



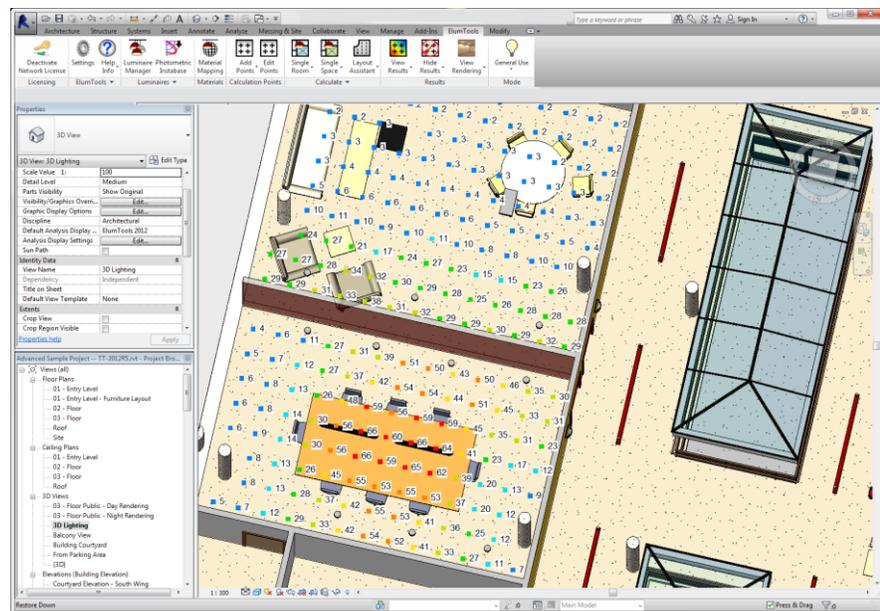
***A fully-integrated lighting calculation tool for Autodesk® Revit®***

## Introduction

The growth of BIM (Building Information Modeling) software is exploding and in many architectural design and engineering firms, it is almost completely replacing CAD software for the purposes of architectural and building system design. To date, the industry standard illumination design software programs lack the ability to easily exchange information with models in the BIM environment. The reason for this is two-fold; current illumination software utilizes a complete environment approach to the calculation of illuminance which is burdened by the large size of the BIM model, and the complexity of exported geometry from BIM is beyond the needs of practical calculation of workplane or surface illuminance. With today's illumination design software not getting the job done, there remains a need to quickly compute basic illuminance (fc or lux) from electric and daylight sources within individual environments in a BIM model, and tabulate the results in a way consistent with the behavior of the BIM software.

## Introduce ElumTools

ElumTools is a calculation Add-in used to predict the performance of electric lighting systems and daylight within the Autodesk® Revit® software. With ElumTools the need to utilize external software to compute illuminance from light sources placed in Revit is no longer necessary.



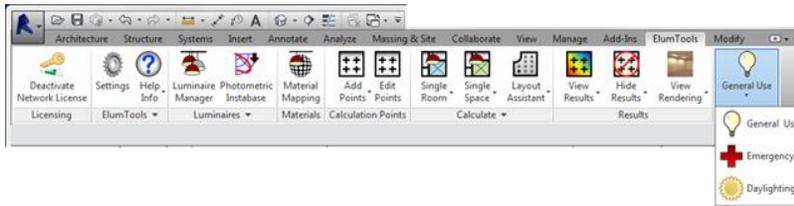
When ElumTools is installed in Revit, it appears with its own tab on the top menu bar. Selecting the ElumTools tab reveals the icons for the various ElumTools commands.

ElumTools™ Add-in lighting software for Autodesk® Revit®

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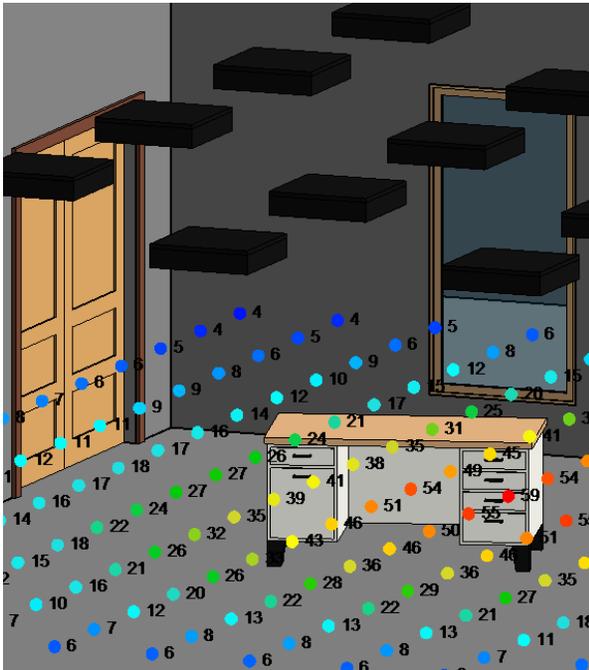


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## How does ElumTools work?

The entire concept of ElumTools as a Revit Add-in is based around the ability to leverage content that is already present in the Revit model. Utilizing existing content from Revit allows the lighting software functionality to be simplified to only those tasks necessary for the accurate modeling of light.



