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Naval Network & Space Operations Command (NNSOC)
Dahlgren, VA

Technical Assignment 1
10/05/2006
Dr. Mistrick

Executive Summary

The following technical report summarizes the current conditions of the lighting and daylight systems of the Naval Network & Space Operations Command (NNSOC) in Dahlgren, VA. The four spaces that I will be analyzed are the entrance lobby, auditorium, an open office area and the exterior parking and entrance area. Using the plans provided to me by Kling and creating AGI models of the spaces, a complete study of the building can be made and discover possible redesign ideas.

Referring to ASHRAE 90.1 and the IESNA Handbook, standards exist that need to be implemented in order to meet code in power densities and light levels, respectively. Studying the plans and elevations, along with identifying specific circumstances for each space, many performance criteria can be evaluated to ensure the best possible lighting design. These include glare, VDT criteria, aesthetics, psychological aspects and others.

The materials and finishes of each of the spaces are given in the plans and will be taken into account in the analysis. Reflectance values were not included but will be approximated in the AGI renderings. The glass type is a standard ¼" minimum laminated glazing for all exterior windows, but transmittance values could not be found so assumptions had to be made. They differ space by space, and will be included in the report. I used AGI 1.9 for my modeling and analysis. These are simple models and do not include all the details of each space. If an .ies file could not be found for a specific fixture, a comparative alternate was used. Results that come from these models may not truly indicate how the real spaces perform due to assumptions and other unknown factors.

Auditorium

Spatial Overview

The auditorium space is used as a training assembly for the occupants. The theater is tiered following the existing site grading down to the front of the room. One ramp is available along the north side of the auditorium for handicap access and the seating is arranged in a gentle arc, focusing attention toward the presenter and projection screen. There are three aisles that lead down the rows to the front of the room, one in the middle and two on each end. The main purpose of the space is to attend lectures and view presentations. Structural columns were carefully placed in areas where there would be no site line obstructions to the front wall.

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Finishes

The materials used in this space were chosen to provide a warm inviting environment and to minimize future maintenance needs.

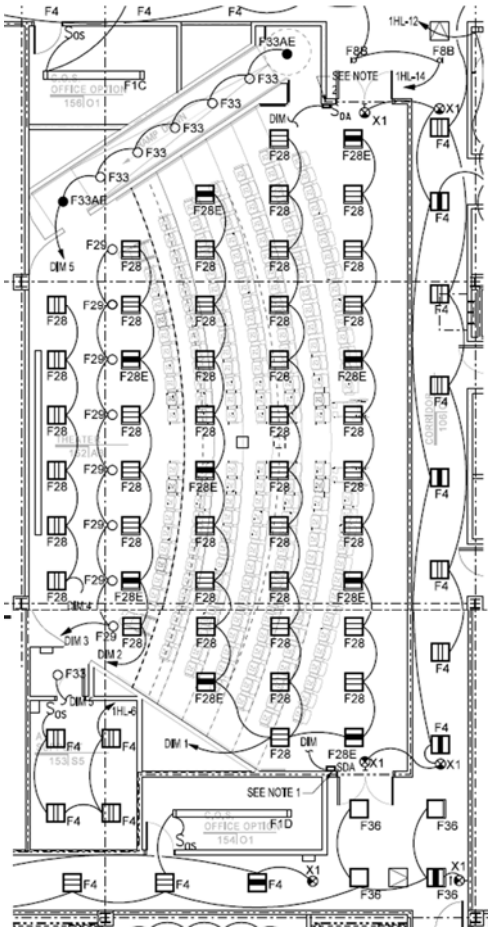
Materials:

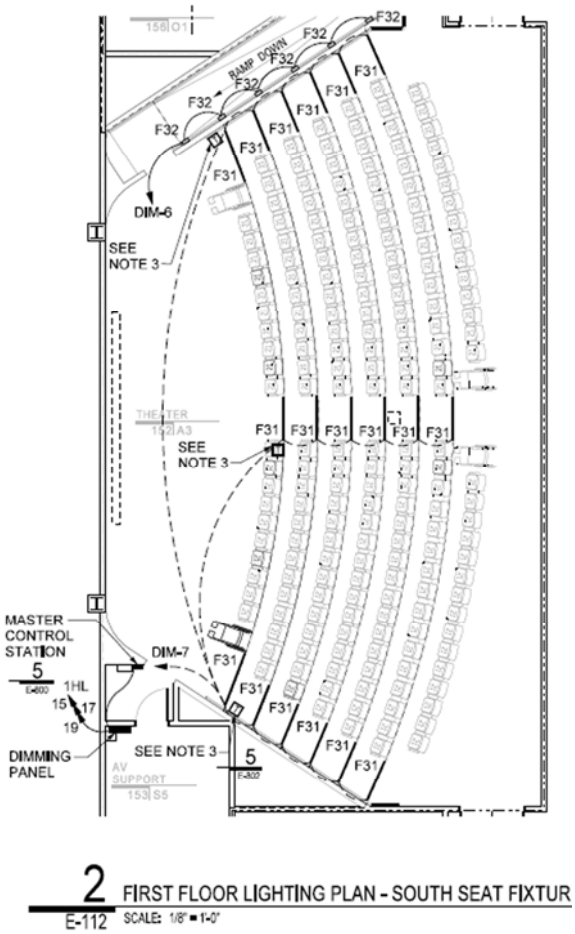
Floor – Broadloom Carpet – Reflectance 20% (Assumed)

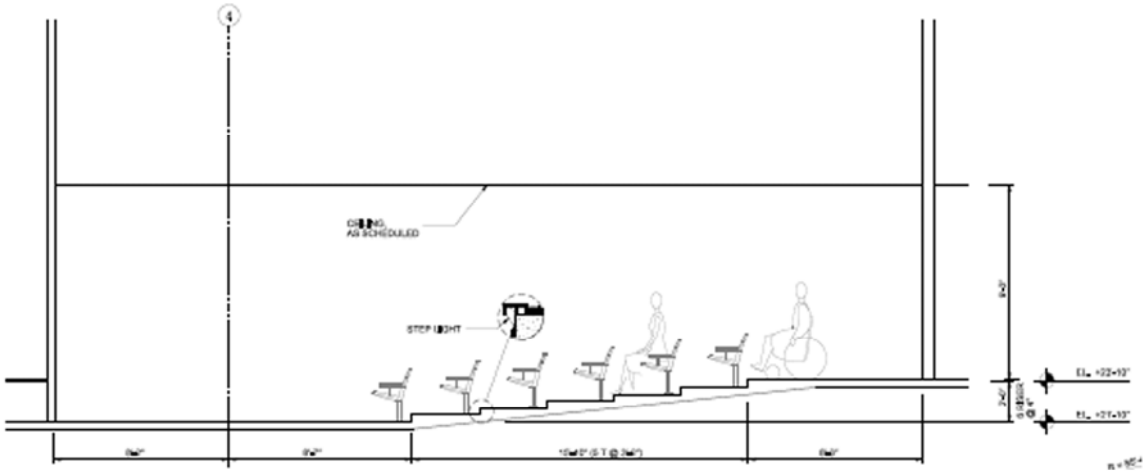
Walls – Acoustical Wall Covering – Reflectance 30% (Assumed)

Ceiling – Acoustical Ceiling Tile – Reflectance 85%

Plan and Section Drawings







Cross-Section of Auditorium

Luminaires

Type	Mtg.	Lamping	Volts	Total Watts
F28	R,C	(2) FT40DL/835	277	78
F28E	R,C	(2) FT40DL/836	277	78
F29	R,C	(1) Q50MR16/C/FL40	12/277	150
F31	AI	INCLUDED	12/277	1 W. LF.
F32	R,W	(1) F13DBX23T4/SPX35	277	27
F33	R,C	(1) F32TBX/SPX35/A/4P	277	34
F33A	R,C	(1) F32TBX/SPX35/A/4P	277	34

* Full Luminaire Schedule attached at the end of the report.

LLF's

TYPE	BF	CLEANING	MAINTENANCE	LLD	LDD	RSDD	LLF
F28	0.95	12 Month	III	0.92	0.9	0.9	0.70794
F28E	0.95	12 Month	III	0.92	0.9	0.9	0.70794
F29	1	12 Month	III	0.94	0.9	0.93	0.78678
F31	1	12 Month	V	0.85	0.88	0.95	0.7106
F32	1	12 Month	V	0.85	0.88	0.95	0.7106
F33	1	12 Month	III	0.85	0.9	0.85	0.65025
F33A	1	12 Month	III	0.85	0.9	0.85	0.65025

Power Density and Illuminance Levels

F28/E: 48 luminaires x 1 lamp x 78W = 3744W
F29: 8 luminaires x 1 lamp x 150W = 1200W
F31: 18 luminaires x 1 lamp x 3W = 54W
F32: 6 luminaires x 1 lamp x 27W = 162W

F33: 5 luminaires x 1 lamp x 34W = 170W
F33A: 2 luminaires x 1 lamp x 34W = 68W

Total Wattage = 5398W
Total Square Ft. = 4290s.f.
Power Density = 1.26 W/sq ft.

Using the Space-by-Space Method in ASHRAE 90.1
Classroom/Lecture/Training: 1.4 W/sq ft.

This lighting design meets the power density allowed for this space.

Illuminance Levels:
According to the Final RFP
Theater: 50fc on the work plane
According to the IES Handbook
Horizontal: Desk 30-50fc
Walking 10fc
Vertical: 5fc

Controls

Automated lighting control panel is provided to enable remote monitoring and control of the building's non-emergency interior and exterior lighting from the Base's MODBUS SCADA System. The auditorium has an automatic programmable remote control. There are 7 dim zones in the auditorium; the following chart describes each zone:

AUDITORIUM SUMMARY LOAD SCHEDULE

LUTRON ZONE	DIM ZONE	ZONE / CIRCUIT DESCRITION	VOLTAGE	LOAD TYPE	ACTUAL LOAD(VA)
A1-1	1	BACK 2 x 2's	277V	FL - HILUME / ECO 10	2720
A1-2	2	MID 2 x 2's	277V	FL - HILUME / ECO 10	640
A1-3	3	FRONT 2 x 2's	277V	FL - HILUME / ECO 10	960
A1-4	4	SPEAKER ACCENTS	277V	MAGNETIC LV	480
A1-5	5	RAMP DNLT WW	277V	FL - NON-DIM	340
A1-6	6	RAMP STEP	277V	FL - NON-DIM	188
A1-7	7	BULL NOSE STEP	277V	MAGNETIC LV	900

This SDA system has one control box at each entrance to control Dim Zones 1-4, and a Master Control Station in the front left corner that has control over the entire system. Total control of the lighting system is achieved by this configuration.

Performance Considerations

A space like an auditorium has a few different scenarios in which lighting design must be taken into account. Sitting in one of the seats a person will typically have two or three different areas to look at. One is at the projection screen, another would be toward a presenter/speaker and the third would be reading/writing sitting in a seat. For most cases, the eyes will be switching back and forth between two of them. Care has to be taken in the lighting design to make sure the ratios of the speaker and the screen are relatively similar, within 3:1. This ratio should be the same for these tasks to the background wall as well, with the background being darker.

Reflectances can be a huge issue when they are discussed with VDT and projection screens. First thing is to realize that having a high reflectance floor is not suitable. Carpet is the best choice because it has a matte surface which is able to diffuse the light in a non-glaring manner. Choice of light fixtures is also a daunting task. Direct glare, multiple light levels, and a comfortable feeling all need to be evaluated for an auditorium space. A designer needs to make sure that the fixtures won't cause glare to the audience, as well as on the projection screen. Recessed fixtures are usually a good choice for a space like this, especially when multiple lamps can be placed in the fixtures and switched on for different lighting levels. The walls should be fairly bland and not draw attention by having pictures or artwork hanging anywhere. This will keep the eyes from wandering around and help keep attention on the presentation, instead of somewhere else.

Controlling a space like an auditorium is a must for today's technologies. With all the different events that a space this flexible can hold, it is imperative to be able to control multiple lighting fixtures, with multiple settings such as dimming and switching of different lamps within a single fixture. Adding more fixtures to the space can also add flexibility. Placing step lights in the aisles can allow all the overhead fixtures to be turned off, providing the brightest screen possible for the projector. Once again, having control over the lighting system to meet each individual presenters needs is probably the best possible solution. Being able to control the lighting environment completely, allows the greatest flexibility without sacrificing quality.

Analysis

Lighting

Using the recessed parabolic troffers were one of many choices that can make this space suitable as an auditorium. Since this space is set up with a control board and dimmable fixtures, almost any type of recessed fixture could be used to meet the ambient lighting levels. I like the troffers, but I would be interested to see if dimmable compact fluorescent downlights would work just as well as these 2x2's.

The LED step lights under the riser of each stair was a great design in order to keep the power density down, and still give the space a good feel. I feel that more flexibility could be introduced into this space by providing wall sconces or indirect sources of some kind on the ceiling. Adding coves might also make for a more appealing visual affect instead of seeing plain old 2x2 troffers.

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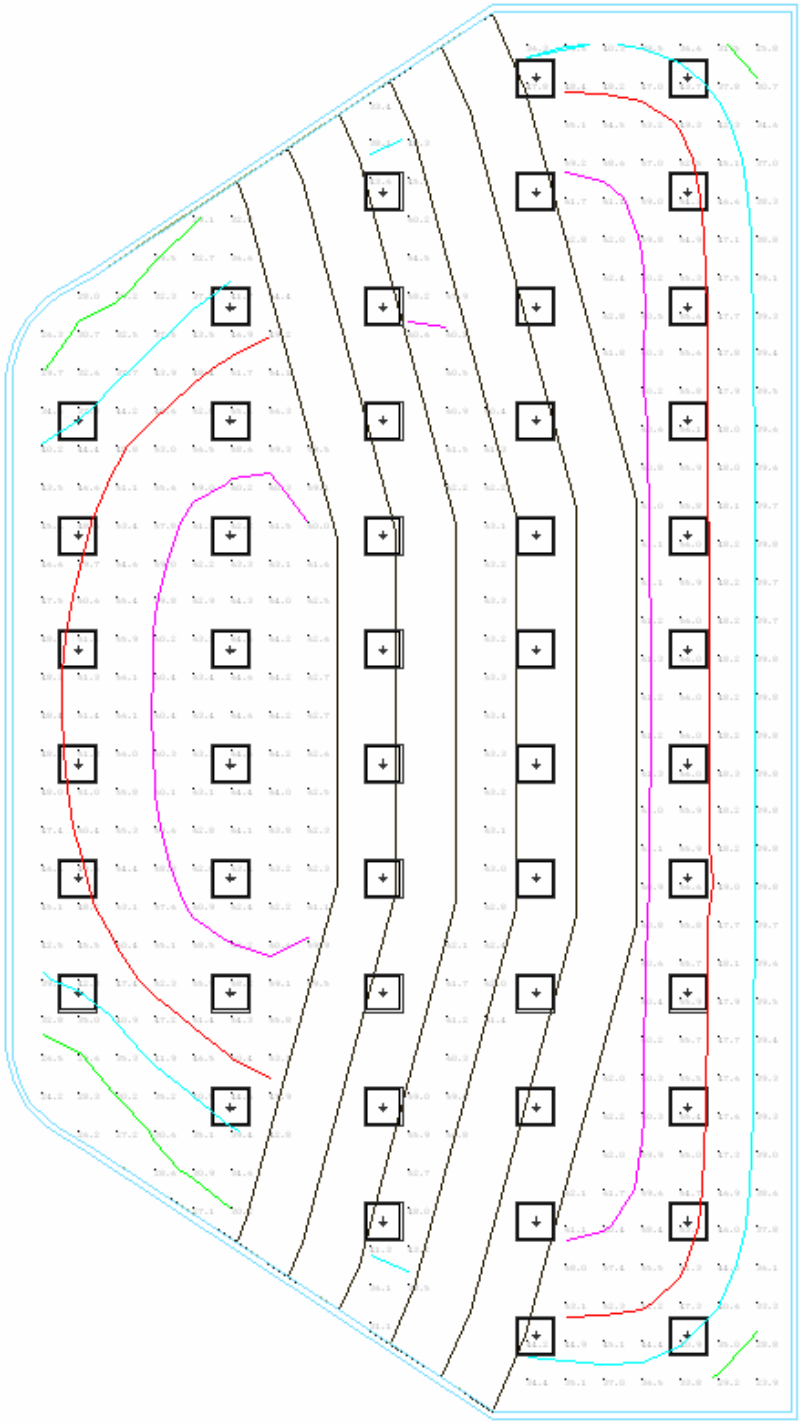
Project_1
Calc Pts

floor_7
_presentation floor
Illuminance Values
(Fc)
Average=50.43
Maximum=64.6
Minimum=24.2
Avg/Min=2.08
Max/Min=2.67

floor_1_top floor
Illuminance Values
(Fc)
Average=49.46
Maximum=62.8
Minimum=23.9
Avg/Min=2.07
Max/Min=2.63

floor_4_mid floor
Illuminance Values
(Fc)
Average=55.73
Maximum=63.4
Minimum=31.1
Avg/Min=1.79
Max/Min=2.04



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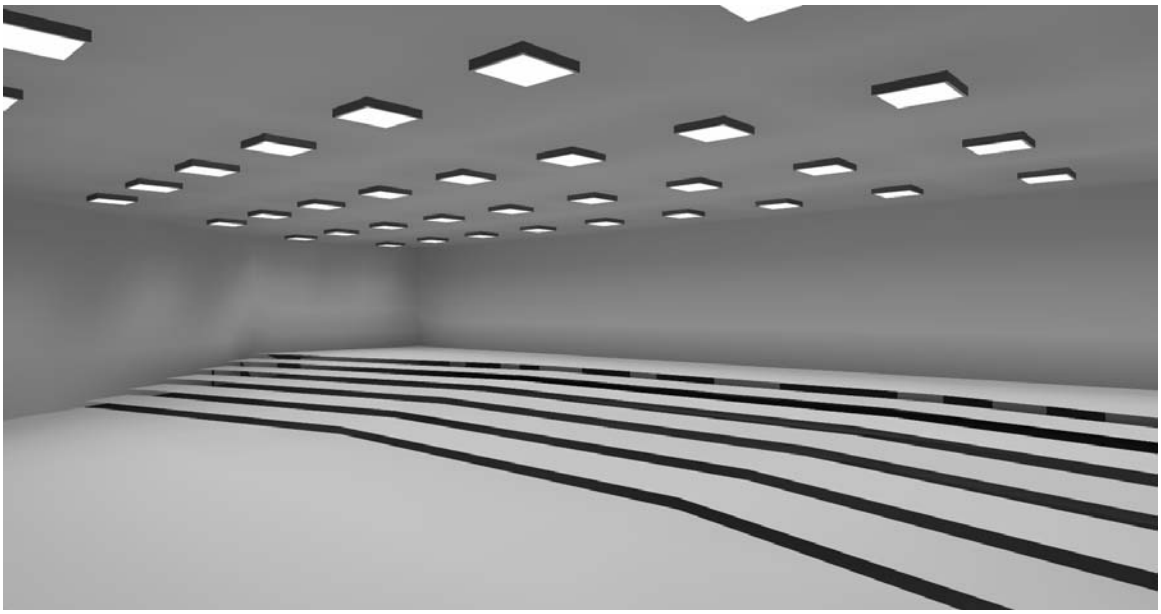


Lobby

Spatial Overview

The lobby area is the main feature of the building. It connects the existing building with the new building (NNSOC) and acts as a bridge between the two. This two story space is mostly a glass curtain wall and serves as a welcome area to the occupants. The space is 35' floor to ceiling and is the only public entrance to these facilities. There are two entrances into the lobby, one from the back parking lot and another from the front lot. The lobby has a bridge on the 2nd floor, 17'4" from the ground that extends about 6' from the NNSOC wall and connects to the existing building on the 2nd floor. There are no pictures or artwork hanging on the walls as of now and the only furniture in the space is a security desk and an X-RAY machine.

