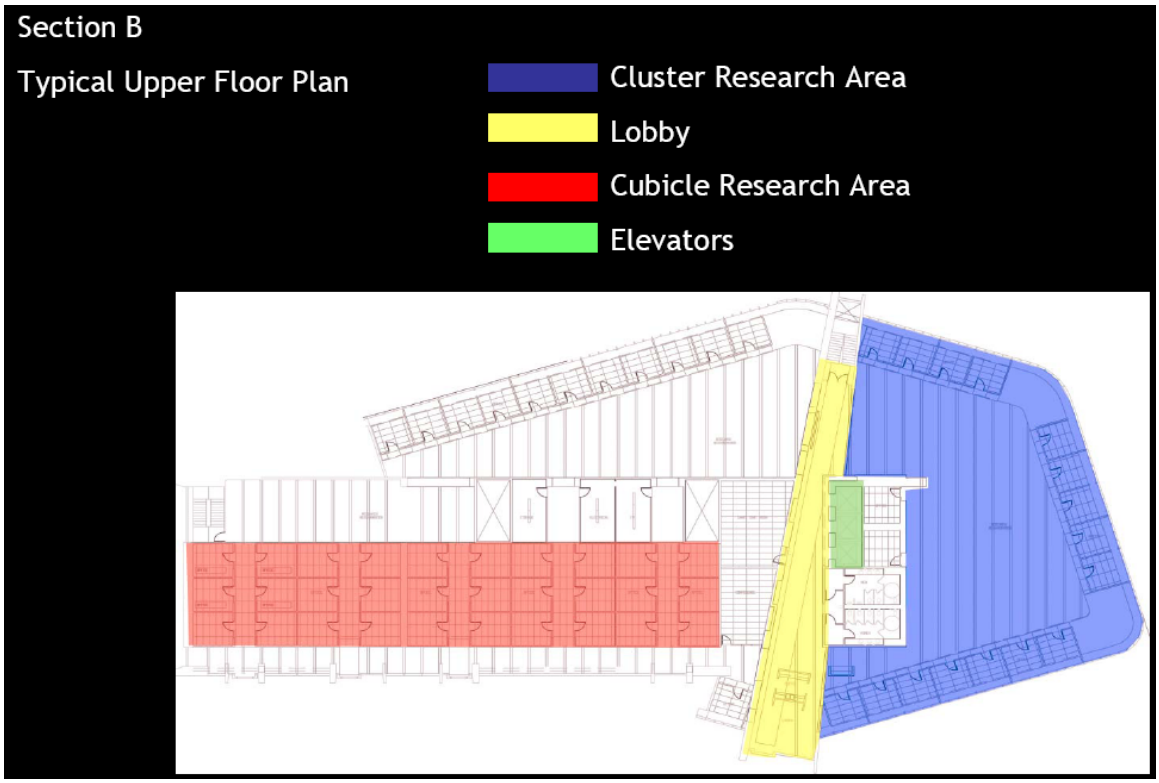
3100 Research Cluster

The 3100 research cluster area is located on the third floor of building section B. The open office entails a large empty space with moving furniture for experiments and collaborating. Many times, tables with computers and drawings will be laid out for group discussions. The ceiling is completely exposed to structural and mechanical members making the space appear larger than it really is. This space is then surrounded by private offices each with a vertical window to look into as well as a lowered finished ceiling. These private offices are home to many professors and workers in the college for telecommunications and research. Each corner has an open area with tables and chairs for networking and small presentations when necessary.



Design Criteria

Reflectances

Walls: 50% (Light green and white paint)
Ceiling: 20% (exposed ceiling painted black)
Floor Covering: 20% (tan/taupe bur bur carpeting)
Furniture: 40% (assumed value for future furniture installation)

Ceiling Characteristics

The ceiling of 3100 (the research area on the third floor) is an exposed ceiling of trusses, ductwork, and hanging light fixtures. The mechanical and structural work is painted black to have a low reflectance with suspended direct fluorescent louvered striplights. The room shows its design elements to enhance the function of the room (being a research area of technology).

Theme

The research area exhibits a feeling of creativeness, adaptive ability, and convenience. It is surrounded by private offices with windows overshadowing the space providing some minimal daylight to the space. This space will show sleek modern design with economical and energy efficient ideas.