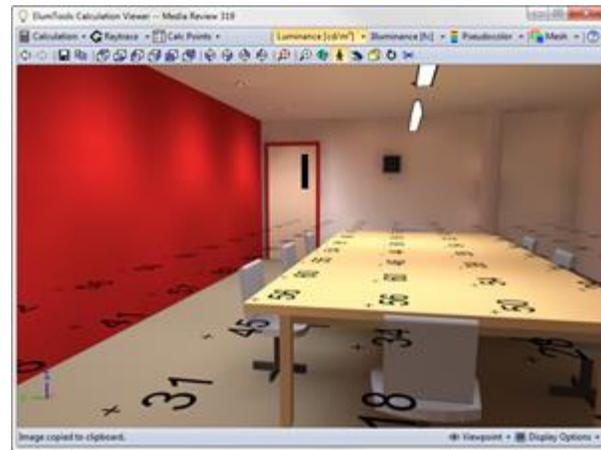
The accurate calculation of illuminance on a workplane or surface requires the following components: surface geometry, surface reflectance/color, luminaire locations and luminaire photometry. ElumTools is able to extract surface geometry in the form of “Rooms” or “Spaces” as defined in Revit, or if necessary, the user can simply select the surfaces to be included in the calculation using Revit commands. Surface reflectance and color can be interpreted from the Revit “Graphics Shading” property of the surface and “mapped” to a more suitable reflectance and/or color as necessary. Luminaire locations already present in Revit can be consumed by ElumTools and photometric file associations created if not already present.

With these elements known, ElumTools has the information required to utilize a radiosity process to compute the selected geometry and present an interactive visualization depicting the luminous exitance of all surfaces. However, there is an additional fundamental need to allow the user to assign calculation points to any surface or workplane to verify illuminance present from the Revit layout of luminaires. This is easily accomplished using ElumTools Calculation Points command.

With materials mapped, luminaires defined and calculation points placed, ElumTools calculation commands enable the computation of the selected geometry.



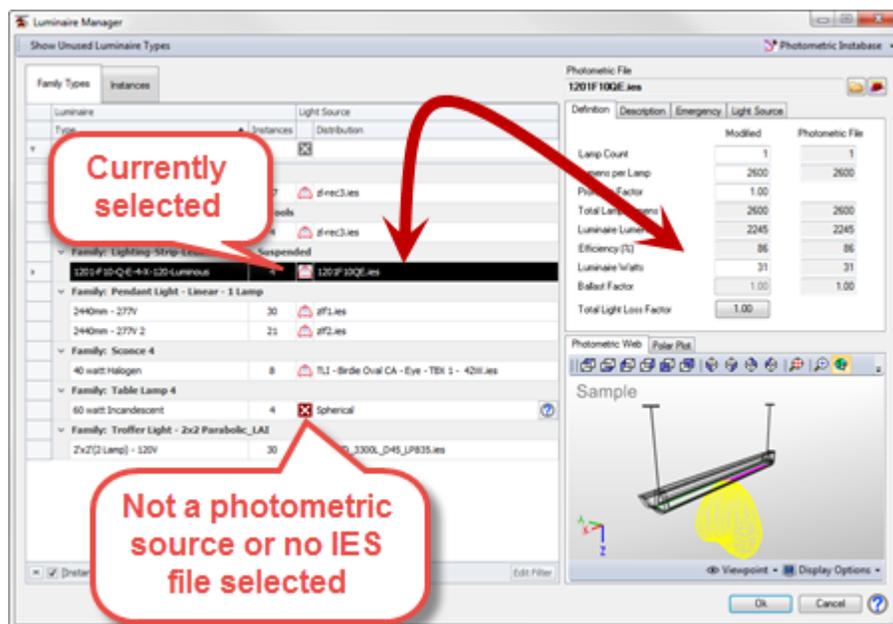
Revit defined Rooms or Spaces can be computed alone or as a group if they contribute light to one another. The computed results can then be examined in an interactive visualization window (a separate window for each Room or Space). The point-by-point illuminance results can be seen in the visualization, as well as directly in the Revit model views of your choice. Finally, all statistics are available to Revit's scheduling tools for summary and inclusion in the BIM model.



## Anatomy of a typical workflow

**Manage luminaires** – This is the process of assigning all of the necessary elements to each luminaire family within the Revit model that will be used for lighting calculations. Required inputs include: a photometric web source type, assignment of a valid photometric file in IES format (IES document LM-63), entry of a light loss factor if other than 1 (initial conditions), and a validity check on lumens, watts and photometric source positioning.

