

Sustained BY Nature

Compelled BY Nature

Committed BY Nature

Enhanced BY Nature

Restored BY Nature

Visionary BY Nature



GREENBUILD[®]
INTERNATIONAL CONFERENCE AND EXPO

Resolved BY Nature

Human x Nature

Powered BY Nature

***Public Excerpt of Presentation Given at
Greenbuild 2018 in Chicago***

Driven BY Nature

Strengthened BY Nature

How to use LEED v4 EQ7 successfully to both get more points and better daylight design outcomes

- Daniel Glaser | *LightStanza*
- Derek Felschow | *Point Energy Innovations*
- Kris Callori | *Verdacity*
- Patrick Sheehan | *Gensler*

To achieve maximum credit, LEED v4 EQ7 uses a new scoring system reliant on complex metrics and calculation tables. These new metrics are highly processed and its total score difficult to deconstruct. Hence, very few design teams even consider going through this option. This talk will not only demystify this process, but illustrate how design teams can productively use these scorecards to both advance their daylight design as well as obtain EQ7 credits. The first speaker will provide insight on how they progressed using the LEED EQ7 scorecards and how they were able to score better as they gained more experience and integrate into their long established daylight practices. To better understand and critique the process, the second speaker will engage you with instructions on how to calculate a small portion of the LEED scorecard. You will share your results with neighboring groups who together will form a larger report card. In doing these exercises you will get a practical understanding of the borders of the credit, where there is flexibility, and what additional calculations may be necessary outside LEED. The 3rd and 4th speakers will also provide both background as well as detailed case studies.

Today, you will learn...

1. Different options for calculating the Daylight Credit in LEED v4 BD+C:

- Option 1 (Simulation: Spatial Daylight Autonomy)
- Option 2 (Simulation: Illuminance Calculations)

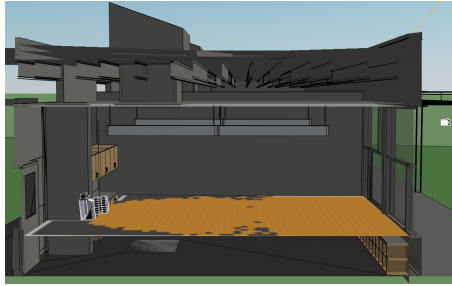
2. How to calculate the following requirements for LEED v4 BD+C Daylight:

- Spatial Daylight Autonomy (sDA)
- Annual Sunlight Exposure (ASE)

3. How robust LEED v4 simulation tools are successfully applied to design projects through case studies

- Menlo Park Office Building
- Albuquerque, New Mexico
- San Francisco Airport

Course Outline



1. Introduction and LEED v4 EQ7 Metrics Explanation

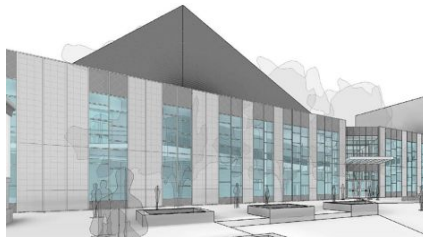
The Content of This SlideDeck



2. Case Study: Menlo Park Office Building



3. Activity: Calculating LEED v4 Daylight Requirements on Your Own



4. Case Studies: Albuquerque, New Mexico



5. Case Study: San Francisco Airport



Daylight Design FAIL:

All blinds are drawn in the middle of the day



Daylight Design SUCCESS: Maximum daylight with minimum glare

Cunningham Group, Architect of Record:
Studio B Architects, Design Consultant

LEED v4 Credit Achievement

Percent of all LEED BD+C v4 projects that earned credit

Low

Medium

High

LOCATION AND TRANSPORTATION

LT Credit: Sensitive Land Protection	High
LT Credit: High-Priority Site	Low
LT Credit: Surrounding Density and Diverse Uses	High
LT Credit: Access to Quality Transit	Medium
LT Credit: Bicycle Facilities	Medium
LT Credit: Reduced Parking Footprint	Medium
LT Credit: Green Vehicles	Medium

SUSTAINABLE SITES

SS Credit: Site Assessment	Medium
SS Credit: Site Development—Protect or Restore Habitat	Low
SS Credit: Open Space	Medium
SS Credit: Rainwater Management	Low
SS Credit: Heat Island Reduction	Medium
SS Credit: Light Pollution Reduction	Medium

WATER EFFICIENCY

WE Credit: Cooling Tower Water Use	Low
WE Credit: Water Metering	High

ENERGY AND ATMOSPHERE

EA Credit: Enhanced Commissioning	Medium
EA Credit: Advanced Energy Metering	Medium
EA Credit: Demand Response	Low
EA Credit: Renewable Energy Production	Low
EA Credit: Enhanced Refrigerant Management	High
EA Credit: Green Power and Carbon Offsets	Low

MATERIALS AND RESOURCES

MR Credit: Building Life-Cycle Impact Reduction	Low
MR Credit: Building Product Disclosure and Optimization—Environmental Product Declarations	Low
MR Credit: Building Product Disclosure and Optimization—Sourcing of Raw Materials	Low
MR Credit: Building Product Disclosure and Optimization—Material Ingredients	Low
MR Credit: Construction and Demolition Waste Management	High

INDOOR ENVIRONMENTAL QUALITY

EQ Credit: Enhanced Indoor Air Quality Strategies	Medium
EQ Credit: Low-Emitting Materials	High
EQ Credit: Construction Indoor Air Quality Management Plan	High
EQ Credit: Indoor Air Quality Assessment	High
EQ Credit: Thermal Comfort	Medium
EQ Credit: Interior Lighting	Medium
EQ Credit: Daylight	Low
EQ Credit: Quality Views	Medium
EQ Credit: Acoustic Performance	Low

Hard to Achieve!

Daylight Design SUCCESS



Daylight Modeling in Design Stage to Earn LEED v4 EQ7 Credit



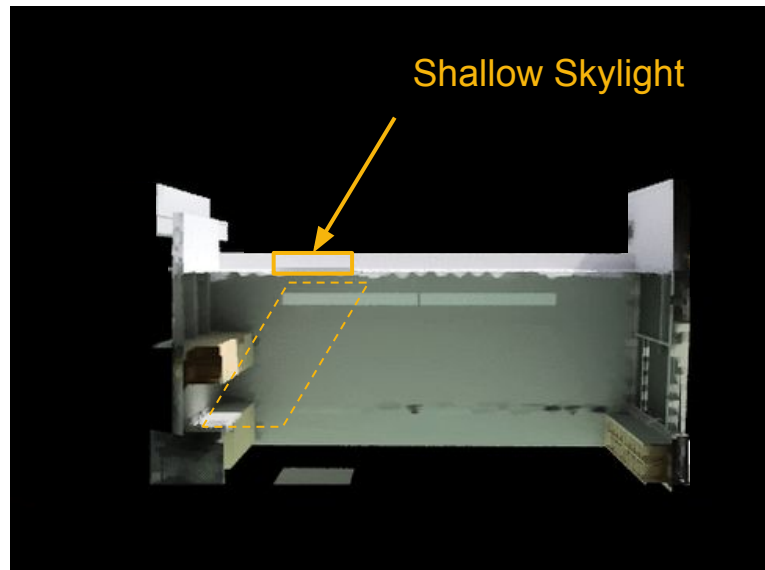
Important Daylight Modeling Details to get the LEED v4 Daylight Credit



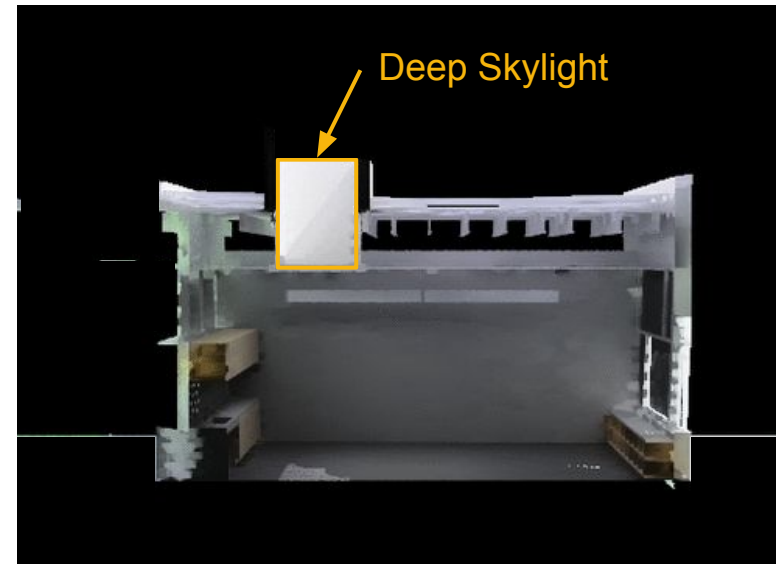
- 3D Geometry + Optical Properties
- Window Details- 2" accuracy
- Blinds
- Furniture (above 36")
- Exterior Obstructions- to 100'
- Climate Database
- Use Caution Reusing Energy Model

Examples of Modeling for LEED v4 Daylight Credit

Bad Modeling



Good Modeling



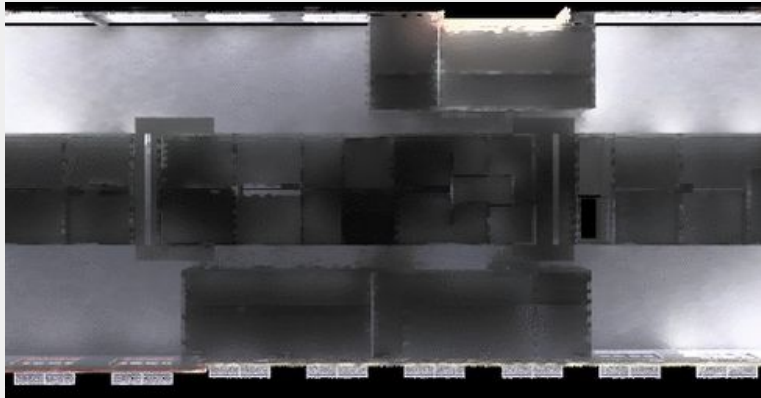
LEED v4 EQ7 Scoring Options

Option 1

(BEST OPTION)

