South Nassau Communities Hospital North Addition

Oceanside, New York

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AGI files located on Y Drive folder CAS Thesis

Executive Summary

The following report is a detailed analysis of the existing lighting design of four spaces within the North Addition of the South Nassau Communities Hospital. Completed in 2005, the North Addition added 160,000 SF of new facility to the existing hospital. This analysis focuses on four different types of spaces: a large work space (a second floor nurse's station), a special purpose space (the auditorium and conference center), a circulation space (the main entrance lobby), and an outdoor space (the courtyard adjacent to the conservatory). Information for each space is divided into three parts; existing conditions complete with plans, elevations, sections, images, and existing equipment; lighting design criteria and considerations; and an evaluation of the existing lighting design.

The lighting design of the North Addition attempts to compliment the architecture of the space. Strong linear lines and sharp edges are used throughout the building, with the exception of the auditorium which unique curved shape stands in contrast to the rest of the building. The lighting enhances the architecture by using linear luminaires and cove lighting to highlight the transition between walls and ceilings. The lighting design was also designed to be functional and provided adequate illuminance levels for the task at hand.

For the most part, the lighting design works with the architecture in the space. There are some areas where a similar effect could have been achieved and better manner from a lighting standpoint. In almost all cases, the spaces were overdesigned based on IESNA, ASHRAE, and New York state requirements. These spaces were assumed to be operating with the existing lighting at full output, and even with the controls used in most spaces, there is significant room for improvement in all spaces.

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Building Statistics

Summary

Completed in May 2005, the North Addition of the South Nassau Communities Hospital provides an additional 108 medical / surgical beds, LDRs (Labor/Delivery/Recovery), an obstetrical suite, a behavioral health unit, offices, and a 300 seat auditorium to the existing complex. Designed to accentuate the strengths of the existing historical building, the North Addition serves as a welcoming entrance and helps to create a modern image for the hospital.

Building Name | South Nassau Communities Hospital North Addition

Location | Oceanside, New York

Building Occupant | South Nassau Communities Hospital

Occupancy Type | Institutional (Group I-2), Assembly (Group A-3)

Size | 160,000 SF

Stories | 5 (all above grade)

Project Team

Owner | South Nassau Communities Hospital
Architect | Cannon Design
Engineers | Cannon Design
Communications Consultant |
Civil Engineer |
Construction Manager | Bovis Lend Lease
General Contractor | KLMK Group

Dates of Construction | December 2003 – May 2005

Cost | $64,100,000

Project Delivery Method: Guaranteed Maximum Price

Large Workspace | Second Floor Nurse's Station

Existing Conditions

Description:

Located throughout the hospital, the nurse's stations are the center of activity for the surrounding area. The stations serve as a central monitoring location for nurses as well as an area for doctors and nurses to communicate and organize patient information. Visitors and patients also use the nurse's stations to request information. The nurse's station to be studied in this report is located in the West wing of the second floor. Two corridors surround the station, which is positioned in the center of the surrounding patient rooms. Custom workstations provide areas for computer usage in addition to drawer and file space. Specific dimensions, plans, and materials for this space are detailed below.

Area: 830 SF

Dimension: Approximately 30' x 27', with a ceiling height of 9'-6".

Materials:

Nurse's Station Materials and Finishes Schedule					
Abbreviation	**Finish Type**	**Object**	**Manufacturer**	**Color**	**Reflectance**
ACT-1	Ceiling Tile	Ceiling	Armstrong	White	0.90[b]
PL-3	Plastic Laminate	Desk Top	Formica (933-58)	White-Matte	0.93[c]
SOS-2	Surface	Desk Side	Trespa (Varitop)	Amber (Matte)	0.30[c]
VCT-2	Vinyl Composite Tile	Floor	Azrock	White	0.82[c]
VWB-1	Vinyl Wall Base	Wall	Roppe	Taupe	0.20[c]
W-3	Wood	Wall	Crown Veneer	Cherry	0.20[a]
WPG-1	Wall Guard	Wall	C/S Group	Dark grey	0.15[c]
WPP-1	Wall Panel	Wall	C/S Group	Light beige	0.43[c]

[a] Reflectance values not available. Assumed from Table 8.5, *Architectural Lighting Design*, Gary R. Steffy, 2008.

[b] Value obtained from manufacturer's data.

[c] Reflectance values not available. Assumed from manufacturer's sample imported into AGI32.

