



Illuminate Your Best Design with Revit Daylighting Analysis

Maria Fox Montgomery

Associate AIA
Designer III, Design Technology Leader
LEED AP BD+C and WELL AP

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Architect, AIA
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Computational Designer
LEED AP BD+C

Perkins&Will



Clemson University, Watt Family Innovation Center, Perkins and Will

About the Speakers

Perkins&Will



Maria Fox Montgomery

- Joined the Atlanta Perkins and Will office in 2014.
- Received her undergraduate architecture degree from Clemson University and Master of Architecture degree from the University of Tennessee.
- Specializes in higher education and laboratory design.
- 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.



Tyrone Marshall

- Joined the San Francisco Perkins and Will office in 2007 and later joined the Atlanta office in 2012.
- 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.
- Licensed architect and researcher who 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.

Perkins&Will

FOUNDED IN

1935

DISCIPLINES

5

- Architecture
- Interior Design
- Branded Environments
- Planning + Strategies
- Landscape Architecture

TOTAL STAFF

2600+

STUDIOS

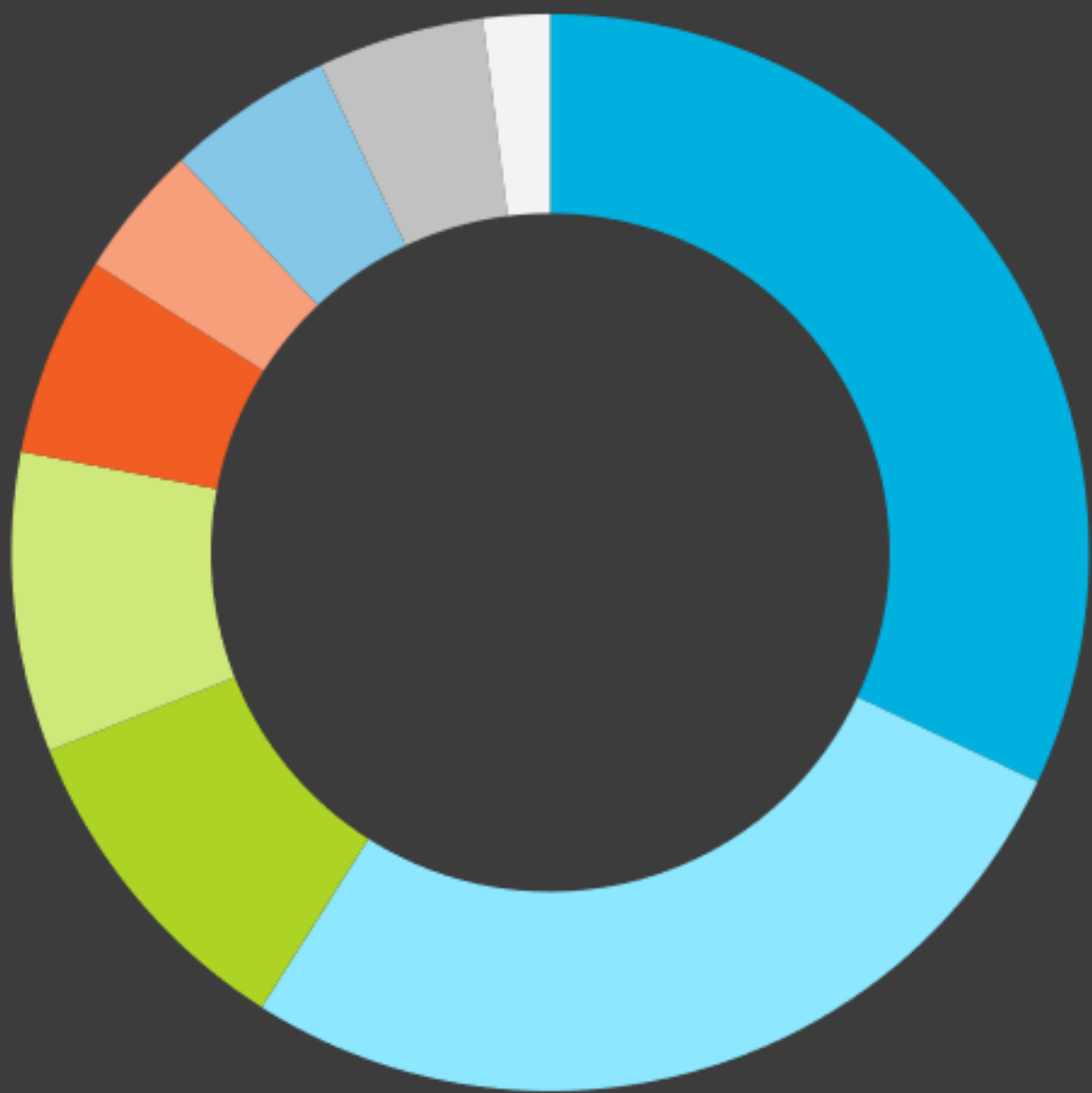
24

- | | | |
|-----------|-------------|----------------|
| Atlanta | Dubai | Ottawa |
| Austin | Durham | San Francisco |
| Boston | Houston | São Paulo |
| Charlotte | London | Seattle |
| Chicago | Los Angeles | Shanghai |
| Dallas | Miami | Toronto |
| Denmark | Minneapolis | Vancouver |
| Denver | New York | Washington, DC |

PRACTICE AREAS

9

- Corporate + Commercial
- Science + Technology
- K-12 Education
- Urban Design
- Sports + Recreation
- Healthcare
- Higher Education
- Transportation
- Civic + Cultural



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Design Process



Human Experience



Mobility



Energy



Building Technology



Resilience



Material Performance

PRACTICE-INFORMED

RESEARCH

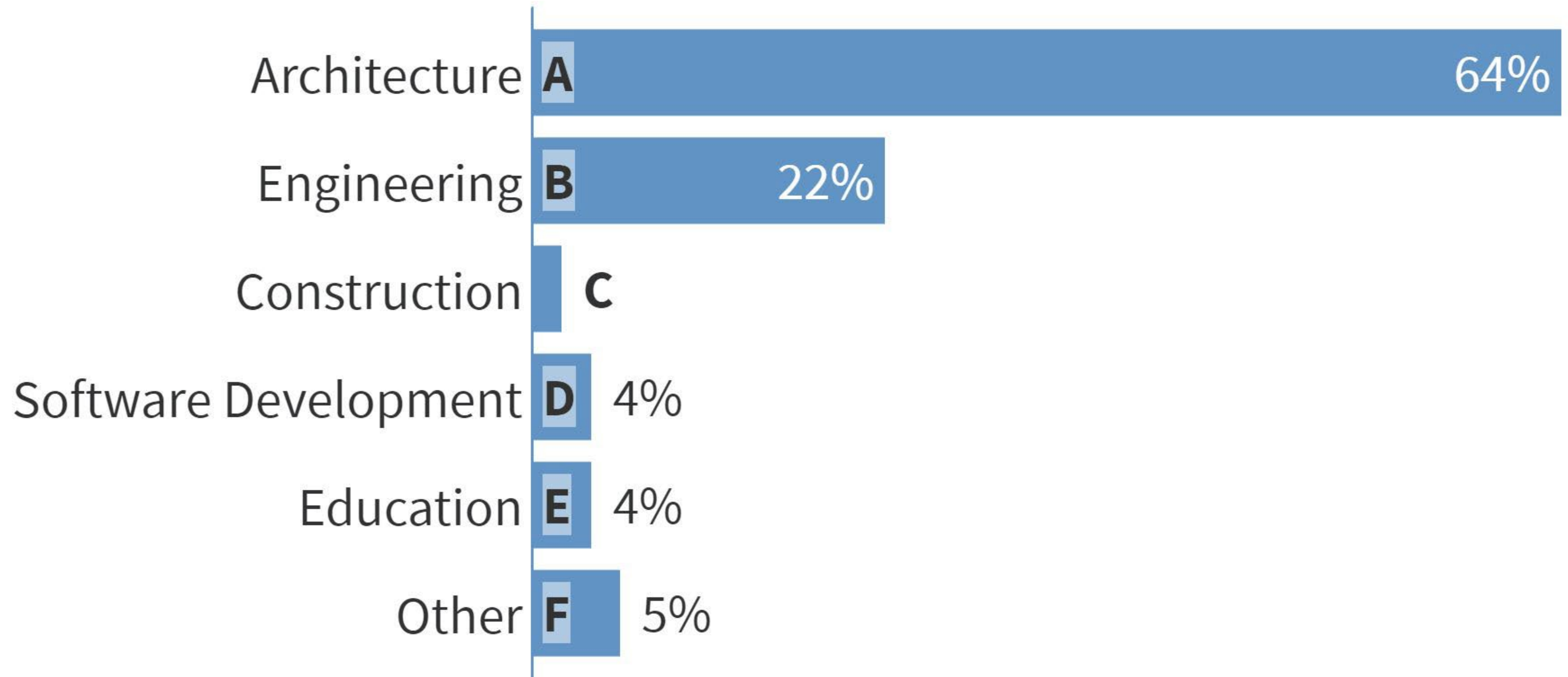
— FOR A —

RESEARCH-INFORMED

PRACTICE

<https://perkinswill.com/research/>

What industry group are you a part of?



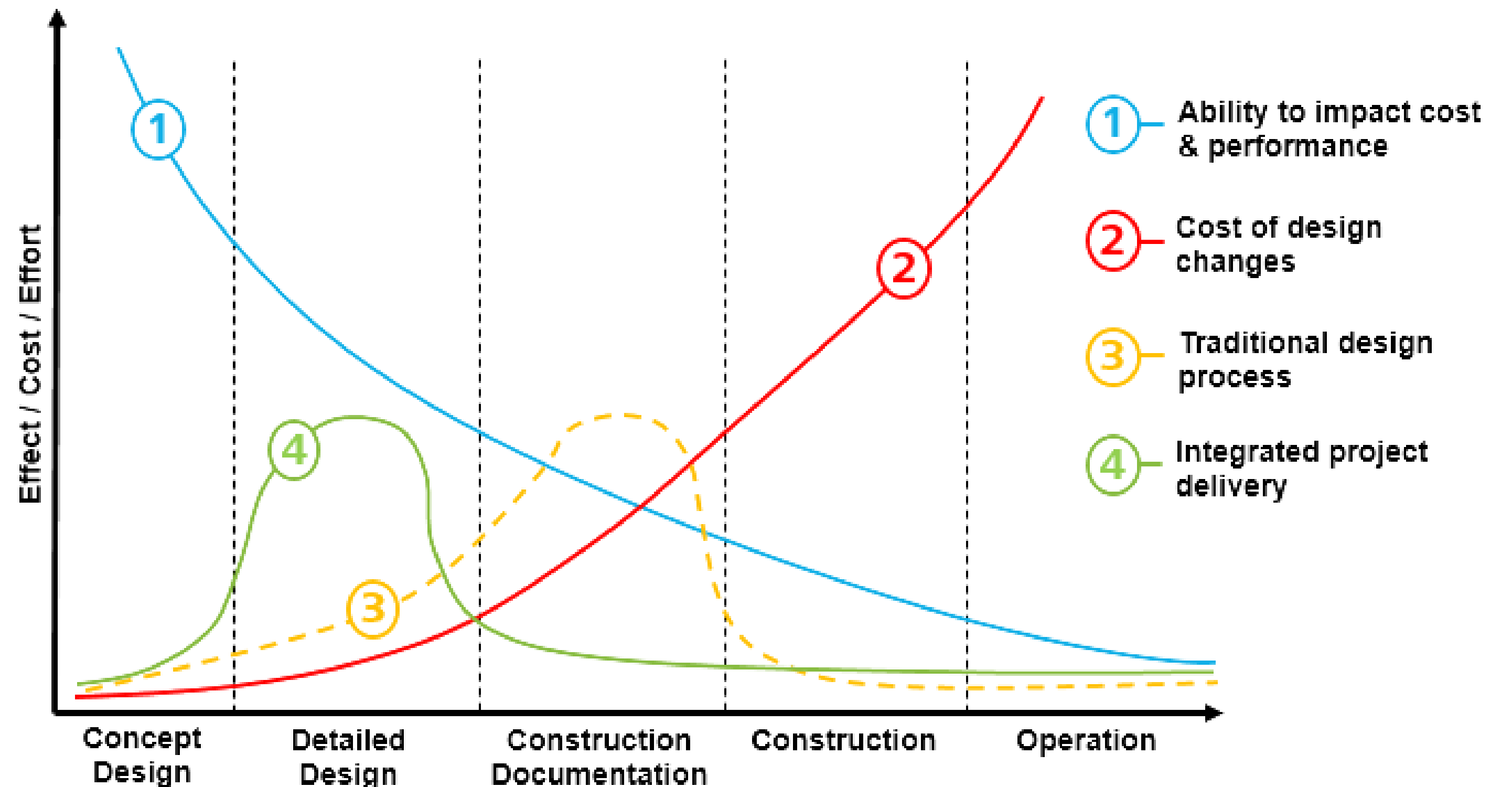


WHEN to run a daylight analysis?

When should we incorporate daylighting strategies?

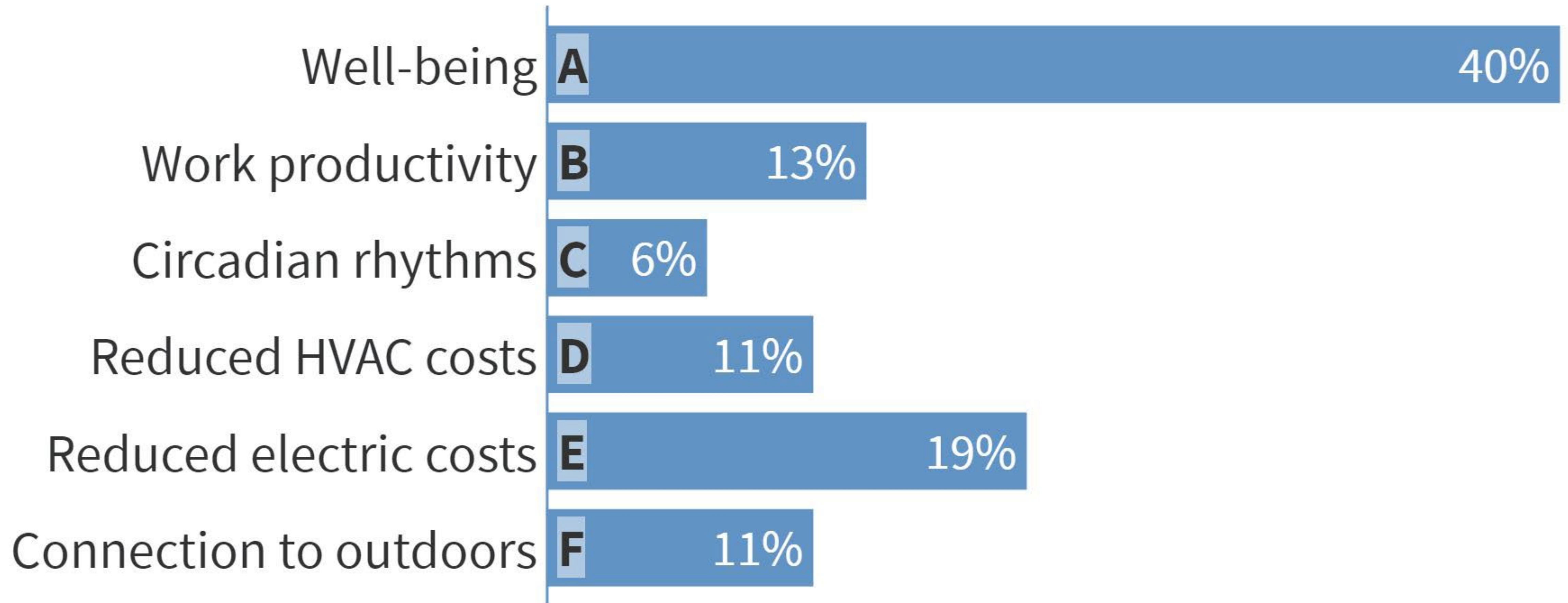
- Recommendation

- Make use of Revit daylighting analysis early in your design process
- Inform the design with regards to improving access to natural daylight
- Daylighting design follows Patrick MacLeamy's observation in 2004 about the development of the architectural project and the difficulty to make changes



MacLeamy Curve by Patrick MacLeamy

What words come to mind when considering daylighting strategies in your design?





WHY run a daylight analysis?

Why should we incorporate daylighting strategies?

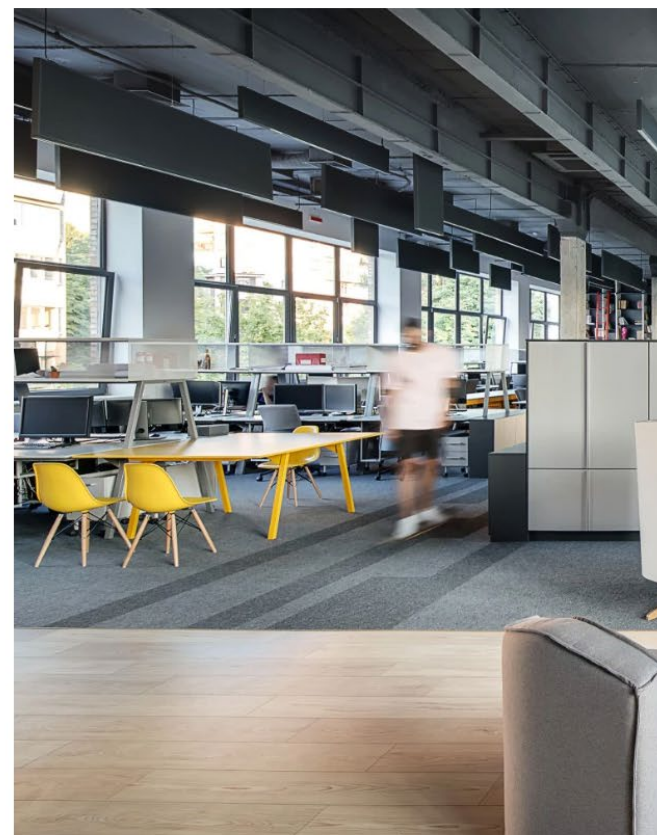
- Well-Being
 - Daylight connects us to the outdoors
 - Daylight reinforces circadian rhythms
 - Passive daylight design reduces electric lighting

COMMUNITY // May 23, 2019

The Number One Office Perk You Need

A survey of 1,614 employees reflected that more than half of the workforce thinks natural light and views of the outdoors is the most important office perk.

By [Ina Song](#), Marketing Manager at lumenomics



Office in a loft style with natural light from large windows

Over 50 percent of workforce agrees natural light and view of the outdoors is an important office perk, ranking higher than fitness centers, child care, and on-site cafeterias. This was found in a survey of 1,614 employees in a study by Future Workplace and View Dynamic Glass.

In the world of architecture, daylighting means the use of natural light. The benefits of daylighting include supporting occupants' visual demand, health and wellbeing. Numerous researches have found access to natural light to increase the well being, health, productivity, and happiness of occupants during their days indoors. This include organizations such as [Wor](#) and International Well Building Institute

This is why natural light is the number one desired office perk and many companies are working to increase the use of natural light in their workspaces.

Human Resource
Executive

**Want Healthy Employees?
Give Them Light!**

Two new studies show that natural light is a key ingredient in healthy workplaces.

By: [Andrew R. McIlvaine](#) | August 13, 2019 · 2 min read

Topics: Benefits and Compensation | Engagement | Wellness



Employee well-being is the hot new buzzword these days. Companies are increasingly aware that it's not just the physical health of their workers that's crucial—their mental and financial health is also important, and wellness programs that fail to address these factors will most likely be ineffective.

