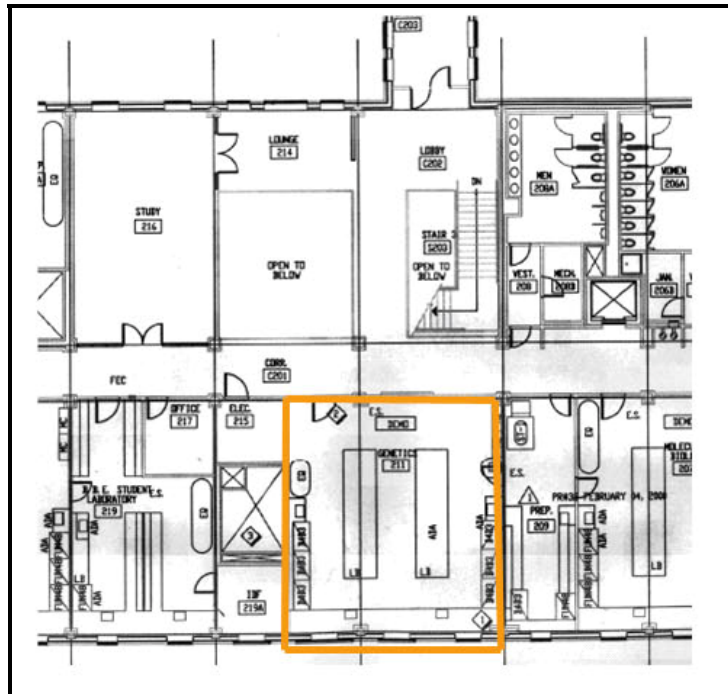




Genetics Laboratory

Space Description

The Genetics Laboratory is located on the second floor of the laboratory building. The main functions of this space are as a learning and research area. There is a white board located on the north wall to facilitate with teaching.



Surface Materials		
Surface	Material	Reflectance
Ceiling	Acoustic Ceiling Tile	80%
Walls	Painted Gypsum Wall Board	75%
Floor	Vinyl Composition Tile	32%
Doors	Solid Core Wood (Maple)	31%
Glazing	Sealed Insulating Glass	16%
		Transmittance: 48%



Design Criteria

The IESNA Lighting Handbook was referenced for the design criteria.

There are many design considerations and criteria in this space. There is a white board at the front of the room which provides a focal point. There will also be a lot of research being performed here, so there should be a good visibility. The luminaires should be spaced as to contribute to an orderly and academic atmosphere as opposed to a chaotic one. Direct glare should be avoided so that people who are in the laboratory for an extended period of time performing tedious experiments do not become uncomfortable due to it. Light distribution on the lab benches is also extremely important. Demonstrations and experiments will be performed there along with note taking and reading. Therefore, the lab benches should be well illuminated. The task plane illuminance should be 50fc, with 30fc falling vertically on the white board.

Design Concept

The focus of the genetics laboratory should be either on the speaker at the front of the room while demonstrations are going on or on the research being performed on the lab benches. The goals of this design are to provide a clean, productive atmosphere. Light should be focused on the lab benches and on the white board at the front of the room. Two solutions were analyzed for this space. The first utilized direct/ indirect luminaires and the second utilized direct luminaires as the main source of light.

Luminaire Schedule

SOLUTION 1

Luminaire Schedule									
Type	Description	Lamp			Mounting	Ballast			
		Number	Type	Watts		PF	BF	Watts	Input Current
F1	1'x4' Direct/ Indirect	2	T8	32	Recessed	> 0.95	0.88	30	0.27
WW1	Wall Washer	1	T5HO	54	Recessed	>0.98	1.00	62	0.51

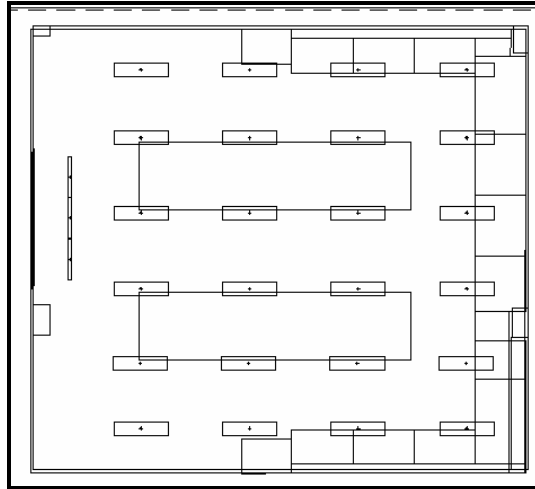
SOLUTION 2

Luminaire Schedule									
Type	Description	Lamp			Mounting	Ballast			
		Number	Type	Watts		PF	BF	Watts	Input Current
F2	1'x4' Louvered	2	T8	32	Recessed	> 0.95	0.88	30	0.27
WW1	Wall Washer	1	T5HO	54	Recessed	>0.98	1.00	62	0.51



Lighting Plan

SOLUTION 1 & SOLUTION 2



Both Solution 1 and Solution 2 have the same layout. For Solution 1, all of the 1'x4' fixtures are type F1 and for solution 2, all of the 1'x4' fixtures are type F2. The wall washers are type WW1 for both solutions.

Controls

Both solutions will be controlled with 3-way wall switches. F1 and F2 will both be dimmable in order to adjust the light for research or different presentations where low light level may be necessary. Refer to Appendix A for the control specifications and the Electrical Depth section for circuiting.

Light Loss Factors

SOLUTION 1

Luminaire	Ballast Factor	Cleaning Interval	Maintenance	LLD	RSDD	LDD	LLF
F1	0.88	Clean (12 months)	IV	0.85	0.94	0.89	0.63
WW1	1.00	Clean (12 months)	IV	0.89	0.98	0.89	0.78

SOLUTION 2

Luminaire	Ballast Factor	Cleaning Interval	Maintenance	LLD	RSDD	LDD	LLF
F2	0.88	Clean (12 months)	IV	0.85	0.98	0.89	0.65
WW1	1.00	Clean (12 months)	IV	0.89	0.98	0.89	0.78

The light loss factors for each solution are very close. F1 and F2 only differ by 0.02.



Power Density

SOLUTION 1

Luminaire	# Lamps	Ballast Watts	Total Watts
F1	48	30	1440
WW1	3	62	186
TOTAL WATTS			1626
AREA (ft2)			1186
POWER DENSITY (W/ft2)			1.37

SOLUTION 2

Luminaire	#	Ballast Watts	Total Watts
F2	48	30	1440
WW1	3	62	186
TOTAL WATTS			1626
AREA (ft2)			1186
POWER DENSITY (W/ft2)			1.37

Because F1 and F2 use the same lamp, a 32W T8 fluorescent, and the layouts are the same, the power density does not differ between the two spaces. The allowable power density for this space is 1.4W/s.f. according to ASHRAE 90.1. Each solution has a power density of 1.37 W/s.f. Therefore, each solution has an acceptable power density for this space.