Finishes

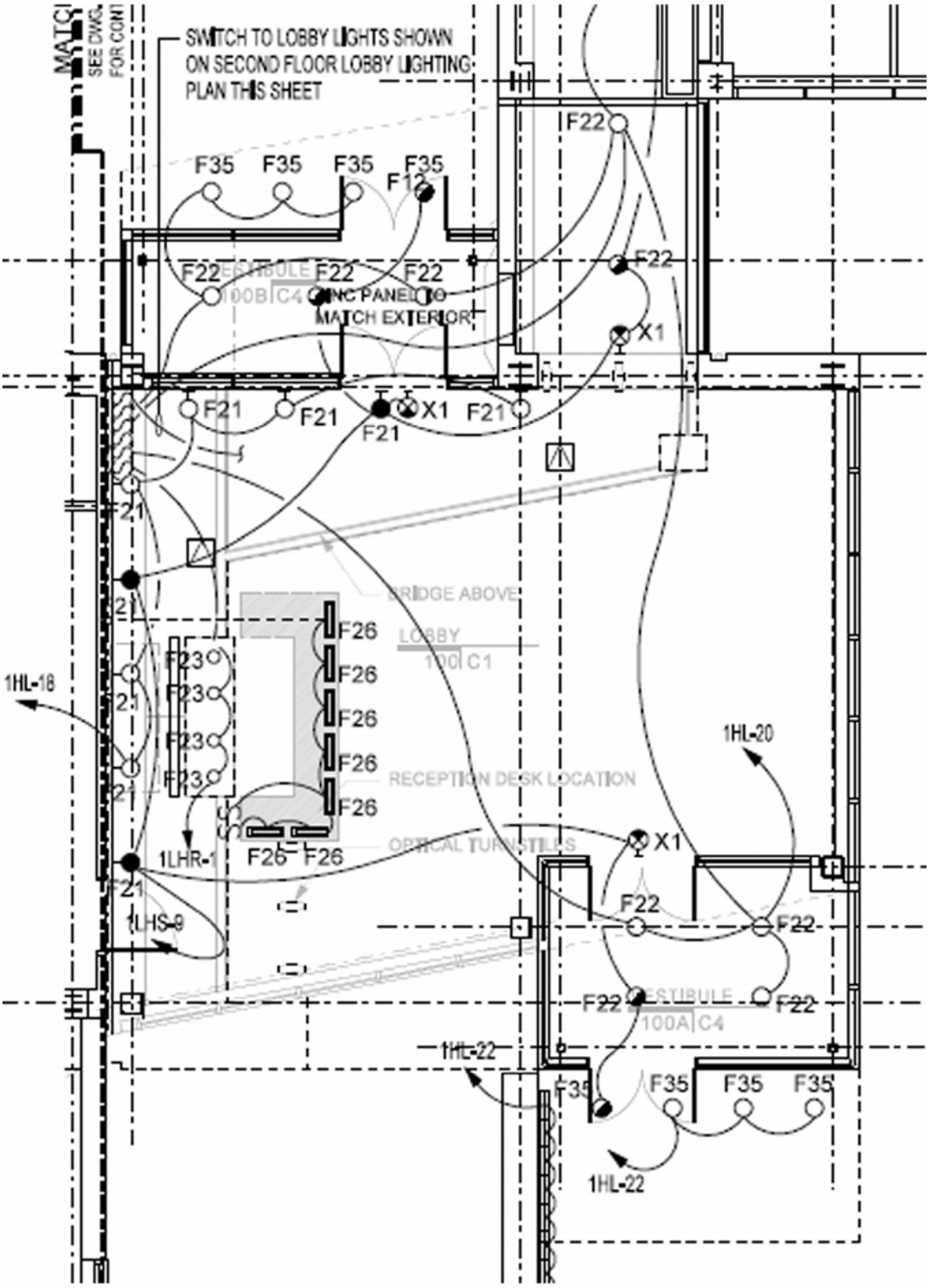
Materials:

Floor – Broadloom Carpet – Reflectance 20% (Assumed)

Walls – Painted – Reflectance 50% (Assumed)

Ceiling – Gypsum Wall Board/Painted – Reflectance 70% (Assumed)

Plan and Section Drawings



1st floor lobby

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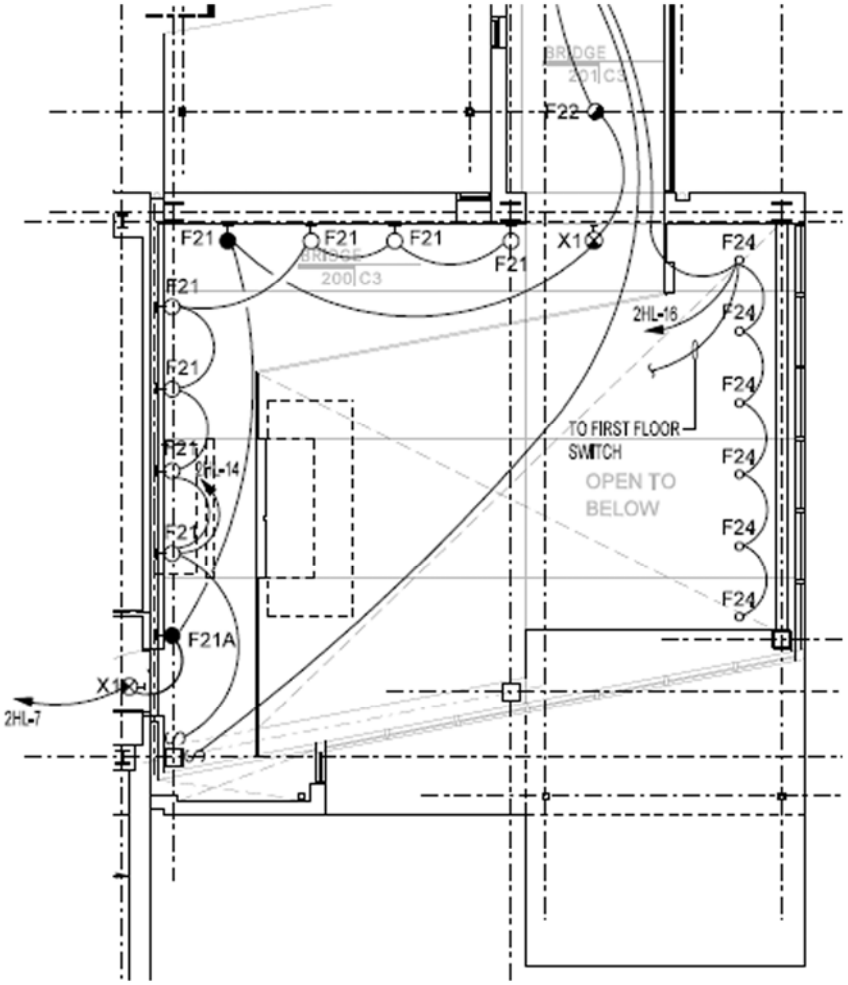
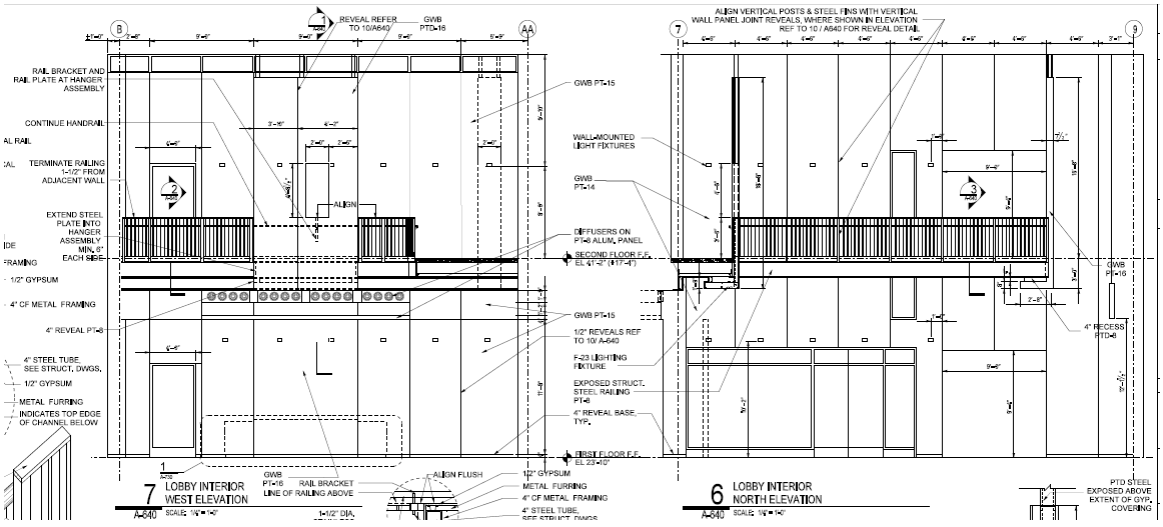
2nd floor lobby





Lobby Interior Elevations

Luminaires

Type	Mtg	Lamping	Volts	Total Watts
F21	S,W	(1) Q300T3 (1) Q50GU10/FL/CD	120	350
F22	R,C	(1) F32TBX/SPX35/A/4P	277	34
F23	R,C	(1) Q50MR16/C/FL40	12/277	75
F24	P	(2) FLE28QBX/A/827	120	56
F26	AI	(1) F24T5/HO/835 [1 LAMP IN SECTION]	277	27

* Full Luminaire Schedule attached at the end of the report.

LLF's

TYPE	BF	CLEANING	MAINTENANCE	LLD	LDD	RSDD	LLF
F21	1	12 Month	I	0.98	0.93	0.86	0.783804
F22	1	12 Month	III	0.85	0.9	0.93	0.71145
F23	1	12 Month	III	0.94	0.9	0.93	0.78678
F24	1	12 Month	VI	0.85	0.86	0.86	0.62866
F26	0.95	12 Month	III	0.92	0.9	0.9	0.70794

Power Density and Illuminance Levels

F21: 18 luminaires x 350W =6300W
F22: 7 luminaires x 34W = 238W
F23: 4 luminaires x 75W = 300W
F24: 6 luminaires x 56W = 336W
F26: 7 luminaires x 27W = 189W

Total Wattage = 7363W
Total Square Ft. = 2150s.f.
Power Density = 3.42 W/sq ft.

Using the Space-by-Space Method in ASHRAE 90.1
Lobby: 1.3 W/sq ft.

This space is 2.63 times larger than the allowable value for power density in a lobby space. There are separate controls for some of the lighting in this space, so the additional 1.0 W/s.f. allowance may be permitted here if these fixtures serve the space as an added decorative appearance. Overall power density of the building would have to be calculated to see if the lobby space could "borrow" from lower power density areas to meet the ASHRAE 90.1 standards for the entire building.

Illuminance Levels:

According to the Final RFP

Building Entry & Reception: 30fc on the work plane

According to the IES Handbook

Horizontal: Desk 30-50fc
Walking 10fc

Vertical: 5fc

Controls

The light fixture control in this space is an Automatic programmable remote control with time clock interface. Switches are located on the back wall beside the northern entrance door. There are 6 switches to control the first floor lobby, and two more to control the task lighting at the security desk. On the 2nd floor there are two switches which control the fixtures on the bridgeway and the pendants hanging by the glass curtain wall on the east facade. By having multiple switches, this space meets the ASHRAE 90.1 design code for controllability.

Performance Considerations

The lobby is generally a circulation area with many people going through it all day. Tasks such as reading and writing do not apply in here, except possibly for an information directory or directional sign. The security desk will need extra vertical and horizontal illuminance for facial appearance and writing tasks. The best way to achieve this is most likely using task lighting on the desk surface. This will keep the direct glare out of the secretary's eyes while providing the needed levels to prevent fatigue by straining the eyes.

Another important issue in a lobby design is the transition from outside to inside and vise-versa. The light levels need to help adjust the eyes to the upcoming environment so people do not have to pause or squint when entering. This will be hard to do, but implementing daylight photosensors can be a good method to keep a constant ratio between outside and inside the lobby space.

Lobby spaces are generally a good place to display artwork and other visual enhancements to make the space more interesting. Illuminating these can sometime be tricky due to reflections and glare, but with careful placement can really accent the lobby well.

Analysis

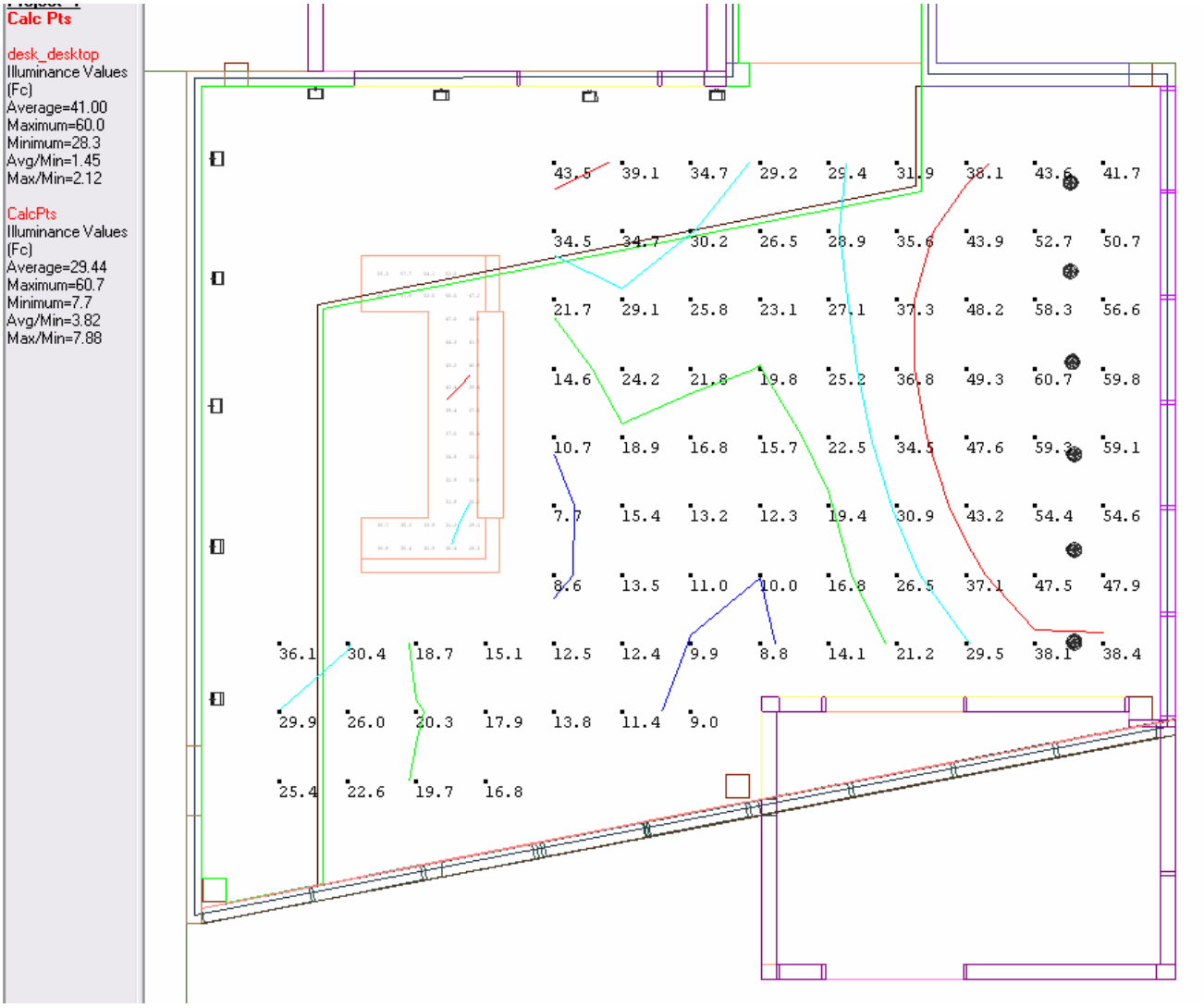
Lighting

For analyzing this space I had a lot of trouble getting the model right. I had trouble finding any of the fixtures and their respective .ies files, along with getting the right reflectances on the surfaces and the types of glass and glazing in the space. I finally picked some fixtures that I thought would have a similar distribution and intensity and placed them in the model. I do not feel confident at all that this space resembles what the true space looks like under lighting conditions. All interpretations and suggestions for this space come from my own opinions on what I have available to study. Another issue

is the time of day that occupants are using the lobby; if this is just a daytime facility then a whole different design approach needs to be taken due to the abundant daylight.

