

# THE AUGUST WILSON CENTER FOR AFRICAN AMERICAN CULTURE

PITTSBURGH, PENNSYLVANIA



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**ARCHITECTURAL ENGINEERING SENIOR THESIS PROJECT  
FINAL REPORT**

**PRESENTED APRIL 16, 2008**

**LIGHTING / ELECTRICAL OPTION**

**ADVISORS: DR. RICHARD MISTRICK  
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## **EXECUTIVE SUMMARY:**

The August Wilson Center for African American Culture is designed to become a signature element in a revitalized downtown Pittsburgh. From the former site of run-down buildings and a barren parking lot will raise a beacon of Pittsburgh art that highlights the culture and history of African Americans. Prominently located on Liberty Avenue near the new convention center, the center will be home to a performance theater, exhibit spaces, a lecture room, gathering spaces, and a café.

In this report, the essence of the synthesis of architecture and engineering will be examined through detailed research, design, and analysis. The core of the report is an analysis and redesign of the lighting and electrical systems for four spaces within the building: the Liberty Avenue Façade, the main lobby, the education and lecture room, and the meeting room. To create a distinct appearance that relates to the streetscape, the transparency of the building has been utilized to allow the building to embody its core performing arts function. As the building cycles between unoccupied and occupied, the lighting system will shift and the patrons will become actors in a live performance. At the end of the night, the 'curtains' will close and the building will rest.

To accomplish the goals set forth in the conceptual lighting design, the electrical system required alteration to allow for greater and more varied control. Additional investigations into the electrical system revealed a substantial costs savings is possible by redesigning part of the system at a higher voltage. In contrast, a feasibility study of photovoltaics indicates such a system is not cost effective due predominantly to the building's location.

Attempting to add to the dynamic spaces which already exist, a roof terrace has been designed to provide another venue for exhibitions and gatherings. Additionally, the design integrates with the goals for the lighting redesign, helping to bring together the composition that is seen from Liberty Avenue.

Finally, the acoustic properties of two spaces, the Music Café and the multipurpose room, have been analyzed and a new design has been generated. As a signature building filled with performance spaces, the acoustics of the August Wilson Center are a key element to the building's success.

Any great building is comprised of many parts which all function together to produce an outstanding result. The August Wilson Center looks to be Pittsburgh's next great building and therefore the systems within the building all must perform at a very high level.