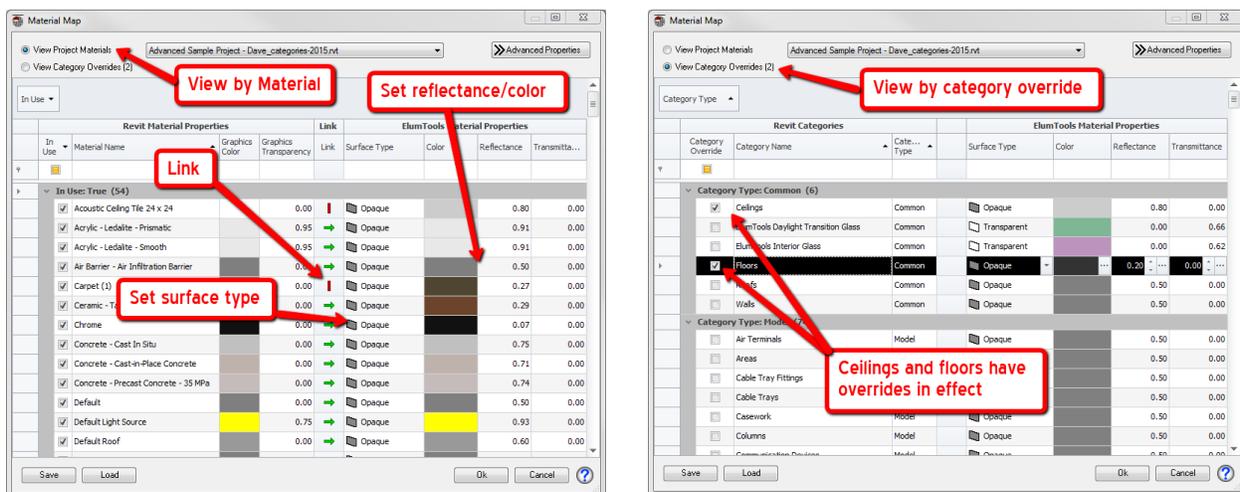
The ElumTools Luminaire Manager provides simple access to most necessary inputs for your luminaire families. The luminaire list can be shortened to show only luminaire families currently in use in the Revit model if desired, and all Instances can be seen from the Instances tab.



**Map materials** – In order to perform accurate calculations for the propagation of light within an interior environment it is extremely important to correctly consider the reflectance of the primary surfaces such as ceiling, walls and floors. Transparency is also required to correctly consider light passing through exterior glass for daylight calculations, or electric light for interiors. ElumTools provides the Material Mapping command to cross reference Revit material properties with ElumTools material properties to ensure surface reflectances and transparencies are set correctly.

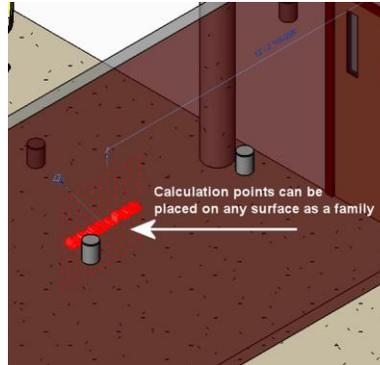
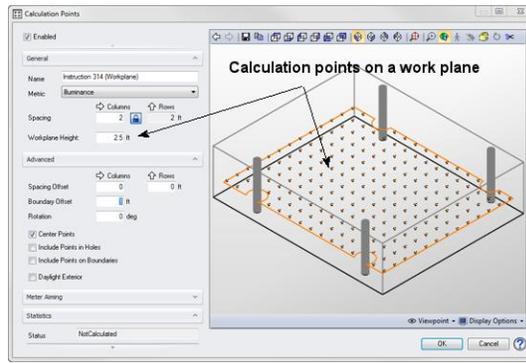
The fundamental approach is to map all surface properties by material. This is done by setting the dialog in the “View Project Materials” mode. ElumTools has access to the “Graphics Shading” color in Revit for all materials in the model. This provides a starting point for the calculation of surface reflectance from the RGB color.\* If the Revit graphics color is not an accurate color from which to calculate reflectance, it is necessary to map that surface to a different and more appropriate color, and hence, a more suitable reflectance. Glass and other translucent or transparent materials must also be mapped to the appropriate surface type in ElumTools for accurate daylighting calculations.

ElumTools also provides the ability to override the materials mapping process and assign reflectances to Revit Categories. This can collectively assign a reflectance to all materials within a category such as “Walls”. Using Category overrides you can easily simplify the task of verifying your surface reflectances.



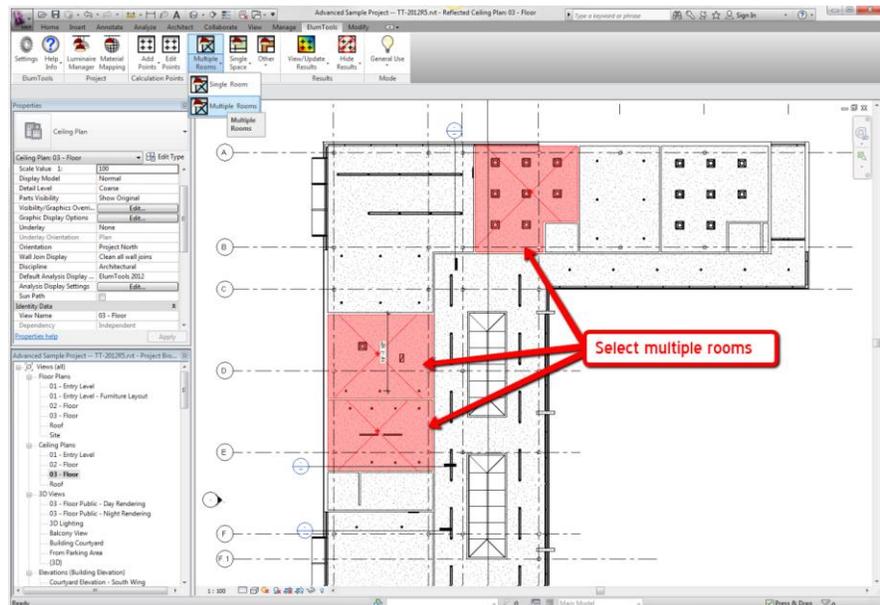
*\*As of the release of Revit 2015, the Revit Application Programmers Interface (API) provided by Autodesk does not provide access to the materials “Render Appearance” information. This may change in a future release providing more accurate material color and reducing the need to map some materials.*