Table 1: Materials and Finishes for Large Workspace

Floor Plans, Elevations, and Images

Figure 1: Photograph of Nurse's Station

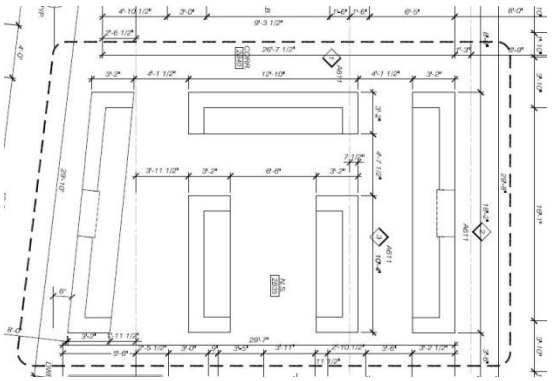

Figure 2: Nurse's Station floor plan

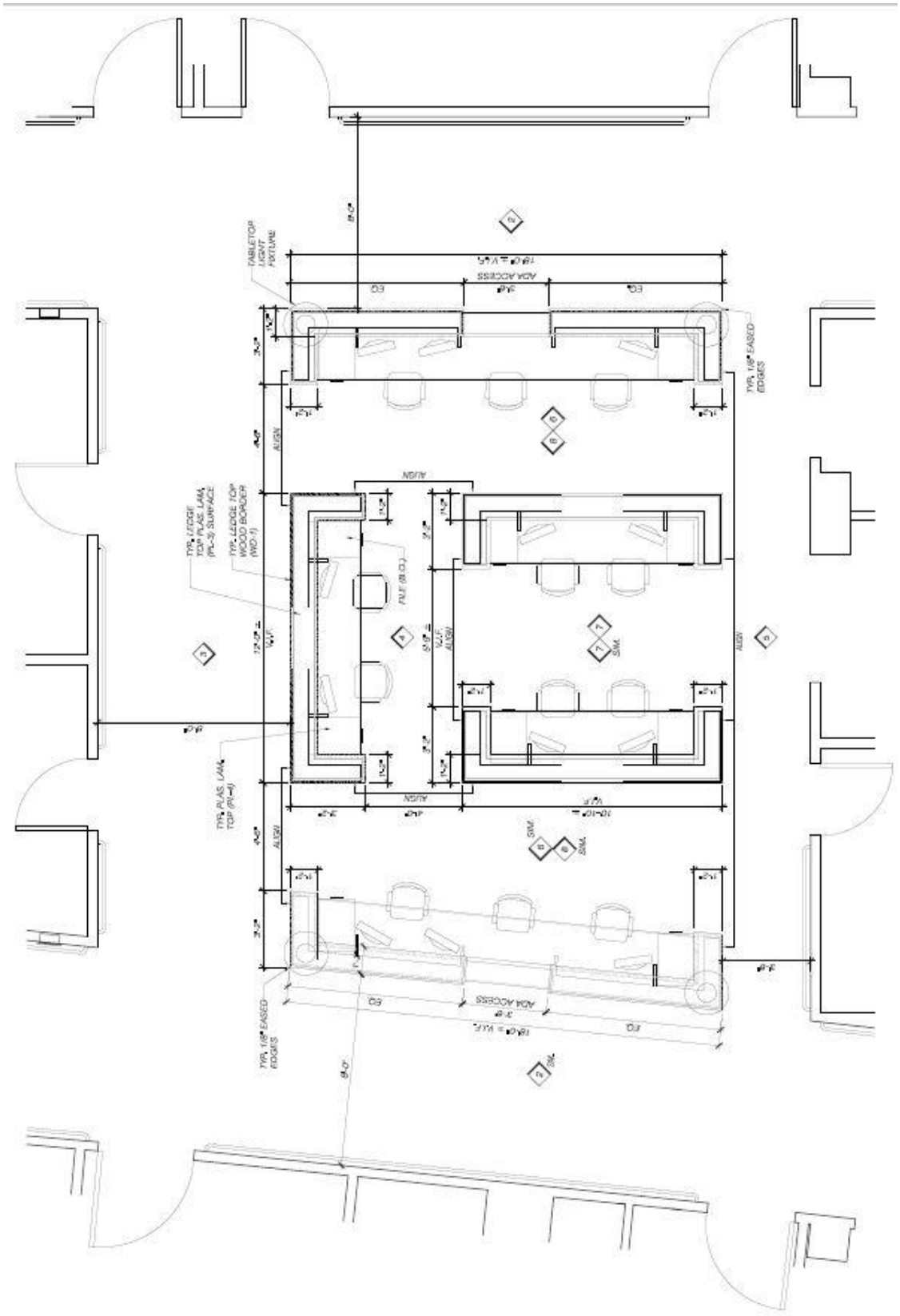

Figure 3: Nurse's Station and surrounding area

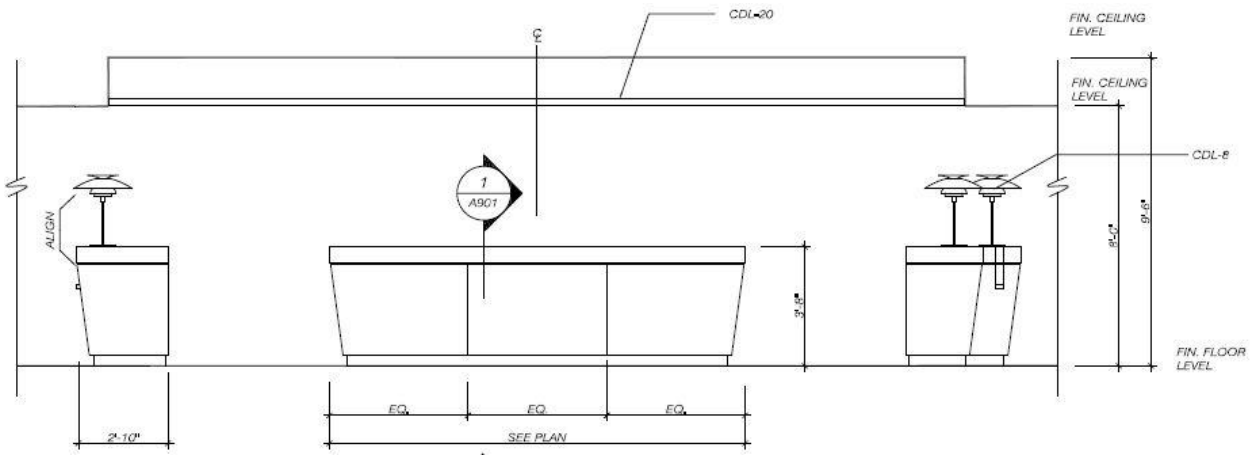

Figure 4: Nurse's Station elevation

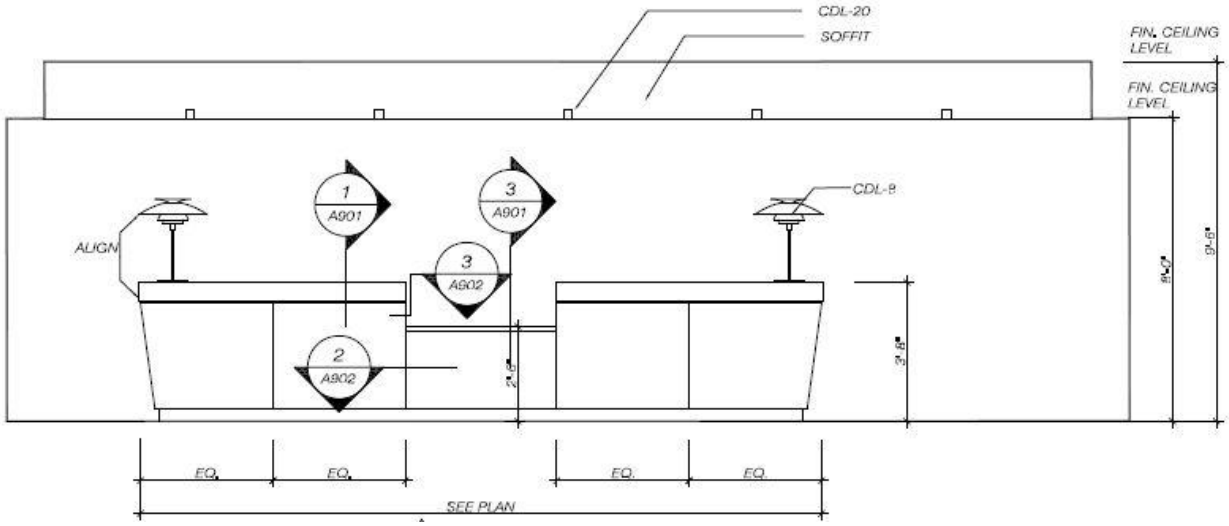

Figure 5: Nurse's Station elevation

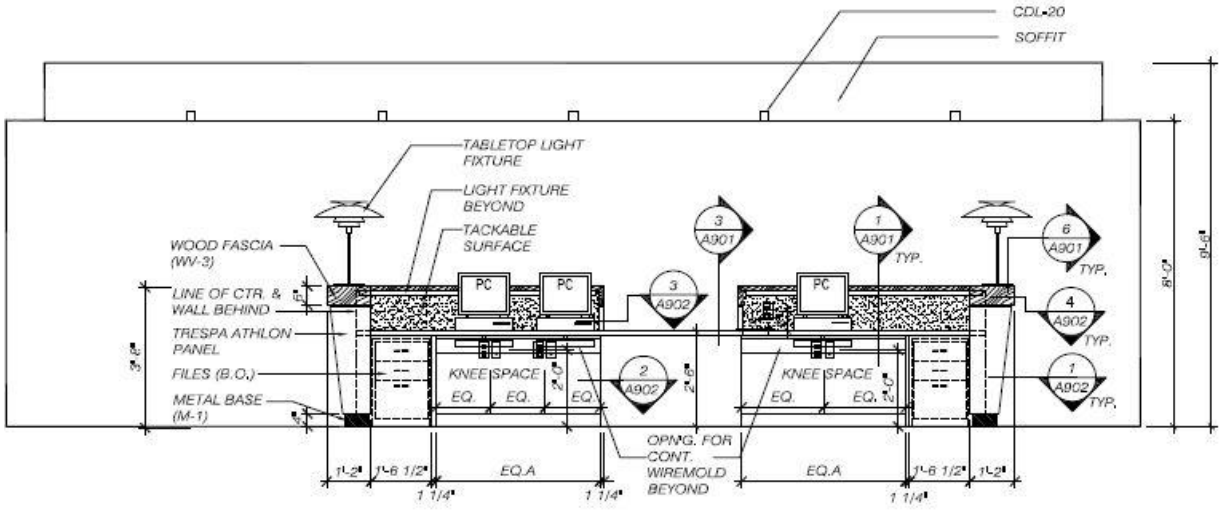

Figure 6: Nurse's Station elevation

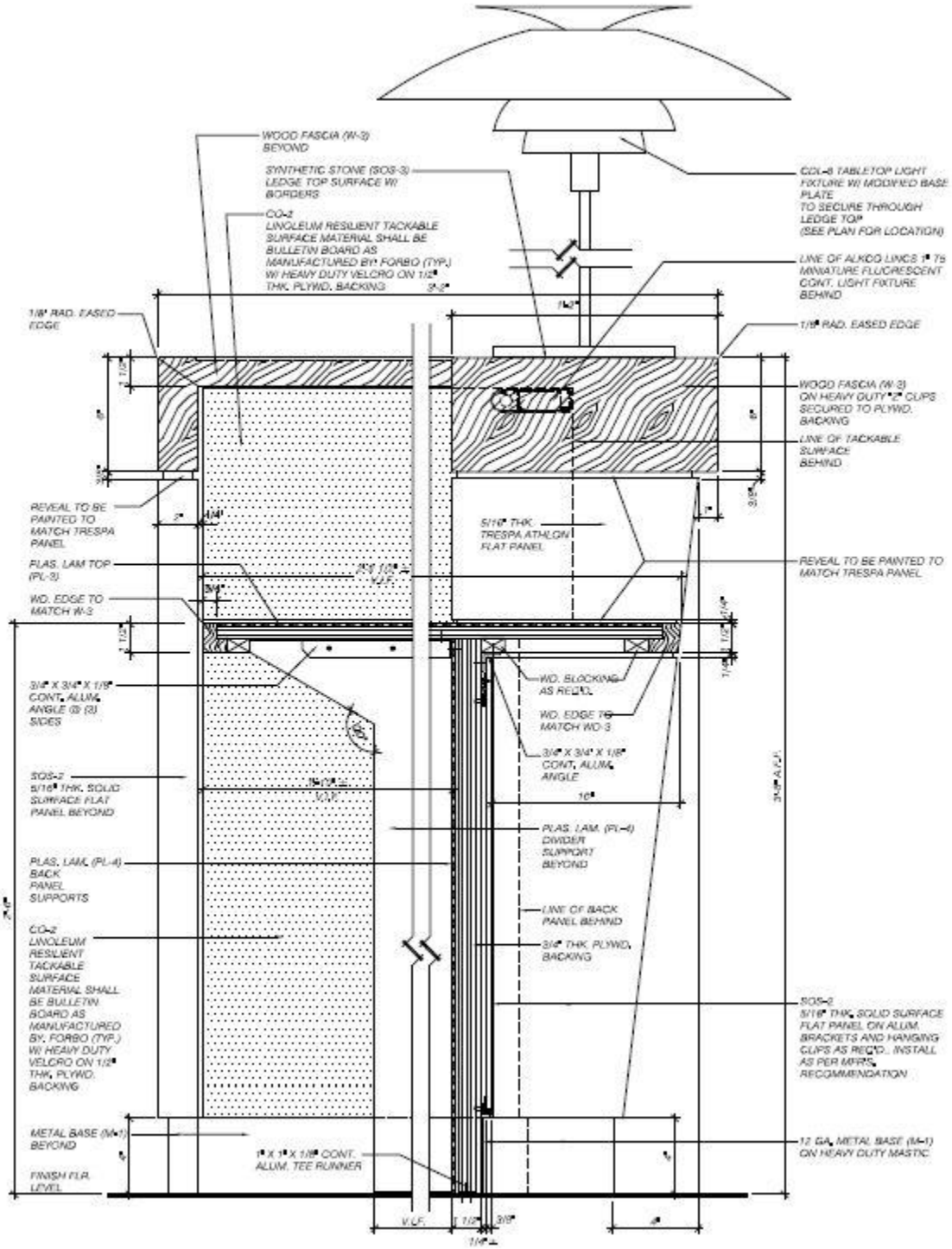

Figure 7: Nurse's Station typical desk section

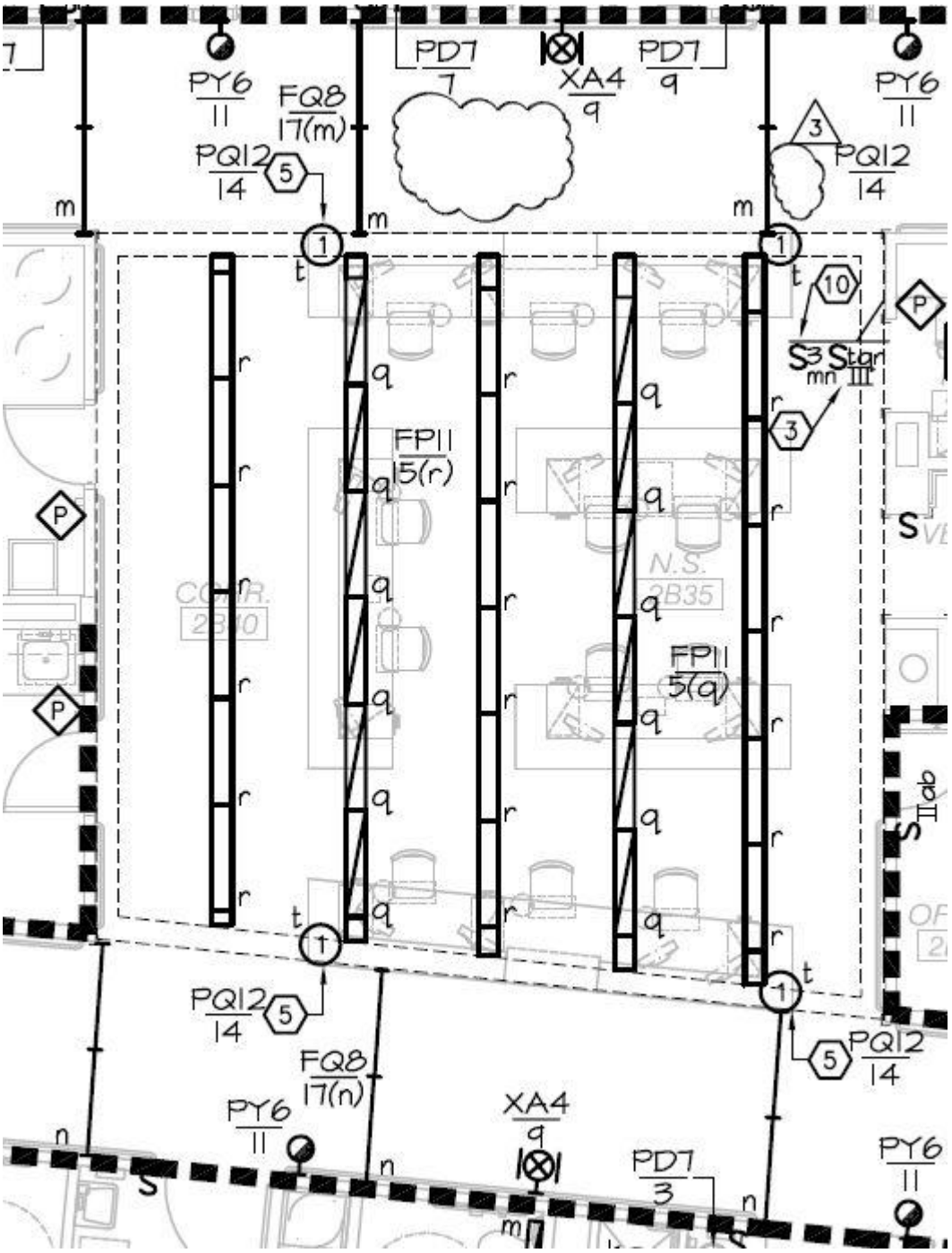

Figure 8: Nurse's Station lighting plan

Existing Lighting Equipment

The lighting for the nurse's station consists primarily of indirect fluorescent lighting (FP11) above the work area. Decorative luminaires (PQ12) with incandescent lamps anchor the corners of the workstation. Under-cabinet fluorescent luminaires (shown in Figure 7) provide additional task lighting on the work plane. Although not part of the lighting for the nurse's station, luminaires used in the corridors add to the illuminance levels in the nurse's station. Corridor lighting is achieved primarily by cove lighting which uses a cove lighting fixture (FQ8) with a fluorescent source. A recessed linear fluorescent wall sconce (PY6) provides additional light to the space. Switching for the surrounding hallway lighting is located in the nurse's station. The switching of luminaires for the nurse's station allows alternating rows of the indirect luminaires to be switched on and off. Separate switching is also provided for the decorative desk luminaires.

Existing Lighting in Nurse's Station and Surrounding Corridor							
Type	**Quantity**	**Input Watts**	**Location**	**Mounting**	**Manufacturer**	**Lamp Type**	**Notes**
FP11	30	30	Nurse's Station	Ceiling Pendant	Gammalux GB44U Series	(1) GE F28T5/835	Custom color Extruded aluminum lens Aircraft cable
PQ12	4	100	Nurse's Station	Desk Surface	Louis Polsen PH 80 Table Series	(1) 100W A Lamp	White opal acrylic shade
-	-	-	Nurse's Station	Desk Surface	Alkco Lincs 1"	(1) T5	Not listed in lighting documents
FQ8	12	55	Corridor	Cove	Ledalite 3808T02EN	(2) GE F32T8/835	Dust cover 20 GA. C.R.S. White
PY6	4	37	Corridor	Recessed Sconce	Se'lux M100 Series	(1) (GE) F28T5/835	White flush end Satine lens

Table 2: Existing luminaires for Nurse's Station

Design Criteria and Considerations

Summary:

The following sections list important design criteria and considerations for the nurse's station. Criteria listed include recommended illuminance values as well as power requirements. The final design will strive to meet all design criteria listed, and all existing conditions will be measured against these criteria. All issues listed under considerations come from the IESNA Lighting Handbook in addition to special design issues that relate to this space and project. While many design issues should be considered, the list provided below summarizes the most important issues for this application.

Design Criteria:

Table 3 shows recommended illuminance levels specifically for nursing stations. However, individual tasks that are likely to be performed in the area should also be considered. These tasks as well as recommended illuminance values are listed in Table 4. Table 5 and Table 6 summarize lighting power densities according to ASHRAE and the New York State Building Code.

IESNA Illumination Recommendations for Nursing Stations		
Area	**Illuminance**	
	Horizontal	**Vertical**
General Illuminance	30 fc	5 fc
Desk Illuminance	50 fc	10 fc

Table 3: IESNA Illumination Recommendations

IESNA Illumination Recommendations for Tasks		
Task	**Illuminance**	
	Horizontal	**Vertical**
Reading: VDT Screens	3 fc	3 fc
Reading: Keyboard	30 fc	-
Reading: #2 Pencil	30 fc	-
Reading: Ball point pen	30 fc	-
Reading: 8 – 10 point font	30 fc	-

Table 4: IESNA Illumination Recommendations

ASHRAE 90.1-2007 Lighting Power Densities Allowance	
Space Type	**LPD, W/ft^2**
Hospital	1.2
Nursing Station	1.0

Table 5: ASHRAE Lighting Power Densities Allowance

New York State Building Code Lighting Power Requirements	
Space Type	**LPD, W/ft^2**
Hospital	1.2
Nursing Station	1.0

Table 6: Building Code of New York State Lighting Power Requirements

Additional Power Requirements and Allowances:

- New York State Building Code requires that each area required to have a manual control shall also have a control that allows the occupant to reduce the connected lighting load in a reasonably uniform pattern by at least 50%. Corridors and areas controlled by occupancy sensors are exempt. This reduction may be achieved in the following ways:
  - Controlling all lamps and luminaires
  - Dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps
  - Switching the middle lamps independently of the outer lamps
  - Switching each luminaire or each lamp

- ASHRAE allows tradeoffs among spaces provided that the total installed interior lighting power does not exceed the interior lighting power allowance.
- For spaces where decorative lighting is installed in addition to the general lighting, an additional 1.0 W/ft^2 is allowed for the space.

When comparing Table 3 and Table 2, the recommended illuminance values are about the same. An illuminance of 50 fc on the desk and 30 fc in the surrounding area would be appropriate for this space. When comparing allowable lighting power densities, the requirements for the state of New York and ASHRAE are identical. In addition to the design criteria listed, there are many design considerations that must be taken into account. These considerations are summarized in the following section.

Design Considerations:

Color Appearance

Appropriate color rendering is critical in nurse's stations. Nurses and doctors must be able to diagnose patients based on visual observation as well as correctly identify medicine that may be similar in color, shape, and size. As a result, lamps with high CRI should be used and decorative luminaires that may alter color should be avoided.

Modeling of Faces and Objects

As mentioned earlier, the nurse's station is the center of activity on patient floors. There are numerous interactions between doctors, nurses, patients, and visitors, and as a result the ability to read and interpret facial expressions is critical to effective communication. Direct downlight that creates harsh facial shadows should be avoided.

Psychological Impression

The nurse's station is the center of activity. Doctors, nurses, patients, and visitors will be performing multiple tasks and frequently moving through a relatively small area. A lighting design that evokes a sense of spaciousness while provide a pleasant workplace will help to make the space feel less confined.

Direct and Reflecting Glare

Direct glare can be distracting to the occupants performing tasks commonly performed in the space such as reading and writing of charts as well as the use of computer screens and should be avoided if possible. Reflected glare could be an issue depending on VDTs used in the area. Almost all of the materials in the area have a matte finish that will reduce reflected glare. The best lighting design will minimize vertical illuminance in the occupant's field of view. Additionally, luminaire luminances should not be greater than 100 times the luminance of surrounding areas. Design solutions include illuminating the ceiling in addition to the task plane.

Appearance of Space and Luminaires

Hospitals are often designed to look modern and clean. The lighting design can assist in meeting these goals by utilizing a clean and uniform layout that reduces visual clutter. Luminaires that are sleek and clean should be chosen to accentuate the hospital's modern design. The surrounding patient rooms should have little to no direct view of the luminaires to eliminate unwanted glare or light.

Light Distribution

Patterns of light on surfaces and the task plane can affect task visibility, comfort, and perception. As a result, the spacing and light distribution of luminaires should be carefully analyzed. Excessive brightness and shadows should be avoided. The task illuminance should be higher than the surroundings to draw attention to the task. The luminance ratio between paper tasks and an adjacent VDT screen and the ratio between a task and adjacent dark surroundings should not exceed 3:1. Between the task and remote surface, the luminance ratio should not exceed 10:1.[1]

Controls

As outlined in the design criteria, New York State Building Code requires additional controls for the space. The lighting system for the space should also be flexible. The system should be able to operate at higher illuminance levels during the day and lower levels at night to avoid disturbing patients who are sleeping. Since the space lacks natural light, daylight sensors are not a feasible option. Motion sensors could be used, however the lighting will likely always remain on since the will be a constant flow of occupants through the space.

Flicker

Flicker and strobe can create an undesirable work environment. Luminaires that utilize light sources prone to flickering should be avoided. High frequency electronic ballasts should also be used to eliminate flicker.

Daylighting Integration and Control

Daylighting integration and control are important from an energy conservation standpoint; however for this particular space daylight integration is not feasible due to the lack of natural light in the area.

Evaluation and Critique

Summary

The nursing station functions simply as a workspace, and this is mirrored in the lighting design of the space. As shown in Figure 1, the indirect luminaires provide a uniform illuminance on the work plane while helping to add to the modern image of the hospital. The uplight from the luminaires compliments the cove lighting in the corridor, while the thin linear shape of the fixture works well

with the wall sconces. The linearity also follows the lighting design used throughout most space in the building.

Lamp selection is consistent throughout the space. Fluorescent lamps with CRIs in the 80's and CCTs of 3500 give the space a warm feel while rendering colors pretty well. The design of the controls allows alternating rows of luminaires to be switched separately, achieving the New York State Building Code requirement that lighting be able to switch to 50% output. Even with switching, dimming may have been a better option as it would have allowed more control of the space and since task lighting is available at the desks.

While the aesthetics work well with the architectural design, the performance and feel of the space are a different story. The use of indirect fixtures creates an almost shadow free environment, and without direct downlighting in the space, the space feels almost hazy. A combination of indirect lighting with downlights and some wall washing could have been used to create a more pleasant space.

The nurse's station was one of two spaces analyzed using AGI32, and based on the calculation results, the nurse's station exceeds all criteria presented in Table 2 through Table 5. Table 6 shows a comparison of the recommended and existing illuminance and power density values.

Criteria Comparison for Nurse's Station		
Criteria	**Recommended**	**Existing**
General Horizontal Illuminance @ 2.5'(fc)	30	63
General Vertical Illuminance (fc)	5	77
Desk Horizontal Illuminance @ 2.5' (fc)	50	63
Desk Vertical Illuminance (fc)	10	77
LPD (W/ft^2)	1.0	1.07

Table 7: Comparison of design criteria

As Table 7 shows, the existing illuminance values greatly exceed those recommended by IESNA. A more detailed breakdown of the AGI calculation results is shown in Table 9 and Figures 9 through 12. Calculations were run using the light loss factors outlined in Table 10 and Table 11. It should be noted that calculations for the nurse's station were run with corridor luminaires on, since that best simulates the working condition. This could be one reason why illuminance values in the space are so high. Lighting power density calculations, summarized in Table 8, were conducted using only the luminaires above the nurse's station (FP11). The existing LPD exceeds the recommendations of both ASHRAE and New York State, however, if the extra 1.0 W/ft^2 for decorative lighting is applied, the lighting design passes requirements. The existing lighting design, which includes indirect lighting in addition to task lighting for the work plane, seems excessive, especially when additional light from the surrounding corridor is considered. The lighting redesign should create a more pleasant space that adheres to the criteria presented.

Lighting Power Density for Nurse's Station			
Type	**Quantity**	**Watts / Luminaire**	**Total Watts**
FP11	30	30	900

Total Watts:	900
Total Area (ft^2):	840
LPD (W/ft^2):	1.07

Table 8: Lighting power density calculation

Illuminance Values for Nurse's Station			
Horizontal Illuminance Work Plane		**Vertical Illuminance at 4'**	
Average Illuminance (fc)	62.68	Average Illuminance (fc)	77.76
Maximum Illuminance (fc)	86.10	Maximum Illuminance (fc)	91.80
Minimum Illuminance (fc)	10.30	Minimum Illuminance (fc)	49.00
Maximum : Minimum	8.36	Maximum : Minimum	1.87
Average : Minimum	6.09	Average : Minimum	1.59

Table 9: Summary of AGI32 calculations for nurse's station

Luminaire Light Loss Factors for Nurse's Station									
Type	**Cleaning Interval**	**LDD Case**	**Initial Lumens**	**Design Lumens**	**LLD**	**LDD[a]**	**RSDD[b]**	**BF**	**Total LLF**
FP11	Clean, 6 mo.	X	2900	2660	0.92	0.92	0.98	0.96	0.796

[a] Luminaire dirt depreciation calculated using new method to be published in *IESNA Lighting Handbook* 10th ed.

[b] Room surface dirt depreciation calculated using Figure 9-19 in *IESNA Lighting Handbook* 9th ed., 2000, IESNA.

Table 10: Light loss factors for nurse's station luminaires

Luminaire Light Loss Factors for Corridor									
Type	**Cleaning Interval**	**LDD Case**	**Initial Lumens**	**Design Lumens**	**LLD**	**LDD[a]**	**RSDD[b]**	**BF**	**Total LLF**
FQ8	Clean, 6 mo.	X	2800	2660	0.95	0.92	0.98	0.88	0.754
PY6	Clean, 6 mo.	W	2900	2660	0.92	0.93	0.98	0.96	0.801

[a] Luminaire dirt depreciation calculated using new method to be published in *IESNA Lighting Handbook* 10th ed.