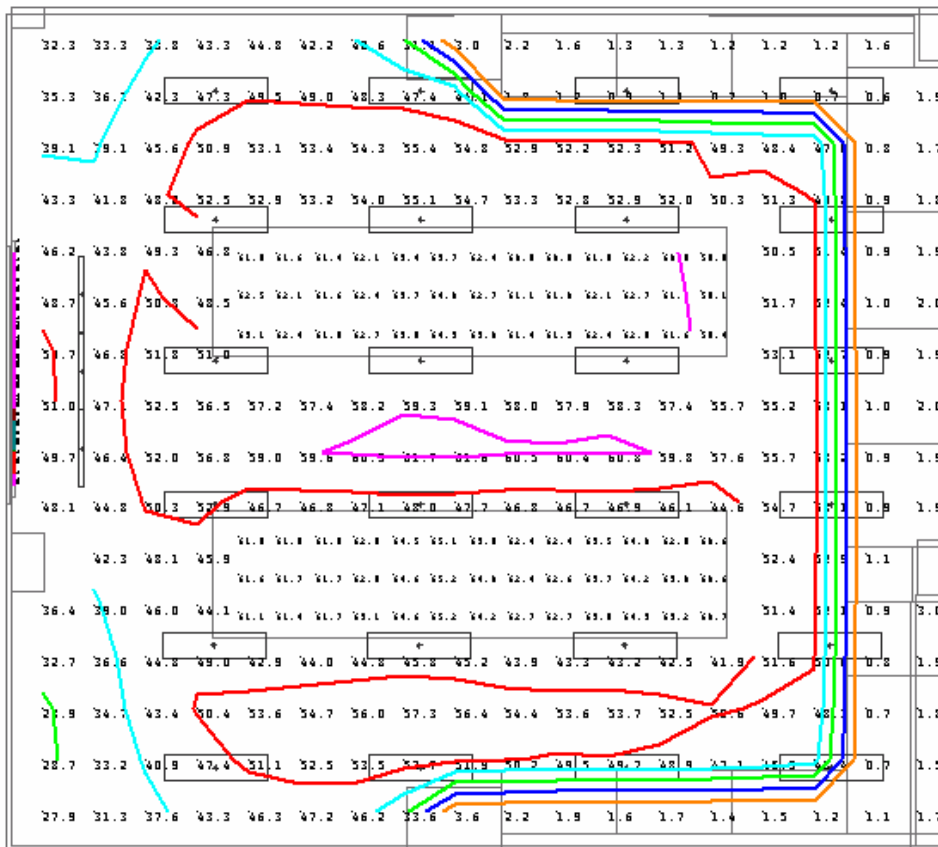


Isolines

ISOLINE VALUES

Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
10	Orange	50	Red	90	Teal
20	Blue	60	Magenta	100	Brown
30	Green	70	Dark Blue		Purple
40	Cyan	80	Dark Green		Olive

SOLUTION 1

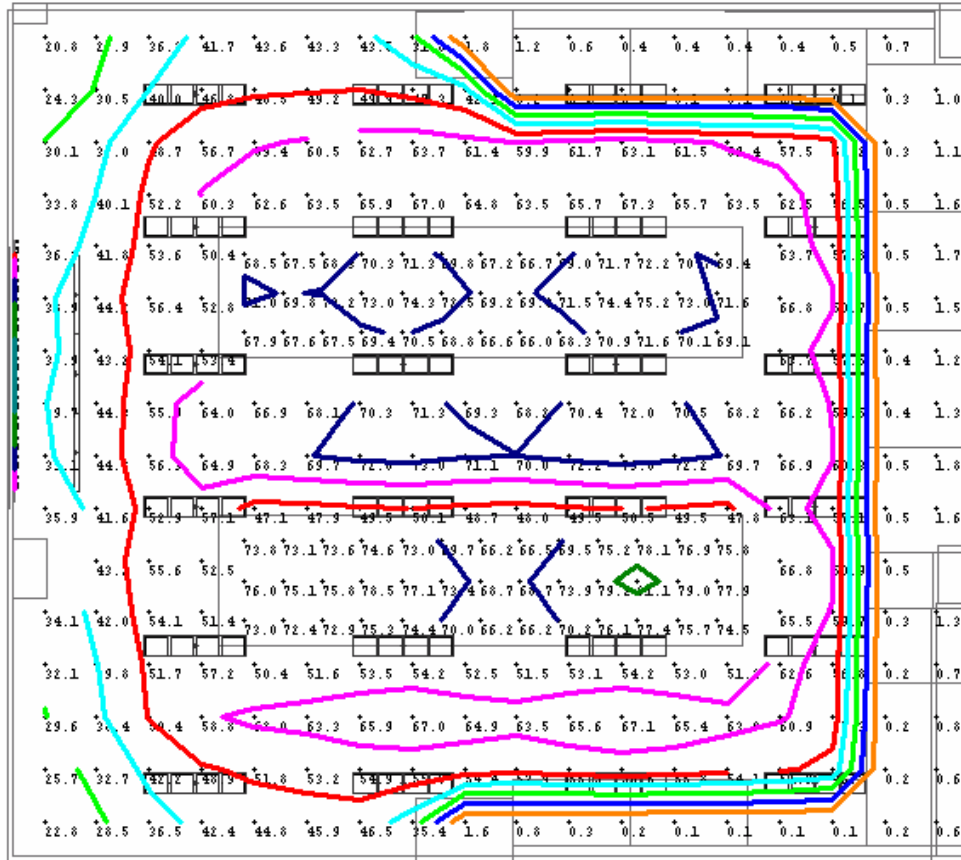


Solution 1 Illuminance Values:

- Floor: 38 fc
- White Board: 55 fc
- Lab Bench: 60 fc



SOLUTION 2



Solution 2 Illuminance Values:
Floor: 42 fc
White Board: 55 fc
Lab Bench: 70 fc

While both solutions exceed the necessary illuminance levels, F1 and F2 can be dimmed. Solution 1 provides the best solution, as far illuminance levels are concerned, because its illuminance levels are the closest to the necessary ones.



