

THE AUGUST WILSON CENTER FOR AFRICAN AMERICAN CULTURE

PITTSBURGH, PENNSYLVANIA



PERKINS + WILL

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**TECHNICAL REPORT ONE:
EXISTING CONDITIONS AND DESIGN CRITERIA**

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**LIGHTING / ELECTRICAL OPTION
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EXISTING CONDITIONS AND DESIGN CRITERIA REPORT

EXECUTIVE SUMMARY

The lighting systems of the August Wilson Center for African American Culture, designed by Studio i Lighting, attempt to create a dynamic space while conforming to the guidelines of the IESNA and the regulations of ASHRAE/IESNA Standard 90.1. An analysis of the existing lighting conditions shows that the design is fairly successful in meeting the IESNA design criteria. The overall lighting scheme successfully compliments the style of the architecture to enhance the feel for which the architect is striving.

The overall design is very cognizant of the appearance of the building from the exterior. The front façade, on Liberty Avenue, is predominantly clear glass curtain wall. Therefore, the interior spaces, and especially the lighting system, are visible from the street during the night.

Calculations show that the system is achieving the desired levels for the spaces. However, daylighting integration is limited at best. The design is upscale and aesthetically pleasing but certain things can possibly be done to improve the overall system.

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SECTION ONE: Existing Conditions Description

General Building Description:

The building is arranged around the theater, which is visible as a core penetrating through the space when viewed from Liberty Avenue. The building's other primary spaces, permanent and temporary exhibit spaces, are stacked on the southeast side of the building. The north façade, which is predominantly glazed, is the focus of the building. This façade is punctuated on the northeast corner with a large sail structure. From the main lobby on the first level, one can access the box office, a gift shop, the permanent exhibit space, the theatre, and a café, among other service spaces. The main lobby is a fluid space that is defined more by its surrounding spaces than by walls. A second level lobby which is similar to the first level lobby provides access to educational, meeting, and office spaces as well as a multi-purpose studio space.

The building's lighting systems attempt to accentuate the style of the architecture. Many of the ceilings are left exposed to the structure above and coated in a black acoustical blanket. This eliminates the use of indirect lighting for most of the building as it would be very inefficient. The key to the overall lighting design is the expression of the design when viewed from Liberty Avenue. The transparent façade means that the interior environment defines the building during the night. With many spaces visible from the exterior, creating continuity in the design from space to space is essential.

Large Work Space: Education and Lecture Room

Drawings: Available in Appendix A.1, Page 23

Description:

The education and lecture room is an approximately 64' by 32' rectangular room located on the north side of the second level. The main entrance is from the second level lobby through either two standard doors or a large, mechanically operated pivot door. A second means of egress is provided via a bridge to a separate egress stairwell. The space is almost completely transparent with large amounts of glazing on all sides. As all the glass is clear, this transparency exists both looking into the space and looking out of the space. All of the glass can be covered with mechanically operated black-out shades.

The meeting room is accessed directly from this space, meaning it will partially function as a circulation space. Access to the meeting room is provided via two glass doors as well as another mechanically operated pivot door.

The south wall features built-in cabinets which break the plane of the glass wall. These provide storage as well as a sink.

Surface Materials:

Material descriptions and assumed properties are available in the materials legend, Appendix D.1, page 52.

North Wall: The north wall is an exterior wall which is entirely curtain wall (MATERIAL GLZ-1). A painted gypsum board soffit (MATERIAL PT-1) houses a recessed window shade. Three structural columns are finished with gypsum board (MATERIAL PT-1) while a beam running the length of the space at approximately 12' above the finished floor is shielded for a formed metal cover. Radiant heaters are located along the base of this wall.

South Wall: The south wall is the most unique wall in this space. It is a combination of casework (MATERIAL P-2) and glazing (MATERIAL GL-1 and GL-2, butt glazed). The casework surfaces extend approximately 18" into the room, adding depth to the wall. The glass looks into the grand staircase and onto a stone wall beyond.

West and East Walls: The west and east walls, which are nearly identical, are predominantly a massive, mechanically operated pivot door with a wood (MATERIAL WD-2) and metal (MATERIAL MP-4) slighting curved face. A column on either side of the door is finished with gypsum board (MATERIAL PT-1). Also to either side is a glass passage door in a glass partition wall (MATERIAL GL-3).

Ceiling: A ceiling grid hangs at approximately 19'-6" high. The grid consists of a 4' by 4' black square grid as well as 8" metal baffles spaced 2' apart that run perpendicular to the liberty avenue façade. The bottom of the structure above is covered in black acoustic blanket. The ductwork is left exposed and is painted (MATERIAL PT-2) the same color as the walls above the ceiling grid.

Floor: The floor is carpeted (MATERIAL CPT-3) wall to wall.

Furnishings:

The room is furnished with tables and chairs much like any typical classroom. They are oriented in rows facing the east wall.

Lighting Hardware:

A lighting fixture schedule for this space is available in Appendix B.1, page 34.

The main lighting in the space comes from seven 24' strips of combination T5HO and LV MR16 (FIXTURE SK). The T5 fixtures feature highly specular bivergence louvers. Each 24' strip is circuited with two dimmable circuits. A track (TRACK SN) with seven heads (FIXTURE SJ1) is located on the east side of the room. The track heads are 100W PAR38 halogen fixtures with integral baffles and hood. Wall station controls for the dimming rack are located on the east and west walls (CONTROL DR-202). The control rack is located in the casework on the south wall.

Special Purpose Space: Meeting Room

Drawings: Available in Appendix A.2, Page 27

Description:

The meeting room is prominently situated within the sail at the northeast corner of the building. The room is approximately 24' by 32' and is accessed from the education and lecture room by standard doors or the large pivoting door. Because it is in the sail the east wall is arched (in section view). Large sections of curtain wall exist on the south, east, and north sides of the space which will provide plenty of daylight. Shading is provided for all of the glazing. The ceiling slopes, opening to the curved wall of the sail. It is assumed that this space would be used for smaller functions or as a conference room.

Surface Materials:

Material descriptions and assumed properties are available in the materials legend, Appendix D.1, page 52.

North and South Walls: Mirror images of each other, the north and south walls are half curtain wall (MATERIAL GLZ-1) and half painted gypsum (MATERIAL PT-1). There is a column at approximately the third point of the walls at which the ceiling begins to slope upwards towards the sail. All of the walls in the room have baseboard (MATERIAL WB-2) at the bottom.

East Wall: The east wall curves as it is a portion of the sail that forms the corner of the building. Curved curtain wall (MATERIAL GLZ-3) forms the center of this wall while the left and right sides are painted gypsum (MATERIAL PT-1). Baseboard is provided throughout the room (MATERIAL WB-2).

West Wall: The west wall is described above. It is the same as the East and West walls of the education and lecture room.

Ceiling: The ceiling in this space is painted gypsum (MATERIAL PT-1). Moving from west to east, it is level before beginning to slope at column line A1. This creates an aperture effect opening the view looking out of the sail.

Floor: This space is fully carpeted (MATERIAL CPT-1).

Furnishings:

Furnishings for this space are not provided on the drawings. It is assumed that this space would have a conference table(s) with seating facing multiple directions.

Lighting Hardware:

A lighting fixture schedule for this space is available in Appendix B.1, page 34.

[Note: In the most current set of architectural drawings, the reflected ceiling plan shows downlights in this space. The lighting plan from the same set shows pendant fixtures. I am using the lighting drawings for this analysis.]

The lighting in this space is provided by four runs of four 4' sections of direct/indirect pendant fixtures. The dimmable fixtures are controlled by a wall station in the southwest corner of the room. They are on the dimmer rack for the education and lecture room. The fixtures are 54WT5HO fixtures. The runs are arranged running parallel to the Liberty Avenue Façade.

Circulation Space: Main Lobby First Level

Drawings: Available in Appendix A.3, Page 30

Description:

The lobby acts as the main circulation core for the building. From this space, one can reach the permanent exhibit space, the theatre, the gift shop, box office, and the main grand staircase to the second level. It totals 4,429 square feet of irregularly shaped space. The lobby runs most of the length of the Liberty Avenue façade, approximately 120'. Spaces such as the box office and the gift shop are not completely defined by walls and function as defined areas within the lobby. It is the other spaces that it connects which really delineate the boundaries of the lobby.

The most notable design element in this space is the large elliptical wall that forms the back of the theater space. This 'drum,' as it is referred to, can be seen as a volume from the exterior the protrudes through the first and second levels and out the roof of the structure.

Surface Materials:

Material descriptions and assumed properties are available in the materials legend, Appendix D.1, page 52.

The irregular shape of this space as well as the lack of definition between spaces makes the materials difficult to describe for this space. In general, the floor is a finished concrete (MATERIAL CONC-2) while the ceiling is a combination of an open 4' by 4' black grid with 8" metal baffles running perpendicular to the Liberty Avenue facade spaced every 2'. The baffles hang at approximately 13'-2" above the finished floor. Above the grid system is the structure which is covered with black acoustical blanket, as well as mechanical systems which are painted (MATERIAL PT-2). Other materials in this space include stone (MATERIAL STN-1) and metal panels (MATERIAL MP-2 and MP-3).

The north wall is almost entirely curtain wall (MATERIAL GLZ-1). Shades are not provided for this glazing. A majority of other surfaces in the space are painted gypsum (MATERIAL PT-1). The one exception is the large drum of the theater. It is finished in a combination of wood

paneling (MATERIAL WD-2) and various colors of painted gypsum board (MATERIAL PT-1 and PT-5). It has stainless steel reveal channels as well as baseboard (MATERIAL WB-2)

Furnishings: There are no furnishings shown on any of the available drawings. I will assume that there may be benches on the north side of the space. There are not many surfaces that would be used for artwork. The only true wall in the space is the large curved wall of the auditorium drum which is not likely to have any permanent artwork attached to it due to its shape.

Lighting Hardware:

A lighting fixture schedule for this space is available in Appendix B.1, page 35.

General ambient light is provided by suspended compact fluorescent downlights (FIXTURE SA). Where a soffit exists, recessed downlights are used (FIXTURE SB). The theatre drum is highlighted by 50W ceiling recessed MR16 wallwash fixtures (FIXTURE SAX) and by neon strips (FIXTURE SBD) mounted inside a custom curved steel channel. The drum fixtures are dimmable and are on the Auditorium Rack #5 Dimmer. A wall station in the box office provides control for these, as well as lockouts for the general downlights.

Outdoor Space: Liberty Avenue Facade

Drawings: Available in Appendix A.4, Page 31

Description:

Material descriptions and assumed properties are available in the materials legend, Appendix D.1, page 52.

The Liberty Avenue façade is approximately 150' long and two stories tall, making it appear very horizontal. It is punctuated by the sail shaped feature on the corner of Liberty Avenue and William Penn Avenue (left). This sail is the focal point of the building's exterior. It is book ended on the opposite end by a protruding cube that extends out from the plane of the façade by 9'. Also at this end of the building is a small seating area outside the café. The façade sits approximately 25' back from the street curb. A row of street trees will run the length of the façade, spaced 35' apart. These trees are significant when viewing the façade. It is the north facing façade.

Surface Materials:

This façade is arranged in horizontal bands of clear curtain wall (MATERIAL GLZ-1) and silver metallic metal panels (foamed in place) (MATERIAL MTL-3). Spandrels (MATERIAL GLZ-2) are used where necessary. The large sail structure is also made of the metal and glass but uses fritted glass for the top section (MATERIAL GLZ-5). It has a granite base (MATERIAL STN-1).

Where sections of the facade are not in the regular plane of the building, a different metal system is used. The sail and the columns along the first level are surfaced with composite metal panels (MATERIAL MTL-1). Protrusions extending out the top of the building are surfaced in an exposed fastener profiled metal panel system (MATERIAL MTL-2). The far right section of the facade is faced with a concealed fastener metal panel system (MATERIAL MTL-4). The sidewalk in front of the building is the standard concrete that is required by the city of Pittsburgh.

Lighting Hardware:

A lighting fixture schedule for this space is available in Appendix B.1, page 35.

The long Liberty Avenue façade is generally not illuminated from the exterior. It is predominantly curtain wall. I believe the intent was to allow pedestrians to view the inside of the facility during nighttime hours and be drawn inside. The entrance canopy has compact fluorescent recessed downlighting (FIXTURE SM). A continuous strip of 18mm 3000K dimmable neon (FIXTURE SAG) borders the sidewalk under the overhanging portion of the façade and continues around to enclose the small exterior seating area. It does not appear that this exterior seating area is illuminated at night.

The sail at the end of the façade is lit with 105W in-grade ceramic metal halide fixtures (FIXTURE SF) as well as exterior neon strips (FIXTURE SAG). The inside of the sail is also lit from the roof with an outdoor rated fluorescent floodlight (FIXTURE SBB). A bench below the sail has strips of neon (FIXTURE SAG) under the bench to illuminate the ground.

Around the corner, on the southeast wall, a strip of neon (FIXTURE SAG) is located near the bottom of the windowless façade, while metal halide spots with ornamental bracket arms (FIXTURE SAR) are used to wash the wall and highlight large banners.

There are four existing streetlights on the sidewalk along Liberty Avenue. It appears that these will be maintained or replaced. The current fixtures are cobrahead fixtures which are mounted high on poles for the purpose of lighting the street.

SECTION TWO: Design Criteria

Education/Lecture Room (Educational Facilities – Lecture Halls – Demonstration)

IESNA Very Important Criteria:

- Light Distribution on Task Plane (Uniformity)
- Category F (100 FC) Horizontal Illuminance
- Category E (50 FC) Vertical Illuminance

IESNA Important Criteria:

- Daylighting Integration and Control
- Direct Glare
- Reflected Glare
- Shadows
- Source/Task/Eye Geometry
- Surface Characteristics

IESNA Somewhat Important Criteria:

- Appearances of Space and Luminaires
- Color Appearance (and Color Contrast)
- Flicker (and Strobe)
- Light Distribution on Surfaces
- Luminances of Room Surfaces
- Modeling of Faces or Objects
- Point(s) of Interest
- System Control and Flexibility

ASHRAE/IESNA 90.1 Regulations:

Table 9.6.3 allows for and LPD of 1.4 W/ft² for classroom / lecture / training rooms. An additional 1.0 W/ft² can be used strictly for decorative lighting.

Discussion:

The IESNA recommendations provide some guidance, but it is necessary to evaluate the individual space in order to make proper decisions. The most critical aspect of the lighting for this space is the integration and control of daylight. One entire wall of this space is curtain-wall. The illuminance levels recommended for this space seem high. The space may have multiple uses, suggesting that a flexible lighting system is very important. A third aspect that I think is important to highlight is the materials in the room. It is a unique

architectural space, rather than a box with white walls. This should be emphasized with wall washing where applicable.

Since it is an educational space visual clarity should be achieved. This will include eliminating or reducing glare and ensuring proper levels for the task plane. As an upscale space, it is important to consider the appearance of the luminaires. A 'clean' design will also contribute to an impression of visual clarity. It is important to focus on accurate modeling of faces and objects, but I think it would be good to avoid highlighting points of interest as they may take focus from a presenter.

Another unique aspect of this space is its relation to the conference room. A large glass wall separates the two spaces. Special consideration must be given to how this wall is treated. The spaces may or may not be used at the same time, making it necessary to consider how this will be handled. One must also consider glare and continuity of appearance, among other things, when designing the lighting for these two spaces.

Furthermore, the exterior of the building is not illuminated as the interior lighting is used to create a glow from the inside. It is important to consider the buildings surroundings and the possibility of creating an overly illuminated monumental feature in an area that includes residences. I think the approach that was taken is prudent. This consideration will apply to all the spaces on the north side of the building.

Meeting Room (Conference Rooms - Meeting)

IESNA Very Important Criteria:

- Appearance of Space and Luminaires
- Direct Glare
- Modeling of Faces and Objects

IESNA Important Criteria:

- Color Appearance (and Color Contrast)
- Light Distribution on Surfaces
- Light Distribution on Task Plane (Uniformity)
- Luminances of Room Surface
- Reflected Glare
- Surface Characteristics
- Illuminance Category D (30 FC) Horizontal
- Illuminance Category B (5 FC) Vertical

IESNA Somewhat Important Criteria:

- Daylighting Integration and Control

Flicker (and Strobe)
Shadows
Source/Task/Eye Geometry

ASHRAE/IESNA 90.1 Regulations:

Table 9.6.3 allows for and LPD of 1.3 W/ft² for conference / meeting / multipurpose spaces. An additional 1.0 W/ft² can be used strictly for decorative lighting.

Discussion:

The conference room's location within the building makes it one of the most dynamic and interesting spaces. Sitting within the space, it will receive a lot of daylight, making integration and control of daylight an extremely important issue. However, it is also important to consider how this is controlled, because the view from this space should also be considered. One of the other important factors is the flexibility of the chosen lighting system. It is important to note that, as usual, the conference room can have many uses. A preset control system will likely be beneficial for this system.

The appearance of the luminaires will also be important as they could possibly be a decorative element for the space. This would also allow for a additional w/sf allowance according to the ASHRAE 90.1 Standard. It is important to create a high class appearance in this space. The suggested Illuminance levels seem accurate for this space.

As previously stated, this space must show some continuity with the education room, as they are separated by a glass partition. Because of this, it will also be important to wash the walls to highlight materiality, as was suggested for the education room.

