Lighting Depth

Depth Analysis: Lighting Design

Lighting design is not just the placement of lights, but the concept and feeling it portrays as well. ASHRAE 90.1 and LEED both have to be observed, while creating different atmospheres for different spaces. Rio Hondo Library and Learning Resource Center aims to be a beacon for the campus and shall be emphasized with the light.

In becoming a beacon, a lantern for the community, the library needs to feel warm and inviting, so people feel welcome and want to be in that space. Four spaces were chosen to accomplish these atmospheres: Lobby, Microfilm and Reading Area, Stacks, and Exterior Façade. The redesign of the exterior will highlight the architectural features while providing the lantern effect for the community. The three other spaces will achieve a clean, warm environment that will invite students to learn in a comfortable atmosphere.

After satisfying ASHRAE 90.1 the next goal will be the highest LEED credit possible for the building. The goal of the lighting design will be to achieve the correct light levels while minimizing the power consumption and maximizing the natural daylight.

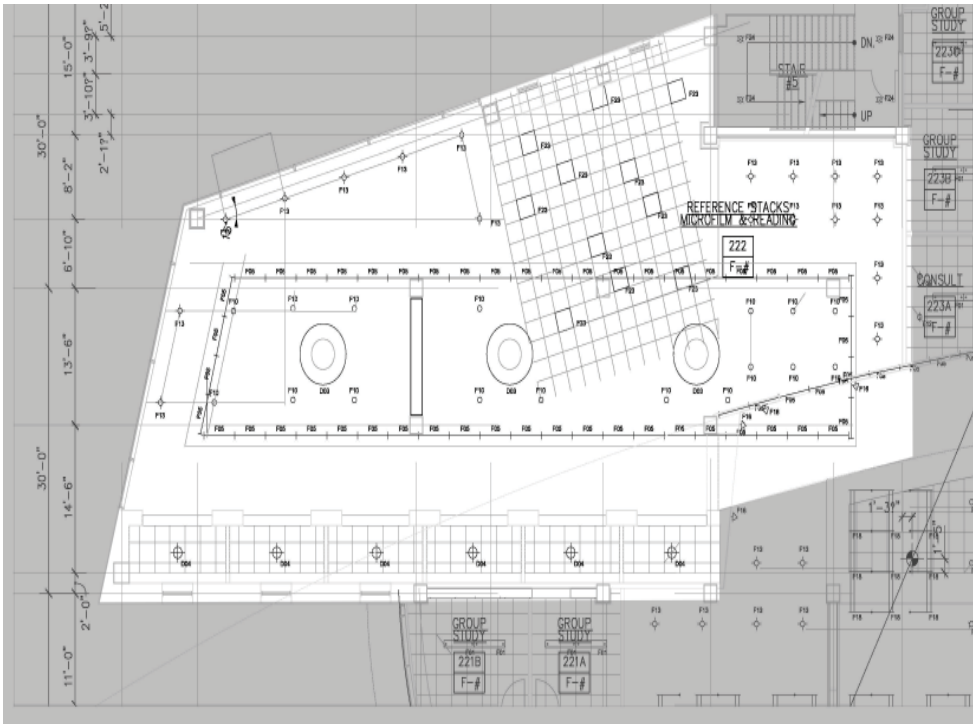
The following report shows a lighting daylight research into three possible solutions for new daylighting systems for two of the spaces. Each were calculated with the use of AGI 32 lighting software to see which system directed the most daylight into the area.

In addition to the daylighting system, new lighting designs were implemented in the four spaces to achieve certain atmospheres in the different spaces. The spaces are all unique and had different criteria that needed to be met. This is explained further in detail when describing each space.

Microfilm and Reading Area

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.



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)

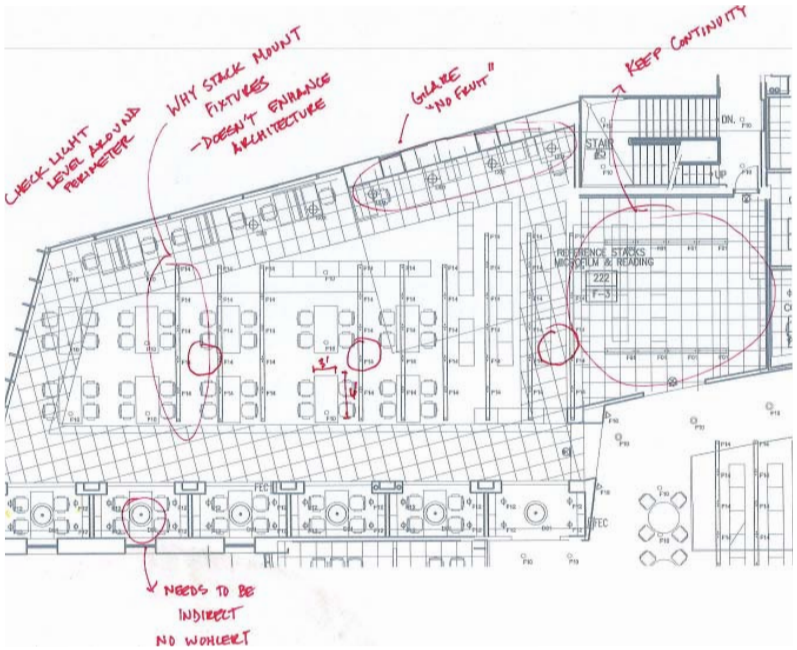
Vertical illuminance is not of high importance in this space other than to accentuate the space and for facial rendering.

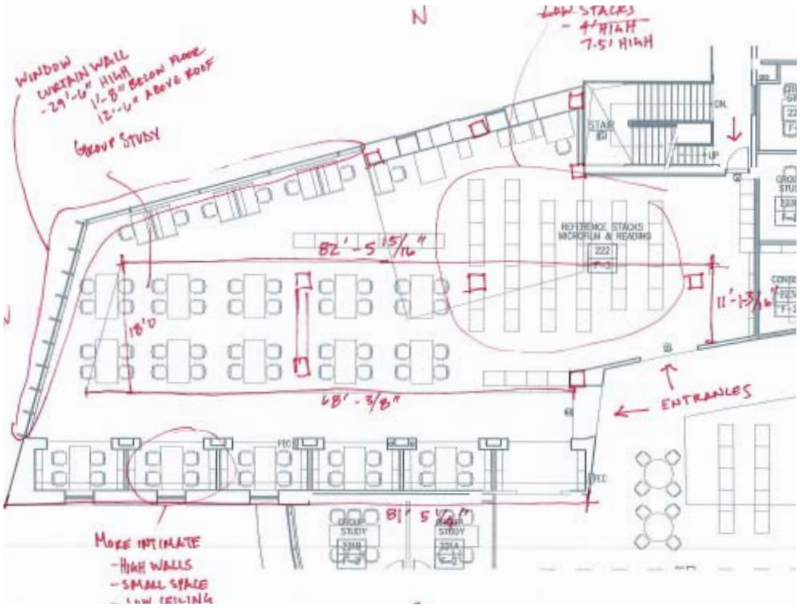
- Title 24

In this area according to ASHRAE 90.1, the allowed wattage for this space based on area is 4491 watts per ft^2. Currently summing the ballast watts for this space, only 3095 watts have been used which falls greatly below the maximum power allowance.

Materials and Reflectances

Location	Ceiling	Ceiling	Ceiling	Walls	Floor
Materials	Higher ceiling plane	Lower ceiling plane Painted Gypsum	Painted Gypsum Board	Painted Gypsum Board	Carpet
Reflectance	0.55	0.57	0.23	0.91	0.3

