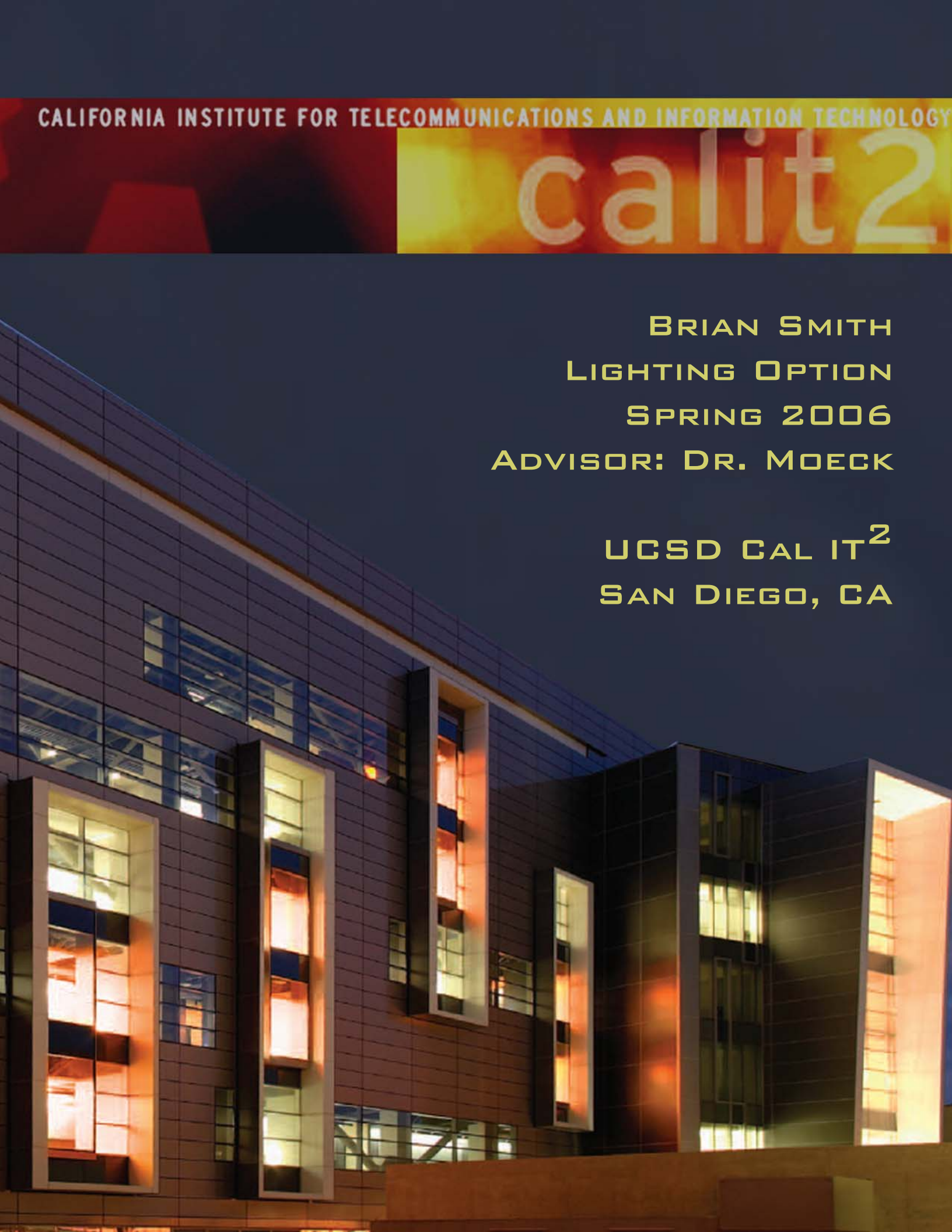
CALIFORNIA INSTITUTE FOR TELECOMMUNICATIONS AND INFORMATION TECHNOLOGY

calit2

Brian Smith
Lighting Option
Spring 2006
Advisor: Dr. Moeck

UCSD Cal IT^2
San Diego, CA



Cal (IT)^2
University of California, San Diego

Brian Smith
Lighting/Electrical Option
http://www.arche.psu.edu/thesis/eportfolio/current/portfolios/bts151

Project Team

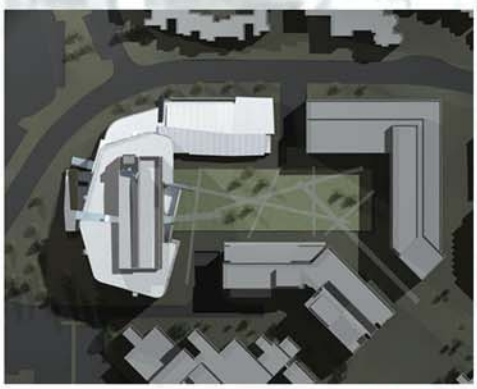
- Owner: University of California, San Diego
- General Contractor: Gilbane
- Architect: NBBJ
- Civil Engineer: Pountney Consulting Group
- Structural Engineer: Rutherford & Chekene
- MEP Engineer: Flack & Kurtz
- Lighting Designer: HLB Lighting Design

Project Statistics

- 220,000 sq ft
- 7 stories
- Cost: $61,200,000
- Dates of Construction: Jan 03 - Oct 05
- Delivery Method: Design - Bid - Build
- Meets California Title 24 Energy Standards

Architecture

- Modern technological design
- Underground tunnel or "worm-hole" through middle of building
- 200 seat black box theater
- Glass and steel facade with tiled concrete panels and aluminum cladding



Mechanical

- VAV air re-circulation system
- 16 Air Handling Units with hydronic cooling, heating and preheating coils service the entire building
- Gas fired boiler system

Lighting

- Compact fluorescent downlights
- Pendant fluorescent strip lights in research areas
- Blue cove lighting in lobby
- Occupancy sensors and automatic shutoff controls

Structural

- Structural steel framing
- Poured concrete slab on metal form decking
- Seismic connections

Electrical

- 208Y/120V and 480Y/277V supply system
- 12 kV power distribution
- 750 kW emergency diesel generator
- Receptacles and misc interior lighting stepped down to 208Y/120V system

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EXECUTIVE SUMMARY

The University of California, San Diego Cal IT^2 building combines technology, architecture, and function into an impressive statement on the UCSD campus. The 7 story tall sleek gray building encloses a courtyard to join the engineering buildings into a significant part of the campus. The new California Institute for Telecommunications and Information Technology (Cal IT^2) brings high-end laboratories, clean rooms, a black box theater, and many other important entities that make this building a staple in the school. Of the many disciplines integrated into this building, lighting is a very important aspect for this design.

This report will include an in-depth study on a proposed lighting redesign for five major spaces in the building. This will include luminaire selection, ballast and lamp information, fixture placement, and conceptual design. Integrating my design into an already well designed space was quite a challenge in the beginning. By bringing new concepts to many of the spaces, I was able to work around the existing conditions to provide a very different approach to some rather typical spaces.

This report will also be including an electrical depth analysis. This will include the circuiting and wiring of my new lighting redesign. A complex control system is being implemented to provide flexibility in the lighting controls for easier maintenance. Since this will be a redesign for the building, I have also checked the branch circuiting for protection purposes. An emergency power study was also done to verify the generator that was provided by the engineers with my new design.

Because the building industry thrives on economics, a cost analysis was conducted for my construction management breadth. I compared the cost of the existing lighting system compared to my new redesign to show how a good lighting design can be implemented without a major price. I have also shown the labor and installation costs involved with my redesign for economic purposes. This gives insight to how much lighting alone can cost to an owner.

The last topic my report will cover is an acoustical analysis for the black-box theater. The theater is a major aspect of the building, and needs to be designed properly for its many uses. I performed a reverberation time study to show the existing conditions and my new redesign for sound. The study shows how a very tiny detail can go a long way in the transmission of sound.

Cal IT^2 is really an intriguing building. Through all of my topics of study, I have really learned a great deal about Cal IT^2 and the building industry in general. This project showed the integration of architecture, energy efficiency, and aesthetic appeal to the University of California, San Diego campus and can be used as a great example of integration for the future.

BUILDING STATISTICS

General Building Statistics

- **Building Name:** UCSD Cal IT^2 California Institute for Telecommunications and Information Technology
- **Location and Site:** University of California, San Diego, CA ,Jacobs College of Engineering
- **Building Occupant Name:** UCSD Facilities Design and Construction
- **Occupancy or Function Types:** Cal IT^2 contains many research labs for 3D scanning, processing, metrology, and laser research. Two unique features of the building are a 200 seat black box theater and a 2000 sq ft exhibit gallery.
- **Size:** 234,492 sq ft
- **Number of Stories:**
  - **Above Grade:** 7 Stories
  - **Total Levels:** 8 Levels
- **Primary Project Team:**
  - **Owner**: UCSD Facilities Design and Construction
    Website: www.ucsd.edu
  - **General Contractor:** Gilbane
    Website: www.gilbaneco.com
  - **Architect:** NBBJ Architects
    Website: www.nbbj.com
  - **Landscape Architect:** Spurlock, Poirier
    Website: www.sp-land.com
  - **Civil Engineer:** Pountney Consulting Group
    Website: www.psomas.com
  - **Structural Engineer:** Rutherford & Chekene Consulting Engineering
    Website: www.ruthchek.com
  - **MEP Engineer:** Flack & Kurtz Consulting Engineering
    Website: www.flackandkurtz.com
  - **Lighting Designer:** HLB Lighting Design
    Website: www.hlblighting.com
- **Dates of Construction (Start to Finish):** Jan 2003 – Sept 2005
- **Cost:** $61,200,000
- **Project Delivery Method:** Design-Bid-Build

Building Envelope

As one stares at the exterior of UCSD Cal IT^2, one can see the design itself showing through its architecture. On the North side facing the street, the entire façade is tinted glass. Once you stare through it, the steel design can be seen as a criss-cross pattern of HSS8 x 10 5/8 steel beams and horizontal W21 x 68 steel beams for each floor. On the East, South and West sides, a combination of resin wall panels, aluminum cladding for the mullions, and various types of clear vision glass panels for the windows spanning vertically and horizontally are used.

Construction

The project was constructed as a design-bid-build project. Design began in mid 2001 with the designers and the UCSD facilities office. Construction began as planned in January 2003 with a cost of roughly $54 million. UCSD Cal IT^2 was planned to open in January 2005, but was delayed until September 2005. Construction costs grew to about $61 million averaging about $261/ sq ft with more square footage as originally planned.

Electrical

UCSD Cal IT^2 uses both 480/277V and 208/120V standard power distributions for the 12kV service provided by East campus. A 6-way switchboard is connected to distribute the power to three substations with one spare switch. A 750kW standby diesel generator is connected in case of a black-out for elevators, emergency lighting, mechanical equipment, data back-up, and other necessities. From the substations, many distribution panels and boards provide power to the three sections of Cal IT^2 accordingly.

Lighting

UCSD Cal IT^2 uses many different lighting systems through the building because of the various functions this building has. Most of the lighting is fed off the 277V power; however there are some fed off the 120V power. Because of Title 24 requirements in

California, energy efficient lamps, controls and luminaries are used to decrease any power possible to the building. All open-office areas have automatic lighting shut-off, occupancy sensors are used for private offices and override the automatic shut-off, tandem wiring is used, and daylight area control is used for the larger open spaces where lighting may not be required during daylight hours.

On the exterior of the building, a variety of in-grade metal halide up-lights, compact fluorescent step lights, metal halide PAR flood lights, HID sconces, low pressure sodium pole lights, and compact fluorescent bollards are used to highlight the building and walkways to the building for safety purposes and aesthetics.

For the interior, the amount of light fixtures used is immense. In the East Lobby and many surrounding corridors, large decorative compact fluorescent pendants are hung from the ceiling emphasizing the height of the space. The North Lobby uses blue cove lights surrounding the cove ceiling with compact fluorescent downlights for ambient lighting. More fluorescent wall-washers are used throughout the building on corridors and decorative colored walls. Suspended fluorescent T8 fixtures are used for open office areas along with recessed strip lights in private offices and some corridors. As can be seen, because of the variety of spaces for this building, the lighting was designed to coordinate with each separate space while also integrating each space into the next with similar lamps, feels, and ambience.

Mechanical

UCSD Cal IT^2 utilizes 16 air handling units (AHU). The clean room has its own AHU with a 16,000 cfm supply and 11 AHU for re-circulation. It contains a hydronic cooling coil, heating coil, and a preheating coil. The two big AHU located on the roof of section B are supplying air at 86,000 cfm to the 7 floors below. All systems are using a VAV system with air-recirculation in emphasis for the clean room.

Structural

A steel structural system is used for UCSD Cal IT2. The beams support 16 and 18 gauge metal decking with a concrete slab per floor. The steel columns surrounding the building vary in size and support the building from wind load. Trusses support the metal decking and loads for the upper floors in Section B. Along the North side, the steel bracing creates a truss pattern with W21 x 68 girders. Because of the location, the building was built with seismic connections and standards.

Fire Protection

Fire protection is an important issue within higher education buildings. All primary steel members are sprayed with a 3 hour rating while secondary members are sprayed with 2 hour ratings. As for fire warning systems, the whole building is equipped with hand-pull fire stations, fire extinguishers, horns, smoke/heat detectors, and strobes. A sprinkler system, compatible with UCSD fire marshal standards, is installed throughout the building.

Plumbing

UCSD Cal IT^2 uses 2 oil powered double wall water heaters from manufacturer P-K Compact Series with a domestic flow rate of 44 gpm. The thermal expansion tank has a capacity of 77 gallons. The oil tank underground is leak monitored by a panel underground as well. Pumps are used to get the water from the mechanical room to the upper floors. Emergency power is supplied to the pumps for safety showers in the labs and the sprinkler system. Seismic restraints are also in place in case of earthquake activity.

Transportation

Cal IT^2 houses four passenger elevators located in sections B and C for transportation to the above floors with only one going to the penthouse on level 7. Elevators #1, #2, and #3 are all traction type elevators. Elevators #1 and #2 have capacities of 3500 lbs and move at a speed of 350 ft per minute while elevator #3 (to the Penthouse) has a capacity of 4000 lbs moving at the same speed. Elevator #4 is located in section C outside the Black-Box Theater. It is a hydraulic type elevator with a capacity of 2500 lbs and moves at a speed of 125 ft per minute. Emergency power is provided to these elevators during a black-out.

Telecommunications

Every space in the UCSD Cal IT^2 building is equipped with basic voice and data jacks wired with CAT-6 cable throughout the entire building as well as wireless communication in many spaces. Being a state of the art technological building with laboratories, research facilities and offices, it is expected that the building be as up-to-date as possible.

Architecture

The California Institute of Telecommunications and Information Technology at the University of California, San Diego makes a huge mark on technology in the campus. Through its architecture, it encourages the advancement of technology and expresses the use of fast, wireless communication. The design of three different buildings integrated into one creates the sense of the different areas of research under one roof. The first section of the building is used for laboratories and an elaborate clean room. The second section of the building encompasses the large tower which holds offices and research clusters for professionals and professors in the field. The final section houses a black-box theater space, and a virtual immersion lab which can be toured and peered at during working hours. They are connected by long hallways with clean lines and sharp corners. The glass and steel box design emphasizes the importance of the ever-growing field in technology. By using the grey and black colors for the façade, it appears as a computer hub for the campus. The height of the building along with the elongated windows emphasizes the size of the building making it a staple in the academic courtyard. It appears to have something significant happening inside, which it in fact, it does. Another feature of this building is the underground tunnel or "wormhole" moving under the building to the other side. It serves as a passageway and shows the advancement of the changing campus and its acknowledgement for the convenience of the students and researchers. A great deal can be said just by gazing at this immense architectural statement in San Diego. It shows technological advancement with how far we've come and how far we will go in the telecommunication and building industry.

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.

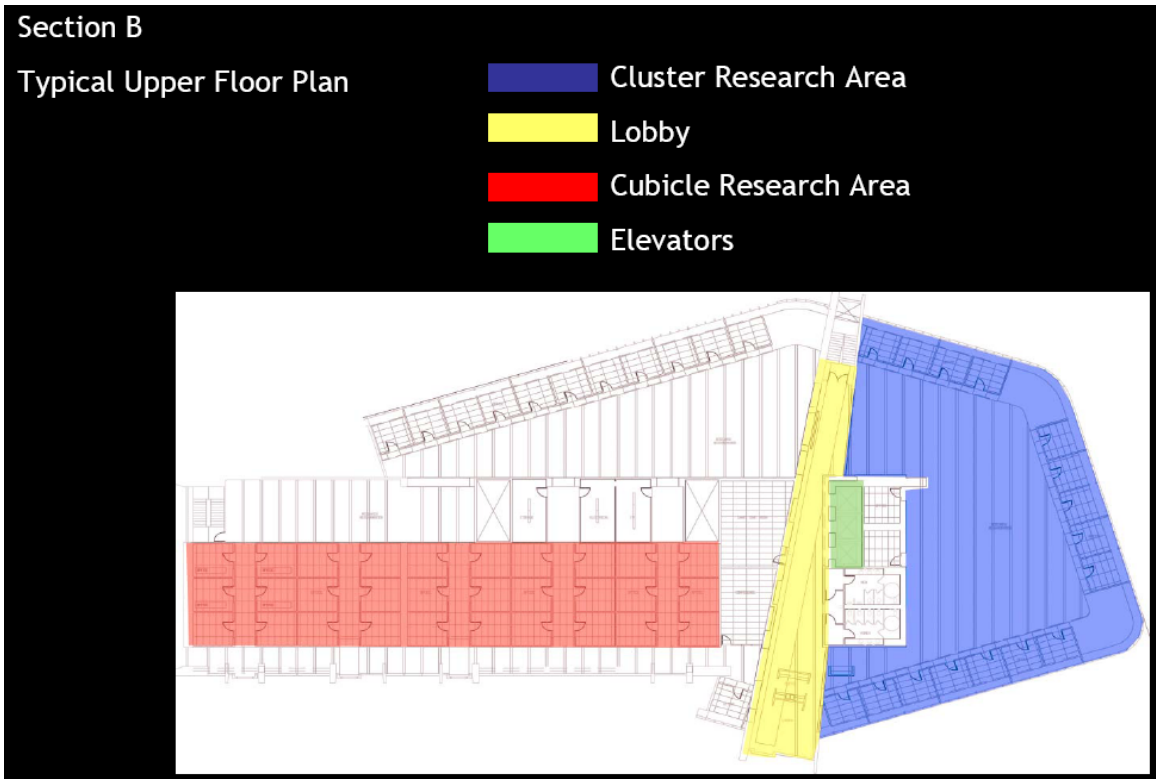
The second space I chose was the black-box theater. This space proved to be very challenging and involved the most layers of lighting. With the theater being 2 stories tall and having architectural and acoustical surfaces to work around, the space was limited to location for many of the fixtures. In 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

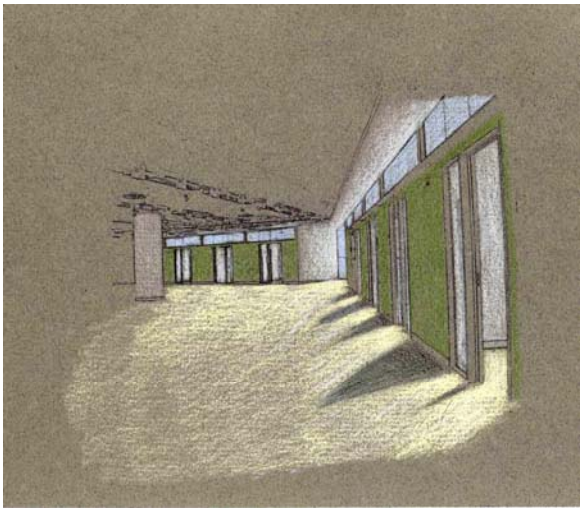
According to California Title 24 Energy Standards, open office area's power density should be < 1.3 W/SF.

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.

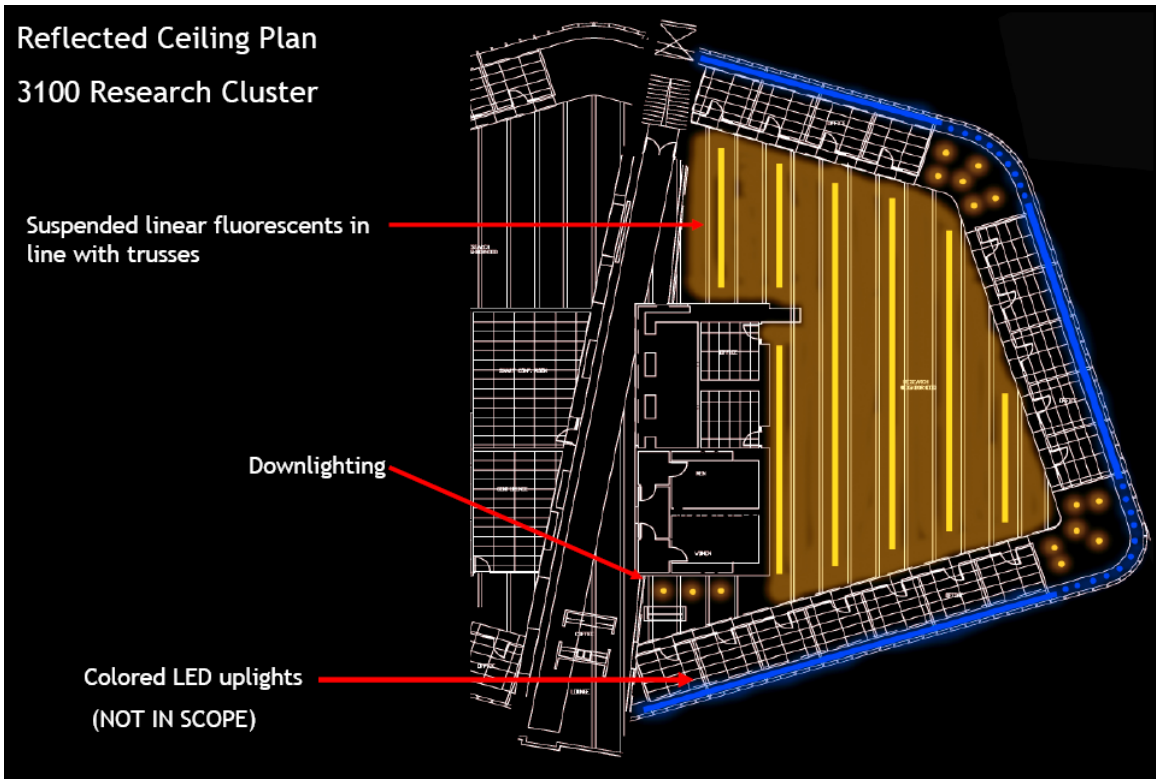
Schematic Design

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

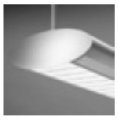


windows were not enough to bring a large amount of light into the space as intended. This moved the design forward with choosing a good linear parabolic fixture to run in between the exposed trusses. A suspended direct/indirect source for the private offices also helped on appearance between the spaces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

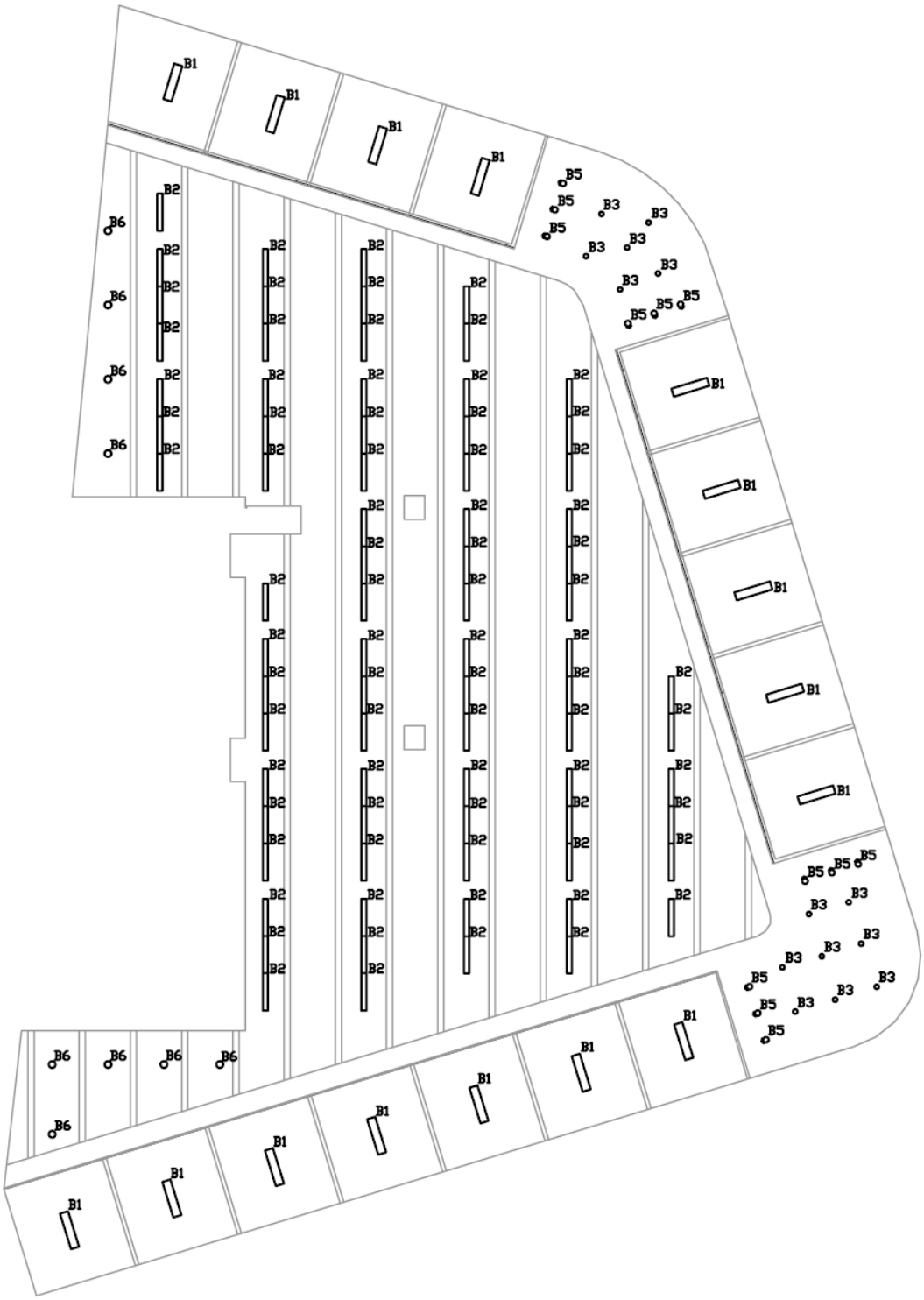
Light Loss Factors								
Type	Cleaning Interval	Category	BF	LLD	LDD	RSDD	LLF	Location
B1	12 Months (Clean)	II	0.88	0.95	0.88	0.96	0.71	Private Offices
B2	12 Months (Clean)	IV	0.88	0.95	0.88	0.96	0.71	Open Office
B3	12 Months (Clean)	IV	1.00	0.85	0.88	0.96	0.72	Window Corners
B5	12 Months (Clean)	IV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

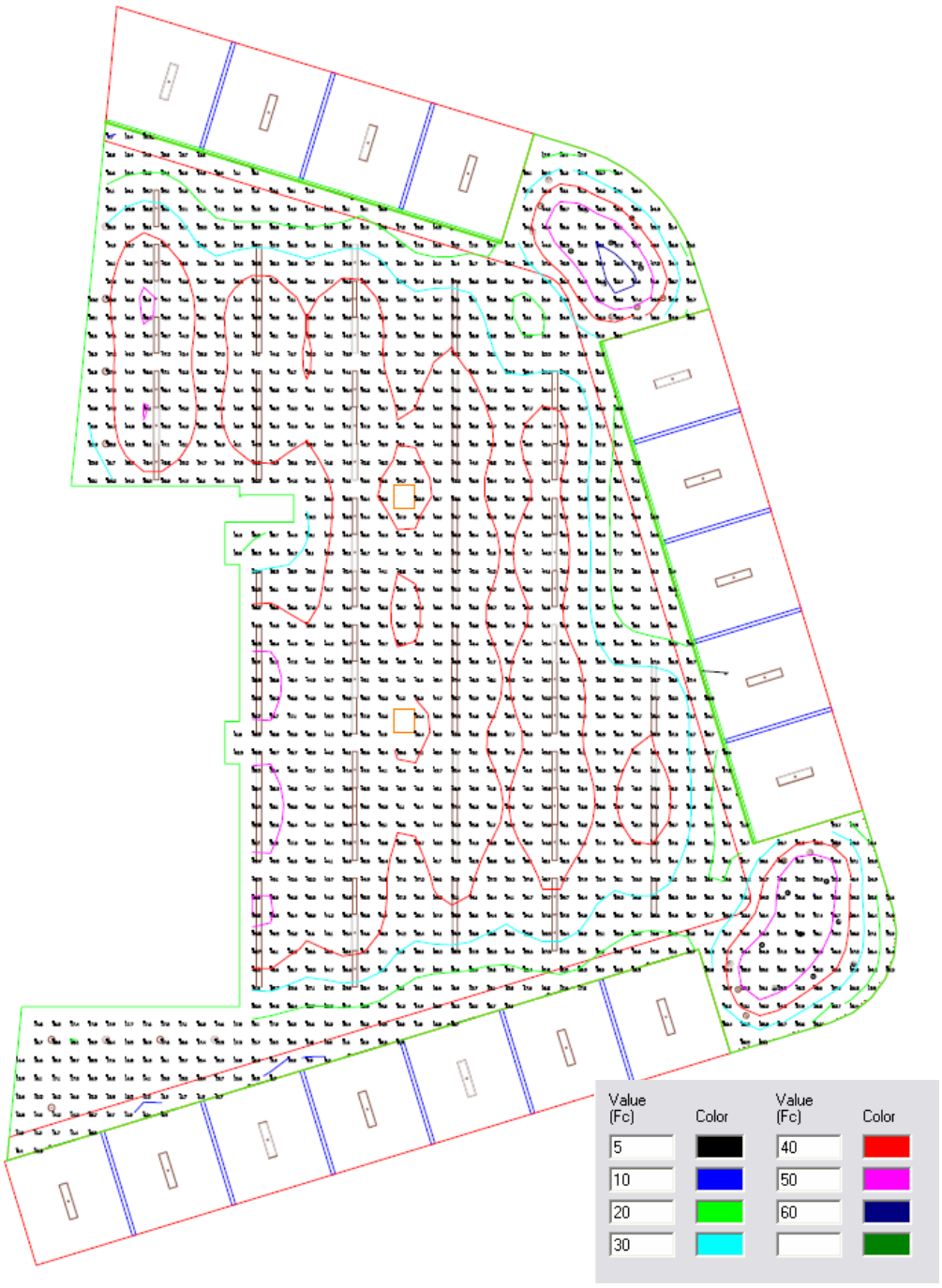
Power Density					
Fixtures	Fixture Count	Watts	Total watts	SF	W/SF
B1	16	68	1088		
B2	76	68	5168		
B3	14	36	504		
B5	12	36	432		
B6	9	36	324		
			7516	8121.6	**0.93**

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:

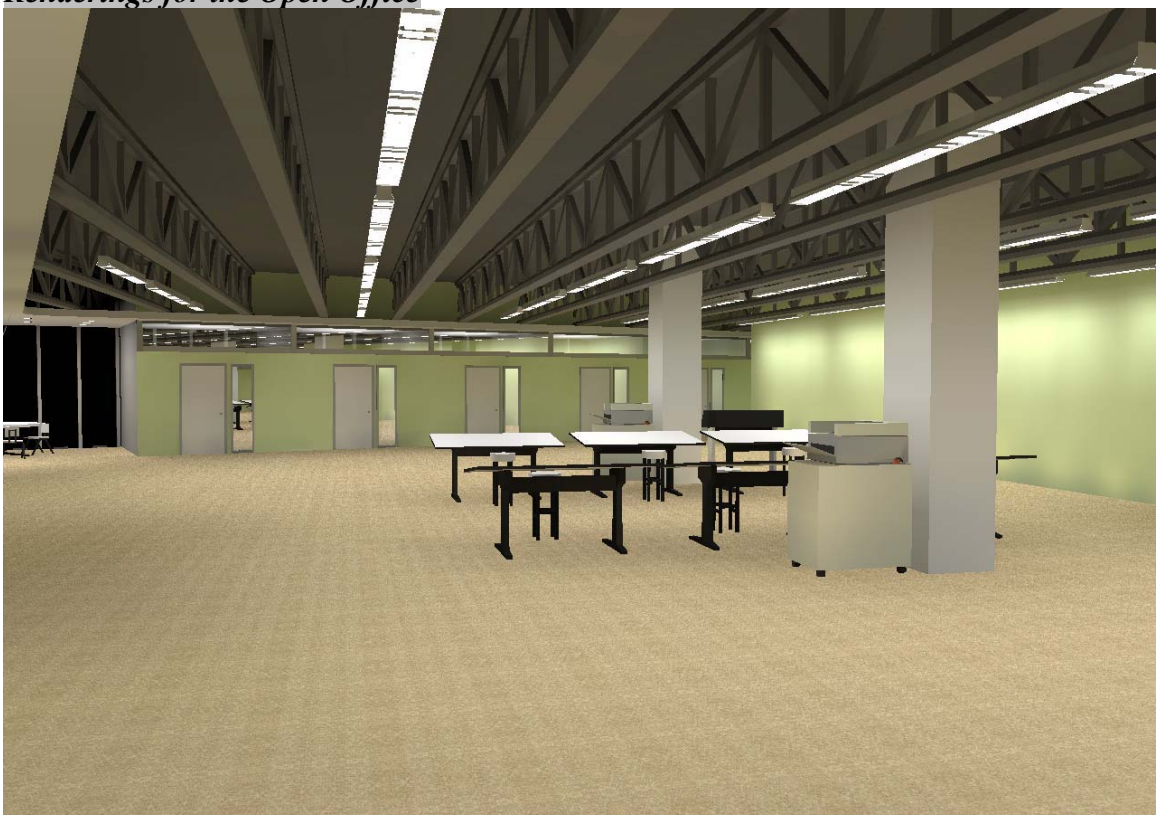
43.52 kWh * $0.10 / kWh = $4.35 / day

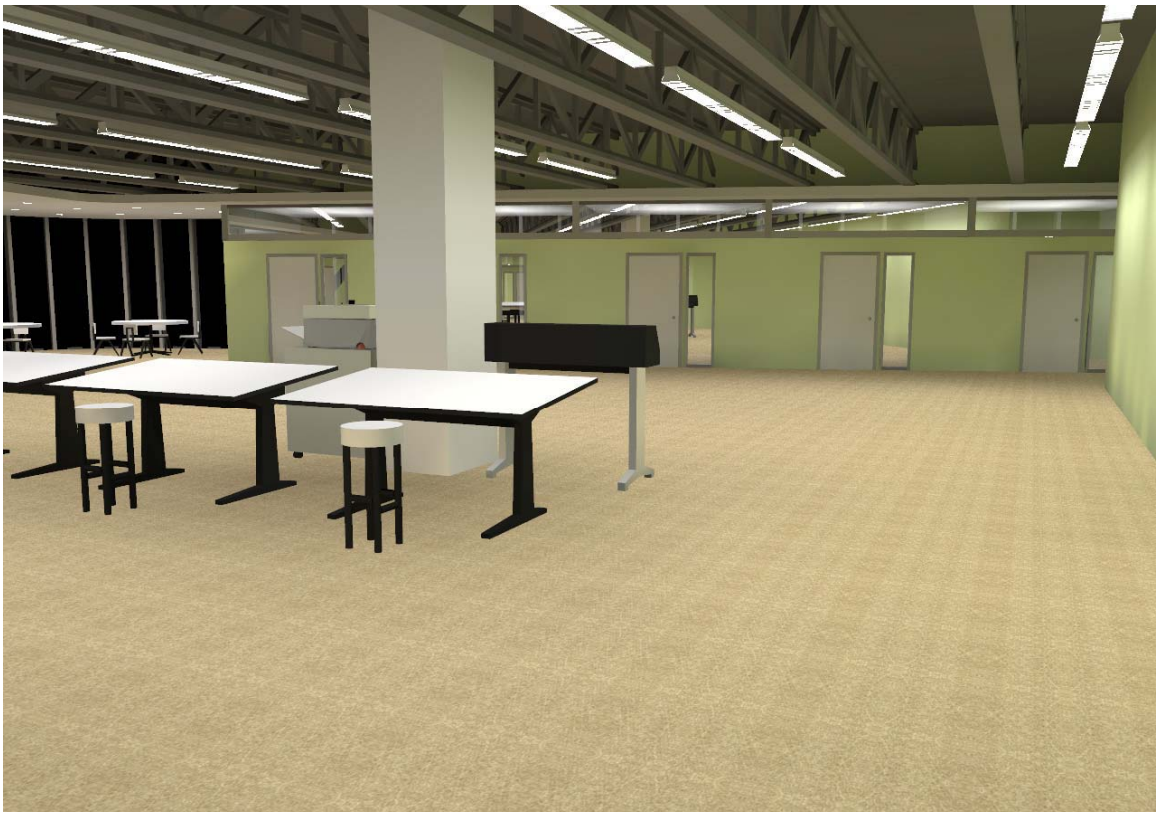
Estimated Typical Usage Days/year : 275 days

$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





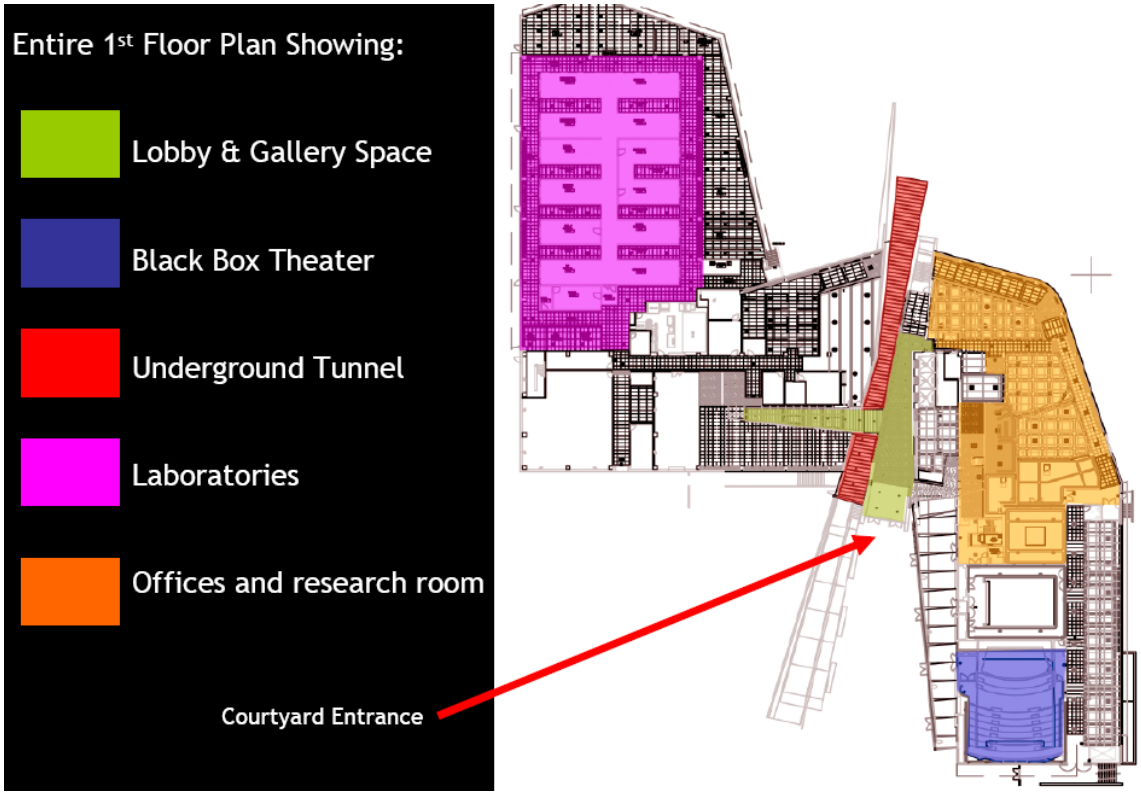
Entrance to Open Office

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.

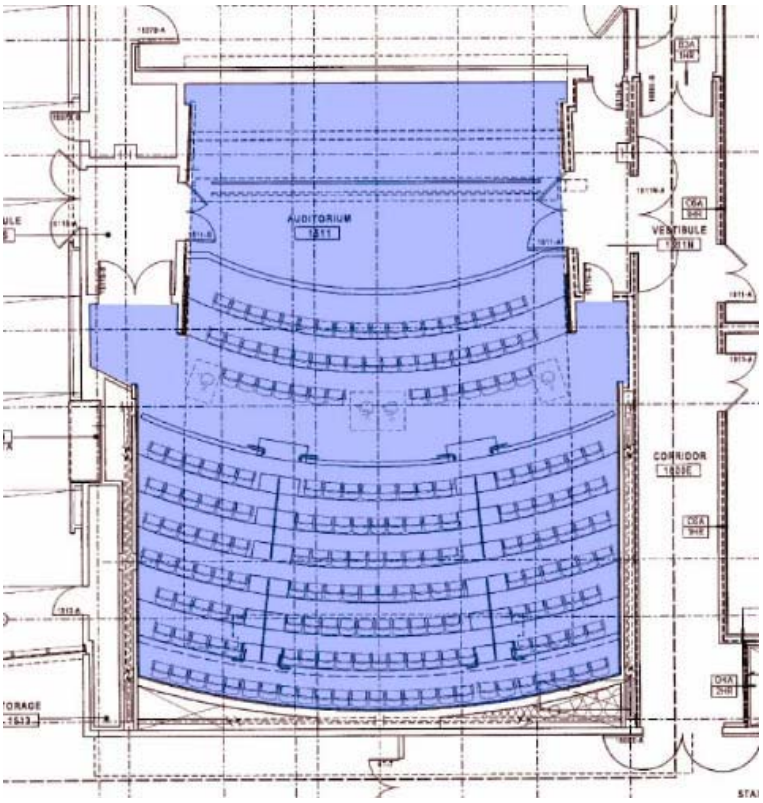
Black-Box Theater

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.

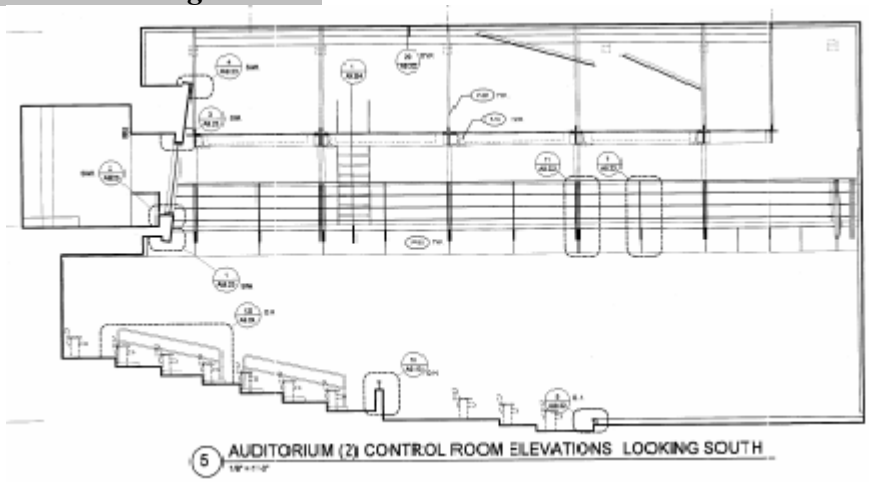


This plan shows the location of the theater relative to the courtyard and other entities of the building. Directly next to the theater is a large multipurpose room for various events sponsored by the college of telecommunications.

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

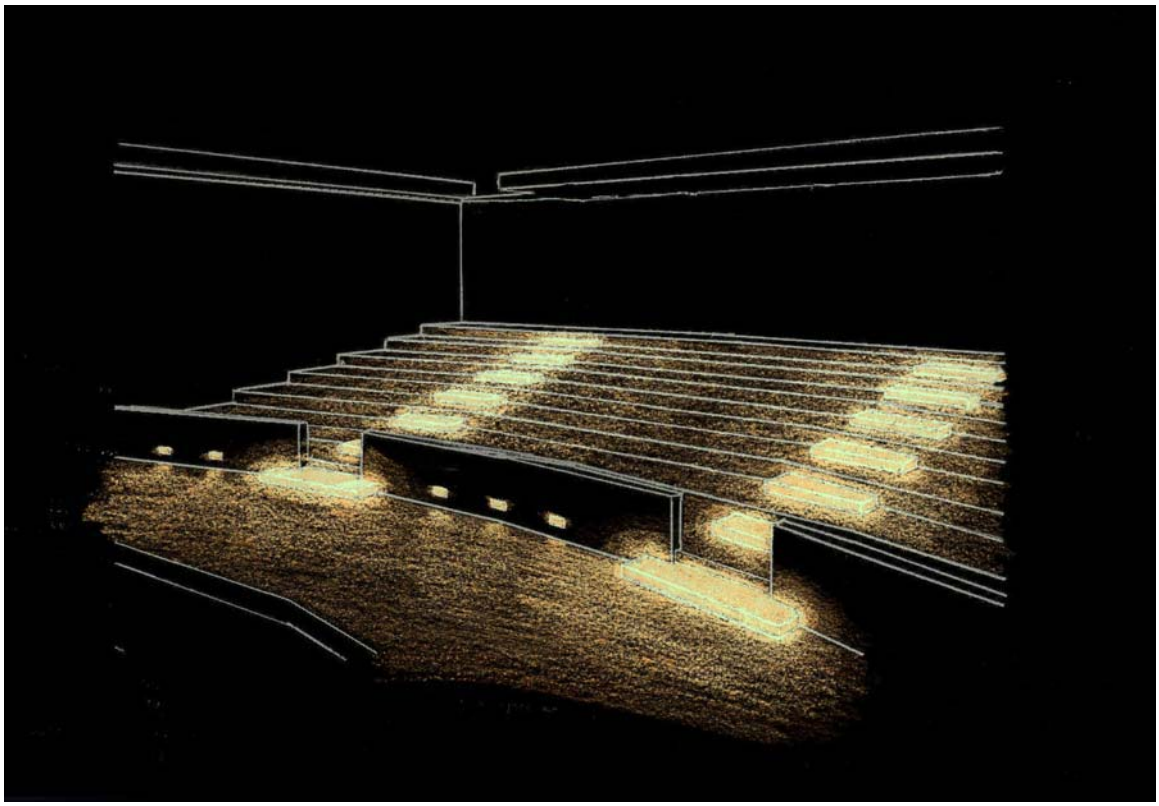
A uniform CCT of 3500K will be used in these areas with a CRI of about 82. Since this is a theater, I did not want to use a very cold source, but wanted to keep in tune with the technological feel. A 3500K lamp is a good neutral CCT for this space. A color rendering index of 82 is going to be uniform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

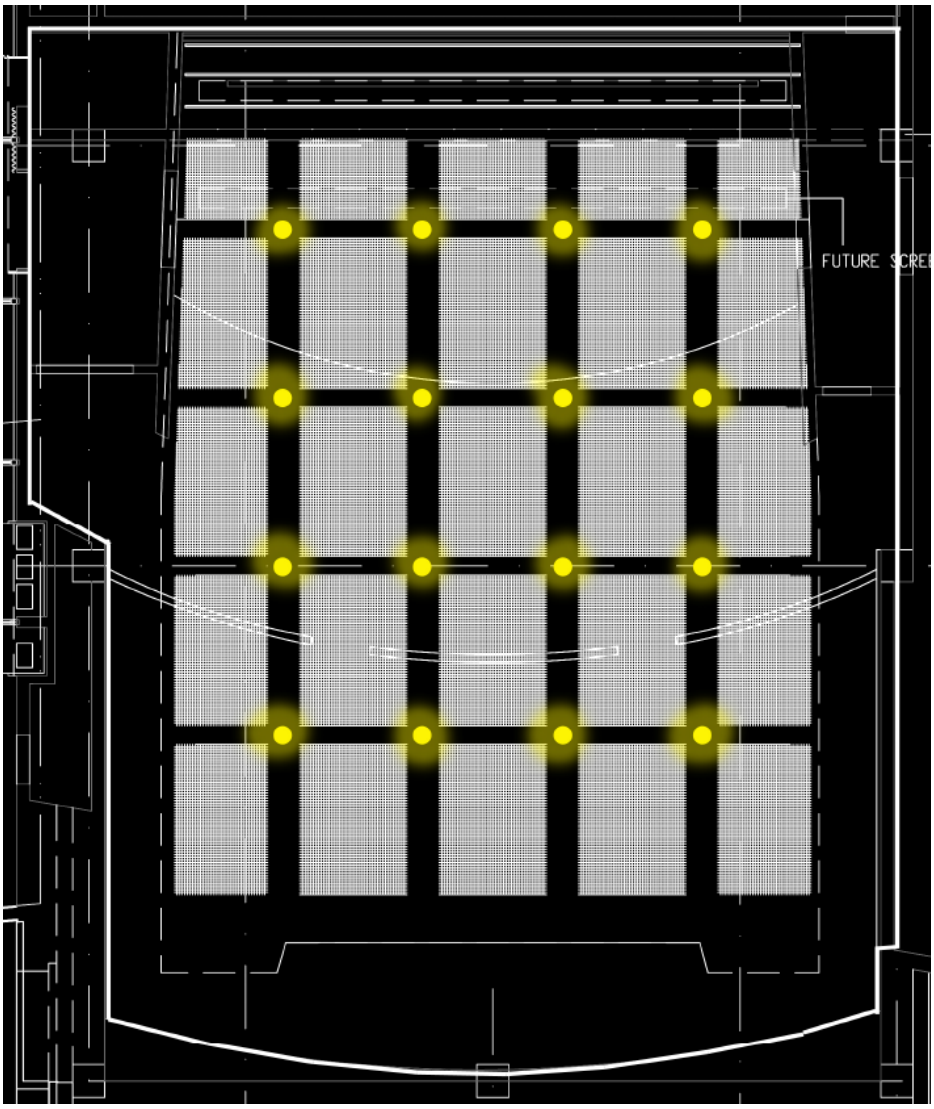
Schematic Design

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.

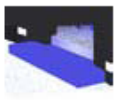


The next layer I will be using is washing the walls with light. By grazing the fabric walls with either blue or white light, this will add depth to the space as well as avoid dark shadows in the corners of the theater which can often happen. The next two layers involve the two tiered ceiling. The metal mesh grid at the 2nd 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** 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** 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** 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** Description: 4' linear recessed wall-washer with 1 32W T8 fluorescent	1 32W T8 FL	Location: Black Box Theater
B11		**Lightolier 1108 / 1104F1**** Description: 6" recessed compact fluorescent downlight with 1-CFQ13W lamp. Optics: painted or anodized aluminum cone reflector.	1-CFQ13W lamp	Location: Black Box Theater
B12		**Cooper Ltg - Metalux 2M-XRD-2-U6T8-PBIS-*-277-EB81-*** 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-*** 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

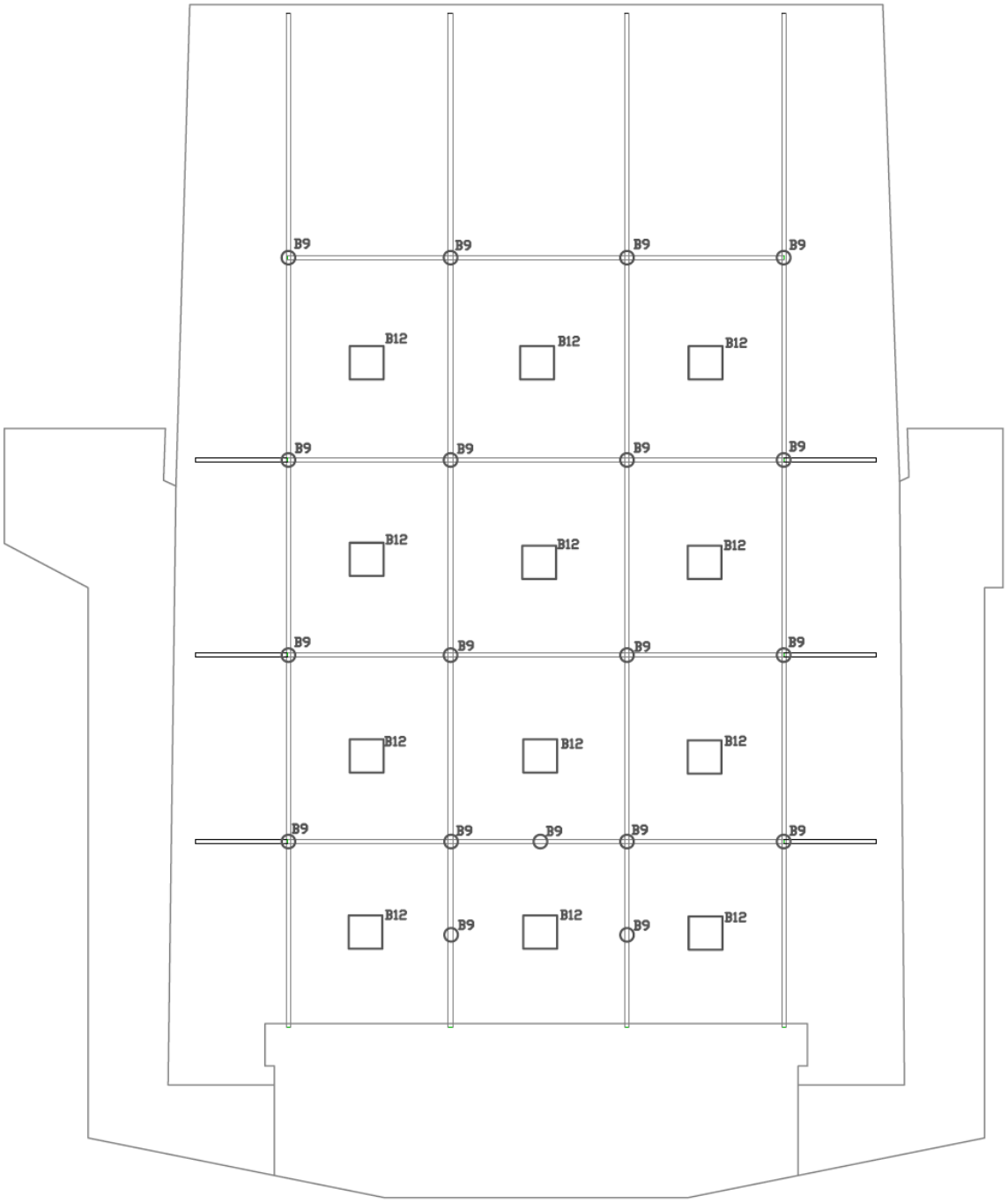
Light Loss Factors								
Type	Cleaning Interval	Category	BF	LLD	LDD	RSDD	LLF	Location
B7	12 Months (Clean)	IV	1.00	0.85	0.88	0.96	0.72	Black-Box Theater
B8	12 Months (Clean)	VI	0.88	0.85	0.86	0.93	0.60	Black-Box Theater
B9	12 Months (Clean)	IV	1.00	0.85	0.88	0.96	0.72	Black-Box Theater
B10	12 Months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

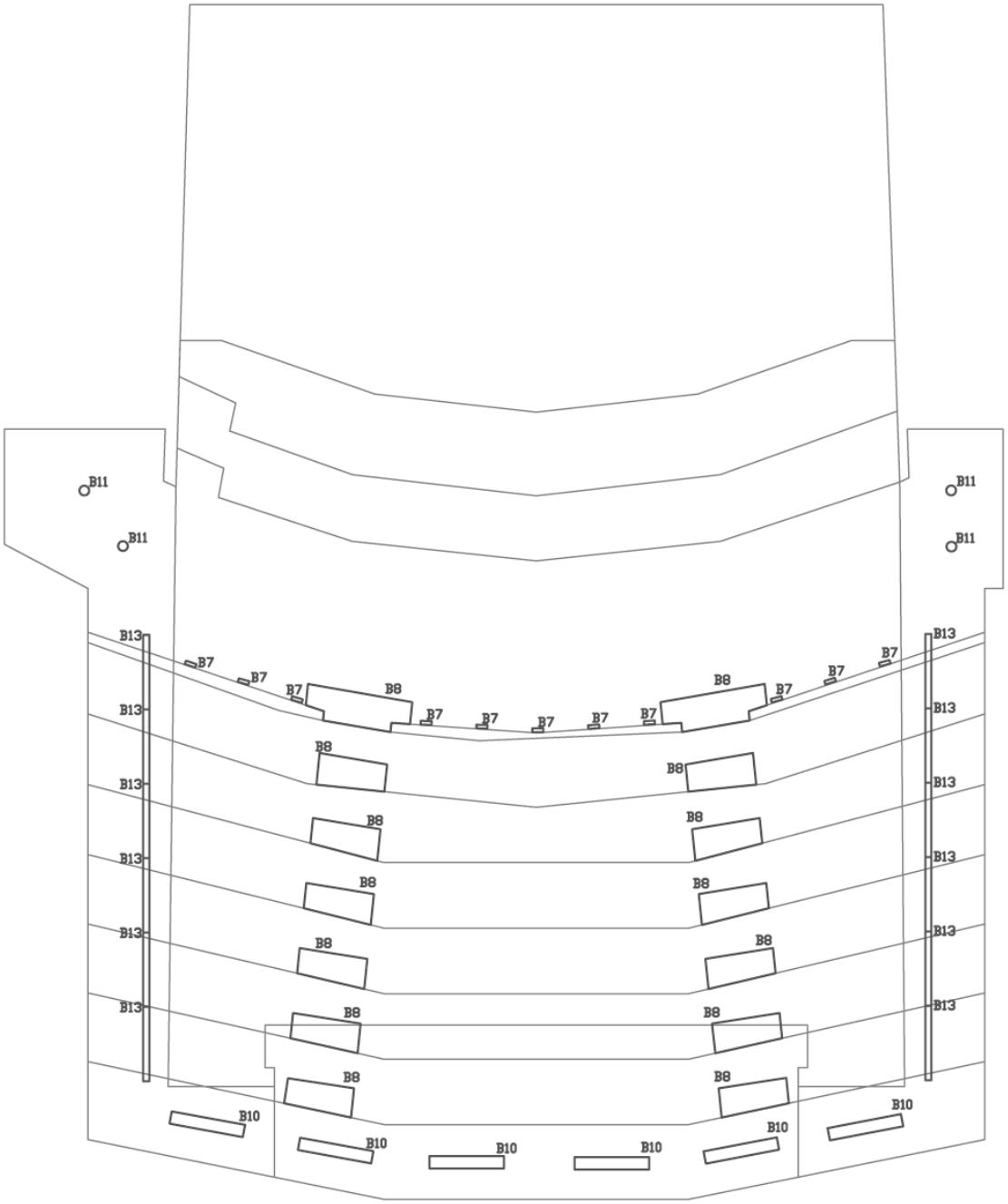
Power Density					
Fixtures	Fixture Count	Watts	Total watts	SF	W/SF
B7	11	13	143		
B8	14	17	238		
B9	19	80	1520		
B10	6	36	216		
B11	4	18	72		
B12	12	65	780		
B13	12	35	420		
			3389	2845	1.19

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.

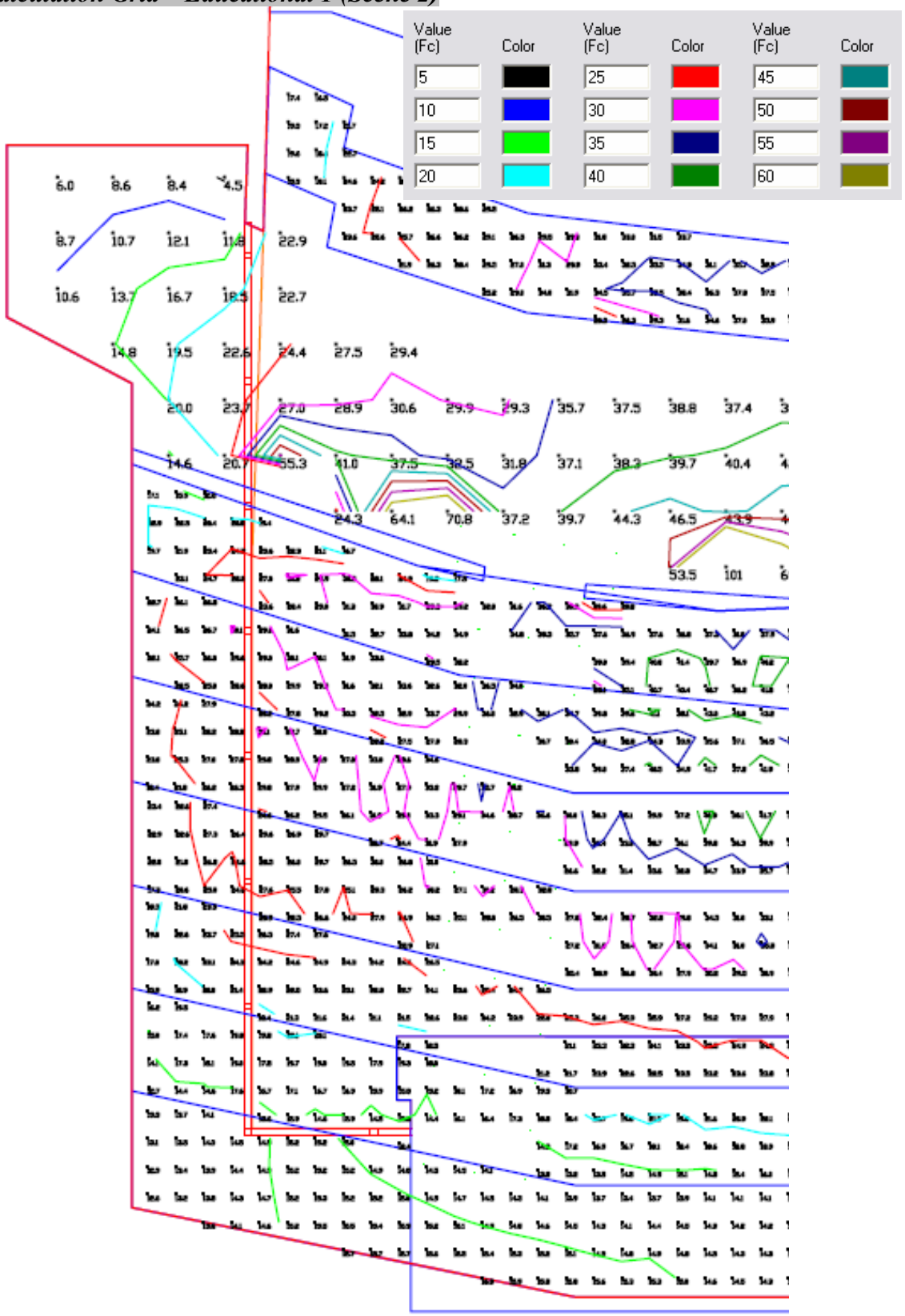
Scene 4

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.

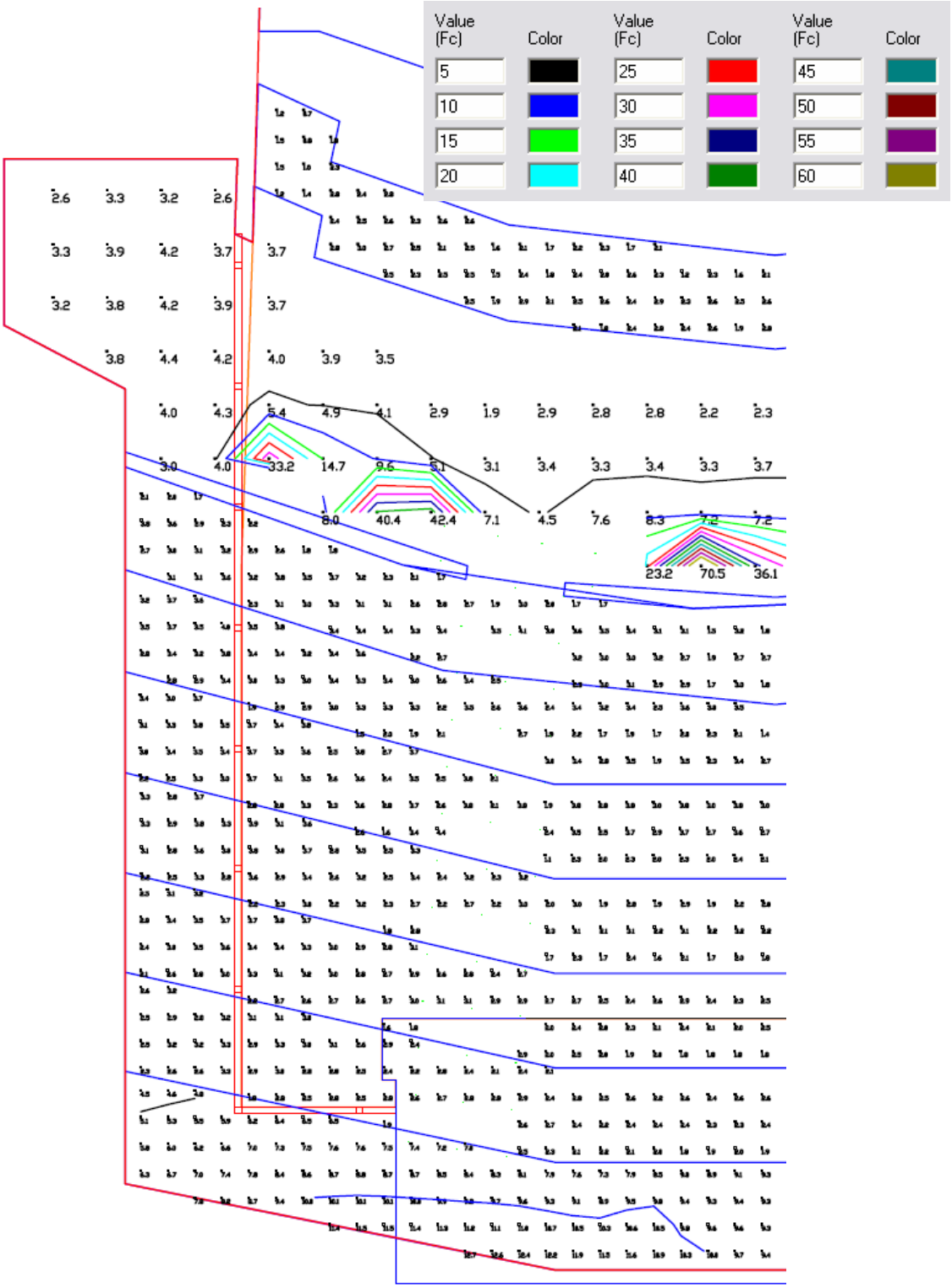
Scene 5

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.