Horizontal Illuminance

According to IES criteria, a research area room which will most likely contain intensive VDT use and paper tasks should have an illuminance level of 30 to 50 fc. Workstations are required to have 30 fc while laboratories with experimentation and intensive VDT use should provide 50 fc.

Glare Consideration

Glare should be considered in this space because of the work-like environment. The suspended fluorescent striplights will most likely not cause a problem, but must be taken into account.

Vertical Illumination

A vertical illumination of 5 fc is required for this open office research area.

Daylight Consideration

Daylight will be entering the space through the windows in the corners and through the upper windows above the private offices. Even though the light is minimal, system

controls may be able to regulate energy usage and turn off many luminaries during daylight hours to save on energy consumption.

Lamping Criteria

A uniform CCT of 4100K will be used in these areas with a CRI of about 82. Color rendering and daylight quality light was an important factor in this space because of the research and experimentation occurring. A cooler color temperature also matches the laboratory and research facility atmosphere better than a warmer lamp would.

Controls

Since the Lutron Grafik Eye will be used in the building to control a majority of the fixtures, the office will be included in this. California Title 24 requires automatic turn-off for spaces not used during the evening hours in academic buildings. Electric light in the private offices should take into account the large amount of daylight entering the space. Since the open office is not used 24 hours a day, occupancy sensors would be a good idea to save energy and ensure automatic turn-off. More detail on the controls can be found in my electrical depth.

Power Density

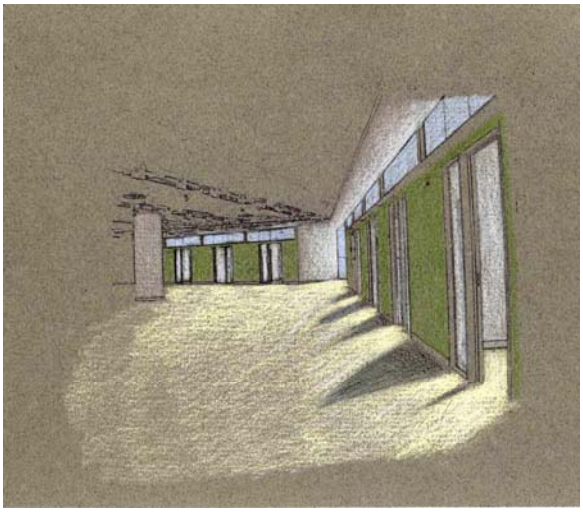
According to California Title 24 Energy Standards, open office area's power density should be < 1.3 W/SF.

Design Intent

My goal for this space is to provide enough light on the work plane for a comfortable environment. I also want to avoid veiling reflections on any VDTs in the space which can be a big distraction for anyone working on them. Using light, I want to emphasize the size of the open office by using linear sources running in the direction of the trusses. By combing these ideas, a comfortable office environment can be had.

