currently active.

3D Views
    03 - Floor Public - Day Rendering
    03 - Floor Public - Night Rendering
    _Lighting Analysis Model View
    Balcony View
    Building Courtyard
    From Parking Area
    **{3D}**

From the Insight 360 panel select **Lighting** to access your analysis results. This time, select the results for the analysis that has been completed and select **Go**.
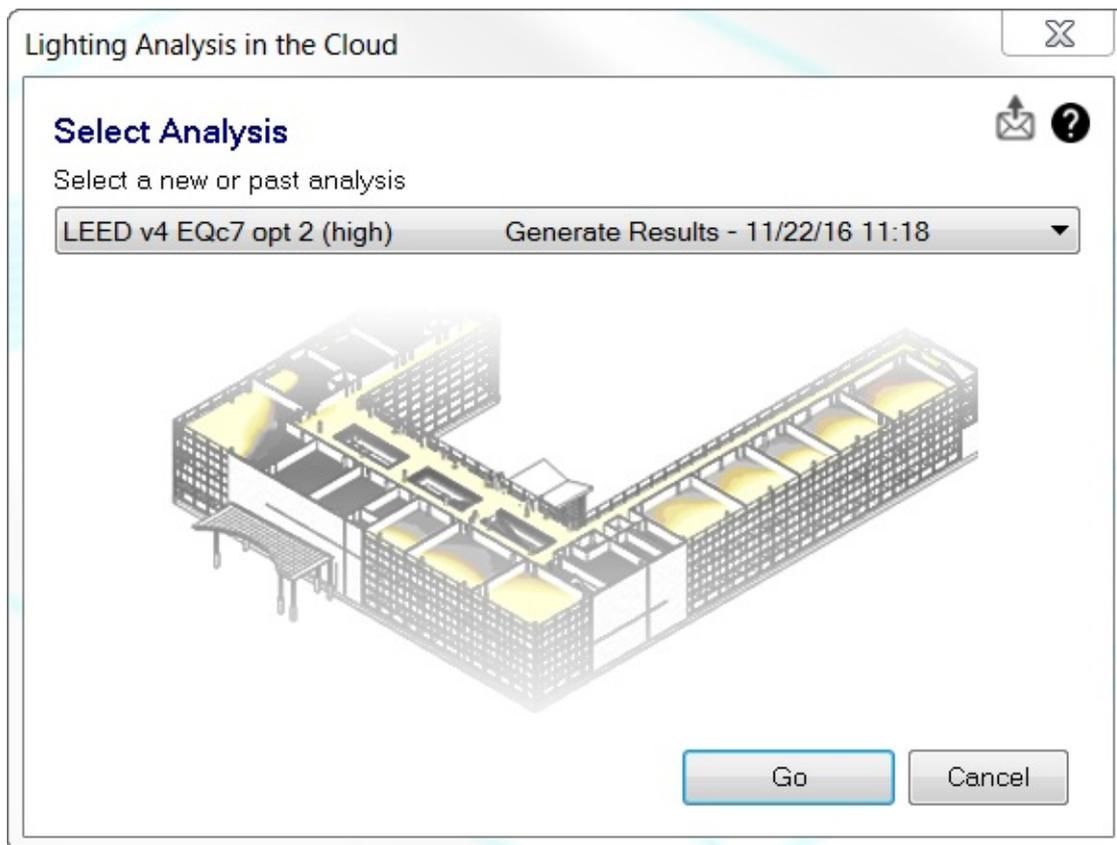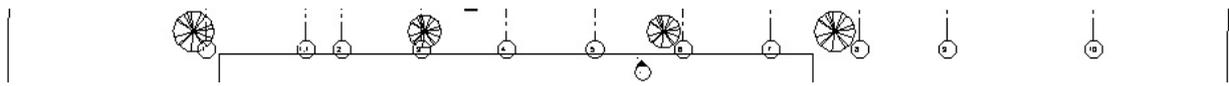
You'll be prompted with a dialog box with a summary of your results. If you are doing a LEED type analysis, then the amount of achievable points will also be included.
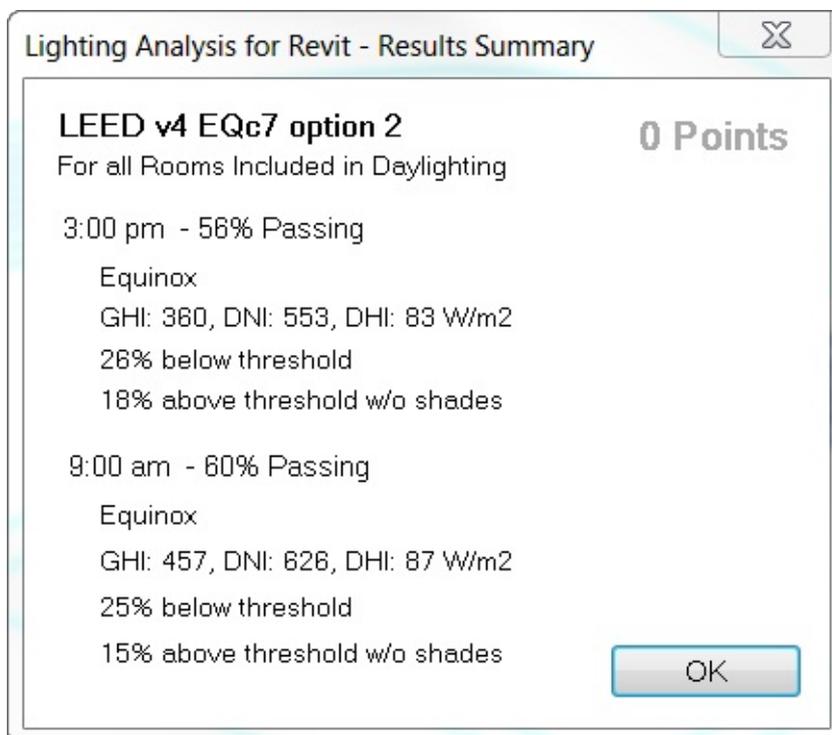


Use the *Section Box* to view the results in 3D or open the corresponding "*_Lighting*" floor plan.

Lighting Analysis Results-02 - Floor (LUX)
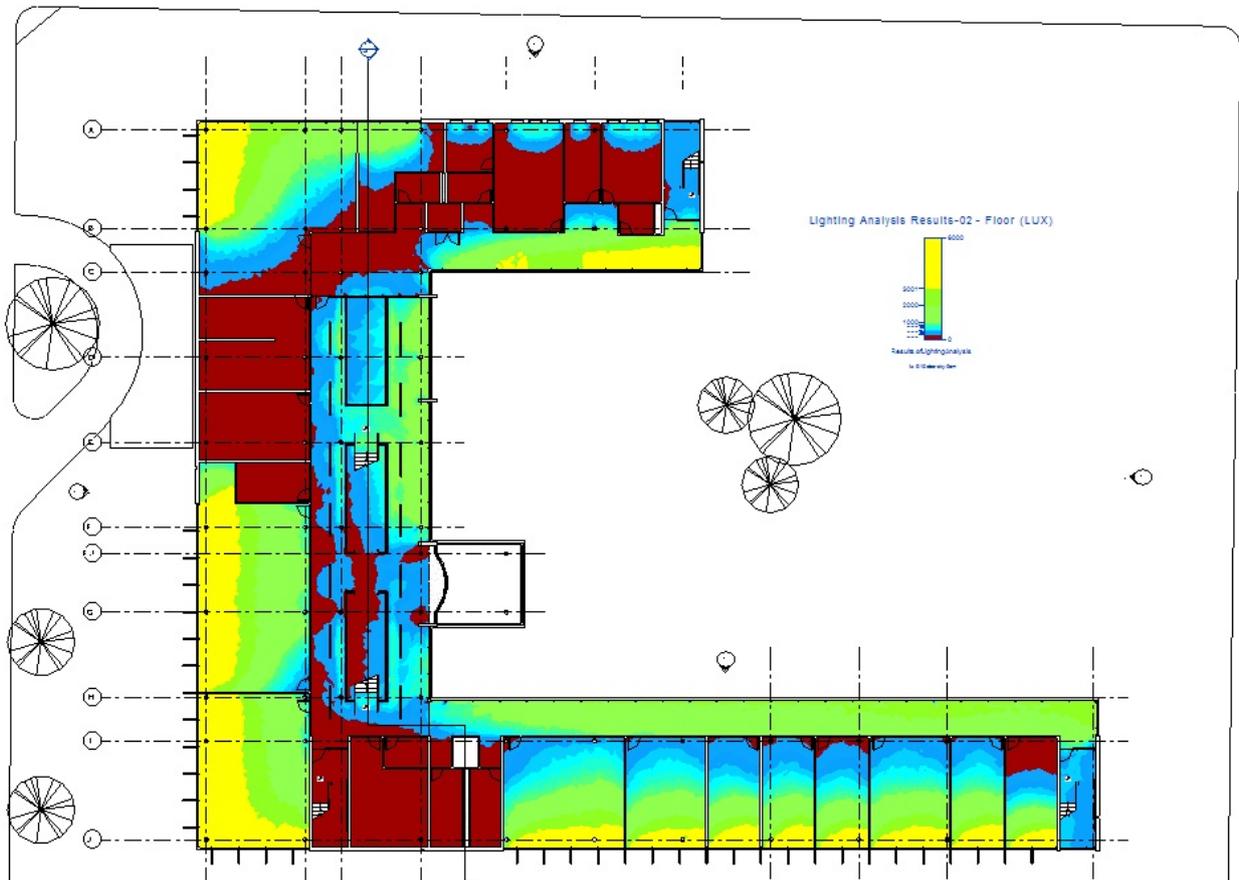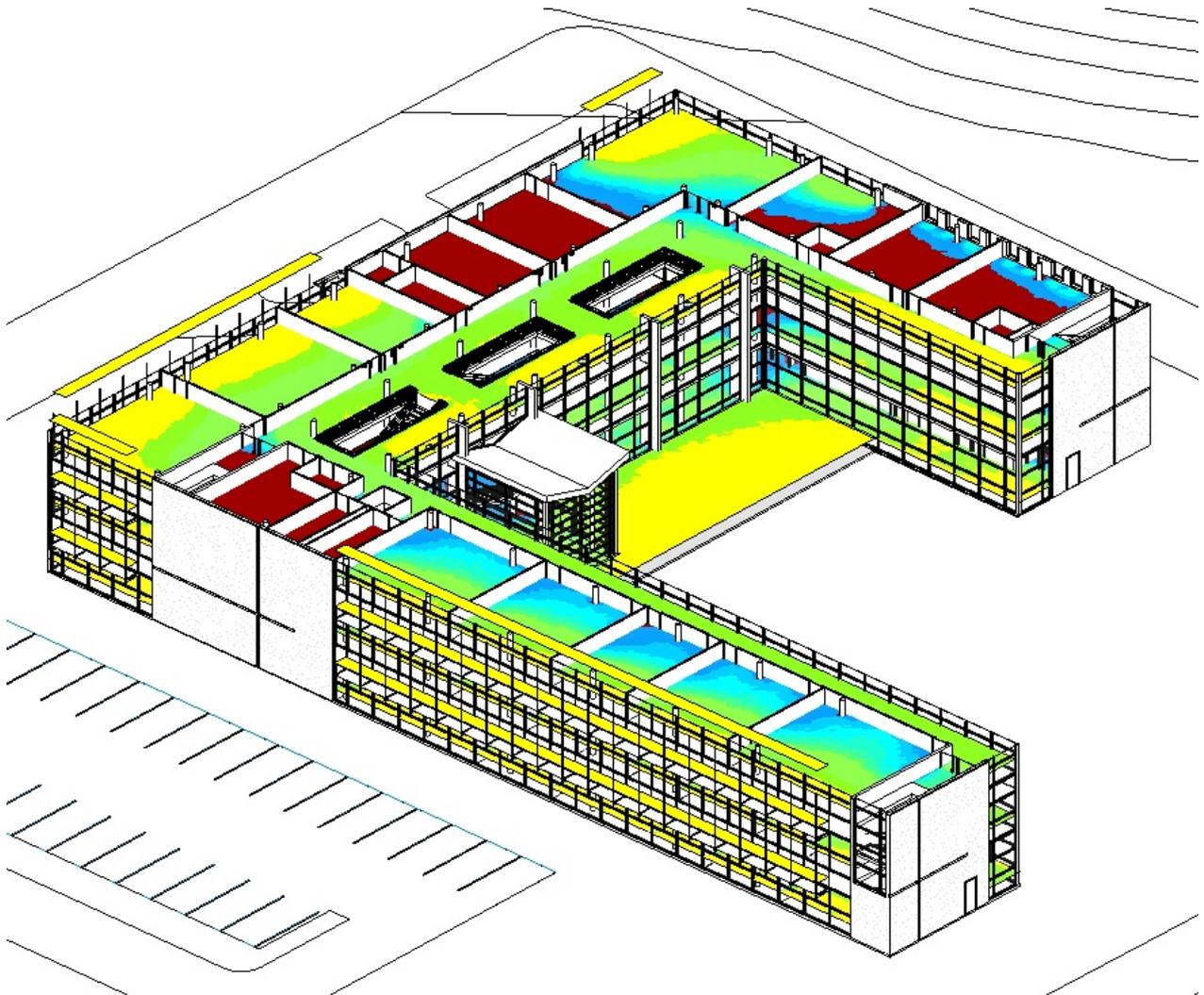
Note that "_Lighting" floor plans are only produced if rooms are placed for the levels.

For analysis types that represent a single point in time, you can toggle between the two dates and times that were simulated by selecting the analysis plane, and changing the **Analysis Configuration** in the *Properties* panel.
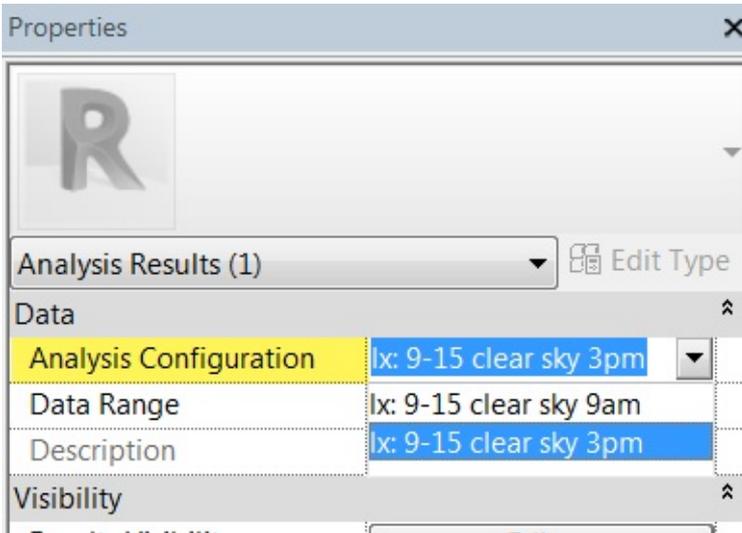


Open **_Lighting Analysis Room Schedule**. If you define rooms, those rooms and corresponding analysis values will be populated here.

<_Lighting Analysis Room Schedule>

LEED v4 EQc7 opt2Whole Building Results - 9am: 56% within, 3pm: 60% within

9/15 3pm GHI: 360, DNI: 553, DHI: 83 W/m2

9/15 9am GHI: 457, DNI: 626, DHI: 87 W/m2

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 9am threshold results | | | | | | 3pm threshold results | | | | | |
| | | | | | | within threshold | | above threshold | | below threshold | | within threshold | | above threshold | | below threshold | |
| Level | Name | Number | Area | Include In Daylighting | Automated Shades | % | Area | % | Area | % | Area | % | Area | % | Area | % | Area |
| 01 - Entry Level | Vest. | 101 | 41 m² | ✓ | | 99 | 40 m² | 0 | 0 m² | 1 | 1 m² | 98 | 40 m² | 0 | 0 m² | 2 | 1 m² |
| 01 - Entry Level | Lobby | 102 | 327 m² | ✓ | | 70 | 231 m² | 23 | 74 m² | 7 | 22 m² | 80 | 261 m² | 0 | 0 m² | 20 | 66 m² |
| 01 - Entry Level | Cafeteria | 121 | 147 m² | ✓ | | 98 | 144 m² | 0 | 0 m² | 2 | 3 m² | 72 | 106 m² | 20 | 30 m² | 8 | 11 m² |
| 01 - Entry Level | Prep/Dish | 122 | 22 m² | ✓ | | 17 | 4 m² | 0 | 0 m² | 83 | 18 m² | 22 | 5 m² | 0 | 0 m² | 78 | 17 m² |
| 01 - Entry Level | Dry Storage | 124 | 8 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 8 m² | 0 | 0 m² | 0 | 0 m² | 100 | 8 m² |
| 01 - Entry Level | Electrical | 125 | 6 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 6 m² | 0 | 0 m² | 0 | 0 m² | 100 | 6 m² |
| 01 - Entry Level | Conference | 123 | 42 m² | ✓ | | 19 | 8 m² | 0 | 0 m² | 81 | 34 m² | 23 | 10 m² | 0 | 0 m² | 77 | 32 m² |
| 01 - Entry Level | Office | 127 | 15 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 15 m² | 0 | 0 m² | 0 | 0 m² | 100 | 15 m² |
| 01 - Entry Level | Admin | 126 | 16 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 16 m² | 0 | 0 m² | 0 | 0 m² | 100 | 16 m² |
| 01 - Entry Level | Storage | 128 | 10 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 10 m² | 0 | 0 m² | 0 | 0 m² | 100 | 10 m² |
| 01 - Entry Level | Toilet | 129 | 6 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 6 m² | 0 | 0 m² | 0 | 0 m² | 100 | 6 m² |
| 01 - Entry Level | Stair | 130 | 19 m² | ✓ | | 48 | 9 m² | 2 | 0 m² | 50 | 9 m² | 23 | 4 m² | 0 | 0 m² | 77 | 15 m² |
| 01 - Entry Level | Corridor | 131 | 55 m² | ✓ | | 1 | 1 m² | 98 | 54 m² | 0 | 0 m² | 80 | 44 m² | 19 | 11 m² | 0 | 0 m² |
| 01 - Entry Level | Sprinkler | 119 | 9 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 9 m² | 0 | 0 m² | 0 | 0 m² | 100 | 9 m² |
| 01 - Entry Level | Electrical | 118 | 17 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 17 m² | 0 | 0 m² | 0 | 0 m² | 100 | 17 m² |
| 01 - Entry Level | Instruction | 117 | 49 m² | ✓ | | 48 | 23 m² | 0 | 0 m² | 52 | 25 m² | 42 | 20 m² | 58 | 28 m² | 0 | 0 m² |
| 01 - Entry Level | Lounge | 120 | 41 m² | ✓ | | 70 | 29 m² | 30 | 12 m² | 0 | 0 m² | 100 | 41 m² | 0 | 0 m² | 0 | 0 m² |

Any changes made in the schedule do not require you re-run the analysis. Simply select **Lighting** and access the study results to regenerate results considering the information updated in the schedule.

# LEED Studies (Single point in time)

You can use Insight Lighting Analysis to determine your design's progress towards achieving LEED daylighting criteria, specifically LEED 2009 IEQc8 opt1and LEED v4 EQc7 opt2. Both of these credits require specific illuminance levels at the equinoxes.

To conduct either of these studies, follow the steps outlined in the **Overview** and take note of the following.

When selecting either LEED analysis type, note that the majority of the analysis settings are preset according to the LEED specifications.
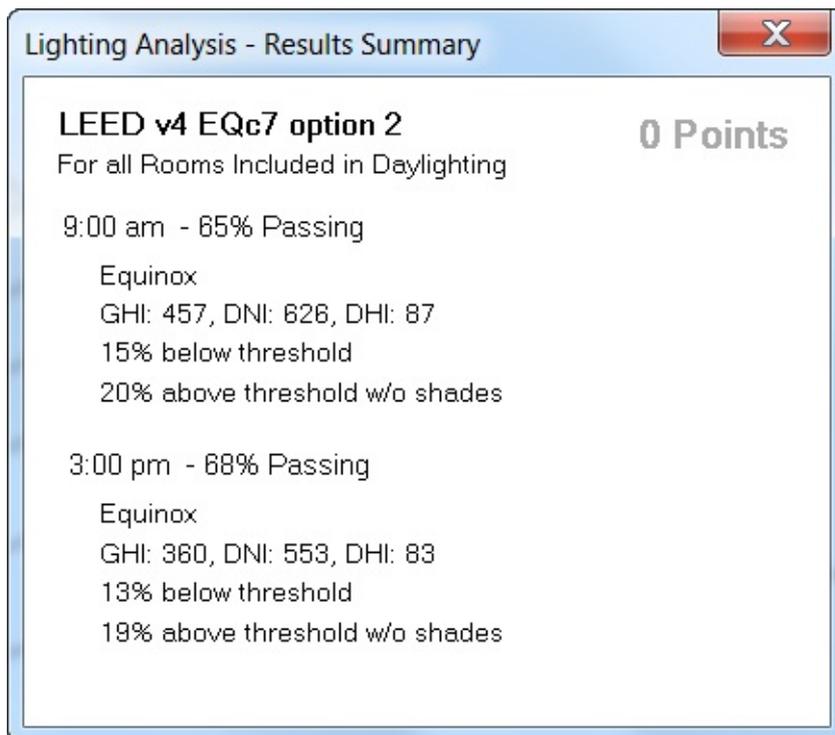


**A.**The *Location* is set based on the Revit project location.

| Analysis Type | Description |
|---|---|
| *LEED 2009 IEQc8 opt1* | As defined by USGBC, this simulation requires a clear sky condition within 15 days of September 21 at 9am and 3pm. |
| *LEED v4 EQc7 opt2* | As defined by USGBC, this simulation requires a clear sky condition and uses average weather data within 15 days of September 21 and March 21. |

LEED single point in time analysis times automatically use the Perez Sky model.

