

Rock Creek Middle School Daylighting Analysis

Existing and Proposed Spaces



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Project Overview:
Rock Creek Middle School
Location: 14897 SE Parklane Dr., Happy Valley, OR.
Year of Completion: 2010
Square Footage: 129,000 square feet
Occupancy: 750

Bora is starting design work on a conversion of Rock Creek Middle School (completed by BORA in 2010) into a high school. This conversion was always envisioned and will soon become a reality. The project will double the size of the existing school, with additional structure being added to most sides and even the roof of one wing. The will impact existing daylight access in various ways that we'd like to understand better. The goal of this research project is to help us understand existing daylight conditions in areas that will be impacted by proposed additions, leading to informed design decisions about how to mitigate negative effects and maintain optimal daylight in these spaces. BORA will identify a few key areas to study. Students will obtain field measurements to quantify existing daylight effectiveness, and conduct parallel Diva analysis to establish a modeled baseline of the existing conditions. Then, our proposed additions will be added to the model to analyze resultant daylight performance. Impacts will be quantified and potential design studied as time allows.

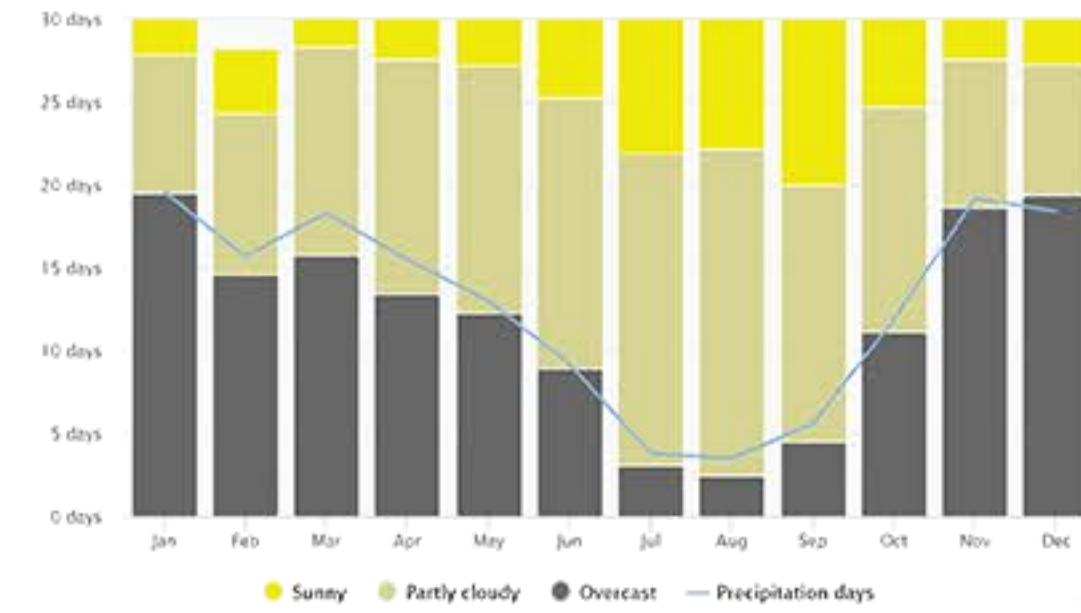
BORA Timeline	SEPTEMBER 2017
Sept. 26th: First day of class - Introduction to building science research firms	Sept. 27th: Firm Assignment
Oct. 9th: Research collaboration introductions and goals	Sept. 28th: Email introductions with BORA team
Oct. 16th: Solar path analysis + Working draft presented Rhino tutorial	OCTOBER 2017 Oct. 23rd: North wing hallway - Rhino model Proposed additions delivered
Nov. 1st: Site visit and light analysis	Oct. 30th: Rhino model of commons area Proposed additions presented
Nov. 3rd: Diva tutorial	NOVEMBER 2017 Nov. 13th: North wing hallway proposed expansion + Diva daylighting analysis
Nov. 9th: Midterm presentation Email check-in - Diva solstices simulations	Nov. 20th: Design adjustments of proposed spaces Excel spreadsheet of daylighting data Daylight factor + Radiation map simulations
	Nov. 27th: Deliver first draft of poster presentation Make adjustments accordingly
	DECEMBER 2017 Dec. 7th: Final presentation

