

University of Idaho

Day-lit space



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Wallace Residence Hall

Ballard Wing



Fourth floor study room in the Ballard Wing residence hall at the University of Idaho. Fairly rectilinear room with three exterior walls. One set of windows on the north facing wall. An adjacent wall from neighboring residence wing is located 15 feet north of study room.

Performance Analysis



The room does not currently receive adequate daylighting but has the potential to be solely day-lit.



With the buildings current schematics the daylighting from the north facing windows does not have much potential to save energy. There is a wall 15 feet away that is about 20 feet higher, blocking most of the sun. Overall daylighting is poor.

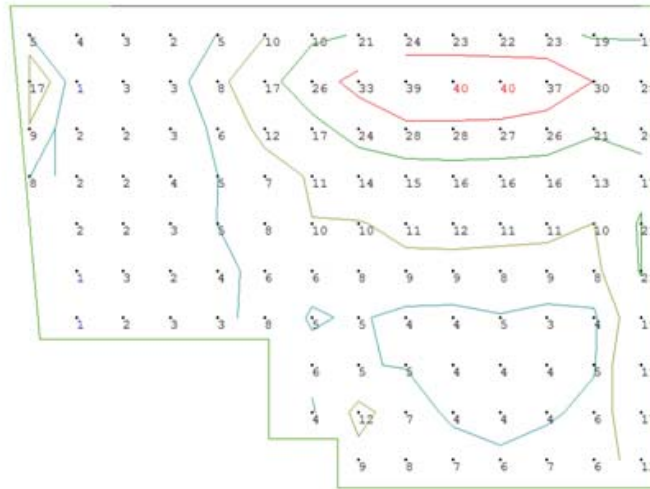
Performance Analysis

Current Daylighting



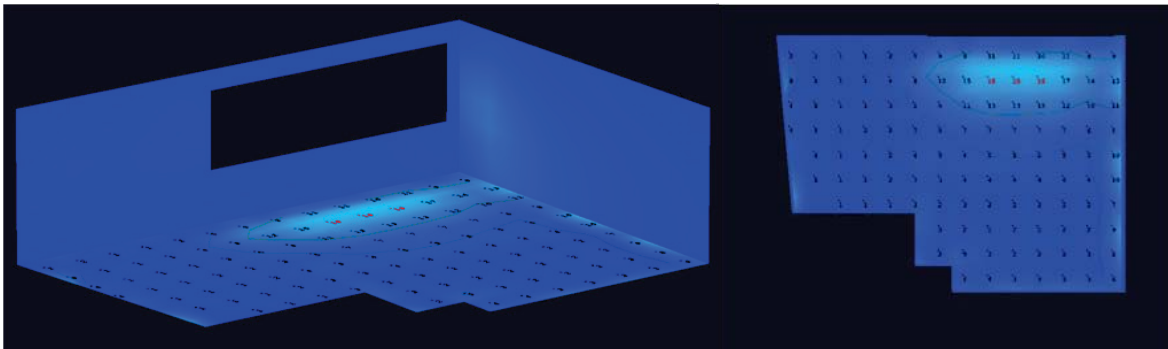
Performance Analysis

Existing foot candles with single window



Performance Analysis

Existing foot candles with single window



Existing illumination

Existing space
with foot candles

Performance Analysis

