

AS319998

Illuminate Your Best Design with Revit Daylighting Analysis

Maria Fox Montgomery
Perkins&Will

Tyrone Marshall
Perkins&Will

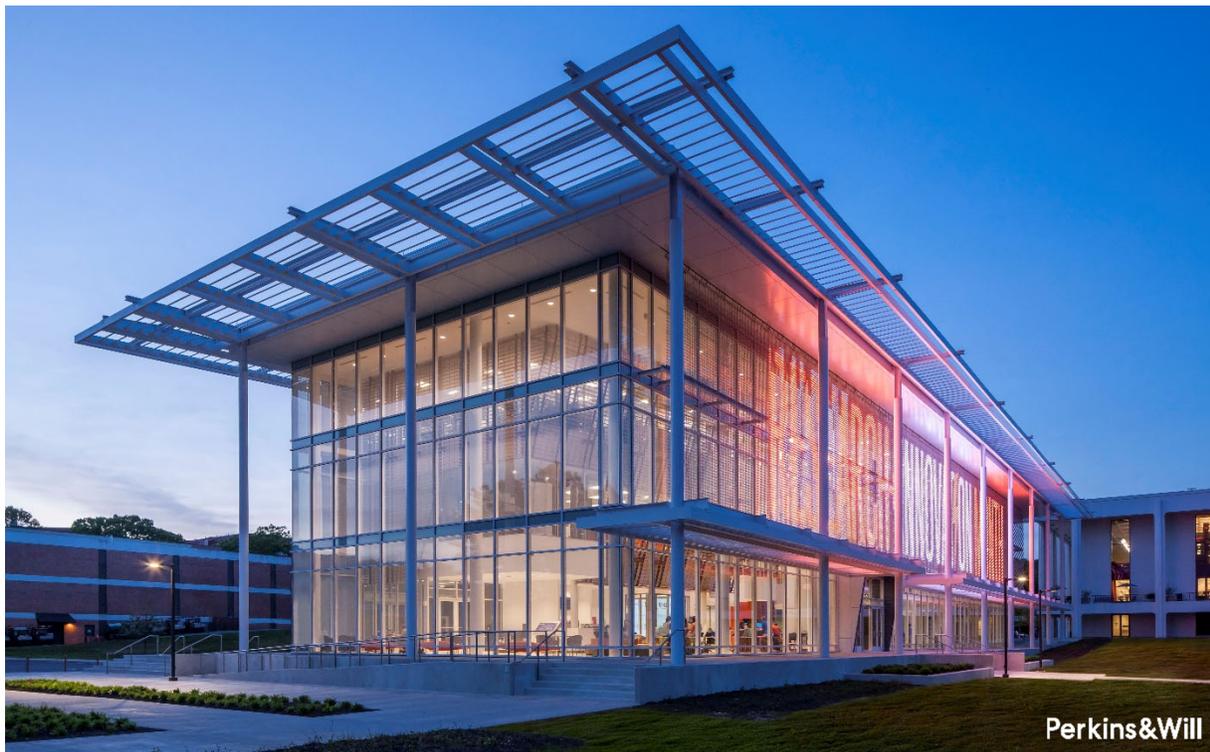


FIGURE 1: CLEMSON UNIVERSITY, WATT FAMILY INNOVATION CENTER, PERKINS AND WILL

Learning Objectives

- Learn the importance of incorporating daylighting strategies early in your design
- Learn how to effectively set up daylighting analysis in Revit
- Learn how to translate Revit data into documents and calculations for a LEED V4.1 quality submission
- Gain learning aids to successfully run daylighting analysis studies back at your office

Description

Take a deeper dive into Revit software's daylight analysis tool. This class will provide you with a workflow, helpful hints, and best practices used by one of the largest architectural firms in the world. If you are questioning why, when, and how to use these daylight analysis tools, this is the class for you. Architectural spaces should connect building occupants with the outdoors and reinforce circadian rhythms through design features that reduce electric lighting and introduce more natural daylight. Learn how to develop detailed daylighting analysis models concerning factors such as geometry and material definitions. This class will also show you how to use Revit software to provide accurate performance feedback and visual information for an indication of your design relative to sustainability goals for LEED reporting. Please join us for this class as we light your way to a better Revit daylighting analysis process.

Speakers

Maria Fox Montgomery

After receiving her undergraduate architecture degree from Clemson University and masters in architecture from the University of Tennessee, Maria Montgomery joined the Atlanta office of Perkins and Will in 2014 as an integral part of the architectural team. While specializing in higher education and laboratory design, she has contributed to a wide range of project types. In addition to an architectural designer, she also serves as a BIM Manager and Sustainability Manager on many of her projects. She held a major role in the success of a 150,000 sf university science building awarded LEED Platinum. Along with being a USGBC LEED Accredited Professional in Building Design+Construction, she is a Design Technology Leader and the only WELL Accredited Professional in the Atlanta Perkins and Will office. With Maria's attention to detail, constantly strive to learn, and outgoing personality, she brings memorable energy to all projects she works on and presentations she gives.

Maria.Montgomery@perkinswill.com

Tyrone Marshall

Tyrone Marshall is a Perkins and Will licensed architect and researcher. He works as a Senior Researcher & Computational Designer with project teams for their strategies to address architectural performance design, including the planning, development, implementation of new processes from our research program. He has a Master of Science with a major in Architecture and concentration High-Performance buildings from the Georgia Institute of Technology in Atlanta, Georgia, and a Bachelor of Architecture from the College of Arts in San Francisco, California. He has expertise in architectural design, computational design, and biologically inspired design, building technology and science with knowledge in energy performance and environmental impact of buildings, hygrothermal transient heat and moisture transport, daylight analysis, envelope design, life cycle analysis, and critical ecological thinking.

Tyrone.Marshall@perkinswill.com

Learn the importance of incorporating daylighting strategies early in your design.

WHEN

When is it important to incorporate daylighting strategies and begin running analysis?

We recommend that daylighting analysis is used in the early charrette stages of design to understand the effect of several building variables. It is a good place to start to inform the design process with regards to building energy use during pre-design and schematic design phases.

In 2004, Patrick MacLeamy observed that the architectural project becomes more difficult to change, the more developed it becomes.

