Lighting Depth

Introduction

The Duke University School of Nursing Building serves students and faculty in the Duke University Medical School and provides them with spaces to learn, research, meet, and relax. The Duke University name carries with it great prestige and grandeur with not only its medical studies and research but also with its architecture. As with all the buildings on campus, the Duke University School of Nursing building is built in the "Duke Gothic" architecture style. The lighting system that is proposed herein will not only compliment the Duke's Gothic style of architecture but also highlight the defining features of the building.

A complete lighting analysis will be conducted for the following four spaces:

1. Duke Tower Entrance Lobby
2. Peter & Ginny Nicholas Auditorium & Learning Center
3. Café DUSON- Student Lounge
4. Champagne Courtyard- Outdoor Patio

The lighting analysis will thoroughly discuss the lighting design for each proposed lighting system, which includes: a complete design criteria survey of pertinent lighting features; light loss factors (LLFs); controls; light level performance data; and power densities. Each proposed lighting space shall be compliant with IESNA lighting requirements as well as ASHRAE 90.1 energy standards.

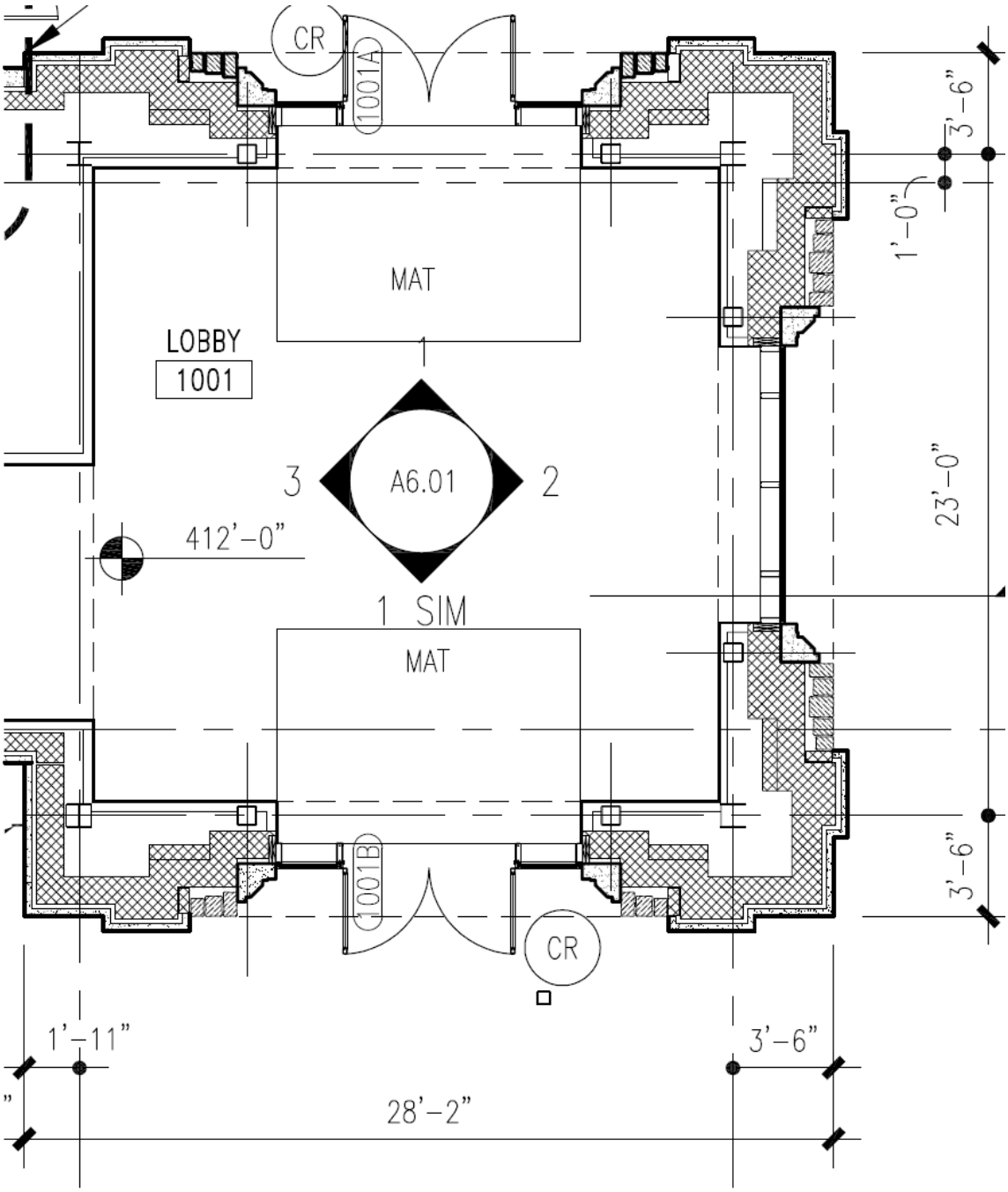
Duke Tower Main Entrance Lobby Overview

This is the main entrance to the building that is located in the prominent tower portion of the building. The floor of this lobby has the Duke University School of Nursing emblem worked into the terrazzo flooring. This could be considered a grand entrance, since it covers an area of approximately 530 SF and is about 26 feet high with three full height glass curtain walls.

*The above are Pre-construction conceptual renderings by ASG

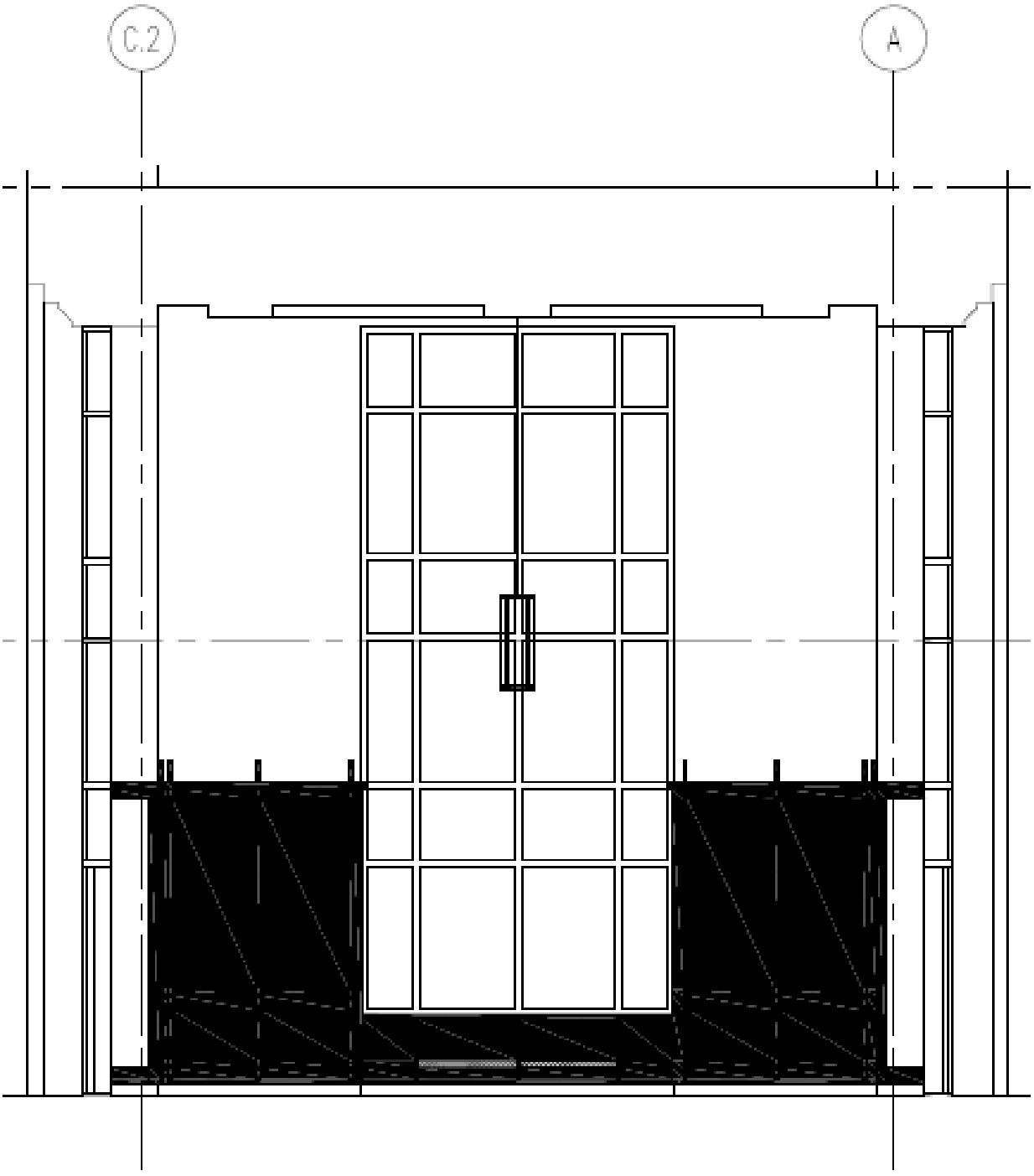
Architectural Plan

Plan:



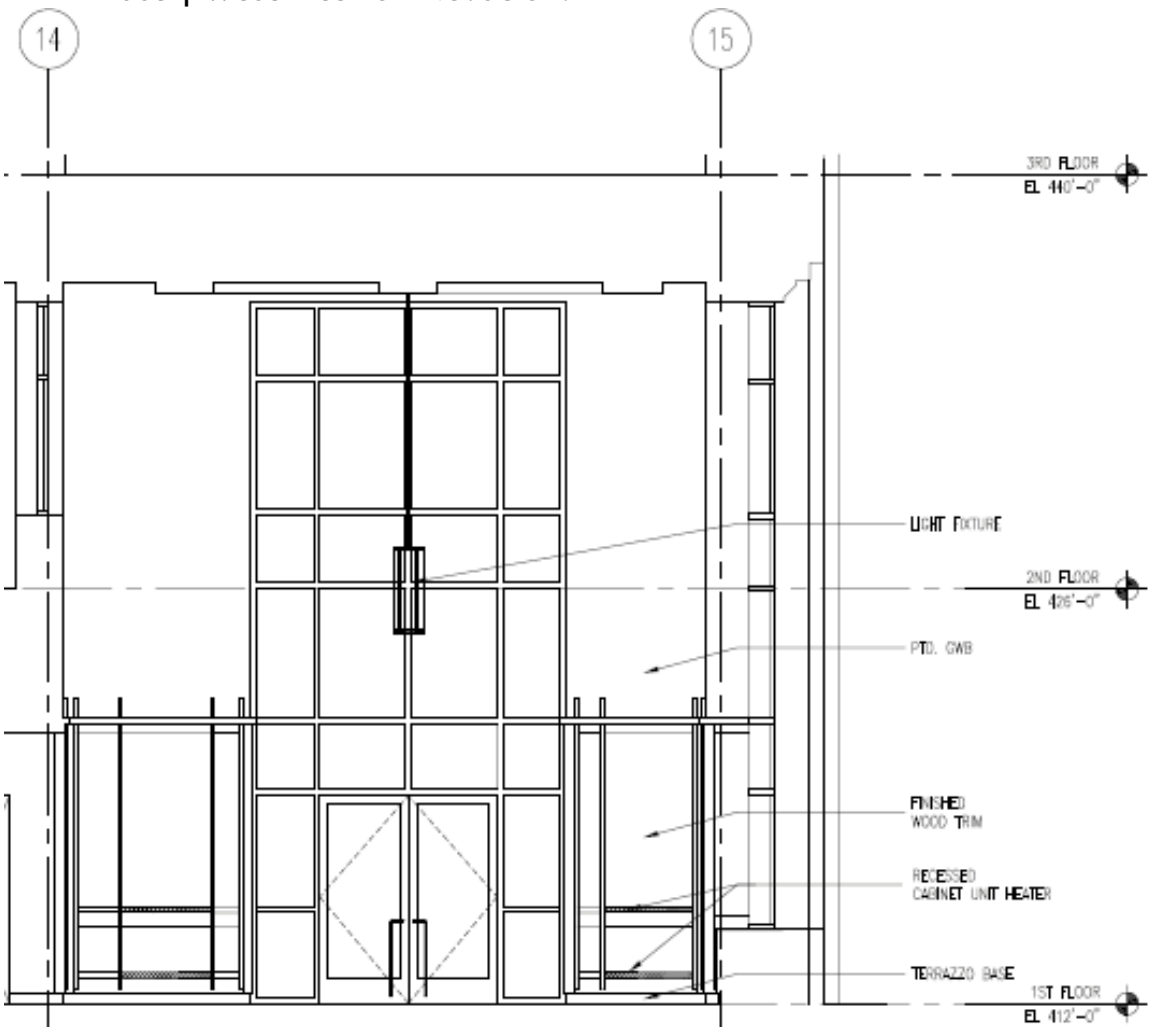
Architectural Interior Elevations

South Interior Elevation:



Architectural Interior Elevations

East | West Interior Elevation:



IESNA Design Criteria

Appearance of Space and Luminaires:

The space needs to appear inviting and carry a sense of grandeur, for this is the main entrance to the lobby. The luminaires should complement the Gothic style of the building, since most of the room is visible through the large glass windows of the tower.

Color Appearance:

The space should have warm color tones, in order for the space to have a warm and inviting feeling to it. Also, the color of the wood paneling will be enhanced by the warm color of light.

Daylight Integration and Controls:

The space is exposed to eastern, southern, and western sunlight by the three double high glass curtain walls. For this reason the use of photocell-controlled sensors or astronomical time clocks should be utilized for control of the fixtures.

Glare:

Direct and reflected glare from the luminaires should be considered to reduce seeing most of the fixtures in the glass and the waxed terrazzo floor.

Light Distribution on Surfaces:

The space should maintain a moderate level of uniform light on the walls of the tower, in order to help provide a sense of spaciousness and grandeur. However, due to the space being 26-ft high, some scalloping may occur if recessed fixtures are used.

Light Distribution on Task Plane:

The space is a major thoroughfare for the building and as a matter of public safety the task plane, the floor, should have some degree of uniformity. However, in order to highlight the School's emblem the center of the floor must be maintained at a higher light level to create the light difference in highlighting. This highlighting will cause the uniformity of the floor to decrease. The decrease in uniformity will not cause a safety hazard.

Luminance of Surfaces:

Being that the space is an entry lobby; the main goal is to lead the occupants to the corridor. By having variable surface luminances this can be achieved.

Points of Interest:

The main point of interest in the space is the Duke University School of Nursing emblem worked into the terrazzo flooring. This emblem should be highlighted with light.

Shadows*:*

Some shadowing is inherent with the sun tracking from east to the west throughout the day.

Surfaces Characteristics*:*

The space has wood wall paneling that, with the proper lighting, will enhance its beautiful characteristics. This wood paneling is contrasted by stark white walls above the wall paneling, and need to be considered so that they are not over lit. Finally, the gray terrazzo flooring needs to be properly lit to limit glare.

IESNA Illuminance Recommendations

Horizontal

Public Spaces	50 lx (5 fc)

Vertical

Public Spaces	IESNA does not recommend a vertical illuminance value for a lobby.

Existing Material Conditions

Surface Materials within the Space:

- Gray Terrazzo flooring
  - Reflectance = 37%
- Painted White GWB Ceiling
  - Reflectance = 80%
- Painted White GWB Walls
  - Reflectance = 80%
- Wood Panel Walls
  - Reflectance = 10%
- Wood Beams Ceiling
  - Reflectance = 10%

Glazing:

- **G-5:** 1" Insulated Glass - Float
  - U-Value = 0.57
  - Transmittance = 0.55
  - Shading Coefficient = 0.45

- **G-4:** 1" Insulated Glass – Laminated (door glass)
  - U-Value = 0.57
  - Transmittance = 0.55
  - Shading Coefficient = 0.45

Luminaire Schedule

Duke Tower Entrance Lobby- Luminaire Schedule								
Type	Mounting	Manufacturer	Catalog Number	Lamp	Input Watts	Volts	Ballast Catalog Number	Fixture Description
A	Ceiling Recessed	Lightolier	8021-CCLW	(1) 26W Triple Tube CFL GE F26TBX/SPX30A/4P	31	277	Advance VEZ-1T42-M2-BS	6" Direct Downlight Vetical Lamp Electronic Ballast
G	Pendant Chandelier	Custom	Custom	(2) 26W Triple Tube CFL GE F26TBX/SPX30A/4P	58	277	Advance VEZ-2Q26-M2-LD	Custom designed pendant that reflects Gothic Architecture/Style

Lamp Schedule

Duke Tower Entrance Lobby- Lamp Schedule							
Type	Manufacturer	Cat. #	Rated Wattage	CRI / CCT	Rated Life	Initial Lumens	Assoc. Fixture
L1	General Electric	F26TBX/SPX30A/4P	26	82 / 3000K	12000	1710	A / G