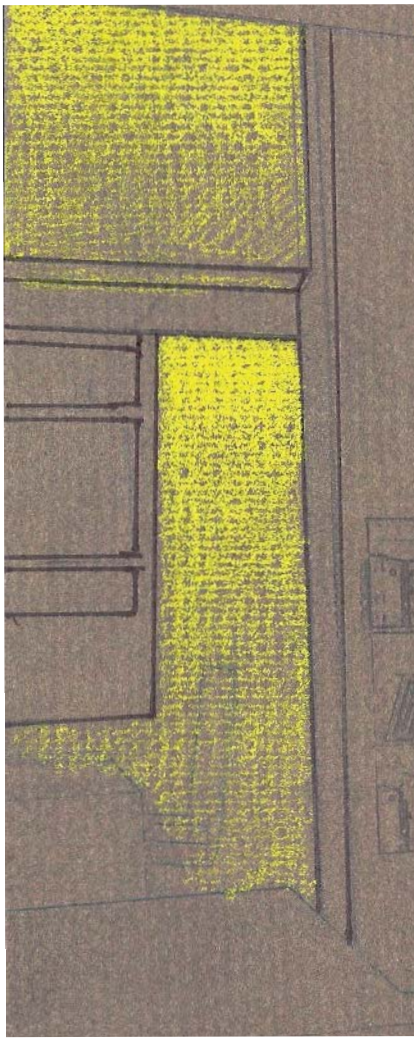


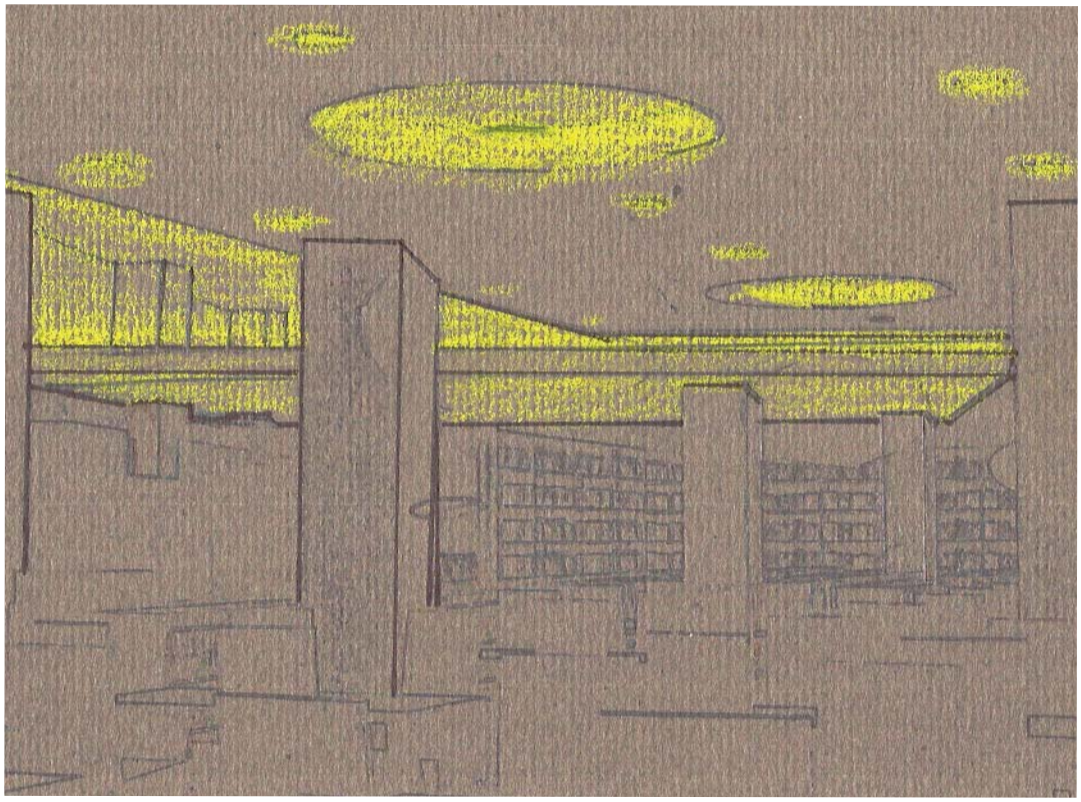


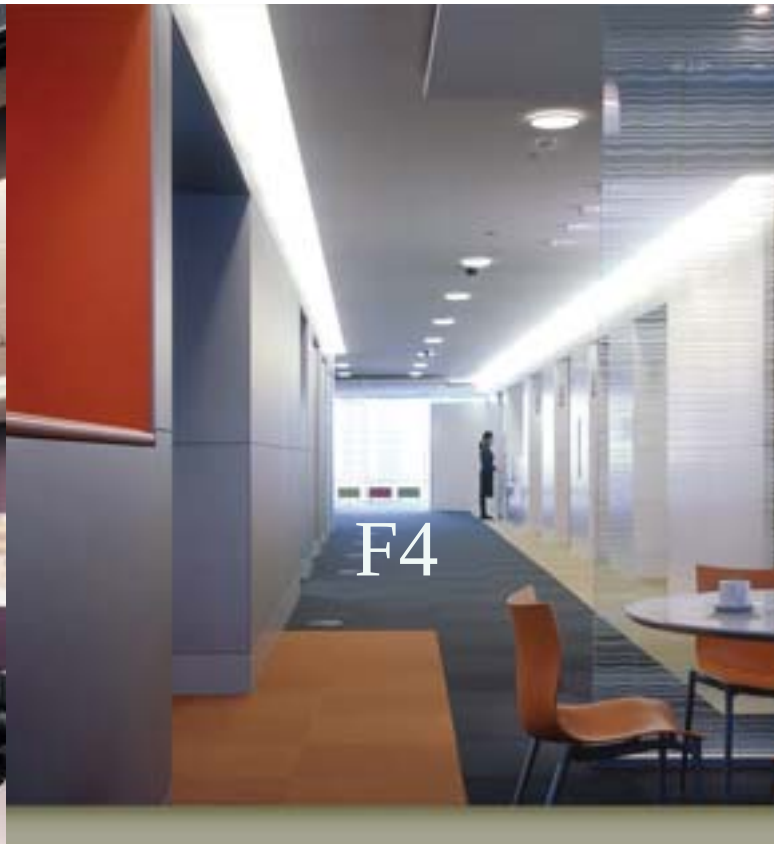
Design Process

Schematics

The design process starts with recognizing the problems with the given system. The first problem in this area, the architect chose the aesthetics of the fixture as opposed to the function of the fixture. In redesigning this area, function came first. Layers of light enhance the architecture within the unique space: lighting the ceiling with a cove light, the walls with linear wall washers, downlights to achieve the correct light level, and indirect pendants to throw another layer of light onto the ceiling. The use of clean indirect and direct fixtures adds the fourth element to the architecture.







Type	Source	Name	Notes	Wattage	Lamp	CRI	CCT
F04	Fluorescent	Recessed 1x4 Wallwash Troffer	"Avenue A" series	28w	(1) 28w T5	82	3500
F05	Fluorescent	Slot Light	"Ashley" series, integral electronic ballast, emergency ballast as required by Electrical Engineer	54w	(1) T5HO	85	3500
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	32w	(1) TT	82	3500
F12	Fluorescent	Recessed 6" WallWash	"Haze" Alzak reflector	32w	(1) TT	82	3500
F18	Fluorescent	Indirect Pendant	"Metro" series, low profile round housing 11" diameter luminous acrylic diffuser	42w	(4) TT	82	3500
F23	Fluorescent	Recessed 2'x2' Square	"Sky" series, Bi directional	14w	(4) 14w T5	82	3500

Ballast Schedule

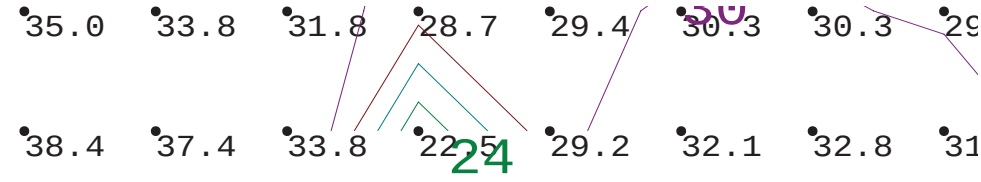
Ballast ID	Ballast	Voltage	Lamp	Input Wattage	Input Current	Fixtures	Electric/Magnetic	Dim
Es5840K	Ballast 1	120	(1) T5	63	0.53	F05	Electronic	Yes
ES5000	Ballast 2	120	(1) 32w TT	35	0.3	F10, F12	Electronic	Yes
Es5850	Ballast 3	120	(4) 14w T5	56	0.28	F23	Electronic	Yes
Es5000HT	Ballast 4	120	(4) 42w TT	176	0.34	F18	Electronic	Yes
ES5842K	Ballast 5	120	(1) 28w T5	37	0.3	F04	Electronic	Yes

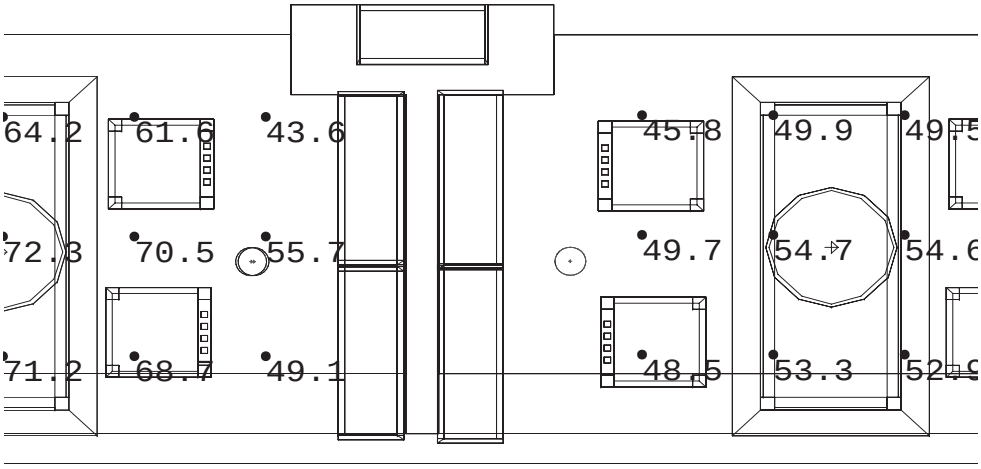
Power Density

Location	Fixture	Quantity	Watts	Total Watts	Area (ft^2)	Power Density	Allowable Power Densi
Microfilm Area	F05	30	63	1890		1.492465534	1.5
	F10	26	35	910			
	F12	12	35	420			
	F18	9	176	1584			
	F23	10	56	560			
	F04	6	37	222	3742.8		

