Corbin Building

Final Summary Report

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AE 481W
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Corbin Building

New York, NY

Matt Trethaway | Lighting/ Electrical

http://www.engr.psu.edu/ae/thesis/portfolios/2012/MTT5034/index.html

Building Statistics

- Location: 192 Broadway
- Building Occupancy: Retail | Office
- Size: 53,000 Square Feet
- Cost: $59.5 Million
- Project Delivery: Design-Bid-Build

Project Team

- Owner: Metropolitan Transit Authority
- CM: Judlau Contracting
- Architect: Page Ayres Cowley Architects
- Engineers: Arup

Architecture

- Restoration of exterior façade and interior
- Detailed terracotta façade
- Intricately decorated grand staircase
- Two express escalators from modern lobby to subway platform

Lighting

- Normal and emergency lighting is powered by 120V
- Offices use linear direct/indirect fluorescent fixtures
- Lobby uses recessed downlights with compact fluorescent lamps
- Occupancy sensors controls

Electrical

- Service entrance located on 5th floor
- 1200A switchboard located in basement
- Building utilization 265/460V and 120/208V
- Emergency power 30KVA UPS can run 24KW for 15mins

Mechanical

- 7 Air handling units with a total of 43,225 SCFM
- Steam feed from neighboring building
- Steam to liquid heat exchanger
- Constant volume distribution system

Structural

- Masonry spread and strip footings
- Exterior masonry columns
- Floors consist of existing wrought iron beams with terracotta arches

Executive Summary

The Corbin Building is a restoration of the existing building to restore the façade to the 1917 era and upgrade all the existing building systems. The Corbin Building consist of two retail spaces, an entrance to the Fulton Street Transit Center/subway on the street level and floors two through nine are offices.

This report is the final submission report for the AE Senior Thesis Studio. The main topic of this report covers the lighting redesign of four key spaces throughout the building, the 3rd floor office, the Fulton Street Transit Lobby, the façade and retail space 1. The lighting redesign was based on renovation and integration into the design of the transit center while preserving its historical character. The lighting design will highlight historical character with modern light sources and fixtures.

In addition to the lighting redesign, the electrical depth modified the branch circuit distribution for each space listed above to adapt the lighting redesign. Feeders and panels were analyzed for coordination and voltage drop. A protective device coordination study was performed along with short circuit analysis for a path originating at the utility entrance, through the main switchboard and to the lighting panel on the fourth floor. SKM was used to do a short circuit analysis, load flow analysis and arc fault study for the entire electrical distribution system. A cost comparison of using bus duct was completed for an alternative solution to the existing rigid steel conduit and wire feeder for the main feeder to the switchboard.

An architectural breadth was conducted to design an architectural layout for retail space 1. The design included creating a modern luxury boutique clothing store. A mechanical breath was integrated with the lighting and architectural redesigns to create a visually please duct layout. A daylighting study on the office was done to see how much daylight penetration occurs with tall surrounding buildings, for a MAE focus using AE565 knowledge.

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Corbin Building Statistics

Location .... 192 Broadway
New York, NY

Building Occupancy .... Retail/ Office

Size .... 53,000 Square Feet

Number of Stories .... 9 Stories above grade 2 below grade

Project Team

Owner .... Metropolitan Transit Authority (MTA)
http://www.mta.info/capital/index.php

General Contractor .... Judlau Contracting, Inc.
http://www.judlau.com/

Architect .... Page Ayres Cowley Architects, LLC
http://www.pac-architects.com

Engineers .... Arup
http://www.arup.com/

Construction Dates 01/2010-12/2012

Cost .... $59.5 million
Restoration and repairs to the building

Project Delivery Method .... Design-Bid-Build

Architecture

The Corbin Building includes retail stores at street level and office space in the upper floors, in the heart of lower Manhattan. The design of the Corbin Building is restoration so it looks just like it did in 1910-1917. While still incorporating a new subway entrance to connect to the Fulton Street Transit Center using an escalator threw the basement of the Corbin Building.

Major Codes:
New York State Building Code 2002
New York City Building Code
New York City Electrical Code

Zoning:

Commercial District (C5-5) with continuous retail frontage

Historical Requirements:

The Corbin Building is going to be restored with the façade from 1910-1917. On December 18th 2003 the Corbin Building was added to the National Register of Historic Places.

Roofing

There are two types of roofs on this building. The first type is the slanted roof on the East and West towers. They are cover in a 2" metal barrel tile with red kynar paint. Under the metal tiles are a 3" galvanized steel deck and new steel frame. The second type of roof is a flat roof that covers the building which is designed to NYCTA Specifications.

Sustainability

Existing building was preserved during construction

Install brand new efficient HVAC system

Construction:

The restoration of the Corbin Building is part of the construction of the Futon Street Transit Center. The project delivery method was design-bid-build, with this method the project was broking into five contracts. The Corbin Building was renovated while the construction of the transit center was being built. Scheduling has been important since many contracts are intertwined with other contracts. For the safety of the people on the street a full cage around the building had to be constructed with nets and scaffolding when restoring the façade.

Electrical:

The electrical distribution system in the Corbin Building is provided by Con Edison. The service entrance comes from the fifth floor of the Fulton Street Transit Center (FSTC), which is the neighboring building on the north-side. The service entrances enters the Corbin Building on the fifth floor and goes down to the basement to feed a 1200A switchboard with a AIC rating of 100K which than services other branch circuits of the electrical system.

There are two voltages in the building, the primary voltage is 265/460V, 3PH, 4W and the secondary voltage is 120/208V, 3PH, 4W. The mechanical, escalator and elevator systems run on 460V. The lighting and plug loads run on 120V. The emergency backup system consists of a UPS to operate the emergency lights.

Lighting:

The lighting system in the Corbin Building consists of fluorescent and incandescent sources. All the lighting in the building is operating at 120V. In the offices there are direct/ indirect fluorescent two T8 lamps pendant fixtures. Lighting within the Corbin Building makes use of different control systems. In the open offices the linear fluorescent pendants are controlled with occupancy sensors. The copy rooms and storage areas use a typical switch to turn on and off the lights in those areas. Recessed downlights with compact fluorescent lamps are located in the lobby. The lights in the lobby are not switched because the New York City Electrical Code requires the lobby of the subway entrance to always be on for safety. Incandescent lamps are used in replica pendants and wall sconces to match the original grand staircase and restore the feeling back to 1917.

Mechanical:

The mechanical systems consist of constant volume air handing units serving the retail and office spaces. Each air handing unit distributes 6,400 CFM per floor (floors 2-9) with a dedicated outdoor air system unit on level nine providing fresh air to constant volume air handing units. Fan coil units serve the street level retail spaces.

Chilled water supply service is coming from the central 1500 ton chiller plant in the Fulton Street Transit Center at 300 GPM at 42 degrees F. Heating hot water supply is coming from the steam to water shell and tube heat exchanger in the Corbin Building at 585 GPM at 200 degrees F.

Structural:

The structural system is the existing system from original construction. The building is a brick masonry building with wrought iron beams. The building is supported in the basement by inverted brick arches. Some of structure is being fixed and replaced with modern steel. The Corbin Building uses an eight bay layout that is eleven stories. The beams are existing fifth-teen inches deep and frame into twenty-four inches deep girders, and then go into HSS4x4x1/2 columns. The slabs on floors two through nine use a two and half inch light weight concrete.

Lighting Design Overview

The overall lighting design goal was renovation and integration into the design of the transit center while preserving its historical character. The four lighting spaces to be analyzed and redesigned include:

large workspace | Open Office 3rd floor
circulation space | lobby
exterior space | façade
special purpose space | retail space 1

The redesign and restoration of the Corbin Building to the 1917 era includes restoring many detailed ceilings, window moldings and façade. This detail is not found on many buildings in the area and the lighting will highlight many of these architectural details to make the building stand out and create presents in the neighborhood.

The lighting must be designed to meet IESNA handbook recommendations and ASHREA 90.1 code. Included in the lighting analysis are a summary of the space, design concepts, criteria and considerations, equipment and control schedules and all the technical documentation for the design.

3rd Floor Open Office- Large Work Space

Lighting Redesign

Space Description

The large work space consists of an open office plan on the third floor. The floor area of the open office is about thirty-two feet wide by 162 feet long and with twelve foot ceilings, and an approximate area of 5,184 square feet. The north wall of the office has no windows just two doors that go into the Fulton Street Transit Center building next door. On the west end of the office there is a bay window the length of the wall. The south wall is filled with restored cast-iron windows. The ceiling in the consists of original arch vaults. The vaults run both north to south and east to west creating a non-unformed grid on the ceiling.

Task/ Activities

The task preformed in this space would be administrative tasks, reading and writing. I assumed that the primary task will be computer task for extended periods of time thought the day. Writing and oral communication are also critical task within the office. The north wall is where the main corridor and will be the main path for movement within the office.

Materials

Surface	Material	Color	Reflectance
Walls	GWB	China White	0.8
Window	Glass	Low -E	τ= .7
Floor	Carpet	Blue	0.2
Ceiling	Plaster	White	0.6

Table 1: Open Office Finishes

Open Office Floor Plans and Sections

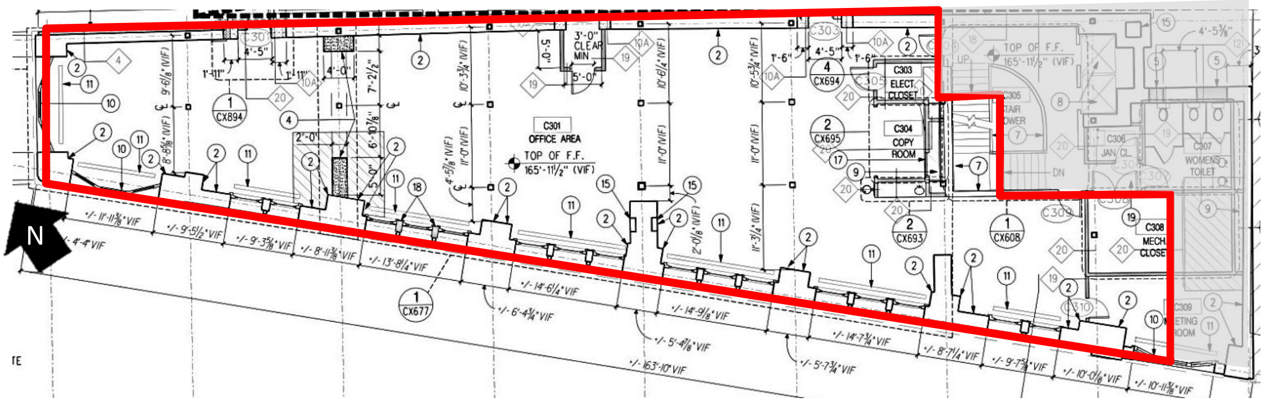


Figure 1: 3rd Level Floor Plan

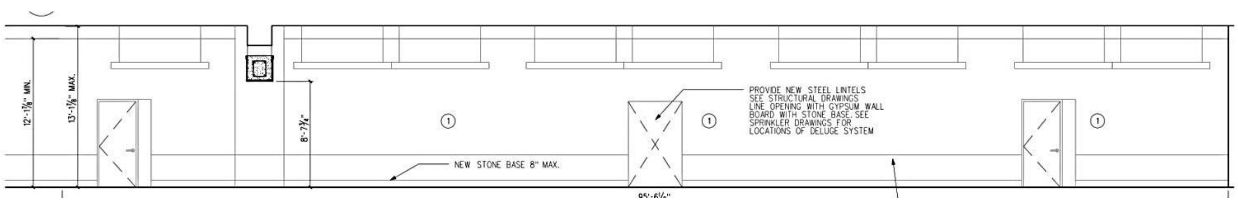


Figure 2: 3rd Level North Elevation

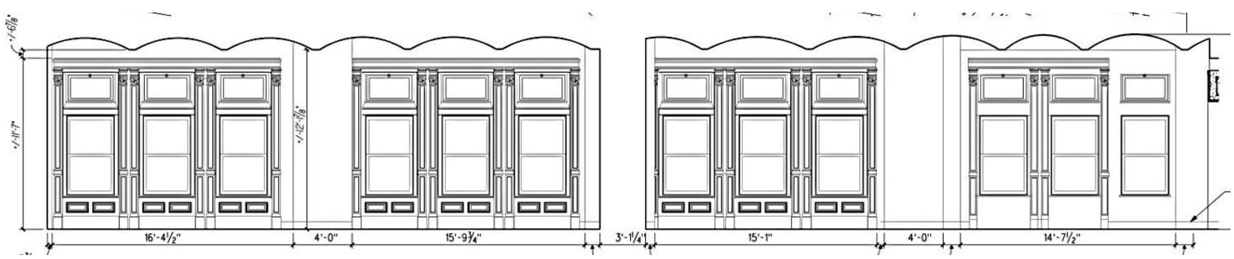


Figure 3: 3rd Level South Elevation

Lighting Design Considerations and Criteria

Quantity of Light

2010 IESNA handbook:

Age of at least half the observers is between 25 and 65 years old.

- Desired illuminance levels office- VDT Screen and Keyboard CSA/ISO Types I and II positive polarity
    - Horizontal-30 fc at 2'-6" AFF
    - Vertical- 15 fc at 3'-6" AFF
- Circulation space
    - Horizontal- 20 Fc at AFF

ASHRAE 90.1-2010: Space by Space

- Office- Open Plan LPD 0.98W/ft^2

NY State Energy Code 2007

- LPD Office 1.1 W/ft^2

Quality of Light

The open office should feel spaciousness since it is a very narrow building and desk might feel like they are top of each other. The south walls already have windows to allow natural daylight in, but the north wall creates a dark environment. Placing light on the north perimeter wall, it will give the impression of a larger open area. The ceilings are arched and vaulted which is not common in a typical office, so visitors will be looking at the ceiling which means the luminaires choice is very important. By having this decorative ceiling creating visual clarity for task in the space is easy by creating a brightly light attractive ceiling to bounce light back down to the space and provide a uniform illuminance across the work plane.

Design Considerations

Appearance of Space and Luminaires-
Since the building has such unique arched vaulted ceilings the luminaires need to match the space. The luminaires should be consistent with the architectural forms and use rounded edges and curved surfaces.

Color Qualities of Light-
In an office color rendering is important for both creating a pleasant place to work and see colors on documents. An office works with a lot of colors and layouts and needs to ensure their print materials are attractive. Also skin tones need to look presentable for people interactions and meetings. The lamps will have a CRI of 85 and a CCT of 4100K.

Control-
Occupancy sensors will be used to control the lights. This will help save money and energy on the lighting by turning off the lights when no one is in that space.

Flicker/ Strobe-
Flicker and strobe lights can cause headaches and is annoying to occupants. This will cause loss revenues and poor working conditions.

Direct and Reflected Glare-
When a VDT is used in an office it is important to minimize glare so the employees are comfortable and productive, while enhancing contrast for VDT and reading and writing task. Luminaire location is important so it is not in view of the computer monitor. Shades will be used on the windows to prevent direct sun on the work surface.

Light Distribution on Task Plane-
Light distribution on the task plane should be uniform on the workstation at the correct light level of 30 footcandles.

Model of Faces and Objects-

Occupant's skin tones should look healthy under electric lighting. Facial recognition is important in face to face meetings and also when interacting with someone in the office.

Luminances on Room Surfaces-
Having light on the wall and ceiling creates a feeling of spaciousness within a very narrow office.

Lighting Solution Overview

Visual clarity was a critical design factor so people can function in the space and perform critical tasks. The architecture was enhanced by picking a visual appealing fixture that meet the lighting levels needed for an office without delivering glare on computer screens was the most critical design goal. A parabolic shaped fixture was chosen to mimic the arched vault ceiling and provide uplight to highlight the ceiling, and direct illuminance to prevent a cave effect. The north wall had vertical illumination from the pendant fixtures mounted next to wall, and provide perimeter lighting.

At the entrance and around the copy room the ceiling is lower and pendant mounted fixtures would hang to lower in that area. Recessed compact fluorescents were used to light the space, since they create a clean ceiling and do not take away from the architectural vaulted ceiling. Lamps with a CRI greater than 82 were selected to provide adequate color rending for people and task.

Luminaire Schedule

LIGHTING EQUIPTMENT SCHEDULE						
Type	**Picture**	**Mounting**	**Catalog # | Manufacturer**	**Description**	**Lamp**	**Input Watts**
A		Pendant	EGSCM4-2-28T5-SSB-R4-120-GEB10-1SE-EC-SCT-LP835-FC2-24-C100 PEERLESS LIGHTING	Housing and endcaps are made from extruded aluminum. Die formed reflectors with white enamel finish. Shielding uses an 18" parabolic semi-specular aluminum baffles. Satin anodized finish is applied to the fixture. Pendant mounted on aircraft cable 24" long.	(2) T5 LAMPS LUMENS: 2600 CCT: 4100K CRI: 85	59
B		Recessed	P926FM-SP Kurt Versen	Steel housing with twist lock socket. Flush mount design with 5 7/8" opening with a graphite softglow cone.	(1) 32W Triple Tube CFL Lumens: 2400 CCT: 4100 CRI: 82	36

Table 2: Luminaire Schedule

Light Loss Factors:

Light Loss Factors				
Lamp Type	**LLD**	**LDD**	**BF**	**Total**
A	0.92	0.91	0.95	0.80
B	0.90	0.91	0.98	0.80

Table 3: Light Loss Factors for Open Office

Assumed a 24 month cleaning cycle.

Control Scheme

The main goal for the control scheme in the office is to provide energy savings when the occupants are not in the space. This will be done by using occupancy sensors to turn the lights on and off when occupants are only in the space. Each bay is circuited together so if one person is working in a specific area the other areas can turn off. A daylight study is conducted later in the report under the MAE daylighitn anyalsis to see if dimming is a cost effective addition.

Control Equipment Schedule				
Product	**Manufacture**	**Part Number**	**Technology**	**Description**
Sensor	WattStopper	DT-200	PIR/ Ultrasonic	Dual technology ceiling/wall sesnsor with PIR and ultrasonic technologies. Time delays can be autoset or fixed. Operatetion voltage 24VDC.
Power Pack	WattStopper	B347D-P	-	Power pack provides 24VDC operating voltage to all WattStopper 24VD occupancy sensors and daylighting controlers.