**Assign calculation areas –** ElumTools makes it easy to assign a grid of calculation points to your choice of surfaces and/or work planes in the Revit environment. Simply select the Calculation Points command followed by the Room or Space of interest to place points on a work plane or floor. Or, drop an instance of the points family on selected surfaces as required. The points will automatically attach only to the Revit surface. Openings such as windows or doors would not be included and could be covered with another instance of the point family if necessary.



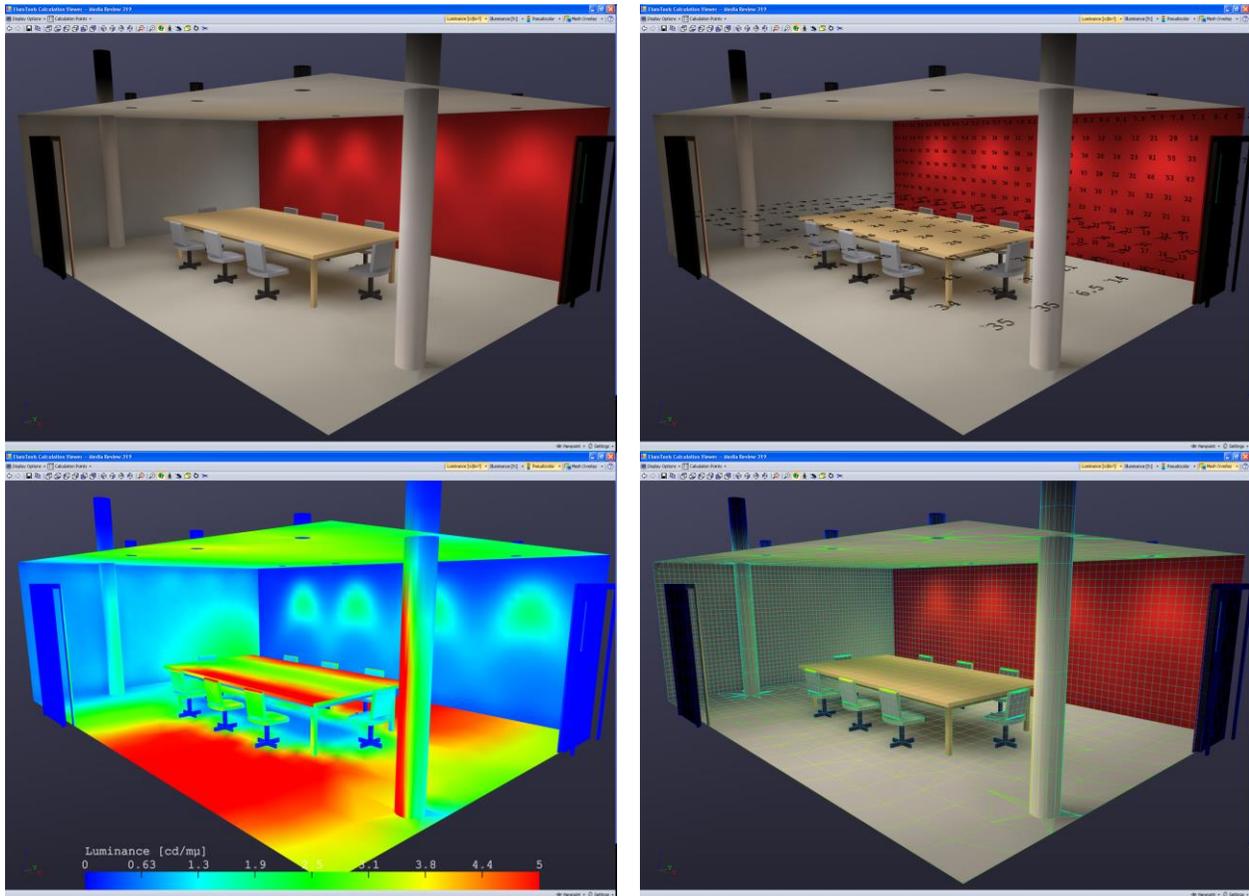
**Calculate Room or Space –** Rooms and Spaces are spatial placeholders created by Revit. If the Revit model does not have Room or Space designations, it is only a matter of a few clicks to add them.

ElumTools allows the calculation of either Rooms or Spaces using a single or multiple selection technique. When selecting multiple Rooms or Spaces, ElumTools allows multiple calculations to be performed simultaneously. If separate environments may exchange light with one another, they can be computed in a single execution.

