

Auditorium – Lighting Redesign

Description of Space

The 300-seat capacity auditorium resides on the first floor of the building. Upon entering the building through the curved façade that features large expanses of glass, one would find themselves in the lobby of the building. The auditorium entrance would then be straight ahead when in the lobby. The auditorium is used for lectures, demonstrations, film projects, and guest presentations. The tasks will be mainly note-taking, reading, and writing. The dimensions of the auditorium are 70' wide by 77' long by 15' high. This equates to a square footage of approximately 5,412 ft².

Floor Plan

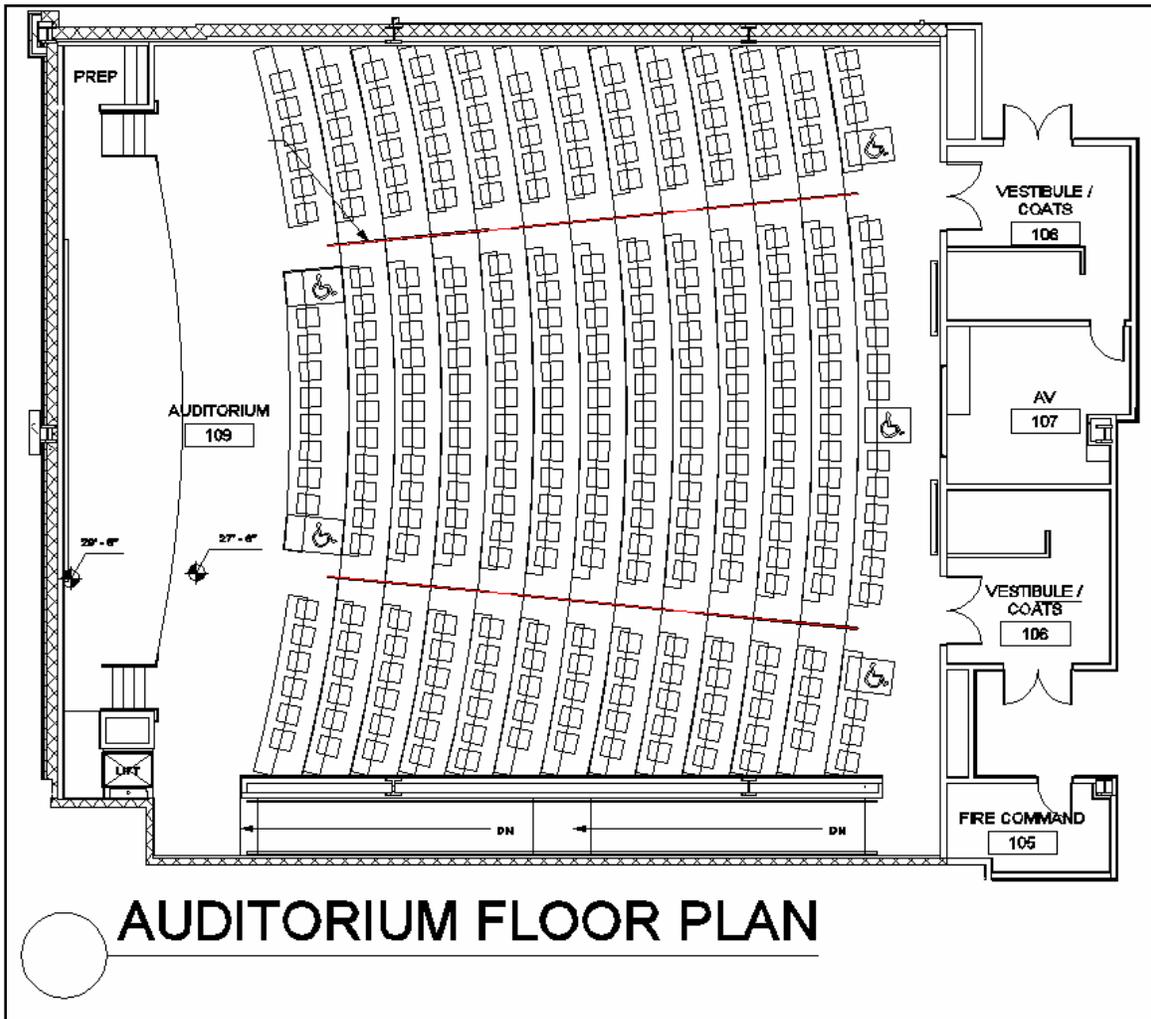


Figure 17: Auditorium Floor Plan

Design Concept

The design concept of the auditorium is to provide various scenes for the different tasks of the space, provide ample task lighting on the desks, and to accent the chalkboard/whiteboard. The space should provide a user friendly control system with the scene selection at the touch of a button. A smooth transition from the lobby will be incorporated into the design.

Design Criteria*Appearance of Space and Luminaires*

The appearance of the space and luminaires is somewhat important in the auditorium. The auditorium will hold seminars with special speakers; therefore, the space and luminaires need to be aesthetically pleasing.

Color Appearance (and Color Contrast)

Color appearance can affect visibility and aesthetics. A color rendering index (CRI) of 70 or above is acceptable when dealing with educational facilities; however, a CRI greater than 80 may be needed in order to ensure a pleasant appearance of skin tones. Since the auditorium will have special speakers and guest lecturers, a CRI of 80 or greater will be beneficial. A CCT should be around 3500 K in order to provide a warmer feel to the space.

Light Distribution on Surfaces

Harsh striated patterns of excessive brightness or noticeable shadows should be avoided. Illuminance patterns should correspond with objects of the space. Ceiling and walls should have luminances within a 3:1 ratio. The current layout should not provide a harsh pattern on any surfaces in the space. The walls of the space can be uniform or non-uniform depending on the final design. Acoustical panels are on the upper portion of the wall. Depending on the appearance of the panels, a decision will be made on whether or not to make the light on the walls uniform or non-uniform.

