ARCHITECTURAL ENGINEERING THESIS SUMMARY REPORT

Spring 2009
04.07.09

UCI Natural Science Unit II

Grant W Kightlinger

L / E Option

Electrical Advisor: Prof. Ted Dannerth

Lighting Advisor: Dr. Kevin Houser

Pennsylvania State University

Architectural Engineering Senior Thesis

UCI natural sciences unit two

irvine, california

grant w kightlinger
lighting/electrical

http://www.engr.psu.edu/ae/thesis/portfolios/2009/gwk124

info

project area: 146,075 ft²
height: 5 stories
total cost: $45M
construction time: 17 mar 2005 – 01 sep 2008
delivery method: modified design / build

team

owner: the university of california irvine
architect of record: carrier-johnson
design architect: zimmer-gunsul-frasca architects
general contractor: hensel phelps construction co.
structural: bfl owen & assoc.
civil: boyle engineering
mechanical: ma engineers
electrical: konsortum 1
landscape: ima design

arch

The academic building is composed of a four-story laboratory wing and a five-story office wing which form the shape of an “L”, with a two-story entrance lobby located between the two. A small outdoor courtyard is sheltered on two sides by the wings of the building. The fifth floor features a terrace with access to the main stair. Concrete shear walls and red granite panels make up the building façade. The roof is reinforced modified bitumen with copper and steel accents.

struc

18” thick concrete shear walls form the bulk of the façade. The building foundation consists of reinforced piles below a 6” slab-on-grade. 10” thick two-way slabs are typical on upper floors. The structure employs a reinforced concrete framing system with 8” drop panels.

ltg/ elec

A 12kV service connected to UCI’s underground distribution network provides normal power to the building. A 2500kVA pad-mounted transformer feeds the 480/277V three-phase system. A 1250 kW diesel generator provides emergency backup power. 2’ x 4’ linear fluorescent fixtures are typical throughout office and lab areas. Recessed compact fluorescent downlights are used in public and circulation areas.

mech

Three air handling units located in the mechanical room on the first floor supply conditioned air to the spaces and have a combined 160,000 cfm capacity. Constant air volume and variable air volume terminal units with reheat coils are used within the branch duct system.

CONTENTS

EXECUTIVE SUMMARY

Natural Science Unit II is a notable new building on the campus of The University of California Irvine. This report presents a summary of work completed in the spring semester of 2009, and is the culmination of a year-long study of various systems within the building and their interaction with one another. The primary focus of this report is the lighting and electrical systems within Natural Sciences Unit II.

The lighting depth section presents a redesign of the architectural lighting for four student-selected spaces: the building's north façade and entry plaza, the main entry lobby, the main conference room, and a third floor open office space. New designs have been conceived based on several technical and aesthetic criteria relating to the use and architectural style of the facility. Calculations and renderings have been performed to confirm the effectiveness of the proposed redesigns for each of the four spaces. Unique design concepts and developments are also discussed in each section. Proposed solutions are generally responsive to design goals and are successful in meeting the design criteria set forth.

In addition to the lighting redesign, an electrical systems redesign was also performed to accommodate changes in the building illumination systems. Panelboards and feeders for each room were sized according to the redesigned load, and circuiting and control diagrams are presented. A protective device coordination and short circuit analysis have also been performed for a path through the electrical distribution system. Additional depth studies in the electrical section include a feasibility analysis of the installation of a photovoltaic array on the roof of the building, and a study of the possible financial and performance implications of changing the building's feeder material from copper to aluminum. Both of these solutions represent a significant opportunity for fiscal savings by the university.

As energy efficiency is a major concern in most modern institutional projects, a daylighting study has been performed for the open office space on the third floor. Daylight conditions throughout the year have been evaluated an appropriate photosensor-based system has been designed for the space to allow wiser use of energy and materials.
Two additional topics outside the lighting and electrical focus have been studied and are also presented here. First, a mechanical study evaluating the heat loss through a large expanse of glass in the main lobby has been performed, and suggestions for improving the building's glazing system are given. An acoustical study of the lobby space was also completed through the discussion of architectural modifications, building materials, and reverberation times and was found to be acceptable.

Through the simultaneous evaluation of all these topics, this report provides insight into the unique building systems and integration issues concerning UCI Natural Science Unit II.

BUILDING STATISTICS

General

Project Name: University of California Irvine Natural Sciences Unit II
Location: Irvine, California, USA
Building Occupant: The University of California Irvine, Physical and Biological Science Departments
Size: 146,075 Square Feet
Number of Stories: Five levels above grade
Dates of Construction: March 2005 – September 2008
Total Building Cost: $45.5M
Delivery Method: Modified Design Build
Major National Codes: 2001 California Building Code (UBC with amendments)

Project Team

Owner: The University of California Irvine
Architect of Record: Carrier-Johnson Architects
Design Architect: Zimmer-Gunsul-Frasca Architects
General Contractor: Hensel Phelps Construction Co.
Structural Engineer: BFL Owen & Associates
Civil Engineer: Boyle Engineering
Mechanical Engineer: MA Engineers
Electrical Engineer: Konsortum 1
Landscape Architect: IMA+ Design

Architecture

The building includes a four-story laboratory and classroom wing and a five-story office wing which form the shape of an "L", with a two-story entrance lobby located between the two. The facility is shared by the Schools of Biological and Physical Sciences, each predominantly occupying two floors of the structure. A small outdoor courtyard is sheltered on two sides by the wings of the building. The fifth floor features a balcony with access to the main stair. The architecture is modern and consistent with existing surrounding buildings and the master plan of the campus.

Construction

A modified design-build scheme was used for this construction. DD-level 'bridging' plans and specifications were prepared, and then were bid on and completed by the design-build team. Construction was completed for the project on September 1, 2008.

Building Envelope

The exterior façade is composed of 18" concrete shear walls with interior furring and insulation. Architectural red granite panels are attached at the base of the building. The doors and windows feature dual-pane, low-e glazing for energy conservation. Ceramic tiles are used in some areas as exterior accents. Stainless steel and copper accents are also used on the main stair tower. The roof is constructed of reinforced modified bitumen built up over rigid foam insulation.

Construction

A modified design-build scheme was used for this construction. DD-level 'bridging' plans and specifications were prepared, and then were bid on and completed by the design-build team. Construction was completed for the project on September 1, 2008.

Electrical

Natural Science Unit 2 is connected to the University of California Irvine utility distribution system. The building's electrical distribution system is radial with a service entrance in the electrical room at the southeast corner of the main building. A 2500 KVA, 3Ø, 4W, pad-mounted transformer reduces the campus supply voltage from 12kV to 480/277V. A 4000A main switchboard distributes power to subsequent panel boards throughout the building. Emergency backup power is provided by a 1250 KW, 480/277V diesel generator located in the high energy lab building. The emergency power system feeds life safety and lab critical distribution panels for the building.

Lighting

The lighting system in the building is generally modern and designed to reduce power consumption. Lobbies and public areas feature recessed compact fluorescent downlights and some cove lighting while laboratories and offices predominantly use recessed 2' by 4' linear fluorescent fixtures. Conference rooms on each floor utilize both compact and linear fluorescent sources in a multi-scene control system. The main atrium space includes two decorative metal halide pendants on the second and fourth floors. The building orientation allows daylighting to be a significant source of light in many spaces, further reducing energy use during the day.

Mechanical

Three air handling units located in the mechanical room on the first floor supply conditioned air to the spaces and have a combined 160,000 cfm capacity. Constant air volume and variable air volume terminal units with reheat coils are used within the branch duct system.

Structural

Natural Science Unit 2 uses a reinforced concrete pile foundation system. The first floor of the building is slab-on-grade of varying thickness. 10" thick two-way slabs are typical on all upper floors. 20" square concrete columns with 8" thick drop panels are located in the office and laboratory wings while the main lobby uses 20" circular columns.

Fire Protection

The fire detection and suppression system features a central control center with interface panel. Fire sprinkler flow and tamper switches, elevator status, smoke fire dampers and relays can be monitored and controlled through the interface panel. Visible and audible cues are used to alert occupants in an emergency. The entire fire system is backed up by a dedicated battery system.

Transportation

Two elevators and three stairwells allow vertical circulation through the main building. The main entry stair is outdoor with access to the lobby at the northwest corner of the building and the terrace on the fifth floor

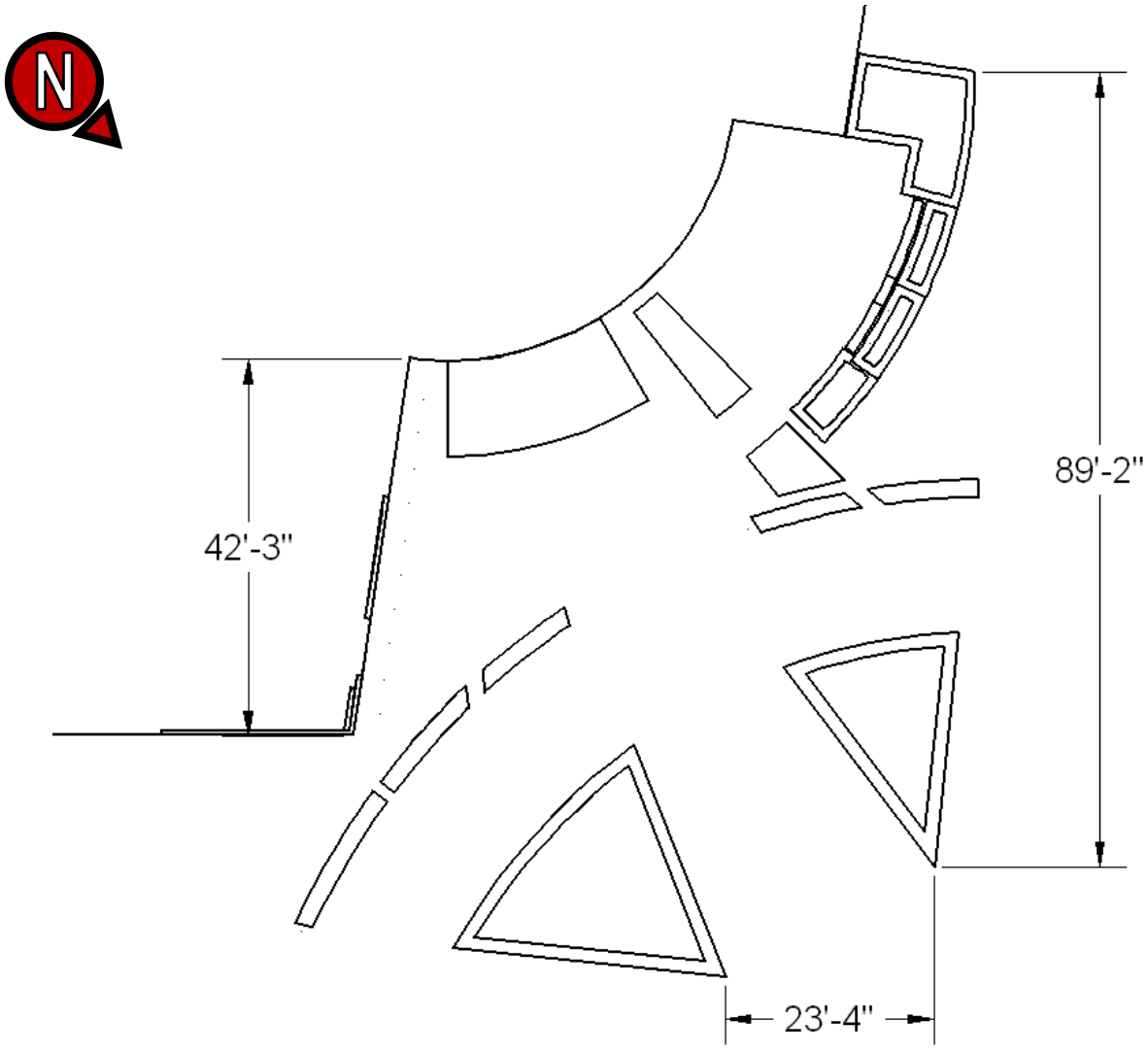
Communications

The building's main distribution frame in the first floor data room is connected to the campus utility tunnel system through underground conduit. Vertically stacked data rooms are located on each floor and act as access points for wiring and conduit. Combination voice/data outlets are located throughout the building. Audiovisual systems are installed in the conference rooms on each floor. A projector is mounted on the ceiling with data input terminals near the south wall of each room. An automatic projection screen is operated by a switch on the south wall.

LIGHTING – NORTH FAÇADE AND PLAZA

The main entry to UCI Natural Science Unit II is marked by a four-story glass curtain wall, an outdoor stair feature and a 5875 square foot landscaped plaza. Trees are located within planters in the center of the plaza, and paving patterns highlight the radial center point within the lobby. The scope of the proposed lighting redesign includes the inner plaza area, the curtain wall, the adjacent office wall, and stair wall at the west side of the plaza. Stairway lighting is not in scope.

Dimensions



Partial Site Plan
Scale: NTS

Materials

Paving

Color:	Slate Grey
Reflectance:	0.20

Stair Wall / Lower Office Wall

Material:	Red Granite Panels
Reflectance:	0.40

Upper Wall

Material:	Exposed Architectural Concrete
Reflectance:	0.50

Glazing

Material:	Heat Mirror 66 – Clear
Transmittance:	0.56
Shading Coefficient:	0.44

Design Concept Development

The north façade and plaza lighting is intended to lead pedestrians into the main entry of the building and to echo the architectural aesthetic of the interior. A strong sense of motion is created by linear elements which converge within the lobby. A transparent connection between the lobby and plaza lighting through the curtain wall bring them together to create one unified space. The cutout section of the stair wall has been accentuated by keeping the exterior wash at a low light level, creating a focal point of the motion of pedestrians up and down the stairway. This also acts to prevent any confusion caused by the stairway being exterior and not within the lobby itself.

The plaza – lobby interaction is the most obvious example of the use of color differences which is echoed throughout the project. A colored LED cove in the interior lobby and blue wall surfaces provide a stark contrast to the warm, earth-tone façade of the building. This difference has been embraced and accentuated in order to create a cool, technological and clean impression of the interior.

The design themes have remained generally the same throughout the project, but the façade lighting was toned down from the first schematic presentation in order to increase transparency into the lobby space. The interior lighting in the lobby (especially near the curtain wall) acts also to create an exterior impression, and great care has been taken to coordinate the two spaces visually. Luminaire maintenance issues also had to be considered here due to the height of the building façade.

Lobby Schematic Design

Design Objectives / Considerations

Appearance of Space and Luminaires

The building façade must maintain its modern, curvilinear feel. Fixture choices should echo these styles, and also highlight the features on the building itself. The plaza area may be allowed to feel more free-flowing or disorganized than the building itself, to compliment the soft, organic forms of the landscaping.

Psychological Impressions

The façade and plaza of the natural sciences building are the first to be experienced by visitors to the building, and they should produce a welcoming and comfortable atmosphere. In keeping with the themes of dynamic activity in the lobby area, the vertical stair is a symbolically important feature. A strong flow between the plaza and the lobby should be created. Transparency and visual clues should lead visitors into the lobby space or up the stairs without confusion.

Glare

In-grade uplights might create a glare problem if their output is too intense. Also, care must be taken to avoid reflections of site fixtures in the curtain wall from producing glare.

Light Distribution on Surfaces

Uniformity is favored for the architectural style of the building, but some non-uniformity is desired in the plaza to highlight organic forms.

Light Distribution on Task Plane

Pathways should be uniformly illuminated for safety.

Points of Interest

The main vertical stair wall, lobby levels within the building, vegetation in the plaza, and paving materials/textures are all focal points in this area.

Control/Daylight Integration

A time clock system is to be installed to ensure that site fixtures are turned off when the building is closed, and/or when there is sufficient daylight.

Technical Objectives

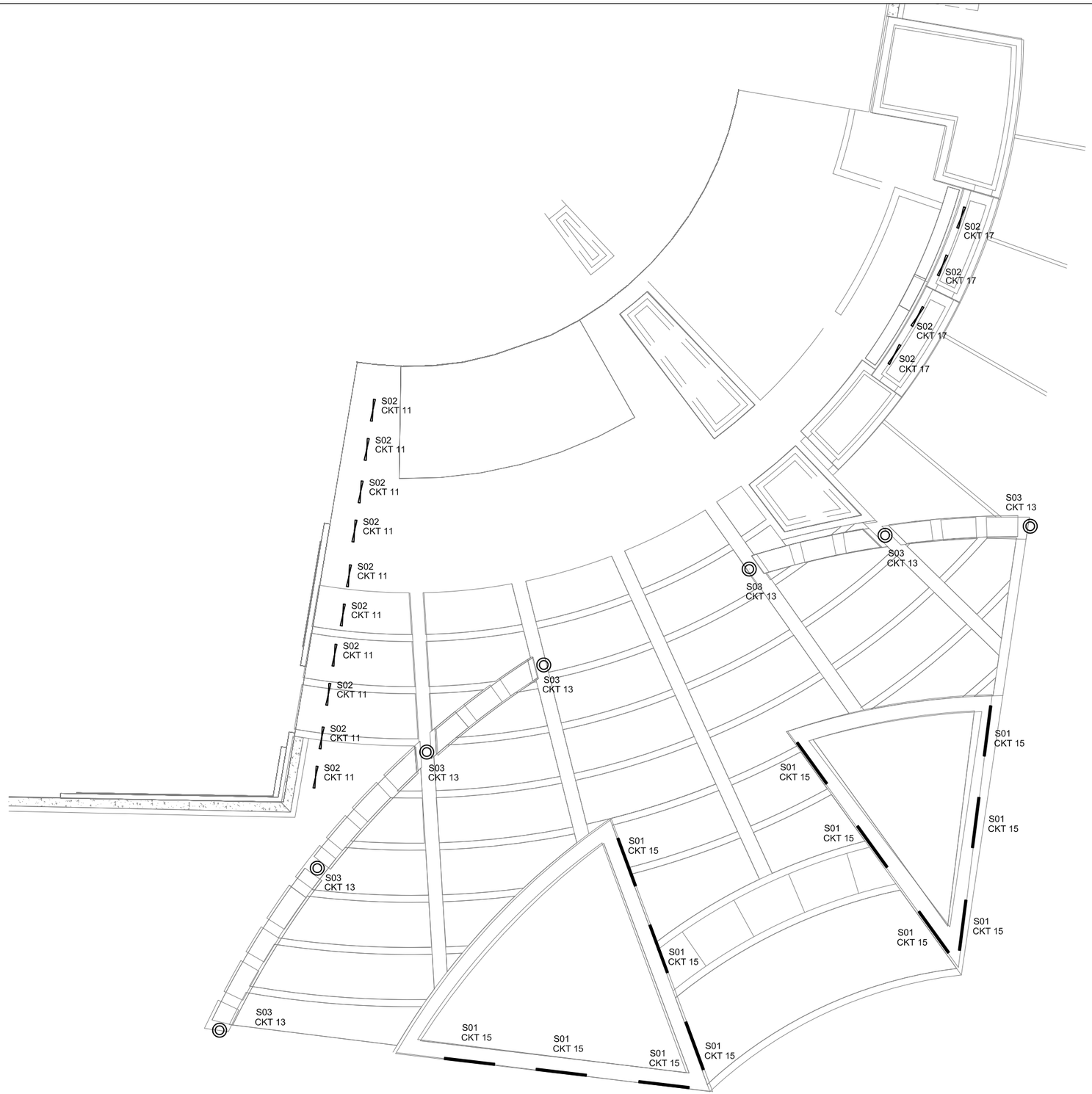
DESCRIPTION	GOAL	RESULT	MET?
Horizontal Illuminance	Floor: **1** fc	**1.64** fc Avg.	**YES**
Power Density (ASHRAE 90.1)	See Below		**YES**

Power Allowances

AREA	QUOTA	MULTIPLIER	ALLOWED WATTS	DESIGNED WATTS
PLAZA	0.2 W/ft²	5875 ft²	1175 W	784 W
ENTRY	30 W/ft of Door Width	6 ft	180 W	0 W
ATTACHED CANOPY	1.25 W/ft²	233 ft²	291 W	0 W
ILLUMINATED WALL (STAIR)	0.2 W/ft²	1015 ft²	203 W	104 W
ILLUMINATED WALL (OFFICE)	0.2 W/ft²	2858 ft²	572 W	260 W
		TOTAL	**2421** W	**1148** W

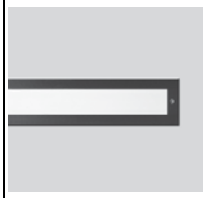
Power Density Calculation

FIXTURE	QUANTITY	WATTS	TOTAL WATTS
S01	12	38.5	462
S02	14	26	364
S03	7	46	322
		TOTAL Watts	1148
		Area (SF)	5875
		Power Density (W/SF)	**0.195**

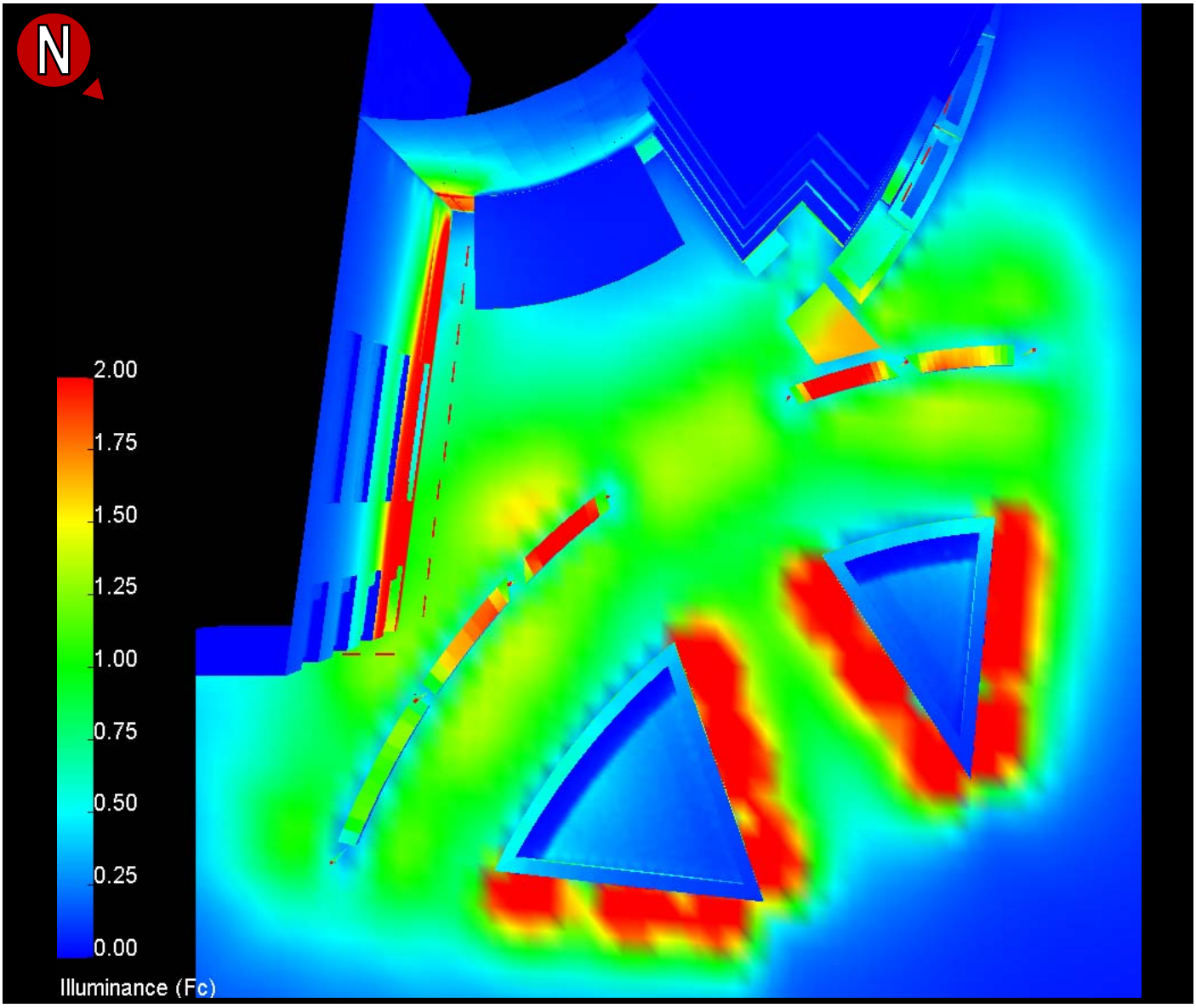


	UCI Nat. Sci. Unit II Irvine, California	Lighting Consultant: Dr. Kevin Houser	Grant Kightlinger L/E Option	Penn State University AE Senior Thesis	PLAZA LIGHTING PLAN 3/32" = 1'-0"

Partial Fixture Schedule

TYPE	IMAGE	MANUF.	DESCRIPTION
OUTDOOR / SITE FIXTURES			
S01		BEGA	RECESSED LINEAR WALL FIXTURE. STAINLESS STEEL FINISH. RATED FOR WET LOCATION.
S02		BEGA	IN-GRADE RECESSED FLODLIGHT. LINEAR FLUORESCENT. DRIVE OVER. RATED FOR WET LOCATION. STAINLESS STEEL FINISH.
S03		BEGA	LINEAR STAINLESS STEEL POLE-MOUNTED SITE FIXTURE. RATED FOR WET LOCATION.

Pseudocolor Renderings

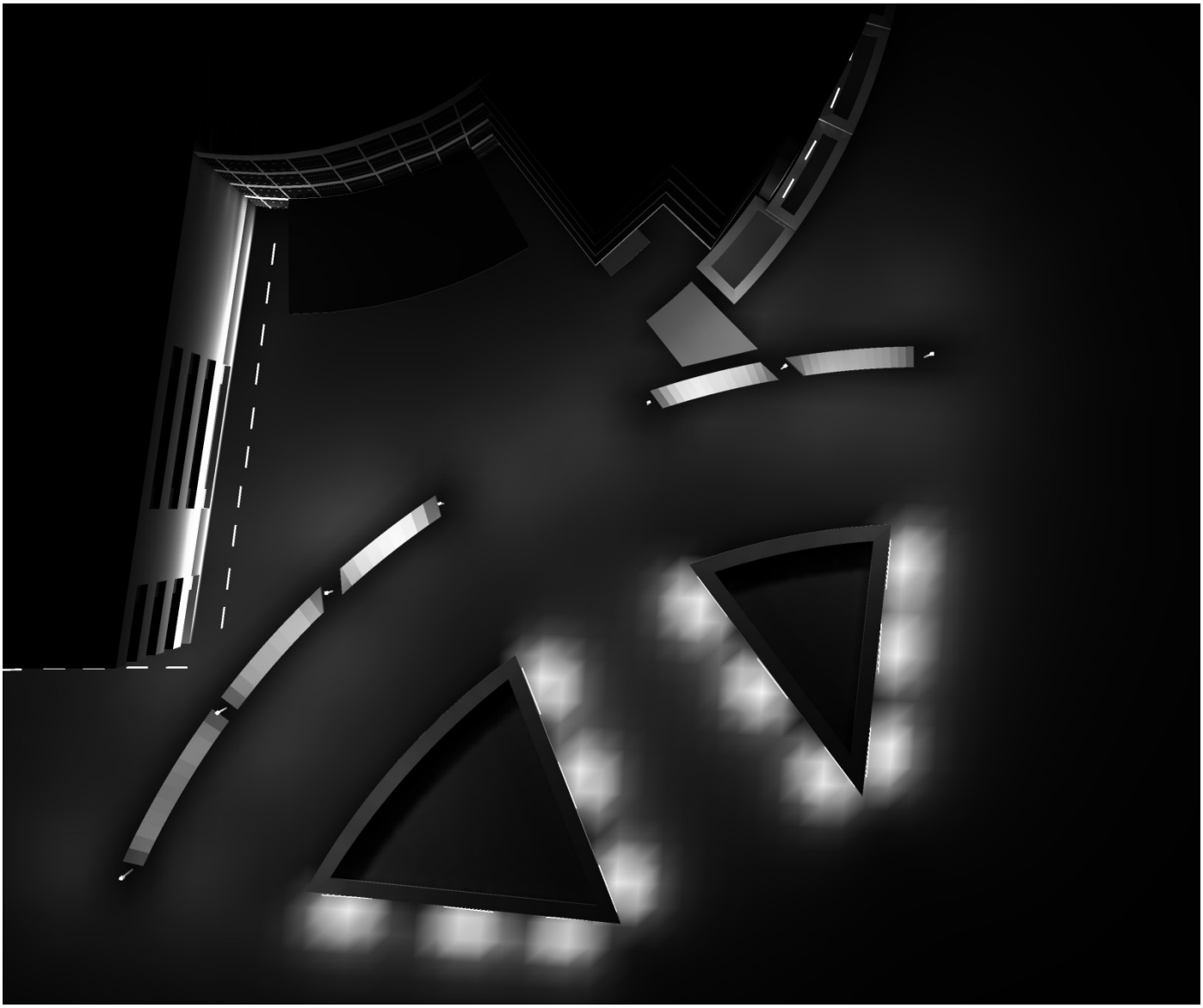


*NOTE: Tree lighting is not included in this calculation.

Statistics

ZONE	HEIGHT	UNITS	AVG	MAX	MIN	AVG/MIN	MAX/MIN
Plaza	0'-0" AFF	fc	1.21	6.00	0.20	6.05	30.00

Renderings



Plaza from Above

Plaza and Façade from Street

Light Loss Factors

FIXTURE	MAINT. CAT.	DISTR.	LLD	LDD	RSDD	BF	TOTAL LLF
S01	VI	DIRECT	0.95	0.80	0.94	1.00	**0.71**
S02	VI	DIRECT	0.95	0.80	0.94	1.00	**0.71**
S03	VI	DIRECT/INDIRECT	0.90	0.80	0.87	1.22	**0.76**

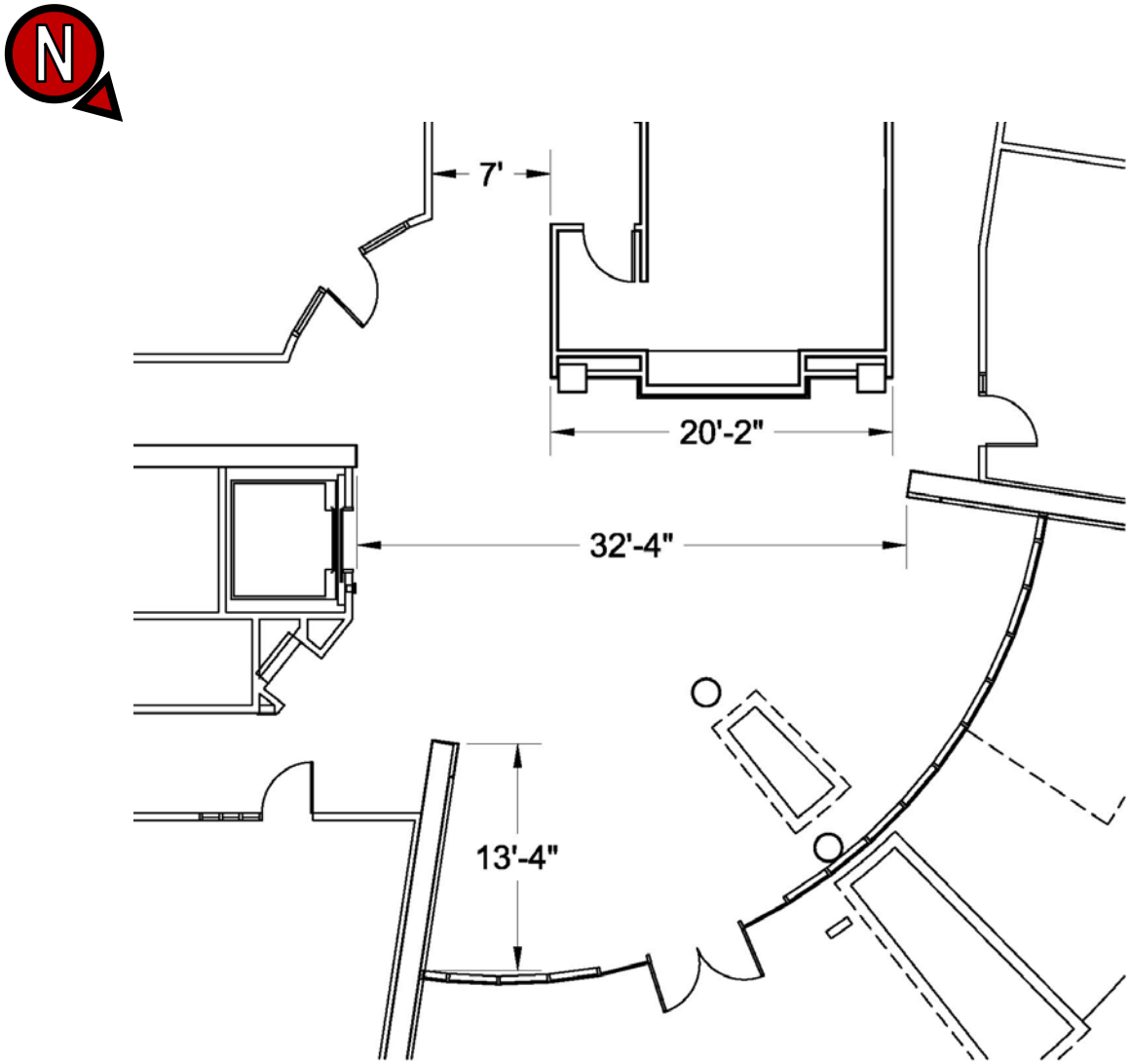
* Assumptions:

1. Medium Environment, 12-month cleaning cycle.
2. 35°C lamp data used in calculations.

LIGHTING – LOBBY

The lobby space adjacent to the north façade is the main entry point for the building. The lobby measures approximately 1230 square feet per floor and features a large curved glass curtain wall to the north. This space is the primary access to classrooms and circulation. Above the main doorway, a double height atrium space connects the first and second floor lobbies. The main conference room is directly adjacent to the lobby on the first floor, and each level provides access to the main outdoor stair of the building.

Dimensions



Partial First Floor Plan
Scale: NTS

Materials

Floor

Material:	Carpet / Stone
Color:	Dark Blue, Tan / Gray
Reflectance:	0.20, 0.20

Walls

Material:	Painted Gypsum / Concrete
Color:	Shell White, Dark Blue, Gray
Reflectance:	0.80, 0.20, 0.30 / 0.3

Whiteboard Wall

Material:	Wood - White Maple
Reflectance:	0.60

Ceiling

Material:	Painted Gypsum
Color:	Shell White
Reflectance:	0.85

Doors

Material:	Wood - White Maple / Painted Steel
Reflectance:	0.60 / 0.2

Glazing (Exterior)

Material:	Heat Mirror 66 – Clear
Transmittance:	0.56
Shading Coefficient:	0.44

Glazing (Interior)

Material:	Translucent Tempered Glass
Transmittance:	0.40

Wooden Wall

Material:	Wood - White Maple
Reflectance:	0.60

Design Concept Development

The lobby acts as the focal point the building and is intended to convey radial and vertical motion, especially from the center point of the space. A strong association with the exterior plaza to the north reinforces a theme of transparency in the building. Lighting highlights the central focus of the space and also leads occupants to key points of circulation such as hallways, doors and elevators. Lighting elements are intended to be viewed both from the interior and the exterior of the building. Vertical pendants located in the two-story atrium area serve as focal points from both sides, and also act to bring the eye up into the atrium space.

Since the first schematic design submission, the lobby (and the rest of the spaces) have come to use more regular and evenly spaced luminaire organization in order to avoid visual confusion and clutter. Radial linear elements have remained the key points of the visual impression in this space. An RGB LED cove has been installed where there was previously a fluorescent cove. This feature would act as a unique identifier for the building, and allows the university to signify special events within the building at night. The default setting for the cove would be blue in order to accentuate the previously mentioned color difference between interior and exterior.

Lobby Schematic Design Submission

Design Objectives / Considerations

Focal Points

The central point of the lobby should be defined. Views of campus from inside should act as additional focal points, especially on the higher floors. Elevators and stairs should be easily identifiable for ease of circulation. The large wooden feature wall on each floor should be highlighted without causing shadows on readable objects mounted on the wall.

Appearance of Space and Luminaires

Clearly the appearance of the lobby/atrium space is critical. This north entry will likely experience the most traffic, as it faces central campus. Night is a critical time when the lobby will be most visible from outside, therefore, light should be used to highlight activity within the lobby and to also produce a welcoming glow from within.

Psychological Impressions

The architecture seems to designate this particular space as the hub of activity for the building, as well as for its adjacent buildings. Thus, a dynamic mood should be reinforced. Radial linear patterns act to support this theme.

Glare

Solar glare should not present a significant problem due to the curtain wall's northerly orientation. Fixture glare should be carefully considered, especially in the double-height atrium space. Any possible viewing angle of the luminaire needs to be considered.

Light Distribution on Surfaces

Walls should be well lit to create a night presence through the curtain wall. General non-uniformity can help to accent visual foci and create a deeper appearance. Local uniformity, however, is still important in maintaining the clean, strong image defined by the existing architecture.

Facial Rendering

As a social space, multi-source ambient light should be used to soften shadows and assume idea facial rendering.

Color

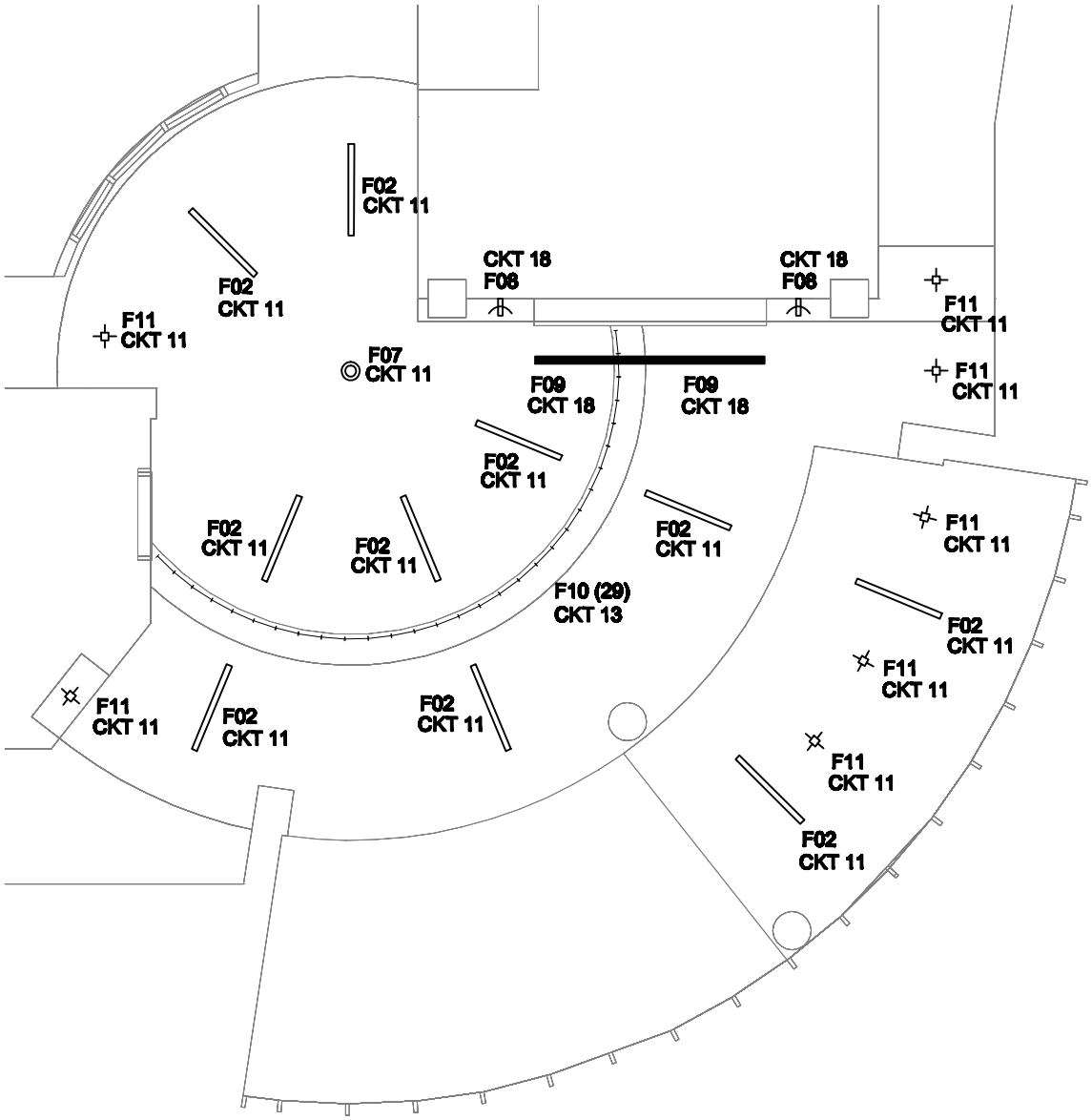
As with the rest of the building, a higher color temperature can help to convey the technology and modernity of the building. Color rendering is also important in this space due to the rich colors of finishes.

Technical Objectives

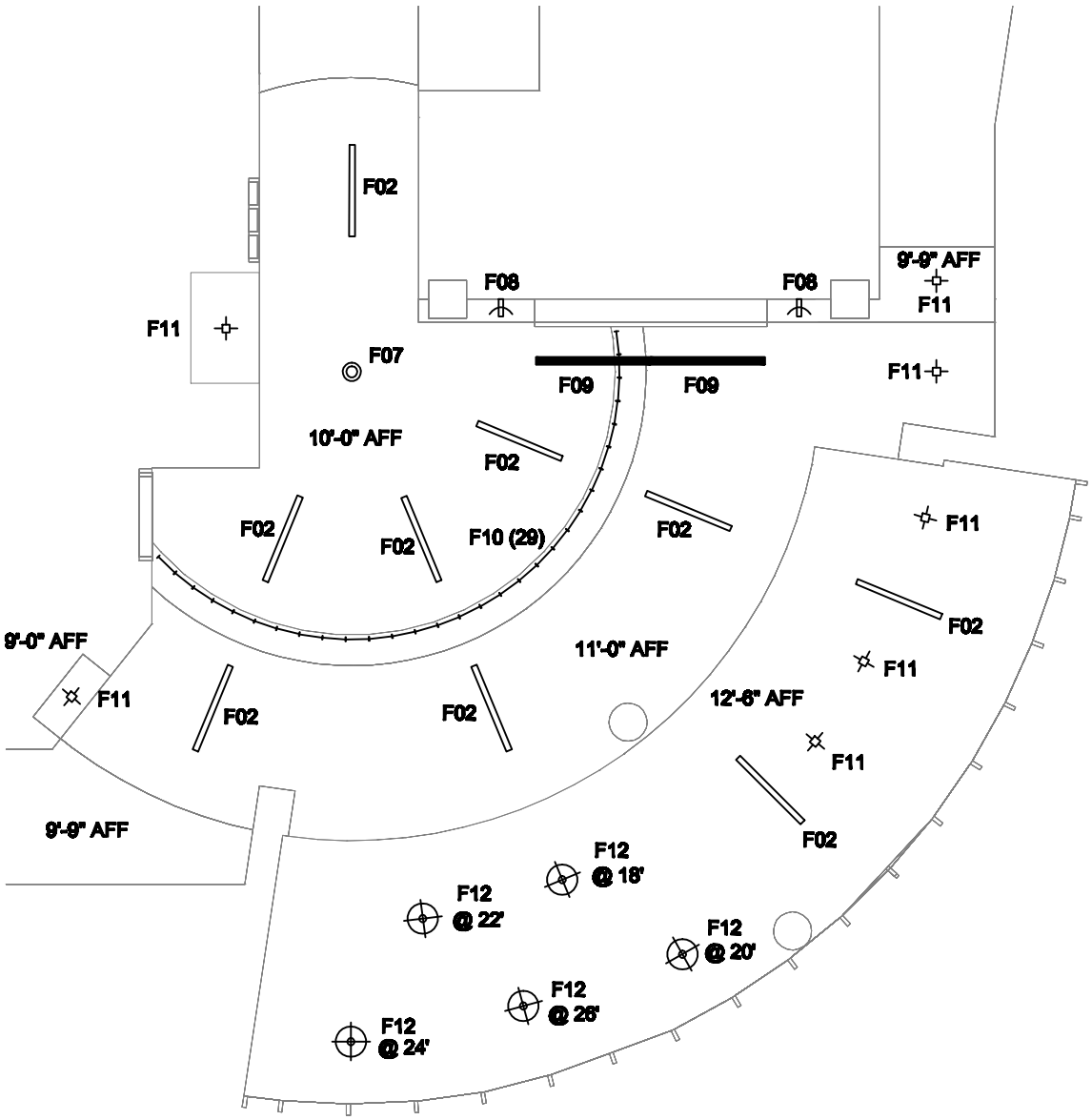
DESCRIPTION	GOAL	RESULT	MET?
Horizontal Illuminance	Floor: **10** fc	**10.1, 9.8** fc Avg.	**YES**
Power Density (ASHRAE 90.1)	**1.3** W/SF (Space Method)	**0.79** W/SF	**YES**

Power Density Calculation (Total First and Second Floors)

FIXTURE	QUANTITY	WATTS	TOTAL WATTS
F02	20	32	640
F07	2	20	40
F08	4	32	128
F09	4	38	152
F10	60	3	180
F11	14	35	490
F12	5	64	320
		TOTAL Watts	1950
		Area (SF)	1230 x 2 = 2460
		Power Density (W/SF)	**0.79**

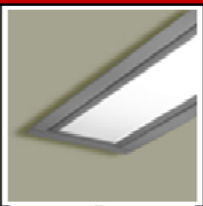
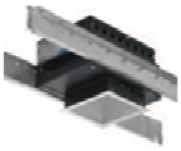


UCI Nat. Sci. Unit II Irvine, California	Lighting Consultant: Dr. Kevin Houser	Grant Kightlinger L/E Option	Penn State University AE Senior Thesis	1F LOBBY LIGHTING RCP 1/8" = 1'-0"

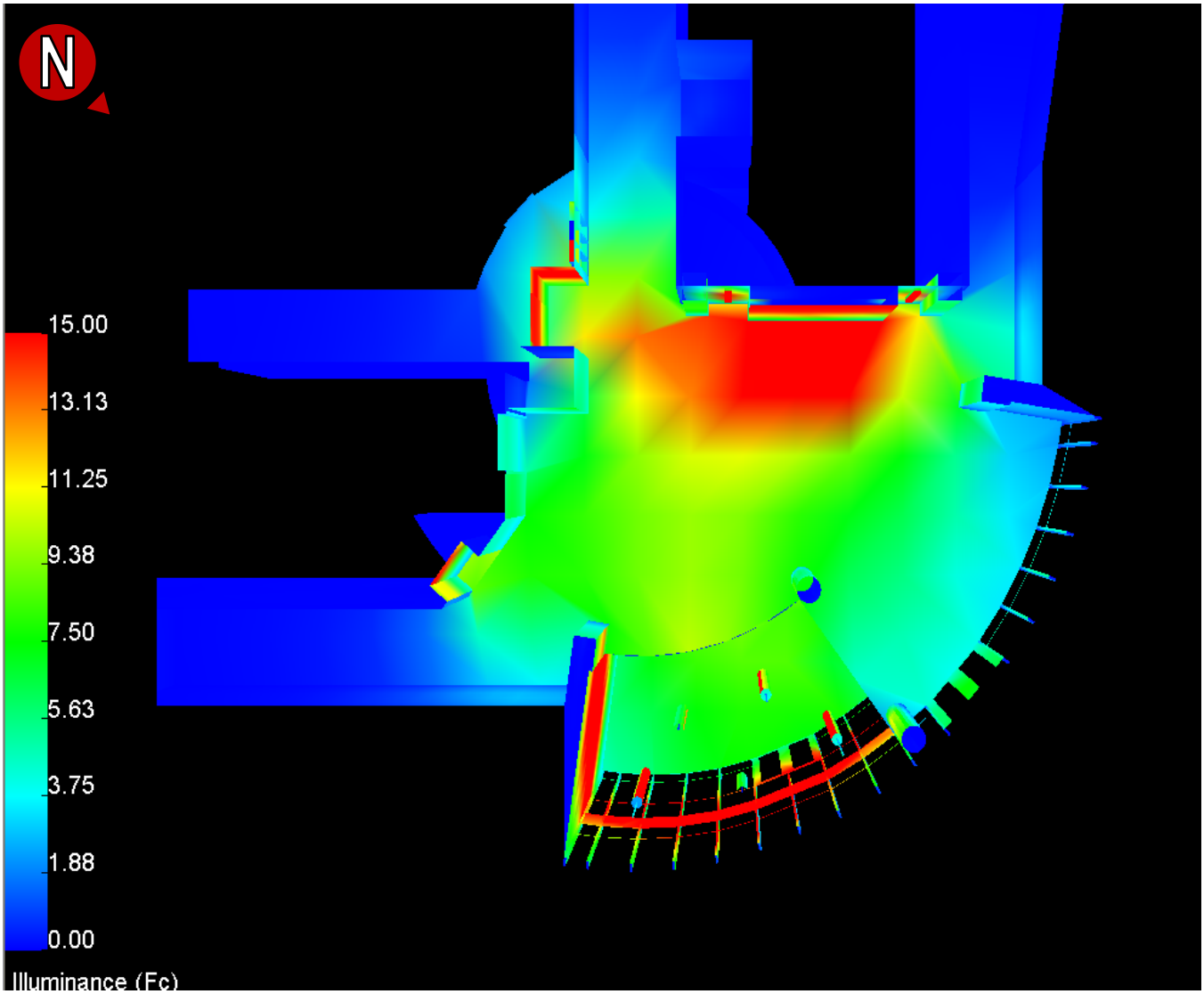


UCI Nat. Sci. Unit II Irvine, California	Lighting Consultant: Dr. Kevin Houser	Grant Kightlinger L/E Option	Penn State University AE Senior Thesis	2F LOBBY LIGHTING RCP 1/8" = 1'-0"

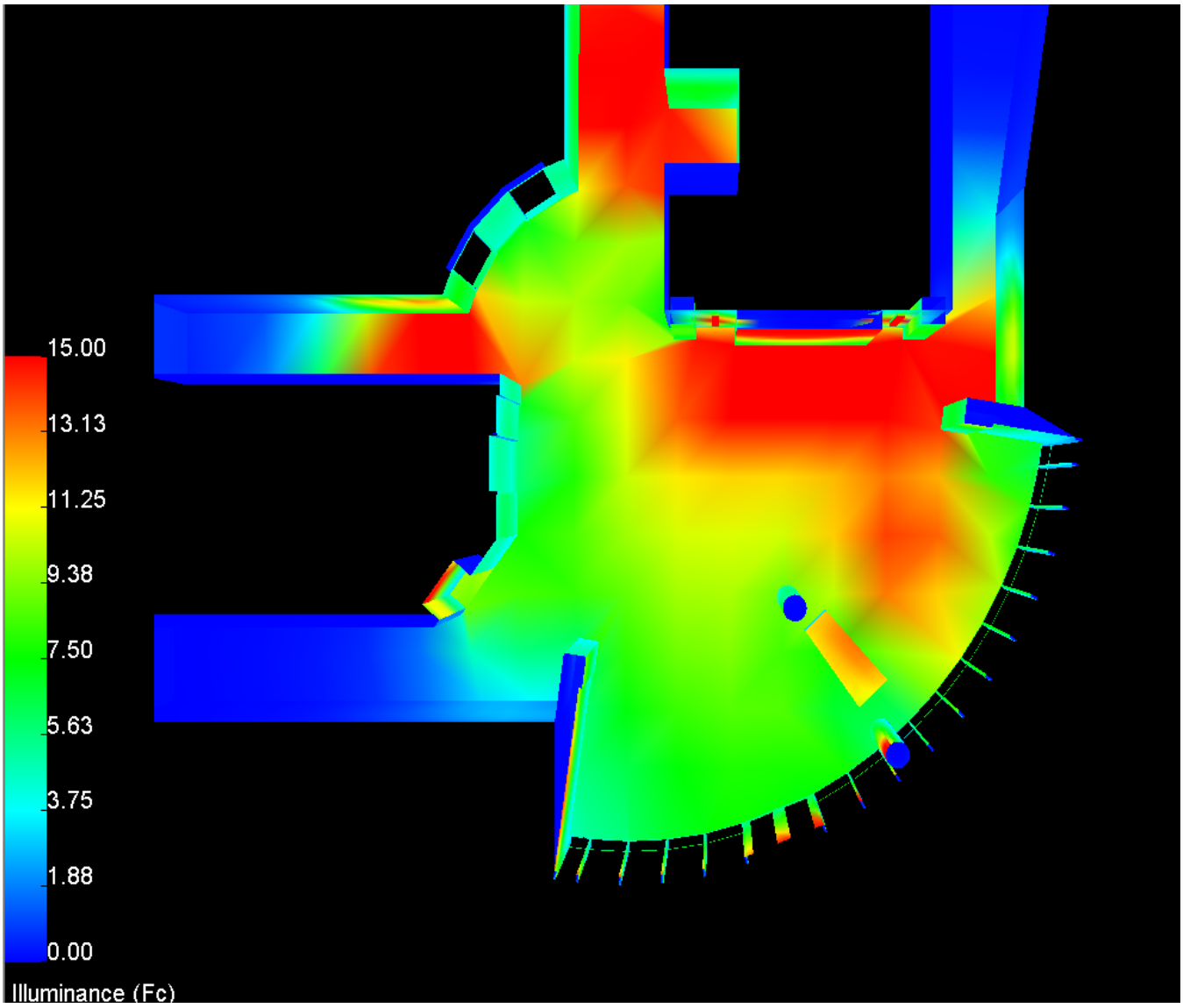
Partial Fixture Schedule

TYPE	IMAGE	MANUF.	DESCRIPTION
INDOOR FIXTURES			
F02		FOCAL POINT	"AVENUE B" - RECESSED SLOT FIXTURE. DIFFUSE FLUSH LENS, SINGLE CIRCUIT, DRYWALL FLANGE, MATTE WHITE HOUSING. STEEL CONSTRUCTION.
F07		LOUIS POULSEN	"BALLERUP"
F08		LIGHTOLIER	"SOLI" WALL-MOUNTED DECORATIVE T5 FIXTURE. METALLIC ALUMINUM FINISH, SEE DIFFUSER SPECIFICATION BELOW (ORDER SEPERATELY). ADA COMPLIANT
F09		ELLIPTIPAR	"STYLE 102" WALL CANTILEVER-MOUNTED WALL WASH LUMINAIRE. BRIGHT ALUMINUM FLUTED HOUSING WITH SILVER END PLATES, 18" CANTILEVEL ARM. 5' LENGTH.
F10		COLOR KINETICS	"iCOLOR COVE QLX" COVE-MOUNTED RGB COLOR-CHANGING COVE FIXTURE. 120 DEGREE CANDLEPOWER DISTRIBUTION, ADJUSTABLE POSITION MOUNTING BRACKET.
F11		PHILIPS	"OMEGA REVELATION" 4-INCH SQUARE CFL DOWNLIGHT. CLEAR SPECULAR REFLECTOR.
F12		SCHMITZ	"TOOL" PENDANT FIXTURE. NO DOWNLIGHT. RIBBED ACRYLIC TUBE, SATIN NICKEL FINISH. ADJUSTABLE SUSPENSION CABLE.

