Executive Summary

This assignment goes into depth into the existing lighting conditions of the Rio Hondo Library and Learning Resource Center. The lobby, Reference Stacks and Microfilm Area, the Stack Area on the second floor, and the main entrance of the building will all be evaluated for redesign. The existing lighting layout, luminaries, lamps, and light loss factors are included. Daylight needs to be addressed in all interior spaces to assure that the space is neither over lit nor is power wasted.

Because this building is a LEED building, power consumption is of high importance. LEED points are accumulated by the percentage of savings in wattage for Title 24. Points towards LEED certification, silver, gold, and platinum can also be gained by Daylight and Views of the spaces. For the spaces under evaluation I will try and achieve these extra points pushing towards the highest certification possible.

Another consideration for design criteria that needs to be assessed is ASHRAE 90.1. Each space will be evaluated under the space by space method and the building as a whole will be evaluated also comparing both values.

General Building

Lighting in the Library and Learning Resource Center consists primarily of fluorescent lamps running from 277/120V. Metal halide lamps are used in a few areas such as the entry exterior glass wall, exterior signage, columns, and in special areas of the lobby. In the spaces not evaluated, the corridors are uplit by fluorescent cove lighting. The restrooms also receive this cove light pushing light on the ceiling and avoiding the cave like feeling. The back up house rooms are lit by simple strip lights with wire guards for functionality. The classrooms, offices, and private offices all consist of pendant mounted indirect/direct linear acrylic patterned diffuser luminaries.

Design Goal
"The building design is bold and dramatic while at the same time providing enhanced functionality for both the library areas and the learning resources areas, " according to Dr. Arnold. "It will truly be a signature building for the campus and become the anchor of the lower quad." In this bold and dramatic building, everything is streamlined. The architecture is very clean and so should the lighting. The architecture has many attributes that can be highlighted and accented. The current lighting scheme does this, but daylighting can be integrated more in the system.

Title 24
The overall building area is 93,740 s.f. According to the overall building method and Title 24's stipulation on allowed wattage a school can have 1.4 w/s.f. which equals to 131,236 watts for the overall building allowance. Each space is evaluated under the space by space method later in the report.

A Circulation Space

The Lobby – The lobby is a two story open circulation space. It contains a 3 panel focal point that extends to the top of the 39' ceiling and separates the lobby into two different spaces: the large circulation space, and the gallery space. A skylight runs lengthwise along the left side of the lobby. Daylight will be able to be addressed. Access to the second floor is available by ramp or by stairwell. Above the stairwell there is a floating wooden ceiling. A bridge runs across widthwise connecting the west and east side on the second floor. Activities include a gallery space, circulation, and access to the second floor.

The existing lighting in this area is primarily fluorescent however in some areas metal halide was used due to the high ceilings. Recessed elliptipar fixtures are used in the slanted ceiling plane to illuminate the walls to relieve the cave effect. Downlights are used in the floating wooden ceiling above the stairwell as well as under the bridge to achieve the needed 10 fc for circulation in a lobby space. Recessed floor uplights are used to accent the three panels that are the focal point in the lobby. Recessed wall lights are used under the stairwell and in the entrance of the lobby to achieve the needed 10 fc. In the space in the rear of the lobby there are recessed multi-lamp fixtures with mixed metal halide and fluorescent sources. The primary activity in this space is a gallery space for art work to be displayed. In technical assignment three I will investigate if there is a better way for this area to be illuminated.

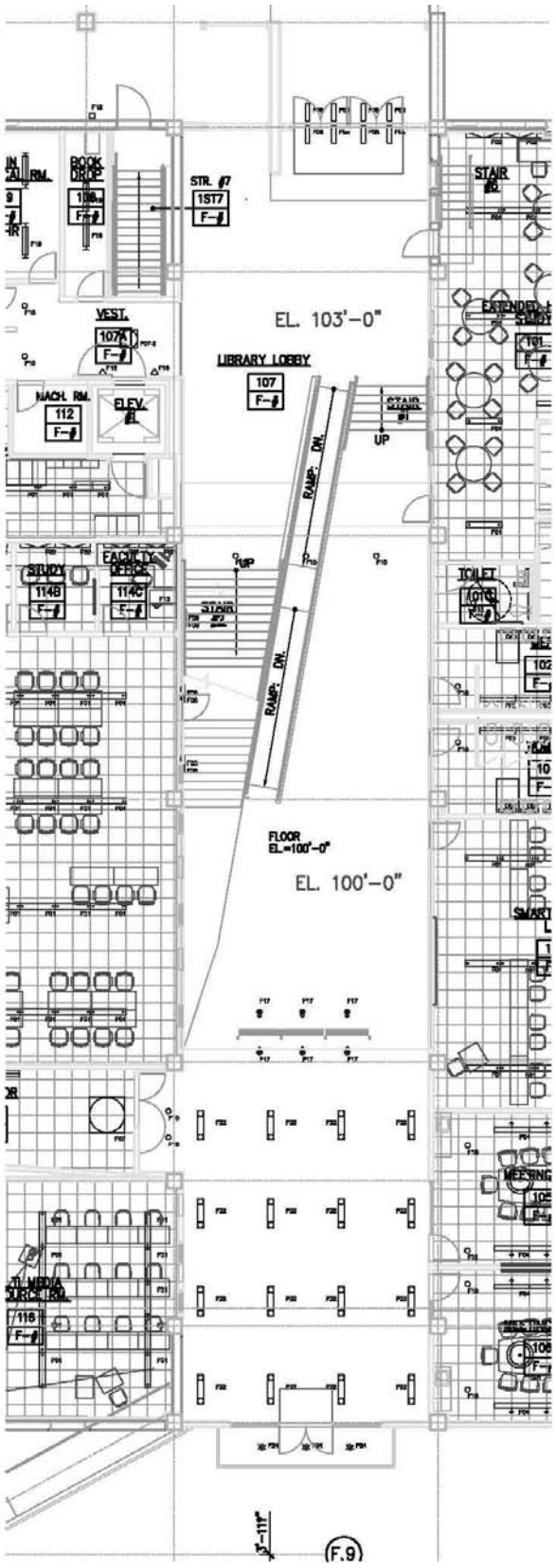


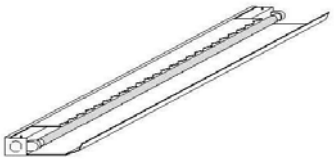
Figure 1 Floor Plan with Lighting Layout

Figure 2 Lighting Layout

Type	Source	Name	Notes	Wattage	Lamp	CRI	CCT	Ballast Watts	Ballast Factor	Lamps per Balla	Fixture Quantity	Total Watts
F05	Fluorescent	Slot Light	"Ashley" series, integral electronic ballast, emergency ballast as required by Electrical Engineer	26w	(1) T5	85	3500	26	1.04	1	16	416
F08	Fluorescent	Recessed 2' Linear Strip	"Cricket 61", symmetric distribution, opal glass lens	14w	(1) T5	85	3500	14	0.95	1	10	140
F10	Fluorescent	Recessed 6" Downlight	5-11/16" aperture, horizontal lamp orientation, "haze" Alzak reflector with white trim ring, emergency battery pack as required by the Electrical Engineer	42w	(1) TT	82	3500	42	0.98	1	17	714
F17	Metal Halide	Recessed Adjustable 11" Uplight	"Centaur" series, medium wide beam	39w	(1) T4 CMH	82	3000	48	1	1	6	288
F21	Metal Halide	Recessed Combo Light (Lobby)	"Combo Classic", trimless	78w	(2) 39w PAR 30 CMH	81	3000	78	0.98	2	9	702
F22	Metal Halide	Recessed Combo Light (Exhibit)	"Combo Classic", trimless	54w	(1) 14w T5 + (2) 20w T4 CMH	81	3500 for T5 and 3000 for T4	54	0.95	1	16	864
											Total Watts	3124

Figure 3 Luminaires

F05



F21 and F22

Design Criteria

- Appearance of Space and Luminaires

The lobby is a two story atrium that has clean straight lines throughout the space. Many of the luminaires are hidden in respect that they are recessed in the ceiling. The luminaires that are visible to everyone need to be clean, straight fixtures that reinforce the architecture of the building. Under the bridge, and under the floating wooden ceiling lie recessed downlights giving the walkway the correct light level. Located in the ceiling close to the skylight are recessed adjustable wallwash troffers that throw light onto wall that extends up to the second floor. The floor uplights accent the three panels that are the focal point in the lobby. The lobby is the first place where visitors and students enter and should leave an impression yet be functional. The lighting is equally important because it introduces the visitors to the space and serves the function of circulation.

- Color Appearance and Color Contrast

The color appearance in a lobby should be very important because it is the first space that people encounter. As much as it should be inviting, it should not cast unwanted shadows on people's faces. Good face rendering and skin coloring should be a goal of the lighting of the lobby too. CRI should be kept at mid 80's or higher because good color rendering is important when you first enter a space. This CRI should aid in face rendering and skin coloring. The CCT should stay in the 3000 range making the space inviting and comfortable.

- Daylighting Integration and Control

The skylight that runs the length of the lobby can contribute a lot to the light level and needs to be further investigated to see if there is a surplus of energy that can be removed. The skylight is high enough, 39', that glare should not be too much of an issue for visitors on ground level. The way the skylight is directed and the way the ceiling is shaped should allow minimal glare and discomfort. See below for diagram of skylight.

- Direct Glare

Direct glare is a very important element to not have inside a lobby space. A calculation will need to be done to make sure the glare rating is acceptable in the space. The space seems to be big and tall enough to not have luminous surfaces that are considered too bright.

- Luminances of Room Surfaces

The luminance values of a room are always important in a space that is primarily meant for circulation. Lighting the spaces to different luminances should guide a person through the space. My concern right now is the area in the back of the lobby where the gallery space is located. Further investigation will show if the space is overlit and draws too much attention with a high ratio contrast compared to the other parts of the lobby.

- Reflected Glare

Reflected glare could be an issue in this space due to the reflective materials. Much of the lobby is made of wood and glass where reflected glare will be a problem. Avoiding this glare into the eyes of the public will need to be addressed. Could be checking the angles of the direct light or maybe changing to a less reflective material.

- Illuminance (Horizontal)

According to the IESNA Handbook the horizontal illuminance is 10 fc for the general entrance in the lobby space. If the lobby achieves 10 fc on the ground plane then the visitors have ample light to find their way around. With the entrance being primarily made of glass, the natural daylight should illuminate the entrance space to at least 10 fc. Dimmers may be able to be used in this situation. The transition from the extremely bright natural daylight to unnatural illuminance needs to be comfortable.

- Illuminance (Vertical)

A value from 5-10 fc should be reached for people's faces in the lobby. The three panel focal points should reach a level where it is a high contrast to the surrounding that draws immediate attention.

- Title 24

According to ASHRAE 90.1 space by space method the allowed watts for this lobby space is 6268.5 watts per ft^2, that is 1.5 watts per ft^2 and the area of the space is 4179 ft^2. With 10 percent reduction of the watts to concede with LEED standings the total watts allowed is then 5641 watts. Currently by summing the ballast watts for the fixtures in this space the total wattage is 3124 watts per ft^2. Currently the power density is well below the allowed, so there is some room to add more if needed.