[b] Room surface dirt depreciation calculated using Figure 9-19 in *IESNA Lighting Handbook* 9th ed., 2000, IESNA.

Table 11: Light loss factors for corridor luminaires

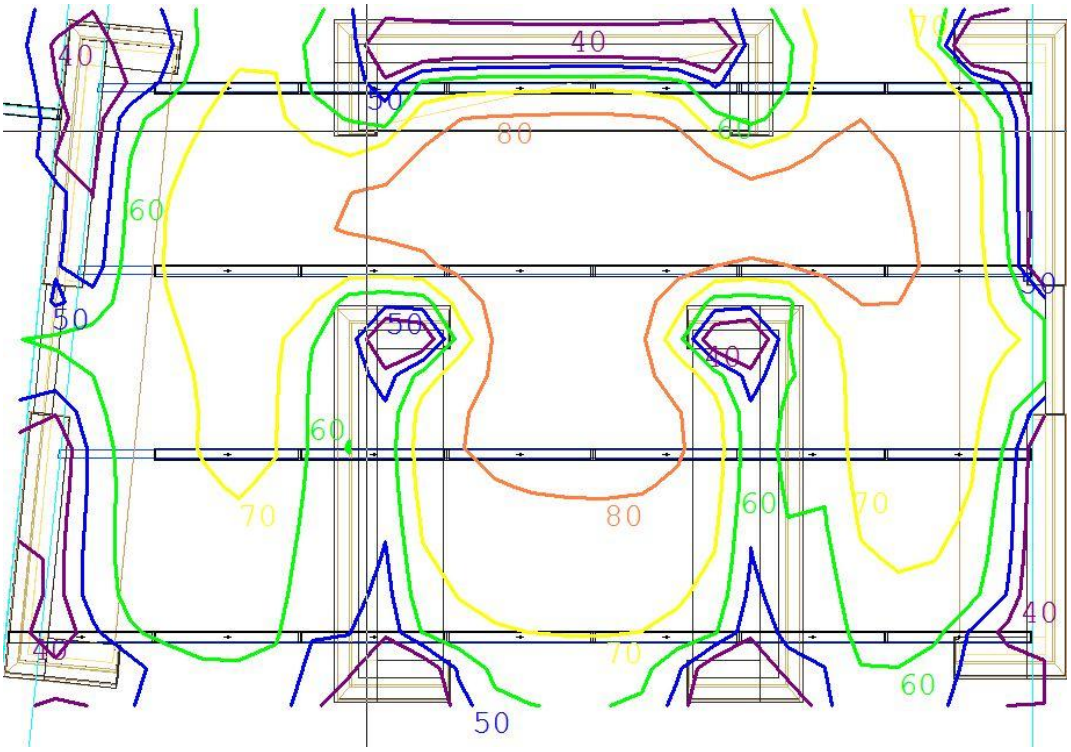

Figure 9: Iso lines of horizontal illuminance values for nurse's station

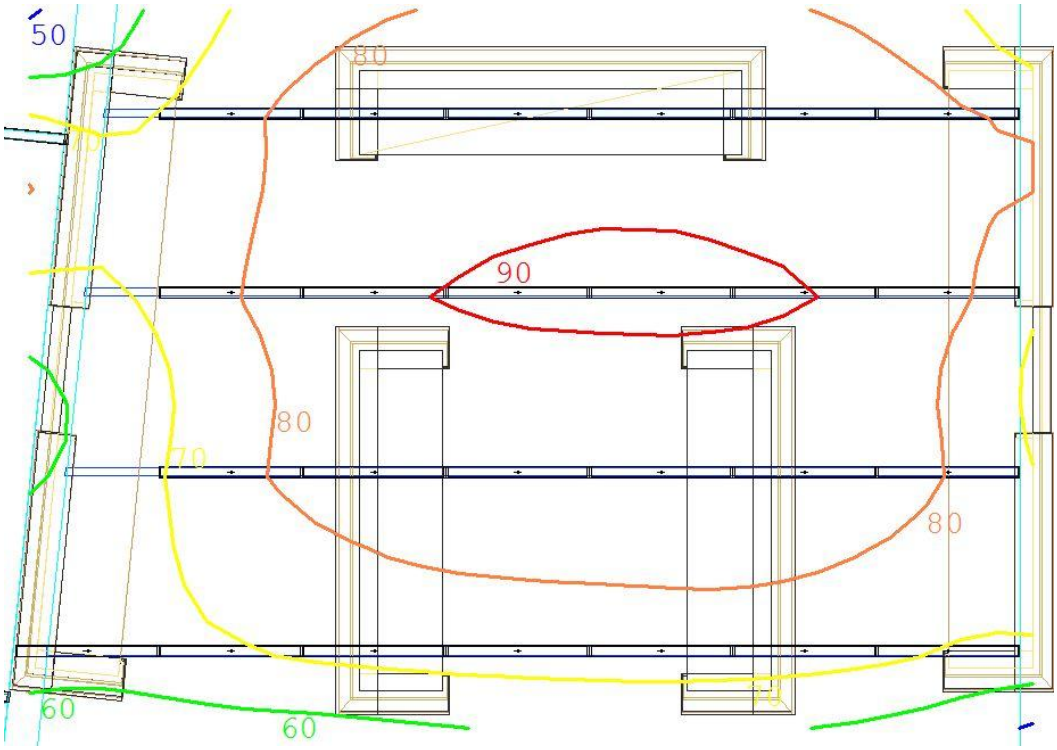

Figure 10: Iso lines of vertical illuminance values for nurse's station

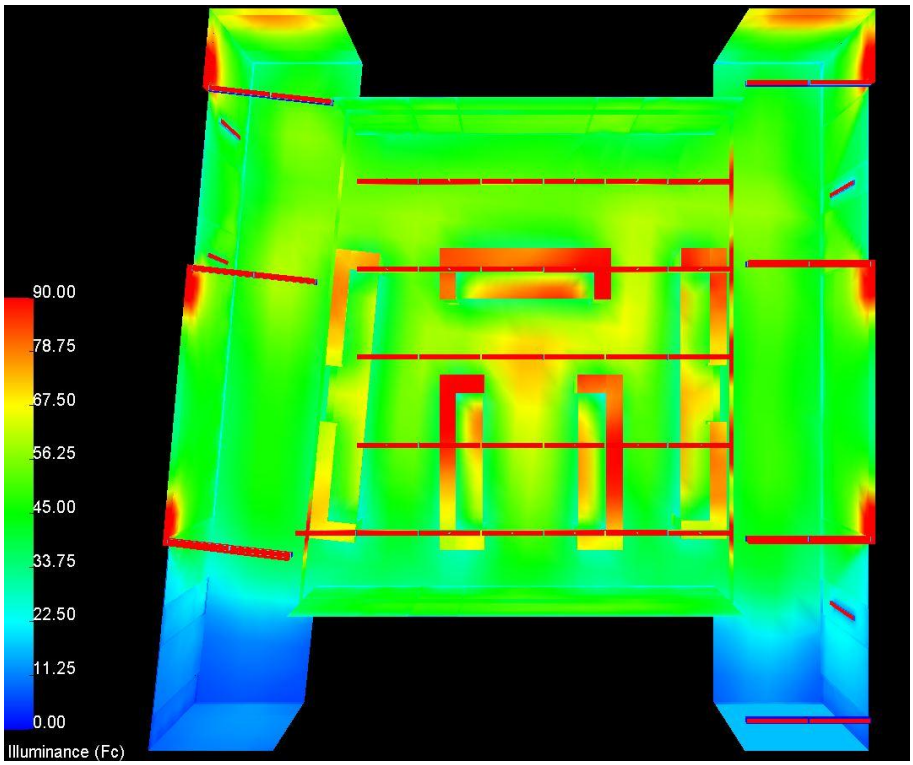

Figure 11: Psuedo color rendering of nurse's station

Figure 12: AGI32 rendering of nurse's station

Special Purpose Space | Auditorium

Existing Conditions

Description:

The auditorium is located adjacent to the main lobby on the ground floor. Designed to function as an auditorium as well as a small conference center, the space can be divided into three separate rooms and can be used for public functions as well as to host more formal events. The main projector screen is located on the front wall of the auditorium. Visual tasks will vary depending on the function of the space. As a conference center, visual tasks will likely include reading and writing, but could also include viewing presentations. Minimizing glare and producing good facial rendering on the speaker will be important to consider when designing the lighting for a presentation space. The auditorium is roughly in the shape of an ellipse with the wall serving as an interesting architectural element in the space. Specific dimensions, plans, and materials for this space are detailed below.

Area: 2700 SF

Dimension: Approximately 75' x 40', with a ceiling height of 16'.

Materials:

Auditorium Materials and Finishes Schedule					
Abbreviation	**Finish Type**	**Object**	**Manufacturer**	**Color**	**Reflectance**
ACT-3	Ceiling Tile	Ceiling	Decoustics	White,Claro	0.90[b]
CPT-2	Carpet	Floor	Atlas	Light Brown	0.23[c]
FWC-1	Fabric wall	Wall	Texaa	Orce rouge 390	0.08[c]
W-2	Wood	Doors	Crown Veneer	Walnut	0.10[a]
W-6	Wood	Wall	Crown Veneer	Match FWC-1	0.08[c]

[a] Reflectance values not available. Assumed from Table 8.5, *Architectural Lighting Design*, Gary R. Steffy, 2008.

[b] Value obtained from manufacturer's data.

[c] Reflectance values not available. Assumed from manufacturer's sample imported into AGI32.