This awareness extends to the actual design of the workplace. Employees tend to thrive (and be more productive) in workspaces that allow for a mix of collaboration and solitude. One of the most important design elements that can positively affect mental well-being is natural light.

The latest Work Environment Survey, released earlier this summer, finds that in addition to natural light, employees are also “craving more connections to nature,” said Spurlin.

Employees rank access to natural light, daylight and outdoor views higher than perks such as an on-site gym and a pet-friendly workplace policy, according to the *Workplace Wellness Study*, a new survey from Future Workplace, a New York-based research firm. The survey, conducted in partnership with technology firm View, also finds that comfortable lighting was the second-most highly rated wellness factor (air quality in the workplace ranked No. 1).

Human Resource
Executive

Forbes

2,696 views | Aug 13, 2019, 01:31pm

New Study: Air Quality And Natural Light Have The Biggest Impact On Employee Well-Being



Alan Kohll Contributor ⓘ
Leadership Strategy

I cover corporate wellness, employee well-being and health trends.

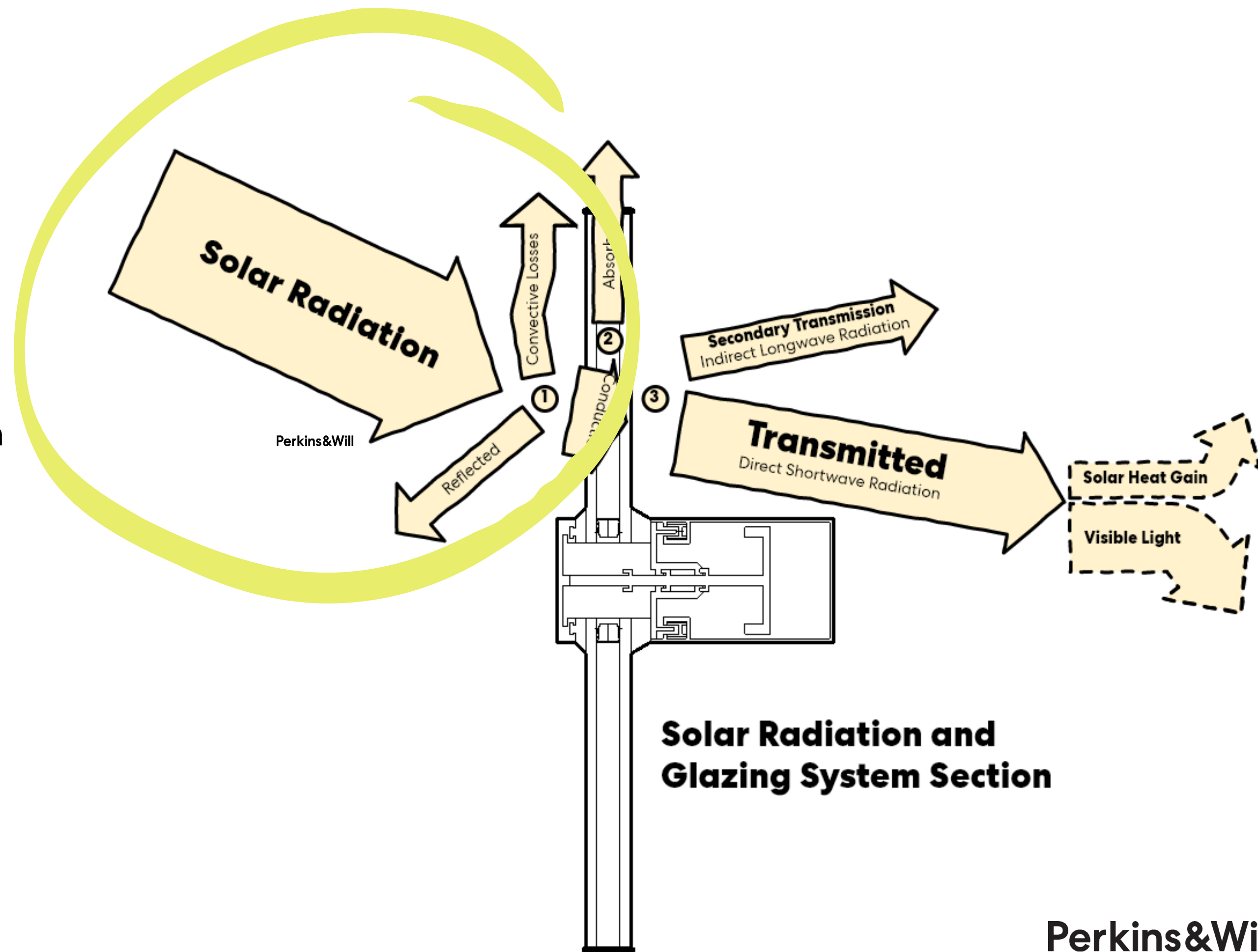


Office view. Dezeen Offices. UNIVERSAL IMAGES GROUP VIA GETTY IMAGES

When you think about creating a healthy work environment, you might think of cafeterias filled with bowls of fresh food or yoga in the conference room. But according to a new study on workplace wellness, the two most important factors are natural light and good air quality. These type of environmental factors are often overlooked in modern workplaces that emphasize rock walls, basketball courts, free gourmet meals, and sleep pods.

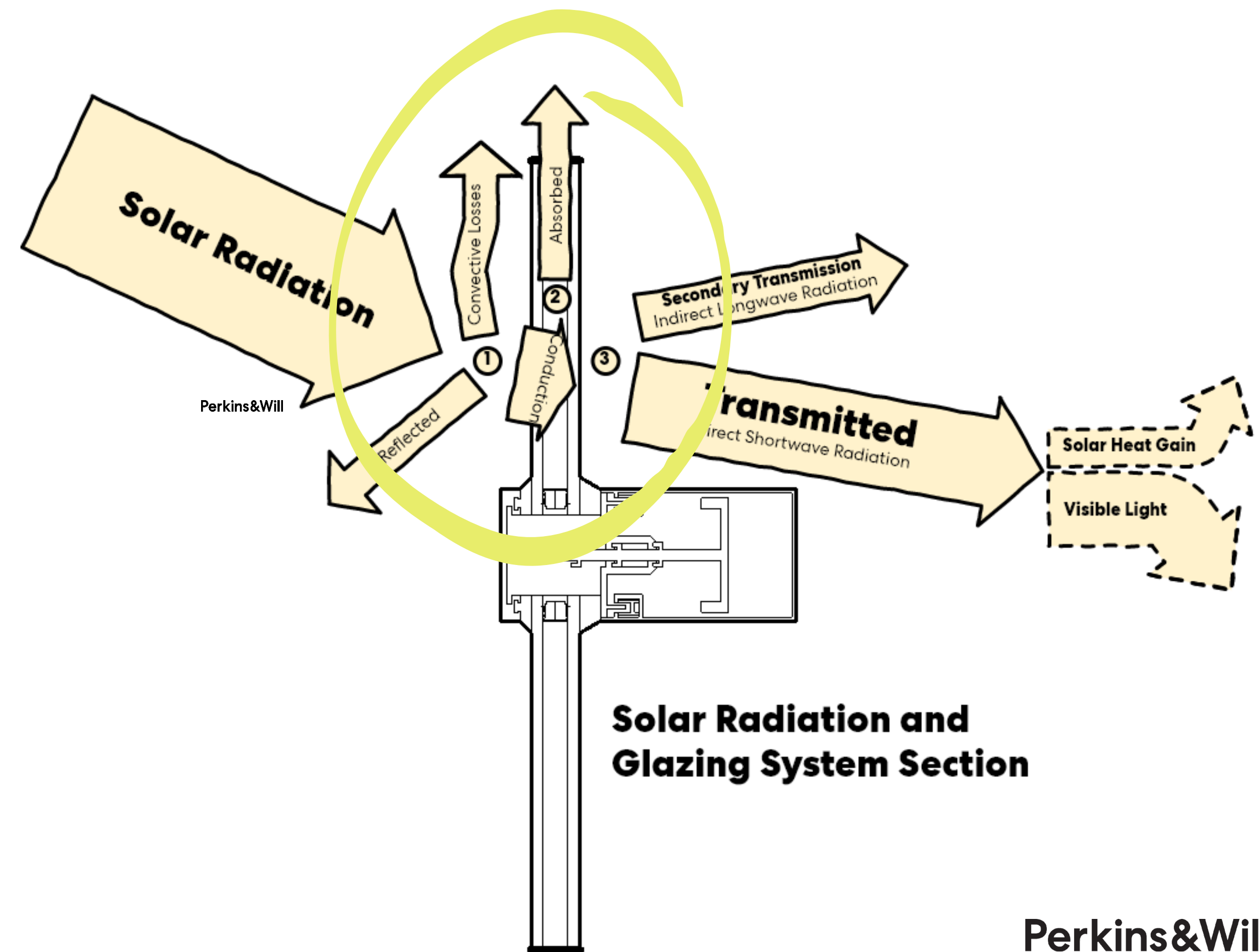
Why is daylight so important when it comes to glazing?

- Impact of Solar Radiation on Exterior
 - Only a small amount of visible light through the glazing system is received from the total amount of the sun's solar radiation.
 - 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.



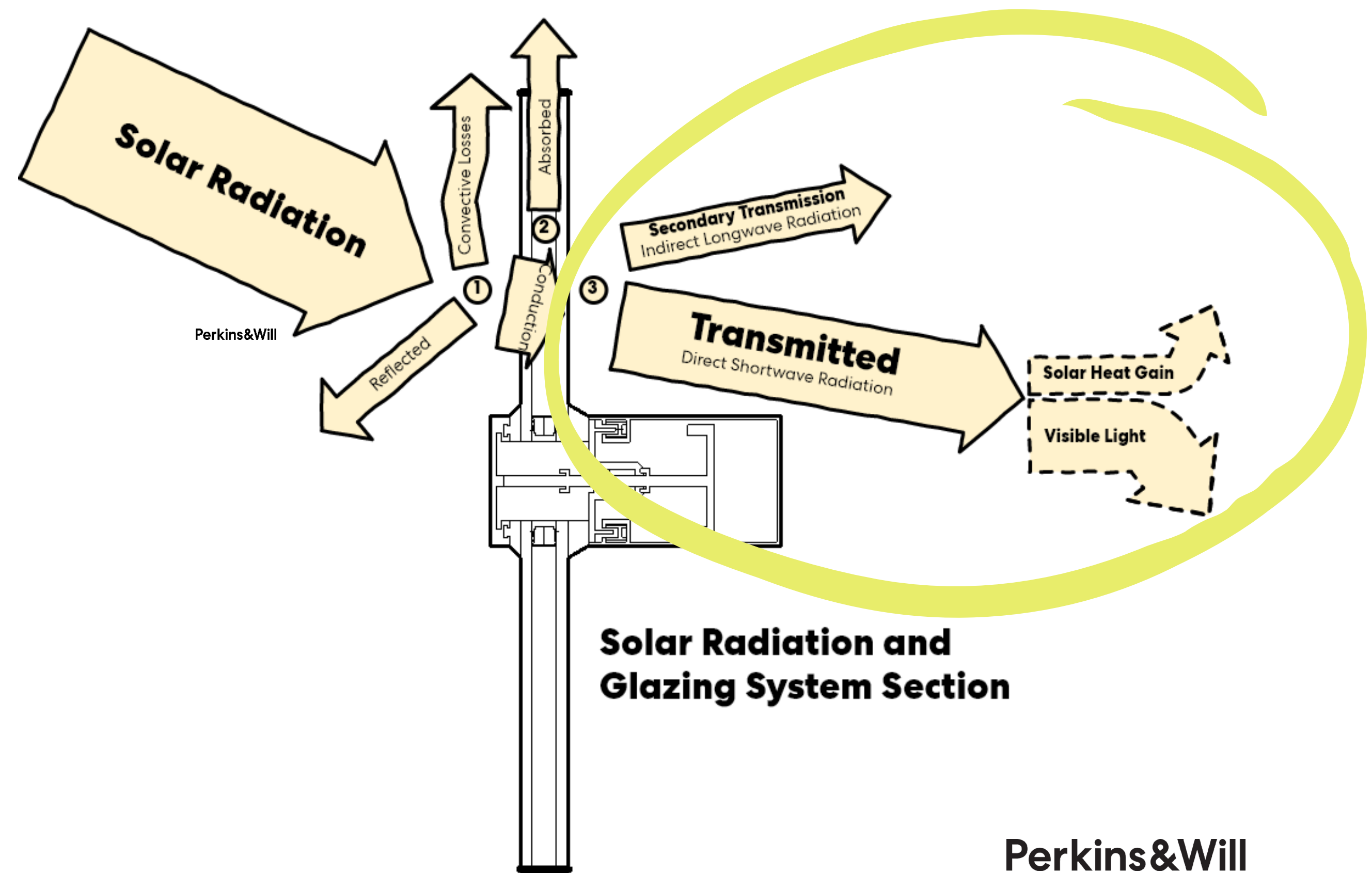
Why is daylight so important when it comes to glazing?

- Transmission of Solar Radiation through the Envelope Glazing System
 - 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.



Why is daylight so important when it comes to glazing?

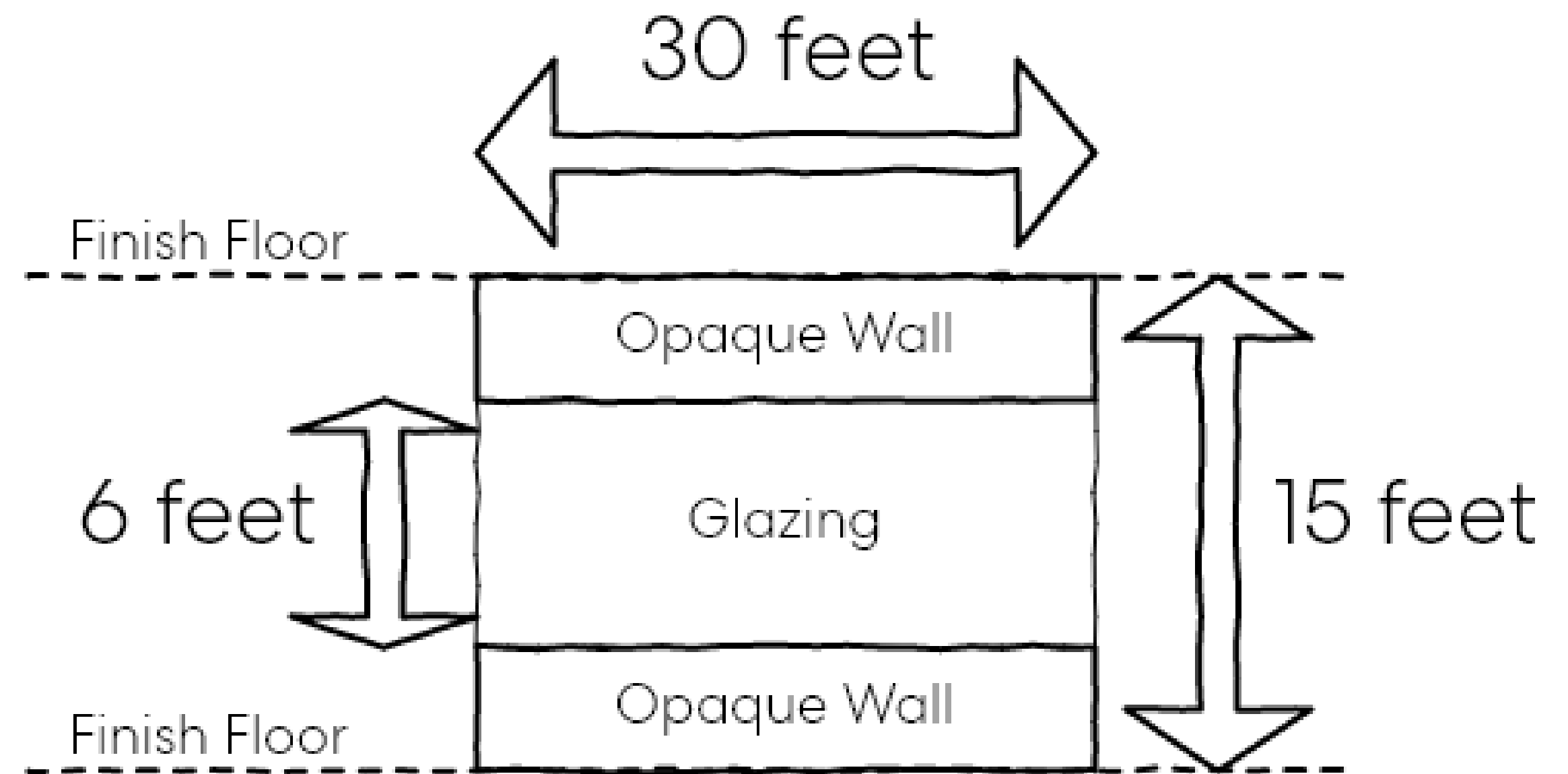
- Solar Radiation into Interior
 - Much of the energy transmits into the interior space as shortwave energy as solar heat gain and visible light energy.
 - A small amount from the earlier conduction and absorption radiates back into space as longwave secondary transmission while increasing the glass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



Why is the amount of envelope glazing so important?

- Glazing

- 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.
- Typically, we are concerned in daylighting and tools, like Revit, of a glazing products' performance as it retains the visible light transmittance.
- Remember, in Revit, you add the reported wall area and glazing area to get the gross wall area.