**B.** LEED 2009 and v4 specify different thresholds, so you will see these values change depending on which version of LEED you choose for the analysis type. Additionally, LEED requires the analysis occur at 30 inches above the finished floor. The analysis plane automatically is generated at this height for LEED studies.

When you generate the results in your Revit model, you will also get a summary of percentage of rooms passing and estimated LEED credit points the project is eligible for.

```
Lighting Analysis - Results Summary                    X

  LEED v4 EQc7 option 2                    0 Points
  For all Rooms Included in Daylighting

  9:00 am  - 65% Passing

      Equinox
      GHI: 457, DNI: 626, DHI: 87
      15% below threshold
      20% above threshold w/o shades

  3:00 pm  - 68% Passing

      Equinox
      GHI: 360, DNI: 553, DHI: 83
      13% below threshold
      19% above threshold w/o shades
```

It is often the case that you will want to exclude rooms that are not regularly occupied from the analysis so not to skew your results. You can control this through the schedule.

**Automated Shades** are also available to include and will extend the acceptance threshold.

| Level | Name | Number | Area | Include In Daylighting | Automated Shades |
|-------|------|--------|------|:----------------------:|:----------------:|
| 01 - Entry Level | Vest. | 101 | 41 m² | ☑ | ☐ |
| 01 - Entry Level | Lobby | 102 | 327 m² | ☐ | ☐ |
| 01 - Entry Level | Cafeteria | 121 | 147 m² | ☑ | ☐ |
| 01 - Entry Level | Prep/Dish | 122 | 22 m² | ☑ | ☐ |

Any changes made in the schedule do not require you re-run the analysis. Simply select **Lighting** and access the study results to regenerate results considering the information updated in the schedule.

# LEED sDA & ASE Studies (Annual simulation)

You can use Insight Lighting Analysis to produce sDA and ASE results according to LEED v4 EQc7 opt1. This credit requires annual simulation at an hourly time step.

To conduct this studies, follow the steps outlined in the **Overview** and take note of the following.

Similar to the LEED studies for a single point in time, many of the settings for this analysis type are automatically predefined.

**A.** The time range will be automatically set to a full annual simulation, from 8am to 6pm. LEED sDA and ASE studies automatically use the Perez Sky model.

**B.** Per the LEED requirements, sDA300/50 for at least 55% or 75% regularly occupied floor area is achieved. Additionally, ASE1000/250 of no more than 10% for the occupied floor area that is daylit per sDA300/50. LEED requires the analysis occur at 30 inches above the finished floor. The analysis plane automatically is generated at this height for LEED studies.

**C.** sDA and ASE calculations require at 24 inch analysis grid, which is automatically set.

Since the sDA and ASE simulation is more intensive than a single point in time, the analysis will cost more Cloud Credits and take more time than a single point in time analysis. Select **Check Price** before submitting the model for analysis to see the required number of cloud credits for the analysis.

Results summaries will provide guidance on how to improve design to achieve LEED requirements as well as more information about the metrics.

Visual results and schedule results will present sDA300/50 and ASE1000/250 results, sDA and ASE Annual Hours, as well as combined metric results.
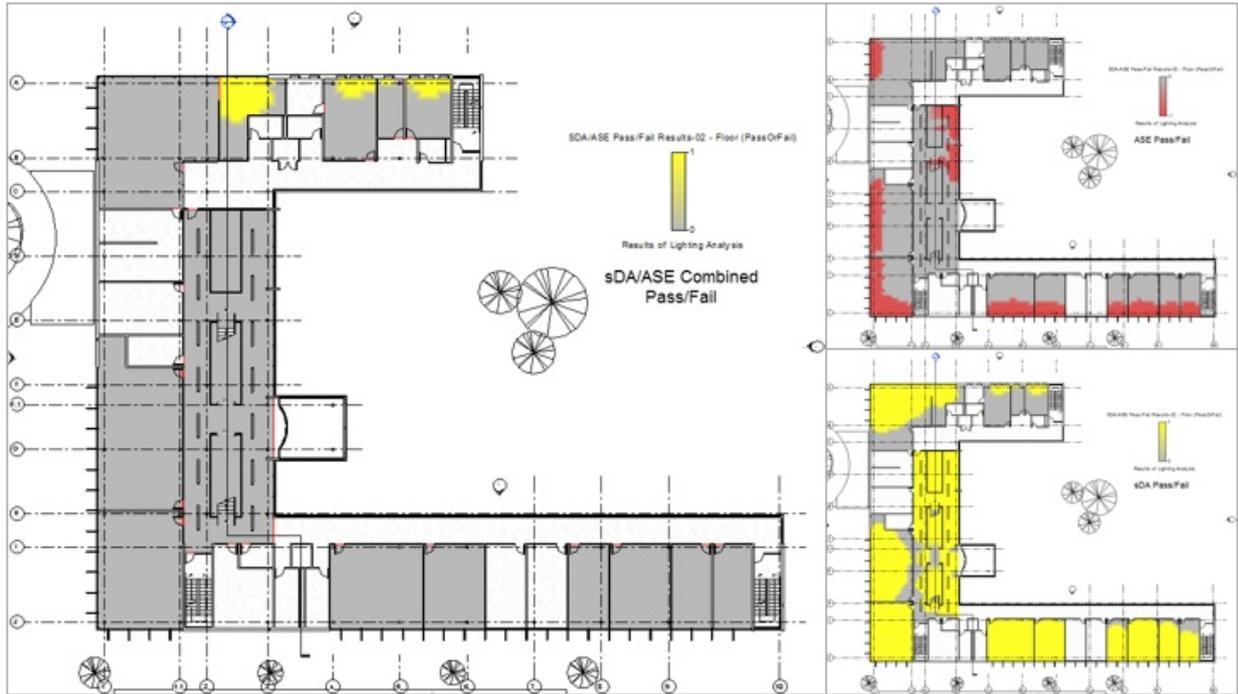


| <_Lighting Analysis Room Schedule> | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| LEED Daylight Autonomy Results Summary: Manchester, NH | | | | | | | | | | |
| 3% of Building Area meets sDA & ASE for 8:00am - 6:00pm, January 1 - December 31 | | | | | | | | | | |
| LEED points for % Building Area >sDA300/50 in Rooms with ASE1000/250 < 10% of Room area - 55% (2 pts) or 75% (3 pts) | | | | | | | | | | |
| A | B | C | D | E | F | G | H | I | J | K |
| | | | | Include In Daylighting | sDA 300/50 | | ASE 1000/250 | | sDA/ASE | |
| Level | Name | Number | Area | | % | Points | % | Pass | % | Points |
| | | | | | | | | | | |
| 02 - Floor | Stair | 201 | 19 m² | ☐ | | | | | | |
| 02 - Floor | Instruction | 202 | 31 m² | ☑ | 68 | 2 pt | 33 | No | 0 | none |
| 02 - Floor | Computer Lab | 203 | 32 m² | ☑ | 88 | 3 pt | 32 | No | 0 | none |
| 02 - Floor | Instruction | 204 | 48 m² | ☑ | 97 | 3 pt | 34 | No | 0 | none |
| 02 - Floor | Instruction | 205 | 32 m² | ☑ | 82 | 3 pt | 32 | No | 0 | none |
| 02 - Floor | Corridor | 235 | 138 m² | ☐ | | | | | | |
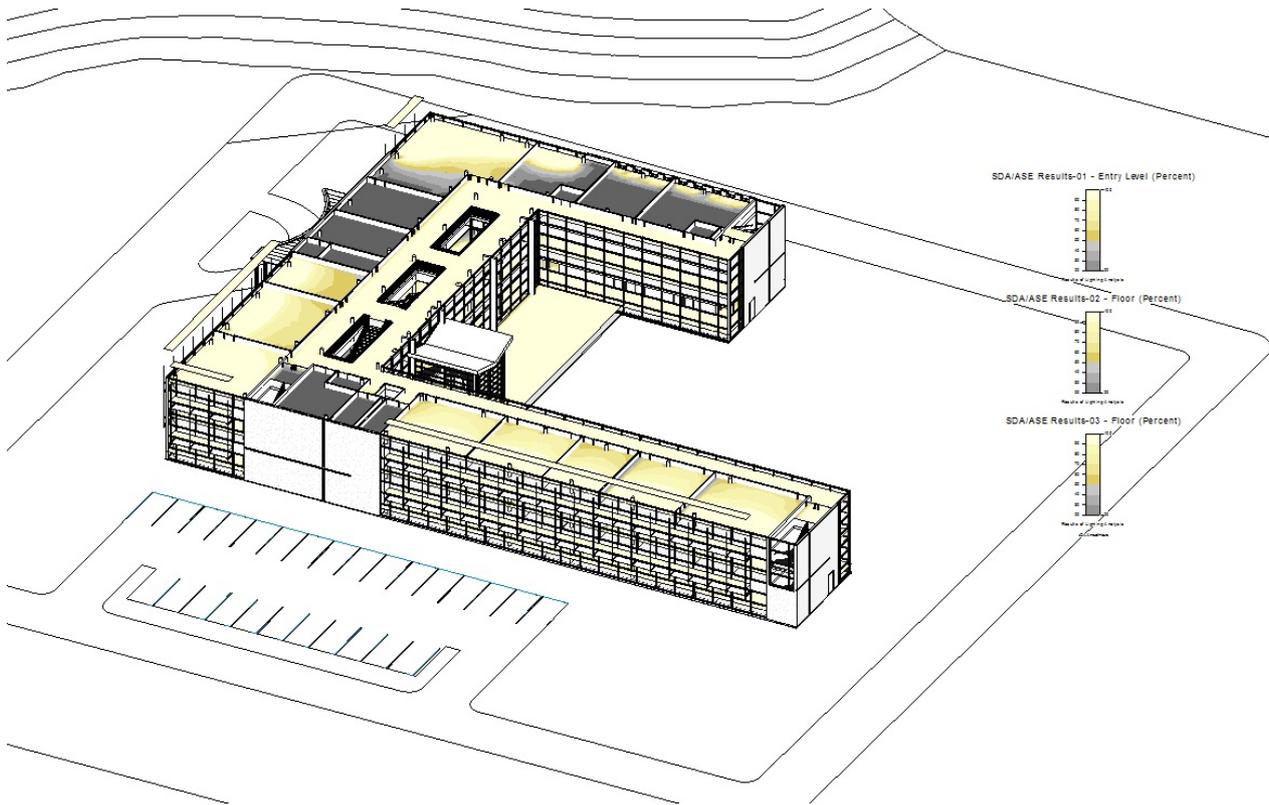
Note that since the sDA and ASE simulations much more computationally intensive than a single point in time analysis, the Cloud Credit costs and time will likely be greater than for other analysis types. The **Daylight Autonomy (sDA Preview)** study type will analyze a sampling of the 3650 hours used in the full *LEED v4 EQc7 opt1 (sDA+ASE)* analysis. The **sDA Preview** study type will run faster, and cost less Cloud Credits. Results will be in line with those from the full *LEED v4 EQc7 opt1 (sDA+ASE)* analysis.

# Solar Access

You can use Insight Lighting Analysis to study solar access, or hours of direct sun over a given day by selecting the **Solar Access** study type. Requirements like SEPP 65 can be tested and validated using the Solar Access workflow.

To conduct this studies, follow the steps outlined in the **Overview** and take note of the following.

**Solar Access** studies are conducted for a day and selected time range, with several customizable settings.

**A.** Select the date and time range for the study. For all hours selected, the Direct Normal Irradiance (DNI) and Global Horizontal Irradiance (GHI) will be set to 1000 W/m2, and the Diffuse Horizontal Irradiance (DHI) will be set to 1 W/m2. **Solar Access** automatically uses the CIE Clear Sky model.

**B.** Set the minimum number of hours that will be required to have direct solar access and analysis plane height. In order to meet the minimum threshold, any point in the room must exceed 4000 lux.

The results summary will use the threshold you specified to calculate the percentage of passing rooms and produce in context results and a corresponding schedule.

<_Lighting Analysis Room Schedule>

## Direct Solar Access Results Summary: Manchester, NH

### 76% of Rooms Analyzed meet minimum number of hours of Direct Solar

### Direct Solar - 9-21 9am to 3pm - minimum 3 hours

| A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|
| | | | | | Hours Direct Solar | |
| Level | Name | Number | Area | Include In Daylighting | Hours | Pass |
| 01 - Entry Level | Vest. | 101 | 41 m² | ☑ | 0 | No |
| 01 - Entry Level | Lobby | 102 | 327 m² | ☑ | 4 | Yes |
| 01 - Entry Level | Cafeteria | 121 | 147 m² | ☑ | 3 | Yes |
| 01 - Entry Level | Prep/Dish | 122 | 22 m² | ☑ | 0 | No |
| 01 - Entry Level | Dry Storage | 124 | 8 m² | ☐ | | |
| 01 - Entry Level | Electrical | 125 | 6 m² | ☐ | | |
| 01 - Entry Level | Conference | 123 | 42 m² | ☑ | 0 | No |
| 01 - Entry Level | Office | 127 | 15 m² | ☐ | | |
| 01 - Entry Level | Admin | 126 | 16 m² | ☐ | | |
| 01 - Entry Level | Storage | 128 | 10 m² | ☐ | | |
| 01 - Entry Level | Toilet | 129 | 6 m² | ☐ | | |
| 01 - Entry Level | Stair | 130 | 19 m² | ☐ | | |

# Custom Illuminance Studies (Single point in time)

Selecting **Illuminance Analysis** as the study type will allow you to create a customized single point in time analysis.

To conduct this studies, follow the steps outlined in the **Overview** and take note of the following.

**Illuminance Analysis** study type will allow you to select a date, time, acceptance threshold, and analysis plane height.
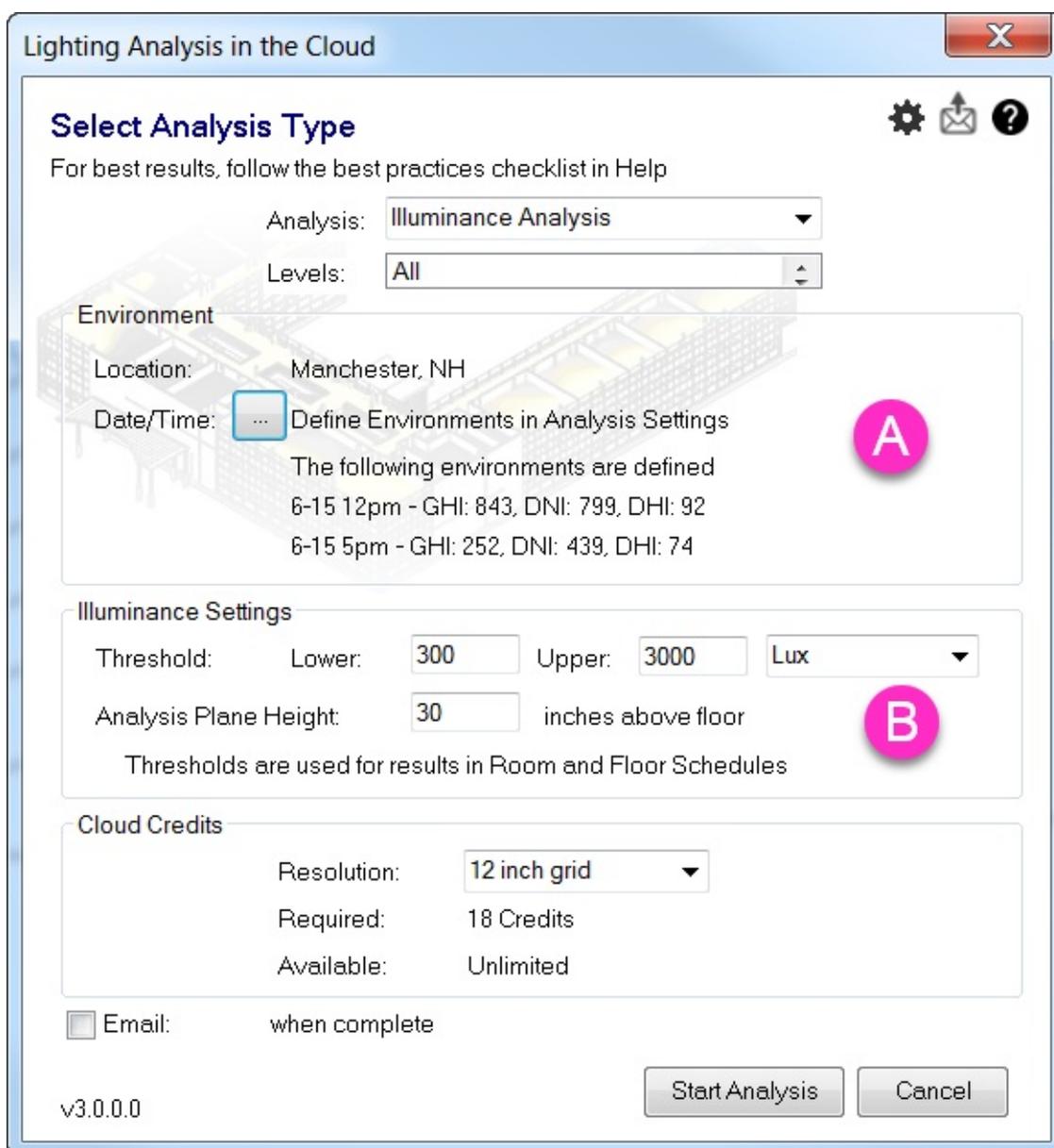
**A.** Select two different date and times for the analysis. Custom illuminance analysis study types will let you analyze two different scenarios for the cost of one analysis.



Select a *Sky model*, *Date*, and *Time*. The weather data for the selected date and time will automatically be filled in based on what is available in the corresponding weather file. If you wish to override these values, uncheck *Use Weather Data*, and enter your own data for Global Horizontal Irradiance (*GHI*), Direct Normal Irradiance (*DNI*), and Diffuse Horizontal Irradiance (*DHI*). When using the weather data values, the sky cover percentage will be shown for the selected date/time. 0% indicates a clear sky.

**B.** Specify lower and upper *Threshold* values and units. These values will be used to calculate pass/fail results and populate the schedule.

