Montessori of the Rio Grande Charter School

DAYLIGHT ANALYSIS UPDATE

March 8, 2017

TERMINOLOGY

Daylighting: The passive illumination of buildings by natural light.

Illuminance Grid: An imaginary horizontal plane where daylight levels are measured; for the purposes of this report, the illuminance grid is set at 30" above finished floor.

Glare: Caused by a significant difference in the luminance levels between a task area (work station) and a light source.

Foot-candle (Fc): A unit of measure for daylight analysis that represents the illuminance on a 2-square foot surface of which there is a uniformly distributed flux of one lumen.

Lux: A measure of light intensity as perceived by the human eye; 1 = 1 lumen per square meter = 10.7 footcandles = 1 candella per square meter.

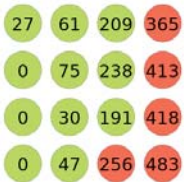
Daylight Autonomy (DA): A measure of how much time a room's illuminance level can be met with daylight alone. This metric is useful for exploring potentials of electric lighting with dimming systems.

Annual Sunlight Exposure (ASE): A LEED version 4 (LEEDv4) metric that measures the annual number of hours illuminance values in a space exceed a given threshold. Spaces are compliant with LEEDv4 requirements if illuminance values do not exceed 1,000 lux for more than 250 hours in a year.

Daylight Autonomy Plot:

The Daylight Autonomy Plots show the percentage of annual daylight hours when the space reaches the 30 foot-candle threshold. Lighter values in the plot show areas that are reaching the 30 foot-candle threshold for a greater percentage of the day. Darker values in the plot show areas that reach the 30 foot-candle threshold for a smaller percentage of the year.

Annual Solar Exposure Plot:



Annual Solar Exposure (ASE) plots show the annual number of hours illuminance values in a space are expected to exceed 1,000 foot-candles during the year. Areas that exceed 250 hours per year are considered over-lit. Circles are shown in green if the total annual hours are less than 250 and red if the annual hours are greater than 250. Similar to the Daylight Autonomy Plot, the Annual Solar Exposure (ASE) plot is analyzed at a 5-square foot interval.

DAYLIGHT DESIGN

Project Goals

- Achieve LEEDv4 EQ. Daylight compliance
- Enhance daylight quality to improve occupant experience over the course of the year.

Intent

The intent of this deliverable is to document the design compliance with LEEDv4 daylight requirements. Noncompliant areas are identified with recommendations for improving performance. This assessment is based upon preliminary schematic layouts provided by the architect.

LEED v4 Metric - EQ Daylight Compliance

TABLE 1. Points for daylit floor area: Spatial daylight autonomy

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality	
sDA (for regularly occupied floor area)	**Points**
55%	2
75%	3

- Demonstrate through annual computer simulations that spatial daylight autonomy (sDA) of at least 55% or 75% is achieved. Use regularly occupied floor area.
- Demonstrate through annual computer simulations that annual sunlight exposure1000,250 (ASE1000,250) of no more than 10% is achieved. Use the regularly occupied floor area that is daylit per the sDA 300/50% simulations.

Process

A preliminary design iteration has been evaluated to inform daylight design related to building orientation and other factors.

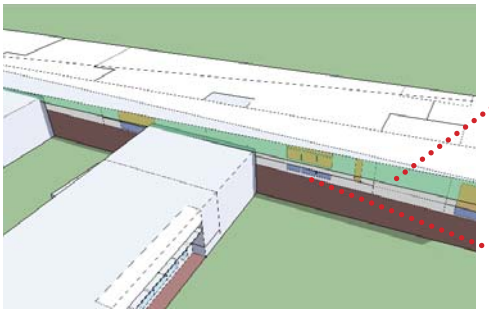
PRELIMINARY DESIGN ITERATION

Intent

Based on the Architect's Site Design phase floor plans and elevations drawings, the initial daylight analysis evaluated performance based upon the scheme with the elongated East-West axis. The analysis used one classroom module as a unit to inform initial recommendations. The following assumptions guided the process:

- Analysis grid for daylight performance set to 30" above finished floor with 5' module
- Glazing Visible Transmittance:
  - » West and East facing windows - 35%
  - » South facing windows - 50%
  - » North facing windows - 70%

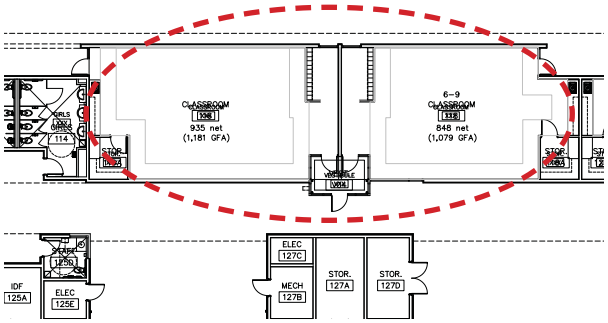
FINAL ASSESSMENT - CLASSROOM 116 AND 118



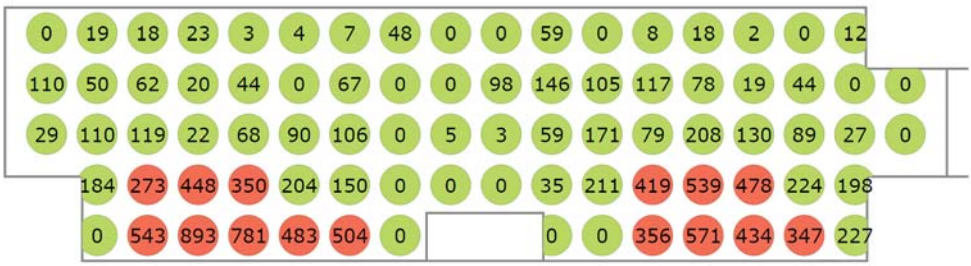
Shade Screen

Door:
Vision Glazing Area (below 7'6"): 47 sqft

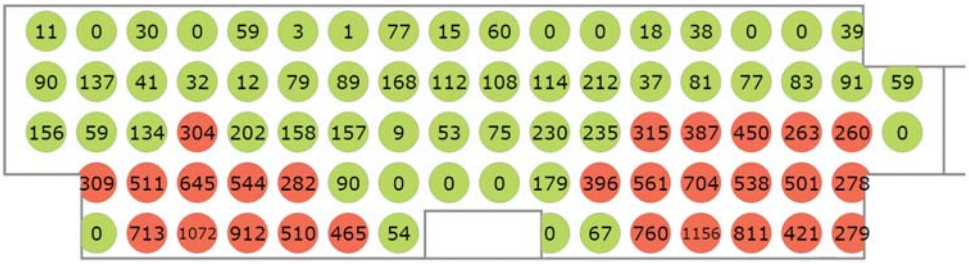
Daylight Glazing Area (above 7'6"): 15 sqft



South Perspective at noon on 12/21



25% Open Exterior Screen
Annual Sunllight Exposure (ASE) = 18%

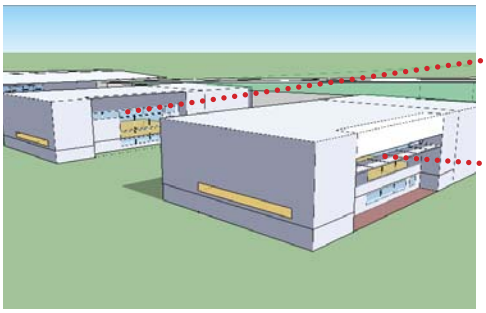


No Exterior Screen
Annual Sunlight Exposure (ASE) = 51%

Anaylsis:
The Annual Sunlight Exposure Simulation shows the classrooms receive excess daylight at the location of the sliding doors. With the addition of an exterior shade screen with 25% open area, overlit area and annual hours are significantly reduced.

Recommendations:
- Provide additional glare control at south glazing.
- Decrease vision glazing at the sliding glass doors.