Pseudocolor Renderings



First Floor Lobby



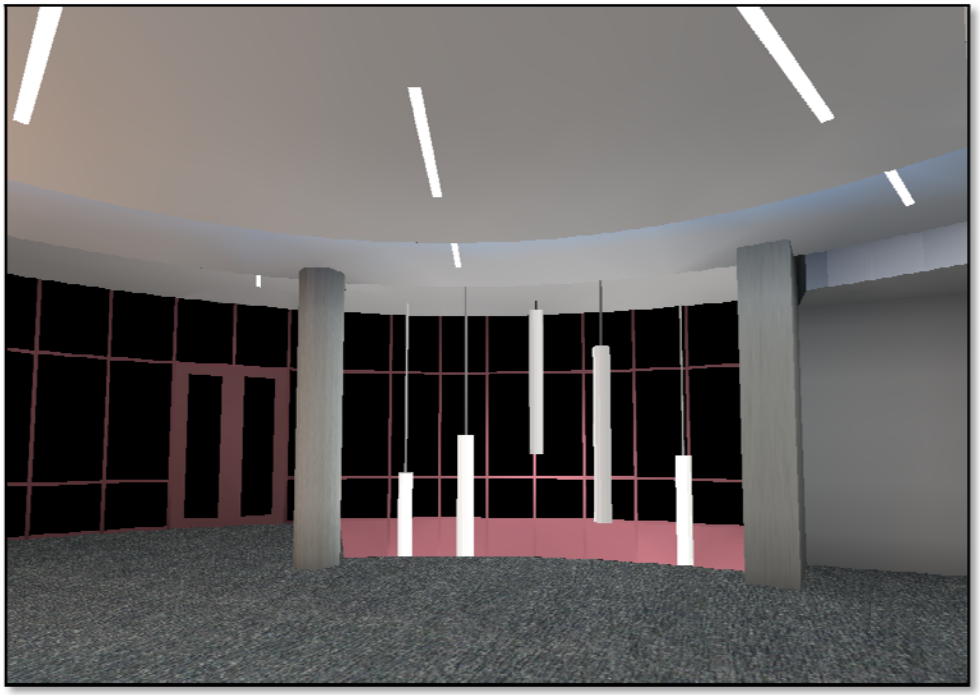
Second Floor Lobby

Statistics

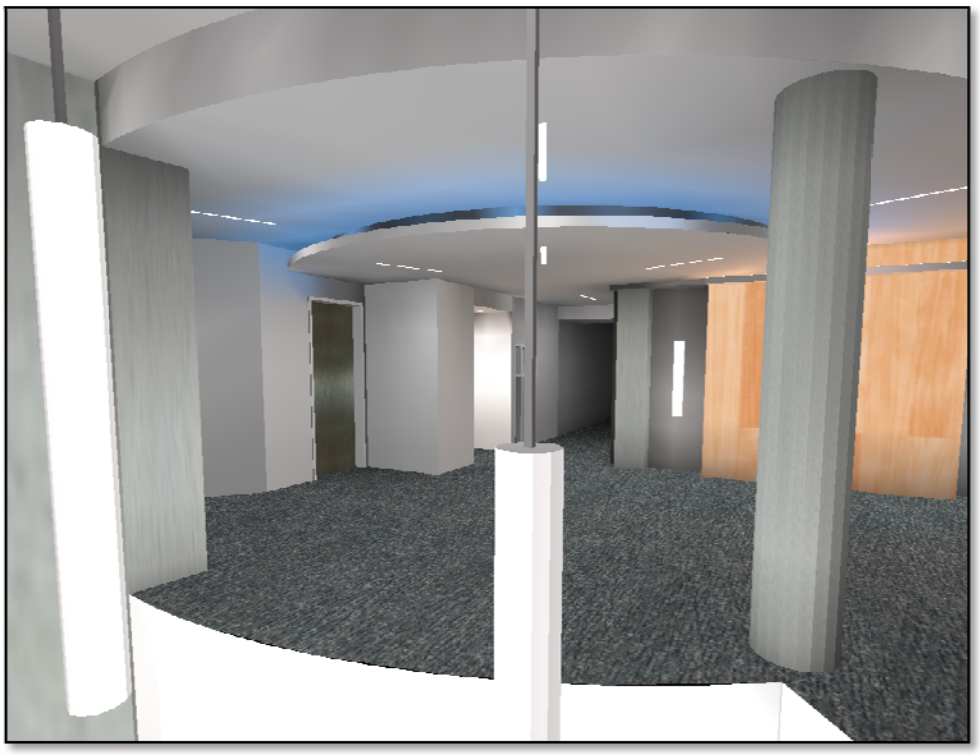
ZONE	HEIGHT	UNITS	AVG	MAX	MIN	AVG/MIN	MAX/MIN
First Floor	0'-0" AFF	fc	10.1	29.0	3.4	3.0	8.5
Second Floor	0'-0" AFF	fc	9.8	27.6	3.3	3.0	8.4

Renderings

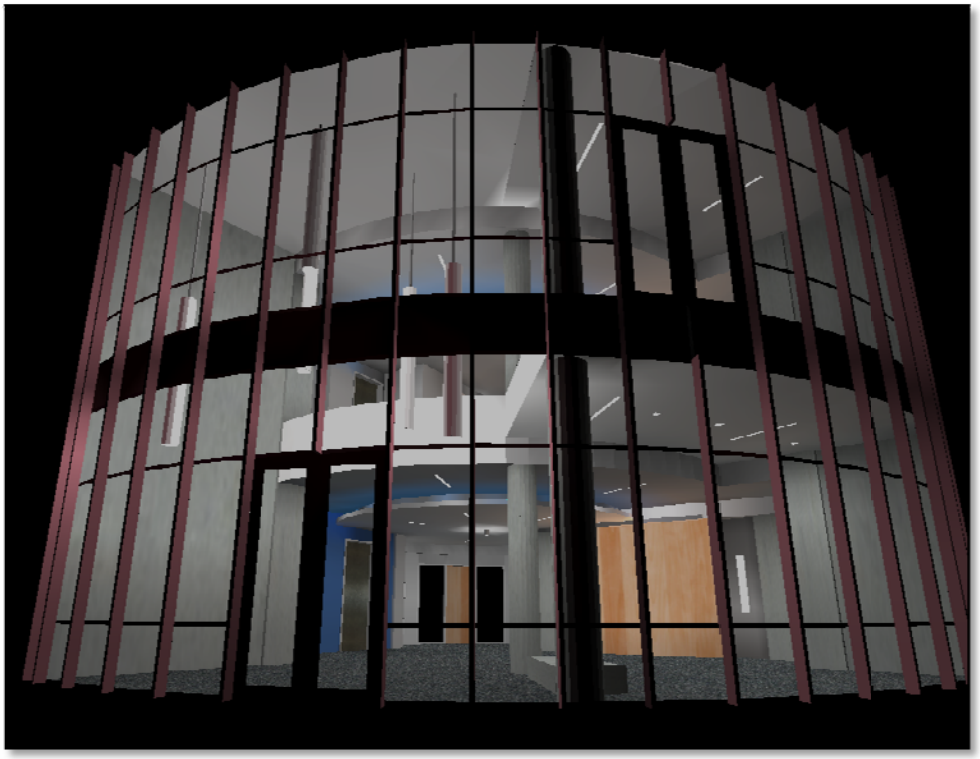
1st Floor from Main Doorway



2nd Floor from Center



2nd Floor from Atrium



View from North Plaza

Light Loss Factors

FIXTURE	MAINT. CAT.	DISTR.	LLD	LDD	RSDD	BF	TOTAL LLF
F02	V	DIRECT	0.93	0.87	0.96	1.00	0.78
F07	IV	DIRECT	0.85	0.89	0.96	1.00	0.73
F08	II	DIRECT/INDIRECT	0.93	0.87	0.93	1.00	0.75
F09	IV	DIRECT	0.96	0.89	0.96	1.00	0.82
F10	VI	DIRECT	0.85	0.85	0.96	-	0.70
F11	IV	DIRECT	0.85	0.89	0.96	1.00	0.73
F12	II	DIRECT	0.93	0.87	0.96	1.00	0.77

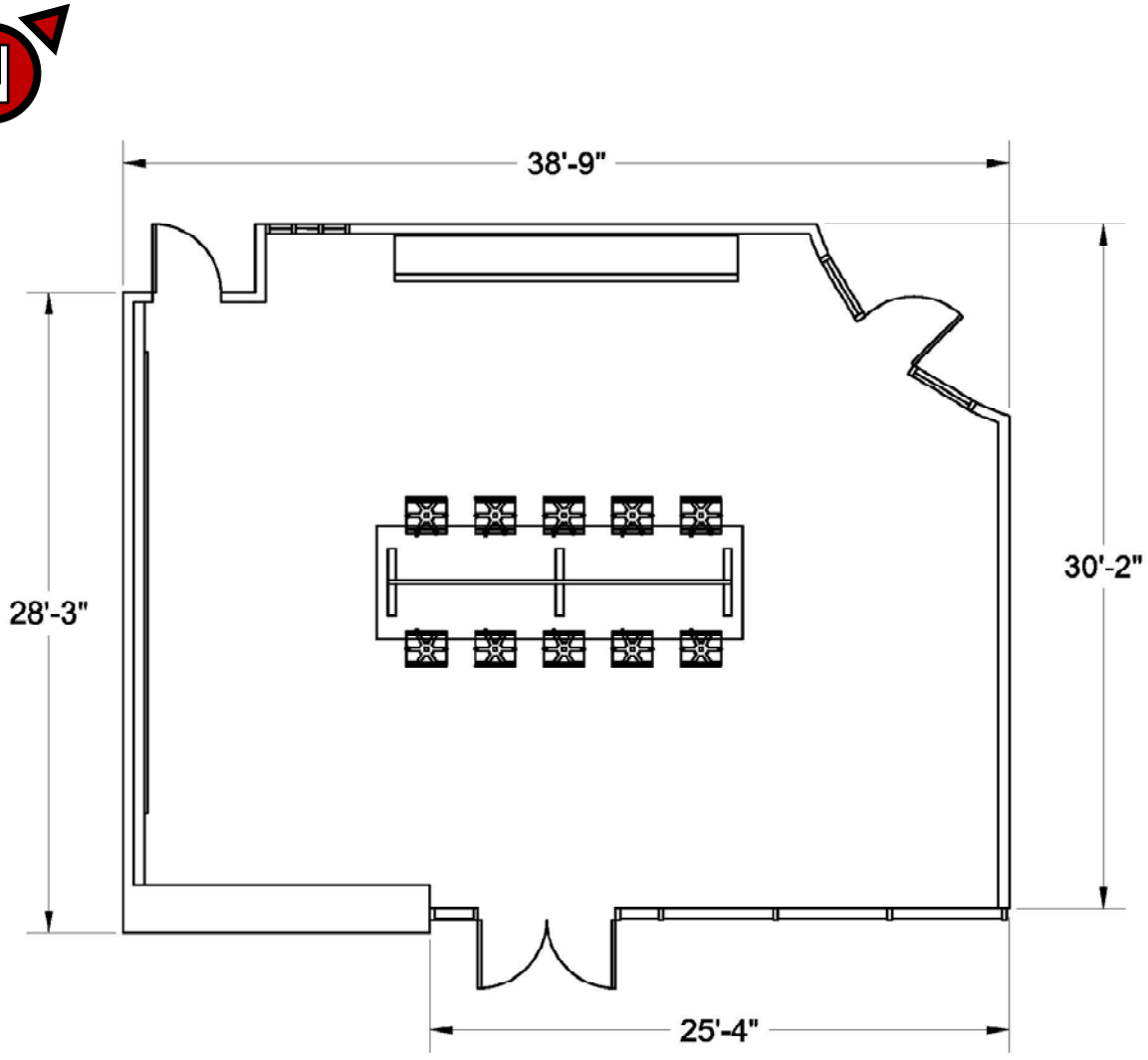
* Assumptions:

1. Clean Environment, 12-month cleaning cycle.
2. 35°C lamp data used in calculations.

LIGHTING – CONFERENCE ROOM

The large conference room on the first floor of the building is a multi-purpose space and serves as a location for face-to-face meetings, whiteboard lectures, A/V presentations and social gatherings. It measures approximately 1050 square feet. The room can be accessed through a main door connecting to the lobby to the north, and also through a secondary interior door to the west. Windows and doors on the southeast side of the room open to an outdoor patio space. On the southwest wall, a whiteboard is framed by a white maple wall. A credenza runs along the wall between the two interior entries, and a large conference table sits in the center of the room.

Dimensions



Partial First Floor Plan
Scale: NTS

Materials

Floor

Material:	Carpet
Color:	Medium Brown
Reflectance:	0.20

Walls

Material:	Painted Gypsum
Color:	Semi-Gloss White, Semi-Gloss Blue
Reflectance:	0.6, 0.3

Whiteboard Wall

Material:	Wood - White Maple
Reflectance:	0.60

Ceiling (Upper)

Material:	Acoustic Ceiling Tile - 2’ x 2’ Suspended Grid
Color:	White
Reflectance:	0.89

Ceiling (Lower)

Material:	Painted Gypsum
Color:	501 “Shell White”
Reflectance:	0.65

Doors (Interior)

Material:	Wood - White Maple
Reflectance:	0.60

Glazing (Exterior)

Material:	Heat Mirror 66 – Clear
Transmittance:	0.56
Shading Coefficient:	0.44

Glazing (Interior)

Material:	Translucent Tempered Glass
Transmittance:	0.40

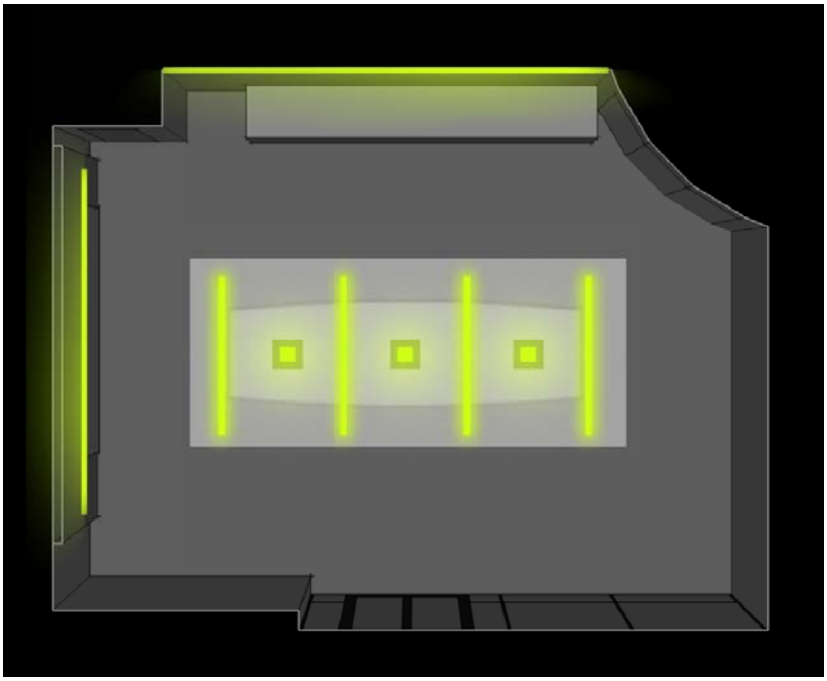
Table/Credenza

Material:	Wood - White Maple

Design Concept Development

This space is unique in that it has direct pedestrian access to a landscaped patio to the south. The transparency between these two spaces is of great importance for the lighting redesign. Within the room itself, flexibility of use is an important consideration. The lighting design is elegant and customizable to accommodate audio/visual presentations, group meetings, lectures, and casual entertaining situations without being too complex for user operation. The clean, linear fixtures in this room reinforce the linear motion theme which is echoed throughout the building and the simple, modern architectural style. Cool color temperature sources and colored surfaces are in contrast to the warmer color theme used in the exterior spaces.

The lighting in the conference room has gone through a few changes over the course of the project. The north wall is highlighted for visual interest and for the display of artwork. The surface behind the credenza has been fitted with a decorative texture which is then grazed from the top of the wall. This provides a focal point for the interior and exterior of the space. The general concept of the central fixture has been maintained, but has been simplified and suspended for a more ambient lighting solution, which is crucial for good facial rendering in the space.



Conference Room Schematic Design

Design Objectives / Considerations

Desired Perceptions

Conceptually, the conference room should be an extension of the patio and vice versa, particularly at night—allowing occupants to appreciate and explore the outdoor space. A transparent feeling should be achieved whenever possible. Visual clutter is to be avoided in this space, allowing the occupants to focus on the meeting or presentation at hand. Peripheral emphasis is used to encourage relaxation, especially in the social mode.

Focal Points

The accessible patio is a major focal point of the space as mentioned above. Within the room itself, other focal emphases vary by mode and include: facial rendering for meetings, the whiteboard/projection screen, the textured credenza wall, and the accented art and/or articles posted on the rear wall.

Light Distribution on Task Plane

The several modes of use of the space each require different task plane illuminances. In general, the conference table should have a very uniform distribution, allowing occupants to perform necessary visual tasks regardless of seating location. Uniform light also helps to reinforce the clean, modern feel of the space.

Facial Rendering

Facial rendering in the meeting mode is extremely important, and sufficient vertical illuminance at the table is critical. Ambient light is maximized to help soften shadows and provide a more favorable facial image.

Color

Color rendering is somewhat important in social modes to provide favorable rendering of faces and possibly food or other displays. Cool (high CCT) sources are selected to fit with the technological, modern style of the building.

Facial Rendering

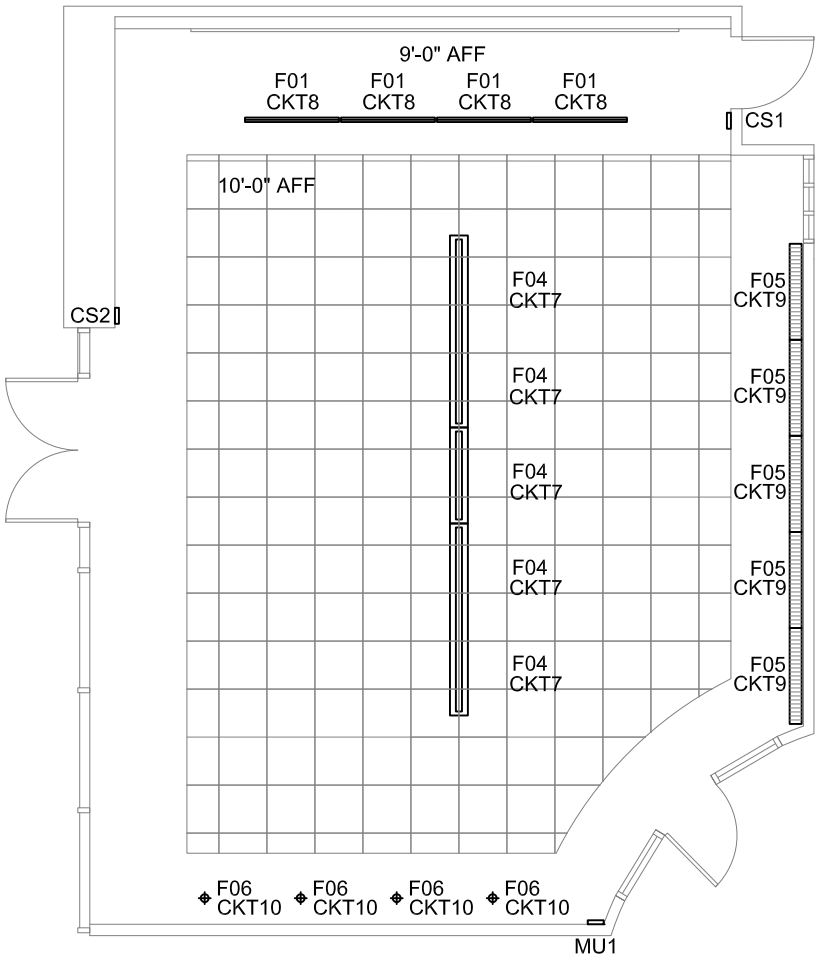
Facial rendering in the meeting mode is extremely important, and sufficient vertical illuminance at the table is critical. Ambient light is maximized to help soften shadows and provide a more favorable facial image.

Technical Objectives

DESCRIPTION	GOAL	RESULT	MET?
Meeting / Classroom Mode	Table: **30 fc** Avg. Horizontal	**33.7 fc**	**YES**
	Credenza: **15 fc** Avg. Horizontal	**25.0 fc**	**YES**
	Whiteboard: **30 fc** Avg. Vertical	**35.6 fc**	**YES**
	Faces: **15 fc** Avg. Vertical	**25.6 fc**	**YES**
A/V Presentation Mode	Projection Screen: **< 5 fc** Max Vertical	**2.6 fc**	**YES**
	Table: **15-30 fc** Avg. Horizontal	**16.3 fc**	**YES**
Social Mode	Faces: **15 fc** Avg. Vertical	**16.1 fc**	**YES**
	Credenza: **15 fc** Avg. Horizontal	**28.3 fc**	**YES**
Power Density (ASHRAE 90.1)	**1.3** W/SF (Space Method)	**0.56 fc**	**YES**

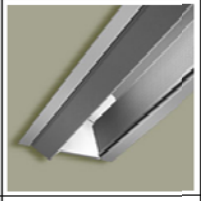
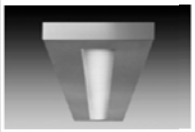
Power Density Calculation

FIXTURE	QUANTITY	WATTS	TOTAL WATTS
F01	4	32	128
F04	5	32	160
F05	5	32	160
F06	4	35	140
		TOTAL Watts	588
		Area (SF)	1050
		Power Density (W/SF)	**0.56**



UCI Nat. Sci. Unit II Irvine, California	Lighting Consultant: Dr. Kevin Houser	Grant Kightlinger L/E Option	Penn State University AE Senior Thesis	CONF ROOM LIGHTING RCP 1/8" = 1'-0"

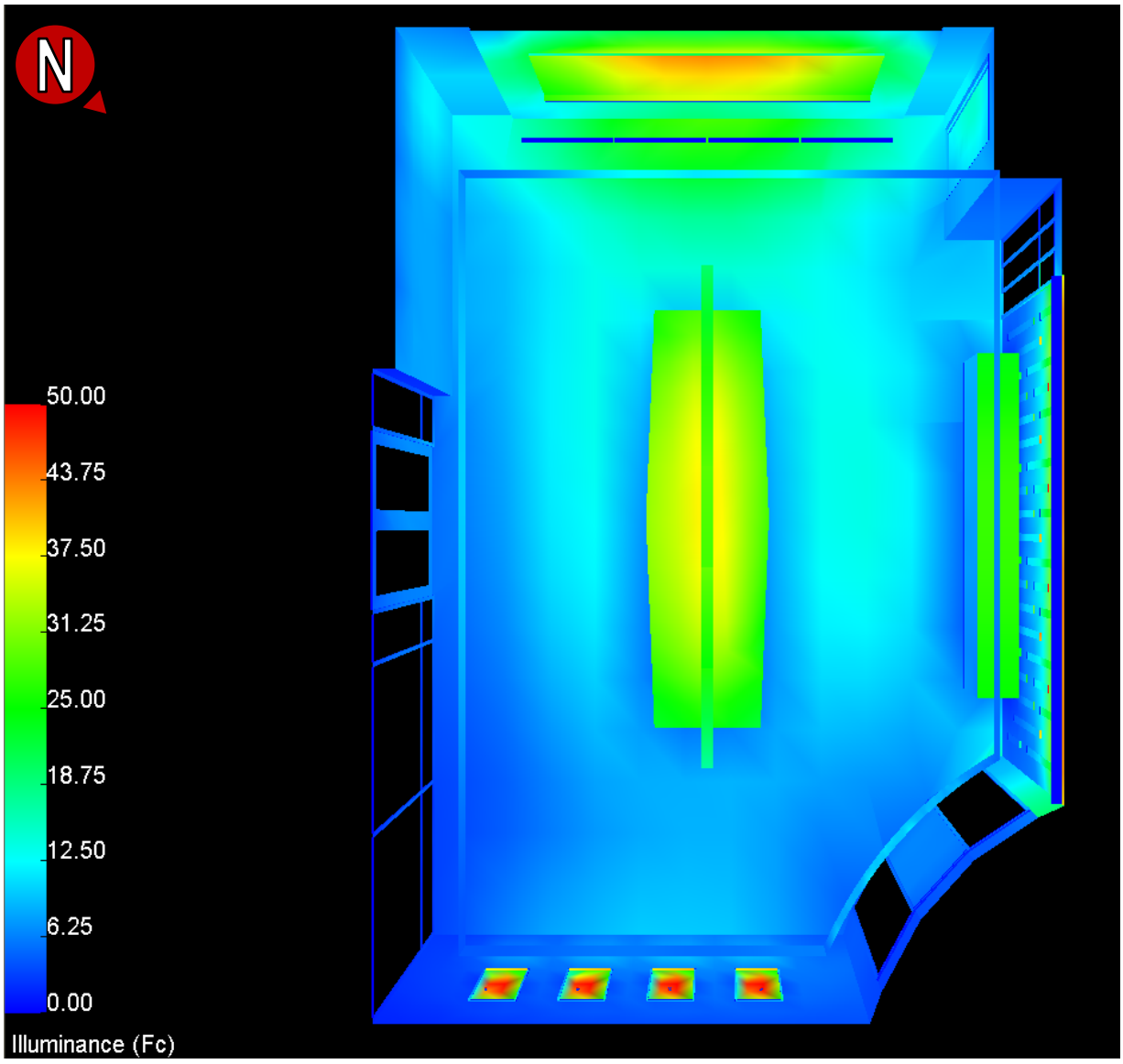
Partial Fixture Schedule

TYPE	IMAGE	MANUF.	DESCRIPTION
INDOOR FIXTURES			
F01		FOCAL POINT	"AVENUE A" - NARROW APERTURE ASYMMETRIC WALL WASHER. SINGLE CIRCUIT, DRYWALL FLANGE, MATTE WHITE HOUSING, 4' NOMINAL LENGTH. STEEL CONSTRUCTION.
F04		FOCAL POINT	"TWELVE" - SUSPENDED INDIRECT/DIRECT LUMINIRE. PARALLEL BLADE LOUVER, 24" CABLE SUSPENSION, INTEGRAL WATTSTOPPER OCCUPANCY SENSOR, TITANIUM SILVER FINISH, FACTORY 20' RUN
F05		LIGHTOLIER	"PTS5-1" - RECESSED PERIMETER WALL WASH. STRAIGHT BLADE ALUMINUM LOUVER, DIE-FORMED STEEL CONSTRUCTION
F06		TECH LIGHTING	"SPOT" TRACK HEAD. COMPATIBLE WITH MONORAIL SYSTEM. 4.5" LENGTH. SATIN NICKEL FINISH. DESIGNER APPROVAL REQUIRED FOR LAMP SUBSTITUTION.

Meeting / Classroom Mode – Dimming Levels

ZONE	OUTPUT LEVEL
1 – Table Pendant	100%
2 – Whiteboard Wash	100%
3 – Credenza Wall	80%
4 – Rear Wall Accent	100%

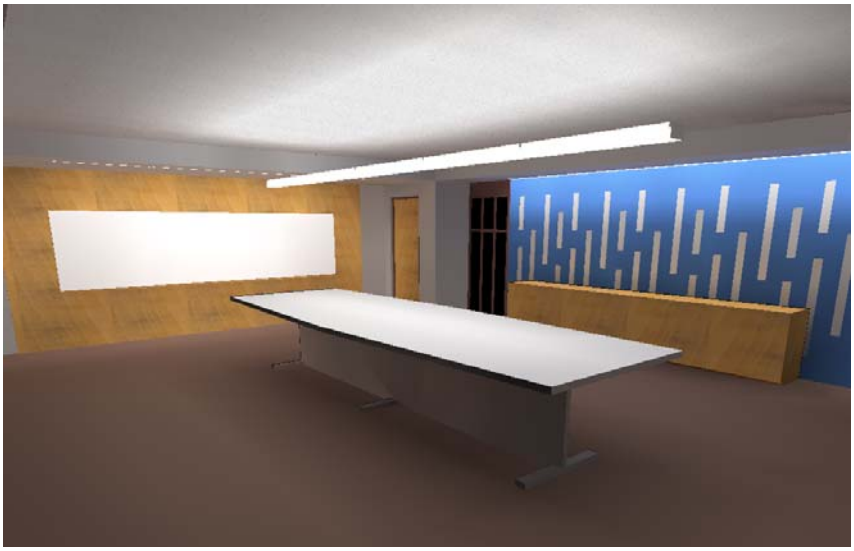
Meeting / Classroom Mode – Pseudocolor Renderings



Meeting / Classroom Mode - Statistics

ZONE	HEIGHT	UNITS	AVG	MAX	MIN	AVG/MIN	MAX/MIN
Conference Table	3'-0"	fc	33.7	38.0	25.3	1.3	1.5
Faces @ Table	Vertical	fc	25.6	27.8	20.4	1.3	1.4
Whiteboard	Vertical	fc	35.6	46.0	20.2	1.8	2.3
Credenza	3'-0"	fc	24.9	35.3	14.1	1.8	2.5
Artwork	Vertical	fc	46.7	197	11.2	4.2	17.6

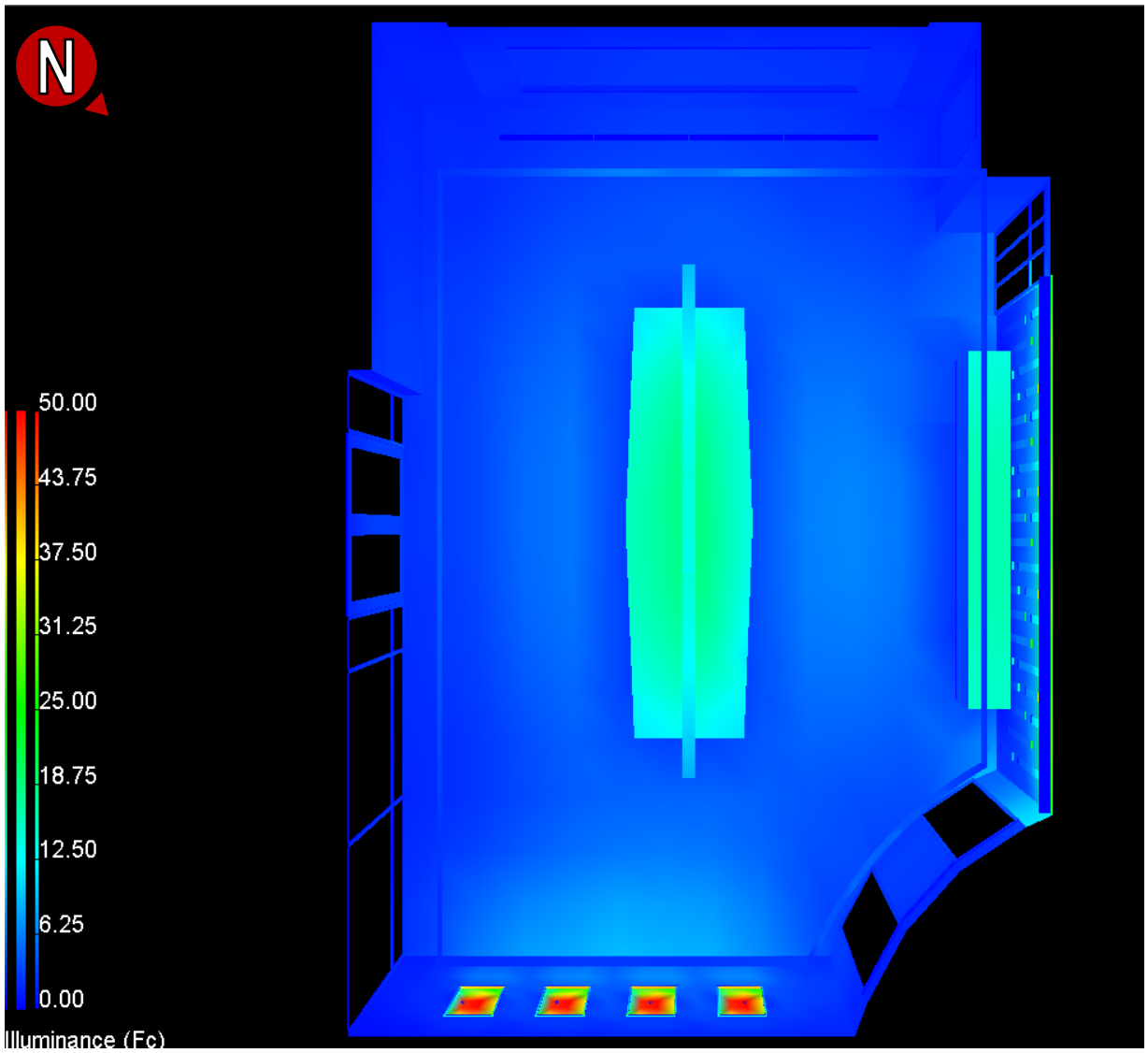
Meeting / Classroom Mode - Renderings



A/V Presentation Mode – Dimming Levels

ZONE	OUTPUT LEVEL
1 – Table Pendant	50%
2 – Whiteboard Wash	OFF
3 – Credenza Wall	50%
4 – Rear Wall Accent	100%

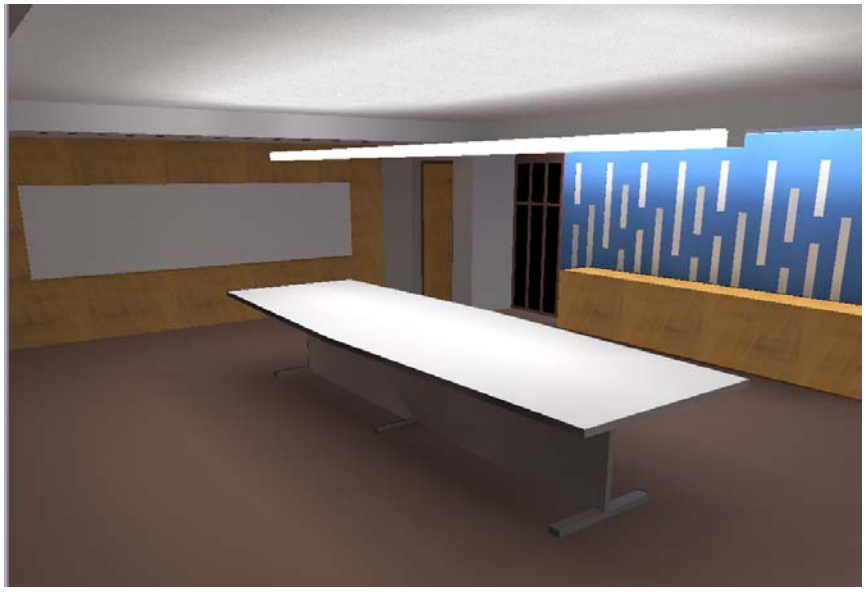
A/V Presentation Mode – Pseudocolor Renderings



A/V Presentation Mode – Statistics

ZONE	HEIGHT	UNITS	AVG	MAX	MIN	AVG/MIN	MAX/MIN
Conference Table	3'-0"	fc	16.3	18.5	12.6	1.3	1.5
Faces @ Table	Vertical	fc	12.3	13.5	10.1	1.2	1.3
Projection Screen	Vertical	fc	2.4	2.6	1.9	1.3	1.4
Credenza	3'-0"	fc	14.8	24.9	6.5	2.3	3.8
Artwork	Vertical	fc	46.9	197	11.3	4.2	17.4

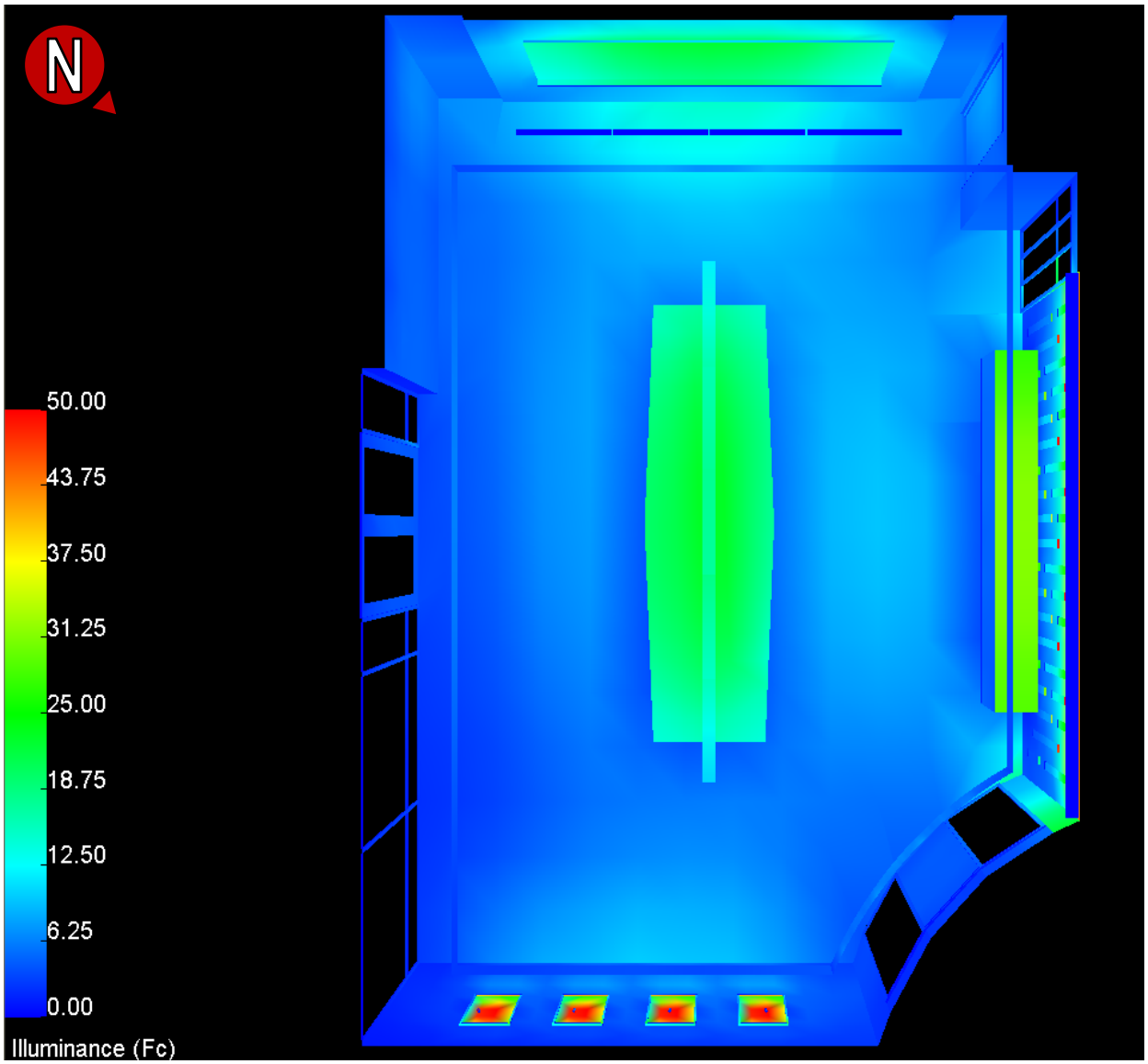
A/V Presentation Mode – Renderings



Social Mode – Dimming Levels

ZONE	OUTPUT LEVEL
1 – Table Pendant	60%
2 – Whiteboard Wash	50%
3 – Credenza Wall	100%
4 – Rear Wall Accent	100%

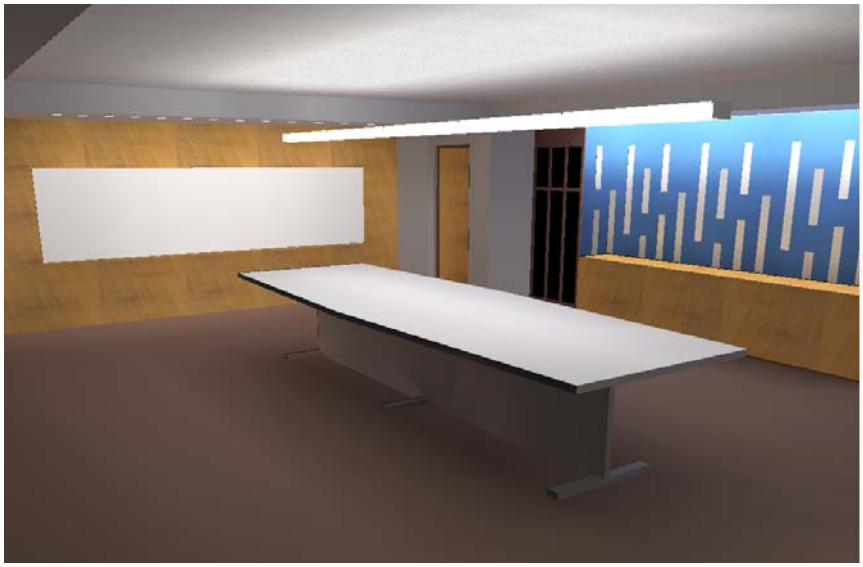
Social Mode – Pseudocolor Renderings



Social Mode – Statistics

ZONE	HEIGHT	UNITS	AVG	MAX	MIN	AVG/MIN	MAX/MIN
Conference Table	3'-0"	fc	20.6	23.2	15.6	1.3	1.5
Faces @ Table	Vertical	fc	16.1	17.4	13.0	1.2	1.3
Whiteboard	Vertical	fc	18.7	23.9	10.8	1.7	2.2
Credenza	3'-0"	fc	28.3	41.4	14.4	2.0	2.9
Artwork	Vertical	fc	49.9	212	9.5	5.25	22.3

Social Mode – Renderings



Light Loss Factors

FIXTURE	MAINT. CAT.	DISTR.	LLD	LDD	RSDD	BF	TOTAL LLF
F01	IV	DIRECT	0.93	0.89	0.98	1.0	0.81
F04	II	SEMI-INDIRECT	0.93	0.94	0.94	1.0	0.82
F05	IV	DIRECT	0.93	0.89	0.98	1.0	0.81
F06	IV	DIRECT	0.85	0.89	0.98	-	0.74

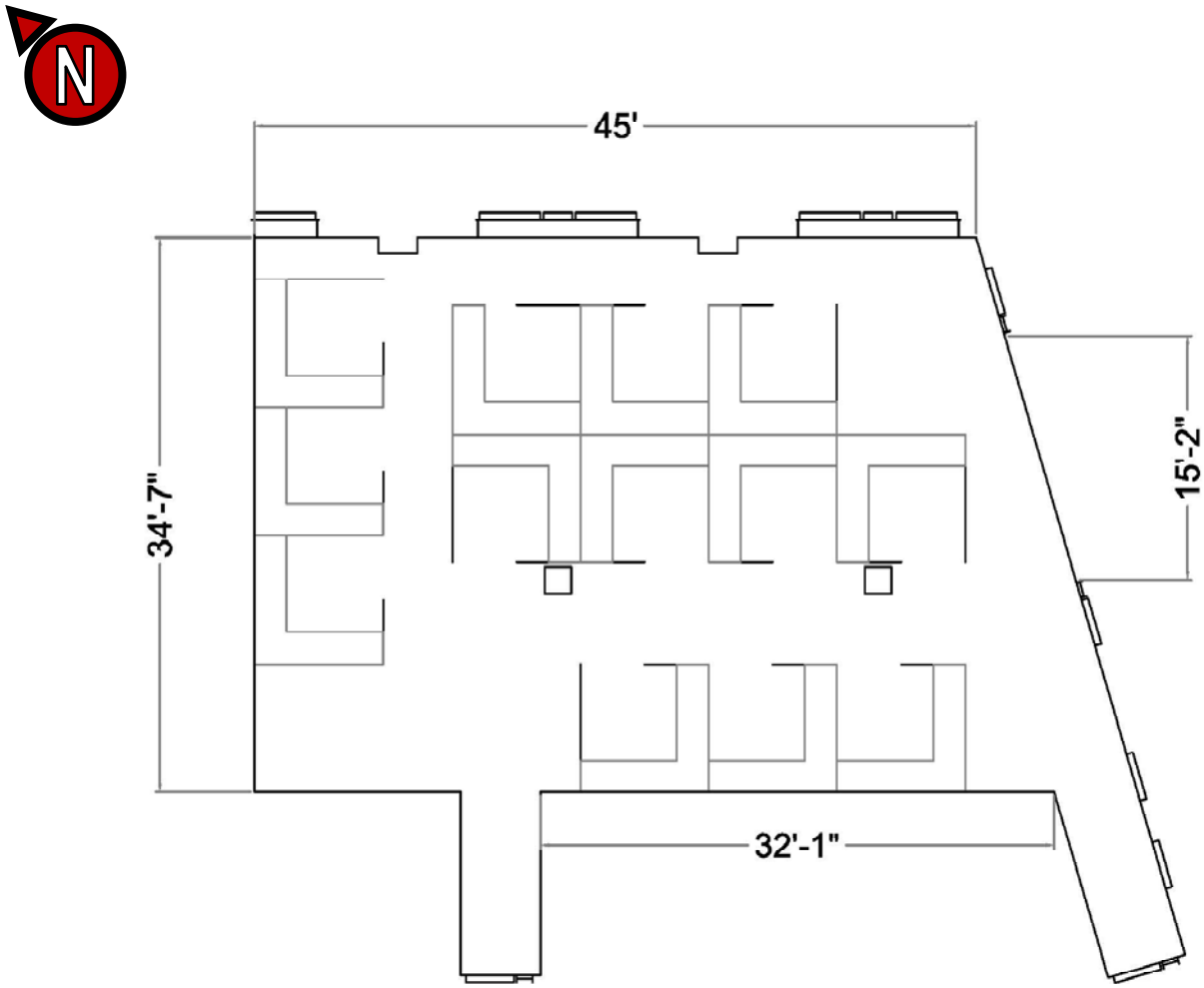
* Assumptions:

1. Clean Environment, 12-month cleaning cycle.
2. 35°C lamp data used in calculations.

LIGHTING – OPEN OFFICE

Located on the third floor of the building, the open office contains workspaces for graduate students of the Biological Sciences department at UCI. The space measures approximately 1,840 square feet and features three large windows facing to the north-east. It is adjacent to two work rooms and several private faculty offices and is accessed through short corridors on the south wall.

Dimensions



Partial Third Floor Plan
Scale: NTS

Materials

Floor

Material:	Carpet
Manufacturer:	Designweave
Color:	Medium Brown
Reflectance:	0.20

Walls

Material:	Painted Gypsum
Color:	Semi-Gloss White, Semi-Gloss Blue
Reflectance:	0.6, 0.3

Ceiling

Material:	Gypsum
Color:	White
Reflectance:	0.89

Doors

Material:	Wood - White Maple
Reflectance:	0.60

Glazing

Material:	Heat Mirror 66 – Clear
Transmittance:	0.56
Shading Coefficient:	0.44

Window Framing

Material:	Painted Steel
Transmittance:	0.15

Desks

Material:	Wood - White Maple
Reflectance:	0.60

Design Concept Development

The overarching design concept for the building embraces motion, especially radial or explosive motion between the interior and exterior of the structure. Parallel linear elements are used to support this sensation of unidirectional motion. Through the manipulation of color temperature and surface finishes, the inner spaces are given a cool, blue tone in contrast to the warmer exterior surfaces. Recessed ceiling strips are low-profile and are not distracting to the eye. Lighting elements below the ceiling have been avoided in this space to maintain views through the windows and to create a sleeker, custom appearance. The views from the exterior into the space played a large part in the decision to lay fixtures perpendicular to the window plane, which creates a more dramatic effect.

The office has been significantly redesigned since the schematic design presentation to create a more aesthetically exciting space from inside and outside the building. The unique lighting solution in this space relies and plays upon the overarching concepts of the architecture and lighting design without being too distracting. The windows have been highlighted as a central focus in the space and are framed by the lighting and the circulation paths between workspaces. Peripheral walls have been highlighted to accentuate color and architectural features which can be seen throughout the space.

Design Objectives / Considerations

Desired Perceptions

The space is intended to feel clean, cool and dynamic. Due to the relatively low ceiling height (10'-0"), fixtures are tucked away as much as possible to avoid visual clutter in the space. A strong connection to the outdoors should be felt during the day and at night.

Focal Points

The main focal point of the space is intended to be the view of campus from the row of windows on the north wall. The north-south orientation and low profile of the ceiling fixtures draw the eye toward the windows. An announcement/posting area is highlighted on the slanted east wall, and becomes a secondary focus of the room. Columns and pilasters are also accented in blue for balance and visual interest.

Glare

Reflected glare on computer screens from ceiling fixtures is a concern in this space. High contrast ratios have been avoided as much as possible. An assumption has been made that the computers in this space use flat, diffuse screen technology, greatly reducing the possibility of reflected glare from the ceiling fixtures. Please refer to the glare potential calculation on the next page for more information.

Light Distribution on Task Plane

Sufficient and uniform illuminance of the work plane is a very important consideration. Paper-based and computer-based tasks are both common in the space. Multiple sources of light are used to create an ambient light and to reduce hard shadows. Individual task lighting allows the occupants to manually adjust their workspaces depending on the task at hand.

Control / Daylight Integration

Although some flexibility of control is desired in the space, it has only one prevalent mode of use. The space is likely to be used at least 8 hours per day on weekdays, with intermittent use on weekends. Thus, the most important feature of the control system is simplicity. An occupancy sensor system will be organized in such a way that it will maintain illumination whenever there are people working, even if they are not moving about the space. A daylight-based dimming or switching system may be practical for luminaires near the window.

Technical Objectives

DESCRIPTION	GOAL	RESULT	MET?
Workplane Illuminance	**25 – 35** horizontal fc on workplane (3'-0") *	Avg. = **28.9** fc	**YES**
Workplane Uniformity	Workplane uniformity Max/Min ≤ **5:1**	Avg./Min = **4.9:1**	**YES**
Circulation Illuminance	**>10** horizontal fc in circulation areas (0'-0")	Avg.= **19.6**	**YES**
Power Density (ASHRAE 90.1)	**1.1** W/SF (Space Method)	**0.86** W/SF	**YES**

* NOTE: This value does not include illumination from personal task lighting. Keeping the overall lighting at a lower level saves energy by allowing occupants to turn off task lights when absent or not performing visually intensive activities.

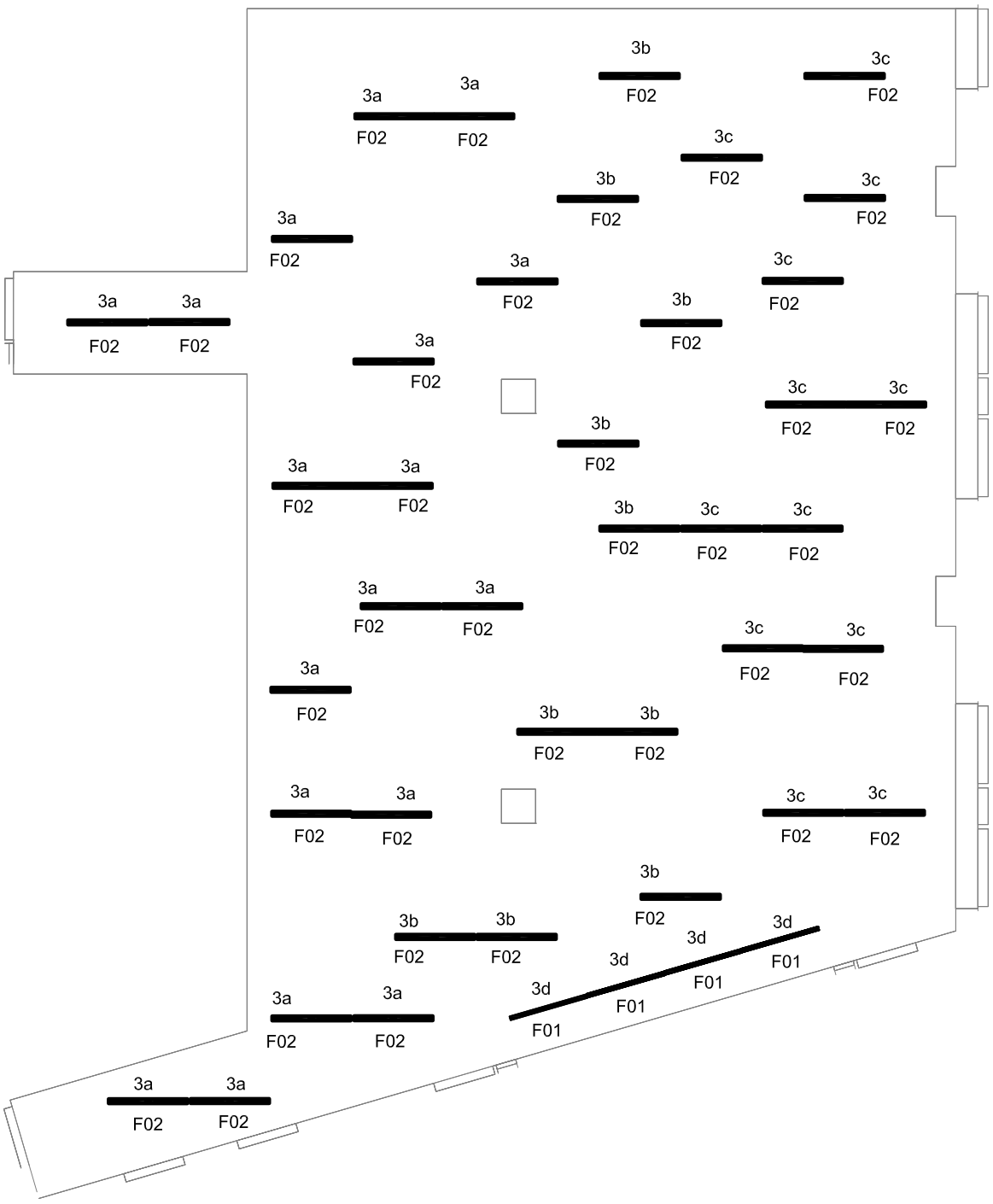
Power Density Calculation

FIXTURE	QUANTITY	WATTS	TOTAL WATTS
F01	4	32	128
F02	40	32	1280
F03	13	13	169
		TOTAL Watts	1577
		Area (SF)	1840
		Power Density (W/SF)	**0.86**

Glare Potential Calculation

According to ANSI / IESNA RP-1-04, normal office spaces with regular use of visual display terminals (VDTs) should meet certain candlepower limits by vertical angle in order to reduce visual discomfort and reflected glare. The recommended practice names these maximum values as: 300 cd at 65 degrees, 185 cd at 75 degrees, and 60 cd at 85 degrees from the vertical. The following excerpt from the specifications of fixture type F02 show that the values for 65 degrees are only slightly over recommended values. To achieve a desirable aesthetic impression in the space, and with the assumption that modern desktop display terminals are not perfectly specular, the fixture has still been specified.

Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
65°	356	338	310	297	293	315
75°	165	158	150	144	142	160
85°	35	37	38	38	40	41

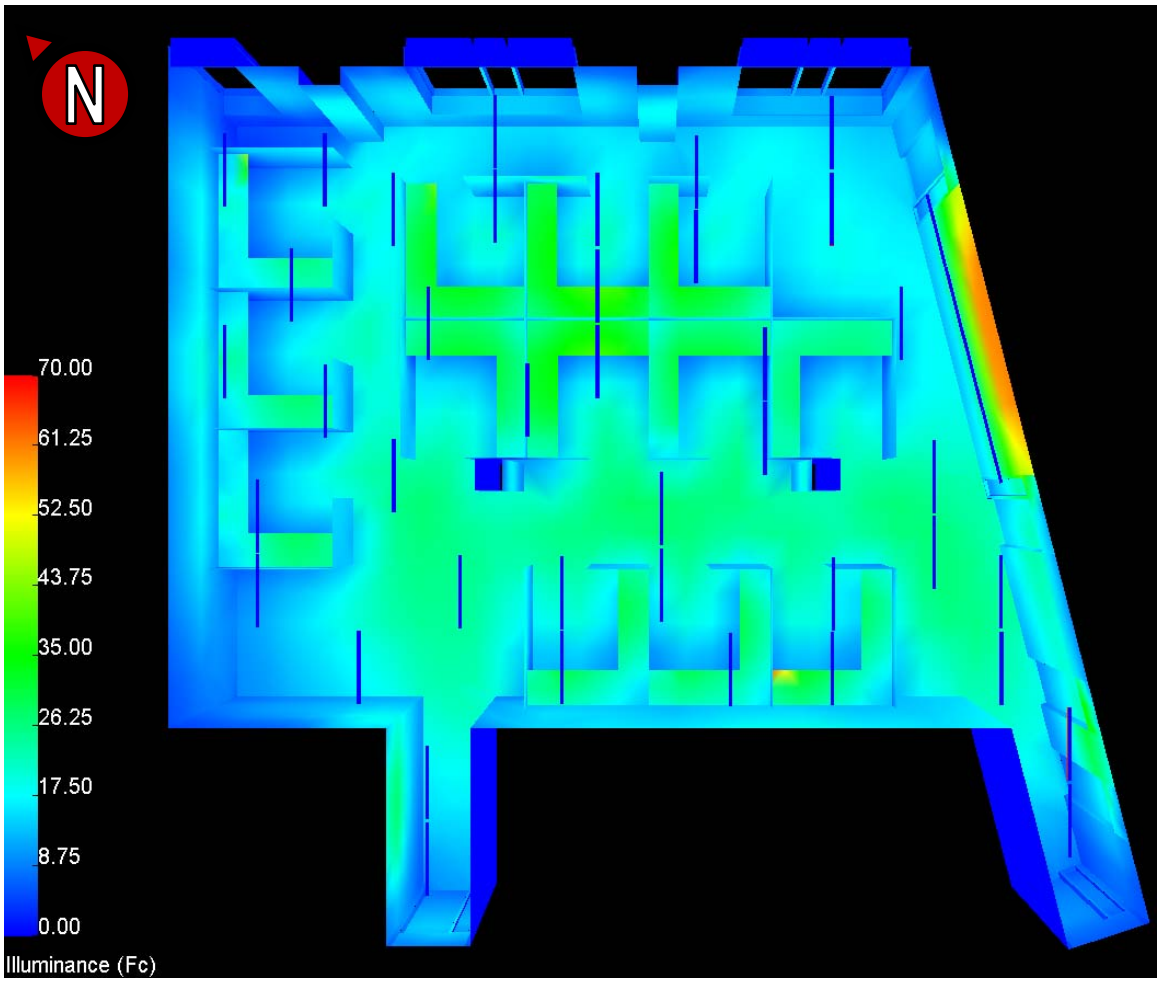


UCI Nat. Sci. Unit II Irvine, California	Lighting Consultant Dr. Kevin Houser	Grant Kightlinger L/E Option	Penn State University AE Senior Thesis	OPEN OFFICE LIGHTING RCP 1/8" = 1'-0"

Partial Fixture Schedule

TYPE	IMAGE	MANUF.	DESCRIPTION
INDOOR FIXTURES			
F01		FOCAL POINT	"AVENUE A" - NARROW APERTURE ASYMMETRIC WALL WASHER. SINGLE CIRCUIT, DRYWALL FLANGE, MATTE WHITE HOUSING, 4' NOMINAL LENGTH. STEEL CONSTRUCTION.
F02		FOCAL POINT	"AVENUE B" - RECESSED SLOT FIXTURE. DIFFUSE FLUSH LENS, SINGLE CIRCUIT, DRYWALL FLANGE, MATTE WHITE HOUSING. STEEL CONSTRUCTION.
F03		LIGHTOLIER	"SURFSIDE" CFL PERSONAL TASK LIGHT. 20" ARM, SILVER FINISH, TABLE BASE

Pseudocolor Renderings

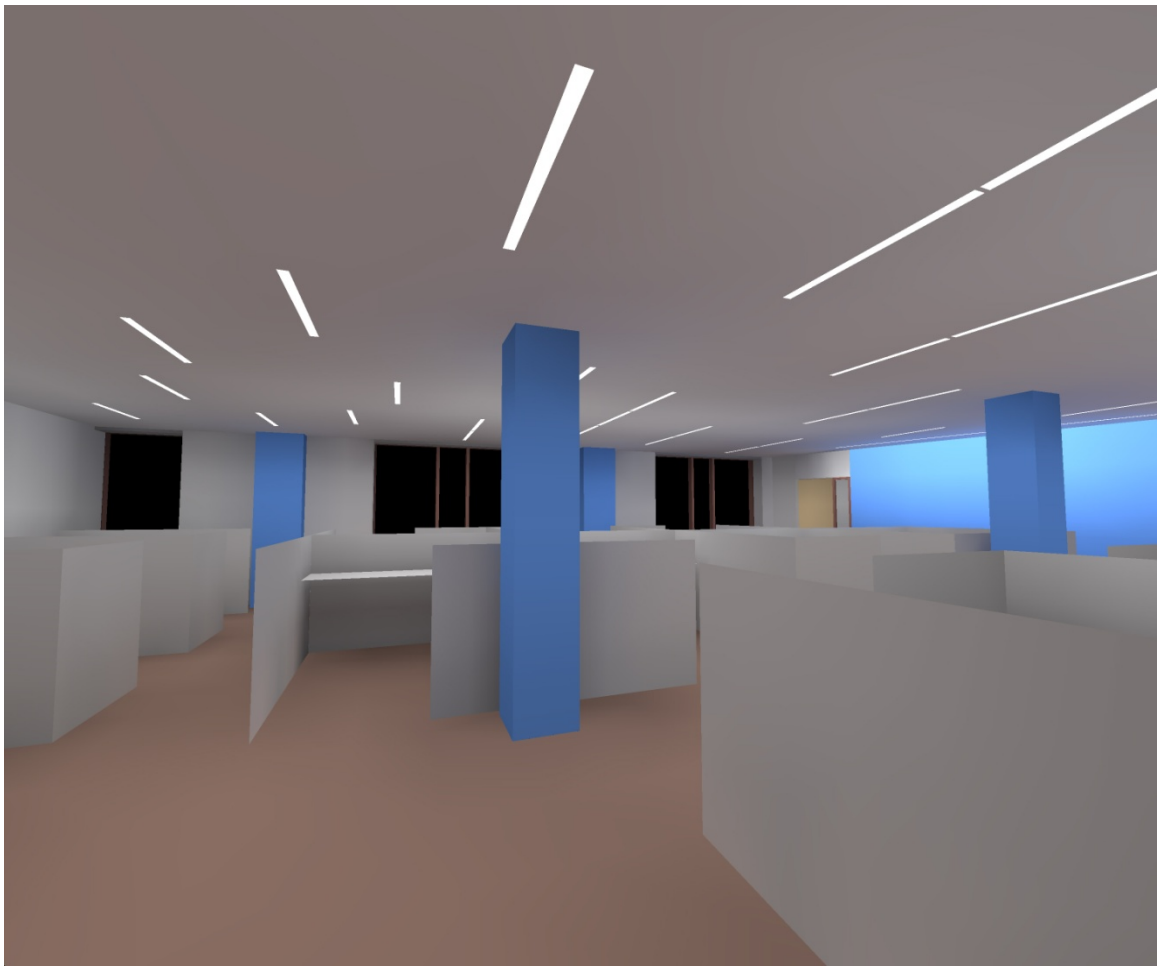


Statistics

ZONE	HEIGHT	UNITS	AVG	MAX	MIN	AVG/MIN	MAX/MIN
Workplane	3'-0"	fc	28.9	41.8	8.4	3.4	4.9
Circulation	0'-0"	fc	19.6	28.6	2.0	9.8	14.3

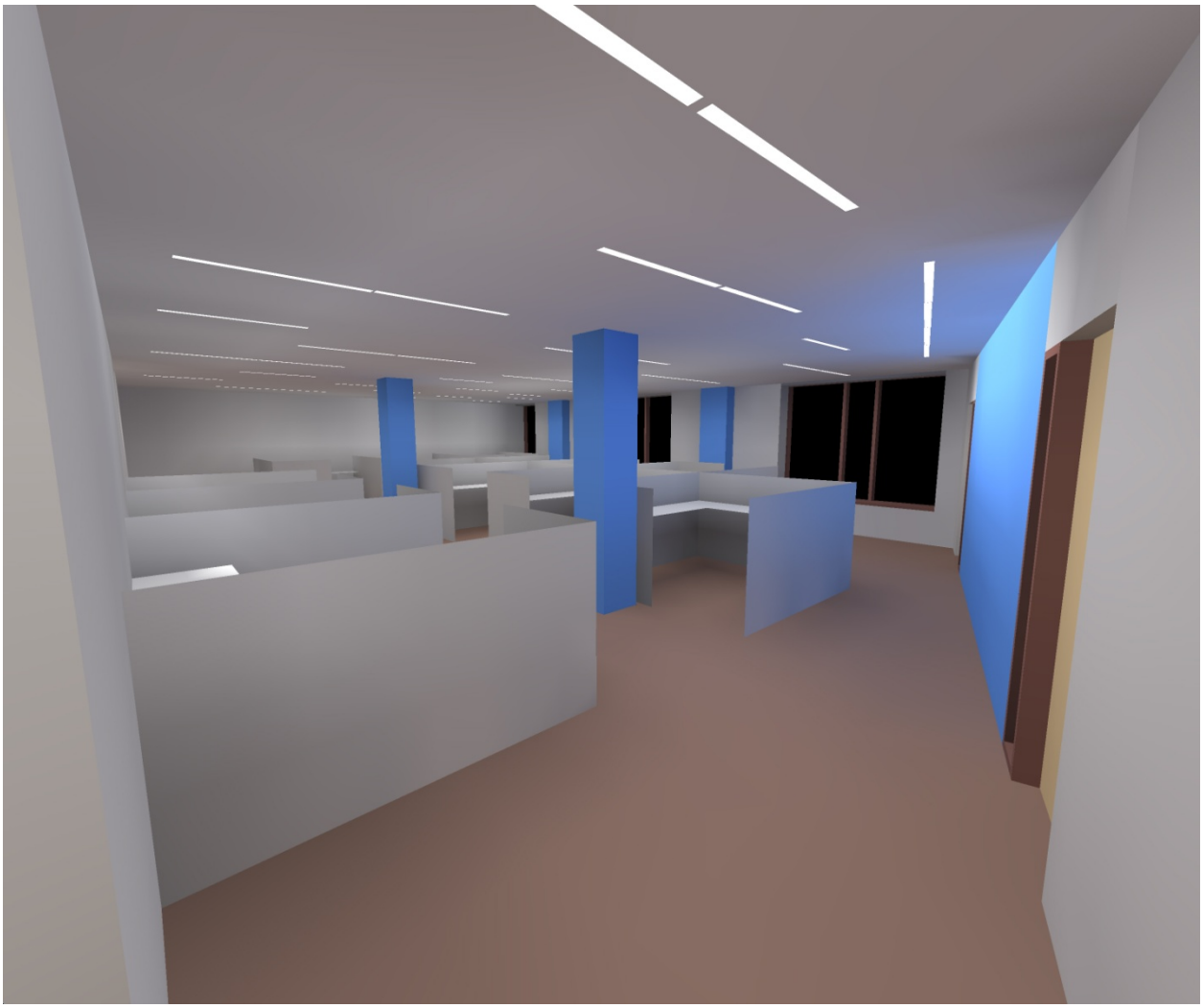
* NOTE: All calculations were completed in AGI32 and use grid spacing of 1'-0".

