



Thesis Proposal

Princeton Theological Seminary Library

Princeton, NJ

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Lighting | Electrical

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Executive Summary

The Princeton Theological Seminary is celebrating its bicentennial by adding a 100,000 sqft addition to their library. Capturing this prestigious history and focusing on the hard work being performed by the masters and PhD students that use this library, the concept for the lighting redesign will represent the connection between God and his pupils. ‘God is light’. Through the emphasis on verticality and sparkle, translated as reaching for the heavens, the students learning about God will feel closer to him in this space. The four spaces to be redesigned are as follows:

Building Façade | South Façade and Grounds

Special Purpose Space | Café

Circulation Space | Atrium

Large Work Space | Reference Reading Room

Refining the schematic design from the fall semester, design development will take place to calculate illuminance levels and energy consumption to meet ASHRAE Standard 90.1 2010. This will assist with the electrical depth topic which is to introduce a dual bus system to the building. Eliminating the need for AC to DC transformers, equipment that naturally runs on DC will be powered by the existing PV panels on the roof. An energy and cost analysis will be performed to access the benefits of this system.

Two breadth topics will also be introduced during the spring semester to gain a deeper understanding of the systems used in the building. An architectural breadth study will be conducted in the atrium to change the fenestration characteristics based off of a daylighting study in Daysim. In response to the façade and roof changes from the architectural breadth, a structural breadth study will redesign the affected members accordingly to best integrate these changes into the existing structure. The existing structural system will be studied beforehand in order to decide what the best redesign approach will be.

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General Building Information

Building Name | Princeton Theological Seminary Library

Site | 64 Mercer St, Princeton, NJ

Building Occupant Name | Princeton Theological Seminary

Occupancy Type | Group A-3 Assembly

Size | 99,585 ft²

Stories | 4 + 1 basement

Project Team

Owner | Princeton Theological Seminary

Construction Manager | Barr & Barr

Design Architects | EinhornYaffee Prescott

Architect of Record |EwingCole

Engineers |EwingCole

Landscape Architect |Andropogon Associates

Civil Engineer | Van Note Harvey Associates

Lighting Depth

The four spaces to be redesigned are the south façade and grounds, café, atrium and reference reading room. These areas designate the most highly populated path of pedestrians through the library and will show how the lighting concept can be applied to many different room types.

Schematic lighting design concepts developed during the fall semester will be refined and finalized in order to move into the design development stage in the spring semester. Each space will be fully designed and documented in a full set of plans including fixture schedules meeting ASHRAE 90.1 2010 requirements.

Concept

The whole premise of adding the addition onto their existing library was to celebrate the bicentennial of the Princeton Theological Seminary. The school has been historically influential in American theological education since its establishment and should be recognized as such. Capturing this prestigious history and focusing on the hard work being performed by the masters and PhD students that use this library, the lighting design will represent the connection between God and his pupils. ‘God is light’. Through the emphasis on verticality and sparkle, translated as reaching for the heavens, the students learning about God will feel closer to him in this space.

The lighting design in the library will grasp the visitors’ attention with eye catching elements then create a comfortable and productive environment in which they can study. Brightly lit work areas will keep occupants awake with a feeling of openness by taking advantage of the height of the spaces. Supplemental task lighting will allow for flexibility in light levels based on occupancy and daylight availability. Daylight has a significant contribution to the light levels in all of the spaces to be redesigned and will have an effect on the fixture and control devices chosen. Daylighting controls will be used to reduce glare in the reading areas and to control dimming when applicable.

Designer Comments

Shawn Good

- Good graphics/imagery
- Good pace
- Quotes about companies seemed generic, not about project and didn't relate to design
- Think about what the owner wants to achieve
- Images need more contrast
- Be careful with word choices
- Is there a good reason for colored light in the café?
- Don't say "I'm using this fixture" say "I'm placing light here.... Because..."
- For the façade it was hard to connect the 'decorate, minimize and focus schemes'
- Draw more attention to the façade entrance

Michael Baker

- Good layout, images
- Start presentation from outside
- For the façade 'decorate' scheme – ambient light from the inside will take away from the window fixtures?
- Don't let your equipment selection be your guide
- Consider more indirect lighting in the Reference Reading Room
- One bright source in room might be a problem
- Look into stack fixtures
- For the café look at putting light on wall between windows
- For the atrium – watch out for people looking down into the indirect fixture
- Atrium images need more contrast
- Architecture quotes seemed ambiguous

South Façade and Grounds

The south façade is the face of the building to all pedestrians who enter. The different elements of the façade serve different purposes and should be treated as such. The goal should be to guide pedestrians toward the entrance while creating an aesthetically pleasing view of the building.