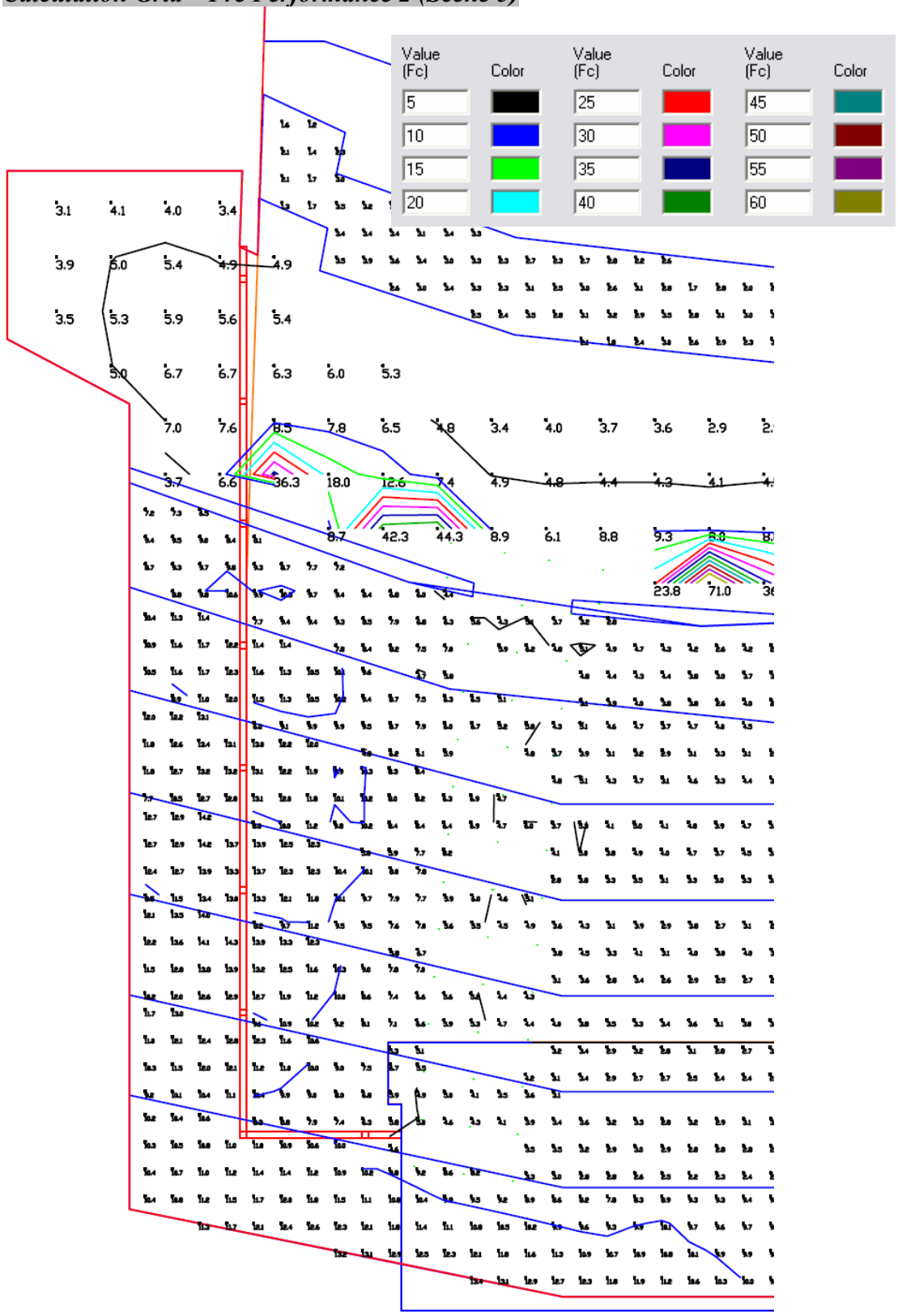
Calculation Grid – Educational 1 (Scene 2)



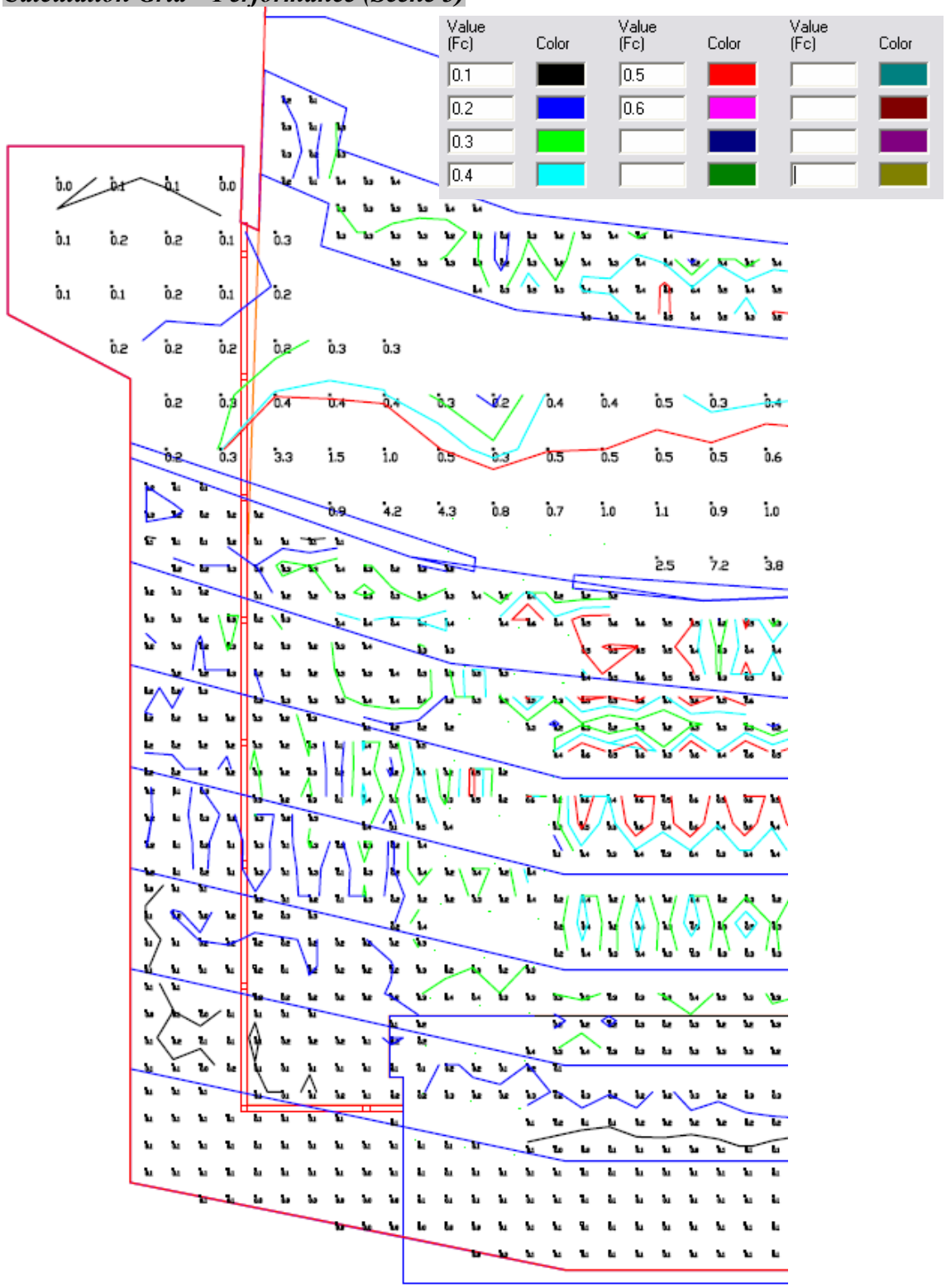
Calculation Grid – Pre Performance 1 (Scene 1)



Calculation Grid – Pre Performance 2 (Scene 5)

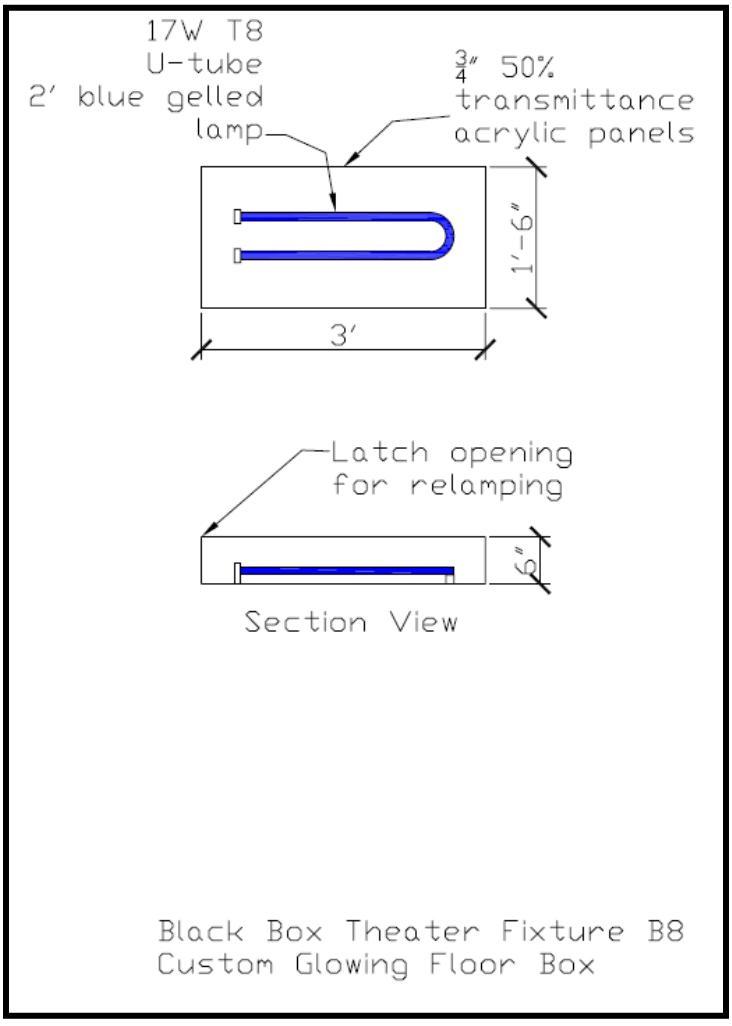


Calculation Grid – Performance (Scene 3)

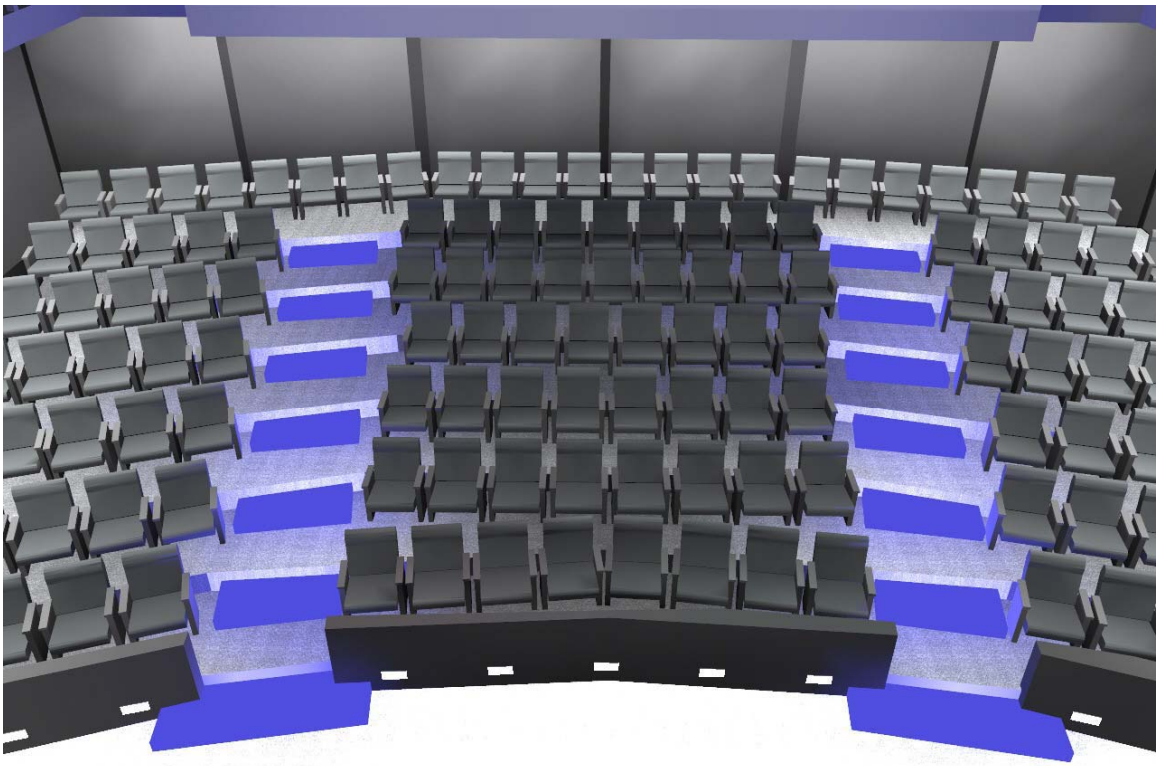


Theater Illuminance Values										
(in Footcandles)	Values	Bottom Row	Circultation Area	1st Row	2nd Row	3rd Row	4th Row	5th Row	6th Row	Top Row
Educational 1	Avg	29.16	33.12	30.05	32.45	31.21	27.56	23.34	17.12	14.54
(Scene 2)	Max	39.60	10.10	42.40	44.90	42.10	35.80	29.20	23.10	16.00
	Min	15.30	4.50	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

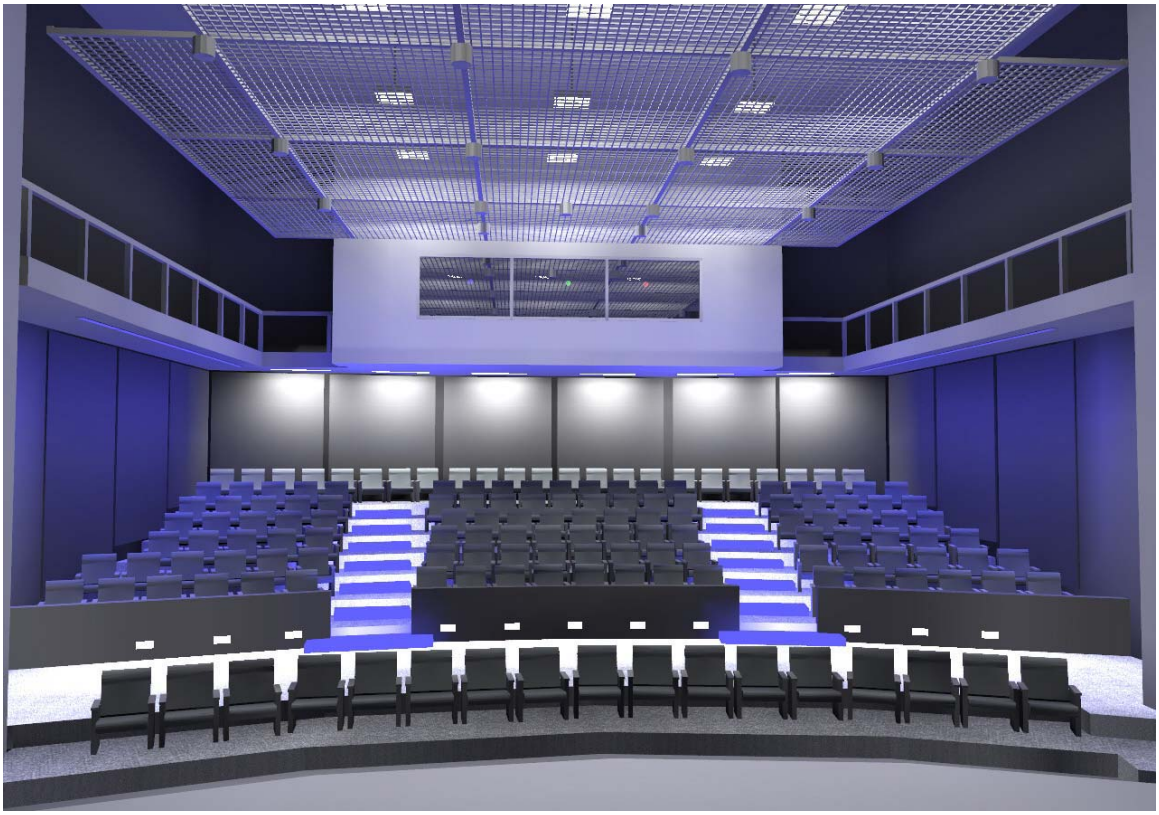
Fixture Details

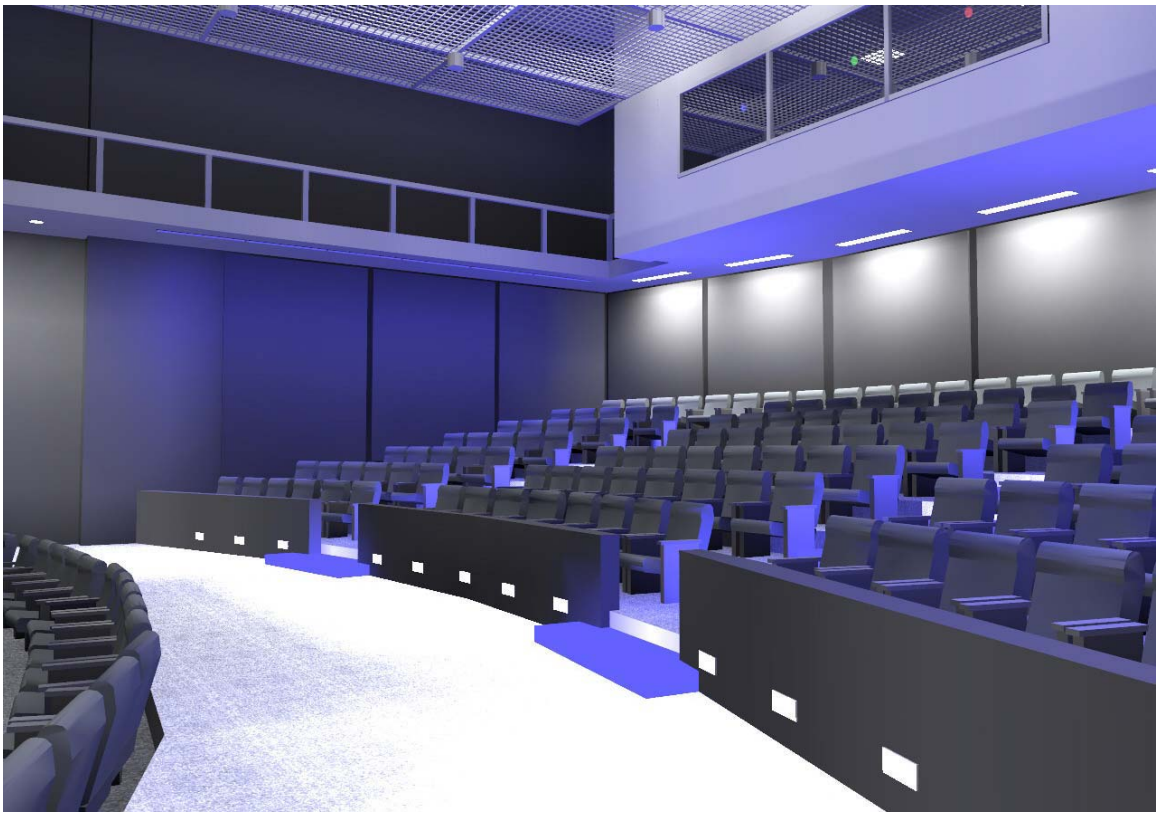


Renderings for All Scenes in Theater
Performance Entrance Example



Performance Entrance 1 – Scene 1





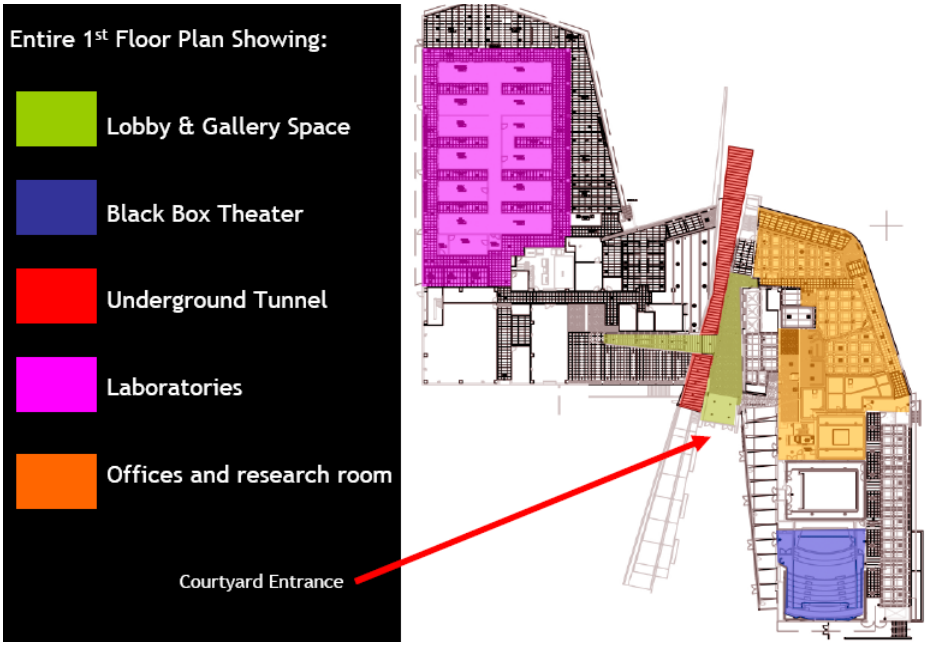
Educational Set-up – Scene 2

Conclusion

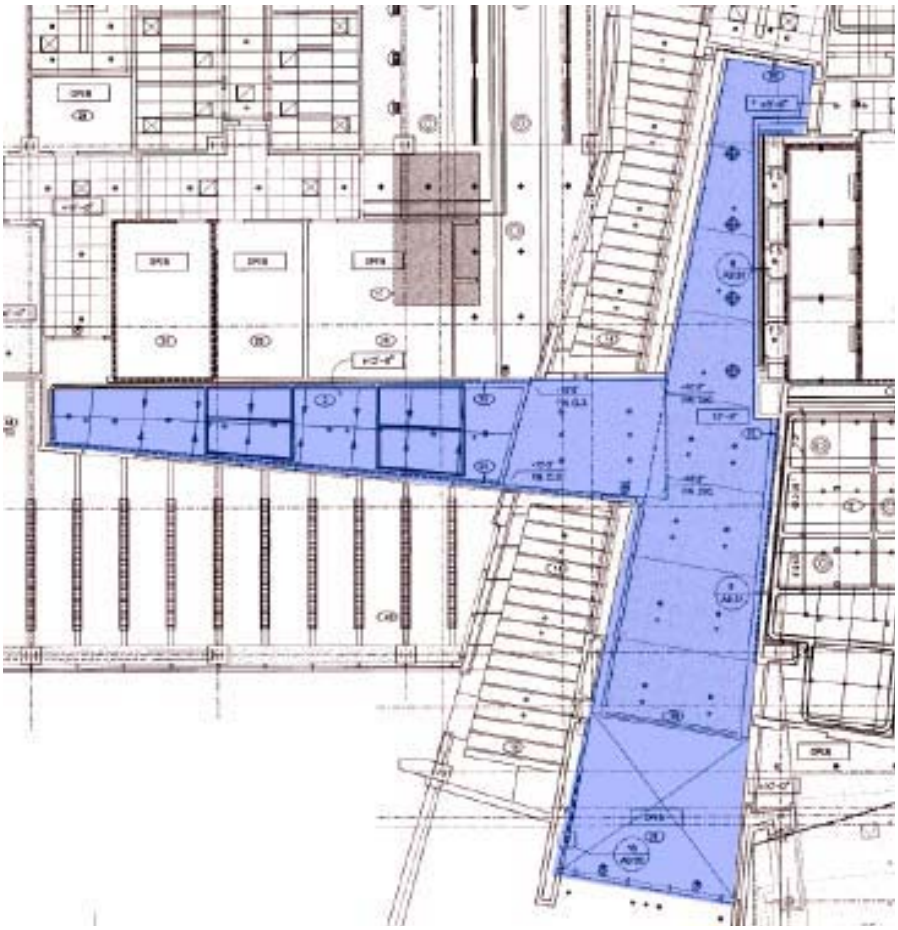
The Black-Box Theater is a multi-functional space. It can be used for educational purposes, small student performances, lectures, and guest speakers. Because of this broad range of tasks, the lighting must accommodate all of these in one system. I have created a multi-layered system that can be controlled 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

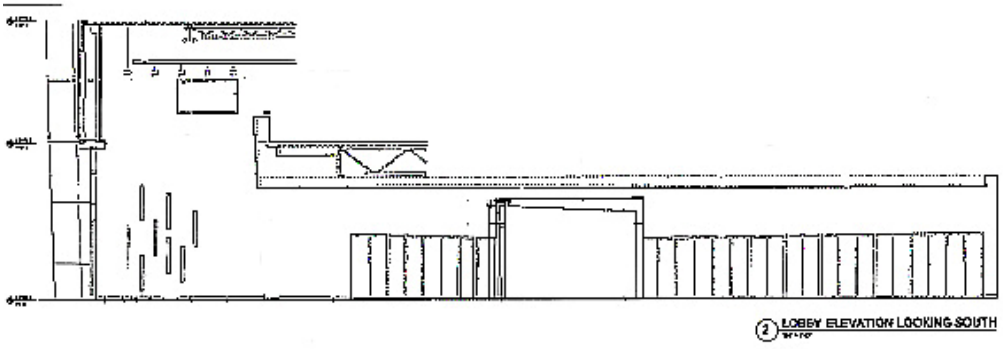
The main entrance lobby of Cal IT^2 is located on the first floor of building section B looking into the academic courtyard. The dark glassed façade leads into this space with a technological feel to it. The lobby is constructed with three different ceiling heights (entrance at 32 ft, main area at 12.75 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

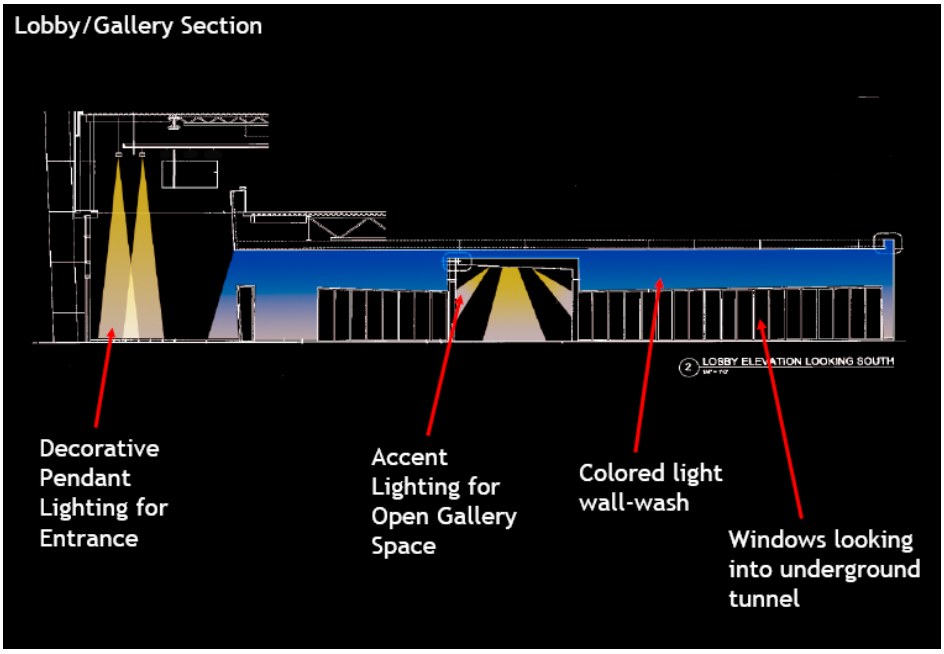
According to California Title 24 Energy Standards, a lobby's power density should be < 1.5 W/SF.

Schematic Design

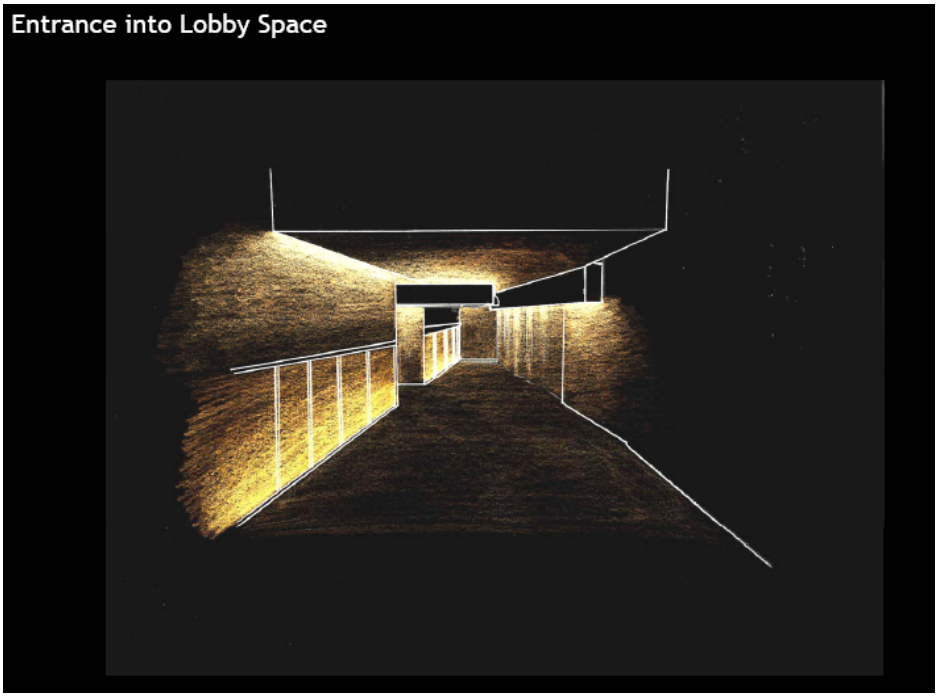
In my redesign, I intend to use light as the guiding tool for people to follow. Upon first entering the large open area of the entrance, one will be able to gaze up at the large clean lined custom fixtures hanging in various lengths from the 32 ft ceiling. As you continue through the space, coves of 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** 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** 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** Description: 6" recessed compact fluorescent downlight with 1-CFTR32W lamp. Optics: anodized aluminum parabolic reflector.	1-CFTR32W lamp	Location: Lobby
B17		**Erco 88120.023** Description: 6" recessed halogen accent light with 1-MR16 50W max lamp.	1-MR16 50W max lamp	Location: Lobby
B18		**Zumtobel Staff SLR2-*-1285-*** Description: Recessed fluorescent downlight with (1) 28W T5 lamp in cross section.	(1) 28W T5	Location: Lobby
B19		**D'AC Custom Design** 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

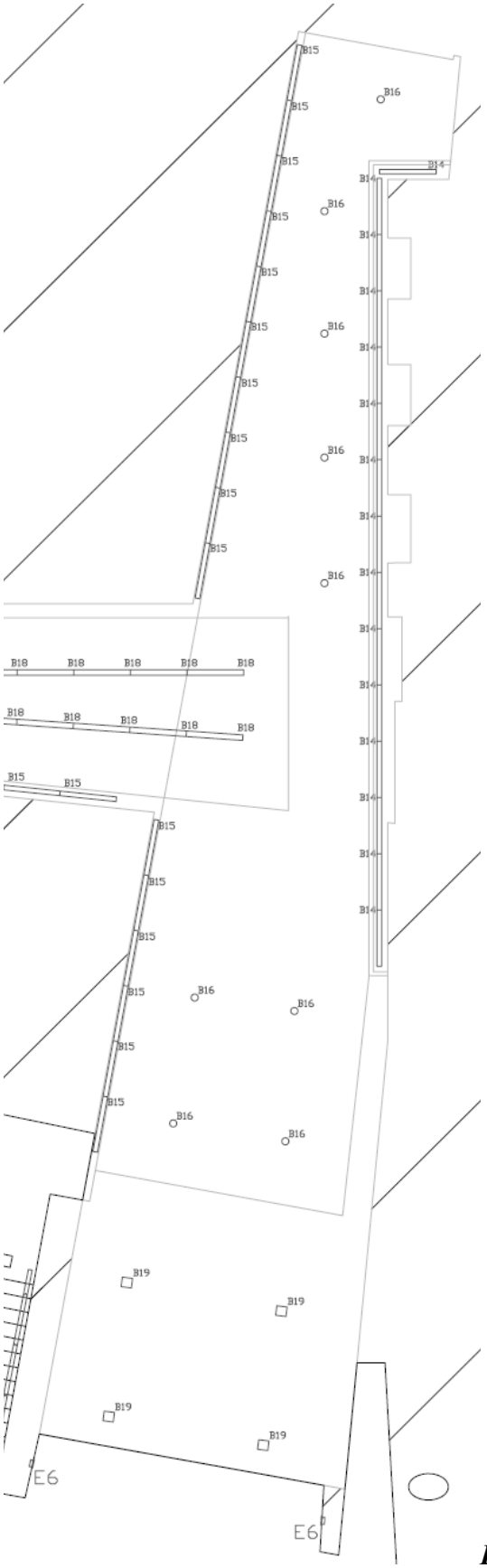
Designation	Manufacturer	Type	Bulb	Wattage	CCT	CRI	Relevant Fixtures
A	Philips	Fluorescent	T8 FL	32W	4100K	86	B1,B2,B10,B13,B14,B15,E7,E11,E12
B	Philips	Compact FL	CFTR	32W	4100K	82	B3,B5,B6,B16
C	Philips	Compact FL	CFT	13W	3500K	82	B7
D	Sylvania	Fluorescent	FBT8 FL	17W	3500K	82	B8
E	Philips	Compact 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.

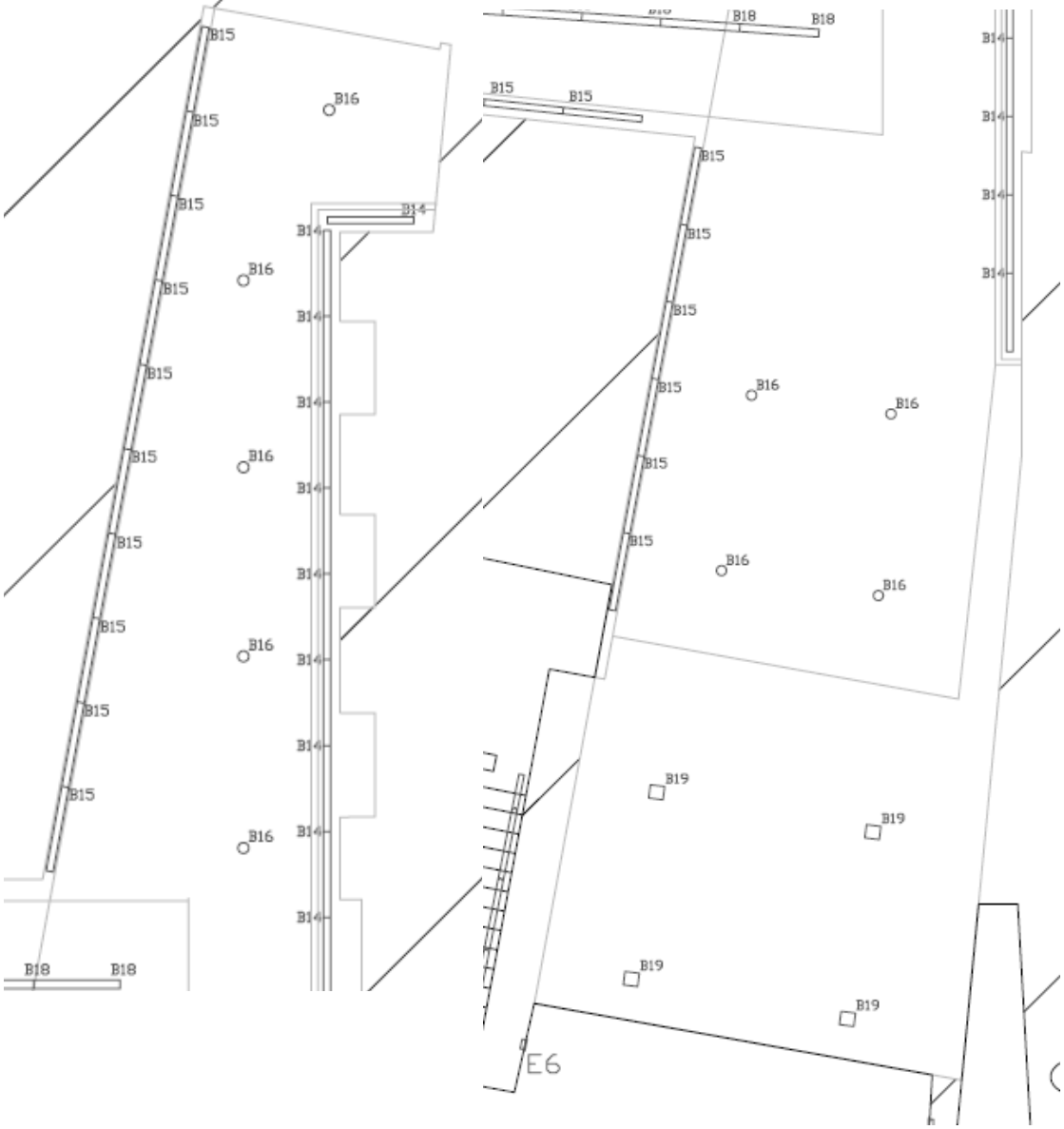
Power Density					
Fixtures	Fixture Count	Watts	Total watts	SF	W/SF
B14	16	29.5	472		
B15	36	29.5	1062		
B16	9	36	324		
B17	7	50	350		
B18	26	30	780		
B19	4	72	288		
			3276	2410	1.36

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.

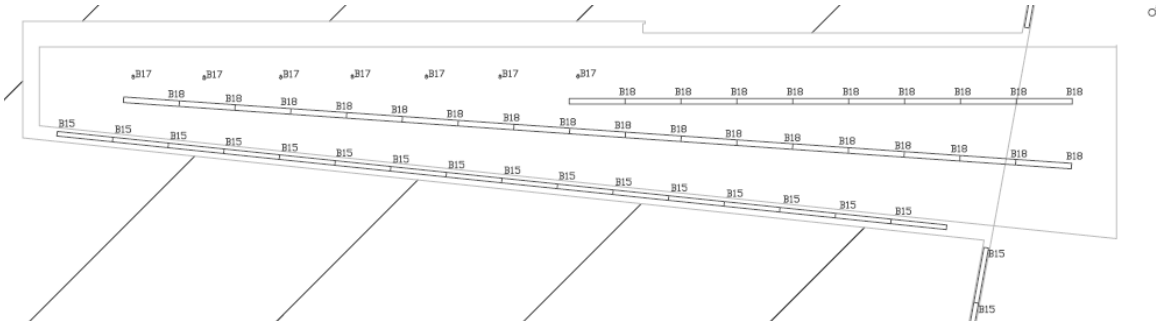


Entire Lobby Section Lighting Plan

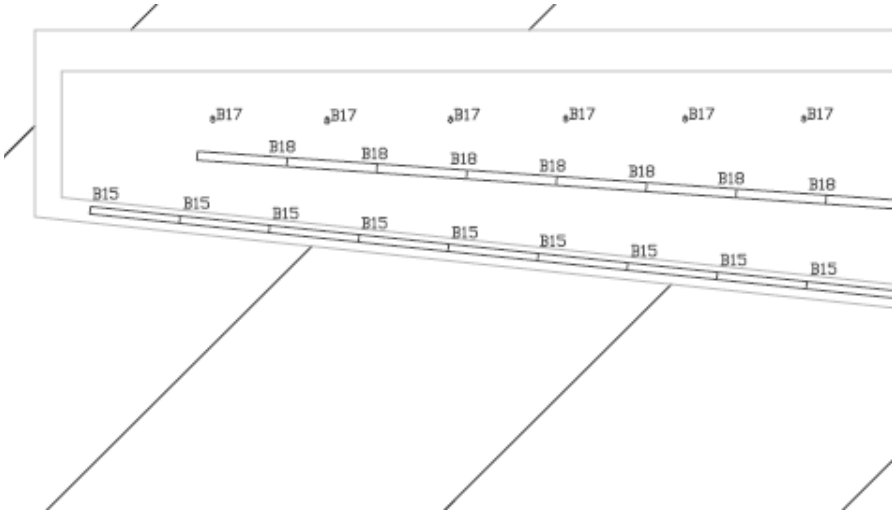
Lobby Close-up Lighting Plan of West and East End



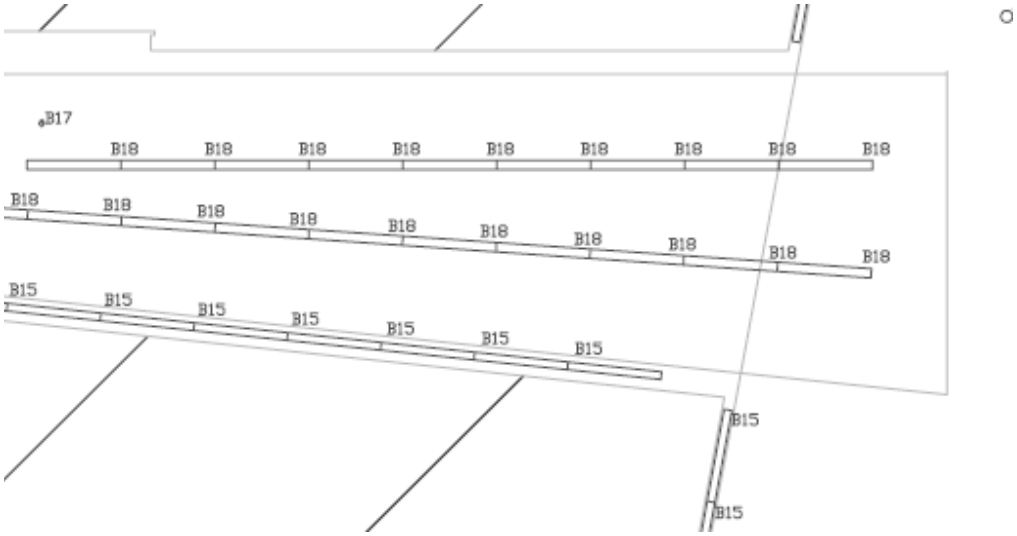
Entire Gallery Lighting Plan



Far South End of Gallery

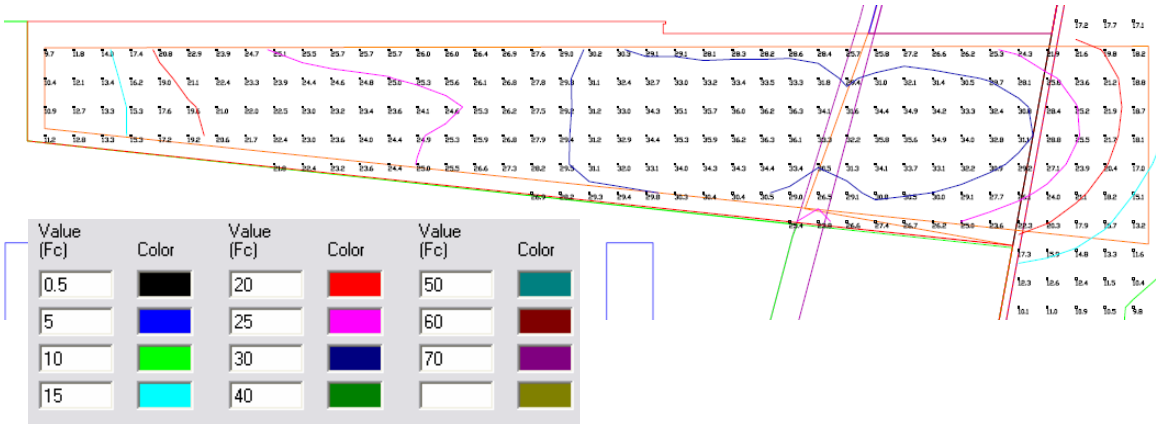


Gallery Continued

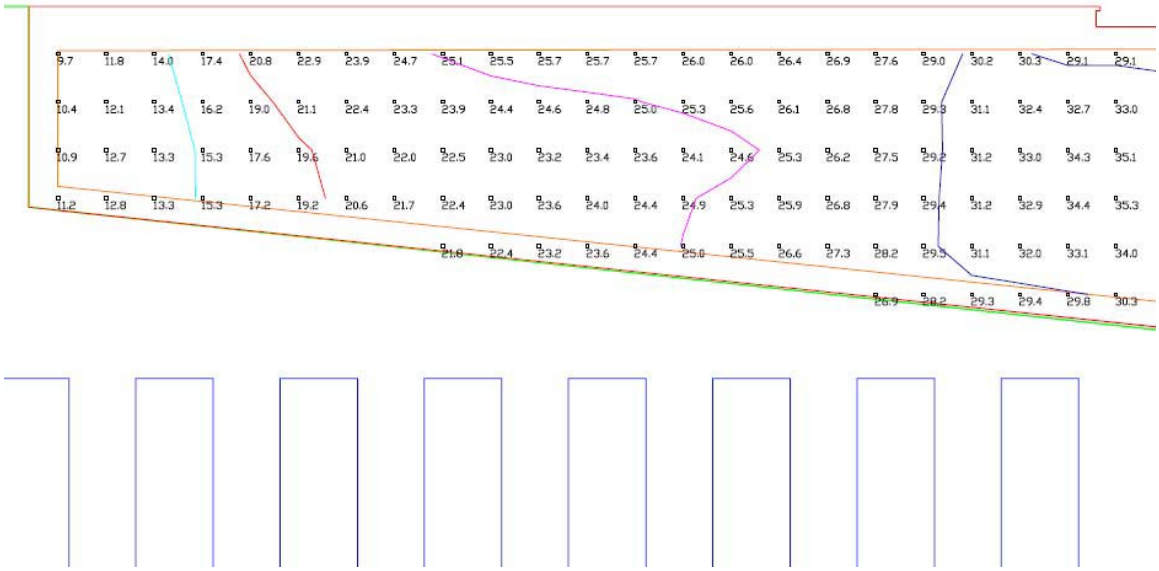


Calculation Grid – Lobby

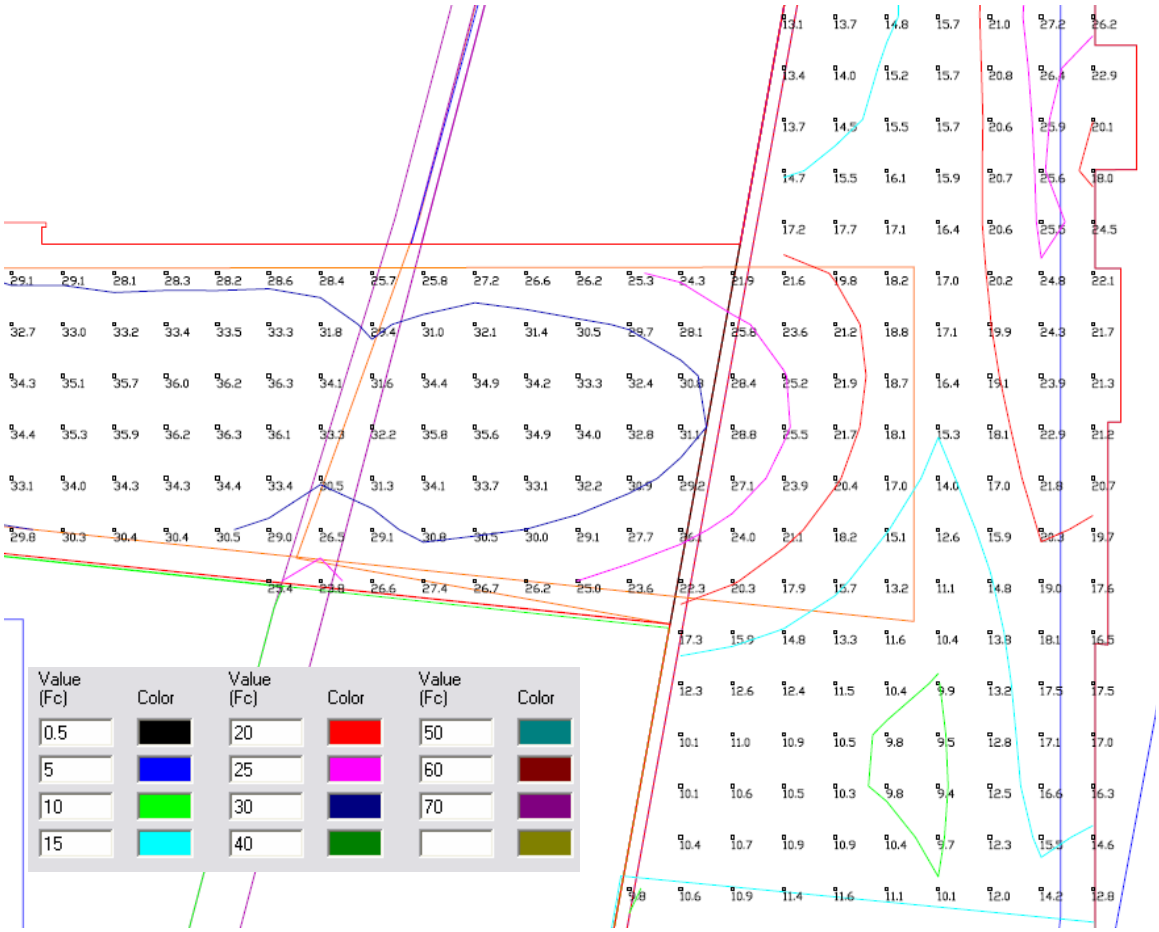
Calculation Grid – Gallery



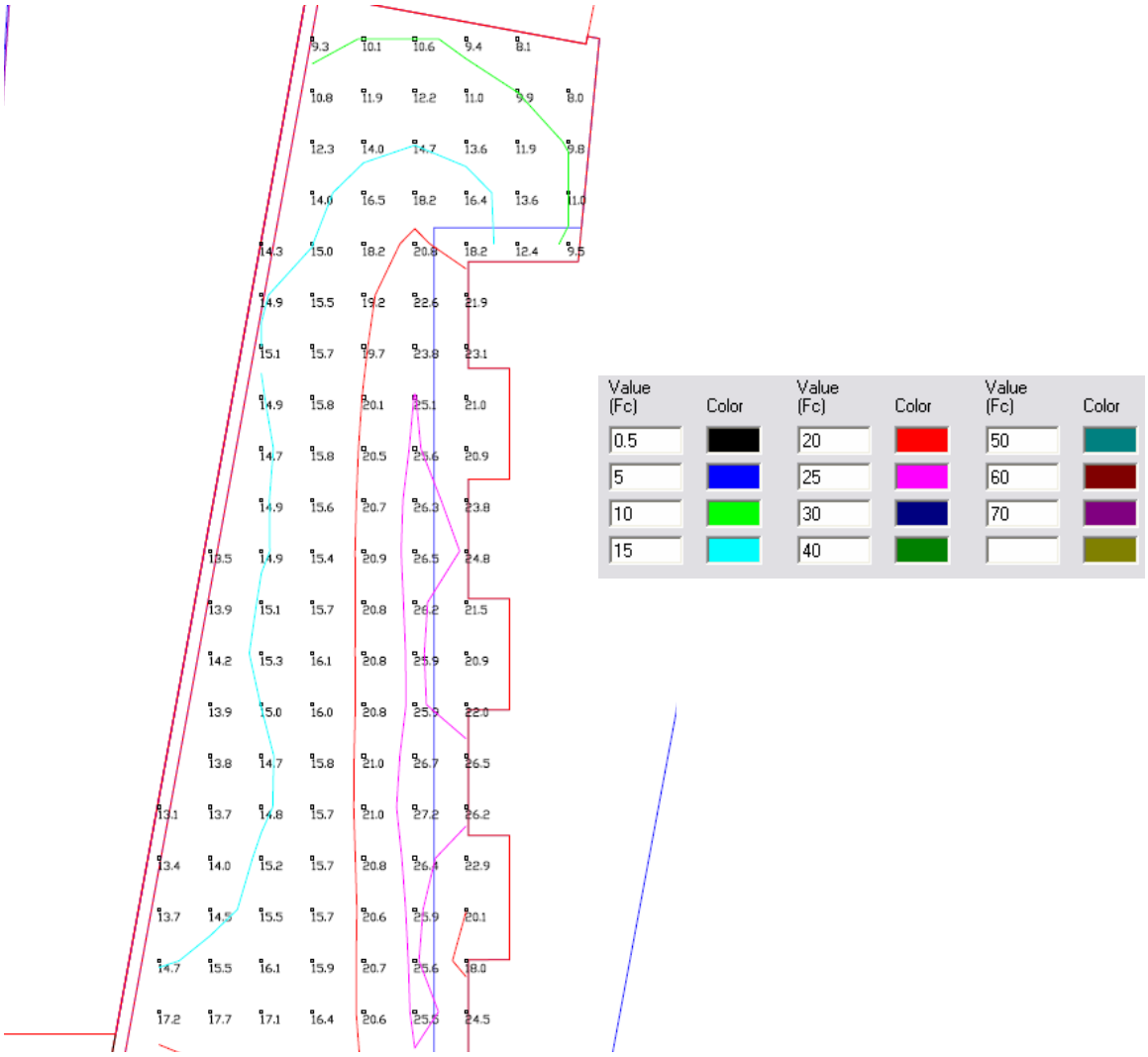
End of Gallery Hallway



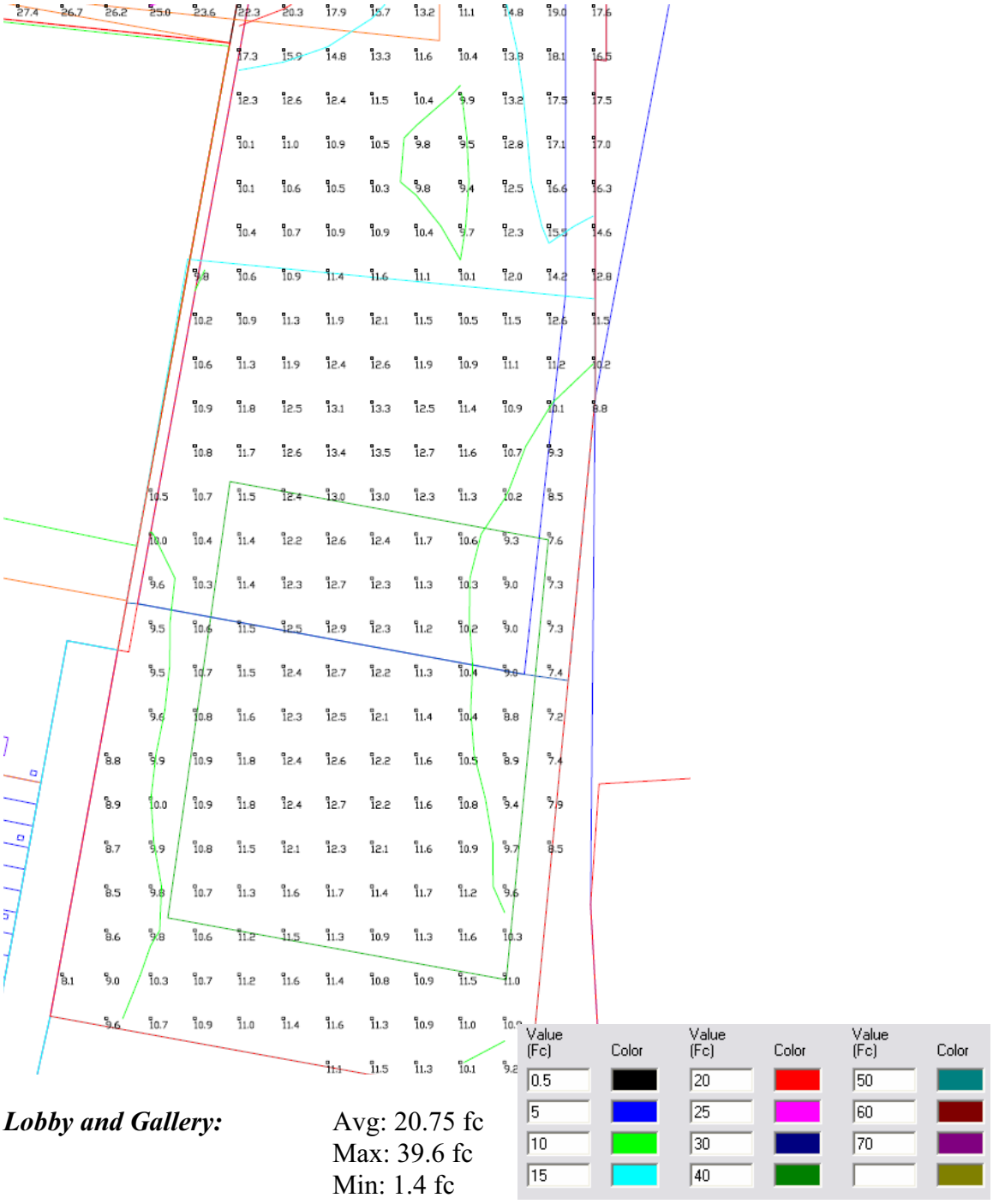
Intersection of Gallery and Lobby



End of Lobby Hallway



Lobby Entrance Space

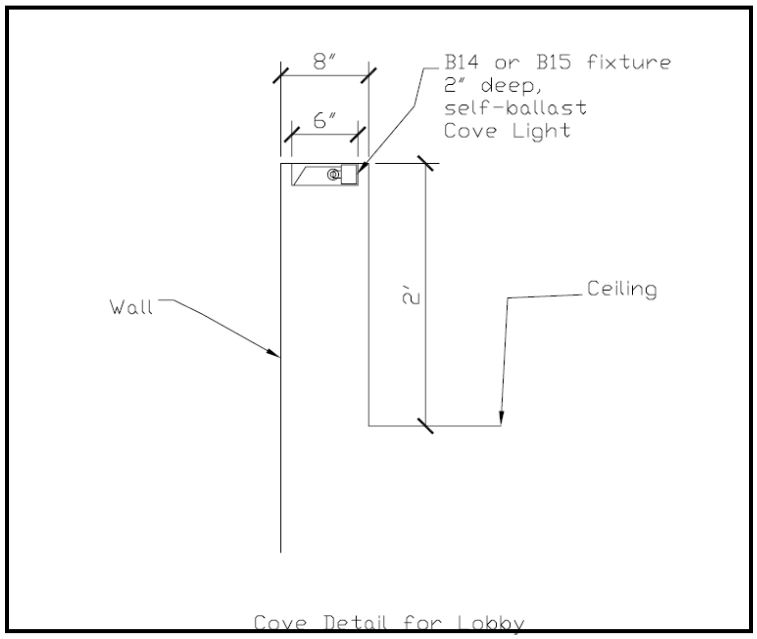


Lobby and Gallery:

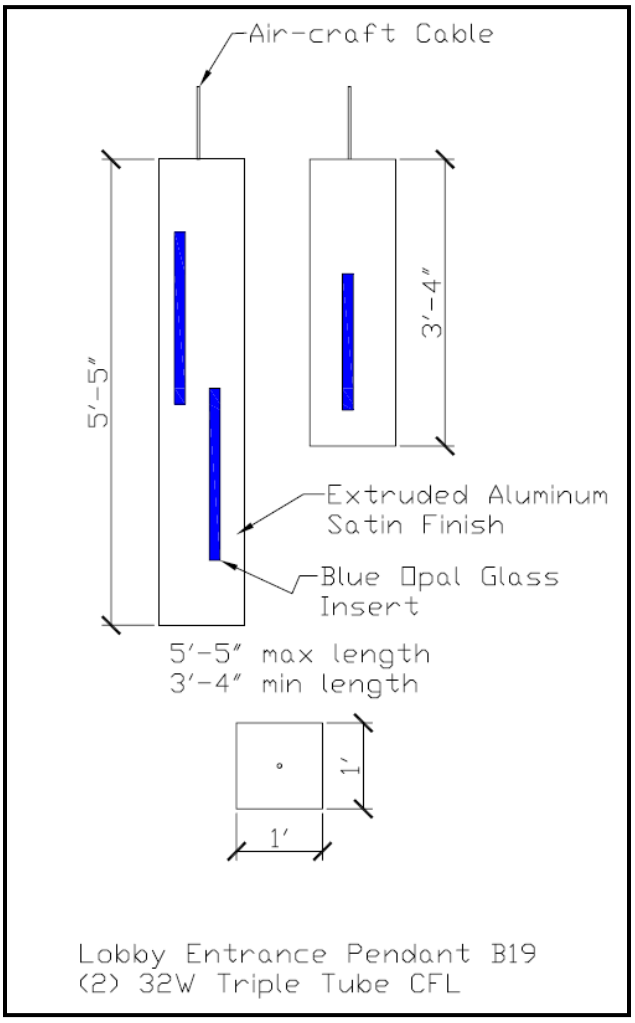
Avg: 20.75 fc
Max: 39.6 fc
Min: 1.4 fc

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



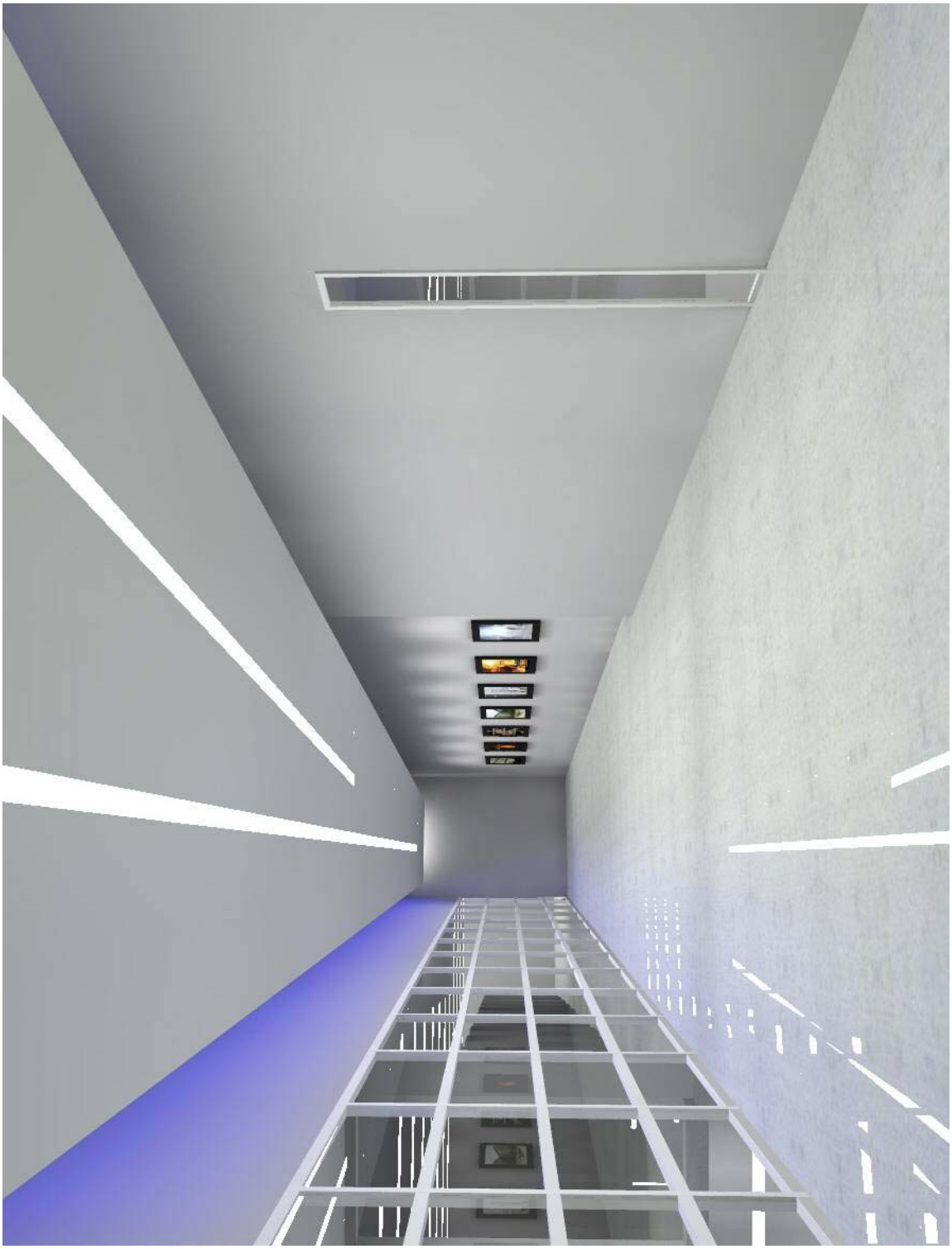
Cove Detail for Lobby



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

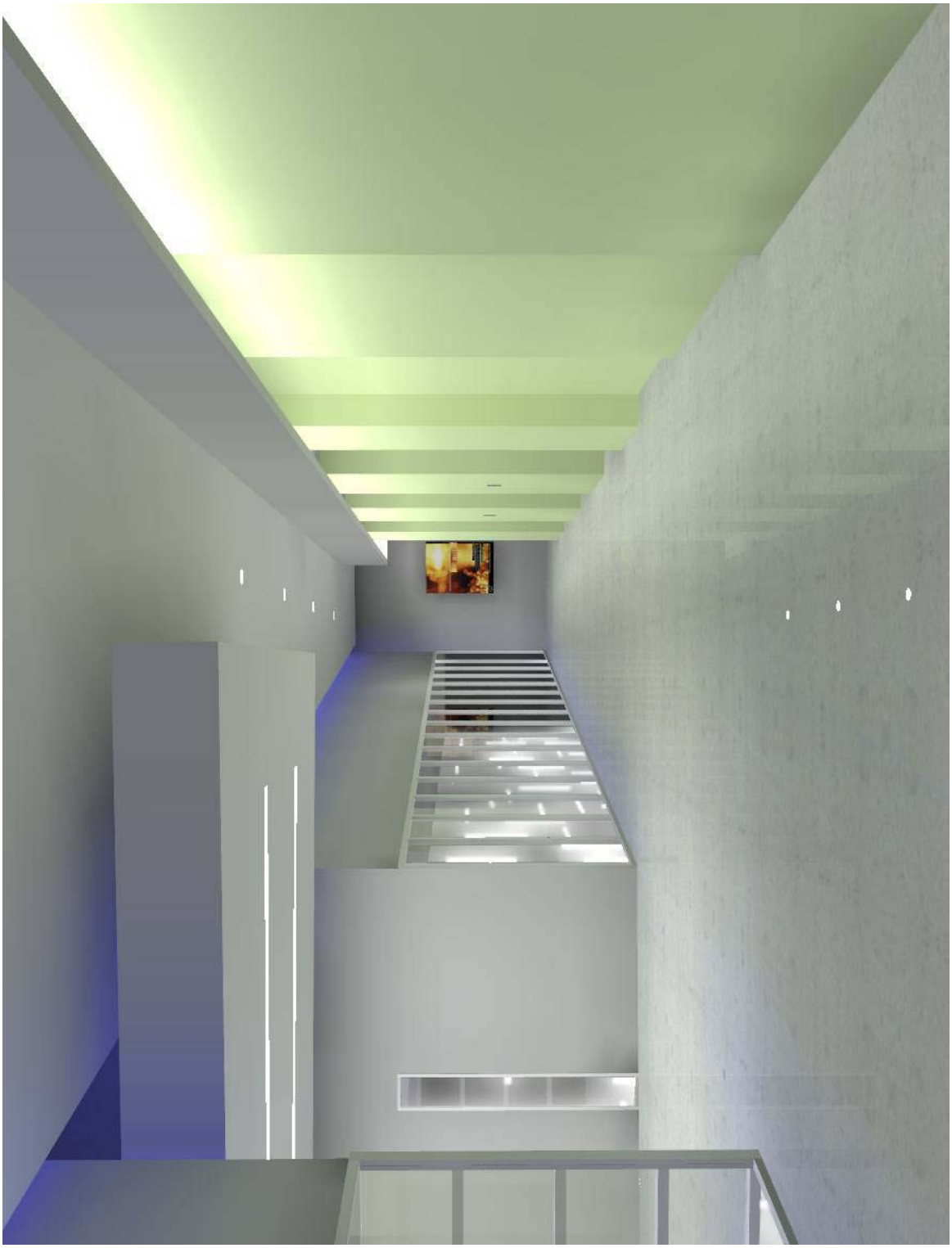
Renderings for the Main Lobby/Gallery

Gallery Corridor – Everything On



Gallery Corridor – Only Accent and Cove On

Lobby Corridor



Lobby Corridor

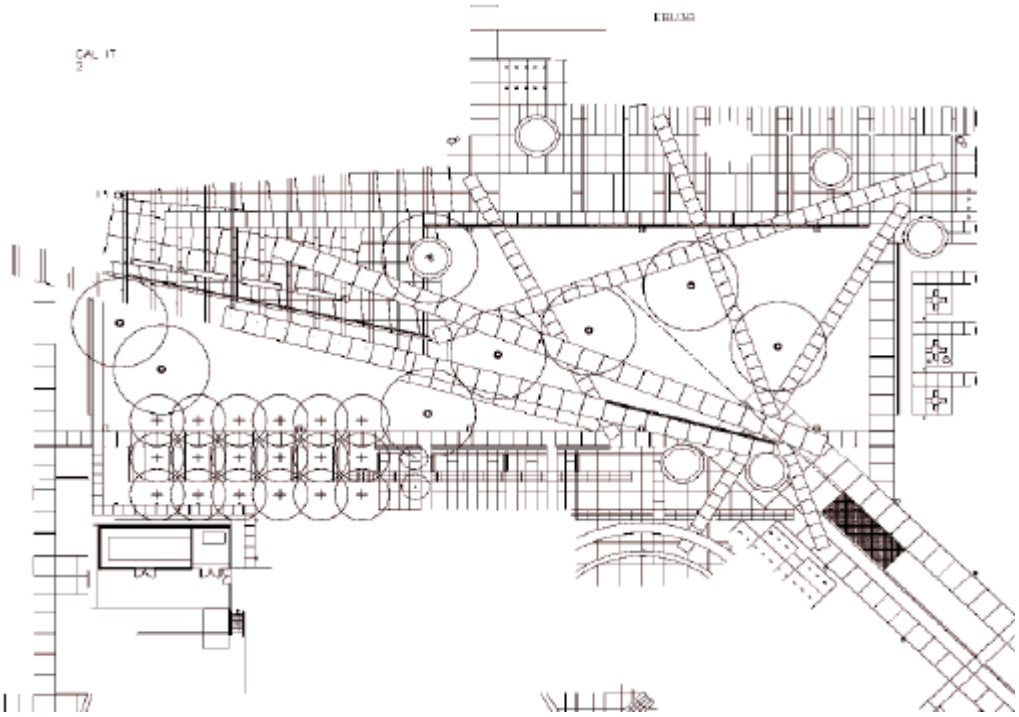
Lobby Exterior View

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

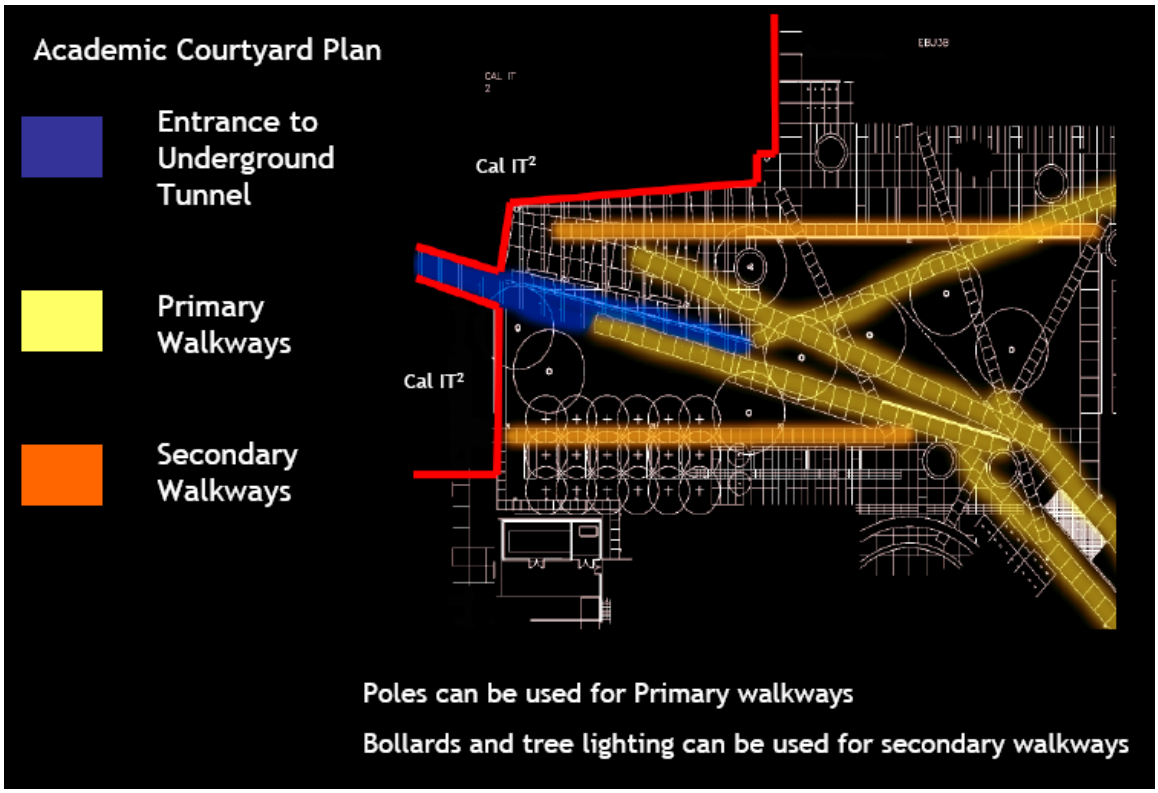
For these particular fixtures, the color temperature will be very low (1700K). The low pressure sodium lamps create a deep orange glow which won't render certain colors very well. By adding another layer of cooler color temperature metal halide lamps, better color rendering will be possible.

Power Density

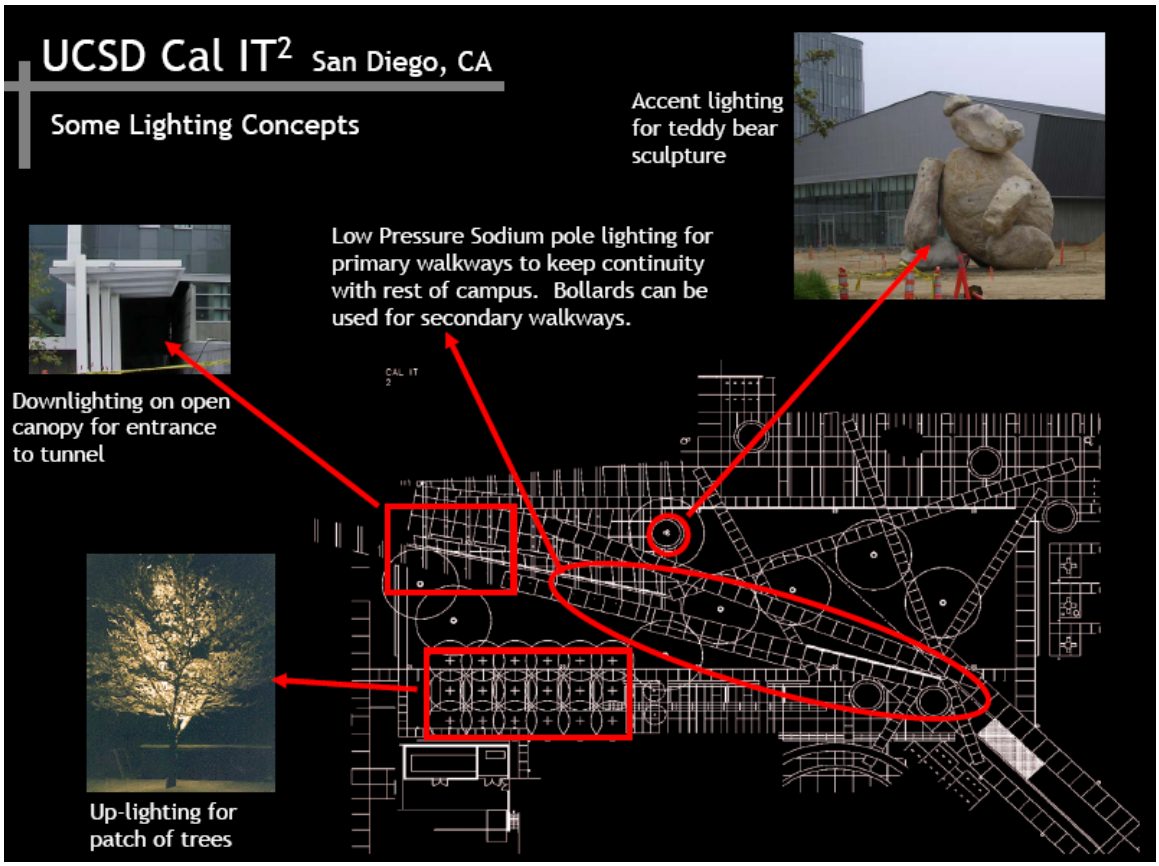
According to California Title 24 Energy Standards, an exterior courtyard's power density should be < 0.2 W/SF.

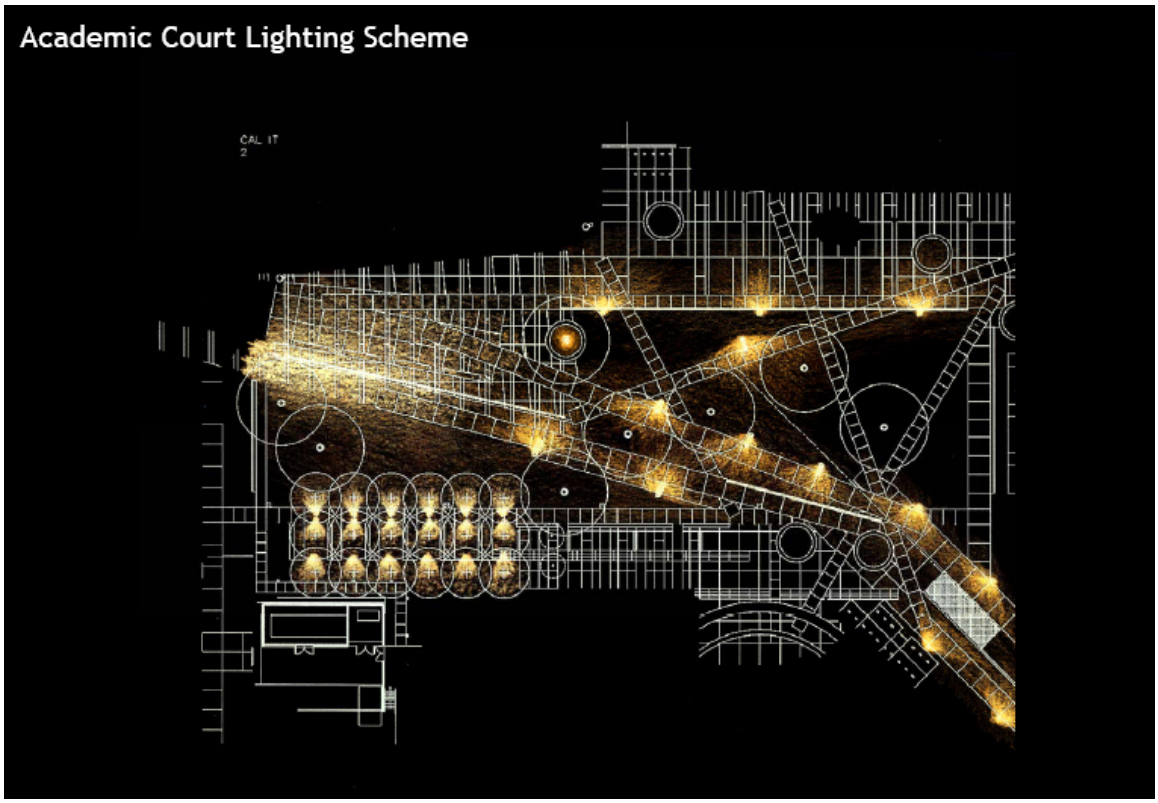
Schematic Design

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.

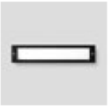


The following two concept diagrams exhibit the ideas described above. In my redesign, the only concept I changed since the schematic was the accent lighting on the sculpture. I didn't want the sculpture to be highlighted since the main focus of the courtyard is really the glowing Cal IT^2 building.


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** Description:	(1) 135W LPS	Location: Academic Court
E2		**Bega 8534MH** 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** 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-*** 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** 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 *** 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** 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-*** 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** 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** 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

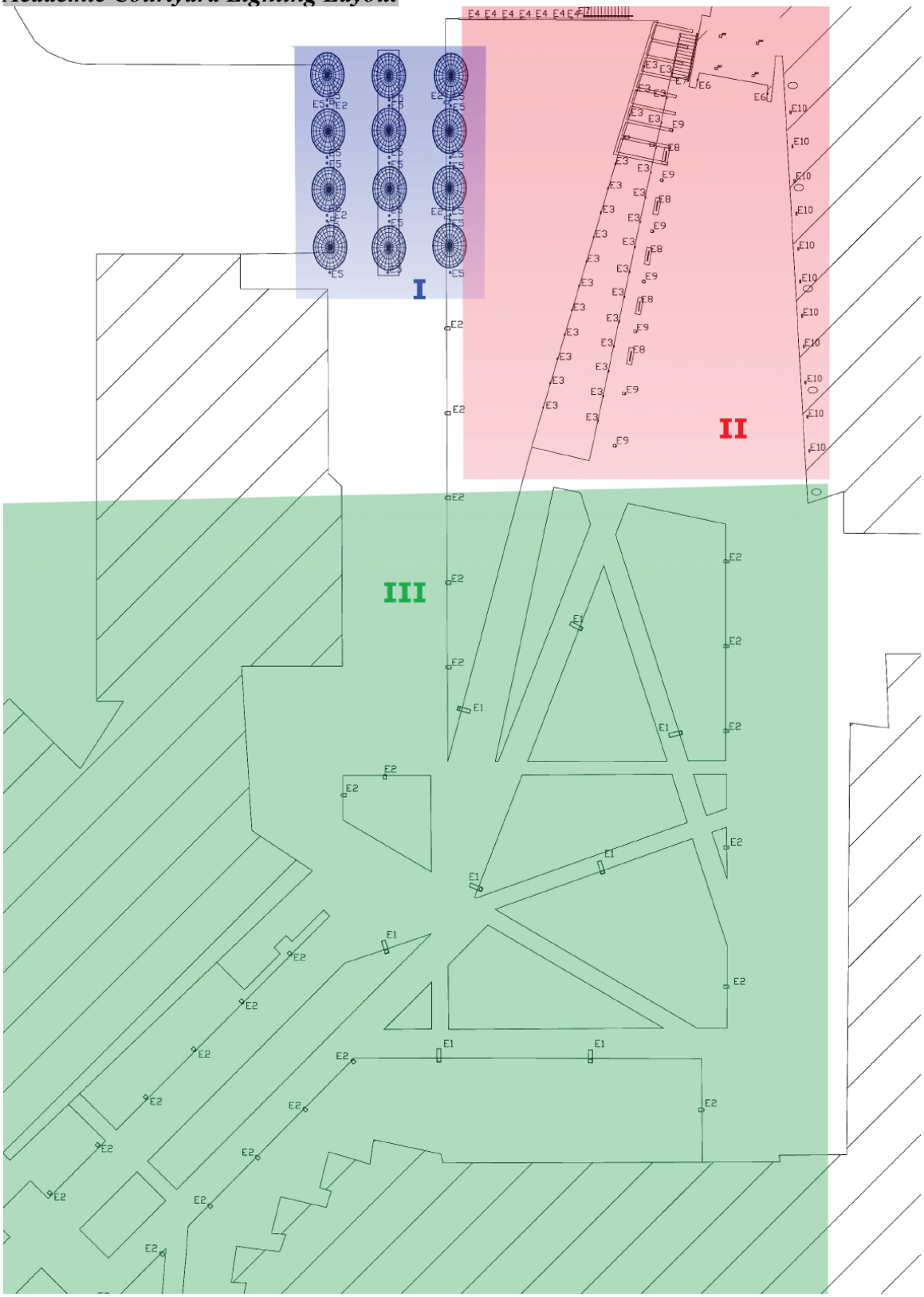
Light Loss Factors								
Type	Cleaning Interval	Category	BF	LLD	LDD	RSDD	LLF	Location
E1	12 Months (Medium)	V	1.00	1.00	0.78	0.94	0.73	Academic Courtyard
E2	12 Months (Medium)	V	1.00	0.76	0.78	0.94	0.56	Academic Courtyard
E3	12 Months (Medium)	V	0.92	0.85	0.78	0.94	0.57	Academic Courtyard
E4	12 Months (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.

