User Responses to the Lighting Design at the Mount Angel Abbey Library

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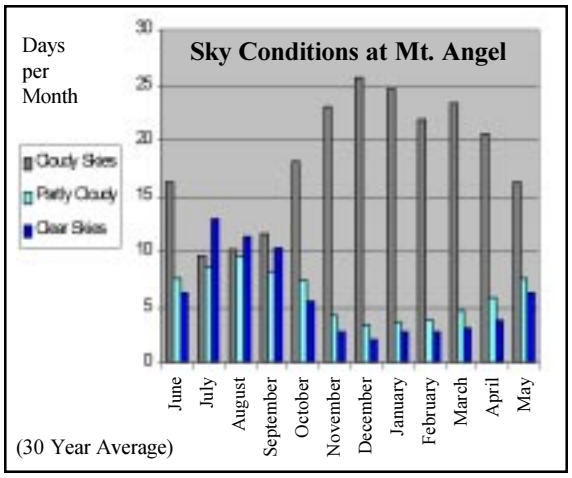
Introduction

This is a study of the lighting design of the main public areas at the Mount Angel Abbey Library, in Saint Benedict, Oregon. The information for this project was derived from interviews and surveys of the building's users within a time period of thirty days before, and thirty days after, the Winter Solstice of December 21, 1997. This study was conducted to determine how the luminous interior environment does, or does not, meet the needs of this Library's users.

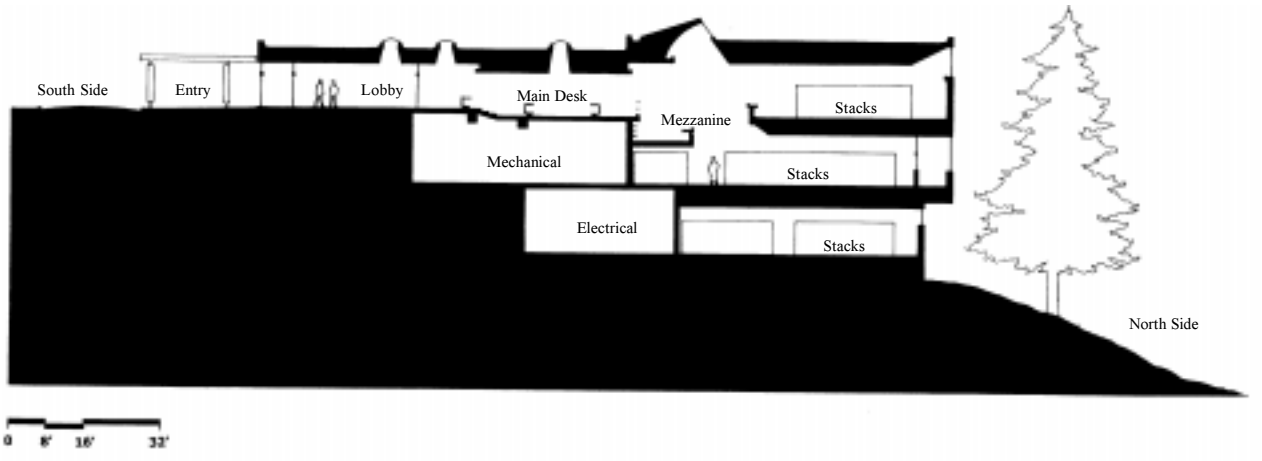
The 44,000 square foot Mount Angel Abbey Library is located approximately 450 feet above sea level, upon a picturesque hilltop within the agricultural Willamette Valley. The Abbey is located outside the small farming community of Mt. Angel at 45 degrees north latitude, approximately forty miles south of Portland, Oregon. The Willamette Valley receives a considerable amount of annual rainfall, with a thirty-year average of 46.5 inches per year. The climate in this region is characterized by its moderate temperatures, ranging between a thirty-year average of 39°F and 66°F. There is a high percentage of cloud cover throughout the year; 19% of the days are clear, 20% of the days are partly cloudy, with 61% of the days cloudy.



The Library was designed by the Finnish architect, Alvar Aalto, between 1967 and 1969, with construction completed in 1970. The Library is well known by architects and architecture students within Oregon for its exemplary daylighting and dramatic interior space. 1998 marks the 100th birthday of Alvar Aalto, which is being acknowledged with centenary events in Finland, New York, and Oregon.

The Library is sited upon the edge of a hillside, defining the north edge of the Benedictine Monk's campus. Upon approach from the south, the pale yellow brick building's facade appears simple and undistinguished. Visitors enter beneath a metal frame canopy into a lobby area, which doubles as an art gallery and reception space. After passing though another pair of doors along the north side of the lobby, one can look out over the centralized receptionist's desk to the main reading and book stack areas, which visually unfolds into a dramatic atrium-like environment. If visiting during the day, a crescent-shaped skylight over the multi-story interior space bathes a series of radiating light shelves, reading desks, and cantilevered floors in soft natural light.