Table 12: Materials and finishes for special purpose space

Floor Plans, Elevations, and Images

Figure 13: Photograph of Auditorium

Figure 14: Photograph of Auditorium Entrance

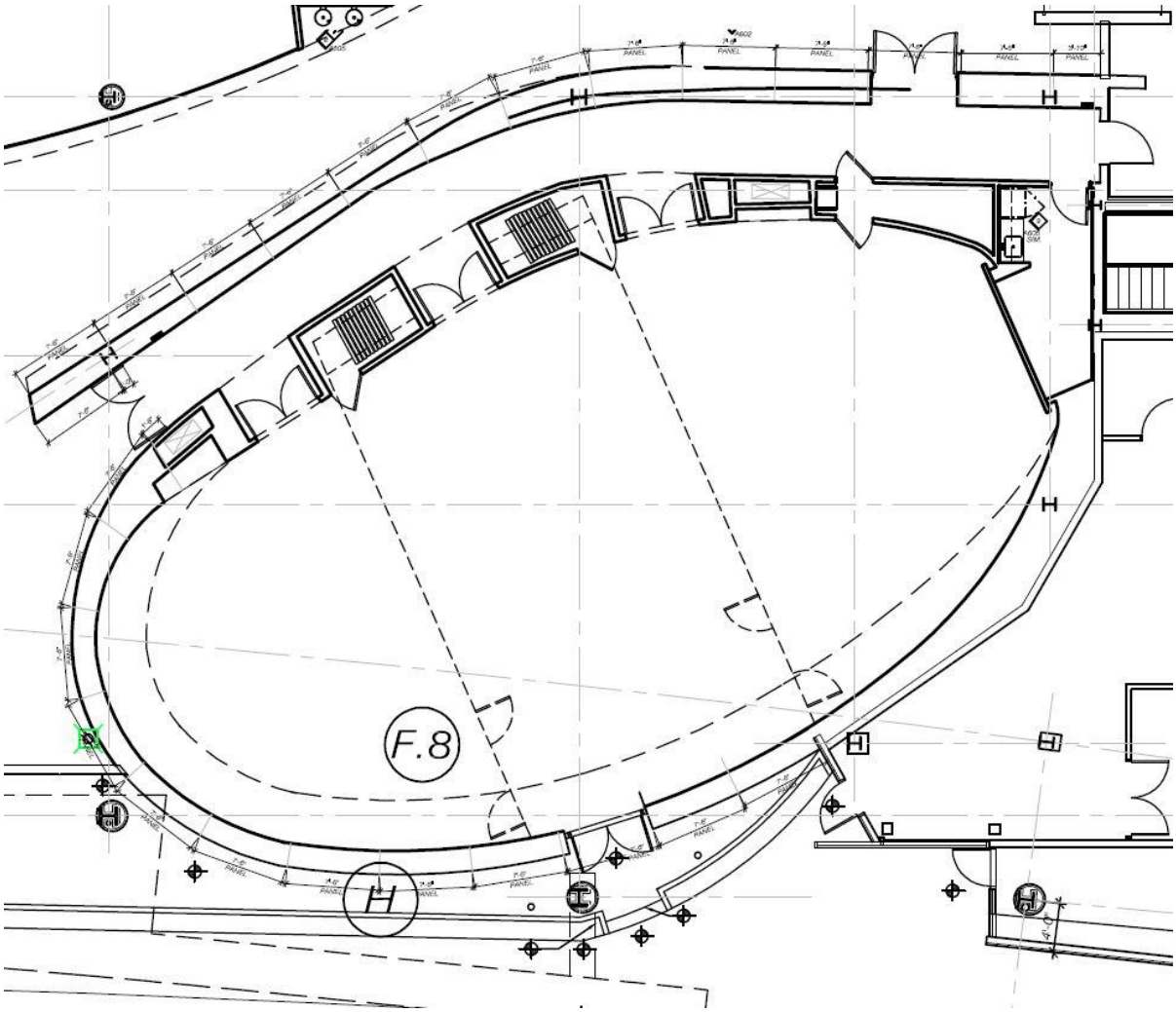

Figure 15: Auditorium floor plan

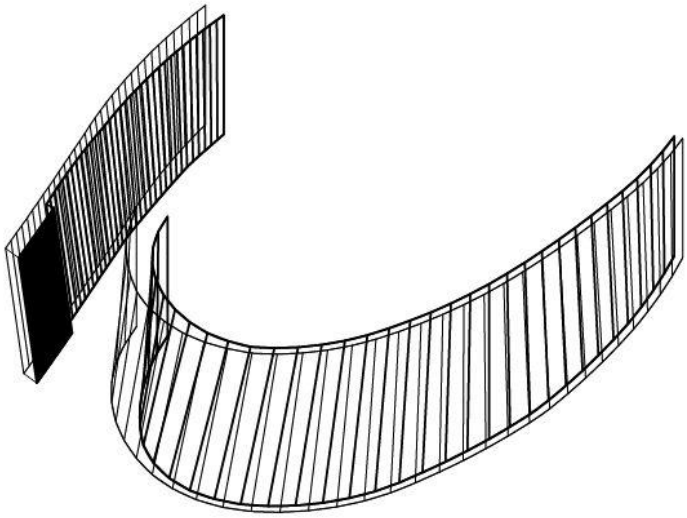

Figure 16: Auditorium wall shape

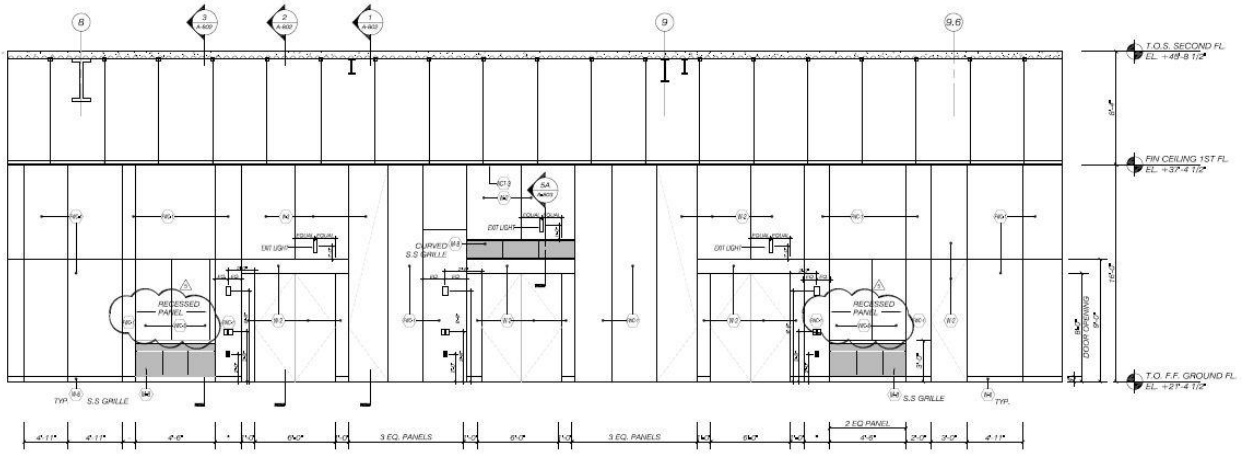

Figure 17: Elevation of Auditorium entrance

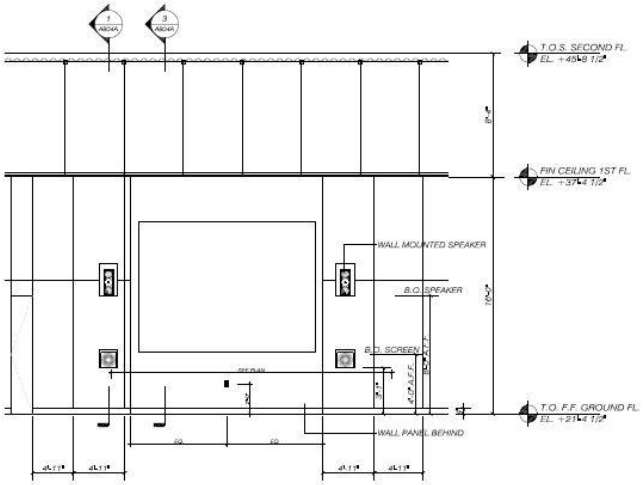

Figure 18: Elevation of Auditorium front

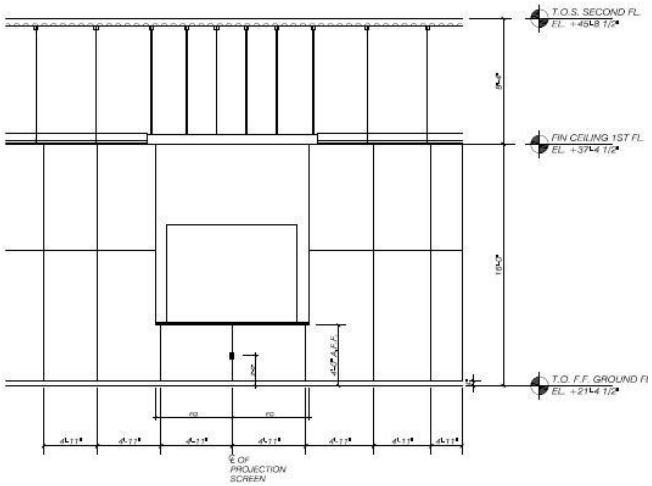

Figure 19: Elevation of Auditorium back

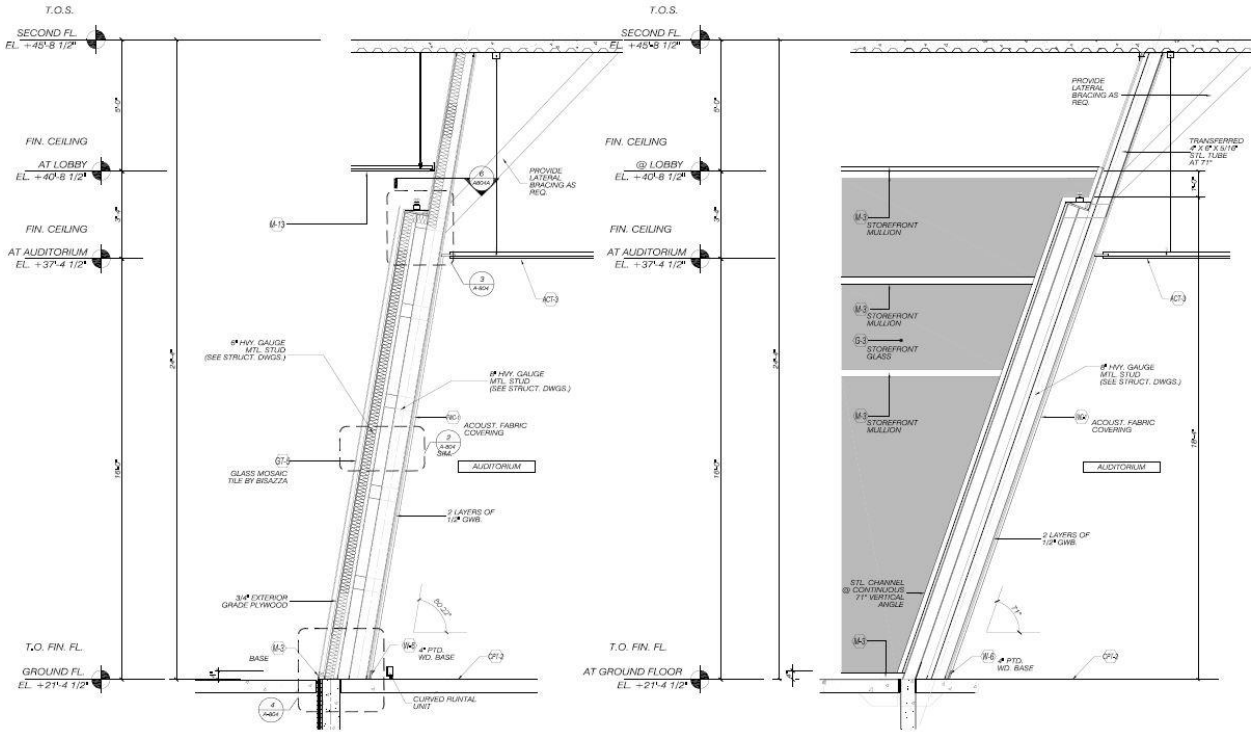

Figure 20: Auditorium wall sections

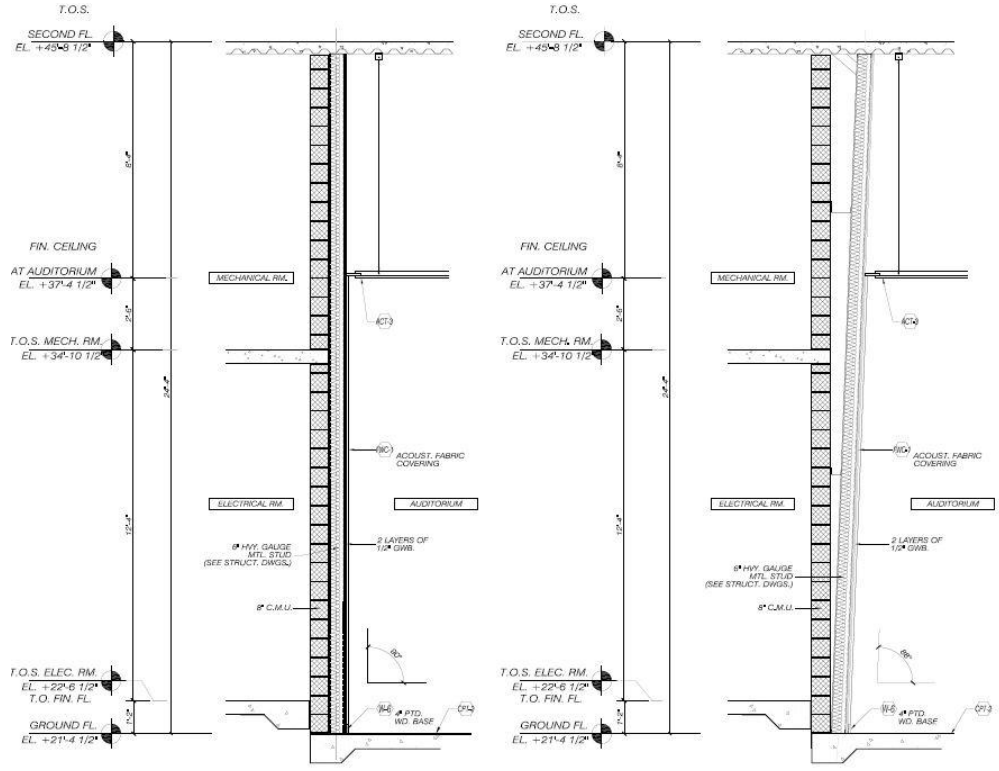

Figure 21: Auditorium wall sections

Figure 22: Auditorium Lighting Plan

Existing Lighting Conditions

The lighting in the auditorium was designed to cater to the multiple functions of the space. There are two primary lighting systems; recessed linear fluorescent luminaires and recessed-can halogen downlights, both of which help to define the ceiling grid in the space. The linear fluorescents (FT10) run parallel to the front wall of the auditorium and the linear diffusers in the ceiling. The recessed halogen downlights (PL5) are located between diffusers. Recessed circular wall washers (PL6) with halogen lamping are used in the front and rear of the auditorium to illuminate the wall. The front and rear of the auditorium also contains additional recessed circular halogen downlights (PL7) to provide lighting to be used in the event of a presentation or lecturer. Three rows of halogen track lighting (PT6) are also used in the space. The lighting in the auditorium is dimmable and is controlled by a Lutron Graphic Eye 4000 Series Dimming Panel. The fluorescent lighting is switched to allow alternating luminaires in a row to be controlled separately. To allow the auditorium to function as three separate spaces, the lighting systems are switched to allow each space to be controlled separately.

Existing Lighting for Auditorium							
Type	Quantity	Input Watts	Location	Mounting	Manufacturer	Lamp Type	Notes
FT10	46	120	Auditorium	Ceiling Recessed DL	Linear Lighting RC68-D2-ET5HO	(2) GE F54T5HO/835	Mounted in cont. row Specular parabolic louvers
PL5	49	75	Auditorium	Ceiling Recessed DL	Zumtobel Spec 3 Series	(1) 75W/MR16 NFL 25 Degree	4" aperture Integral mag. 120V/12V tran. Alzak reflector
PL6	8	75	Auditorium	Ceiling Recessed WW	Zumtobel Spec 3 Series	(1) 75W/MR16 NFL 25 Degree	4" aperature Integral mag. 120V/12V tran. Alzak reflector, lens
PL7	16	75	Auditorium	Ceiling Recessed DL	Zumtobel Spec 3 Series	(1) 75W/MR16 NFL 25 Degree	4" aperature Integral mag. 120V/12V tran. Alzak reflector, frosted lens
PT6	10	75	Auditorium	Ceiling Track	Lighting Services Inc. 216 Series	(1) 75W/MR16 NFL 25 Degree	Single circuit track Integral elec. 75W trans.

Table 13: Existing luminaires for Auditorium

Design Criteria and Considerations

Summary:

The following sections list important design criteria and considerations for the auditorium. Criteria listed include recommended illuminance values as well as power requirements. The final design will strive to meet all design criteria listed, and all existing conditions will be measured against these criteria. All issues listed under considerations come from the IESNA Lighting Handbook in addition to special design issues that relate to this space and project. While many design issues should be considered, the list provided below summarizes the most important issues for this application.

Design Criteria:

Table 14 shows recommended illuminance levels specifically for auditoriums. However, individual tasks that are likely to be performed in the area should also be considered. These tasks as well as recommended illuminance values are listed in Table 15. Table 16 and Table 17 summarize lighting power densities according to ASHRAE and the New York State Building Code.

IESNA Illumination Recommendations for Auditoriums		
Task	Illuminance	
	Horizontal	Vertical
Assembly	10 fc	-
Social Activity	5 fc	3 fc
Meeting	30 fc	5 fc
Video Conference	50 fc	30 fc

Table 14: IESNA Illumination Recommendations

IESNA Illumination Recommendations for Tasks		
Task	**Illuminance**	
	Horizontal	**Vertical**
Reading: VDT Screens	3 fc	3 fc
Reading: Keyboard	30 fc	-
Reading: #2 Pencil	30 fc	-
Reading: Ball point pen	30 fc	-
Reading: 8 – 10 point font	30 fc	-

Table 15: IESNA Illumination Recommendations

ASHRAE 90.1-2007 Lighting Power Densities Allowance	
Space Type	**LPD, W/ft^2**
Hospital	1.2
Conference / Multipurpose	1.3

Table 16: ASHRAE Lighting Power Densities Allowance

New York State Building Code Lighting Power Requirements	
Space Type	**LPD, W/ft^2**
Hospital	1.2
Conference / Multipurpose	1.3

Table 17: Building Code of New York State Lighting Power Requirements

Additional Power Requirements and Allowances:

- New York State Building Code requires that each area required to have a manual control shall also have a control that allows the occupant to reduce the connected lighting load in a reasonably uniform pattern by at least 50%. Corridors and areas controlled by occupancy sensors are exempt. This reduction may be achieved in the following ways:
  - Controlling all lamps and luminaires
  - Dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps
  - Switching the middle lamps independently of the outer lamps
  - Switching each luminaire or each lamp
- ASHRAE allows tradeoffs among spaces provided that the total installed interior lighting power does not exceed the interior lighting power allowance.
- For spaces where decorative lighting is installed in addition to the general lighting, an additional 1.0 W/ft^2 is allowed for the space.

When comparing Table 16 and Table 17, the recommended illuminance values are about the same. An average illuminance of 30 fc, with a higher illuminance value of 50 fc in selected areas such as the front of the auditorium, would be appropriate for this space. Controls should be used to lower the illuminance levels when the space functions more as an auditorium than a conference center.

When comparing allowable lighting power densities, the requirements for the state of New York and ASHRAE are identical. In addition to the design criteria listed, there are many design considerations that must be taken into account. These considerations are summarized in the following section.

Design Considerations:

Appearance of Space and Luminaires

The auditorium is a unique space. The lighting design should complement the space and should have a clean design. The auditorium will most likely host important functions and the lighting design should help the space give a good impression. Visual clutter should be minimized, and luminaires should be arranged in a uniform layout to eliminate areas of greater brightness that may distract occupants.

Direct and Reflecting Glare

Direct glare can be distracting to the occupants performing tasks commonly performed in the space. Direct glare from luminaires can cause discomfort and can make it difficult for occupants to focus on a presenter, projection screen, and other points of interest. The best lighting design will minimize vertical illuminance in the occupant's field of view. Additionally, luminaire luminances should not be greater than 100 times the luminance of surrounding areas.

Modeling of Faces and Objects

Since the auditorium can function as a presentation space, the modeling of the presenter's face and presented objects are very important. The ability to read and interpret the facial expressions of the presenter is critical to effective communication. Direct downlight that creates harsh facial shadows should be avoided.

Controls

As outlined in the design criteria, New York State Building Code requires additional controls for the space. The lighting system for the space should also be flexible. The system needs to be able to cater uses ranging from a private social function to a public conference. The space can also be divided in to three spaces, and the lighting design should be similar throughout each space and should be controlled separately. Dimming controls should be utilized in the space.

Psychological Impression

The multiple functions of the auditorium create a unique opportunity to explore multiple psychological impressions. When hosting private social functions, the space should feel private, with low levels of direct downlight and higher illuminance levels on the walls. When functioning as a conference center, the space should feel public and spacious and should allow visual clarity.

Color Appearance

Appropriate color rendering in the auditorium is important. Since social interactions occur in the space, the lighting design should render skin tones properly. The bright red walls and wood

tones in the space should also be rendered correctly to ensure the architect's vision for the space is achieved.

Flicker

Flicker and strobe can create an undesirable work environment. Luminaires that utilize light sources prone to flickering should be avoided. High frequency electronic ballasts should also be used to eliminate flicker.

Light Distribution

Patterns of light on surfaces and the task plane can affect task visibility, comfort, and perception. As a result, the spacing and light distribution of luminaires should be carefully analyzed. Excessive brightness and shadows should be avoided. The task illuminance should be higher than the surroundings to draw attention to the task. The luminance ratio between the presenter or projection screen and the surrounding walls should be carefully considered. Between the task and remote surface, the luminance ratio should not exceed 10:1.[1]

Evaluations and Critique

Summary

The multiple functions of the auditorium are evident when looking at the lighting design of the space. The strong linear lines created by the fluorescent lights compliments the ceiling grid and give the space a public feeling. The recessed can with halogen lamping help to create a warmer, more private feeling for the space and works well with the materials used in the space. The wall washers at the front and rear of the room can be used to draw attention to the projection screen; however the scallops produced by the luminaires make the careen difficult to view. The halogen track lighting provides a more flexible lighting system that can be changed as needed.

Lamp selection is somewhat consistent throughout the space. Fluorescent lamps with CRIs in the 80's and CCTs of 3500 are used in all fluorescent luminaires in the space. The recessed cans and track lighting use 75 watt halogen lamps with a 25 degree beam spread and provide good color rendering. When the systems are used separately, the colors in the space are consistent. However when used together, there is noticeable color different between the fluorescent and incandescent sources, which is expected. The Lutron dimming panel used to control the luminaires provides great flexibility in the space. All luminaires can be dimmed, and the linear strips, recessed cans, and track lighting can be switched separately. Each of these systems can also be controlled separately in each of the three divided spaces. The design of the controls also allows alternating linear luminaires to be switched separately.

The auditorium was the second space calculated using AGI32, and based on the calculation results, the auditorium exceeds all criteria presented in Table 13 through Table 17. Table 18 and Table 19 shows a comparison of the recommended and existing illuminance and power density values.

Criteria Comparison for Auditorium with Fluorescent Lighting			
Criteria	**Recommended**	**Existing @ 2.5'**	**Existing @ 0'**
Assembly Horizontal Illuminance (fc)	10	86	80
Social Horizontal Illuminance (fc)	5	86	80
Meeting Horizontal Illuminance (fc)	30	86	80
Video Conf. Horizontal Illuminance (fc)	50	86	80
LPD (W/ft^2)	1.3	2.04	2.04

Table 18: Comparison of design criteria

Criteria Comparison for Auditorium with Incandescent Lighting			
Criteria	**Recommended**	**Existing @ 2.5'**	**Existing @ 0'**
Assembly Horizontal Illuminance (fc)	10	29	28
Social Horizontal Illuminance (fc)	5	29	28
Meeting Horizontal Illuminance (fc)	30	29	28
Video Conf. Horizontal Illuminance (fc)	50	29	28
LPD (W/ft^2)	1.3	2.02	2.02

Table 19: Comparison of design criteria

Table 18 shows that the illuminance levels from the fluorescent lighting system greatly exceed those recommended by the IESNA. While the switching of these fixtures can reduce the illuminance on the floor and work plane, the most the fluorescent system should provide with all fixtures on is 50 fc. As shown in Table 19, the calculated illuminance value of the incandescent lighting meet the IESNA recommendation of 30 fc for a meeting space, but exceeds the recommended values for assembly and social events. It should be noted that dimming allows all luminaires to be adjusted; however dimming the luminaires to reach a recommended maximum illuminance is not acceptable.