Wall sconces in this space I feel work really well and have a nice effect, but selecting a more efficient fixture or lamp would help the high power density that has accumulated in this space. The pendant fixtures along the east wall are a great idea for displaying the lobby at night to the public passing by outside. Adding in task lighting on the security desk is also good choice for this space, and the use of T5 lamps is great for efficiency and intensity.

Lobbies generally do not need to have such high levels of illumination on the floor because no intensive tasks such as reading and writing are done in this space. I would look to select fixtures that do not provide as much light, but still allow for transportation through the space. This will cut down on the power density and get it back under the requirements of ASHRAE 90.1.



Lighting Levels on first floor

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Rendered Views

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Daylight

Daylight analysis of this space is very important due to the lobby's orientation and massive glass surfaces. The glass curtain wall is just slightly off from being directly east facing, and the main entrance doors are facing south. Due to not being able to find the window glazing and transmittance values for this space, I used the Double Pane Low E Tint Gray Glass surface from AGI with a transmittance value of 37% for all glass surfaces in this space. Running daylight studyings without the lights on in the space, for clear days on June 21, Sept. 21, and Dec. 21, at 9am and 1pm, my results suggest there needs to be daylight integration incorporated into the lighting design of the lobby.

The lobby sees some direct sun until well after 1pm on every day of the year, providing it's sunny outside. Adding photosensors to the lobby can help regulate the amount of time that the luminaires need to be on any given day. This can cut down on electricity by a fair amount. Another issue direct sunlight causes is radiation, or heating of the space. To prevent the direct sunlight from penetrating the lobby, shading devices such as blinds or shades could be implemented, especially in the summer, to help keep some of that radiation out. Another option could be to have diffuse glass or alternate glazings in the windows, which could also create interesting patterns on the floor, while keeping out the sunlight. The results of my study are below, each shows the illuminance values on the floor for that day and time, and a rendered image of the lobby.

Dahlgren, VA Coordinates: 38 North, 77 West window reflectance 37% for lobby

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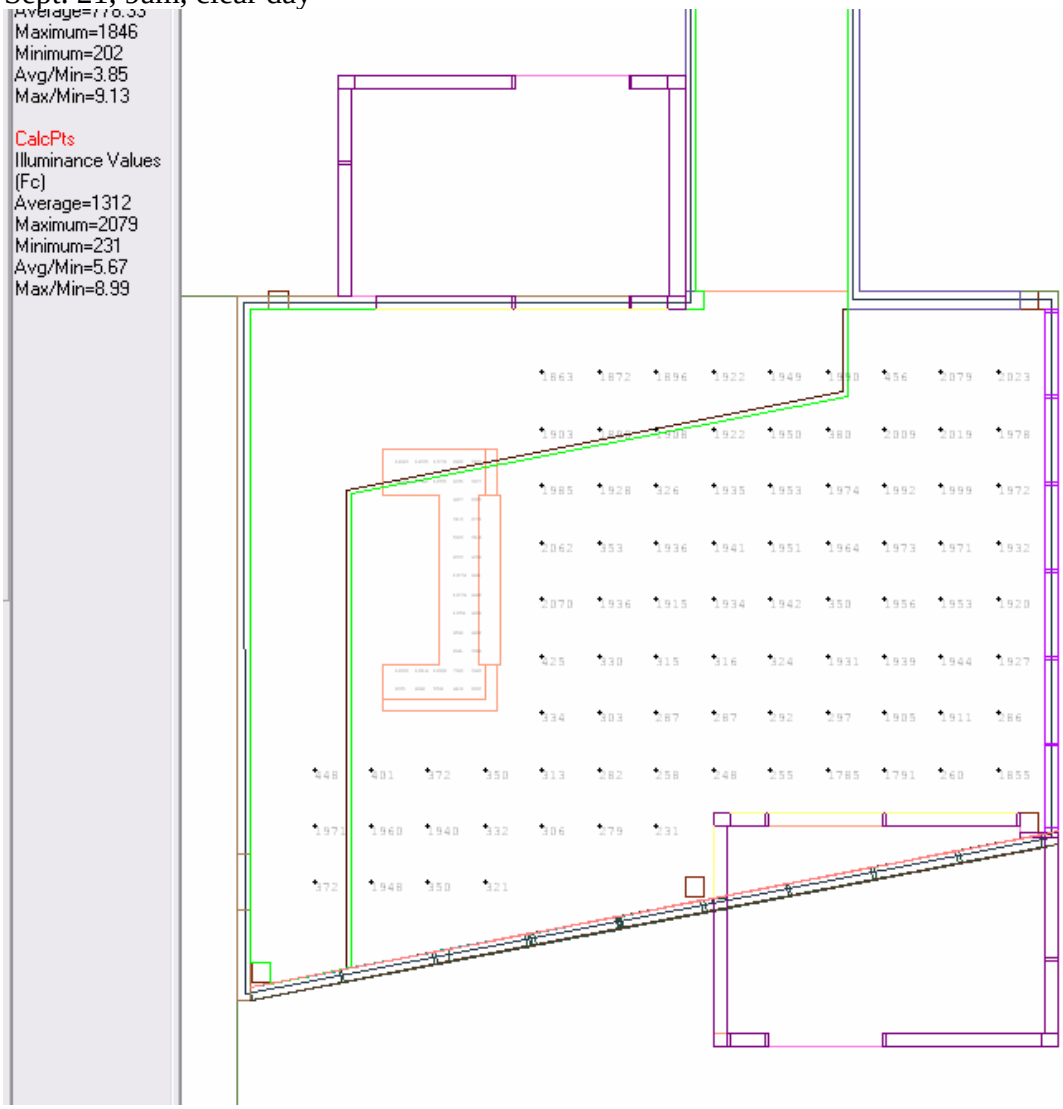
Sept. 21, 9am, clear day



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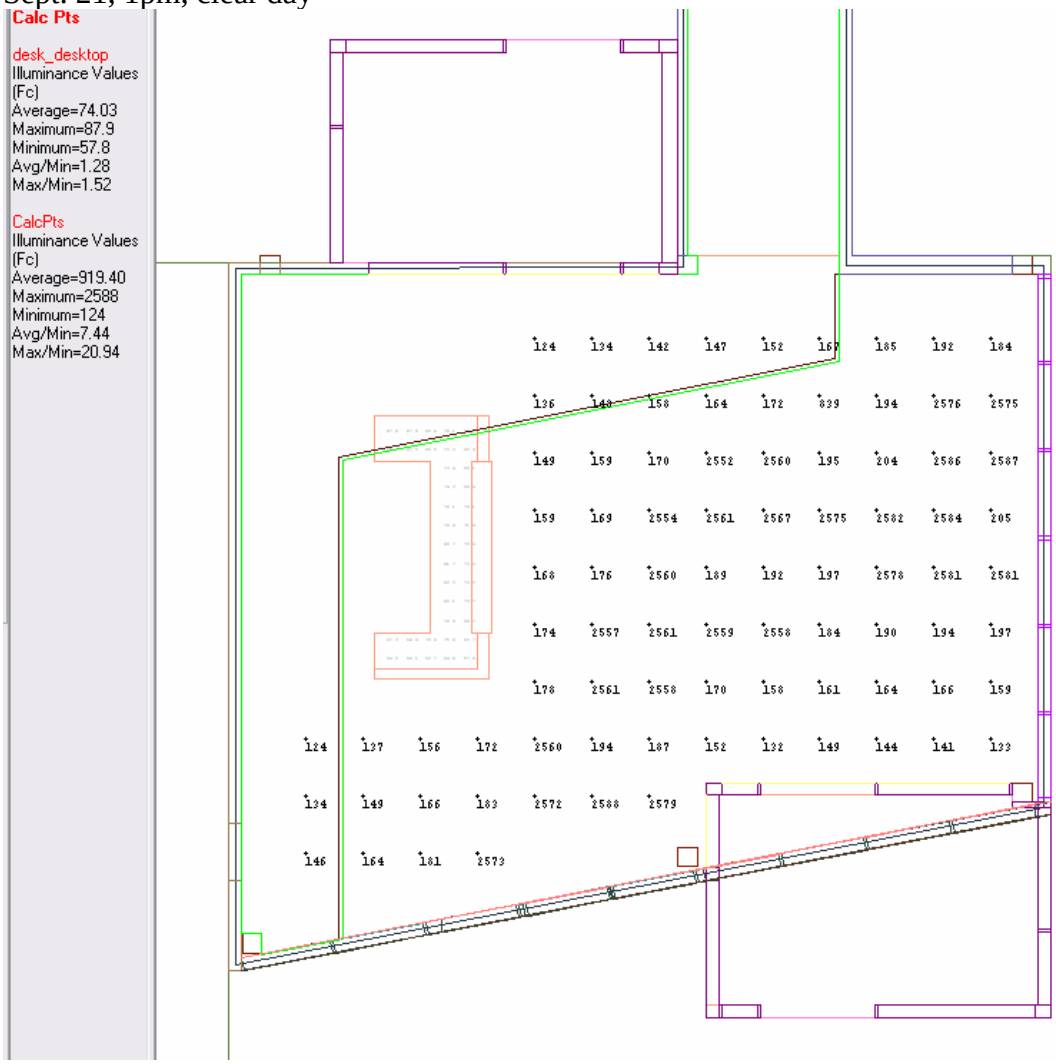
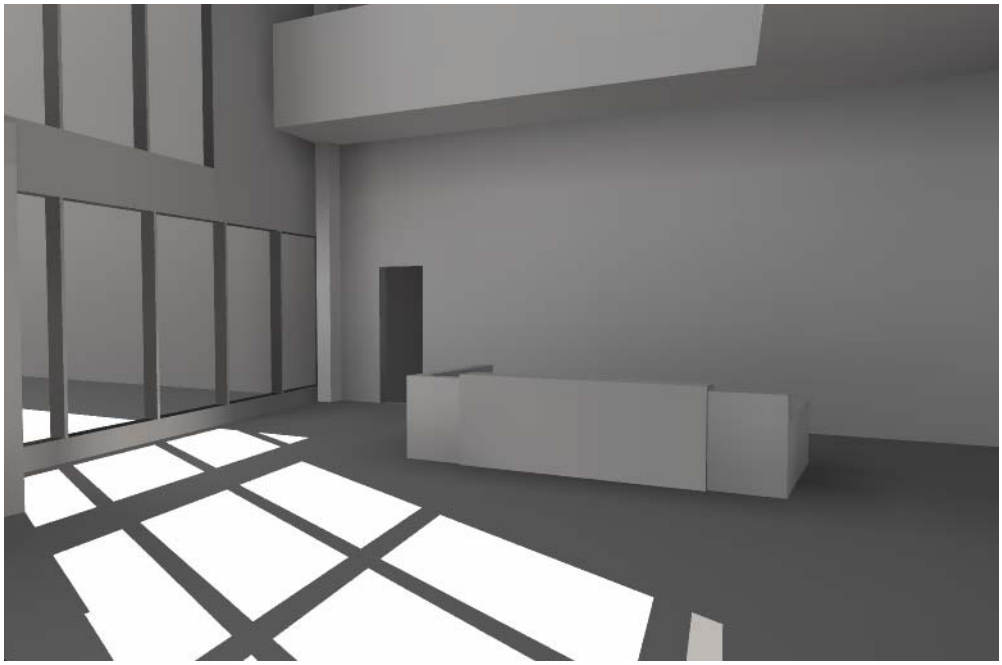
Sept. 21, 1pm, clear day





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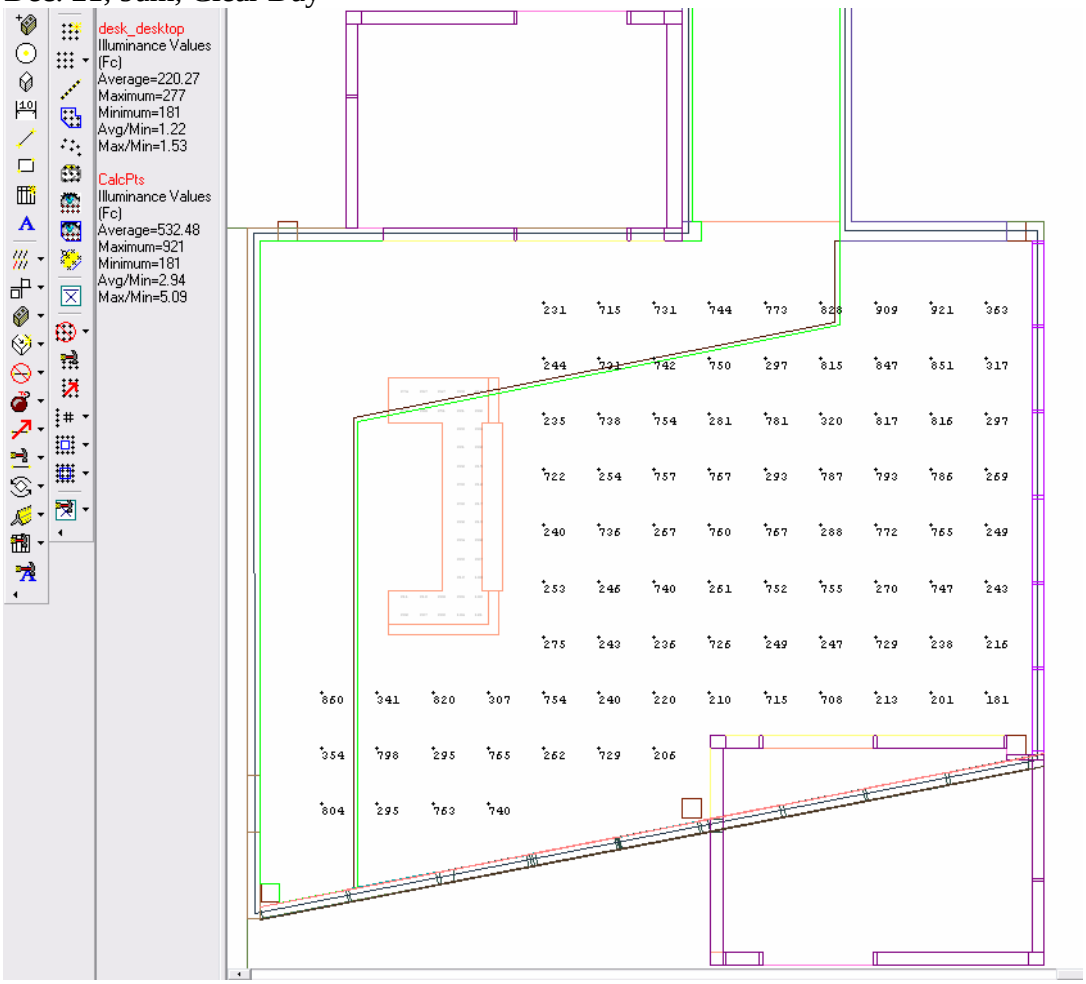
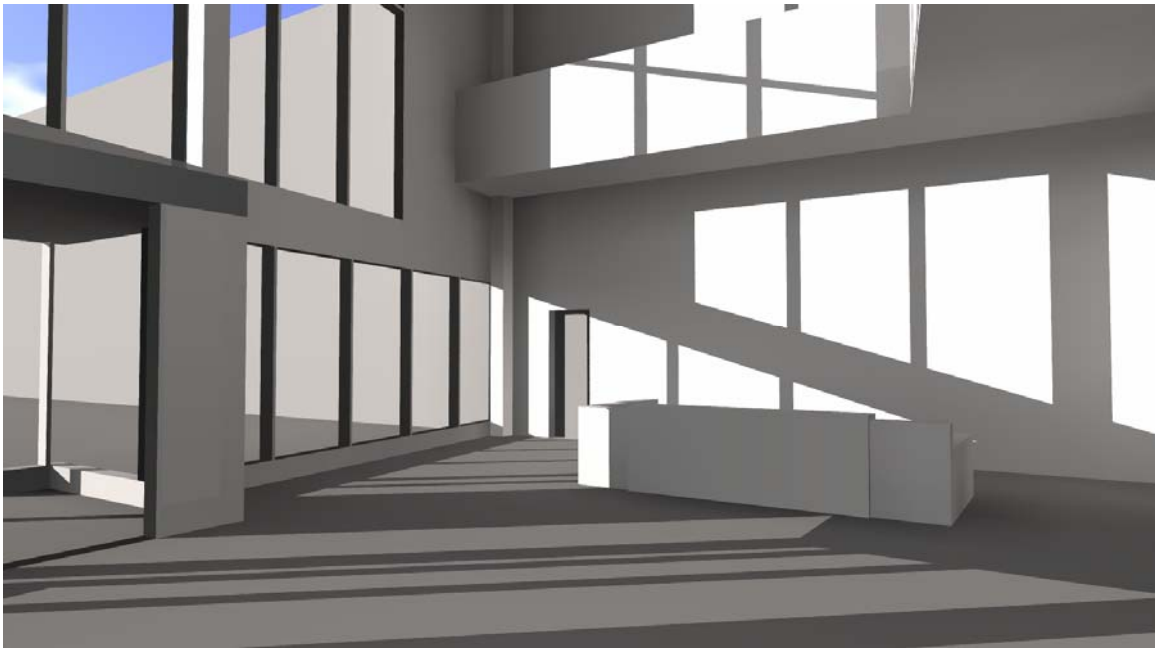
Dec. 21, 9am, Clear Day