Several factors combine to contribute to a visitor's positive first impression of the Library. There is a sense of pilgrimage when travelling to this remote facility within its ecclesiastical setting. For those with an architectural background, there can be a sense of excitement to visiting one of only three environments designed by Aalto, and still in existence, within the United States; the other two being MIT's Baker Dormitory and the interior design of the Kaufman Conference Rooms in New York. The austere exterior of the south entry evolves into what Newsweek magazine (March 2, 1998. p.72) refers to as, "…one of the most breath-taking interiors in America." The Library is an example of integrated design, displaying the design cohesiveness of the architecture, support systems, interiors, furniture, hardware, light fixtures, and other elements. Interactions with the Library's staff reflect their Mission Statement to, "…serve patrons in a spirit of monastic hospitality." This study seeks to penetrate the veil of first impressions and learn about the successes and failures of the interior lighting from those who use the Library on a regular basis.



Cross-Section of the Library (Looking West)

Hypothesis

The premise of this project was that the success of this Library's lighting design is dependent upon its ability to meet the needs of its users. One assumption, made during the early stages of this undertaking, was that the Library's occupants and users possess worthwhile information about the achievements, and potential shortcomings, of the Library's interior lighting and controls. Subjective and qualitative information obtained from the users about the interior lighting of the Library was considered to be paramount over the accumulation and evaluation of quantitative lighting data. The results of the interviews could be studied for patterns leading to lessons to be learned about the successes and shortcomings to the luminous interior environment at the Mount Angel Abbey Library.

After the initial visits to the Library, in October of 1997, the following questions were formulated to serve as the basis for this inquiry:

- Is the illumination of the Library's interior considered to be exemplary by its users?
- What do the users of the Library like about the interior lighting?
- Are there problems associated with the extensive use of natural light within the Library; i.e. glare, fading of materials, or over-heating?
- Do the users of the Library have any control of the natural and electric lighting?
- Have changes been made to the Library's lighting design since the building was completed in the early 1970's?
- Are there any potential modifications to the lighting design and controls, which could add value to the Library's users?

Methods

At the heart of this study are the interviews of the Library's administration, staff, and facility manager. The interviews were conducted to learn about the successes and failures of the Library's interior lighting in response to the user's needs. Each interview was conducted on a one-on-one individual basis, within the Library. Specific questions about the lighting were asked of each individual after a period of informal dialogue to establish trust, rapport, and mutual understanding as to the purpose of the interview and the potential utilization of the information gathered. While there were several generic themes of questions, such as those stated in the hypothesis, the interviews were conducted more in the format of improvisational jazz, searching for insights into the building's lighting design from the perspective of each individual's unique interaction with the environment. The length of each interview ranged from thirty minutes to an hour and a half.

The results of these seven interviews provided clues to the potential benefit of a subsequent questionnaire for the Library's most frequent patrons, composed prima-

rily of the monastery's faculty and students. Several of the statements of those interviewed were made as assumptions about the patron's responses to the interior lighting. The results from a questionnaire would be an opportunity for the Library's frequent users to comment on the lighting design, directly. The questionnaire would also be an occasion to search for patterns of responses; i.e. Is the reading light in the Periodical Room considered inadequate by more than two of the individuals interviewed?

The questionnaire was composed into three major sections as an inquiry into the respondent's 1) use of the Library, 2) request for positive comments, and 3) a search for those qualities found to be less than adequate. The questionnaire was made available to patrons at the Main Desk, was distributed as a hand out during the monthly faculty meeting, and was issued electronically to some of the faculty and students. The respondents were provided with two weeks to respond to the questionnaire from the date they were issued. Due to the Christmas holiday and the end of the Seminary's Fall term, only eighteen questionnaires, out of a potential forty six, were returned with responses to the questions.

The questions included:

1) I would like to start by asking you a few questions about who you are (name optional) and why you use the Library. What parts of the Library do you use; i.e., the periodical reading room, the computers, the carrels, the central reading area, etc.? What times of the day do you use the Library?
2) Do you consider the lighting wonderful, and if so, why? What are your favorite times of the day to be in the Library? How would you describe the quality of the light during that time? Have you ever had an experience within the Library where the quality of the light moved you, or contributed to a memorable experience?
3) Has the lighting, natural or electric, ever been less than adequate during your use of the Library? Has glare ever been a problem for you during your use of the Library? Do you believe that the Library has found a satisfactory balance between the needs to conserve energy and simultaneously provide adequate light levels? Do you have any recommendations you can share about how the lighting design, or controls, could be improved upon?