Renderings



Perspective from West Entrance

Exterior View from North



Perspective from East Entrance

Light Loss Factors

FIXTURE	MAINT. CAT.	DISTR.	LLD	LDD	RSDD	BF	TOTAL LLF
F01	IV	DIRECT	0.93	0.89	0.98	1.0	0.81
F02	VI	DIRECT	0.93	0.87	0.98	1.0	0.79
F03	IV	DIRECT	0.80	0.89	0.98	1.0	0.70

* Assumptions:

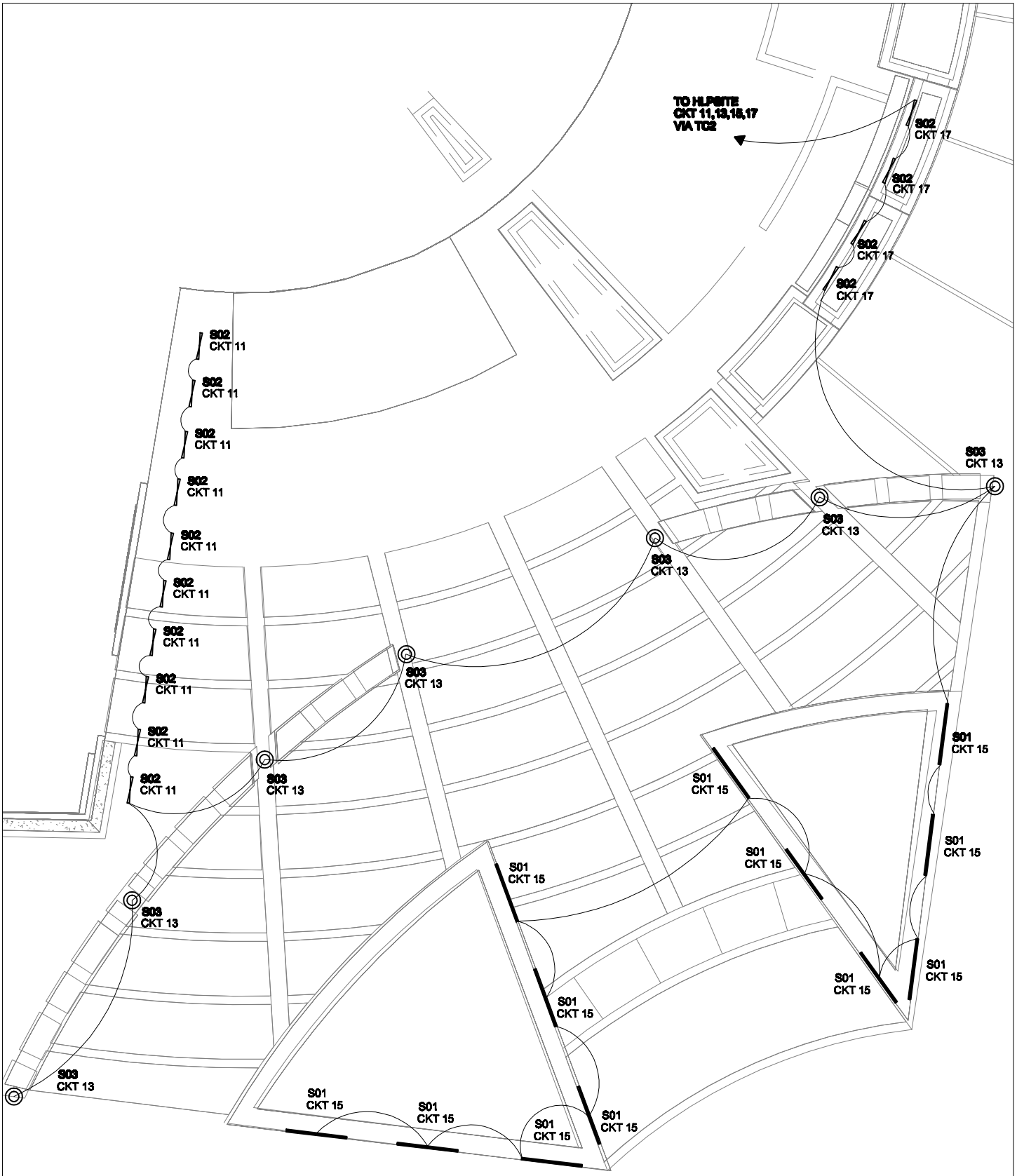
1. Clean Environment, 12-month cleaning cycle.
2. 35°C lamp data used in calculations.

ELECTRICAL REDESIGN – NORTH FAÇADE AND PLAZA

The main entry to UCI Natural Science Unit II is marked by a four-story glass curtain wall, an outdoor stair feature and a 5875 square foot landscaped plaza. The scope of the proposed lighting redesign includes the inner plaza area, the curtain wall, the adjacent office wall, and stair wall at the west side of the plaza. Stairway lighting is not in scope.

Control Scheme

The outdoor lighting of the building is to be controlled by a simple time clock device which will save energy and prolong lamp life by shutting off and/or lowering the lighting levels in the plaza and the exterior of the building when it is not in use.



UCI Nat. Sci. Unit II Irvine, California	Electrical Consultant: Prof. T. Dannerth, PE	Grant Kightlinger L/E Option	Penn State University AE 882 Senior Thesis	PLAZA ELECTRICAL PLAN 3/32" = 1'-0"

Existing Panel Schedule

PANEL HLPSITE

MOUNTING	SURFACE	DOUBLE LUG	NO	VOLTS	277/480	MAIN	M.L.O.
NEMA 3R	NO	200% NEUTRAL	NO	PHASE	3	BUS	100A
FEED THRU	NO	I/G BUS	NO	WIRE	4	A.I.C.	SEE SC REPORTS

NOTES	LOCATION	A	B	C	LTG	CONV	KIT	RECP	MISC	BKR	CIRC		CIRC	BKR	MISC	RECP	KIT	CONV	LTG	A	B	C	LOCATION	NOTES
	EXTERIOR LTG	2698			19					20/1	1		2	20/1									SPARE	
	EXTERIOR LTG		720		8					20/1	3		4	20/1									SPARE	
	HIGH BAY EXT LTG			1988	14					20/1	5		6	20/1									SPARE	
	EXTERIOR LTG	750			15					20/1	7		8	20/1									SPARE	
	EXTERIOR LTG		192		6					20/1	9		10	20/1									SPARE	
	EXTERIOR LTG			910	9					20/1	11		12	20/1									SPARE	
	EXTERIOR LTG	1000			4					20/1	13		14	20/1									SPARE	
	EXTERIOR LTG		804		14					20/1	15		16	20/1									SPARE	
	EXTERIOR LTG			250	5					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	
	SPACE										25		26										SPACE	
	SPACE										27		28										SPACE	
	SPACE										29		30										SPACE	

A= 4448 B= 1716 C= 3148

TOTAL VA=	9312	W/LCL=	11640	AMPS=	**14**	TOTAL LCL=	9312	X .25 =	2328
HIGH PHASE VA=	4448	W/LCL=	5560	HIGH PHASE AMPS=	**20.1**	HIGH PHASE LCL=	4448	X .25 =	1112

New Panelboard Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HLPSITE	Panel Location:			Elec. Rm. 1282	
Nominal Phase to Neutral Voltage------->					277	Phase:			3	
Nominal Phase to Phase Voltage-------->					480	Wires:			4	
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	EXTERIOR LTG	3	SITE	2698	va	0.95	2563	2698	
2	A	SPARE		-	3600	va	1.00	3600	3600	
3	B	EXTERIOR LTG	3	SITE	720	va	0.95	684	720	
4	B	SPARE		-	3600	va	1.00	3600	3600	
5	C	HIGH BAY EXT LTG	3	SITE	1988	va	0.95	1889	1988	
6	C	SPARE		-	3600	va	1.00	3600	3600	
7	A	EXTERIOR LTG	3	SITE	750	va	0.95	713	750	
8	A	SPARE		-	3600	va	1.00	3600	3600	
9	B	EXTERIOR LTG	3	SITE	192	va	0.95	182	192	
10	B	SPARE		-	3600	va	1.00	3600	3600	
11	C	EXTERIOR LTG	3	SITE	260	w	0.95	260	274	
12	C	SPARE		-	3600	va	1.00	3600	3600	
13	A	EXTERIOR LTG	3	SITE	322	w	0.95	322	339	
14	A	SPARE		-	3600	va	1.00	3600	3600	
15	B	EXTERIOR LTG	3	SITE	462	w	0.95	462	486	
16	B	SPARE		-	3600	va	1.00	3600	3600	
17	C	EXTERIOR LTG	3	SITE	104	w	0.95	104	109	
18	C	SPARE		-	3600	va	1.00	3600	3600	
19	A	SPARE		-	3600	va	1.00	3600	3600	
20	A	SPARE		-	3600	va	1.00	3600	3600	
21	B	SPARE		-	3600	va	1.00	3600	3600	
22	B	SPARE		-	3600	va	1.00	3600	3600	
23	C	SPARE		-	3600	va	1.00	3600	3600	
24	C	SPARE		-	3600	va	1.00	3600	3600	
25	A	SPACE		-		va	1.00	0	0	
26	A	SPACE		-		va	1.00	0	0	
27	B	SPACE		-		va	1.00	0	0	
28	B	SPACE		-		va	1.00	0	0	
29	C	SPACE		-		va	1.00	0	0	
30	C	SPACE		-		va	1.00	0	0	
31	A					va	1.00	0	0	
32	A					va	1.00	0	0	
33	B					va	1.00	0	0	
34	B					va	1.00	0	0	
35	C					va	1.00	0	0	
36	C					va	1.00	0	0	
37	A					va	1.00	0	0	
38	A					va	1.00	0	0	
39	B					va	1.00	0	0	
40	B					va	1.00	0	0	
41	C					va	1.00	0	0	
42	C					va	1.00	0	0	
PANEL TOTAL								61.2	61.6	Amps= 74.1

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					21.6	21.8	35%	78.7
PHASE TOTAL	B					19.3	19.4	32%	70.0
PHASE TOTAL	C					20.3	20.4	33%	73.5

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.80	0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		7.2	7.6	0.95	6.8	7.2	0.95		
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0		0.0	0.0			
7	heating		0.0	0.0		0.0	0.0			
8	kitchen equipment		0.0	0.0		0.0	0.0			
9	unassigned		54.0	54.0		54.0	54.0	1.00		
Total Demand Loads						60.8	61.2			
Spare Capacity			20%			12.2	12.2			
Total Design Loads						73.0	73.4	0.99	Amps=	88.3

New Panelboard Schedule

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: HLPSITE
PANEL LOCATION: Elec. Rm. 1282
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
EXTERIOR LTG	SITE	2563	20A/1P	1	*			2	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	684	20A/1P	3		*		4	20A/1P	3600	-	SPARE
HIGH BAY EXT LTG	SITE	1889	20A/1P	5			*	6	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	713	20A/1P	7	*			8	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	182	20A/1P	9		*		10	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	260	20A/1P	11			*	12	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	322	20A/1P	13	*			14	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	462	20A/1P	15		*		16	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	104	20A/1P	17			*	18	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	19	*			20	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	21		*		22	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	23			*	24	20A/1P	3600	-	SPARE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE
0	0	0	20A/1P	31	*			32	20A/1P	0	0	0
0	0	0	20A/1P	33		*		34	20A/1P	0	0	0
0	0	0	20A/1P	35			*	36	20A/1P	0	0	0
0	0	0	20A/1P	37	*			38	20A/1P	0	0	0
0	0	0	20A/1P	39		*		40	20A/1P	0	0	0
0	0	0	20A/1P	41			*	42	20A/1P	0	0	0

CONNECTED LOAD (KW) - A	21.60	TOTAL DESIGN LOAD (KW)	72.98
CONNECTED LOAD (KW) - B	19.33	POWER FACTOR	0.99
CONNECTED LOAD (KW) - C	20.25	TOTAL DESIGN LOAD (AMPS)	88

Feeder Size

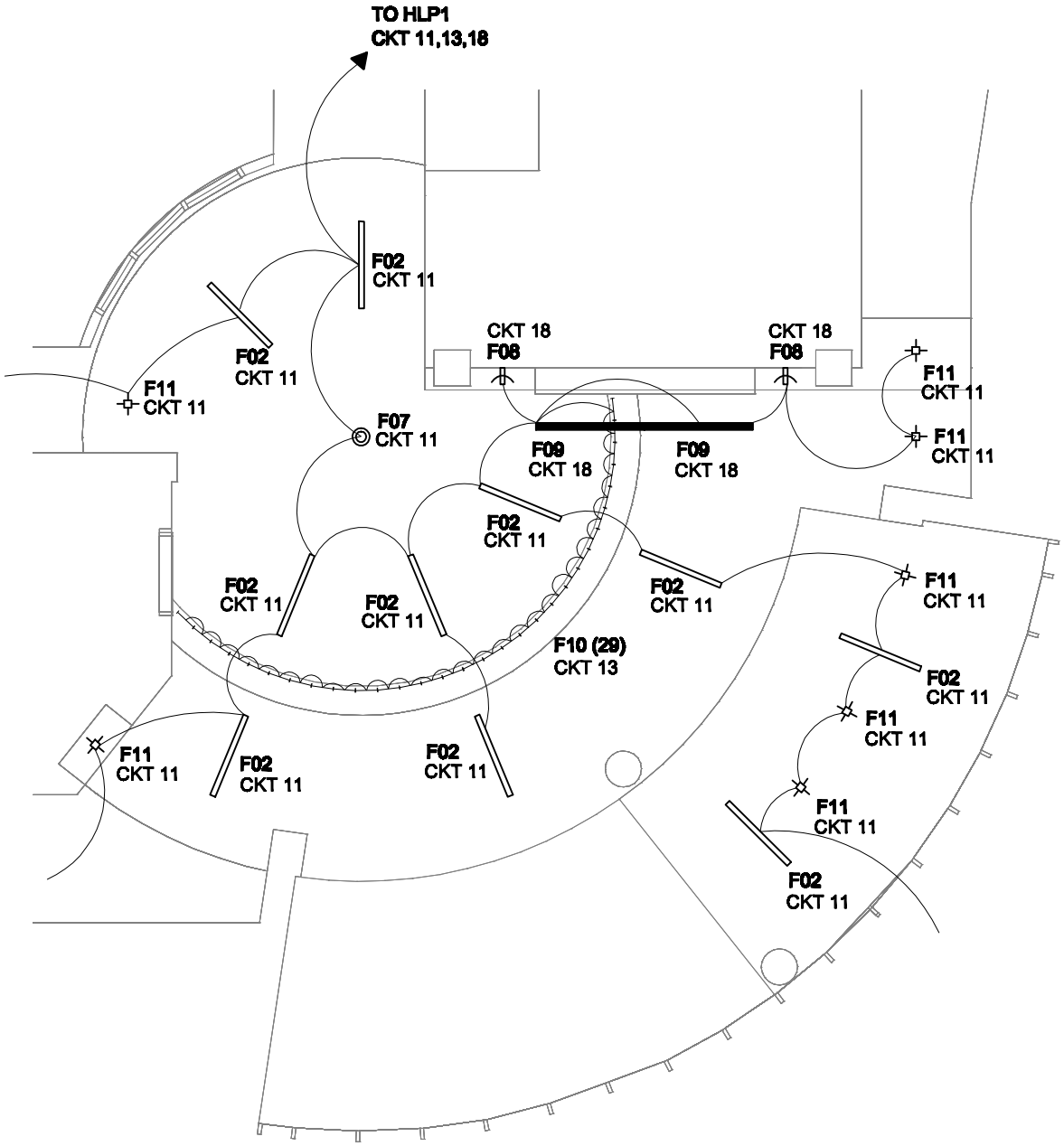
DESIGN LOAD (WITH 20% SPARE)	88 A
CIRCUIT BREAKER SIZE	90 A
x 125% FOR 4 CCC'S	112.5 A
PHASE CONDUCTORS	(3) #2 AWG, 75° CU THWN
NEUTRAL CONDUCTOR	(1) #2 AWG, 75° CU THWN
GROUND CONDUCTIOR	(1) #8 AWG, 75° CU THWN

ELECTRICAL REDESIGN – LOBBY

The lobby space adjacent to the north façade is the main entry point for the building. The lobby measures approximately 1230 square feet and features a large curved glass curtain wall to the north. This space is the primary access to classrooms and circulation. Above the main doorway, a double height atrium space connects the first and second floor lobbies. The main conference room is directly adjacent to the lobby on the first floor, and each level provides access to the main outdoor stair of the building.

Control Scheme

Since the lobby is a public circulation space, easy access to user-customizable controls are not necessarily desired. The lobby system should be discreet and should serve the lighting needs of the space throughout the day without the need for any manual adjustment. However, a dimming system has also been specified to allow adjustments for special events within the lobby and the adjacent main conference room. One special feature within the room is an RGB led cove fixture which requires a separate controller to create visual effects for special events within the space. The fixtures in this space are divided into three zones: general ambient downlights, peripheral accent, and cove lighting.



UCI Nat. Sci. Unit II Irvine, California	Electrical Consultant: Prof. T. Dannerth, PE	Grant Kightlinger L/E Option	Penn State University AE 882 Senior Thesis	1F LOBBY ELEC RCP 1/8" = 1'-0"

Existing Panel Schedule

PANEL HLP1

MOUNTING	SURFACE	DOUBLE LUG	NO	VOLTS	277/480	MAIN	225A
NEMA 3R	NO	200% NEUTRAL	NO	PHASE	3	BUS	225A
FEED THRU	NO	I/G BUS	NO	WIRE	4	A.I.C.	SEE SC REPORTS

NOTES	LOCATION	A	B	C	LTG	CONV	KIT	RECP	MISC	BKR	CIRC		CIRC	BKR	MISC	RECP	KIT	CONV	LTG	A	B	C	LOCATION	NOTES
	OFFICE LTG.	2520			21					20/1	1		2	20/1					15	1123			CORRIDOR LTG.	
	OFFICE LTG.		2818		24					20/1	3		4	20/1					30		2220		LAB 1128,1130 LTG.	
	OFFICE LTG.			3120	26					20/1	5		6	20/1					28			2220	LAB 1124,1122 LTG.	
	CONF. RM. LTG.	2328			39					20/1	7		8	20/1					29	2280			LAB 1118,1120 LTG.	
	OFFICE RESTROOM LTG.		2664		38					20/1	9		10	20/1					22		1740		LAB 1114,1112,1110,1105 LTG.	
	LOBBY LTG.			1548	43					20/1	11		12	20/1					7			868	LAB 1150 LTG.	
	LOBBY LTG.	561			33					20/1	13		14	20/1									SPARE	
	CORRIDOR LTG.		331		6					20/1	15		16	20/1									SPARE	
	CORRIDOR/RECEPTION LTG.			863	20					20/1	17		18	20/1									SPARE	
A	EXIT SIGNS - OFFICE WING	36			12					20/1	19		20	20/1									SPARE	
A	EXIT SIGNS - LAB WING		30		10					20/1	21		22	20/1									SPARE	
	SPARE									20/1	23		24	20/1									SPARE	
	SPARE									20/1	25		26	131313									SPARE	
	SPARE									20/1	27		28	20/1									SPARE	
	SPARE									20/1	29		30	20/1									SPARE	
	FUTURE SPARE									20/1	31		32	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	33		34	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	35		36	20/1									FUTURE SPARE	
	SPACE										37		38										SPACE	
	SPACE										39		40										SPACE	
	SPACE										41		42										SPACE	

		A= 8848				B= 9803				C= 8619	
	TOTAL VA=	27270	W/LCL=	34088		AMPS=	**41**		TOTAL LCL=	27270	X .25 = 6818
	HIGH PHASE VA=	9803	W/LCL=	12254		HIGH PHASE AMPS=	**44.2**		HIGH PHASE LCL=	9803	X .25 = 2451

New Panelboard Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HLP1	Panel Location:			Elec. Rm. 1282	
Nominal Phase to Neutral Voltage------->					277	Phase:			3	
Nominal Phase to Phase Voltage-------->					480	Wires:			4	
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	OFFICE LTG	3	1F	2520	va	0.95	2394	2520	
2	A	CORR. LTG	3	1F	1123	va	0.95	1067	1123	
3	B	OFFICE LTG	3	1F	2818	va	0.95	2677	2818	
4	B	LAB LTG	3	1F	2220	va	0.95	2109	2220	
5	C	OFFICE LTG	3	1F	3120	va	0.95	2964	3120	
6	C	LAB LTG	3	1F	2220	va	0.95	2109	2220	
7	A	CONF RM LTG	3	1F	2328	va	0.95	2212	2328	
8	A	LAB LTG	3	1F	2280	va	0.95	2166	2280	
9	B	FFICE RESTRM LT	3	1F	2664	va	0.95	2531	2664	
10	B	LAB LTG	3	1F	1740	va	0.95	1653	1740	
11	C	LOBBY LTG	3	1F	945	w	0.95	945	995	
12	C	LAB LTG	3	1F	868	va	0.95	825	868	
13	A	LOBBY LTG	3	1F	87	w	0.95	87	92	
14	A	SPARE		-	3600	va	0.95	3420	3600	
15	B	CORRIDOR LTG	3	1F	331	va	0.95	314	331	
16	B	SPARE		-	3600	va	0.95	3420	3600	
17	C	ORR/RECEPTION L	3	1F	863	va	0.95	820	863	
18	C	LOBBY LTG	3	1F	136	w	0.95	136	143	
19	A	EXIT SIGNS OFFICE	3	1F	36	va	0.95	34	36	
20	A	SPARE		-	3600	va	1.00	3600	3600	
21	B	XIT SIGNS LAB WIN	3	1F	30	va	0.95	29	30	
22	B	SPARE		-	3600	va	1.00	3600	3600	
23	C	SPARE		-	3600	va	1.00	3600	3600	
24	C	SPARE		-	3600	va	1.00	3600	3600	
25	A	SPARE		-	3600	va	1.00	3600	3600	
26	A	SPARE		-	3600	va	1.00	3600	3600	
27	B	SPARE		-	3600	va	1.00	3600	3600	
28	B	SPARE		-	3600	va	1.00	3600	3600	
29	C	SPARE		-	3600	va	1.00	3600	3600	
30	C	SPARE		-	3600	va	1.00	3600	3600	
31	A	FUTURE SPARE		-	0	va	1.00	0	0	
32	A	FUTURE SPARE		-	0	va	1.00	0	0	
33	B	FUTURE SPARE		-	0	va	1.00	0	0	
34	B	FUTURE SPARE		-	0	va	1.00	0	0	
35	C	FUTURE SPARE		-	0	va	1.00	0	0	
36	C	FUTURE SPARE		-	0	va	1.00	0	0	
37	A	SPACE		-	0	va	1.00	0	0	
38	A	SPACE		-	0	va	1.00	0	0	
39	B	SPACE		-	0	va	1.00	0	0	
40	B	SPACE		-	0	va	1.00	0	0	
41	C	SPACE		-	0	va	1.00	0	0	
42	C	SPACE		-	0	va	1.00	0	0	
PANEL TOTAL								67.9	69.6	Amps= 83.7

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					22.2	22.8	33%	82.2
PHASE TOTAL	B					23.5	24.2	35%	87.4
PHASE TOTAL	C					22.2	22.6	32%	81.6

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.80	0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		25.1	26.4	0.95	23.8	25.1	0.95		
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0		0.0	0.0			
7	heating		0.0	0.0		0.0	0.0			
8	kitchen equipment		0.0	0.0		0.0	0.0			
9	unassigned		42.8	43.2		42.8	43.2	0.99		
Total Demand Loads						66.7	68.3			
Spare Capacity			20%			13.3	13.7			
Total Design Loads						80.0	81.9	0.98	Amps=	98.6

New Panelboard Schedule

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: HLP1
PANEL LOCATION: Elec. Rm. 1282
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
OFFICE LTG	1F	2394	20A/1P	1	*			2	20A/1P	1067	1F	CORR. LTG
OFFICE LTG	1F	2677	20A/1P	3		*		4	20A/1P	2109	1F	LAB LTG
OFFICE LTG	1F	2964	20A/1P	5			*	6	20A/1P	2109	1F	LAB LTG
CONF RM LTG	1F	2212	20A/1P	7	*			8	20A/1P	2166	1F	LAB LTG
FFICE RESTRM LT	1F	2531	20A/1P	9		*		10	20A/1P	1653	1F	LAB LTG
LOBBY LTG	1F	945	20A/1P	11			*	12	20A/1P	825	1F	LAB LTG
LOBBY LTG	1F	87	20A/1P	13	*			14	20A/1P	3420	-	SPARE
CORRIDOR LTG	1F	314	20A/1P	15		*		16	20A/1P	3420	-	SPARE
ORR/RECEPTION LT	1F	820	20A/1P	17			*	18	20A/1P	136	1F	LOBBY LTG
EXIT SIGNS OFFICE	1F	34	20A/1P	19	*			20	20A/1P	3600	-	SPARE
XIT SIGNS LAB WIN	1F	29	20A/1P	21		*		22	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	23			*	24	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	25	*			26	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	27		*		28	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	29			*	30	20A/1P	3600	-	SPARE
FUTURE SPARE	-	0	20A/1P	31	*			32	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	33		*		34	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	35			*	36	20A/1P	0	-	FUTURE SPARE
SPACE	-	0	20A/1P	37	*			38	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	39		*		40	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	41			*	42	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A	22.18	TOTAL DESIGN LOAD (KW)	79.99
CONNECTED LOAD (KW) - B	23.53	POWER FACTOR	0.98
CONNECTED LOAD (KW) - C	22.20	TOTAL DESIGN LOAD (AMPS)	99

*NOTE: Approximately 400 watts of fixture load exist outside the scope of the lobby lighting redesign on circuit 11 and have therefore been included in addition to the actual fixture load as designed.

Feeder Size

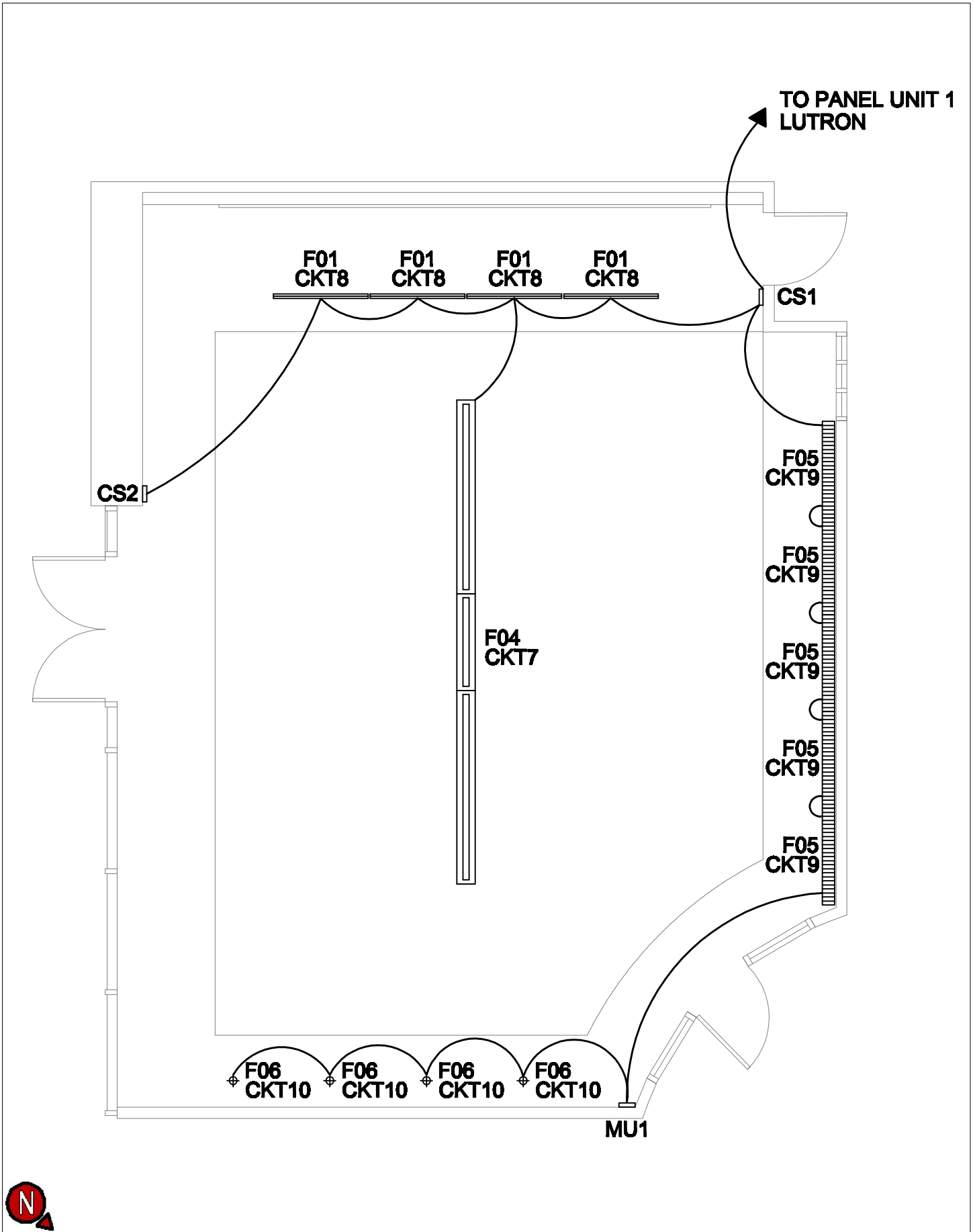
DESIGN LOAD (WITH 20% SPARE)	99 A
CIRCUIT BREAKER SIZE	100 A
x 125% FOR 4 CCC'S	125 A
PHASE CONDUCTORS	(3) #1 AWG, 75° CU THWN
NEUTRAL CONDUCTOR	(1) #1 AWG, 75° CU THWN
GROUND CONDUCTIOR	(1) #6 AWG, 75° CU THWN

ELECTRICAL REDESIGN – CONFERENCE ROOM

The main conference room is located on the first floor of the building. It measures approximately 1050 square feet. The room can be accessed through a main door connecting to the lobby to the north, and also through a secondary interior door to the west. Windows and doors on the southeast side of the room open to an outdoor patio space. On the southwest wall, a whiteboard is framed by a white maple wall. A credenza runs along the wall between the two interior entries, and a large conference table sits in the center of the room.

Control Scheme

Flexibility of use is one of the most important design goals in this space. The lighting system should be able to adapt to several uses including face-to-face meetings, whiteboard lectures, A/V presentations and social gatherings. The overall aesthetic appearance is also crucial in this space. A Lutron control system has been selected to offer more streamlined user control over the lighting environment and to allow for more dramatic lighting transitions.



UCI Nat. Sci. Unit II Irvine, California	Electrical Consultant: Prof. T. Dannerth, PE	Grant Kightlinger L/E Option	Penn State University AE 882 Senior Thesis	CONF ROOM ELEC RCP 3/16" = 1'-0"

Existing Panel Schedule

PANEL HLP1

MOUNTING	SURFACE	DOUBLE LUG	NO	VOLTS	277/480	MAIN	225A
NEMA 3R	NO	200% NEUTRAL	NO	PHASE	3	BUS	225A
FEED THRU	NO	I/G BUS	NO	WIRE	4	A.I.C.	SEE SC REPORTS

NOTES	LOCATION	A	B	C	LTG	CONV	KIT	RECP	MISC	BKR	CIRC		CIRC	BKR	MISC	RECP	KIT	CONV	LTG	A	B	C	LOCATION	NOTES
	OFFICE LTG.	2520			21					20/1	1		2	20/1					15	1123			CORRIDOR LTG.	
	OFFICE LTG.		2818		24					20/1	3		4	20/1					30		2220		LAB 1128,1130 LTG.	
	OFFICE LTG.			3120	26					20/1	5		6	20/1					28			2220	LAB 1124,1122 LTG.	
	CONF. RM. LTG.	2328			39					20/1	7		8	20/1					29	2280			LAB 1118,1120 LTG.	
	OFFICE RESTROOM LTG.		2664		38					20/1	9		10	20/1					22		1740		LAB 1114,1112,1110,1105 LTG.	
	LOBBY LTG.			1548	43					20/1	11		12	20/1					7			868	LAB 1150 LTG.	
	LOBBY LTG.	561			33					20/1	13		14	20/1									SPARE	
	CORRIDOR LTG.		331		6					20/1	15		16	20/1									SPARE	
	CORRIDOR/RECEPTION LTG.			863	20					20/1	17		18	20/1									SPARE	
A	EXIT SIGNS - OFFICE WING	36			12					20/1	19		20	20/1									SPARE	
A	EXIT SIGNS - LAB WING		30		10					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	
	FUTURE SPARE									20/1	31		32	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	33		34	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	35		36	20/1									FUTURE SPARE	
	SPACE										37		38										SPACE	
	SPACE										39		40										SPACE	
	SPACE										41		42										SPACE	

		A= 8848				B= 9803				C= 8619	
	TOTAL VA=	27270	W/LCL=	34088	AMPS=	**41**	TOTAL LCL=	27270	X .25 =	6818	
	HIGH PHASE VA=	9803	W/LCL=	12254	HIGH PHASE AMPS=	**44.2**	HIGH PHASE LCL=	9803	X .25 =	2451	

New Panelboard Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HLP1	Panel Location:			ELEC RM 1282	
Nominal Phase to Neutral Voltage------->					277	Phase:			3	
Nominal Phase to Phase Voltage-------->					480	Wires:			4	
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	OFFICE LTG	3	1F	2520	va	0.95	2394	2520	
2	A	CORRIDOR LTG	3	1F	1123	va	0.95	1067	1123	
3	B	OFFICE LTG	3	1F	2818	w	0.95	2818	2966	
4	B	LAB 1128,1130 LTG	3	1F	2220	va	0.95	2109	2220	
5	C	OFFICE LTG	3	1F	3120	va	0.95	2964	3120	
6	C	LAB 1124,1122 LTG	3	1F	2220	va	0.95	2109	2220	
7	A	CONF RM LTG	3	1F	160	w	0.95	160	168	
8	A	CONF RM LTG	3	1F	128	w	0.95	128	135	
9	B	CONF RM LTG	3	1F	160	w	0.95	160	168	
10	B	CONF RM LTG	3	1F	140	w	0.95	140	147	
11	C	LAB 1118,1120 LTG	3	1F	2280	va	0.95	2166	2280	
12	C	SPARE	3	1F	3600	va	0.95	3420	3600	
13	A	LAB LTG	3	1F	1740	va	0.95	1653	1740	
14	A	LOBBY LTG	3	1F	1548	va	0.95	1471	1548	
15	B	LAB 1150 LTG	3	1F	868	va	0.95	825	868	
16	B	LOBBY LTG	3	1F	561	va	0.95	533	561	
17	C	SPARE	3	-	3600	va	0.95	3420	3600	
18	C	CORRIDOR LTG	3	1F	331	va	0.95	314	331	
19	A	EXIT SIGNS-OFFICE	3	1F	36	va	0.95	34	36	
20	A	CORRIDOR LTG	3	1F	863	va	0.95	820	863	
21	B	SPARE	3	-	3600	va	0.95	3420	3600	
22	B	SPARE	3	-	3600	va	0.95	3420	3600	
23	C	SPARE		-	3600	va	1.00	3600	3600	
24	C	EXIT SIGNS-LAB	3	1F	30	va	0.95	29	30	
25	A	SPARE		-	3600	va	1.00	3600	3600	
26	A	SPARE		-	3600	va	1.00	3600	3600	
27	B	OFFICE/RSTRM LTG	3	1F	2664	va	0.95	2531	2664	
28	B	SPARE		-	3600	va	1.00	3600	3600	
29	C	SPARE		-	3600	va	1.00	3600	3600	
30	C	SPARE		-	3600	va	1.00	3600	3600	
31	A	SPARE		-	3600	va	1.00	3600	3600	
32	A	SPARE		-	3600	va	1.00	3600	3600	
33	B	SPARE		-	3600	va	1.00	3600	3600	
34	B	FUTURE SPARE		-	0	va	1.00	0	0	
35	C	FUTURE SPARE		-	0	va	1.00	0	0	
36	C	FUTURE SPARE		-	0	va	1.00	0	0	
37	A	FUTURE SPARE		-	0	va	1.00	0	0	
38	A	FUTURE SPARE		-	0	va	1.00	0	0	
39	B	FUTURE SPARE		-	0	va	1.00	0	0	
40	B	FUTURE SPARE		-	0	va	1.00	0	0	
41	C	SPACE		-	0	va	1.00	0	0	
42	C	SPACE		-	0	va	1.00	0	0	
PANEL TOTAL								70.5	72.5	Amps= 87.3

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					22.1	22.5	31%	81.3
PHASE TOTAL	B					23.2	24.0	33%	86.6
PHASE TOTAL	C					25.2	26.0	36%	93.8

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.80	0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		38.1	40.1	0.95	36.2	38.1	0.95		
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0		0.0	0.0			
7	heating		0.0	0.0		0.0	0.0			
8	kitchen equipment		0.0	0.0		0.0	0.0			
9	unassigned		32.4	32.4		32.4	32.4	1.00		
Total Demand Loads						68.6	70.5			
Spare Capacity			20%			13.7	14.1			
Total Design Loads						82.3	84.6	0.97	Amps=	101.8

New Panelboard Schedule

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: HLP1
PANEL LOCATION: ELEC RM 1282
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
OFFICE LTG	1F	2394	20A/1P	1	*			2	20A/1P	1067	1F	CORRIDOR LTG
OFFICE LTG	1F	2818	20A/1P	3		*		4	20A/1P	2109	1F	LAB 1128,1130 LTG
OFFICE LTG	1F	2964	20A/1P	5			*	6	20A/1P	2109	1F	LAB 1124,1122 LTG
CONF RM LTG	1F	160	20A/1P	7	*			8	20A/1P	128	1F	CONF RM LTG
CONF RM LTG	1F	160	20A/1P	9		*		10	20A/1P	140	1F	CONF RM LTG
LAB 1118,1120 LTG	1F	2166	20A/1P	11			*	12	20A/1P	3420	1F	SPARE
LAB LTG	1F	1653	20A/1P	13	*			14	20A/1P	1471	1F	LOBBY LTG
LAB 1150 LTG	1F	825	20A/1P	15		*		16	20A/1P	533	1F	LOBBY LTG
SPARE	-	3420	20A/1P	17			*	18	20A/1P	314	1F	CORRIDOR LTG
EXIT SIGNS-OFFICE	1F	34	20A/1P	19	*			20	20A/1P	820	1F	CORRIDOR LTG
SPARE	-	3420	20A/1P	21		*		22	20A/1P	3420	-	SPARE
SPARE	-	3600	20A/1P	23			*	24	20A/1P	29	1F	EXIT SIGNS-LAB
SPARE	-	3600	20A/1P	25	*			26	20A/1P	3600	-	SPARE
OFFICE/RSTRM LTG	1F	2531	20A/1P	27		*		28	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	29			*	30	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	31	*			32	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	33		*		34	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	35			*	36	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	37	*			38	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	39		*		40	20A/1P	0	-	FUTURE SPARE
SPACE	-	0	20A/1P	41			*	42	20A/1P	0	-	SPACE

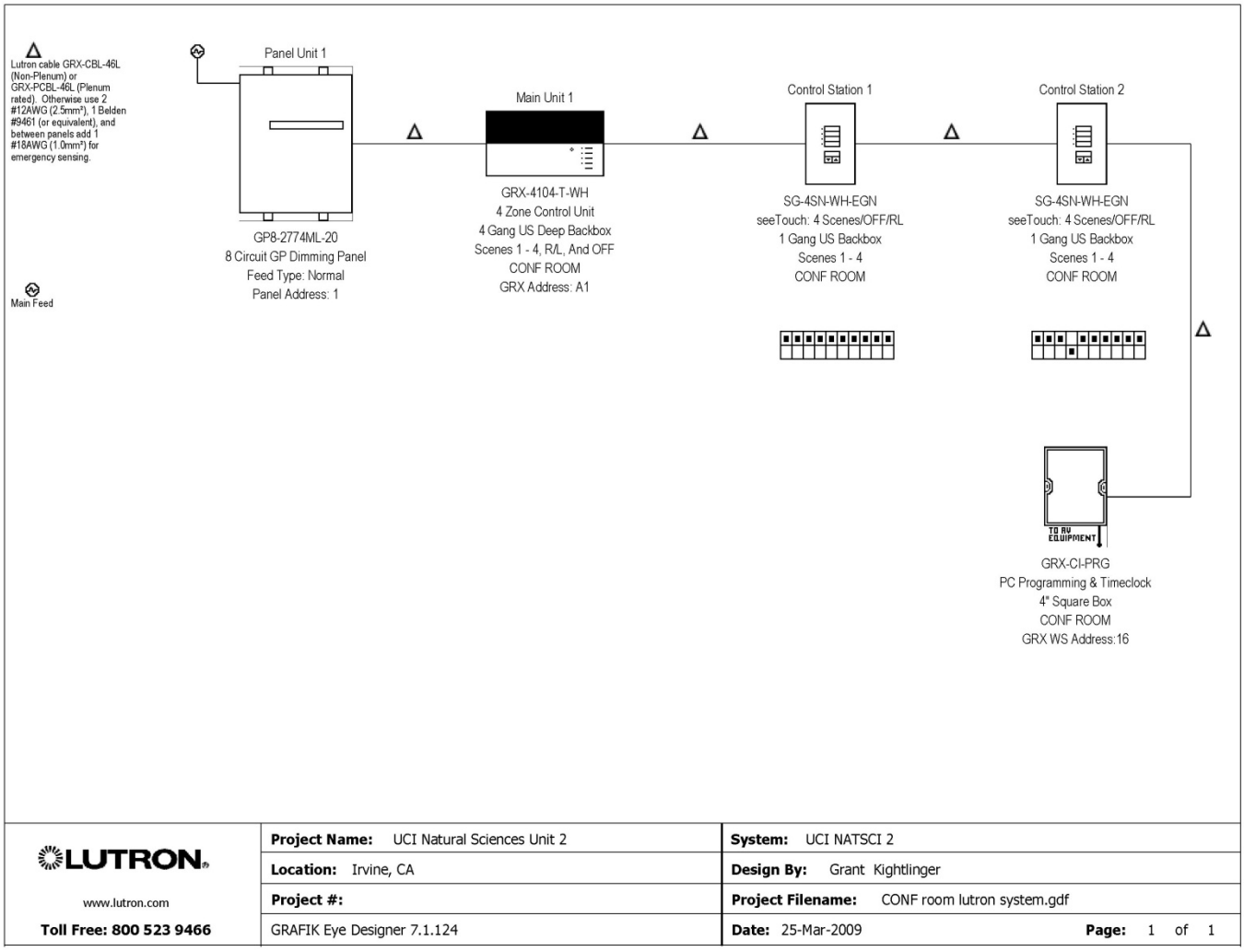
CONNECTED LOAD (KW) - A	22.13	TOTAL DESIGN LOAD (KW)	82.32
CONNECTED LOAD (KW) - B	23.16	POWER FACTOR	0.97
CONNECTED LOAD (KW) - C	25.22	TOTAL DESIGN LOAD (AMPS)	102

Feeder Size

DESIGN LOAD (WITH 20% SPARE)	102 A
CIRCUIT BREAKER SIZE	110 A
x 125% FOR 4 CCC'S	137.5 A
PHASE CONDUCTORS	(3) 1/0 AWG, 75° CU THWN
NEUTRAL CONDUCTOR	(1) 1/0 AWG, 75° CU THWN
GROUND CONDUCTIOR	(1) #6 AWG, 75° CU THWN

LUTRON Control System Specifications

*NOTE: See lighting design section for scene dim levels, etc.



Description:

UCI Natural Sciences Unit 2

Design By: Grant Kightlinger

Company:

Address:

Phone:

Design For:

Company:

Address:

Phone:

Lutron Contact Information
USA +1 610 282 3800
UK +44 (0)20 7702 0657
Singapore +65 6220 4666
France +33 (0)1 41 05 42 80

COMMISSIONING / STARTUP OPTION:
LCP128 Systems, Softswitch128 Systems, and GRAFIK Eye 4000 Systems containing LP, XP, or GP Power Panels include factory commissioning. Factory commissioning is optional for GRAFIK Eye 3000 and RadioTouch Systems.

Systems purchased with factory commissioning include 1 on-site visit by a Lutron field service engineer during normal business hours (M-F, 7am-6pm). Visits will include a complete system function test as well as system operation and maintenance training for the facilities team.

Please contact Lutron or check www.lutron.com for specific details about your warranty and commissioning program.

SCHEDULING:
Lutron requires 10 working days notice prior to system commissioning. Visits scheduled outside normal business hours, multiple visits or additional time on site due to circumstances beyond Lutron's direct control, or visits scheduled with less than 10 days notice will result in additional charges.

DELIVERY:
All standard products as listed in the current price guide ship within 48 hours unless otherwise indicated. Consult Lutron Customer Service for lead time on all Custom products. Build-to-order systems take approximately 4-6 weeks to manufacture after release of order from the distributor. Any changes to order will result in rescheduling, longer manufacturing time, and/or additional engineering charges.

CANCELLATION:
There will be a minimum cancellation charge of 25% of the value of this equipment should this order be cancelled.

RETURNS:
Custom products and systems are not returnable unless there is a defect in workmanship by Lutron Electronics Co., Inc.

LUTRON
Toll Free: 800 523 9466

Project Type: School/University
Location: Irvine, CA
Project #:
Project Filename: NEW PROJECT
GRAFIK Eye Designer 7.1.124
Date: 25-Mar-2009

CONF ROOM Summary Load Schedule

Lutron Zone	Customer Zone	Zone/Circuit Description	Customer Circuit #	Voltage	Load Type	Actual Load (W/VA)
A1-1	Zone 1	IND/DIR	7	277V	FL - Eco-10	160
A1-2	Zone 2	WHITEBD	8	277V	FL - Eco-10	128
A1-3	Zone 3	WALL WASH	9	277V	FL - Eco-10	160
A1-4	Zone 4	MR16s	10	277V	Incandescent	140

LUTRON
Toll Free: 800 523 9466

Project Name: UCI Natural Sciences Unit 2
Location: Irvine, CA
Project #:
System: UCI NATSCI 2
Design By: Grant Kightlinger
Project Filename: NEW PROJECT
GRAFIK Eye Designer 7.1.124
Date: 25-Mar-2009
Page: 1 of 1

CONF ROOM GP Dimming Panel Load Schedule

Panel Name: Panel Unit 1
Lutron Model No.: GP8-2774ML-20
Panel Address / Location: 1 /

Area/Room	Customer Circuit #	Customer Zone	Lutron Circuit	Lutron Zone	Zone/Circuit Description	Load Type	Actual Load (W/VA)	Max. Load (W/VA)	BRKR Size	Phase
CONF ROOM	10	Zone 4	1	A1-4	MR16s	Incandescent	140	4432	20A-1P	A
CONF ROOM	7	Zone 1	2	A1-1	IND/DIR	FL - Eco-10	160	4432	20A-1P	B
CONF ROOM	9	Zone 3	3	A1-3	WALL WASH	FL - Eco-10	160	4432	20A-1P	C
CONF ROOM	8	Zone 2	4	A1-2	WHITEBD	FL - Eco-10	128	4432	20A-1P	A
			5		Spare		0	4432	20A-1P	
			6		Spare		0	4432	20A-1P	
			7		Spare		0	4432	20A-1P	
			8		Spare		0	4432	20A-1P	

Phase A: 268 W/VA
Phase B: 160 W/VA
Phase C: 160 W/VA

277/480V, 3Ø-4 Wire Main Lugs GP Dimming Panel containing 1 20A-1Pole branch breaker rated at 14,000AIC for each of the 8 dimming circuits. Max input feed = 60A

Feed Type: Normal

LUTRON
Toll Free: 800 523 9466

Project Name: UCI Natural Sciences Unit 2
Location: Irvine, CA
Project #:
System: UCI NATSCI 2
Design By: Grant Kightlinger
Project Filename: NEW PROJECT
GRAFIK Eye Designer 7.1.124
Date: 25-Mar-2009
Page: 1 of 1

CONF ROOM Equipment Schedule

Lutron Model No.	Device Name	Address	Description	Function	Location	Notes
GP8-2774ML-20	Panel Unit 1	Panel 1	277/480V, 3Ø-4 Wire Main Lugs GP Dimming Panel containing 1 20A-1Pole branch breaker rated at 14,000AIC for each of the 8 dimming circuits. Max input feed = 60A	-		
GRX-4104-T-WH	Main Unit 1	A1	4 Zone GRAFIK Eye 4000 Control Unit with Translucent Top Cover. For use with Lutron GP, LP, and XP Power Panels. 4 Gang US Backbox.	Scenes 1 - 4, R/L, And OFF		
SG-4SN-WH-EGN	Control Station 1	GRX WS 1	seeTouch series GRAFIK Eye wallstation. Recalls preset light levels for up to 4 scenes plus off. Fine-tuning of light levels with master raise/lower. Noninsert Version; Optional Backlighting. 1 Gang US Backbox.	Scenes 1 - 4		
SG-4SN-WH-EGN	Control Station 2	GRX WS 2	seeTouch series GRAFIK Eye wallstation. Recalls preset light levels for up to 4 scenes plus off. Fine-tuning of light levels with master raise/lower. Noninsert Version; Optional Backlighting. 1 Gang US Backbox.	Scenes 1 - 4		
GRX-CI-PRG		GRX WS 16	RS232 and Ethernet Interface. Allows for PC Programming with GRX-3500 and GRX-4500 Control Units. Can also be used as an astronomic timeclock for any GRAFIK Eye system. Surface mount.			

LUTRON

Toll Free: 800 523 9466

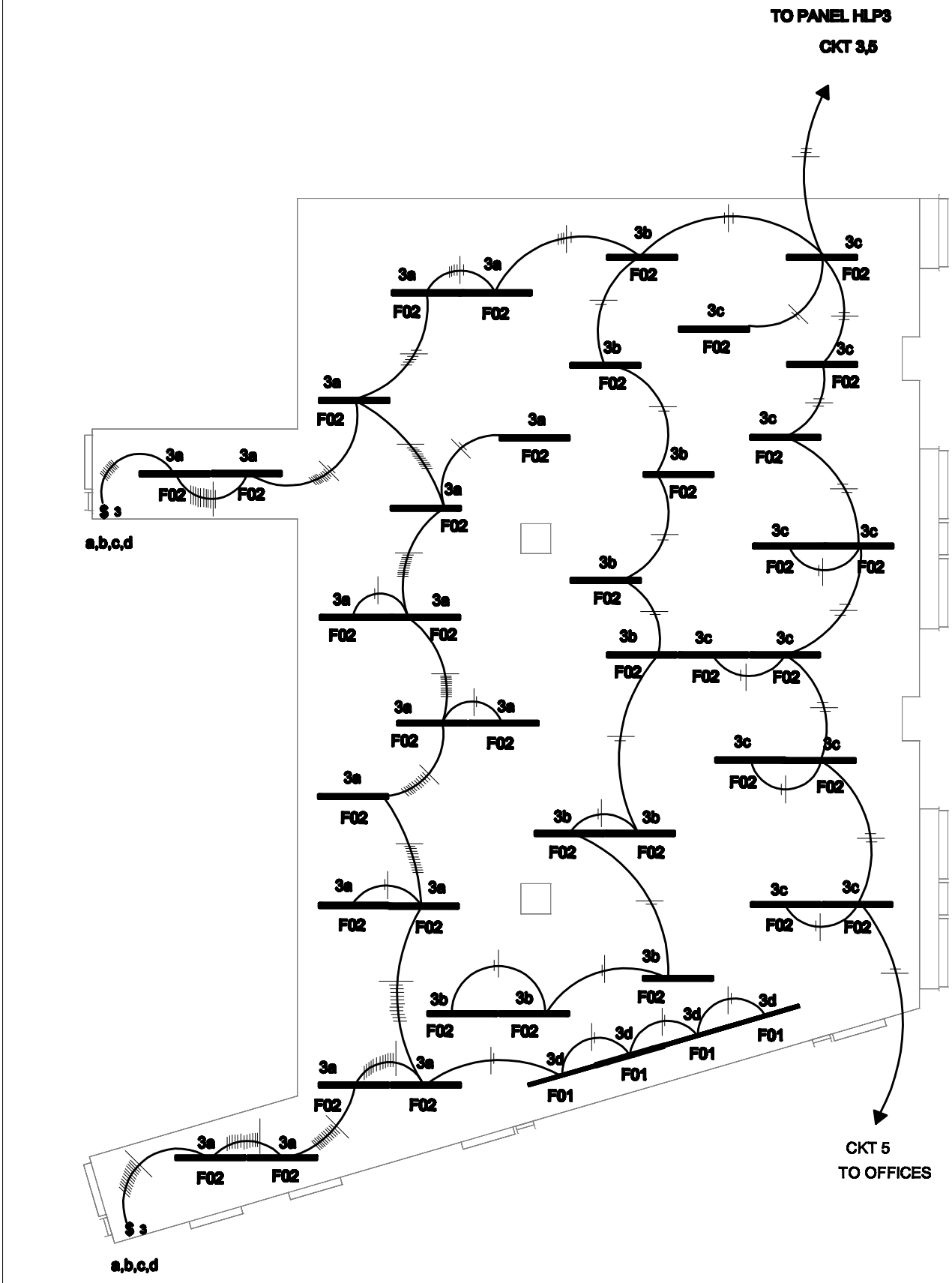
Project Name: UCI Natural Sciences Unit 2	**System:** UCI NATSCI 2	
Location: Irvine, CA	**Design By:** Grant Kightlinger	
Project #:	**Project Filename:** NEW PROJECT	
GRAFIK Eye Designer 7.1.124	**Date:** 25-Mar-2009	**Page:** 1 of 1

ELECTRICAL REDESIGN – OPEN OFFICE

Located on the third floor of the building, the open office contains workspaces for graduate students of the Biological Sciences department at UCI. The space measures approximately 1,840 square feet and features three large windows facing to the north-east. It is adjacent to two work rooms and several private faculty offices and is accessed through short corridors on the south wall.

Control Scheme

Although some flexibility of control is desired in the office, it has only one prevalent mode of use. The space is likely to be used at least 8 hours per day on weekdays, with intermittent use on weekends. Thus, the most important feature of the control system is simplicity. An occupancy sensor system is organized in such a way that it will maintain illumination whenever there are people working, even if they are not moving about the space. Please refer to the MAE daylight study section of this report for a more complete description of control details for this space.