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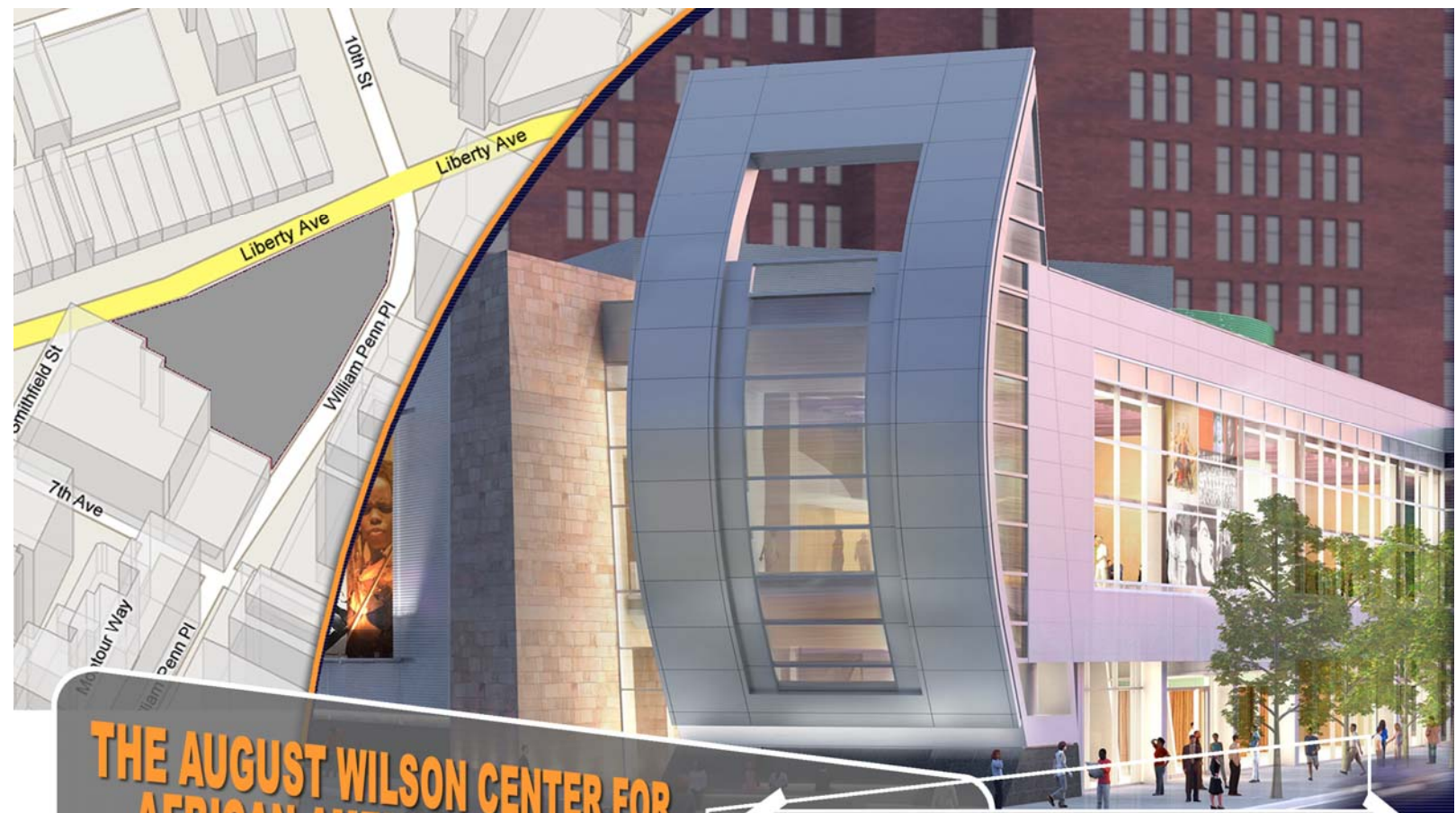
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This report, along with addition information, is available in electronic format at:  
<http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/>



# THE AUGUST WILSON CENTER FOR AFRICAN AMERICAN CULTURE

LIBERTY AVENUE PITTSBURGH, PA

## ARCHITECT:

PERKINS + WILL

## CIVIL ENGINEER:

A&A CONSULTANTS

## STRUCTURAL ENGINEER:

ATLANTIC ENGINEERING

## CONSULTANTS:

ARUP

ATS CHESTER ENGINEERS

AUERBACK+POLLACK+FRIEDLANDER

DUQUESNE LIGHT

HORNFECK ENGINEERING

MIDDLEBROOK+LOUIE

SEXTANT GROUP

THE STOUID | COMPANY

TIMOTHY ENGINEERING

## CONSTRUCTION MANAGEMENT:

TURNER CONSTRUCTION

STERLING CONTRACTING, LCC

EBONY DEVELOPMENT, LLC

## OWNERS REPRESENTATIVE:

OXFORD DEVELOPMENT COMPANY

## DELIVERY METHOD:

CM AGENT

24 PRIME CONTRACTS

### architecture

The 63,000 SF facility located in downtown Pittsburgh features a 500 seat performance venue, permanent and temporary exhibit spaces, educational and meeting spaces, a cafe, a book store and offices. The building consists of two levels above grade and is scheduled to be constructed between August 2007 and May 2009 at a budgeted cost of 23 million dollars.

### lighting

Aside from the fully functional theatre lighting system, light is provided by a wide variety of systems including, fluorescent and HID fixtures and a full range of distribution types. Exposed interior structure dictates interior fixture selection in many spaces, while the sail and banners are accented on the exterior.