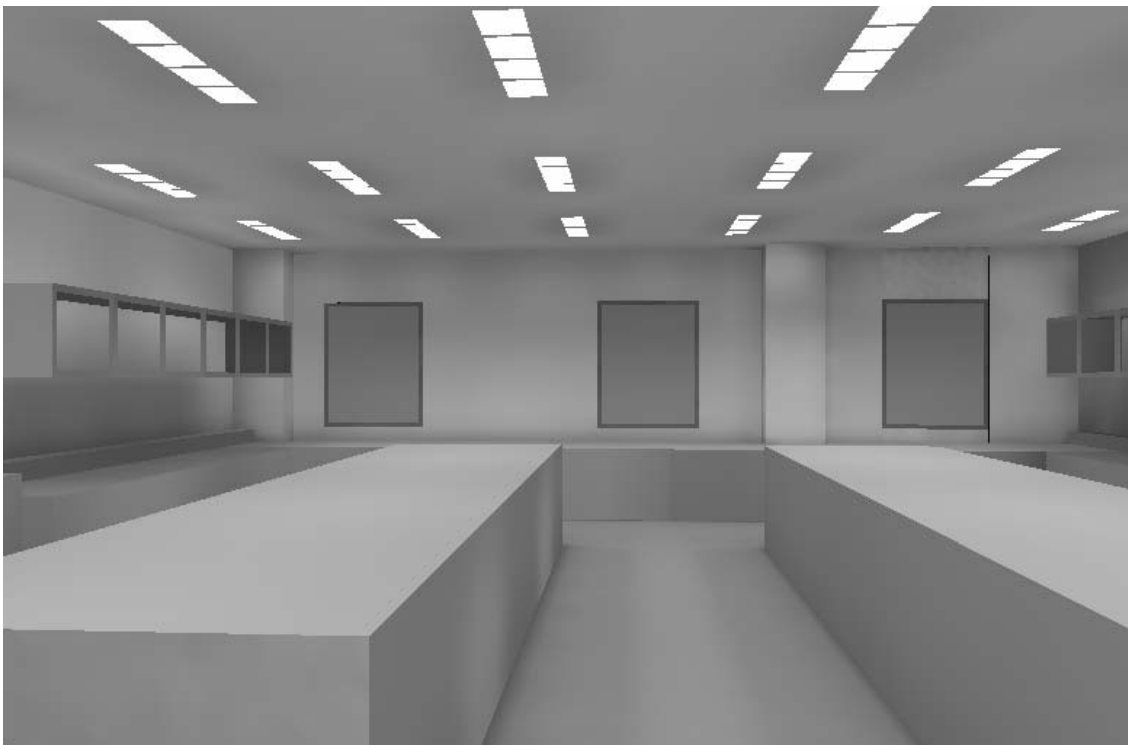
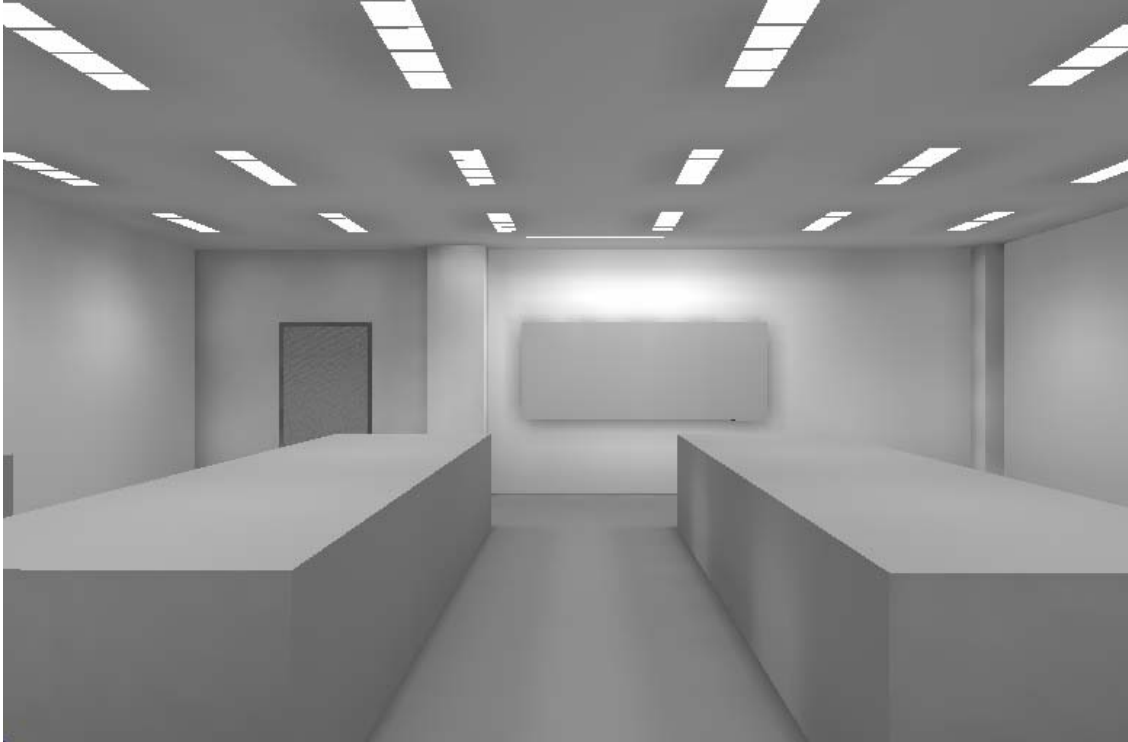
Renderings

SOLUTION 1





SOLUTION 2





Conclusions

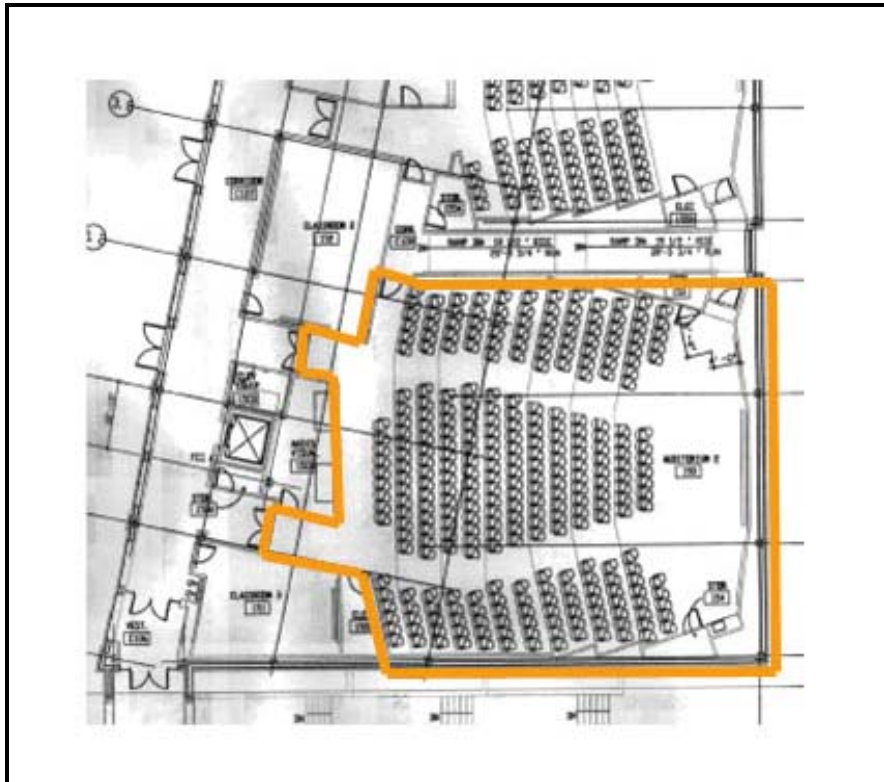
The wall washers focus the attention on the white board and the front of the room during lectures and demonstrations. Fixtures F1 and F2 both provide light for the lab benches and general ambient lighting. Because both layouts were the same, and both F1 and F2 used the same lamp, each solution had the same power density. The light loss factors for F1 and F2 were also extremely close. Both solutions did exceed the necessary illuminance levels, but because research is being performed and F1 and F2 are dimmable, this should be okay. Overall, in comparison, Solution 1 is the best solution of the two studied. The direct/ indirect fixtures provide levels of illuminance that are closest to the necessary levels. These fixtures will also provide less of a glare within the space, which will be beneficial if students are recording research results on their laptops. Both solutions provide an academic and clean atmosphere for research and learning.



Auditorium

Space Description

The auditorium is located on the first floor of the classroom building. There are approximately 300 seats. Since the room is used primarily for class lectures, there are 2 white boards, 2 white boards on a horizontal track, and a projection screen mounted over the tracked white boards on the east wall. The space can also be used for guest speakers. The auditorium is located on the first floor of the classroom building.





Surface Materials		
Surface	Material	Reflectance
Ceiling	Acoustic Ceiling Tile	83%
	Gypsum Wall Board	65%
Walls	Acoustic Wall Panels	80%
Floor	Vinyl Composition Tile	32%
	Carpet	20%
Doors	Solid Core Wood (Maple)	31%
Glazing	Float Glass Type I	16%
		Transmittance: 48%

Design Criteria

The IESNA Lighting Handbook was referenced for the design criteria.

There are many design considerations and criteria in this space. The white boards at the front of the room provide a main focal point for this space. The atmosphere of this room should be very academic, well lit and clean. Facial modeling is also important as another main focus will be whoever is speaking at the front of the room.