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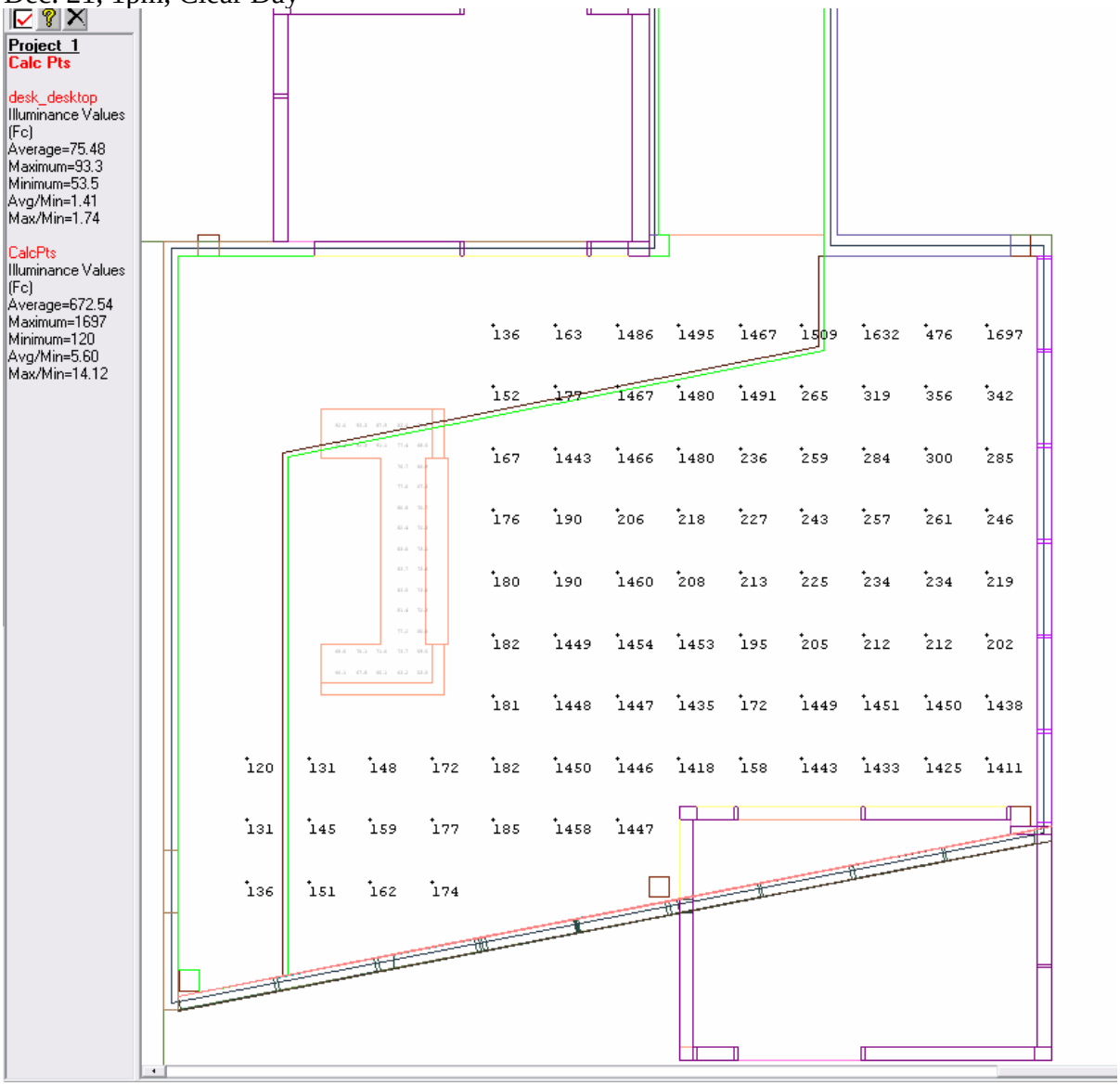
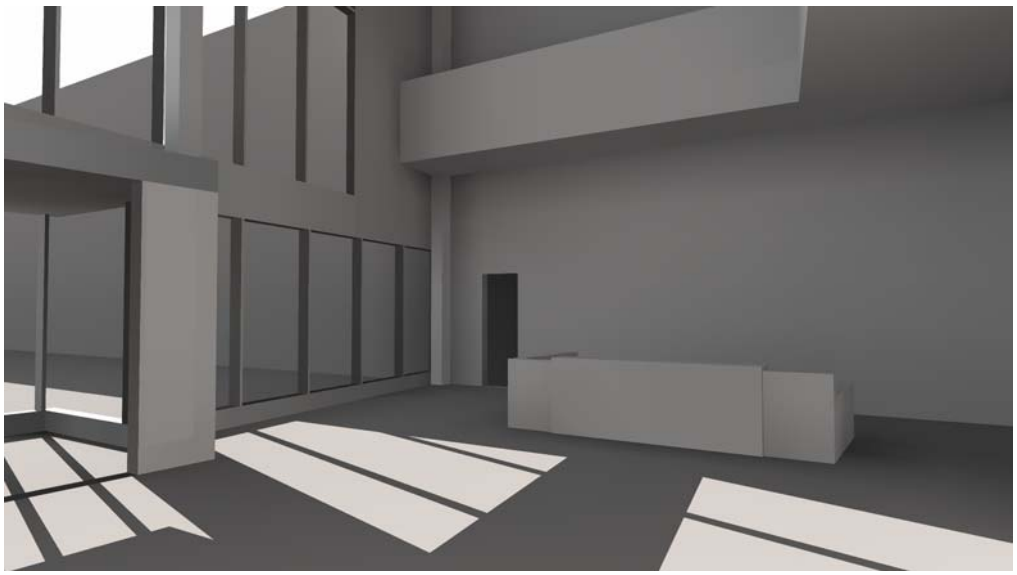
Dec. 21, 1pm, Clear Day





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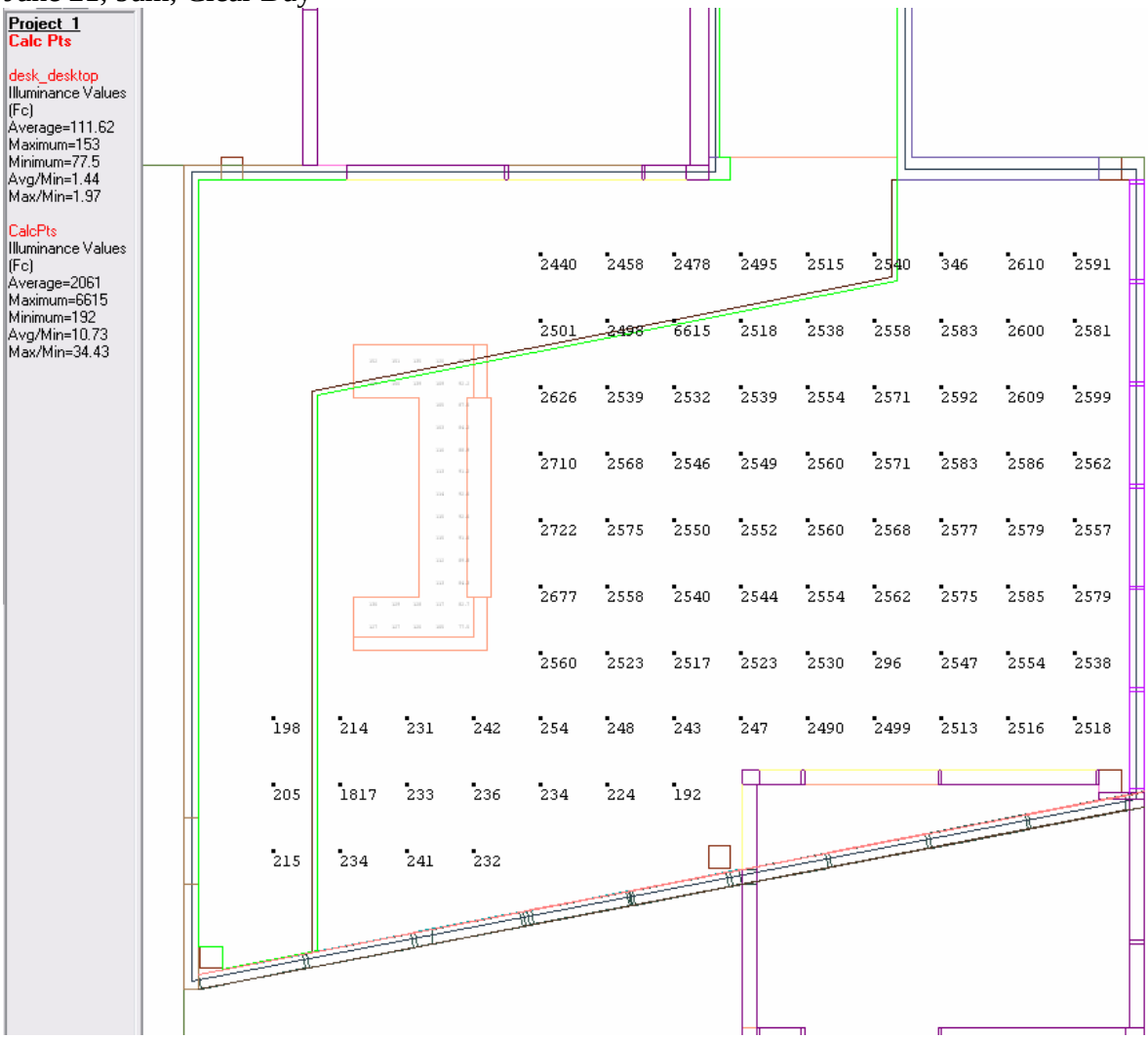
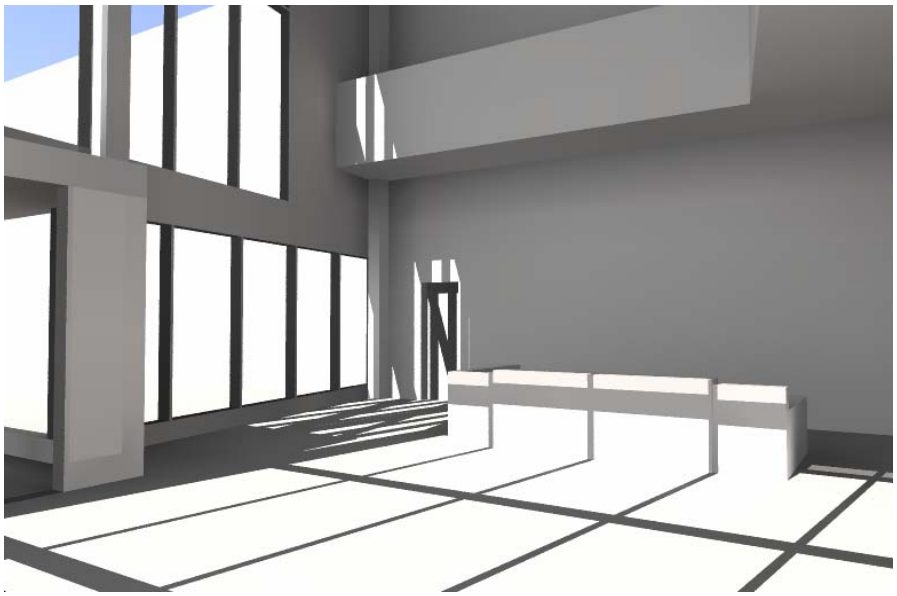
June 21, 9am, Clear Day





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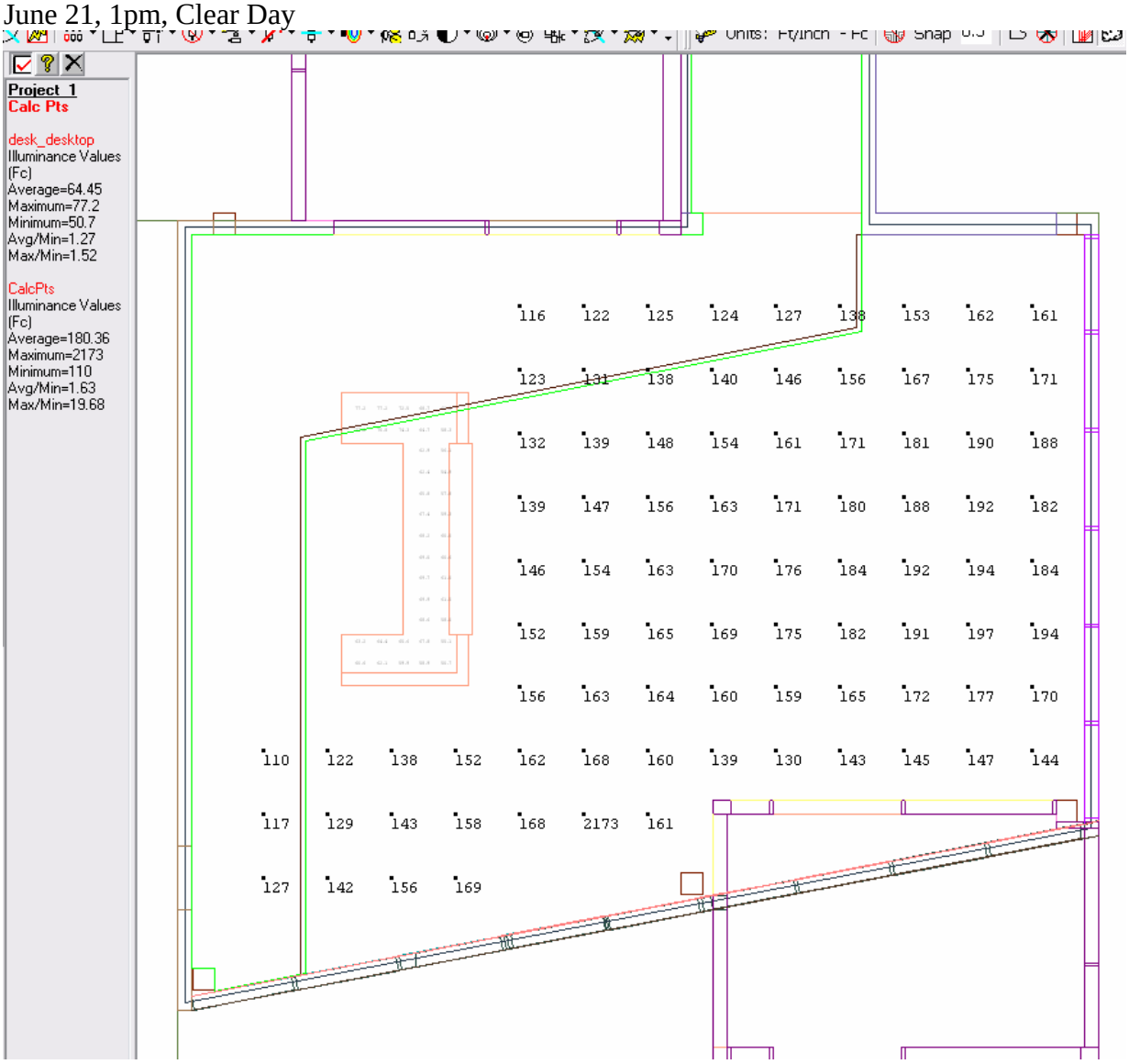
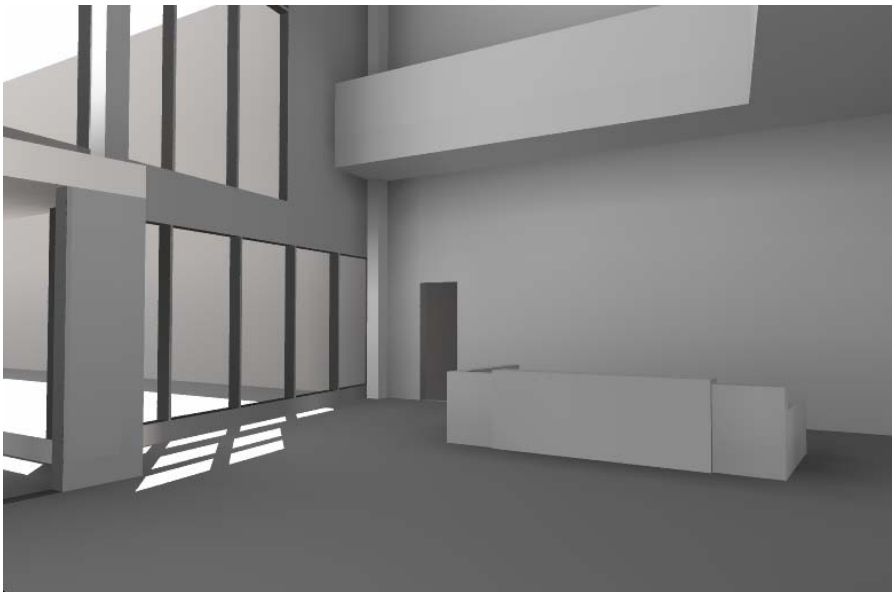
June 21, 1pm, Clear Day





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Open Office

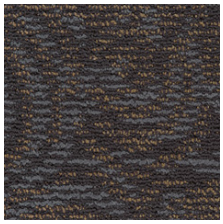
Spatial Overview

The office space I am studying is oriented along the west façade of the building. The desk layout is set up in four cubicle groups, placed along the walls of the office. The cubicle heights are not given so I will be assuming 4' for my analysis. Windows that are evenly spaced line the south, west, and north walls, which indicate there will be a good bit of daylight in the space for at least half of the day. Each cubicle has a computer station so issues that involve computer viewing will also need to be discussed. The lighting system uses indirect fixtures, which will be discussed in detail later.

