# LIGHTING DEPTH

## *Introduction*

The University of California, San Diego Cal IT$^2$ building is a large research, academic building. As stated earlier, the building is used for lectures, laboratory experiments, private offices, and a small black-box theater set to the side. Because of the many uses, the lighting must incorporate all of these as well as have a central theme for its design in the building. Being a telecommunications study research facility, it contains many computer servers and serves as a path from one end of the wire to the other. Movement is prevalent all around this building from the bustle of the people inside, to the wires processing data from one end to the other. Cal IT$^2$ acts as a large computer hub and was the main concept for my lighting redesign. There were four major design goals in mind when redesigning my spaces. I wanted to guide people through the building using light, provide a feeling of technological advancement as you move through the space, provide a comfortable atmosphere to be able to work long hours, and have a welcoming yet humble entering atmosphere.

The first space I chose to redesign was the large research cluster on the third floor commonly known as 3100. This very open office space is surrounded by private offices with an exposed ceiling to the structural and mechanical members. In this space, I have redesigned the lighting for all the private offices as well as the coves, entrances, and the large open office area. Linear sources were a major impact in this space.

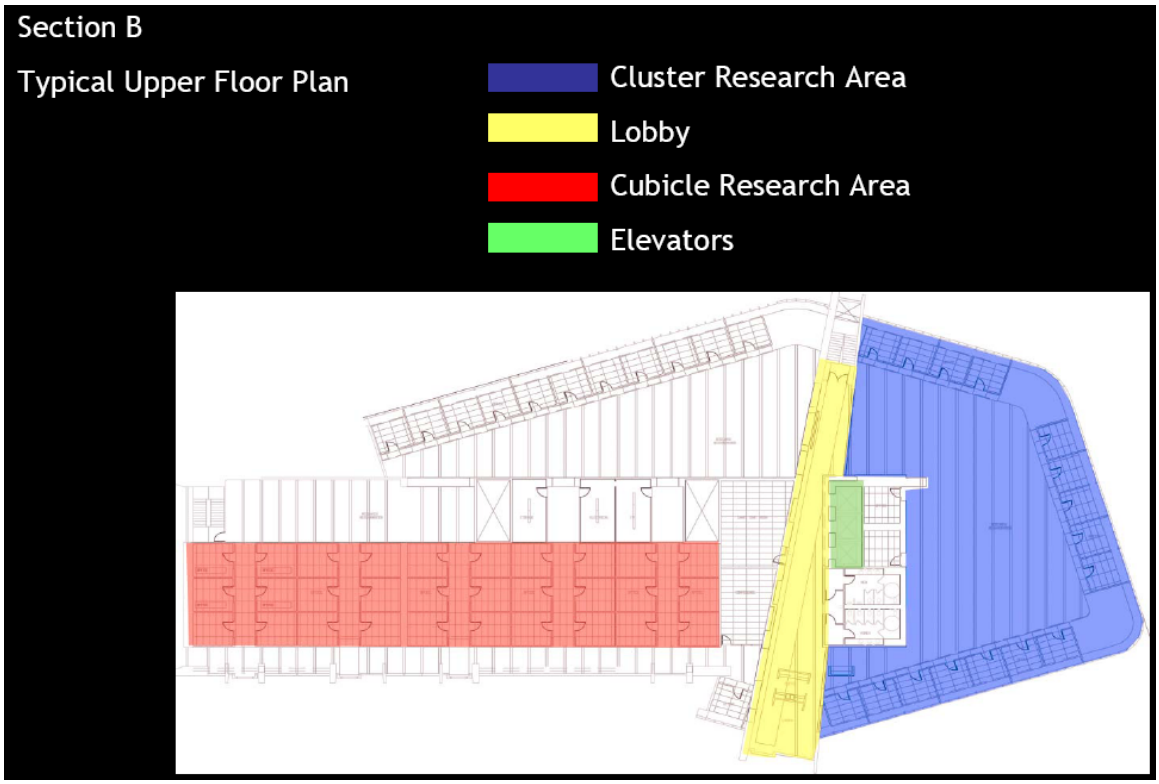
The second space I chose was the black-box theater. This space proved to be very challenging and involved the most layers of lighting. With the theater being 2 stories tall and having architectural and acoustical surfaces to work around, the space was limited to location for many of the fixtures. In this space I custom designed a fixture which makes a great impact in the theater as well as provided the different levels of light for all of its various functions.

The third space I chose was the main entrance lobby from the academic courtyard. This space actually contained three spaces in all. With its odd shape and many connections to the outside, it proved difficult to design. The clean lined walls and various height ceilings made this space a beacon for movement. All the lights designed in these spaces have a “motion” to them and guide people through the space. The lobby leads into the gallery which showcases some works of art and a view into the computer server room which houses most of the buildings back-up software. In conjunction with both of these spaces, an underground tunnel is connected to both of these rooms through clear windows. This underground tunnel keeps this theme of movement while also showing the “guts” of the building as if walking through the insides of a server.

The fourth and final space chosen for a redesign is the academic courtyard. For this exterior space, feelings of comfort and safety were a main focus in this design. I also wanted to lead people into the building and tunnel by highlighting certain areas slightly more than others. Through the use of different sources and types of fixtures, I have made the courtyard a pleasant and safe atmosphere.

## *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***

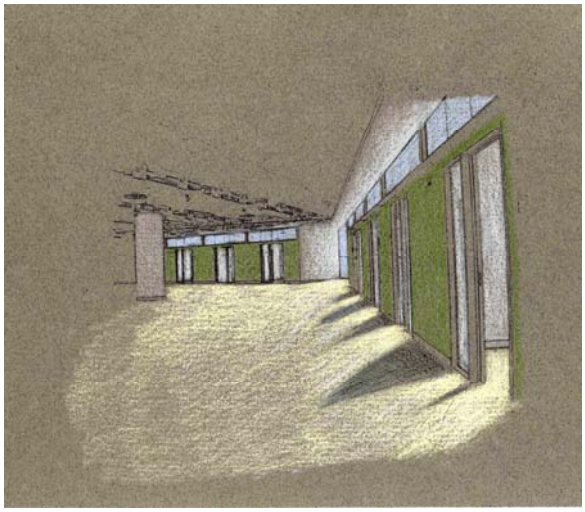
According to California Title 24 Energy Standards, open office area's power density should be < 1.3 W/SF.

***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.

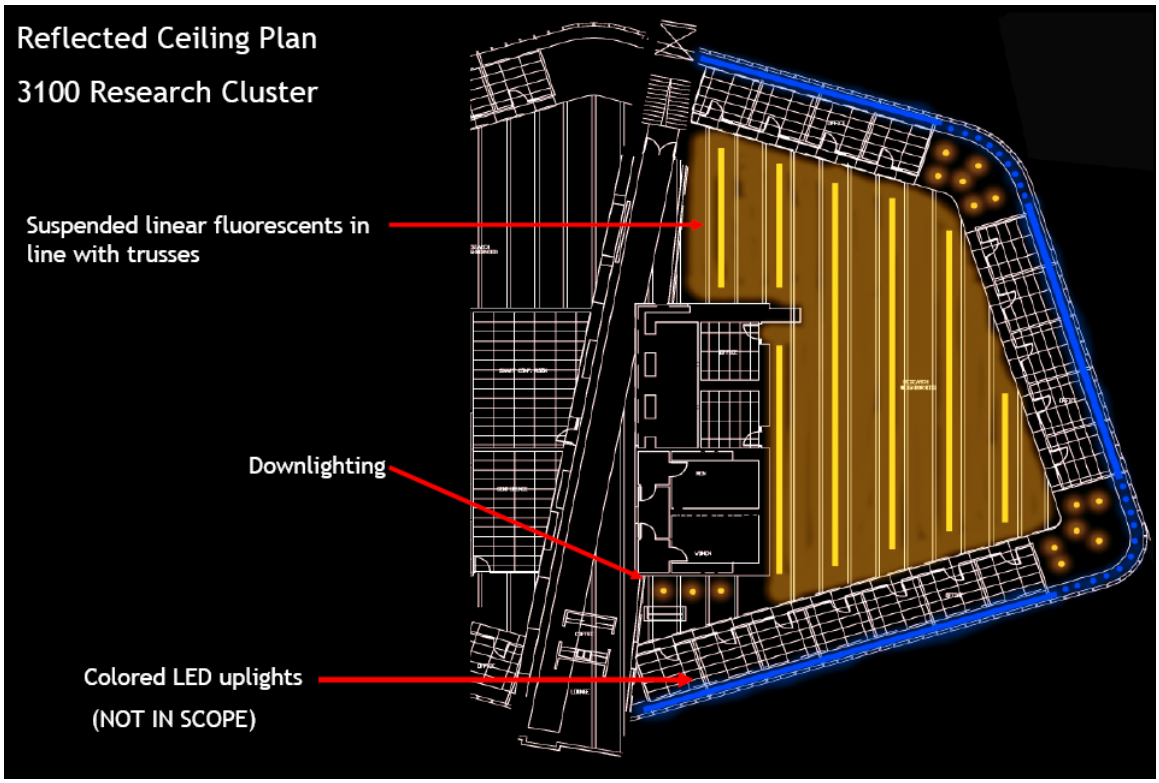
***Schematic Design***

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

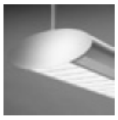


windows were not enough to bring a large amount of light into the space as intended. This moved the design forward with choosing a good linear parabolic fixture to run in between the exposed trusses. A suspended direct/indirect source for the private offices also helped on appearance between the spaces 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 |

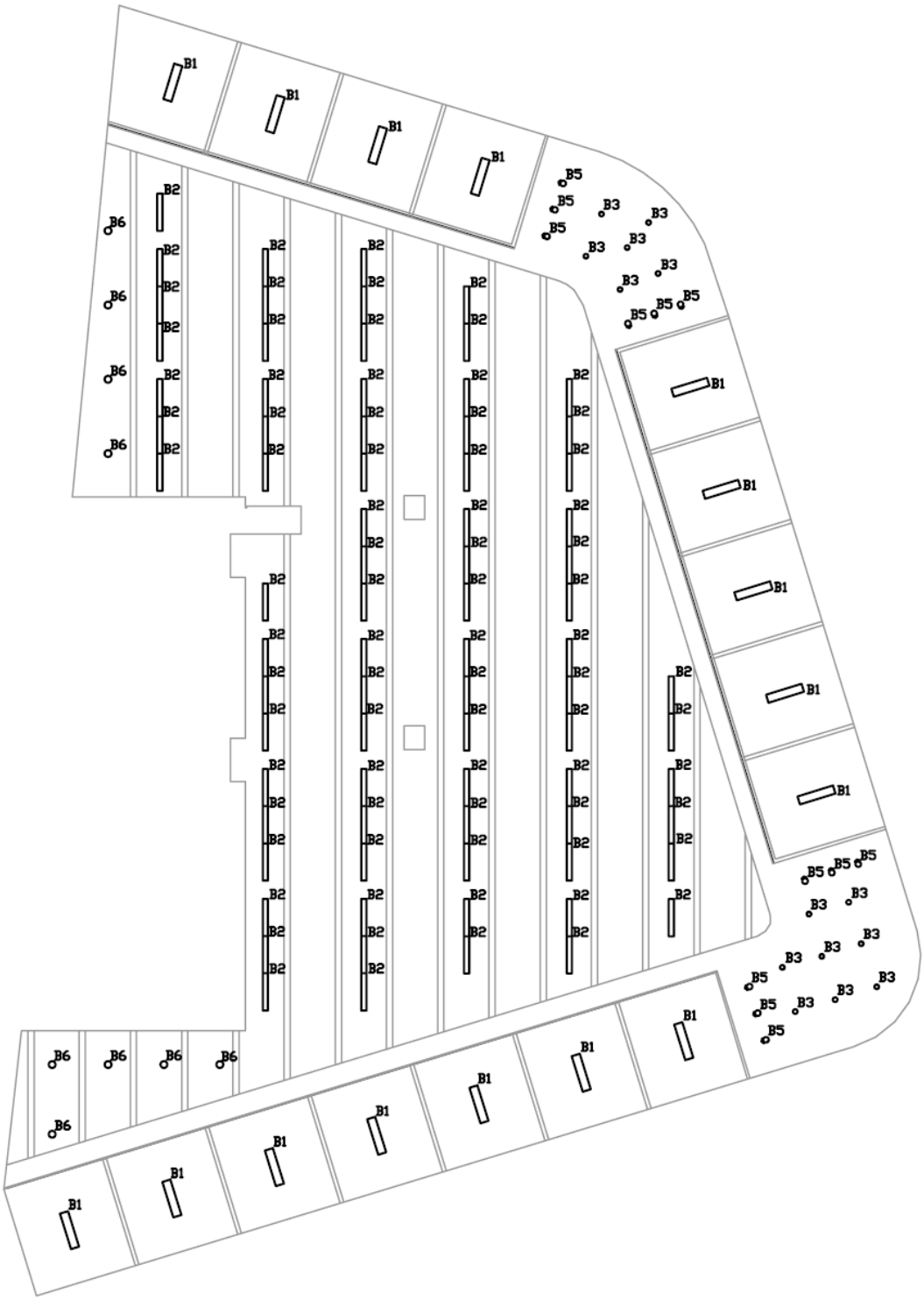
| Light Loss Factors | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type | Cleaning Interval | Category | BF | LLD | LDD | RSDD | LLF | Location |
| B1 | 12 Months (Clean) | II | 0.88 | 0.95 | 0.88 | 0.96 | 0.71 | Private Offices |
| B2 | 12 Months (Clean) | IV | 0.88 | 0.95 | 0.88 | 0.96 | 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.

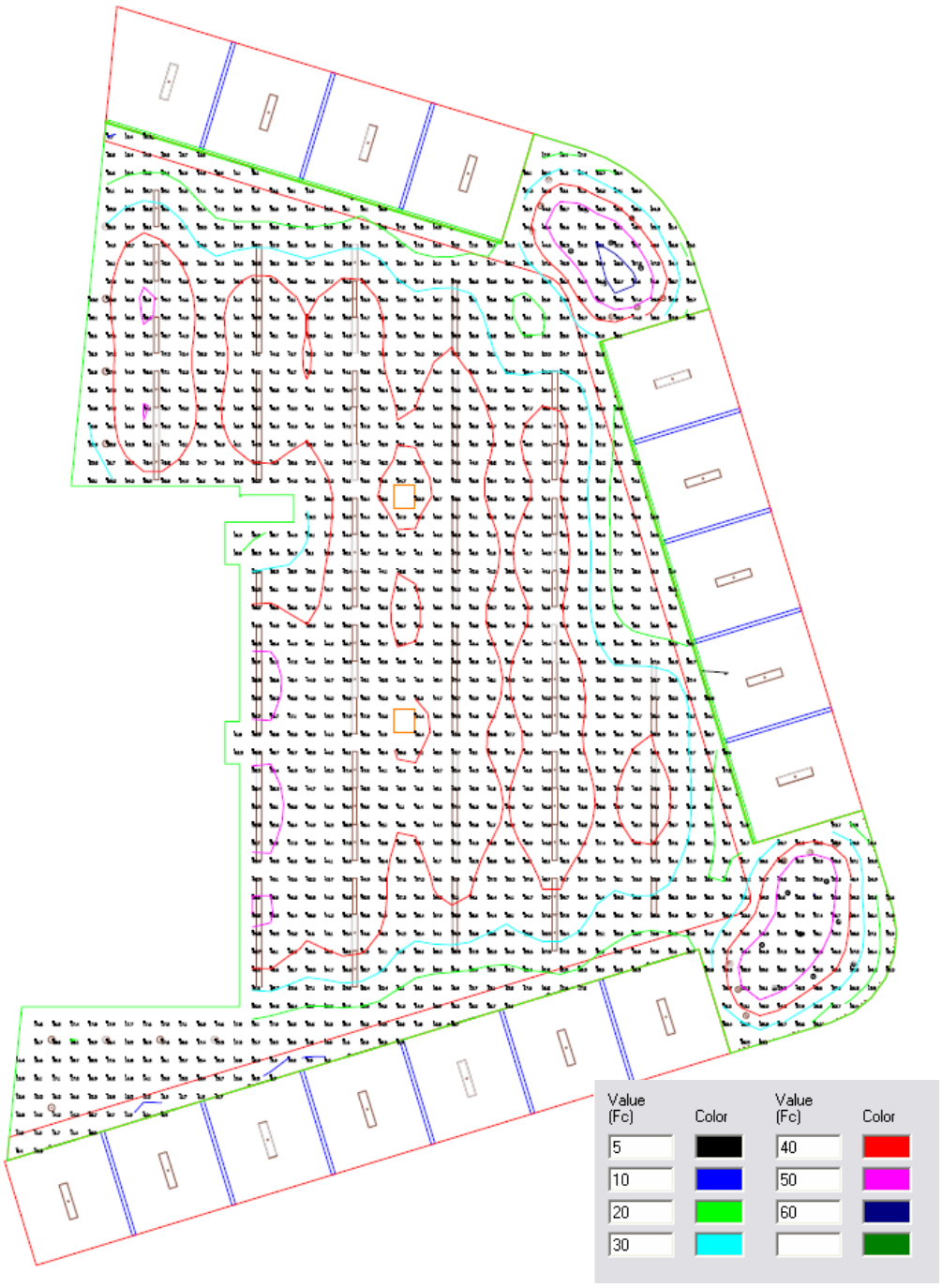
| Power Density | | | | | |
|---|---|---|---|---|---|
| Fixtures | Fixture Count | Watts | Total watts | SF | W/SF |
| B1 | 16 | 68 | 1088 | | |
| B2 | 76 | 68 | 5168 | | |
| B3 | 14 | 36 | 504 | | |
| B5 | 12 | 36 | 432 | | |
| B6 | 9 | 36 | 324 | | |
| | | | 7516 | 8121.6 | **0.93** |

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:

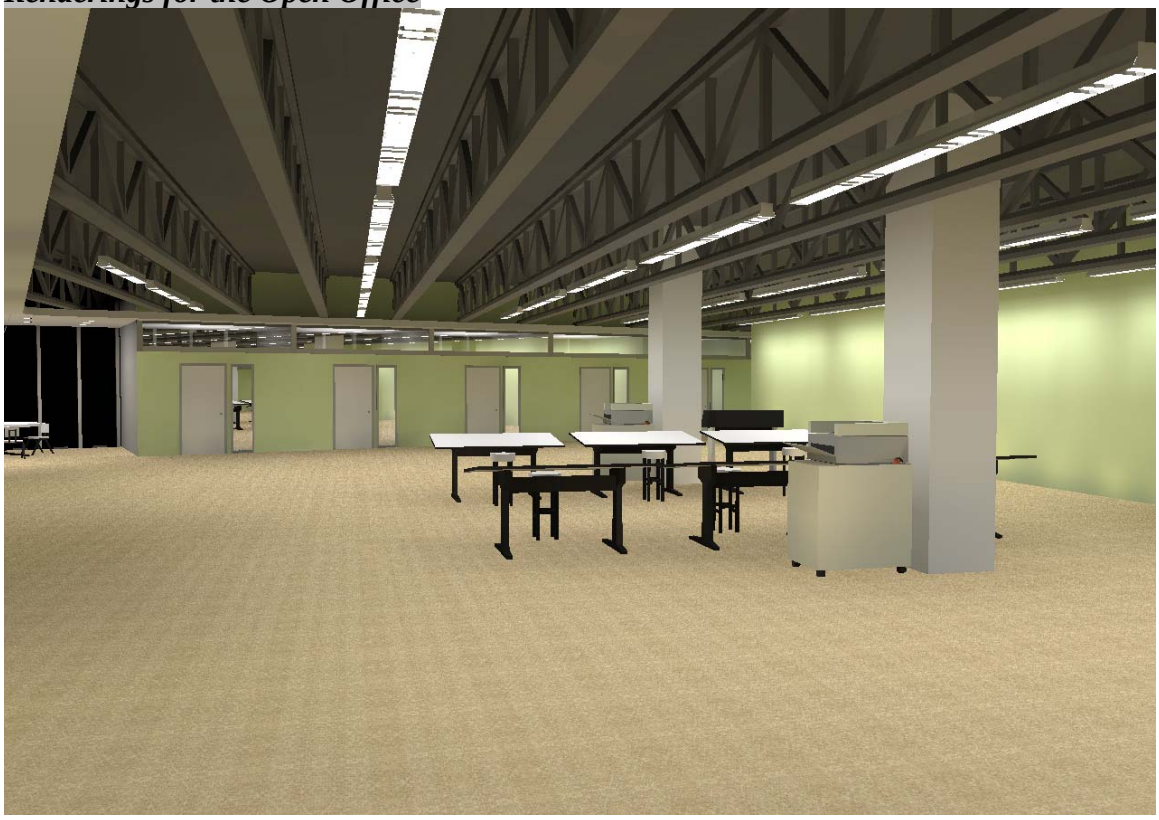
43.52 kWh * $0.10 / kWh = $4.35 / day

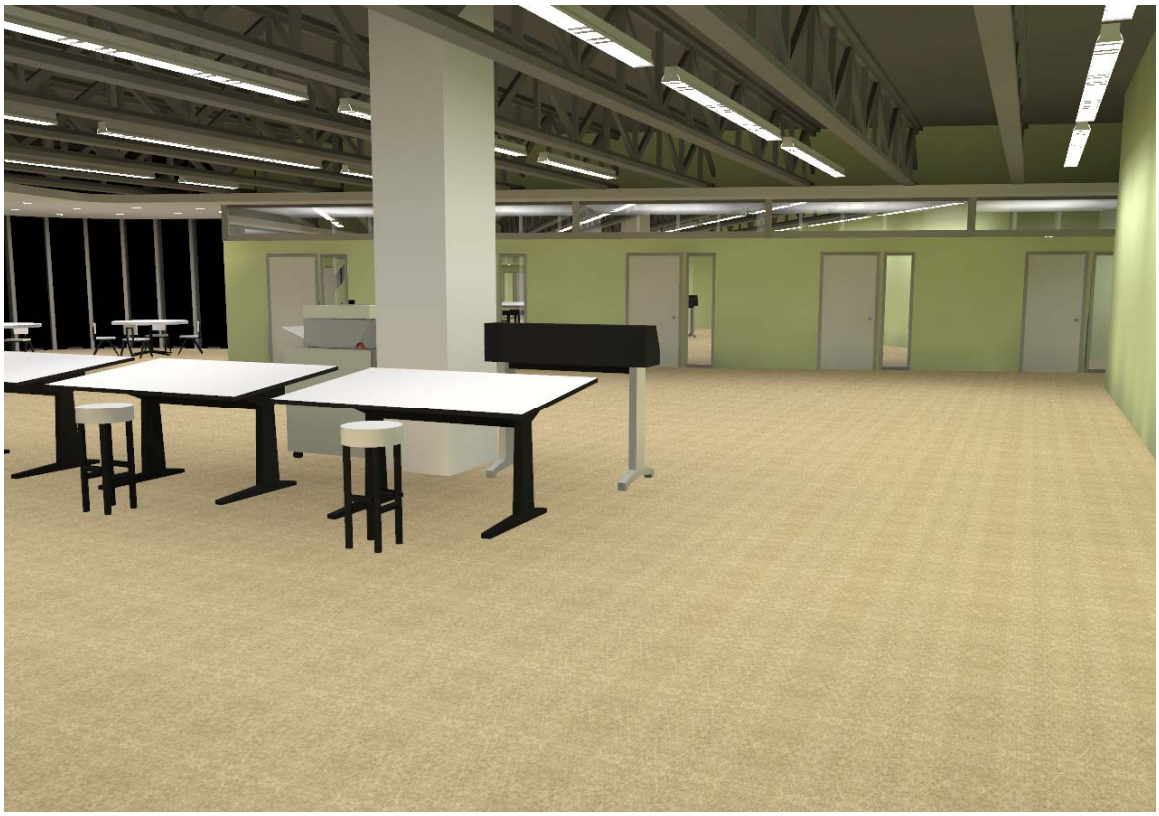
Estimated Typical Usage Days/year : 275 days

$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*





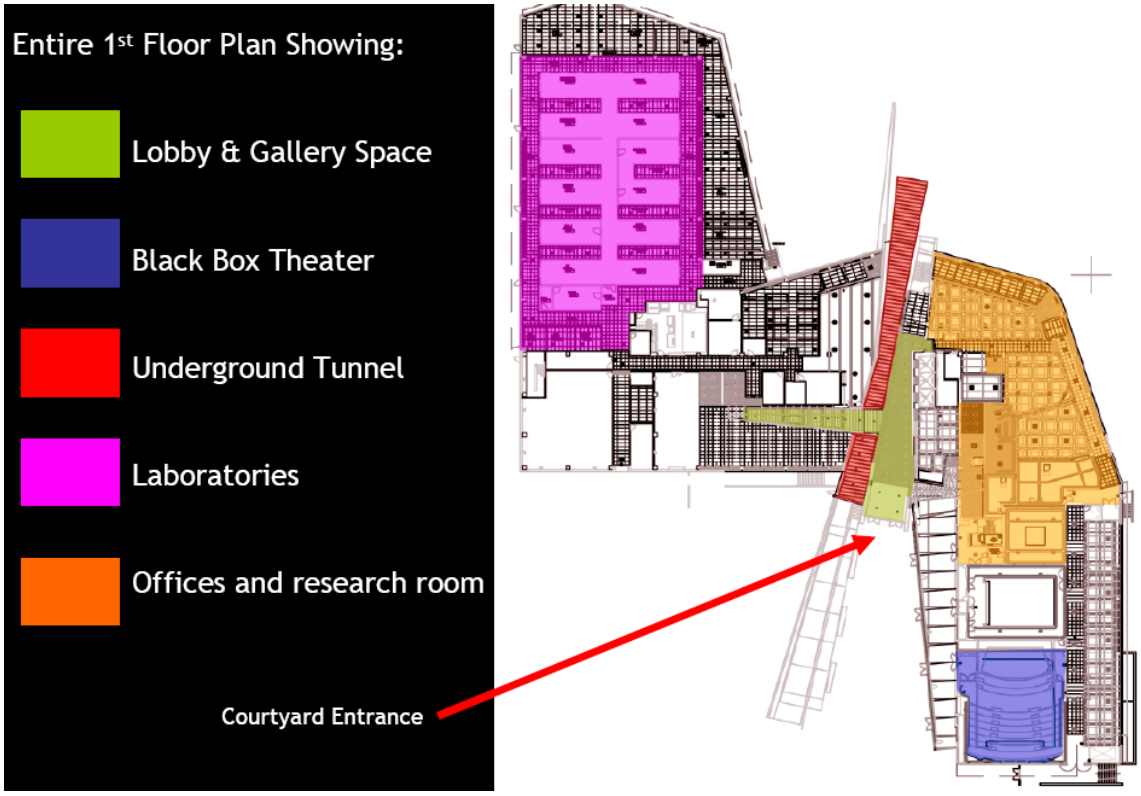
***Entrance to Open Office***

***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.

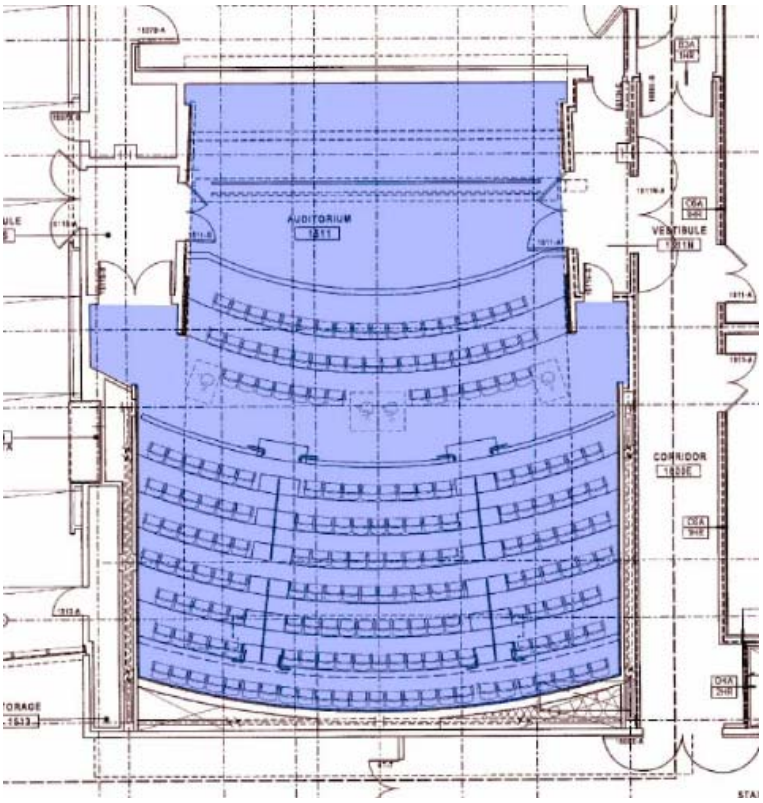
## *Black-Box Theater*

The black-box theater of Cal IT$^2$ is located on the first floor of building section C. A black box theater by definition is a small educational theater with moveable parts, black walls, black ceiling, black floors, and dark furniture. For the purpose of Cal IT$^2$, the theater brings many different aspects. This theater, all in black, is intended for educational purposes as well as small student performances, guest lecturers, and audio/visual movies and presentations. This makes the black-box theater of Cal IT$^2$ one of the more unique spaces in this large technological building. The 50 ft x 58 ft space has a two-story ceiling and seats 200 people at a time. The walls are covered with acoustic diffuser panels painted black. The front curtains to the stage are a black heavyweight material with the seats upholstered in a dark grey fabric. The ceiling contains acoustically reflective ceiling clouds made of plywood, also painted black, to reflect the sound effectively within the space. A catwalk also runs around the ceiling for theater lighting equipment, ceiling adjustments, and maintenance.