Table 4: Office Control Equipment Table

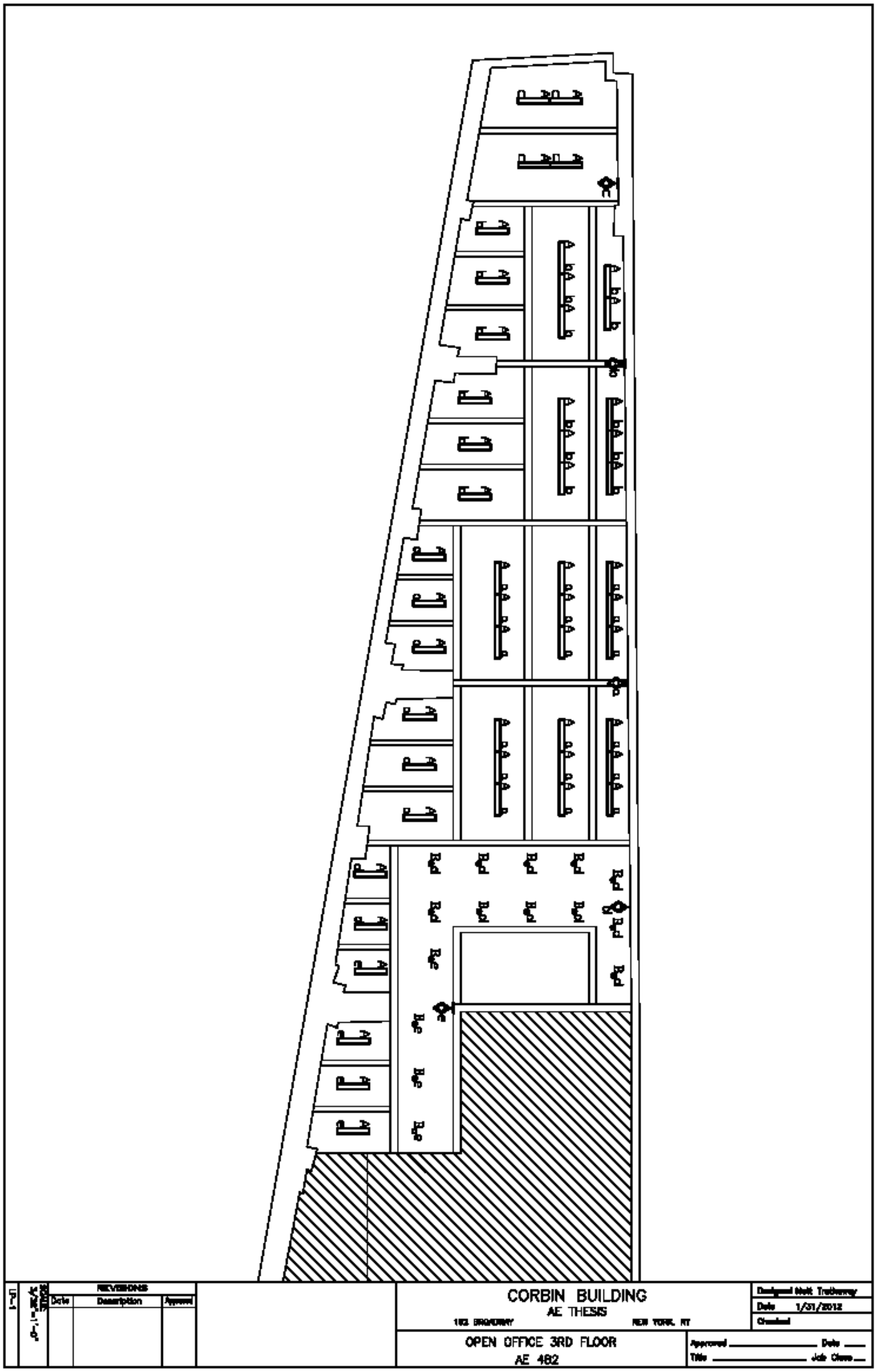


Figure 4: Lighting Plan

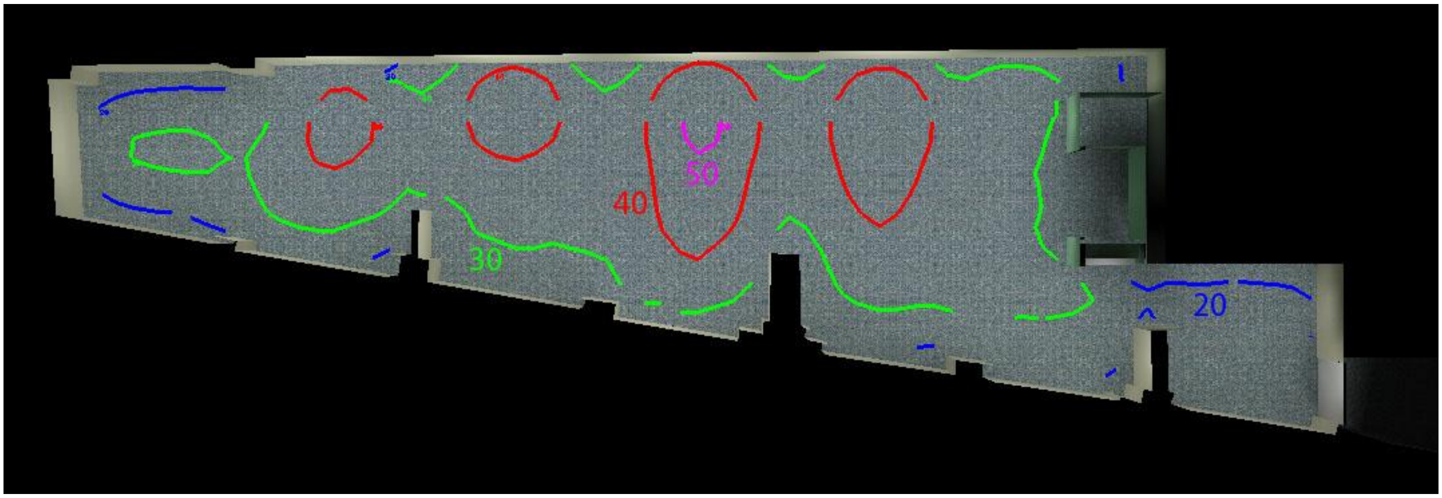


Figure 5: Isolines

Visual Performance Renderings

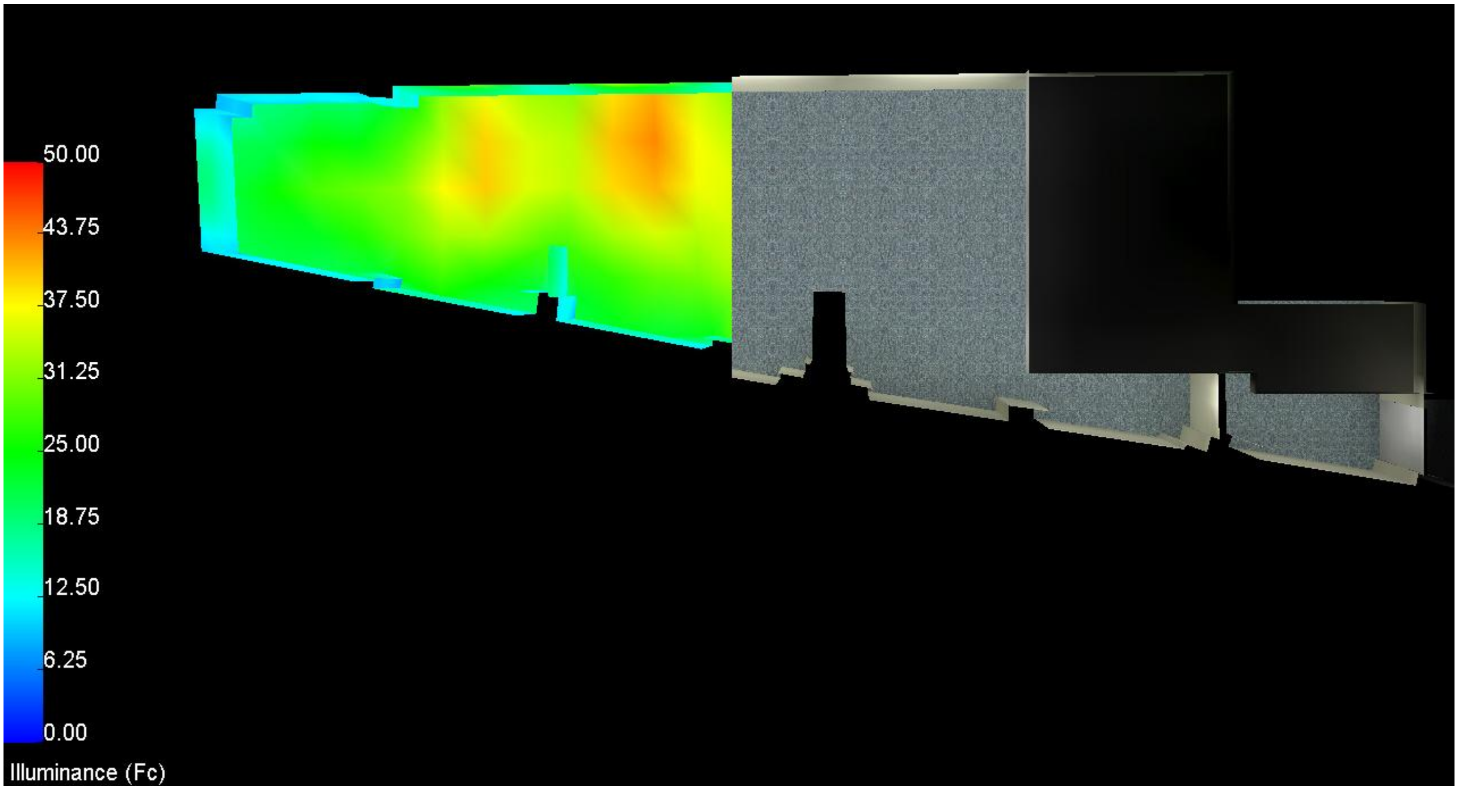


Figure 6: AGI32 Pseduo and Rendering Top View

Figure 7: AGI North Elevation

Figure 8: Office Rendering

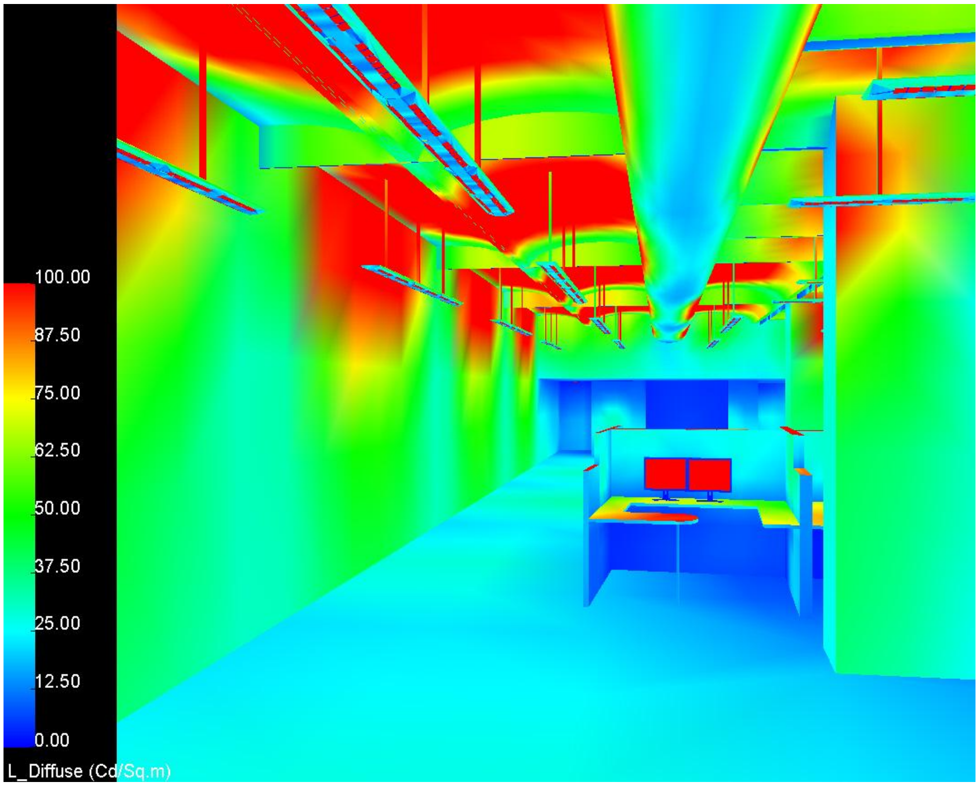


Figure 9: AGI32 Pseduo Color Rendering- Luminance

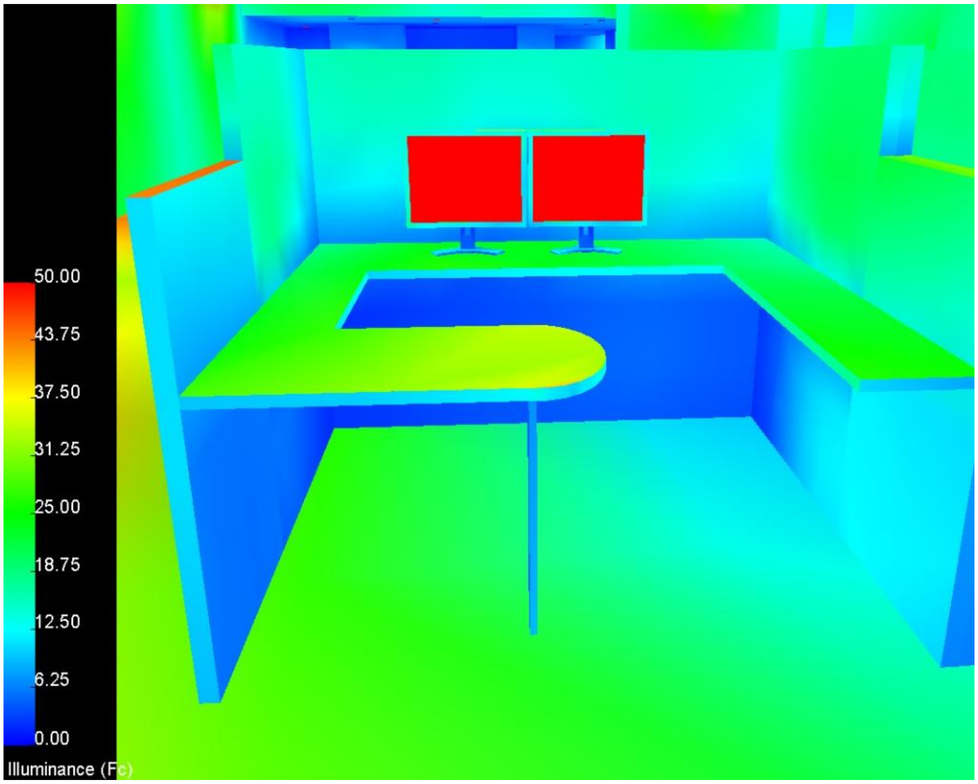


Figure 10: AGI Pseudo Color Rendering of Desk- Illumiance

Illuminance Values				
	Average (Fc)	Max (Fc)	Min (Fc)	Max/Min (Fc)
Open Office	30.4	52.1	14.3	3.64
Circulation	30.7	51.3	10.7	4.79

Table 5: Illumination Values of the Open Office

Energy Code Compliance

ASHREA 90.1-2010 Energy Calculation

Office Lighting Power Density			
Type	**Quantity**	**Input Watts**	**Total Watts**
A	51	59	3009
B	15	36	540
		Total Watts	3549
		Total SF	3903
		ASHREA 90.1 (W/SF)	1.1
		LPD (W/SF)	**0.91**

Table 6: Office Lighting Power Density

Evaluation

The bright, uniform lighting layout provides the open office with plenty of light on the work plane and an inviting place to work. The even illuminance across the workplane provides enough light at any location in the office to perform required task. The pendant lights have an arch shape to complement the arch ceiling. The ceiling is brightly illuminated with uplight to draw attention to the arch vaulted ceilings which acts like a giant reflector to bounce diffuse light back into the space. This also prevents glare on people's computer screens, and the direct component provides the vertical illuminance needed. The desks have been placed north to south so the daylight entering the space is perpendicular to prevent direct sun on a worker's computer screen. The fixtures near the north wall create scallops, which were intently done to help balance the daylight entering on the south side. Art work can be placed in middle of the scallops to draw attention to art, while highlighting it at the same time.

A CRI of 82 or greater was used in the space to provide good color rendering, so workers can see proper colors and healthy skin tones. Providing proper rendering of skin tones of employees and other visitors is critical to create a comfortable work space. The circulation space was originally placed against the north wall, but tenants might decide to use that space for desk and have a center aisle, which is why the corridor was illuminated over the IESNA recommended value of 20fc to 30fc to be illuminated the same as the office. This design also allowed for tenant flexibility to use the space in which best fits their needs.

The fixtures are divided into zones, so each group is controlled separately. This was accomplished by using WattStopper occupancy sensors to save energy when the workers are not in that specific zone. This design meets the IESNA standards and has a lower lighting power density than ASHREA demands. This design is architecturally pleasing and energy efficient.

Fulton Street Transit Center Lobby- Lobby Space

Lighting Redesign

Space Description

The Fulton Street Transit Center (FSTC) lobby is an important entrance for the subway system. The lobby is meant to transition people from the street to the subway system or FSTC. Inside the thrity-seven foot wide by thrity foot long double height lobby there are two express escalators which bring you to the platform level of the subway system inside the FSTC. The space is a connection from the historical Corbin Building to the ultra-modern FSTC. The new subway lobby architectural style brings many new features to an entrance not seen in other subway entrances, such as escalators and copper panels.

This lobby will have thousands of people passing though each day, while spending only a few seconds in the space. The space will be very congested during rush hours and movement through the space is the most important functions.

Task/ Activities

The purpose of the lobby is to move people from the exterior to the interior of the building. The most important activity in the lobby would be the movement of people. Tourists will be reading a map trying to navigate their way through the subway or the streets of lower Manhattan. A lobby is also a place to meet people and should feel safe.

Materials

Surface	Material	Color	Reflectance
Walls	GWB	China White	0.8
Walls	Copper	Copper	0.8
Window	Glass	Clear	τ= .5
Door	Glass	Clear	τ= .5
Door	Steel	Black	0.5
Floor	Granite	Black	0.2
Sign	Steel	Black	0.2
Ceiling	Plaster	White	0.6

