

Classroom (505) – Lighting Redesign

Description of Space

The 60-person classroom is located on the fifth floor of the building. The fifth floor of the Dorrance H. Hamilton Building also includes other classrooms, lecture halls, two skills simulation labs, storage rooms, a small lobby, and a library/meeting room. The back wall of the classroom is a curved glass ribbon window, which will have dual/solar blackout shades. The shades will provide the space with a visual display terminal (VDT) friendly environment. The space tasks include note-taking, reading, writing, chalkboard use, and VDT use. The classroom is 32' long by 54' wide by 10' high. This equates to an area of 1728 ft².

Floor Plan

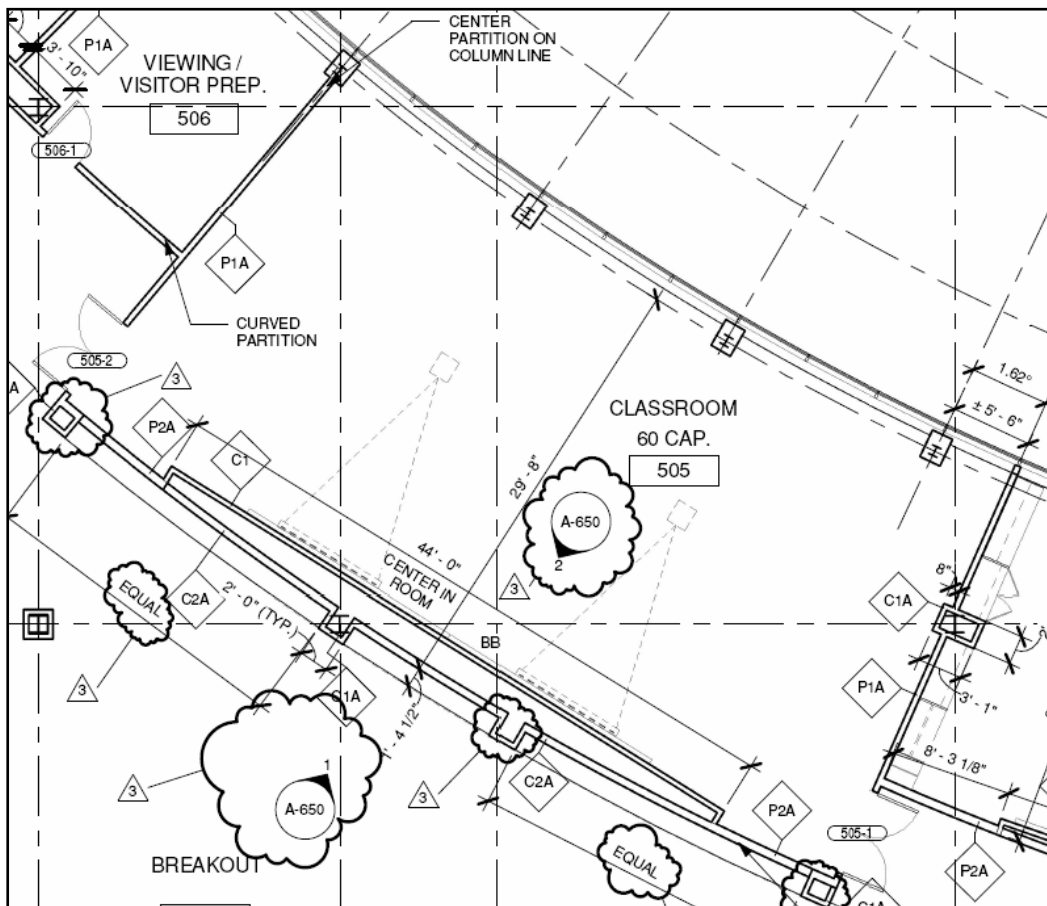


Figure 25: Classroom Floor Plan

Design Concept

The design concept of the classroom 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 be user friendly with only switching to turn the lights on and off. The front row of lights will be on a separate switch in order to provide sufficient lighting for the chalkboard/whiteboard. The 2x2 fixtures throughout the room will provide a sufficient area source of light. A fluorescent wall mounted light will be on top of the chalkboard to provide adequate illuminance.