Design Concept

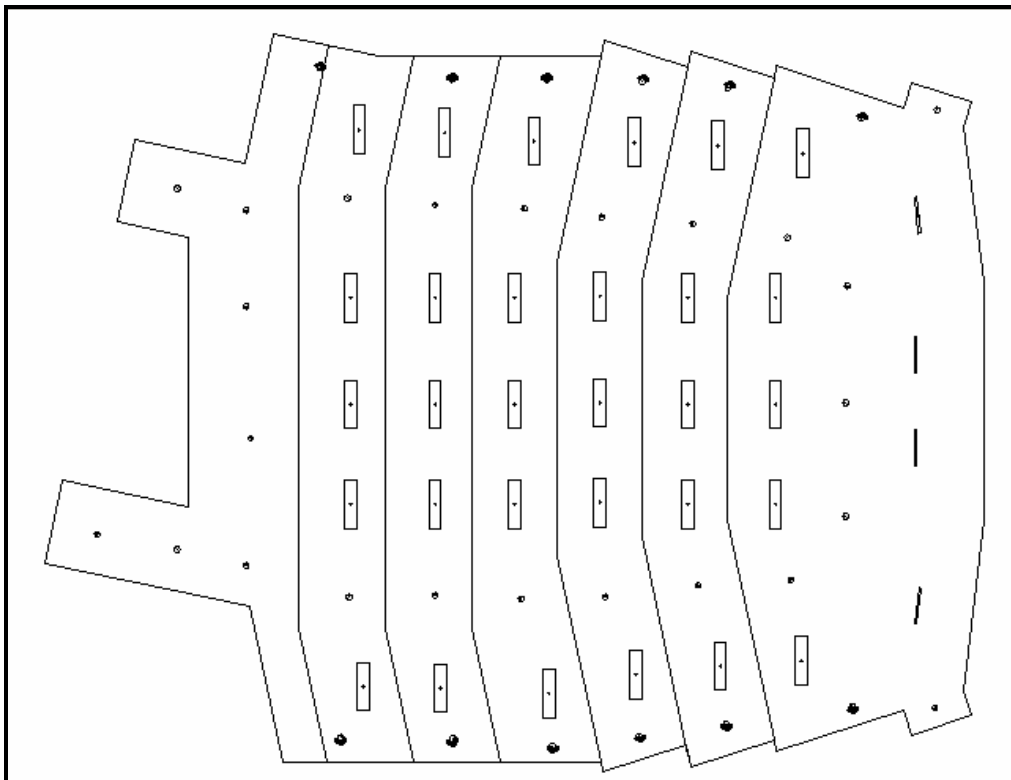
Various activities will take place here. Classes will be held on a regular basis along with guest speakers throughout the year. Therefore, the lighting in this space should be flexible and allow for various light levels. It should not be distracting as the focus should be on the speaker or presentation.



Luminaire Schedule

Luminaire Schedule									
Type	Description	Lamp			Mounting	Ballast			
		Number	Type	Watts		PF	BF	Watts	Input Current
D1	Downlight	1	CFQ	13	Recessed	0.97	1.00	13	n/a
F1	1'x4' Direct/ Indirect	2	T8	32	Recessed	> 0.95	0.88	30	0.27
WW1	Wall Washer	1	T5HO	54	Recessed	>0.98	1.00	62	0.51
WW3	Downlight/ Wall Washer	1	CFQ	13	Recessed	0.97	1.00	13	n/a

Lighting Plan



NOTE:

1. All downlights type D1.
2. All 1'x4' fixtures type F1.
3. All downlight/ wall washers type D2.
4. All wall washers type WW1.



Controls

The auditorium is controlled through a dimming panel. There are varying zones that allow for various light levels, depending on the task at hand. Refer to the Electrical Depth for circuiting.

Light Loss Factors

Luminaire	Ballast Factor	Cleaning Interval	Maintenance	LLD	RSDD	LDD	LLF
D1	1.00	Clean (12 months)	V	0.86	0.97	0.89	0.74
F1	0.88	Clean (12 months)	IV	0.89	0.94	0.89	0.66
WW1	1.00	Clean (12 months)	IV	0.89	0.98	0.89	0.78
WW3	1.00	Clean (12 months)	IV	0.86	0.97	0.89	0.74

Power Density

Luminaire	#	Ballast Watts	Total Watts
D1	26	13	338
F1	60	30	1800
WW1	4	62	248
WW3	10	13	130
		TOTAL WATTS	2516
		AREA (ft ²)	3875
		POWER DENSITY (W/ft ²)	0.65

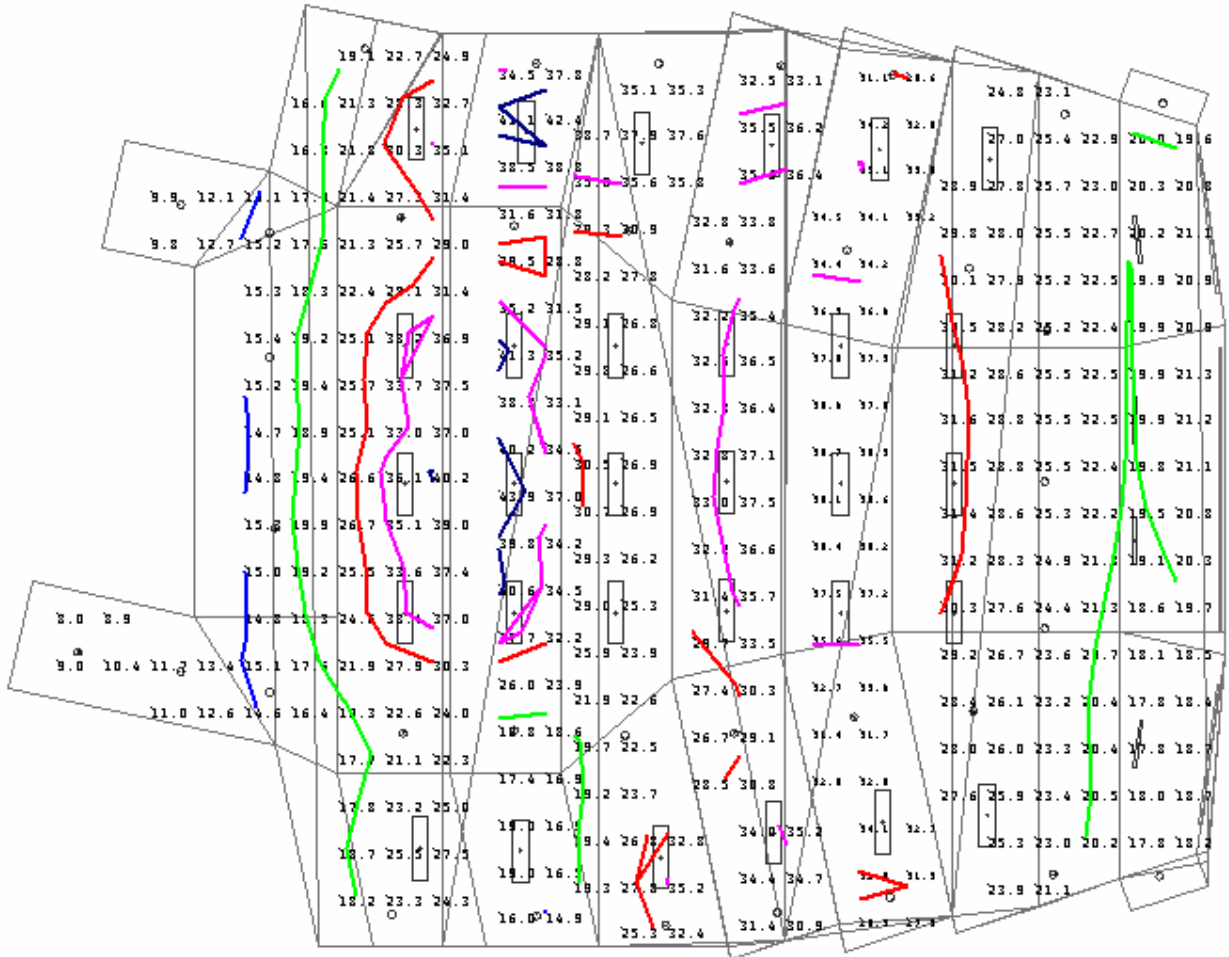
According to ASHRAE 90.1, the allowable power density for this space is 1.4 W/s.f. The auditorium power density is only 0.65 W/s.f., which is acceptable.