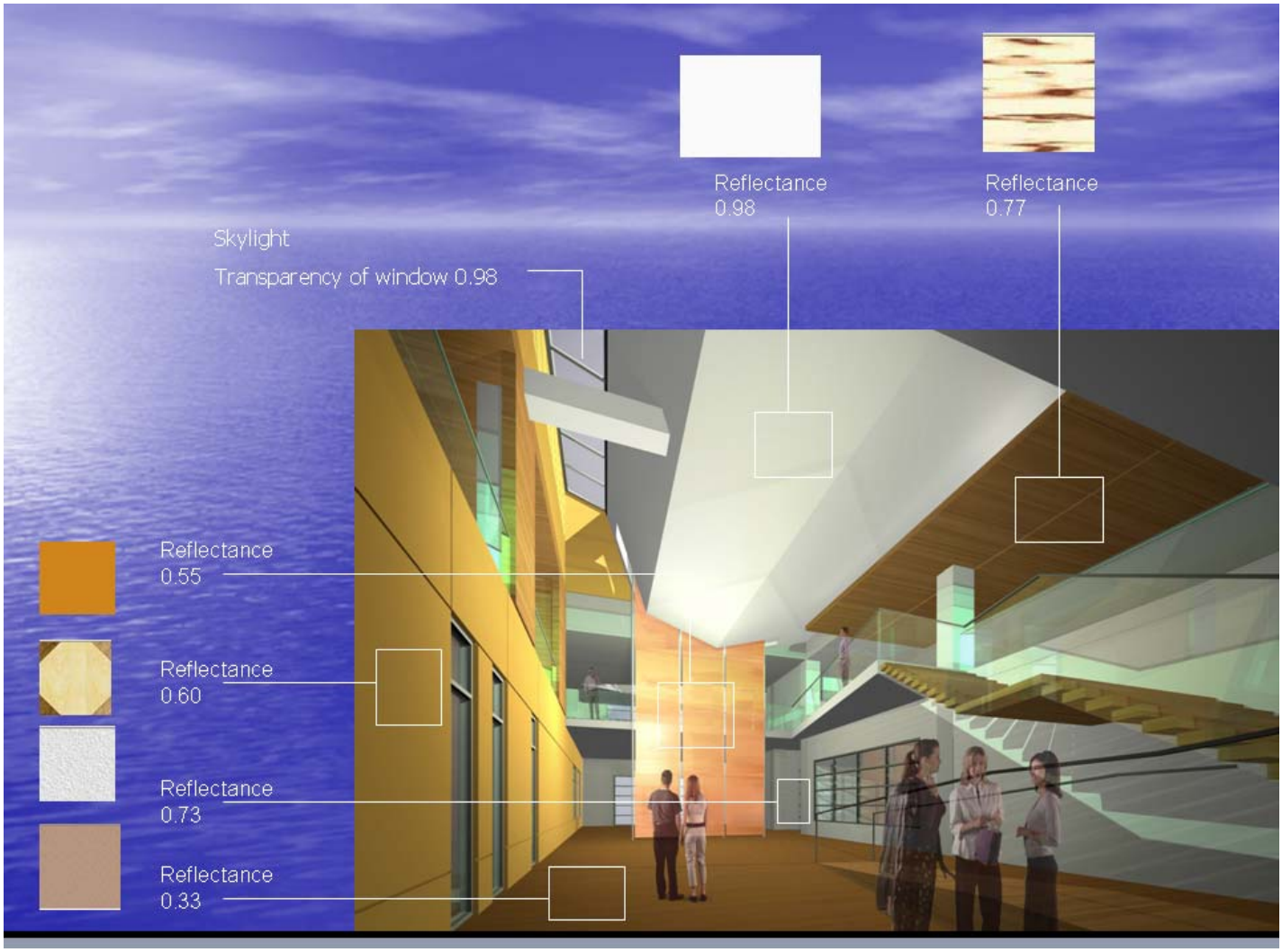
Calculations

Calculations were made for the ground plane for circulation purposes, east wall, ceiling, and a box representing a person's face. Below are the light loss factors used for calculations as well as materials and their reflectance.

Figure 4 Light Loss Factors

Type	Maintenance Category	Cleaning Interval	Initial Lumens	Mean Lumens	LLD	LDD	RSDD	BF	Total LLF
F05	VI	Clean - 6 months	2900	2726	0.94	0.92	0.66	1.04	0.59
F08	V	Clean - 6 months	1350	1269	0.94	0.92	0.91	0.95	0.75
F10	IV	Clean - 6 months	3200	2690	0.84	0.95	0.91	0.98	0.71
F17	V	Clean - 6 months	3150	2600	0.83	0.92	0.91	1	0.69
F21	IV	Clean - 1 year	2400				0.91	0.98	0.00
F22	IV	Clean - 6 months	1350	1269	0.94	0.95	0.78	0.95	0.66
		T4	1700	1200	0.71	0.95	0.91	0.95	0.58

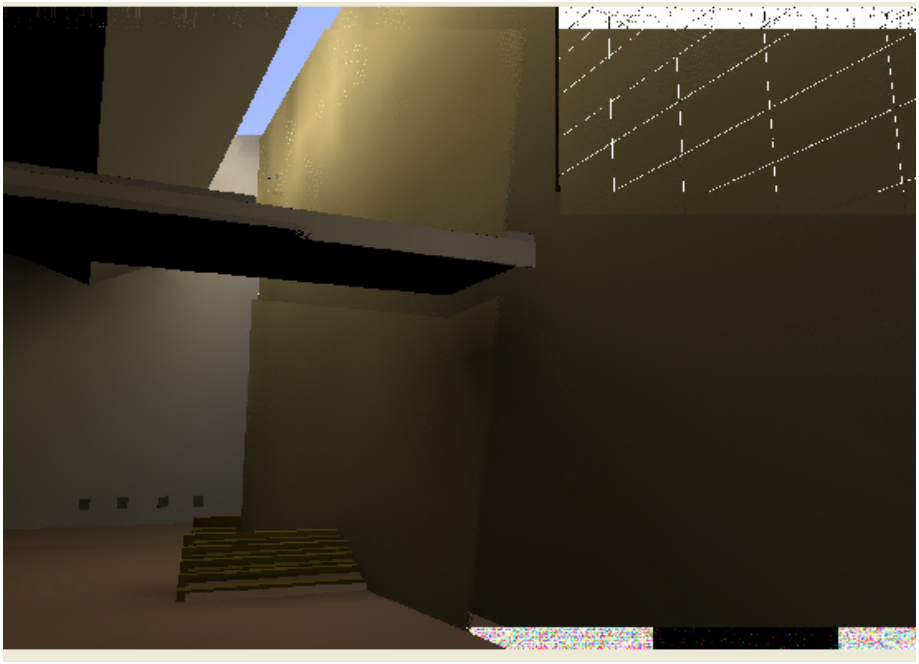
Figure 5. Materials and Reflectance



Location	Ceiling	Floating Ceiling	East Wall	Entry wall	All other walls	Floor
Materials	Painted Gypsum Board	Wood	Wood Veneer Paneling	Painted Concrete	Painted Gypsum Board	Carpet
Reflectance	0.98	0.77	wood 0.6	0.73	0.73	0.33

Daylight Study – The skylight above that runs the length of the lobby can be very useful in the daytime hours. Below is showing the lobby lit by daylight only and then daylight and electric lights. The study shows that the skylight provides a sufficient amount of illumination for the task at hand.

Figure 6 Daylight only 7:54 am, clear sky conditions



	7:54 AM
Illuminance Values (fc)	Ground floor
Average	102.13
Maximum	246
Minimum	0
Avg/Min	0
Avg//Max	0

Illuminance Values (fc)	Bridge
Average	244.43
Maximum	523
Minimum	50.5
Avg/Min	4.84
Avg//Max	10.36

Illuminance Values (fc)	East Wall
Average	5981
Maximum	7023
Minimum	5405
Avg/Min	1.11
Avg//Max	1.3

Figure 7 Daylight only 12:54 pm, clear sky conditions

	12:54 PM
Illuminance Values (fc)	Ground floor
Average	162.61
Maximum	361
Minimum	0.1
Avg/Min	1626
Avg//Max	3618

Illuminance Values (fc)	Bridge
Average	440.35
Maximum	792
Minimum	118
Avg/Min	3.71
Avg//Max	6.67

Illuminance Values (fc)	East Wall
Average	5168
Maximum	9774
Minimum	631
Avg/Min	8.18
Avg//Max	15.48

Figure 8 Daylight only 5:54 pm, clear sky conditions

	5:54 PM
Illuminance Values (fc)	Ground floor
Average	42.03
Maximum	92.4
Minimum	0
Avg/Min	0
Avg//Max	0

Illuminance Values (fc)	Bridge
Average	93.31
Maximum	185
Minimum	17.8
Avg/Min	5.24
Avg//Max	10.43

Illuminance Values (fc)	East Wall
Average	499.33
Maximum	776
Minimum	270
Avg/Min	1.85
Avg//Max	2.88

Figure 9 Daylight and Electric Lights, 7:54 am, clear sky conditions

	7:54 AM
Illuminance Values (fc)	Ground floor
Average	117.96
Maximum	437
Minimum	3.8
Avg/Min	31.04
Avg//Max	115.03

Illuminance Values (fc)	Bridge
Average	266.32
Maximum	567
Minimum	62.2
Avg/Min	4.28
Avg//Max	9.13

Illuminance Values (fc)	East Wall
Average	5992
Maximum	7021
Minimum	5406
Avg/Min	1.11
Avg//Max	1.3

Figure 10 Daylight and Electric Lights, 12:54 pm, clear sky conditions

	12:54pm
Illuminance Values (fc)	Ground floor
Average	178.29
Maximum	538
Minimum	3.6
Avg/Min	49.53
Avg//Max	0.33

Illuminance Values (fc)	Bridge
Average	464.3
Maximum	842
Minimum	131
Avg/Min	3.54
Avg//Max	0.55

Illuminance Values (fc)	East Wall
Average	5179
Maximum	9778
Minimum	632
Avg/Min	8.19
Avg//Max	15.46

Figure 11 Daylight and Electric Lights, 5:54pm, clear sky conditions

	5:54 PM
Illuminance Values (fc)	Ground floor
Average	58.18
Maximum	367
Minimum	1.7
Avg/Min	34.22
Avg//Max	0.16

Illuminance Values (fc)	Bridge
Average	116.78
Maximum	233
Minimum	29.7
Avg/Min	3.93
Avg//Max	7.87

Illuminance Values (fc)	East Wall
Average	511.33
Maximum	774
Minimum	271
Avg/Min	1.89
Avg//Max	2.86

Figure 12 Daylight and Electric Lights, 7:54am, clear sky conditions Dec 7

	7:54 AM
Illuminance Values (fc)	Ground floor
Average	28.12
Maximum	340
Minimum	0.5
Avg/Min	56.24
Avg//Max	681.4

	7:54 AM
Illuminance Values (fc)	Bridge
Average	46.31
Maximum	97.7
Minimum	15.5
Avg/Min	2.99
Avg//Max	6.3

	7:54 AM
Illuminance Values (fc)	East Wall
Average	36.49
Maximum	335
Minimum	6.4
Avg/Min	5.7
Avg//Max	52.48

Figure 13 Daylight and Electric Lights, 12:54am, clear sky conditions Dec 7

	12:54 PM
Illuminance Values (fc)	Ground floor
Average	83.68
Maximum	408
Minimum	2
Avg/Min	41.84
Avg//Max	204.4

	12:54 PM
Illuminance Values (fc)	Bridge
Average	190.96
Maximum	414
Minimum	46.6
Avg/Min	4.1
Avg//Max	8.9

	12:54 PM
Illuminance Values (fc)	East Wall
Average	222.93
Maximum	822
Minimum	22.1
Avg/Min	10.09
Avg//Max	37.23

Figure 14 Daylight and Electric Lights, 5:54pm, clear sky conditions Dec 7

	5:54 PM
Illuminance Values (fc)	Ground floor
Average	49.17
Maximum	359
Minimum	1.2
Avg/Min	40.98
Avg//Max	299.42

	5:54 PM
Illuminance Values (fc)	Bridge
Average	95.11
Maximum	190
Minimum	25.5
Avg/Min	3.73
Avg//Max	7.49

	5:54 PM
Illuminance Values (fc)	East Wall
Average	204.94
Maximum	2960
Minimum	16.6
Avg/Min	12.35
Avg//Max	178.32