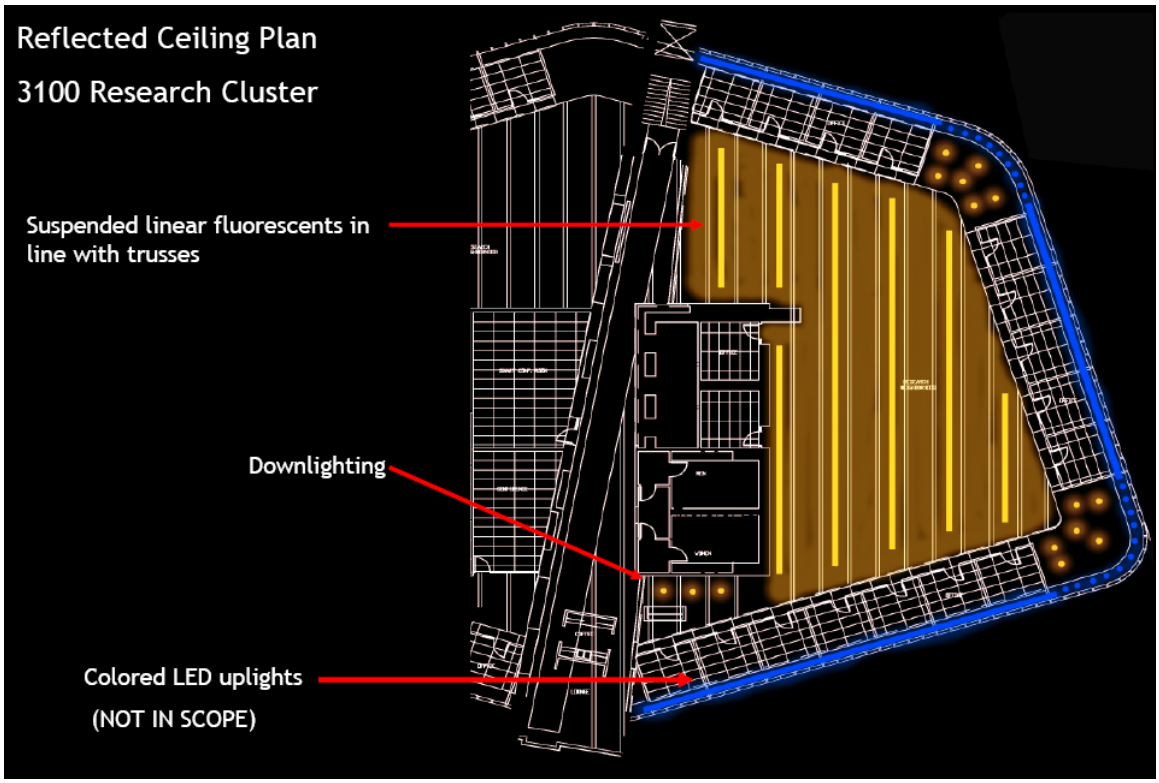
Schematic Design

In my original schematic design approach, I was going to use daylight as a big factor in the space. The private offices surrounding the large area all have floor to ceiling windows and contain interior windows from the private offices to the open one. This, in turn would have saved a great a deal of energy and cost. Unfortunately, the tinted glazing on the exterior windows, and the depth and height of the interior

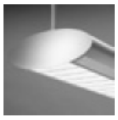


windows were not enough to bring a large amount of light into the space as intended. This moved the design forward with choosing a good linear parabolic fixture to run in between the exposed trusses. A suspended direct/indirect source for the private offices also helped on appearance between the spaces as well as avoiding veiling reflections and glare on the computer screens. Lastly, I used wall washers and circular downlights to separate the coves from the open areas. The difference in ceilings creates a nice nook for small presentations and gatherings.

Concept Diagram



Lighting Fixture Schedule
University of California, San Diego Cal IT2

Type		Mfr/Catalog #	Lamping	Notes
B1		**Prudential Lighting LGD-P-2T8-*-SPL-*** Description: Suspended fluorescent up/downlight with 2-F32T8 (48in) lamps (in cross-section). Optics: 1-1/2" deep parabolic louver 2.5" o.c. , steel die-formed reflector.	2-F32T8 (48in) lamps (in cross-section)	Location: Open Office
B2		**Metalumen SD3-B-*-*-A-K-*-*-4-*** Description: 6" suspended fluorescent downlight with 2-F32T8 (48in) lamps (in cross-section). Optics: parabolic louver.	2-F32T8 (48in) lamps (in cross-section)	Location: Open Office
B3		**Lightolier 8037*** / 7132BU 32W** Description: 7" recessed compact fluorescent downlight with 1-CFTR32W lamp. Optics: painted or anodized aluminum parabolic reflector.	1-CFTR32W lamp	Location: Open Office
B5		**Lightolier 8087*** / 7132BU 32W** Description: 7" recessed compact fluorescent wallwasher with 1-CFTR32W lamp. Optics: painted or anodized aluminum parabolic reflector , single.	1-CFTR32W lamp	Location: Open Office
B6		**Lightolier CS8142HUCL 32W** Description: 9" surface-mounted compact fluorescent downlight with 1-CFTR32W lamp. Optics: anodized aluminum parabolic reflector.	1-CFTR32W lamp	Location: Open Office

All fixture cut-sheets can be found in the appendix.