A more detailed breakdown of the AGI calculation results is shown in Table 21 and Figures 23 through 28. Calculations were run using the light loss factors outlined in Table 22. Calculations were run with for three scenarios; fluorescent lighting only, halogen lighting only, and all lighting. Lighting power density calculations, summarized in Table 9, were conducted using all luminaires in the space. Independent lighting system power densities are shown in Table 18 and Table 19. The existing combined LPD exceeds the recommendations of both ASHRAE and New York State with the extra 1.0 W/ft^2 for decorative lighting applied. When looking at the systems separately, they also exceed the recommended LPD of 1.3 W/ft^2. The current lighting design is extremely flexible and works well aesthetically with the space, but exceeds recommended illuminance and LPD values.

Lighting Power Density for Nurse's Station			
Type	**Quantity**	**Watts / Luminaire**	**Total Watts**
FT10	46	120	5520
PL5	49	75	3675
PL6	8	75	600
PL7	16	75	1200
PT6	10	75	750

Total Watts:	11,745
Total Area (ft^2):	2700
LPD (W/ft^2):	4.35

Table 20: Lighting power density calculation

Calculated Illuminance Values for Auditorium			
Fluorescent Lighting		**Halogen Lighting**	
Horizontal Illuminance Work Plane		**Horizontal Illuminance Work Plane**	
Average Illuminance (fc)	86.45	Average Illuminance (fc)	29.32
Maximum Illuminance (fc)	153.00	Maximum Illuminance (fc)	89.00
Minimum Illuminance (fc)	26.10	Minimum Illuminance (fc)	3.30
Maximum : Minimum	5.85	Maximum : Minimum	26.97
Average : Minimum	3.31	Average : Minimum	8.88
Horizontal Illuminance Floor		**Horizontal Illuminance Floor**	
Average Illuminance (fc)	80.94	Average Illuminance (fc)	28.53
Maximum Illuminance (fc)	123.00	Maximum Illuminance (fc)	72.50
Minimum Illuminance (fc)	36.20	Minimum Illuminance (fc)	3.50
Maximum : Minimum	3.40	Maximum : Minimum	20.71
Average : Minimum	2.24	Average : Minimum	8.15
Vertical Illuminance Front Wall		**Vertical Illuminance Front Wall**	
Average Illuminance (fc)	27.58	Average Illuminance (fc)	14.36
Maximum Illuminance (fc)	46.50	Maximum Illuminance (fc)	31.90
Minimum Illuminance (fc)	8.50	Minimum Illuminance (fc)	4.80
Maximum : Minimum	5.74	Maximum : Minimum	6.65
Average : Minimum	3.24	Average : Minimum	2.99

Table 21: Summary of AGI32 calculations for auditorium

Luminaire Light Loss Factors for Auditorium									
Luminaire Designation	**Cleaning Interval**	**LDD Case**	**Initial Lumens**	**Design Lumens**	**LLD**	**LDD[a]**	**RSDD[b]**	**BF**	**Total LLF**
FT10	Clean, 12 mo.	W	5000	4600	0.92	0.93	0.96	1.0	0.821
PL5	Clean, 12 mo.	W	NA	NA	0.95[c]	0.93	0.96	1.0	0.848
PL6	Clean, 12 mo.	W	NA	NA	0.95[c]	0.93	0.96	1.0	0.848
PL7	Clean, 12 mo.	W	NA	NA	0.95[c]	0.93	0.96	1.0	0.848
PT6	Clean, 12 mo.	W	NA	NA	0.95[c]	0.93	0.96	1.0	0.848

[a] Luminaire dirt depreciation calculated using new method to be published in *IESNA Lighting Handbook* 10th ed.

[b] Room surface dirt depreciation calculated using Figure 9-19 in *IESNA Lighting Handbook* 9th ed., 2000, IESNA.

[c] Halogen lamp lumen depreciation calculated using Figure 6-20 in *IESNA Lighting Handbook* 9th ed., 2000, IESNA.

Table 22: Light loss factors for auditorium luminaires

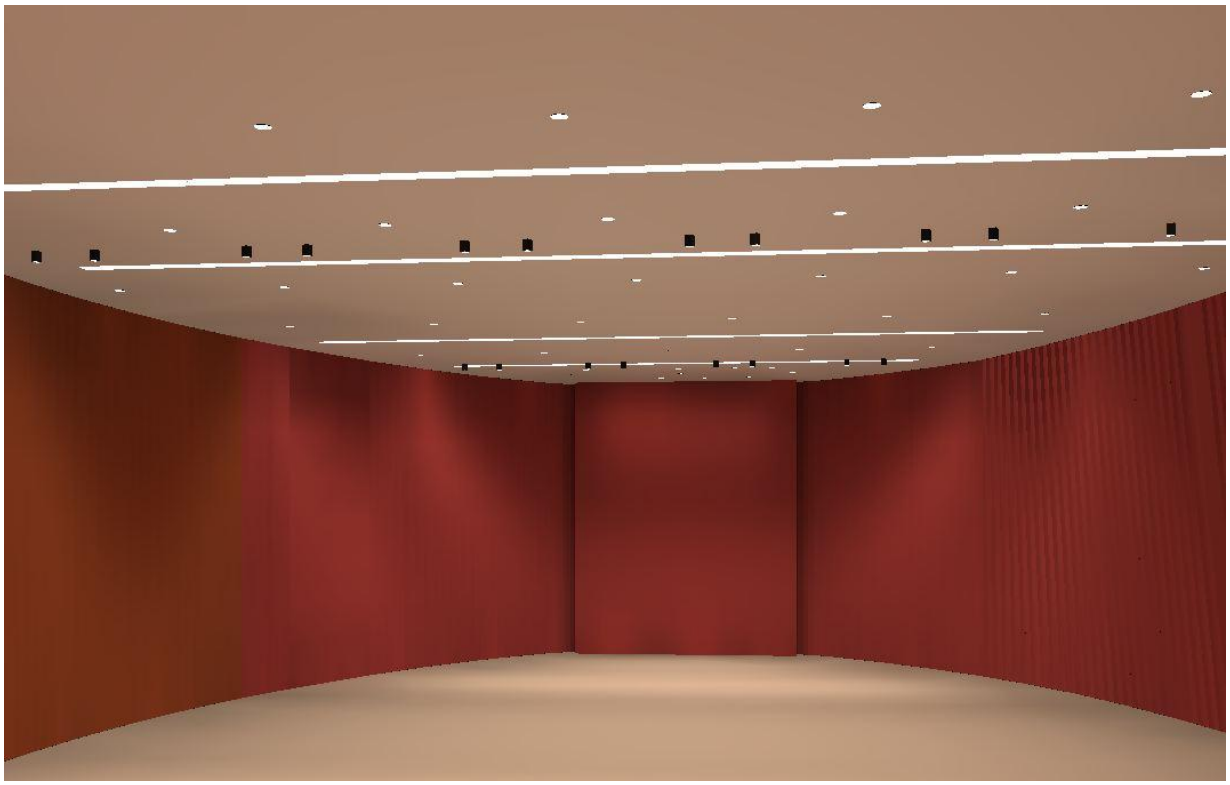

Figure 23: AGI32 rendering of auditorium

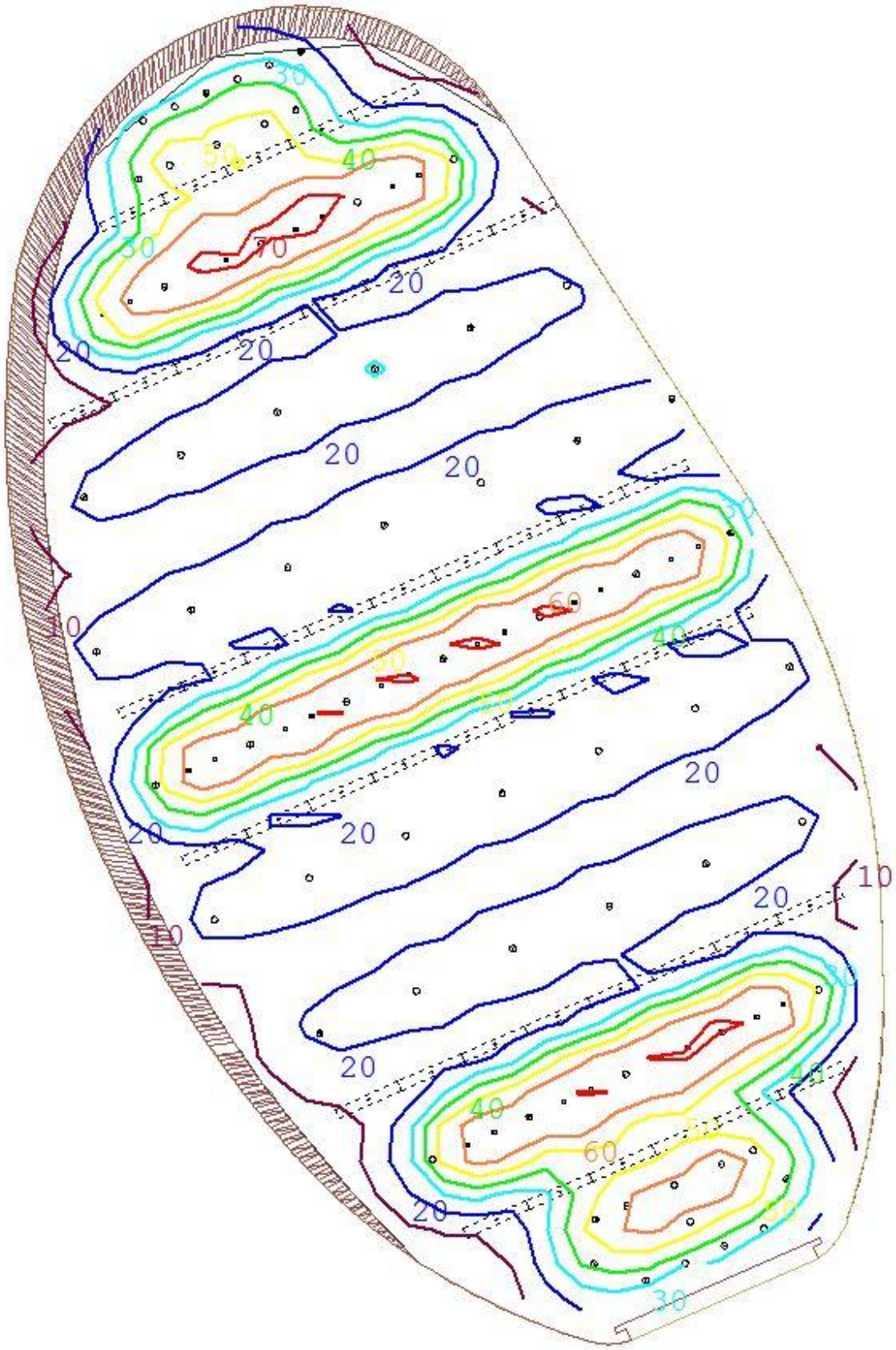

Figure 23: Iso lines of floor horizontal illuminance from incandescent lights for auditorium

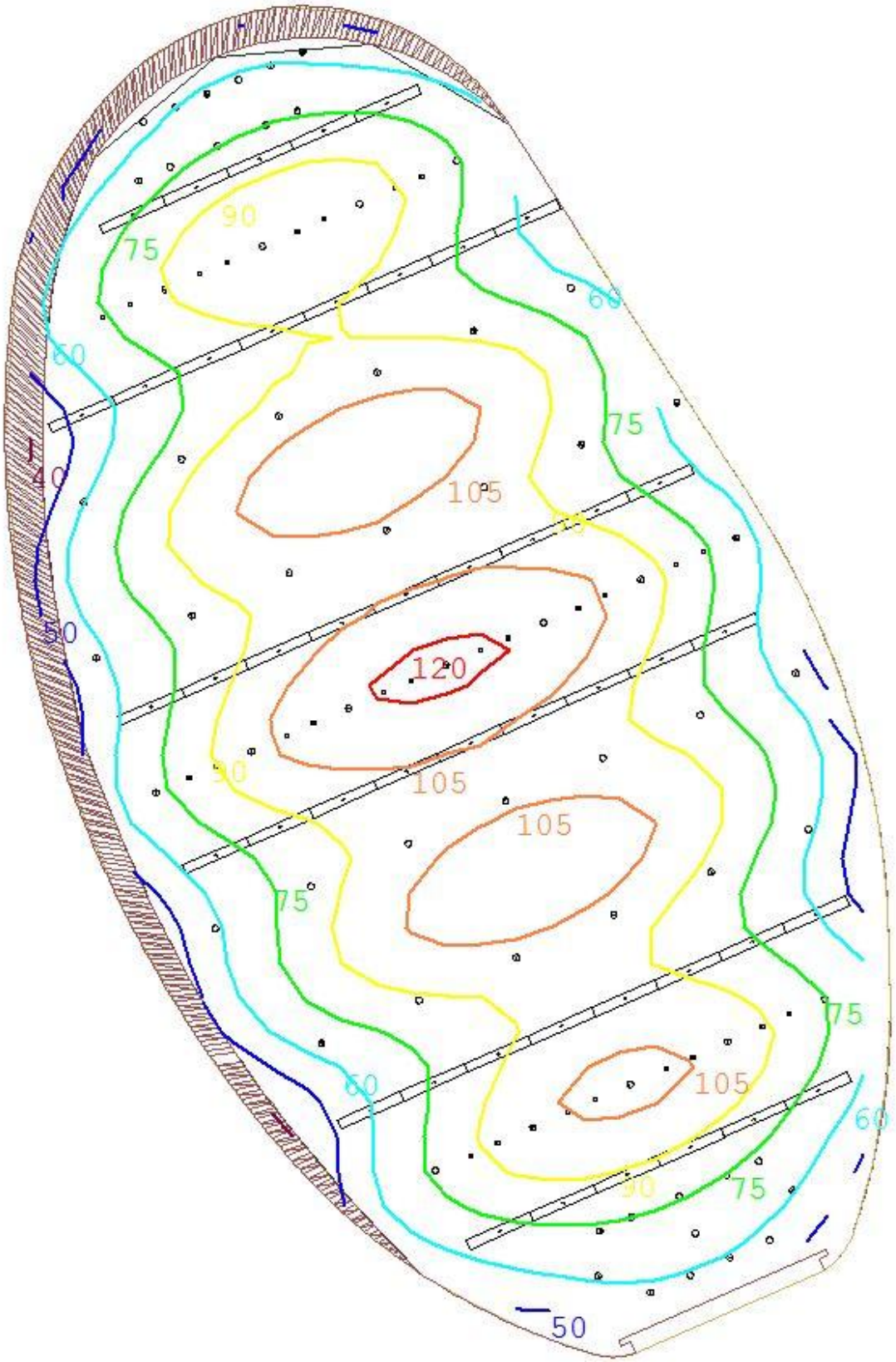

Figure 24: Iso lines of floor horizontal illuminance from fluorescent lights for auditorium

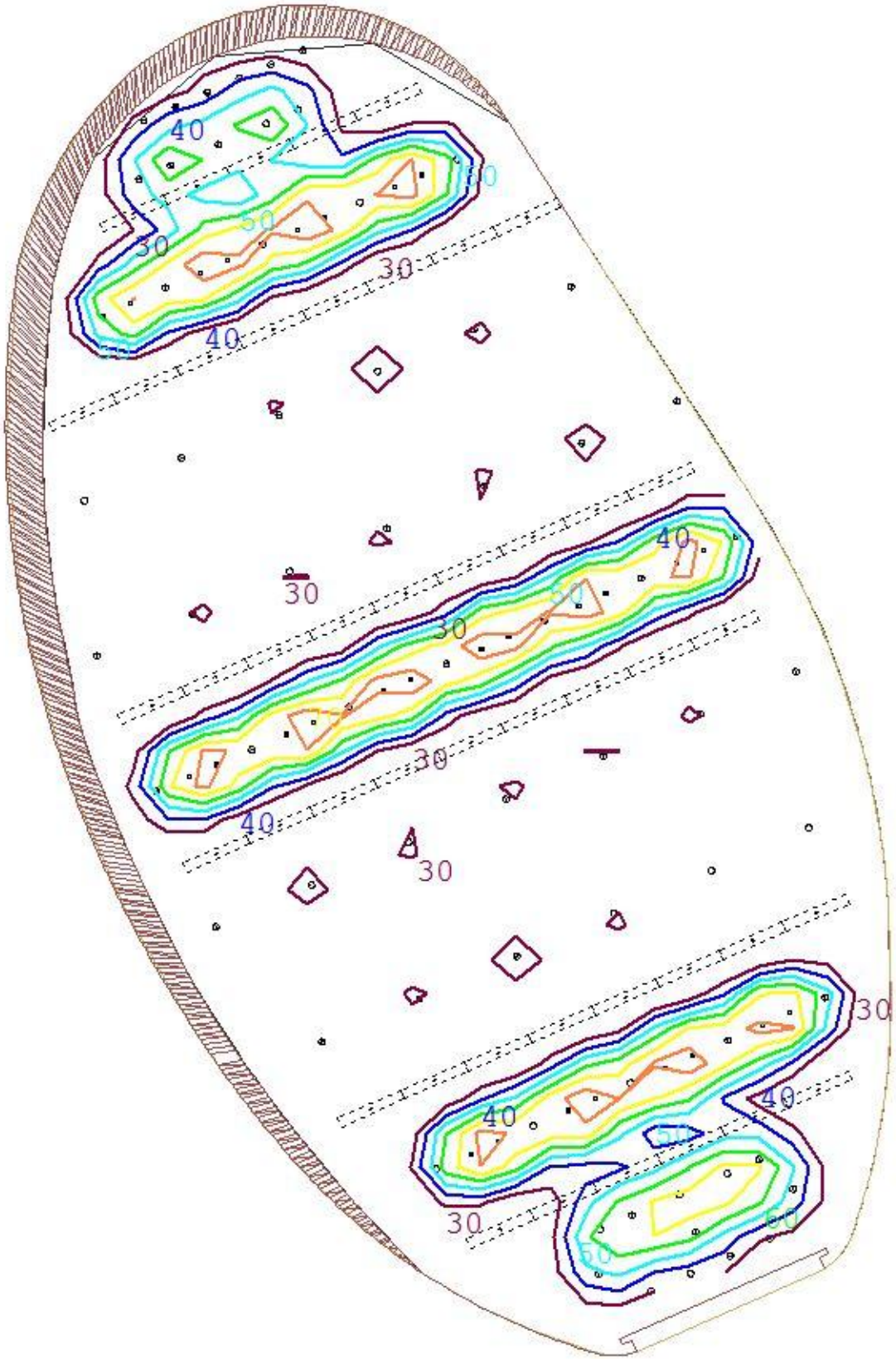

Figure 25: Iso lines of work plane horizontal illuminance from incandescent lights for auditorium