Light Distribution on Task Plane (Uniformity)

Patterns of light on the task plane should be uniform. The desks in the room are used for reading and writing. A non-uniform pattern of light on the work plane would be distracting or confusing. The task illuminance should be higher than the immediate surroundings. With a work

plane illuminance that is 1.5 to 3 times higher than those in the surrounding areas will assist in directing the occupants' attention to the task, which is very important in educational facilities. The illuminance of the speaker should also be illuminated greater than the surrounding tasks (approximately 25-30 fc).

Point(s) of Interest

The points of interest in the space include the projection screen and the podium at the front of the space. The projection screen should be a lower illuminance and the podium will prosper with a slightly higher illuminance.

Source/Task/Eye Geometry

Extremely important to a lecture hall is the source/task/eye geometry. The angular relationships between the viewer, the task, and the luminaire are frequently critical to task visibility. This should not be an issue due to the height of the ceiling.

System Control and Flexibility

System control and flexibility is very important due to the different tasks in the space. A couple of different systems include a scene for a projection screen, a guest speaker, lectures, and general reading/writing tasks. Dimming ballasts will be required.

Illuminance (Horizontal)

The IESNA handbook calls for a horizontal illuminance of 50 lux (5 fc) on the work plane for auditoriums; however, the horizontal illuminance of a classroom is 500 lux (50 fc). When the projection screen is in use, a horizontal illuminance of 50 lux (5 fc) on the work plane is needed.

Illuminance (Vertical)

The IESNA handbook recommends a vertical illuminance of 30 lux (3 fc) when the projection screen is in use. The points of interest for vertical illuminance include the chalkboard, the speaker, and the projection screen. Note that the projection screen should be a lower illuminance than the surrounding space.

Power Allowances from ASHRAE 90.1 Standards

The power allowance by the space by space method for a classroom, lecture, or training space is 1.4 W/ft².