Annual Climate Based Analysis

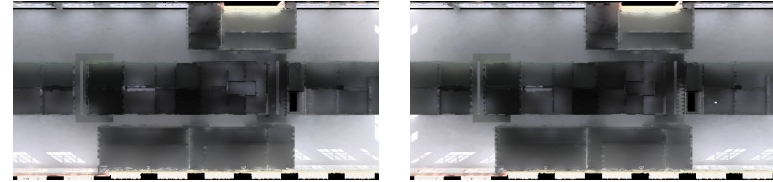
3-4 points



Option 2

9am/3pm Analyses

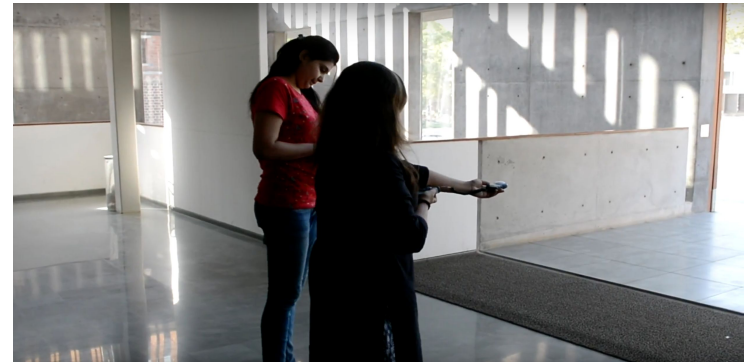
2 points



Option 3

Physical Measurement

1-3 points



How LEED v4 EQ7 Option 1 Metric was Developed

A-1 Occupant Survey



**Reviewed
61 spaces**

Bldg ID _____ Room ID _____ Survey ID _____

OCCUPANT SURVEY – How Comfortable is this Room?

1. Today's date _____ day _____ month _____ year 2. Your age _____ yrs.

Please choose the closest correct answer

3. What are the weather conditions right now?
☐ It's a foggy day ☐ I can see patches of sunlight inside this room
☐ It's a lightly overcast day ☐ I can see patches of sunlight, but only outside of this room
☐ It's a dark overcast day (and/or rain or snow) ☐ It's a clear blue day, but I can't see any direct sunlight
☐ It is variable, with big clouds moving by and occasional sun ☐ It is variable, with big clouds moving by and occasional sun

4. About how close are you to a window with a view?
☐ about 5 feet from the window ☐ 10-15 feet from the window ☐ 20-30 feet (or more) from the window
☐ I can't see any view from where I work ☐ not applicable or don't know

5. If this room has windows with blinds or curtains, overall right now are they:
☐ fully closed ☐ ¾ closed ☐ ½ closed ☐ ¼ closed ☐ fully open ☐ no blinds or curtains

6. For about how long have you been using this room?
☐ just today ☐ a week ☐ a month ☐ 2-4 months ☐ 5-11 months ☐ a year or more

7. When you come here, how many hours per day do you generally spend in this space?
☐ an hour or less ☐ 2-4 hours ☐ 5-7 hours ☐ 8 or more hours per day

Please consider your experience of this room based on ALL the time you have spent here.

8. I enjoy being in this room. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

9. I find this room visually attractive. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

10. Temperature in the room is always comfortable. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

11. Noise level in the room is always comfortable. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

12. I like the view I have from the window. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

13. I think the view out the window(s) is big enough. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

14. I am happy with how the blinds (or curtains) operate. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

15. The lighting conditions are always comfortable. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

16. The electric light in this room is always sufficient. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

17. The electric lights are never too bright. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

18. I can work happily in this room with SOME of the electric lights turned off. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

19. I can work happily in this room with ALL of the electric lights turned off. Strongly Disagree 1 2 3 4 5 6 7 8 9 10 Strongly Agree

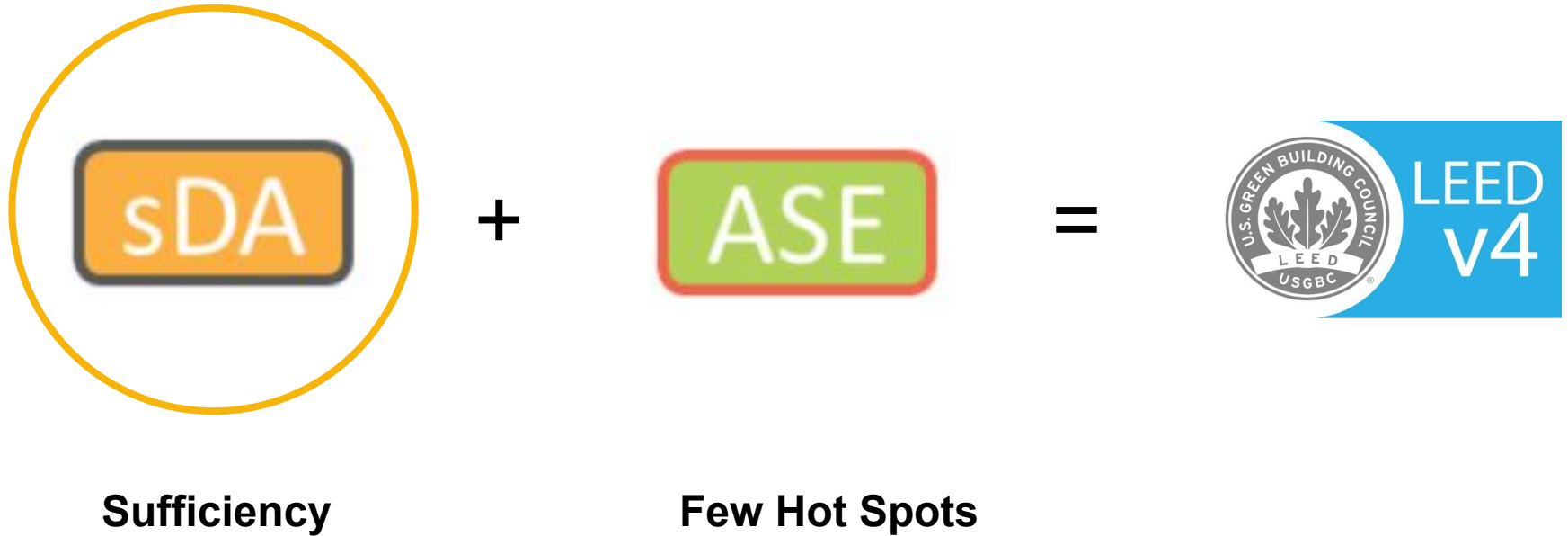


Conducted occupant and expert surveys

- “Daylight Always Sufficient”
- “Glare or troubling reflections?”

Heschong Mahone Group. Daylight Metrics - PIER Daylighting Plus Research Program. Final Report to the California Energy Commission, CA, USA, 2012.

sDA & ASE are Required for LEED v4 Credit



LEED v4 Requirement Metric #1: sDA - Spatial Daylight Autonomy



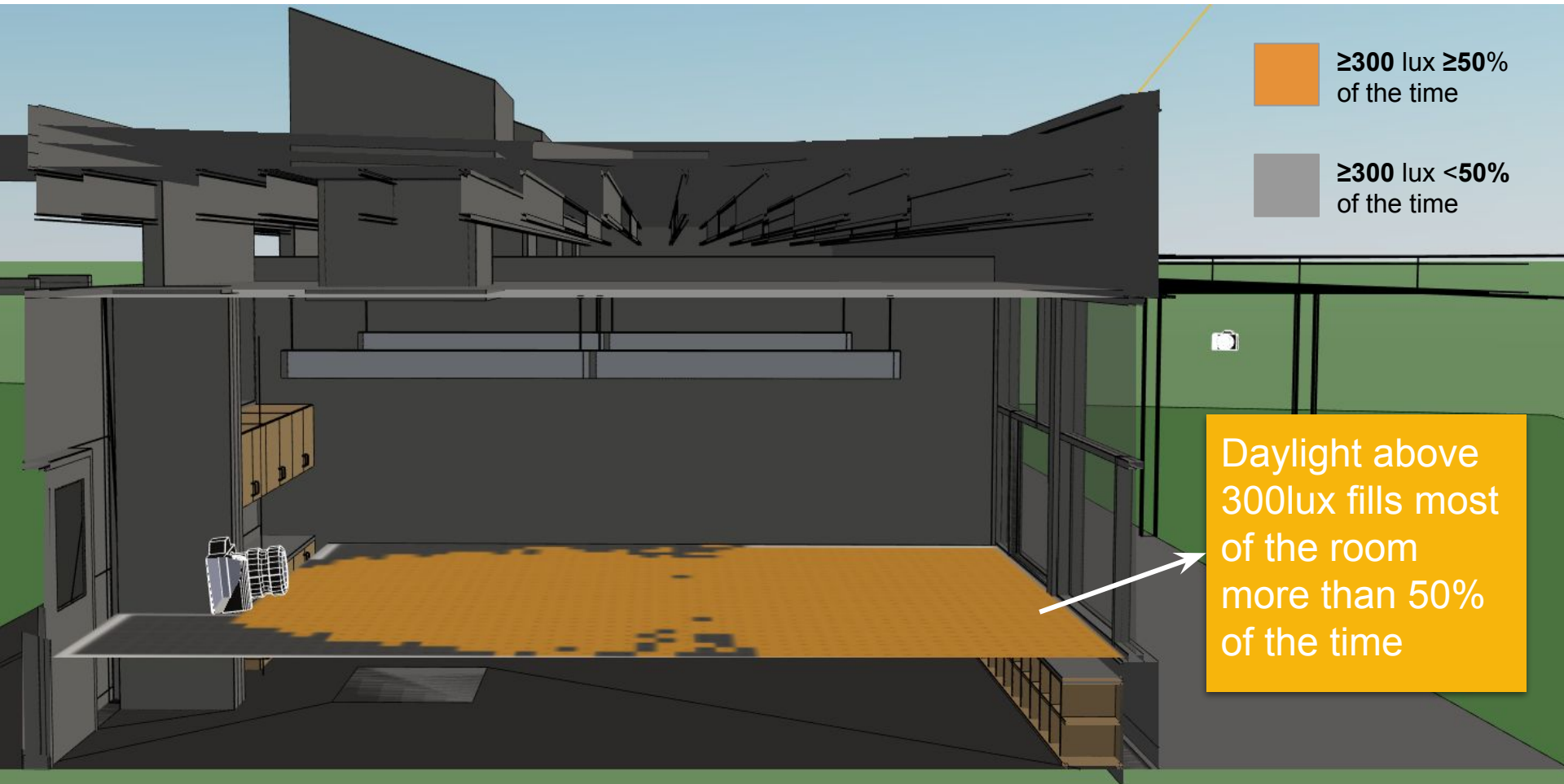
Natural light is both healthy and reduces electricity.