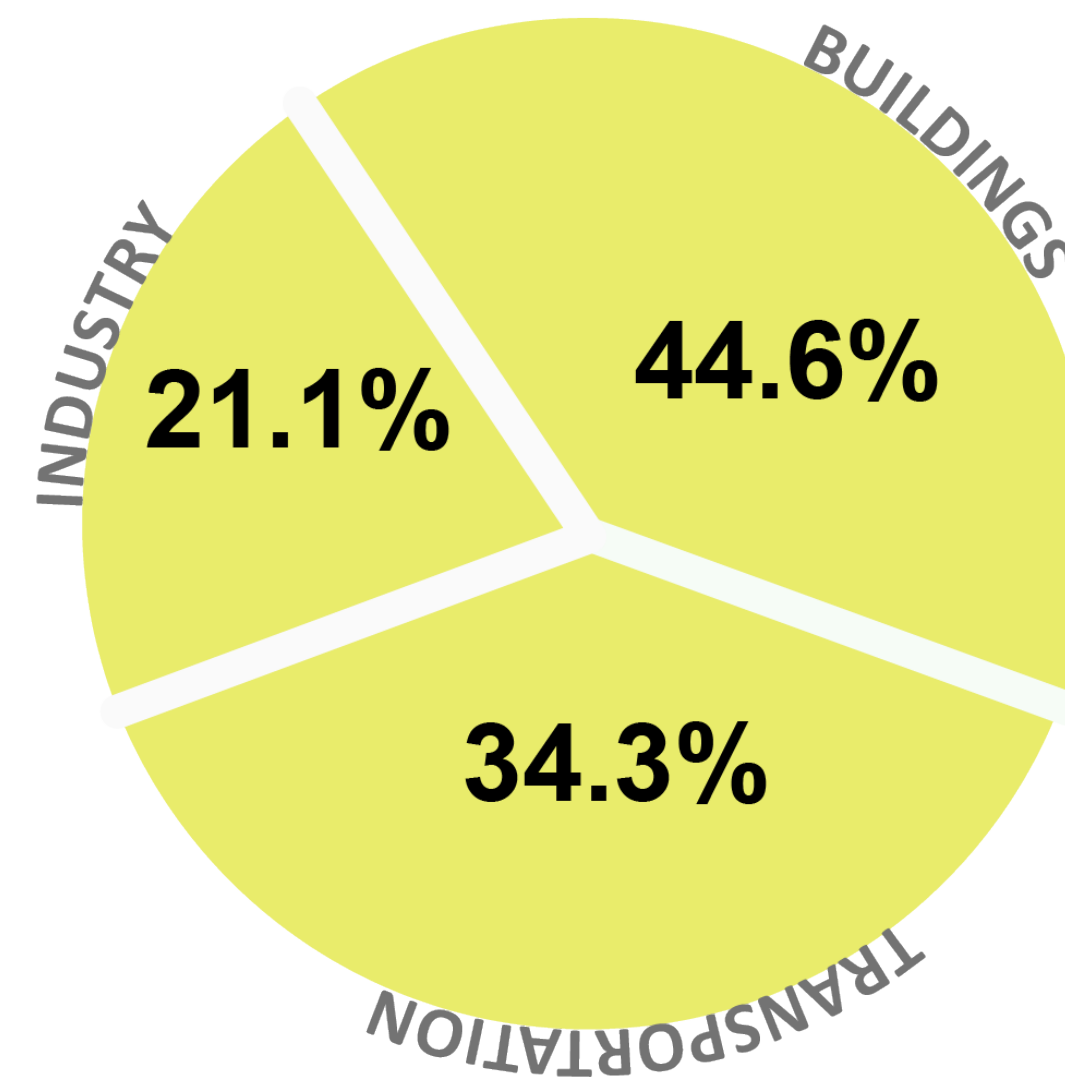
Window to Wall Ratio by Perkins and Will

Perkins&Will

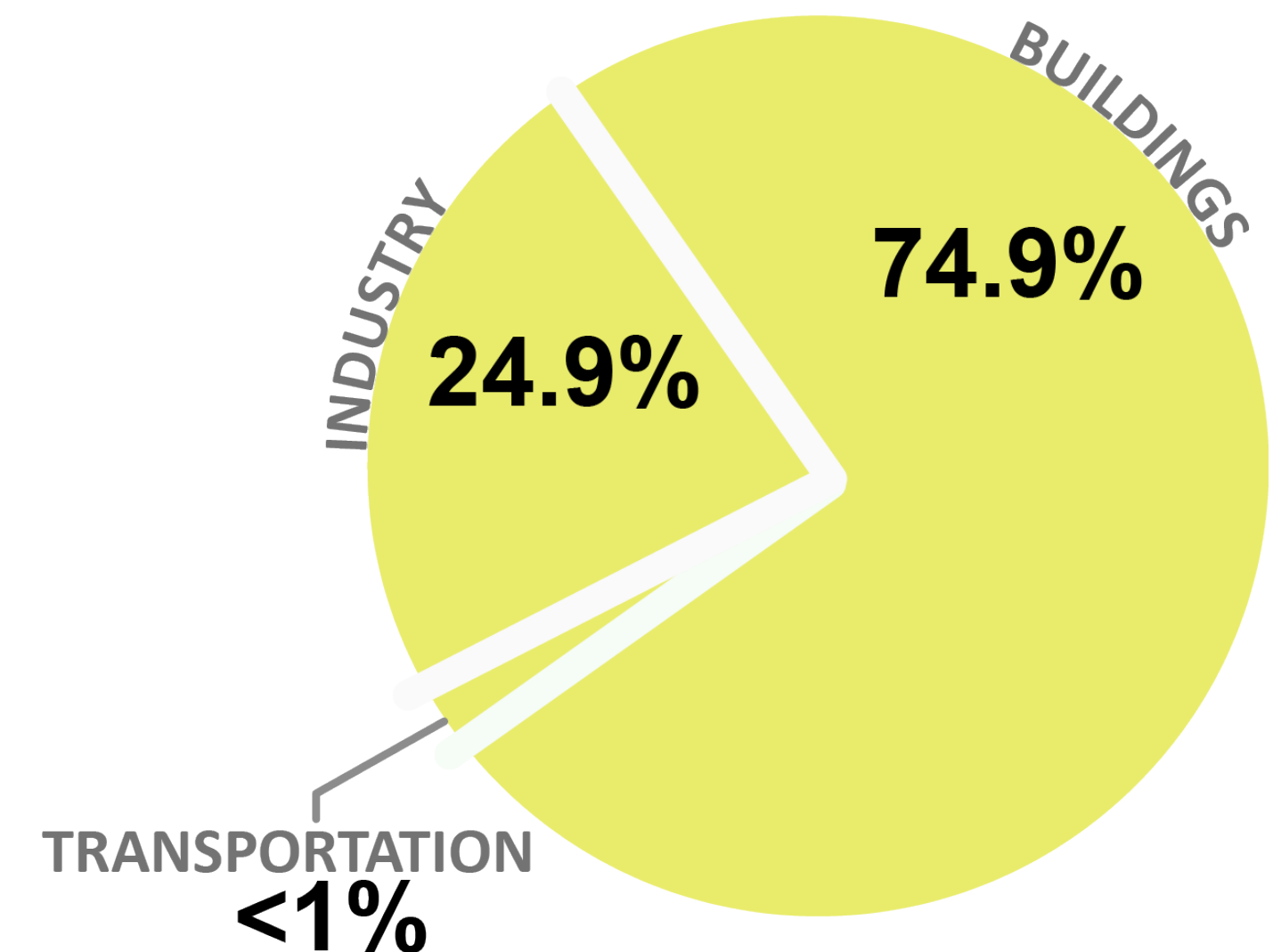
Energy Consumption

- Lighting Energy Contribution
 - 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.

U.S. ENERGY CONSUMPTION
BY SECTOR



U.S. ELECTRICITY CONSUMPTION
BY SECTOR



Source: 2013 2030, Inc./ Architecture 2030. All rights reserved.
Data Source: U.S. Energy Information Administration

Saving Lighting Energy

- Reduce Electric Lighting

–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.

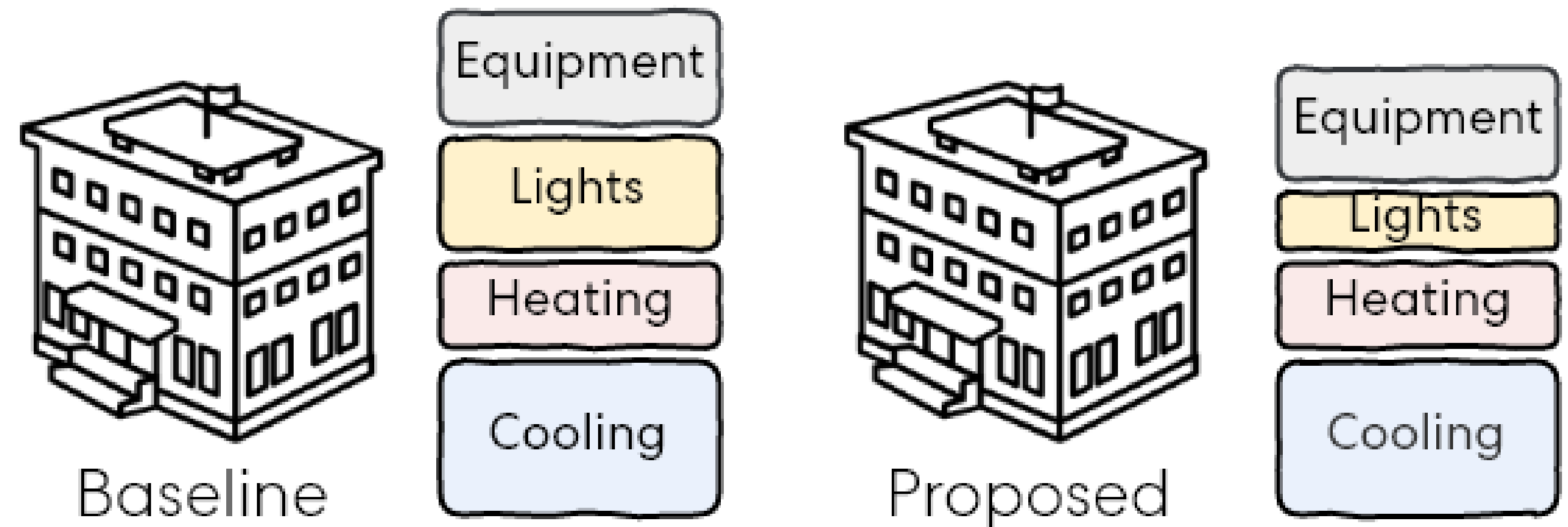
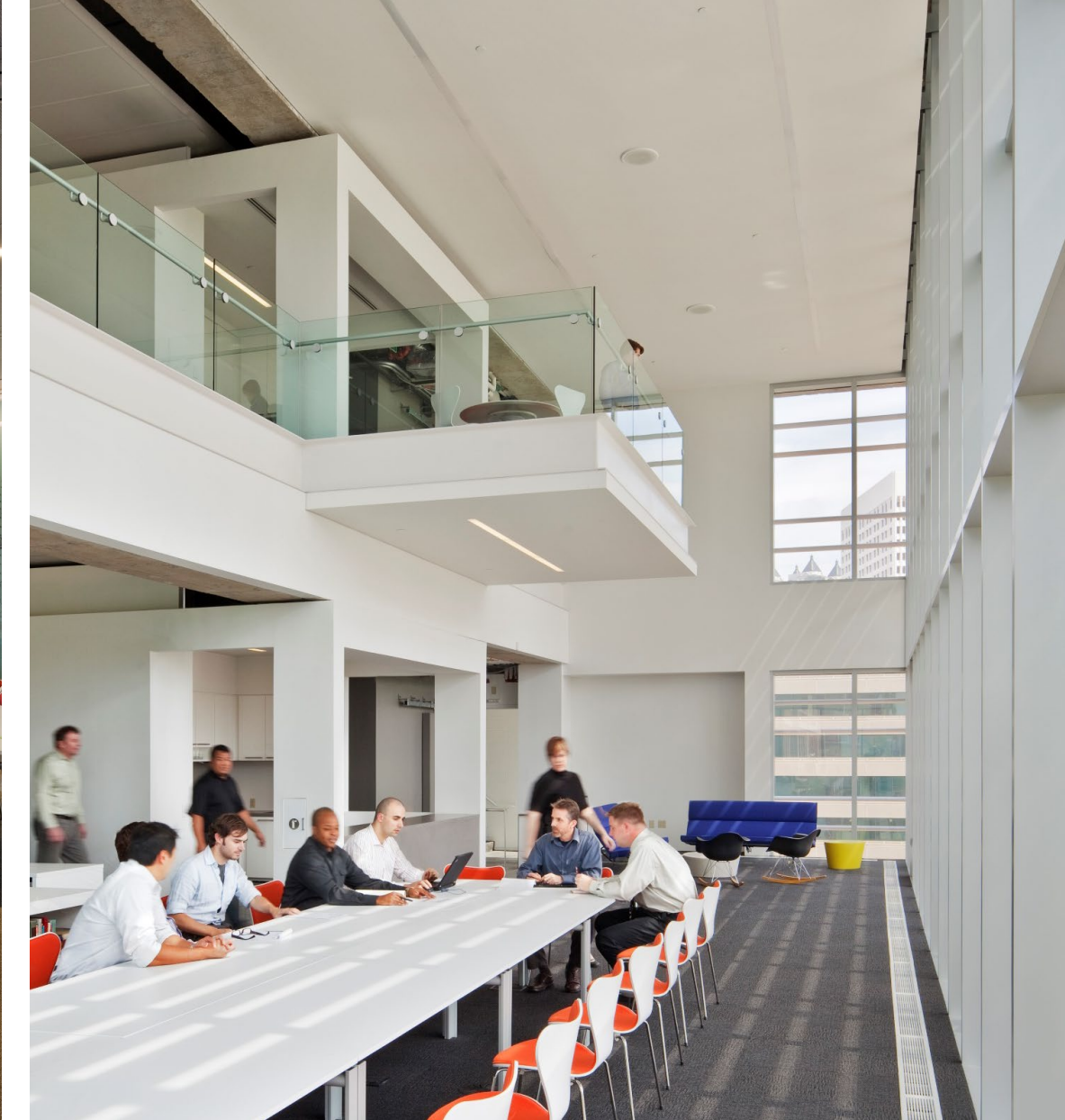


Diagram by Perkins and Will

Perkins&Will

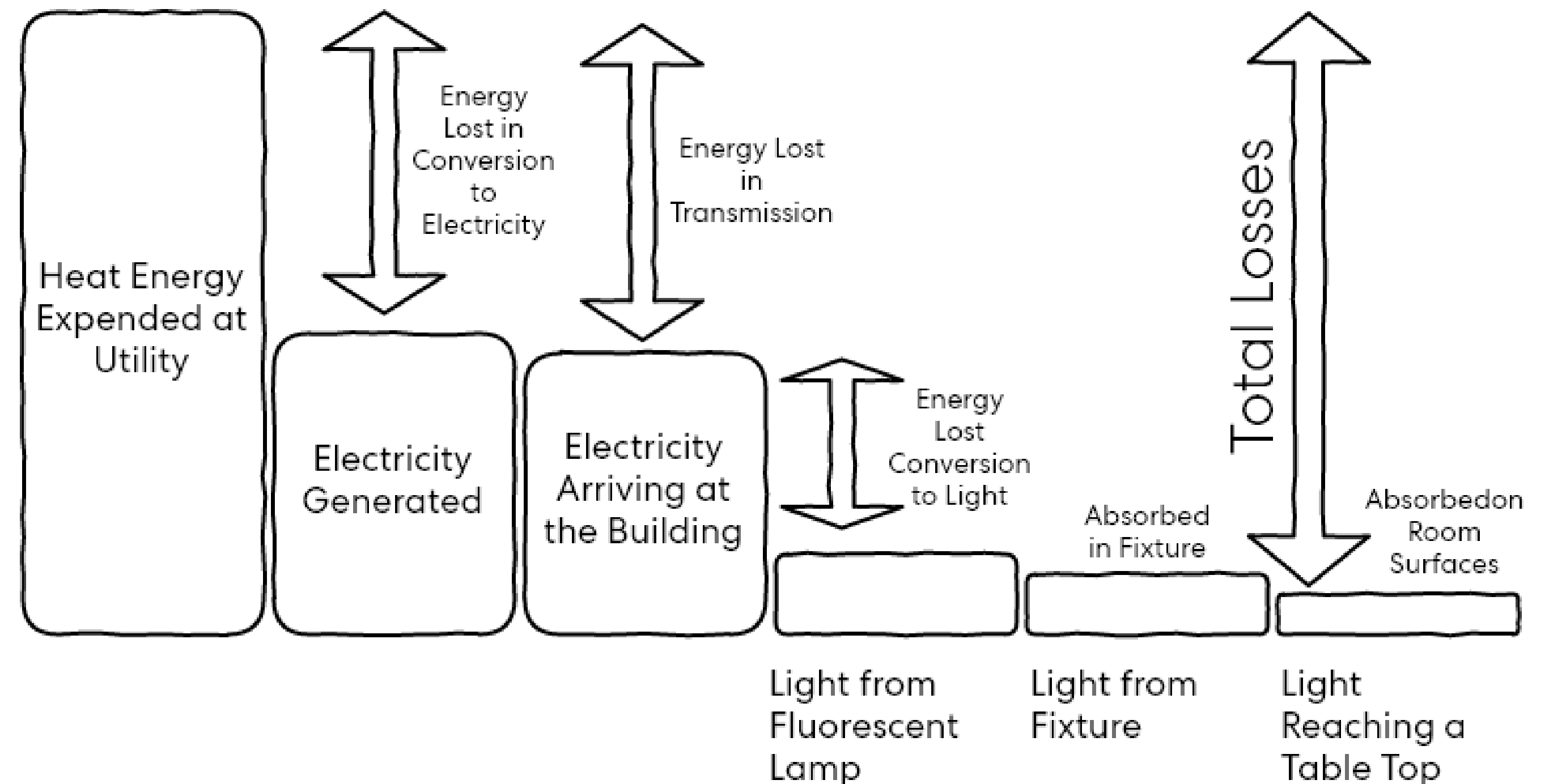
1315 Peachtree Street

- Atlanta Perkins and Will Office
 - Maintaining a connection to natural daylight and usable outdoor space was a design priority.
 - The open workspace allows natural daylight and views throughout every floor.
 - This reduced the amount of energy needed for lighting by **67%**.



Lighting Energy Losses

- An Inefficient Use of Energy
 - 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.
 - Note the conversion and transmission losses in taking raw energy at the power plant to useable illumination on the task surface.



Inefficiencies Of Electric Light Generation By NC State Design Adapted By Perkins and Will

Perkins&Will

Clear, Tinted, and Dark Glazing

- Glazing Visible Light Transmittance
 - A few types of high-performance glazing systems were physically modeled and analyzed with energy simulation to understand performance concerning building energy demand with only change in 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 assumption does not consider the use of any daylight controls to change the lighting energy use.

High-Performance
Glazing with VLT 60%

EUI 206 kBtu/ft²/year

High-Performance
Glazing with VLT 50%

EUI 206 kBtu/ft²/year

High-Performance
Glazing with VLT 40%

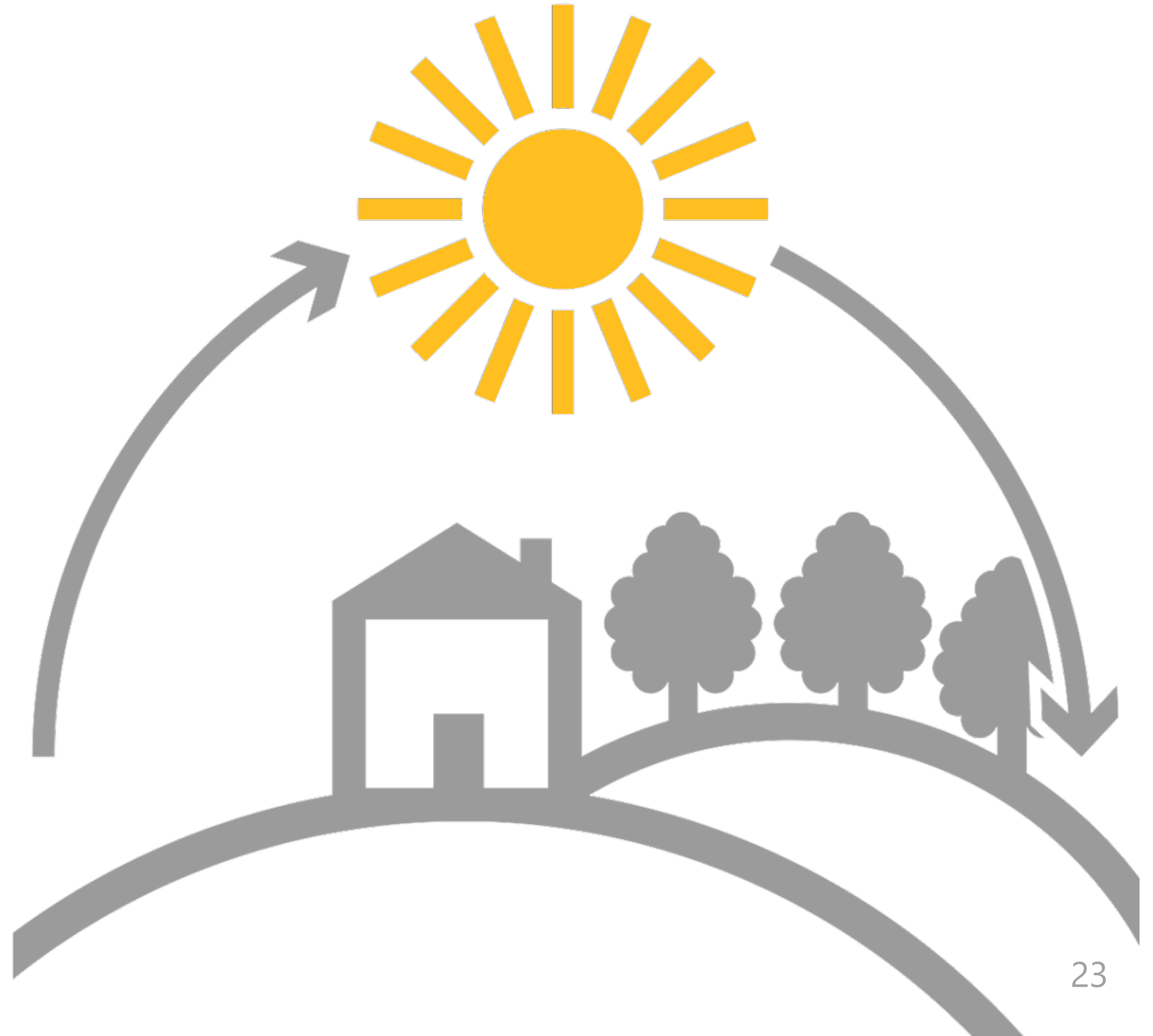
EUI 206 kBtu/ft²/year

Glazing Visible Light Transmittance and Energy Use by Perkins and Will

Perkins&Will

Factors Affecting Daylighting

- 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



Daylighting Design Metrics

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 enough 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.

