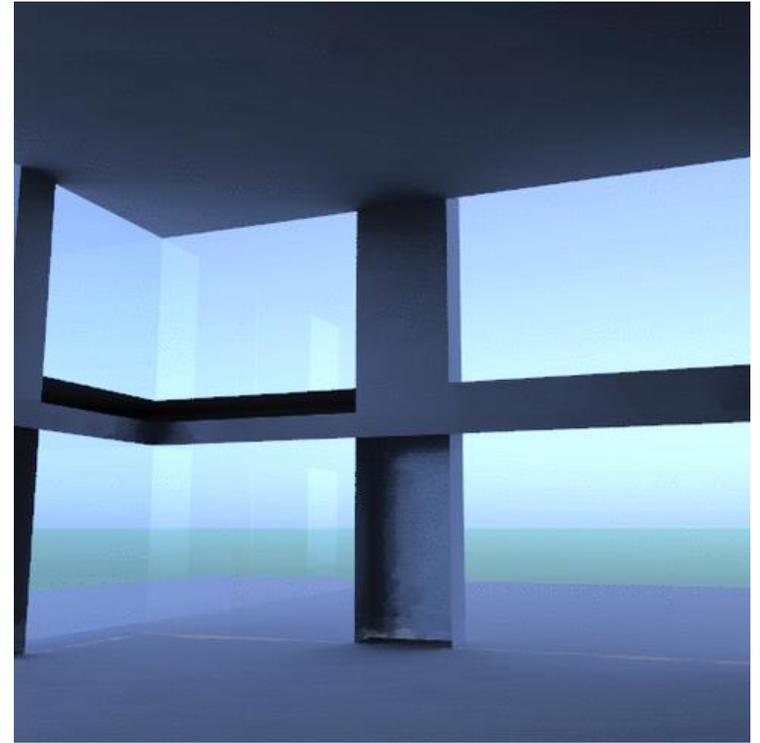


Predicting the Performance of Automated Glare Management Systems to Inform Design

Daniel Glaser, PhD | Principal, LightStanza
California Daylight Symposium
April 29, 2019

New Era of Daylight Modeling

- Advanced Climate-based simulation methodology
- Annual Performance Metrics
- Manufacturer Product Standards (BSDF)
- Cloud Computing



Sep 21, 06:00

Daylight Design SUCCESS

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

How to Predict that Design Solutions will Work?



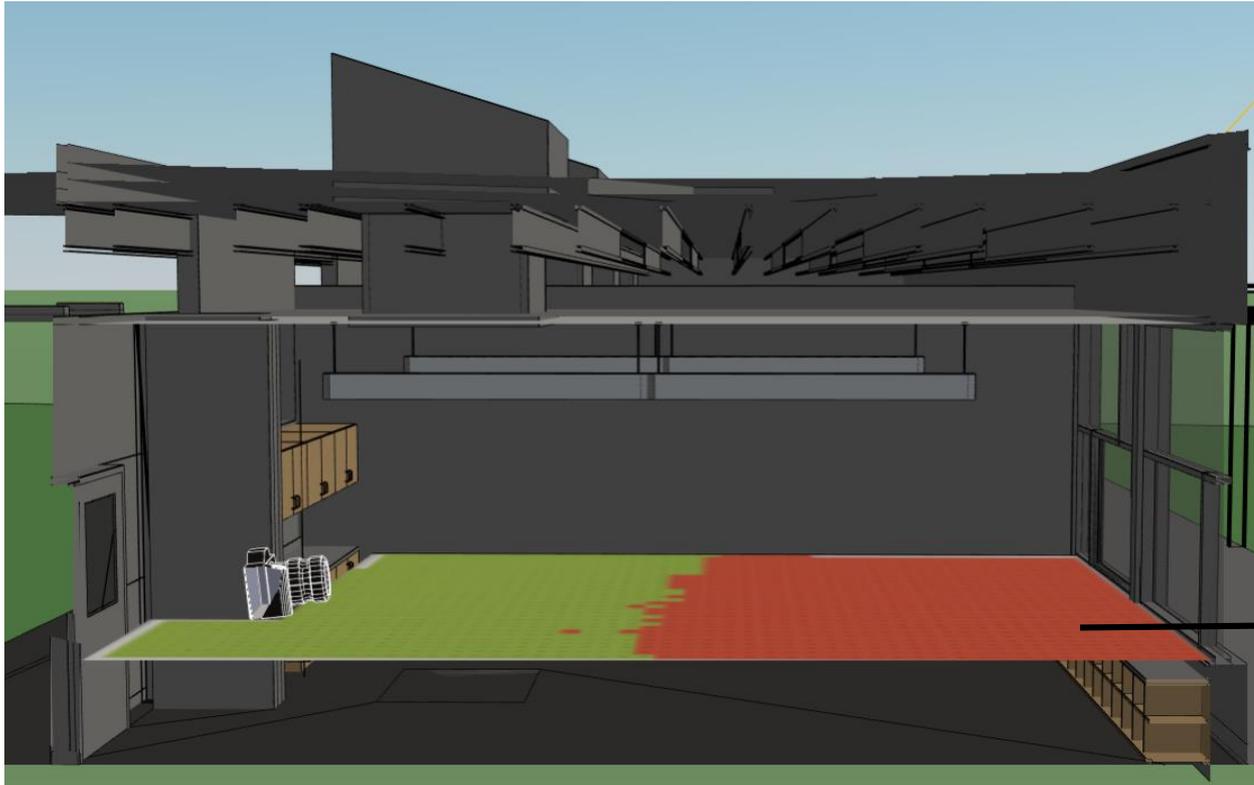
Spatial Daylight Autonomy $sDA_{300/50\%}$