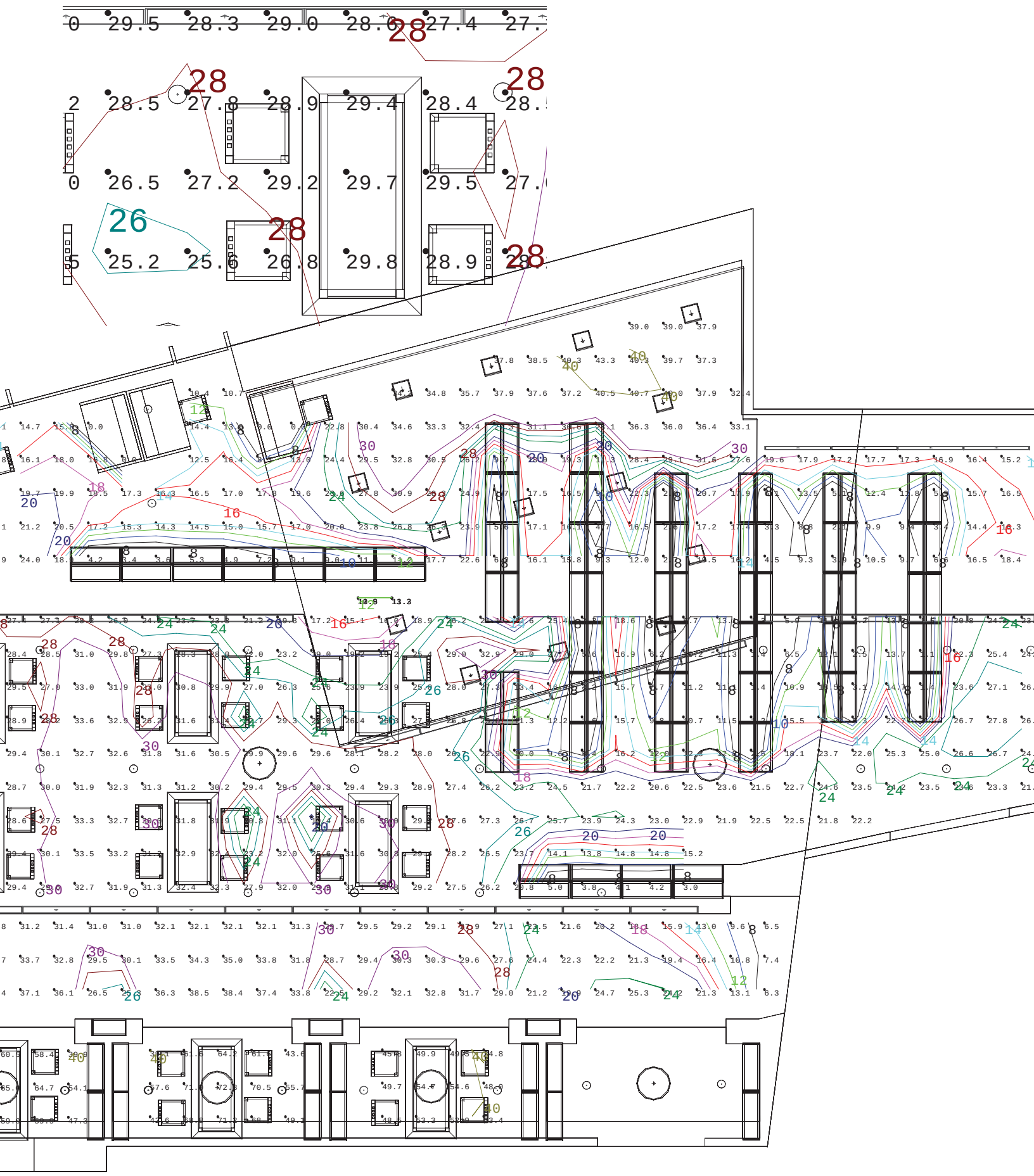
Light Loss Factors

Type	Maintenance Category	Cleaning Interval	LLD	LDD	RSDD	BF	Total LLF
F04	V	Clean - 12 months	0.95	0.88	0.96	1	0.80
F05	VI	Clean - 12 months	0.94	0.92	0.66	1	0.57
F10	IV	Clean - 12 months	0.84	0.95	0.91	1	0.73
F12	IV	Clean - 12 months	0.84	0.95	0.93	1	0.74
F18	IV	Clean - 12 months	0.85	0.88	0.96	1	0.72
F23	V	Clean - 12 months	0.95	0.92	0.93	1	0.81





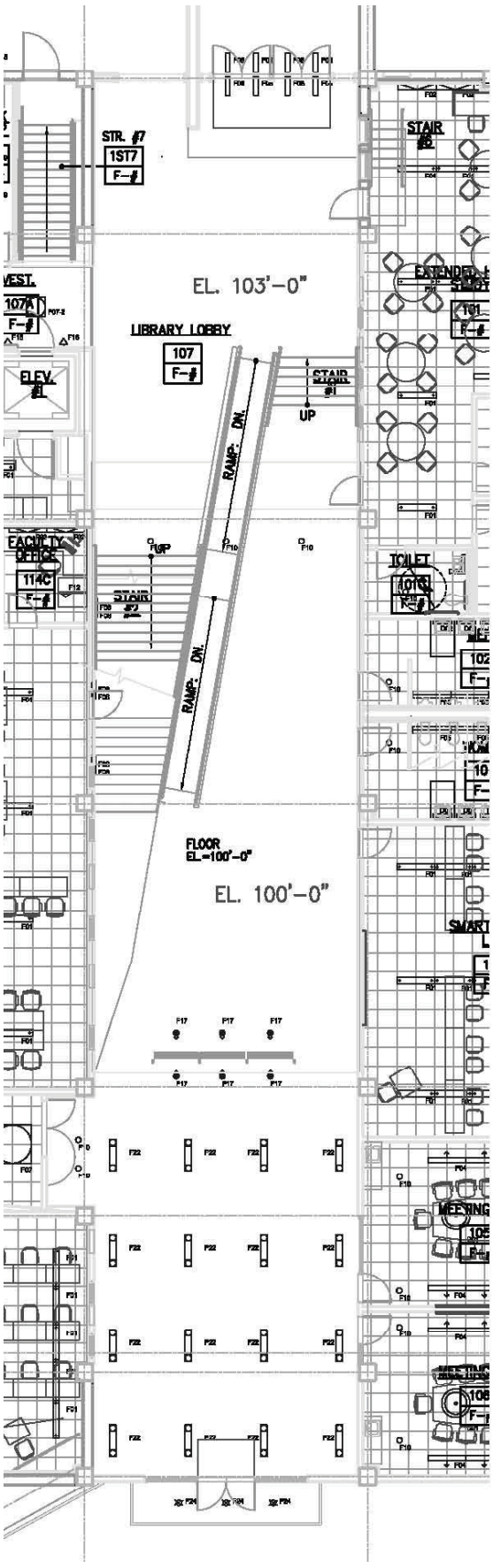
5Fc
10 Fc
15Fc
20 Fc
25 Fc
30 Fc
40 Fc
50Fc
60Fc



Conclusions

In this area the use of simple unobtrusive fixtures allow the space to show off its architecture. The light now serves a function. The use of indirect and direct fixtures enhances the space with multilayers of light.

Lobby


STR. #1
1ST7
F-#
STAIR
EL. 103'-0"
LIBRARY LOBBY
107
F-#
ELEV.
#1
STAIR
#1
UP
RAMP: DN.
FACULTY OFFICE
114C
F-#
UP
STAIR
#2
RAMP: DN.
TOILET
FLOOR
EL.=100'-0"
EL. 100'-0"
MEETING

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.

Design Criteria

• 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.

• 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.

•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 c eiling 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.

• 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.

• Illuminance (Vertical)

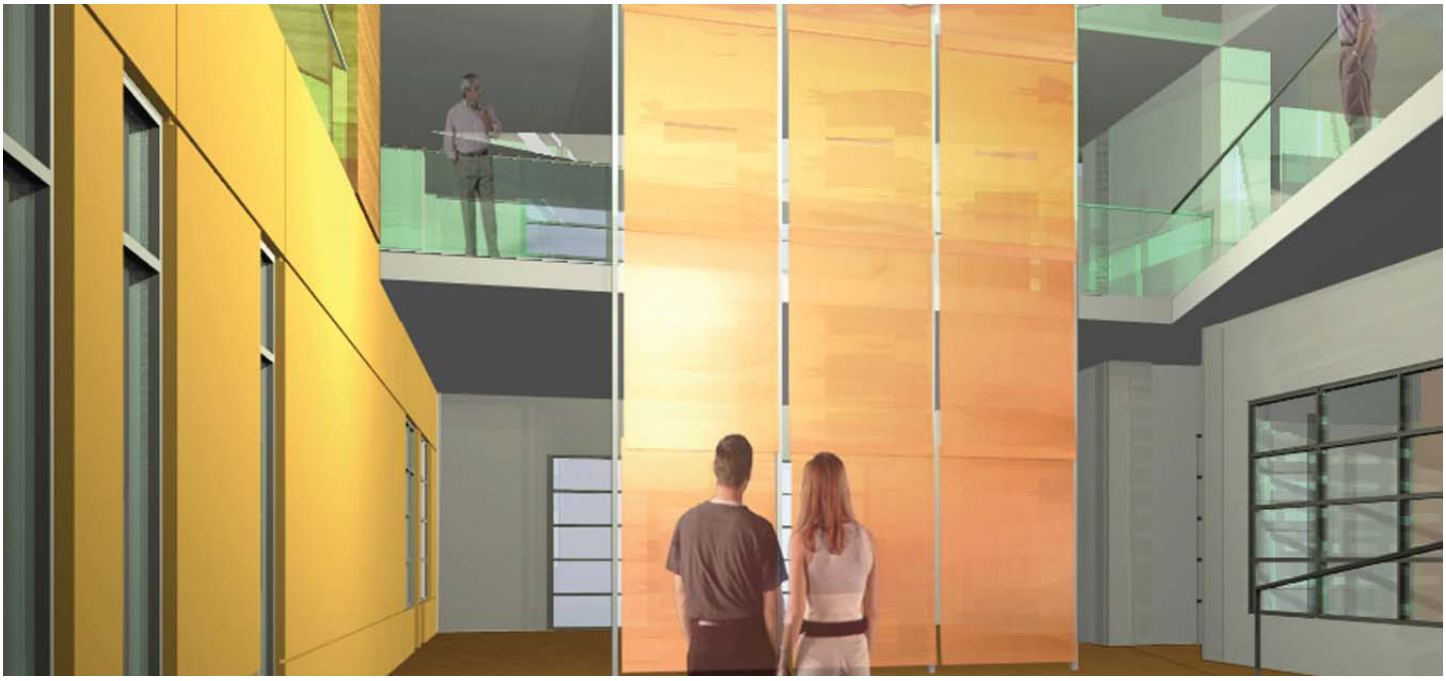
A value from 5-10 fc should be reached for people's faces in the lobby. The three panel focal points should reach a level where it is a high contrast to the surrounding that draws immediate attention.

• 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

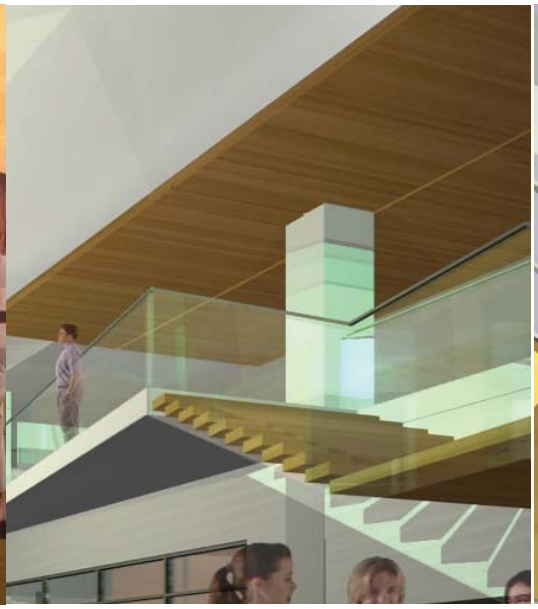
• Title 24

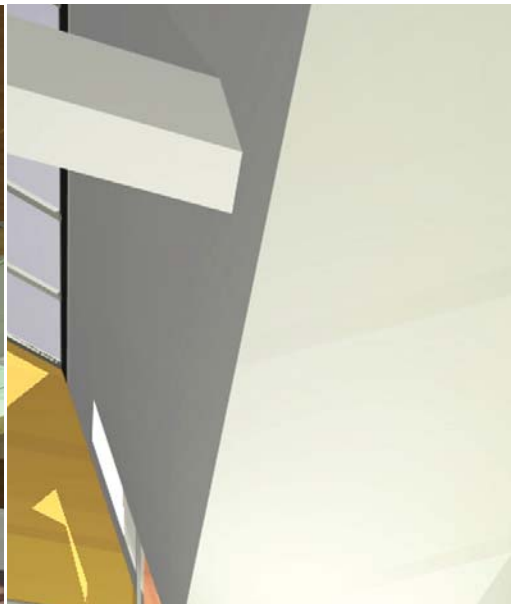
According to ASHRAE 90.1 space by space method the allowed watts for this lobby space is 6268.5 watts per ft^2, that is 1.5 watts per ft^2 and the area of the space is 4179 ft^2. Currently by summing the ballast watts for the fixtures in this space the total wattage is 3124 watts per ft^2. Currently the power density is well below the



