Fall 2017

Rock Creek Middle School Daylighting Analysis: Existing and Proposed Spaces

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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

Sept. 28th:
Email introductions with BORA team

OCTOBER 2017
Oct. 9th:
Research collaboration
Introductions and goals

Oct. 16th:
Solar path analysis +
Working draft presented
Rhino tutorial

Oct. 23rd:
North wing hallway
-Rhino model
Proposed additions delivered

Oct. 30th:
Rhino model of commons area
Proposed additions presented

NOVEMBER 2017
Nov. 1st :
Site visit and light analysis

Nov. 3rd:
Diva tutorial

Nov. 9th:
Midterm presentation
Email check-in
- Diva solstices simulations

Nov. 13th:
North wing hallway proposed expansion
+ Diva daylighting analysis

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

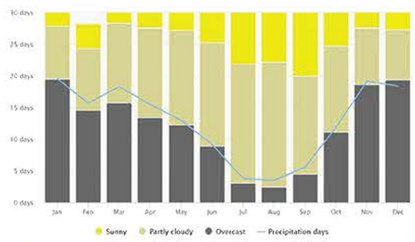
DECEMBER 2017
Dec. 7th:
Final presentation

Methodology

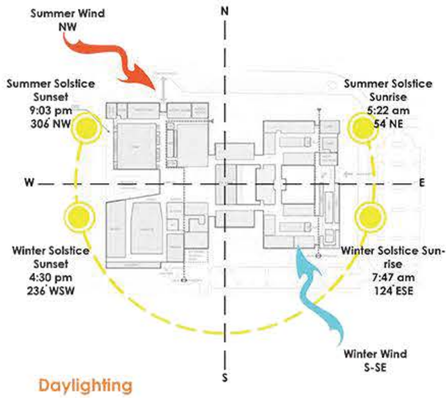
We used the Lutron LX-103 light meter as to collect field measurements at Rock Creek Middle School. We set the device to footcandles and switched the range to A. When taking the measurements, we held the light meter 30 inches above the ground and recorded the data every ten feet throughout the entire 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.

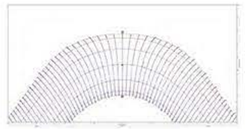


Daylighting

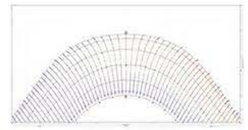
Is a passive strategy using natural lighting to illuminate interior spaces. The benefits from daylighting range from improved aesthetic qualities including better color balance and connection to the outdoors, to increase energy efficiency. Adding an active component can enhance the effectiveness of these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

Intent

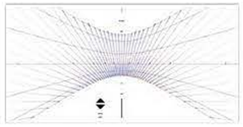
To connect building occupants with the outdoors, reinforce circadian rhythms, and reduce the use of electrical lighting by introducing daylighting into the space.
(http://art-tech.over-blog.com/2014/10/light-effects-2.html)



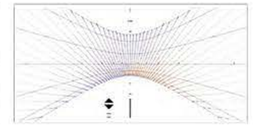
Sun Shading Chart
Winter Spring (December 21 to June 21)



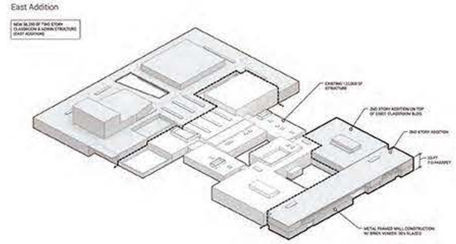
Sun Shading Chart
Summer Fall (June 21 to December 21)

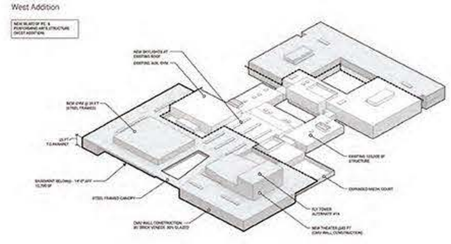


Sun Chart
Winter Spring (December 21 to June 21)
Warm/Hot > 75•F (Shade Needed)
Comfort > 68•F (Shade Helps)
Cold/Cool < 68•F (Sun Needed)