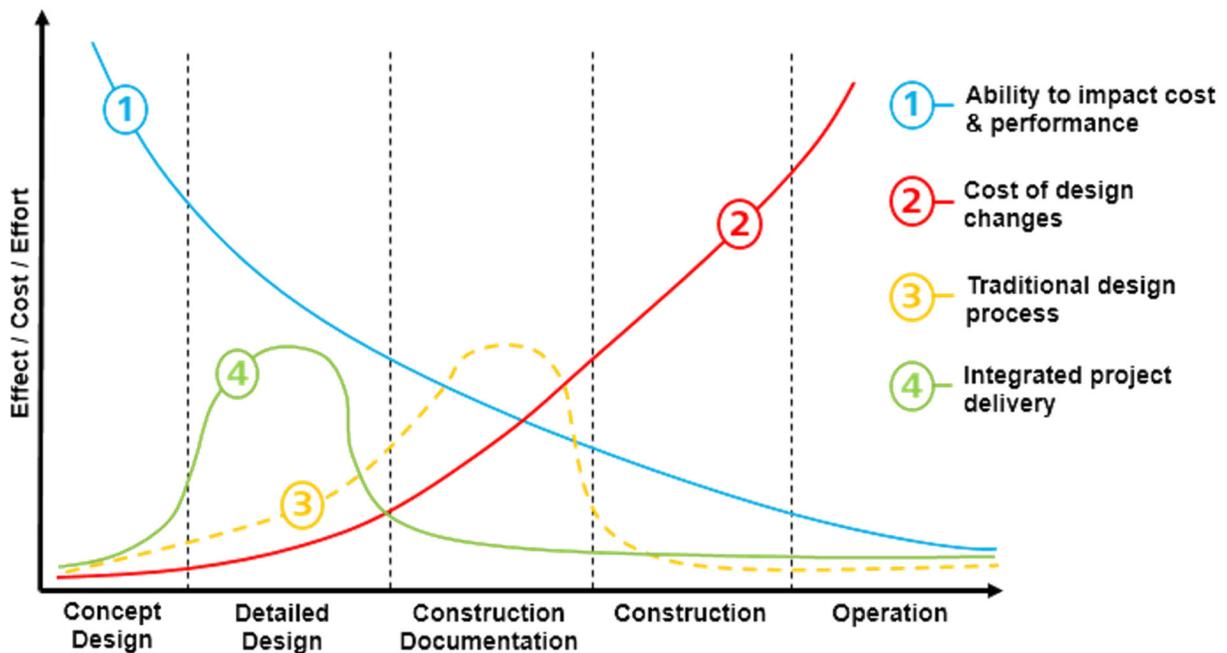


FIGURE 2: MACLEAMY CURVE BY PATRICK MACLEAMY

WHY

Building Design and Daylighting



FIGURE 3: CLEMSON UNIVERSITY, WATT FAMILY INNOVATION CENTER, PERKINS AND WILL

Architectural spaces should connect building occupants with the outdoors and reinforce circadian rhythms through design features that reduce electric lighting and introduce more natural daylight. This module uses Revit to provide accurate performance feedback and visual information for an indication of your design relative to sustainability goals for LEED reporting of Options for Illuminance or Spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure (ASE).

Daylighting is the controlled admission of natural light; direct sunlight and diffuse skylight—into a building to create a visually stimulating and productive environment for occupants and to reduce electric lighting and save energy.

Direct Light – Daylight received directly from the sun

Diffuse Light – All skylight and diffuse-reflected sunlight

Assemblies for Transparent and Opaque Constructions

The diagram below explains the transmission of solar radiation through the envelope glazing system. As shown, the actual amount of received visible light through transmission through the glazing system is a small amount of the total amount of solar radiation from the sun.

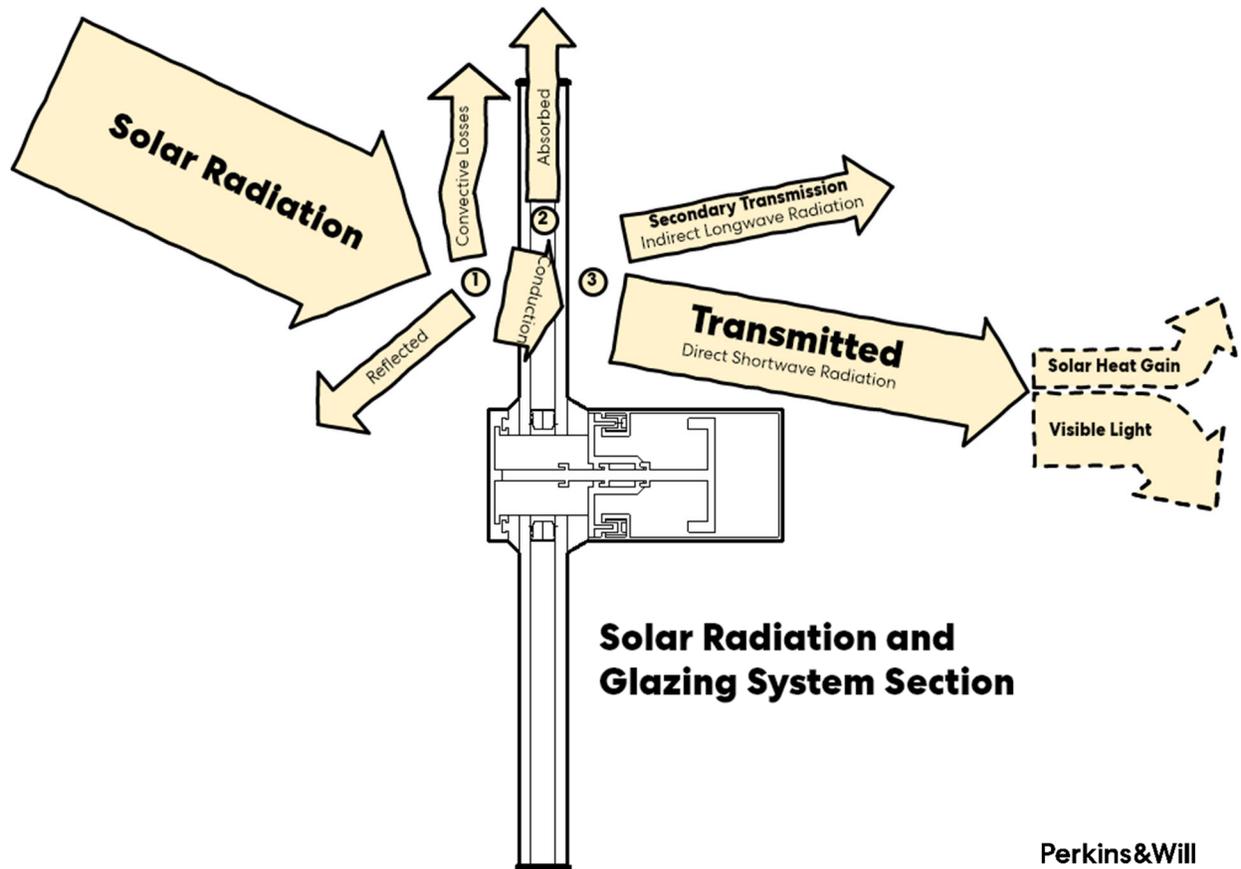


FIGURE 4: SOLAR RADIATION AND GLAZING IGU FROM PERKINS AND WILL

1. Exterior

- The diagram shows the transmission of solar gain through the typical glazing curtain wall system where some of the short wave solar radiation energy incident on the surface of the glass has losses from convection by laminar airflow along the surface, and then some of it reflects away from the glass.

2. Window

- The glazing assembly absorbs and conducts the remaining solar energy through the insulated glazing unit (IGU). The performance of the IGU system for solar heat gain and the visible light that passes through the window will be dependent on the low emissive coating and its location, as well as glass visible light transmittance properties.

3. Interior

- Much of the energy transmits into the interior space as shortwave energy as solar heat gain and visible light energy. A small amount from the earlier conduction and absorption radiates back into space as longwave secondary transmission while increasing the glass surface temperature.