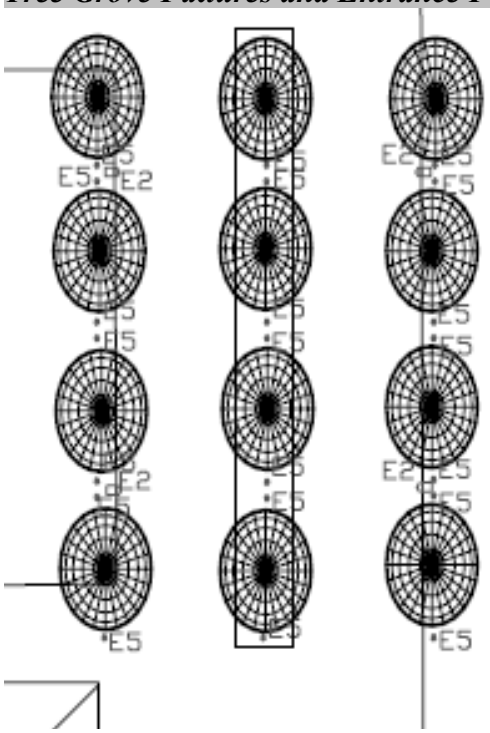
Power Density					
Fixtures	Fixture Count	Watts	Total watts	SF	W/SF
E1	8	135	1080		
E2	29	44	1276		
E3	29	14	406		
E4	7	24	168		
E5	21	50	1050		
E6	4	30	120		
E7	8	29.5	236		
E8	5	10	50		
E9	7	44	308		
E10	11	79	869		
			5563	61000	0.09

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.

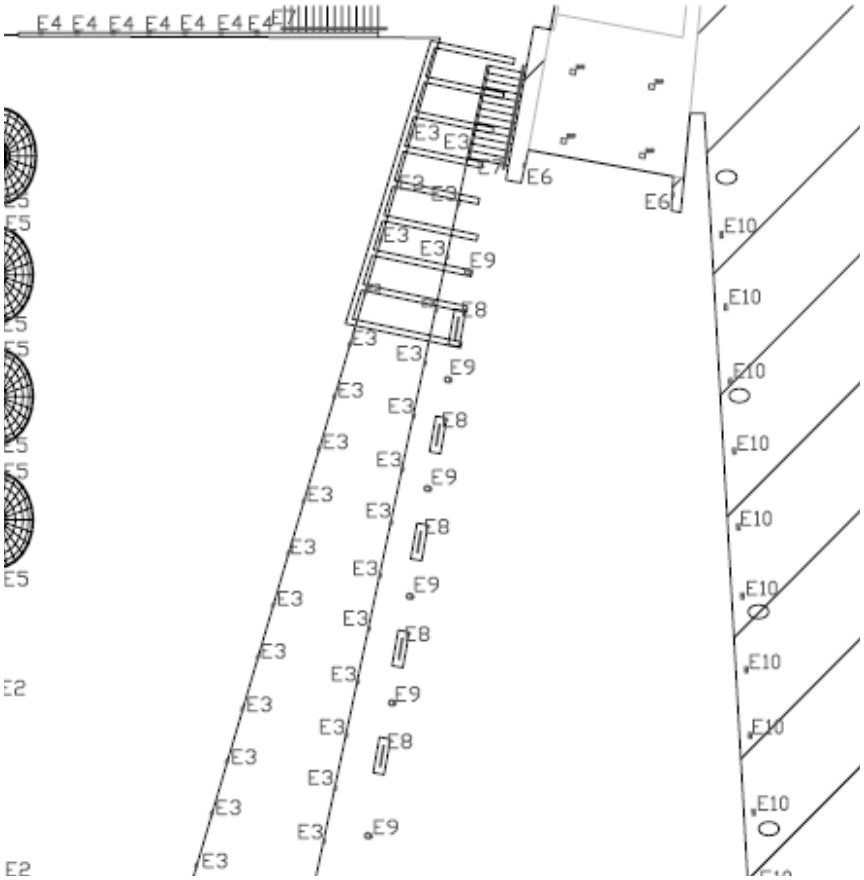
Academic Courtyard Lighting Layout



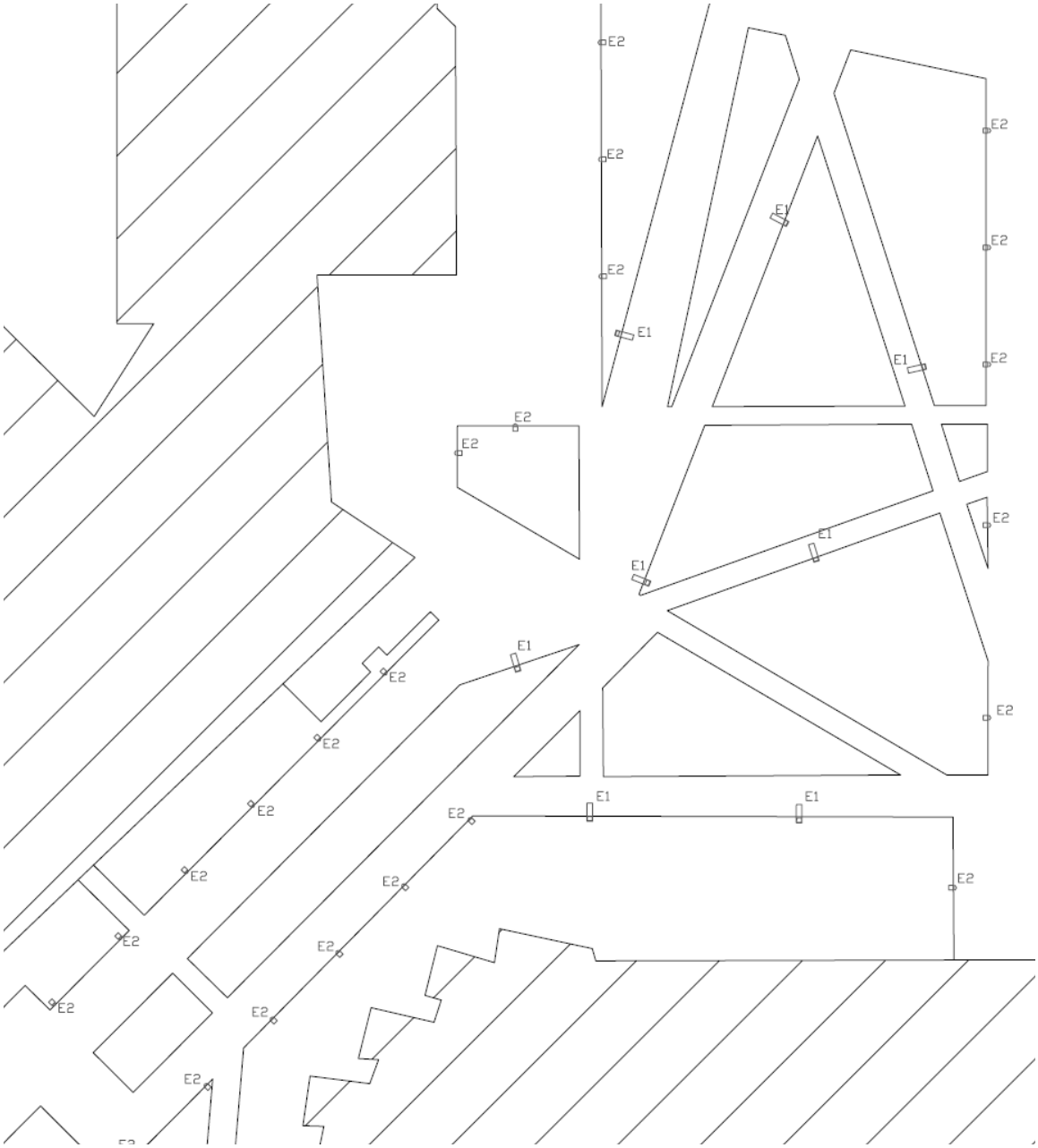
Tree Grove Fixtures and Entrance Fixtures - I



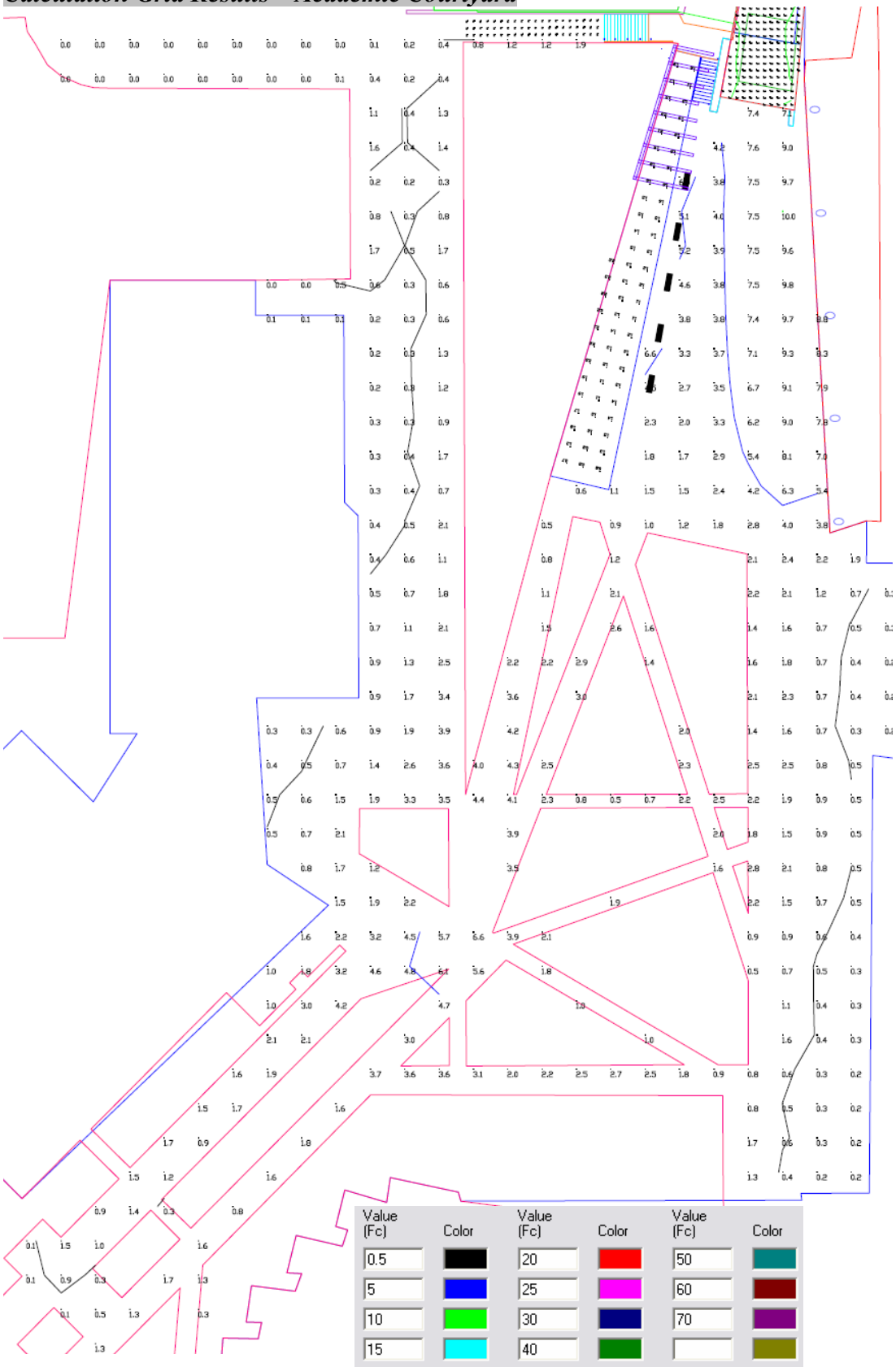
Courtyard Patio Area - II



East Side of Courtyard - III



Calculation Grid Results – Academic Courtyard



Calculation Results

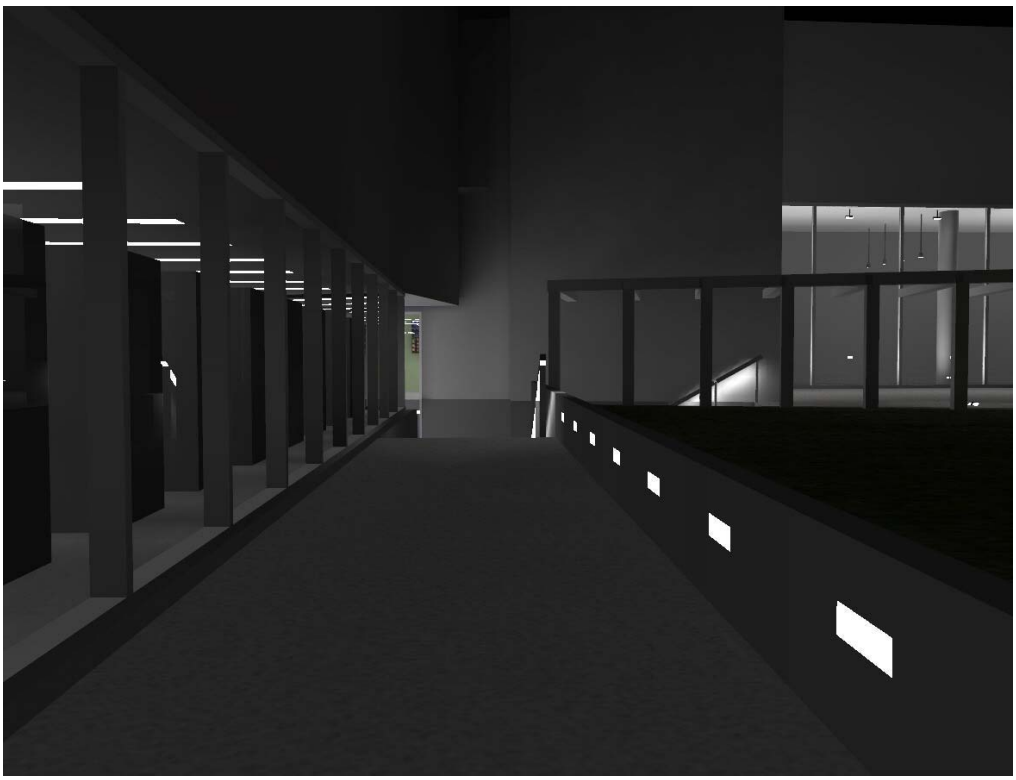
Pathways Illuminance:	Avg: 2.10 fc Max: 11.2 fc Min: 0.0 fc
Ramp leading to Tunnel:	Avg: 1.59 fc Max: 2.4 fc Min: 0.8 fc
Walkway beside server room:	Avg: 1.2 fc Max: 5.3 fc Min: 0.6 fc

Renderings for Academic Courtyard
Ramp Entrance to the Tunnel

Stair Detail

Tree Grove Near Building

Walkway to Stairs



South East entrance to Academic Courtyard

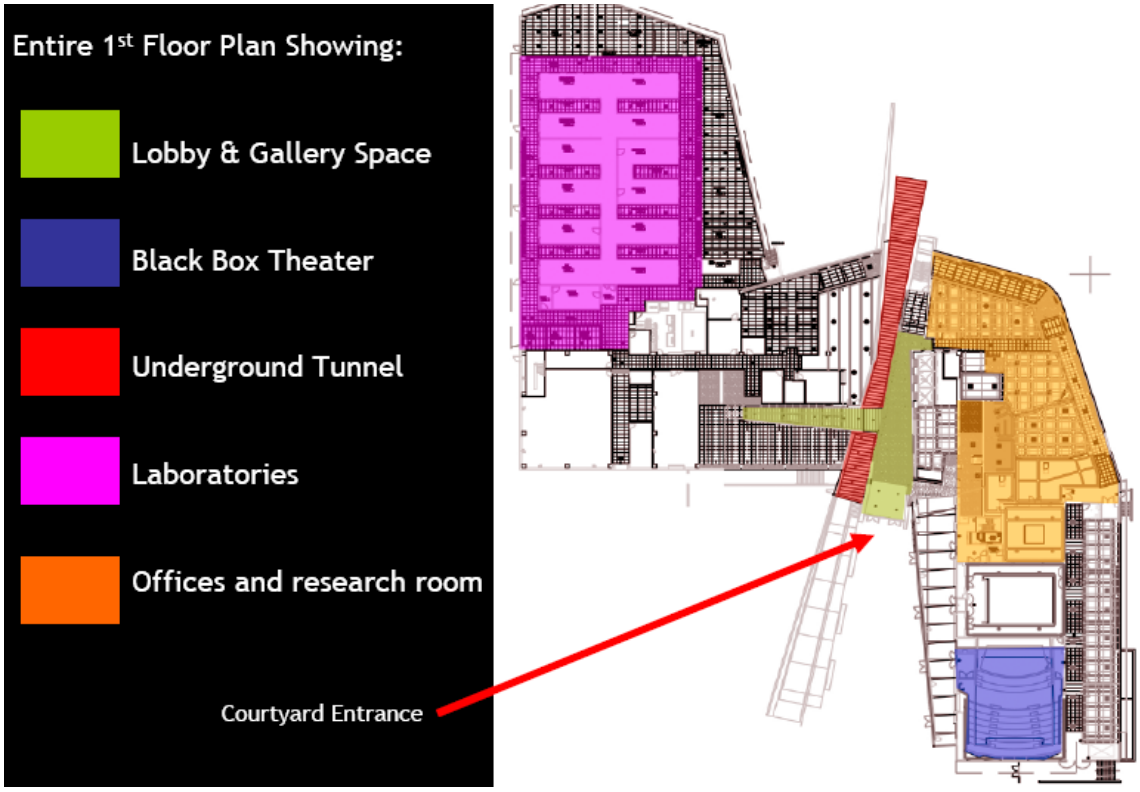
Sky View Looking Down on Courtyard

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

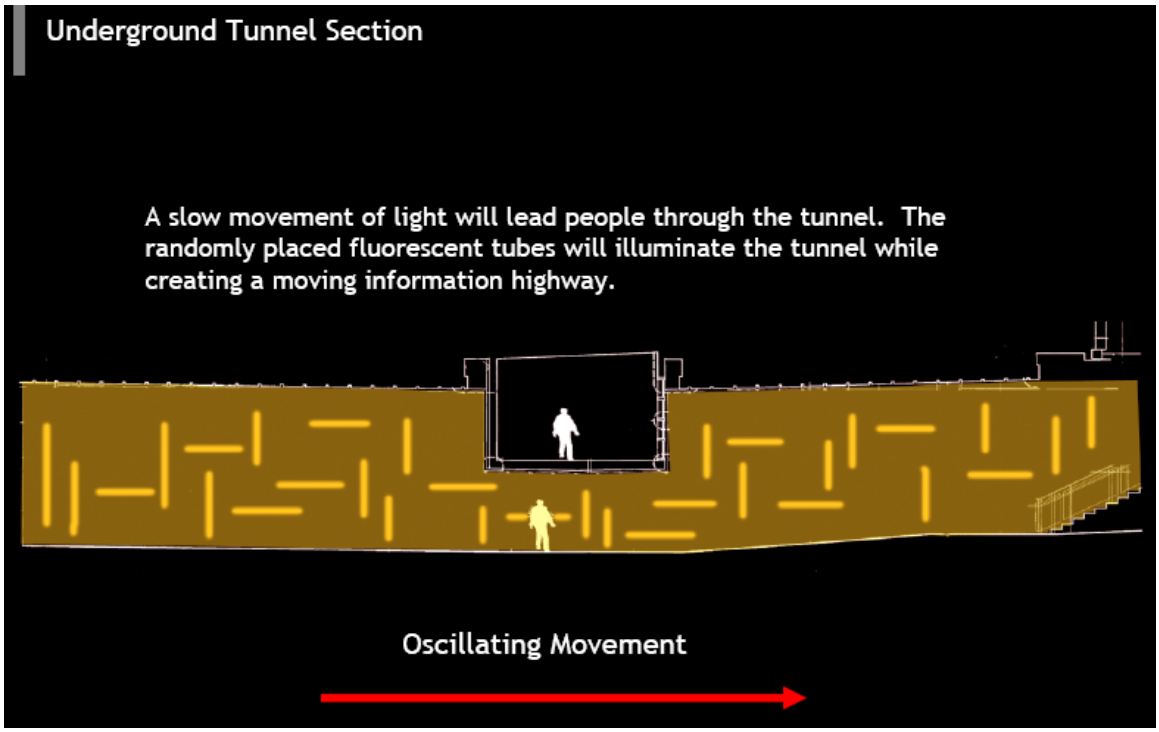
Glare could be a major issue with a large lighting display integrated into the entire wall of the tunnel. 60% transparent acrylic will be used to diffuse the light and make the light boxes less intense. The reflections from the corresponding windows on the other side of the tunnel will also be an issue.

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** 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-*** 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

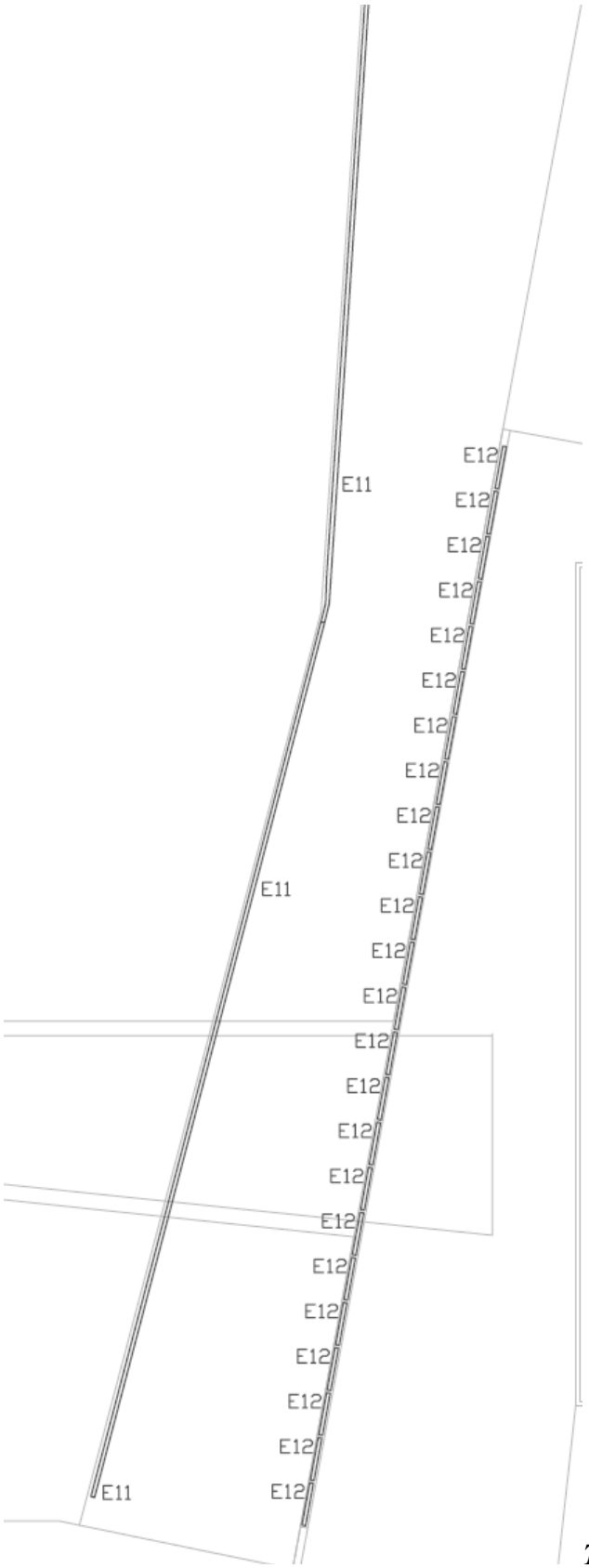
Ballast Schedule

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

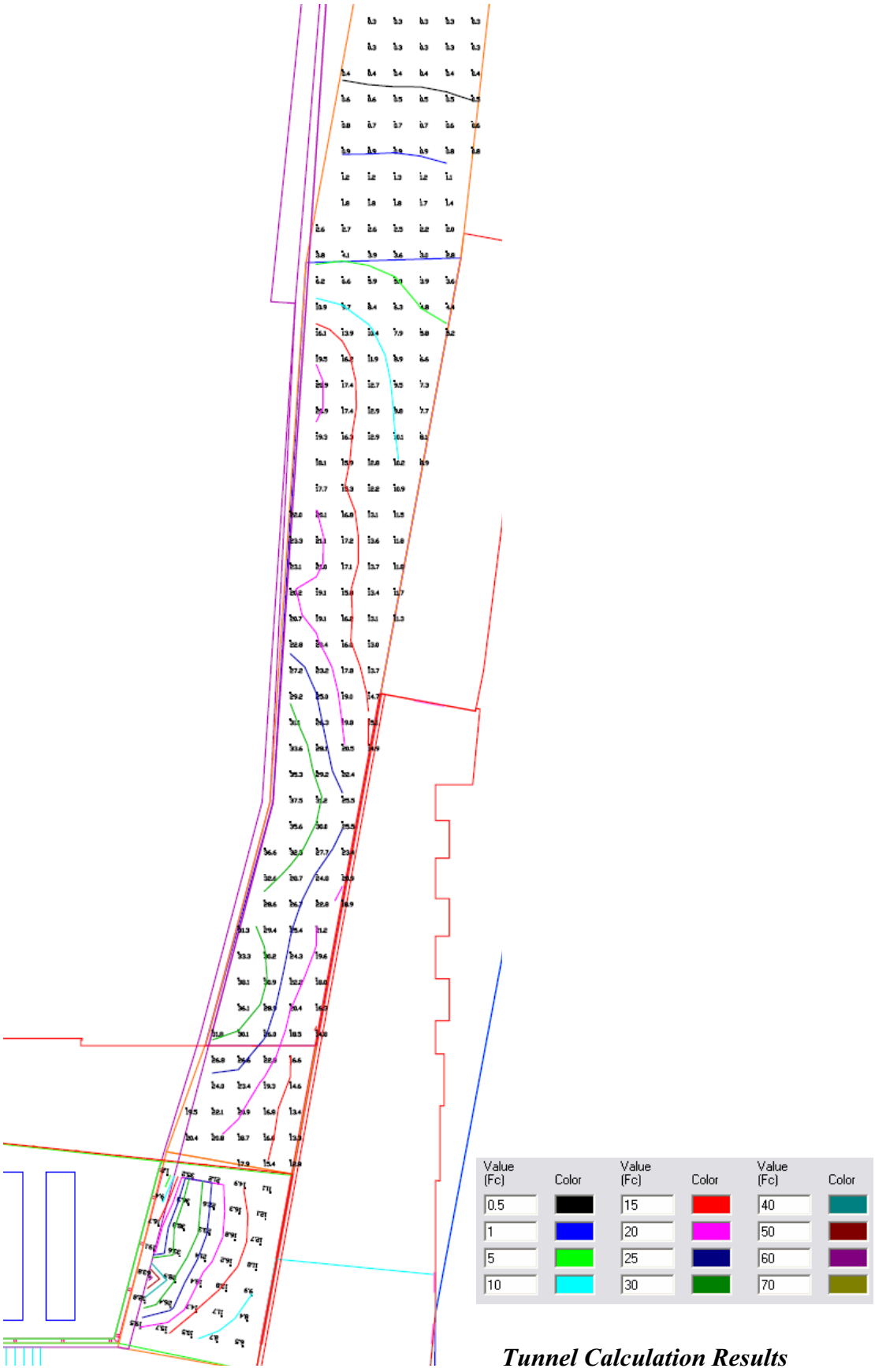
All ballast cut-sheets can be found in the appendix.

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



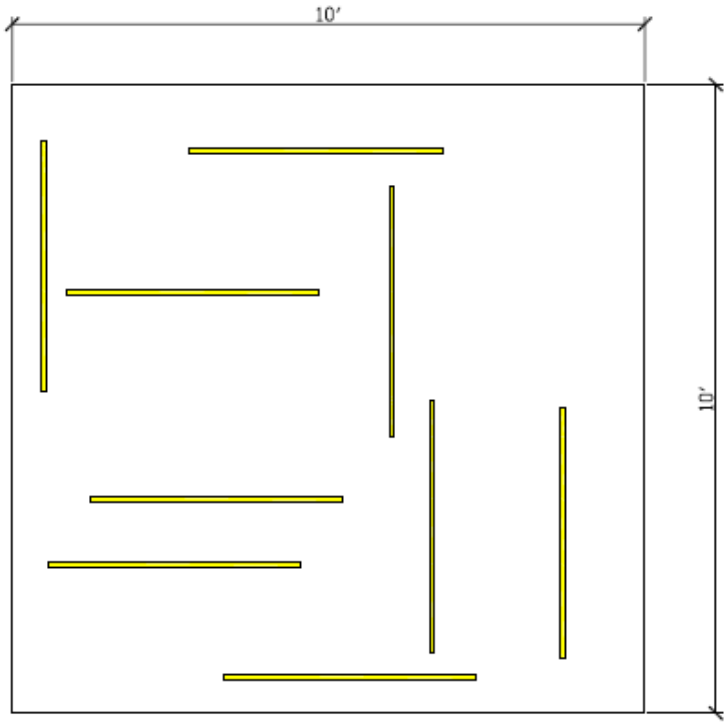
Tunnel Calculation Results

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.

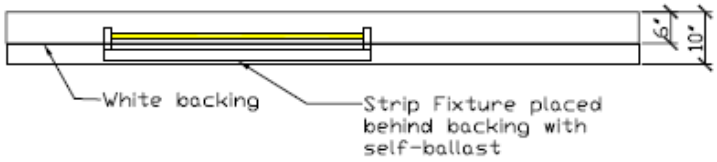
Avg: 16.5 fc
Max: 63.8 fc
Min: 1.2 fc

Fixture Details



Tunnel Wall Fixture E11

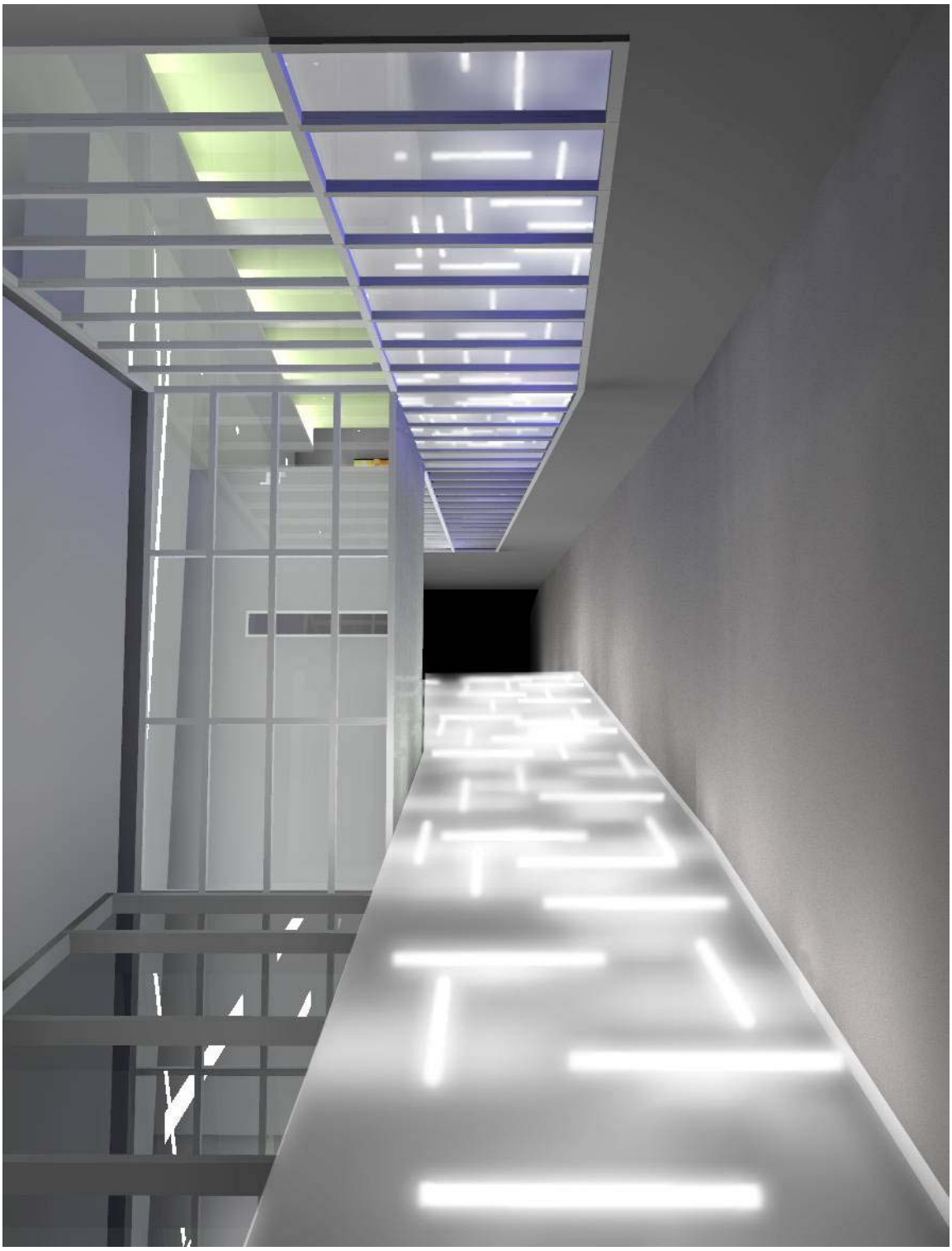
Randomly placed 32W T8 lamps
Fixture comes in custom sizes to fit tunnel walls
Suggested size is 10' x 10'
Ballasts placed in cavity behind fixture and tandem wired
¾" diffuse temperature treated acrylic with 60% transmittance
Panels can be re-lamped by taking front panel off with latch



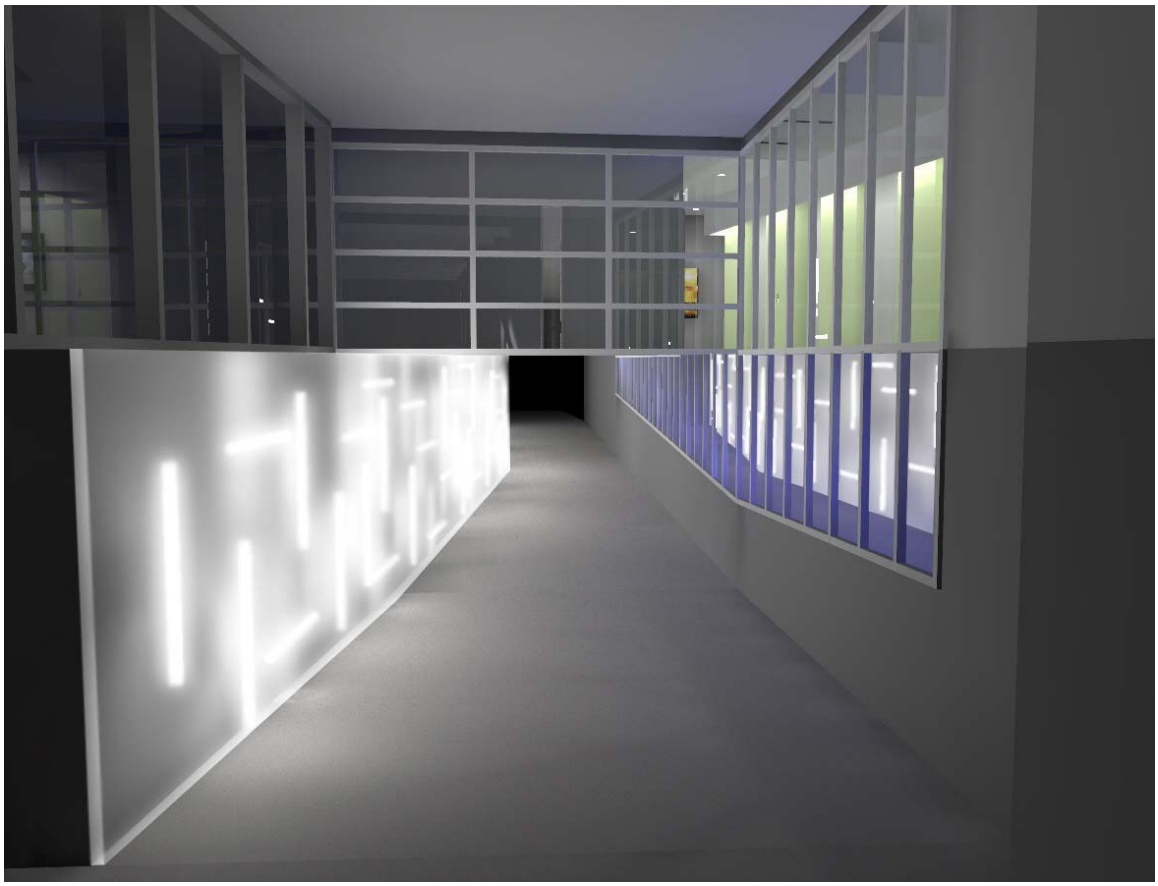
Renderings of Tunnel

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.

ELECTRICAL DEPTH

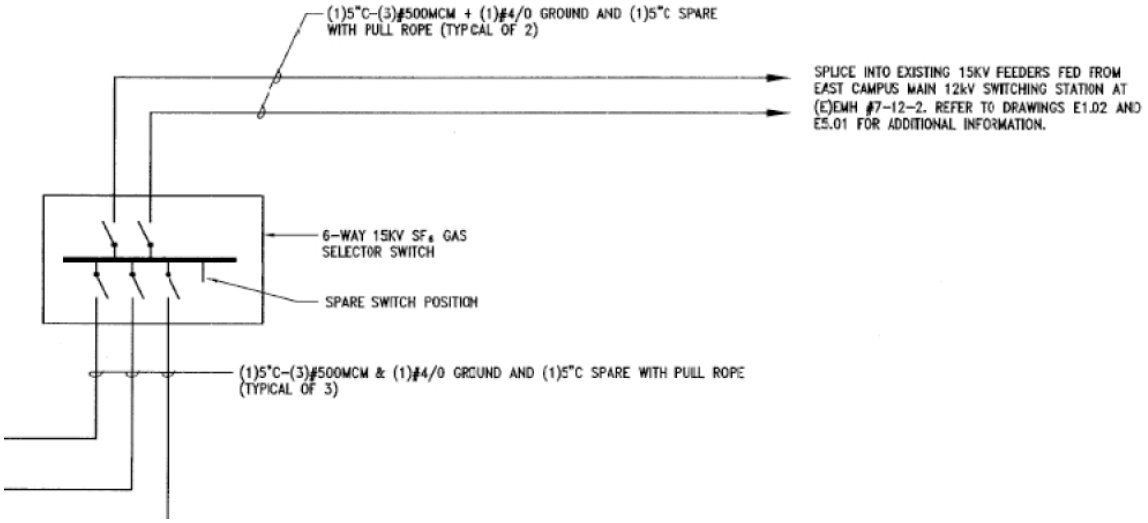
Introduction

The University of California, San Diego Cal IT^2 Building was electrically designed for a lot of future growth. With my changes in the lighting system and control zones, a study was done to check my new design incorporated into the existing conditions. I first showed the circuiting and zoning. I then chose the most affected panelboard and conducted a study on the circuit breaker size and feeder sizes. Finally, I checked the emergency power supply while providing emergency lighting plans to follow my redesigns.

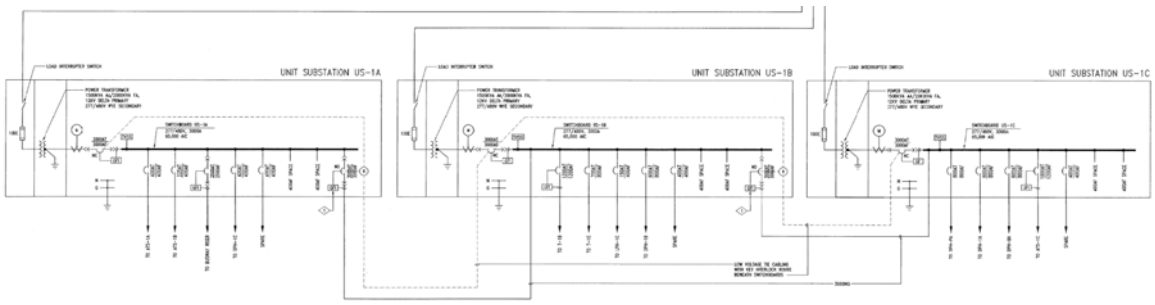
Basic Electrical Layout Background

Cal IT^2 is fed from a 15kV service from East Campus. This power is tapped to a six-way switch where it is distributed into three major substations. These substations all feed to the distribution panels and panelboards to power the building. As you can see in the next two diagrams, the substations are all connected in case of a gray-out where one substation circuit breaker fails. Being a telecommunication building, back-up power is essential for equipment and research being conducted. One substation is primarily connected to only the clean room equipment and HVAC. A 750 kW emergency diesel generator is connected the some distribution panels through three automatic transfer switches. In case of a black-out, only HVAC, elevator, some software back-ups, and emergency lighting loads will be powered for a short while. There is also one main bus duct running up the center of the tower for tapping the 7 floors of offices and research clusters. The rest of the panelboards are located in the electrical room located in the basement of building section A. This is the basic structure of the electrical system for Cal IT^2.

Incoming Service



Substations



Control Plans and Lighting Loads

I separated my lighting into various zones for different switching and circuiting. Below is a table showing the different zones of light, location, and types of switching used. Lutron Grafik Eye 4000 was used to switch most of the lighting in these spaces. I decided to use the Grafik Eye because of the type of building and various uses it will have. Using the Grafik Eye, I can provide multiple scenes in one room using only one control. I can also provide power and preset timed dimming abilities for my oscillating lighting display. Various Wattstopper sensors were also integrated into the system for ease of control.

Lighting Zones

Zone	Location	Fixtures	Panelboard	Control
A	Open Office	B2, B6	ELPH-2A	SA
B	Open Office Cut-outs	B3, B5	ELPH-2A	S1
C	Private Offices	B1	LPH-3A	SB
D	Black Box Theater Ceiling	B12	ELPH-BA	S3
E	Black Box Theater Ceiling	B9	ELPH-BA	S3
F	Black Box Theater Floor Level	B7, B11	ELPH-BA	S3
G	Black Box Theater Floor	B8	ELPH-BA	S3
H	Black Box Theater Floor Level	B10, B13	ELPH-BA	S3
I	Black Box Theater Floor Level	B10, B13	ELPH-BA	S3
J	Lobby Cove	B15	LPH-1B	S2
K	Gallery	B17, B18	LPH-1A	S2
L	Lobby	B14, B16	LPH-1B	S2
M	Lobby Entrance	B19	LPH-1B	SC
N	Façade and Theater Lobby	E6, E10	LPH-1B	SD
O	Tunnel Entrance	E3, E7, E8, E9	LPH-1B	SD
P	Courtyard Tree Uplights	E5	LP-1A	S4
Q	Courtyard Poles and Bollards	E1, E2	LPH-1B	SD
R	Tunnel Custom Fixture	E11	ELPH-1A	S5
S	Tunnel Uplight Fixtures	E12	ELPH-1A	S1

Below is a table showing the switches and sensors referred to above. Cut-sheets are available in the Appendix.

Switches & Sensors			
Labels	**Location**	**Manufacturer**	**Type**
SA	Open Office	WattStopper	Occupancy Sensor
SB	Private Offices	WattStopper	Occupancy/Daylight Sensor
SC	Lobby Entrance	WattStopper	Daylight Photosensor
SD	Building Section C Roof	WattStopper	Daylight Photosensor
S1	Open Office Cut-outs, Tunnel	Lutron	Single Switch
S2	Lobby (three locations)	Lutron	Control Zone Panel
S3	Black Box Theater	Lutron	Control Zone Panel
S4	Mechanical Room	WattStopper	Timer Switch
S5	Underground Tunnel	Lutron	Control Zone Panel

Grafik Eye 4000 Details

I chose the Grafik Eye 4000 to use in Cal IT^2. This system can easily control all the open office research clusters, the black-box theater, underground tunnel display, main lobby, and possibly the labs and clean rooms. The Grafik Eye 4000 can control 24 zones and can have scene selections for up to 16 scenes. This gives good flexibility for control of the lobby, theater and lab rooms. I placed each lighting zone on a separate circuit for each of the spaces as will be shown below. Using these zones, scenes and dimming can be chosen to accommodate each space to the people using them. The various other sensors and photosensors used are all compatible with the Grafik Eye based on manufacturer approval. Based on my circuiting and loads below, one Grafik Eye unit can control all of the research clusters on the upper floors since each floor carries only 4 circuits. The Black Box Theater will be controlled on a different unit along with the theater lobby and multi-purpose rooms next door. The underground tunnel will be put on its own unit because of the programmed dimming that will be occurring constantly throughout the non-day lit hours. Programmable timed dimming is essential for the lighting design in the tunnel which is why I chose the Grafik Eye 4000 for this space.

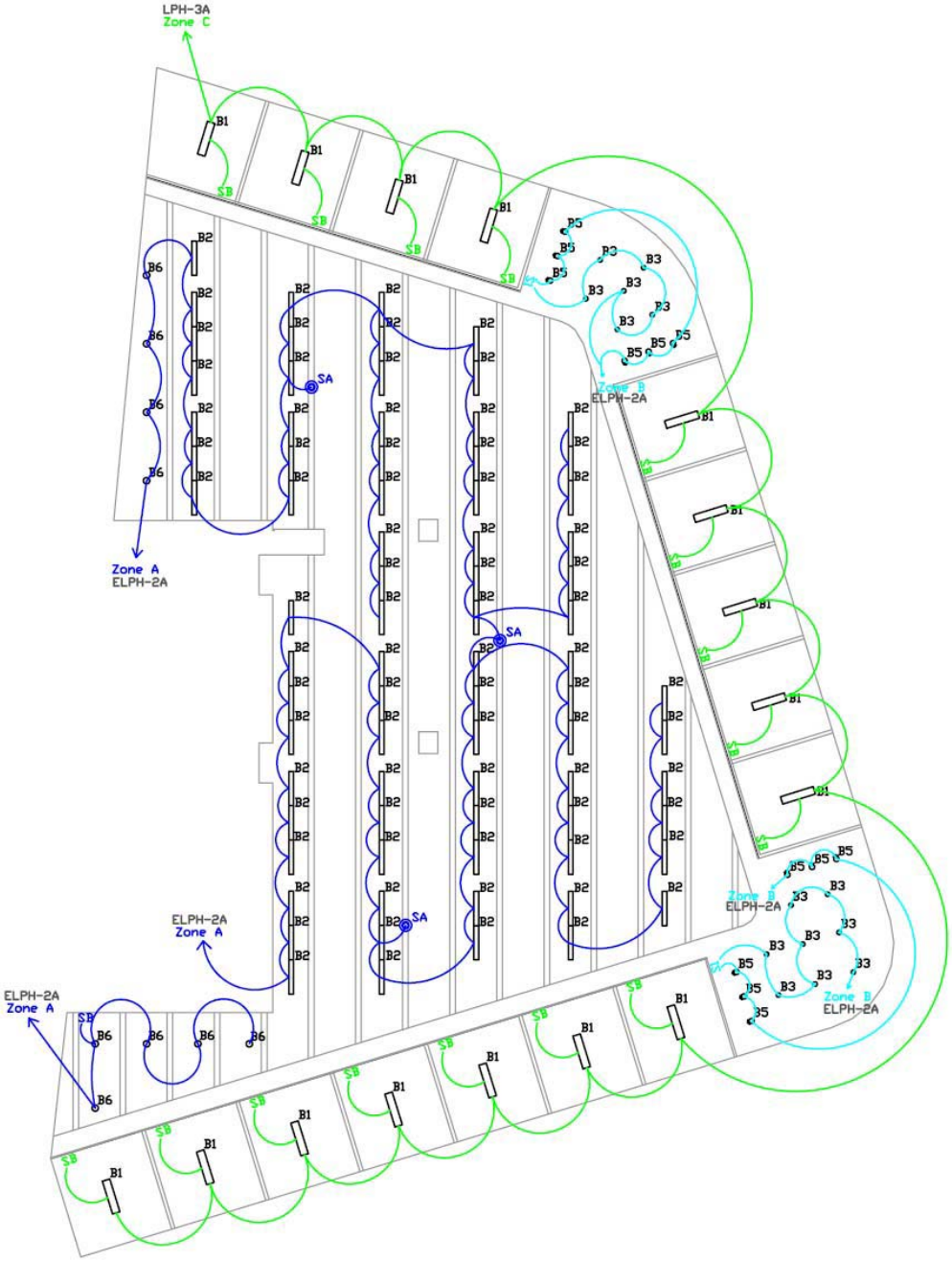
3100 Research Cluster

For this space, the private office fixtures were put on dimmable daylight photosensors with occupancy sensor automatic turn-off. These switches must be visible to the office and not behind a shelf or door for them to properly work. The open-office fixtures were put on infrared occupancy sensors for automatic turn-off. These were placed in 24 foot intervals which was the recommendation by Wattstopper. The only hand switching is for the open-office cut-outs which are put on single tap switches. These spaces are used intermittently and set next to full-length windows. Electric lights will only be needed during evening hours and possibly for highlighting works on the walls. Below is the circuiting calculations and power plan for this space.

Zone A:	(37) B2 and (4) B6 fixtures	= 2516 VA + 144 VA = 2660 VA = 2660 VA / sqrt(3)*480V = 3.199 A
Zone A:	(39) B2 and (5) B6 fixtures	= 2652 VA + 180 VA = 2832 VA = 2832 VA / sqrt(3)*480V = 3.406 A
Zone B:	(14) B3 and (12) B5 fixtures	= 504 VA + 432 VA = 936 VA = 936 VA / sqrt(3)*480V = 1.126 A
Zone C:	(16) B1 fixtures	= 1088 VA = 1088 VA / sqrt(3)*480V = 1.309 A

The VA values are all below the (480V)*(sqrt3)*(16A) = 13302 VA maximum per circuit allowed.

Circuiting and Switching Diagram



Black Box Theater

For this space, many different scenes are put into action using the Lutron Grafik Eye 4000. The theater is used for many different tasks, so variety in the lighting is important. Since every light in the space is put on electric dimming ballasts, all fixtures can be modified to provide just the right atmosphere you are looking for. I have preset 5 scenes for which the light levels and atmosphere work well with each use. Below is a schedule of the five scenes I have provided.

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%)

For the power plan, each lighting zone was put on a different circuit. The ceiling plan and floor contain different aspects of the lighting since the space is two stories tall with very different elements.

Zone D: (12) B12 fixtures = 780 VA
= 780 VA / sqrt(3)*480V = 0.938 A

Zone E: (19) B9 fixtures = 1520 VA
= 1520 VA / sqrt(3)*480V = 1.828 A

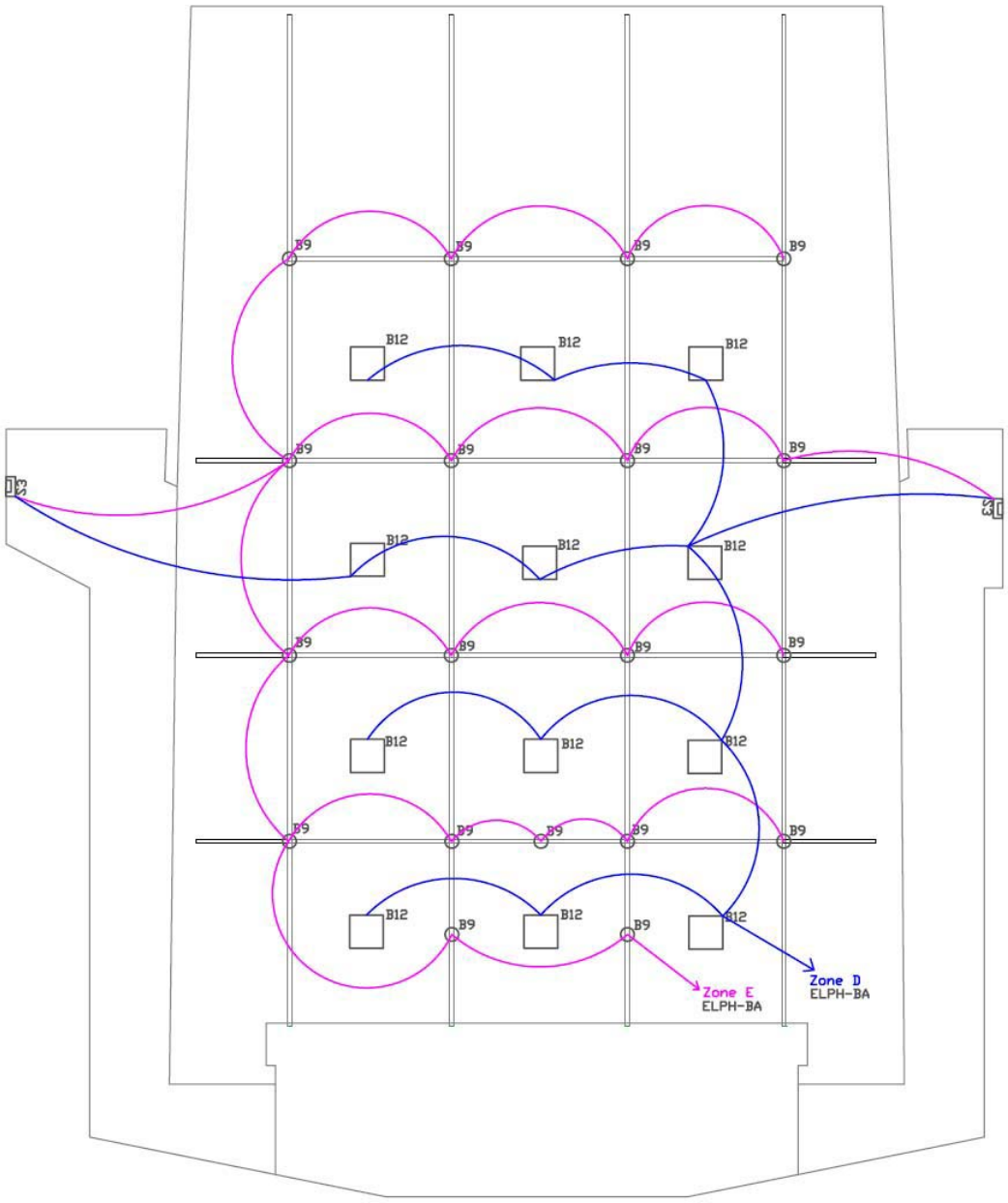
Zone F: (11) B7 and (4) B11 fixtures = 220 VA + 72 VA = 292 VA
= 292 VA / sqrt(3)*480V = 0.351 A

Zone G: (14) B8 fixtures = 238 VA
= 238 VA / sqrt(3)*480V = 0.286 A

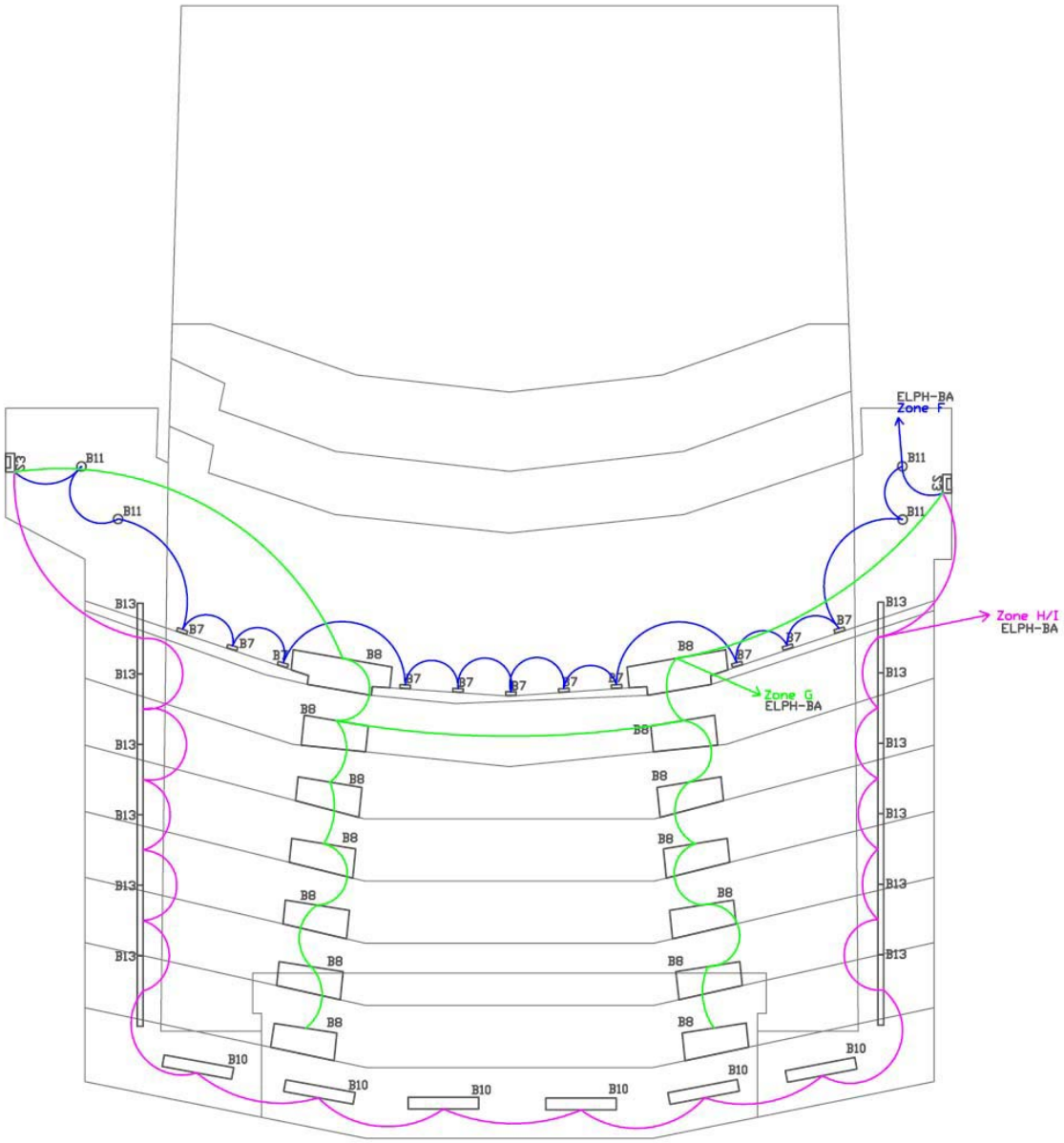
Zone H/I: (6) B10 and (12) B13 fixtures = 210 VA + 816 VA = 1026 VA
= 1026 VA / sqrt(3)*480V = 1.234 A

The VA values are all below the (480V)*(sqrt3)*(16A) = 13302 VA maximum per circuit allowed.

Black-Box Theater 2nd Floor Ceiling Circuiting Plan



Black-Box Theater 1st Floor Circuiting Plan



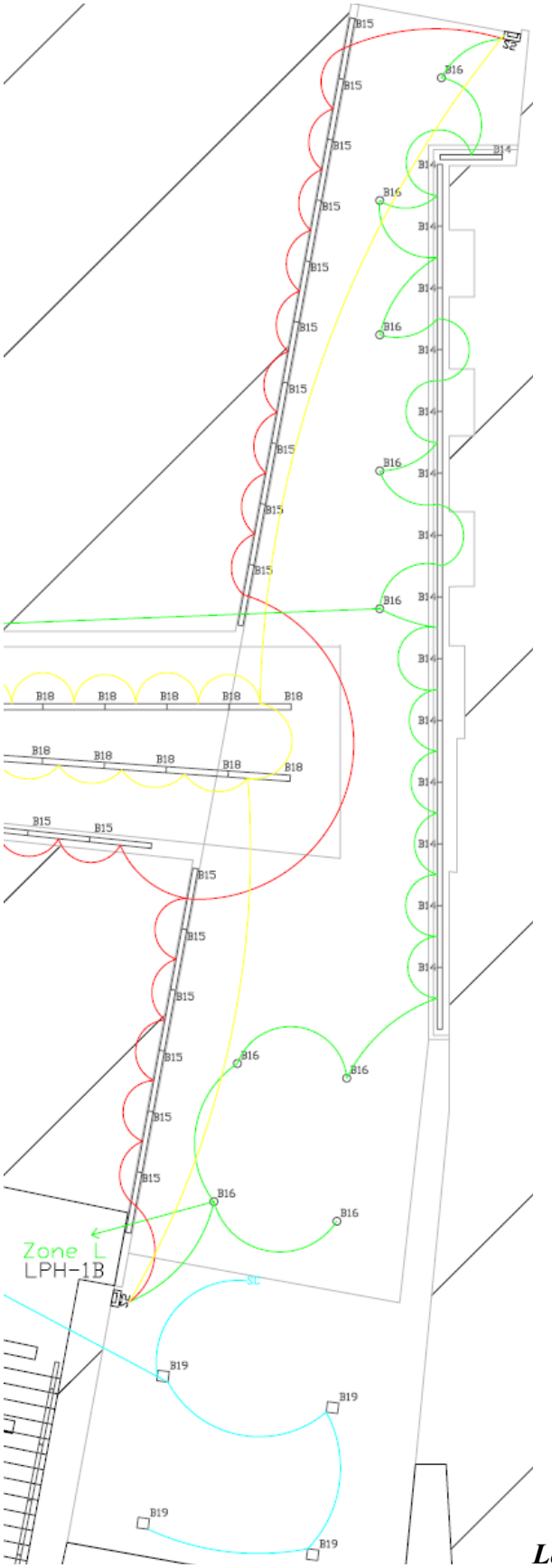
Main Lobby

For this space, the main concern was being able to switch all the different sets of light on one control pad. Using Lutron Grafik Eye 4000, all the lights in the main lobby and gallery can be adjusted pertaining to the times of day and comfort levels. A daylight photosensor is used for the four pendants in the main entrance from the courtyard to be turned on only when dusk is approaching. The other fixtures will be switched using three different control pads mounted at all three exits. During some daytime hours, the blue cove lights might not be needed due to the bright daylight conditions on San Diego, CA as well as to showcase the gallery photos and works using only the recessed accent lights.

Zone J:	(36) B15 fixtures	= 1062 VA = 1062 VA / 480V*sqrt(3) = 1.277 A
Zone K:	(26) B18 and (7) B17 fixtures	= 780 VA + 350 VA = 1130 VA = 1130 VA / 480V*sqrt(3) = 1.359 A
Zone L:	(16) B14 and (9) B16 fixtures	= 472 VA + 324 VA = 796 VA = 796 VA / 480V*sqrt(3) = 0.957 A
Zone M:	(4) B19 fixtures	= 288 VA = 288 VA / 480V*sqrt(3) = 0.346 A

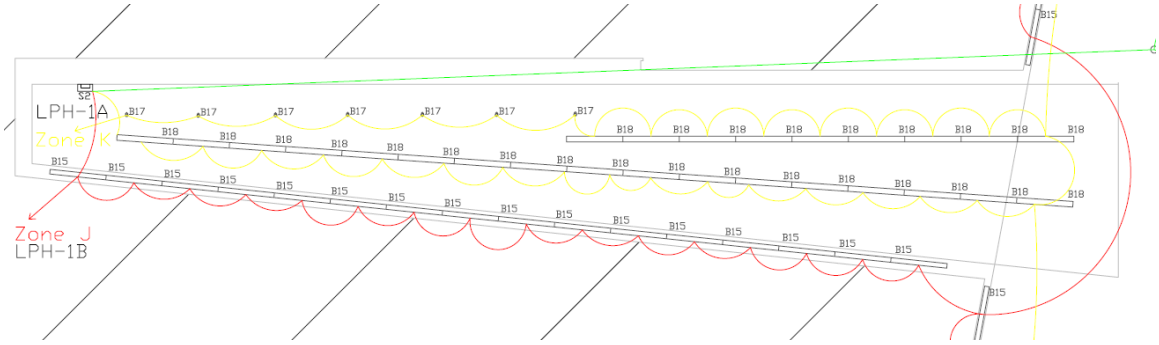
The VA values are all below the (480V)*(sqrt3)*(16A) = 13302 VA maximum per circuit allowed.

Below are the two circuiting diagrams of the lobby. The first diagram is the main entrance leading to the elevators. The second diagram illustrates the gallery corridor that juts out to the left of the lobby.



Lobby Main Entrance

Gallery Corridor off the Lobby



Academic Court

For this area, all the fixtures will be controlled by a daylight photosensor placed on the roof of building section C (the theater portion). This limits the fixtures from turning on too early or late and wasting energy. The up-lit tree fixtures are controlled separately since they will be turned off after midnight by a timer switch. These are turned off for reasons deemed by the University of California, San Diego's Facilities Office.

Zone N: (4) E6 and (11) E10 fixtures = 120 VA + 869 VA = 989 VA
= 989 VA / 480V*sqrt(3) = 1.189 A

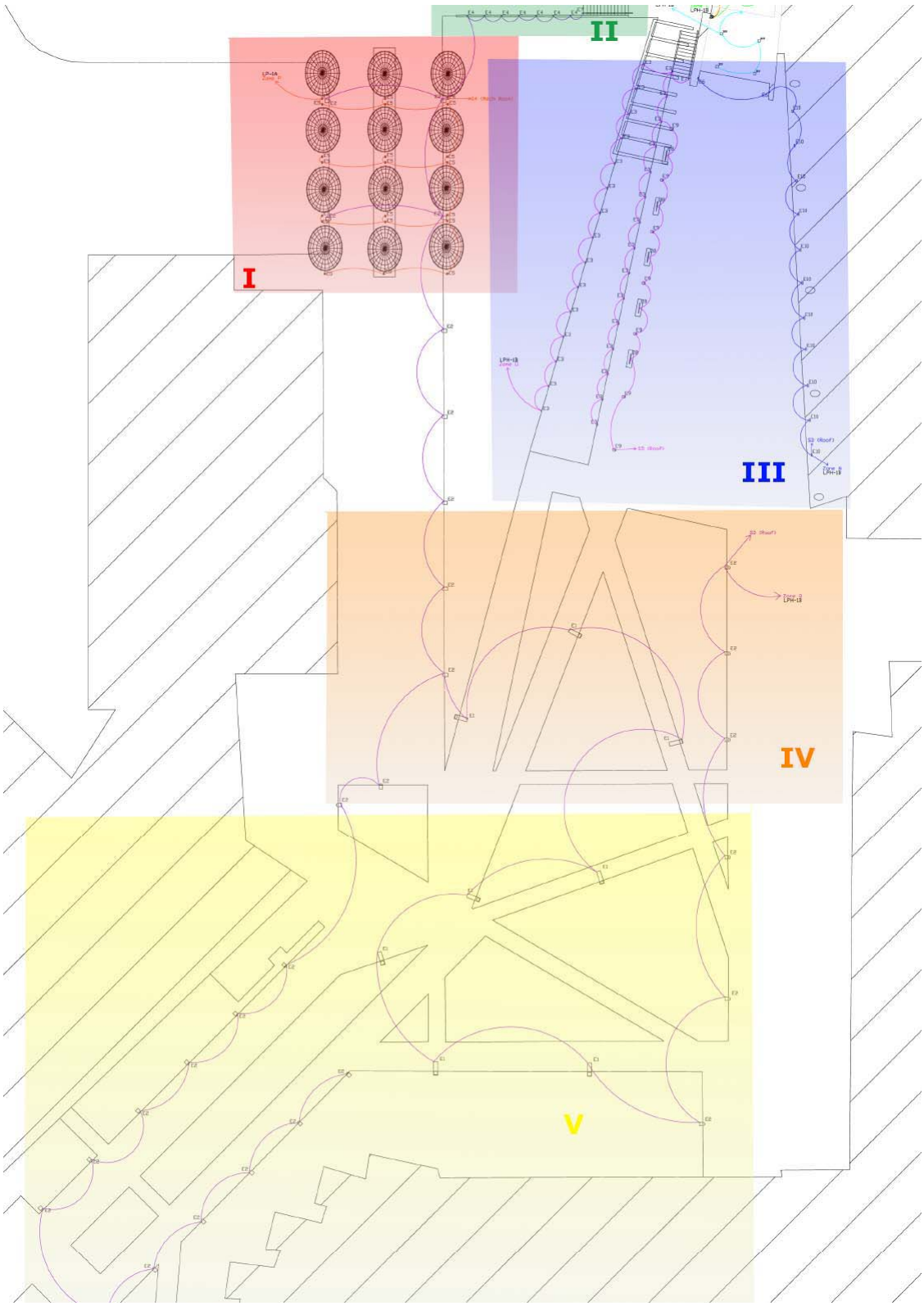
Zone O: (29) E3, (4) E7, (5) E8, (7) E9 = 406 + 118 + 40 + 308 = 872 VA
= 872 VA / 480V*sqrt(3) = 1.049 A

Zone P: (21) E5 fixtures =1050 VA
= 1050 VA / 208V*sqrt(3) = 2.914 A

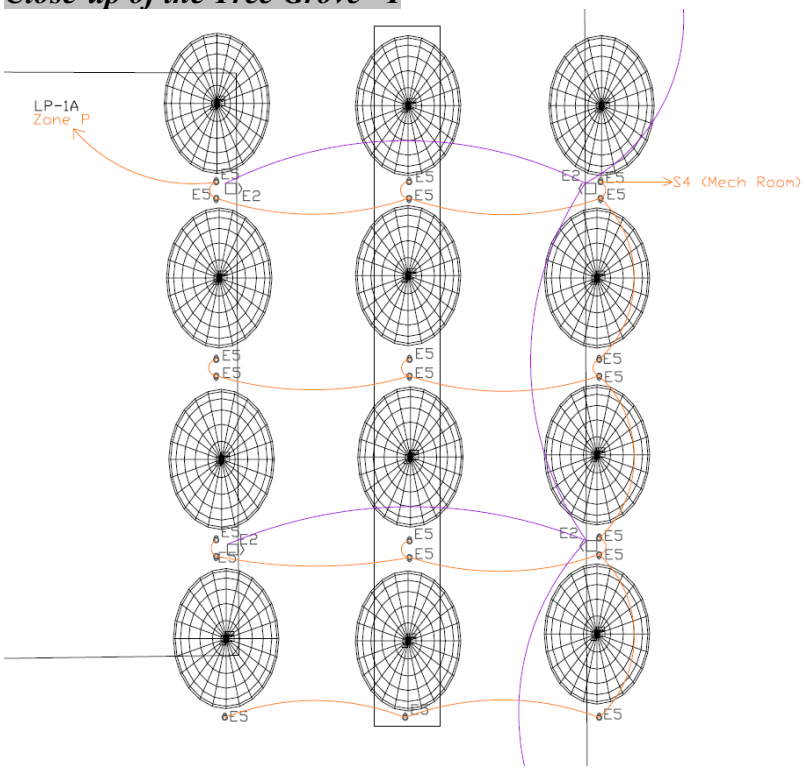
Zone Q: (8) E1 and (29) E2 fixtures = 1080 VA + 1276 VA = 2356 VA
= 2356 VA / 480V*sqrt(3) = 2.834 A

The VA values are all below the (480V)*(sqrt(3))*(16A) = 13302 VA and (208V)*(sqrt(3))*(16A) = 5764 VA maximum per circuit allowed.

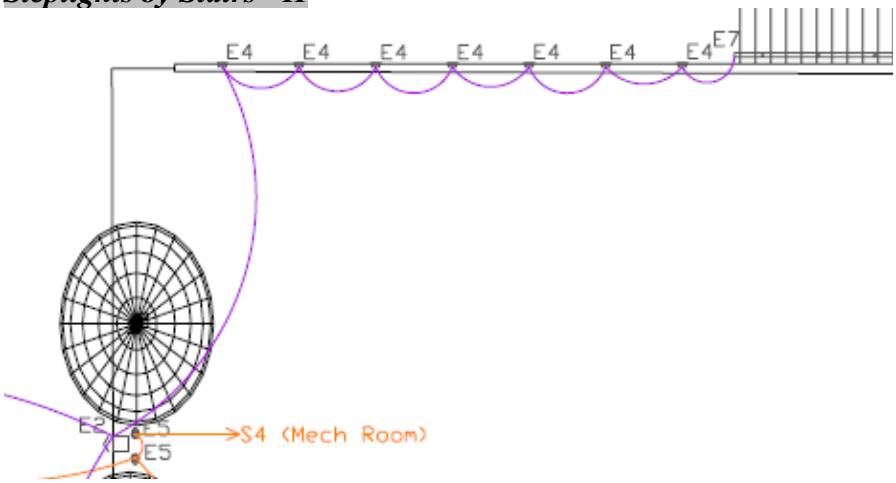
Academic Court Circuiting Diagram



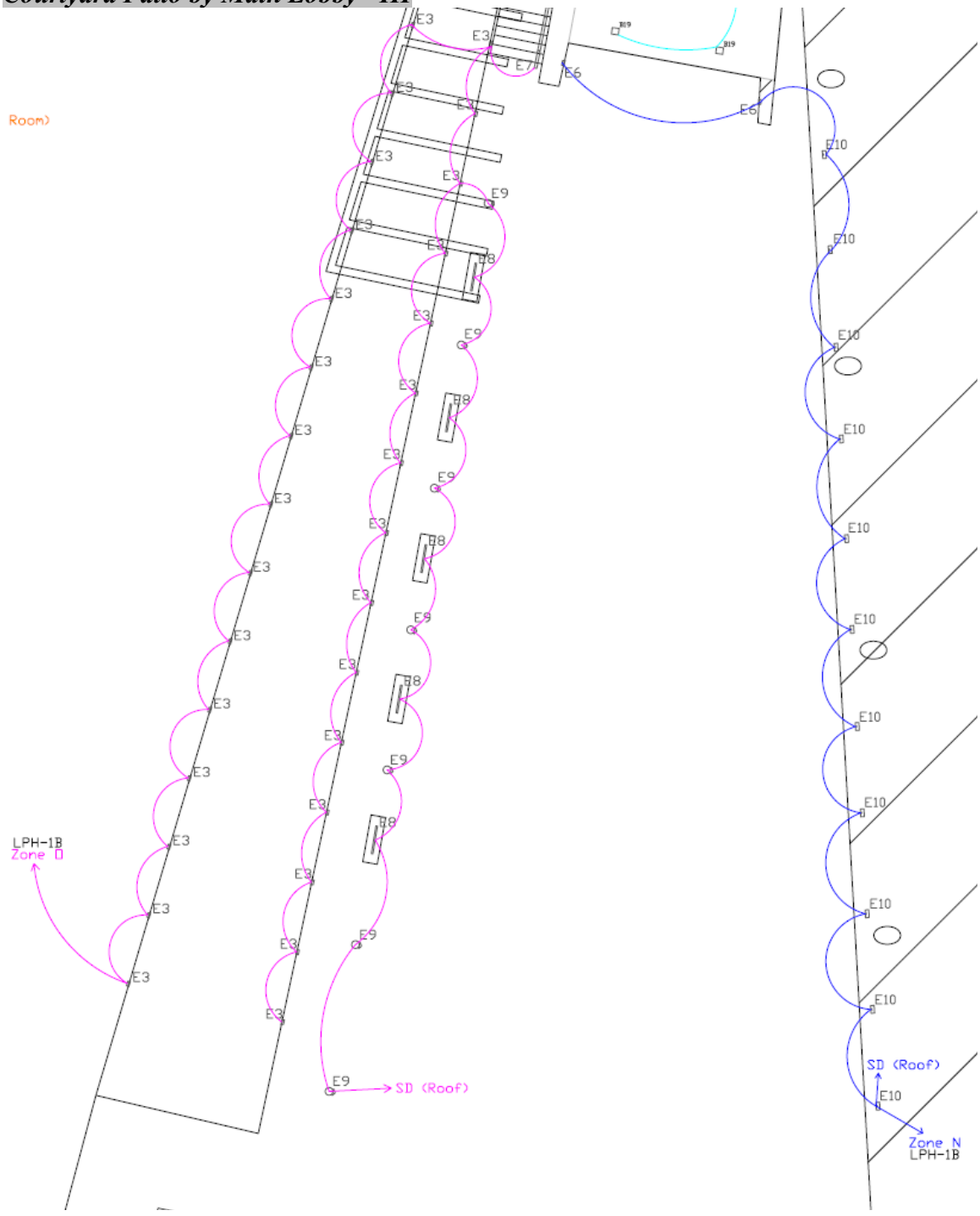
Close-up of the Tree Grove - I



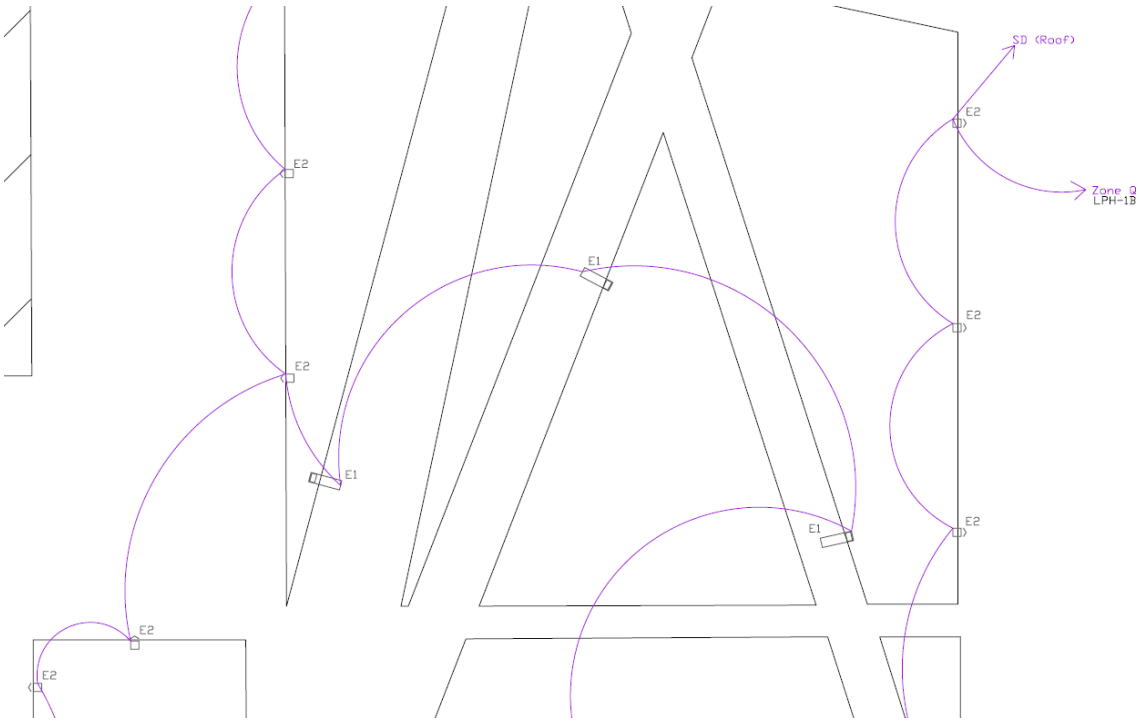
Steplights by Stairs - II



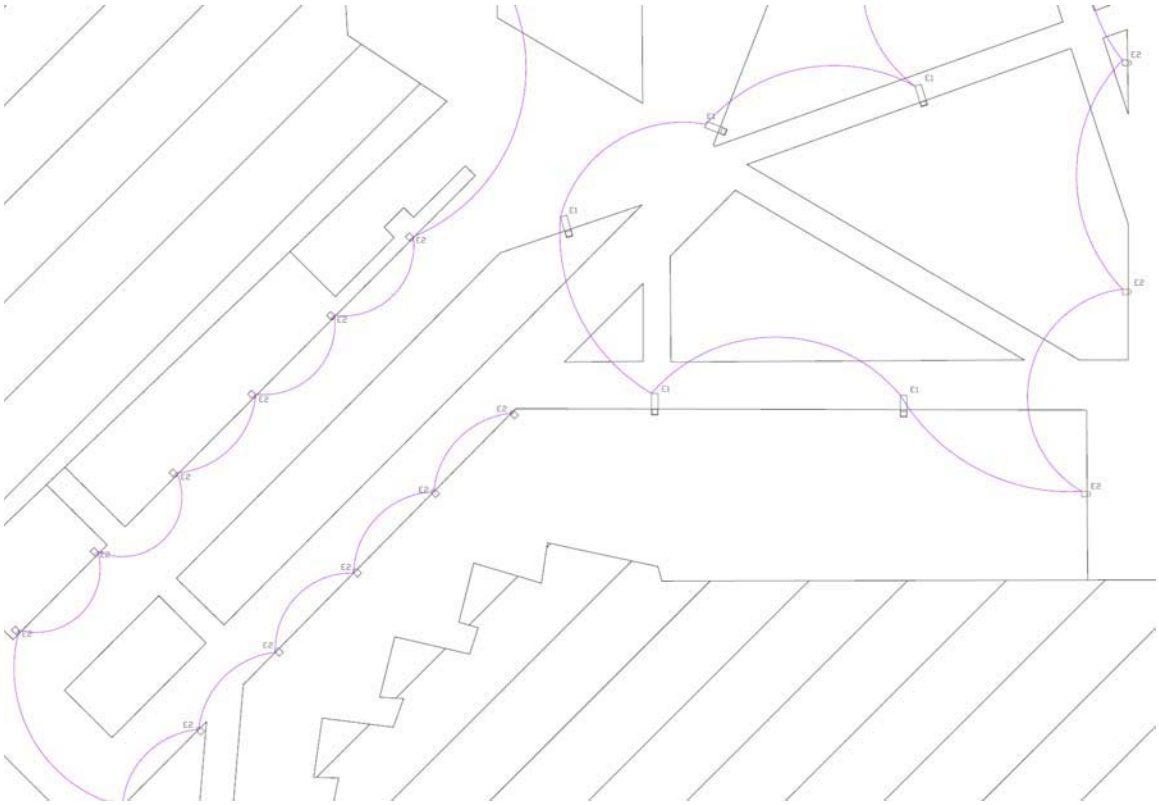
Courtyard Patio by Main Lobby - III



Middle Courtyard – IV



Courtyard East End – V



Underground Tunnel

For this area, there are two levels of lighting to be switched. The blue uplights in the glass windows will be single switched separately. The oscillating fluorescent panels will be controlled by the Lutron Grafik Eye 4000 control panel. These controls will be located in a locked case beside the stairwell to prevent people from adjusting the lights themselves. Shown below are the zone calculations and the circuiting diagram for the tunnel. The large custom panel is shown as a giant box for simplicity purposes. It will be broken into about 9 sections in the end for wiring and size constraint purposes. (See cut-sheets in Appendix for details)

Zone R:	(80) E11 fixtures	= 2880 VA = 2880 VA / 480V*sqrt(3) = 3.464 A
Zone S:	(24) E12 fixtures	= 864 VA = 864 VA / 480V*sqrt(3) = 1.039 A

The VA values are all below the (480V)*(sqrt(3))*(16A) = 13302 VA maximum per circuit allowed.