Figure 15 Daylight only, 7:54am, clear sky conditions Dec 7

	7:54 AM
Illuminance Values (fc)	Ground floor
Average	11.99
Maximum	29.3
Minimum	0
Avg/Min	0
Avg//Max	0

Illuminance Values (fc)	Bridge
Average	23.07
Maximum	45.9
Minimum	4.1
Avg/Min	5.63
Avg//Max	11.2

Illuminance Values (fc)	East Wall
Average	32.9
Maximum	316
Minimum	4
Avg/Min	8.23
Avg//Max	79

Figure 16 Daylight only, 12:54am, clear sky conditions Dec 7

	12:54pm
Illuminance Values (fc)	Ground floor
Average	67.68
Maximum	203
Minimum	0
Avg/Min	0.00
Avg//Max	0.00

Illuminance Values (fc)	Bridge
Average	167.67
Maximum	362
Minimum	34.2
Avg/Min	4.90
Avg//Max	10.61

Illuminance Values (fc)	East Wall
Average	218.68
Maximum	922
Minimum	22.1
Avg/Min	9.9
Avg//Max	41.74

Figure 17 Daylight only, 5:54pm, clear sky conditions Dec 7

	5:54 PM
Illuminance Values (fc)	Ground floor
Average	32.95
Maximum	72.3
Minimum	0
Avg/Min	0.00
Avg//Max	0.00

Illuminance Values (fc)	Bridge
Average	71.6
Maximum	143
Minimum	13.6
Avg/Min	5.26
Avg//Max	10.54

Illuminance Values (fc)	East Wall
Average	197.71
Maximum	2939
Minimum	13.3
Avg/Min	14.87
Avg//Max	221.02

A Special Purpose Space

Reference Stacks and Microfilm Area – In this unique area the architect plays with multi level ceiling planes that adds interest to the space. Under the center ceiling plane that runs west to east through the space lays the open space where group tables are located. Then close to the perimeter of the space on the south side the architect creates much smaller more intimate spaces.

In this reference area, the lighting takes more of a playful theme with the huge 6' globular fixtures made by DARK from Belgium. Inside the intimate spaces pendants hang making the space a much more relaxed environment. Downlights are recessed in the ceiling plane to achieve at least 30 fc on the work plane below. Above the ceiling plane, there are cove lights which illuminate the ceiling and further define the ceiling plane with a band of light.

Fig 18. Floor Plan with Lighting Layout

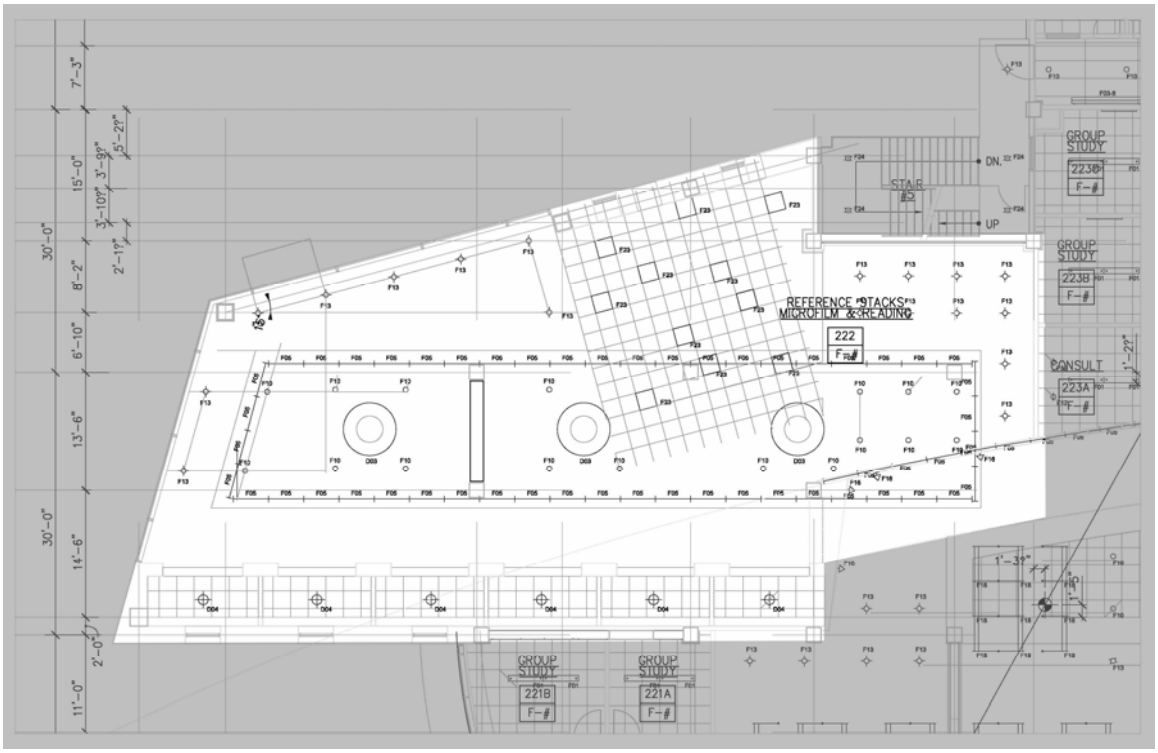


Fig 19. Lighting Layout

Type	Source	Name	Notes	Wattage	Lamp	CRI	CCT	Ballast Watts	Ballast Factor	Lamps per Ballast	Fixture Quantity	Total Watts	
D03	Fluorescent	Decorative Pendant	"No Fruit"	117w	(3) 39w T5	85	3500	39	1.02	1	3	117	
D04	Compact Fluorescent	Decorative Pendant - 13.8"	Wohlert	26w	(1) 26w TT	82	3500	26	0.98	1	6	156	
F05	Fluorescent	Slot Light	"Ashley" series, integral electronic ballast, emergency ballast as required by Electrical Engineer	26w	(1) T5	85	3500	26	1.04	1	49	1274	
F10	Fluorescent	Recessed 6" Downlight	5-11/16" aperture, horizontal lamp orientation, "haze" Alzak reflector with white trim ring, emergency battery pack as required by the Electrical Engineer	42w	(1) TT	82	3500	42	0.98	1	15	630	
F13	Compact Fluorescent	Surface Mounted Cylinder - 6"	Medium beam distribution, haze Alzak reflector	32w	(1) 32w TT	82	3500	32	0.98	1	17	544	
F23	Fluorescent	Recessed 2'x2' Square	"P-9200" series, 2'x2'. White acrylic diffuser, smooth frame	34w	(2) 17w T8	82	3500	34	0.96	2	11	374	
												3095	Total

Fig 20. Luminaires

Design Criteria

- Appearance of Space and Luminaires

In this space the architect chose the luminaires which shows how important the appearance of the space and luminaires is to this area. In this area the lighting takes on a different shape. In this space the architect wished to use globular luminaires instead of the square or rectangle shape used in the majority of the building. These luminaires add interest to the space and make it not feel as though you are in a library. Keeping this feeling will be a big goal in this revision.

- Color Appearance and Color Contrast

The appearance of faces in this space is highly important because it is where group studies can take place. Being able to see your partner without harsh shadows is a must. Color appearance is crucial because you want to be comfortable in this space and bad color rendering is not inviting.

- Daylighting Integration

Daylighting is another issue in this space but not as critical as in the others that are being evaluated. In the small intimate areas daylighting can be addressed because one of the walls in the small space are the Solarban 60 window which will allow natural daylight to be utilized. How much needs to be further looked into.

- Direct Glare

A glare calculation needs to be done with the huge globular fixtures that DARK makes. Studying directly under the luminaires will prove to be hazardous with glare. Being able to read and write in this space is crucial so too much glare will be totally unacceptable. Also this is the Microfilm area which means VDT use is high, so any glare should be addressed.

- Luminances of Room Surfaces

In this unique area, the luminances of the room surfaces should be highly important. The architect went to all the trouble in making these intersecting different level ceiling planes why not accentuate that with the lighting. There is also small stacks that are located on the vertical surfaces in between the small, intimate study areas. Bringing out different levels of luminances will give the space an even more unique feel, while following the architecture.

- Uniform Light Distribution on Task Plane

This is very important considering the tasks at hand. A low ratio of max/min will be needed on the task plane. Avoiding hot spots and drop offs will be necessary.

- Reflected glare

Reflected glare is as important as direct glare because of the VDT use in the area.

- Illuminance (Horizontal)

Horizontal illuminance for reading is 30 fc or greater.

- Illuminance (Vertical)

Vertical illuminance is not of high importance in this space other than to accentuate the space and for facial rendering.

- Title 24

In this area according to ASHRAE 90.1, the allowed wattage for this space based on area is 4491 watts per ft^2. With the ten percent LEED factor that brings the wattage down to 4041 total watts. Currently summing the ballast watts for this space, only 3095 watts have been used which falls greatly below the maximum power allowance.

Calculations

Calculations were made for the desk plane, the ceiling, and a wall of an individual study area. Below are the light loss factors used for calculations as well as materials and their reflectance.

Figure 21 Light Loss Factors

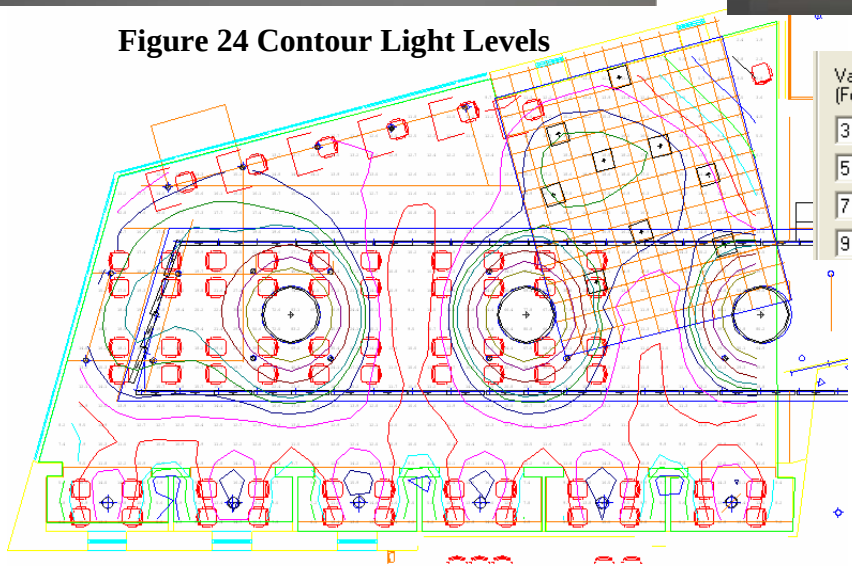
Type	Maintenance Category	Cleaning Interval	Initial Lumens	Mean Lumens	LLD	LDD	RSDD	BF	Total LLF
D03	V	Clean - 3 months	3500	3290	0.94	0.91	0.79	1.02	0.69
D04	V	Clean - 3 months	1710	1440	0.84	0.91	0.79	0.98	0.59
F05	VI	Clean - 6 months	2900	2726	0.94	0.92	0.66	1.04	0.59
F10	IV	Clean - 6 months	3200	2690	0.84	0.95	0.91	0.98	0.71
F13	IV	Clean - 6 months	2200	1850	0.84	0.95	0.93	0.98	0.73
F23	V	Clean - 6 months	1325	1260	0.95	0.92	0.93	0.96	0.78

Figure 22 Materials and Reflectance

Location	Ceiling	Ceiling	Ceiling	Walls	Floor
Materials	Higher ceiling plane	Lower ceiling plane Painted Gypsum	Painted Gypsum Board	Painted Gypsum Board	Carpet
Reflectance	0.8	0.52	0.66	0.5	0.2

Figure 23 Agi Renderings

Figure 24 Contour Light Levels



Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
3		11		19	
5		13		25	
7		15		35	
9		17		45	

Illuminance Values (fc)	Work Plane
Average	17.07
Maximum	83.2
Minimum	1.9
Avg/Min	8.98
Avg//Max	43.79

A Large Work Space

On the south side of the building lies the stack area on the second floor. This south façade is a glass SolarBan curtain wall. An integrated daylight system could be very useful in this space. The ceiling in this space is sloped downward towards the perimeter of the building. This space is primarily used for stacks and along the perimeter it is mostly used for studying at the single desks. Through the center axis of this space is the study area where group tables are located and end at the reference desk. Activities in this space include individual and group study, and reading in the stacks.

