

THE AUGUST WILSON CENTER FOR AFRICAN AMERICAN CULTURE

PITTSBURGH, PENNSYLVANIA



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PROPOSAL

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LIGHTING / ELECTRICAL OPTION

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August Wilson Center for African American Culture
Pittsburgh, Pennsylvania
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PROPOSAL

EXECUTIVE SUMMARY:

This proposal details the work to be complete for AE482 in the spring semester of 2008. The four areas to be considered are breadths in architecture and acoustics and depths in lighting and electrical design. The lighting depth will include redesigning the four spaces that have been previously analyzed. The electrical depth will include an analysis of photo voltaic arrays as well as a study based on voltage conversion. For the architecture breadth, a roof terrace will be designed. Finally, for the acoustics breadth, two spaces will be analyzed and redesigned based on STC and reverberation time.

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BACKGROUND

Thesis Overview:

This architectural engineering thesis will be completed as part of a dual honors thesis in architectural engineering and architecture. The thesis will be completed within the framework of the standard architectural engineering thesis but will feature a large breadth study in architecture. The work in architecture will provide a framework for the other breadth and depth studies.

Building Overview:

The 64000 SF August Wilson Center for African American Culture is currently under construction at a cost of approximately 23 million dollars. The project site is at the corner of Liberty Avenue and William Penn Place in Pittsburgh, Pennsylvania. The cornerstone of the project is a 500 seat performance theater. Additional spaces include exhibit spaces, education spaces, administrative offices, a gift shop, and a café. Designed as a signature building, the August Wilson Center's unique forms and modern materials make it stand out among the skyscrapers of downtown Pittsburgh.

For the architecture portion, a premise has been established that an additional 25 million dollars has become available to add to the currently designed building. The adjacent property at 411 Seventh Avenue, on which currently stands a 16 storey office building, will be considered available for use as the site of the addition.

Construction began in August of 2007 and is expected to last approximately 18 months. Small changes continue to be made to the design. For example, what was previous a somewhat undefined space, the meeting room, has received extra funding and will now become a donor lounge. These changes will be taken into consideration with the lighting redesign.

BREADTH PROPOSALS

Architecture:

I will investigate and design the addition of a rooftop terrace/gathering space for the facility. This will involve a code analysis, design analysis, and a determination of the effect on other building systems. The final product will include design documentation and renderings.

Acoustics:

I will complete a reverberation time and STC analysis for both the Music Café and Multi-purpose rooms. These spaces are critical acoustically because of the intent to use them for small performances. The reverberation time in these spaces will be important to their success. Both spaces are also located in close proximity to the main lobby and main theatre. Because multiple events may occur at the same time, keeping sound isolated will be important. In other words, a high STC value is critical.

After analyzing these values for both spaces I will determine if changes are necessary. If changes are required, I will select new products that can be used and design a layout to optimize acoustical performance.

DEPTH PROPOSAL: LIGHTING

The existing lighting system uses mostly standard fluorescent pendants to create adequate levels while using wall-wash fixtures where applicable to provide accent/perimeter lighting. Many of the rooms are connected to a dimming system; however, both the upper and lower lobbies are connected to standard equipment. The lobbies receiving a lot of daylight but the current system does little to address this.

Two of the key elements of the design of this building is the transparency of the façade and the sail feature which defines the corner at Liberty Avenue and William Penn Place. These elements must be considered in the design of all the spaces. The individual spaces combine to form the complete exterior aesthetic.

The lighting of the new addition will also need to be integrated into the existing lighting design. In designing the new addition, it will be paramount to consider the existing façade and its importance to the lighting system.

The lighting work will involve four spaces: the Façade, the Lobby, the Education and Lecture Room, and the Meeting Room. Additional work will be completed in key spaces of the addition.

Designer Comments from Presentation at Lutron (12/13/07)

From Charles Stone:

- Hand sketch needs to be refined and improved. It is too messy
- Too many layers on the slide. Simplify to make clearer.
- Is the "awake" slide a rendering or a diagram? It needs to be one or the other. "awake" text is distracting
- Use numbers to back up statements and illustrate knowledge (For example, with the amount of light needed on the shades at night).
- Present more fixture/source type information to make a stronger presentation

From Luke Tigue:

- Color can be jumpy. Green does not stand out as intended.
- Basic bones of the presentation are present, needs refinement and additional lighting substance.
- Some detail drawings need to show reference to provide orientation
- Picked correct problems and thought about solutions but need to provide more information to communicate the solutions.

