Penn State University

Spring Proposal

The HUB Addition

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Tech Report 2

Executive Summary

This report is a proposal of the work to be complete for AE Senior Thesis in the spring semester of 2016. The project includes a lighting redesign of four spaces and an electrical study to support the new lighting designs in the HUB addition.

The lighting depth involves a redesign of four areas within the HUB, each relating back to the concept of connection.

Surrounding outdoor area
Atrium
Bookstore
Theater

To accommodate the new lighting design some aspects of the electrical system will need to be redesigned. This includes the branch circuits and associated panel boards that handle the lighting loads. Additionally, a short circuit study will be conducted to ensure that all electrical equipment involved in the redesign is adequately protected.

A daylight study using parametric design practices drawing from concepts learned in AE565 will be done on the atrium curtain wall. Several daylight control options will be specified and tested using parametric design to find the optimal type and layout.

In response to the change in daylighting within the space, an energy study specifically for the mechanical implications will be done, covering the first breadth. The second breadth will focus on the construction management side, by looking at the cost of the new curtain wall system and the potential energy savings of decreased mechanical loads, if any. Additionally, appropriate daylighting controls need to be specified for the new lighting design, which also needs to be evaluated with a cost to energy savings study.

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Building Overview

The Hetzel Union Building addition is a multipurpose space that provided supplemental spaces for the main portion of the HUB. Additional gathering areas, conference rooms, THON offices, seating/eating areas, retail/private businesses, specialty areas, and a new bookstore were included in the addition. The addition also provides better access to the rest of the building from the east and south sides of campus, as well as the HUB parking deck.

Name | The Hetzel Union Building (HUB)
Location | University Park, State College, PA 16801
Occupant Type | A-1, A-2, A-3, B, M
Size | 107,000 S.F.
Number of Stories | Three stories above grade and two basement levels
Construction Dates | May 2013 – May 2015
Estimated Building Cost | $44,600,000
Project Delivery Method | Design-Bid-Build

Project Team

Owner: Penn State University
Construction Manager: Gilbane Building Company
Architect: Gund Partnership
Landscape Architect: Andropogon Associates, Ltd.
MEP Engineer: Vanderweil Engineers
Civil Engineer: Sweetland Engineering and Assoc.
Structural Engineer: LeMessurier Consultants
Acoustic Consultant: Acentech Incorporated
AV/IT Consultant: Vantage Technology Group
Lighting Consultant: Horton Lees Brogden Lighting Design

Lighting Depth

The concept behind the lighting design is based around the idea of connectivity. The addition itself was made to better connect the HUB to various parts of the campus and each space within seeks to connect people to something. This connection could be to other spaces or to a function specific to that particular space. The lighting design should reinforce and encourage these connections between people and the architecture, as well as functions of the spaces.

Surrounding outdoor area

The outdoor area surrounding the addition serves to guide people around and to the building. Many paths converge in this area, bringing in foot traffic from various parts of campus. There are two main entrances, an upper and lower, allowing access to the building from campus. These entryways have a variety of architectural features and materials that include aluminum overhangs and solar shades, terracotta panels, and curtain walls.

The concept for the outdoors revolves around the idea of connecting people to the building. The lighting will funnel traffic through and around the outdoor area and into the building. It will also introduce visual interest to the area, by highlighting some of the architectural features that are inherent to the entryways. By doing so, focal points will be introduced to help guide people from the outside in. In addition to the aesthetics of the space, the purposed lighting design will be comprised of fixtures that are robust enough to withstand the often hostile environment of a college campus, as well as provide adequate illuminance levels for safety and security.

Atrium

The first area that occupants of the building will likely encounter is the atrium. This space serves many purposes ranging from transitional space to eating and gathering areas. There are a few main areas that include the grand stair, connecting the first and mezzanine levels, the main seating area on the first floor, and the various satellite seating areas that populate much of the mezzanine level. Most, if not all of the seating within the atrium is movable and is often rearranged to allow a variety of activities to take place. The main materials that make up the

space are a combination of metal and glass panels for the roof, terrazzo and wood flooring, and gypsum wall board and curtain walls. The steel trusses supporting the roof are exposed, creating another layer of architectural elements.

Daylight is utilized throughout the space through the skylights and aluminum curtain walls, making the atrium appear bright and spacious throughout the day. This should be carried through to the electrical lighting design, since the HUB is a 24/7 building. Overall, the lighting design concept is based on the idea of connecting people to people. Recognizing the various gathering spaces and variety of functions occurring throughout the day the lighting will need to highlight and promote social interactions of many forms. Highlighting the gathering areas is one of my main goals. This will help encourage gathering and interaction between occupants within the space. The lighting will also accent and enhance the architecture forms present in the space. In addition, any lighting design solution should take into account the vast amount of daylighting in the space and adapt to the ever changing daylight conditions for visual comfort and energy conservation.