Do we have sufficient light in the space?



Annual Sunlight Exposure $ASE_{1000/250hr}$



Is there too much glare in this space?

 ≥ 250 hours of direct sun
 ≥ 1000 lux

 < 250 hours of direct sun
 ≥ 1000 lux

Multiple Design Options to Find Best Solution



Blinds
(automated/manual)



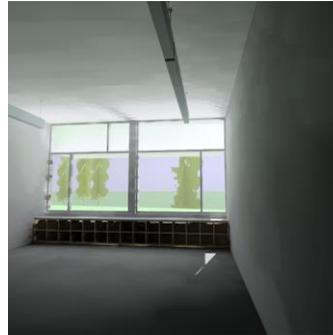
overhang



dynamic glass



diffusing glass



redirect film



honeycomb & dynamic

LightStanza - Design x +

https://app.lightstanza.com/design/5cb8c89feebba3200037ff03

LightStanza Office 1 + ↓ ↗

1.524 server hours used

Activity X

NEW

Filter by: All

- 4/25/19 2:24 PM Deleted material CS-TBK7-1000-1030
- 4/25/19 2:09 PM Added material CS-TBK7-1000-1030 to the design
- 4/25/19 2:09 PM Deleted material CS-TBK7-1000-1030
- 4/25/19 1:51 PM

4730 Walnut St, Boulder, CO 80301, USA (40.0°, -105.2°)

Glare Analysis: Ft. Collins Administration Building, Stantec

Overhangs

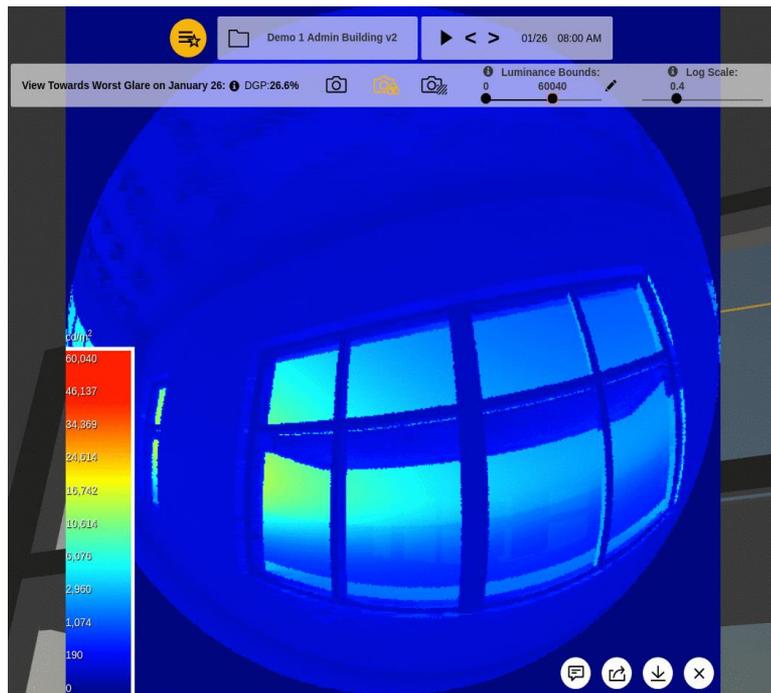


USGBC Mountain West Green Building of the Year (2018)