E11
E11
E11
E12
E12
E12
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E12
E12
E12
E12
E12
E12
E12
E12
E12
E12
E12
E12
E12
E12
E12
E12
Zone R
ELPH-1A
E11
Zone S
ELPH-1A
S1.S5

Panelboard Analysis

After assessing all the panelboards, LPH-1B was the most affected by the lighting design changes made. A calculation of the loads was made to verify the circuit breaker size and wire sizing.

Panel Board LPH-1B		
Circuit	**Label**	**Load**
1	Lobby Zone J Lighting	1080
2	Conference Room 1601 Ltg	500
3	Audio Spat. 1604A Ltg	1140
4	Private Offices Ltg	1240
5	Performance 1606 Ltg	1140
6	Restrooms/Video Editing Ltg	1320
7	Lobby Zone L Lighitng	804
8	Storage/Classrooms	600
9	Open Office Suite Ltg	1000
10	Prefunction 1B, 1C Ltg	800
11	Corridor 1C Ltg	640
12	Prefunction 1B, 1C Ltg	900
13	Lobby Zone M	200
14	Reconfig Research Ltg	1920
15	Corridor Ltg	700
16	Equipment Gallery Ltg	500
17	Site Ltg (not in scope)	750
18	Auditorium Ltg (theatrical)	960
19	Future Academic Court Ltg	1500
20	Multi purpose Ltg	180
21	Exterior Ltg Zone O	872
22	Multi purpose Ltg	1650
23	Exterior Ltg Zone N	989
24	Multi purpose Ltg	1650
25	Exterior Ltg Zone Q	2356
26	Spare	
27	Site Ltg	200
28	Spare	
29	Site Ltg	500
30	Spare	
31	Site Ltg	200
32	Spare	
33	Site Ltg	750
34	Spare	
35	Site Ltg	800
36	Spare	
37	Spare	
38	Spare	
39	Spare	
40	Spare	
41	Spare	
42	Spare	
	TOTAL	27841

Connected Load = 27.841 kW
Demand Load = 27.841 * 1.25 = **34.8 kW**

Circuit Breaker Protection and Conductors

Maximum load on any circuit = 2356 VA
Maximum allowed Current/circuit = 2356 VA / 480 V*sqrt(3) = **2.834 A**
So, a standard **20 A** circuit breaker for each circuit is sufficient.
Since this is a three phase, four wire system, **(3) #12 AWG & (1) #12 Neutral in ½" C** will be used throughout the panelboards and all the branch circuiting.

Total load on Panel = 34.8 kW
Maximum allowed current = (34800 VA) / (480 V * sqrt(3)) = **41.858 A**
The **100 A** circuit breaker for the panelboard is sized correctly. The oversize is used for future growth.

Panelboard Schedules

The redesigned lighting loads are in **red.**

PANEL: ELPH-2A — 277/480V, 3 PHASE-4 WIRE — SURFACE MOUNTED
MAIN: M.O — BUS AMPACITY: 225A — 22,000 AIC RMS SYMMETRICAL

TYPE	DESCRIPTION	DEVICE	CKT	LOAD/PHASE (VA) A	B	C	CKT	DEVICE	DESCRIPTION	TYPE
L	STAIRWELL NO.1	20/1	1	500			2	20/1	STAIRWELL NO.2	L
L	CORRIDOR 3000	20/1	3		1,540		4	20/1	CORRIDOR 2000	L
L	CLUSTER RESEARCH 3300/3400	20/1	5			1,200	6	20/1	CLUSTER RESEARCH 2300/2400	L
L	CLUSTER RESEARCH 3100 ZONE A	20/1	7	2660			8	20/1	CLUSTER RESEARCH 2100	L
L	LOBBY 3000	20/1	9		1,120		10	20/1	LOBBY 2000	L
	CLUSTER RESEARCH 3100 ZONE B	20/1	11			936	12	20/1	MECHANICAL PLENUM	L
	CLUSTER RESEARCH 3100 ZONE A	20/1	13	2832			14	20/1	SPARE	
	SPARE	20/1	15				16	20/1	SPARE	
	SPARE	20/1	17				18	20/1	SPARE	
	SPARE	20/1	19				20	20/1	SPARE	
	SPARE	20/1	21				22	20/1	SPARE	
	SPARE	20/1	23				24	20/1	SPARE	
	SPARE	20/1	25				26	20/1	SPARE	
	SPARE	20/1	27				28	20/1	SPARE	
	SPARE	20/1	29				30	20/1	SPARE	
	SPARE	20/1	31				32		SPACE	
	SPARE	20/1	33				34		SPACE	
	SPARE	20/1	35				36		SPACE	
	SPACE		37				38	70/3	ET-2A	
	SPACE		39				40	"	"	
	SPACE		41				42	"	"	
	SUBTOTAL (VA)			5992	2,660	2136	1,300	2,660	2,040	SUBTOTAL (VA)
	TOTAL ALL PHASES (VA)			PHASE A		PHASE B		PHASE C		TOTAL ALL PHASES (AMPS)
	16788			7292		5,329		4176		20

LOAD SUMMARY BY TYPE	CONNECTED LOAD	DEMAND FACTOR	NEC LOAD
E = EQUIPMENT	0 VA	1.00	0 VA
H = ELECTRIC HEAT	0 VA	1.00	0 VA
K = KITCHEN EQUIPMENT	0 VA	1.00	0 VA
L = LIGHTING	16788 VA	1.25	20985 VA
M = MOTOR	0 VA	1.00	0 VA
M = LARGEST MOTOR	VA	1.25	0 VA
R = RECEPTACLE	0 VA	1.00	0 VA

CONNECTED LOAD SUMMARY
16788 VA
20 AMPS

NEC LOAD SUMMARY
20985 VA
25 AMPS

PANEL: ELPH-BA — 277/480V, 3 PHASE-4 WIRE — SURFACE MOUNTED
MAIN: 100A/3P — BUS AMPACITY: 100A — 14,000 AIC RMS SYMMETRICAL

TYPE	DESCRIPTION	DEVICE	CKT	LOAD/PHASE (VA) A	B	C	CKT	DEVICE	DESCRIPTION	TYPE
L	BASEMENT MECH. RM.	20/1	1	900		1,440	2	20/1	MULTI PURPOSE RM	L
L	THEATER ZONE D	20/1	3		780		4	20/1	SPARE	
L	THEATER ZONE E	20/1	5			1520	6	20/1	SPARE	
L	THEATER ZONE F	20/1	7	300			8	20/1	SPARE	
L	THEATER ZONE G	20/1	9		240		10	20/1	SPARE	
L	THEATER ZONE H/I	20/1	11			1026	12	20/1	SPARE	
	SPARE	20/1	13				14	20/1	SPARE	
	SPARE	20/1	15				16	20/1	SPARE	
	SPARE	20/1	17				18	20/1	SPARE	
	SPARE	20/1	19				20	20/1	SPARE	
	SPARE	20/1	21				22	20/1	SPARE	
	SPARE	20/1	23				24	20/1	SPARE	
	SPARE	20/1	25				26	20/1	SPARE	
	SPARE	20/1	27				28	20/1	SPARE	
	SPARE	20/1	29				30	20/1	SPARE	
	SPARE	20/1	31				32		SPACE	
	SPARE	20/1	33				34		SPACE	
L	SITE LIGHTING	20/1	35			720	36		SPACE	
	SPACE		37				38	50/3	ET-BA	E
	SPACE		39				40	"	"	E
	SPACE		41				42	"	"	E
	SUBTOTAL (VA)			1200	1020	2546	1,440	0	0	SUBTOTAL (VA)
	TOTAL ALL PHASES (VA)			PHASE A		PHASE B		PHASE C		TOTAL ALL PHASES (AMPS)
	6206			2640		1020		2546		8

LOAD SUMMARY BY TYPE	CONNECTED LOAD	DEMAND FACTOR	NEC LOAD
E = EQUIPMENT	0 VA	1.00	0 VA
H = ELECTRIC HEAT	0 VA	1.00	0 VA
K = KITCHEN EQUIPMENT	0 VA	1.00	0 VA
L = LIGHTING	6206 VA	1.25	7758 VA
M = MOTOR	0 VA	1.00	0 VA
M = LARGEST MOTOR	VA	1.25	0 VA
R = RECEPTACLE	0 VA	1.00	0 VA

CONNECTED LOAD SUMMARY
6206 VA
8 AMPS

NEC LOAD SUMMARY
7758 VA
10 AMPS

PANEL: LP-1A ◇1 | 120/208V, 3 PHASE-4 WIRE | SURFACE MOUNTED
MAIN: 225A/3P | BUS AMPACITY: 225A | 10,000 AIC RMS SYMMETRICAL

TYPE	DESCRIPTION	DEVICE	CKT	LOAD/PHASE (VA) A	B	C	CKT	DEVICE	DESCRIPTION	TYPE
R	CONFERENCE RM 1601A	20/1	1	720			2	20/1	LOBBY	R
R	CONFERENCE RM 1601A	20/1	3		900		4	20/1	LOBBY	R
R	CONFERENCE RM 1601A - FLR	20/1	5			1,000	6	20/1	LOBBY	R
R	PRIVATE OFFICES	20/1	7	900			8	20/1	RESTROOMS	R
R	PRIVATE OFFICES	20/1	9		900		10	20/1	EXTERIOR TREE UPLIGHTING	L
R	PRIVATE OFFICES	20/1	11			900	12	20/1	SPARE	
R	PRIVATE OFFICES	20/1	13	900			14	20/1	SPARE	
K	COFF	20/1	15		1,740		16	20/1	SPARE	
K	GD	20/1	17			996	18	20/1	SPARE	
K	MW	20/1	19	1,500			20	20/1	SPARE	
K	U/C REF	20/1	21		800		22	20/1	SPARE	
K	REF	20/1	23			1,800	24	20/1	SPARE	
K	PRINTER	20/1	25	1,680			26	20/1	SPARE	
K	FAX	20/1	27		470		28	20/1	SPARE	
K	COF	20/1	29			1,900	30	20/1	SPARE	
R	PRIVATE OFFICES	20/1	31	720			32	20/1	SPARE	
R	CONVENIENCE REC.	20/1	33		540		34	20/1	SPARE	
R	CONVENIENCE REC.	20/1	35			900	36	20/1	EF-1-1	M
	SPARE	20/1	37			5,520	38	100/3	LP-1A(2)	E
	SPARE	20/1	39				40	"	"	E
	SPARE	20/1	41				42	"	"	E
	SUBTOTAL (VA)			6,420	5,350	7,496	7,320	7290	6,565	SUBTOTAL (VA)
	TOTAL ALL PHASES (VA)			PHASE A		PHASE B		PHASE C		TOTAL ALL PHASES (AMPS)
	40441			13,740		12640		14,061		113

LOAD SUMMARY BY TYPE	CONNECTED LOAD	DEMAND FACTOR	NEC LOAD
E = EQUIPMENT	16,560 VA	1.00	16,560 VA
H = ELECTRIC HEAT	0 VA	1.00	0 VA
K = KITCHEN EQUIPMENT	10,886 VA	1.00	10,886 VA
L = LIGHTING	1050 VA	1.25	1312 VA
M = MOTOR	325 VA	1.00	325 VA
M = LARGEST MOTOR	VA	1.25	0 VA
R = RECEPTACLE	11,620 VA	1.00	10,810 VA

CONNECTED LOAD SUMMARY
40441 VA
113 AMPS

NEC LOAD SUMMARY
39893 VA
111 AMPS

PANEL: LPH-1A | 277/480V, 3 PHASE-4 WIRE | SURFACE MOUNTED
MAIN: MLO | BUS AMPACITY: 225A | 30,000 AIC RMS SYMMETRICAL

TYPE	DESCRIPTION	DEVICE	CKT	LOAD/PHASE (VA) A	B	C	CKT	DEVICE	DESCRIPTION	TYPE
L	3D FABRICATION	20/1	1	1,000		750	2	20/1	ROOMS 1206 & 1206A	L
L	Gallery Corridor	20/1	3		1130		4	20/1	PRIVATE OFFICES - NORTH	L
L	SERVER ROOM 1101	20/1	5			2,050	6	20/1	RESTROOMS	L
L	SERVER ROOM 1101	20/1	7	1,300			8	20/1	SPARE	
L	CLUSTER RESEARCH 1202	20/1	9		930		10	20/1	SPARE	
		20/1	11				12	20/1	SPARE	
	SPARE	20/1	13				14	20/1	SPARE	
	SPARE	20/1	15				16	20/1	SPARE	
	SPARE	20/1	17				18	20/1	SPARE	
	SPARE	20/1	19				20	20/1	SPARE	
	SPARE	20/1	21				22	20/1	SPARE	
	SPARE	20/1	23				24	20/1	SPARE	
	SPARE	20/1	25				26	20/1	SPARE	
	SPARE	20/1	27				28	20/1	SPARE	
	SPARE	20/1	29				30	20/1	SPARE	
	SPARE	20/1	31				32	20/1	SPARE	
	SPARE	20/1	33				34	20/1	SPARE	
	SPARE	20/1	35				36	20/1	SPARE	
	SPACE		37				38		SPACE	
	SPACE		39				40		SPACE	
	SPACE		41				42		SPACE	
	SUBTOTAL (VA)			2,300	2060	2,050	750	1,000	800	SUBTOTAL (VA)
	TOTAL ALL PHASES (VA)			PHASE A		PHASE B		PHASE C		TOTAL ALL PHASES (AMPS)
	8960			3,050		3060		2,859		11

LOAD SUMMARY BY TYPE	CONNECTED LOAD	DEMAND FACTOR	NEC LOAD
E = EQUIPMENT	0 VA	1.00	0 VA
H = ELECTRIC HEAT	0 VA	1.00	0 VA
K = KITCHEN EQUIPMENT	0 VA	1.00	0 VA
L = LIGHTING	8960 VA	1.25	11200 VA
M = MOTOR	0 VA	1.00	0 VA
M = LARGEST MOTOR	VA	1.25	0 VA
R = RECEPTACLE	0 VA	1.00	0 VA

CONNECTED LOAD SUMMARY
8960 VA
11 AMPS

NEC LOAD SUMMARY
11200 VA
14 AMPS

PANEL: LPH-1B — 277/480V, 3 PHASE-4 WIRE — SURFACE MOUNTED
MAIN: MLO — BUS AMPACITY: 100A — 30,000 AIC RMS SYMMETRICAL

TYPE	DESCRIPTION	DEVICE	CKT	LOAD/PHASE (VA) A	B	C	CKT	DEVICE	DESCRIPTION	TYPE
L	LOBBY 1000 ZONE J	20/1	1	1080			2	20/1	CONFERENCE ROOM - 1801A	L
L	AUDIO SPAT. -1604A	20/1	3		1,140		4	20/1	PRIVATE OFFICES - EAST	L
L	PERFORM. COMP. - 1606	20/1	5			1,140	6	20/1	RESTROOMS/VIDEO EDITING	L
L	LOBBY 1000 ZONE L	20/1	7	804			8	20/1	STORAGE / CLASSROOMS	L
L	OPEN OFFICE SUITE	20/1	9		1,000		10	20/1	PREFUNCTION - 1B, 1C	L
L	CORRIDOR - LEVEL 1C	20/1	11			640	12	20/1	PREFUNCTION - 1B, 1C	L
L	LOBBY 1000 ZONE M	20/1	13	200			14	20/1	RECONFIG. RESEARCH	L
L	CORRIDOR	20/1	15		700		16	20/1	EQUIPMENT GALLERY	L
L	SITE LIGHTING	20/1	17			750	18	20/1	AUDITORIUM	L
L	FUTURE ACADEMIC CT.	20/1	19	1,500			20	20/1	MULTIPURPOSE RM.	L
L	EXTERIOR LIGHTING ZONE O	20/1	21		872		22	20/1	MULTIPURPOSE LIGHTING	L
L	EXTERIOR LIGHTING ZONE N	20/1	23			989	24	20/1	MULTIPURPOSE LIGHTING	L
L	EXTERIOR LIGHTING ZONE Q	20/1	25	2356			26	20/1	SPARE	
L		20/1	27		200		28	20/1	SPARE	
L		20/1	29			300	30	20/1	SPARE	
L	SITE LIGHTING	20/1	31	200			32	20/1	SPARE	
L	SITE LIGHTING	20/1	33		750		34	20/1	SPARE	
L	SITE LIGHTING	20/1	35			800	36	20/1	SPARE	
	SPACE		37				38		SPACE	
	SPACE		39				40		SPACE	
	SPACE		41				42		SPACE	
SUBTOTAL (VA)				6140	4662	4619	3,200	4,190	4,830	SUBTOTAL (VA)
TOTAL ALL PHASES (VA)				PHASE A		PHASE B		PHASE C		TOTAL ALL PHASES (AMPS)
27641				9340		8852		9449		34

LOAD SUMMARY BY TYPE	CONNECTED LOAD	DEMAND FACTOR	NEC LOAD
E = EQUIPMENT	0 VA	1.00	0 VA
H = ELECTRIC HEAT	0 VA	1.00	0 VA
K = KITCHEN EQUIPMENT	0 VA	1.00	0 VA
L = LIGHTING	27641 VA	1.25	34551 VA
M = MOTOR	0 VA	1.00	0 VA
M = LARGEST MOTOR	VA	1.25	0 VA
R = RECEPTACLE	0 VA	1.00	0 VA

CONNECTED LOAD SUMMARY
27641 VA
34 AMPS

NEC LOAD SUMMARY
34551 VA
42 AMPS

PANEL: LPH-3A — 277/480V, 3 PHASE-4 WIRE — SURFACE MOUNTED
MAIN: MLO — BUS AMPACITY: 225A — 30,000 AIC RMS SYMMETRICAL

TYPE	DESCRIPTION	DEVICE	CKT	LOAD/PHASE (VA) A	B	C	CKT	DEVICE	DESCRIPTION	TYPE
L	PRIVATE OFFICES 3100	20/1	1	550			2	20/1	PRIVATE OFFICES - NORTH	L
L	CLUSTER RESEARCH 3100	20/1	3		2,040		4	20/1	PRIVATE OFFICES - SOUTH	L
L	LOBBY 3000	20/1	5			2,500	6	20/1	RESTROOMS/PRIVATE OFFICES	L
L	CLUSTER RESEARCH 3300	20/1	7	2,090			8	20/1	PRIVATE OFFICES - NORTH	L
L	CORRIDOR 3200	20/1	9		1,030		10	20/1	PRIVATE OFFICES	L
L	OFFICE 3400A	20/1	11			1,470	12	20/1	PRIVATE OFFICES	L
L	ELEVATOR COVE	20/1	13	700			14	20/1	VENDING / COPY AREA	L
	SPARE	20/1	15				16	20/1	SPARE	
	SPARE	20/1	17				18	20/1	SPARE	
	SPARE	20/1	19				20	20/1	SPARE	
	SPARE	20/1	21				22	20/1	SPARE	
	SPARE	20/1	23				24	20/1	SPARE	
	SPARE	20/1	25				26	20/1	SPARE	
	SPARE	20/1	27				28	20/1	SPARE	
	SPARE	20/1	29				30	20/1	SPARE	
	SPARE	20/1	31				32	20/1	SPARE	
	SPARE	20/1	33				34	20/1	SPARE	
	SPARE	20/1	35				36	20/1	SPARE	
	SPACE		37				38		SPACE	
	SPACE		39				40		SPACE	
	SPACE		41				42		SPACE	
SUBTOTAL (VA)				3340	3,070	3,970	6,070	3,310	2,550	SUBTOTAL (VA)
TOTAL ALL PHASES (VA)				PHASE A		PHASE B		PHASE C		TOTAL ALL PHASES (AMPS)
22610				9410		6,580		6,520		28

LOAD SUMMARY BY TYPE	CONNECTED LOAD	DEMAND FACTOR	NEC LOAD
E = EQUIPMENT	0 VA	1.00	0 VA
H = ELECTRIC HEAT	0 VA	1.00	0 VA
K = KITCHEN EQUIPMENT	0 VA	1.00	0 VA
L = LIGHTING	22610 VA	1.25	28262 VA
M = MOTOR	0 VA	1.00	0 VA
M = LARGEST MOTOR	VA	1.25	0 VA
R = RECEPTACLE	0 VA	1.00	0 VA

CONNECTED LOAD SUMMARY
22610 VA
28 AMPS

NEC LOAD SUMMARY
28262 VA
35 AMPS

PANEL: ELPH-1A — 277/480V, 3 PHASE-4 WIRE — SURFACE MOUNTED
MAIN: MLO — BUS AMPACITY: 100A — 14,000 AIC RMS SYMMETRICAL

TYPE	DESCRIPTION	DEVICE	CKT	LOAD/PHASE (VA) A	B	C	CKT	DEVICE	DESCRIPTION	TYPE
L	WEST CORRIDOR - 1B	20/1	1	1,200			2	20/1	SOUTH STAIRWELL - 1B	L
L	EAST CORRIDOR - 1B	20/1	3		1,030		4	20/1	SOUTH CORRIDOR - 1B	L
L	RECON. RESEARCH LABS	20/1	5			640	6	20/1	STEPLIGHTS - 1A	L
L	CORRIDOR - 1C	20/1	7	300			8	20/1	STEPLIGHTS - 1A	L
L	CLASSROOMS - 1A	20/1	9		1,000		10	20/1	TUNNEL LTG ZONE R	L
L	CORRIDOR - 1A	20/1	11			1,550	12	20/1	STEPLIGHTS - 1C	L
L	TUNNEL - 1B	20/1	13	500			14	20/1	STEPLIGHTS - 1C	L
L	METALIZATION 1425	20/1	15		200		16	20/1	METROLOGY 1423	L
L	METALIZATION 1429	20/1	17			200	18	20/1	METROLOGY 1419	L
L	THERMAL PROCESS 1431	20/1	19	200			20	20/1	LITHOGRAPHY 1417	L
L	BACK END PROCESS 1433	20/1	21		200		22	20/1	LITHOGRAPHY 1413	L
L	ETCH 1439	20/1	23			200	24	20/1	E-BEAM LITHOGRAPHY 1409	L
L	WET PROCESS 1443	20/1	25	200			26	20/1	DEVELOPMENT 1405	L
L	MAIN ELECTRICAL ROOM	20/1	27		230		28	20/1	TUNNEL LTG ZONE S	
L	PRE-UNCTION	20/1	29			200	30	20/1	SPARE	
L	MULTIPURPOSE	20/1	31	100			32	20/1	SPARE	
	SPARE	20/1	33				34	20/1	SPARE	
	SPARE	20/1	35				36	20/1	SPARE	
	SPACE		37				38	50/3	ET-1B	E
	SPACE		39				40	"	"	E
	SPACE		41				42	"	"	E
SUBTOTAL (VA)				2,600	2,660	2,790	1,420	3744	700	SUBTOTAL (VA)
TOTAL ALL PHASES (VA)				PHASE A		PHASE B		PHASE C		TOTAL ALL PHASES (AMPS)
13914				4,020		6404		3,490		17

LOAD SUMMARY BY TYPE	CONNECTED LOAD	DEMAND FACTOR	NEC LOAD
E = EQUIPMENT	0 VA	1.00	0 VA
H = ELECTRIC HEAT	0 VA	1.00	0 VA
K = KITCHEN EQUIPMENT	0 VA	1.00	0 VA
L = LIGHTING	13914 VA	1.25	17392 VA
M = MOTOR	0 VA	1.00	0 VA
M = LARGEST MOTOR	VA	1.25	0 VA
R = RECEPTACLE	0 VA	1.00	0 VA

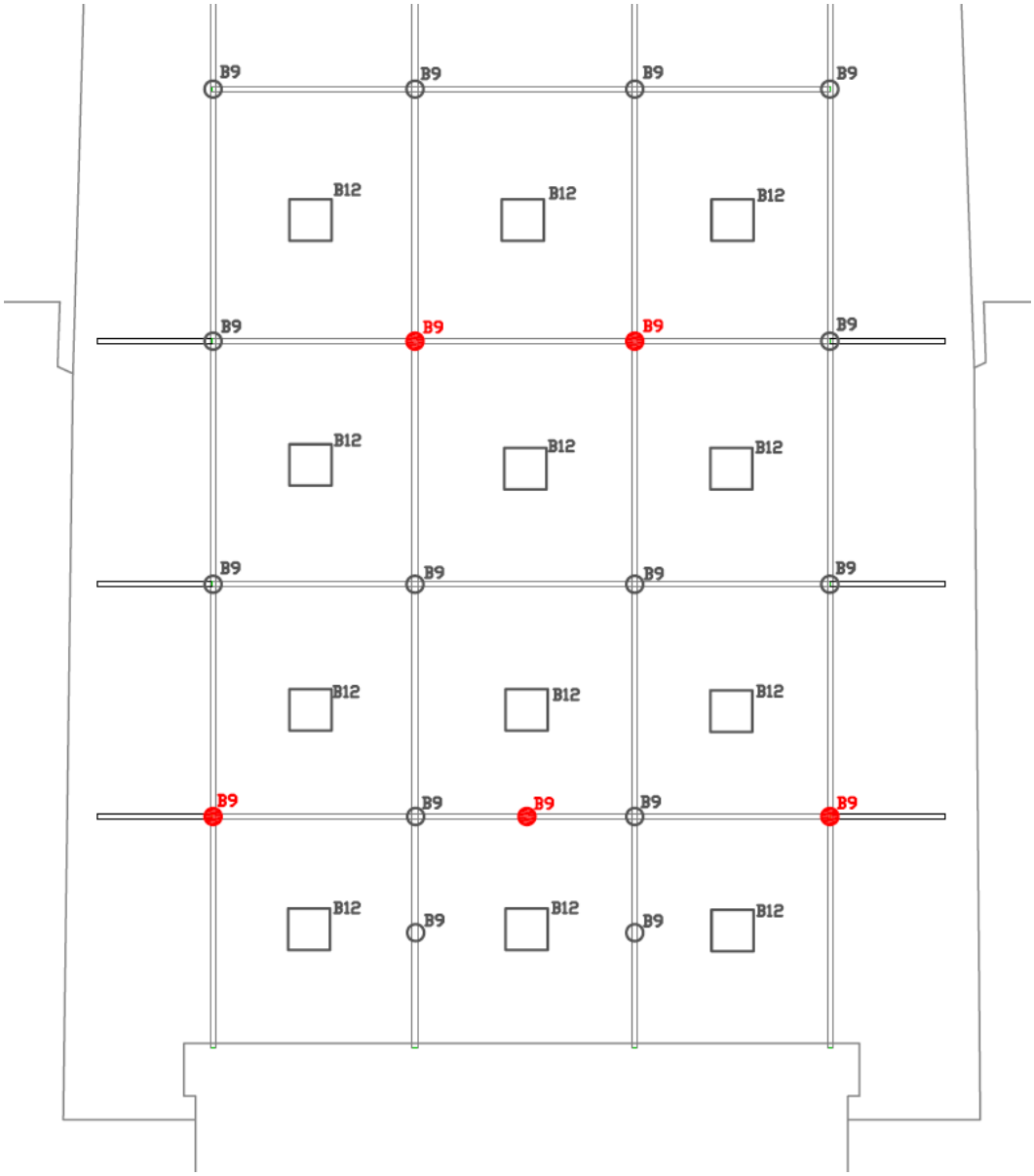
CONNECTED LOAD SUMMARY
13914 VA
17 AMPS

NEC LOAD SUMMARY
17392 VA
21 AMPS

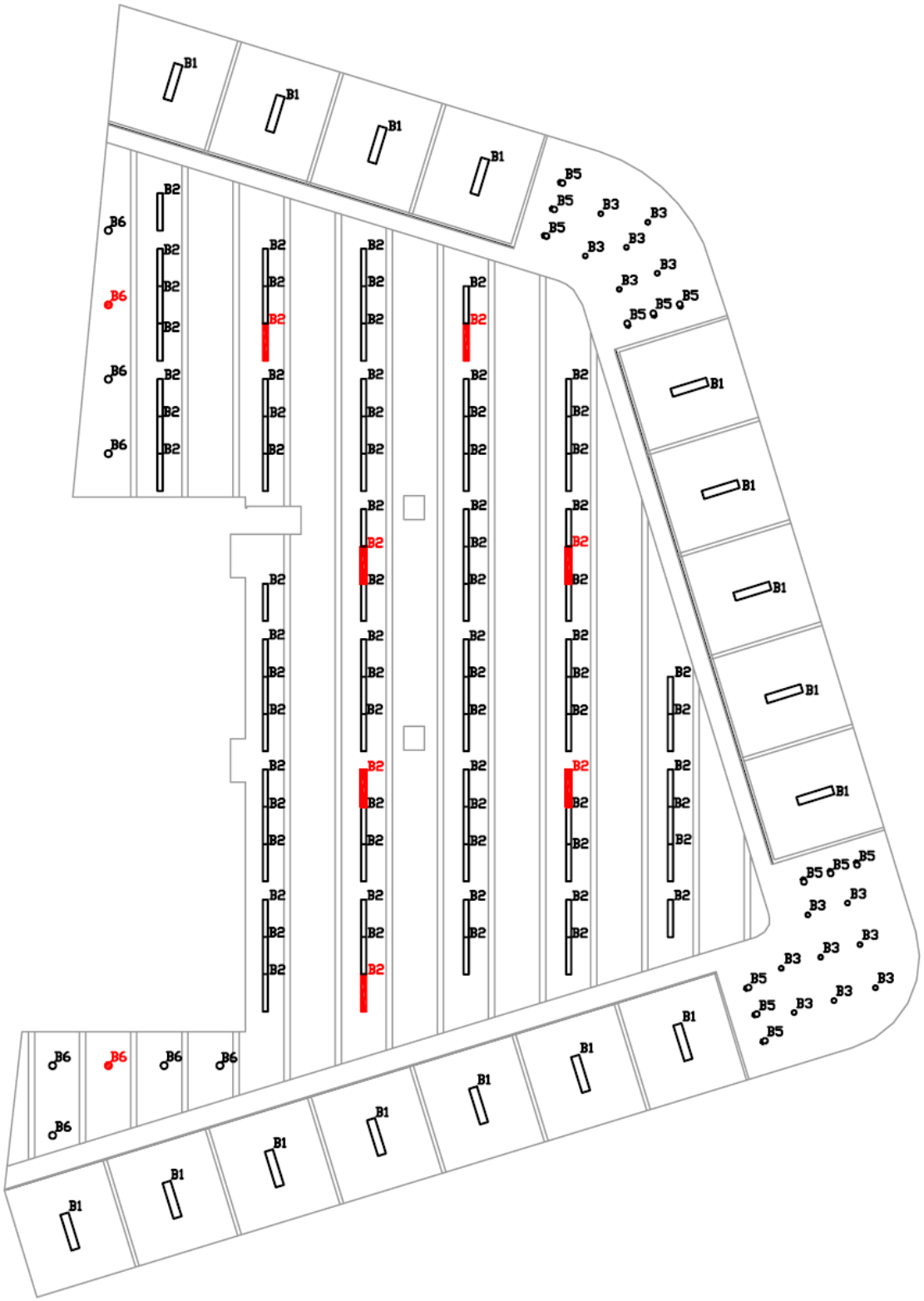
Emergency Lighting

I have provided emergency lighting plans to show the fixtures connected to the emergency panel boards in case of a black-out. They are shown in red. Not many are used because only light for evacuation is needed which entails only 1 fc. The lobby and academic court are not included in the emergency lighting plan.

Emergency Lighting Plans - Theater



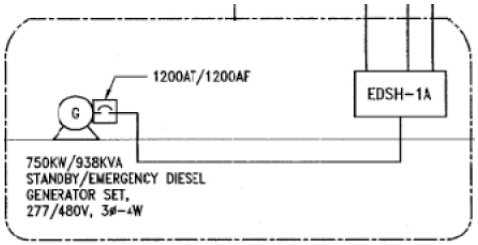
Emergency Lighting Plans – 3100 Research Area



Emergency Power

Cal (IT)^2 currently uses a 750 kW (938 kVA), 1200A 3 phase, 4 wire standby emergency diesel powered generator. In case of a power outage, there are three automatic transfer switches to transfer the power from the emergency generator to the emergency power loads. The emergency power is distributed by the switch board EDSH-1A which contains emergency lighting, mechanical equipment, clean room equipment, and elevator loads. In this study, I will be resizing the emergency generator with my new current emergency lighting loads to verify the emergency power needed in case of a power outage.

EDSH-1A Loads			
Distribution Panel	**Circuit Loads**	**Loads (kVA)**	**Total**
EDPH-1A			
	ELPH-BA	7.758	
	ELPH-1A	10.253	
	ELPH-2A	20.985	
	ELPH-4A	11.913	
	ELPH-PA	2.625	
			53.534
EDPH-ELEV-PA			
	ELEV-1	29.830	
	ELEV-2	29.830	
	ELEV-3	29.830	
	ELP-ELEV-PA	2.580	
			92.07
EDPH-1B			
	EDPH-2A	182.730	
	EDPH-PA	49.620	
	CH-1	0.750	
	CAC-1-1	3.730	
	CAC-1-2	3.730	
	CAC-1-3	3.730	
	MOCVD Equipment	100.000	
			344.29
		TOTAL kVA	**489.894**



The load values in this chart can be referred to in Technical Assignment #2.

Total kVA = 489.894 = about **500 kVA**
Current generator = 938 kVA > 500 kVA, so the generator is sized properly.

Circuit breaker sizing for EDSH-1A
(489.894 kVA) / (0.48 kV * sqrt(3)) = **590 A**
Current circuit breaker = 1200 A > 590 A, so the protection is sized properly.

Conclusions

The current electrical power loads for the building are sized properly. Being a technological research facility, I expected all the panelboards and distribution panels to be oversized by a significant amount due to the future installation of lab equipment and materials.

Construction Management Breadth

In every project, the initial design and the end result are usually very different. One main reason for this drastic change in a project is the budget. Unfortunately, each and every project has a budget which affects the many different disciplines involved. Sometimes, a very tight spending budget can run the entire project. This is the reason I have chosen to perform a cost analysis based on my redesign.

My study involves the contractor costs for the existing luminaires compared to the contractor costs for the lighting redesign. I controlled the study to involve only the interior fixtures involved with the main lobby, black-box theater, and the 3100 research cluster. I received these estimates by contacting various vendors and reps for contractor cost pricing on these various fixtures. These costs will be about 30% more for the owner because of mark-ups by the architect, designer, and distributor. I have also done a labor and installation cost analysis based on R.S. Means for 2005 for all the spaces I mentioned as well as the entire courtyard redesign. This will give an idea for the total costs involved with purchasing and installing these fixtures.

Existing Conditions

Cost Analysis

Existing Conditions

Fixture	Location	Cost Unit	Unit	Total Cost	Total Cost per Room
F1	3100 Research Cluster	$75/ft	248 ft	$18,600.00	
F1A	3100 Research Cluster	$75/ft	32 ft	$2,400.00	
F2	3100 Research Cluster	$30/ft	64 ft	$1,920.00	
F5	3100 Research Cluster	$195/fx	14	$2,730.00	
F7	3100 Research Cluster	$483/fx	9	$4,347.00	
F20	3100 Research Cluster	$220/fx	12	$2,640.00	
					$32,637.00
F12	Main Lobby	382/fx	11	$4,202.00	
F13A	Main Lobby	$290/fx	20	$5,800.00	
F21C	Main Lobby	$500/fx	4	$2,000.00	
F23	Main Lobby	$220/fx	15	$3,300.00	
F38A	Main Lobby	$320/fx	20	$6,400.00	
F39	Main Lobby	$450/fx	22	$9,900.00	
F49	Main Lobby	$225/fx	4	$900.00	
					$32,502.00
F42	Black-Box Theater	$384/fx	11	$4,224.00	
F43	Black-Box Theater	$165/fx	4	$660.00	
F44	Black-Box Theater	$250/fx	16	$4,000.00	
F51	Black-Box Theater	$540/fx	6	$3,240.00	
F53	Black-Box Theater	$85/fx	22	$1,870.00	
					$13,994.00
				TOTAL	$79,133.00

This shows the existing fixtures currently installed in the three interior spaces I redesigned. The total contractor cost for these spaces is about $79,133.00. These do not include the ballasts or lamps for the fixtures.

Redesign Conditions

Cost Analysis					
Redesign Conditions					
Fixture	Location	Cost Unit	Unit	Total Cost	Total Cost per Room
B1	3100 Research Cluster	$35/ft	64 ft	$2,240.00	
B2	3100 Research Cluster	$55/ft	308 ft	$16,940.00	
B3	3100 Research Cluster	$200/fx	14	$2,800.00	
B5	3100 Research Cluster	$255/fx	12	$3,060.00	
B6	3100 Research Cluster	$504/fx	9	$4,536.00	
					$29,576.00
B7	Black-Box Theater	$384/fx	11	$4,224.00	
B8	Black-Box Theater	$1250/fx	14	$17,500.00	
B9	Black-Box Theater	$504/fx	19	$13,281.00	
B10	Black-Box Theater	$225/fx	6	$1,350.00	
B11	Black-Box Theater	$165/fx	4	$660.00	
B12	Black-Box Theater	$289/fx	12	$3,468.00	
B13	Black-Box Theater	$220/fx	12	$2,640.00	
					$43,123.00
					$25,623.00
B14	Main Lobby	$315/fx	16	$5,040.00	
B15	Main Lobby	$315/fx	36	$11,340.00	
B16	Main Lobby	$236/fx	9	$2,124.00	
B17	Main Lobby	$430/fx	7	$3,010.00	
B18	Main Lobby	$65/ft	104 ft	$6,760.00	
B19	Main Lobby	$1550/fx	4	$6,200	
					$34,474.00
					$28,274.00
		With Custom Fixtures		TOTAL	$107,173.00
		Without Custom Fixture		TOTAL	$83,473.00

This table shows my redesigned budget. The fixtures highlighted in light blue are the custom fixtures I added to the spaces. Since these are custom designs, I estimated the prices of these fixtures by talking to professionals and manufacturers about rough costs for parts. Much of this was very broad and not precise which is why I also calculated a cost for the redesign not including the custom fixtures.

As you can see, the total contractor cost for these redesigned spaces is about $107,173.00. Without the custom fixtures, the total contractor cost is about $83,473.00. I had predicted my redesign would be more expensive based purely on my imaginary budget and the freedom to design custom fixtures and use any manufacturers I pleased. Though expensive, without using any custom fixtures, a difference of only about $5000 on the job is not a significant amount compared to the total cost.

Labor and Installation Costs

Labor Costs									
Fixture	Location	Number	Labor Cost	Labor Hours	Daily Output	# Electricians	Total Labor Costs	Total Hours	Total Days
B1	Open Office	16	$57.00	1.400	5.700	1	$912.00	22.40	2.8
B2	Open Office	76	$74.00	1.818	8.800	2	$5,624.00	138.17	8.6
B3	Open Office	14	$41.00	1.000	8.000	1	$574.00	14.00	1.8
B5	Open Office	12	$41.00	1.000	8.000	1	$492.00	12.00	1.5
B6	Open Office	9	$112.00	2.667	3.000	1	$1,008.00	24.00	3.0
B7	Theater	11	$41.00	1.000	8.000	1	$451.00	11.00	1.4
B8	Theater	14	$40.00	3.500	3.000	1	$560.00	49.00	4.7
B9	Theater	19	$112.00	2.667	3.000	1	$2,128.00	50.67	6.3
B10	Theater	6	$57.00	1.404	5.700	1	$342.00	8.42	1.1
B11	Theater	4	$41.00	1.000	8.000	1	$164.00	4.00	0.5
B12	Theater	12	$46.50	1.143	7.000	1	$558.00	13.72	1.7
B13	Theater	12	$57.00	1.404	5.700	1	$684.00	16.85	2.1
B14	Lobby	16	$38.50	0.941	8.500	1	$616.00	15.06	1.9
B15	Lobby	36	$38.50	0.941	8.500	1	$1,386.00	33.88	4.2
B16	Lobby	9	$41.00	1.000	8.000	1	$369.00	9.00	1.1
B17	Lobby	7	$21.00	0.500	16.000	1	$147.00	3.50	0.4
B18	Lobby	26	$57.00	1.404	5.700	1	$1,482.00	36.50	4.6
B19	Lobby	4	$50.00	3.250	4.000	2	$200.00	13.00	1.0
E1	Courtyard	8	$163.00	4.000	2.000	2	$1,304.00	32.00	4.0
E2	Courtyard	29	$121.00	2.963	2.700	1	$3,509.00	85.93	10.7
E3	Courtyard	29	$41.00	1.000	8.000	1	$1,189.00	29.00	3.6
E4	Courtyard	7	$41.00	1.000	8.000	1	$287.00	7.00	0.9
E5	Courtyard	21	$121.00	2.963	2.700	1	$2,541.00	62.22	7.8
E6	Courtyard	4	$57.00	1.404	5.700	1	$228.00	5.62	0.7
E7	Courtyard	8	$57.00	1.404	5.700	1	$456.00	11.23	1.4
E8	Courtyard	5	$57.00	1.404	5.700	1	$285.00	7.02	0.9
E9	Courtyard	7	$121.00	2.963	2.700	1	$847.00	20.74	2.6
E10	Courtyard	11	$112.00	2.667	3.000	1	$1,232.00	29.34	3.7
E11	Tunnel	Custom	$50.00	1.500	6.000	2	$750.00	12.00	1.5
E12	Tunnel	24	$38.50	0.941	8.500	1	$924.00	22.58	2.8
					w/ Custom	TOTAL	$31,249.00	799.85	89.3
					w/o Custom	TOTAL	$29,739.00	725.85	82.10

Using the R.S. Means Cost Estimating Book for 2005, I estimated the cost for labor and installation and a rough amount of hours and days it will take for 1 electrician, or 2 in some cases, to complete the installation of these redesigned fixtures. This gives an estimate for the owner and contractor as to how much money is needed for just installing lighting fixtures in 4 spaces. This gives reason to why MEP construction costs are very high and take up about 25% of the total project cost.

Conclusion

Through this analysis, I learned the true value of fixtures and the savings involved using the different types and different manufacturers for particular sources. I expected the outcome to be high with my custom fixtures, but only spent about $5000 more without custom fixtures. This, in turn, can show using light in creative ways can really save on cost without using expensive fixtures. Labor and installation costs were a lot higher than I expected, but can add reason to the high cost for any building.

ACOUSTICAL BREADTH

The Black-Box Theater of Cal IT^2 is a multi-functional space. It will be used for small student theatrical performances, small live music ensembles, guest speakers, video/audio presentations, and as a classroom for theater based students. Acoustics plays a large role in the comfort level of this space. Without the proper materials, the theater can sound rather dead and life-less. In this theater, I will be adding in acoustical materials to the walls, floor, and ceiling. I will then be calculating the acoustical properties by determining absorption coefficients of the materials and the reverberation times of the various frequencies.

Materials – Existing Conditions

Floor – Dark grey carpeting
Walls – Fiberglass fabric drapery on top gypsum board
Ceiling – Plywood custom shaped to reflect sound into crowd
Seats – Fabric, well-upholstered seats with perforated seat pans (audience seated)

Acoustical Method – Existing Conditions

Reverberation time is the time required for sound to decay 60 dB (decibels) after the source has stopped. This is important for live music and theatrical performances to be pronounced and lively as well as guest and audio speakers.

I will be using the Sabine formula as given: $T = 0.05 * (V / A)$

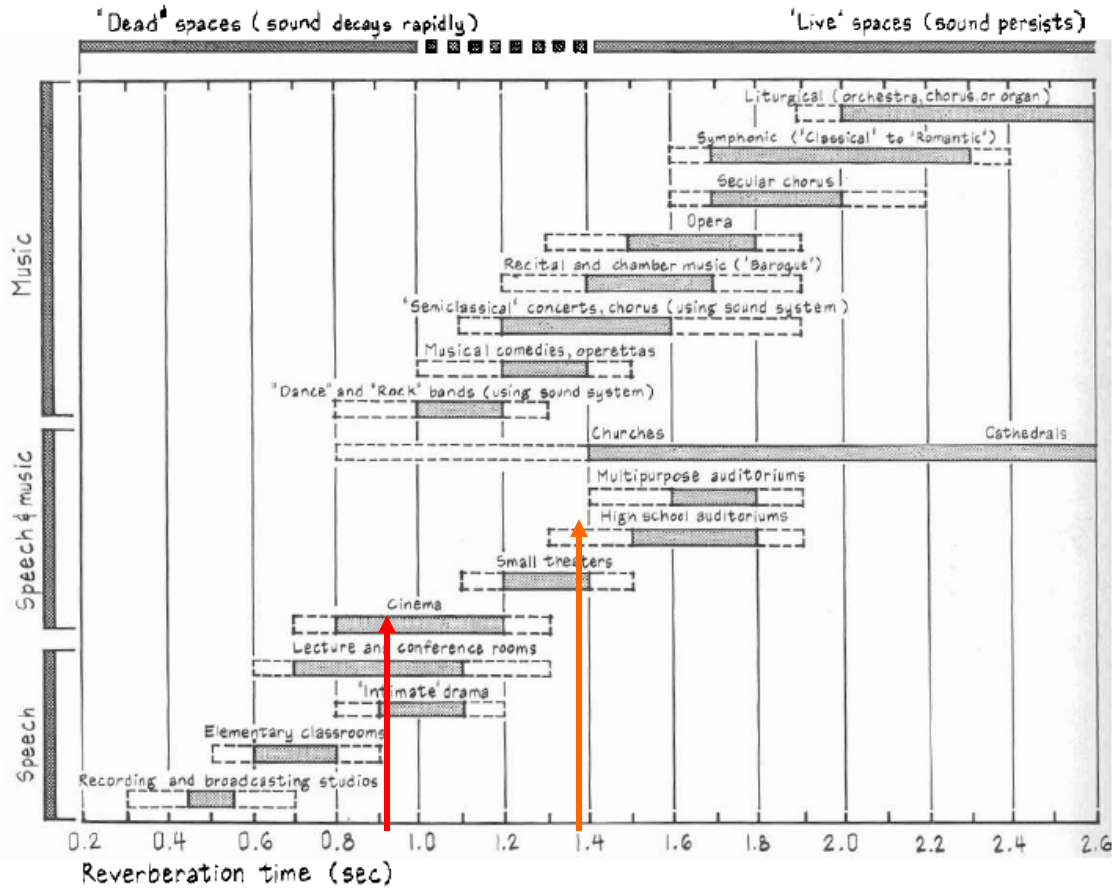
V = Room Volume
A = total square feet of room absorption
T = reverberation time

Sound Absorption Data for Materials and Furnishings

Room Part	Material	Surface Area (sq ft)	Absorption Coefficient					
			125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Walls	Fiberglass fabric curtain with small airspace between curtain and gyp board	3926	0.09	0.32	0.68	0.83	0.39	0.76
Floors	Carpet, heavy, on concrete	2095	0.02	0.06	0.14	0.37	0.6	0.65
Ceilings	Metal Mesh Grid	1452	0.15	0.22	0.29	0.36	0.43	0.5
	Plywood, 3/8" thick	400	0.28	0.22	0.17	0.09	0.1	0.11
Seating Area	Audience, seated in upholstered seats with perforated pans	900	0.39	0.57	0.8	0.94	0.92	0.87

Reverberation Times						
Room Part	Room Absorption					
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Walls	353.34	1256.32	2669.68	3258.58	1531.14	2983.76
Floors	41.90	125.70	293.30	775.15	1257.00	1361.75
Ceilings	217.80	319.44	421.08	522.72	624.36	726.00
	112.00	88.00	68.00	36.00	40.00	44.00
Seating Area	351.00	513.00	720.00	846.00	828.00	783.00
Total sq. ft	1076.04	2302.46	4172.06	5438.45	4280.50	5898.51
Volume (Cu. Ft)	85500	85500	85500	85500	85500	85500
T (sec)	3.973	1.857	1.025	0.786	0.999	0.725

The average reverberation time (which is taken between the 500 and 1000 Hz levels) is about **0.9055 sec**. I will be using different materials on the walls and floor to provide a longer reverberation time as recommended by the chart below. I am treating the space as a small theatre with multiple uses.



Materials* – *Redesigned Conditions

Floor – Dark grey carpeting on foam rubber
Walls – Lightweight drapery on top gypsum board
Ceiling – Plywood custom shaped to reflect sound into crowd
Seats – Fabric, well-upholstered seats with perforated seat pans (audience seated)

Acoustical Method* – *Redesigned Conditions

Sound Absorption Data for Materials and Furnishings

Room Part	Material	Surface Area (sq ft)	Absorption Coefficient					
			125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Walls	Lightweight drapery	3926	0.03	0.04	0.11	0.17	0.24	0.35
Floors	Carpet, heavy, on foam rubber	2095	0.08	0.24	0.57	0.69	0.71	0.73
Ceilings	Metal Mesh Grid	1452	0.15	0.22	0.29	0.36	0.43	0.5
	Plywood, 3/8" thick	400	0.28	0.22	0.17	0.09	0.1	0.11
Seating Area	Audience, seated in upholstered seats with perforated pans	900	0.39	0.57	0.8	0.94	0.92	0.87

Reverberation Times

Room Part	Room Absorption					
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Walls	117.78	157.04	431.86	667.42	942.24	1374.10
Floors	167.60	502.80	1194.15	1445.55	1487.45	1529.35
Ceilings	217.80	319.44	421.08	522.72	624.36	726.00
	112.00	88.00	68.00	36.00	40.00	44.00
Seating Area	351.00	513.00	720.00	846.00	828.00	783.00
Total sq. ft	966.18	1580.28	2835.09	3517.69	3922.05	4456.45
Volume (Cu. Ft)	85500	85500	85500	85500	85500	85500
T (sec)	4.425	2.705	1.508	1.215	1.090	0.959

The new average reverberation time (which is taken between the 500 and 1000 Hz levels) is about **1.3615 sec**.

Conclusions

The primary concern with the space was keeping the aesthetics in tune with the black-box theater atmosphere as well as rising the reverberation time to adequate levels for the various uses the theater has. By using the Sabine formula, it was easy to see how the absorption coefficients really affected the sound attenuation. Adding foam rubber under the carpeting and lighter drapery on the walls, the theater sounds more like the small multi-purpose theater it was built as.

Conclusions

The University of California, San Diego Cal IT^2 building is quite an impressive building. It marks as a staple on the UCSD campus. From its modern architecture to its elaborate electrical scheme, CAL IT^2 integrates everything into a working piece of art. From analyzing the existing conditions in both the lighting and electrical areas, I have learned a great deal about the composition of this technological building. It entails a wide variety of lighting schemes and electrical wiring with constant back-up for all the software and documentation going on inside.

In my redesign, I have provided an easily controlled lighting scheme for the theater, lobby, research area, academic courtyard, and the underground tunnel. As you saw, I have kept in mind the occupants and how they will be using each of these spaces while also keeping in tune with the architecture and purpose for the building itself. I have checked the electrical equipment installed with my new lighting system to verify the power consumption for everything new. I have also provided an acoustical and cost analysis to show how all trades of the industry are affected by one another.

I have learned a great deal from this whole experience. From this I will be taking away an understanding of how the industry works and how design can affect the many disciplines involved in each area. Even with the greatest challenge, a common ground can always be heard.

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6. California Title 24 Energy Standards 2005

7. ASHRAE 90.1 Energy Standards

Acknowledgements

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I would also like to thank HLB Lighting Design for supporting me through this process and providing me a wonderful project to work on. Angela Mcdonald and Lillian Rodriguez really helped me out last minute when things didn't go as planned. Another thanks goes to Heather Lion for her help with my questions throughout.

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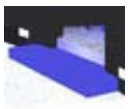
Lastly, I would like to thank all my brothers and friends for being there when I wasn't doing work or in the lab. Their support was always there.

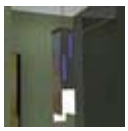
Appendix A

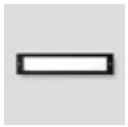
Luminaire Cut-sheets

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
B7		**Bega 2286P** 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** 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** 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** Description: 4' linear recessed wall-washer with 1 32W T8 fluorescent	1 32W T8 FL	Location: Black Box Theater
B11		**Lightolier 1108 / 1104F1**** Description: 6" recessed compact fluorescent downlight with 1-CFQ13W lamp. Optics: painted or anodized	1-CFQ13W lamp	Location: Black Box Theater

aluminum cone reflector.

B12		**Cooper Ltg - Metalux 2M-XRD-2-U6T8-PBIS-*-277-EB81-*** 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-*** Description: 1x4" recessed fluorescent wallwasher with 2-F32T8 (48in) lamps. Optics: anodized aluminum reflector , single.	2-F32T8 (48in) lamps	Location: Black Box Theater
B14		**Cooper Ltg - Corelite CI-SN-1T8-1-C-277-08** 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** 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** Description: 6" recessed compact fluorescent downlight with 1-CFTR32W lamp. Optics: anodized aluminum parabolic reflector.	1-CFTR32W lamp	Location: Lobby
B17		**Erco 88120.023** Description: 6" recessed halogen accent light with 1-MR16 50W max lamp.	1-MR16 50W max lamp	Location: Lobby
B18		**Zumtobel Staff SLR2-*-1285-*** Description: Recessed fluorescent downlight with (1) 28W T5 lamp in cross section.	(1) 28W T5	Location: Lobby
B19		**D'AC Custom Design** 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
E1		**Gardco LSA14-1-A-135LPS-277-BLP-LF** Description:	(1) 135W LPS	Location: Academic Court
E2		**Bega 8534MH** 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** Description: Recessed compact fluorescent step light with 1-CFT9W	1-CFT9W lamp	Location: Academic Court

		lamp. Optics: tempered glass diffuse white lens.		
E4		**Belfer 3510FPS-BHS-13-1-*** 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** 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 *** 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** 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-*** 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** 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** 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
E11		**Zumtobel Staff Custom Fixture** 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-*** Description: Surface-mounted fluorescent strip light, rigid housing with blue gelled 1-F32T8 (48in) lamp.	rigid housing 1-F32T8 (48in) lamp	Location: Underground Tunnel

Note: Verify all product specifications and catalog numbers with manufacturer. Product data is subject to change without notice. While every effort has b to ensure the accuracy and reliability of the data, eLumit does not directly or impliedly warrant or endorse the data provided.

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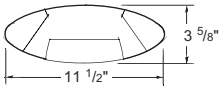
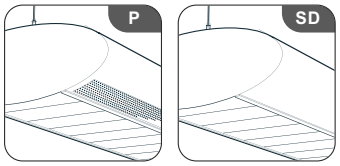
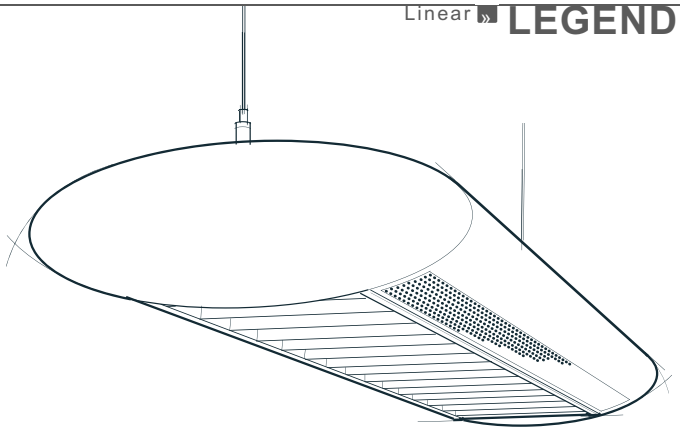
Type
Job Name
Catalog Number

Linear LEGEND







ordering

body series/style	lamp rows	nominal length	shielding	color/finish	circuiting	voltage	mounting	ceiling system	options
LGD-									
P perforated	2T8	04'	SPL* silver parabolic louver	TMW* textured matte white	SC single circuit	120	CA48"* aircraft cable (adjustable)	X1* exposed T-bar	EML
SD* solid	3T8	08'	PRA prismatic acrylic lens	YGW gloss white	DC dual circuit (in-line)	277	CA96" aircraft cable (adjustable)	X3 hard ceiling	EMH
*standard		12'	*standard	Y__ premium color		347	CA144" aircraft cable (adjustable)	X6 slot grid	DM
		R__*		CC custom color			SSC__ top-swivel stem mount (specify length in inches)	*standard	RSE
		*row length		GLV galva-nized			*standard		10THD
				*standard					B__
									FH
									AMP*
									BSH†
									*for existing/variable mounting locations
									†stem-mounting only

Applications Classrooms, laboratories, open offices, small offices, mixed-use areas, retail.

Features A classic oval linear direct/indirect lighting system. The internal reflectors are die-formed steel (white). Semi-specular parabolic louver is 1 1/2" high, 2 3/8" on center and provides 32° longitudinal shielding. Using an adjustable mounting plate (AMP) and conveniently located ballast cover knockouts, the fixture can accommodate existing or variable mounting and feed locations. Finish plates can be removed for continuous row-installation. Fixtures are connected and secured together by aligning with and bolting through alignment holes in end plates. When row-mounting is specified, quick-connect circuit assemblies are supplied.

Construction The housing, available in 4-, 8- or 12-foot standard lengths, is made of 20-gauge steel. Finish plates are 18-gauge steel.

Finish The standard exterior body color is textured matte white (TMW) or optional gloss white (YGW) using polyester powder paint. Refer to ordering matrix for optional metal finishes or refer to **Defining Section** for optional paint colors. Canopies and stems match body color unless otherwise specified. Galvanized fixtures come with galvanized canopies and pewter (YMP) stems when stem-mounting is specified.

Electrical T8 fixtures have instant-start electronic ballasts with less than 20% THD. Fixtures are U.L. Damp labeled (non-emergency) and I.B.E.W. manufactured. Maximum ballast size available: 2 3/8" width x 1 1/2" height.

Mounting Fixture is suspended with aircraft cables or stem-mounted.

Options **EML**: emergency battery (T8=600 lumens); **EMH**: emergency battery (T8=1200 lumens); **DM**: dimming (consult factory); **RSE**: rapid-start electronic; **10THD**: ballast with < 10% total harmonic distortion; **B_**: specific ballast, specify manufacturer and catalog number (consult factory); **FH**: fixture fusing (slow blow); **AMP**: adjustable mounting plate; **BSH**: longitudinal body sway hanger (stem-mounting only).

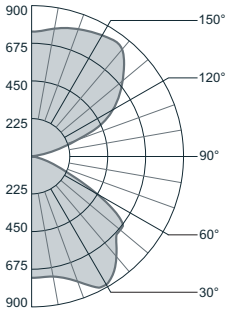
Prudential Lighting # LGD-P-2T8-*-SPL-*		**B1**
Brian Smith	**UCSD Cal IT2**	**# of #**

http://www.prulite.com/downloads/Legend_Dec03.pdf

photometric data

LGD-SD-2T8-04-SPL-TMW

Report # LSI15345 D=43.7% I=56.3%
Spacing Criteria: Along 1.2; Across 1.6
Lamp Lumens: 2950 Input Watts: 61



Candlepower Summary

Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Output Lumens
0	726	726	726	726	726	
5	722	723	724	723	726	70
15	684	689	712	741	752	203
25	620	643	726	820	857	338
35	529	591	751	821	849	443
45	403	517	636	675	711	459
55	229	345	442	562	636	386
65	61	90	160	221	248	166
75	9	13	21	44	68	35
85	0	0	1	5	7	5
90	0	0	0	0	0	
95	22	30	31	31	30	39
105	107	218	214	170	153	197
115	227	382	432	461	457	394
125	351	475	593	612	634	488
135	471	566	705	767	776	511
145	576	640	736	813	846	453
155	656	691	751	799	821	344
165	713	729	753	778	794	213
175	743	748	747	750	754	73
180	745	745	745	745	745	

Zonal Lumen Summary

Zone	% Lamp	% Luminaire
0-90	35.67	43.70
90-180	45.97	56.30

Efficiency = 81.6%

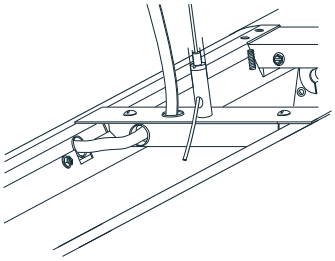
Coefficients of Utilization (%)

Floor	effective floor cavity reflectance = .20									
Ceiling	80				70				50	
Wall	70	50	30	10	70	50	30	10	50	30	10
RCR **0**	86	86	86	86	79	79	79	79	65	65	65
1	79	76	73	71	73	70	68	65	58	57	55
2	73	67	63	59	67	62	58	55	52	49	47
3	67	60	54	50	61	55	50	47	46	43	40
4	61	53	47	42	56	49	44	40	41	37	34
5	56	47	41	36	51	44	38	34	37	33	29
6	52	42	36	31	47	39	33	29	33	29	25
7	47	38	31	27	43	35	29	25	29	25	22
8	44	34	27	23	40	31	26	22	26	22	19
9	40	30	24	20	37	28	23	19	24	19	16
10	37	27	21	18	34	25	20	16	21	17	14

Luminance Summary (cd/m²)

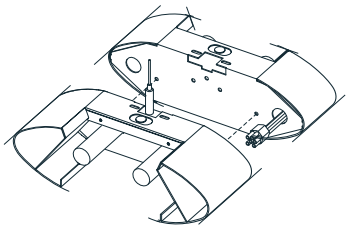
Angle	0°	45°	90°
45	3372	5345	5970
55	2357	4576	6583
65	854	2254	3490
75	210	477	1551
85	0	94	499

Adjustable Mounting Plate

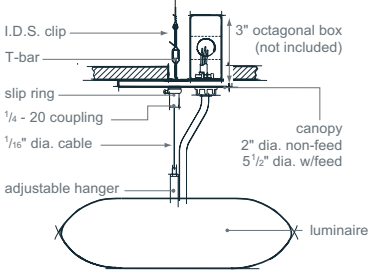


installation

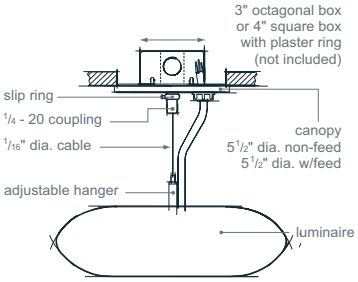
Adjoining Detail



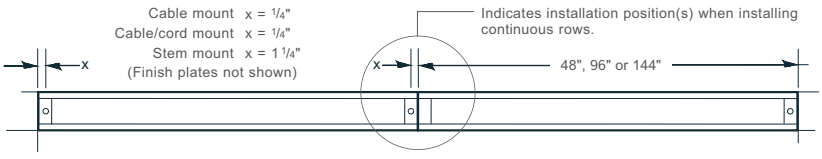
Suspension (x1)



Suspension (x3)



Mounting Locations



Note: When connecting two or more fixtures in a row, mounting assemblies are required on both ends of the first fixture, with only one mounting assembly required on each additional fixture.

In an effort to continually provide the highest quality products, Prudential reserves the right to change design specifications and/or materials, without notice.

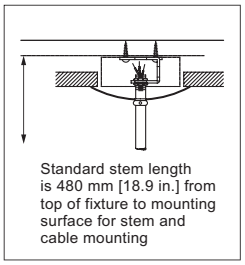
Prudential Lighting 1737 E. 22nd St. Los Angeles, CA 90058 phone 213.746.0360 fax 213.741.8590 **www.prulite.com**

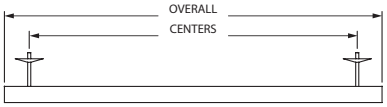
Prudential Lighting # LGD-P-2T8-*-SPL-*		**B1**
Brian Smith	**UCSD Cal IT2**	**# of #**

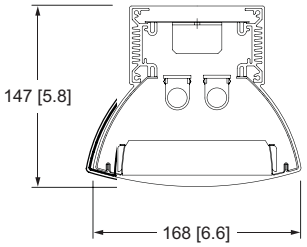
Mounting Information

Nominal Length	Overall mm [in]	Centers mm [in]
4' T5	1242 [48.9]	1219 [48.0]
8' T5	2436 [95.9]	2413 [95.0]
12' T5	3630 [142.9]	3607 [142.0]
4' T8	1291 [50.8]	1268 [49.9]
8' T8	2534 [99.8]	2511 [98.9]
12' T8	3776 [148.7]	3753 [147.8]

Mounting dimensions indicated above are for individual units only. For continuous row mounting dimensions consult factory.

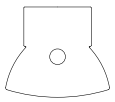
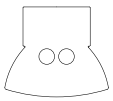






Model Shown:
2 Lamps Direct

Photometrics on reverse

Series / Model	Length	Body	Control Up / Control Down	Mounting / Finish	Source / Voltage
SD3					
A  1 - lamp direct	**4** 4' long	**D** detailed	Light Control Up **A** solid housing **P** perforated housing strip	Mounting **1** solid stem **4** aircraft cable ☐ standard 480mm [18.9"] ☐ or indicate length	Source **4** T8 **5** T5 **6** T5 HO
B  2 - lamps direct	**8** 8' long	**S** smooth	Light Control Down **J** solid cross blade baffle **O** solid cross blade baffle and opal overlay **L** perforated cross blade baffle **M** perforated cross blade baffle and opal overlay **K** specular parabolic louver **Z** specular parabolic louver and opal overlay	Finish **A** anodized aluminum body with silver metallic paint finish on metal housing and metal end caps **S** special paint finish on metal housing and metal end caps, indicate paint # and manufacturer	Voltage **A** 120 Volt **B** 277 Volt **C** 347 Volt
	C 12' long				
	R continuous rows				

METALUMEN
Distinguished Design ↔ Engineered Excellence

METALUMEN MANUFACTURING INC.
570 Southgate Drive, Guelph, Ontario N1G 4P6
Mailing Address: P. O. Box 1779, Guelph, Ontario N1H
toll free 1-800-621-6785 t 519-822-4381 f 519-822-458

www.metalumen.com

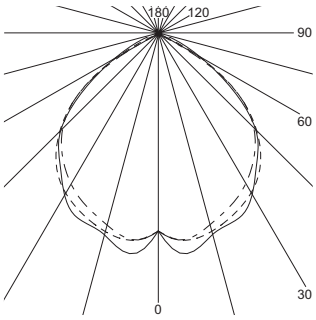
Approvals

Signature

Date

Metalumen # SD3-B-*-*-A-K-*-*-4-*		B2
Brian Smith	**UCSD Cal IT2**	**# of #**

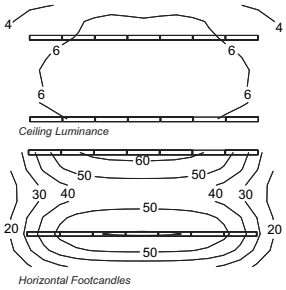
Distribution Curve



Candlepower Summary

Angle	0.0	22.5	45	67.5	90	Output Lumens
0	1462	1462	1462	1462	1462	8
5	1495	1513	1493	1465	1587	119
15	1422	1435	1473	1472	1495	364
25	1306	1345	1374	1407	1424	550
35	1148	1211	1227	1206	1190	632
45	940	994	965	949	955	577
55	574	600	587	556	540	370
65	35	67	147	208	231	95
75	3	4	9	54	88	17
85	2	3	9	37	46	8
90	2	3	17	50	59	9
95	2	3	24	53	66	18
105	3	4	23	46	57	23
115	4	5	17	32	38	17
125	4	6	13	19	23	9
135	5	8	12	16	15	5
145	7	9	13	13	13	4
155	8	9	11	12	11	3
165	8	11	10	9	10	1
175	7	9	11	10	6	0
180	7	7	7	7	7	0

Room Layout

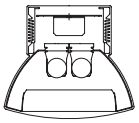


10.7(L) x 9.1(W) x 3.0(H)m [35 x 30 x 10 ft]
Reflectances: 80/50/20
Maintenance factor: 0.70
Fixture spacing: 3.0m [10'-0"]
Pendant length: 457mm [18"]

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Luminaire
0-30	1192	20.6	33.9
0-40	1948	33.6	55.5
0-60	3210	55.4	91.4
0-90	3400	58.6	96.8
90-120	76	1.3	.2
90-130	88	1.5	.5
90-150	104	1.8	.9
90-180	112	1.9	3.2
0-180	3512	60.5	100.0

T8 2 Lamp



Photometric report - file # SD3BPK-4
Efficiency = 60.5%
96.8% Direct / 3.2% Indirect
Model Shown 2 - T8 Lamp
Perforated housing with specular parabolic louver

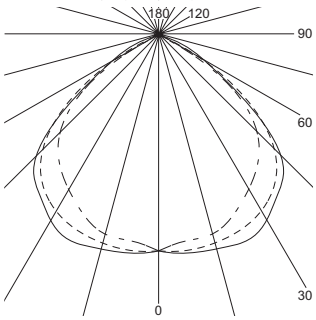
Coefficients of Utilization
Zonal Cavity Method

Effective Floor Cavity Reflectance = .20

RC	80				70				50		
RW	70	50	30	10	70	50	30	10	50	30	10
RCR											
0	71	71	71	71	69	69	69	69	66	66	66
1	66	64	62	60	65	63	61	59	60	58	57
2	61	57	54	51	60	56	53	50	54	51	49
3	57	51	47	44	55	50	46	43	48	45	42
4	52	46	41	38	51	45	41	38	43	40	37
5	48	41	37	33	47	41	36	33	39	35	32
6	45	38	33	29	44	37	32	29	36	32	29
7	42	34	29	26	41	34	29	26	33	28	25
8	39	31	26	23	38	31	26	23	30	26	23
9	36	29	24	21	35	28	24	21	27	23	21
10	34	26	22	19	33	26	22	19	25	21	19

Laboratory results may not be representative of field performance.
Ballast factors have not been applied.