Daylighting Design Metrics Case Study in Revit

Illuminance
300-3,000 LUX

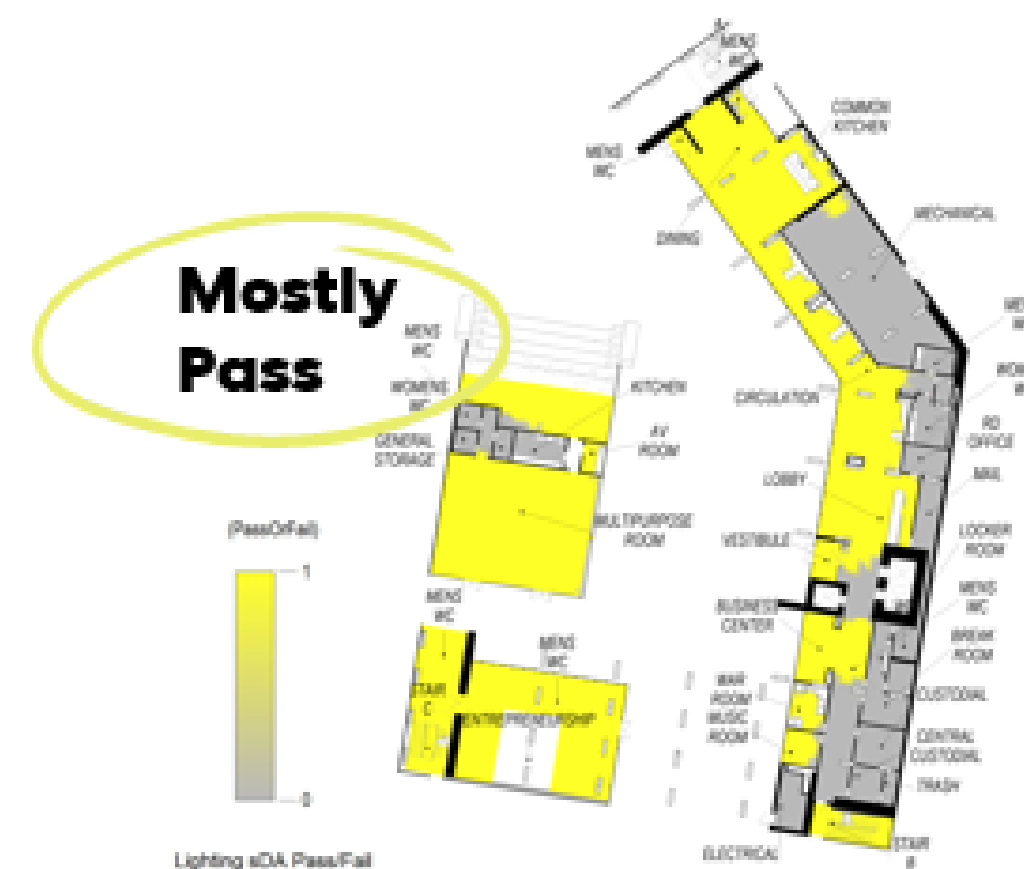


Perkins and Will Project

Opportunities

Daylight quality measures such as daylight and occupant sensors

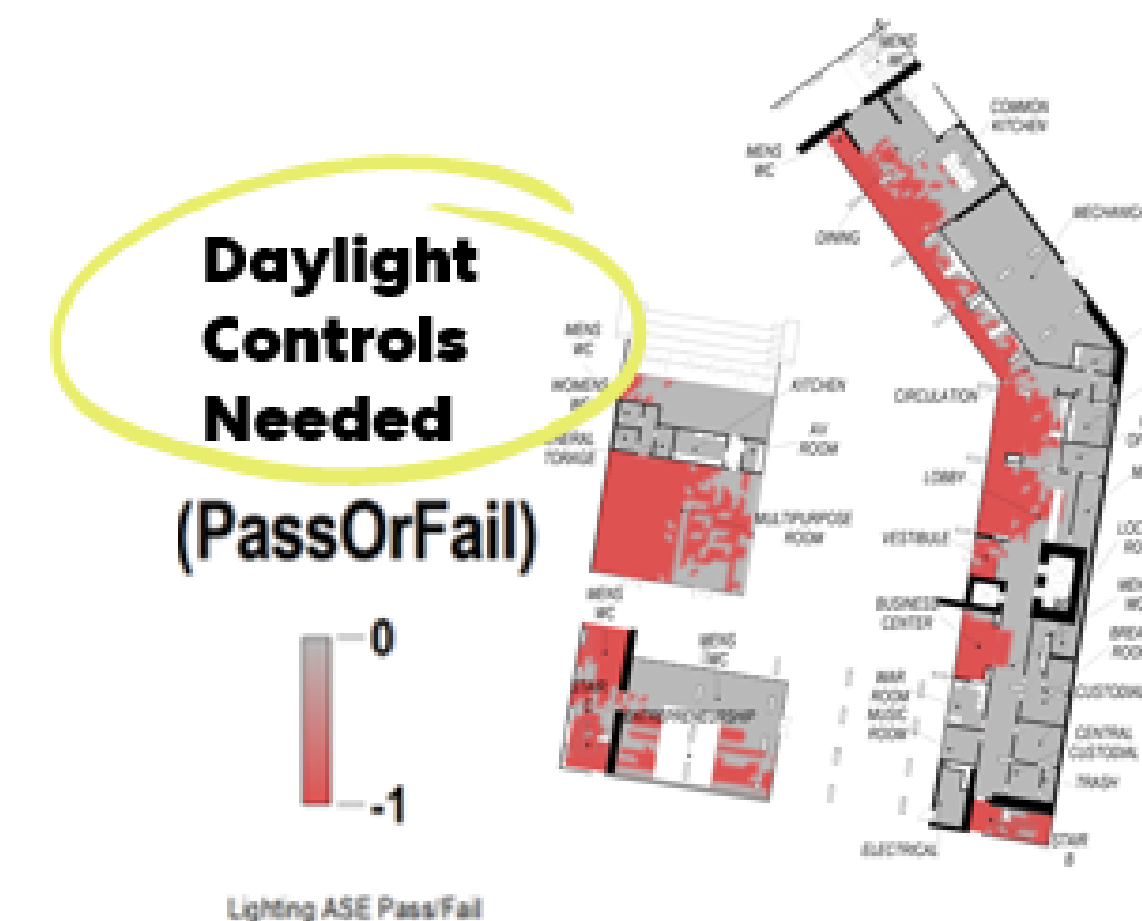
Spatial Daylight Autonomy
sDA 300/50



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

Landscaping that shades structure

Annual Sun Exposure
ASE 1,000/250



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

The image shows a bright, modern interior space, likely a university library or innovation center. It features a high ceiling with recessed lighting, large windows on the left side, and a multi-level design with glass railings. People are seen working at tables, sitting on colorful armchairs, and walking through the space. The overall atmosphere is open and collaborative.

WHAT runs a daylight analysis?

Why should we use Revit for daylighting analysis?

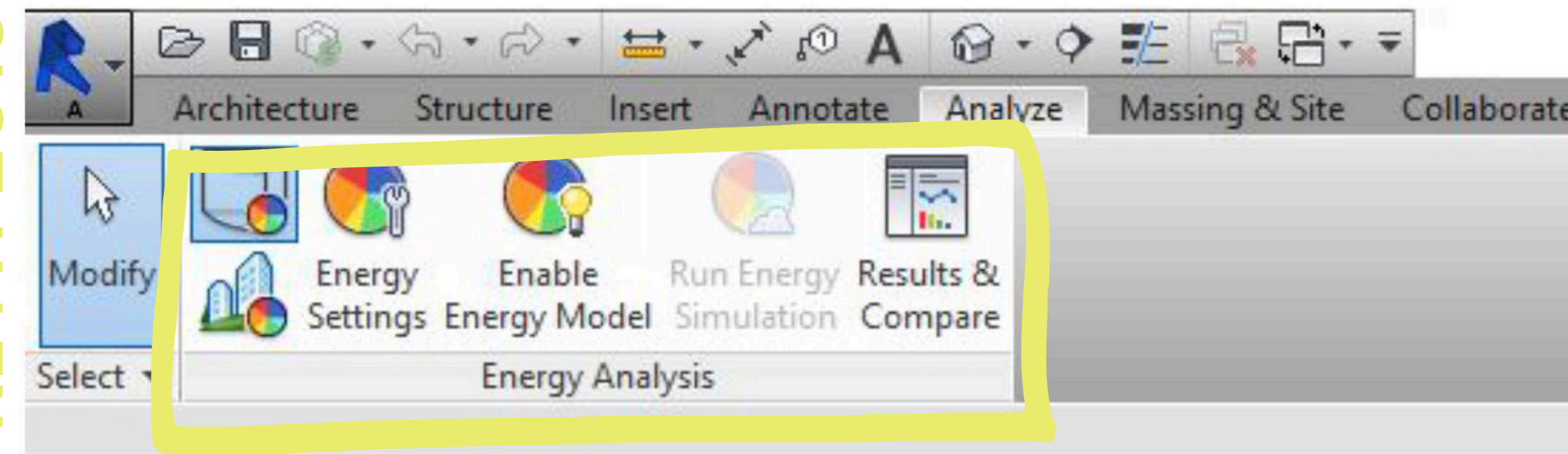
- Useful Daylighting Simulation must provide:
 - Accurate calculation
 - Quick performance feedback
 - Simple Visual Information
 - Report on progress of daylight sustainability goals such as sDA and ASE



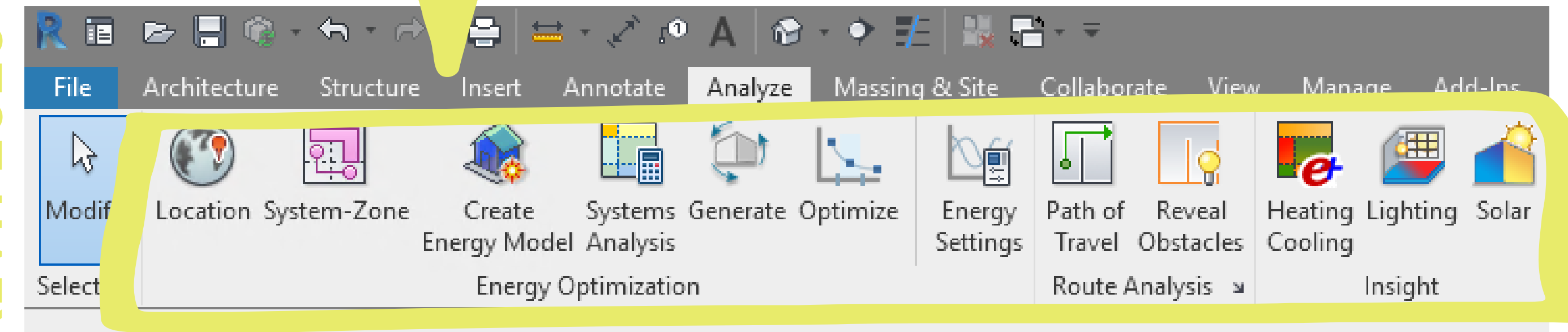
I INSIGHT

- Revit plug-in that serves as a building performance analysis software.
- Can use Insight to analyze:
 1. Energy
 2. Lighting
 3. Solar
- 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

REVIT 2015

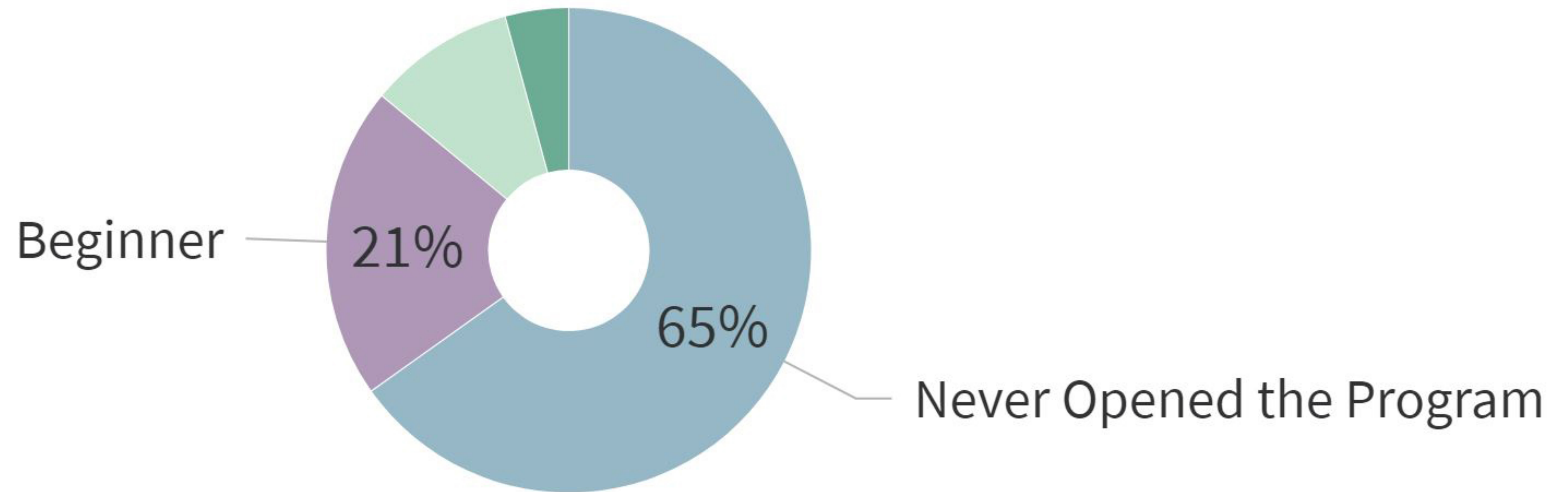


REVIT 2020



What is your Insight Lighting level of expertise?

Never Opened the Program **A** Beginner **B** Intermediate **C** Advanced **D**





HOW to run a daylight analysis?

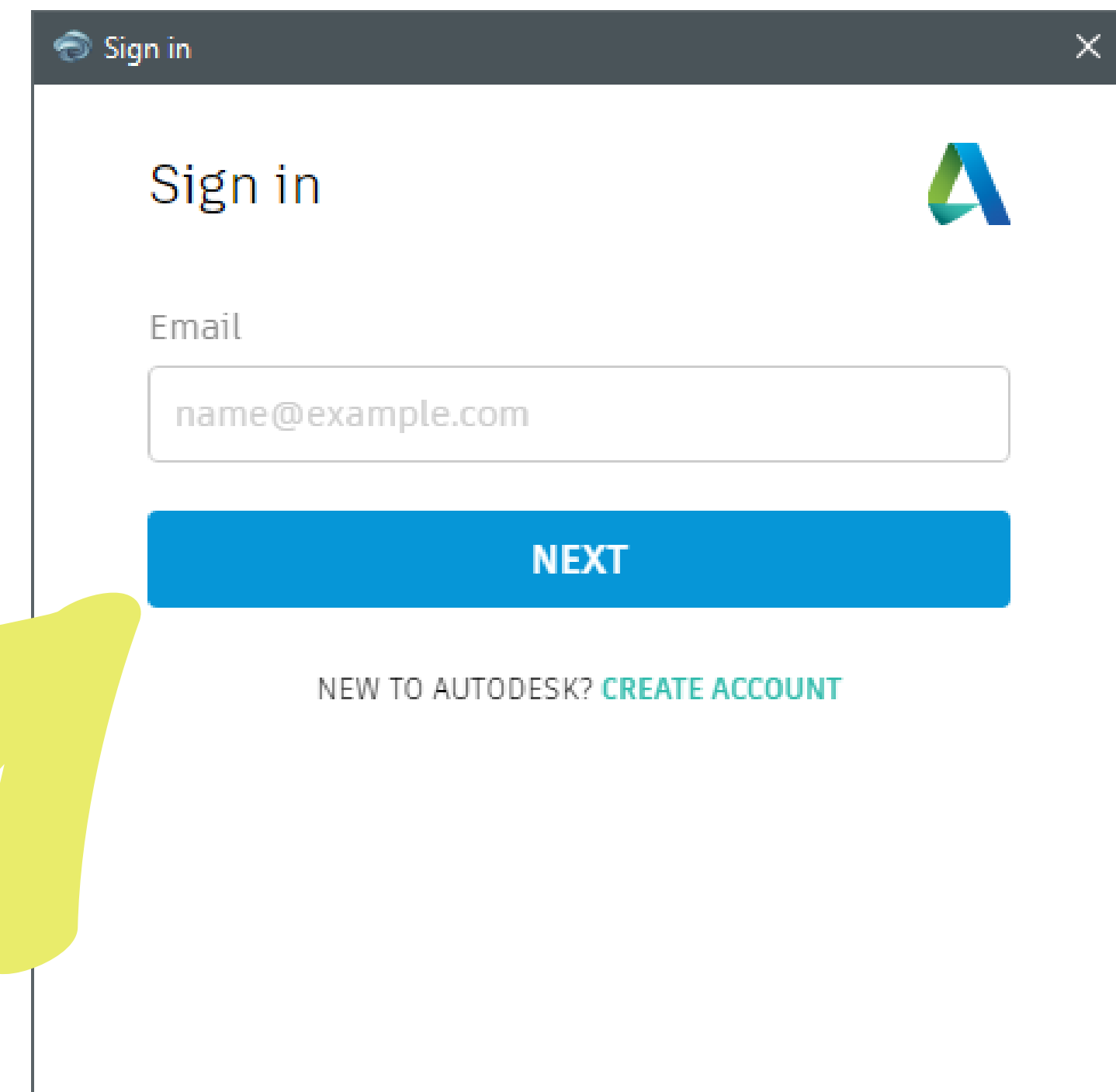
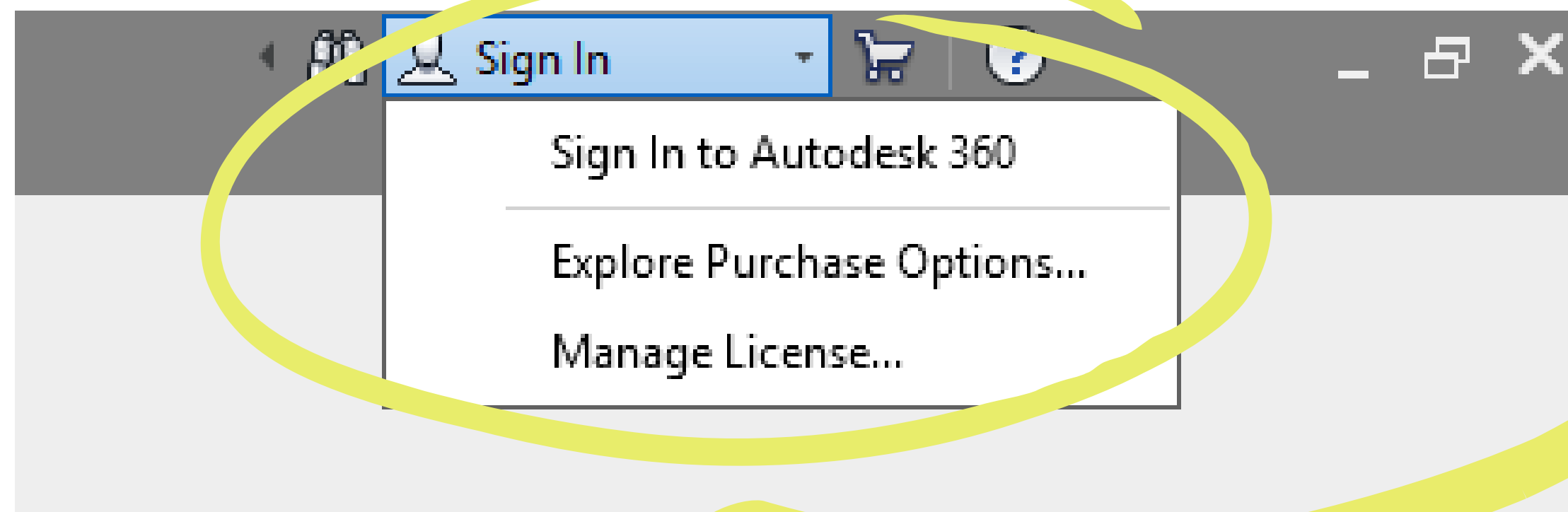
General Steps to Using Insight

1. Be sure to be signed-in to your Autodesk 360 account.
2. Set model location.
3. Model contents and cleanup.
4. Create appropriate glazing criteria in the model for visible light transmittance and opaque surfaces performance.
5. Select an Analysis with an appropriate grid resolution.
6. 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.
7. Open the room analysis schedule and verify the regularly occupied rooms to include in the daylighting analysis.
8. Generate and View Results to update the lighting analysis design results with your routinely selected regularly occupied rooms.
9. Review the analysis with the design team for making decisions to improve the design.