Table 7: Lobby Materials

Lobby Floor Plans and Sections

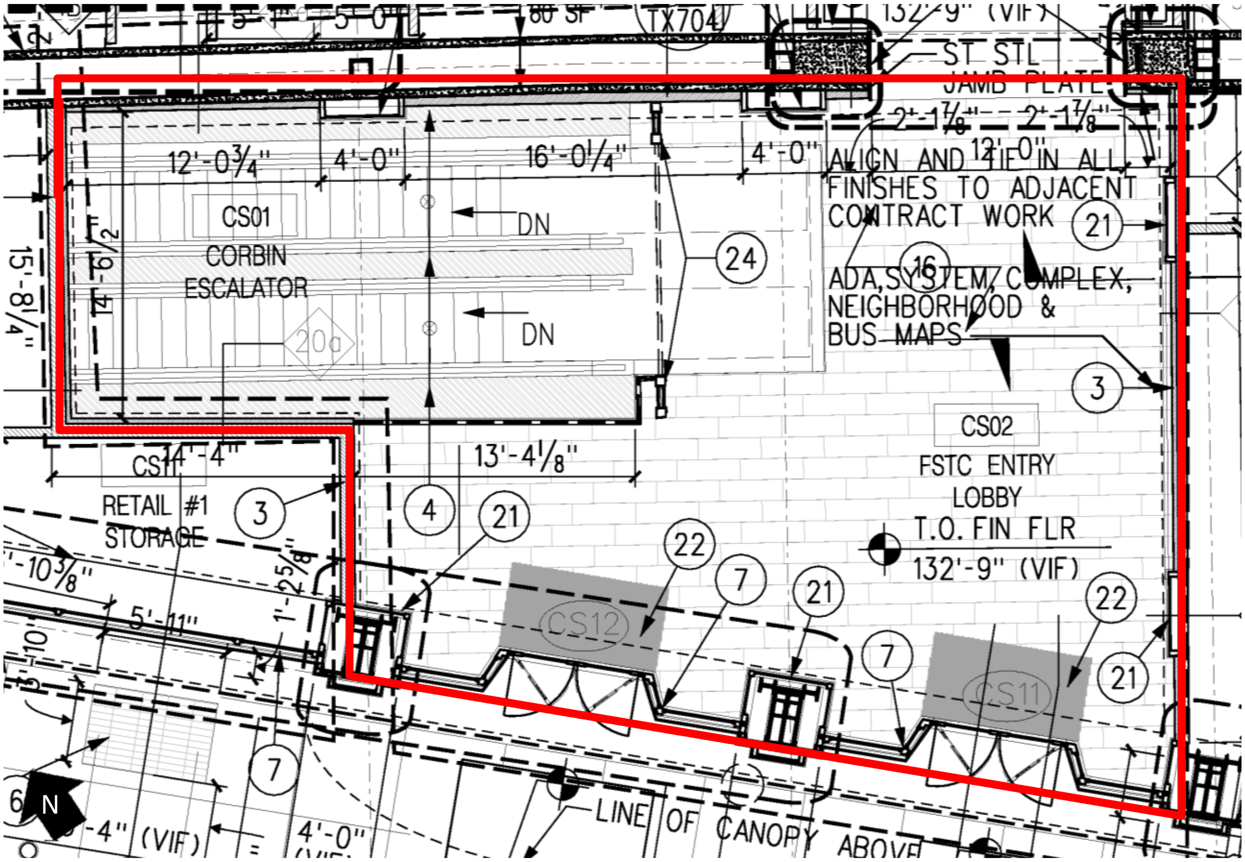


Figure 11: Floor Plan

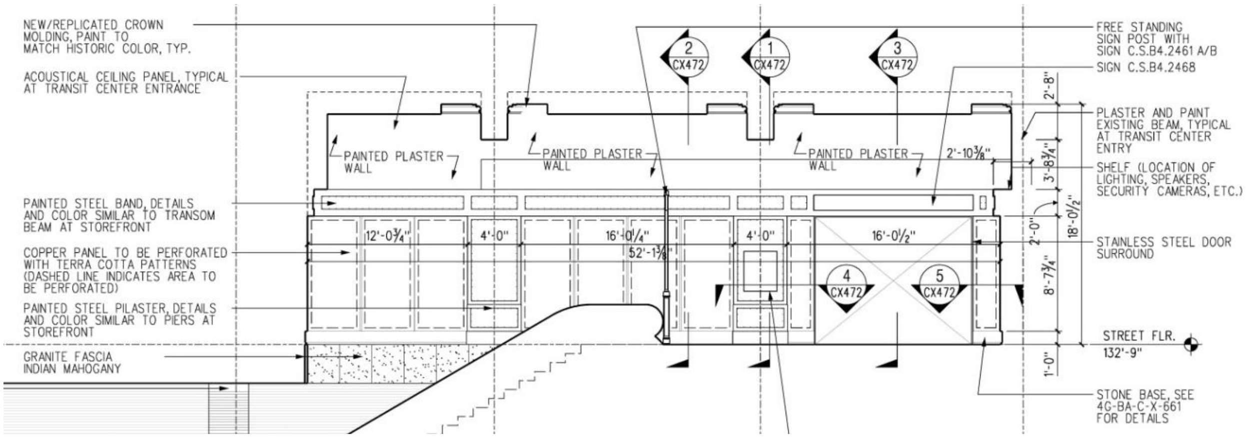


Figure 12: North Section

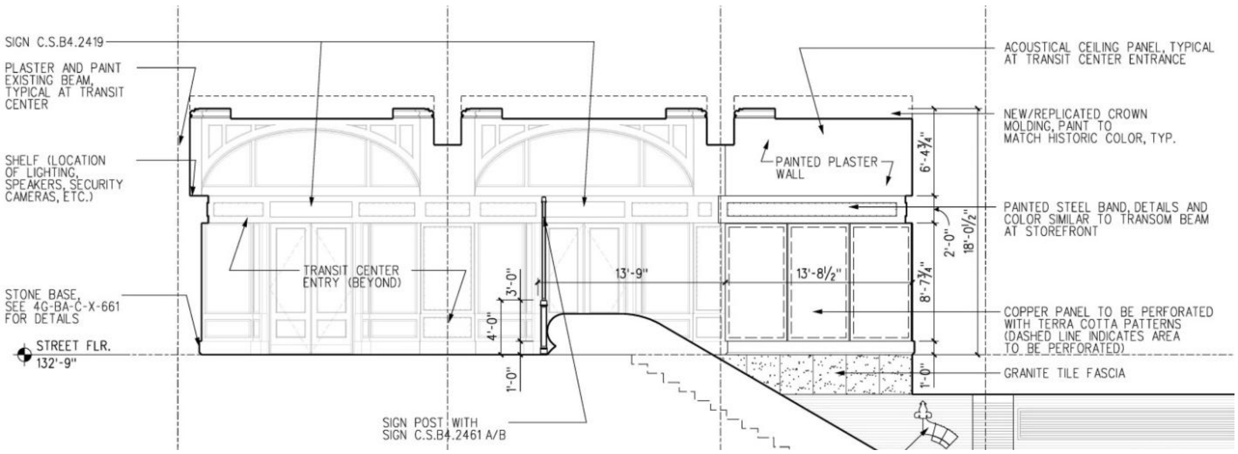


Figure 13: South Section

Lighting Design Considerations and Criteria

Quantity of Light

2010 IESNA handbook:

- Escalators
  - Horizontal- 5 fc at floor
  - Vertical- 3 fc at 5'AFF
- Lobbies at building entries
  - Day
    - Horizontal- 10 fc at floor
    - Vertical- 3 fc at 5'AFF
  - Night
    - Horizontal- 5 fc at floor
    - Vertical- 2 fc at 5'AFF

ASHRAE 90.1-2010: Space by Space

- Lobby- LPD 1.3 W/ft^2

MTA New York City Transit: Planning and Design Guidelines

- Escalators
  - 20-25 fc
- Street-level Entrance Lobby
  - 10-15 fc

NY State Energy Code 2007

- LPD from Table 805.5.2 (Appendix A)
  - Lobby-Other = 1.3W/ft^2
- 805.2.1 Interior lighting controls. Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the

controls or be a remote switch that identifies the lights served and indicates their status.

- Exceptions:
- Areas designated as security or emergency areas that must be continuously lighted.
- Lighting in stairways or corridors that are elements of the means of egress.

Quality of Light

The lobby should be a space will a person feels comfortable and safe. This lobby should feel spacious by placing light on to the walls and ceiling to give the impression of a larger volume. Way finding and visual clarity of the signs and ability to read small text are the main task. To promote safety the space will be illuminated so it creates the feel of being safe.

Design Considerations

Color Qualities of Light-
Color rendering and color temperature have a strong influence on the person's sense of clarity. To get good color appearance lamps will be chosen with a CRI greater than 80 and a CCT of about 4100K. This will help the signs and subway maps show the vibrant colors.

Direct and Reflected Glare-
Direct and reflected glare can cause annoyance and pain. The lights need to be aimed so there is no glare in the pedestrians' eyes that are coming up the escalator. Also need to be away of glare coming off the copper walls.

Light Distribution on Task Plane-
Light distribution on the floor is critical since it's the main task of the space people need to see where to walk.

Model of Faces and Objects-
Lighting a façade provide pedestrians with a sense of security within the lobby. Lamps with a CRI of above 80 will help with identifying people and distinguishing colors.

Appearance of Space and Luminaires-
Aesthetic issues are important but since the lobby has been modernized with copper panels. The fixtures are hidden to in the parameter of the space to make the feeling of spacious.

Luminances on Surfaces-
Since the walls are copper the illuminance on the walls need to be done in a way to prevent glare. Also the light needs to be placed carefully to prevent shines and dark spots in the copper.

Lighting Solution Overview

Fulton Street is a very congested part of New York City and the subway entrances are usually very populated spaces. The lighting design solution for space implemented the psychological feeling of spaciousness. This was chosen because it prevents people from feeling claustrophobic. The lighting was concealed to create a visually clean area which creates a streamline design. People will not be in this space very long and by drawing a person's eye to the walls and ceiling will help a person enjoy the space.

The spaciousness impression was created by using cove lighting to create an illuminated ceiling to give the visual impression of the space being taller. Using linear fluorescent provided an even glow on the ceiling to fill the room with ambient light, while providing a uniform illuminance across the floor. The copper panels on the wall have been offset from the wall about eight inches, to allow enough room for a surface mount strip fixture to be attached to the wall behind the panel. The panels will appear to be floating in space with a warm glow from the light bouncing off the copper behind them. This warm glow brightens up the lobby while providing perimeter lighting and creating the impression of a more openness lobby. Recessed metal halide fixtures have been installed over the door ways and escalator to provide additional general illumination to safely get on and off the escalator and exit the building. The brighter areas also provide wayfinding device.

Luminaire Schedule

LIGHTING EQUIPTMENT SCHEDULE						
Type	**Picture**	**Mounting**	**Catalog # | Manufacturer**	**Description**	**Lamp**	**Input Watts**
C		Recessed	37420 ERCO Lighting	4 inch square flush mounted downlight. Cast aluminum frame with Aluminum satin matt anodized reflector. Cut-off angle 30° with frosted class diffuser.	(1) CMH LAMP CDM- TM 35W BASE: GU6.5 LUMENS: 3900 CCT: 3000K CRI: 93	45
D		Cove-Surface	CD-SN-1T8-1C-120 Cooper Lighting- Corelite	Once pier of die-formed steel with standard fixture lengths of 4 feet. Reflectors are highly specular anodized aluminum. Fixture mounts directly to architectural cove and has adjustable aiming system for 5° adjustments.	(1) T8 Lamp Lumens: 2950 CCT: 3000K CRI: 85	30
E		Surface	SNF-128T5-120V-EBT1N Cooper Lighting- METALUX	Narrow bare strip channel of die-formed from steel with fixture length of 4 feet. Baked white enamel finished.	(1) T5 Lamp Lumens: 2600 CCT: 3000K CRI: 85	31

Table 8: Lobby Luminaire Schedule

Light Loss Factors

Light Loss Factors				
Lamp Type	**LLD**	**LDD**	**BF**	**Total**
C	0.85	0.91	1.00	0.77
D	0.94	0.91	0.88	0.75
E	0.90	0.91	1.05	0.86

Table 9: Lobby Light Loss Factors

Assumed a 24 month cleaning cycle.

Control Scheme

Subway stations operate on a twenty four hour, seven day week basis. A station- management system will provide lighting control in all the public areas. The station-management system is already installed in the subway station and the entrance lights will be connected into the system. This gives the building owner remote control of the lobby. The breaker connected to the lights will be a switch rated breaker so the lights can be turned off manually for maintenance or encase of an emergency.

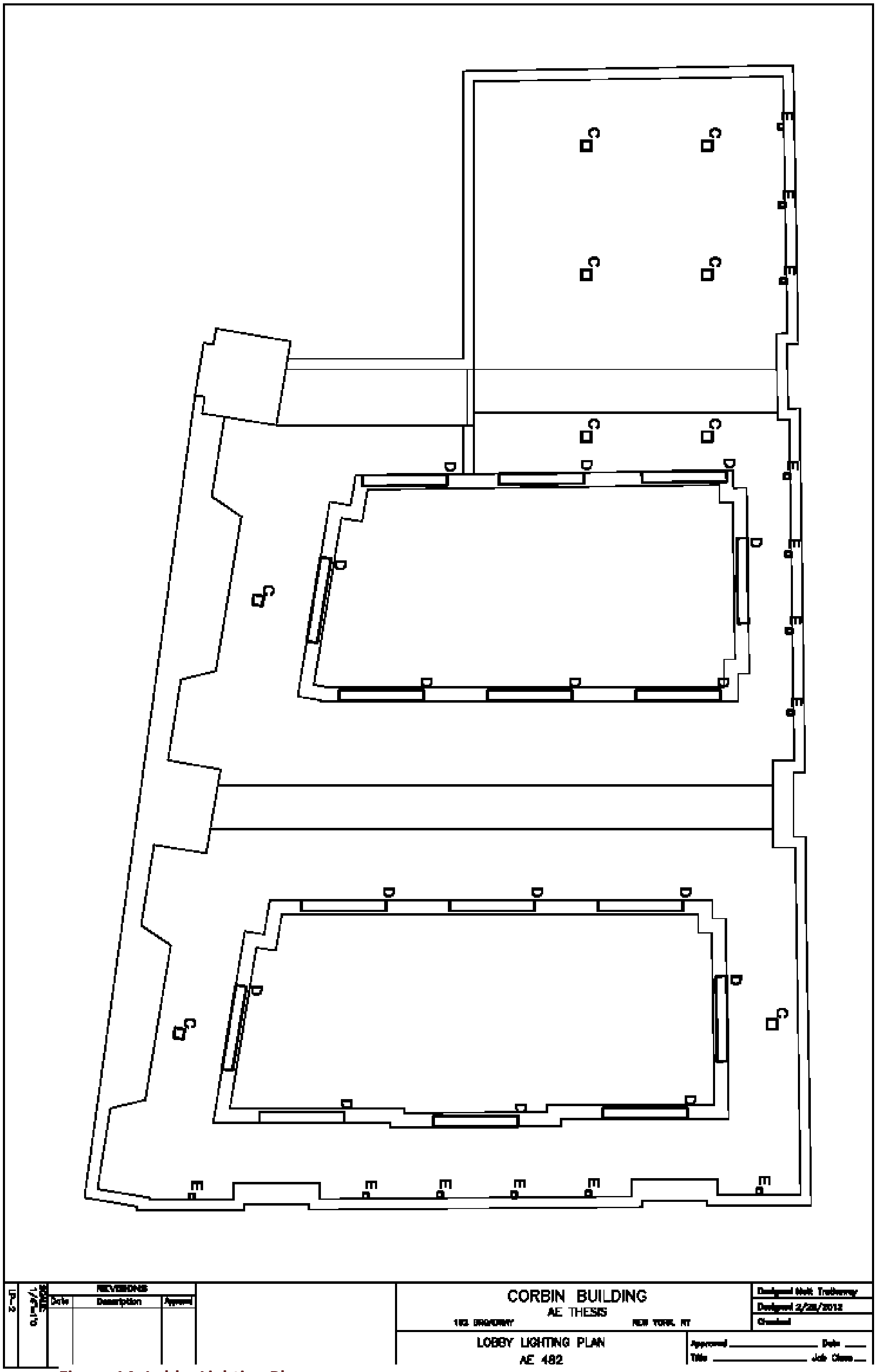


Figure 14: Lobby Lighting Plan

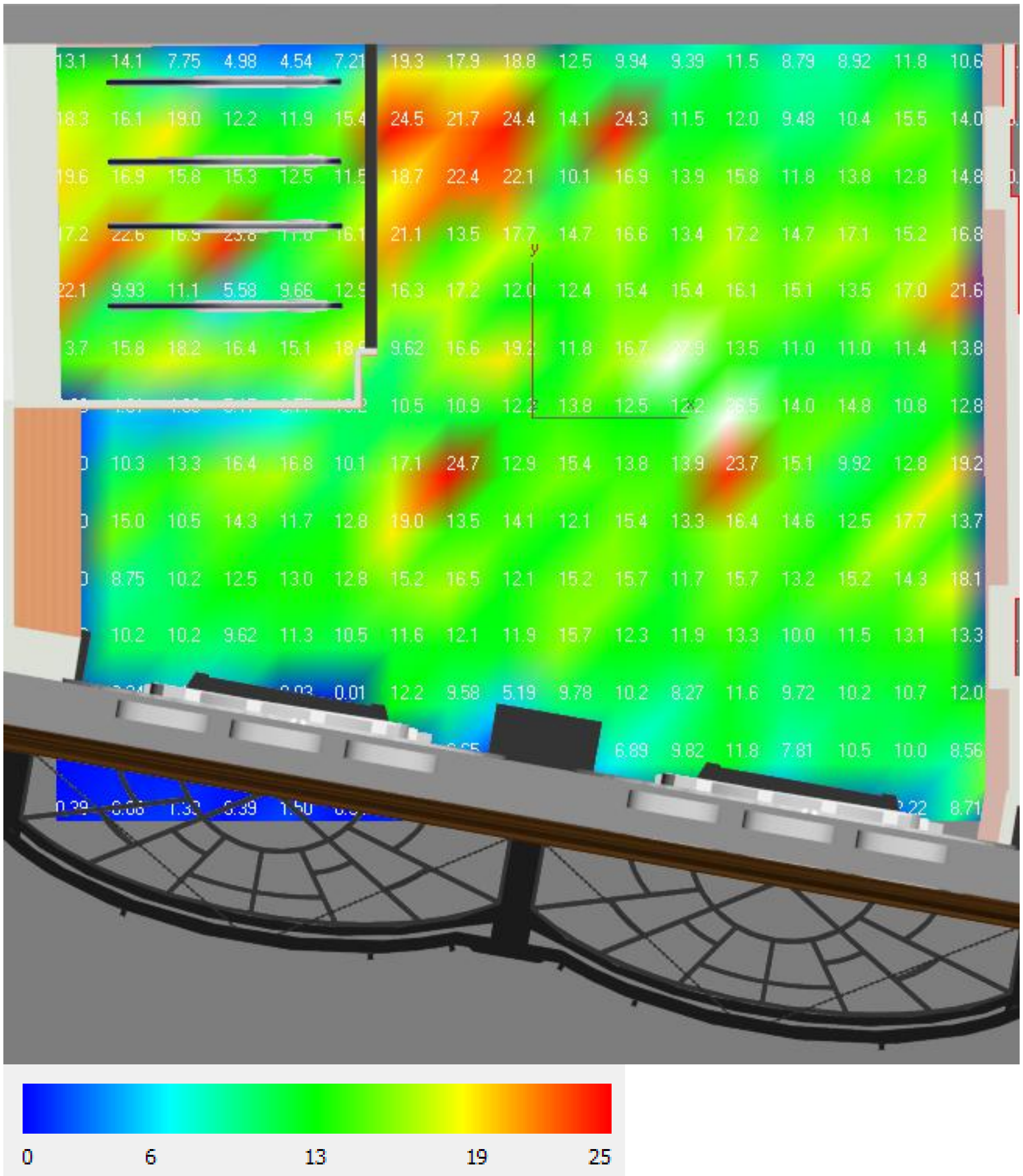


Figure 15: Lobby Illuminance (Fc) Level

Average Illuminance: 13.14 fc

Visual Performance Renderings

Figure 16: Lobby Rendering From Entrance

Figure 17: Lobby Rendering- Looking up Escalator

Energy Code Compliance

ASHREA 90.1-2010 Energy Calculation

Lobby Lighting Power Density			
Type	Quantity	Input Watts	Total Watts
C	9	45	405
D	16	30	480
E	13	31	403
		Total Watts	1288
		Total SF	1460
		ASHREA 90.1 (W/SF)	1.3
		LPD (W/SF)	**0.88**

Table 10: Lobby Lighting Power Density

Evaluation

The lobby lighting design's main goal was to provide general illumination to provide the psychological impression of spaciousness. The new subway lobby architectural style brings many new features to an entrance not seen in other subway entrances. The copper panels provide an interesting focal point around the lobby entrance.

To create a space that a subway rider would remember all the cooper panels were backlight to provide a golden glow on the walls. By backlighting the copper panels, it helps draw attention to the walls and provide the impression of spaciousness, while providing perimeter lighting. This would also create an interesting space that the pedestrian might remember. The ceiling was also highly illuminated to draw attention into the lobby from the street and provide a uniform illuminance across the floor.

The lobby had an average illuminance of about 13 fc which fell in the range of the MTA design guide of 10-15fc. Light sources were concealed to prevent as much glare as possible while going up and down the escalator, so your eye does not look directly into the source and provides a clean ceiling. Lamps of CRI above 85 were specified so skin appearances and facial recognition appears healthy and colors on maps are vibrant. The lighting power density was 0.88 W/SF which was significantly the under 1.3 W/SF.

Façade- Exterior Lighting

Lighting Redesign

Space Description

The façade of the Corbin Building is being restored to the original façade of 1910-1917. The south side of the façade consists of three pieces base, shaft, and crown extending 162 feet along John Street. The building height is about 120 feet tall with two towers on each end. On the street level there are multiple entrances, one is for the Fulton Street Transit Center Lobby and the other is for the Corbin Building, and also two smaller entrances used for the retail stores. The entrances for the retail space are sunk into the thick sandstone walls. The Corbin Building stair entrance is an extruded void in to the building. The only entrance that sticks out is the Fulton Street Transit Center lobby. There is also an awning over the door to symbolize the main entrance. This is the most important entrance since it is going to be the most used and needs to be easily found. Secondary entrances are the retail and the main entrance to the Corbin Building lobby along with the window displays.

Task/ Activities

The façade creates a wayfinding for pedstrians to find the subway. People will be walking down the sidewalk to enter the subway doors at the middle of the building. While some people will be going into the retail stores and also looking at the window displays. The façade lighting needs to create a safe space for pedstrains to walk and feel comfortable and provide enough illumination for pedestrians to see other people. The façade is an extremaly detailed building and is a piece of art that provides decoration to the street scape. The façade is a histrocal element of the building and is the last thing seen outside before assending into a modern subway station.

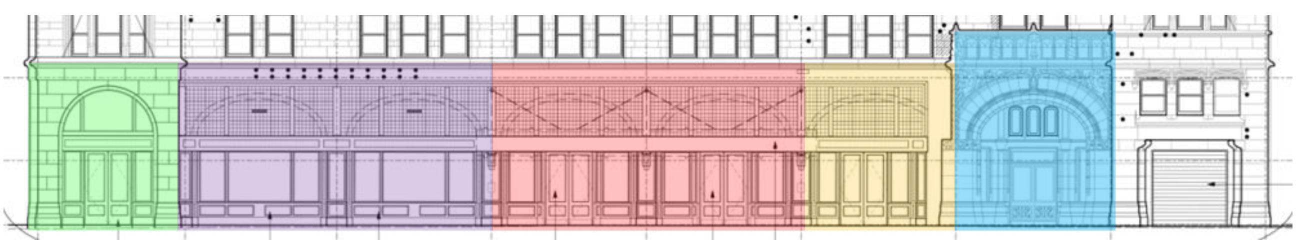
Materials

Surface	Material	Color	Reflectance
Façade	Sandstone	tawny	0.3
Façade	Brick	Red	0.3
Façade	Terracotta	Red	0.4
Door	Glass	Clear	τ= .5
Door	Steel	Black	0.5
Steel	Paint	Black	0.5
Window	Glass	Low -E	τ= .7
Cast Iron	Iron	Black	0.3

Figure 18: Materials for Façade

Façade Elevations

Figure 19: South Elevation



| Retail 1 | Window Displays | FSTC Lobby | Retail 2 | Corbin Lobby |

Lighting Design Considerations and Criteria

Quantity of Light

2010 IESNA handbook:

- Zone: LZ4- High Ambient Lighting
- Façade Details or Features – apply strategically to <25% of the area of the building façade

- Surface Reflectance <0.5= 40fc
- Surface Reflectance >0..5= 20fc

- *Canopied Entries- High Activity- LZ4*
  - *Horizontal- 4 fc*
  - *Vertical- 2 fc*

NY State Energy Code 2007

- LPD for façade 1.0W/ft^2
- 805.6 Exterior lighting. When the power for exterior lighting is supplied through the energy service to the building, all exterior lighting, other than low-voltage landscape lighting, shall have a source efficacy of at least 45 lumens per watt.
- Exception: Where approved because of historical, safety, signage or emergency considerations.
- 805.2.3 Exterior lighting controls. Automatic switching or photocell controls shall be provided for all exterior lighting not intended for 24-hour operation. Automatic time switches shall have a combination seven-day and seasonal daylight program schedule adjustment, and a minimum 4-hour power backup.

