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

Partial Lighting Redesign
2/15/2007
Dr. Mistrick

Executive Summary

The following report consists of the lighting redesign in two spaces of the Naval Network & Space Operations Command building located in Dahlgren, VA. The training theater and the outdoor entrance area will be the focus of this redesign. In the redesign of the training theater, I will be implementing a cove system into the general illumination of the room. This should provide a space that's more pleasant than direct troffers by distributing the light to the ceiling area creating a more comfortable setting. In the outdoor space I am trying to highlight areas that represent the Navy and United States. This is done by spotting light on the U.S. flag and a Navy anchor. Coordinating the outside lighting with the lobby space will be designed later.

Training Theater

Spatial Overview

The training theater 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.

Design Concept

The design concept for the theater is to provide a flexible lighting system that minimizes glare and has a comfortable look. My design attempt is to draw away from the acoustical ceiling tile and 2'x2' fluorescent troffers, and replace them with a gypsum wallboard cove system that still keeps the feel of a Navy Command Center. The cove system follows the form and dimensions of the tiered floor system which gives a nice balance to the space. The lighting controls are all dimmable and separated into different zones, giving the user optimal control over the entire space.

Finishes

The materials used in this space were chosen to provide good acoustics and to minimize future maintenance needs.

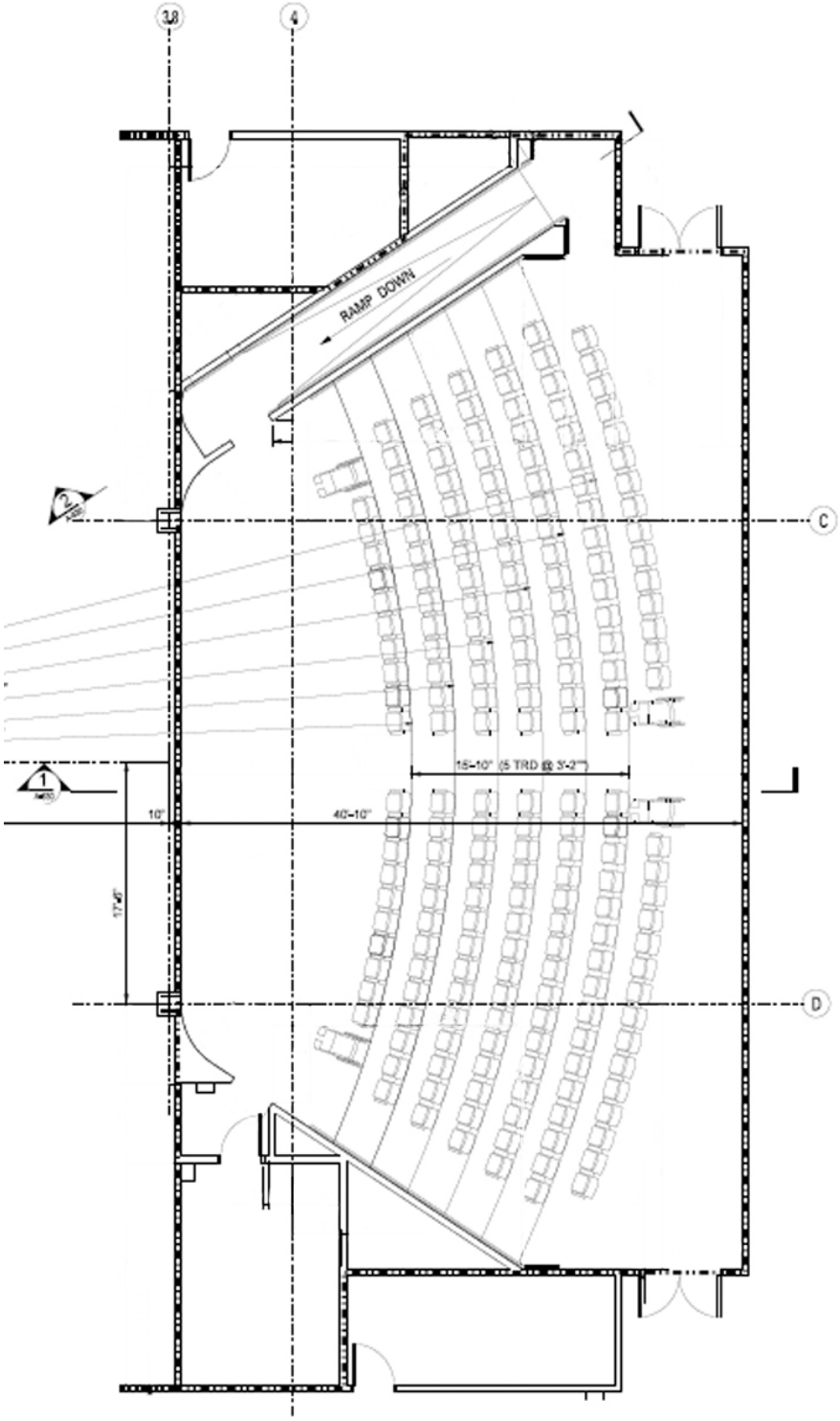
Materials and Dimensions:

Room: Floor: Broadloom Carpet – Reflectance 20% (Assumed)

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

Ceiling – Replace Acoustical Ceiling Tile with White Painted Gypsum Wallboard – Reflectance 85%

Original Plan



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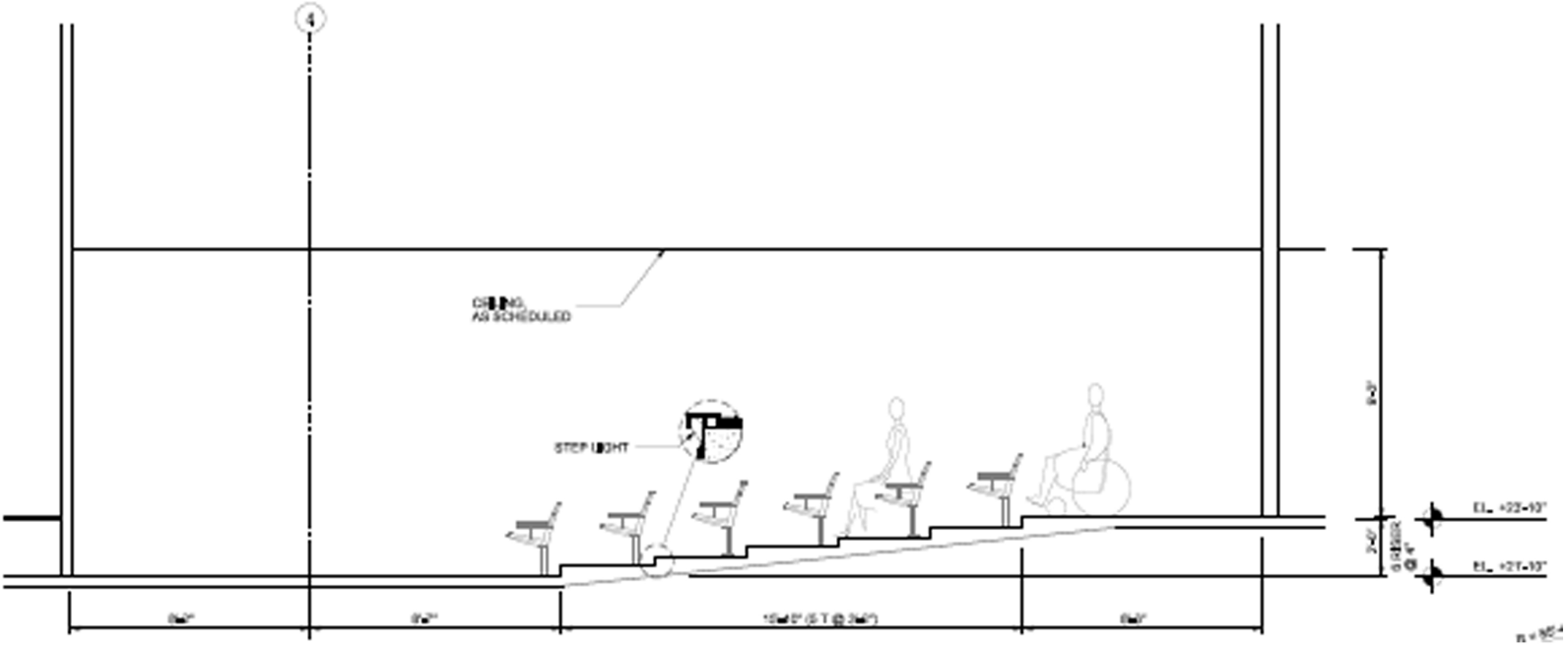
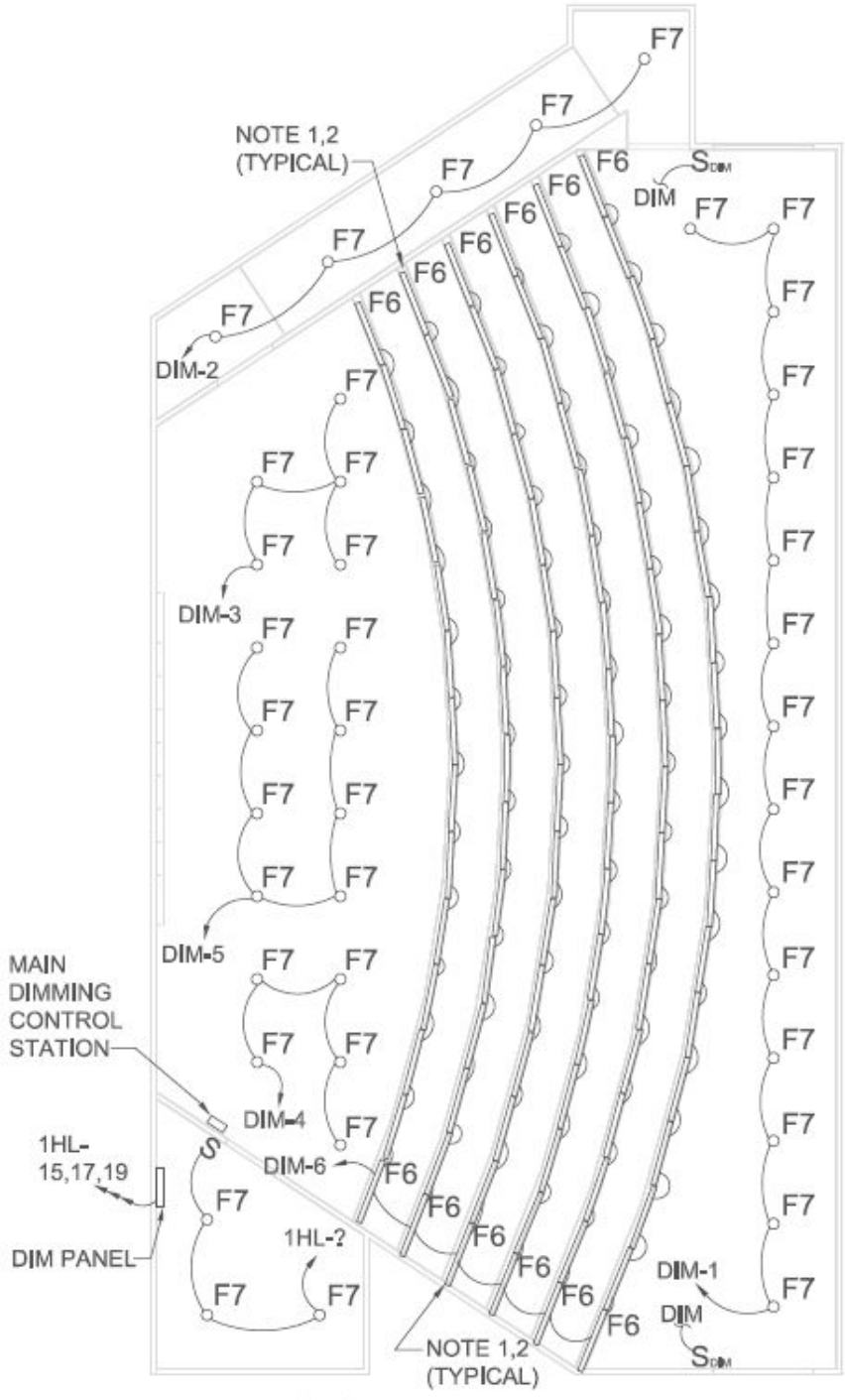
Original Section of Training Theater