The *Analysis Plane Height* dictates where the analysis plane will be in inches above the Revit floor element.
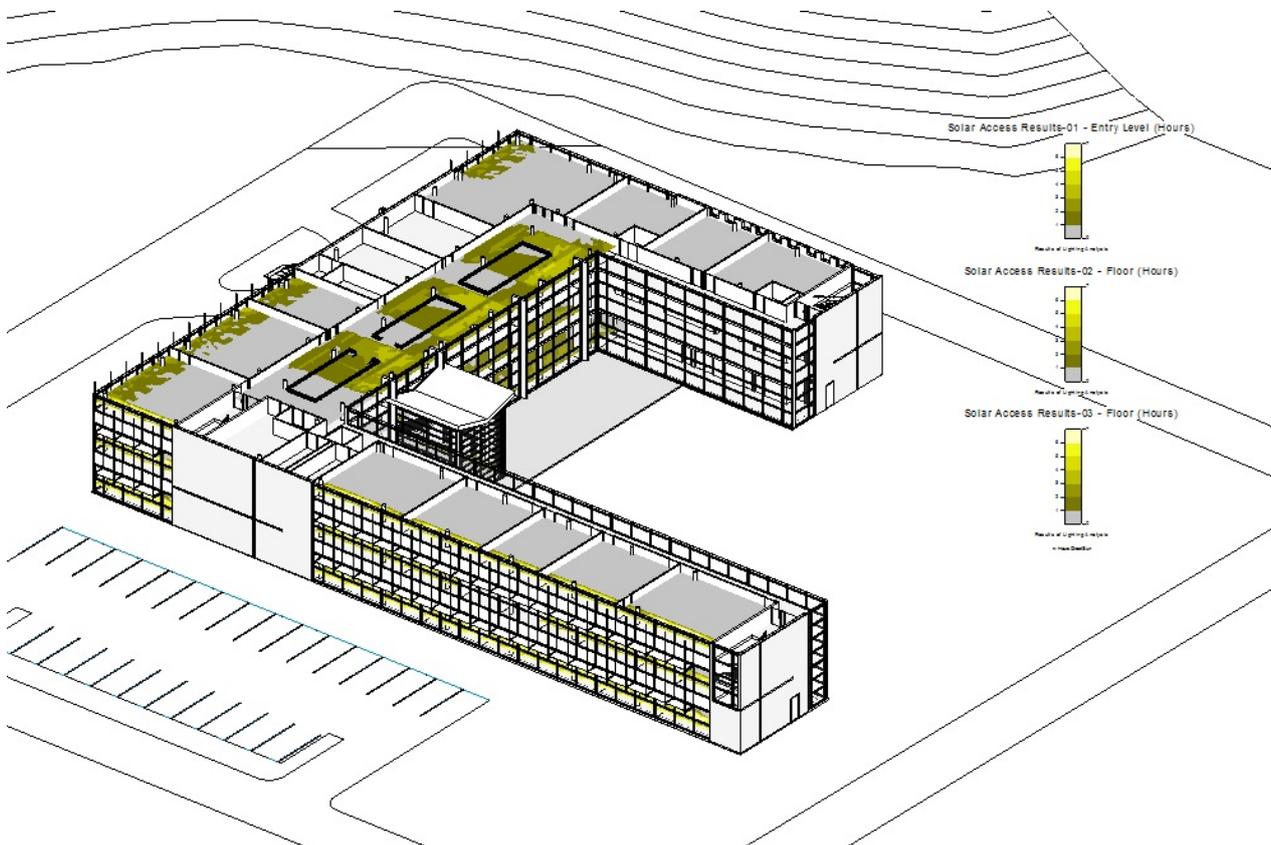
The results summary will use the threshold you specified to calculate the percentage of passing rooms and produce in context results and a corresponding schedule.
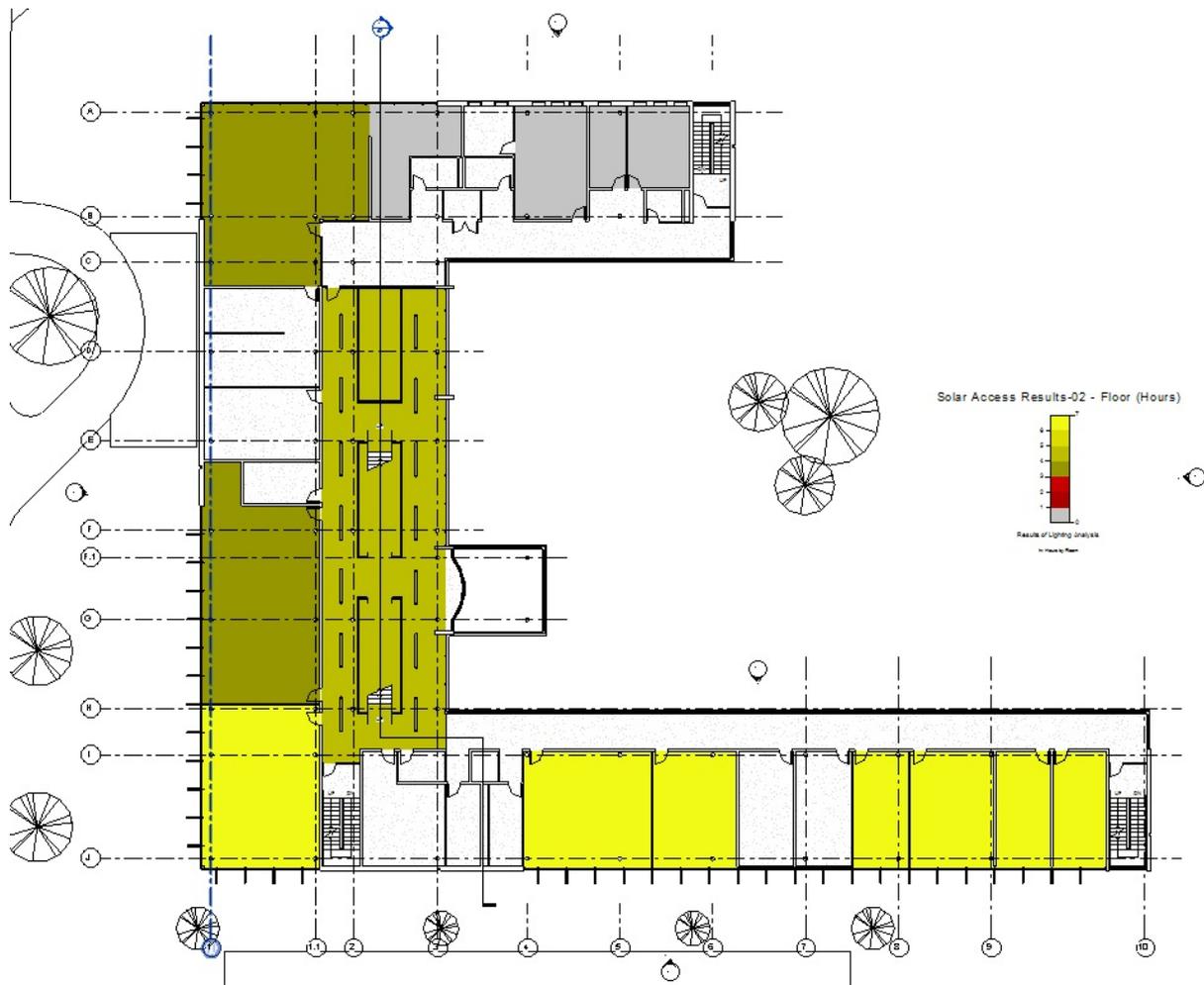
### Lighting Analysis - Results Summary

**Custom Analysis**

For all Rooms Included in Daylighting

9:00 am  - 62% Passing

September 21
GHI: 223, DNI: 315, DHI: 44
26% below threshold
12% above threshold w/o shades

3:00 pm  - 69% Passing

September 21
GHI: 192, DNI: 308, DHI: 47
20% below threshold
11% above threshold w/o shades

Lighting Analysis Results-01 - Entry Level (LUX)

Lighting Analysis Results-02 - Floor (LUX)

Lighting Analysis Results-03 - Floor (LUX)
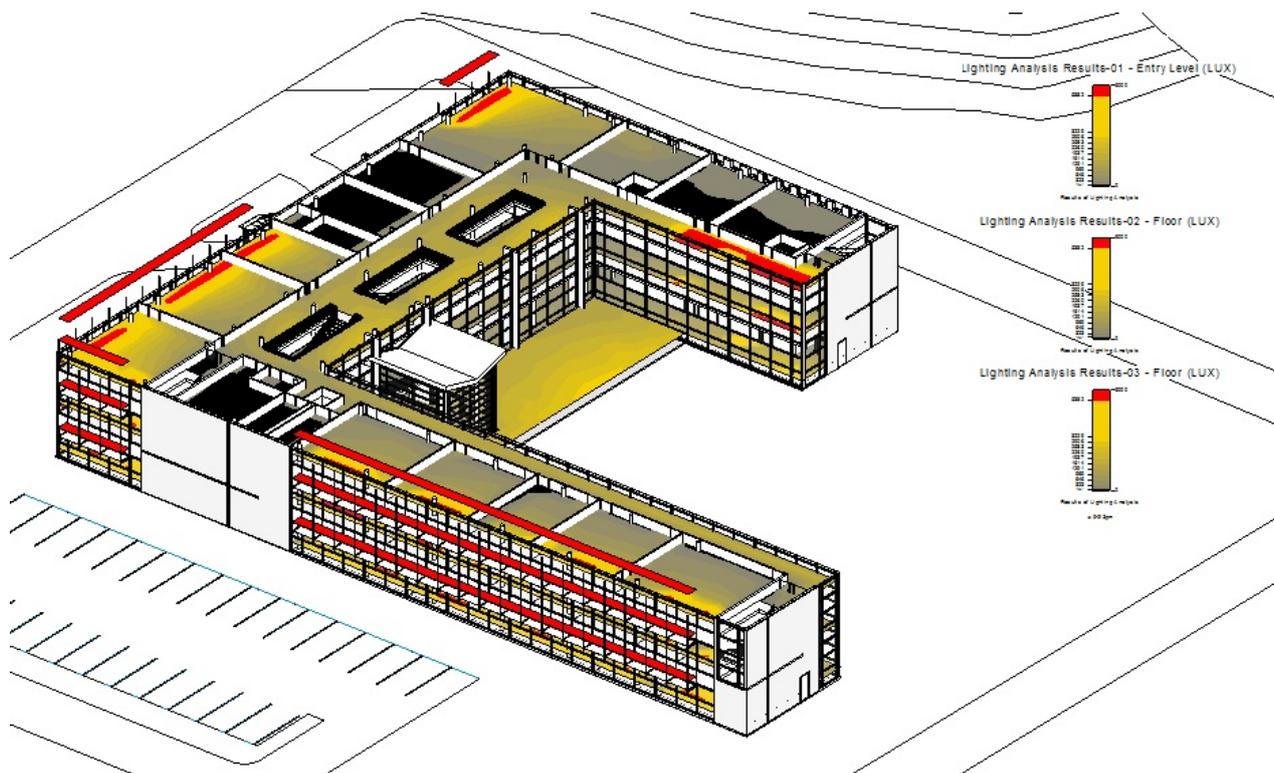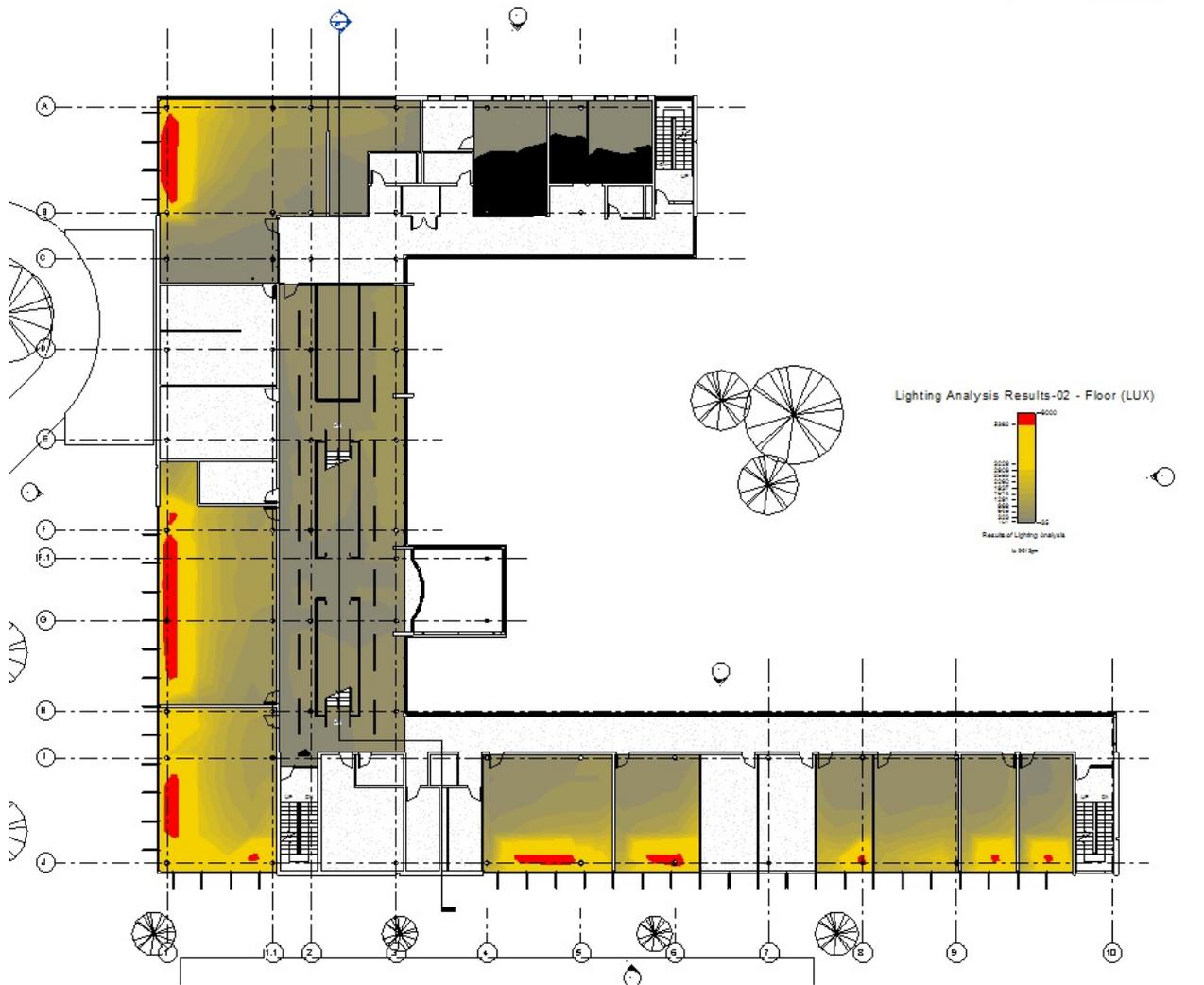
<_Lighting Analysis Room Schedule>

Custom Analysis  Whole Building Results: Manchester, NH

9-21 9am: 63% & 9-21 3pm: 69% of points are between 300-3000 lux

Solar Values (W/m2):  9-21 9am GHI: 223, DNI: 315, DHI: 44  &  9-21 3pm GHI: 192, DNI: 308, DHI: 47

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 9am threshold results | | | | | | 3pm threshold results | | | | |
| | | | | Include In | Automated | within threshold | | above threshold | | below threshold | | within threshold | | above threshold | | below thre |
| Level | Name | Number | Area | Daylighting | Shades | % | Area | % | Area | % | Area | % | Area | % | Area | % |
| 01 - Entry Level | Vest. | 101 | 41 m² | ✓ | | 83 | 34 m² | 0 | 0 m² | 17 | 7 m² | 94 | 39 m² | 0 | 0 m² | 6 |
| 01 - Entry Level | Lobby | 102 | 327 m² | ✓ | | 76 | 247 m² | 10 | 32 m² | 15 | 48 m² | 66 | 215 m² | 0 | 0 m² | 34 |
| 01 - Entry Level | Cafeteria | 121 | 147 m² | ✓ | | 88 | 129 m² | 0 | 0 m² | 13 | 18 m² | 70 | 103 m² | 10 | 15 m² | 20 |
| 01 - Entry Level | Prep/Dish | 122 | 22 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 22 m² | 0 | 0 m² | 0 | 0 m² | 100 |
| 01 - Entry Level | Dry Storage | 124 | 8 m² | | | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 |
| 01 - Entry Level | Electrical | 125 | 6 m² | | | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 |
| 01 - Entry Level | Conference | 123 | 42 m² | ✓ | | 0 | 0 m² | 0 | 0 m² | 100 | 42 m² | 10 | 4 m² | 0 | 0 m² | 90 |
| 01 - Entry Level | Office | 127 | 15 m² | | | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 |
| 01 - Entry Level | Admin | 126 | 16 m² | | | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 |
| 01 - Entry Level | Storage | 128 | 10 m² | | | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 |
| 01 - Entry Level | Toilet | 129 | 6 m² | | | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 |
| 01 - Entry Level | Stair | 130 | 19 m² | | | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 | 0 m² | -1 |

To switch between the two dates and times that were simulated, select the analysis plane, and change the **Analysis Configuration** in the *Properties* panel.

# Including Electric Lights

By default, all analysis types consider natural daylight from the sun only. However, if you would like to understand light level conditions when electric lights are considered, you have the option to include them as part of the custom illuminance analysis study type.

If you are new to using lights in Revit, review the resources available here.

To include electric lights in your simulations, you'll need to make sure your model has lighting fixture families, and specifically, associated IES files.

Initiate the Lighting Analysis plugin, and select **Run New Analysis**. Click on the settings icon in the top right to access the *Light Analysis Settings*.
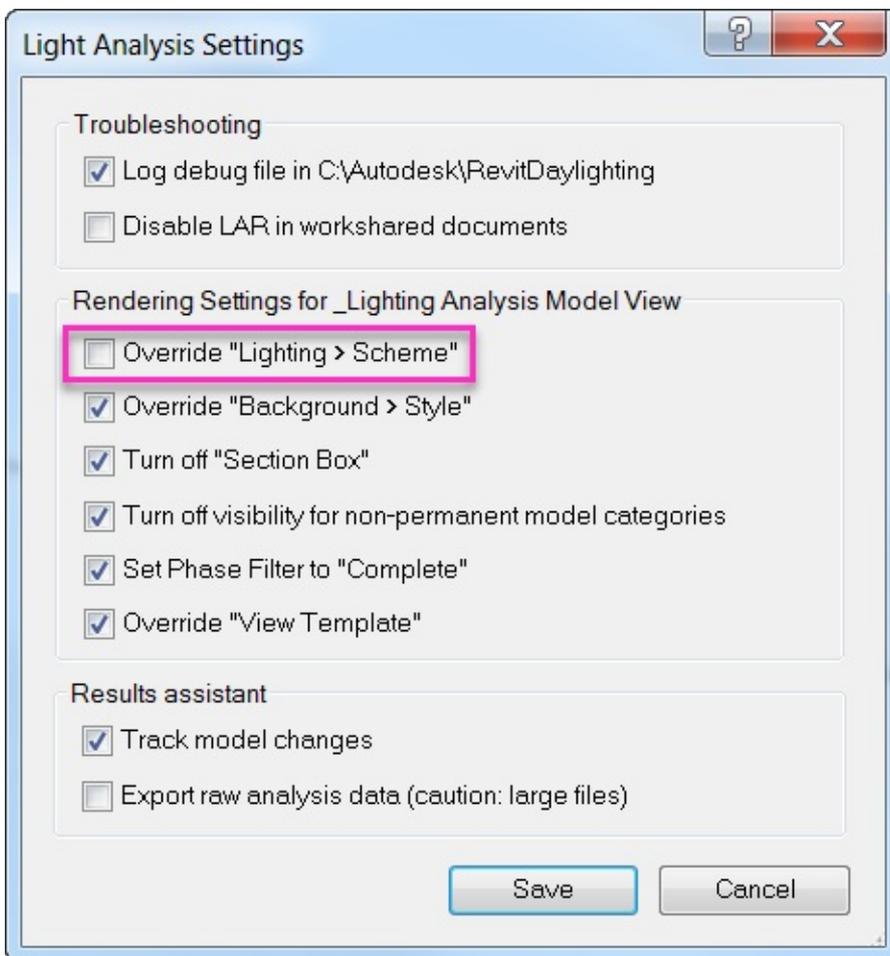


Uncheck **Override "Lighting > Scheme"** and press **Save**. When this setting is checked, Revit will override any *Rendering Settings* and include only daylighting from the sun. Unchecked, this setting allows you to change the *Rendering Settings* to include electric lights.

Close the *Lighting Analysis in the Cloud* dialog box.