Some of the interviews and questionnaires produced interesting comments about the design and management of the Library, which were not relevant to the topic of this inquiry. Some of these have been captured, and documented at the end of this report, for the potential of further investigation, or additional Vital Signs case studies, by others.

Results of the Interviews:

The results of the interviews have been organized into the following five categories:

1) Positive Comments About the Library's Lighting
2) Opportunities for Improvements to the Lighting
3) Comments About the Control of the Lighting and Energy Conservation
4) Other General Comments Related to the Lighting Design

The comments of those interviewed have been distilled for clarity and brevity. Some of the comments are documented as quotes to present the character of the statement. The initials of the individual's job title appear after the respective comment. The seven individuals interviewed include the Library's Director (LD), Facility Manager (FM), Retired Librarian (RL), Office Manger (OM), Experienced Receptionist (ER), New Receptionist (NR), and Senior Archivist (SA).

1) **Positive Comments About the Library's Lighting** (Interviews)
   A) "The interior of the Library is organically pleasing. All of the pieces fit

beautifully together. It is not just the lighting, but also the shapes, the volumes, and textures which all seem to come together quite nicely." (ER)

B) The Library is delightful to be in. It's pleasant to sit in the open area beneath the central skylight. (LD, FM, RL)

C) It is not uncommon to hear flattering comments from visitors about the natural light within the Library. Many of the visitors are not aware that a famous architect designed the building. The fact that this is an Aalto designed building does not seem to affect the positive comments we consistently hear from visitors. (LD, RL, ER, NR)

D) "Alvar Aalto was a master at utilizing light. Within the Library, you can see how he has bent, borrowed, and shielded the light. Light is very important to us in this climate, and Aalto understood this. I have a deep appreciation for his ability to manipulate light for utility and beauty." (RL)

E) All of the lighting, no mater where you sit or stand, is soft. There are few shadows, even at night, when you no longer have the benefit of the soft natural lighting. (ER)

F) "Although I've worked at the Library since it was built, I didn't take notice of the lighting. It just seemed right. I probably would have been more aware of the lighting if there were problems with it." (ER)

G) "As a student, I was impressed with the wonderful lighting at the Library. I am now an employee of the Library and remain in awe of the ever-changing, subtle, and delightful qualities of the soft natural light." (NR)

H) Within the Library, one may experience an inward-focusing contemplative environment, not that different from a church or cathedral. The Library's atmosphere facilitates meditation and spiritual development. (RL)

I) "The lighting and design of the Library is one of the benefits of employment at the Library. This is a wonderful place to work. I constantly receive the comments from visitors which reinforces my desire to work in this delightful setting." (NR)

J) During a four-day power outage, following a windstorm in 1996, most of the staff on the campus was excused, except those who worked in the Library. The Library was the only facility on the campus providing adequate natural light to operate during the day and thus remained open to faculty, students, and visitors. (OM)

K) It is not uncommon for patrons to spend long periods of time studying within the Library. One individual, who has used the facility on a daily basis since the facility was built, believes that the ability to maintain long periods of concentrated study during the day is due, in part, to the soft and subtle shifting of the natural light. (RL)

L) "I have very fond memories of being within the Library during clear nights with the only source of light being the full moon hovering above." (RL)

M) To truly appreciate the lighting at the Library, one must visit it during the day, and then at night. (RL, OM)

N) The central skylight creates an atrium-like space that attracts people. The space is evenly illuminated, with few shadows. Without being outdoors, there is a sense of the weather and time of day. Indirect sunlight enters the building from the main skylight and bounces off the surrounding ceiling and wall surfaces. The light on a patron's book may be coming from a multitude of directions. (FM, RL, ER)

O) "The design of the central skylight seems to multiply the amount of sunlight into the space beneath it. If you look at the skylight from the mezzanine or the roof, its size appears small in comparison to the amount of light that it produces." (FM)

P) The interior light levels beneath the central skylight appear brighter on overcast days than on clear days. (RL, OM, ER)

Q) Many people are impressed with efficiency of the small circular skylights throughout the Library to bathe the interior with natural light on clear and overcast days. (SA)

R) It is unusual to experience direct sunlight shining into the Library through the skylights or clerestory windows during the periods of time our Library is open to the public. With the exception of a few days in June, the only time one will see direct light from the main skylight into the Library is during the very early hours of the morning, or the late afternoon. (RL)

S) It is rare to witness direct light on any of the books, which is quite surprising, considering the amount of natural light within the interior of the Li-

brary. (FM, RL, SA)