Design Criteria*Daylighting Integration and Control*

The space incorporates a curved ribbon window on the entire rear wall of the room. This will be a design issue during the use of the projector and screen and may even cause glare on the blackboard. Dual/Solar blackout blinds will remedy this potential problem; however, they will also limit the daylight in the space.

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, so a non-uniform pattern of light on the task plane would be distracting and/or confusing. In a learning environment, the task plane illuminance should be 1.5 to 3 times higher than those in the surrounding areas in order to assist occupant's attention on the task at hand.

System Control and Flexibility

System control and flexibility are of extreme importance in the space due to the various tasks provided in the classroom. A couple of different scenes of the space include the projection screen, blackboard/whiteboard applications, and general lecture talks. This will be accomplished by the front row of luminaires to be on a separate switch.

Illuminance (Horizontal)

The IESNA Handbook recommends a horizontal illuminance of 500 lux (50 fc) on the task plane for reading and writing tasks. When the projection screen is in use, a

horizontal illuminance of 30 lux (3 fc) on the task 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: 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 – 1.6 W/ft².

Reflectances

Ceiling: Acoustical Ceiling Tile

- Assume 85% ceiling reflectance

Walls: To Be Determined

- Assume 50% wall reflectance

Floor: To Be Determined

- Assume 50% floor reflectance

Fixture Schedule

Label	Description	Lamps	Ballast/ Transformer	Watts	Voltage	Mfr.	Catalogue No.
F-B1	2x2 Parabolic Grid Troffer with Specular Louver Finish	3 – F17T8	B-D1 - Advance Electronic Dimming/Instant Start Mark 10 PowerLine	51	277	Holophane	1-HP-G-N-22-X-N-D33-023-EP-1-2
F-B2	Obround Wall Mount Luminaire with Specular Aluminum Reflector	2 – F40T8	B-D2 – Advance Electronic/Instant Start Optanium	80	277	LAM Lighting	OB70-2/T8-O-L-WN-8-SGW-277-GLR

Table 16: Classroom 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%.

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

$$RCR = [(5)*(10')*(32' + 54')] / (32')*(54') = 2.49 = 2.5$$

Label	Maintenance Category	LLD	RSDD	LDD	BF	LLF
F-D1	IV	0.95	0.98	0.93	1.05	0.91
F-D2	IV	0.93	0.98	0.93	1.03	0.87

Table 17: Classroom Light Loss Factors

Ballast Information

Label	Type	Ballast Watts	Ballast Factor	Voltage	Max THD %	Mfr.	Catalogue No.
B-D1	Electronic Dimming/ Instant Start/ 3-Lamp	56	1.05	277	10	Advance - Mark 10 PowerLine	VEZ-3S32-SC
B-D2	Electronic/Instant Start/2-Lamp	81	1.03	277	10	Advance - Optanium	VOP-4P32-SC

Table 18: Classroom Ballast Information

Lamp Information

Label	Type	CRI	CCT	Watts	Initial Lumens	Mean Lumens	Mfr.	Ballast
L-D1	F17T8 TL841 ALTO TG	85	4100	17	1400	1330	Philips	B-D1 - Advance Electronic Dimming/Instant Start Mark 10 PowerLine
L-D2	F40T8 TL841 ALTO	86	4100	40	3775	3500	Philips	B-D2 - Advance Electronic/Instant Start Optanium

Table 19: Classroom Lamp Information

Power Density

Label	Ballast Watts	No. of Fixtures	Total Watts	
F-D1	59	28	1652	
F-D2	81	4	324	
			1976	Watt Total
			1506	Square Foot Total
1.31 W/ft²				

Table 20: Classroom Power Density

Therefore, the power density is slightly below the target IESNA value of 1.4 W/ft² to 1.6 W/ft². The space is at an appropriate illuminance level, so the power density is sufficient.

