AE 481W

FINAL PROPOSAL

Towson West Village Commons

Towson University
Towson, Maryland

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Executive Summary

This report outlines the proposed areas of study for AE 482, the spring session of the Architectural Engineering Senior Thesis. The proposal spans an electrical and lighting depth along with three breadths. The electrical depth includes electrical analysis of the lighting redesign, a protective coordination study and two topic areas including DC distribution and a comprehensive short circuit analysis. The lighting design will cover the redesign of five key building spaces, the grand staircase, roof terrace, study lounge, HRL suite, and multi-purpose room. The redesign will meet both ASHRAE and IESNA standards. As part of the M.A.E. program, a breadth will be conducted in the area of daylighting. Daylighting will be studied through the changing of glazing materials for the study lounge. Concurrently, a mechanical breadth will be conducted to study the load profile changes based on glazing. A final breadth in the structural discipline will be conducted to study the effects on the structure of an addition of a photovoltaic array used for the DC distribution electrical depth.

Introduction

General Building Information

- **Building Name:** Towson West Village Commons
- **Location:** Towson University, Towson Maryland (Include map graphic)
- **Occupancy:** Non-Separated Mixed Use (Type A-2, A-3, B, Utility)
- **Main Function:** University food commons for students and faculty of Towson University.
- **Size:** 86,339 sq. ft.
- **Levels Above Grade:** 4 levels
- **Total Levels:** 5 levels

Towson West Village Commons is unique in its initial design as it works with the surrounding environment, while providing a unique building for the campus. Considered the west entrance to Towson University, the building incorporates Emerson drive into the building. The basement, first, and second floor are relatively smaller than the third and fourth floor, making room for an underpass for Emerson drive. This incorporates the hillside into the third and fourth floor providing a natural pathway into and out of every floor.

Inside of the building, each floor is unique in its intended function. The first floor provides retail food sales along with other building support spaces. The second floor is dedicated to an open style buffet food commons for university students, faculty and staff. The third floor, which spans over Emerson Drive, offers office space, a small fitness facility and open study/lounge space. This floor also offers access out into a garden. This garden acts as a meeting space and the roof for part of the second floor. The fourth floor is predominantly dedicated to a multipurpose room and the second tier of the student study/lounge space.

Connecting the first and second floors and also the study lounge tiers are grand staircases. Main corridors are kept primarily on the east side of the building. The glass found on the third floor study lounge and along the east hallway face into the center of campus. The views create a place where the vision for Towson can be easily experienced. Whether coming through the underpass, enjoying the roof garden, or enjoying the study lounge, the focus remains on Towson University.

Lighting Proposal

Problem

Towson University constructed the West Village Commons as a signature space for the West side of campus and to draw students to live on campus. In each of the spaces, lighting should highlight the building and reinforce the importance of the building. It should also add character to the building, creating a visual point of interest for everyone coming to and living on the campus. After conducting an analysis in previous technical reports, five spaces were selected for lighting redesign. The lighting redesign will look at light placement, controllability, and power consumption. Each of the five spaces will be need to be designed in compliance with ASHRAE 90.1 – 2007 and IESNA guidelines.

Grand Staircase

The grand staircase is the main entrance for students coming from the residence halls. This space will need to be open and inviting, along with focusing on key interest points and the flow of people throughout the building. The proposed lighting design offers wall grazing to highlight the wood texture, along with individual stair grazing to illuminate the stair tread evenly while adding character to the riser. Additional lighting will highlight the lounge area near the media wall and cloud ceiling concept developed by the architect.

Roof Terrace

The roof terrace located on the 3rd floor is one of the most important spaces found in Towson West Village Commons. This green roof is a publicly accessible relaxation space that looks out over the campus. The space lighting has been refined to highlight points of interest for relaxation or to overlook the campus. All lighting is kept low to the ground to reduce light pollution and allow for the space to be accented by the internal glow of the indoor spaces.

Study Lounge

The study lounge is the most important student space within the building. Shrouded in glass, the lounge will be occupied by students for long periods of time. Because of its earth tones and the glazing, the space should feel relaxed and spacious. Through the use of perimeter lighting and additional downlights, a level of ambience and a feeling of relaxation can be created for students. At night the signature columns running through the space will glow and will be seen by all residence halls, drawing constant attention and focus to the building.