T) With the possible exception of the computer screens, there are not any problems with glare within the Library. (LD, RL, OM, ER, NR)

U) "We have architecture and engineering students tour our Library every year. I overheard one of the instructors telling his students that our Library is an excellent lighting demonstration facility. For electric lighting, we have all types of different fixtures for students to study. If you're interested in natural light, you can see this interesting central skylight, those clerestory windows, or the various circular skylights. They are all quite functional, as well as aesthetic" (RL)

2) Opportunities for Improvements to the Lighting (Interviews)

A) The lighting at the Main Desk is inadequate, especially during the evenings. There are not enough light fixtures, and the light from the small round skylights do not provide adequate illumination for the evening Receptionist. (LD, ER, NR, SA)

B) The Library is too dark at night, even with all of the lights turned on. It was noticeably brighter before the electric utility sponsored energy upgrade project a few years ago. (OM)

C) The lighting in the Periodical Room is inadequate, especially for reading the fine print of newspapers, magazines, and books. Although it was not necessarily good before the energy remodel, it became worse after they replaced the incandescent with compact fluorescent lamps to the ceiling light fixtures. (FM, OM)

D) There are light fixtures mounted on the roof, which are aimed over each of the circular skylights. These lights provide little more than a dim glow to the interior during the evenings. They gave off more light before the energy upgrade project. They are no longer turned on very often. (OM, SA)

E) There is some glare on the computer screens in the public computer area. This area, which was devoted to the card catalogues, is over-illuminated. The ceiling lights are probably not necessary, except during the evenings, when the skylight is no longer functional. (RL, ER)

F) There is a small little desk light, which sits on top of the counter at the Main Desk. Most people do not know what it is for. It's obvious that it was not part of the original design, as it has the appearance of being store bought, and is not in character with the rest of the building. It is a night light for users of the enclosed carrels to find their way up and down the stairs, without having to turn on all of the lights within the Library. (RL, ER, SA)

G) The lighting within the enclosed and open carrels is in front of the occupants, which results in direct glare from the fixture. (SA)

H) There had been some fading of the bindings and edges to the pages of a few books beneath the main skylight and clerestory windows. These books have since been moved to other areas. The oldest books, made with rag paper, and the new books, constructed of acid-free paper, have not noticeably faded. (RL, SA)

3) Comments About the Control of the Lighting and Energy Conservation (Interviews)

A) An energy conservation remodel in 1995 was the result of the local electric utilities sponsored energy conservation program. The Oregon Public Utility Commission mandated each electric utility within the state to devote a specific amount of their annual operating budget to energy conservation activities. These programs, referred to as Demand Side Management (DSM), often offer financial rebates to customers who agree to improve the energy efficiency of their facilities. The Mount Angel Abbey enrolled in a program with their local electric utility to replace all of the incandescent lamps throughout their campus with more energy efficient fluorescent lamps. In addition, many of the lighting controls where changed, resulting in more control by the campus staff, and less control by the users. (FM)

B) Many of the Library's users were displeased with the quality of the light resulting from the energy conservation remodel in 1996. The primary objection was the users' perception that there was inadequate light in the reading areas, especially during the evenings. This was the by-product of

replacing the incandescent lamps with compact fluorescent lamps within all of the recessed and surface mounted ceiling light fixtures. In response to complaints by the Library's users, the lamps have been changed back to incandescent in the Periodical Room, the Lobby, and the Auditorium. (LD, FM, RL, ER, SA)

C) "An electrical contractor carried out the design for the lighting and controls of the energy conservation project. In retrospect, the Library's lamp replacement and lighting controls remodel probably would have been more successful if an architect, or lighting designer, was involved." (FM)

D) Most of the lighting in the public areas is controlled from a single bank of switches located at the Main Desk, and controlled by the on-duty receptionist. There is little instruction provided to each receptionist about which lights to on or off. Each receptionist is to use their own discretion, and respond to their own preferences for illuminating the Library. The result is that most of the lights are left on, even during the brightest days, when the Library would otherwise be adequately lit from the natural light of the skylights and windows. (LD, SA)

E) When the janitor arrives at 6:00 am each morning, they turn on all of the lights to the Library, enabling them to adequately see all of the surfaces for cleaning. The janitor departs with all of the lights left on, as the receptionist arrives shortly after they leave. It is not unusual for the receptionist to leave the lights on, as they found them, even though there may be plenty of natural light throughout the upper levels of the Library. (LD, SA)

F) The controls to the lights of the mezzanine and lower level stacks were formerly controlled at the stairs. The controls were moved to the Main Desk during the energy conservation project. The contractor for the project thought that it would save more energy if the Receptionist would be in control of turning the lights on and off and they saw the need for an area to be used. The opposite appears to have occurred, as the Receptionists rarely turn the lights off, except at the end of the day. (ER)