Solution:

A short description is provided for each solution. Please refer to Technical Report Three for more in-depth information and renderings.

Overall, the key to the lighting design of the chose spaces is the nighttime views from the exterior of the building. The transparency of the façade allows the interior of the building to become the focus. A dual-mode system will be used to show when the building is active and when it is closed, much like a curtain being pulled in front of a stage. Existing shades will be lowered to 'close' the building and will be illuminated to low levels. When the building is 'awake' a consistent pattern of fixtures is necessary in all spaces visible from the exterior. This will be developed as a linear patten as dictated by the linear baffles. Fixture selection will be made based on desired spacing and required levels. Dimming will be key to all spaces visible from the exterior as these spaces also receive high levels of daylight.

Other key features of the overall project are the sail and the theater drum. The sail will be illuminated from the interior and at the top the glass will be fritted. The theatre drum will be washed on all levels and where it continues up and out of the rectangular building form it will be illuminated.

The key to the lobby will be to use low ambient levels to allow points of interest to have significantly higher illuminance levels. A dimmable system that can respond to daylight and various uses will be implemented.

The education and lecture room on the second floor will continue many of the themes of the lobby. From the exterior, the spaces must appear seamless. Additional fixtures will be used in this room to accommodate more demanding uses such as lectures and presentations.

What was formerly the meeting room will now be a donor lounge and the lighting will be upgraded accordingly. Custom pendants will be used to create ambient light while reducing the volume of the space. They will be designed to complement the existing lines of the interior of the sail, where this room is located. A relaxing environment will be created by using wall washes to create peripheral emphasis and accent lighting to recognize donors.

Overall the three main goals are to create a lighting design that responds to the architecture and to the activity of the building, is flexible in its uses and can adapt to various situations as well as exterior light conditions.

Solution Method:

The new lighting designs will be completed and documented using a combination of hand sketching and computer software. It will be important to follow the steps of the design process from conceptual design to final documentation. The end result will be a set of lighting plans for all spaces redesigned and at least two photorealistic renderings.

Tools:

The design will be complete within the regulations of ASHRAE Standard 90.1. Guidelines documented in the IESNA Handbook will be followed wherever applicable or justification will be given when deviation from the guidelines occurs. Design criteria established in Technical Report One will be used to guide and evaluate the new designs.

Conceptual designs will be created using a combination of Photoshop and hand sketching. As the designs progress, AGI32 will be used to verify designs and perform necessary calculations. Final renderings will be completed using Autodesk VIZ.

Required Tasks:**1. Conceptual Design**

The conceptual design will be completed at the end of the fall semester. The designs will be presented at Lutron where they will be analyzed by professionals. The conceptual designs will then be modified or clarified according to the suggestions of the professionals.

2. Equipment selection

Equipment will be selected to match the conceptual designs. Custom fixtures will be designed where applicable. Daylight dimming equipment will be specified.

3. Preliminary Renderings

AGI32 will be used to create preliminary renderings using the specified equipment. These models can then be used to make appropriate calculations.

4. Calculations

Light levels in all spaces will be calculated to ensure compliance with levels recommended by the IESNA. Energy consumption will be calculated to ensure compliance with ASHRAE 90.1.

5. Design Review

The AGI32 models will be reviewed to ensure the designs meet the criteria established for each space in Technical Report One. A comprehensive analysis of both performance characteristics and aesthetics will be made and the designs will be modified as deemed necessary.

6. Documentation

Design documentation will include lighting plans, fixture schedules, calculations summaries, and fixture cut sheets.

7. Final Renderings

Autodesk VIZ will be used to create photorealistic renderings.