FINAL ASSESSMENT - CLASSROOM 125 AND 127

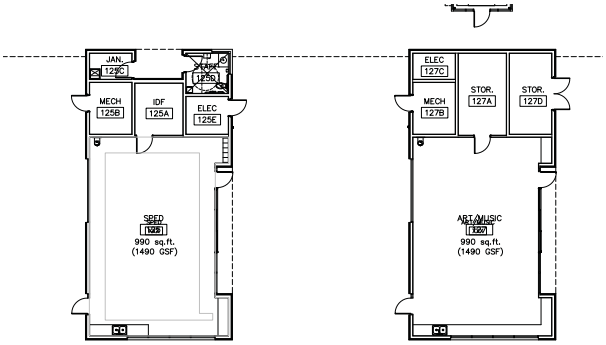


Glazed area as designed

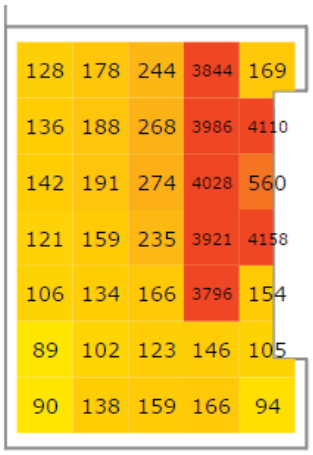
B.O. Roof 9' AFF

Horizontal shade device at 7' AFF

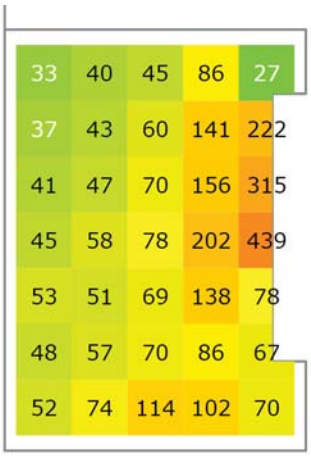
Reduced vision glazing at door



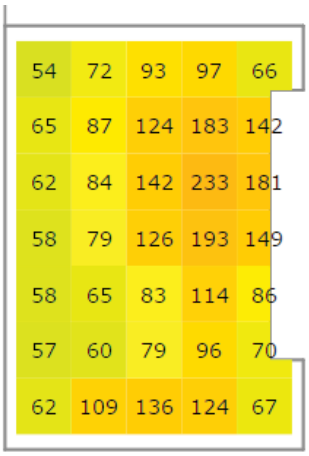
East Perspective at 9am on 9/21



SPED 125 without shades
Key Time Simulation



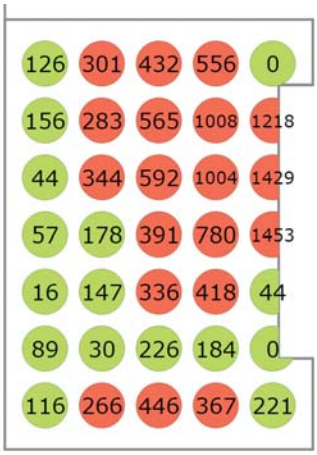
SPED 125 with 3% shades
Key Time Simulation



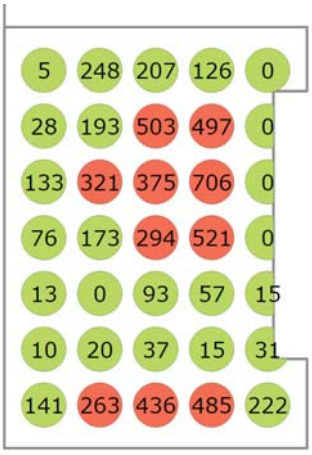
Art/Music 127 without shades
Key Time Simulation

Anaylsis:
Key Time Simulations show that SPED 125 will receive excess daylight at east facade. Addition of an operable 3% shade will mediate the overlit condition. The proposed design strategies for Art/Music 127 provides optimal daylight without need for interior shades.

The Annual Sunlight Exposure Simulation shows that the area and quantity of overlit hours is reduced by half in Art/Music 127 as compared to SPED 125.