Finishes

Materials:

Floor – Broadloom Carpet – Reflectance 15% (Assumed)



Walls – Painted – Reflectance 60% (Assumed)

Ceiling – Acoustical Ceiling Tile – Reflectance 85%

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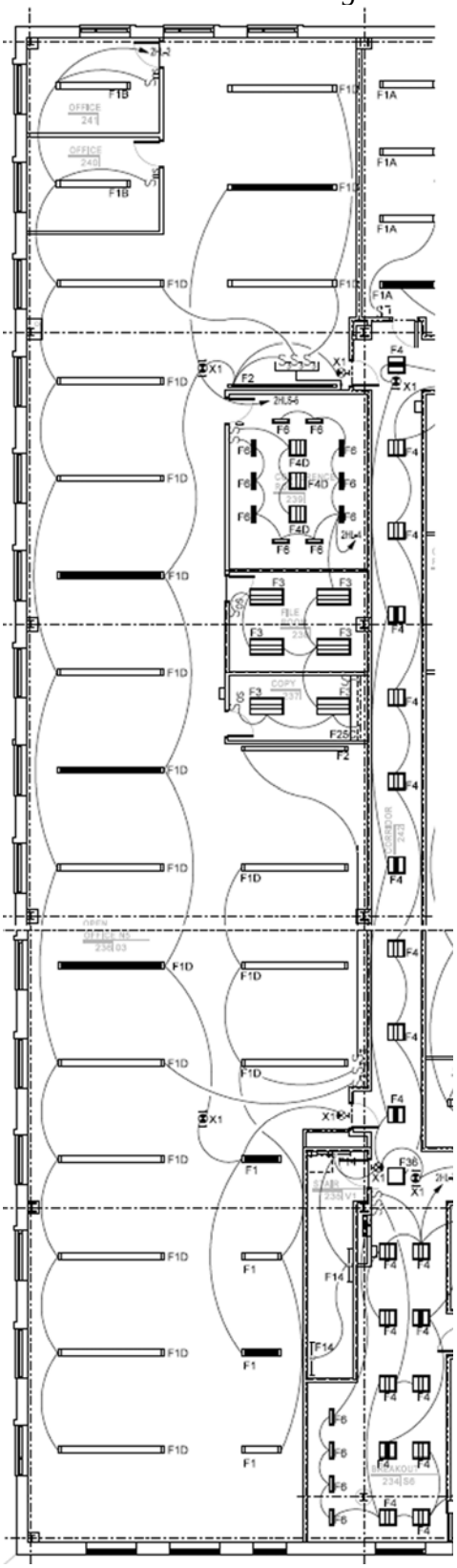
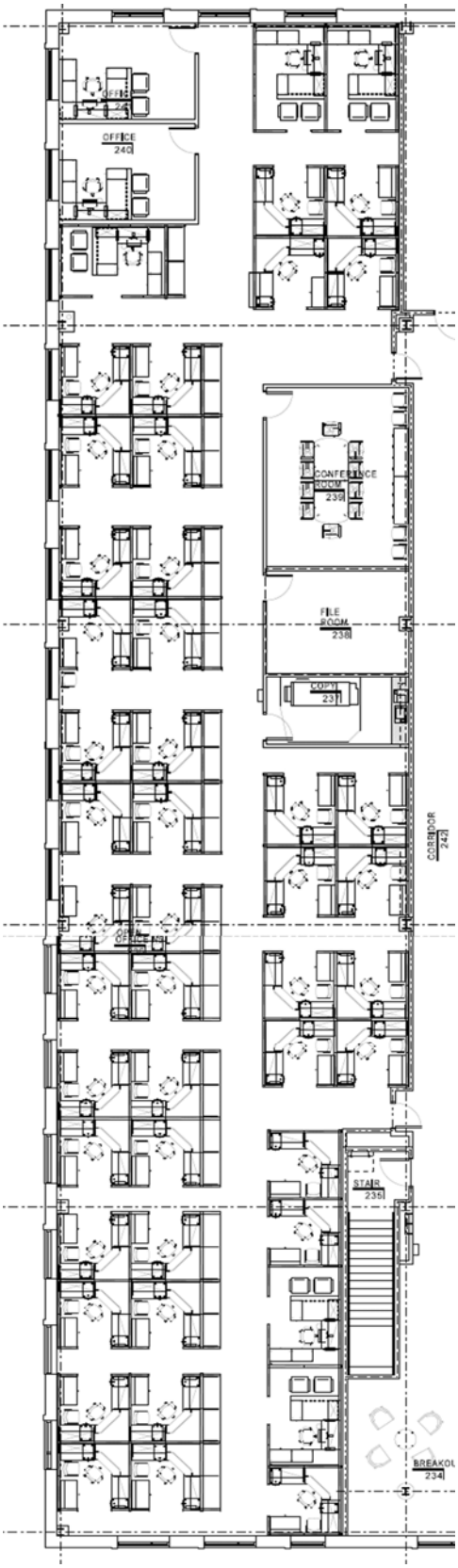
Plan and Furniture Drawings





Luminaires

Type	Mtg	Lamping	Volts	Total Watts
F1	P	(1) F54T5/HO/835 [1 LAMP IN SECTION]	277	62
F1D	P	(3) F54T5/HO/835 [1 LAMP IN SECTION]	277	179
F2	W	(3) F54T5/HO/835 [1 LAMP IN SECTION]	277	179

* Full Luminaire Schedule attached at the end of the report.

LLF's

TYPE	BF	CLEANING	MAINTENANCE	LLD	LDD	RSDD	LLF
F1	0.95	12 Month	VI	0.94	0.86	0.95	0.729581
F1D	0.95	12 Month	VI	0.94	0.86	0.95	0.729581
F2	0.95	12 Month	VI	0.94	0.86	0.95	0.729581

Power Density and Illuminance Levels

F1: 4 luminaires x 350W = 1400W
F1D: 19 luminaires x 179W= 3401W
F2: 2 luminaires x 179W=358W

Total Wattage = 5159W
Total Square Ft. = 5837 s.f.

Power Density = 0.88 W/sq ft.

Using the Space-by-Space Method in ASHRAE 90.1
Open Office: 1.1 W/sq ft.

This space meets the requirements of ASHRAE 90.1 and is better than it by 20%. This will help lower how much the lobby is over the limit and help to meet the entire building's power density requirements.

Illuminance Levels:
According to the Final RFP
Open Plan Areas: 50fc on the work plane
According to the IES Handbook
Horizontal: Open Office (VDT use) 30-50fc
Vertical: Open Office (VDT use) 5fc

Controls

For the open office occupancy sensors and automatic programmable remote control system was implemented for control of the lighting. Three, three-way switches were added at each entrance to override the control system when needed. One switch controls the left side of the room, while the other two switches control the right side.

Performance Considerations

Performance in an open office space has everything to do with comfort, and how well the surroundings interact with each individual's personal preference. Although it is just about impossible to please everyone in an office, a few basic strategies can help to get the most production out of the staff. Performance criteria in an office include glare, veiling reflections, light distribution and daylight integration.

Glare is a major issue that needs to be dealt with anytime computer work is involved. Glare can come from the ceiling to the computer screen, directly from the luminaires and from windows. Using VDT luminaires works well for reducing glare, but seems to bring a more depressing mood to the office. Adding in wall washers can help make the space more comfortable again. Another issue that VDT luminaires have is that they can create shadows.

Light distribution in an office needs to be fairly uniform if possible. This is so the ratios of tasks to background stay within the 3:1 acceptable levels. Another reason is that open office plans tend to change and move cubicles here and there, and a uniform distribution over the whole space will alleviate any problems with illumination on any workplane.

Analysis

Lighting

This office uses indirect pendant mounted fixtures for the lighting of the open floor plan. This system works great for providing a uniform distribution over the entire workplane. Reflections from the luminaires and the ceiling may cause eye strain, but if the ratios are within the acceptable ranges, then this design should work just fine. One concern I have with the design is the illuminance values on the workplane when no daylight is included. The average value I was getting was around 26fc on the workplane, when the IESNA Handbook says this should be between 30-50fc. After running the calculations with daylight included, the illuminance average was 50fc, but this would only be during the day, and on clear days at that. This problem could be due to not using the same .ies files as the designer or same input values such as reflectances. I'm sure that the true design works just fine and meets all required light levels.

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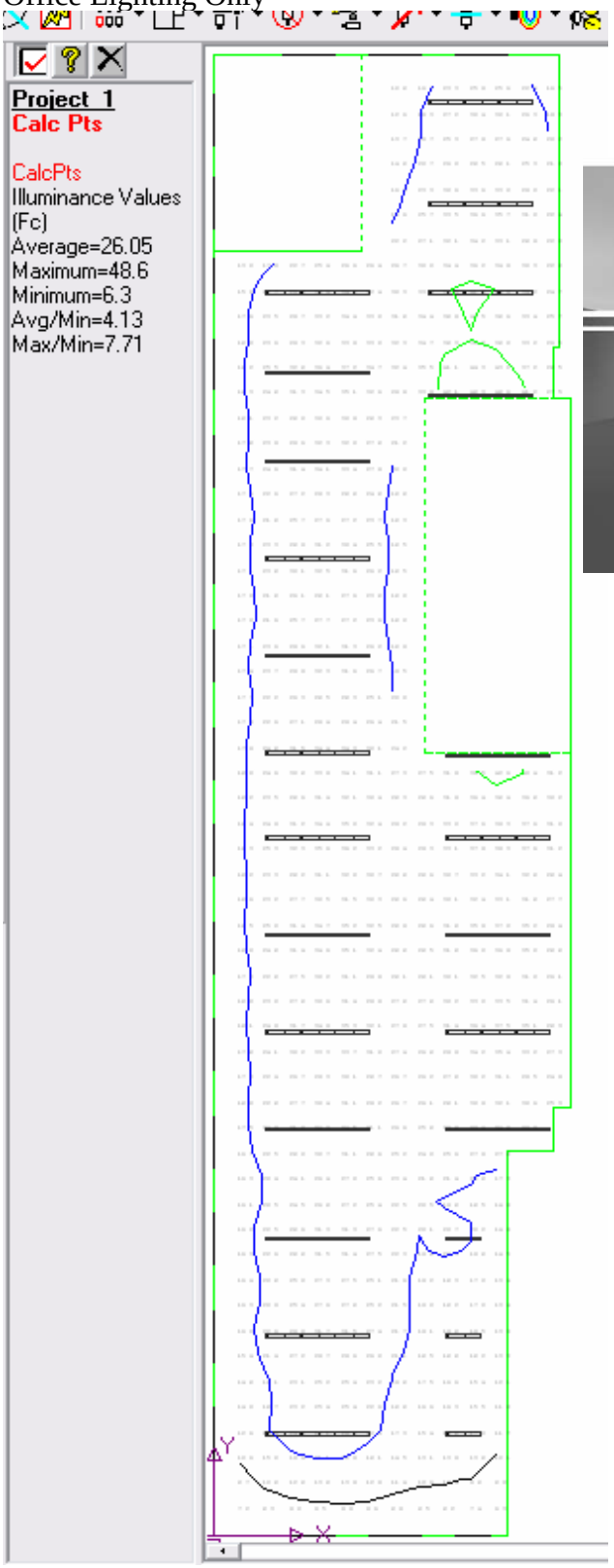
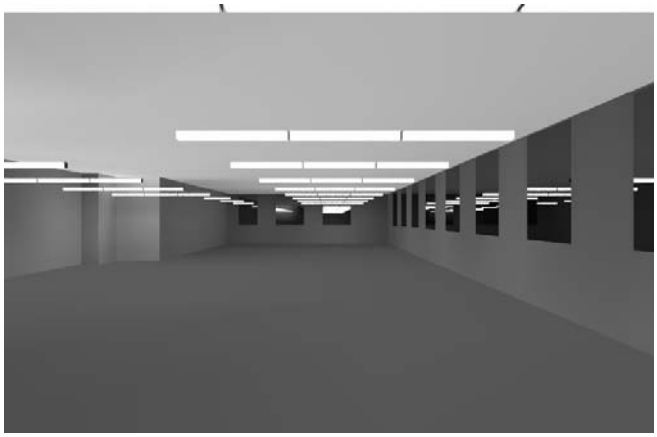
Dahlgren, VA

Office Lighting Only





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Dahlgren, VA

Daylight

For all the windows in this space, there is no daylight integration at all. Saving electricity can be done, especially along the west wall where direct or indirect sunlight come through all day long. Setting up photosensors, and zoning the luminaires can make for a nice design as well as save some money. Along with the daylight integration, blinds or shades should be made available when glare from the windows or direct sunlight is penetrating through the space.

I believe that this space would be great to add some type of overhead skylight system in. It is on the top floor, which has a slightly pitched roof, and the roof system runs trusses parallel to the lighting system. Any type of skylight system should be able to work in this space, but some research needs to be done to see which system would provide the best solution to enhance the office. The following AGI renderings and calculations have been done the same way as the lobby was previously.

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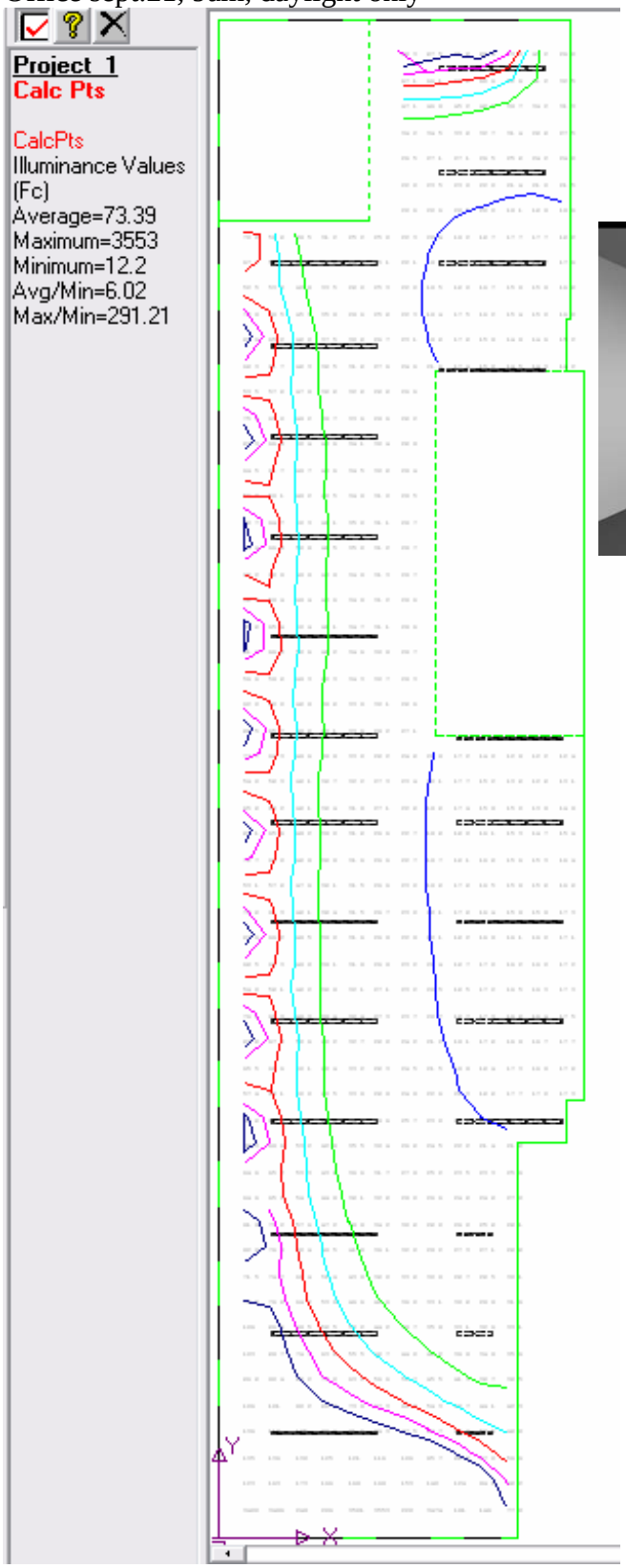
Office sept.21, 9am, daylight only



Chris Ankeny
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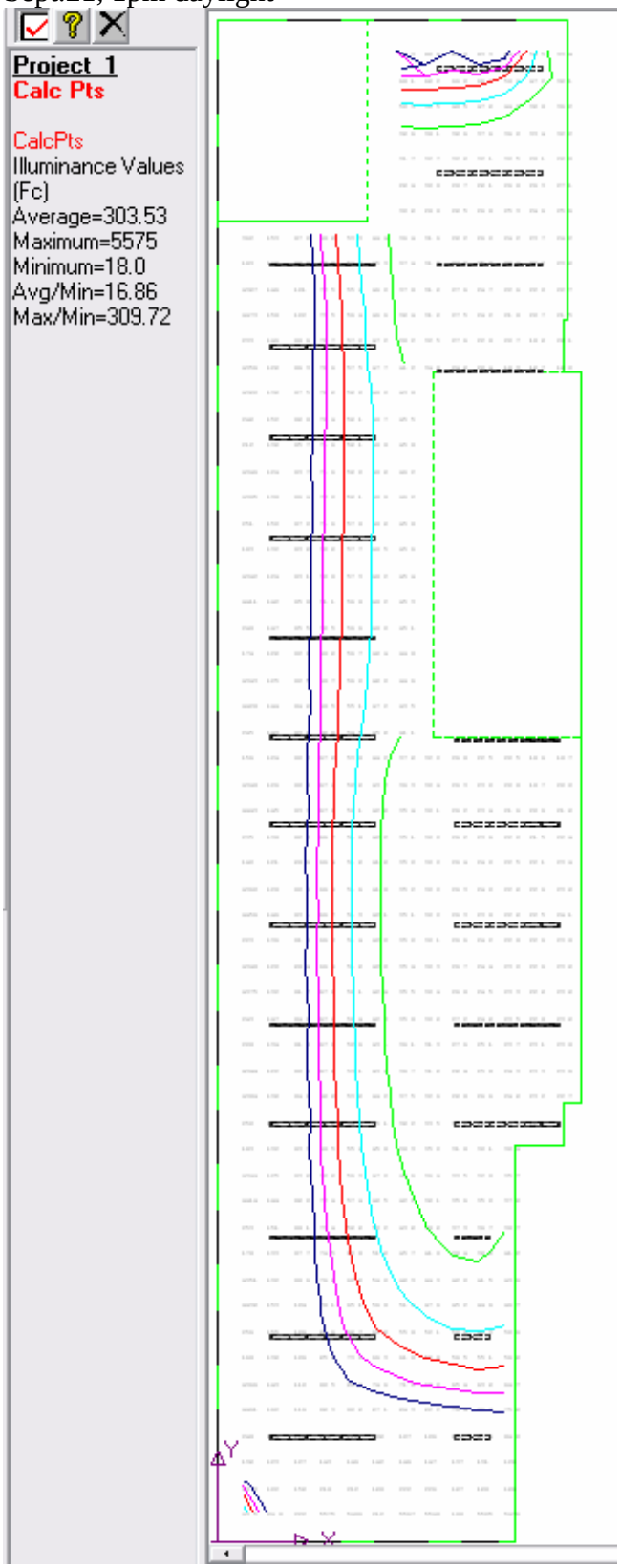
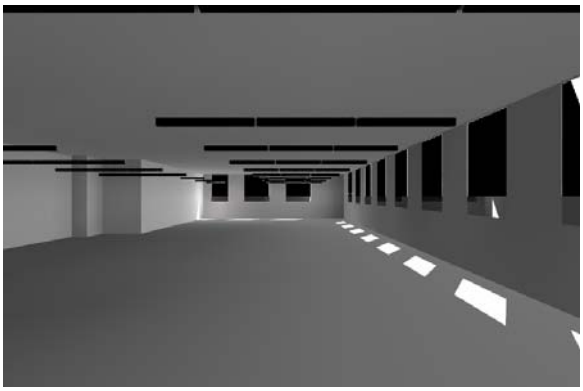
Sept.21, 1pm daylight