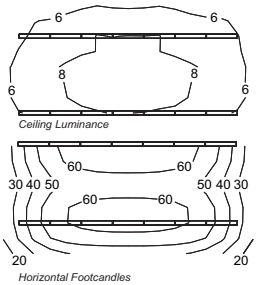
Distribution Curve



Candlepower Summary

Angle	0.0	22.5	45	67.5	90	Output Lumens
0	1368	1368	1368	1368	1368	8
5	1324	1366	1376	1364	1389	122
15	1300	1318	1360	1388	1401	384
25	1179	1244	1312	1363	1395	602
35	1035	1116	1205	1253	1250	741
45	836	935	982	1002	1033	746
55	466	555	560	522	495	475
65	16	41	111	186	222	113
75	1	1	6	33	53	18
85	1	2	5	11	15	5
90	1	3	11	25	27	7
95	1	4	22	46	56	21
105	2	3	20	47	61	27
115	2	3	11	25	34	14
125	3	5	8	11	12	7
135	3	5	9	10	9	6
145	4	4	10	9	9	5
155	5	5	7	8	8	3
165	4	5	5	5	6	1
175	7	5	6	4	4	0
180	8	8	8	8	8	0

Room Layout

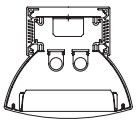


10.7(L) x 9.1(W) x 3.0(H)m [35 x 30 x 10 ft]
Reflectances: 80/50/20
Maintenance factor: 0.70
Fixture spacing: 3.0m [10'-0"]
Pendant length: 457mm [18"]

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Luminaire
0-30	1117	21.4	33.8
0-40	1857	35.6	56.2
0-60	3078	59.0	93.1
0-90	3218	61.7	97.3
90-120	65	1.2	.0
90-130	72	1.4	.2
90-150	83	1.6	.5
90-180	88	1.7	.7
0-180	3306	63.3	100.0

T5 2 Lamp



Photometric report - file # SD3BPK-5
Efficiency = 63.3%
97.3% Direct / 2.7% Indirect
Model Shown 2 - T5 Lamp
Perforated housing with specular parabolic louver

Coefficients of Utilization
Zonal Cavity Method

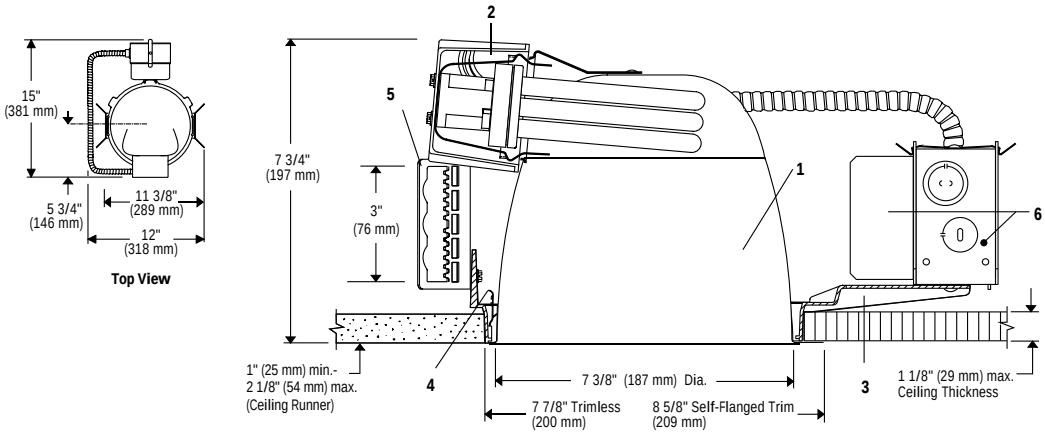
Effective Floor Cavity Reflectance = .20

RC	80				70				50		
RW	70	50	30	10	70	50	30	10	50	30	10
RCR											
0	75	75	75	75	73	73	73	73	69	69	69
1	70	67	65	63	68	66	64	62	63	61	60
2	65	60	57	54	63	59	56	53	57	54	52
3	60	54	50	46	58	53	49	46	51	48	45
4	55	48	44	40	54	48	43	40	46	42	39
5	51	44	39	35	49	43	38	35	41	37	34
6	47	40	34	31	46	39	34	31	38	33	30
7	44	36	31	27	43	35	31	27	34	30	27
8	41	33	28	24	40	32	28	24	31	27	24
9	38	30	25	22	37	30	25	22	29	25	22
10	36	28	23	20	35	27	23	20	27	23	20

Laboratory results may not be representative of field performance.
Ballast factors have not been applied.

Calculite® Compact Fluorescent Open Downlight **8037**

7 3/8" Triple Tube Horizontal Lamp



Ceiling Cutout: 8" (203 mm) Dia.

Reflector Trim		Frame-In Kit			Lamp
8037CLW	Clear Iridescence Free, White Flange	**7132BU**	Electronic	120V - 277V	**26 or 32W Triple Tube**
8037CLP	Clear Iridescence Free, Polished Flange	**7132BCU**	PowerSpec® Dimming	120V - 277V	4-Pin (Amalgam)
8037CL	Clear Iridescence Free, Molded Trim Ring	**7142BU**	Electronic	120V - 277V	**42W Triple Tube**
8037☐	Add suffix. See options for other finishes.	**7142BCU**	PowerSpec® Dimming	120V - 277V	4-Pin (Amalgam)
		Remodeler Frame-In Kit			Lamp
		7132BURM	Electronic	120V - 277V	Same as 7132BU
		7142BURM	Electronic	120V - 277V	Same as 7142BU

Features

1. Reflector: 16 ga. Alzak® aluminum, 55° visual cutoff to lamp and lamp image, wide distribution. Iridescence Free finish. Self-flanged or flangeless with molded white trim ring (field paintable).
2. Socket Cup: Die-cast aluminum cup effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
3. Mounting Frame: Die-cast aluminum for dry or plaster ceilings.
4. Retaining Springs: Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
5. Mounting Brackets: 16 ga. steel. Adjust from inside of fixture. Use 3/4" or 1 1/2" lathing channel, 1/2" EMT, or optional mounting bars.
6. Ballast/J-Box: Outboard mounted to reduce heat transfer and maintain lamp efficacy and life. Service from below without tools.

Electrical

Note: For ballast electrical data and latest lamp/ballast compatibility refer to "Ballast" specification sheet for complete electrical data.
7132BU, 7132BCU, 7142BU, 7142BCU: UL listed for through branch circuit wiring with max of (8) No. 12 AWG, 90°C supply conductors.
7132BURM, 7142BURM: UL listed for No. 12 AWG, 90°C supply conductors.

Options and Accessories

Comfort Clear™ Finishes[1]		Other Finishes	
Clear	CCL	White	WH
Diffuse	CCD	Multigroove	MG
Champagne Bronze	CCZ		
Pewter	CPW		

[1]Specify desired flange
W White, P Polished
Blank - Molded Ring

Options and Accessories (continued)

Emergency	Add suffix EM*
Chicago Plenum	Add suffix LC
Existing/Thk. Ceiling	FA EC7*
Emergency Ltg. Kit	FA EM3E*
	FA EM4E*
Fuse (Slow Blow)	Add Suffix F

*See Spec. Sheets: FAEC, FAEM

Mounting Bars & Accessories; see Specification Sheet MBA.
Sloped Ceiling Adapters; see Specification Sheet SCA.

Labels

UL listed for damp locations, I.B.E.W.

Alzak® is a registered trademark of ALCOA.
US Patent Pending.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

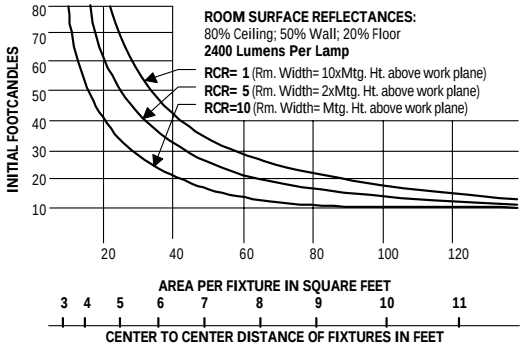
Notes:

Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
We reserve the right to change details of design, materials and finish.

LIGHTOLIER®

Lightolier # 8037*** / 7132BU 32W		**B3**
Brian Smith	**UCSD Cal IT2**	**# of #**

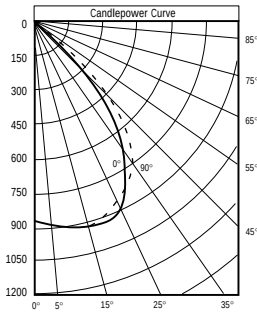
32W
Quick Calculator



This quick calculator chart determines the number and spacing of 1 lt.- 32W PL-T units with clear reflector, for any level of illumination.

Spacing Ratio = 1.3

Report No.: LRL 796-1G
PREPARED BY: LIGHTING RESEARCH LABORATORY, INC
PREPARED FOR: LIGHTOLIER
DESCRIP.: 7-3/8" dia. x 7" Ht. recessed downlight
- open bottom spun semispecular reflector; tilted horizontal lamp
BALLAST: LIGHTOLIER GLT423-120I.
LAMPS: 1 PLT-32W rated at 2400 LUMENS.



**** EFFICIENCY = 66.3% ****

ZONE	CANDLEPOWER 0	22	45	67	90
DEG.	CANDELAS				
90	0	0	0	0	0
85	1	1	1	1	1
80	1	1	1	1	1
75	1	1	1	1	1
70	2	2	2	2	2
65	3	3	3	3	3
60	6	6	5	6	6
55	57	58	49	47	51
50	240	241	238	153	257
45	424	425	425	459	463
40	546	557	561	599	600
35	667	690	696	738	737
30	781	776	761	811	805
25	895	862	823	885	875
20	921	923	870	904	907
15	947	984	927	922	937
10	918	937	909	909	915
5	888	891	892	894	893
0	870	870	870	870	870

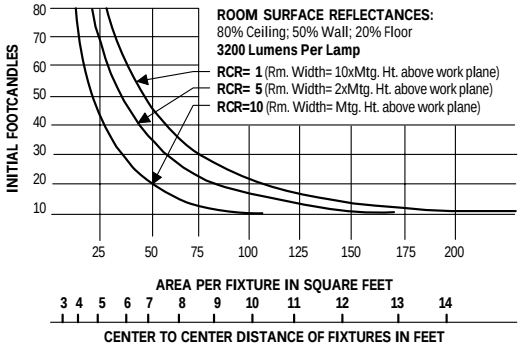
ZONE	LUMENS	%BARE LAMP	%LUMINAIRE
0-30	743	31.0	46.7
0-40	1178	49.1	74.1
0-60	1586	66.1	99.7
0-90	1591	66.3	100.0
40-90	413	17.2	25.9
60-90	5	0.2	0.3
90-120	0	0.0	0.0
90-150	0	0.0	0.0
90-180	0	0.0	0.0
0-180	1591	66.3	100.0

Coefficients Of Utilization

ROOM CAVITY RATIO	% EFFECTIVE CEILING CAVITY REFLECTANCE 80			70			50			30			10			0
	% WALL REFLECTANCE 50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.73	.72	.70	.72	.70	.69	.68	.67	.67	.67	.66	.65	.64	.64	.63	.62
2	.68	.66	.63	.67	.65	.63	.65	.63	.61	.63	.61	.60	.61	.60	.59	.58
3	.64	.61	.58	.63	.60	.58	.61	.59	.57	.60	.58	.56	.58	.56	.55	.54
4	.59	.56	.53	.59	.55	.52	.57	.54	.52	.56	.53	.51	.55	.52	.51	.50
5	.55	.51	.48	.55	.51	.48	.53	.50	.48	.52	.49	.47	.51	.49	.47	.46
6	.51	.47	.44	.51	.47	.44	.50	.46	.44	.49	.46	.44	.48	.45	.43	.42
7	.48	.43	.40	.47	.43	.40	.46	.43	.40	.45	.42	.40	.45	.42	.40	.39
8	.44	.40	.37	.44	.40	.37	.43	.39	.37	.42	.39	.36	.42	.39	.36	.35
9	.40	.36	.33	.40	.36	.33	.39	.36	.33	.39	.36	.33	.38	.35	.33	.32
10	.36	.31	.28	.35	.31	.28	.35	.31	.28	.34	.31	.28	.34	.30	.28	.27

20% FLOOR CAVITY REFLECTANCE

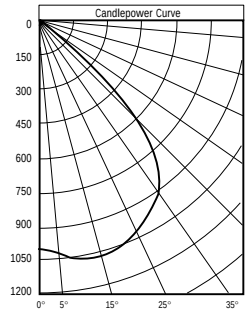
42W
Quick Calculator



This quick calculator chart determines the number and spacing of 1 lt.- 42W PL-T units with clear reflector, for any level of illumination.

Spacing Ratio = 1.4

Report No.: LRL 796-1F
PREPARED BY: LIGHTING RESEARCH LABORATORY, INC
PREPARED FOR: LIGHTOLIER
DESCRIP.: 7-3/8" dia. x 7" Ht. recessed downlight
- open bottom spun semispecular reflector; tilted horizontal lamp
BALLAST: LIGHTOLIER GLT423-120I.
LAMPS: 1 PLT-42W rated at 3200 LUMENS.



**** EFFICIENCY = 65.4% ****

ZONE	CANDLEPOWER 0	22	45	67	90
DEG.	CANDELAS				
90	0	0	0	0	0
85	1	1	1	1	1
80	1	1	1	1	1
75	3	3	3	3	3
70	3	3	3	3	3
65	4	4	4	4	4
60	9	9	9	9	9
55	93	99	80	77	78
50	436	409	436	398	413
45	634	622	634	663	680
40	737	758	800	850	850
35	866	905	920	951	948
30	975	964	923	1022	1049
25	1045	1050	1030	1066	1103
20	1053	1070	1077	1117	1148
15	1074	1097	1148	1141	1176
10	1046	1076	1091	1099	1121
5	1004	1009	1017	1021	1020
0	1002	1002	1002	1002	1002

ZONE	LUMENS	%BARE LAMP	%LUMINAIRE
0-30	896	28.0	42.8
0-40	1465	45.8	70.0
0-60	2084	65.1	99.6
0-90	2092	65.4	100.0
40-90	627	19.6	30.0
60-90	8	0.3	0.4
90-120	0	0.0	0.0
90-150	0	0.0	0.0
90-180	0	0.0	0.0
0-180	2092	65.4	100.0

Coefficients Of Utilization

ROOM CAVITY RATIO	% EFFECTIVE CEILING CAVITY REFLECTANCE 80			70			50			30			10			0
	% WALL REFLECTANCE 50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.72	.70	.69	.71	.69	.68	.68	.67	.66	.65	.64	.64	.63	.62	.62	.61
2	.67	.64	.62	.66	.63	.61	.64	.62	.60	.62	.60	.59	.60	.59	.57	.56
3	.62	.59	.56	.61	.58	.56	.60	.57	.55	.58	.56	.54	.57	.55	.53	.52
4	.57	.54	.51	.57	.53	.50	.55	.52	.50	.54	.51	.49	.53	.50	.49	.48
5	.53	.49	.46	.53	.49	.46	.51	.48	.46	.50	.47	.45	.49	.47	.45	.44
6	.49	.45	.42	.49	.45	.42	.48	.44	.42	.47	.44	.41	.46	.43	.41	.40
7	.45	.41	.38	.45	.41	.38	.44	.40	.38	.43	.40	.37	.42	.40	.37	.36
8	.42	.37	.34	.41	.37	.34	.40	.37	.34	.40	.36	.34	.39	.36	.34	.33
9	.38	.34	.31	.38	.34	.31	.37	.33	.31	.36	.33	.30	.36	.33	.30	.29
10	.33	.29	.26	.33	.29	.26	.32	.28	.26	.32	.28	.25	.31	.28	.25	.24

20% FLOOR CAVITY REFLECTANCE

Job Information **Type:**

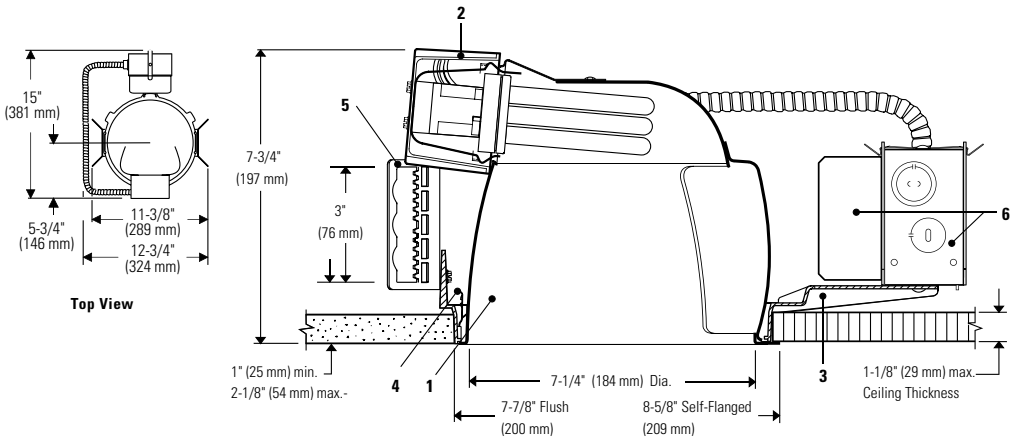
Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Lightolier # 8037*** / 7132BU 32W		**B3**
Brian Smith	**UCSD Cal IT2**	**# of #**

Calculite® Compact Fluorescent Open Wall Washer **8087**

7 3/8" Aperture Triple Tube Horizontal Lamp



Ceiling Cutout: 8" (203 mm) Dia.

Reflector Trim		Frame-In Kit			Lamp
8087CLW	Clear Iridescence Free, White Flange	**7132BU**	Electronic	120V - 277V	**26 or 32W Triple Tube**
8087CLP	Clear Iridescence Free, Polished Flange	**7132BCU**	PowerSpec® Dimming	120V - 277V	4-Pin (Amalgam)
8087CL	Clear Iridescence Free, Molded Trim Ring				
8087 ☐	Add suffix. See options for other finishes.	**7142BU**	Electronic	120V - 277V	**42W Triple Tube**
		7142BCU	PowerSpec® Dimming	120V - 277V	4-Pin (Amalgam)

Features

1. **Downlight Wall Washer Reflector:** 16 ga. Specular Alzak® aluminum, 55° lamp cutoff to lamp and lamp image. Provides vertical surface wall wash and downlighting. Iridescence Free finish. Self-flanged or flangeless with molded white trim ring (field paintable).
2. **Socket Cup:** Die-cast aluminum cup effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
3. **Mounting Frame:** Die-cast aluminum for dry or plaster ceilings.
4. **Retaining Springs:** Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
5. **Mounting Brackets:** 16 ga. steel. Adjust from inside of fixture. Use 3/4" or 1 1/2" lathing channel, 1/2" EMT, or optional mounting bars.
6. **Ballast/J-Box:** Outboard mounted to reduce heat transfer and maintain lamp efficacy and life. Service from below without tools.

Electrical

Note: For ballast electrical data and latest lamp/ballast compatibility refer to **"Ballast"** specification sheet for complete electrical data.

UL listed for through branch circuit wiring with max of (8) No. 12 AWG, 90° C supply conductors.

Options and Accessories

Comfort Clear™ Finishes[1]		**Other Finishes**	
Clear	**CCL**	White	**WH**
Diffuse	**CCD**		
Champagne Bronze	**CCZ**		
Pewter	**CPW**		

[1]Specify desired flange
W White, **P** Polished
Blank - Molded Ring

Options and Accessories (continued)

Emergency	Add suffix **EM***
Chicago Plenum	Add suffix **LC**
Existing/Thk. Ceiling	**FA EC7***
Emergency Ltg. Kit	**FA EM3E***
	FA EM4E*
Fuse (Slow Blow)	Add suffix **F**

*See Spec. Sheets: FAEC, FAEM

Mounting Bars & Accessories; see Specification Sheet MBA.
Sloped Ceiling Adapters; see Specification Sheet SCA

Labels

UL listed for damp locations, I.B.E.W.

Alzak® is a registered trademark of ALCOA.
US Patent Pending.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

Notes:

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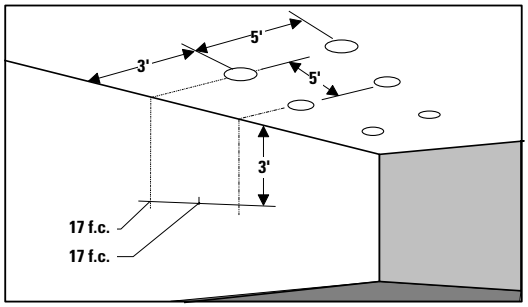
LIGHTOLIER®

Lightolier # 8087*** / 7132BU 32W		**B5**
Brian Smith	**UCSD Cal IT2**	**# of #**

Lighting Data

Footcandles On Wall: Multiple 32W Units



EXAMPLE: With multiple clear reflector units located 3' from wall and spaced 5' on center (matching downlights 5' on center), the illumination on the wall 3' down from ceiling will be 17 f.c. beneath units and 17 f.c. between units.

Footcandle values are averaged and rounded off and are based on a minimum of five units.

Conversion Factor: 26W: (Clear), f.c. x 0.9.

2' from Wall-2' On Center

Distance From Ceiling in Feet			
1	46	51	46
2	58	55	58
3	47	45	47
4	35	34	35
5	26	27	26
6	20	21	20
7	16	16	16
8	13	13	13
9	11	11	11

2' from Wall-3' On Center

Distance From Ceiling in Feet			
1	34	29	34
2	38	41	38
3	34	30	34
4	24	24	24
5	19	19	19
6	15	16	15
7	13	13	13
8	11	11	11
9	9	10	9

2' from Wall-4' On Center

Distance From Ceiling in Feet			
1	31	16	31
2	33	26	33
3	23	25	23
4	19	17	19
5	15	14	15
6	12	12	12
7	10	10	10
8	9	9	9
9	8	8	8

3' from Wall-3' On Center

Distance From Ceiling in Feet			
1	18	18	18
2	22	25	22
3	27	25	27
4	25	23	25
5	20	20	20
6	17	17	17
7	14	15	14
8	12	13	12
9	11	11	11

3' from Wall-4' On Center

Distance From Ceiling in Feet			
1	15	12	15
2	17	18	17
3	19	21	19
4	20	17	20
5	16	15	16
6	13	13	13
7	11	11	11
8	10	10	10
9	9	9	9

3' from Wall-5' On Center

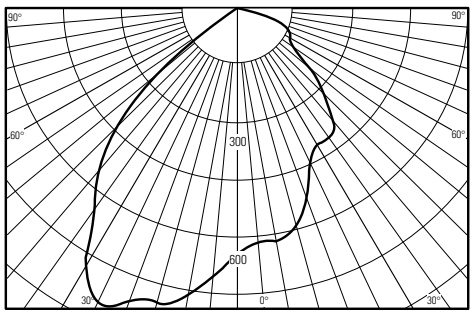
Distance From Ceiling in Feet			
1	14	8	14
2	15	13	15
3	[17]	[17]	[17]
4	15	15	15
5	13	12	13
6	11	10	11
7	9	9	9
8	8	8	8
9	7	8	7

3' from Wall-6' On Center

Distance From Ceiling in Feet			
1	13	5	13
2	14	9	14
3	15	12	15
4	13	13	13
5	10	10	10
6	9	9	9
7	8	8	8
8	7	7	7
9	6	6	6

Candlepower Distribution Downlight Spacing Ratio 1.0

Downlight Side Wall Washer Side



Coefficients of Utilization

	% EFFECTIVE CEILING CAVITY REFLECTANCE															
	80			70			50			30			10			0
	% WALL REFLECTANCE															
ROOM CAVITY RATIO	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.72	.70	.68	.70	.68	.67	.67	.66	.65	.65	.64	.63	.63	.62	.61	.60
2	.65	.62	.59	.64	.61	.59	.62	.60	.57	.60	.58	.56	.56	.57	.55	.54
3	.60	.56	.52	.59	.55	.52	.57	.54	.51	.55	.53	.50	.54	.52	.50	.48
4	.55	.50	.47	.54	.50	.47	.52	.49	.46	.51	.48	.46	.50	.47	.45	.44
5	.50	.45	.42	.49	/45	.42	.48	.44	.41	.47	.44	.41	.46	.43	.41	.40
6	.46	.41	.38	.45	.41	.37	.44	.40	.37	.43	.40	.37	.42	.39	.37	.36
7	.42	.37	.34	.41	.37	.33	.40	.35	.33	.39	.36	.33	.39	.35	.33	.32
8	.38	.33	.30	.38	.33	.30	.37	.33	.30	.36	.32	.30	.35	.32	.29	.28
9	.35	.30	.27	.34	.30	.27	.34	.29	.27	.33	.29	.26	.32	.29	.26	.25
10	.32	.27	.24	.31	.27	.24	.31	.27	.24	.30	.26	.24	.30	.26	.23	.23

20% FLOOR CAVITY REFLECTANCE
For 26W units multiply C.U. by 1.0.

LIGHTOLIER®

Job Information **Type:**

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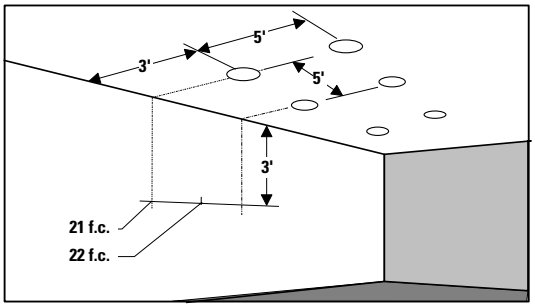
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
We reserve the right to change details of design, materials and finish.

Lightolier # 8087*** / 7132BU 32W		**B5**
Brian Smith	**UCSD Cal IT2**	**# of #**

Lighting Data

Footcandles On Wall: Multiple 42W Units



EXAMPLE: With multiple clear reflector units located 3' from wall and spaced 5' on center (matching downlights 5' on center), the illumination on the wall 3' down from ceiling will be 21 f.c. beneath units and 22 f.c. between units.

Footcandle values are averaged and rounded off and are based on a minimum of five units.

2' from Wall-2' On Center

Distance From Ceiling in Feet	2'		2'
1	62	67	62
2	74	68	74
3	57	55	57
4	41	41	41
5	31	32	31
6	24	25	24
7	19	19	19
8	16	16	16
9	13	13	13

2' from Wall-3' On Center

Distance From Ceiling in Feet	3'		3'
1	46	39	46
2	47	52	47
3	41	37	41
4	29	29	29
5	23	23	23
6	18	18	18
7	15	15	15
8	13	13	13
9	11	11	11

2' from Wall-4' On Center

Distance From Ceiling in Feet	4'		4'
1	42	21	42
2	41	34	41
3	28	31	28
4	23	21	23
5	17	17	17
6	14	15	14
7	12	12	12
8	10	11	10
9	9	10	9

3' from Wall-3' On Center

Distance From Ceiling in Feet	3'		3'
1	22	23	22
2	29	32	29
3	34	31	34
4	30	28	30
5	24	24	24
6	20	20	20
7	17	17	17
8	15	15	15
9	13	13	13

3' from Wall-4' On Center

Distance From Ceiling in Feet	4'		4'
1	19	16	19
2	23	24	23
3	24	26	24
4	24	21	24
5	19	19	19
6	15	16	15
7	14	14	14
8	12	12	12
9	11	11	11

3' from Wall-5' On Center

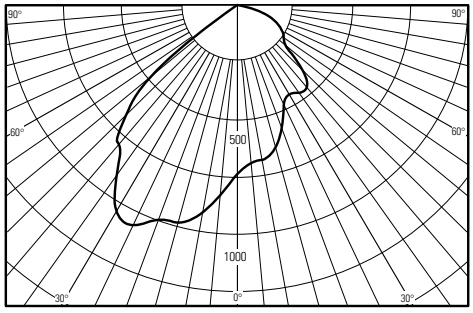
Distance From Ceiling in Feet	5'		5'
1	17	10	17
2	20	17	10
3	21	22	21
4	18	19	18
5	16	15	16
6	13	13	13
7	11	11	11
8	10	10	10
9	9	9	9

3' from Wall-6' On Center

Distance From Ceiling in Feet	6'		6'
1	17	7	17
2	18	12	18
3	19	16	19
4	15	17	15
5	12	13	12
6	11	10	11
7	10	9	10
8	8	8	8
9	7	8	7

Candlepower Distribution Downlight Spacing Ratio 1.0

Downlight Side Wall Washer Side



Coefficients of Utilization

	% EFFECTIVE CEILING CAVITY REFLECTANCE															
	80			70			50			30			10			0
	% WALL REFLECTANCE															
ROOM CAVITY RATIO	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.67	.65	.63	.65	.64	.62	.63	.61	.60	.60	.59	.58	.58	.57	.57	.55
2	.61	.58	.55	.60	.57	.55	.58	.55	.53	.56	.54	.52	.54	.53	.51	.50
3	.55	.51	.49	.54	.51	.48	.53	.50	.47	.51	.49	.47	.50	.48	.46	.45
4	.51	.46	.43	.50	.46	.43	.48	.45	.42	.47	.44	.42	.46	.43	.41	.40
5	.46	.42	.38	.46	.41	.38	.44	.41	.38	.43	.40	.38	.42	.39	.37	.36
6	.42	.38	.34	.41	.37	.34	.40	.37	.34	.40	.36	.34	.39	.36	.33	.32
7	.38	.34	.30	.36	.33	.30	.37	.33	.30	.36	.32	.30	.33	.32	.30	.29
8	.35	.30	.27	.34	.30	.27	.34	.30	.27	.33	.29	.27	.32	.29	.26	.25
9	.32	.27	.24	.31	.27	.24	.31	.27	.24	.30	.26	.24	.29	.26	.23	.23
10	.29	.24	.21	.28	.24	.21	.28	.24	.21	.27	.24	.21	.27	.23	.21	.20

20% FLOOR CAVITY REFLECTANCE

LIGHTOLIER®

Job Information **Type:**

Lightolier a Genlyte Thomas Company www.lightolier.com
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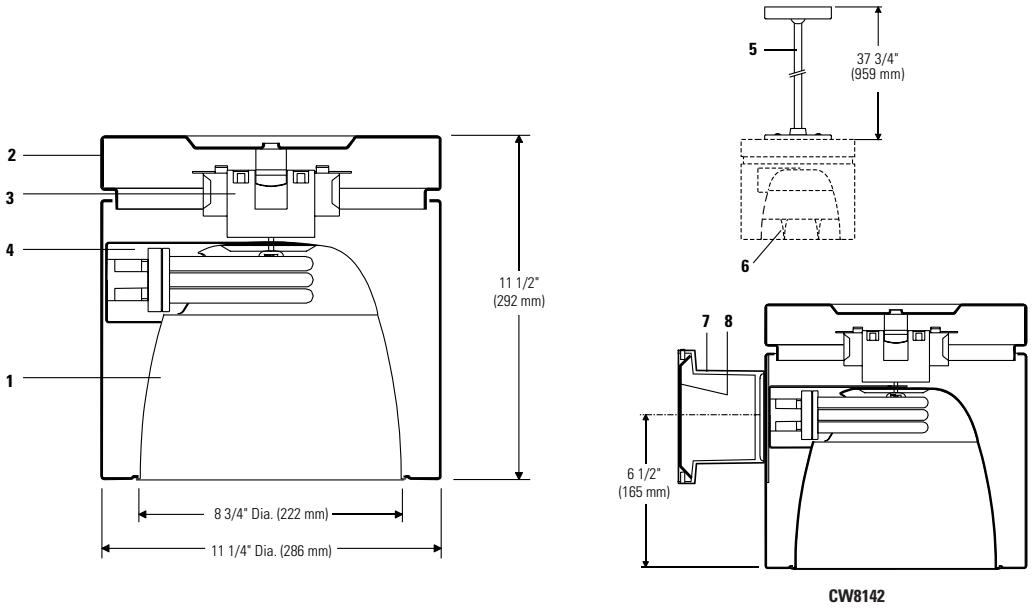
We reserve the right to change details of design, materials and finish.

Lightolier # 8087*** / 7132BU 32W		B5
Brian Smith	**UCSD Cal IT2**	**# of #**

Calculite® Compact Fluorescent Surface Cylinder **CS8142**

8" Aperture Triple Tube (4-Pin) Ceiling & Wall Mount



CW8142

Complete Fixture Ceiling Mount			Lamp
CS8142HUCL	Clear Iridescence Free Reflector, White Housing	120V - 277V	**26W/32W/42W Triple Tube** 4-Pin (Amalgam)

Complete Fixture Wall Mount			Lamp
CW8142HUCL	Clear Iridescence Free Reflector, White Housing	120V - 277V	**26W/32W/42W Triple Tube** 4-Pin (Amalgam)

Features

1. **Reflector:** 16 ga. Specular Alzak® aluminum, 55° visual cutoff to lamp and lamp image, wide distribution. Iridescence Free finish.
2. **Housing:** Seamless, heavy-gauge aluminum. Two part construction provides ventilation. Returned edge precisely seats reflector. Matte white finish.
3. **Ballast:** Mounted on support bracket, can be easily removed for service.
4. **Socket Bracket:** Die-formed steel. Attaches to reflector for correct optical alignment.
5. **Stem Kit:** Cat. No. FA CSA36: Provided with 1/2" dia. stem and 4 1/2" dia. canopy. Self aligning swivel provides maximum 38° vertical adjustment. Installs over 4" octagonal outlet box. Stem can be cut to length on site. Matte white baked enamel finish.
6. **(Optional) Turbo Louver:** (not shown) Specular clear Alzak® aluminum deep reflector with removable radial louver assembly combines good efficiency with a shield aperture, 50° cutoff to lamp.
7. **Crossbar:** Install over 4" octagonal or rectangular outlet box.
8. **Bracket:** One piece cast aluminum with integral backplate.

Electrical

Note: For complete ballast electrical data and latest lamp/ballast compatibility refer to "**Ballast**" specification sheet.

UL listed for 90°C supply conductors.

Options and Accessories

Other Housing and Reflector Finishes
Consult Factory

Frame & Mounting

Dimming	Consult Factory
Fuse (Slow Blow)	Add Suffix **F**
Turbo Louver	Add Suffix **TB**

Labels

UL listed for damp locations, I.B.E.W.

Alzak® is a registered trademark of ALCOA.
US Patent Pending.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

Notes:

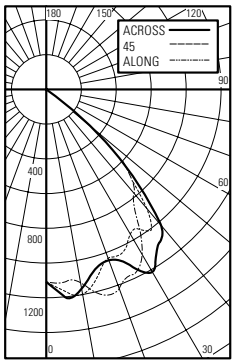
Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Lightolier # CS8142HUCL 32W		**B6**
Brian Smith	**UCSD Cal IT2**	**# of #**

Spacing Ratio = 1.5

CERTIFIED TEST REPORT NO. 0213FR (Based on Recessed fixture 8038CLW/8142HE120)
COMPUTED BY LSC PROGRAM **TEST-LITE**
CALCULITE 8 3/4" HORIZONTAL COMPACT FLUORESCENT RECESSED DOWNLIGHT
WITH CLEAR IRIDESCENCE FREE FINISH REFLECTOR
1-42W P-LT TRIPLE TUBE COMPACT FLUORESCENT LAMP. LUMEN RATING = 3200 LMS.



** EFFICIENCY = **66.2%** **
DATE: NOV 6, 1996
PREPARED FOR: LIGHTOLIER, MA

CANDLEPOWER SUMMARY

ANGLE	ALONG	22.5	45	67.5	ACROSS	OUTPUT LUMENS
0	1110	1110	1110	1110	1110	
5	1112	1131	1167	1185	1197	110
10	1126	1187	1196	1166	1155	
15	1220	1226	1112	1058	1072	321
20	1212	1167	1024	1019	1036	
25	1166	1058	1025	1106	1115	498
30	1079	1006	949	1117	1201	
35	879	927	989	1080	1094	616
40	762	780	872	984	997	
45	616	596	603	647	655	476
50	354	347	349	330	327	
55	37	39	46	52	50	97
60	1	1	1	2	2	
65	0	0	0	0	0	0
70	0	0	0	0	0	
75	0	0	0	0	0	0
80	0	0	0	0	0	
85	0	0	0	0	0	0
90	0	0	0	0	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	928	29.01	43.82
0-40	1544	48.26	72.91
0-60	2117	66.19	99.99
0-90	2118	66.20	100.00
40-90	573	17.93	27.09
60-90	0	.01	.01
90-180	0	.00	.00
0-180	2118	66.20	100.00

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

Coefficients of Utilization

% EFFECTIVE CEILING CAVITY REFLECTANCE

	80			70			50			30			10			0
	% WALL REFLECTANCE															
ROOM CAVITY RATIO	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.73	.71	.70	.72	.70	.69	.69	.68	.67	.66	.65	.64	.64	.63	.63	.61
2	.68	.65	.63	.67	.64	.62	.64	.62	.61	.62	.61	.59	.61	.59	.58	.57
3	.62	.59	.56	.61	.58	.56	.60	.57	.55	.58	.56	.54	.57	.55	.53	.52
4	.58	.54	.51	.57	.54	.51	.56	.53	.50	.54	.52	.50	.53	.51	.49	.48
5	.53	.49	.46	.53	.49	.46	.51	.48	.46	.50	.47	.45	.49	.47	.45	.44
6	.49	.45	.42	.49	.45	.42	.48	.44	.41	.47	.43	.41	.46	.43	.41	.40
7	.45	.41	.38	.45	.40	.37	.44	.40	.37	.43	.39	.37	.42	.39	.37	.36
8	.41	.37	.34	.41	.36	.33	.40	.36	.33	.39	.36	.33	.39	.35	.33	.32
9	.38	.33	.30	.37	.33	.30	.37	.33	.30	.36	.32	.30	.35	.32	.29	.28
10	.34	.30	.27	.34	.30	.27	.33	.29	.27	.33	.29	.26	.32	.29	.26	.25

20% FLOOR CAVITY REFLECTANCE

LIGHTOLIER®

Job Information **Type:**

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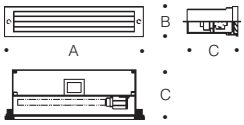
We reserve the right to change details of design, materials and finish.

Lightolier # CS8142HUCL 32W		**B6**
Brian Smith	**UCSD Cal IT2**	**# of #**

Recessed wall luminaires

Type:
BEGA Product #:
Project:
Voltage:
Color:
Options:
Modified:

Housing: Constructed of die cast and extruded aluminum with integral wiring compartment. Mounting tabs provided.
Enclosure: One piece die cast aluminum louvered faceplate, 1/8" thick. Tempered etched glass. Faceplate is secured by two (2) socket head, stainless steel, captive screws threaded into stainless steel inserts in the housing casting. Continuous high temperature O-ring gasket for weather tight operation.
Electrical (Fluorescent): Lampholder; GX23 (13W) rated 75W, 250V. Ballast is magnetic, HPF, available 120V or 277V - specify.
Through Wiring: Maximum of four (4) No. 12 AWG conductors (plus ground) suitable for 90°C. Two 7/8" knockouts provided for 1/2" conduit.
Finish: These luminaires are available in five standard BEGA colors: Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV); Eurocoat™ (URO). To specify, add appropriate suffix to catalog number. For complete description of BEGA finishing process, refer to technical information section at end of catalog. Custom colors supplied on special order.
U.L. listed, suitable for wet locations and for installation within 3 feet of ground. Suitable for all types of construction including poured concrete. Type non-IC. Protection class: IP 64

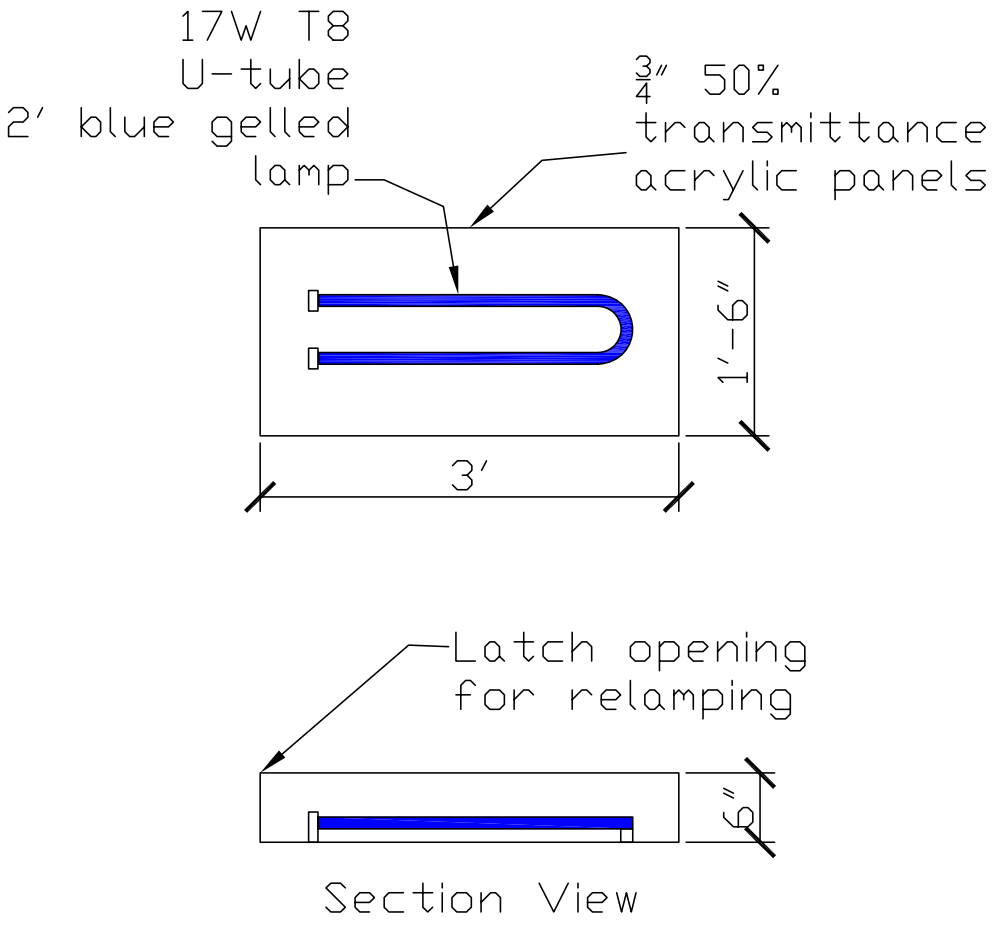


Recessed luminaires with die cast aluminum louvers and etched tempered diffusers.
U.L. listed, suitable for wet locations. IP 64.
Color: Standard BEGA finishes.
Opening: 11 13/32" x 2 7/16" x 4"

		Lamp	Lumen	A	B	C
2286P Recessed	ADA	1 13W CF twin-2p	825	11 13/16	2 3/16	4 1/4

BEGA/US 1000 BEGA Way, Carpinteria, CA 93013 [P] 805·684·0533 [F] 805·684·6682

Bega # 2286P		**B7**
Brian Smith	**UCSD Cal IT2**	**# of #**

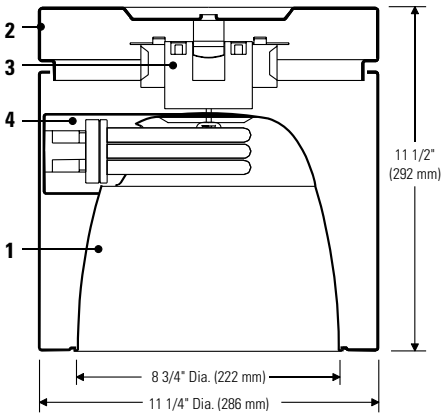


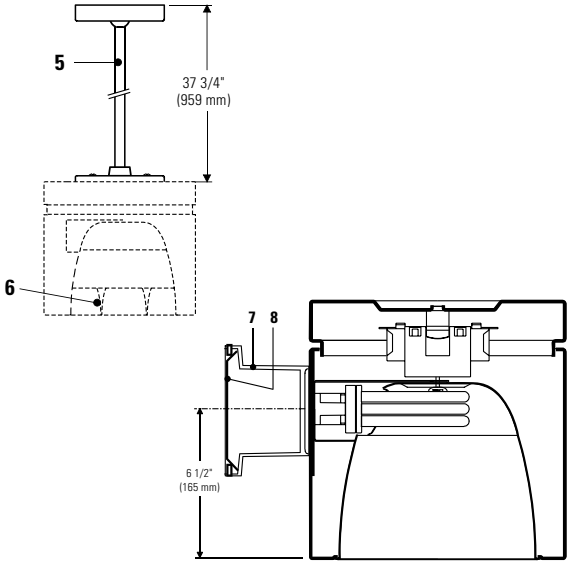
Black Box Theater Fixture B8
Custom Glowing Floor Box

Zumtobelstaff # Custom Fixture		**B8**
Brian Smith	**UCSD Cal IT2**	**# of #**

Calculite® Compact Fluorescent Surface Cylinder **CS8232/42**

8" Aperture Triple Tube (4-Pin) Ceiling & Wall Mount





CW8242 (Wall Mount)

Complete Fixture Ceiling Mount			Lamp
CS8242HUCL	Clear Iridescence Free Reflector, White Housing	120V - 277V	**(2) 26/32/42W Triple Tube 4-Pin** (Amalgam)

Complete Fixture Wall Mount			Lamp
CW8242HUCL	Clear Iridescence Free Reflector, White Housing	120V - 277V	**(2) 26/32/42W Triple Tube 4-Pin** (Amalgam)

Features

1. **Reflector:** 16 ga. Specular Alzak® aluminum, 55° visual cutoff to lamp and lamp image, wide distribution. Iridescence Free finish.
2. **Housing:** Seamless, heavy-gauge aluminum. Two part construction provides ventilation. Returned edge precisely seats reflector. Matte white finish.
3. **Ballast:** Mounted on support bracket, can be easily removed for service.
4. **Socket Bracket:** Die-formed steel. Attaches to reflector for correct optical alignment.
5. **Stem Kit:** Cat. No. FA CSA36: Provided with 1/2 dia. stem and 5 1/2 dia. canopy. Self aligning swivel provides maximum 40° vertical adjustment. Installs over 4" octagonal outlet box. Stem can be cut to length on site. Matte white baked enamel finish.
6. **(Optional) Turbo Louver:** (not shown) Specular clear Alzak® aluminum deep reflector with removable radial louver assembly combines good efficiency with a shield aperture, 50° cutoff to lamp.
7. **Crossbar:** Install over 4 octagonal or rectangular outlet box.
8. **Bracket:** One piece cast aluminum with integral backplate.

Electrical

Note: For ballast electrical data and latest lamp/ballast compatibility refer to **"Ballast"** specification sheet for complete electrical data.

UL listed for 90° C supply conductors.

Options and Accessories

Fuse (Slow Blow) Add Suffix **F**
Turbo Louver Add Suffix **TB**
Reflector Finishes: Consult Factory
Other Housing Finishes: Consult Factory

Labels

UL listed for damp locations, I.B.E.W.

Alzak® is a registered trademark of ALCOA.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

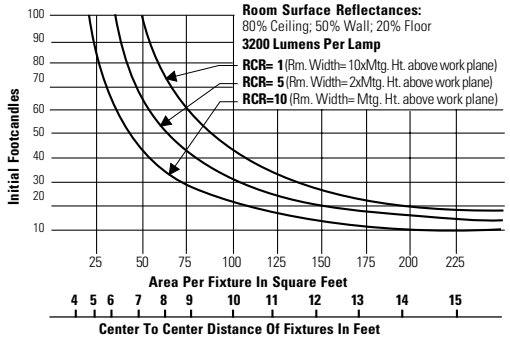
Notes:

Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Lightolier # CS8242HUCL 42W		**B9**
Brian Smith	**UCSD Cal IT2**	**# of #**

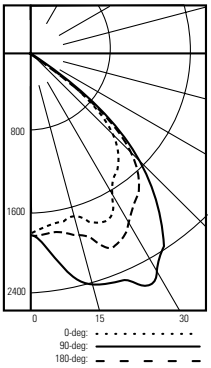
42W
Quick Calculator



This quick calculator chart determines the number and spacing of 2 lt. - 42 Watt PL-T units with clear reflector: for any level of illumination.

Spacing Ratio: Along=1.4 Across=1.7

Certified Test Report N0. ITL44463
Independent Testing Laboratories, Inc.
Recessed Calculite Downlight 8038CLIF/8242HE120
8" Aperture Specular Clear Reflector
Two Philips 42-Watt Pl-t 42W/4P Triple U-Tube. Compact Fluorescents.
Horizontal Position. Lumen Rating =3200 Lms



CANDLE POWER SUMMARY

ANGLE	0.0	45.0	90.0	135.0	180.0	FLUX
0	1800	1800	1800	1800	1800	
5	1748	1821	1960	1951	1817	184
15	1695	2065	2423	2380	1892	616
25	1828	2305	2516	2461	2082	1048
35	1505	2016	2330	2138	1821	1264
45	1135	1419	1505	1454	1366	1063
55	49	83	63	53	46	142
65	4	3	3	3	2	3
75	1	1	1	1	1	1
85	0	0	0	0	0	0
90	0	0	0	0	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	1847	28.9	42.8
0-40	3112	48.6	72.0
0-60	4316	67.4	99.9
0-90	4320	67.5	100.0
90-180	0	0.0	0.0
0-180	4320	67.5	100.0

**** Efficiency = 67.5% ****

Date: Jan 3, 1996
Prepared For: Lightolier, Fall River, MA

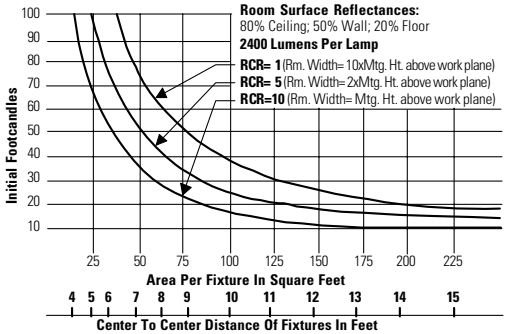
Tested According To IES Procedures.
Test Distance Exceeds Five Times the Greatest Luminous Opening Of Luminaire.

Coefficients Of Utilization

	% Effective Ceiling Cavity Reflectance															
	80			70			50			30			10			0
	% Wall Reflectance															
Room Cavity Ratio	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.74	.72	.70	.72	.70	.69	.69	.68	.67	.67	.66	.65	.65	.64	.63	.62
2	.67	.64	.61	.66	.63	.61	.64	.61	.59	.62	.60	.58	.60	.58	.57	.56
3	.61	.57	.54	.60	.57	.54	.58	.55	.53	.57	.54	.52	.55	.53	.51	.50
4	.56	.51	.48	.55	.51	.48	.54	.50	.47	.52	.49	.46	.51	.48	.46	.45
5	.51	.46	.43	.50	.46	.43	.49	.45	.42	.48	.44	.42	.47	.44	.41	.40
6	.47	.42	.38	.46	.42	.38	.45	.41	.38	.44	.40	.38	.43	.40	.37	.36
7	.43	.41	.37	.46	.41	.37	.45	.40	.37	.44	.40	.37	.43	.39	.36	.35
8	.39	.35	.31	.39	.34	.31	.38	.34	.31	.37	.34	.31	.37	.33	.31	.30
9	.36	.32	.28	.36	.31	.28	.35	.31	.28	.35	.31	.28	.34	.31	.28	.27
10	.34	.29	.26	.33	.29	.26	.33	.29	.26	.32	.28	.26	.32	.28	.26	.25

20% Floor Cavity Reflectance

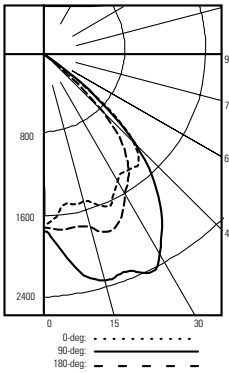
32W
Quick Calculator



This quick calculator chart determines the number and spacing of 2 lt. - 32 W PL-T units with clear reflector: for any level of illumination.
For 26W lamps, multiply F.C. by 0.8.

Spacing Ratio: Along=1.4 Across=1.6

Certified Test Report N0. ITL44462
(Based on recessed fixture 8038CLW/8232HE120)
Independent Testing Laboratories, Inc.
Recessed Calculite Downlight 8038CLIF/8232HE120
8" Aperture Specular Clear Reflector
Two Philips 32-Watt 32W/35/4P Triple U-Tube. Compact Fluorescents.
Horizontal Position. Lumen Rating =2400 Lms



CANDLE POWER SUMMARY

ANGLE	0.0	45.0	90.0	135.0	180.0	FLUX
0	1499	1499	1499	1499	1499	
5	1502	1555	1643	1573	1426	152
15	1546	1829	2017	1862	1330	505
25	1628	2073	2090	1747	1440	844
35	1312	1820	1842	1573	1242	1007
45	823	1034	1242	1222	1181	849
55	31	55	61	58	61	118
65	2	2	3	2	2	3
75	1	1	1	1	1	1
85	0	0	0	0	0	0
90	0	0	0	0	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	1500	31.3	43.1
0-40	2508	52.2	72.1
0-60	3475	72.4	99.9
0-90	3479	72.5	100.0
90-180	0	0.0	0.0
0-180	3479	72.5	100.0

**** Efficiency = 72.5% ****

Date: Dec 4, 1995

Tested According To IES Procedures.
Test Distance Exceeds Five Times the Greatest Luminous Opening Of Luminaire.

Coefficients Of Utilization

	% Effective Ceiling Cavity Reflectance															
	80			70			50			30			10			0
	% Wall Reflectance															
Room Cavity Ratio	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	79	.77	.75	.78	.76	.74	.75	.73	.72	.72	.71	.70	.69	.68	.68	.66
2	.72	.69	.66	.71	.68	.65	.69	.66	.64	.66	.64	.62	.64	.62	.61	.60
3	.66	.62	.58	.65	.61	.58	.63	.59	.57	.61	.58	.56	.59	.57	.55	.54
4	.60	.55	.52	.59	.55	.51	.58	.54	.51	.56	.53	.50	.55	.52	.49	.48
5	.55	.50	.46	.54	.49	.46	.53	.49	.45	.51	.48	.45	.50	.47	.44	.43
6	.50	.45	.41	.50	.45	.41	.48	.44	.41	.47	.43	.40	.46	.43	.40	.39
7	.46	.41	.37	.46	.41	.37	.45	.40	.37	.44	.40	.37	.43	.39	.36	.35
8	.42	.37	.34	.42	.37	.34	.41	.37	.33	.40	.36	.33	.40	.36	.33	.32
9	.39	.34	.31	.39	.34	.31	.38	.34	.30	.37	.33	.30	.37	.33	.30	.29
10	.36	.31	.28	.36	.31	.28	.35	.31	.28	.35	.31	.28	.34	.30	.28	.26

20% Floor Cavity Reflectance. For 26W lamps, multiply C.U. by 1.1.

Job Information **Type:**

Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Lightolier # CS8242HUCL 42W		B9
Brian Smith	UCSD Cal IT2	# of #

Perceiva®

WW

Linear Wallwash

Intended Use

Developed to provide high performance, uniform, wall illumination. Use to highlight merchandise, artwork and signage.

Features

Recessed fluorescent wallwash system provides energy-efficient accent lighting.

Provides maximum wall illumination with minimum brightness.

Eliminates hot spots, scalloping and shadows on vertical surfaces.

Highlights artwork, signage and merchandise.

High performance — 92% of light output illuminates wall. Asymmetric-throw reflector completely surrounds lamp cavity.

Choice of one or two T8 lamps or compact lamp versions.

Ballast accessible from room side.

Reversible end trim accommodates both grid and screw-slot ceiling systems.

GF trim provides ceiling-tile support trims on long sides, grid trim on ends. Continuous row (grid trim only) or unit installation.

T-bar hold-down clips supplied standard. DGA accessory available to provide trim flange and fixture support in plaster or plasterboard ceilings. For use with G trim fixture.

UL Listed (standard). CSA Certified (see Options).

Ordering Information

Example: **WW G 2 32 120 IRLS GEB**

Series	Trim type	Number of lamps	Lamp type	Voltage	Reflector finish	Options
WW 12" wide For tandem double-length unit, add prefix **T**. Example: **TWW**	**G** Lay-in grid[1] **GF** Grid flanged[2] **ST** Screw slot	**1, 2** Not included.	**17** 17W T8 (24") **32** 32W T8 (48") **CF18** 18W TT5 (12") **CF40** 40W TT5 RS (24") **CF50** 50W TT5 RS (24") **CF55** 55W TT5 (24") **25** 25W T8 (36") **60T8** 40W T8 (60")	**120** **277** **347** **MVOLT*** Others available. * 120-277V. Must specify GEB10IS.	**IRLS** Low iridescent specular silver **IRLD** Low iridescent diffuse silver	**1/4** One 4-lamp ballast **GEB** Electronic ballast, ≤20% THD **GEB10IS** T8 electronic ballast, ≤10% THD, instant start **GEB10RS** T8 electronic ballast, ≤10% THD, rapid start **CSA** CSA Certified See pages 91 for others.

Accessories (Order separately)

DGA Flanged grid to drywall adapter, unit installation[3]

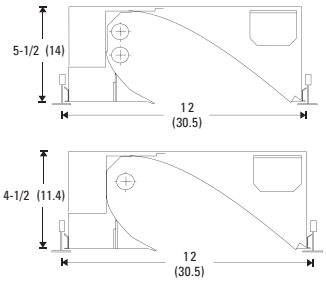
NOTES:

1 Use G trim plus DGA accessory for fixture-trim flange and fixture support in plaster or plasterboard ceilings.
2 Flanged sides, grid ends used in grid applications only.
3 Insert fixture width and length (in feet). Example: **DGA12.**

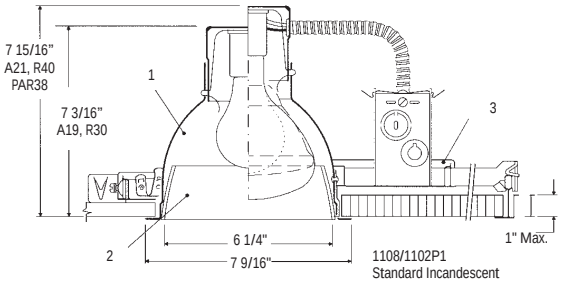
Availability and Dimensions

Series	Nominal length	Lamps per cross section	Lamps per fixture	Lamp type	Height in.(cm)
WW	1'	1	1	CF18	4½ (11.4)
WW	2'	1	1	17, CF40, CF50	4½ (11.4)
		2	2	17	5½ (14.0)
WW	4'	1	1	32	4½ (11.4)
		2	2	32	5½ (14.0)
TWW	4'	1	2	CF40, CF50	4½ (11.4)
WW	3'	1	1	25	4½ (11.4)
		2	2	25	5½ (14.0)
WW	5'	1	1	60T8	4½ (11.4)
		2	2	60T8	5½ (14.0)

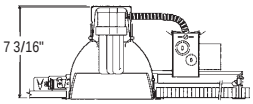
Dimensions are shown in **inches (centimeters)** unless otherwise noted.



Lithonia # WW-ST-1-32-277-IRLS-1/4		**B10**
Brian Smith	**UCSD Cal IT2**	**# of #**

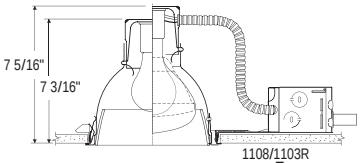


1108/1102P1
Standard Incandescent

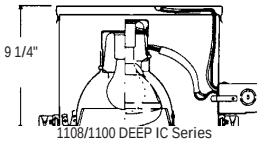


1108/1102D Series
1108/1100FT Series
Fluorescent/Non-IC

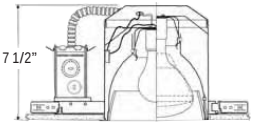
1108/1102F Series
1108/1910XFH1
1108/1910XDH1
1108/1100FTU



1108/1103R
Lytening™ Non-IC
Remodeler Ring



1108/1100 DEEP IC Series
Incandescent Insulated Ceiling



1108/1104IC/N
Lytening™ Convertible
IC/Non-IC

Complete Fixture consists of Reflector Trim & Frame-In Kit. Select each separately.

Reflector Trim	Frame-In Kit — See Individual Frame-In Kit Specification Sheets							
	Incandescent				Fluorescent			
	Frame-In Kit	Installation Type	Lamping	Height	Frame-In Kit	Installation Type	Lamping	Height
1108*	1102P1	Non-IC	100W A19	7 3/16" 7 15/16"	1102F1	Non-IC		7 3/16"
Brushed Gold	1103R	Non-IC	150W A21, PAR38, BR40	7 3/16" 7 15/16"	1102FH1	Non-IC		7 3/16"
1110*	1100IC	IC	75W A19	7 5/16"	1102FH2	Non-IC	1 Lamp Quad Tube	7 3/16"
Brushed Clear	1100AICM	IC	90W PAR38	7 5/16"	1102FH1R	Non-IC Remodeler	13W (GX23-2)	7 3/16"
1112*	1100DICM	IC	100W BR40	9 1/4"	1104F1R	Non-IC Remodeler		7 1/2"
Specular Gold	1100DAICM	IC		9 1/4"	1104F1/N	IC		7 1/2"
1113*	1104ICX/N	IC	60W A19	7 1/4"	1910XFH1	Conversion		7 3/16"
Specular Clear			120W BR40		1102D1	Non-IC	2 Lamp Quad Tube	7 3/16"
1113BK*			100W PAR38		1102DH1	Non-IC	13W (GX23-2)	7 3/16"
Specular Black			90W w/1113BK		1102DH1R	Non-IC Remodeler		7 3/16"
					1102DH2	Non-IC		
					1910XDH1	Conversion		7 3/16"
1113CD*	1104IC/N	IC	60W A19*	7 1/2"	1102DM1	Non-IC Emergency		7 3/16"
Clear Diffuse					1102DM2	Non-IC Emergency		7 3/16"
White Flange	1104ICR	IC Remodeler	75W PAR38	7 1/2"	1100FTU	Non-IC	1 Lamp Triple Tube	7 3/16"
					1100FTUEM	Non-IC Emergency	26W or 32W	7 3/16"
					1100FTURM	Non-IC Remodeler	(GX24q-3)	7 3/16"
1113WH			65W BR40		1100AICMFT	AirSeal-IC		6 7/8"
Matte White			*52W w/1113BK					
	1104IC/N	Non-IC	100W A19*, PAR38	7 1/2"				
	1104ICR	Non-IC Remodeler	150W BR40	7 1/2"				
			*75W w/1113BK					

*Add "NM" to SKU for Natural Metal™ Flange

Features

1. Reflector: Hydroformed aluminum, .040" minimum thickness; Anobrite® (anodic-processed) semi-specular finish for permanent reflectivity; matte white or Natural Metal™ trim flange.
2. Aperture Cone: Aluminum cone painted or anodized finish.
3. Frame-In Kit: (1102P1 standard frame shown). Other frames listed above and shown on the right. See Frame-In Kit specification sheets for more details.

Options & Accessories

Lytegems®:	See 1500 Series Specification Sheets
Retaining Clips:	1955 - For installing in existing ceiling
Extra Wide Flange Trim Ring:	1954 - 8-5/8" O.D.

Labels

U.L. (Suitable for Damp Locations); I.B.E.W.

US Patent Numbers: 4,751,624; 5,045,985
Other US & Foreign Patents Pending.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

Notes:

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

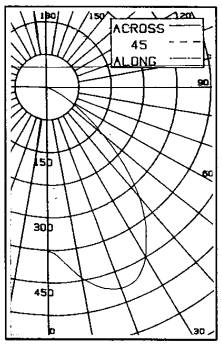
LIGHTOLIER®

Lightolier # 1108 / 1104F1**		**B11**
Brian Smith	**UCSD Cal IT2**	**# of #**

SPACING RATIO = 1.5

CERTIFIED TEST REPORT NO. 2182
COMPUTED BY LSI PROGRAM **TEST-LITE**

RECESSED LYTECASTER DOWNLIGHT
6 1/2" DIA. APERTURE, SPECULAR CLEAR CONE
TWO 13W DTT LAMPS. LUMEN RATING = 860 LMS.
LOWER LAMP POSITION USED



CANDLEPOWER SUMMARY

ANGLE	MEAN CP	LUMENS
0	378	
5	402	39
10	445	
15	477	134
20	491	
25	485	221
30	450	
35	395	246
40	329	
45	249	193
50	169	
55	105	98
60	57	
65	25	29
70	7	
75	1	3
80	1	
85	0	0
90	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	% LUMINAIRE
0—30	393	22.90	40.92
0—40	640	37.21	66.52
0—60	930	54.11	96.72
0—90	962	55.95	100.00
40—90	322	18.73	33.48
60—90	31	1.84	3.28
90—180	0	.00	.00
0—180	962	55.95	100.00

** EFFICIENCY = 55.9% **

DATE: OCTOBER 12, 1990
PREPARED FOR:
LIGHTOLIER, SECAUCUS N.J.

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

COEFFICIENTS OF UTILIZATION

% EFFECTIVE CEILING CAVITY REFLECTANCE

	80			70			50			30			10			0
	% WALL REFLECTANCE															
ROOM CAVITY RATIO	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.61	.60	.58	.60	.59	.57	.58	.57	.56	.56	.55	.54	.54	.53	.52	.51
2	.56	.54	.52	.55	.53	.51	.53	.52	.50	.52	.50	.49	.50	.49	.48	.47
3	.52	.48	.46	.51	.48	.46	.49	.47	.45	.48	.46	.44	.47	.45	.43	.42
4	.47	.44	.41	.47	.44	.41	.46	.43	.40	.44	.42	.40	.43	.41	.39	.38
5	.43	.40	.37	.43	.39	.37	.42	.39	.36	.41	.38	.36	.40	.38	.36	.35
6	.40	.36	.33	.39	.35	.33	.38	.35	.33	.37	.35	.32	.37	.34	.32	.31
7	.36	.32	.29	.36	.32	.29	.35	.31	.29	.34	.31	.29	.34	.31	.29	.28
8	.33	.29	.26	.33	.29	.26	.32	.28	.26	.31	.28	.26	.31	.28	.26	.25
9	.30	.26	.23	.30	.26	.23	.29	.26	.23	.29	.25	.23	.28	.25	.23	.22
10	.28	.24	.21	.27	.24	.21	.27	.23	.21	.26	.23	.21	.26	.23	.21	.20

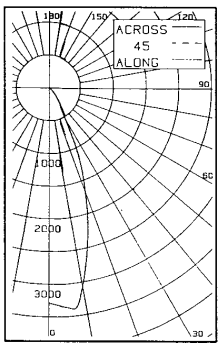
20% FLOOR CAVITY REFLECTANCE

Conversion Factors: 2 Lt. 13W Quad Tube: White, C.U. x 0.7; Black, C.U. x 0.65. 1 Lt. 13 Quad Tube: Clear & Gold, C.U. x 1.15; White, C.U. x 1; Black, C.U. x 0.85. 100W A19 and 150W A21: Clear & Gold, C.U. x 1.15; White, C.U. x 1.1; Black, C.U. x 0.8.

SPACING RATIO = 0.7

CERTIFIED TEST REPORT NO. 2222
COMPUTED BY LSI PROGRAM **TEST-LITE**

RECESSED LYTECASTER DOWNLIGHT
6 1/4" DIA. APERTURE, SPECULAR CLEAR CONE
ONE 150W PAR38 FLOOD LAMP. LUMEN RATING = 1740 LMS.
UPPER SOCKET POSITION USED



CANDLEPOWER SUMMARY

ANGLE	MEAN CP	LUMENS
0	3290	
5	3366	312
10	3062	
15	2354	667
20	1645	
25	1064	497
30	522	
35	287	195
40	145	
45	64	57
50	21	
55	4	7
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	% LUMINAIRE
0—30	1476	84.84	85.09
0—40	1671	96.05	96.33
0—60	1734	99.71	100.00
0—90	1734	99.71	100.00
40—90	63	3.65	3.67
60—90	0	.00	.00
90—180	0	.00	.00
0—180	1734	99.71	100.00

** EFFICIENCY = 99.7% **

DATE: NOVEMBER 26, 1990
PREPARED FOR:
LIGHTOLIER, SECAUCUS N.J.

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

COEFFICIENTS OF UTILIZATION

% EFFECTIVE CEILING CAVITY REFLECTANCE

	80			70			50			30			10			0
	% WALL REFLECTANCE															
ROOM CAVITY RATIO	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	1.13	1.11	1.09	1.11	1.09	1.07	1.07	1.05	1.04	1.03	1.02	1.01	1.00	.99	.98	.97
2	1.08	1.05	1.02	1.06	1.03	1.01	1.03	1.01	.99	1.00	.98	.97	.97	.96	.95	.93
3	1.03	1.00	.97	1.02	.99	.96	.99	.97	.95	.97	.95	.93	.95	.93	.92	.91
4	.99	.95	.92	.98	.95	.92	.96	.93	.91	.94	.92	.90	.93	.90	.89	.88
5	.95	.91	.88	.94	.90	.88	.93	.89	.87	.91	.88	.86	.90	.87	.85	.84
6	.92	.88	.85	.91	.87	.84	.90	.87	.84	.89	.86	.83	.87	.85	.83	.82
7	.88	.84	.81	.88	.84	.81	.86	.83	.81	.85	.82	.80	.85	.82	.80	.79
8	.85	.81	.78	.84	.81	.78	.84	.80	.77	.83	.79	.77	.82	.79	.77	.76
9	.82	.78	.75	.81	.78	.75	.81	.77	.74	.80	.76	.74	.79	.76	.74	.73
10	.79	.75	.72	.79	.75	.72	.78	.74	.72	.77	.74	.72	.77	.74	.71	.70

20% FLOOR CAVITY REFLECTANCE

Conversion Factor: 150W PAR38 FL: White, C.U. x 0.95; Black, C.U. x.0.9. 150W BR40 FL: Clear and Gold, C.U. x 1.0; White, C.U. x 0.95; Black, C.U. x 0.85.

To convert lighting data for a lower wattage incandescent lamp of the same type, multiply the footcandle (or candlepower) values by the ratio of the lumens of the two lamps. The coefficients of utilization remain the same.

LIGHTOLIER®

Job Information **Type:**

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
We reserve the right to change details of design, materials and finish.

Lightolier # 1108 / 1104F1**		B11
Brian Smith	**UCSD Cal IT2**	# of #

TYPE:

CATALOG#:

METALUX®

DESCRIPTION

The M Series combines a low profile, surface modular design with the latest in energy-efficient technology. The dihedral recessed top design allows for cooler fixture operation. Other features include a die-formed housing, surface or stem mounting (single or continuous row), full seam -welded corners and a broad selection of attractive door frames.

APPLICATION

The versatile modular M Series can be the perfect solution when used in applications such as commercial office spaces, schools, hospitals, and retail merchandising areas.

SPECIFICATION FEATURES

A···Construction

Housing die formed code gauge prime cold rolled steel. Smooth sides permit flush joint for continuous row mounting. Dihedral recessed top design insures cooler ballast operation. Die formed captive lampholder bracket fully encloses wiring permitting easy lampholder replacement. Ballast covers easily removed without tools.

B···Electrical*

Ballasts are CBM/ETL Class "P" and are positively secured by mounting bolts. Pressure lock lampholders. UL/CUL listed. Suitable for damp locations.

C···Finish

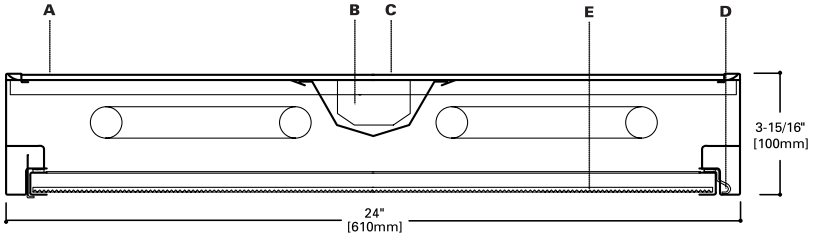
Painted after fabrication. Electrostatically applied baked white polyester powder enamel finish. Multistage cleaning cycle, iron phosphate coating with rust inhibitor. Conveyorized application and baking timing accurately controlled at an elevated temperature.

D···Hinging/Latching

Positive cam action steel latches with baked white enamel finish. Safety lock T-hinges allow hinging and latching either side.

E···Frame/Shielding

Die formed, flat white extruded aluminum door with reinforced corners and baked white enamel finish. Door frame quadrasealed to prevent light spillage. Light stabilized 100% virgin acrylic prismatic shielding. Standard #12 pattern. Optional shielding available.



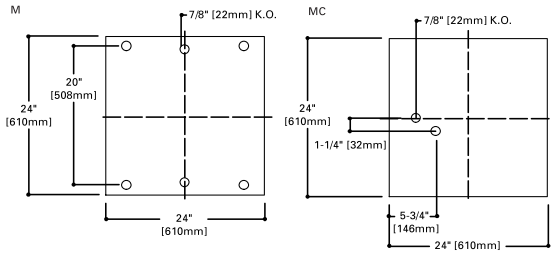
2M420
417
2U6
2U6T8
2U1-5/8
2BX40
3U1-5/8
3BX40

2' X 2' SURFACE 4 LAMPS LTS

2' X 2' SURFACE 2 LAMPS

Surface Modular

MOUNTING DATA

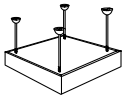


STEM MOUNTING METHODS

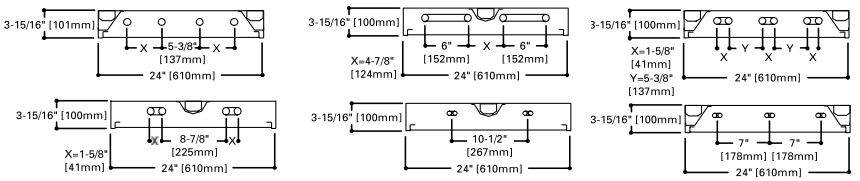
Consult Pre Sales Technical Support for Continuous Row Application

Fixture Application

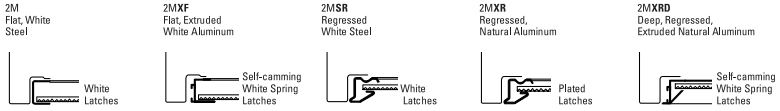
4 Point Suspension



LAMP CONFIGURATIONS



DOOR FRAMES



ENERGY DATA

Input Watts:

EB Ballast & STD Lamps
417 (45)
2U6 (72)
2U6T8 (61)
2U1-5/8 (61)
2BX40 (67)
3U1-5/8 (91)
3BX40 (110)

ES Ballast & STD Lamps
420 (116)
417 (90)
2U6 (86)
2U6T8 (71)
2U1-5/8 (71)
3U1-5/8 (108)

STD Ballast & STD Lamps
2BX40 (82)
3BX40 (128)

Luminaire Efficacy Rating
LER = FL-58
Catalog Number: 2M-2U6T8A

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $4.14

*Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements.

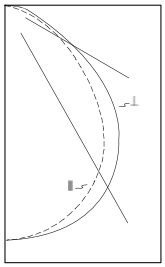
ADF020659
(Supersedes ADF991783)

COOPER LIGHTING

Cooper Ltg - Metalux # 2M-XRD-2-U6T8-PBIS-*-277-EB81-*		**B12**
Brian Smith	**UCSD Cal IT2**	**# of #**

http://www.cooperlighting.com/specfiles/pdf/Metalux/020659%202M420.pdf

PHOTOMETRICS



2M-2U6T8A
Energy Saving Ballast

FB31T8/TL735/6 Lamps
2600 Lumens

Spacing criterion: (II) 1.2 x mounting height, (⊥) 1.3 x mounting height

Efficiency 71.0%

Test Report #132P115

LER = FL-58

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $4.14

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	85	85	85	85	83	83	83	83	79	79	79	76	76	76	72	72	72	71
1	78	75	73	70	76	74	71	69	71	69	67	68	66	65	65	64	63	62
2	72	67	63	59	70	66	62	59	63	60	57	61	58	56	59	57	55	53
3	67	60	55	51	65	59	54	51	57	53	50	55	52	49	53	50	48	47
4	62	54	48	44	60	53	48	44	51	47	43	50	46	43	48	45	42	41
5	57	48	42	38	55	47	42	38	46	41	37	45	40	37	43	40	37	35
6	52	43	38	33	51	43	37	33	42	37	33	40	36	33	39	35	32	31
7	48	39	33	29	47	39	33	29	38	33	29	37	32	29	36	32	28	27
8	45	35	29	25	43	35	29	25	34	29	25	33	28	25	32	28	25	24
9	41	32	26	22	40	31	26	22	30	25	22	30	25	22	29	25	22	20
10	38	29	23	19	37	28	23	19	28	23	19	27	22	19	26	22	19	18

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1169	22.5	31.7
0-40	1905	36.6	51.6
0-60	3138	60.3	85.0
0-90	3692	71.0	100.0
0-180	3692	71.0	100.0

Typical VCP Percentages

	Height Along		Height Across	
Room Size (Ft.)	8.5′	10.0′	8.5′	10.0′
20 x 20	63	67	59	64
30 x 30	56	60	53	57
30 x 60	48	50	43	46
60 x 30	58	62	56	60
60 x 60	48	51	45	48

Candela

Angle	Along II	45°	Across ⊥
0	1485	1485	1485
5	1479	1478	1485
10	1455	1460	1477
15	1413	1430	1460
20	1357	1388	1432
25	1286	1331	1387
30	1197	1255	1315
35	1089	1152	1227
40	961	1023	1122
45	807	868	999
50	643	721	845
55	507	580	662
60	395	427	470
65	305	295	320
70	228	191	237
75	166	131	192
80	123	105	147
85	66	60	82
90	0	0	0

ORDERING INFORMATION

SAMPLE NUMBER: 2M-2U6T8A

2	M								

2' Width

Series

Standard=Flat White Steel Door (Leave Blank)
XF[1]=Flat White Extruded Aluminum Door
SR=5/16" Regressed White Steel Door
XR=5/16" Regressed Natural Anodized Aluminum Door
XRD=5/8" Deep Regressed Natural Anodized, Extruded Aluminum Door[4]
(Self-camming spring loaded latches on XF and XRD)

Number of Lamps
2, 3 or **4** lamps
(Not included)

Wattage (Length)
20=20W (24")
17=17W (24")
U6=40W (24")
U6T8=31W (24")
U1-5/8=31W T8 (24")
BX40=40W Biaxial (24")

A=#12 Pattern Acrylic
A125=#12 Pattern Acrylic (.125" Thick)
A19/156=#19 Pattern Acrylic (.156" Thick)
IMA 48=Injection Molded Acrylic (.150" Thick)
PB1S=Silver Parabolic Louver (1/2" x 1/2" x 1/2")
DA=Dropped Dish - Matte White Acrylic
(Additional Shielding Media Available. See Accessory Section.)