The architect's intent is to keep the sloped ceiling clean of fixtures. It would be more energy and cost efficient to pendant mount the fixtures because less hardware would be needed and each individual stack does not necessarily call for its own fixture. However in keeping with the architect's intention, the stacks are illuminated by T5HO stack mounted fixtures. Downlights are used around the perimeter of the area to achieve the necessary 30 fc on the desk plane. Decorative pendants add interest to the main axis of the stack group area while attaining the correct light level at the desk plane.

The south façade is a dominant feature in this building where daylight integration can become very useful. The south façade is a glass curtain wall made of Solarban 60 with ceramic frit. It is specifically designed to provide solar control, while still offering the traditional insulating performance and the benefits of low-emissivity coated glasses. Its window U-value is 0.28 while summer solar heat is 0.39 and has transmittances of ultraviolet energy is 0.16 and visible like is 0.71.

Figure 23 Floor Plan with Lighting Layout (grey area out of scope)

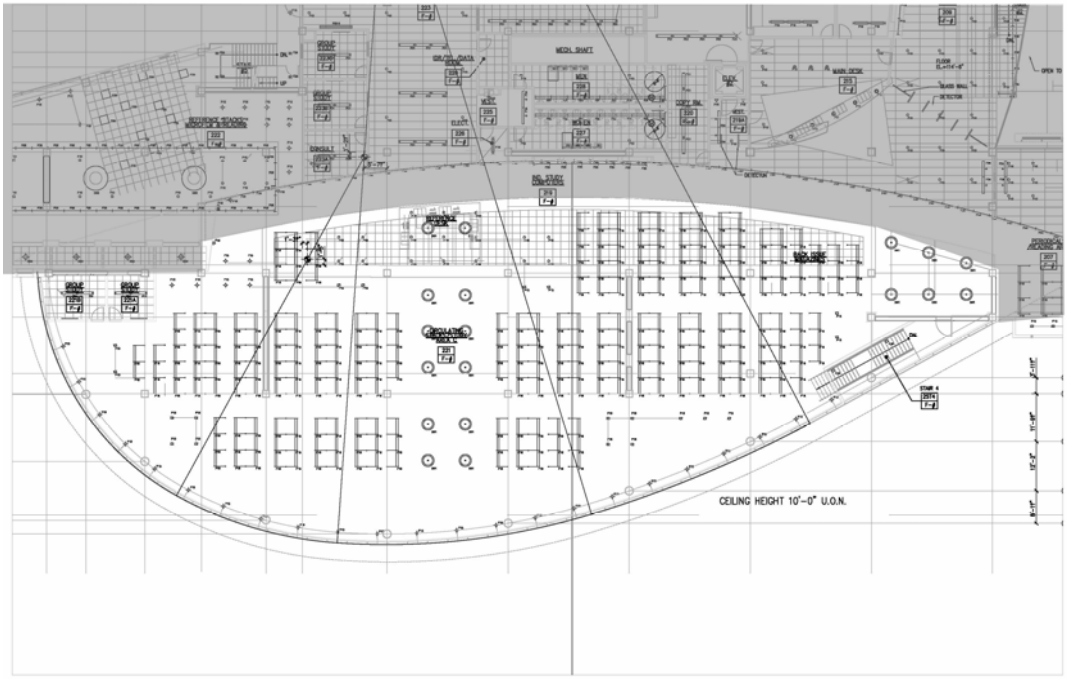


Figure 25 Lighting Layout

Type	Source	Name	Notes	Wattage	Lamp	CRI	CCT	Ballast Watts	Ballast Factor	Lamps per Ballast	Fixture Quantity	Total Watts	
D01	Fluorescent	Decorative Pendant - 3'	"Metro" series, frosted white acrylic shielding, dual circuit, integral electronic program start ballast, suspension to be confirmed, emergency battery pack as required by the electrical engineer, titanium silver finish	300	(6) 50w BX	82	3500	50	0.84	2	18	5400	
F10	Fluorescent	Recessed 6" Downlight	5-11/16" aperture, horizontal lamp orientation, "haze" Alzak reflector with white trim ring, emergency battery pack as required by the Electrical Engineer	42	(1) TT	82	3500	42	0.98	1	16	672	
F13	Compact Fluorescent	Surface Mounted Cylinder - 6"	Medium beam distribution, haze Alzak reflector	32	(1) 32w TT	82	3500	32	0.98	1	33	1056	
F18	Fluorescent	Stack Light	Stack mounted	54	(1) 54w T5HO	85	3500	54	1.02	1	262	14148	
												21276	Total

Figure 26. Luminaires

D01

F10

F18

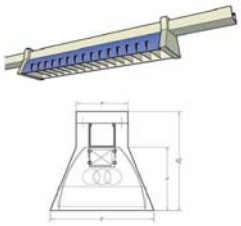


Figure 27. Solarban 60 window

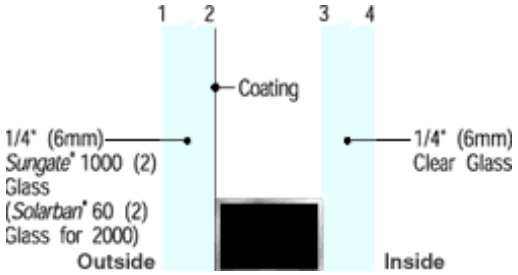


Figure 28. Exterior view of south facade

Design Criteria

- Daylighting Integration

In this space this is the most important element that has not been looked into as extensively as needed. The entire south façade is made of a Solarban 60 window which will allow natural daylight to light this space more than adequately for the majority of the time here. There are pendant mounted downlights that provide the individual desks with the proper light level needed to read and write, however the calculation done at the time did not take into account daylighting. With all the natural daylight coming into the space are the downlights necessary? How many kids study there when daylight is not available or useful?

- Color Appearance and Color Contrast

Not as important in this space as in the other spaces because most of this area is for individual study.

- Direct Glare

The daylight while giving off this natural light will also cause a big glare problem for the students sitting next to the windows. It provides a direct glare source and will provide a reflected glare source as well off the desks. The glare cause by the luminaires is neglible compared to the glare cause by the daylight.

- Modeling of Faces and Objects

The modeling of faces isn't as important in this space because once again it is an individual space and most likely you aren't looking at yourself. However because the stacks usually give off an uneasy feeling already there is no reason why to add to it by bad facial modeling. While not as important as if you were in a meeting, but the safety factor of making someone appear normal in the stacks is worth it. But, the modeling of the books is of much importance because the main activity in this area is reading in the stacks.

- Reflected Glare

Reflected glare is very important in this space not only in the stacks but off of the desks that are placed by the windows. The desk specularity can be changed to help with reflected glare. At night there could be a potential problem with the pendant downlights reflecting off the glass, too.

- Illuminance (Horizontal)

Horizontal illuminance should not fall below 30 fc on the work plane to achieve the tasks that take place in this area. In the corridor areas, on the ground between the stacks the light level does not need to exceed 5 fc to walk.

- Illuminance (Vertical)

Vertical illuminance is highly important in this area due to the stacks. The architect wanted the stacks to be lit by stack mounted linears to keep the ceiling free from fixtures. The stack light is a 54w HO to really push that light towards the bottom shelf so the books on the bottom see the correct light level. The ratio from top to bottom needs to be minimal on the stacks so as to put equal importance on the books on the bottom as well as the top.

- Title 24

According to ASHRAE 90.1, the stack area allows for a maximum allowance of 18,616 watts. Currently the wattage for the stack area is 21276 total watts. This is neither ASHRAE compliant nor Title 24 compliant, so this will need to be addressed. For LEED certification, the wattage needs to be ten percent lower than the Title 24 allowance, so lowering the wattage will be a main goal of this area.

Calculations

A calculation was taken of the work plane, a typical stack, ceiling, and the floor for circulation. The following are the light loss factors applied in addition to the materials and their reflectance.

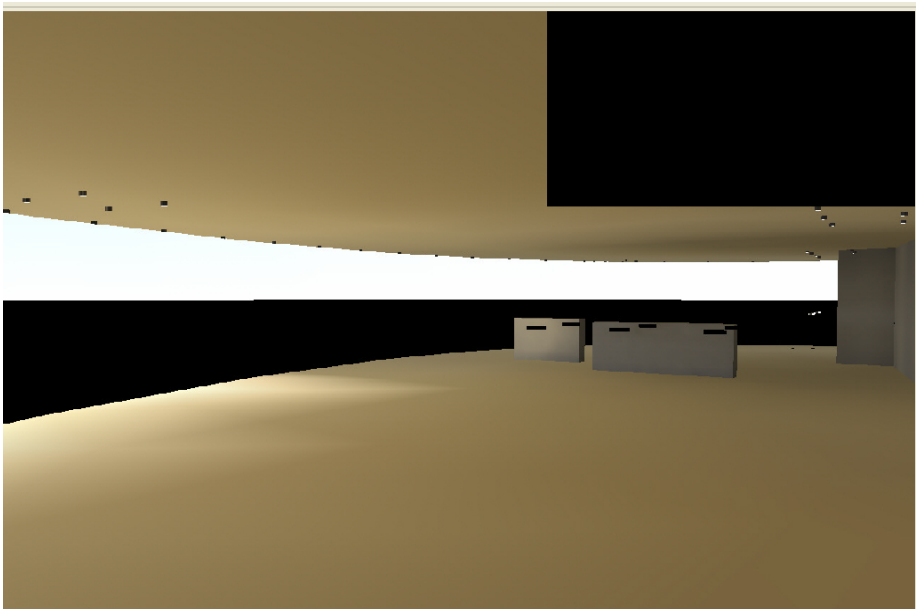
Figure 29. Light Loss Factors

Type	Maintenance Category	Cleaning Interval	Initial Lumens	Mean Lumens	LLD	LDD	RSDD	BF	Total LLF
D01	V	Clean - 3 months	4000	3400	0.85	0.91	0.79	0.84	0.51
F10	IV	Clean - 6 months	3200	2690	0.84	0.95	0.91	0.98	0.71
F13	IV	Clean - 6 months	2200	1850	0.84	0.95	0.93	0.98	0.73
F18	V	Clean - 6 months	5000	4700	0.94	0.92	0.93	1.02	0.82

Figure 30 Materials and Reflectance

Daylight Study – The south façade is made of Solarban 60 windows that can be a great advantage for daylighting this area. The study below shows that in December and July the natural sunlight provides a huge amount of illumination for the space. Included are the contours of the agi rendering to see where the light zones are located.