G) As all of the lights to the study carrels are on the same circuit and controlled from a single switch, the evening use of a one carrel results in all thirty carrels of a single floor level being illuminated simultaneously. (SA)

H) The lighting to the enclosed study carrels are controlled from the Main Desk. The users of the carrels currently are required to go to the Main Desk to have their lights turned on, or off. Users of the study carrels prefer to have individual control of their lights. (RL, SA)

I) An energy conservation remodel to the lighting controls resulted in relocating the localized control of the stack's lighting to the Main Desk. Long-time users of the Library miss the localized control. (LD, RL, OM, ER, NR, SA)

J) Several individuals expressed doubt that there was any energy savings resulting from the energy conservation remodel to the Library. They stated that they might have more appreciation for the work, which they believe created inferior interior lighting, if they knew how much actual energy, and resulting money, had been saved. (ER, SA)

K) A few of those interviewed stated that they wish that the designers of the energy conservation remodel had consulted the Library's staff for input. (LD, OM, SA)

L) "The lack of local control to the lighting seems un-Aalto-like." (SA)

M) The fluorescent lights above the open carrels on the upper level are almost always turned on, and provide little additional light during the day. (SA)

N) There is too much light to the upper level stacks area. These lights are almost always left on, and are usually not necessary during the day, due to the amount of natural light from the main skylight. (SA)

O) There is not an operational incentive to conserve the use of electricity within the Library. The Library, and other buildings on the campus, is not individually metered for electric, gas, or water use. They are billed by the campus administration a fixed monthly rate for all utility services. Individual efforts to conserve energy are the result of the administration and staff believing that it is simply the right thing to do. (LD)

4) Other General Comments Related to the Lighting Design (Interviews)

A) Aalto's design for the Library was prepared prior to his first visit to the site. After accepting the commission to design the building, Aalto wrote the current librarian, asking for him to write back with a description of the

character of the light at the site, including a narrative on how the sun and clouds moved. (RL)

B) It was Aalto's opinion that the dominant colors within the Library should be those of the books and the people within the space. He designed the interior surfaces to be light colored to maximize the reflection of the interior light, minimize the contrast and glare, and celebrate the interaction between the Library's patrons and the books. (FM)

C) The original color of the interior walls and ceilings was a brilliant white. This color was selected by one of the campus administrators, despite the selection of a warmer off-white color proposed by Aalto. Several years later, the original white was considered too bright. The walls and ceilings were repainted to Aalto's preferred color, which had a slight amount of red added to the white, which warmed and muted the color. Aalto's white was considered a better match to the exposed maple wood of the furniture, rails, and interior trim. The new color is softer to the eyes, creates less glare, and is generally more pleasing. (FM)

D) The washing of the windows along the north side of the building is a challenging task, especially those beneath the wood grills. (FM)

E) The numerous wood grills on the exterior of building, which shade the interior from direct sunlight, are difficult to maintain. Most of the wood grills are difficult to access, due to their height from the ground. They require re-staining every three to five years, and occasional replacing due to their slim wood profile. (FM)

F) One individual, who was involved with the design of the Library, recalled Aalto being confronted about the limited number of view windows between the Library's interior and the valley to the north, during one of his few pre-construction visits to Oregon. Aalto replied that a Library should be an inward-focused environment, unlike a student union. (RL)

G) The Library is a good example of Igloo Architecture. The architect could have been more generous with his use of windows to the picturesque farm valley to the north. (FM)

H) "I am grateful to be one of the few people, who uses the Library on a regular basis, to have the opportunity to view out the windows to the north." (NR)

I) The Library is always quite comfortable, with regards to temperature. Rarely is it too warm or too cool within the Library. The Main Desk occasionally becomes a little warm, as it seems that there is a void in the air movement there. (ER, NR)

Results of the Questionnaire:

The results of the questionnaires have been organized into three of the same categories as those of the interviews, 1) Positive Comments About the Library's Lighting, 2) Opportunities for Improvement to the Lighting, and 3) Comments About the Control of the Lighting and Energy Conservation.

1) Positive Comments About the Library's Lighting (Questionnaire)

A) "The natural lighting throughout the Library is wonderful. The natural light shows off the curves and forms of the interior."

B) "One can feel the moods of the day very strongly by the light reflecting in the building. Sunsets, sunrises, and stormy days are wonderful in the Library!"

C) "Even on a dark day the Library is full of light."

D) "I am very often aware of the fact that I am working in a piece of art, from which I receive a feeling of serenity and the ability to focus attention."

E) "The best part about the building is the natural light. As the weather changes, the quality of the light changes with it, which is nice."

