Shepherd University Wellness Center | AE 481 Thesis Proposal

Shepherdstown, West Virginia

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Lighting/ Electrical Option
Dr. Houser and Professor Dannerth
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Executive Summary

The proposal explains the work that will be completed in the Spring of 2011. A description of the redesign of several systems of the Shepherd University Wellness Center and an explanation of the two depth and two breadth topics are provided. This proposal does not conclude that there are existing problems with the constructed systems, but presents potential solutions and redesigns as alternatives.

The lighting depth presents new design concepts for four building spaces: the outdoor entry at the North façade, the rotunda at the main entrance, the multi-purpose room, and the fitness area. The new design aims to create a motivating and safe environment for the building occupants. The electrical depth includes a redesign of the branch circuit distribution for the four spaces to be redesigned in the lighting depth. A short circuit analysis will also be conducted. A comparison between the use of a generator versus a central or distributed batteries for emergency lighting will be analyzed as well as the use of photo voltaic arrays to save building energy.

An acoustical analysis and redesign will be investigated as a breadth topic for the building rotunda to minimize the noise pollution from the spaces surrounding the rotunda. An architectural study will be conducted to redesign the back office space of the building to make it more aesthetically pleasing.

Contents

Lighting Depth

Background

The Shepherd University Wellness Center is located on Shepherd University's campus in Shepherdstown, West Virginia. The facility is over 70,000 square feet with two stories and was completed in June of 2009 with the cost of construction of about 21.6 million dollars. As a university fitness and educational center, the building serves as a multi-function facility that provides a balanced recreational program for the students, faculty, and staff of the University. The three key elements are the fitness zone, a pool area, and a multi-function gymnasium. The building contains open spaces adjacent to a large rotunda that promotes circulation and openness. Also included in the building are a 25 yard pool, 2 basketball courts, an indoor jogging track, an over 7,500 square foot fitness area, dining venue, and administrative offices.

The four spaces that will be studied are the fitness room, as a large work space; the multi-purpose room, as a special purpose space; the rotunda, as a circulation space; and the outdoor entry, as the outdoor space. The existing lighting system within the building mainly uses linear fluorescent sources with metal halide sources in select areas. The existing lighting design adequately provides light for the desired activities within each space. The fitness room uses light to distinguish sub spaces of different workout tasks, while the multi-purpose room allows for flexibility of the use of light for each type of aerobic activity. The rotunda enhances the architecture of the building entrance. The outdoor entry relates the building to the University campus.

Problem

Outdoor Entry

The existing lighting system for this space addresses the needs for the space. Metal halide lamps and university standard poles provide lighting for the parking lot and relate to the campus environment. With full uplight cutoff ability, these pole luminaires meet dark sky requirements. Compact fluorescent step lighting provides enough light in the walking paths and stairway leading up to the main entrance. The lighting design does not; however, address the architecture of the building or highlight the main entrance.

Rotunda

The façade glazing provides daylighting in the rotunda complimented by linear fluorescent, metal halide, and xenon sources. The existing lighting system highlights the architecture by grazing the walls and using cove lighting around the circular ceiling. Downlights are used throughout this two story space to increase the desired ambient illuminance. Linear xenon lamps bisect the ceiling on the second level to add an interesting component to the space. The existing lighting enforces the spacious appeal of the rotunda, but does not incorporate the theme of movement and circulation of the building.

Multi-Purpose Room

The existing lighting system consists of a uniform layout of sixteen troffers, each two foot by four foot, with three T8 fluroescent lamps. The lighting plan allows for switch and dimming control. As an open square for freedom of movement for aerobic and wellness classes, this space should impart the feeling of festivity for high intensity classes and somberness for lower energy classes like yoga. The

lighting design should also minimize glare from the light source and hide the source from the users' direct lines of sight.

Fitness Area

The fitness room uses two types of fluorescent luminaires for the overall ambient lighting. Low voltage halogen lamps provide task lighting above the main desk and compact fluorescent downlights accent the space by the window. The existing lighting design provides enough uniform lighting for the aerobic activities that take place here. The design should complement the architecture of the space and encourage the theme of movement.

Solution

The architect's vision was to have "three key elements provide a balanced recreation program: fitness zone, new pool, and a multi-function gymnasium." The lighting design will mirror this image of balance through the concepts of movement, navigation, and safety. Movement will energize the users and stimulate their interest to workout. Navigation is imperative to directing the users to and through the spaces. The design will provide enough light for the users to use the space and its components safely.

Outdoor Entry

The existing lighting design adequately provides light for the safety of the space. In addition, the circular component of the architecture will be highlighted to emphasize the building core by flood lighting the steel roof. As the "crown" of the building, the illuminated roof will capture the movement of the building in the main circulation area and draw attention to the building entrance within this area.