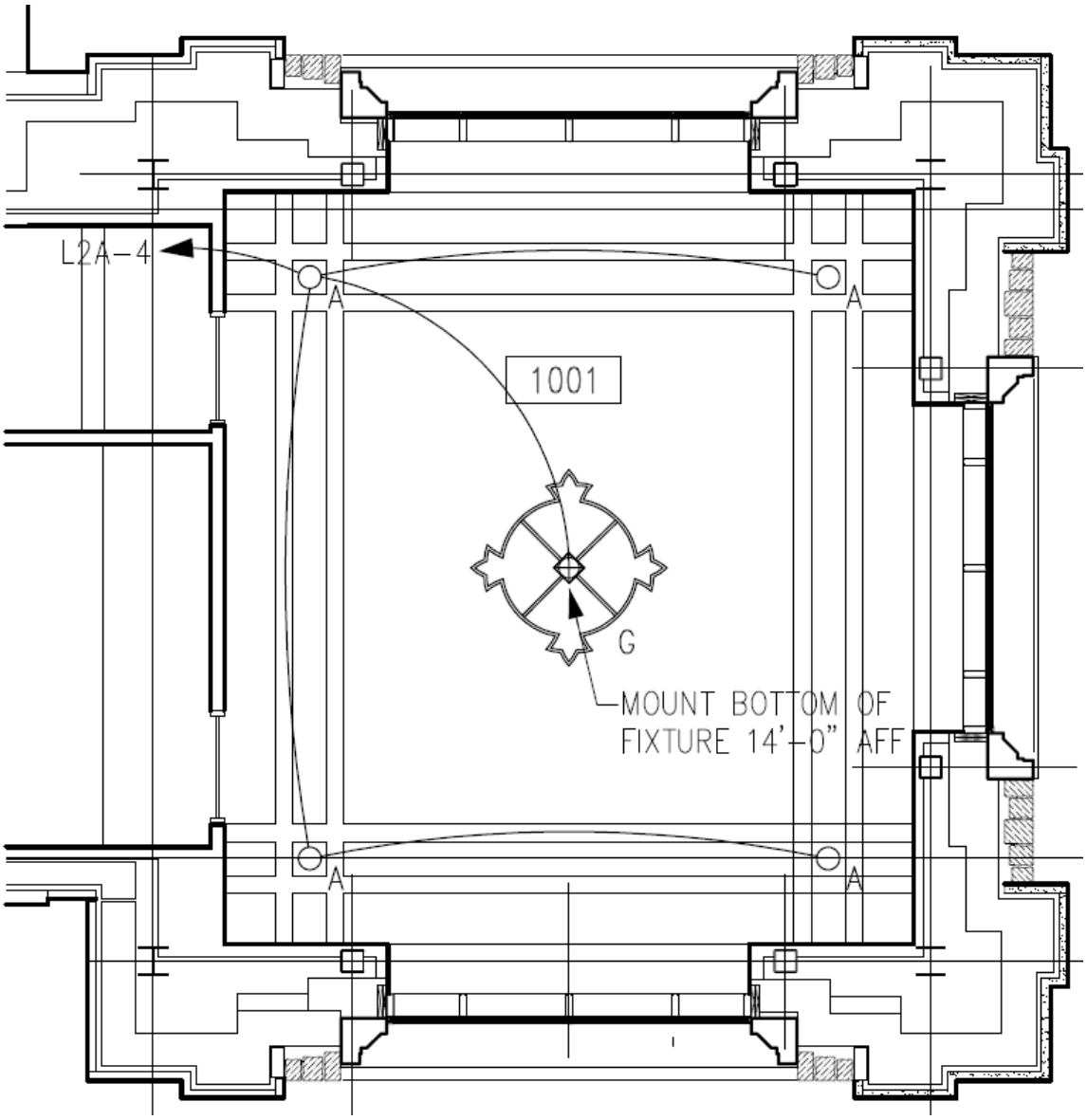
Notes: (1) please refer to Appendix A for all product cut sheets and complete schedules.
(2) Lighting is controlled by an astronomical time clock, which is located in the second floor electrical closet where PNL L2A is located.

Light Loss Factors

Duke Tower Entrance Lobby- Light Loss Factors													
Type	Fixture Description	Lamp	Mean Lumens [Initial Lumens]	LLD	Room Properties (Ft.)		RCR	Assumptions	Expected Dirt Depreciation	RSDD	LDD	BF	Total LLF
A	26W CFL 6" Open Maintenance **Category III** **Direct** Downlight	(1) 26W Triple Tube CFL GE F26TBX/SPX30A/4P	1440 / 1710	0.842	Height	24	10.11	Clean / 12 Months Cleaning Cycle	12	0.955	0.9	1.05	0.760
					Length	23.5							
					Width	24							
					Perimeter	95							
					Area (ft^2)	564							
G	Custom Pendant Chandelier	(2) 26W Triple Tube CFL GE26TBX/SPX30A/4P	1440 / 1710	0.842	Height	24	10.11	Clean / 12 Month Cleaning Cycle	12	0.955	0.9	1.00	0.724
					Length	23.5							
					Width	24							
					Perimeter	95							
					Area (ft^2)	564							

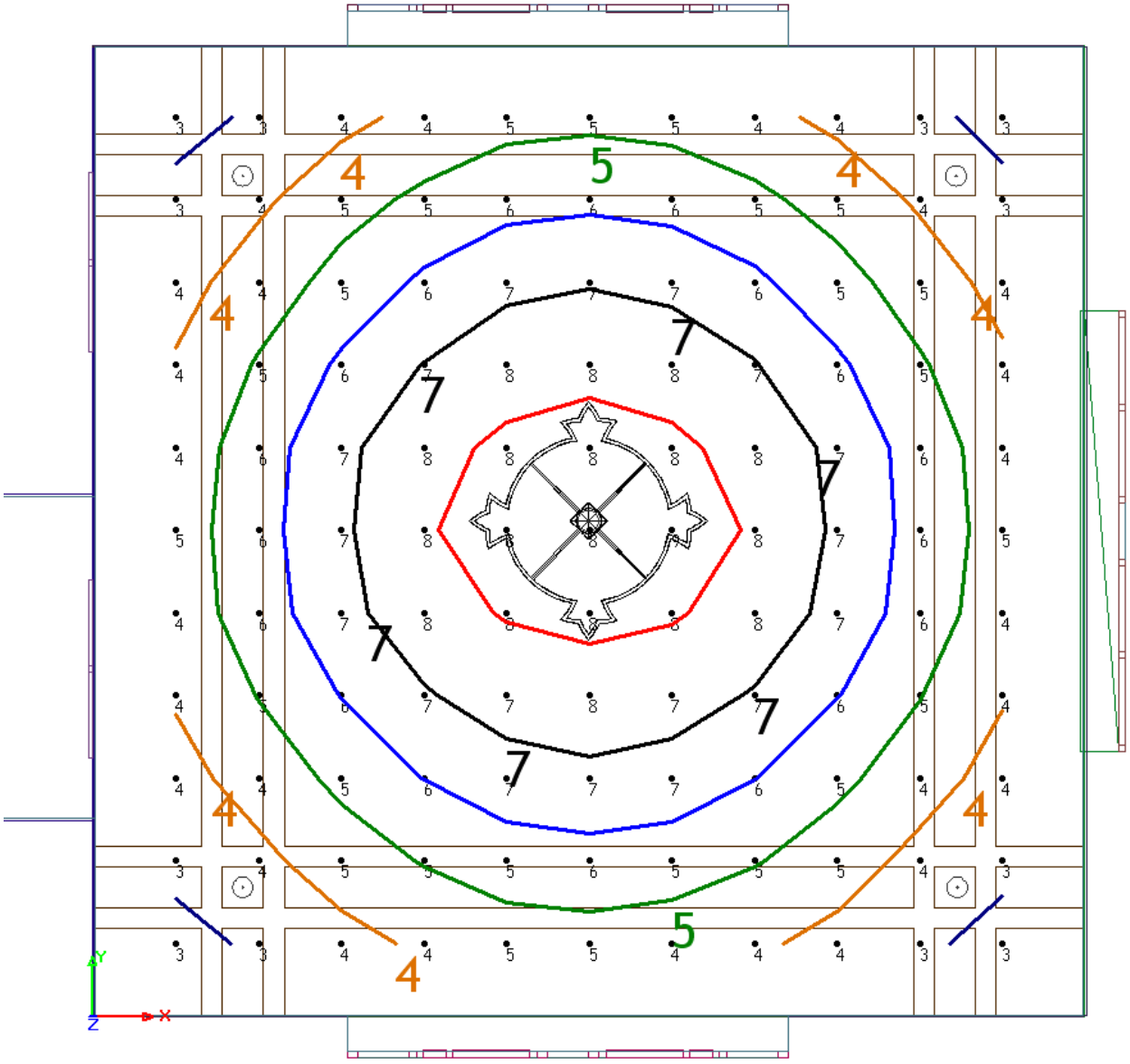
Lighting Plan

Second Floor Lighting Plan (Double High Space):



Note: Please refer to Appendix B for 1/8" = 1'0" Lighting and Circuiting Plan

Illuminance Data

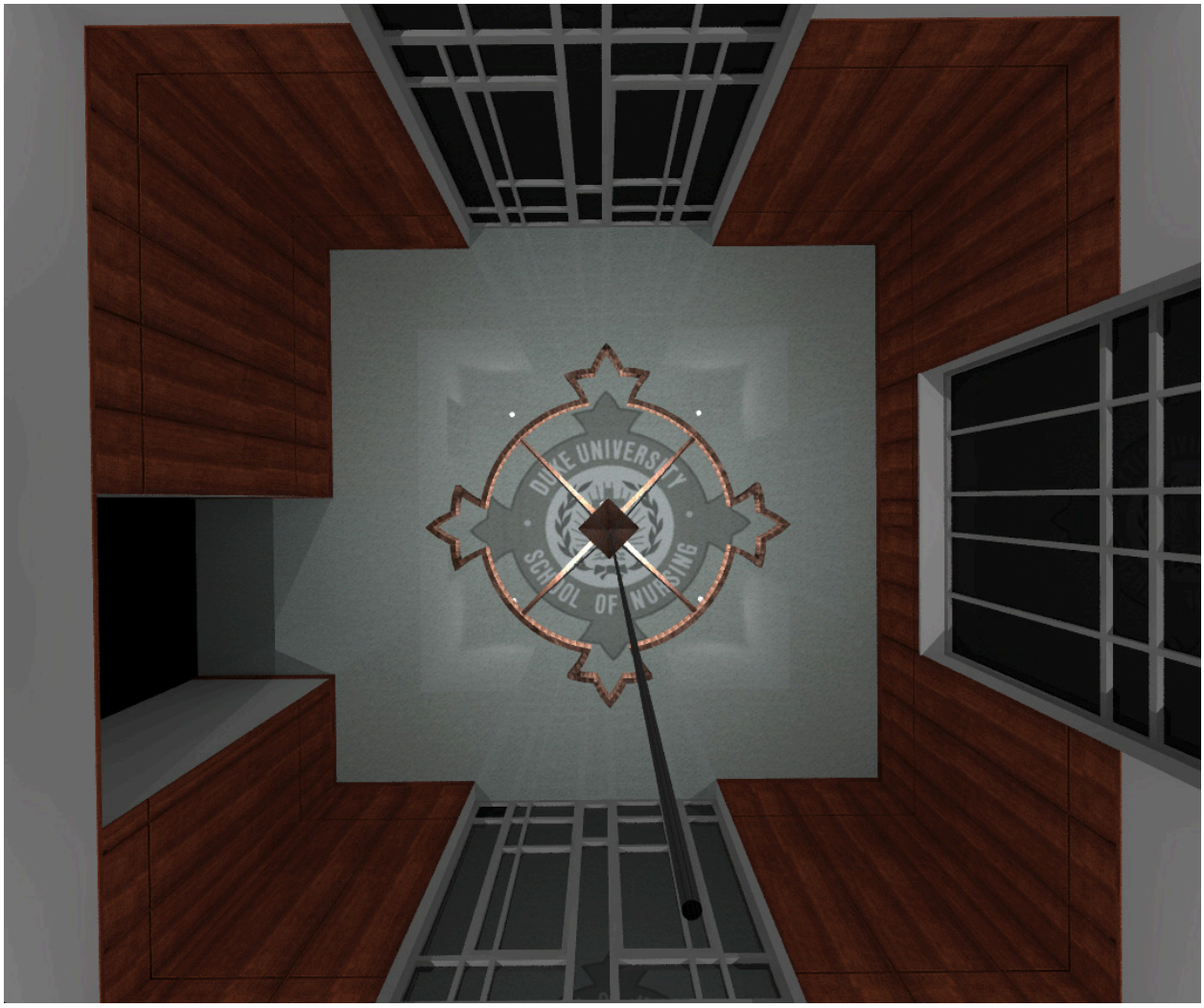


AGI32-v2.0 Statistical Summary

Duke Tower Entrance Lobby- Illuminance Results					
Average Illuminance	Maximum Illuminance	Minimum Illuminance	Avg/Min	Max/Min	Uniform Gradient
5.5	9.0	3.0	1.8	3.0	1.5

Raytraced Renderings

Plan View:

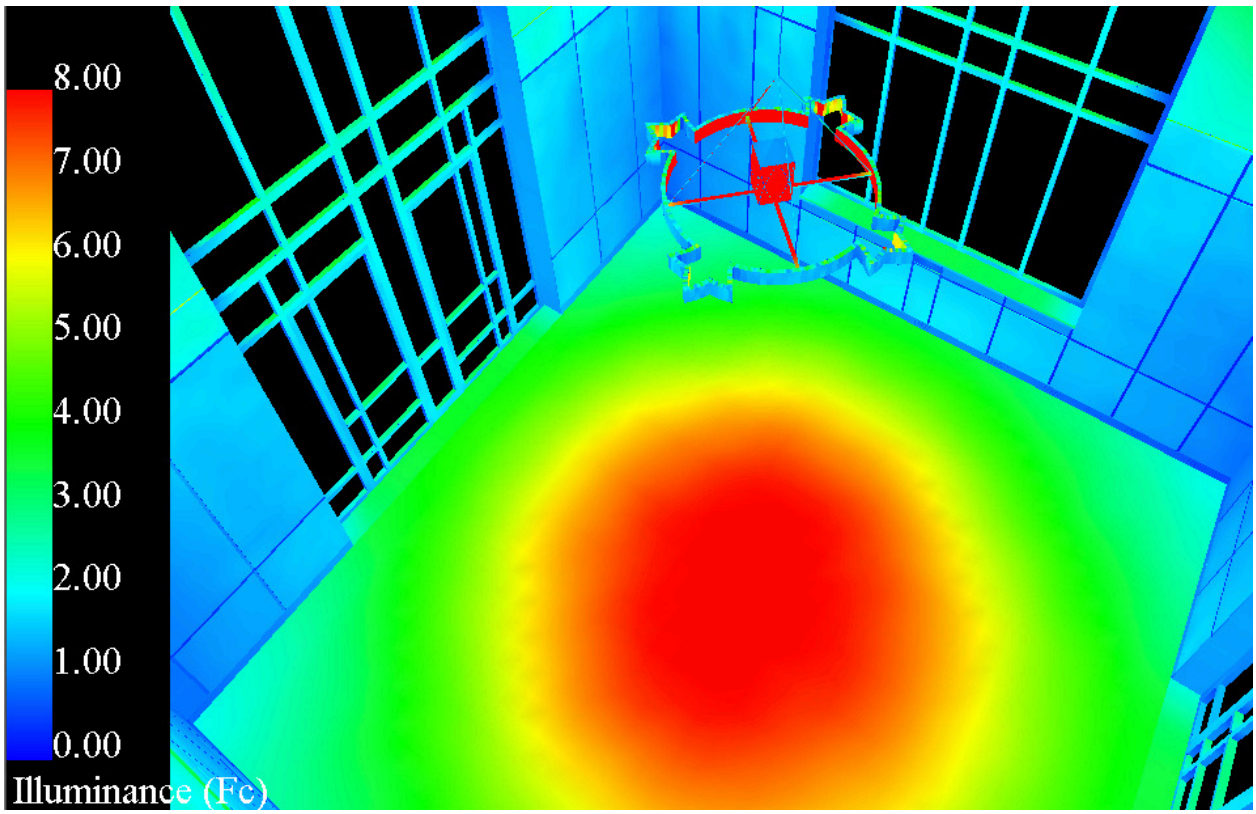


View from Second Floor Windows:

View from First Floor Corridor:

View of the Second Floor Windows and First Floor Corridor:

Pseudo Color Rendering:



Power Density

Duke Tower Entrance Lobby Power Density						
Fixture Type	Fixture Quantity	Fixture Wattage	Total Wattage (W)	Total Area (sf)	Actual Power Density (W/sf)	ASHRAE 90.1 Allowed Power Density
A	4	31	124			
			124	564	0.22	1.2
Fixture Type	Fixture Quantity	Fixture Wattage	Total Wattage (W)	Total Area (sf)	Actual Power Density (W/sf)	ASHRAE 90.1 Allowed Power Density
G*	1	58	58			
			58	564	0.10	1.0
*Decorative Fixture, Additional 1.0 W/sf						