F) "Personally, my spirits go up and down with the sun. However, even when it is gloomy out, the Library is fairly bright, due to the structure and the white

walls."

G) "I consider the lighting wonderful, especially from the standpoint of natural light combined with some artificial lighting. It is two things at once: beautiful and useful."

H) "Memorable experiences within the Library: summer sunrises, summer sunsets, and then sudden inexplicable moments when just looking up or around I am struck by the gift of light."

I) "I am able to read for several hours without fatigue to my eyes. I believe that this is due to the gentle shifting of the natural light."

J) "It is not the lighting, per se, that is interesting; rather it is the play of light along the gently rounding curves of the building that catches, or holds, one's attention."

K) "It is the unintrusive nature of the Library's lighting that is most effective. The most memorable aspect of the lighting is that you don't remember it, at least until after you've left the building."

L) "The lighting within the stacks is better than most of the libraries I have studied within."

2) Opportunities for Improvements to the Lighting (Questionnaire)

A) "The new energy efficient lighting is not bright enough in some of the areas, especially the Periodical Room."

B) "The carrels are not adequately illuminated at night."

C) "The lighting during the night to the lower level stacks is in need of improvement."

D) "When the Library is closed, during which times I am sometimes here still working, all of the lights are turned off, except for one blinking desk lamp up front. In the utter darkness, I stumble up the stairs, bumble up the two flights, and hope not to trip over a chair left in an aisle. As the Library is increasingly used for the purpose of faculty offices, these issues will have to be addressed."

E) "There is inadequate light at the Main Desk and in the Periodical Room."

F) "The upper level stacks are too bright during the day, and do not require the supplemental illumination of the artificial lights."

G) "The windows to my office, which is within one of the enclosed carrels, are usually filthy, greatly detracting from the pleasure of the natural light. I realize it must be difficult to keep them clean with the wood grills on the outside of the building."

H) "Unless you are one of the fortunate ones to be issued an enclosed carrel, it is unfortunate that there are so few windows from the Library to see the spectacular view of the Cascade mountain range and farmland below, to the north of the Abbey."

3) Comments About the Control of the Lighting and Energy Conservation (Questionnaire)

A) "The controls to the lighting seem less efficient now than before the remodel."

B) "The all or nothing approach to stack lighting seems to me to be mistaken. It used to be possible to turn on several stacks of light at a time, as needed. This was a better use of energy, plus it made for interesting and unpredictable variations of light in the whole building at a given time. Lights going on and off as needed gave the building a liveliness, reflecting its actual use."

C) "It makes no sense to me to have the overhead lights in the open carrels on and all or nothing scheme. There would never be a time when all those lights are needed. It would be better if they could be individually controlled."

D) "The Librarians have explained to me that light for the entire Library is controlled by a few switches. This means that in order to provide light for specific areas, a large amount of energy must be expended to also light areas not in active use. This is particularly an issue in the carrels, where apparently a whole row of lights must be turned on to provide light for any carrel. This forces me to have an extra lamp in my office which takes up precious space and is quite inadequate for reading and writing."

E) "The controls to the lighting should be returned to the original design so the lighting can be used as needed. Now it is all or nothing."

F) "I think it would be nice to have lighting for each row of shelves controlled

from a switch on the end of that row, with a fifteen minute auto-off to save electricity."

G) "It is rare that there is really a need to have all the lights illuminated, and yet this is often done both during the day and at night. Apart from the waste, this is also the least interesting lighting scheme."

Conclusions

There are several dominant themes that emerge from the interviews and questionnaires. The users are overwhelmingly appreciative of the Library's use of natural light and generally favorable to the quality of the electric light during the nighttime use. Many of the respondents expressed their appreciation of the interaction between the interior architectural forms and the lighting design. There were a surprising number of comments about how wonderful it was to experience the subtle changes to the natural light throughout the day, and how the interior light levels seemed brighter beneath the main skylight during overcast days. It is interesting to note that there were not any comments requesting any control over the natural light sources. The individual's interviewed expressed a strong sense of pride in being able to work within, what a few referred to as, "a work of art".

If judged from the standpoint of the users, the current lighting design at the Mount Angel Library is not flawless. Several aspects to the lighting design and controls emerged as being less than adequate. Most of the lighting elements subject to criticism by the users, are not the fault of the architect, but instead are due to changes occurring after the facility was built and occupied. One example is the over-illuminated patron's computer area, which was initially used for the card catalogues. Opportunities for improvements to the lighting include increasing the light levels to the Main Desk, the Periodical Room, and to the roof top light fixtures above the circular skylights. There appears to be a need to find a new means of providing lighting and controls for the circulation routes between the carrels and the front door during evening use.