Spatial Daylight Autonomy is a metric describing ***annual sufficiency of ambient daylight*** levels in interior environments.

How to Calculate an sDA_{300/50%} Score?

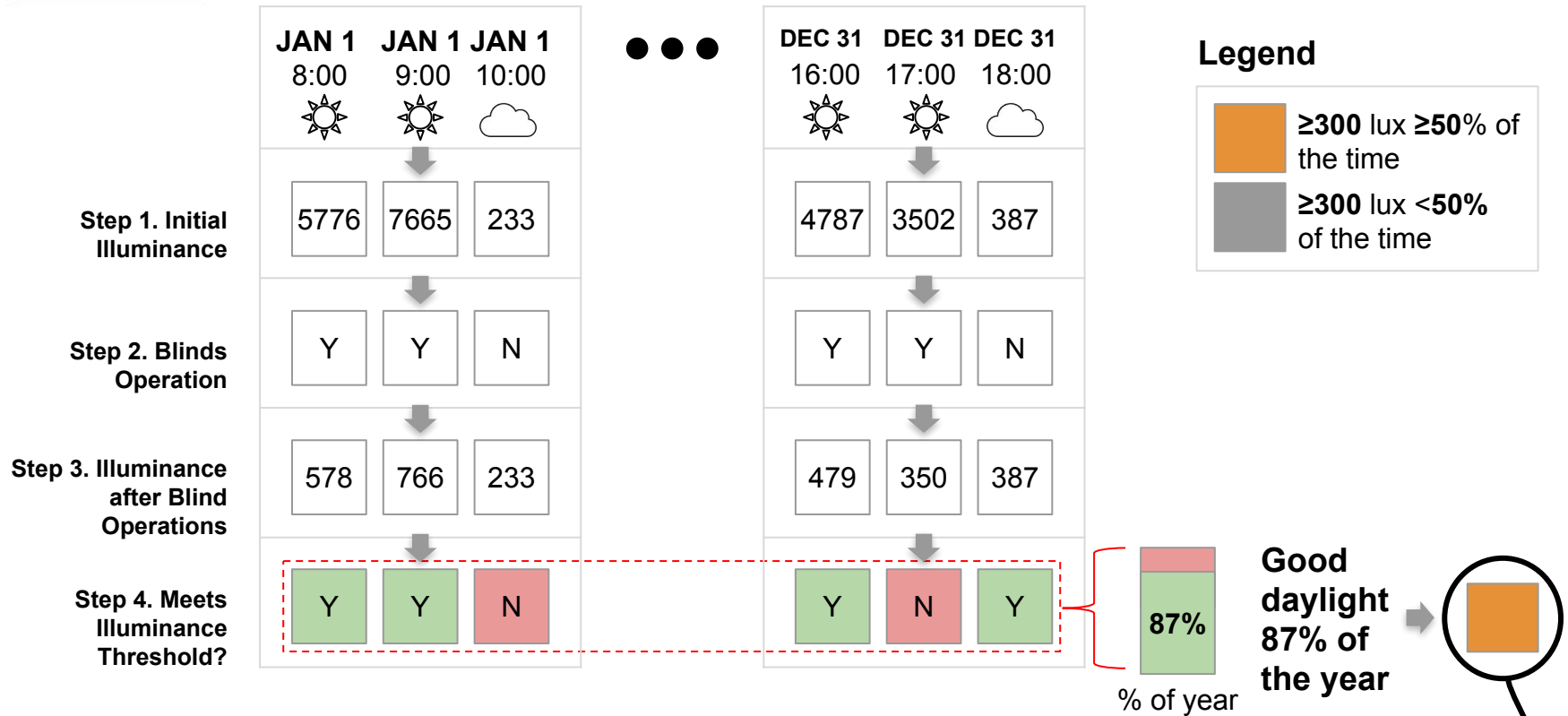


A percentage of Floor Area that exceeds a specified illuminance level (300lux) for the specified analysis period (50%)





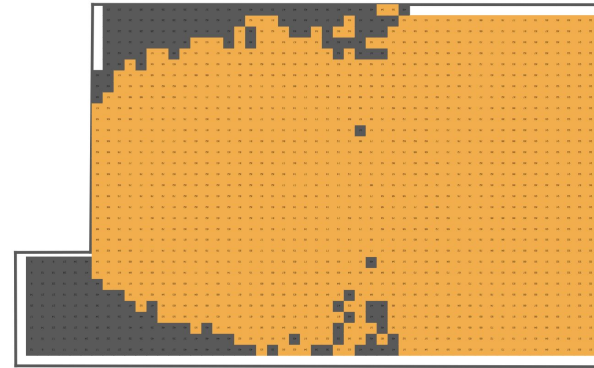
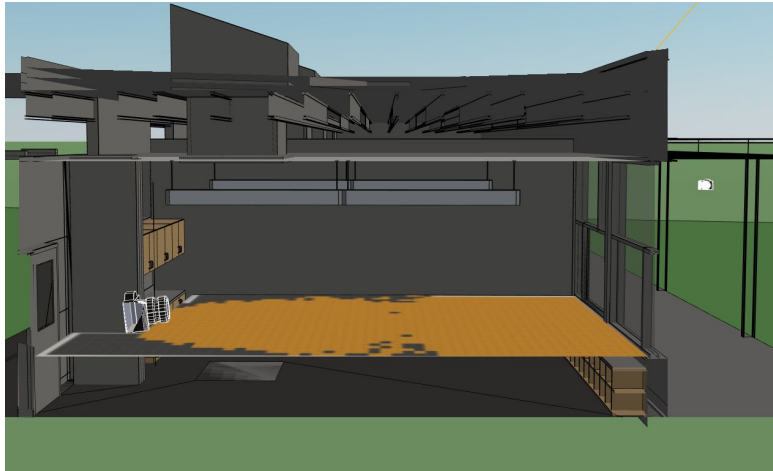
A Look Inside the Calculation



How to Get Total sDA Score



sDA = 84.6%

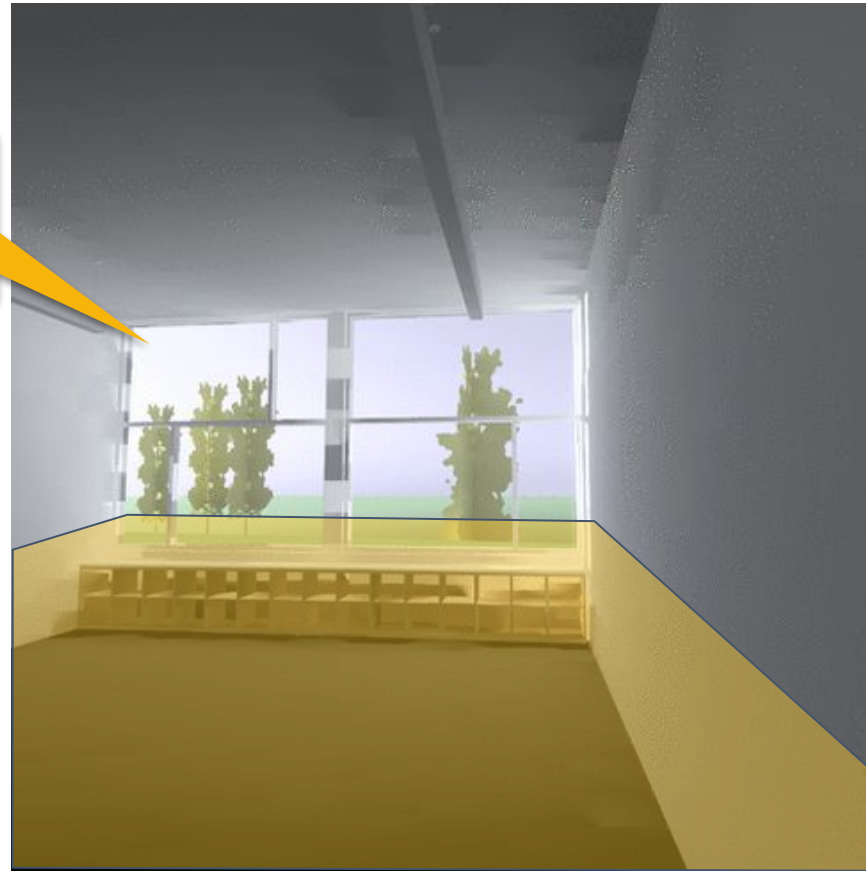


84.6% of the space has sufficient daylight

Blinds are part of the sDA Calculation



Blinds close when
there is too much
direct sun



2% Rule

Sep 21, 06:00

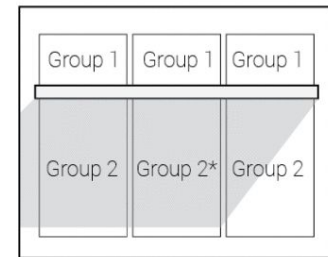
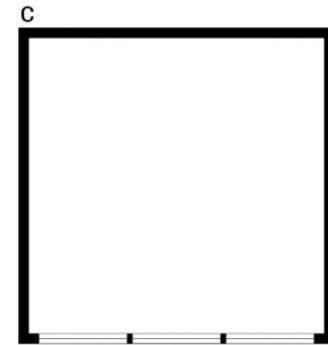
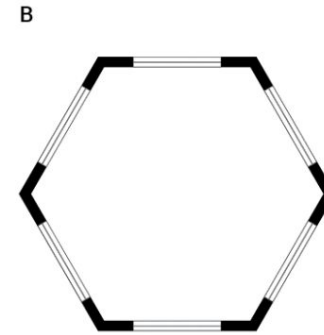
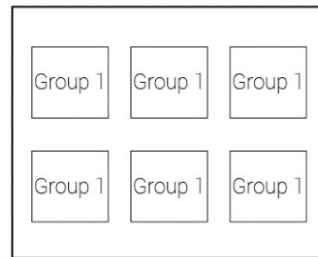
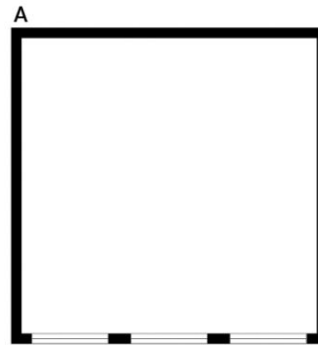
Evaluate optimal blind operations using software analysis