Materials and Reflectances

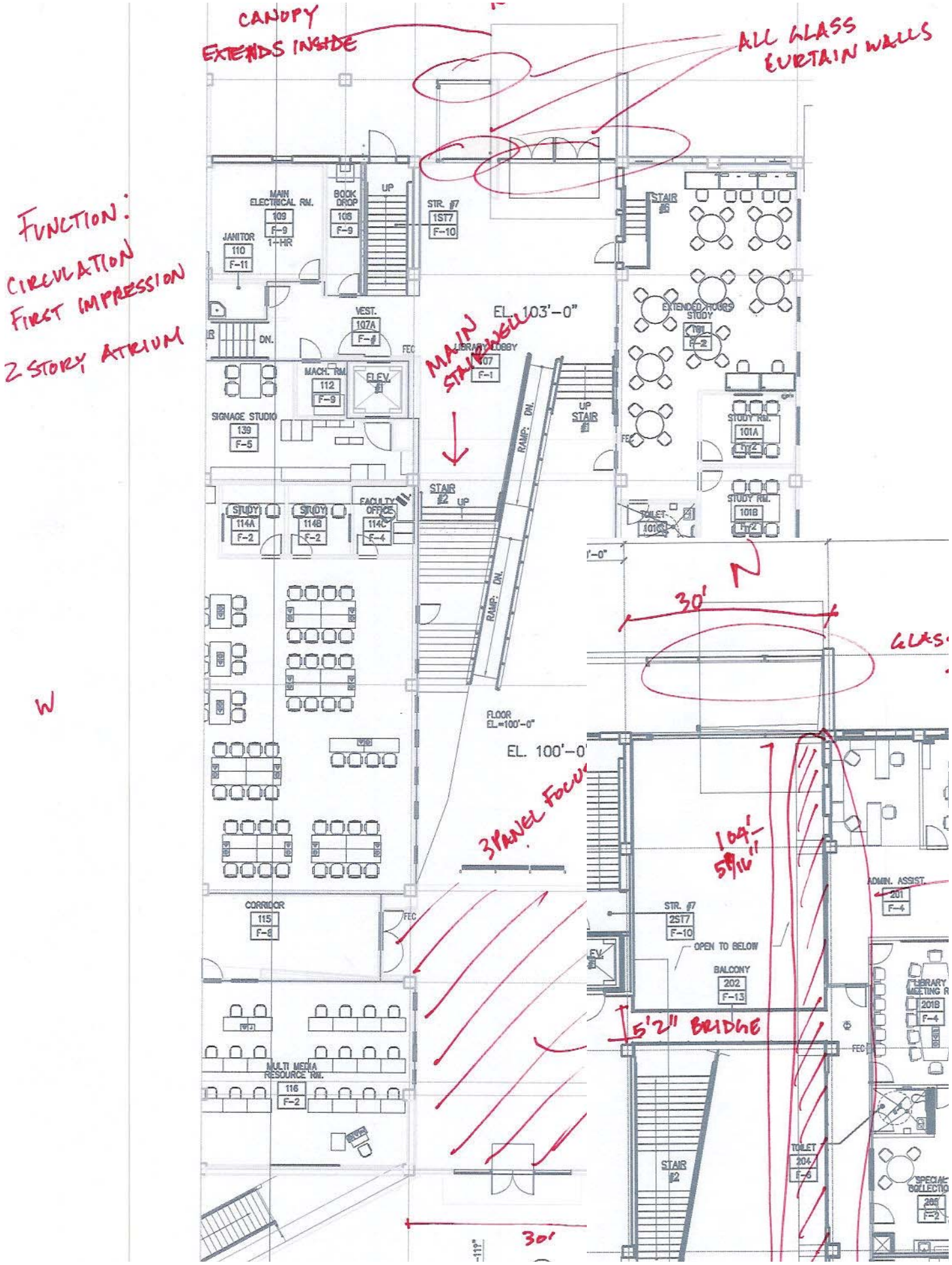
Location	Ceiling	Floating Ceiling	East Wall	Entry Wall	All other walls	Floor	Glass
Materials	Painted Gypsum Board	Wood	Wood Veneer Paneling	Painted Concrete	Painted Gypsum Board	Carpet	Clear Glazing
Reflectance	0.91	0.77	0.6	0.73	0.91	0.3	.8 transmittance

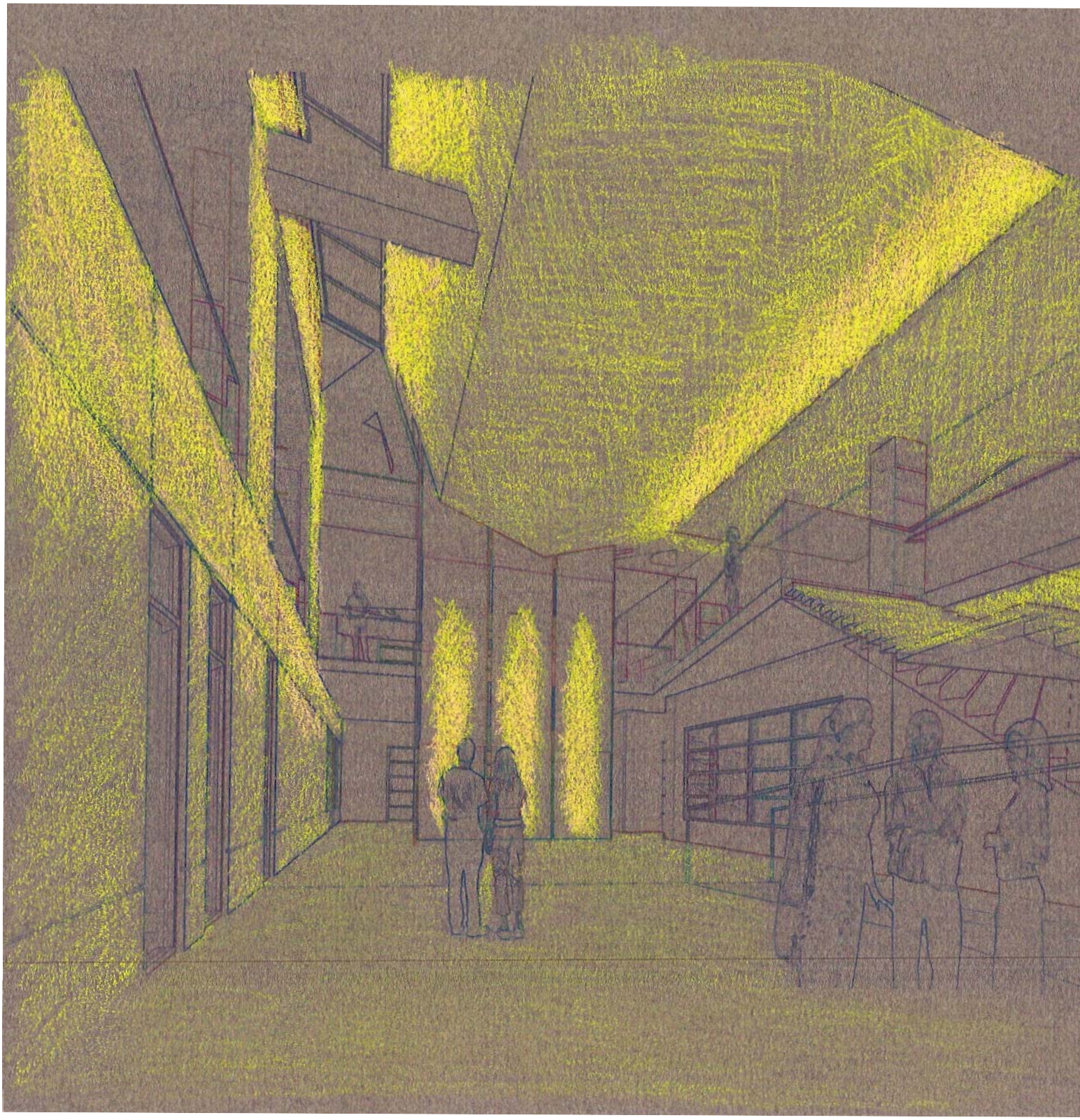


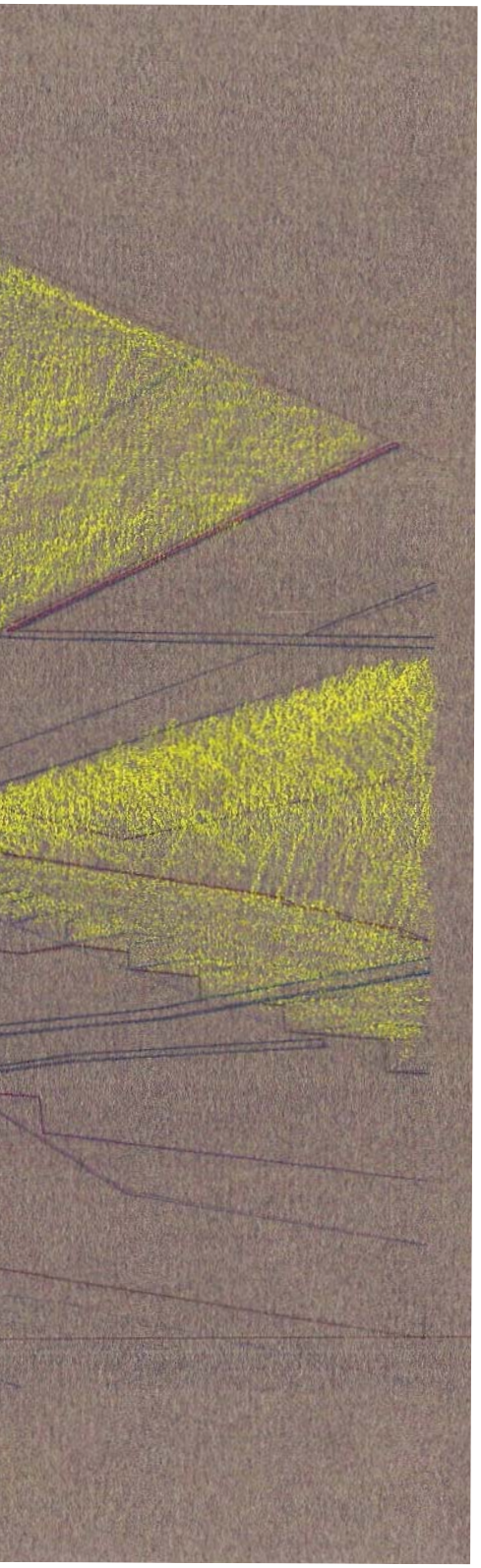


Design Process

As this space was approached there were different factors than the Microfilm Area. The lobby space is the first space students and visitors enter when they use Rio Hondo's Library and Learning Resource Center. The need for comfort and an inviting atmosphere takes precedence in this space. This two story atrium has a huge 39' focal point that takes hierarchy in the middle of the lobby. Behind the panels the space is designated for an ever changing gallery space for artwork to be displayed. Nothing is permanent in this space, so the lighting had to be the most flexible possible in being able to shoot and highlight at different angles from one day to the next. This is also more of an intimate space being that it is only 10' high compared to the 39' ceiling beyond the panel. The lobby has to have two atmospheres to address each different environment.