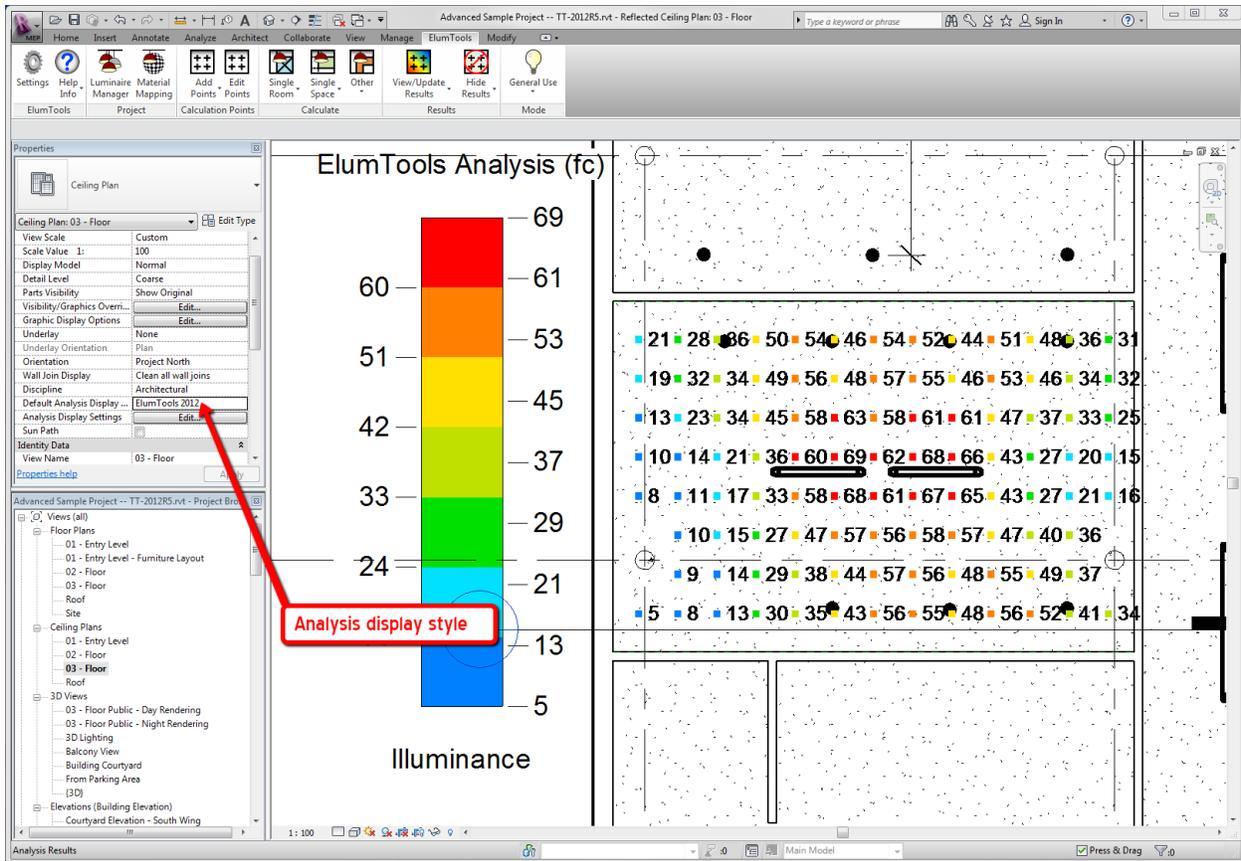


**Calculate Other Geometry** – Occasionally it is necessary to select all the elements to be included in a calculation independently of Revit Rooms or Spaces. ElumTools provides the capability to select all elements to be considered manually using Revit commands and compute the propagation of light within this subset.

**Interactive visualization** – ElumTools provides a fully interactive visualization in a pop-up window as a by-product of every calculation. This rendering is designed to allow validation of lighting results (are all my luminaires included?) and a verification of the behavior of light and surface (scalloping from downlights on an adjacent wall). The visualizations are fully navigable and can be recalled when necessary using the Rendering Manager. Additional evaluation tools are available such as scaled pseudo color analysis, radiosity mesh and visibility of calculation points.



**View point-by-point results in Revit** – The illuminance values at all calculation points placed in the Revit model can be seen directly in Revit. The appearance of the value color can be changed using Revit's Analysis Visualization Framework (AVF) to scale the gradient of illuminance values for improved readability.



**Schedule** – All illuminance statistics computed by ElumTools are properties of the Room or Space and available to be summarized with Revit’s schedule feature.