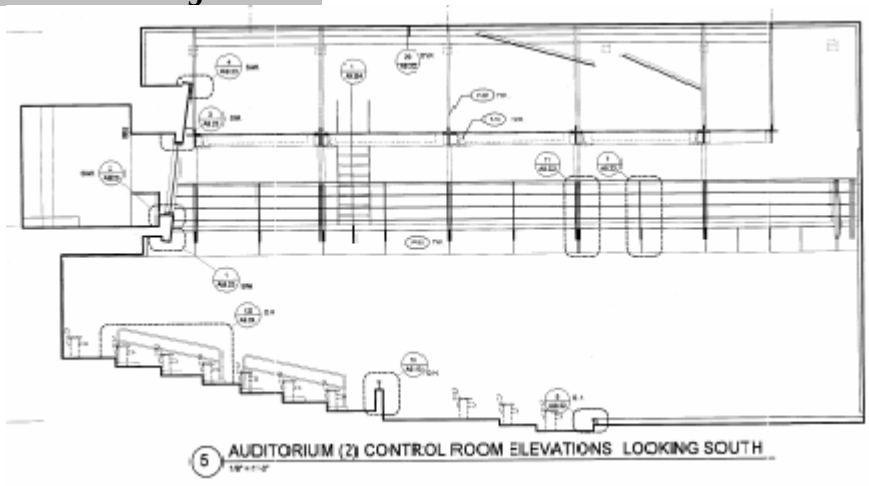



This plan shows the location of the theater relative to the courtyard and other entities of the building. Directly next to the theater is a large multipurpose room for various events sponsored by the college of telecommunications.

***Theater Furniture Plan***




***Theater Section Showing Catwalk***



## *Design Criteria*

### *Reflectances*

Side and Back Walls: 22% (Carnegie Xorel Fabric Wall Coverings)
Ceiling: 20% (Dark black paint on mesh acoustical ceiling and plywood)
Flooring: Assumed 20% (Collins & Aikman's Sequence ST320 -17 Carpet)
Chairs: 10% (Dark grey upholstered auditorium seating)

### *System Controls*

Controls are going to be a major impact on the design of this space. With the many tasks that will be occurring in the theater, multiple scenes must be made with-in the space to accommodate the changing atmosphere and clientele. Since I will be using the Lutron Grafik Eye 4000 to control this space as specified in the control section of my electrical depth, I will preset scenes to accommodate 5 different atmospheres before the building is occupied. These scenes will consist of 2 pre-performances, performance, educational, and a general ambient atmosphere. All fixtures in this space will have dimming capabilities for personal preference control over the lighting.

### *Ceiling characteristics*

The ceiling is designed as a grid with small steel beams running up and down, left and right. Above the steel grid is a black painted plywood acoustical system designed to reflect the sound back to the audience with minimal reverberation time. The panels behind the mesh are angled toward the stage and reflecting sound onto the crowd. The ceiling is 16 feet above the catwalk. The catwalk along the sides of the theater also creates a cove-like atmosphere around the seating where lighting will be installed. I will be using light above and below the mesh grid to create layers of light through the ceiling.

### *Theme*

The theater setting is created to be very dark and intimate with only 200 seats available and minimal lighting on the audience. The mood I want to place in this room is one of comfort, but also technologically advanced. Most of the performances and presentations will be for entertainment purposes, so minimal light needs to be cast on the audience for visual tasks. The audience should be very comfortable to be able to sit and listen and gather knowledge from the presentations without a feeling of sleepiness or an overwhelming atmosphere. Using many different layers of light, I will be using the floor, walls and two levels of the ceiling to light the theater. One main feature that will be implemented is walk-over floor box luminaires. These will act as guiding lights to seats as well as create a modern technological feel.

***Facial appearances***

The shadows placed on the presenter or cast of people on the stage is a strong issue for the angles at which the light is aimed at the people. Since theatrical fixtures will be casting all the light on the stage area, this scenario is not in my scope of work.

***Horizontal Illuminance***

Theater during performances: emergency lighting needed at 0.2 fc
Theater in between performances: 5 fc for circulation
Theater during educational sessions: 30 fc

Light levels should be minimal due to the highlighting of the stage area with the theatrical fixtures. Only path-lights and low-voltage ambient lighting should be used for egress.

***Vertical Illuminance***

Vertical illuminance is not really an issue in the black-box theater.

***Glare Consideration***

Glare should be considered in this space because of the illuminated floor boxes. Bright glowing steps can cause a problem if too bright. Since this is a college campus, the crowd will be of a younger age, and distracting light on the floor shouldn't be a huge problem.

***Lamping Criteria***

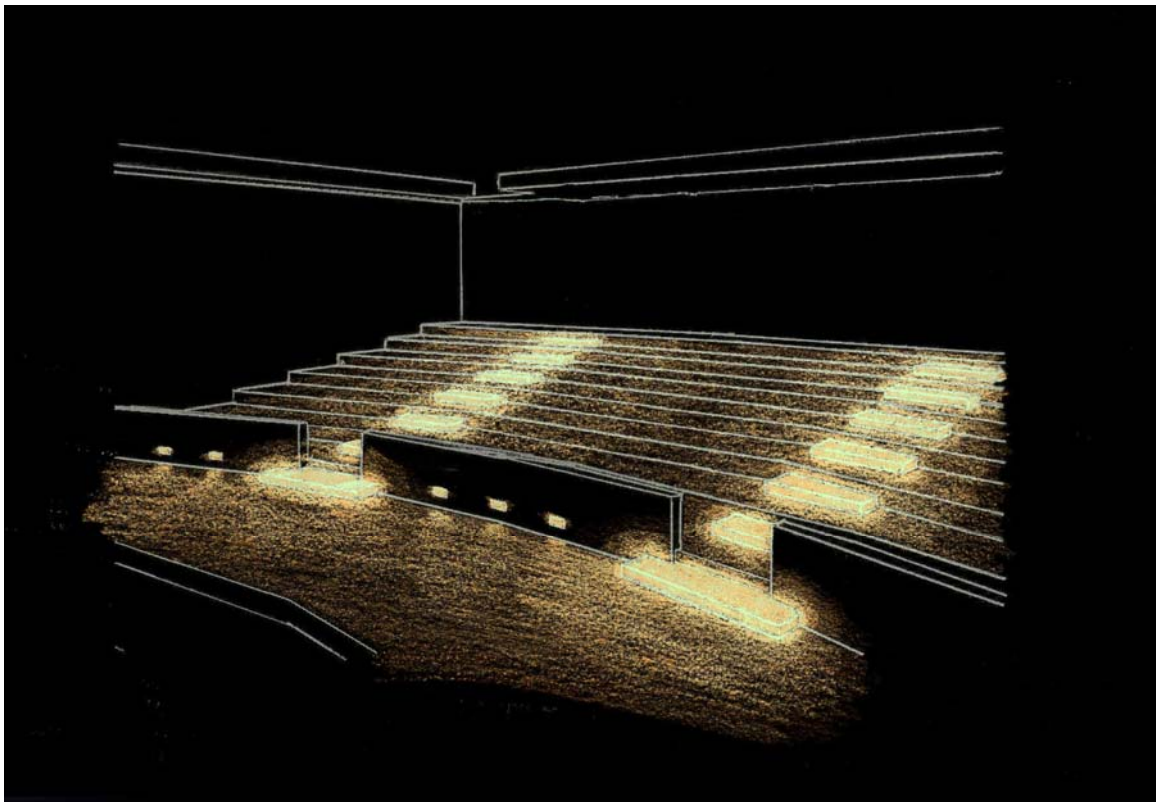
A uniform CCT of 3500K will be used in these areas with a CRI of about 82. Since this is a theater, I did not want to use a very cold source, but wanted to keep in tune with the technological feel. A 3500K lamp is a good neutral CCT for this space. A color rendering index of 82 is going to be uniform throughout the whole building.

***Power Density***

According to California Title 24 Energy Standards, a small theater's power density should be < 1.4 W/SF.

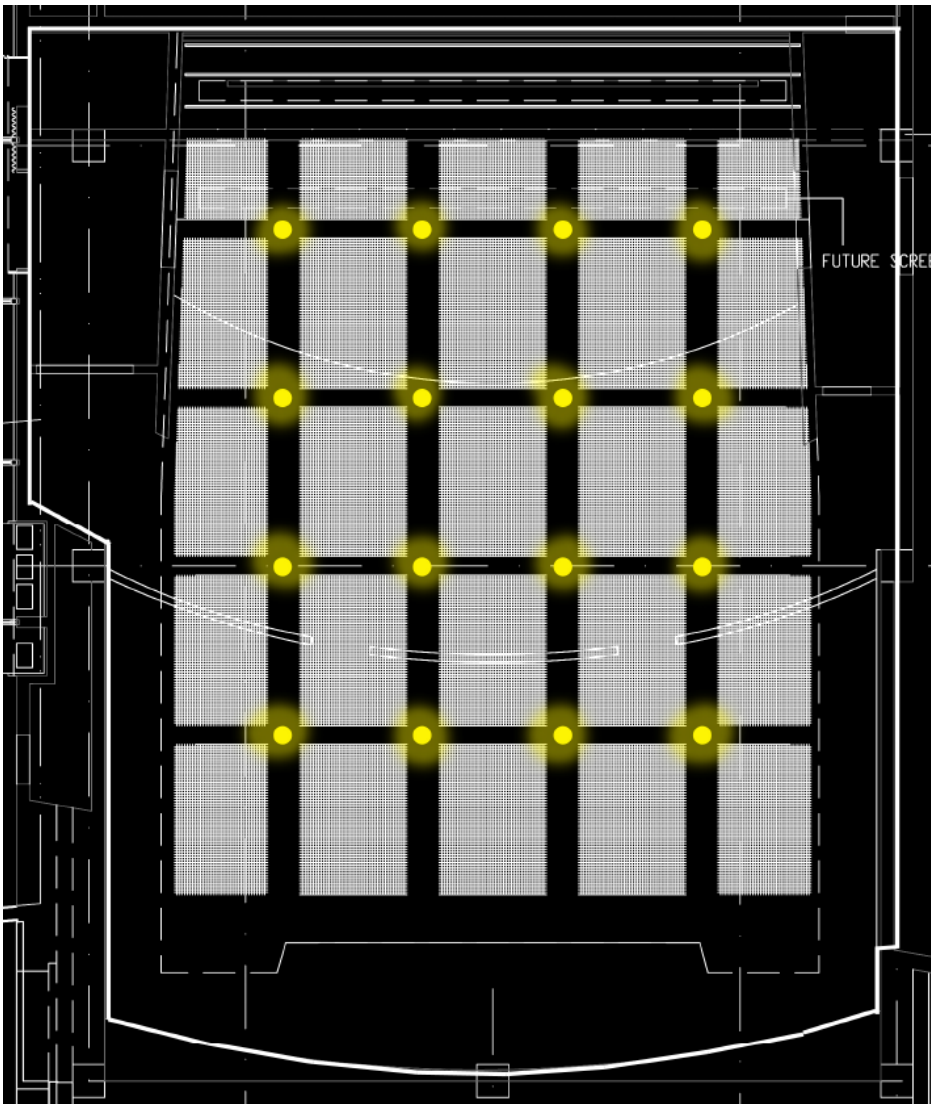
***Schematic Design***

In my redesign, I intend to provide multiple layers of light to convey the complexity and technological feel of the building and the theater's purpose. The first layer will entail my custom walk-over floor box luminaires. The intention with these boxes is to provide enough light for vision and circulation, but also to feel the anticipation of a great performance. With the slight dimming and brightening of these fixtures, a great sense of space and technology can be accomplished. My future intention with these luminaires is to program these dimming lights to go with a performance or musical piece in sequence. This is dependent upon a technological manager and the creativity of the staff at Cal IT$^2$.

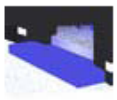


The next layer I will be using is washing the walls with light. By grazing the fabric walls with either blue or white light, this will add depth to the space as well as avoid dark shadows in the corners of the theater which can often happen. The next two layers involve the two tiered ceiling. The metal mesh grid at the 2$^{nd}$ floor level creates a smaller enclosure. By adding lights above and shining light through the metal mesh, it creates an added height to the theater as well as an intriguing effect on the source and position of the lights. Downlights will be added in between the grids to add in more effective lighting for the educational purposes as well as emphasize the mesh grid border between the catwalk and the public space as seen in the diagram on the next page. The final layer of light is purely criteria and safety based. For exiting and entering the space, steplights and dimmed downlights guide people to their destinations.

*Diagram of Mesh Grid Downlights*



**Lighting Fixture Schedule**
University of California, San Diego Cal IT2

| Type | | Mfr/Catalog # | Lamping | Notes |
|---|---|---|---|---|
| B7 |  | **Bega 2286P**<br>Description: Recessed compact fluorescent step light with 1-CFT13W lamp. Optics: grill louver , tempered glass diffuser. | 1-CFT13W lamp | Location: Black Box Theater |
| B8 |  | **Zumtobelstaff Custom Fixture**<br>Description: Floor surface mounted as steps. Walk-over fixture with blue gelled lamp and 3form acylic glass overlay. | (1) 17W UT8 | Location: Black-Box Theater |
| B9 |  | **Lightolier CS8242HUCL 42W**<br>Description: 9" surface-mounted compact fluorescent downlight with 2-CFTR42W lamps. Optics: anodized aluminum parabolic reflector. | 2-CFTR42W lamps | Location: Black Box Theater |
| B10 |  | **Lithonia WW-ST-1-32-277-IRLS-1/4**<br>Description: 4' linear recessed wall-washer with 1 32W T8 fluorescent | 1 32W T8 FL | Location: Black Box Theater |
| B11 |  | **Lightolier 1108 / 1104F1****<br>Description: 6" recessed compact fluorescent downlight with 1-CFQ13W lamp. Optics: painted or anodized<br><br>aluminum cone reflector. | 1-CFQ13W lamp | Location: Black Box Theater |
| B12 |  | **Cooper Ltg - Metalux 2M-XRD-2-U6T8-PBIS-*-277-EB81-***<br>Description: 24" surface-mounted fluorescent downlight with 2-F31T8/U (22.5in) lamps. Optics: acrylic prismatic lens. | 2-F31T8/U (22.5in) lamps | Location: Black Box Theater |
| B13 |  | **Cooper Ltg - Metalux RWW-2-32-MI-277-EB81-***<br>Description: 1x4" recessed fluorescent wallwasher with 2-F32T8 (48in) lamps. Optics: anodized aluminum reflector , single. | 2-F32T8 (48in) lamps | Location: Black Box Theater |

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 |

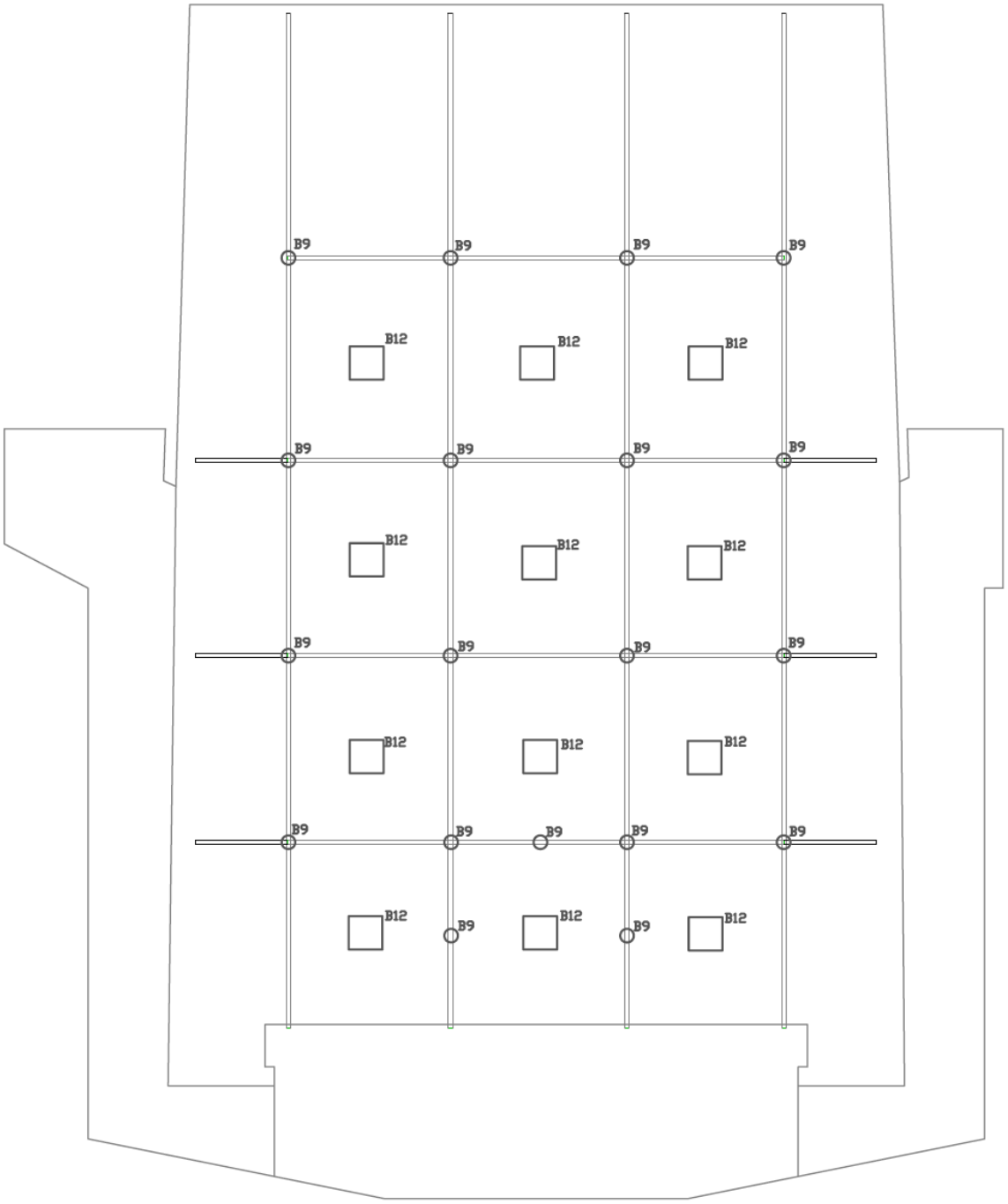
| Light Loss Factors | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type | Cleaning Interval | Category | BF | LLD | LDD | RSDD | LLF | Location |
| B7 | 12 Months (Clean) | IV | 1.00 | 0.85 | 0.88 | 0.96 | 0.72 | Black-Box Theater |
| B8 | 12 Months (Clean) | VI | 0.88 | 0.85 | 0.86 | 0.93 | 0.60 | Black-Box Theater |
| B9 | 12 Months (Clean) | IV | 1.00 | 0.85 | 0.88 | 0.96 | 0.72 | Black-Box Theater |
| B10 | 12 Months (Clean) | IV | 1.00 | 0.95 | 0.88 | 0.96 | 0.80 | Black-Box Theater |
| B11 | 12 Months (Clean) | IV | 1.00 | 0.85 | 0.88 | 0.96 | 0.72 | Black-Box Theater |
| B12 | 12 Months (Clean) | IV | 0.88 | 0.85 | 0.88 | 0.96 | 0.63 | Black-Box Theater |
| B13 | 12 Months (Clean) | IV | 0.88 | 0.95 | 0.88 | 0.96 | 0.71 | Black-Box Theater |

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 theater since the room will be used intermittently and cleaned after every performance by janitorial staff.

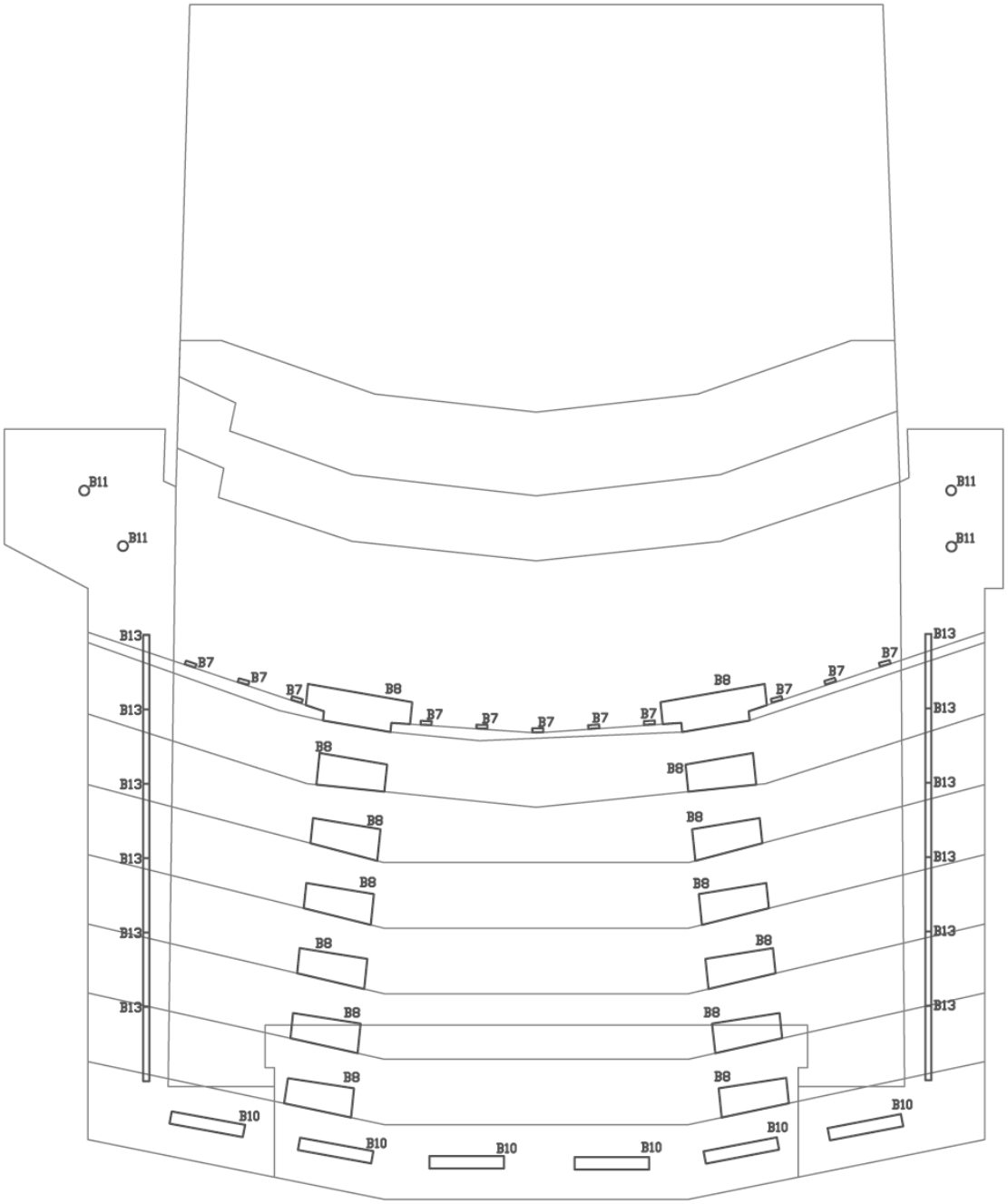
| Power Density | | | | | |
|---|---|---|---|---|---|
| Fixtures | Fixture Count | Watts | Total watts | SF | W/SF |
| B7 | 11 | 13 | 143 | | |
| B8 | 14 | 17 | 238 | | |
| B9 | 19 | 80 | 1520 | | |
| B10 | 6 | 36 | 216 | | |
| B11 | 4 | 18 | 72 | | |
| B12 | 12 | 65 | 780 | | |
| B13 | 12 | 35 | 420 | | |
| | | | 3389 | 2845 | 1.19 |

Using the input wattage from the specified ballasts and lamps, the power density came in under the maximum allowed of 1.4 W/SF which meets California Title 24 standards.