CANOPY EXTENDS INSIDE
ALL GLASS CURTAIN WALLS
FUNCTION:
CIRCULATION
FIRST IMPRESSION
2 STORY ATRIUM
W
MAIN ELECTRICAL RM. 109 F-9 1-HR
BOOK DROP 108 F-9
UP
STR. #7 1ST7 F-10
JANITOR 110 F-11
VEST. 107A F-1
DN.
EL. 103'-0"
MAIN STAIR #1
LIBRARY LOBBY 107 F-1
MACH. RM. 112 F-9
ELEV. #1
SIGNAGE STUDIO 139 F-5
RAMP: DN.
UP STAIR #3
STAIR #2 UP
STUDY 114A F-2
STUDY 114B F-2
FACULTY OFFICE 114C F-4
RAMP: DN.
FLOOR EL.=100'-0"
EL. 100'-0"
3 PANEL FOCUS
CORRIDOR 115 F-8
FEC
MULTI MEDIA RESOURCE RM. 116 F-2
30'
STAIR #5
EXTENDED HOURS STUDY 101 F-2
STUDY RM. 101A F-2
TOILET 101C
STUDY RM. 101B F-2
N
30'
GLASS
104'-5 9/16"
ADMIN. ASSIST. 201 F-4
STR. #7 2ST7 F-10
OPEN TO BELOW
BALCONY 202 F-13
5'-2" BRIDGE
LIBRARY MEETING R 201B F-4
FEC
TOILET 204 F-6
STAIR #2
SPECIAL COLLECTIO 205 F-2





The goal of main lobby area is to glow as a beacon for the campus. The front and rear façade are predominately glass calling for it to be a lantern. For this effect, all the surfaces must be illuminated so there are no dark spots on the inside. So from the outside it reads as a glowing force. The main features are the angled ceiling, the huge focal points, and the warm materials. The three main panels are lit from in-grade fixtures allowing the panels to be highlighted. The walls are lit from linear wall washers giving off a uniform wash. The ceiling is lit from the walls above the second floor. Angled luminaries push the light towards the ceiling. Beams that cross into the angled ceiling from the second floor were used to house downlights that also have the capability of being angled so the walls and the floor can be washed. Washing the walls with warm light will enhance the warm materials chosen for this space.

Type	Source	Name	Notes	Wattage	Lamp	CRI	CCT
F05	Fluorescent	Slot Light	"Ashley" series, integral electronic ballast, emergency ballast as required by Electrical Engineer	54w	(1) T5HO	85	3500
F08	Fluorescent	Recessed Step Light	"Heli" series,	20w	(1) T9	85	3500
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
F17	Halogen	Recessed Adjustable Light	"Grid in Limit" series, includes Reflector FL-20 degrees and Glass UV Q Top	50w	(2) 50w	82	3000
F21	Halogen	Juno Track Light	"Classic" series	50w	(1) 50w MR16	100	3050
F22	Halogen	Recessed Floor luminaire	Erco "Nadir" series, 30 degree angle	75w	(1) PAR 30	81	2830
F04	Fluorescent	Recessed 1x4 Wallwash Troffer	"Avenue A" series	28w	(1) 28w T5	82	3500

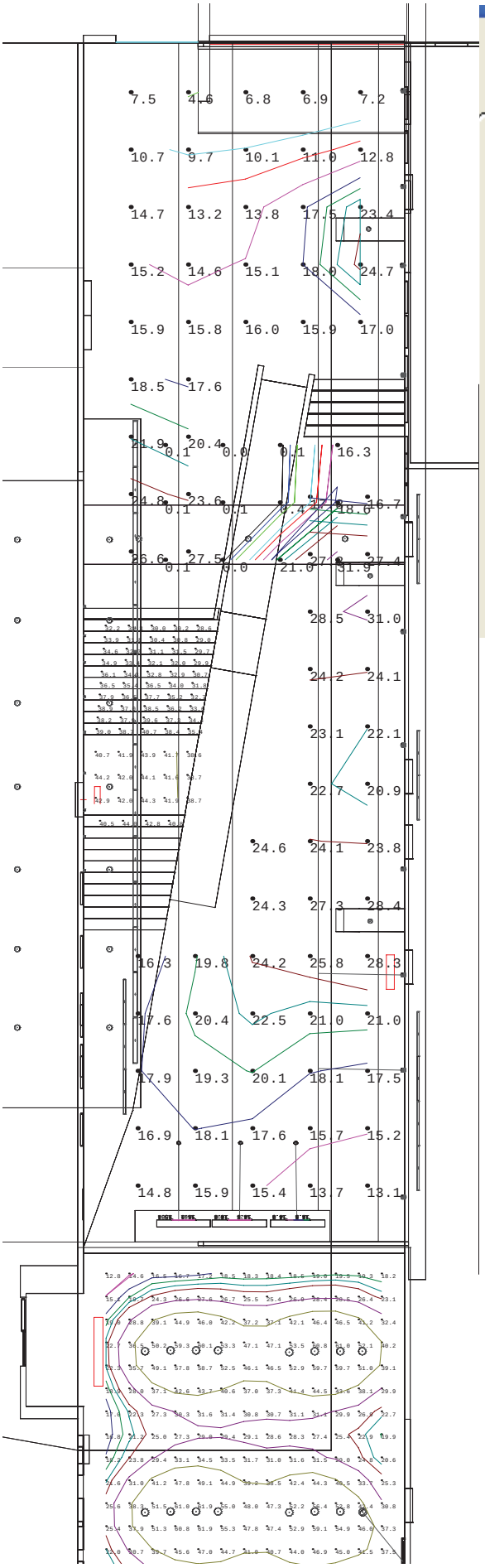
Type	Maintenance Category	Cleaning Interval	Initial Lumens	Mean Lumens	LLD	LDD	RSDD	BF	Total LLF
F04	IV	Clean 12 months	2900	2750	0.94	0.97	0.94	1	0.86
F05	VI	Clean 12 months	5000	4700	0.94	0.97	0.94	1	0.86
F08	VI	Clean 12 months	800	560	0.70	0.94	0.96	0.75	0.47
F10	IV	Clean 12 months	3200	2690	0.84	0.95	0.91	0.98	0.71
F17	IV	Clean 12 months	1030	825	0.80	0.95	0.91	0.98	0.68
F21	IV	Clean 12 months	825	620	0.75	0.94	0.94		0.66
F22	V	Clean 12 months	1030	790	0.77	0.88	0.96		0.65

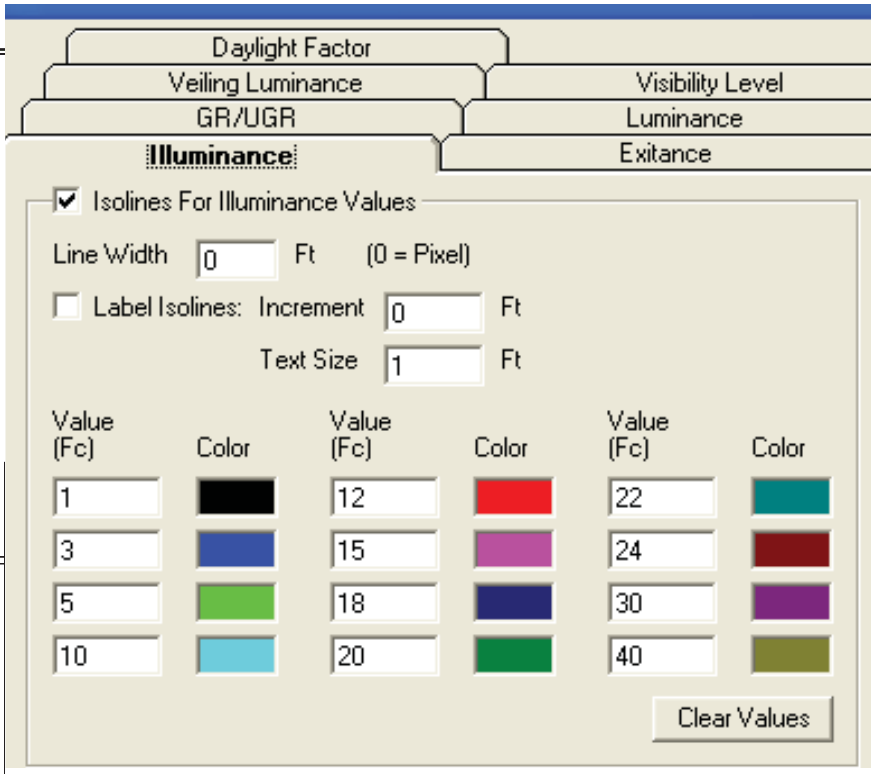
New Ballasts

Ballast ID	Ballast	Voltage	Lamp	Input Watts	Input Current	Fixtures	Electronic/Magn	Dimming	Manufacturer	BF
RLQS122TPW	Ballast 6	120	(1) 20w	24		F08	Magnetic	Fixed	Advancetransformer	0.75

Power Density

Location	Fixture	Quantity	Watts	Total Watts	Area (ft^2)	Power Density	Allowable
Lobby	F05	14	54	756			
	F08	9	24	216			
	F10	17	42	714			
	F17	14	100	1400			
	F21	50	50	2500			
	F22	3	75	225			
	F04	11	28	308			
				6119	4179	1.46	1.5





The light level on the ground floor is a little over the normal 10 fc. However, with the glass facade and the skylight running the length of the lobby the extra light will add to a better transition from the exterior. The location of the fixtures in this space was important due to the fact that the architecture has such clean lines. Wall sconces and other visible fixtures would not fit as well as streamlined fixtures. In the gallery space the track system is the most versatile lighting system with its ability to change with whatever is changing in the atmosphere.