Window to Wall Ratio

A Review on Window to Wall Ratio

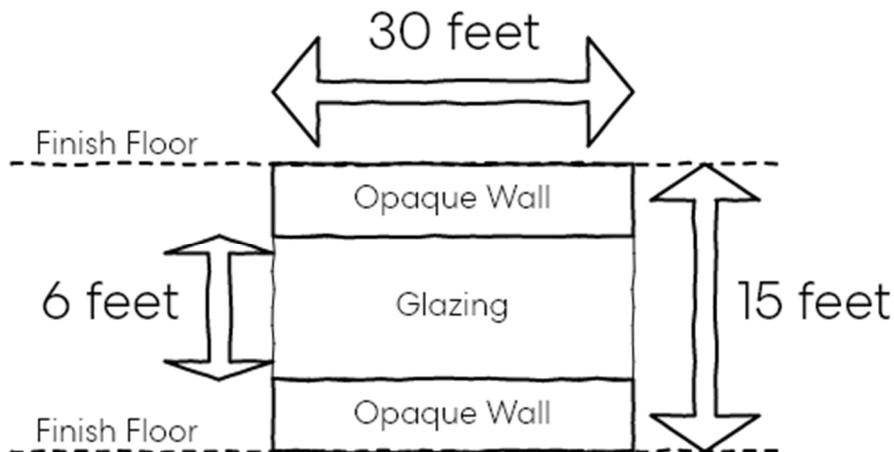


FIGURE 5: WINDOW TO WALL RATIO BY PERKINS AND WILL

Window to Wall Ratio typically assumes that the baseline percentage of glazing for a project will be equal to about 40% of the above-grade wall area or that in the proposed design. It is usually distributed uniformly in horizontal bands across the four orientations in the most uncomplicated cases.

Glazing

Typically, we are concerned in daylighting and tools, like Revit, of a glazing products' performance as it retains the visible light transmittance.

Saving Lighting Energy

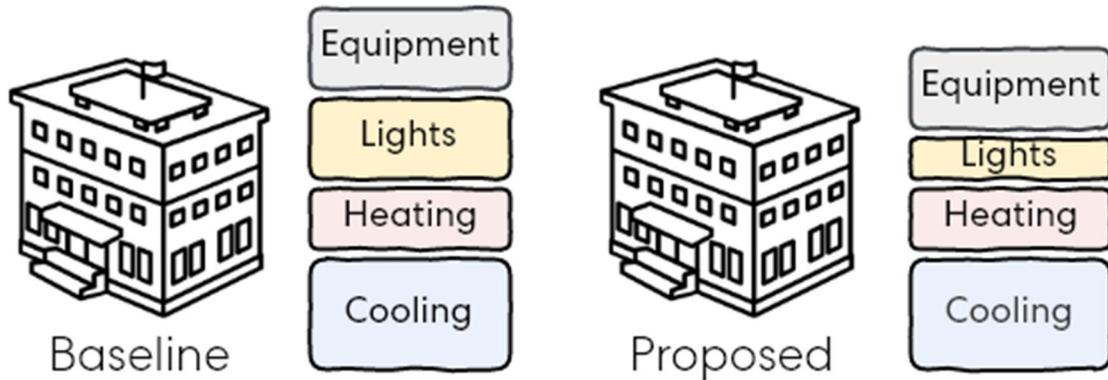
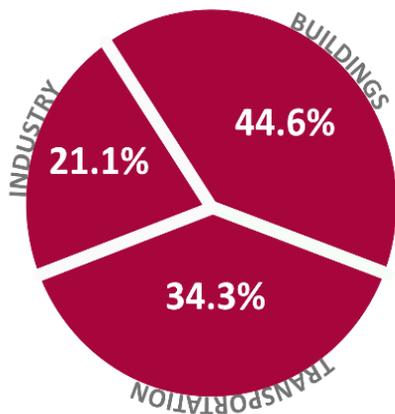


FIGURE 6: PERKINS AND WILL

If we can reduce the amount of energy required to light our interior spaces by providing good natural daylight, we can not only gain better-designed spaces for our occupants, but also reductions in energy use, higher energy savings, and lower annual energy cost savings from operating the building. All of these actions have secondary effects as well, such as providing potential life cycle cost savings and lowering the number of metric tons of greenhouse gases emitted into the atmosphere.

U.S. ENERGY CONSUMPTION BY SECTOR



U.S. ELECTRICITY CONSUMPTION BY SECTOR

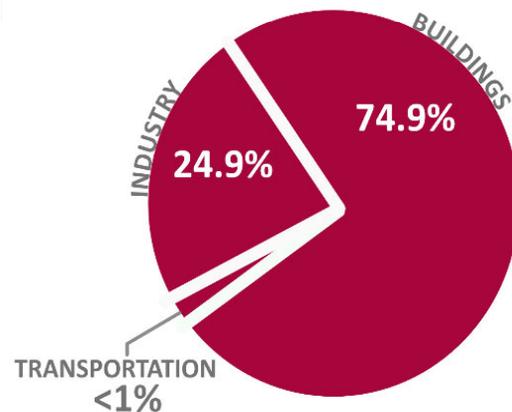


FIGURE 7: SOURCE: 2013 2030, INC./ ARCHITECTURE 2030. ALL RIGHTS RESERVED.
DATA SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION

In commercial buildings, electric lighting accounts for 35 - 50% of total electrical energy consumption. We aim for the strategic use of daylight that can reduce this energy demand.

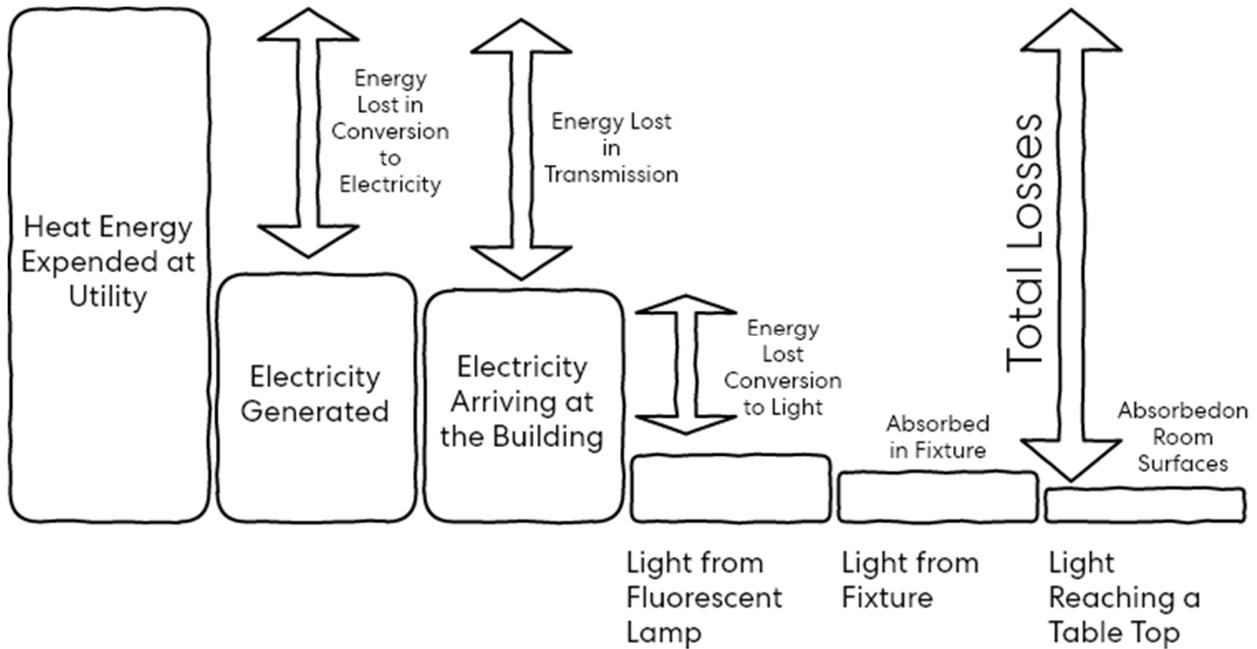


FIGURE 8: INEFFICIENCIES OF ELECTRIC LIGHT GENERATION BY [NC STATE DESIGN](#) ADAPTED BY PERKINS AND WILL

Electricity is intrinsically one of the more expensive energy sources that we use in buildings and electric lighting fixtures are quite inefficient in the conversion of that energy to light, as is demonstrated by the graphic presented here showing the conversion and transmission losses in taking raw energy at the power plant to useable illumination on the task surface.