Reflectances

Ceiling: Sloped Gypsum Wallboard Planes with Fascias to Follow Radius of Seating Tiers

- Assume 90% ceiling reflectance

Walls: Fabric Covered Acoustical Panels/Wood Panels/Painted Gypsum Wallboard

- Assume 50% wall reflectance

Floor: Constantine Commercial Carpet, "Corporate Exchange" 12' W Broadloom; Color T.B.D.

- Assume 20% floor reflectance

Fixture Schedule

Label	Description	MH	Lamps	Ballast/ Transformer	Watts	Voltage	Mfr.	Catalogue No.
F-C1	Concealed Cove-30 System with High-Reflectance White Reflectors	16'	1 - T5HO	REZ-154 - Mark 10 Powerline Electronic Dimming/Programmed Start	54	120	Lite Control Corporation	CC-AI-3024-T5-CWM-TW-2CWQ-277
F-C2	Triples-H 232/7 Recessed CFL Downlight/Wallwasher with EvenTone Clear Reflector	16'	2 - 32 Watt CFL	IZT-2T42-M3-BS@277 - Mark 7 - Electronic Dimming/Programmed Start	64	277	Edison Price Lighting	TRPH 232/7-277-VOL-DM
F-C3	Strip LED Lights for the Stairs	4"	10 - LEDS	Packaged Unit	24	120	Color Kinetics Incorporated	501-000010-00 MEDIUM
F-C4	Obround Wall Mount Luminaire with Specular Aluminum Reflector	11'	2 - F40T8	B-D2 - Advance Electronic/Instant Start Optanium	80	277	LAM Lighting	OB70-2/T8-O-L-WN-8-SGW-277-GLR

Table 11: Auditorium Fixture Schedule

Light Loss Factors

The assumed room cleaning period for this room is 6 months and the room is clean. The expected dirt depreciation was calculated at 8%.

$$RCR = [(5)*(H)*(L + W)] / (L)*(W)$$

$$RCR = [(5)*(15')*(77' + 70')] / (5412 \text{ ft}^2) = 2.04 = 2.0$$

Label	Maintenance Category	LLD	RSDD	LDD	BF	LLF
F-C1	VI	0.90	0.90	0.92	1.00	0.75
F-C2	IV	0.83	0.98	0.93	1.00	0.76
F-C3	II	0.70	0.94	0.97	1.00	0.64
F-C4	IV	0.93	0.98	0.93	1.03	0.87

Table 12: Auditorium Light Loss Factors

Ballast Information

Label	Type	Ballast Watts	Ballast Factor	Voltage	Max THD %	Mfr.	Catalogue No.
B-C1	Electronic Dimming/Programmed Start	63	1.00	120	10	Advance – Mark 10 Powerline	REZ-154
B-C2	Mark 7 – Electronic Dimming/Programmed Start	75	1.00	277	10	Advance	IZT-2T42-M3-BS@277
B-C4	Electronic/Instant Start/2-Lamp	81	1.03	277	10	Advance – Optanium	VOP-4P32-SC

Table 13: Auditorium Ballast Information

Lamp Information

Label	Type	CRI	CCT	Watts	Initial Lumens	Mean Lumens	Mfr.	Ballast
L-C1	F54T5/830 HO ALTO TG	85	3000	54	5000	4500	Philips	REZ-154 – Mark 10 Powerline Electronic Dimming/Program med Start
L-C2	PL-T 32W/830 GX24Q-3/4P	82	3000	32	2400	2000	Philips	IZT-2T42-M3- BS@277 – Mark 7 – Electronic Dimming/Program med Start
L-C4	F40T8 TL841 ALTO	86	4100	40	3775	3500	Philips	B-D2 – Advance Electronic/Instant Start Optanium

Table 14: Auditorium Lamp Information

Power Density

Label	Ballast Watts	No. of Fixtures	Total Watts	
F-C1	63	42	2646	
F-C2	75	48	3600	
F-C3	24	48	1152	
F-C4	81	7	567	
			7965	Watt Total
			5412	Square Foot Total
			1.47 W/ft²	

Table 15: Auditorium Power Density

Therefore, the power density is slightly above the target IESNA value of 1.4 W/ft². If the power density must be lower than 1.4 W/ft², then the amount of cove luminaires could be reduced in order to obtain the proper power density. The space is at an appropriate illuminance level of approximately 42.3 fc, so the power density is sufficient.

