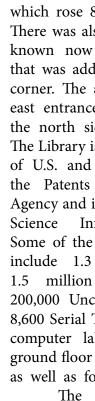
# LIBRARY



Natural daylighting in the University of Idaho's Library could be used to light the stack area on the top floor during daylight hours without supplemental lighting.

## REVISITED

of Idaho Library was designed by architects known now as the fish bowl, Whitehouse and Price that was added to the northeast from Spokane, Washington. The corner. The addition caused the original building was completed east entrance to be located on in 1957 at a cost of \$1,362,295. the north side of the building. The building's footprint was 138 The Library is a major depository feet wide by 205 feet long. It of U.S. and Idaho Documents, consisted of a basement, a ground the Patents Defense Mapping floor, and three additional floors. Agency and is a designated Earth The building also housed the Science Information Center. campus branch of U. S. Post Some of the library's collections Office from 1957 to 1990. In include 1.3 million volumes, 1991 architects Ellis-Feeney 1.5 million U.S. documents, from Lewiston, Idaho were 200,000 Uncataloged Maps and hired to remodel the building 8,600 Serial Titles. There are two and designed a 66,000 sq. ft. computer labs located on the addition at a cost of \$12.3 ground floor and the fourth floor million. The addition included as well as four graduate rooms. the new clock and stair tower,





he original University which rose 86 feet above grade. There was also a glass enclosure, The library employs a

Name University of Idaho
Location Moscow, ID
Owner University of Idaho
Principal Use Includes
Library
Gross Square Footage
157,450
Total Cost \$13.6 Million
Cost Per Square Foot
\$86
Substantial Completion/
Occupancy 1957
Occupancy 100%

staff of 46 people, consisting of: one Dean, 18 Faculty members, and 27 employees. Many of the employees are students that are in a work study program on campus. There are 800 seats located within the library and daily occupancy during a semester weekday fluctuates between 2,000 to 3,000 visitors.

Much of the library's floors are lit by an electric fluorescent lighting system. This includes the book stacks, two computer labs, administrative offices, and storage.

### **4th Floor Study: Existing Conditions**

In our study of the library we wanted to determine if there was a way to decrease the amount of electrical lighting being used best place for our study was the fourth floor, where book stacks and a computer studio are located. The space was chosen for the potential use of diffused lighting from skylights.

Our hypothesis is; natural daylighting could be used to light the stack area on the top floor of the University of Idaho Library during daylight hours without supplemental lighting.

Currently the fourth floor of the library is lit by rows of electrical fluorescent lights that run perpendicular to the 7'6" tall book stacks. Along the north side of the building there are large windows spaced 8' on center. These windows are 5'x5' and have a sill that is 3' above the

throughout the building. The and individual study areas are lit the large windows in the north adequately by natural daylight facing wall. There is adequate from the windows, the southern day-lighting along the northern circulation walkway and the circulation walkway area as well. book stack area (located deeper However there is a noticeable into the space) currently require decrease of natural daylight additional lighting to meet the once entering the book stacks: ASME Standards for lighting. The as seen in [Figure 3] the area to ASME requirements state that the space must have at least 15 foot-candles of light when visual tasks are occasionally performed, or while reading small size print.

The current conditions in the southern walkway and the book stack areas do not meet the ASME Foot Candle minimum a digital 3D model of the existing recommendation. As seen in [Figure 2]the northern side of the daylight in footcandles. We also building has sufficient daylight during the day without the aid of an electric lighting system, as floor. While the north walkway adequate daylight is provided from sunny day. The 3D digital model

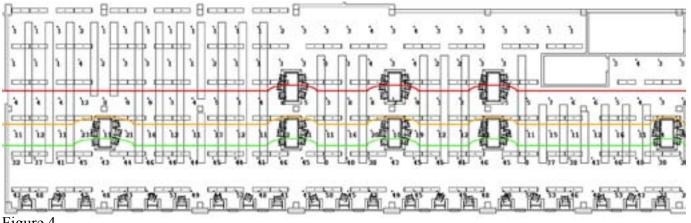
the right has sufficient daylight only when the electric lighting is turned on during the day. There is inadequate daylight along the southern walkway located behind the book stacks with the electrical lighting system turned off.

