Walter Nichols
Hawthorn Building
Altoona, PA

Executive Summary

The depth and breadth proposals summarize the areas of the Hawthorn Building that I will be focusing on in the spring semester. The unique uses for some of the rooms as well as the multipurpose uses in others create some challenges to meet illuminance design criteria and maintaining acceptable power allowances at the same time. My lighting design emphasis is going to be providing adequate levels of light as well as doing it in a clean and efficient way. For my electrical redesign, I want to redesign the currently largely oversized distribution system into a smaller system if possible. Other areas of architectural engineering that I want to explore include an acoustical redesign of the music room, as well as a cost comparison between economic fixtures and lamps vs. the existing fixtures and lamps. Due to the mechanical equipment being located directly above the music room, a mechanical redesign might be taken into consideration as well.

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Background of the Problem

The Hawthorn Building is located on the Penn State Altoona Campus, in Altoona, PA. The building was built to replace the existing computer lab and classroom space that shared a common building with the campus library. The building is 58,800 square feet and houses computer labs, classrooms, a music room, and faculty offices. The four spaces I chose for my lighting design are the following: Computer Labs, Pechter Family Music Room, Lecture Hall/Video Conferencing Room, and Main Corridor.

Depth Proposal – Lighting

Problem

The main problem in doing the lighting design for this space is effectively meeting the needs of each space. There is very little daylight contribution in the building, and many of the spaces have multiple purposes. Some concerns for the spaces include: direct and reflected glare, daylighting integration where applicable, color rendering, facial rendering, video conferencing requirements, power density, and appearances of spaces. Technical Assignment 1 addressed these spaces on an individual basis.

Solution Method

The purposed lighting design will incorporate all aspects and concerns listed above in a manner that is efficient and easy to use, as well as meeting criteria specified by the IES. Lighting placement, patterns, and illuminance levels will be analyzed in the lighting software AGI32. AGI32 will also be used to study daylighting in the appropriate spaces. AutoCAD will be used to create 3d fixtures, and high quality renderings will either be produced using AGI32 or AutoDesk VIZ. Power density calculations will be done by hand and arranged in excel for easy reading.

Tasks and Tools

Fixture Selection

- Fixtures will be chosen based on photometric properties, appearance, and ability to integrate with the architecture of the space
- Energy efficient lamps will be specified when applicable
- Compatible and efficient ballasts will be specified when applicable

Luminaire Spacing and Locations

- Spacing criteria and trial and error via AGI32 will be used to determine the correct lighting layouts and amount of fixtures needed for each space

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Modeling

- 3d Models will be built in AutoCAD and imported into AGI32 for lighting analysis
- Renderings will be done in AGI32 or AutoDesk VIZ

Daylighting Analysis

- Daylighting analysis will be done in AGI32
- Different window glazing types and blind types will be analyzed for the best possible daylighting system

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Depth Proposal – Electrical

Problem

It will be necessary to provide power to the additional lighting, mechanical, and other loads added to the building. After analyzing the distribution system in Technical Assignment 2, it was discovered that the existing system is largely oversized, and the existing panel boards have plenty of room for growth already included. An additional utility service is not needed for the building.

Solution

Because of the existing oversized electrical system, I plan on doing analysis to see if a smaller distribution system can be used instead of the existing system. If a smaller system can be used, a cost comparison will be done to see if it would be beneficial to use a smaller distribution system or keep the existing one.

Solution Method

Using the NEC 2002 edition, load factors will be used to calculate electrical loading for the building. New lighting loads, panel board locations, and additional transformers will also be taken into consideration. Also, new wire sizes, conduit sizes, and breaker sizes will be analyzed. From here, a new main distribution system can be sized and cost comparison calculation can be done.

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Tasks and Tools

Power Location

- Determine the location of all electrical equipment (switches, receptacles, luminaires, panel boards, motors, etc)

Calculated Loads

- Determine loading of electrical equipment
- Divide loads into categories (lighting, receptacles, etc)
- Determine demand factors for the loading
- Determine if additional transformers are needed, and if so, where at

Size Panel Boards

- Using Appendix D of the NEC 2002, size panel boards
- Size circuit breakers
- Size over current protection for equipment
- Place lighting and receptacle loads on 20A circuits
- Size main distribution system from panel board loads

Wire Sizing

- Size wires using NEC 2002
- Size conduit using NEC 2002

Riser Diagram

- Create riser diagram for the new distribution system

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Breadth Proposal

Mechanical

Due to the lighting redesign in the music room, an acoustical analysis or redesign will be needed to make sure that the new acoustics in the room are still adequate after the new lighting system is used. If the acoustics are not ok after the new lighting system, a redesign will be needed. In the same room, mechanical ductwork runs above the ceiling grid, so a mechanical redesign of moving the equipment somewhere else is also possible.

Construction Management

As a second breadth work topic, I want to find the savings of using energy efficient lamps versus standard lamps, and find out if the payback period makes it worth using economic lamps. Also, as stated in my electrical depth, a cost analysis will be looked at when sizing the new distribution system.

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Week	Planned Task
1/9-1/22	Build 3d cad models to import into AGI32
1/23-1/29	Import models into AGI32 and complete lighting analysis and daylight studies
1/30-2/10	Resize the distribution system
2/11-2/25	Analysis of acoustics in music room and possible mechanical redesign
2/26-3/5	Economical analysis of lamps and distribution system
3/6-3/12	Spring break
3/13-3/19	Make final corrections and analysis to lighting system and distribution system
3/20-3/26	Organize breadth work data and complete anything not yet done
3/27-4/1	Create final thesis booklet
4/2-4/9	Create Powerpoint presentation
4/10-4/12	Thesis presentations
5/13	Graduation