ASHRAE/IESNA 90.1-2010: Space by Space

Maximum Power Density

- 0.2 W/ft^2 for each illuminated wall or surface or 5.0 W/ linear foot for each illuminated wall or surface length
- 1.25 W/ft^2 for Canopies and Overhangs
- 30W/linear ft. of door width for Main entries
- 20W/linear ft. of door width for all other doors
- 1.0 W/ft^2 for walkways less than 10 ft. wide
- Additional Allowance | Total allowance is the sum of the individual power densities
- plus an unrestricted 5% of that sum
- Tradable Allowance | All power densities listed above are tradable except for the façade
- Exemptions | Advertising signage lighting

Quality of Light

The Corbin Building is being saved since it is a historical building and a large amount of money is going into restoring the façade to 1910-1917. The façade should be light at night so pedestrians are able to enjoy this building at all times of the day. Aesthetic issues are very important since the façade is being restored to an age where modern fixtures did not exist.

To create an appealing lighting design on a historical building luminances must be properly balanced, fixtures must be either hidden or architecturally pleasing, and photometry carefully specified to distribute light to the proper places. Shadows, surface details, source/task/eye geometry, face modeling, color, and glare must all be considered to make this happen. A warm source color will balance will with a red in the brick work. Grazing the surface will bring out all the texture in the bricks and also in the ornate details on the columns.

Design Considerations

Appearance of Space and Luminaires-
Aesthetic issues are very important since the owner is investing a large amount of money to restore the façade. The fixtures should be hidden if possible or architecturally pleasing to make the least amount of impact on the façade.

Color Appearance-
Color rendering and color temperature have a strong influence on the person sense of visual attraction. To get good color appearance lamps will be chosen with a CRI greater than 80 and a CCT of about 3500K.

Daylighting Integration and Control-
Daylight controls such as photocells need to be integrated into the lighting to be turned on and off dusk and dawn to save energy.

Model of Faces and Objects-
Lighting a façade provide pedestrians with a sense of security. Lamps with a CRI of above 80 will help with identifying people and distinguishing colors along the street on the sidewalk and also in front of the lobby and retail entrances.

Direct and Reflected Glare-
Direct and reflected glare can cause annoyance and pain. The lights need to be aimed so there is no glare in the pedestrians' eyes that are walking down the street. Also need to be away of glare coming off the glass.

Luminances on Surfaces-
The lighting of the vertical surface of the façade will use light to graze the surface and bring out the texture in the brickwork and also all the ornamental detail. The sidewalk needs to have enough light on it to guide pedestrians into the building safely. Having light on the sidewalks and entrances will need to be coordinated with the security cameras so they are not blinded.

Lighting Solution Overview

The purpose of the restoration of the Corbin Building was to restore the façade to its original design. The Corbin Building is rich in detail and historical character which cannot be found on other buildings in the area. The idea was to highlight only specific parts of the building. The idea was to frame the building with a glowing illumination. The building when originally built was considered a sky-scraper which is why the two larger towers are illuminated. The towers contain many small details and the best way to get these to stand out at night is grazing the vertical surface. The towers contain a large 3 story arch which is why large ceramic metal halide lamps are used to provide enough uplight to hit the top of the arch. By using uplight it does not create a disability glare to the pedestrians walking by façade.

The walkway next to the building was illuminated with compact fluorescent downlights the whole way down John Street to promote safety and see into the stores and window displays.

Highlighting the subway entrance helps provide wayfinding and guided circulation down the sidewalk. The FSTC lobby entrance door has been illuminated brighter than any other entrance so people know that entrance is more important than the other doors. Also the brighter door creates a feeling of safety when a people are waiting for a cab or other people.

Luminaire Schedule

LIGHTING EQUIPTMENT SCHEDULE						
Type	**Picture**	**Mounting**	**Catalog # | Manufacturer**	**Description**	**Lamp**	**Input Watts**
F		Surface	4754-2/28T5-MVOLT-WFL-AWM-FSS-PLPKX-CSL50-LP35K-DDB Hydrel	49" extruded aluminum with stainless steel fasteners rated for outdoor use. Linear fluorescent fixture with cold weather option to provide full light output at 0°F. Lens is curved clear acrylic. Adjustable wall mount bracket. Wet location rated.	(2) T5 Lamp Lumens: 2600 CCT: 3500K CRI: 85	60
G		Recessed	8091CCLP Lightolier	6" inch round lensed downlight. Clear aluminum reflector with polished flange. Wet location rated.	(1) 32W Triple Tube CFL Lumens: 2950 CCT: 3500K CRI: 85	36
H		Pendant	CFVL8-32TRT-6SB-T73-MVOLT-PM-DDB Gotham	8" lensed pendant hung cylinder for wet location. Heavy gauge aluminum housing with polyester power paint and tempered prismatic lens. Fixture is hung with 3/8" threaded rod 48" below ceiling.	(1) 32W Triple Tube CFL Lumens: 2950 CCT: 3500K CRI: 85	36
I		Recessed	613-50MR16-UNV-BK Cooper Lighting	4-1/2" Diameter ingrade recessed uplight. Corrosion -resistant stainless steel with solid brass and stainless steel parts. Gasket housing and trim with 1/4" thick tempered glass lens. Remote 12V transformer required. Wet location rated.	(1) 50W MR16 Lumens: 1500 CCT: 3050K CRI: 100	50
J		Surface	M152-400C-V-06-1-000 Elliptipar	17 3/16" extruded aluminum with clear flat tempered glass lens. Gasket around door. Specular extruded aluminum relfector. Wet location rated.	(1) 400W CMH Lumens: 41000 CCT: 3600K CRI: 80	426

Table 11: Façade Lighting Equipment Schedule

Light Loss Factors

Light Loss Factors				
Lamp Type	**LLD**	**LDD**	**BF**	**Total**
F	0.90	0.72	0.96	0.62
G	0.85	0.72	0.98	0.60
H	0.85	0.72	0.98	0.60
I	0.85	0.72	1	0.61
J	0.76	0.72	1	0.55

Table 12: Light Loss Factors for Façade

Assumed a 24 month cleaning cycle and environment was dirty.

Control Scheme

Controlling the façade lighting is just as important as the design. An electronic time clock is used to control the lighting. The ET8000 electronic time switch from Intermatic has an astronomic feature which provides sunset on and sunrise off to prevent the need of separate photosenors. The time clock also allows for 28 set points to be programed to turn the lights on and off for different applications or days. Only two circuits are able to be attached to each time clock so multiple time clocks will be used and then configured to run at the same time.

Control Equipment Schedule				
Product	**Manufacture**	**Part Number**	**Technology**	**Description**
Time Clock	Intermatic	ET8215C	Electronic Time Clock	7-Day astronomic time switch that features 7-day programming to provide flexibility. 2- circuits able to be separately controlled. On and off control with out additional photosensor.

Table 13: Control Equipment Schedule for Façade

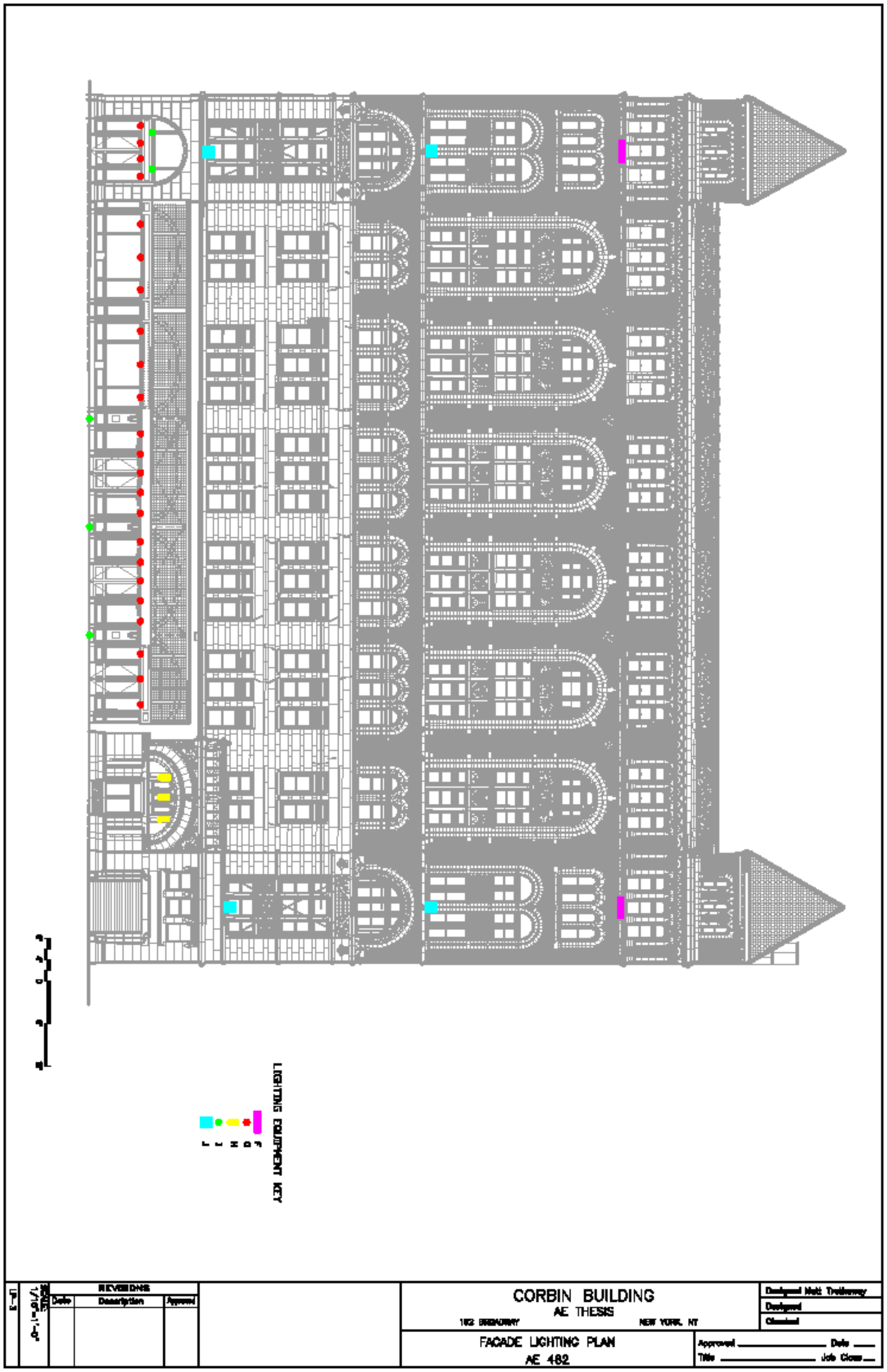


Figure 20: Facade Lighting Plan

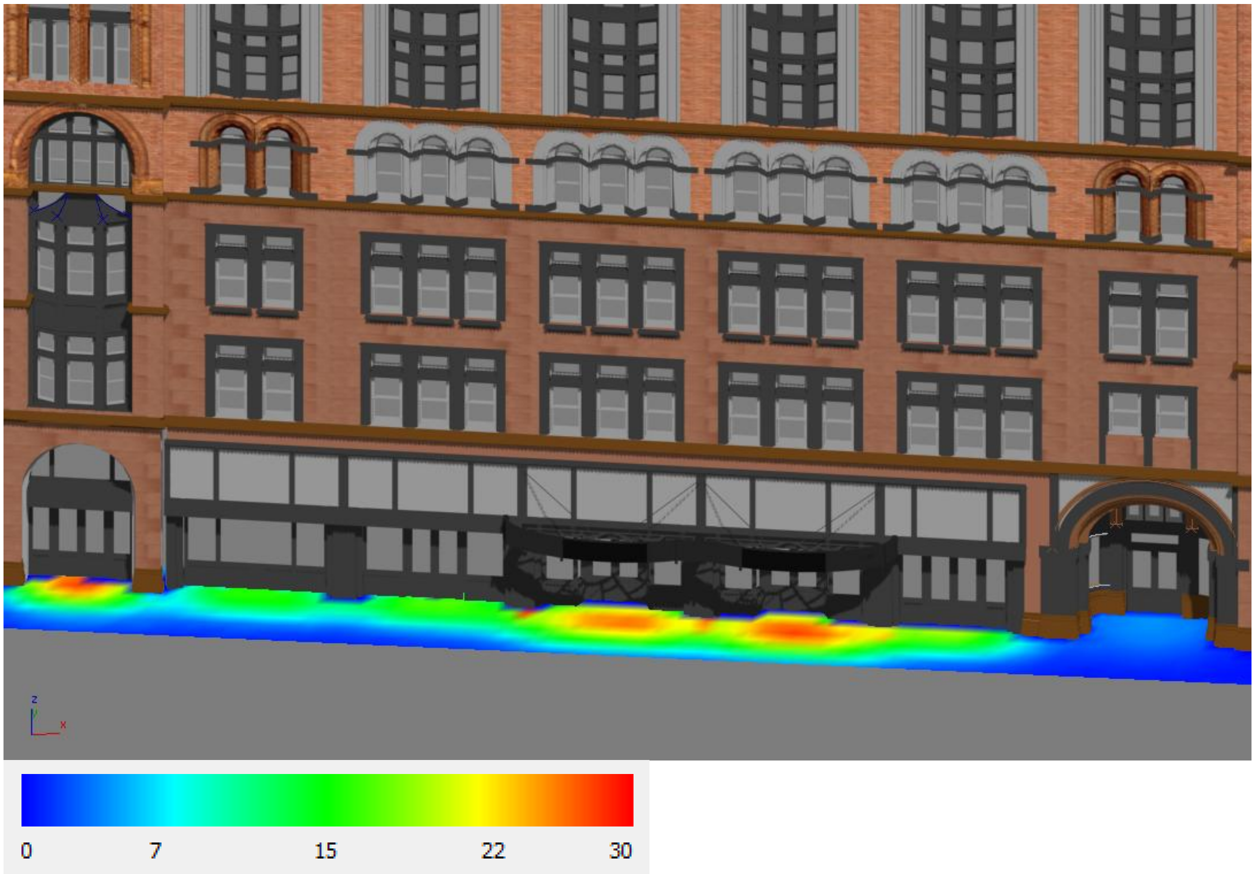


Figure 21: Façade Illuminance (Fc) Level

Retail 1 Illuminance- 18.3 Fc
Sidewalk – 5.3 Fc
FSTC Lobby- 20.3 Fc

Visual Performance Renderings

Figure 22: Facade Rendering

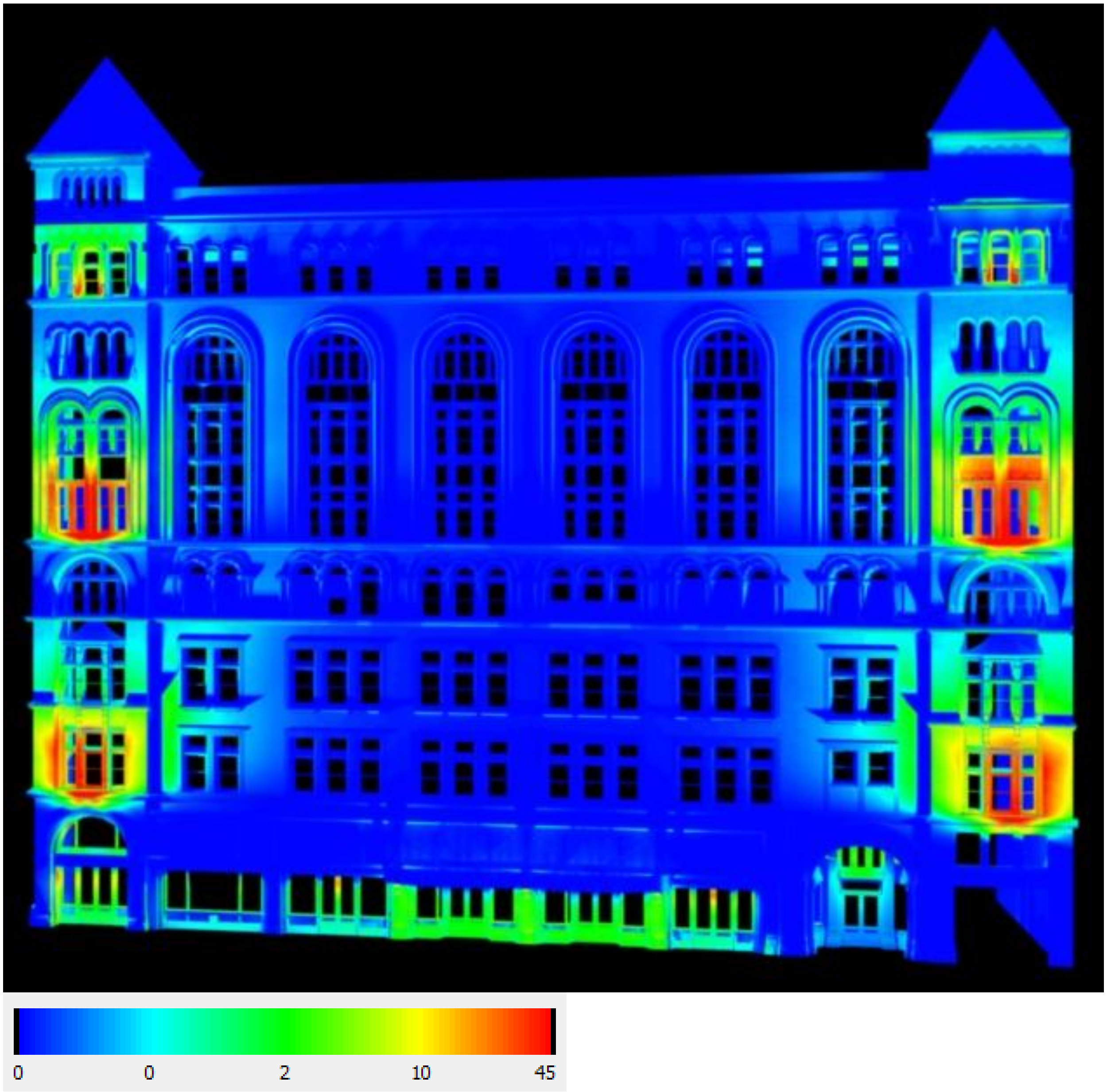


Figure 23: Façade Pseudo Color Rendering

Figure 24: Lobby Entrance Rendering

Energy Code Compliance

ASHREA 90.1-2010 Energy Calculation

Façade Lighting Power Density			
Type	Quantity	Input Watts	Total Watts
F	2	60	120
G	28	36	1008
H	3	36	108
I	5	50	250
J	4	428	1712
		Total Watts	3198
		Total SF	17820
		ASHREA 90.1 (W/SF)	See Below
		LPD (W/SF)	**0.18**

Table 14: Façade Lighting Power Density

Façade Lighting Power Density			
	ASHRAE	**Watts Allowed**	**Watts Used**
Tradable			
Retail 1 Door	20 W/LF	388	244
FSTC Lobby	30 W/LF	1224	726
Retail 2 Door	20 W/LF	408	108
Corbin Lobby	30 W/LF	612	108
	Total Tradable	**2632**	**1186**
Non-Tradable			
Façade	.2W/SF	3240	1832
	Total Non-Tradable	**3240**	**1832**

Table 15: Façade Lighting Power Density from ASHRAE

Evaluation

The façade lighting meets its goals of providing illumination at night to highlight its detail and restored façade. The façade has two main viewing points one is at the sidewalk next to the building and the other is across the street diagonal to the building. The view from across the street allows the whole building to become in view while along the sidewalk you only are able to see the street level façade.