*Lighting Plan – 2nd Story*



*Lighting Plan – 1st Story*



***Preset Control Scenes***

| Theater Scenes | | | | |
|---|---|---|---|---|
| **Scene** | **Name** | **Zones** | **Fixtures** | **Dimming** |
| Scene 1 | Performance Entrance | D, F, G, I | B7, B8, B10, B11, B12, B13 | D(10%) |
| Scene 2 | Educational | D, E, F, H | B7, B9, B10, B11, B12, B13 | |
| Scene 3 | Performance | G, F | B7, B8, B11 | G(1%), F(1%) |
| Scene 4 | Educational 2 | D, E, H | B9, B10, B12, B13 | |
| Scene 5 | Performance Entrance 2 | D, H, F | B7, B10, B11, B12, B13 | D(10%), H(10%) |

***Scene 1***

This scene will be used for entering the theater for a performance or possibly a guest speaker. The custom blue floor boxes are turned on with a white wall wash on the back acoustical panels and a blue wall wash on the side walls. The square pendants above the mesh ceiling are dimmed 25% while the circular downlights are turned off completely. The entrance downlights and steplights will be turned on for circulation around the theater.

***Scene 2***

This scene will be used educational purposes during classes and demonstrations. The floor boxes will be turned off. All the wall-washers will be turned on with white light along with the pendants on full capacity and the circular downlights. The steplights and entrance/exit lights are also turned on in this scene.

***Scene 3***

This scene is used during a performance or speaker where note taking is not needed. The blue floor boxes, steplights, and entrance/exit lights are dimmed to 1%. This provides enough light for entering or exiting only. In case of more light being needed, the wall washers can easily be turned on.

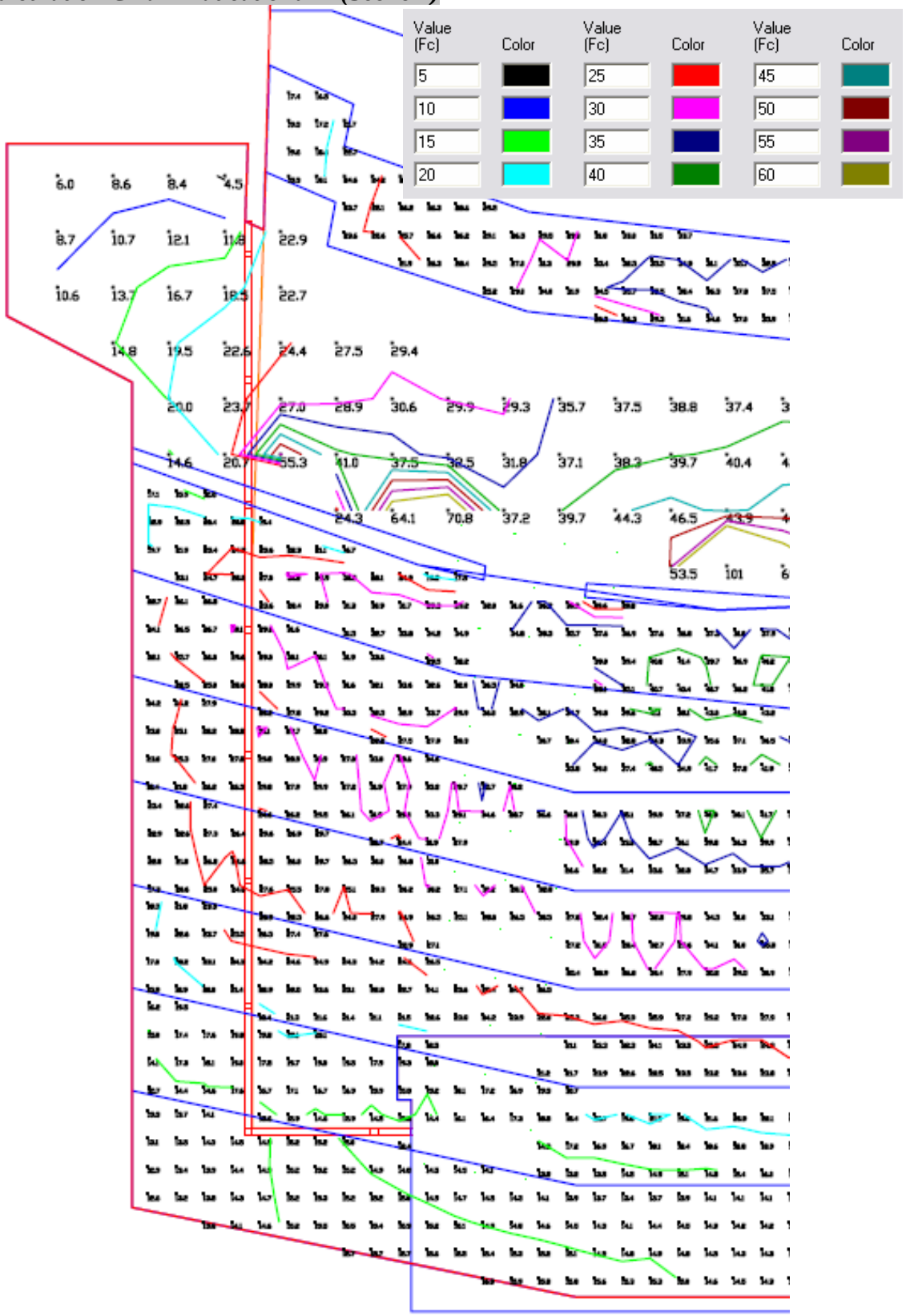
***Scene 4***

This scene is used for general ambience or educational purposes. All the lights are on in white light except the floor boxes, steplights, and the entrance/exit lights. This is used for clean-ups, general tasks, and educational reasons.

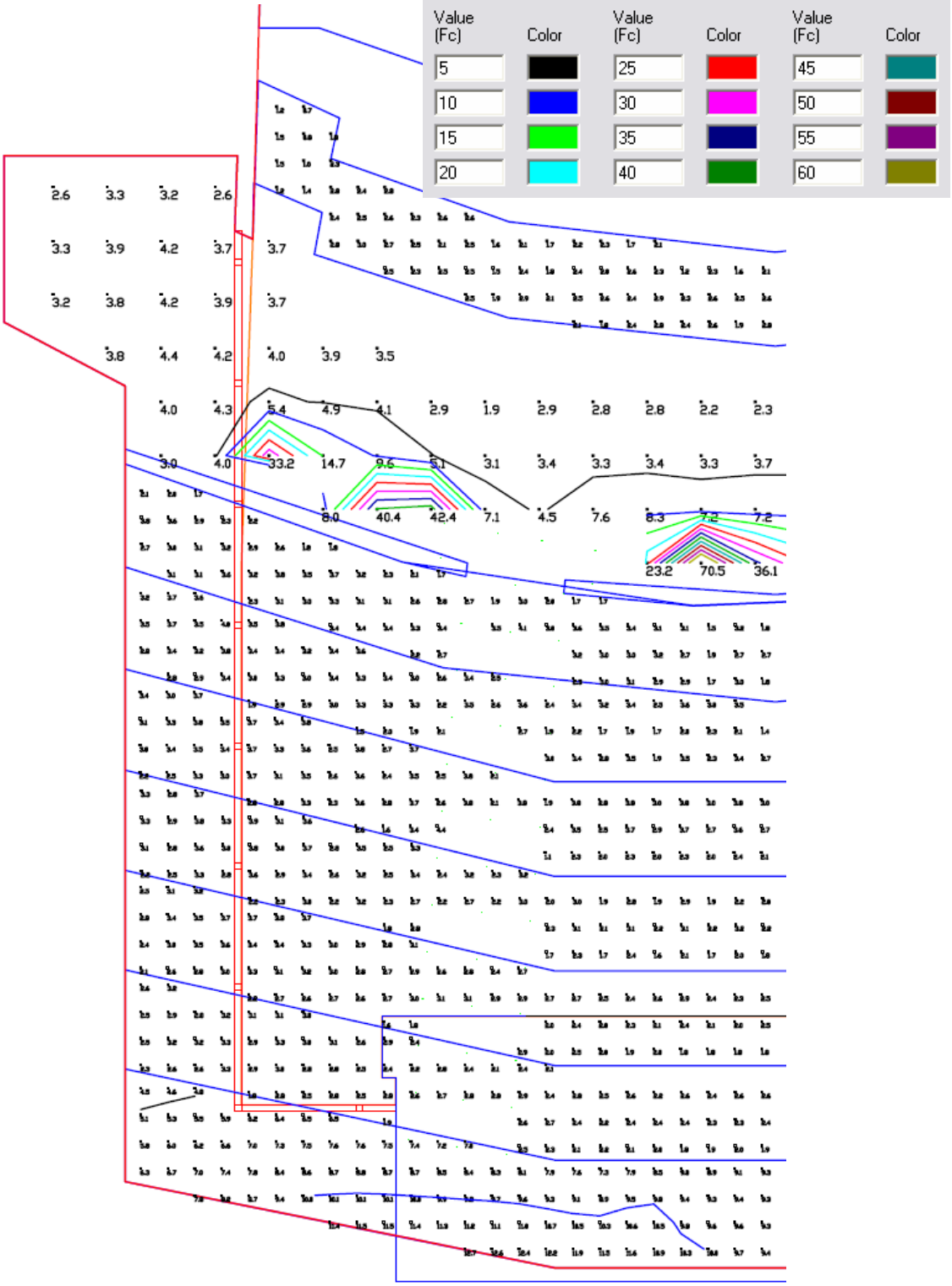
***Scene 5***

This scene is used for entering the theater for a performance or guest lecturer. This entails all the aspects of Scene 1 without the blue floor boxes. This also includes the wall-washers being dimmed to 10% for a more intimate setting possibly to let the audience know the show will be starting momentarily and to be seated.

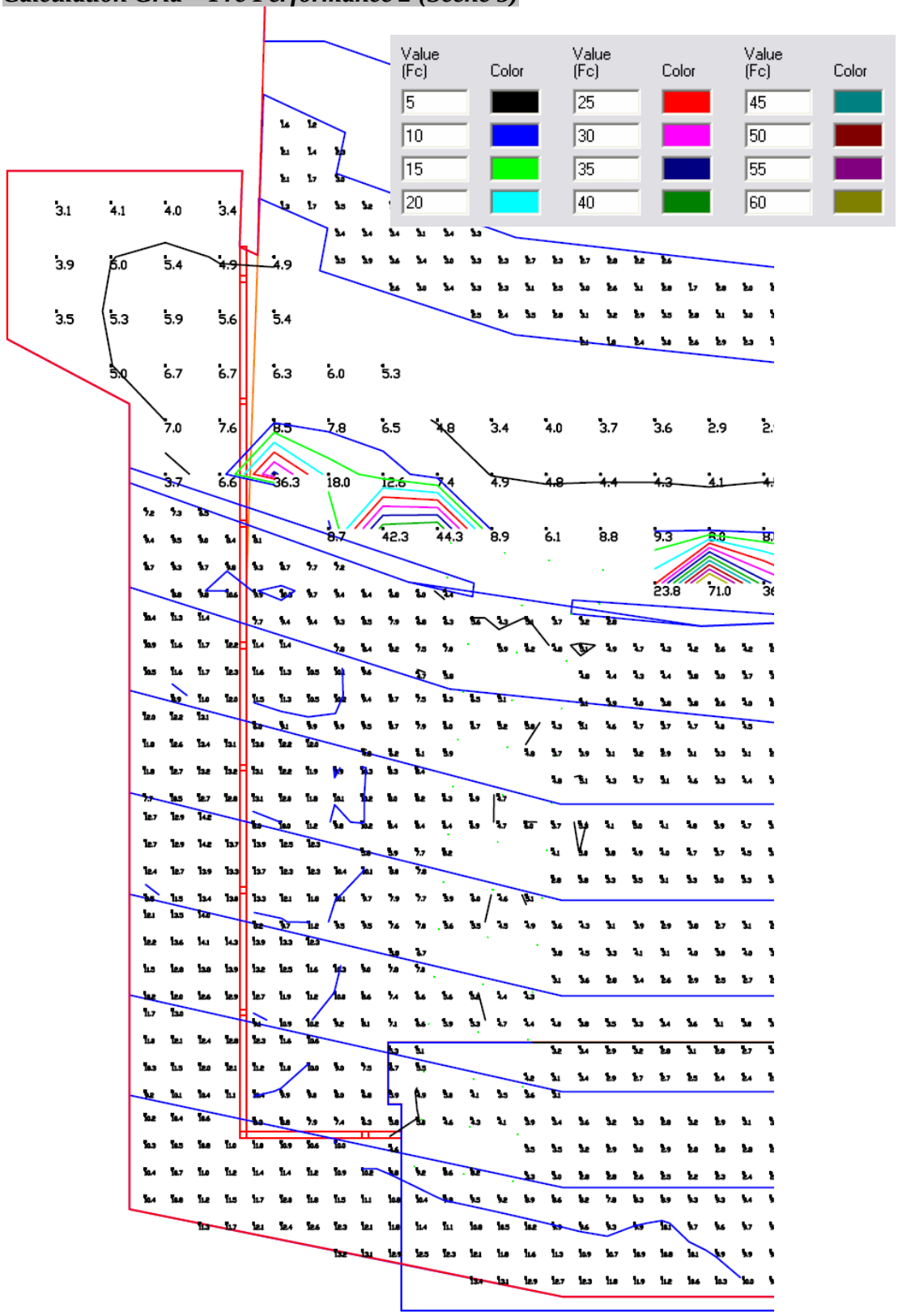
## *Calculation Grid – Educational 1 (Scene 2)*



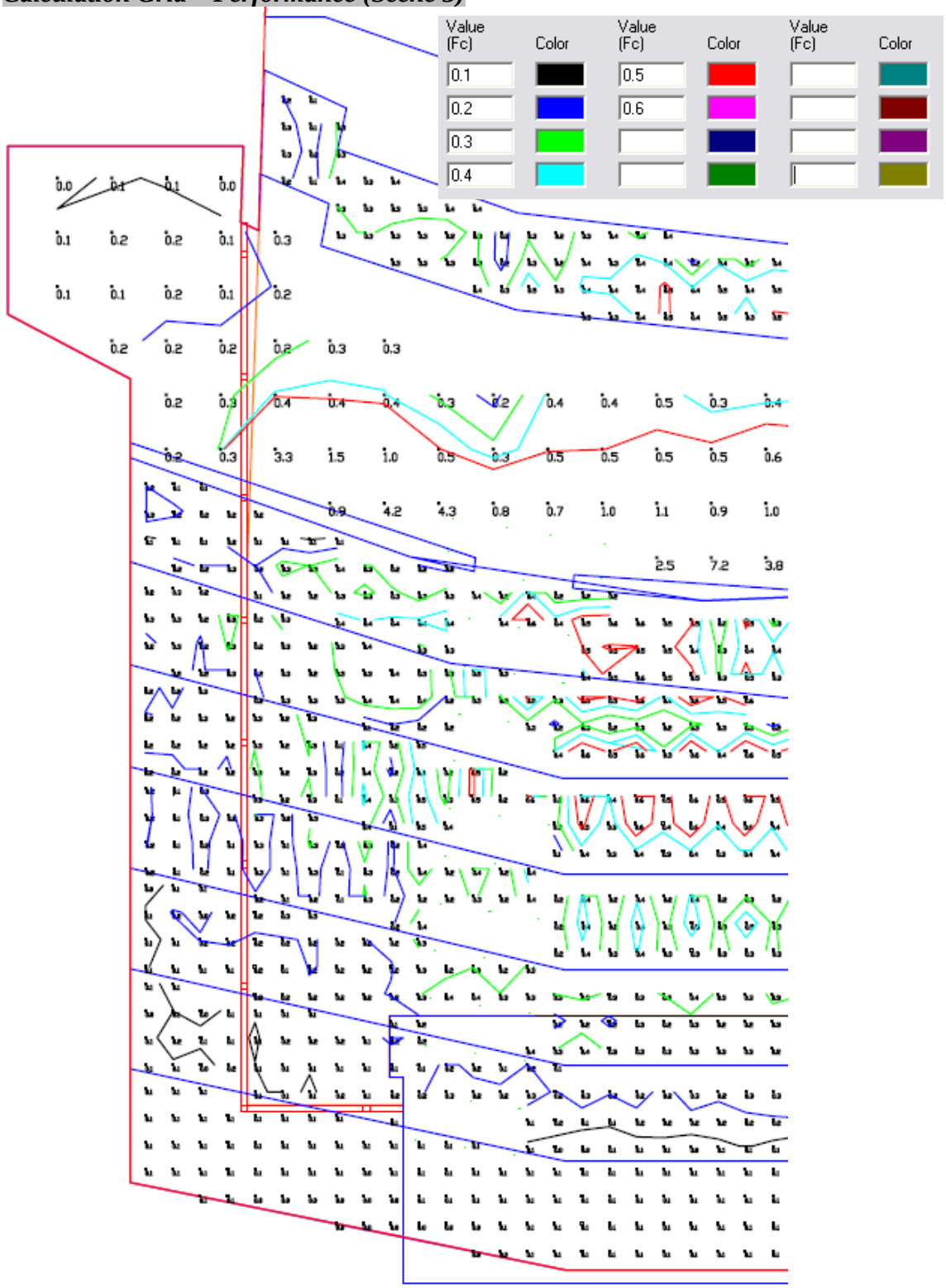
## *Calculation Grid – Pre Performance 1 (Scene 1)*



## *Calculation Grid – Pre Performance 2 (Scene 5)*

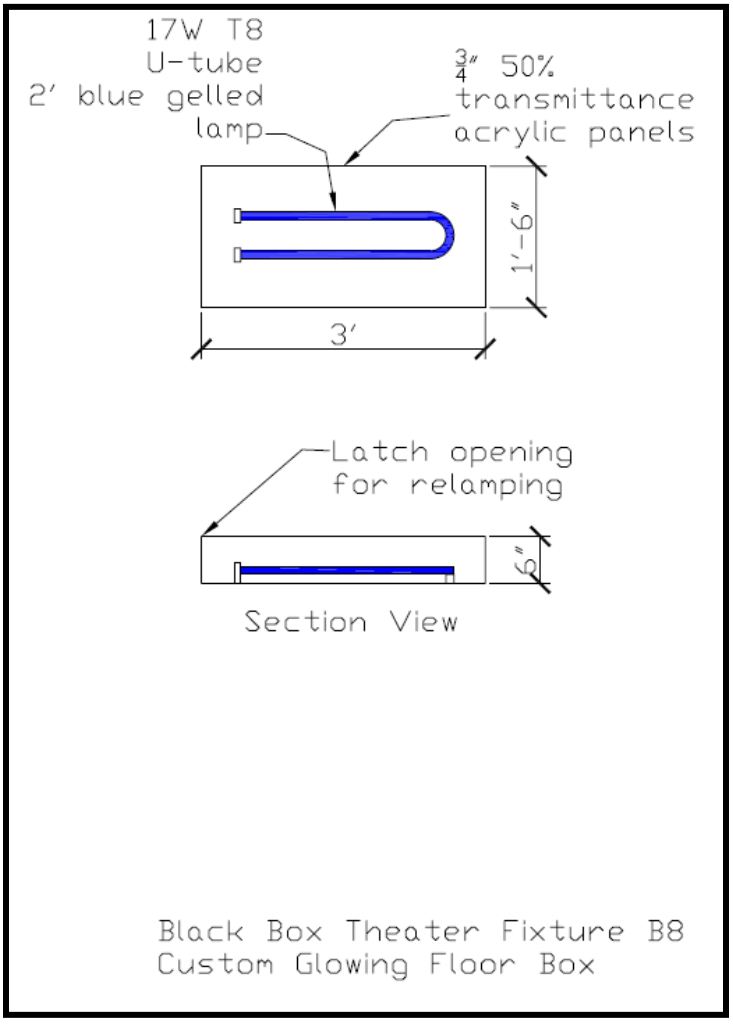


## *Calculation Grid – Performance (Scene 3)*

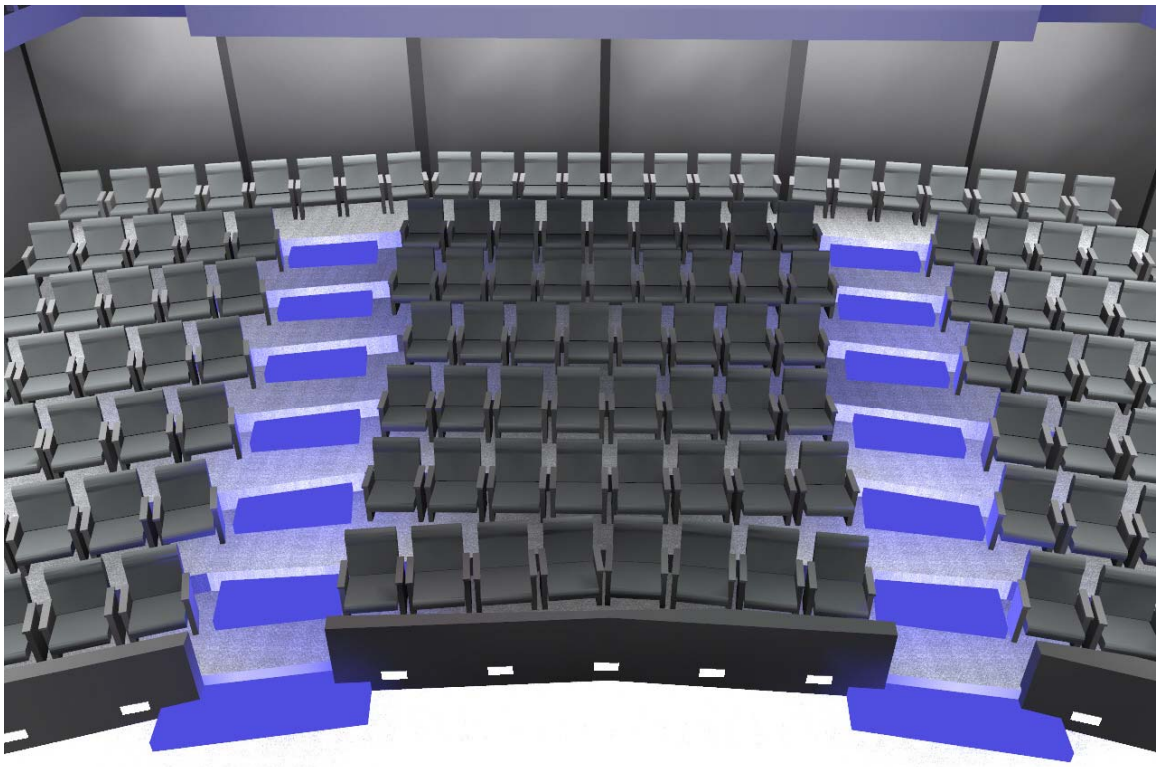


| Theater Illuminance Values | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| (in Footcandles) | Values | Bottom Row | Circultation Area | 1st Row | 2nd Row | 3rd Row | 4th Row | 5th Row | 6th Row | Top Row |
| Educational 1 | Avg | 29.16 | 33.12 | 30.05 | 32.45 | 31.21 | 27.56 | 23.34 | 17.12 | 14.54 |
| (Scene 2) | Max | 39.60 | 10.10 | 42.40 | 44.90 | 42.10 | 35.80 | 29.20 | 23.10 | 16.00 |
| | Min | 15.30 | 4.50 | 12.10 | 20.20 | 18.40 | 17.20 | 15.90 | 12.30 | 12.50 |
| Educational 2 | Avg | 29.16 | 27.29 | 30.05 | 32.45 | 31.21 | 27.56 | 23.34 | 17.12 | 14.54 |
| (Scene 4) | Max | 39.60 | 44.30 | 42.40 | 44.90 | 42.10 | 35.80 | 29.20 | 23.10 | 16.00 |
| | Min | 15.30 | 4.40 | 12.10 | 20.20 | 18.40 | 17.20 | 15.90 | 12.30 | 12.50 |
| Pre-performance 1 | Avg | 2.28 | 8.94 | 2.82 | 2.96 | 3.04 | 2.65 | 2.65 | 2.54 | 8.65 |
| (Scene 1) | Max | 3.30 | 74.10 | 4.10 | 4.00 | 4.40 | 3.90 | 3.80 | 3.30 | 12.70 |
| | Min | 0.70 | 1.90 | 1.50 | 1.40 | 1.10 | 1.50 | 1.40 | 1.70 | 4.20 |
| Pre-performance 2 | Avg | 2.86 | 10.52 | 6.40 | 7.36 | 7.90 | 7.61 | 7.30 | 6.24 | 10.56 |
| (Scene 5) | Max | 4.10 | 75.70 | 10.60 | 12.30 | 13.40 | 14.20 | 14.30 | 13.00 | 13.40 |
| | Min | 1.20 | 2.80 | 2.40 | 2.40 | 2.80 | 2.50 | 2.00 | 2.10 | 7.80 |
| Performance | Avg | 0.33 | 0.89 | 0.32 | 0.33 | 0.33 | 0.25 | 0.22 | 0.14 | 0.09 |
| (Scene 3) | Max | 0.60 | 7.50 | 0.60 | 0.70 | 0.60 | 0.50 | 0.40 | 0.30 | 0.10 |
| | Min | 0.10 | 0.00 | 0.00 | 0.00 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 |