UCI Nat. Sci. Unit II Irvine, California	Electrical Consultant: Prof. T. Dannerth, PE	Grant Kightlinger L/E Option	Penn State University AE 882 Senior Thesis	OPEN OFFICE ELEC. PLAN 1/8" = 1'-0"

Existing Panel Schedule

PANEL HLP3

MOUNTING	SURFACE			DOUBLE LUG	NO			VOLTS	277/480			MAIN	225A										
NEMA 3R	NO			200% NEUTRAL	NO			PHASE	3			BUS	225A										
FEED THRU	NO			I/G BUS	NO			WIRE	4			A.I.C.	SEE SC REPORTS										
NOTES	LOCATION	A	B	C	LTG	CONV	KIT	RECP	MISC	BKR	CIRC		CIRC	BKR	MISC	RECP	KIT	CONV	LTG	A	B	C	LOCATION	NOTES
	OFFICE LTG	3120			26					20/1	1		2	20/1					15	725			LAB CORRIDOR LTG	
	OPEN OFFICE LTG		2040		17					20/1	3		4	20/1					35		2760		LAB LTG	
	OFFICE LTG			3058	26					20/1	5		6	20/1					28			2160	LAB LTG	
	CONFERENCE RM LTG	2484			52					20/1	7		8	20/1					28	2160			LAB LTG	
	OFFICE/RESTRM LTG		2664		38					20/1	9		10	20/1					34		2640		LAB LTG	
	LOBBY LTG			1368	38					20/1	11		12	20/1					34			2640	LAB LTG	
	LOBBY LTG	561			33					20/1	13		14	20/1					25	1800			LAB LTG	
	CORRDOR LTG		331		6					20/1	15		16	20/1					34		2820		LAB LTG	
	CORRDOR LTG			1223	12					20/1	17		18	20/1					33			2460	LAB LTG	
A	EXIT SIGNS - OFFICE WING	45			15					20/1	19		20	20/1									SPARE	
A	EXIT SIGNS - LAB WING		45		15					20/1	21		22	20/1									SPARE	
	SPARE									20/1	23		24	20/1									SPARE	
	SPARE									20/1	25		26	20/1									SPARE	
	FUTURE SPARE									20/1	27		28	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	29		30	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	31		32	20/1									FUTURE SPARE	
	SPACE										33		34										SPACE	
	SPACE										35		36										SPACE	
	SPACE										37		38										SPACE	
	SPACE										39		40										SPACE	
	SPACE										41		42										SPACE	
		A= 10895								B= 13300										C= 12909				
	TOTAL VA=	37104	W/LCL=	46380						AMPS=	56								TOTAL LCL=	37104	X .25 =	9276		
	HIGH PHASE VA=	13300	W/LCL=	16625						HIGH PHASE AMPS=	60.0								HIGH PHASE LCL=	13300	X .25 =	3325		

New Panelboard Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HLP3	Panel Location:			Elec. Rm. 3277	
Nominal Phase to Neutral Voltage------->					277	Phase:			3	
Nominal Phase to Phase Voltage-------->					480	Wires:			4	
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	OFFICE LTG	3	3F	3120	va	0.95	2964	3120	
2	A	LAB CORR. LTG	3	3F	725	va	0.95	689	725	
3	B	OPEN OFFICE LTG	3	3F	1408	w	0.95	1408	1482	
4	B	LAB LTG	3	3F	2760	va	0.95	2622	2760	
5	C	OFFICE LTG	3	3F	3058	va	0.95	2905	3058	
6	C	LAB LTG	3	3F	2160	va	0.95	2052	2160	
7	A	CONF RM LTG	3	3F	2484	va	0.95	2360	2484	
8	A	LAB LTG	3	3F	2160	va	0.95	2052	2160	
9	B	OFFICE/RSTRM LTG	3	3F	2664	va	0.95	2531	2664	
10	B	LAB LTG	3	3F	2640	va	0.95	2508	2640	
11	C	LOBBY LTG	3	3F	1368	va	0.95	1300	1368	
12	C	LAB LTG	3	3F	2640	va	0.95	2508	2640	
13	A	LOBBY LTG	3	3F	561	va	0.95	533	561	
14	A	LAB LTG	3	3F	1800	va	0.95	1710	1800	
15	B	CORRIDOR LTG	3	3F	331	va	0.95	314	331	
16	B	LAB LTG	3	3F	2820	va	0.95	2679	2820	
17	C	CORRIDOR LTG	3	3F	1223	va	0.95	1162	1223	
18	C	LAB LTG	3	3F	2460	va	0.95	2337	2460	
19	A	EXIT SIGNS - OFFIC	3	3F	45	va	0.95	43	45	
20	A	SPARE		-	3600	va	1.00	3600	3600	
21	B	EXIT SIGNS - LAB	3	3F	45	va	0.95	43	45	
22	B	SPARE		-	3600	va	1.00	3600	3600	
23	C	SPARE		-	3600	va	1.00	3600	3600	
24	C	SPARE		-	3600	va	1.00	3600	3600	
25	A	SPARE		-	3600	va	1.00	3600	3600	
26	A	SPARE		-	3600	va	1.00	3600	3600	
27	B	FUTURE SPARE		-	0	va	1.00	0	0	
28	B	FUTURE SPARE		-	0	va	1.00	0	0	
29	C	FUTURE SPARE		-	0	va	1.00	0	0	
30	C	FUTURE SPARE		-	0	va	1.00	0	0	
31	A	FUTURE SPARE		-	0	va	1.00	0	0	
32	A	FUTURE SPARE		-	0	va	1.00	0	0	
33	B	SPACE		-	0	va	1.00	0	0	
34	B	SPACE		-	0	va	1.00	0	0	
35	C	SPACE		-	0	va	1.00	0	0	
36	C	SPACE		-	0	va	1.00	0	0	
37	A	SPACE		-	0	va	1.00	0	0	
38	A	SPACE		-	0	va	1.00	0	0	
39	B	SPACE		-	0	va	1.00	0	0	
40	B	SPACE		-	0	va	1.00	0	0	
41	C	SPACE		-	0	va	1.00	0	0	
42	C	SPACE		-	0	va	1.00	0	0	
PANEL TOTAL								56.3	58.1	Amps= 70.0

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					21.2	21.7	37%	78.3
PHASE TOTAL	B					15.7	16.3	28%	59.0
PHASE TOTAL	C					19.5	20.1	35%	72.6

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.80	0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		34.7	36.5	0.95	33.0	34.7	0.95		
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0		0.0	0.0			
7	heating		0.0	0.0		0.0	0.0			
8	kitchen equipment		0.0	0.0		0.0	0.0			
9	unassigned		21.6	21.6		21.6	21.6	1.00		
Total Demand Loads						54.6	56.3			
Spare Capacity			20%			10.9	11.3			
Total Design Loads						65.5	67.6	0.97	Amps=	81.3

New Panelboard Schedule

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: HLP3
PANEL LOCATION: Elec. Rm. 3277
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
OFFICE LTG	3F	2964	20A/1P	1	*			2	20A/1P	689	3F	LAB CORR. LTG
OPEN OFFICE LTG	3F	1408	20A/1P	3		*		4	20A/1P	2622	3F	LAB LTG
OFFICE LTG	3F	2905	20A/1P	5			*	6	20A/1P	2052	3F	LAB LTG
CONF RM LTG	3F	2360	20A/1P	7	*			8	20A/1P	2052	3F	LAB LTG
OFFICE/RSTRM LTG	3F	2531	20A/1P	9		*		10	20A/1P	2508	3F	LAB LTG
LOBBY LTG	3F	1300	20A/1P	11			*	12	20A/1P	2508	3F	LAB LTG
LOBBY LTG	3F	533	20A/1P	13	*			14	20A/1P	1710	3F	LAB LTG
CORRIDOR LTG	3F	314	20A/1P	15		*		16	20A/1P	2679	3F	LAB LTG
CORRIDOR LTG	3F	1162	20A/1P	17			*	18	20A/1P	2337	3F	LAB LTG
EXIT SIGNS - OFFIC	3F	43	20A/1P	19	*			20	20A/1P	3600	-	SPARE
EXIT SIGNS - LAB	3F	43	20A/1P	21		*		22	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	23			*	24	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	25	*			26	20A/1P	3600	-	SPARE
FUTURE SPARE	-	0	20A/1P	27		*		28	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	29			*	30	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	31	*			32	20A/1P	0	-	FUTURE SPARE
SPACE	-	0	20A/1P	33		*		34	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	35			*	36	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	37	*			38	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	39		*		40	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	41			*	42	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A	21.15	TOTAL DESIGN LOAD (KW)	65.50
CONNECTED LOAD (KW) - B	15.71	POWER FACTOR	0.97
CONNECTED LOAD (KW) - C	19.46	TOTAL DESIGN LOAD (AMPS)	81

Feeder Size

DESIGN LOAD (WITH 20% SPARE)	81 A
CIRCUIT BREAKER SIZE	90 A
x 125% FOR 4 CCC'S	112.5 A
PHASE CONDUCTORS	(3) #2 AWG, 75° CU THWN
NEUTRAL CONDUCTOR	(1) #2 AWG, 75° CU THWN
GROUND CONDUCTIOR	(1) #8 AWG, 75° CU THWN

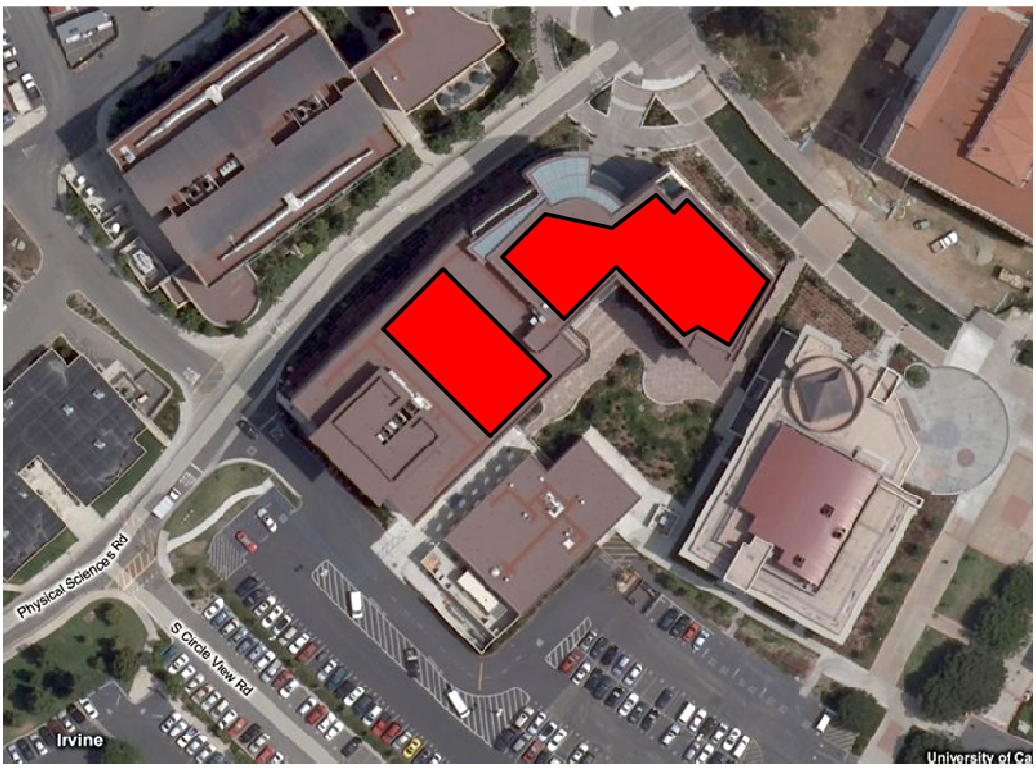
ELECTRICAL DEPTH: PHOTOVOLTAIC ARRAY STUDY

Heightened energy costs and increased environmental awareness in the building industry demand the consideration of alternative energy solutions for new construction. The University of California is a leader is sustainable technologies research, and seeks to maintain its image of environmental responsibility. This study is intended to determine the economic feasibility of implementing a roof-based photovoltaic array system UCI Natural Science Unit II. RETScreen 4 energy modeling software has been used to estimate the power production and climate data for this study.

System Scale

UCI Natural Science Unit II is taller than all surrounding buildings, and therefore is not in danger of shading from adjacent structures. The roof is vacant except for an equipment canopy area above the laboratory wing. This general area has been avoided due to possible shading. In addition, a roof area usability factor of 75% has been assumed for the analysis. This preserves enough extra space to allow for access to the panels for maintenance and repairs.

Unoccupied Roof Area:	21302 ft²
Usable Roof Area (assume 75%):	15976 ft²
PV Unit Frame Area:	13.6 ft²
Total Installable Units:	1174 panels



Available Roof Area
[maps.live.com]

Photovoltaic Equipment

The BP Solar 3165 photovoltaic panel has been used for this analysis. This particular model has been selected for its relatively high capacity (165 Watts) and also for its high module efficiency of 13.1%. Complete specifications for this equipment can be found at the end of this section.

Typical electrical characteristics	BP 3165	
	(STC)[1]	(NOCT)[2]
Rated power (P_{max})	165W	119W
Voltage at P_{max} (V_{mp})	35.2V	31.3V
Current at P_{max} (I_{mp})	4.7A	3.8A
Short circuit current (I_{sc})	5.1A	4.1A
Open circuit voltage (V_{oc})	44.2V	40.2V
Limiting reverse current	5.1A	
Module efficiency at STC	13.1%	
Efficiency reduction at 200W/m^2	< 3%	
Temperature coefficient of I_{sc}	(0.065±0.015)%/ºC	
Temperature coefficient of V_{oc}	-(0.36±0.05)%/ºC	
Temperature coefficient of P_{max}	-(0.5±0.05)%/ºC	
NOCT[3]	47±2ºC	
Maximum series fuse rating	15A (BP ####N) / 20A (BP ####J)	
Application class	Class A installation (IEC 61730)	
Maximum system voltage	1000V (IEC 61730) 600V (UL)	

[www.bp.com]

Climate Data

Climate information was unavailable for Irvine, California within the RETScreen database. Therefore, climate data for the nearby city of Long Beach was utilized for the purposes of this analysis. The following is a summary of the climate profile which was used.

	Unit	Climate data location	Project location
Latitude	°N	33.8	33.8
Longitude	°E	-118.2	-118.2
Elevation	ft	17	17
Heating design temperature	°F	6.2	
Cooling design temperature	°F	30.9	
Earth temperature amplitude	°F	13.5	

Month	Air temperature	Relative humidity	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days	Cooling degree-days
	°F	%	kWh/m²/d	kPa	mph	°F	°F-d	°F-d
January	55.2	64.4%	2.79	101.8	5.6	55.2	285	162
February	56.7	66.7%	3.61	101.7	6.3	56.8	217	186
March	57.9	67.2%	4.73	101.5	7.2	60.7	201	246
April	60.8	65.8%	5.99	101.4	7.4	65.5	108	324
May	63.5	68.3%	6.43	101.3	7.4	70.2	28	419
June	66.7	69.7%	6.71	101.2	7.2	75.2	0	502
July	70.9	68.9%	7.26	101.2	6.9	79.0	0	647
August	72.1	68.9%	6.67	101.2	6.7	79.5	0	686
September	70.5	69.5%	5.37	101.1	6.3	76.6	0	616
October	66.7	68.2%	4.16	101.4	5.8	70.2	0	519
November	60.3	66.3%	3.13	101.6	5.6	61.5	124	308
December	55.2	65.5%	2.59	101.7	5.1	55.5	285	162
Annual	63.1	67.5%	4.96	101.4	6.4	67.2	1,247	4,776
Measured at	ft				32.8	0.0		

System Performance

The estimated performance of the selected system was calculated using RETScreen software. The following results have been incorporated into the financial feasibility analysis.

Photovoltaic			
Power capacity	kW	193.71	
Manufacturer		BP Solar	
Model		poly-Si - BP 3165	1174 unit(s)

Financial Analysis

Initial Cost

RS Means 2009 section D5090 has been used to estimate the initial cost of the entire system described in this report. Cost figures include all necessary peripheral and installation equipment and labor for the proposed system. A similar 167 Watt, 60 unit array is priced at $112,810. Adjusted for the 1174 proposed panels, the initial system cost amounts to an estimated **$2,211,033** for the entire system.

Utility Savings

According to RETScreen, the 15,917 ft² array is expected to produce approximately 270.5 MWh annually. At a utility cost of $90.33 per MWh (or $0.09033 per kWh), the system will save an estimated utility cost of **$24,434** per year.

Month	Daily solar radiation - horizontal kWh/m²/d	Electricity ported to grid MWh
January	2.79	13.54
February	3.61	15.63
March	4.73	22.37
April	5.99	26.94
May	6.43	29.63
June	6.71	29.65
July	7.26	32.62
August	6.67	29.98
September	5.37	23.70
October	4.16	19.36
November	3.13	14.47
December	2.59	12.60
Annual	**4.96**	**270.48**
MWh/m²	1.81	

*NOTE: Utility costs are based on Southern California Edison's TOU-8 time-of-use based rate structure. A mid-peak summer seasonal rate has been selected for use in this estimation. For more information on the utility rates for the UCI campus, see the electrical appendix of this report.

Incentives – California Solar Initiative

The California Solar Initiative (CSI) is a program which rewards utility customers of Southern California Edison for the production solar power technologies. SCE non-residential rewards for systems with capacities greater than 50 kW are currently set at $0.22 per kWh produced. Using the incentive calculator provided by the CSI website at www.csi-epbb.com, the total anticipated incentive amount for this system was determined to be **$293,169**.

Site Specifications:	
Project Name	UCI Natural Science Unit II
ZIP Code	92612
City	Irvine
Utility	SCE
Customer Type	Commercial
Incentive Type	PBI
PV System Specifications:	
PV Module	BP Solar:SX3165I 165.0W STC, 146.1W PTC
Number of Modules	1174

Results	
Annual kWh	266,517
Summer Months	May-October
Summer kWh	164,464
CEC-AC Rating	**166.376 kW**
Capacity Factor[1]	18.286%
Prevailing Capacity Factor[2]	20.000%
Design Factor[3]	**91.430%**
Eligible Annual kWh[4]	**266,517**
Incentive Rate	**$0.22/kWh**
Incentive[5]	**$293,169**
Report Generated on	4/2/2009 10:06:21 PM

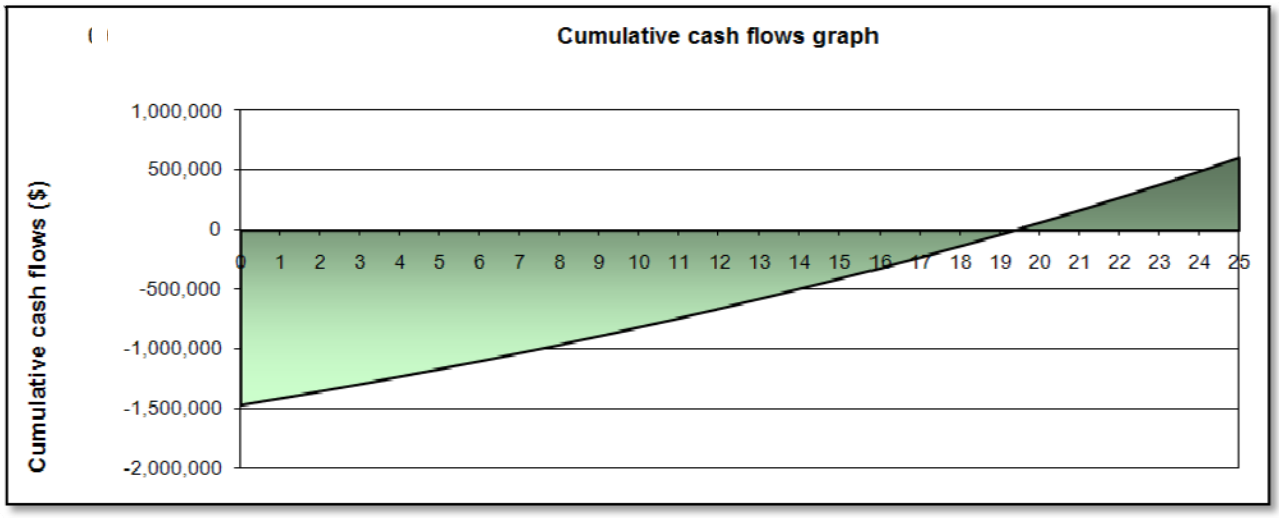
Incentives – Federal Tax Credit

An additional federal tax credit of approximately **$456,000** is also applicable to this project. This estimation was performed using the BP Solar Clean Power Estimator at bpsolar.cleanpowerestimator.com. The combination of these two incentives represents a total savings of $749,169 for this installation.

System Financial Details

The collected financial data has been entered into RETScreen and a cash flow analysis has been performed. The results predict an approximate equity payback period of 19.4 years for the proposed system.

Financial parameters		
Inflation rate	%	3.0%
Project life	yr	25
Debt ratio	%	0%
Initial costs		
Power system	$	2,211,033
Other	$	
Total initial costs	$	2,211,033
Incentives and grants	$	749,169
Annual costs and debt payments		
O&M (savings) costs	$	-24,434
Fuel cost - proposed case	$	0
	$	
Total annual costs	$	-24,434
Annual savings and income		
Fuel cost - base case	$	0
Electricity export income	$	30,656
	$	
Total annual savings and income	$	30,656
Financial viability		
Pre-tax IRR - assets	%	2.5%
Simple payback	yr	26.5
Equity payback	yr	19.4



Conclusions

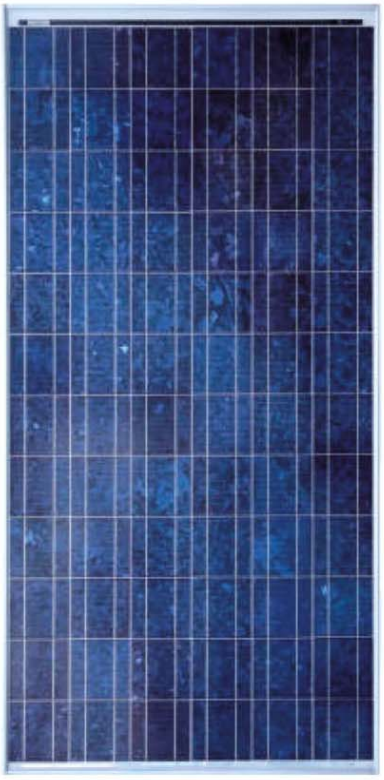
From the data collected in this study, the installation of a photovoltaic system on the roof of UCI Natural Science Unit II has been shown to be a viable option. Assuming a minimum 25 year system life (during which time the equipment is under warranty by BP Solar), a positive net result seems to be achievable for this project. The initial cost of installing the system represents a significant investment, but the overall economic value of the system needs to be considered.

In addition to the financial benefits of installing a photovoltaic system, social benefits for the university are also probable. A solar array on the roof of this building might allow students to perform unique hands-on studies of alternative energy solutions. Furthermore, the image of The University of California Irvine as an institution which is deeply committed to environmental issues and sustainable building methods will be highlighted. In turn, these opportunities may help to bring more students and faculty to the campus on a long-term level.

Based on these economic and social benefits, a photovoltaic array on the roof of UCI Natural Science Unit II is recommended.

165 watt photovoltaic module
BP 3165

The BP 3165 is an advanced 165 watt module utilising anti-reflective coatings on both its multicrystalline cells and glass. The module also features IntegraBus™ technology which is a printed circuit board with integrated diodes that has been designed to ensure reliability whilst conducting higher currents. The BP 3165 has been designed for grid-connected solar applications, such as large commercial roofs, residential systems and photovoltaic (PV) power plants, as well as remote off-grid applications such as telecommunications, water pumping and residential systems. This 72-cell module offers superior value – greater performance from a white polyester back-sheet and innovative, high-efficiency cells.



BP 3165

Performance	BP 3165	BP 3160
Rated power	165W	160W
Power tolerance	±3%	±3%
Nominal voltage	24V	24V
Warranty *	90% of minimum warranted power output over 12 years 80% of minimum warranted power output over 25 years Free from defects in materials and workmanship for 5 years	

Configuration

BP 3165N	Universal frame, a sealed junction box with output cables and polarised Multicontact (MC III) connectors.
BP 3165J	Universal frame with an accessible junction box for cable connection.

Qualification test parameters

Temperature cycling range	-40ºC to +85ºC
Damp heat test	85ºC and 85% relative humidity
Front and rear static load test (eg: wind)	2400Pa (equivalent to 245kg/m^2 load distributed)
Front load test (eg: snow)	5400Pa† (equivalent to 550kg/m^2 load distributed)
Hailstone impact test	25mm hail at 23m/s
Impulse voltage test	8000V waveform impulse according to high voltage test techniques IEC60060-1 standard
Reverse current overload test	135% of the overcurrent protection rating for two hours

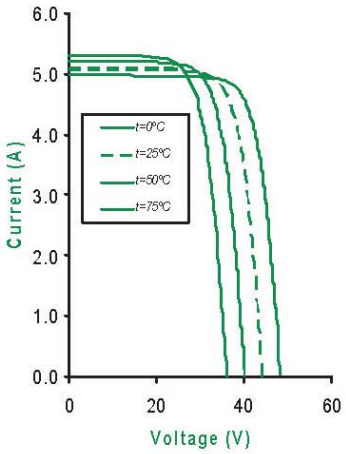
Quality and safety

- Certified according to the extended version of the IEC 61215:2005 (crystalline silicon terrestrial photovoltaic modules – design qualification and type approval).
- Certified according to IEC 61730-1 and IEC 61730-2 (photovoltaic module safety qualification, requirements for construction and testing).
- Listed by Underwriter's Laboratories for electrical and fire safety (Class C fire rating).
- Approved by Factory Mutual Research in NEC Class 1, Division 2, Groups C and D hazardous locations (BP ####J).
- Module electrical measurements are calibrated to world radiometric reference via third party international laboratories.
- Manufactured in ISO 9001 and ISO 14001 certified factories.

* Refer to BP Solar's warranty document for terms and conditions.

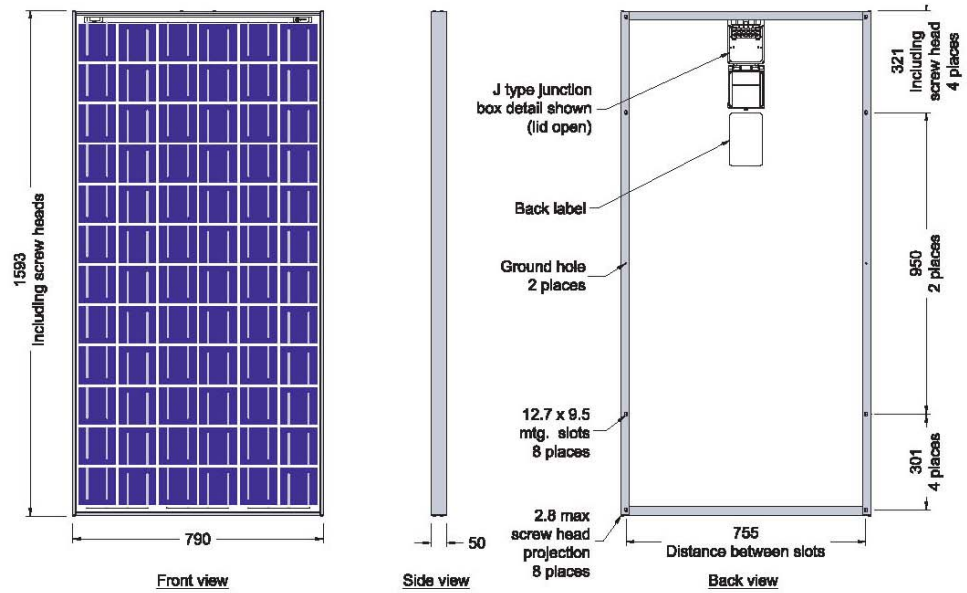
† When module mounted in accordance with BP Solar's installation instructions.

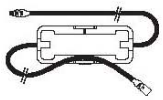
BP3165 I-V Curves



165 watt photovoltaic module
BP 3165

Module diagram





N type junction box detail with wire-hold feature (not to scale)

Typical electrical characteristics

	BP 3165		BP 3160	
	(STC)[1]	(NOCT)[2]	(STC)[1]	(NOCT)[2]
Rated power (P_{max})	165W	119W	160W	115W
Voltage at P_{max} (V_{mp})	35.2V	31.3V	35.1V	31.2V
Current at P_{max} (I_{mp})	4.7A	3.8A	4.55A	3.6A
Short circuit current (I_{sc})	5.1A	4.1A	4.8A	3.9A
Open circuit voltage (V_{oc})	44.2V	40.2V	44.2V	40.2V
Limiting reverse current	5.1A		4.8A	
Module efficiency at STC	13.1%		12.7%	
Efficiency reduction at 200W/m^2	< 3%			
Temperature coefficient of I_{sc}	(0.065±0.015)%/°C			
Temperature coefficient of V_{oc}	-(0.36±0.05)%/°C			
Temperature coefficient of P_{max}	-(0.5±0.05)%/°C			
NOCT[3]	47±2°C			
Maximum series fuse rating	15A (BP ####N) / 20A (BP ####J)			
Application class	Class A installation (IEC 61730)			
Maximum system voltage	1000V (IEC 61730) 600V (UL)			

Mechanical characteristics

Solar cells	72 multicrystalline cells (125 x 125mm) connected in series.
Construction	Front: high transmission 3.2mm tempered anti-reflective coated glass. Encapsulant: EVA. Rear: white polyester.
Frame	Clear anodised aluminium, alloy type 6063T6. Colour: silver.
Diodes	IntegraBus™ technology includes 3 Schottky bypass diode – one for every 24 cells – on a printed circuit board.
Output cables (N type)	RHW AWG# 12 (3.3mm^2) cable with polarised weatherproof DC-rated MC III connectors; asymmetrical lengths 1250mm (-) and 800mm (+).
Junction box (J type)	IP65 junction box with four terminal screw connection block, accepts PG 13.5, M20, 13mm conduit, or cable fittings accepting 6 – 12mm diameter cable. Terminals accept 2.5 – 10mm^2 (8 to 14 AWG) wire.
Dimensions	1593 x 790 x 50mm (overall tolerances ±3mm)
Weight	15.4kg

Your BP Solar Dealer:

1. Standard test conditions (STC), irradiance of 1000W/m^2 at an AM1.5G solar spectrum and a cell temperature of 25°C.
2. 800W/m^2, NOCT, AM 1.5G solar spectrum.
3. Normal operating cell temperature (NOCT) air temperature of 20°C; irradiance 800W/m^2; wind speed 1m/s.

ELECTRICAL DEPTH: COPPER VS. ALUMINUM FEEDERS

The focus of this depth study is to determine the economic and other impacts of changing the entire electrical feeder system from copper to aluminum conductors for UCI Natural Science Unit II. Basic advantages and disadvantages have been studied and are presented here, along with a calculation of the estimated financial impact of the change for this particular building project.

Copper Considerations

The existing system in the building uses Copper THWN conductors throughout. Copper feeders are preferable for several reasons over aluminum feeders and have probably been chosen in this case for their long-term value as opposed to an initial installation cost. The higher conductivity of copper allows the wires to be smaller than aluminum for the same load. This, in turn, means that they are easier and less expensive to install in terms of labor. In addition, conduit sizes can generally be smaller with copper feeders for the reason stated above, and this saves additional labor time and cost. Another advantage of copper conductors is their higher resiliency to physical stress which reduces maintenance cost for the system over its life. This type of feeder is generally preferred by contractors.

Aluminum Considerations

Perhaps the most obvious advantage of using aluminum feeders is their significantly lower material cost. This leads to attractive initial installation savings for project owners. Aluminum is also a lighter-weight metal than copper. However, notable disadvantages of aluminum conductors include lower conductivity which requires larger wire sizes and conduit sizes. This represents additional labor and material cost for the project. Generally, aluminum feeders are considered to be less resilient and do not last as long as a copper feeder system. Both feeder types are made of recyclable materials.

Cost Comparison

The following cost comparison utilizes RS Means version 2009 estimations for material and labor costs for conduit and conductors. The run lengths for each feeder have been estimated based on panel locations. A full feeder schedule is available in the electrical appendix of this report.

				EXISTING - COPPER FEEDERS				PROPOSED - ALUMINUM FEEDERS				
				PHASE	NEUTRAL	GROUND	CONDUIT	PHASE	NEUTRAL	GROUND	CONDUIT	
TAG	TOTAL FT	PROTECTION	TAG FT									
1	264	-	264	$14,890	$7,445	$3,622	$104	$6,716	$3,358	$2,661	$176	*
2	110	4000A	110	$51,183	$17,061	$17,061	$239	$23,087	$7,696	$11,447	$478	*
3	380	600A	800	$33,888	$0	$4,912	$138	$16,896	$0	$3,456	$267	
4	121	225A	2489	$51,224	$17,075	$4,406	$416	$29,719	$9,906	$3,099	$416	
5	279	400A	795	$22,419	$0	$1,662	$133	$10,112	$0	$1,550	$137	*
6	156	225A	156	$2,140	$0	$276	$11	$1,242	$0	$194	$13	
7	356	500A	356	$13,144	$0	$2,186	$62	$7,519	$0	$1,538	$119	
8	120	1000A	120	$11,437	$3,812	$1,638	$60	$5,702	$1,901	$990	$71	
9	135	225A	4844	$99,690	$66,460	$8,574	$809	$57,837	$38,558	$6,031	$957	
10	160	1200A	480	$60,998	$40,666	$10,752	$379	$30,413	$20,275	$6,106	$463	
11	428	700A	428	$36,209	$0	$3,193	$169	$16,332	$0	$2,773	$286	*
12	50	250A	50	$1,197	$0	$89	$8	$621	$0	$62	$8	
13	110	125A	110	$1,013	$0	$138	$8	$713	$0	$107	$10	
14	254	100A	254	$1,916	$639	$230	$15	$1,433	$478	$199	$22	
15	296	600A	672	$10,140	$3,380	$1,216	$78	$7,580	$2,527	$1,055	$116	
16	296	800A	672	$56,851	$18,950	$5,013	$265	$25,644	$8,548	$4,355	$449	*
17	888	2000A	888	$225,374	$75,125	$42,517	$1,284	$101,658	$33,886	$29,304	$1,780	*
18	148	350A	296	$12,521	$0	$619	$58	$5,648	$0	$577	$99	*
19	20	800A	20	$1,692	$0	$149	$8	$763	$0	$130	$13	*
20	148	175A	698	$9,528	$0	$876	$60	$5,759	$0	$681	$60	
21	82	25A	82	$154	$0	$51	$3	$140	$0	$47	$3	
22	82	60A	82	$435	$145	$51	$5	$306	$102	$47	$5	
23	75	70A	442	$2,347	$0	$400	$20	$1,651	$0	$347	$26	
24	75	150A	442	$4,946	$1,649	$555	$38	$3,342	$1,114	$347	$38	
25	112	50A	112	$422	$141	$70	$5	$328	$109	$64	$6	
26	135	150A	320	$3,581	$0	$402	$23	$2,419	$0	$312	$28	
27	75	400A	360	$15,228	$10,152	$752	$87	$6,869	$4,579	$702	$142	*
28	148	50A	296	$1,114	$0	$185	$13	$866	$0	$169	$13	
				$745,681	**$262,699**	**$111,594**	**$4,498**	**$371,313**	**$133,037**	**$78,349**	**$6,201**	
				TOTAL COPPER COST:				**TOTAL ALUMINUM COST:**				
				$1,124,472				**$588,900**				

NOTES:

- Tags marked with a * symbol have been split into additional runs to avoid feeder sizes over 500KCMIL conductors.
- Please see the full feeder schedule for specific run origins and destinations. This table is a summary of tag totals.

Cost Data

The following cost data was used for this analysis and was obtained from RS Means 2009.

	COPPER WIRE			ALUMINUM WIRE		
SIZE	MATL	LABOR	TOTAL	MATL	LABOR	TOTAL
-	0	0	0	0	0	0
#10	$25	$38	$63	$16	$21	$37
#8	$44	$47	$91	$23	$34	$57
#6	$68	$58	$126	$32	$47	$79
#4	$106	$71	$177	$40	$58	$98
#3	$134	$75	$209	$47	$65	$111
#2	$168	$84	$252	$54	$71	$125
#1	$213	$94	$307	$79	$84	$162
"1/0"	$259	$114	$373	$94	$94	$188
"2/0"	$325	$130	$455	$112	$104	$216
"3/0"	$410	$150	$560	$138	$114	$252
"4/0"	$515	$171	$686	$154	$121	$275
250KCMIL	$610	$188	$798	$188	$130	$318
300KCMIL	$725	$198	$923	$259	$139	$398
350KCMIL	$850	$209	$1,059	$264	$150	$414
400KCMIL	$970	$221	$1,191	$310	$163	$473
500KCMIL	$1,175	$235	$1,410	$340	$188	$528

	CONDUIT PRICING		
INCHES	MATL	LABOR	TOTAL
0.75	$1.05	$2.31	$3.36
1	$1.84	$2.62	$4.46
1.25	$2.81	$2.98	$5.79
1.5	$3.78	$3.34	$7.12
2	$4.88	$3.76	$8.64
2.5	$11.70	$5.00	$16.70
3	$13.75	$6.00	$19.75
3.5	$17.40	$6.70	$24.10

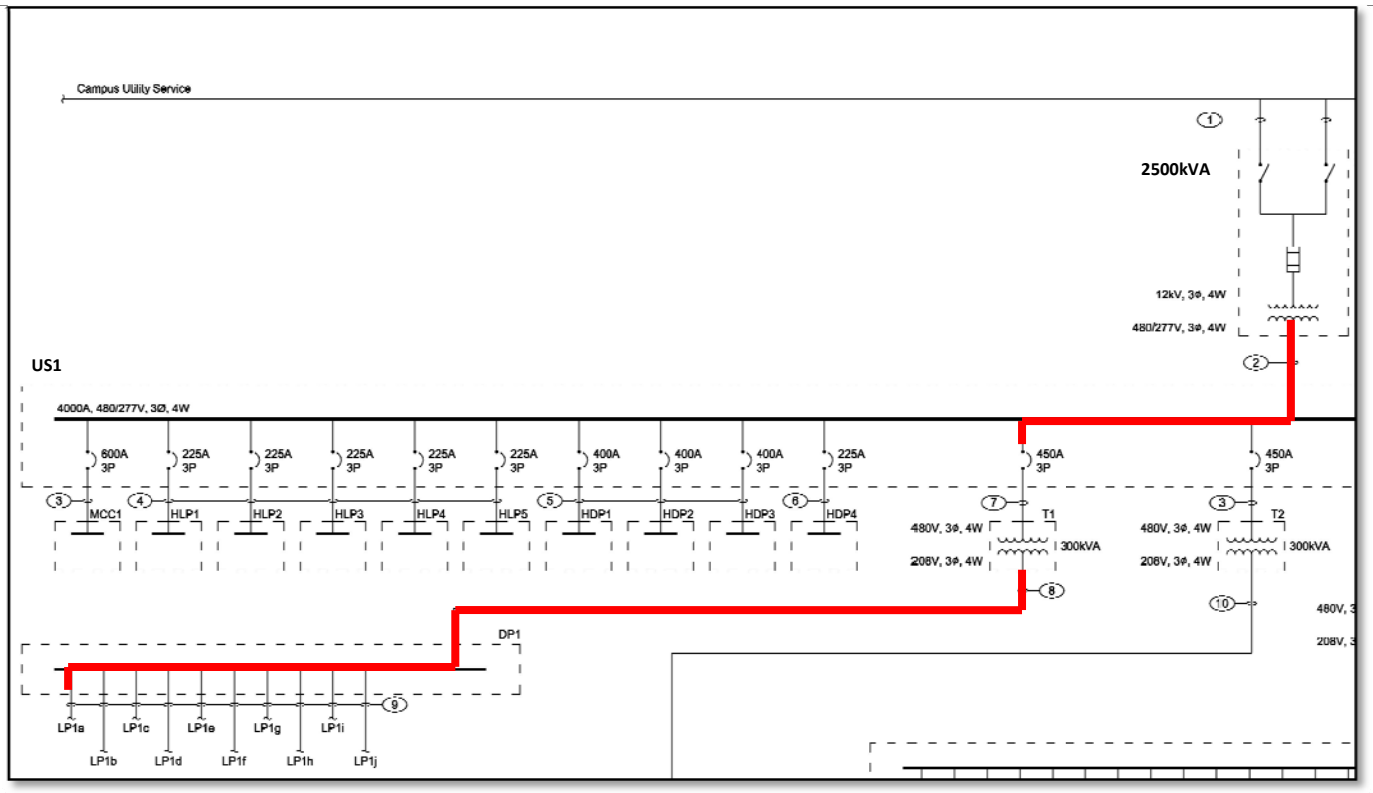
Conclusions / Recommendation

A total cost estimate of the existing system which uses copper feeders has been found to be $1,124,472. This is in comparison to approximately $588,900 for an all aluminum feeder system. The significant difference in these two figures is most likely a result of several long runs of feeders throughout the building which serve to amplify the price difference between the two wire types. An installation cost savings of $555,572 (approximately 48%) applies to the aluminum system.

Although this is a very significant savings, the higher maintenance cost of aluminum systems was not included in this analysis and would reduce this difference somewhat. The recommended course of action in this case would depend somewhat on the budget of the project. However, based on the potential for a 48% savings in this particular case, very serious consideration of using aluminum feeders is recommended.

SHORT CIRCUIT ANALYSIS

Short Circuit Analysis Path



Analysis Summary

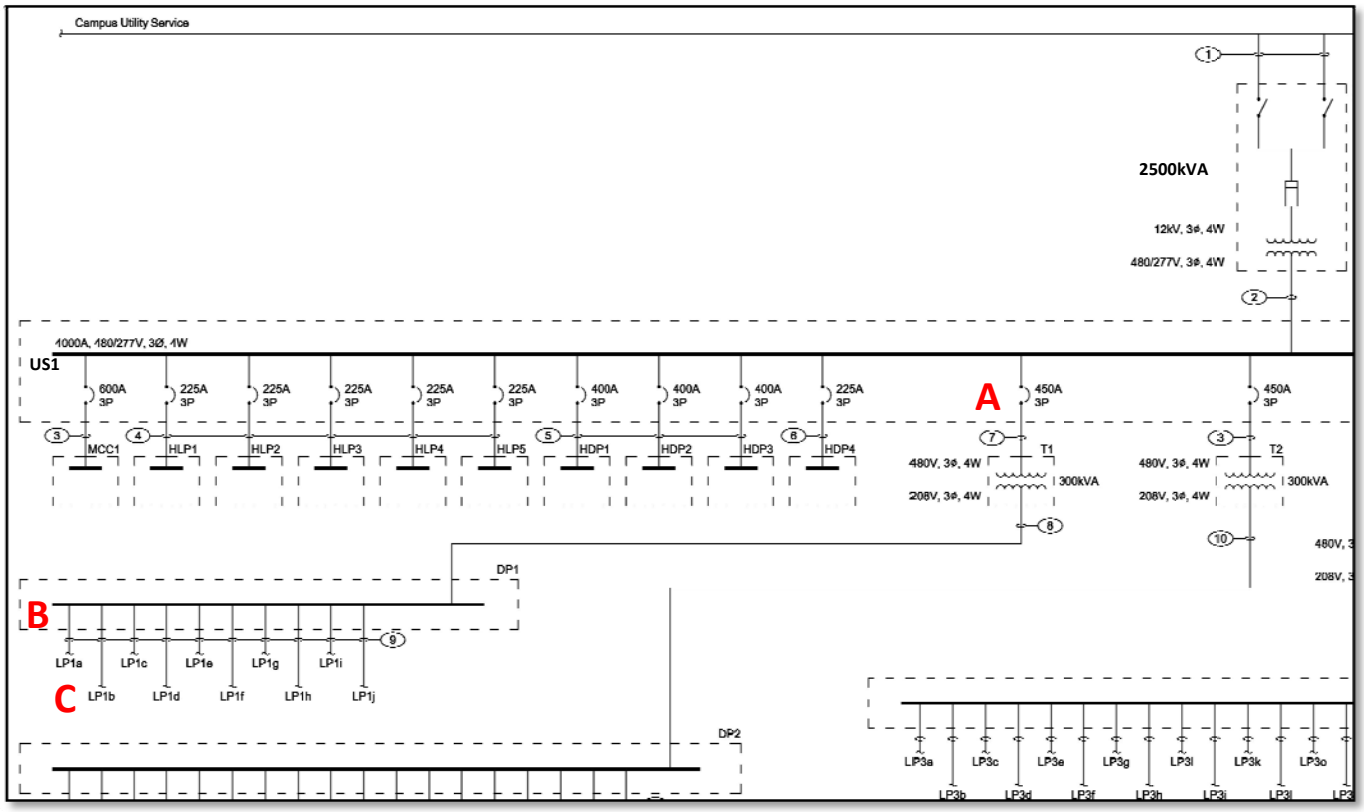
LOCATION	FAULT CURRENT	STANDARD BREAKER RATING
UTILITY XFMR SECONDARY	52,303 A	65,000A
SWITCHBOARD US1	48,680 A	50,000 A
PANEL DP1	12,415 A	14,000 A
PANEL LP1a	5,309 A	14,000 A

Analysis Details

UTILITY XFMR SECONDARY							
Base kVA (Assumed)	10000						
Avail. Utility Fault (kVA)	1000000						
System Voltage (kV)	0.48						
Utility Transformer (kVA)	2500.00	**X (p.u.)**	0.010000	(Base kVA / Utility S.C. kVA)			
Average % Z	5.50	**X (p.u.)**	0.219240	(%X * Base kVA) / (100 *XFMR kVA)			
Average X/R	12.00	**R (p.u.)**	0.018270	(%R * Base KVA) / (100 *XFMR kVA)			
R (%)	0.4568						
X (%)	5.4810	**ΣX(p.u.)**	0.229240				
		ΣR(p.u.)	0.018270				
		ΣZ(p.u.)	0.229967	$\sqrt{(\Sigma X(p.u.))^2+(\Sigma R(p.u.))^2}$			
SHORT CIRCUIT CURRENT (A)	**52303.73**						
US1							
Number of Sets	11	**X(p.u.)**	0.016189				
Length (Ft)	110.00	**R(p.u.)**	0.010286				
Wire Size	500KCMIL						
(TABLE 7) X_L	0.03730000						
(TABLE 7) R	0.02370000	**ΣX(p.u.)**	0.245429				
X	0.00037300	**ΣR(p.u.)**	0.028556				
R	0.00023700	**ΣZ(p.u.)**	0.247085	$\sqrt{(\Sigma X(p.u.))^2+(\Sigma R(p.u.))^2}$			
SHORT CIRCUIT CURRENT (A)	**48680.13**						
DP1							
Number of Sets	3	**X(p.u.)**	0.383691				
Length (Ft)	120.00	**R(p.u.)**	0.708210				
Wire Size	350KCMIL						
(TABLE 7) X_L	0.04150000						
(TABLE 7) R	0.07660000	**ΣX(p.u.)**	0.629120				
X	0.00166000	**ΣR(p.u.)**	0.736767				
R	0.00306400	**ΣZ(p.u.)**	0.968823	$\sqrt{(\Sigma X(p.u.))^2+(\Sigma R(p.u.))^2}$			
SHORT CIRCUIT CURRENT (A)	**12415.21**						
LP1a							
Number of Sets	1	**X(p.u.)**	0.623498				
Length (Ft)	65.00	**R(p.u.)**	1.150841				
Wire Size	4/0						
(TABLE 7) X_L	0.04150000						
(TABLE 7) R	0.07660000	**ΣX(p.u.)**	1.252618				
X	0.00269750	**ΣR(p.u.)**	1.887608				
R	0.00497900	**ΣZ(p.u.)**	2.265417	$\sqrt{(\Sigma X(p.u.))^2+(\Sigma R(p.u.))^2}$			
SHORT CIRCUIT CURRENT (A)	**5309.46**						

OVERCURRENT PROTECTION DEVICE COORDINATION STUDY

Overcurrent Protection Devices



A – 450A 3P Circuit Breaker at US1

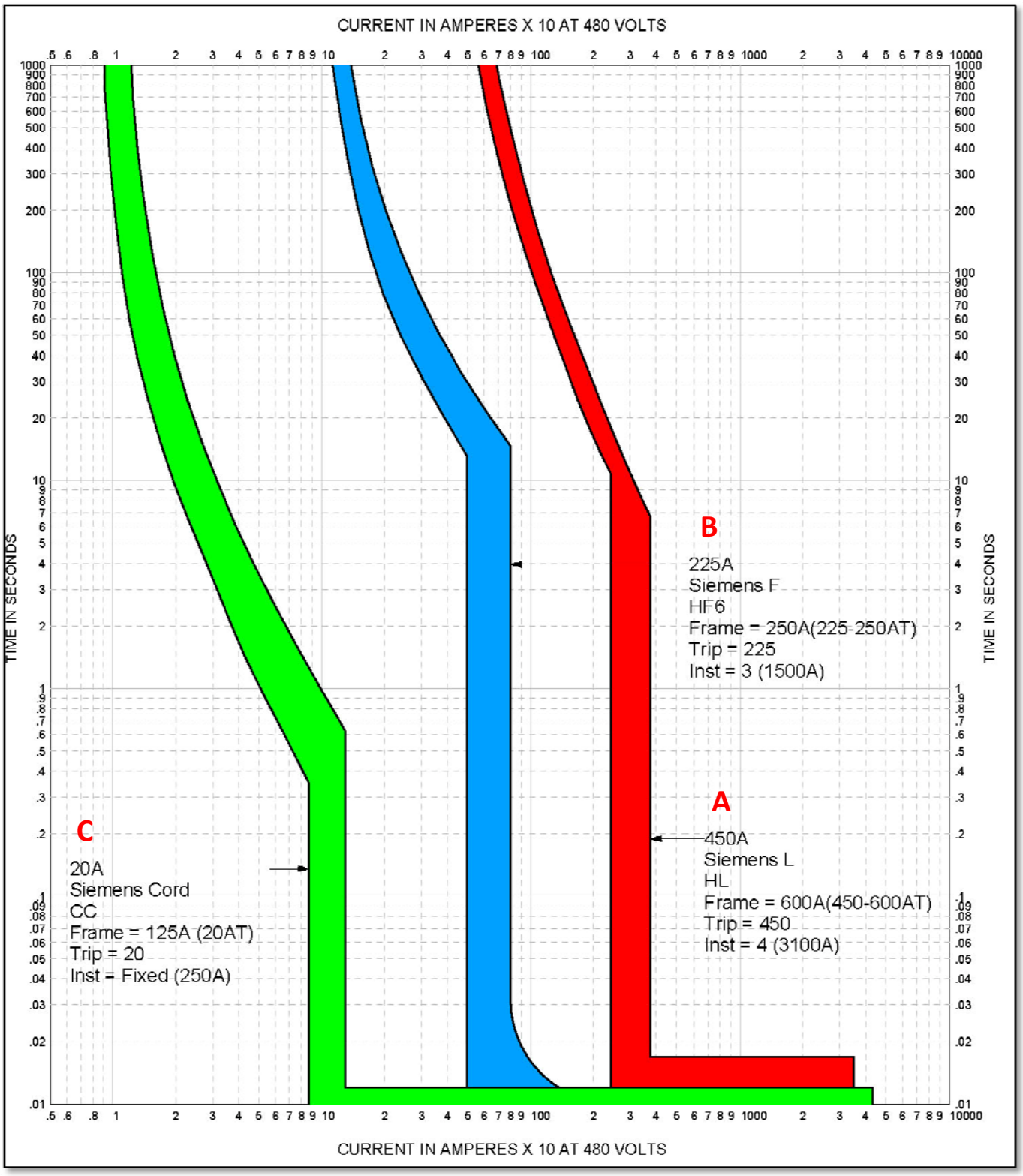
B – 225A 3P Molded Case Circuit Breaker at DP1

C – 20A 1P Molded Case Circuit Breaker at LP1a

Coordination Study Results

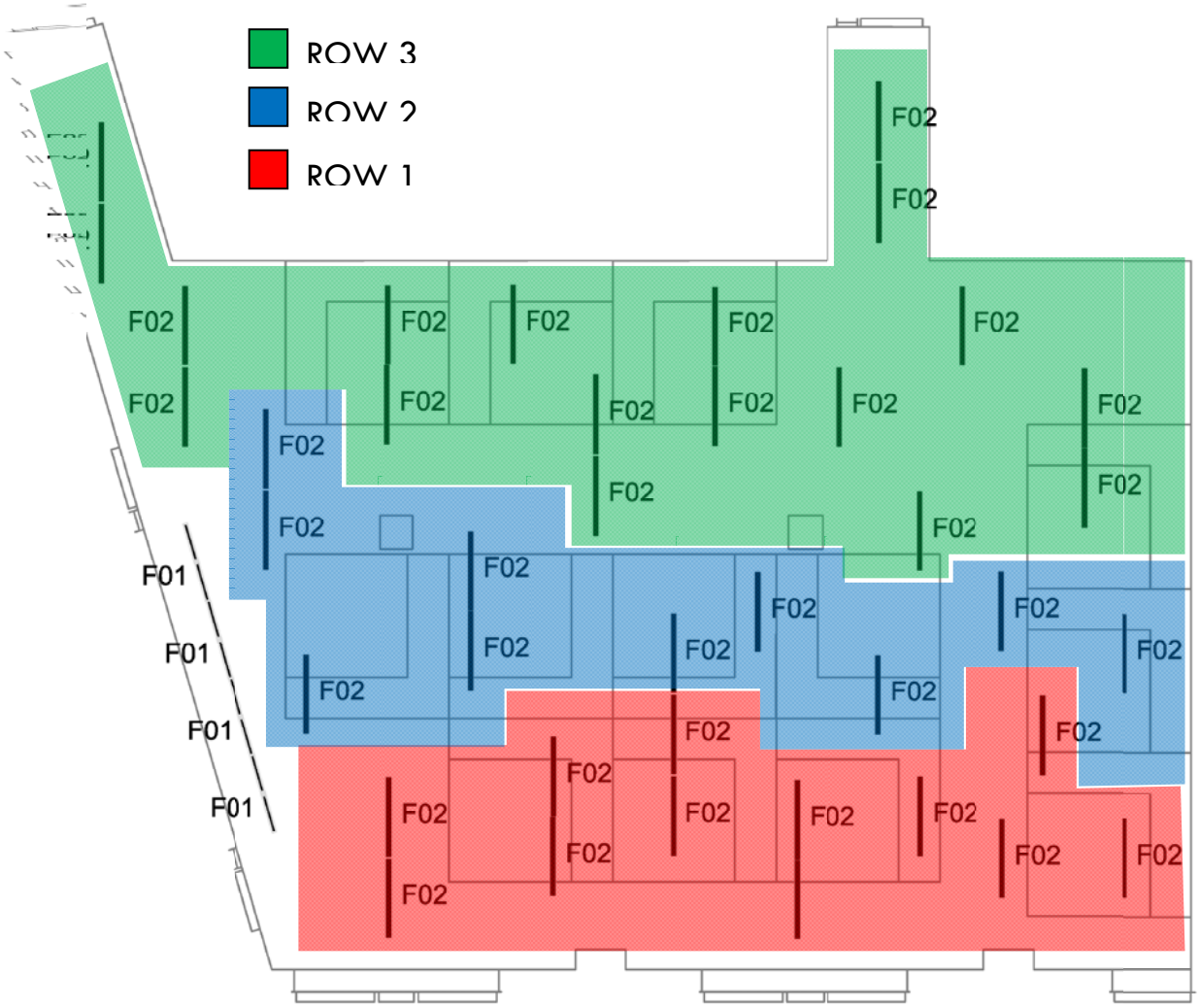
As can be seen from the following figure, there is limited overlap between the three selected circuit breakers, and they appear to be properly coordinated with the protection device closes to the possible fault being the first to trip. All circuit breakers have been assumed to be Siemens molded-case style for this study.

Time-Current Curves



MAE DEPTH – DAYLIGHTING STUDY

To complete the MAE additional depth requirement for thesis, a daylighting analysis for the third floor open office space has been performed. Three northern windows provide diffuse natural light into the space throughout the year. The purpose of the following study is to propose an effective photosensor dimming system for the open office with the goal of providing long-term economic benefits. Once an appropriate system has been determined, the annual energy saved can then be estimated based on the lighting power use in the space.



Office Lighting Plan

Critical Point Analysis

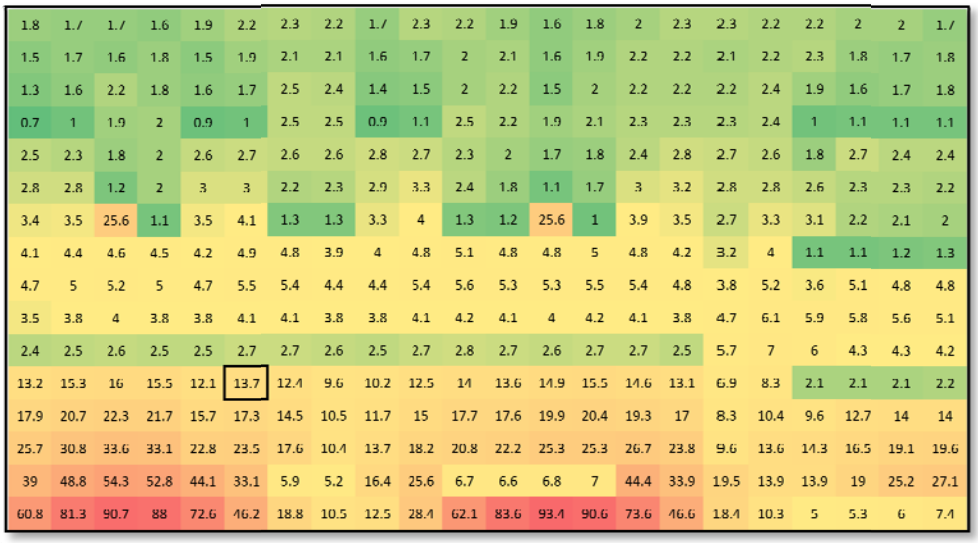
AGI32 lighting software was used to study several daylight scenarios for the building. The worst-case scenario (the time of year when the least natural daylight is available on the workplane) was determined to be the winter solstice, December 21. Due to the north-facing orientation of the windows, low-angle winter sun rays are unable to enter the space directly. A rough solar study of the northern wall is also performed within the photovoltaic electrical depth analysis for this report.

Using December 21 as a date inputting the longitude and latitude of Irvine, California to simulate the project's location, a calculation with sunny and overcast sky conditions was performed and recorded. In addition to natural light, the artificial lighting system within the office has been divided into three distinctly controllable zones—one near the windows, one toward the opposite wall, and one in between with row one being nearest the windows. Through the coordinated dimming of the ceiling recessed fixtures in the space, a fairly uniform light condition should be attainable in the office without the distraction of the luminaires being switched on and off as the light varies throughout the day.

Each combination of active rows has been calculated with no added natural light. The AGI calculation output was then imported into Microsoft Excel for comparison. Based on this data, an appropriate photosensor location has been chosen for the space and is shown here outlined in black.