Main Lobby (Offices – Lobbies, Lounges, and Reception Areas)

IESNA Very Important Criteria:

Appearances of Space and Luminaires

IESNA Important Criteria:

Color Appearance (and Color Contrast)

Direct Glare

Light Distribution on Surfaces

Luminances of Room Surfaces

Modeling of Faces or Objects

Surface Characteristics

Category A (3 FC) Vertical Illuminance (at the entrance)

IESNA Somewhat Important Criteria:

Daylighting Integration and Control

Flicker (and Strobe)
Reflected Glare
Shadows
Category C (10 FC) Horizontal Illuminance

ASHRAE/IESNA 90.1 Regulations:

According to table 9.6.1 a lobby for a performing arts theater has an LPD (W/ft²) of 3.3. This is much higher than other types of lobbies which have an LPD of 1.1. Additionally, section 9.6.3 allows for an additional 1.0 W/ft² for lighting installed for decorative appearance.

Discussion:

The IESNA recommendations are accurate in suggesting that the appearance of the space and luminaires is very important for this space. As the main lobby, everyone will see this space. The lighting must accentuate the architecture. The building has a modern appearance which uses bold materials. The lighting should highlight these surfaces.

The IESNA Illuminance levels seem low for this space. I believe this space needs to be flexible in order to provide proper conditions depending on the function that is occurring at the time. This space is not only the lobby for the theatre, but also for the galleries, gift shop, bookstore and café.

It is important that the lighting in this space creates a relaxed environment to welcome patrons. Layers of light can be used to create a variety of conditions that may be controlled with a preset system. A relaxing environment can be created with non-uniform and peripheral lighting. This mood will be created by highlighting the several points of interest within the space. The ticket booths should be highlighted to draw the attention of patrons. Higher illuminances in the gift shop will make it another point of interest. The entrance to the exhibit spaces should also be highlighted. The large curved wall that forms the back of the theatre can also be highlighted to create a visual centerpiece for the lobby.

Liberty Avenue Façade (Building Exteriors – Prominent Structures)

IESNA Very Important Criteria:

Appearances of Space and Luminaires
Light Distribution on Surfaces
Light Pollution / Treescape
Point(s) of Interest
Reflected Glare
Shadows
Source/Task/Eye Geometry

Surface Characteristics
Category A (3 FC) Vertical Illuminance

IESNA Important Criteria:

Color Appearance (and Color Contrast)
Direct Glare
Modeling of Faces or Objects
Category B (5 FC) Horizontal Illuminance

IESNA Somewhat Important Criteria:

Peripheral Detection
Sparkle/Desirable Reflected Highlights

ASHRAE/IESNA 90.1 Regulations:

According to table 9.4.5, building facades are allowed 0.2 W/ft² for each illuminated surface or 5.0 W/linear foot for each illuminated wall. Also, building entrances and exits are allowed 30W/linear foot of door width (main entrances) or 20 W/linear foot of door width (other doors). For walkways 10 wide or greater and plaza areas, an allowance of 0.2 W/ft² is granted. Several exceptions are granted by section 9.4.5 but none are applicable to this project.

Discussion:

This façade is very important and prominent. It is very important to avoid just washing this surface, however, as it is sheathed in metal panels which will be highly reflective. Accentuating the sail feature at the end of the façade is a very important consideration, however. Architecturally, this feature plays to the history of Pittsburgh architecture and the many prominent corner features throughout the city.

The placement of luminaires is also a very important consideration for several reasons. Improper placement can create harsh glare and can also lead to light pollution. With taller buildings on adjacent sites, it is important to avoid stray light that may disturb other people.

It is very important to consider the overall effect that the lighting will have on the surrounding environment. Lighting to the appropriate level will provide an inviting environment that will encourage visitors to the site. Lighting the sidewalk to levels that are too high will anger area residents as well as creating a spotlight effect that may make pedestrians uncomfortable.

The small café seating area at the end of the façade also requires special attention. This area will require adequate levels for eating or conversing with consideration for modeling of faces. It is also important to create a relaxing environment to encourage patrons to use the space. This can be done with non-uniform and perimeter lighting.

SECTION THREE: Evaluation and Critique

General Building

The overall building lighting system design is particularly critical for this project. This transparent Liberty Avenue façade and the open flowing space of the lobbies create the need to integrate the lighting design for each space into the overall whole. I feel that the lighting design as a whole is successful in creating a dynamic atmosphere for a dynamic building. However, I do see some areas that could be improved to provide a better overall system.

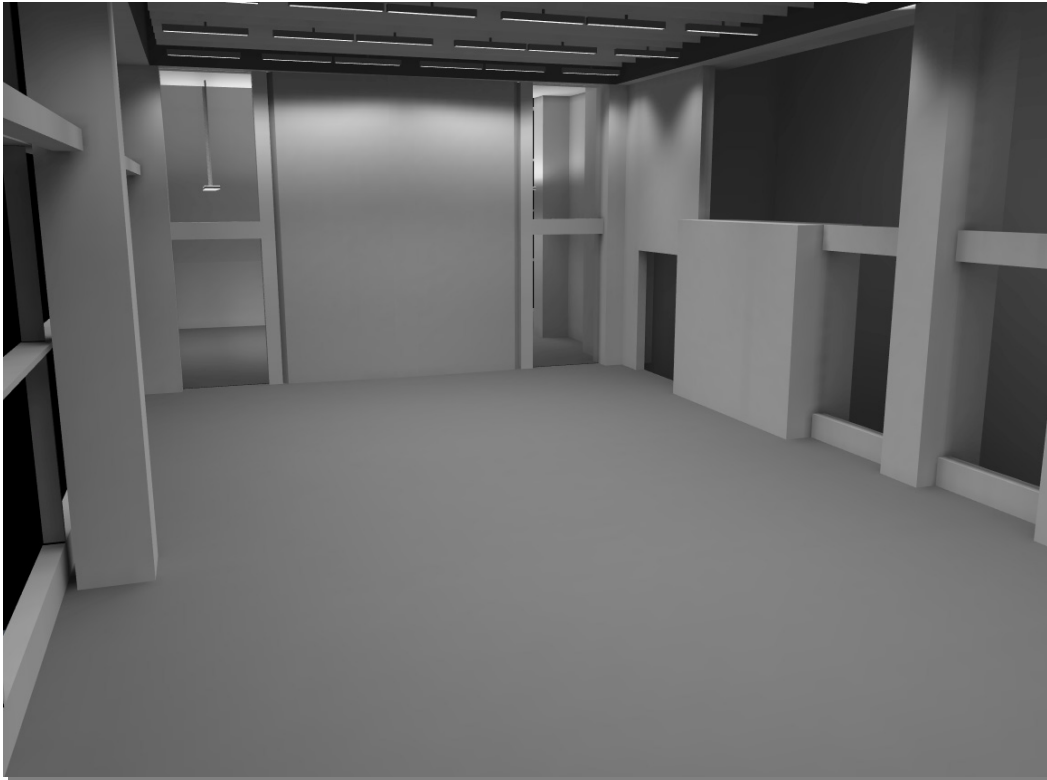
From the exterior, there is continuity between the spaces visible from the street because of the repeated use of the metal baffles and open plenum ceiling. However, this is slightly broken by the fixtures selected for the education and lecture room because they are linear fixtures instead of round downlights. I believe the systems should match to create a uniform appearance for the façade. Using a linear system throughout would further emphasize the strong lines already created by the long runs of metal baffles.

One of the challenges of lighting this building is dealing with very little definition for functions within spaces. The permanent exhibit, temporary exhibit and multi-purpose spaces will all change in function over time. Therefore, it is difficult to create a lighting design that is very unique. The track systems chosen fit the needs of the spaces and the requirements of the user.

Dimming systems are used in several spaces, but not in the lobby spaces. I feel this may hurt the overall atmosphere of the space by limiting flexibility. Theater lobbies are critical spaces for creating a mood.

The number of different luminaires selected for this project seems very high. The total number of luminaires also seems very high. On both levels the drum is washed with 37 fixtures. This seems very costly. Using fewer luminaire types may also increase the continuity between spaces.

Education and Lecture Room (AGI32 Rendering and Calculation Grid Analysis)



AGI 32 Radiosity Rendering. View looking towards east wall. A variety of renderings is available in Appendix C.1, page 36.

The education and lecture room has a very high ceiling which creates difficulties in providing adequate lighting. The critical elements in the design of this space are daylighting control, luminaire appearance, and the light distribution.

The calculations show that with just the linear fluorescent fixtures operating, the work plane has an average illuminance of approximately 47 footcandles (See Appendix C1.5 and C1.8, pages 42 and 44). This is very adequate for a classroom setting. The track fixtures at the east end of the space can be used to focus light on the presenter. The MR16 fixtures can also be used to provide flexibility should the space be used for something other than a lecture.

During the day, even though the glazing faces north, the illuminance levels in this space jump to over 400 footcandles (See Appendix C1.6, page 43). Shades are incorporated into the design to control this light should a dark space be needed for a presentation. However, no system is in place to tie the dimmability of the fixtures to the availability of daylight.

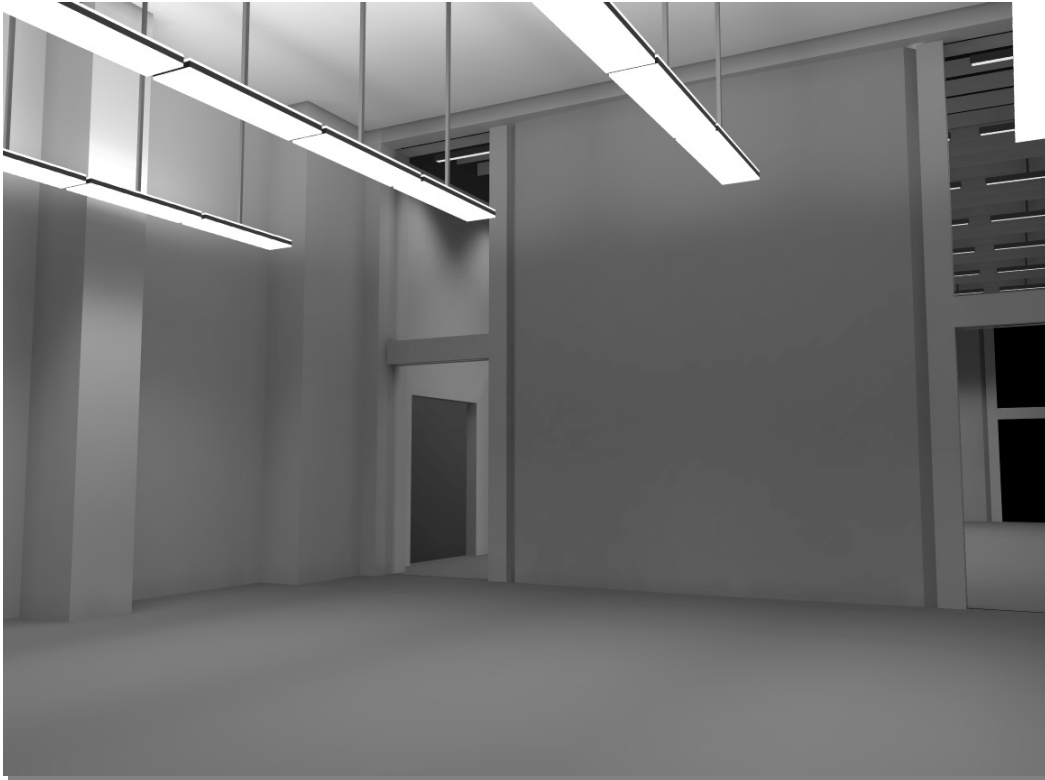
The choice of fixtures will definitely provide a clean and modern appearance, however the locations of the rows of fixtures creates some problems. First, it provides scalloping on the walls which is very irregular since parts of the walls are glass. Comparing the east and west walls, one is very bright while the other is very dark due to this spacing of the luminaires. The row of luminaires next to the east wall seems to be too close to the wall. The track fixtures are located above this and will provide focused light

to the front of the room. Centering the rows of luminaires in the space would provide a more uniform distribution.

Another issue that may arise is glare from the fixtures for patrons walking down the staircase. With the glass wall and the viewing position moving lower, the glare might be very noticeable, even with louvers, unless the windows are shaded. There is not much of a solution to this problem, however, as the illumination of the stone wall in the stairwell will provide a nice accent to this space.

Overall, I feel this is a more stylish way of lighting what is essentially a classroom. The open plenum ceiling limits the range of fixtures to only direct fixtures. The design could be improved, however, with more integration of daylighting and slight modifications to the luminaire layout.

Meeting Room (AGI32 Rendering and Calculation Grid Analysis)



AGI32 Radiosity Rendering. View looking towards west wall. A variety of renderings is available in Appendix C.2, page 44.

This space could be one of the most unique and interesting spaces in the building. Sadly, Not having a furniture layout for this room is probably limiting what has been designed. It seems that this space is caught between being a conference room and a small classroom. Recent changes to the design made the space about eight feet wider, intensifying this issue.

The meeting room and education and lecture rooms are closely related, especially due to the glass partitions between them. However, the lighting systems of the two spaces do not have much in common.

The system provides adequate light levels (approximately 30 to 40 footcandles, See Appendix 2.5, page 48) for a variety of uses, but it is not a customized system for a conference room. The system is dimmable, but like the education and lecture room, it does not integrate the daylighting that is readily available. During the day and without shades, the space is very bright, with over 400 footcandles on the floor (See Appendix C2.6, page 49).

The spacing of the luminaires creates some bright spots on the walls as well as leaving the west wall relatively dark. One of the problems is that these pendant fixtures cannot hang in the path of the pivot door. Perhaps the recent change by the architect to move this wall and change it from a pure glass partition to the pivot door has not yet been reflected in a new lighting design, although this change is shown on the current lighting plans (See Appendix A2.2, page 29).

The fixtures are stylish, but they seem too generic for this application. In both the architecture and lighting design, I think this space is lacking identity. As this project develops further, I can see this space changing. The most recent architectural reflected ceiling plan shows a change to round downlights in this space but the lighting drawings from the same set shows the direct/indirect pendants.

Main Lobby (Lumen Method Calculation and Plan Analysis)

This space is too complex to model and it is difficult to determine the light levels because it is not a well defined area but rather the space between other spaces. To attempt to get a rough idea of the level provided by the general pendant downlights, I completed a lumen method calculation on a rectangular area in the center of the space. The area is 14' wide by 78' long, with a height of 13'. This provides a room cavity ratio of approximately 5.5. I tried to choose the boundaries of the area to provide the best approximation of the entire space.

I used a floor reflectance of .20. For the walls, I used .50. While there are no walls, I choose this number as an approximation because while light will not be reflected back, light will come from other sources. For the ceiling, I calculated an effective ceiling reflectance with the baffles and black acoustical blanket to be approximately .15. With these values, I was able to determine the CU of fixture type SA to be approximately .37.

Using the lumen method equation:

$$\text{Illuminance (FC)} = [\text{lamp lumens/luminaire} * \text{no. luminaires} * \text{CU} * \text{LFF}] / \text{Area}$$

$$\text{Illuminance (FC)} = [3200 * 20 * .37 * .83] / 1092 = \mathbf{18 \text{ FC}}$$

Considering the design criteria, I feel this number is adequate. One problem I see, however, is that the system is not very flexible. This space may seem very bright at night and not provide enough contrast to the points of interest, such as the gift shop and box office. I think putting these fixtures on a dimming system would be very beneficial and help create the right atmosphere in the space when it is desired.

These fixtures were a late change from surface mounted luminaires that I assume would have been mounted above the baffles. While it is not explicitly shown, I assume these fixtures will be mounted level with the baffles or slightly below them. I think this is a good change which helps to provide more light to the surface instead of wasting light in the ceiling plenum. I also think this change will help the appearance of the space. The GER line of fixtures from Omega is stylish and modern in appearance. This will compliment the metal panels and metal baffles.

I like the idea of washing the wall of the theatre drum. This focuses attention on the core function of the building and helps to create layers of light and a relaxing atmosphere. Again, my only concern is that the ambient levels are too high and they will wash over this feature. Washing this wall will also highlight the different materials and paint colors of the drum.

Another criteria which was important, highlighting materials, is difficult to analyze for this space because many of those materials lie in adjacent spaces. The nature of the lobby as a space between spaces means that the lighting system for all the spaces must mesh to create a single overall appearance. The stone in the staircase is highlighted which I think will create an inspiring contrast between the rough stone texture and smooth metal texture that is prevalent throughout the building.

Considering the lobby as its own entity, it is difficult to come to a conclusion on the effectiveness of the lighting system. However, when including adjacent spaces that act as points of interest for the lobby space, I feel the system will provide several lighting layers and enough non-uniformity to be a relaxing and inviting space.

Liberty Avenue Façade (Rendering and Plan Analysis)



Photoshop Image of Liberty Avenue and William Penn 'Sail' Corner. The North Façade is brighter and more colored than it might appear in true darkness. This is a conceptual image and not meant to accurately represent the lighting design. (Original Rendering by PERKINS + WILL)

Overall, I feel the design is successful, but there are certain items that I feel would make the design outstanding. I see the strongpoints of the design as the strong emphasis of the interior becoming the exterior image of the building. With clear glass, the interior shines through to make the building appear lively. This concept also prevents the use of excessive floodlighting to wash the façade, and will probably keep the neighbors content. The only drawback to this design is that either the lights will have to stay on around the clock or the building will become a black hole.