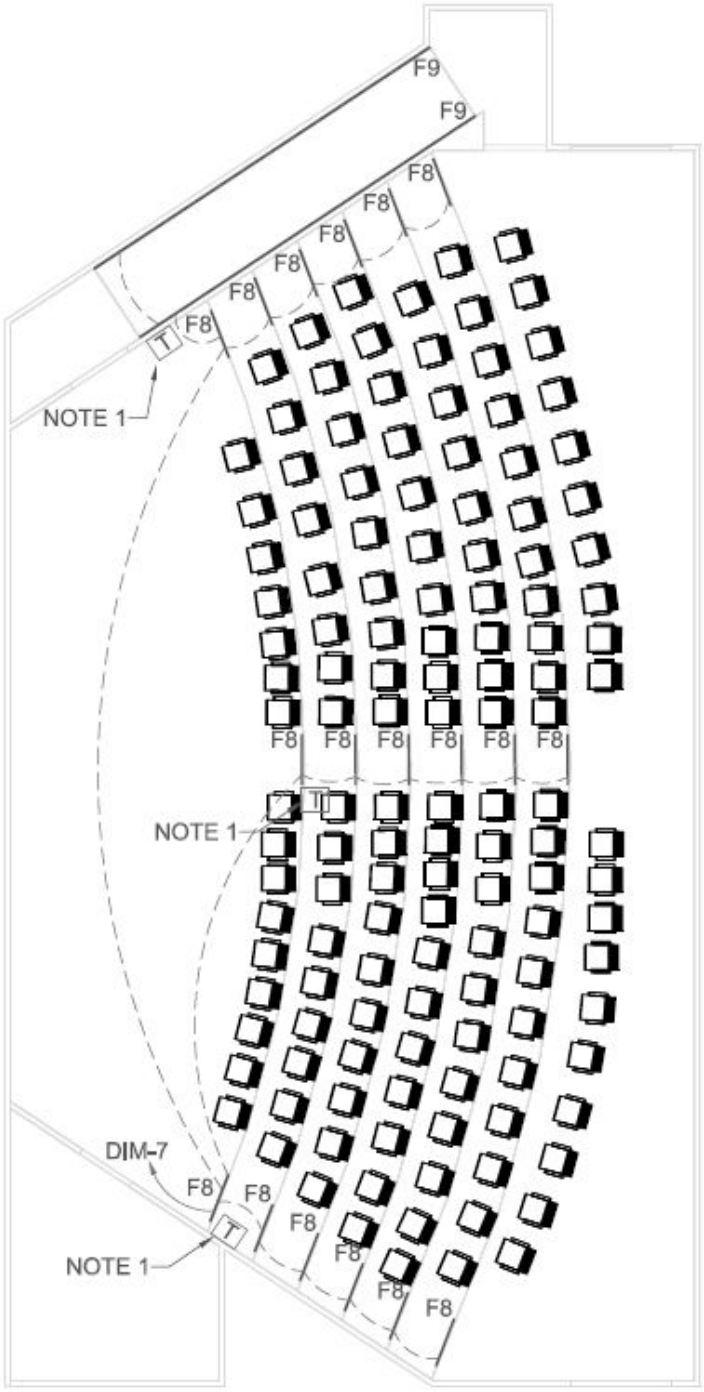


Lighting Plan



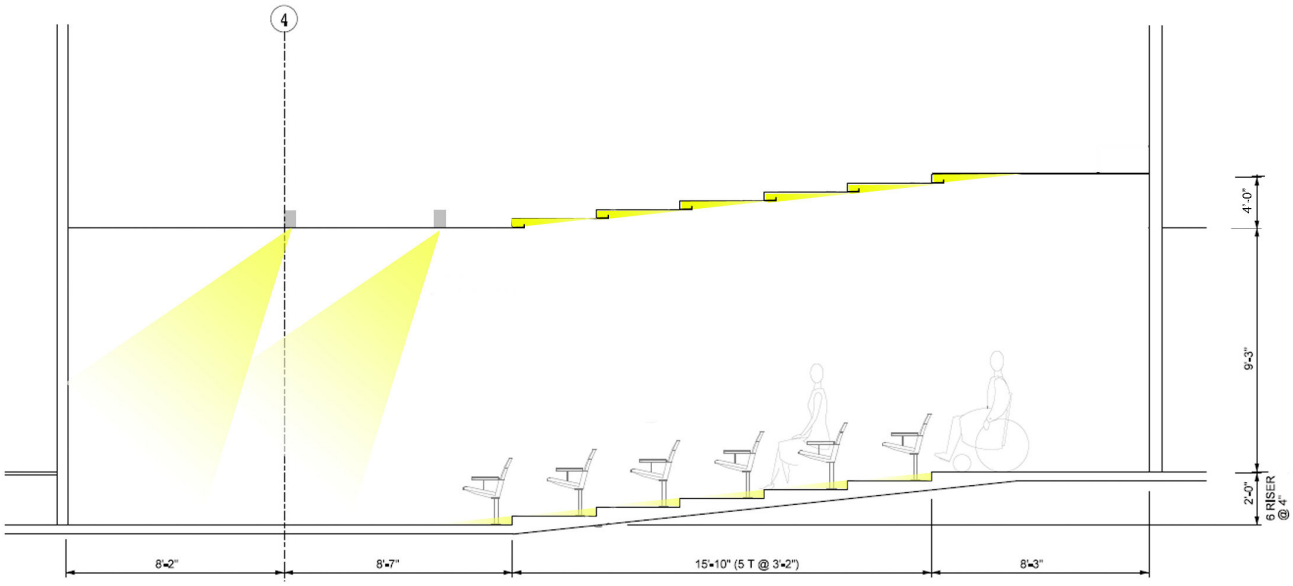
NOTES:
1. ALL COVE LUMINAIRES OF TYPE F6.
2. SEE COVE DETAIL FOR MOUNTING.