AGi32 was used to create library space for calculating the measured the daylight levels in the library's fourth floor using a light meter during midday on a clear

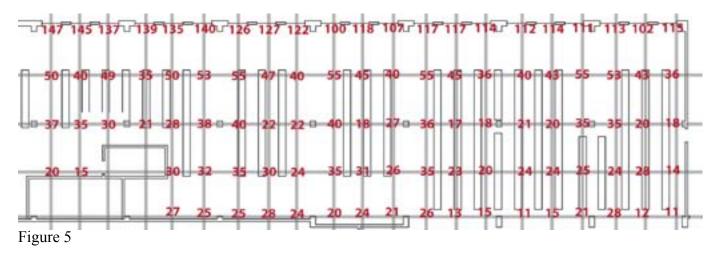






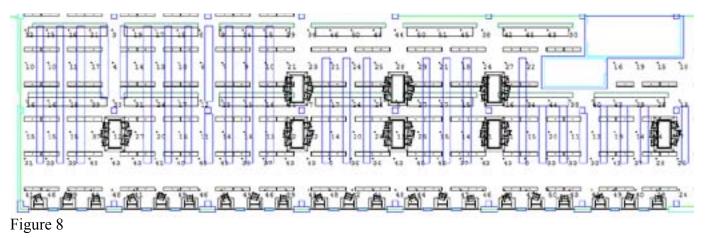


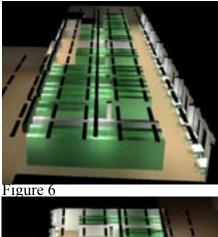




generated using AGi32 the three into the space. From the windows green line can be seen and indicates is only a short distance into the

has north facing down and the the values found using the light electric lighting system has been meters. In [Figure 5] with north turned off. In the daylighting plan facing up, the values collected with the light meter confirm the colored lines indicate the quality similarity in the calculations levels of natural light penetration from the AGi32 3D digital model. After analyzing the 3D to just inside the book stacks the digital model and the data from the light meter, we proceed to there is a sufficient amount of use the AGi32 model to examine daylight for tasks such as reading changes that could be made to and writing. At the orange line the space, in order to increase level the amount of daylight the daylight amounts that would starts to become insufficient: this meet the ASME requirements. We used skylights that book stacks. It makes tasks such were placed between the current as reading more difficult. At and electrical lighting system. The beyond the red line level there skylights were spaced at equal is no longer adequate daylight intervals from the windows on for tasks or for walking. The the north wall. As seen in [Figure values calculated in the AGi32 6, Figure 7] the natural light from 3D digital model were similar to the windows reaches further back





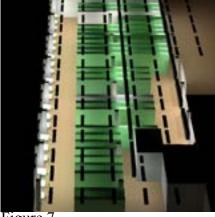


Figure 7

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of footcandles also increased within the book stacks. [Figure 8] shows the new calculations made from the AGi32 3D digital model with the changes applied.

The light levels for sufficient task work have become adequate with the integration of the natural daylight from the skylights, and the windows located on the northern wall.

In addition to the daylight study we also produced and administered a survey to 100 students and administrative workers within the library. The survey consisted of 13 questions which asked how people felt about the daylight in the space library. It is based on the European or whether they used the space near the windows for reading. The survey was structured using the Likert scale with values ranging from "never" or "poor" "always" and "excellent". to The results from the survey displayed in [Figure 9]. are The data collected from the the carbon emissions for the survey shows that the majority of the people found the space near the window to have an adequate amount of light and

into the book stacks and the levels library for ways to save energy, we needed first to see how much the building currently used. [Figure 10] shows the past year energy usage for the entire library. From that data we found that the peak energy usage was in the summer and fall. This was due to the need to cool the building using air conditioning rather than natural ventilation. With that data we found that reducing the electrical load from the lights would reduce the total energy used by the library.