Glazing Visible Light Transmittance and Energy Use

High-Performance Glazing with VLT 60%	EUI 206 kBtu/ft ² /year
High-Performance Glazing with VLT 50%	EUI 206 kBtu/ft ² /year
High-Performance Glazing with VLT 40%	EUI 206 kBtu/ft ² /year

FIGURE 9: GLAZING VISIBLE LIGHT TRANSMITTANCE AND ENERGY USE BY PERKINS AND WILL

A few types of high-performance glazing systems were physically modeled and analyzed with energy simulation to understand performance concerning building energy demand for a patient room with only a change concerning visual transmittance. This model does not consider the impact of daylight sensors and controls on reducing peak lighting energy demand from varying visible light transmittance (VLT). The work shows that visible light transmittance has no impact on building energy use. It is a consideration for the quality of daylight when it comes to consideration for over-exposed conditions that are above a given foot-candle or lux threshold. The assumption does not consider the use of any daylight controls to change the lighting energy use.

Occupant Comfort and Productivity

As a whole, we want to design interior spaces that increase an occupant's visual comfort. As we improve visual comfort, we also make beneficial health impacts on occupants' psychological and physiological health. These can be measured in terms of increasing productivity and providing mental and visual stimulation necessary to regulate human circadian rhythms. We measure visual comfort in illumination levels and distribution, that is sensitive to not only the brightness of light sources, but also the colors, and general spread of light around spaces and onto surfaces. In the end, we want to illuminate tasks without using too much energy or causing overexposure conditions.

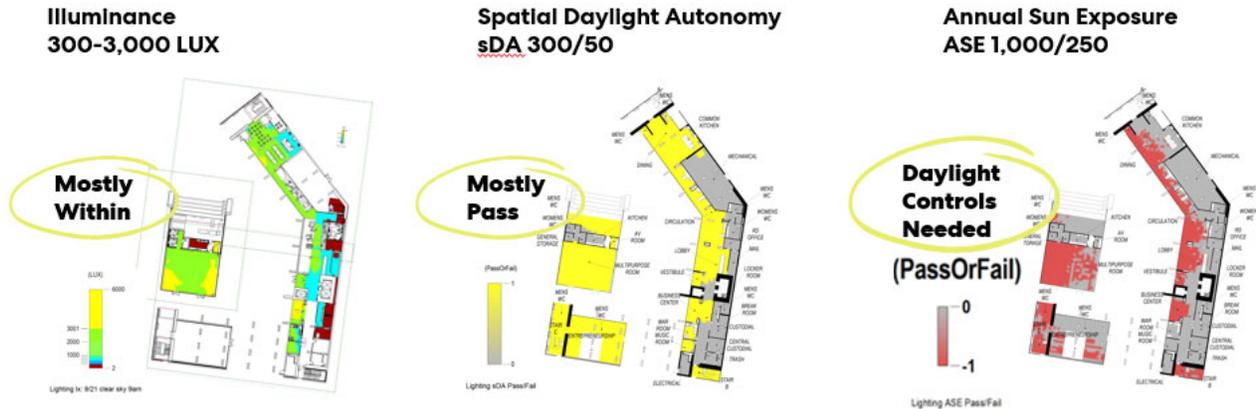
Factors Affecting Daylighting



Typically, the following impact the design of interior spaces, and we check our analysis models for the following:

- Site location for Latitude
- Model Orientation
- Modeling Massing
- Model Glazing Visible Light Transmittance
- Interior Space Material Light Reflectance Values
- Sky Condition for Clearest Sky During a Set Time Frame for LEED V4.0/4.1 Option 2

Some Useful Daylighting Design Metrics



Opportunities

Daylight quality measures such as daylight and occupant sensors

Passive Design that uses building massing, overhangs, and vertical fins to minimize overexposure

Landscaping that shades structure

For program spaces such as multi-purpose space, the control of daylight becomes more critical for minimizing overexposure

FIGURE 10: PERKINS AND WILL PROJECT

Illumination

Illuminance analysis measures the amount of light falling on a horizontal work surface at 30 inches above the floor in either foot-candles or Lux for a given point in time, such as 9 A.M. on September 21st.

sDA

Spatial Daylight Autonomy (sDA) describes how much of the space receives sufficient daylight. We typically measure our design potential for daylight quality by the percentage of floor area that receives at least 300 Lux for at least 50% of the time.

ASE

Annual Sun Exposure (ASE) describes how much space receives too much direct sunlight, which can cause visual discomfort from over-exposure or glare and an increase in cooling loads. The criteria for this metric states that no more than 10% of the total floor area receives at least 1,000 Lux and 250 occupied hours a year.

Learn how you can effectively set up daylighting analysis in Revit.

WHAT

What is Insight?

Autodesk defines Insight as a Revit plug-in that serves as a building performance analysis software. This cloud-based analysis tool assists architects and engineers with designing more energy-efficient buildings with building performance analysis data and improved simulation engines. Insight allows you to maximize your BIM workflows and helps you improve energy and environmental performance throughout the building life cycle by allowing you to integrate energy analysis, lighting analysis, and solar analysis.

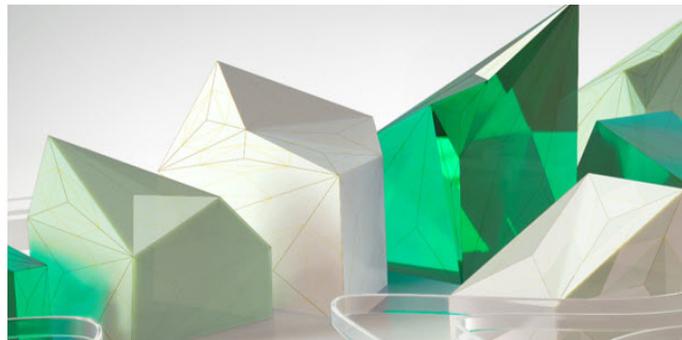


FIGURE 11: AUTODESK

Insight can assist in some of the following tasks:

- Produce energy models.
- Work with key performance indicators and real-time feedback.
- Evaluate heating and cooling loads.
- Simulate sun and shadow studies.
- Perform daylighting and glare studies.
- Assist with solar photovoltaic analysis.

Today, we are going to focus on using Insight to perform the lighting analysis on a project throughout the different phases of design.