Fixture Relevant Schedules

Ballast Schedule

Ballast	Voltage	Lamp	Input Wattage	Input Current	Fixtures	Dimming	Elec/Mag	Manufacturer
BAL1	277V	(2) 32W T8	68	0.25	B1, B2, B13	Yes	E	Advance
BAL2	277V	(1) 32W CFTR	36	0.13	B3, B5, B6, B16	No	E	Universal
BAL3	277V	(1) 13W CFT	20	0.26	B7	No	M	Advance
BAL4	277V	(1) 17W U T8	17	0.08	B8	Yes	E	Lutron
BAL5	277V	(2) 42W CFTR	80	0.36	B9	Yes	E	Advance
BAL6	277V	(1) 32W T8	35	0.13	B10	Yes	E	Advance
BAL7	277V	(1) 13W CFQ	18	0.07	B11	Yes	E	Advance
BAL8	277V	(2) 32W U T8	65	0.25	B12	Yes	E	Lutron
BAL9	277V	(2) 32W T8	59	0.21	B14, B15, E7, E11, E12	No	E	Advance
BAL10	277V	(1) 28W T5	30	0.11	B18	No	E	Advance
BAL11	277V	(1) 135W LPS	135	0.2	E1	No	M	Advance
BAL12	277V	(1) 39W T6 MH	44	0.16	E2, E9	No	E	Advance
BAL13	277V	(1) 9W CFT	14	0.17	E3	No	M	Advance
BAL14	277V	(1) 13W CFQ	24	0.24	E4	No	M	Advance
BAL15	277V	(2) 28W T5	60	0.22	E6	No	E	Advance
BAL16	277V	(1) 70W T6 MH	79	0.29	E10	No	E	Advance
BAL17	277V	(1) 32W CFTR	32	0.28	B19	Yes	E	Advance

All ballast cut-sheets can be found in the appendix.

Lamp Information

Designation	Manufacturer	Type	Bulb	Wattage	CCT	CRI	Relevant Fixtures
A	Philips	Fluorescent	T8 FL	32W	4100K	86	B1,B2,B10,B13,B14,B15,E7,E11,E12
B	Philips	Compact FL	CFTR	32W	4100K	82	B3,B5,B6,B16
C	Philips	Compact FL	CFT	13W	3500K	82	B7
D	Sylvania	Fluorescent	FBT8 FL	17W	3500K	82	B8
E	Philips	Compact FL	CFTR	42W	3500K	82	B9
F	Philips	Compact FL	CFQ	13W	3500K	82	B11
G	Philips	Compact FL	CFQ	13W	3000K	82	E4
H	Philips	Fluorescent	FBT8 FL	32W	3500K	85	B12
I	Philips	Fluorescent	T5 FL	28W	4100K	85	B18,E6
J	Philips	Halogen	MR16	50W	3050K	100	B17
K	Philips	Low Pressure Sodium	SOX	135W	1700K	NA	E1
L	Philips	Metal Halide	T6	39W	3000K	81	E2,E9
M	Philips	Compact FL	CFT	9W	3000K	82	E3
N	Philips	Incandescent	PAR20	50W	NA	100	E5
O	Sylvania	LED	LED	1W	NA	NA	E8
P	Philips	Metal Halide	T6	70W	3000K	82	E10