### building systems

The building rests on a cast-in-place concrete foundation system to grade (partial basement). A combination moment frame and braced frame steel system with reinforced concrete slabs is used for the two upper floors. The building is serviced by Duquesne Light electrical service which is converted to a 208Y/120 system. Theatre and building loads are serviced from separate main boards. Multiple dimming systems are utilized and a backup generator protects the entire system. The mechanical system is forced air heating and cooling with steam to steam humidification. Five AHUs are housed on the roof.

an architectural engineering senior thesis portfolio

**MICHAEL PATRICK ROYER**

lighting and electrical option

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## SECTION TWO | Project Background and Overview

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Prominently located on Liberty Avenue, The August Wilson Center for African American Culture is designed to be a signature element of downtown Pittsburgh. Rich materials and bold geometric forms set the stage for a magnificent cultural experience in which any visitor is sure to participate. Beyond the aesthetic beauty of the architecture lie structural, mechanical, acoustical, electrical, and lighting systems that must perform precisely and efficiently in order to make the building function. The synthesis of aesthetics and functionality is the pinnacle of great design.

The project architect, Perkins+Will, describes the August Wilson Center as follows:

*Allison Williams, Lead Designer for the architectural firm of Perkins+Will has designed this home for the August Wilson Center as a conceptually transparent, flexible container in which the accomplishments and artifacts, the activities and traditions of this culture can be proudly celebrated layered and displayed. The building opens itself to educating people about the important contribution of African Americans to Pittsburgh and beyond. It is timeless, flexible and powerful in its simplicity.*

*The signature character of the building comes as a result of its content, in response to the program and is in continuous transformation as a result of the changing exhibits and activities within. It is through the design element at the corner of Liberty Avenue and William Penn Way that the architects position the building as a distinct icon, and abstraction of this culture and a new landmark for Pittsburgh. This is where the August Wilson Center finds its voice, its identity, its energy and its distinct signature quality.*

This capstone design project and Architectural Engineering senior thesis involved a substantial analysis of the existing building approach, specifically in the areas of lighting and electrical systems. This analysis provided goals for redesigning these systems for four spaces: the Liberty Avenue façade, the main lobby, the education and lecture room, and the meeting room. These four spaces surround the main theater and are critical to the appearance and function of the building.

Additional studies in architectural design resulted in the design of a roof terrace to create a new venue for performance and culture. An analysis of room acoustics provided the basis for a new design for the Music Café and the multipurpose room.

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## SECTION THREE | Building Statistics for Existing Design

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### GENERAL BUILDING DATA:

**Building Name:** August Wilson Center for African American Culture

**Location and Site:** Liberty Avenue and William Penn, Pittsburgh, Pennsylvania

**Building Occupant Name:** August Wilson Center for African American Culture

**Occupancy or Function Types:** The building will open in phases. The first phase to open will be gallery and display space. A 500 seat performance theater will be opened second.

**Size:** 63,000 Square Feet

**Number of Stories Above Grade:** Two

**Primary Project Team:**

**Architect:** Perkins + Will (<http://www.perkinswill.com>)

**Engineering:**

Civil: A&A Consultants (<http://aaconsultinc.com/>)

Structural: Atlantic Engineering Services (<http://www.aespj.com>)

**Consultants:**

ARUP (<http://www.arup.com>)

ATS Chester Engineers (<http://www.atschester.com>)

Auerbach + Pollack + Friedlander (<http://www.auerbackconsultants.com>)

Duquesne Light (<http://www.duqlight.com>)

Hornfeck Engineering (<http://www.hornfeck.com>)

Middlebrook + Louie (<http://www.MplusL.com>)

Sextant Group (<http://www.thesextantgroup.com>)

the studio i company (<http://www.studioilighting.com>)

Timothy Engineering (<http://www.timothyengineering.com>)

**Construction Management:**

Ebony Development, LLC (<http://www.ebonydevelopment.com>)

Sterling Contracting, LLC (<http://www.sterlingcontractingllc.com/>)

Turner Construction (<http://www.turnerconstruction.com/>)

**Law Firm:**

Buchanan Ingersoll & Rooney, PC (<http://www.bipc.com>)

**Owner's Representative:**

Oxford Development Company (<http://www.oxforddevelopment.com>)

**Dates of Construction:** Start Date – August 2, 2007. Expected Duration – 18 months.

**Cost:** The budget cost decided by the owner is 23 million dollars. The project has come in over budget and value engineering is taking place in order to achieve a final cost that is acceptable to the owner.