LED Lighting Plan

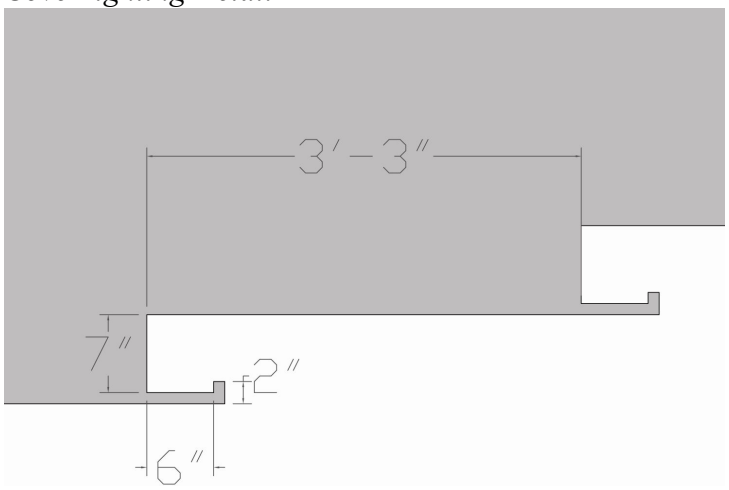


NOTES:
1. TRANSFORMER IN RECESSED FLOOR BOX-277V TO 9.5V DC, FOR LED STEPLIGHT LUMINAIRES.

Section Drawing



Cove Lighting Detail



Luminaires

Type	Mtg.	Lamping	Volts	Total Watts
F6	S	(1) CMH35/T/UVC/U/830/G12	277	116-(4) LAMPS
F7	R	(1) F32TBX/830/A/ECO	277	75-(2) LAMPS
F8	S	INCLUDED	9.5V DC	0.2
F9	S	INCLUDED	9.5V DC	0.2

* Full Luminaire, Lamps, and Ballasts schedule and cutsheets attached in Appendix A.

LLF's

TYPE	BF	CLEANING	MAINTENANCE	LLD	LDD	RSDD	LLF
F6	0.88	12 Month	VI	0.86	0.90	0.90	0.62
F7	1	12 Month	V	0.88	0.84	0.95	0.70
F8	1	12 Month	V	0.88	0.88	0.95	0.74
F9	1	12 Month	V	0.88	0.88	0.95	0.74

*Assuming 12 month cleaning cycle within a clean environment.
RCR= (2.5 cavity height * cavity perimeter)/area of cavity base

Power Density and Illuminance Levels

TYPE	# LUMINAIRES	# LAMPS/LUMINAIRE	WATTAGE/LAMP	WATTAGE
F6	99	1	116-(4)LAMPS	2900
F7	41	1	75-(2)LAMPS	1575
F8	108	1	0.2	21.6
F9	50	1	0.2	10

Total Wattage = 4506.6W
Total Square Ft. = 3035s.f.
Power Density = 1.48 W/sq ft.

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

This lighting design is slightly higher than the power density allowed for this space, but I plan to make up the difference in another space.

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 training theater has an automatic programmable remote

control. There are 7 dimmable zones in the theater; the following chart describes each zone:

Training Theater Summary Load Schedule					
Lutron Zone	DIM Zone	Zone/Circuit Description	Voltage	Load Type	Wattage
DIM 1	1	Back Downlights	277	Mark 7 0-10V	600
DIM 2	2	Ramp Downlights	277	Mark 7 0-10V	225
DIM 3	3	Left Front Downlights	277	Mark 7 0-10V	225
DIM 4	4	Right Front Downlights	277	Mark 7 0-10V	225
DIM 5	5	Middle Front Downlights	277	Mark 7 0-10V	300
DIM 6	6	Cove Lighting	277	Mark 7 0-10V	2900
DIM 7	7	Steplights	277	Magnetic LV	31.6

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. This control solution for the theater provides many different options regarding which lights are on and at what levels are wanted for each specific configuration.

Renderings and Calculation Results

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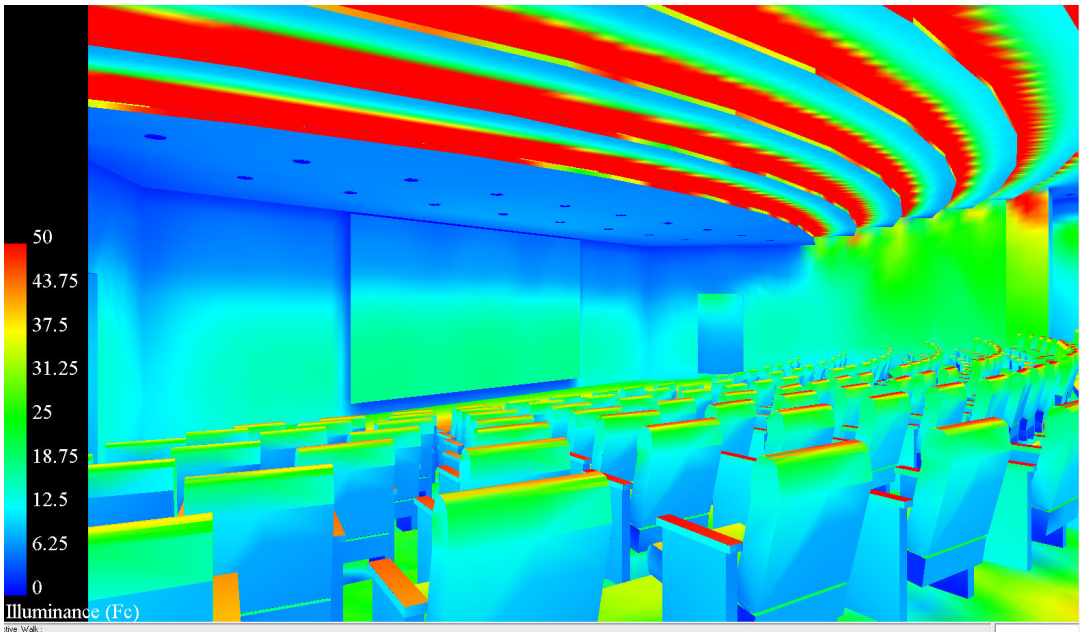
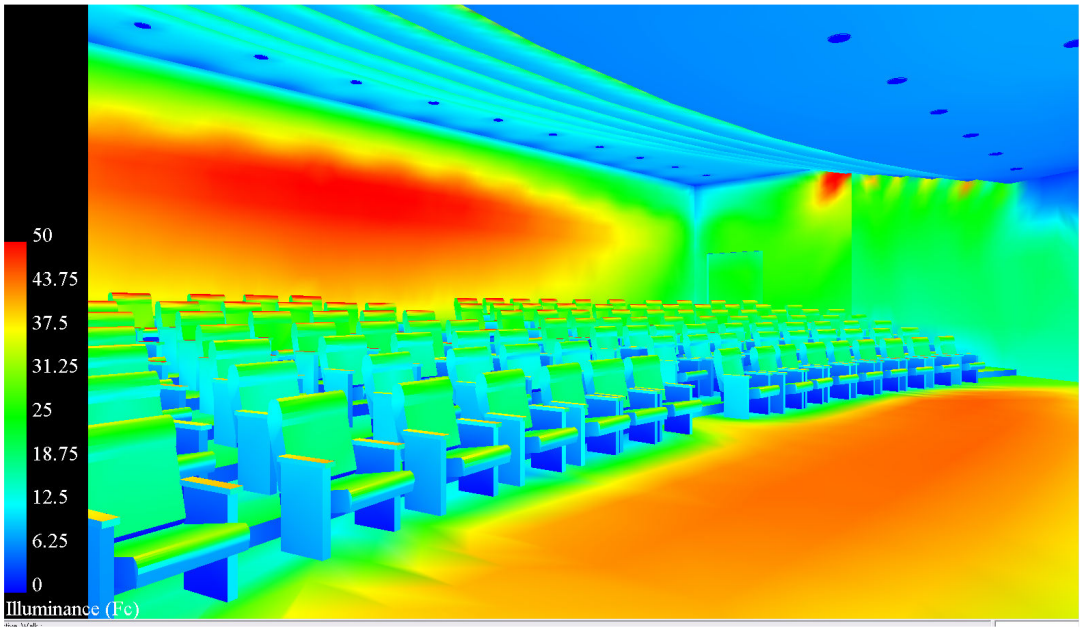
I feel these renderings show really well how this space would perform with the exception of the omitted step lighting. The cove lighting in the first rendering seems like a really bright, high contrast surface compared to the rest of the space, but that is at full output. Dimming down the cove lighting would provide a much more comfortable sitting area for listening to lectures while still being able to take notes.