Conclusions

This space is the first space where visitors enter and get their first impression of the new library. Providing a warm and welcoming environment is a priority. Adding light to the ceiling and wall surfaces throughout the space allows the space to feel even larger. The warm, welcoming spacious, environment is exactly the feeling that this space should portray.

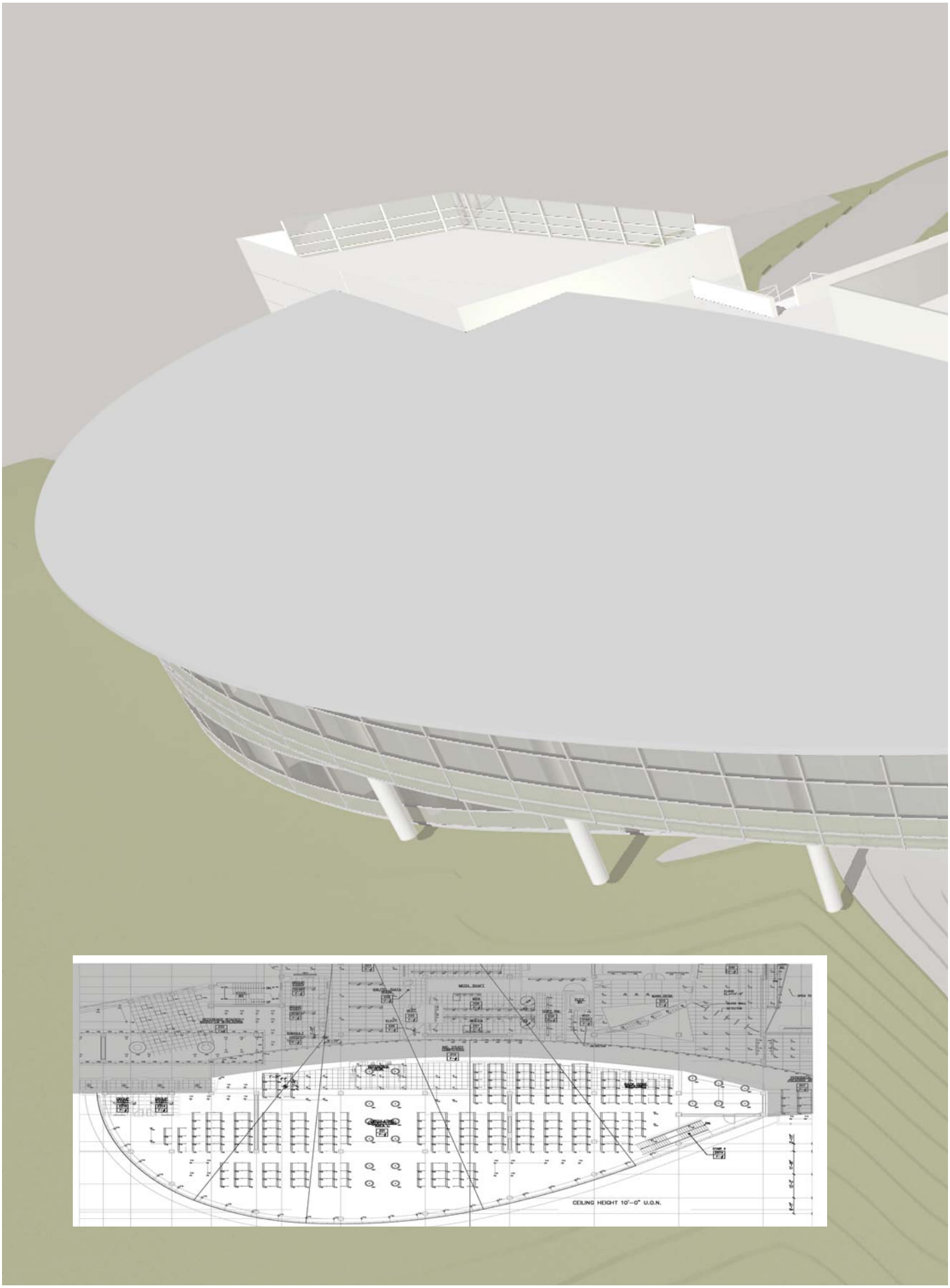
The Stacks

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.



CEILING HEIGHT 10'-0" U.O.N.

DESIGN CR

- 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.

- 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.

RITERIA

- 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 (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

- Illuminance (Horizontal)

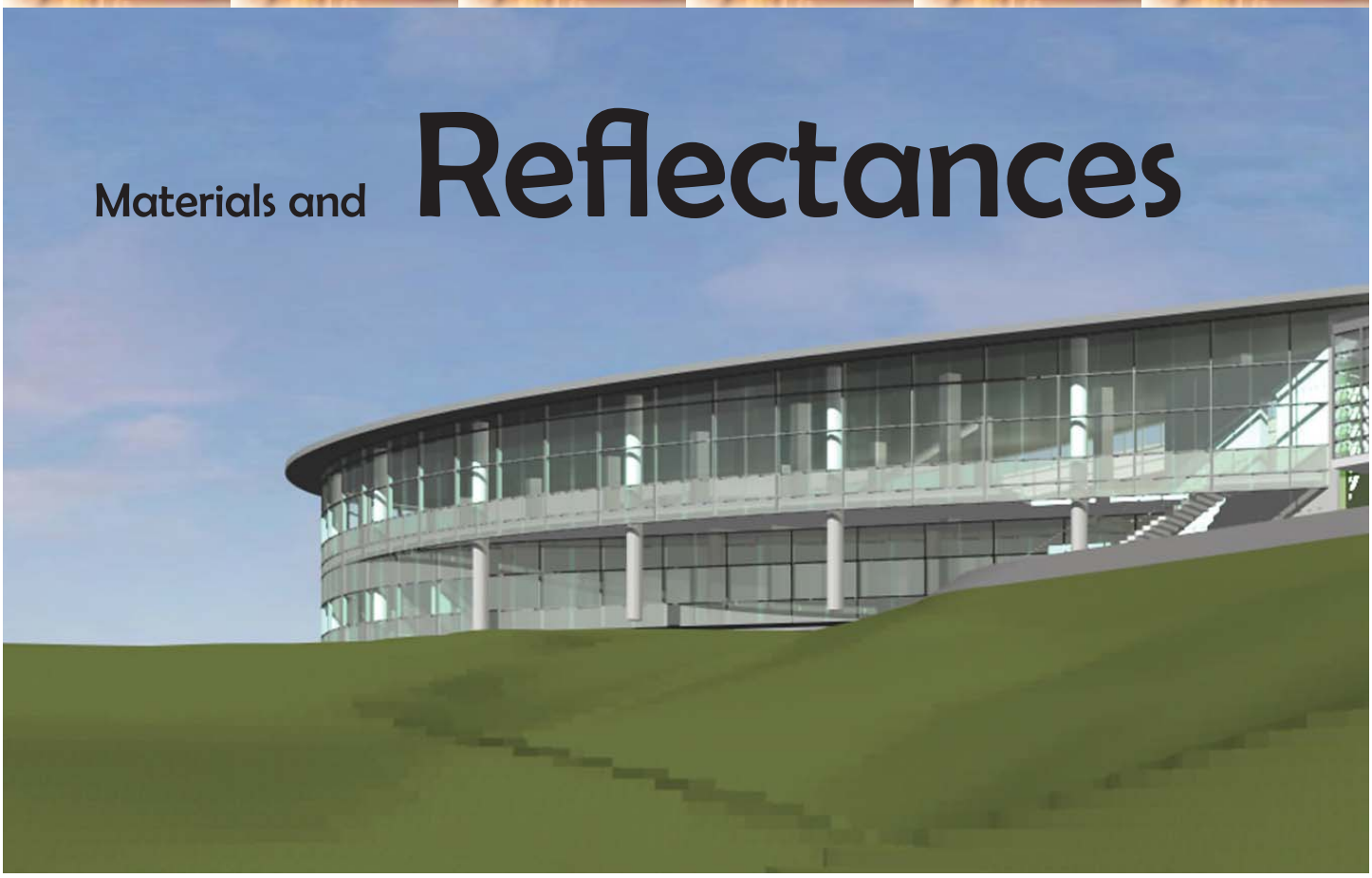
Horizontal illuminance should not fall below 30 fc on the work plane to achieve the tasks that take place in this area. In the corridor areas, on the ground between the stacks the light level does not need to exceed 5 fc to walk.