**Project Delivery Method:** The project began with a GMP contract. However, it is currently structured as a CM agent with approximately 23-24 prime contracts.

#### **ARCHITECTURAL INFORMATION:**

**Design and Functional Components:** The program consists of a central performing arts theater surrounded by lobby and gallery space. There is space allocated for both permanent and temporary exhibits. There is a café off of the ground floor lobby. The second level also includes a multi-purpose room, classrooms and an open office area for administrative activities related to the center.

**Major National Model Codes:** IBC 2003

**Zoning:** Commercial

**Historical Requirements:** None. The site is owned by the Urban Redevelopment Authority (URA) of Pittsburgh. Requirements must be met during the demolition and site preparation in order for the ownership to transfer to the August Wilson Center.

**Building Envelope:** The building features several exterior wall systems. The foundation and basement is cast-in-place concrete to grade. Above grade structural steel with concrete/steel decking and 6" metal stud walls forms the building envelope. The exterior of the building features several materials including 2" insulated aluminum panel, ACM (Aluminum Composite) panels, ribbed metal panels, aluminum/glass curtain wall, and 8" CMU cavity wall. These systems are integrated and used in various combinations throughout the building. The walls are insulated with R19 batt insulation, and surfaced with 5/8" sheathing and waterproof membrane. The roof is an EPDM system over tapered insulation to provide adequate drainage. Parapet walls are used as necessary and capped with metal coping.

#### **CONSTRUCTION METHOD:**

Turner Construction Company is the primary construction management firm for this project. The delivery method was original GMP with a project budget of 23.5 million dollars. When the project came in over budget, the method was switched to CM Agent with Turner as the CM and 23-24 prime contracts between the August Wilson Center and the contractor. This switch occurred in the summer of 2007.

With a location in downtown Pittsburgh, the site had previously been occupied and it was therefore necessary to complete demolition prior to beginning new construction. The site was owned by the Pittsburgh Urban Redevelopment Authority (URA). When excavation began, soil contamination was discovered and the agreement with the URA stated that it must be remedied before the land ownership would be transferred.

A set of permit review drawings was released October 2, 2007. Due to the late shift in delivery method, Turner had to pre-purchase materials for early bid packages, such as the steel. The estimated length of construction is 18 months.



**ELECTRICAL SYSTEM:**

The building runs on a 208Y/120V, 3 phase, 4 wire electrical system and is connected to the Duquesne Light system. Service enters the building on the south side of the building where two transformers are located. Each transformer supplies a main switchboard. One of these switchboards supplies predominantly mechanical and equipment loads while the second switchboard supplies mainly lighting and other end-user loads.

Dimming equipment is necessary to accommodate theatre equipment and is also used for some of the general purpose spaces. The most unique part of the system is a motorized orchestra pit lift. However, this piece of equipment is slated to be added at a later time.

A 200KW diesel generator provides emergency power to certain parts of the system through two automatic transfer switches.

**LIGHTING SYSTEMS:**

The building's lighting system is faced with the challenge of responding to the building's unique architectural form and varying materials. With open plenum ceiling that have open grids and vertical metal baffles, indirect lighting is not an option. Black acoustical blanket on the ceiling means the reflectance is very low.

Regular arrays of round downlights light the upper and lower lobbies. Accent and interest is provided by varying lighting in the adjacent spaces that connect to the lobby and by highlighting the oval shaped drum of the theater that protrudes through the entire building.

In the gallery spaces track lighting is used to provide a very flexible solution. Dimming systems are used in spaces such as the education room and meeting room to provide variable light levels. Motorized blackout shades are used to address the large amounts of daylight that will enter the spaces through the Liberty Avenue Façade.