Rotunda

Three lighting design concepts were created for the rotunda. The first concept is based on movement and emphasizes the circulation paths within the space. Light is used to navigate the users to the building's facilities. The second concept evokes lightness within the space. Based on the Flynn impression of spaciousness, this concept accentuates the grand interior entrance and architecture of the building. Perimeter lighting along the walls and emphasis on the ceiling attract users to the large and open space. The third concept mirrors the building's use and imparts motivation. The space will be dynamic with different points of interest to engage the user.

Multi-Purpose Room

The lighting design will be flexible for the spaces' diverse uses. Two distinct scenes will be set to convey the Flynn impressions of festive and somber. Indirect luminaires will be used above the general vicinity of the space to hide the sources from the users' line of sight.

Fitness Area

The lighting design for the fitness area will provide for safety and visual clarity. The long narrow area will be defined by spaces within through the use of three light levels: ambient, architectural, and task. Strips of light between the columns will define the spaces within the fitness area and provide ambient light with linear recessed fluorescent luminaires. Adjustable downlights will highlight the

columns and define the architecture in the space. Task lighting will draw attention to the reception desk for the fitness zone.

Lutron Comments

A schematic design presentation was given at Lutron on December 8, 2010 to a group of five lighting designers. Feedback on the design and presentation was provided and summarized below.

Shawn Good

Presentation
- Good pace, controlled

Outdoor Entry
- Decent concept
- Image had distracting shadows from the car

Rotunda
- Scheme three was not motivational
- Liked comparative slide
- Select the design that you like for you or for the client? Do they line up? Think about the client

Multi-Purpose Room
- Only difference in light level

Charles Stone

Presentation
- Words at the bottom of the slides did not line up with the context box
- Navigation at bottom can be over powering
- Very well prepared
- Had passion

Outdoor Entry
- Take image one step further and give it some sex so it does not look so flat
- Space addressed light trespass properly

Rotunda
- Pantheon image did not match lightness concept
- Downlight cones were too over powering

Multi-Purpose Room
- Fireworks image did not convey the festive concept

Fitness Room
- Last rendering, slide 43, was the best slide because it was entertaining and had good ratios
- Great sketch and liked the use of three colors
- Leave out technical story

Sandra Stashik

Presentation
- Great presentation skills but be more animated and passionate to sell it
- Nice presentation overall

The use of larger images was preferred
Good use of a building map to walk through the building
Started with architect's ideas, said how you understood it, and want to incorporate into design
Good conclusion summary
Introduction and summary tied together

Outdoor Entry
Rendering needs work
Good exterior concept

Rotunda
Weak sketches
Sketches need to show where light is and not be overpowered by the cones of light
Work at to tell the story
Consider the ceiling height and relamping

Multi-Purpose Room
Somber and festive concepts were unclear
Liked the use of lighting controls

Fitness Room
Great sketches

Solution Method

The lighting solutions will be completed and analyzed using the aid of computer software calculations and lighting renderings, including AGI32, AutoCAD, and 3D Studio Max. Documentation of the solution will include lighting plans, details, calculations, renderings, luminaire schedule, and cut sheets.

Tasks and Tools

1. Complete Schematic Lighting Design and Concepts

Solidify the proposed lighting design and incorporate the design comments from the panel of lighting designers at the Lutron schematic design presentation.

2. Model Spaces

Use AutoCAD to model all four spaces in three dimensions.

3. Select Equipment

Choose all lighting equipment necessary to meet the requirements of the schematic design goals and criteria.

4. Calculate and Analyze Spaces

Use AGI32 to perform all lighting calculations on the AutoCAD models to ensure the lighting design provides illuminance levels specified by the design criteria. IES files for each luminaire and room material properties will need to be applied.

5. Calculate Lighting Power Densities

Calculate the lighting power densities of the selected equipment and check that it complies with ASHRAE 90.1 requirements.

6. Revisit Designs
Alter any designs that may need to be reworked to satisfy any design criteria that may not have been met after analysis.
7. Create Renderings
Import AutoCAD model into 3D Studio Max and apply materials and IES files within the computer program to create more realistic renderings.
8. Documentation
Document all design solutions, analysis, and conclusions. Include lighting plans, calculation summaries, luminaire schedule, and cut sheets.

Electrical Depth

Background

The Shepherd University Wellness Center has a radial electrical system that enters the building through one service entrance point located in the building's main electrical room. The main transformer, which is provided by the contractor, has a secondary voltage of 480Y/277V, 3Ph, 4W. The 2500A main distribution panel supplies power to subsequent feeders and panels. Emergency power is provided by a 75kW propane-fired generator.

Four Spaces

Since the lighting loads of each space analyzed will change, a redesign of the branch circuit distribution is necessary.

Outdoor Entry

This gathering exterior space serves as the focal point of the building, drawing visitors inside. The space connects the parking lot and exterior pathways to the vestibule entrance and the building's front façade. The existing lighting includes university standard metal halide poles and luminaires throughout this space. Compact fluorescent steplights are added for safety in areas that do not receive enough light.