SPED 125 No Exterior Screen
ASE = 54%

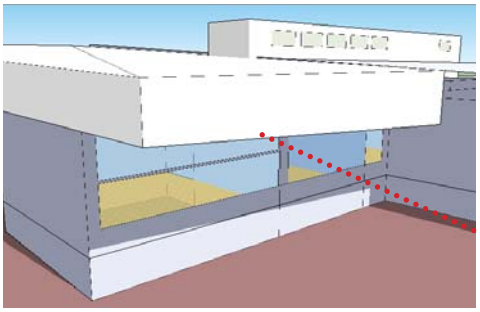


Art/Music 127 No Exterior Screen
ASE = 29%

Recommendations:

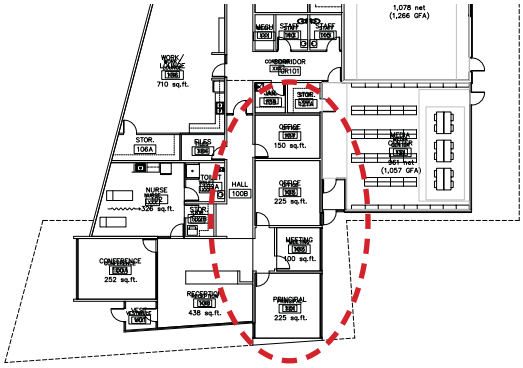
- Consider exterior shade structures and roof overhang at east facade.
- Decrease vision glazing at the sliding glass doors.

FINAL ASSESSMENT - OFFICE

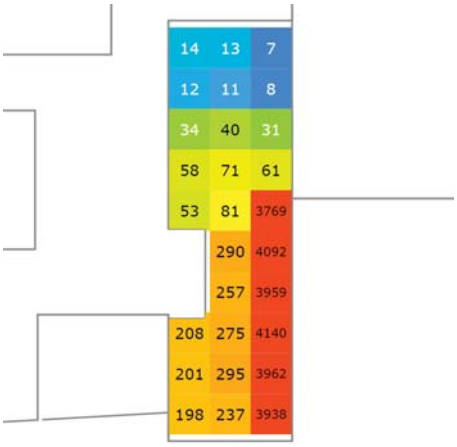


East Perspective at 9am on 9/21

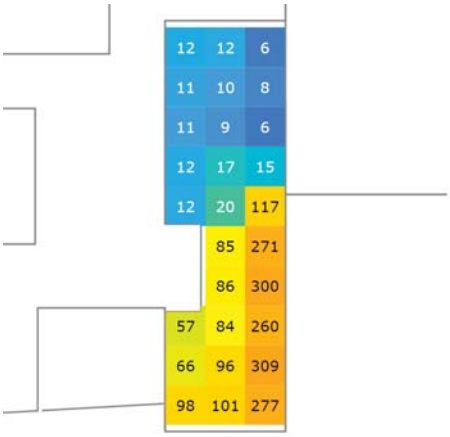
Roof:
9' above finished floor



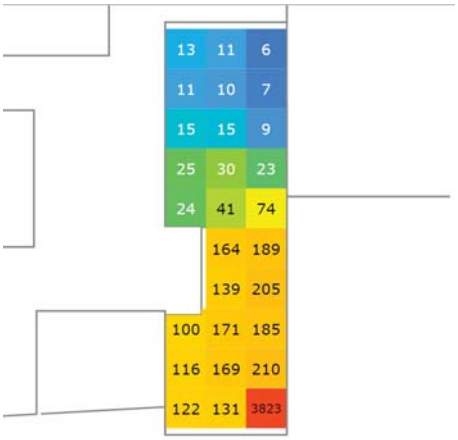
Key Time Simulation - 9/21 @ 9am



Roof at 12' without shades



Roof at 12' with shades



Roof at 9' without shades

Anaylsis:
The Key Time Simulation shows that lowering the roof at 9' AFF will reduce the overlit condition. Addition of an operable 3% shade will also mediate the overlit condition.

The Annual Sunlight Exposure Simulation shows that the area and quantity of overlit hours is reduced by 25% when the bottom of roof is set to 9' AFF.

Office - Roof at 12' without shades
ASE = 57%

Office - Roof at 9' without shades
ASE = 43%

Recommendations:
- Provide glare control or decrease vision glazing at east and south facade.
- Try to bring more light into north office