Evaluation

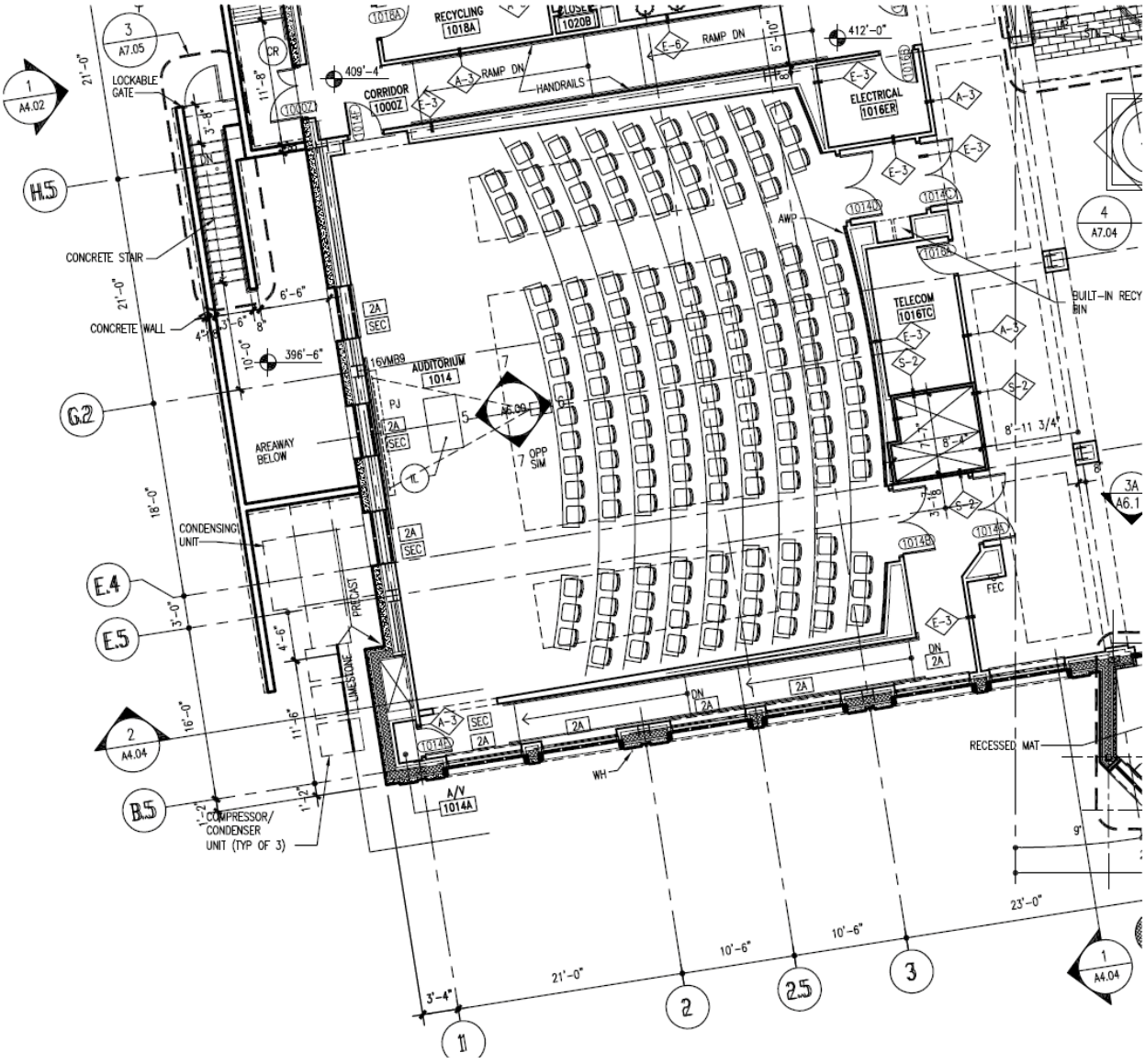
A custom chandelier was created for this space. After studying traditional Gothic architecture and lighting, the design of the central "lantern" surrounded by an outer ring was chosen. The outer ring of the custom chandelier was inspired by the Duke University School of Nursing emblem that it is in fact accenting. The architecture of the ceiling and placement of lights is a design element that was successfully carried out throughout all the redesigned interior spaces. The implemented lighting system satisfies the basic illumination requirements spelled out in the IESNA handbook.

Peter | Ginny Nicholas Auditorium | Learning Center Overview

The Peter | Ginny Nicholas Auditorium | Learning Center is a large auditorium used as a classroom and meeting area. The auditorium has seating for approximately 150 people and covers an area of approximately 2700 SF. The seating and desks are permanent fixtures within the space. The ceiling is a combination of painted GWB and acoustic ceiling tiles. The ceiling is basically one level and bears no resemblance to the other "Gothic" spaces that are being redesigned. Therefore, to tie this space both architecturally and lighting wise with the Lobby and the Café, the ceiling was dropped and a cross pattern of square light coves were implemented.

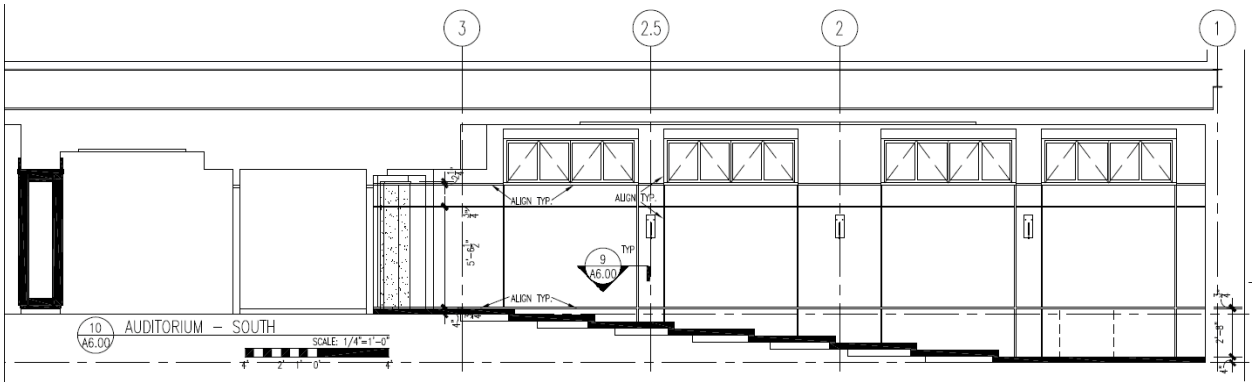
The floor gradually steps down from the back of the room towards the front of the room where the lecturer stands, with a total change of about 3 Ft. This stadium seating effect allows the farthest people in the back to be able to not only see but also hear the lecturer. The back wall curved and composed of fabric wrapped acoustic panels. The auditorium is intended to be a classroom and meeting place, and therefore requires a sense of visual clarity as well as set a studious atmosphere.

Architectural Plan

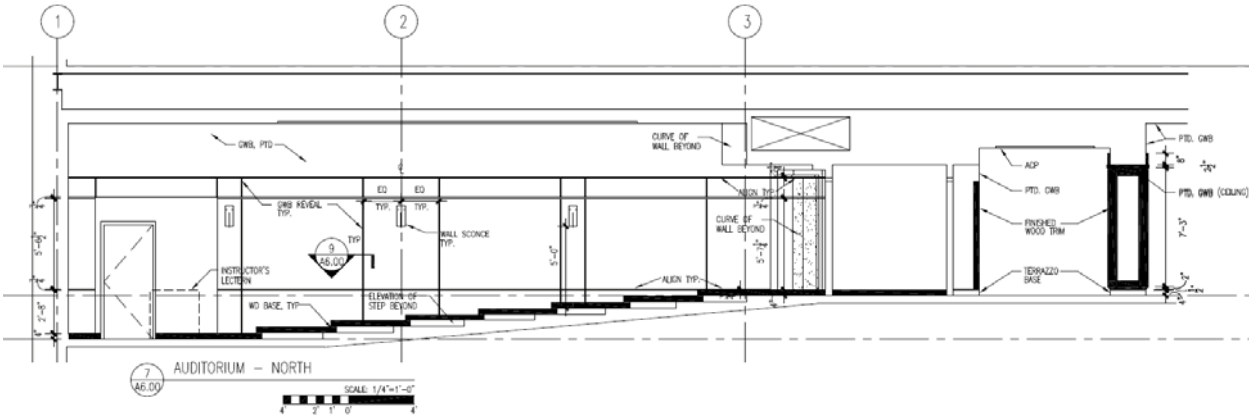


Architectural Interior Elevations

South Interior Elevation:

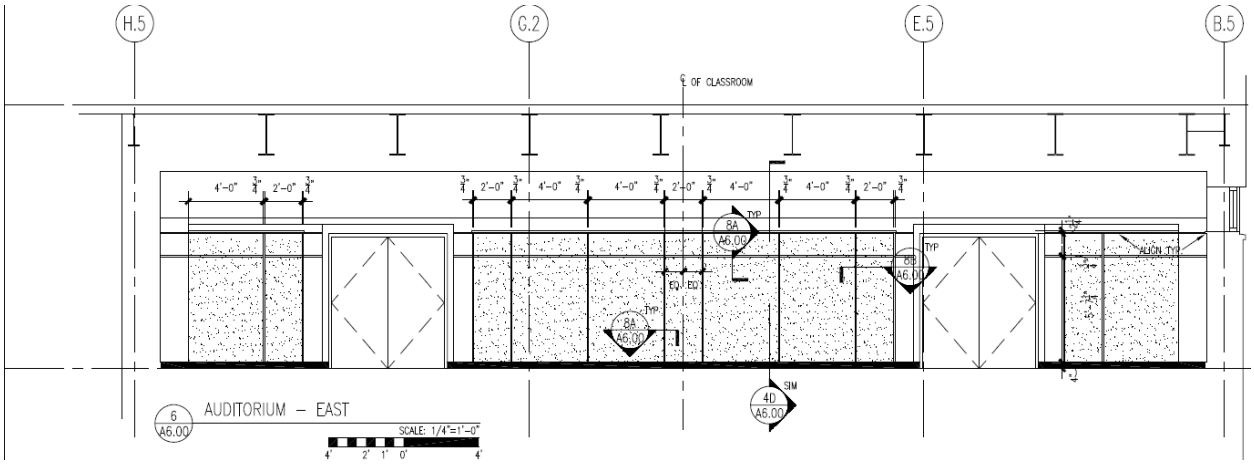


North Interior Elevation:

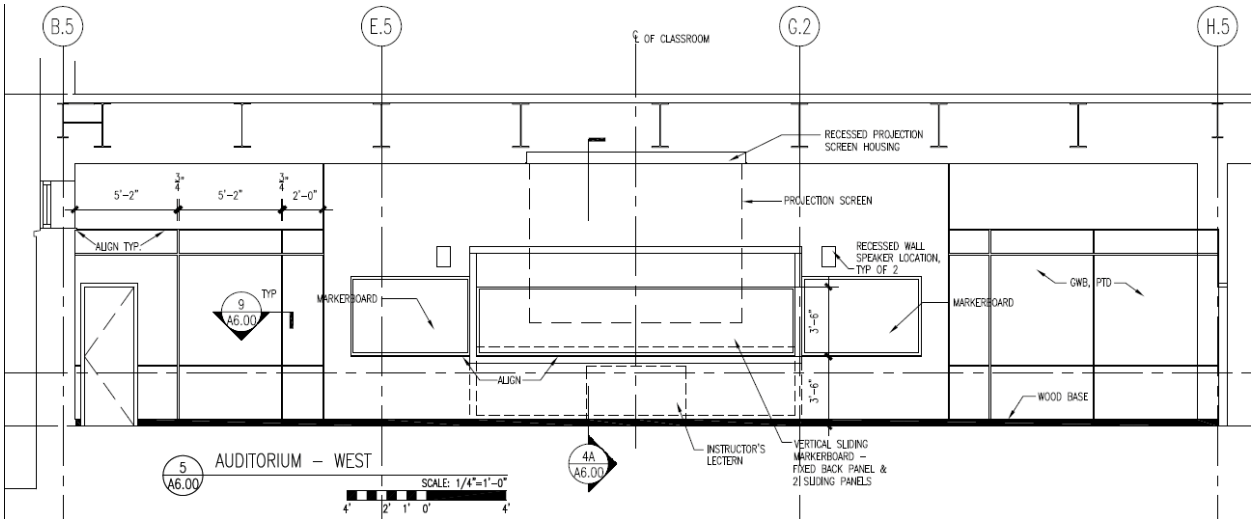


Architectural Interior Elevations (cont.)

East Interior Elevation:



West Interior Elevation:



IESNA Design Criteria

Appearance of Space and Luminaires:

The Peter & Ginny Nicholas Auditorium is intended to provide a studious atmosphere and the feeling of visual clarity, since it is a classroom. The space should also create a feeling of pleasantness to make the classroom an inviting place and a reduced institutional feel to the space. The luminaires in this space should provide a visually pleasing environment while maintaining a clean look.

Color Appearance:

The proper balance of color tone must be achieved to provide the sense of pleasantness while keeping a studious atmosphere and users of the space alert.

Daylight Integration and Controls:

The space has a series of four ribbon windows high on the west wall. This space has a projector and screen used by lectures to show presentations as well as videos. For this reason motorized shading of the windows must be considered for the daylight issues associated with projectors. The space is a classroom and meeting area and therefore requires flexible lighting and shading controls for the variety of activities that go on in this space. A scene selection control system should be used to automatically control shades and lights for a pre program scenario, like a power point presentation or a lecture on the white boards.

Glare:

Direct glare from the luminaires should be considered to ensure that the space maintains a comfortable feel for the occupants. Also, direct glare from the sun should be avoided by installing the appropriate shading and controls for the windows. Reflected glare is also a great concern, especially on the whiteboards.

Light Distribution on Surfaces:

The space should maintain a rather uniform light distribution on the desks. Accent lighting will be used on the podium to draw the audience's attention. Downlighting will be used to on the walkways as a means of showing egress, but also to add some direct light interest in the main indirect lighting system of the coves.

Light Distribution on Task Plane:

Considering the space is a classroom, visual clarity is of great importance. For this visual clarity, the task plane should have a uniform light distribution on it.

Modeling of Faces:

Being that the space is a classroom the point of focus is the professor or whoever is presenting before the class, modeling of faces is an important issue to address. Students who are able to see the eyes and facial expressions of a professor or speaker will naturally have a higher level of focus than if the face cannot be seen as well.

Points of Interest:

The main point of interest is the front of the room, which contains the lecturer, lectern, whiteboards, and projection screen. Therefore, this area must be appropriately lit for all these tasks to create the point of interest or focal point.

Shadows:

Shadows should be avoided except for the shadows created by the furniture.

Surfaces Characteristics:

The space contains a multitude of surfaces with varying characteristics. The main critical surface in this space is the surface of the whiteboards, since these have a high reflectance value to them. The other surfaces include carpeting; fabric wrapped acoustics panels; and painted GWB.

Source Task Eye Geometry:

Source task eye geometry must be considered since the space is a classroom. The location as well as the types of luminaires must be taken into consideration to reduce glare and veiling reflections.

Luminance of Surfaces:

Since the desks in the space are of a darker brown, the luminance ratio of the light color of paper to the dark color of the desks must be considered to achieve proper visual clarity.

- 3:1 Task to Adjacent Background
- 10:1 Task to Non-Adjacent Background

Other Issues:

The floor has a stepping effect to it and therefore this changes the level of the task plane, the desk surface, for every step made. This must be considered in the reading of the horizontal illuminance of the space.

IESNA Illuminance Recommendations

Horizontal

Educational Lecture Hall	300 lx (30 fc)

Vertical

Lecture Hall Whiteboard	30 lx (30 fc)

Existing Material Conditions

Surface Materials within the Space:

- Beige Thin Carpeting
  - Reflectance = 25%
- Painted White GWB Ceiling
  - Reflectance = 85%
- Beige Painted GWB Walls
  - Reflectance = 85%
- Fabric Wrapped Acoustic Wall Panels
  - Reflectance = 38%
- PLAM Wood Desks
  - Reflectance = 13%
- Wood Trim
  - Reflectance = 13%
- Brown Doors
  - Reflectance = 13%
- White Boards
  - Reflectance = 95%
  -

Other Materials within the Space:

- Beige Fabric Covered Chairs

Glazing:

- **G-5:** 1" Insulated Glass - Float
  - U-Value = 0.57
  - Transmittance = 0.55
  - Shading Coefficient = 0.45

Luminaire Schedule

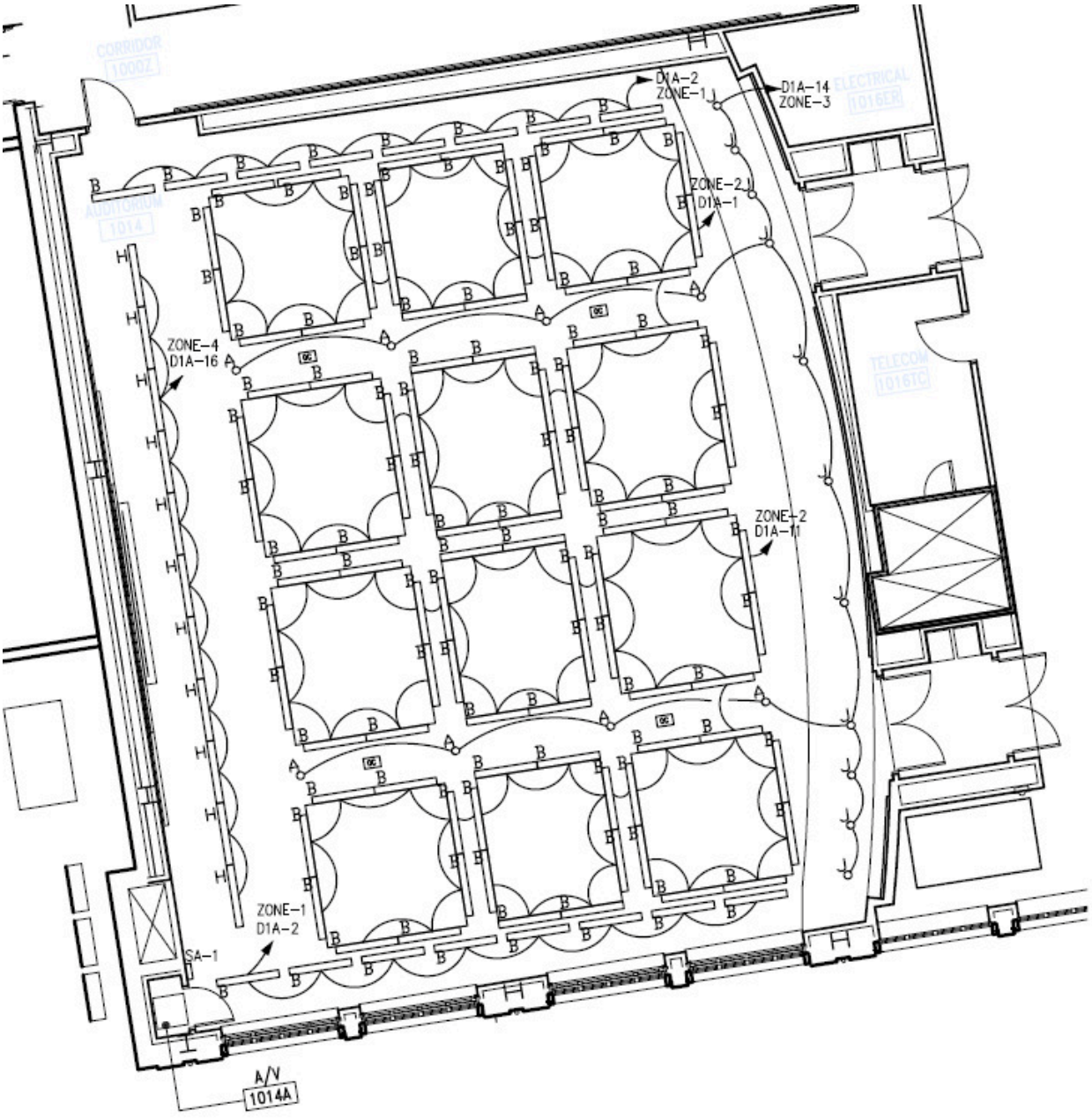
Peter & Ginny Nicholas Auditorium & Learning Center Luminaire Schedule									
Type	Mounting	Manufacturer	Catalog Number	Lamp	Input Watts	Input Amps	Volts	Ballast Catalog Number	Fixture Description
A	Ceiling Recessed	Lightolier	8021-CCLW	(1) 26W Triple Tube CFL GE F26TBX/SPX30A/4P	31	0.11	277	Advance VEZ-1T42-M2-BS	6" Direct Downlight Vetical Lamp Electronic Ballast
B	Surface Cove	Elliptipar	F306-A128-S-00-2-000	(1) 32W T8 GE F32/T8/SPX30/ECO	25	0.1	277	Advance ICN1P32LWSC	4 Ft. Assymetric Cove Electronic Ballast
H	Ceiling Recessed	Lightolier	WMRL143277PS	(1) 32W T8 GE F32/T8/SPX30/ECO	25	0.1	277	Advance IOP2S32LWSC	4 Ft. Linear Wallwasher Electronic Ballast
J	Ceiling Recessed	Lightolier	8021-CCLW	(1) 26W Triple Tube CFL GE F26TBX/SPX30A/4P	31	0.11	277	Advance IOP2S32LWSC	6" Direct Wallwasher Horizontal Lamp Electronic Ballast