Open the "**_Lighting Analysis Model View**" 3D view and select **Rendering Settings** from the *Properties* panel.
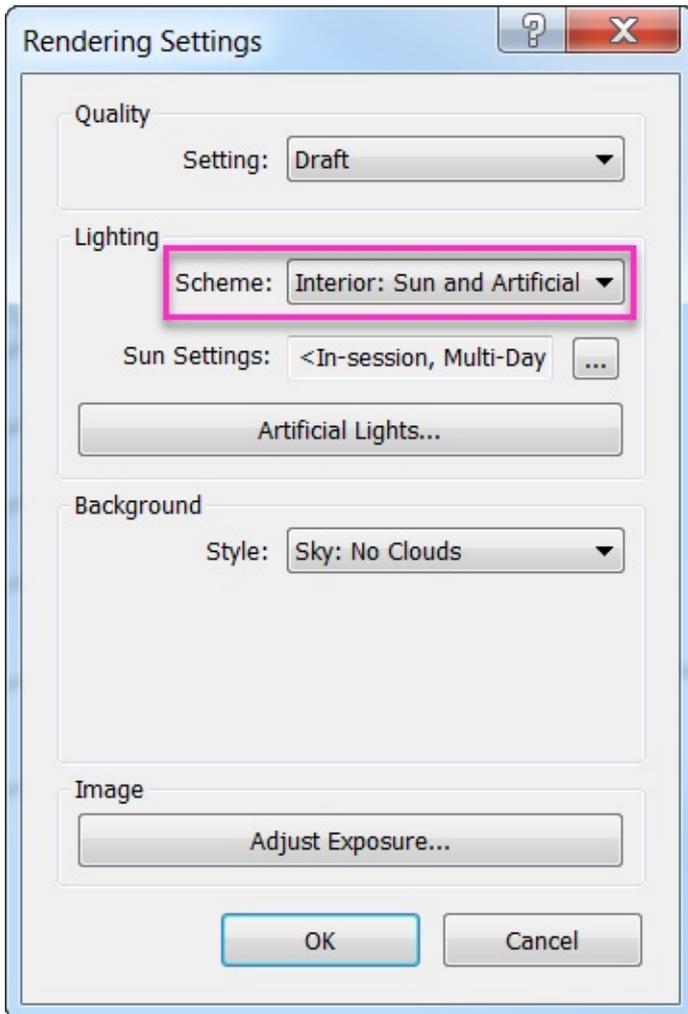


Change the *Scheme* to include "*Artificial*" or electric lights.

| Scheme setting | Outcome |
|---|---|
| *Interior: Sun only* | Only daylight from the sun considered (default for all lighting analysis types) |
| *Interior: Sun and Artificial* | Daylight from the sun and electric lights included |
| *Interior: Artificial only* | Only electric lights included |

Once you have selected an option that includes electric lights, you can select **Artificial Lights…** and control which lights will be on (*Dimming = 1*) and which lights will be off (*Dimming = 0*) for the analysis.
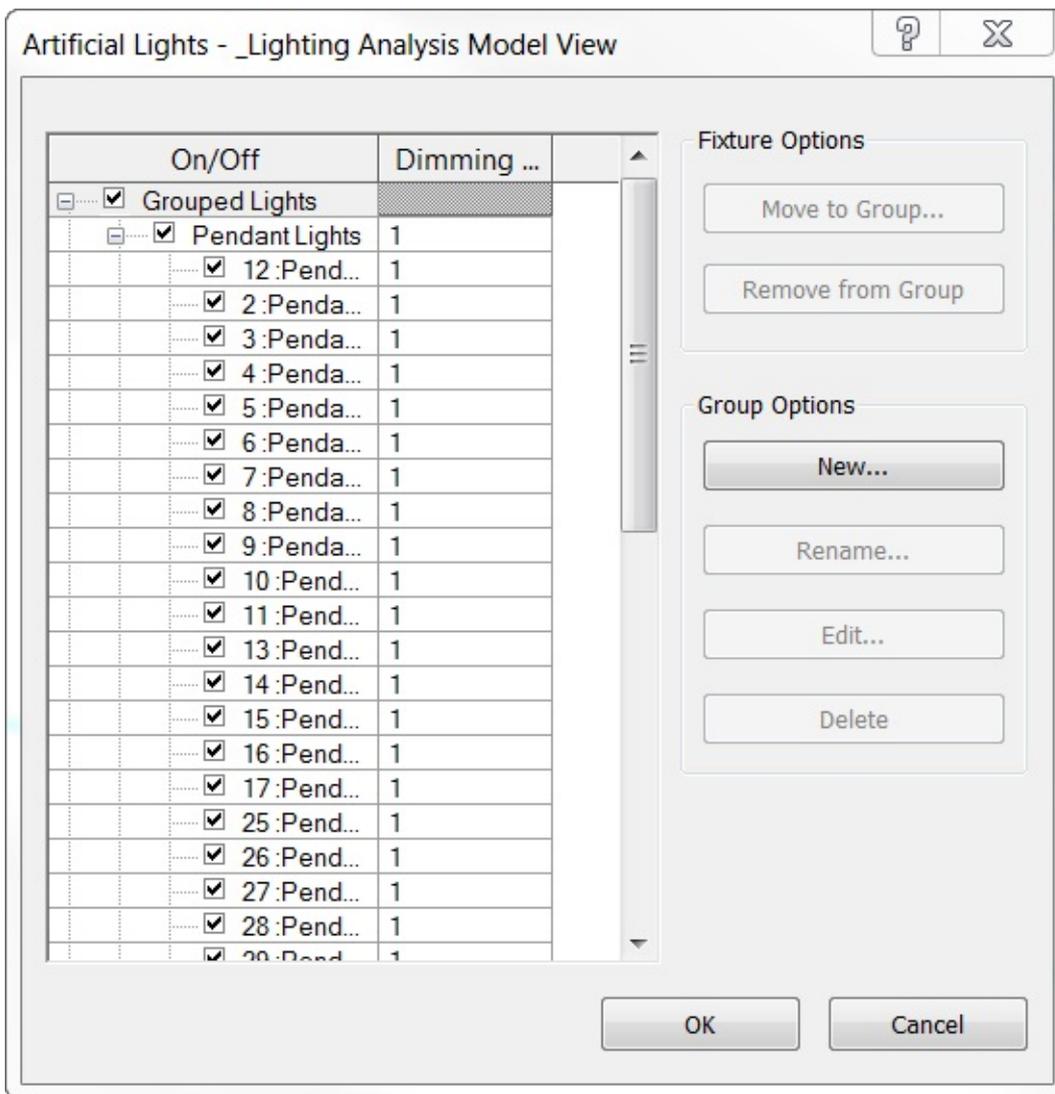
After you have included electric lights, and controlled which ones will be on or off, initiate the Lighting Analysis plugin again, and this time set the date, time and other settings and start the analysis.

After receiving your results, save the project. You also might want to open the **Light Analysis Settings** and check **Override "Lighting > Scheme"** again. This will make sure that all future analyses only include daylight from the sun. (Electric lights will be included for future analyses for all projects until the **Override "Lighting > Scheme"** is checked again—this setting persists with Revit, not the project.)

# Perspective Illuminance Renderings

In addition to in context analysis planes, you can also render illuminance levels in 3D perspective views from Revit. The steps outlined below follow a different process from the standard Insight Lighting Analysis workflow, however they use the same settings and A360 Rendering engine.

Open a building element model in Revit. Also be sure to login to your A360 account. Lighting analysis consumes Cloud Credits, so Revit will need to be able to access your A360 account to complete the analysis.

For new projects, make sure that your location is set and a weather file is selected.

From the *View* tab, select **Render in Cloud**.
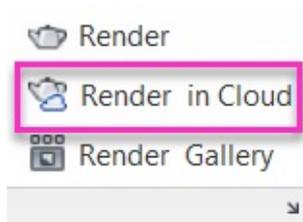


The *Render in Cloud* dialog will appear where you can control your settings and configurations.
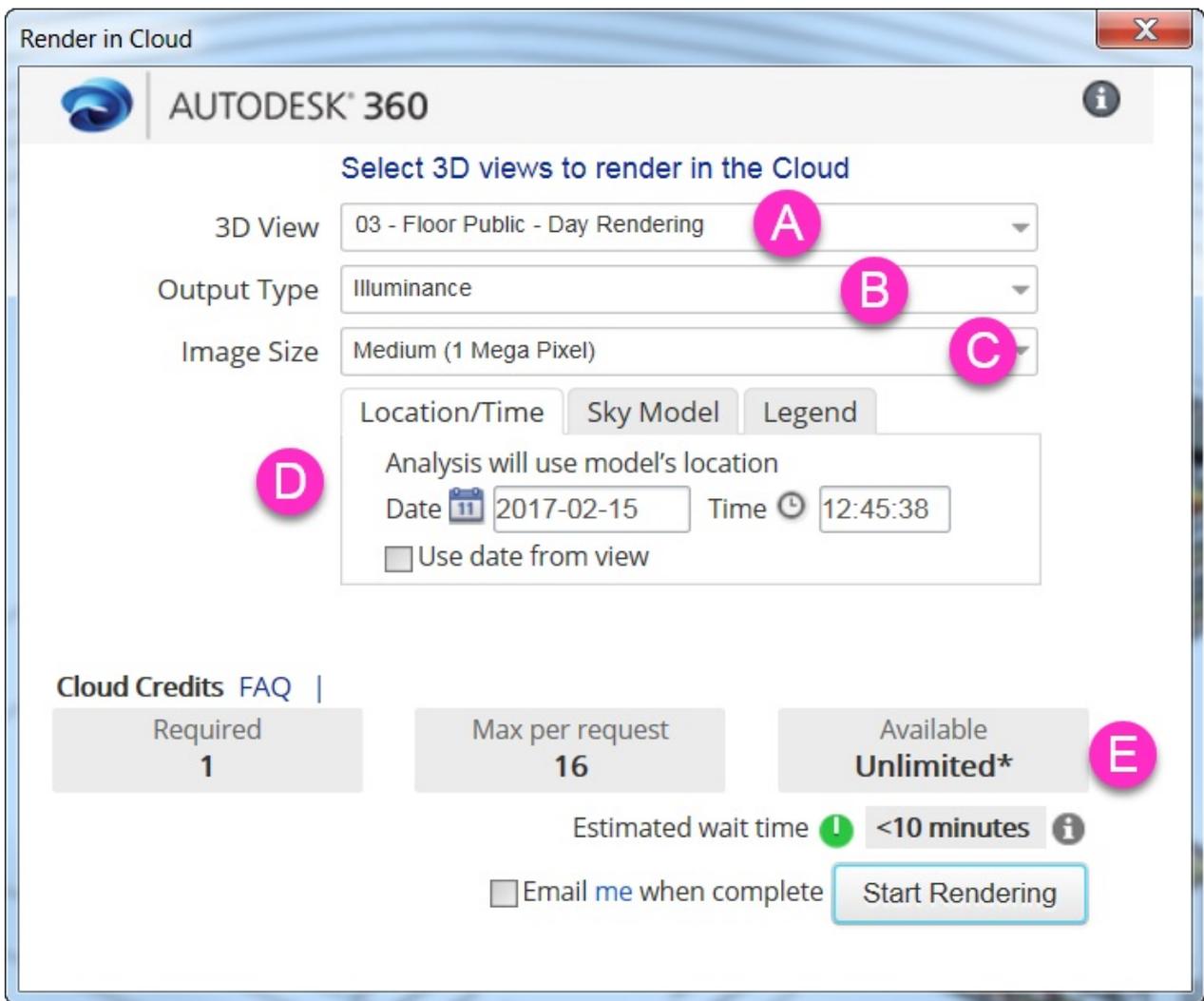
**A.** Perspective illuminance renderings require a *3D View*. All 3D views available in your project will be populated in the dropdown. Select one, or multiple, 3D views that you wish to render results for. Note that the date and time settings used will be applied to all 3D views selected.

**B.** Set the *Output Type* to **Illuminance**.

**C.** Set the *Image Size* and resolution of the output image. This will impact Cloud Credit costs.

**D.** Select any *Date* and *Time*, or alternatively select to use settings from the 3D view selected.



Select a *Sky Model* for the analysis. Options include:

- Perez All-Weather Sky
- CIE Overcast Sky
- CIE Intermediate Sky
- CIE Clear Sky
- CIE Uniform Sky
- Daylight Factor Sky

Enter the appropriate *DNI* and *DHI* values for the analysis. **These values do not update with your location and date and time settings**. It is necessary you manually enter these values in order to get accurate sky conditions.



Set the *Units* and *Legend* preferences. By default, a linear scale is used with 10 proportional subdivisions based on the range chosen.

**E.** Predicted Cloud Credit usage will update as the settings are modified. Select **Start Rendering** to begin the simulation. Cloud Credits will be charged once this command is selected.

When the renderings are complete, you will receive a notification in Revit as well as an email if you selected to receive one. From the *View* tab, select **Render Gallery** to access renderings.
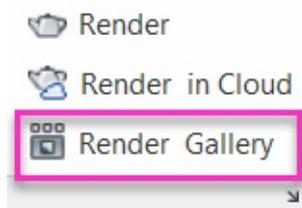


Renderings in the *Render Gallery* are sorted by project name and date submitted. Locate your project, and click on the rendering thumbnails to enlarge the images.
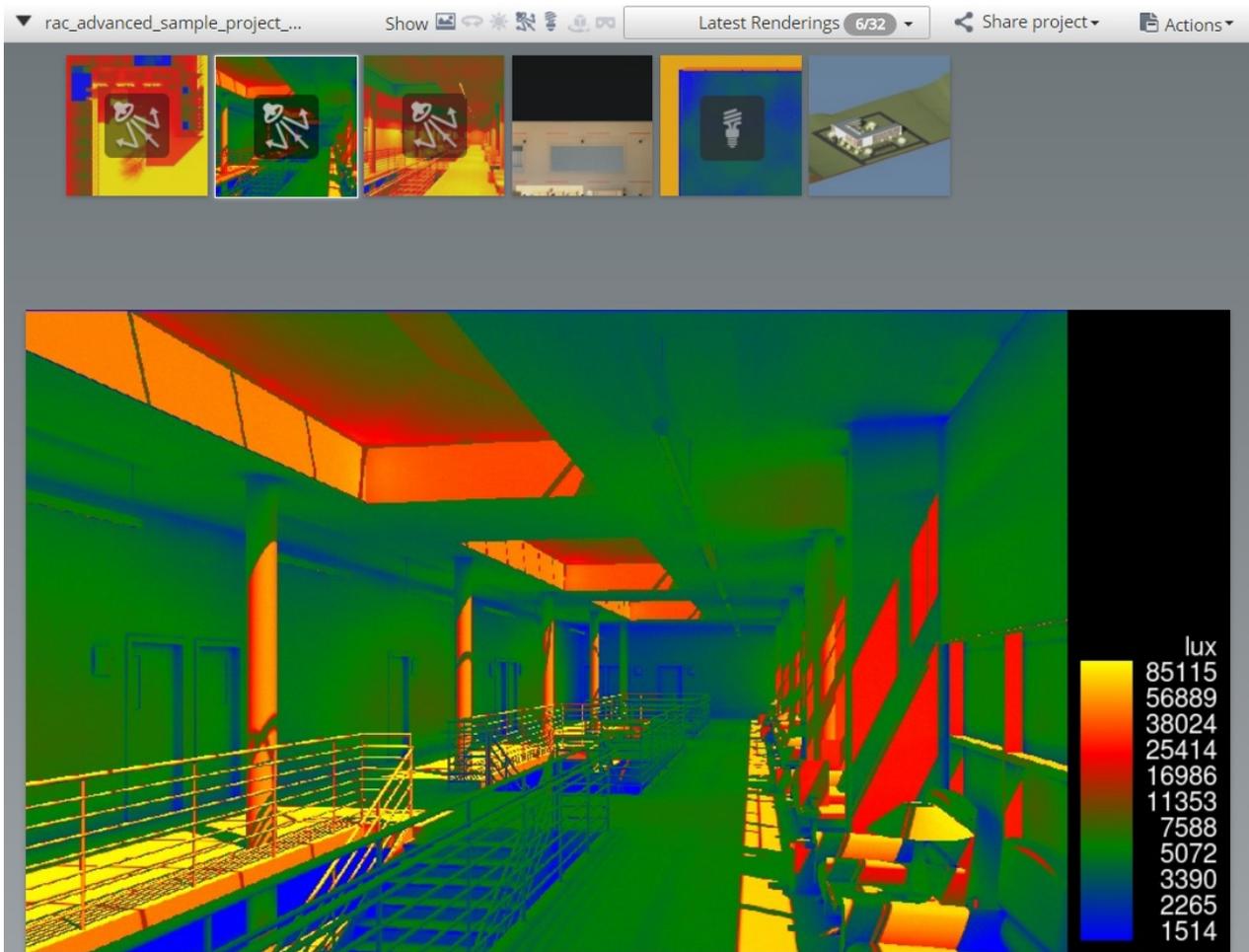
Renderings can be downloaded as JPG by selecting the drop down menu of the thumbnails or selecting **Actions** in the top right.

To change any of the rendering settings for a particular view, select **Re-render using new settings**.
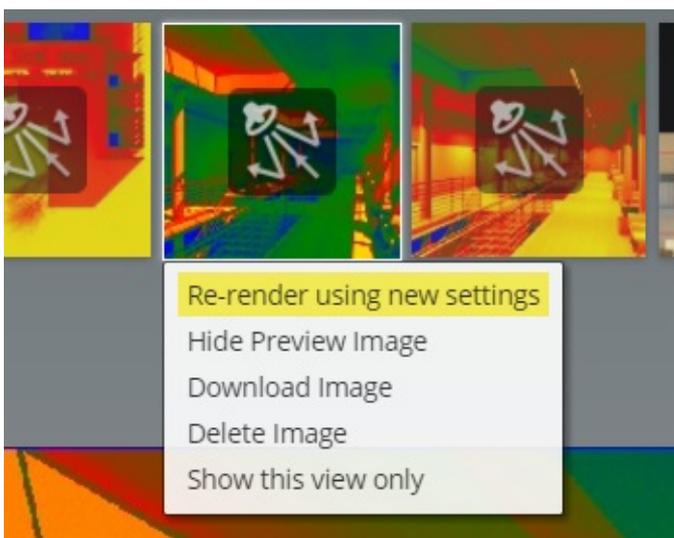


You will not be able to change the 3D view itself, but you can re-render an existing view and modify dates and times, sky models, or legend scales. To change a 3D view or any of the material properties, you will need to initiate the rendering from Revit.

Change any of the settings and select **Start Rendering**. The new rendering will automatically appear in your *Render Gallery*.

The *Rendering Settings* for each 3D view analyzed control if electric lights are included in the analysis. To include electric lights, open the 3D view you will be submitting and access *Rendering Settings*. Set the **Scheme** according to the desired outcome.
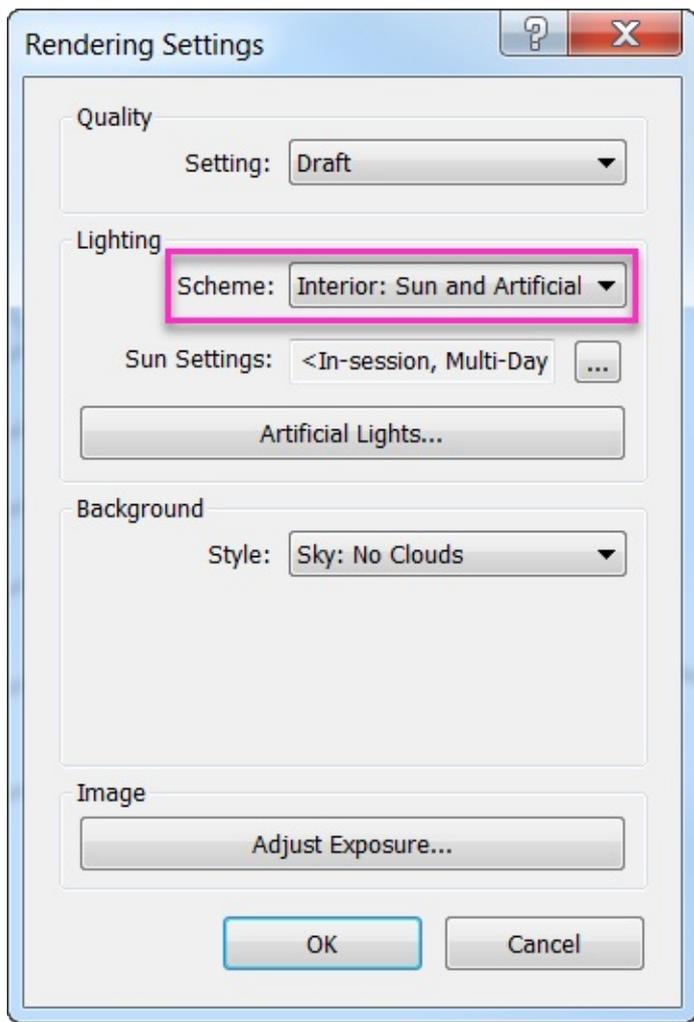
# Managing Results

Results are accessed by selecting a completed analysis, and populating results in Revit.
From there, views, corresponding 2D floor plans, and schedules will be updated with results.

# Accessing & Saving Results

When analysis results are complete, you will be prompted to accept the Cloud Credit charges and save the project. The results will then be added to the drop down list for selection.