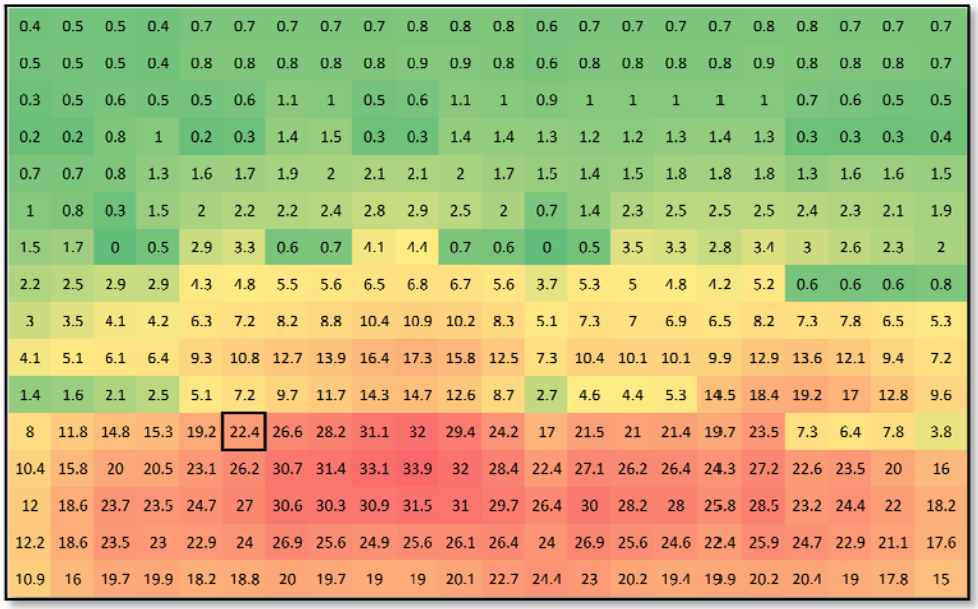
5.1	5.2	5.2	5.1	5.5	6.3	6.7	6.4	5.3	6.5	6.6	6.2	5.1	5.3	5.9	6.9	6.8	6.8	6.6	6.3	6.2	5.6
4.7	5.2	5.5	5.3	5	6.2	6.8	6.7	5.1	5.9	6.5	6.6	5	5.8	6.5	7	6.8	6.7	6.4	5.7	5.6	5.4
4	5.2	6.1	5.5	4.7	5.5	7.7	7.4	4.7	5.2	6.5	6.6	5	6.2	6.7	6.7	6.7	6.9	6.1	5.2	5.2	5.2
2.5	3.3	6.1	6.4	2.9	3.5	8.1	8	3	3.6	7.5	7	6.1	6.4	6.8	7.1	7.2	7.2	3.4	3.7	3.6	3.6
7.1	6.7	5.8	6.5	8	8.4	8	8.2	8.4	8.2	7.3	6.6	5.7	6	7.2	8.1	8.1	7.8	5.5	7.7	7.4	7.4
8.2	7.7	4	6.5	9	9.1	7.6	7.7	9.1	9.8	7.7	6.1	4.1	5.7	8.7	9.3	8.6	8.4	7.9	7.5	7.2	7.1
9.6	9.7	10.9	3.9	10.2	11.6	4.7	4.7	10.1	11.5	4.7	4.2	10.9	3.4	10.7	10.1	8.3	9.4	9	7.1	6.9	6.8
10.9	11.7	12.3	11.9	11.7	13.4	13.3	11.4	11.5	13.3	14.1	13.3	12.9	13.5	13	11.8	9.5	11.2	3.8	3.9	4	4.5
12.1	13.1	13.5	12.8	13	14.6	14.7	12.7	12.5	14.7	15.1	14.4	13.9	14.5	14.5	13.1	11.1	13.8	10.1	13.8	13.5	12.9
11.2	12.2	13.1	12.4	12.5	13.6	13.6	12.6	12.4	13.9	14	13.7	13.2	13.9	13.7	12.6	13.2	16.1	15.7	15.7	14.7	13.9
7.2	7.9	8.4	8	8.2	8.9	8.9	8.5	8.4	9.1	9.2	9	8.6	9	8.8	8.2	15.6	18.4	17.3	14.1	13.7	13.2
28.5	32.4	33.4	32.2	27.4	30.9	29.4	25.2	25.1	29.2	31.3	29.9	31	32.6	32	29.5	18.4	21.5	6.9	6.9	6.9	7.1
34.7	39	41.4	40.2	31.6	35.6	33	27	27.3	32.3	35.2	34.5	36.1	38	37.5	34.8	21.3	25.3	21.9	28.2	29.9	29
44.5	50.8	54.3	53.6	39.5	43.9	37.5	26.9	30	35.5	37.8	38.3	40.5	41.8	45.6	44.1	23.2	31.5	31.7	33.5	35.4	34.6
56.6	66.8	72.4	71.6	62.9	53.3	19.2	16.4	34.8	44.9	22.4	22	21.9	23.2	64.2	54.5	38.7	33.5	31.6	34.7	39	40.3
70.6	88.8	98.5	97.7	85.6	64.2	41.1	29.4	29.8	44.8	72.5	92	103	102	87.2	64.9	40.1	29	15.3	16.1	17.5	19.7

Clear Sky



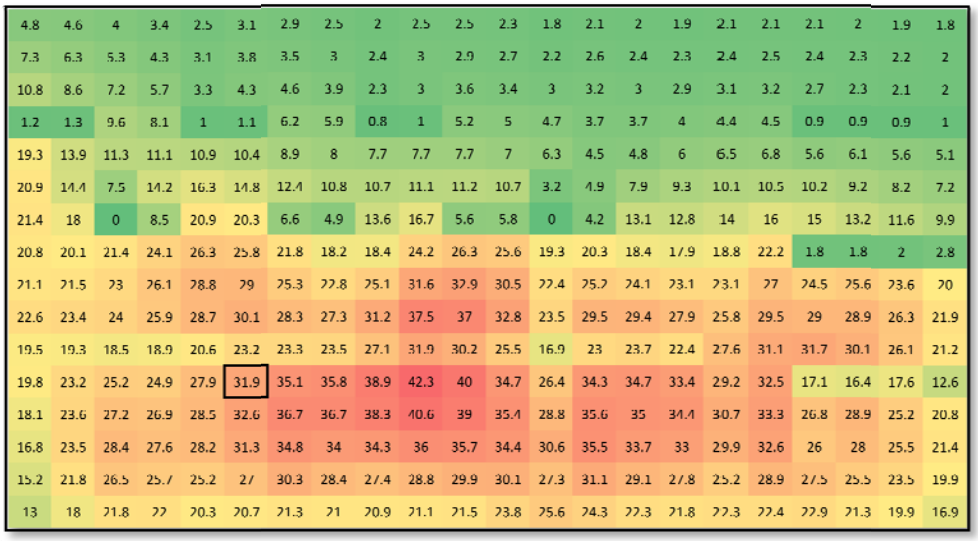
1.8	1.7	1.7	1.6	1.9	2.2	2.3	2.2	1.7	2.3	2.2	1.9	1.6	1.8	2	2.3	2.3	2.2	2.2	2	2	1.7
1.5	1.7	1.6	1.8	1.5	1.9	2.1	2.1	1.6	1.7	2	2.1	1.6	1.9	2.2	2.2	2.1	2.2	2.3	1.8	1.7	1.8
1.3	1.6	2.2	1.8	1.6	1.7	2.5	2.4	1.4	1.5	2	2.2	1.5	2	2.2	2.2	2.2	2.4	1.9	1.6	1.7	1.8
0.7	1	1.9	2	0.9	1	2.5	2.5	0.9	1.1	2.5	2.2	1.9	2.1	2.3	2.3	2.3	2.4	1	1.1	1.1	1.1
2.5	2.3	1.8	2	2.6	2.7	2.6	2.6	2.8	2.7	2.3	2	1.7	1.8	2.4	2.8	2.7	2.6	1.8	2.7	2.4	2.4
2.8	2.8	1.2	2	3	3	2.2	2.3	2.9	3.3	2.4	1.8	1.1	1.7	3	3.2	2.8	2.8	2.6	2.3	2.3	2.2
3.4	3.5	25.6	1.1	3.5	4.1	1.3	1.3	3.3	4	1.3	1.2	25.6	1	3.9	3.5	2.7	3.3	3.1	2.2	2.1	2
4.1	4.4	4.6	4.5	4.2	4.9	4.8	3.9	4	4.8	5.1	4.8	4.8	5	4.8	4.2	3.2	4	1.1	1.1	1.2	1.3
4.7	5	5.2	5	4.7	5.5	5.4	4.4	4.4	5.4	5.6	5.3	5.3	5.5	5.4	4.8	3.8	5.2	3.6	5.1	4.8	4.8
3.5	3.8	4	3.8	3.8	4.1	4.1	3.8	3.8	4.1	4.2	4.1	4	4.2	4.1	3.8	4.7	6.1	5.9	5.8	5.6	5.1
2.4	2.5	2.6	2.5	2.5	2.7	2.7	2.6	2.5	2.7	2.8	2.7	2.6	2.7	2.7	2.5	5.7	7	6	4.3	4.3	4.2
13.2	15.3	16	15.5	12.1	13.7	12.4	9.6	10.2	12.5	14	13.6	14.9	15.5	14.6	13.1	6.9	8.3	2.1	2.1	2.1	2.2
17.9	20.7	22.3	21.7	15.7	17.3	14.5	10.5	11.7	15	17.7	17.6	19.9	20.4	19.3	17	8.3	10.4	9.6	12.7	14	14
25.7	30.8	33.6	33.1	22.8	23.5	17.6	10.4	13.7	18.2	20.8	22.2	25.3	25.3	26.7	23.8	9.6	13.6	14.3	16.5	19.1	19.6
39	48.8	54.3	52.8	44.1	33.1	5.9	5.2	16.4	25.6	6.7	6.6	6.8	7	44.4	33.9	19.5	13.9	13.9	19	25.2	27.1
60.8	81.3	90.7	88	72.6	46.2	18.8	10.5	12.5	28.4	62.1	83.6	93.4	90.6	73.6	46.6	18.4	10.3	5	5.3	6	7.4

Overcast



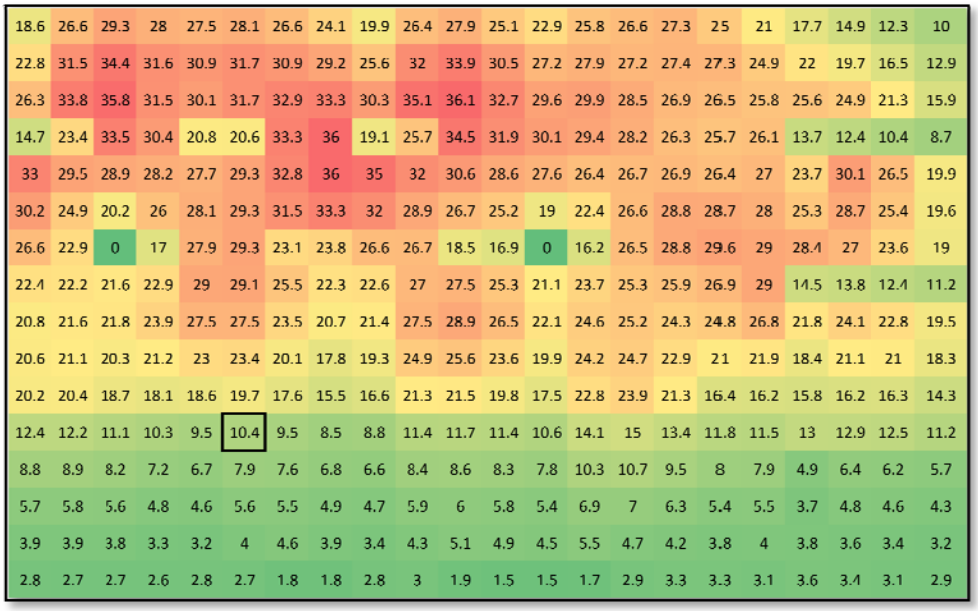
0.4	0.5	0.5	0.4	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7
0.5	0.5	0.5	0.4	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.8	0.6	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.7
0.3	0.5	0.6	0.5	0.5	0.6	1.1	1	0.5	0.6	1.1	1	0.9	1	1	1	1	1	0.7	0.6	0.5	0.5
0.2	0.2	0.8	1	0.2	0.3	1.4	1.5	0.3	0.3	1.4	1.4	1.3	1.2	1.2	1.3	1.4	1.3	0.3	0.3	0.3	0.4
0.7	0.7	0.8	1.3	1.6	1.7	1.9	2	2.1	2.1	2	1.7	1.5	1.4	1.5	1.8	1.8	1.8	1.3	1.6	1.6	1.5
1	0.8	0.3	1.5	2	2.2	2.2	2.4	2.8	2.9	2.5	2	0.7	1.4	2.3	2.5	2.5	2.5	2.4	2.3	2.1	1.9
1.5	1.7	0	0.5	2.9	3.3	0.6	0.7	4.1	4.4	0.7	0.6	0	0.5	3.5	3.3	2.8	3.4	3	2.6	2.3	2
2.2	2.5	2.9	2.9	4.3	4.8	5.5	5.6	6.5	6.8	6.7	5.6	3.7	5.3	5	4.8	4.2	5.2	0.6	0.6	0.6	0.8
3	3.5	4.1	4.2	6.3	7.2	8.2	8.8	10.4	10.9	10.2	8.3	5.1	7.3	7	6.9	6.5	8.2	7.3	7.8	6.5	5.3
4.1	5.1	6.1	6.4	9.3	10.8	12.7	13.9	16.4	17.3	15.8	12.5	7.3	10.4	10.1	10.1	9.9	12.9	13.6	12.1	9.4	7.2
1.4	1.6	2.1	2.5	5.1	7.2	9.7	11.7	14.3	14.7	12.6	8.7	2.7	4.6	4.4	5.3	14.5	18.4	19.2	17	12.8	9.6
8	11.8	14.8	15.3	19.2	22.4	26.6	28.2	31.1	32	29.4	24.2	17	21.5	21	21.4	19.7	23.5	7.3	6.4	7.8	3.8
10.4	15.8	20	20.5	23.1	26.2	30.7	31.4	33.1	33.9	32	28.4	22.4	27.1	26.2	26.4	24.3	27.2	22.6	23.5	20	16
12	18.6	23.7	23.5	24.7	27	30.6	30.3	30.9	31.5	31	29.7	26.4	30	28.2	28	25.8	28.5	23.2	24.4	22	18.2
12.2	18.6	23.5	23	22.9	24	26.9	25.6	24.9	25.6	26.1	26.4	24	26.9	25.6	24.6	22.4	25.9	24.7	22.9	21.1	17.6
10.9	16	19.7	19.9	18.2	18.8	20	19.7	19	19	20.1	22.7	24.4	23	20.2	19.4	19.9	20.2	20.4	19	17.8	15

Row One Active



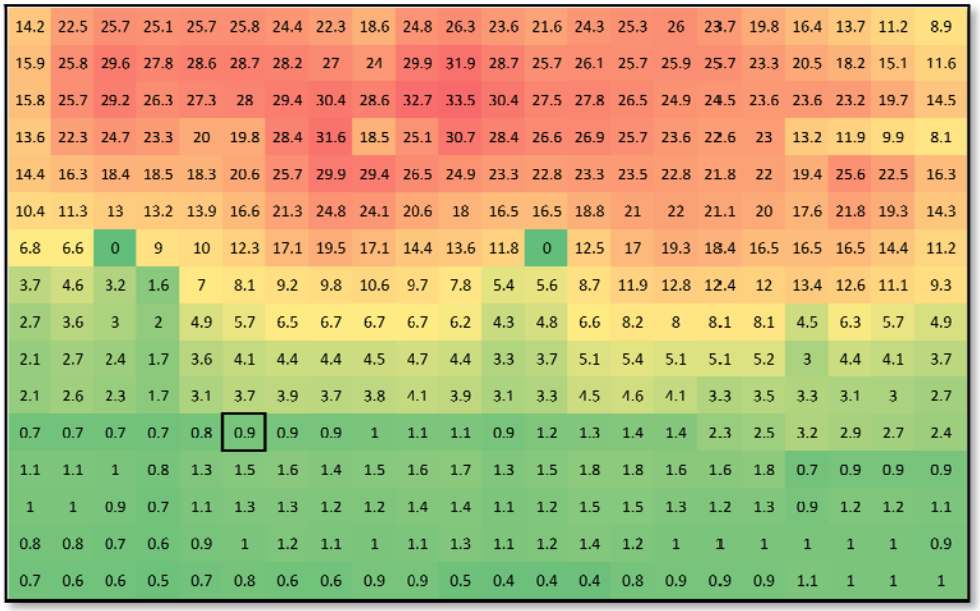
4.8	4.6	4	3.4	2.5	3.1	2.9	2.5	2	2.5	2.5	2.3	1.8	2.1	2	1.9	2.1	2.1	2.1	2	1.9	1.8
7.3	6.3	5.3	4.3	3.1	3.8	3.5	3	2.4	3	2.9	2.7	2.2	2.6	2.4	2.3	2.4	2.5	2.4	2.3	2.2	2
10.8	8.6	7.2	5.7	3.3	4.3	4.6	3.9	2.3	3	3.6	3.4	3	3.2	3	2.9	3.1	3.2	2.7	2.3	2.1	2
1.2	1.3	9.6	8.1	1	1.1	6.2	5.9	0.8	1	5.2	5	4.7	3.7	3.7	4	4.4	4.5	0.9	0.9	0.9	1
19.3	13.9	11.3	11.1	10.9	10.4	8.9	8	7.7	7.7	7.7	7	6.3	4.5	4.8	6	6.5	6.8	5.6	6.1	5.6	5.1
20.9	14.4	7.5	14.2	16.3	14.8	12.4	10.8	10.7	11.1	11.2	10.7	3.2	4.9	7.9	9.3	10.1	10.5	10.2	9.2	8.2	7.2
21.4	18	0	8.5	20.9	20.3	6.6	4.9	13.6	16.7	5.6	5.8	0	4.2	13.1	12.8	14	16	15	13.2	11.6	9.9
20.8	20.1	21.4	24.1	26.3	25.8	21.8	18.2	18.4	24.2	26.3	25.6	19.3	20.3	18.4	17.9	18.8	22.2	1.8	1.8	2	2.8
21.1	21.5	23	26.1	28.8	29	25.3	22.8	25.1	31.6	32.9	30.5	22.4	25.2	24.1	23.1	23.1	27	24.5	25.6	23.6	20
22.6	23.4	24	25.9	28.7	30.1	28.3	27.3	31.2	37.5	37	32.8	23.5	29.5	29.4	27.9	25.8	29.5	29	28.9	26.3	21.9
19.5	19.3	18.5	18.9	20.6	23.2	23.3	23.5	27.1	31.9	30.2	25.5	16.9	23	23.7	22.4	27.6	31.1	31.7	30.1	26.1	21.2
19.8	23.2	25.2	24.9	27.9	31.9	35.1	35.8	38.9	42.3	40	34.7	26.4	34.3	34.7	33.4	29.2	32.5	17.1	16.4	17.6	12.6
18.1	23.6	27.2	26.9	28.5	32.6	36.7	36.7	38.3	40.6	39	35.4	28.8	35.6	35	34.4	30.7	33.3	26.8	28.9	25.2	20.8
16.8	23.5	28.4	27.6	28.2	31.3	34.8	34	34.3	36	35.7	34.4	30.6	35.5	33.7	33	29.9	32.6	26	28	25.5	21.4
15.2	21.8	26.5	25.7	25.2	27	30.3	28.4	27.4	28.8	29.9	30.1	27.3	31.1	29.1	27.8	25.2	28.9	27.5	25.5	23.5	19.9
13	18	21.8	22	20.3	20.7	21.3	21	20.9	21.1	21.5	23.8	25.6	24.3	22.3	21.8	22.3	22.4	22.9	21.3	19.9	16.9

Rows One and Two Active



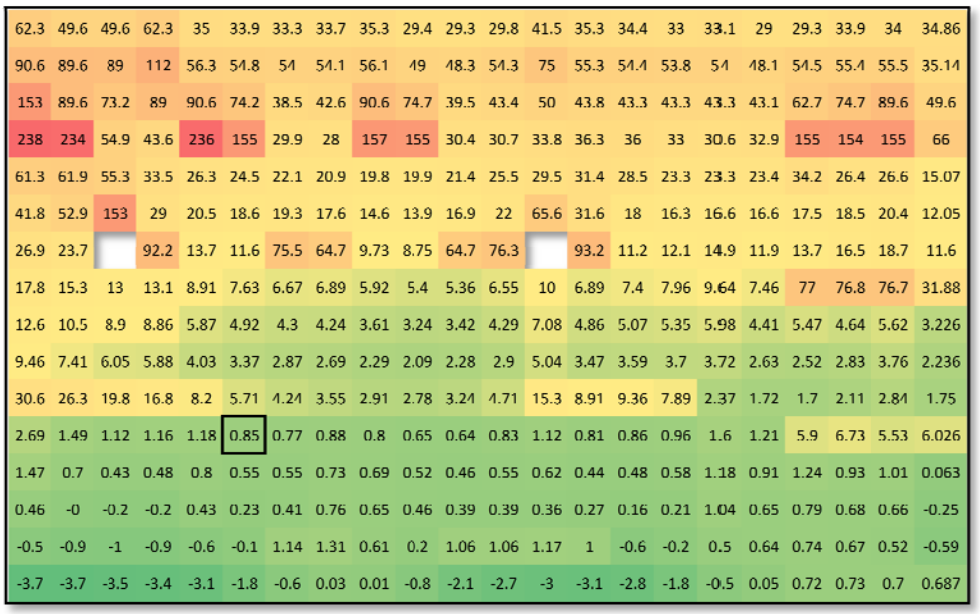
18.6	26.6	29.3	28	27.5	28.1	26.6	24.1	19.9	26.4	27.9	25.1	22.9	25.8	26.6	27.3	25	21	17.7	14.9	12.3	10
22.8	31.5	34.4	31.6	30.9	31.7	30.9	29.2	25.6	32	33.9	30.5	27.2	27.9	27.2	27.4	27.3	24.9	22	19.7	16.5	12.9
26.3	33.8	35.8	31.5	30.1	31.7	32.9	33.3	30.3	35.1	36.1	32.7	29.6	29.9	28.5	26.9	26.5	25.8	25.6	24.9	21.3	15.9
14.7	23.4	33.5	30.4	20.8	20.6	33.3	36	19.1	25.7	34.5	31.9	30.1	29.4	28.2	26.3	25.7	26.1	13.7	12.4	10.4	8.7
33	29.5	28.9	28.2	27.7	29.3	32.8	36	35	32	30.6	28.6	27.6	26.4	26.7	26.9	26.4	27	23.7	30.1	26.5	19.9
30.2	24.9	20.2	26	28.1	29.3	31.5	33.3	32	28.9	26.7	25.2	19	22.4	26.6	28.8	28.7	28	25.3	28.7	25.4	19.6
26.6	22.9	0	17	27.9	29.3	23.1	23.8	26.6	26.7	18.5	16.9	0	16.2	26.5	28.8	29.6	29	28.4	27	23.6	19
22.4	22.2	21.6	22.9	29	29.1	25.5	22.3	22.6	27	27.5	25.3	21.1	23.7	25.3	25.9	26.9	29	14.5	13.8	12.4	11.2
20.8	21.6	21.8	23.9	27.5	27.5	23.5	20.7	21.4	27.5	28.9	26.5	22.1	24.6	25.2	24.3	24.8	26.8	21.8	24.1	22.8	19.5
20.6	21.1	20.3	21.2	23	23.4	20.1	17.8	19.3	24.9	25.6	23.6	19.9	24.2	24.7	22.9	21	21.9	18.4	21.1	21	18.3
20.2	20.4	18.7	18.1	18.6	19.7	17.6	15.5	16.6	21.3	21.5	19.8	17.5	22.8	23.9	21.3	16.4	16.2	15.8	16.2	16.3	14.3
12.4	12.2	11.1	10.3	9.5	10.4	9.5	8.5	8.8	11.4	11.7	11.4	10.6	14.1	15	13.4	11.8	11.5	13	12.9	12.5	11.2
8.8	8.9	8.2	7.2	6.7	7.9	7.6	6.8	6.6	8.4	8.6	8.3	7.8	10.3	10.7	9.5	8	7.9	4.9	6.4	6.2	5.7
5.7	5.8	5.6	4.8	4.6	5.6	5.5	4.9	4.7	5.9	6	5.8	5.4	6.9	7	6.3	5.4	5.5	3.7	4.8	4.6	4.3
3.9	3.9	3.8	3.3	3.2	4	4.6	3.9	3.4	4.3	5.1	4.9	4.5	5.5	4.7	4.2	3.8	4	3.8	3.6	3.4	3.2
2.8	2.7	2.7	2.6	2.8	2.7	1.8	1.8	2.8	3	1.9	1.5	1.5	1.7	2.9	3.3	3.3	3.1	3.6	3.4	3.1	2.9

Rows Two and Three Active



14.2	22.5	25.7	25.1	25.7	25.8	24.4	22.3	18.6	24.8	26.3	23.6	21.6	24.3	25.3	26	23.7	19.8	16.4	13.7	11.2	8.9
15.9	25.8	29.6	27.8	28.6	28.7	28.2	27	24	29.9	31.9	28.7	25.7	26.1	25.7	25.9	25.7	23.3	20.5	18.2	15.1	11.6
15.8	25.7	29.2	26.3	27.3	28	29.4	30.4	28.6	32.7	33.5	30.4	27.5	27.8	26.5	24.9	24.5	23.6	23.6	23.2	19.7	14.5
13.6	22.3	24.7	23.3	20	19.8	28.4	31.6	18.5	25.1	30.7	28.4	26.6	26.9	25.7	23.6	22.6	23	13.2	11.9	9.9	8.1
14.4	16.3	18.4	18.5	18.3	20.6	25.7	29.9	29.4	26.5	24.9	23.3	22.8	23.3	23.5	22.8	21.8	22	19.4	25.6	22.5	16.3
10.4	11.3	13	13.2	13.9	16.6	21.3	24.8	24.1	20.6	18	16.5	16.5	18.8	21	22	21.1	20	17.6	21.8	19.3	14.3
6.8	6.6	0	9	10	12.3	17.1	19.5	17.1	14.4	13.6	11.8	0	12.5	17	19.3	18.4	16.5	16.5	16.5	14.4	11.2
3.7	4.6	3.2	1.6	7	8.1	9.2	9.8	10.6	9.7	7.8	5.4	5.6	8.7	11.9	12.8	12.4	12	13.4	12.6	11.1	9.3
2.7	3.6	3	2	4.9	5.7	6.5	6.7	6.7	6.7	6.2	4.3	4.8	6.6	8.2	8	8.1	8.1	4.5	6.3	5.7	4.9
2.1	2.7	2.4	1.7	3.6	4.1	4.4	4.4	4.5	4.7	4.4	3.3	3.7	5.1	5.4	5.1	5.1	5.2	3	4.4	4.1	3.7
2.1	2.6	2.3	1.7	3.1	3.7	3.9	3.7	3.8	4.1	3.9	3.1	3.3	4.5	4.6	4.1	3.3	3.5	3.3	3.1	3	2.7
0.7	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1	1.1	1.1	0.9	1.2	1.3	1.4	1.4	2.3	2.5	3.2	2.9	2.7	2.4
1.1	1.1	1	0.8	1.3	1.5	1.6	1.4	1.5	1.6	1.7	1.3	1.5	1.8	1.8	1.6	1.6	1.8	0.7	0.9	0.9	0.9
1	1	0.9	0.7	1.1	1.3	1.3	1.2	1.2	1.4	1.4	1.1	1.2	1.5	1.5	1.3	1.2	1.3	0.9	1.2	1.2	1.1
0.8	0.8	0.7	0.6	0.9	1	1.2	1.1	1	1.1	1.3	1.1	1.2	1.4	1.2	1	1	1	1	1	1	0.9
0.7	0.6	0.6	0.5	0.7	0.8	0.6	0.6	0.9	0.9	0.5	0.4	0.4	0.4	0.8	0.9	0.9	0.9	1.1	1	1	1

Row Three Active



62.3	49.6	49.6	62.3	35	33.9	33.3	33.7	35.3	29.4	29.3	29.8	41.5	35.3	34.4	33	33.1	29	29.3	33.9	34	34.86
90.6	89.6	89	112	56.3	54.8	54	54.1	56.1	49	48.3	54.3	75	55.3	54.4	53.8	54	48.1	54.5	55.4	55.5	35.14
153	89.6	73.2	89	90.6	74.2	38.5	42.6	90.6	74.7	39.5	43.4	50	43.8	43.3	43.3	43.3	43.1	62.7	74.7	89.6	49.6
238	234	54.9	43.6	236	155	29.9	28	157	155	30.4	30.7	33.8	36.3	36	33	30.6	32.9	155	154	155	66
61.3	61.9	55.3	33.5	26.3	24.5	22.1	20.9	19.8	19.9	21.4	25.5	29.5	31.4	28.5	23.3	23.3	23.4	34.2	26.4	26.6	15.07
41.8	52.9	153	29	20.5	18.6	19.3	17.6	14.6	13.9	16.9	22	65.6	31.6	18	16.3	16.6	16.6	17.5	18.5	20.4	12.05
26.9	23.7		92.2	13.7	11.6	75.5	64.7	9.73	8.75	64.7	76.3		93.2	11.2	12.1	14.9	11.9	13.7	16.5	18.7	11.6
17.8	15.3	13	13.1	8.91	7.63	6.67	6.89	5.92	5.4	5.36	6.55	10	6.89	7.4	7.96	9.64	7.46	77	76.8	76.7	31.88
12.6	10.5	8.9	8.86	5.87	4.92	4.3	4.24	3.61	3.24	3.42	4.29	7.08	4.86	5.07	5.35	5.98	4.41	5.47	4.64	5.62	3.226
9.46	7.41	6.05	5.88	4.03	3.37	2.87	2.69	2.29	2.09	2.28	2.9	5.04	3.47	3.59	3.7	3.72	2.63	2.52	2.83	3.76	2.236
30.6	26.3	19.8	16.8	8.2	5.71	4.24	3.55	2.91	2.78	3.24	4.71	15.3	8.91	9.36	7.89	2.37	1.72	1.7	2.11	2.84	1.75
2.69	1.49	1.12	1.16	1.18	0.85	0.77	0.88	0.8	0.65	0.64	0.83	1.12	0.81	0.86	0.96	1.6	1.21	5.9	6.73	5.53	6.026
1.47	0.7	0.43	0.48	0.8	0.55	0.55	0.73	0.69	0.52	0.46	0.55	0.62	0.44	0.48	0.58	1.18	0.91	1.24	0.93	1.01	0.063
0.46	-0	-0.2	-0.2	0.43	0.23	0.41	0.76	0.65	0.46	0.39	0.39	0.36	0.27	0.16	0.21	1.04	0.65	0.79	0.68	0.66	-0.25
-0.5	-0.9	-1	-0.9	-0.6	-0.1	1.14	1.31	0.61	0.2	1.06	1.06	1.17	1	-0.6	-0.2	0.5	0.64	0.74	0.67	0.52	-0.59
-3.7	-3.7	-3.5	-3.4	-3.1	-1.8	-0.6	0.03	0.01	-0.8	-2.1	-2.7	-3	-3.1	-2.8	-1.8	-0.5	0.05	0.72	0.73	0.7	0.687

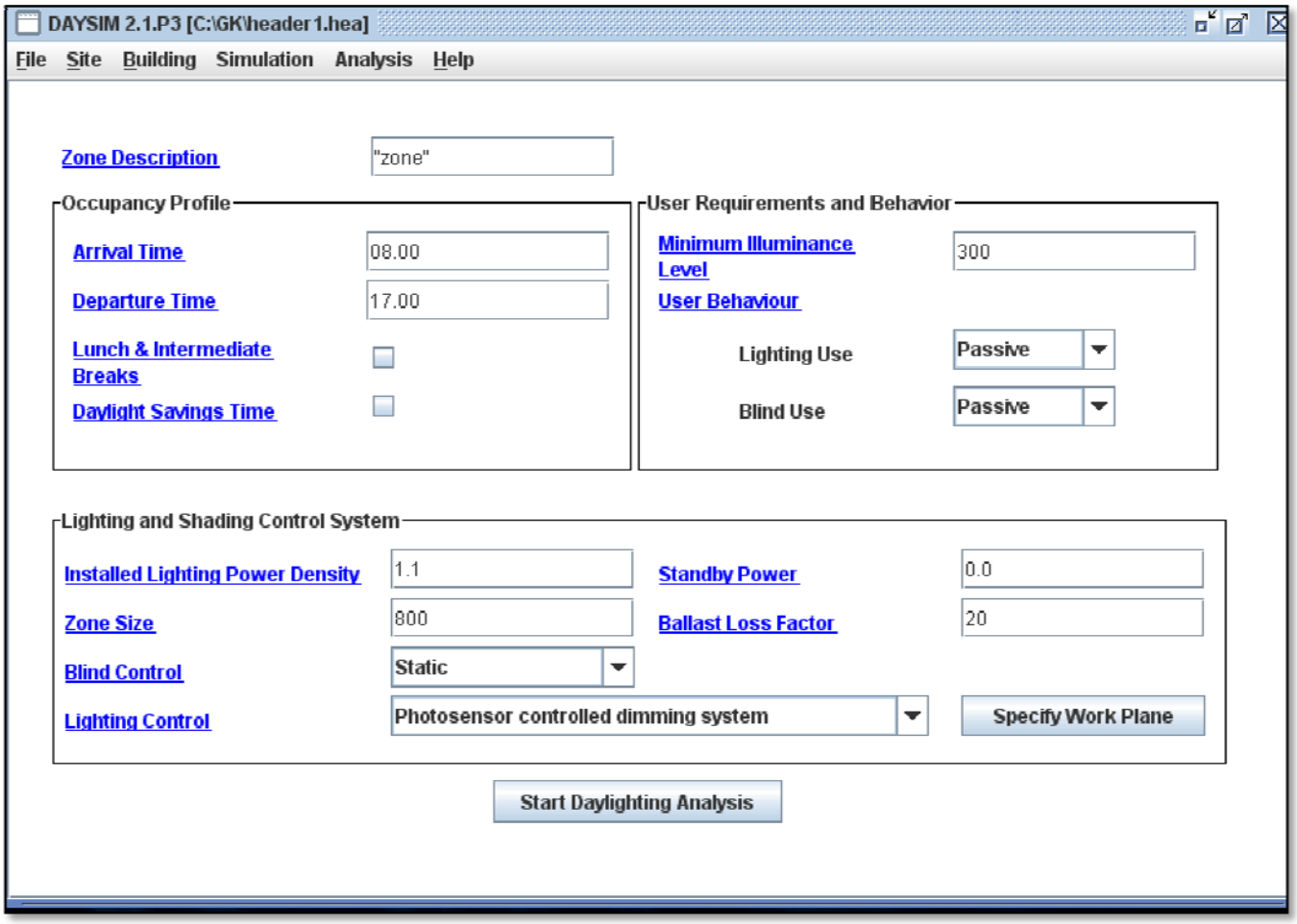
Dim Level = (Target Level – Clear Condition) / Row One Active

*NOTE: These plots also show striations formed by the cubicle walls within the room, and care was taken not to select a photosensor location which could be shaded at some point during the day.

Daysim Analysis

After the critical point has been determined, Daysim simulation software can be used to quantify any savings which might be achieved by the implementation of a dimming photosensor system. The room and surrounding geometry were modeled in AutoCAD and then imported into the program. Daysim is then able to simulate long-term use of the system and provide estimates of the total energy used by the lighting system annually. The original target value for illuminance on the work plane was 30fc without the use of personal task lighting. The analysis was run without blinds or shades because the windows are well protected from direct solar glare by their orientation and position within the building. An additional analysis was completed using a target illuminance value of over 1 million, thereby preventing the system from ever dimming and providing a data set for a comparable non-dimming lighting solution.

Daysim Inputs



Results

Daysim Simulation Report (Non-Dimming System)

In short…

- Daylight Factor (DF) Analysis: 100% of all illuminance sensors have a daylight factor of 2% or higher. If the sensors are evenly distributed across 'all spaces occupied for critical visual tasks', the investigated lighting zone should qualify for the LEED-NC 2.1 daylighting credit 8.1 (see www.usgbc.org/LEED/).
- Daylight Autonomy (DA) Analysis: The daylight autonomy for the core workplane sensor is 0% .
- Useful Daylight Index (UDI) Analysis: The Useful Daylight Indices for the Lighting Zone are $UDI_{<100}$=1%, $UDI_{100-2000}$=38%, $UDI_{>2000}$=61% .
- Continuous Daylight Autonomy (DA_{con})and DA_{max} Analysis: 0% of all illuminance sensors have a DA_{con} above 40% . 0% of all illuminance sensors have a DA_{max} above 5% .
- Electric Lighting Use: The predicted annual electric lighting energy use in the investigated lighting zone is: 3.6 kWh/unit area. Assuming a lighting zone size of 800 [unit area], this corresponds to a **total annual lighting energy use of 2914.7 kWh.**

Daysim Simulation Report (Photosensor Dimming System)

In short…

- Daylight Factor (DF) Analysis: 100% of all illuminance sensors have a daylight factor of 2% or higher. If the sensors are evenly distributed across 'all spaces occupied for critical visual tasks', the investigated lighting zone should qualify for the LEED-NC 2.1 daylighting credit 8.1 (see www.usgbc.org/LEED/).
- Daylight Autonomy (DA) Analysis: The daylight autonomy for the core workplane sensor is 98% .
- Useful Daylight Index (UDI) Analysis: The Useful Daylight Indices for the Lighting Zone are $UDI_{<100}$=1%, $UDI_{100-2000}$=38%, $UDI_{>2000}$=61% .
- Continuous Daylight Autonomy (DA_{con})and DA_{max} Analysis: 100% of all illuminance sensors have a DA_{con} above 80% . 100% of all illuminance sensors have a DA_{max} above 5% .
- Electric Lighting Use: The predicted annual electric lighting energy use in the investigated lighting zone is: 0.6 kWh/unit area. Assuming a lighting zone size of 800 [unit area], this corresponds to a **total annual lighting energy use of 477.0 kWh.**

Conclusion

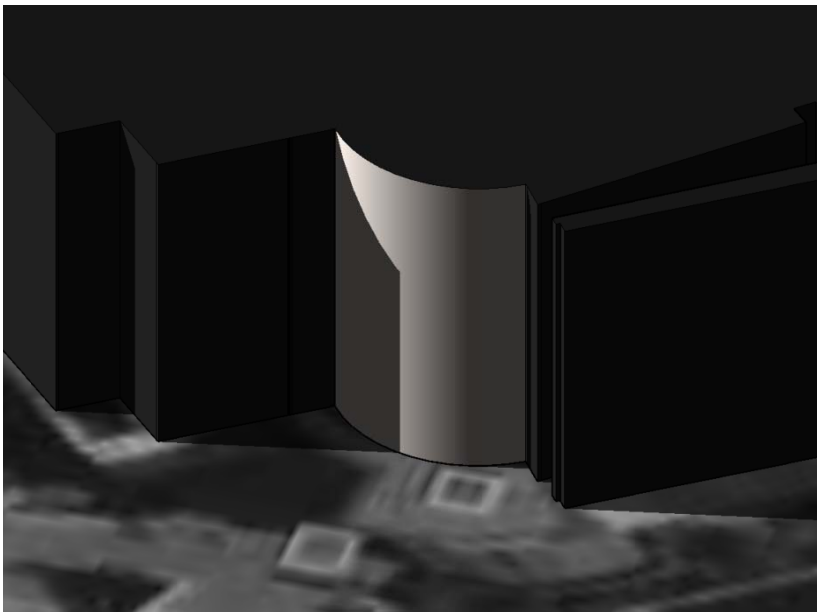
The simulation results indicated a possible lighting power savings of approximately 2437.7 kWh. At an approximate utility cost of $0.09033 per kWh (see the derivation of this value in the photovoltaic electrical depth study), the installation of a photosensor dimming system in the office space has the potential to save just $220 per year. This is likely not enough savings to warrant the installation of photosensor system in this space financially. The low savings is likely due to the relatively small size of the windows in comparison to the space. In addition, since the orientation of the windows is to the north, the amount of available daylight is limited.

MECHANICAL BREADTH – CURTAIN WALL STUDY

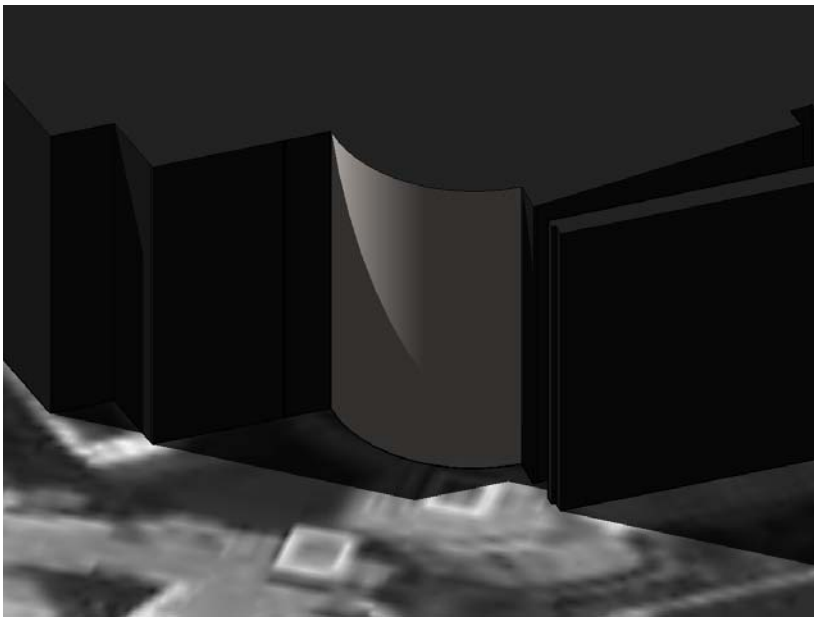
One of the most prominent architectural features of the building is the four-story glass curtain wall between the lobby and the north plaza space. Although visually important to the architecture, this large expanse of glazing has the potential to be a weak point in the building envelope. The thermal impact of the north curtain wall is the subject of this mechanical breadth study.

Solar Study

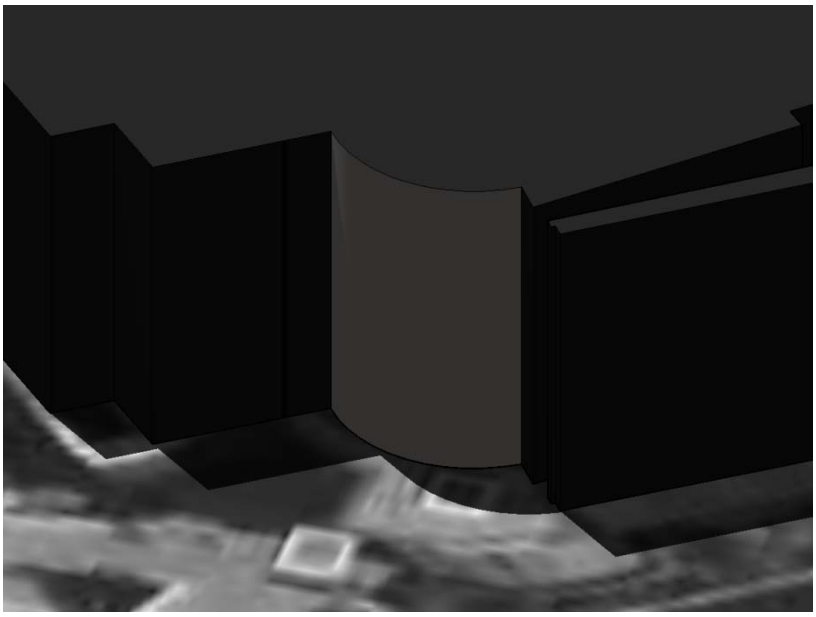
A solar penetration study was performed for the curtain wall to determine the amount of possible solar gain for the lobby. Because the curtain wall faces roughly north, the summer solstice was determined to be the worst-case scenario for daylight penetration into the space, as the sun travels to its most northern point in the sky at noon. Several times were analyzed on this day. As illustrated by the figures below, very little direct sunlight is able to enter the space, even on the solstice. This information suggests that the solar heat gain calculated in this study may be somewhat high as compared to the real value if the calculation assumes no additional shading of the curtain wall.



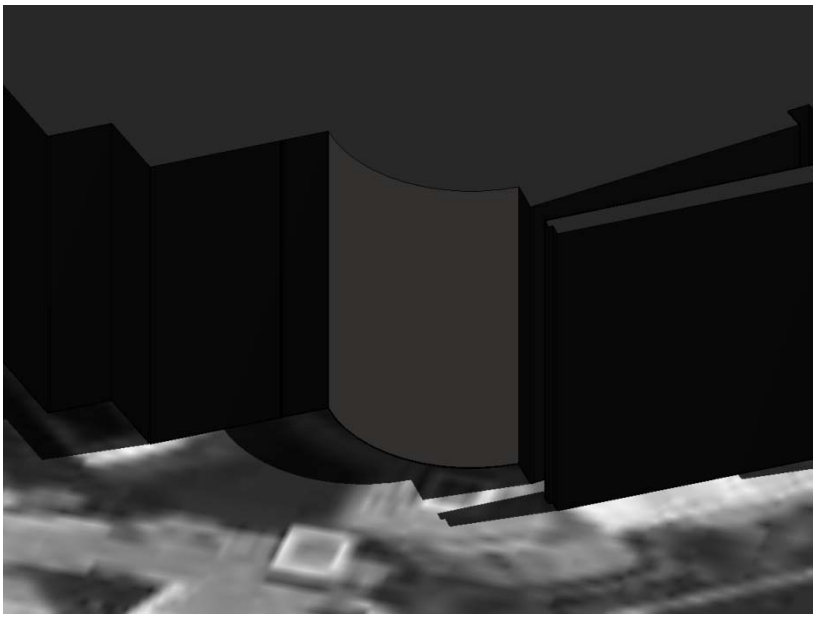
Summer Solstice – June 21 – 7AM



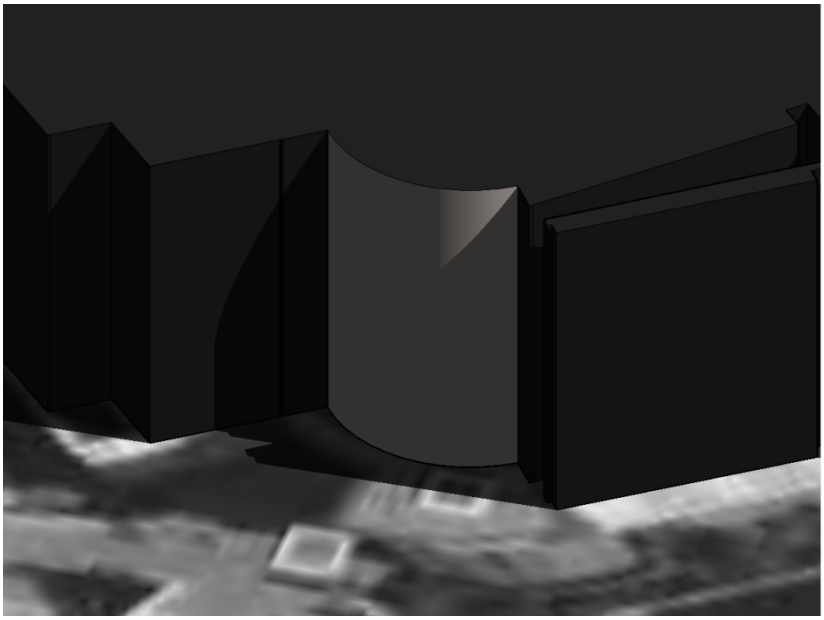
Summer Solstice – June 21 – 9AM



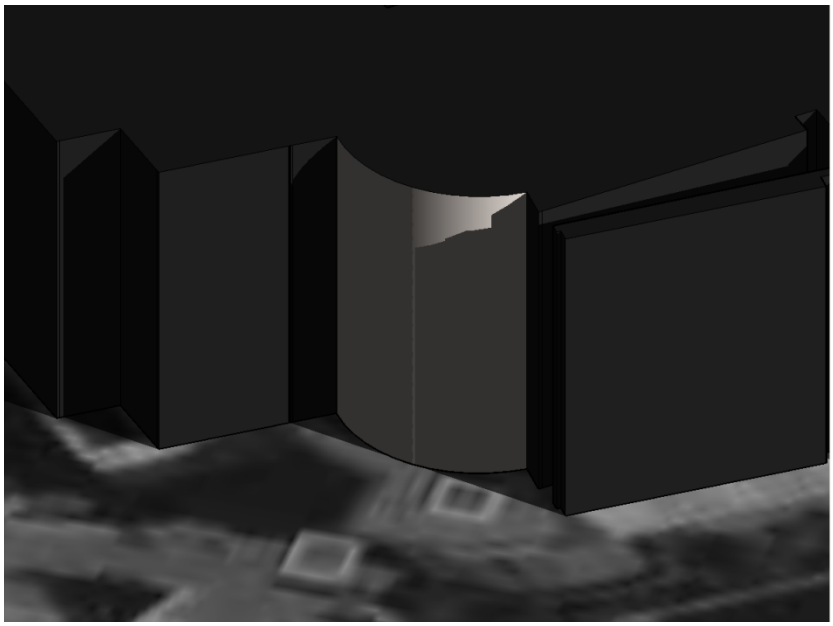
Summer Solstice – June 21 – 11AM



Summer Solstice – June 21 – 1PM



Summer Solstice – June 21 – 3PM



Summer Solstice – June 21 – 5PM

Existing Glazing

The curtain wall glazing is defined in the project specifications to be 1" thick insulated Heat Mirror 66 Clear with a U-value of 0.29 and a minimum shading coefficient (SC) of 0.44. Using the online window heat gain calculation tool at *http://susdesign.com/windowheatgain/index.php*, approximate heat gain values in BTU/ft²/day have been calculated for each month based on climate data for Los Angeles, California.

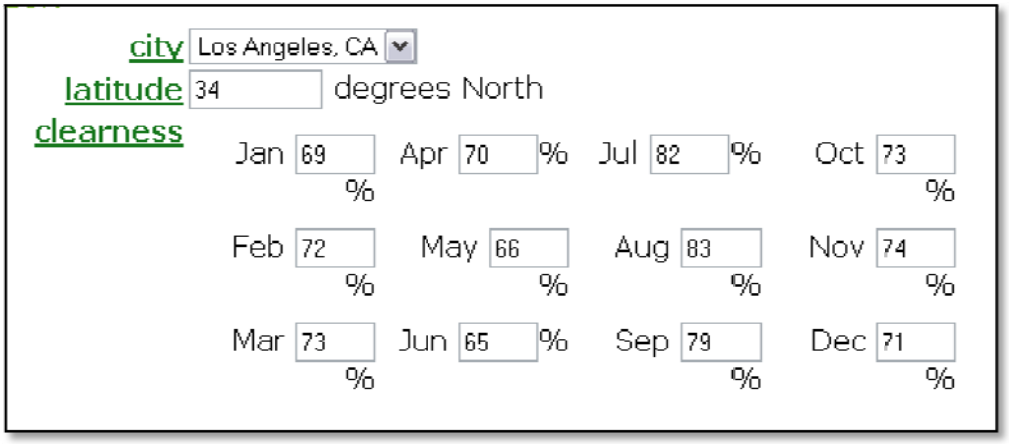
Input Data Assumptions / Calculations

Solar Heat Gain Coefficient (SHGC):
SHGC = SC x 0.87 = 0.44 x 0.87 = 0.3696 ≈ 0.37

Ground Surface Reflectance:
New Concrete = 0.32

Façade Orientation:
North

Climate Data



* Based on National Climatic Data Center (NCDC) measurements – www.ncdc.noaa.gov

Output and Calculated Heat Gain

Month	Heat Gain Rate (BTU per ft² per Day)	Calculated Heat Gain (BTU per Day)	Days	Monthly Heat Gain (BTU)
January	52	139457	31	4323182
February	71	190413	28	5331567
March	93	249414	31	7731845
April	113	303052	30	9091556
May	139	372781	31	11556199
June	157	421054	31	12631630
July	178	477374	30	14798585
August	140	375462	31	11263874
September	102	273551	30	8480088
October	74	198459	31	5953762
November	56	150185	31	4655735
December	47	126048	30	3781444
		ANNUAL TOTAL	365	99599467

* Curtain wall glass area used for these calculations: 2681.9 ft²

Modified Glazing

A new curtain wall glazing has been selected as a comparison to analyze energy savings over the existing system. PPG SOLARBAN 70XL glass has been chosen for its low solar heat gain coefficient and superior visible light transmission, which is an important architectural design quality. Partial product specifications are included below.

***Solarban*® 70XL Glass Performance — Commercial Insulating Glass Unit**

Insulating Vision Unit Performance Comparisons 1-inch (25mm) units with 1/2-inch (13mm) airspace and two 1/4-inch (6mm) lites; interior lite clear unless otherwise noted

Glass Type	Transmittance			Reflectance		U-Value (Imperial)		European U-Value	Shading Coefficient	Solar Heat Gain Coefficient	Light to Solar Gain (LSG)
	Ultra-violet %	Visible %	Total Solar Energy %	Visible Light %	Total Solar Energy %	Winter Night-time	Summer Day-time				
Coated											
SOLARBAN*® 70XL Solar Control Low-E Glass											
SOLARBAN 70XL (2) *STARPHIRE*	6	64	25	12	52	0.28	0.26	1.50	0.32	0.27	2.37
SOLARBAN 70XL (3) *SOLEXIA*	3	56	20	11	13	0.28	0.26	1.50	0.37	0.32	1.74
SOLARBAN 70XL (3) *ATLANTICA*	2	49	17	10	8	0.28	0.26	1.50	0.32	0.28	1.74
SOLARBAN 70XL (3) *CARIBIA*	2	49	17	9	8	0.28	0.26	1.50	0.32	0.28	1.75
SOLARBAN 70XL (3) *AZURIA*	4	49	17	9	8	0.28	0.26	1.50	0.33	0.29	1.70
SOLARBAN 70XL (3) Bronze	3	38	15	8	20	0.28	0.26	1.50	0.30	0.26	1.48
SOLARBAN 70XL (3) Gray	2	32	13	7	15	0.28	0.26	1.50	0.27	0.24	1.34
SOLARBAN 70XL (3) *OPTIGRAY* 23	1	17	7	5	7	0.28	0.26	1.50	0.19	0.16	1.04
SOLARBAN 70XL (3) *GRAYLITE*	1	10	5	5	11	0.28	0.26	1.50	0.16	0.14	0.71

www.ppg.com

Input Data

Solar Heat Gain Coefficient (SHGC):

SHGC = 0.27

Output and Calculated Heat Gain

Month	Heat Gain Rate (BTU per ft² per Day)	Calculated Heat Gain (BTU per Day)	Days	Monthly Heat Gain (BTU)
January	38	101911	31	3159249
February	52	139457	28	3904810
March	67	179686	31	5570254
April	82	219914	30	6597412
May	101	270869	31	8396950
June	114	305734	31	9172012
July	130	348644	30	10807956
August	102	273551	31	8206537
September	75	201141	30	6235359
October	54	144821	31	4344637
November	41	109957	31	3408663
December	34	91184	30	2735512
		ANNUAL TOTAL	365	72539350

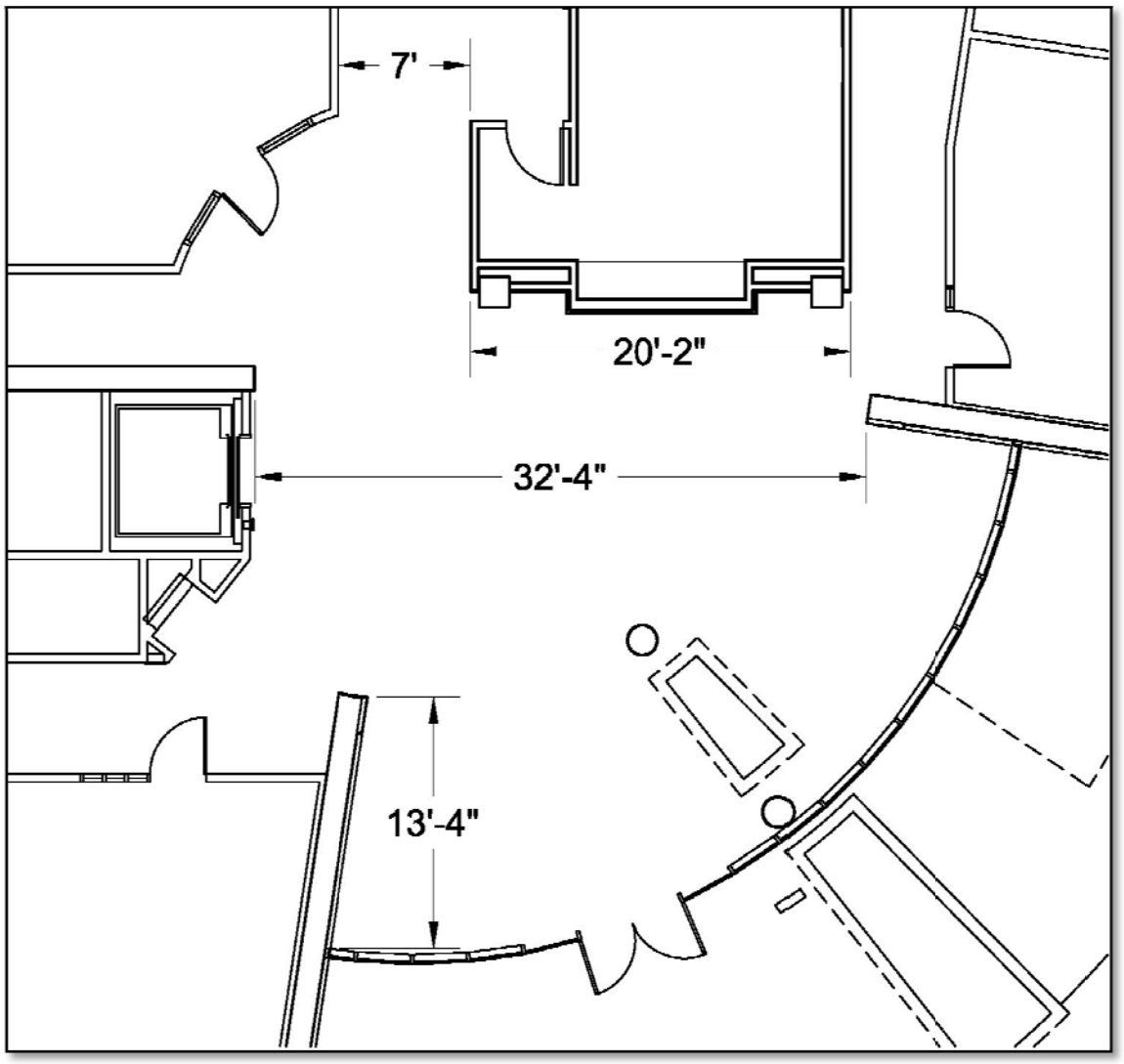
Conclusions

After completing the thermal gain analysis, the modified curtain wall system using PPG SOLARBAN 70XL glass is expected to reduce the annual heat gain from 99,599 kBTU to 72,539 kBTU. This represents an approximate 27% reduction in cooling load for this space. Although the initial installation cost would be higher, consideration of a more thermally resistant glazing system for the north curtain wall is recommended.

ACOUSTICS BREADTH – LOBBY ANALYSIS

The main entry lobby of the building is an important space within Natural Science Unit II and the surrounding campus. This area is intended to be a place for social and academic interaction between student and faculty at the university. In order to accommodate comfortable conversation in this space, an appropriate acoustic environment is required. For this reason, an analysis of the acoustics in the first floor lobby space has been analyzed in this study. The main purpose of the analysis is to determine whether the lobby area meets recommended professional standards of acoustical quality. It is unlikely that this type of analysis was performed during the design and construction of the project. In addition, an architectural change to a portion of the ceiling (from acoustic ceiling tile to gypsum) was made during the lighting redesign of this space. The effects of this change have also been determined in the following analysis.

Room Dimensions



Partial First Floor Plan
Scale: NTS

Material Properties

DESCRIPTION	MATERIAL	ABSORPTION COEEFFICIENT (α)					
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Floor 1	Carpet on Concrete	0.020	0.060	0.140	0.370	0.600	0.650
Floor 2	Stone	0.010	0.010	0.015	0.020	0.020	0.020
Interior Walls	Gypsum Wall Board	0.290	0.100	0.050	0.040	0.070	0.090
Wooden Panel Wall	Wood	0.150	0.110	0.100	0.070	0.060	0.070
Concrete Walls	Concrete	0.010	0.010	0.015	0.020	0.020	0.020
ACT Ceiling	Acoustic Ceiling Tile	0.760	0.930	0.830	0.990	0.990	0.940
Ceiling 2	Gypsum	0.290	0.10	0.050	0.040	0.070	0.090
Interior Doors	Wood	0.190	0.140	0.090	0.060	0.060	0.050
Elevator Doors	Steel	0.050	0.100	0.100	0.100	0.070	0.020
Exterior Doors	Steel	0.050	0.100	0.100	0.100	0.070	0.020
Curtain Wall	Glass - Heavy	0.180	0.060	0.040	0.050	0.020	0.020
Curtain Wall Framing	Steel	0.050	0.100	0.100	0.100	0.070	0.020
Interior Windows	Glass - Ordinary	0.180	0.060	0.040	0.030	0.020	0.020
Corridor Openings	Open	0.600	0.600	0.600	0.600	0.600	0.600

Reverberation Time – Existing

DESCRIPTION	SURFACE AREA S [ft²]	S x α					
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Floor 1	696	13.92	41.76	97.44	257.52	417.60	452.40
Floor 2	534	5.34	5.34	8.01	10.68	10.68	10.68
Interior Walls	517	149.93	51.70	25.85	20.68	36.19	46.53
Wooden Panel Wall	132	19.80	14.52	13.20	9.24	7.92	9.24
Concrete Walls	330	3.30	3.30	4.95	6.60	6.60	6.60
ACT Ceiling	499	372.40	455.70	406.70	485.10	485.10	460.60
Ceiling 2	490	144.71	49.90	24.95	19.96	34.93	44.91
Interior Doors	42	7.98	5.88	3.78	2.52	2.52	2.10
Elevator Doors	24	1.20	2.40	2.40	2.40	1.68	0.48
Exterior Doors	42	2.10	4.20	4.20	4.20	2.94	0.84
Curtain Wall	594	106.92	35.64	23.76	29.70	11.88	11.88
Curtain Wall Framing	18	0.90	1.80	1.80	1.80	1.26	0.36
Interior Windows	48	8.64	2.88	1.92	1.44	0.96	0.96
Corridor Openings	226	135.60	135.60	135.60	135.60	135.60	135.60
Space Volume (V)		13,530 ft³					
a = Σ (S x α)		837.14	810.62	754.56	987.44	1155.86	1183.18
T_{60} = 0.05 x V/a		0.808	0.835	0.897	0.685	0.585	0.572

a = Room Absorption (Sabins)

T_{60} = Reverberation Time (Seconds)

Reverberation Time – Designed

DESCRIPTION	SURFACE AREA S [ft²]	S x α					
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Floor 1	696	13.92	41.76	97.44	257.52	417.60	452.40
Floor 2	534	5.34	5.34	8.01	10.68	10.68	10.68
Interior Walls	517	149.93	51.70	25.85	20.68	36.19	46.53
Wooden Panel Wall	132	19.80	14.52	13.20	9.24	7.92	9.24
Concrete Walls	330	3.30	3.30	4.95	6.60	6.60	6.60
ACT Ceiling	0	0.00	0.00	0.00	0.00	0.00	0.00
Ceiling 2	989	286.81	98.90	49.45	39.56	69.23	89.01
Interior Doors	42	7.98	5.88	3.78	2.52	2.52	2.10
Elevator Doors	24	1.20	2.40	2.40	2.40	1.68	0.48
Exterior Doors	42	2.10	4.20	4.20	4.20	2.94	0.84
Curtain Wall	594	106.92	35.64	23.76	29.70	11.88	11.88
Curtain Wall Framing	18	0.90	1.80	1.80	1.80	1.26	0.36
Interior Windows	48	8.64	2.88	1.92	1.44	0.96	0.96
Corridor Openings	226	135.60	135.60	135.60	135.60	135.60	135.60
Space Volume (V)		13,530 ft³					
a = Σ (S x α)		742.44	403.92	372.36	521.94	705.06	766.68
T_{60} = 0.05 x V/a		0.911	1.675	1.817	1.296	0.959	0.882

Comparison / Analysis

	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
T_{60} – Existing (Seconds)	0.808	0.835	0.897	0.685	0.585	0.572
T_{60} – Designed (Seconds)	0.911	1.675	1.817	1.296	0.959	0.882
Difference (Seconds)	0.103	0.840	0.920	0.611	0.374	0.310

The removal of the acoustic ceiling tile from the center of the lobby creates a notable increase in the reverberation times within the space. This difference has the potential to adversely affect the quality of speech recognition in the lobby. Any increase in reverberation time is undesirable in the space. However, the final values for reverberation time are still marginally acceptable for a large public space such as this. Several unknown variables such as plant life and human occupancy in the space will also likely act to decrease the reverberation time here.