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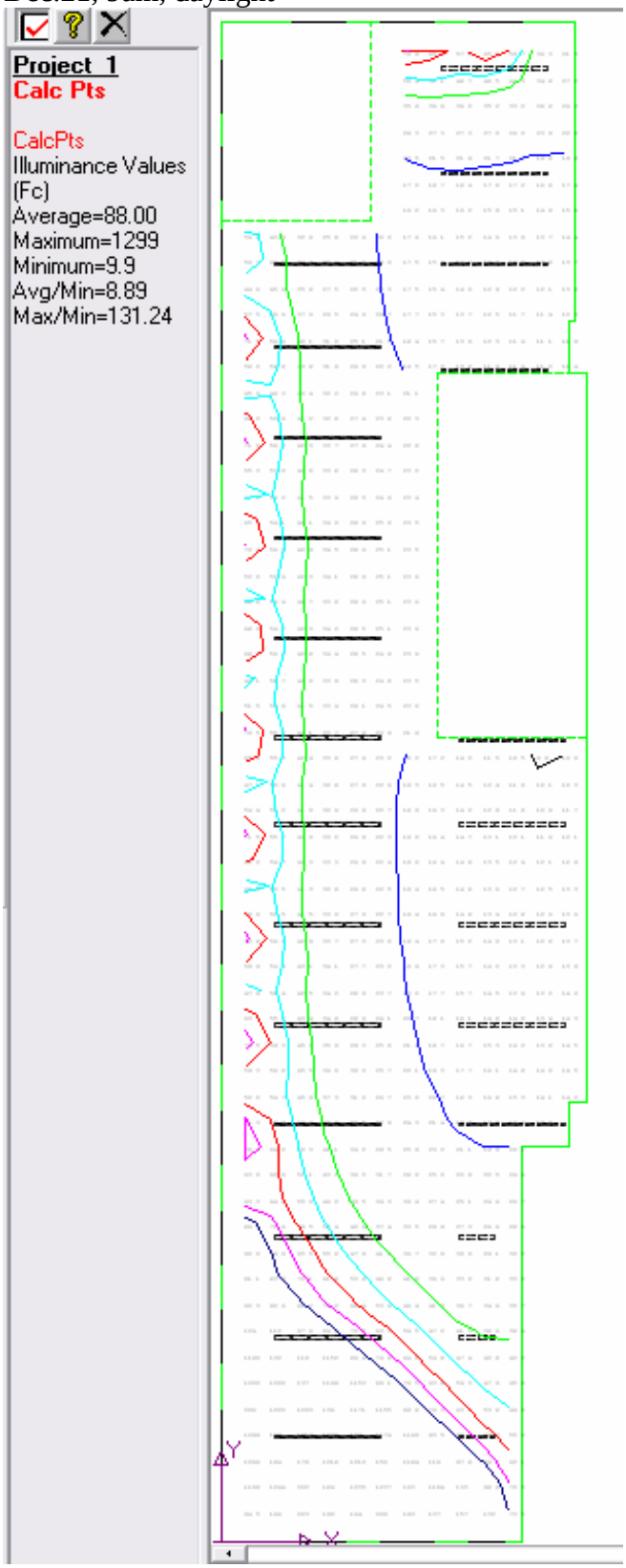
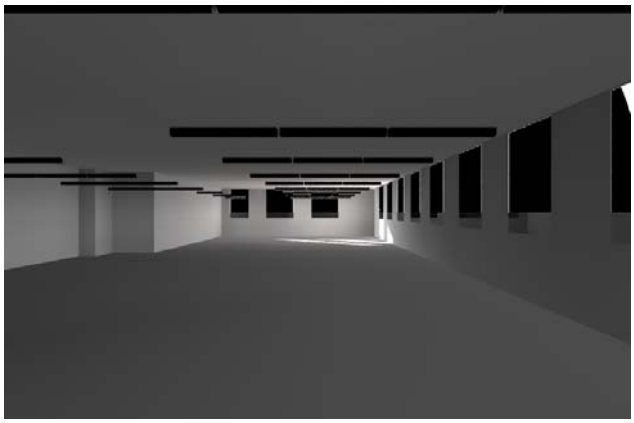
Dec.21, 9am, daylight





Chris Ankeny
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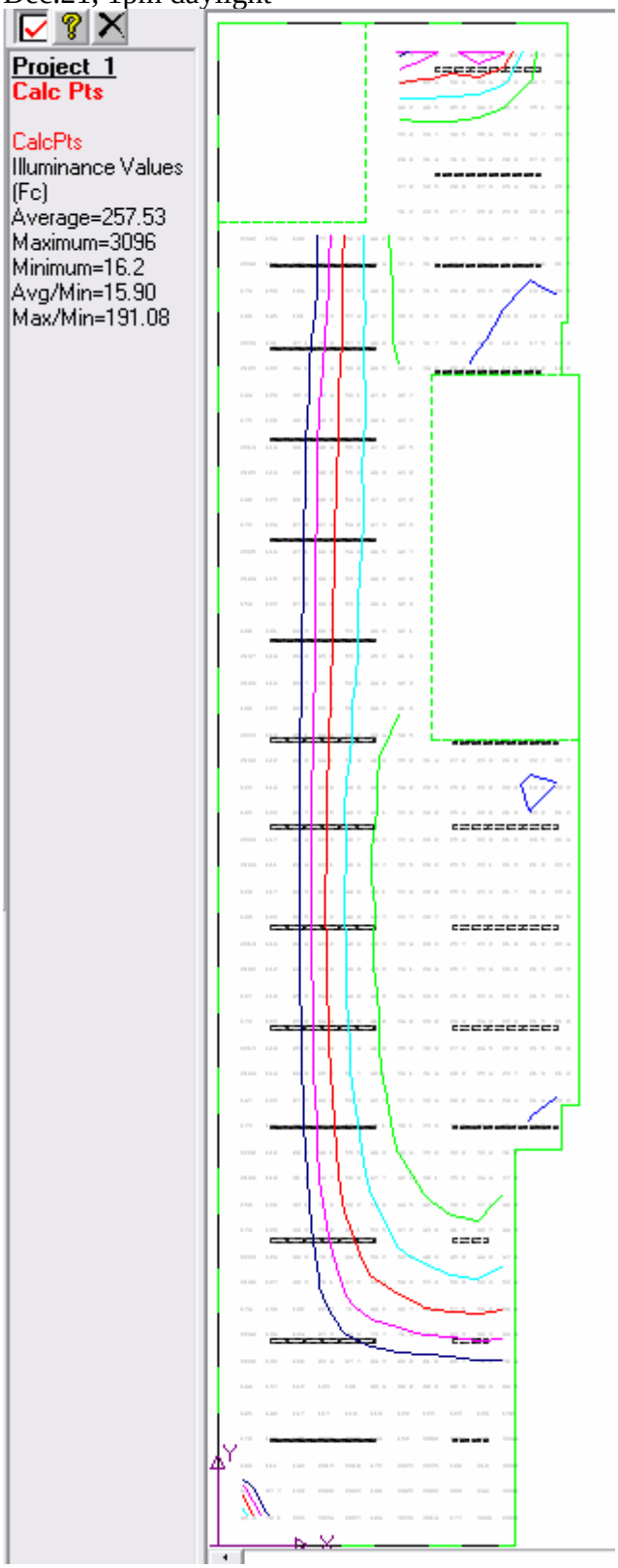
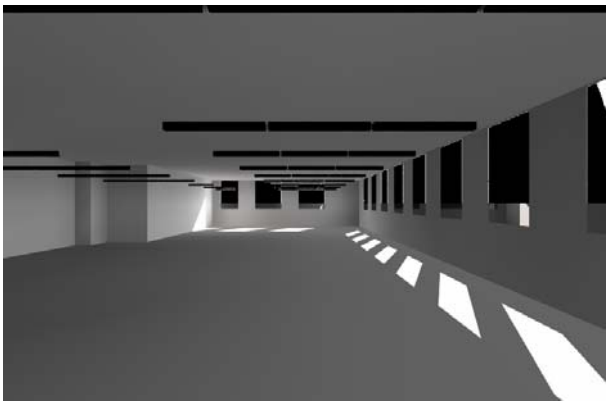
Dec.21, 1pm daylight





Chris Ankeny
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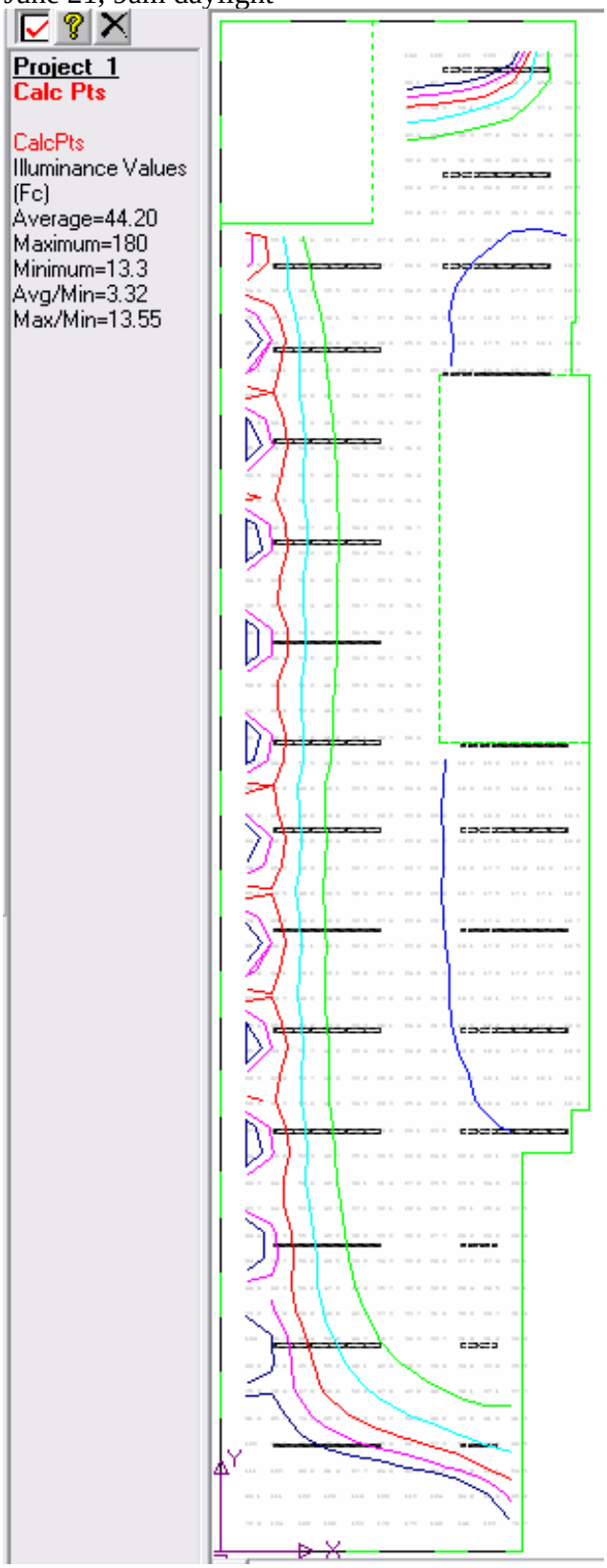
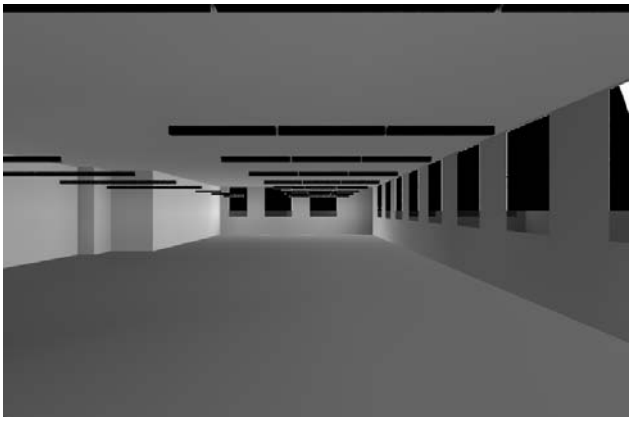
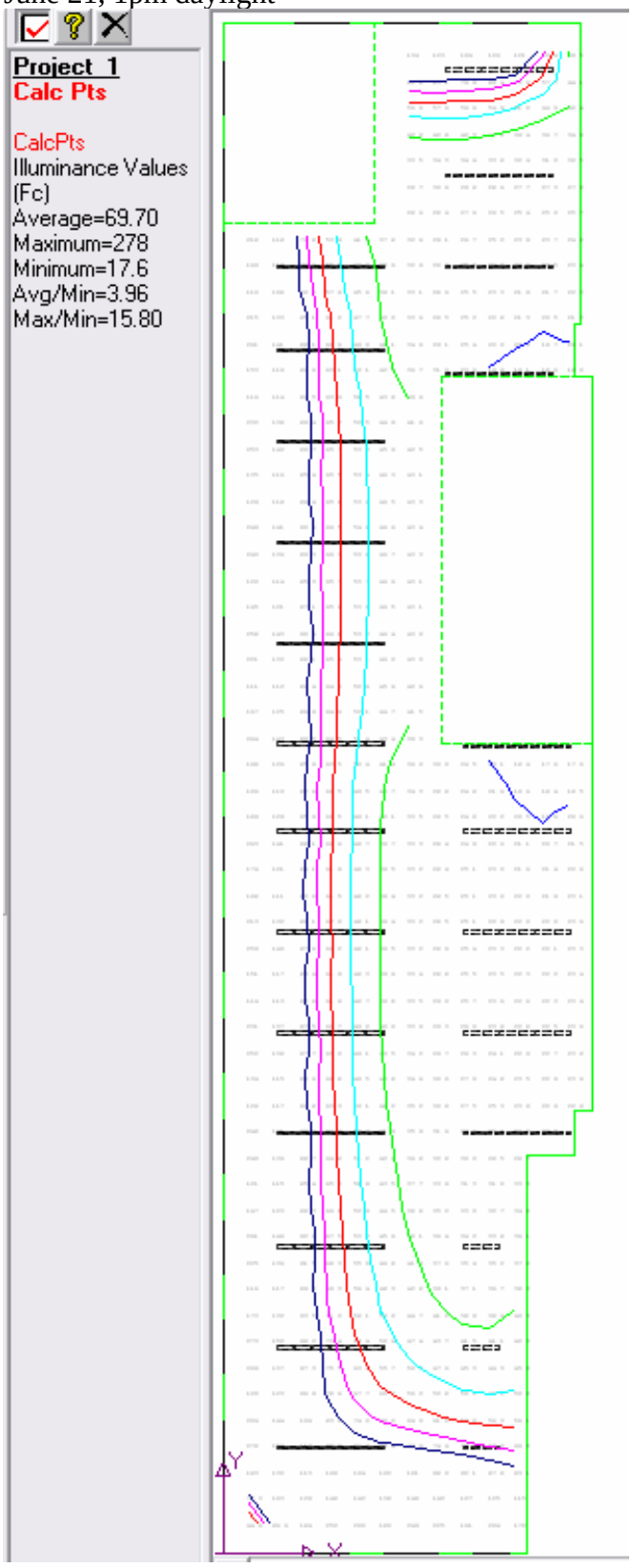
June 21, 9am daylight