Lamp Schedule

Peter & Ginny Nicholas Auditorium & Learning Center Lamp Schedule							
Type	Manufacturer	Cat. #	Rated Wattage	CRI / CCT	Rated Life	Initial Lumens	Assoc. Fixture
L1	General Electric	F26TBX/SPX30A/4P	26	82 / 3000K	12000	1710	A / J
L2	General Electric	F32/T8/SPX30/ECO	32	86 / 3000K	20000	2950	B / H

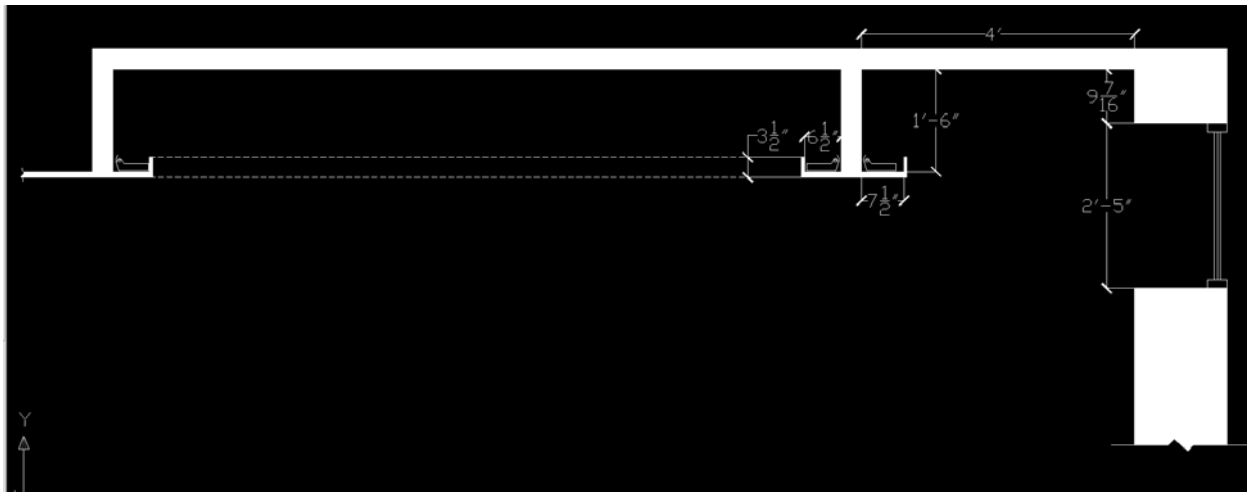
Notes: (1) please refer to Appendix A for all product cut sheets and complete schedules.
(2) Lighting control intent is located in the electrical depth section of this report.

Lighting Plan



Note: Please refer to Appendix B for 1/8" = 1'0" Lighting and Circuiting Plan

Cove Lighting System Detail (typ.)



Light Loss Factors

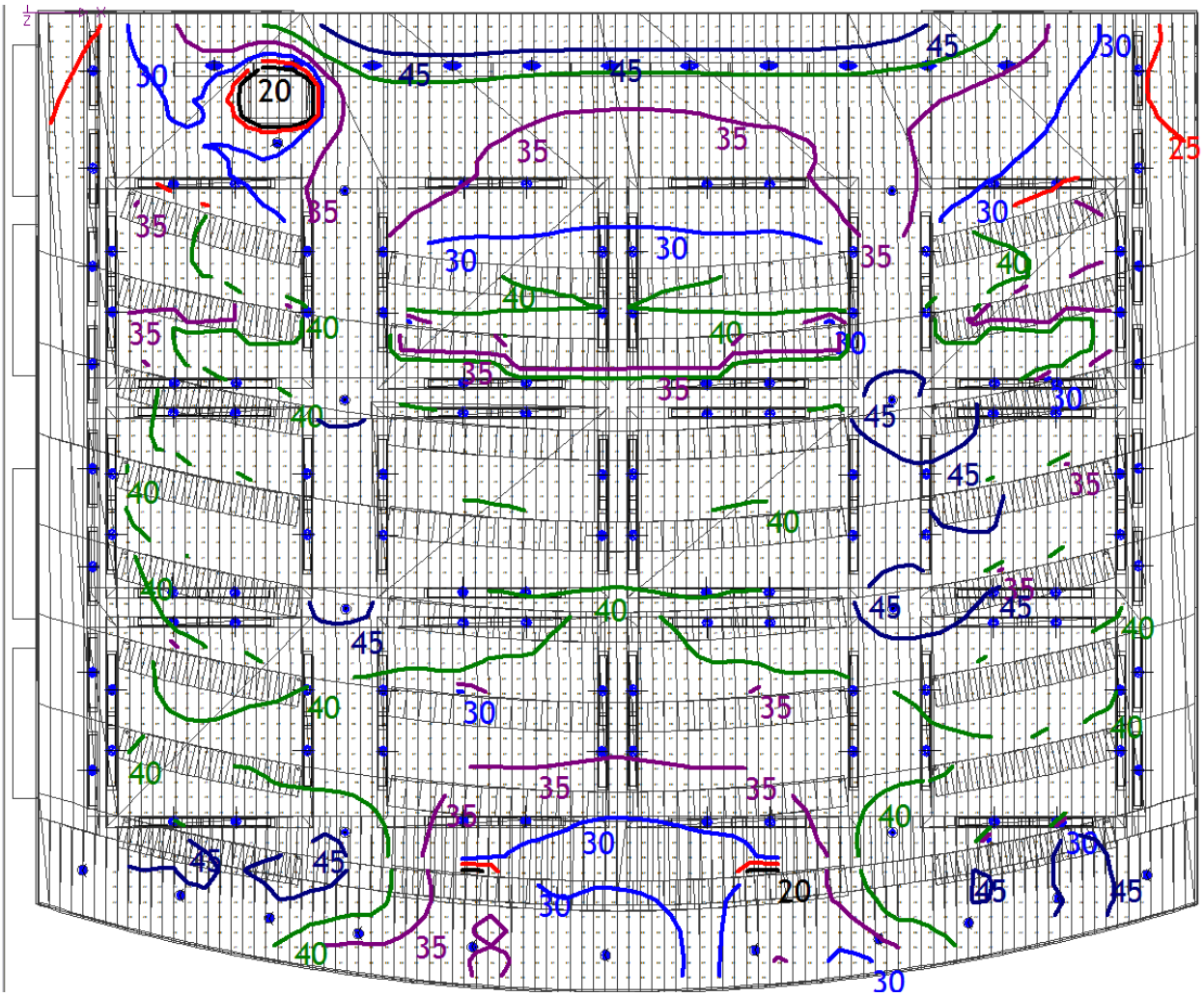
Peter & Ginny Nicholas Auditorium & Learning Center LLF													
Type	Fixture Description	Lamp	Mean Lumens [Initial Lumens]	LLD	Room Properties (Ft.)		RCR	Assumptions	Expected Dirt Depreciation	RSDD	LDD	BF	Total LLF
A	26W CFL 6" Open Maintenance **Category IV** **Direct** Downlight	(1) 26W Triple Tube CFL GE F26TBX/SPX30A/4P	1440 1710	**0.842**	Height Length Width Perimeter Area (ft^2)	11.5 46 57.33 204 2704	2.17	Clean 12 Months Cleaning Cycle	12	**0.978**	**0.89**	**1.05**	**0.77**
B	32W T8 Open top Closed Bottom Maintenance **Category VI** Assymetric Cove **Indirect** Uplight	(1) 32W T8 GE F32/T8/SPX30/ECO	2950 2800	**1.054**	Height Length Width Perimeter Area (ft^2)	11.5 46 57.33 204 2704	2.17	Clean 12 Month Cleaning Cycle	12	**0.89**	**0.87**	**0.73**	**0.60**
H	32W T8 Closed Top Open Bottom Maintenance **Category IV** Linear Wallwasher	(1) 32W T8 GE F32T8/SPX30/ECO	2950 2800	**1.054**	Height Length Width Perimeter Area (ft^2)	11.5 46 57.33 204 2704	2.17	Clean 12 Month Cleaning Cycle	12	**0.978**	**0.89**	**0.73**	**0.67**
J	26W CFL 6" Open Maintenance **Category IV** **Direct** Wallwasher	(1) 26W Triple Tube CFL GE F26TBX/SPX30A/4P	1440 1710	**0.842**	Height Length Width Perimeter Area (ft^2)	11.5 46 57.33 204 2704	2.17	Clean 12 Months Cleaning Cycle	12	**0.978**	**0.89**	**1.05**	**0.77**

Control Scenes

Control Scenes				
Scenes:	**Zone-1**	**Zone-2**	**Zone-3**	**Zone-4**
Projector	OFF	OFF	Dimmed to 20%	OFF
Speaker	1/2 Switched ON	1/2 Switched ON	Dimmed to 50%	All ON
Class/Exam	All ON	All ON	All ON	All ON

Note: Controlled by a Graffic Eye 3000

Illuminance Data

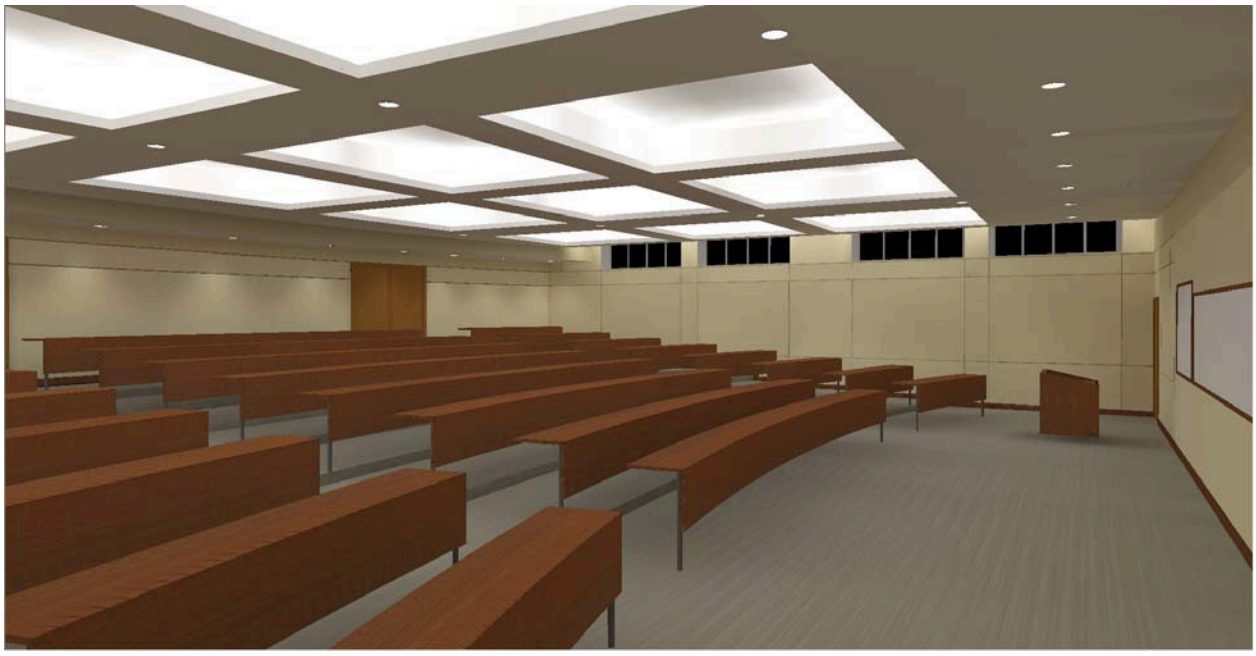


Peter & Ginny Nicholas Auditorium & Learning Center-Illuminance Results					
	Average Illuminance	Maximum Illuminance	Minimum Illuminance	Avg/Min	Max/Min
Floor in Front of Room	33.8	50.0	0.0	--	--
First Row of Desks	40.1	44.0	28.0	1.4	1.6
Second Row of Desks	39.6	45.0	28.0	1.4	1.6
Third Row of Desks	42.7	46.0	34.0	1.3	1.4
Fourth Row of Desks	42.6	46.0	33.0	1.3	1.4
Fifth Row of Desks	41.4	47.0	29.0	1.4	1.6
Sixth Row of Desks	38.4	43.0	31.0	1.2	1.4
Seventh Row of Desks	36.8	46.0	13.0	1.9	2.4
Eighth Row of Desks	38.0	46.0	28.0	1.4	1.6

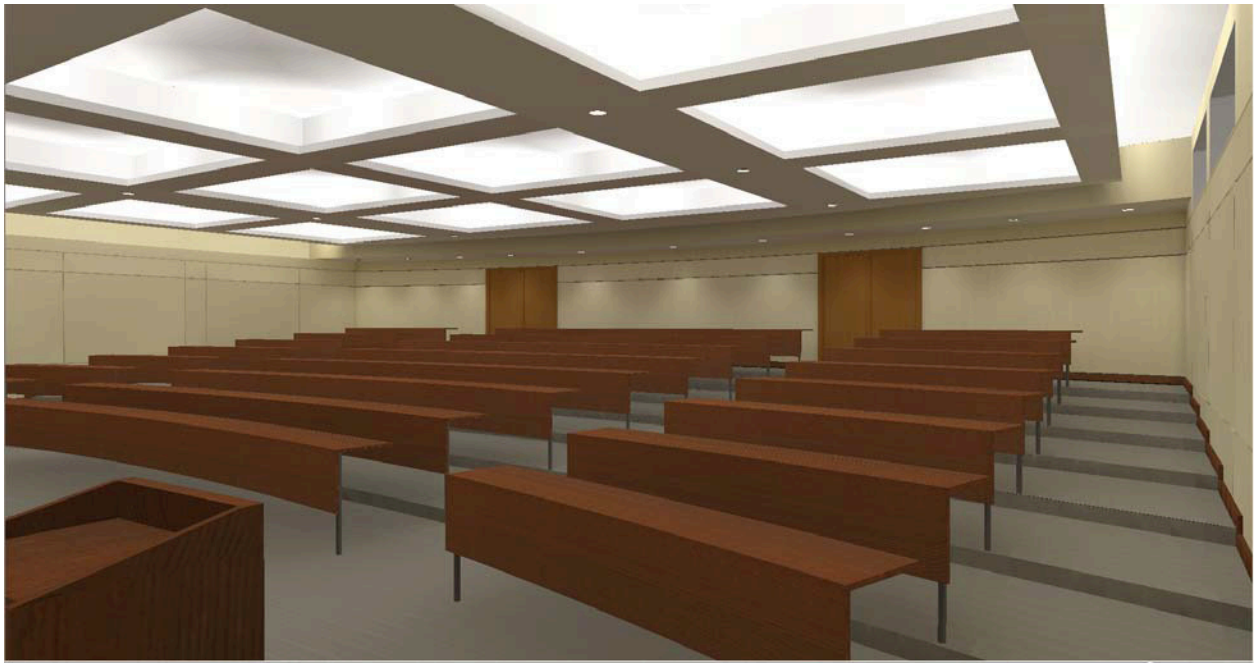
Note: All desk calculations were taken from the top of the desk, 2.5 ft AFF

Raytraced Renderings

Looking Southeast from Front of Room:



Looking Northeast from Front of Room:

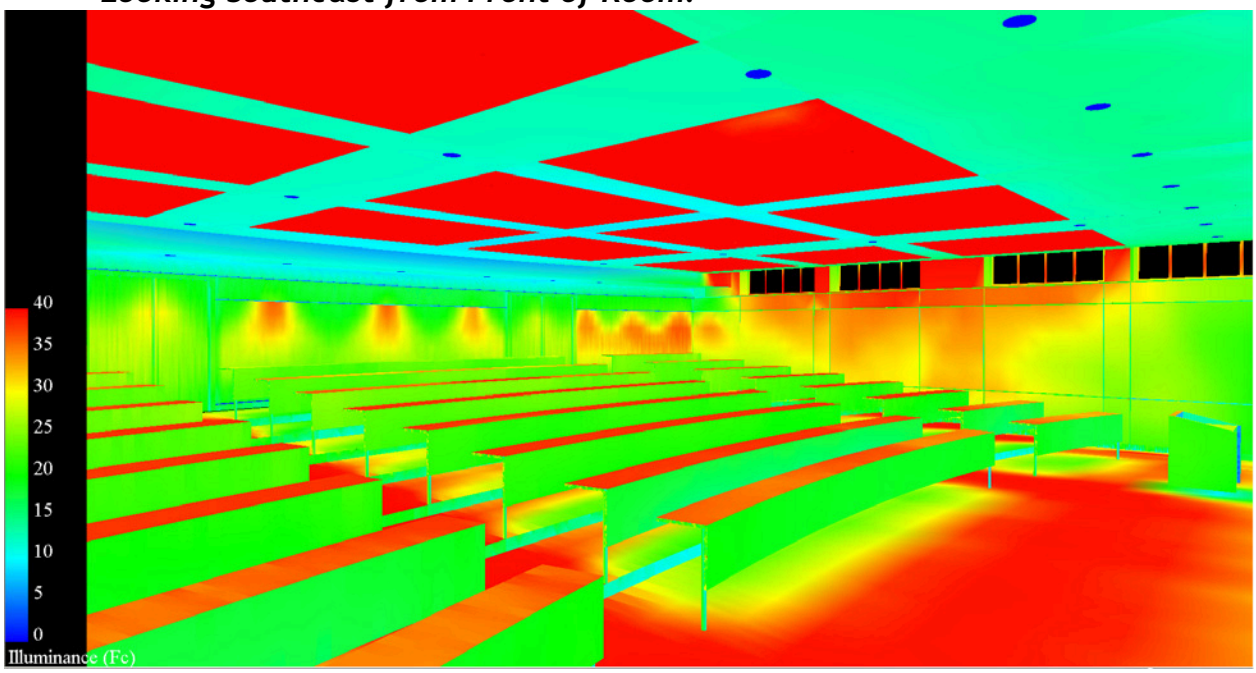


Looking South-Southeast from Back of Room:

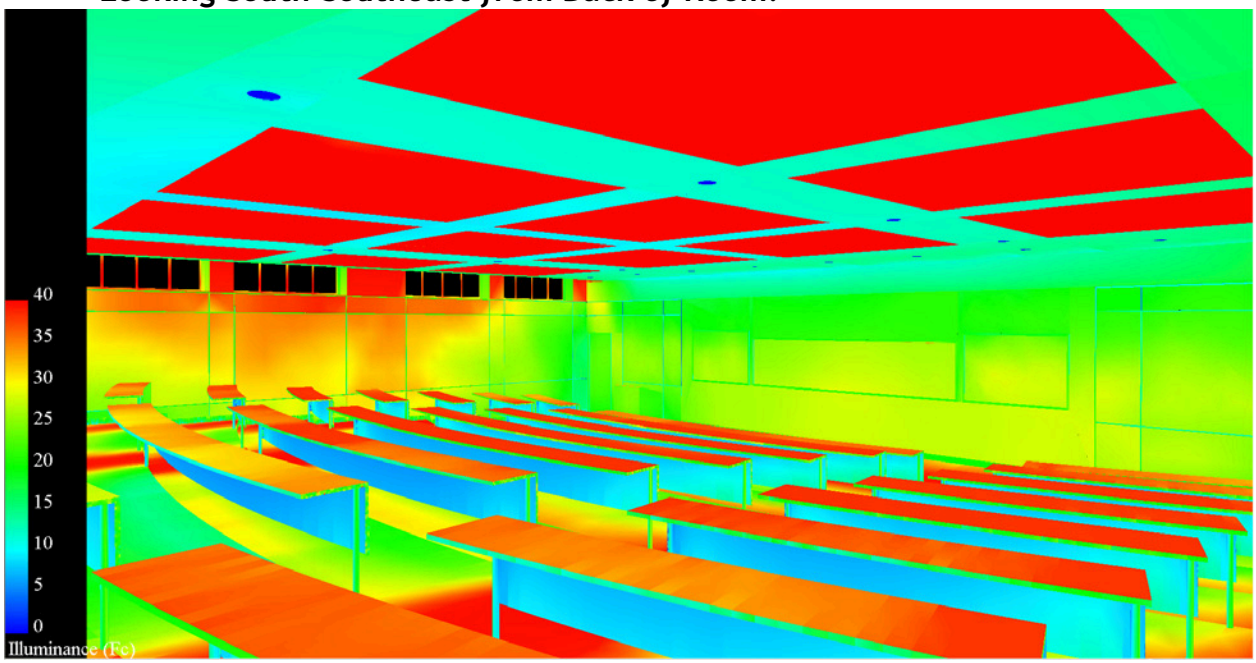
Looking South-Southeast from Back of Room:

Pseudo Color Renderings

Looking Southeast from Front of Room:



Looking South-Southeast from Back of Room:



Power Density

Peter & Ginny Nicholas Auditorium & Learning Center Power Density						
Fixture Type	Fixture Quantity	Fixture Wattage	Total Wattage (W)	Total Area (sf)	Actual Power Density (W/sf)	ASHRAE 90.1 Allowed Power Density
A	8	31	248			
B	112	25	2800			
H	11	25	275			
J	11	31	341			
			3664	2704	1.36	1.40

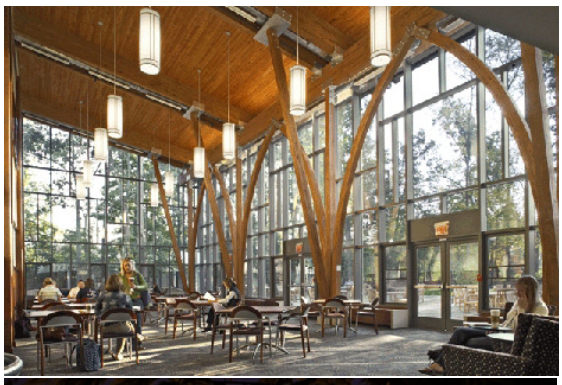
Evaluation

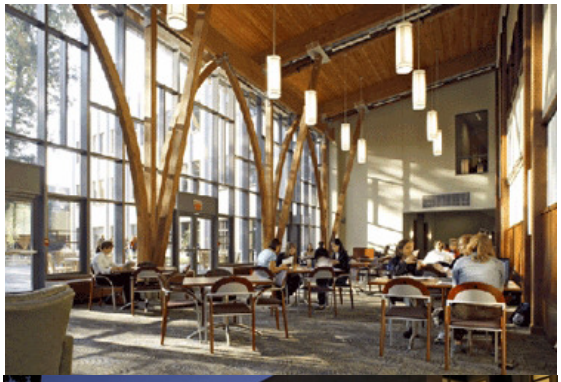
The lighting system that has been implemented meets the basic illumination requirements recommended in the IESNA. The design intent for changing the ceiling was to tie the architectural sense of the lobby together with this space. The cove system provides a clean look to the space as one looks out across the ceiling. The cove lighting system provides the main lighting for the space. However, since the cove lighting system is totally indirect lighting it creates what is known as a cloudy sky effect. This cloudy sky effect was avoided by introducing direct downlight atop the walkways. By placing direct light over the walkways, it increases the level of illumination and thereby providing a natural means of way finding. Finally, the front of the room, mainly the podium and whiteboards, were lit to a higher illuminance. The desired hierarchy of light for the space was successfully achieved.

Café DUSON- Overview

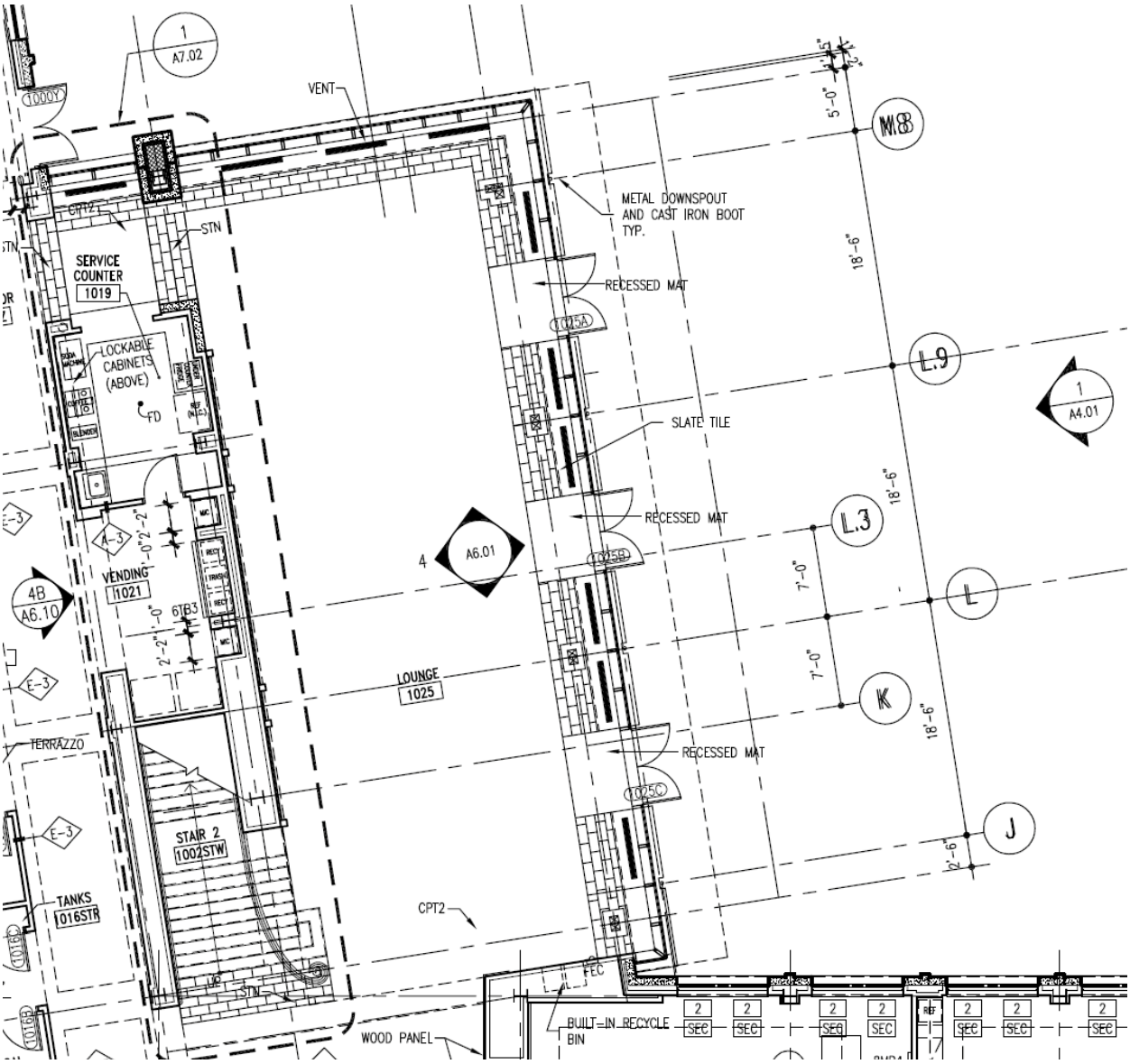
Café DUSON is a study lounge with seating and tables to seat approximately 65 people in an area of about 1850 SF. The café is a double high space with full height windows on the North and Eastern walls. This space also contains large arching roof supports that are large wooden timbers and made to look like Gothic Cathedral arches, which follow the Duke University architectural style. Café DUSON is designed to hold a feeling of relaxation while still having a studious atmosphere.

The lighting design intent for this space was to tie lighting and architectural feel together with the other interior spaces that were redesigned, the lobby and the auditorium. The first lighting goal was to create a clean look as one looks out across the space, just like in the auditorium. The second goal was to bring a sense of Gothic style to the space with a chandelier, the same chandelier from the lobby that also symbolizes the school. The final goal was to integrate part of the lighting into the large beams with the mechanical ducts to help in visually cleaning up the space but also refer back to the lobby and the luminaire locations between the beams.



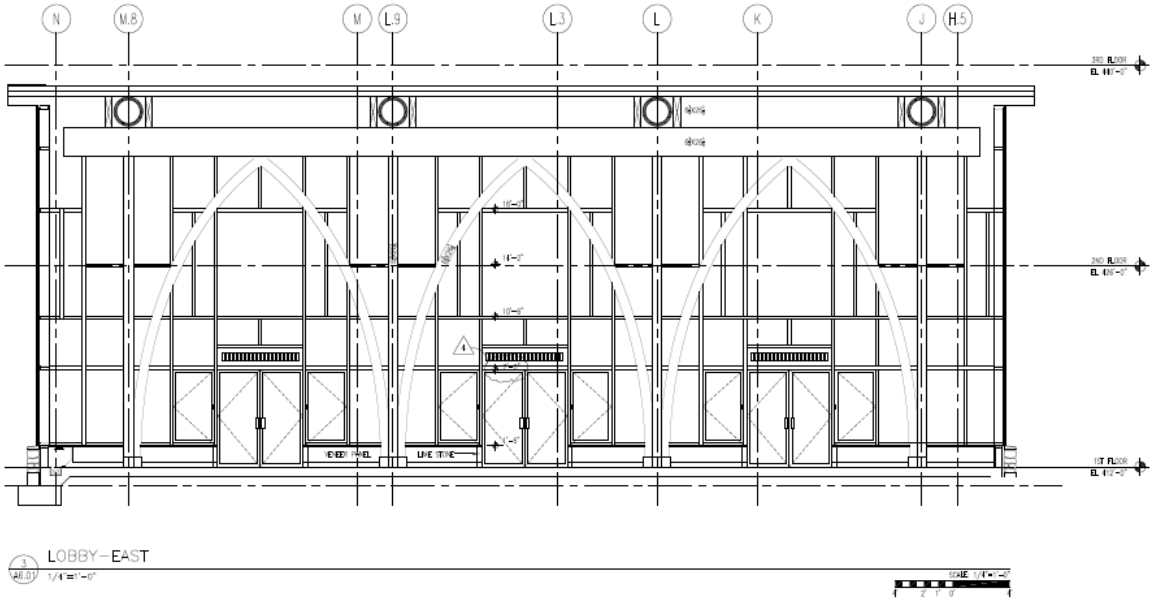


Architectural Plans

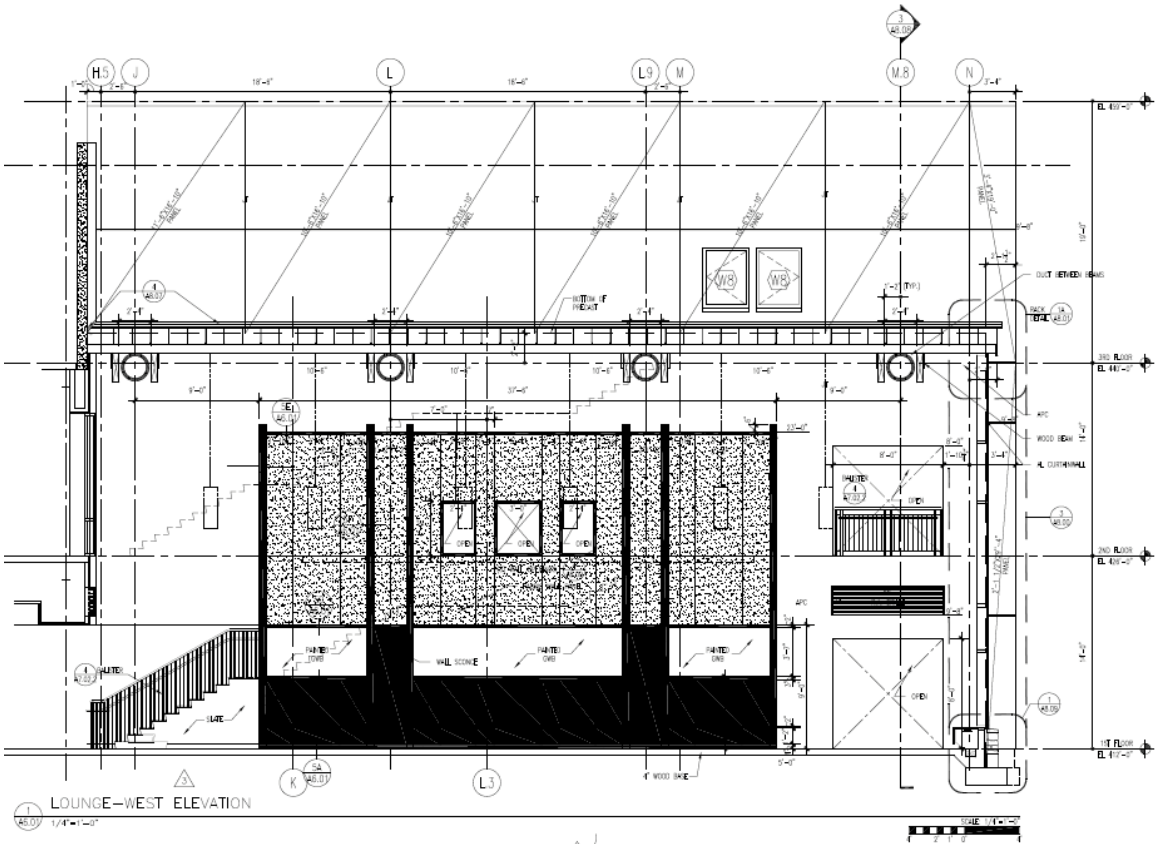


Architectural Interior Elevations

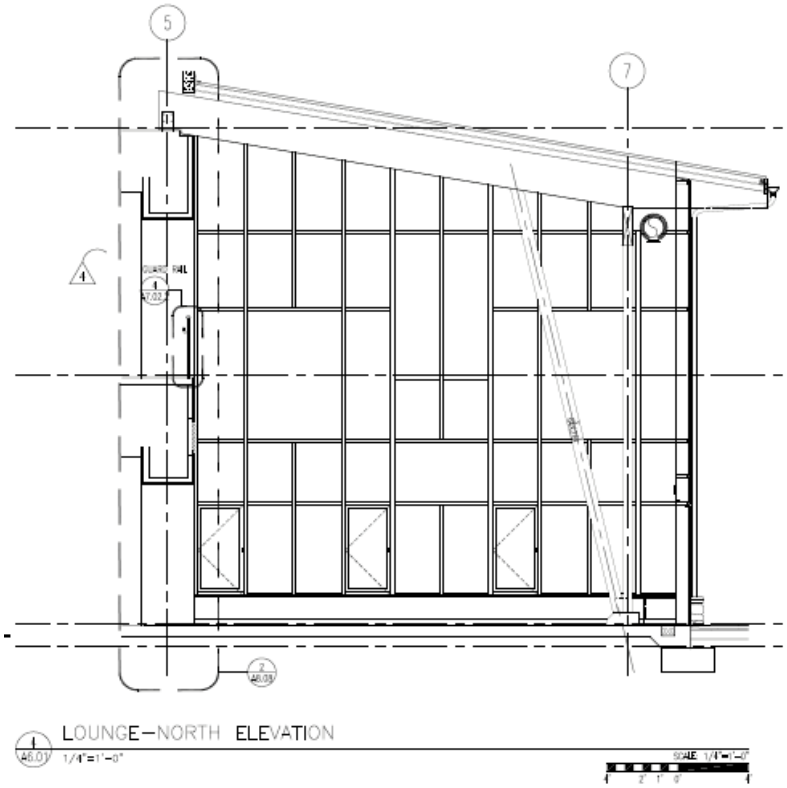
East Interior Elevation:



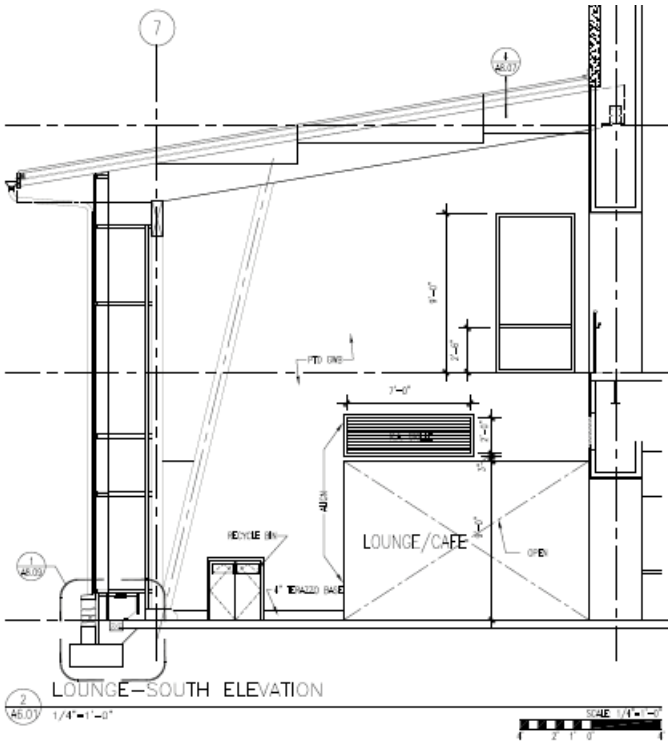
West Interior Elevation:



North Interior Elevation:



South Interior Elevation:


LOUNGE/CAFE
RECYCLE BIN
LOUNGE—SOUTH ELEVATION

IESNA Design Criteria

Appearance of Space and Luminaires:

Café DUSON is intended to possess a relaxing atmosphere, where you can relax and take a break from the busy schedule of the day. This space already posses some inherent properties of relaxation with its double high ceiling, natural wood beams, columns, wall paneling and ceiling. Also, the lounge looks out directly onto the courtyard with its gradual curves and the large trees surrounding it. The café also has a modern feel to it with the exposed air ducts and glass and aluminum curtain walls. Therefore, the styles of the luminaries should have a slight modernistic style to them while still holding to the Duke Gothic style. The lighting design intent is to maintain a clean look as you look across the space. For this reason, three chandeliers will be the only fixtures hanging from the ceiling. All the other light fixtures will be incorporated into or hidden by the architecture of the space.

Color Appearance:

The color appearance of the café should have a warm tone to it to enhance the natural tones of the wood throughout the space and maintain the intended feeling of relaxation.

Daylight Integration and Controls:

Café DUSON has glass curtain walls that face North and East. For this reason daylight integration should be utilized to save electrical energy. Also, this space could potentially be used for other events, such as banquets or parties. Therefore, an adjustable control system should be utilized to provide a versatile lighting system.

Direct Glare:

Direct glare from the luminaires is a concern, since the space is intended to have a feeling of comfort and relaxation. Direct sun glare from the easterly glass walls is a concern. However, the large trees that surround the courtyard could potentially diffuse some of the direct glare from the sun on the eastern curtain wall.

Light Distribution on Surfaces:

The space contains a lot of expensive woodwork and should be lit in such a way to bring out its natural beauty. Also, there is a 3-dimensional quality to the wooden arches, beams, and columns that should be expressed. Therefore, portions of the wood should have uniformity while also providing depth with shadows and direct lighting. The arches at night will not be highlighted by light but rather be in silhouette against the wallwashed wall behind it.

Light Distribution on Task Plane:

The task plane should be relatively uniform since there are tables and chairs for studying and working. Also, since this space could potentially have multiple uses, the task plane height could vary but should still maintain a uniform light distribution.

Modeling of Faces:

Modeling of faces is not of great importance. This space is intended for a relaxing work atmosphere, and therefore having a high vertical illuminance on the peoples' faces is actually not recommended.

Points of Interest:

The large wooden arches that look like Gothic cathedral arches and the wooden columns that support the roof system are a well defined point of interest within the space.

Shadows:

Some shadowing is desired to achieve a sense of depth with the large wooden timbers and arches. The desired lighting effect on the arches looking from the exterior is leaving the arches in strong shadows against the uniformly wallwashed wall behind the arches. However, shadows are not desired on the task plane.

Surfaces Characteristics:

The café contains a variety of surface materials. Some of the most prominent materials in the space are natural wood and of course the glass from the curtain walls. The space also contains some acoustic fabric wrapped paneling and white painted GWB.

IESNA Recommended Illuminance

Horizontal

For a lounge	300 lx (30 fc)

Vertical

For a lounge	No recommended illuminance

Café DUSON- Existing Conditions

Surface Materials within the Space:

- Gray Thin Outer Carpeting
  - Reflectance = 29%
- Gray Thin Inner Carpet
  - Reflectance = 35%
- Natural Wood Ceiling
  - Reflectance = 9%
- Natural Wood Timber
  - Reflectance = 13%
- White Painted GWB
  - Reflectance = 88%
- Acoustic Wall Panels
  - Reflectance = 48%
- Natural Wood Wall Panels
  - Reflectance = 13%
- Gray Painted Aluminum Mullions
  - Reflectance = 58%

Glazing:

- **G-5:** 1" Insulated Glass Curtain Wall System of Café DUSON
  - U-Value = 0.57
  - Transmittance = 0.55
  - Shading Coefficient = 0.45

- **G-4:** 1" Insulated Glass – Laminated (door glass)
  - U-Value = 0.57
  - Transmittance = 0.55
  - Shading Coefficient = 0.45

Luminaire Schedule

Café DUSON Student Lounge- Luminaire Schedule									
Type	Mounting	Manufacturer	Catalog Number	Lamp	Input Amps	Input Watts	Volts	Ballast Catalog Number	Fixture Description
C	Ceiling Recessed	Cooper Lighting	M6043S-Q-740-10012P	(1) 100W BD17MED CMH GE CMH100/U/830/MED	1.1	118	277	Advance 71A5337J	Max height 6-in 10-in Direct Downlight Horizontal Lamp Core and Coil Ballast
D	Surface	Elliptipar	F305-T328-S-00-2-000	(1) 54W T5HO GE F54W/T5/830	0.52	62	277	Advance ICN4S5490C2LSG_277	4 ft. Asymmetric Cove Electronic Ballast
F	Semi-Recessed	Elliptipar	M204-0175-T-02-B	(1) 175W ED28 CMH MVR175/SP30/U	0.45	206	277	Advance 71A5543T	18-in Louvered Semi-recessed CMH Wallwasher Coir and Coil Ballast
G	Pendant Chandelier	Custom	Custom	(2) 26W Triple Tube CFL GE F26TBX/SPX30A/4P	0.21	58	277	Advance VEZ-2Q26-M2-LD	Custom designed pendant that reflects Gothic Architecture/Style

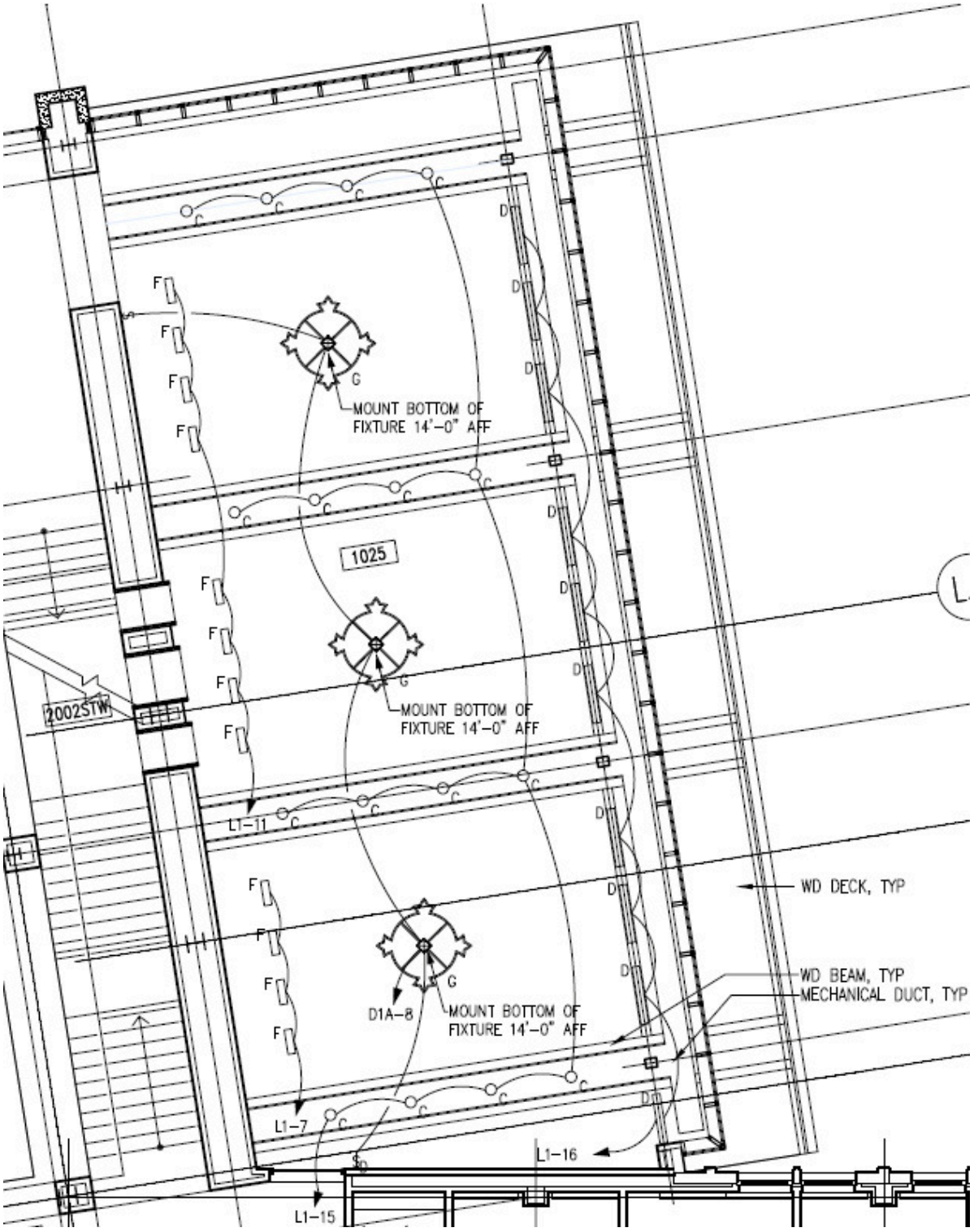
Lamp Schedule

Café DUSON Student Lounge- Lamp Schedule							
Type	Manufacturer	Cat. #	Rated Wattage	CRI / CCT	Rated Life	Initial Lumens	Assoc. Fixture
L1	General Electric	F26TBX/SPX30A/4P	26	82 / 3000K	12000	1710	G
L3	General Electric	CMH100/U/830/MED	100	83 / 3000K	15000	9200	C
L4	General Electric	F54W/T5/830	54	85 / 3000K	20000	5000	D
L5	General Electric	MVR175/SP30/U	175	70 / 3000K	6000	10300	F

Note: (1) All fixture cut sheets are located in the Appendix A

(2) This space is controlled by an astronomical time clock and a wall dimmer

Lighting Plan

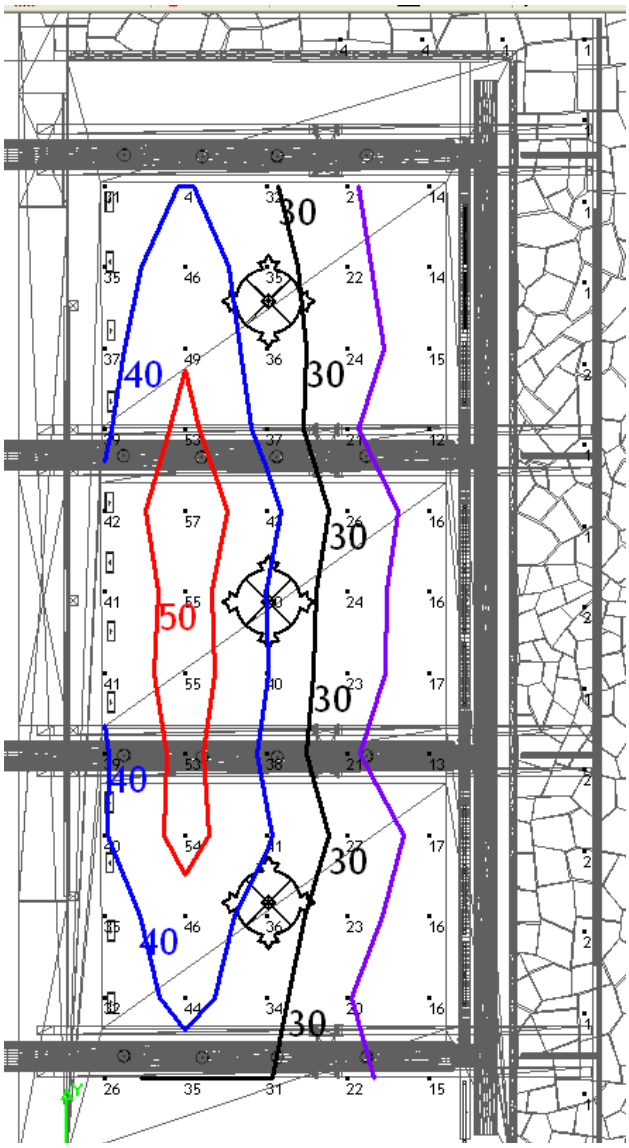


Note: Please refer to Appendix B for 1/8" = 1'0" Lighting and Circuiting Plan

Light Loss Factors

Café DUSON Student Lounge- LLF													
Type	Fixture Description	Lamp	Mean Lumens [Initial Lumens]	LLD	Room Properties (Ft.)		RCR	Assumptions	Expected Dirt Depreciation	RSDD	LDD	BF	Total LLF
C	100W MH Open Maintenance **Category III** **Direct** Downlight	(1) 100W BD17MED CMH GE CMH100/U/830/MED	6400 / 9200	0.696	Height / Length / Width / Perimeter / Area (ft²)	25.5 / 67 / 27 / 190 / 1843	6.57	Clean; 12 Months Cleaning Cycle	12	0.96	0.9	1.00	0.60
D	54W T5HO Open top Closed Bottom Maintenance **Category VI** Asymmetric **Indirect** Uplight	(1) 54W T5HO GE F54W/T5/830	4700 / 5000	0.940	Height / Length / Width / Perimeter / Area (ft²)	25.5 / 67 / 27 / 190 / 1843	6.57	Clean; 12 Month Cleaning Cycle	12	0.87	0.86	0.99	0.70
F	175W CMH Closed top Louvered Bottom Maintenance **Category IV** Wallwasher **Direct**	(1) 175W ED28 CMH MVR175/SP30/U	6500 / 10300	0.631	Height / Length / Width / Perimeter / Area (ft²)	25.5 / 67 / 27 / 190 / 1843	6.57	Clean; 12 Month Cleaning Cycle	12	0.96	0.89	1.00	0.54
G	Custom Pendant Chandelier	(2) 26W Triple Tube CFL GE26TBX/SPX30A/4P	1440 / 1710	0.842	Height / Length / Width / Perimeter / Area (ft²)	25.5 / 67 / 27 / 190 / 1843	6.57	Clean; 12 Month Cleaning Cycle	12	0.96	0.9	1.00	0.72

