JOHN PAUL JONES ARENA

CHARLOTTESVILLE, VIRGINIA

LOGAN BROWN

LIGHTING / ELECTRICAL OPTION

THESIS PROPOSAL

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EXECUTIVE SUMMARY

This proposal set is to be used in order to complete work for AE 482 during the spring semester of senior thesis. There are four areas in which to be considered for the project. There are breadths in architecture / sustainability and structural systems, with project depths accounting for electrical and lighting design. The architecture / sustainability breadth will include the design and integration of a green-roof system over the flat areas of the arena, with the structural breadth being tied into this in order to account for the added loads that come along with a green-roof system. An electrical depth will show analysis of using copper vs. aluminum feeders, as well as the benefits to using energy efficient transformers compared to standard transformers. The lighting breadth will show the redesign for four, site-specific spaces that have been previously discussed and analyzed in technical assignments.

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BACKGROUND INFORMATION

BUILDING OVERVIEW:

The John Paul Jones Arena, situated on the campus of The University of Virginia, is a perfect match between the classic architectural style founded by Thomas Jefferson over 200 years ago and the modern amenities of a top-of-the-line performance venue. One enters the arena through a monumental colonnade accented by 16 Doric style columns covered by a pergola style roof system. After passing through the entrance, the lobby and upper concourse level become visible. This large opening allows the spectator to get a sneak peek into the court area, yet at the same time create a bit of mystery as to what lies beyond.

As one moves around the concourse, there are team shops, numerous concession stands, restrooms and executives suites. Across the arena from the main entrance is the second most important architectural feature, an elevated terrace with another colonnade that mimics its monumental counterpart. This feature is rare to see in an arena because it allows an increased level of exterior lighting into the actual court and seating area. The theme of bringing the outside in is one that is successfully achieved in the JPJ.

The arena is broken up into 3 main floors: the event level, which is where the court and team locker rooms are located; the lower concourse, which has an athletic dining room and the Hall of Fame museum and finally the upper concourse, which is the main level of entry through the colonnade and where access to all the seating is located.

Most of the spaces throughout the building are more than a standard floor height which eliminates the use of indirect lighting. The majority of luminaires are direct-recessed or surfaced-mounted, with the lamping either compact fluorescent or metal halide. The lighting design is one that tries to take the dullness away from the grey concrete structure and give it live and create an inviting feel to all those who enter the space.

BREADTH PROPOSALS

ARCHITECTURE / SUSTAINABILITY:

I plan to research and design a green-roof system on the flat roof sections of the John Paul Jones Arena. These areas surround the elevated-dome structure above the court floor. It is important to the JPJ arena as it tries to maximize the open areas of the roof by implementing a green-system that assists in lowering the energy consumption of a large building, improving storm-water management issues, purifying the local air as well as reducing the temperature extremes that occur within a given building footprint. This process will include how the new system will be affected by local codes and how the design will affect the overall impression of the building. A final product will be comprised of architectural plans, sections, renderings and overall design documentation.

STRUCTURAL

Due to the increased loads that come along with the implementation of a green-roof system on an existing structure, I plan to redesign the structural members that are affected by all the added weight. This will include cost analysis and the overall affect changing beams and columns has on the construction and design process.

ELECTRICAL DEPTH PROPOSAL

1. **Redesign the branch circuit distribution for the four spaces that the lighting is being redesigned.**

   The four spaces that are being redesigned include the exterior façade (western entrance), main entrance lobby, athletic dining room and the team reading room / academic center. This redesign will include the resizing of distribution equipment and related feeders, while at the same time designing and laying out panelboards that accompany the modifications.

2. **Conduct a protective device coordination study that addresses a single-path through the distribution system, showing the devices included in the redesign and providing short-circuit calculations.**

   This process will be analyzed while looking at the path to panel board P1N-1NW2. The path to this panel board begins at the main service entrance and moves toward main switchboard 2 (MS-2). After the switchboard, the path goes through transformer T-1NW1 before ending up at the distribution panel (D3N-1NW1), where the test panel is located.