While the little exterior lighting that is provided does focus on the sail feature, I still feel it could use more emphasis. In this rendering especially, it seems to go dark against the glowing Liberty Avenue façade. This is partly due to the rendering, but also partly due to the fact that it is only lit from below. With its concave shape, the top will be significantly darker. The newest architectural plans call for fritted glass on the top portion of the sail. This may help it catch the light more than the clear glass which the light will simply pass through. The in-grade fixtures do go against the philosophy of dark skies, but considering the location of the building, I do not find this a cause for concern.

I think the strongest part of the façade is the accent of the stone next to the sail. The lighting here does a good job of emphasizing the contrast in materials between metal panels and the

stone. The patterns produced are pleasing, and they continue down the southeast façade. The lighting and banners here help to enliven an otherwise bland façade.

One area that I feel is neglected is the outdoor seating area for the café. This area is not lit at all (See Appendix A4.2, page31). Often times theatre performances are in the evening and this space would likely get used if it were illuminated. Without light, this space is wasted. Even if the café will not be open past the afternoon, I still feel the space could be used as a gathering area before or after a show on a nice summer evening.

SECTION FOUR: File Listing

CAD Drawings and rendered images are available through links with each image, or can be found at the following location:

T:/mpr184/drawings/

- A211 – First Floor Architectural Plan
- A212 – Second Floor Architectural Plan
- A300 – Liberty Avenue Façade Elevation
- A401 – Liberty Avenue Façade Section
- A501 – Interior Elevations
- A502 – Interior Elevations
- A503 – Interior Elevations
- L000 – Lighting Schedule Part I
- L001 – Lighting Schedule Part II
- L100 – Exterior Lighting Plan
- L601 – First Floor Lighting Plan
- L602 – Second Floor Lighting Plan
- L800 – Lighting Details 1
- L801 – Lighting Details 2
- L802 – Lighting Details 3
- awcc_corner.jpg
- awcc_side.jpg

AGI32 Files:

T:/mpr184/working files/Tech Report One Files/
Education and Meeting Model.A32
Education and Meeting Model – Daylight.A32

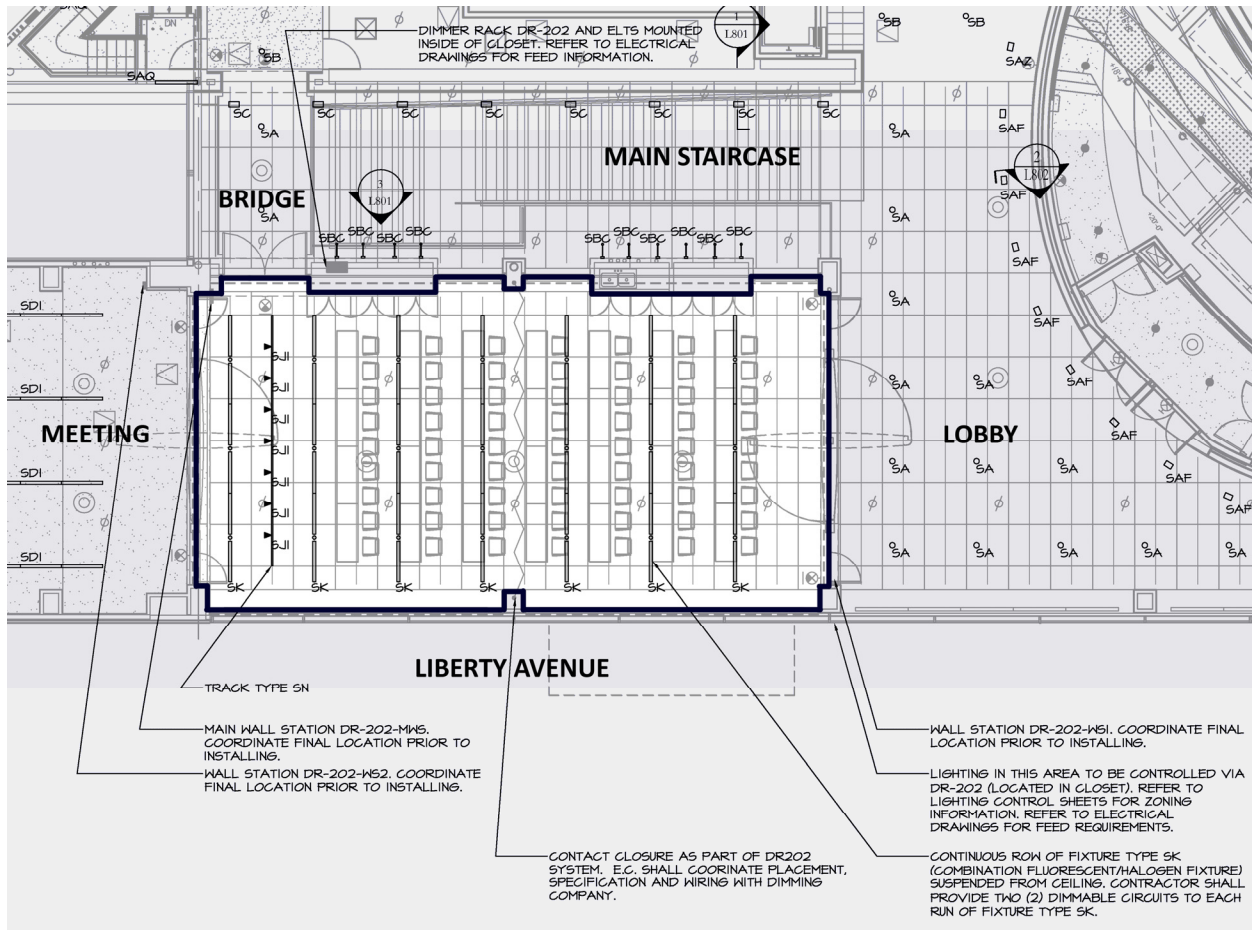
Other Files:

T:/mpr184/working files/Tech Report One Files/
Light Loss Factors.xlsx
Fixture Schedule.xlsx

T:/mpr184/working files/Tech Report One Files/Images/
Rendered tiff files are available in this directory.

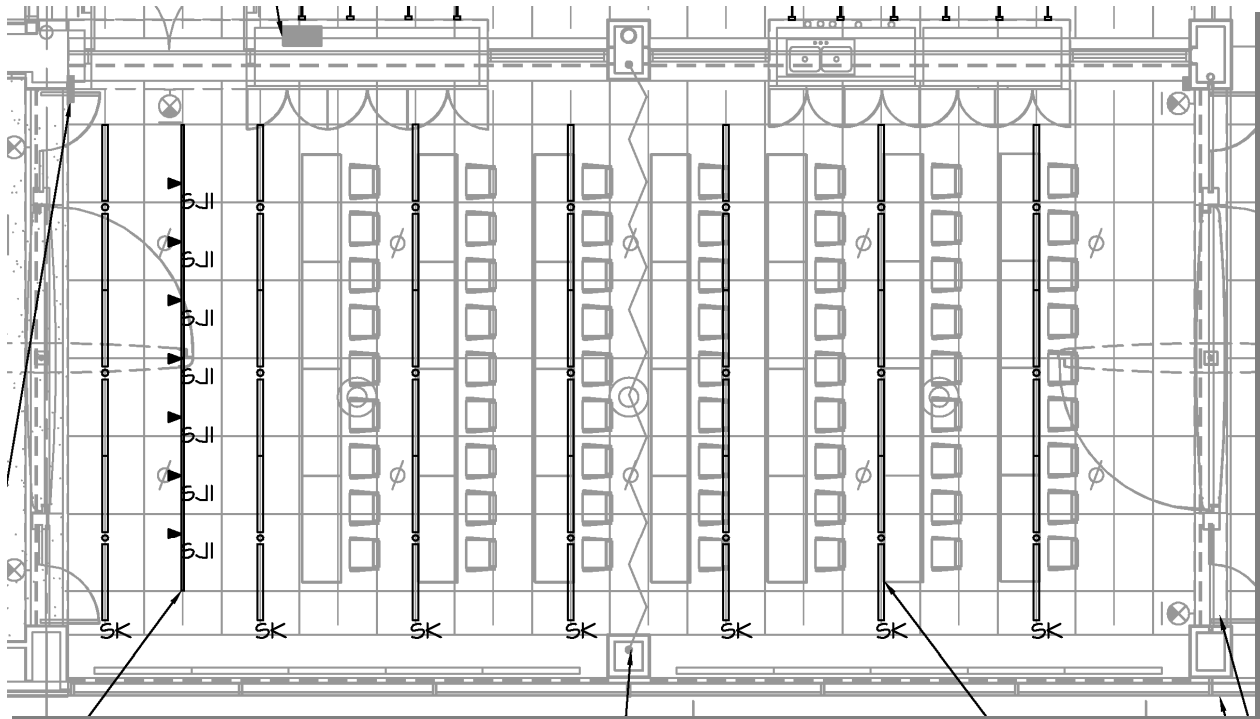
SECTION FIVE: Appendix A - Drawings

A.1: Education and Lecture Room Drawings



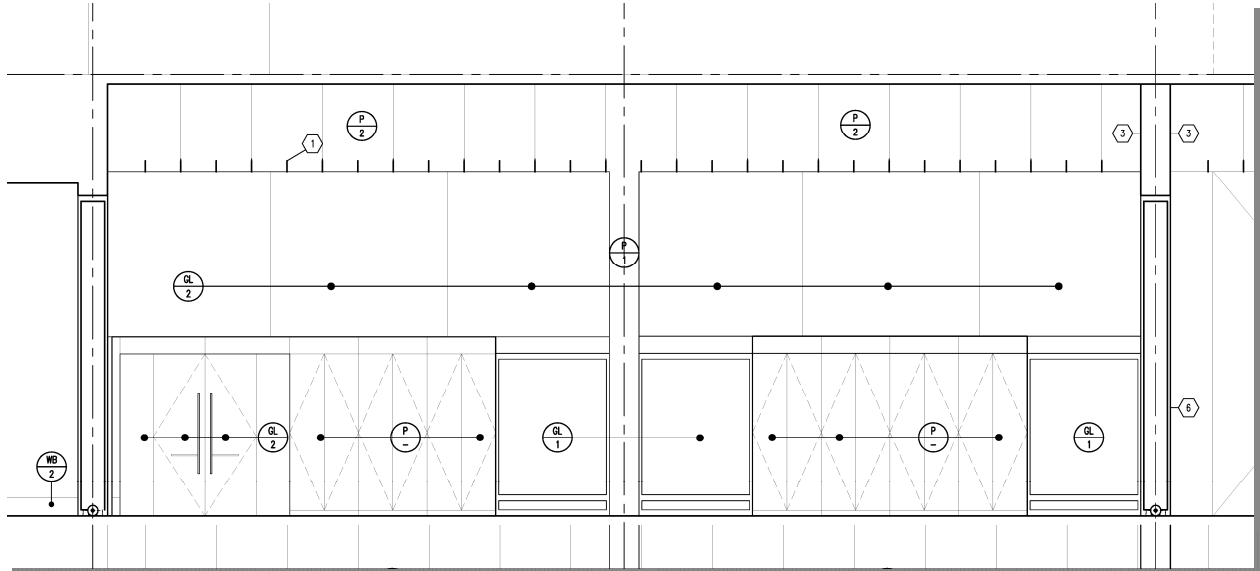
A1.1 Education and Lecture Room Lighting Plan (Not To Scale)

Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/L602.dwg>



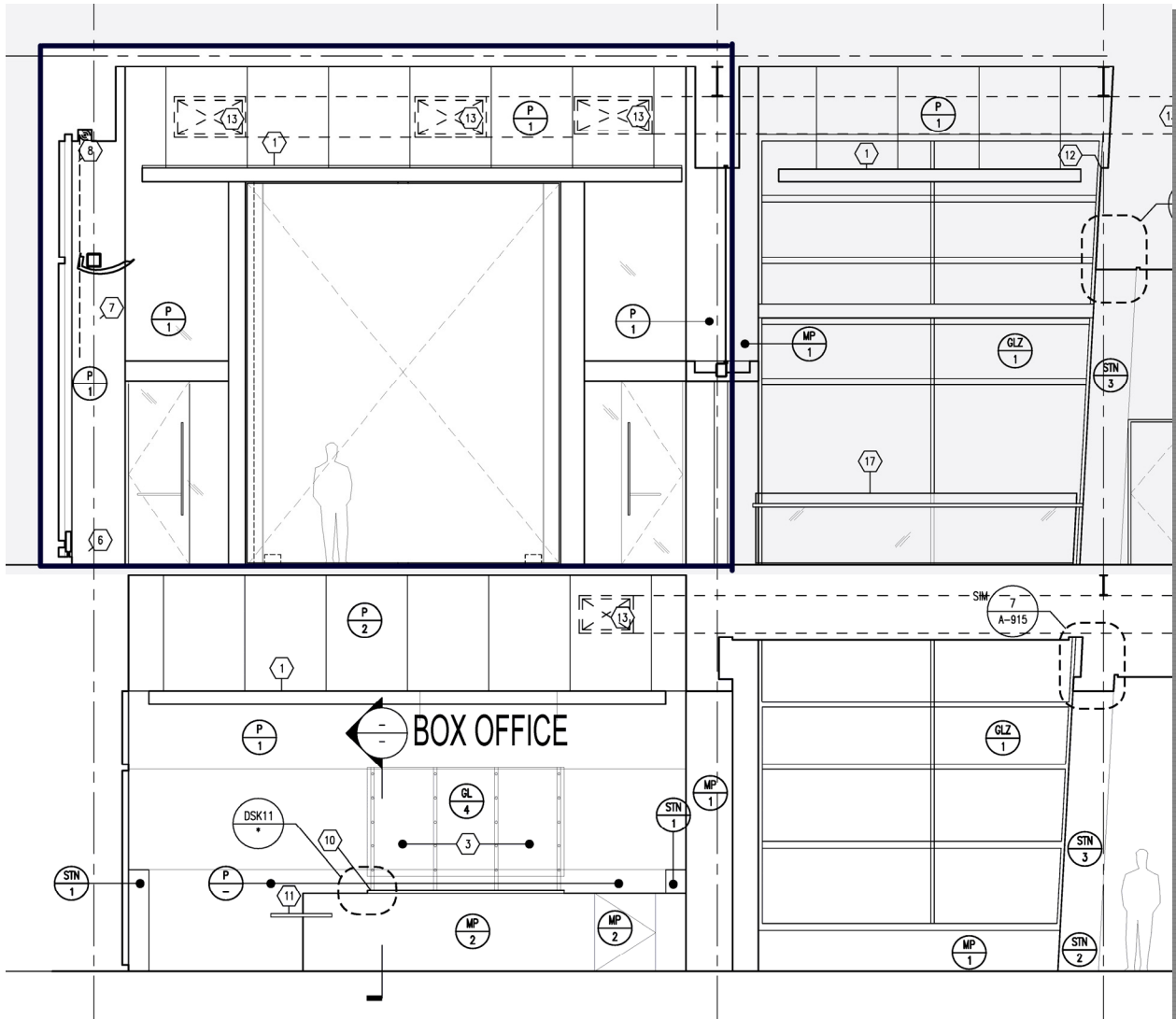
A1.2 Enlarged Education and Lecture Room Lighting Plan (Not to Scale)

Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/L602.dwf>



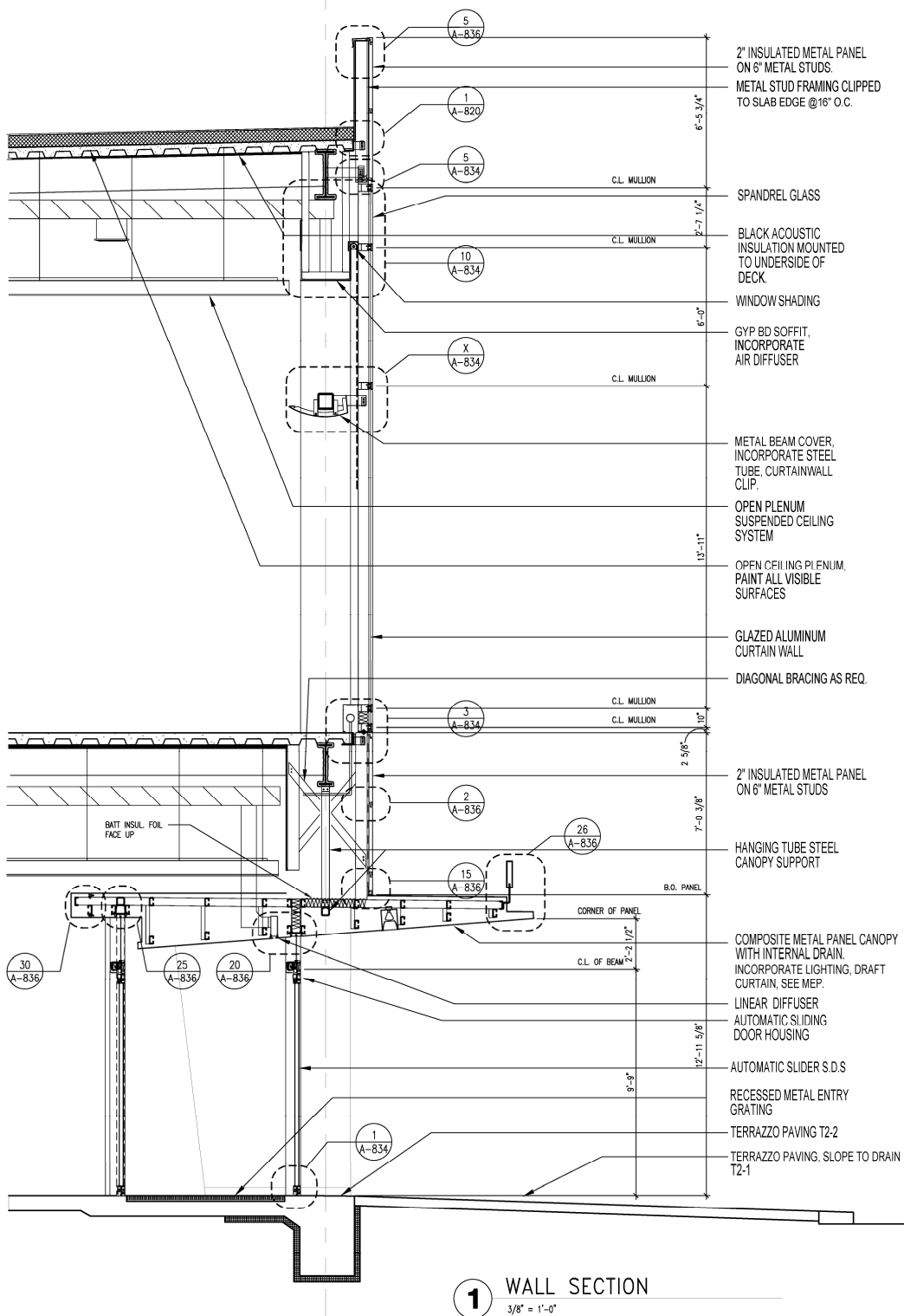
A1.3 South Wall of the Education and Lecture Room (Not to Scale)

Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/A502.dwf>



A1.4 Section looking towards the East Wall of the Education and Meeting Room (Not to Scale)

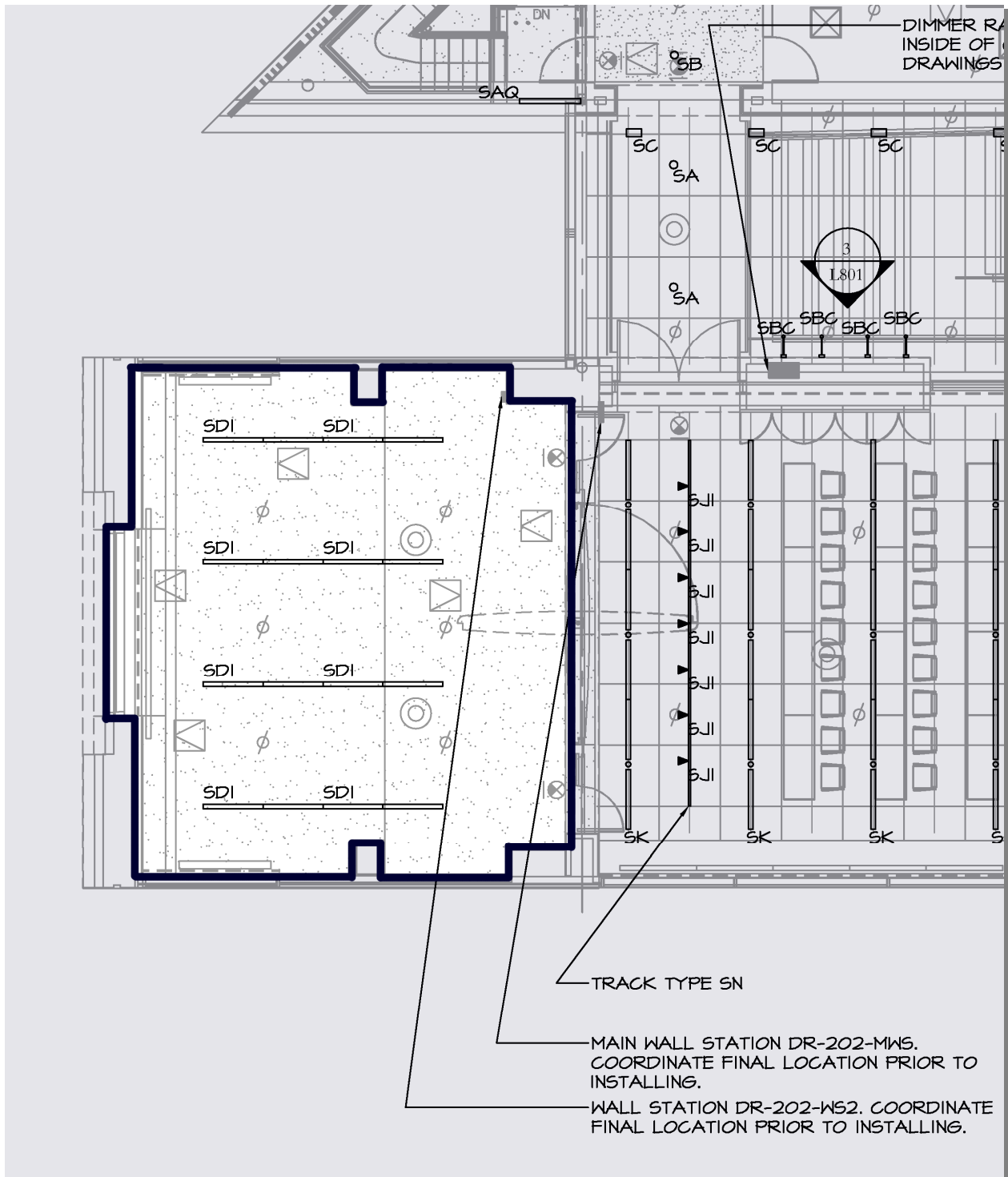
Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/A501.dwf>



A1.5 Wall Section through Meeting Room and Entry Vestibule (Not to Scale)

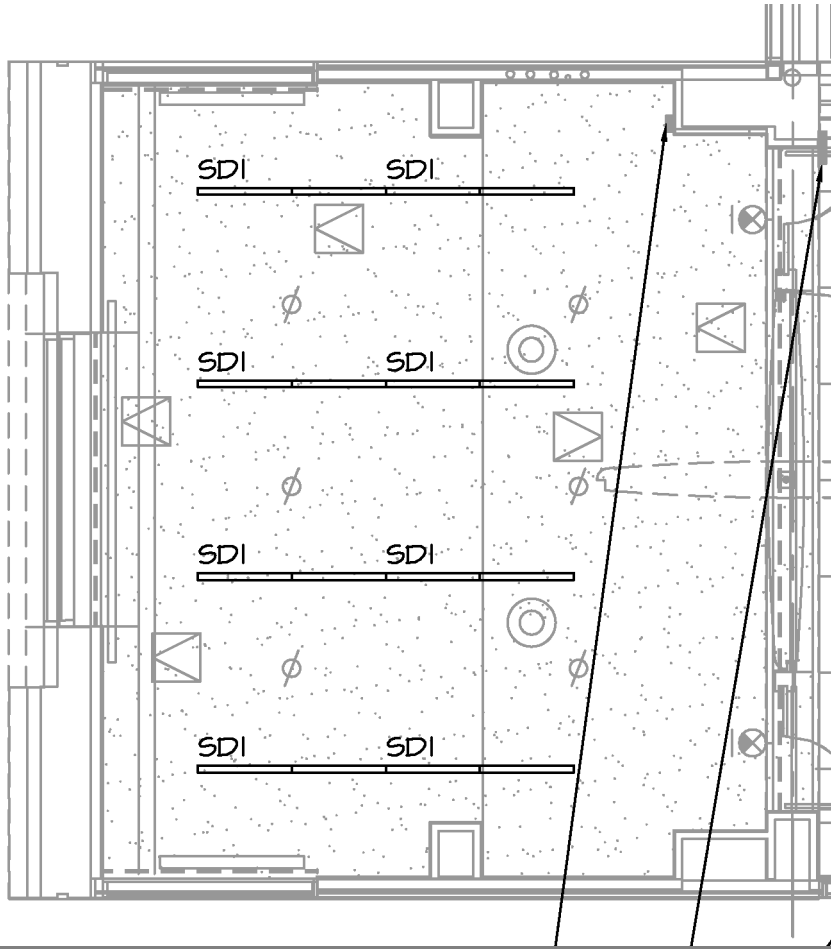
Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/A501.dwf>

A.2: Meeting Room Drawings



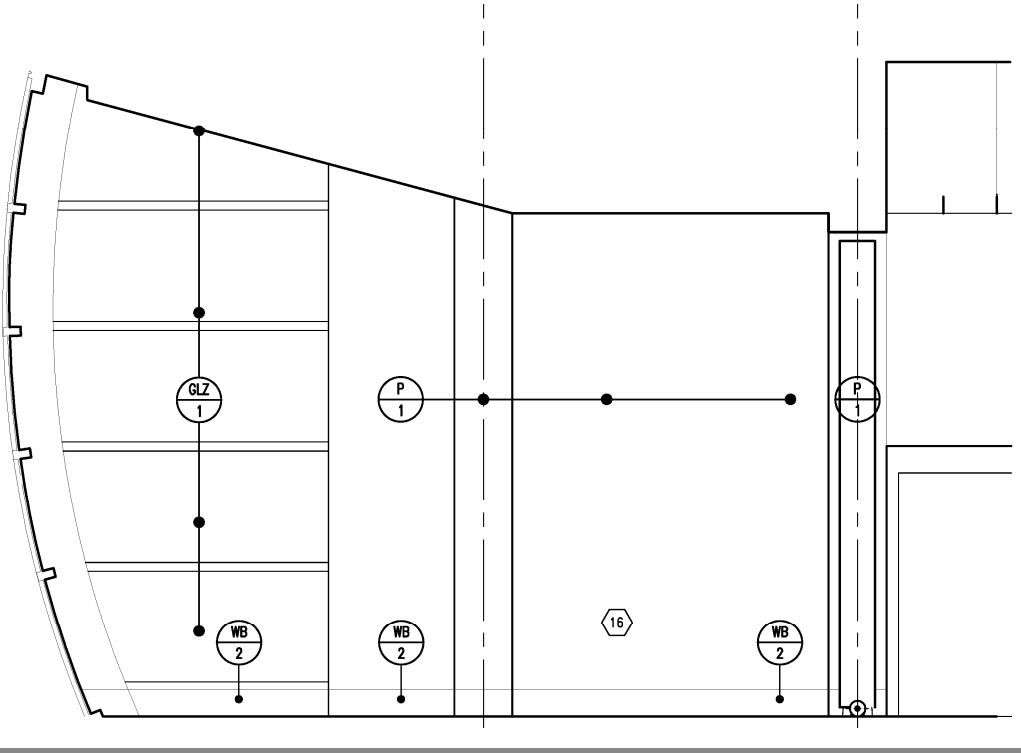
A2.1 Meeting Room Lighting Plan (Not to Scale)

Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/L602.dwf>



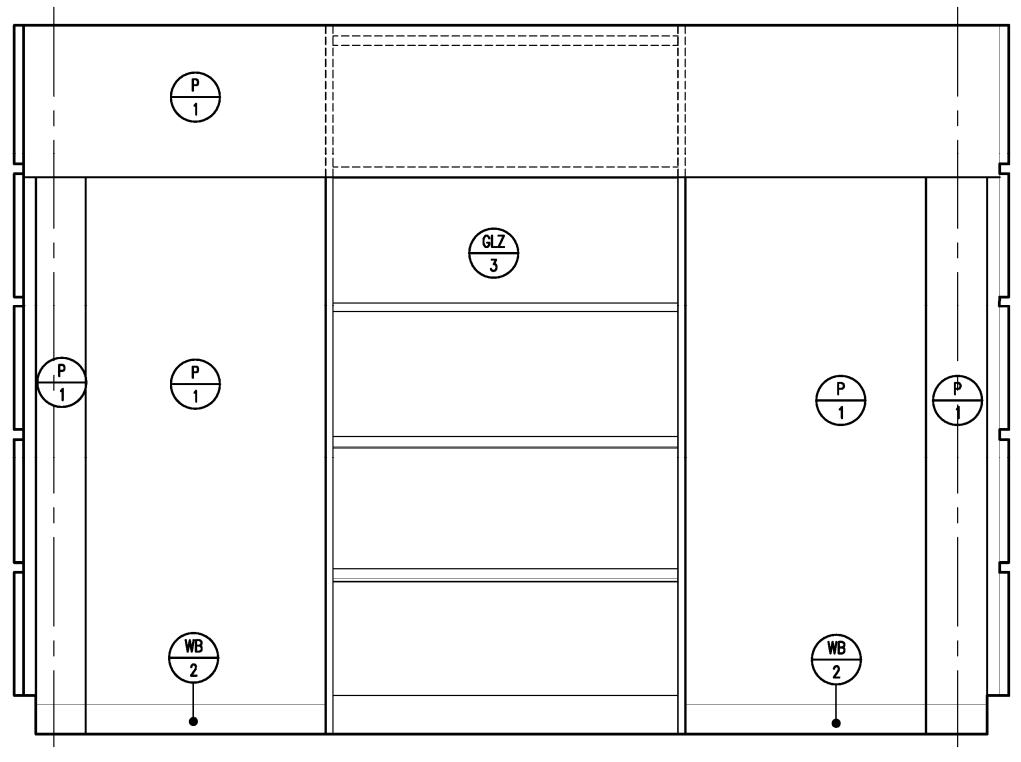
A2.2 Enlarged Meeting Room Light Plan (Not to Scale)

Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/L602.dwf>



A2.3 Meeting Room South Wall Elevation (North Wall is Mirror Image) (Not to Scale)

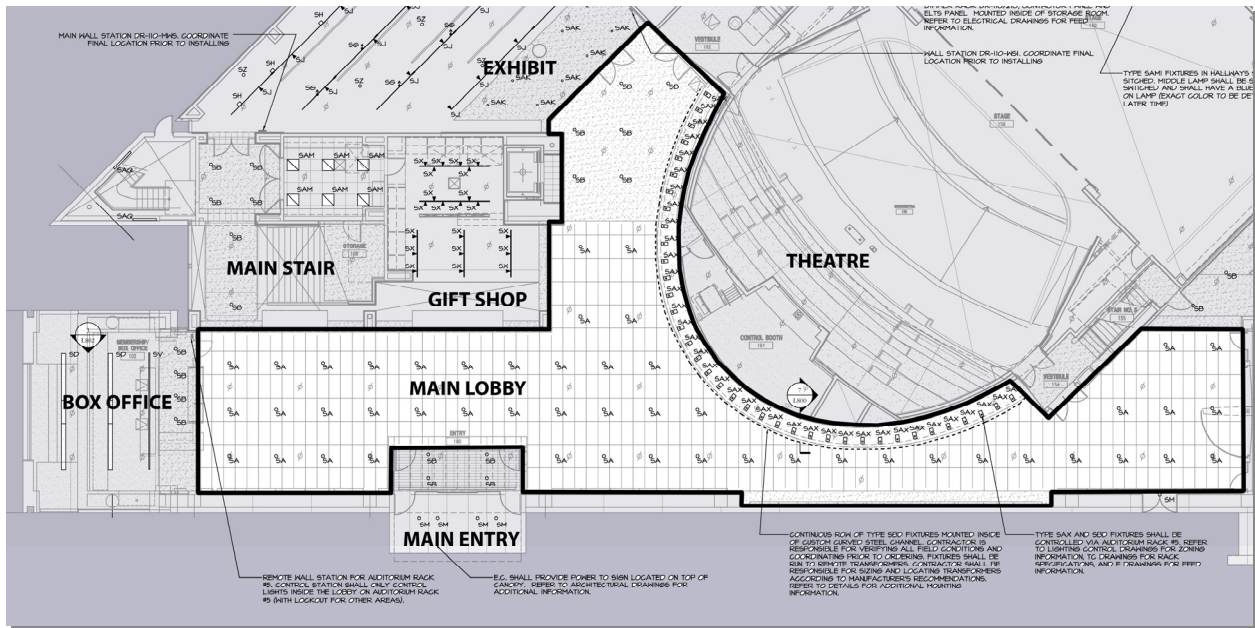
Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/A502.dwf>



A2.4 Meeting Room East Wall Elevation (Not to Scale)