Illuminance Data

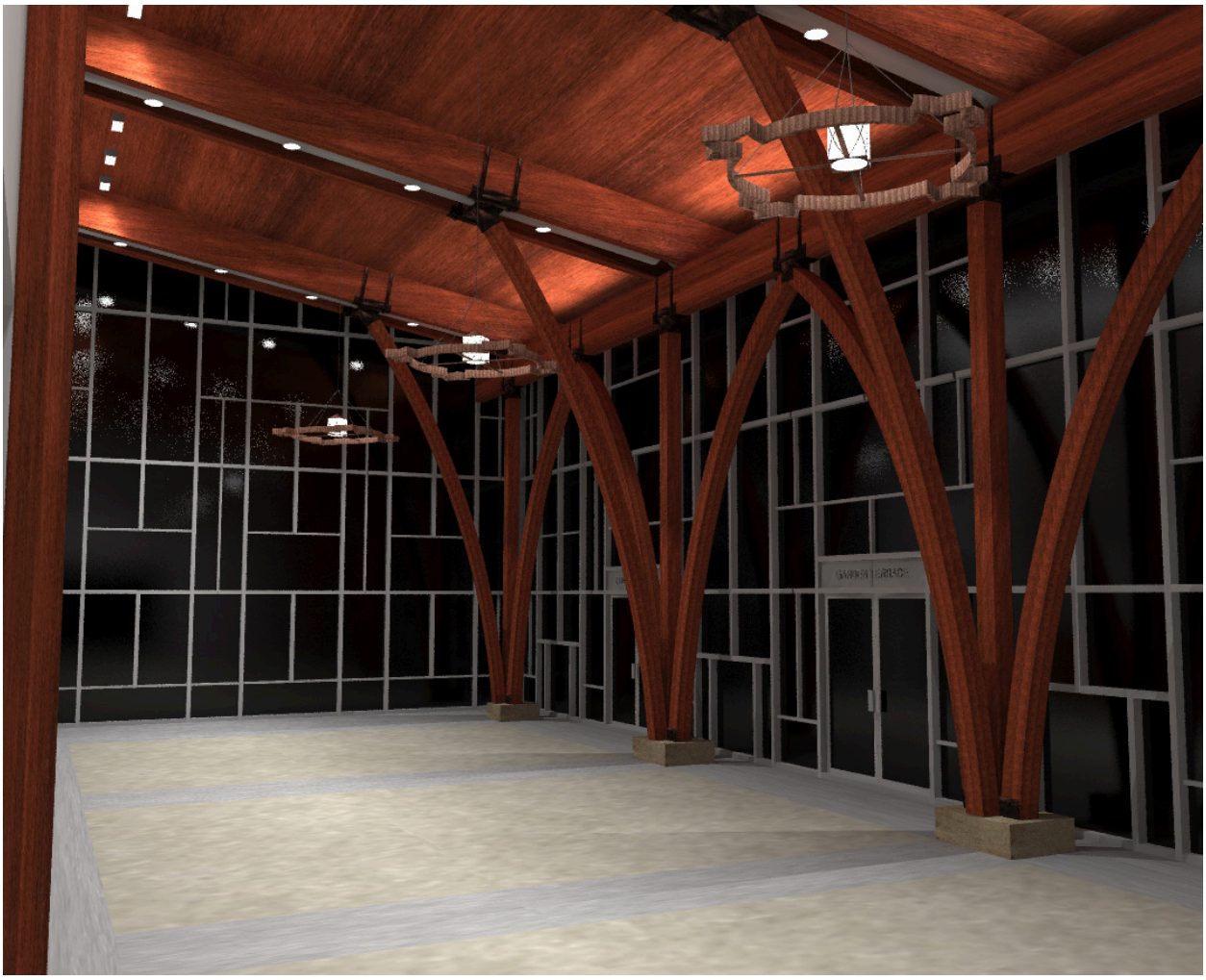


AGI32-v2.0 Statistical Summary

Café DUSON Student Lounge- Illuminance Results					
Average Illuminance	Maximum Illuminance	Minimum Illuminance	Avg/Min	Max/Min	Uniform Gradient
32.2	58.0	12.0	2.7	4.8	1.8

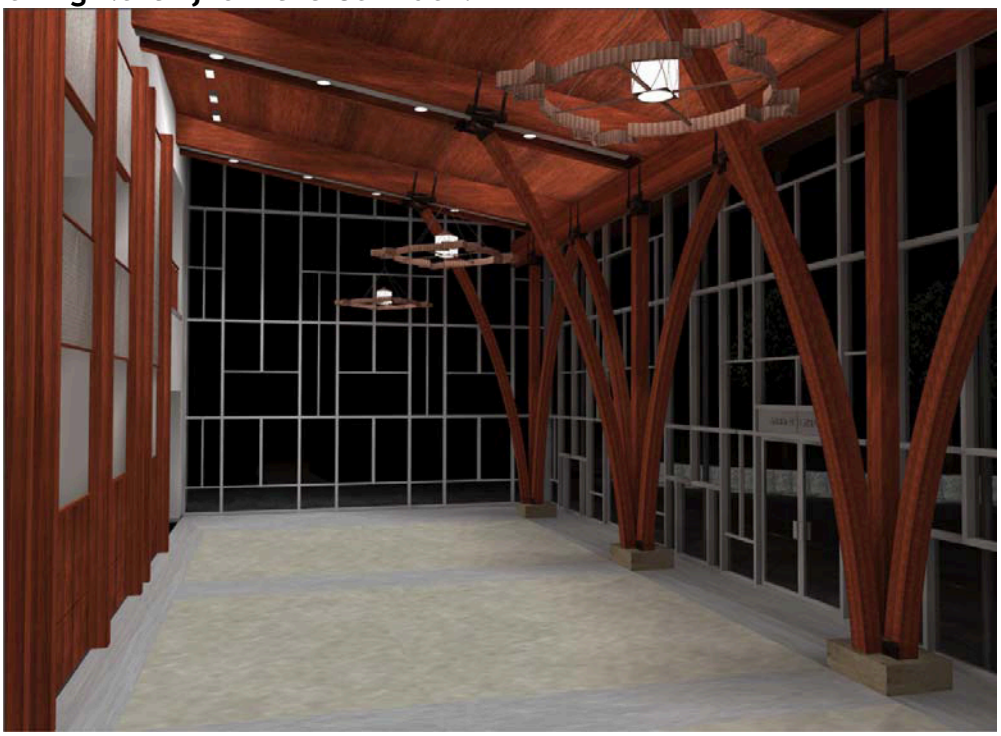
AGI32 Raytraced Renderings

Looking North-Northeast from the Corridor:



AGI32 Radiosity Renderings

Looking North from the Corridor:



Looking Northeast from the Corridor toward the Courtyard:

Looking East from the Second Floor Corridor:

Looking West from the Courtyard:

Power Density

Café DUSON Student Lounge Power Density						
Fixture Type	Fixture Quantity	Fixture Wattage	Total Wattage (W)	Total Area (sf)	Actual Power Density (W/sf)	ASHRAE 90.1 Allowed Power Density
C	12	118	1416			
D	11	62	682			
F	11	206	2266			
			4364	1843	2.30	1.2
Fixture Type	Fixture Quantity	Fixture Wattage	Total Wattage (W)	Total Area (sf)	Actual Power Density (W/sf)	ASHRAE 90.1 Allowed Power Density
G*	3	58	174			
			174	1843	0.09	1.0
*Decorative Fixture, Additional 1.0 W/sf						

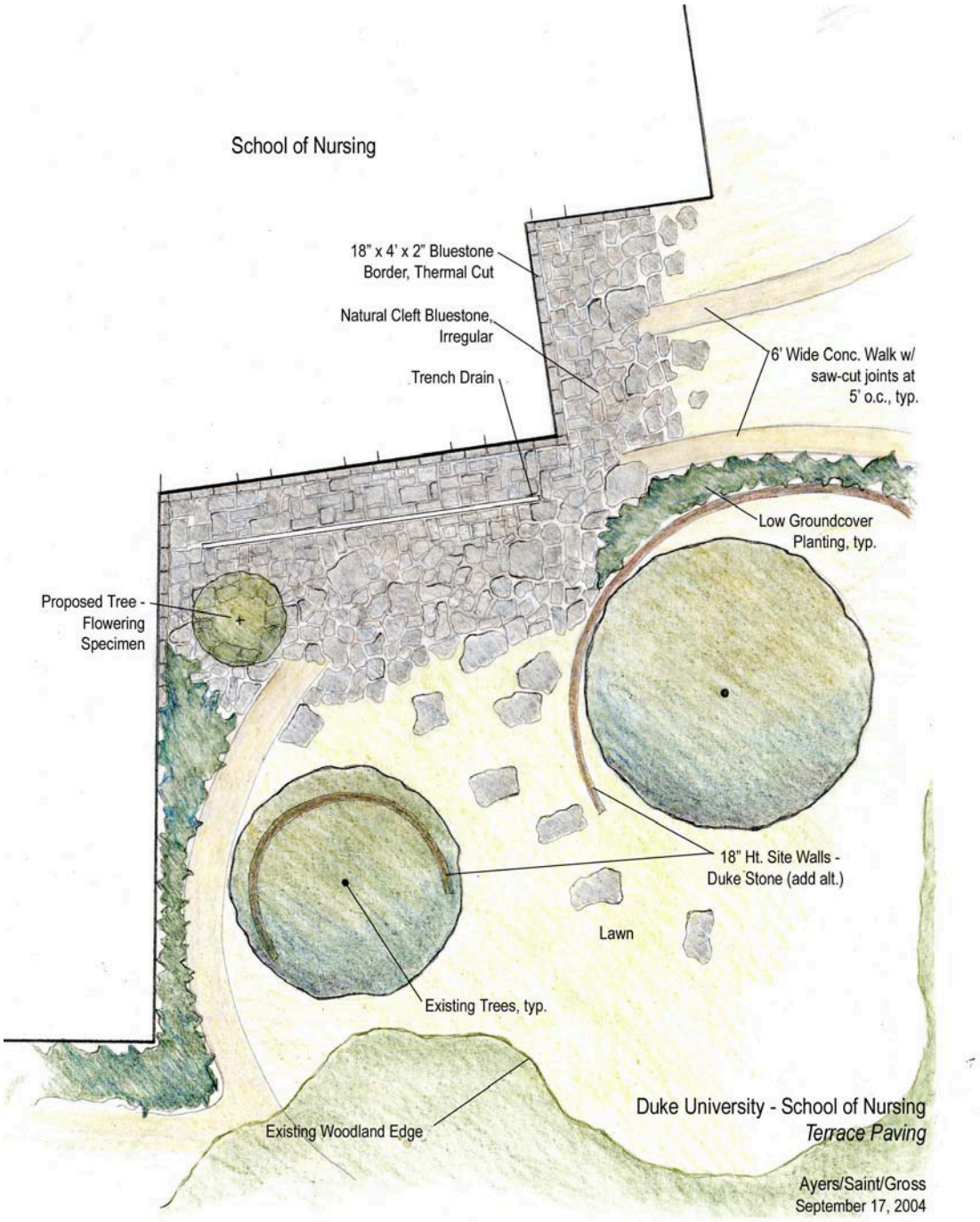
Evaluation

This space is just about on target for the recommended horizontal illuminance. It is currently higher by about 9fc. Since I am 0.26 W/sf above the ASHRAE standard, I will look into changing the ballast for the CMH fixtures. For the final submission I am going to Photoshop the wallwashers to soften the white luminous surface, since in reality you would see a soft metallic glow. After making minor modifications and putting my custom fixture in, I am pleased with the results.

Champagne Outdoor Courtyard Overview

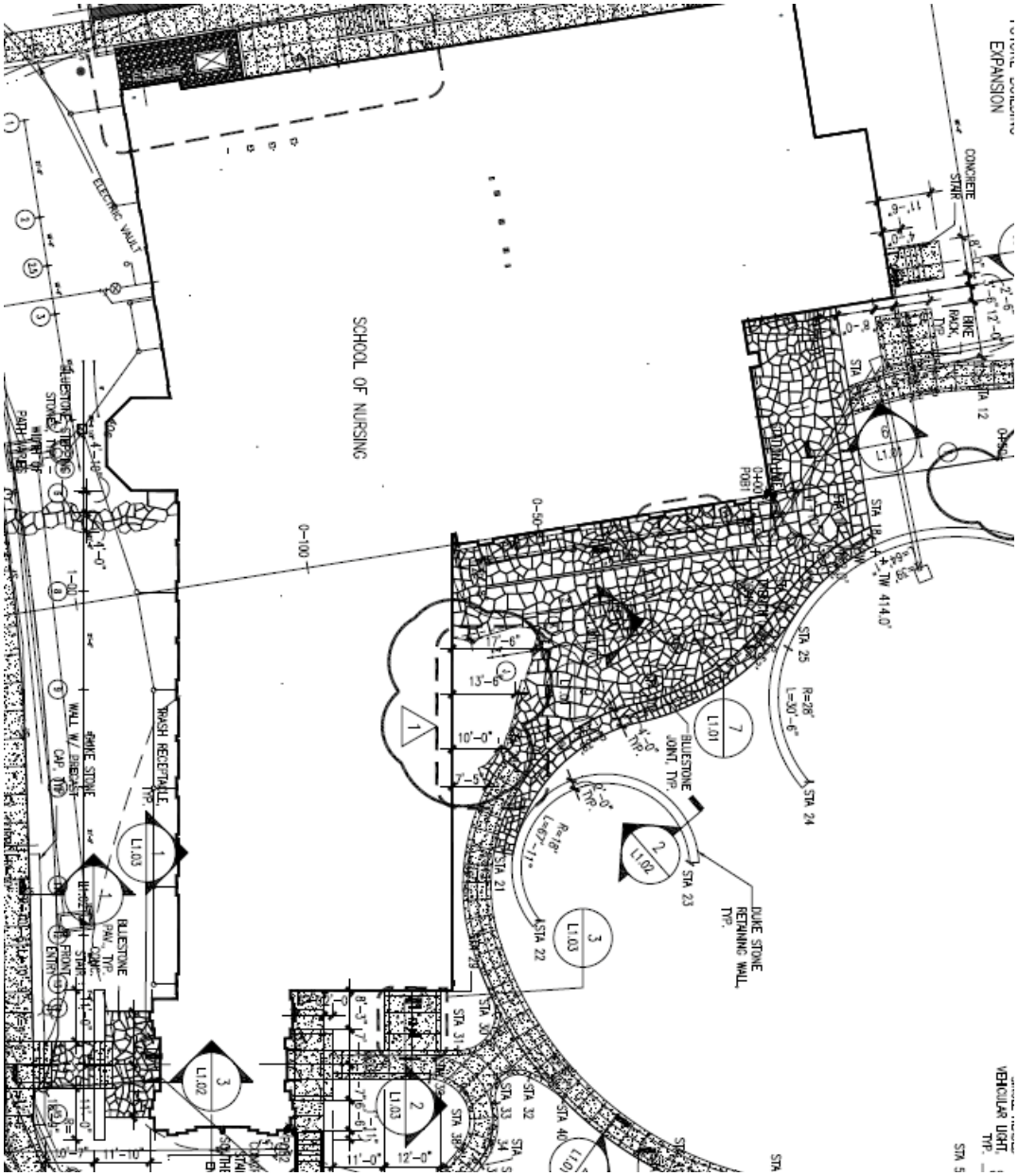
The courtyard is located on the East side of the building and covers an approximate area of 1450 SF. The courtyard serves as the outdoor portion of the Café DUSON lounge. There are tables and benches that seat approximately 54 people. The courtyard is intended to provide a sense of relaxation and comfort, with its gentle curving retaining walls, random natural cleft Bluestone paver pattern, and the incorporation of trees and shrubbery around the courtyard.

Architect's Conceptual Rendering



*The above is a conceptual rendering by ASG

Architectural Plan



Architectural Elevations

The curved retaining walls are rise 2-ft off of the courtyard stone pavers.

IESNA Design Criteria

Appearance of Space and Luminaires:

The courtyard is a space that is intended for people to gather and work or relax. With the knowledge of this intended use, it is critical that the space appear inviting and have a sense of pleasantness. The luminaire styles should accent the Duke University Architectural Style of Gothic Architecture.

Color Appearance:

The color appearance of the courtyard should have a slight warm tone to it. Being that the courtyard is adjacent to and essentially the outdoor portion of the warmly lit Café DUSON, it is critical that the courtyard carry similar characteristics.

Controls:

All the outdoor luminaries within this space should use an astronomical time clock.

Light Distribution on Surfaces:

For public safety, some degree of uniformity must be maintained on the pathways. To create visual interests and bring out the inherent textures of the materials of the space, grazing and other forms of non-uniformity should be used.

Light Distribution on Task Plane:

The courtyard and its walkways are some of the main means of egress from the building and therefore require the walkways and courtyard surface to maintain an illuminance level of 1 lx (0.1 fc) over the entire path of egress.

Modeling of Faces and Objects:

The courtyard is used by occupants of the building as well as passersby therefore face and object recognition is important for security and safety reasons.

Points of Interest:

The trees surrounding the courtyard were an important part of the building, since these trees are original to the site. The architecture of the courtyard retaining walls highlight their existence and give them a sense of importance to the space. For this reason, accenting these trees with light will reinforce this design objective and provide a point of interest. Also, the curved retaining walls that contain the previously mentioned trees are an interesting architectural feature that should also be highlighted for the patrons of the café and passersby to notice.

Shadows:

Shadows should be avoided in the interest of safety and security.

Surfaces Characteristics:

The courtyard has a variety of stonework and trees that should be highlighted to some extent to draw out their natural textures by grazing.