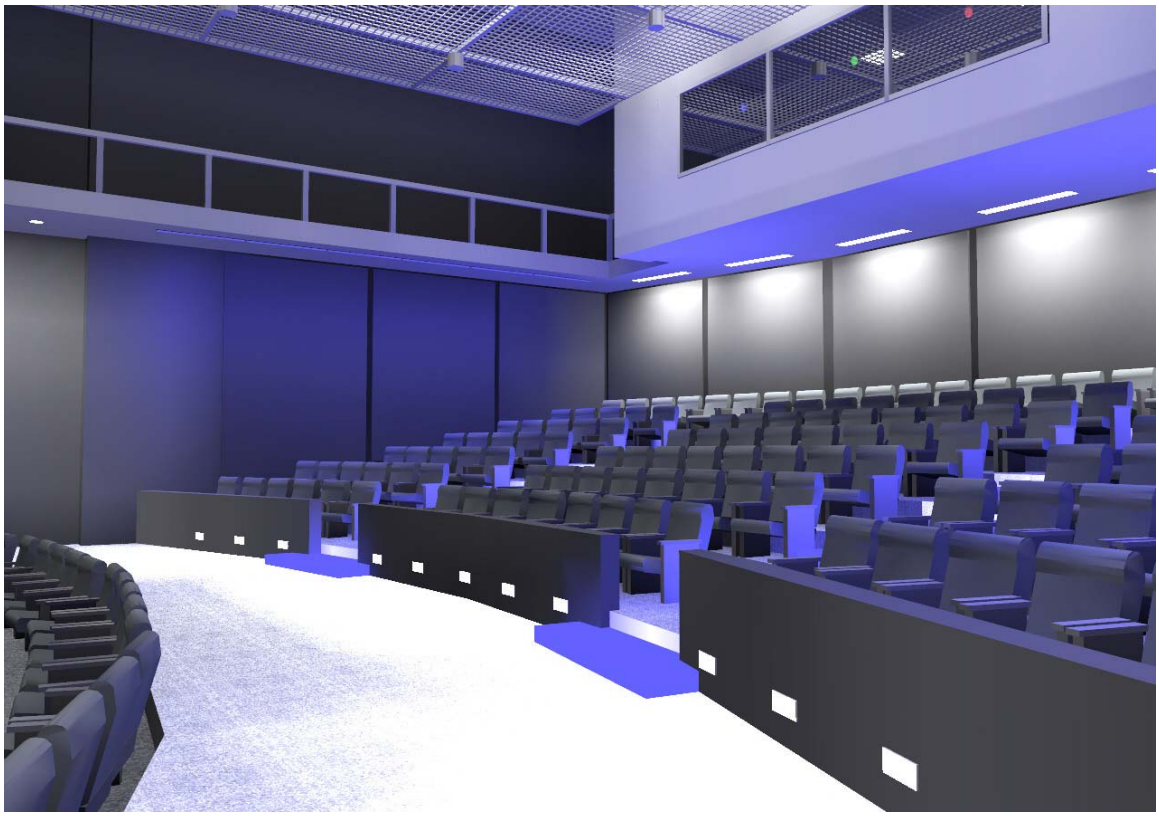
***Fixture Details***



***Renderings for All Scenes in Theater***
***Performance Entrance Example***



*Performance Entrance 1 – Scene 1*



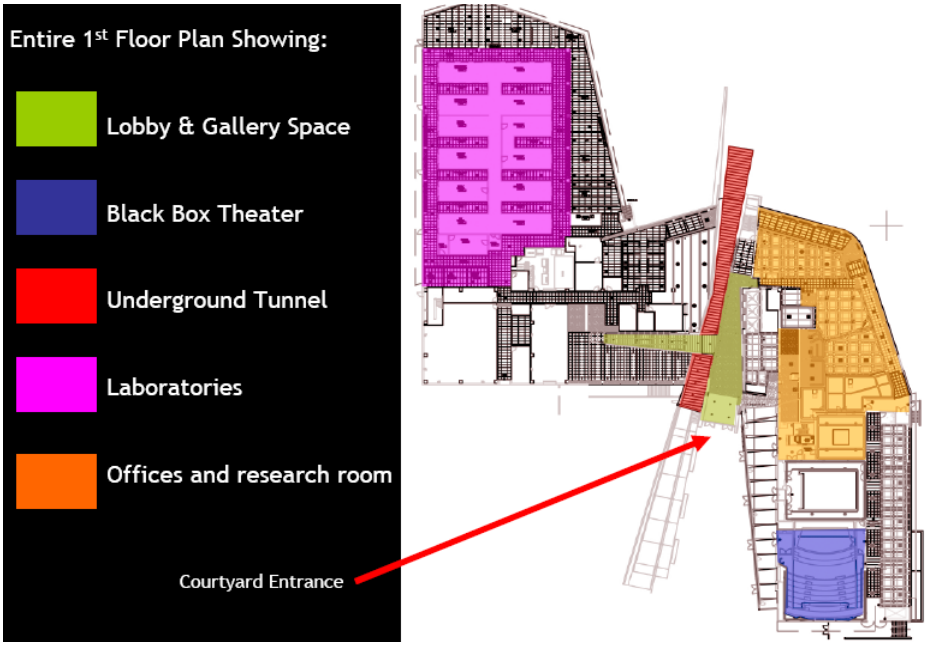
*Educational Set-up – Scene 2*

***Conclusion***

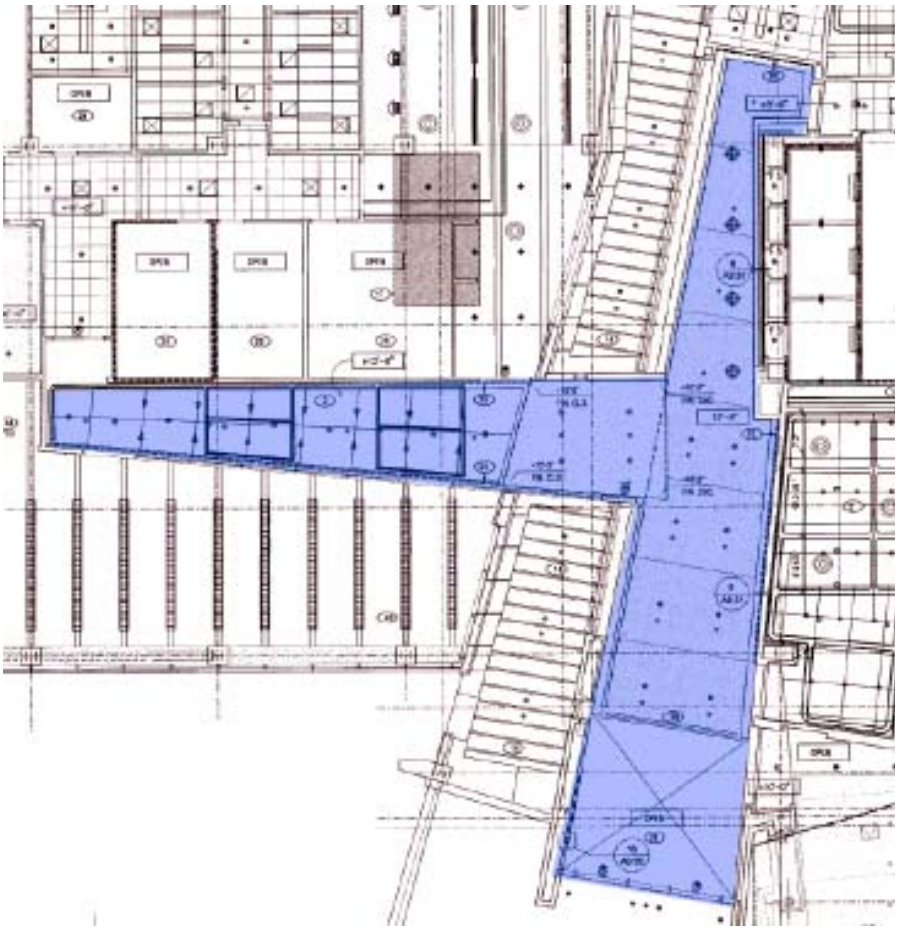
The Black-Box Theater is a multi-functional space. It can be used for educational purposes, small student performances, lectures, and guest speakers. Because of this broad range of tasks, the lighting must accommodate all of these in one system. I have created a multi-layered system that can be controlled easily using the Lutron Grafik Eye with only two control pads in the theater. With my preset scenes as well as the ability to add more scenes, the flexibility for the lighting of this space is very tangible and works well. Adding the blue light floor boxes adds a technological feel to the space as well as adds aesthetic appeal. The layers of light in the ceiling can be used to either close the space off, or make the space ceiling seem higher for a more dramatic effect. Flexibility was one of my main goals and I have accomplished this using the multiple layers of light with a preset control system.

## *Main Entrance Lobby*

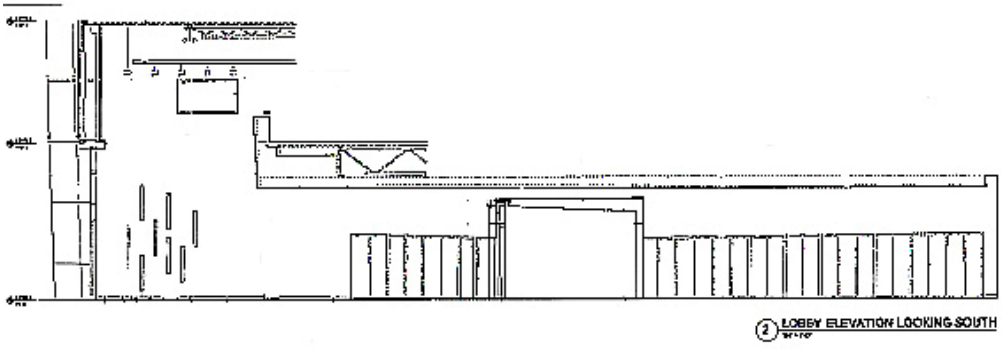
The main entrance lobby of Cal IT$^2$ is located on the first floor of building section B looking into the academic courtyard. The dark glassed façade leads into this space with a technological feel to it. The lobby is constructed with three different ceiling heights (entrance at 32 ft, main area at 12.75 ft, and the gallery at 10 ft). These ceiling heights defined spaces into little areas by which I designed the lighting atmospheres. This lobby however, is a very odd shape. The main entrance leads down a long converging hallway to the elevators and another hallway. Jutting out to the side is the gallery space which looks into the server room (the hub of the building) and also leads down a narrow converging space to yet another hallway. Another main feature of this space is the ¾ height windows that look into the underground tunnel going through the building. As talked about later, a lighting display will be seen from the tunnel into the space. The main function of this space is to guide people through to their destination. It gives an initial feel for the building and showcases the technological advancement of projects and experiments through art and equipment. My purpose for this space is to provide an impression of what Cal IT$^2$ is about as the people walk through.



## *Lobby and Gallery Layout*



## *Lobby Section*



## *Design Criteria*

### *Reflectances and Materials*

Walls: 50% (White and Light green paint from Sherwin Williams)
Ceiling: 80% (White coved ceiling)
Floor: 30% (Terrazzo glass and stone pour in place flooring)
Glass: 80% transmittance clear glazing
Façade glass: 14% transmittance tinted glazing
Black leather furniture chairs: 30-40% reflectance
Small tables: 42% reflectance

### *Ceiling Characteristics*

The ceiling in the lobby is multistoried. When first entering, the ceiling expands up to the exposed truss system 32 ft high. As you continue on, the second floor creates a cove ceiling the rest of the way at 12'-9" high. The bridge over the tunnel has another ceiling that is sloped at only 10 ft high. Because of the differing ceilings, many different lights can be used to emphasize the size of the space, the length of the space and the jagged edges that all the ceilings create when put together. These ceilings also define the three different areas by which the lobby is defined: entrance area, guiding area, and the gallery.

### *Theme*

As you enter the space, the lobby is meant to invite you into the building and give a sense of what it is hiding inside. In Cal $(IT)^2$, the blue cove lights, modern hanging custom pendants, and misshaped ceilings give a sense of modern improvement and the advancement of building technology. This is the sense that I am going to highlight in my redesign. Clean lines should be able to guide people through this space. I want to avoid anything blocking a clean line to the destination. All fixtures should appear hidden and recessed.

### *Horizontal Illuminance*

In the lobby, a horizontal illuminance of 5-10 fc is sufficient for circulation and entering according to the IES standards. It is a simple orientation to the building with only a short visit.

### *Vertical Illuminance*

In the lobby, a vertical illuminance of 3 fc is needed.

### *Daylight Integration*

This space has large tinted glazing windows when you first enter the space from the courtyard in the East. Daylight can help generate much of the light needed during the

daytime hours to illuminate the immediate two story space upon entering; however, since the windows are tinted, the pendants will need to be used during the early dusk hours to generate enough light on the floor. A daylight photosensor will be used to turn these fixtures on and off. More on the controls can be found in my electrical depth section.

***Color and Texture***

For this technological building, all of the walls are painted grey, white and a lightened green. The choice of these colors really emphasizes its use as an educational facility while also showing a form of design. Accenting these colors well can create an atmosphere pleasant and suitable for the growing technology that is being designed within its walls. All textures are very clean and smooth. The chairs in the lobby are designed with black smooth leather, the window mullions with smooth extruded aluminum.

***Glare Consideration***

Glare should be considered in this space because of the specular surface floor. Since all the fixtures in the lobby are recessed or hidden in coves, they do not cause a problem with this. Another concern was the lighting display in the tunnel shining into the lobby space. This proved to be advantageous since it also provided some light onto the floor as well as give a showpiece to peer at.

***Lamping Criteria***

A uniform CCT of 4100K will be used in these areas with a CRI of about 82. This keeps in tune with the technological feel of the space as well as renders the works of art on the walls in the gallery well. A color rendering index of 82 is going to be uniform throughout the whole building.

***Power Density***

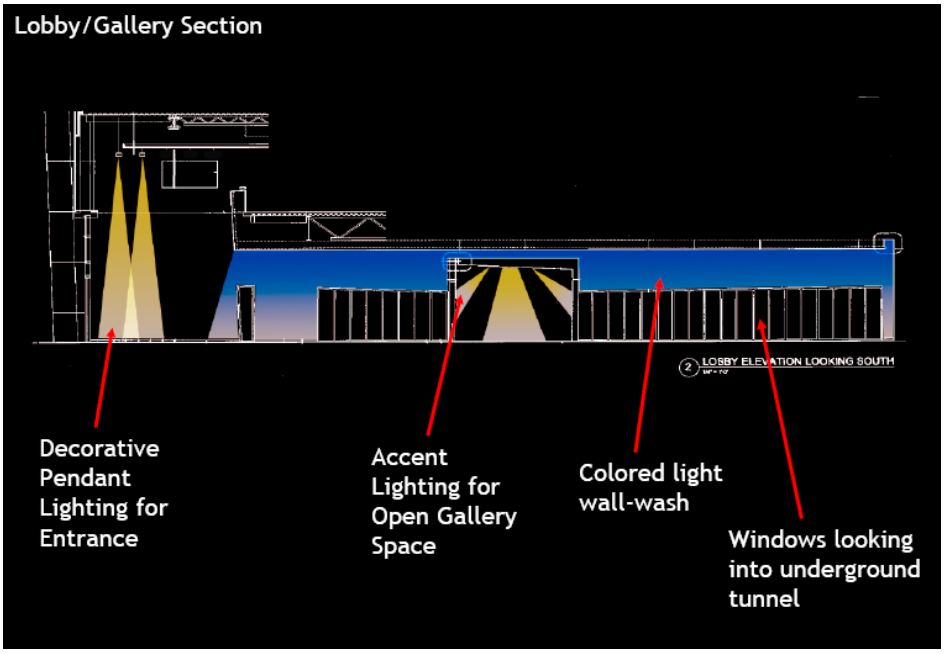
According to California Title 24 Energy Standards, a lobby's power density should be < 1.5 W/SF.

## *Schematic Design*

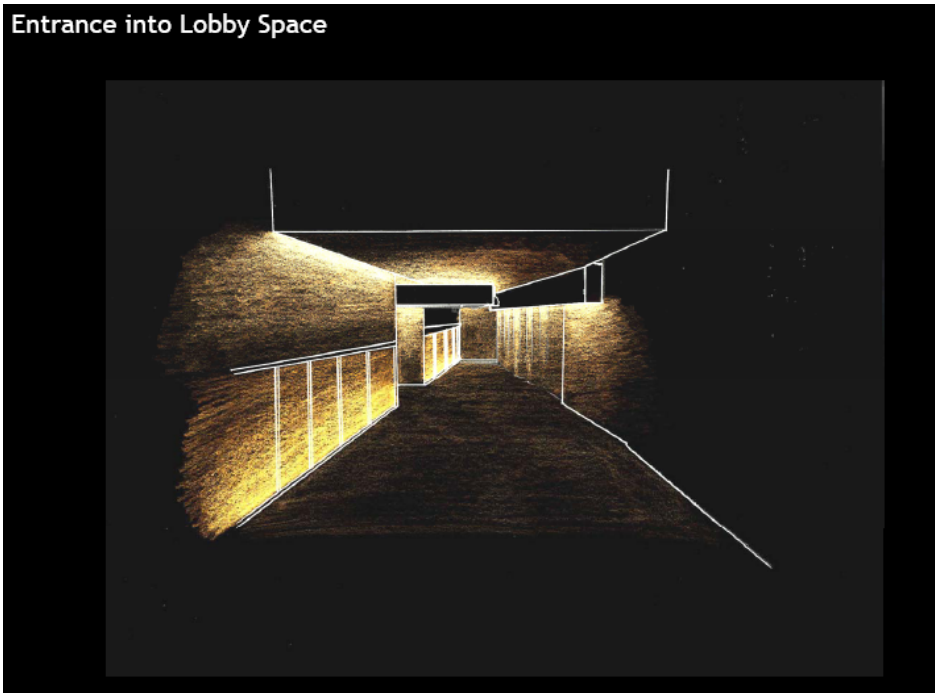
In my redesign, I intend to use light as the guiding tool for people to follow. Upon first entering the large open area of the entrance, one will be able to gaze up at the large clean lined custom fixtures hanging in various lengths from the 32 ft ceiling. As you continue through the space, coves of colored and white light lead your way to the elevators and hallway at the end of the converging lobby. Using lines of guiding light in the ceiling and walls, I hope to achieve a directional space that shows the creativity and technological advancement of the building and its occupants. Using the same concept, I

will be using long converging lines of light to lead people into the gallery area and building section A. With the sleek, clean design, I hope to achieve a statement of triumph for the telecommunications institute this building encompasses. The following diagram shows a section of the lobby space with these concepts in place.

***Section of Lobby Showing Schematic Design***




***Schematic Design Sketch Showing Entrance View***



**Lighting Fixture Schedule**
University of California, San Diego Cal IT2

| Type | | Mfr/Catalog # | Lamping | Notes |
|---|---|---|---|---|
| B14 |  | **Cooper Ltg - Corelite CI-SN-1T8-1-C-277-08**<br>Description: Fluorescent cove light with 1-F32T8 (48in) lamp (in cross-section). | 1-F32T8 (48in) lamp (in cross-section) | Location: Lobby |
| B15 |  | **Cooper Ltg - Corelite CI-SN-1T8-1-C-277-08**<br>Description: Fluorescent cove light with blue gelled 1-F32T8 (48in) lamp (in cross-section). | 1-F32T8 (48in) lamp (in cross-section) | Location: Lobby |
| B16 |  | **Edison Price TPX 132/6**<br>Description: 6" recessed compact fluorescent downlight with 1-CFTR32W lamp. Optics: anodized aluminum parabolic reflector. | 1-CFTR32W lamp | Location: Lobby |
| B17 |  | **Erco 88120.023**<br>Description: 6" recessed halogen accent light with 1-MR16 50W max lamp. | 1-MR16 50W max lamp | Location: Lobby |
| B18 |  | **Zumtobel Staff SLR2-*-1285-***<br>Description: Recessed fluorescent downlight with (1) 28W T5 lamp in cross section. | (1) 28W T5 | Location: Lobby |
| B19 |  | **D'AC Custom Design**<br>Description: A 4' pendant with extruded aluminum body and blue opal glass inserts. Hung by aircraft cable with separated housings. | (2) 32W CFTR lamps | Location: Lobby Entrance |

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**

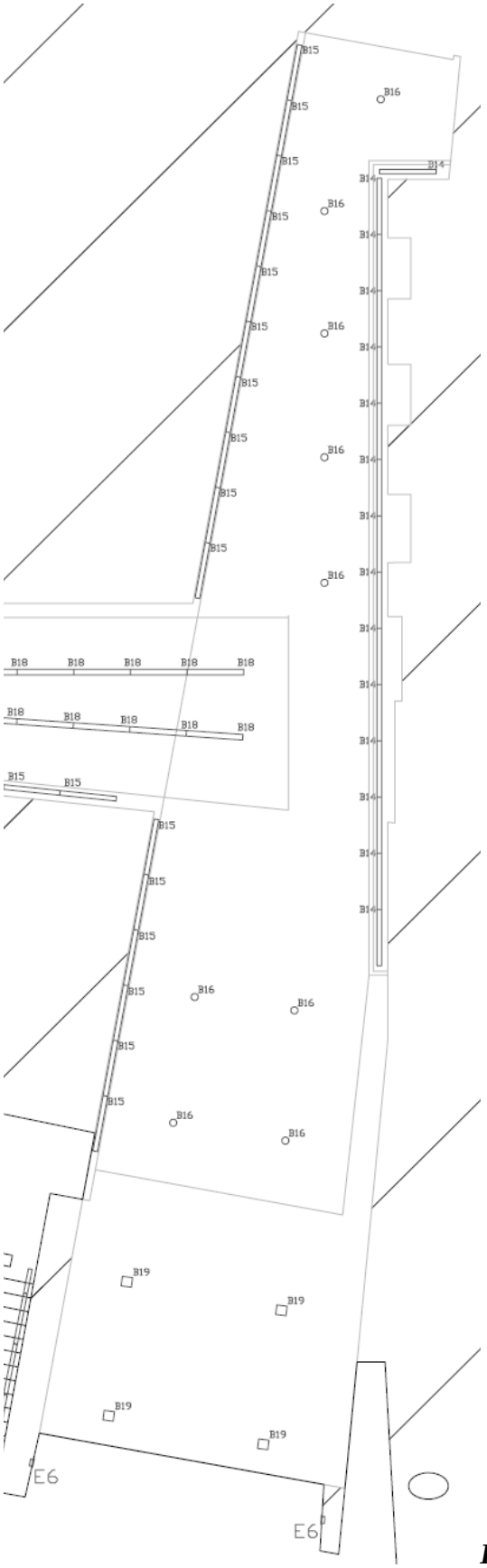
| Designation | Manufacturer | Type | Bulb | Wattage | CCT | CRI | Relevant Fixtures |
|---|---|---|---|---|---|---|---|
| A | Philips | Fluorescent | T8 FL | 32W | 4100K | 86 | B1,B2,B10,B13,B14,B15,E7,E11,E12 |
| B | Philips | Compact FL | CFTR | 32W | 4100K | 82 | B3,B5,B6,B16 |
| C | Philips | Compact 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 |
| B14 | 12 Months (Clean) | IV | 0.88 | 0.95 | 0.88 | 0.95 | 0.70 | Lobby |
| B15 | 12 Months (Clean) | IV | 0.88 | 0.95 | 0.86 | 0.95 | 0.68 | Lobby |
| B16 | 12 Months (Clean) | IV | 1.00 | 0.85 | 0.88 | 0.96 | 0.72 | Lobby |
| B17 | 12 Months (Clean) | IV | 1.00 | 0.95 | 0.88 | 0.96 | 0.80 | Lobby |
| B18 | 12 Months (Clean) | V | 0.98 | 0.95 | 0.88 | 0.96 | 0.79 | Lobby |
| B19 | 12 Months (Clean) | IV | 1.00 | 0.85 | 0.88 | 0.96 | 0.72 | Lobby |

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 theater since the room will be used intermittently and cleaned after every performance by janitorial staff.