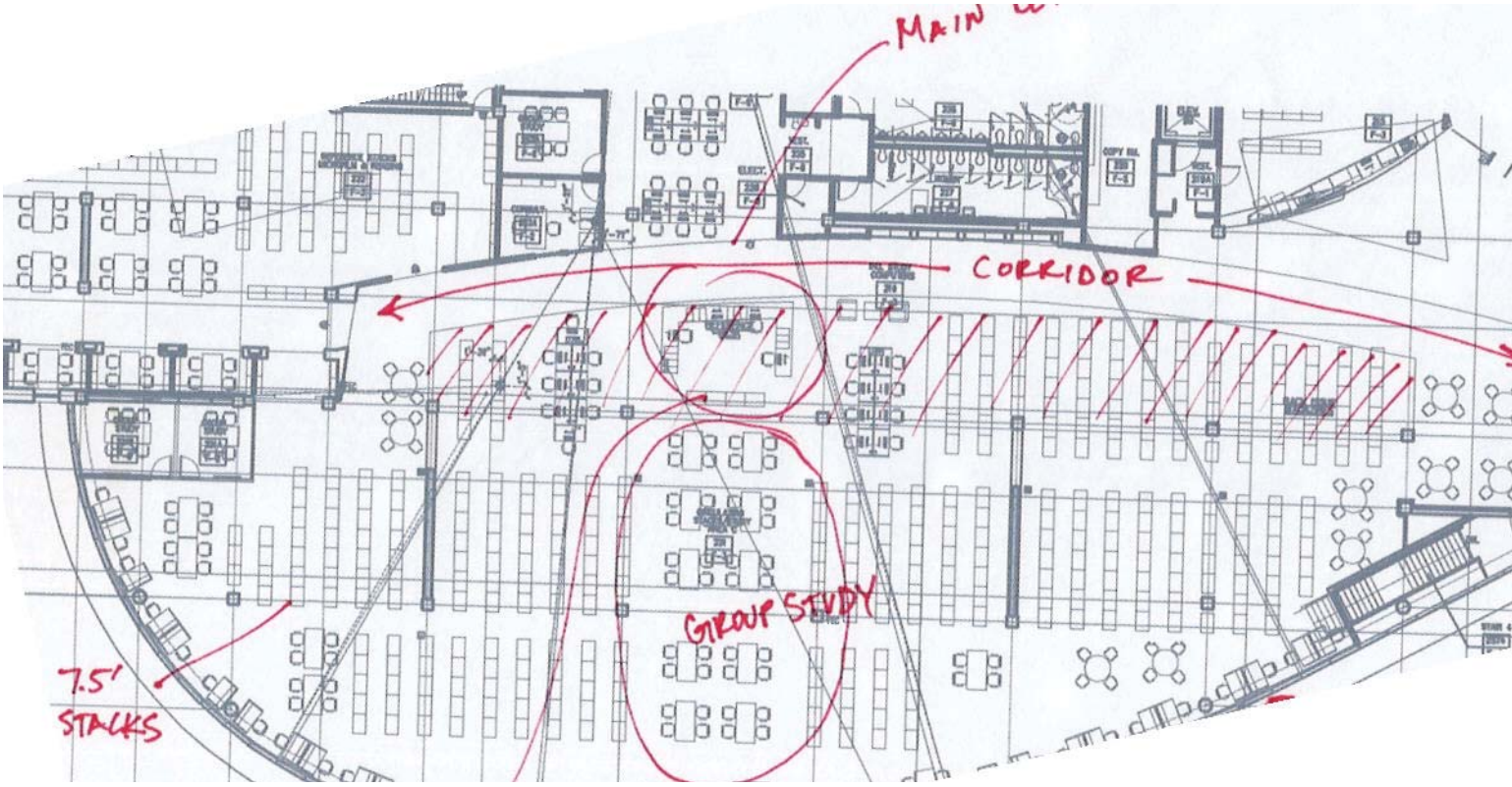
- Title 24

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 low-

Location	Ceiling	South Wall	Walls	Floor
Materials	Wood Veneer	Glass curtain wall Solarban 60 windows	Painted Gypsum Board	Carpet
Reflectance	0.47	0	0.5	0.2
Transmittance		0.71		

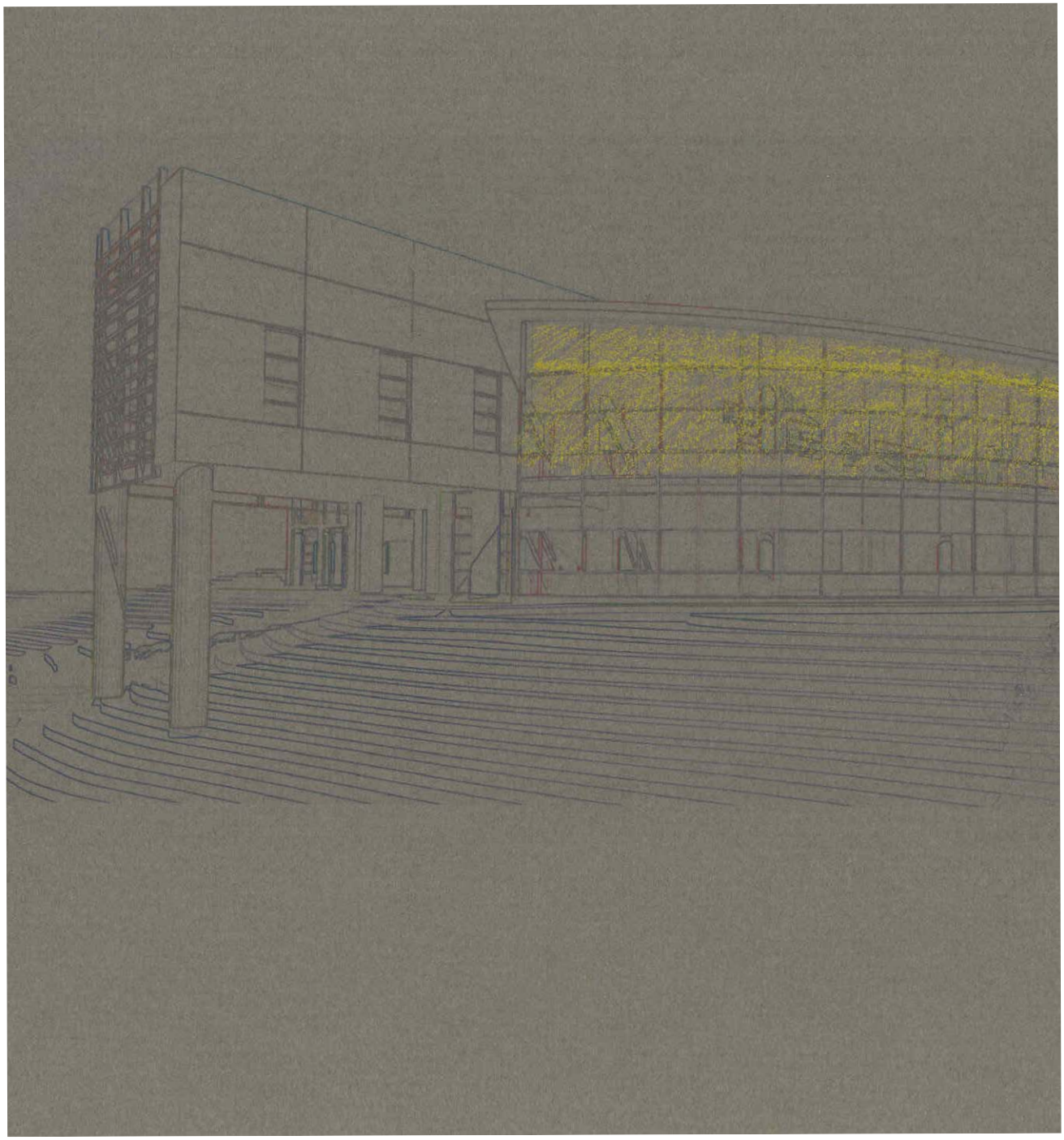
Materials and Reflectances





Design Process

Designing the stack area lighting scheme was the most difficult part in this thesis because it brought challenges that were unfamiliar. Not only is placement important for the luminaire but also the luminaire itself has to be efficient. In the redesign, the stack mounted fixtures were replaced with linear up/down lights. Choosing the up/down lights will help with the cave-like feeling often felt in tight spaces with only downlights. The ceiling slops to a clerestory of 20' so having the indirect portion of the light will open the space and throw light on the ceiling. The south façade of the library is a glass curtain wall that will also act as a beacon when the interior surfaces are lit. Direct pendants march through the main axis of walkway to achieve the necessary light level for the student group tables. Downlights are used around the perimeter to achieve the correct light level for the individual desks. Cove lights were added to the floating ceiling to add another layer of light onto the ceiling while also providing the necessary amount of light onto the corridor.



Goal of Space

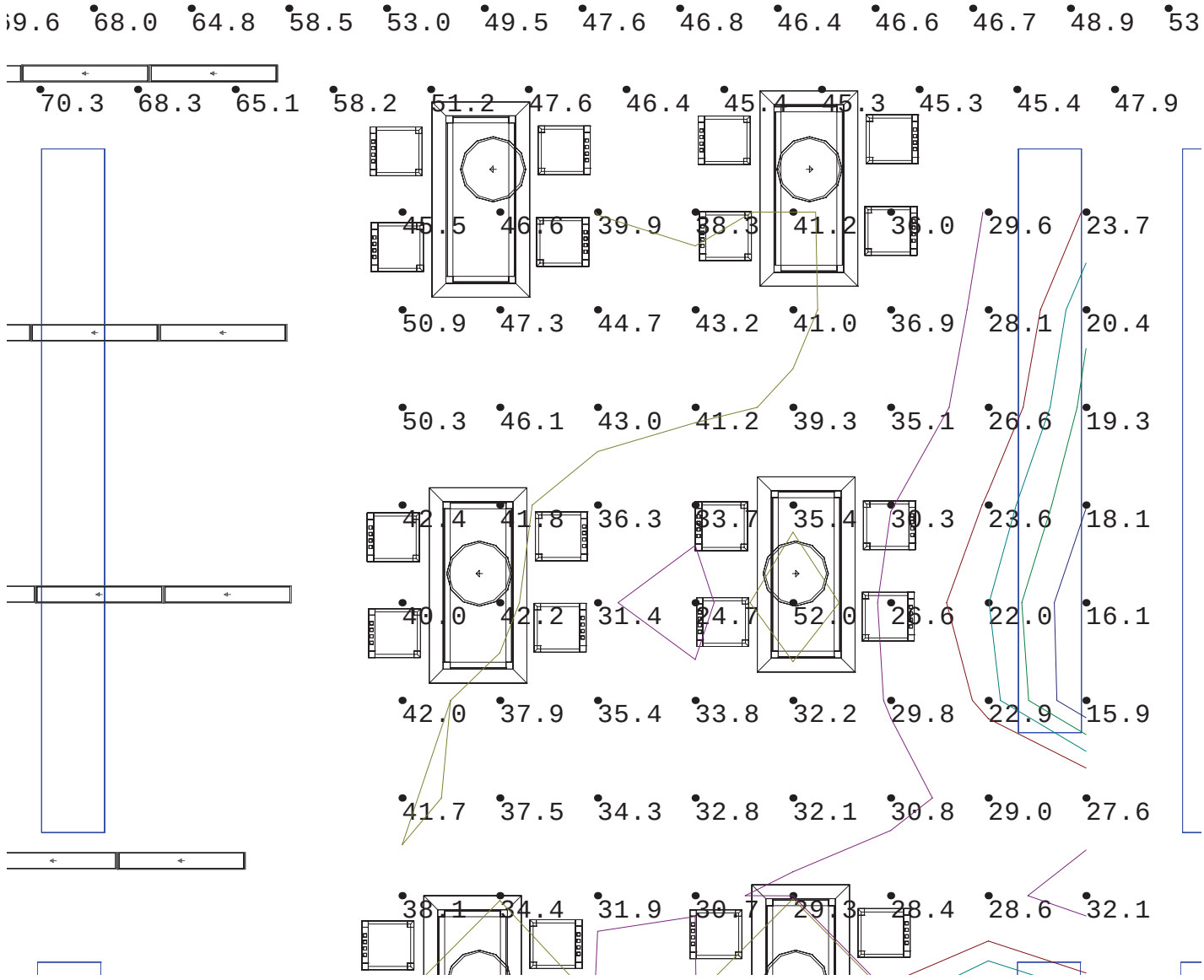
Type	Source	Name	Notes	Wattage	Lamp	CRI	CCT
D01	Fluorescent	Decorative Pendant - 3'	"Club C" series, Deltalight, Halospot 111, Alu-reflektor	75w	(4) 75w	82	3500
F10	Fluorescent	Recessed 6" Downlight	5-11/16" aperture, horizontal lamp orientation, "haze" Alzak reflector with white trim ring, emergency battery pack as required by the Electrical Engineer	42w	(1) 42w TT	82	3500
F13	Compact Fluorescent	Surface Mounted Cylinder - 6"	Medium beam distribution, haze Alzak reflector	42w	(1) 42w TT	82	3500
F14	Fluorescent	Stack Light	Metro series, up down light	54w	(2) 54w T5HO	85	3500
F05	Fluorescent	Slot Light	"Ashley" series, integral electronic ballast, emergency ballast as required by Electrical Engineer	54w	(1) T5HO	85	3500
F04	Fluorescent	Recessed 1x4 Wallwash Troffer	"Avenue A" series	28w	(1) 28wT5	82	3500

