George Washington University School of Business and Public Management

Thesis Proposal
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The Thesis Design Proposal is a brief description of the different breadth topics that will be covered in my final report. Though the emphasis of my time at The Pennsylvania State University has been focused on lighting design, my thesis will not focus solely on lighting design in Duques Hall, the new School of Business and Public Management on the George Washington University campus. In Addition, redesign focusing mainly on the Mechanical and Electrical system, will be done for the main lobby, the capital market classroom, the auditorium, a typical classroom, and the exterior façade. In addition to the lighting design, analysis will be done on day lighting capabilities and cost benefits of the system, as well as mechanical and electrical implications and improvements that can be made with in the spaces.

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Thesis Proposal – Breadth Topic

All Penn State Architectural Engineers are trained to be well rounded engineers and display knowledge in all aspects, not just their discipline. My breadth topics are going to involve studies in the construction management and mechanical options. Studies in my lighting design will involve the integration of daylight into my building, and will bring the possibility of cash saving. The construction management breadth will help to determine the cost payback of a day lighting system and the money saved with the use of the system. My mechanical breadth will examine the affect that emergency power will have on the system and the different affects the emergency system will have on the mechanical systems.

Building Overview

Duques Hall, the new addition to the George Washington school of business and public management, is located in Washington DC on the George Washington University campus. The addition is a 170,000 sq. ft. and stands six stories above grade with two stories below. The building is primarily for educational use, with a portion of the building being used as faculty office and a few of the spaces being slated as having a multi-purpose dimension. Construction began in January 2004 and completion is slated for December 2005.

Four spaces were slated originally to have the lighting redesigned, the lobby, the capital market classroom, the auditorium, and the exterior façade. All four of the spaces are unusual in nature mostly due to their architectural feature, but also because of the different functions the rooms are intended to be used for. The four spaces are described briefly below.

The lobby contains the main entrance to the building and is the primary circulation for the building. A two story area, the lobby has main access to the more important areas on the first two floors, an auditorium, the capital market classroom, and the main lounges. The auditorium seats just over one hundred people and will serve the purpose of a large classroom and a meeting room for university associated groups. As with the auditorium, the capital market classroom is designed to have multiple uses. Designed to simulate a "Wall Street" environment, the capital market room is a unique classroom. The exterior façade provides many very unique opportunities to help make the building unique and memorable.

In addition to these spaces, redesign will also be done for classroom for all south facing windows as those will have a major affect on my other design solutions. The study lounge space on the corner of the building will also be redesigned as they will have a major affect on the lighting design façade.

Lighting Design

Lighting standards and guidelines are set forth according to the IESNA Lighting handbook and ASHRAE standards, yet these are simply standards for the backbone of a system. The design and use of light in the space however should succeed in creating a comfortable and desirable atmosphere for people to work in. Therefore, the primary depth work will be in creating a satisfactory and useable design for the four spaces that were mentioned previously. Following the standards set forth in the IESNA handbook and the ASHRAE standards mentioned in Technical Assignment 1, a design was developed to improve the existing system that is currently installed in the building.

The design for the mentioned spaces has already been designed and was presented to a panel of lighting designers at Lutron on December 6th. Lighting design for the four primary spaces was discussed and my design ideas were refined to produce a better design. To view the presentation presented at Lutron and my design ideas for these spaces, visit my thesis page on the technical assignment page.

Some of the design goals are listed below.

- Create an unforgettable and dynamic exterior system
- Create a spacious and comfortable and environment for all the interior spaces
- Integrate day lighting into the building
- Implement a variable design system that allows the user to maximize the positive attributes of the system.
- Integrate lighting into the architecture to help minimize glare and create a more impressive environment
- Highlight key building features

In addition to the lighting design that was stated in the third technical assignment, there is an additional lighting design point that I want to integrate into the space. Day lighting is one of the new building system additions that I would like to expand on to help decrease energy consumption. Using day light can significantly decrease dependency on electric light and if designed properly can become a great addition to the building. Primarily, the day lighting will be integrated into the capital market, along with the classrooms which I will discuss next. Along with the day lighting systems, the controls will be very important in operating these systems. The controls will also help to create the desirable and variable atmospheres for the different spaces.

A large portion of the upper floors are taken up by classrooms, an these rooms are all south facing. These rooms will be utilized primarily during the day time hours, so they will hold great significance in the design of day lighting systems. Another importance of these rooms is the impact they can hold on the exterior façade design. Because of the close proximity of the surrounding building, most people will be looking up to view the building and during the night time will be see straight into these

classrooms. Proper design of these classrooms can help to light up the exterior façade and decrease exterior lights and limit light pollution and light trespass.