DEPTH PROPOSAL: ELECTRICAL

- 1. *Redesign branch circuit distribution for spaces where lighting was redesigned.***

The four spaces to be redesigned are the exterior, the lower level lobby, the education and lecture room, and the meeting room. The redesign will included resizing distribution equipment and feeders as well as laying out panelboards.
- 2. *Complete a protective device coordination study including short circuit calculations.***

The path to panel board 1N1 will be analyzed. This path goes from the service entrance to main distribution panel MSB2 to panel 1NDP1 to panel 1N1.
- 3. *Complete an analysis of the effectiveness of using a photo voltaic array***

I will investigate the feasibility and cost effectiveness of adding a photo voltaic array to the roof of the new addition. Whenever a new addition is proposed it is necessary to take into consideration many options for on-site electrical generation in order to reduce life cycle costs of the building. One such option that is becoming increasingly realistic to include is a photo voltaic array.

For this project, the feasibility was low for use on the existing building because roof mounted mechanical equipment left little roof area available. However, as I will be designing a new addition, I can make the use of a photo voltaic array a goal.

With a photo voltaic array, it is always necessary to complete a cost analysis to ensure that the increased initial cost is worthwhile. With the constantly increasing prices of purchasing energy, on site generation may prove to be a very valuable addition. My analysis will require looking at the geometry and environmental conditions that will affect the energy that the array can capture. This will be projected into the future to estimate energy savings. This number will be compared to the initial cost of the materials and labor to install the array as well as maintenance costs over the life of the array. Another important consideration is the usability of the energy that is produced and other additional costs that may be necessary to make the energy usable.

To obtain the necessary information, an AGI analysis will be necessary to determine the amount of light that can be received by the system. As this project is in a urban environment, many tall surrounding buildings may mean that not enough light will reach the array to make it cost effective. I will also need to gather cost information for both the panels and energy.

4. ***Investigate the partial system voltage conversion from 208Y/120V to 480/277V.***

The current design uses parallel service entrances and two main switchboards. One of the main switchboards serves predominantly mechanical equipment. Therefore, a conversion from 208Y/120V to 480/277V would be feasible and could potential reduced costs due to smaller sized electrical equipment and feeders.

The selected portion of the system will be redesigned and new equipment will be priced using R.S. Means. A comprehensive analysis of all factors will determine if making the switch is a viable option.

PROPOSED SCHEDULE

AE482 Calendar		
WEEK	Area	Description of Activities
Winter Vacation	ARCH	Schematic Design
	ALL	Begin Construction of 3D Model
1/14/08 to 1/20/08	ARCH	Existing Building 3D Model
	LTG	Concepts Finished
1/21/08 to 1/27/08	ARCH	Finalize Schematic Design
	ARCH	Existing Building 3D Model
	LTG	Fixture Selection
	EL	Coordination Study
1/28/08 to 2/3/08	ARCH	Existing Building 3D Model Completed
	LTG	Fixture Selection
2/4/08 to 2/10/08	LTG	Existing Building Calculations
	ARCH	Massing Model Completed
2/11/08 to 2/17/08	LTG	Existing Building Calculations Completed
	ARCH	Design Docs
2/18/08 to 2/24/08	LTG	Existing Building Design Refinements
	ARCH	Design Docs
2/25/08 to 3/2/08	ARCH	Design Docs Finished
	LTG	Existing Building Final Calculations
	EL	PV Panel Analysis
3/3/08 to 3/9/08	ARCH	New Addition Computer Model Finished
	LTG	New Addition Schematic Design
	EL	PV Panel Analysis
3/10/08 to 3/16/08		SPRING BREAK (No work planned)
3/17/08 to 3/23/08	ARCH	Final Drawings/Revisions
	CM	Cost Estimating
	LTG	New Addition Calculations
	LTG	Existing Building Documentation
3/24/08 to 3/30/08	ARCH	Final Drawings/Revisions
	CM	Cost Estimating Finished
	EL	New Addition Sizing and Branch Circuit Redesign
	LTG	New Addition Documentation
	LTG	Final Renderings
3/31/2008 to 4/6/08	ARCH	Model
	CM	Scheduling
	EL	New Addition Sizing and Branch Circuit Redesign
	LTG	Final Renderings Finished
4/7/08 to 4/13/08	ARCH	Model Finished
	LTG/EL	Report Completed
4/14/08 to 4/20/08	ALL	Powerpoint Presentation
	ALL	Faculty Jury Presentations