Isolines

ISOLINE VALUES

Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
5	Black	30	Red	50	Teal
15	Blue	35	Magenta	60	Brown
20	Green	40	Dark Blue	70	Purple
252	Cyan	45	Dark Green	80	Olive

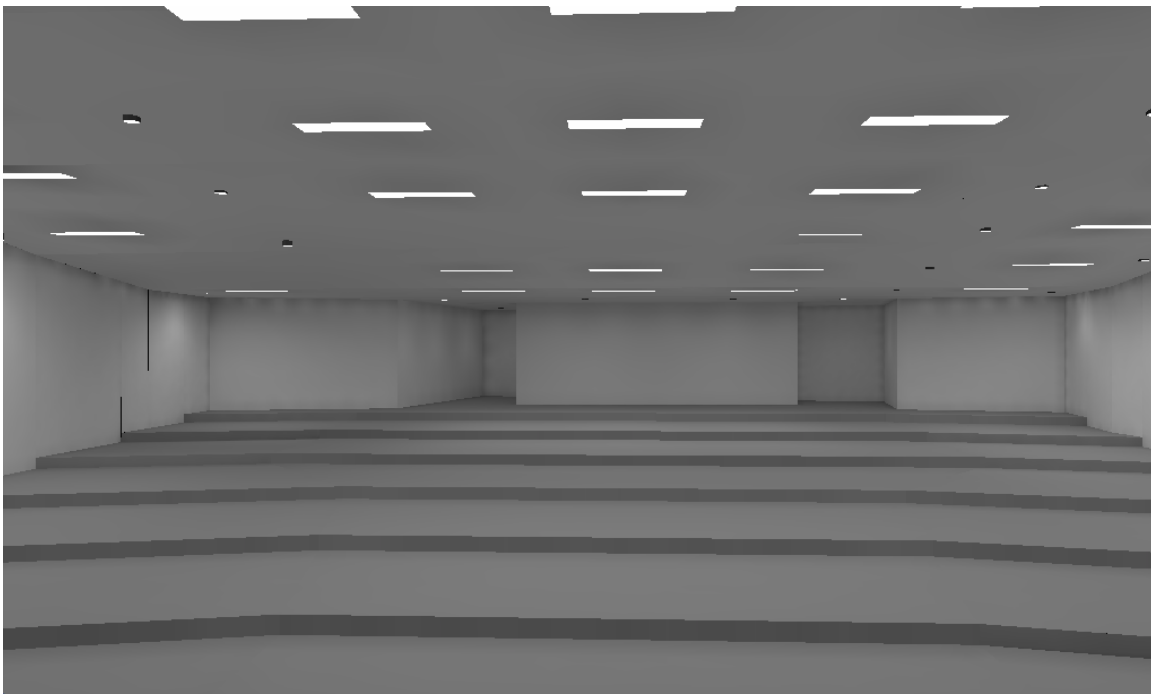
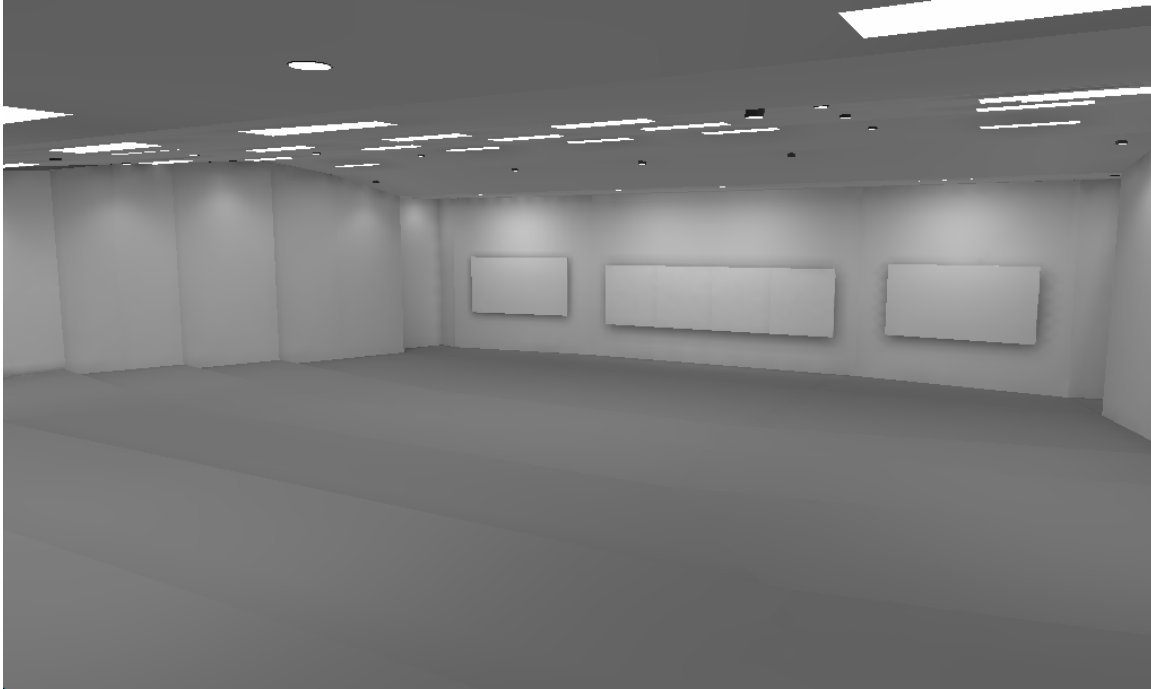


ILLUMINANCE VALUES:
 Floor: 30 fc
 Task: 35 fc

Lindsay Rekuc
Virginia Commonwealth University Life Sciences Building
Richmond, VA



Renderings



Lindsay Rekuc
Virginia Commonwealth University Life Sciences Building
Richmond, VA



Conclusions

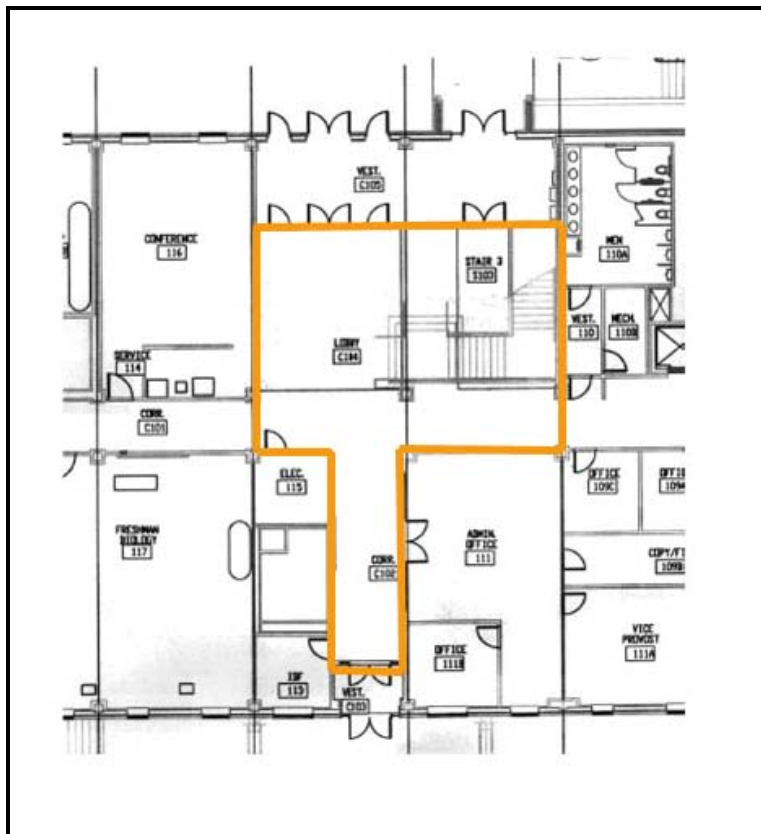
The auditorium lighting design provides an academic atmosphere with flexibility. It is a bit lower than the recommended illuminance values though. In the other areas of consideration, this is an adequate design. The power density of 0.65 W/s.f., is below the allowable 1.4 W/s.f. The control system also allows for many different light levels; this important in that many tasks will take place here. Classes will be held on a daily basis in which students will be taking notes or viewing PowerPoint presentations. Guest speakers will also be coming to the university and presenting here. The lighting design puts the focus on the front of the room with the speaker and the white boards, while allowing the audience to take notes when necessary.