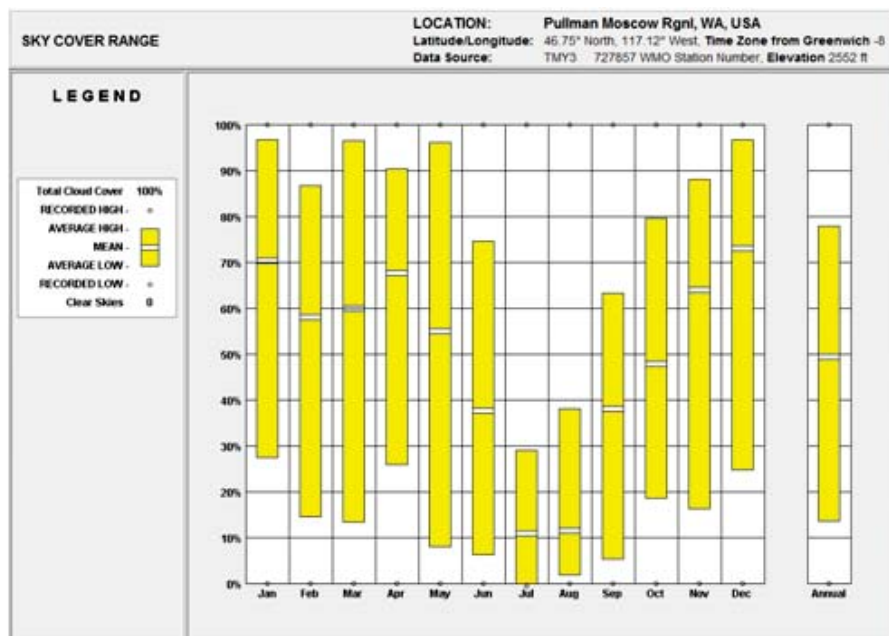
Glare Analysis

Newly designed space has minimal glare due to strategies Implemented, such as:

- Splayed Apertures
- Window/skylight combination
- Evenly distributed apertures on two different surfaces
- Approx 7% skylight to floor area percentage (>25%)👍
- High IRC

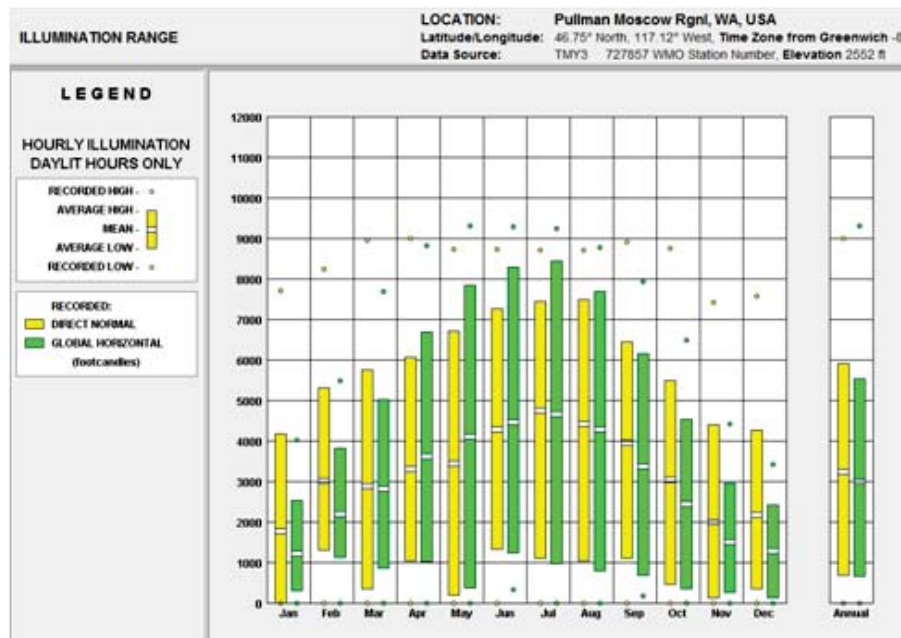
The tools provided by the course web page proved to be inaccurate and rather discouraging. We counseled our expert programmer "Michael from the printing lab" who said, "The program does not exist nor work due to multiple errors." Therefore we were unable to determine technical glare data.

Performance Analysis



We have on average 49% cloud coverage annually.

Performance Analysis



Hours of illumination day-lit hours through the year for Moscow.
On average, we have 3000fc annually.

Building Redesign

How can the daylighting scheme be improved?

- Adding clearstory windows on the top of the east wall with shading devices on the southern clearstories.
- Adding windows to the southern wall with light shelf shading devices.
- Adding skylight near entry of room for even light distribution.