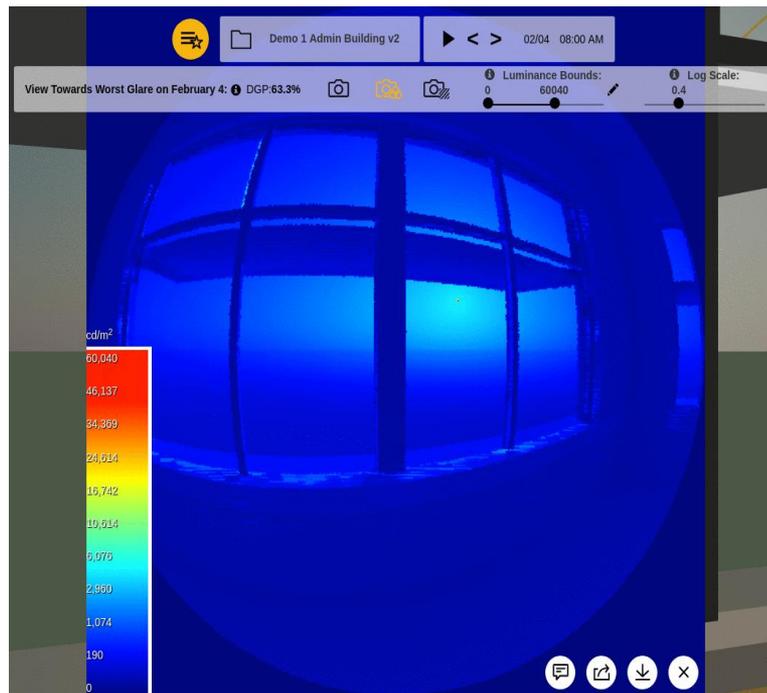
Tracking Winter Glare in a South Facing Office