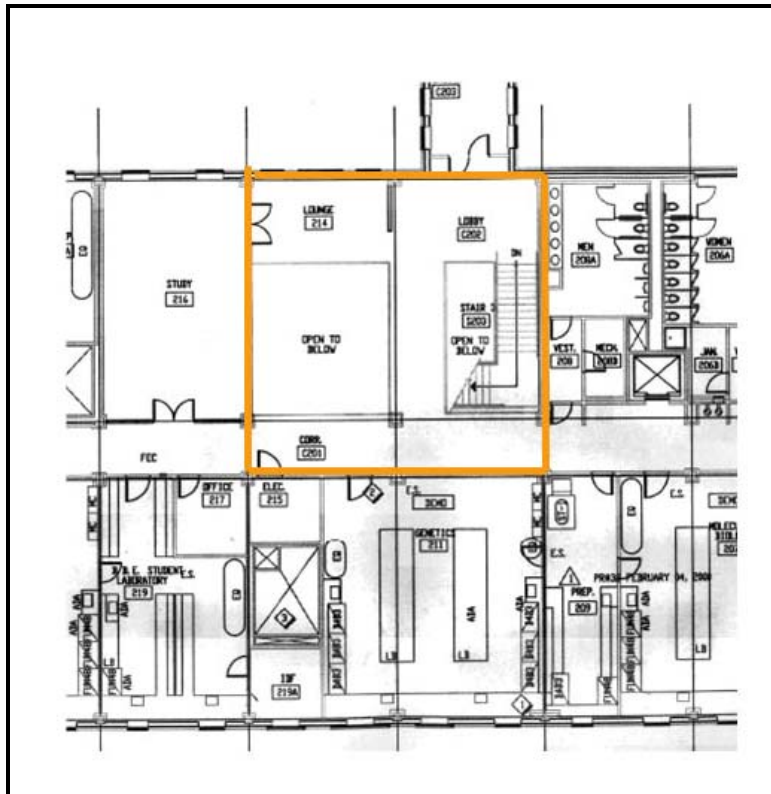
Lobby

Space Description

The main lobby is located in the laboratory building both on the first and second floors with an open staircase connecting the two. There are exterior entrances on both the north and south ends of the 1st floor lobby and an entrance on the second floor from the bridge that connects the second floors of the laboratory and classroom buildings. There is also space on the second floor that is open to below.



Lobby: First Floor



Lobby: Second Floor

Surface Materials		
Surface	Material	Reflectance
Ceiling	Acoustic Ceiling Tile	83%
	Gypsum Wall Board	60%
Walls	Gypsum Wall Board	60%
	Wood Paneling	16%
Floor	Vinyl Composition Tile	32%
	Slate	29%
Doors	Solid Core Wood (Maple)	31%
Glazing	Sealed Insulating Glass	16%
		Transmittance: 48%



Design Criteria

The IESNA Lighting Handbook was referenced for the design criteria.

The appearance of the lobby and luminaires is extremely important as this is the first area someone sees when they walk into the building. It is important for the lobby to represent the building in a positive way and to provide direction. There is wood paneling on the walls, so the lighting should highlight this and give the space a very vibrant, but natural feel. The main focal points in the lobby should be the stairway and the entrances. The lobby should also have a very inviting and warm atmosphere.

Design Concept

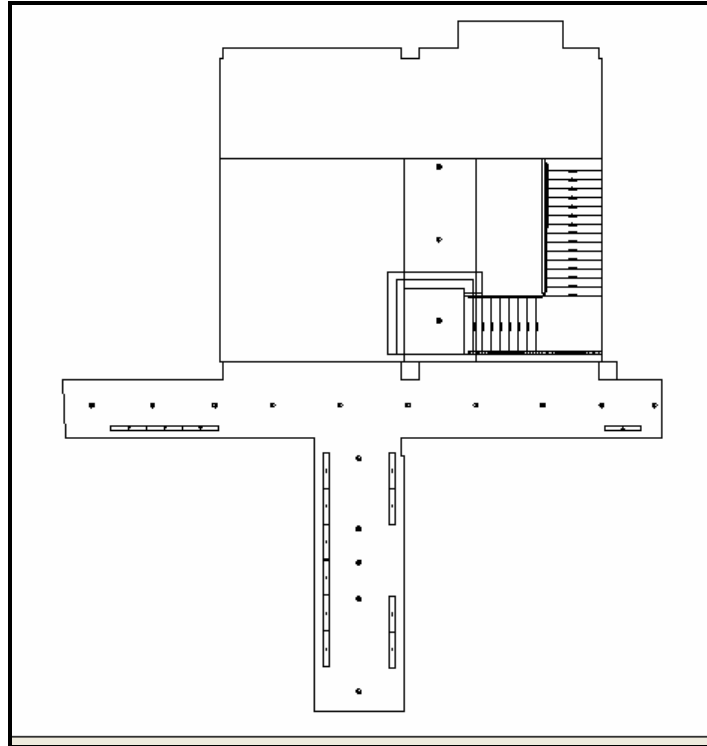
The lobby should draw people into the building and then direct them. Wall washers lead the way down the hallways and highlight the wood paneling. The chandelier draws people into the center of the space and towards the stairwell. The downlights provide ambient lighting throughout the spaces.

Luminaire Schedule

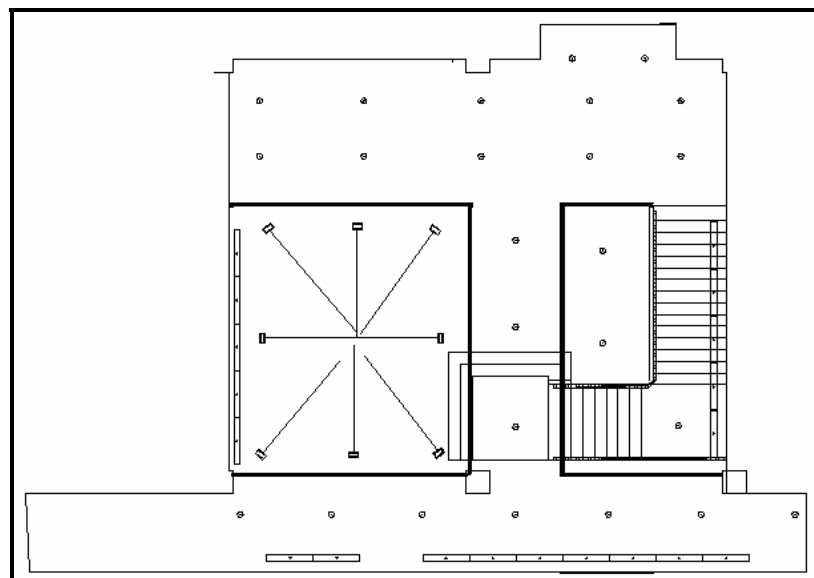
Luminaire Schedule									
Type	Description	Lamp			Mounting	Ballast			
		Number	Type	Watts		PF	BF	Watts	Input Current
D1	Downlight	1	CFQ	13	Recessed	0.97	1.00	13	n/a
S1	Steplight	1	CFQ	13	Recessed	0.97	1.00	13	n/a
T1	Track	1	MR16	50	Recessed	n/a	n/a	n/a	n/a
WW2	Wall Washer	1	T8	32	Recessed	0.95	0.88	30	0.12



Lighting Plan



Lobby: First Floor Lighting Plan



Lobby: Second Floor Lighting Plan



NOTE:

1. All down lights type D1.
2. All track fixtures type T1.
3. All wall washers type WW2.
4. All step lights type S1.

Controls

The lobby is controlled with wall switches located throughout the space. They control all of the corridor lighting and lobby lighting. There is no daylight to supplement the electric lighting in the lobby, so the lighting should be on when the building is in use. The lobby and corridor luminaires are not dimmable and are intended to be used at their full power. Refer to the Electrical Depth for circuiting.