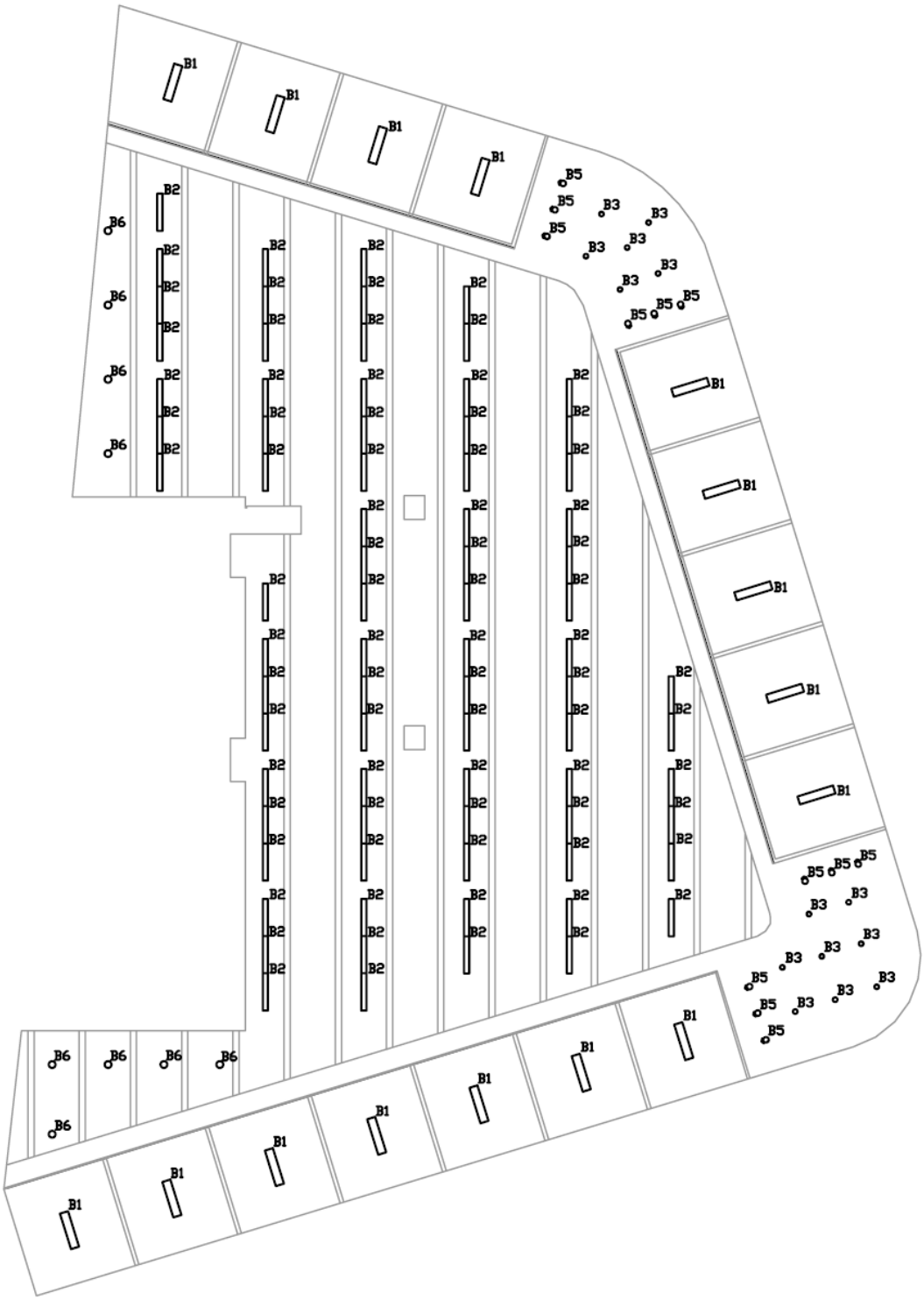
Light Loss Factors								
Type	Cleaning Interval	Category	BF	LLD	LDD	RSDD	LLF	Location
B1	12 Months (Clean)	II	0.88	0.95	0.88	0.96	0.71	Private Offices
B2	12 Months (Clean)	IV	0.88	0.95	0.88	0.96	0.71	Open Office
B3	12 Months (Clean)	IV	1.00	0.85	0.88	0.96	0.72	Window Corners
B5	12 Months (Clean)	IV	1.00	0.85	0.88	0.96	0.72	Window Corners
B6	12 Months (Clean)	IV	1.00	0.85	0.88	0.96	0.72	Open Office Entrances

I assumed a 12 month cleaning interval for all fixtures since the building is located on the University campus. I also assumed a clean environment in the open office since the building has many clean rooms and laboratories which are cleaned extremely often.