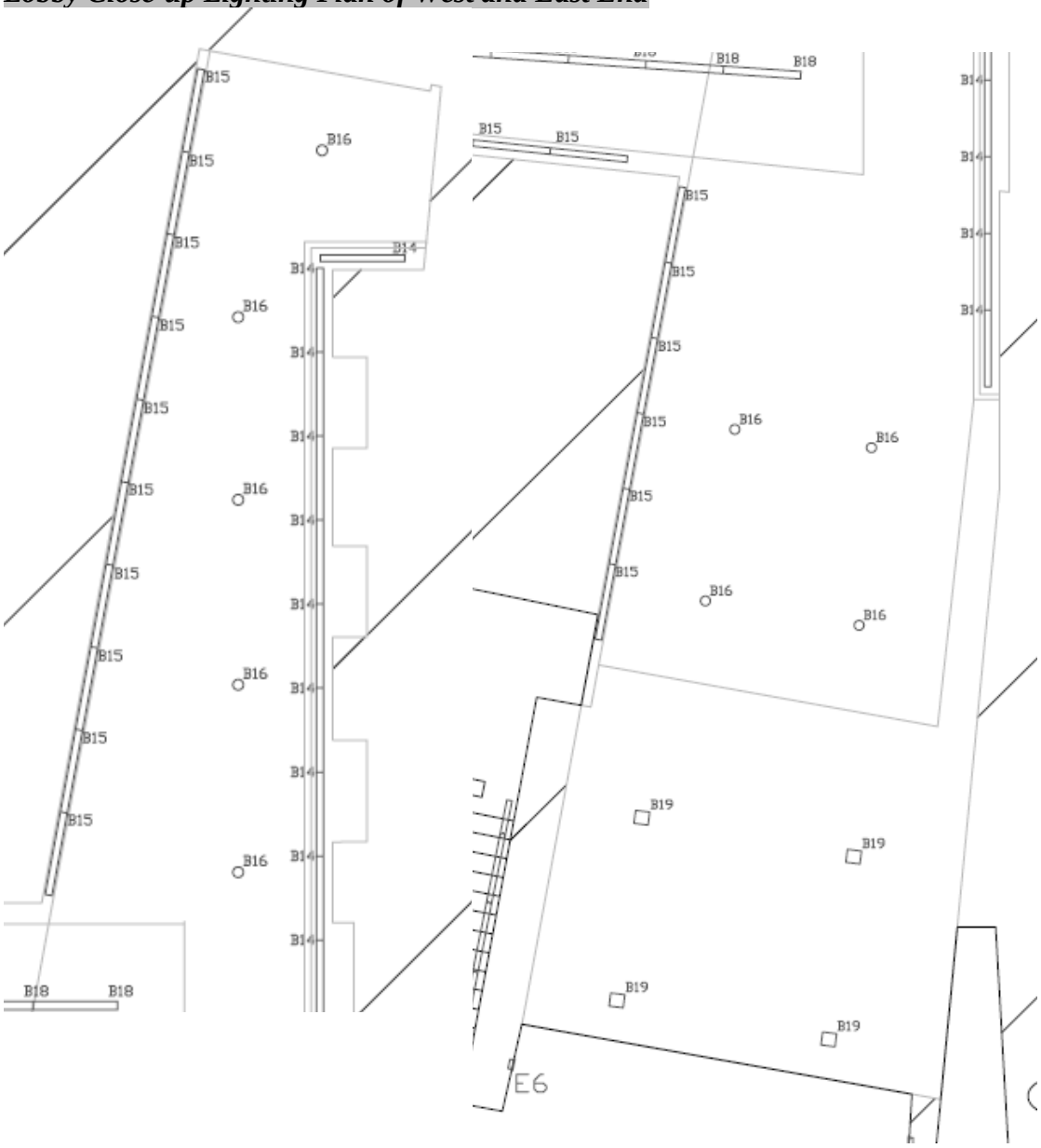
| Power Density | | | | | |
|---|---|---|---|---|---|
| Fixtures | Fixture Count | Watts | Total watts | SF | W/SF |
| B14 | 16 | 29.5 | 472 | | |
| B15 | 36 | 29.5 | 1062 | | |
| B16 | 9 | 36 | 324 | | |
| B17 | 7 | 50 | 350 | | |
| B18 | 26 | 30 | 780 | | |
| B19 | 4 | 72 | 288 | | |
| | | | 3276 | 2410 | 1.36 |

Using the input wattage from the specified ballasts and lamps, the power density came in under the maximum allowed of 1.5 W/SF which meets California Title 24 standards. An added 1.0 W/sf can also be added for the four decorative fixtures, but is unnecessary because of the already fitting power density.

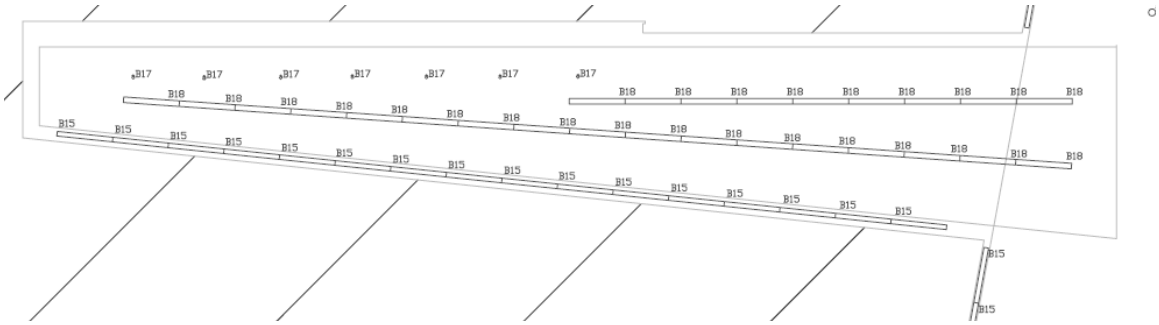



*Entire Lobby Section Lighting Plan*

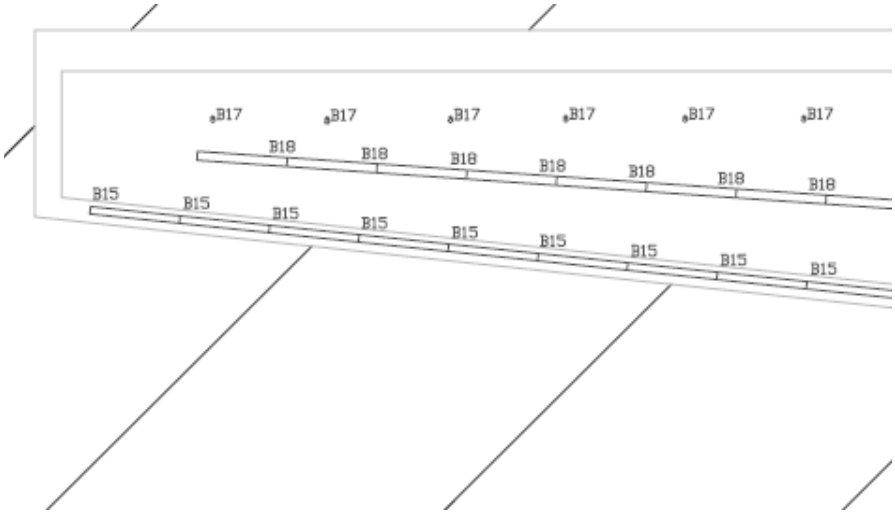
***Lobby Close-up Lighting Plan of West and East End***



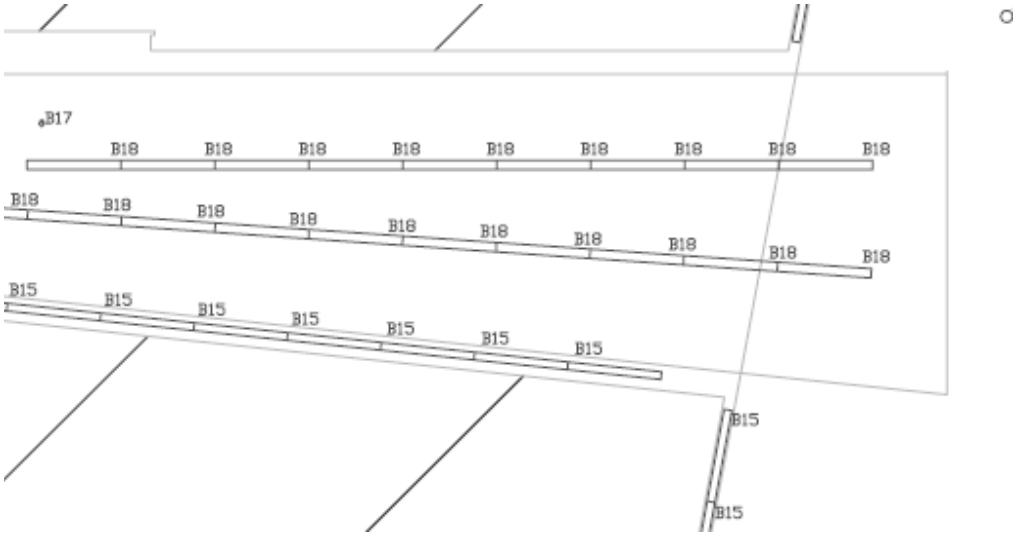
***Entire Gallery Lighting Plan***




***Far South End of Gallery***

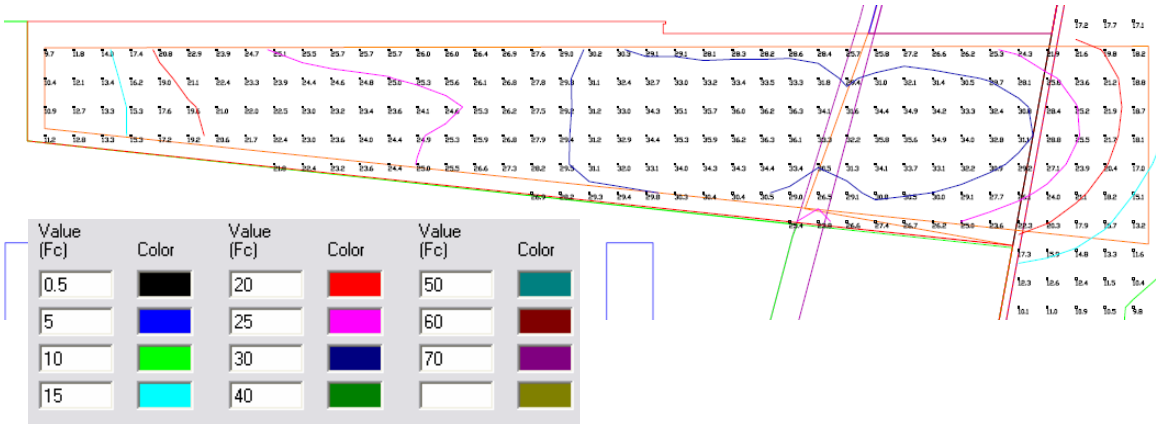



***Gallery Continued***

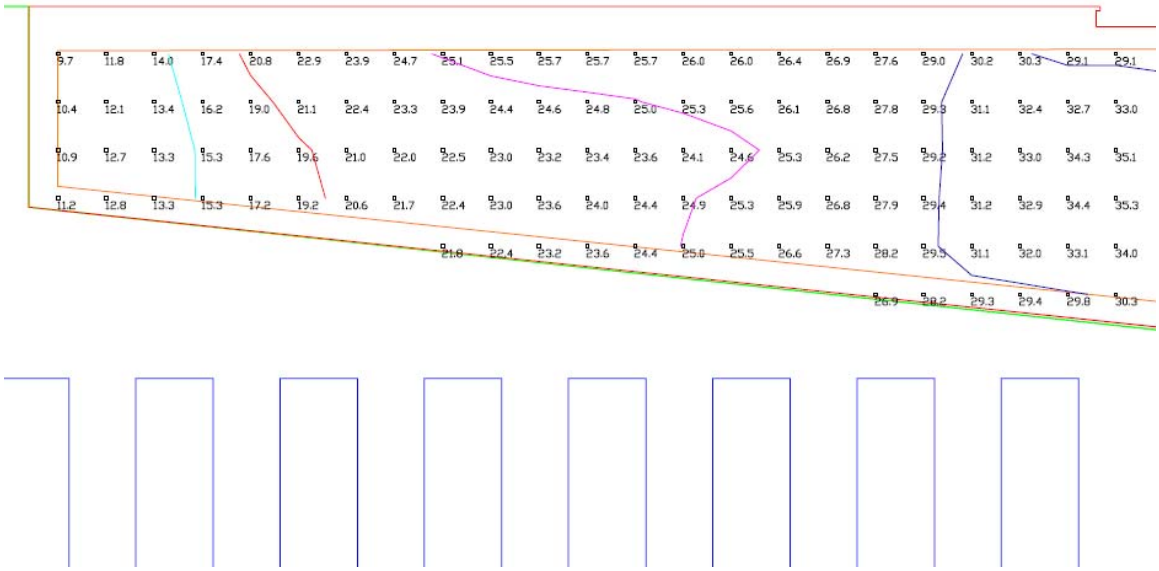



*Calculation Grid – Lobby*

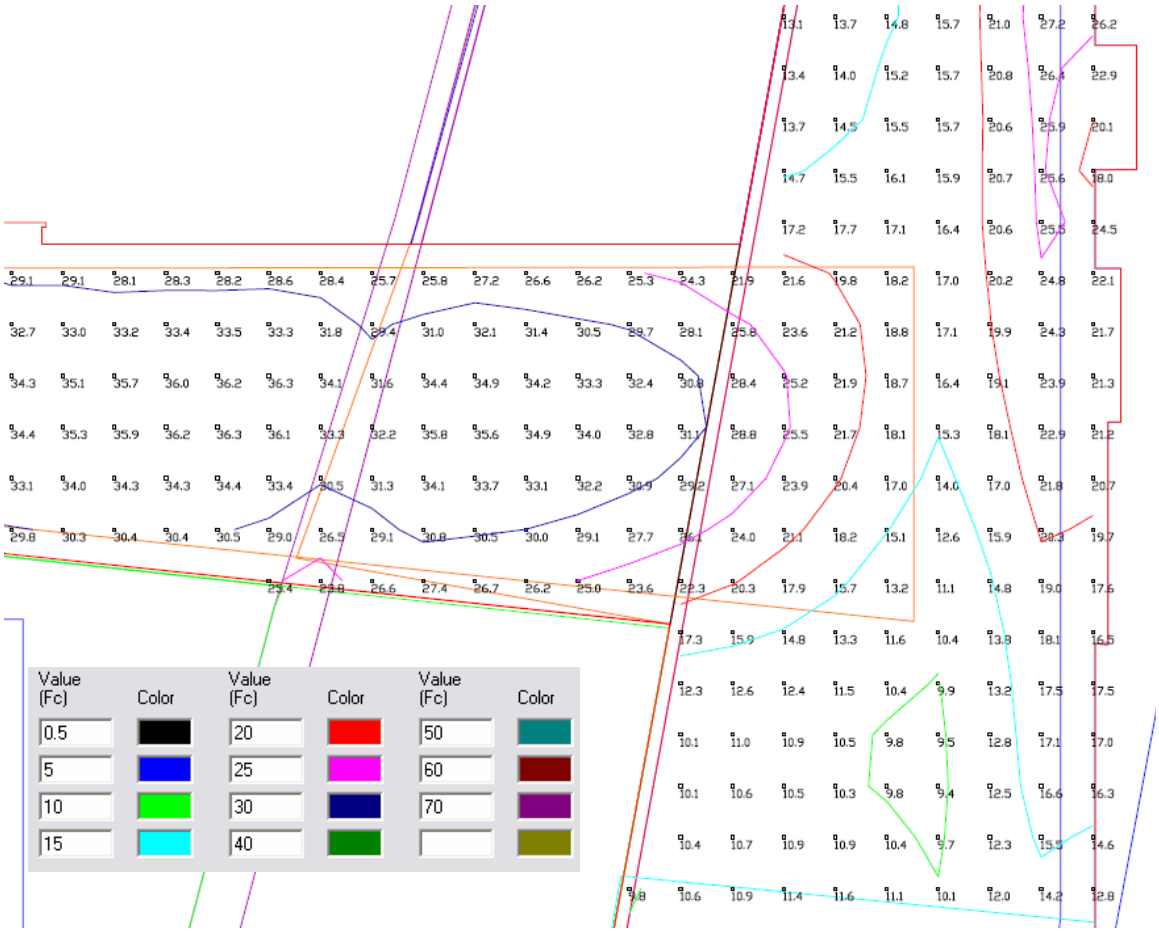
## *Calculation Grid – Gallery*



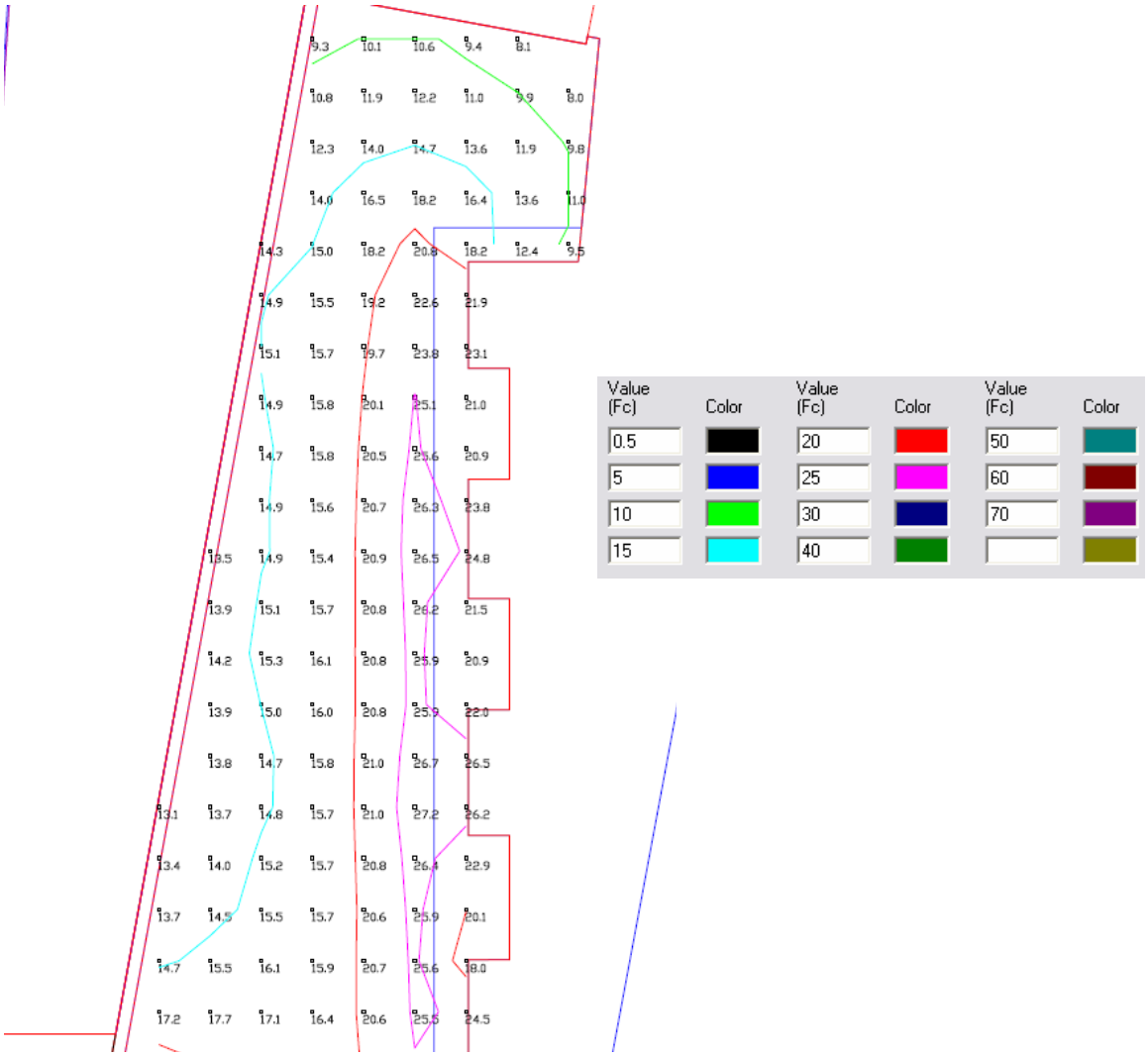

## *End of Gallery Hallway*



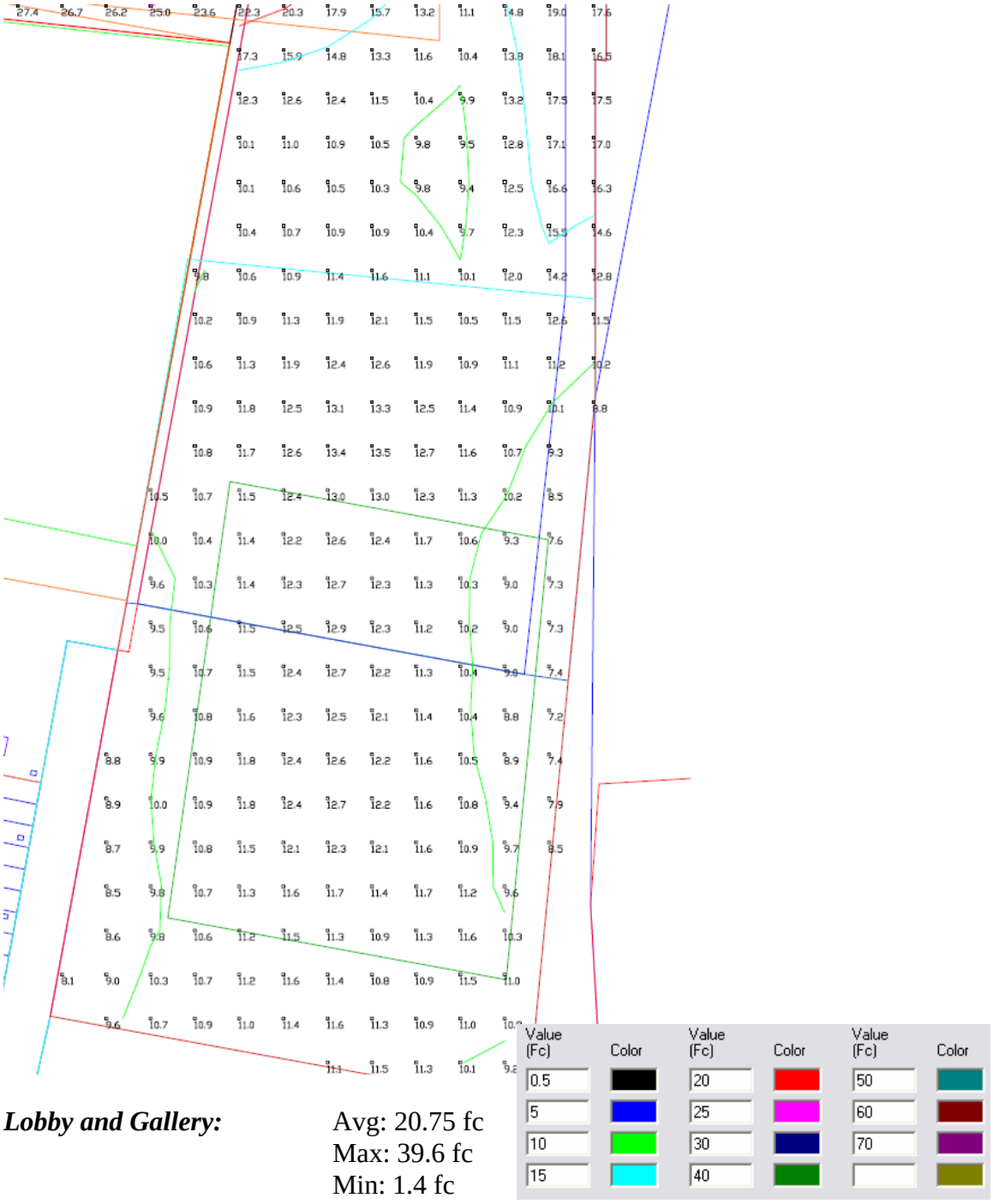
## *Intersection of Gallery and Lobby*



## *End of Lobby Hallway*



## *Lobby Entrance Space*

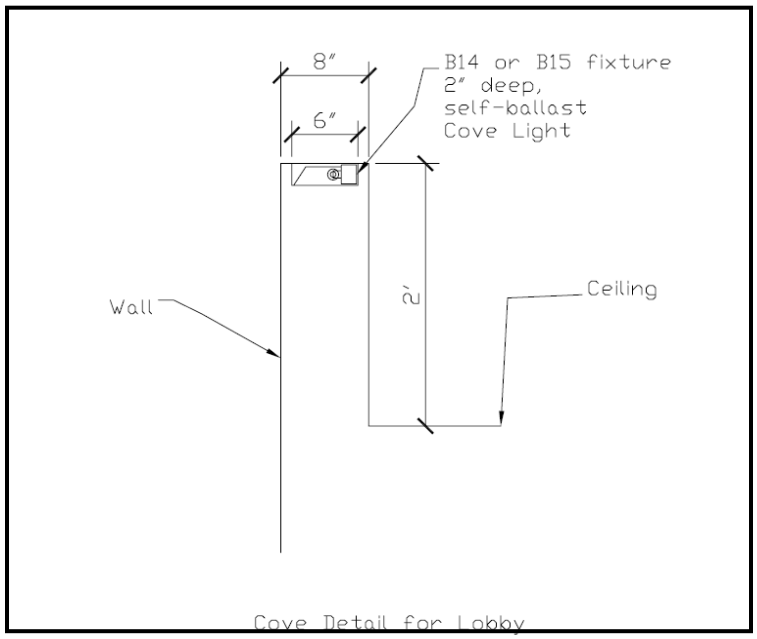



***Lobby and Gallery:***

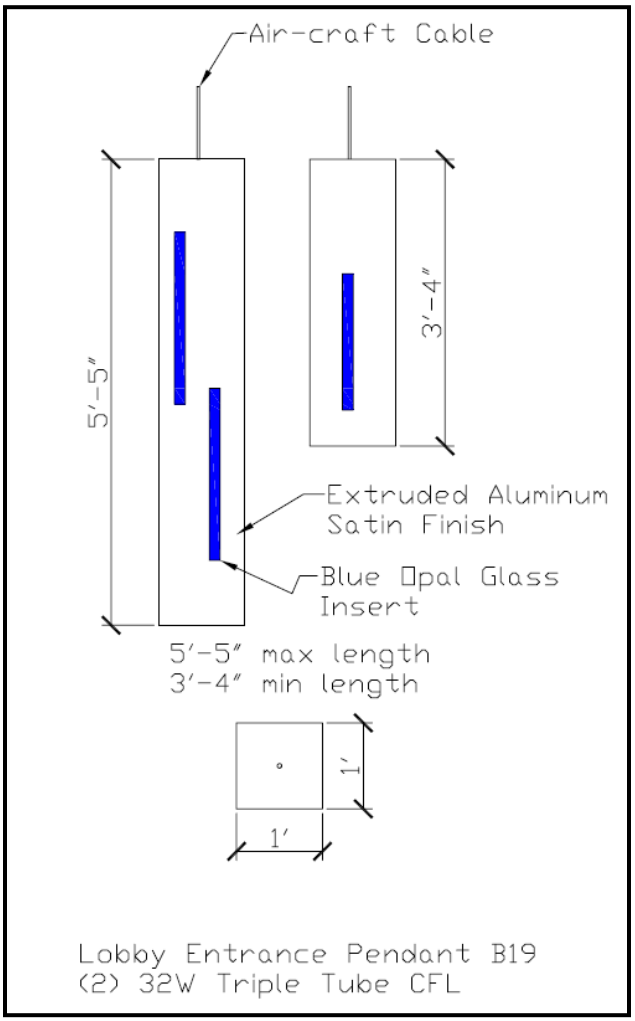
Avg: 20.75 fc
Max: 39.6 fc
Min: 1.4 fc

The lighting calculation results proved to be higher than expected. My goal was to have around 10-15 fc on the ground for general circulation purposes, but the end result provides good levels to buffer from the sunny atmosphere outside to the indoors. This meets the IES criteria I had mentioned.