There are several opportunities to further conserve energy. These range from the simple administration of directing the janitor to re-set specific light levels upon completion of their early morning tasks, to rewiring the electrical circuits for individual lighting controls at the carrels. The Library administration will have the challenge of balancing the user's requests for more localized control of the lighting with the recently completed centralized, supposedly energy conserving, switching. Opportunities to further conserve energy include the installation of motion sensors in seldom used rooms, such as the Rare Books Room and Restrooms. Light sensing dimming switches may be an effective means to control the electric lightings in area subject to natural light, as found in the Mezzanine, Stacks, Carrels, and the areas surrounding the centralized roof monitor.

The most dominant criticism of the existing lighting at the Library was directed at the electric utility-sponsored energy conservation remodel, which impacted the Library's users with lowered light levels and the loss of localized lighting control. Many of those who criticized the results of the energy remodel shared their disappointment in the process that the changes to the lighting occurred. The Library's administration and staff felt that their electric utility and design-build electrical contractor should have consulted with the staff and patrons on the proposed changes. They felt that they should have been informed of the energy conservation goals and resulting savings. Perhaps this specific utility sponsored energy conservation program should have involved lighting design professionals skilled at fine tuning high performance lighting facilities and facilitating the input of diverse individuals into a successful design strategy.

This Library is an excellent facility to witness a wide variety of electric lighting fixtures and daylighting features. Within the areas open to the public, one can view various

recessed down-lights, strip, cove and up-lighting, a multitude of task lights, track lighting, and custom surface-mounted and pendant luminaires. Within the domain of natural lighting, the Library exhibits clerestory windows, circular skylights, and the dominant crescent-shaped roof monitor. Aalto's light-enhancing features include utilizing light-reflecting surfaces adjacent to the skylights, windows, and roof monitor to maximize the utilization of the available daylight. There are several instances of his employment of borrowed light by incorporating clear and diffused glass on interior walls to rooms with perimeter windows, as witnessed at the enclosed Carrels.

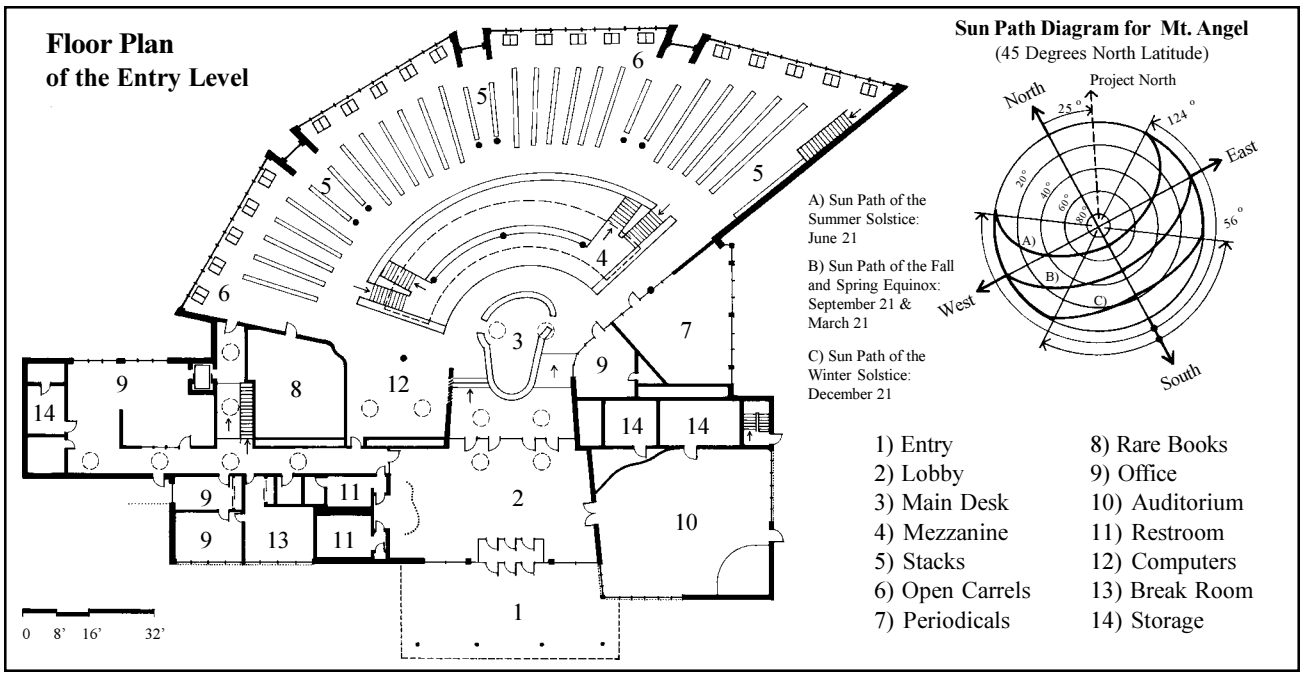
The interior illumination of the Mount Angel Abbey Library is considered successful by its users. The Library exhibits superlative daylighting within a climate dominated by moderate temperatures, a high percentage of cloud cover throughout the year, and a considerable amount of rainfall. There are few problems associated with the extensive use of natural light within the Library. The potential issues of glare and overheating were rarely mentioned. The Library's facility manager, administration, and staff portray a sense of stewardship towards Alvar Aalto and his design for the Library, which will enable visitors the opportunity to visit exemplary architectural design.