Voltage
LTS[2]=Low Trigger Start (20 Watt)
HTS[2]=High Trigger Start (20 Watt)

Voltage[4]
120=120V
277=277V
347=347V
UNV=Universal Voltage 120-277V

Ballast Type
Standard Magnetic Ballast Leave Blank
LE3= Energy Saving Magnetic Ballast Ⓔ
LEOC8= Energy Saving Magnetic Ballast (T-8 Lamp Only)
EB_ _ = Generic Electronic Ballast
No. of Ballasts
1 or **2**
Lamp Size
2=T12
8=T8
5=T5
(For Specific Electronic Ballast Specify Brand and Catalog Number)

Leave Blank for LTS and HTS Fixtures.

Options (add as suffix)

Options
GL=Internal Single Element Fusing
GM=Dual Element Fusing
EL4=Emergency Lighting self-contained.[4]
SMB=Side Mounted Ballast For Stem Applications. (Recommended For 4 Point Suspension)
RIF1=Radio Interference Suppressor
VRS=Vandal Resistant[5]
EKO=End Plate with 7/8" KO (Required for Continuous Row Mounting)
RLS=Rotor-Lock Socket (T8 Lamps Only)
(Additional options available. See Accessory Section)

ACCESSORIES

(Order Separately)

SCF=Fixed Stem Set (Specify Length)
SCS=Swivel Stem Set (Specify Length)
SCA=Adjustable 48" Stem Set
(Additional Accessories Available. See Options and Accessories Section.

SHIPPING INFORMATION

Catalog No.	Wt.
2M-417A-LTS[2]	23 lbs.
2M-2U6T8A	20 lbs.
2M-2U1-5/8A	20 lbs.
2M-2BX40A	20 lbs.
2M-3U1-5/8A	21 lbs.
2M-3BX40A	21 lbs.

NOTE See option/accessory sections for additional detailed product data.
Specifications and Dimensions subject to change without notice.

[1] Flat Natural Aluminum Door Available - **NDF** (See Options).
[2] Standard Ballast (Non-LE3)
[3] 2M-420 and 2M-417 Must Use Side Mounted Ballast Pattern.
[4] Consult Pre Sales Technical Support.
[5] Available on flat doors only.

COOPER Lighting

Visit our web site at www.cooperlighting.com
Customer First Center 1121 Highway 74 South Peachtree City, GA 30269 770.486.4800 FAX 770.486.4801 ADF020659

Cooper Ltg - Metalux # 2M-XRD-2-U6T8-PBIS-*-277-EB81-*		**B12**
Brian Smith	**UCSD Cal IT2**	**# of #**

TYPE:

CATALOG#:

METALUX®

DESCRIPTION

The Metalux Horizon Recessed Wall Wash Series features recessed aesthetics and the latest in Energy Efficient Technology. The clean architectural design incorporates precision-formed aluminum reflector features that produces efficient, uniform and continuous vertical wall illumination.

APPLICATION

The Horizon Recessed Wall Wash Series is specifically designed for effective use in various retail, merchandising and commercial wall washing environments. Horizon is ideal for retail displays, showrooms, corridor walls, art lighting and the elimination of the "Cave Effect" in office lighting applications.

SPECIFICATION FEATURES

A···Construction

Nominal 4-1/2" deep 10"x4' housing designed for use with T8 and biaxial lamps. The housing is constructed of die formed code gauge prime cold rolled steel. Housing incorporates a longitudinal flange for grid installation or ceiling tile support. KO's for continuous row mounting.

B···Electrical*

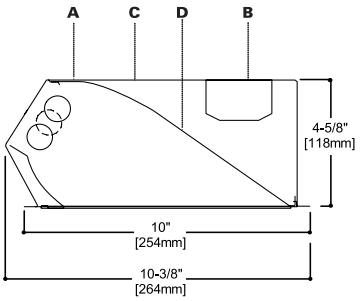
Ballasts are CBM/ETL Class "P" and are positively secured. Biax models use 2G11 base lampholders with double-edge wiping action pressure lock contacts and lamp support clips. T8 models use pressure-lock lampholders. UL/CUL listed. Suitable for damp locations.

C···Finish

Electrostatically applied baked white polyester powder enamel finish. Multistage cleaning cycle, iron phosphate coating with rust inhibitor. Conveyorized application and baking timing accurately controlled at an elevated temperature.

D···Reflector Optical Assembly

The internal aluminum reflector optical assembly incorporates an upper "Scoop" and lower "Kick" reflector design. This design produces uniform even illumination on vertical surfaces. Continuous illumination is maintained to the junction of the wall and the ceiling. Reflectors are precision manufactured from specular low iridescent aluminum in a computer-controlled operation.



RWW132
232
T1BX40

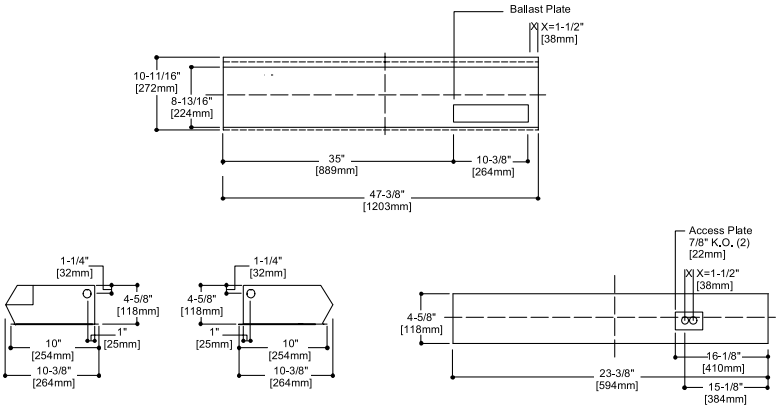
1' X 4'
RECESSED
WALL WASH

Vertical Illumination Luminaire

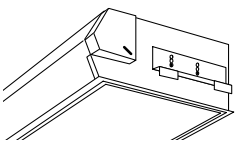
T8 or Biaxial Lamps

HORIZON™

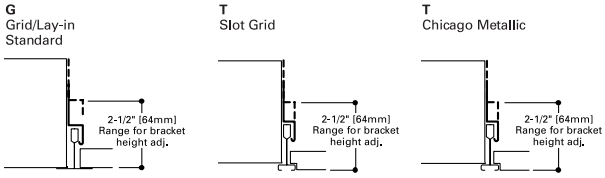
MOUNTING DATA



INSTALLATION DATA



COOPER LIGHTING



ENERGY DATA

Input Watts:

Electronic Ballast & STD Lamps
132 (32)
232 (58)
T1BX40 (71)
T1BX50 (106)
T1BX55 (117)

ES Ballast & STD Lamps
132 (30)
232 (55)
1BX50 (54 Watts)
T2BX50 (106 Watts)

STD Ballast & STD Lamps
T1BX40 (77)

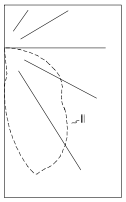
*Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements.

ADF020635
(Supersedes ADF991761)

Cooper Ltg - Metalux # RWW-2-32-MI-277-EB81-*		**B13**
Brian Smith	**UCSD Cal IT2**	**# of #**

http://www.cooperlighting.com/specfiles/pdf/Metalux/020635%20RWW132.pdf

PHOTOMETRICS



RWW-232MI
Electronic Ballast
F32T8/835 Lamps
2800 Lumens
Efficiency 69.7%
Test Report
#167P115

Candela

Angle	Along ⊥	45°	Across ⊥
0	943	943	943
5	1435	1319	940
10	2087	1803	930
15	2601	2227	910
20	2656	2529	880
25	2595	2556	839
30	2479	2436	791
35	2332	2317	736
40	2136	2155	675
45	1817	1961	607
50	1667	1737	532
55	1554	1442	454
60	1416	1258	379
65	1197	1111	305
70	938	912	234
75	663	657	166
80	422	406	110
85	184	166	59
90	0	0	0

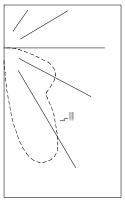
Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	959	17.1	24.6
0-40	1640	29.3	42.0
0-60	2973	53.1	76.2
0-90	3902	69.7	100.0
0-180	3902	69.7	100.0

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%			70%			50%			30%			10%		0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	0
RCR															
0	83	83	83	83	81	81	81	81	77	77	77	74	74	74	71	71	71	70
1	76	73	70	67	74	71	68	66	68	66	64	65	64	62	63	61	60	59
2	69	63	59	55	67	62	58	54	60	56	53	57	54	52	55	53	51	49
3	63	56	50	46	61	55	50	45	53	48	45	51	47	44	49	46	43	42
4	58	49	43	39	56	49	43	38	47	42	38	45	41	37	44	40	37	35
5	53	43	37	32	51	43	37	32	41	36	32	40	35	32	39	34	31	30
6	48	39	32	28	47	38	32	28	37	31	27	36	31	27	35	30	27	26
7	44	35	28	24	43	34	28	24	33	28	24	32	27	24	31	27	23	22
8	41	31	25	21	40	30	25	21	30	24	20	29	24	20	28	23	20	19
9	37	28	22	18	36	27	22	18	26	21	18	26	21	17	25	21	17	16
10	35	25	19	15	34	25	19	15	24	19	15	23	19	15	23	18	15	14



RWW-T1BX40
Electronic Ballast
F40BX/835/RS Lamps
3150 Lumens
Efficiency 79.9%
Test Report
#167P114

Candela

Angle	Along ⊥	45°	Across ⊥
0	419	419	419
5	931	826	423
10	2342	1586	419
15	3471	2733	412
20	3766	3408	403
25	3847	3601	389
30	3629	3573	371
35	3145	3500	349
40	2378	3154	328
45	2092	2635	306
50	2014	1960	283
55	2006	1721	260
60	1961	1593	236
65	1899	1514	219
70	1631	1382	209
75	1099	1146	203
80	675	653	191
85	405	326	99
90	0	0	0

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1095	17.4	21.8
0-40	1998	31.7	39.7
0-60	3648	57.9	72.5
0-90	5031	79.9	100.0
0-180	5031	79.9	100.0

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%			70%			50%			30%			10%		0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	0
RCR															
0	95	95	95	95	93	93	93	93	89	89	89	85	85	85	81	81	81	80
1	86	82	79	76	84	81	77	74	77	74	72	74	72	70	71	69	68	66
2	78	71	66	61	76	70	65	60	67	63	59	64	61	57	62	59	56	54
3	71	62	56	50	69	61	55	50	59	53	49	57	52	48	54	51	47	45
4	65	55	48	42	63	54	47	42	52	46	41	50	45	41	48	44	40	38
5	59	48	41	35	57	47	40	35	45	39	34	44	38	34	42	38	34	32
6	54	43	35	30	52	42	35	30	40	34	29	39	33	29	38	33	29	27
7	50	38	31	26	48	37	30	25	36	30	25	35	29	25	34	29	25	23
8	45	34	27	22	44	33	26	22	32	26	22	31	26	21	30	25	21	20
9	42	30	23	18	40	30	23	18	29	23	18	28	22	18	27	22	18	16
10	39	27	20	16	37	27	20	16	26	20	16	25	20	16	24	19	16	14

Wall Illuminance

Individual Unit*

Ceiling	0'	1'	2'	3'	4'	5'	6'	7'	8'
8'	65	59	42	24	13	7	4	2	2
7'	82	74	56	35	20	11	7	4	3
6'	64	59	47	33	21	13	8	5	3
5'	50	46	38	28	19	13	8	6	4
4'	35	33	29	23	17	12	8	6	4
3'	25	24	21	18	14	10	8	6	4
2'	18	18	16	14	11	9	7	5	4
1'	14	14	13	11	10	8	6	5	4
Floor									

Multiple Units*

Ceiling	0'	1'	2'	3'	4'	5'	6'	7'	8'
					8'				
8'	69	63	48	33	27	33	48	63	69
7'	88	81	65	49	42	49	65	81	88
6'	72	68	58	48	44	48	58	68	72
5'	59	56	50	44	42	44	50	56	59
4'	45	43	40	37	36	37	40	43	45
3'	34	34	33	31	31	31	33	34	34
2'	28	27	27	26	26	26	27	27	28
1'	23	23	23	23	23	23	23	23	23
Floor									

Continuous Row*

Ceiling	0'	1'	2'	3'	4'	5'	6'	7'	8'
8'	95	95	95	95	95	95	95	95	95
7'	128	129	129	129	129	129	129	129	129
6'	113	113	114	114	114	114	114	114	115
5'	96	97	98	98	99	99	99	99	99
4'	76	78	78	79	79	79	80	79	79
3'	60	62	62	63	63	63	64	64	64
2'	49	50	51	51	52	52	52	52	52
1'	41	43	43	44	44	44	45	45	45
Floor									

*Units located 3' from wall
Data provided for RWW-232MI Unit

ORDERING INFORMATION

SAMPLE NUMBER: RWW-232MI

RWW — Series: Horizon Wall Wash

2 — Number of Lamps (Not included)
1=1- Lamp (T8 Only)
2=2- Lamp (T8 Only)
T1=4' Fixture with one Biax Lamp at each end

32 — Wattage (Length)
32=32W T8
BX40=40W Biax
BX50=50W Biax[2]
BX55=55W Biax[2]

MI — Reflector Finish
MI=Specular Low Iridescent (Standard)
I=Semi-Specular Low Iridescent

Voltage[3]
120=120V
277=277V
347=347V
UNV=Universal Voltage 120-277V

Ballast Type
Standard Magnetic Ballast Leave Blank (40W Biax Only)
LEOC8= Energy Saving Magnetic Ballast (T-8 Lamp Only)
EB_ _= Generic Electronic Ballast
No. of Ballasts **1** or **2**[4]
Lamp Size **8**=T8 **5**=Biax
(For Specific Electronic Ballast Specify Brand and Catalog Number)

Options (add as suffix)
TBW2= Thin White Baffle Accessory (2' Fixture)[1]
TBW4= Thin White Baffle Accessory (4' Fixture)[1]
CAL2= Clear Acrylic Lens (2' Fixture)[1]
CAL4= Clear Acrylic Lens (4' Fixture)[1]
GL=Internal Single Element Fusing
GM=Dual Element Fusing
RIF1=Radio Interference Suppressor
REP=Approved by City of New York Bureau of Electrical Control (Submission #98A0640, Calender #40443)
DF-104-W=Drywall Frame Kit (Order Individually as Accessory)
RLS=Rotor-Lock Socket (T8 Lamps Only)
(Additional options available. See Accessory Section)

NOTE See option/accessories sections for additional detailed product data.
Specifications and Dimensions subject to change without notice.
[1] Field installed accessory ships in separate carton.
[2] Electronic Ballast Only.
[3] Consult Pre Sales Technical Support
[4] Above ceiling ballast access for 1 ballast only

SHIPPING INFORMATION

Catalog No.	Wt.
RWW-132	17.5
RWW-232	17.5
RWW-T1BX40	18.0

COOPER Lighting

Visit our web site at www.cooperlighting.com
Customer First Center 1121 Highway 74 South Peachtree City, GA 30269 770.486.4800 FAX 770.486.4801 ADF020635

Cooper Ltg - Metalux # RWW-2-32-MI-277-EB81-*		**B13**
Brian Smith	**UCSD Cal IT2**	**# of #**

TYPE:

CATALOG#:

Corelite™

DESCRIPTION

Corelite's small scale 'Cove 2x6' is an asymmetric lighting solution for the interior environment that offers flexibility in application and installation. The Cove 2x6 optimizes four different lamp configurations with an engineered optical system that produces a smooth even gradient of light onto room surfaces. This small scale luminaire may serve to either accent architectural details or simply create an ambient layer of light.

SPECIFICATION FEATURES

A···Construction

Housing one piece die formed 18 gauge corrosion resistant steel forming a 2" deep ballast channel. Standard 2'-0", 3'-0", 4'-0", 8'-0", and 12'-0" fixture lengths combine for continuous rows.

B···Reflectors

Reflectors are die formed high reflectance aluminum. Reflector pan high reflectance white finish.

C···Electrical

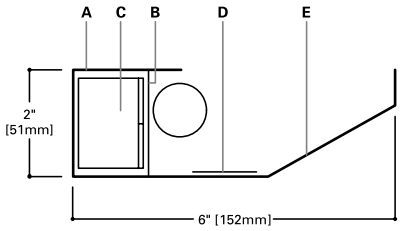
Fixtures are pre-wired with quick wire connectors and use instant start UL listed Class P, 265 ma T8 electronic ballasts, Power Factor of 95% with less than 20% THD. Fixtures and electrical components certified to UL standards.

D···Mounting

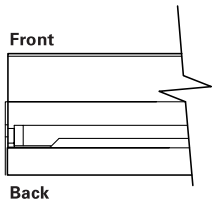
Fixture mounts directly to architectural cove or to wall structure. Refer to installation section for details.

E···Finish

Reflector pans are standard white using a baked polyester powder coating electrostatically applied. Ballast channels are corrosion resistant steel.



TOP VIEW



LENGTHS

24" [610mm]

36" [914mm]

48" [1219mm]

96" [2438mm]

144" [3658mm]

Cove 2x6

1T8

ARCHITECTURAL COVE

ASYMMETRIC INDIRECT

ORDERING INFORMATION

SAMPLE NUMBER: **CI-SN-1T8-1C-120-12**

CI	S	N	1	T8	1			

Series
CI=Cove 2x6

Reflector
S=Specular

Number of Lamps
(not included)
1=1 Lamp

Wattage (Length)
T8=32W (4' Unit)

Number of Circuits[1]
1=1 Circuit

Wiring[1]
C=Standard Circuit
D=Dimming
E=Emergency/Night Light
B=Battery Pack

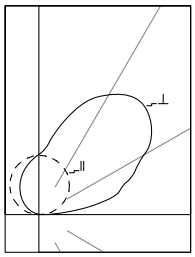
Voltage
120=120V
277=277V
347=347V

Run Length
04= 4' Section
08= 8' Section
12= 12' Section
16= 2-8' Sections
20= 1-8', 1-12' Section
24= 2-12' Sections
24+ = must be a combination of 8' and 12' sections.

[1]Not all options available. Please consult your Cooper Lighting Representative for availability
Specifications and Dimensions subject to change without notice.

Cooper Ltg - Corelite # CI-SN-1T8-1-C-277-08		B14
Brian Smith	**UCSD Cal IT2**	**# of #**

PHOTOMETRICS



CI-SN-1T8

(1) F32T8/TL841
3000 Lumens

Efficiency 70.5%

Test Report
#LSI14516

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	67	67	67	67	57	57	57	57	39	39	39	23	23	23	07	07	07	00
1	61	58	56	53	52	50	48	45	34	33	32	20	19	18	06	06	06	00
2	55	51	47	43	47	43	40	37	30	28	26	17	16	15	05	05	05	00
3	51	45	40	36	43	38	34	31	26	24	22	15	14	13	05	05	04	00
4	46	39	34	30	39	34	29	26	23	21	19	13	12	11	04	04	04	00
5	42	34	29	26	36	30	26	22	21	18	16	12	10	09	04	03	03	00
6	39	31	26	22	33	27	22	19	18	16	14	11	09	08	03	03	03	00
7	36	28	22	19	30	24	19	16	16	14	12	10	08	07	03	03	02	00
8	33	25	20	16	28	21	17	14	15	12	10	09	07	06	03	02	02	00
9	30	22	17	14	26	19	15	12	13	11	09	08	06	05	03	02	02	00
10	28	20	16	13	24	17	14	11	12	10	08	07	06	05	02	02	02	00

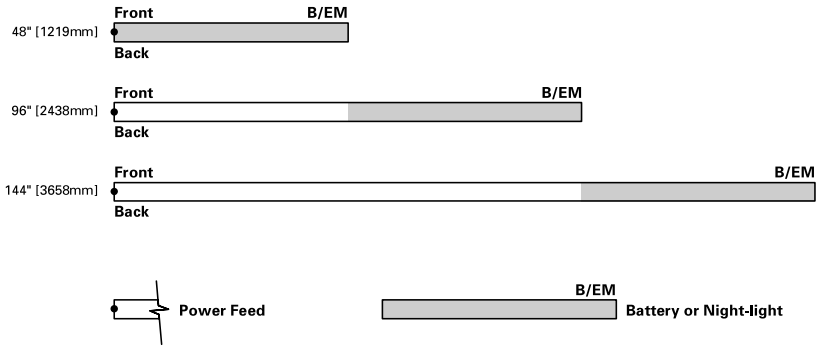
Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
180-150	391	13.51	19.16
180-140	702	24.23	34.36
180-120	1426	49.20	69.78
180-90	2044	70.51	100.00
140-90	1342	46.28	65.64
120-90	617	21.31	30.22
0-90	0	.00	.00
0-180	2044	70.51	100.00

Candela

Angle	Along II	45°	Across ⊥
180	393	393	393
175	408	432	449
170	437	497	554
165	464	566	659
160	491	627	755
155	513	695	843
150	534	741	914
145	554	789	951
140	570	816	962
135	573	809	946
130	559	777	903
125	541	727	839
120	503	665	701
115	450	596	646
110	387	472	552
105	310	386	490
100	208	290	331
95	113	147	171
90	0	0	0

STANDARD BATTERY AND EMERGENCY/NIGHT LIGHT LOCATIONS



QUANTITY OF FIXTURE LENGTH PER CONTINUOUS RUNS

FIXTURE LENGTH	4'	8'	12'	16'	20'	24'	28'	32'	36'	40'	44'	48'	52'	56'	60'	64'	68'	72'	76'	80'	84'	88'	92'	96'	100'	104'	108'
4'	1																										
8'		1		2	1		2	1		2	1		2	1		2	1		2	1		2	1		2	1	
12'			1		1	2	1	2	3	2	3	4	3	4	5	4	5	6	5	6	7	6	7	8	7	8	9

NOTE: Specifications and dimensions subject to change without notice.

COOPER Lighting

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Corelite 4675 A Holly Street Denver, CO 80216 303.393.1522 FAX 303.393.1477 ADE000700

Cooper Ltg - Corelite # CI-SN-1T8-1-C-277-08		B14
Brian Smith	UCSD Cal IT2	# of #

TYPE:

CATALOG#:

Corelite™

DESCRIPTION

Corelite's small scale 'Cove 2x6' is an asymmetric lighting solution for the interior environment that offers flexibility in application and installation. The Cove 2x6 optimizes four different lamp configurations with an engineered optical system that produces a smooth even gradient of light onto room surfaces. This small scale luminaire may serve to either accent architectural details or simply create an ambient layer of light.

SPECIFICATION FEATURES

A···Construction

Housing one piece die formed 18 gauge corrosion resistant steel forming a 2" deep ballast channel. Standard 2'-0", 3'-0", 4'-0", 8'-0", and 12'-0" fixture lengths combine for continuous rows.

B···Reflectors

Reflectors are die formed high reflectance aluminum. Reflector pan high reflectance white finish.

C···Electrical

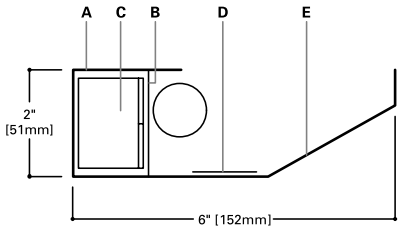
Fixtures are pre-wired with quick wire connectors and use instant start UL listed Class P, 265 ma T8 electronic ballasts, Power Factor of 95% with less than 20% THD. Fixtures and electrical components certified to UL standards.

D···Mounting

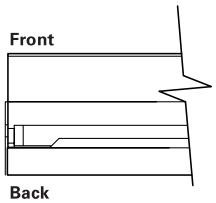
Fixture mounts directly to architectural cove or to wall structure. Refer to installation section for details.

E···Finish

Reflector pans are standard white using a baked polyester powder coating electrostatically applied. Ballast channels are corrosion resistant steel.



TOP VIEW



LENGTHS

24" [610mm]

36" [914mm]

48" [1219mm]

96" [2438mm]

144" [3658mm]

Cove 2x6

1T8

ARCHITECTURAL COVE

ASYMMETRIC INDIRECT

ORDERING INFORMATION

SAMPLE NUMBER: **CI-SN-1T8-1C-120-12**

CI	S	N	1	T8	1			

Series
CI=Cove 2x6

Reflector
S=Specular

Number of Lamps
(not included)
1=1 Lamp

Wattage (Length)
T8=32W (4' Unit)

Number of Circuits[1]
1=1 Circuit

Wiring[1]
C=Standard Circuit
D=Dimming
E=Emergency/Night Light
B=Battery Pack

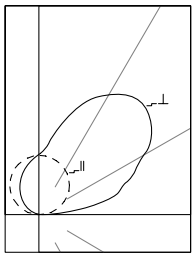
Voltage
120=120V
277=277V
347=347V

Run Length
04= 4' Section
08= 8' Section
12= 12' Section
16= 2-8' Sections
20= 1-8', 1-12' Section
24= 2-12' Sections
24+ = must be a combination of 8' and 12' sections.

[1]Not all options available. Please consult your Cooper Lighting Representative for availability
Specifications and Dimensions subject to change without notice.

Cooper Ltg - Corelite # CI-SN-1T8-1-C-277-08		B15
Brian Smith	**UCSD Cal IT2**	**# of #**

PHOTOMETRICS



CI-SN-1T8

(1) F32T8/TL841
3000 Lumens

Efficiency 70.5%

Test Report
#LSI14516

Coefficients of Utilization

Effective floor cavity reflectance	20%																					
rc	80%				70%				50%			30%			10%			0%					
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0				
RCR																						
0	67	67	67	67	57	57	57	57	39	39	39	23	23	23	07	07	07	00				
1	61	58	56	53	52	50	48	45	34	33	32	20	19	18	06	06	06	00				
2	55	51	47	43	47	43	40	37	30	28	26	17	16	15	05	05	05	00				
3	51	45	40	36	43	38	34	31	26	24	22	15	14	13	05	05	04	00				
4	46	39	34	30	39	34	29	26	23	21	19	13	12	11	04	04	04	00				
5	42	34	29	26	36	30	26	22	21	18	16	12	10	09	04	03	03	00				
6	39	31	26	22	33	27	22	19	18	16	14	11	09	08	03	03	03	00				
7	36	28	22	19	30	24	19	16	16	14	12	10	08	07	03	03	02	00				
8	33	25	20	16	28	21	17	14	15	12	10	09	07	06	03	02	02	00				
9	30	22	17	14	26	19	15	12	13	11	09	08	06	05	03	02	02	00				
10	28	20	16	13	24	17	14	11	12	10	08	07	06	05	02	02	02	00				

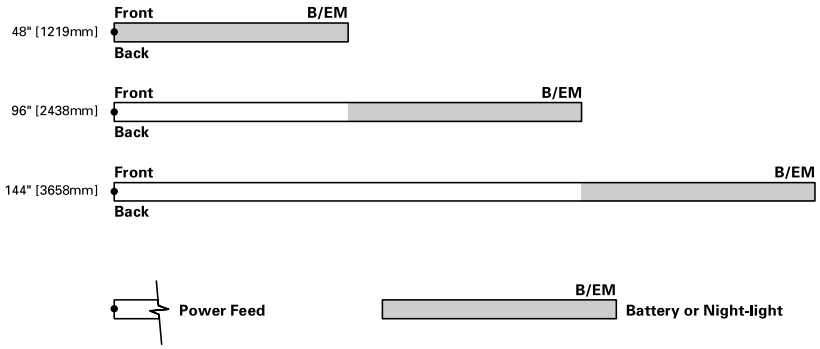
Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
180-150	391	13.51	19.16
180-140	702	24.23	34.36
180-120	1426	49.20	69.78
180-90	2044	70.51	100.00
140-90	1342	46.28	65.64
120-90	617	21.31	30.22
0-90	0	.00	.00
0-180	2044	70.51	100.00

Candela

Angle	Along II	45°	Across ⊥
180	393	393	393
175	408	432	449
170	437	497	554
165	464	566	659
160	491	627	755
155	513	695	843
150	534	741	914
145	554	789	951
140	570	816	962
135	573	809	946
130	559	777	903
125	541	727	839
120	503	665	701
115	450	596	646
110	387	472	552
105	310	386	490
100	208	290	331
95	113	147	171
90	0	0	0

STANDARD BATTERY AND EMERGENCY/NIGHT LIGHT LOCATIONS



QUANTITY OF FIXTURE LENGTH PER CONTINUOUS RUNS

FIXTURE LENGTH	4'	8'	12'	16'	20'	24'	28'	32'	36'	40'	44'	48'	52'	56'	60'	64'	68'	72'	76'	80'	84'	88'	92'	96'	100'	104'	108'
4'	1																										
8'		1		2	1		2	1		2	1		2	1		2	1		2	1		2	1		2	1	
12'			1		1	2	1	2	3	2	3	4	3	4	5	4	5	6	5	6	7	6	7	8	7	8	9

NOTE: Specifications and dimensions subject to change without notice.

COOPER Lighting

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Corelite 4675 A Holly Street Denver, CO 80216 303.393.1522 FAX 303.393.1477 ADE000700

Cooper Ltg - Corelite # CI-SN-1T8-1-C-277-08		B15
Brian Smith	UCSD Cal IT2	# of #

TRIPLES-H 132/6

recessed compact fluorescent downlight/wallwasher

FEATURES

Triples-H 132/6 is an efficient 6" aperture low brightness downlight, for use with one 32-watt, 4-pin,triple tube compact fluorescent lamp by GE, OSRAM/Sylvania or Philips. Triples-H 132/6 provides shielding angles of 40° parallel to and 40° perpendicular to the lamps. Recess depth is only 6 ½".

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

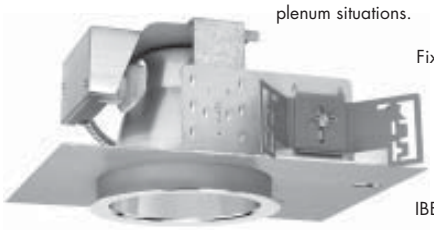
Triples-H 132/6 uses one 32-watt, 4-pin, triple tube lamp providing 2400 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; **EvenTone**, partially diffuse, anti-iridescent and gently luminous in appearance; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter, and bronze. Wallwash (120°) and double wallwash (2x120°) reflectors are also available.

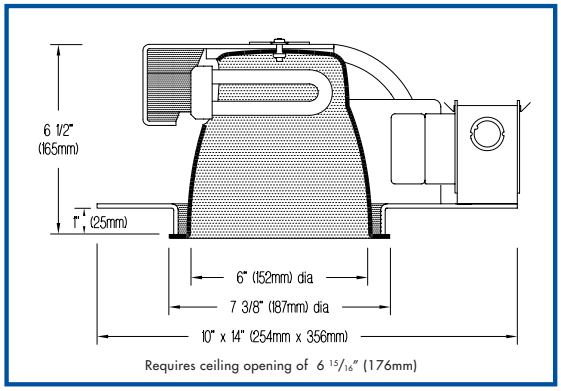
Triples-H 132/6 includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are available as accessories.

APPLICATIONS

Fixture is recommended for downlighting or wallwashing in offices, corridors, shops, banks, schools, hospitals and airports, as well as lobbies and public areas. The shallow recess depth allows mounting in constricted plenum situations.



Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is union made IBEW and in compliance with the component based efficiency standards of the 1995 New York State Energy Conservation Code. Fixture is prewired with high power factor Class P electronic ballast and approved for eight #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.



Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPH 132/6

Reflector Type	
Downlight	no suffix
Wallwash	WW
Double Wallwash	DWW

Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
OptiTone Clear	COL	CFL
EvenTone Clear	VOL	VFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates one lamp in event of power outage. Fixture footprint increases to 10 x 16 ¾" (254 x 425mm). Additional 1 ¼" (32mm) is required to remove EM pack through aperture. Not for outdoor application or double wallwasher (DWW) ..... – EM

⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

- For combinations of the Options above, contact factory or Edison Price Lighting representative.
- A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.
- A modified fixture suitable for 347-volt service is available on special order. Contact factory.
- An install-from-below version of this fixture, suitable for installation outside North America, is also available. Contact factory.
- Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING

41-50 22ND STREET, LIC NY 11101 TEL 718.685.0700 FAX 718.786.8530 www.epl.com

Edison Price # TPX 132/6		**B16**
Brian Smith	**UCSD Cal IT2**	**# of #**

TRIPLES-H 132/6

PHOTOMETRIC REPORT

LTL *Luminaire Testing Laboratory Report No. 05281. Original test report furnished upon request.*

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector
Lamp..... Philips 32-watt triple-tube compact fluorescent, 4-pin, GX24q-3 base, 2400 lumens
Efficiency 54.4%
Spacing Criteria .. 0°- 1.3, 90°-1.4, 180°-1.4
Axis orientation ... 0° plane is parallel to lamps, opposite sockets

BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	37	34
Line Current (A)	.31	.12
Power Factor (%)	>99	>99
THD (%)	<10	<10
Min. Starting Temp* (°F)	–5	–5

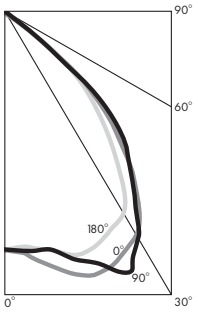
**Consult lamp manufacturers for specific temperatures.*

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	622	25.9	47.1
0 - 40°	998	41.6	76.5
0 - 60°	1301	54.2	99.8
0 - 90°	1304	54.4	100.0
90 -180°	0	0.0	0.0
0 -180°	1304	54.4	100.0

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*				
	0.0	*45.0*	*90.0*	*135.0*	*180.0*
0	665	665	665	665	665
5	657	672	670	689	677
15	698	724	711	775	756
25	673	740	799	782	748
35	546	578	613	614	629
45	318	362	408	377	368
55	6	7	6	6	6
65	3	3	3	3	4
75	0	0	0	0	0
85	0	0	0	0	0
95	0	0	0	0	0



LUMINANCE DATA *(Candela/m²)*

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*	*Average 180° Longitude*
45	24652	28063	31629
55	573	669	573
65	389	389	389
75	0	0	0
85	0	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

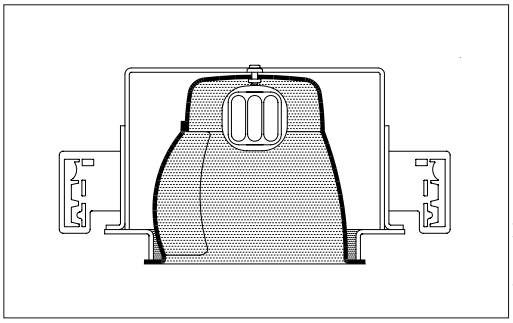
Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	65	65	65	65	63	63	63	63	60	60	60	58	58	58	55	55	55	54
1	61	60	58	57	60	59	57	56	56	55	54	54	54	53	53	52	51	50
2	58	55	53	51	57	54	52	50	53	51	49	51	50	48	49	48	47	46
3	55	51	48	46	54	50	48	45	49	47	45	47	46	44	46	45	43	42
4	52	47	44	41	50	46	43	41	45	42	40	44	42	40	43	41	39	39
5	48	43	40	37	47	43	39	37	42	39	36	41	38	36	40	38	36	35
6	45	40	36	34	44	39	36	34	39	36	33	38	35	33	37	35	33	32
7	42	37	33	30	42	36	33	30	35	32	30	35	32	30	34	32	30	29
8	39	33	29	27	39	33	29	27	32	29	27	32	29	27	31	28	26	26
9	36	30	26	24	36	30	26	24	29	26	24	29	26	23	28	25	23	23
10	34	27	24	21	33	27	24	21	27	23	21	26	23	21	26	23	21	20

TRIPLES-H 132/6 WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*		*3'6" From Wall; 3'6" O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	12	10	7	6	4	4
2	16	16	11	10	7	7
3	23	24	14	15	9	9
4	25	25	17	17	12	12
5	21	22	17	17	13	13
6	18	17	15	15	12	13
7	14	14	13	13	11	11
8	11	11	11	10	10	10
9	9	8	9	9	8	8
10	7	7	7	7	7	7

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.

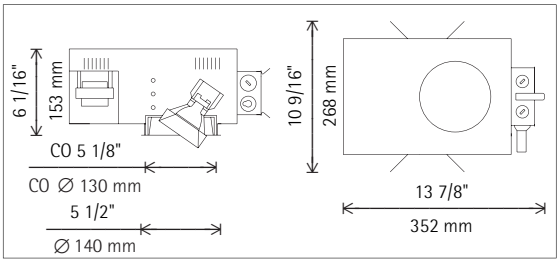


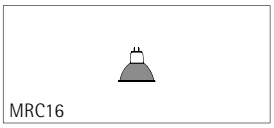
Edison Price # TPX 132/6		**B16**
Brian Smith	**UCSD Cal IT2**	**# of #**

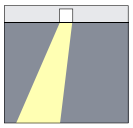
ERCO

Gimbal Directional spotlight

for low-voltage halogen lamps

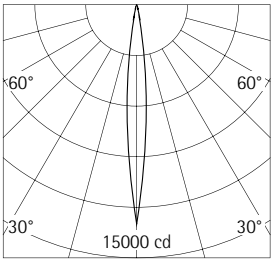






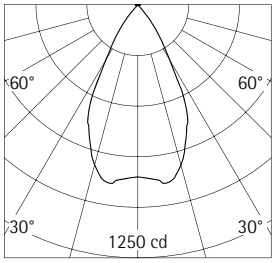
88120.023
MRC16 50W 12V GU5.3 10°
MRC16 50W 12V GU5.3 55°

Product description
Size 4
Luminaire: cast aluminum, black powder-coated.
Mounting ring: plastic, white (RAL9002), with multigroove baffle, cast aluminum, black powder-coated. Fixing springs. Cardanic suspension of the luminaire in the mounting ring. 0°-40° tilt. Pivots are to be locked.
Mounting box for preinstallation with junction box for through-wiring. Magnetic transformer 120/12V, 60Hz inside mounting box. Snap-in plug for connection between transformer and luminaire.
Anti-glare ring as lamp retainer: plastic, black.
Type Non IC luminaire.
Insulation materials must be kept away from the luminaire by a minimum of 3". Thermally protected luminaire. Suitable for damp location. Removal of luminaire allows access to transformer and junction box from below.
Max. ceiling thickness 3/4".
Weight 8.82lbs / 4.00kg



MRC16 50W 12V GU5.3 10°

h(ft)	E(fc)	D 10°
3	1444	0'6"
6	361	1'1"
9	160	1'7"
12	90	2'1"
15	58	2'7"



MRC16 50W 12V GU5.3 55°

h(ft)	E(fc)	D 55°
3	94	3'1"
6	24	6'3"
9	10	9'4"
12	6	12'6"
15	4	15'7"

ERCO Lighting, Inc.
160 Raritan Center Parkway
Suite 10
Edison, NJ 08837
USA
Tel.: +1 732 225 8856
Fax: +1 732 225 8857
info.us@erco.com

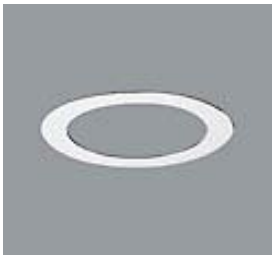
Technical Region: 120V/60Hz
Edition: December 21, 2005
Please download latest version from
www.erco.com/88120.023

Erco # 88120.023		**B17**
Brian Smith	**UCSD Cal IT2**	**# of #**

ERCO

Gimbal Directional spotlight

Accessories



83980.000
Cover ring
Metal, white. For covering the gap where ceiling cut-outs are too big. Inner and outer diameter to be specified when placing order.

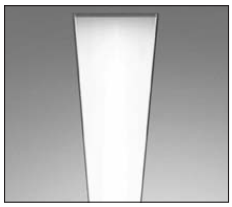
Erco # 88120.023		**B17**
Brian Smith	**UCSD Cal IT2**	**# of #**

SLOTLIGHT PRO

Fluorescent
One or Two Lamp,
28W T5 or 54W T5 HO

2 1/2" Recessed Custom Length

online Find it Fast 269



Applications: SLOTLIGHT is a lighting solution as unobtrusive as it is sophisticated. Because of its streamlined design, the luminaire itself is nearly absorbed into the architecture; slim, contemporary "ribbons of light" seem to glow out of the ceiling. Ideal for educational facilities, financial institutions, offices, retail spaces, lobbies and conference centers. Choose SLOTLIGHT PRO wherever long continuous runs or custom lengths of SLOTLIGHT are required.

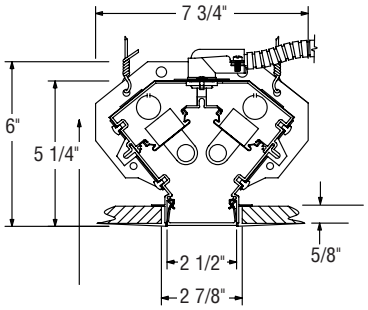
Type: _____

Project: _____

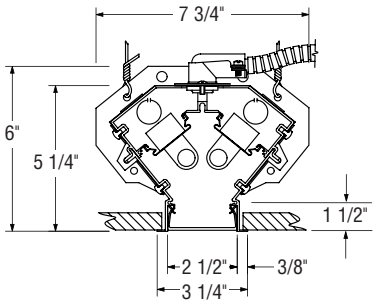
ORDERING NOTE: Specify ceiling type, lamping, run length and voltage/ballast.

▼Fixture	▼Ceiling Type	▼Lamping (Cross Section)	▼Run Length	▼Voltage/Ballast
SLR2				
SLR2 SLOTLIGHT PRO, 2 1/2" Recessed, Custom Length	**E** Concealed ceilings, flangeless **F** Concealed ceilings, flanged	**1285** (1) 28W T5 **2285** (2) 28W T5 **1545** (1) 54W T5 HO **2545** (2) 54W T5 HO	***Rough-in extrusion will allow adjustability of +/- 1/4" from run length. End of run finishing extrusion to be field cut by contractor.***	**U** Universal 120/277V **347** Consult factory **DA_*** Dimming, Analog (0-10V) **DD_*** Dimming, DALI **DE_*** Dimming, Lutron ECO-10 **DH_*** Dimming, Lutron HiLume **** Indicate 120V (1) or 277V (2) Not available for 28W***

Cross Section, flangeless



Cross Section, flanged



c UL us
LISTED
Suitable for damp locations
Approved for thru-wiring

IBEW Union Made

1. Housing - Extruded aluminum in standard lengths of 4', 8' and 12', as well as custom length units. Aluminum end caps. Standard finish is clear anodized aluminum.

2. Sockets - Lamp configurations allow for twist lock installation. Sockets are adjustable to allow for perfect lamp overlap at custom lengths.

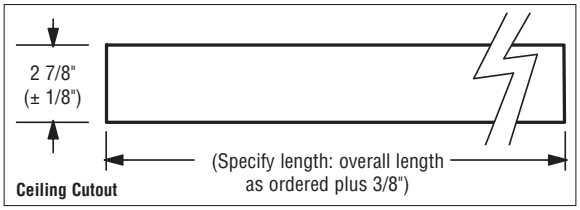
3. Lamping - One or two lamp cross section 28W T5 or 54W T5 HO fluorescent lamps, supplied by others. For custom lengths, a combination of 2', 3', 4' and 5' lamps will be used. Lamps overlap. Remove lens for access to lamp.

4. Upper reflector - White high efficiency paint powder coat finish.

5. Ballast - Universal voltage electronic 120/277V ballast.

6. Lens - Extruded white opal acrylic lens.

7. Mounting - Fixture installs from behind ceiling. Use 1/2" trade-size fitting to attach feed to the fixture. Fixture length will be as specified with built-in adjustability of +/-4".



Ceiling Cutout

Note: for lengths other than 4', 8' or 12', we will supply drawings prior to approval. Sign-off is required prior to production.

8. Junction Box - 4" octagonal junction box supplied by others.

9. Dimming - Consult factory for specific dimming requirements other than those listed above.

10. Weight - 16.0 lbs. (4' fixture).

In a continuing effort to offer the best product possible we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Technical specification sheets that appear on www.zumtobelstaff.us are the most recent version and supersede all other versions that exist in any other printed or electronic form.

Zumtobel Staff Lighting Inc. ©2006
3300 Route 9W • Highland, NY 12528-2630
www.zumtobelstaff.us
TEL (845) 691-6262 • (800) 932-0633 • FAX (845) 691-6289
1/16/06

ZUMTOBEL STAFF

Zumtobel Staff # SLR2-*-1285-*		**B18**
Brian Smith	**UCSD Cal IT2**	**# of #**

Photometric Data

SLR2 2395 3' (2) 39W T5HO

3' RECESSED FLUORESCENT, 2-1/2" WIDE, TRANSLUCENT WHITE ACRYLIC

LTL 08208

Total Luminaire Efficiency 19%

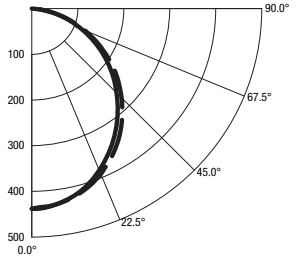
0% Uplight 100% Downlight

Spacing Criteria

Lateral Plane	0°	90°
	1.2	1.2

TOTAL LAMP LUMENS = 6160
INPUT WATTS = 75

Candela Distribution



Vertical Angle	Horizontal Angle 0°	45°	90°	Zonal Lumens
0°	438	438	438	
5°	434	435	435	38.6
15°	416	415	413	116.7
25°	381	376	371	173.2
35°	334	326	319	203.6
45°	276	267	260	206.0
55°	212	204	199	182.8
65°	142	137	133	135.7
75°	74	71	70	75.3
85°	16	16	16	18.1
90°	0	0	0	

Luminance Data in Candela / Sq. Meter

Angle in Vertical°	Average 0°	Average 45°	Average 90°
45°	5393	5217	5080
55°	5106	4914	4793
65°	4642	4479	4348
75°	3950	3790	3737
85°	2536	2536	2536

Coefficients of Utilization

Effective Floor Cavity Reflectance = 20%

pcc	0.8				0.7				0.5			0.3		
pw	0.7	0.5	0.3	0.1	0.7	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1
0	22	22	22	22	22	22	22	22	21	21	21	20	20	20
1	20	20	19	18	20	19	18	18	18	18	17	18	17	17
2	19	17	16	15	18	17	16	15	16	15	14	15	15	14
3	17	15	14	12	17	15	13	12	14	13	12	14	13	12
4	16	13	12	10	15	13	12	10	13	11	10	12	11	10
5	14	12	10	9	14	12	10	9	11	10	9	11	10	9
6	13	11	9	8	13	11	9	8	10	9	8	10	9	8
7	12	10	8	7	12	10	8	7	9	8	7	9	8	7
8	11	9	7	6	11	9	7	6	9	7	6	8	7	6
9	11	8	7	6	10	8	7	6	8	7	6	8	6	6

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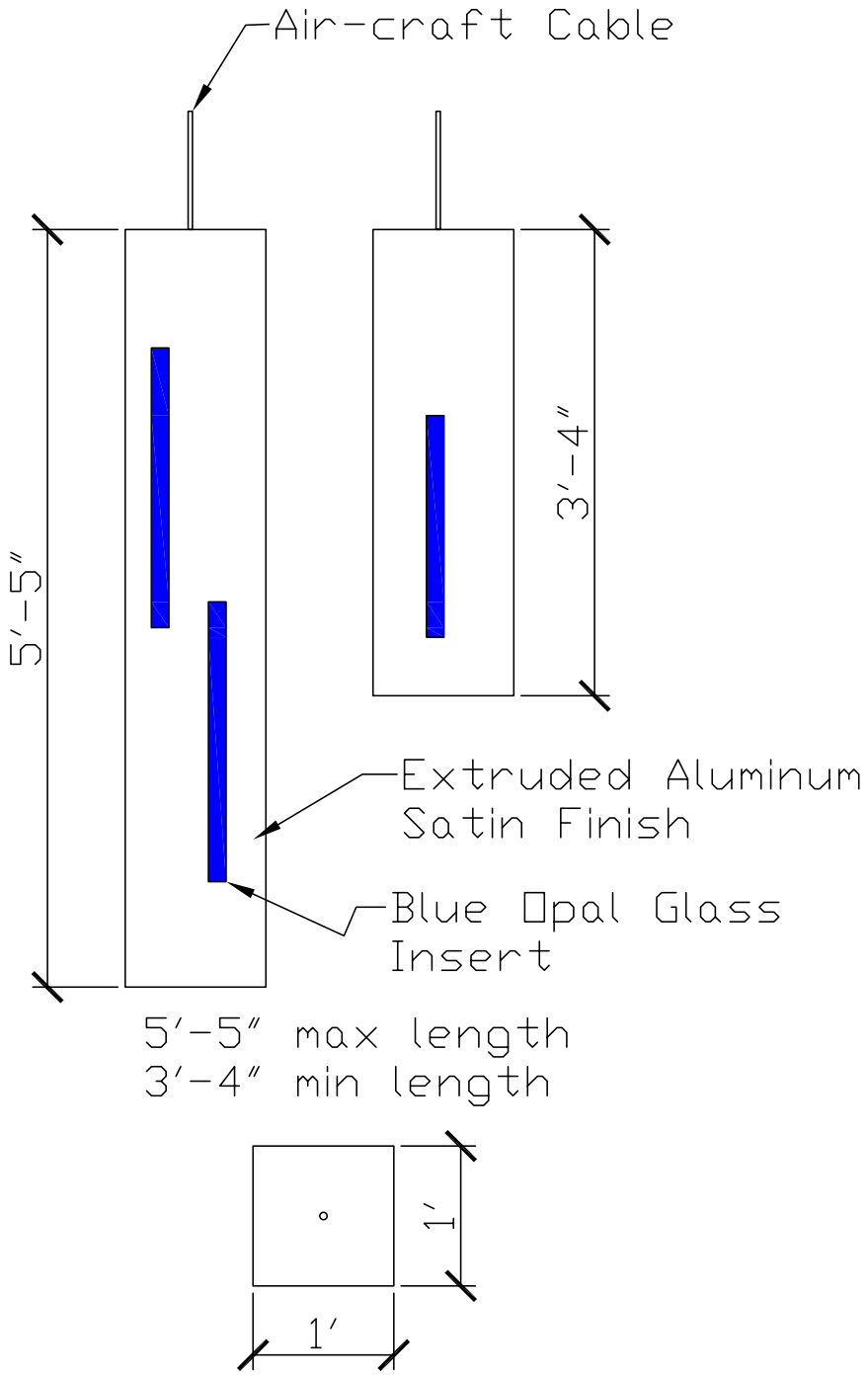
1/16/06

SL-3A

ZUMTOBEL STAFF

Zumtobel Staff # SLR2-*-1285-*		**B18**
Brian Smith	**UCSD Cal IT2**	**# of #**



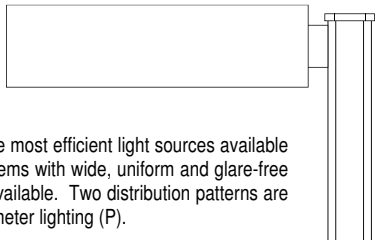
Lobby Entrance Pendant B19
(2) 32W Triple Tube CFL

D'AC # Custom Design		**B19**
Brian Smith	**UCSD Cal IT2**	**# of #**

Notes:	Job: Type:

FORM 10

LPS - LOW PRESSURE SODIUM



GENERAL DESCRIPTION: The Form 10 low pressure sodium luminaire combines one of the most efficient light sources available with advanced optical technology. Through Gardco's leadership in sharp cutoff reflector systems with wide, uniform and glare-free light distribution, a lamp and luminaire package unequaled in performance and efficiency is available. Two distribution patterns are offered; a rectangular pattern for area applications (A) and an asymmetric distribution for perimeter lighting (P).

ORDERING

PREFIX	CONFIGURATION	DISTRIBUTION	WATTAGE	VOLTAGE	FINISH	OPTIONS

Enter the order code into the appropriate box above. Note: Gardco reserves the right to refuse a configuration. Not all combinations and configurations are valid. Refer to notes below for exclusions and limitations. For questions or concerns, please consult the factory.

PREFIX

LA14[7]	*End Arm Mount, Pole*
LSA14[5]	*Side Arm Mount, Pole*
LP14[2,5,7]	*End Direct Mount, Pole*
LSP14[5]	*Side Direct Mount, Pole*
LJ14[1,3,4]	*Post Top Mount*
LW14[1,6]	*Side Wall Mount*

1. *Single configuration only.*
2. *LP Style luminaires should be mounted to CA5, CA6 or SSA poles only.*
3. *LJ Style luminaires furnished with Gardco Poles will be supplied with a square fitter for cruciform, SSA and SSS poles. A round fitter will be supplied for round poles.*
4. *LJ Style luminaires furnished for poles by others will be supplied with a 5" O.D. fitter for a 4" x 6" tenon or a 3.5" O.D. fitter for a 2 3/8" x 4" tenon.*
5. *LP, LSP and LSA luminaires may not be ordered in 2-way @ 90°, 3-way or 4-way configurations.*
6. *LW luminaires are available with Type P-Perimeter optics only.*
7. *LA and LP with Type P, Perimeter optics permit 180° optical system rotation to provide light in the desired direction.*

CONFIGURATION

1	Single Assembly
2	Twin Assembly
3	Triple at 90º *(LA14 only)*
4	Quad Assembly *(LA14 only)*

DISTRIBUTION

A	Area Distribution, Type V
P	Perimeter Distribution, Type IV

WATTAGE

55LPS
90LPS
135LPS
180LPS

VOLTAGE

120
208
240
277
480

FINISH

BRP	Bronze Paint
BLP	Black Paint
WP	White Paint
NP	Natural Aluminum Paint
BLA	Black Anodized
BRA	Bronze Anodized
NA	Natural Aluminum Anodized
OC	Optional Color Paint *Specify RAL designation ex: OC-RAL7024*
SC	Special Color Paint *Specify Color. Must supply color chip.*

OPTIONS

F	Fusing *(In Head)*
LF	In-Line/In-Pole Fusing
PC	Photocontrol and Receptacle *(N/A with 480V)*
PCR	Photocontrol Receptacle only
POLY	Polycarbonate Lens (*In lieu of Acrylic)*
PTF2	Pole Top Fitter - 2 3/8" Dia. Tenon
PTF3	Pole Top Fitter - 3-3 1/2" Dia. Tenon
PTF4	Pole Top Fitter - 3 1/2-4" Dia. Tenon
MF	Mast Arm Fitter

A Genlyte Company

Gardco Lighting
2661 Alvarado Street
San Leandro, CA 94577

800/227-0758
510/357-6900 in California
Fax: 510/357-3088
www.sitelighting.com

GARDCO LIGHTING

79115-13/0804

Gardco # LSA14-1-A-135LPS-277-BLP-LF		**E1**
Brian Smith	**UCSD Cal IT2**	**# of #**

FORM 10

LPS - LOW PRESSURE SODIUM

SPECIFICATIONS

GENERAL DESCRIPTION: Each Gardco Form 10 LPS unit is a rectilinear luminaire that meets all criteria of the Illuminating Engineering Society's cutoff classification.

HOUSING: Housing side sections are composed of precisely mitered and welded aluminum extrusions. Tops are press-formed and internally welded to the housing sides. Pressure injected silicone provides a continuous weather-tight seal at all miters and points of material transition.

DOOR/LENS ASSEMBLY: The door frame is constructed of mitered and welded anodized aluminum sections. The optically clear, non-yellowing, impact-resistant acrylic lens is secured in the door frame. Corrosion resistant, hollow core, memory retentive silicone gaskets seal both the lens to the door frame and the door frame to the housing.

REFLECTOR ASSEMBLY: The Form 10 reflector systems are constructed of homogeneous sheet aluminum that is electrochemically brightened, anodized and sealed. The highly specular reflector segments are precisely positioned to produce either an area distribution pattern (A) that conforms to an IES Type V or a perimeter distribution pattern (P) that conforms to an IES Type IV. Luminaires have lamp stabilizers positioned to secure LPS lamps irrespective of lamp length that may vary by manufacturer.

ELECTRICAL: All luminaires utilize magnetic ballasts that are high power factor and designed for reliable lamp starting to -20ºF. The electrical components are mounted on a unitized tray and prewired with quick electrical disconnects.

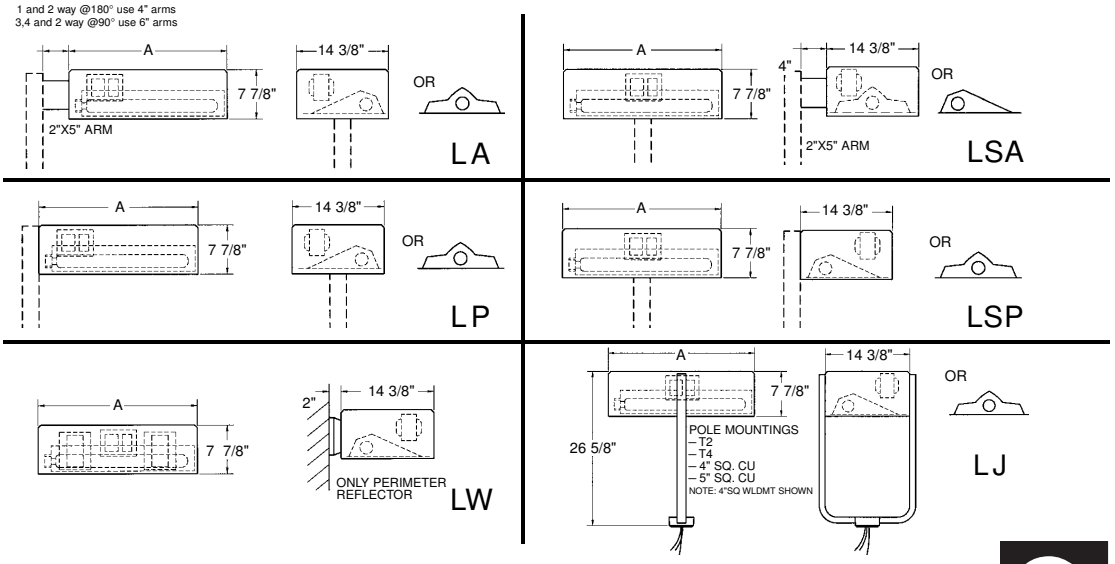
FINISH: Housings are finished with an Architectural Class 1 anodizing or TGIC polyester powdercoat.

LABELS: All fixtures bear UL or CUL (where applicable) Wet Location labels.

LUMINAIRE EPAS

Wattage	Dimension"A"	LP14		LA14		LJ14	LSA14, LSP14
		1 Way	2 Way	1 Way	2 Way	1 Way	1 & 2 Way
180	48"	2.90	5.80	2.97	5.94	3.03	2.90
135	34 3/8"	2.08	4.16	2.15	4.30	2.21	2.08
90	24 5/8"	1.49	2.98	1.56	3.12	1.62	1.49
55	24 5/8"	1.49	2.98	1.56	3.12	1.62	1.49

DIMENSIONS



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GARDCO LIGHTING

79115-13/0804

Gardco # LSA14-1-A-135LPS-277-BLP-LF		**E1**
Brian Smith	**UCSD Cal IT2**	**# of #**

Bollards for illuminating horizontal surfaces

Post construction: One piece trapezoidal extruded aluminum, 3/16" wall thickness with one piece die cast aluminum top housing and base, internally welded into an assemble.

Lamp enclosure: Clear tempered safety glass with an internal spread optical texture, 1/8" thick. One piece die cast aluminum faceplate secured by four (4) flush, flathead stainless steel screws threaded into stainless steel inserts. Internal reflector of pure anodized aluminum. Fully gasketed using a molded silicone, high temperature gasket.

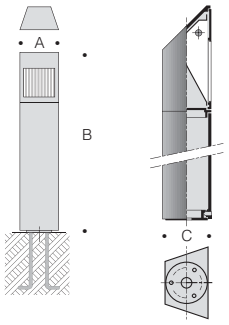
Electrical: Lampholders Incandescent: Metal Halide; Single ended porcelain, G12 bi-pin with nickel plated contacts. HID sockets are supplied with 180°C high temperature leads. HID Ballasts are magnetic, located on an upright bracket attached to the anchor base and are available in 120V or 277V - specify.

Anchor Base: Heavy die cast aluminum, slotted for precise alignment. Provided with three anchor bolts provided for installation on an existing concrete pad (Kit F). Mounts to BEGA # 895A anchorage kit (supplied).

Finish: Available in five standard BEGA colors:Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV); Eurocoat™ (URO). To specify, add appropriate suffix to catalog number. Custom colors supplied on special orders.

U.L. listed, suitable for wet locations. Protection class: IP 65.

Type:
BEGA Product #:
Project:
Voltage:
Color:
Options:
Modified:



Bollards for surface washing ground surfaces. Extremly rugged construction with clear tempered safety glass with an internal optical spread texture.
U.L. listed, suitable for wet locations. IP 65.
Colors: Standard BEGA finishes.

		Lamp	Lumen	A	B	C
8533MH	Bollard	1 39W T6 G12 MH	3300	9⅞	43 5/16	5½
895A	Anchorage included					

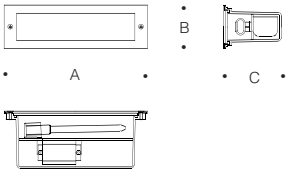
BEGA/US 1000 BEGA Way, Carpinteria, CA 93013 [P] 805·684·0533 [F] 805·684·6682

Bega # 8534MH		**E2**
Brian Smith	**UCSD Cal IT2**	**# of #**

Recessed wall luminaires - stainless steel

Type:
BEGA Product #:
Project:
Voltage:
Color:
Options:
Modified:

Housing: Constructed of die cast and extruded aluminum with integral wiring compartment. Mounting tabs provided.
Enclosure: All stainless steel faceplate, 3⁄16" thick. 1⁄8" thick, tempered clear glass with white translucent coating. Faceplate is secured by two (2) flat socket head, stainless steel, captive screws threaded into stainless steel inserts in the housing casting. Continuous high temperature O-ring gasket for weather tight operation.
Electrical: Lampholder: G23 (7W/9W), 2-pin, rated 75W, 600V.
Ballast: Magnetic, HPF available in 120V or 277V - specify.
Through Wiring: Maximum of four (4) No. 12 AWG conductors (plus ground) suitable for 75°C. Two 7⁄8" knockouts provided for 1⁄2" conduit.
Finish: #4, brushed stainless steel. Stainless steel requires regular cleaning and maintenance, much like household appliances, to maintain its luster and to prevent tarnishing or the appearance of rust like stains.
U.L. listed, suitable for wet locations and for installation within 3 feet of ground. Suitable for all types of construction including poured concrete. Type non-IC. Protection class: IP 64.



Recessed luminaires with stainless steel faceplate and white diffusers. May be mounted horizontal or vertical.
U.L. listed, suitable for wet locations. IP 64.
Finish: #4 brushed stainless steel.

		Lamp	Lumen	A	B	C
2031P Recessed	⬬	1 7/9W CF twin-2p	400/600	10 3⁄8	3 3⁄16	4

BEGA/US 1000 BEGA Way, Carpinteria, CA 93013 [P] 805·684·0533 [F] 805·684·6682

Bega # 2289P		**E3**
Brian Smith	**UCSD Cal IT2**	**# of #**

Features

Originally designed for patient room lighting, this unobtrusive, glare free luminaire allows patients to sleep while maintaining a well illuminated walkway area in hospitals and healthcare facilities. Nearly invisible and easy to maintain, the 3510 has found applications in theatres, nightclubs, auditoriums, banquet facilities and casinos. Energy efficient compact fluorescent lamps provide long life and high output from these ADA approved fixtures. Powerful, compact and flush to the wall, the 3510 draws attention to the walkway surface and not itself.

- Suitable For Concrete Pour
- Custom Finishes Available, Consult Factory
- Optional Tamper-Proof Hardware Kit
  Order # 3510TPK
- Optional GLR Fuse Kit
  Order # GLR Fuse Kit
- UL and CUL Listed Damp Location
- UL and CUL Listed Wet Location Kit Available
  Order # 3510LWL or 3510SWL

Belfer Lighting For Architecture
TEL: (732) 493-2666 . FAX: (732) 493-2941 . www.belfer.com

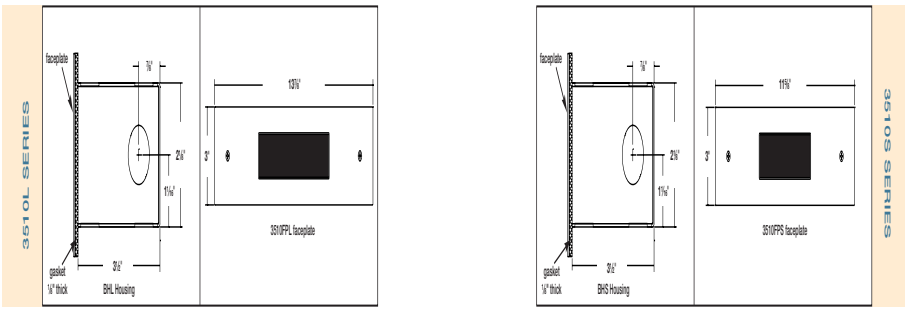
BELFER
Lighting For Architecture

P.O. Box 2079
Ocean, New Jersey 07712
TEL: (732) 493-2666
FAX: (732) 493-2941
Toll Free in Canada: 1-800-726-5759
www.belfer.com

BELFER
Lighting For Architecture

Step & Aisle Lighting with PhotoOsmetic™ Lens

Belfer # 3510FPS-BHS-13-1-*		**E4**
Brian Smith	**UCSD Cal IT2**	**# of #**



3510L Series

STEP & CORRIDOR LIGHT WITH PHOTOSMETIC™ LENS
9 WATT, 13 WATT, 18 WATT QUAD & 26 WATT QUAD

- Housing Cutout (nominal):
  12 5/16"W x 2 5/16"H x 3 1/2"D
- Compact Fluorescent Lamp Options:
  - 9 Watt (G23)
  - 13 Watt (GX23)
  - 18 Watt Quad (G24q-2)
  - 26 Watt Quad (G24q-3)
- Voltage Options:
  - 120 Volt
  - 277 Volt
- Standard Ballast Options:
  - High Power Factor (120 volt only)
  - Normal Power Factor (120 volt only)
  - Electronic (120 volt and 277 volt)
    (4 pin 18 watt and 26 watt quad lamps only)
- UL and CUL Listed Damp Location Standard
  Wet Location Kit Available # 3510LWL

DAMP LOCATION
WET LOCATION NOT AVAILABLE

BELFER LIGHTING FOR ARCHITECTURE
TEL: (732) 493-2666 . FAX: (732) 493-2941 . www.belfer.com

3510S Series

STEP & CORRIDOR LIGHT WITH PHOTOSMETIC™ LENS
5 WATT, 7 WATT, 9 WATT QUAD & 13 WATT QUAD

- Housing Cutout (nominal):
  10 1/16"W x 2 5/16"H x 3 1/2"D
- Compact Fluorescent Lamp Options:
  - 5 Watt (G23)
  - 7 Watt (G23)
  - 9 Watt Quad (G23-2)
  - 13 Watt Quad (GX23-2)
  - 13 Watt Quad (G24q-1)
- Voltage Options:
  - 120 Volt
  - 277 Volt
- Standard Ballast Options:
  - High Power Factor (120 volt only)
  - Normal Power Factor (120 volt only)
  - Electronic (120 volt and 277 volt)
    (4 pin 13 watt quad G24q-1 lamp only)
- UL and CUL Listed Damp Location Standard
  Wet Location Kit Available # 3510SWL

DAMP LOCATION
WET LOCATION NOT AVAILABLE

BELFER LIGHTING FOR ARCHITECTURE
TEL: (732) 493-2666 . FAX: (732) 493-2941 . www.belfer.com

3510L Series

Ordering Format

Please specify both faceplate and housing. Choose one from each category

FACEPLATE	HOUSING	LAMP	VOLTAGE	BALLAST
3510FPL faceplate	BHL housing	9 9 watt compact fluorescent (G23)	1 120 volt	N normal power factor
		13 13 watt compact fluorescent (GX23)		H high power factor
		18Q 18 watt quad compact fluorescent (G24q-2)	1 120 volt	E electronic
		26Q 26 watt quad compact fluorescent (G24q-3)	2 277 volt	

DAMP LOCATION
WET LOCATION NOT AVAILABLE

3510S Series

Ordering Format

Please specify both faceplate and housing. Choose one from each category

FACEPLATE	HOUSING	LAMP	VOLTAGE	BALLAST
3510FPS faceplate	BHS housing	5 5 watt compact fluorescent (G23)	1 120 volt	N normal power factor
		7 7 watt compact fluorescent (G23)		H high power factor
		9Q 9 watt quad compact fluorescent (G23-2)		
		13Q 13 watt quad compact fluorescent (GX23-2)		
		13Q 13 watt quad compact fluorescent (G24q-1)	1 120 volt	E electronic
			2 277 volt	

DAMP LOCATION
WET LOCATION NOT AVAILABLE

Step Light Lamp Specifications

	LAMP NUMBER	DESCRIPTION	LUMENS (nominal)	LIFE HOURS (nominal)
For use with Housing BHL	CF9/35K	9W Twin Tube 3500°K G23 Base Compact Fluorescent	600	10,000
	CF13/35K	13W Twin Tube 3500°K GX23 Base Compact Fluorescent	900	10,000
	CF18Q/35K/4	18W Quad Tube 3500°K G24q-2 Base Compact Fluorescent	1,250	10,000
	CF26Q/35K/4	26W Quad Tube 3500°K G24q-3 Base Compact Fluorescent	1,800	10,000
For use with Housing BHS	CF5/35K	5W Twin Tube 3500°K G23 Base Compact Fluorescent	250	10,000
	CF7/35K	7W Twin Tube 3500°K G23 Base Compact Fluorescent	400	10,000
	CF9Q/35K	9W Quad Tube 3500°K G23-2 Base Compact Fluorescent	550	10,000
	CF13Q/35K/2	13W Quad Tube 3500°K GX23-2 Base Compact Fluorescent	860	10,000
	CF13Q/35K/4	13W Quad Tube 3500°K G24q-1 Base Compact Fluorescent	900	10,000

BELFER LIGHTING FOR ARCHITECTURE
TEL: (732) 493-2666 . FAX: (732) 493-2941 . www.belfer.com

Belfer # 3510FPS-BHS-13-1-*		**E4**
Brian Smith	**UCSD Cal IT2**	**# of #**

Just a word about ballasts ....

Belfer works closely with ballast manufacturers to test and select quality ballasts in order to assure the most reliable fixture operation. There are four different types of ballasts utilized in our fluorescent products.

Normal Power Factor (N or NPF) Ballasts:
Quality Normal Power Factor ballasts are primarily used in installations where minimum space is available.

High Power Factor (H or HPF) Ballasts:
Our standard High Power Factor ballasts carry a Class A sound rating and offer a Power Factor rating of .90 or better. High Power Factor ballasts consume less energy than Normal Power Factor (NPF) ballasts, due to capacitive power factor correction.

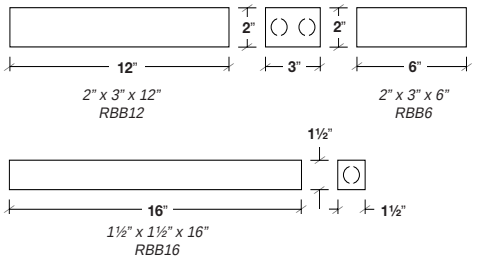
Electronic (E or ELB) Ballasts:
Our standard Electronic ballasts also carry a Class A sound rating and are quieter and less expensive to operate than High Power Factor (HPF) or Normal Power Factor (NPF) ballasts. Electronic ballasts are able to start lamps at lower temperatures and are more efficient than High Power Factor ballasts due to high frequency operation.

Dimming (D or DMB) Ballasts:
Belfer is an authorized Lutron Dimming ballast OEM. Lutron provides one of the most popular and reliable dimming ballasts in the industry. The Lutron Eco-10™ ballasts provide a dimming range of 100% to 10%. Although Lutron Eco-10™ dimming ballasts are standard in many of our products, other quality dimming sources are available. Please consult our sales department for more information.

Substitution of Ballasts:
Based on our quality assured testing of ballasts, unless specified, we select ballasts at our discretion. Of course, the specification may indicate a particular type or brand of ballast suitable for the installation. This may adjust costs and lead times for our products. At the customers request, we will also install ballasts supplied to us by an authorized ballast distributor. If requested, we may also ship fluorescent products without ballasts.

Ballast Warranties:
At Belfer, we supply the best grade of ballasts from top rated manufacturers. Ballasts are covered by warranties issued by the ballast manufacturer. This warranty is passed through to our customer. There are varying terms and conditions that may apply to your specific installation. Copies of respective ballast warranties are available upon request.

Remote Ballast Boxes:
Belfer remote ballast boxes are constructed of white formed aluminum for superior heat transfer and corrosion resistance. Ballast box sizes are listed on each product page.



phone: *(732) 493-2666*
fax: *(732) 493-2941*
canada: *(800) 726-5759*

BELFER

Belfer # 3510FPS-BHS-13-1-*		**E4**
Brian Smith	**UCSD Cal IT2**	**# of #**

McKinley Series™

The **McKinley Series™** utilizes the PAR20, 50 watt halogen lamp; no need for a low voltage transformer. The use of the McKinley Series with the 120V PAR20 halogen lamp makes an economical system for outdoor lighting and yet when specified with one or more of the many optical accessories available, it can provide very dramatic lighting effects. Like all B-K Lighting fixtures, the McKinley is machined from solid aluminum and is finished in one of eight polyester powder coat finishes. The exclusive B-K Lighting Posilock™ Knuckle is utilized to ensure its aiming integrity.

Features

- Tamper proof design.
- Completely sealed optical compartment.
- Clear, tempered glass lens, factory sealed.
- Machined aluminum construction with stainless steel hardware.
- Mounting knuckle allows vertical to horizontal aiming, provides integral wireway and has Posilock™ feature.
- Medium base lamp holder with 250° C, 18 ga., wire leads.
- & Listed with PAR20 lamps to 50 watts.
- For use with 120V, no transformer required.