STEP 1

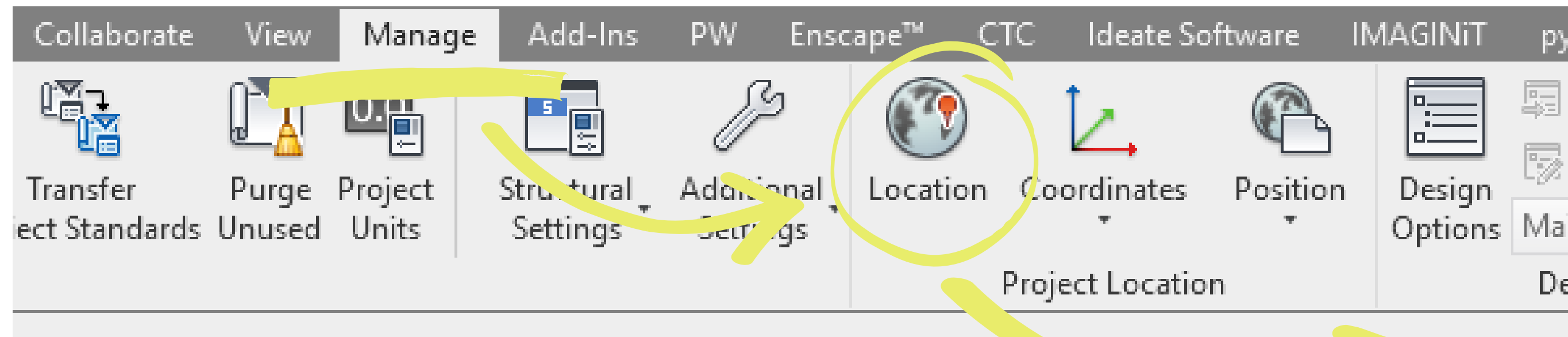
Autodesk Sign-In

- Sign into your Autodesk Account you have set up prior to opening your Revit model but within your Revit session.
- Confirm your Autodesk username matches your Revit username.

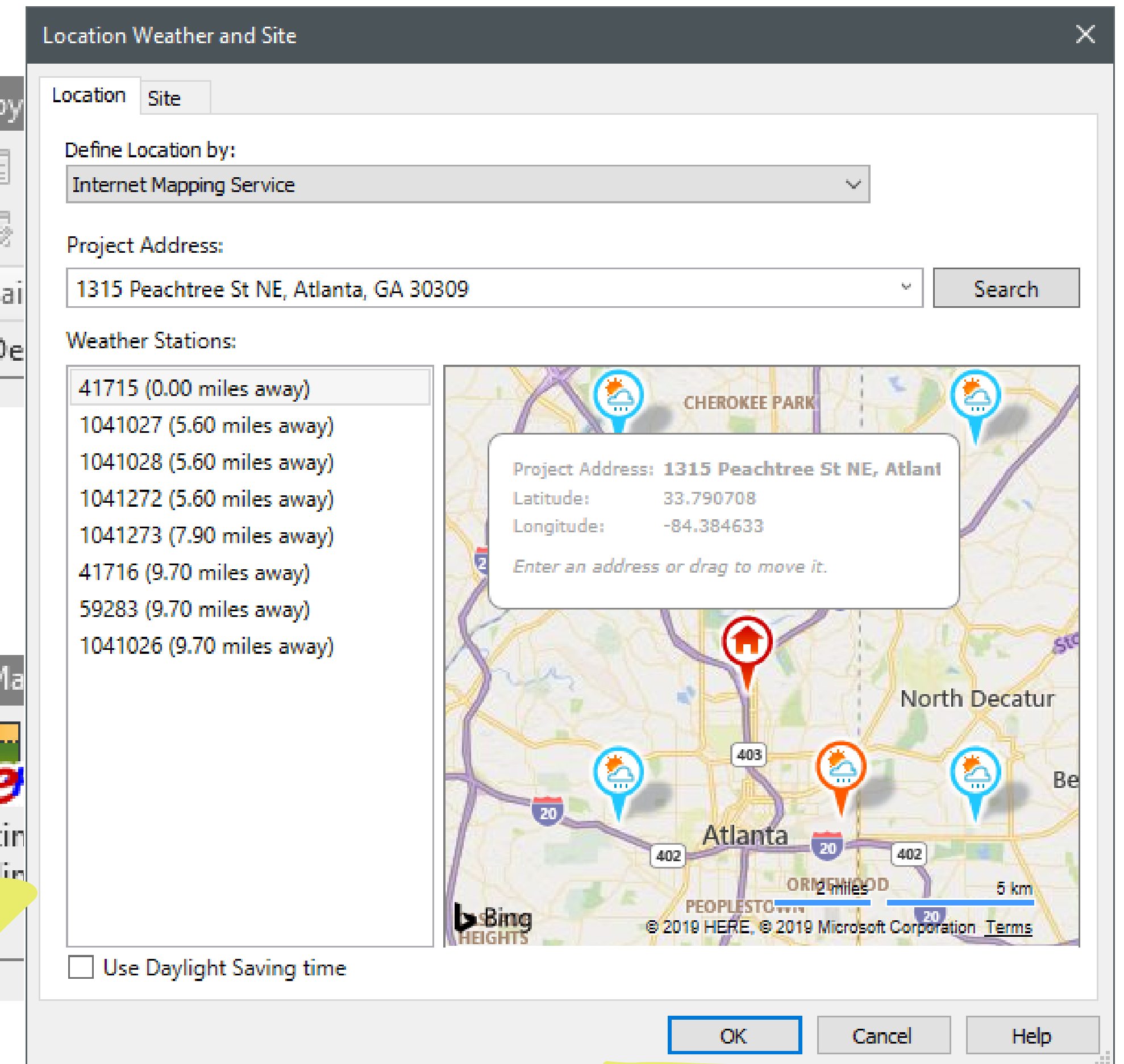
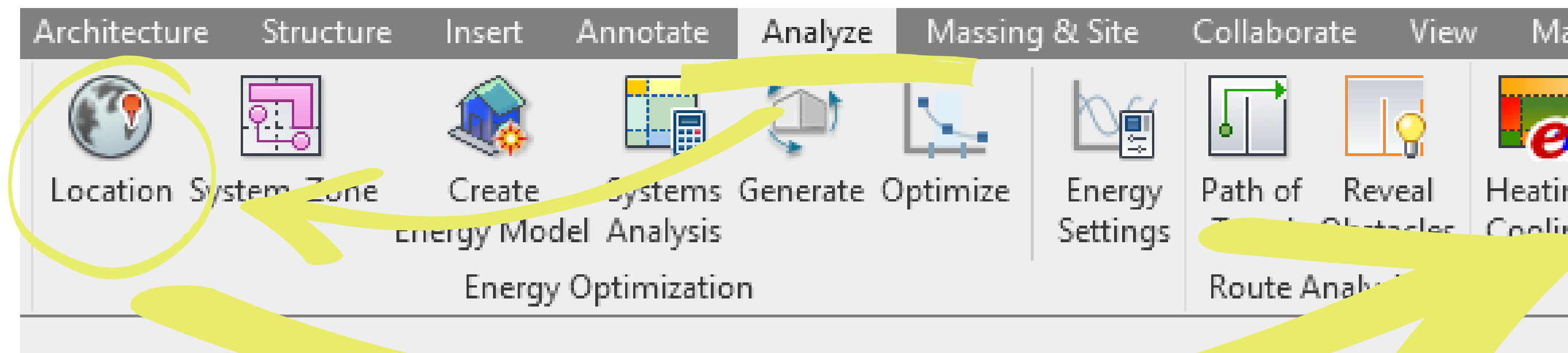


STEP 2

Set Revit Model Location



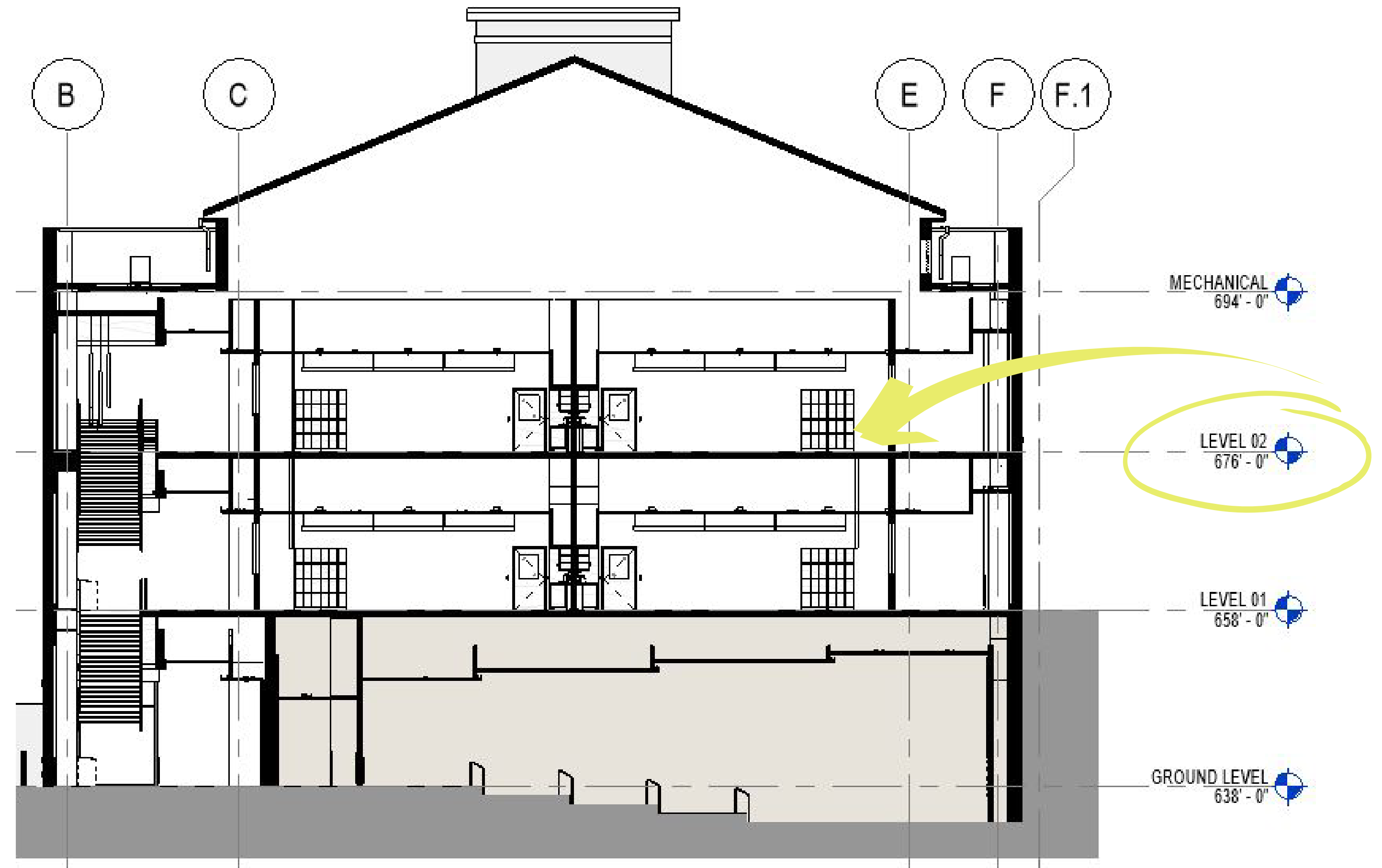
OR



STEP 3.1

Elements that Must be Modeled

1. At least one level must be created
2. An enclosed space (this can consist of a floor to floor space, a floor to ceiling space, or a floor to roof space)
3. Glazing must be present
4. A room must be placed

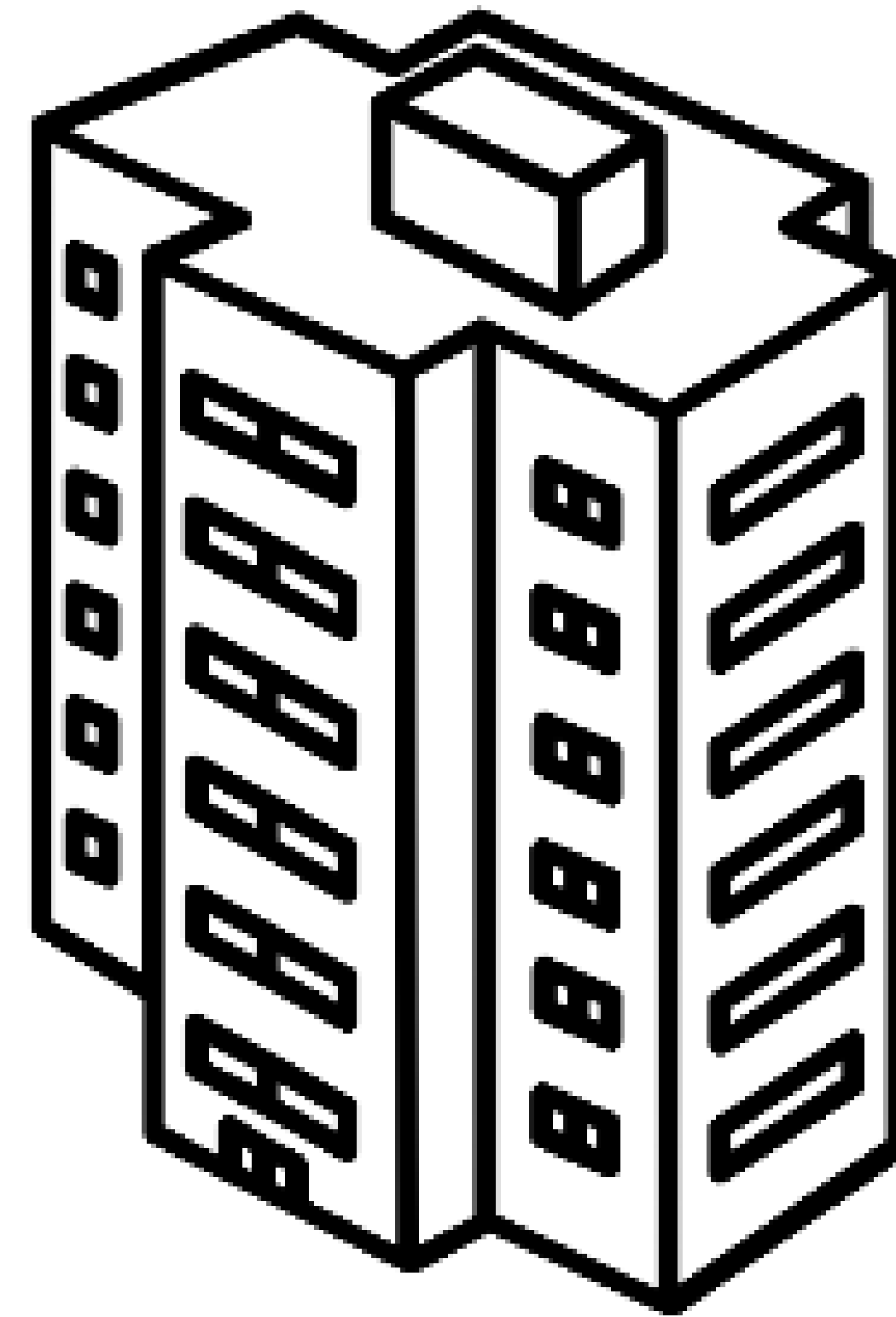


Perkins and Will Project

STEP 3.2

Model Contents and Cleanup

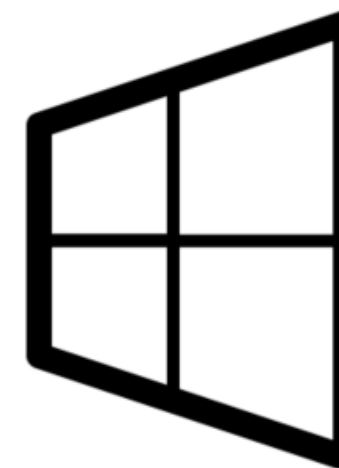
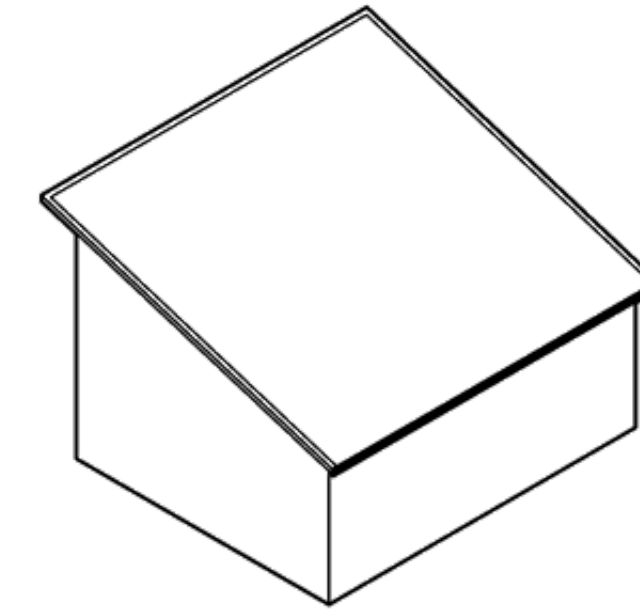
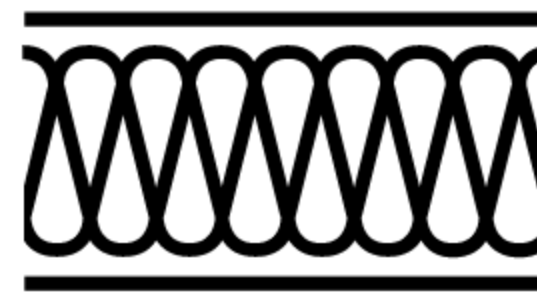
- Digital Models Today
 - Divided into areas of work using links
 - Or a single model but with a digital building model execution plan for future model breakup
- Daylighting Requires
 - Rooms and Floors in the same model
- Overview of Model Prep
 - Detach a saved copy of the model with rooms from an interiors model if not in a single model
 - Copy Monitor any floors from another model such as Core and Shell
 - Glazing changes from “Render-Ready” to “Daylighting Design-Ready”



STEP 3.3

Final Checks

- Verify that ceilings, exterior walls and roofs are in either the main model or in a linked model and are visible.
- Check that there are no transparent materials applied to the model elements listed above.
- Turn off all light fixtures as these will interfere with the daylight analysis.
- Check glazing areas for misplaced opaque geometry that block glazing areas as these will interfere with the daylight analysis.
- Check to be sure there are no modeled floors representing anything other than your actual floor levels, such as landscape elements or terrain.