If the project budget allows, addition of sound absorbing materials back into the space should be used to improve the acoustic performance. Another option is to change the lighting design back to be integrated into an acoustic tile ceiling in the lobby. For this project, the lighting design and visual experience of the space from indoors and outdoors are of greater importance than a minor improvement in acoustic quality. Ideally, a new sound dampening method would allow the lighting appearance to stay fairly constant while still reducing the reverberation time in the room.

SUMMARY / CONCLUSION

The solutions presented within this report are generally promising and have met most of the technical design criteria set forth at the beginning of the project. The proposed design represents an improvement in the occupant experience of the engineered systems for the building and the nearby campus. As much as possible, the breadth and depth topics have been related to one another and the impact of one system on another is clearly visible from the results.

The lighting redesign was successful in creating a more exciting and appropriate occupant experience within the building. The building has been defined internally and externally as a prominent fixture on the UCI campus. The architectural themes of the building have been integrated into the lighting design so as to for a cohesive and elegant design solution in the four spaces. Electrical depth topics produced acceptable and definitive results in most cases, with both depth studies revealing a potential for the university to save energy and money through the modification of existing building systems.

In studying the mechanical and acoustical properties of the lobby, results have indicated that although the existing systems are somewhat sufficient, there is certainly potential for improvement of the systems and, in the case of the mechanical study, potential to save money on annual energy costs and to be seen as a more environmentally responsible institution.

The thesis project as a whole has been an excellent opportunity to gain first-hand knowledge of the building construction industry and its many fields. The experience provided by the project is unique and will be extremely valuable in the pursuit of a position in the industry as a professional.

ACKNOWLEDGEMENTS

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Professor M. Kevin Parfitt

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Andrea Hartranft
Mike Barber
Sean Good

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Naomi Miller
Billy Hodges
Chip Israel

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Carrier-Johnson Architects – Gary Hipolite, Philip Pipal
Tangram Interiors – Tom Walsh
Fox + Fox Design – John Fox, Debra Fox

Others

AE Colleagues
Friends and Family

Appendix

LIGHTING EQUIPMENT SCHEDULE

TYPE	MANUF.	CATALOG #	LAMP(S)	BALLAST	INPUT WATTS	VOLTS	MOUNTING	DESCRIPTION
INDOOR FIXTURES								
F01	FOCAL POINT	FAVA-NS-1T5-1C-277-S-F-WH-4'	(1) 28W T5, 4100K, CRI=85, FP28/841/ECO	ADVANCE ICN-2S28-N	30 (PER FX)	277	CEILING SEMI-RECESSED	"AVENUE A" - NARROW APERTURE ASYMMETRIC WALL WASHER. SINGLE CIRCUIT, DRYWALL FLANGE, MATTE WHITE HOUSING, 4' NOMINAL LENGTH. STEEL CONSTRUCTION.
F02	FOCAL POINT	FAVB-FL-1T5-1C-277-D-F-WH-4'	(1) 28W T5, 4100K, CRI=85, FP28/841/ECO	DIMMING: LUTRON ECO-T528-277-2	30 (PER FX)	277	CEILING RECESSED	"AVENUE B" - RECESSED SLOT FIXTURE. DIFFUSE FLUSH LENS, SINGLE CIRCUIT, MATTE WHITE HOUSING. STEEL CONSTRUCTION.
F03	LIGHTOLIER	SU-F-L-S-T-SL	(1) 13W CFL, 4-PIN/2G7 BASE, 3500K, INCLUDED	IN-LINE ELECTRONIC	13	120	TABLE	"SURFSIDE" CFL PERSONAL TASK LIGHT. 20" ARM, SILVER FINISH, TABLE BASE
F04	FOCAL POINT	FTWS-PB-1-1-277-D-J12-TS-20'	(1) 28 W T5, 4100K, CRI=85, FP28/841/ECO	DIMMING: LUTRON ECO-T528-277-2	30 (PER FX)	277	CEILING SUSPENDED	"TWELVE" - SUSPENDED INDIRECT/DIRECT LUMINIRE. PARALLEL BLADE LOUVER, 24" CABLE SUSPENSION, INTEGRAL WATTSTOPPER OCCUPANCY SENSOR, TITANIUM SILVER FINISH, FACTORY 20' RUN
F05	LIGHTOLIER	PTS5-1-S-S-2-4	(1) 28W T5, 4100K, CRI=85, FP28/841/ECO	DIMMING: LUTRON ECO-T528-277-2	30 (PER FX)	277	CEILING RECESSED	"PTS5-1" - RECESSED PERIMETER WALL WASH. STRAIGHT BLADE ALUMINUM LOUVER, DIE-FORMED STEEL CONSTRUCTION.
F06	TECH LIGHTING	700-MO-SPT6-04-S	(1) 35W SOLUX MR16, 4100K, 17 DEGREE SPREAD	N/A	35	12	TRACK-MOUNTED	"SPOT" TRACK HEAD. COMPATIBLE WITH MONORAIL SYSTEM. 4.5" LENGTH. SATIN NICKEL FINISH. DESIGNER APPROVAL REQUIRED FOR LAMP SUBSTITUTION.
F06-A	TECH LIGHTING	700MOA-48+24-S	N/A	N/A	N/A	12	CEILING SURFACE	"MONORAIL" LOW-VOLTAGE STRAIGHT RAIL TRACK. 48" + 24" FOR TOTAL 72" OVERALL RUN. SATIN NICKEL FINISH WITH CLEAR INSULATOR. SEE CUTSHEETS FOR ADDITIONAL EQUIPMENT.
F07	LOUIS POULSEN	BAL-1/18W CF GX24q-2 - 277V - WHT	(1) 18W CFL, 4100K, CRI=82, PL-T 18W/841/4P/ ALTO	OSRAM QTP 1x18CF/UNV	20	277	CEILING SEMI-RECESSED	"BALLERUP" SEMI RECESSED DECORATIVE CFL DOWNLIGHT.
F08	LIGHTOLIER	48023ALU	(1) 28W T5, 4100K, CRI=85, FP28/841/ECO	ADVANCE ICN-2S28-N	30 (PER FX)	277	WALL MOUNTED	"SOLI" WALL-MOUNTED DECORATIVE T5 FIXTURE. METALLIC ALUMINUM FINISH, SEE DIFFUSER SPECIFICATION BELOW (ORDER SEPERATELY). ADA COMPLIANT
F09	ELLIPTIPAR	F101-T335-X-01-2-000	(1) 35W T5, 4100K, CRI=85, F35T5/841/ ALTO	ADVANCE ICN-2S28-N	38 (PER FX)	277	WALL CANTILEVER MOUNTED	"STYLE 102" WALL CANTILEVER-MOUNTED WALL WASH LUMINAIRE. BRIGHT ALUMINUM FLUTED HOUSING WITH SILVER END PLATES, 18" CANTILEVEL ARM. 5' LENGTH.
F10	COLOR KINETICS	101-000066-00	45 LEDs (15 RED, 15 GREEN, 15 BLUE)	N/A	3W	24V DC	COVE MOUNTED	"iCOLOR COVE QLX" COVE-MOUNTED RGB COLOR-CHANGING COVE FIXTURE. 120 DEGREE CANDLEPOWER DISTRIBUTION, ADJUSTABLE POSITION MOUNTING BRACKET.
F10-A	COLOR KINETICS	PDS-60ca 24V	N/A	N/A	N/A	277	REMOTE	277V AC - 24V DC LED POWER SUPPLY.
F10-B	COLOR KINETICS	101-000008	N/A	N/A	N/A	N/A	REMOTE	"COLORDIAL" DMX LED CONTROLLER.
F11	PHILIPS	OM4-1H-32 PLT-SQ-CS-120/277	(1) 32W CFL, 4100K, CRI=82, PL-T 32W/841/4P/ ALTO	OSRAM QTP 2X32CF/UNV BM	35 (PER FX)	277	CEILING RECESSED	"OMEGA REVELATION" 4-INCH SQUARE CFL DOWNLIGHT. CLEAR SPECULAR REFLECTOR.
F12	SCHMITZ	26237.06	(2) 28W T5, 4100K, CRI=85, FP28/841/ECO	ADVANCE ICN-2S28-N BF	60 (PER FX)	277	PENDANT	"TOOL" PENDANT FIXTURE. NO DOWNLIGHT. RIBBED ACRYLIC TUBE, SATIN NICKEL FINISH. ADJUSTABLE SUSPENSION CABLE.
OUTDOOR / SITE FIXTURES								
S01	BEGA	2007 P	(1) 35W T5, 3000K, CRI=85, F35T5/830/ALTO	ADVANCE ICN-2S28, BF	38.5 (PER FX)	277	WALL RECESSED	RECESSED LINEAR WALL FIXTURE. STAINLESS STEEL FINISH. RATED FOR WET LOCATION.
S02	BEGA	8642 P	(1) 24W T5HO, 3000K, CRI=85, F24T5/830/HO/ALTO	ADVANCE ICN-2S24, BF	26 (PER FX)	277	IN-GRADE RECESSED	IN-GRADE RECESSED FLODLIGHT. LINEAR FLUORESCENT. DRIVE OVER. RATED FOR WET LOCATION. STAINLESS STEEL FINISH.
S03	BEGA	8989 P	(1) 36W CFL, 3000K, CRI=82, PL-L 36W/830/4P	ADVANCE ICN-2S54, BF	46	277	POLE	LINEAR STAINLESS STEEL POLE-MOUNTED SITE FIXTURE. RATED FOR WET LOCATION.

VISUAL INDEX

avenue® a

FOCAL POINT®

FEATURES

Narrow aperture high performance T5/T5HO asymmetric wall wash.

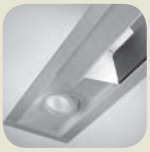
Precision micro-optic delivers shadow free illumination from the ceiling to the floor.

Features 2" narrow aperture for clean unobtrusive aesthetic.

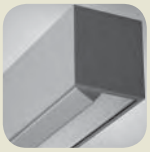
Drywall installation is available, which allows for both individual or continuous row mount capability.

Great solution for conference rooms, highlighting artwork, corridors, white board or any application that requires high levels of vertical illumination.

companion luminaire



mr16



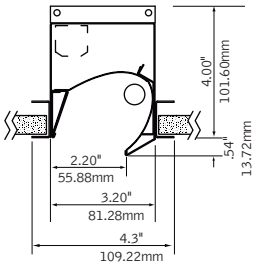
linear

recessed wall mount

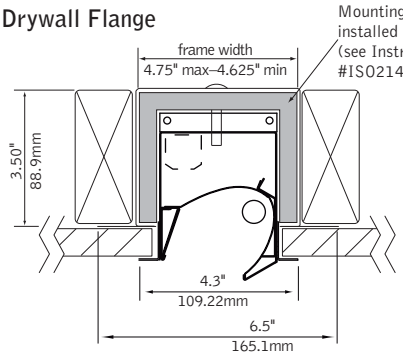
November 2007

DIMENSIONAL DATA

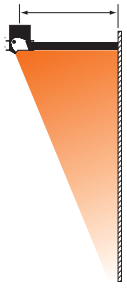
Grid Mount



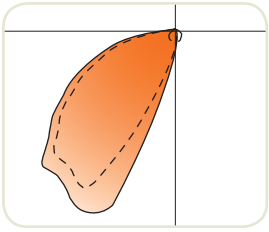
Drywall Flange



24-30" Recommended Distance from Wall



PERFORMANCE



1–Lamp T5HO
57% Efficiency
1933 cd @ 25°

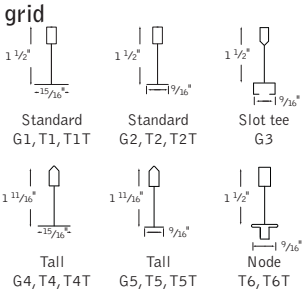
See **Photometric** section for additional performance data.

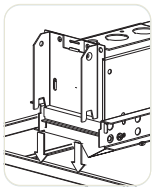
fixture type:

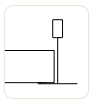
project name:

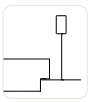
DETAILS

grid









drywall

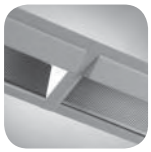
2' unit (cutout dimension: 3.5" x 23.6")

3' unit (cutout dimension: 3.5" x 35.6")

4' unit (cutout dimension: 3.5" x 47.6")

5' unit (cutout dimension: 3.5" x 59.6")

Drywall flange version provided with mounting yoke.



row mount detail

SPECIFICATIONS

construction

One-piece 20 Ga. steel housing.
Grid luminaires include 20 Ga. steel, .5" wide universal flange rail.

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

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

optic

.020" specular aluminum upper reflector and .020" semi-specular lower reflector.
24 Ga. perforated matte black diffuser with 24% opening.

please note:

radial cut-off louver FAVA-RL or the clear lens FAVA-CL cannot be field installed on the non-shielded profile FAVA-NS.

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.

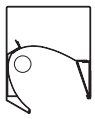
finish

Polyester powder coat applied over a 5-stage pre-treatment.
Standard luminaire housing finished in Matte Satin White or Matte Black.
Perforated diffuser always finished in Matte Black.

ORDERING

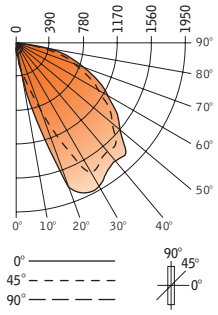
luminaire series		FAVA
Avenue A	FAVA	
shielding		NS
No Shielding, Open Optic (Radial cut-off louver FAVA-RL or the clear lens FAVA-CL cannot be field installed on the non-shielded profile FAVA-NS)	NS	
lamping		1T5
One Lamp T5	1T5	
One Lamp T5HO	1T5HO	
circuits		1C
Single Circuit	1C	
voltage		277
120 Volt	120	
277 Volt	277	
347 Volt (Consult factory for availability)	347	
ballast		S
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast	D	
ceiling configurations (For mounting configurations, see Reference section)		G1
Drywall Flange (Consult factory for custom variations)	F	
Std. 15/16" Lay-in	G1	
Std. 15/16" Tegular	T1	
Std. 15/16" Tegular, against Tee	T1T	
Std. 9/16" Lay-in	G2	
Std. 9/16" Tegular	T2	
Std. 9/16" Tegular, against Tee	T2T	
9/16" Slot-tee Tegular	G3	
Tall 15/16" Lay-in	G4	
Tall 15/16" Tegular	T4	
Tall 15/16" Tegular, against Tee	T4T	
Tall 9/16" Lay-in	G5	
Tall 9/16" Tegular	T5	
Tall 9/16" Tegular, against Tee	T5T	
Node 9/16" Tegular	T6	
Node 9/16" Tegular, against Tee	T6T	
factory options		-
Chicago Plenum	CP	
Emergency Circuit	EC	
Emergency Battery Pack (3' & 4' Luminaires 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	
Titanium Silver	TS	
Matte Black Housing (Perforated diffuser always painted black)	BK	
luminaire length		4'
2' Nominal Housing	2'	
3' Nominal Housing	3'	
4' Nominal Housing	4'	
5' Nominal Housing (Dimming not available with 5' lamps) (For continuous row mount in drywall ceiling, specify luminaire run length, ie 24')	5'	

avenue® a



Filename: FAVANS1T5H.IES
Catalog #: FAVA-NS-1T5HO-1C-120-S-G-WH-4'
Efficiency: 57%
Test #: 12355.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	108	108	108	108	108	
5°	276	256	214	154	101	13
15°	919	771	499	291	102	85
25°	1933	1873	1300	415	101	279
35°	1832	1799	1695	707	96	408
45°	1806	1775	1647	1296	88	610
55°	1434	1416	1329	1108	74	580
65°	1072	1052	962	811	56	473
75°	655	631	568	458	39	294
85°	317	294	224	129	14	119
90°	183	165	112	40	2	
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	

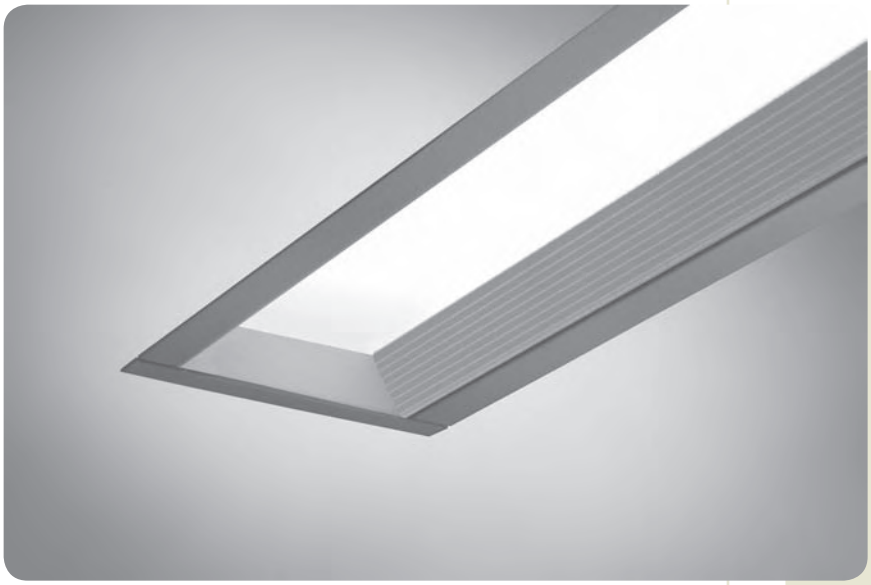
LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	376	7.5	13.2
	0°-40°	784	15.7	27.4
	0°-60°	1975	39.5	69.0
	0°-90°	2861	57.2	100.0
Total Luminaire	0°-180°	2861	57.2	100.0

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

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.

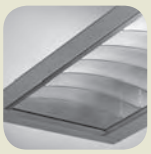
Drywall installation is available, which allows for both individual or continuous row mount capability.

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

shielding options

corrugated regress trim

solid regress trim

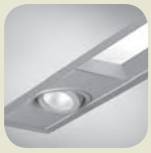


concave louver

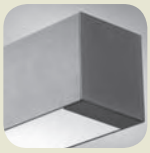
flush lens

microglow™ lens

companion luminaire



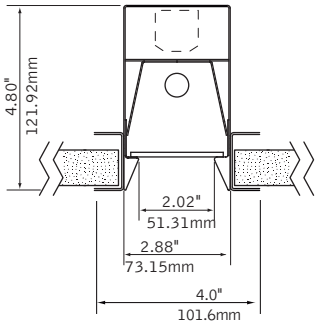
mr16



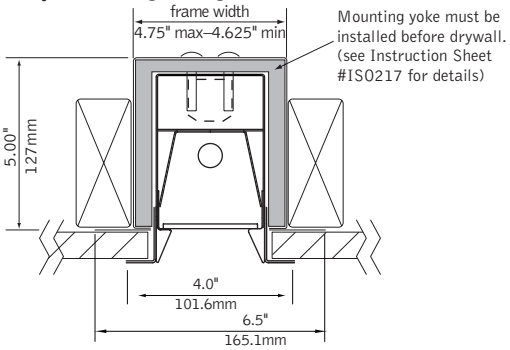
linear

DIMENSIONAL DATA

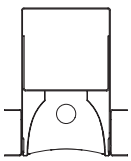
Grid Mount (Regress Trim Shown)



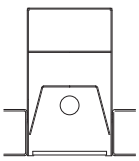
Drywall Flange (Regress Trim Shown)



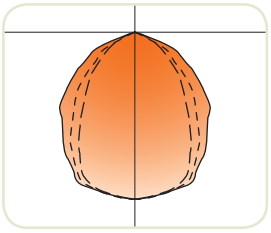
Louver



Flush Lens



PERFORMANCE



1–Lamp T5
62% Efficiency
1466 cd @ 0°

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

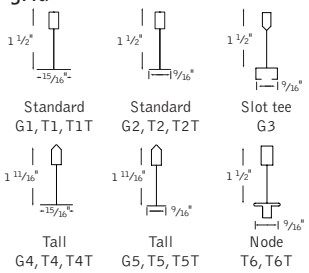
january 2008

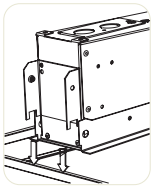
fixture type:

project name:

DETAILS

grid





drywall

2' unit (cutout dimension: 3.5" x 23.6")

3' unit (cutout dimension: 3.5" x 35.6")

4' unit (cutout dimension: 3.5" x 47.6")

5' unit (cutout dimension: 3.5" x 59.6")

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 Satin White.

Grid luminaires include 20 Ga. steel, .5" wide 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.

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.

Frosted Acrylic lens diffuser .118" thick.

Clear Acrylic MicroGlow™ diffuser .125" thick with miniature prismatic pattern.

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.

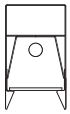
Standard luminaire housing finished in Matte Satin White.

ORDERING

luminaire series		FAVB
Avenue B	FAVB	
shielding		NS
Corrugated Regressed Trim Frst.Lns	CR	
Solid Regressed Trim Frosted Lens	SR	
Concave Parabolic Louver	PL	
Flush Frosted Lens	FL	
Corrugated Regressed Trim with MicroGlow™ Lens	CRM	
Solid Regressed Trim MicroGlow™ Lens	SRM	
Flush MicroGlow™ Lens	FLM	
White Concave Parabolic Louver	PW	
lamping		1T5
One Lamp T5	1T5	
One Lamp T5HO	1T5HO	
circuits		1C
Single Circuit	1C	
voltage		277
120 Volt	120	
277 Volt	277	
347 Volt (Consult factory for availability)	347	
ballast		S
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast	D	
ceiling configurations (For mounting configurations, see Reference section)		G1
Drywall Flange (Consult factory for custom variations)	F	
Std. 15/16" Lay-in	G1	
Std. 15/16" Tegular	T1	
Std. 15/16" Tegular, against Tee	T1T	
Std. 9/16" Lay-in	G2	
Std. 9/16" Tegular	T2	
Std. 9/16" Tegular, against Tee	T2T	
9/16" Slot-tee Tegular	G3	
Tall 15/16" Lay-in	G4	
Tall 15/16" Tegular	T4	
Tall 15/16" Tegular, against Tee	T4T	
Tall 9/16" Lay-in	G5	
Tall 9/16" Tegular	T5	
Tall 9/16" Tegular, against Tee	T5T	
Node 9/16" Tegular	T6	
Node 9/16" Tegular, against Tee	T6T	
factory options		-
Chicago Plenum	CP	
Emergency Circuit	EC	
Emergency Battery Pack (3' & 4' Luminaires 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		WH
2' Nominal Housing	2'	
3' Nominal Housing	3'	
4' Nominal Housing	4'	
5' Nominal Housing (Dimming not available with 5' lamps) (For continuous row mount in drywall ceiling, specify luminaire run length, ie 24')	5'	

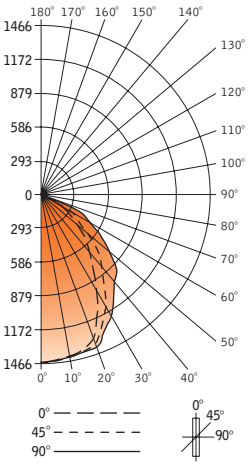
Focal Point L.L.C. 4201 South Pulaski Rd, Chicago, Illinois 60632 | T: 773.247.9494 | F: 773.247.8484 | info@focalpointlights.com | www.focalpointlights.com

regress with lens
avenue® b



Filename: FAVBSR1T5HO.IES
Catalog #: FAVB-SR-1T5HO-1C-120-S-G1-WH-4'
Efficiency: 62%
Test #: 12914.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	1466	1466	1466	1466	1466	
5°	1457	1457	1456	1456	1456	139
15°	1432	1428	1417	1399	1393	401
25°	1311	1299	1254	1187	1150	575
35°	1102	1073	958	837	793	599
45°	934	866	701	586	553	565
55°	649	578	426	357	335	416
65°	404	328	232	187	174	257
75°	184	133	77	60	58	103
85°	39	21	19	18	17	24
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 1.2
Criterion: 1.1

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	1115	22.3	36.2
	0°-40°	1714	34.3	55.7
	0°-60°	2695	53.9	87.5
	0°-90°	3078	61.6	100.0
Total Luminaire	0°-180°	3078	62	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	16467	12359	9750
55°	14106	9259	7281
65°	11918	6844	5133
75°	8863	3709	2794
85°	5579	2718	2432

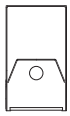
CO-EFFICIENTS OF UTILIZATION

Floor		80			70			50	30	10	00
Ceiling								20			
Wall	70	50	30	10	70	50	10	50	10	10	00
RCR 0	73	73	73	73	72	72	72	68	65	63	62
1	68	66	64	62	67	65	61	62	59	60	57	58	56	54
2	63	59	56	53	62	58	52	56	51	54	50	52	49	48
3	59	53	49	46	57	52	45	51	45	49	44	48	43	42
4	54	48	43	40	59	47	40	46	39	45	39	43	38	37
5	50	43	38	35	49	42	34	41	34	40	34	39	33	32
6	46	39	34	31	45	39	30	37	30	36	30	36	30	29
7	43	35	31	27	42	35	27	34	27	33	27	32	26	25
8	40	32	27	24	39	32	24	31	24	30	23	29	23	22
9	37	29	24	21	36	29	21	28	21	27	21	27	20	19
10	34	26	22	19	33	26	19	25	18	25	18	24	18	17

Numbers indicate percentage values of reflectivity.

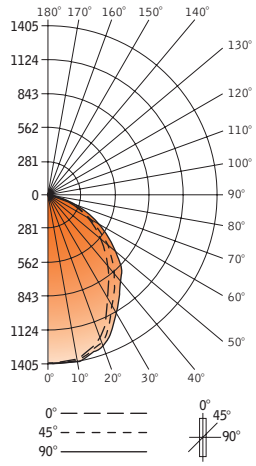
Go to www.focalpointlights.com for additional photometric data.

flush lens
avenue® b



Filename: FAVBFL1T5.IES
Catalog #: FAVB-FL-1T5HO-1C-120-S-G1-WH-4'
Efficiency: 65%
Test #: 13734.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	1397	1397	1397	197	1397	
5°	1395	1395	1394	1391	1392	133
15°	1361	1357	1342	1329	1324	381
25°	1242	1228	1192	1159	1145	552
35°	1029	1005	950	903	885	599
45°	8446	812	747	700	684	586
55°	580	550	501	471	464	458
65°	356	338	310	297	293	315
75°	165	158	150	144	142	160
85°	35	37	38	38	40	41
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 1.2
Criterion: 1.0

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	1066	21.3	33.0
	0°-40°	1665	33.3	51.6
	0°-60°	2709	54.2	84.0
	0°-90°	3225	64.5	100.0
Total Luminaire	0°-180°	3225	64.5	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	19577	17286	15828
55°	16546	14293	13237
65°	13784	12003	11344
75°	10432	9483	8977
85°	6571	7134	7510

CO-EFFICIENTS OF UTILIZATION

Floor		80			70			50	30	10	00
Ceiling								20			
Wall	70	50	30	10	70	50	10	50	10	10	00
RCR 0	77	77	77	77	75	75	75	72	72	69	69	66	66	65
1	71	69	66	64	70	67	63	64	61	62	59	60	57	56
2	66	61	57	54	64	60	53	58	52	56	51	54	50	49
3	61	55	50	46	59	54	46	52	45	50	44	49	44	42
4	56	49	44	40	55	48	40	47	39	45	39	44	38	37
5	51	44	38	34	50	43	34	42	34	41	34	39	33	32
6	48	40	34	30	46	39	30	38	30	37	30	36	29	28
7	44	36	30	27	43	35	27	34	26	33	26	32	26	25
8	43	32	27	23	40	32	23	31	23	30	23	29	23	22
9	37	29	24	20	37	29	20	28	20	27	20	26	20	19
10	35	26	21	18	34	26	18	25	18	25	18	24	18	17

Numbers indicate percentage values of reflectivity.

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

Surfside is a sleek, contemporary adjustable arm task light with two arm sizes and two distinctively different light sources. Available in either 13 watt compact fluorescent or state of the art LED versions, Surfside will provide the right amount of light where needed in the task area. Surfside is available in black or silver with 10 solid or transparent colored shade options. The shade assemblies are easily interchangeable to suit user preference.

SURFSIDE

Ordering Information

SU	F	—	L	S	T	—	SL
Series	**Lamps**		**Arm**	**Color**	**Mounting**		**Options**

SU = Surfside

F = 13W Compact Fluorescent
L = LED 8x1w

S = 14"
L = 20"

B = Black
S = Silver

E = Edge Clamp
F = Floor Stand
P = Panel Bracket
S = Slat Wall Bracket
T = Table Base
Z = Zero Clearance Bracket

Shade Color Options
AM = Amber
BK = Black (solid)
BL = Blue
BW = Blue White
GN = Green
PL = Purple
SM = Smoke
SI = Silver (solid)
WN = Wine
WT = White (solid)

Example = SUF–SSP–WT

Note: Colorsnot designated as solid are transparent.

Dimensions

Shade

Entire Fixture

Shade Color Options

Solid Color Shade Color Options

SURFSIDE

Fluorescent / LED Task Light

Features

Lamp: 13w compact fluorescent 4-pin /2G7 base (3500k). Lamps included. Or 8x1w LEDs (6500k). LEDs included.

Electrical: Wired for 120V 60Hz operation.

Ballast: In-line hybrid electronic ballast with quick connect cord.

Transformer (LED): In-line transformer with quick connect cord. Primary input: 120V. Secondary output: 12V.

Power Cord: Quick connect. Minimum 6ft (182mm) long.

Arm: Extruded aluminum, spring-balanced arm with adjustable tension joints. Available in 14" or 20" lengths.

Shade: Hi-impact polycarbonate with a perforated reflector and prismatic lens. Solid or transparent colors. See color options in options block.

Finish: Matte black or silver

Listing: UL/cUL listed.

Mounting Options

Edge Clamp (E): Clamps onto edge of desk or table.

Floor Stand (F): Weighted floor base.

Panel Bracket (P): Attaches to 1" slotted panel standard. Consult factory for furniture compatibility.

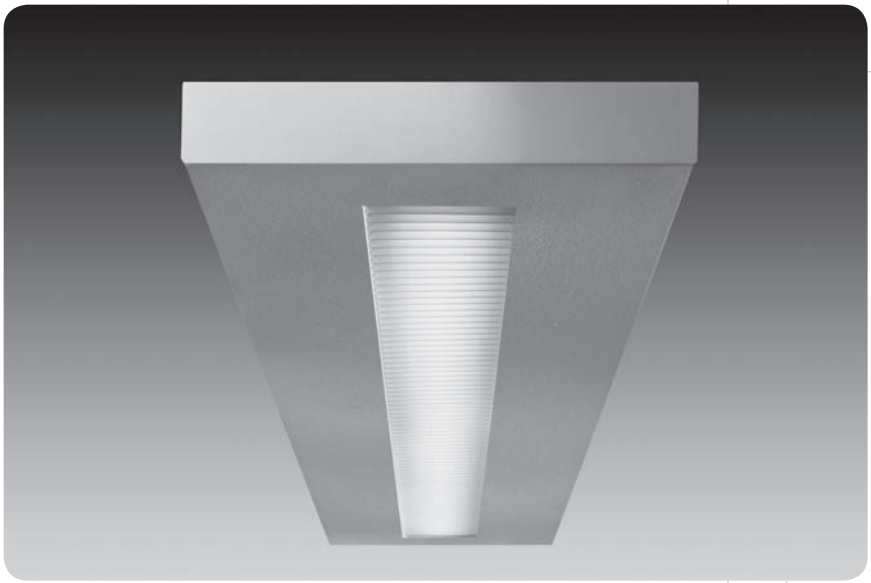
Slat Wall Bracket (S): Attaches to many furniture slat wall systems. Consult factory for furniture compatibility.

Table Base (T): 9" diameter weighted base for desktop use.

Zero Clearance Bracket (Z): Two-piece edge clamp for tight spaces. Clamps onto edge of desk or table.

louver/indirect

twelve™



Covered by the following U.S. Patents: 5,733,028; 5,914,487; 5,967,652; 6,043,873; 6,064,061; 6,088,091; 6,238,077; 6,266,136; 6,334,700.

FOCAL POINT®

features

Suspended direct/indirect ideal for low ceiling applications.

Twelve™ delivers 70% indirect/30% direct illumination.

The CU Filter precisely controls lamp brightness above the fixture to allow for 12" suspension lengths.

Sleek rectilinear design adds clean style to any space.

Parallel blade louver with acrylic lens diffuser provides comfortable downlight shielding.

Excellent choice for lower ceiling applications and areas where ceiling uniformity is important.

shielding options

solid indirect

louver

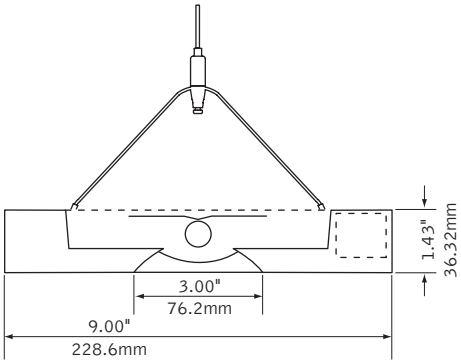
sensor options

daylight / occupancy sensor

companion luminaire

wall mount

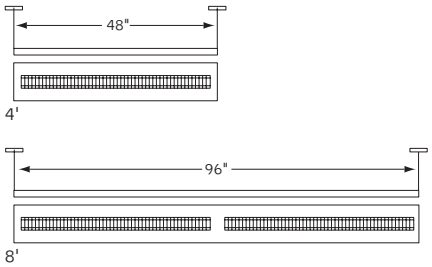
dimensional data



lamping options

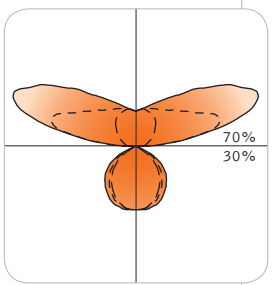
T5/T5HO LAMPS

fixture information



performance

1–Lamp T5HO
90% Efficiency
1264 cd @ 115°



Visit focalpointlights.com for complete photometric data.

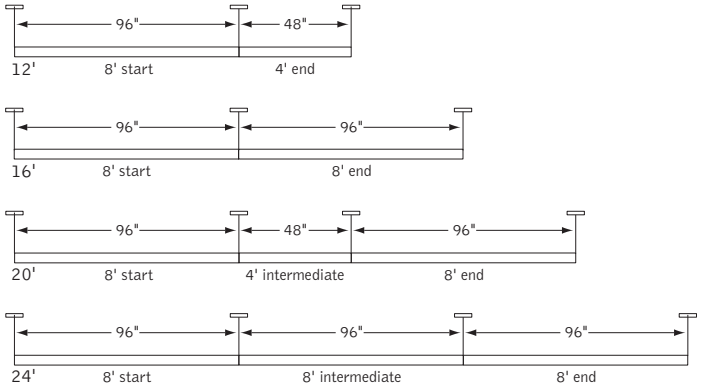
everGreen™

july 2008

fixture:

project:

suspension information



Consult factory for additional row length information.

specifications

construction

One-piece 20 Ga. steel housing.
14 Ga. steel end caps mechanically attach flush to housing with concealed fasteners.
For row installation, internal brackets form hairline joint.
Standard lengths are available in 4' and 8'.
All luminaires are provided with Y-cable suspension mounted on 48" or 96" centers.

4' unit weight: 20 lbs.
8' unit weight: 38 lbs.

optic

Reflector fabricated of low iridescent, semi specular premium grade aluminum.
Parallel Blade Louver: 24 Ga. steel, .5"H x 2.8"W x .56" frequency.
Louver blade finished to match housing and backed with an acrylic lens diffuser.
24 Ga. steel Ceiling Uniformity Filter (CU Filter) finished in high reflectance white powder coat.

electrical

Luminaires are pre–wired with factory installed branch circuit wiring and over-molded quick connects.
Factory installed SJT power cord at feed location is included.
Electronic ballasts are thermally protected and have a Class "P" rating.
Optional dimming ballasts available.
UL and cUL listed.

sensors

Lutron Daylight sensor is a directional sensor that operates with a Lutron EcoSystem ballast. The sensor has an integrated IR receiver for EcoSystem programming. One sensor controls multiple fixtures or groups of fixtures differently. Sensor should be mounted 1 to 2 times the effective window height (from 3' AFF, or bottom of window to top of window).

Lutron IR sensor controls individual or grouped EcoSystem ballasts or BMFs. Sensor provides a flashing LED response to indicate signal reception and received IR signals from up to 8' away when mounted on a 10' ceiling. Order Lutron IR remote accessory (LOR).

Wattstopper Daylight sensor is a closed loop system that measures total light level from daylight and electric light. A 0-10V dimming ballast is required, one sensor controls multiple fixtures. Sensor should be mounted 6-12' from window. Wattstopper daylight setup remote required for programming; one included per order. Order additional setup remote accessory (WYSR) or occupant controller remote accessory (WOR) for increased control.

Wattstopper Occupancy sensor is a passive infrared sensor designed for cubicles and small offices. It has built-in daylight sensing that will hold lights off when adequate ambient light exists. One sensor controls multiple fixtures.

finish

Polyester powder coat applied over a 5-stage pre–treatment.
Canopy finished in Matte Satin White.

ordering

fixture series		FTWS
twelve	FTWS	
shielding		NS
Parallel Blade Louver with CU Filter	PB	
Solid, no lens, 100% indirect	SD	
lamping		1T5
1 Lamp T5	1T5	
1 Lamp T5HO	1T5HO	
2 Lamp T5	2T5	
2 Lamp T5HO	2T5HO	
circuit		277
Single Circuit	1C	
Dual Circuit (Multiple lamp luminaires only)	2C	
voltage		S
120 Volt	120	
277 Volt	277	
347 Volt	347	
ballast		G1
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast*	D	
mounting		-
12" Cable Suspension (5" canopy at feed locations and 2" canopy non–feed locations) (specify "C" in place of "J" for 5" dia. canopies both at power feed and non–feed locations) (suspension may be adjusted up to 24". Consult factory for lengths longer than 24")	J12	
Stem Mount (specify stem length in inches Standard stem lengths 6, 12, 18, 24, 36, 48". Stem painted white unless otherwise specified)	S__	
factory options		
Emergency Circuit*	EC	WH
Emergency Battery Pack*	EM	
HLR/GLR Fuse	FU	4'
Include 3000K Lamp	L830	
Include 3500K Lamp	L835	
Include 4100K Lamp (factory installed lamps recommended)	L841	
Lutron™ Daylight Sensor* (EcoSystem ballast required)	LY1	
Lutron™ IR Receiver* (EcoSystem ballast required)	LIR	
Lutron™ Sensor Feed* (EcoSystem ballast required)	SF	
WattStopper™ Daylight Sensor* (0–10V dimming ballast required)	WY1	W01
WattStopper™ Occupancy Sensor*	W01	
finish		TS
Matte Satin White	WH	
Titanium Silver (louver painted to match housing)	TS	
fixture run length		20'
4'	4'	
8'	8'	
12' (8'+4')	12'	
16' (8'+8')	16'	
20' (8'+4'+8')	20'	
24' (8'+8'+8') (individual units may not be field modified for continuous row mount)	24'	
remotes (specify quantity)		
WattStopper™ Daylight Setup Remote* (required for daylight programming, one included per order)	WYSR	
WattStopper™ Occupant Controller*	WOR	

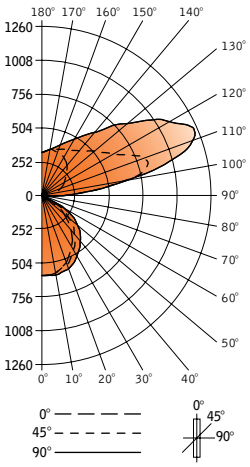
* for more information see Reference section.

Focal Point LLC | 4141 S. Pulaski Rd, Chicago, IL 60632 | T: 773.247.9494 | F: 773.247.8484 | info@focalpointlights.com | www.focalpointlights.com.

louver
twelve™

Filename: FTWSPB1T5H.IES
Catalog #: FTWS-PB-1T5HO-1C-120-S-C12-WH-4'
Efficiency: 90%
Test #: 12096.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	590	590	590	590	590	
5°	587	589	590	593	593	56
15°	551	553	562	575	582	160
25°	486	492	510	537	553	238
35°	394	404	429	464	486	273
45°	290	301	333	376	407	263
55°	178	193	226	269	301	208
65°	86	99	126	157	177	127
75°	29	41	52	60	59	52
85°	0	7	11	11	7	9
90°	0	0	1	1	1	
95°	17	171	105	74	69	107
105°	75	364	788	952	937	690
115°	136	315	772	1151	1264	729
125°	202	312	609	928	1051	555
135°	255	330	516	722	806	406
145°	321	355	449	550	302	285
155°	357	373	415	462	490	194
165°	373	377	385	399	410	110
175°	365	365	365	364	364	35
180°	352	352	352	352	352	

Spacing 1.1
Criterion: 1.3

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	454	9.1	10.1
	0°-90°	1387	27.7	30.8
	90°-130°	2082	41.6	46.3
	90°-180°	3112	62.2	69.2
Total Luminaire	0°-180°	4498	90.0	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	2147	2466	3014
55°	1625	2063	2748
65°			
75°	1066	1531	2193
85°	587	1052	1194

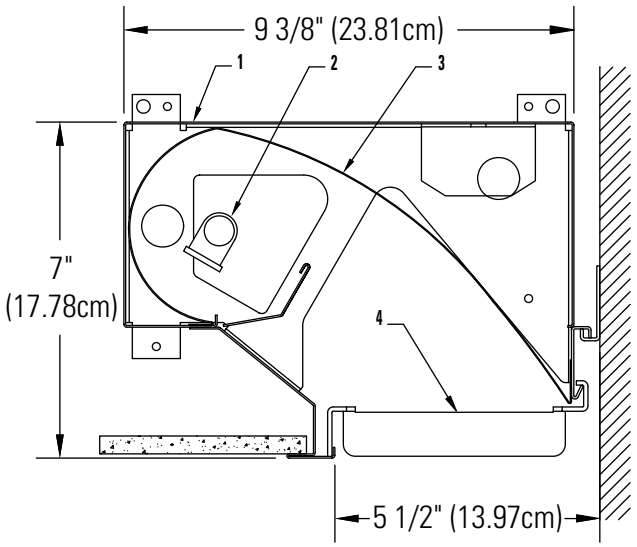
CO-EFFICIENTS OF UTILIZATION

Floor		80			70		50		30		10	00
Ceiling							20					
Wall	70	50	30	10	70	50	10	50	10	50	10	00
RCR 0	92	92	92	92	83	83	83	65	65	49	49	35	35	28
1	85	81	78	75	76	73	68	58	54	44	42	31	30	24
2	77	71	66	62	69	64	56	51	46	39	36	28	26	21
3	71	63	57	52	64	57	47	46	39	35	31	25	23	19
4	65	56	49	44	58	51	40	41	33	31	27	23	20	16
5	59	50	43	38	53	45	35	36	29	28	23	21	17	14
6	55	45	38	33	49	40	30	33	25	25	20	19	15	12
7	51	40	33	29	45	36	26	30	22	23	18	17	13	11
8	47	36	30	25	42	33	23	27	19	21	16	15	12	09
9	43	33	27	22	39	30	20	24	17	19	14	14	10	08
10	40	30	24	20	36	27	18	22	15	17	12	13	09	07

Numbers indicate percentage values of

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

F05



Quarter Scale

Module Ordering Information

Family	Lamps	Lamp Type	Shielding	Voltage	Length	Options
PTS5	1	S	S	2	4	
	1 = 1 Lamp	**S** = Standard **H** = HO	**O** = Open **L** = Lens **S** = Straight Blade Louver	**1** = 120V **2** = 277V **3** = 347V **D1** = 120V Dim. **D2** = 277V Dim. **E1** = 120V Emerg. **E2** = 277V Emerg.	**2** = Two-Foot **3** = Three-Foot **4** = Four-Foot **6** = Six-Foot **8** = Eight-Foot	**Blank** = No Options **A** = Adjustable* **X4** = 4 thru wires **X5** = 5 thru wires **A4** = Adjustable 4 thru wires* **A5** = Adjustable 5 thru wires*

** only available on Two-Foot, Three-Foot and Four-Foot versions. See length variations of adjustable fixtures on page 2.*

Features

1. **Housing:** Die-formed 20 gauge pre-painted steel. Integral heavy gauge bulkheads support housing and trim, permitting modules to be bolted together in continuous runs and facilitate suspension.
2. **Lamping:** Cross-sectional one linear T5 fluorescent lamp. Provided by others.
3. **Reflector:** Precision parabolic roll-formed semi-specular aluminum.
4. **Louver:** Lift and shift straight blade louver constructed from die-formed aluminum and painted to match housing. Louver blades are 1" (2.54cm) high on 1-1/8" (2.86cm) centers. (Optional)

Mounting

"J" Rail is first mounted to the wall and the modules connect to the rail for 1/4" (0.64cm) wall adjustment. Modules are hung from suspension wires attached to the fixture bulkheads and the structure above.

Electrical

Electronic Ballast: Programmed start, 3 conductor, 12 gauge wire. Color-coded quick connectors allow easy connection for modular fixutres. Factory installed ballast disconnect allows the ballast to be disconnected from and reconnected to incoming power under load without turning the entire circuit off.

Dimming: T5 lamp uses PowerSpec® HDF. Use PowerSpec® HDF compatible three-wire control (extra control lead required).

T5 HO lamp uses Advance Mark X. Use Advance compatible two-wire control (no extra control lead required).

Emergency Battery Pack: 450 Lumens @ 90 minimum.

Ordering Instructions

Individual Fixtures:

1. Order number of MODULES required.
2. Order one END SET per MODULE.

Continuous Rows:

1. Determine run length.
2. Order the appropriate number of MODULES for the complete ROW.
3. Stagger rows must be completed with an adjustable module. (2-light only)
4. Non-stagger rows must be completed with an adjustable module unless row lengths are in precise 1 foot (30.48cm) intervals.
5. Order one END SET per ROW.

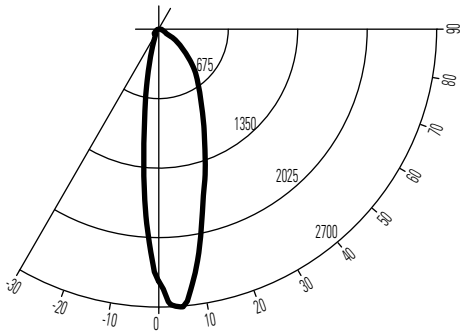
Labels

UL, cUL and IBEW

Job Information	Type:
Job Name:	
Cat. No.:	
Lamp(s):	
Notes:	

631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

Performance & Quick Calculators



Report No: ITL53559
Cat No: PTS51HS14
Lamps: 1 F54T5
Lumens: 5000
Efficiency: 37.2%

CANDLEPOWER

ZONE	0	45	90	135	180
DEG.					
180	0	0	0	0	0
175	0	0	0	0	0
165	0	0	0	0	0
155	0	0	0	0	0
145	0	0	0	0	0
135	0	0	0	0	0
125	0	0	0	0	0
115	0	0	0	0	0
105	0	0	0	0	0
95	0	0	0	0	0
90	21	28	0	0	0
85	27	39	12	10	0
75	34	78	53	45	9
65	66	190	106	89	20
55	224	262	176	128	34
45	428	408	433	130	60
35	673	686	997	123	55
25	1036	1163	1558	203	83
15	1674	1943	2044	611	343
5	2708	2681	2376	1811	1594
0	2450	2450	2450	2450	2450

COEFFICIENTS OF UTILIZATION

% EFFECTIVE CEILING CAVITY REFLECTANCE

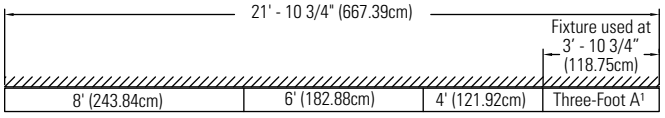
	80			70			50		
	% WALL REFLECTANCE								
ROOM CAVITY RATIO	70	50	30	70	50	30	50	30	10
0	44	44	44	43	43	43	41	41	41
1	41	40	39	40	39	38	28	37	36
2	39	36	34	38	36	34	34	33	32
3	36	33	31	35	33	30	32	30	28
4	34	30	28	33	30	28	29	27	25
5	32	28	25	31	28	25	27	25	23
6	30	26	23	29	26	23	25	23	21
7	28	24	22	28	24	22	24	21	20
8	27	23	20	26	23	20	22	20	18
9	25	21	19	25	21	19	21	19	17
10	24	20	18	24	20	18	20	17	16

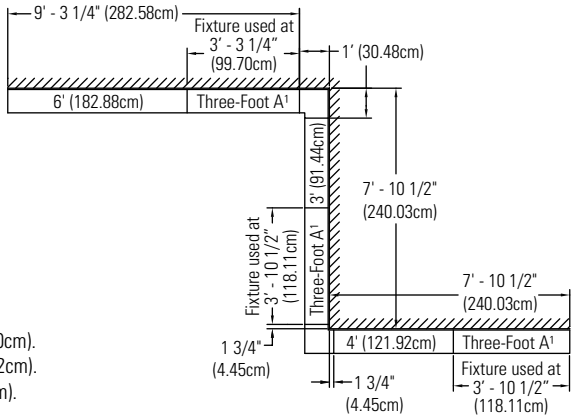
Floor cavity reflectance = 20%

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% BARELAMP	% LUMINAIRE
0-90	1861	37.2	100.0
90-180	0.0	0.0	0.0
0-180	1861	37.2	100.0

Sample Run



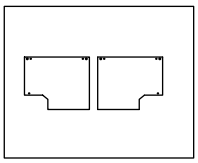


[1] *A = Adjustable Fixture or Adjustable Staggered Fixture*

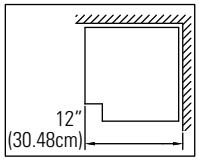
For Fixture Using non-Staggered Lamps
The Four-Foot Adjustable Fixture has a range of 48.75"(123.83cm) - 60"(152.40cm).
The Three-Foot Adjustable Fixture has a range of 36.75"(93.35cm) - 48"(121.92cm).
The Two-Foot Adjustable Fixture has a range of 24.75"(62.87cm) - 36"(91.44cm).

For Fixture Using Staggered Lamps
The Four-Foot Adjustable Staggered Fixture has a range of 51"(129.54cm) - 60"(152.40cm).
The Three-Foot Adjustable Staggered Fixture has a range of 39"(99.06cm) - 48"(121.92cm).
The Two-Foot Adjustable Staggered Fixture has a range of 27"(68.58cm) - 36"(91.44cm).

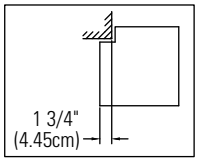
End Plate and Corner Block Accessories



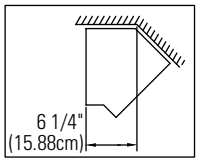
End Cap Set:
PTSEP



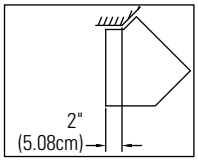
90° Inside Corner:
PTS9ØINCO - Open
PTS9ØINCL - Lens
PTS9ØINCS - Straight Blade Louver



90° Outside Corner:
PTS9ØOTCO - Open
PTS9ØOTCL - Lens
PTS9ØOTCS -Straight Blade Louver



135° Inside Corner:
PTS135INCO - Open
PTS135INCL - Lens
PTS135INCS - Straight Blade Louver



135° Outside Corner:
PTS135OTCO - Open
PTS135OTCL - Lens
PTS135OTCS - Straight Blade Louver

Job Information **Type:** F05

631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

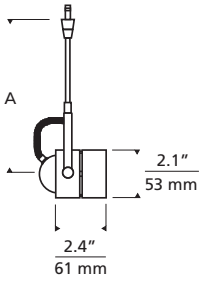
LOW-VOLTAGE ELEMENTS

Spot

FreeJack	MonoRail	Two-Circuit MonoRail	Wall MonoRail	Kable Lite	T~trak™
				N/A	

ARCHITECTURAL HEAD

SPOT WITH EGGCRATE LOUVER
Shown approximately 50% actual size.



Socket terminates with FreeJack male connector, which may be installed into a system connector. Elements ordered with a system prefix include a connector for that system.

DESCRIPTION
Classic head rotates 360˚ around stem, pivots 290˚. Can hold one lens or louver (sold separately). Low-voltage, MR16 lamp of up to 50 watts (not included).

SYSTEM
Available for FreeJack, MonoRail, Two-Circuit MonoRail, and Wall MonoRail. For use on T~trak, order FreeJack version and T~trak FreeJack Connector (sold separately).

COLOR
None.

FINISH
Chrome, satin nickel.

LAMP
Low-voltage halogen MR16 lamp up to 50 watts (not included).

ACCESSORIES AND OPTICAL CONTROLS
Compatible optical controls (sold separately): Eggcrate Louver, Glass Lens.

WEIGHT
0.84 lb./0.38 kg. ±

ORDERING INFORMATION

700	SYSTEM	SPT6	LENGTH (A)	FINISH
	FJ FREEJACK		**04** 4.5"	**C** CHROME
	MO MONORAIL		**06** 6"	**S** SATIN NICKEL
	MO2 TWO-CIRCUIT MONORAIL		**12** 12"	
			18 18"	
	WMO WALL MONORAIL			

TECH LIGHTING®

7400 Linder Avenue
Skokie, Illinois 60077
T 847.410.4400
F 847.410.4500

www.techlighting.com

700 MO SPT6 04 S

FIXTURE TYPE: F06

JOB NAME: UCI NAT. SCI. II

Straight Rail

ANTIQUE BRONZE - BROWN INSULATOR

ANTIQUE BRONZE - CLEAR INSULATOR

CHROME - CLEAR INSULATOR

SATIN NICKEL - CLEAR INSULATOR

SHOWN ACTUAL SIZE
(0.60" height x 0.30" width)

mo_straight_rail_spec.pdf

DESCRIPTION

Low-voltage conductor of two individual conductive metal pieces fused together by a plastic separator. Hand-bendable, field-cuttable MonoRail is rated for 300 watts at 12 volts, 600 watts at 24 volts. Each piece of rail is shipped with conductive connectors to join rail pieces end to end. Order additional connectors if cutting and rejoining rails. Standard MonoRail bends horizontally to a radius as small as 6" and vertically to a radius as small as 24".

COLOR

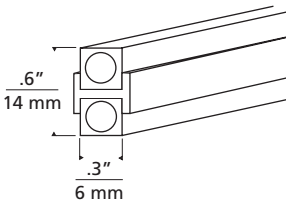
Insulator is available in clear and brown.

FINISH

Antique bronze, chrome, satin nickel.

WEIGHT

24": 0.27 lb./0.12 kg. ±
48": 0.55 lb./0.25 kg. ±
96": 1.10 lb./0.50 kg. ±



ORDERING INFORMATION

700MOA

LENGTH		FINISH/INSULATOR	
24	24" (0.6 m)	**BRZ**	ANTIQUE BRONZE W/ BROWN INSULATOR
48	48" (1.2 m)	**Z**	ANTIQUE BRONZE W/ CLEAR INSULATOR
96	96" (2.4 m)	**C**	CHROME W/ CLEAR INSULATOR
		S	SATIN NICKEL W/ CLEAR INSULATOR

TECH LIGHTING®

7400 Linder Avenue
Skokie, Illinois 60077
T 847.410.4400
F 847.410.4500

www.techlighting.com

700MOA 48+24 S

FIXTURE TYPE: T01

JOB NAME: UCI NAT. SCI II

Ballerup

compact fluorescent

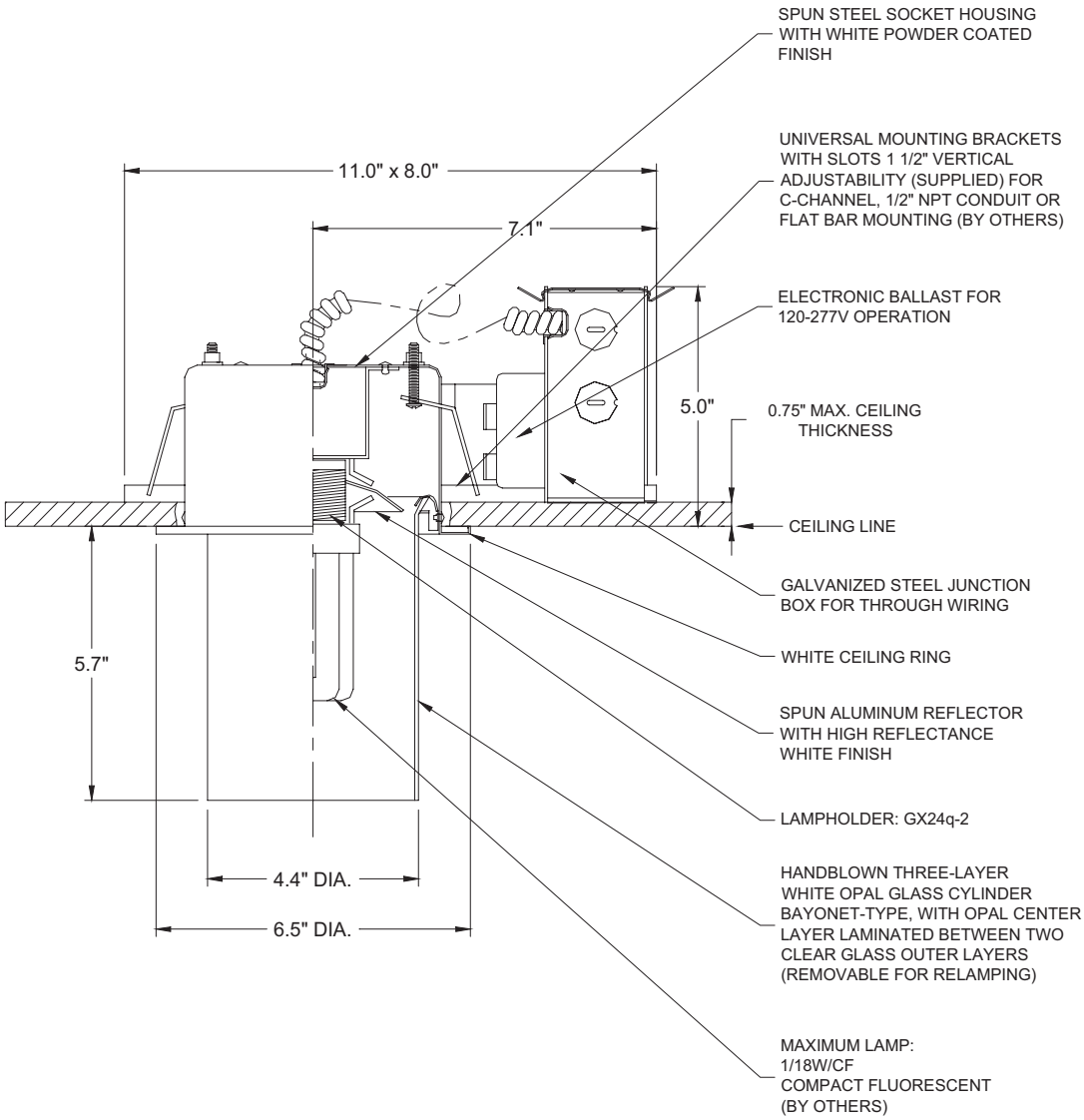
Design: C. J. Nørgaard Pedersen
and P. Hougaard Nielsen

Type: F07

Project:

Catalog Number:

NOTES:
1. SUITABLE FOR ACCESSIBLE NON-ACCESSIBLE CEILING TYPES
2. CEILING CUTOUT = 5.5" DIAMETER



louis poulsen

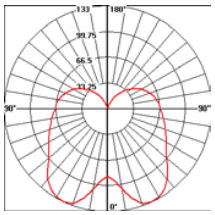
Louis Poulsen Lighting, Inc., 3260 Meridian Parkway, Fort Lauderdale, FL 33331 Telephone: (954) 349-2525 Fax: (954) 349-2550

www.louispoulsen.com

Ballerup

semi-recessed & surface

compact fluorescent



Photometric Report: BAL-1-18W-GX24Q-2.IES
Report No.: L3453
Poulsen Report No.: BAL-1-18W-GX24Q-2.IES
Luminaire: Ballerup Ceiling, Opal, Compact Fluorescent
Lamp: 1/18W/GX24Q-2
Efficiency: 86.6%
Description: All data shown are per 1000 lumens. This report can be used for calculation on all versions listed below. Use only actual lumen data when calculating.