Lessons Learned

- The users of a facility can be a valuable source of information about the positive and negative aspects of a building's design and operation. Interviews and questionnaires can be an effective means of collecting general and specific information about a building's performance, especially when data collecting devices are either unavailable or inappropriate.
- This Library demonstrates that daylighting is a design concept not limited to climates which are dominated by clear sky conditions. Opportunities for effective daylighting may increase on overcast and cloudy days, due to the multi-directional source of the diffused light.
- A building's intended performance may be adversely affected by operational issues and well-intended retrofits. Modifications to lighting for the sake of energy conservation needs to be balanced with concerns for the resulting light quality. Environmental problem solving should be considered systemically.

Opportunities for Further Study

During the interviews and visits to the Library, and as a result of the questionnaires, there emerged several opportunities to explore tangential subjects. These are included for the consideration of other students for



future Vital Signs investigations.

1) A tour of the mechanical room, during the interview with the Facility Manager, revealed fans, filters, and ductwork which appeared substantially larger than expected in relation to the size of the facility. Several individuals during their interviews noted, that the Library was always thermally comfortable, that there appeared to be few fluctuations between warm and cool, and that they rarely experienced drafts. A few individuals mentioned that they never heard the sound of mechanical equipment or air flowing from the registers within the Library. This forced air system may be a low velocity, high volume design worthy of further study.
2) The Library has its original built-up tar and felt paper roof, which has been in place for over twenty-eight years. The Facility Manager reports that they have not experienced any roof leaks since the facility was completed in 1970. This is considered to be unusually successful for this climate. Why has this roofing system been so successful, despite the wet climate, flat roof, and numerous penetrations by skylights, vents, electrical conduit, and the crescent-shaped roof monitor?
3) During a review of the Facility Manager's construction documents, and subsequent visual investigations, it was discovered that the building was built without any roof or wall insulation, and that all of the windows and skylights are of single pane glazing. This is not unusual for buildings built prior to the oil embargo of 1974. It would be interesting to conduct a study as to what it would take to bring the building into compliance with the Oregon Energy Code, with minimal obstruction to the building's historic value. What might the resulting energy savings be? Would the resulting changes be cost effective for the Abbey to implement?

4) As the Library is not metered separately from the other buildings at the Abbey, it is difficult to determine it's actual natural gas and electric consumption. What would it take to isolate the metering of the Library? What might a review of the Library's annual metering reveal about its energy consumption? Based upon the Library's size, use, climate and design, it would be interesting to determine if it is a "skin load dominated" or an "internally load dominated" building.
5) Are there other instances where electric utility-sponsored energy and lighting retrofits have resulted in less than adequate results for the users of the facility to which the "upgrades" were made? If so, are there patterns that emerge which, if remedied, would make the remodels more successful for the utilities and users?
6) Why did several of the users feel that they could concetrate for longer periods of time when working in a naturally illuminated environment? What is the psychological effect which daylighting has upon those who are working within it? Does modeled and subtly shifting light reduce eye strain during extended periods of reading? Are there aspects to the changing nature of natural light that could be integrated into electric lighting to make it effective for those working within it?
7) How do the light levels within the Library compare with IES (Illumination Engineering Society) standards? Would it have been approriate for this facility to have been designed to IES standards initially? What impact did the energy remodel of 1995 have impact upon IES light level recommendations for the various areas?
8) Why does the crescent-shaped light monitor seem to be such an effective daylighting device? Why do the Library's users consider the light beneath it to be brighter on overcast days than on clear days? What would be the result of replacing the red rock roof ballast with white rock? Is this element an anomaly? Are there lessons to be learned about the design of the roof monitor that could be utilized by architects throughout this region?

Architects Vernon DeMars, FAIA and John Wells, AIA, the "Executive Architects" for the Library, review the preliminary plans during the Alvar Aalto Centennary Symposium at the Mount Angel Abbey Library, May 15, 1998.