Lighting Plan

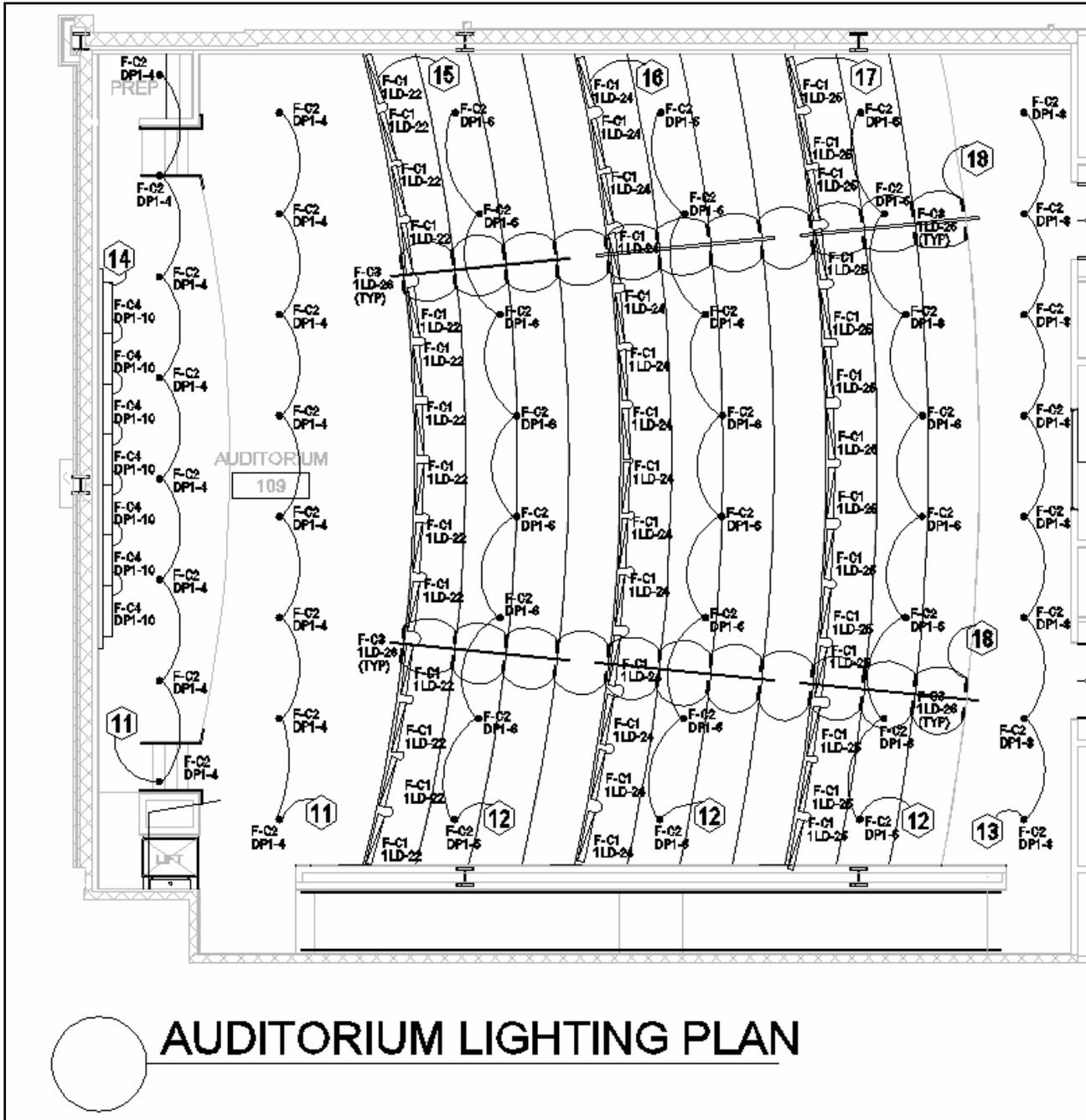


Figure 18: Auditorium Lighting Plan

Lighting Controls

The different zones represent different dimming areas. A Lutron 100 system is being utilized by the DH Hamilton Building. Occupancy sensors are being used as in the previous spaces.