Tracking Winter Glare in a South Facing Office

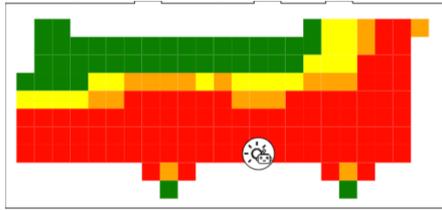


Standard Glass

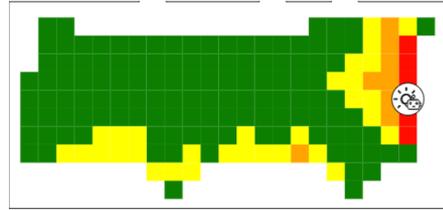


Dynamic Glass

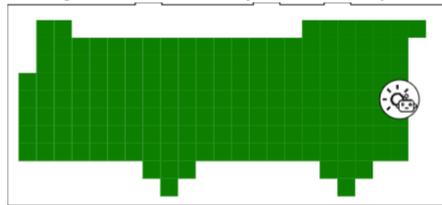
Glare Management Strategies



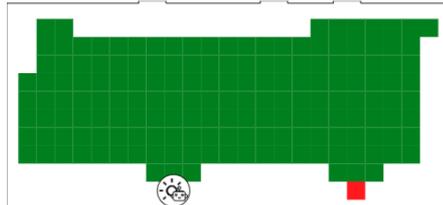
Overhang only



Overhang and Redirect film



Dynamic Glass

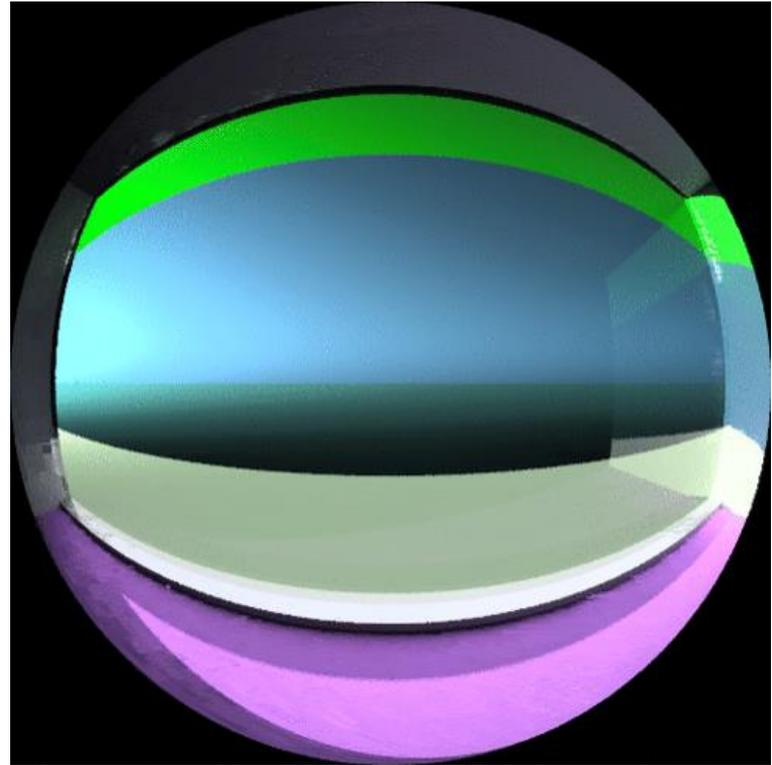
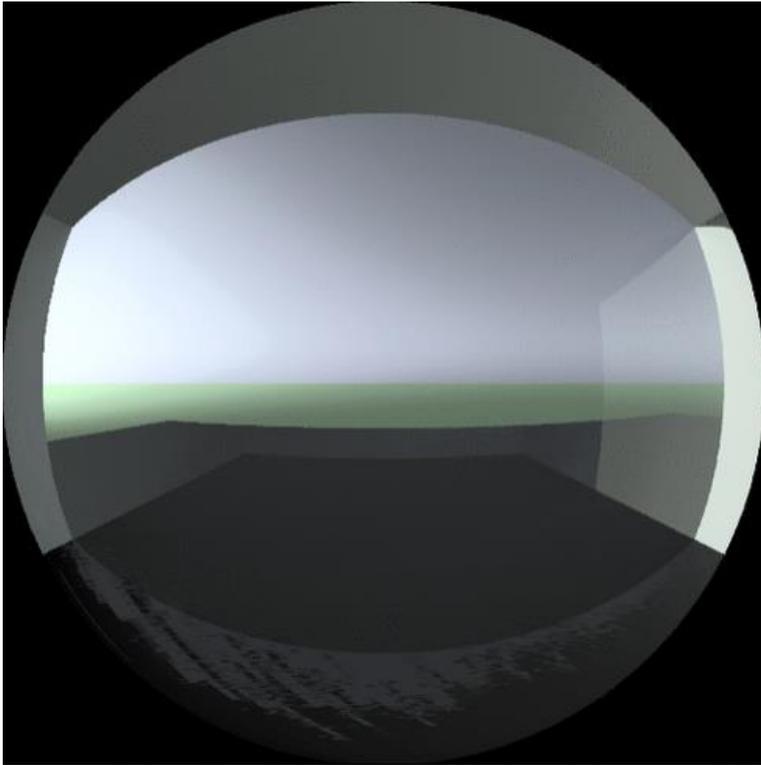