Light Loss Factors

Luminaire	Ballast Factor	Cleaning Interval	Maintenance	LLD	RSDD	LDD	LLF
D1	1.00	Clean (12 months)	IV	0.86	0.97	0.89	0.74
S1	1.00	Clean (12 months)	IV	0.86	0.96	0.89	0.73
T1	1.00	Clean (12 months)	IV	0.88	0.97	0.89	0.76
WW2	0.88	Clean (12 months)	IV	0.85	0.97	0.89	0.65

Power Density

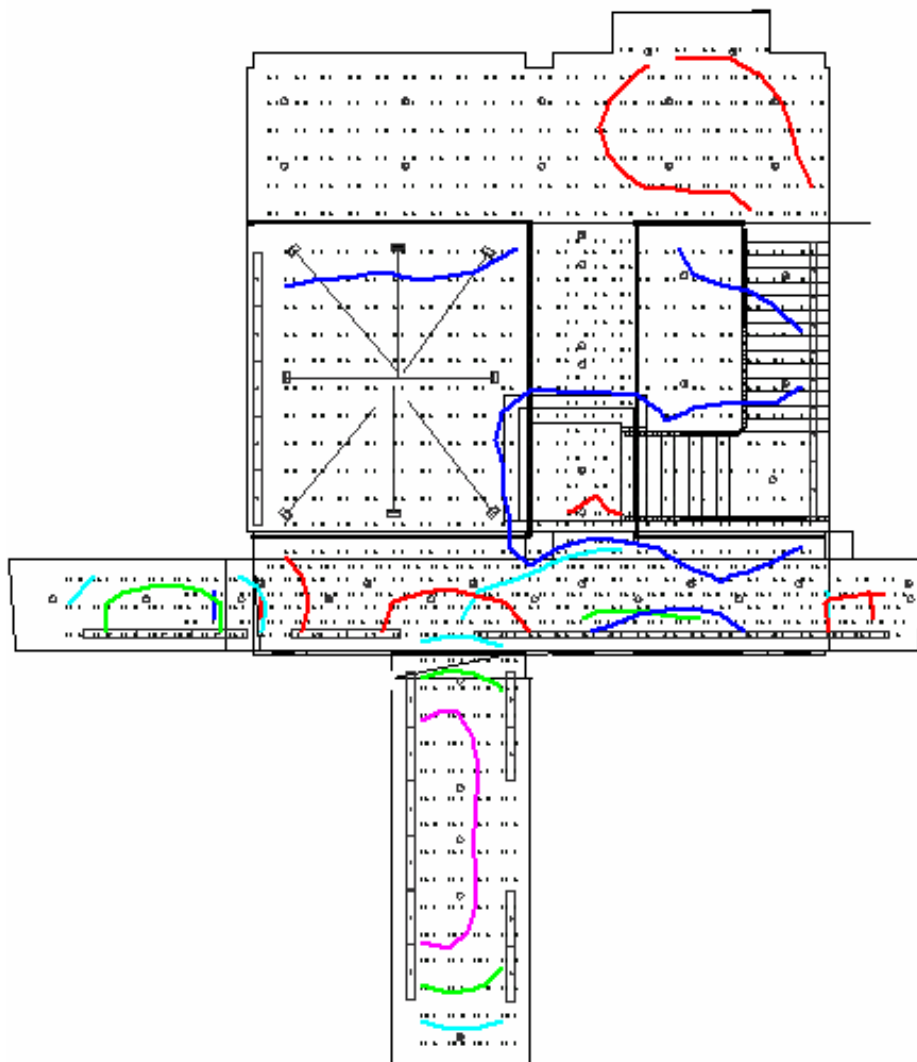
Luminaire	#	Ballast Watts	Total Watts
D1	46	13	598
S1	23	13	299
T1	8	50	400
WW2	33	30	990
		TOTAL WATTS	2287
		AREA (ft ²)	2660
		POWER DENSITY (W/ft ²)	0.86

According to ASHRAE 90.1, the allowable power density in the lobby is 1.3 W/s.f. The power density for this design is 0.86 W/s.f. which is below what is allowable and therefore acceptable.



Isolines

Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
2	Orange	20	Green	40	Teal
5	Blue	25	Magenta	45	Dark Red
10	Red	30	Dark Blue	50	Purple
15	Cyan	35	Dark Green		Olive



ILLUMINANCE VALUES:
First Floor: 10 fc
Second Floor: 10 fc



Renderings



Conclusions

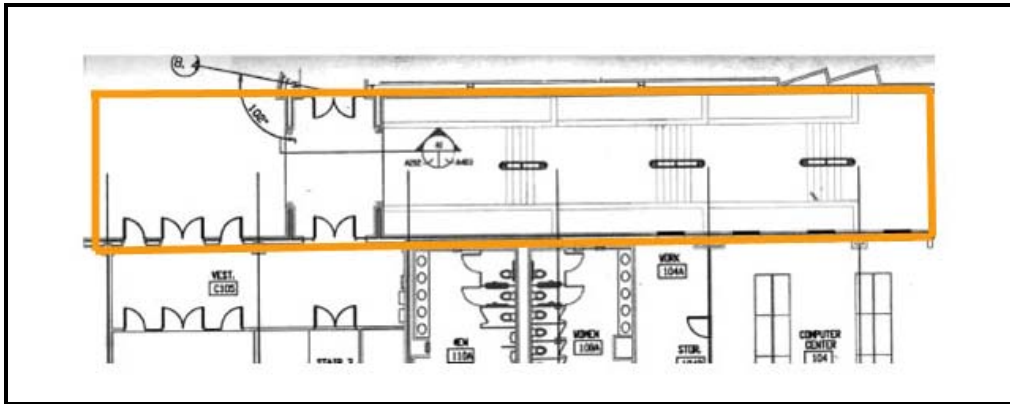
The design criteria and goals were achieved through the use of wall washers, down lights, and the chandelier fixtures. The wall washers highlight the wood paneling throughout the lobby area giving it a vibrant feel while providing direction. The down lights provide ambient light throughout the space. The pendant fixture draws people into the center of the lobby and towards the main corridor and stairway. It also serves to provide aesthetic appeal. The power density of 0.86 W/s.f. is well below the allowable 1.3 W/s.f.



Exterior

Space Description

The exterior area being considered is the narrow area between the classroom and laboratory buildings. The classroom building is on the northeast and is two stories tall. The laboratory building on the south is three stories tall. There is also a bridge overhead that connects the second floors of both buildings. This area is the main area of entrance to the laboratory building for students.



Surface Materials		
Surface	Material	Reflectance
Exterior Walls	Brick	20%
	Precast Concrete	38%
Ground	Grass	9%
	Concrete	40%
Doors	Solid Core Wood (Maple)	31%
Glazing	Sealed Insulating Glass	16%
		Transmittance: 48%



Design Criteria

This exterior area is used as a main circulation space for anyone using the two buildings or just passing through. The main task is to direct people as to where to go. Because it is outside and such a narrow, but tall, space, it is necessary that it be illuminated well in order for people to see where they are going. There are also a few steps which are important to be illuminated at night. The recommended illuminance value is 5fc.