***Fixture Details***



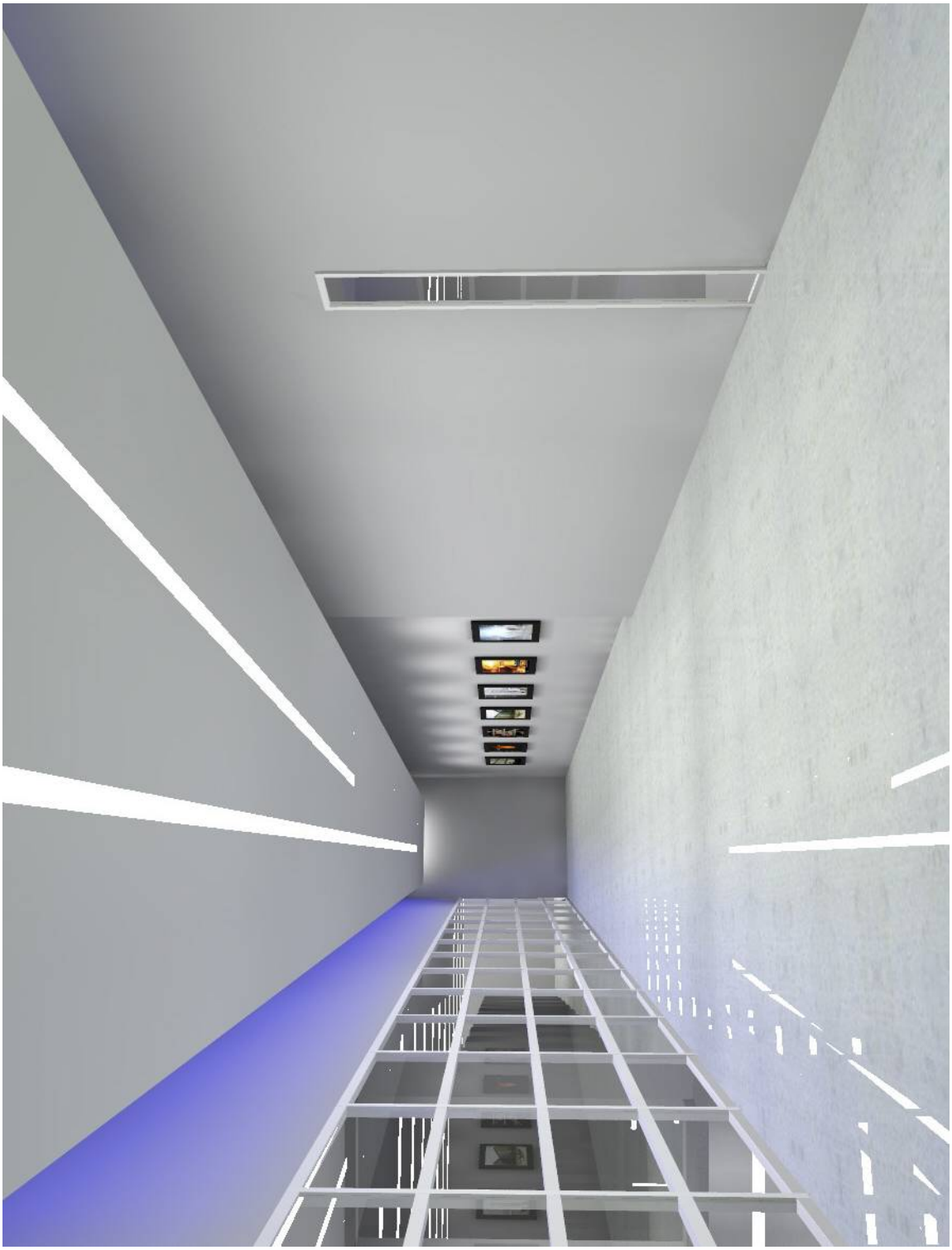

Cove Detail for Lobby




Lobby Entrance Pendant B19
(2) 32W Triple Tube CFL

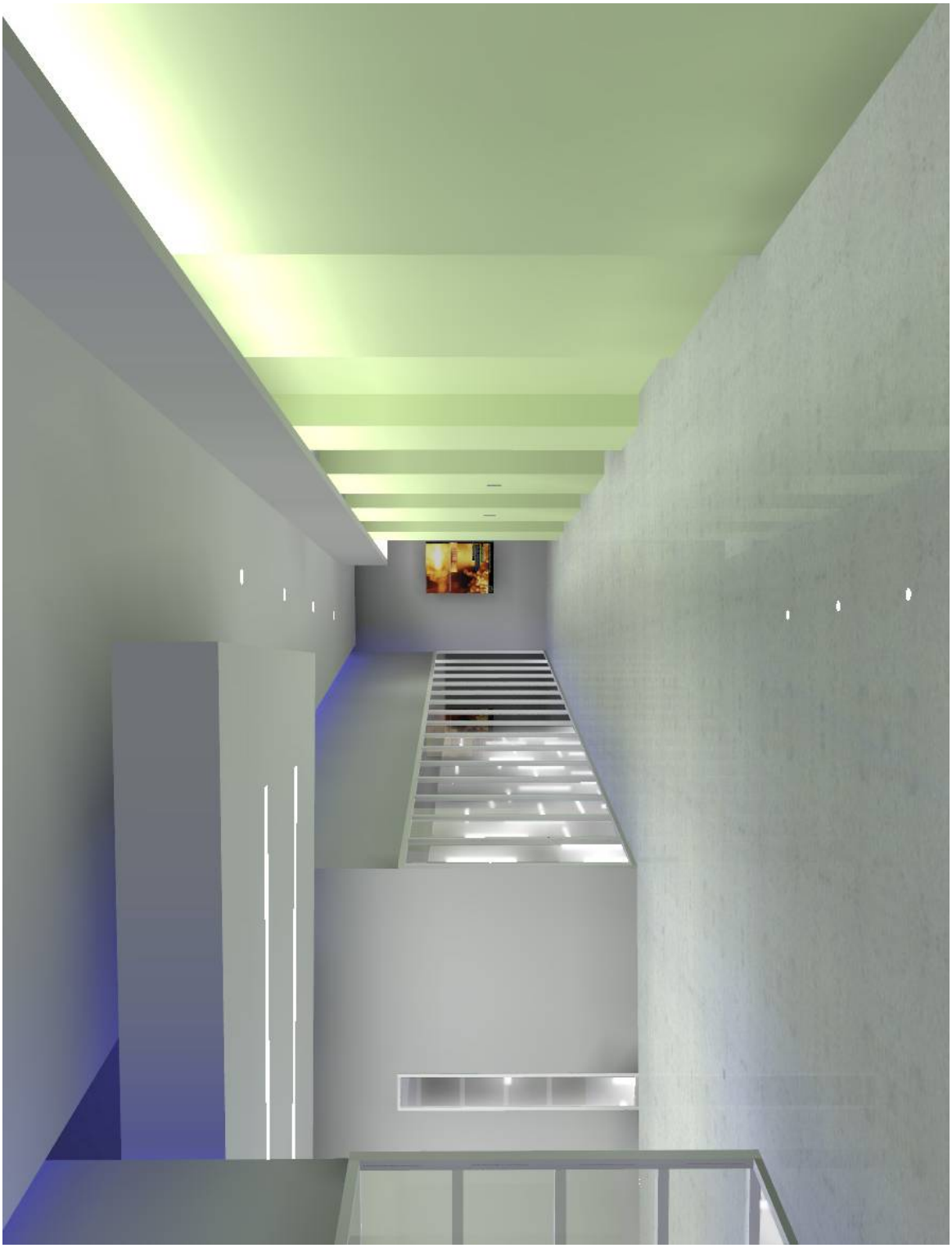
***Renderings for the Main Lobby/Gallery***

***Gallery Corridor – Everything On***



*Gallery Corridor – Only Accent and Cove On*

*Lobby Corridor*



*Lobby Corridor*

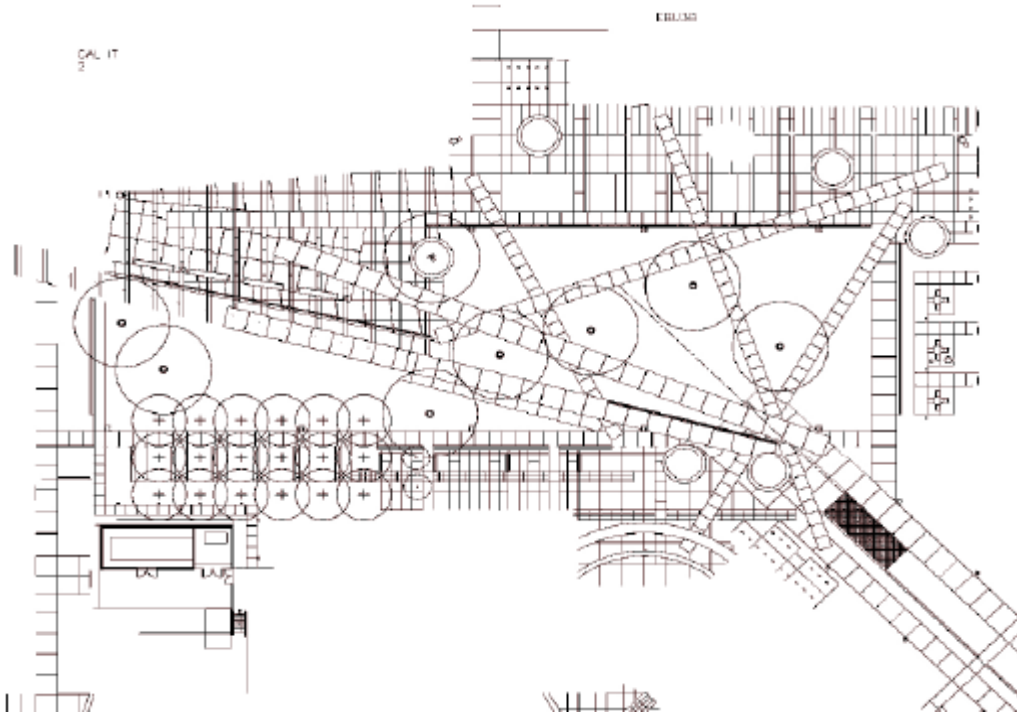
*Lobby Exterior View*

## *Conclusions*

The lobby and gallery spaces are a very important aspect of the building. The main lobby gives a first impression of the Cal IT$^2$ as to what is happening inside as well as the theme for the rest of the building. In my design, my intention was to provide guiding lights using minimal appearance of fixtures and obstructions. The blue cove lights showcase advancement in movement with the minimal downlights providing ambient lighting for the area. The recessed linear fluorescents in the gallery appear to converge to really emphasize the elongated gallery and lead to the other sections of the building. With this sleek design, I have provided a technological feeling encompassed in a new modern building for telecommunication research.

# *Academic Courtyard*

The academic courtyard contains an open grassy area in the Jabocs School of Engineering at the University of California, San Diego. Three other buildings and Cal IT$^2$ form this courtyard in the middle with small grassy areas, trees, a sculpture, and benches for a nice break in the afternoon sun. The courtyard is the place that leads into the main lobby and underground tunnel of Cal IT$^2$. It is approximately 280 ft x 95 ft with concrete walkways in all directions leading to all ends of the rectangular space. This space is primarily used for walking from one building to the other. During breaks and peak times, you can find students and colleagues enjoying the sun and outside air in this space. A large concrete patio exists in front of Cal IT$^2$ with a concrete ramp leading down to the tunnel. This is a very open area and is very open to design. One stipulation as stated by the UCSD Facilities Office is to use low pressure sodium lamps for all pole mounted fixtures, as well as use full-cut where ever possible.



## *Design Criteria*

### *Reflectances*

A ground reflectance was not considered in this study. Only direct illuminance was studied for safety conditions.

***Theme***

The general lighting theme for the academic courtyard was to provide a safe walking atmosphere during the nighttime hours while complying with the University of California, San Diego's lighting policies. Low pressure sodium lamps, which generate a deep orange glow, were chosen due to the existing lighting conditions which already exist on the rest of the campus. The up-lighting on the trees add some depth to the space with a more aesthetic look taking over the deep orange glow of the pole lights.

***Horizontal Illuminance***

In the courtyard, a horizontal illuminance of 0.5 fc is required for safety and pedestrian identification at night from IES standards.
Building exterior entrances should be highlighted as well as stairs and ramps for safety concerns.

***Vertical Illuminance***

In the courtyard, a vertical illuminance of 0.5 fc is also required by IES standards.

***Glare Considerations***

Glare could be an issue when walking down the concrete paths towards the 20'poles and up-lights on the trees. Since they are relatively tall compared to the average person, it shouldn't prove to be a concern, but attention should be paid to it.

***Facial Recognition***

Facial and body recognition is a major factor in the lighting design for this space. For safety matters, my redesign should pay attention to the vertical illuminance on a person and deleting any major dark spots where a person can hide.

***Light Pollution***

Light pollution is another concern that should be considered. Since all the poles in this courtyard have a type IV distribution, most of the light should not escape into the atmosphere.

***Color Temperature Appearance***

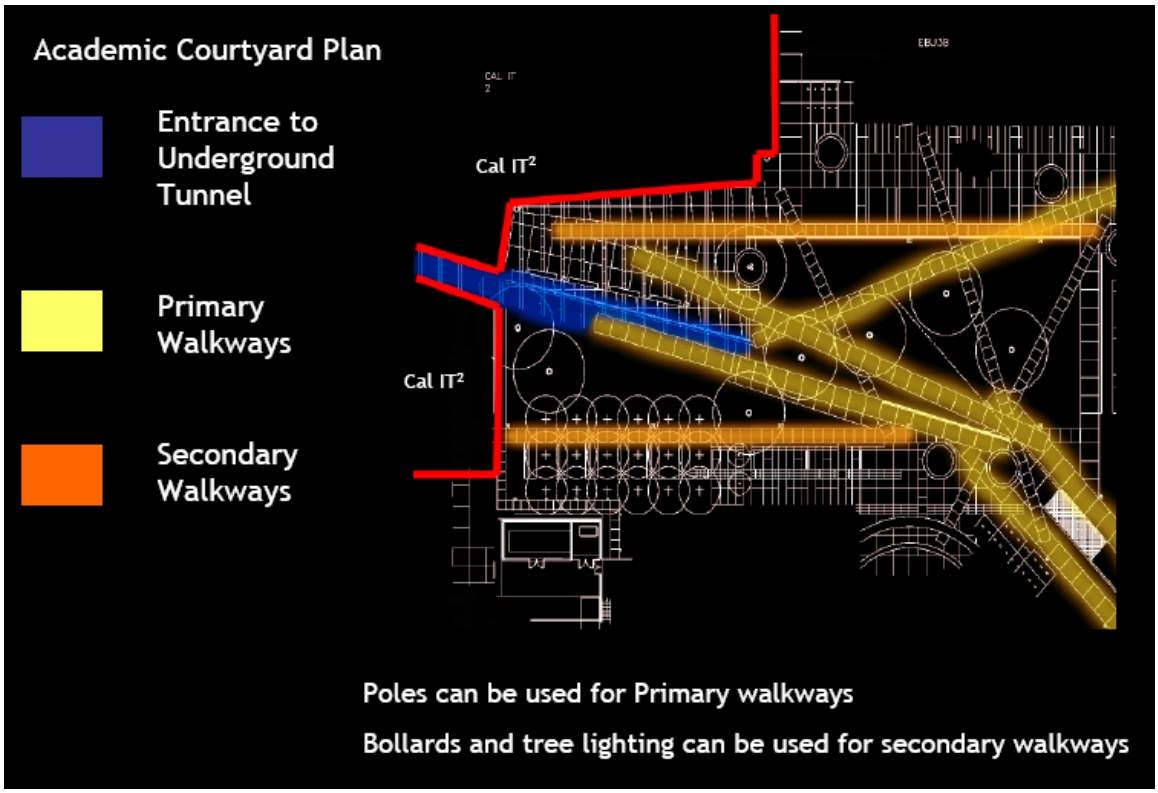
For these particular fixtures, the color temperature will be very low (1700K). The low pressure sodium lamps create a deep orange glow which won't render certain colors very well. By adding another layer of cooler color temperature metal halide lamps, better color rendering will be possible.

***Power Density***

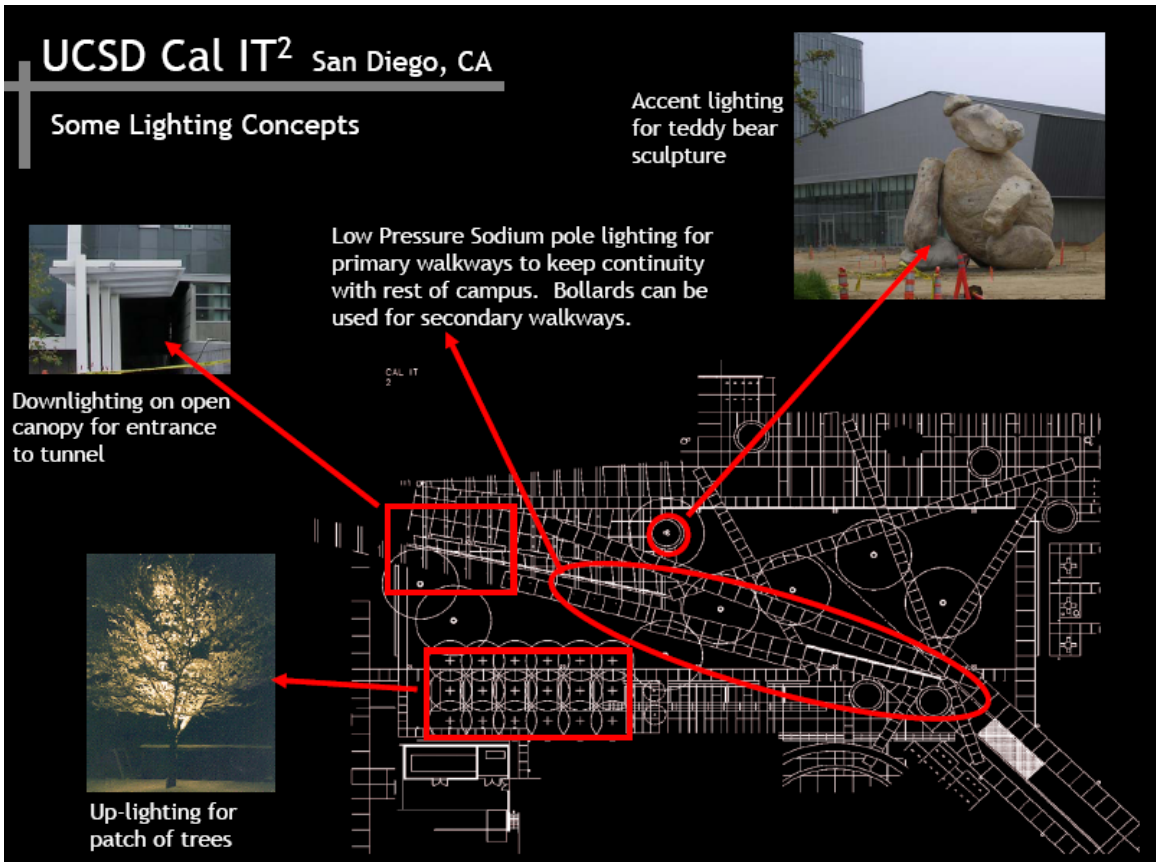
According to California Title 24 Energy Standards, an exterior courtyard's power density should be < 0.2 W/SF.

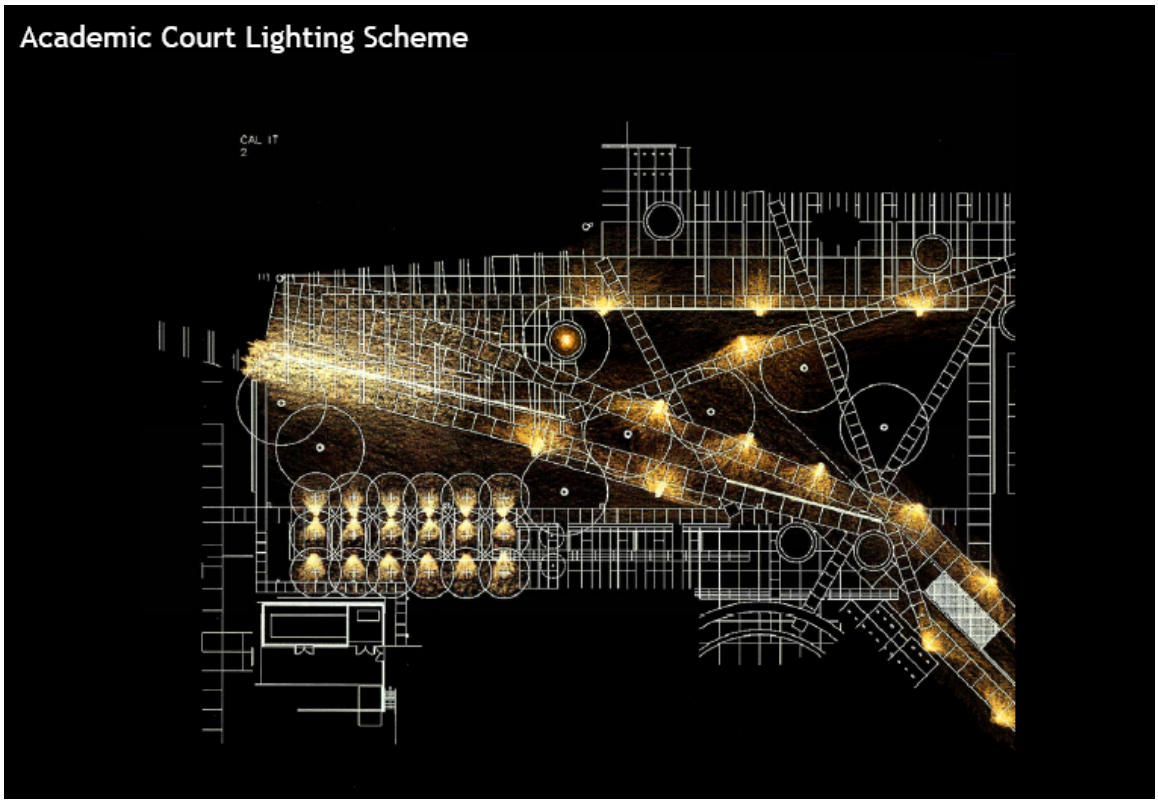
## *Schematic Design*

In my redesign, I will be paying particular attention to the University of California, San Diego's Lighting policies. Based on their requirements as stated earlier, I will be using low pressure sodium pole lights to keep the theme from the rest of campus continuing. I will, however, add some more depth to this courtyard with cooler color temperatures to emphasize the technology of Cal IT$^2$ and the surrounding engineering facilities. Use of brighter lights will be used to highlight the entrance to the underground tunnel to promote its use as well as introduce people to the lighting display in place as will be discussed in the next space.




The following two concept diagrams exhibit the ideas described above. In my redesign, the only concept I changed since the schematic was the accent lighting on the sculpture. I didn't want the sculpture to be highlighted since the main focus of the courtyard is really the glowing Cal IT$^2$ building.