HOW

Process

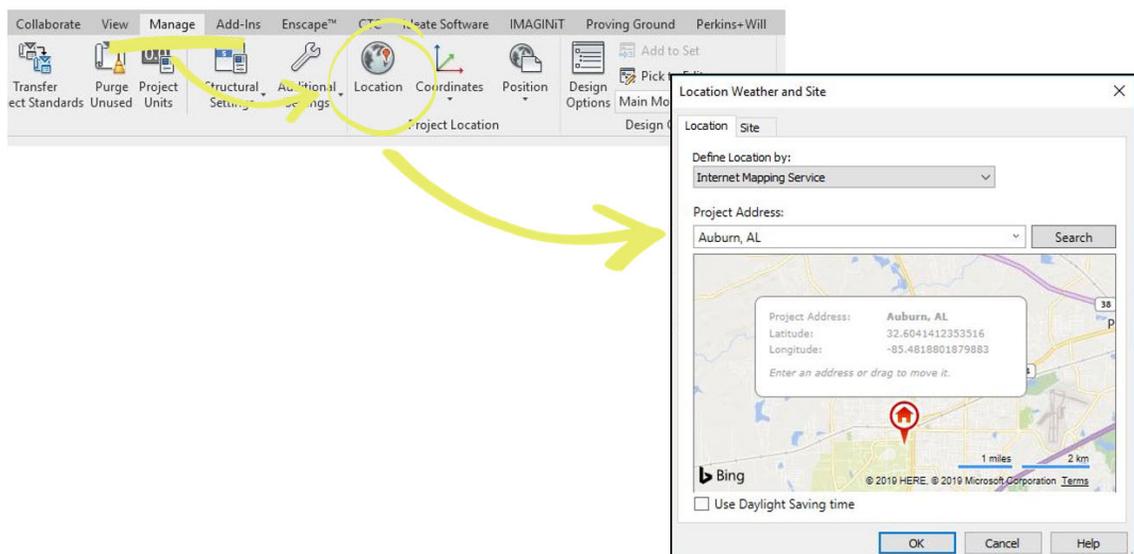
Insight is an iterative design tool. You can download the plug-in for Revit 2016 and any newer Revit version. To use this plug-in, be sure to be signed-in to your Autodesk 360 account before opening an existing or the start of a new Revit model. It can work in a new or existing Revit in schematic design, design development, or construction document phase. Today, we are going to be walking you through how to use Insight with Revit 2020.

The general steps to best practices for using the Insight plug-in for daylight design involves the following steps:

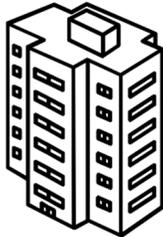
1. Set model location
2. Model contents and cleanup
3. Create appropriate glazing criteria in the model for visible light transmittance and opaque surfaces performance
4. Select an Analysis with an appropriate grid resolution
5. Run the analysis to create a lighting result of daylighting levels and 3D model with schedules for the floors and the rooms in the model
6. Open the room analysis schedule and verify the regularly occupied rooms to include in the daylighting analysis
7. Generate and View Results to update the lighting analysis design results with your routinely selected regularly occupied rooms
8. Review the analysis with the design team for making decisions to improve the design

Set the Model Location

Verify that the project model location is set and does not have the default city selected. Check the true north to verify the project's true north alignment.



Model Contents and Cleanup



Our work today usually starts with either model provisioned into links, or there is a plan for the model breakup in the Digital Execution Plan. For daylighting, at a minimum, we must have the rooms and floor in the same model that you will run the daylighting analysis. Often, the rooms reside in the interiors model and the floors in the core and shell model. First, we only work in a detached saved copy of the single Revit model or the interiors model if it is a split model workflow. There are a couple of things that will need to take place that differs from the active production model, such as changing the glazing from “Render-Ready” to “Daylighting Design-Ready,” and we must have the rooms and floors in the same model. If you find that your rooms and floors are not in the same model, then it is best to copy and monitor the floors from the core and shell into the interiors model after you work in a local detached copy of the file. In the past, we have attempted “Binding” Revit models, but in most cases it fails, and so the best option currently is to copy/monitor the floors.

The last check you should perform is to make sure you have ceilings, exterior walls, and roofs in a link that you can see and that there no transparent materials applied to any of these elements. The last item is to turn off all light fixtures or disable them appearing in the model from the view visibility settings as these will interfere with the daylighting analysis results. A cursory check and mitigation of the model avoiding misplaced items or elements that block glazing areas, or any other items that will interfere with the daylighting analysis.

- The model will require at least one level and a “placed” room and floor assembly element for an analysis run.
- In summary, floors must be modeled in a non-linked reference model with the associated room and not within a group. The Copy/Monitor feature on a linked floor will work in a model with rooms.

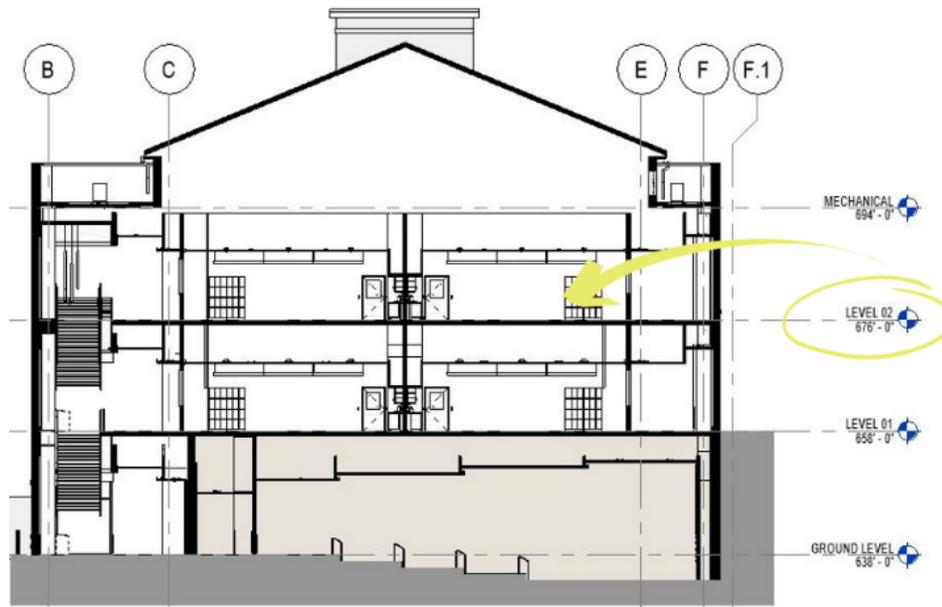


FIGURE 12: PERKINS AND WILL PROJECT

Model Glazing Criteria



See the reference below for your Revit version regarding the transparent and opaque material RGB settings and additional instructions. As a first daylight design step, we only work on the glazing settings.

We will provide an online calculator for interpolating in between the values listed from the Autodesk reflectivity of glazing materials for illuminance studies reference for class participants.

Please consult the [Autodesk Building Performance Analysis](#) Help document for more details on setting the reflectivity of glazing materials for illuminance studies.

Model Opaque Criteria

The opaque material settings can be left as-is if the interior design specification of materials is present. Only consider the step here if you are within a percent or two of your daylighting target as it can be time-consuming.

We generally apply the following fundamental light reflectance values below; these can be different pending compliance for Interior Lighting credit option for lighting controls:

- Ceilings 80%
- Walls 50%
- Floors 20%

Please consult the [Autodesk Building Performance Analysis](#) Help document for more details on setting the reflectivity of opaque materials for illuminance studies.

We will provide an online library of material light reflectance values for class participants.

Grid Resolution

Always check the cost estimate from Revit for the daylight analysis.