Figure 31 Daylight and Electric Lights, 7:54 am, clear sky conditions July 7



8:54 AM

Illuminance Values (fc)	Work Plane
Average	231.27
Maximum	1351
Minimum	1.3
Avg/Min	177.9
Avg//Max	1039

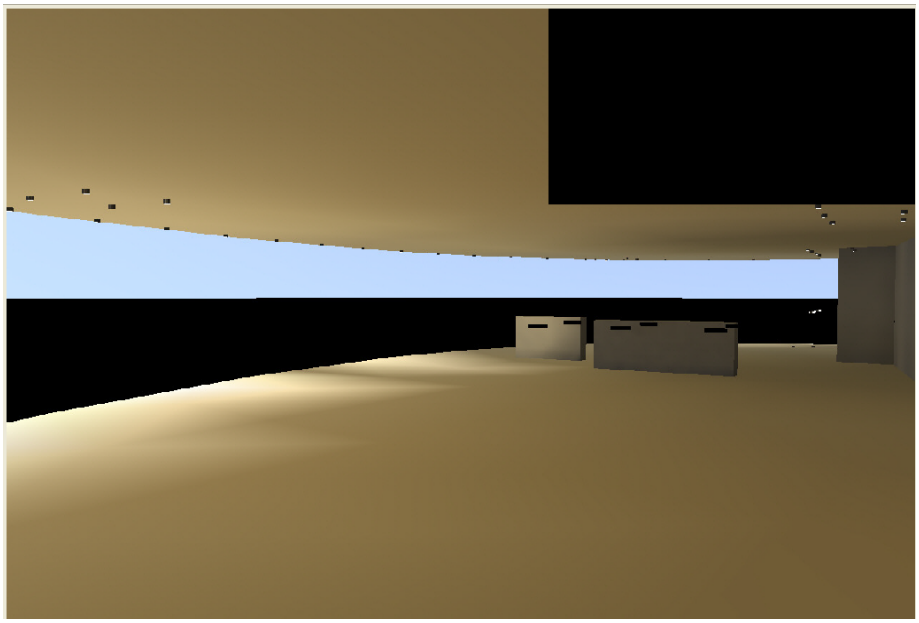
8:54 AM

Illuminance Values (fc)	Stack Near to window
Average	381.2
Maximum	480
Minimum	223
Avg/Min	1.7
Avg//Max	2.15

8:54 AM

Illuminance Values (fc)	Stack Far from window
Average	145.88
Maximum	173
Minimum	124
Avg/Min	1.17
Avg//Max	1.39

Figure 32 Daylight and Electric Lights, 12:54 pm, clear sky conditions



Illuminance Values (fc)	Work Plane
Average	606.33
Maximum	4299
Minimum	2.6
Avg/Min	233.2
Avg//Max	1653

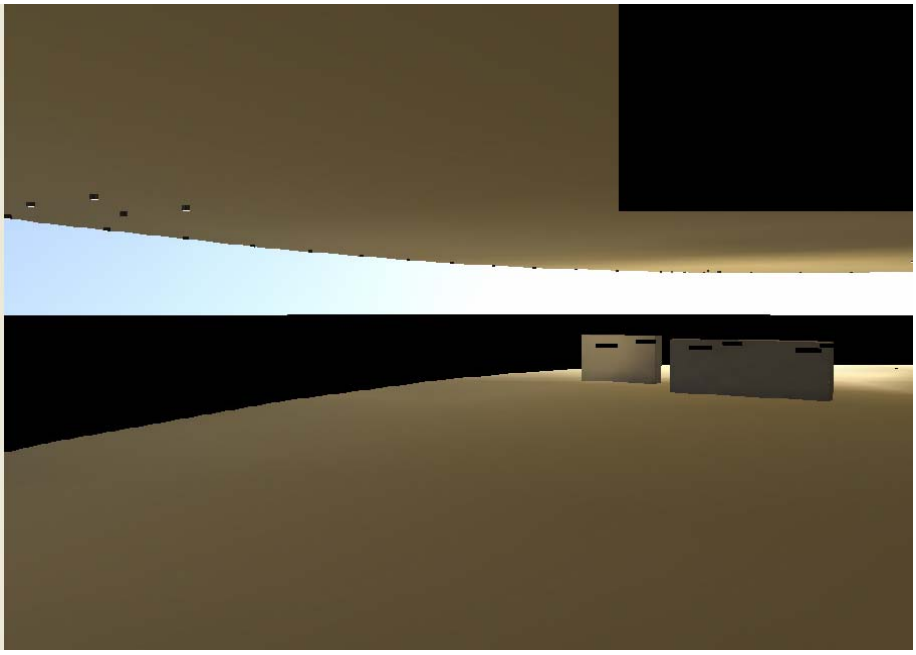
11:54 AM

Illuminance Values (fc)	Stack Near to window
Average	872.58
Maximum	1179
Minimum	403
Avg/Min	2.16
Avg//Max	2.92

11:54 AM

Illuminance Values (fc)	Stack Far from window
Average	192.83
Maximum	234
Minimum	164
Avg/Min	1.18
Avg//Max	1.43

Figure 33 Daylight and Electric Lights, 5:54 pm, clear sky conditions



Illuminance Values (fc)	Work Plane
Average	483.05
Maximum	2653
Minimum	2.9
Avg/Min	166.57
Avg//Max	915.07

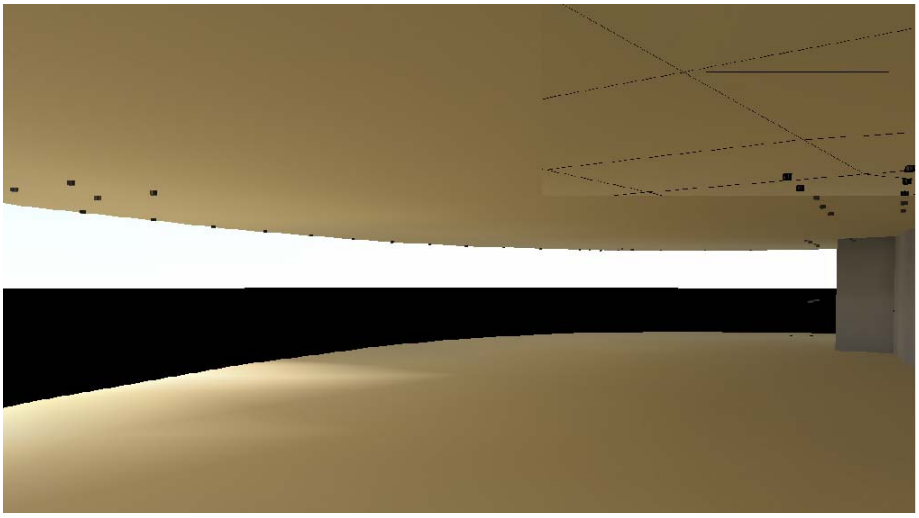
3:54 PM

Illuminance Values (fc)	Stack Near to window
Average	515.79
Maximum	678
Minimum	248
Avg/Min	2.08
Avg//Max	2.73

3:54 PM

Illuminance Values (fc)	Stack Far from window
Average	112.51
Maximum	133
Minimum	100
Avg/Min	1.12
Avg//Max	1.33

Figure 34 Daylight only, 7:54 am, clear sky conditions



8:54 AM

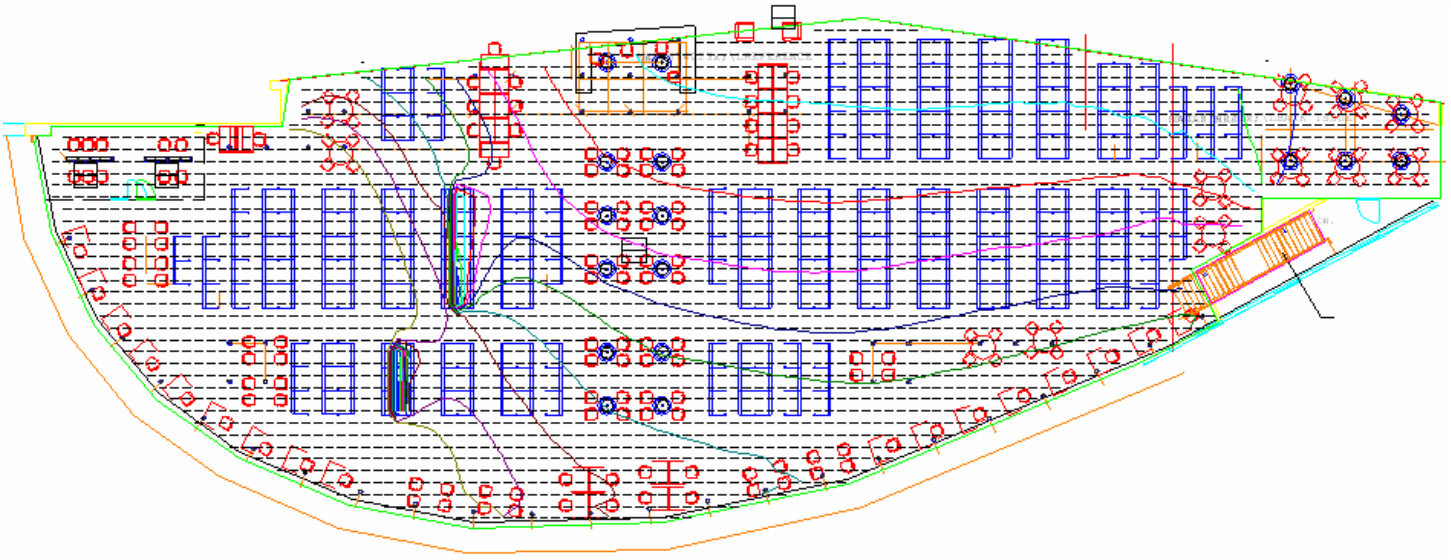
Illuminance Values (fc)	Work Plane
Average	207.81
Maximum	1335
Minimum	0.9
Avg/Min	230.9
Max/Min	1483

8:54 AM

Illuminance Values (fc)	Stack Near to window
Average	356.04
Maximum	450
Minimum	212
Avg/Min	1.68
Max/Min	2.12

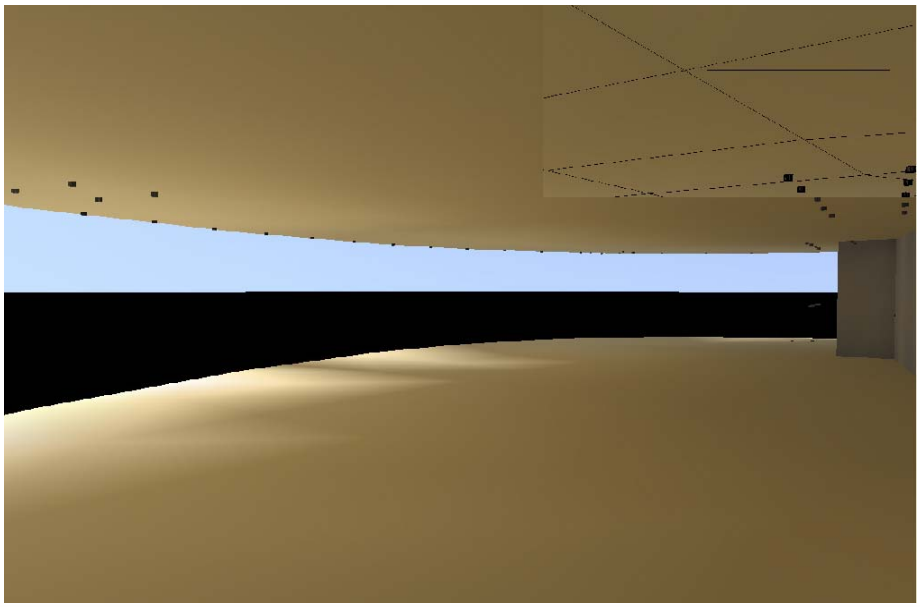
8:54 AM

Illuminance Values (fc)	Stack Far from window
Average	128.88
Maximum	159
Minimum	107



Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
3		125		250	
50		150		300	
75		175		350	
100		200		400	