UCSD Cal IT² San Diego, CA
Some Lighting Concepts
Accent lighting for teddy bear sculpture
Low Pressure Sodium pole lighting for primary walkways to keep continuity with rest of campus. Bollards can be used for secondary walkways.
Downlighting on open canopy for entrance to tunnel
Up-lighting for patch of trees


Academic Court Lighting Scheme

**Lighting Fixture Schedule**
University of California, San Diego Cal IT2

| Type | | Mfr/Catalog # | Lamping | Notes |
|---|---|---|---|---|
| E1 |  | **Gardco LSA14-1-A-135LPS-277-BLP-LF**<br>Description: | (1) 135W LPS | Location: Academic Court |
| E2 |  | **Bega 8534MH**<br>Description: Metal halide bollard with 1-39W T6 single-ended base lamp. 10" length, 6" width, 43" height/depth. | 1-39W T6 single-ended base lamp | Location: Academic Court |
| E3 |  | **Bega 2289P**<br>Description: Recessed compact fluorescent step light with 1-CFT9W lamp. Optics: tempered glass diffuse white lens. | 1-CFT9W lamp | Location: Academic Court |
| E4 |  | **Belfer 3510FPS-BHS-13-1-***<br>Description: Recessed compact fluorescent step light with 1-CFQ13W lamp. Optics: micro louver , tempered glass clear lens. | 1-CFQ13W lamp | Location: Academic Court |
| E5 |  | **B-K Lighting MC-*-***-9-C**<br>Description: Surface-mounted halogen landscape light with 1-PAR20 50W max lamp. aluminum housing. Adjustability: 180° tilt, 360° rotation lockable. | 1-PAR20 50W max lamp | Location: Academic Court |
| E6 |  | **Focal Point FAVB FL 1T5 1C ***<br>Description: 2" recessed fluorescent downlight with 1-F28T5 (48in) lamp (in cross-section). Optics: acrylic diffuse white lens , steel die-formed reflector. | 1-F28T5 (48in) lamp (in cross-section) | Location: Academic Court |
| E7 |  | **Cole Lighting LR 2W**<br>Description: Wall-mounted fluorescent step light with 1-T8 lamp (in cross-section). Optics: acrylic prismatic lens. | 1-T8 lamp (in cross-section) | Location: Academic Court |
| E8 |  | **io 0-03-*-*-100-1-***<br>Description: Surface-mounted LED strip light, rigid housing with LED (in cross-section). Optics: acrylic clear lens. | rigid housing LED (in cross-section) | Location: Academic Court |
| E9 |  | **Bega 8729MH**<br>Description: Semi-recessed metal halide path light with 1-39W T6 double-ended base lamp. Optics: borosilicate glass diffuser. | 1-39W T6 double-ended base lamp | Location: Academic Court |
| E10 |  | **Elliptipar M-115-070G-E-99-2-000**<br>Description: Canopy suspended wash light with 70W T6 metal halide lamp. Housing color to match ceiling. Optics: Clear glass lens | (1) 70W T6 MH | Location: Theater Lobby to Courtyard |

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 |

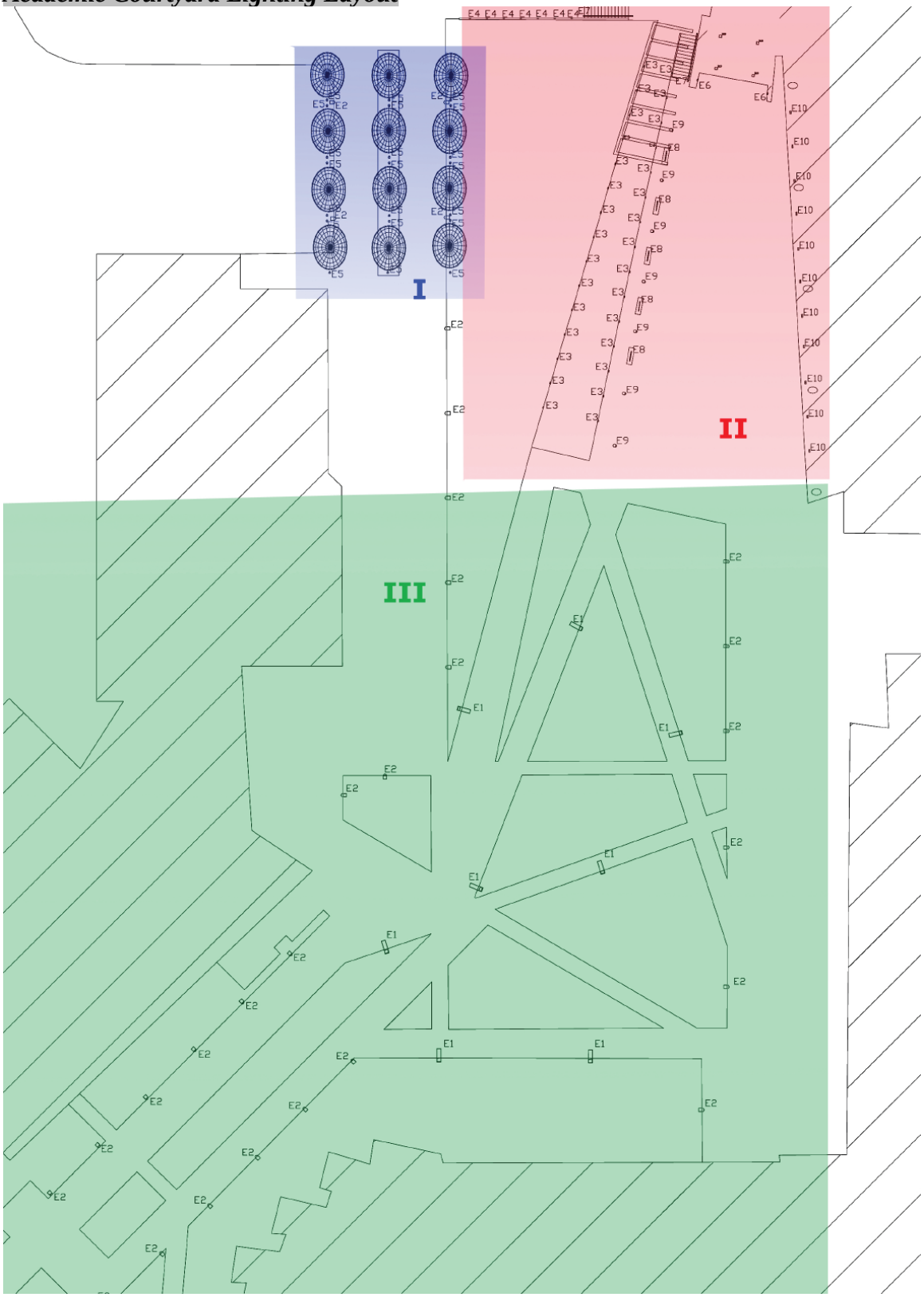
| Light Loss Factors | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type | Cleaning Interval | Category | BF | LLD | LDD | RSDD | LLF | Location |
| E1 | 12 Months (Medium) | V | 1.00 | 1.00 | 0.78 | 0.94 | 0.73 | Academic Courtyard |
| E2 | 12 Months (Medium) | V | 1.00 | 0.76 | 0.78 | 0.94 | 0.56 | Academic Courtyard |
| E3 | 12 Months (Medium) | V | 0.92 | 0.85 | 0.78 | 0.94 | 0.57 | Academic Courtyard |
| E4 | 12 Months (Medium) | V | 0.98 | 0.83 | 0.78 | 0.94 | 0.60 | Academic Courtyard |
| E5 | 12 Months (Medium) | II | 1.00 | 1.00 | 0.86 | 0.94 | 0.81 | Academic Courtyard |
| E6 | 12 Months (Medium) | V | 0.98 | 0.95 | 0.78 | 0.94 | 0.68 | Academic Courtyard |
| E7 | 12 Months (Medium) | V | 0.88 | 0.95 | 0.78 | 0.94 | 0.61 | Academic Courtyard |
| E8 | 12 Months (Medium) | V | 1.00 | 1.00 | 0.78 | 0.94 | 0.73 | Academic Courtyard |
| E9 | 12 Months (Medium) | V | 1.00 | 0.85 | 0.78 | 0.94 | 0.62 | Academic Courtyard |
| E10 | 12 Months (Clean) | V | 1.00 | 0.79 | 0.88 | 0.94 | 0.65 | Academic Courtyard |

I assumed a 12 month cleaning interval for all fixtures since the building is located on the University campus. I also assumed a medium dirt level since these fixtures are exterior and prone to dirt and dust.

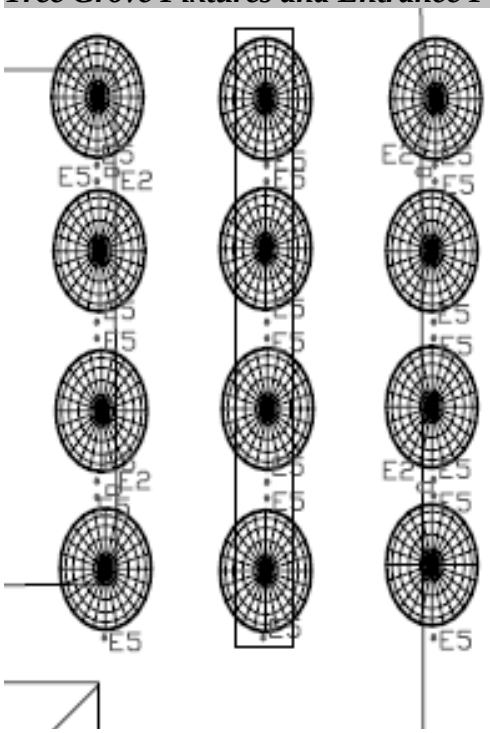
| Power Density | | | | | |
|---|---|---|---|---|---|
| Fixtures | Fixture Count | Watts | Total watts | SF | W/SF |
| E1 | 8 | 135 | 1080 | | |
| E2 | 29 | 44 | 1276 | | |
| E3 | 29 | 14 | 406 | | |
| E4 | 7 | 24 | 168 | | |
| E5 | 21 | 50 | 1050 | | |
| E6 | 4 | 30 | 120 | | |
| E7 | 8 | 29.5 | 236 | | |
| E8 | 5 | 10 | 50 | | |
| E9 | 7 | 44 | 308 | | |
| E10 | 11 | 79 | 869 | | |
| | | | 5563 | 61000 | 0.09 |

Using the input wattage from the specified ballasts and lamps, the power density came in under the maximum allowed of 0.2 W/SF which meets California Title 24 standards.

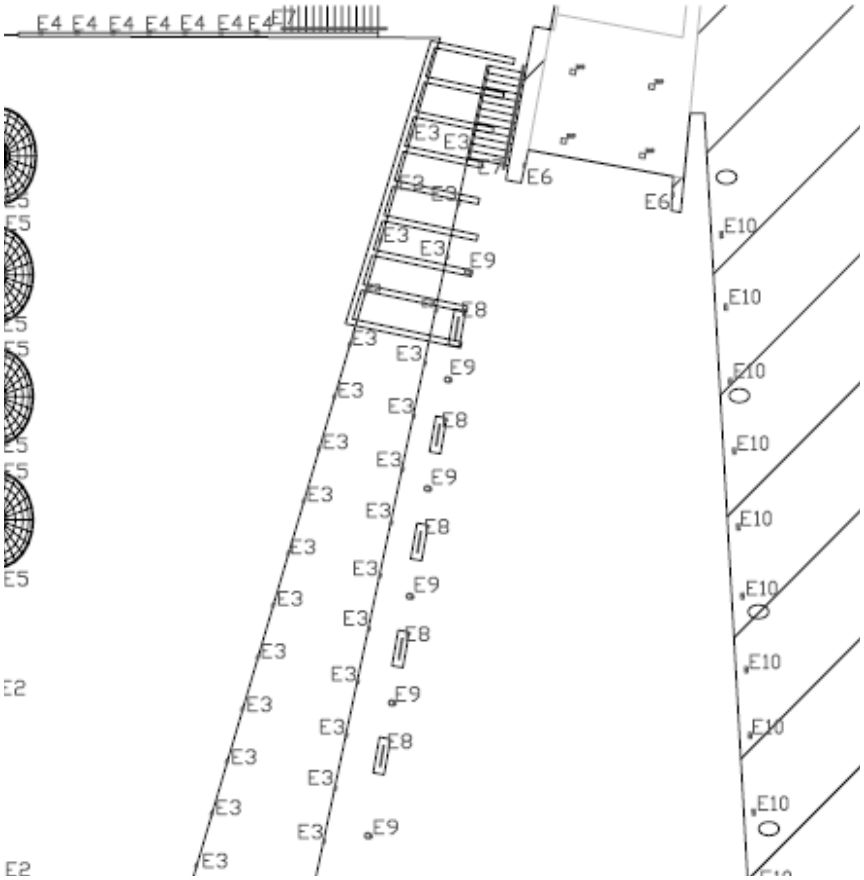
*Academic Courtyard Lighting Layout*



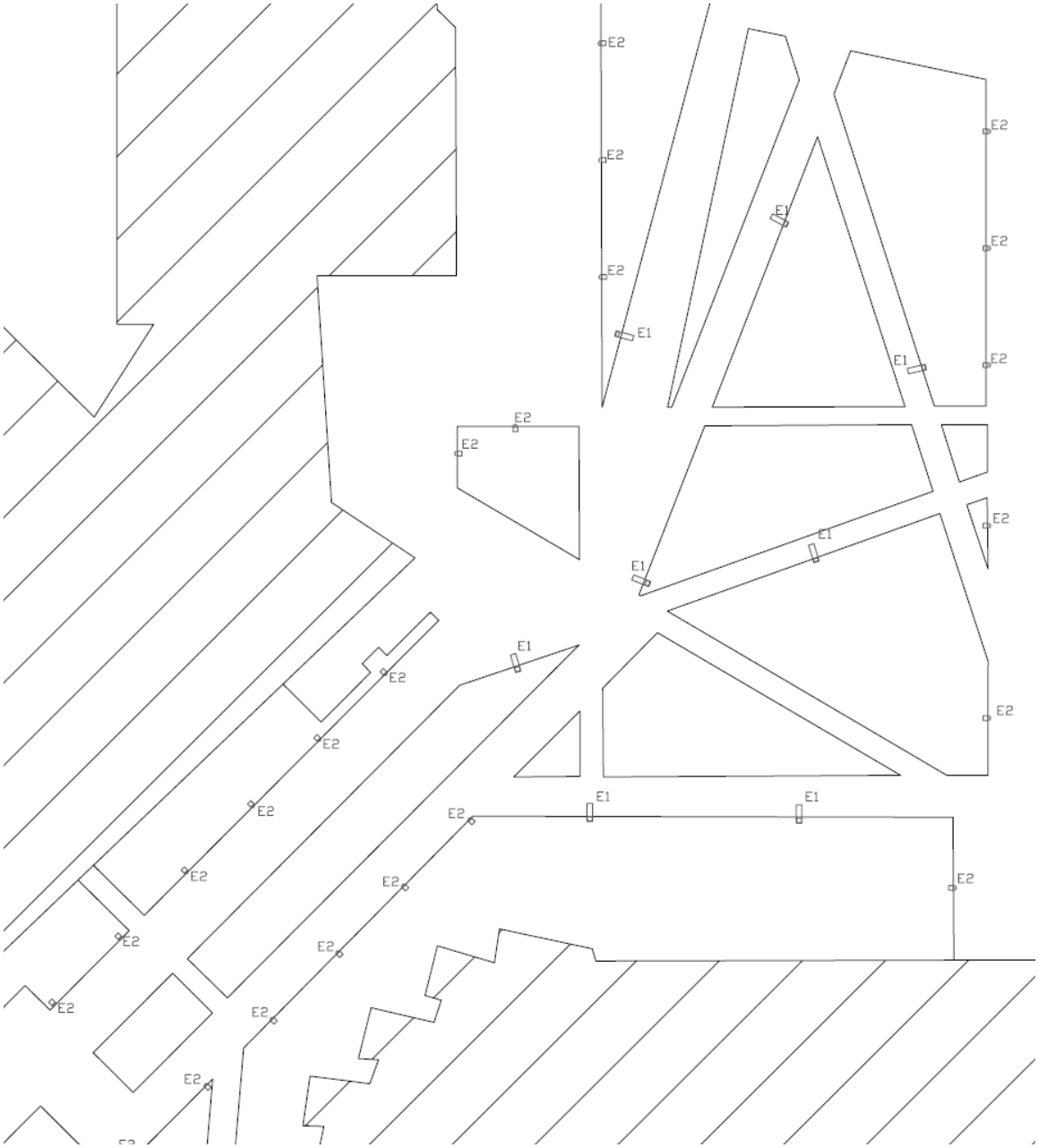
***Tree Grove Fixtures and Entrance Fixtures - I***



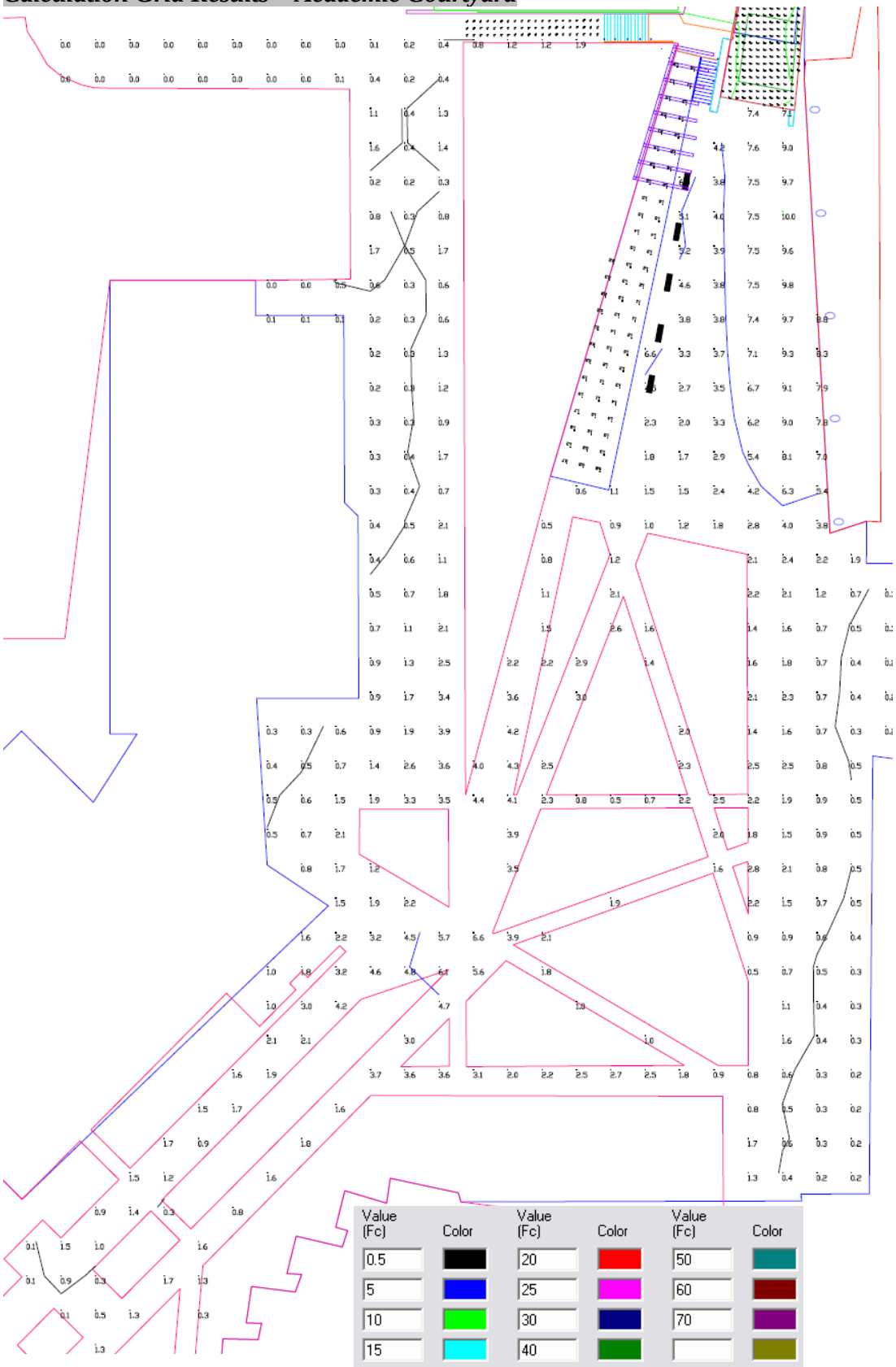

***Courtyard Patio Area - II***



*East Side of Courtyard - III*



## *Calculation Grid Results – Academic Courtyard*



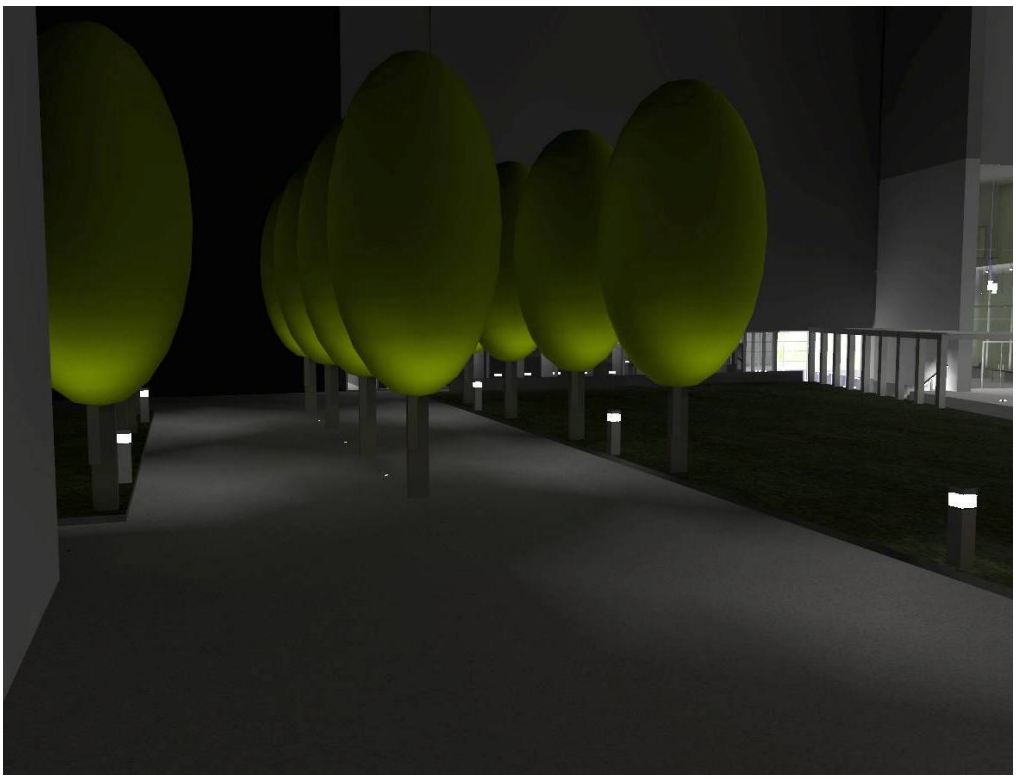
***Calculation Results***

| | |
|---|---|
| Pathways Illuminance: | Avg: 2.10 fc<br>Max: 11.2 fc<br>Min: 0.0 fc |
| Ramp leading to Tunnel: | Avg: 1.59 fc<br>Max: 2.4 fc<br>Min: 0.8 fc |
| Walkway beside server room: | Avg: 1.2 fc<br>Max: 5.3 fc<br>Min: 0.6 fc |

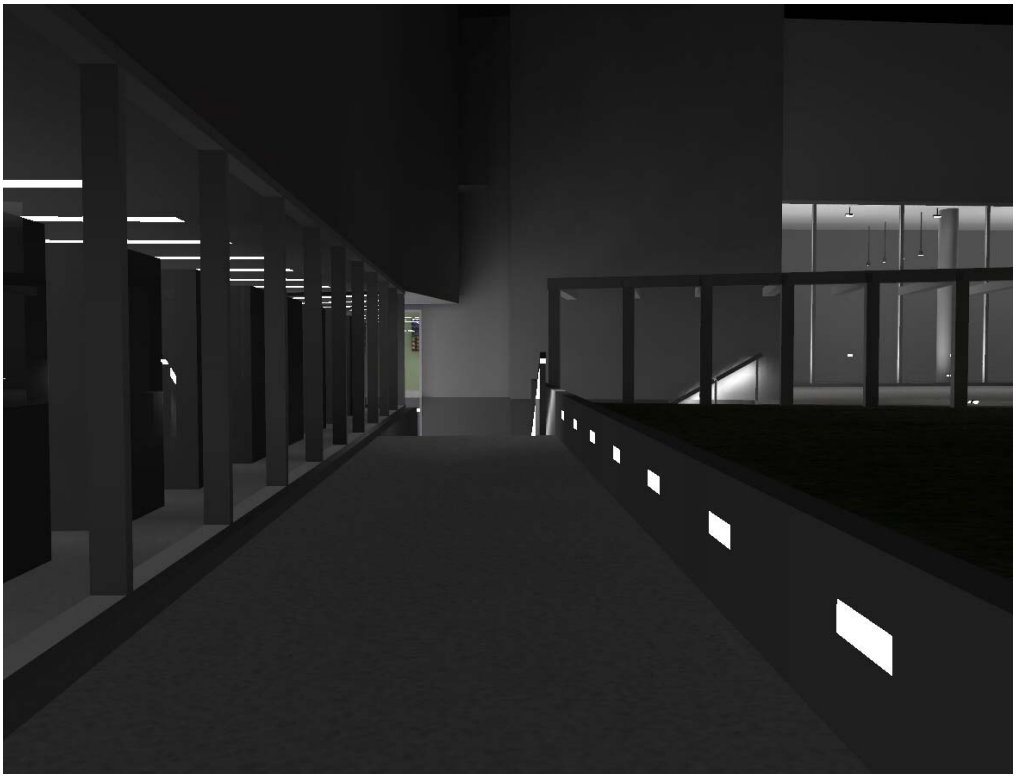
***Renderings for Academic Courtyard***
***Ramp Entrance to the Tunnel***

***Stair Detail***

*Tree Grove Near Building*



*Walkway to Stairs*



*South East entrance to Academic Courtyard*

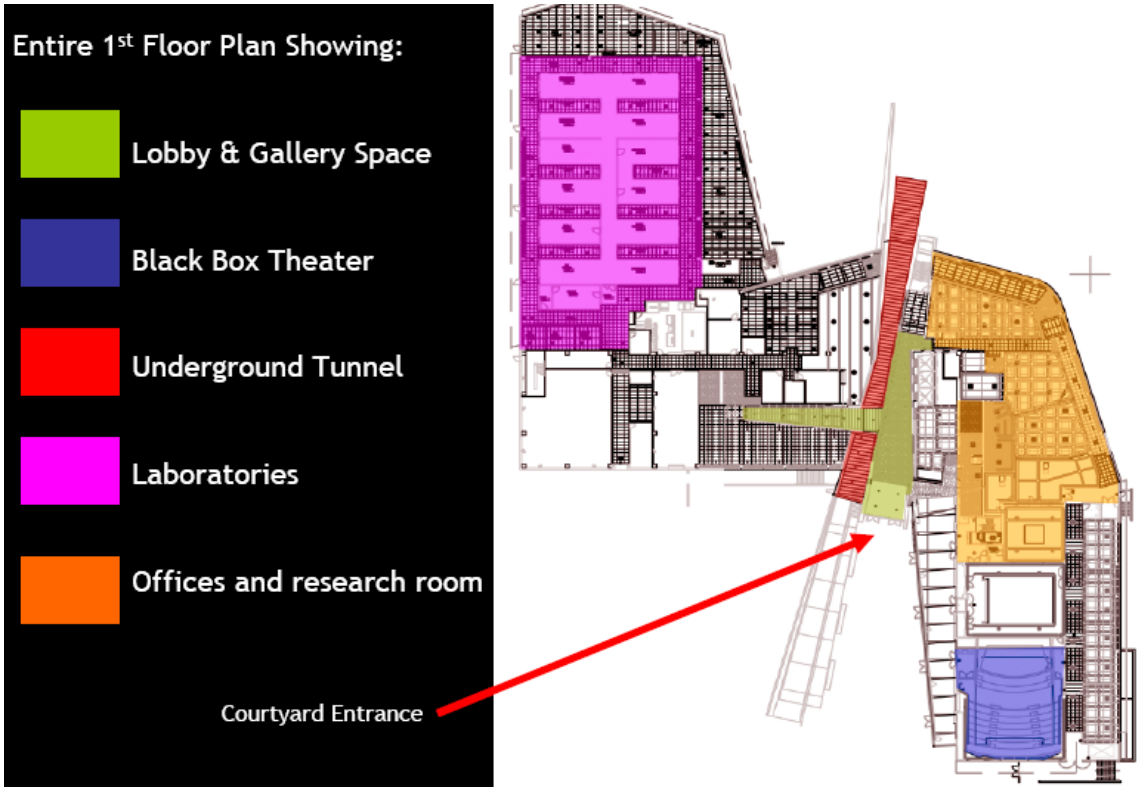
*Sky View Looking Down on Courtyard*

## *Conclusions*

The academic courtyard contains layers of light to focus on certain aspects. While the pole lights are used for general safety and circulation at night, the cooler color temperatures in the bollards and steplights lead you toward Cal IT$^2$. The steplights in the ramp lead you in a converging line to the underground tunnel through the building. The up-lights on the trees add some definition to the space for aesthetics and a nature feel to lean away from the technological feel. The under bench lights by the lobby entrance are used for accents as well as the small pathlights skimming the ground by the entrance. Overall, this space gives a nice blend of safety, function, and aesthetic lighting for the campus. The uplift for this area will hopefully draw more people to the space at night and result in even more expansion.