The exterior lighting design is focused on accenting special elements rather than washing the entire façade. The building glows from the inside due to the large expanses of clear glass. The corner sail is highlight from inside and from in-grade recessed fixtures.

**MECHANICAL SYSTEM:**

Building heating and cooling is handled by five air handling units (condenser capacities: 735, 608, 727, 530, 951 MBH) that are housed on the roof of the structure. The units contain DX coiling coils and glycol preheat and reheat hot water heating coils. One of these units is also connected to the backup emergency system. Four small split AC units serve mechanical and equipment rooms. Additional heating is provided by electric baseboard heaters in the exhibit hall.

A steam and water room in basement of the building houses plumbing equipment, heating coils and other water related mechanical equipment.

**STRUCTURAL SYSTEM:**

The foundation of the building is provided by 10 to 12 inch poured concrete foundation walls which rest on grade beams. Concrete piles are used to support the columns. The basement level is only a portion of the area of the first level. On grade floors are concrete slab on grade. Where the basement level exists, the first floor is a two way structural concrete slab that is 10 inches thick or a 15-20" thick one way slab.

W shape steel columns support the second floor and roof loads. The column arrangement is not regular due to the generally triangular shape of the overall building and the oval shape of the theater core. The triangular system is a moment frame construction while the inner oval shape of the theater is a braced frame construction. Bent beams are used to make the curved theater walls.

The second level floor is framed with structural steel with steel decking and concrete slab. The roof uses a similar system but is sloped for drainage and includes rigid insulation on top. The balcony seating area is a series of cantilevered concrete slabs.

**FIRE PROTECTION:**

With only two stories, the building does not require d to have active fire protection throughout. Fire protection (1HR) is provided around egress stairwells and elevators. The theatre stage area has a two hour rating. Several other walls, including exterior walls bordering other buildings have a one hour rating. Many of the electrical/mechanical spaces are also protected by a one hour fire rated wall assembly. Steel is protected by cementitious fireproofing where necessary. The building utilizes a sprinkler system throughout. A separate water service for the sprinkler system enters the building from the south where a main control system is located. A dry system is used to protect the two exhibit spaces while a wet system is used for the remainder of the building.

**TRANSPORTATION SYSTEM:**

The transportation system includes three elevators, one of which is a large elevator that can be used to move equipment. Only two of these elevators service the basement. The larger elevator connects through to the basement and two exhibit spaces.

The building has three standard egress stairwells one of which connects the basement. A grand staircase connects the two lobbies while two staircases provide direct pedestrian access to the balcony seating in the theatre.

A service entrance to the building is located on the south side of the structure and comes off of William Penn Place. This entrance provides a two bay loading dock with access to the stage area of the main theatre.

**TELECOMMUNICATIONS:**

The building communication systems consist of standard ethernet, and phone systems with a few items related to projectors and audio systems. The theatrical communication and audio systems will not be considered for this report. The main control and distribution panels are located in room 111 on the south side of the building. This is where service from Verizon enters the building below grade from the street. A secondary control station, room 211, is located directly above room 111.

The voice and data network runs throughout the building. This system will provide internet connectivity as well as phone lines to the various building spaces. This is especially relevant for the open office area. Various types of outlet boxes are used depending on the constraints of mounting locations. Everything from wall to floor to ceiling boxes are used, with various numbers of both voice and data jacks mounted together.

The overall audio and video system includes a regular array of speakers located through the lobbies of the building. Separate audio systems are in place for the café, education/lecture room, and meeting room. Audio system control for the lobbies is provided by an AV rack in the gift shop. Video projection systems are used in the café, gift shop, and education and lecture room, with two projectors in each space.

The security system consists of cameras located throughout the buildings lobbies and hallways. These are mostly in the first level of the main lobby with a few on the second level and some at the building entrances. Many of the building's doors are operated with electronic card swipes. Some also have audio alarms.

**LEED CERTIFICATION:**

This project is seeking LEED certification.