Figure 35 Daylight only, 12:54 pm, clear sky conditions



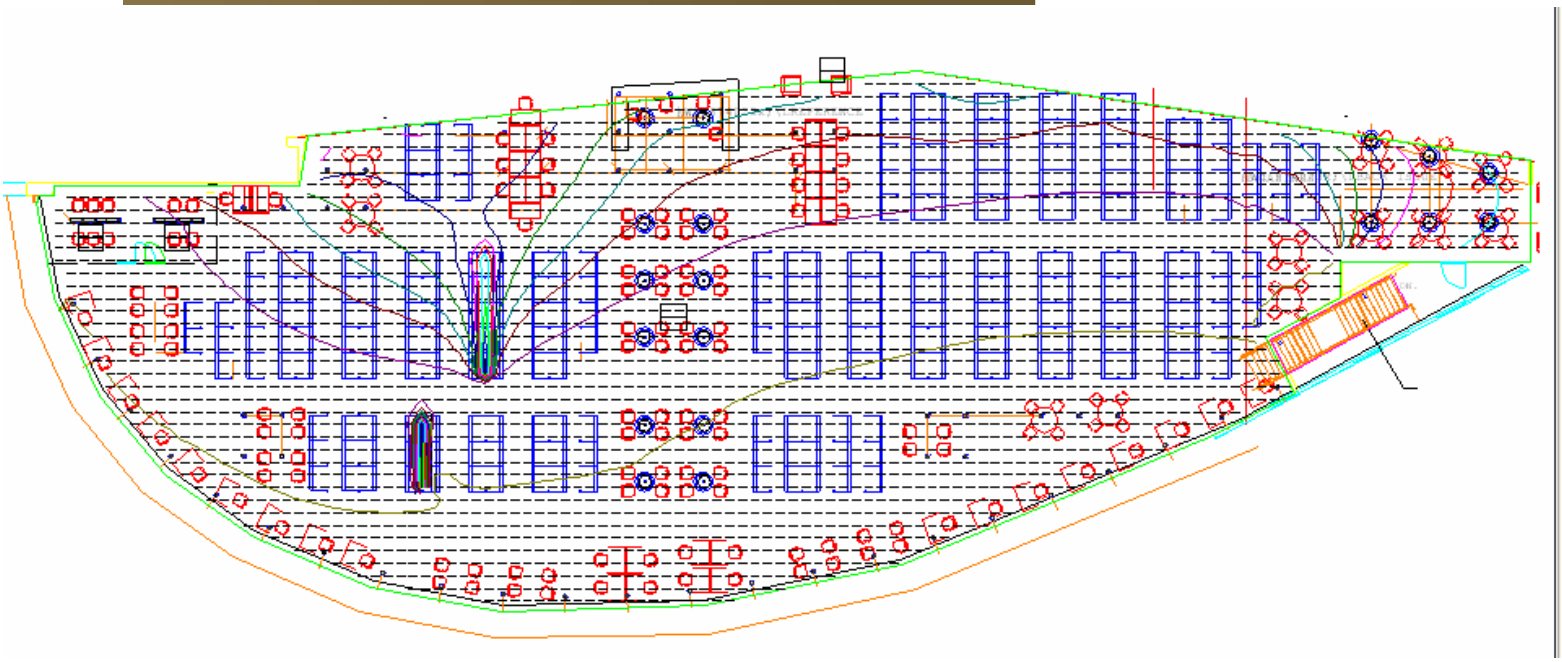
Illuminance Values (fc)	Work Plane
Average	583.67
Maximum	4284
Minimum	3.1
Avg/Min	188.28
Max/Min	1382.00

11:54 AM

Illuminance Values (fc)	Stack Near to window
Average	851.16
Maximum	1117
Minimum	392
Avg/Min	2.17
Max/Min	2.85

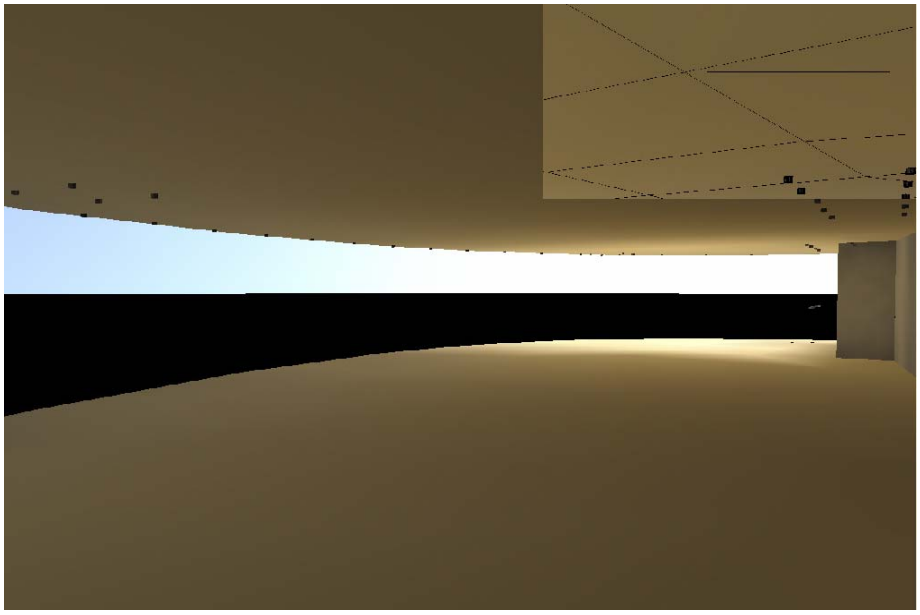
11:54 AM

Illuminance Values (fc)	Stack Far from window
Average	177.21
Maximum	217
Minimum	144
Avg/Min	1.23
Max/Min	1.51



Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
25		125		225	
50		150		250	
75		175		300	
100		200		500	

Figure 36 Daylight only, 5:54 pm, clear sky conditions



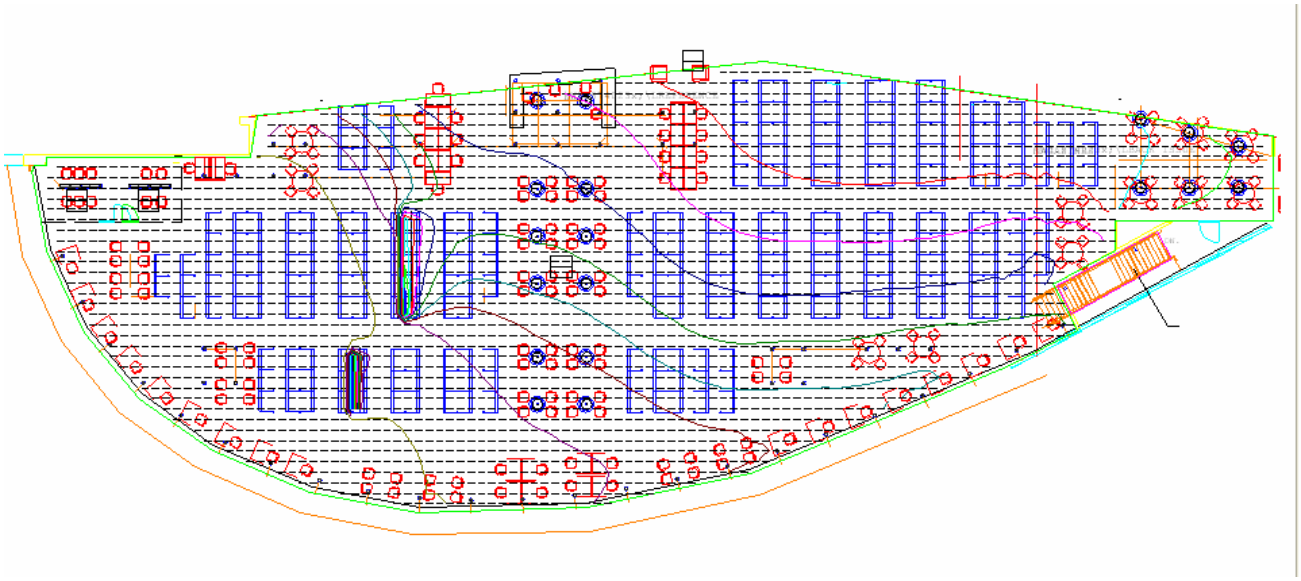
Illuminance Values (fc)	Work Plane
Average	460.13
Maximum	2637
Minimum	3.2
Avg/Min	143.79
Max/Min	824.13

3:54 PM

Illuminance Values (fc)	Stack Near to window
Average	496.19
Maximum	663
Minimum	231
Avg/Min	2.14
Max/Min	2.86

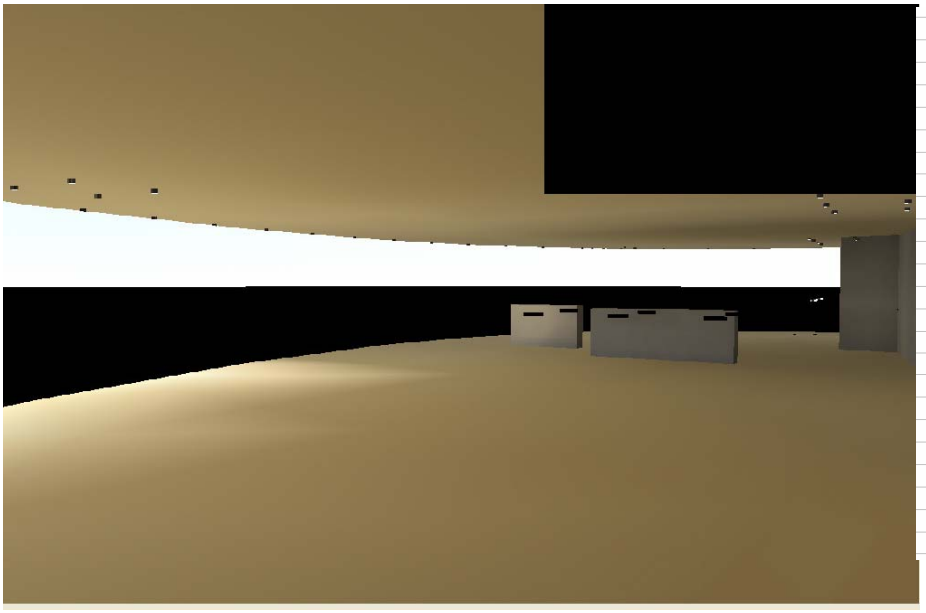
3:54 PM

Illuminance Values (fc)	Stack Far from window
Average	95.7
Maximum	115
Minimum	80.2
Avg/Min	1.19
Max/Min	1.44



Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
25		125		225	
50		150		250	
75		175		300	
100		200		400	

Figure 37 Daylight and Electric light, 7:54 am, clear sky conditions Dec 7



Illuminance Values (fc)	Work Plane
Average	207.8
Maximum	1335
Minimum	1
Avg/Min	207.8
Avg//Max	1335

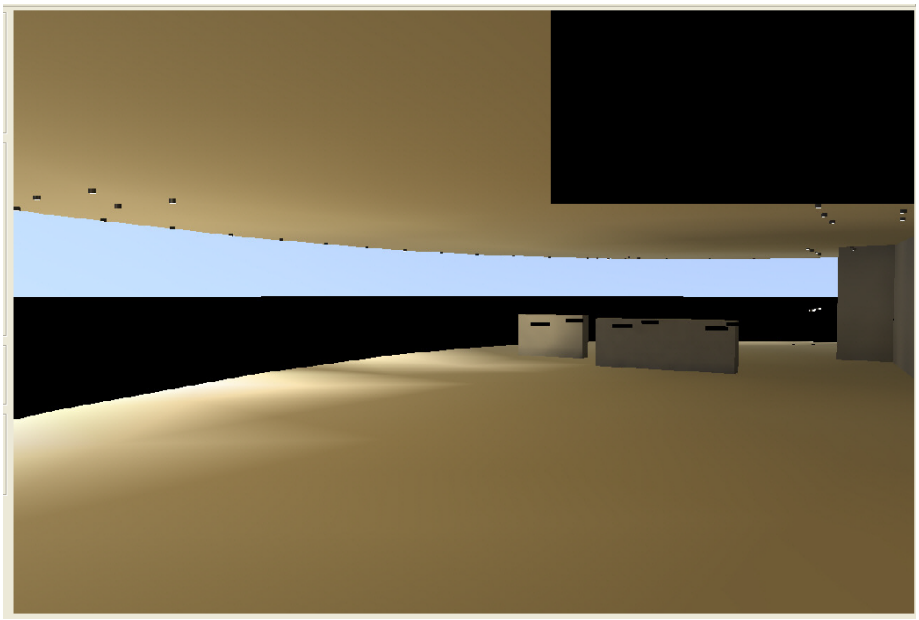
8:54 AM

Illuminance Values (fc)	Stack Near to window
Average	356.72
Maximum	451
Minimum	208
Avg/Min	1.71
Avg//Max	2.16