The drop down menu will list all available analysis results. The analysis denoted with a "*" identifies the most recent set of results that were populated in the Revit model. This is important to indicate, because it means these are the results that are stored with the Revit model.
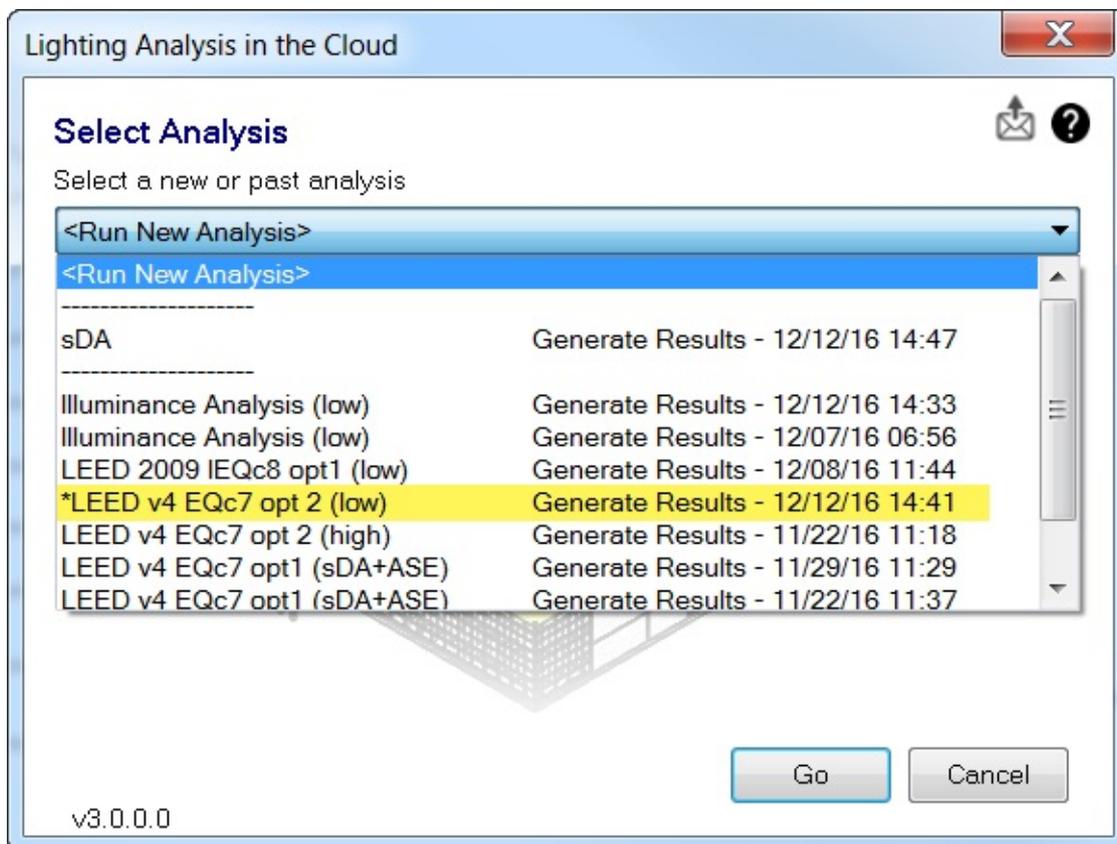


When you save and close the Revit model, the results with the "*" will be accessible by the next user who opens the model; regardless of their user account ID. All other results will only be accessible by the user account ID that originally submitted them.

You can change which set of results is accessible by selecting a different set of results to generate in the model, then saving the Revit model. You will see the "*" move to the latest set of results accessed.

In addition to accessing analysis results, you can also manage and export analysis results.
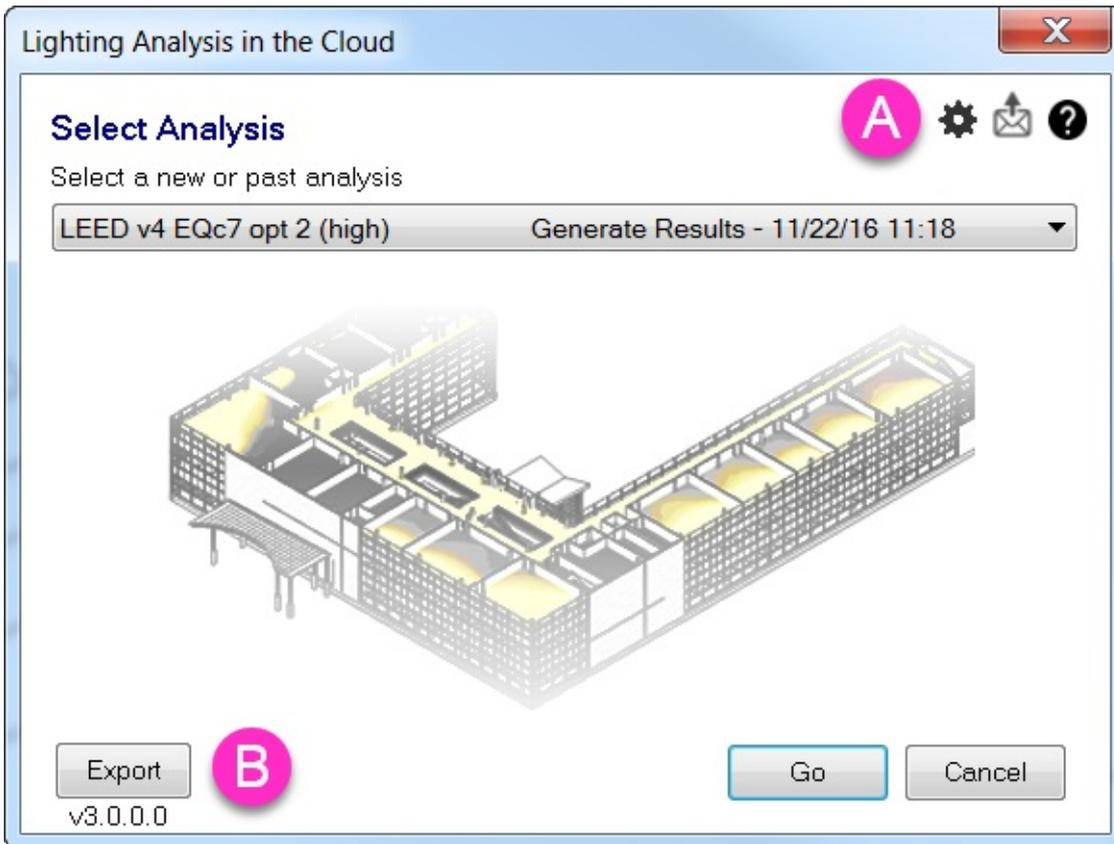
**A.** The **Analysis List Manager** allows you to **Delete** or **Rename** the selected analysis. Renaming can be helpful when you have multiple analysis types you are trying to organize. Analyses you have renamed will appear above the break in the drop down list.

**B. Export** will export all the settings associated with the selected analysis. It produces an XML file that includes information such as date and time settings, sky conditions, and location.

# Analysis Display Settings

Insight Lighting Analysis with Revit uses Revit **Floor** elements to produce analysis planes.

For most study types, multiple results are available. To change between results, select the analysis plane and change the **Analysis Configuration** in the *Properties* panel.
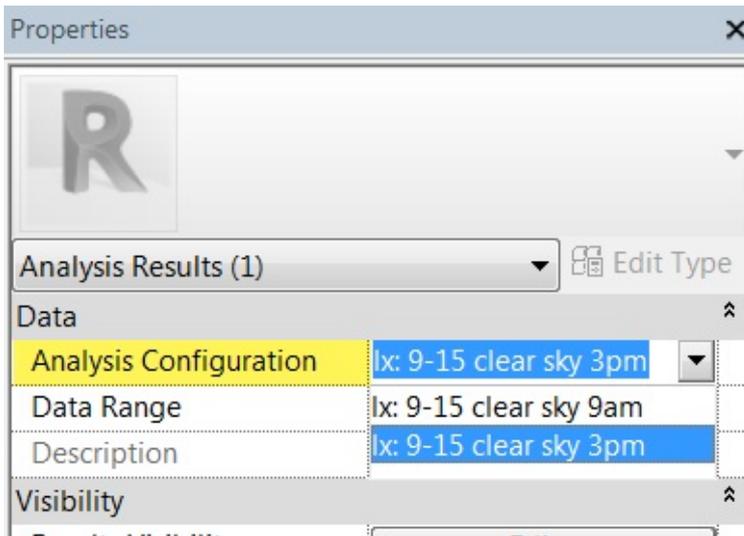


You can also turn analysis planes on and off by level in 3D views. Open a 3D view and select **Analysis Display Settings** from the *Properties* panel to select which analysis planes are visible in the view.
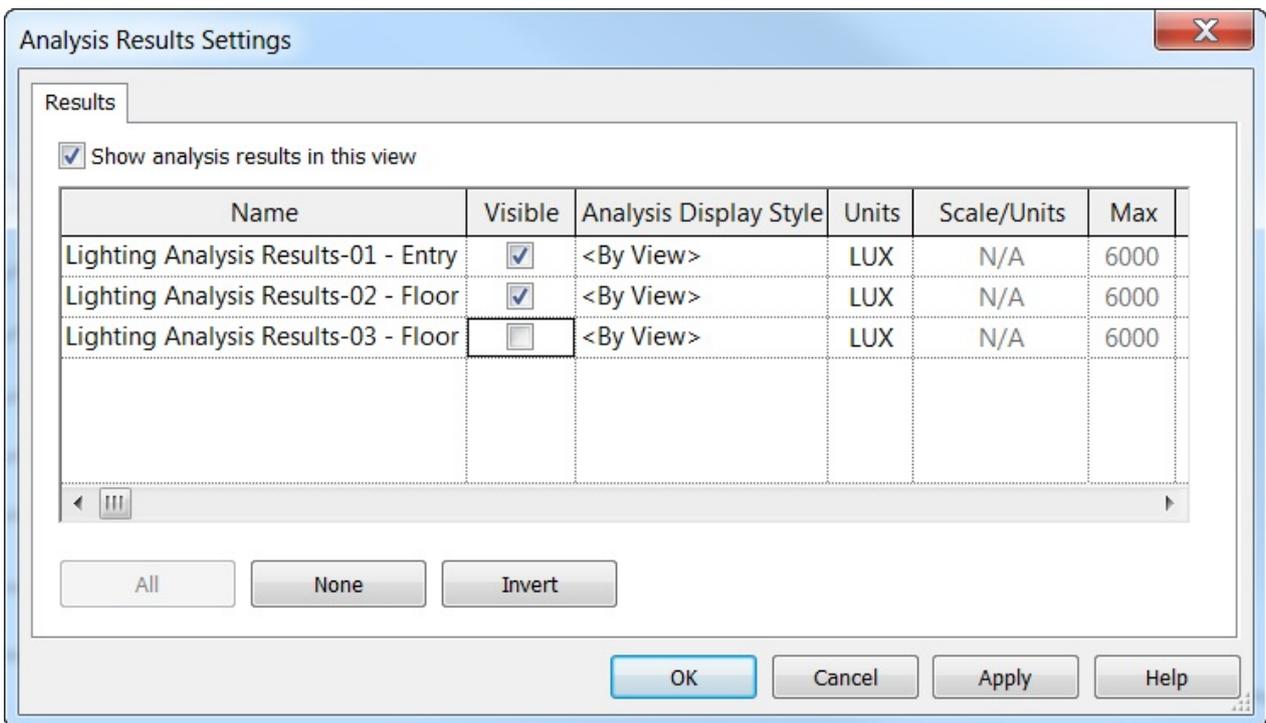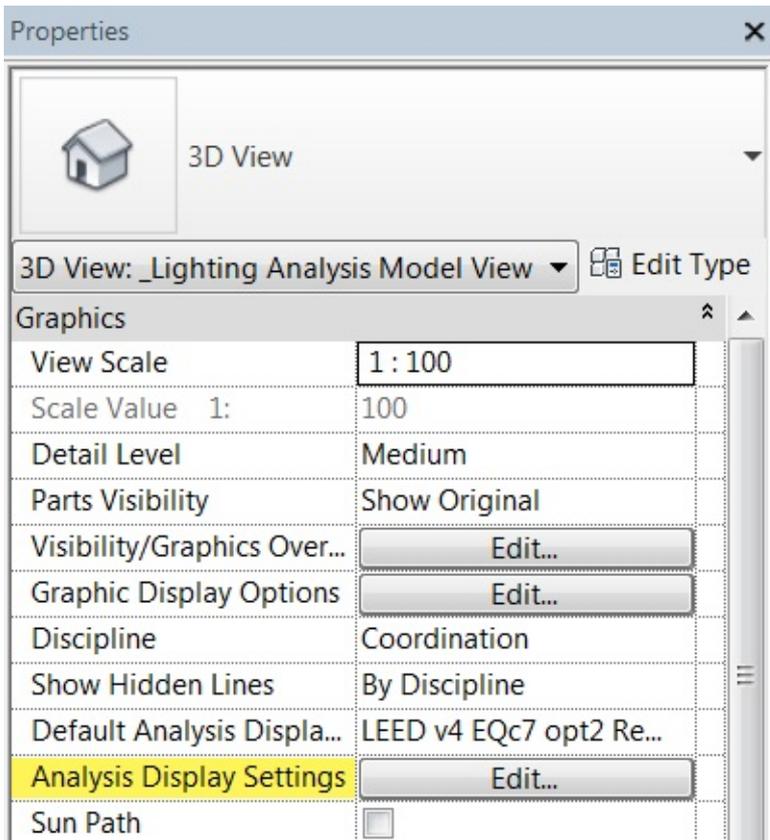
You can also change result *Units* through this dialog.

# Customizing Analysis Visual Styles

For all analysis types, default analysis display styles are used to visualize results. The steps below will allow you to modify these or create your own.

Open any view that has visible analysis results. In the *Properties* panel, select the [**…**] for **Default Analysis Display Style**.
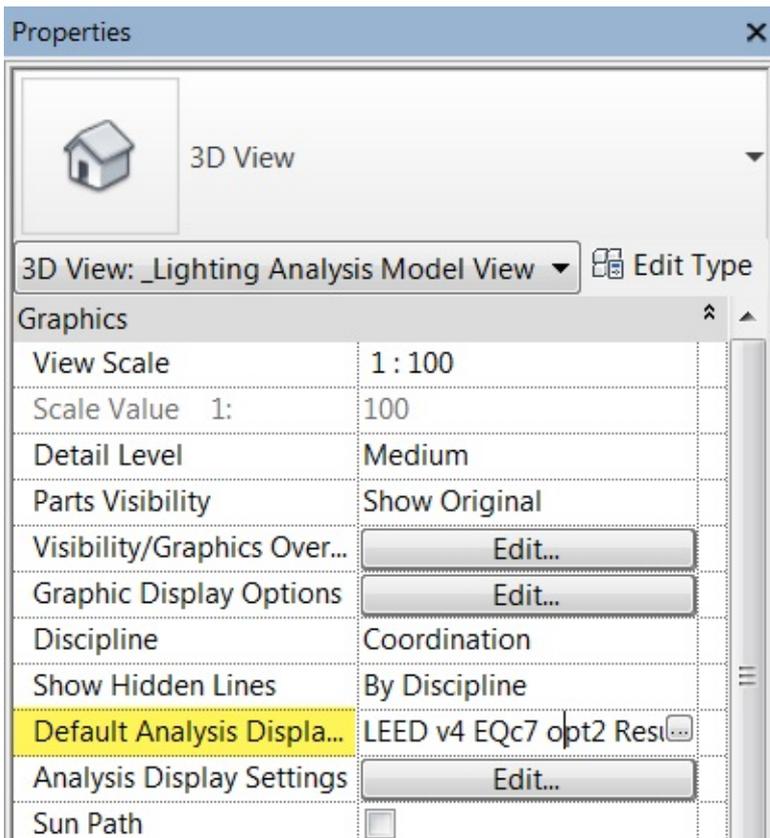


The **Analysis Display Styles** dialog will appear. The styles on the left are all default styles. Select any one of these to see change the visualization style in the current view.

To create your own style, select **New**.
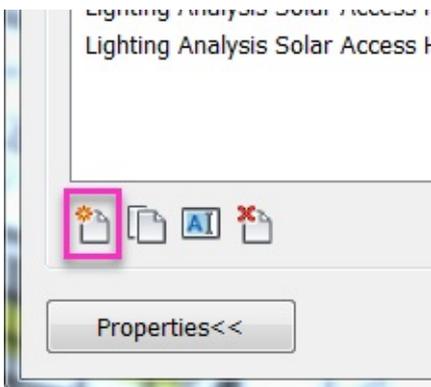
For lighting analysis results, **Colored surface** and **Markers with text** are the styles that should be used.
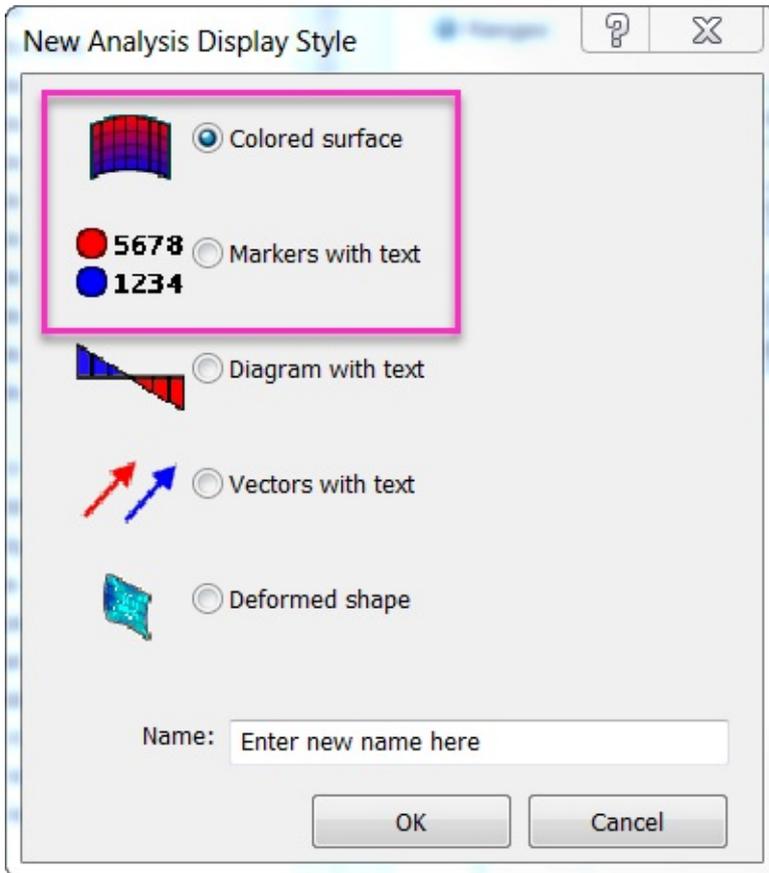


Control the **Settings**, **Color**, and **Legend** in the respective tabs.

## Analysis Display Styles

### Styles

Enter Search Words

LEED 2009 IEQc8.1 IDL Style
LEED 2009 IEQc8.1 IDL Style Pts
LEED 2009 IEQc8.1 IDL Style Pts Anno
LEED 2009 IEQc8.1 Results Style
LEED 2009 IEQc8.1 Results Style Pts
LEED 2009 IEQc8.1 Results Style Pts Anno
LEED v4 EQc7 opt1 Results Style
LEED v4 EQc7 opt1 Results Style Pts
LEED v4 EQc7 opt1 Results Style Pts Anno
LEED v4 EQc7 opt2 Results Style
LEED v4 EQc7 opt2 Results Style Pts
LEED v4 EQc7 opt2 Results Style Pts Anno
Lighting Analysis Default
Lighting Analysis Ecotect Style 0-100fc
Lighting Analysis IDL Style 10-500fc
Lighting Analysis Pass or Fail Style
Lighting Analysis Radiance Style 0-100fc
Lighting Analysis Rendering Style 0-100fc
Lighting Analysis SDA/ASE Detail Style
Lighting Analysis SDA/ASE Validation Style
Lighting Analysis Solar Access ASE Style
Lighting Analysis Solar Access Hours Style 1
Lighting Analysis Solar Access Hours Style 2

**Settings | Color | Legend**

Color mapping:

○ Gradient
◉ Ranges

Preview

| Value | Color below value |
|-------|-------------------|
| Max   | Yellow            |
| 3001  | Yellow            |
| 3000  | RGB 145-255-0     |
| 2000  | RGB 145-255-0     |
| 1000  | RGB 087-255-1     |
| 900   | RGB 058-255-1     |
| 800   | RGB 029-255-2     |
| 700   | Cyan              |
| 600   | RGB 004-209-2     |
| 500   | RGB 009-163-2     |
| 400   | RGB 013-166-2     |
| 300   | RGB 023-023-2     |
| 299   | RGB 159-000-0     |
| Min   |                   |

1

+

-

Properties<<    No Style    OK    Cancel    Apply

Adding values associated with specific colors will allow you to highlight specific thresholds.

# Room Parameters

When Rooms are specified in the model, and a lighting analysis is run, Room parameters get automatically created. These parameters are used for the schedule calculations. These parameters are editable in the "**_Lighting Analysis Room Schedule**" as well as when a room is selected and the *Properties* are edited.
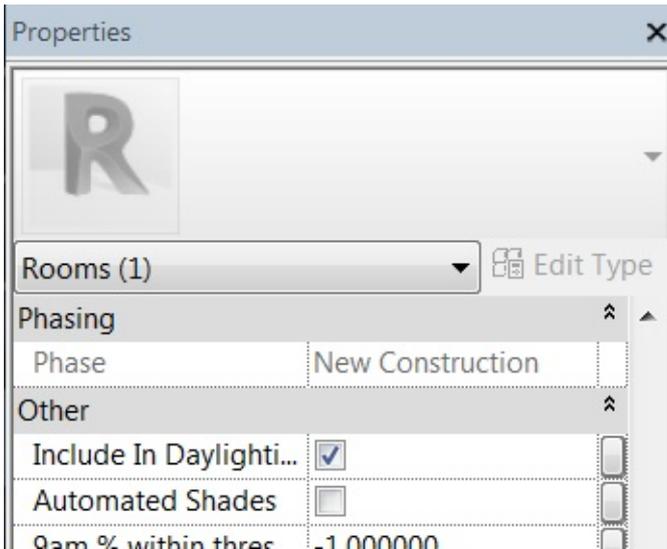
# Additional Settings & Considerations

- Model Requirements
- Views & Schedules
- Material Settings
- Light Analysis Settings
- Sky Models
- Analysis Costs

# Model Requirements

Insight Lighting Analysis with Revit requires a model composed of building elements (walls, floors, roofs, windows, curtain walls, etc). *A conceptual mass model will not work*.