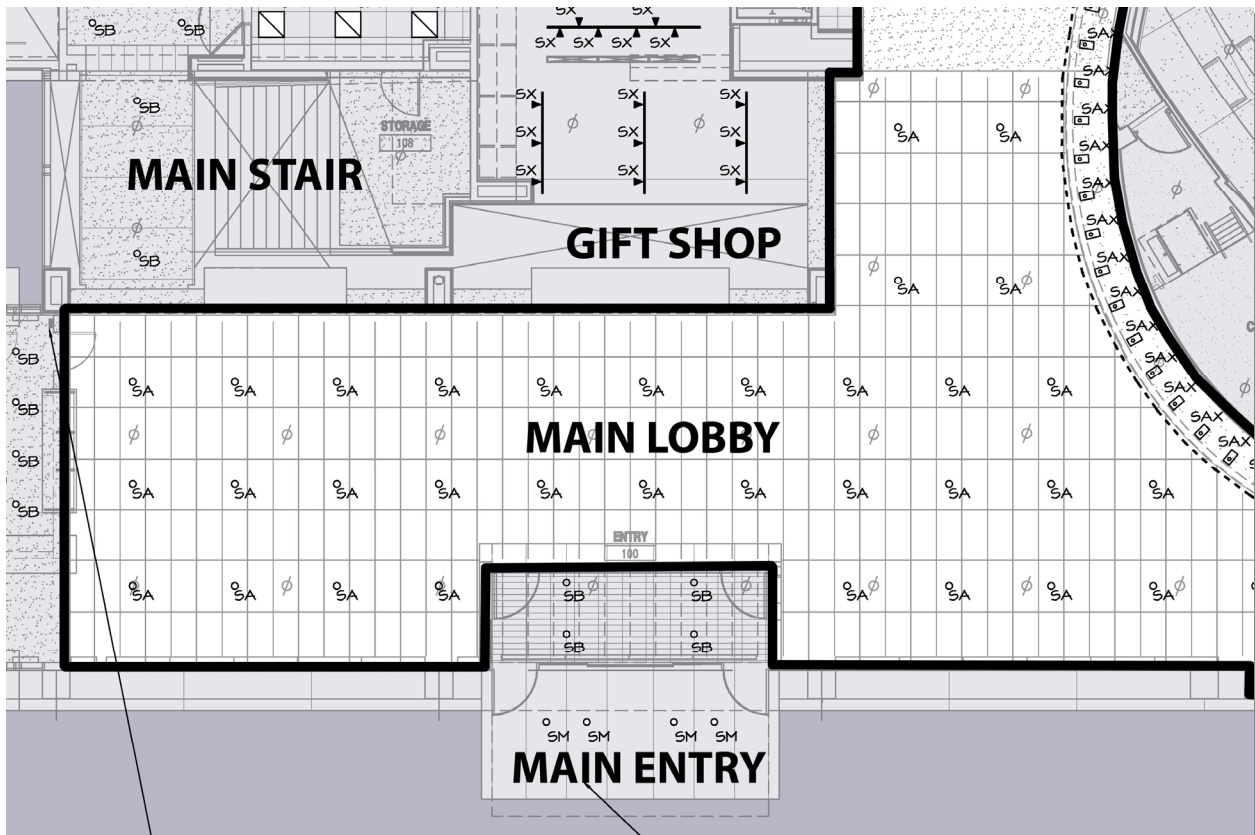
Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/A502.dwf>

A.3: Main Lobby Drawings



A3.1 Main Lobby Lighting Plan (Not to Scale)

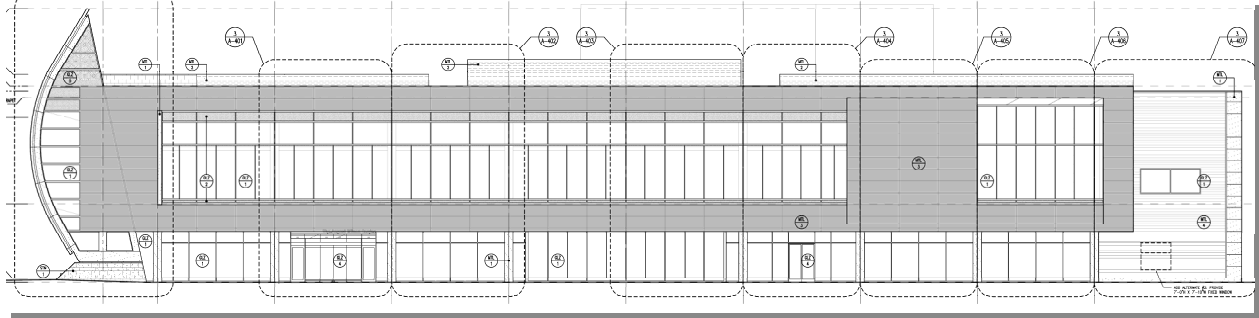
Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/L602.dwf>



A3.2 Enlarged Main Lobby Lighting Plan (Not to Scale)

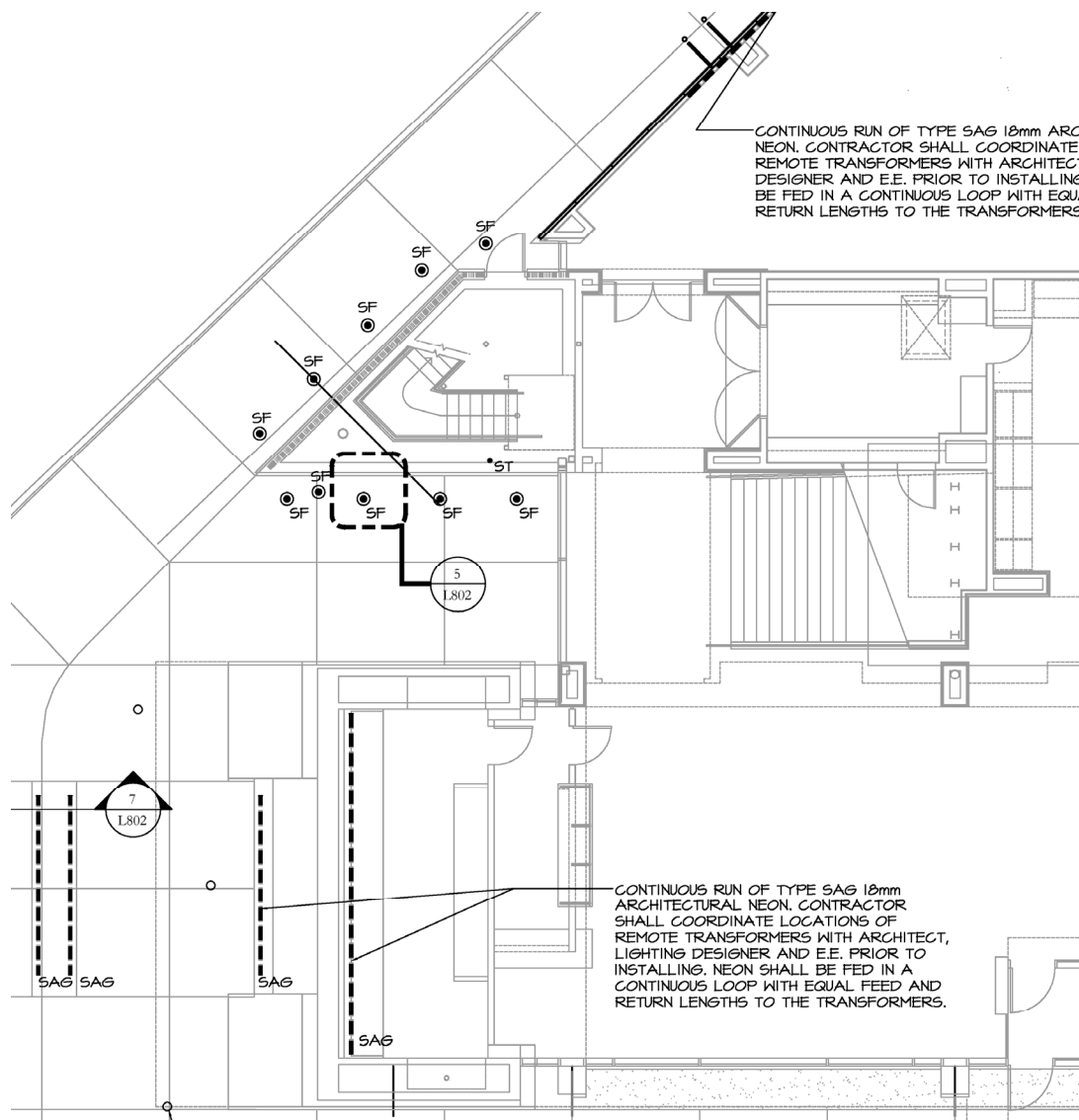
Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/L602.dwf>

A.4: Liberty Avenue Facade Drawings



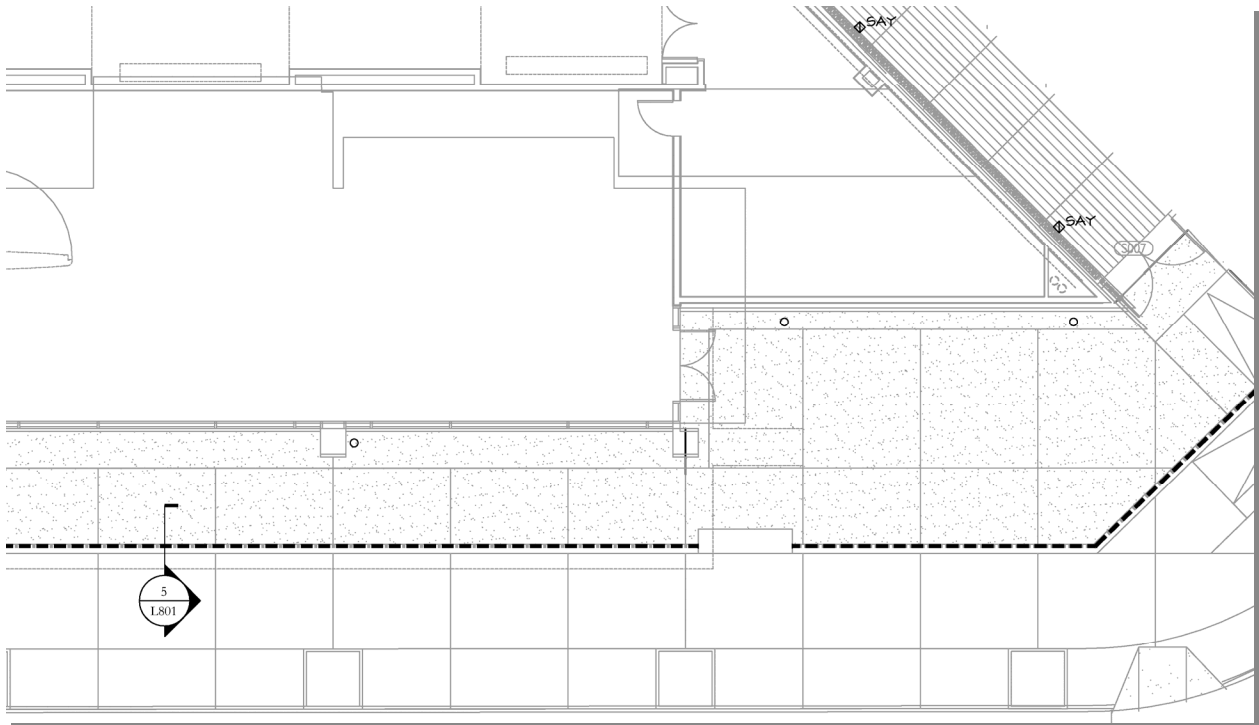
A4.1 Liberty Avenue (North) Elevation (Not to Scale)

Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/A300.dwf>



A4.2 Partial Exterior Lighting Plan – Sail Area (Not to Scale)

Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/L100.dwf>



A4.3 Partial Exterior Lighting Plan – Seating Area (Not to Scale)

Drawing available at <http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/L100.dwf>



A4.4 Liberty Avenue Rendering (Rendering by PERKINS + WILL)

Image available at http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/awcc_side.jpg




A4.5 Liberty Avenue and William Penn Rendering (Rendering by PERKINS + WILL)

Image available at http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/drawings/awcc_corner.jpg


SECTION FIVE: Appendix B – Fixture Schedules


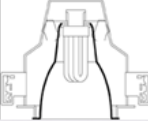
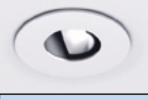
[Note: This information is as accurate as possible. The fixture schedule from Studio i Lighting is noted to be obsolete as it was prepared in 2006. A correct listing of fixtures is available in the approved submittal package from Repco II, but this information is not available to me. Fixture types and wattages are generally correct. I have attempted to update and correct catalogue numbers, but some may not match the exact fixture selected for the project.]




Education and Lecture Room Lighting Fixture Schedule								
Tag	Image	Fixture Description	Mounting	Manufacturer	Catalog Number	Watts/Lamp	Volts	Quantity
SK		24' TSHO linear fluorescent RP1 strip lights with three 1' sections of LV MR16 downlights	Suspended	ZUMTOBEL	RX5-DX 1545: 4'-8'-8'-4' w/ dimming and (3) modules	(6) 54, (3) 50	120	7 sets
SJ1	[unknown]	Halogen Par 38 track head with integral baffles, hood, and WL	Track	LSI	238-00-WL	100	120	7
SN	NA	Single circuit surface mount track	Surface Ceiling	LSI	3100 Series, Black	NA	NA	1

Full size schedules available at

<http://www.engr.psu.edu/ae/thesis/portfolios/2008/mpr184/files/schedules.pdf>

Meeting Room Lighting Fixture Schedule								
Tag	Image	Fixture Description	Mounting	Manufacturer	Catalog Number	Watts/Lamp	Volts	Quantity
SD1		Linear Fluorescent direct indirect pendant	Suspended	ZUMTOBEL	CSI-1545-xx-T-DO-DA-CD1	54	120	16

Main Lobby Lighting Fixture Schedule								
Tag	Image	Fixture Description	Mounting	Manufacturer	Catalog Number	Watts/Lamp	Volts	Quantity
SA		CFL pendant downlight	Suspended	DAYBRITE (Omega Origins)	GER6-42PLT-WH-CSS-S-U	42	120	49
SB		CFL recessed downlight with nominal 6" opening	Recessed Ceiling	EDISON PRICE	TRPV 42/6-ECOL	42	120	6
SAX		Recessed MR16 wallwash	Recessed Ceiling	RSA	ACM5002-S w/ACM500-MAG-120	50	120/12	37
SBD	NA	Neon (Interior) with dimmable transformer	Custom	SQUARE 1	25mm, triphospher 3000k w/ European bendback	NA	Per EE	NA

Facade Lighting Fixture Schedule								
Tag	Image	Fixture Description	Mounting	Manufacturer	Catalog Number	Watts/Lamp	Volts	Quantity
SF		CMH burial uplight with internal linear spread lens, 6 degree wallwash optic, and cool touch adapter	Recessed Ground	WE-EF	ETC 150 -HO-6 611-5053 w/ 611-8156 611-8158 and 611-8050	150	120	20
SM		CFL vertical recessed downlights	Recessed Ceiling	WE-EF	DOC 250	26	120	2
SAG	NA	Neon (Exterior) with dimmable transformer	Custom	SQUARE 1	18mm, triphospher 3000k w/ European bendback	NA	Per EE	NA
SAR		CMH spotlight with ornamental bracket arm	Wall	WE-EF	FLC230-F, 667-0152 flood lens	35	120	10
SBB	[Unknown]	Outdoor rated fluorescent floodlight	Surface Unistrut			(2) 32	120	2

	Light Loss Factors					
	BF	LLD	LDD	RSDD	TOTAL	
SK (Linear)	1.02	0.920	Category II	0.950	0.930	0.829
SK Spot, SJ1	1	0.767	Category V	0.870	0.970	0.647
SD1	1.02	0.920	Category IV	0.880	0.970	0.801
SAX	1	1.000	Category V	0.870	0.970	0.844
SA, SB	0.95	0.940	Category II	0.950	0.980	0.832

(12 Month Cycle)
(Clean Environment)

B2.2 Light Loss Factors

SECTION FIVE: Appendix C – Renderings and Background Information

AGI Rendering Settings

These rendering settings were used for all renderings. They are the general settings. Some modifications had to be made to the mesh on certain surfaces.