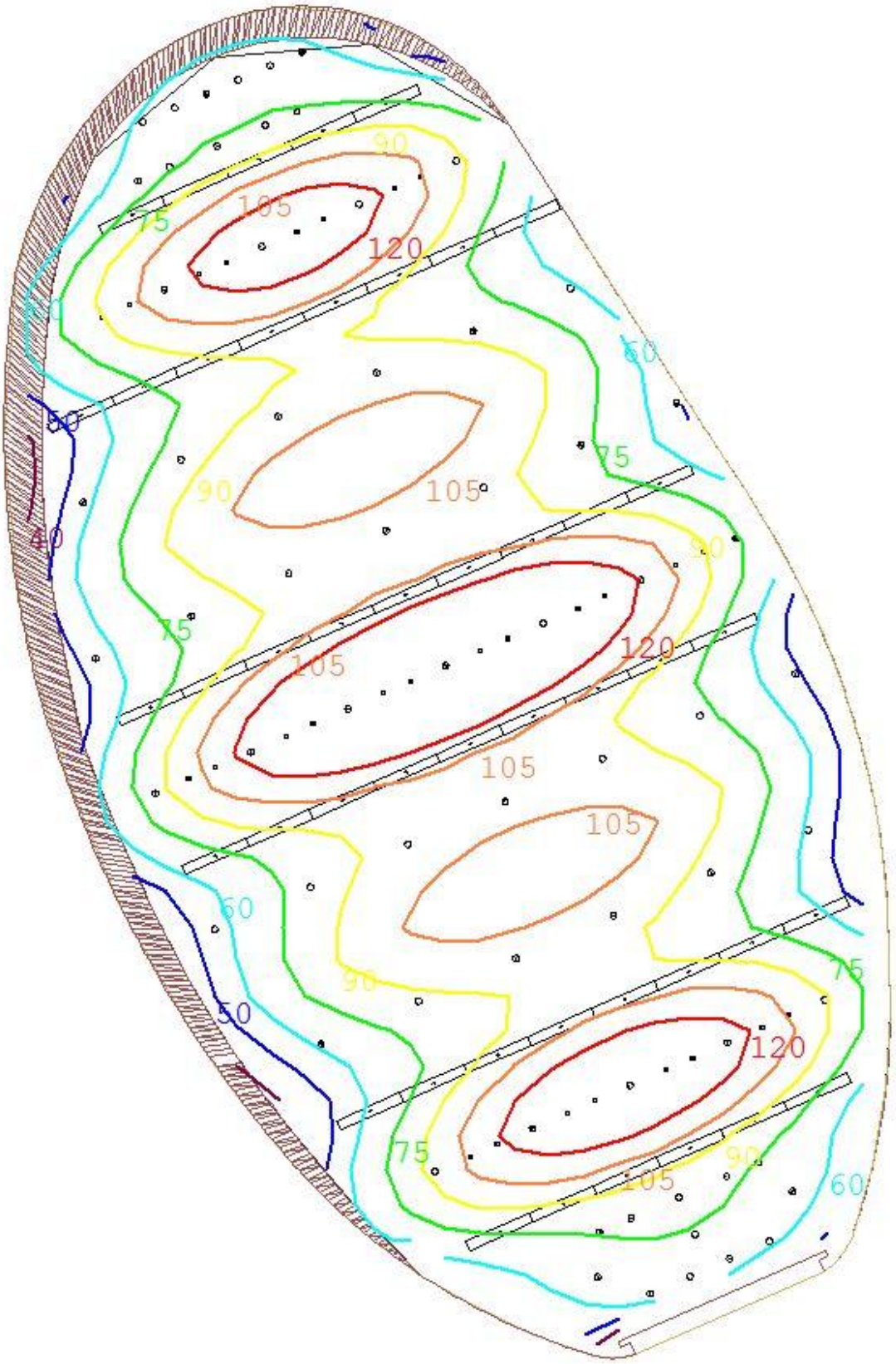

Figure 26: Iso lines of work plane horizontal illuminance from fluorescent lights for auditorium

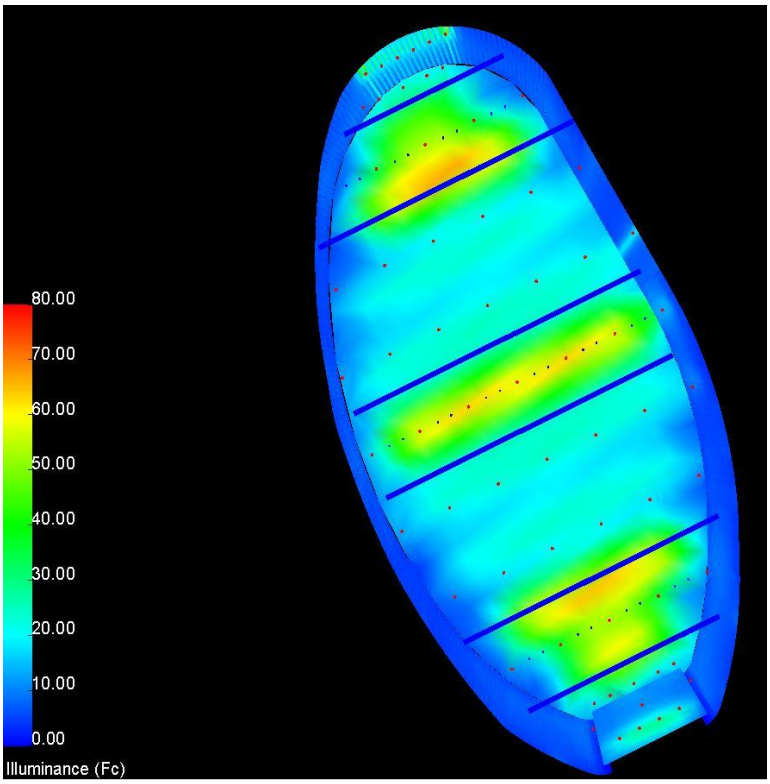

Figure 27: Pseudo color rendering of auditorium floor with incandescent lighting

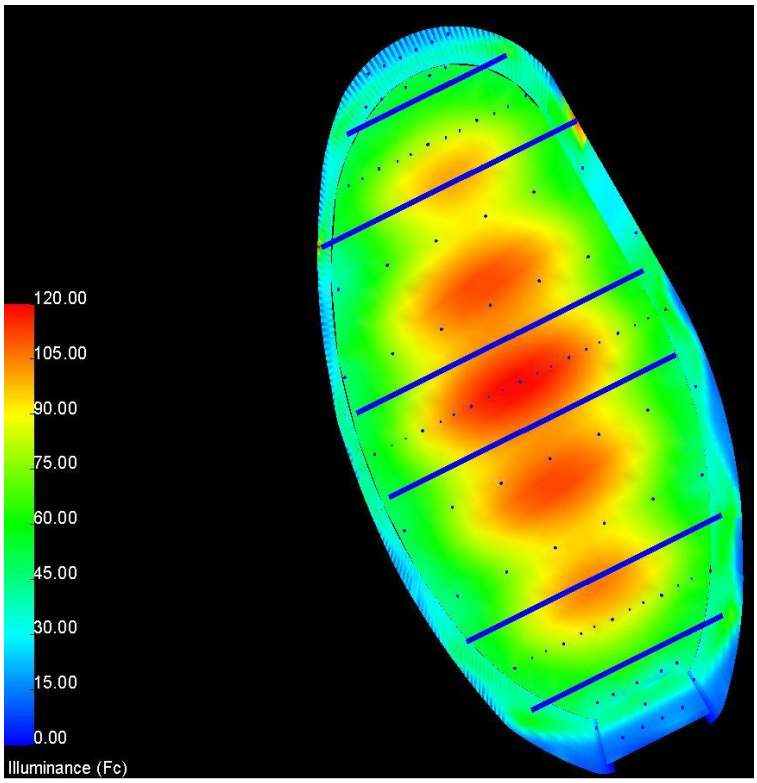

Figure 28: Pseudo color rendering of auditorium floor with fluorescent lighting

Circulation Space | Main Lobby

Existing Conditions

Description:

Upon entering the lobby, occupants are greeted by the reception desk located to their left. The lobby serves as a transition and circulation space between the elevator lobby, conservatory, and auditorium. Lined by a frosted glass railing, the walkway on the second floor overlooks the double storied space. A small seating area placed around large support columns provides a relaxing space to wait. A corridor leads from the main lobby to a smaller entrance lobby near the auditorium. Natural materials such as stone and wood decorate the walls, and the outside of the auditorium is an important architectural feature in the space. Due to the large number of social interactions that occur in the space, the lighting should provide good facial rendering Specific dimensions, plans, and materials for this space are detailed below.

Area: Approximately 6500 SF

Dimension:

Main Lobby: Approximately 95’ x 53’, with a ceiling height of 19’-4”.
Corridor adjacent to auditorium: Approximately 54’ x 15’, with a ceiling height of 19’-4”.
Auditorium Lobby: Approximately 35’ x 25’, with a ceiling height of 19’-4”.
Security: Approximately 18’ x 9’, with a ceiling height of 8’-0”.

Materials:

Lobby Materials and Finishes Schedule					
Abbreviation	**Finish Type**	**Object**	**Manufacturer**	**Color**	**Reflectance**
ACT-3	Ceiling Tile	Ceiling	Decoustics	White	0.90[c]
CPT-1	Carpet	Floor	Atlas	Sorrel, IT11	0.23[d]
GT-5	Glass Tile	Wall	Bisazza	Brown	0.04[d]
M-1	Metal	Wall	PPG	Champagne	0.65[b]
M-3	Metal	Wall	Milgo / Bufkin	Stainless Steel	0.60[b]
M-9	Metal	Wall	Zahner	Stainless Steel	0.65[b]
P-1	Paint	Wall	Benjamin Moore	Ivory	0.60[d]
PL-9	Plastic Laminate	Wall	Abet Laminati	Silver	0.47[d]
S-2	Stone	Wall	Vetter Stone	Veined Pink	0.41[d]
TZ-2	Terrazzo	Floor	Nat. Terrazzo	Beige	0.55[d]
W-1	Wood	Wall	Crown Veneer	Anegre	0.30[a]
Abbreviation	**Finish Type**	**Object**	**Manufacturer**	**Color**	**Transmittance**
G-3	Glazing	Glazing	PPG	Clear	.90[c]
G-9	Glazing	Glazing	Bendheim	White-Polished	.20[b]

[a] Reflectance values not available. Assumed from Table 8.5, *Architectural Lighting Design*, Gary R. Steffy, 2008.

[b] From Figure 1-36, *IESNA Lighting Handbook*, 2000, IESNA

[c] Value obtained from manufacturer’s data.

[d] Reflectance values not available. Assumed from manufacturer sample imported into AGI32.

Table 23: Materials and finishes for circulation space

Floor Plans, Elevations, and Images:

Figure 29: Photograph of Lobby Seating

Figure 30: Photograph of Auditorium Exterior

Figure 31: Photograph of Auditorium Lobby

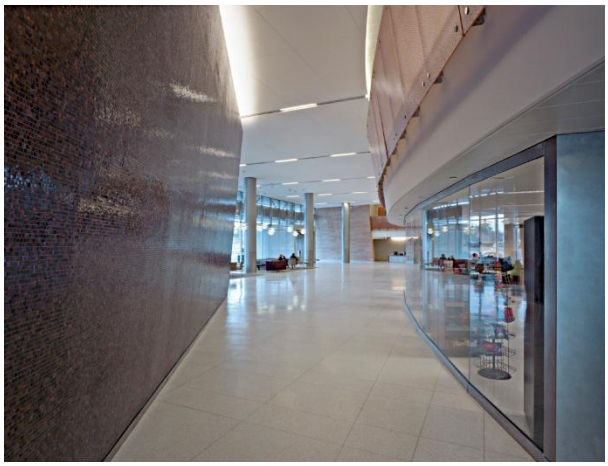

Figure 32: Photograph of Lobby Corridor

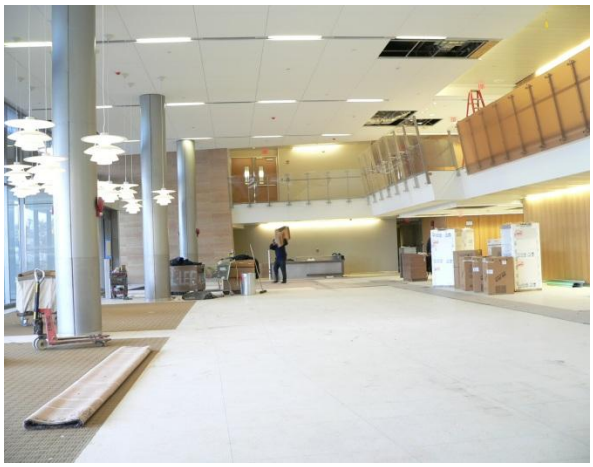

Figure 33: Photograph of reception area

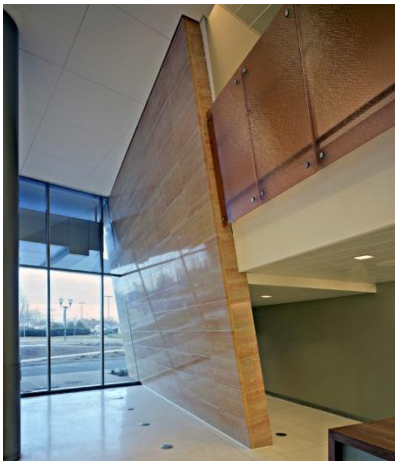

Figure 34: Stone wall at reception area

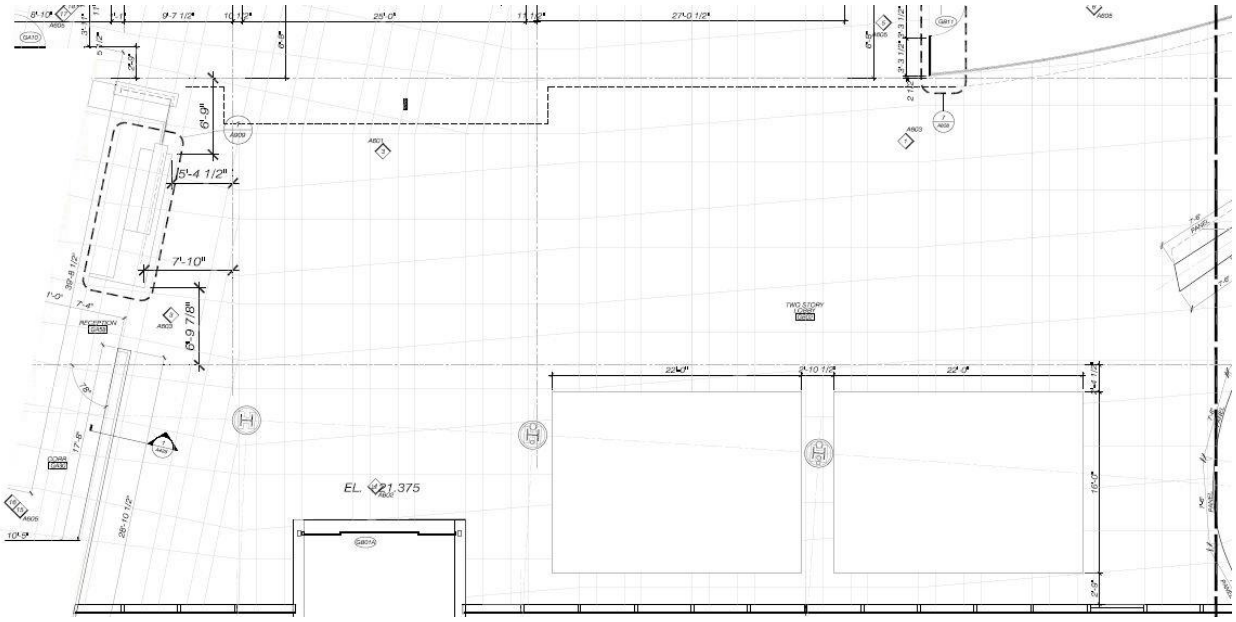

Figure 35: Main lobby floor plan

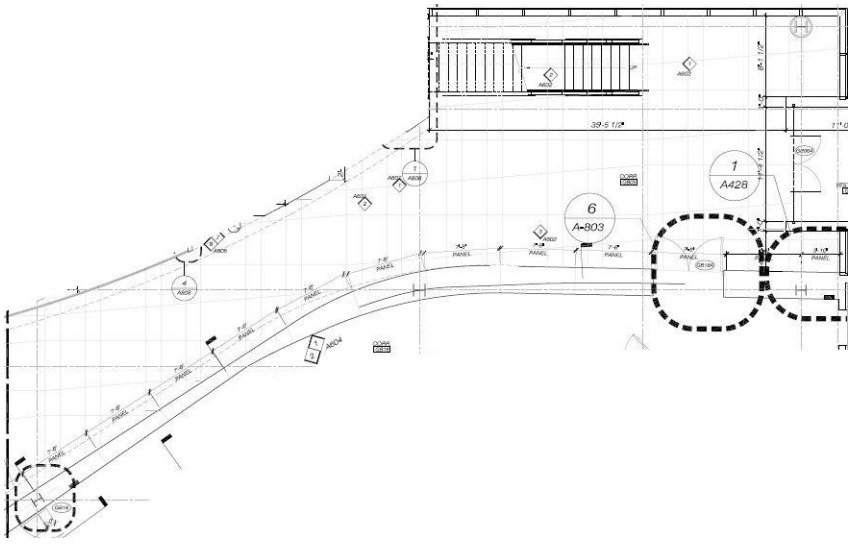

Figure 36: Auditorium lobby and corridor floor plan

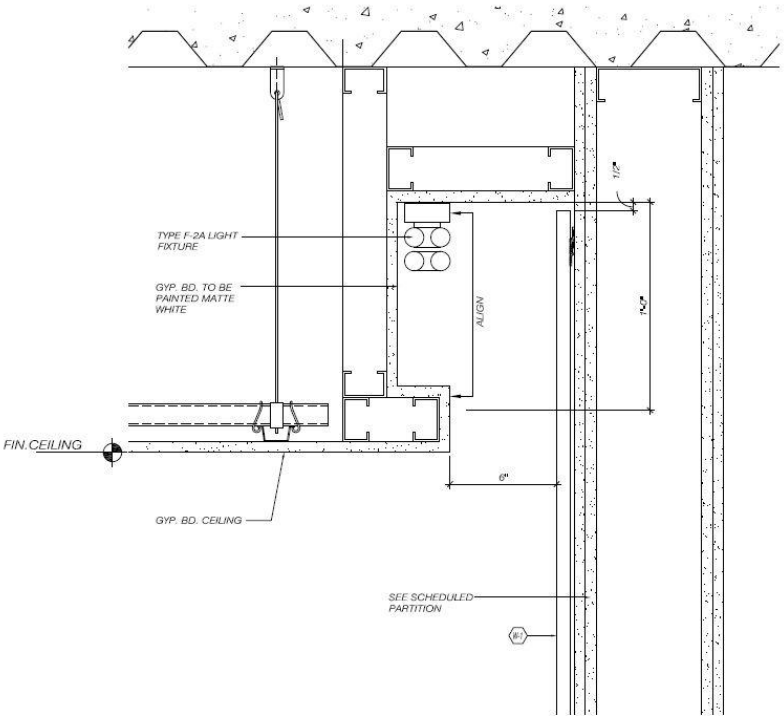

Figure 37: Typical cove detail

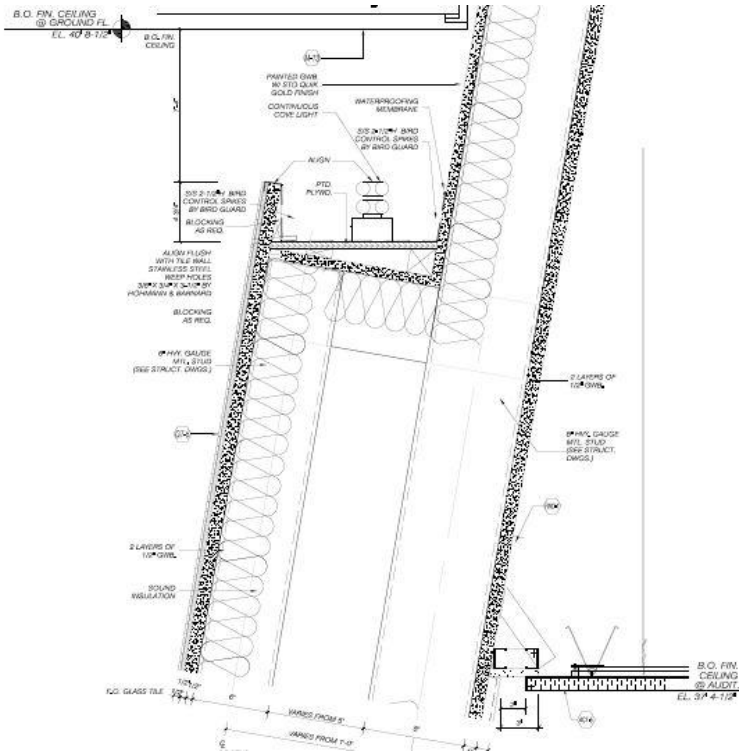

Figure 38: Typical cove detail at Auditorium Wall

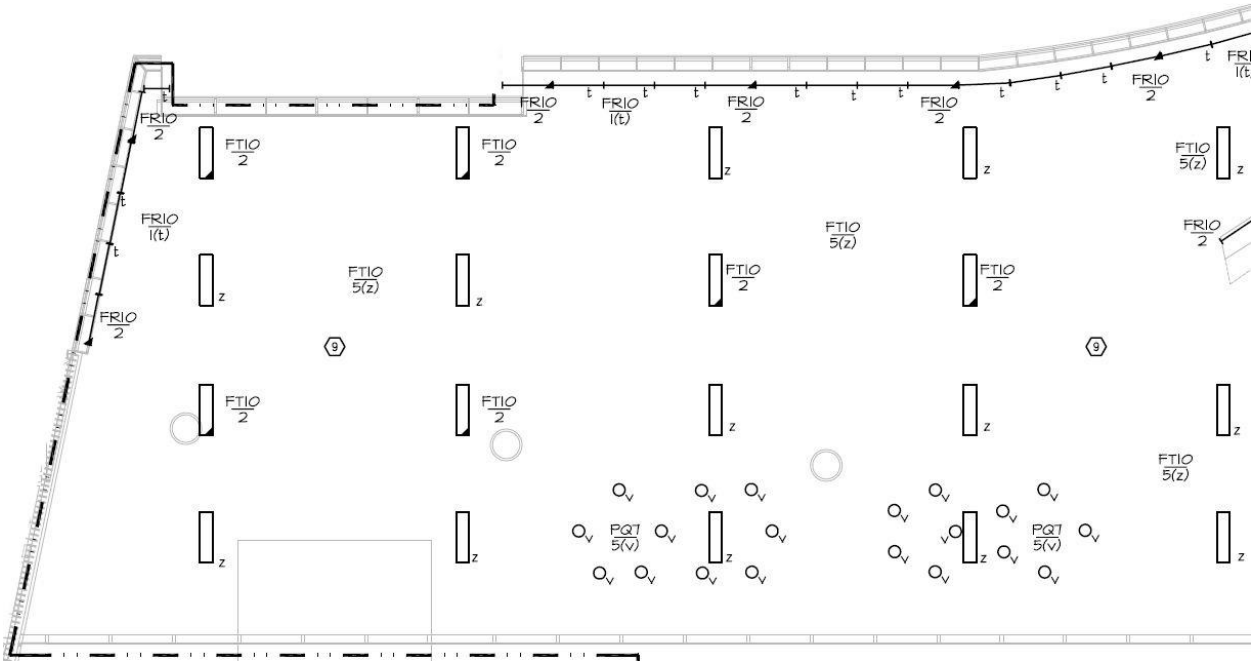

Figure 39: Main lobby lighting plan

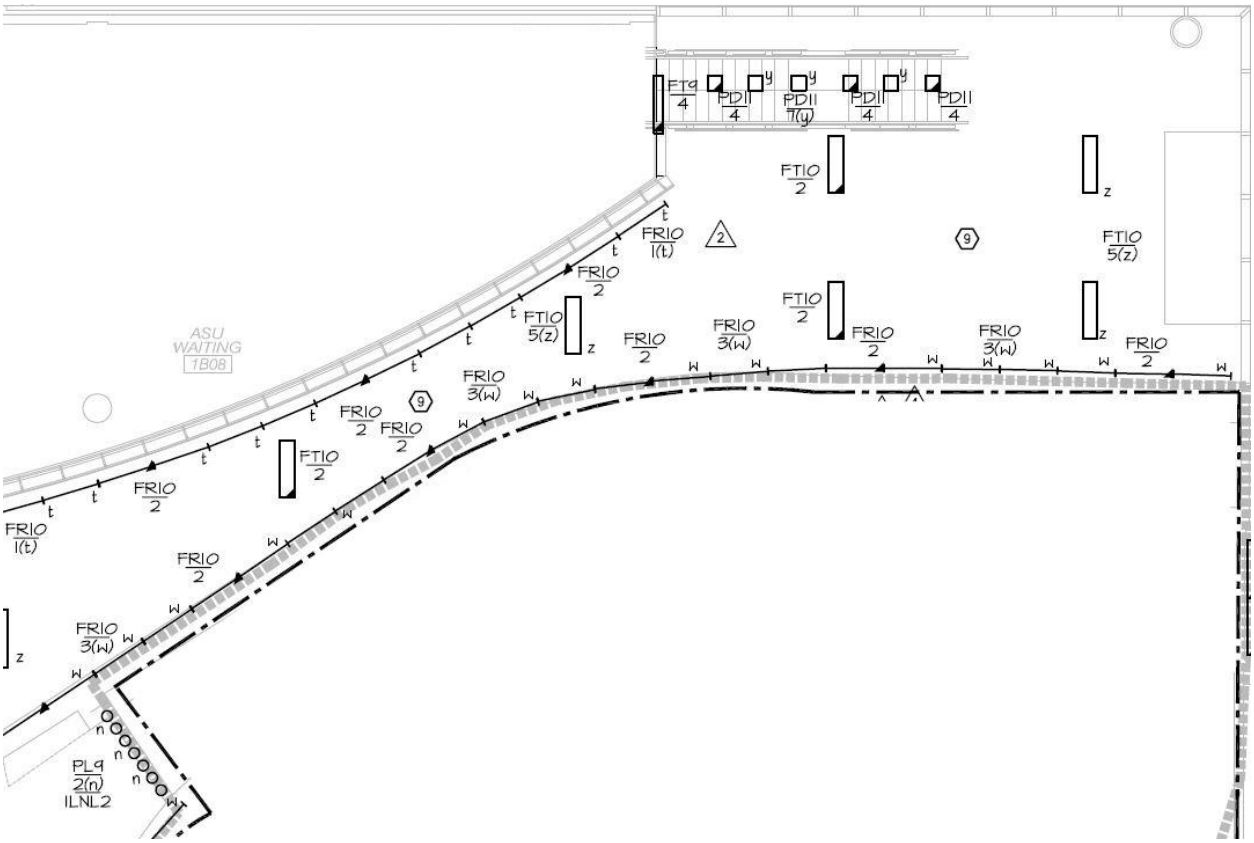

Figure 40: Auditorium lobby and corridor lighting plan

Existing Lighting Conditions

The general lighting in the lobby comes from recessed linear fluorescent 1' x 4' luminaires (FT10) located in the ceiling. Decorative fluorescent cove lighting (FR10) is used along the top of the exterior wall of the auditorium as well as to define the walkway on the first floor. The typical mounting for this luminaire is shown in Figure 38. A similar fixture (FR9) mounted in a wall slot is used to graze the wall behind the reception desk as well as the wood paneling near the elevator lobby. The stone wall next to the left of the reception desk is illuminated from the floor by recessed metal halide floodlights (PX15) that are flush with the lobby floor. Additional lighting is provided above the reception desk with recessed CFL downlights (PD9) in a square aperture. A similar fixture (PD11) with metal halide lamping is used in the auditorium lobby above the stairway to the first floor shown in Figure 31. Decorative pendants (PQ7) with ceramic metal halide lamps are used above the seating area. Each lighting system is switched separately and is controlled from the reception desk.

Existing Lighting for Main Lobby							
Type	**Quantity**	**Input Watts**	**Location**	**Mounting**	**Manufacturer**	**Lamp Type**	**Notes**
FT10	25	120	Lobby	Ceiling Recessed DL	Linear Lighting RC68-D2-ET5HO	(2) GE F54T5HO/835	Mounted in cont. row Specular parabolic louvers
FR9	16	80	Lobby	Ceiling Slot WG	Celestial Lighting UBL 5000 BXO	(2) 40W BIAX CFL per 40"	Low profile Overlapping "ramped" socket Continuous length of cove
FR10	36	80	Lobby	Surface Cove	Celestial Lighting UBL 5000 BXO	(2) 40W BIAX CFL per 40"	Low profile Overlapping "ramped" socket Continuous length of cove
PD9	4	46	Lobby Reception	Ceiling Recessed DL	Kurt Versen H8643	(1) 42W CFL	6" square aperture Matte silver finish
PD11	6	48	Auditorium Lobby Stair	Ceiling Recessed DL	Kurt Versen H8402-SC	(1) 39W MH PAR20	4 1/2" square aperture Matte silver finish
PQ7	20	48	Lobby Seating	Ceiling Pendant DL	Louis Polsen PH6 Series	(1) 39W CMH T6 840	White Remote ballast in canopy
PX15	5	48	Lobby Reception	Floor Recessed	HP^2-CO^2	(1) 35W MH PAR20FL	Remote ballast Stainless steel face plate 30 degree flood

Table 24: Existing luminaires for Main Lobby

Design Criteria and Considerations

Summary:

The following sections list important design criteria and considerations for the main lobby. Criteria listed include recommended illuminance values as well as power requirements. The final design will strive to meet all design criteria listed, and all existing conditions will be measured against these criteria. All issues listed under considerations come from the IESNA Lighting Handbook in addition to special design issues that relate to this space and project. While many design issues should be considered, the list provided below summarizes the most important issues for this application.

Design Criteria:

Table 25 shows recommended illuminance levels specifically for the lobby. However, individual tasks that are likely to be performed in the area should also be considered. These tasks as well as recommended illuminance values are listed in Table 26. Table 27 and Table 28 summarize lighting power densities according to ASHRAE and the New York State Building Code.

IESNA Illumination Recommendations for Main Lobby		
Area	**Illuminance**	
	Horizontal	**Vertical**
Lobby	5 fc	3 fc
General Waiting Area	10 fc	3 fc
Reading in Waiting Area	30 fc	5 fc
Corridors / Stairs	5 fc	-
Reception	50 fc	30 fc

Table 25: IESNA Illumination Recommendations

IESNA Illumination Recommendations for Tasks		
Task	**Illuminance**	
	Horizontal	**Vertical**
Reading: VDT Screens	3 fc	3 fc
Reading: Keyboard	30 fc	-
Reading: #2 Pencil	30 fc	-
Reading: Ball point pen	30 fc	-
Reading: 8 – 10 point font	30 fc	-
Reading: Glossy magazines	30 fc	-

Table 26: IESNA Illumination Recommendations

ASHRAE 90.1-2007 Lighting Power Densities Allowance	
Space Type	**LPD, W/ft^2**
Hospital	1.2
Lobby	1.3

Table 27: ASHRAE Lighting Power Densities Allowance

New York State Building Code Lighting Power Requirements	
Space Type	**LPD, W/ft^2**
Hospital	1.2
Lobby	1.3

Table 28: Building Code of New York State Lighting Power Requirements

Additional Power Requirements and Allowances:

- ASHRAE allows tradeoffs among spaces provided that the total installed interior lighting power does not exceed the interior lighting power allowance.
- For spaces where decorative lighting is installed in addition to the general lighting, an additional 1.0 W/ft^2 is allowed for the space.

When comparing Table 25 and Table 26, the recommended illuminance values for a waiting area and reception area are about the same as the recommended illuminance levels for the various tasks that will be performed in this space. An average illuminance of 5 - 10 fc, with a higher illuminance value of 30 fc for reading related tasks in the waiting area and a value of 50 fc at the reception desk, would be appropriate for this space. When comparing allowable lighting power densities, the requirements for the state of New York and ASHRAE are identical. In addition to the design criteria listed, there are many design considerations that must be taken into account. These considerations are summarized in the following section.

Design Considerations:

Appearance of Space and Luminaires

When entering the hospital, the lobby gives the first impression. Proper lighting design that enhances the architecture can help significantly in giving a favorable impression. The lighting design should complement the space and should have a clean design. Since the lobby functions primarily as a circulation space, how the lighting design guides the occupant through the space is an important consideration. Uniform layouts with straight lines can be used to guide occupants to a particular area, while a less uniform layout may encourage a more random movement through the space.