Bookstore

The bookstore is located right inside of the lower entryway. A two story storefront curtain wall serves as the primary division between the lower lobby and the retail space. The store opens up to the double high retail space. This gives way to the mezzanine level that breaks up the apparel and supply sections of the store. The very rear of the store is reserved for the stacks and campus bookstore. The walls consist of a combination of gypsum wall board and curtain wall strips along the southern wall. The flooring is made up of carpet in the main retail area, tile flooring in the book area and stacks, and a wooden path that guides people through the space.

This space was meant to connect people to knowledge, by bringing them on through the learning process as they journeyed through the space. Each layer of light will represent a stage in the learning process, starting with the initial knowledge required to grasp higher concepts and ending with enlightenment obtained through the synthesis of ideas and experience.

The journey will begin in the retail area, where general and accent lighting will be used to create a hierarchy, dividing the transition spaces, general retail, and specials or high importance items. As you move through the space and under the mezzanine an array of fixtures arranged to evoke

movement from the perimeter and front of the store to the rear will provide general illuminance. These will ultimately terminate at the stacks and bookstore, which will be highlighted to signify the end of the journey through the space. Providing a public impression is important within this space, as to make it inviting for potential customers.

Theater

The final area of focus is the flex theater, located on the mezzanine level in the atrium. Much like the atrium, a variety of activities take place, ranging from social events to theatrical performances. Pull out seating is used to accommodate these various uses. The main control panel is located on a balcony overlooking the main space. Theatrical fixtures are mounted on a rig suspended from the black ACT ceiling. The floor is made of terrazzo and walls are gypsum wall board.

This space's main purpose is to connect people to emotions. To do this the lighting needs to connect people to the performance from the moment they walk into the space. The lighting should be flexible in use to allow the permanent architectural fixtures to be integrated into a theatrical performance. The lighting system will be able to provide a myriad of psychological impressions that John Flynn outlines. This would allow the house lighting to be used to begin setting the mood before a performance even begins. In addition, it would support using the space as a black box theater, where a variety of performance types could be implemented.

Professional Feedback & Personal Review

Kevin Houser

Described project as HUB, not HUB addition, be clearer on this.

Difficult to read how light exists in space through plans and elevations for outdoor space

Didn't agree with permanent festive impression in theater

Ken Douglas

Didn't like scribble effect to show light on perspectives

Was confused as to why only the bottom portion of the exterior wall was lit

Thought that arch fixtures used in 2nd design were frail

Fiber optics are really high maintenance

Atrium is too busy. Solution should be simpler

Bookstore is visually heavy

Elevations are needed for atrium and bookstore

Don't use bollards in outdoor design due to harsh environment

Lee Waldron

Atrium design is highlighting the wrong elements

Be more subtle in highlighting the stairway in atrium

Consider theater in all states, not just when seats are extended

Shawn Good

Arches in 2nd outdoor design may restrict movement

Know your client and see if you can use their language

Consider the light that will come through the curtain wall from inside

Renders feel incomplete, need to be more visually complete

Personal considerations

Challenge myself to work within the client's usual language and consider the environment I'm working in

Rethink all designs and possible solutions to create simple clean designs, rather than heavy handed busy ones

Create more complete renders and graphics to better represent the spaces and lighting

Tasks and Tools

Schematic

Hand Sketches and Photoshop

3D Modeling, Lighting Calculations, Renderings

Revit and Rhino model

AGI32 and/or 3Ds Max for lighting calculations and renderings

Photoshop for post-processing renders

Daylighting analysis/Parametric Design

Rhino with Diva and Grasshopper

Documentation

Revit and AutoCAD

Electrical Depth

The HUB's building utility voltage is 480/277V, 3PH, 4W. This voltage allows the mechanical equipment to be run at 480V. This also allows for a mix of 277V and 120V lighting depending on the location in the building. Step-down transformers allow the 208/120V loads to be accommodated throughout the building. These lower voltage loads include receptacles and some continuous loads, like the security systems. Emergency power is provided by a secondary feed from campus.

My electrical depth will be both a branch circuit redesign and a short circuit analysis to ensure the electrical system accommodates the new lighting solutions. Additional elements may be added to this section per Gary's recommendations.

Short Circuit Analysis

A coordination study of the protective devices will be done for all of the panelboards effected by the new lighting designs to ensure that the electrical equipment is adequately protected

Branch Circuit Redesign

To ensure that the new lighting solutions are integrated properly, a branch circuit redesign and equipment resizing will be performed.

MAE Depth (Focus AE565)

Daylighting and Parametric Design

Since the atrium uses curtain walls so liberally, I will be doing an in-depth daylighting analysis to determine the current daylighting conditions, such as glare. Using a parametric model, I will then determine the optimal type of daylight control, which will include, but isn't limited to frit and electrochromic glass. The layout of each option will also be optimized.

Mechanical Breadth

Tying in with the MAE depth, I will look at the HVAC implications that the chosen daylighting design has on the atrium. This will be compared to the base case in terms of potential increased mechanical energy demands from solar heat gain. The ideal case would be a solution that has lower loads, while also better managing incoming daylight.