Rotunda | First Level

This two-story space provides views to outside the front of the building as well as to interior spaces, like the fitness room and gymnasium. The first level contains a casual seating area and front desk. A circular walking path with a bisecting arc shaped walking path breaks up the openness of the space on the second level. The existing lighting consists of incandescent, fluorescent, metal halide, and xenon lamp sources are found in this space. Cove lighting on the first and second floor surround the perimeter of the space.

Multi-Purpose Room | First Level

Located on the first floor of the facility, the multi-purpose room is an open square for freedom of movement required by the aerobic and dance classes that take place here. This existing lighting uses a uniform layout of 16 troffers, each two foot by four foot, with three T8 fluorescent lamps.

Fitness Area | Second Level

This weight and fitness area is about 7,500 square feet and consists of free weights, resistance machines, and cardio equipment. The space also contains nine flat screen televisions. The existing lighting uses two types of fluorescent luminaires for the overall ambient lighting. Low voltage halogen lamps provide task lighting above the main desk. Compact fluorescent downlights accent the space by the window.

Short Circuit

A short circuit analysis will be performed through a single path along the distribution system. The source will begin at the utility transformer and go through the main distribution panel section 2, feeder tag 7, and the panel board H1.

Depth Topic One- Generator vs. Central or distributed batteries for emergency lighting

The Shepherd University Wellness Center currently uses a 75KW, 480Y/277V, 3Ph, 4W propane fired generator that distributes emergency power to the circuit breaker for the equipment branch automatic transfer switch and the life safety branch automatic transfer switch, both 60A, 600V. When transferred to the emergency power position, power is distributed to the emergency distribution panels EL, for the emergency equipment and fire alarms, and EHP1, for the life safety equipment and egress lighting. A change to a central or distributed battery system may improve the system reliability. A research and analysis of each emergency lighting system will be conducted to determine the best system for this building.

Depth Topic Two- Photo Voltaic Array

As a building located in West Virginia, the Shepherd University Wellness Center can take advantage of incorporating solar power to save energy to improve the economy. Photo voltaic array materials and costs will be researched and analyzed. A proposed layout drawing and wiring diagram will show how the photo voltaic arrays will connect to the building electrical system.

Acoustical Breadth

The Rotunda is a large, open, two-story space that opens up to the fitness area on the second floor. To minimize the noise level in this space from the fitness equipment and the users of the space, an acoustical analysis will be conducted. A reverberation time calculation will be calculated to determine the necessary changes to the acoustical design of the space. New acoustical wall and ceiling products will be researched and analyzed. A new acoustical layout will be designed using the selected equipment deemed appropriate.

Architectural Breadth

The conference and back office area on the first level is basic and ordinary looking. A redesign of the space will be performed to make this back area more attractive while utilizing the small space

provided and maintaining the functionality of space. The redesign will be documented with drawings and renderings.

Schedule

Week	Focus	Task
Winter Break	Lighting	Finalize concepts and designs; Model four spaces in AutoCAD
	Architectural	Redesign back offices conceptually; Model back offices in AutoCAD
Jan. 10- 16	Acoustical	Begin analysis
	Lighting	Import models into AGI32 and 3D Studio Max and apply materials
	Electrical	Short circuit calculation
Jan. 17- 23	Lighting	Begin selecting sources/luminaires and organize cutsheets
		Import ies files into AGI32 and begin lighting calculations
	Acoustical	Research acoustical materials
	Electrical	Complete short circuit analysis
Jan. 24- 30	Lighting	Run lighting calculations and making appropriate modifications
	Acoustical	Complete analysis
Jan. 31- Feb. 6	Lighting	Continue run lighting calculations and making appropriate modifications
	Electrical	Begin branch circuit distribution analysis
Feb. 7-13	Lighting	Continue working on lighting calculations and begin renderings
	Architectural	Finalize new design
	Electrical	Continue branch circuit distribution analysis
Feb. 14- 20	Lighting	Continue working on lighting calculations and begin renderings
	Electrical	Begin depth study #1; Finish branch circuit distribution
Feb. 21-27	Lighting	Continue working on lighting renderings
		Finalize lighting calculations
		Finalize documentation of lighting hardware
	Electrical	Finish depth study #1; Begin depth study #2
Feb. 28-Mar. 6	Architectural	Begin documentation of design
	Lighting	Finalize lighting renderings
	Electrical	Finish depth study #2
March 7- 13		Spring Break
March 14- 20	All	Start organizing and preparing final report
March 21- 27	Lighting	Documentation
Mar. 28- Apr. 3	All	Documentation
April 4	All	Powerpoint Presentation
April 7	All	Final Report Due
April 11	All	Faculty Presentation

Milestones

1. January 28th
2. February 18th
3. March 4th
4. April 25th