Methodology

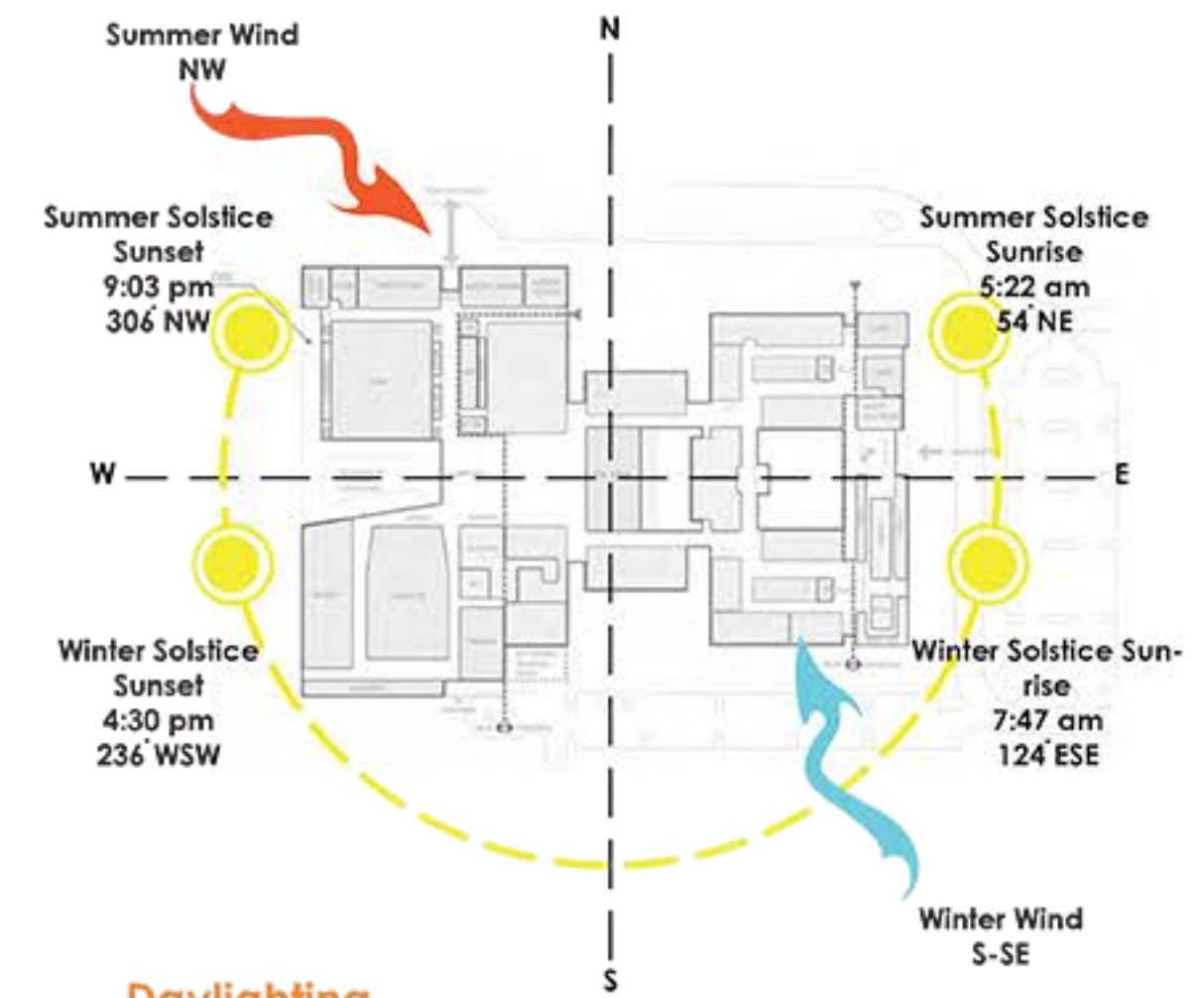
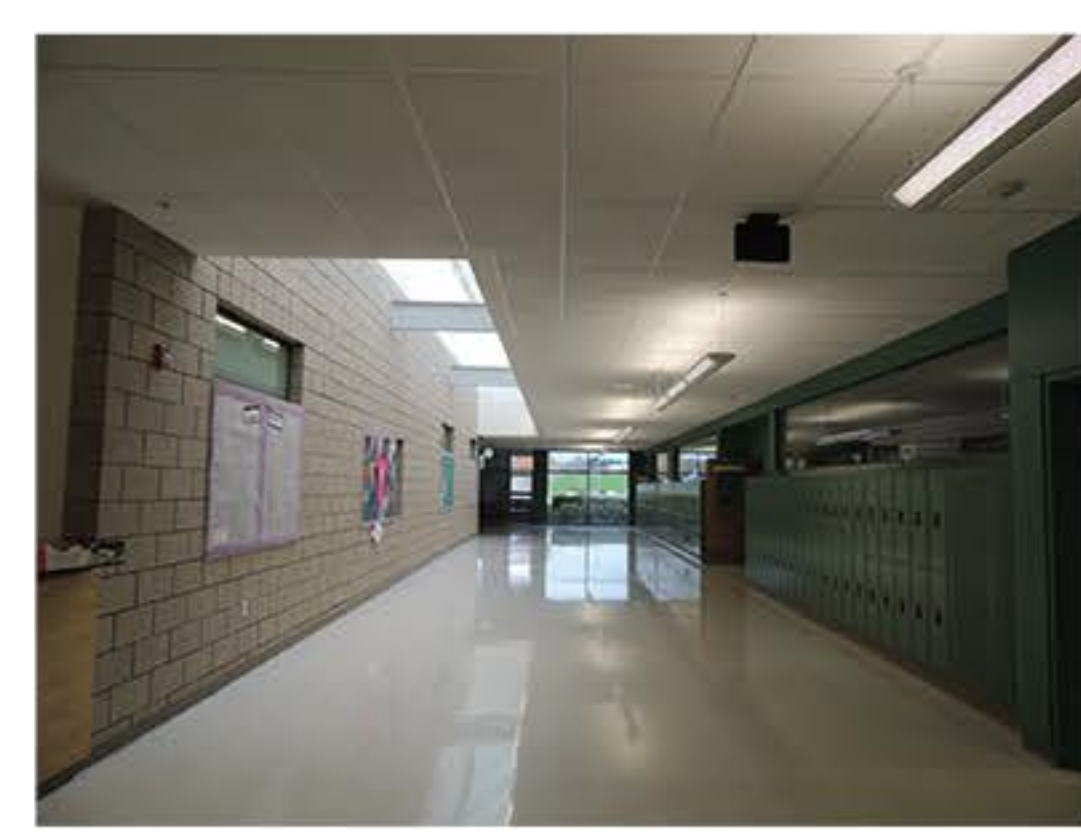
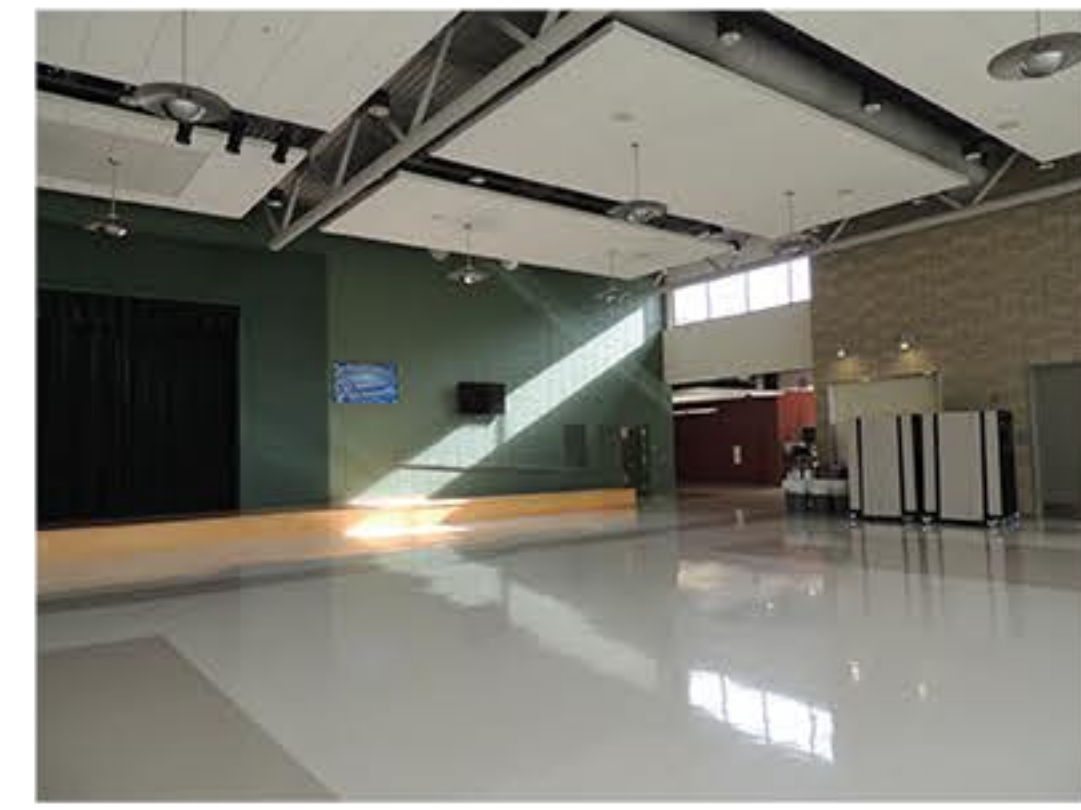
We used the Lutron LX-103 light meter as to collect field measurements at Rock Creek Middle School. We set the device to footcandles and switched the range to A. When taking the measurements, we held the light meter 30 inches above the ground and recorded the data every ten feet throughout the entire hallway. In the commons area we used the same method but only recorded every 10 feet twice in the center of the room going vertically and then again horizontally. We have taken these field measurements and compared them to the Diva analysis of the existing spaces and proposed spaces.

