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Lighting/ Electrical

UC Santa Barbara Student Resource Building
Thesis Proposal

Executive Summary

The following thesis proposal outlined herein will describe the approach that I intend to take towards the redesign of my thesis building. This process will be encompass an in depth redesign process of the lighting and electrical system in the Student Resource Building. Lighting redesign work will focus on the implementation and execution of what has been proposed in my schematic redesign report and electrical work will involve a redesign of a portion of the power distribution system.

In addition, I will also be conducting a breath analyses focusing on two additional areas: LEED and Architecture. Although the Student Resource Building is currently aiming for a LEED Silver Certification, the first breadth study will aim to develop methods to achieve more points to garner an even higher rating for this building.

As a second breath topic, the Architecture of the North East Plaza will be reexamined. A complete design reconfiguration will be proposed with the aim of recreating a public space that is more in tune with the ideals behind a piazza. A new lighting scheme will be proposed in addition to the initial redesign of the same space as presented in my schematic design report.

Background

The Student Resource Building was envisioned to be a pedestrian gateway that connects an adjacent neighborhood of Isla Vista to the rest of the UC Santa Barbara Campus. The building houses many important student affairs bodies as well as other University administration offices. Construction began in early spring 2005 and was due for completion in November 2006.

The current design is aiming for a LEED silver certification by means of efficient utilization of available daylight as well as well natural ventilation in most spaces in the building. The later is made possible by the operable clerestory windows located in the triple height forum located at the heart of the building.

Depth Proposal: Lighting

Problem

The Student Resource Building will primarily function as a pedestrian gateway in addition to being a gathering point for students to gather. Though the current lighting design effectively addresses the requirements as stated by the IESNA and California's Title 24, more could be done to ensure that the design is attuned with the fundamental principles behind this building. Performance issues that will need consideration will include but are not limited to: illuminance levels, illuminance ratios, glare, power density and maintenance.

Solution

The proposed lighting scheme as outlined in my schematic design report will aim to create a comfortable environment for people to socialize and exchange ideas. Light shall be used to not only enhance the way a building occupant's experiences their surroundings, but also stimulate their mental capacities by providing a visually interesting environment. In spaces like the Forum that also function as the primary pedestrian thoroughfare through the building, lighting shall also be used to provide visual cues for movement. It is crucial that the design creates an environment that is both visually and physically appealing so that people will be more willing to convene in this space.

As the building has a modern aesthetic, so will the lighting. Where possible, fixtures will be concealed in such a manner as to give the impression that the architectural elements in the space are emitting light. Elements of special interest shall also be highlighted with light.

Solution Method

A series of different lighting and visualization software shall be utilized to ensure that the proposed goals in addition to other important design criteria as stated by the IESNA are achieved. The four spaces that I will focus my redesign on will first be modeled using computer software. Once appropriate luminaires and lamps have been selected, the design shall be tested using lighting analysis software to ensure that light levels meet IESNA requirements. Daylight availability of the current design shall be analyzed and appropriate changes shall be implemented to ensure that natural light delivery into the building is optimized. Appropriate control systems for these spaces shall also be specified. All spaces shall be checked to ensure that the design complies with the requirements outlined in Title 24.

Tasks and Tools

I. Finalize Lighting Design Schematic
   a. Review final design as specified in technical assignment 3. If applicable, alternate solutions will be proposed.
   b. Ensure that the final design for each space satisfies IESNA guidelines.
   c. Development of lighting layout for each space. Where necessary, mounting details will be issued
   d. LEED daylight requirements to be verified and if necessary, delivery method will be optimized for each interior space.

II. Fixture Selection
   a. Fixture selection to be finalized based on available manufacturer data.
   b. Lamp type and wattage will be selected to ensure that the overall goal satisfies Title 24 requirements.
   c. Where applicable, ballast will be selected to provide the necessary controls.

III. Software Modeling

a. Computer models used for analysis to be created in AutoCAD 2007.
b. AGI32 and/or Radiance shall be used for both daylight and electrical light calculations.
c. Results to be analyzed and if necessary, schematic will be revised to satisfy needs.
d. Autodesk VIZ to be used to generate final presentation images.

Lutron Comments

In general, the comments I received from the Lutron presentations were positive. A main area of concern was that though the design was interesting, a more human scale should be considered. The comments of the lighting designers will be considered during the finalization process.

Please see “Lutron Comments” on my Technical Assignment page for a more detailed narrative.

Depth Proposal: Electrical

Problem

Although the current design of the electrical distribution system is more than sufficient to meet the power consumption needs of the building, the redesigned lighting scheme as proposed in my schematic design report will undoubtedly affect this. As a result, protection devices will need to be resized to cater for the change in electrical load experienced by the system. The current electrical system also has the potential to be optimized to ensure a more efficient power distribution system. Future expansion needs of the system will also be considered.