Renderings



Figure 19: Rendering of Auditorium



Figure 20: Rendering of Auditorium

Renderings



Figure 21: Rendering of Auditorium



Figure 22: Rendering of Auditorium

Pseudo Color

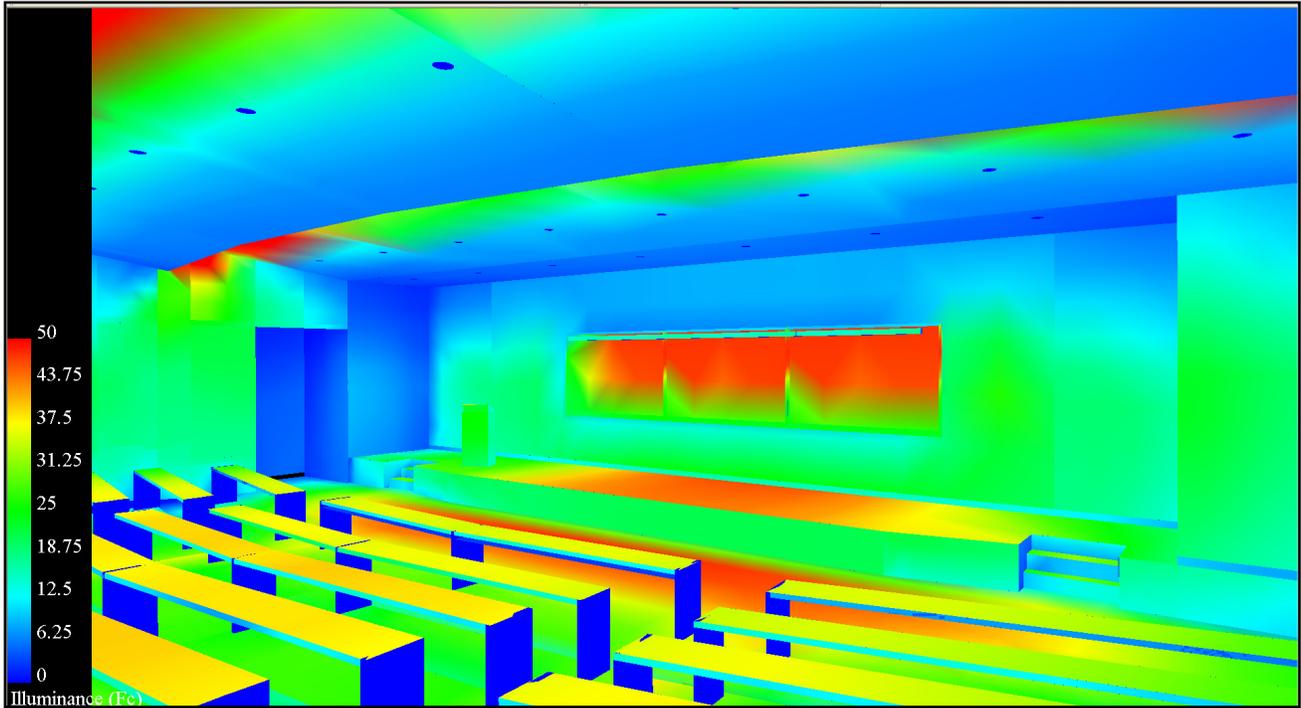


Figure 23: Pseudo Color of Auditorium

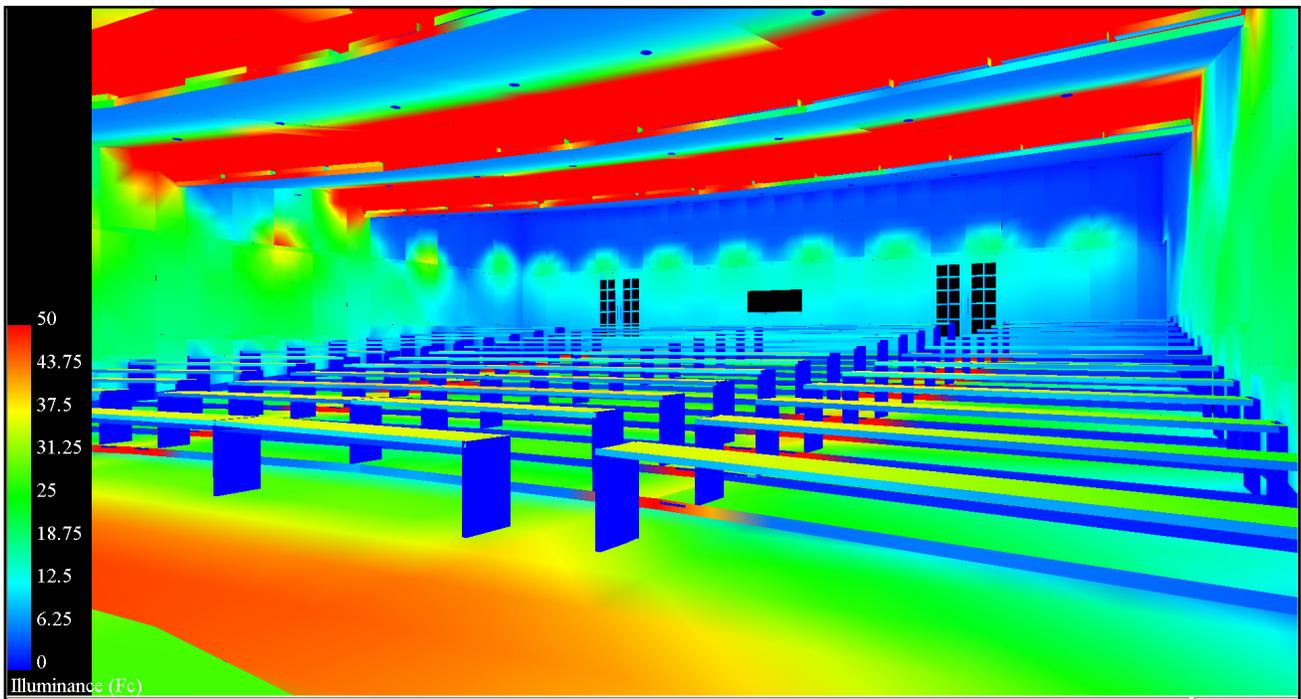


Figure 24: Pseudo Color of Auditorium

Conclusion

The auditorium was the hardest space to provide the lighting design for. The space had a curved ceiling with various heights across the whole ceiling. A curved cove was used throughout the space to achieve some area lighting. The rest of the ambient lighting was done through downlights. The steps have a built in LED strip. Overall, the lighting design achieved the space design goals. The average illuminance on the work plane was 42.3 fc, which is low for the IESNA value for a classroom/lecture space of 50 fc. The power density was 1.47 W/ft², which was slightly over the ASHRAE 90.1 Standards of 1.4 W/ft² for a classroom/lecture space.