When taking another look at the coves and the distribution of light, I feel like the cove luminaires may need to be tilted out toward the space to provide better distribution

across the ceiling. This solution is possible with the luminaire I chose and will be something to look into.





In these pseudo images, the front of the room is dark on the ceiling which I consider good since the projection screen will normally be on and a dark front area will have a clearer image on the screen for the viewer. Having the front lights separated into 3 zones will also help control where the light is going and which of the three areas a user wants turned on or dimmed.

Outside Area

Spatial Overview

Outside the building left of the main entrance is a building sign, flagpole and anchor surrounding the walkway into the building. There is also a parking lot here with sidewalks leading to the entrance area. I am keeping the existing lighting design for the parking lot area and changing the lighting outside the entrance. Security bollards are placed every 5' surrounding the lobby and entrance area. The building façade is all CMU except for the punched windows and the glass lobby.

Design Concept

My design concept for the outdoor area is to provide a visually appealing space that commends our Navy and Nation. The flagpole, building sign, and anchor are the three main attractions leading into the building and need to stand out from the rest of the area. The outdoor space also needs to complement the lighting design I am trying to create within the lobby.

Finishes

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

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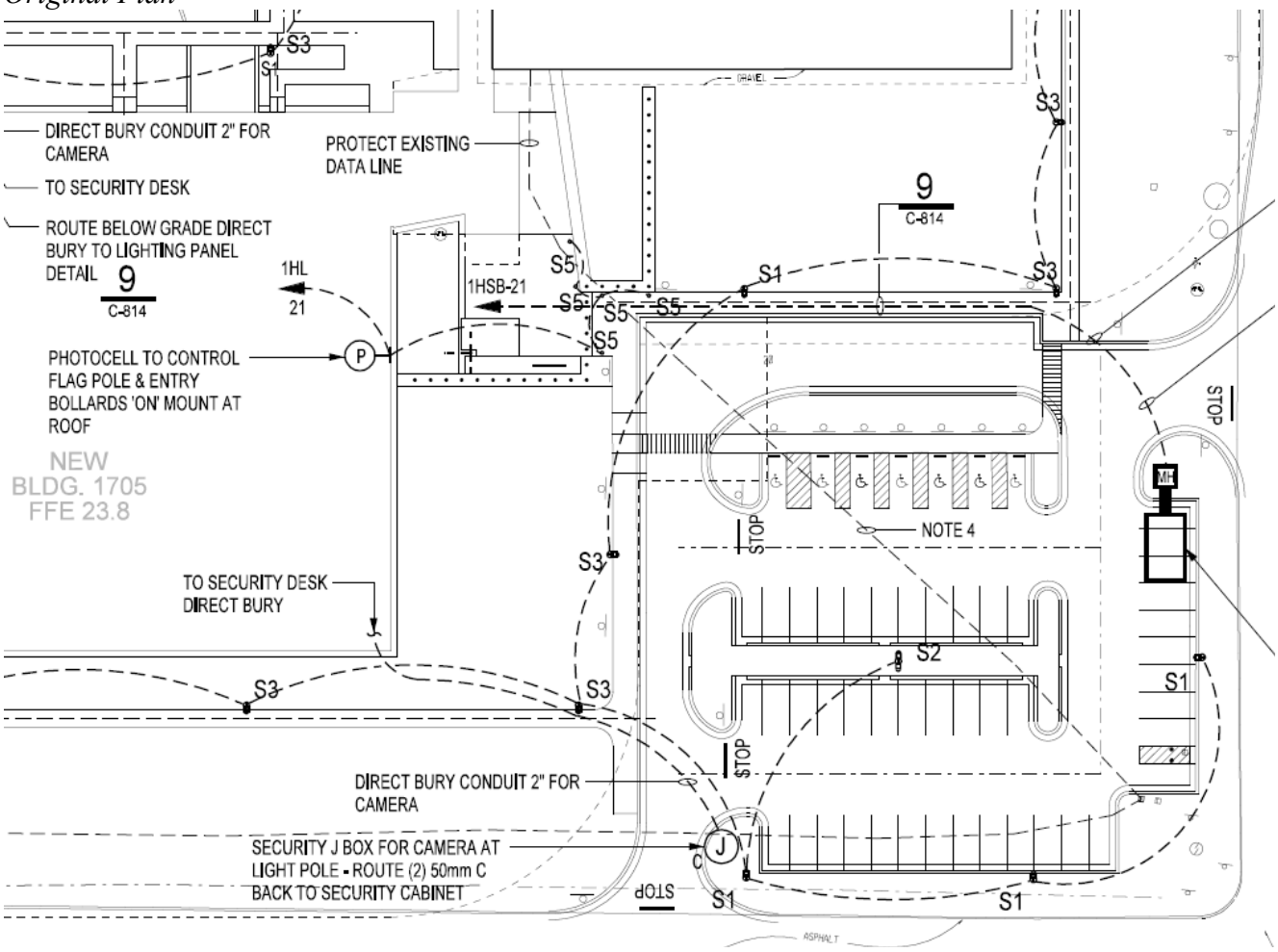
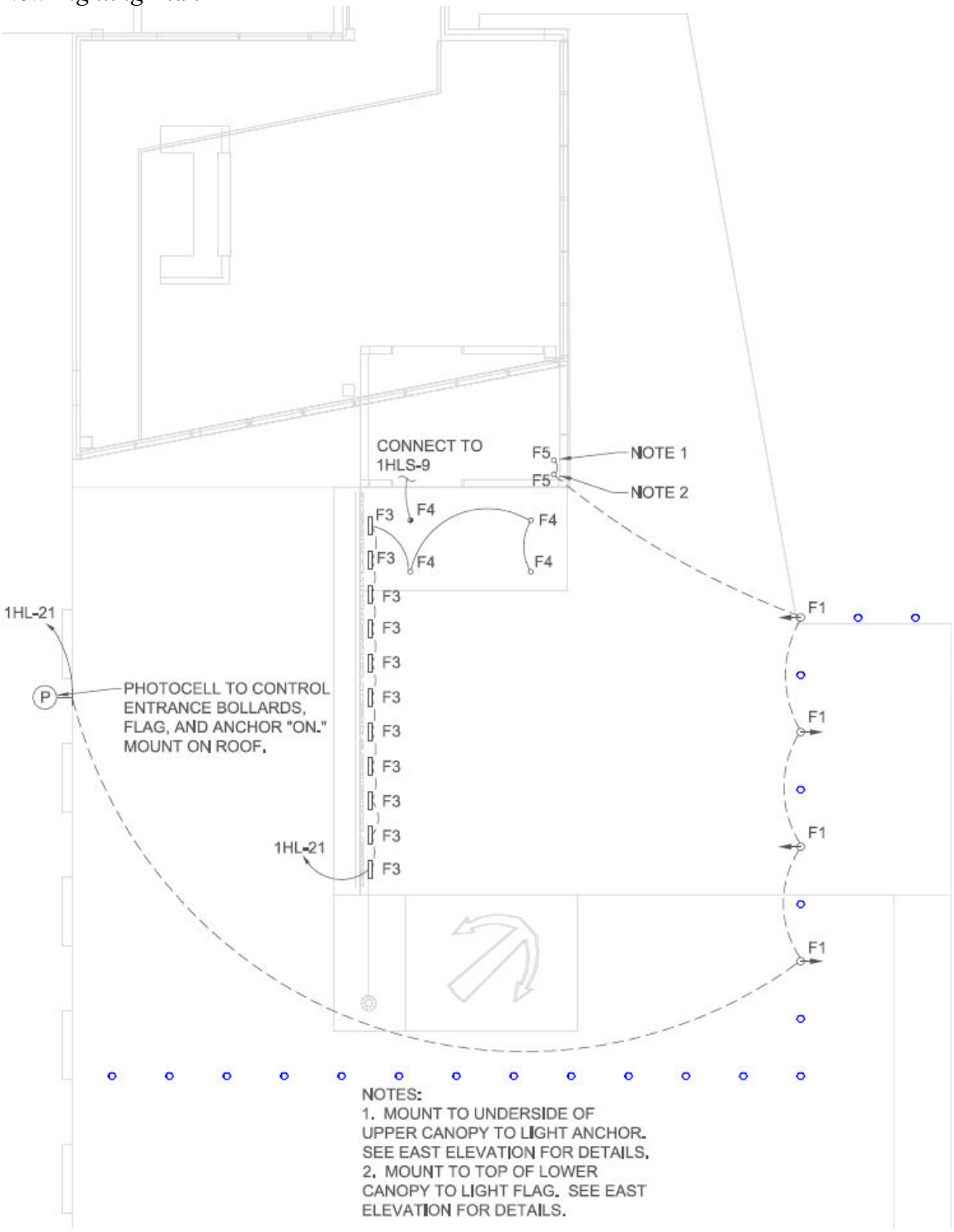
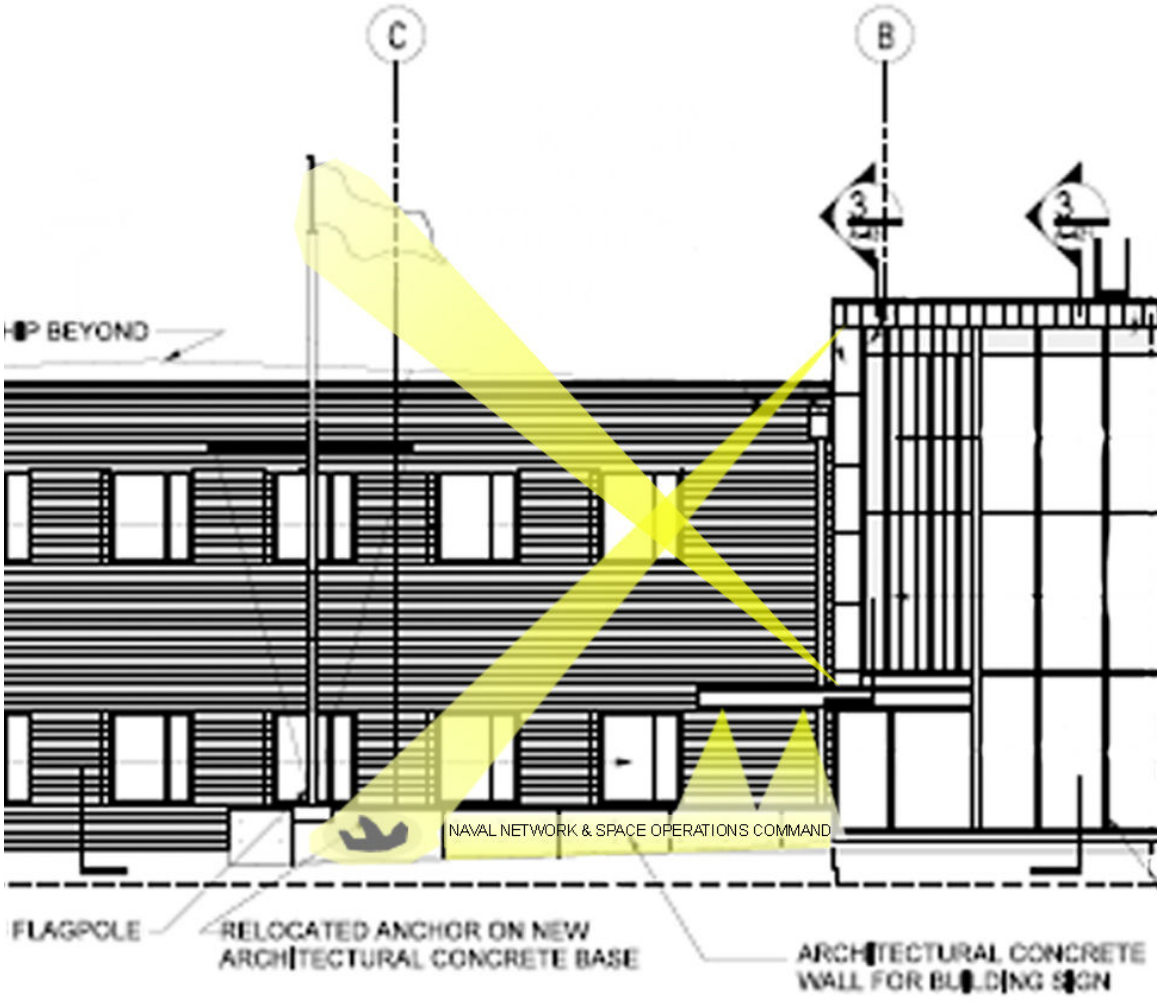
Original Plan