8:54 AM

Illuminance Values (fc)	Stack Far from window
Average	128.43
Maximum	156
Minimum	109
Avg/Min	1.18
Avg//Max	1.43

Figure 38 Daylight and Electric light, 12:54 pm, clear sky conditions Dec 7



Illuminance Values (fc)	Work Plane
Average	583.57
Maximum	4283
Minimum	3.1
Avg/Min	188.25
Avg//Max	1381

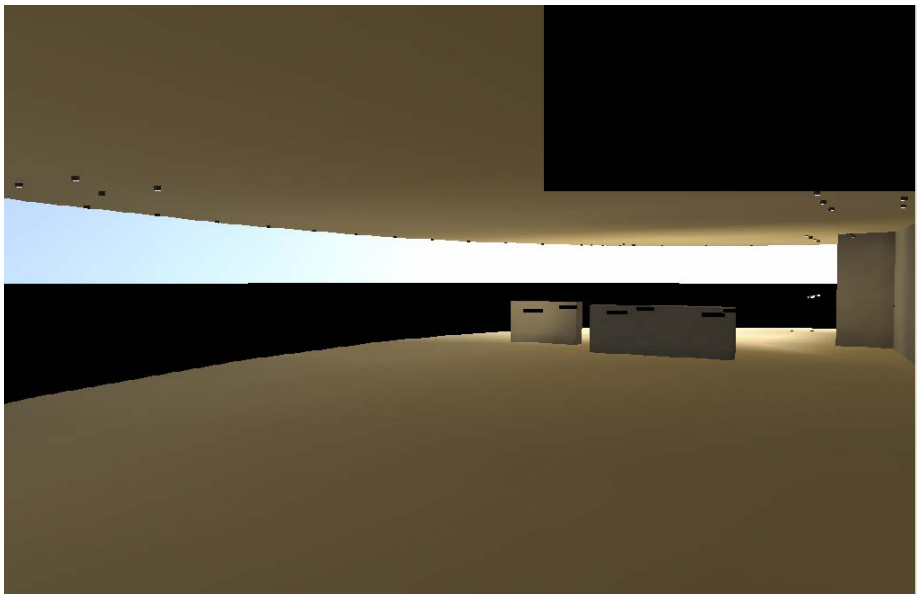
11:54 AM

Illuminance Values (fc)	Stack Near to window
Average	851.07
Maximum	1117
Minimum	400
Avg/Min	2.12
Avg//Max	2.79

11:54 AM

Illuminance Values (fc)	Stack Far from window
Average	177.83
Maximum	213
Minimum	144
Avg/Min	1.23
Avg//Max	1.48

Figure 39 Daylight and Electric light, 5:54 pm, clear sky conditions Dec 7



Illuminance Values (fc)	Work Plane
Average	460.16
Maximum	2636
Minimum	3.8
Avg/Min	121.09
Avg//Max	693.89

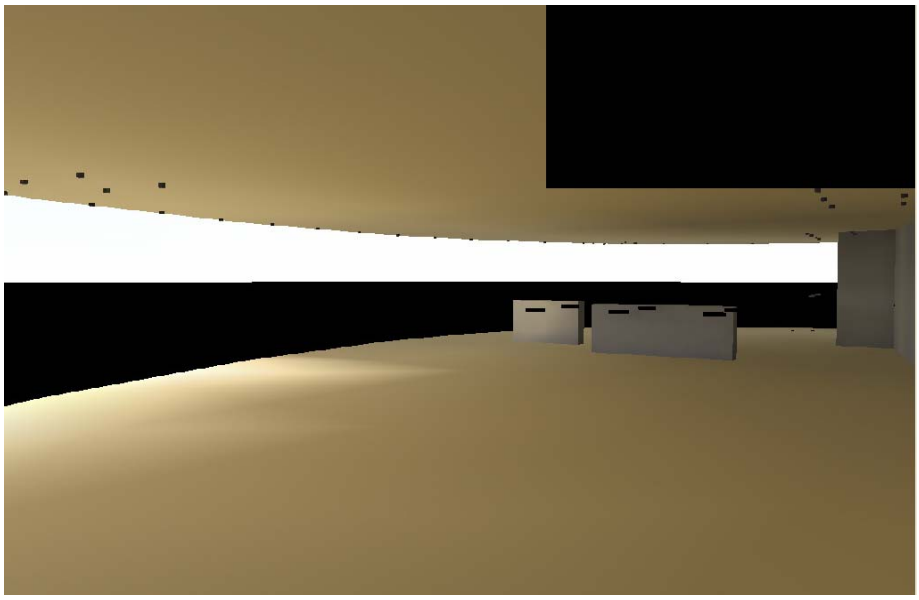
3:54 PM

Illuminance Values (fc)	Stack Near to window
Average	494.73
Maximum	657
Minimum	243
Avg/Min	2.03
Avg//Max	2.7

3:54 PM

Illuminance Values (fc)	Stack Far from window
Average	95.93
Maximum	117
Minimum	80.7
Avg/Min	1.19
Avg//Max	1.45

Figure 40 Daylight only, 7:54 am, clear sky conditions Dec 7



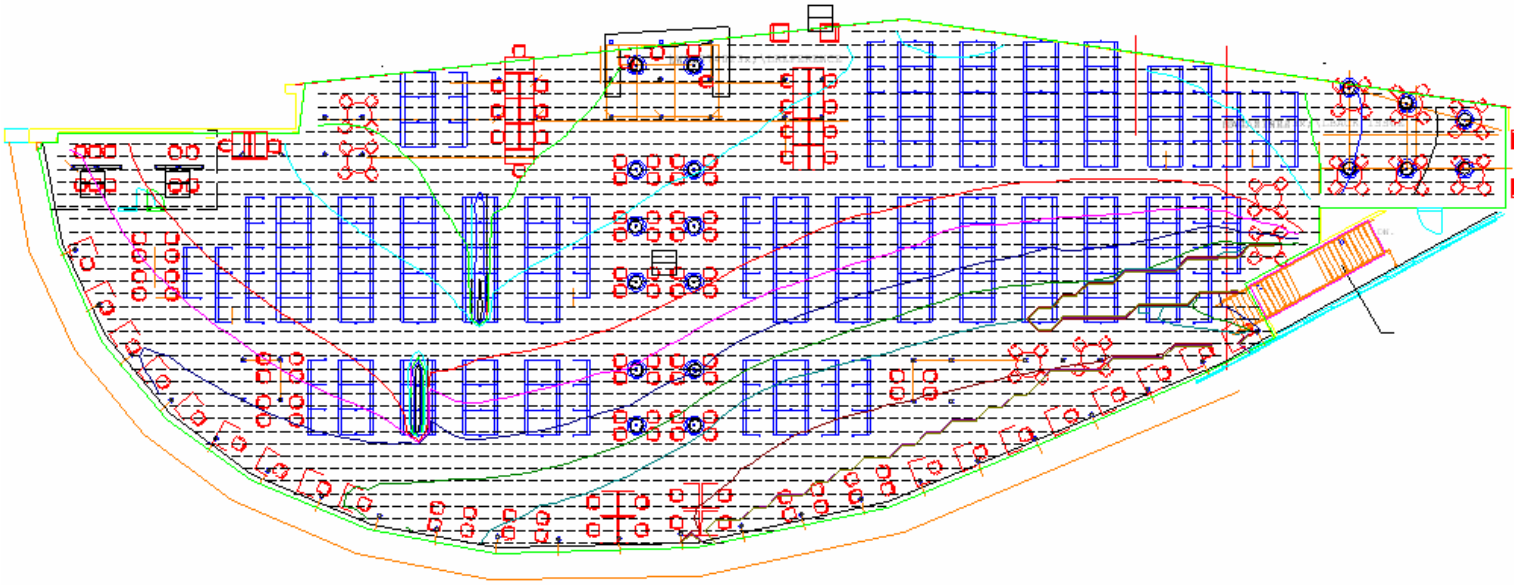
Illuminance Values (fc)	Work Plane
Average	231.28
Maximum	1351
Minimum	1.1
Avg/Min	210.25
Max/Min	1228

8:54 AM

Illuminance Values (fc)	Stack Near to window
Average	380.37
Maximum	478
Minimum	226
Avg/Min	1.68
Max/Min	2.12

8:54 AM

Illuminance Values (fc)	Stack Far from window
Average	145.4
Maximum	171
Minimum	124
Avg/Min	1.17
Max/Min	1.38



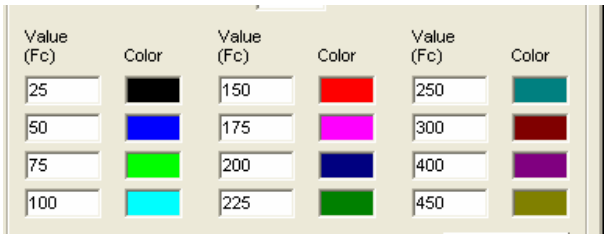
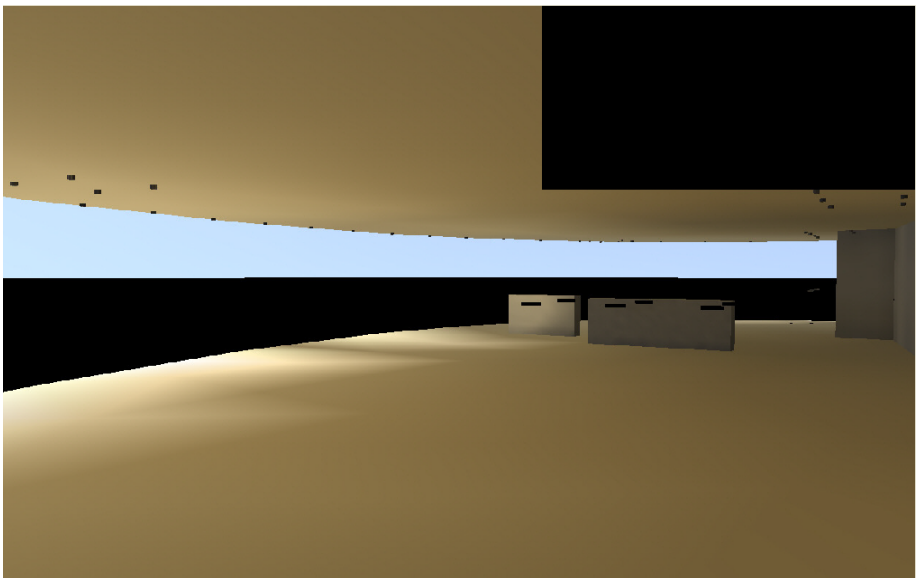