Lighting Plan

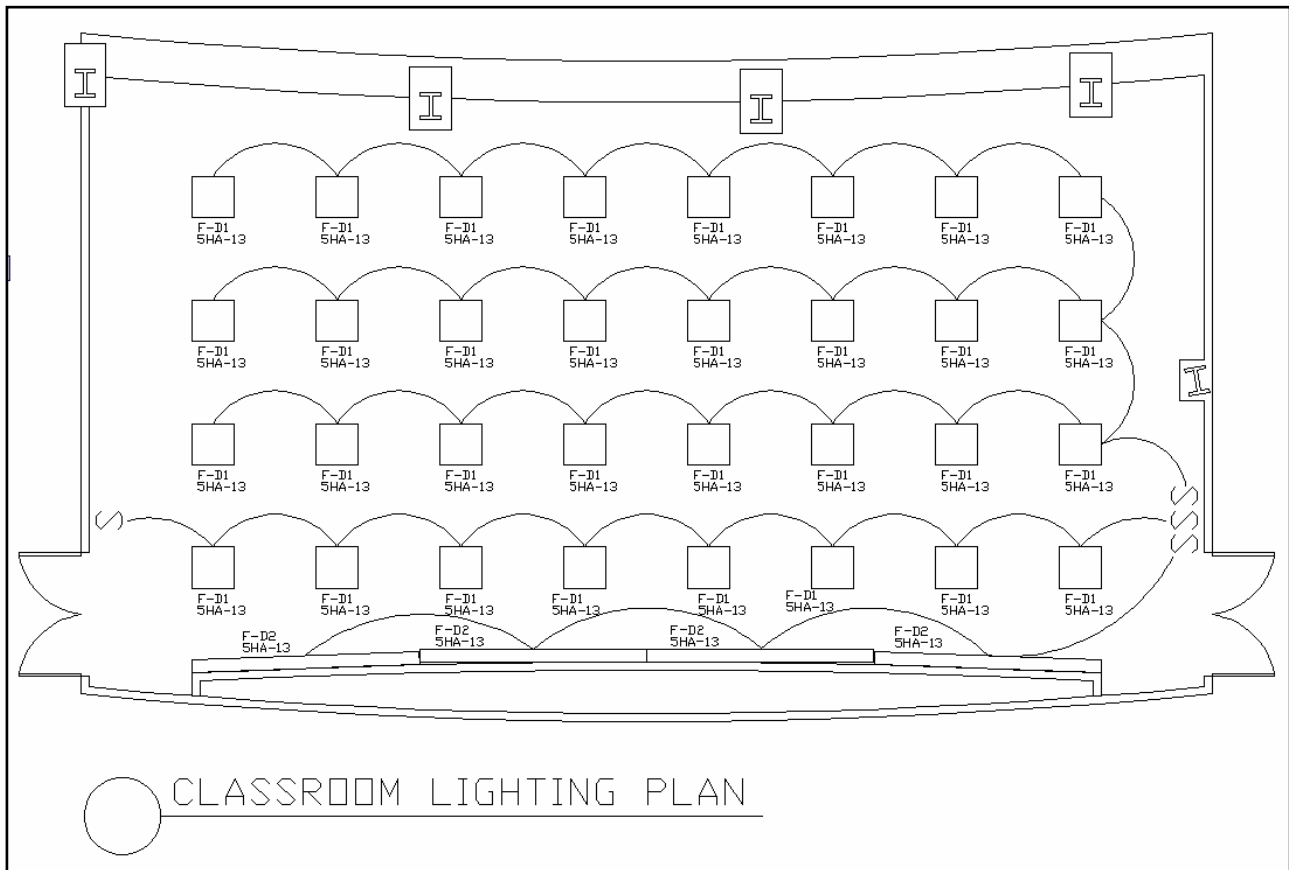


Figure 26: Classroom Lighting Plan

Lighting Controls

The classroom will use two dual technology occupancy sensors due to the size of the classroom. The sensors will be located in two rear corners of the classroom. The sensors can accommodate lower levels of activity without false triggers. Dimming ballasts are specified for use with these lighting controls.

Isometrics

The Isolines from AGI32 were analyzed on the work plane height of 2.5'. The average illuminance throughout the classroom was 49.66 fc.