Conclusions

When reviewing the Diva simulations of our current proposed additions at Rock Creek Middle School, it has been concluded the windows in the commons area allow too much light inside during the spring, summer and fall which would result in a significant heat gain. An additional iteration is necessary as to adjust the window sizes and placement as to lessen this impact. Some initial changes will include the size and placement of the windows, what type of windows are used (fritted windows most likely), as well as the angle of the opening of the windows.



The graph shows the monthly number of sunny, partly cloudy, overcast and precipitation days. Days with less than 20% cloud cover are considered as sunny, with 20-80% cloud cover as partly cloudy and with more than 80% as overcast.

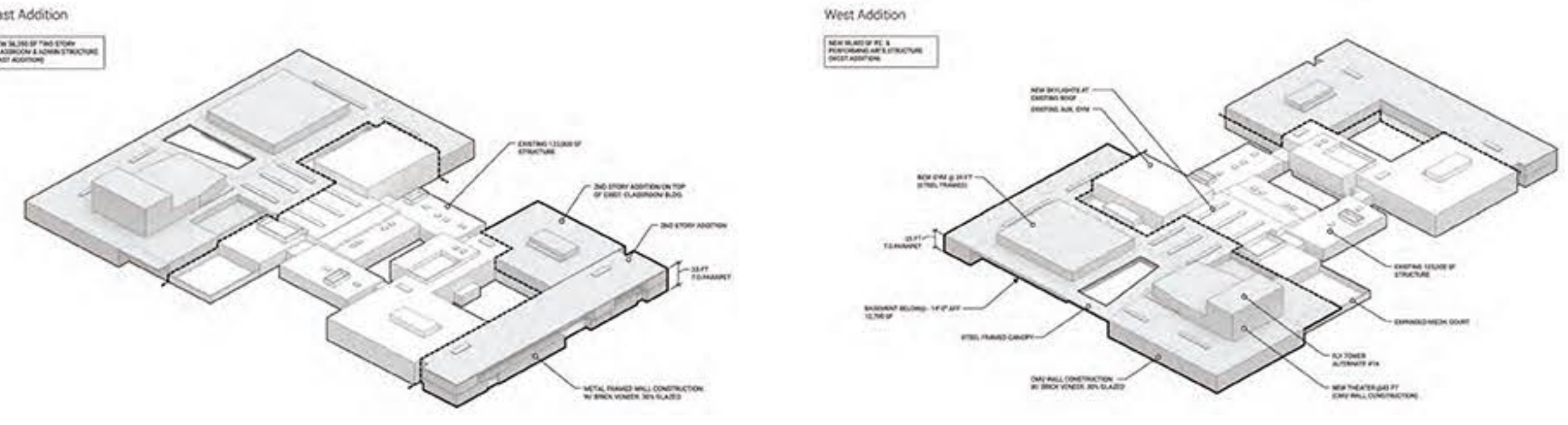
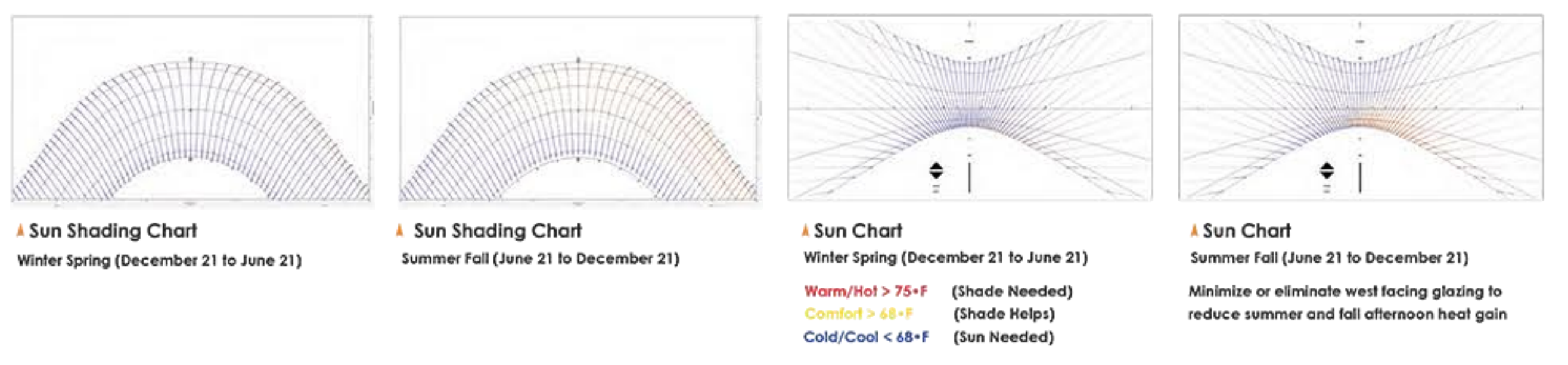


Daylighting

Is a passive strategy using natural lighting to illuminate interior spaces. The benefits from daylighting range from improved aesthetic qualities including better color balance and connection to the outdoors, to increase energy efficiency. Adding an active component can enhance the effectiveness of these strategies shown. (LEED Reference Guide for Building Design and Construction, pg. 723)