In consideration for LEED, there is a possibility to make this building partially self sufficient by the implementation of an on-site "green" energy generator.

Solution

Per my redesign scope, the design loads shall be altered and distribution equipment resized as necessary. Panelboards performance will be verified and a protective device coordination study that addresses a single path through the distribution system shall be performed. A study will also be done to see if the implementation of an on-site photovoltaic array system will be advantageous to meet the energy demands of this building.

Solution Method

Electrical loads will be recalculated per the 2005 National Electric Code with consideration of appropriate design factors. Affected electrical panel boards will be relocated to satisfy the needs of the redesigned lighting loads. Other electrical components including: conductors, conduits and over current protection devices will then be resized per NEC 2005.

Tasks and Tools

I. Calculate Loads
   a. New lighting loads to be determined for redesigned spaces per NEC 2005.

II. Specify Panelboards and Transformers
   a. Lighting panel boards to be resized per calculations.
   b. Overcurrent protection for panelboards will be sized with strict adherence to NEC.
   c. Loads on affected panelboards to be distributed to optimize electrical load balance on each phase.
   d. Energy efficient transformers to be implemented that satisfy redesigned loads.

III. Specify Circuits
   a. Conductors to be sized with reference to article 310 in NEC 2005.
   b. Conduits to be sized with reference to annex C in NEC 2005.

IV. Protective Device Coordination
   a. Overcurrent protection devices to be sized appropriately.
   b. Overcurrent protection device coordination to be verified.

V. Photovoltaic Array Study
   a. PV array system feasibility to be analyzed based on manufacturer data with consideration for existing site and structural conditions.
   b. Cost-Benefit study to be determined based on schematic system cost and assumed payback period.

Breath Proposal: LEED

The current design of the Student Resource Building is aiming for a LEED silver rating. The study will examine what changes could be made in terms of material selection, system design and/or delivery process will potentially help this building achieve a higher certification status. I hope to first contact the LEED consultant and/or building owner to determine which points the building is anticipated to achieve. From that I will determine what additional points may be possible. Currently, I intend to implement the following:

Light Pollution Reduction, controlled exterior lighting
Renewable Energy (with regards to PV array study in depth work)
Increase Ventilation Effectiveness
Innovation in Design

Breath Proposal: Architecture

Combined with the weather of Santa Barbara, California, the North East Plaza is envisioned as a place for people to convene and exchange ideas. However, the architectural form of this space can lend itself better to this ideal if it was improved. If one considers the piazzas of old, an analogy I used in my schematic design, the current design is not as contained as it could be to mimic that experience. I intend to do a thorough study of the form and circulation patterns of different piazzas around the world after which a schematic reconfiguration of this space will be proposed. The goal will be to provide a better and more aesthetically pleasing environment for people to socialize. An additional lighting scheme will be proposed for this redesigned space at the schematic level. Drainage issues will also be considered.

Tentative Schedule

Week	Objective
Christmas Break	**Begin research on Architectural breadth work and start conceptual design work.** **Research PV array systems.**
01/15 – 01/22	Build 3D models for depth work analysis.
01/23 – 01/30	Finish 3D models and import into AGI32 for calculations. All materials to be modified with appropriate reflectance values. Finalize fixture selection. Collect all .ies files, manufacturer cutsheets and ballast information.
01/30 – 02/07	Determine appropriate lighting layout and run calculations to determine required spacing and feasibility. All new electrical loads to be calculated. Energy efficient transformers to be implemented. Resize feeders, panelboards and over current protection devices. All manufacturer cutsheets to be collected.
02/08 – 02/15	Finalize fixture schedule. Complete circuit power plans and lighting plans. Perform over current protection coordination analysis. Design schematic PV array system.
02/16 – 02/23	***02/16 – Preliminary submittal of 2 lighting spaces with associated electrical requirements.*** Determine cost-benefit of energy efficient transformers. Begin implementation of Architectural breath.
02/24 – 03/03	Determine cost-benefit of schematic PV array system. Perform LEED and Architectural breadth.
03/04 – 03/11	Finalize Architectural and LEED breadth. Develop presentation renders.
03/12 – 03/18	***Spring Break***
03/19 – 03/26	Begin Thesis report.
03/27 – 04/05	Finalize thesis report and prepare for submission. Being work on thesis presentation PowerPoint.
04/06 – 04/15	***04/16 – Submit final report.*** Finish presentation Powerpoint.
04/16 – 04/20	**Thesis Presentations**