HRL Suite

The HRL suite is a completely interior space with no connection to the outdoors. Because of this, employees can sometimes feel compressed. The suite will need to feel open and spacious and be welcoming to students. Within the space are two counters, a work counter and attendant counter. The attendant counter will be the initial space for interaction between employees and students. The counter should have a modern look. The work counter may be used for lunch preparation, or light office work. The task lighting is most important so that employees can focus on their work and see their task.

Multi-Purpose Room

The multi-purpose room has the ability to either be one large space or three individual spaces. When three individual spaces are separated, they are exactly identical. The lighting system must be flexible enough to work as one system and also as three independent systems. Ideally the each of the spaces should be mirrored designs. The individual spaces will need to have a feeling of spaciousness and elegance as this will be used for more than just student activities. This space has the potential to be the defining space the public interacts with when it visits Towson University. The functions held in the space will include both banquets and guest lectures.

Solution

Each space will be designed to the criteria listed above, but will require to include the overall context of the building. The overall context requires each space to be defining, sustainable and spacious. A computer based analysis of each space will be conducted to maintain the proper illuminance values and luminance ratios as specified in technical report 1. Each of the space was schematically design in technical report 3. After presenting to design professionals on December 8, 2010, comments and feedback were obtained. Feedback is listed below by designer. This will be used to further develop the design as I move forward. The designs will be carried through to create construction documents. These documents will include lighting plans, schedules, and renderings. Included in the final report will also be a summary of calculations and design values.

Design Comments

Lee Brandt

- Look at how light will interact with the media wall.
- How are the critical points addressed with respect to the grand stair?
- Make sure to hide strip lighting under the lip of the stair.
- Slot fixtures won't have a defined edge for "daylight" schematic. Look at using point sources.
- Façade benefits the roof terrace. Additional features may need to be added to the roof terrace for aesthetic.
- Grazing glass may have problems with reflections and glare.
- Columns should have a special finish, not the typical grey.
- Scenarios were very flexible with the space.
- Office could benefit from perimeter lighting
- Multipurpose room concept needs redevelopment for a clear cut choice.
- What kind of space would you, as a student, want to be in?

Luke Tique

- Parallel Construction. Carry the lighting scheme throughout the building.

- Impressions should be experienced in all spaces
- Use consistent graphic views, such as perspectives for each space.
- Look at control systems. What should be allowed on and off at one time?
- Say which scheme you want, not which ones you do not.

Mike Barber

- Develop a story, rather than just terms.
- How will the building feed off the surrounding buildings?
- Daylight is a higher CCT, wood uses a lower CCT. Develop integration.
- Lighting through the clouds is a nice idea.
- Terrace was very clean and simple.
- The lounge should develop with daylight in mind.
- Use 30 fc for the office and add task lighting.
- Add layers of light to the multipurpose space.

Lighting Tools:

- AGi32
- AutoCAD
- Autodesk 3DS Max
- Microsoft Excel
- Photoshop

Electrical Proposal

Lighting Redesign (5 spaces)

Grand Stair (North Entrance, 1st and 2nd floors)

The Grand Staircase is the primary means of transportation from the ground level to the commons eatery found on the second floor. The space is highlighted by a media wall, lounge areas and a student information desk. The existing lighting includes compact fluorescent downlights and PAR 38 lamps to wash the wood wall. The proposed design will include linear fluorescent, compact fluorescent and LED light sources.

Roof Terrace (East Façade, 3rd floor)

The roof terrace is an outdoor green roof space accessible to the public. Currently, only fluorescent wall lighting and some LED under bench lighting can be found in the space. Proposed lighting includes LED rail and bench lights along with LED photovoltaic pavers for the pathway.

Study Lounge (Above Grand Stair, 3rd and 4th floors)

The study lounge is a two story space that is shrouded in glass. The current lighting scheme only uses recessed compact fluorescent downlights. The proposed design will mix colored LEDs, linear fluorescent, and halogen sources within the space.