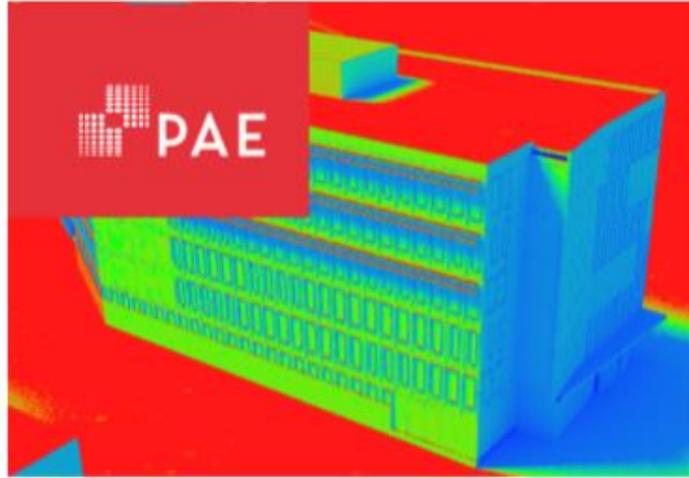
Automated Shades

Glare Type	
	Imperceptible
	Perceptible
	Disturbing
	Intolerable

- Full Year Analysis
- 26 view directions from each grid point

Dynamic Glass Optimizes Daylight Control





Detailed Analysis

Excerpts from PAE Engineers daylight analysis report on an office building

Baseline

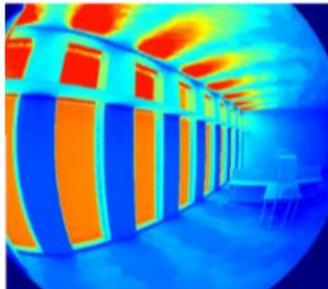
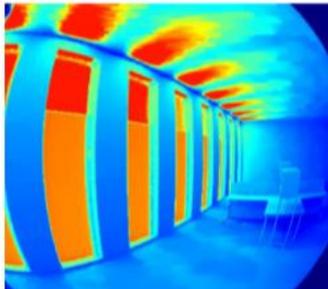
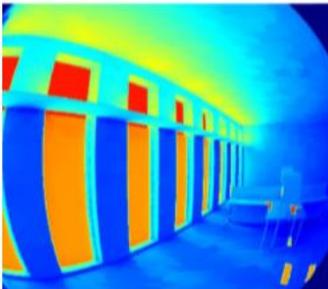
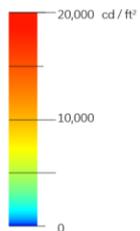
Light Shelf

Redirecting Film

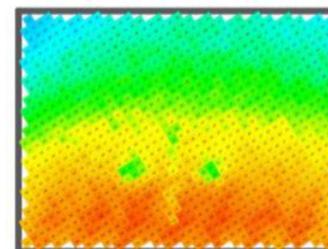
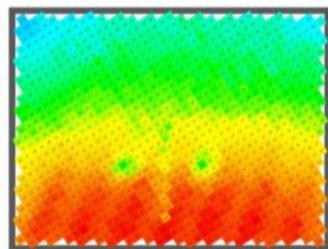
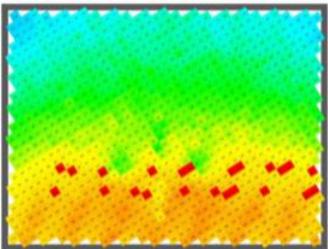
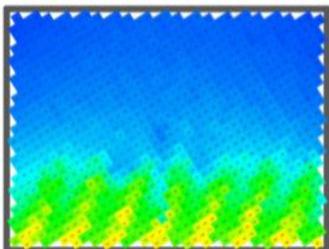
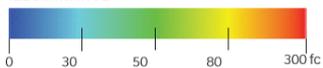
Light Shelf &
Redirecting Film



LUMINANCE
(Occupant perception)



ILLUMINANCE

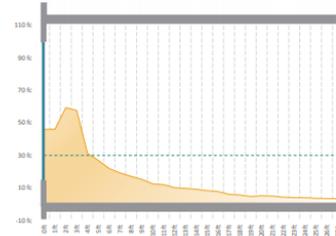


Daylight Illuminance Section

South

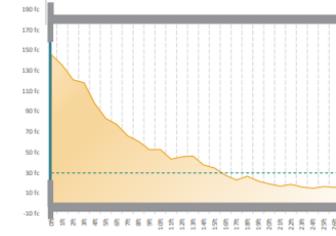


Baseline



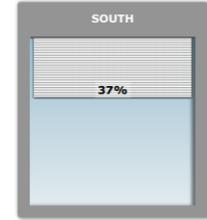
September 21st, 3 PM

Light Shelf with Redirecting Film

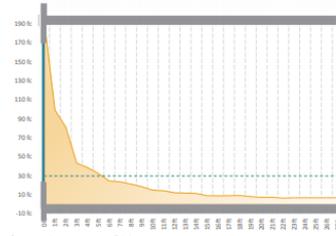


September 21st, 3 PM

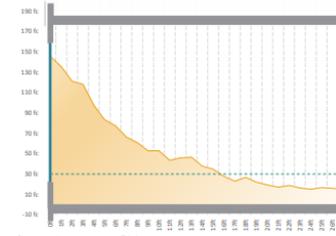
Percent of Hours Over the Year Blinds Deploy