3. **Analyze the change of copper feeders to aluminum feeders throughout the building.**

   The amount of copper wiring that is present in the arena runs into the thousands of feet. And with the cost of copper on the gradual increase, and with the benefits of aluminum conduit in larger buildings out-weighing those of copper, I plan to analyze the affects of changing the current system of copper conduit to aluminum. The outcome of this analysis will show that a change is beneficial to the university in the terms of cost, its affect on sustainability (aluminum is more abundant then copper) and that there is no real difference (in terms of performance) of switching to aluminum. I will analyze the proposal using AutoCAD to determine runs of conduit and hand calculations to figure out the cost differences and affect on the overall building loads.

4. **Determine whether it is beneficial to use energy efficient transformers vs. standard transformers that are currently installed.**

   The current building does not take into account any allowances or design ideas needed to obtain a LEED rating. With my architectural breadth dealing with a green-roof, I plan to incorporate other aspects of sustainability. This includes an in-depth analysis of the transformers and how an alternate, more energy-efficient system can contribute to the arena being more sustainable. My proposed solution will show that a change from the current system will not only lower energy consumption, but also benefit the arena and surrounding campus grounds. I will analyze the transformers using hand calculations and show how the changes will be seen throughout the building with comparisons of cost, energy consumption and overall energy savings over a given period.

LIGHTING DEPTH PROPOSAL

INTRODUCTION

The current lighting systems for the arena are predominantly a mixture of fluorescent and metal halide fixtures with a few incandescent and halogen fixtures spread throughout the space. The fluorescent luminaires are combinations of linear strips, down-lights, wall sconces, step lights, pendants and recessed fixtures. These systems are primarily used along the concourse level where pedestrian traffic is prevalent, as well as in the more private spaces of the arena including the locker rooms, training spaces, work areas and meeting spaces. The metal halide fixtures are a mixture of high bay pendants, recessed down-lights, surface mounted down-lights and step lights. They are used around the concourse in coordination with the fluorescent fixtures to aid in pedestrian movement as well as in the main gymnasium for event lighting. The combination of systems provides higher Illuminance levels through the spaces that have higher ceilings and are generally larger in comparison to the smaller spaces. The catwalks above the arena floor use a system of quartz-type fixtures.

The exterior lighting systems follow those of the interior by using fluorescent and metal halide fixtures. The uniformity of systems makes it easy for the occupants to adjust from outside conditions to those of the interior. It also creates visual unity between the interior and exterior through the large glass curtain wall that makes up the entry corridor. The metal halide fixtures are pole mounted on the entrance colonnade to give a monolithic appearance and create a strong visual image upon entering the arena.

The scope of the lighting breadth will include the redesign of four specific spaces: the exterior façade (western entrance), the main entrance lobby, athletic dining room and the team reading room / academic center.

DESIGNER COMMENTS FROM LUTRON PRESENTATIONS (12/11/08)

From Sandra Stashik:

- Good beginning
- Render existing images / show concept ideas
- Watch light entering windows from exterior
- Confusion on lighting the peripheral in the lobby
- Need some more general lighting
- Watch the contrast between the ceiling and glass lighting
- List tasks and uses of spaces

From Lee Brandt:

- Slow down when speaking

- Understand that architecture relative to campus is not a goal: it needs to match the lighting
- How linear lights affect the experience and visual environment of exterior
- Confusing arrows on floor plans and section cuts
- Some plans don't show uniformity, clean up definition of goals

SOLUTION

Brief explanation of each space and the proposed design solutions. Please refer to Technical report Three for more in-depth information and images.

The main goal for the exterior façade (western facing entrance) is to match the lighting scheme to that of the entire campus. The historic nature of the university lends itself to dramatic lighting and shadows that is important to follow and mimic on the façade of one of the largest building on campus. It is also important to minimize the appearance of luminaires on the exterior by creating clean and seamless lines. The last aspect of the design is accent the major features (Doric columns and entrances), while also providing enough illuminance on the task plane for occupants to feel safe. The overall goal is create depth and provide a visual interest as people approach the arena for an event.