Separation of Blinds Into Window Groups Optimizes Score



Sep 21, 06:00

Close Only Blinds
Facing Direct Sun



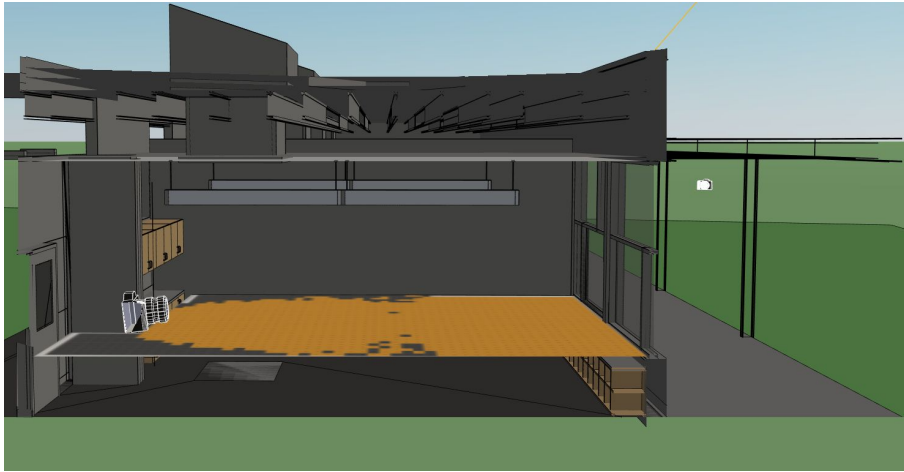
LEED v4 Window Groups

How to Improve Your sDA Score



No Solar Control/Blinds

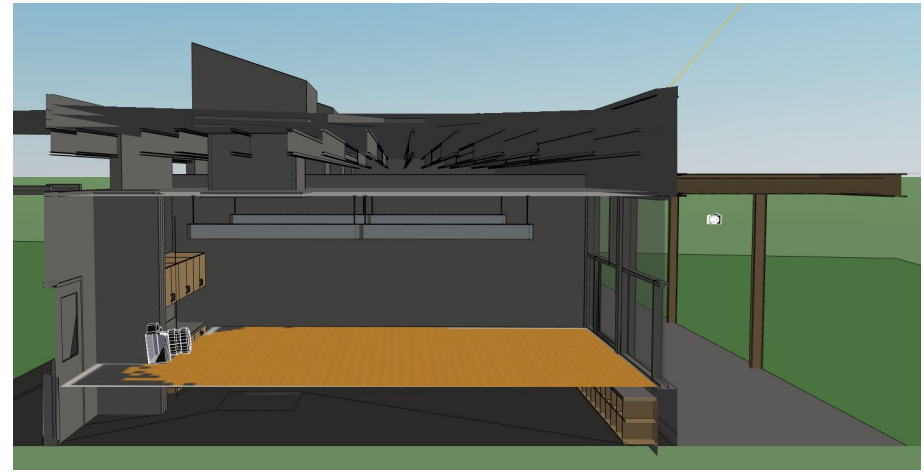
sDA = 84.6%



Direct sun closes blinds and reduces sDA score

Trellis

sDA = 95.9%



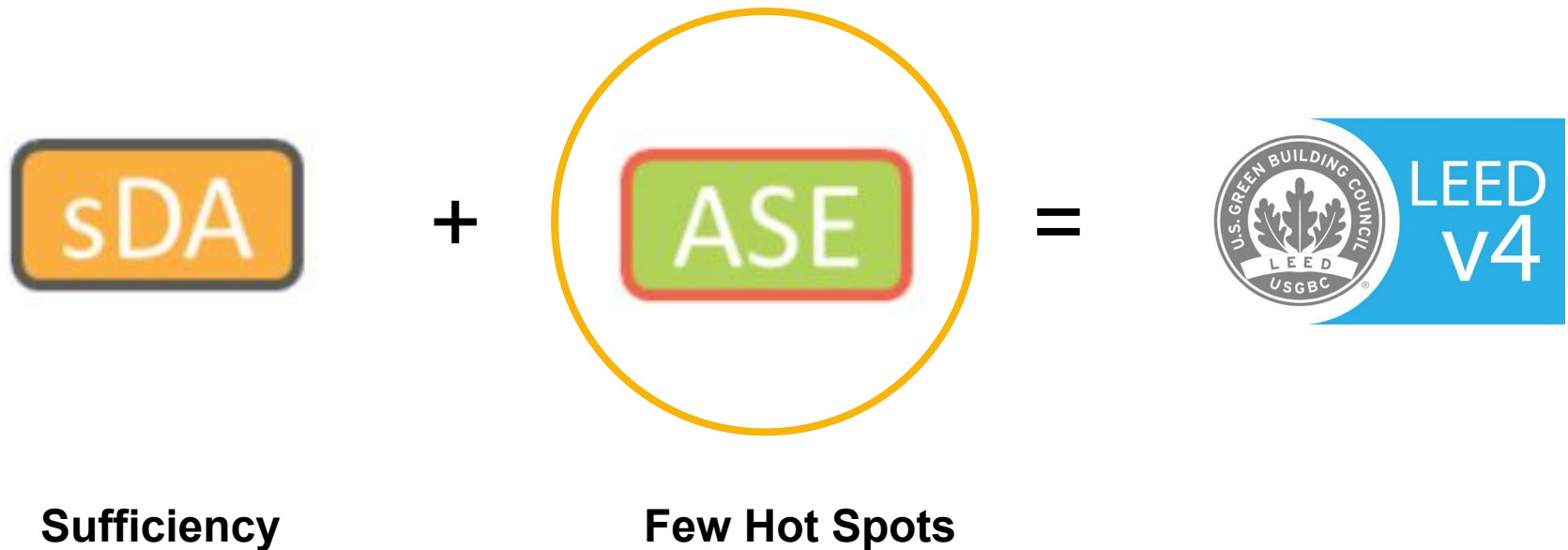
The trellis diffuses light

Good Daylight Design Keeps The View



With trellis, blinds don't need to go down and you can keep the view!

sDA & ASE are Required for LEED v4 Credit



LEED v4 Requirement Metric #2: Annual Sunlight Exposure



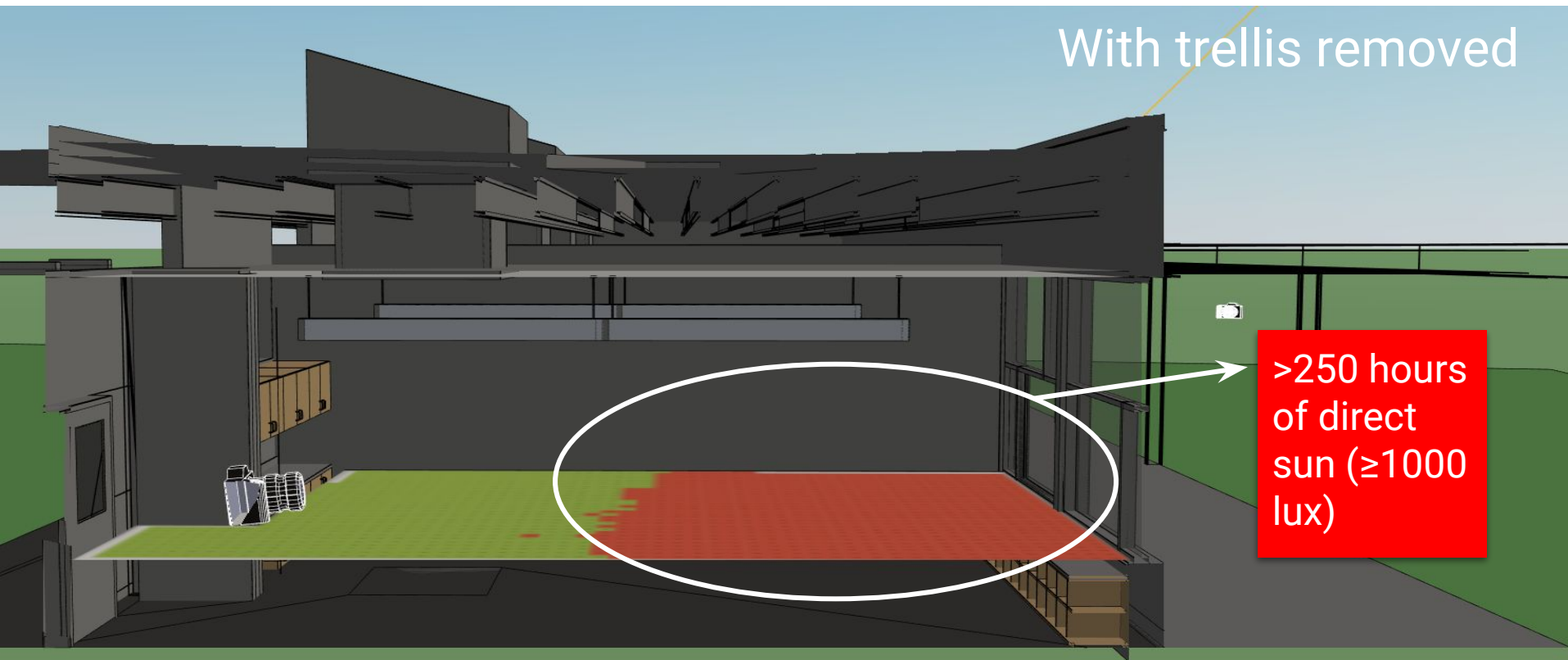
**People want
sun, but not
excessive
direct sun!**

Annual Sunlight Exposure is a metric that describes the potential for visual discomfort (from glare) in interior work environments.