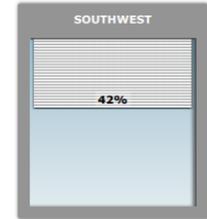
Southwest



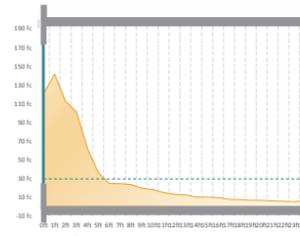
September 21st, 12 PM



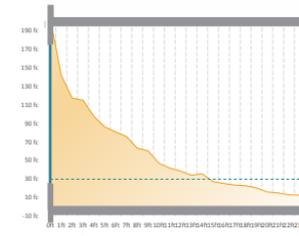
September 21st, 12 PM



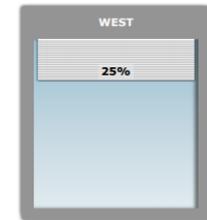
West



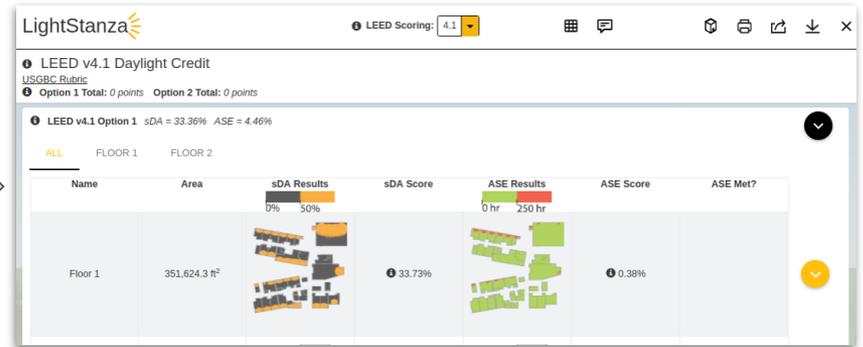
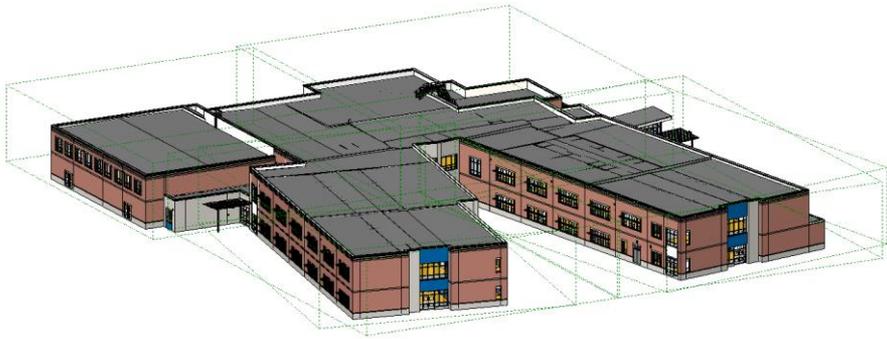
June 21st, 3 PM