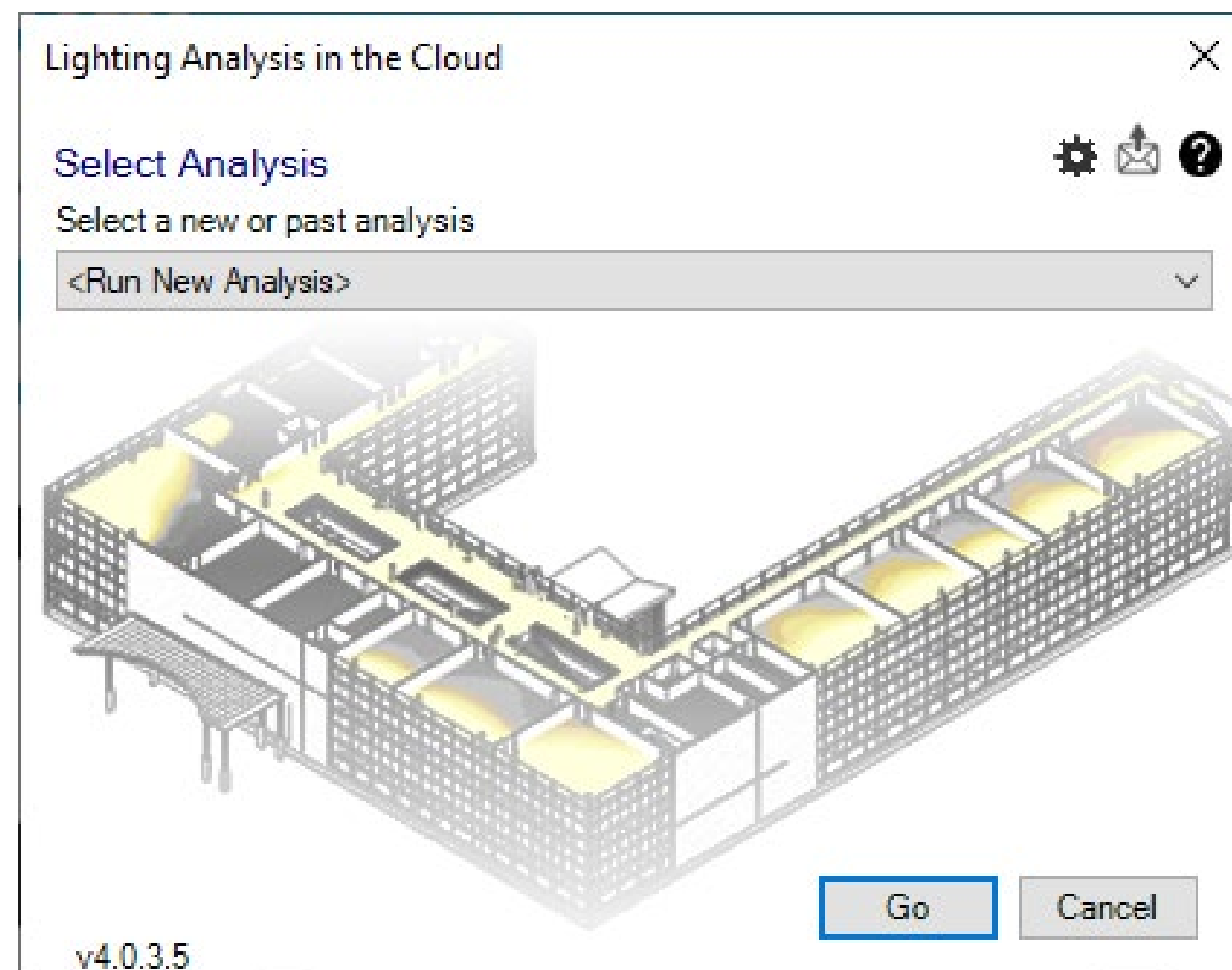


STEP 4.1 a

Setting Valid Glazing Properties (Tvis)

1. See the following URL for special instructions concerning glazing VLT for Insight version 4.0 or later

– [Weblink](#)



2. Using the Glazing Material Prior to Insight Plugin V4 and V2 Cloud Rendering Engine
 - Multiply your Actual Glass Product VLT in % by 255 to get the Insight Plugin V4 individual RGB values

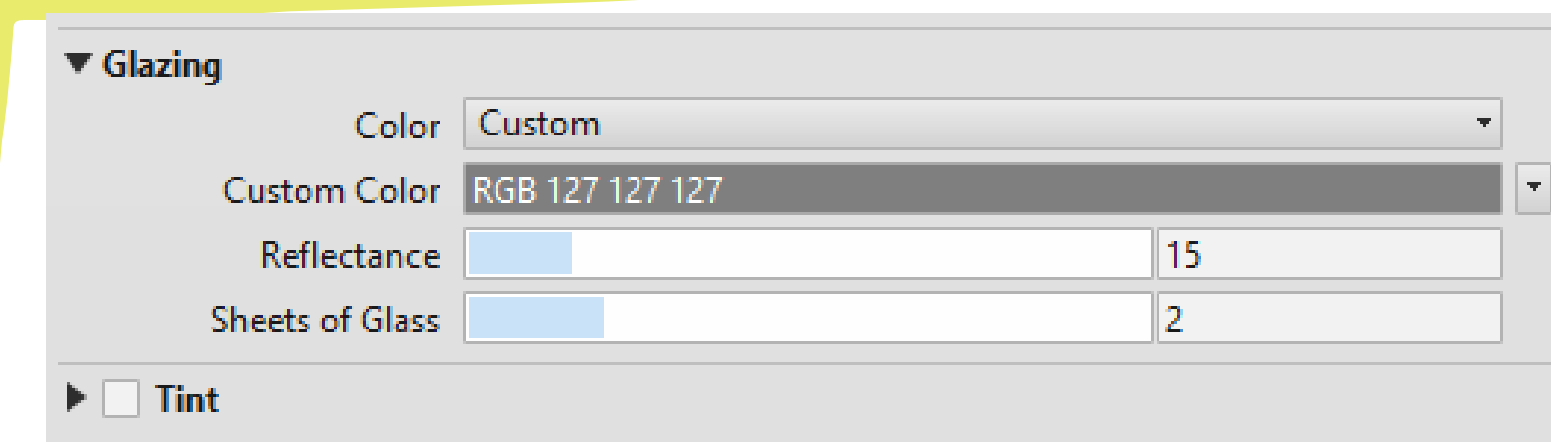
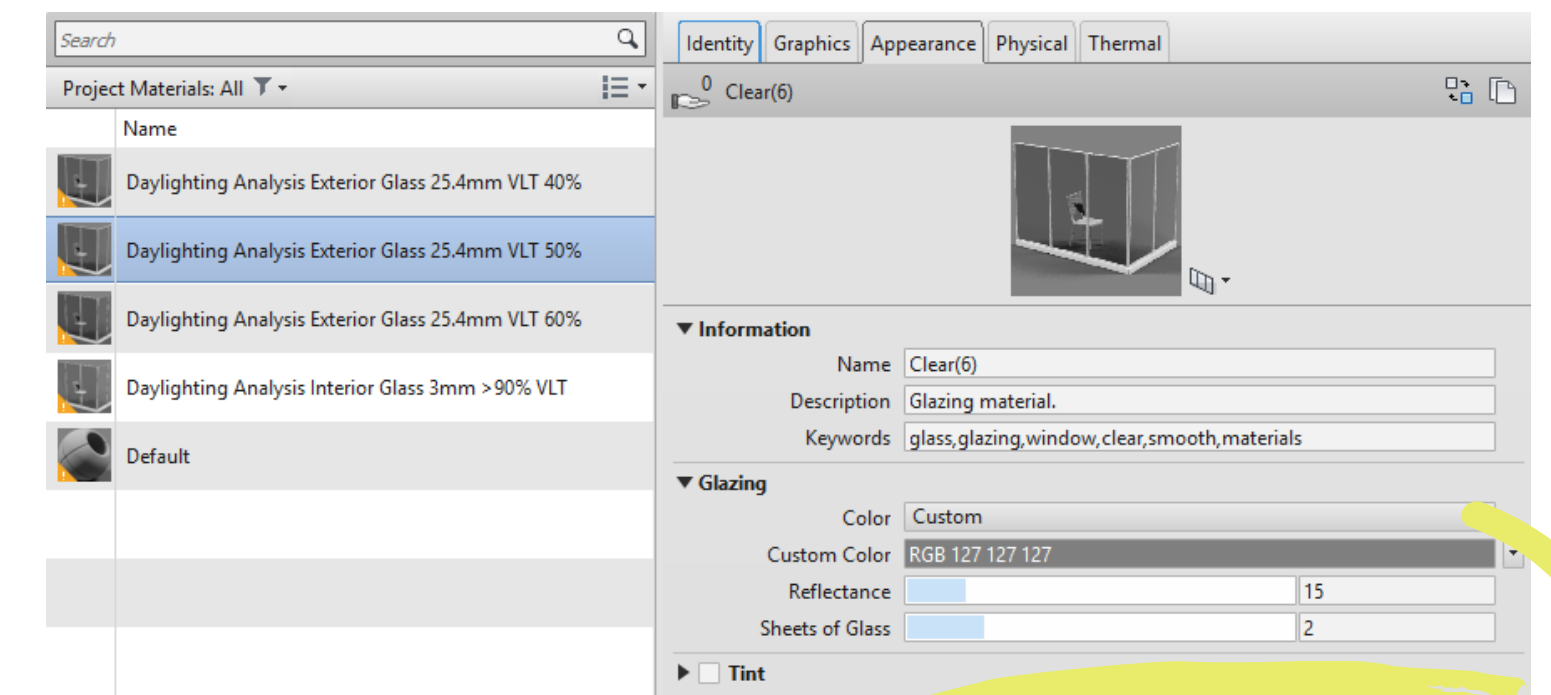
Example:

Glazing Product VLT is 50%

Individual R, G, and B Values are:

$$0.50 \times 255 = 127.5$$

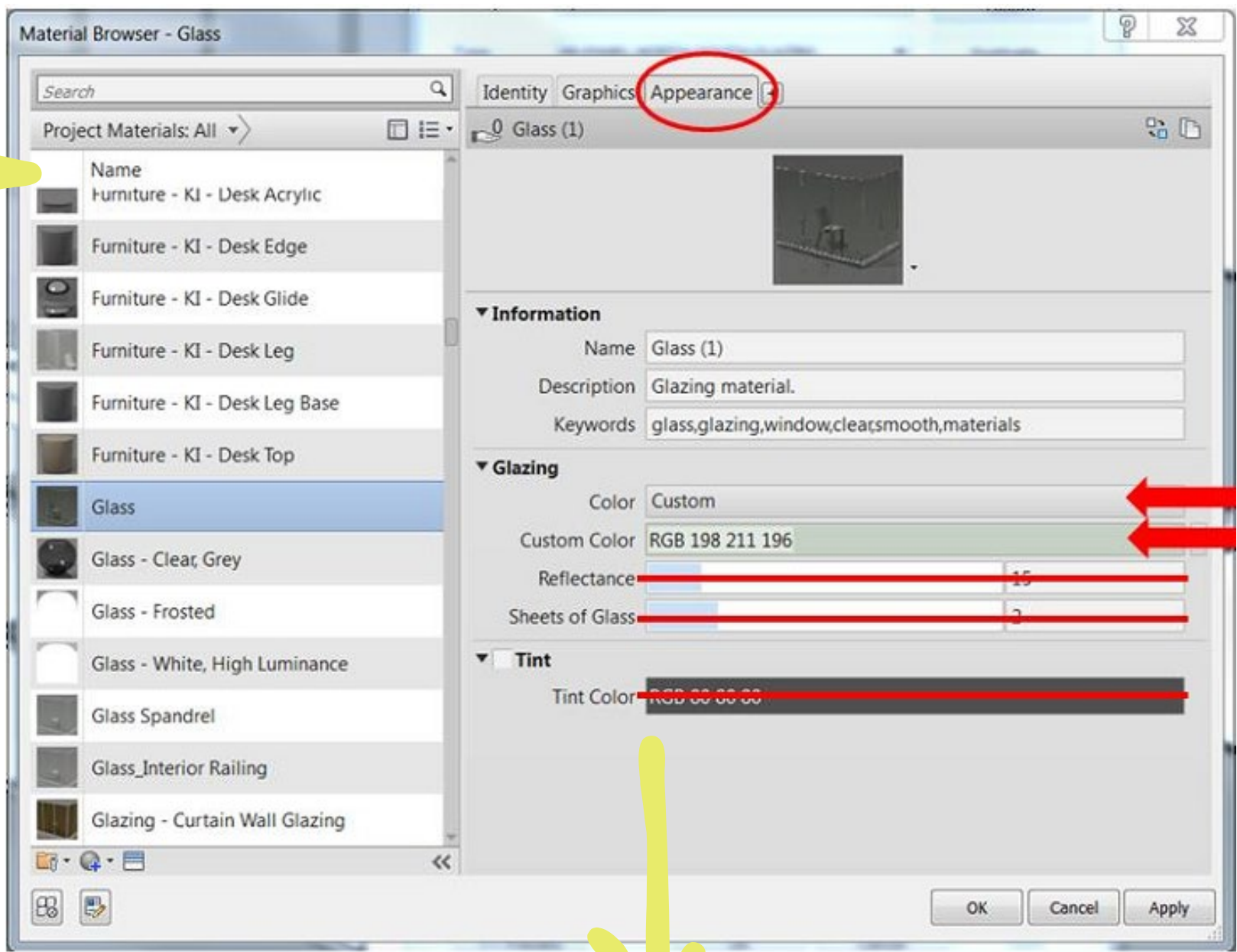
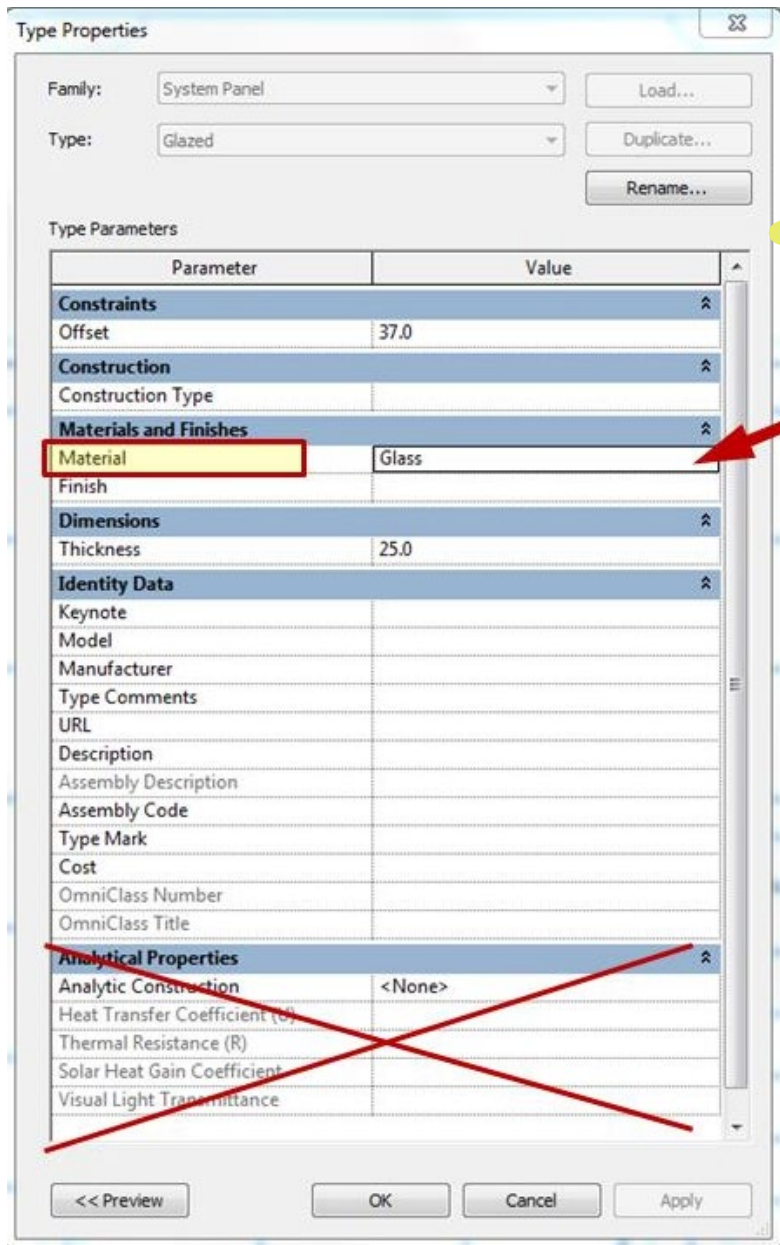
- We round it down per Autodesk instruction to 127 for similarity to 50% VLT.
- The new glazing visual transmission model does not consider the thickness of the modeled glass element.



STEP 4.1b

Setting Valid Glazing Properties (Tvis)
Insight Version Before 4.0

- 1. Select the glass pane to which you want to assign material properties and From the **Properties** editor, select **Edit Type**.
- 2. From the **Material and Finishes** category, click on the "..." in the **Value** column for **Material** (or select window and in the properties window from **Materials and Finishes** select "..." in front of glass).
- 3. In the **Material Browser** dialog box go straight to the **Appearance** tab.
- 4. Note that T-Vis should be set by changing ONLY the **Custom Color** parameter. In the Color field, select **Custom**.
- 5. Set the RGB value with the help of the table provided.



R,G,B Tvis										
Thickness		90%	80%	70%	60%	50%	40%	30%	20%	10%
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
dual	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
	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
triple	6.0 mm	-	198	113	59	28	11	3	0	0
	8.0 mm	-	211	139	86	48	24	9	2	0
	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

STEP 4.2 b

Using the Revit Glazing RGB VLT Calculator
Insight Version Before 4.0

- 1. Use the table provided here, along with the RGB table provided in the prior slide, to set up your Revit Glass Transparent Settings.