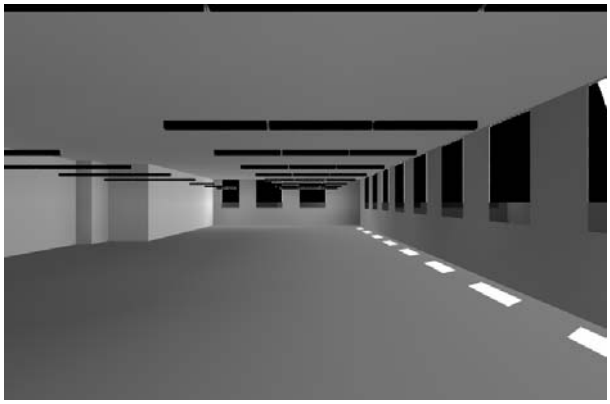




Chris Ankeny
NNSOC
Dahlgren, VA

June 21, 1pm daylight





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Outside Area

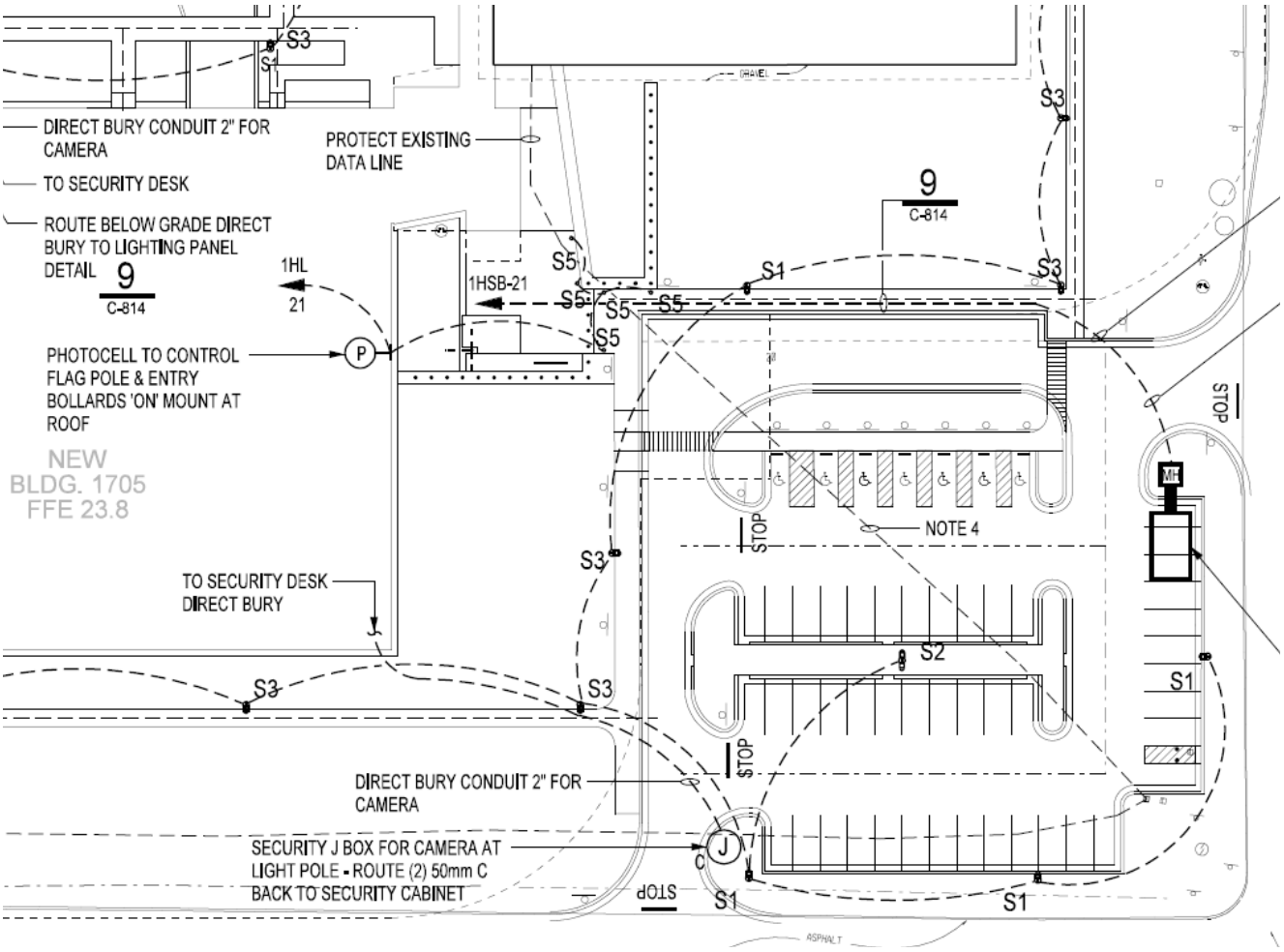
Spatial Overview

Outside the building left of the main entrance is a flagpole and anchor that are illuminated during the night. There is also a parking lot here with sidewalks leading up to the building. Along the sidewalks bollard fixtures are spaced about every 20'. There is a parking lot east of the building that has about 35 parking spaces and 7 handicapped ones. The building façade is all CMU except for the punched windows and the glass lobby.

Finishes

Concrete - reflectance - 0.15 (Assumed)
Asphalt – reflectance – 0.05 (Assumed)
Grass – reflectance – 0.18 (Assumed)
Flag Pole – reflectance – 0.50 Assumed)

Plan and Elevation Drawings



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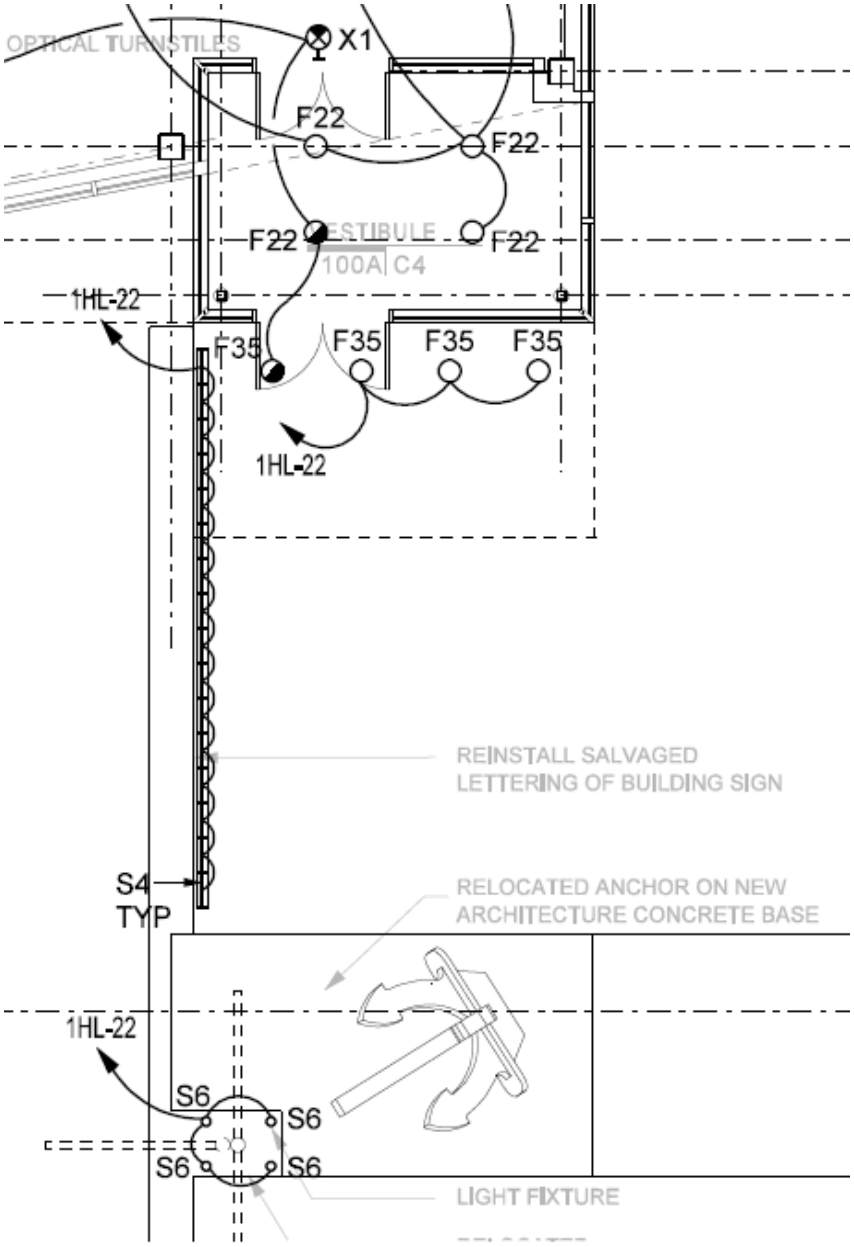

Enlarged Plan of flagpole and anchor

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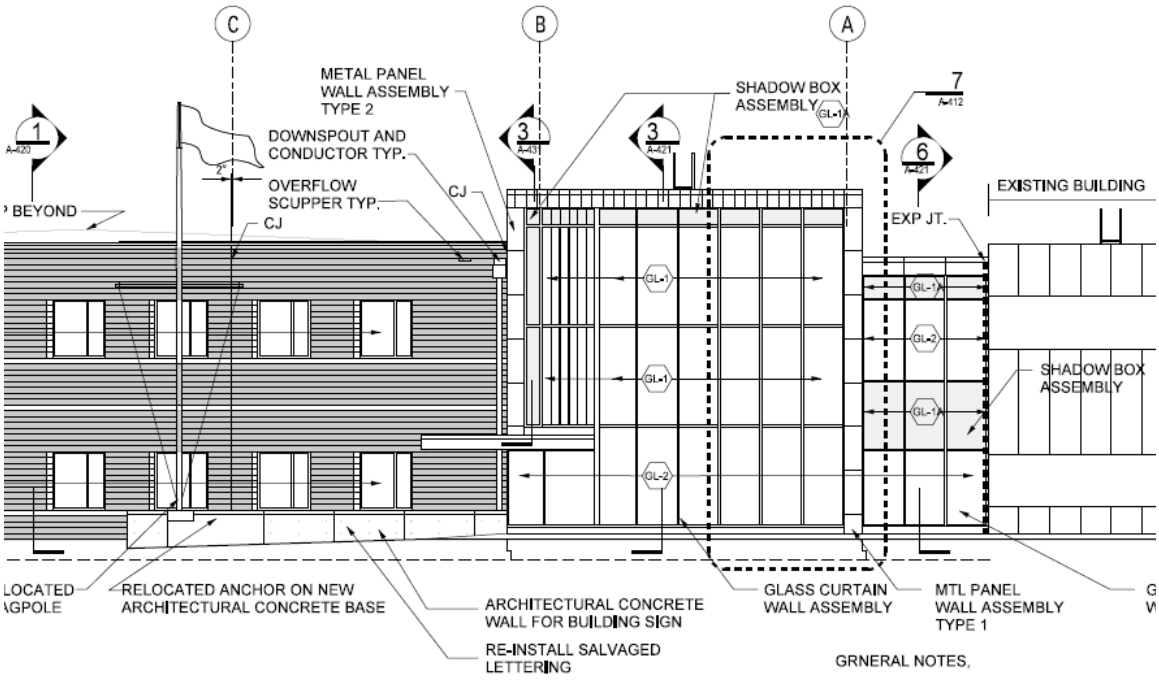
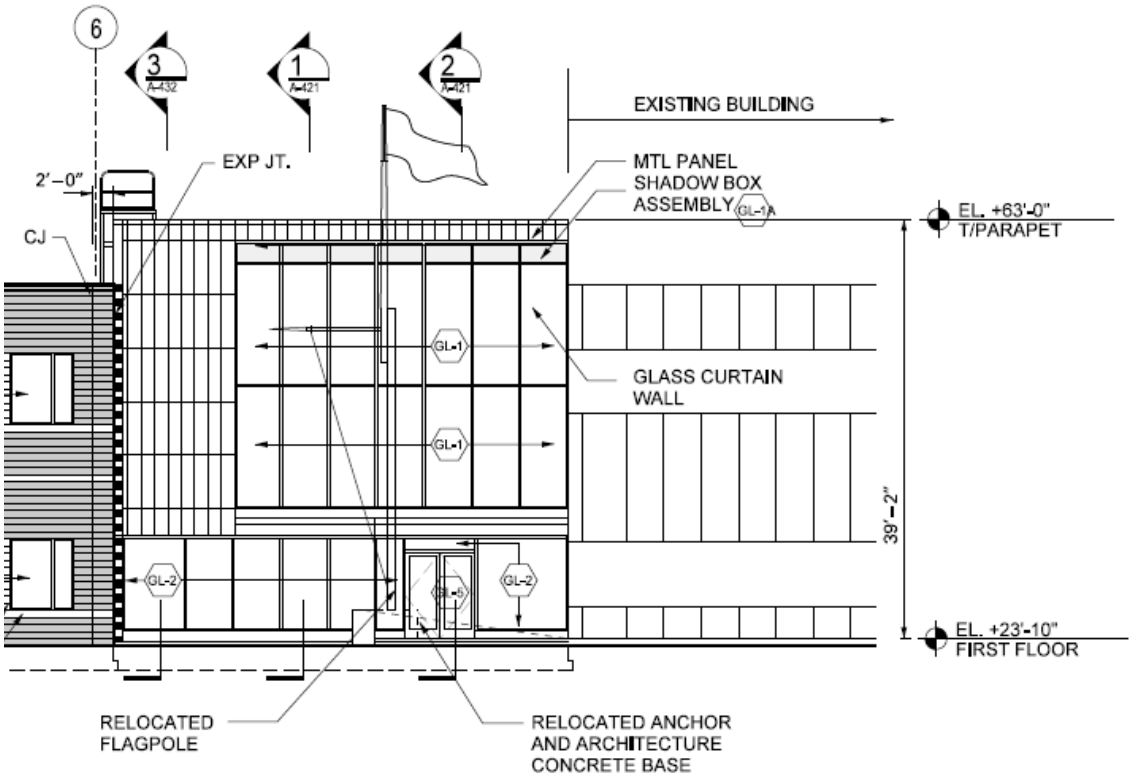


East Elevation



South Elevation

Rendered View (Courtesy of Kling)

Luminaires

Type	Mtg	Lamping	Volts	Watts
F35	S,W	(1) Q50MR16/C/FL40	12/277	50
S1	CB	(1) MVR150/U/WM	277	195
S2	CB	(2) MVR150/U/WM	277	390
S3	CB	(1) MVR100/U/MED	277	120
S4	AI	OSI: (1) FM11/835	277	18
S5	AI	(1) MVR50/C/U/MED	277	75
S6	AI	(1) Q50MR16/C/NSP15	12/277	50

*Full Luminaire Schedule attached at the end of the report.

LLF's

TYPE	BF	CLEANING	MAINTENANCE	LLD	LDD	RSDD	LLF
F35	1	12 Month	VI	0.94	0.86	0.85	0.68714
S1	1	12 Month	III	0.83	0.88	0.8	0.58432
S2	1	13 Month	III	0.83	0.88	0.8	0.58432
S3	1	12 Month	III	0.83	0.88	0.8	0.58432
S4	1	12 Month	VI	0.85	0.75	0.8	0.51
S5	1	12 Month	V	0.83	0.75	0.8	0.498
S6	1	12 Month	VI	0.94	0.75	0.8	0.564

Power Density and Illuminance Levels

F35: 4 luminaires x 50W = 200W
S1: 4 luminaires x 195W = 780W
S2: 1 luminaire x 390W = 390W
S3: 3 luminaires x 120W = 360W
S4: 16 luminaires x 18W = 288W
S5: 5 luminaires x 75W = 375W
S6: 4 luminaires x 50W = 200W

Wattage on Walkways 10' or greater (S4 & S5) = 663W
Wattage under Canopy (F35) = 200W
Wattage in Parking Lot (S1, S2, S3) = 1530W
Wattage on Façade (S6) = 200 W

Power Density on Walkways: 663/3750 = 0.18 W/sq ft.
Power Density under Canopy: 200/180 = 1.2 W/sq ft.
Power Density in Parking Lot: 1530/13000 = 0.12 W/sq ft.
Power Density on Façade: 200/1200 = 0.17 W/sq ft.

Using the Space-by-Space Method in ASHRAE 90.1
- Walkways 10' wide or greater = 0.2 W/sq ft.
- Parking Lots and Drives = 0.15 W/sq ft.
- Canopy = 1.25 W/sq ft.
- Building Facades = 0.2 W/sq ft.

All the requirements are met for ASHRAE 90.1 for the outdoor power density.

Illuminance Levels:
- According to the Final RFP
  - Parking Lots: 0.6fc on the ground minimum
  - Main Building Entrance: 2fc minimum
  - Building surrounding: 0.6fc minimum
- According to the IES Handbook
  - On walkways: 5-10fc
  - Building Façade: 5-10fc

Controls

An automatic programmable remote control with photocell interface is the control device of the outside lighting system. All parking lot lighting will turn on and off simultaneously.

Performance Considerations

The main performance of the outdoor lighting is to provide enough light to see walking to and from the building. Light pollution is a major concern so selecting luminaires that have the correct cutoff angles are a must. Aesthetically, having the lobby

glowing, along with a nice view of the flagpole and anchor will help to make this square box building into an attractive sight at night.

Analysis

Lighting

The bollards that line the sidewalk, coupled with the uplight fixtures washing the short stone wall, provide a nice decorative finish leading to the entrance way, while providing the necessary amounts of light on the concrete sidewalk. I am unsure if my fixture angle were correct or not, but the lighting at the base of the flagpole seems to only illuminate a few feet up the pole. Whether I chose the wrong fixture or aimed it incorrectly, a nice way to highlight the pole is to use narrow beam distribution fixtures from the base of the pole.

Reading the RFP to the designers, the outdoor space was supposed to meet required light levels while giving an aesthetic appeal if possible. This is exactly what the designers achieved. I feel that more can be done with this area than just meeting illuminance levels though. The entire exterior of the building is made of tan color CMU, which has a bumpy texture and would provide a nice visual affect if it would be lighted with wall sconces in certain areas. The other main addition to the lighting design that I would like to see is the anchor that is lying beside the flagpole. I feel this anchor is the cornerstone of this building, and shows exactly what type of facility this is. Highlighting the anchor along with the flagpole would provide a feeling of pride to the United States and the Department of the Navy alike. Some architectural issues I would like to see implemented would be to show the anchor on a slope so that is stands out more to the casual passerby. It may be like this on site, but I could not tell from the drawings that I have available. The results below show the required light levels and a rendering of the space and how it performs.