How to Calculate an ASE_{1000/250hr} Score for a Classroom?

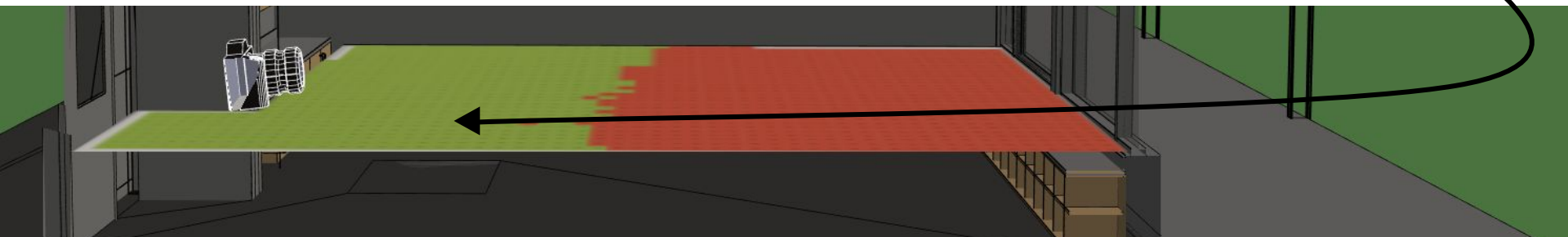
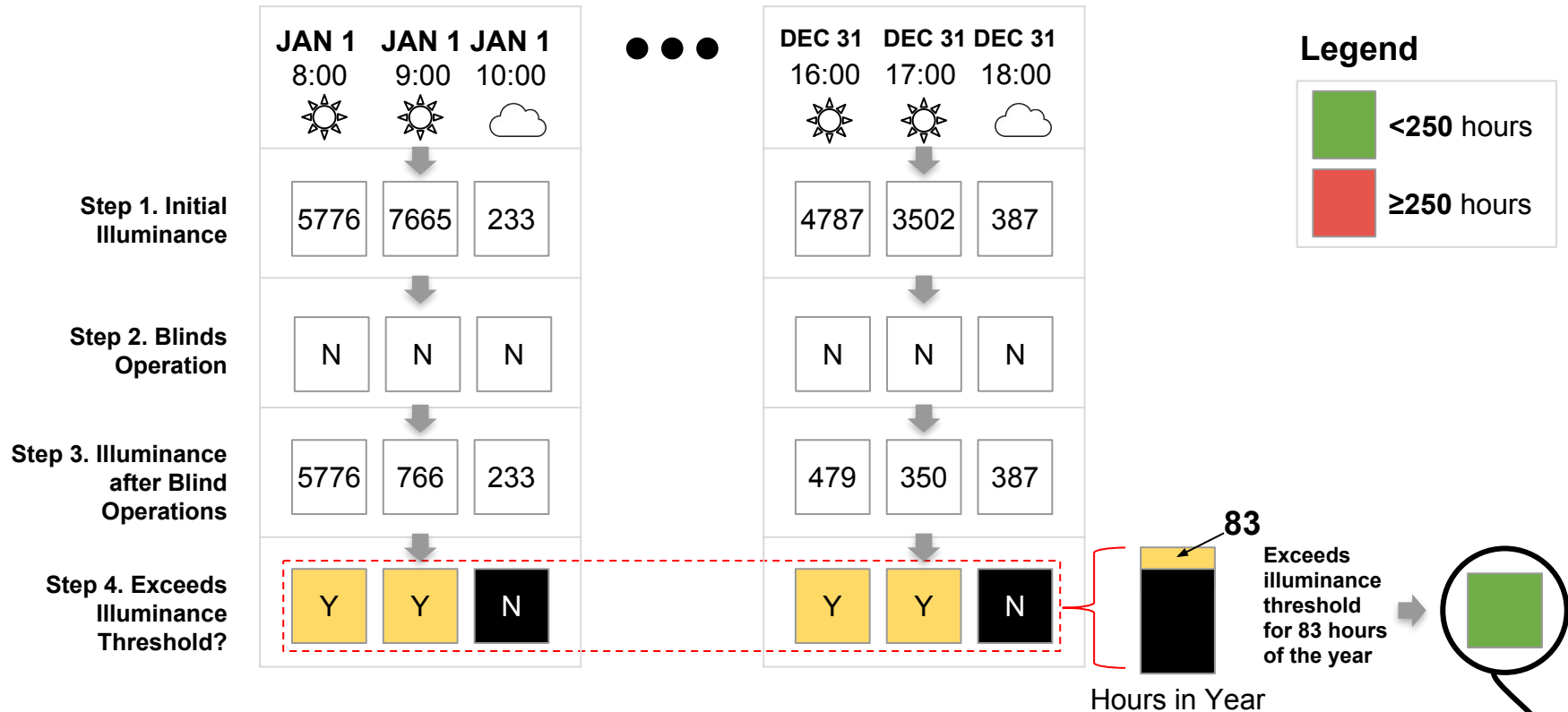


The percent of an analysis area that exceeds a specified direct sunlight illuminance level (1000lux) more than a specified number of hours per year (250 hours), with operable blinds left open





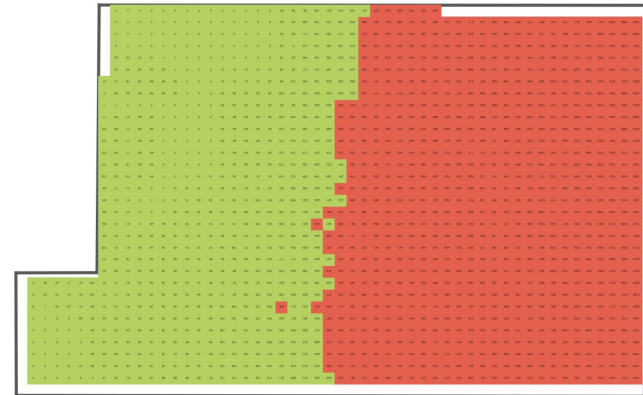
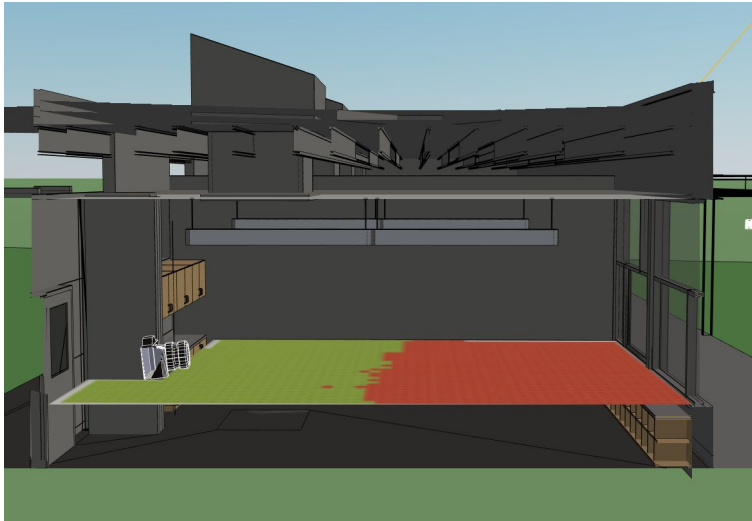
A Look Inside the Calculation



How to get Total ASE



ASE = 53%



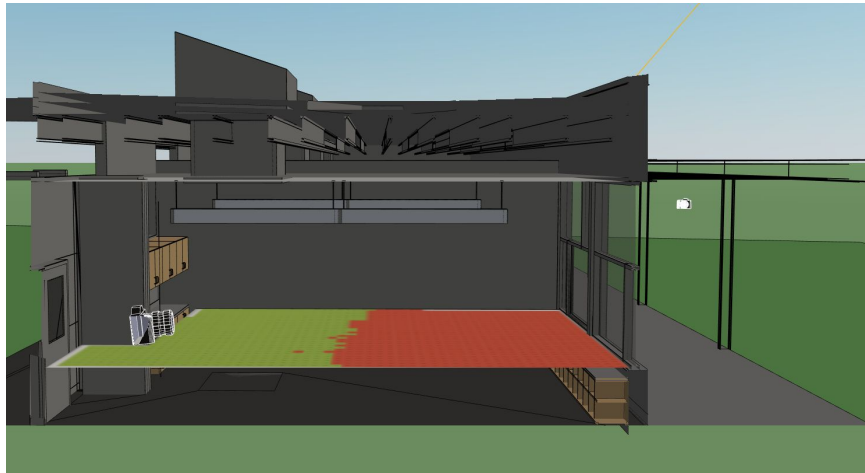
53% of the space has excessive (red) direct sun