New Lighting Plan



East Elevation Detail



Luminaires

Type	Mtg	Lamping	Volts	Watts
F1	CB	(1) CMH70/TD/942RX7S	277	77
F3	R	(1) FM 11W/760 W4,3 UNV1	277	11
F4	R	(1) F18TBX/SPX41/A/4	277	18
F5	S	(1) CMH35/T/UVC/U/830/G12	277	35

* Full Luminaire, Lamp and Ballast schedule and cutsheets attached in Appendix A.

LLF's

TYPE	BF	CLEANING	MAINTENANCE	LLD	LDD	RSDD	LLF
F1	1	12 Month	V	0.65	0.88	-	0.57
F3	1	12 Month	VI	0.90	0.86	-	0.77
F4	1	12 Month	V	0.90	0.88	-	0.79
F5	1	12 Month	V	0.65	0.88	-	0.57

*Assuming 12 month cleaning cycle within a clean environment.

Power Density and Illuminance Levels

TYPE	# LUMINAIRES	# LAMPS/LUMINAIRE	WATTAGE/LAMP	WATTAGE
F1	4	1	77	308
F3	11	1	11	121
F4	4	1	39-(2) LAMPS	78
F5	2	1	35	70

Wattage on Walkways 10' or greater (F1, F3, F5) = 464W
Wattage under Canopy (F4,F3) = 111W

Power Density on Walkways: 464/2500 = 0.19 W/sq ft.
Power Density under Canopy: 111/180 = 0.62 W/sq ft.

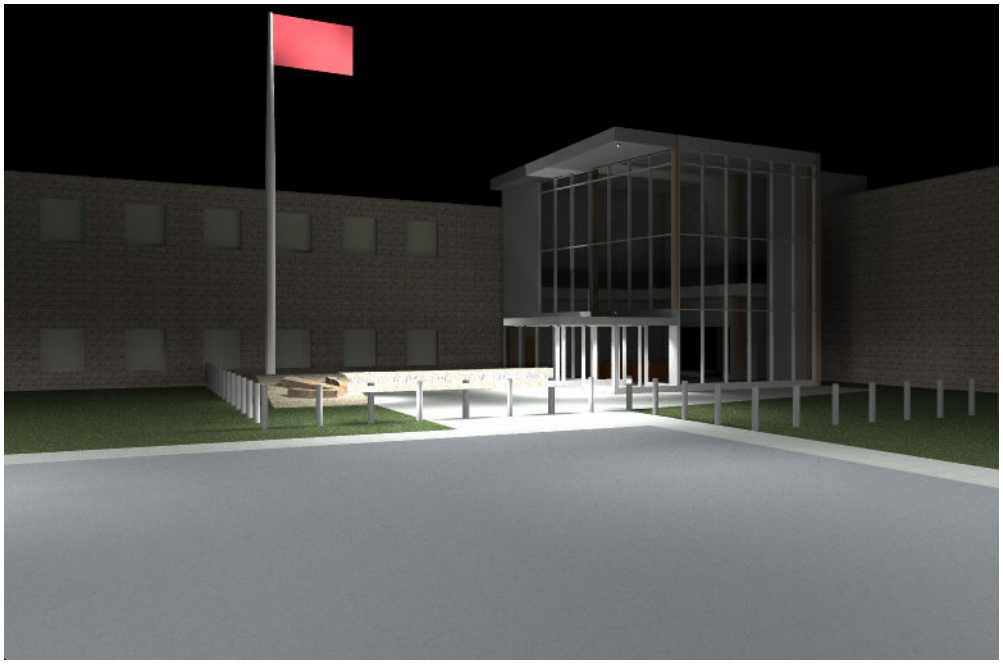
Using the Space-by-Space Method in ASHRAE 90.1
Walkways 10' wide or greater = 0.2 W/sq ft.
Canopy = 1.25 W/sq ft.

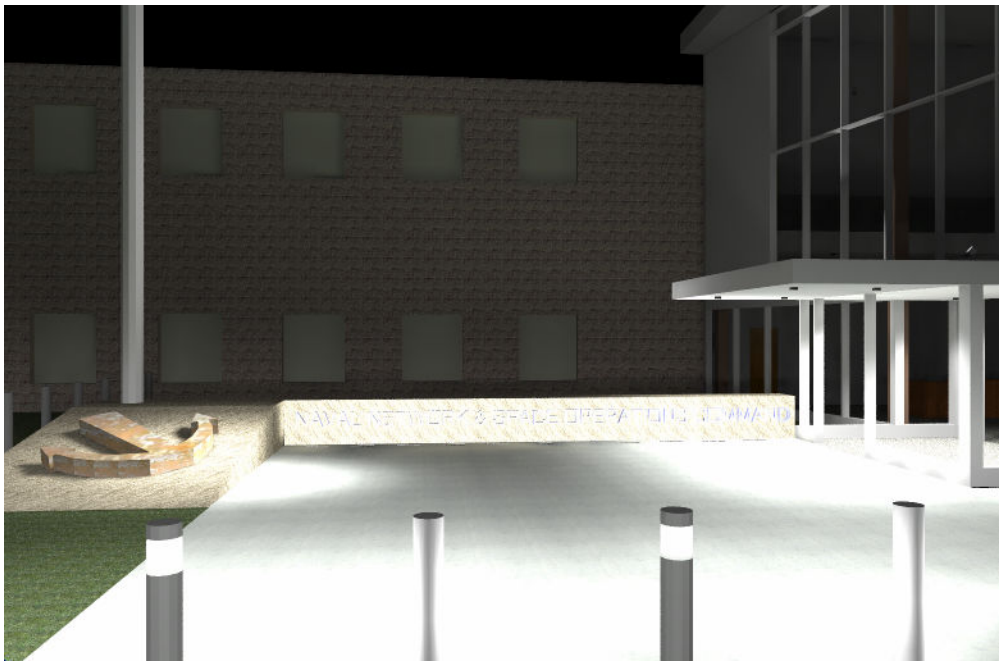
All the requirements are met for ASHRAE 90.1 for the outdoor power density.