Daylight factor of 0.0133
(based on 40fc required/average global horizontal of 3000)

Redesign Performance Analysis



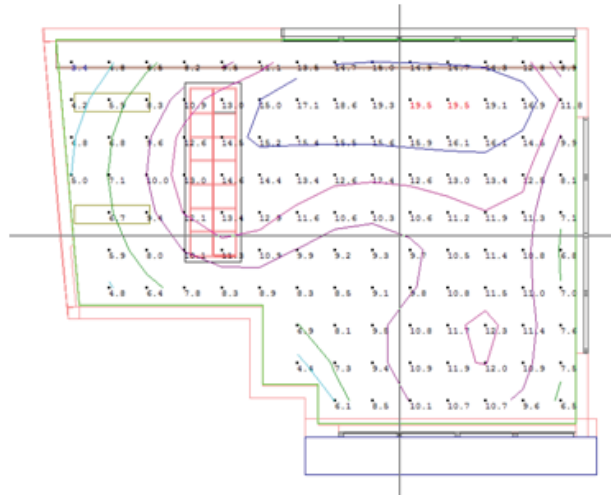
- We provided Low-E glazing on the north and east sides, but clear on the south for maximum passive solar gain.
- After adding additional windows, the exterior wall 15 ft away now acts as a wind shield from cold winter winds.

Redesign Performance Analysis



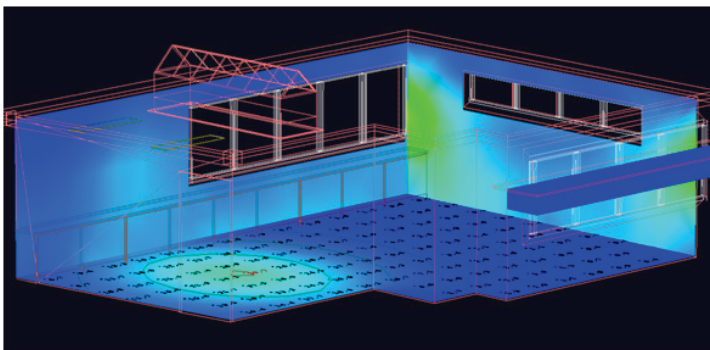
- For passive solar heating we faced most of the exposed glass area to the south to maximize winter sun exposure.
- We also designed overhangs to fully shade in the summer.
- The Window overhangs reduce the need for air conditioning in the summer drastically

Redesign Performance Analysis

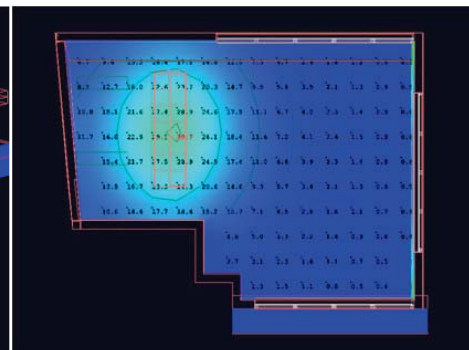


Redesigned foot candles

Redesign Performance Analysis



Foot candles in redesigned space



Foot candles of redesign showing effectiveness of skylight

Redesign Performance

Energy Savings due to Daylight

- Daylighting Energy Savings (kWh/sf-yr)
\$3.27
- Daylighting Consumption Savings (\$/sf-yr)
\$2.29
- Annual Electric Consumption Cost Savings Due to Daylighting for Building (\$*1000) **\$0.9**
- Total Daylighted Area (% of total; based on entered depth for sidelit; 100% for top): **100%**

Device Name:	Compact Fluorescent Lamp	Cost Per Hour:	\$0.356000
Wattage of Device:	400	Cost Per Day:	\$4.832000
Kilowatt Hour Cost:	0.7	Cost Per Week:	\$28.224
Hours of use per day:	12	Cost Per Month:	\$112.90
Calculate Cost		Cost Per Year:	\$1,467.65

Most of the year we get full daylight coverage with our design saving \$1,467/year. Factoring in darker months, we save \$900/year.

Building Redesign



Current Lounge



Lounge with sunlight after redesign



Lounge with daylight after redesign

Redesign Conclusion

- Increases natural lighting in the space through the use of east clearstory windows, addition of southern windows with a light-shelf design, as well as a skylight near the entry.
- Distributes daylight more evenly through the space with the incorporation of the light-shelf.
- Reduces glare by illuminating an increased number of surfaces and reducing contrast.
- Increases ventilation of the space with operable glazing to allow for passive ventilation and cooling.
- For passive solar heating we faced most of the exposed glass area to the south to maximize winter sun exposure.
- We also designed overhangs to fully shade from summer sun.
- The Window overhangs reduce the need for air conditioning in the summer drastically.