How to Improve ASE Score to get more LEED v4 Credits



No Solar Control/Blinds

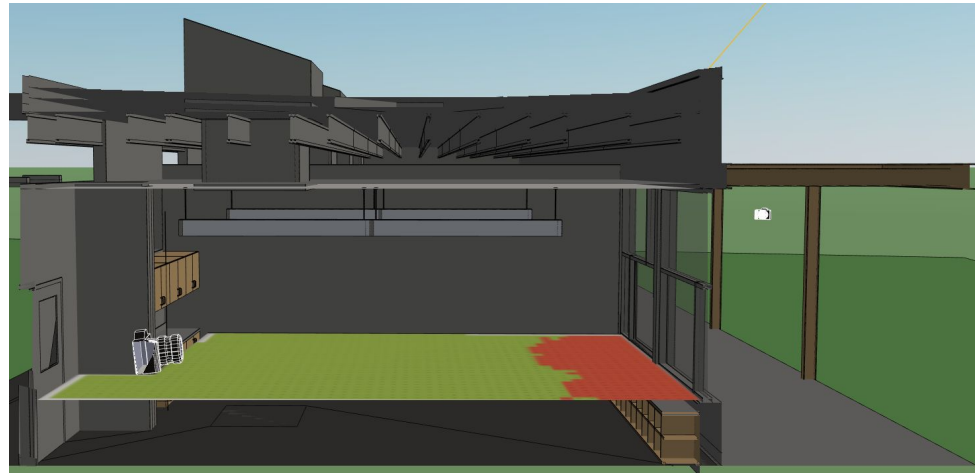
ASE= 53.9%



Blinds stay open for sunlight exposure calculation

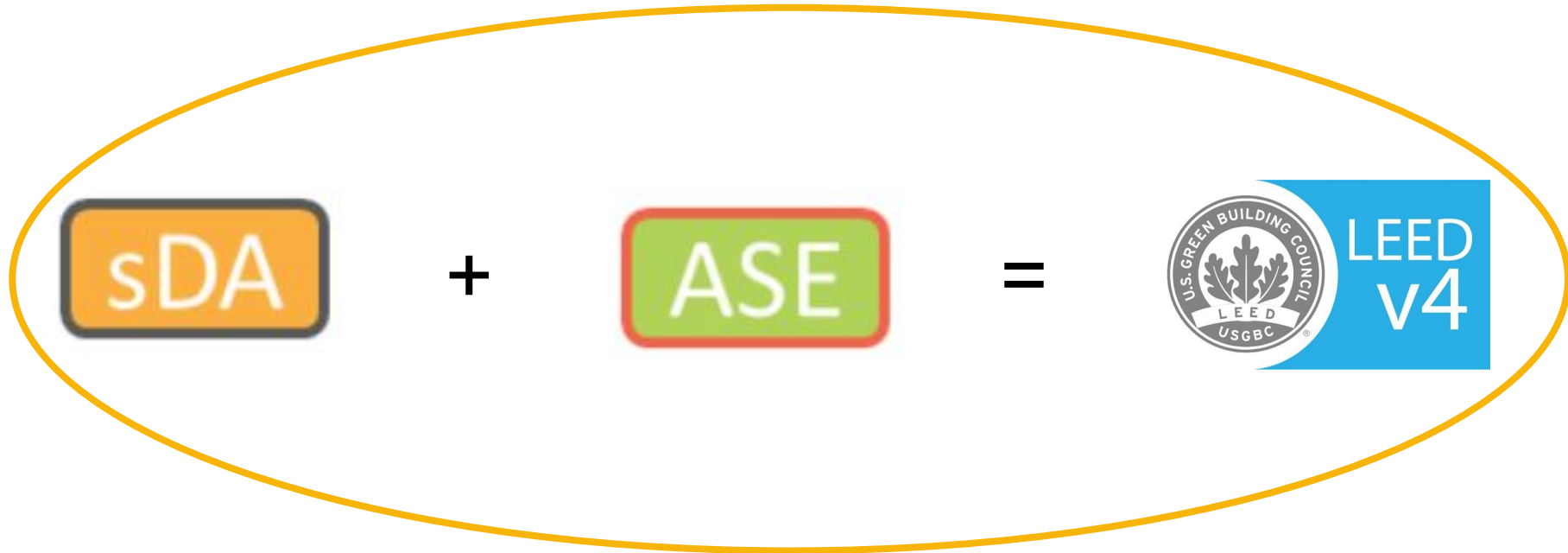
Trellis

ASE= 18.8%



The trellis design is effective at reducing sunlight exposure

sDA & ASE are Required for LEED v4 Credit



LEED v4 Scoring: sDA + ASE



sDA > 55%	2 points
sDA > 75%	3 points



ASE < 20%	Full SDA Credit
ASE > 20%	No SDA Credit Exemptions: <ul style="list-style-type: none">• Spaces with Automated Dynamic Façade Systems• Spaces < 250 sq ft

60% of Option 1 scores with 2 & 3-points get an additional +1 Exemplary point!

BONUS POINT

+1 Exemplary Performance Credit if sDA>55% and ASE for all spaces <10%

(including Jan 2017 Interpretation #100002149)

LEED v4 Scoring: sDA + ASE Another View



sDA > 55%	ASE < 20%	Up to 2 LEED Points
sDA > 55%	ASE < 10%	Up to 3 LEED Points
sDA > 75%	ASE < 20%	Up to 3 LEED Points
sDA > 75%	ASE < 10%	Up to 4 LEED Points

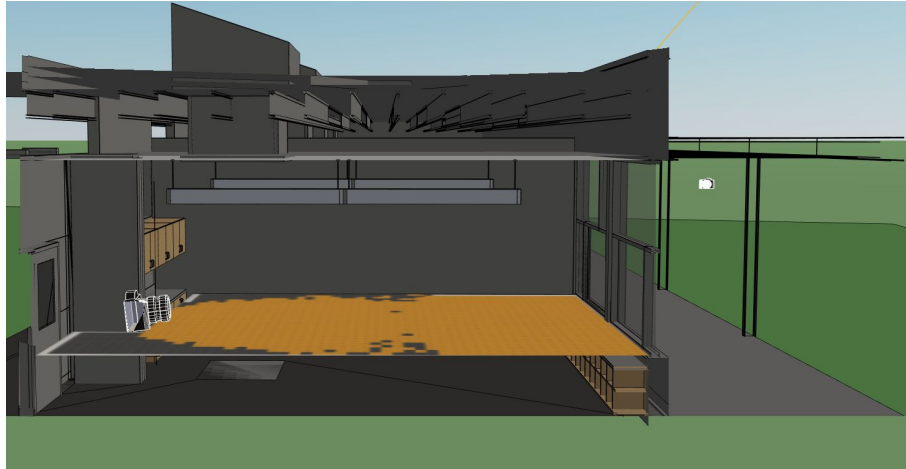


Example Scoring: No Solar Control

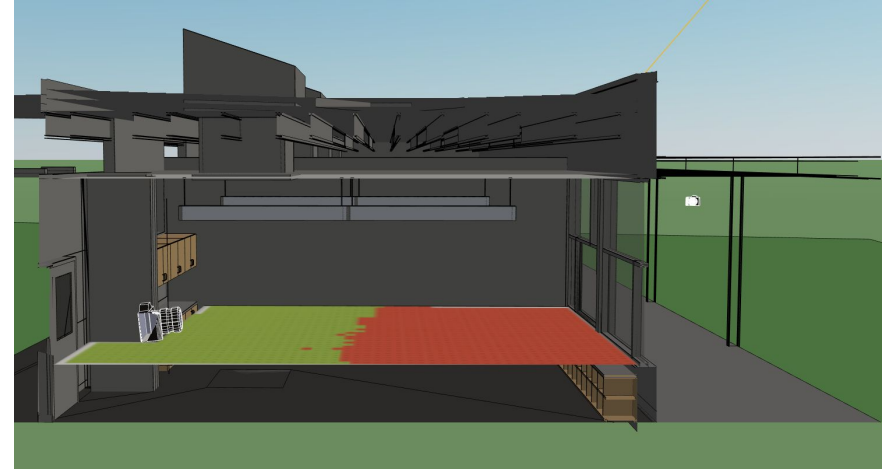


sDA = **0 points** (~~84.6%~~)

ASE = **53.9%**



sDA > 55%	2 points
sDA > 75%	3 points

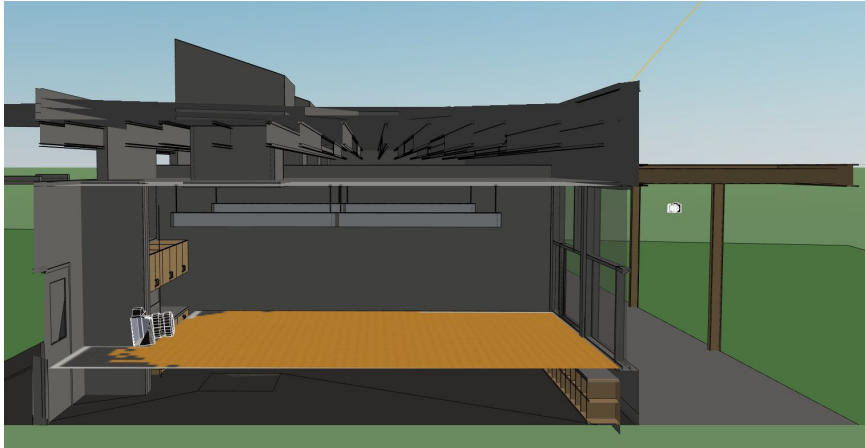


ASE < 20%	Full SDA Credit
ASE > 20%	No SDA Credit (Don't forget about exemptions!)

Example Scoring: Trellis

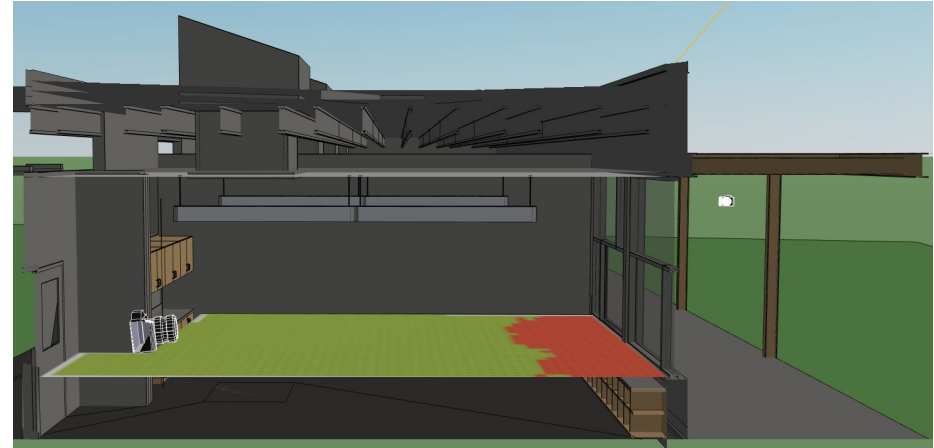


sDA = 3 points (95.9%)



sDA > 55%	2 points
sDA > 75%	3 points

ASE = 18.8%



ASE < 20%	Full SDA Credit
ASE > 20%	No SDA Credit (Don't forget about exemptions!)