Along with the energy data collected, the survey of the users, and the data collected from the space in the library we also created a building certificate for the standards for building to meet energy usages. The certificate is on the following page and shows the adjusted EUI number for the building. The average EUI value for a campus building is 100. Last year's EUI value for the library is 50. The certificate also shows building over the last three years.

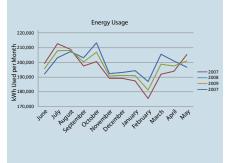
#### **Recommendations**

was Our hypothesis preferred to study in that area. that natural day lighting could While examining the be used to light the book stack



First Year Graduate Student Name Jeremiah Long University of Idaho Architecture First Year Graduate Student

#### **ENERGY USAGE DATA**



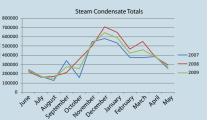
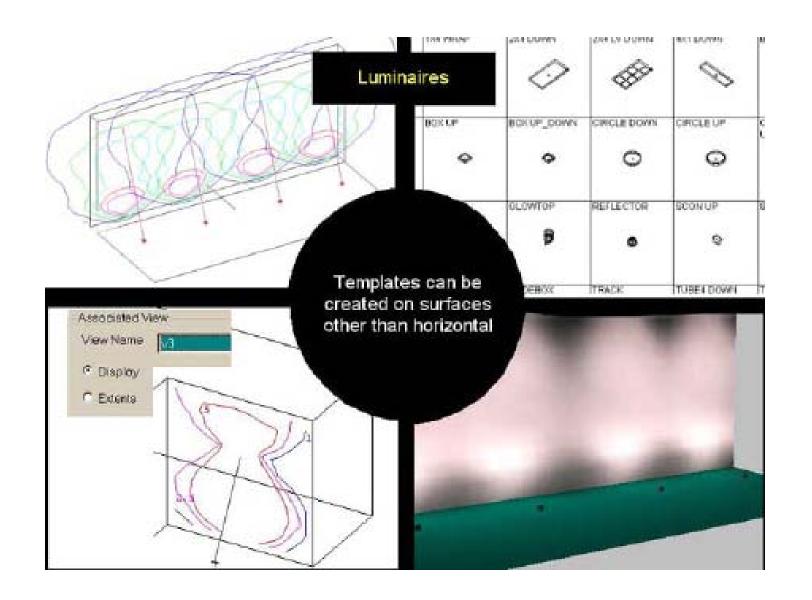
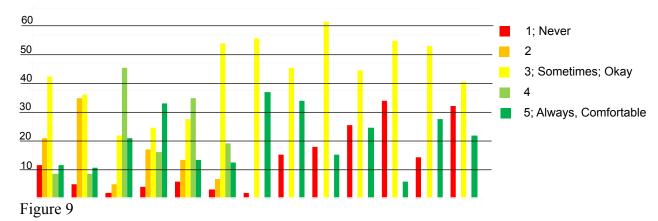




Figure 10







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### DISPLAY ENERGY CERTIFICATE

25

B

75

E

125

F

150

6

175



The disting shart in the middle describes how efficiently energy has been used in the building of note. These numbers do not represent actual units of energy consumed but are adjusted numbers based on the Energy Use Interactly (EUI) for comparison to the second energy use from buildings of this type. 100 is the edjusted everage.

The Energy Performance Paring for this building is determined frough ass of the following equations:

 $X^*Y = 100$ (A/B) \* Y :: Energy Performance Rating

where,

X: Average EU for the building type (KBTU/aqft) Y: Adjustment Factor (aqft/KBTU)

A: Total Energy Usage for one year in the building of note (KERU) B: Total Roor Amain the building of noteted()

Previous Operational Ratings This talk yes how efficiently every has been

used in this building over the last three. accounting periods.

