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Lighting/Electrical
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One Christina Crescent
Wilmington, DE
November 9, 2009

Executive Summary

The thesis proposal defines the scope and nature of work to be completed in AE 482 during the spring semester of 2010. The depth and breadth analyses for One Christina Crescent investigate issues related to aesthetics and space performance within a number of disciplines. An overview is included of the building existing conditions as they relate to the thesis work.

The depth analyses are concerned with the lighting and electrical systems of One Christina Crescent. Four spaces are to be redesigned for the lighting depth in accordance with the design criteria and conceptual design presented in Technical Assignment #1 and Technical Assignment #3, respectively. Comments about the conceptual design from the jury of lighting designers at Lutron will be addressed during the design and analysis of the system during the next semester. The design solution and its methodology are detailed within this proposal, along with a complete listing of tasks and tools.

The electrical depth addresses the redesign of branch circuits and over-current protection devices that feed the four spaces to be redesigned in the lighting depth. Also in the depth are a protective device coordination study and short circuit analysis for a single path through the electrical distribution system. Completing the electrical depth are the analysis and design of a motor control center for the new motors and photovoltaic array proposed as part of the architecture breadth. A schedule and equipment elevations will be provided in addition to calculations of design loads for branch conductors, feeders and protective devices. A layout of the photovoltaic cells will be shown on the roof plan with a cost estimate of all materials and wiring diagram for union with the building's electrical distribution system.

The breadth analyses will be conducted within the acoustics and architecture disciplines. An acoustical analysis of the second floor auditorium, one of the spaces redesigned in the lighting depth, will focus on reverberation time within the space. The results will be used to implement an acoustical solution if conditions deviate from established criteria for this space. The architecture breadth will be concerned with the geometry of the building with respect to daylight harvesting. An innovative approach to harvesting daylight will be presented and analyzed. The concept is that of a dynamic building that shifts its shape in relation to solar position, simultaneously shielding the structure from undesirable direct daylight penetration and exposing the interior to indirect diffuse natural light. This second breadth topic will integrate with the electrical depth, providing a new set of motors to shift the building as well as an array of photovoltaic cells intended to generate supplemental power for the building.

This proposal concludes with a schedule of deadlines and their respective tasks to be completed during the spring semester of 2010.

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Acoustics Breadth

The second floor auditorium is a 541 seat presentation space that is capable of being used for speakers as well as video viewing. The room currently has many glass surfaces as well as a grid of acoustical ceiling tile. The ceiling plane itself steps up from 9'-0" at the rear of the room to 10'-0" AFF at the front where the three video screens are located. The room has a parabolic shape and carpeting on the floor. A reverberation time analysis will be performed for this space and its results compared to acoustical criteria for an auditorium space such as this one. Solutions will be implemented within this space to correct deviances from established acoustical criteria if required.

Architecture Breadth

The architecture breadth will be concerned with the geometry of the building with respect to daylight harvesting. The intent is to have each level of the building slide on top of the one another to provide simultaneous solar shading and daylighting. The massing of the dynamic building will be depicted with three dimensional modeling to exhibit how the structure will shift in relation to the sun's movement. The dynamic nature of the structure will obviously have a comprehensive and correlated impact on the design and integration of various building systems. A brief consideration for the impact on each general building system will be presented. A basic calculation of the workplane illuminance at key annual points due to daylight harvesting will be conducted to prove that lighting energy savings are possible. In addition, a simple estimation of the correct overhang length based upon the solar profile angle will be shown. This second breadth topic will integrate with the electrical depth, providing a new set of motors to shift the building as well as an array of photovoltaic cells intended to generate supplemental power for the building. Although, this breadth will touch on various building systems, the intent is to focus on the building as a whole and how all systems will coordinate together as to create a space that adapts to its environment.