Hierarchy is also used as a guiding device for pedestrians to bring them to the most important entrances. The lighting also helps provide a wayfinding device use illumination on the FSTC lobby doors to be brighter than the rest of the street level entrances. The FSTC lobby entrance was illuminated to about 20 fc, because the subway entrance will be the busiest entrance at night. Downlights with CRI of 85 have been used in the entrance canopies to provide lighting on the people, which help facial recognition and also creates healthy skin rendering. Ingrade fixtures were also mounted at each iron column at the door to highlight the column and provide some uplight. The fixtures used had a small beam angle to prevent spill light causing direct glare.

The Corbin entrance is an important entrance during the day, but since the office is used during the daylight hours the door entrance was illuminated to 5 fc enough to maintain a safe entrance. The façade lighting incorporates grazing technique at three critical locations on the towers to bring out the texture in the details and bricks. Each metal halide uplight fixture has been mounted at the bottom of a three story arch, which allows enough light to graze the ornamental details. A linear fluorescent was used to graze the top of the tower to finish the tower lighting from the top to the bottom.

Warm color temperature of 3600K was used to complement the red colors in the terracotta and bricks, while a CRI above 80 was used to provide accurate color rendering on the façade. Power density was 0.18 for the entire exterior lighting which is less than the 0.2 Watts/ Square Foot allowed by ASHREA just on the façade before including the entrances.

Retail Space 1- Special Purpose Space

Lighting Redesign

Space Description

The retail space is a luxury boutique retail space to sell a few articles of clothing and accessories such as sunglasses, shoes and bags. The integration of architecture, mechanical and lighting systems are very important in the design consideration to create a clean modern architectural style. The architectural and mechanical redesign breadths are located under the breath sections in this report.

The retail store has entrances on the south and east façade at a prominent corner of Broadway and John street in lower Manhattan. The space was designed with in the architectural breath. The impression the retail space creates is a modern luxury boutique store. The store cliental has very high expectations and the lighting design must add to the space.

The retail space is about 32 feet long by 20 feet wide with double height ceilings. The store has about 840 square feet of usable floor area. The retail space has window displays along the south façade. The north wall contains all the built-in casework for hanging cloths, sunglass and shelves for other items. In the center of the store there is a display for manikins and also more shelf space around the edge. The center display can be seen through the windows and will be used for attracting customers inside.

Task/ Activities

The activities that will go on inside the retail space are circulation for navagating around the store. Customers will be wondering around viewing and handling the merchandise. One the most difficult task will be reading the clothing tags, since they normaly have small text. Looking at yourself in the mirror is also an important task while buying an item.

Employees will be interacting with customers, helping in finding mechandise and any other task needed. Workers will also be stocking shelves and reorganzing the displays on off hours. Sales staff will be visually scanning invoices or credit slips and checking merchandise at the sales transation areas.

Materials

Surface	Material	Color	Reflectance
Walls	GWB	White	0.8
Inside of Casework	Wood	White	0.8
Outside of Casework	Wood	Mahogany	0.3
Window	Glass	Clear	τ= .5
Door- Glass	Glass	Clear	τ= .5
Door- Frame	Steel	Black	0.2
Floor	Wood	Mahogany	0.2
Glass Case	Glass	Clear	τ= .75
Mirror	Mirror	Clear	0.95
Ceiling	GWB	White	0.8
Countertop	Granite	Cream	0.3

Table 16: Retail Materials

Retail Floor Plans and Sections

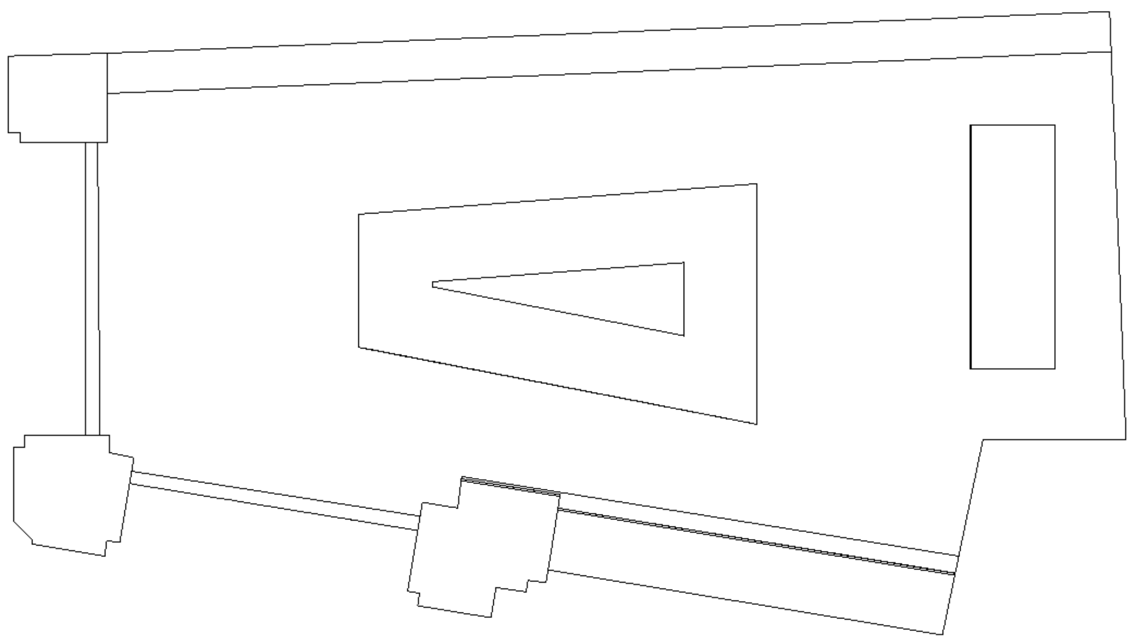


Figure 25: Retail Floor Plan

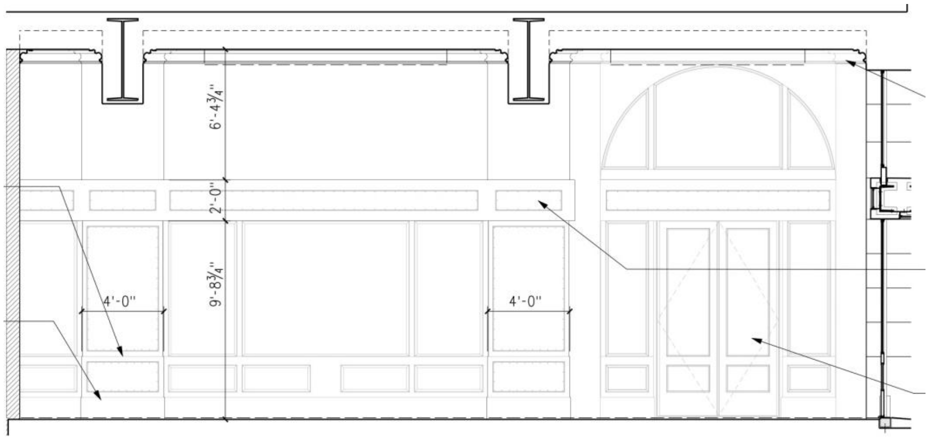


Figure 26: South Elevation

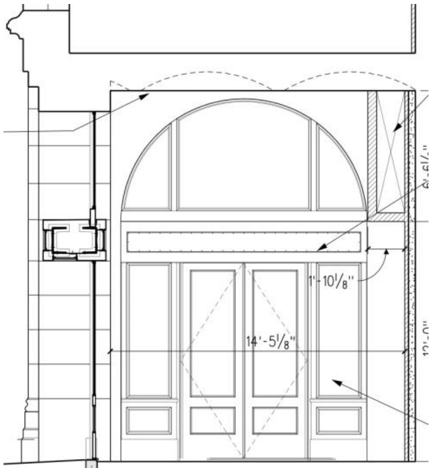


Figure 27: West Elevation

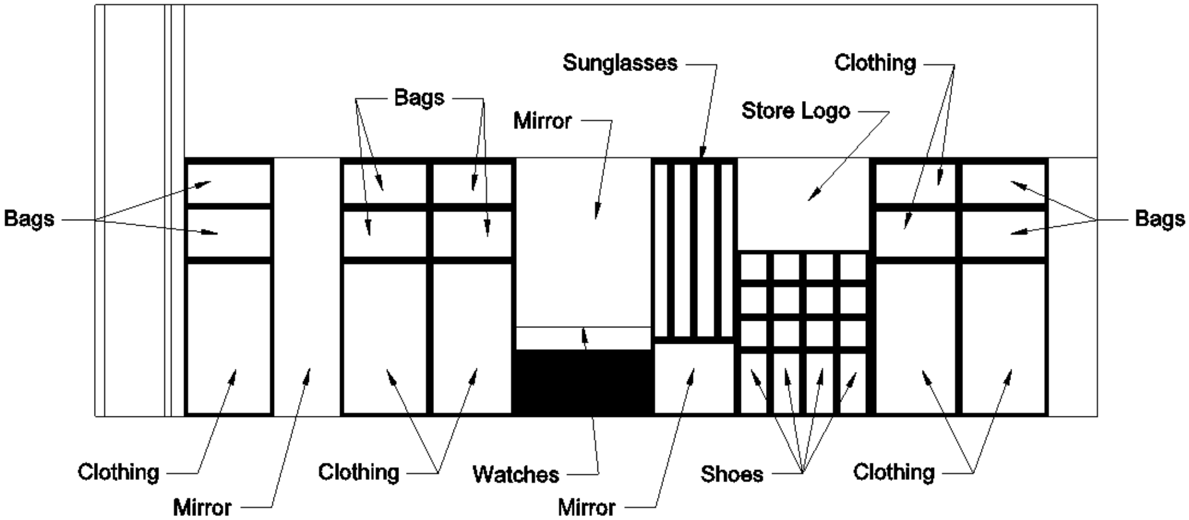


Figure 28: North Elevation

Lighting Design Considerations and Criteria

Quantity of Light

2010 IESNA handbook:

- Desired illuminance levels- Upscale Specialty
    - *Circulation:*
        - Horizontal-10 fc at floor
        - Vertical- 3 fc at 5' AFF
    - *General Retail:*
        - Horizontal-30 fc at 2'-6" AFF
        - Vertical- 10 fc at 3'-5" AFF
    - *Perimeter*
        - Vertical- 30fc at 5' AFF
    - Feature Displays
        - *Dazzle*
            - 10 times greater than E_h of adjacent retail area
        - *Highlight*
            - 5 times greater than E_h of adjacent retail area

ASHRAE/IESNA 90.1-2010: Space by Space

- Retail LPD 1.4W/ft^2
- Retail Area 3 = the floor area used for the sale of furniture, clothing, cosmetics, and artwork
- Additional Interior Lighting Power Allowance = 1000 watts + (Retail Area 3 × 1.4W/ft2)
    - Additional Interior Lighting Power Allowance = 1000 watts + (840 × 1.4W/ft2) =2176W

Quality of Light

It is important that the interior design matches the same quality of the merchandise that is sold in the store. The customer is expecting an impressive quality of light in the store that enhances the merchandise. The store needs to have attractive lighting fixtures that have to be located and aimed correctly to highlight the merchandise. Accent lighting will be very important to create focal points.

Merchandise is spread out around the store and creates a feeling of preference that will draw people to specific areas of the store first. This can be best accomplished by highlighting specific displays and using non-uniform lighting. The customer should feel relaxed in the space so they do not rush out before purchasing. This feeling can be created using the same nonuniform lighting and softly highlighting displays. Also a variation in illuminnances will establish a visual hierarchy of merchandise in the store and is central to the design strategy.

Design Considerations

Appearance of Space and Luminaires-
Since the store is upscale and selling upscale clothes the luminaires need to blend with the store design and present a uniform look. The luminaires should be consistent with the interior design and be aimed correctly to highlight specific displays.

Color Qualities of Light-
In a retail environment color rendering is important for both creating vibrant colors in the clothing. Also skin tones need to look healthy for interaction between customers and workers. Lamps will be chosen with a CRI greater than 80 and a CCT of 3600K to create a warm space where customers will feel more comfortable.

Flicker/ Strobe-
Flicker and strobe lights can cause headaches and is annoying to occupants. This will cause loss revenues and customers not to return.

Model of Faces and Objects-
It critical that people look good to others, such as when shopping with friends. The intensity and angles of light will determine whether the light is flattering to the merchandise and the people in the store.

Merchandise Fading and Bleaching-
Display lighting, particularly highlighting and dazzle can cause merchandise to fade and bleach. This will cause discoloration in the fabrics and ruin the product. The best way to prevent this is rotating the merchandise. The highlight displays will be recommended to be changed every two weeks.

Perimeter Lighting and Feature Displays-
Perimeter lighting will illuminate the merchandise on the walls and promotes a sense of spaciousness. The spill light from the perimeter lighting will help illuminate the circulation space.

Direct and Reflected Glare-
Direct and reflected glare can cause annoyance and pain. The lights need to be aimed so there is no glare in the customer's eyes and also on VDT at the checkout counter. Also the daylight entering on the south side windows might need shades.

Lighting Solution Overview

The design goal was to create a luxury boutique retail space to sell a few articles of clothing and accessories such as sunglasses, shoes and bags, with the integration of lighting into the modern luxury architecture to enhance the stores appearance and feeling. This was accomplished by providing both perimeter lighting and feature displays. The perimeter lighting is used to direct shoppers' attention while in the process of circulating through the space and encouraging them to explore the merchandise. Another benefit is its promotion of a sense of spaciousness. The spill light from the perimeter lighting adds to the circulation illuminance. A feature display was used to attract shoppers through visual intriguing and exciting merchandise.

The perimeter lighting is used to graze the merchandise along the north wall and accentuate the mahogany backdrop. Recessed two-head T6 metal halide fixture is used to provide the perimeter lighting. The grazing of the merchandise allows the customer to examine the items texture better. All the merchandise on the wall is illuminated evenly from backlight LED panels. The white acrylic does not allow a person to see through it but allows for an even glow onto the merchandise. With the mahogany wood around the edge of the case it will create a frame with the merchandise as the art and the glow from the panel enhances this feeling. This will give the customer the impression they are buying a designers art work not just an item of clothing. Mirrors are located next to the displays which provide an area for the customer to look at themselves and a recessed adjustable LED downlight provides a higher illuminance for that task.

A feature display is located in the middle of the store which can be easily seen from both entrances. The highlight display is illuminated brighter than the surrounding area to create visual interest. The focal feature in the middle contains a LED light stage with mannequins lined up on top of the creating the impression of a fashion runway. Mannequins are illuminated by two-head metal halide T6 lamps that are adjustable, to provide flexibility for displays to change.

Ambient light is provided from spill light from the perimeter and accent lighting on the merchandise. The LED panels provide some illumination also into the circulation space. The sales transaction area has been illuminated at the bottom front edge to draw a person to the transaction area and provide a floating feeling. Shades have been included for privacy and also in case there is a lot of direct sun entering the space the shades can be lowered down.

Luminaire Schedule

LIGHTING EQUIPTMENT SCHEDULE						
Type	**Picture**	**Mounting**	**Catalog # | Manufacturer**	**Description**	**Lamp**	**Input Watts**
K		Recessed	VAP-2-P235-W/B-N-AD-1 Starfire Lighting	24" length x 10" width recessed open aperture accent fixture with adjustable lampholders. Two 35 watt PAR20 Lamps. White plaster trim and no lens.	(2) 35W PAR20MH LUMENS: 1950 CCT: 3000K CRI: 94 BEAM: 30°	89
L		Surface 6" AFF	eW Cove MX Powercore Philips Color Kinetics	Solid white linear LED fixture for accent lighting. Strip size is 2x12x1.5 inches made out of die- cast aluminum with white powder- coat finish. Polycarbonate lens with integrated male and female connectors.	LED LUMENS: 446 CCT: 3000K CRI: 83 BEAM: Medium	12.5
M		Surface	SW3672-30K-TL-1-S-WM INSIGHT	LED luminous whit lighting panel 36x72 inchs. Extruded aluminum frame covers perimeter of acrylic panel. Acrylic panel is white translucent. Controlled by DMX controller.	LED CCT: 3000K	170
N		Recessed 11'-6" AFF	FLSA4A-8SLED-L30-FL-120-RO-T Focal Point	4.5 inch diameter recessed adjustable LED fixture. LED is a Philips Fortimo with aluminum heat sink. Manual locking at 40° vertical tilt. Parabolic reflector cone with white flange finish.	LED LUMENS: 800 CCT: 3000K CRI: >80 BEAM: 40°	14

Table 17: Retail Space Lighting Equipment Schedule

Light Loss Factors

Light Loss Factors				
Lamp Type	**LLD**	**LDD**	**BF**	**Total**
K	0.85	0.90	0.9	0.69
L				0.70
M				0.70
N				0.70

Table 18: Light Loss Factors for Retail Space

Assumed a 24 month cleaning cycle and environment was clean. For LED lamp sources assumed light loss factor was equal to 0.7.

Control Scheme

The retail space requires different lighting settings for different conditions. The easiest way for different employees to set the proper lighting conditions is to have them pre-set as scenes. The control system used is the Lutron GRAFIK Eye QS Wireless system. The GRAFIK Eye can control up to 6 lighting zones and 3 shade zones, all 6 zones were used and one shade zone was used.

The different scenes set are "Open, Closed, Stock and All Off". The open scene turns on all the lights on when the store is open and ready for business, while the closed setting will leave specific lights on like the dim the LED panels to 50%, leave the window display and the center display on so people walking by can see inside the store. The stock display will turn off the LED backlight panels and the LEDS under the sales transaction area, which is not need for stocking the shelves. All off would be used if for some reason they needed to turn off all the lights quickly with one button.