Candlepower Distribution

Vertical Angle	Candela
0	88
5	93
10	105
25	133
40	120
55	92
70	79
85	70
90	67
120	50
150	16
180	0.1

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0-30	104	10.4	12
0-40	184	18.4	21.2
0-60	351	35.1	50.4
0-90	590	59	68.1
90-120	190	19	21.9
90-130	230	23	26.6
90-150	271	27.1	31.3
90-180	276	27.6	31.9
0-180	866	86.6	100.0

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	97	97	97	97	91	91	91	91	81	81	81	72	72	72	63	63	63	59
1	85	79	75	70	79	75	70	66	66	62	59	58	55	53	50	48	46	42
2	76	68	61	55	71	63	57	52	56	51	47	49	45	41	42	39	37	33
3	68	58	51	44	64	55	48	42	48	43	38	42	38	34	37	33	30	27
4	62	51	43	37	58	48	41	35	42	36	32	37	32	28	32	28	25	22
5	57	45	37	31	53	43	35	30	38	31	27	33	28	24	29	25	21	19
6	52	40	32	27	49	38	31	25	34	28	23	30	25	21	26	22	18	16
7	48	36	29	23	45	34	27	22	30	24	20	27	22	18	23	19	16	14
8	45	33	25	20	42	31	24	19	28	22	18	24	19	16	21	17	14	12
9	42	30	23	18	39	28	22	17	25	20	16	22	18	14	20	16	13	11
10	39	27	21	16	36	26	20	15	23	18	14	21	16	13	18	14	11	10

Design
C. J. Nørgaard Pedersen & P. Hougaard Nielsen

Concept
Ballerup creates symmetrical down light illumination. The vertical three layer opal glass cylinder provides both the ceiling and the rest of the space with soft, diffuse illumination, with the majority of light directed downward.

Finish
White, powder coated. White opal glass.

Material
Diffuser: Handblown white opal glass. Housing: Spun steel.

Mounting
Semi-recessed: Mounting frame with two vertically adjustable brackets spaced equally at 180° to be installed prior to closing the ceiling. Ceiling types: Accessible and non-accessible ceilings. Ceiling cutout: 5.5" diameter.

Weight
Max. 10 lbs.

Label
cUL, Damp location. IBEW.

Product code	Light source	Voltage	Finish	Options
BAL	1/18W/CF GX24q-2 1/100W/A-19/CL medium	120-277V 120/277V 120V 277V	WHT	EMPK LUTRON DIMMING

Specification notes:
a. CF variants provided with one 120-277V electronic ballast.
b. Incandescent variants only available in 120V.
c. EMPK (emergency power pack) is available in dual tap 120/277V with remote mounted test switch.
d. LUTRON dimming 120V or 277V is digital dimming.

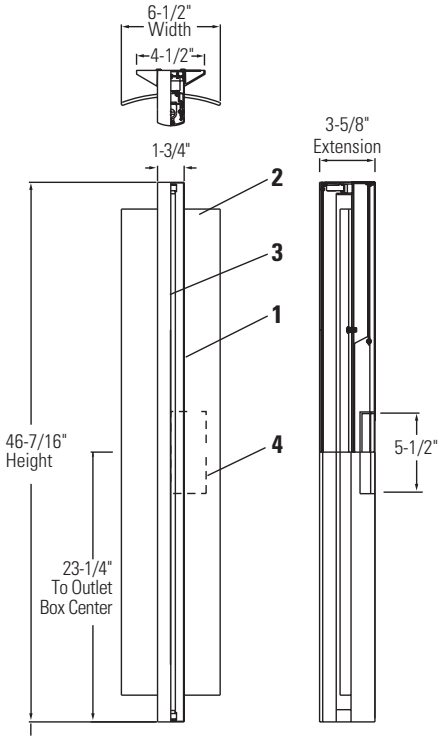
Info notes:
I. The comparable EU version has the following classification: Ingress Protection Code: IP20.

louis poulsen

Louis Poulsen Lighting, Inc., 3260 Meridian Parkway, Fort Lauderdale, FL 33331 Telephone: (954) 349-2525 Fax: (954) 349-2550

www.louispoulsen.com

F08



Note:
Luminaire can be ordered with or without diffuser shield. Order each separately.
Can be mounted vertically or horizontally.

Fixture Ordering Information

Catalog No.	Finish	Wattage	Voltage	Lamping	Options
48023ALU	Powder Coated	28W	120/277V	T-5 Miniature Bi-Pin Fluorescent	See Below
48023AL54U	Metallic **Aluminum**	54W	120/277V	T-5 Miniature Bi-Pin Fluorescent HO	

Diffuser Ordering Information

Catalog No.	Description	Dimensions
40876	Translucent Etched Soda Lime Glass w/ Pencil Polished Edges	43" L x 6.5" W x 5 mm Thick
40916	Extruded Opal Virgin Acrylic w/ Pencil Polished Edges	43" L x 6.5" W x 5 mm Thick

Features

1. **Housing:** Extruded and die-cast aluminum ballast and lamp chamber.
2. **Optional Diffuser/Reflector:** Curved etched glass or extruded opal virgin acrylic.
3. **Optics:** Internal white acrylic diffuser covers slit on front cover.
4. **J-Box Covers:** Die-cast split covers to enclose 4" octagonal J-Box (J-Box by others).

Mounting

Mounts directly to switch box or 4" octagonal J-Box. Octagonal box mounting requires use of "J-Box Covers" and "Support Plate" supplied standard.

Electrical

Ballast: Electronic

120/277V	28W	54W
Total Input Watts:	33W	62W
Max. Line Current:	120V = 0.28 277V = 0.12	120V=.51 277V=.21
Power Factor:	.98	.98
Ballast Factor:	1.00	1.00
THD:	120V = <10% 277V = <10%	120V = <10% 277V = <10%
Starting Temp:	0°F / -18°C	0°F / -18°C

Finish

All painted parts utilized the powder coat process. Lightolier Metallic Aluminum Powder Coat Enamel.

Options

Dimming: (Voltage Specific/54W HO lamps only)
Add **MX1** suffix code (for 120V) to Cat. No.
Add **MX2** suffix code (for 277V) to Cat. No.
for example: 48023AL4MX1
Emergency: Integral Bodine LP550 emergency battery pack, test switch and light, add **E** suffix code.
DALI: Digital Dimming System ballast 120/277V. For 28W lamps add **28DA** suffix code to Cat. No. For 54W lamps add **54DA** suffix code to Cat. No.
for example: 48023AL54DA

Labels

cULus Listed. Suitable for Damp Locations.

Job Information Type:

Job Name:

Cat. No.:

Lamp(s):

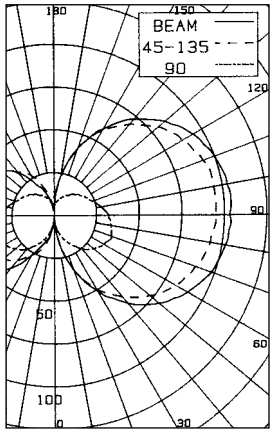
Notes:

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

LIGHTOLIER

F08

CERTIFIED TEST REPORT NO. 2221FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
LIGHTOLIER ARCHITECTURAL DECORATIVE LUMINAIRE SOLI
CAT. NO. 48023ALU / 40876, ETCHED GLASS SHIELD
1-28W SYLVANIA T-5 LAMP. LUMEN RATING = 2610 LMS.
UNIVERSAL BALLAST #B228PUNVC



Prepared For:
Lightolier
Fall River, MA
Date: May 11, 2003

ZONE ➤ DEG. ▼	90	67.5	45	22.5	Beam
	CANDLEPOWER				
	CANDELAS				
0	2	2	2	2	2
5	5	4	5	6	6
15	10	13	24	27	25
25	16	30	42	45	43
35	22	41	56	59	59
45	28	52	68	70	74
55	32	60	78	80	85
65	35	67	85	87	94
75	35	72	91	92	100
85	33	75	94	95	103
95	30	77	95	97	104
105	26	77	95	96	102
115	22	74	90	92	97
125	20	68	84	85	90
135	17	61	74	76	79
145	14	50	63	66	66
155	12	41	50	53	50
165	9	25	33	35	33
175	7	11	14	15	15
180	6	6	6	6	6

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 REFLECTION															
ROOM CAVITY RATIO	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
0	27	27	27	25	25	25	21	21	21	17	17	17	14	14	14	12
1	21	20	19	20	18	17	16	15	14	13	12	12	10	10	9	8
2	18	16	14	16	15	13	13	12	11	11	10	9	8	7	7	5
3	15	13	11	14	12	10	11	10	8	9	8	7	7	6	6	4
4	13	11	9	12	10	8	10	8	7	8	6	5	6	5	4	3
5	12	9	7	11	8	7	9	7	6	7	5	4	5	4	3	2
6	10	8	6	9	7	6	8	6	5	6	5	4	5	3	3	2
7	9	7	5	8	6	5	7	5	4	5	4	3	4	3	2	2
8	8	6	5	8	6	4	6	5	3	5	4	3	4	3	2	1
9	7	5	4	7	5	4	6	4	3	4	3	2	3	2	2	1
10	7	5	3	6	4	3	5	4	3	4	3	2	3	2	1	1

DETERMINED IN ACCORDANCE WITH CURRENT IES PUBLISHED PROCEDURES
20% FLOOR CAVITY REFLECTANCE

DISTRIBUTION

Zone	Lumens	% Lamp	% Luminaire
0-30	18	0.7	2.87
0-40	43	1.6	6.61
0-60	128	4.9	19.69
0-90	323	12.4	49.44
40-90	279	10.7	42.83
60-90	194	7.4	29.75
90-180	330	12.7	50.56
0-180	653	25.0	100.00

** EFFICIENCY = 25.0% **

Note:
For 54 watt lamp, multiply calculated footcandle values by 1.7

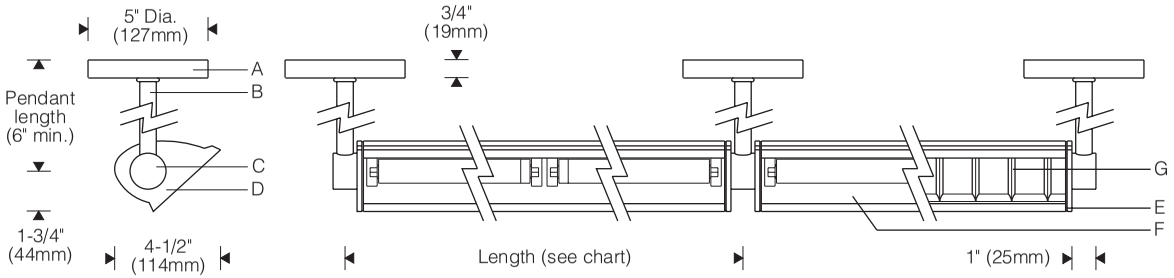
LIGHTOLIER

Job Information Type:

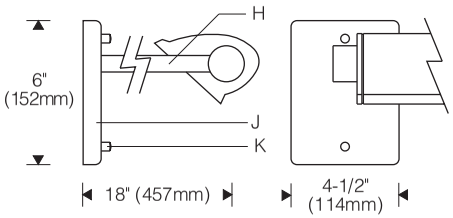
Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
We reserve the right to change details of design, materials and finish.

F09

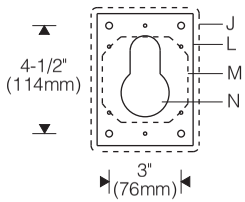
Pendant Mount 1:8 Scale



Cantilever Mount 1:8 scale



Mounting Plate



Nominal Lamp Length	*Length (center to center of hangers)*	
	T8	*T5*
1 x 2'	26-7/16" (672mm)	24-7/16" (621mm)
1 x 3'	38-7/16" (976mm)	36-1/4" (921mm)
1 x 4'	50-7/16" (1281mm)	48" (1219mm)
1 x 5'	62-5/16" (1583mm)	60" (1524mm)
2 x 3'	74-15/16" (1903mm)	72" (1829mm)
2 x 4'	98-15/16" (2513mm)	96" (2438mm)
2 x 5'	122-15/16" (3123mm)	120" (3048mm)

Specifications

A Round aluminum canopy (pendant mount)
B 11/16" O.D. aluminum pendant stem
C Machined aluminum mounting hub
D Die-cast aluminum end plates
E Aluminum reveal plates (black)
F Specular extruded aluminum reflector
G Optional snap-in specular parabolic cross baffle
H 11/16" O.D. cantilever arm
J Rectangular aluminum canopy (cantilever mount)
K Chrome cap nuts
L Cantilever mounting plate
M Outlet box (by others)
N Splice access opening

Finish:
Style 101 fluted - bright clear anodized aluminum housing. Painted end plates in choice of silver or semi-gloss black.

Style 102 smooth - semi-gloss white housing and end plates.

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:
Pendant or cantilever mounting hangers (ordered separately); specify end and intermediate hangers.

Pendant assembly furnished with canopy for mounting on recessed outlet box. Optional hang-straight allows mounting on slopes up to 45° (in the plane perpendicular to wall).

Cantilever wall plate mounts over recessed outlet box (suitable backing structure required). Adjustable interface plate (concealed under canopy) allows for leveling of arms. **Cantilever limited to single lamp reflectors (up to 5' long).**

Electrical:
Use 90°C wire for supply connections.

Remote electronic HPF thermally protected class P ballast (with end-of-life protection for T5 lamps). Aluminum ballast enclosure includes four 7/8" diameter entries and a knockout for an accessory fuse.

Maximum wire length between electronic ballast and fixture is 7' for two-lamp reflectors and 12' for one-lamp reflectors, less length of stem or arm.

For dimming, see Styles 105/106 with integral dimming ballast.

For complete ballast specifications, see Accessories Section.

Standard:
UL listed or CSA certified for damp locations. (Style 124 painted model with lens recommended for damp locations.)

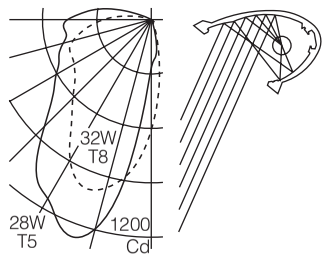
Features

- *Unequaled low energy wall lighting with T5 or T8 lamps*
- *Machined aluminum mounting hub attaches to pendant stem or cantilever arm without exposed threads*
- *Die-cast end plate joins at articulated black reveal - no exposed fasteners*
- *Optional snap-in specular parabolic cross baffle*

W 4.0

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, see www.elliptipar.com.

elliptipar

To Order

Style 101 / 102

To form a Catalog Number

F [ ] - [ ] - [ ] [ ] - [ ] - [ ] [ ]

1 2 3 4 5 6 7 8

Project: **UCI NATURAL SCIENCES UNIT 2**

Type: **F09**

1 Source

F = Linear fluorescent

2 Style

101 = Small fluted surface, **remote** ballast
102 = Small smooth surface, **remote** ballast

3 Lamp

T **3** **35** = **Lamp Code**

Lamp Wattage (see chart below)

Reflector Configuration, specify **1**, **2** or **3** (see chart below)

A = T8 Fluorescent
T = T5 Fluorescent

Example: **A325** = two nominal 3' reflectors, each for use with one 25W T8 lamp; one 2-lamp ballast

Reflector Configuration

1	1-Lamp Ballast 1-Lamp Reflector
2	2-Lamp Ballast 2-Lamp Reflector
3	2-Lamp Ballast 1-Lamp Reflector 1-Lamp Reflector

Lamp Wattage

Lamp Length (nominal)	*Lamp Wattage (Lamp Number)*		
	T8	*T5*	*T5 HO*
2'	**17** (F17T8)	**14** (F14T5)	**24** (F24T5/HO)
3'	**25** (F25T8)	**21** (F21T5)	**39** (F39T5/HO)
4'	**32** (F32T8)	**28** (F28T5)	**55** (F54T5/HO)
5'	**40** (F40T8)	**35** (F35T5)	**80** (F80T5/HO)

For complete lamp and ballast information, see Accessories Section. Standard T5 lamp color is 3000K / 80+ CRI. T8 lamps by others.

4 Mounting

X = For use with end and intermediate hangers. Available in pendant or cantilever (order separately).

Note: Cantilevers are limited to use with single lamp reflectors (Configuration **1** or **3**) up to 5' long.

5 Finish

Style 101 Fluted

01 = Bright aluminum housing with silver end plates
81 = Bright aluminum housing with semi-gloss black end plates

Style 102 Smooth

02 = Semi-gloss white reflector and end plates
99 = Custom RAL or computer matched color to be specified, consult sales representative

6 Voltage/Ballast

Electronic

1 = 120V
2 = 277V
3 = 347V (Canada)

*Dimming**

* For dimming, see Styles 105/106 with integral dimming ballast.

7 Option (See Accessories Section for specifications)

00 = No options
0B = Snap-in parabolic cross baffle, specular finish, provides 35° lengthwise shielding
0E = Remote emergency battery pack
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

F102 - A132 - X - 02 - 1 - 000

Small smooth surface model for use with one 32W T8 lamp in nominal 4 foot reflector. Semi-gloss white. Remote 1-lamp 120V electronic ballast. UL. (Order pendant or cantilever mounting hangers separately.)

Mounting Hangers

For individually mounted luminaires, order two end hangers for each reflector.

For a continuous row, order two end hangers. To determine the quantity of intermediate hangers, total the number of reflectors in the row and subtract one. Example: a row of five reflectors requires 2 end hangers and 4 intermediate hangers.

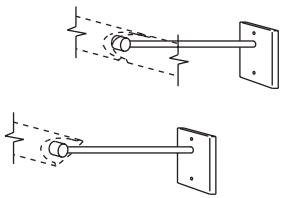
Note: In determining hanger quantities, treat Reflector Configuration **3** as *two* reflectors.

HS [ ] [ ] **18** [ ] = **Cantilever** hanger with wall plate, 18" (457mm) setback **(Limited to single lamp reflectors up to 5' long)**

0 = UL
J = CSA

02 = Semi-gloss white
07 = silver
08 = Semi-gloss black

C = Intermediate
D = End



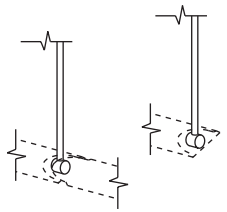
HS [ ] [ ] [ ] [ ] = **Pendant** hanger with canopy

0 = UL
J = CSA

Length in inches, up to 60" (1.5m), 6" minimum

02 = semi-gloss white
07 = silver
08 = semi-gloss black

F = Intermediate, straight
G = End, straight
J = Intermediate, swivel (up to 45°)
K = End, swivel (up to 45°)



Accessories

Order separately. See Accessories Section for specifications.

AFK000X [ ] = Ballast **fuse** kit

0 = UL
J = CSA

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

iColor Cove QLX

CK INTELLIGENT SERIES

Preliminary

iColor Cove® QLX is a compact linear fixture that generates saturated color and dynamic effects in alcoves, accent areas, and other interior spaces. The fixture is available with a wide (120° x 120°) or medium (100° x 40°) beam. An integrated rotating mount and optional mounting track provide precise positioning, and end-to-end connections ensure a simple installation.

- Integral mounting bracket with 180° rotation
- 24 VDC input power
- End-to-end connectors
- Two standard lengths: 6 in (152 mm) and 12 in (305 mm)
- Optibin® technology ensures uniform light quality
- Chromasic® technology provides precise and cost-efficient digital control

CHROMACORE® CK TECHNOLOGY

CHROMASIC® CK TECHNOLOGY

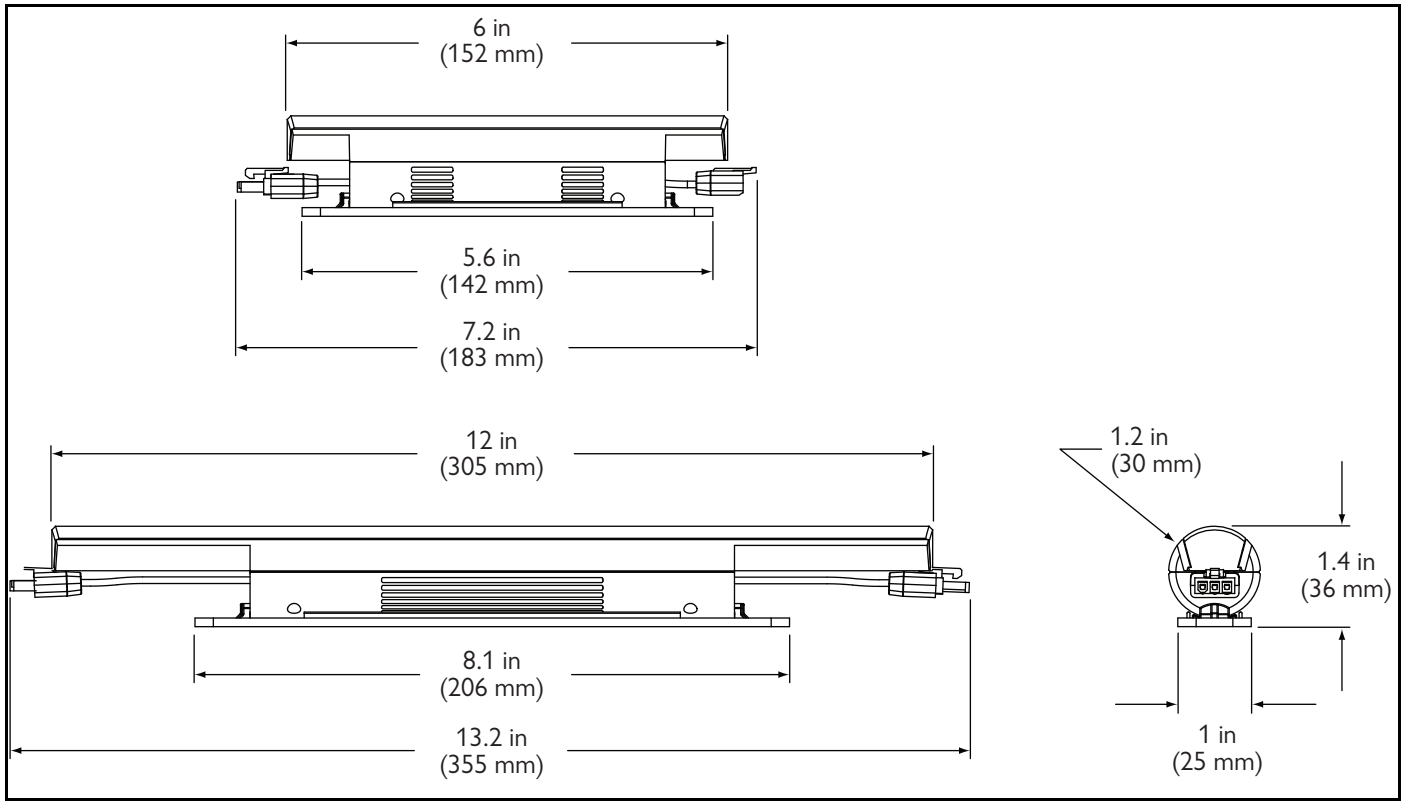
OPTIBIN® CK TECHNOLOGY

c UL us LISTED

CE

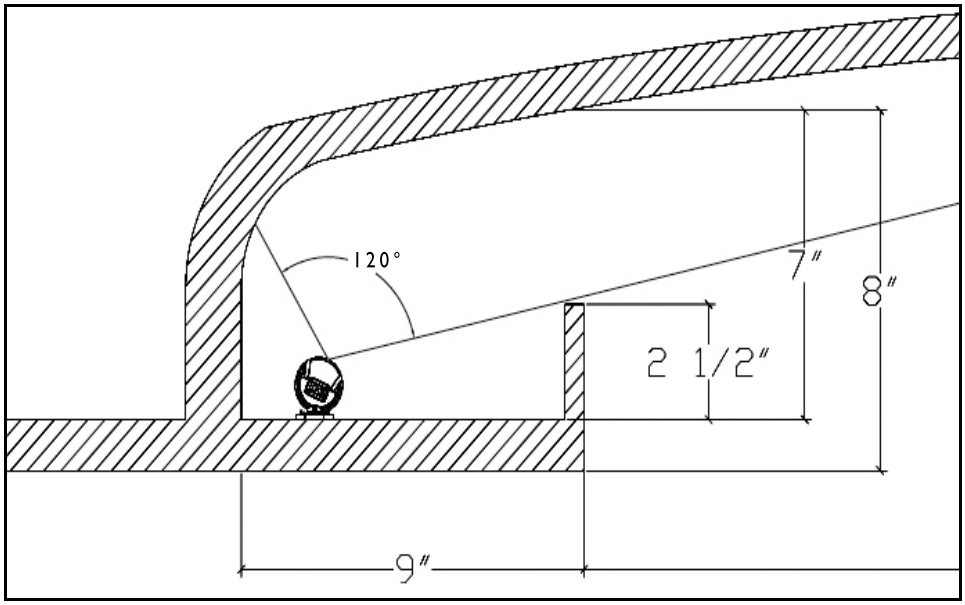
PHILIPS

iColor Cove QLX Dimensions



Typical Installation Cut-Away

iColor Cove QLX fixtures can be used effectively in numerous applications. A typical ceiling cove construction cut-away is shown below. (See “Installation Details” on page 9.)



F10

iColor Cove QLX Specifications

Specifications are subject to change without notice.

	6-Inch Fixture	12-Inch Fixture
Length	6 in (152 mm)	12 in (305 mm)
Width	1.25 in (32 mm) (tube diameter)	
Height	1.37 in (35 mm)	
Weight	3 oz. (85 g)	5 oz. (142 g)
LEDs Per Fixture	5 each: red, green, and blue	10 each: red, green, and blue
Total Output (Lumens)	26: Wide (120° x 120°) beam angle: 20.8: Medium (100° x 40°) beam angle	49.8: Wide (120° x 120°) beam angle 46.1: Medium (100° x 40°) beam angle
Efficacy (Lm/W)[a]	13: Wide (120° x 120°) beam angle 10.4: Medium (100° x 40°) beam angle	16.6: Wide (120° x 120°) beam angle 15.4: Medium (100° x 40°) beam angle
Source	High-brightness LEDs.	
Color Range	16.7 million (8-bit) additive RGB colors; continuously variable intensity	
Beam Angle	120° x 120° or 100° x 40°	
Mixing Distance	2 in (51 mm) to uniform light	
Housing	Charcoal gray, UL-recognized, injection-molded plastic	
Lens	Clear polycarbonate. V-0 flame rating. F1 UV rating.	
Medium-Beam Optics	Polycarbonate.	
Environment	UL Dry; IP20	
Fixture Connectors	IEC 15 A (max) with C13 plug	
Configuration	See “Maximum Number of Fixtures and Cables” below.	
Listings	CE, PSE, RoHS, UL/CUL, WEEE, C-Tick	
Control	Chromasic input data	
Operating Voltage	24 VDC from a Philips or Color Kinetics DMX In / Chromasic Out power supply	
Power Consumption	2 W maximum at full output steady state.	3 W maximum at full output steady state.
Temperature Range	-4°F – 122°F (-20°C – 50°C) operating temperature	
Humidity Range	0 – 95% non-condensing	
LED Source Life	50,000 hours, based on LED manufacturers’ test data	

a. Measurements made at full RGB.

Maximum Number of Fixtures and Cables

If no jumper cables are used, you may interconnect as many as either 30 6 in (152 mm) fixtures (on a single 60W power supply) or 20 12 in (305 mm) fixtures (on a single 60W power supply).

If you plan to use jumper cables:

- The maximum number of 1 ft (305 mm) jumper cables is nine; the maximim number of 5 ft (1524 mm) jumper cables is five.
- If you plan to combine jumper cables of different lengths, please contact support@colorkinetics.com for help with planning your configuration.

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Ordering Information

iColor Cove QLX Item Numbers

Fixture Length	Beam Angle	Item Number	Part Number
12 in (305 mm)	Wide 120° x 120°	101-000066-00	910503700217
	Medium 100° x 40°	101-000066-01	910503700219
6 in (152 mm)	Wide 120° x 120°	101-000066-02	910503700218
	Medium 100° x 40°	101-000066-03	910503700220

Accessories for iColor Cove QLX Fixtures

iColor Cove QLX fixtures are part of a low-voltage system made up of the fixtures and:

- One or more compatible power supplies from the list below.
- One leader cable used to connect each power supply output port to a series of fixtures.
- A Philips, Color Kinetics, or other DMX512-based controller that works with iColor Cove QLX fixtures. The number of fixtures that can be addressed varies with each controller and jumper cable length. For information on Philips or Color Kinetics controllers, see http://www.colorkinetics.com/support/systemguide/SysMatrix.pdf.

Compatible Philips and Color Kinetics Power Supplies	Item Number	Part Number
sPDS-60ca 24V — provides 60W output that can be split between two ports.	109-000021-02 (DMX / Ethernet)	910503700106
PDS-60ca — provides 60W output that can be split between two ports.	109-000016-00 (preprogrammed) or 109-000016-01 (DMX)	910503700095
sPDS-480ca 24V — provides eight 60W output ports	109-000026-00	910503700110

Leader Cable	Item Number	Part Number
30 ft (9144 mm) leader cable	108-000015-00	910503700072

Depending on the installation's design, you may need optional jumper cables to add space between fixtures. Optional mounting tracks ensure straight runs of fixtures.

Jumper Cables	Item Number	Part Number
1 ft (305 mm) jumper cable	108-000020-00	910503700079
5 ft (1524 mm) jumper cable	108-000020-01	910503700080

Mounting Track	Item Number	Part Number
Box of 25 mounting tracks — 4 ft (1219 mm) in length — for straight runs	523-000006-00	910403326201

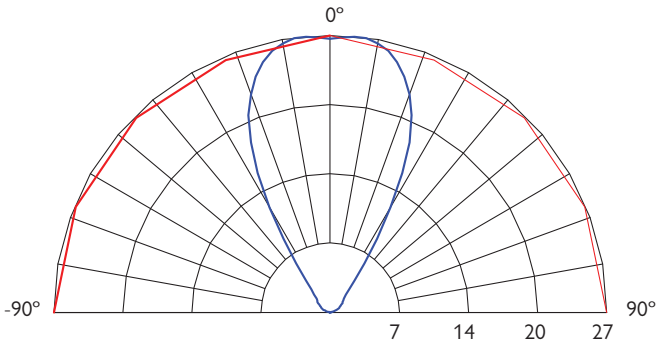
F10

12 Inch iColor Cove QLX — Medium Beam Photometrics

This photometric data is based on test results from an independent testing lab. IES files are available at http://www.colorkinetics.com/support/ies.

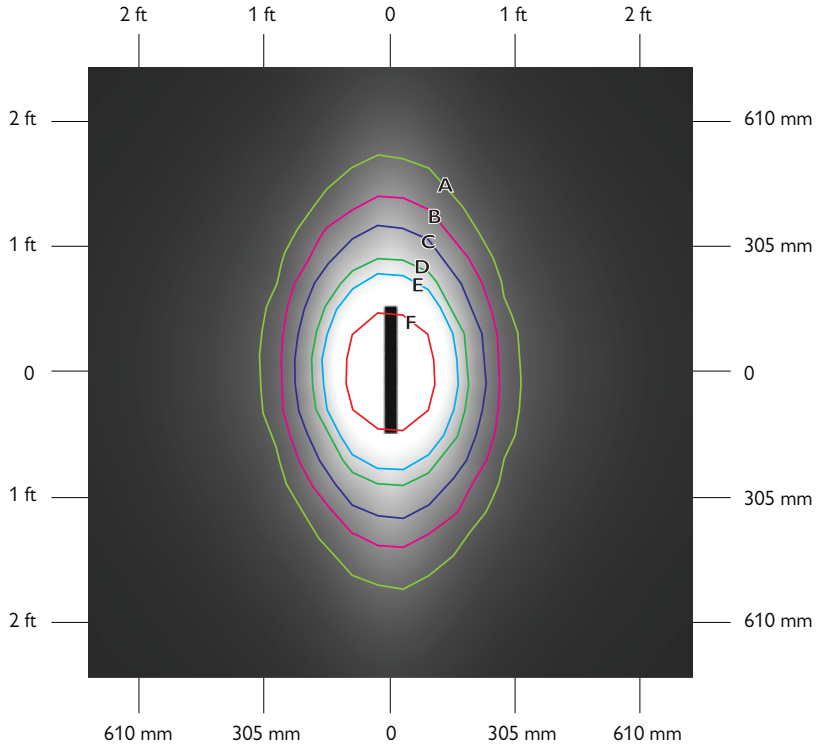
Candle Power Distribution

Data to come later: The dashed line indicates that x candela is x% of peak.



Illuminance Distribution

This illustration shows the plane x ft (x mm) from the fixture. Data is in footcandles and (lux).



A 1.5 fc (16 lux) B 3 fc (32 lux) C 5 fc (54 lux)
D 8 fc (86 lux) E 10 fc (108 lux) F 15 fc (161 lux)

Illuminance Beam Angle

This illustration shows measurement of the center beam and the fixture's angle. Data is in footcandles and (lux).

Illustration to come later

F10

12 Inch iColor Cove QLX — Wide Beam Photometrics

This photometric data is based on test results from an independent testing lab. IES files are available at http://www.colorkinetics.com/support/ies.

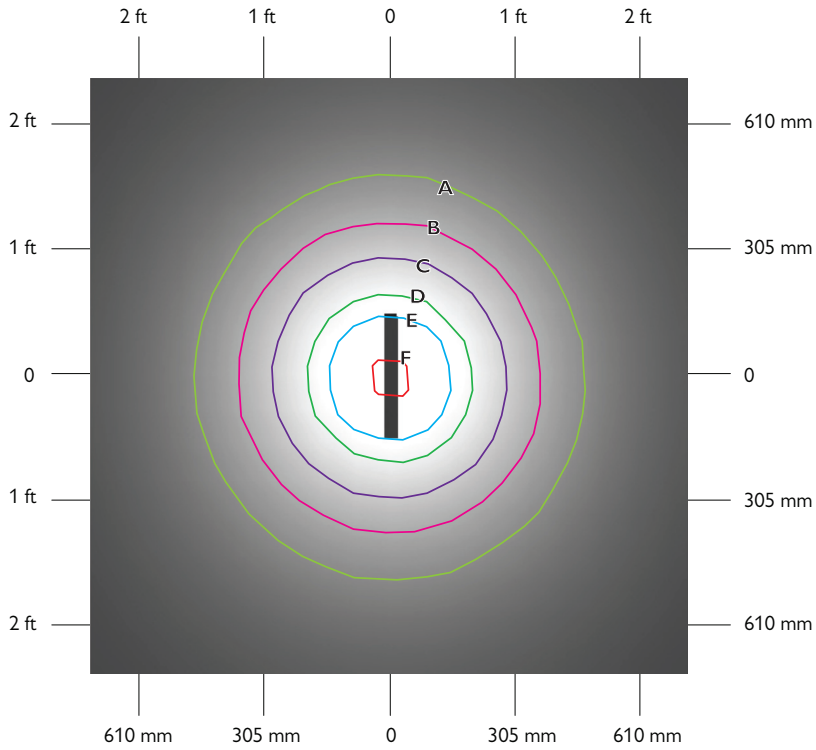
Candle Power Distribution

Data to come later: The dashed line indicates that x candela is x% of peak.

Illustration to come later

Illuminance Distribution

This illustration shows the plane x ft (x mm) from the fixture. Data is in footcandles and (lux).



A 1.5 fc (16 lux) B 3 fc (32 lux) C 5 fc (54 lux)
D 8 fc (86 lux) E 10 fc (108 lux) F 13 fc (140 lux)

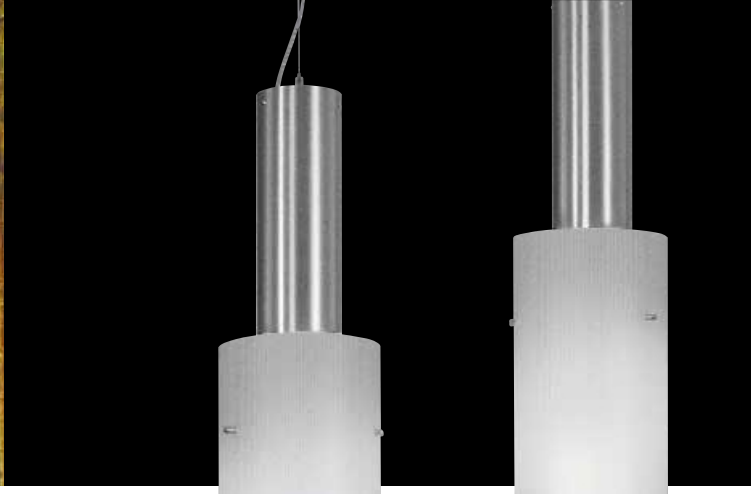
Illuminance Beam Angle

This illustration shows measurement of the center beam and the fixture's angle. Data is in footcandles and (lux).

Illustration to come later

PENDANT LIGHTS

TOOL



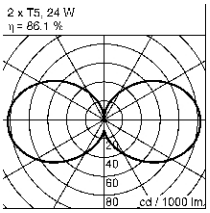
TOOL

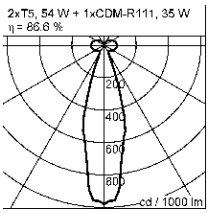
satin nickel
ribbed acrylic tube satin
with electronic ballast
120 / 277 VAC

contact factory for dimming options

add HO for high output T5 lamp

mounting note: canopy to fit standard junction box





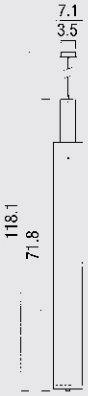
2 x T5, 28 W
and
1 x CDM-R111, 35 W, GX8.5
36237.06

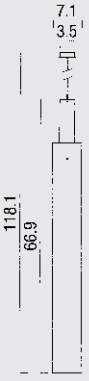
2 x T5 HO, 54 W
and
1 x CDM-R111, 35 W, GX8.5
36214.06

please specify
120 or 277 VAC

2 x T5, 28 W
26237.06

2 x T5 HO, 54 W
26213.06





T5 | CDM-R111 | GX24q-3/4 | 2G11

F11

TOOL

2 x T5, 14 W
and
1 x CDM-R111, 35 W, GX8.5
36238.06

2 x T5 HO, 24 W
and
1 x CDM-R111, 35 W, GX8.5
36212.06

please specify
120 or 277 VAC

2 x T5, 14 W
26238.06

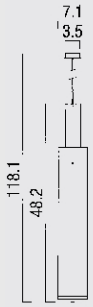
2 x T5 HO, 24 W
26211.06

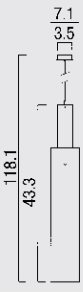
2 x 2G11, 24 W
26210.06

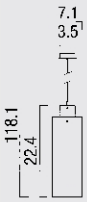
2 x 2G11, 18 W
26209.06

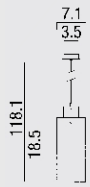
1 x GX24q-3, 32 W
16207.06

1 x GX24q-4, 42 W
16208.06









see chapter
wall lights

see chapter
ceiling lights

Recessed wall luminaires · faceplate stainless steel

Housing: Aluminum outer rough-in housing provided. The outer housing is provided with (2) ½" conduit openings suitable for through wiring. Inner housing made from die-cast aluminum end caps welded to an aluminum extrusion. The welds are continuous and ground flat to provide a watertight inner lamp housing module. All aluminum used in the construction is marine grade and copper free.

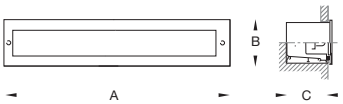
Enclosure: Faceplate is constructed of machined stainless steel, secured to the inner housing with captive stainless steel fasteners. Tempered white glass, ⅜" thick, machined to be flush with the faceplate. Fully gasketed with a molded silicone "U" channel gasket. The inner lamp module is fully sealed and independent of the outer housing installation.

Electrical: Lampholders; Fluorescent T5 HO, G5 miniature bi-pin. Ballasts; integral electronic, universal voltage 120 V through 277 V, class P, HPF, program start, minimum start temperature of 0 °F. Ballasts have circuitry to reliably shut down the system at the end of lamp life. Standard T5 lamping available on request.

Finish: #4 brushed stainless steel. Custom colors are not available. 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. Protection class: IP 65. Not suitable for installation inside of a spa, sauna, or in the wall of a shower/bath stall. BEGA does not recommend luminaires with non-isolated metal parts be used in these applications.

Type: S01
BEGA Product: 2007P
Project: UCI NAT SCI II
Voltage: 277
Color:
Options:
Modified:



Unshielded light · **white** safety glass

		Lamp*	Lumen	A	B	C
2007 P	ADA	80 W FL T5 HO	7000	60 7/8	5	5

* Standard T5 lamping available

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com

Drive-over in-grade floodlights for linear fluorescent lamps

Type: S02
BEGA Product: 8642P
Project: UCI NAT SCI II
Voltage: 277
Color:
Options:
Modified:

Enclosure: Outer housing: Constructed of high tensile strength, copper free die-cast aluminum alloy.

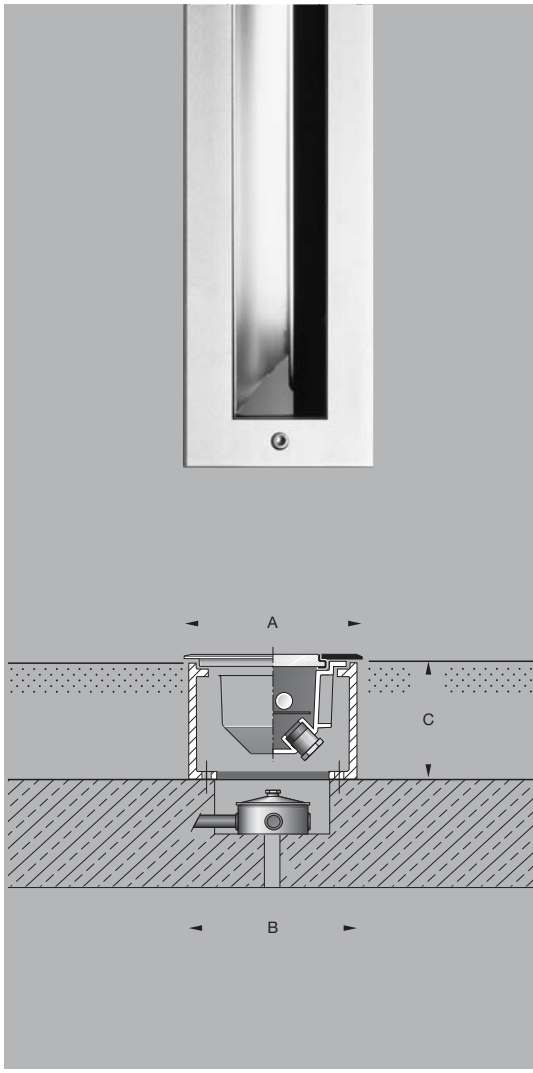
Inner housing: One piece copper free die-cast aluminum housing with welded end caps. Trim/Faceplate is heavy gauge, machined stainless steel secured to the inner housing by stainless steel threaded welded studs. Relamping requires removal of inner housing/trim/faceplate assembly from outer housing by means of two flush, socket head stainless steel screws. ½" thick tempered glass machined flush to faceplate. Reflector of pure anodized aluminum. One piece molded U-channel, high temperature silicone gasket.

Electrical: Lampholders: Fluorescent T5 HO, rated 660 W, 600 V. Ballasts are electronic, universal voltage 120 V through 277 V. Inner housing pre-wired with three (3) feet of 18/3 waterproof cable, cable clamp, and waterproof cable gland entry into housing. A separate weatherproof single gang wiring box for power supply must be provided (by contractor).

Finish: Machined #4 stainless steel. Custom colors are not available.

U.L. Listed, suitable for wet locations and vehicle drive over. Protection class: IP 67.

Note: A foundation and proper drainage must be supplied by the contractor. These luminaires are designed to bear pressure loads up to 11,000 lbs. from vehicles with pneumatic tires. The luminaires must not be used for traffic lanes where they are subject to horizontal pressure from vehicles braking, accelerating and changing direction.



Asymmetrical floodlights · **clear** safety glass

	Lamp	β	Lumen	T	A	B	C
8642P	1 24 W FL T5 HO	65 x 92°	2000	40°	4 5/8 x 25	4 3/16 x 24 5/8	4 15/16

β = Beam angle

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com

Light building elements · STAINLESS STEEL

Post construction: Seamless stainless steel tubing with a machined top insert and a machined base internally welded into an assembly.

Lamp enclosure: Seamless stainless steel tubing with machined diffuser opening, louvers or slot. The lamp enclosure is secured to the post with two captive stainless steel set screws. One piece, handblown three-ply opal glass. Fully gasketed using high temperature silicone rubber O-ring gaskets. Free space of at least dimension 'B' is required above the luminaires for relamping.

Electrical: Lampholders; 2G11 rated 75 W, 250 V. Ballasts are electronic, universal voltage 120 V through 277 V.

Anchor base: Heavy gauge stainless steel with four (4) threaded stainless steel studs which accept BEGA #896 A anchorage kit (supplied).

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. Protection class IP 65.

Type: S02
BEGA Product: 8989P
Project: UCI NAT SCI II
Voltage: 277V
Color: STEEL
Options:
Modified:

Light building elements · **unshielded** — Light sector 140°/140°

	Lamp	Lumen	A	B	C	D	Anchorage
8989 P	1 39 W CF twin-4p	2900	4 3/8	31 1/2	98 1/2	8 7/8	**896 A**

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com

Eco-10 Overview

Eco-10 lighting management electronic dimming ballasts are designed to maximize the benefits of a lighting management system. Eco-10 offers 100% to 10% dimming, and is ideal for use in any space where saving energy is the primary goal of the design.

Eco-10, case type C
1.18 in. w (30 mm) x 1.00 in. h (25 mm) x 18.00 in. l (457 mm)

Eco-10, case type D
1.58 in. w (40 mm) x 1.00 in. h (25 mm) x 9.50 in. l (241 mm)

Eco-10, case type F
2.38 in. w (60 mm) x 1.50 in. h (38 mm) x 9.50 in. l (241 mm)

Features

- Continuous, flicker-free dimming from 100% to 10%
- Standard 3-wire line-voltage phase-control technology for consistent fixture-to-fixture dimming performance
- Models available for T5 and T5-HO linear, T8 linear and U-bent, and T5 twin-tube 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 T5 and T5-HO linear models) ensures safe operation throughout entire lamp life cycle
- For linear lamps, ballasts maintain consistent light output for different lamp lengths, ensuring uniformity
- Ultra-quiet operation
- Protected from miswires of any input power to control lead
- 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

Job Name:	Model Numbers:	
UCI NAT SCI II	T528-277-2	
Job Number:		

Specifications

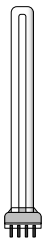
Performance

- Dimming Range: 100% to 10% measured relative light output
- 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: 120 V or 277 V 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 and T5 twin-tube lamps, equal to 1.0 for T5 lamps
- Power Factor: greater than .95
- Total Harmonic Distortion (THD): less than 20%
- Maximum Inrush Current: 7 amps per ballast at 120 V, 3 amps per ballast at 277 V
- Sound Rating: Inaudible in a 27 dBa 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) – specific model numbers only
- Class P thermally protected
- Meets ANSI C82.11 High Frequency Ballast Standard
- Meets FCC Part 18 Non-Consumer requirements for EMI/RFI emissions
- Meets ANSI C62.41 Category A surge protection standards up to and including 4 kV
- Manufacturing facilities employ ESD reduction practices that comply with the requirements of ANSI/ESD S20.20
- Lutron Quality Systems registered to ISO 9001.2000

Eco-10 Ballast Models

Lamp Type	Lamp Watts (length)	Lamps per ballast	Case Type	120 VOLTS Ballast Current (amps)	120 VOLTS **Eco-10** Model Number	277 VOLTS Ballast Current (amps)	277 VOLTS **Eco-10** Model Number
T5 linear  5/8 in. diameter	14 W (22 in.)	1 2	C C	.17 .32	E 3 T514 C 120 1 E 3 T514 C 120 2	.08 .14	E 3 T514 C 277 1 E 3 T514 C 277 2
	21 W (34 in.)	1 2	C C	.25 .43	E 3 T521 C 120 1 E 3 T521 C 120 2	.11 .19	E 3 T521 C 277 1 E 3 T521 C 277 2
	28 W (45.3 in.)	1 2	C C	.30 .55	ECO-T528-120-1 ECO-T528-120-2	.14 .25	ECO-T528-277-1 ECO-T528-277-2
T5-HO linear high output  5/8 in. diameter	24 W (21.5 in.)	1 2	C C	.26 .45	ECO-T524-120-1 ECO-T524-120-2	.13 .20	ECO-T524-277-1 ECO-T524-277-2
	39 W (33.4 in.)	1 2	C C	.38 .76	ECO-T5H39-120-1 ECO-T5H39-120-2	.17 .31	ECO-T5H39-277-1 ECO-T5H39-277-2
	54 W (45.3 in.)	1 2	C C	.58 1.1	ECO-T554-120-1 ECO-T554-120-2	.25 .45	ECO-T554-277-1 ECO-T554-277-2
T5 Twin-Tube  5/8 in. diameter	36/39 W (16 in.)	1 2 3	F F F	.33 .58 .85	ECO-T539-120-1* ECO-T539-120-2* ECO-T539-120-3*	.14 .25 .35	ECO-T539-277-1* ECO-T539-277-2* ECO-T539-277-3*
	40 W (22 in.)	1 2 3	F F F	.33 .61 .88	ECO-T540-120-1* ECO-T540-120-2* ECO-T540-120-3*	.14 .25 .38	ECO-T540-277-1* ECO-T540-277-2* ECO-T540-277-3*
	50 W (22 in.)	1 2	F F	.38 .69	ECO-T550-120-1* ECO-T550-120-2*	.17 .32	ECO-T550-277-1* ECO-T550-277-2*

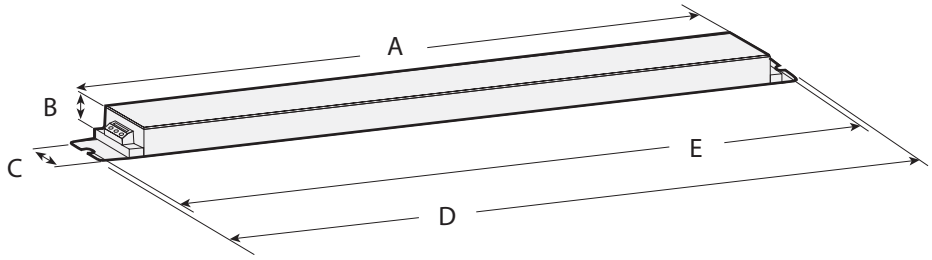
*UL certified only

Eco-10 Ballast Models continued ...

Lamp Type				120 VOLTS		277 VOLTS	
	Lamp Watts (length)	Lamps per ballast	Case Type	Ballast Current (amps)	**Eco-10** Model Number	Ballast Current (amps)	**Eco-10** Model Number
T8 linear and U-bent  1 in. diameter	17 W (24 in.)	1	F	.19	ECO-T817-120-1	.08	ECO-T817-277-1
		2	F	.31	ECO-T817-120-2	.15	ECO-T817-277-2
		3	F	.43	ECO-T817-120-3	.20	ECO-T817-277-3
	25 W (36 in.)	1	F	.24	ECO-T825-120-1	.12	ECO-T825-277-1
		2	F	.43	ECO-T825-120-2	.19	ECO-T825-277-2
	32 W (48 in.)	1	C	- -	- -	- -	- -
		1	D	.34	ECO-T832-120-1-L	.14	ECO-T832-277-1-L
		1	D	.34	ECO-T832-120-1-T	.14	ECO-T832-277-1-T
		1	F	- -	- -	.15	ECO-T832-277-1
		2	C	- -	- -	- -	- -
		2	D	.53	ECO-T832-120-2-L	.23	ECO-T832-277-2-L
		2	D	.53	ECO-T832-120-2-T	.23	ECO-T832-277-2-T
		2	F	- -	- -	.22	ECO-T832-277-2
		3	F	.82	ECO-T832-120-3	.35	ECO-T832-277-3

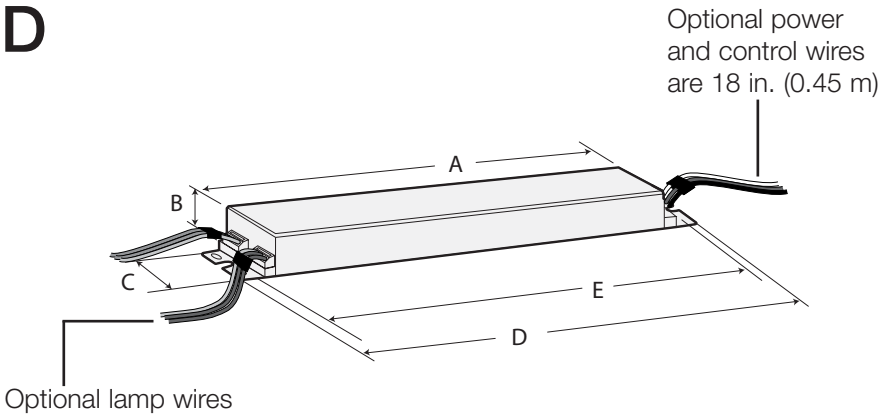
Eco-10 Case Dimensions

C



A 16.12 in. (409 mm)
B 1.00 in. (25 mm)
C 1.18 in. (30 mm)
D 18.00 in. (457 mm)
E 17.70 in. (450 mm)
(mounting centers)

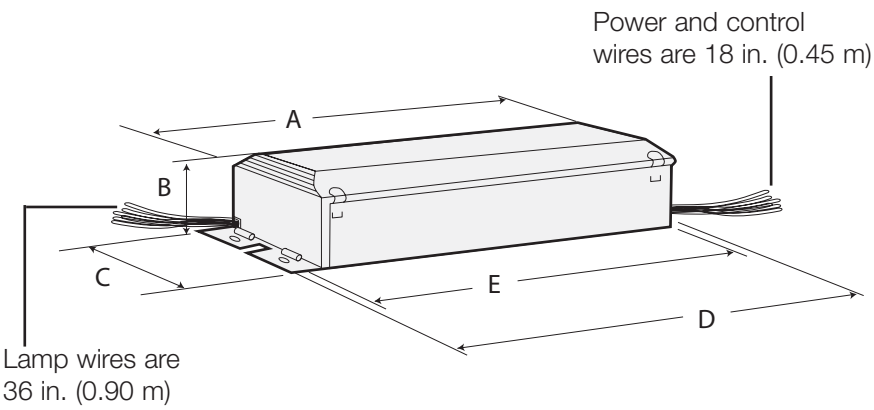
D



A 7.13 in. (181 mm)
B 1.00 in. (25 mm)
C 1.58 in. (40 mm)
D 9.50 in. (241 mm)
E 8.91 in. (226 mm)
(slot mounting centers)

If using four hole mount, mounting centers are 9.00" (229 mm) x 1.06 in. (27 mm).

F

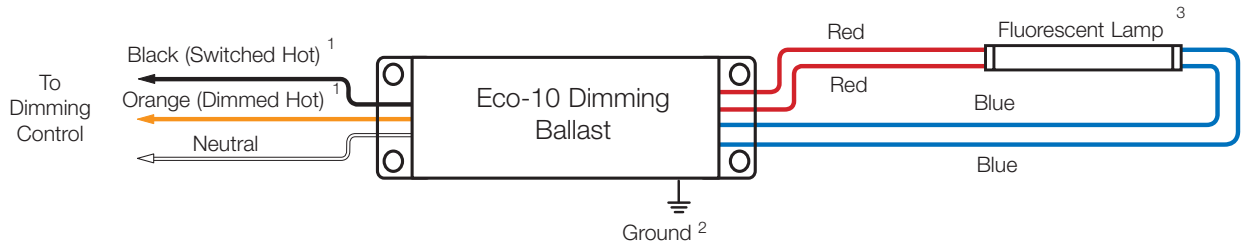


A 8.30 in. (211 mm)
B 1.50 in. (38 mm)
C 2.38 in. (60 mm)
D 9.50 in. (241 mm)
E 8.91 in. (226 mm)
(slot mounting centers)

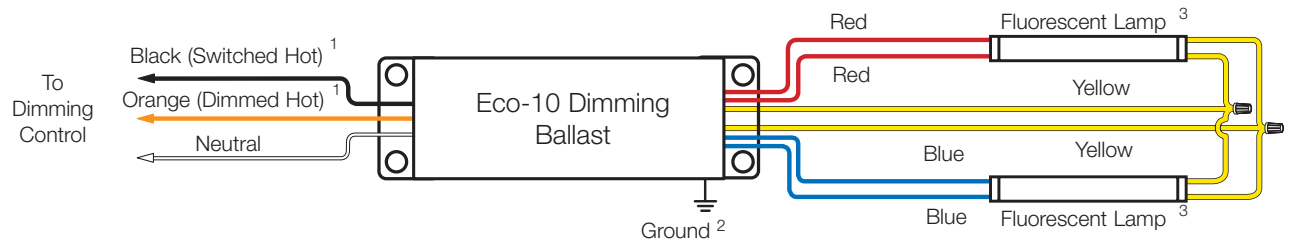
If using four hole mount, mounting centers are 9.21 in. (234 mm) x 1.70 in. (43 mm).