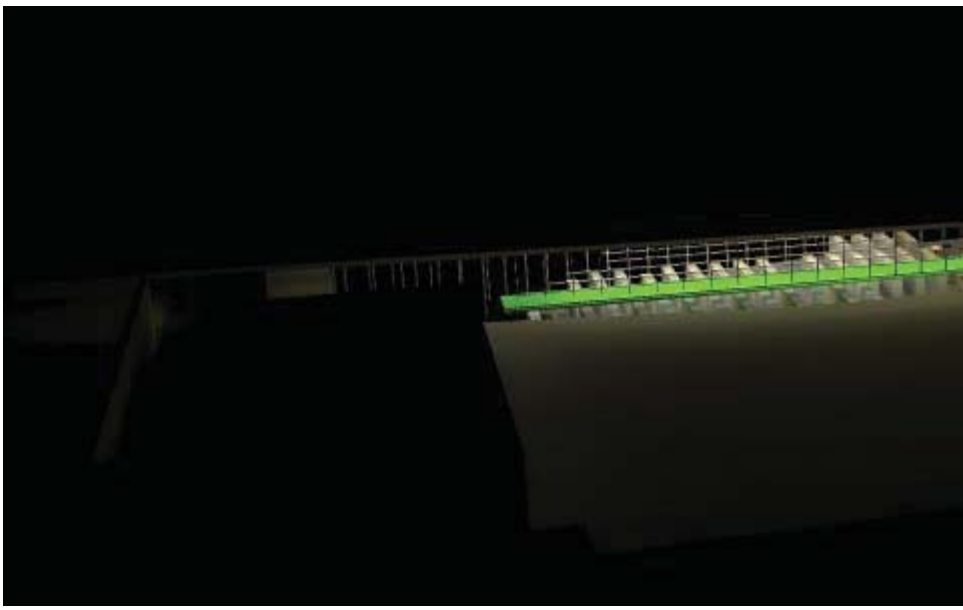
My power density is over the allowed wattage but will be compensated by the dimming controls. During library hours many of luminaires will not be at full output.

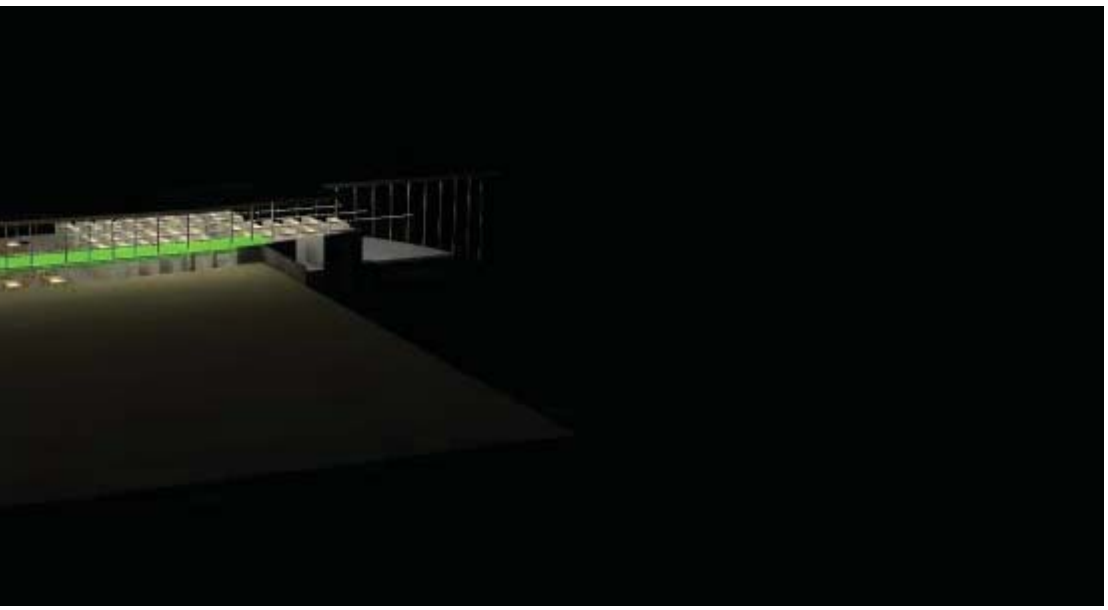
Ballast ID	Ballast	Voltage	Lamp	Input Watts	Input Current	Fixtures	Electronic/Magnetic	Dimming	Manufacturer	BF
Es5840K	Ballast 6	120	(1) T5	63	0.53	F05	Electronic	Yes	Universal	1
Es5000HT	Ballast 5	120	(1) 42w TT	44	0.34	F10	Electronic	Yes	Universal	1
Es5000HT	Ballast 7	120	(1) 42w TT	44	0.34	F13	Electronic	Yes	Universal	1
Es5840K	Ballast 8	120	(2) T5	126	0.53	F14	Electronic	Yes	Universal	1
ES5842K	Ballast 9	120	(1) 28w T5	37	0.3	F04	Electronic	Yes	Universal	1

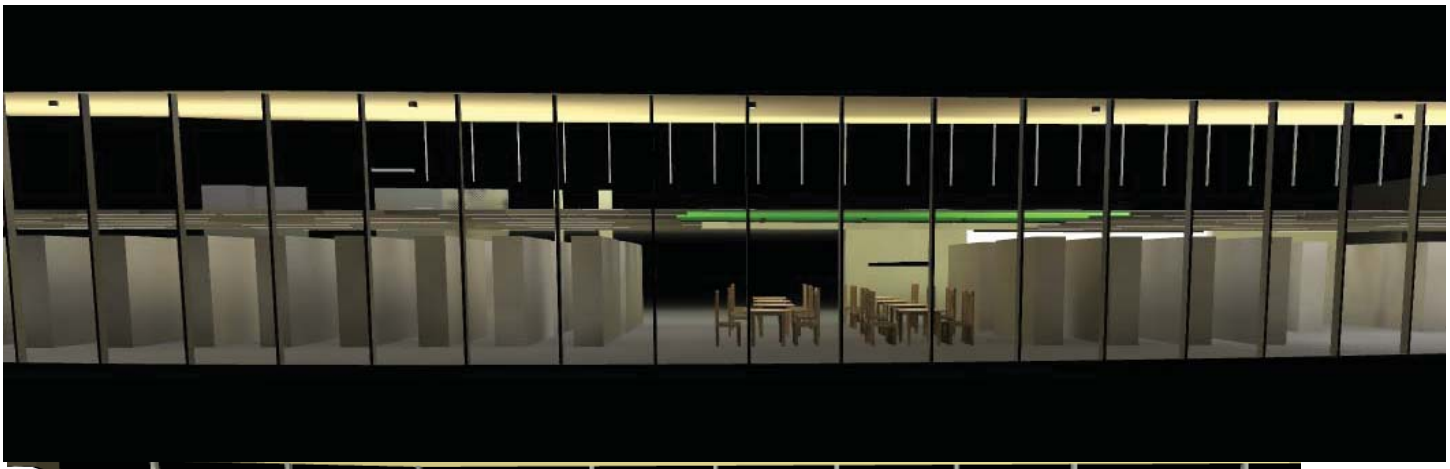
Power Density

	Location	Fixture	Quantity	Watts	Total Watts	Area (ft^2)	Power Density	Allowable
41	Stack	F05	31	54	1674		1.696728854	1.5
		F10	30	44	1320			
	200	F14	130	126	16380			
		D01	6	200	1200			
		F13	11	44	484			
					21058	12410.94		


59.6 68.0 64.8 58.5 53.0 49.5 47.6 46.8 46.4 46.6 46.7 48.9 53
70.3 68.3 65.1 58.2 51.2 47.6 46.4 45.4 45.3 45.3 45.4 47.9
45.5 46.6 39.9 38.3 41.2 36.0 29.6 23.7
50.9 47.3 44.7 43.2 41.0 36.9 28.1 20.4
50.3 46.1 43.0 41.2 39.3 35.1 26.6 19.3
42.4 41.8 36.3 33.7 35.4 30.3 23.6 18.1
40.0 42.2 31.4 34.7 52.0 26.6 22.0 16.1
42.0 37.9 35.4 33.8 32.2 29.8 22.9 15.9
41.7 37.5 34.3 32.8 32.1 30.8 29.0 27.6
38.1 34.4 31.9 30.7 29.3 28.4 28.6 32.1







Conclusions

The use of indirect/direct pendants instead of the stack mounted fixture proves to be a better solution in throwing light on all surfaces to relieve the cave effect.