The walkways around the south facade include straight and curving pathways from several directions that guide visitors toward the main entrance at the base of the tower. From the parking lot and streets, the width of the path varies based on estimated pedestrian traffic and should be lit to ensure safety. Providing light from above will serve the purpose of illuminating the path as well as the faces of the people around you. The other path leading to the entrance is the arcade that extends the length of the building, tucked underneath it and exposed to the grounds between its columns. Using in-grade uplights to graze the limestone columns as well as brighten the ceiling, the space will feel open and safe while calling attention to the interesting texture of the building. By providing higher light levels where the entrance is located in the arcade, pedestrians will be led in that direction.

Seen from the grounds leading up to the building, the large bay windows create a pattern on the façade and provide insight into the activities on the interior. These will be illuminated from inside, exposing the special collection workroom on the second floor and the open offices of the PhD students on the third.

Café

Located immediately to the right of the main entrance, the café is a place to relax and take a break from the hard work being done in the rest of the building. It should catch people's attention as soon as they enter the building and encourage them to enter. Movable tables and chairs in the room allow for flexibility in furniture layout to adapt to varying needs.

Implementing the psychological impression of relaxation is crucial to defining the function of this room as being different from the rest of the building. Lighting methods to accomplish this feeling will be responsive to the varying contribution from daylight throughout the day and year. There are three ceiling height windows in the room that face east and south. These will bring daylight into the space in the morning and early afternoon hours. As daylight makes people feel connected with the exterior and allows them to see outside, it can also provide dark areas that would appear to be unwelcoming. By providing high light levels on the walls, it will fill in those dark areas when daylight is present. This will also accomplish relaxation as recommended by John Flynn by creating peripheral emphasis away from the people. People are relaxed when they feel as if the attention is not on them. Dim overhead lighting will also be introduced throughout the rest of the room to provide general illumination. It will be organized in an irregular pattern to provide non-uniform light levels across the space. A drop ceiling effect, through the use of light, will be introduced to reinforce the concept of light from the heavens entering the space while also providing illumination to the perimeter areas of the ceiling.

Atrium

The atrium is the largest and most memorable area of the building. It extends up five stories from the basement and connects the addition to the existing Luce building. Designed to be a very bright space, the atrium has scattered skylights above it, clerestories along its north side and two levels of side windows on the west.

By providing a focus in the center of the atrium with the use of sparkle and vertical emphasis, the height of the space will appear to be extended all the way up to the heavens. To reinforce this focus, the surrounding areas will be simple and discrete. General illumination will need to be provided to the multi-level bridges connecting the addition to the existing building and on each level of the stairs. For the surrounding reading areas, task lighting will provide additional light when it is needed. Because the use of a pendant hung from the roof will not provide light to the lower levels and the sidelighting will not reach that space, additional lighting will need to be added. The lower level is the only floor where people will walk through the atrium so the focal point on this floor should be away from this area. Multi-purpose rooms on each floor extend into the atrium stacked on top of each other that provide the perfect opportunity for peripheral emphasis. To avoid wall-mounted fixtures that will break up the height of these walls, in-ground linear uplights will be used to graze the walls that extend into the atrium.

Daylight will be an integral part to the fixture selection and controls chosen for the atrium. Multiple photosensors will be needed to control different zones for dimming.

Reference Reading Room

Located on the western facade of the building, the Reference Reading Room is special because of its hexagonal shape and large window area. The small overhang into the space on the first floor allows for additional reading areas without blocking light from reaching the majority of the lower level. Important areas for illumination are located all around the room including stacks in the center and recessed into the walls as well as reading tables elsewhere on the first floor and lower level.