Auto mesh levels:

8': .5

32': 1

128': 2

384': 3

Other: 4

Element Size Factor: .5

Adaptive Subdivision:

Maximum Subdivision Level: 3

Minimum Element Area: .25

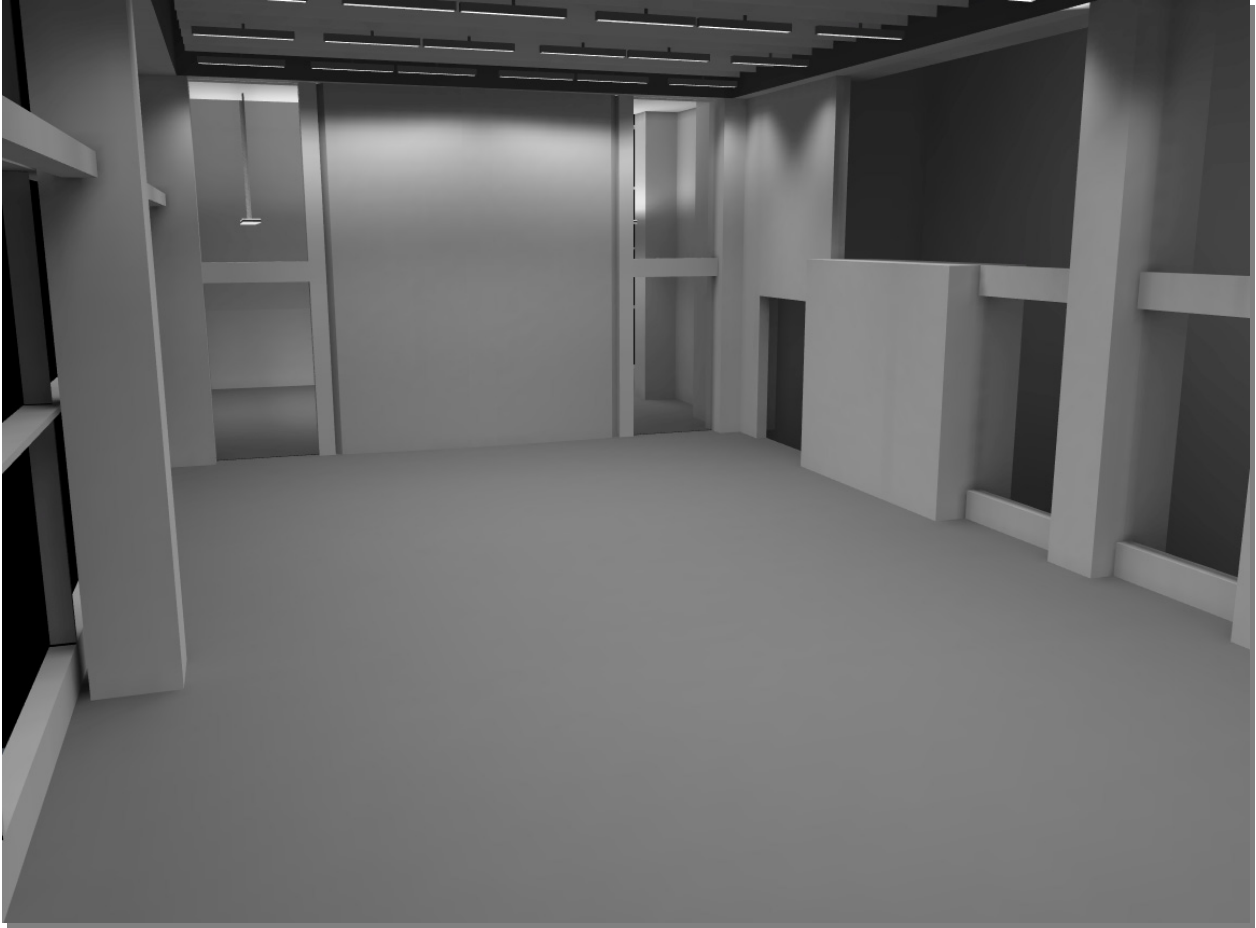
Element Luminance Threshold: 1.2

Radiosity Convergence:

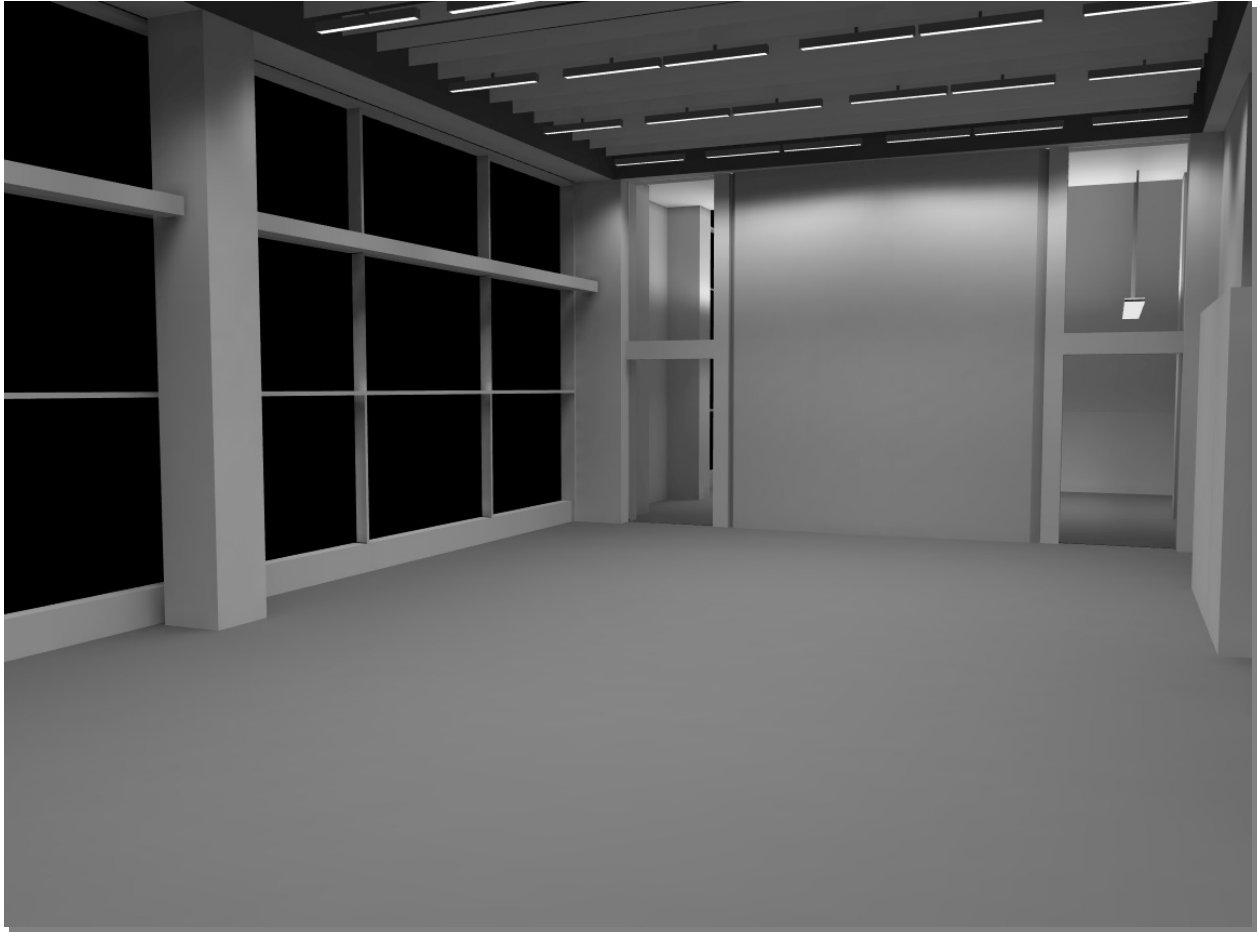
Maximum Steps: 1000

Stopping Criterion (Convergence): .01

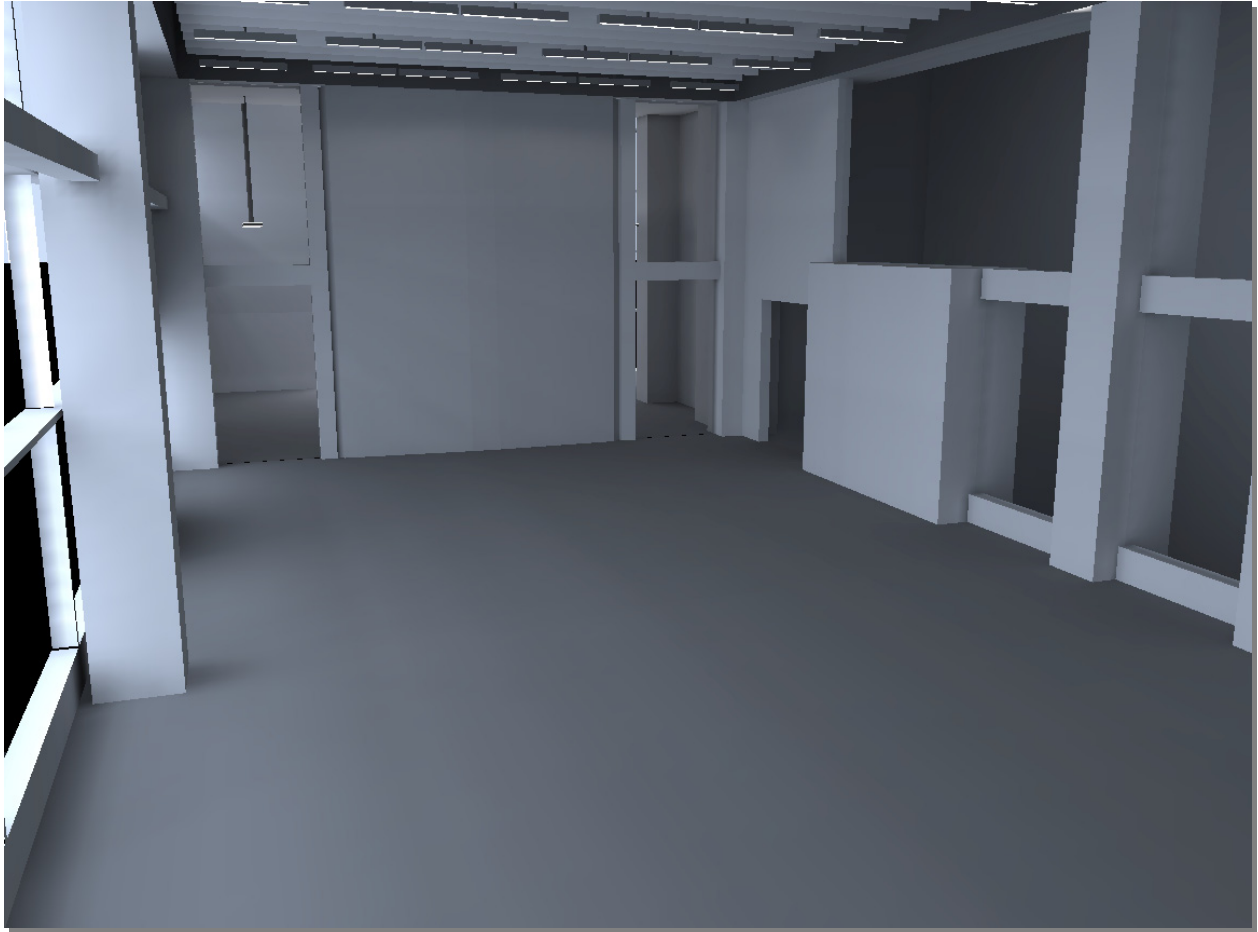
C.1: Education and Lecture Room Renderings



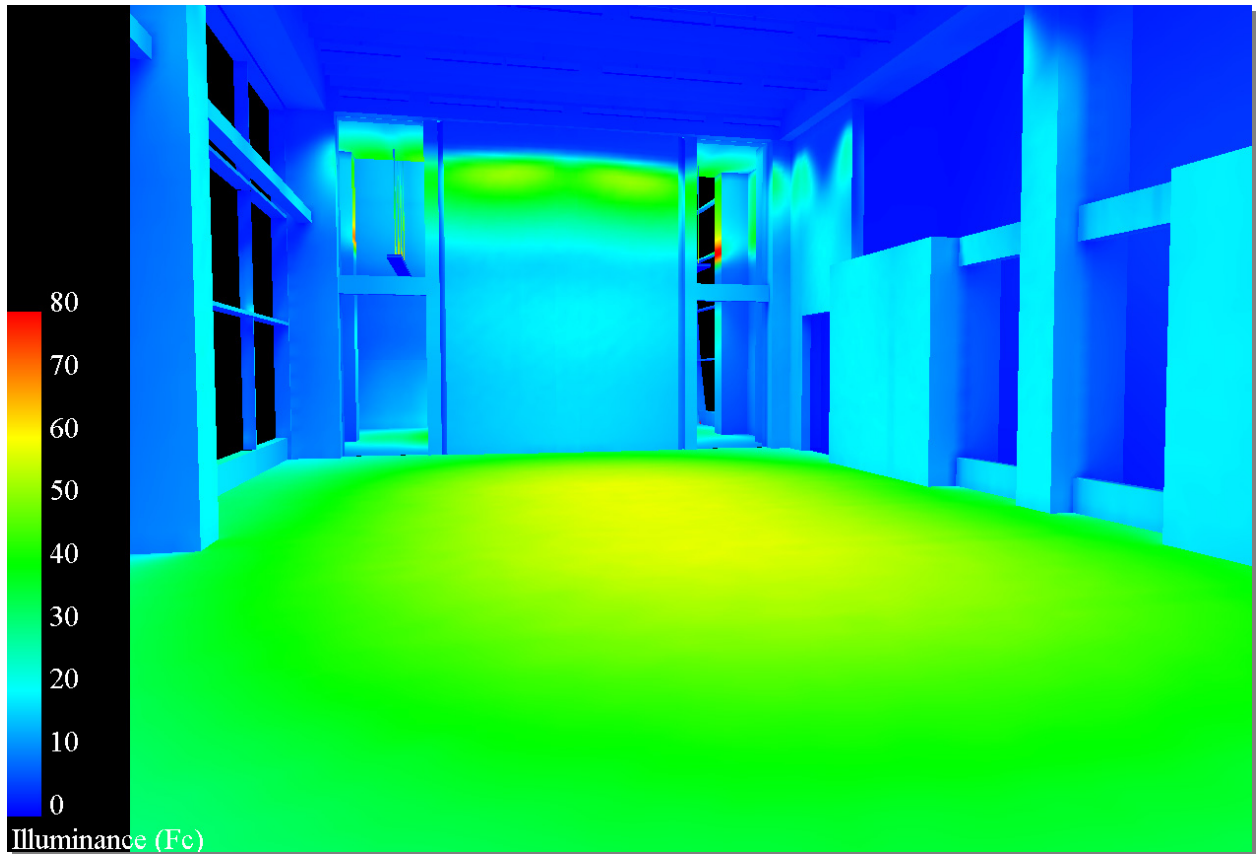
C1.1 Education and Lecture Room AGI32 Radiosity Rendering. View towards east wall.



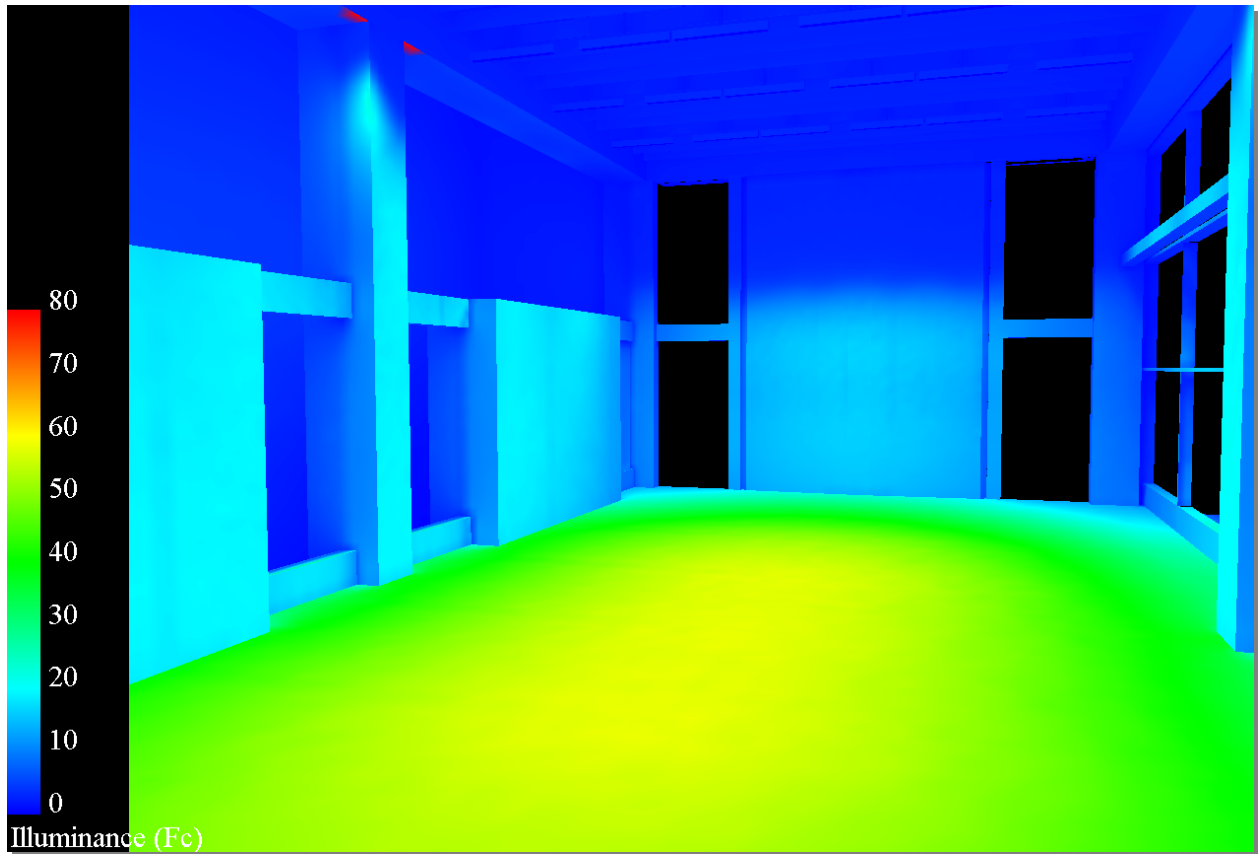
C1.2 Education and Lecture Room AGI32 Radiosity Rendering. View towards east and north walls.