HRL Suite (South End Interior, 3rd floor)

The HRL suite is an open office design with no view to the exterior of the building. The current scheme uses linear fluorescent recessed fixtures. The proposed design will use a combination of linear fluorescent and LED sources.

Multi-Purpose Room (South End, 4th Floor)

The multi-purpose space is a flexible space that can be used as a large banquet hall or three individual lecture rooms. The current design utilizes linear fluorescent recessed fixtures and incandescent spotlights. The proposed design will utilize linear fluorescent, compact fluorescent, and some halogen sources.

Protective Device Coordination Study

A short circuit analysis will be conducted for the redesign panels based on the new lighting loads and controls developed in the lighting portion of this thesis. The circuit studied will include protection curves and the short circuit current. The studied path will range from the utility transformer, through the switchboard SWB, panels LP4, RP4, RP4A and finally to panel DM4A.

Electrical Depth 1 – DC Electric Distribution

A photovoltaic array would not be able to handle the electrical needs of the building. With several spaces only needing energy from an 8am to 5pm, a direct connection from a photovoltaic array can be made to a DC electric distribution system. This system also uses a power core to provide additional energy from the AC building distribution system. This distribution system has been developed and integrated into ceiling grid layouts so for this project, the DC distribution will only occur within the HRL Suite, since it is already being redesigned for a new lighting system. The lighting system will utilize a 24VDC system and can be directly tied to the photovoltaic array. An array will be sized, along with the DC distribution system and will be compared to a traditional AC lighting system with photovoltaics and an inverter. Through the use of TRNSYS software, the inverter can be modeled along with the photovoltaics to study the energy loss of the use of an inverter. A cost analysis of the system will also be looked at as for a payback period.

Electrical Depth 2 – Comprehensive Short Circuit Analysis

Using the SKM software, an arc fault, short circuit, and coordination study will be conducted. This will include the updated lighting loads, and the power core studied in depth 1. The each piece of equipment used in the system will then be recorded with its tag, description, actual AIC rating, and the available short circuit current analyzed by the software. From the arc fault study, the arc fault level and required protective clothing will also be determined.

Electrical Tools

- SKM software
- TRNSYS software

Daylighting Breadth (M.A.E.)

The building uses several different types of glass to enclose the building. On the North end of the building, the student study lounge is enclosed with clear, fritted and translucent glazing. For this breadth, each of the glass types will be changed to clear glazing and have shades incorporated. This will require a study of the photosensor location along with shade heights, since the space spans 2 levels in height. Because of the north facing nature of the space, clear glass can provide views out towards the residential buildings and to the rest of campus throughout the day while the sun is in the southern sky. The study will be conducted using DAYSIM analysis, with varying shading conditions.

Breadth Tools

- AutoCAD
- DAYSIM software

Mechanical Breadth

In parallel with the daylighting breadth, my mechanical breadth will analyze the load impact of changing glazing types. Glazing changes will change the heat gained by the space throughout the year. When shades are incorporated the loads will continue to decrease. Using the DAYSIM analysis, shading conditions can be recorded for each hour of the year. This can be included in RTSM Energy modeling to analyze the impact of shades on energy loads. Three RTSM models will be developed to analyze the peak cooling loads on the space. These models will be for the base condition, change in glazing, and the incorporated shading.

Breadth Tools

- ASHRAE RTSM Method
- DAYSIM software

Structural Breadth

When adding photovoltaics, there will be an increased building load. The dead load, wind load, and snow drift can all be affected by the addition of a photovoltaic array, especially when panels are sloped for optimized collection. The existing structure will be analyzed to determine whether the photovoltaic array can be placed on the roof of the 4^{th} level without adjusting the structure.