June 21st, 3 PM

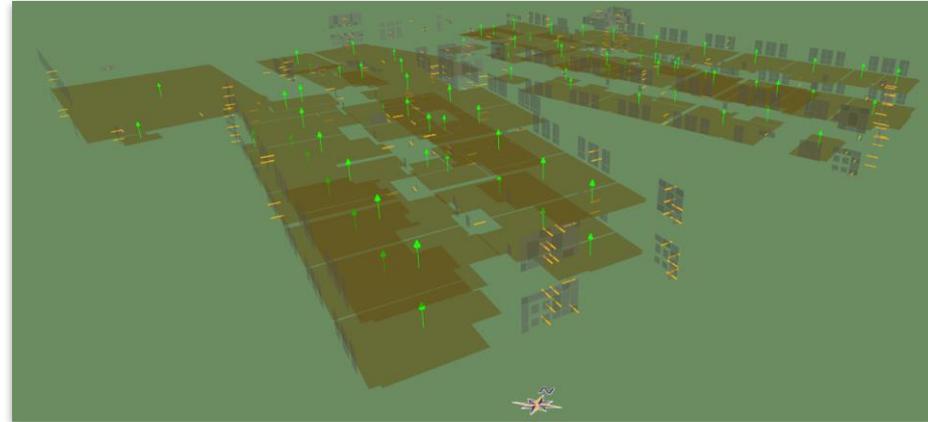
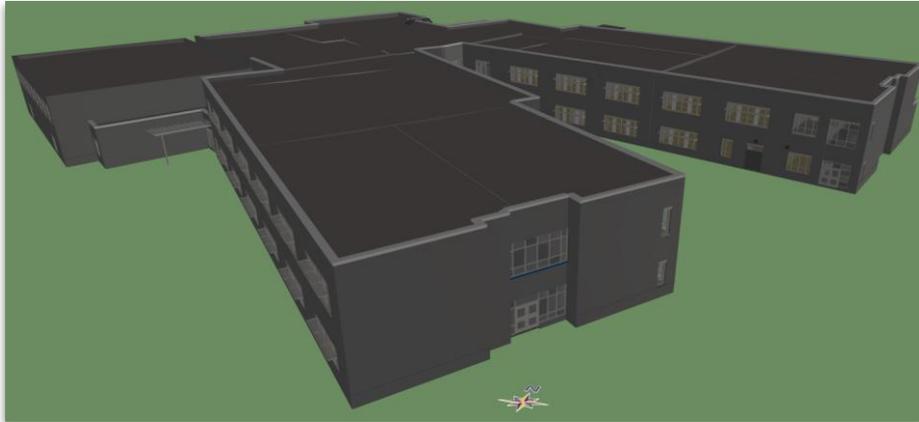


From Architectural to Rigorous Daylight Compliance Model

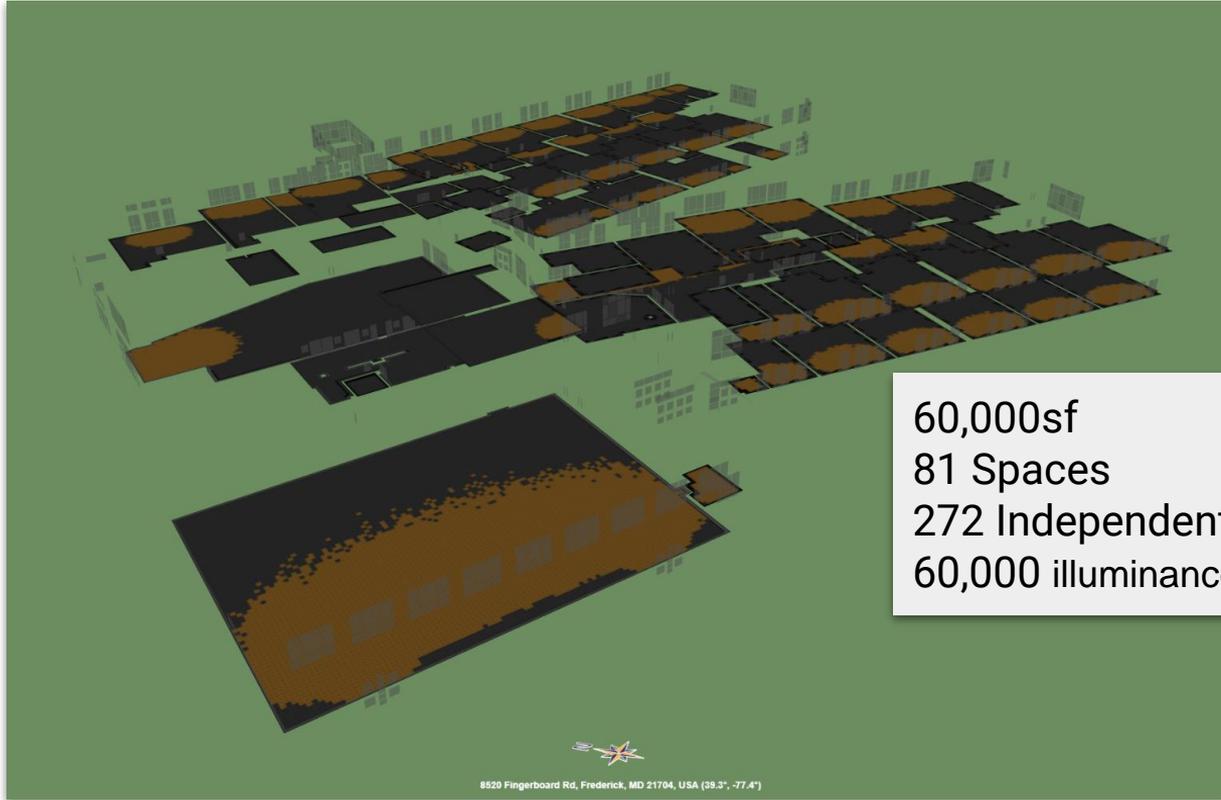


Decomposing Geometry

1. Geometry → Window groups + Illuminance Grids
2. Automatically identify blind locations
3. Mapping window groups to illuminance grid points