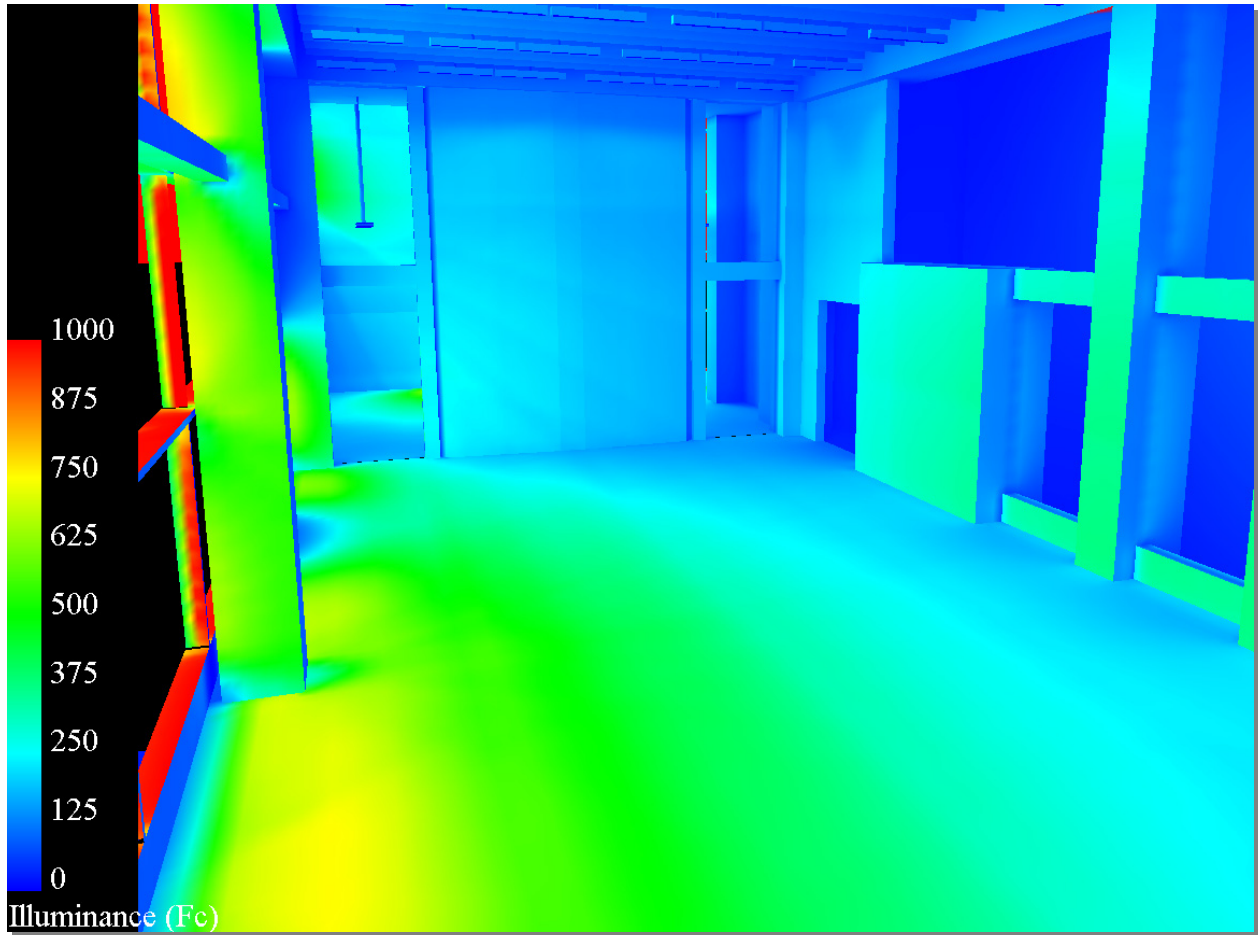
C1.3 Education and Lecture Room AGI32 Radiosity Rendering with Daylighting.



C1.4 Education and Lecture Room AGI32 Psuedo Color Illuminance Rendering. View towards east wall.



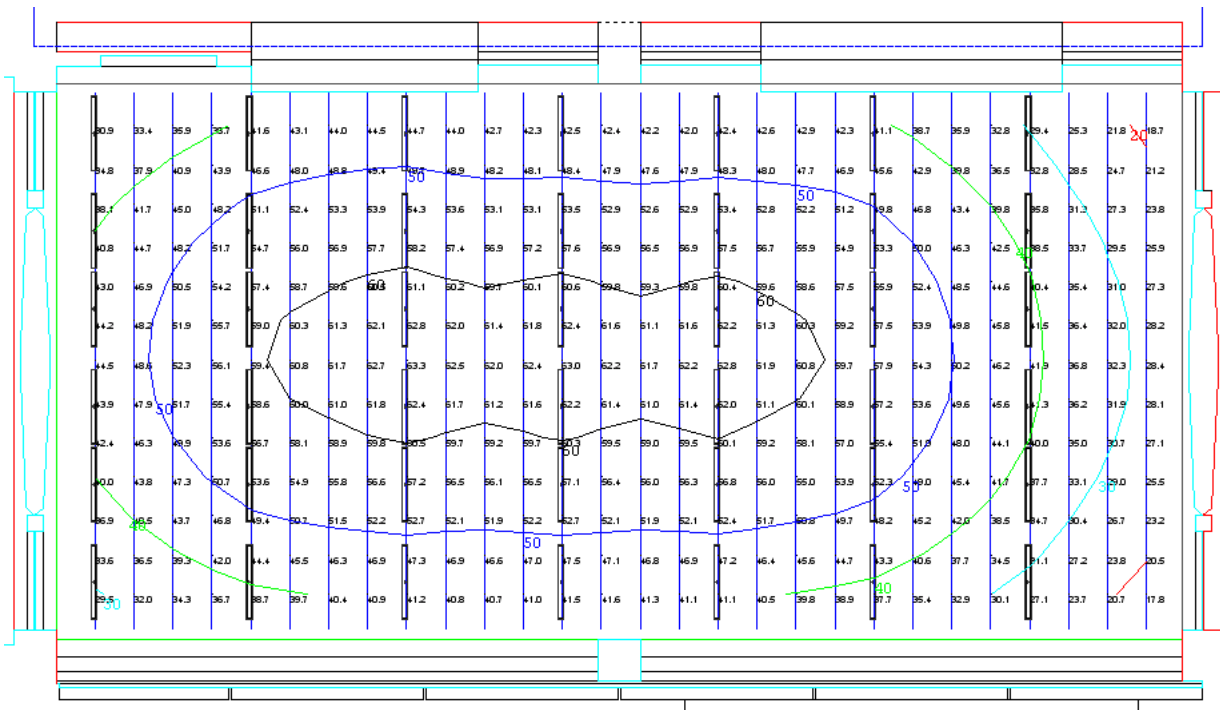
C1.5 Education and Lecture Room AGI32 Psuedo Color Illuminance Rendering. View towards west wall.



C1.6 Education and Lecture Room AGI32 Psuedo Color Illuminance Rendering with Daylight. View towards east wall.

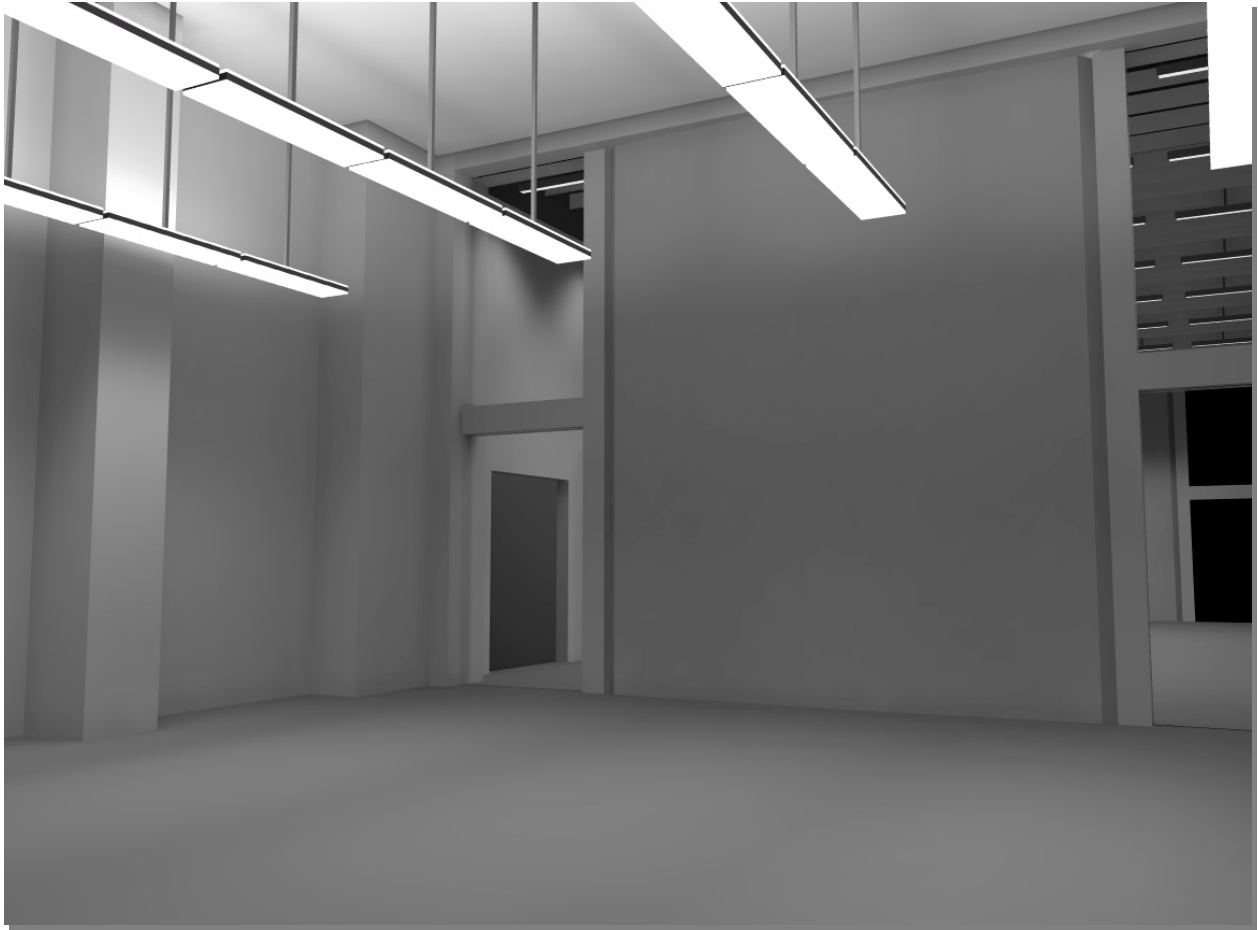


C1.7 Education and Lecture Room AGI32 Meshing Levels.



C1.8 Education and Lecture Room AGI32 Work Plane Calculation Grid.

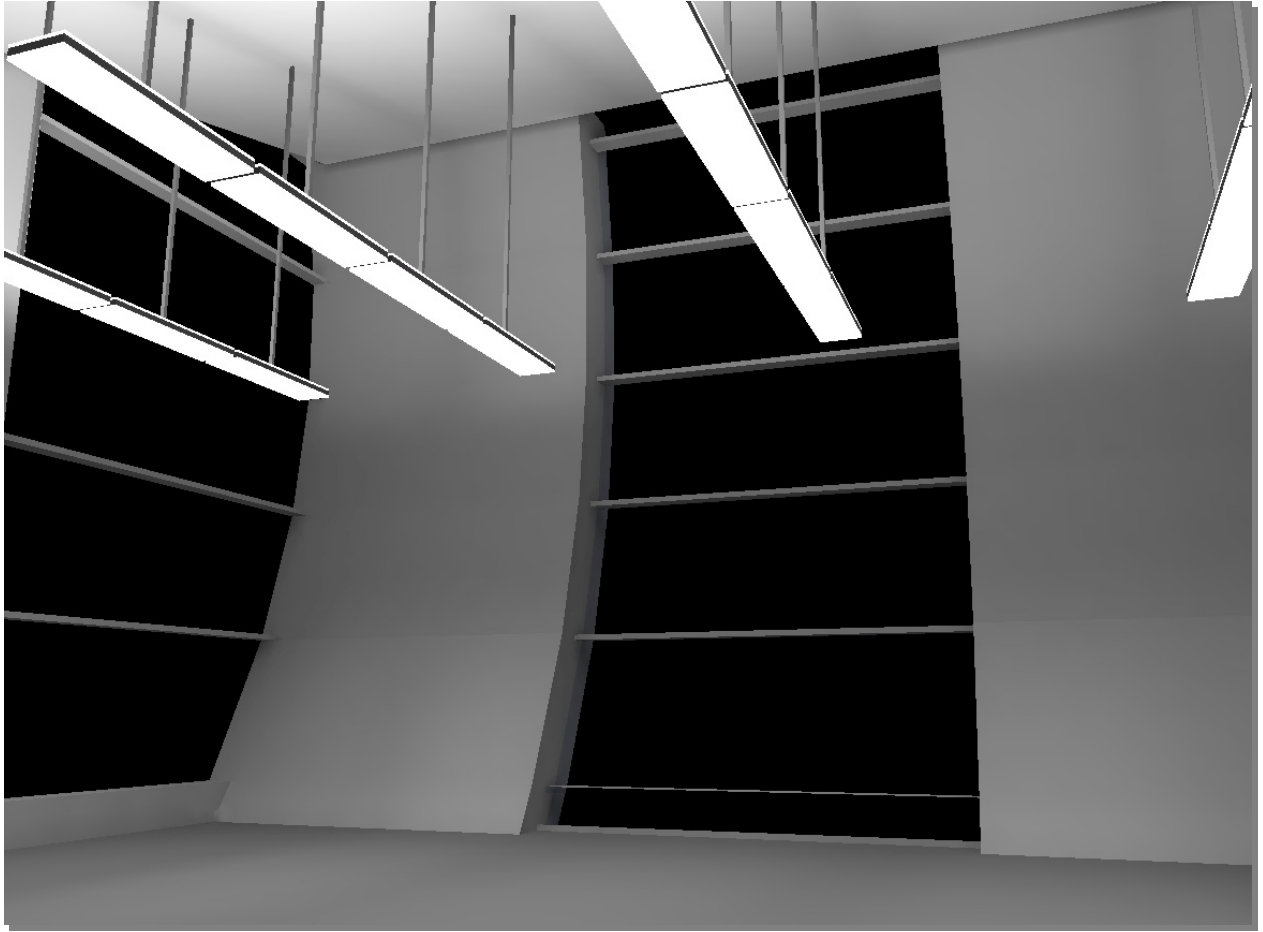
C.2: Meeting Room Renderings



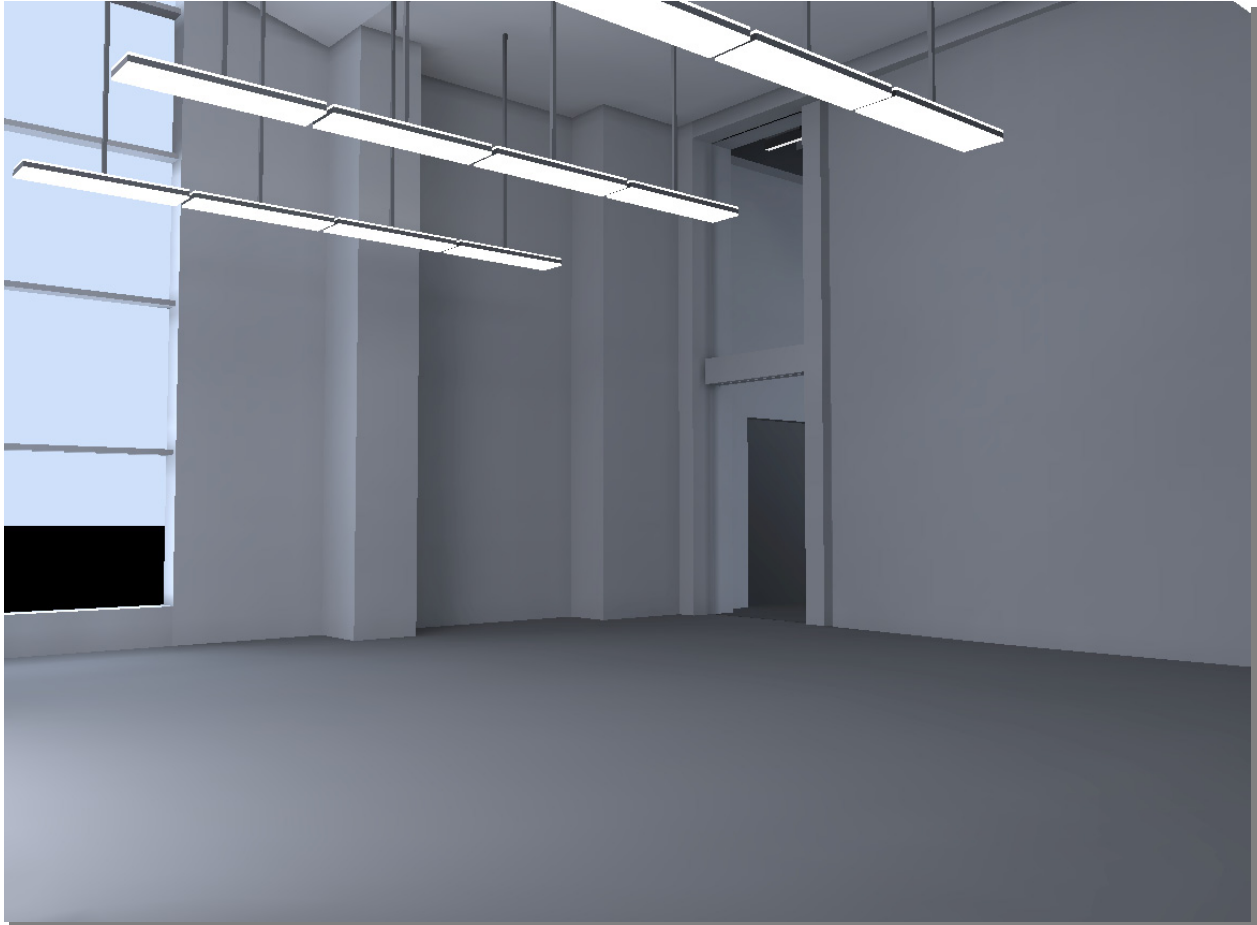
C2.1 Meeting Room AGI32 Radiosity Rendering. View towards west wall.