Controls

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

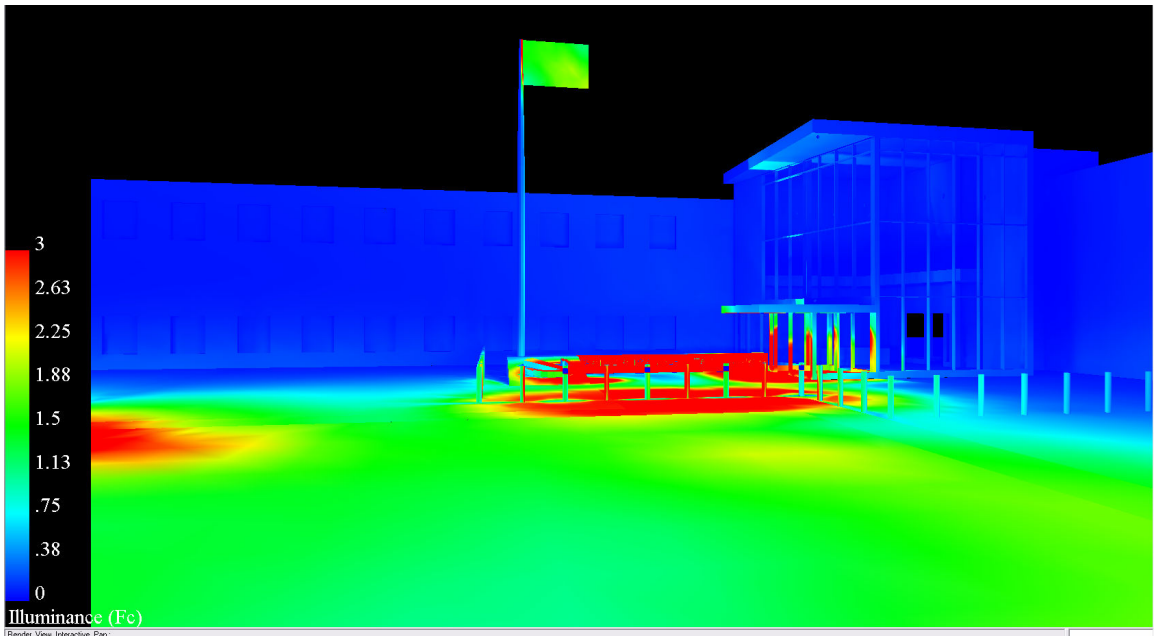
Renderings and Calculation Results

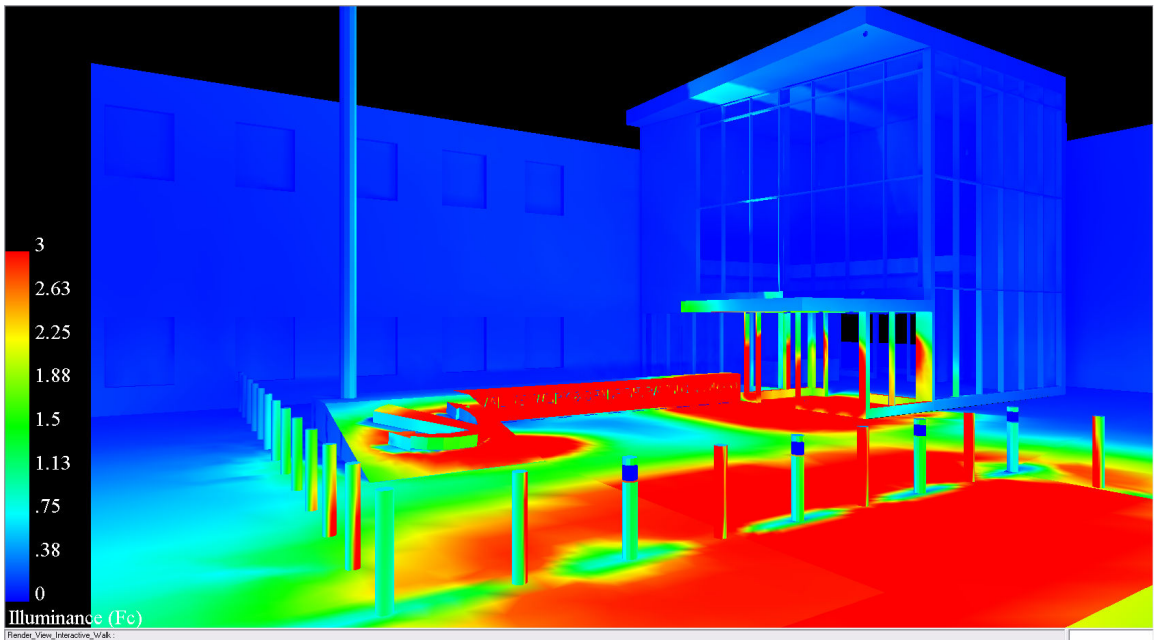


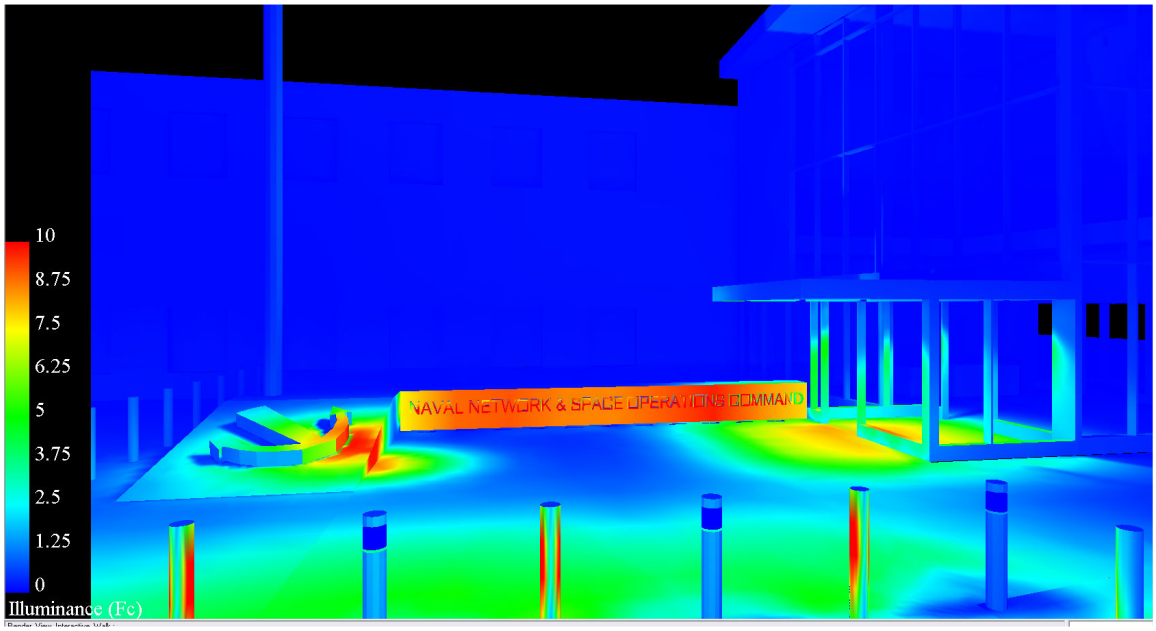


The light really washes out the surfaces in these renderings but I feel that is due to the lack of light in the background. Once the lobby space is done and each area

complements the other, the exposure of light should balance out and hopefully provide a good rendering of the outdoor spaces.







There is a dead space between the anchor and the entrance door that may need to be looked into further. Overall I think the design highlights the areas that I feel are the most important to the space. The flag is only receiving 1-2 fc but I feel is this acceptable since the surround is dark sky. The anchor and sign seem to have the most light and should draw a person's attention to each of these items.

Power Requirements

The panelboards that are changing due to the redesigned lighting system have loads from all four areas of the building on each of them. Due to this I haven't been able to do any of the panel or feeder sizes yet. The following is the panels as they originally were and what circuits were removed from them. Also below is the redone panels for the circuits that have been completed as of now, the sizing of the panels and feeders will be finished once all the spaces of lighting are redesigned.