50 Mig 2010 5 No 200 40 No 200

0 23 10 15 100 123 100 125 200

### Recommendations

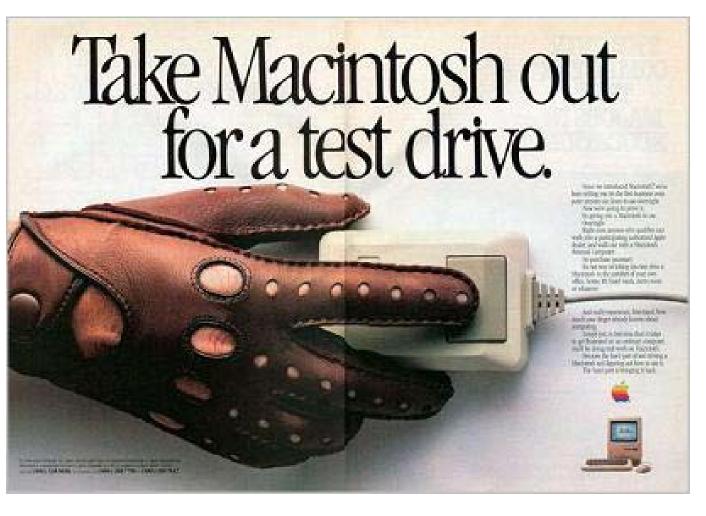
There are an world recommendations to improve the energy average of the Library. The first is to add adglights to the furth floor. This Would became the encount of electrical lighting mended. Second Would be to use light the lights with the back stacks, this Would allow sections to be turned off that are not in use. Third, add deplight summers to the Whole building to alle W as much of the building to be networkly deplit. Finally, adding cleak lamps to the Work spaces. Would reduce the arange used from the larger lights in the building.

Recommendations for improving the energy efficiency of the building are contained in Report Reference Number 3458,2300-0203-2121

area on the fourth floor of the University of Idaho Library during daylight hours without supplemental electric lighting. We proposed adding 13 skylights to supply the additional day light needed for the recommended 15 footcandels by the ASME. This plan shows our proposed skylight patterns. It consists of 2' x 18' areas of skylights, with two rows of skylights located on either side of the fourth bay of electric lights. The size and spacing would be based on building structure. The skylights would

Conclusion

to



fechnical Information **RVERAGE** This talks you technical information about here energy is used in this building Consumption data based on actual Main hunting fact Steen Air Conditioned Environment Tetal spelal floor area (agit: 171,400 Heating Destries. Assession Service 158 Lin (White) you Tepl coll George 185 Un (Whitether **Large tran** to successful as Administrative Information This a Display Energy Confidents as defined in \$12007-221 as 2008-3800 Certificate laves Date:

amanded. Number of Stall: Avg. Occupancy/Day:

Total Floor Arees Number of Rears Building Unegotheers/weekt 105

November 116, 2018 170,480 sph.

University of Idaho

Maxcow ID 93944

24E-7283-8790-2121

Total CO, Emissions

No.2010

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**Gertificate Reference Number** 

It shows tone per year of CO2.

This chart shelfs you the annual Carbon.

E paicle environment that the beaking environ

Bachicity- Kenting- Remewables -

Library Rayburn St.

prevent direct southern light but allow diffuse northern light. Another recommendation improve the overall performance of the building is to incorporate electric dimmers to supplement the electric lighting system and the natural daylight through the space.

The natural lighting decrease on the ceiling from the north facing windows would be supplemented by the daylight from the skylights. The skylights would even out the natural lighting of the space and make electric lighting during the day unnecessary. This would create significant reductions in energy consumption for the building. The north and southern walkways would now receive an adequate amount of daylight from the north facing windows and the skylights. Another recommendation to improve the overall performance of the building is to incorporate electric dimmers to supplement the electric lighting system and the natural daylight through the space.

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