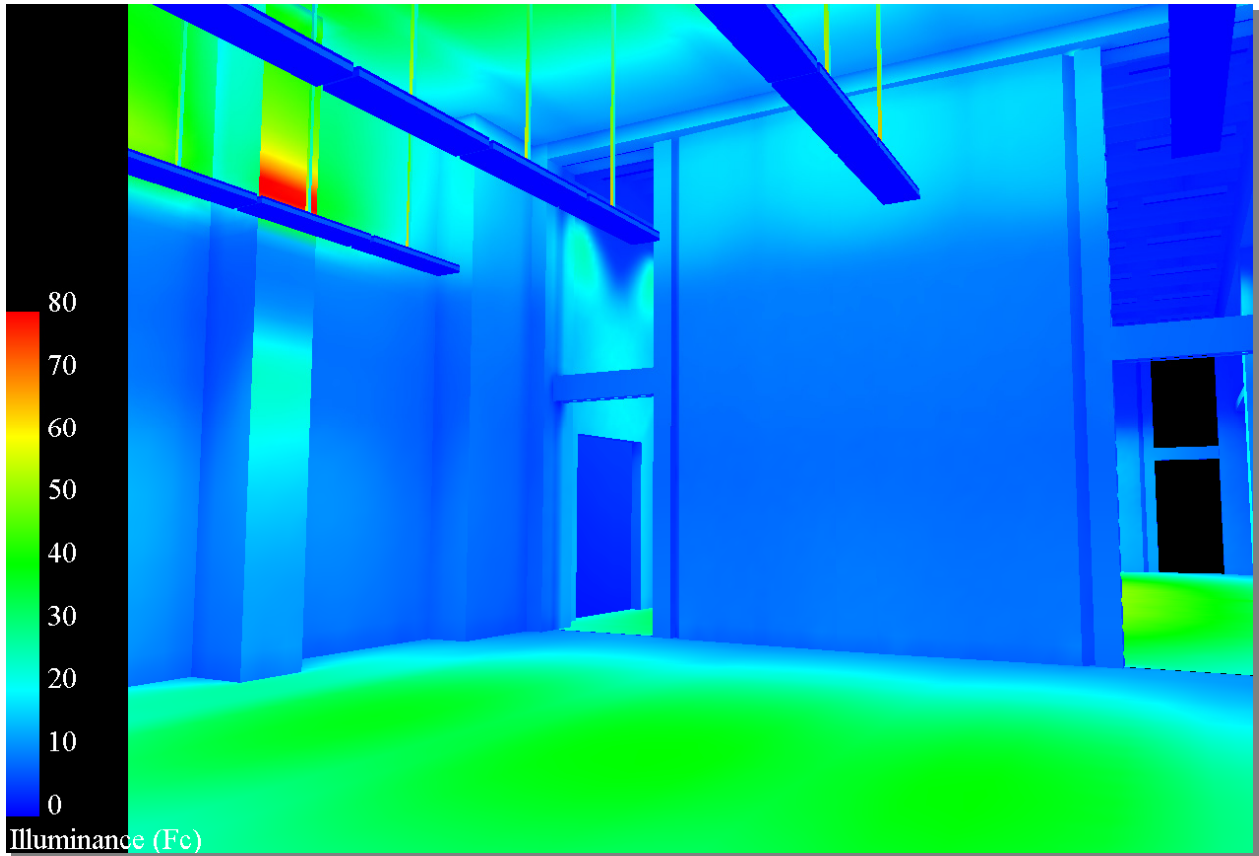
C2.2 Meeting Room AGI32 Radiosity Rendering. View from exterior of sail.



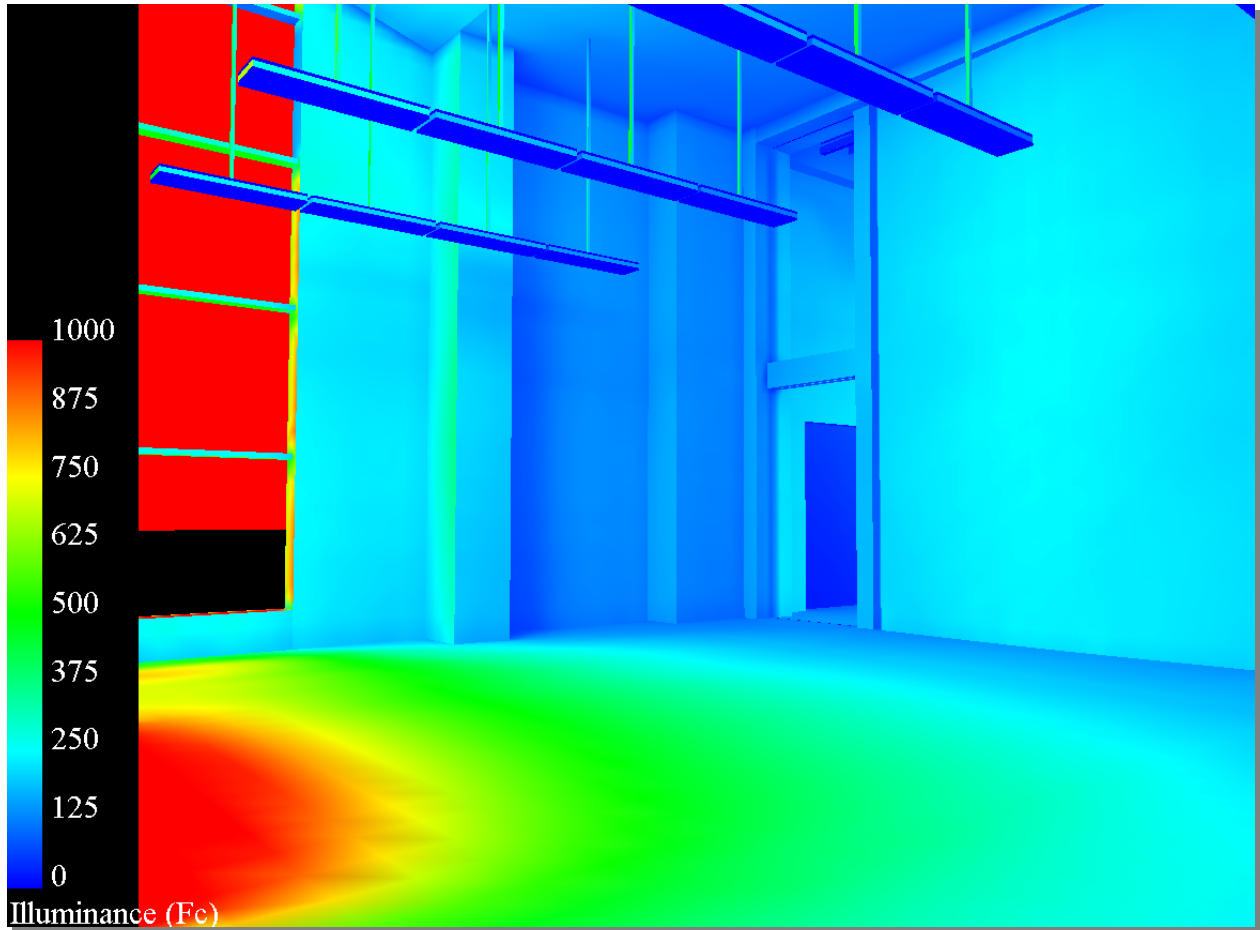
C2.3 Meeting Room AGI32 Radiosity Rendering. View towards sail.



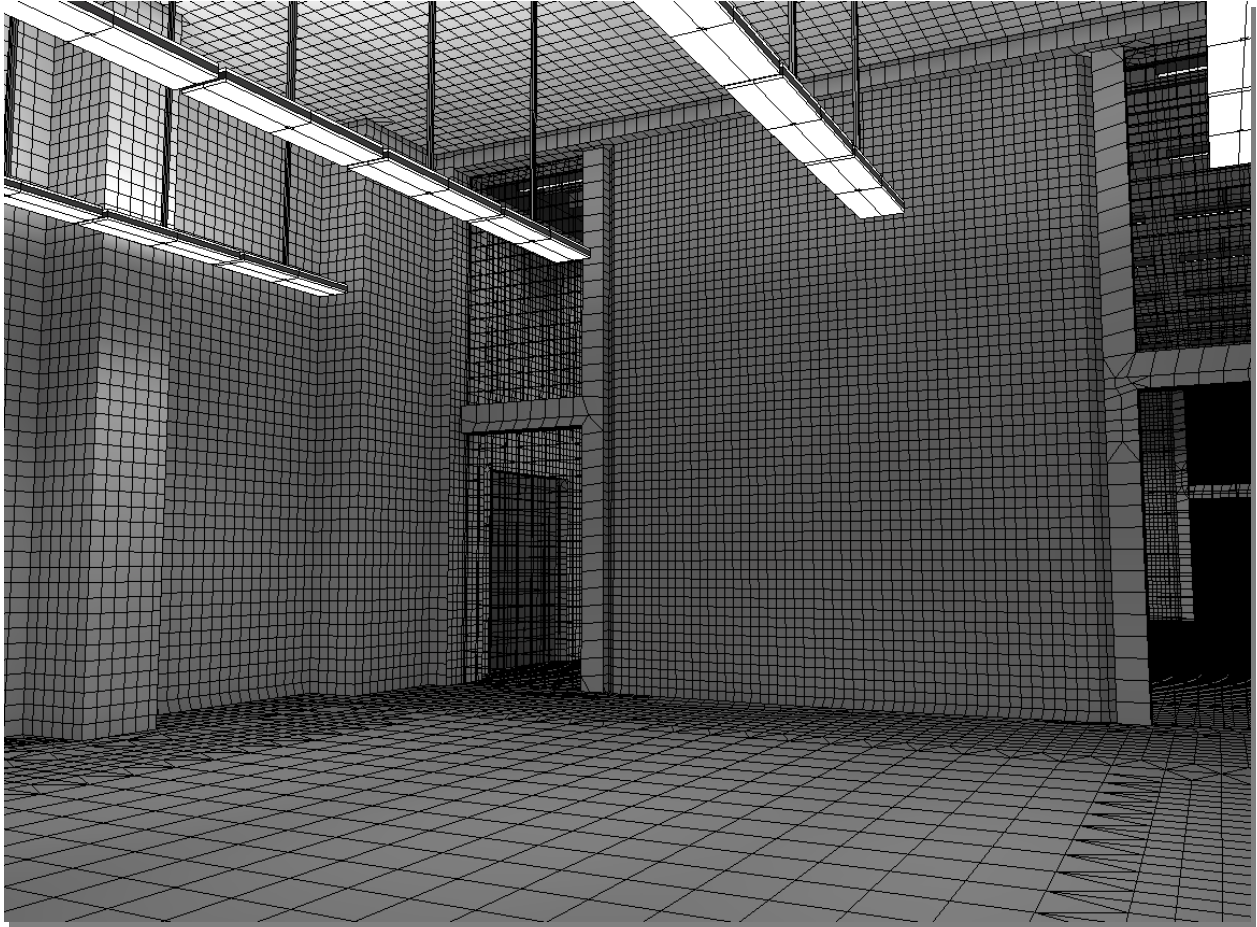
C2.4 Meeting Room AGI32 Radiosity Rendering with Daylight.



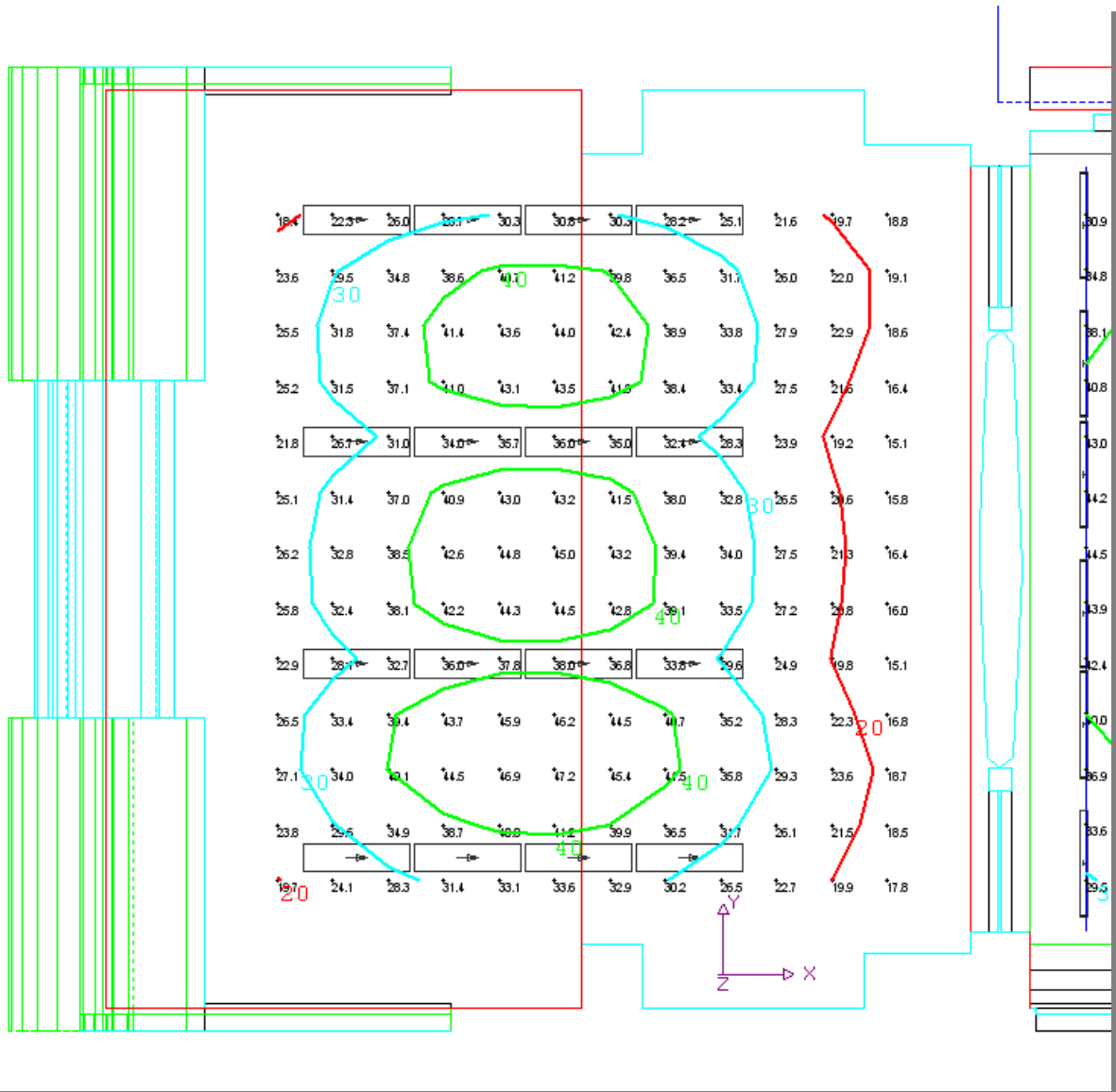
C2.5 Meeting Room AGI32 Psuedo Color Illuminance Rendering. View towards west wall.



C2.6 Meeting Room AGI32 Psuedo Color Illuminance Rendering with Daylight. View towards west wall.



C2.7 Meeting Room AGI32 Meshing Levels.



C2.8 Meeting Room Illuminance Calculation Grid.

SECTION FIVE: Appendix D – Materials Legend

August Wilson Center For African American Culture Modified Finish Schedule for Technical Report One		
Tag	Description	Properties (Assumed)
CONC - 2	Finished Concrete	Reflectance: .3
CPT - 1	Carpet	Reflectance: .2
CPT - 3	Carpet	Reflectance: .15
GL - 1	1/4" Clear float glass	Transmittance: .90
GL - 2	1/4" Clear float glass tempered	Transmittance: .90
GL - 3	1/2" Clear float glass	Transmittance: .90
GL - 4	1/2" Clear float glass tempered	Transmittance: .90
GLZ - 1	IGU 1/4" glass with 1/2" airspace, Clear low-E Coating	Transmittance: .74, U Value: .35, Shading Coefficient: .70, Solar Heat Gain Coefficient: .61, Light to Solar Gain: 1.20
GLZ - 2	Non-insulated glazed unit (Spandrel)	Transmittance: 0, Reflectance: .5
GLZ - 3	IGU Curved Clear	Transmittance: .74, U Value: .35, Shading Coefficient: .70, Solar Heat Gain Coefficient: .61, Light to Solar Gain: 1.20
GLZ - 4	Laminated clear glazed unit (Exterior Doors)	Transmittance: .74, U Value: .35, Shading Coefficient: .70, Solar Heat Gain Coefficient: .61, Light to Solar Gain: 1.20
GLZ - 5	Fritted Glass	Not Modeled
MP - 2	Metal Panel	Reflectance: .5
MP - 3	Metal Panel	Reflectance: .5
MP - 4	Metal Panel	Reflectance: .5
MTL - 1	Composite Metal Panel - (BOD:	Not Modeled
MTL - 2	Profiled Exposed Fastener Panels	Not Modeled
MTL - 3	Foamed in Place Panels (Centria Dimension Series)	Not Modeled
MTL - 4	Concealed fastener metal panel (Centria Concept Series CS-660)	Not Modeled
PT - 1	Paint (Ceiling Plenum)	Reflectance: .1
PT - 2	Paint (General Paint)	Reflectance: .5
STN - 1	Stone	Reflectance: .4
WB - 2	Wood wall base, painted	Not Modeled
WD-2	Wood Panelling	Reflectance: .4
XPC-1	Exposed Plenum Ceiling System - Chicago Metallic Intaline System. Standard White Painted Finish.	Reflectance: .85

Special thanks to Turner Construction Company for sponsoring my thesis project and providing drawings.