spertus | Institute of Jewish Studies | Chicago, IL

AE481/482 Lighting/Electrical Option

Thesis Proposal | 12.15.09

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Executive Summary

This proposal details the work to be complete for Senior Thesis Project AE897G in the spring semester of 2009. The scope of work that will be proposed for Spertus, Institute of Jewish Studies includes in depth redesign for lighting and electrical system and breadth topics in acoustics and integrated design. The lighting depth will include redesigning the four spaces including the building façade, lobby atrium, theater, and open office. The electrical depth will include an analysis of using energy efficient transformers and selecting energy efficient lighting loads to improve electrical distribution system. For the breadth topics, acoustical system in the theater will be analyzed and redesigned. Integrated designed will be performed to accommodate architectural lighting, theatrical lighting, mechanical system, acoustical system, and architecture of the space.

Background

Spertus Institute of Jewish Studies is a 155,000 Square foot building in the new Michigan Boulevard Historic District. South Michigan Ave. The 10 stories Institute comprises of the Spertus Museum, the Asher Library, Feinberg Theater, and the Spertus College. Spertus Museum consists of two-storey of flexibly planned exhibit spaces. In the Asher Library, ancient manuscripts and rare maps are maintained in state-of-the-art storage systems including movable stacks. Spertus College contains classrooms and offices that offer students and faculties a facility to interact and being productive. Spertus also offers a state-of-the-art theater for live performance and film, space for community events and celebrations.

The building was completed in November of 2007 with the actual construction cost of 59 million dollars.

Depth Proposal: Lighting

The lighting redesign will involve four spaces including building façade, lobby atrium, theater, and open office. The new lighting designs will follow the fundamental steps of the lighting design process. Schematic lighting design concepts developed in fall semester will be carried on and employed as the fundamentals in design development and documentation phase in the spring semester. The lighting redesign will be completed and documented using a combination of various computer software programs. The final result will be a set of lighting plans, details, and lighting equipment schedule and specifications for all spaces redesigned and at least two photorealistic renderings of the new lighting design.

Overall Design

Since Spertus is located in the new Michigan Boulevard Historic District, the façade of the building has a significant impact on the appearance of the Michigan Ave. A meaningful lighting design concept is proposed to create lighting scheme that reinforces and highlights the façade of the building.

The same lighting design concept from the façade with different interpretation is applied to the lobby area to create a cohesive transition spaces. Integrated lighting system to the interior architecture of the space is one of the main considerations that is carried throughout the spaces. Since the lobby may be rented out for private event during, proposed lighting scheme will provide flexibility and dramatic lighting. Efficient light sources will be introduced to the space to not only improve quality of light but also to reduce energy consumption.

Proposed lighting design solution for the Feinberg Theater offers flexibility in control and energy saving strategy. Acoustic breadth analysis will be done in this space to not only optimize acoustical performance but also to better integrate lighting in the space.

The open office area includes two adjacent spaces in the scope which consist of reception area and a conference room. The reception area serves multiple functions including transition space and waiting are. Point of interest will be created in this area to help the traffic flow and to create relaxing environment for waiting guests. Proposed lighting solutions for the main open office is ambient-task approach. The conference room will be separated from the open office area with Electrified-Privacy-Glass. Daylighting analysis will be performed in this space. Appropriate photosensor-based lighting control system, detail configuration, and layout will be developed. Annual energy savings potential will also be determined to ensure system performance.

Designer Comments from Presentation at Lutron (12/11/08)

Lee Brandt

- Great Presentation/Speaking/Renderings
- Façade
    - Explain what is the glass and how to make illuminate canopy.
    - Star of David – Change order of slides if it is a concept for certain space.
    - Explain if the glazing will be light from the outside or inside.
    - Option 1 is best reinforcement of Star of David Concept.
- Lobby
    - Mention about general illumination first.
    - Choose one technique of rendering per space to avoid confusion and be consistent.
    - Photo rendering of reception desk is great. Should do the same thing for the sculpture wall.
- Theater
    - HID downlight system – no one wants warm-up time. Suggest compact fluorescent or incandescent.
    - Side walls may be a better place to do dynamic lighting instead of on the balcony.
- Open Office
    - Should show general illumination first.
    - Talk more about controls, zoning, daylighting, and process.
    - Pendant in the conference room is great. It helps reinforcing Star of David concept.
    - Identify the presentation wall and explain about flexibility in control.

Sandra Stashik

- Overall presentation was nice.
- Disagree with Lee on applying Star of David concept. The concept is applied throughout the spaces.
- Façade
    - Comparison of three different options for façade slide is great. Good to express opinion on which one you like.
    - Uplight fritted glass is best to do from the inside
    - A combination of first and third option may create a good design by outlining the six faces.

- Lobby
    - Photograph rendering is good.
    - Sketch renderings were good but photos would be really helpful for sculpture wall
- Theater
    - Vertical wall glazers are good to draw attention to the stage. They do not create distraction.
    - HID/Incandescent solution is good for energy but must think about warm-up time.
- Open Office
    - Nice to show three different solutions. They are strong variation of ideas.
    - Conference room design solution is simple and effective.
    - Very nice job.

Solution Method

At this point of the design process, schematic proposed lighting design schemes will be developed, analyzed, detailed, and documented. It is crucial to carry over the design concepts and develop them further. The new lighting designs will be completed and documented using a combination of hand sketching and computer software. Final documentation will include lighting plans, calculations to verify light levels, and final renderings.