ASE Exemption #1: No Penalties for Spaces with Automated or Dynamic Facades



Clear glass on southern exposure has high ASE score (54%) which scores this space 0



Dynamic Glass gives this space up to 3 points

ASE Exemption #2: No Penalties for Spaces Less Than 250 sq ft



sDA=96.88%

54	73	73	52
64	76	74	34
68	76	78	68
76	81	80	52
80	84	84	78
84	87	88	62
87	90	91	92
85	91	93	92

ASE=34.38% (>20%)

24	16	57	64
83	124	95	23
71	110	88	89
153	168	201	18
204	257	248	105
242	348	425	0
396	599	676	531
351	835	1065	877

NO PENALTY!
SMALL SPACE
159 < 250 sq ft

LEED v4 Example Report Card

Option 1: Spatial Daylight Autonomy and Annual Sunlight Exposure (3 points and 1 exemplary point possible)

Total points: 0 **sDA = 45.35% * 86.43%** **ASE = 18.54%**

FLOOR 1

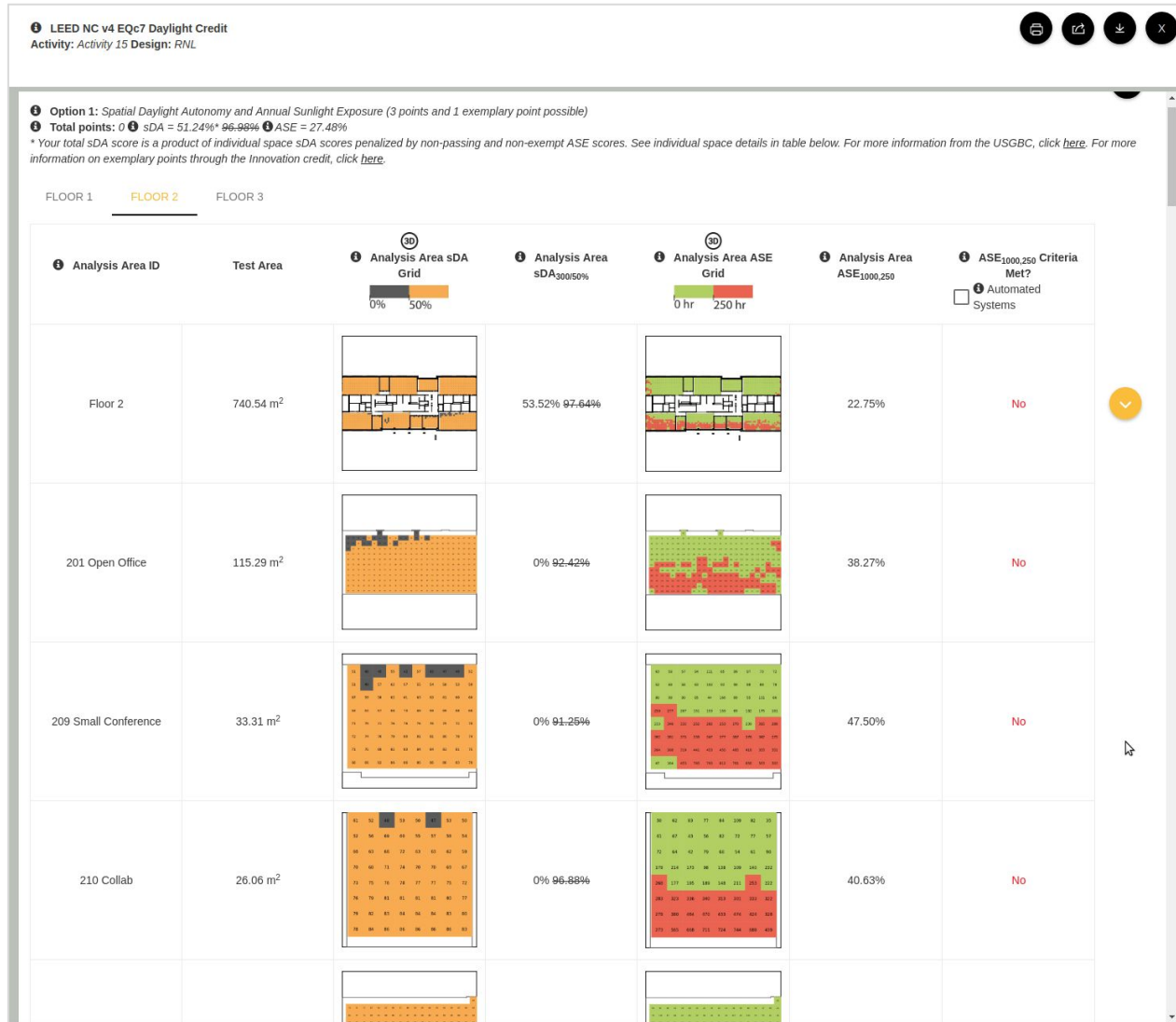
FLOOR 2

FLOOR 3

FLOOR 4

Analysis Area ID	Test Area	Analysis Area sDA Grid ^(3D)	Analysis Area sDA _{300/50%}	Analysis Area ASE Grid ^(3D)	Analysis Area ASE _{1000,250}	ASE _{1000,250} Criteria Met? <input type="checkbox"/> Automated Systems
112 Training Board	1,173.69 ft ²		0% 100.00%		39.39%	No
122 CS Counter	159.30 ft ²		96.88%		34.38%	Exempt
132 Open Office	2,393.35 ft ²		98.43%		8.35%	Yes

LEED v4 EQ7 Option 1 Scorecard Overview



LEED Points and Beyond- Qualitative Analysis



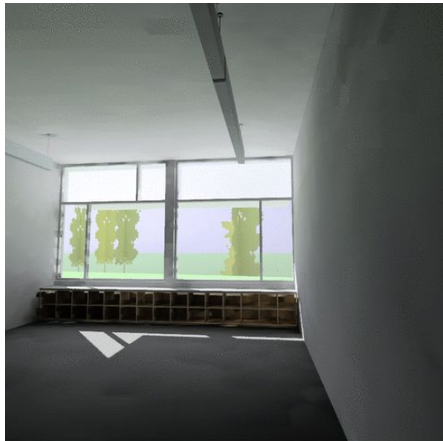
clear glazing
0 Points



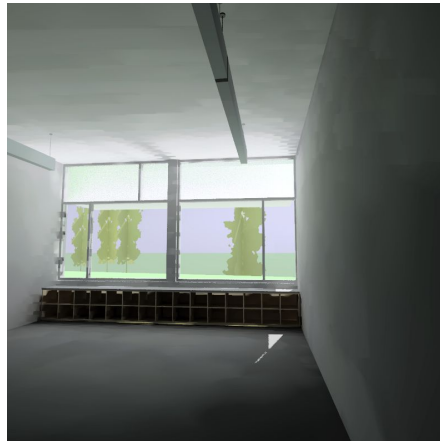
overhang
0-4 points



dynamic glass
0-4 points



diffusing glass
0-4 points



redirect film
0-4 points



honeycomb & dynamic
0-4 points

Beyond LEED - Daylight Glare Probability

Dynamic Glass

Legend

	Glare Type	sDGP Range	Frequency
■	Imperceptible	0 - 35%	38.1%
■	Perceptible	35 - 40%	4.8%
■	Disturbing	40 - 45%	6.3%
■	Intolerable	45%+	50.8%



Diffusing Glazing

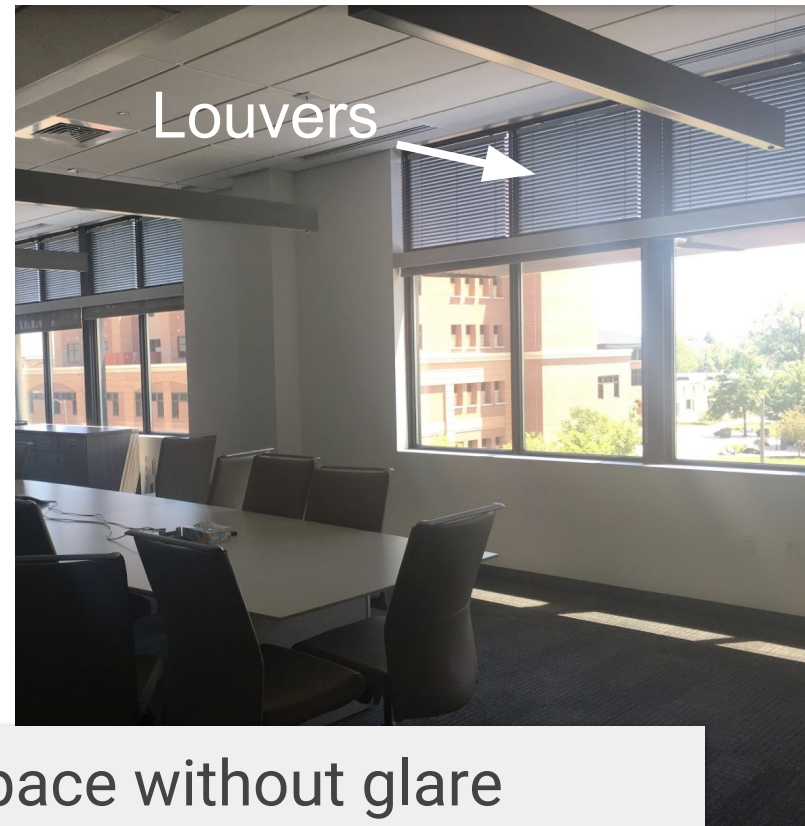
Legend

	Glare Type	sDGP Range	Frequency
■	Imperceptible	0 - 35%	73.0%
■	Perceptible	35 - 40%	6.3%
■	Disturbing	40 - 45%	3.2%
■	Intolerable	45%+	17.5%