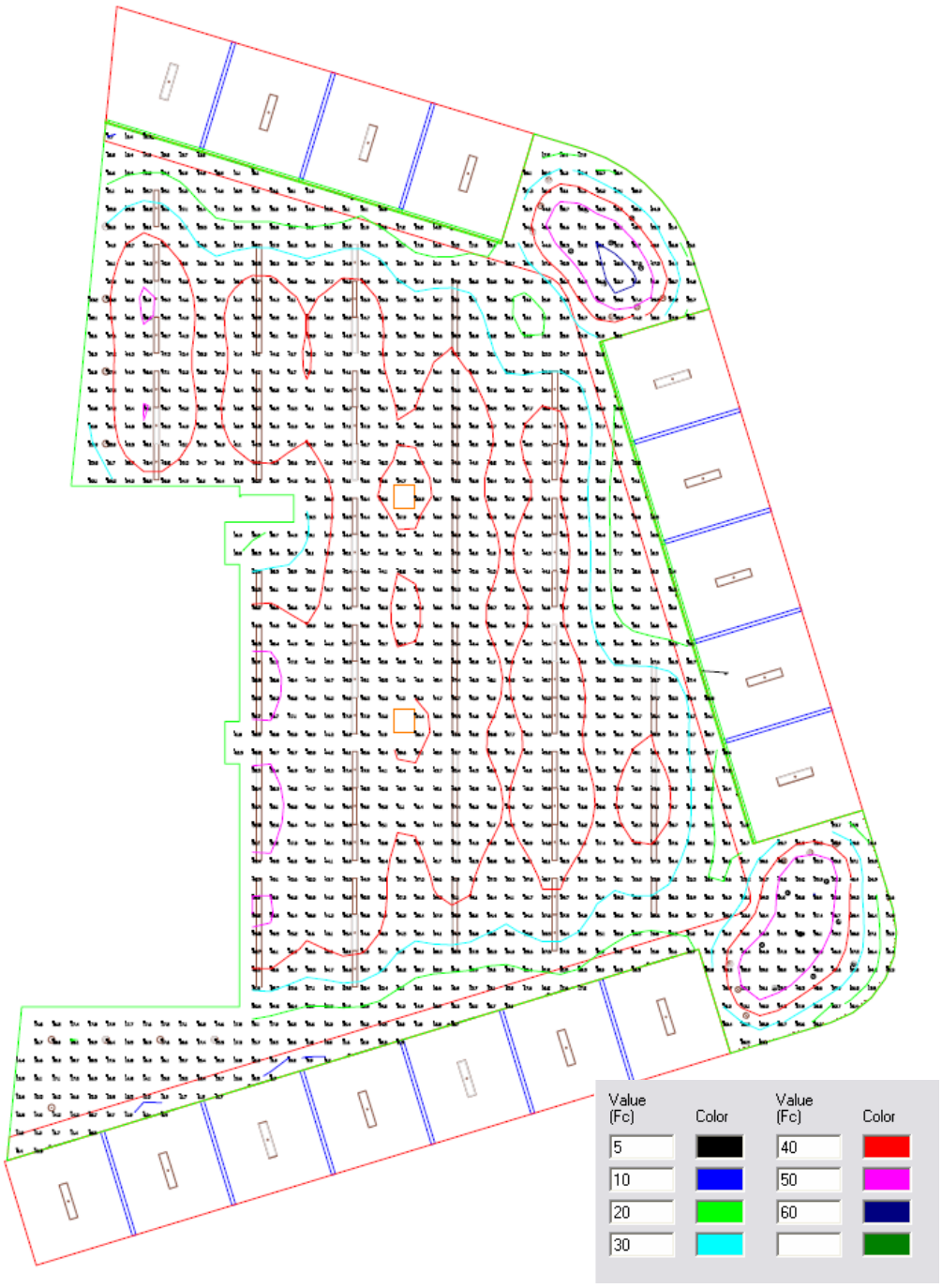
Power Density					
Fixtures	Fixture Count	Watts	Total watts	SF	W/SF
B1	16	68	1088		
B2	76	68	5168		
B3	14	36	504		
B5	12	36	432		
B6	9	36	324		
			7516	8121.6	**0.93**

Using the input wattage from the specified ballasts and lamps, the power density came in under the maximum allowed of 1.3 W/SF which meets California Title 24 standards.

Lighting Plan



Calculation Results



For the open office area, the average illuminance value was 35 fc with a maximum of 64 fc and a minimum of 9 fc. The lower values near the entrances brought the average down a bit. The values in the open area where work would be done was all above 40 fc which is a good light level for office work with VDTs and paper tasks according to IES standards. The contour lines show the illuminance values for this space according to the chart.