Eco-10 Wiring Diagrams

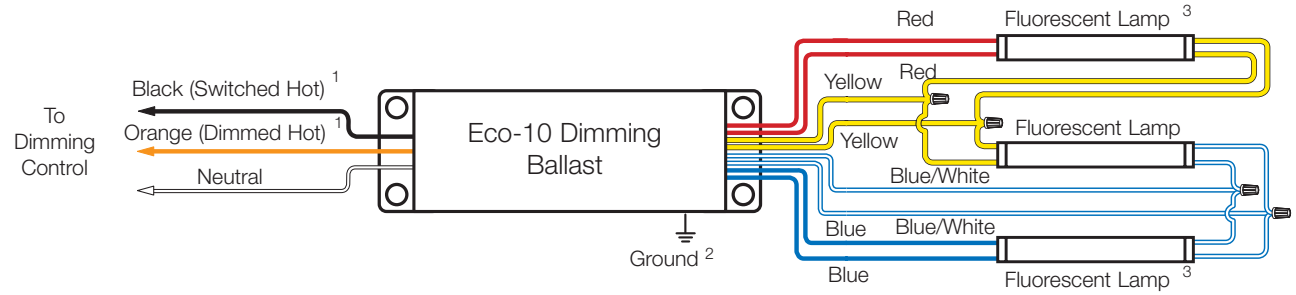
One T5 or T8 lamp



Two T5 or T8 lamps



Three T8 lamps



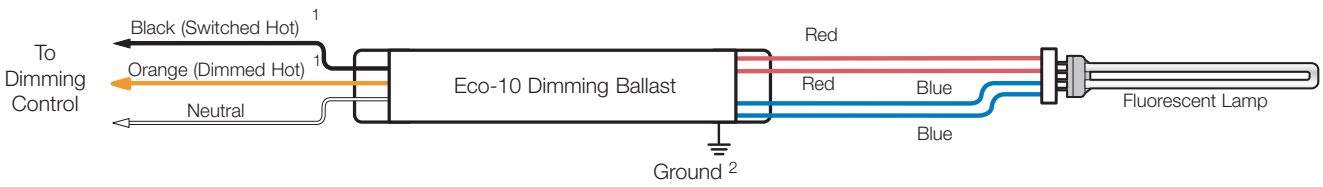
[1] Dimming control wire colors do not necessarily match ballast wire colors (e.g. control 'dimmed hot' may be yellow, and ballast 'dimmed hot' may be orange. Wire colors shown are for Lutron ballasts and controls only.
[2] Ballast and lighting fixture must be effectively grounded.
[3] Includes 31 W T8 U-bent lamps

Note: For T5 and T8 lamps, maximum lamp-to-ballast wire length is 7 feet (2 m).

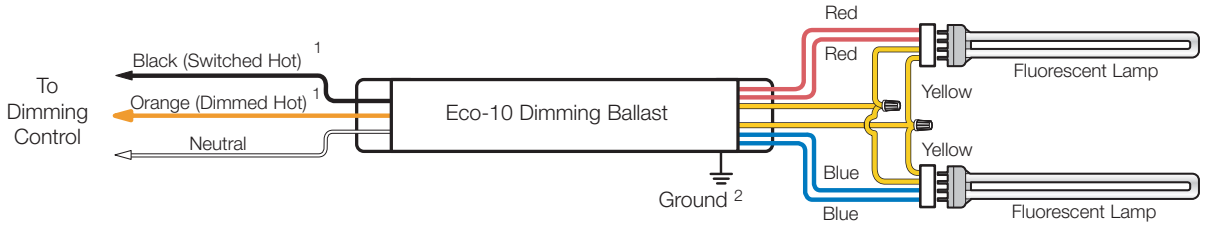
Job Name:	Model Numbers:	
UCI NAT SCI II	T528-277-2	
Job Number:		

Eco-10 Wiring Diagrams continued

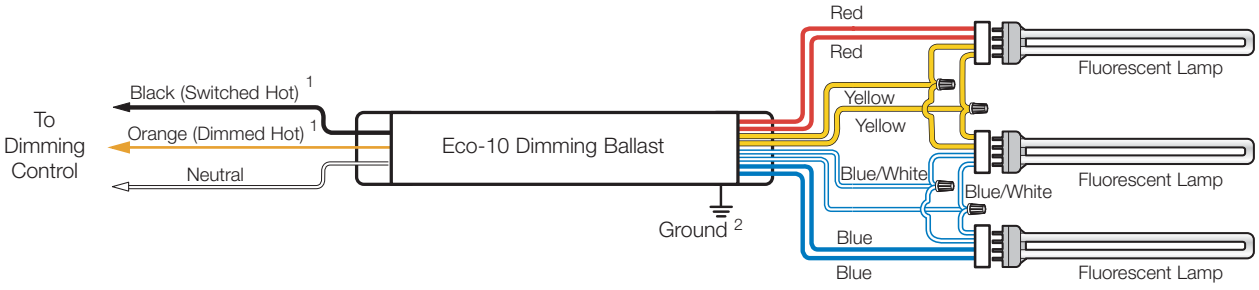
One T5 twin-tube lamp



Two T5 twin-tube lamps



Three T5 twin-tube lamps



[1] Dimming control wire colors do not necessarily match ballast wire colors (e.g. control 'dimmed hot' may be yellow, and ballast 'dimmed hot' may be orange). Wire colors shown are for Lutron ballasts and controls only.
[2] Ballast and lighting fixture must be effectively grounded.

Note: For T5 twin-tube lamps, maximum lamp-to-ballast wire length is 3 feet (1 m).

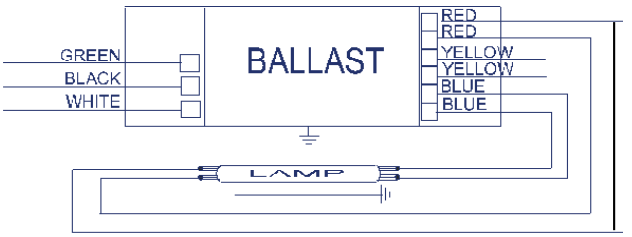
PHILIPS ADVANCE

ICN-2S54@277V	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series/Parallel
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 (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
* FT36W/2G11	1	36	-20/-29	0.18	46	1.22	20	0.96	1.7	2.65
FT36W/2G11	2	36	-20/-29	0.32	86	1.20	10	0.98	1.7	1.40

Wiring Diagram



For 1 lamp operation, do not use yellow leads

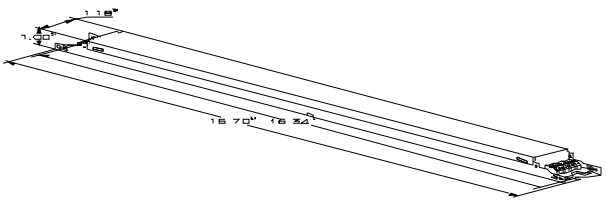
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	31	78.7
White	31	78.7
Blue	28	71.1
Red	28	71.1
Yellow	48	121.9
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)
16.70 "	1.18 "	1.00 "	16.34 "
16 7/10	1 9/50	1	16 17/50
42.4 cm	3 cm	2.5 cm	41.5 cm

Revised 03/11/2009

Data is based upon tests performed by Philips Lighting Electronics N.A. in a controlled environment and is 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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PHILIPS
ADVANCE

ICN-2S54@277V	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series/Parallel
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be provided with integral leads or poke-in wire trap connectors color-coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start.

2.2 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.3 Ballast shall operate from 50/60 Hz input source of _____ (120V through 277V or 347V through 480V) with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

2.4 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

2.5 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 20% for Standard models and THD of less than 10% for Centium models when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of _____ {-18C (0F) or -29C (-20F)} for primary lamp. Consult lamp manufacturer for temperature versus light output characteristics.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

2.13 Ballast shall have a hi-low switching option when operating (4) F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps or 3-1 lamp.

2.14 Four-lamp ballast shall have semi-independent lamp operation.

Section III - Regulatory Requirements

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.4 Ballast shall comply with ANSI C82.11 where applicable.

3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

3.6 Ballast shall comply with UL Type CC rating.

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C. Ballasts with a "90C" designation in their catalog number shall also carry a three-year warranty at a maximum case temperature of 90C.

4.3 Manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.

Revised 03/11/2009

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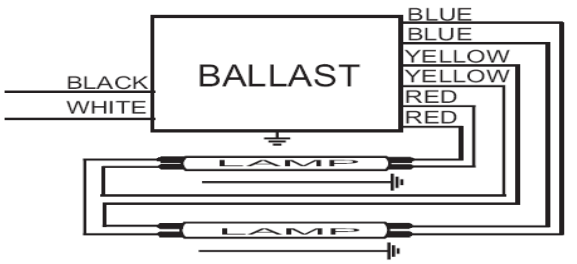
PHILIPS ADVANCE

ICN-2S28-N@277	
Brand Name	CENTIUM T5
Ballast Type	Electronic
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 (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F14T5	1	14	0/-18	0.07	17	1.07	10	0.98	1.7	6.29
F14T5	2	14	0/-18	0.12	33	1.04	10	0.98	1.7	3.15
F21T5	1	21	0/-18	0.10	25	1.06	10	0.98	1.7	4.24
F21T5	2	21	0/-18	0.18	49	1.02	10	0.98	1.7	2.08
F28T5	1	28	0/-18	0.12	31	1.05	10	0.98	1.7	3.39
* F28T5	2	28	0/-18	0.22	60	1.00	10	0.98	1.7	1.67

Wiring Diagram



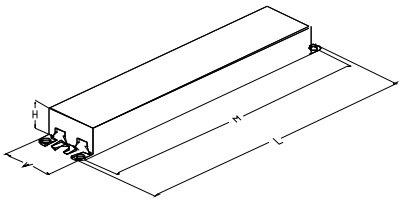
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	23	58.4
White	23	58.4
Blue	27	68.6
Red	27	68.6
Yellow	42	106.7
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)
9.5 "	1.3 "	1.0 "	8.9 "
9 1/2	1 3/10	1	8 9/10
24.1 cm	3.3 cm	2.5 cm	22.6 cm

Revised 03/03/2009

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PHILIPS
ADVANCE

ICN-2S28-N@277	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be provided with integral leads or poke-in wire trap connectors color-coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start.

2.2 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.3 Ballast shall operate from 50/60 Hz input source of _____ (120V through 277V or 347V through 480V) with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

2.4 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

2.5 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 20% for Standard models and THD of less than 10% for Centium models when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of _____ {-18C (0F) or -29C (-20F)} for primary lamp. Consult lamp manufacturer for temperature versus light output characteristics.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

2.13 Ballast shall have a hi-low switching option when operating (4) F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps or 3-1 lamp.

2.14 Four-lamp ballast shall have semi-independent lamp operation.

Section III - Regulatory Requirements

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.4 Ballast shall comply with ANSI C82.11 where applicable.

3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

3.6 Ballast shall comply with UL Type CC rating.

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C. Ballasts with a "90C" designation in their catalog number shall also carry a three-year warranty at a maximum case temperature of 90C.

4.3 Manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.

Revised 03/03/2009

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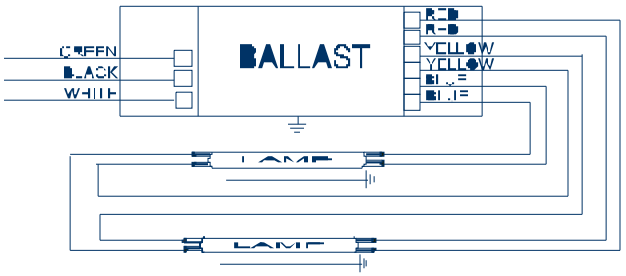
PHILIPS ADVANCE

ICN-2S24@277V	
Brand Name	CENTIUM T5
Ballast Type	Electronic
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 (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F24T5/HO	1	24	0/-18	0.10	27	1.02	10	0.98	1.7	3.78
* F24T5/HO	2	24	0/-18	0.19	52	1.00	10	0.98	1.7	1.92
F39T5/HO	1	39	0/-18	0.15	40	0.90	10	0.98	1.7	2.25
FC12T5	1	40	0/-18	0.15	40	0.84	10	0.98	1.7	2.10
FC9T5	1	22	0/-18	0.10	27	1.02	10	0.98	1.7	3.78
FC9T5	2	22	0/-18	0.19	52	1.00	10	0.98	1.7	1.92
FT24W/2G11	1	24	0/-18	0.10	27	1.02	10	0.98	1.7	3.78
FT24W/2G11	2	24	0/-18	0.19	52	1.00	10	0.98	1.7	1.92
FT36W/2G11	1	36	0/-18	0.13	34	0.90	10	0.98	1.7	2.65
FT40W/2G11/RS	1	40	0/-18	0.17	47	1.00	10	0.98	1.7	2.13

Wiring Diagram



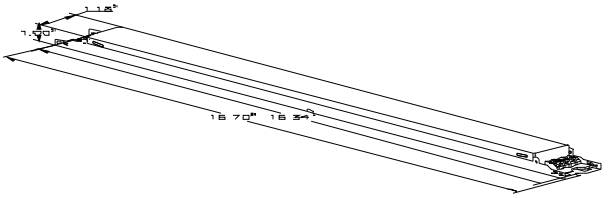
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
16.70 "	1.18 "	1.00 "	16.34 "
16 7/10	1 9/50	1	16 17/50
42.4 cm	3 cm	2.5 cm	41.5 cm

Revised 09/01/2004

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PHILIPS ADVANCE

ICN-2S24@277V	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be provided with integral leads or poke-in wire trap connectors color-coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start.

2.2 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.3 Ballast shall operate from 50/60 Hz input source of _____ (120V through 277V or 347V through 480V) with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

2.4 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

2.5 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 20% for Standard models and THD of less than 10% for Centium models when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of _____ {-18C (0F) or -29C (-20F)} for primary lamp. Consult lamp manufacturer for temperature versus light output characteristics.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

2.13 Ballast shall have a hi-low switching option when operating (4) F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps or 3-1 lamp.

2.14 Four-lamp ballast shall have semi-independent lamp operation.

Section III - Regulatory Requirements

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.4 Ballast shall comply with ANSI C82.11 where applicable.

3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

3.6 Ballast shall comply with UL Type CC rating.

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C. Ballasts with a "90C" designation in their catalog number shall also carry a three-year warranty at a maximum case temperature of 90C.

4.3 Manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.

Revised 09/01/2004

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9/4/2009

F28T5/841 ALTO TG 1LP

Product family description

Product data	
Product Number	166744
Full product name	F28T5/841 ALTO TG 1LP
Ordering Code	F28T5/841 TG
Pack type	1 Lamp
Pieces per Sku	1
Skus/Case	40
Pack UPC	046677166748
EAN2US	
Case Bar Code	50046677166743
Successor Product number	
System Description	High Efficiency
Base	Miniature Bipin
Base Information	Green [Green Base]
Bulb	T5 [16mm]
Packing Type	1LP [1 Lamp]
Packing Configuration	40
Rated Avg. Life	24000 hr
Type	F28T5
Feature	ALTO®
Ordering Code	F28T5/841 TG
Pack UPC	046677166748
Case Bar Code	50046677166743
Watts	28W
Lamp Wattage EL	28.0 W
Dimmable	Yes
Color Code	841 [CCT of 4100K]
Color Rendering Index	85 Ra8

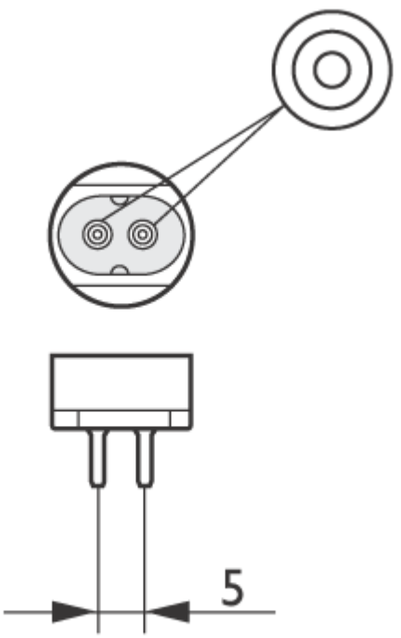
A47

PHILIPS

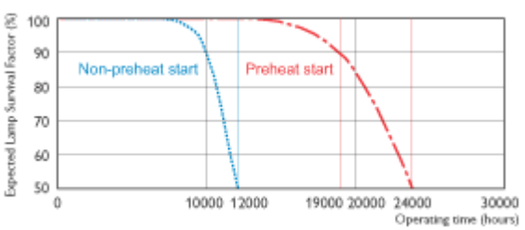
9/4/2009

Product data	
Color Designation	841
Color Description	na [-]
Color Temperature	4000 K
Initial Lumens	- Lm
Overall Length C	1163.2 mm
Diameter D	17 mm
Special Note	TuffGuard™ [TuffGuard Coated]
Product Number	166744

TL5 HE

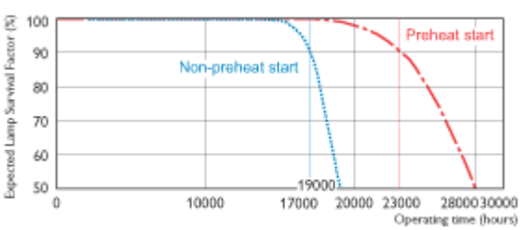


Base Miniature Bipin



Life Expectancy 3h cycle

TL5 HE



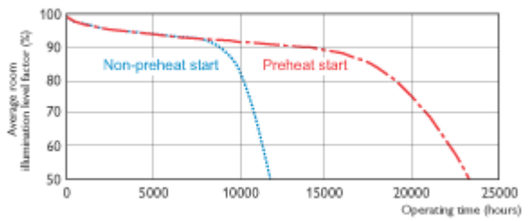
Life Expectancy 12h cycle

TL5 HE

A48

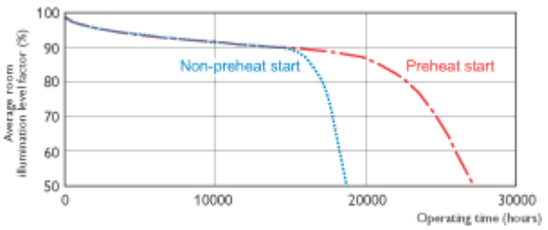
PHILIPS

9/4/2009



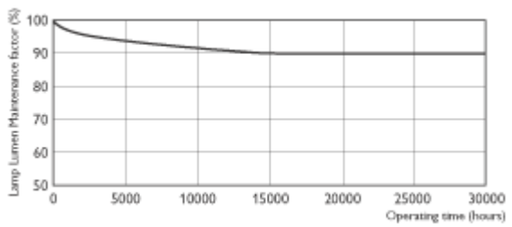
Service Life 3h cycle

TL5 HE



Service Life 12h cycle

TL5 HE



TL5 HE

9/4/2009

PL-C ALTO 13W/841 G24q-1 /4P 1CT

Product family description

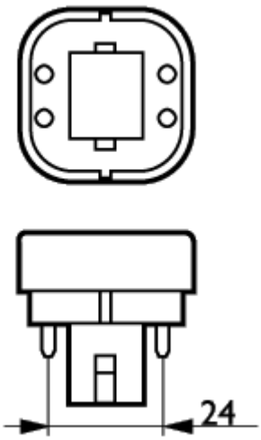
Product data	
Product Number	383281
Full product name	PL-C ALTO 13W/841 G24q-1 /4P 1CT
Ordering Code	PL-C 13W/841/4P/ALTO
Pack type	1 Lamp in a Folding Carton
Pieces per Sku	1
Skus/Case	50
Pack UPC	046677240004
EAN2US	
Case Bar Code	60046677240006
Successor Product number	
Base	G24q-1
Base Information	4P
Execution	/4P [4 Pins]
Packing Type	1CT [1 Lamp in a Folding Carton]
Packing Configuration	5X10BOX
Avg. Life	10000 hr
Rated Avg. Life	12000 hr
Ordering Code	PL-C 13W/841/4P/ALTO
Pack UPC	046677240004
Case Bar Code	60046677240006
Watts	13W
Lamp Wattage EL	12.5 W
Dimmable	Yes
Mercury (Hg) Content	- mg
Color Code	840 [CCT of 4000K]
Color Rendering Index	82 Ra8
Color Designation	Cool White

PHILIPS

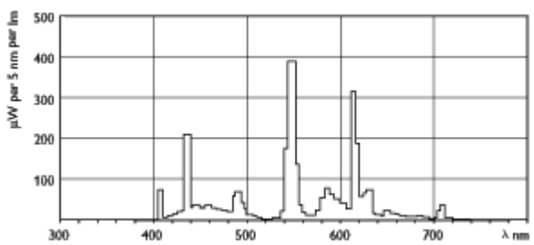
9/4/2009

Product data	
Color Description	840 Cool White
Color Temperature	4000 K
Initial Lumens	900 Lm
Initial Lumens	900 Lm
Overall Length C	142.9 mm
Diameter D	27.1 mm
Diameter D1	27.1 mm
Product Number	383281

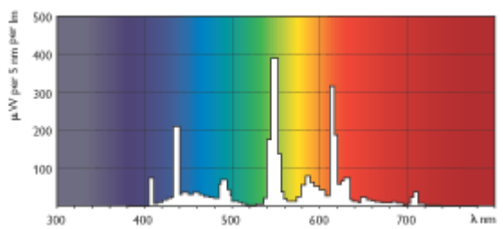
PL-C 13W



Base G24q-1



PL-C/840



PL-C/840

PL-C

SoLux 4100K 35W Specs.

Technical Data SoLux 4100 Kelvin

PHYSICAL
Bulb Type: MR 16
Cover Glass: Yes
Bulb Diameter: 2" (50mm)
Maximum Overall Length: 1 3/4 " (45 mm
Base 2 pin / GX5.3

ELECTRICAL
Watts: 35
Volts: 12
Filament. C-8
Burning Position: Any

LIGHT
Life: 4000 Hrs.
Color Temperature: 4100 Kelvin
Color Rendition Index. 98+ C.R.I.

IR EMISSION
56 % Less Than
Standard MR16 50W

UV VALUES
UV : 9.75 Microwatt / Lumen
UVA: 9.39 Microwatt / Lumen (380-315 nm)
UVB: 0.36 Microwatts / Lumen (315-280nm)

CANDLEPOWER
#35011 (10°) = 7897
#35012 (17°) = 2782
35014 (24°) = 1701
35013 (36°) = 1048

Part Number 35011 35012 35014 35013

10°						17°				24°				36°			
Distance		**Beam Diameter**		**Illuminance**		**Beam Diameter**		**Illuminance**		**Beam Diamter**		**Illuminance**		**Beam Diameter**		**Illuminance**	
Feet	Meters	Feet	Meters	fc	Lux	Feet	Meters	fc	Lux	Feet	Meters	fc	Lux	Feet	Meters	fc	Lux
2	0.6	0.35	0.11	2038.7	21936.1	0.60	0.20	718.2	7727.8	0.90	0.26	439.1	4725.0	1.30	0.40	270.5	2911.1
4	1.2	0.70	0.21	509.7	5484.0	1.20	0.40	179.5	1931.9	1.70	0.52	109.8	1181.3	2.60	0.80	67.6	727.8
6	1.8	1.05	0.32	226.5	2437.3	1.80	0.55	79.8	858.6	2.60	0.78	48.8	525.0	3.90	1.20	30.1	323.5
8	2.4	1.40	0.43	127.4	1371.0	2.40	0.73	44.9	483.0	3.40	1.04	27.4	295.3	5.20	1.60	16.9	181.9
10	3.0	1.75	0.53	81.5	877.4	3.00	0.91	28.7	309.1	4.30	1.30	17.6	189.0	6.50	2.00	10.8	116.4

Tailored Lighting Inc.
1-800-254-4487

9/4/2009

PL-T 18W/841/4P 1CT

Product family description
PL-T Triple 4pin Fluorescent Lamp with Amalgam.

Features/Benefits

- ALTO® Lamp Technology - Passes EPA's TCLP test for non-hazardous waste.
- Utilizes amalgam technology to provide > 90% of rated lumens in ambient temperatures from 23F to 130F.
- Triple tube design available in 18, 26, 32, and 42W.
- Excellent Color Rendering - 82 Color Rendering Index (CRI).
- Broad Range of Color Temperature - Available in 2700, 3000, 3500 and 4100K.
- Dimmable - PL-T 4-pin lamps may be used with electronic dimming ballasts.
- Long Life - 12,000 hours.
- Energy Saving - Designed for use with electronic ballasts for lower operating costs and flicker-free starting.

Applications

- Ideal for downlights and medium bay multi-lamp fixtures for general lighting.

Notes

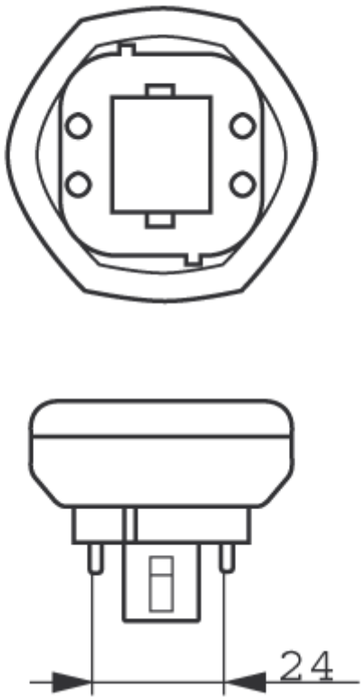
- Rated average life under specified test conditions with lamps turned off and restarted no more frequently than once every 3 operating hours. Lamp life is appreciably longer if lamps are started less frequently. (202)
- Approximate Initial Lumens. The lamp lumen output is based upon lamp performance after 100 hours of operating life, when the output is measured during operation on a reference ballast under standard laboratory conditions. (203)
- Design Lumens are the approximate lamp lumen output at 40% of the lamp's Rated Average Life. This output is based upon measurements obtained during lamp operation on a reference ballast under standard laboratory conditions. (208)

Product data	
Product Number	268227
Full product name	PL-T 18W/841/4P 1CT
Ordering Code	268227
Pack type	1 Lamp in a Folding Carton
Pieces per Sku	1
Skus/Case	12
Pack UPC	046677268220
EAN2US	

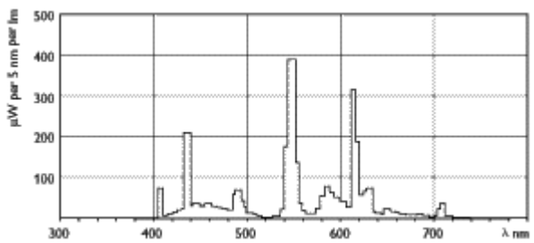
PHILIPS

Product data	
Case Bar Code	50046677268225
Successor Product number	
Base	GX24q-2
Base Information	4P
Execution	/4P [4 Pins]
Packing Type	1CT [1 Lamp in a Folding Carton]
Packing Configuration	12
Avg. Hrs. Life	16000 hr
Ordering Code	PL-T 18W/841/4P/ALTO
Pack UPC	046677268220
Case Bar Code	50046677268225
Watts	18W
Lamp Wattage EL	16.5 W
Lamp Voltage	100 V
Dimmable	Yes
Color Code	840 [CCT of 4000K]
Color Rendering Index	82 Ra8
Color Designation	Cool White
Color Description	840 Cool White
Color Temperature	4000 K
Initial Lumens	1200 Lm
Initial Lumens	1200 Lm
Overall Length C	116.4 mm
Diameter D	39.85 mm
Diameter D1	39.65 mm
Product Number	268227

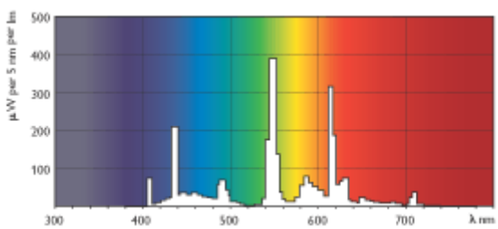
PL-T 18W



Base GX24q-2



PL-T/840



PL-T/840

9/4/2009

F35T5/841 TG

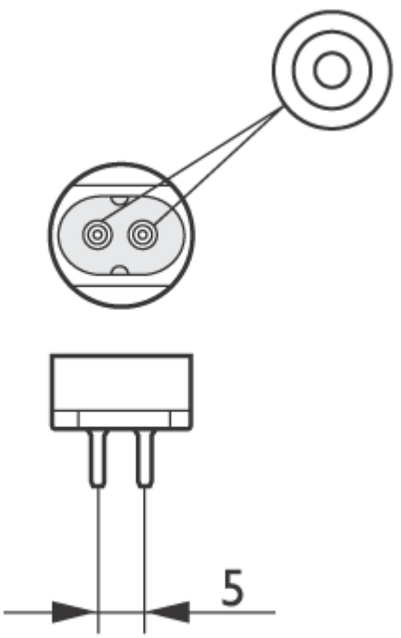
Product family description

Product data	
Product Number	167338
Full product name	F35T5/841 TG
Ordering Code	F35T5/841 TG
Pack type	1 Lamp
Pieces per Sku	1
Skus/Case	40
Pack UPC	046677167332
EAN2US	
Case Bar Code	50046677167337
Successor Product number	
System Description	High Efficiency
Base	Miniature Bipin
Base Information	Green Plate
Bulb	T5 [16mm]
Packing Type	1LP [1 Lamp]
Packing Configuration	40
Rated Avg. Life	24000 hr
Type	F35T5
Feature	na [Not Applicable]
Ordering Code	F35T5/841 TG
Pack UPC	046677167332
Case Bar Code	50046677167337
Watts	35W
Lamp Wattage EL	35 W
Dimmable	Yes
Color Code	841 [CCT of 4100K]
Color Rendering Index	85 Ra8

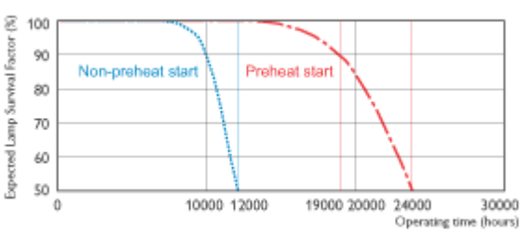
9/4/2009

Product data	
Color Designation	841
Color Description	na [-]
Color Temperature	4000 K
Initial Lumens	- Lm
Overall Length C	1463.2 mm
Diameter D	17 mm
Product Number	167338

TL5 HE

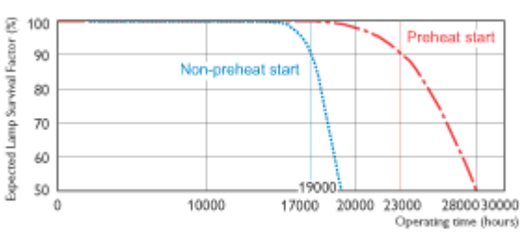


Base Miniature Bipin



Life Expectancy 3h cycle

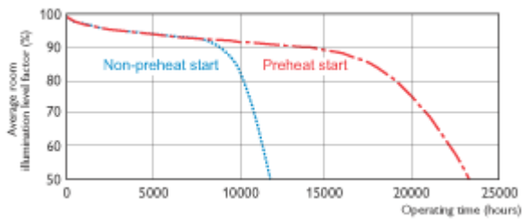
TL5 HE



Life Expectancy 12h cycle

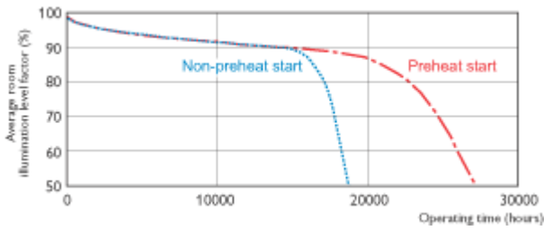
TL5 HE

PHILIPS



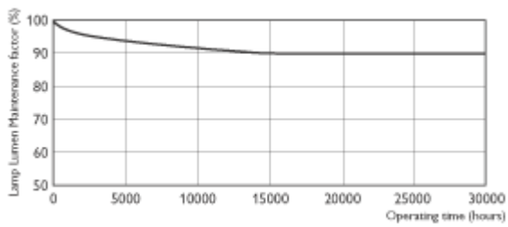
Service Life 3h cycle

TL5 HE



Service Life 12h cycle

TL5 HE



TL5 HE

9/4/2009

PL-T 32W/841/4P 1CT

Product family description
PL-T Triple 4pin Fluorescent Lamp with Amalgam.

Features/Benefits

- ALTO® Lamp Technology - Passes EPA's TCLP test for non-hazardous waste.
- Utilizes amalgam technology to provide > 90% of rated lumens in ambient temperatures from 23F to 130F.
- Triple tube design available in 18, 26, 32, and 42W.
- Excellent Color Rendering - 82 Color Rendering Index (CRI).
- Broad Range of Color Temperature - Available in 2700, 3000, 3500 and 4100K.
- Dimmable - PL-T 4-pin lamps may be used with electronic dimming ballasts.
- Long Life - 12,000 hours.
- Energy Saving - Designed for use with electronic ballasts for lower operating costs and flicker-free starting.

Applications

- Ideal for downlights and medium bay multi-lamp fixtures for general lighting.

Notes

- Rated average life under specified test conditions with lamps turned off and restarted no more frequently than once every 3 operating hours. Lamp life is appreciably longer if lamps are started less frequently. (202)
- Approximate Initial Lumens. The lamp lumen output is based upon lamp performance after 100 hours of operating life, when the output is measured during operation on a reference ballast under standard laboratory conditions. (203)
- Design Lumens are the approximate lamp lumen output at 40% of the lamp's Rated Average Life. This output is based upon measurements obtained during lamp operation on a reference ballast under standard laboratory conditions. (208)

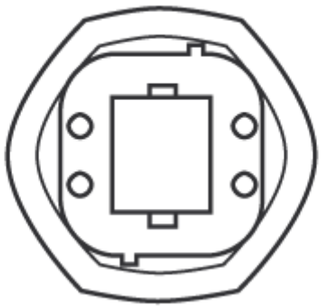
Product data	
Product Number	268722
Full product name	PL-T 32W/841/4P 1CT
Ordering Code	268722
Pack type	1 Lamp in a Folding Carton
Pieces per Sku	1
Skus/Case	12
Pack UPC	046677268725
EAN2US	

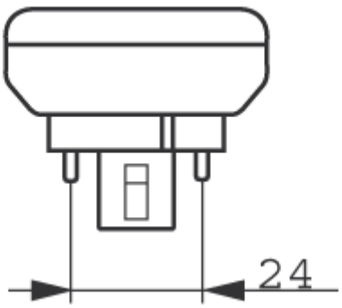
9/4/2009

Product data	
Case Bar Code	50046677268720
Successor Product number	
Base	GX24q-3
Base Information	4P
Execution	/4P [4 Pins]
Packing Type	1CT [1 Lamp in a Folding Carton]
Packing Configuration	12
Avg. Hrs. Life	16000 hr
Ordering Code	PL-T 32W/841/4P/ALTO
Pack UPC	046677268725
Case Bar Code	50046677268720
Watts	32W
Lamp Wattage EL	32.0 W
Lamp Voltage	- V
Dimmable	Yes
Color Code	840 [CCT of 4000K]
Color Rendering Index	82 Ra8
Color Designation	Cool White
Color Description	840 Cool White
Color Temperature	4000 K
Initial Lumens	- Lm
Initial Lumens	2400 Lm
Overall Length C	141.4 mm
Diameter D	39.85 mm
Diameter D1	39.65 mm
Product Number	268722

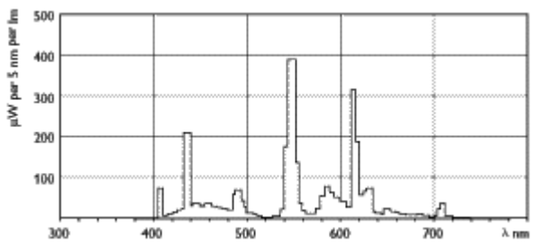
9/4/2009

PL-T 32W

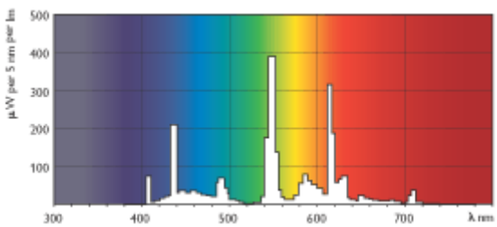




Base GX24q-3



PL-T/840



PL-T/840

9/4/2009

24W/841 Min Bipin T5 HO ALTO UNP

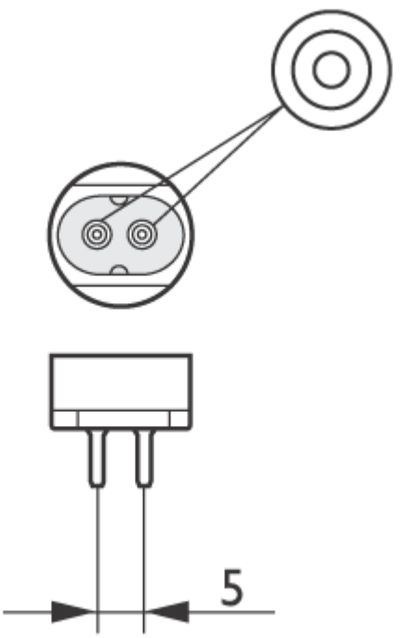
Product family description

Product data	
Product Number	290213
Full product name	24W/841 Min Bipin T5 HO ALTO UNP
Ordering Code	F24T5/841/HO/ALTO
Pack type	Unpacked
Pieces per Sku	1
Skus/Case	40
Pack UPC	046677290214
EAN2US	
Case Bar Code	50046677290219
Successor Product number	
System Description	High Output
Base	Miniature Bipin
Base Information	Green [Green Base]
Bulb	T5 [16mm]
Packing Type	UNP [Unpacked]
Packing Configuration	40
Rated Avg. Life	24000 hr
Type	na
Feature	na [Not Applicable]
Ordering Code	F24T5/841/HO/ALTO
Pack UPC	046677290214
Case Bar Code	50046677290219
Watts	24W
Lamp Wattage EL	22.5 W
Dimmable	Yes
Color Code	840 [CCT of 4000K]
Color Rendering Index	85 Ra8

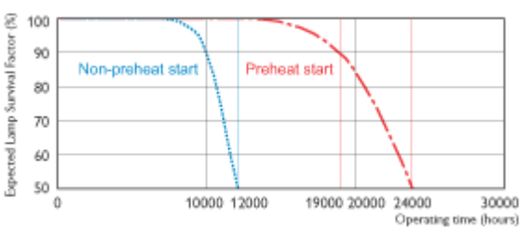
9/4/2009

Product data	
Color Designation	Cool White
Color Description	840 Cool White
Color Temperature	4000 K
Initial Lumens	- Lm
Overall Length C	563.2 mm
Diameter D	17 mm
Special packing	ALTO
Product Number	290213

TL5 HO

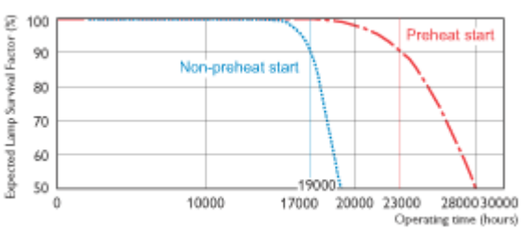


Base Miniature Bipin



Life Expectancy 3h cycle

TL5 HO

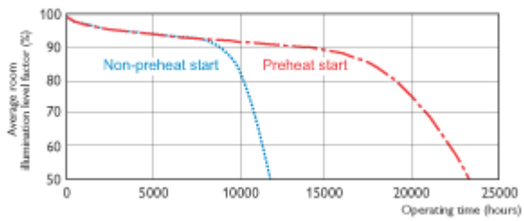


Life Expectancy 12h cycle

TL5 HO

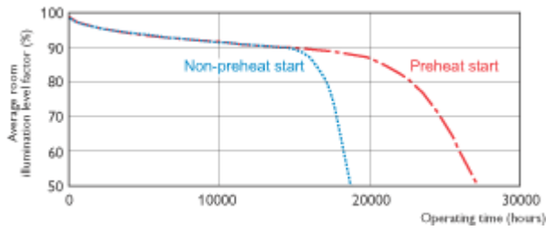
PHILIPS

9/4/2009



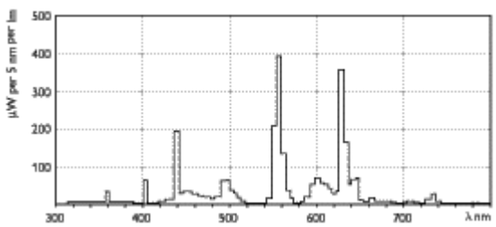
Service Life 3h cycle

TL5 HO

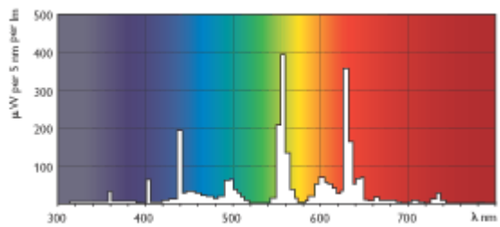


Service Life 12h cycle

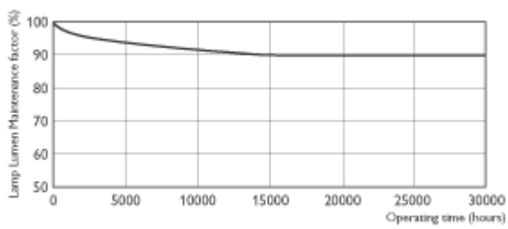
TL5 HO



TL5 HO/840



TL5 HO/840



TL5 HO

9/4/2009

PL-L 36W/830 2G11/4P 1CT

Product family description
PL-L Long 4pin Fluorescent Lamp.

Features/Benefits

- High lumen Output in a slim, compact size.
- Broad range of available wattages: 18, 24, 36, 40, 50, 55, and 80W.
- Excellent Color Rendering - 82 Color Rendering Index (CRI); 55W available with 91 CRI.
- Available in 3000, 3500 and 4100K; 55W available as 5000K only.
- Dimmable - PL-L 4-pin lamps may be used with electronic dimming ballasts.
- Long life: 15,000 to 20,000 hours average life depending on wattage.

Applications

- Ideal for commercial interior lighting applications in 2'x2' fixtures,1'x2' fixtures, and indirect lighting.

Notes

- Rated average life under specified test conditions with lamps turned off and restarted no more frequently than once every 3 operating hours. Lamp life is appreciably longer if lamps are started less frequently. (202)
- Approximate Initial Lumens. The lamp lumen output is based upon lamp performance after 100 hours of operating life, when the output is measured during operation on a reference ballast under standard laboratory conditions. (203)
- Design Lumens are the approximate lamp lumen output at 40% of the lamp's Rated Average Life. This output is based upon measurements obtained during lamp operation on a reference ballast under standard laboratory conditions. (208)

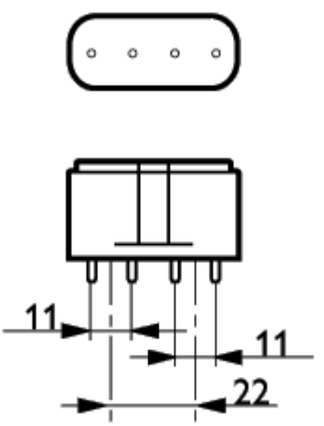
Product data	
Product Number	345116
Full product name	PL-L 36W/830 2G11/4P 1CT
Ordering Code	345116
Pack type	1 Lamp in a Folding Carton
Pieces per Sku	1
Skus/Case	25
Pack UPC	046677345112
EAN2US	
Case Bar Code	50046677345117
Successor Product number	

PHILIPS

9/4/2009

Product data	
Base	2G11
Base Information	4P
Bulb Finish	Silicon
Execution	/4P [4 Pins]
Packing Type	1CT [1 Lamp in a Folding Carton]
Packing Configuration	25
Avg. Life	15000 hr
Rated Avg. Life	20000 hr
Ordering Code	PL-L 36W/830/4P
Pack UPC	046677345112
Case Bar Code	50046677345117
Watts	36W
Lamp Wattage EL	32.0 W
Dimmable	Yes
Color Code	830 [CCT of 3000K]
Color Rendering Index	82 Ra8
Color Designation	Warm White
Color Description	830 Warm White
Color Temperature	3000 K
Initial Lumens	2900 Lm
Initial Lumens	2900 Lm
Overall Length C	416.6 mm
Diameter D	38 mm
Diameter D1	18 mm
Product Number	345116

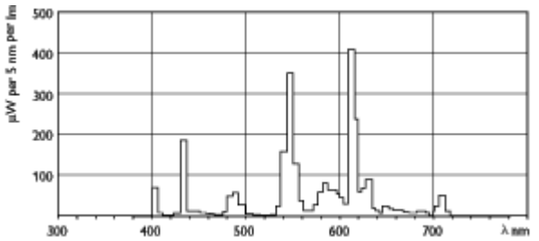
PL-L 36W



Base 2G11

PHILIPS

9/4/2009



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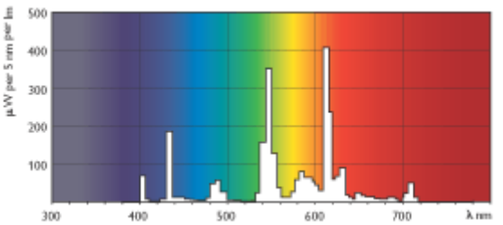

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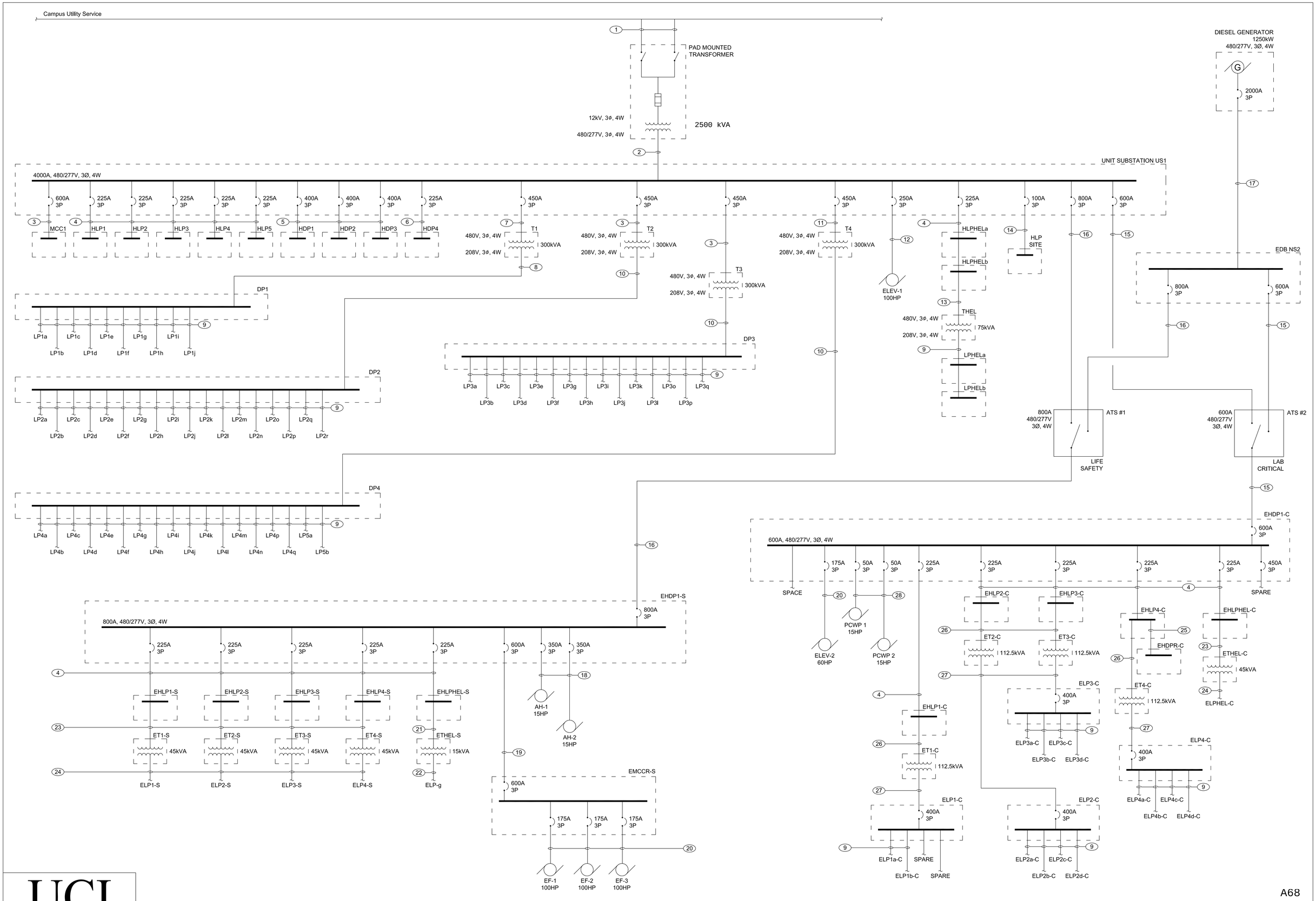

A68

UCI	Student Name:	Electrical Consultant:	Assignment:	Date:	The Pennsylvania State University	Drawing Title:
Natural Sciences, Unit II Irvine, California	Grant W. Kightlinger Lighting/Electrical Option	Professor T. Dannerth, PE	THESIS SUMMARY REPORT	APRIL 7, 2009	Architectural Engineering AE 481 - Senior Thesis Project	Single-Line Diagram

FEEDER SCHEDULE

Tag	From	To	No. of Sets	Conduit (Per Set)		Conductors (Per Set)									Size of Overcurrent Protection
						Phase Conductors			Neutral Conductors			Ground Conductors			
				Size	Type	No.	Size	Type	No.	Size	Type	No.	Size	Type	
1	UTILITY	XFMR	2	5"	EMT	2	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	4/0	CU THWN	-
2	XFMR	US1	11	4"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	500KCMIL	CU THWN	4000A
3	US1	MCC1	2	3"	EMT	2	350KCMIL	CU THWN	-	-	CU THWN	1	#1	CU THWN	600A
3	US1	T2	2	3"	EMT	2	350KCMIL	CU THWN	-	-	CU THWN	1	#1	CU THWN	600A
3	US1	T3	2	3"	EMT	2	350KCMIL	CU THWN	-	-	CU THWN	1	#1	CU THWN	600A
4	US1	HLP1	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	US1	HLP2	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	US1	HLP3	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	US1	HLP4	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	US1	HLP5	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	US1	HPHELa	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-C	EHLPHEL-C	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-C	EHLP4-C	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-C	EHLP3-C	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-C	EHLP2-C	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-C	EHLP1-C	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-S	EHLPHEL-S	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-S	EHLP1-S	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-S	EHLP2-S	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-S	EHLP3-S	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
4	EHDP1-S	EHLP4-S	1	2.5"	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	#4	CU THWN	225A
5	US1	HDP1	1	3"	EMT	2	500KCMIL	CU THWN	-	-	CU THWN	1	#3	CU THWN	400A
5	US1	HDP2	1	3"	EMT	2	500KCMIL	CU THWN	-	-	CU THWN	1	#3	CU THWN	400A
5	US1	HDP3	1	3"	EMT	2	500KCMIL	CU THWN	-	-	CU THWN	1	#3	CU THWN	400A
6	US1	HDP4	1	2.5"	EMT	2	4/0	CU THWN	-	-	CU THWN	1	#4	CU THWN	225A
7	US1	T1	2	2.5"	EMT	2	300KCMIL	CU THWN	-	-	CU THWN	1	#1	CU THWN	500A
8	T1	DP1	3	4"	EMT	3	350KCMIL	CU THWN	1	350KCMIL	CU THWN	1	2/0	CU THWN	1000A
9	DP1	LP1a	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1b	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1c	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1d	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1e	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1f	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1g	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1h	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1i	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP1	LP1j	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2a	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2b	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2c	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2d	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2e	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2f	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2g	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2h	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2i	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A

FEEDER SCHEDULE (CONTINUED)

Tag	From	To	No. of Sets	Conduit (Per Set)		Conductors (Per Set)									Size of Overcurrent Protection
						Phase Conductors			Neutral Conductors			Ground Conductors			
				Size	Type	No.	Size	Type	No.	Size	Type	No.	Size	Type	
9	DP2	LP2j	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2k	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2l	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2m	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2n	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2o	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2p	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2q	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP2	LP2r	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3a	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3b	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3c	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3d	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3e	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3f	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3g	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3h	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3i	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3j	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3k	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3l	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3o	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3p	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP3	LP3q	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4a	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4b	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4c	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4d	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4e	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4f	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4g	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4h	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4i	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4j	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4k	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4l	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4m	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4n	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4p	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP4q	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP5a	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	DP4	LP5b	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP1-C	ELP1a-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP1-C	ELP1b-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP2-C	ELP2a-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP2-C	ELP2b-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP2-C	ELP2c-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A

FEEDER SCHEDULE (CONTINUED)

Tag	From	To	No. of Sets	Conduit (Per Set)		Conductors (Per Set)									Size of Overcurrent Protection
						Phase Conductors			Neutral Conductors			Ground Conductors			
				Size	Type	No.	Size	Type	No.	Size	Type	No.	Size	Type	
9	ELP2-C	ELP2d-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP3-C	ELP3a-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP3-C	ELP3b-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP3-C	ELP3c-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP3-C	ELP3d-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP4-C	ELP4a-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP4-C	ELP4b-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP4-C	ELP4c-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	ELP4-C	ELP4d-C	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
9	THEL	LPHELa	1	2.5"	EMT	3	4/0	CU THWN	2	4/0	CU THWN	1	#4	CU THWN	225A
10	T2	DP2	4	3"	EMT	3	350KCMIL	CU THWN	2	350KCMIL	CU THWN	1	3/0	CU THWN	1200A
10	T3	DP3	4	3"	EMT	3	350KCMIL	CU THWN	2	350KCMIL	CU THWN	1	3/0	CU THWN	1200A
10	T4	DP4	4	3"	EMT	3	350KCMIL	CU THWN	2	350KCMIL	CU THWN	1	3/0	CU THWN	1200A
11	US1	T4	2	3.5"	EMT	3	500KCMIL	CU THWN	-	-	CU THWN	1	1/0	CU THWN	700A
12	US1	ELEV-1	1	2.5"	EMT	3	250KCMIL	CU THWN	-	-	CU THWN	1	#4	CU THWN	250A
13	HLPHELb	THEL	1	1.5"	EMT	3	#1	CU THWN	-	-	CU THWN	1	#6	CU THWN	125A
14	US1	HLP SITE	1	1.25"	EMT	3	#2	CU THWN	1	#2	CU THWN	1	#8	CU THWN	100A
15	US1	ATS #2	2	3"	EMT	3	#2	CU THWN	1	#2	CU THWN	1	#8	CU THWN	600A
15	EDB NS2	ATS #2	2	3"	EMT	3	#2	CU THWN	1	#2	CU THWN	1	#8	CU THWN	600A
15	ATS #2	EHDP1-C	2	3"	EMT	3	#2	CU THWN	1	#2	CU THWN	1	#8	CU THWN	600A
16	US1	ATS #1	2	4"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	1/0	CU THWN	800A
16	EDB NS2	ATS #1	2	4"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	1/0	CU THWN	800A
16	ATS #1	EHDP1-S	2	4"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	1/0	CU THWN	800A
17	GENERATOR	EDB NS2	6	4"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	250KCMIL	CU THWN	2000A
18	EHDP1-S	AH-1	1	3"	EMT	3	500KCMIL	CU THWN	-	-	CU THWN	1	#3	CU THWN	350A
18	EHDP1-S	AH-2	1	3"	EMT	3	500KCMIL	CU THWN	-	-	CU THWN	1	#3	CU THWN	350A
19	EHDP1-S	EMCCR-S	2	3"	EMT	3	500KCMIL	CU THWN	-	-	CU THWN	1	1/0	CU THWN	800A
20	EHDP1-S	ELEV-2	1	1.5"	EMT	3	2/0	CU THWN	-	-	CU THWN	1	#6	CU THWN	175A
20	EMCCR-S	EF-1	1	1.5"	EMT	3	2/0	CU THWN	-	-	CU THWN	1	#6	CU THWN	175A
20	EMCCR-S	EF-2	1	1.5"	EMT	3	2/0	CU THWN	-	-	CU THWN	1	#6	CU THWN	175A
20	EMCCR-S	EF-3	1	1.5"	EMT	3	2/0	CU THWN	-	-	CU THWN	1	#6	CU THWN	175A
21	EHLPHEL-S	ETHEL-S	1	3/4"	EMT	3	#10	CU THWN	-	-	CU THWN	1	#10	CU THWN	25A
22	ETHEL-S	ELP-g	1	1"	EMT	3	#4	CU THWN	1	#4	CU THWN	1	#10	CU THWN	60A
23	EHLPHEL-C	ETHEL-C	1	1"	EMT	3	#4	CU THWN	-	-	CU THWN	1	#8	CU THWN	70A
23	EHLP1-S	ET1-S	1	1"	EMT	3	#4	CU THWN	-	-	CU THWN	1	#8	CU THWN	70A
23	EHLP2-S	ET2-S	1	1"	EMT	3	#4	CU THWN	-	-	CU THWN	1	#8	CU THWN	70A
23	EHLP3-S	ET3-S	1	1"	EMT	3	#4	CU THWN	-	-	CU THWN	1	#8	CU THWN	70A
23	EHLP4-S	ET4-S	1	1"	EMT	3	#4	CU THWN	-	-	CU THWN	1	#8	CU THWN	70A
24	ETHEL-C	ELPHEL-C	1	2"	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	#6	CU THWN	150A
24	ET1-S	ELP1-S	1	2"	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	#6	CU THWN	150A
24	ET2-S	ELP2-S	1	2"	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	#6	CU THWN	150A
24	ET3-S	ELP3-S	1	2"	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	#6	CU THWN	150A
24	ET4-S	ELP4-S	1	2"	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	#6	CU THWN	150A
25	EHLP4-C	EHDPR-C	1	1"	EMT	3	#6	CU THWN	1	#6	CU THWN	1	#10	CU THWN	50A
26	EHLP2-C	ET2-C	1	1.5"	EMT	3	1/0	CU THWN	-	-	CU THWN	1	#6	CU THWN	150A
26	EHLP3-C	ET3-C	1	1.5"	EMT	3	1/0	CU THWN	-	-	CU THWN	1	#6	CU THWN	150A
26	EHLP4-C	ET4-C	1	1.5"	EMT	3	1/0	CU THWN	-	-	CU THWN	1	#6	CU THWN	150A
26	EHLP1-C	ET1-C	1	1.5"	EMT	3	1/0	CU THWN	-	-	CU THWN	1	#6	CU THWN	150A
27	ET1-C	ELP1-C	1	4"	EMT	3	500KCMIL	CU THWN	2	500KCMIL	CU THWN	1	#3	CU THWN	400A

FEEDER SCHEDULE (CONTINUED)															
Tag	From	To	No. of Sets	Conduit (Per Set)		Conductors (Per Set)									Size of Overcurrent Protection
						Phase Conductors			Neutral Conductors			Ground Conductors			
				Size	Type	No.	Size	Type	No.	Size	Type	No.	Size	Type	
27	ET2-C	ELP2-C	1	4"	EMT	3	500KCMIL	CU THWN	2	500KCMIL	CU THWN	1	#3	CU THWN	400A
27	ET3-C	ELP3-C	1	4"	EMT	3	500KCMIL	CU THWN	2	500KCMIL	CU THWN	1	#3	CU THWN	400A
27	ET4-C	ELP4-C	1	4"	EMT	3	500KCMIL	CU THWN	2	500KCMIL	CU THWN	1	#3	CU THWN	400A
28	EHDP1-C	PCWP 1	1	1"	EMT	3	#6	CU THWN	-	-	CU THWN	1	#10	CU THWN	50A
28	EHDP1-C	PCWP 2	1	1"	EMT	3	#6	CU THWN	-	-	CU THWN	1	#10	CU THWN	50A

NOTES:

1. REFER TO SINGLE-LINE DIAGRAM FOR FEEDER TAGS
CU = COPPER