Luminaire Schedule								
Count	Family and Type	Total Light Loss Factor	Wattage	Lamp Count	Lamp Lumens	Luminaire Lumens	Efficiency	Efficacy Rating (LER)
24	Downlight - Recessed Can_LAI: 6" Incandescent - 120V	1.00	60 W	1	5600 lm	2656 lm	0.48	28
28	Troffer Light - 2x2 Parabolic_LAI: 2x2(2 Lamp) - 120V	0.88	40 W	1	3150 lm	2321 lm	0.74	44

Sampling Points Schedule						
Name	Metric	Avg	Min	Max	Avg / Min	Max / Min
Room 7 Workplane	Illuminance	48.0	8.4	119.0	5.7	14.3
Room 8 Workplane	Illuminance	22.8	2.7	40.7	8.4	15.1
Room 12 Workplane	Illuminance	25.3	10.2	39.1	2.5	3.8
Room 19 Wall	Illuminance	29.4	1.3	56.4	22.6	43.4
Room 19 Workplane	Illuminance	53.9	16.7	83.4	3.2	5.0
Room 35 Workplane	Illuminance	28.4	10.7	43.4	2.6	4.0



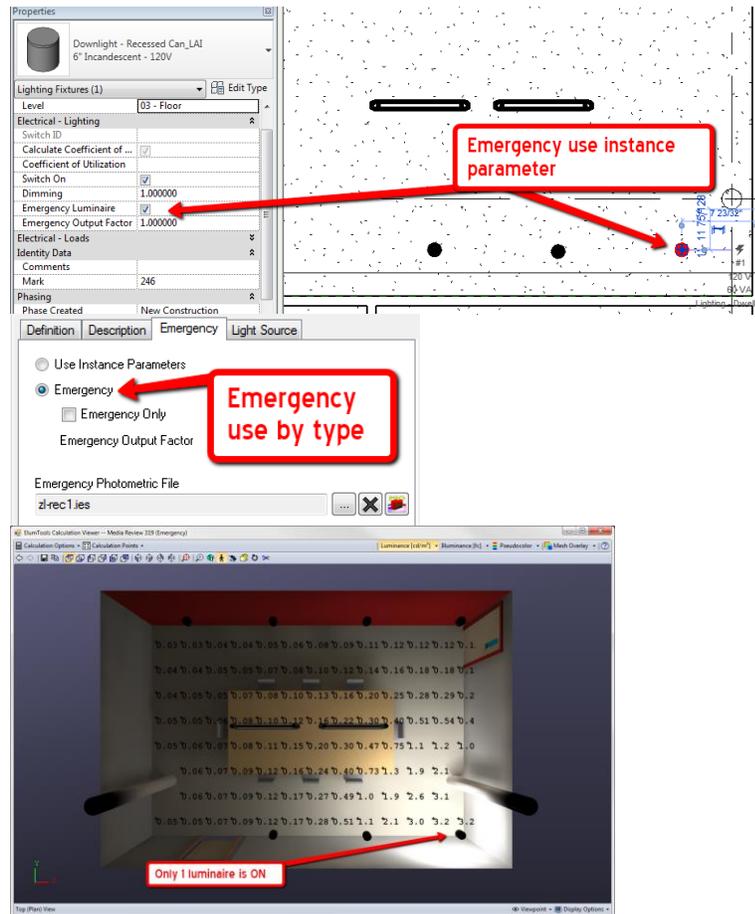
## Emergency lighting calculations

ElumTools supports separate emergency lighting calculations by simply switching the program into “Emergency Mode”. All Rooms and Spaces can be recalculated for only the emergency lighting component. Luminaires can be designated for emergency use by instance parameter with output dimmed if necessary, or the luminaire family type can be assigned emergency parameters in Luminaire Manager.



This provides two different workflows for handling the task of emergency calculations. Some will prefer using instance parameters; other will find using designated emergency types to be more efficient. Regardless, it is easy to switch back and forth between Emergency and General Use with a click on the button on the ribbon.

The ElumTools calculation viewer shows an emergency mode calculation in the capture. Switching back to General Use will enable all luminaires and statistics are tracked separately.

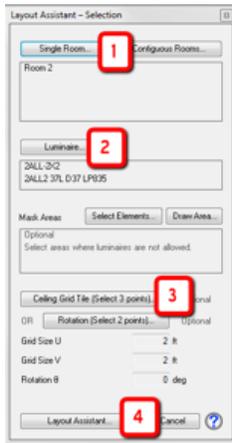


## Layout Assistant

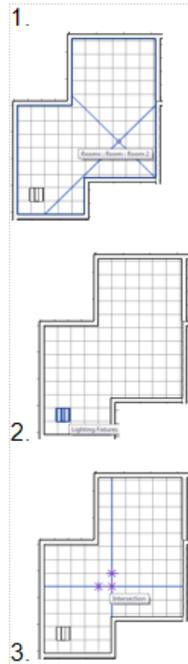
ElumTools can compute luminaire quantity to meet a specific light level (on the floor or workplane) for any Revit Room or Space using the Layout Assistant. This very handy command in ElumTools will provide a series of estimates and possible luminaire layouts for you to examine and manipulate. Select the layout of choice, compute the actual point-by-point results, AND export the luminaire positions back into Revit. It is a tremendous time saver.