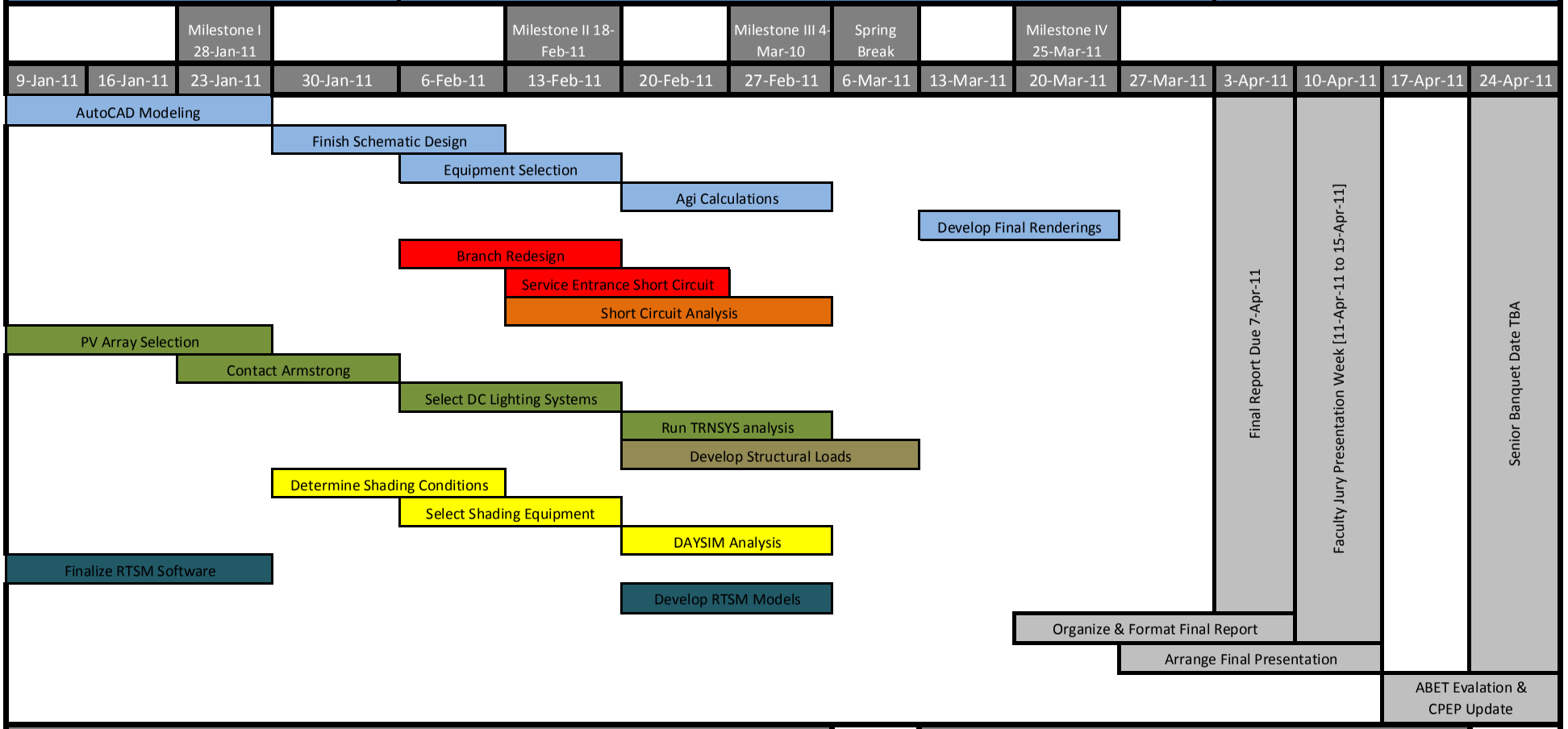
Proposed Thesis Schedule

January 2011 - April 2011
Submitted: December 10, 2010

Towson West Village Commons

Towson, MD

Patrick M. Morgan
Lighting/Electrical Option
Consultant: Dr. Richard Mistrick



Milestones	
I	AutoCAD Modeling, Photovoltaic Selection, RTSM Software
II	Final Lighting Design, Branch Redesign, DC Lighting Selection, Shading Equipment
III	Agi Calculations, Short Circuit Analysis, DAYSIM Analysis, RTSM Models
IV	Structural Load Analysis, Develop Final Renderings

Color Code Key
Lighting Depth (5 Spaces)
Electrical Required (Branch Circuit Redesign / Short Circuit)
Electrical Depth 1 (DC Electric Distribution)
Electrical Depth 2 (Short Circuit Analysis)
MAE Depth (Daylighting Study Lounge)
Breadth Topic 1 (Mechanical)
Breadth Topic 2 (Sturctural)