Control Equipment Schedule				
Product	**Manufacture**	**Part Number**	**Quantity**	**Description**
Control Unit	Lutron	QAGRJ-6P	1	GRAFIK Eye® QS Wireless Control Unit
Power Pack	Lutron	QSGFP-1WH-NST	1	GRAFIK Eye® QS Faceplate Kit
Stripe	Lutron	QSGS-BL	1	GRAFIK Eye® QS Stripe Kit
Power Pack	Lutron	PHPM-SW-DV-WH	2	Power Module
Power Pack	Lutron	PHPM-3F-120-WH	4	Power Module
Switch	Lutron	QSWS2-5BN-WH	2	QS 5-Button Wallstation, no insert
Power Supply	Lutron	QSPS-P1-10-60	1	Smart Panel Power Supply

Figure 29: Retail Control Equipment

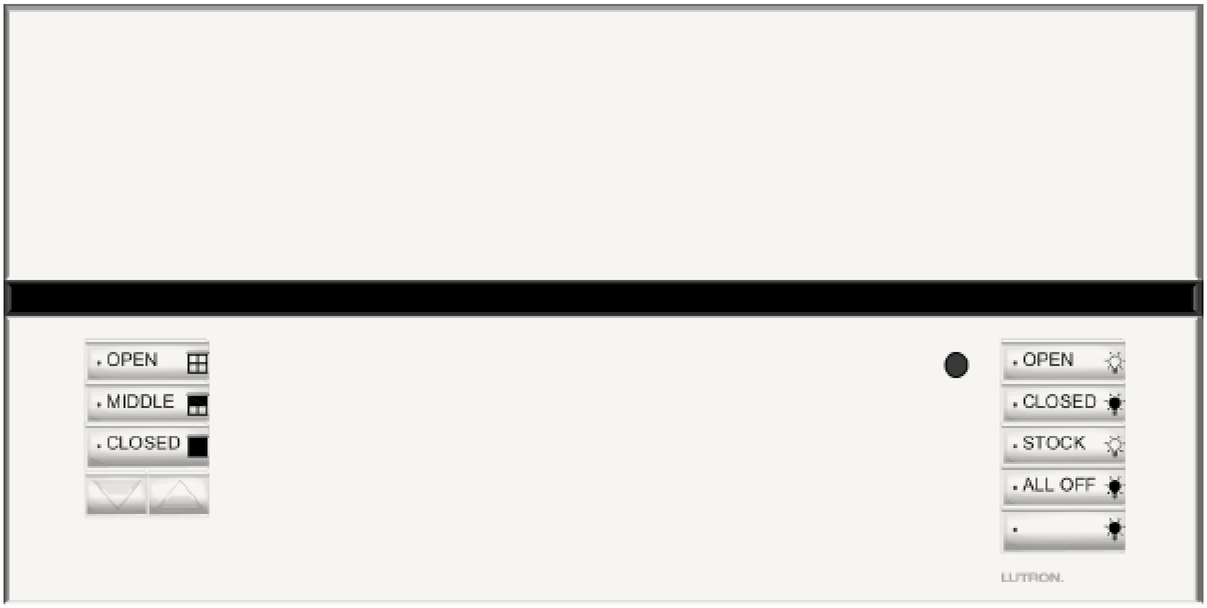


Figure 30: Wall Mounted Controller

Phase Control Zones					
Zone	**Name**	**Load Type**	**No. Fixtures**	**Wattage/Fixture**	**Total Wattage**
a	Grazers/General	Non-dim / Switched	11	89	979
b	LED Panels	Inc / Hal	11	170	1870
c	Window Display	LED 3-Wire	4	14	56
d	LED Mirrors	LED 3-Wire	3	14	42
e	LED Counter	Non-dim / Switched	9	13	117
f	Center Display	Non-dim / Switched	2	89	178