Tools

Recommended design guideline from IESNA Lighting Handbook will be used as a reference but not necessary as a design goal. Justification will be provided if deviation from the guidelines occurs.

Computer programs will be used to visualize the space and evaluate performance of lighting solutions. Lighting calculations will be performed in AGI32 to verify performance and light levels. 3D models of each space will be constructed in AutoCAD and rendered in AGI32. Additional photorealistic renderings for building façade will be generated in 3Ds MAX Studio.

Each of the lighting design schemes will be designed to compliance with Building Energy Codes ASHRAE/Standard 90.1 2004. Evaluation of power density will be assessed to ensure code compliance.

Depth Proposal: Electrical

1. **Redesign branch circuit distribution for the four spaces where lighting is redesigned.**

   Four spaces in Spertus, Institute of Jewish Studies will be re-lighted as a lighting depth portion of the senior thesis project. The scope of lighting design includes the following spaces: building facade, lobby atrium, theater, and open office.

2. **Conduct a protective device coordination study that addresses a single-path through the distribution system, including short circuit calculations.**

   New lighting design schemes may introduce new light sources and completely new lighting layouts and control schemes. As a result, electrical system must be redesigned to accommodate these changes. The path to panel board 0L-2 will be analyzed. This path goes from the service entrance switchboard GSWB-1 to the main distribution panel 0G-1 to panel 0L-2. Panelboards will also be rearranged according to new lighting zones and control schemes.

3. **Selecting energy efficient loads (Lighting and Mechanical)**

   Low-voltage halogen light source is being utilized in the public areas throughout the building. Energy efficient High Intensity Discharge will be introduced to reduce electrical load while maintaining quality of light. Metal halide lamps require electrical ballasts to regulate the arc current flow and deliver the proper voltage to the arc. One the other hand, existing low-voltage halogen lamps required transformers in order to step down voltage. This modification may or may not affect the performance of electrical distribution system.

4. **Investigate the use of energy efficient transformers.**

   Spertus has five transformers provided by ComEd utility company. Four of them step down to 480Y/277V and one to 208Y/120V. Internally, there are four transformers that step down voltage from 480V – 208/120V. By switching to energy efficient transformers will not only help the building owner save money from electricity cost, but will also help enhancing the facility's performance, reliability, safety and ease of use. Initial costs and maintenance costs for both transformer types will be analyzed. Pay-back period will be identified for the more expensive type of transformer to counter act the higher initial costs.

Breadth Proposal

Acoustic:

Reverberation time and STC analysis will be performed for the Feinberg Theater. Ceiling panels will be proposed to not only improve acoustical performance, but also to better integrate lighting system and mechanical system to the space. Analysis of this alteration will be performed to ensure acoustical performance. The Feinberg Theater is a multifunction facility including live performance, film, community events, and lectures. Acoustical criterions and characteristics will be defined and used as a design guideline. Adjustable acoustical shades or devices maybe required in some areas to adjust acoustical performance according to the activity being performed in the space.

Design Integration:

Integration of systems design will be proposed to the Feinberg Theater. Integration will not only enhance system performance, but also to sustain the integrity of the architecture in the space. Proposed acoustical panels will be used as place holders for architectural house lighting, theatrical lighting, and mechanical supply system. The physical shapes, sizes, and exact location of the panels will be designed to implement existing architecture and accommodate both lighting and mechanical system. Mechanical supply diffusers will be specified to supply appropriate amount of fresh air to the space.

Spring Semester Schedule:

AE 897G Schedule	
Week	**Description of Activities**
Winter Vacation	Begin Construction of 3D Model
	Finalize and Excecute Schematic Design
1/12/09 to 1/18/09	Continue Construction of 3D Model
	Finalize and Excecute Schematic Design
	Begin Design Development
1/19/09 to 1/25/09	Construction Criterions for Luminaires Selection
	Lumiaire Research and Selection
	Start Developing Acoustical Design Creterion for the Theater
1/26/09 to 2/01/09	Luminaire Selection
	Start Prelimenary Acoustical Analysis for the Theater
	Start Analyzing Existing Lighting Load
2/02/09 to 2/08/09	Massing Model Completed
	Research on Acoustical Panels
	Continue Acoustical Analysis
2/09/09 to 2/15/09	Start AGI Calcuations
	Analyze Mechanical System and Loads in the Theater
	Redesign Lighting System to reduce Lighting Loads
2/16/09 to 2/22/09	Continue AGI Calculation
	Start Daylighting Analysis
	Calculate New Lighting Load
2/23/09 to 3/01/09	Start Redesigning the Branch Circuit Distribution for Four Spaces
	Continue Daylighting Analysis
	Select Air Supply Diffusers
3/02/09 to 3/08/09	Start Integrating Lighting and Mechanical System on Ceiling Panels
	Complete Daylighting Analysis
	Continue on Redesigning Branch Circuit Distributions
3/09/09 to 3/15/09	Complete AGI Calculation
3/16/09 to 3/22/09	Start Generating Renderings
	Analyze Acoustical Performance for New Theater Design
3/23/09 to 3/29/09	Conduct a Protective Device Coordination Study
	Analyzing Existing Transformers
3/30/09 to 4/05/09	Generating Renderings
	Reseach on Efficient Transformers
	Start Power Point Presentation
4/06/09 to 4/12/09	Analyze Energy Efficient Transformers VS Standard Transformers
	Generating Renderings
	Complete Ceiling Panels Redesign
4/13/09 to 4/19/09	Complete and Review Final Report
	Power Point Presentation
	Faculty Jury Presentation