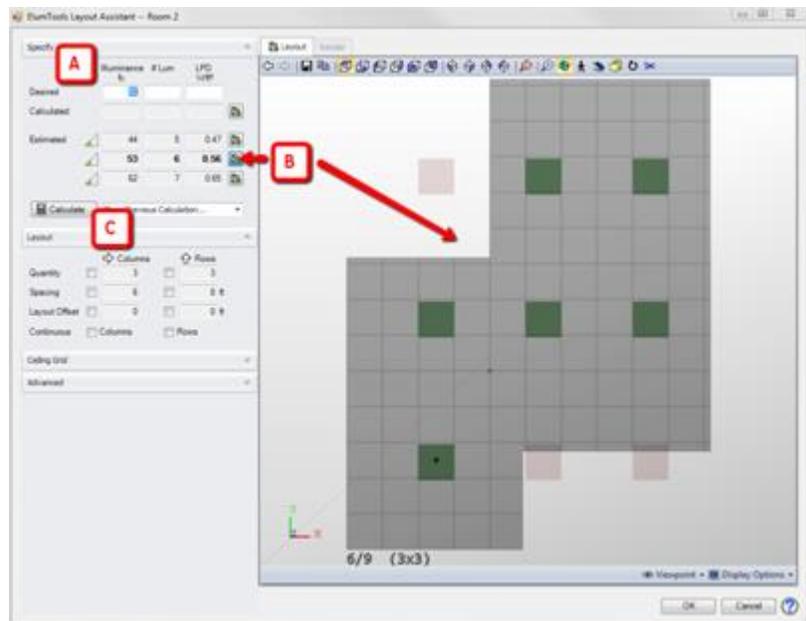
The following steps show the basic Layout Assistant workflow.



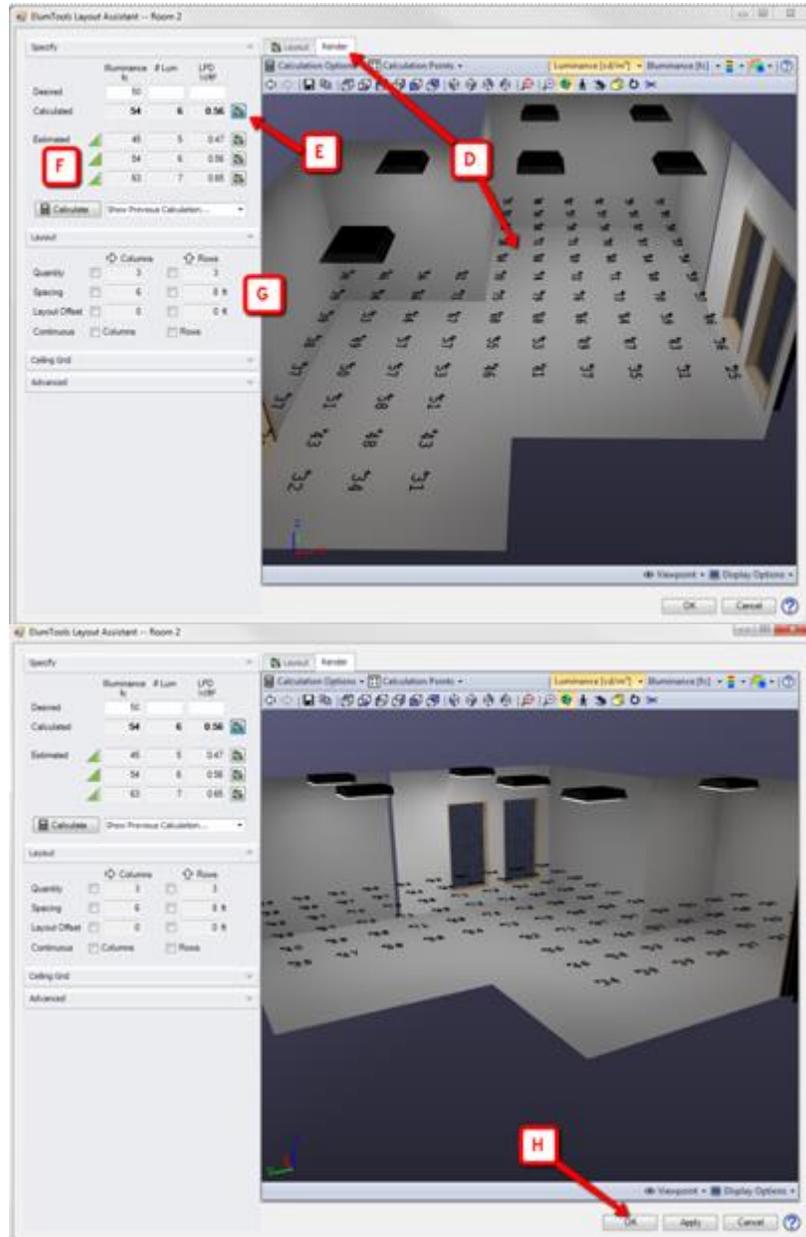
1. Select the Room or Space.
2. Select a luminaire instance to be used for the layout, preferably already hosted in the Room/Space.
3. Click three corners of a ceiling tile, if present.
4. Click the Layout Assistant button.



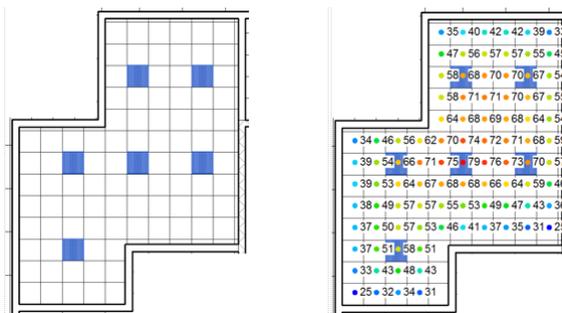
- A. Enter the desired illuminance on the floor or workplane (if calculation points are not already placed in the room, that dialog will appear first to enable points on floor or workplane).
- B. Layout Assistant generates three estimates, with the current selection highlighted and shown.
- C. If satisfied, run the complete radiosity calculations.