Psychological Impression

As described above, the impression of the space important. Visitors should feel comfortable and relaxed upon entering the hospital. Direct downlighting should be avoided. In the seating area and the main lobby in general, an occupant should feel relaxed. This impression can be achieved through lighting by the use of non-uniform peripheral luminances.

Modeling of Faces and Objects

The modeling of faces at the reception area and entrance to the building are very important. The ability of staff and security to read and interpret the facial expressions of occupants entering the building is critical to effective communication and safety. Direct downlight that creates harsh facial shadows should be avoided above the reception desk.

Daylighting Integration and Control

Daylighting integration and control are important from an energy conservation standpoint and should be used in the lobby area due to the availability of natural light near the seating area.

Photosensors should be used to control luminaires in close proximity to the glazing. Proper glazing and shading should be used to block direct glare from the sun.

Direct and Reflecting Glare

Direct glare can be distracting to the occupants performing tasks commonly performed in the space. Direct glare from luminaires can cause discomfort and can make it difficult for occupants to circulate through the space. Direct views of lamps sources should be avoided as much as possible. Additionally, luminaire luminances should not be greater than 100 times the luminance of surrounding areas.

Color Appearance

Appropriate color rendering in the lobby is important. Since social interactions occur in the space, the lighting design should render skin tones properly. The natural materials used throughout the space should also be rendered correctly to ensure the architect's vision for the space is achieved.

Light Distribution

Patterns of light on surfaces and the task plane can affect task visibility, comfort, and perception. As a result, the spacing and light distribution of luminaires should be carefully analyzed. Excessive brightness and shadows should be avoided. The task illuminance should be higher than the surroundings to draw attention to the task. The luminance ratio between the presenter or projection screen and the surrounding walls should be carefully considered. Between the task and remote surface, the luminance ratio should not exceed 10:1.

Flicker

Flicker and strobe can create an undesirable environment. Luminaires that utilize light sources prone to flickering should be avoided. High frequency electronic ballasts should also be used to eliminate flicker.

Shadows

Shadows can interfere with tasks as well as set a mood for a space. A dark corridor or area of the lobby can deter occupants from circulating through the area. Point sources tend to created harsher shadows while linear sources tend to produce softer shadows.

Evaluation and Critique

Summary

The lighting design for the lobby is adequate for the space, but could be designed better. The strong linear lines created by the fluorescent lights work well with the sharp edges of the architecture but create a sense of forced circulation in an open lobby where movement should flow more freely. The cove lighting in the space works well along the second floor walkway by adding a line of light that

helps to define the curve. However when used along the auditorium wall, the lighting system creates undesirable "hot spots" across the top of the wall. A luminaire that is angled or is mounted in a way that shoots light across the ceiling would have created a more desirable effect. Additionally, no attempt was made to actually high light the auditorium wall itself. Slot mounted luminaires could have achieved a similar effect as the existing design while highlighting the exterior walls of the auditorium.

Aside from the cove lighting on the auditorium wall, decorative lighting is used well is the space. The in-ground fixtures draw attention to the stone wall next to the reception desk. In the seating area, the pendants help to scale down the space and provide additional lighting for tasks performed in the area. The use of slot mounted fixtures along the walls help to define boundary between the wall and ceiling, but not without creating a line of noticeably higher illuminance at the top of the wall. A fixture that sends light down the wall in a more uniform matter would have created a better effect.

Since the fluorescent lighting used in the lobby is the same fixture used in the auditorium, based on the relatively low amount of luminaires in the lobby I would assume that the lighting levels are closer to the IESNA recommended levels than in the auditorium. However, since the nurse's station and auditorium were severely overdesigned, it is likely that the illuminance levels in the lobby exceed recommendations. The lighting power density for the lobby is 1.01 W/ft^2, which is well under the 1.3 W/ft^2 required by ASHRAE and New York.

Lighting Power Density for Nurse's Station			
Type	**Quantity**	**Watts / Luminaire**	**Total Watts**
FT10	25	120	3000
FR9	16	80	1280
FR10	36	80	600
PD9	4	46	184
PD11	6	48	288
PQ7	20	48	960
PX15	5	48	240

Total Watts:	6552
Total Area (ft^2):	6500
LPD (W/ft^2):	1.01

Table 29: Lighting power density calculation

Outdoor Space | Courtyard

Existing Conditions

Description:

The courtyard serves as an extension of the conservatory and functions primarily as a circulation space that connects the conservatory to the older sections of the hospital. A small seating area sits just outside the entrance to the conservatory. Visual tasks in the space are primarily related to circulation, so the lighting design should facilitate safe and easy movement through the courtyard. The surrounding exterior walls of the hospital are brick with some brushed stainless steel panels. The shell of the conservatory is composed of clear laminated glass. The ground of the courtyard is concrete with surrounding planters covered with grass.

Area: Approximately 14,000 SF.

Materials:

Courtyard Materials and Reflectance Values					
Abbreviation	**Finish Type**	**Object**	**Manufacturer**	**Color**	**Reflectance**
B-3	Brick	Wall	-	Red Dark Iron	0.20[a]
C-1	Concrete	Ground	-	Grey	0.25[a]
GR	Grass	Ground	-	Green	0.10[b]
M-1	Metal	Wall	Trespa Virtuon	Red	0.60[a]
M-14	Metal	Wall	Texaa	Orce rouge 390	0.60[a]
P-12	Paint	Wall	Ben. Moore	Baked Clay	0.25[c]
Abbreviation	**Finish Type**	**Object**	**Manufacturer**	**Color**	**Transmittance**
G-1	Glazing	Wall	PPG Solarban 60	Clear	0.70[c]
G-4	Glazing	Conservatory	PPG Solarban 60	Clear	0.70[c]

[a] Reflectance values not available. Assumed from Table 8.5, *Architectural Lighting Design*, Gary R. Steffy, 2008.

[b] From Figure 5-19, *IESNA Lighting Handbook*, 2000, IESNA

[c] Value obtained from manufacturer's data.

Table 30: Materials and finishes for outdoor space

Floor Plans, Elevations, and Images:

Figure 41: Photograph of courtyard from conservatory

Figure 42: Photograph of courtyard

Figure 43: Photograph of courtyard seating area

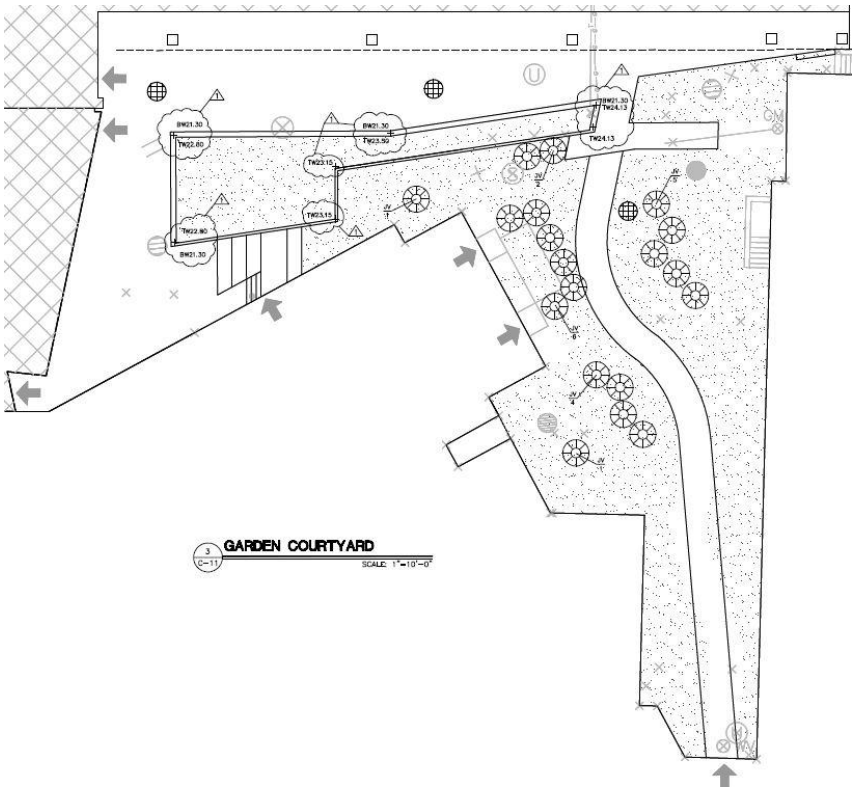

Figure 44: Courtyard landscaping plan

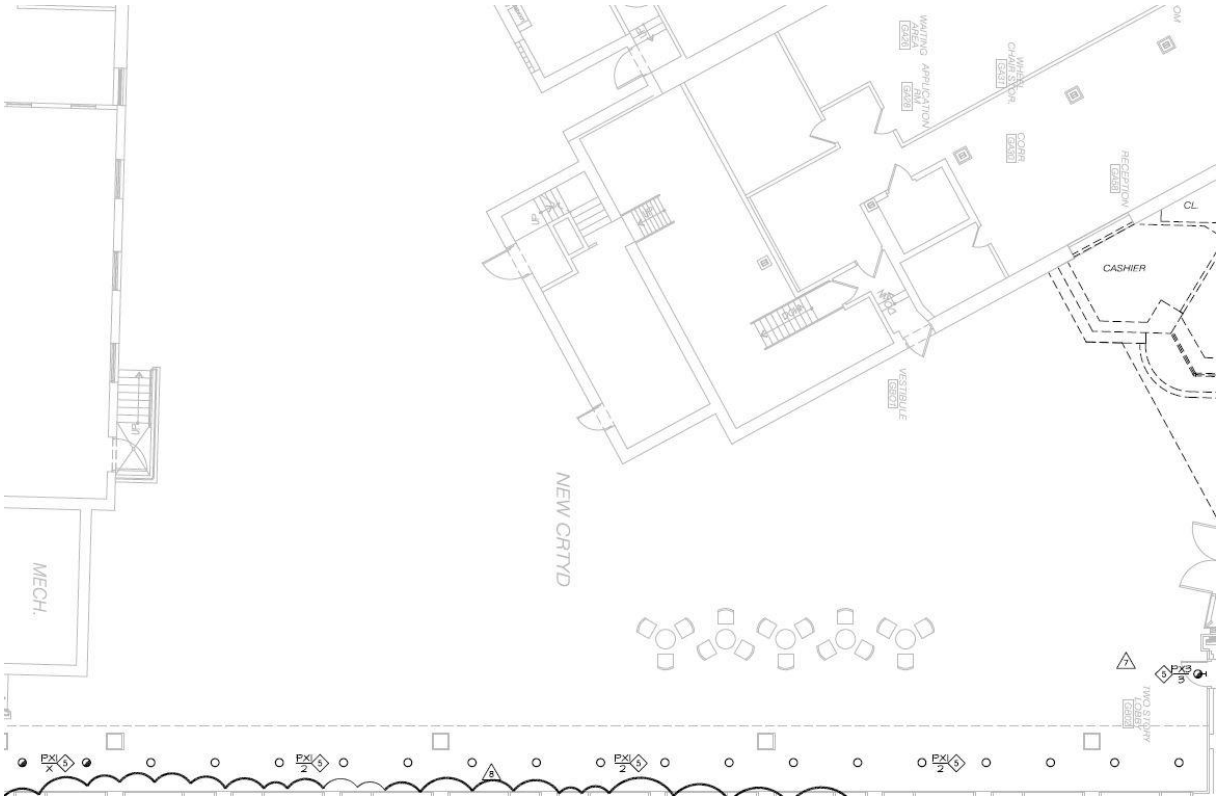

Figure 45: Courtyard lighting plan

Existing Lighting Conditions

There is no lighting design for the seating area and main pathways in the courtyard. The only exterior lighting in the area comes from metal halide downlights (PX1) that are recessed in the overhang of the first floor.

Existing Lighting for Main Lobby							
Type	**Quantity**	**Input Watts**	**Location**	**Mounting**	**Manufacturer**	**Lamp Type**	**Notes**
PX1	19	94	First floor overhang	Ceiling Recessed DL	Gotham Lighting LGH-70M	(1) 70W MH	8" aperture Specular azlack reflector Fresnel lens

Table 31: Existing luminaires for Courtyard

Design Criteria and Considerations

Summary:

The following sections list important design criteria and considerations for the courtyard. Criteria listed include recommended illuminance values as well as power requirements. The final design will strive to meet all design criteria listed, and all existing conditions will be measured against these criteria. All issues listed under considerations come from the IESNA Lighting Handbook in addition to

special design issues that relate to this space and project. While many design issues should be considered, the list provided below summarizes the most important issues for this application.

Design Criteria:

Table 32 shows recommended illuminance levels specifically for the courtyard. The space serves primarily as a circulation space, and other tasks would likely be performed in the adjacent conservatory. Table 33 and Table 34 summarize lighting power densities according to ASHRAE and the New York State Building Code.

IESNA Illumination Recommendations for Main Lobby		
Area	**Illuminance**	
	Horizontal	**Vertical**
General Lighting	5 fc	2 fc
Paths	10 fc	3 fc
Steps	10 fc	3 fc
Emphasize trees	3 fc	3 fc
Small focal points	10 fc	3 fc

Table 32: IESNA Illumination Recommendations

ASHRAE 90.1-2007 Lighting Power Densities Allowance	
Space Type	**LPD**
Walkways < 10 ft. wide	1.0 W/ linear ft^2
Plaza areas	1.0 W/ft^2
Stairways	1.0 W/ft^2
Canopies	1.25 W/ft^2

Table 33: ASHRAE Lighting Power Densities Allowance

New York State Building Code Lighting Power Requirements	
Space Type	**LPD, W/ft^2**
Courtyard (Other)	1.0

Table 34: Building Code of New York State Lighting Power Requirements

Additional Power Requirements and Allowances:

- New York State Building Code requires automatic switching or photocell controls to be used for all exterior lighting not intended for 24-hour operation
- ASHRAE allows tradeoffs among spaces provided that the total installed interior lighting power does not exceed the interior lighting power allowance.
- For spaces where decorative lighting is installed in addition to the general lighting, an additional 1.0 W/ft^2 is allowed for the space.

Base on the values listed in Table 33, an average illuminance of 5 - 10 fc would be appropriate for this space. The amount of uplight from luminaires should be carefully considered since the patient rooms overlook the courtyard. When comparing allowable lighting power densities, the requirements for the state of New York and ASHRAE differ. For this space, ASHRAE recommendations should be followed since they are more stringent. In addition to the design criteria listed, there are many design considerations that must be taken into account. These considerations are summarized in the following section.

Design Considerations:

Direct and Reflecting Glare

The issue of direct glare is extremely important in the courtyard. Direct glare from luminaires can cause discomfort and can make it difficult for occupants to circulate through the space. Direct and reflected glare are especially important due to the close proximity of patient rooms, and as a result luminaires with no uplight and shields should be used.

Modeling of Faces and Objects

The modeling of faces at near the building entrance and pathways is very important. The ability of staff and security to read and interpret the facial expressions of occupants entering the building is critical to effective communication and safety.

Shadows

Shadows in an outdoor space can pose numerous safety concerns. Shadows on stairs and pathways can cause occupants to trip or fall which could be a liability for the hospital. Shadows can also set the mood for a space, and an outdoor area with numerous shadows can deter occupants from circulating through the area.

Light Distribution

Patterns of light on surfaces and the task plane can affect task visibility, comfort, and perception. As a result, the spacing and light distribution of luminaires should be carefully analyzed. Excessive brightness and shadows should be avoided. Illuminance levels should allow occupants to move through the space without creating a disruption to patients in nearby rooms.

Points of Interest

The lighting design should highlight features of the courtyard and should guide occupants through the space. The lighting design should also reinforce the architecture, landscaping, and materials of the surrounding area.

Daylighting Integration and Control

Luminaires used in the courtyard should be controlled by photocells that will switch luminaires on and off depending on the amount of sunlight available.

Flicker

Flicker and strobe can create an undesirable environment. Luminaires that utilize light sources prone to flickering should be avoided. High frequency electronic ballasts should also be used to eliminate flicker.

Evaluation and Critique

Summary

The only current lighting in the courtyard area is located under the overhang provide by the first floor. The metal halide source is appropriate for the outdoor space and the close proximity to the building. Illuminance levels are likely higher than recommended since the mounting height is approximately 9'-0" above the ground and the luminaires use a 70W lamp. High illuminance values in this area are of special concern since there office windows are located adjacent to the pathway under the overhang.

There was no attempt made to light the pathways from the existing hospital to the new addition, which deters occupants from using the space at night. Ambient lighting from inside the conservatory provides some light on the adjacent exteriors seating area. The decision to not illuminate the building features surrounding the courtyard was a good decision since patient rooms look into the courtyard on all sides. However, a method of lighting the walls or other architectural elements without producing direct and reflected glare should have been explored.

Since 70W lamps were used, the illuminance levels likely exceed the IESNA recommended values. The lighting power density, which is based on an overhang area of approximately 1136 SF, is 1.57 W/ft^2 and does not meet the required value of 1.25 W/ft^2.

Lighting Power Density for Nurse's Station			
Type	**Quantity**	**Watts / Luminaire**	**Total Watts**
FT10	19	94	1786

Total Watts:	1786
Total Area (ft^2):	1136
LPD (W/ft^2):	1.57

Table 35: Lighting power density calculation