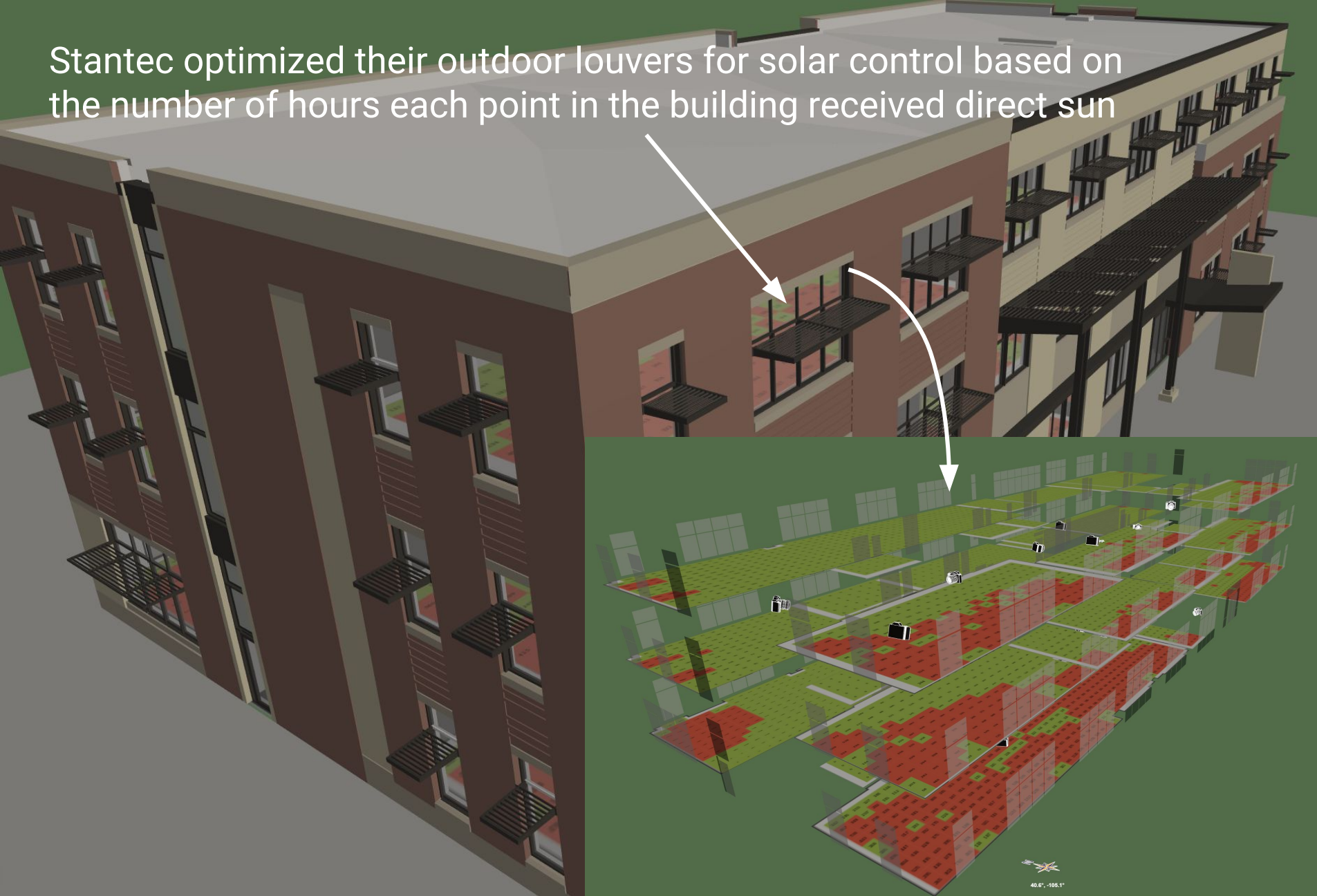
Example: Green Building of the Year 2018 (USGBC Mountain West Region)

Ft. Collins Administration Building, Stantec



Design brings daylight into space without glare

Stantec optimized their outdoor louvers for solar control based on the number of hours each point in the building received direct sun



Option 2: Legacy Option



$\geq 75\%$ = 1 point
 $\geq 90\%$ = 2 points

9AM



3PM



Option 2 clearest days used for averaging 9AM and 3PM direct (●) and horizontal (●) irradiance (measured in W/m^2):

Spring (03/25)

- 9AM: ● 884 ● 74
- 3PM: ● 950 ● 76

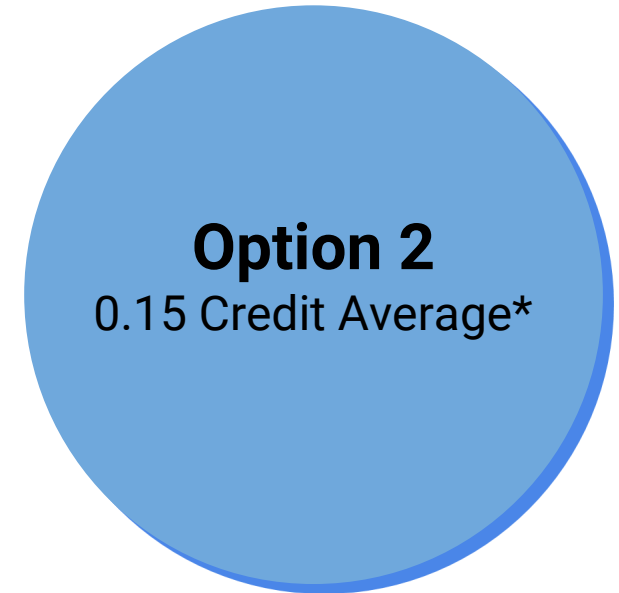
Fall (09/15)

- 9AM: ● 800 ● 86
- 3PM: ● 860 ● 101

Why Option 1 is the Better Choice

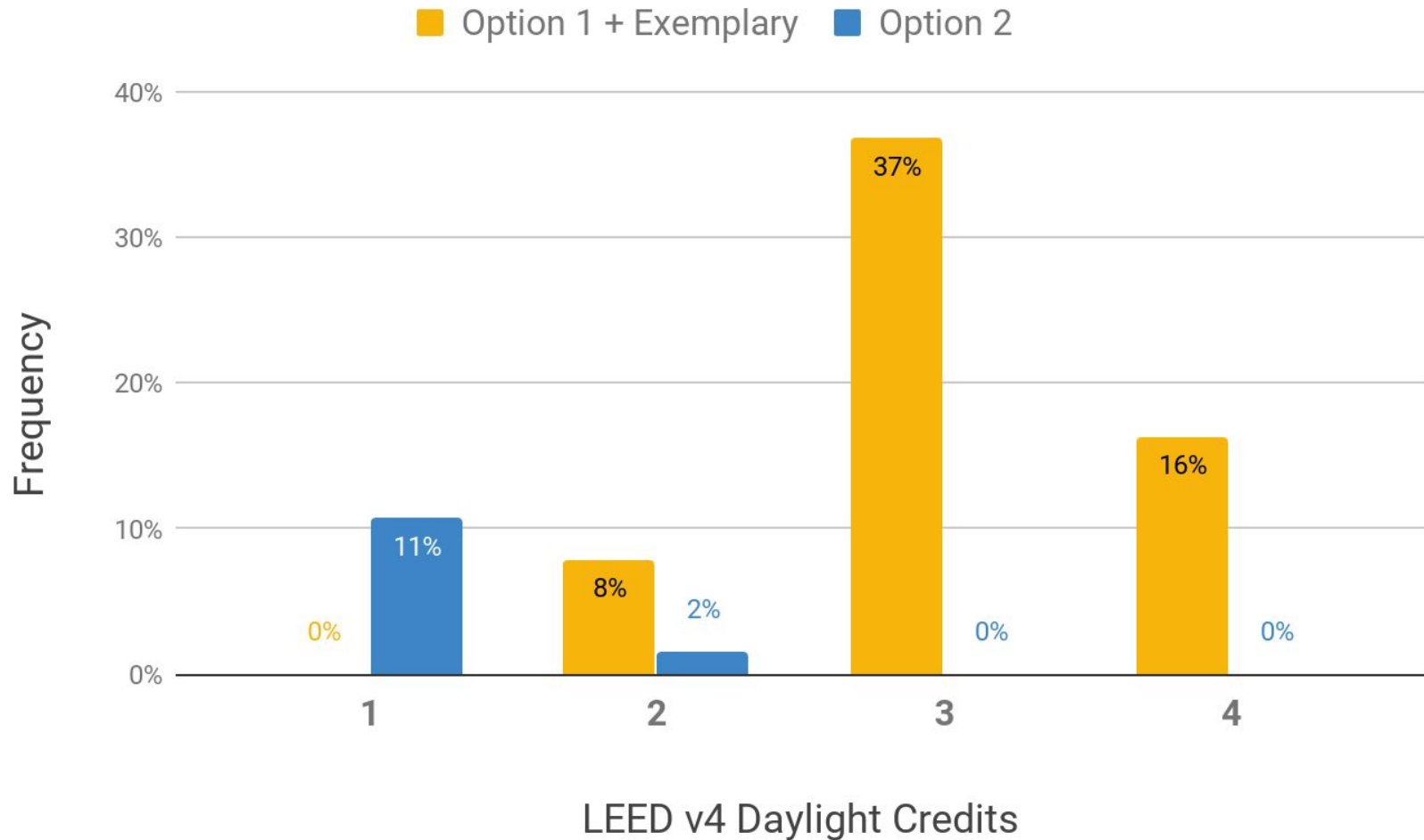


or



*Results of simulation software analysis

Option 1 will Outperform Option 2



LEED v4 Daylight Credit Summary

- **Use Option 1**

- More comprehensive analysis
- Correlates with empirical studies of how people function in buildings
- sDA + ASE = LEED v4 score
- Get more points + innovation credit

- **Create a daylight model using software that can model all LEED v4 requirements**

- Predict score accurately
- Make better design decisions