- D. When calculations are complete, the Render tab is enabled with full interactive viewing.
- E. The calculated layout is now the current selection.
- F. New estimates are prepared with more knowledge on how the light and geometry behave. The confidence level is higher.
- G. Adjust the spacing and rows, columns if desired.
- H. Click the OK button to export the luminaire locations and calculations back to the current Revit view.

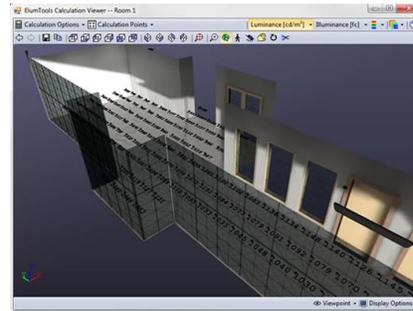


- I. Here we have new luminaire positions and calculations, all done from the Layout Assistant.

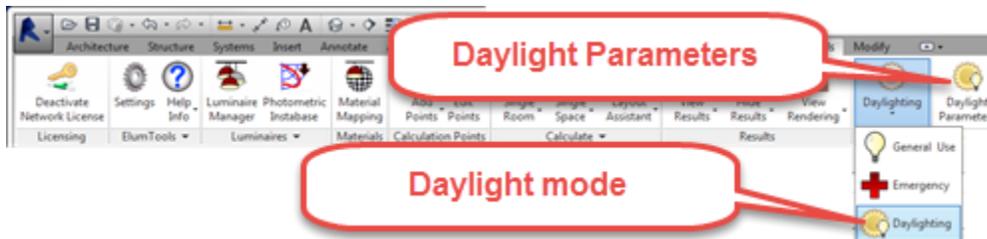


## Daylighting

ElumTools is capable of calculating daylight illuminance using the Perez All-Weather Sky model with a global weather conditions database from US-DOE. Daylight can also be combined with electric light to calculate illuminance results due to both sources.

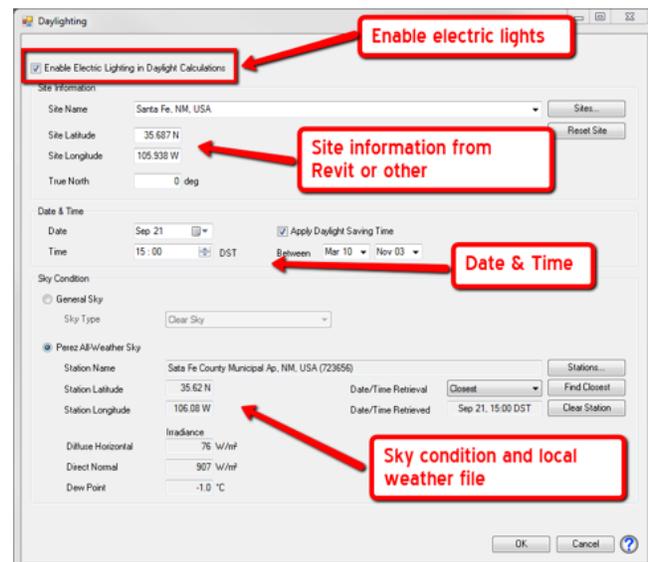


Daylighting is available as a separate mode on the ElumTools ribbon similar to the Emergency setting. When Daylight mode is selected the Daylight Parameters button becomes visible.



The Daylight Parameters dialog contains all the settings relative to the site location, orientation, date, time and sky conditions. The optional switch to consider electric lighting is also available here.

Current daylight capabilities compute a single date and time when executing the calculate Room or Space commands.



## Additional capabilities

ElumTools can also render the correlated color temperature (CCT) of light sources, accurately simulate colored sources due to filters or otherwise, and ray trace your favorite viewpoints for higher quality visualizations.





## ElumTools is exceedingly simple & efficient

The concept of computing the lighting results directly within the Revit environment using a Space by Space (or Room by Room) methodology fosters a fast and efficient workflow removing the long calculation times associated with the whole environment approach of external software. Designers can utilize the software as a design tool on an iterative basis as needed. Point-by-point results provide validation of required lighting criteria and interactive draft visualizations yield an understanding of the lighting system only possible with radiosity rendering.

Unlike many of today's all-encompassing lighting simulation programs, The *ElumTools* software is exceptionally intuitive, streamlined and approachable. By design, the software can be productive for any Revit user with basic lighting knowledge and very little if any training is required.

ElumTools can be licensed on a single user or network basis. An annual subscription plan is available to ensure you receive the next upgrade to the corresponding version of Revit. Licensed users have access to backward releases of ElumTools to use with older Revit versions.

Download a Trial version and take advantage of our learning videos at [www.elumtools.com](http://www.elumtools.com).

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