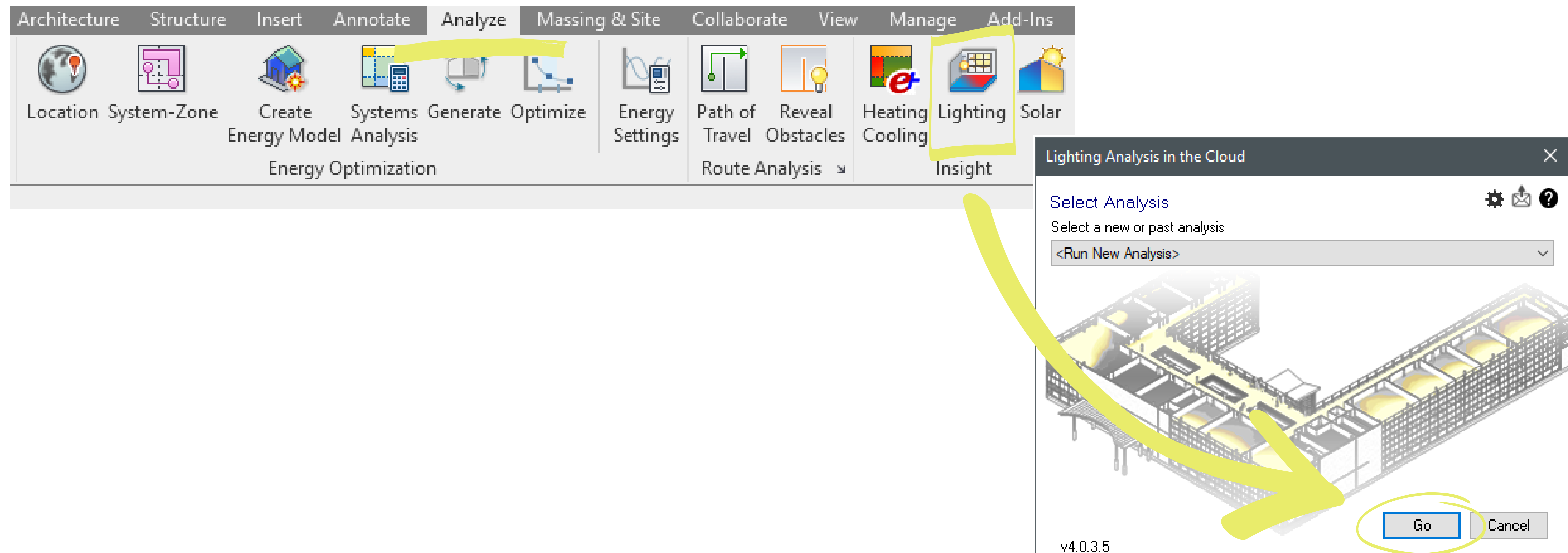
	A	B	C
1	Steps	Revit Glass Transparent Settings	
2	Step 1	50.00	Actual Glass Product VLT (%)
3	Step 2	60.00	Closest VLT to Actual Product VLT from Autodesk Document(%)
4	Step 3	113	RGB of VLT Above Actual Glass Product VLT
5	Step 4	59	RGB of VLT At or Below Actual Glass Product VLT
6	Auto	5.4	Calculated Change Per % Point
7	Auto	54	Calculated Difference
8	Auto	10.00	Calculated Difference
9	Revit Glazing RGB	113	Actual Glass Product Revit Daylight Glazing RGB
10			

This table can be found here for your use: <https://1drv.ms/x/s!Ave4LshhbAEuhZOR6PB3dFr4MKOcIA?e=eGddqB>

STEP 5.1

Insight Access

- Launch Insight from within the Revit model.



STEP 5.2

Grid Resolution

- The grid resolution will effect the cost to run the daylight analysis.
 - The lower the grid resolution, the more expensive your daylight analysis will be
- 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.
- 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

Lighting Analysis in the Cloud

Select Analysis Type

For best results, follow the best practices checklist in Help

Analysis: **Illuminance Analysis**

Levels: **Level 1**

Environment

Location: 1315 Peachtree St NE, Atlanta, GA 30309

Date/Time: ... Define Environments in Analysis Settings

The following environments are defined

9/21 9am - GHI: 373, DNI: 571, DHI: 82

9/21 3pm - GHI: 544, DNI: 687, DHI: 88

Illuminance Settings

Threshold: Lower: **300** Upper: **3000** **Lux**

Analysis Plane Height: **32** inches above floor

Thresholds are used for results in Room and Floor Schedules

Cloud Credits

Resolution: **72 inch grid**

Required: Check Price

Available: 124 Credits

v4.0.3.5

Check Price Cancel

STEP 6

Run Analysis

1. Select appropriate analysis type.

- Illuminance Analysis
- Daylight Autonomy (sDA preview)
- LEED 2009 IEQc8 opt1
- LEED V4 EQc7 opt 1 (sDA+ASE)
- LEED V4 EQc7 opt 2
- Solar Access

2. Select floor levels to analyze.

3. Select resolution.

4. Click “Check Price.”

5. Click “Start Analysis.”

Lighting Analysis in the Cloud

Select Analysis Type

For best results, follow the best practices checklist in Help

Analysis: **Illuminance Analysis**

Levels: **Level 1**

Environment

Location: 1315 Peachtree St NE, Atlanta, GA 30309

Date/Time: ... Define Environments in Analysis Settings

The following environments are defined

9/21 9am - GHI: 373, DNI: 571, DHI: 82

9/21 3pm - GHI: 544, DNI: 687, DHI: 88

Illuminance Settings

Threshold: Lower: **300** Upper: **3000** **Lux**

Analysis Plane Height: **32** inches above floor

Thresholds are used for results in Room and Floor Schedules

Cloud Credits

Resolution: **72 inch grid**

Required: Check Price

Available: 124 Credits

v4.0.3.5

Check Price Cancel

Lighting Analysis in the Cloud

Select Analysis Type

For best results, follow the best practices checklist in Help

Analysis: **Illuminance Analysis**

Levels: **Level 1**

Environment

Location: 1315 Peachtree St NE, Atlanta, GA 30309

Date/Time: ... Define Environments in Analysis Settings

The following environments are defined

9/21 9am - GHI: 373, DNI: 571, DHI: 82

9/21 3pm - GHI: 544, DNI: 687, DHI: 88

Illuminance Settings

Threshold: Lower: **300** Upper: **3000** **Lux**

Analysis Plane Height: **32** inches above floor

Thresholds are used for results in Room and Floor Schedules

Cloud Credits

Resolution: **72 inch grid**

Required: 0 Credits

Available: 124 Credits

v4.0.3.5

Start Analysis Cancel

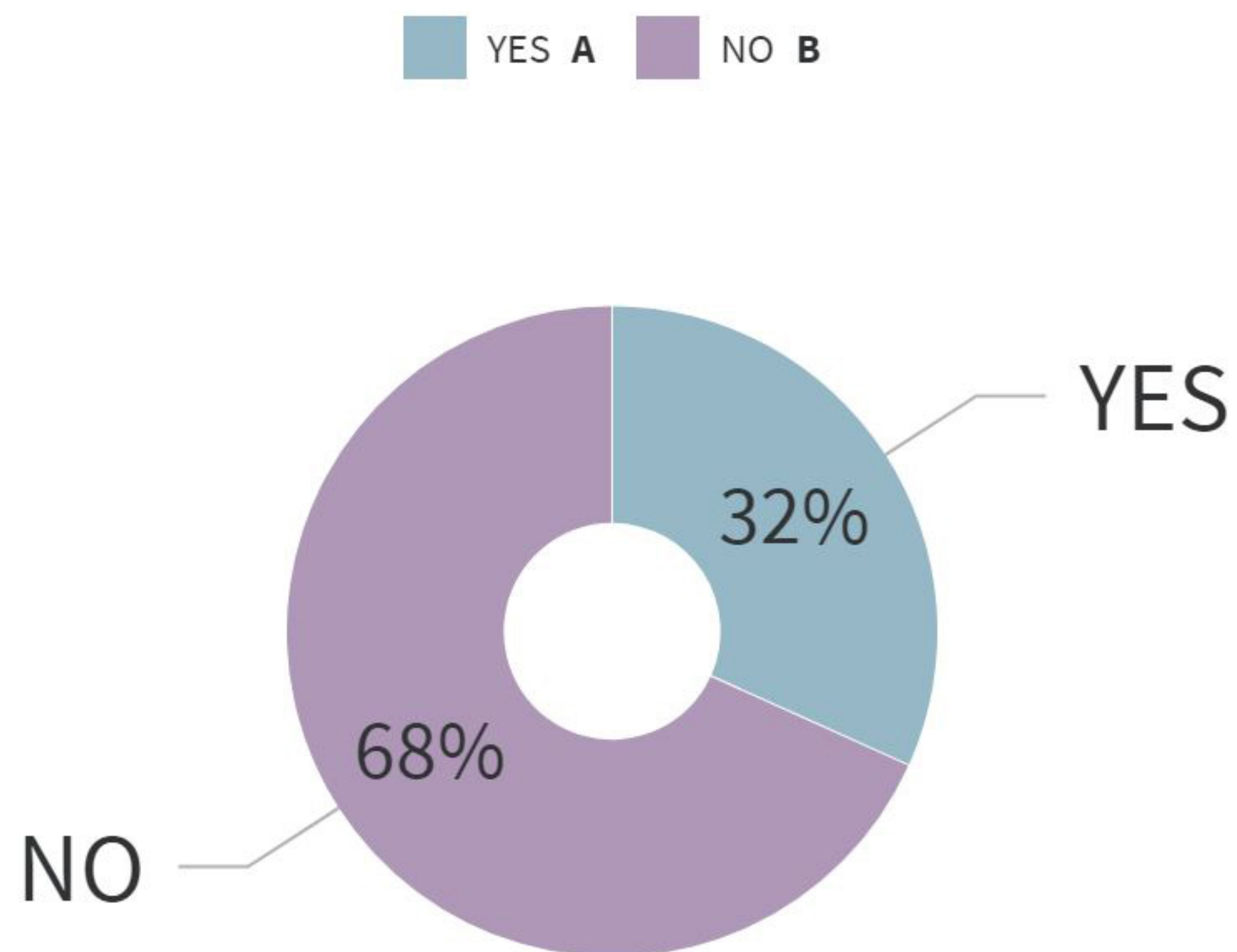
STEP 7

Setup Daylighting Room Schedule

- Running the analysis will create a 3D view specifically for Insight Daylighting with schedules for the floors and the rooms within the model.
- Verify the regularly occupied spaces to include in the daylighting analysis.
- Defining the spaces:
 - Occupied Space
 - Non-Occupied Space
 - Daylight Exempt Occupied Space



Do you have experience submitting documentation for LEED Daylighting Credits?



Design Targets for LEED Daylighting

Design Targets for LEED Daylighting Option 1 Credit



LEED Daylight Credit SimulationSDA/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

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 for LEED

- 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

The screenshot shows the 'Lighting Analysis in the Cloud' dialog box. The 'Select Analysis Type' section has 'Illuminance Analysis' selected in the dropdown menu, which is circled in yellow. Below this, the 'Environment' section shows the location '1315 Peachtree St NE, Atlanta, GA 30309' and a date/time of '9/21 9am'. The 'Illuminance Settings' section shows a threshold of '300' to '3000' Lux and an analysis plane height of '32' inches. The 'Cloud Credits' section shows a resolution of '72 inch grid' and 124 credits available. A yellow arrow points from the 'Illuminance Analysis' dropdown to the 'LEED v4 EQc7 opt 2' dropdown in the next screenshot.

Lighting Analysis in the Cloud

Select Analysis Type

For best results, follow the best practices checklist in Help

Analysis: **Illuminance Analysis**

Levels: Level 1

Environment

Location: 1315 Peachtree St NE, Atlanta, GA 30309

Date/Time: ... Define Environments in Analysis Settings

The following environments are defined

9/21 9am - GHI: 373, DNI: 571, DHI: 82

9/21 3pm - GHI: 544, DNI: 687, DHI: 88

Illuminance Settings

Threshold: Lower: 300 Upper: 3000 Lux

Analysis Plane Height: 32 inches above floor

Thresholds are used for results in Room and Floor Schedules

Cloud Credits

Resolution: 72 inch grid

Required: Check Price

Available: 124 Credits

v4.0.3.5

Check Price Cancel

The screenshot shows the 'Lighting Analysis in the Cloud' dialog box with 'LEED v4 EQc7 opt 2' selected in the 'Select Analysis Type' dropdown menu. The 'Environment' section shows the location '1315 Peachtree St NE, Atlanta, GA 30309' and a date/time of '9/21 9am'. The 'Illuminance Settings' section shows a threshold of '300 to 3000 lux' and a note that the 'LEED v4 EQc7 opt 2 threshold will be used'. The 'Cloud Credits' section shows a resolution of '12 inch grid' and 0 credits required. A yellow arrow points from the 'Start Analysis' button to the 'Start Analysis' button in the next screenshot.

Lighting Analysis in the Cloud

Select Analysis Type

For best results, follow the best practices checklist in Help

Analysis: **LEED v4 EQc7 opt 2**

Levels: Level 1

Environment

Location: 1315 Peachtree St NE, Atlanta, GA 30309

Date/Time: ... Define Environments in Analysis Settings

The following weather values will be used:

Average weather file data of 2 clear sky days within 15 days of 9/21 3/21 at 9am and 3pm

Illuminance Settings

Threshold: 300 to 3000 lux

LEED v4 EQc7 opt 2 threshold will be used

Thresholds are used for results in Room and Floor Schedules

Cloud Credits

Resolution: 12 inch grid

Required: 0 Credits

Available: 124 Credits

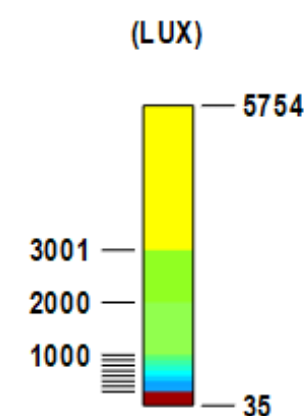
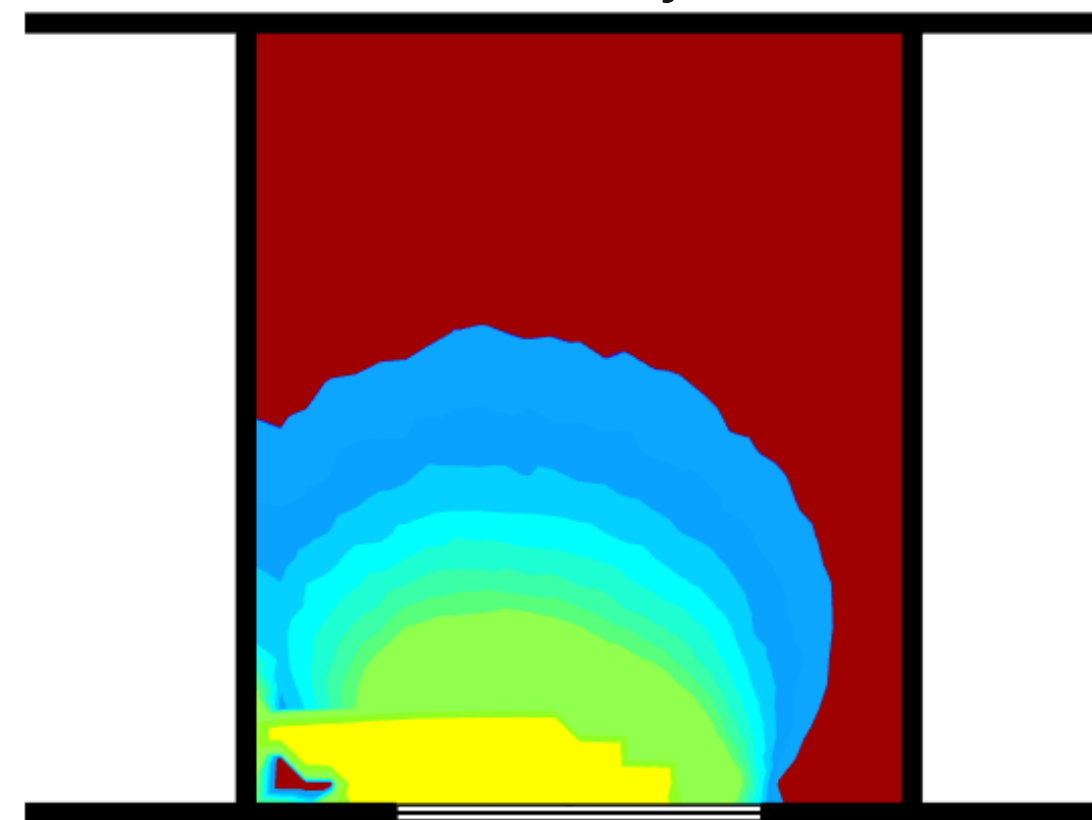
v4.0.3.5

Start Analysis Cancel

Simple and Clear Daylighting Analysis Style

Default Style Versus Design Analysis Style for LEED and Well Daylighting Simulation

Default Style

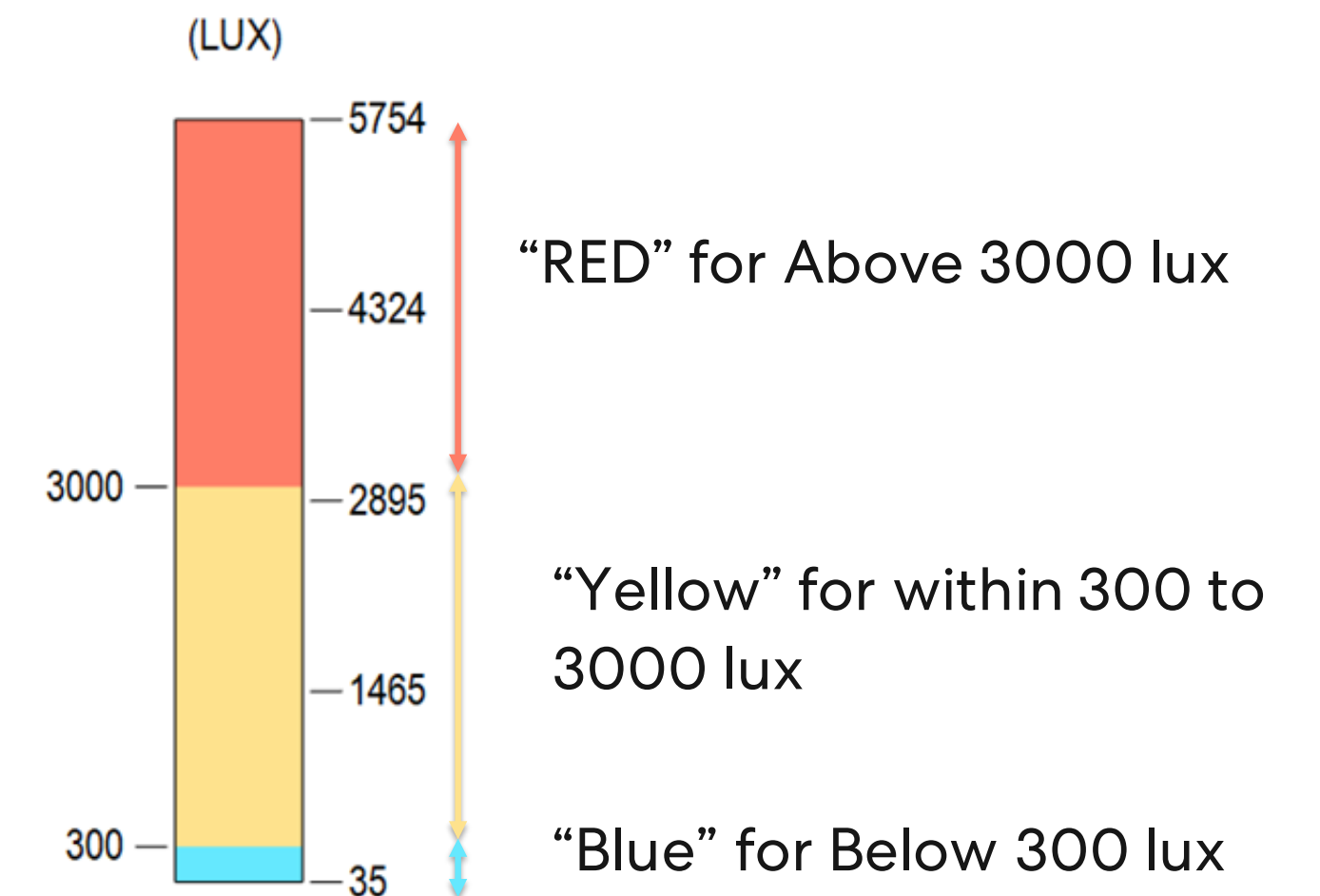
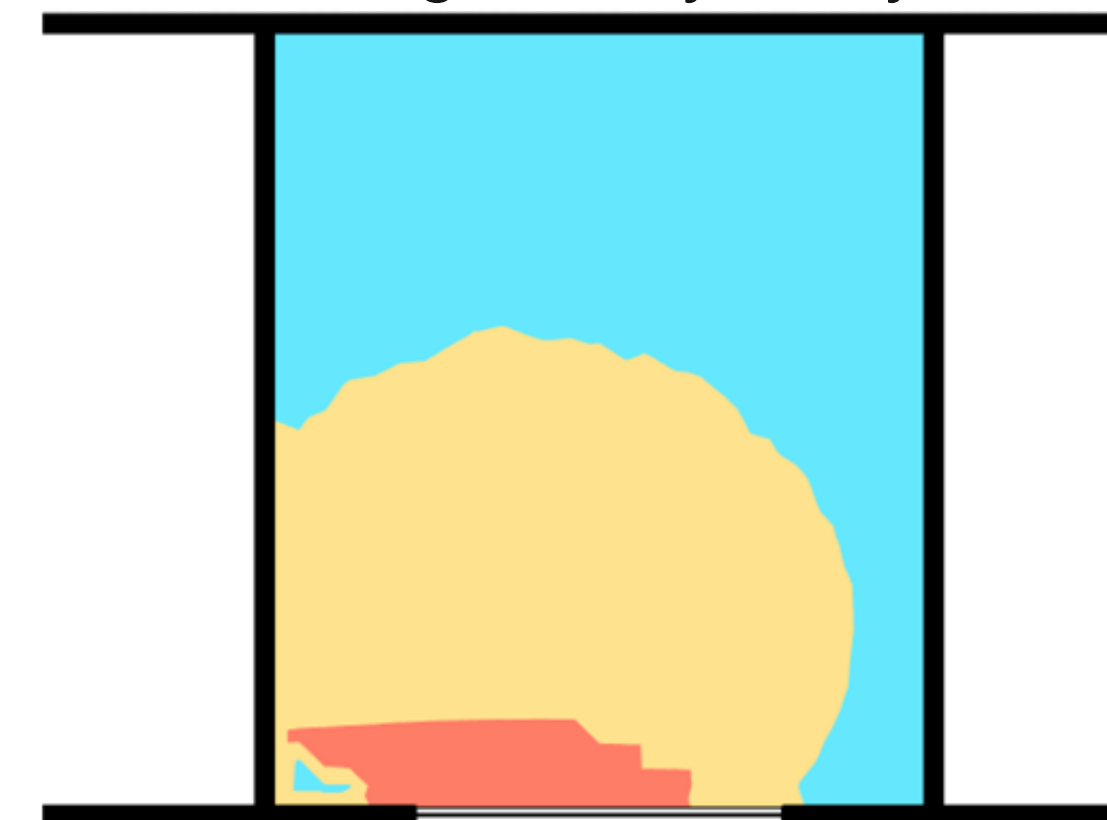