Construction Breadth

There will likely be a cost associated with purchasing and installing these additional daylighting elements. I will compare this cost to the potential cost savings, assuming that no additional mechanical loads are introduced in the new design. A cost verse energy saving analysis of appropriate daylighting controls for the new lighting design will also be performed.

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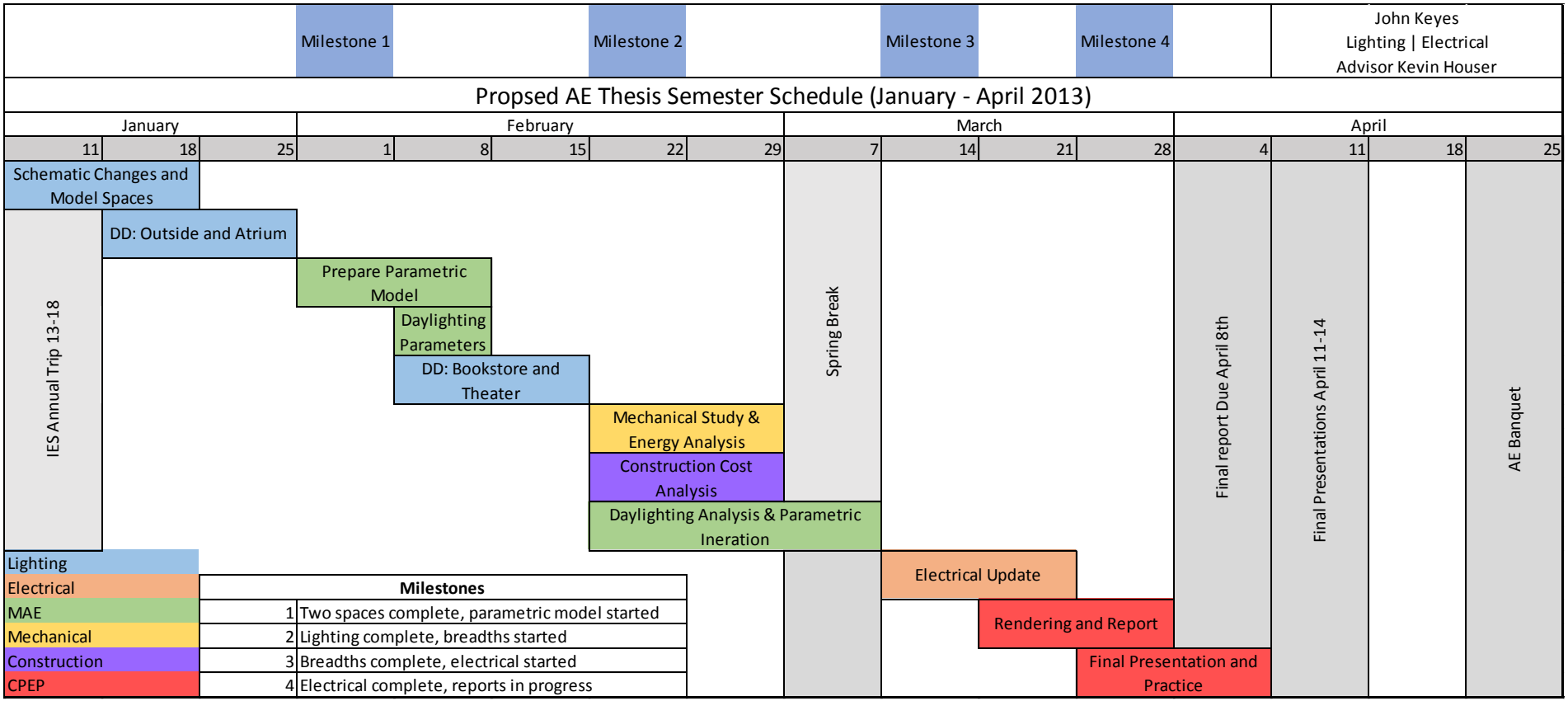
Milestone 1
Milestone 2
Milestone 3
Milestone 4
John Keyes
Lighting | Electrical
Advisor Kevin Houser
Propsed AE Thesis Semester Schedule (January - April 2013)
January
February
March
April
11
18
25
1
8
15
22
29
7
14
21
28
4
11
18
25
Schematic Changes and Model Spaces
DD: Outside and Atrium
Prepare Parametric Model
Daylighting Parameters
DD: Bookstore and Theater
Mechanical Study & Energy Analysis
Construction Cost Analysis
Daylighting Analysis & Parametric Ineration
Electrical Update
Rendering and Report
Final Presentation and Practice
IES Annual Trip 13-18
Spring Break
Final report Due April 8th
Final Presentations April 11-14
AE Banquet
Lighting
Electrical
MAE
Mechanical
Construction
CPEP
Milestones
1 Two spaces complete, parametric model started
2 Lighting complete, breadths started
3 Breadths complete, electrical started
4 Electrical complete, reports in progress