Daylighting Study for Private Offices

The private offices in the 3100 research cluster receive a lot of daylight during the morning and afternoon hours. A study was done to estimate the hours that electric light can be saved during these times. Appendix D shows some various examples of the calculation grids I performed for these spaces with two window orientations. I used a 43% transparent window to take into account the mullions and tinting of the glass. Direct sun never really enters the space except on the near wall late in the day on December 21st and March 21st depending on the orientation. My results from this study show that the electric lights can be completely shut off or dimmed to 5% (depending on preference of the occupant) between the hours of 8 AM and 4 PM on any ordinary day which saves 8 hours of energy. This shows a drastic savings on energy and cost for the private office lighting. Since the spaces are ordinarily used between 7 AM until about 6 PM, electric light is not needed about 70% of the time based on my daylighting studies. The daylight sensors in the office are located on the wall next to the door when you first walk in.

Unfortunately, the daylight doesn't escape the private offices as well as I had hoped to add to the light in the open office. Some daylight is contributed from the coves in the corner and above the shelf in the private offices, but not enough to dim the lights in the open area. This is the reason the open area is on occupancy sensors and the corners are switched by single switches based on need and use.

Since these open office/private office areas are typical for the upper floors above the 2nd floor, this can save a significant amount of energy for the building. When summed for the five upper floors, this can have a total energy savings of:

(1088 VA per floor) * 5 floors = 5440 VA

5440 VA = 5.44 kW

5.44 kW * 8 hours = 43.52 kWh

Estimating $0.10 / kWh from the San Diego Gas and Electric Service Utility Structure which can be found in Technical Assignment #2:

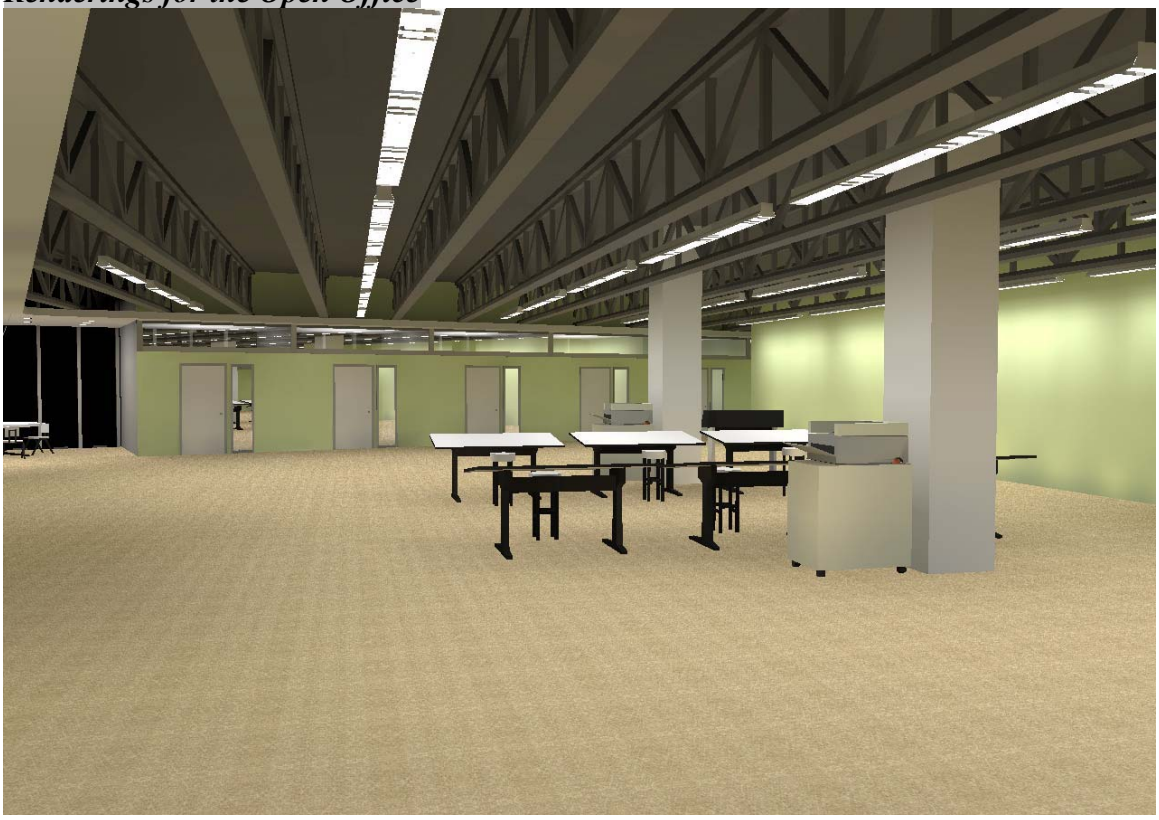
43.52 kWh * $0.10 / kWh = $4.35 / day

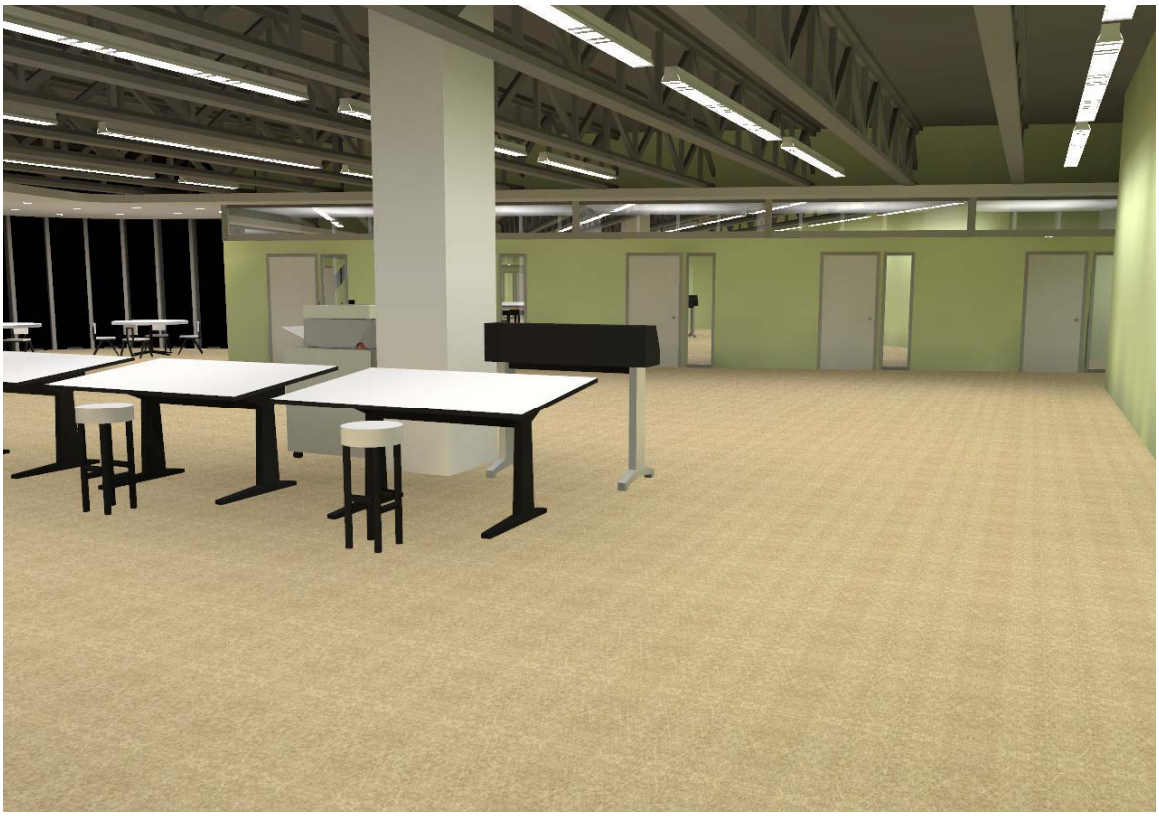
Estimated Typical Usage Days/year : 275 days

$4.35 / day * 275 days = $1196.25 / year in savings

Even though this is not a significant number compared to the total cost of energy for the entire building, every little bit counts. Because California has such a shortage for energy, this sets a good example for the future of building and daylighting integration. Energy costs are constantly rising proving any reduction is helpful.

Renderings for the Open Office





Entrance to Open Office

Conclusions

The 3100 research cluster encompasses many different qualities. As you walk into the open office, you can see the many private offices lining the walls with various other tasks happening in the center. This space is meant for constant hustle and bustle to be incorporated into the large space. Using the direct linear pendants throughout the office emphasize the linear trusses lining the ceiling and exhibit the length of the space. The small nooks in the corners use circular downlights to provide a more intimate feel for small discussions and meetings. Providing the proper amount of light on the workplane was definitely a main concern for this space and was accomplished using this layout.