CATALOG NUMBER LOGIC

Example: MC - 49 - VER - 10 - 11 - B

Series

Lamp Type
0 - By others
47 - 50 PAR20/H/NSP(50W), 9° N. Spot
48 - 50 PAR20/H/SP(50W), 16° Spot
49 - 50 PAR20/H/NFL(50W), 30° N. Flood

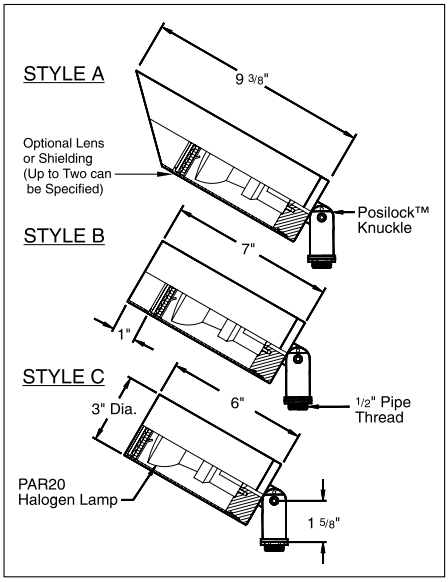
Finish

Powder Coat Color	Satin	Wrinkle
Bronze	BZP	BZW
Black	BLP	BLW
White(Gloss)	WHP	WHW
Aluminum	SAP	——
Verde	——	VER

Lens Type
9 - Clear (Standard), 10 - Spread, 13 - Rectilinear

Shielding
11 - Honeycomb Baffle

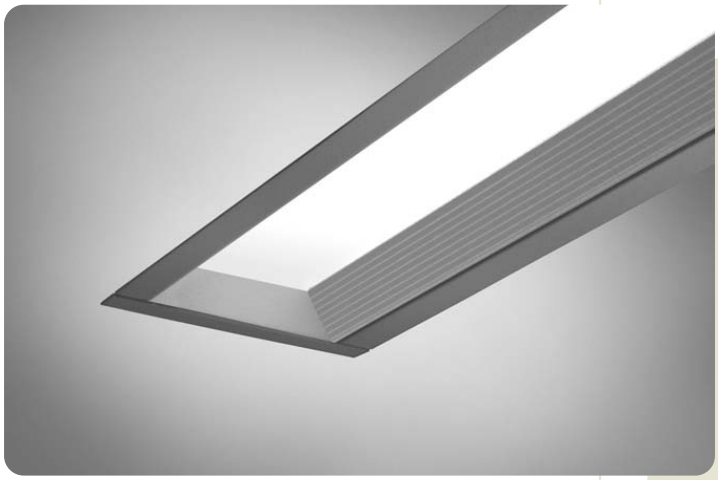
Cap Style
A - 45°, B - 90°, C - Flush



B-K Lighting # MC-*-***-9-C		**E5**
Brian Smith	**UCSD Cal IT2**	**# of #**

new in '05

avenue® b



FOCAL POINT®

FEATURES

Narrow 3" slot T5 fluorescent with opaque satin lens.

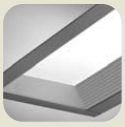
Shielding options include corrugated, solid regressed trim, concave louver as well as flush lens.

Universal mounting allows compatibility for multiple grid types.

Drywall installation is available, which allows for both individual or continuous row mount capability.

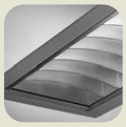
Avenue® B is a great solution for general illumination in a narrow aperture.

shielding options

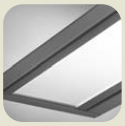


corrugated regress trim

solid regress trim



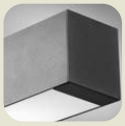
concave louver



flush lens

companion luminaire

mr16

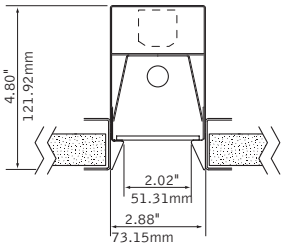


linear

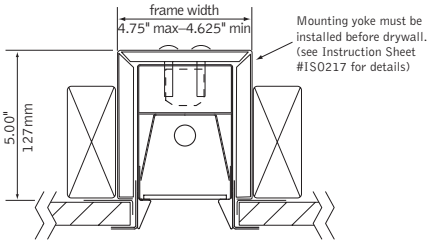
november 2005

DIMENSIONAL DATA

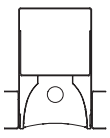
Grid Mount (Regress Trim Shown)



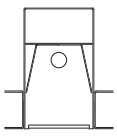
Drywall Flange (Regress Trim Shown)



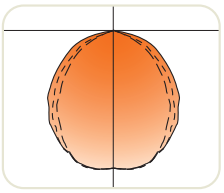
Louver



Flush Lens



PERFORMANCE



1–Lamp T5
60% Efficiency
709 cd @ 5°

See **Photometric** section for additional performance data.

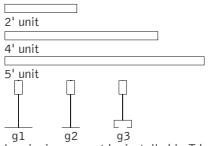
Focal Point # FAVB FL 1T5 1C *		**E6**
Brian Smith	**UCSD Cal IT2**	**# of #**

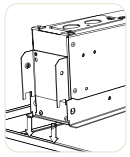
fixture type:

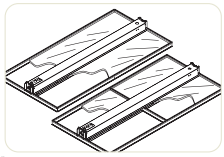
project name:

DETAILS

grid

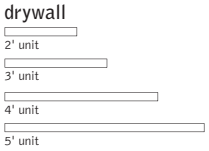






Luminaires cannot be installed in T-bar ceiling systems over 1.5".

drywall



Drywall flange version provided with mounting yoke.

SPECIFICATIONS

construction

One-piece 20 Ga. steel housing

Corrugated and solid regress trim constructed of 6063-T5 extruded aluminum finished in Matte Stain White.

Grid fixtures include 20 Ga. steel, .5" wide universal flange rail finished in Matte Satin White.

Drywall flange option is provided with 20 Ga. steel, .5" wide flange kit and 20 Ga. galvanized steel mounting yoke.

Surface mount 20 Ga. housing is also available.

2' unit weight:	5 lbs.
3' unit weight:	6 lbs.
4' unit weight:	7 lbs.
5' unit weight:	8 lbs.

optic

22 Ga. steel reflectors finished in High Reflectance White powder coat.

Acrylic lens diffuser .125" thick with opal white finish.

Concave parabolic louver: 1"H x 1" frequency fabricated of low iridescent, semi-specular premium grade aluminum.

Louver can be specified with matte white finish.

electrical

Luminaires are individually wired for specified circuits.

Thru-wiring not available.

Electronic ballasts are thermally protected and have a Class "P" rating.

Optional DALI and other dimming ballasts available.

Consult factory for dimming specifications and availability.

UL and cUL listed.

emergency

Emergency battery packs provide 90 minutes of illumination.

Initial lumen output for lamp types are as follows:

T5 Lamp:	Up to 550 lumens
T5HO Lamps:	Up to 825 lumens

Battery pack requires unswitched hot from same branch circuit as AC ballast.

finish

Polyester powder coat applied over a 5-stage pre–treatment.

Standard luminaire housing finished in Matte Satin White.

ORDERING

luminaire series		FAVB
Avenue B	FAVB	
shielding		_____
Corrugated Regressed Trim with Lens	CR	
Solid Regressed Trim with Lens	SR	
Flush Lens	FL	
Concave Parabolic Louver	PL	
White Concave Parabolic Louver	PW	
lamping		_____
One Lamp T5	1T5	
One Lamp T5HO	1T5HO	
circuits		1C
Single Circuit	1C	
voltage		_____
120 Volt	120	
277 Volt	277	
347 Volt (Consult factory for availability)	347	
ballast		_____
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast (Consult factory for dimming availability)	D	
mounting		_____
15/16" Grid	G1	
9/16" Grid	G2	
9/16" Slot Tee	G3	
Drywall Flange Cut out dimensions: 2': 3.5" x 23.6" 3': 3.5" x 35.6" 4': 3.5" x 47.6" 5': 3.5" x 59.6"	F	
Surface Mount	SM	
factory options		_____
Chicago Plenum	CP	
Emergency Circuit	EC	_____
Emergency Battery Pack (3' & 4' Fixtures Only)	EM	
Seismic Brackets	EQ	_____
HLR/GLR Fuse	FU	_____
Include 3000K Lamp	L830	_____
Include 3500K Lamp	L835	
Include 4100K Lamp	L841	
finish		WH
Matte White Housing	WH	
luminaire length		_____
2' Nominal Housing	2'	
3' Nominal Housing	3'	
4' Nominal Housing	4'	
5' Nominal Housing (For continuous row mount in drywall ceiling, specify luminaire run length, ie 24')	5'	

Focal Point L.L.C. 4201 South Pulaski Rd, Chicago, Illinois 60632 | T: 773.247.9494 | F: 773.247.8484 | info@focalpointlights.com | www.focalpointlights.com

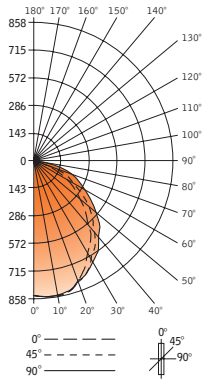
Focal Point # FAVB FL 1T5 1C *		**E6**
Brian Smith	**UCSD Cal IT2**	**# of #**

regress with lens

avenue® b

Filename: FAVBSR1T5.IES
Catalog #: FAVB-SR-1T5-1C-120-S-G1-WH-4'
Efficiency: 60%
Test #: 12373.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	703	703	703	703	703	
5°	706	707	707	707	709	68
15°	705	705	703	702	702	199
25°	646	646	640	623	614	294
35°	573	572	541	511	503	340
45°	482	470	420	385	372	330
55°	365	340	285	250	238	264
65°	253	216	163	128	112	171
75°	136	97	43	39	37	70
85°	32	11	11	11	11	15
90°	0	0	0	0	0	0
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

Spacing 1.3
Criterion: 1.2

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	561	19.3	32.0
	0°-40°	900	31.0	51.4
	0°-60°	1494	51.5	85.4
	0°-90°	1750	60.3	100.0
Total Luminaire	0°-180°	1750	60.3	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	8112	7068	6261
55°	7573	5913	4938
65°	7124	4590	3154
75°	6253	1977	1701
85°	4369	1502	1502

CO–EFFICIENTS OF UTILIZATION

Floor	20															
Ceiling	80				70			50		30		10		00		
Wall	70	50	30	10	70	50	10	50	10	50	10	50	10	00		
RCR 0	72	72	72	72	70	70	70	67	67	64	64	62	62	60		
1	67	64	62	60	65	63	59	61	57	58	56	56	54	53		
2	62	57	54	51	60	56	50	54	49	52	48	51	47	46		
3	57	51	47	44	56	51	43	49	43	47	42	46	41	40		
4	53	46	41	38	51	45	37	44	37	42	36	41	36	35		
5	48	41	36	32	47	40	32	39	32	38	32	37	31	30		
6	44	37	32	28	43	36	28	35	28	34	28	33	28	26		
7	41	33	28	25	40	33	25	32	25	31	24	30	24	23		
8	38	30	25	22	37	30	22	29	21	28	21	27	21	20		
9	35	27	22	19	34	27	19	26	19	25	19	25	18	17		
10	32	24	20	17	32	24	17	24	19	23	16	22	16	15		

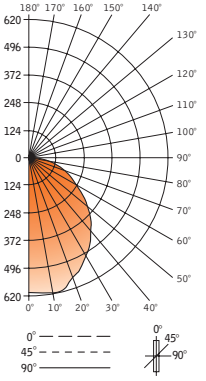
Numbers indicate percentage values of reflectivity.

flush lens

avenue® b

Filename: FAVBFL1T5.IES
Catalog #: FAVB-FL-1T5-1C-120-S-G1-WH-4'
Efficiency: 59%
Test #: 12397.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	610	610	610	610	610	
5°	613	613	613	613	611	59
15°	616	616	616	615	615	175
25°	559	558	556	553	553	257
35°	490	489	487	484	483	306
45°	405	403	402	399	399	311
55°	304	302	299	299	298	269
65°	206	204	201	200	198	200
75°	110	108	108	107	108	114
85°	29	29	25	22	21	28
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

Spacing 1.3
Criterion: 1.3

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	490	16.9	28.5
	0°-40°	796	27.4	46.3
	0°-60°	1376	47.5	80.1
	0°-90°	1718	59.3	100.0
Total Luminaire	0°-180°	1718	59.3	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	7474	7418	7363
55°	6916	6802	6779
65°	6360	6206	6113
75°	5546	5445	5445
85°	4342	3743	3144

CO–EFFICIENTS OF UTILIZATION

Floor	20															
Ceiling	80				70			50		30		10		00		
Wall	70	50	30	10	70	50	10	50	10	50	10	50	10	00		
RCR 0	71	71	71	71	69	69	69	66	66	63	63	60	60	59		
1	65	62	60	58	63	61	57	59	55	56	54	54	52	51		
2	60	55	51	48	58	54	48	52	46	50	45	48	44	43		
3	55	49	44	41	53	48	40	46	40	45	39	43	38	37		
4	50	44	39	35	49	43	35	41	34	40	34	39	33	32		
5	46	39	33	30	45	38	29	37	29	35	29	34	28	27		
6	42	35	29	26	41	34	26	33	25	32	25	31	25	24		
7	39	31	26	22	38	31	22	30	22	29	22	28	22	21		
8	36	28	23	19	35	27	19	27	19	26	19	25	19	18		
9	33	25	20	17	32	25	17	24	17	23	17	23	16	15		
10	31	23	18	15	30	22	15	22	15	21	15	21	15	14		

Numbers indicate percentage values of reflectivity.

Go to www.focalpointlights.com for additional photometric data.

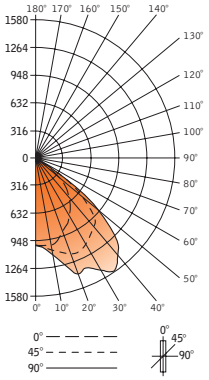
Focal Point # FAVB FL 1T5 1C *		**E6**
Brian Smith	**UCSD Cal IT2**	**# of #**

louver

avenue® b

Filename: FAVBPL1T5H.IES
Catalog #: FAVB-PL-1T5HO-1C-120-S-G1-WH-4'
Efficiency: 54%
Test #: 12387.0

CANDLEPOWER DISTRIBUTION



Spacing 1.1
Criterion: 1.9

Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	1012	1012	1012	1012	1012	
5°	1017	1024	1030	1037	1041	98
15°	984	1026	1127	1235	1279	320
25°	849	940	1188	1330	1386	530
35°	681	861	1107	1404	1583	707
45°	473	646	957	1165	1326	710
55°	115	202	381	446	392	288
65°	18	24	35	55	44	36
75°	7	8	9	9	11	9
85°	1	1	1	2	2	2
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	948	19.0	35.1
	0°-40°	1655	33.1	61.3
	0°-60°	2653	53.1	98.3
	0°-90°	2700	54.0	100.0
Total Luminaire	0°-180°	2700	54.0	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	8729	17660	2447
55°	2616	8668	8918
65°	556	1081	1359
75°	353	454	555
85°	150	150	299

CO–EFFICIENTS OF UTILIZATION

Floor		80				70			20		50		30		10		00
Ceiling									50								
Wall	70	50	30	10	70	50	10	50	10	50	10	50	10	50	10	00	
RCR 0	64	64	64	64	63	63	63	60	60	57	57	55	55	54			
1	61	59	57	56	59	58	55	55	53	53	52	51	50	49			
2	57	54	51	49	56	53	48	51	47	49	46	48	45	44			
3	53	49	46	43	52	48	43	47	42	45	41	44	41	40			
4	49	44	41	38	48	44	38	42	37	41	37	40	36	35			
5	46	40	36	33	45	40	33	38	33	37	32	37	32	31			
6	42	36	32	29	41	36	29	35	29	34	29	33	29	28			
7	39	33	29	26	38	32	26	32	25	31	25	30	25	24			
8	36	29	25	22	35	29	22	28	22	28	22	27	22	21			
9	33	26	22	19	32	26	19	25	19	25	19	24	19	18			
10	30	24	20	17	30	23	17	23	17	22	17	22	17	16			

Numbers indicate percentage values of reflectivity.

Go to www.focalpointlights.com for additional photometric data.

Focal Point # FAVB FL 1T5 1C *		**E6**
Brian Smith	**UCSD Cal IT2**	**# of #**

C O L E L I G H T I N G

Illuminated Handrails

LIGHTRAIL · LR 2

LR 2W Wall Mounted
LR 2P Post Mounted

Description

LR 2 Series Lightrail is a flexible system of wall or post mounted illuminated handrails with a symmetrical design. It projects illumination equally to both sides. LR 2 Series Lightrail is complementary to the LR 1 Series, which should be used when an asymmetrical light pattern is required. Companion non-illuminated Lightrail is also available for this series. Design features comply with ADA and other codes.

Features

A high impact acrylic lens provides a symmetrical illumination pattern that effectively washes walkways with light to both sides. To ease maintenance the lens prisms are on the lamp side. Illumination is provided by T8 fluorescent lamps with the ballasts positioned above the lamps to maximize continuous uninterrupted light. The heavy extruded aluminum rail is welded at all intersections and features cast and extruded aluminum wall mounting brackets or extruded aluminum posts. The optional griprail with smaller dimensions meets ADA requirements.

Applications

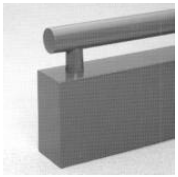
LR 2 Lightrail is ideal as guardrails, stair and ramp railings as well as elevator railings.

Custom

We would be pleased to discuss the production of modified standard Lightrail or custom railings to suit your specific conditions. Modifications possible include custom extrusions, alternate finishes or materials, mounting adaptions, end treatments and alternate light sources.

To learn more about our custom capabilities and standard product lines call us directly or contact your local Cole representative.

LR 2 Lightrail produces a symmetrical light distribution pattern that washes walkways with light to both sides.



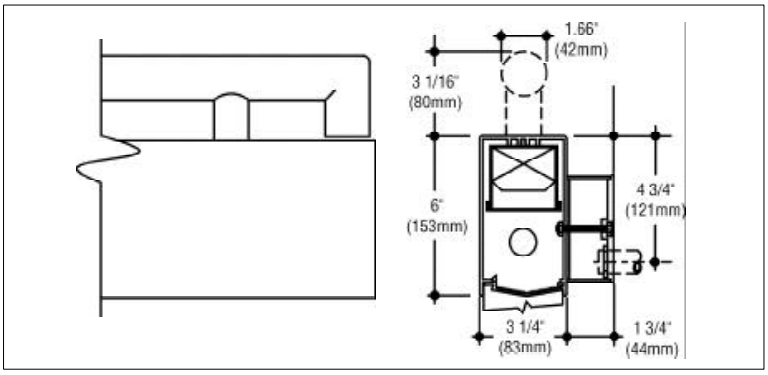
Optional griprail may be specified for mounting on the top of the Lightrail when required by ADA or other codes.

C. W. Cole & Company, Inc.
2560 N. Rosemead Boulevard
South El Monte, CA 91733-1593

Fax (626) 443-9253
Tel. (626) 443-2473
info@colelighting.com
www.colelighting.com

Cole Lighting # LR 2W		**E7**
Brian Smith	**UCSD Cal IT2**	**# of #**

C O L E L I G H T I N G

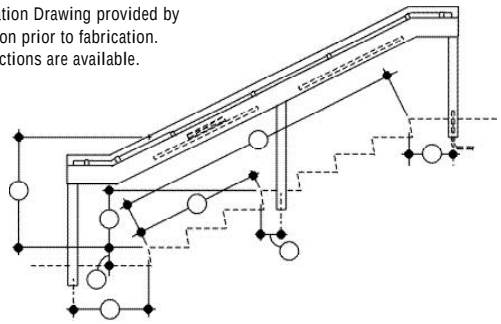


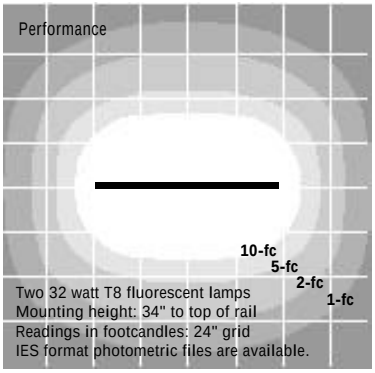
Illuminated Handrails

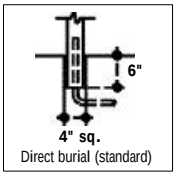
LIGHTRAIL • LR 2

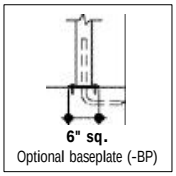
LR 2W Wall Mounted
LR 2P Post Mounted

Sample Field Confirmation Drawing provided by Cole for each installation prior to fabrication. Field measuring instructions are available.









Specifications

Construction

• Railing is extruded .125" wall, 6063-T5 aluminum • Posts are 3" square, .125" wall extruded aluminum tubing • Wall brackets are 4" square at electrical feed locations, 4" x 2" at other locations • Brackets are .125" wall extruded aluminum tube with cast aluminum wall plate • Clear, prismatic snap-in lens is extruded high-impact acrylic with prisms on the inside for better maintenance • Ends and all railing miters are welded and ground smooth • Optional griprail is 1.66" diameter x 0.19" wall aluminum pipe • Medium bronze polyester coating is the standard finish; other colors and finishes are available.

Electrical

• Prewired for T8 rapid start fluorescent lamps with 120V-277V standard (347V available), 0° F (-18° C) electronic ballasts • Lamping will be determined by the factory to ensure maximum even illumination • Other lamping available for special applications • Ballasts in LR 2 models are above lamps, permitting uninterrupted illumination • UL/cUL listed suitable for wet locations.

Mounting

• Posts are provided to a maximum of 8' centers, wall brackets provided up to 6' centers, subject to spacing requirements of the particular installation • Posts are provided with extra 6" length for direct burial and 4" square x 6" styrofoam forms for pre-casting hole; contractor to finish with quick-setting concrete • 6" x 6" x 3/8" baseplate with four 5/8" holes is available as an option • 4" square wall bracket allows mounting over conduit stub • Wall bracket mounting bolts (by others) are concealed.

Options

Griprail: 1.90" diameter. To specify, add suffix **-H**.
Baseplate: 6" x 6" x 3/8" baseplate with four 5/8" holes. To specify, add suffix **-BP**.
Pickets: 3/4" pickets, 4 3/4" on center, top rail 4" below bottom of Lightrail, bottom rail 4" above ground. To specify, add suffix **-K**.
Non-illuminated: Without lighting components. To specify, add suffix **-U**.
Finishes: Special finishes are available; contact factory.
Emergency Battery: Provides battery operation for up to 90 minutes during power outage for all or selected lamps. To specify, add suffix **-EM**.

QB 6M F02

How to Specify

Every Lightrail is custom designed and fabricated to your specific project conditions. Architectural drawings are required that clearly show the desired configurations and locations. A detailed drawing (similar to the sample above) will be provided by Cole prior to fabrication for your field verification.

1. Give catalog number, options, and voltage. Example: LR 2W-H-277. Lamping will be determined by the factory to maximize even illumination.
2. Select desired options and add appropriate suffixes.

C. W. Cole & Company, Inc.
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South El Monte, CA 91733-1593

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www.colelighting.com

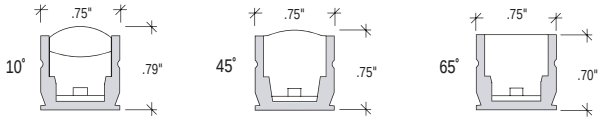
Cole Lighting # LR 2W		**E7**
Brian Smith	**UCSD Cal IT2**	**# of #**

line
series .75

10˚, 45˚, 65˚

PATENT PENDING

Beam Spread Options



Power Supply (Driver) Information

Standard Light Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v20w	up to 78"	32'-0" (w/18awg)
24v100w	up to 35'-0"	18'-0" (w/18awg)
	(2) runs up to 49' with (1) run NTE 35'-0"	46'-0" (w/14awg)
		71'-0" (w/12awg)

High Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v100w	up to 12'-0"	18'-0" (w/18awg)
		46'-0" (w/14awg)
		71'-0" (w/12awg)

Application

io lighting's line series .75 is approximately .75" x .75" in cross section. UL listed for dry locations, its low profile housing enables functional luminous intensities from "tight" architectural details such as niches, coves, handrails & casework. Similar to halogen light sources, LEDs are point sources that offer superior definition to three dimensional objects and sparkle to reflective surfaces.

series .75 is a low voltage linear accent luminaire that may be ordered in incremental nominal lengths that range from 6" to 96". Optional beam spreads along the perpendicular axis of the fixture include 10˚, 45˚, and 65˚. For details on the asymmetric beam spread, see dedicated specification sheet. Average rated life for series .75 is 50,000 hours. Lamp lumen depreciation at 50,000 hrs. is 30%.

Light Output

line series .75 is available with two lumen outputs for white light only. Red, green, blue and amber are available in standard output only:

Standard:
- Warm White: 38 lms/ft
- Cool White: 48 lms/ft

High Output:
- Warm White: 127 lms/ft
- Cool White: 145 lms/ft

Refer to light output tables for footcandle values at various distances. IES format files may be obtained from the factory or downloaded from iolighting.com.

Construction

The light weight, yet durable extruded aluminum housing provides recommended heat sink requirements for LEDs. Precision optic is composed of a customized acrylic material that offers very high transmisivity, UV stability, and excellent longevity. series .75 is UL listed for dry locations only.

Electrical

Universal 120 or 277 Volt supply required for 24 volt remote driver. 4'-0" 22 AWG, 600 volt TFFN rated power cords are supplied with strain reliefs for both electric feed and connectors (for continous row application).

Power Consumption

- standard: 2 w/ft
- high output: 8 w/ft

Finish

Anodized aluminum finish is standard. Custom finishes available upon request.

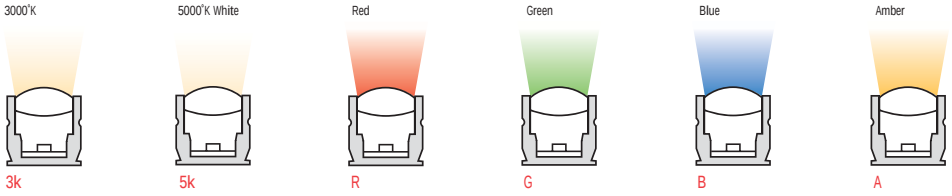
370 Corporate Woods Pkwy Vernon Hills, IL 60061-3107
T 847.735.7000 F 847.735.7001 E info@iolighting.com w iolighting.com

io # 0-03-*-*-100-1-*		**E8**
Brian Smith	**UCSD Cal IT2**	**# of #**

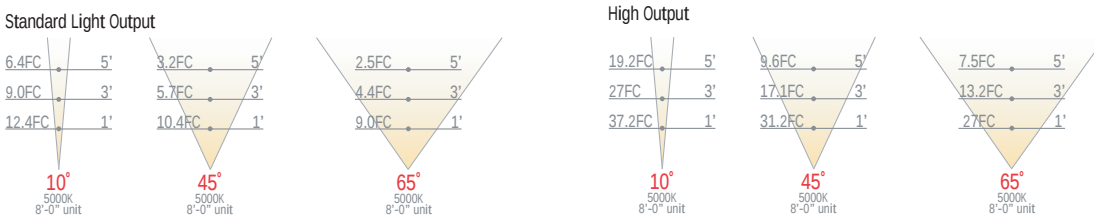
line
series .75

10°, 45°, 65°
PATENT PENDING

Color Options

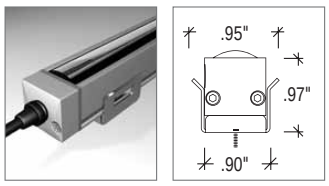


Applications / Light Output

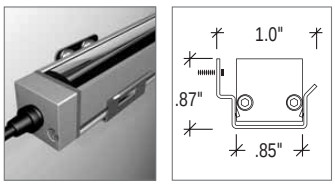


Mounting Options

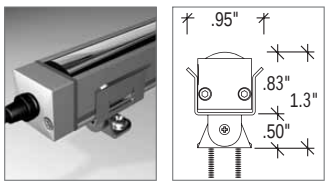
100 surface



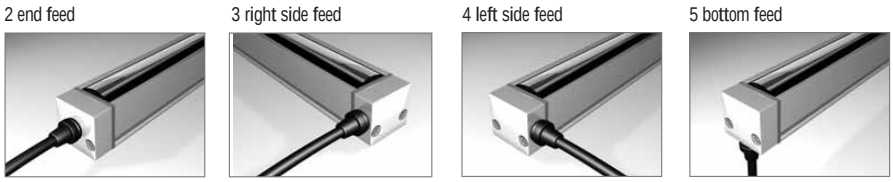
101 side surface



102 field adjustable



Electrical End Feed Options



Order Code

0	03	I	□□□□	□□	□□□	□	□□	□	□	□
io	Line .75	location	Color	Distribution	Mounting	Finish	Length	Electrical Feed	Voltage/Dimming	Driver Enclosure OPTIONAL
		Interior only	3k 3000°K 3kHO 3000°K High Output 5k 5000°K 5kHO 5000°K High Output R Red G Green B Blue A Amber	10 10 degree 45 45 degree 65 65 degree	100 Surface 101 Side surface 102 Field adjustable	1 Anodized Aluminum 2 Anodized Custom Color	UNITS (actual) 01 6" (6.15") 02 12" (11.84") 03 18" (17.59") 04 24" (23.15") 05 30" (28.84") 06 36" (34.59") 07 42" (40.15") 08 48" (45.84") 09 54" (51.59") 10 60" (57.15") 11 66" (62.84") 12 72" (68.59") 13 78" (79.84") 14 84" (85.59") 15 90" (91.15") 16 96" (96.84")	2 End feed 3 Right side feed 4 Left side feed 5 Bottom feed FOR CONTINOUS ROW 2-2 Right end feed Left end feed 3-4 Right side feed Left side feed 5-5 Right bottom feed Left bottom feed	1 120v 2 277v 3 120v w/dim 4 277v w/dim 5 other	I Interior Rated N Not Req'd by io *Supplied by others*

Note: "Actual" length provided includes end feed and non-feed endcaps. Add .27 when electrical feed occurs on both ends (for continous row mounting).

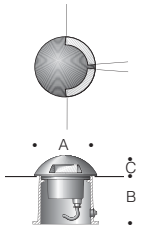
370 Corporate Woods Pkwy Vernon Hills, IL 60061-3107
T 847.735.7000 F 847.735.7001 E info@iolighting.com W iolighting.com

io # 0-03-*-*-100-1-*		**E8**
Brian Smith	**UCSD Cal IT2**	**# of #**

Drive over luminaires for special applications

Type:
BEGA Product #:
Project:
Voltage:
Color:
Options:
Modified:

Outer housing: Constructed of high tensile strength, copper free die cast aluminum alloy.
Inner housing: Constructed of copper free die cast aluminum alloy, with two piece die cast aluminum clamping ring/cover/guard, removable for relamping, secured together with four (4) heavy stainless steel bolts which provide a pressure seal to gasket and glass. Two (2) captive socket head stainless steel screws secure inner housing cover to outer housing.
Enclosure: One piece heavy die cast aluminum cover with clear borosilicate focusing lens with cast aluminum guard. Molded, one piece, high temperature silicone rubber gasket.
Electrical: G12 porcelain bi-pin lampholder with stainless steel contacts. Magnetic HPF ballast available 120V or 277V - specify.
Inner housing pre-wired with three (3) feet of 18/3 waterproof cable , cable clamp, and waterproof cable gland entry into housing. A separate waterproof wiring box for power supply must be provided (by contractor).
Finish: Standard finish is an eight step process consisting of two coats of black high solids, UV stabilized polyurethane, one with light texture over a phosphate base. Custom colors are not available.
U.L. listed, suitable for wet locations and vehicle drive over.
Protection class: IP 67.
Luminaires are designed to withstand loads of up to 8800 lbs. at speeds up to 12 mph when installed on a proper foundation. Proper drainage must be provided.



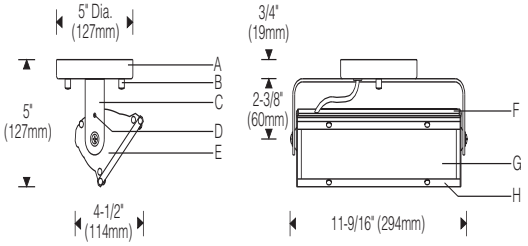
High strength aluminum alloy, stainless steel and bronze construction. Optical lens made from clear crystal glass.
U.L. listed, suitable for wet locations. IP 67.
Finish: Black.

		Lamp	Lumen	A	B	C
8729MH	Single 180°	1 39W T6 G12 MH	3300	10 1/16	6 7/8	3

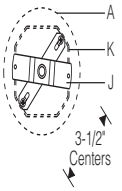
BEGA/US 1000 BEGA Way, Carpinteria, CA 93013 [P] 805·684·0533 [F] 805·684·6682

Bega # 8729MH		**E9**
Brian Smith	**UCSD Cal IT2**	**# of #**

E Mount 1:8 Scale



Canopy



Specifications

- **A** Aluminum canopy
- **B** Chrome cap nuts
- **C** Aluminum yoke
- **D** Locking set screw
- **E** Contoured aluminum end plates
- **F** Specular extruded aluminum reflector
- **G** Micro-prismatic tempered glass lens
- **H** Overlapping aluminum door frame
- **J** Pivoting hanger bar
- **K** Recessed outlet box (by others)

Finish:
Bright clear anodized aluminum reflector with semi-gloss black door frame, end plates, yoke and canopy or all parts semi-gloss white.

Painted surfaces - 6 stage pretreatment and electrostatically applied thermoset powder coat for stable, long lasting and corrosion resistant finish.

Reflector - extruded high purity aluminum with clear anodized specular finish. All luminaire hardware - stainless steel. All mounting hardware - zinc or cadmium plated.

Mounting:
Canopy mounts over recessed outlet box.

Pendant or cantilever mounting assembly ordered separately; specify **X** mount.

Electrical:
Use 90°C wire for supply connections.

Tungsten halogen - DC bayonet lampholder retained with patented clamping supports for maximum heat dissipation.

Metal halide - G12 lampholder for use with single ended lamp. Remote encapsulated high reactance autotransformer (HX-HPF) ballast.

35-150W metal halide - optional electronic ballast provides improved voltage regulation, energy savings and automatic shut-off feature to eliminate end-of-life lamp cycling.

For complete ballast specifications, see Accessories Section.

Standard:
UL listed or CSA certified for damp locations.
(Style 102 painted model with gasketed lens recommended for damp location use; see page W-2.0.)

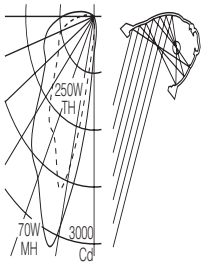
Features

- **KO Series** - *high performance wall lighting for cost conscious projects*
- *Compact yet powerful - up to 250W halogen, 150W MH*
- *Extruded reflector - will not deform during maintenance*
- *Non-corrosive construction - aluminum and stainless steel*
- *No light leaks - overlapping door; sealed end plates*

W 7.0

Performance

Two parabolic reflector sections drive light to the bottom of the wall. An elliptical section shields the lamp from normal viewing angles and redirects its light to a parabola. Glare is minimized and asymmetry of the beam is maximized resulting in high beam efficiency and superior surface uniformity.



For complete photometrics, visit www.elliptipar.com.

elliptipar

REV. 6/04

Elliptipar # M-115-070G-E-99-2-000		**E10**
Brian Smith	**UCSD Cal IT2**	**# of #**

To form a Catalog Number

1	1	5	-				-		-		-		-		
1		2			3		4	5		6		7		8	

1 Source

M = Metal halide
T = Tungsten halogen

2 Style

115 = Small **KO Series** contoured, **remote** ballast

3 Lamp

Lamp Code	*Wattage*	*Lamp Number*	*Voltage(s)*	*Ballast*	*Distance*
Ceramic Metal Halide*					
035G	35	CMH35/T6/G12	**A**,**B**	HX-PHF	10'(3m)
			1,**2**	Electr.	15'(4.5m)
070G	70	CMH70/T6/G12	**A**,**B**,**H**	HX-PHF	20'(6m)
			1,**2**	Electr.	15'(4.5m)
150G	150	CMH150/T6/G12	**A**,**B**,**H**	HX-PHF	10'(3m)
			1,**2**	Electr.	15'(4.5m)
Tungsten Halogen					
0100	100	Q100DC	**A**		
0150	150	Q150DC	**A**		
0250	250	Q250DC	**A**		

W 7.1

For complete lamp and ballast information, see Accessories Section.
* Metal halide lamps using ceramic arc tubes yield higher light output than lamps with quartz arc tubes. They offer improved lamp-to-lamp color consistency and a more stable color temperature over their life (±200K). Standard lamp color is 3000K / 80+ CRI.

4 Mounting

E = External yoke on canopy
X = External yoke for use with accessory pendant or cantilever mounting assembly (order separately)

5 Finish

81 = Bright clear anodized reflector with semi-gloss black door frame, end plates, yoke and canopy
02 = Semi-gloss white
99 = Custom RAL or computer matched color to be specified, consult sales representative

Project:

6 Voltage/Ballast

Magnetic	*Electronic*
A = 120V	**1** = 120V
B = 277V	**2** = 277V
H = 347V (Canada)*	

* Not available for 35W metal halide

7 Option (See Accessories Section for specifications)

00 = No options
0H = Long distance remote ballast (encapsulated HX-HPF magnetic ballast only),
35W: 15' min. up to 50' max. (4.5m - 15m),
70W: up to 50' max. (15m),
150W: up to 50' max. (15m)
0R = Halogen standby lamp with relay field connected at remote ballast. Lamp included (wattage varies).
XX = For modification not listed, include detailed description. Consult factory prior to specification.

8 Standard

0 = UL, Underwriters Laboratories
J = CSA, Canadian Standards Association

Example

M115 - 070G - E - 81 - A - 00J

Small **KO Series** for use with 70W metal halide lamp. Mounted with external yoke on canopy. Bright clear anodized reflector with semi-gloss black door frame, end plates, yoke and canopy. Remote 120V magnetic ballast. CSA.

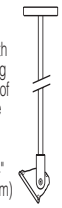
Type:

Accessories

Order separately. See Accessories Section for specifications.

VCS ___ **30** ___ = **Cantilever**, 30" (760mm) setback
0 = UL
J = CSA
02 = semi-gloss white
08 = semi-gloss black

VP ___ ___ ___ ___ = Wallwash **pendant**
0 = UL
J = CSA
Length in inches (54" (1.4m) max. for TH, 42" (1.0m) max. for MH)
02 = semi-gloss white
08 = semi-gloss black
L = straight
E = swivel (up to 45°)
Length ceiling to top of yoke
4-1/4" (108mm)

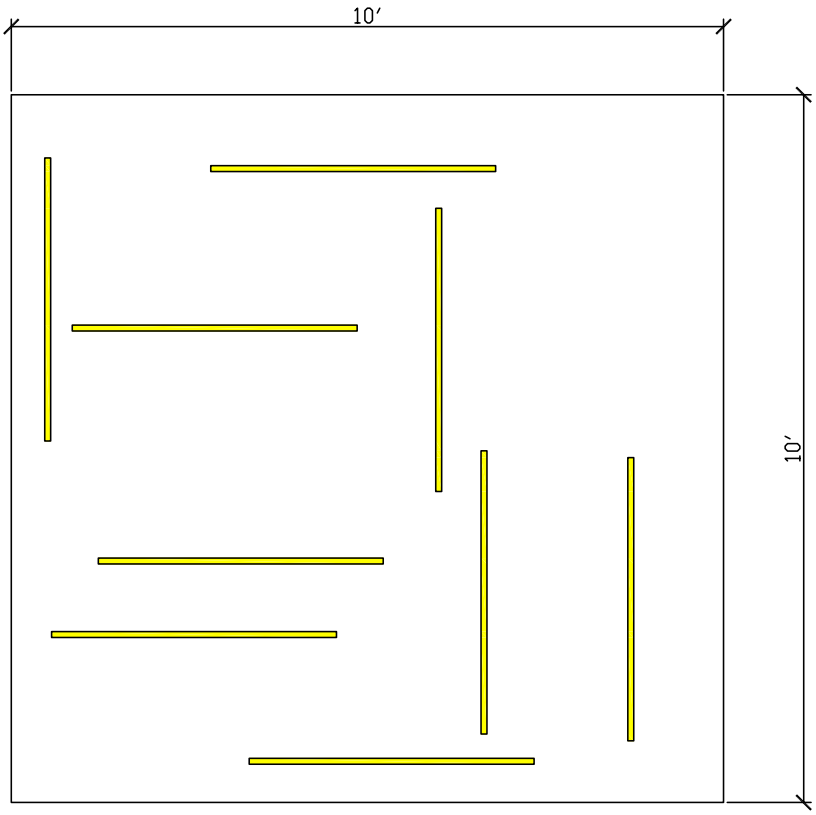


AFK000X ___ = Ballast **fuse** kit
0 = UL
J = CSA

REV. 4/04 **elliptipar**

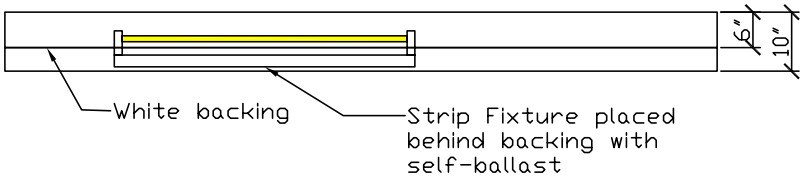
elliptipar
114 Boston Post Road, West Haven, Connecticut 06516, USA
Voice 203.931.4455 • Fax 203.931.4464 • **www.elliptipar.com**

Elliptipar # M-115-070G-E-99-2-000		E10
Brian Smith	**UCSD Cal IT2**	**# of #**



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



Zumtobel Staff # Custom Fixture		**E11**
Brian Smith	**UCSD Cal IT2**	**# of #**

TYPE:

CATALOG#:

METALUX®

DESCRIPTION

The STN Series is a functional and multi-purpose heavy duty strip family that incorporates premium performance and construction durability. The performance and application versatility of this series can be increased by incorporating symmetrical or asymmetrical reflectors. The STN Series can be installed using various mounting methods and numerous options and accessories are available.

APPLICATION

The STN Series can be the illumination solution in commercial, industrial, retail and residential applications. Fixtures can be used in storage/utility areas, coves, display cases, shops, task and general area lighting.

SPECIFICATION FEATURES

A···Construction

Channel die formed code gauge prime cold rolled steel. Deep V-Groove for tong hanger. Die formed channel connector, sleeve type, assures straight rows and continuity of ground through set screws. Numerous KOs for ease of installation. Lampholder mounting brackets easily installed with snap-in action. Channel/wireway cover secured with quarter-turn fasteners.

B···Electrical*

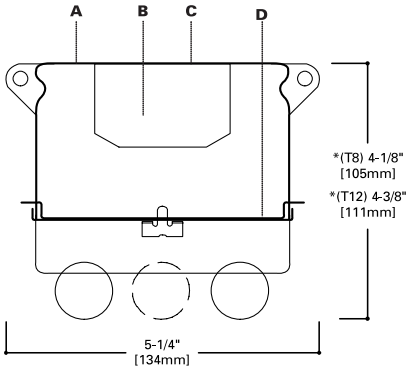
Ballasts are CBM/ETL Class "P" and are positively secured by mounting bolts. Spring loaded lampholders. UL/CUL listed. Suitable for damp locations.

C···Finish

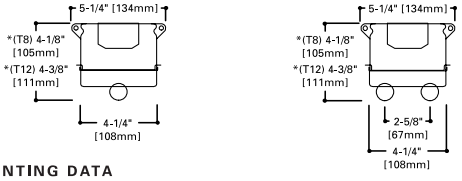
Multistage, iron phosphate pretreatment ensures maximum bonding and rust inhibitor. Lighting grade, baked white enamel finish.

D···Channel/Wireway Cover

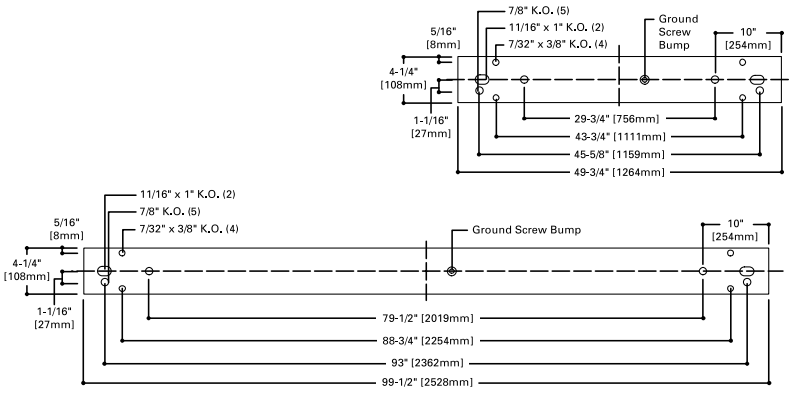
Die formed heavy gauge steel. Tight fit for ease of maintenance. Easily removed without use of tools. Optional reflector available incorporating silver technology enhancements. (SilverLining) Consult Pre Sales Technical Support.



LAMP CONFIGURATIONS



MOUNTING DATA



STN140
132
240
232

4' STRIP
1 OR 2 LAMP

Medium-Duty Striplight

ENERGY DATA

Input Watts:
EB Ballast & STD Lamps
140 (38)
132 (30)
240 (72)
232 (61)

ES Ballast & STD Lamps
140 (50)
132 (37)
240 (86)
232 (71)

Luminaire Efficacy Rating
LER = FS-80
Catalog Number: STN-232

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $3.00

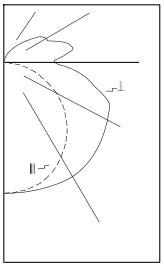
*Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements.

ADF020715
(Supersedes ADF991969)

COOPER LIGHTING

Cooper Ltg - Metalux # STN-132-*		**E12**
Brian Smith	**UCSD Cal IT2**	**# of #**

PHOTOMETRICS



STN-232
Electronic Ballast

F32T8/35K Lamps
2850 Lumens

Spacing criterion: (II) 1.3 x mounting height, (⊥) 1.5 x mounting height

Efficiency 93.5%

Test Report #101P101

LER = FS-80

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $3.00

Coefficients of Utilization

Effective floor cavity reflectance					20%															
rc	80%				70%				50%			30%			10%			0%		
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0		
RCR																				
0	107	107	107	107	102	102	102	102	93	93	93	85	85	85	78	78	78	75		
1	95	90	86	81	91	86	82	78	79	75	72	72	69	67	65	63	61	58		
2	86	77	70	64	81	74	67	62	67	62	58	61	57	53	56	53	50	46		
3	78	67	59	52	74	64	57	51	59	53	47	54	49	44	49	45	41	38		
4	71	59	50	44	67	56	48	42	52	45	40	47	42	37	43	38	35	32		
5	64	52	43	36	61	49	41	35	45	38	33	41	35	31	38	33	29	26		
6	59	46	37	31	56	44	36	30	40	33	28	37	31	26	34	29	25	22		
7	54	41	32	26	51	39	31	26	36	29	24	33	27	23	30	25	21	19		
8	50	37	28	23	47	35	27	22	32	26	21	30	24	19	27	22	18	16		
9	46	33	25	19	43	31	24	19	29	22	18	27	21	17	24	19	16	14		
10	43	30	22	17	40	29	21	17	26	20	16	24	19	15	22	17	14	12		

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	822	14.4	15.4
0-40	1397	24.5	26.2
0-60	2724	47.8	51.1
0-90	4250	74.6	79.8
90-180	1078	18.9	20.2
0-180	5328	93.5	100.0

Candela

Angle	Along II	45°	Across⊥
0	1009	1009	1009
10	996	1001	1009
20	942	979	1014
30	853	945	1026
40	735	898	1008
50	593	823	959
60	432	721	906
70	260	633	824
80	100	460	600
90	9	248	381
100	7	336	527
110	7	255	448
120	7	211	364
130	7	142	276
140	7	76	175
150	7	18	79
160	7	5	5
170	0	0	0
180	0	0	0

ORDERING INFORMATION

SAMPLE NUMBER: STN-232

STN

Tandem
8T=8' Length

Series

Number of Lamps
1 or **2** lamps
(Not included)

Wattage (Length)
40=40W (48")
32=32W T8 (48")

Voltage[2]
120=120V
277=277V
347=347V
UNV=Universal Voltage 120-277V

Ballast Type
LE3= Energy Saving Magnetic Ballast[3]
LEOC8= Energy Saving Magnetic Ballast (T-8 Lamp Only)
EB__= Generic Electronic Ballast
No. of Ballasts
1 or **2**
Lamp Size
2=T12
8=T8
(For Specific Electronic Ballast Specify Brand and Catalog Number)

Options (add as suffix)

Options
GL=Internal Single Element Fusing
GM=Dual Element Fusing
EL4=Emergency Lighting self-contained[2,3]
EL8=Emergency Lighting self-contained[4,5]
RIF1=Radio Interference Suppressor
6-3/18 SJT-C&P-515P=Cord & Plug (120V)
6-3/18 SJT-C&P-L715P=Cord & Plug (277V)
PI/CPI=Plug-In Option
TILW=Tandem In-Line Wiring Option (Consult TILW Option Catalog Page)
RLS=Rotor-Lock Socket (T8 Lamps Only)
(Additional options available. See Accessory Section)

ACCESSORIES

(Order Separately)

A1B=Spacer
GRP-STN=Gripper Hanger (Use 2 Per Fixture)
AYC-Chain/Set=36" Chain Hanger (Use 1 Set Per Fixture)
SCF=Fixed Stem Set (Specify Length)
SCS=Swivel Stem Set (Specify Length)
ATG-4=Tong Hanger (Use 2 Per Fixture)
DI2=Long Connector
STN/SS-ASY-3[1]=3" Asymmetric Reflector (Specify 2', 3', or 4')
STN/SS-ASY/REV-3[1]=3" Asymmetric Reverse Reflector (Specify 2', 3', or 4')
STN/SS-SYM-6[1]=6" Symmetric Reflector (Specify 2', 3', or 4')
STN/SS-ASY-6[1]=6" Asymmetric Reflector (Specify 2', 3', or 4')
IC-4FT-REFL[1]=12" Symmetric Reflector
WG/SS-4FT=Wire Guard

(Additional Accessories Available. See Options and Accessories Section.)

NOTE See option/accessories sections for additional detailed product data. Specifications and Dimensions subject to change without notice.

[1] For SilverLining Reflector Add SR in Catalog Number, Example STN/SS-SR-SYM-6
[2] Consult Pre Sales Technical Support.
[3] Operates rapid start and slimline lamps up to 48".
[4] Operates all lamps up to 96".
[5] For fixtures greater than 8' use Master Sattelite Options.

SHIPPING INFORMATION

Catalog No.	Wt.
STN-132	12 lbs.
8TSTN-132	20 lbs.
STN-232	12 lbs.
8TSTN-232	24 lbs.

COOPER Lighting

Visit our web site at www.cooperlighting.com
Customer First Center 1121 Highway 74 South Peachtree City, GA 30269 770.486.4800 FAX 770.486.4801 ADF020715

Cooper Ltg - Metalux # STN-132-*		E12
Brian Smith	UCSD Cal IT2	# of #

Appendix B

Ballast Cut-sheets

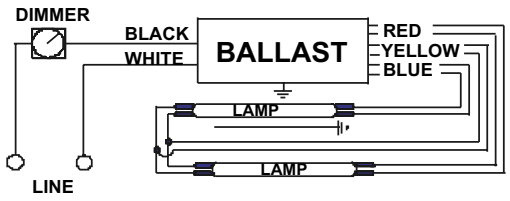
VEZ-2S32-SC

Brand Name	MARK X POWERLINE
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
F17T8	2	17	50/10	0.14	13/38	0.05/1.05	10	0.99	1.6	2.76
F25T8	2	25	50/10	0.20	13/55	0.05/1.05	10	0.99	1.6	1.91
* F32T8	2	32	50/10	0.25	15/68	0.05/1.00	10	0.99	1.6	1.47

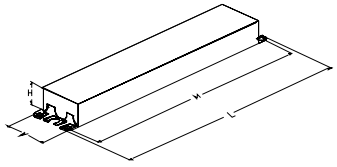
Wiring Diagram



The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.7 "	1.18 "	8.90 "
9 1/2	1 7/10	1 9/50	8 9/10
24.1 cm	4.3 cm	3 cm	22.6 cm

Revised 10/28/2005

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Corporate Offices: Phone: 800-322-2086

Advance #		**BAL1**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

C2642UNV*xxx*

APPLICATION and PERFORMANCE SPECIFICATION

Description: Electronic compact fluorescent ballast(s) for (1) CFM42W/GX24q or (1) CFTR32W/GX24q or (2/1) CFQ/TR26W/GX24q or (1) FT24/27W/2G11 or (1) CFS28W/GR10q (2D) 4-pin lamps or (1) FC9T5-22W or (1) FC12T5-40W or (1) CFS38W/GR10q or (1) CFM36W/2G10

- Line Voltage: 120vac to 277vac, ±10%, 50-60Hz
- High Power Factor
- Programmed Rapid Start
- Series Lamp Connection

Model	Line Volts	Lamp Type	Lamp #	Input Watts*	Nominal Line Amps	Ballast Factor	Power Factor	THD	Crest Factor
C2642UNV	120	CFQ/TR26W	2	56	0.47	.98	> 0.98	< 10%	<1.5
	277	CFQ/TR26W	2	56	0.21	.98	> 0.98	< 10%	<1.5
C2642UNV	120	CFQ/TR26W	1	28	0.25	1.02	> 0.98	< 10%	<1.5
	277	CFQ/TR26W	1	28	0.11	1.02	> 0.98	< 10%	<1.5
C2642UNV	120	CFM42W	1	48	0.41	.98	> 0.98	< 10%	<1.5
	277	CFM42W	1	48	0.18	.98	> 0.98	< 10%	<1.5
C2642UNV	120	CFTR32W	1	36	0.30	1.00	> 0.98	< 10%	<1.5
	277	CFTR32W	1	36	0.13	1.00	> 0.98	< 10%	<1.5
C2642UNV	120	FT24/27W/2G11	1	30	0.26	.90	> 0.95	< 10%	<1.6
	277	FT24/27W/2G11	1	30	0.11	.90	> 0.95	< 10%	<1.6
C2642UNV	120	CFS28W/GR10q	1	31	0.27	.95	> 0.95	< 10%	<1.6
	277	CFS28W/GR10q	1	31	0.12	.95	> 0.95	< 10%	<1.6
C2642UNV	120	FC9T5-22W	1	25	0.21	1.00	> 0.98	< 10%	<1.5
	277	FC9T5-22W	1	25	0.10	1.00	> 0.98	< 10%	<1.5
C2642UNV	120	FC12T5-40W	1	42	0.35	.98	> 0.98	< 10%	<1.5
	277	FC12T5-40W	1	42	0.16	.98	> 0.98	< 10%	<1.5
C2642UNV	120	CFS38W/GR10q	1	33	0.27	.80	> 0.95	< 10%	<1.6
	277	CFS38W/GR10q	1	33	0.12	.80	> 0.95	< 10%	<1.6
C2642UNV	120	CFM36W/2G10	1	32	0.27	.98	> 0.98	< 10%	<1.7
	277	CFM36W/2G10	1	32	0.12	.98	> 0.98	< 10%	<1.7

* ANSI measured wattage; 25°C ambient; benchtop; lamps base up

Application and Performance Specification Information Subject to Change without Notification.

Performance:
- Meets ANSI Standard C82.11
- Meets FCC Part 18 (Non-Consumer), Limits for EMI/RFI
- Operating Frequency Range: Above 60 kHz
- **Auto-Reset Shutdown Circuit** per NEMA Recommendations
  - Both lamps should be replaced at end of life
  - Lamp relights upon insertion in socket
- Suitable for use in air handling spaces when NEC wiring guidelines are followed
- ME version: Input Terminals L N G intended for one supply connection only

Safety:
- No PCB's
- UL listed (Class P) Type 1 Outdoor, Type CC, Type HL
- CSA Certified

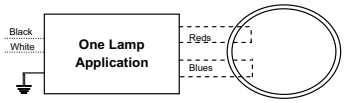
Application:
- Minimum Starting Temperature: 0° F, -18° C
- Maximum Case Temperature (@ t_c): 167° F, 75° C
- Sound Rated: A
- Lead configuration:
  - ***xxx =*** SE - Side Exit (Also available with socket)
  - *or* BE - Bottom Exit
  - *or* BES - Bottom Exit with Studs (2" on center)
  - *or* ME - Multi-Exit Replacement Kit for Distribution
- Remote Mounting 12 feet
- Also operates on 125VDC input, (+)L (-)N

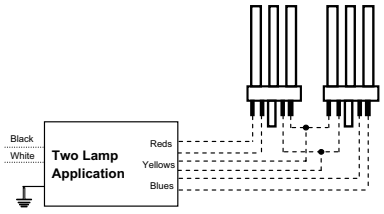
Physical Parameters

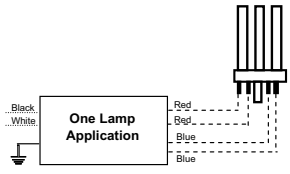
Overall Length:	4.94"
Width:	2.31"
Mounting:	4.61"
Height:	1.00"
Weight:	0.57 lbs
Qty/Carton:	20
Color:	SE-White
	BE/BES-Black
	ME-White
Can Material:	Metal

Warranty:
Universal Lighting Technologies warrants to the purchaser that each electronic ballast will be free from defects in material or workmanship for a period of 5 years from date of manufacture when properly installed and under normal conditions of use. Call **1-800-BALLASTx800** for technical assistance.

- Manufactured in North America
- Ballast has plug in wire trap connectors.
- Use 18 AWG solid copper wire, stripped to 3/8".
- Ballast must be grounded in accordance with national and local electrical codes.







Universal #		**BAL2**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

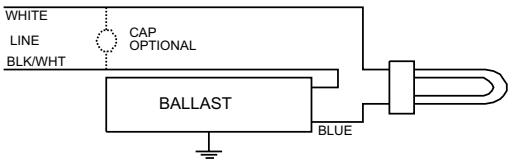
VL-1B13-TP-BLS

Brand Name	COMPACT-NPF
Ballast Type	Magnetic
Starting Method	Pre-Heat
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Starting Current (Amps)	Open Circuit (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor
CFQ13W/GX23	1	13	0/-18	0.24	0.28	0.00	24	0.98	10	0.36
* CFT13W/GX23	1	13	0/-18	0.26	0.28	0.00	20	0.98	15	0.28

Wiring Diagram



Diag. 45

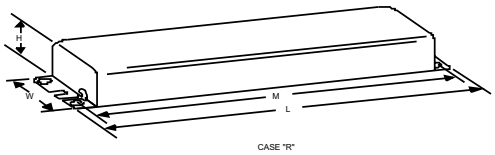
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White		0
Blue	7	17.8
Red		0
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	7	17.8
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (std)/(TP)	Height (H)	Mounting (M)
4.75 "	2.21875 "/0 "	1.625 "	4.375 "
4 3/4	2 7/32 / 0	1 5/8	4 3/8
12.1 cm	5.6 cm / 0 cm	4.1 cm	11.1 cm

Revised 07/01/1999

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Advance #		**BAL3**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

Hi-lume Overview

Hi-lume architectural electronic dimming ballasts are designed to meet the most demanding lighting requirements. By providing industry-leading performance with true full-range 100% to 1% fluorescent dimming, Hi-lume ballasts enable you to provide the ideal visual environment for any application.

Hi-lume, case type A
3.00"w (76mm) x 1.00"h (25mm) x 4.90"l (124mm)

Hi-lume, case type C
1.18"w (30mm) x 1.00"h (25mm) x 18.00"l (457mm)

Hi-lume, case type F
2.38"w (60mm) x 1.50"h (38mm) x 9.50"l (241mm)

Features

- Continuous, flicker-free dimming from 100% to 1%
- Standard 3-wire line-voltage phase-control technology for consistent fixture-to-fixture dimming performance
- Models available for T4 triple-tube compact, T5-HO linear, and T8 lamps
- Programmed rapid start design preheats lamp cathodes before applying full arc voltage
- Lamps turn on to any dimmed level without flashing to full brightness
- Low harmonic distortion throughout the entire dimming range maintains power quality
- Frequency of operation ensures that ballast does not interfere with infrared devices operating between 38 and 42 kHz
- Inrush current limiting circuitry eliminates circuit breaker tripping, switch arcing, and relay failure
- End-of-lamp-life protection circuitry (for T4 and T5-HO models) ensures safe operation throughout entire lamp life cycle
- For linear lamps, ballasts maintain consistent light output for different lamp lengths, ensuring fixture uniformity
- Ultra-quiet operation
- Protected from miswires of any input power to control lead, or from lamp leads to each other and/or ground
- 100% compatible with all Lutron 3-wire fluorescent controls
- 100% performance tested at factory
- Designed and assembled in the USA
- 5-year limited warranty with Lutron field service commissioning (3-year standard warranty) from date of purchase

LUTRON® SPECIFICATION SUBMITTAL Page

Job Name:	Model Numbers:
Job Number:	

Lutron #		BAL4
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

Specifications

Performance

- Dimming Range: 100% to 1% measured relative light output (RLO)
- Lamp Starting: programmed rapid start
- Minimum Lamp Starting Temperature: 10°C (50°F)
- Ambient Temperature Operating Range: 10°C (50°F) to 60°C (140°F)
- Relative Humidity: maximum 90% non-condensing
- Operating Voltage: 120V or 277V at 60Hz
- Lamp Current Crest Factor: less than 1.7
- Lamp Flicker: none visible
- Light Output Variation: constant ±2% light output for line voltage variations of ±10%
- Lamp Life: average lamp life meets or exceeds rating of lamp manufacturer
- Ballast Factor: greater than .85 for T8 lamps, greater than .95 for T4 lamps, equal to 1.0 for T5-HO lamps
- Power Factor: greater than .95
- Total Harmonic Distortion (THD): less than 10%
- Maximum Inrush Current: 7 amps per ballast at 120V, 3 amps per ballast at 277V
- Sound Rating: Inaudible in a 27dBa ambient
- Maximum Ballast Case Temperature: 75°C (167°F)

Standards

- UL Listed (evaluated to the requirements of UL935)
- CSA certified (evaluated to the requirements of C22.2 No. 74)
- Class P thermally protected
- Meets ANSI C82.11 High Frequency Ballast Standard
- Meets FCC Part 18 Non-Consumer requirements for EMI/RFI emissions
- T4 and T5-HO ballasts are MIL Std. 461E compliant (meets the requirements of CE101, RE101 and RE102)
- Meets ANSI C62.41 Category A surge protection standards up to and including 6kV
- Manufacturing facilities employ ESD reduction practices that comply with the requirements of ANSI/ESD S20.20
- Lutron Quality Systems registered to ISO 9001.2000

LUTRON® SPECIFICATION SUBMITTAL Page

Job Name:	Model Numbers:
Job Number:	

Lutron #		BAL4
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

Hi-lume Ballast Models

Lamp Type	Lamp Watts (length)	Lamps per ballast	Case Type	120 VOLTS Ballast Current (amps)	120 VOLTS **Hi-lume** Model Number [1]	277 VOLTS Ballast Current (amps)	277 VOLTS **Hi-lume** Model Number [1]
T4 triple-tube 4-pin  1/2" diameter	26W	1	A	.26	HL3-T426-120-1-S	.12	HL3-T426-277-1-S
	32W	1	A	.31	HL3-T432-120-1-S	.13	HL3-T432-277-1-S
T5-HO linear high output  5/8" diameter	24W (21.5")	1 2	C C	.26 .45	FDB-T524-120-1 FDB-T524-120-2	.13 .20	FDB-T524-277-1 FDB-T524-277-2
	39W (33.4")	1 2	C C	.38 .76	FDB-T539-120-1 FDB-T539-120-2	.17 .31	FDB-T539-277-1 FDB-T539-277-2
	54W (45.3")	1 2	C C	.58 1.1	FDB-T554-120-1 FDB-T554-120-2	.25 .45	FDB-T554-277-1 FDB-T554-277-2
T8 linear and U-bent  1" diameter	17W (24")	1 2 3	F F F	.19 .31 .43	FDB-2427-120-1 FDB-2427-120-2 FDB-2427-120-3	.08 .15 .20	FDB-2427-277-1 FDB-2427-277-2 FDB-2427-277-3
	25W (36")	1 2 3	F F F	.24 .43 .62	FDB-3627-120-1 FDB-3627-120-2 FDB-3627-120-3	.12 .19 .28	FDB-3627-277-1 FDB-3627-277-2 FDB-3627-277-3
	32W (48")	1 2 3	F F F	.30 .57 .82	FDB-4827-120-1 FDB-4827-120-2 FDB-4827-120-3	.14 .25 .35	FDB-4827-277-1 FDB-4827-277-2 FDB-4827-277-3
	40W (60")	1 2	F F	.36 .64	FDB-6027-120-1 FDB-6027-120-2	.16 .30	FDB-6027-277-1 FDB-6027-277-2
T12 linear HO (800ma)	85W (72")	1	F	.75	FDB-7280-120-1	- -	- -
 1½" diameter	95W (84")	1	F	.83	FDB-8480-120-1	- -	- -
	110W (96")	1	F	.88	FDB-9680-120-1	- -	- -

[1] Mounting studs standard for T4 ballasts. Delete suffix -S in the model number if mounting studs not needed.

LUTRON® SPECIFICATION SUBMITTAL Page

Job Name:	**Model Numbers:**
Job Number:	

Lutron #		**BAL4**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

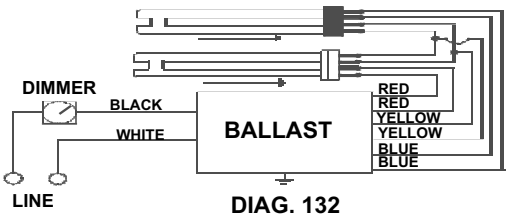
VEZ-2T42-M3-BS

Brand Name	MARK X Powerline
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
CFTR32W/GX24Q	2	32	50/10	0.28	20	0.05	10	0.98	1.6	0.25
* CFTR42W/GX24Q	2	42	50/10	0.36	20	0.05	10	0.98	1.6	0.25
CFTR57W/GX24Q	1	57	50/10	0.24	18	0.05	10	0.98	1.6	0.28
CFTR70W/GX24Q	1	70	50/10	0.29	18	0.05	10	0.98	1.6	0.28

Wiring Diagram

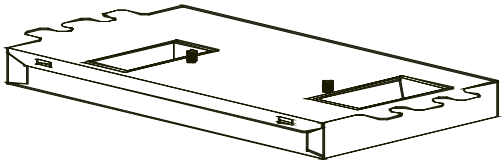


DIAG. 132

The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
6.28 "	3.00 "	1.29 "	2.00 "
6 7/25	3	1 29/100	2
16 cm	7.6 cm	3.3 cm	5.1 cm

Revised 09/10/2002

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Advance #		**BAL5**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

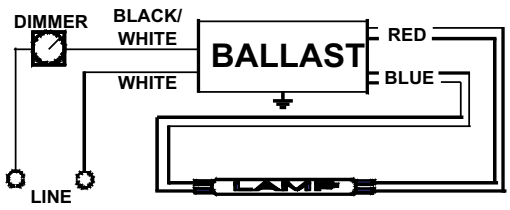
VEZ-132-SC

Brand Name	MARK X POWERLINE
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
F17T8	1	17	50/10	0.09	07/24	0.05/1.05	10	0.99	1.6	4.38
F25T8	1	25	50/10	0.11	07/30	0.05/1.05	10	0.99	1.6	3.50
* F32T8	1	32	50/10	0.13	09/35	0.05/1.00	10	0.99	1.6	2.86

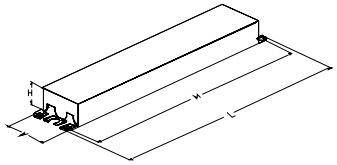
Wiring Diagram



The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.7 "	1.18 "	8.90 "
9 1/2	1 7/10	1 9/50	8 9/10
24.1 cm	4.3 cm	3 cm	22.6 cm

Revised 10/28/2005

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Advance #		**BAL6**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

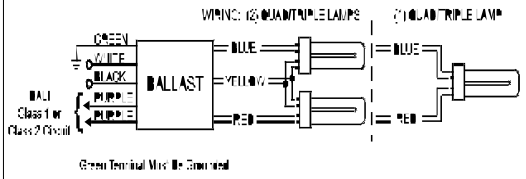
IDL-2S26-M5-BS@277

Brand Name	ROVR
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* CFQ13W/G24Q	1	13	50/10	0.07	06/18	0.03/1.00	10	0.99	1.6	5.56
CFQ13W/G24Q	2	13	50/10	0.12	09/32	0.03/1.00	10	0.99	1.6	3.13

Wiring Diagram



Diag. 165

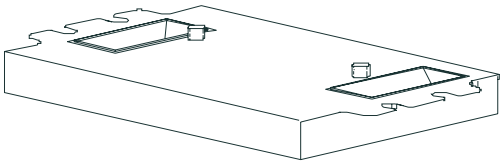
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	3.00 "	1.18 "	2.00 "
4 49/50	3	1 9/50	2
12.6 cm	7.6 cm	3 cm	5.1 cm

Revised 12/03/2003

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Advance #		**BAL7**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

Hi-lume Overview

Hi-lume architectural electronic dimming ballasts are designed to meet the most demanding lighting requirements. By providing industry-leading performance with true full-range 100% to 1% fluorescent dimming, Hi-lume ballasts enable you to provide the ideal visual environment for any application.

Hi-lume, case type A
3.00"w (76mm) x 1.00"h (25mm) x 4.90"l (124mm)

Hi-lume, case type C
1.18"w (30mm) x 1.00"h (25mm) x 18.00"l (457mm)

Hi-lume, case type F
2.38"w (60mm) x 1.50"h (38mm) x 9.50"l (241mm)

Features

- Continuous, flicker-free dimming from 100% to 1%
- Standard 3-wire line-voltage phase-control technology for consistent fixture-to-fixture dimming performance
- Models available for T4 triple-tube compact, T5-HO linear, and T8 lamps
- Programmed rapid start design preheats lamp cathodes before applying full arc voltage
- Lamps turn on to any dimmed level without flashing to full brightness
- Low harmonic distortion throughout the entire dimming range maintains power quality
- Frequency of operation ensures that ballast does not interfere with infrared devices operating between 38 and 42 kHz
- Inrush current limiting circuitry eliminates circuit breaker tripping, switch arcing, and relay failure
- End-of-lamp-life protection circuitry (for T4 and T5-HO models) ensures safe operation throughout entire lamp life cycle
- For linear lamps, ballasts maintain consistent light output for different lamp lengths, ensuring fixture uniformity
- Ultra-quiet operation
- Protected from miswires of any input power to control lead, or from lamp leads to each other and/or ground
- 100% compatible with all Lutron 3-wire fluorescent controls
- 100% performance tested at factory
- Designed and assembled in the USA
- 5-year limited warranty with Lutron field service commissioning (3-year standard warranty) from date of purchase

LUTRON® SPECIFICATION SUBMITTAL Page

Job Name:	Model Numbers:
Job Number:	

Lutron #		BAL8
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

Specifications

Performance

- Dimming Range: 100% to 1% measured relative light output (RLO)
- Lamp Starting: programmed rapid start
- Minimum Lamp Starting Temperature: 10°C (50°F)
- Ambient Temperature Operating Range: 10°C (50°F) to 60°C (140°F)
- Relative Humidity: maximum 90% non-condensing
- Operating Voltage: 120V or 277V at 60Hz
- Lamp Current Crest Factor: less than 1.7
- Lamp Flicker: none visible
- Light Output Variation: constant ±2% light output for line voltage variations of ±10%
- Lamp Life: average lamp life meets or exceeds rating of lamp manufacturer
- Ballast Factor: greater than .85 for T8 lamps, greater than .95 for T4 lamps, equal to 1.0 for T5-HO lamps
- Power Factor: greater than .95
- Total Harmonic Distortion (THD): less than 10%
- Maximum Inrush Current: 7 amps per ballast at 120V, 3 amps per ballast at 277V
- Sound Rating: Inaudible in a 27dBa ambient
- Maximum Ballast Case Temperature: 75°C (167°F)

Standards

- UL Listed (evaluated to the requirements of UL935)
- CSA certified (evaluated to the requirements of C22.2 No. 74)
- Class P thermally protected
- Meets ANSI C82.11 High Frequency Ballast Standard
- Meets FCC Part 18 Non-Consumer requirements for EMI/RFI emissions
- T4 and T5-HO ballasts are MIL Std. 461E compliant (meets the requirements of CE101, RE101 and RE102)
- Meets ANSI C62.41 Category A surge protection standards up to and including 6kV
- Manufacturing facilities employ ESD reduction practices that comply with the requirements of ANSI/ESD S20.20
- Lutron Quality Systems registered to ISO 9001.2000

LUTRON® SPECIFICATION SUBMITTAL Page

Job Name:	Model Numbers:
Job Number:	

Lutron #		BAL8
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

Hi-lume Ballast Models

Lamp Type	Lamp Watts (length)	Lamps per ballast	Case Type	120 VOLTS Ballast Current (amps)	120 VOLTS **Hi-lume** Model Number [1]	277 VOLTS Ballast Current (amps)	277 VOLTS **Hi-lume** Model Number [1]
T4 triple-tube 4-pin  1/2" diameter	26W	1	A	.26	HL3-T426-120-1-S	.12	HL3-T426-277-1-S
	32W	1	A	.31	HL3-T432-120-1-S	.13	HL3-T432-277-1-S
T5-HO linear high output  5/8" diameter	24W (21.5")	1 2	C C	.26 .45	FDB-T524-120-1 FDB-T524-120-2	.13 .20	FDB-T524-277-1 FDB-T524-277-2
	39W (33.4")	1 2	C C	.38 .76	FDB-T539-120-1 FDB-T539-120-2	.17 .31	FDB-T539-277-1 FDB-T539-277-2
	54W (45.3")	1 2	C C	.58 1.1	FDB-T554-120-1 FDB-T554-120-2	.25 .45	FDB-T554-277-1 FDB-T554-277-2
T8 linear and U-bent  1" diameter	17W (24")	1 2 3	F F F	.19 .31 .43	FDB-2427-120-1 FDB-2427-120-2 FDB-2427-120-3	.08 .15 .20	FDB-2427-277-1 FDB-2427-277-2 FDB-2427-277-3
	25W (36")	1 2 3	F F F	.24 .43 .62	FDB-3627-120-1 FDB-3627-120-2 FDB-3627-120-3	.12 .19 .28	FDB-3627-277-1 FDB-3627-277-2 FDB-3627-277-3
	32W (48")	1 2 3	F F F	.30 .57 .82	FDB-4827-120-1 FDB-4827-120-2 FDB-4827-120-3	.14 .25 .35	FDB-4827-277-1 FDB-4827-277-2 FDB-4827-277-3
	40W (60")	1 2	F F	.36 .64	FDB-6027-120-1 FDB-6027-120-2	.16 .30	FDB-6027-277-1 FDB-6027-277-2
T12 linear HO (800ma)	85W (72")	1	F	.75	FDB-7280-120-1	- -	- -
 1½" diameter	95W (84")	1	F	.83	FDB-8480-120-1	- -	- -
	110W (96")	1	F	.88	FDB-9680-120-1	- -	- -

[1] Mounting studs standard for T4 ballasts. Delete suffix -S in the model number if mounting studs not needed.