IESNA Illuminance Recommendations

Horizontal	
Pathways Away from Building	10 lx (1 fc)
Vertical	
Pathways Away from Building	3 lx (0.3 fc)

Existing Material Conditions

Surface Materials within the Space:

- Natural Cleft Bluestone walkway and courtyard
  - Reflectance = 15%
- Duke Stone retaining walls
  - Reflectance = 20%
- Gray Painted Aluminum Mullions
  - Reflectance = 25%

Glazing:

- **G-5:** 1" Insulated Glass Curtain Wall System of Café DUSON
  - U-Value = 0.57
  - Transmittance = 0.55
  - Shading Coefficient = 0.45

- **G-4:** 1" Insulated Glass – Laminated (door glass)
  - U-Value = 0.57
  - Transmittance = 0.55
  - Shading Coefficient = 0.45

Luminaire Schedule

Champagne Outdoor Courtyard- Luminaire Schedule							
Type	Mounting	Manufacturer	Catalog Number	Lamp	Input Watts	Volts	Fixture Description
K	Outdoor In -ground Recessed	Erco	33670	(1) 10W T3 2-Pin G4 Halogen GE Q10T3/CL	10	120	10W Halogen, 120V Outdoor In-ground recessed uplight UL Wet Listed Impact Resistant Cut-off angle 30°

Light Loss Factors

Champagne Outdoor Courtyard- LLF												
Type	Fixture Description	Lamp	Mean Lumens [Initial Lumens]	LLD	Room Properties (Ft.)		RCR	Assumptions	Expected Dirt Depreciation	RSDD	LDD	BF	Total LLF
K	10W T3 Halogen Closed Clear Lens Top Closed Bottom Outdoor in-ground Uplight Maintenance **Category VI**	(1) 10W T3 2-Pin G4 Halogen GE Q10T3/CL	140 140	1.0	Height Length Width Perimeter Area (ft^2)	0 ~95 ~52 405 3860	1.00	Very Dirty 12 Months Cleaning Cycle	30	0.94	0.64	1.00	0.602

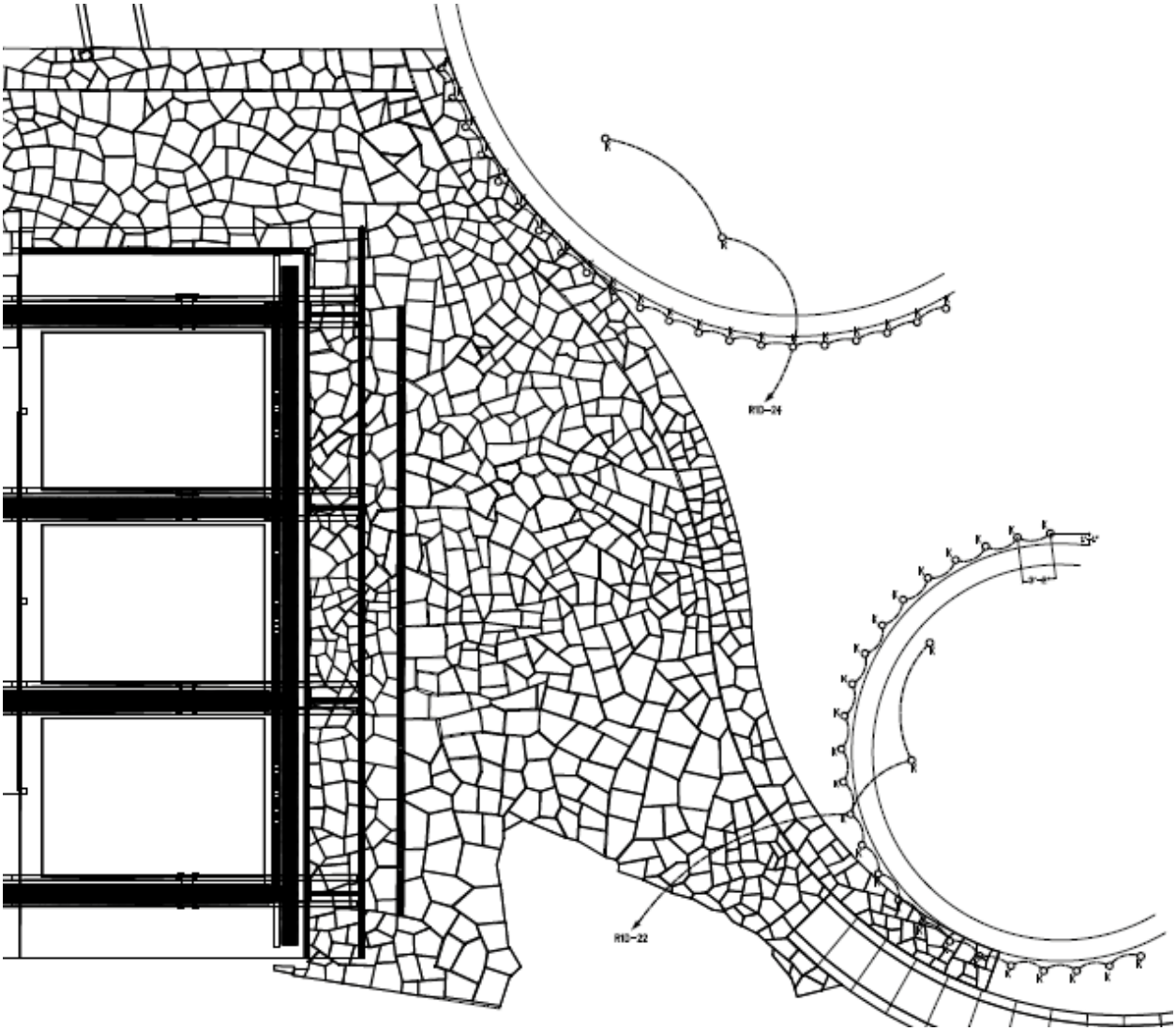
Lamp Schedule

Champagne Outdoor Courtyard- Lamp Schedule							
Type	Manufacturer	Cat. #	Rated Wattage	CRI / CCT	Rated Life	Initial Lumens	Assoc. Fixture
L6	General Electric	Q10T3/CL	10	1.0/2800	2000	140	K

Notes: (1) please refer to Appendix A for all product cut sheets and complete schedules.

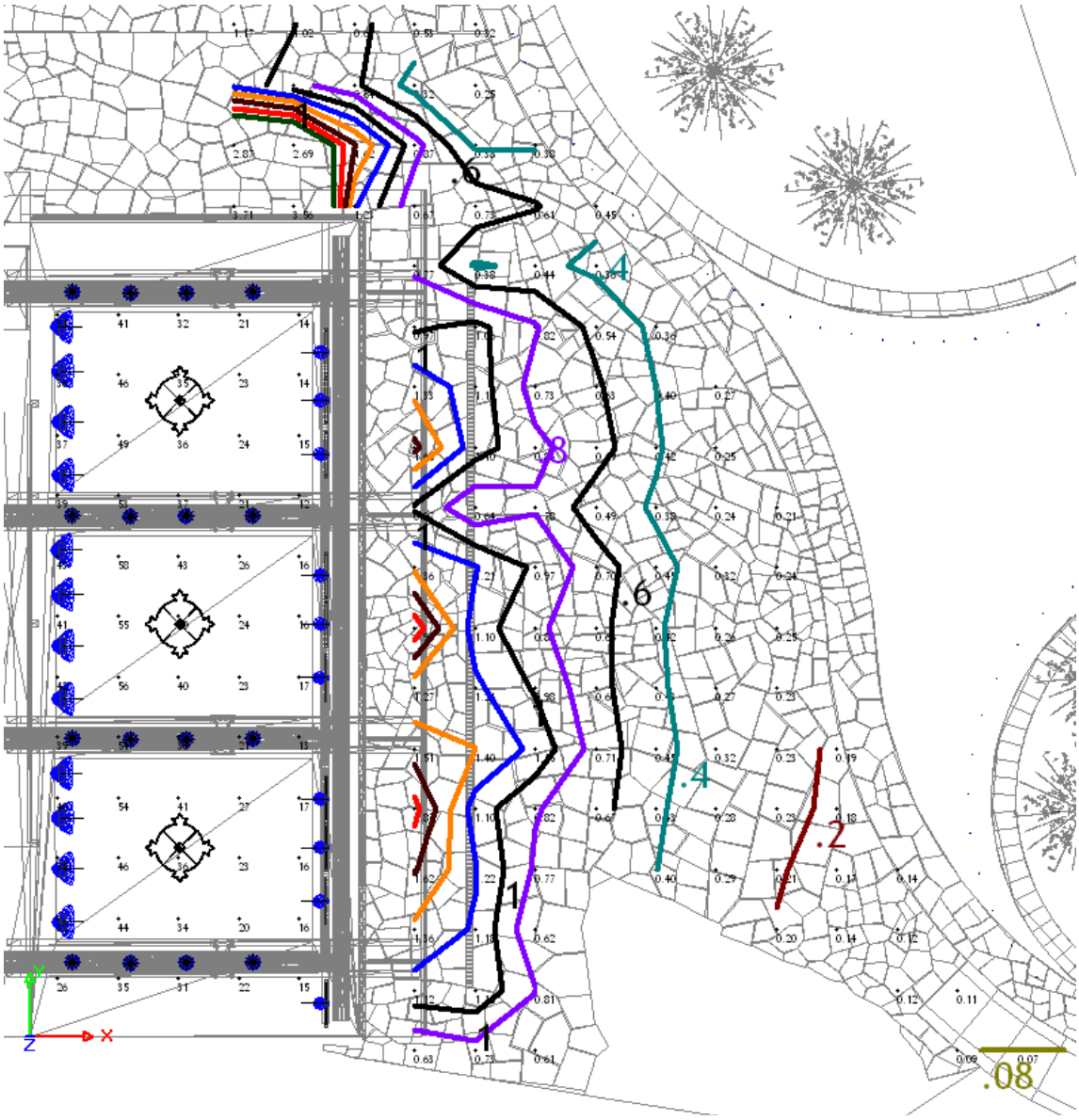
(2) this space will be controlled by an astronomical time clock located in the first floor west AV closet, where PNL R1D is located.

Lighting Plan



Note: Please refer to Appendix B for 1/8" = 1'0" Lighting and Circuiting Plan

Illuminance Data



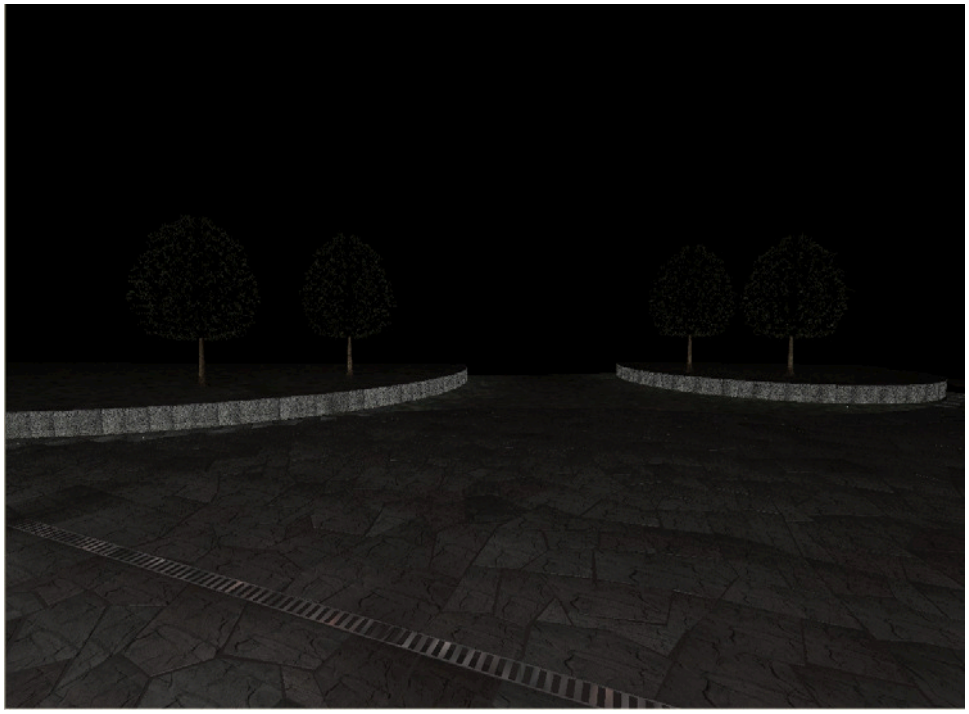
AGI32-v2.0 Statistical Summary

Duke Tower Entrance Lobby- Illuminance Results					
Average Illuminance	Maximum Illuminance	Minimum Illuminance	Avg/Min	Max/Min	Uniform Gradient
0.77	3.70	0.07	11.00	53.00	3.58

Radiosity Renderings

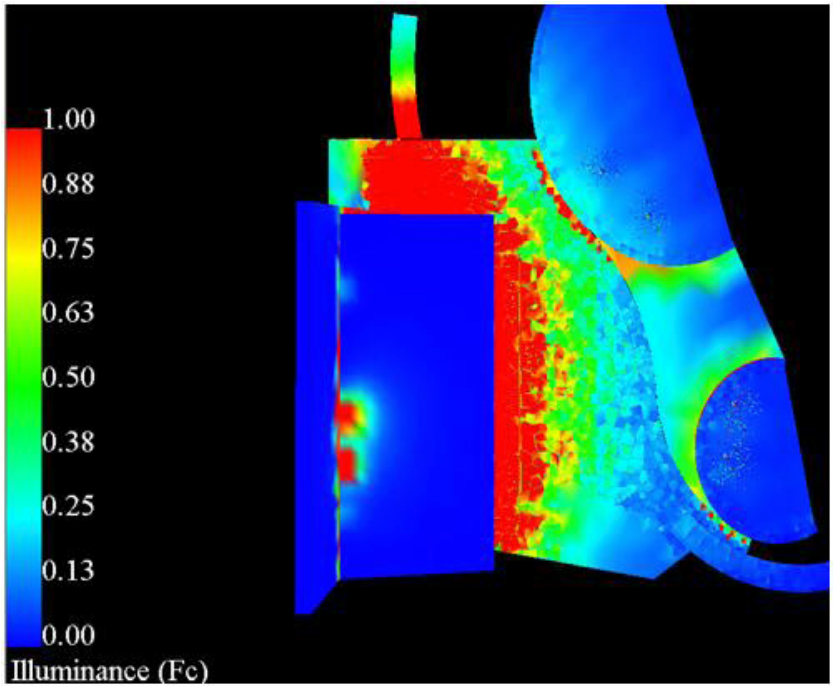
Plan View:

View from Café DUSON East Exterior Doors:

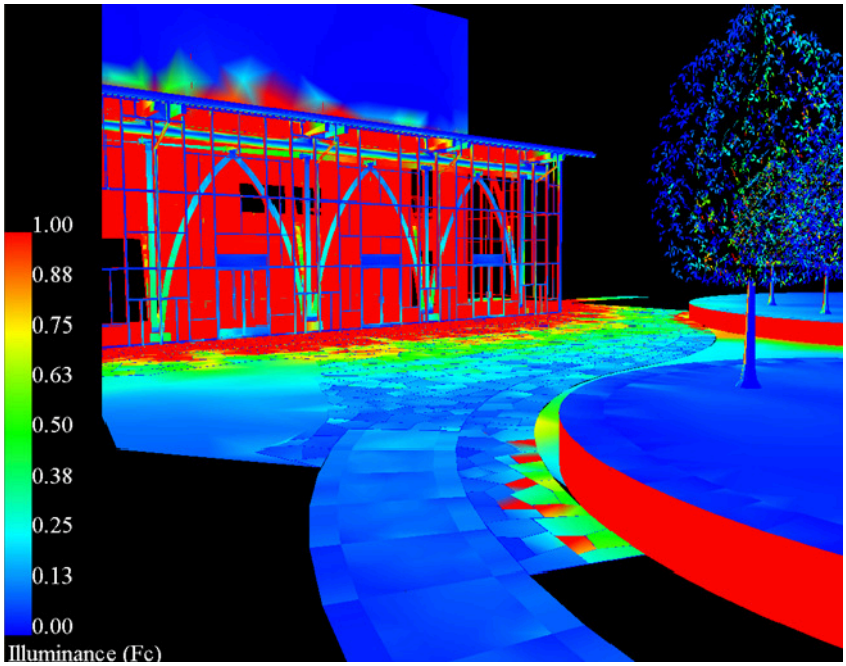


Pseudo Color Renderings

Plan View:



View from South Walkway Looking Northwest:



Power Density

Champagne Outdoor Courtyard Power Density						
Fixture Type	Fixture Quantity	Fixture Wattage	Total Wattage (W)	Total Area (sf)	Actual Power Density (W/sf)	ASHRAE 90.1 Allowed Power Density
C	48	10	480			
			480	3859.6	0.12	0.2

Evaluation

The lighting system that has been implemented almost meets the basic illumination requirements recommended in the IESNA. The average horizontal illuminance was 0.77 fc as compared to the recommended value of 1.0 fc. This illuminance was calculated with no other lights on, where in reality there is trespass light on the space from roadway and parking lot lights that were not part of this scope. Therefore I am comfortable saying that this space meets the IESNA recommended illuminance values.

Total Building Power Density for Redesigned Spaces

Power Density Analysis of Redesigned Spaces			
Space	Actual Power Density (W/sf)	ASHRAE 90.1 Allowed Power Density	Percent Difference
Lobby	0.22	1.2	18.3%
Auditorium	1.36	1.4	97.1%
Café	2.30	1.2	191.7%
Courtyard	0.12	0.2	60.0%
Total Percentage of Actual Power Density to Allowed Power Density =			100.0%

The total power density for the entire building meets ASHRAE 90.1 energy standards. All of the spaces except for the Café DUSON meet and exceed the ASHRAE standard. Even though the Café exceeds the allowed power density by 1.1 W/sf the other three spaces combined are 1.1 W/sf below the allowed power density.