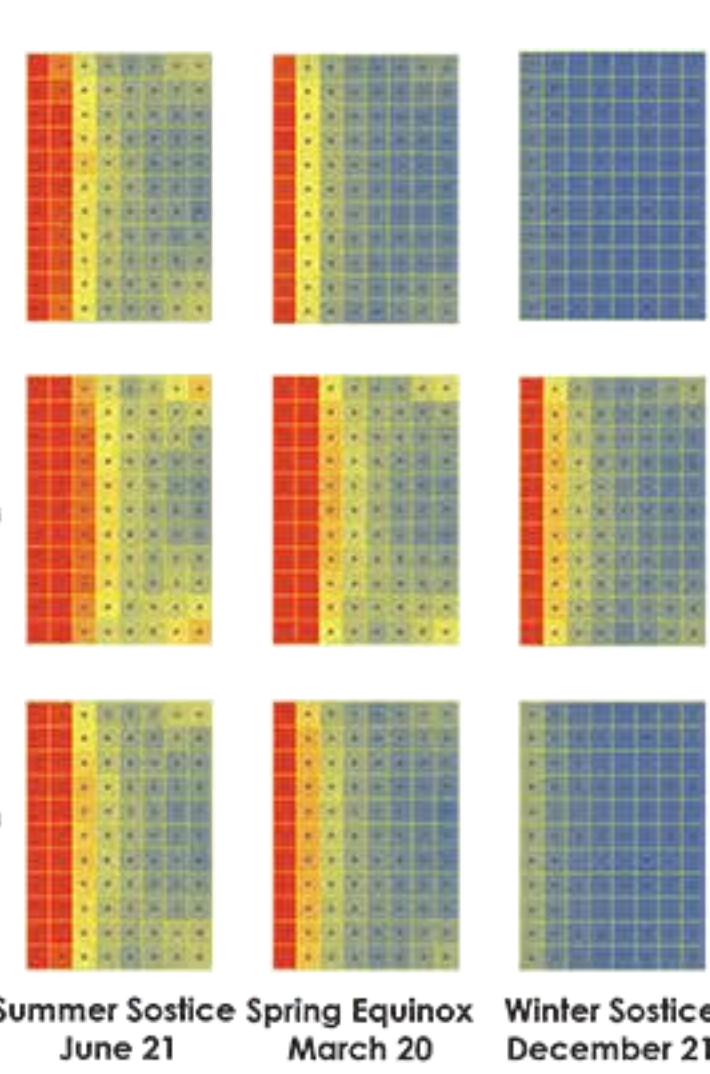
Intent

To connect building occupants with the outdoors, reinforce circadian rhythms, and reduce the use of electrical lighting by introducing daylighting into the space. (<http://art-tech.over-blog.com/2014/10/light-effects-2.html>)