Figure 31: Zone Controls

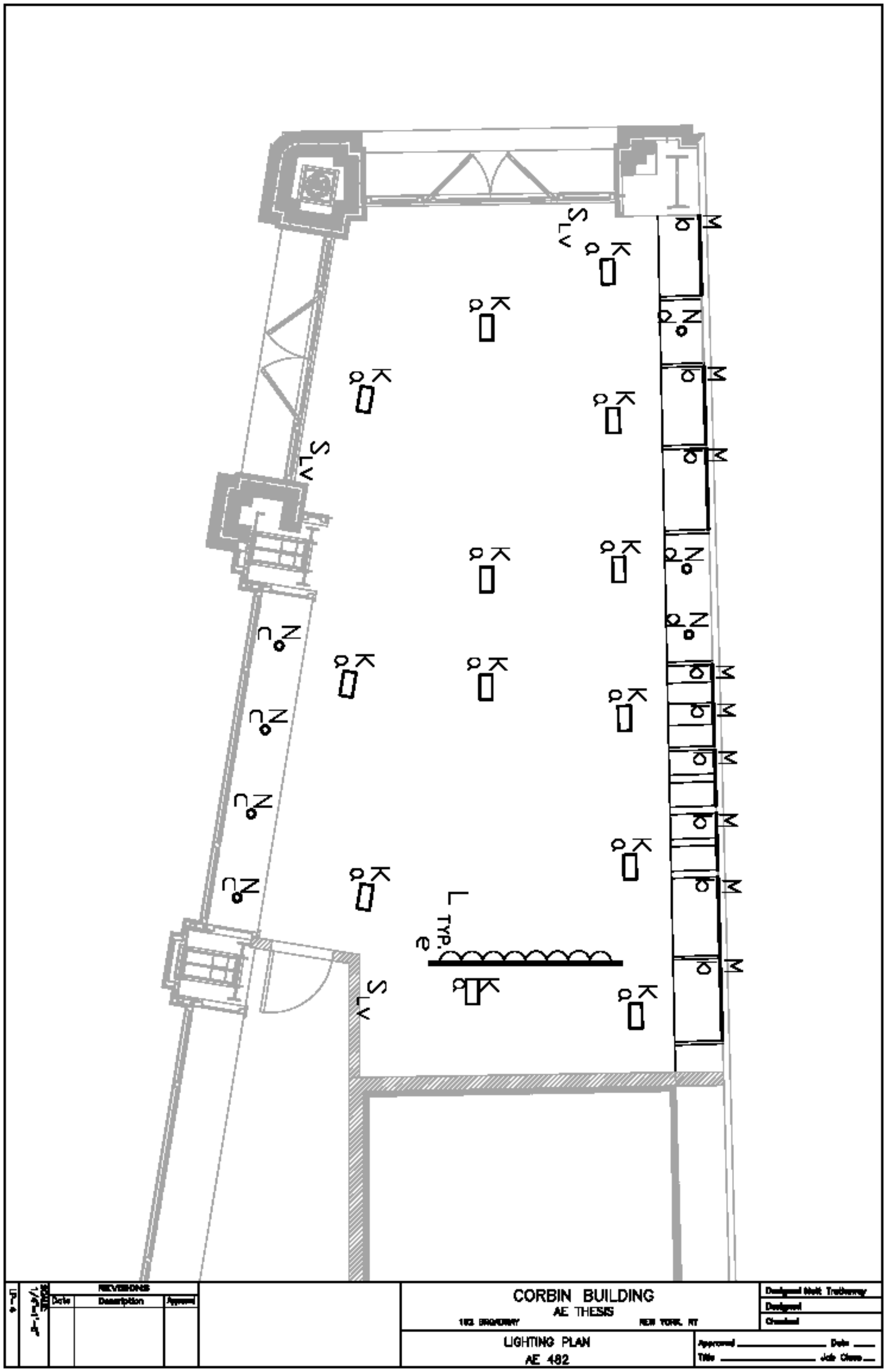


Figure 32: Retail Lighting Plan

Visual Performance Renderings

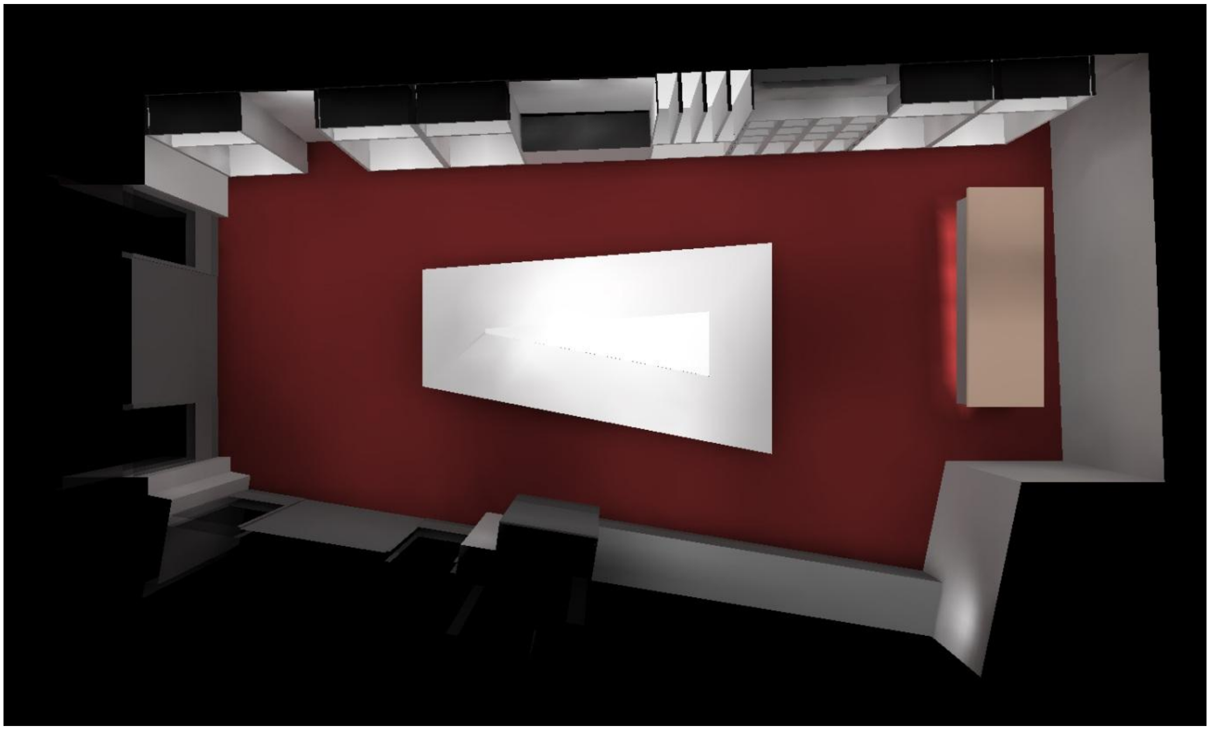


Figure 33: Retail Render Top View

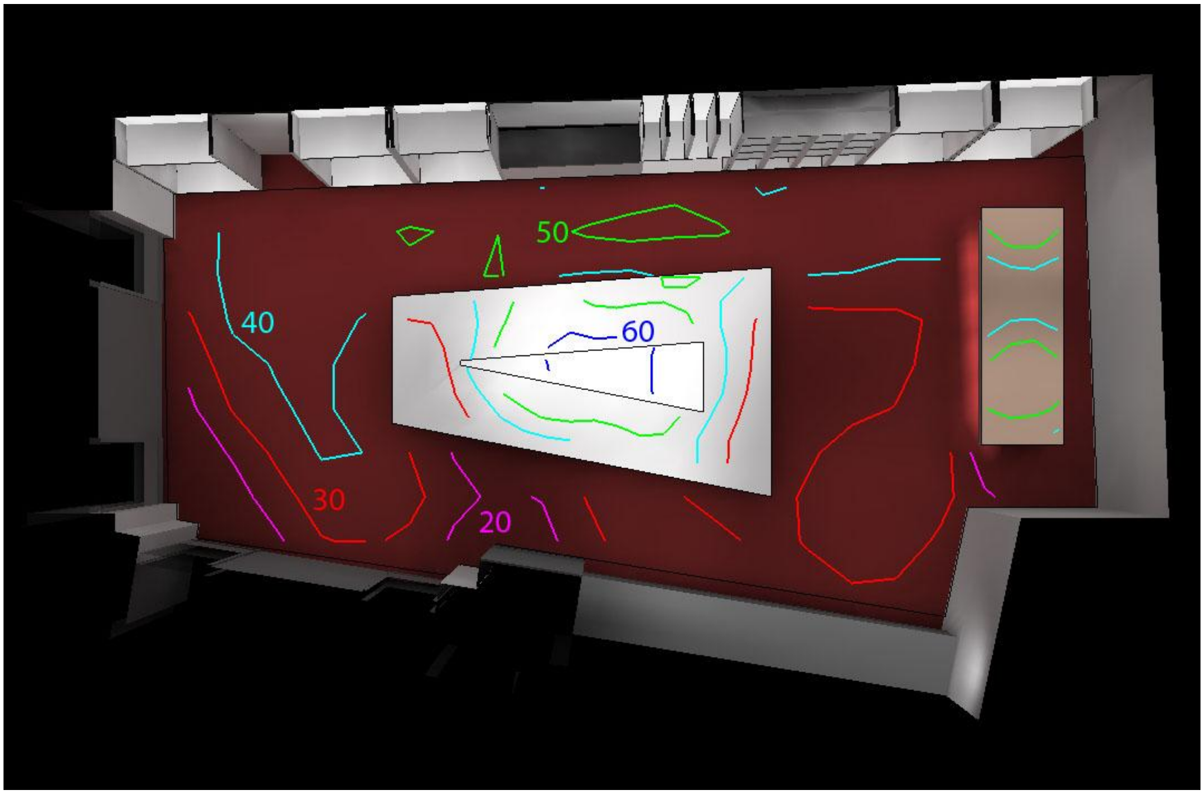


Figure 34: Isoline Rendering

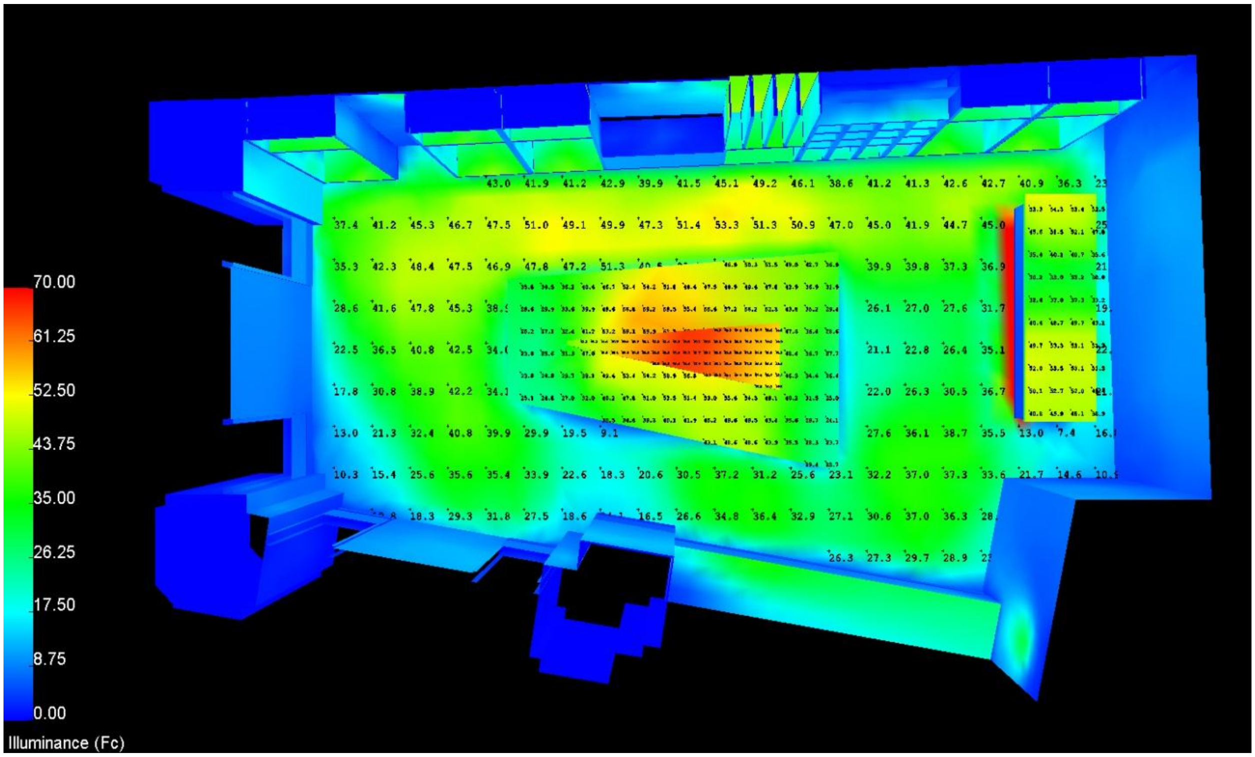


Figure 35: Pseudo Rendering Top View

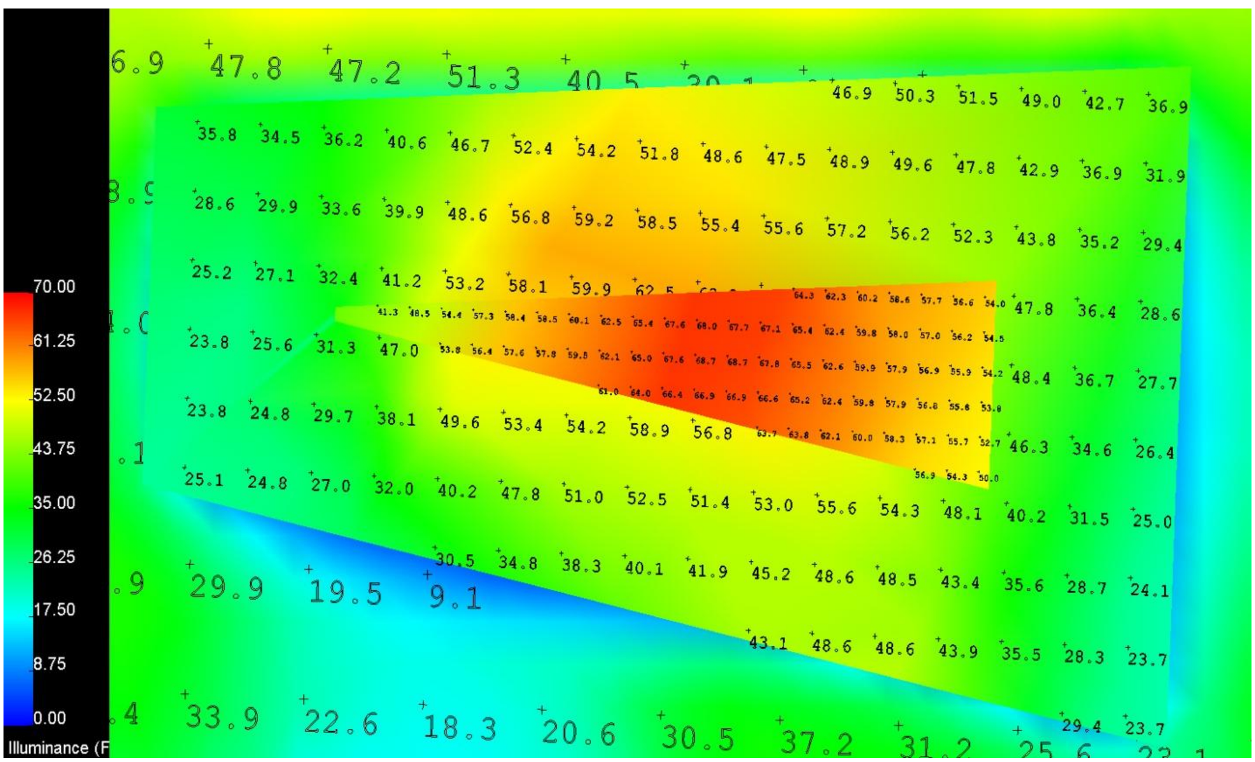


Figure 36: Pseduo Rending Center Display

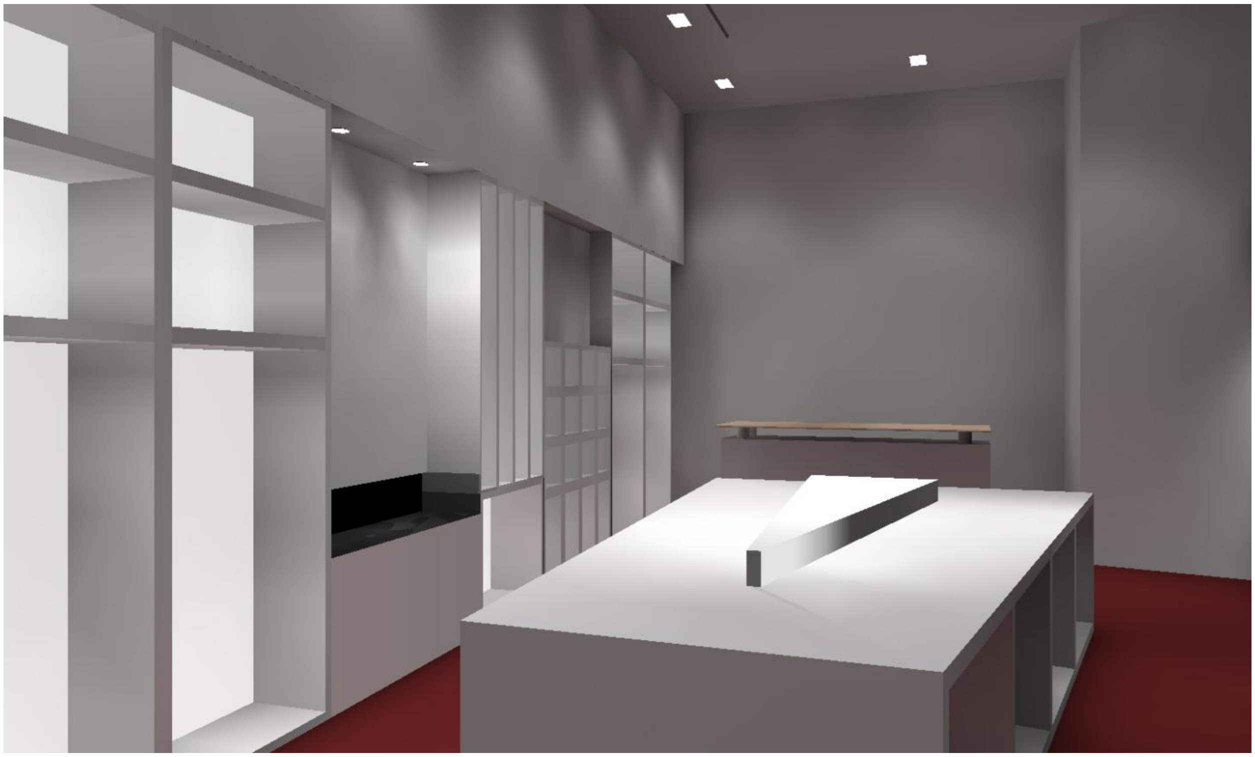


Figure 37: Render View Looking West From Entrance

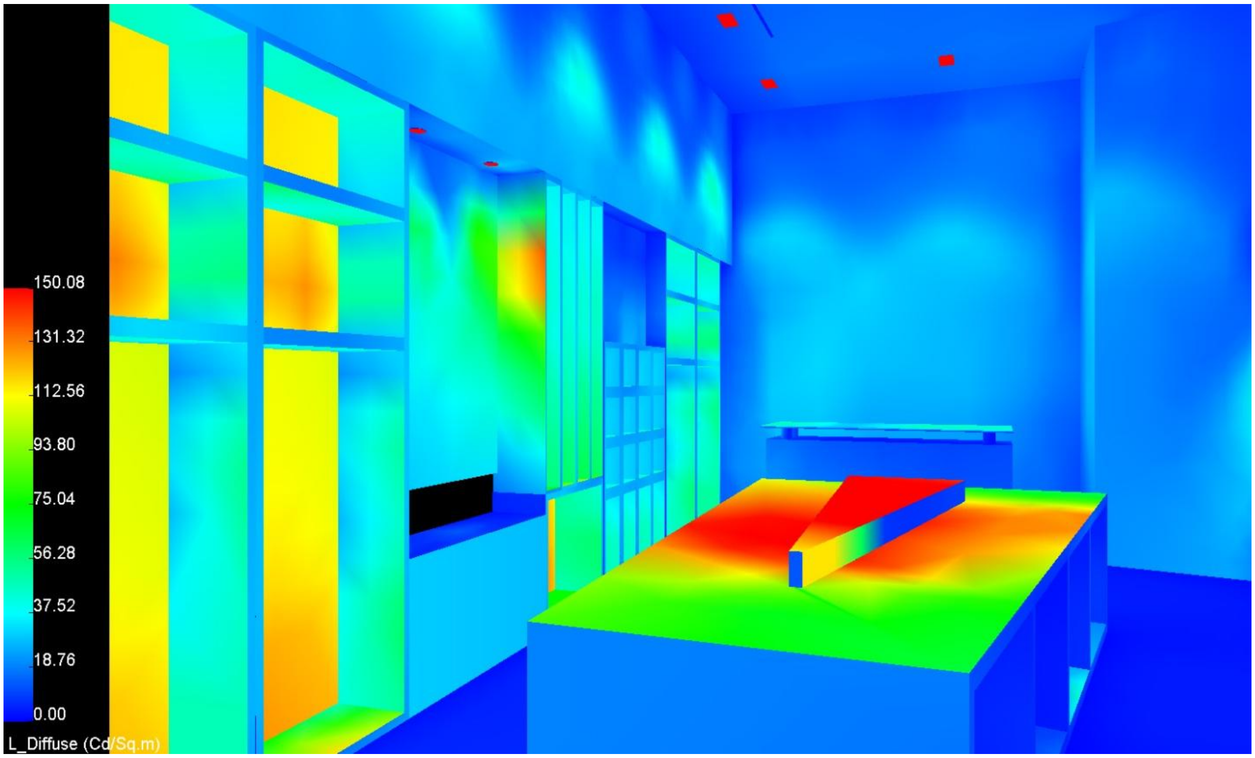


Figure 38: Luminance View from Entrance

Figure 39: Sales Transaction Area

Figure 40: Render View from Sales Transaction Area Looking Southeast

Figure 41: Render View from Window Display Looking Northeast

Illuminance Values				
	Average (Fc)	Max (Fc)	Min (Fc)	Max/Min (Fc)
Circulation	33.64	53.3	7.4	7.20
Center- Table	42.09	63.0	23.7	2.66
Center- Stage	60.00	68.0	41.3	1.66
Sales Transaction Area	45.05	54.3	30.0	1.81

Table 19: Illumination Values of the Retail Space

Energy Code Compliance

ASHREA 90.1-2010 Energy Calculation

Retail Lighting Power Density			
Type	**Quantity**	**Input Watts**	**Total Watts**
K	13	89	1157
L	9	12.5	112.5
M	9	170	1530
N	7	14	98
		Total Watts	2897.5
		Total SF	840
		ASHREA 90.1 (W/SF)	1.4
		Additional Power Allowance (W)	2176
		Decorative Lighting (1.0 W/SF)	840
		Total Watts Allowed (W)	3016
		Total Watts Used (W)	**2897.5**
		LPD (W/SF)	**3.45**

Table 20: Retail Lighting Power Density

Additional Interior Lighting Power Allowance = 1000 watts + (Retail Area 3 × 1.4 W/ft^2)

1000 watts + (840 × 1.4 W/ft^2)= 2176 Watts

An additional 1.0W per square foot was allowed to be used since the led panels behind the casework are only used for highlighting the artwork. The art work is being considered the designers clothing. The additional 840 watts it brings the total allowable watts used 3016 watts.

The total used in the space is 2897.5 which is less than the 3016 watts, so this design meets the code requirements.

Evaluation

Retail lighting must create an environment that is attractive and helps sells merchandise. The design of the lighting was to highlight modern luxury clothing and to enhance the stores appearance and feeling. This was accomplished by highlighting the clothing and grazing the mahogany materials from recessed fixtures in the ceiling. The LED panels behind the clothing provided a glow just onto the clothes and draw customers' attention to them. The center display is the focus to help draw people into the store and also the main highlighted display.

The perimeter light serves multiple purposes to provide light for the merchandise and ambient light into the stores. The circulation space was designed with about 33 fc which is higher than the IES recommended values, because general ambient lighting comes from the lights that illuminate the merchandise and provide the needed vertical illuminance on the merchandise. The center stage has been highlighted and illuminated to 60 fc which creates a focal point since it is about twice as bright as the general surroundings, which draws people's attention to the display area.

Lights above the mirrors help the customer envision themselves with that item of clothing or accessory. The window display lighting allows the items to be viewed at night and be able to see through the glass. All lights in the retails space have a CRI greater than 80 and a CCT of 3000K to make the space feel warm and inviting.

The lighting power density for the space was met and under code, by taking into the additional allowance for retail space and for using decorative lighting.

Electrical

Electrical- Four Lighting Spaces

Office

The large work space consists of an open office plan on the third floor. The floor area of the open office is about thirty-two feet wide by 162 feet long and twelve foot ceilings, with an approximate area of 5,184 square feet. The ceiling in the office consists of arched vaults. The vaults run both north to south and east to west creating a non-unformed grid on the ceiling. The lighting plan for the office consists of direct-indirect luminaires pendant mounted luminaires in middle of each vault. Compact fluorescent recessed downlights light the entrance and around the copy room. The lights in the office are controlled by occupancy sensors.

Lobby

The Fulton Street Transit Center Lobby in the Corbin Building is one of the primary entrances into the subway station. This lobby will have thousands of people passing though each day. The lobby is meant to transition people from the street to the subway or FSTC. The lighting plan for the lobby uses mostly indirect lighting. The light fills the space from the coves in the ceiling and also behind the copper panels offset from the walls. The cove lighting uses T8 linear fluorescent and the lights used behind the copper panels are T5 linear fluorescent. There is also metal halide lighting used over the door ways and escalator. Since the metal halide lamps are connected to a UPS so power failures do not affect the lamps operation.

Façade

The purpose of the restoration of the Corbin Building was to restore the façade to its original design. The Corbin Building is rich in detail and historical character which cannot be found on other buildings in the area. The walkway next to the building is illuminated with compact fluorescent downlights the whole way down John Street, to promote safety and also see into the stores. The FSTC lobby entrance door has been illuminated brighter than any other entrance with compact fluorescents mounted in the awning and also in-grade fixtures uplighting the columns. The façade is illuminated with metal halide uplights to graze the bricks and detail. The top of the towers are light using linear fluorescent.

Retail

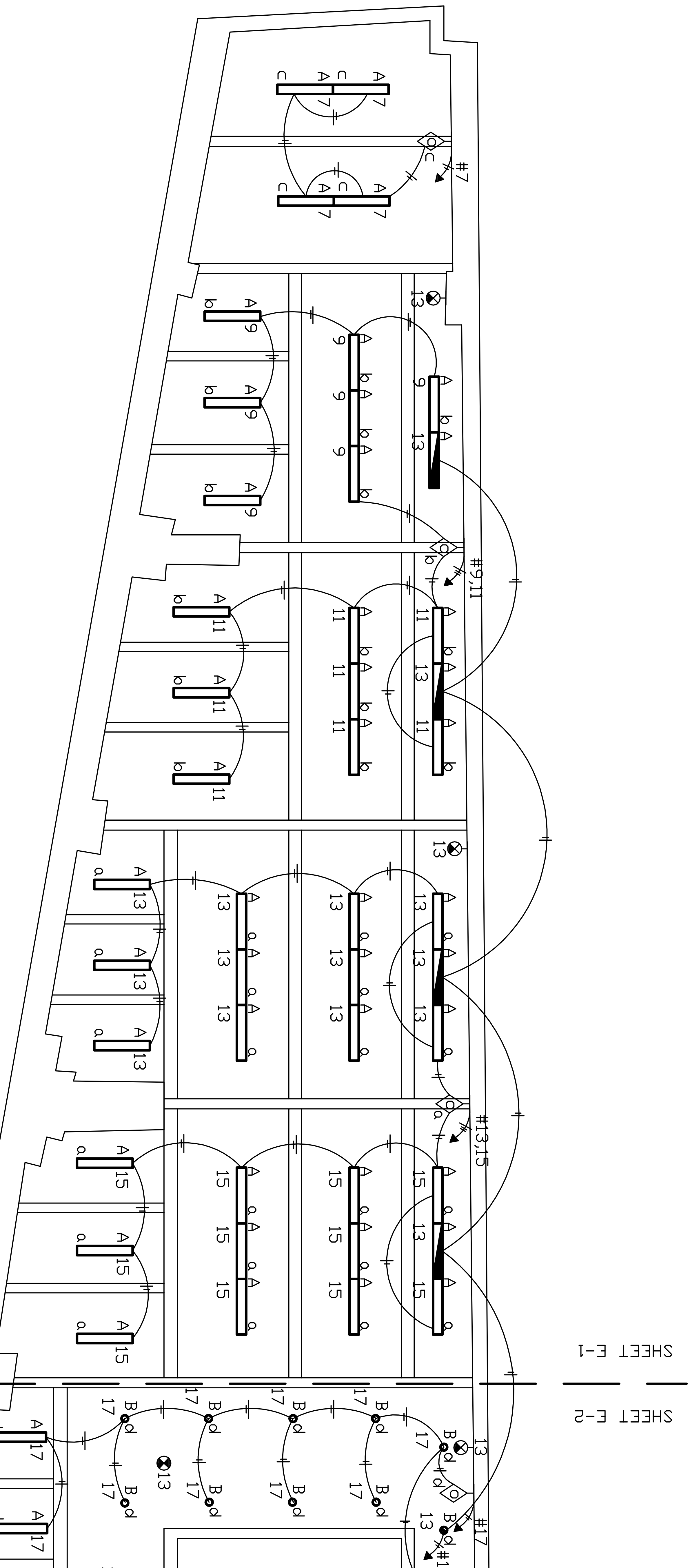
The design goal was to create a luxury boutique retail space to sell a few articles of clothing and accessories such as sunglasses, shoes and bags, with the integration of lighting into the modern luxury architecture to enhance the stores appearance and feeling. This was accomplished by providing both perimeter lighting and feature displays. The perimeter lighting and feature displays use metal halide Par30 lamps that are 35 watts each lamp and the fixture contains two lamps. There is also decorative lighting behind the casework to provide a glow onto the clothes which are 36x72 inch LED panels. The window case and lights above the mirrors are adjustable LED. To highlight the edge of the sales counter led strip lights were mounted underneath to make the impression the counter is floating.

Panelboard Table

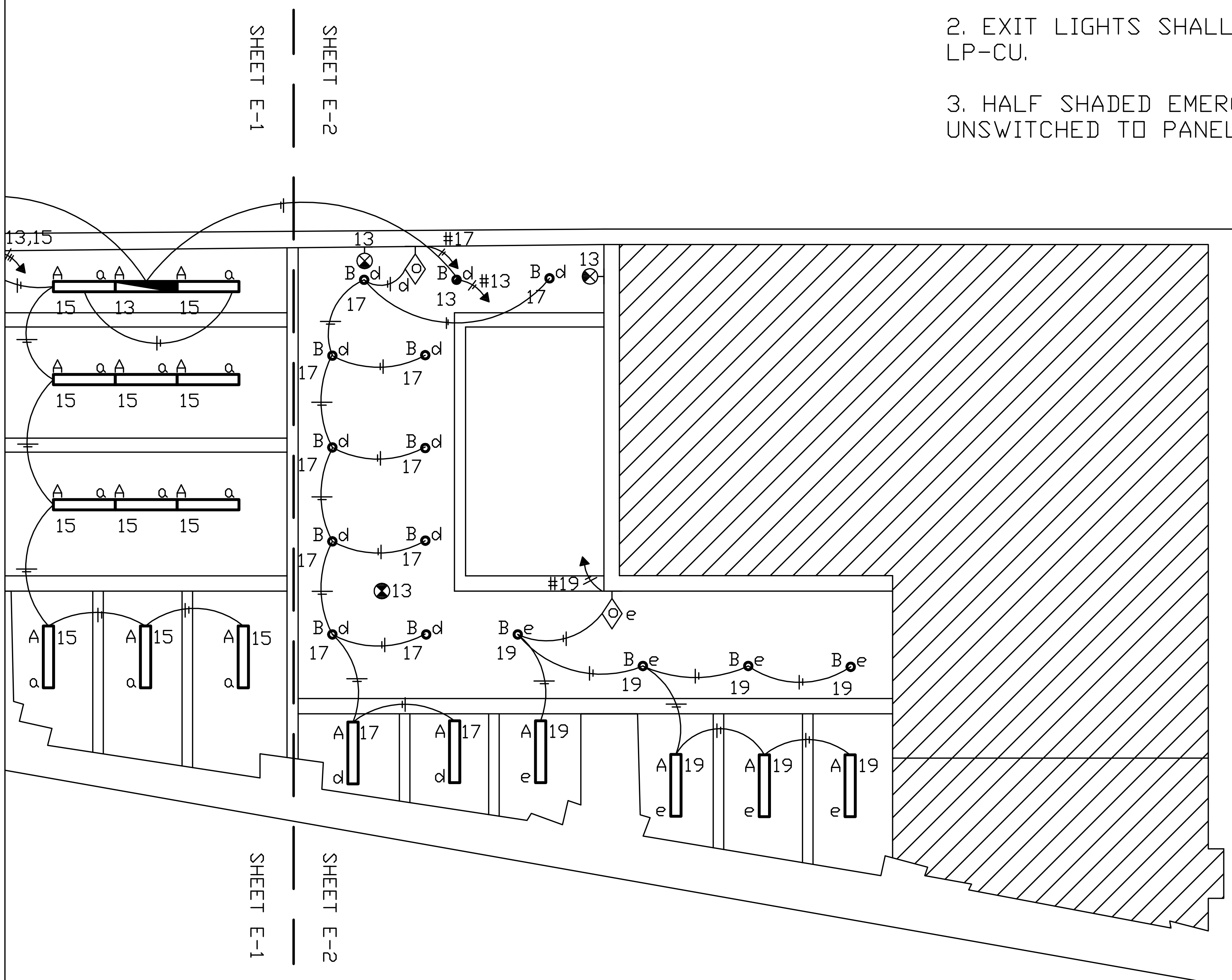
PANELBOARDS						
PANEL TAGS	VOLTAGE	SYSTEM	OFFICE	LOBBY	FAÇADE	RETAIL
LC-3C	208Y/120V, 3P, 4W	N	X			
LC-CS	208Y/120V, 3P, 4W	N		X		
LC-CS	208Y/120V, 3P, 4W	N			X	
LP- Retail	208Y/120V, 3P, 4W	N				X
LP-CU	208Y/120V, 3P, 4W	E	X	X		X

Table 21: Panelboard Table

NOTES:
1. BRANCH CIRCUIT WIRING FOR LIGHTING SHALL BE MINIMUM 2#12+1#12G-3/4" RGS COPPER THHN, 600V GRADE TO PANELBOARD LP-3C, U.O.N.
2. EXIT LIGHTS SHALL BE CIRCUITED UNSWITCHED TO PANELBOARD LP-CU.
3. HALF SHADED EMERGENCY LIGHT FIXTURES SHALL BE CIRCUITED UNSWITCHED TO PANELBOARD LP-CU, U.O.N



E-1	SCALE: 1/8"=1'-0"	REVISIONS: Date / Description / Approved	CORBIN BUILDING AE THESIS 192 BROADWAY NEW YORK, NY	Designed Matt Trethaway Date 1/31/2012 Checked	
			3RD FLOOR ELECTRIC PLAN AE 482	Approved ____ Date ____ Title ____ Job Class ____	



NOTES:

1. BRANCH CIRCUIT WIRING FOR LIGHTING SHALL BE MINIMUM 2#12+1#12G-3/4" RGS COPPER THHN, 600V GRADE TO PANELBOARD LP-3C, U.O.N.

2. EXIT LIGHTS SHALL BE CIRCUITED UNSWITCHED TO PANELBOARD LP-CU.

3. HALF SHADED EMERGENCY LIGHT FIXTURES SHALL BE CIRCUITED UNSWITCHED TO PANELBOARD LP-CU, U.O.N

CORBIN BUILDING
AE THESIS
192 BROADWAY NEW YORK, NY

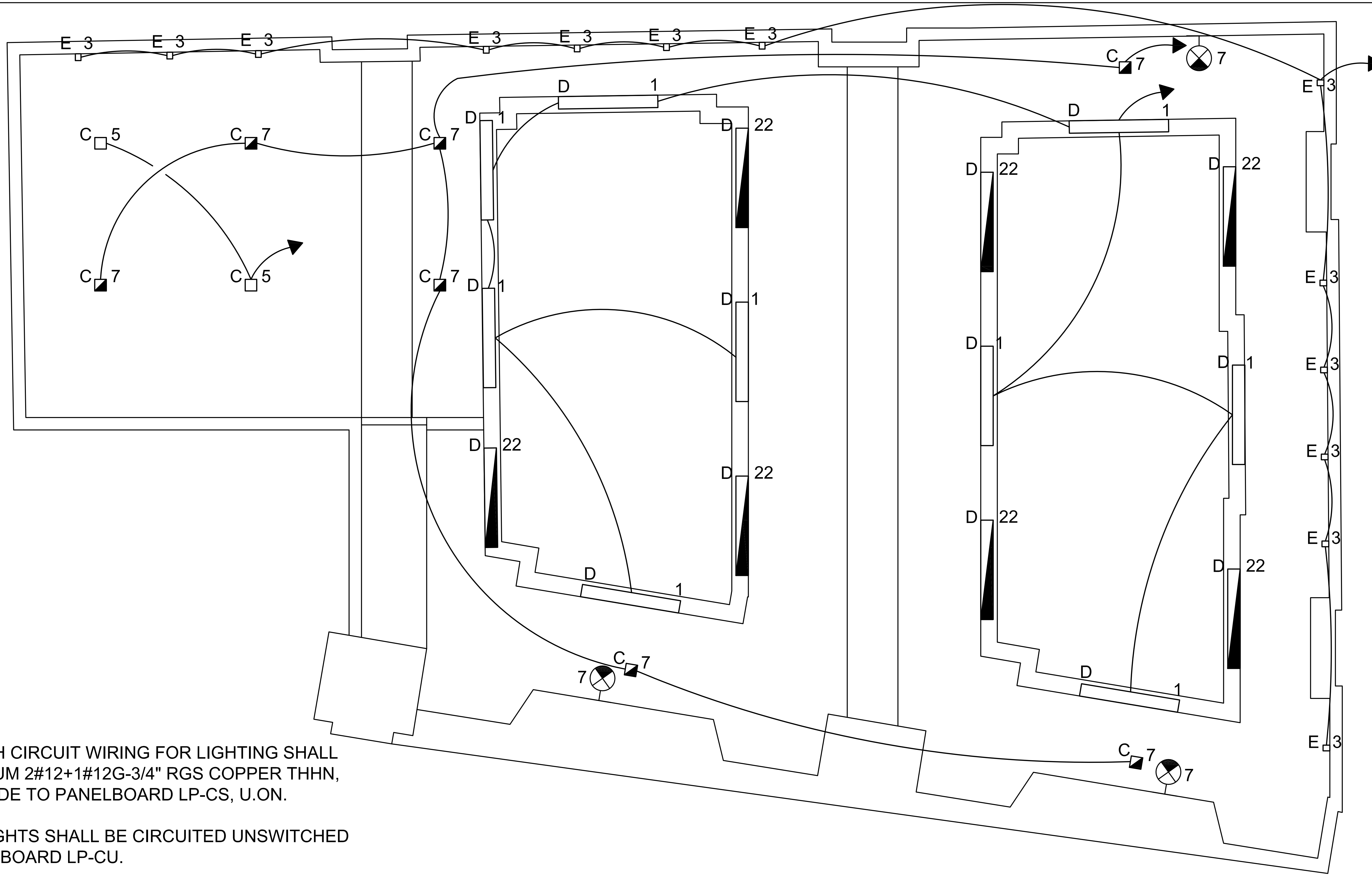
OPEN OFFICE 3RD FLOOR
AE 482

Designed Matt Trethaway
Date 1/31/2012
Checked
Approved ______ Date ____
Title ______ Job Class ____

REVISIONS		
Date	Description	Approved

SCALE: 1/8"=1'-0"

E-2



NOTES:

1. BRANCH CIRCUIT WIRING FOR LIGHTING SHALL BE MINIMUM 2#12+1#12G-3/4" RGS COPPER THHN, 600V GRADE TO PANELBOARD LP-CS, U.ON.