## *Underground Tunnel*

The underground tunnel is located near the entrance to the main lobby from the academic courtyard. It runs beneath Cal IT$^2$ adjacent to the main lobby and out to the road on the other side of Cal IT$^2$. This tunnel has many unique characteristics to it. First, it is connected to the main lobby by half height clear glazing. A small bridge runs over the tunnel creating a divider between a two story ceiling and a single story space. The other side of the tunnel is a large concrete wall, leaving an area open to the imagination. The entrance to the tunnel is already redesigned in my academic courtyard section having multiple compact fluorescent steplights on the paths leading to it and under-rail fluorescent lights for the stairs. In this space, I intend to draw people to it by using light and innovation. A custom lighting display will be placed on the blank wall in the tunnel, and accent lights will be added through the foe windows on the other side. This combination will make an impressive technological statement for the building without ever being inside.



## *Design Criteria*

### *Reflectances*

Ground: 20% (Concrete pour slab)
Walls: 20% (Finished concrete walls)
Glass windows: 80% transmittance

### *Theme*

The underground tunnel was constructed as an easy access path to get to the other side of Cal IT$^2$ without having to walk through the building. Since Cal IT$^2$ is about the fast movement of information and telecommunication, I decided to showcase this concept in an art piece of lighting. This tunnel will act as a fast information highway for people to have a sense of traveling through a computer server (the building's metaphor).

### *Horizontal Illuminance*

In a circulation space, a horizontal illuminance of 5-10 fc is required for safety and pedestrian identification at night from IES standards.

### *Vertical Illuminance*

In the tunnel, a vertical illuminance of 0.5 fc is also required by IES standards.

### *Glare Considerations*

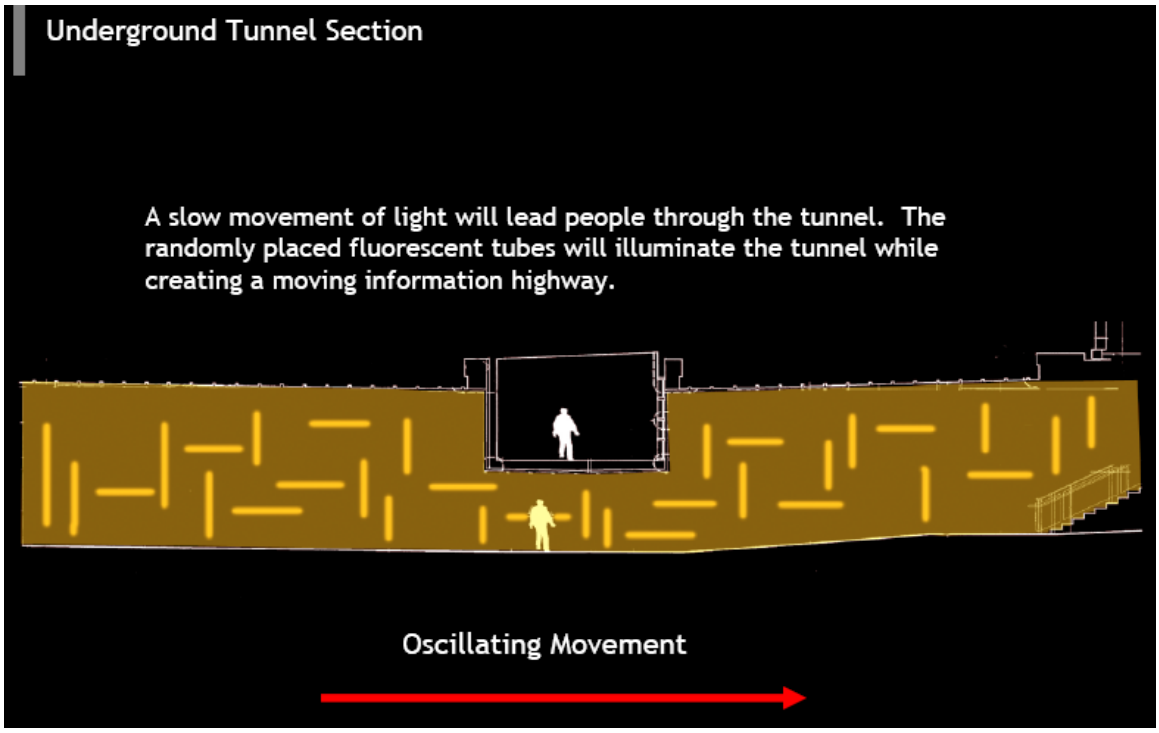
Glare could be a major issue with a large lighting display integrated into the entire wall of the tunnel. 60% transparent acrylic will be used to diffuse the light and make the light boxes less intense. The reflections from the corresponding windows on the other side of the tunnel will also be an issue.

### *Lamping Criteria*

A uniform CCT of 4100K will be used in these areas with a CRI of about 82. This keeps in tune with the technological feel of the space. A color rendering index of 82 is going to be uniform throughout the whole building.

### *Power Density*

According to California Title 24 Energy Standards, a circulation space power density should be < 0.5 W/SF.


Underground Tunnel Section
A slow movement of light will lead people through the tunnel. The randomly placed fluorescent tubes will illuminate the tunnel while creating a moving information highway.
Oscillating Movement

## *Light Fixture Schedule*

**Lighting Fixture Schedule**
University of California, San Diego Cal IT2

| Type | | Mfr/Catalog # | Lamping | Notes |
|---|---|---|---|---|
| E11 |  | **Zumtobel Staff Custom Fixture**<br>Description: Large custom acrylic boxes with 32W T8 lamps with dimming. Various orientations and positions. | (#) 32W T8 FL lamp | Location: Underground Tunnel |
| E12 |  | **Cooper Ltg - Metalux STN-132-***<br>Description: Surface-mounted fluorescent strip light, rigid housing with blue gelled 1-F32T8 (48in) lamp. | rigid housing 1-F32T8 (48in) lamp | Location: Underground Tunnel |

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

**Light Loss Factors**

| Type | Cleaning Interval | Category | BF | LLD | LDD | RSDD | LLF | Location |
|---|---|---|---|---|---|---|---|---|
| E11 | 12 Months (Medium) | V | 0.88 | 0.95 | 0.82 | 0.9 | 0.62 | Underground Tunnel |
| E12 | 12 Months (Clean) | VI | 0.88 | 0.95 | 0.85 | 0.94 | 0.67 | Underground Tunnel |

I assumed a 12 month cleaning interval for all fixtures since the building is located on the University campus. I also assumed a medium dirt level for the lighting display since it is in an exterior space. The uplight in the tunnel is enclosed in a window and is not as prone to the dirt and dust.

**Power Density**

| Fixtures | Fixture Count | Watts | Total watts | SF | W/SF |
|---|---|---|---|---|---|
| E11 | X | X | X | | |
| E12 | 24 | 29.5 | 708 | | |
| | | | 708 | 1925 | **0.37** |

Using the input wattage from the specified ballasts and lamps, the power density came in under the maximum allowed of 0.5 W/SF which meets ASHRAE 90.1 standards. The lighting display box is considered a sculpture or "artwork of light". This is not counted in the power density calculation.

## *Fixture Relevant Schedules*

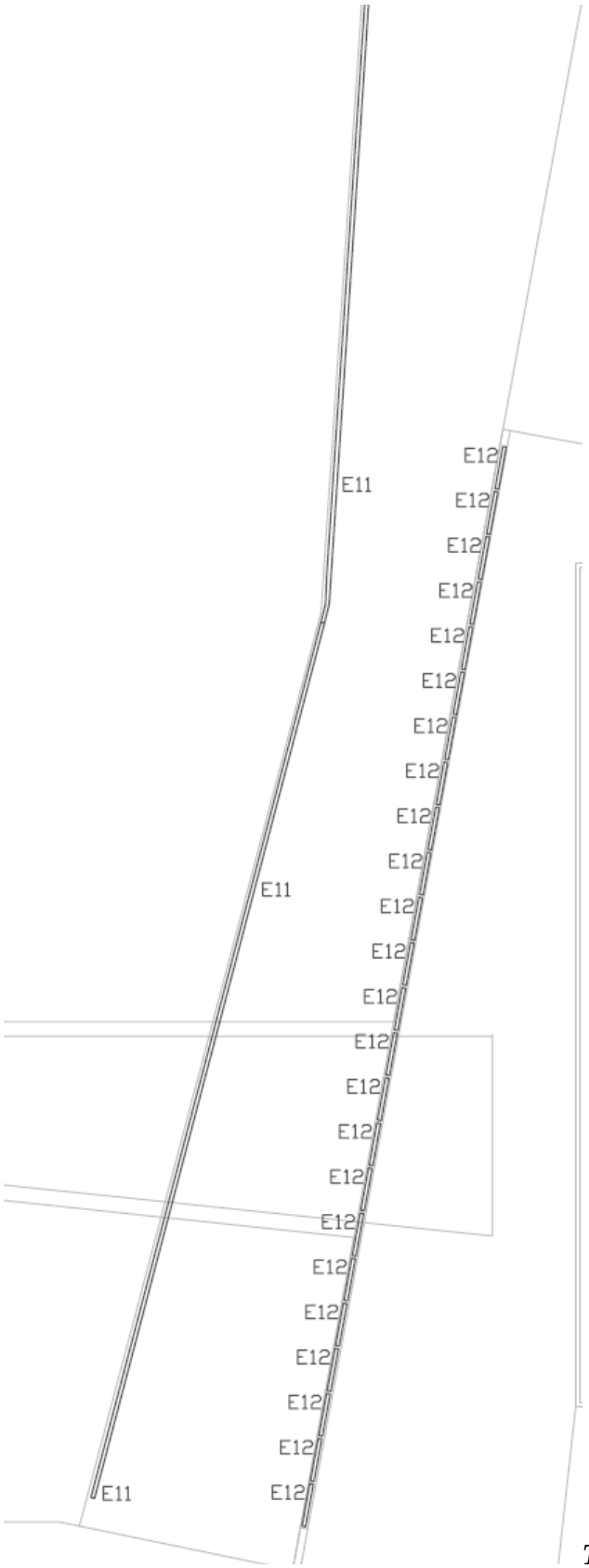
**Ballast Schedule**

| 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 |

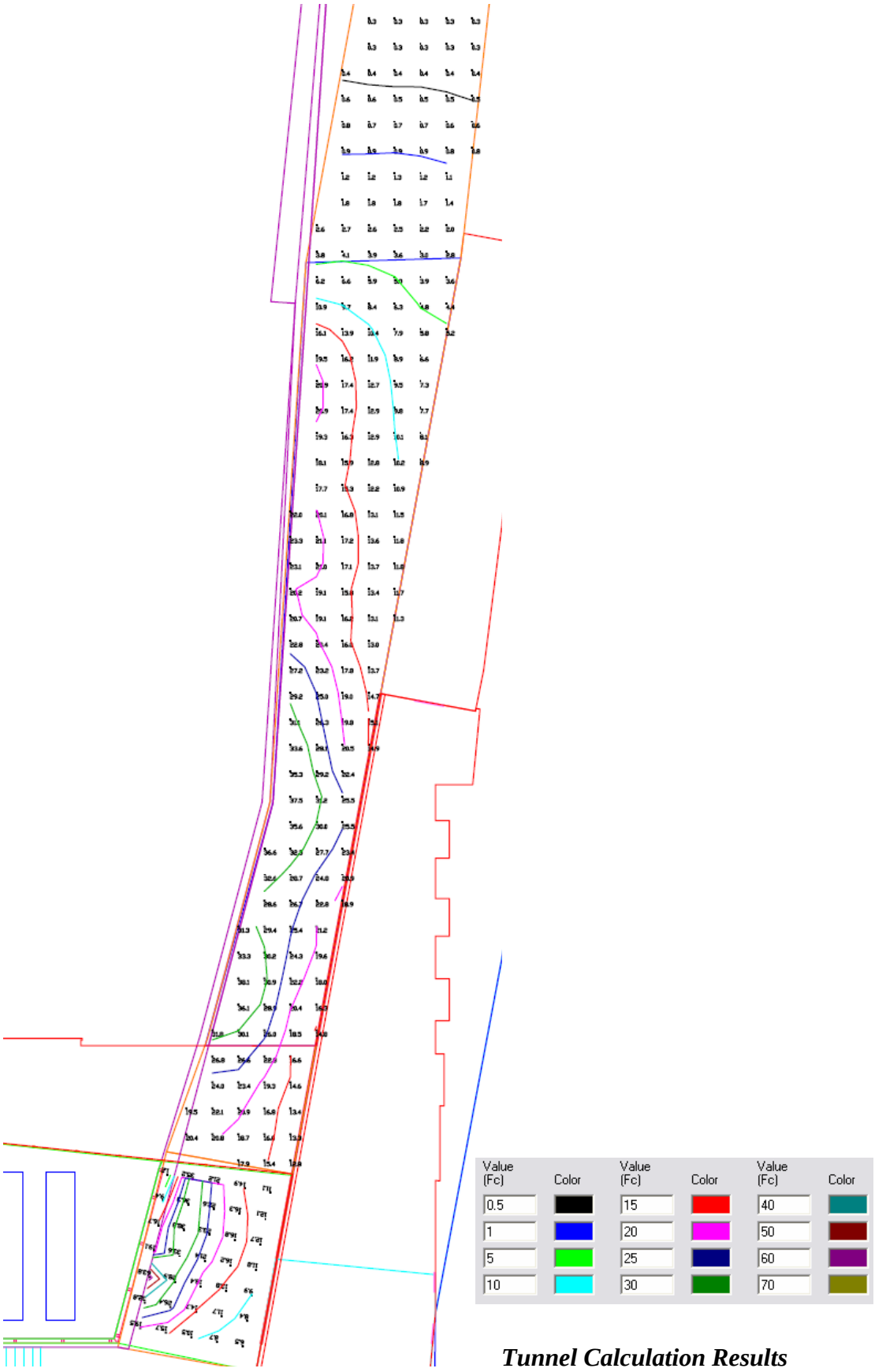
All ballast cut-sheets can be found in the appendix.

**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 |




*Tunnel Lighting Plan*



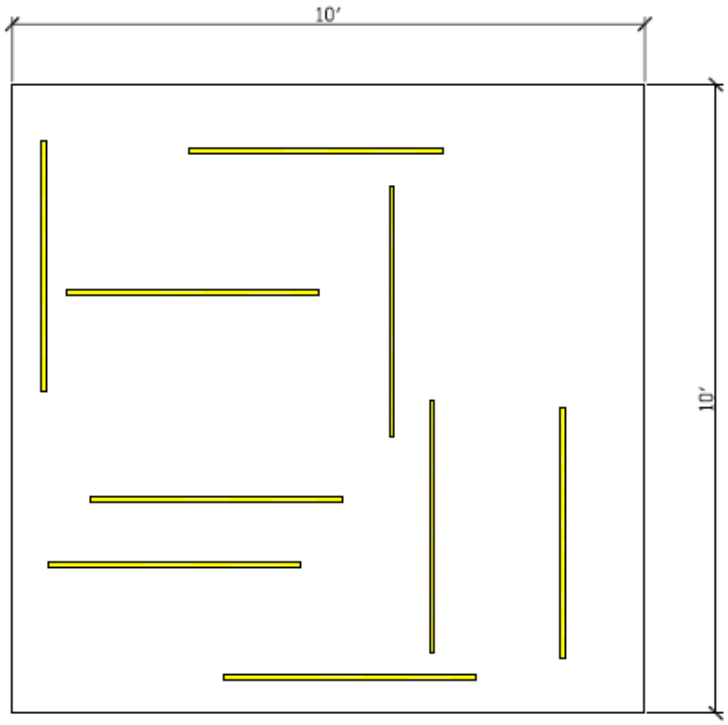

*Tunnel Calculation Results*

## *Calculation Results*

Since this is a circulation space, only 5-10 fc is needed on the floor. Because of the decorative light piece, a lot of light is put on the floor.

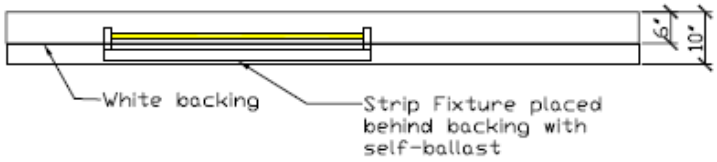
Avg: 16.5 fc
Max: 63.8 fc
Min: 1.2 fc

## *Fixture Details*




Tunnel Wall Fixture E11

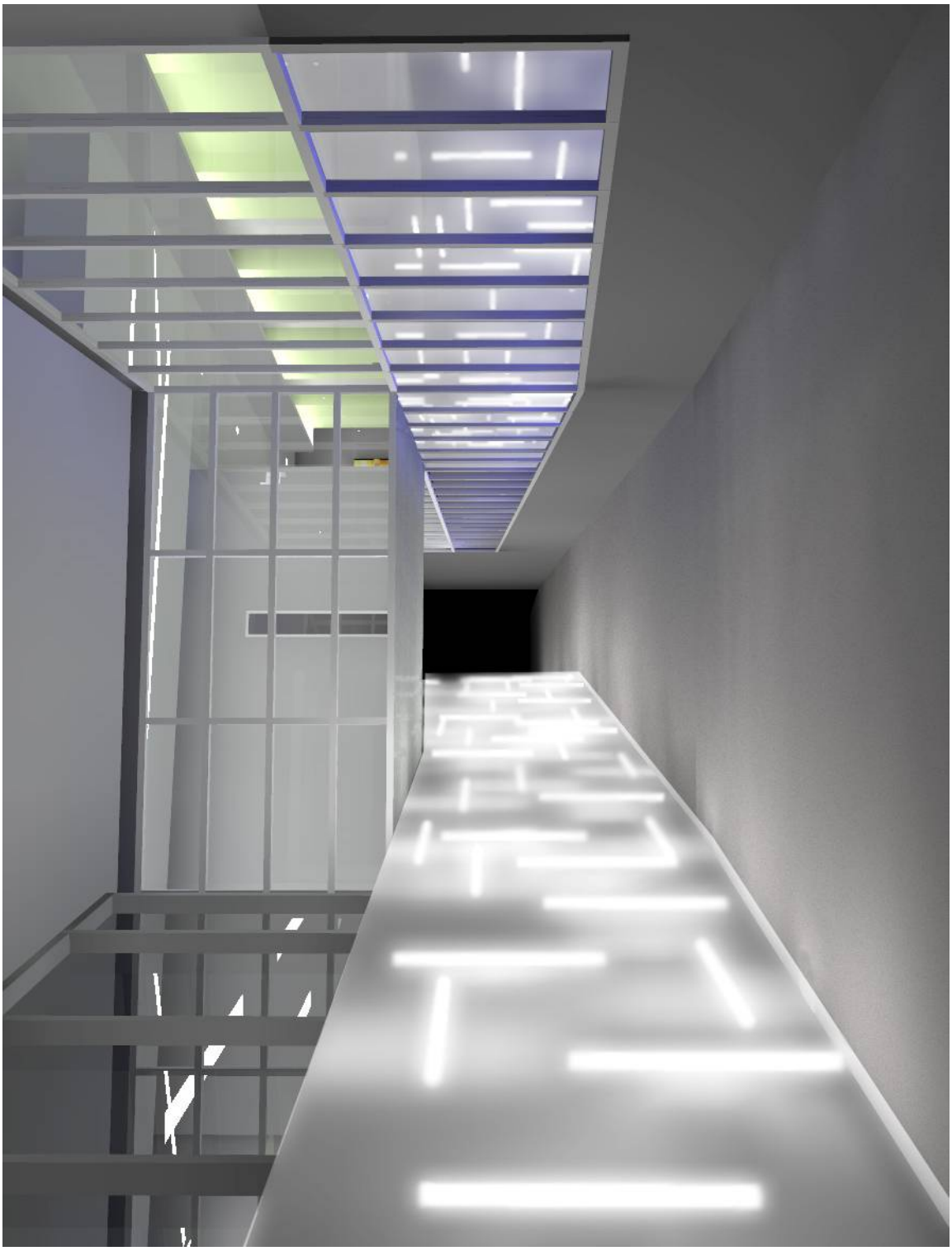
Randomly placed 32W T8 lamps
Fixture comes in custom sizes to fit tunnel walls
Suggested size is 10' x 10'
Ballasts placed in cavity behind fixture and tandem wired
¾" diffuse temperature treated acrylic with 60% transmittance
Panels can be re-lamped by taking front panel off with latch



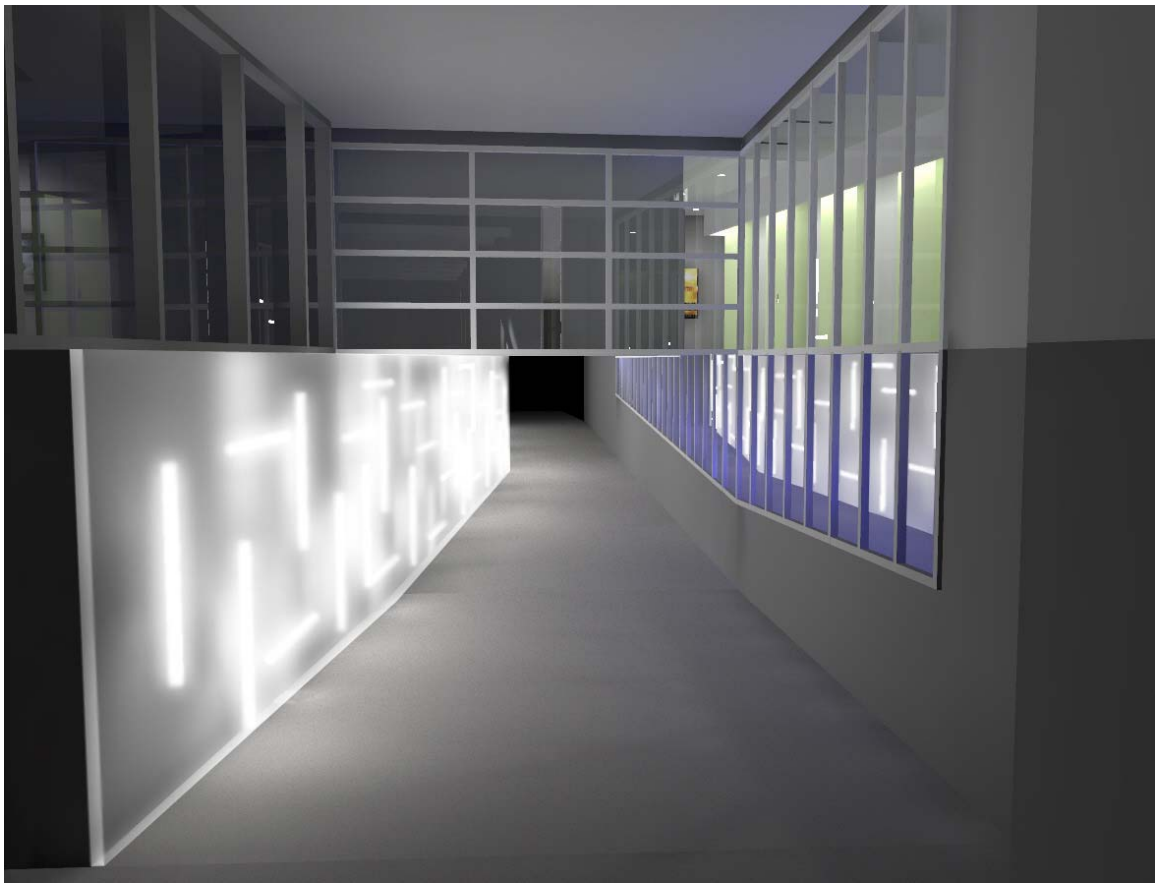
*Renderings of Tunnel*

*West Side Entrance to Tunnel*

*Courtyard Entrance to Tunnel*



***Courtyard Entrance to Tunnel***



***Conclusions***

The underground tunnel is definitely the main focus for all of the redesigns I made. It combines form with function to produce an intriguing display to guide people through. Because of the constant advancement in the telecommunications industry, I wanted to mimic this in the lighting design. Since this is, in a sense, the core of my building, its guts are shown and can leave an impact on the people using it.