Figure 41 Daylight only, 12:54 pm, clear sky conditions Dec 7



11:54 AM

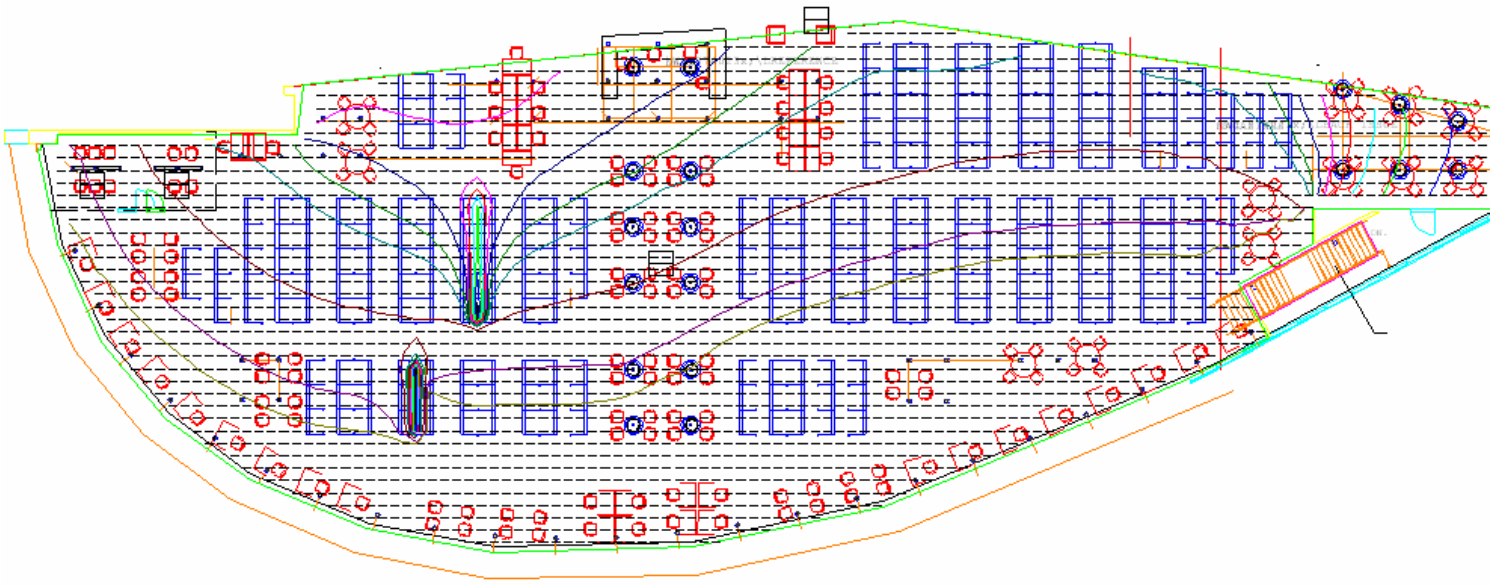
Illuminance Values (fc)	Work Plane
Average	606.39
Maximum	4299
Minimum	2.4
Avg/Min	252.66
Max/Min	1791.00

11:54 AM

Illuminance Values (fc)	Stack Near to window
Average	877.73
Maximum	1170
Minimum	402
Avg/Min	2.18
Max/Min	2.91

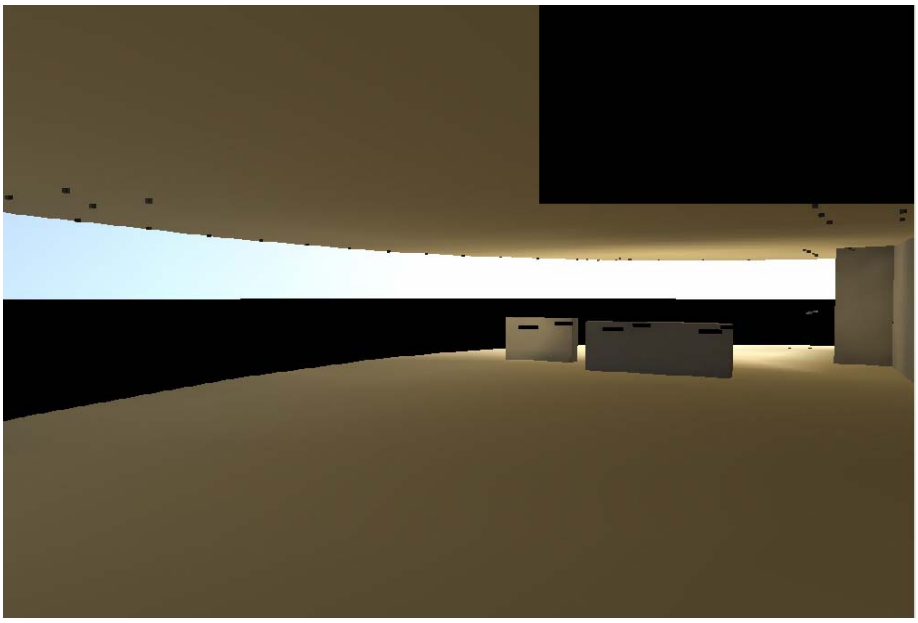
11:54 AM

Illuminance Values (fc)	Stack Far from window
Average	191.69
Maximum	235
Minimum	159
Avg/Min	1.2
Max/Min	1.48



Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
25		125		225	
50		150		300	
75		175		400	
100		200		450	

Figure 42 Daylight only, 5:54 pm, clear sky conditions Dec 7



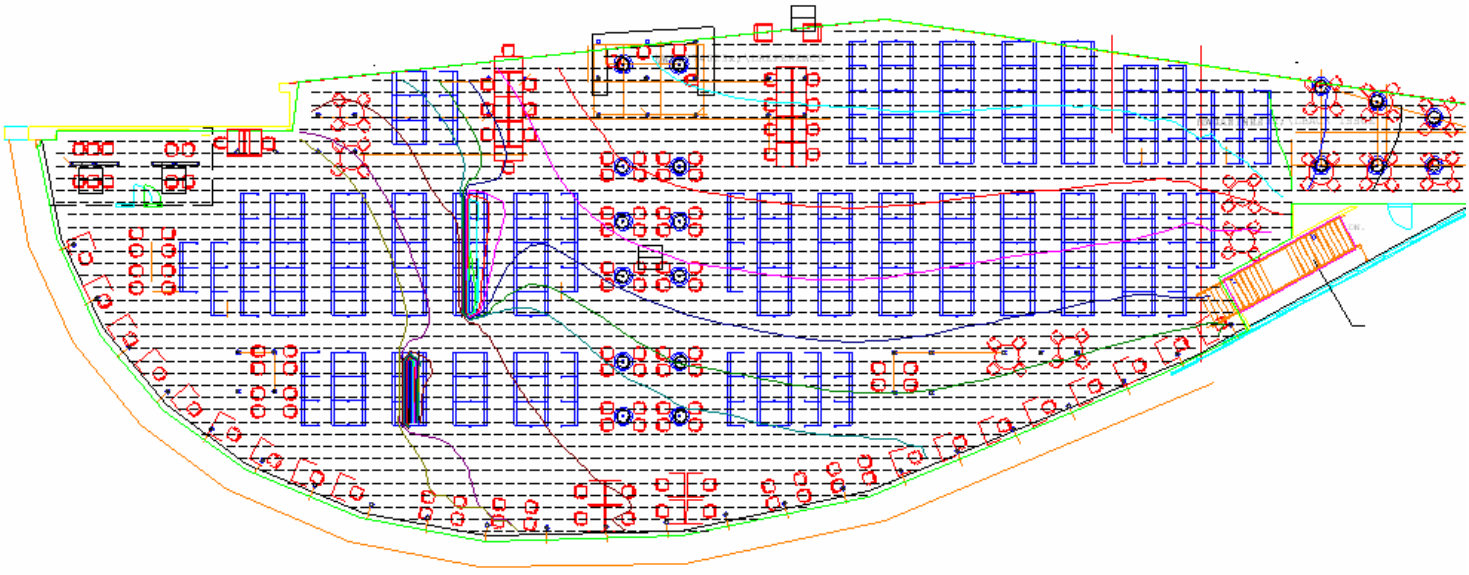
Illuminance Values (fc)	Work Plane
Average	483.01
Maximum	2654
Minimum	3.3
Avg/Min	146.37
Max/Min	804.52

3:54 PM

Illuminance Values (fc)	Stack Near to window
Average	515.96
Maximum	689
Minimum	257
Avg/Min	2.01
Max/Min	2.68

3:54 PM

Illuminance Values (fc)	Stack Far from window
Average	112.69
Maximum	130
Minimum	96.8
Avg/Min	1.16
Max/Min	1.34



Value (Fc)	Color	Value (Fc)	Color	Value (Fc)	Color
25		125		225	
50		150		300	
75		175		400	
100		200		450	

An Outdoor Space

The entry – the architect's intent for this glass curtain wall was to be a beacon or to act like a lantern. The canopy that extends from the interior of the building is made of aluminum and fixtures will not be able to penetrate the material. The signage of the library lies across the beam that extends along the north side of the building. Due to the LEED credit the fixtures will have to be mounted high so they can be aimed down not bleeding any light into the sky.

Currently exterior lighting consists of spotlights mounted high integrated with the framework of the glass curtain wall. These spotlights light the wall behind the curtain wall achieving the "lantern" effect. The canopy contains surface mounted downlights. With the slant of the canopy a direct line of sight into the lamp could be uncomfortable for entering visitors.

Figure 43 Exterior view of entrance

Figure 44 Floor Plan of Entrance

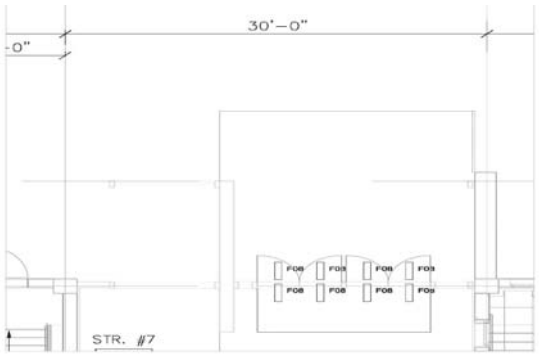


Figure 45 Lighting Layout

Type	Source	Name	Notes	Wattage	Lamp	CRI	CCT	Ballast Watts	Ballast Factor	Lamps per Ballast
F08	Fluorescent	Recessed 2' Linear Strip	"Cricket 61", symmetric distribution, opal glass lens	14w	(1) T5	85	3500	14	0.95	1
F20	Metal Halide	Floodlight	"Gizmo" series, assymetric beam	70w	(1) 70w CMH	82	3000	95	1	1
F24	Fluorescent	Recessed 7" Downlight (concrete)	"RDL" series, fully recessed, fluorescent downlight with clear lens	32w	(1) 32w TT	82	3500	32	0.98	1

Figure 46 Luminaires

F20

F08

Design Criteria

- LEED

Due to the LEED stipulation the fixtures used in the entrance of the building must be classified as full cut-off.

- Glare

With the position of these fixtures right now glare should not be a problem because fixtures will not be able to be seen in their present locations.

- Facial Rendering

Facial Rendering is very important under the canopy of the Library. Because the library should be in use at night people should feel safe as they enter and exit the building. Good facial rendering is of high importance in the safety factor.

- Illuminance (Horizontal)

Being that this is the main entrance of the building the necessary 3fc for an exterior entrance must be met. The light level should be strong enough to guide you into the building and not make the transition so harsh on the eyes.

- Illuminance (Vertical)

The vertical illuminance in the entrance will make the building shine like a lantern. The architect built a wall behind the glass façade purposely for this reason. The light level here should be raised above the normal 5 fc to achieve this effect.

Calculations

A calculation was taken of the back wall to see how much light the spot lights were getting towards the bottom of the wall. The light is evenly dispersed across the wall.

Figure 47 Light Loss Factors

Type	Maintenance Category	Cleaning Interval	Initial Lumens	Mean Lumens	LLD	LDD	BF	Total LLF
F08	V	Clean - 6 months	1350	1269	0.94	0.92	0.95	0.82
F20	V	Dirty - 12 months	6300	4100	0.65	0.76	1	0.49
F24	IV	Dirty - 6 months	3200	2690	0.84	0.82	0.98	0.68

Figure 48 Materials and Reflectance

Location	Ceiling	Wall	Wall	Walls	Floor
Materials	Painted Gypsum Board	Glass curtain wall	Painted Concrete	Painted Gypsum Board	Concrete
Reflectance	0.4	0	0.6	0.5	0.2

Figure 49 AGI Renderings