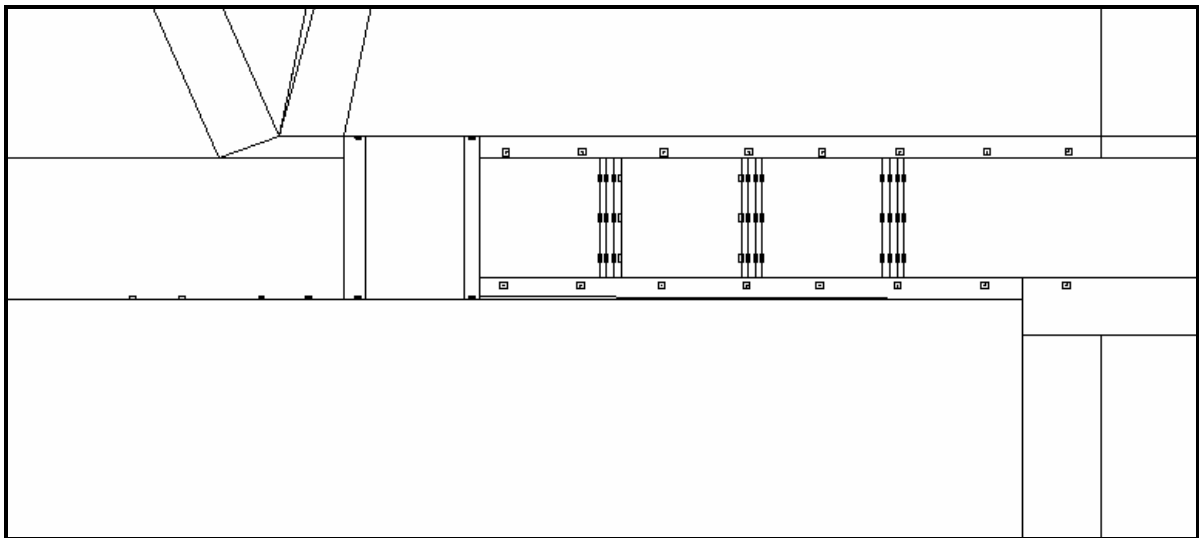
Design Concept

This area should have a safe atmosphere. It should be well lit at night because of the steps and also for facial modeling. People traversing this area should be able to understand where they are going and recognize building entrances.

Luminaire Schedule

Luminaire Schedule									
Type	Description	Lamp			Mounting	Ballast			
		Number	Type	Watts		PF	BF	Watts	Input Current
FL1	Flood	1	MH	70	Surface	>0.97	0.95	80	n/a
S2	Steplight	1	CFQ	18	Recessed	0.97	1.00	19	0.08
SC1	Wall Sconce	1	MH	70	Surface	>0.97	0.95	80	n/a

Lighting Plan





Controls

The exterior lights are controlled through the use of a time clock. This way they will automatically turn on every night and off every morning. Refer to Appendix A for control specifications and the Electrical Depth for circuiting.

Light Loss Factors

Luminaire	Ballast Factor	Cleaning Interval	Maintenance	LLD	RSDD	LDD	LLF
FL1	0.95	Medium(12 months)	IV	0.71	0.92	0.81	0.50
SC1	0.95	Clean (12 months)	IV	0.71	0.95	0.89	0.57
S2	1.00	Medium (12 months)	IV	0.86	0.92	0.81	0.64

Power Density

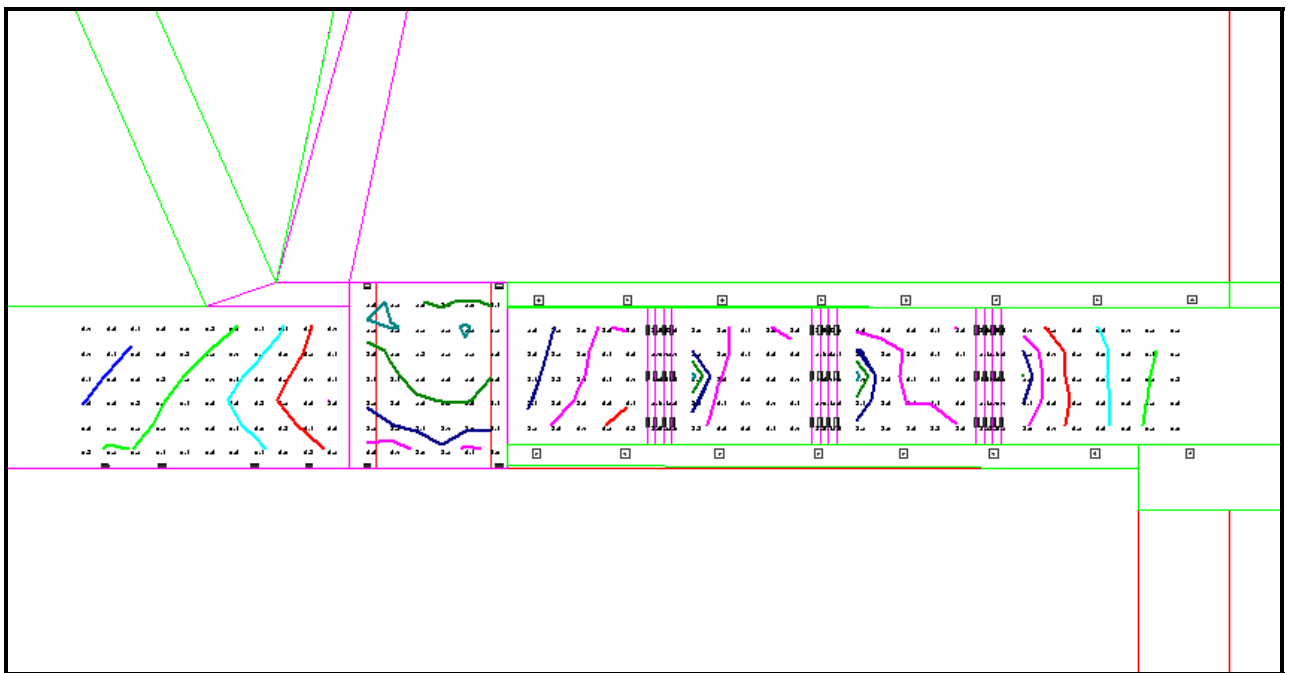
Luminaire	#	Ballast Watts	Total Watts
S2	36	19	684
SC1	8	80	640
FL1	16	80	1280
		TOTAL WATTS	2604
		AREA (ft ²)	2830
		POWER DENSITY (W/ft ²)	0.92

According to ASHRAE 90.1, the allowable power density for this exterior space is 1.0W/s.f., therefore, the exterior area's power density of 0.92 W/s.f. is acceptable.



Isolines

Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
0.5	Black	2.5	Red	4.5	Teal
1	Blue	3	Magenta	5	Brown
1.5	Green	3.5	Dark Blue	5.5	Purple
2	Cyan	4	Dark Green	6	Olive



ILLUMINANCE VALUES:
Walkway: 4 fc
Under Bridge/ Building Entrances: 5 fc



Rendering



Conclusions

The exterior area is a main circulation space. It must be well lit at night to provide a safe and secure atmosphere. The flood lights highlight the building with the wall sconces drawing attention to the building entrances. The step lights serve to highlight where the steps are, so that they will not be missed at night. The power density of 0.92W/s.f. is below the allowable 1.0W/s.f. for this area. The recommended 5fc is achieved for the building entrances and under the overhead walkway. The rest of the walkway is 4fc which is also acceptable.