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Original

PANEL "1HL" (AUTOMATED LIGHTING PANEL)

NEUTRAL BUS: 100% VOLTAGE: 480Y/277V, 3PH, 4W + GND
GROUND BUS: YES MAINS: 125A
ISOLATED GROUND BUS: NO MAIN CIR. BKR.: 100A/3P
MOUNTING: SURFACE AIC RATING: 14,000

CIR. NO.	DESCRIPTION	VA LOAD	BREAKER amps / poles	BREAKER amps / poles	VA LOAD	DESCRIPTION	CIR. NO.
1	LIGHTS - 156, 139, 154, 127, 118, 106, 125, 126	3,240	20/1	20/1	1,560	LIGHTS - 120, 121, 222, 123	2
3	LIGHTS - 165 (WEST)	1,500	20/1	20/1	3,060	LIGHTS - 110, 111, 113, 112, 114, 117,118	4
5	LIGHTS - 165 (CENTER)	1,440	20/1	20/1	1,620	LIGHTS - PERIMETER 112, WITH PHOTOCELL	6
7	LIGHTS - 165 (EAST)	1,500	20/1	20/1	2,980	LIGHTS - 129 (SOUTH), 130, 131, 132, 133	8
9	LIGHTS - 140, 141, 144, 146	3,080	20/1	20/1	3,000	LIGHTS - 129 (NORTH), 134, 135, 136, 137	10
11	EXTERIOR LIGHTS (NORTH & WEST)	2,250	20/1	20/1	2,700	LIGHTS - 103, 103A, 104, 105, 107, 108, 109	12
13	EXTERIOR LIGHTS (SOUTH & EAST)	2,250	20/1	20/1	2,730	LIGHTS - 102, 149, 150, 100	14
15	AUDITORIUM DIMMING PANEL	5,000	60/3	20/1	350	LIGHTS - 163	16
17	-	5,000	-	20/1	1,800	LIGHTS - LOBBY SCONCE	18
19	-	5,000	-	20/1	256	LIGHTS - 100A, 100B, 101	20
21	LIGHTS - MAIN ENTRY BOLLARDS, FLAG POLE	500	20/1	20/1	481	LIGHTS - FLAG POLE, BLDG. SIGN, OVER HANG	22
23	SPARE	-	20/1	20/1	3,120	LIGHTS - PARKING LOT (WEST)	24
25	SPARE	-	20/1	20/1	1,695	LIGHTS - SIDEWALK, ROADWAY (NORTH)	26
27	SPARE	-	20/1	20/1	2,550	LIGHTS - PARK.,SIDEWALK (NORTH & WEST)	28
29	SPARE	-	20/1	20/1	-	SPARE	30
31	SPARE	-	20/1	20/1	-	SPARE	32
33	SPACE	-	-	20/1	-	SPARE	34
35	SPACE	-	-	20/1	-	SPARE	36
37	SPACE	-	-	40/3	-	SCADA UNIT	38
39	SPACE	-	-	-	-	-	40
41	SPACE	-	-	-	-	-	42
	SUB TOTAL	30,760			27,902	SUB TOTAL	

LEGEND: ** 6mA GROUND FAULT CIRCUIT BREAKER
* 30mA GROUND FAULT CIRCUIT BREAKER
• LOCK-ON CIRCUIT BREAKER HANDLE

CONNECTED LOAD
58.7 KVA
70.6 3 PH. AMPS

REMARKS:

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Redone

PANELBOARD SCHEDULE

VOLTAGE: 480
SIZE/TYPE BUS: ?
SIZE/TYPE MAIN: ?

PANEL TAG: 1HL
PANEL LOCATION: Main Elect. Rm 141
PANEL MOUNTING: SURFACE

MIN. C/B AIC: ?
OPTIONS: ?
?

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Lighting	156139	4050	20A/1P	1	*			2	20A/1P	1950	120121	Lighting
Lighting	165(west)	1875	20A/1P	3		*		4	20A/1P	3825	110111	Lighting
Lighting	165(center)	1800	20A/1P	5			*	6	20A/1P	2025	112	Lighting
Lighting	165(east)	1875	20A/1P	7	*			8	20A/1P	3725	129	Lighting
Lighting	140141	3850	20A/1P	9		*		10	20A/1P	3750	129	Lighting
Lighting	Ext. North	2813	20A/1P	11			*	12	20A/1P	3375	103	Lighting
Lighting	Ext. South	2813	20A/1P	13	*			14	20A/1P	3413	102	Lighting
Aud. Dim. Pnl	Theater	1502	20A/1P	15		*		16	20A/1P	#VALUE!	?	Lighting
Aud. Dim. Pnl	Theater	1502	20A/1P	17			*	18	20A/1P	#VALUE!	?	Lighting
Aud. Dim. Pnl	Theater	1502	20A/1P	19	*			20	20A/1P	#VALUE!	?	Lighting
Lighting	Outdoor	557	20A/1P	21		*		22	20A/1P	#VALUE!	?	Lighting
Spare	-	0	20A/1P	23			*	24	20A/1P	3900	Parking	Lighting
Spare	-	0	20A/1P	25	*			26	20A/1P	2119	Roadway	Lighting
Spare	-	0	20A/1P	27		*		28	20A/1P	3188	Parking	Lighting
Spare	-	0	20A/1P	29			*	30	20A/1P	0	-	Spare
Spare	-	0	20A/1P	31	*			32	20A/1P	0	-	Spare
Spare	-	0	20A/1P	33		*		34	20A/1P	0	-	Spare
Spare	-	0	20A/1P	35			*	36	20A/1P	0	-	Spare
Spare	-	0	20A/1P	37	*			38	20A/1P	0	-	Scada Unit
Spare	-	0	20A/1P	39		*		40	20A/1P	0	-	Scada Unit
Spare	-	0	20A/1P	41			*	42	20A/1P	0	-	Scada Unit

CONNECTED LOAD (KW) - A	#VALUE!	TOTAL DESIGN LOAD (KW)	0.00
CONNECTED LOAD (KW) - B	#VALUE!	POWER FACTOR	
CONNECTED LOAD (KW) - C	#VALUE!	TOTAL DESIGN LOAD (AMPS)	0

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Original

PANEL "1HLS"

NEUTRAL BUS: 100% VOLTAGE: 480Y/277V, 3PH, 4W + GND
GROUND BUS: YES MAINS: 125A
ISOLATED GROUND BUS: NO MAIN CIR. BKR.: 30A/3P
MOUNTING: SURFACE AIC RATING: 14,000

CIR. NO.	DESCRIPTION	VA LOAD	BREAKER amps / poles	BREAKER amps / poles	VA LOAD	DESCRIPTION	CIR. NO.
1	EMG LIGHTS - 140 THRU 146	3,000	20/1	20/1	520	EMG LIGHTS - 110 THRU 117	2
3	EMG LIGHTS - C102, C103, C106, 108, C139	2,050	20/1	20/1	130	EMG LIGHTS - 120 THRU 124	4
5	EMG LIGHTS - 118, 126, 127, C138	710	20/1	20/1	440	EMG LIGHTS - OPS	6
7	EMG LIGHTS - AUDITORIUM	680	20/1	20/1	64	EMG LIGHTS - ELEVATOR MACHINE ROOM	8
9	EMG LIGHTS - LOBYY 100, CORR 101	1,058	20/1	20/1	-	SPARE	10
11	SPARE	-	20/1	20/1	-	SPARE	12
13	SPARE	-	20/1	20/1	-	SPARE	14
15	SPARE	-	20/1	20/1	-	SPARE	16
17	SPARE	-	20/1	20/1	-	SPARE	18
19	SPARE	-	20/1	20/1	-	SPARE	20
21	SPARE	-	20/1	20/1	-	SPARE	22
23	SPARE	-	20/1	20/1	-	SPARE	24
25	SPARE	-	20/1	20/1	-	SPARE	26
27	SPARE	-	20/1	20/1	-	SPARE	28
29	SPARE	-	20/1	20/1	-	SPARE	30
31	SPACE	-	-	-	-	SPACE	32
33	SPACE	-	-	-	-	SPACE	34
35	SPACE	-	-	-	-	SPACE	36
37	SPACE	-	-	40/3	-	TVSS UNIT	38
39	SPACE	-	-	-	-	-	40
41	SPACE	-	-	-	-	-	42
	SUB TOTAL	7,498			1,154	SUB TOTAL	

LEGEND:
** 6mA GROUND FAULT CIRCUIT BREAKER
* 30mA GROUND FAULT CIRCUIT BREAKER
• LOCK-ON CIRCUIT BREAKER HANDLE

CONNECTED LOAD
8.7 KVA
10.4 3 PH. AMPS

REMARKS:

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Redone

PANELBOARD SCHEDULE

VOLTAGE: 480
SIZE/TYPE BUS: 400A COPPER
SIZE/TYPE MAIN: 250A/3P MCB

PANEL TAG: 1HLS
PANEL LOCATION: Main Elect. Rm 141
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 12K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Emg Lighting	140-146	3000	20A/1P	1	*			2	20A/1P	520	110-117	Emg Lighting
Emg Lighting	C102,C103	2050	20A/1P	3		*		4	20A/1P	130	120-124	Emg Lighting
Emg Lighting	118126	710	20A/1P	5			*	6	20A/1P	440	OPS	Emg Lighting
Emg Lighting	Theater	680	20A/1P	7	*			8	20A/1P	64	Elev. Mach	Emg Lighting
Emg Lighting	?	#VALUE!	20A/1P	9		*		10	20A/1P	0	-	Spare
Spare	-	0	20A/1P	11			*	12	20A/1P	0	-	Spare
Spare	-	0	20A/1P	13	*			14	20A/1P	0	-	Spare
Spare	-	0	20A/1P	15		*		16	20A/1P	0	-	Spare
Spare	-	0	20A/1P	17			*	18	20A/1P	0	-	Spare
Spare	-	0	20A/1P	19	*			20	20A/1P	0	-	Spare
Spare	-	0	20A/1P	21		*		22	20A/1P	0	-	Spare
Spare	-	0	20A/1P	23			*	24	20A/1P	0	-	Spare
Spare	-	0	20A/1P	25	*			26	20A/1P	0	-	Spare
Spare	-	0	20A/1P	27		*		28	20A/1P	0	-	Spare
Spare	-	0	20A/1P	29			*	30	20A/1P	0	-	Spare
Spare	-	0	20A/1P	31	*			32	20A/1P	0	-	Spare
Spare	-	0	20A/1P	33		*		34	20A/1P	0	-	Spare
Spare	-	0	20A/1P	35			*	36	20A/1P	0	-	Spare
Spare	-	0	20A/1P	37	*			38	20A/1P	0	-	Spare
Spare	-	0	20A/1P	39		*		40	20A/1P	0	-	Spare
Spare	-	0	20A/1P	41			*	42	20A/1P	0	-	Spare

CONNECTED LOAD (KW) - A	4.26	TOTAL DESIGN LOAD (KW)	0.00
CONNECTED LOAD (KW) - B	#VALUE!	POWER FACTOR	
CONNECTED LOAD (KW) - C	1.15	TOTAL DESIGN LOAD (AMPS)	0

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Original

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

Redone

Training Theater Summary Load Schedule					
Lutron Zone	DIM Zone	Zone/Circuit Description	Voltage	Load Type	Wattage
DIM 1	1	Back Downlights	277	Mark 7 0-10V	600
DIM 2	2	Ramp Downlights	277	Mark 7 0-10V	225
DIM 3	3	Left Front Downlights	277	Mark 7 0-10V	225
DIM 4	4	Right Front Downlights	277	Mark 7 0-10V	225
DIM 5	5	Middle Front Downlights	277	Mark 7 0-10V	300
DIM 6	6	Cove Lighting	277	Mark 7 0-10V	2900
DIM 7	7	Steplights	277	Magnetic LV	31.6

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Appendix A

Luminaire Schedule

1. ABBREVIATIONS: C=CEILING: P=PENDANT: R=RECESSED: S=SURFACE: T=TRACK: W=WALL: CB=CONCRETE BASE

LUMINAIRE SCHEDULE

Type	Manufacturer	Description	Mtg	Lamping	Volts	Watts	Ballast	Location	Notes
F1	"GREENLEE" HYPR 70CMH/Med MT OptX BLK DT H42 PCHV	EXTRUDED ALUMINUM BOLLARD LUMINAIRE WITH TYPE V, 360 DEGREE LATERAL LIGHT DISTRIBUTION. NOMINAL 42" HIGH x 8.5" DIAMETER. FINISH IS TO MATCH SECURITY BOLLARDS.	CB	(1) CMH70/TD/942RX7S	277	77	B1	OUTDOOR	
F2	"LITHONIA" KSF1 150M R3 277 RP04 SF DBL LPI	ONE(1) POLE MOUNT HID SHOEBOX LUMINAIRE, NOMINAL 21.25" x 15.5" x 7.25" 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 30' A.F.G.	CB	(1) MVR150/U/WM	277	173	B2	OUTDOOR	SAME AS ORIGINALLY DESIGNED
F2A	"LITHONIA" KSF1 150M R3 277 RP04 SF DBL LPI	SIMILAR TO TYPE "F2" EXCEPT MOUNT UNDERSIDE OF LUMINAIRE AT 20' A.F.G.	CB	(1) MVR150/U/WM	277	173	B2	OUTDOOR	SAME AS ORIGINALLY DESIGNED
F2B	"LITHONIA" KSF1 150M R3 277 RP04 SF DBL LPI	SIMILAR TO TYPE "F2" EXCEPT WITH TWO SHOEBOX LUMINAIRES OPPOSED 180 DEGREES FROM EACH OTHER.	CB	(1) MVR150/U/WM	277	346	B2	OUTDOOR	SAME AS ORIGINALLY DESIGNED
F3	"EXTERIEUR VERT" M2 RMA 7	RECESSED PROJECTOR, TYPE VI, FIXED REFLECTOR LUMINAIRE, NOMINAL 19" x 3.6". DRIVE OVER RATED, WATERPROOF.	R	(1) FM 11W/760 W4,3 UNV1	277	11	INTEGRAL	OUTDOOR	
F4	"ERCO" TC-TEL 18W GX24q-2	CAST ALUMINIUM, SILVER POWDER-COATED TYPE V DOWNLIGHT, NOMINAL 8" DIAMETER x 9" DEPTH. CUT-OFF ANGLE 30 DEGREES. WATER-JET PROOF.	R	(1) F18TBX/SPX41/A/4	277	18	B3	OUTDOOR	
F5	"ERCO" HIT-CE 35W G12	CORROSION-RESISTANT CAST ALUMINIUM TYPE V BEAMER II PROJECTOR, NOMINAL 12" HIGH x 6.25" DIAMETER. 130 DEGREE TILT, MOUNTING PLATE FOR METAL HALIDE LAMPS. CUT-OFF ANGLE 50 DEGREES. WATER-JET PROOF.	S	(1) CMH35/T/UVC/U/830/G12	277	35	NO	OUTDOOR	
F6	"LEDALITE" 280 8 T01 E N 04 7 2 E W	DIE-FORMED 24 GAUGE METAL PAINTED WHITE COVE LUMINAIRE. NOMINAL 6" x 48" x 1.5" DEPTH, TYPE VI ASYMMETRIC DISTRIBUTION.	S	(1) F32T8SP30ISWMECO	277	35	YES	THEATER	
F7	"ERCO" TC-TEL 32W GX24q-3 ECG 1-10V	CAST ALUMINIUM DOWNLIGHT, WHITE POWDER COATED TYPE V SYMMETRIC DISTRIBUTION. NOMINAL 8" DIAMETER x 7" DEPTH	R	(1) F32TBX/830/A/ECO	277	35	YES	THEATER	
F8	"CELESTIAL LIGHTING" LF5000 RO W 4	DELINEATED STAIRNOSE LED LUMINAIRE, LOW VOLTAGE, COMPLIES WITH NFPA'S LIFE SAFETY CODE (0.2 FC) WHEN INSTALLED AS RECOMMENDED.	S	INCLUDED IN LUMINAIRE	9.5V DC	0.2	TRANSFORMER	THEATER	
F9	"CELESTIAL LIGHTING" LF2000 C W 12	CARPET TO WALL PATH LED PATHLIGHT LUMINAIRE, LOW VOLTAGE, COMPLIES WITH NFPA'S LIFE SAFETY CODE (0.2 FC) WHEN INSTALLED AS RECOMMENDED.	S	INCLUDED IN LUMINAIRE	9.5V DC	0.2	TRANSFORMER	THEATER	

Ballast Schedule

Type	Luminaire	Description	BF	Input Watt	PF	THD	#Lamps
B1	F1	GE HID ULTRAMAX GEMH70-SLJ-MV	1	77	0.97	10%	1
B2	F2, F2A, F2B	ADVANCE 150W M102 60HZ R-HPF	0.99	173	0.9	10%	1
B3	F4	ADVANCE CFM18W/GX24q	1.05	39	0.99	10%	2
B4	F6	ADVANCE MARK 7 0-10V F32T8 VZT-4S32-4	0.05/0.88	25/116	0.99	10%	4
B5	F7	ADVANCE MARK 7 0-10V CFM32W/GX24Q	0.05/1.00	19/75	0.98	10%	2

Cutsheets attached as separate pdf file.

References:

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

ASHRAE 90.1

IESNA Handbook 9th Addition

All files placed in P:\thesis\2_16_07
Relative Computer Files:

Models – Auditorium.agi
Outdoor_lobby.agi

Excel Files – LUMINAIRE SCHEDULE

Final Report – tech report final.doc