**Floors** Floor elements are required to produce analysis planes. Therefore, in order for analysis planes to be produced in a model, floors must be present, and visible in the "**_Lighting Analysis Model View**" 3D view.

**Rooms** Rooms are not required for all study types, however they can make parsing through results easier and produce detailed schedules. This information can be accessed in the "**_Lighting Analysis Room Schedule**."

Additionally, Rooms are required for the 2D floor plan "**_Lighting Analysis**" views to be created when results are generated.

The following analysis types require rooms to be placed in a model to get summary results and schedules. This is because the calculations are based on room area.

- LEED v4 EQc7 opt1
- Daylight Autonomy (sDA preview)
- Solar Access

All other analysis types do not require Rooms, but can prove helpful when working with results and schedules. When trying to run one of these analysis types without Rooms, you will receive a warning, but can proceed with the workflow.

**Linked models** When working with linked models, Floors and Rooms must be part of the main model. All other elements can be linked in. The analysis will not run if Floors and Rooms are linked in.

# View & Schedules

The Insight Lighting Analysis plugin automatically creates several views and schedules when an analysis is run. All of these are prefaced with "**_Lighting Analysis**."

| Title | Description |
|---|---|
| _Lighting Analysis Model View | 3D view; This is the view that dictates what is included (or not included) in the lighting analysis rendering; Can be overridden using Light Analysis Settings |
| _Lighting Analysis – XX Floor Plan | 2D floor plan view created for every level that is included in the analysis, and has Rooms specified; If a level has no Rooms, a floor plan view will not be created for it; Can visualize which Rooms are included or not included in this view |
| _Lighting Analysis Floor Schedule | Schedule created showing percentage of area within results thresholds, by level included in analysis |
| _Lighting Analysis Room Schedule | Schedule created showing percentage of area within results thresholds, by level included in analysis |

The "**_Lighting Analysis Model View**" 3D view is used to define the geometry and settings for the lighting analysis. You can create special settings for the analysis by making the necessary changes in this 3D view properties before clicking **Run Analysis**. For instance, you can hide or turn off objects in this view if you wish not include them in the lighting analysis.

Each time a lighting analysis is run, it will automatically change some of the settings for the "**_Lighting Analysis Model View**" 3D view unless you change the settings defined in the **Light Analysis Settings** dialog.

# Design Options

When analyzing and comparing **Design Options** make sure whatever option you want to analyze is active in the "**_Lighting Analysis Model View**" 3D view. Whatever geometry is enabled in this view will be used for the lighting analysis.

# Material Settings

To make your results more accurate, you'll want to assign the appropriate material properties to your window glass and interior surfaces. If you find that you often use similar material finishes or glazing properties in your projects, it might be worth add materials with proper illuminance rendering settings to your **Material Browser**.

# Transparent Materials

Visible transmittance (Tvis) for transparent materials is an important consideration for lighting analysis. It will dictate how much light is able of entering the building through glazing. Visible transmittance is controlled by the **RGB** values in the *Revit Material Browser*. Follow the steps below to set visible transmittance for transparent surfaces.

The default visible transmittance settings for most glazing used in Revit window families are generally much higher than glazing values typically used in buildings today. Setting valid glazing Tvis is important for getting valid illuminance simulation results.

Select the glass pane that you want to edit. Select **Edit Type** from the *Properties* panel.
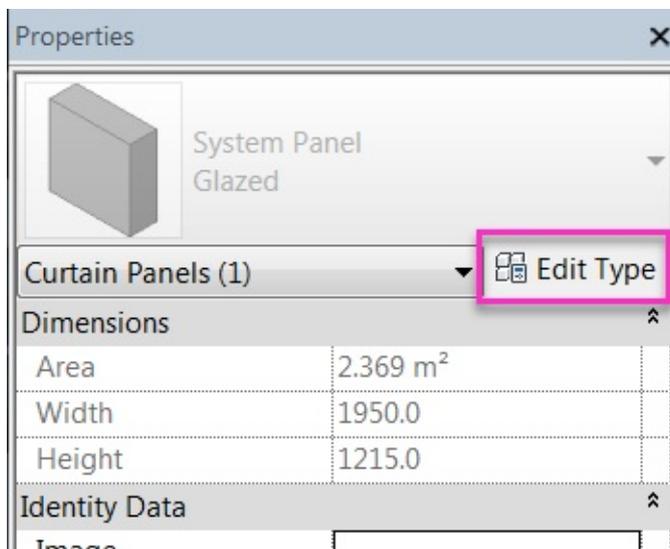


For Window elements, this can be done by editing the family. For Curtain Panels, this can be done by selecting the glazing element.

Glass panes that have a thickness of ½" to 1" (12.7mm to 25.4mm) will provide the most accuracy and flexibility in range of transparency.

To change the visible transmittance for the glass pane, edit the **Material**. This will open the **Material Browser**.
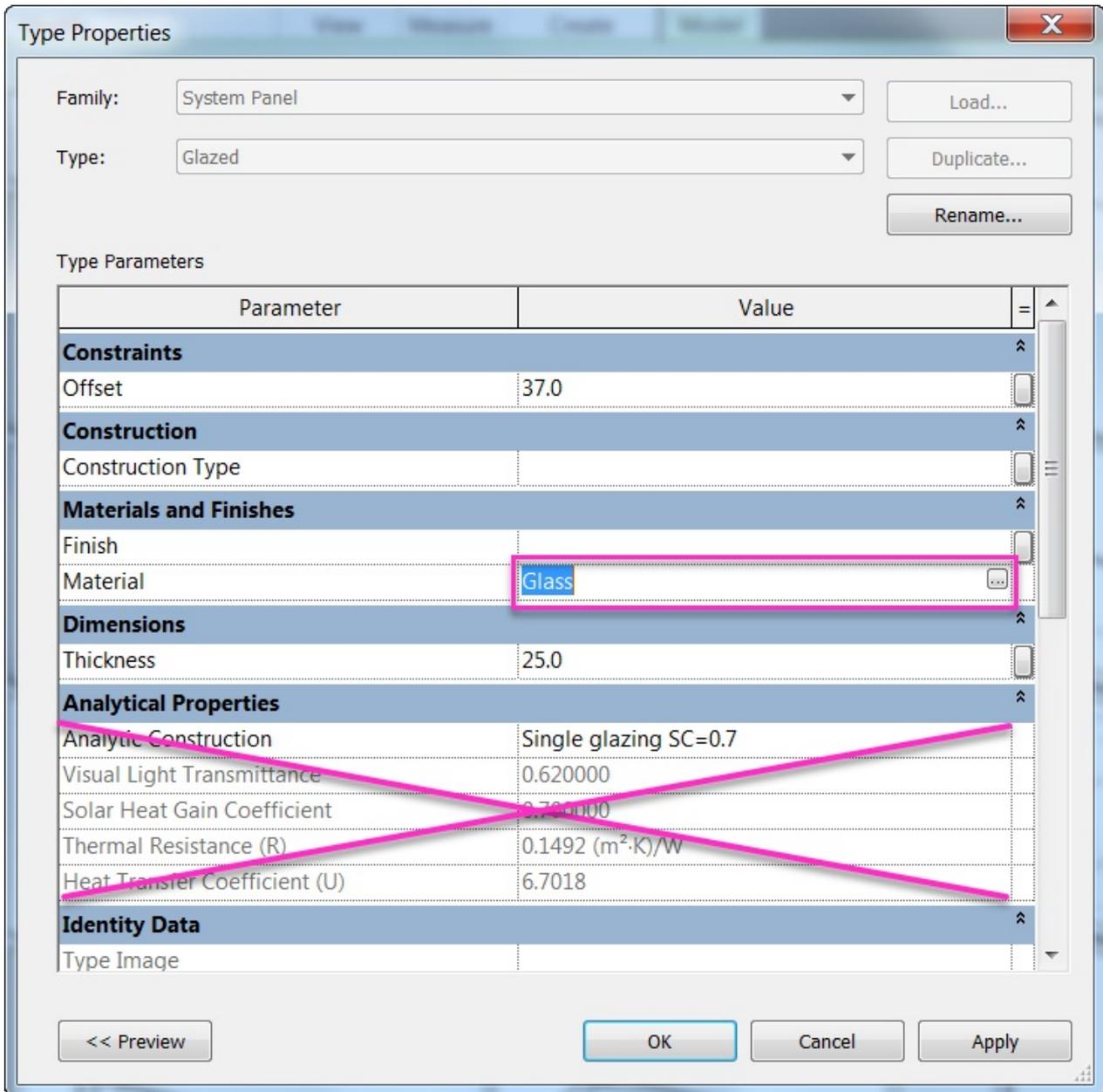
Note that the *Analytical Properties* of the glass will not affect lighting analysis results. These settings are for energy analysis only.

In the *Material Browser*, open the **Appearance** tab. The **Appearance** tab is the *only* tab that affects the results for illuminance analyses.

Make sure that the asset assigned to the material is an actual transparent material. If not, replace the asset using the **Asset Browser** and assign a transparent material, such as **Glazing** or **Glass**.
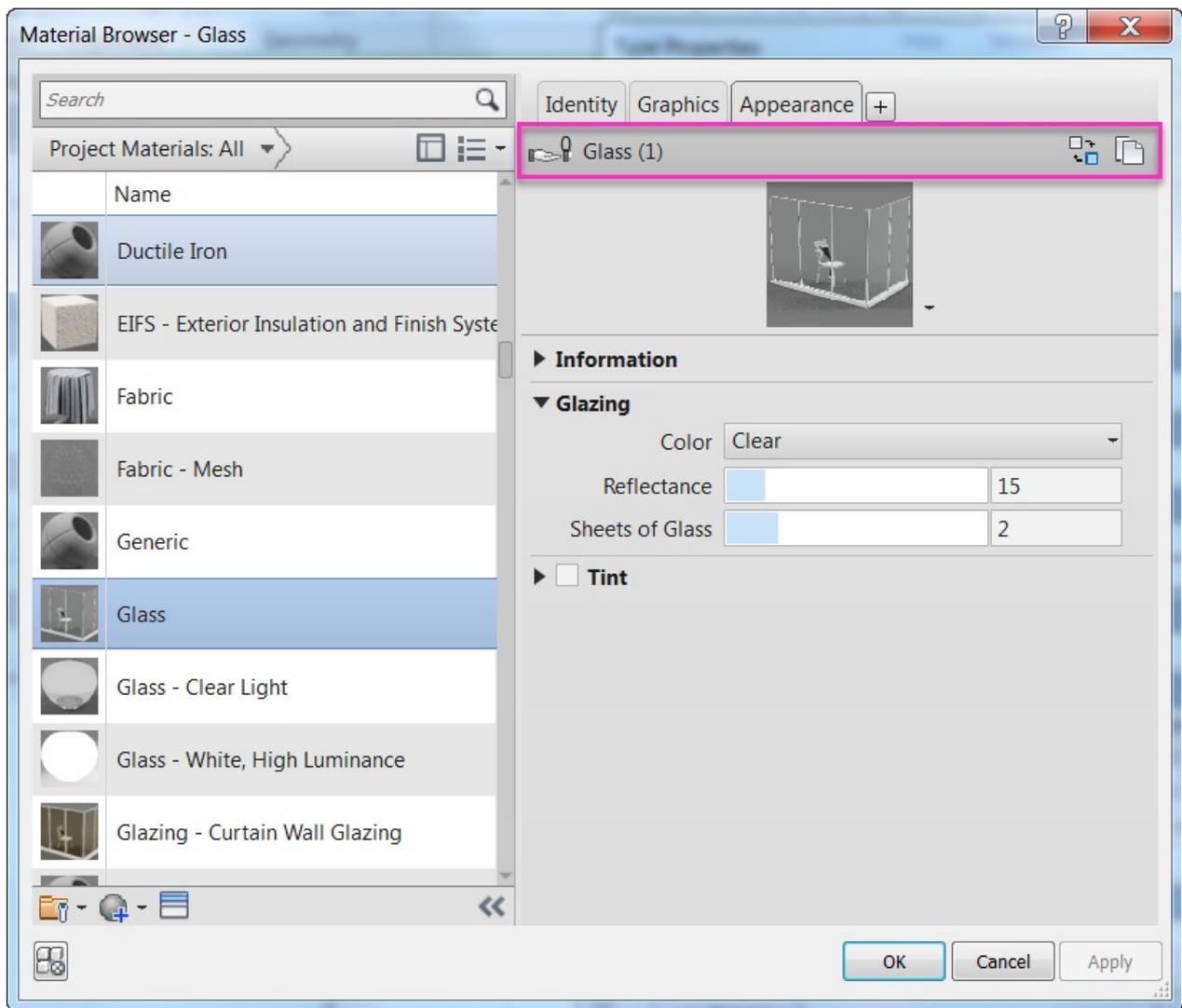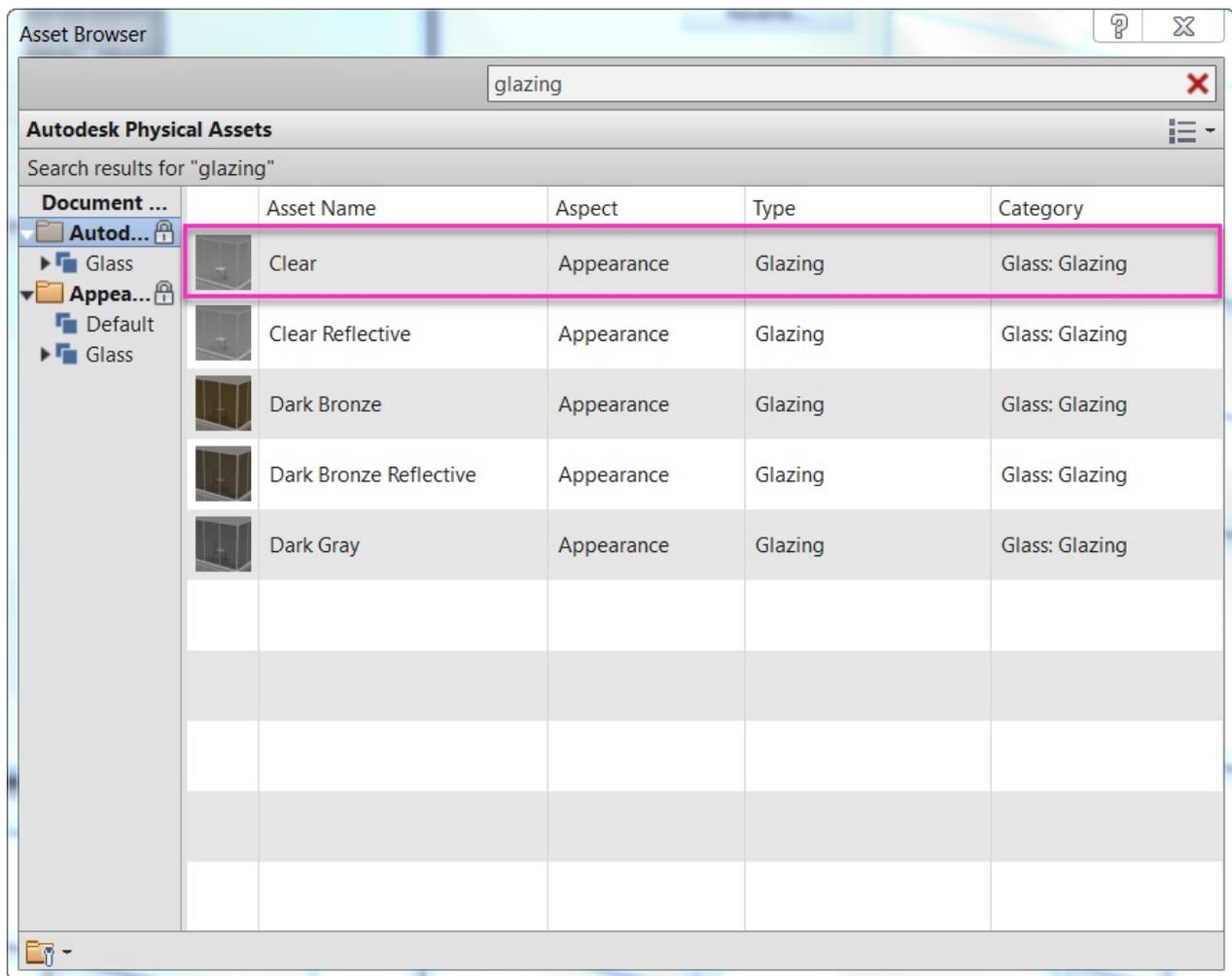
Once a transparent asset has been assigned to the material, under the *Glazing* section, change the **Color** to **Custom**. Then, enter the **RGB** values corresponding to pane thickness and desired Tvis.
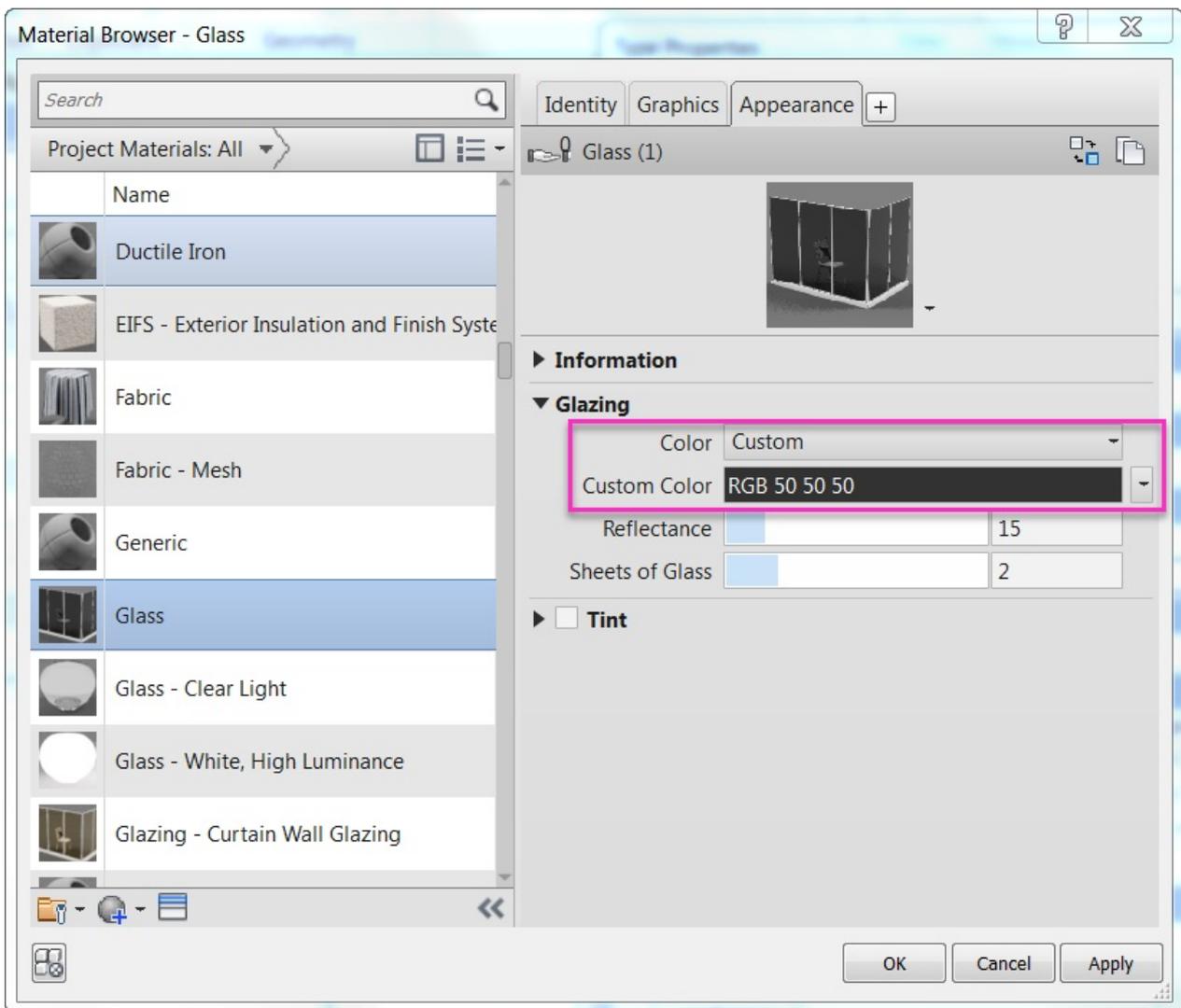
The **Reflectance** setting is *not* used for illuminance renderings. The A360 Rendering engine uses a predefined reflectance of ~4%.

The **Sheets of Glass** is also *not* used for illuminance renderings. The A360 Rendering engine uses the actual modeled Revit geometry. For example, if a Revit window family includes two panes of glass, the illuminance rendering will consider the combined effect of both panels.