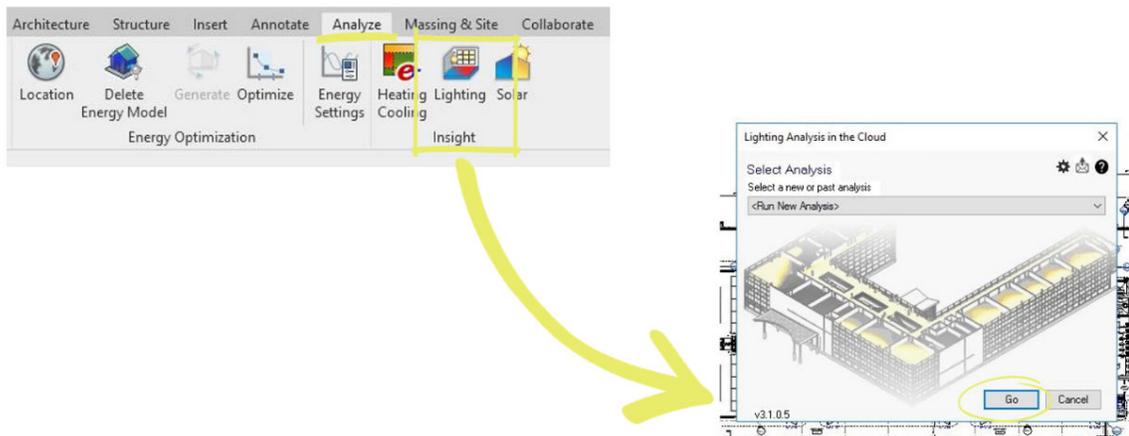
- Use the larger resolution of the 72-inch grid for initial studies, once it is time to submit anything for LEED, then use a 12-inch grid.
 - For 72-inch grid, typical daylight analysis for a given floor costs 0-20 credits, or slightly higher and always less than 100
 - For 12-inch grid, typical daylight analysis for a given simple floor costs 4-20 credits or slightly higher and always less than 100

Only submit a single floor at a time to see if there are any issues with the model.

- Submit a typical single floor for repeating floors in a tower, high-rise, or mid-rise
- If there are no model issues, then only submit unique and typical floors for any tower, high-rise, or mid-rise

Run the Analysis

Launch Insight from within the Revit model. This analysis will create a 3D model with schedules for the floors and the rooms in the model.



Setup Daylighting Room Schedule

Open the room analysis schedules to verify the regularly occupied spaces to include in the daylighting analysis. For verification of which rooms qualify as periodically occupied, you can use a pure determination of a person spending at least one hour a day to consider it as such and reference the following document:

- Always use the checkbox for “Include in Daylighting” for indicating the regularly occupied spaces in your model.
- Illuminating Engineering Society – [The Lighting Handbook 10th Edition](#)

Regularly Occupied Space



FIGURE 13: PERKINS AND WILL DIAGRAM

According to the U.S. Green Building Council, a regularly occupied space is an area where one or more individuals normally spend time seated or standing. On average, more than one hour per person per day spent in these spaces.

Daylight exempt occupied spaces can be excluded from the daylighting and view analysis due to special requirements having to do with the activities taking place in these spaces. Some examples of these rooms include darkrooms and x-ray rooms.

Learn how to translate Revit data into documents and calculations for a LEED V4.1 quality submission.

Design Targets for LEED Daylighting

Provide a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Design Targets for LEED Daylighting Option 1 Credit



LEED Daylight Credit Simulation SDA/ASE Criteria	4.0 Option 1	4.1 Option 1
sDA (300/50%) ASE 1000/250 Floor Area to Achieve Daylighting in Regularly Occupied Spaces	55% for 2 pt. 75% for 3 pts. Healthcare 75% for 1 pt. 90% for 2 pts.	40% for 1 pt. including Healthcare 55% for 2 pts including Healthcare 75% 3 pts or an Exemplary Point for Healthcare If all receive 55% min then 1 or additional exemplary point, only available for Healthcare if initially 1 pt. achieved

Design Targets for LEED Daylighting Option 2 Credit

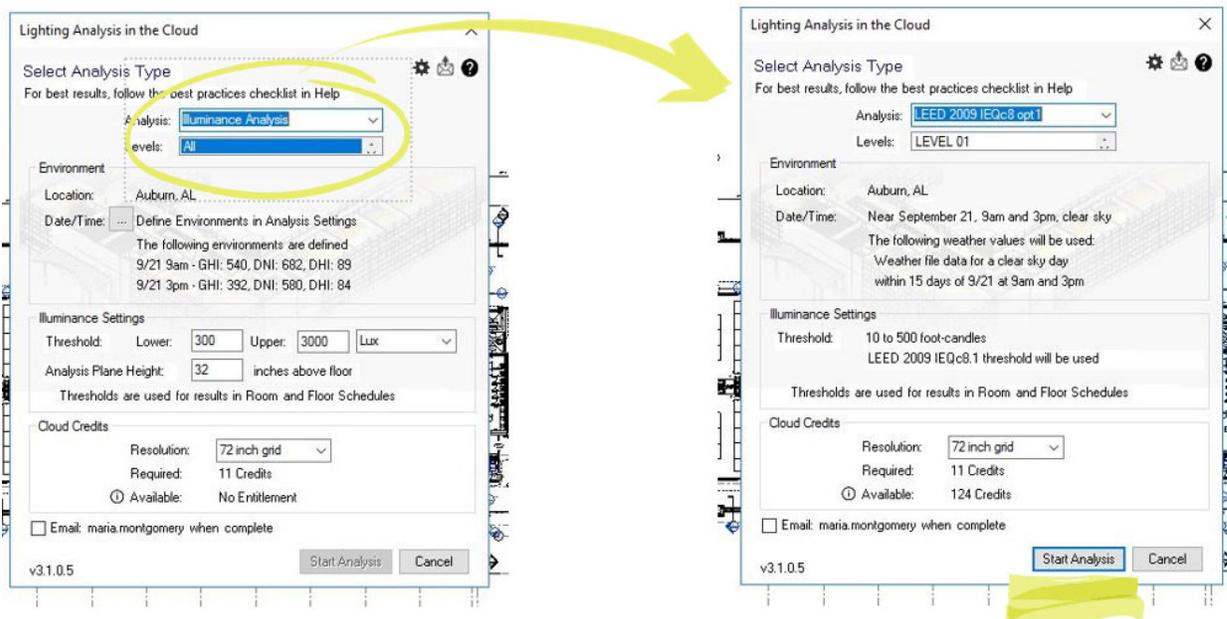


LEED Daylight Credit Illuminance Simulation Criteria	2009 V3 (Option 1)	4.0 Option 2	4.1 Option 2
Floor Area to Achieve Daylighting in Regularly Occupied Spaces	75% for 1 pt.	75% for 1 pt. 90% for 2 pts.	55% for 1 pt. 75% for 2 pts. 90% for 3 pts except HC 90% for Exemplary Performance for HC
Daylight Illuminance Levels for	10-500 fc or 108-5,400 lux	300-3,000 lux	300-3,000 lux
Sky Condition	Clear-Sky	Clear-Sky	Clear-Sky
Time	9/21 at 9 AM and 3 PM	1-day within 15 days of 9/21 and 1-day within 15 days of 3/21 representing the clearest sky condition and use the average of the hourly value of the 2 selected days.	1-day within 15 days of 9/21 and 1-day within 15 days of 3/21 representing the clearest sky condition and use the average of the hourly value of the 2 selected days.

Analysis Type

Before running the lighting analysis, be sure to select the appropriate analysis type from the following options:

- Illuminance Analysis
- Daylight Factor (beta)
- Daylight Autonomy (sDA preview)
- LEED 2009 IEQc8 opt 1
- LEED V4 EQc7 opt 1 (sDA+ASE)
- LEED V4 EQc7 opt 2
- Solar Access



Revit Data into Documents and Calculations

You will learn how to translate Revit data into the following documents and calculations. Please upload these documents to LEED Online with a narrative containing your assumptions for a LEED V4.1 quality submission.