The design for this room focuses on providing light to the specific tasks while emphasizing the verticality of the space by using sparkling fixtures to portray the concept that 'God is light'. There should be a connection made between the atrium and the reference reading room because of the proximity of the spaces. The intent is to create a spacious room that has a central focus similar to that in the atrium. Adding a central sparkling fixture can do this by choosing one similar to the large one in the atrium but at a smaller scale. This will not produce any significant light to the room so wall-mounted uplights will be added around the perimeter to brighten the ceiling. Locally, where the tasks will be occurring, additional lighting will be provided on each table and at each set of stacks.

Electrical Depth

The electrical depth will in part be a response to the changes made during the redesign of the lighting from the four spaces chosen for study. This will consist of calculating loads and resizing panels to adapt to these changes. The main focus of the depth after all the fixture changes are complete is to reevaluate the loads on the building by switching to a dual bus system. This system will allow the building to run on both AC and DC power. The new DC bus system will supply power to LED luminaires, AV/IT devices, data and telecom centers, sensors and controls as well as security and safety equipment. The existing photovoltaic system will be the main power source to the DC powered equipment with electrical power converted from AC to DC as a backup. A cost analysis will be performed based on the new equipment that will be added and the transformers that will no longer be needed.

South Façade and Grounds

The current site lighting uses induction lamp poles and integrated LED handrail fixtures. Metal halide sconces and fluorescent wall-mounted uplights are used in the arcade as well as compact fluorescent downlights and wall washers around the entrance. The proposed redesign will use LED poles along the path to the building and LED steplights on the stairs at the central pathway leading up to the entrance. Sconces will be mounted on each column between the bay windows as well as at the foot of the tower to provide illumination to the courtyard in front of the arcade. Inside the arcade, in-grade uplights will graze the stone columns and spill light onto the ceiling.

Café

Compact fluorescent downlights arranged in a square of four were used in the original design of the café. This lighting technique would make the room feel small and cave-like. To create a feeling of relaxation, low overhead lighting and peripheral emphasis will be the overall scheme of the room. LED striplights will be used around a drop ceiling to create a floating ceiling effect and throughout the room to graze the walls. Additional illumination will come from compact fluorescent downlights scattered in an organic pattern across the ceiling of the room.

Atrium

The current lighting design of the atrium uses a variety of sources including LED, fluorescent, compact fluorescent, incandescent and metal halide. The redesign will use primarily LED fixtures to reduce maintenance and so the fixtures that are mounted in a ceiling grid can be run on DC power. This will include the downlights on the bridge and stacks area on each floor. The in-grade uplights on the lower level will either be LED or fluorescent depending on distribution characteristics. There will also be LED downlights over each level of the stairs.

Reference Reading Room

The existing lighting uses a combination of compact fluorescent, incandescent and LED sources. The uplight pendants that were reused from the demolished Speer Building, that used to occupy this lot, used compact fluorescent and incandescent sources for up and downlight. The task lighting around the room for the stacks and table lighting used fluorescent and LED sources. Compact fluorescent and LED downlights are located under the first floor overhang and in the stairwell. The redesign of the Reference Reading Room will use LEDs as the main source to minimize energy usage and take advantage of the ceiling grid for DC power below the overhang. For ambient light, LED wall-mounted uplights will be used around the perimeter to brighten up the ceiling and LED downlights below the overhang. The task light sources will also be LED and will be mounted to the stacks and the tables in the room. The source of the decorative pendant in the center of the room will depend on the fixture chosen.

Breadth Proposal #1 – Architectural

The architectural breadth for the redesign of the Princeton Theological Seminary Library will be focused on the atrium. A daylighting study will be performed using Daysim to analyze the performance of the existing sidelighting, clerestories and skylights. The focus will be on receiving quality lighting that will minimize the need for shading and that the contribution of daylight from these fenestrations will provide light that will allow for dimming in the atrium and surrounding areas. The windows and skylights will be resized to maximize the performance to meet these criteria.

Breadth Proposal #2 – Structural

The structural breadth will be determined by the results of the architectural breadth. The change in fenestration will affect the structure of the walls and/or roof in the atrium. The redesign of one or both of these elements will be determined and different solutions considered. The best solution in how to adapt to these changes structurally will be determined through analysis. Roof and lateral loads must be taken into account in the analysis of the new structure. Before these changes are made, a study of the existing structure of the building will be performed in order to understand how to perform the redesign.