Another important space are the study rooms on the south east corner of the room. Though small in size, these rooms will also play a very important role in the design of the exterior lighting. Designed to be one of the more prominent features to this building, these rooms are meant to create a light tower at night that will glow brightly in the dark. The design for these spaces will significantly affect the exterior façade, and therefore must be considered along with the other factors in the exterior design.

Lighting Design Tasks

To achieve a viable solution, many steps need to be taken to ensure that the design being implemented is acceptable to those that will be using it. Because a design schematic has already been made, the next step is locating fixtures for this space. Based on photometric reasons and usability purposes, fixtures will be selected to achieve these designs in the most efficient way. To continue along the lines of power saving, energy efficient ballasts would need to be selected. All this equipment would be chosen according to ASHRAE 90.2004 standards of course.

Software modeling will have to be done in order to check the viability of the solution. A three dimensional model will first be created in Autocad, and then imported into AGI32. Using AGI32, calculations will be done to check proper lighting levels for electronic light and also to test the feasibility of the day lighting systems. The system will also be used to test the existing systems as well. Once a system has been finalized, Radiance will be used to create a rendering.

Electrical Design

After analyzing the system, there were no glaring electric problems inside the space, and there are no major opportunities for redesign. The existing system is fed from a pre-existing substation, and after entering the building, the system is stepped down to 480/277 volt and 208/120 volt. The primary electrical system, including the power fed to the lights, outlets, and mechanical equipment, is fed at these voltage. More information on the electrical system can be found with in my 2nd technical report.

Even though the electrical conditions in my building are more than acceptable for it to function properly and efficiently, I will attempt to redesign the distribution of the system to the other floors in an attempt to find a more efficient solution. Once the day light system has been implemented to the building, I'll begin to examine the feeders and bus ways to determine if it is possible to make the electrical distribution more efficient. By examining the power needs, I will determine if it is possible to resize the wires and other protective devices. Also, because my lighting design relies on applying daylight to my building, I'll also examine the affects different day light controls will have on the existing conditions or find a way they can be integrated more efficiently to the electrical system.

Analysis of the electrical system can only begin after day lighting systems have been explored and implemented to my building, and lighting systems have been finalized. Once these systems are in place, a full load calculation will be performed following codes from NEC 2005. Along with the load calculations, the new panels will be sized along with the appropriate wires. Once the system has been designed with the proper considerations in place, the cost of the system will be compared to this system.

Breadth Work

Construction Management

One of the main focuses of my new design is more energy efficient design. With the integration of lighting design, and my attempt to find a more energy efficient design for my system, there can be large cost implications on the system. Once the new system is in place, the cost implication and pay back period comparison will be calculated for the new system compared to the older system. To conclude the breadth study on this topic, a final savings analysis will be completed in order to calculate final savings

Mechanical

With the gains that can be made by optimizing the use of day lighting in a space, it is also important to look at the affects day lighting will have on the mechanical system. In the summer, heat gains are created as excess heat enters the room in the form of sun light and radiation heat. In the winter, heat is lost through windows. To truly optimize the day lighting system, mechanical aspects will be optimized along with the lighting systems.

Along with the study on the impact a day lighting system will have on this building, I will also look into the emergency systems in the building. As one of the aspects I will be examining with my electrical design, it is important to know the affect that emergency power will have on the mechanical systems, and how a mechanical system should work in an event that power is lost in the building. Breadth will be done to examine what would happen during a power outage, how quickly the power needs to come back on, and what is the best way to provide the service in event power cuts off.

Proposed Schedule

Week	Proposed Schedule
Christmas Break	Create 3d Auto Cad models Finalize lighting design proposal
1/8 – 1/14	Select luminaires to achieve lighting design criteria Begin study on Day Lighting systems
1/15 – 1/21	Begin integrating day lighting system to the building Begin study of mechanical systems for day light integration
1/22 – 1/28	Determine repercussions of emergency power on mechanical system Begin exploring possibilities for new electrical design
1/30 – 2/4	Calculate cost of existing lighting/electrical system Finalize lighting design and begin to place and calculate new loads
2/5 – 2/11	Finalize Day Lighting system Finalize Mechanical system
2/12 – 2/18	Finalize new electrical system Calculate new building loads
2/19 – 2/25	Size circuits and calculate feeder size
2/26 – 3/4	Prepare AGI models Prepare Radiance models
Spring Break	Begin final renderings
3/12 – 3/18	Finishing touches on day lighting, electrical and mechanical systems
3/19 – 3/25	Complete cost calculations of all new systems
3/26 – 4/1	Tie up all lose ends and begin preparing thesis book
4/2 – 4/4	Final touches and printing of thesis book
4/5	Thesis book due
4/6 – 4/9	Practice Presentation
4/10 – 4/12	Final Presentation