A lot of the goals described for the exterior follow the occupant as they move into the building and enter the lobby. It is important to match the clean, uniform appearance of luminaires of the exterior in order to create visual comfort and allow the users to enjoy the space. Another important aspect of the lobby is emphasizing the peripherals. There is a lot of detail and focal points on the walls and toward the perimeter of the walkways, it is necessary to call these areas out to enhance the visual interest. The final design goal is to reiterate the hierarchy that starts outside the arena and moves inward through the glass façade and uniform light levels. This hierarchy follows the occupant as they move around the concourse levels and head into the seating area above the court.

The dining room is a space that needs visual interest to mimic the varied ceiling and soffit heights that were designed. They are meant to be architectural features and need to stand out. With these various heights, it is important to create a spacious, yet professional environment that allows all the occupants to enjoy their time before and after the game. As a visual interest to the space, there is a projection screen to show movies and previous events. The screen requires various controls and settings for the space in order to not create unwanted glares and visual discomfort. The aspect of the room is to; again, continue the theme of visual hierarchy. This space starts with the entrance kiosk and moves toward the seating and service areas around the perimeter.

The final space, the academic center, requires different design goals and lighting levels. The most important goal is to create an open, relaxed environment since the space is located below grade and has no windows. Another aspect is to create uniform and proper light distribution on the task plane to aid in all reading and writing tasks that take place. The final goal is create zones that allow for multiple areas that can be controlled to account for the occupancy issues of a space that isn't going to be used at all times of the day.

SOLUTION METHOD:

The lighting designs for the space will be analyzed and documented by using hand calculations, computer software and hand sketches / renderings. The desired end goal is a set of lighting plans for all the required spaces and a collection of renderings and sketches that convey the ideas discussed in the proposal as well as in previous technical assignments. To achieve this goal, it is important to follow the steps of the design process, from concept design to final documents, and make sure that all tasks are met and accomplished in a timely manner.

TOOLS:

All designs will be accomplished using a variety of educational tools. Concept ideas and designs will be rendered using Photoshop. The IESNA handbook will provide guidelines for lighting design, as well as give justification to the selection of fixtures and any other design choices that are made. ASHRAE 90.1 will also be used in order ensure all designs meet energy code requirements and lighting levels. Once all designs are finalized and fixtures selected, a combination of AGI32 and AutoCAD will be used to render environments and express design goals visually.

PROPOSED SCHEDULE

TIME PERIOD	AREA	ACTIVITIES
Winter Vacation	ALL	Construction of 3D Models
1/12-1/18	ALL	Construction of 3D Models
	ARCH	Schematic Design
1/19-1/25	ARCH	Schematic Design
	LIGHT	Finalize All Design Concepts
1/26-2/1	ARCH	Finalize Schematic Design
	LIGHT	Selection of Fixtures
	ELEC	Overall System Analysis
2/2-2/8	ARCH	Design Documents
	LIGHT	Fixture Analysis
2/9-2/15	ARCH	Design Documents
	LIGHT	Finalize Fixtures
	ELEC	Feeder Analysis
2/16-2/22	ALL	Substantial Completion 3D Models
	ARCH	Finalize Green Roof Design
	LIGHT	Building Calculations
2/23-3/1	LIGHT	Design Refinements
	ELEC	Transformer Analysis
	STRUC	Load Analysis
3/2-3/8	ELEC	Finish Feeder and Transformer Analysis
	STRUC	Load Analysis
3/9-3/15	**SPRING BREAK (no work planned)**	
3/16-3/22	ALL	Cost Studies
	LIGHT	Design Refinements
	ELEC	Branch Circuit / Protective Device Study
	STRUC	Finalize Load Analysis
3/23-3/29	ALL	Finish 3D models / Cost Studies / New Documentation
	LIGHT	Finalize Design
	ELEC	Finish Branch Circuit / Protective Device Study
3/30-4/5	ALL	Finalize Renderings / Cost Studies / New Documentation
	ARCH	Coordination of Results
	ELEC	Coordination of Results
	STRUC	Coordination of Results
4/6-4/12	ALL	Powerpoint Presentation
	ARCH	Completed Report
	LIGHT	Completed Report
	ELEC	Completed Report
	STRUC	Completed Report
4/13-4/20	**FACULTY JURY PRESENTATIONS**	