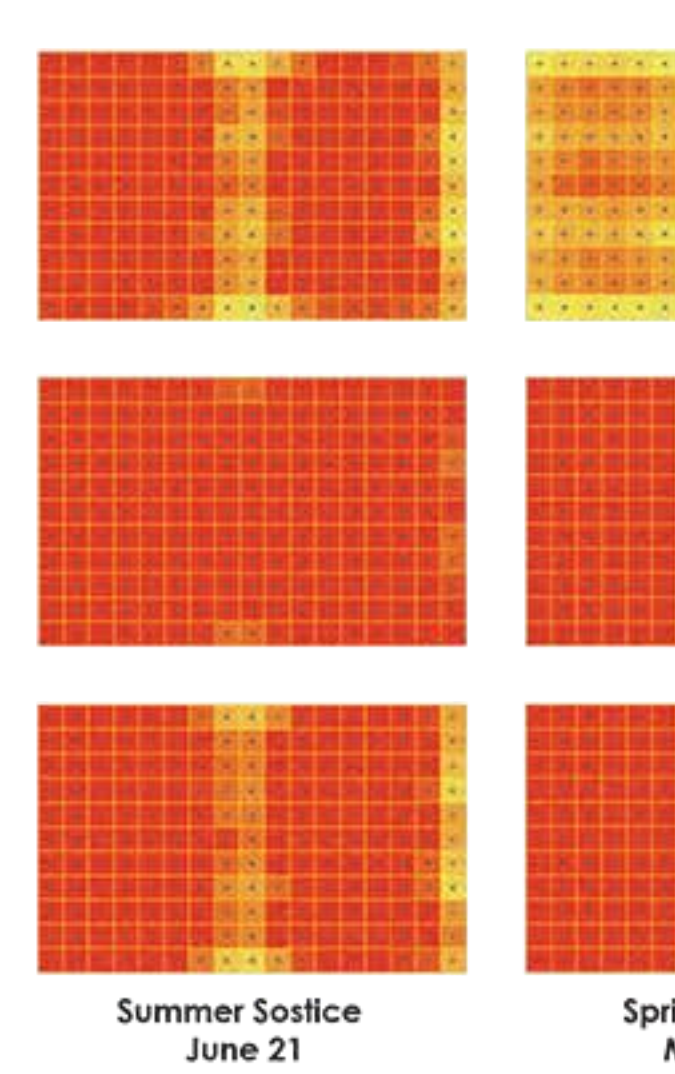


Commons Area Diva Analysis

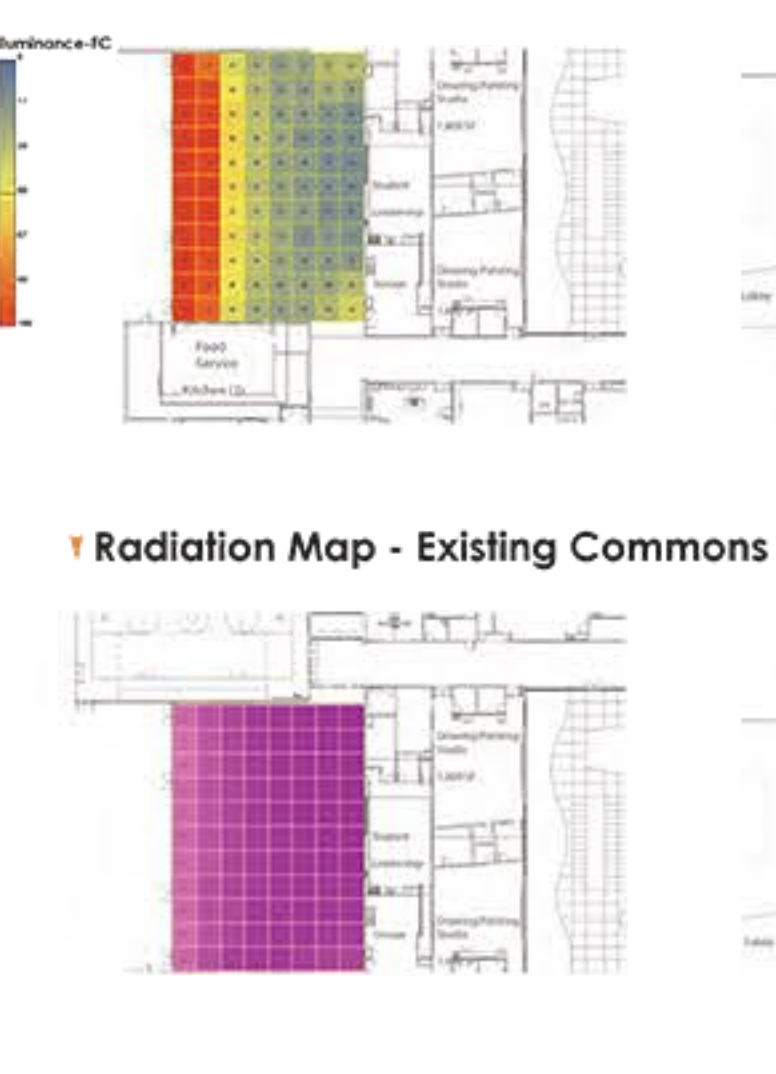
Daylight Factor - Existing Commons



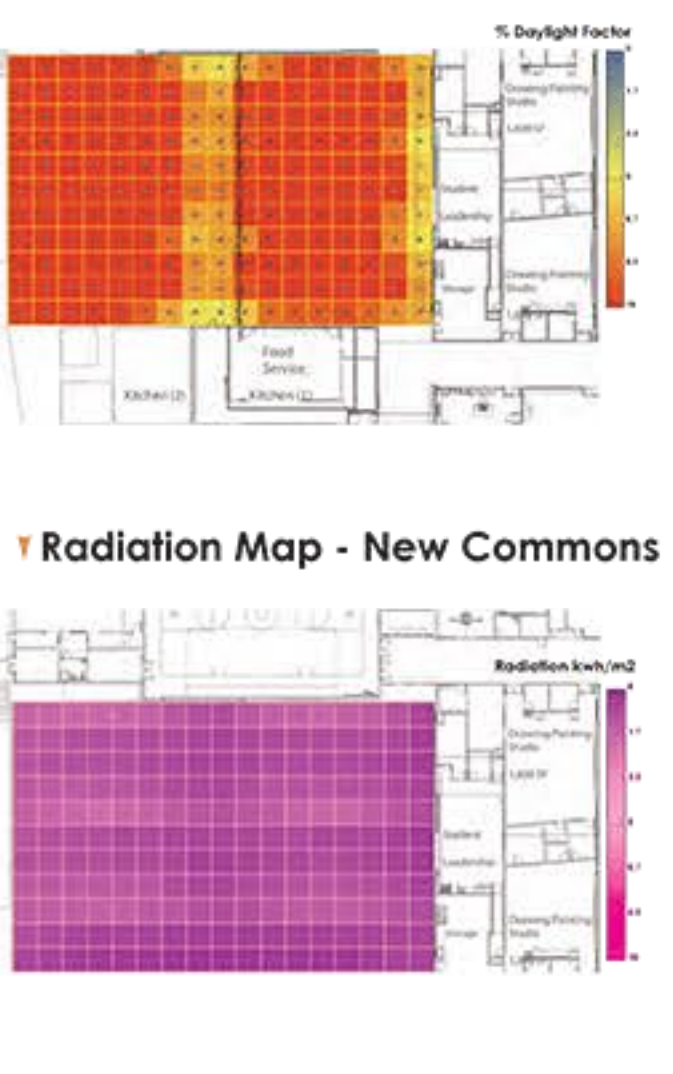