Value (Fc)	Color
30	Black
40	Blue
50	Green
60	Cyan

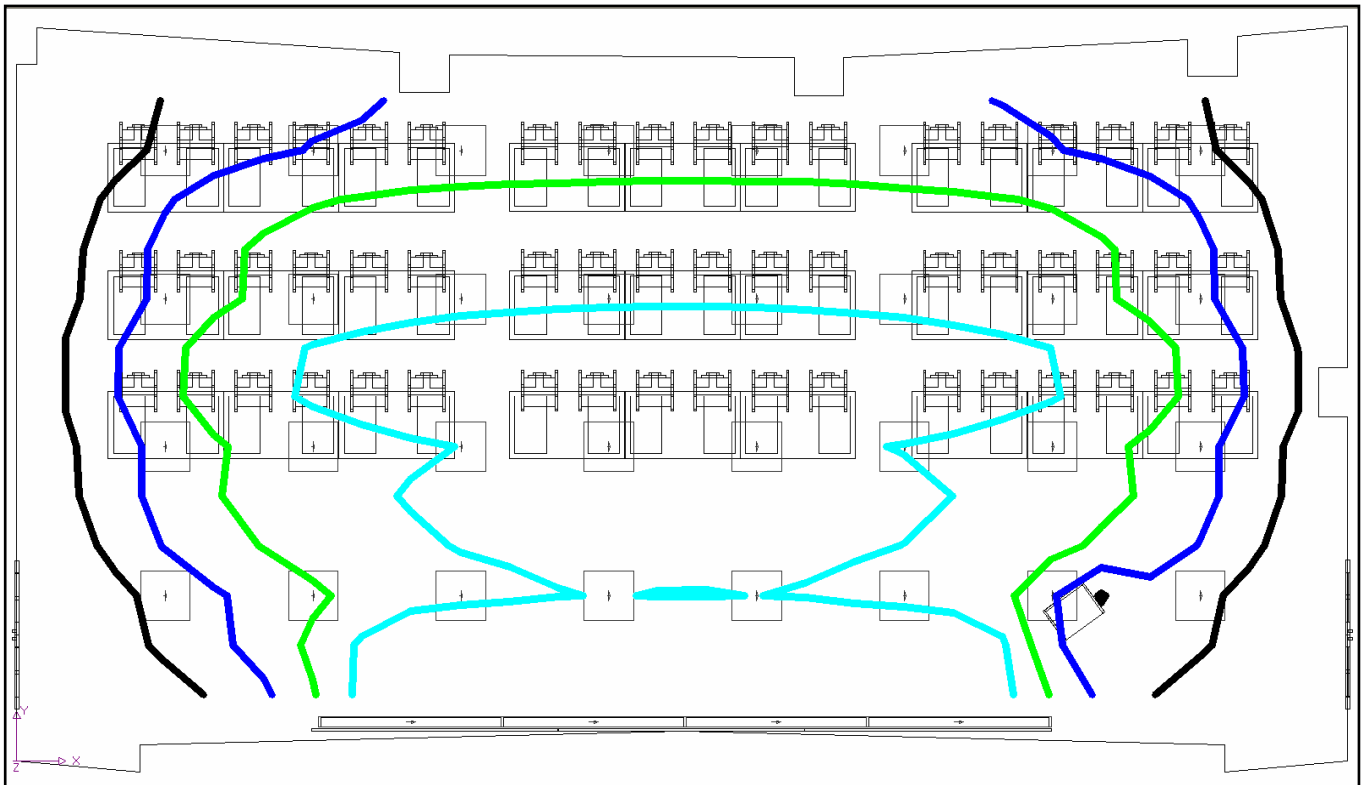


Figure 27: View of Isolines of Classroom

Renderings



Figure 28: Rendering of Classroom



Figure 29: Rendering of Classroom

Conclusion

Overall, the lighting design achieved the space design goals. The 2 by 2 fixtures worked well in accordance with the acoustical tile ceiling grid and provided sufficient light onto the workplane. The average illuminance on the work plane was 49.6 fc, which almost matched the IESNA value for a classroom of 50 fc. The power density was 1.31 W/ft², which was under the ASHRAE 90.1 Standards of 1.4 W/ft² for a classroom.