Proposal

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Lighting/Electrical

1/11/13

University of California, Riverside Student Recreation Center

Riverside, CA

Advisors: Dr. Kevin Houser, Ron Dodson

Executive Summary

This proposal contains information about the proposed body of work for the redesign of some of the engineering systems of the addition to the student recreation center for the University of California, Riverside. The systems to be investigated are lighting, electrical, structural, mechanical, and enclosure. The four lighting spaces to be investigated are listed below.

- Entrance/Courtyard
- Lobby
- Rock Wall
- Gymnasium

The lighting design for each of these spaces will form one cohesive design, reinforcing the University's goal to make this building a place of health, both physical and mental. The design will also strive to use as little energy as possible while still completing the design goals.

The electrical system will also be investigated as the branch circuiting will be analyzed, replacing the existing battery backup system with a generator will be investigated, and the effects of a photovoltaic array will be investigated. A skylight system will be implemented in the gymnasium in order to introduce daylight to the space and to reduce lighting loads. This will require a mechanical and a structural analysis of the space.

Contents

Building Overview

Location: Riverside, CA

Building Occupant Name: University of California, Riverside

Occupancy or Function Types: A-3 Recreation Center

Size: 15,984 SF Renovation, 79,936 SF Addition

Stories Above Grade: Two

Dates of Construction: August 2012 to January 2014

Building Cost: $36.9 Million including construction costs

Lighting Depth

The lighting depth will consist of redesigning the lighting of four spaces in the building. The lighting for these four spaces will be one, cohesive design that will be energy efficient and reinforce the concept of connecting all of the elements of health, both physical and mental. The lighting will be redesigned for the following spaces:

- Entrance/Courtyard
- Lobby
- Rock Wall
- Gymnasium

Based on the comments from the lighting designers at Lutron, the schematic design for each space will need to be developed further. This is the first thing that will be done next semester in order to create a more cohesive lighting design for the building.

Lighting Designer Comments

Kari Nystrom

- Need clearer explanation of lighting solution for gymnasium
- Why is color rendering very important in gymnasium
- LEED isn't criteria, energy efficiency is
- Downlights in exterior rendering not realistic
- More detail of where light sources are
- Very little vertical illuminance outside, need more for CRI to matter

Shawn Good

- Good beginning to presentation – building location, concept
- Connect lighting to concept more throughout the building
- Make lighting in spaces more cohesive throughout building
- CRI, energy efficiency can be building criteria
- Criteria mostly engineering based, include architectural and emotionally driven criteria
- Exterior images dark – show how light fills space
- Lobby rendering – stairs and back wall jump out, doesn't aid circulation

Entrance/Courtyard

The first space that will be redesigned is the entrance to the new building and the courtyard in between the two buildings. It is important that these spaces feel comfortable as well as reinforce the theme of the lighting design so people feel safe in these spaces. Higher light levels will be used near the entrance to draw occupants' attention. Some sort of kinetic lighting will be employed – either changing light levels or creating a Moire pattern over a visible light source.

Lobby

The lobby is the first space an occupant enters when he or she enters the addition. Because of the open floorplan of the building it is important that the space feels public. This can be accomplished by making the space, and especially the walls, very bright. This will be aided during the day by the large amount of daylight in the space.

Rock Wall

The rock wall space is mainly an athletic space and it is important to provide an adequate illuminance for safety. Rock climbers need to make quick decisions when they are climbing so it is important to provide adequate illuminance.

Gymnasium

The gymnasium is an interior spece and is currently lit by metal halide lamps. After the skylight system is implemented a source that is more easily dimmed, such as linear fluorescent, will be installed to save energy using daylight harvesting.

Tasks and Tools

Schematic Design

Schematic design will be continued in the spring semester using sketches and photoshop.

Lighting Calculations

Space will be modeled using AutoCAD and then light levels will be calculated using AGI32.

Daylighting

The daylighting study will be performed using Daysim.

Renderings

Final renderings of the spaces will be created using either AGI32 or 3ds Max.

Electrical Depth

The electrical depth will consist of looking at two topics to change the current electrical system as well as performing the branch circuiting and selecting all of the lighting controls for each of the four lighting spaces. The two depth topics that will be explored are generator replacement and installing a photovoltaic array.

Generator Replacement

Currently the emergency power system is supplied by a bank of batteries. This study will look at the benefits of switching the emergency supply system to a generator. Problems that will need to be solved are location of the generator and fuel supply, sizing the generator, and maintenance costs. The analysis will take into account both cost and other potential reasons for switching such as cogeneration and ease of maintenance.

Photovoltaic Array

One of the many ways to reduce energy costs in a building is to install a photovoltaic array to produce electricity during the day. One of the benefits of a photovoltaic system is that the system generally produces electricity when the building's load is at its peak. The array will be installed on the roof to help offset the cost of electricity. The array will need to be sized, angled and located in order to perform the analysis. The electricity produced, energy savings and payback period will then be determined to see if the system is fiscally reasonable.

MAE Breadth: Daylighting

The gymnasium is an internal space that has solid walls separating it from the rest of the building's mostly open floor plan. There are small windows that provide some light from the track above into the space but this light is most likely to be electric light because of how far into the space they are located. A skylight system will be implemented in the gymnasium to provide natural light in the space and reduce energy costs. This will be integrated into the building system with the new lighting system that will be more easily dimmed. Design strategies and tools used in AE 565, Daylighting, will be used to perform the analysis of the space.

Breadth 1: Structural

The new skylight system in the gymnasium will require the structural system to be reanalyzed. The positioning of the trusses may need to change due to the positioning of the skylights and an entirely new system may need to be investigated. Loads will need to be recalculated due to the different materials of the roof.

Breadth 2: Mechanical

The mechanical loads on the gymnasium will also change as a result of the new skylight system. The addition of daylight will increase the thermal load in the space and the material, construction and number of the skylights will affect how heat is conducted into and out of the space. The new loads will need to be determined and equipment may need to be resized depending on the analysis of the space.

Semester Schedule