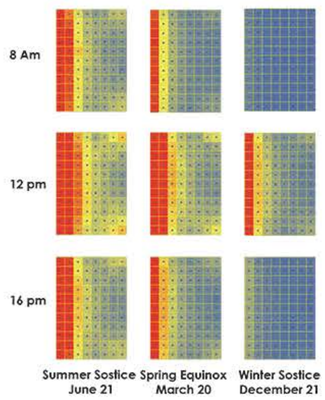
Sun Chart
Summer Fall (June 21 to December 21)
Minimize or eliminate west facing glazing to reduce summer and fall afternoon heat gain



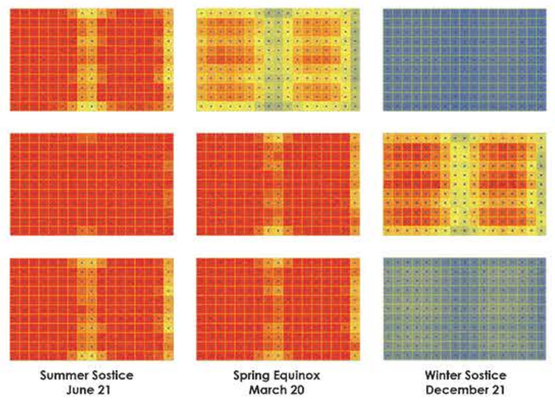


Commons Area Diva Analysis

Diva Analysis - Existing Commons

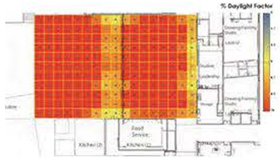


Diva Analysis - New Commons



Daylight Factor - Existing Commons

Daylight Factor - New Commons

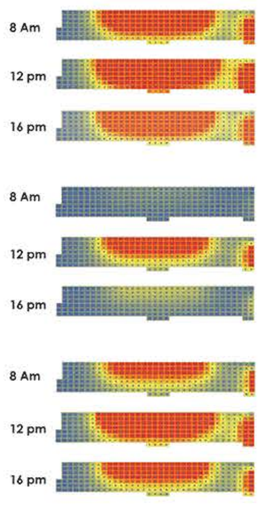


Radiation Map - Existing Commons

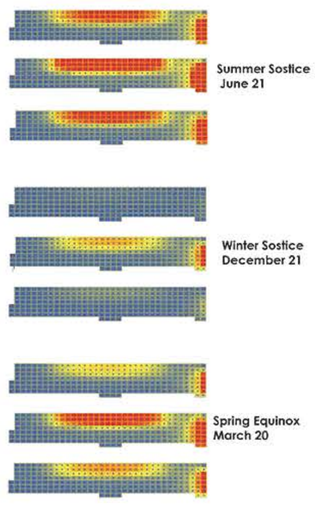
Radiation Map - New Commons

Hallway Diva Analysis

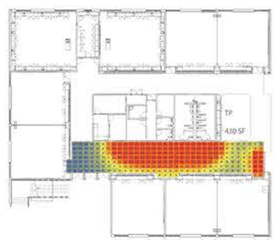
Diva Analysis - Existing Hallway



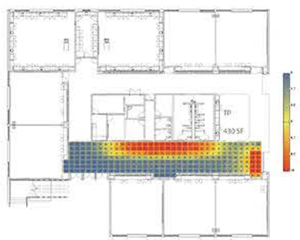
Diva Analysis - New Hallway



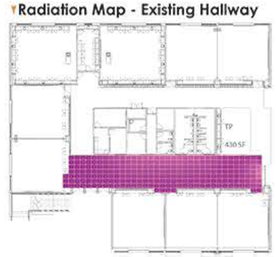
Daylight Factor - Existing Hallway



Daylight Factor - New Hallway



Radiation Map - Existing Hallway



Radiation Map - New Hallway