LUTRON® SPECIFICATION SUBMITTAL Page

Job Name:	**Model Numbers:**
Job Number:	

Lutron #		**BAL8**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

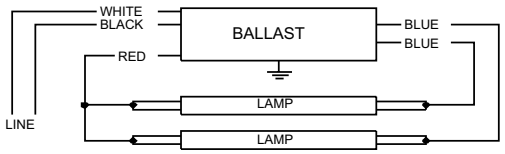
VCN-2M32-MC

Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	2	21	50/10	0.18	50	1.10	10	0.98	1.7	2.20
F25T8	2	25	0/-18	0.18	49	0.88	10	0.99	1.7	1.80
F28T5	2	28	50/10	0.22	60	0.98	10	0.99	1.7	1.63
* F32T8	2	32	0/-18	0.21	59	0.88	10	0.99	1.7	1.49
F32T8/ES (30W)	2	30	60/16	0.20	54	0.88	10	0.99	1.7	1.63

Wiring Diagram



Diag. 64

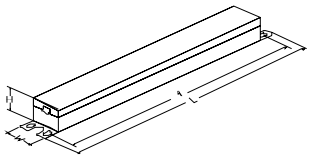
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

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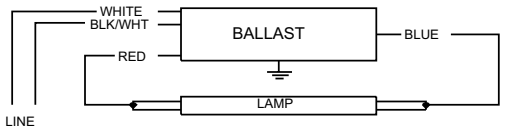
VCN-132-MC	
Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	1	21	50/10	0.10	27	1.10	10	0.98	1.7	4.07
F25T8	1	25	0/-18	0.09	25	0.98	10	0.98	1.7	3.92
* F28T5	1	28	50/10	0.11	30	0.98	10	0.99	1.7	3.27
F32T8	1	32	0/-18	0.11	30	0.98	10	0.98	1.7	3.27
F32T8/ES (30W)	1	30	60/16	0.10	28	0.98	10	0.98	1.7	3.50

Wiring Diagram



Diag. 63

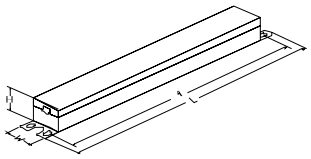
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

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Advance #		BAL10
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

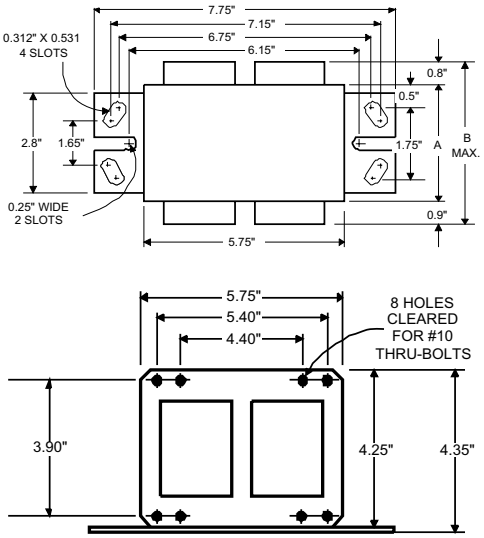
ADVANCE™

Low Pressure Sodium Lamp Ballast

Catalog Number 71A0740
For 180W L74
60 Hz HX-HPF
Status: Active

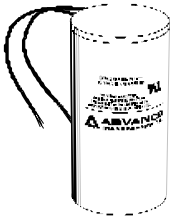
DIMENSIONS AND DATA

4 1/4 X 5 3/4 CORE - 2 COIL UNIT



~~INPUT VOLTS~~		480					
CIRCUIT TYPE	HX-HPF						
POWER FACTOR (min)	90%						
REGULATION							
Line Volts	±5%						
Lamp Watts	±10%						
LINE CURRENT (Amps)							
Operating		0.44					
Open Circuit		1.30					
Starting		0.55					
UL TEMPERATURE RATINGS							
Insulation Class	H(180°C)						
Coil Temperature Code	1029	A					
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C						
NOM. OPEN CIRCUIT VOLTAGE	685						
INPUT VOLTAGE AT LAMP DROPOUT		340					
INPUT WATTS	206						
RECOMMENDED FUSE (Amps)		4					
CORE and COIL							
Dimension (A)	2.40						
Dimension (B)	4.00						
Weight (lbs.)	16.5						
Lead Lengths	12"						
CAPACITOR REQUIREMENT							
Microfarads	16.0						
Volts (min.)	330						
Fault Current Withstand (amps)							
60 Hz TEST PROCEDURES (Refer to Advance Test Procedure for HID Ballasts - Form 1270)							
High Potential Test (Volts)							
1 minute	2000						
2 seconds	2500						
Open Circuit Voltage Test (Volts)	610-760						
Short-Circuit Current Test (Amps)							
Secondary Current	0.90-1.20						
Input Current		0.20 0.30	-	-	-	-	

Capacitor: 7C160M33



Capacitance: 16
Dia/Oval Dim: 1.5
Height: 3.75
Temp Rating: 105°C

Ignitor: NA

This ballast does not require the use of an ignitor.

Wiring Diagram:

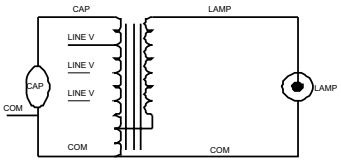


Fig. Q

U.L. RECOGNIZED

Ordering Information	
Order Suffix	**Description**

Data is based upon tests performed by Advance Transformer in a controlled environment and representitive of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice.

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03/18/02

Advance #		**BAL11**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

ADVANCE	e-Vision® Electronic Ballast for Metal Halide Lamps	Catalog Number IMH-50-A For (1) 39W ANSI M130 or (1) 50W ANSI M110 Metal Halide Lamp 120-277V 50/60Hz Electronic Status: Active

DIMENSIONS AND DATA

Lamp Data		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (W)	Ballast Factor	Max THD (%)	Min Power Factor	Wiring Dia	Figure	Weight (lb)	Max Distance to Lamp (ft)
Number	Watts											
39 Watt Lamp, ANSI Code M130 Minimum Starting Temp -30°C/-20°F												
1	39	120	IMH-50-A-xxx	0.38	45	1.0	15	0.9	1	A	1.4	5
		277		0.16	44							
50 Watt Lamp, ANSI Code M110 Minimum Starting Temp -30°C/-20°F												
1	50	120	IMH-50-A-xxx	0.47	56	1.0	15	0.9	2	A	1.4	5
		277		0.20	55							

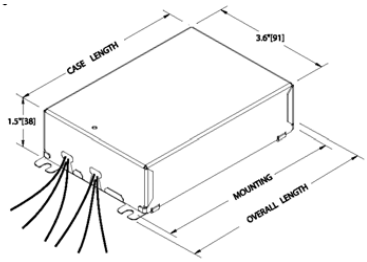
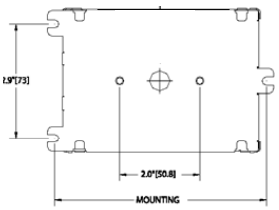
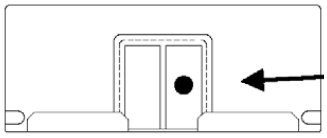


Figure A

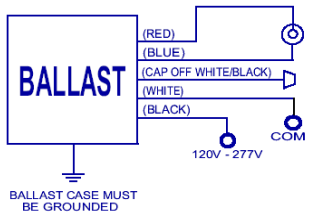
CASE LENGTH = 4.72" [120mm]
MOUNTING LENGTH = 5.20" [132mm]
MOUNTING WIDTH = 2.87" [73mm]
OVERALL LENGTH = 5.51" [140mm]
CASE WIDTH = 3.62" [92mm]
HEIGHT = 1.50" [38mm]



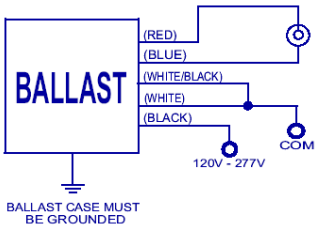


MEASURE CASE TEMPERATURE ON RIGHT HEAT SINK CLIP AT BALAST END

Case Temperature Measurement Location



Wiring Diagram 1



Wiring Diagram 2

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp

***Ordering Information**

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

Data is based on tests performed by Advance transformer in a controlled environment and representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

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10/11//05

Advance #		**BAL12**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

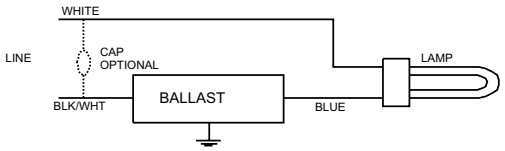
VL-1B9-TP-BLS

Brand Name	COMPACT-NPF
Ballast Type	Magnetic
Starting Method	Pre-Heat
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Starting Current (Amps)	Open Circuit (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor
CFQ9W/G23	1	9	0/-18	0.16	0.18	0.00	15	0.90	10	0.33
CFT5W/G23	1	5	0/-18	0.17	0.18	0.00	12	0.96	15	0.25
CFT7W/G23	1	7	0/-18	0.17	0.18	0.00	14	0.95	15	0.29
* CFT9W/G23	1	9	0/-18	0.17	0.18	0.00	14	0.92	15	0.31

Wiring Diagram



Diag. 42

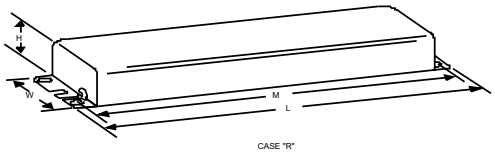
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White		0
Blue	7	17.8
Red		0
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	7	17.8
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (std)/(TP)	Height (H)	Mounting (M)
4.75 "	2.21875 "/0 "	1.625 "	4.375 "
4 3/4	2 7/32 / 0	1 5/8	4 3/8
12.1 cm	5.6 cm / 0 cm	4.1 cm	11.1 cm

Revised 09/14/1999

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Advance #		**BAL13**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

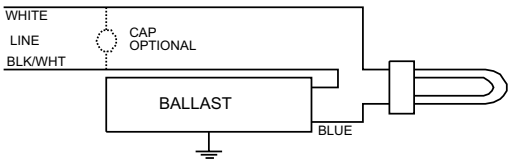
VL-1B13-TP-BLS

Brand Name	COMPACT-NPF
Ballast Type	Magnetic
Starting Method	Pre-Heat
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Starting Current (Amps)	Open Circuit (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor
* CFQ13W/GX23	1	13	0/-18	0.24	0.28	0.00	24	0.98	10	0.36
CFT13W/GX23	1	13	0/-18	0.26	0.28	0.00	20	0.98	15	0.28

Wiring Diagram



Diag. 45

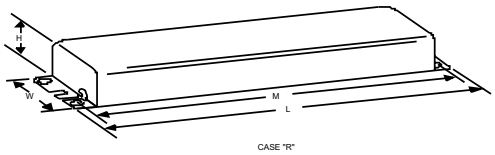
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White		0
Blue	7	17.8
Red		0
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	7	17.8
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (std)/(TP)	Height (H)	Mounting (M)
4.75 "	2.21875 "/0 "	1.625 "	4.375 "
4 3/4	2 7/32 / 0	1 5/8	4 3/8
12.1 cm	5.6 cm / 0 cm	4.1 cm	11.1 cm

Revised 07/01/1999

Data is based upon tests performed by Advance Transformer in a controlled environment and representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

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Advance #		**BAL14**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

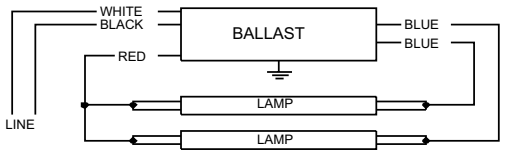
VCN-2M32-MC

Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	2	21	50/10	0.18	50	1.10	10	0.98	1.7	2.20
F25T8	2	25	0/-18	0.18	49	0.88	10	0.99	1.7	1.80
* F28T5	2	28	50/10	0.22	60	0.98	10	0.99	1.7	1.63
F32T8	2	32	0/-18	0.21	59	0.88	10	0.99	1.7	1.49
F32T8/ES (30W)	2	30	60/16	0.20	54	0.88	10	0.99	1.7	1.63

Wiring Diagram



Diag. 64

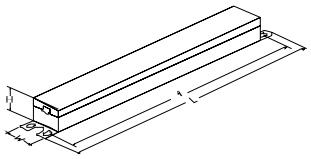
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

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ADVANCE	e-Vision® Electronic Ballast for Metal Halide Lamps	Catalog Number IMH-70-D For (1) 70W Metal Halide Lamp ANSI M98, M139, M143 120-277V 50/60Hz Electronic Status: Active

DIMENSIONS AND DATA

Lamp Data		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (W)	Ballast Factor	Max THD (%)	Min Power Factor	Wiring Dia	Figure	Weight (lb)	Max Distance to Lamp (ft)
Number	Watts											
70 Watt Lamp, ANSI Code M98, M139 or M143 Minimum Starting Temp -30°C/-20°F												
1	70	120	IMH-70-D-xxx	0.67	80	1.0	15	0.9	3	D	1.6	5
		277		0.29	79							

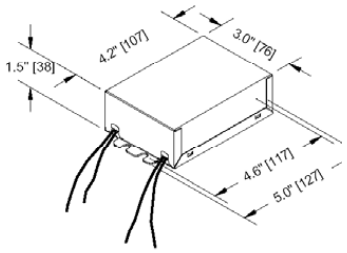
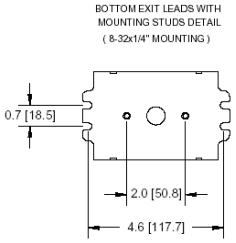
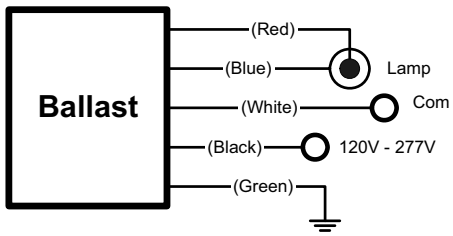


Figure D

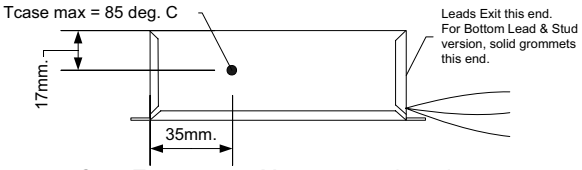
(Side exit leads shown – see diagram at right for bottom leads with mounting studs detail)





Ballast Case must be Grounded

Wiring Diagram 3



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp

***Ordering Information**

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

Data is based on tests performed by Advance transformer in a controlled environment and representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

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Revised 1/13/06

Advance #		**BAL16**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

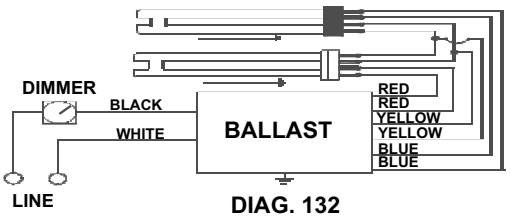
VEZ-2T42-M3-BS

Brand Name	MARK X Powerline
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* CFTR32W/GX24Q	2	32	50/10	0.28	20	0.05	10	0.98	1.6	0.25
CFTR42W/GX24Q	2	42	50/10	0.36	20	0.05	10	0.98	1.6	0.25
CFTR57W/GX24Q	1	57	50/10	0.24	18	0.05	10	0.98	1.6	0.28
CFTR70W/GX24Q	1	70	50/10	0.29	18	0.05	10	0.98	1.6	0.28

Wiring Diagram

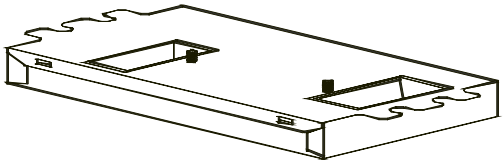


DIAG. 132

The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
6.28 "	3.00 "	1.29 "	2.00 "
6 7/25	3	1 29/100	2
16 cm	7.6 cm	3.3 cm	5.1 cm

Revised 09/10/2002

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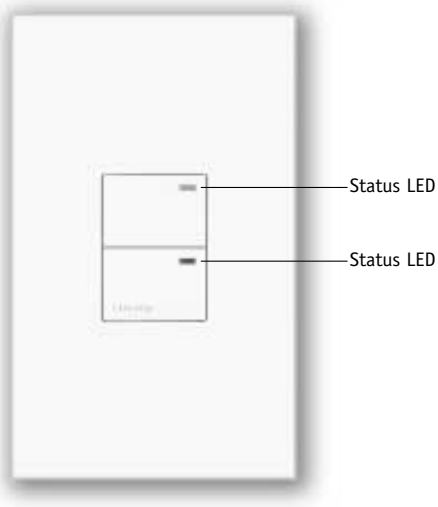
Advance #		**BAL17**
Brian Smith	**UCSD Cal IT2 - Ballasts**	**# of #**

Appendix C

Lighting Controls Cut-sheets

COLOR AND FINISH CODES

NTGRX-2B-SL-__-_
2-Button Wallstation



DESCRIPTION

Often used in entryways, to turn lights on and off.
- Provides many different functions depending on how you set DIP switches 5, 6, and 7.
- Has status LEDs to show which button was pushed last.
- Works with GRX-3000 and GRX-4000 Control Units. Can be set up to invoke functions in just one Control Unit or group of up to eight Control Units.

SPECIAL FINISH

Available with stock engraving.

FUNCTIONS

	DIP SWITCH SETTINGS 5 6 7	Top button does this	Bottom button does this
Entrance Wallstation	■ ■ ■	Selects scene 1.	Turns lights off.
Scene Selection	■ ■ ↓	Selects scene 9.	Selects scene 10.
	■ ↓ ■	Selects scene 13.	Selects scene 14.
Panic Wallstation	■ ↓ ↓	Selects scene 16 (all lighting full on). Locks all other system controls.	Restores previous scene. Disables lockout.
Fine Tuning	↓ ■ ■	Temporarily brightens selected zone(s).	Temporarily dims selected zone(s).
Single-Partition Status Wallstation	↓ ■ ↓	Control Units act in combination — movable wall is open to make one large space.	Control Units act independently — movable wall is closed to make two spaces.
Zone Lockout	↓ ↓ ■	Allows only temporary adjustments to zones. Adjustments won't affect preset scene settings.	Disables zone lockout.
Sequencing	↓ ↓ ↓	Loops continuosly through scenes 5 to 16 using fade times entered at Control Units.	Turns sequencing off.

LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	MODEL NUMBERS:
JOB NUMBER:	

Lutron #		S1
Brian Smith	UCSD Cal IT2 - Controls	# of #

SPECIFICATIONS

Power
Operating voltage: Low-voltage type Class 2(PELV), 12VDC to 24VFW.

Key Design Features
- Meets IEC 801-2. Tested to withstand 15kV electrostatic discharge without damage or memory loss.
- Has faceplate that snaps on with no visible means of attachment.
- Can be ganged to share a common faceplate with NovaT☆ and Vareo Dimmers. For ganging, counts as a "small control."

System Communications and Capacity
- Low-voltage type Class 2 (PELV) wiring connects Wallstations to Control Units and other components.
- You can link up to 8 Control Units and up to 16 total Wallstations and/or Control Interfaces for a total of 24 control points.

Terminals
Capacity: Accept up to two #18 AWG (1.0mm²) typical.

Environment
32-104°F (0-40°C). Relative humidity less than 90% non-condensing.

COLOR AND FINISH CODES

Matte Finishes
Standard – Ships in 48 hours

White	**WH**
Ivory	**IV**
Beige	**BE**
Gray	**GR**
Brown	**BR**
Black	**BL**

Metal Finishes
Ships in 4 to 6 weeks

Bright Brass	**BB**
Bright Chrome	**BC**
Bright Nickel	**BN**
Satin Brass	**SB**
Satin Chrome	**SC**
Satin Nickel	**SN**
Antique Brass	**QB**
Antique Bronze	**QZ**

Anodized Aluminum
Ships in 4 to 6 weeks

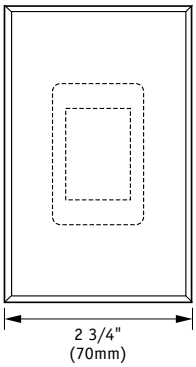
Clear	**CLA**
Black	**BLA**
Brass	**BRA**

Engraving	**E**
No Insert	**NI**

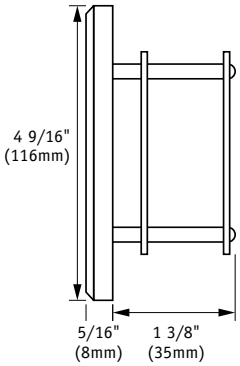
Custom Controls, color matching, and engraving available – Ships in 4 to 6 weeks. Pricing may vary depending on finishes.

DIMENSIONS

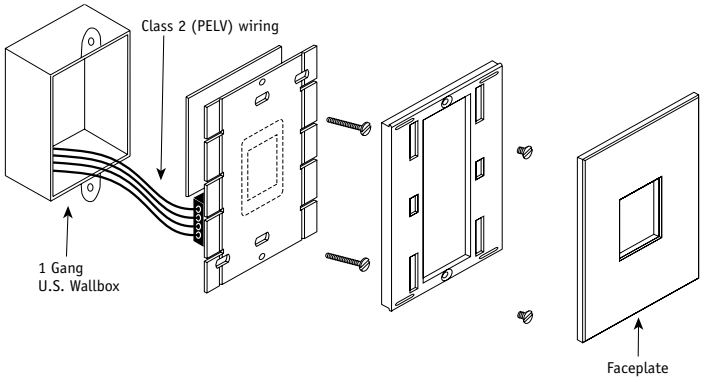
Front View



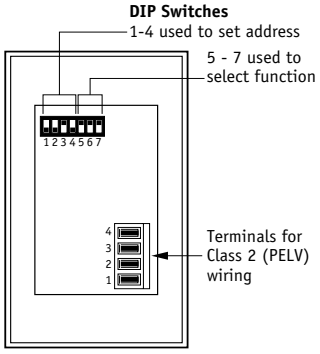
Side View



MOUNTING



Back View



LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	**MODEL NUMBERS:**
JOB NUMBER:	

Lutron #		**S1**
Brian Smith	**UCSD Cal IT2 - Controls**	**# of #**

Wallstation Installation

DIP SWITCHES

- Set DIP switches 1-4 to give the Wallstation the unique system address from 1 to 16.
- Set additional DIP switches (if any) to specify function as shown on the first page of the Wallstation's Specification Submittal.

Address	DIP SWITCH SETTINGS 1	2	3	4
1	■	■	■	■
2	■	■	■	□
3	■	■	□	■
4	■	■	□	□
5	■	□	■	■
6	■	□	■	□
7	■	□	□	■
8	■	□	□	□
9	□	■	■	■
10	□	■	■	□
11	□	■	□	■
12	□	■	□	□
13	□	□	■	■
14	□	□	■	□
15	□	□	□	■
16	□	□	□	□

Reserved for GRX-PRG, if present on link.

LOW-VOLTAGE CLASS 2 (PELV) WIRING

- Use low-voltage Class 2 (PELV) wiring to daisy-chain Wallstations to Control Units and other components.
- Make connections inside the wallbox. Or in a switchbox or junction box with a maximum wire length of 8 feet (2.5m) from the link to the Wallstation.

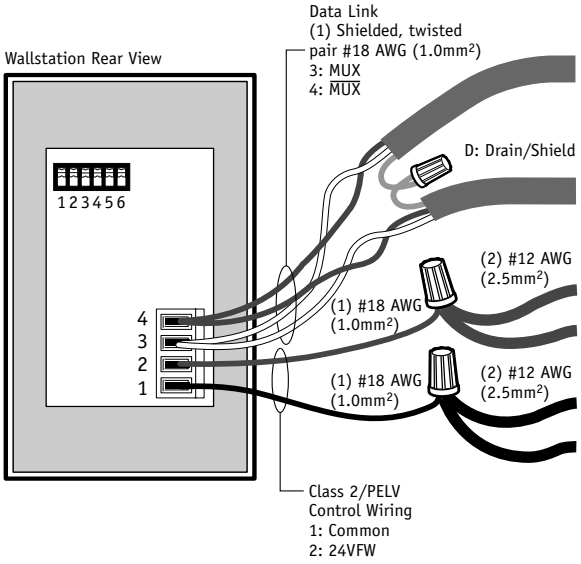
Note: EGRX Eurostyle Wallstations have a D terminal for Drain. You can connect the Drain/Shield at this terminal.

When used with GRX-3000 Control Units

- Two #18 AWG (1.0mm²) conductors for common (terminal 1) and 12VDC (terminal 2). Make sure you wire the the terminal 2 connection correctly. Refer to GRX-3000 Specification Submittal.
- One shielded, twisted pair #18 AWG (1.0mm²) for data link (terminals 3 and 4).

When used with GRX-4000 Control Units

- Two #12 AWG (2.5mm²) conductors for common (terminal 1) and 24VFW (terminal 2). These won't fit in terminals. Connect as shown.
- One shielded, twisted pair #18 AWG (1.0mm²) for data link (terminals 3 and 4).
- Connect Drain/Shield as shown.
  - Do not connect to Ground (Earth) or Wallstation.
  - Connect the bare drain wires and cut off the outside shield.



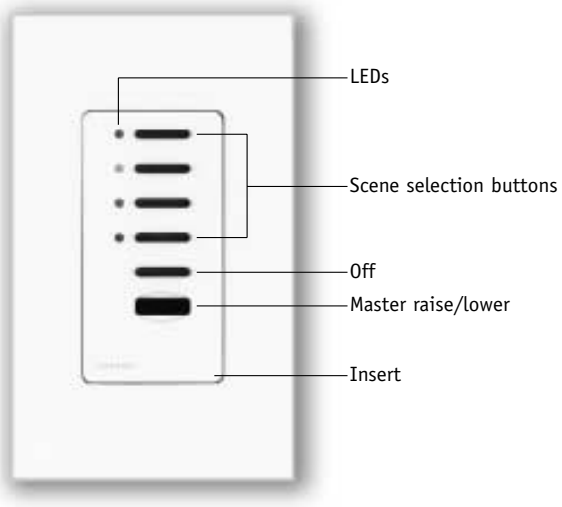
LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	MODEL NUMBERS:
JOB NUMBER:	

Lutron #		S1
Brian Smith	UCSD Cal IT2 - Controls	# of #

COLOR AND FINISH CODES

NTGRX-4S-__-_
Scene Selection Control



DESCRIPTION

Used to select and adjust scenes in GRAFIK Eye Control Units.

- Scene selection buttons activate scenes 1 to 4, 5 to 8, 9 to 12, or 13 to 16 depending on how you set DIP switches 5 and 6.
- Status LEDs show which scene is selected.
- Off button turns all lights off.
- Master raise/lower brightens or dims all lighting in the selected scene.

Works with GRX-3000 and GRX-4000 Control Units. Can be set up to select scenes in just one Control Unit or a group of up to eight Control Units.

SPECIAL FINISH

- Available with stock engraving.
- Available in a "no-insert" version for a sleeker look.

FUNCTIONS

DIP SWITCH SETTINGS 5 6	Scene selection buttons activate...
	Scenes 1 to 4
	Scenes 5 to 8
	Scenes 9 to 12
	Scenes 13 to 16

LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	MODEL NUMBERS:
JOB NUMBER:	

Lutron #		S2
Brian Smith	UCSD Cal IT2 - Controls	# of #

SPECIFICATIONS

Power
Operating voltage: Low-voltage type Class 2(PELV), 12VDC to 24VFW.

Key Design Features
- Meets IEC 801-2. Tested to withstand 15kV electrostatic discharge without damage or memory loss.
- Has faceplate that snaps on with no visible means of attachment.
- Can be ganged to share a common faceplate with NovaT☆ and Vareo Dimmers. For ganging, counts as a "small control."

System Communications and Capacity
- Low-voltage type Class 2 (PELV) wiring connects Wallstations to Control Units and other components.
- You can link up to 8 Control Units and up to 16 total Wallstations and/or Control Interfaces for a total of 24 control points.

Terminals
Capacity: Accept up to two #18 AWG (1.0mm²) typical.

Environment
32-104°F (0-40°C). Relative humidity less than 90% non-condensing.

COLOR AND FINISH CODES

Matte Finishes
Standard – Ships in 48 hours

White	**WH**
Ivory	**IV**
Beige	**BE**
Gray	**GR**
Brown	**BR**
Black	**BL**

Metal Finishes
Ships in 4 to 6 weeks

Bright Brass	**BB**
Bright Chrome	**BC**
Bright Nickel	**BN**
Satin Brass	**SB**
Satin Chrome	**SC**
Satin Nickel	**SN**
Antique Brass	**QB**
Antique Bronze	**QZ**

Anodized Aluminum
Ships in 4 to 6 weeks

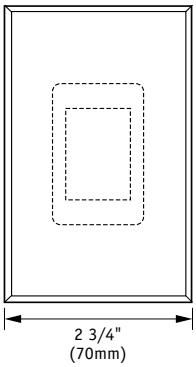
Clear	**CLA**
Black	**BLA**
Brass	**BRA**

Engraving	**E**
No Insert	**NI**

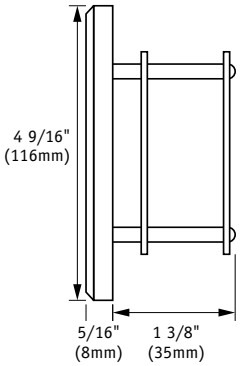
Custom Controls, color matching, and engraving available – Ships in 4 to 6 weeks. Pricing may vary depending on finishes.

DIMENSIONS

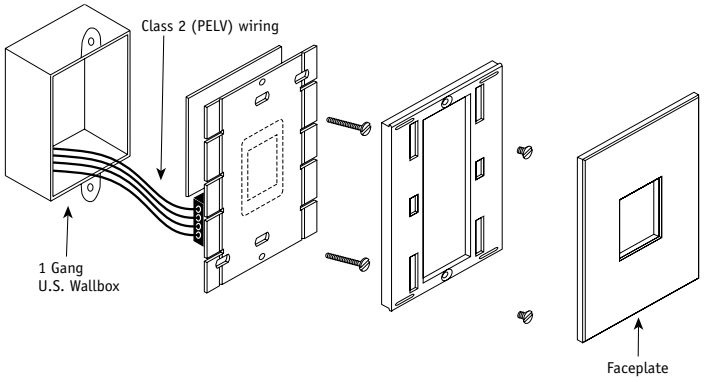
Front View



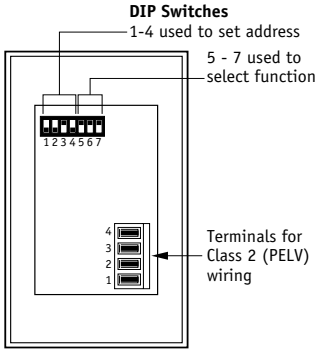
Side View



MOUNTING



Back View



LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	**MODEL NUMBERS:**
JOB NUMBER:	

Lutron #		**S2**
Brian Smith	**UCSD Cal IT2 - Controls**	**# of #**

Wallstation Installation

DIP SWITCHES

- Set DIP switches 1-4 to give the Wallstation the unique system address from 1 to 16.
- Set additional DIP switches (if any) to specify function as shown on the first page of the Wallstation's Specification Submittal.

Address	DIP SWITCH SETTINGS 1	2	3	4
1	■	■	■	■
2	■	■	■	□
3	■	■	□	■
4	■	■	□	□
5	■	□	■	■
6	■	□	■	□
7	■	□	□	■
8	■	□	□	□
9	□	■	■	■
10	□	■	■	□
11	□	■	□	■
12	□	■	□	□
13	□	□	■	■
14	□	□	■	□
15	□	□	□	■
16	□	□	□	□

Reserved for GRX-PRG, if present on link.

LOW-VOLTAGE CLASS 2 (PELV) WIRING

- Use low-voltage Class 2 (PELV) wiring to daisy-chain Wallstations to Control Units and other components.
- Make connections inside the wallbox. Or in a switchbox or junction box with a maximum wire length of 8 feet (2.5m) from the link to the Wallstation.

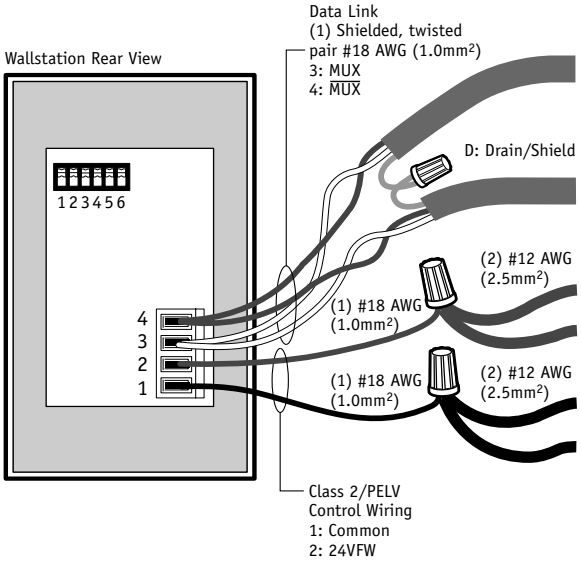
Note: EGRX Eurostyle Wallstations have a D terminal for Drain. You can connect the Drain/Shield at this terminal.

When used with GRX-3000 Control Units

- Two #18 AWG (1.0mm²) conductors for common (terminal 1) and 12VDC (terminal 2). Make sure you wire the the terminal 2 connection correctly. Refer to GRX-3000 Specification Submittal.
- One shielded, twisted pair #18 AWG (1.0mm²) for data link (terminals 3 and 4).

When used with GRX-4000 Control Units

- Two #12 AWG (2.5mm²) conductors for common (terminal 1) and 24VFW (terminal 2). These won't fit in terminals. Connect as shown.
- One shielded, twisted pair #18 AWG (1.0mm²) for data link (terminals 3 and 4).
- Connect Drain/Shield as shown.
  - Do not connect to Ground (Earth) or Wallstation.
  - Connect the bare drain wires and cut off the outside shield.

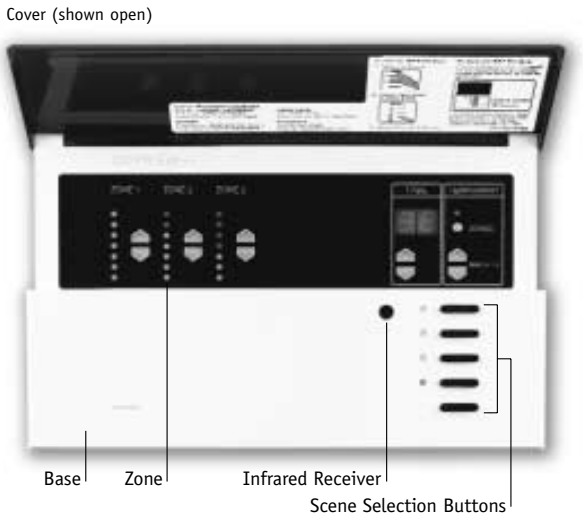


LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	MODEL NUMBERS:
JOB NUMBER:	

Lutron #		S2
Brian Smith	UCSD Cal IT2 - Controls	# of #

GRX-4000 Control Units



DESCRIPTION

- Provide pushbutton recall of four preset lighting scenes.
- Control virtually any light source.
- Provide lockout options to prevent accidental changes.
- Include built-in infrared receiver for operation with an optional remote control.

Models available to:
- Control two to 24 zones of lighting.
- Provide easy setup of preset lighting scenes:
  GRX-4100 Control Units provide standard setup via pushbuttons on the Control Unit.
  GRX-4500 Control Units provide optional setup via a PC, including setting lighting levels in 1% increments.

GRX-4000 Control Units work with:
- GRAFIK Eye Wallstations
- GP and LP Dimming Panels
- XP Softswitch™ Panels

SPECIFICATIONS

Operating Voltage
- Low-voltage type Class 2 (PELV), 12VDC to 24VFW.
- Lightning Strike Protection: Meets ANSI/IEEE standard 62.41-1980. Can withstand voltage surges of up to 6000V and current surges up to 3000A.

Sources/Load Types
Operates sources with a smooth continuous Square Law dimming curve or on a full conduction non-dim basis via GP and LP Dimming Panels and XP Softswitch™ Panels.

Preset Controls
- 4 preset lighting scenes and off for up to 24 zones, accessible from Control Unit faceplate.
- 12 additional scenes stored in Control Unit, accessible via Wallstations and/or Control Interfaces.
- Light levels fade smoothly between scenes. Fade time: 0-59 seconds or 1-60 minutes. Can be set differently for each scene.

Key Design Features
- Meets IEC 801-2. Tested to withstand 15kV electrostatic discharge without damage or memory loss.
- Provides power failure memory: Automatically restores lighting to scene selected prior to power interruption.
- Has faceplate that snaps on with no visible means of attachment.

System Communications and Capacities
Low-voltage type Class 2 (PELV) wiring connects Control Units, Wallstations, and Control Interfaces:
- You can link up to 8 Control Units to control up to 64 zones.
- You can add up to 16 total Wallstations and Control Interfaces for a total of 24 control points.

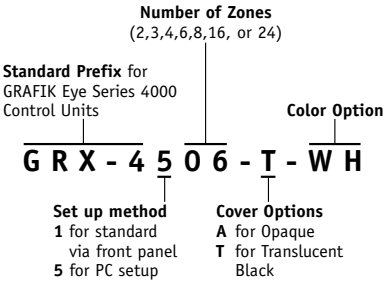
Environment
- 32-104°F (0-40°C). Relative humidity less than 90% non-condensing.

LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	MODEL NUMBERS:
JOB NUMBER:	

Lutron #		S3, S5
Brian Smith	UCSD Cal IT2 - Controls	# of #

HOW TO BUILD A MODEL NUMBER



MODELS

NUMBER OF ZONES	MODEL NUMBER STANDARD SETUP	PC SETUP
2	GRX-4102-_-__	GRX-4502-_-__
3	GRX-4103-_-__	GRX-4503-_-__
4	GRX-4104-_-__	GRX-4504-_-__
6	GRX-4106-_-__	GRX-4506-_-__
8	GRX-4108-_-__	GRX-4508-_-__
16	GRX-4116-_-__	GRX-4516-_-__
24	GRX-4124-_-__	GRX-4524-_-__

COVER OPTIONS

Opaque **A**
Cover and Base will match.
Translucent Black **T**
Black cover and your choice of base color.

BASE COLORS

Matte Finishes
Standard – Ships in 48 hours

White	**WH**
Ivory	**IV**
Beige	**BE**
Gray	**GR**
Brown	**BR**
Black	**BL**

Gloss Finishes
Ships in 4 to 6 weeks
Cover Choice: **A** only

White	**WH**
Light Almond	**GLA**
Almond	**GAL**
Ivory	**GIV**

Metal Finishes
Cover Choice: **T** only

Bright Brass	**BB**
Bright Chrome	**BC**
Bright Nickel	**BN**
Satin Brass	**SB**
Satin Chrome	**SC**
Satin Nickel	**SN**
Antique Brass	**QB**
Antique Bronze	**QZ**

Anodized Aluminum

Clear	**CLA**
Black	**BLA**
Brass	**BRA**

Custom Controls, color matching, and engraving available, Ships in 4 to 6 weeks

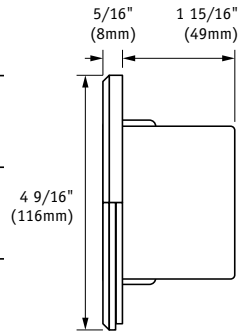
LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	**MODEL NUMBERS:**
JOB NUMBER:	

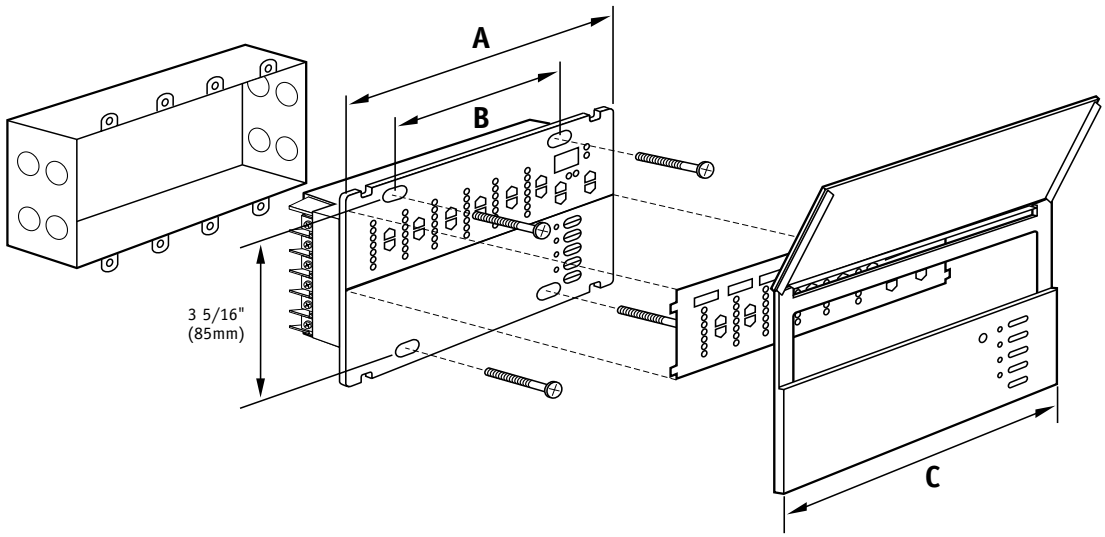
Lutron #		**S3, S5**
Brian Smith	**UCSD Cal IT2 - Controls**	**# of #**

DIMENSIONS AND MOUNTING

MODEL	SIDE VIEW	A	B	C	WALLBOX[1] U.S. SIZE	DEPTH
2-Zone: GRX-4102 GRX-4502		4 5/16" (123mm)	1 13/16" (46mm)	5.56" (141mm)	2 Gang	3.5" (89mm)
3-Zone: GRX-4103 GRX-4503		6 11/16" (168mm)	3 5/8" (92mm)	7.25" (184mm)	3 Gang	3.5" (89mm)
4-Zone: GRX-4104 GRX-4504		8 5/16" (208mm)	5 7/16" (138mm)	8.94" (227mm)	4 Gang	3.5" (89mm)
6-Zone: GRX-4106 GRX-4506		8 5/16" (208mm)	5 7/16" (138mm)	8.94" (227mm)	4 Gang	3.5" (89mm)
8-Zone: GRX-4108 GRX-4508		8 5/16" (208mm)	5 7/16" (138mm)	8.94" (227mm)	4 Gang	3.5" (89mm)
16-Zone: GRX-4116 GRX-4516		8 5/16" (208mm)	5 7/16" (138mm)	8.94" (227mm)	4 Gang	3.5" (89mm)
24-Zone: GRX-4124 GRX-4524		8 5/16" (208mm)	5 7/16" (138mm)	8.94" (227mm)	4 Gang	3.5" (89mm)



[1] Can be ordered from Lutron as Part Number 241-519 (1 Gang gangable boxes).



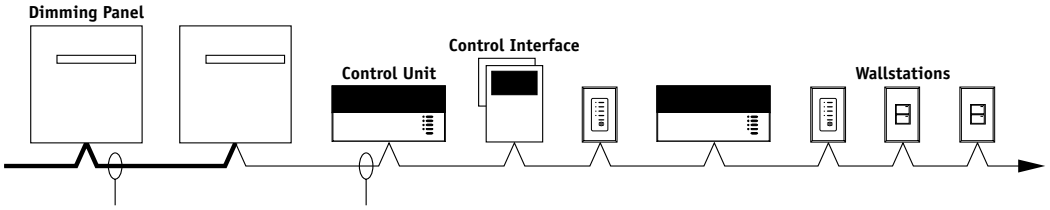
LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	MODEL NUMBERS:
JOB NUMBER:	

Lutron #		S3, S5
Brian Smith	**UCSD Cal IT2 - Controls**	**# of #**

LOW-VOLTAGE CLASS 2 (PELV) WIRING

Pull low-voltage Class 2 (PELV) wiring for system communications.
- Must be daisy-chained.
- Must be less than 2000 feet (600m).
- Must run seperately from line (mains) voltage.



Panel-to-Panel wiring[1]
Include one extra #18AWG (1.0mm²). Used as a "sense line" for emergency (essential) lighting.

Four wires[1] for low-voltage type Class 2 (PELV)
- Two #12 AWG (2.5mm²) conductors for control wiring.
- One shielded, twisted pair #18 AWG (1.0mm²) for data link.

[1] If you use Lutron cable, you can use smaller gauge wires.
- If your total system is less than 500 feet (150m), you can use GRX-CBL-346S:
  - Two #18AWG (1.0mm²) for power.
  - One twisted, shielded pair #22AWG (.625mm²) for data link.
  - No "sense line" included - add your own #18AWG (1.0mm²).
- If your total system is 500 to 2000 feet (150 to 600m), you can use GRX-CBL-46L:
  - Two #12AWG (2.5mm²) for power.
  - One twisted, shielded pair #22AWG (.625mm²) for data link.
  - One #18AWG (1.0mm²) for sense line between Panels.
- Lutron has also approved smaller gauge cable from Belden, Liberty, Alpha, and Signature. Ask for Lutron GRAFIK Eye Cable.

LUTRON® SPECIFICATION SUBMITTAL Page

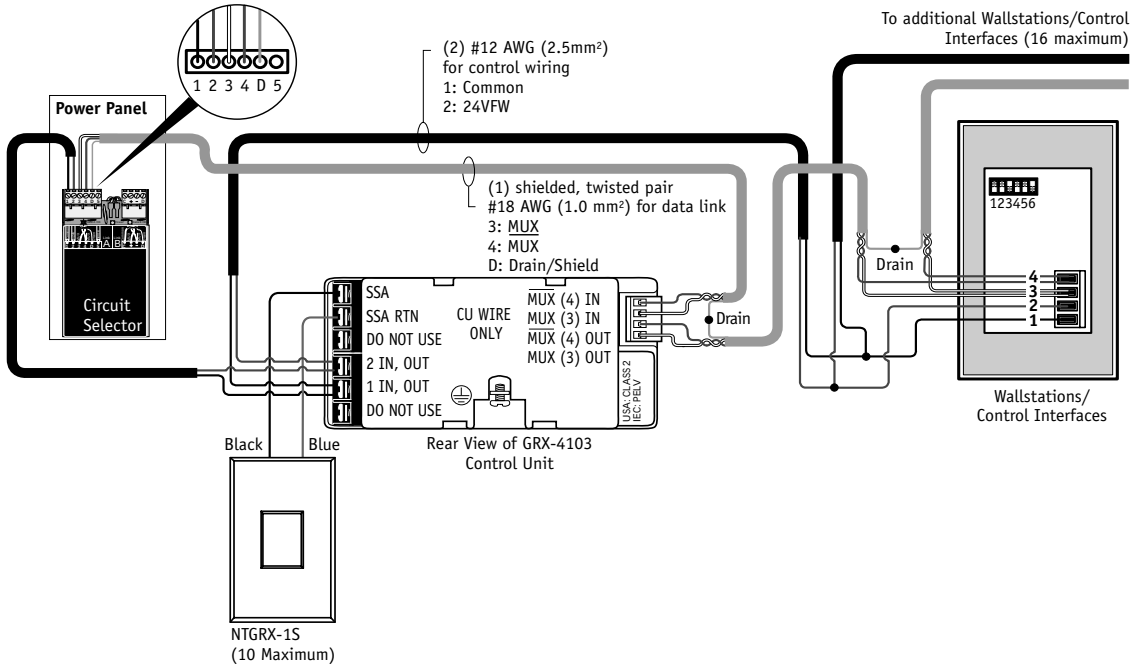
JOB NAME:	MODEL NUMBERS:
JOB NUMBER:	

Lutron #		S3, S5
Brian Smith	**UCSD Cal IT2 - Controls**	**# of #**

CLASS 2 (PELV) TERMINAL CONNECTIONS

Connect Drain/Shield as shown. Terminate only at Power Panel if Drain Terminal is provided. It is easiest to connect the bare drain wires and cut off the outside shield throughout the control link.

Lutron recommends you make all connections in the Control Unit's wallbox. Remote connections must be in a switchbox or junction box with a maximum wire length of 8 ft. (2.5m) from the link to the connected unit.

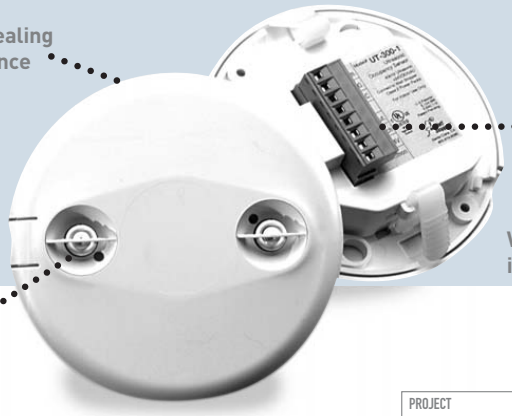


LUTRON® SPECIFICATION SUBMITTAL Page

JOB NAME:	**MODEL NUMBERS:**
JOB NUMBER:	

Lutron #		**S3, S5**
Brian Smith	**UCSD Cal IT2 - Controls**	**# of #**

UT-300 Low Voltage Ultrasonic Occupancy Sensor



PROJECT

LOCATION/TYPE

Product Overview

Description

Watt Stopper/Legrand's low profile UT-300 ultrasonic occupancy sensor automatically turns lighting on and off based on occupancy. The sensor mounts on the ceiling with a flat, unobtrusive appearance and provides 360° coverage.

Operation

The UT-300 operates on 24 VDC, VAC or halfwave rectified. It uses the Doppler Principle and high frequency (40 KHz) ultrasound to sense occupancy and automatically turn lighting on. When no occupancy is detected for the length of the time delay, lighting automatically turns off. For manual-ON operation, the UT works with a low voltage momentary switch.

SmartSet

Using SmartSet™ technology, UT sensors require no adjustment at installation. SmartSet continuously monitors the controlled space to identify usage patterns. With this information, it automatically adjusts time delay and sensitivity settings for optimal performance and energy efficiency. The sensor assigns short delays (as low as 5 minutes) for times when the space is usually vacant, and longer delays (up to 30 minutes) for busier times.

Application

UT sensors offer excellent control of lighting for many spaces including restrooms, large offices, and open office areas. Also, they can control large partitioned office spaces when configured in zone patterns. The UT sensors' performance combined and ease of installation will provide fast paybacks and many years of energy savings.

Features

- Advanced control logic based on RISC microcontroller provides:
  - Detection Signature Processing eliminates false triggers and provides immunity to RFI and EMI
  - SmartSet automatically adjusts sensitivity and time delay settings to fit occupant patterns
  - Walk-through mode turns lights off 3 minutes after the area is initially occupied – ideal for brief visits such as mail delivery
- Advanced Signal Processing Circuitry helps to eliminate false ONs
- Patented ultrasonic diffusion technology spreads coverage to a wider area
- LED indicates occupancy detection
- UT-300 works with low voltage momentary switches for manual control
- DIP switch simplifies sensor adjustments
- Clip mounting system makes ceiling tile installation simple
- Uses depluggable terminal wiring system for quick and easy installation
- Available with isolated relay for integration with BAS or HVAC

WattStopper
legrand
www.wattstopper.com
800.879.8585

WattStopper #		SA
Brian Smith	UCSD Cal IT2 - Controls	# of #

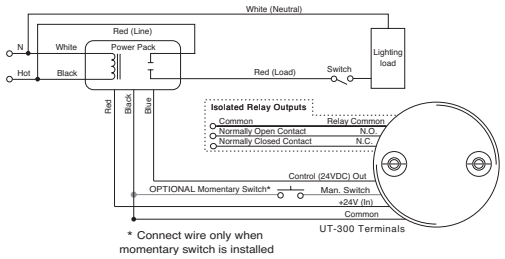
UT-300 Technical Information

Specifications

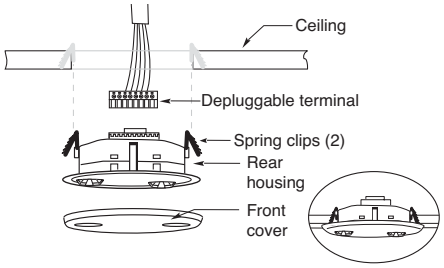
- 24 VDC/VAC
- Time delays: SmartSet (automatic), fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode
- Ultrasonic frequency of 40 kHz
- UT-300 contains isolated relay with N/O and N/C outputs; rated for 1 Amp at 30 VDC/VAC
- Mounting options: ceiling tile; 4 square junction box with double gang mudring
- Units per power pack: UT-300 up to 2(B), up to 3 (BZ); UT-305 up to 3 (B), up to 4 (BZ)
- Dimensions: 4.5" diameter x 1.02" deep (114.3mm x 25.9mm)
- UL and CUL listed; five year warranty

Wiring & Mounting

Wiring & Controls

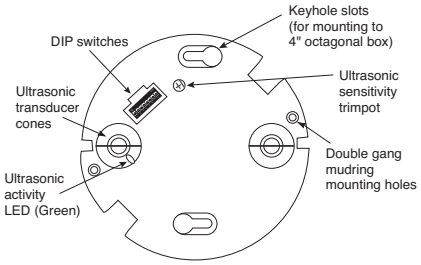


Ceiling Mounting



Controls & Settings

Product Controls



DIP Switch Settings

On Mode	1
Auto On	– ◄
Manual On	●

Override	2
Normal	– ◄
Override	●

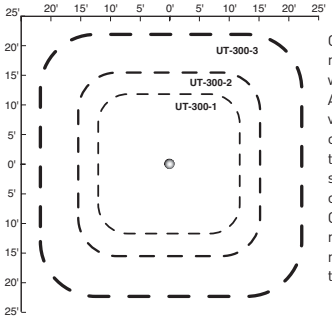
Time Delay	3	4	5
5 sec/SmartSet 🚶	–	–	– ◄
5 minutes	–	–	●
10 min. 🚶	–	●	–
10 minutes	–	●	●
15 min. 🚶	●	–	–
15 minutes	●	–	●
20 minutes	●	●	–
30 min. 🚶	●	●	●

LED	6
Disabled	–
Enabled	● ◄

◄ = Factory Setting
● = ON
– = OFF
🚶 = walk-through mode

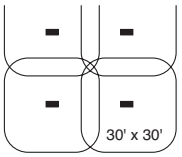
Coverage & Placement

Coverage



Coverages shown represent half-step walking motion. Actual coverages can vary for each application depending on the shape and use of space and the obstacles present. Coverage may be reduced if product is mounted greater than 12 feet high.

Placement



A typical layout for an open office space would be to place UT sensors so they control zones that overlap. For partitioned spaces, a typical zone is about 25' x 25' with an overlap on the coverages that senses motion up to 30' x 30'.

Ordering Information

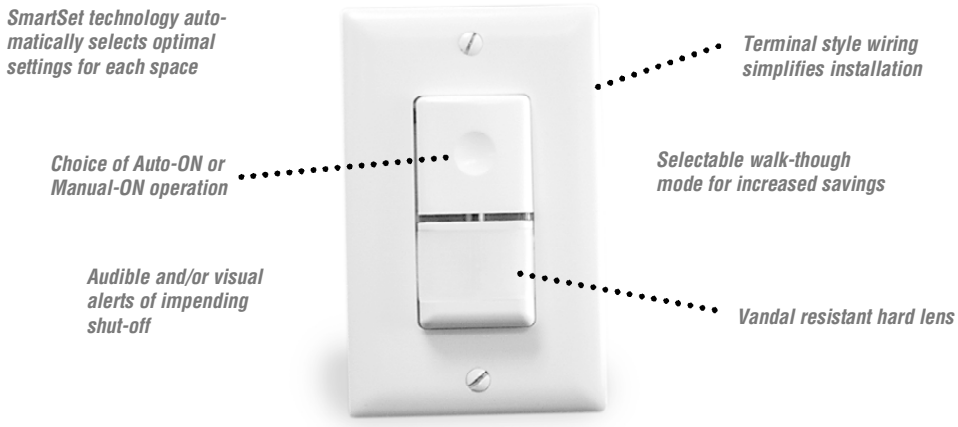
Catalog No.	Voltage	Current	Coverage	Feature
☐ UT-300-1	24 VDC	40 mA	500 ft² (46.5 m²)	Isolated relay
☐ UT-300-2	24 VDC	40 mA	1000 ft² (92.9 m²)	Isolated relay
☐ UT-300-3	24 VDC	45 mA	2000 ft² (185.8 m²)	Isolated relay
☐ UT-305-1	24 VDC	30 mA	500 ft² (46.5 m²)	
☐ UT-305-2	24 VDC	30 mA	1000 ft² (92.9 m²)	
☐ UT-305-3	24 VDC	35 mA	2000 ft² (185.8 m²)	

All units are white and use Watt Stopper power packs. Current consumption can be slightly higher when only one sensor per power pack is used.

Watt Stopper/Legrand®
Pub. No. 16902

WattStopper #		SA
Brian Smith	**UCSD Cal IT2 - Controls**	**# of #**

WA-200 Automatic Wall Switch



Product Overview

Description

The WA-200 passive infrared automatic wall switch turns lighting on and off based on occupancy. These switches feature our innovative SmartSet™ technology which eliminates the adjustment process.

Operation

The WA-200 replaces existing wall switches and operates between 100 and 300 volts. The WA uses advanced passive infrared technology to detect occupancy and turn lights on. Once a space is vacated and the time delay elapses, lights automatically turn off. DIP switch settings allow for a variety of additional control options such as Manual or Automatic-ON, time delay, light level sensing, sensitivity, and audible or visual alerts.

SmartSet

Using SmartSet™ technology, the WA-200 requires no adjustment at installation. SmartSet continuously monitors the controlled space to identify usage patterns. Using this information, it automatically adjusts the time delay and sensitivity settings for optimal performance and energy efficiency. The sensor assigns short delays (as low as 5 minutes) for times when the space is usually vacant, and longer delays (up to 30 minutes) for busier times.

Applications

The WA-200's many options, ease of installation, and great energy saving potential add up to a large return on investment. The sensor's hard lens enables it to be used in public spaces such as teachers' offices and small storage areas in addition to standard applications of offices, small conference rooms, copy rooms, and other enclosed, small building spaces.

Features

- Advanced control logic based on RISC microcontroller provides:
  - Detection Signature Processing eliminates false triggers and provides immunity to RFI and EMI
  - SmartSet automatically adjusts sensitivity and time delay settings to fit occupant patterns
  - Walk-through mode turns lights off 3 minutes after the area is initially occupied
- Hard lens makes sensor resistant to vandalism
- Terminal style wiring makes installation quick and easy, eliminating the need for wire nuts
- Choice of automatic-ON or manual-ON operation
- Optional alerts for impending shut-off include light flash, audible, or both
- For safety, there is no leakage to load in the off mode and sensor is safety grounded

WattStopper #		**SB**
Brian Smith	**UCSD Cal IT2 - Controls**	**# of #**

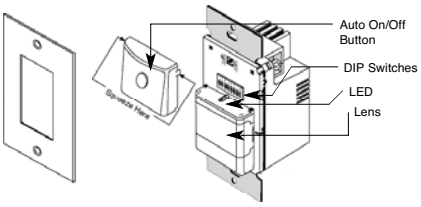
WA-200 Technical Information

Specifications

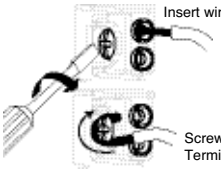
- Universal 100 - 300 VAC; 50/60 Hz operation
- Coverage of 180 degrees, maximum 300 ft² (27.9 m²), 150 ft² (13.9 m²) for desktop activity
- Time delays: SmartSet (automatic), fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode
- Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity
- Adjustable light level setting of 8 to 180 footcandles (86.1 to 1,937.5 lux)
- 1.0 mm hard, poly IR 2 lens; 2 level lens for superior desktop detection
- Compatible with all electronic ballasts and PL lamp ballast systems
- Dimensions: 2.6" x 1.7" x 1.9" (66.0mm x 43.2mm x 48.3mm) L x W x D
- UL and CUL listed; 5 year warranty

Controls & Wiring

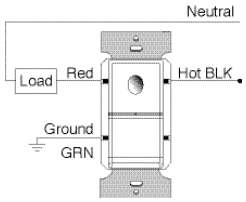
Controls & Installation



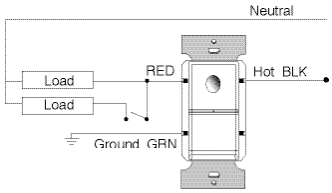
Wire Connections



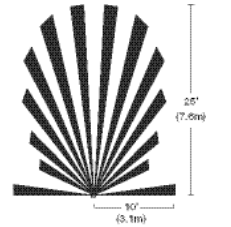
Single Level Lighting



Manual Bi-level Lighting



Coverage



The 2-level lens provides superior coverage at a desk-top level by allowing the sensor to detect vertical as well as horizontal motion.

DIP Switch Settings

	Time Delay	1	2	3	
*	15 sec/SmartSet	↓	↓	↓	◀
	5 minutes	↓	↓	↑	
*	10 minutes	↓	↑	↓	
	10 minutes	↓	↑	↑	
*	15 minutes	↑	↓	↓	
	15 minutes	↑	↓	↑	
	20 minutes	↑	↑	↑	
*	30 minutes	↑	↑	↓	
	Sensitivity			**4**	
	High/SmartSet			↓	◀
	Low			↑	
	ON Mode			**5**	
	Auto On			↓	◀
	Manual On			↑	

Light Level		**6**
Disabled	↓	◀
Enabled	↑	
Audible Alerts		**7**
Disabled	↓	
Enabled	↑	◀
Visible Alerts		**8**
Disabled	↓	◀
Enabled	↑	

↑ = ON ↓ = OFF
◀ Factory settings
★ Walk-through mode enabled
Number indicates DIP switch position

Ordering Information

Catalog No.	Voltage	Load Requirement	Coverage
WA-200	100/120 VAC; 50/60 Hz or 230/277 VAC; 50/60 Hz	0-800 Watt Ballast or 0-1200 Watt Ballast	up to 300 ft²; 180° 27.9 m²
ASP-211	Cover plate for single gang box (one included with each unit)		
ASP-422	Blank cover plate for 2-gang box		
ASP-432	Cover switch plate for 2-gang box with switch option		

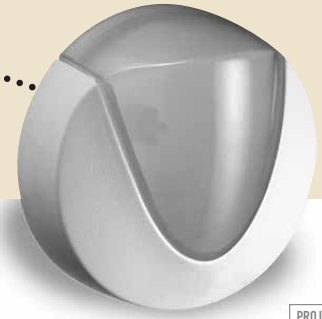
Add to the end of catalog no.: **-W** for white, **-I** for ivory, **-G** for grey, **-B** for black, **-A** for light almond

The Watt Stopper®, Inc.
Pub. No. 14003

LightSaver® LS-290C Photocell

Photocell for LightSaver LCD-203 and LCO-203 controllers

Mounts vertically or horizontally



Footcandle range from 3 - 6000

Architecturally attractive design

PROJECT

LOCATION/TYPE

Product Overview

Description

Watt Stopper/Legrand's LightSaver LS-290C photocell provides the daylight data necessary for operation of the LCD-203 and LCO-203 daylighting control systems.

Operation

Utilizing a photodiode element, the LS-290C continuously measures ambient light levels. The sensor is positioned to "see" incoming daylight from either a window or skylight without seeing electrical light. Users select the applicable footcandle range by a jumper beneath the front cover.

Specifications

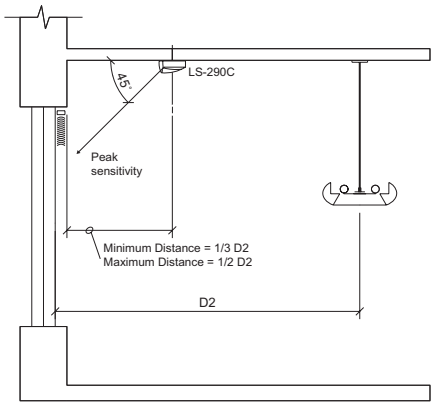
- Three jumper-selectable footcandle ranges: 3-300 fc, 30-3000 fc, 60-6000 fc
- Low voltage, Class 2 device
- Protective hard plastic cover
- 3 conductor 22 AWG twisted cable equal to Belden 8443
- Maximum wire length is 250 feet (76.2m)
- Dimensions: 2" diameter x 1.2" deep (50.8mm diameter x 30.5mm deep)
- UL and CUL listed, five year warranty

Ordering Information

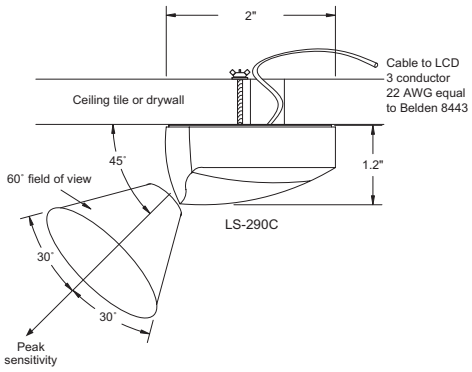
Catalog No.	Description	Footcandle range
☐ LS-290C	Photocell	3 - 6000 (32 - 64,000 lux)

Pub. No. 9606

Photocell Placement



Installation and Wiring



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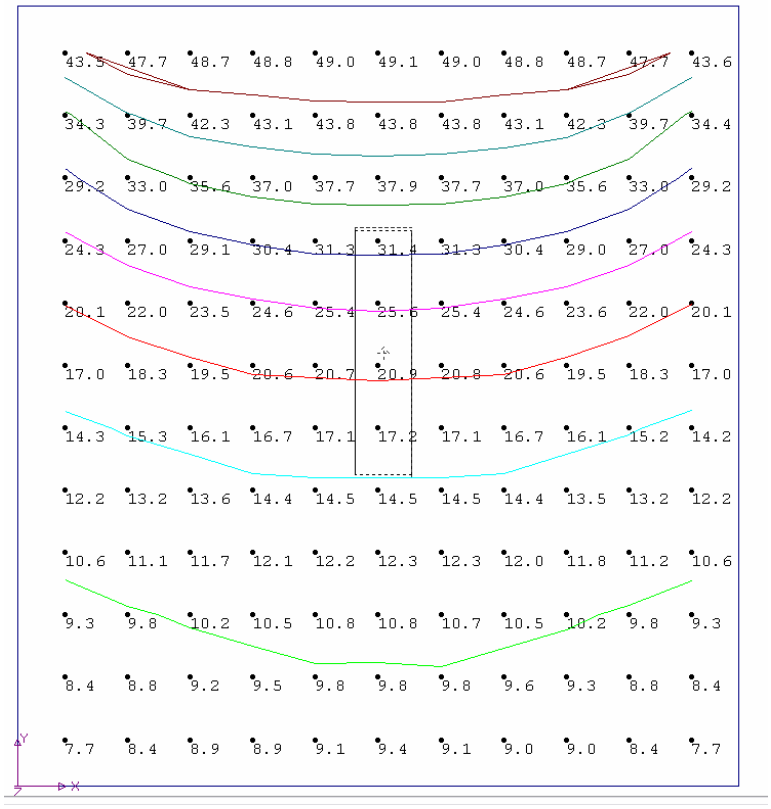
Appendix D

Daylighting Calculations for Private Office

Daylighting Grids

Below are the various tests I performed for the daylighting study in the private office for the 3100 Research Cluster. I used a 60% transparency for the window because of the tinted glass in place. I only tested the two days of the year which each affect the space in different ways. June 21st was not shown because the building will not be used as often in the summer months compared to the usual school semester. It is also unnecessary because of the expected sun contribution during those months. Direct sun doesn't really enter these offices because of their orientation and location, but the suns reflected light makes a large impact on these spaces. Each are labeled the day and time and orientation with the average, maximum, and minimum illuminance values in footcandles. Only the critical times are shown below.

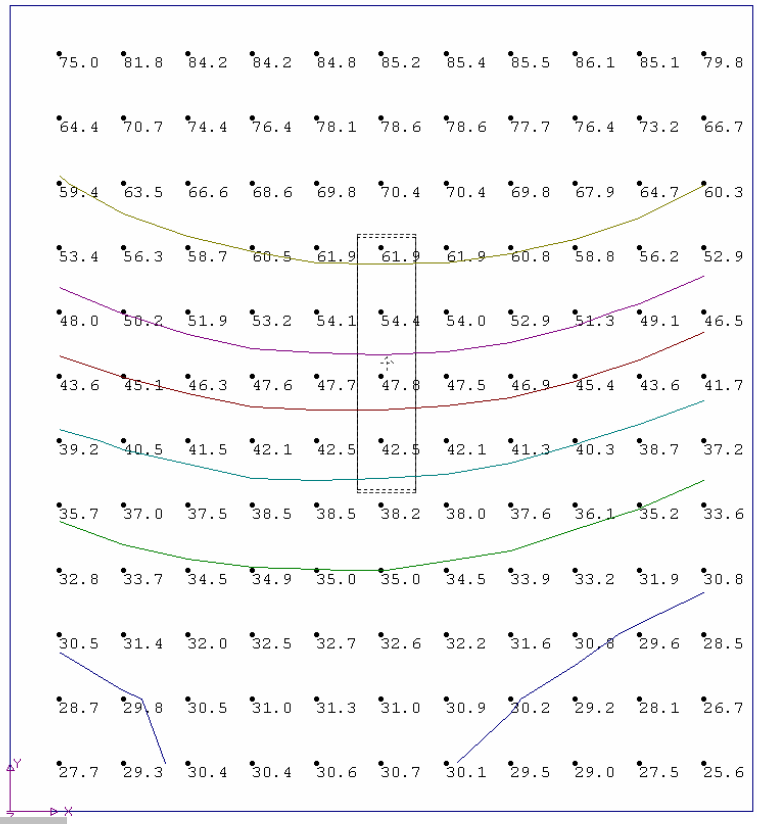
December 21, 4 PM, Overcast



Illuminance Values

Avg - 22.02 fc
Max - 49.1 fc
Min - 7.7 fc

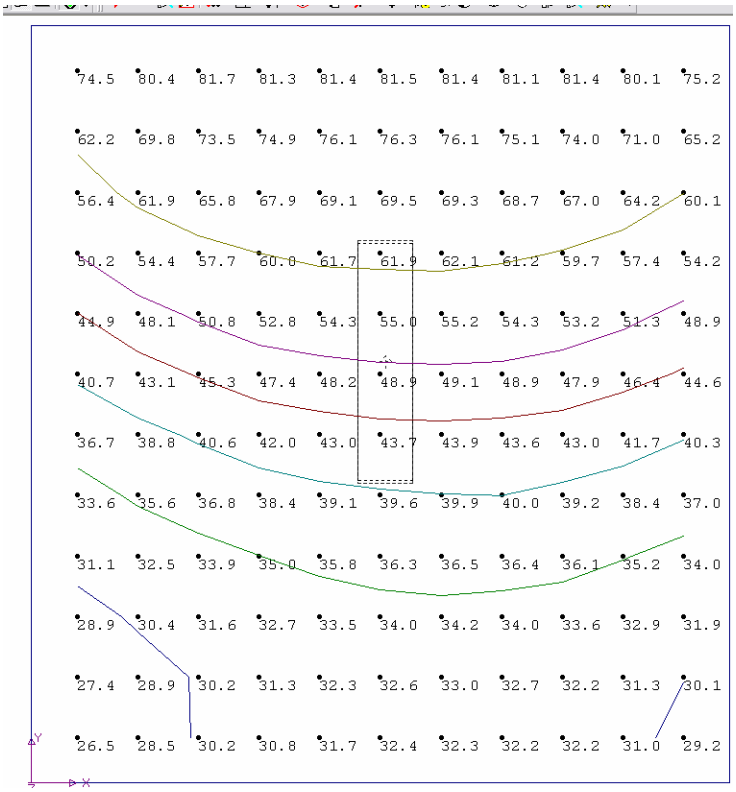
December 21, 4 PM, Clear Sky, North Facing Windows



Illuminance Values

Avg - 48.43 fc
Max - 86.1 fc
Min - 25.6 fc

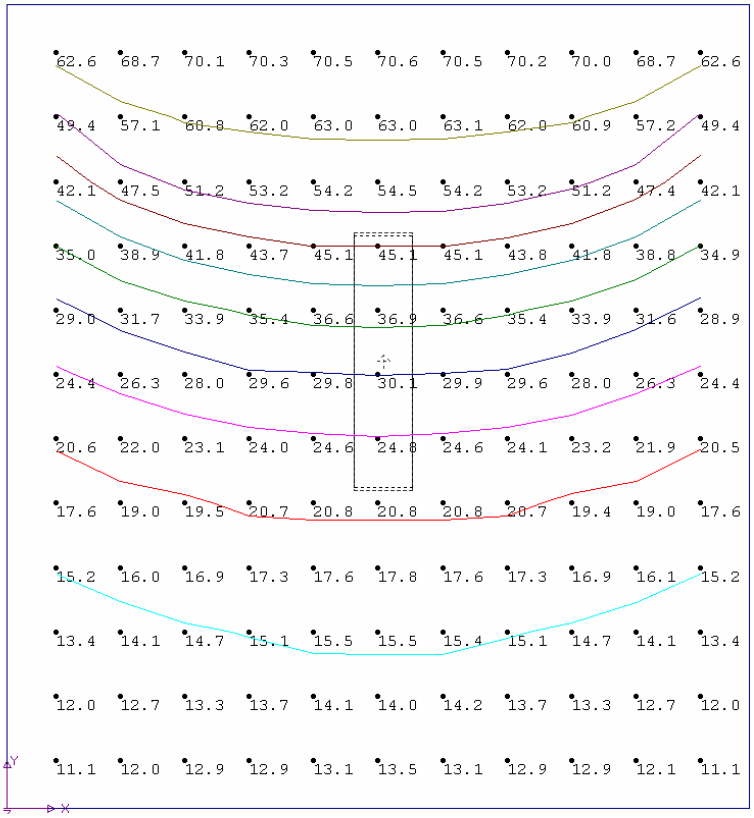
December 21, 4 PM, Clear Sky, East Facing Windows



Illuminance Values

Avg - 48.55 fc
Max - 81.7 fc
Min - 26.5 fc

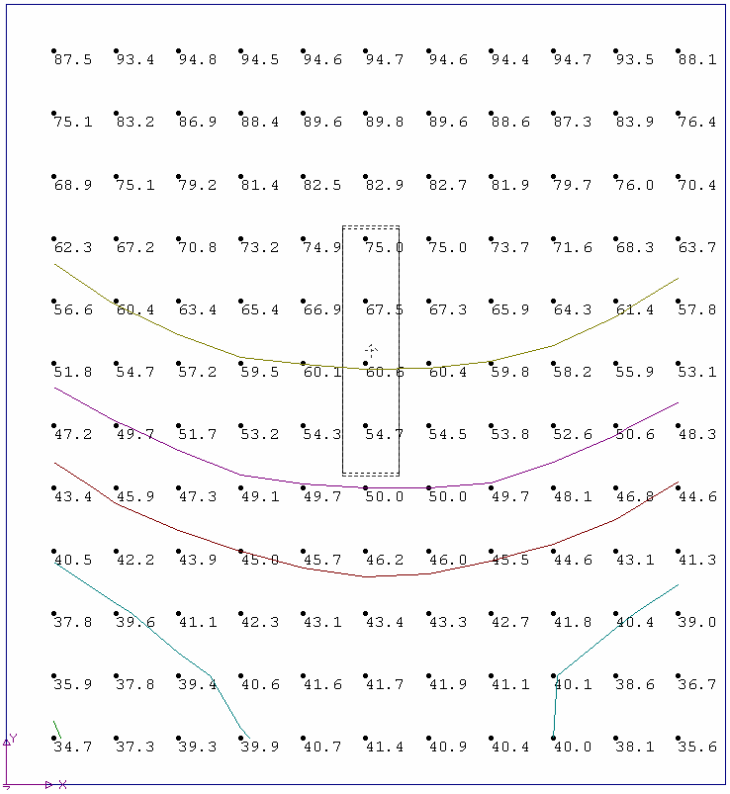
March 21, 5 PM, Overcast



Illuminance Values

Avg - 31.68 fc
Max - 70.6 fc
Min - 11.1 fc

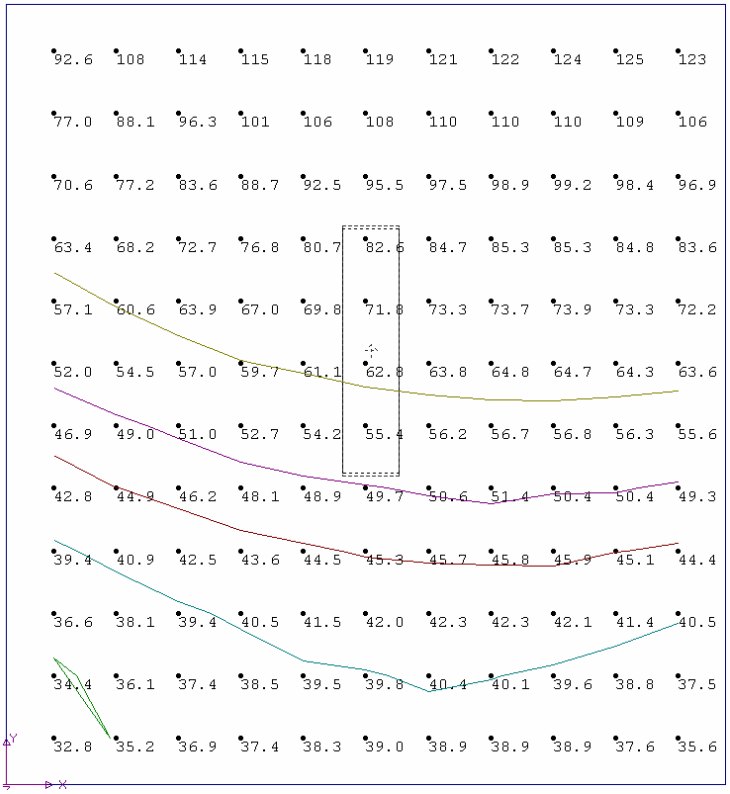
March 21, 5 PM, Clear Sky, East Facing Windows



Illuminance Values

Avg - 59.28 fc
Max - 94.8 fc
Min - 34.7 fc

March 21, 5 PM, Clear Sky, North Facing Windows



Illuminance Values

Avg - 65.06 fc
Max - 125 fc
Min - 32.8 fc