Diffuse glazing and the effect of light passing through frosted or fritted glass is not supported by Revit's material and asset definitions.

To determine what **RGB** values to use to represent the desired Tvis for your glazing, use the table below, or download this worksheet. Defining the visible transmittance depends not only on the RGB values used, but also the thickness of the glass and how many panes are modeled in Revit.

It is recommended to always use RGB values that are equal to each other. This is for simplicity's sake and should not affect analytical results since illuminance renderings are measuring the quantity of light, not the quality or color of that light.

| | | | Visible Transmittance | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 90% | 80% | 70% | 60% | 50% | 40% | 30% | 20% | 10% |
| Revit (modeled) pane thickness | single | 3.0 mm | 171 | 24 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 4.0 mm | 189 | 43 | 8 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | 5.0 mm | 201 | 61 | 16 | 3 | 0 | 0 | 0 | 0 | 0 |
| | | 6.0 mm | 209 | 78 | 25 | 7 | 1 | 0 | 0 | 0 | 0 |
| | | 8.0 mm | 219 | 105 | 45 | 17 | 5 | 1 | 0 | 0 | 0 |
| | | 10.0 mm | 226 | 125 | 64 | 29 | 11 | 3 | 0 | 0 | 0 |
| | | 12.7 mm | 232 | 146 | 86 | 47 | 22 | 9 | 3 | 0 | 0 |
| | | 25.4 mm | 243 | 193 | 148 | 109 | 76 | 49 | 27 | 12 | 3 |
| | | 28.6 mm | 244 | 199 | 157 | 120 | 87 | 59 | 35 | 17 | 5 |
| | double | 3.0 mm | - | 154 | 50 | 14 | 3 | 0 | 0 | 0 | 0 |
| | | 4.0 mm | - | 175 | 76 | 29 | 9 | 2 | 0 | 0 | 0 |
| | | 5.0 mm | - | 189 | 96 | 44 | 18 | 5 | 1 | 0 | 0 |
| | | 6.0 mm | - | 198 | 113 | 59 | 28 | 11 | 3 | 0 | 0 |
| | | 8.0 mm | - | 211 | 139 | 86 | 48 | 24 | 9 | 2 | 0 |
| | triple | 3.0 mm | - | - | 137 | 58 | 21 | 6 | 1 | 0 | 0 |
| | | 4.0 mm | - | - | 160 | 84 | 39 | 15 | 4 | 0 | 0 |
| | | 5.0 mm | - | - | 175 | 105 | 57 | 27 | 10 | 2 | 0 |
| | | 6.0 mm | - | - | 186 | 121 | 73 | 39 | 17 | 5 | 0 |
| | quad | 3.0 mm | - | - | 224 | 118 | 55 | 21 | 6 | 1 | 0 |
| | | 4.0 mm | - | - | 232 | 143 | 81 | 40 | 16 | 4 | 0 |
| | | 5.0 mm | - | - | 236 | 160 | 101 | 58 | 28 | 10 | 1 |
| | | 6.0 mm | - | - | 239 | 173 | 118 | 74 | 40 | 17 | 4 |

To use this chart:

- Determine the modeled thickness of the glazing pane geometry in your Revit model and the number of panes modeled. For multiple panes, the thickness applies to each pane. These values are the rows.
- Determine the overall desired Tvis. This value is the column.

For example, for a double pane window where each pane is 3.0 mm thick, and a desired Tvis of 70%, the RGB values would be 50-50-50, and you would enter R**50**-G**50**-B**50** into the Material Browser. Note that a "perfectly clear" piece of glass would have a Tvis of about 92%.

The actual Tvis derivation for a single pane of glass is calculated as:

Tvis = 0.9216 * 10^(thickness_in * log_10((color/255)^2))

*Where thickness_in* = thickness of the pane in inches *color* = value in the Revit dialog [0-255]

The table above calculates the inverse of this function. The equation is derived from the physics of light transport in glass. It combines the Beer-Lambert law of transmission and the Fresnel equations (which are used to calculate the leading constant:1-R). The renderer implements these physical equations because they automatically account for things like directional variation in reflectivity and transmissivity and greater absorption in thicker panes of glass. Further it ensures that glass is always handled in a physically correct and consistent manner.

# Opaque Materials

Material reflectivity is an important consideration for lighting analysis. It will dictate how much light bounces off the interior surfaces and further into the building. Material reflectivity is controlled by the **RGB** values in the *Revit Material Browser*. Follow the steps below to set material reflectivity for opaque surfaces.

Standard values for material reflectivity are listed below.

| Element | Reflectivity |
|---------|--------------|
| Ceilings | 85% |
| Walls | 60% |
| Floors | 25% |

Download this worksheet to help quickly define RGB values for different reflectivity values.

Select the Revit element that you want to edit. Select **Edit Type** from the *Properties* panel.
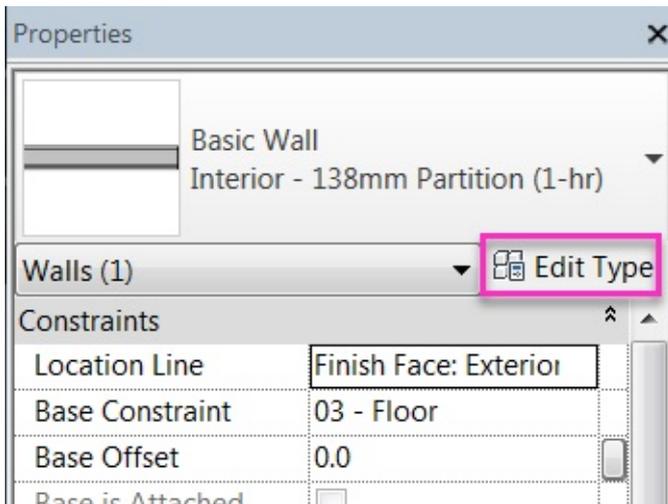


To change the properties associated with the materials that make up the element, **Edit** the **Structure**.
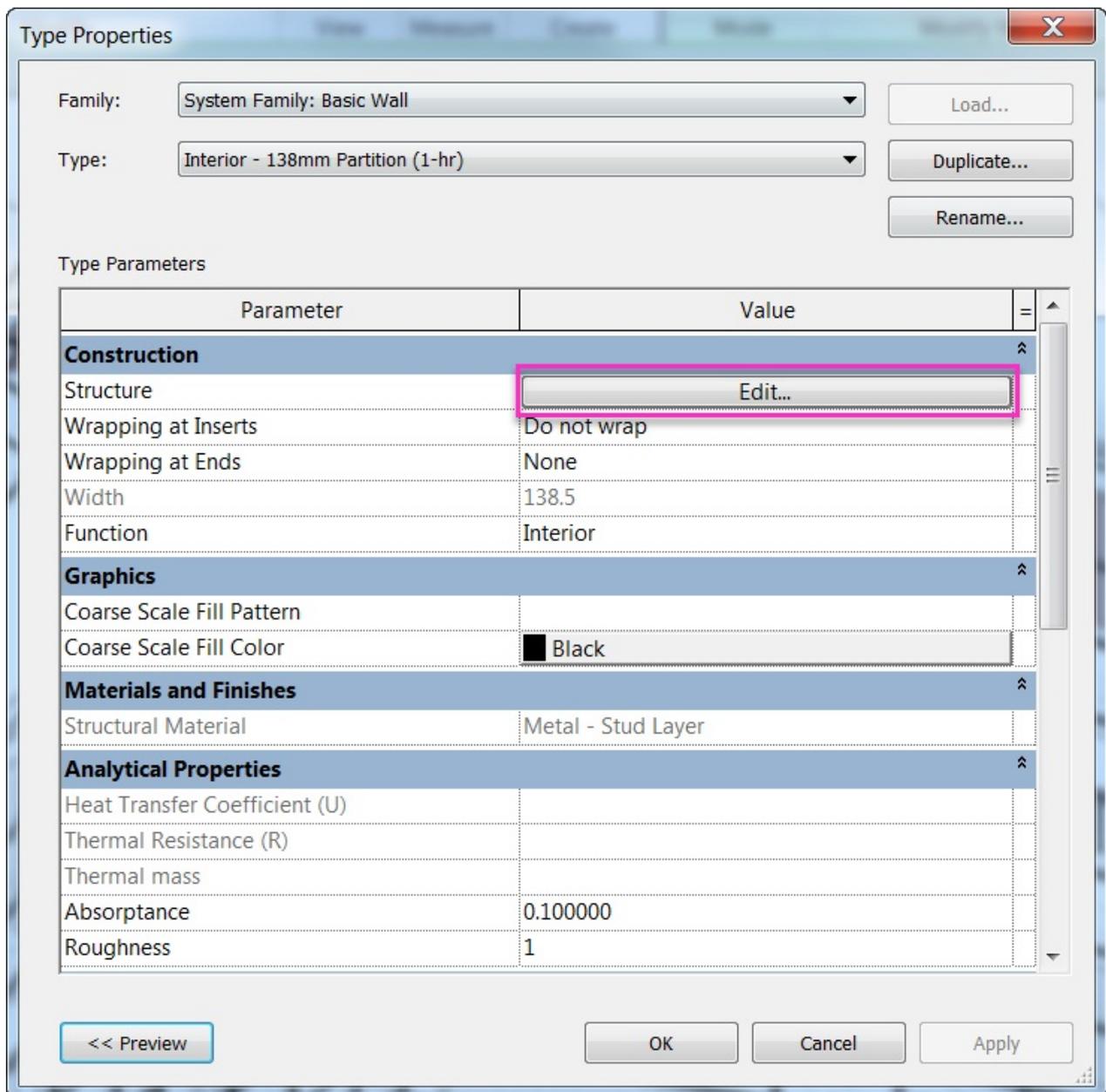
Select the interior face of the element. This will open the *Material Browser*.
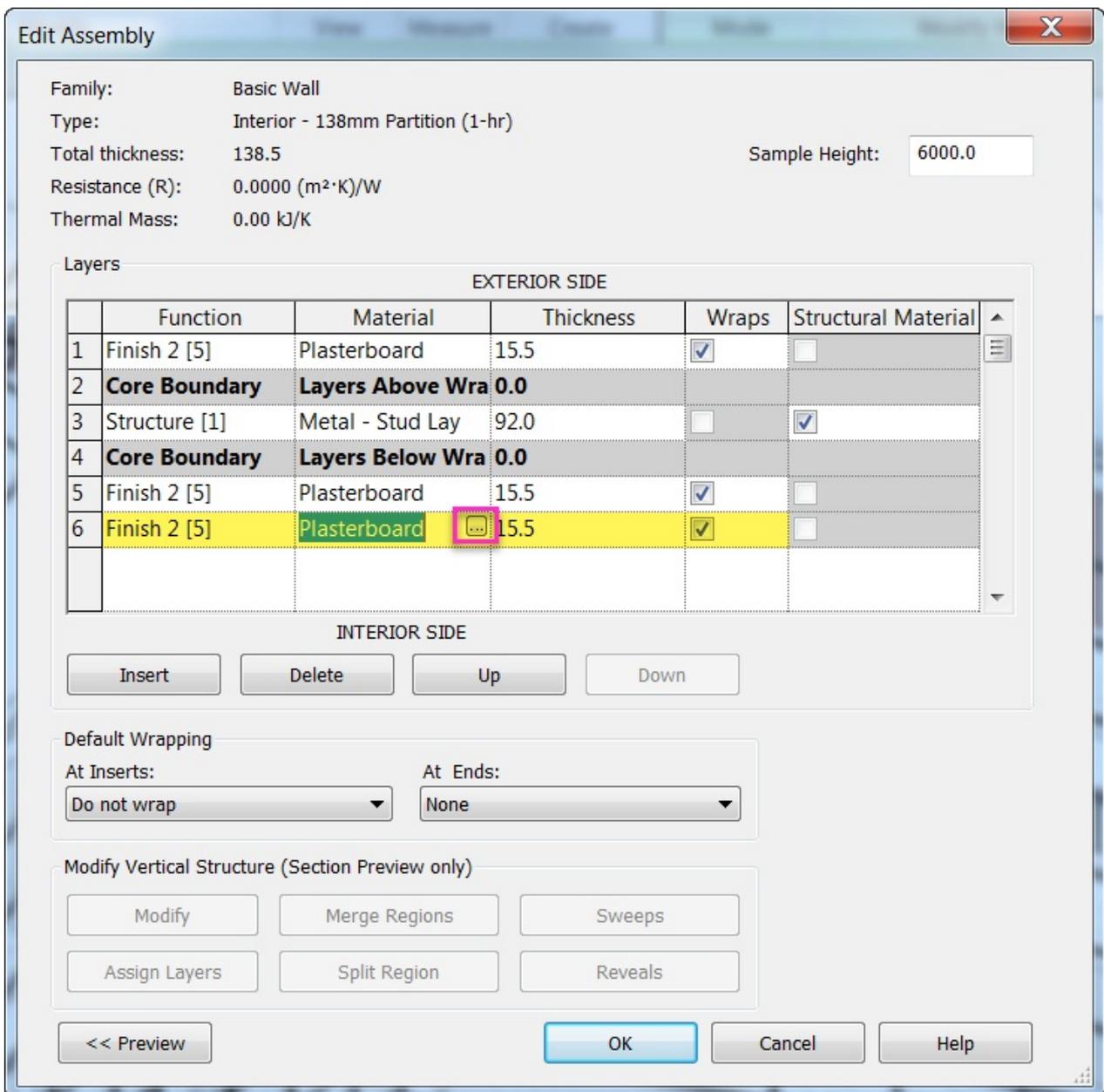
In the *Material Browser*, open the **Appearance** tab. The **Appearance** tab is the *only* tab that affects the results for illuminance analyses.

In the **Generic** panel, editing the **RGB** values will control reflectivity for opaque finishes. If an image is selected for the **Appearance**, the average colors of the picture will determine the basic material reflectivity.
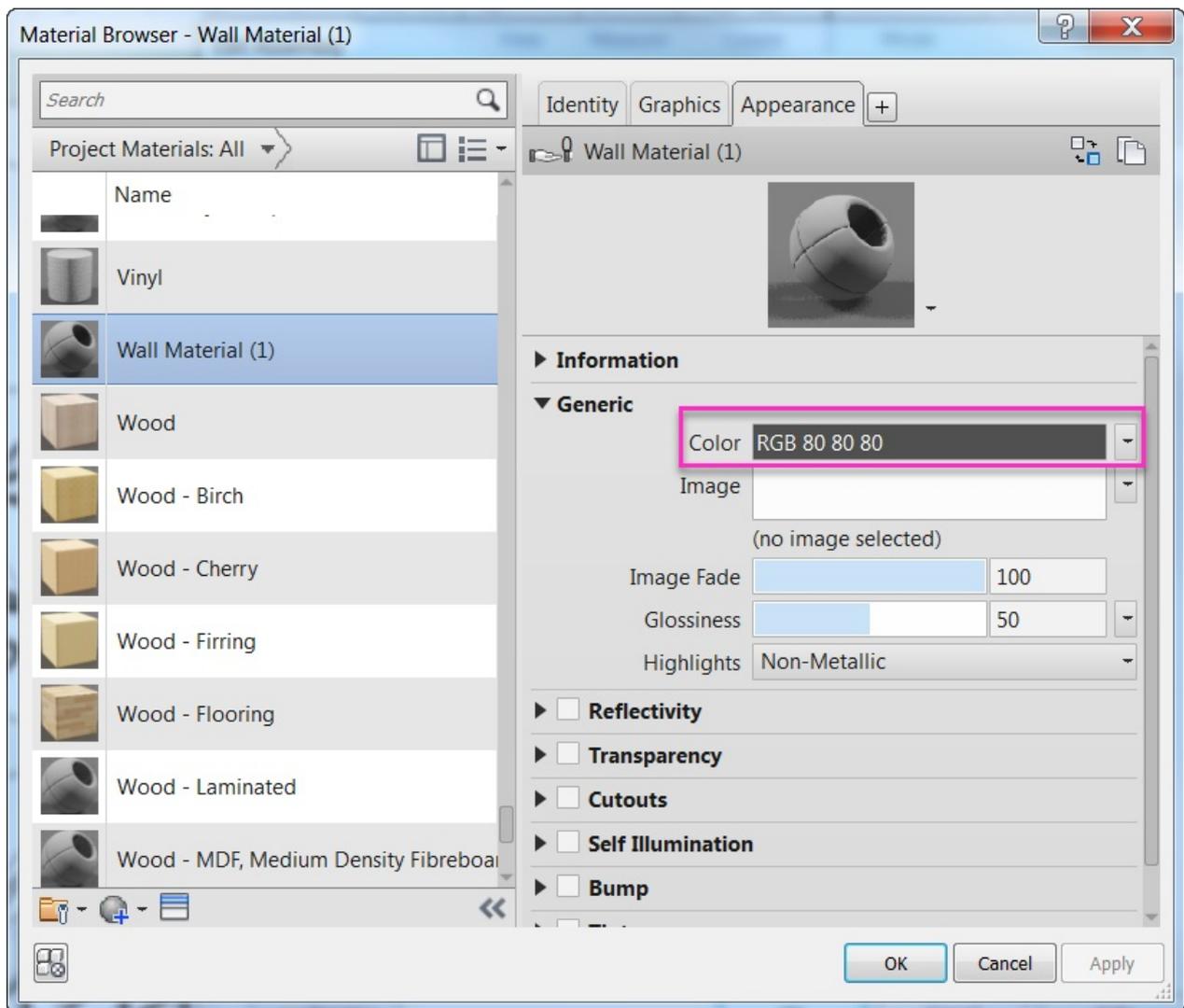
**RGB** values are based on the following formula:

$$ (0.2126R + 0.7152G + 0.0722B) / 255 $$

You can use the table below, or the worksheet available here to define RGB values for specific reflectivity values.

| Reflectivity | R | G | B |
|---|---|---|---|
| 100% | 255 | 255 | 255 |
| 98% | 250 | 250 | 250 |
| 94% | 240 | 240 | 240 |
| 90% | 230 | 230 | 230 |
| 86% | 220 | 220 | 220 |
| 82% | 210 | 210 | 210 |
| 78% | 200 | 200 | 200 |
| 75% | 190 | 190 | 190 |
| 71% | 180 | 180 | 180 |
| 67% | 170 | 170 | 170 |
| 63% | 160 | 160 | 160 |
| 59% | 150 | 150 | 150 |
| 55% | 140 | 140 | 140 |
| 51% | 130 | 130 | 130 |
| 47% | 120 | 120 | 120 |
| 43% | 110 | 110 | 110 |
| 39% | 100 | 100 | 100 |
| 35% | 90 | 90 | 90 |
| 31% | 80 | 80 | 80 |
| 27% | 70 | 70 | 70 |
| 24% | 60 | 60 | 60 |
| 20% | 50 | 50 | 50 |
| 16% | 40 | 40 | 40 |
| 12% | 30 | 30 | 30 |
| 8% | 20 | 20 | 20 |
| 4% | 10 | 10 | 10 |
| 0% | 0 | 0 | 0 |

When all other attributes in the **Appearance** tab are unchecked, the material will have a matte finish and only diffuse reflectivity (it will not be "shiny"). You can simulate shiny, or specular, materials by checking **Reflectivity** and changing the settings.
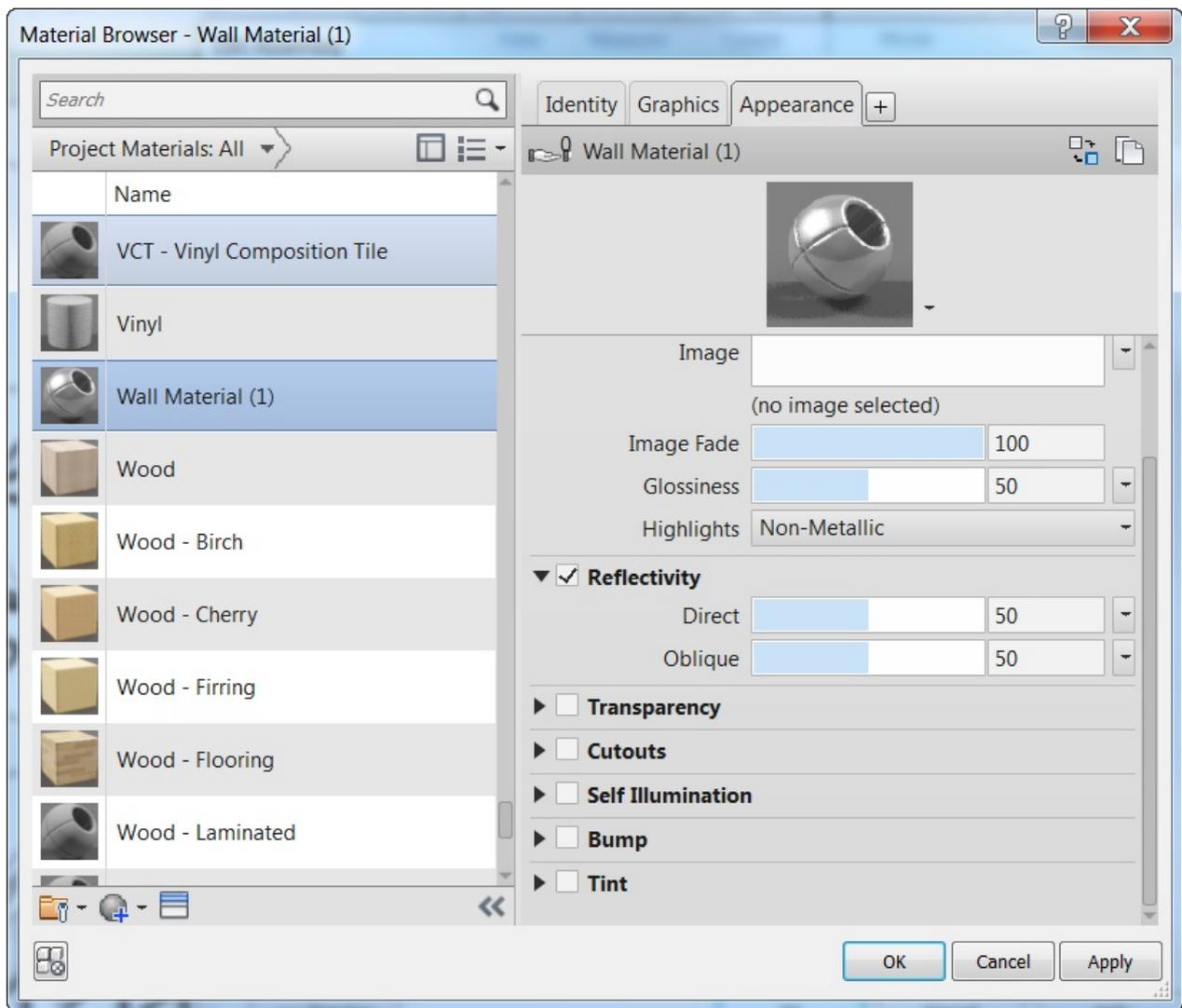
All other categories in the **Appearance** tab (*Transparency*, *Cutouts*, *Self Illumination*, *Bump*, and *Tint*) define surface appearance properties. These will affect overall light reflectivity.