Climate Based Annual Daylight Simulation



60,000sf
81 Spaces
272 Independently controlled blind groups
60,000 illuminance sensors (1 ft spacing)

Scaling with Cloud Computing



Sep 21, 06:00

Large Models:

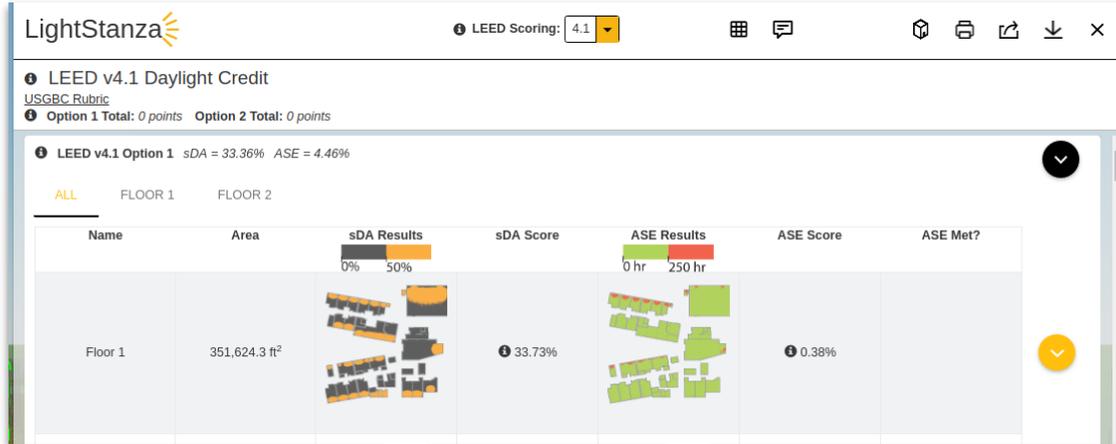
400,000sf

700 Spaces

2,600 Independently controlled blind groups

100,000 Grid Points illuminance sensors (2 ft spacing)

Full Building Compliance Summary



Full Building Compliance Details Upon Demand

LightStanza

LEED Scoring: 4.1

LEED v4.1 Daylight Credit
USGBC Rubric
Option 1 Total: 0 points Option 2 Total: 0 points

LEED v4.1 Option 1 sDA = 33.36% ASE = 4.46%

ALL FLOOR 1 FLOOR 2

Name	Area	sDA Results	sDA Score	ASE Results	ASE Score	ASE Met?
Floor 1	351,624.3 ft ²		33.36%		0.38%	
AP OFFICE A103	187.1 ft ²		100.00%		0.00%	Yes
AP OFFICE A104	162.7 ft ²		100.00%		0.00%	Yes
ART C101	1,017.3 ft ²		37.42%		0.00%	Yes

Additional Case Studies:

Glaser, Felschow, Callori, Sheehan, "How to use LEED v4 EQ 7 successfully to both get more points and better daylight design outcomes", *Greenbuild 2018*, Chicago

International Daylight Codes



Education
Funding
Agency

Do you think daylight should be part of building energy codes?



Joel Callow CEng PhD • 1st

19h ...

Technical Director - Building Physics, Sustainability, QODA Consulting

From this side of the pond I also 100% agree. Only government funded schools in the UK get regular scrutiny for daylight and in my opinion this has really improved their daylight and solar performance compared to a few years ago when daylight was poorly regulated.



BUREAU OF ENERGY EFFICIENCY

Government of India, Ministry of Power

Conclusions + Discussion

- Daylight performance metrics go beyond window to wall ratios
- Improved codes will have both energy and human benefits
- Established ways of modeling and predicting daylight performance



Let's try to prevent this in the future!



Daniel Glaser, PhD, Founder

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