Lighting lx: 9/21 clear sky 9am

Default Style does not make it clearly understandable where the areas of the design are clearly for LEED 2009 Option 1 or LEED V4 Option 2:

- Within illuminance 300-3000 lux
- Above Illuminance 3000 Lux
- Below Illuminance 300 Lux

Design Analysis Style

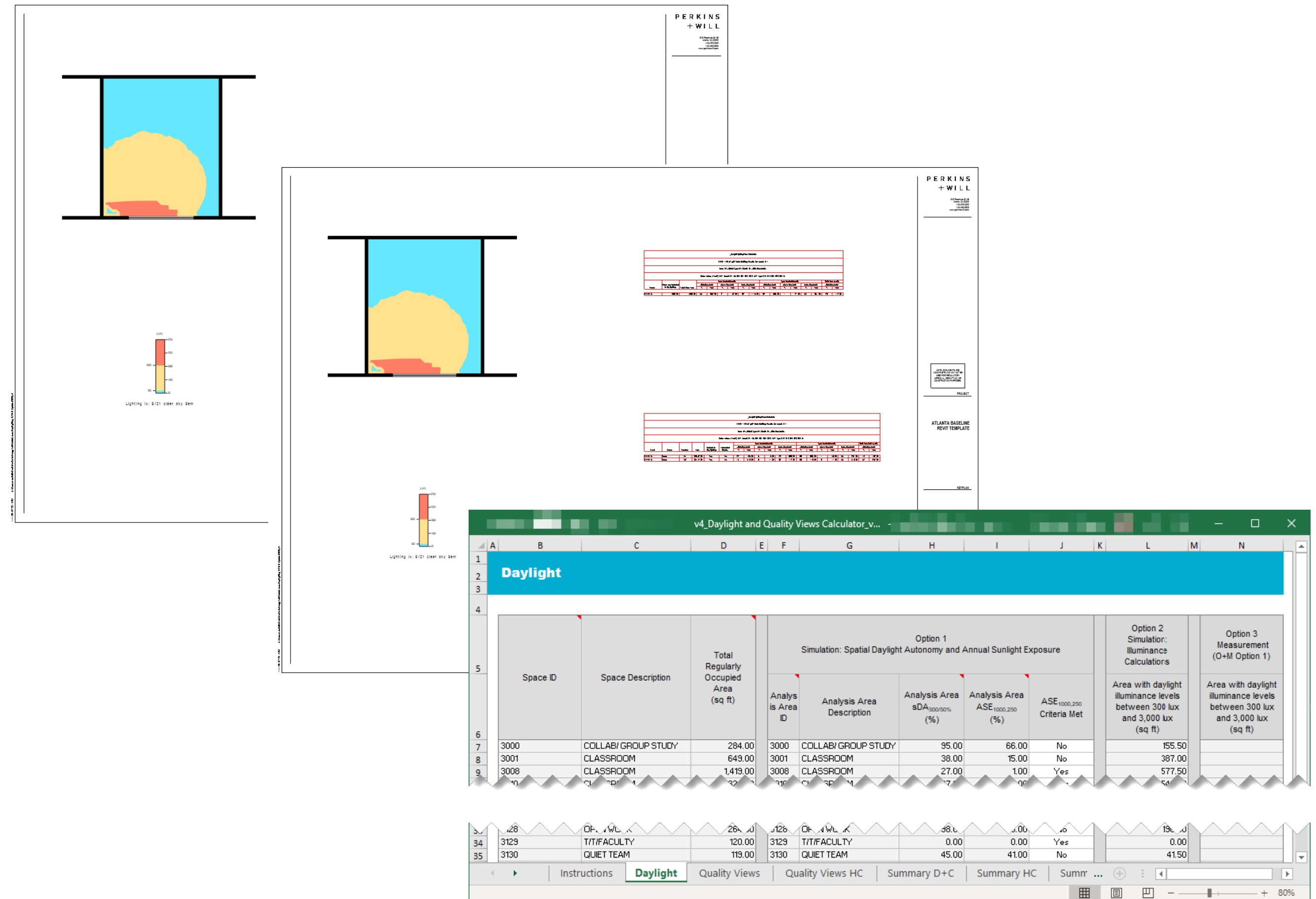


Lighting lx: 9/21 clear sky 9am

LEED Analysis Submission Criteria

Using Revit to Put it Altogether

1. Verify that you have run the analysis from the previous workflow.
2. Place Your Insight Lighting Analysis Floor Plan on a sheet.
3. Include the Insight Lighting Analysis Legend.
4. Add Insight Floor Schedule and Insight Room Schedule to each sheet.
5. Provide a text narrative that contains:
 - Revit and Insight Daylight Plugin Version
 - Project glazing types and the method that you use to input the project VLT product criteria into the Revit 2020 glass materials
 - Highlight regularly occupied spaces and daylit areas and zones and describe all glare control devices in regularly occupied spaces with manually or automatic with manual override
6. Use the LEED Daylight and Quality Views Calculator to provide the actual credit validation.



Example of LEED Documentation Upload

Below is an example of a typical upload to LEED Online showing the project successfully meeting credit requirements.



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: 356, DNI: 546, DHI: 83 W/m2

9% below threshold

15% above threshold w/o shades



LEED V4 IEQ Daylighting Simulation
Illuminance Level 12 (LUX) 9AM
1/16" = 1'-0"

Resource

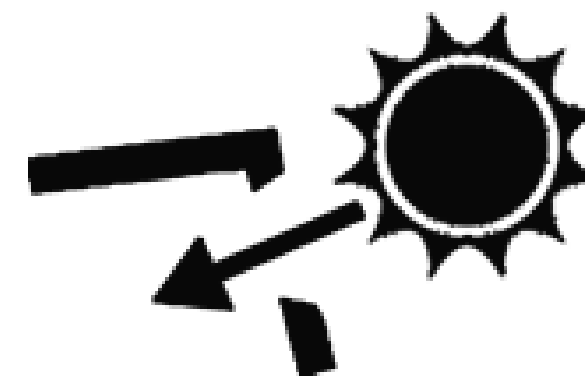
microKnowledge for LEED Daylighting Option 1



While LEED 2009 Registration Closed on 10/31/2016 and the last day for certification submission is 6/30/2021, most project now register for V4.0 or V4.1.

LEED Daylight Option 1 Credit for Version 4.0 and 4.1

- 1** sDA or Spatial Daylight Autonomy provides us with an understanding of how much of our spaces that we design receive enough daylight.
- 2** sDA uses annual weather data for the daylight calculation and refers to IES Standard LM-83-12.
- 3** Annual Sun Exposure (ASE) describes how much of space receives too much direct sunlight, which can cause visual discomfort (glare) or increase cooling loads.
- 4** Verify the location of your regularly occupied, non-occupied, and exempt areas of the floor plans for the credit work, if anyone spends at least an hour in the space per day, then it is regularly occupied.



- 5** **Criteria**
sDA (300/50%) ASE 1000/250
Floor Area to Achieve Daylighting in Regularly Occupied Spaces

Version 4.0 Points

55% for 2 pt.
75% for 3 pts/1 pt. for Healthcare
90% for Exemplary performance/ 2
pts. for Healthcare

Version 4.1 Points

40% for 1 pt.
55% for 2 pts. /1 pt. for Healthcare
75% for 3 pts./2 pts. for
Healthcare
Exemplary performance extra pt.

What do I need to know about LEED Daylighting Credit Option 1?

Perkins&Will

Resource

microKnowledge for LEED Daylighting Option 2



While LEED 2009 Registration Closed on 10/31/2016 and the last day for certification submission is 6/30/2021, most projects now register for V4.0 or V4.1.

LEED Daylight Option 2 Credit for Version 4.0 and 4.1

1

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.

3

Basic light reflectance values should start with those according to IES Standard LM-83-12 such as:

- 70% or 80% for Ceiling Surfaces
- 50% for Wall Surfaces
- 20% for Floor Surfaces
- 30% for Vertical Exterior Surfaces
- 20% for Trees
- 10% for Ground Surfaces

4

Simulation Criteria

Illumination Daylight Levels

Floor Area to Achieve Daylighting in Regularly Occupied Spaces

- Daylight Illuminance Levels 300, 3,000 lux
- Clear-Sky Condition
- Time
 - 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.

2

Verify the location of your regularly occupied, non-occupied, and exempt areas of the floor plans for the credit work, if anyone spends at least an hour in the space per day, then it is regularly occupied.



5

Point Criteria

Version 4.0 Points

75% for 1pt.
90% for 2 pts.

Version 4.1 Points

55% for 1 pt.
75% for 2 pts.
90% for 3 pts. Except for Healthcare
Healthcare Exemplary point for 90%

Resource

microKnowledge for Setup of Revit Glazing for Daylighting



Revit 2019, 2020.1 and above now use Insight Version 4.0 or higher and Version 2 of the Cloud Rendering Engine which is faster, more accurate, and easier to use!

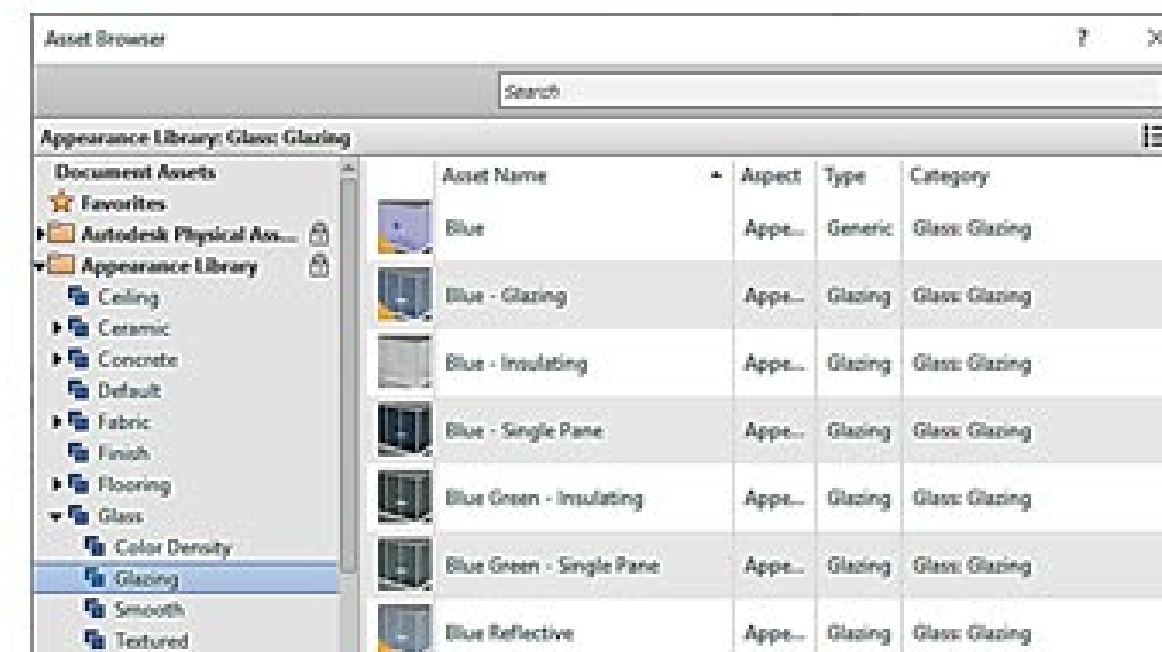
There are two methods for set up of your glazing in Revit

Method 1 - Easier but with Trial and Error

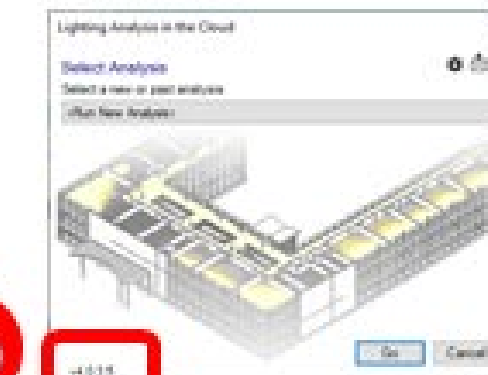
- 1a** Use the Revit Asset Browser and Select an Appropriate Glazing Material from "Appearance Library/Glass/Glazing" from Revit 2020



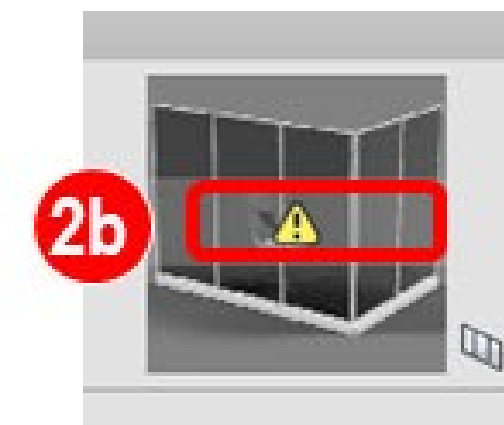
- 4a** Select the appropriate glazing



Method 2 – Faster

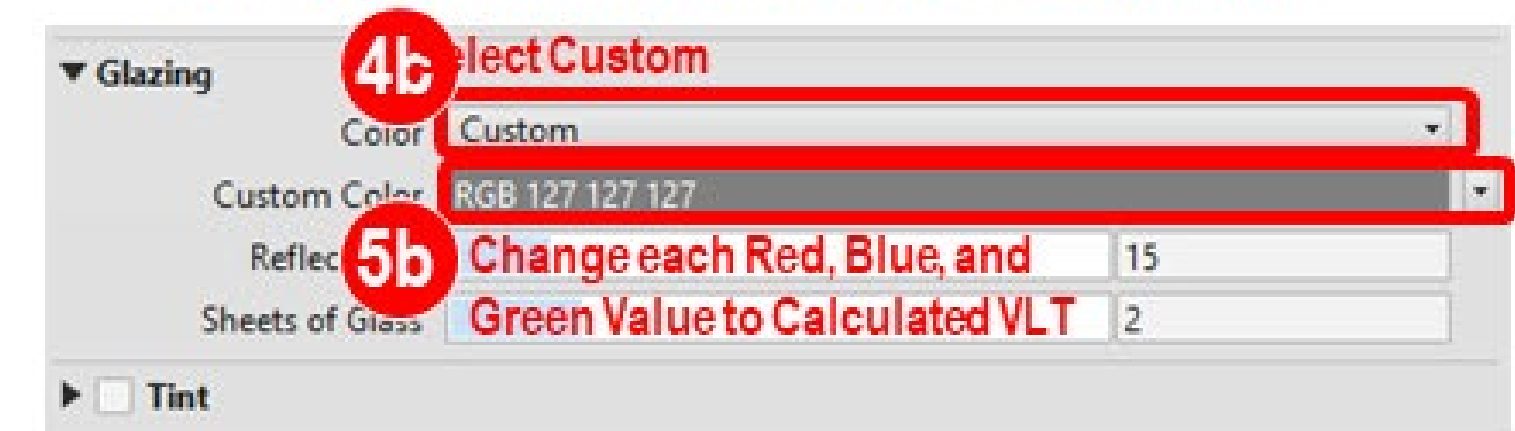


The method here works best for materials created prior to the Insight V4 and V2 Cloud Engine



Check that your material has the caution symbol denoting the fact it has not been converted to the new V2 Cloud Rendering Material

- 3b** Multiply your Actual Glass Product VLT in % by 255 to get the Insight Plugin V4 individual RGB values and change the RGB values here to that number from the previous calculation.



How do I Set up Glazing for Daylighting?
Perkins&Will

Resource

Free Airtable database of Light Reflectance Values

Airtable					MaterialsLRVbase				
<input type="checkbox"/>		Name	Category	Img	Use	Low LRV	High LRV	Average	Reference
<input type="checkbox"/>		Satin Anodised Aluminum	Metal		Veneer Flooring	70.58	79.47	75.03	Leaderflush Shapland
2		Maple Quarter cut	Wood		Veneer Flooring	49.33	69.69	59.51	Leaderflush Shapland
3		Ash Quarter Cut	Wood		Veneer Flooring	48.76	63.07	55.92	Leaderflush Shapland
4		Maple Crown Cut	Wood		Veneer Flooring	49.12	62.22	55.67	Leaderflush Shapland
5		Ash Crown Cut	Wood		Veneer Flooring	44.47	60.94	52.71	Leaderflush Shapland
6		American White Ash Crown Cut	Wood		Veneer Flooring	44.47	59.29	51.88	Leaderflush Shapland
7		Brushed Stainless Steel	Metal		Veneer Flooring	41.45	48.63	45.04	Leaderflush Shapland

This table can be found here for your use: <https://airtable.com/shrXchyBk8gDEmJUI>

We provide it freely and welcome suggestions for additions, send an email to:

Tyrone.Marshall@Perkinswill.com

For your contributions to the database!

Don't forget to
Illuminate Your Best Design using Revit's Daylighting Analysis!

Maria.Montgomery@perkinswill.com

Tyrone.Marshall@perkinswill.com