- Revit Daylighting Schedule
- LEED Daylighting Credit Calculator Spreadsheet
- Best Practice for Aligning the Revit Daylight Schedule to the LEED Daylighting Credit Calculator

Use the resource below to interpolate the best RGB settings between your actual product VLT glazing and the Autodesk Glazing Properties Table.

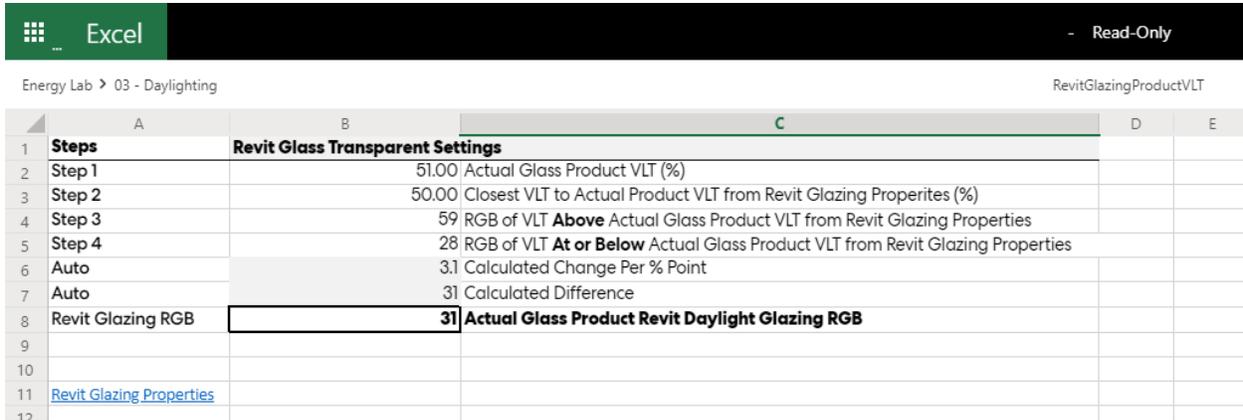
Best Practice LEED Daylighting Submission Suggestions

- For your first initial studies, never submit all levels for any daylight analysis. Submit a single floor at a time to see if there are any issues with the model, such as a large ground level floor that may represent landscaping or a parking layout. Autodesk will charge for each analysis a basis of the amount of floor area that you submit. We often use floors for exterior landscape contours.
- If your project is a tower, high-rise, or mid-rise, then consider only submitting a typical single floor for repeating floors with the necessary documentation in your LEED narrative.
- For the 72-inch grid analysis, the daylight analysis for a given floor costs about 0-30 credits. For sDA and ASE analysis, the cost is at the higher end of the range.
- For the 12-inch grid analysis, the daylight analysis for a given floor costs about 4-30 credits. For sDA and ASE analysis, the cost is at the higher end of the range. If you see anything approaching 100 credits or more for a single study, please contact your local DA, Digital Practice, or Energy Lab for additional help for a determination of the high cost before sending the analysis to Autodesk.
- The analysis credit costs are real dollars that the firm pays, so use your professional judgment and the guidance here whenever approving or accepting an analysis cost from Autodesk.

Gain learning aids to successfully run daylighting analysis studies back at your office.

Revit Daylight Glazing Product VLT Calculator

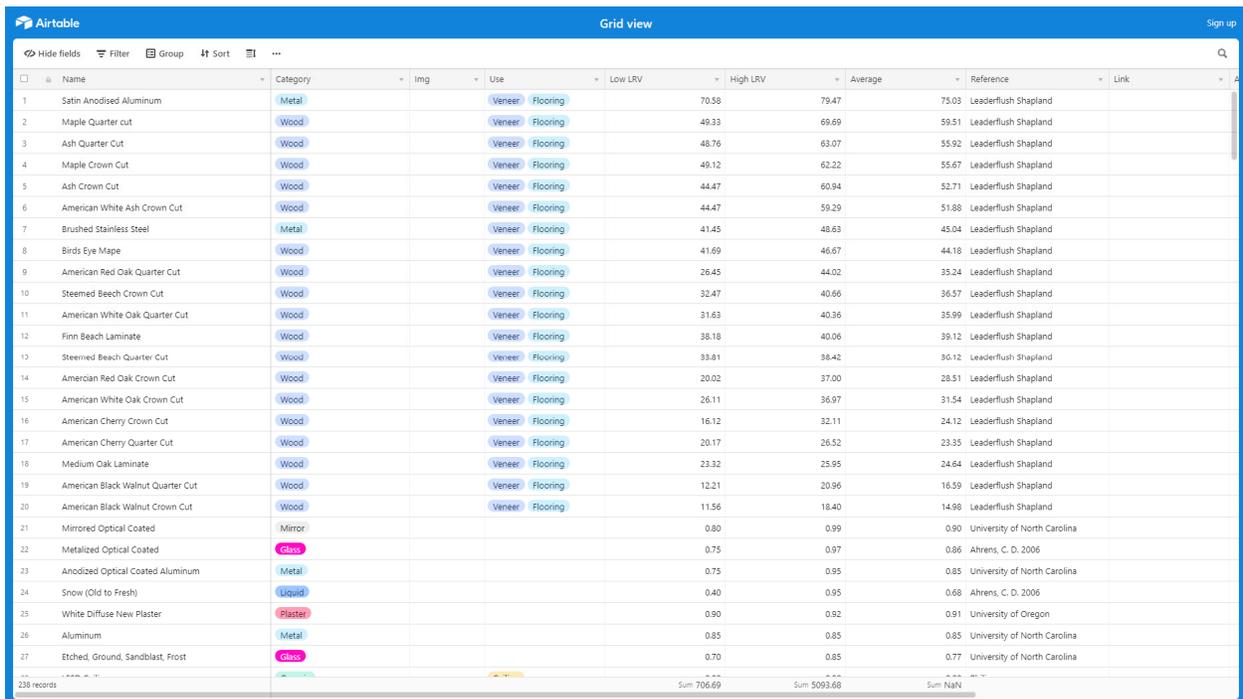
Use the resource below to interpolate the best RGB settings between your actual product VLT glazing and the Autodesk Glazing Properties Table.



Steps	Revit Glass Transparent Settings
Step 1	51.00 Actual Glass Product VLT (%)
Step 2	50.00 Closest VLT to Actual Product VLT from Revit Glazing Properties (%)
Step 3	59 RGB of VLT Above Actual Glass Product VLT from Revit Glazing Properties
Step 4	28 RGB of VLT At or Below Actual Glass Product VLT from Revit Glazing Properties
Auto	3.1 Calculated Change Per % Point
Auto	31 Calculated Difference
Revit Glazing RGB	31 Actual Glass Product Revit Daylight Glazing RGB

Material Light Reflectance Value Database via Airtable

Additional material light reflectance values.