# Light Analysis Settings

For most analysis types, it is not necessary to change any of the default light analysis settings, however some of them can help you work more efficiently. The image below depicts the default settings.

These settings persist with Revit, not the project, so be aware that any changes that you make to the settings will keep for all other projects until you change the settings.
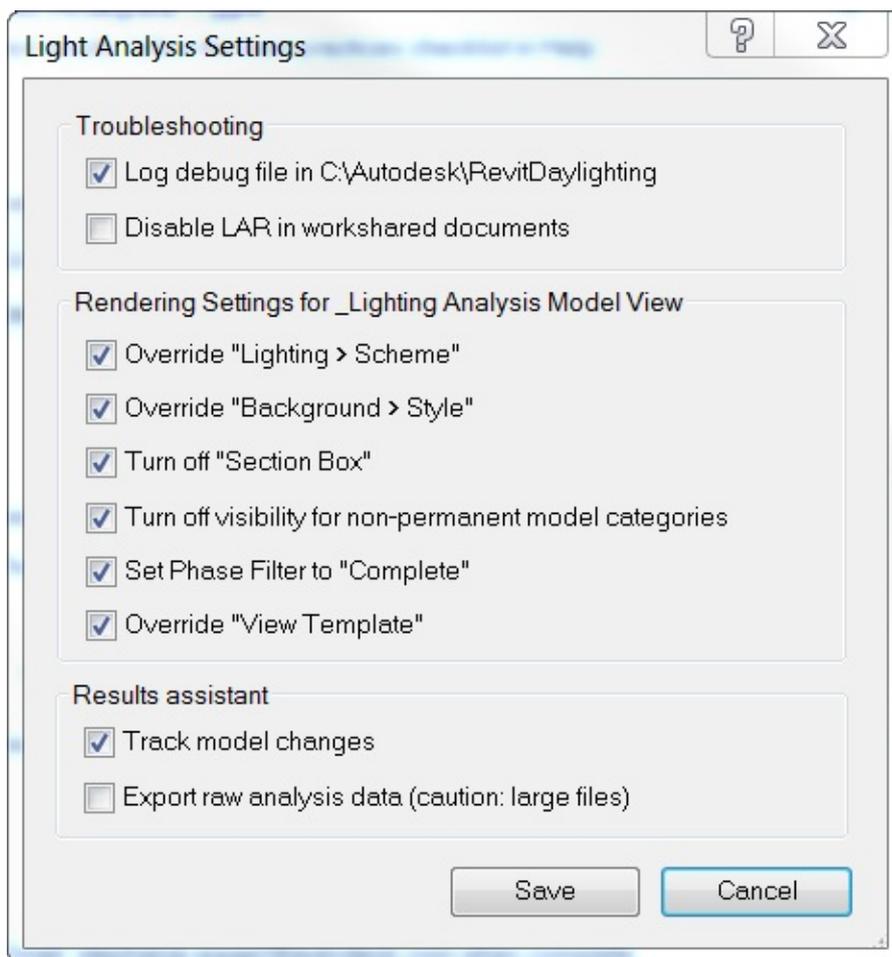


**Troubleshooting**

| | |
|---|---|
| *Log debug file in C:\Autodesk\RevitDaylighting* | This option automatically creates a log file in the listed structure. This can be helpful when troubleshooting. |
| *Disable LAR in workshared documents* | Lighting Analysis saves data from the last analysis generated with the Revit document. Select this option to prevent running a lighting analysis on a workshared model. |

**Rendering Settings for _Lighting Analysis Model View**

The "**_Lighting Analysis Model View**" 3D view is used to define the geometry and settings for the lighting analysis. Any changes you make to this view before selecting **Run Analysis** will be represented in your analysis results. For instance, you can hide or turn off objects in this view to not include them in the lighting analysis.

Each time a lighting analysis is run, it will automatically change some of the settings for the "**_Lighting Analysis Model View**" 3D view, unless you change the settings defined in the **Light Analysis Settings** menu.

| | |
|---|---|
| *Override "Lighting > Scheme"* | If checked, the Lighting **Scheme** for the **Rendering Settings** for the "**_Lighting Analysis Model View**" 3D view is set to "**Interior: Sun only**". Unchecked, this setting allows you to change the **Rendering Settings** to include electric lights. |
| *Override "Background > Style"* | If checked, the **Background Style** for the **Rendering Settings** for the "**_Lighting Analysis Model View**" 3D view is set to "**Sky: No clouds**". |
| *Turn off "Section Box"* | If checked, the section box for the "**_Lighting Analysis Model View**" 3D view is turned off. Unchecked this setting allows you to exclude parts of the model using the section box, but be aware any open areas or floors will be subjected to "full sun." |
| *Turn off visibility for non-permanent model categories* | This option hides the following categories of elements in the "**_Lighting Analysis Model View**" 3D view: *Furniture, Furniture Systems, Entourage, _and* Planting_. Unchecking this setting allows you to include these elements and their impact will be represented in the lighting analysis results. |
| *Set Phase Filter to "Complete"* | If checked, the **Phase Filter** for the "**_Lighting Analysis Model View**" 3D view will be set to "**Show Complete for Lighting**". This Phase Filter will display elements in **New** and **Existing** phases "**By Category**" and elements in Temporary and Demolished phases will not be displayed. |
| *Override "View Template"* | If checked, the **View Template** for the "**_Lighting Analysis Model View**" 3D view will be set to "**None**." |

**Results assistant**

| | |
|---|---|
| *Track model changes* | Check this option to be warned when a change is made to the model that invalidates the lighting analysis results. |
| *Export raw analysis data (caution: large files)* | Use this option opens an Excel window with analysis points and illuminance values when results are generated. This export option is only available for the following study types: *Illuminance Analysis, LEED 2009 IEQc8 opt1, LEED v4 EQc7 opt2* |

# Sky models

Customized *Illuminance Analysis* and *Perspective Illuminance Renderings* allow you to specify **Sky Models** and irradiance data.
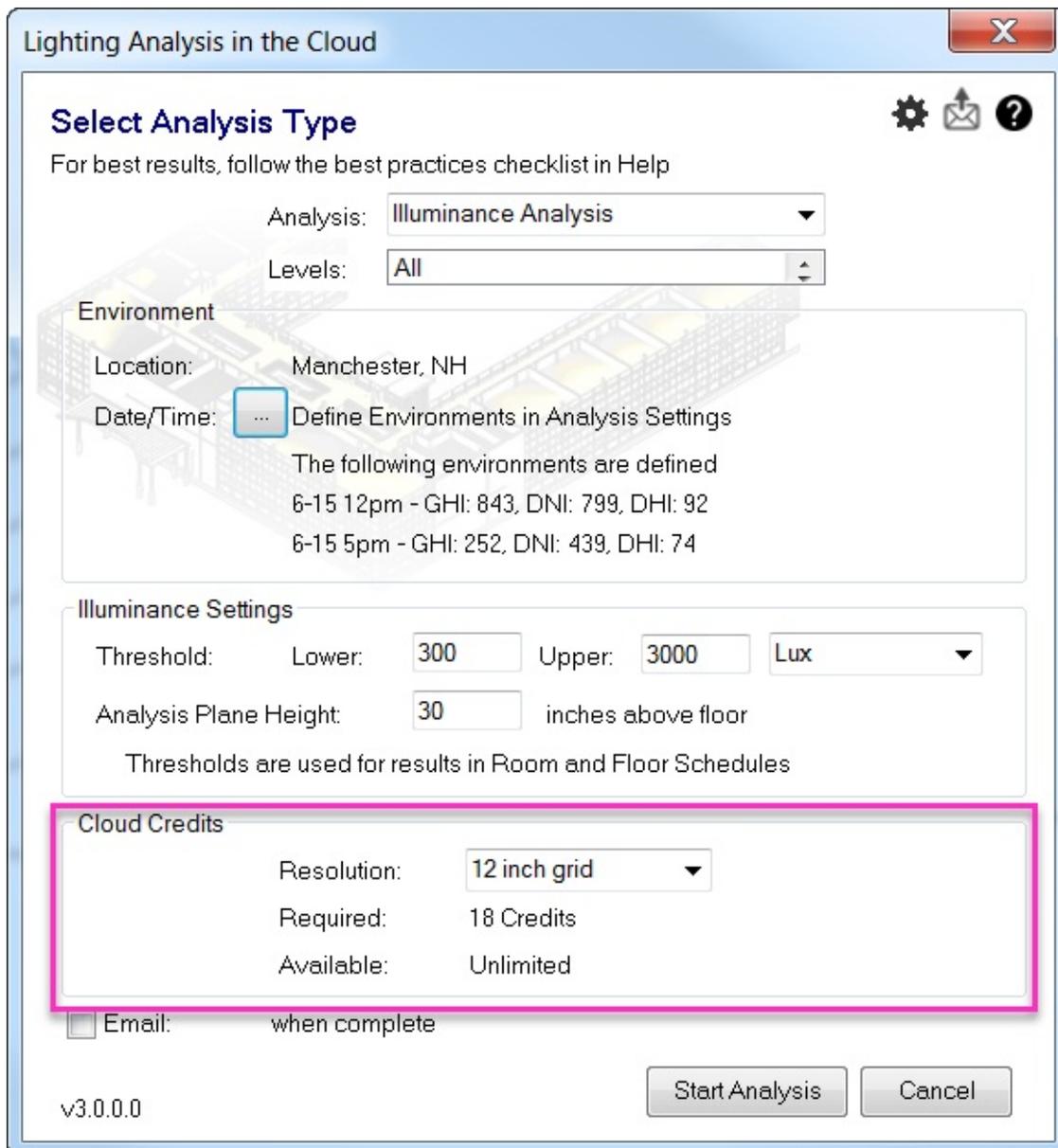
| | |
|---|---|
| **Perez All-Weather Sky** | *The most commonly used model in daylighting simulation applications and the model most analysts use in Radiance. The Perez model yields accurate results for all sky types from clear to fully overcast. It is also the model LEED requires be used for daylighting predictions.* |
| **CIE: Overcast Sky, Intermediate Sky, Clear Sky, Uniform Sky** | *Simplified and standardized instances of the Perez model. They provide standard conditions for daylighting applications. If you know what kind of sky you will have, or you're trying to get values for a particular situation (clear or overcast) then it is a good idea to use a CIE model.* |
| **Daylight Factor Sky** | *Percentage of natural light falling on surfaces compared to that which would have fallen on a completely unobstructed horizontal surface under same sky conditions. The location or time of day does not matter if you are using a Daylight Factor Sky. Results will be expressed as a percentage.* |

If you are unsure of which sky model to use, a good place to start is with the *CIE Overcast Sky* model. This model will not have the unique characteristics of direct sun, and represents an overcast condition that could happen at any time of day and is a good way to put your design to the test. It is often standard practice to also render using the Perez model at an equinox and the solstices to visualize a range of standard conditions.

# Analysis Costs

Insight Lighting Analysis with Revit analysis uses Cloud Credits associated with your A360 account. Learn more about Cloud Credits.

You will be notified how many Cloud Credits are required and how many you have available with each analysis. When changing study type, levels included in the analysis, or resolution settings, selecting **Check Price** will recalculate your Cloud Credit costs. You will not be charged any Cloud Credits until the analysis successfully completes and you generate analysis results in your model. You will have the option to accept or decline the transaction at this point.

# Cloud Credit Pricing

| | | |
|---|---|---|
| **Illuminance Analysis**<br>*LEED 2009 IEQc8 opt1*<br>**LEED v4 EQc7 opt2** | *72 inch grid* | • Free for up to 25,000 sf (2,300 sqm)<br>• ~1 Cloud Credit per 12,500 sf (1,100 sqm) after |
| | *12 inch grid* | • Free for up to 6,000 sf (550 sqm)<br>• ~1 Cloud Credit per 3,000 sf (270 sqm) after |
| **LEED v4 EQc7 opt1** | *24 inch grid* | • Free for up to 1,300 sf (120 sqm)<br>• ~1 Cloud Credit per 1,200 sf (110 sqm) after |
| **Daylight Autonomy<br>(sDA preview)** | *24 inch grid* | • Free for up to 6,000 sf (550 sqm)<br>• ~1 Cloud Credit per 2,500 sf (230 sqm) after |
| **Solar Access** | *12 inch grid* | • Free for up to 6,000 sf (550 sqm)<br>• ~1 Cloud Credit per 2,500 sf (230 sqm) after |

# Manage Cloud Credit Costs

The area of floor objects included in the analysis determines Cloud Credit costs. Keep Cloud Credit costs down by considering the following:

- ***Choose only the floors you are interested in.***

Sometimes floor objects can be used to build exterior surfaces, shading devices, etc. Analyze only specific levels or remove unwanted floor area from the 3D "*_Lighting Analysis Model View*." Also, make sure there are not duplicate floors overlapping on the same level.

- ***Choose one level at a time to confirm model settings before running a full analysis.***

If your level's floor area is within the free pricing threshold, you can often run these setup analyses for free. Use these free analyses to get familiar with how the tool works and test different setting before running an analysis for the full model.

- ***Choose low resolution (72 inch) to confirm model settings before running a high resolution (12 inch) analysis.***

Use a low resolution analysis to check your settings and materials and get familiar with the tool. Low resolution analyses are available for some study types, and require less Cloud Credits. When ready for final analysis, you can use a high resolution.

- ***Only run a new analysis when you make an invalidating change.***

Once you populate analysis results in your model, you can do a lot without having to run a new analysis. If you modify Rooms, Room Parameter settings, analysis display styles, schedule layout and column contents, or modify or create new 3D views, just select the run to repopulate and update results. When you change the model geometry, materials, or light fixtures, then you should run a new analysis, as the lighting conditions are changed.

- ***Join finish floors to underlying floor layers on the same level so only one layer is analyzed.***

Many Revit models include layers of floors to indicate different finish surfaces in different areas of the building. This results in increased floor area, and increased Cloud Credit costs. Best practice is to use *Modify > Geometry > Join* to join the layers. You will still be able to show or hide finish floors in different views, but if floors are joined, only the top level will be used for the analysis.

# Validation

Insight Lighting Analysis with Revit leverages the A360 Rendering service.

A360 Rendering uses bidirectional ray tracing but with an additional intelligent algorithm to determine the ray order such that the most important rays are generated first. The result is a much faster convergence to final results. The engine calculates all the bounces that are important for making conclusions. The algorithm is called Multidimensional Lightcuts (Siggraph 2006), with trade secret/patented extensions. This approach differs from other tools that follow the bounces of a photon even past the point where it practically affects the rendering.

The engine has been validated with the help of one of the top daylighting firms in the country. They used a consistent model to compare A360 Rendering illuminance outputs to both Radiance and to actual light level measurements of the space.

# Support & FAQ

Get support for Insight Lighting Analysis with Revit on the Insight Lighting & Solar Analysis Forums.

Be sure to visit the A360 Rendering Forum if you have specific questions about A360 Rendering.

# Troubleshooting

**All my results are zero (red)—this can't be right.**

This is often the case when transparent assets aren't actually assigned to glazing materials. The glass in your model may look transparent, but you need to make sure the material asset assigned to it is transparent as well. Follow the steps for defining Transparent Materials, and pay special attention to assigning a transparent Asset. Using clear glazing is a good option.

If you're confident that materials are properly set up, make sure there are no opaque elements blocking your windows. For example, sometimes when using layered wall constructions, a window element won't create a void for all wall layers. If there is a wall layer, or any other element, blocking the windows, make sure to hide it in the "_Lighting Analysis Model View._"

Check the _Rendering Settings_ for your view and make sure they are including the daylight or electric light inputs. Also check your _Light Analysis Settings_ to make sure they support your input conditions.

Finally, check to make sure that your simulation date and time is occurring at an appropriate time. If you are analyzing daylight values at 12AM (midnight), there won't be any daylight to simulate (unless of course you are in an extreme northern or southern latitude!).

**I don't think my results make sense.**

If your results don't seem right, be sure to check the suggestions listed above for material settings, glazing obstructions, settings, and simulation time. Additionally, you might want to check the following.

Opaque materials (walls, floors, ceilings, etc) may have a "self-illuminance" modifier defined in the **Appearance** tab of the _Material Browser_. This can happen artificial characteristics are used to enhance visual renderings.

In the "_Lighting Analysis Model View,_" make sure there is not Section Box cutting a wall open, or any other part of your model. The Section Box is usually automatically ignored for analysis, but the _Light Analysis Settings_ option may have been changed.

**I'm seeing conflicting results planes between my 2D and 3D views.**

It might be possible that there are two different Floor elements sandwiched together in your model. Since the lighting analysis planes are created from Floor elements if there are multiple Floor elements on top of each other or assigned to the same Level, there will likely

be multiple analysis planes on top of each other, creating conflicting views or double markers. Try removing or hiding the unnecessary floors in the "_Lighting Analysis Model View." Bonus, doing so will probably lower your Cloud Credit costs as well.

### Can I exclude Rooms from the calculation before I submit the analysis?

Rooms that are checked in checked or unchecked in the "_Lighting Analysis Room Schedule" will only impact results visualizations and threshold calculations. It will not impact futures analyses.

To exclude areas or elements from future lighting analyses, you will want to control the "_Lighting Analysis Model View."

### How do I include the impacts of Sola-tubes in my analysis results?

Tubular skylights (SolaTube, Velux Sun Tunnel, ODL, etc) can be modeled as Light Fixtures associated with an IES lighting distribution profile. The IES files should be specific to location and time of your analysis and are available from most skylight manufacturers. Most manufacturers also have Revit families that can be used to host the IES file, or you can use any generic fixture to create a tubular skylight fixture.

After creating the fixture, follow the workflow to include electric lights, where the skylight fixtures are acting as electric lights.

### Why aren't Automated Shades available for sDA/ASE study types?

One of the differences between LEED v4 EQc7 opt1 (sDA/ASE) calculations and LEED v4 EQc7 opt2 (single point in time) calculations, is that for sDA/ASE analysis types, shades need to physically modeled, versus just expanding the threshold limits. Currently, Revit doesn't include shades for sDA/ASE analysis types. However, it's worth noting that including shades should change the results by a great amount. In fact, including automated shades won't reduce the direct sun (ASE) liability, as ASE has to be calculated with shades open.

### My available Cloud Credits aren't right.

If your available Cloud Credits don't match up with what is listed as available in manage.autodesk.com, you may need to contact your Autodesk reseller or submit a support request.

### What information gets sent to the A360 Rendering engine from my Revit model?

Revit creates an SPD file that gets sent to the A360 Rendering engine. The SPD contains:

- Model geometry (as triangle meshes)
- Project location (represented by the associated weather file)
- Material definitions and texture images (if included)

- Light fixture definitions and associated IES files
- Date and time set for the analysis
- Names and positions of selected 3D view cameras

Data is transmitted, stored, and encrypted.