Daylight Factor - New Commons



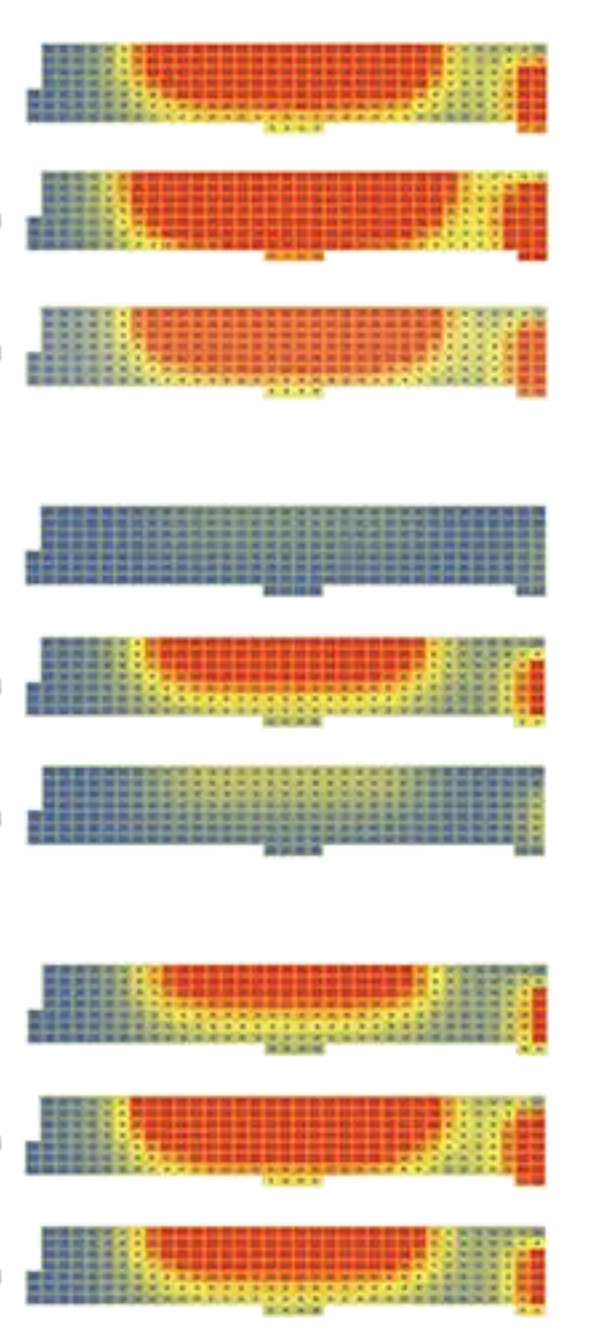
Radiation Map - Existing Commons



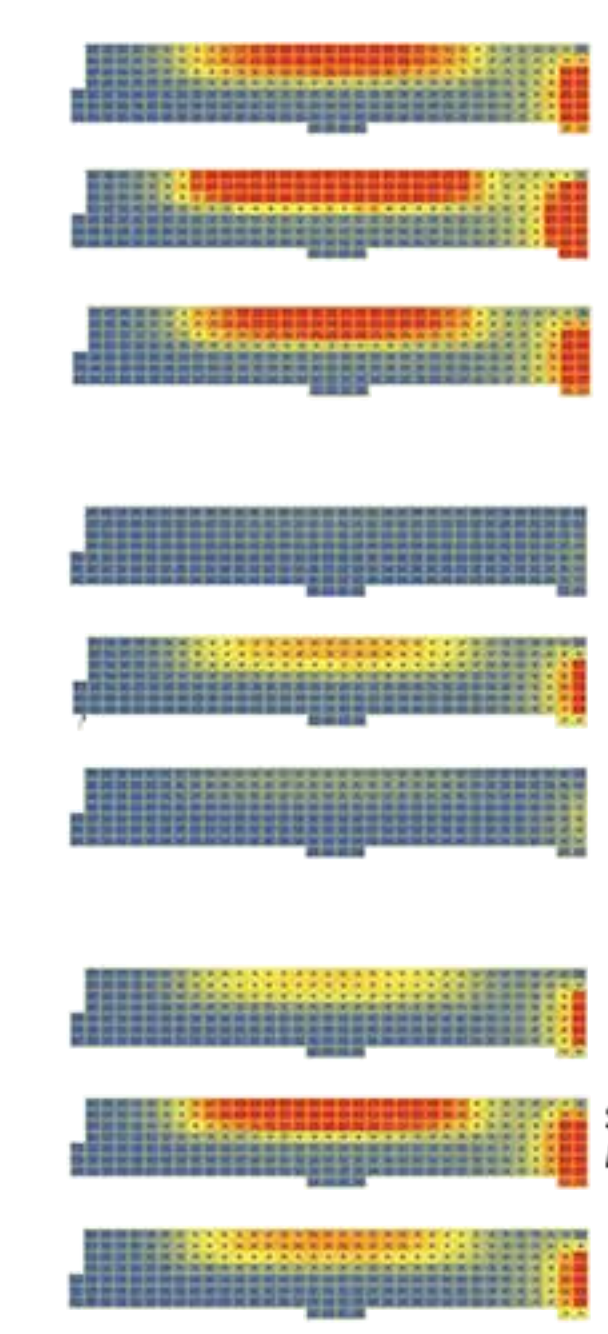
Radiation Map - New Commons



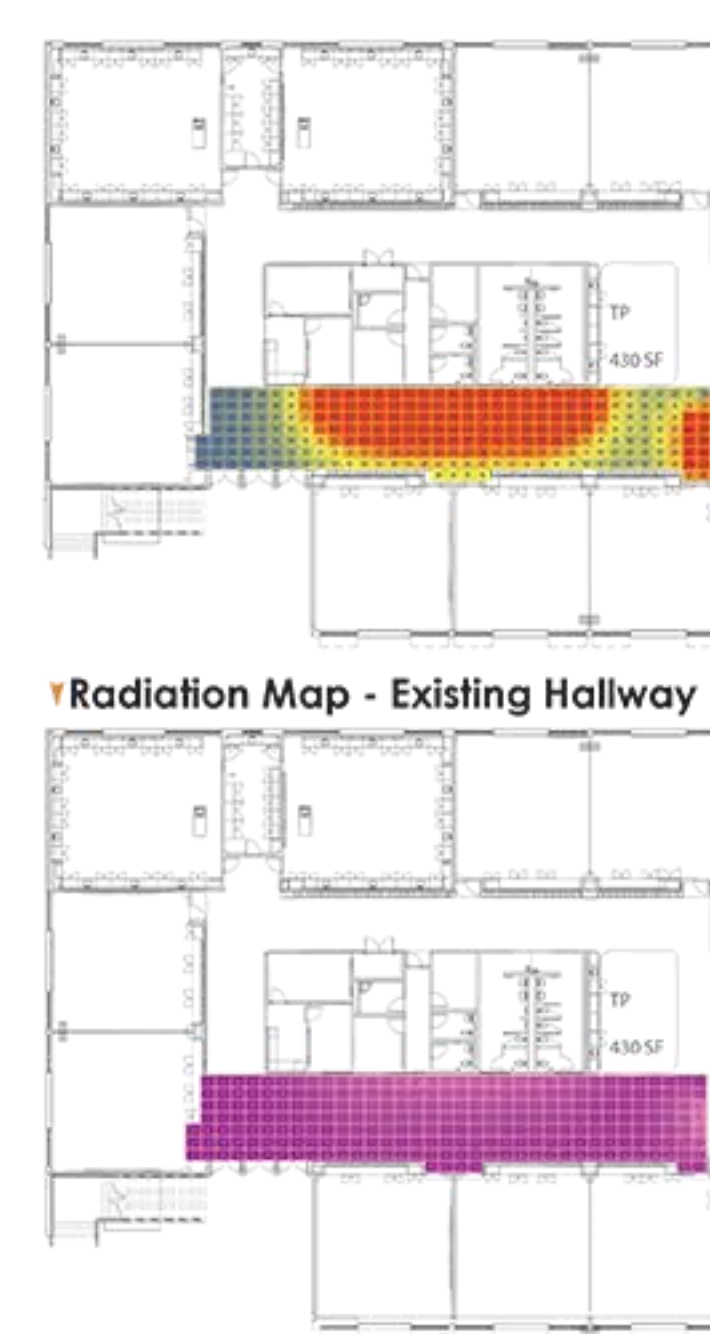