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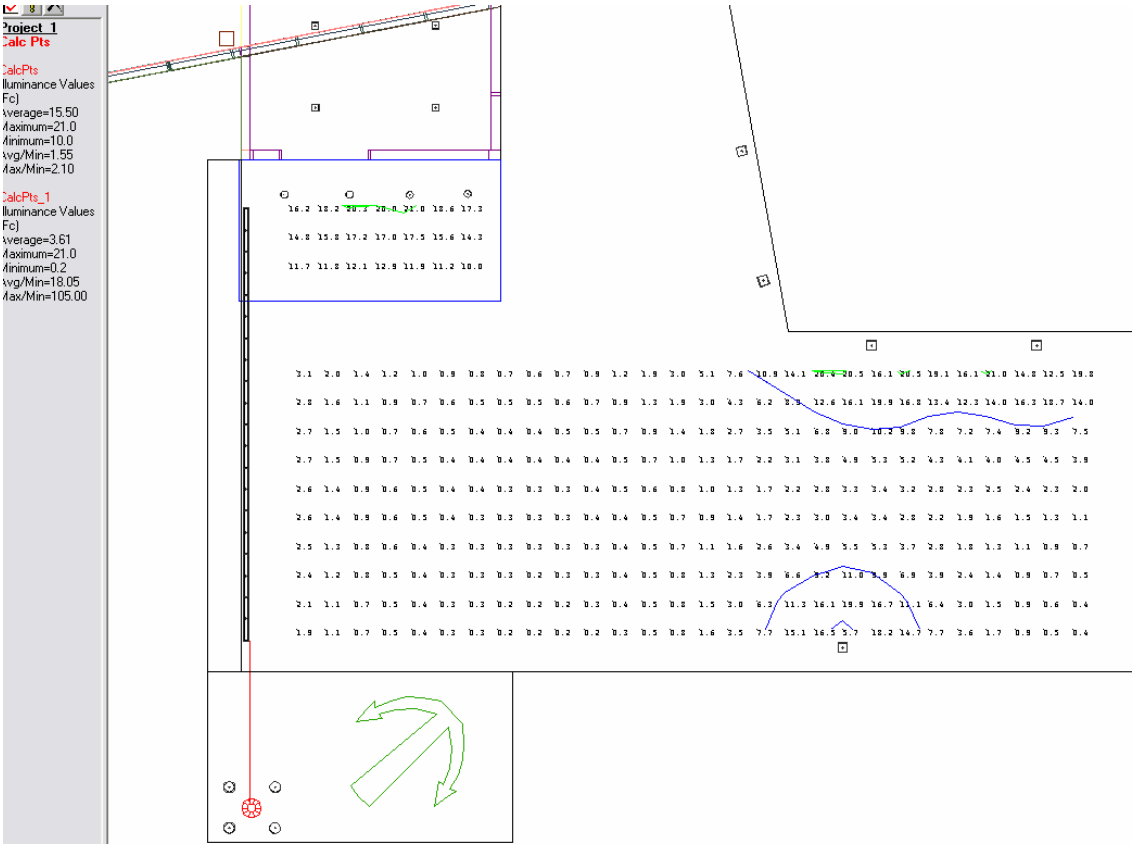

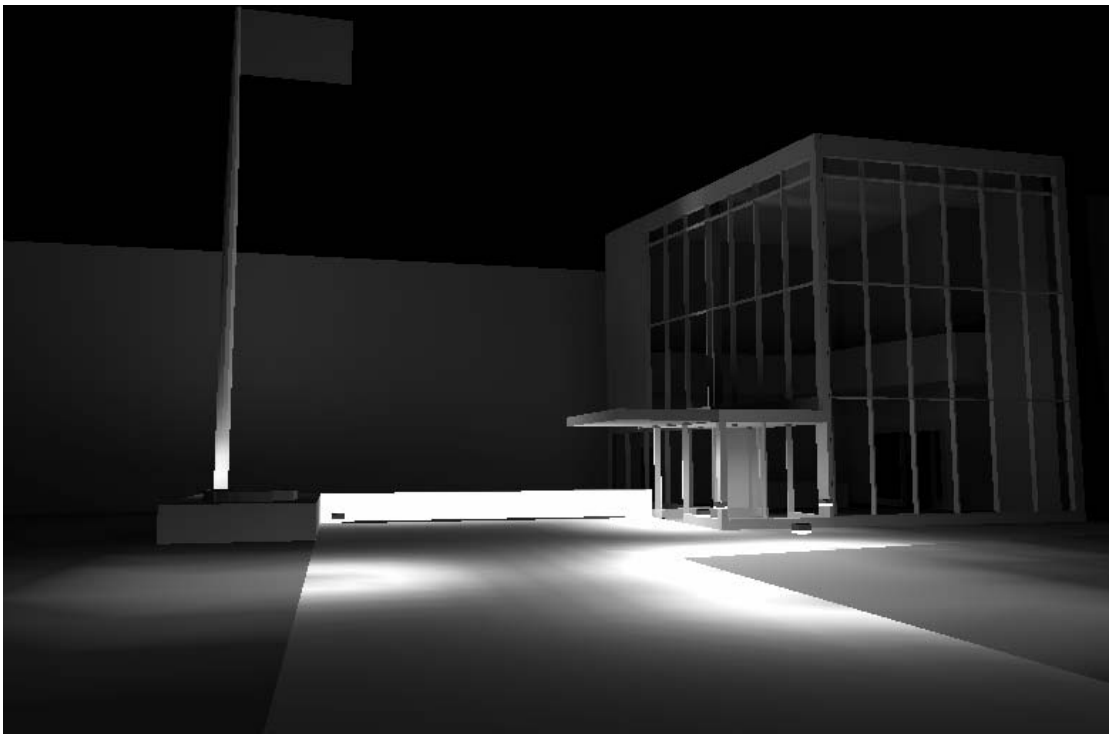

Chris Ankeny
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Dahlgren, VA

LUMINAIRE SCHEDULE

Type	Manufacturer	Alternate Manufacturer	Description	Mtg	Lamping	Volts	Watts	Location
F1	"FINELITE" S12ID WCB 4 1T5H0 WSO OPEN 277 AC CE	LINEAR LIGHTING LITE CONTROL	LINEAR FLUORESCENT INDIRECT LUMINAIRE, NOMINAL 1219mm LONG x 229mm WIDE x 64mm HIGH, FORMED PARTIALLY PERFORATED STEEL CONSTRUCTION, INTEGRAL PROGRAM START BALLAST, WHITE FINISH, AIRCRAFT CABLE SUSPENSION, SUSPEND 8'-0" A.F.F. LUMINAIRE TO BE SUSPENDED FROM CEILING RAILS. **APPROPRIATE HARDWARE AS REQUIRED FOR CEILING CONDITIONS TO BE SUPPLIED BY MANUFACTURER.	P	(1) F54T5/HO/835 [1 LAMP IN SECTION]	277	62	OPEN OFFICE
F1D	"FINELITE" S12ID WCB 12 1T5H0 WSO OPEN 277 AC CE	LINEAR LIGHTING LITE CONTROL	SIMILAR TO TYPE "F1" EXCEPT NUMBER OF LAMPS AND 3658mm LONG.	P	(3) F54T5/HO/835 [1 LAMP IN SECTION]	277	179	OPEN OFFICE
F2	"FINELITE" S12WM ID WCB 12 1T5HO SC 91W 277 SUR CE	LINEAR LIGHTING LITE CONTROL	LINEAR FLUORESCENT INDIRECT LUMINAIRE, NOMINAL 3658mm LONG x 229mm WIDE x 64mm HIGH, FORMED PARTIALLY PERFORATED STEEL CONSTRUCTION, INTEGRAL PROGRAM START BALLAST, WHITE FINISH, WALL MOUNTED, 8'-0" A.F.F.	W	(3) F54T5/HO/835 [1 LAMP IN SECTION]	277	179	OPEN OFFICE
F21	"LIGHT PROJECT: STENG LICHT" MIDI RIGG 2 MAS FROSTED LENS	APPROVED EQUAL	QUARTZ HALOGEN DIRECT/INDIRECT WALL SCONCE LUMINAIRE. NOMINAL 76mm TALL x 102mm WIDE x 254mm PROJECTION, MACHINED ALUMINUM CONSTRUCTION, PAINTED ALUMINUM FINISH.	S,W	(1) Q300T3 (1) Q50GU10/FL/CD	120	350	LOBBY
F22	"KURT VERSEN" H8643	INDY PRESCOLITE	COMPACT FLUORESCENT DOWNLIGHT, NOMINAL 152mm SQUARE APERTURE x 179mm, INTEGRAL BALLAST, HORIZONTAL LAMP ORIENTATION, CLEAR SEMI-SPECULAR SELF-FLANGED REFLECTOR.	R,C	(1) F32TBX/SPX35/A/4P	277	34	LOBBY
F23	"KURT VERSEN" H8416 FR	INDY PRESCOLITE	MAGNETIC LOW VOLTAGE HALOGEN ADJUSTABLE ACCENT, NOMINAL 114mm SQUARE APERTURE x 203mm HIGH, CLEAR SEMI-SPECULAR SELF FLANGED REFLECTOR, INTEGRAL TRANSFORMER.	R,C	(1) Q50MR16/C/FL40	12/277	75	LOBBY
F24	"WINONA" 122904RCS MOD	BALDINGER CUSTOM LIGHTING SOLUTIONS	DECORATIVE PENDENT NOMINAL 914mm TALL x 140mm SQUARE, MOUNT BOTTOM 3696mm A.F.F. FROSTED GLASS PANELS, EXPOSED HARDWARE PAINTED GREY TO MATCH MULLION SYSTEM.	P	(2) FLE28QBX/A/827	120	56	LOBBY
F26	"LITHONIA" MS5 1 24T5HO MVOLT GEB10PS	METALUX COLUMBIA	LINEAR FLUORESCENT STATIC TROFFER, NOMINAL 610mm LONG x 57mm HIGH x 51mm WIDE, INTEGRAL PROGRAM START BALLAST, STEEL CONSTRUCTION.	AI	(1) F24T5/HO/835 [1 LAMP IN SECTION]	277	27	LOBBY
F28	"ZUMTOBEL STAFF" SCI 22 2405 C S 2 DM1%	COLUMBIA LINEAR LIGHTING	LINEAR FLUORESCENT STATIC TROFFER, NOMINAL 610mm WIDE x 610mm LONG x 114mm DEEP, INTEGRAL 1% DIMMING BALLAST, STEEL CONSTRUCTION, LOUVERED LAMP SHIELD, STEPPED HOUSING FINISH, **MOUNTING TRIM AS REQUIRED FOR CEILING CONDITIONS.	R,C	(2) FT40DL/835	277	78	THEATER
F28E	"ZUMTOBEL STAFF" SCI 22 2405 C S 2 DM1% EMH	COLUMBIA LINEAR LIGHTING	SIMILAR TO TYPE "F28" EXCEPT WITH INTEGRAL EMERGENCY BATTERY BALLAST.	R,C	(2) FT40DL/836	277	78	THEATER
F29	"KURT VERSEN" T4216 SC V277-2	PRESCOLITE RSA	MAGNETIC LOW VOLTAGE HALOGEN ADJUSTABLE ACCENT, 2 INDIVIDUALLY ADJUSTABLE HEADS, NOMINAL 114mm x 216mm APERTURE x 203mm HIGH, CLEAR SEMI-SPECULAR SELF FLANGED REFLECTOR, INTEGRAL TRANSFORMER.	R,C	(1) Q50MR16/C/FL40	12/277	150	THEATER
F31	"CELESTIAL LIGHTING" LF 1800 R 4, REMOTE TRANS AND ACCESSORIES AS REQUIRED	ROBERTS STEP LIGHT	LINEAR LOW VOLTAGE LED STEP STRIP, NOMINAL XXmm LONG x 57mm HIGH x 89mm WIDE, RED LED'S REMOTE TRANSFORMER, PVC CONSTRUCTION. CONTRACTOR TO COORDINATE WIRE WAY, CORNER PIECES, WIRE HARNESS AS REQUIRED.	AI	INCLUDED	12/277	1 W. LF.	THEATER
F32	"COLE" F157 2S 13 BLK	MCPHILBEN BEGA	COMPACT FLUORESCENT STEP LIGHT. NOMINAL 127mm HIGH x 203mm LONG x 102mm DEEP, INTEGRAL BALLAST, DIE CAST ALUMINUM CONSTRUCTION, CAST ALUMINUM FACE PLATE, BLACK FINISH.	R,W	(1) F13DBX23T4/SPX35	277	27	THEATER
F33	"GOTHAM" AF 1/32TRT 6AR LD 277	EDISON PRICE PORTFOLIO	COMPACT FLUORESCENT DOWNLIGHT, NOMINAL 152mm DIAMETER APERTURE x 178mm HIGH, INTEGRAL BALLAST, HORIZONTAL LAMP ORIENTATION, CLEAR SEMI-SPECULAR SELF-FLANGED REFLECTOR.	R,C	(1) F32TBX/SPX35/A/4P	277	34	THEATER
F33A	"GOTHAM" AF 1/32TRT 6AR LD 277 CWW	EDISON PRICE PORTFOLIO	SIMILAR TO TYPE "F33" EXCEPT DOWNLIGHT CORNER WALLWASHER.	R,C	(1) F32TBX/SPX35/A/4P	277	34	THEATER
F35	"BK LIGHTING" VS 0 WHW 12, TR300277	LUMIERE WINONA	LOW VOLTAGE INCANDESCENT MR16 DOWNLIGHT, NOMINAL 127mm DIAMETER x 76mm HIGH, CAST ALUMINUM FACE PLATE, TRANSFORMER IN LUMINAIRE BACK BOX.	S,W	(1) Q50MR16/C/FL40	12/277	50	OUTDOOR
S1	"LITHONIA" HEAD:KSF1-150M-R3 277 SF-PER-PE7-DDB POLE: RSS##-4-5B	LSI GARDCO	ONE(1) POLE MOUNT HID SHOEBOX LUMINAIRE, NOMINAL 559mm x 406mm x 178mm DEPTH, ANODIZED, SEGMENTED (TYPE III) OPTICS, SEAM WELDED ALUMINUM HOUSING, FINISHED DARK BRONZE, FLAT TEMPERED GLASS LENS, HORIZONTAL LAMP ORIENTATION, MOUNT UNDERSIDE OF LUMINAIRE AT 9144mm A.F.G. POLE: CONTRACTOR SHALL PROVIDE MANUFACTURER'S CERTIFICATION THAT POLE AND LUMINAIRE ARRANGEMENTS SHALL WITHSTAND BASIC WINDLOADING OF BASIC 100MPH AND GUSTING OF 117MPH. PROVIDE ROUND STRAIGHT STEEL POLE, FINISH TO MATCH LUMINAIRE. CONTRACTOR SHALL COORDINATE POLE HEIGHT AND FOOTING ELEVATION. "##" INDICATES HEIGHT OF POLE.	CB	(1) MVR150/U/WM	277	195	OUTDOOR
S2	"LITHONIA" HEAD:KSF1-150M-R3 277 SF-PER-PE7-DDB POLE: RSS##-4-5B	LSI GARDCO	SIMILAR TO TYPE "S1" EXCEPT WITH TWO SHOEBOX LUMINAIRES OPPOSED 180 DEGREES.	CB	(2) MVR150/U/WM	277	390	OUTDOOR
S3	"LITHONIA" HEAD:KSF1-100M-R3 277 SF-PER-PE7-DDB POLE: RSS##-4-4B	LSI GARDCO	SIMILAR TO TYPE "S1" EXCEPT MOUNT UNDERSIDE OF LUMINAIRE AT 6096mm A.F.G.	CB	(1) MVR100/U/MED	277	120	OUTDOOR
S4	"EXTERIEUR VERT" M2 RMA 7, ME-M2/EV-JB1B- 1/2/QD	APPROVED EQUAL	LINEAR FLUORESCENT INGRADE ASYMMETRIC UPLIGHT, NOMINAL 483mm LONG x 102mm WIDE x 102mm DEEP, INTEGRAL BALLAST, CAST ALUMINUM CONSTRUCTION, DRIVE OVER RATED, IP679.	AI	OSI: (1) FM11/835	277	18	OUTDOOR
S5	"LITHONIA" KBS6-50M-R5-277-SF-DDB	LSI GARDCO	EXTRUDED ALUMINUM BOLLARD LUMINAIRE WITH TYPE V, 360 DEGREE LATERAL LIGHT DISTRIBUTION. NOMINAL 1069mm HIGH x 152mm SQUARE. FINISH TO MATCH SITE POLE STANDARD FINISH.	AI	(1) MVR50/C/U/MED	277	75	OUTDOOR
S6	"EXTERIEUR VERT" C2R 7 D2 PH-P2+/EV-JB2B- 1/2/QD/PH-CSS	APPROVED EQUAL	LOW VOLTAGE MR16 INGRADE UPLIGHT, NOMINAL 152mm DIAMETER x 257mm DEEP, INTEGRAL TRANSFORMER, CAST ALUMINUM CONSTRUCTION, DRIVE OVER RATED, IP677.	AI	(1) Q50MR16/C/NSP15	12/277	50	OUTDOOR
X1	"LITHONIA" LRP ## RC ## 120/277	SURE-LITES PRESCOLITE	EDGE-LIT ACRYLIC L.E.D. EXIT SIGN, ## ARROWS, FACES, AND CHEVERONS PER DRAWINGS, MOUNTING AS REQUIRED TO SUIT FIELD CONDITIONS. RED LETTERS WITH MINIMUM 150mm STROKE AND CHEVRON STYLE ARROWS, BRUSHED ALUMINUM TRIM.	AI	PERMANENT LED (FURNISHED)	277	4	ALL SPACES
X2	"LITHONIA" LQM P 3 R 120/277	SURE-LITES PRESCOLITE	L.E.D. EXIT SIGN, ## ARROWS, FACES, AND CHEVERONS PER DRAWINGS. MOUNTING AS REQUIRED TO SUIT FIELD CONDITIONS, RED LETTERS WITH MINIMUM 150mm STROKE AND CHEVRON STYLE ARROWS, THERMOPLASTIC HOUSING.	AI	PERMANENT LED (FURNISHED)	277	4	

References:

A/E firm Kling for providing the drawings, Specs, RFP report and Proposal

ASHRAE 90.1

IESNA Handbook 9th Addition

Relative Computer Files located in the folder P:\thesis\tech report one

Models – Auditorium.agi
Lobby1.agi
Open Office.agi
Outdoor.agi

Excel Files – LUMINAIRE SCHEDULE THESIS

Final Report – tech report final.doc