Name	Category	Use	Low LRV	High LRV	Average	Reference	Link
Satin Anodized Aluminum	Metal	Veneer Flooring	70.58	79.47	75.03	Leaderflush Shapland	
Maple Quarter cut	Wood	Veneer Flooring	49.33	69.69	59.51	Leaderflush Shapland	
Ash Quarter Cut	Wood	Veneer Flooring	48.76	63.07	55.92	Leaderflush Shapland	
Maple Crown Cut	Wood	Veneer Flooring	49.12	62.22	55.67	Leaderflush Shapland	
Ash Crown Cut	Wood	Veneer Flooring	44.47	60.94	52.71	Leaderflush Shapland	
American White Ash Crown Cut	Wood	Veneer Flooring	44.47	59.29	51.88	Leaderflush Shapland	
Brushed Stainless Steel	Metal	Veneer Flooring	41.45	48.63	45.04	Leaderflush Shapland	
Birds Eye Maple	Wood	Veneer Flooring	41.69	46.67	44.18	Leaderflush Shapland	
American Red Oak Quarter Cut	Wood	Veneer Flooring	26.45	44.02	35.24	Leaderflush Shapland	
Steamed Beech Crown Cut	Wood	Veneer Flooring	32.47	40.66	36.57	Leaderflush Shapland	
American White Oak Quarter Cut	Wood	Veneer Flooring	31.63	40.36	35.99	Leaderflush Shapland	
Finn Beach Laminate	Wood	Veneer Flooring	38.18	40.06	39.12	Leaderflush Shapland	
Steamed Beech Quarter Cut	Wood	Veneer Flooring	33.81	38.42	36.12	Leaderflush Shapland	
American Red Oak Crown Cut	Wood	Veneer Flooring	20.02	37.00	28.51	Leaderflush Shapland	
American White Oak Crown Cut	Wood	Veneer Flooring	26.11	36.97	31.54	Leaderflush Shapland	
American Cherry Crown Cut	Wood	Veneer Flooring	16.12	32.11	24.12	Leaderflush Shapland	
American Cherry Quarter Cut	Wood	Veneer Flooring	20.17	26.52	23.35	Leaderflush Shapland	
Medium Oak Laminate	Wood	Veneer Flooring	23.32	25.95	24.64	Leaderflush Shapland	
American Black Walnut Quarter Cut	Wood	Veneer Flooring	12.21	20.96	16.59	Leaderflush Shapland	
American Black Walnut Crown Cut	Wood	Veneer Flooring	11.56	18.40	14.98	Leaderflush Shapland	
Mirrored Optical Coated	Mirror		0.80	0.99	0.90	University of North Carolina	
Metalized Optical Coated	Glass		0.75	0.97	0.86	Ahrens, C. D. 2006	
Anodized Optical Coated Aluminum	Metal		0.75	0.95	0.85	University of North Carolina	
Snow (Old to Fresh)	Liquid		0.40	0.95	0.68	Ahrens, C. D. 2006	
White Diffuse New Plaster	Plaster		0.90	0.92	0.91	University of Oregon	
Aluminum	Metal		0.85	0.85	0.85	University of North Carolina	
Etched, Ground, Sandblast, Frost	Glass		0.70	0.85	0.77	University of North Carolina	

2020 Revit Daylighting Example Template Model

We will provide class participants with a Revit template model with the following:

- Analysis Display Style for LEED & Well Daylighting Simulation with Illuminance Scale
- Daylighting View Templates for Great Looking Floor Plans and Illustrative Sections
- Daylighting Analysis Glazing for Common IGU with two panes and an Airspace
- Exterior Glazing for Up to 25.4mm/1 inch at 40% Visible Light Transmission
- Exterior Glazing for Up to 25.4mm/1 inch at 50% Visible Light Transmission
- Exterior Glazing for Up to 25.4mm/1 inch at 60% Visible Light Transmission
- Interior Glazing for up to 3mm/1/8" in at >90% VLT, single pane

MicroKnowledge Cards

MicroKnowledge (mK) cards are bite-sized nuggets of image-based know how. Answers dispensed in this light and simple format feature quick comprehension without contributing to the data inundation associated with operating digital tools.

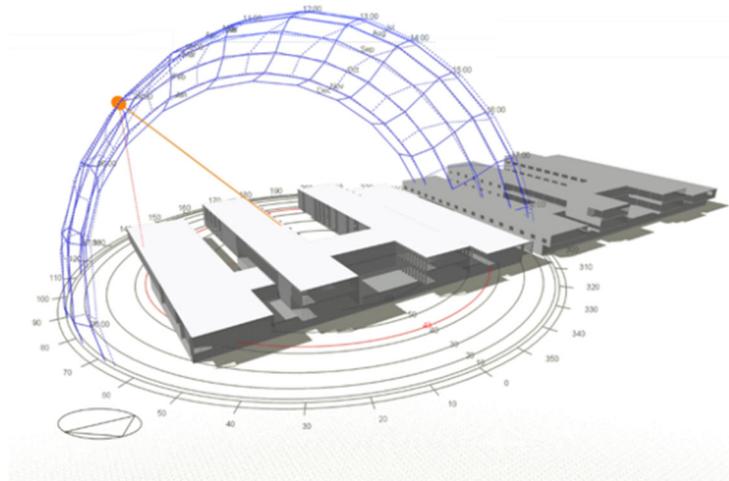
These aids are comprehensive, brief, favoring images over text, and easy to follow, making learning knowledge easy to consume. We use mK cards to help maximize the digital competence of Perkins and Will designers.

We will be providing mK cards on the following topics:

- LEED Daylight Option 1 Credit Guide
- LEED Daylight Option 2 Credit Guide

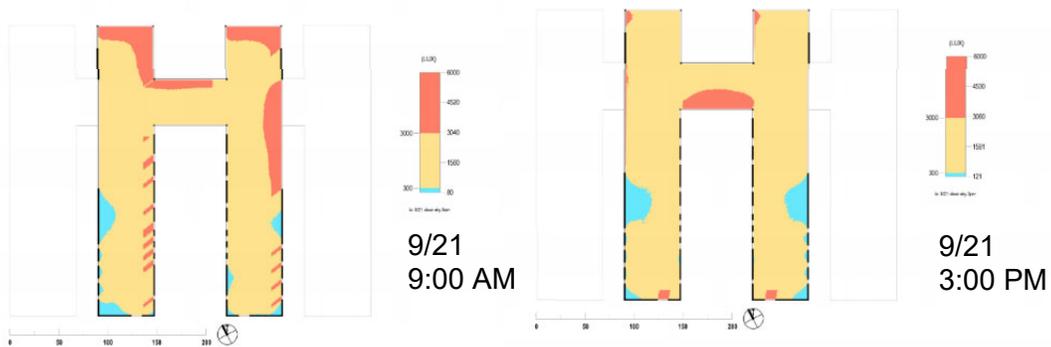
Example of Revit Daylighting in Pursuits and Early Design

The daylight analysis provides a convenient and early analysis of the location and amount of glazing for daylight levels before later stages of the project phase.



Top Floors Illuminance Calculation 94% of Regularly Occupied Spaces

LEED Credit Requires 75% Minimum for V4.0 Opt 2



94%

Floor Plate Daylit Between 300 and 3000 Lux

FIGURE 14: PERKINS AND WILL PROJECT

Example of Revit Daylighting in Later Design Phases

The analysis provides an analysis of later design stage implications of the daylight levels.

LEED v4 EQc7 option 2
For all Rooms Included in Daylighting

1 Point

9:00 am - 76% Passing

Equinox

GHI: 457, DNI: 623, DHI: 87 W/m²

10% below threshold

14% above threshold w/o shades

3:00 pm - 76% Passing

Equinox

GHI: 355, DNI: 546, DHI: 83 W/m²

9% below threshold

15% above threshold w/o shades



FIGURE 15: PERKINS AND WILL PROJECT

Summary

We hope you come out of this class fully understanding how to leverage the Revit daylighting analysis tools to improve your overall design. Now that you have a better understanding of why, when, and how to use these daylight analysis tools, you can successfully illuminate your best design back at your office.