Daylight Factor - Existing Hallway



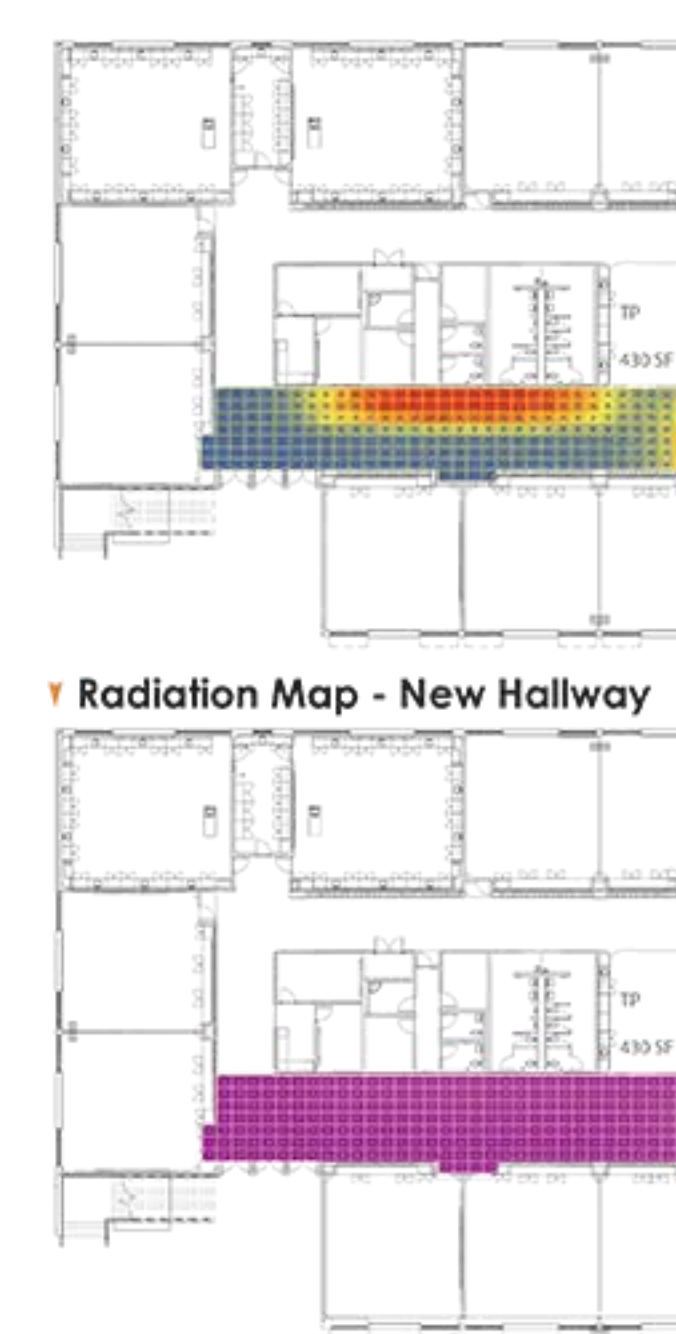
Daylight Factor - New Hallway



Radiation Map - Existing Hallway



Radiation Map - New Hallway



Hallway Diva Analysis