2. EXIT LIGHTS SHALL BE CIRCUITED UNSWITCHED TO PANELBOARD LP-CU.

3. HALF SHADED EMERGENCY LIGHT FIXTURES SHALL BE CIRCUITED UNSWITCHED TO PANELBOARD LP-CU, U.O.N

4. ALL LIGHTS SHALL BE UNSWITCHED. BREAKER SHALL BE SWITCH RATED.

Designed Matt Trethaway
Designed 3/12/2012
Checked

CORBIN BUILDING
AE THESIS
192 BROADWAY NEW YORK, NY

LOBBY ELECTRIC PLAN
AE 482

Approved ______ Date ____
Title ______ Job Class ____

REVISIONS

Date	Description	Approved

SCALE:
1/4"=1'0

E-3

NOTES:

1. BRANCH CIRCUIT WIRING FOR LIGHTING SHALL BE MINIMUM 2#12+1#12G-3/4" RGS COPPER THHN, 600V GRADE, U.ON.
2. TWO CIRCUITS MAX SHALL BE CONNECTED TO TIME CLOCKS.
3. CONNECT CIRCUITS #16 & #18 TO TIME CLOCK 1.
4. CONNECT CIRCUITS #20 TO TIME CLOCK 2.
5. CONNECT CIRCUITS #22 & #24 TO TIME CLOCK 3.
6. CONNECT CIRCUITS #17 TO TIME CLOCK 4.

LIGHTING EQUIPMENT KEY

- F
- G
- H
- I
- J

CORBIN BUILDING

AE THESIS

192 BROADWAY NEW YORK, NY

FACADE LIGHTING PLAN

AE 482

Designed Matt Trethaway
Designed
Checked

Approved ______ Date ____

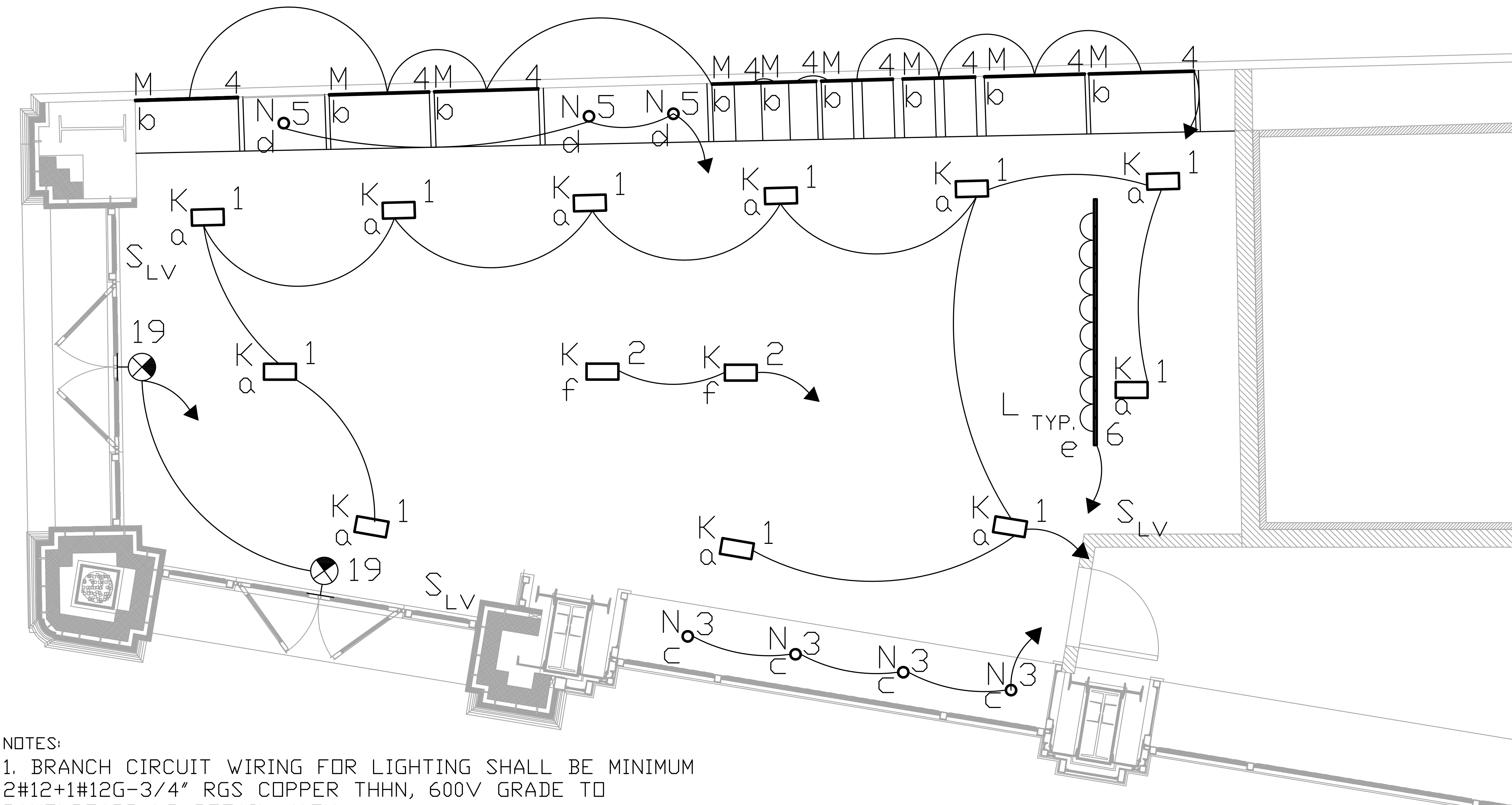
Title ______ Job Class ____

REVISIONS

Date	Description	Approved

SCALE: 1/16"=1'-0"

LP-3



NOTES:

1. BRANCH CIRCUIT WIRING FOR LIGHTING SHALL BE MINIMUM 2#12+1#12G-3/4" RGS COPPER THHN, 600V GRADE TO PANELBOARD LP-RETAIL, U.O.N.

2. EXIT LIGHTS SHALL BE CIRCUITED UNSWITCHED TO PANELBOARD LP-CU.

REVISIONS		
Date	Description	Approved

SCALE: 1/4"=1'-0"

E-5

CORBIN BUILDING
AE THESIS
194 BROADWAY NEW YORK, NY

LIGHTING PLAN
AE 484

Designed Matt Trethaway
Designed
Checked

Approved ______ Date ____
Title ______ Job Class ____

Controls

Office- Control Equipment

The main goal for the control scheme in the office is to provide energy savings when the occupants are not in the space. This will be done by using occupancy sensors to turn the lights on and off when occupants are only in the space. The sensors are wall mounted on the north wall above the corridor in the office to prevent sensor having blind spots. The passive infered and ultrasonic sensors have been chossen so when occupants are moving around the infered can detect them and when sitting at the desk the ultrasonic waves will go around the cubics to detect small movements with in the cubical.

Control Equipment Schedule				
Product	**Manufacture**	**Part Number**	**Technology**	**Description**
Sensor	WattStopper	DT-200	PIR/ Ultrasonic	Dual technology ceiling/wall sesnsor with PIR and ultrasonic technologies. Time delays can be autoset or fixed. Operatetion voltage 24VDC.
Power Pack	WattStopper	B347D-P	-	Power pack provides 24VDC operating voltage to all WattStopper 24VD occupancy sensors and daylighting controlers.

Table 22: Office Control Equipment Table

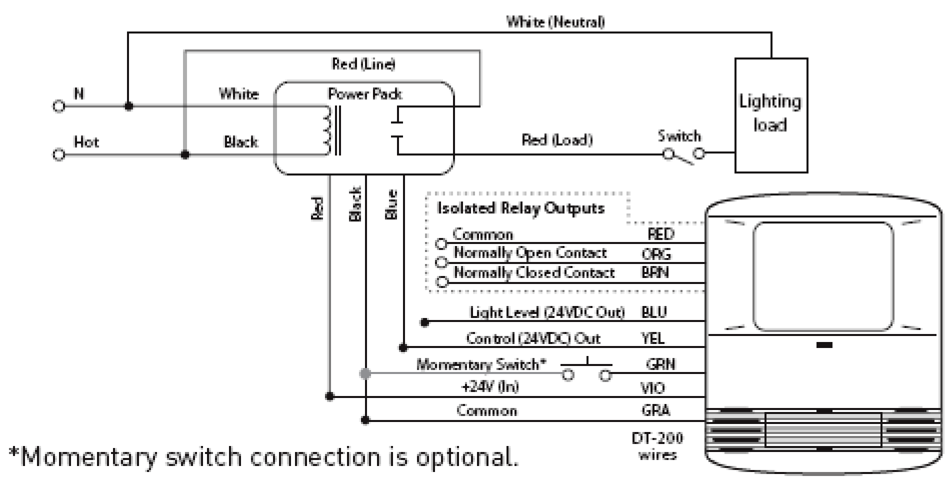


Figure 42: Occupancy Sensor Wiring Diagram

Lobby- Control Scheme

Subway stations operate on a twenty four hour, seven day week basis. A station- management system will provide lighting control in all the public areas. The station-management system is already installed in the subway station and the entrance lights will be connected into the system. This gives the building owner remote control of the lobby. The breaker connected to the lights will be a switch rated breaker so the lights can be turned off manually for maintenance or encase of an emergency.

Figure 43: Switching Rated Breaker

Façade- Control Scheme

An electronic time clock is used to control the lighting. The ET8000 electronic time switch from Intermatic has an astronomic feature which provides sunset on and sunrise off to prevent the need of separate photosenors. The time clock also allows for 28 set points to be programed to turn the lights on and off for different applications or days. The ET5215C allows two circuits to be connected to each time clock and 20 amps when connecting ballast. The façade design will need to use a total of 4 time clocks. Circuiting for the time clocks is noted on the drawings for which circuits go to which time clocks.

Control Equipment Schedule				
Product	**Manufacture**	**Part Number**	**Technology**	**Description**
Time Clock	Intermatic	ET8215C	Electronic Time Clock	7-Day astronomic time switch that features 7-day programming to provide flexibility. 2- circuits able to be separately controlled. On and off control with out additional photosensor.

Table 23: Control Equipment Schedule for Façade

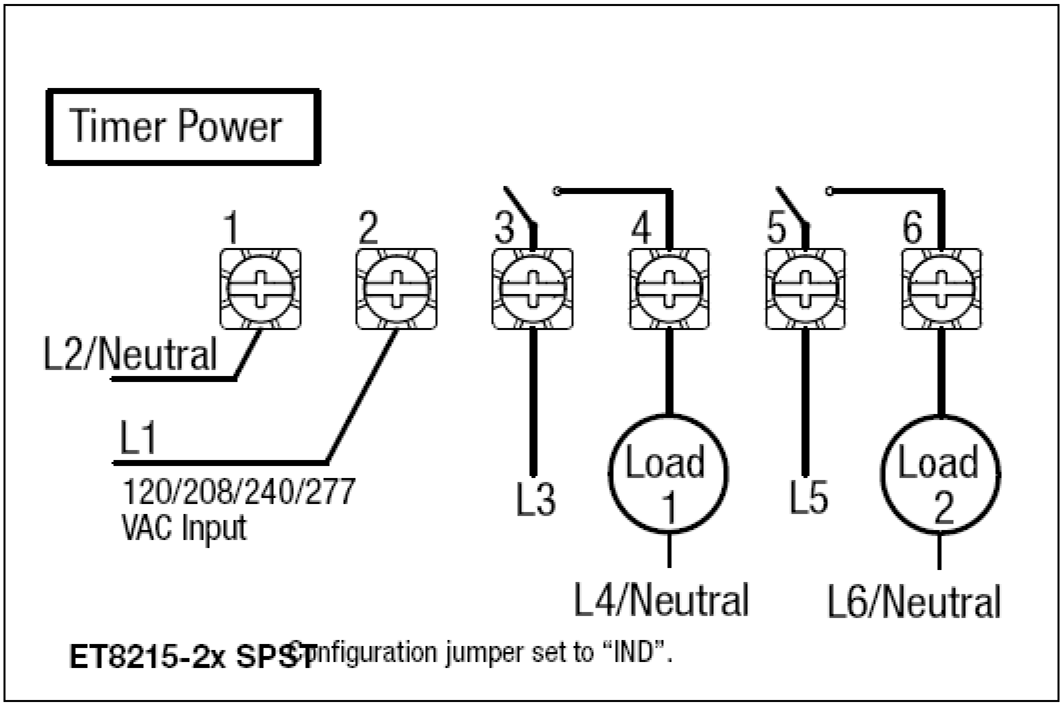


Figure 44: Facade Time Clock Schematic

Retail- Control Scheme

The retail space requires different lighting settings for different conditions. Also the easiest way for different employees to set the proper lighting conditions it is to have scenes pre-set. The control system used is the Lutron GRAFIK Eye QS Wireless system. The GRAFIK Eye can control up to 6 lighting zones and 3 shade zones, all 6 zones were used and one shade zone was used.

The different scenes set are “Open, Closed, Stock and All Off”. The open scene turns on all the lights on when the store is open and ready for business, while the closed setting will leave specific lights on like the dim the LED panels to 50%, leave the window display and the center display on so people walking by can see inside the store. The stock display will turn off the LED backlight panels and the LEDS under the sales transaction area, which is not need for stocking the shelves. All off would be used if for some reason they needed to turn off all the lights quickly with one button.

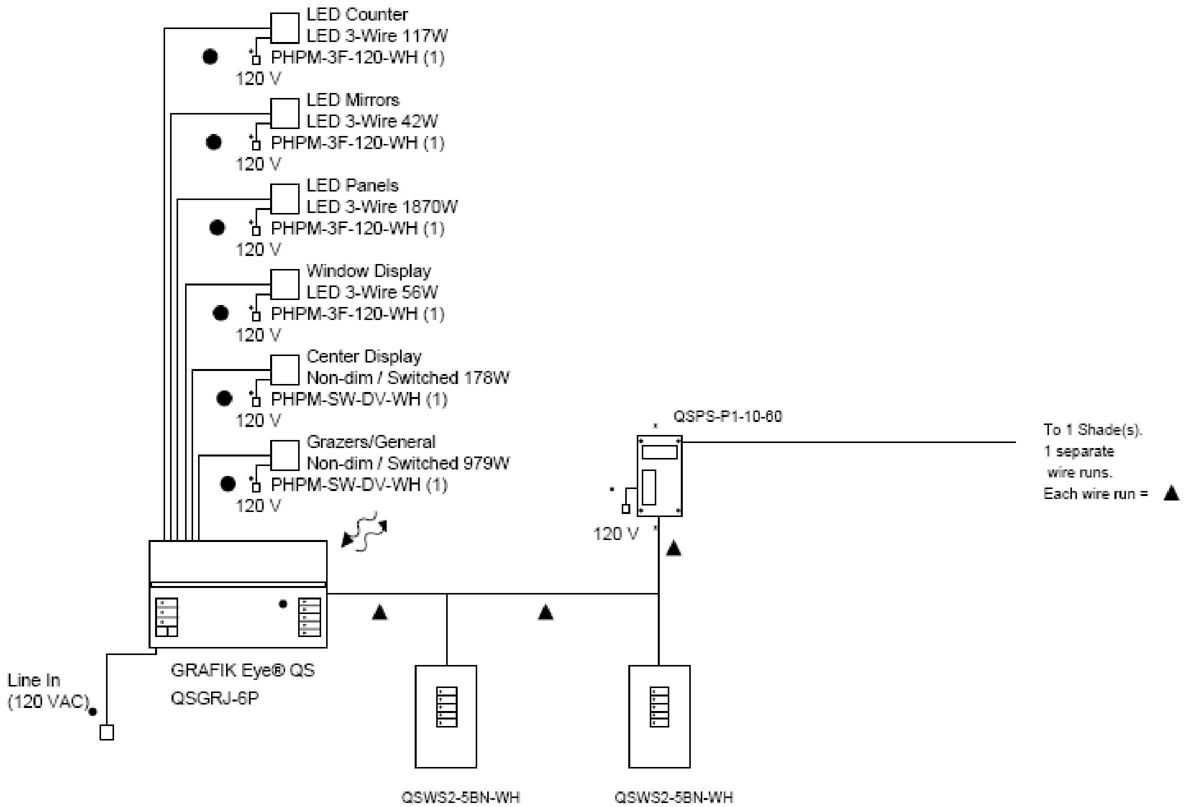


Figure 45: Retail Control One-Line Diagram

Control Equipment Schedule				
Product	**Manufacture**	**Part Number**	**Quantity**	**Description**
Control Unit	Lutron	QAGRJ-6P	1	GRAFIK Eye® QS Wireless Control Unit
Power Pack	Lutron	QSGFP-1WH-NST	1	GRAFIK Eye® QS Faceplate Kit
Stripe	Lutron	QSGS-BL	1	GRAFIK Eye® QS Stripe Kit
Power Pack	Lutron	PHPM-SW-DV-WH	2	Power Module
Power Pack	Lutron	PHPM-3F-120-WH	4	Power Module
Switch	Lutron	QSWS2-5BN-WH	2	QS 5-Button Wallstation, no insert
Power Supply	Lutron	QSPS-P1-10-60	1	Smart Panel Power Supply

Figure 46: Retail Control Equipment

Phase Control Zones					
Zone	**Name**	**Load Type**	**No. Fixtures**	**Wattage/Fixture**	**Total Wattage**
1	Grazers/General	Non-dim / Switched	11	89	979
2	Center Display	Non-dim / Switched	2	89	178
3	Window Display	LED 3-Wire	4	14	56
4	LED Panels	Inc / Hal	11	170	1870
5	LED Mirrors	LED 3-Wire	3	14	42
6	LED Counter	LED 3-Wire	9	13	117

Figure 47: Zone Controls

Panelboard Schedules

Office

Office- Existing Panelboard

PANEL DESIGNATION	LP-C3	LOCATION	LEVEL 3 ELEC CL
SERVICE VOLTAGE	120 /208V, 3P, 4W+G	SERVING	CORBIN BUILDING
BUS RATING	225A	MOUNTING	SURFACE

DESCRIPTION	BREAKER P	BREAKER AMP	VOLTAMP A	VOLTAMP B	VOLTAMP C	CKT	BUS	CKT	VOLTAMP A	VOLTAMP B	VOLTAMP C	BREAKER P	BREAKER AMP	DESCRIPTION
REC-RM C301	1	20	1080			1		2	540			1	20	REC-RM C301
REC-RM C301	1	20		1080		3		4		426		1	20	LIGHTING
REC-RM C301	1	20			1080	5		6			720	1	20	REC-RM C301
LTG OFFICE	1	20	426			7		8	1080			1	20	REC-RM C301
LTG OFFICE	1	20		710		9		10		1080		1	20	REC-RM C301
LTG OFFICE	1	20			710	11		12			1080	1	20	REC-RM C301
LTG OFFICE	1	20	497			13		14	1080			1	20	REC-RM C301
LTG OFFICE	1	20		497		15		16		720		1	20	REC-RM C301
LTG OFFICE	1	20			568	17		18			1080	1	20	REC-RM C301
LTG OFFICE	1	20	497			19		20	770			1	20	REC -MECH RM, MD
LTG OFFICE	1	20		710		21		22		540		1	20	REC - RM C306, C307
LTG OFFICE	1	20			497	23		24			180	1	20	ELEC CLOSET REC
SPARE	1	20				25		26	750			1	20	COPY RM REC
SPARE	1	20				27		28		750		1	20	COPY RM REC
SPARE	1	20				29		30			750	1	20	COPY RM REC
SPARE	1	20				31		32	750			1	20	COPY RM REC
SPARE	1	20				33		34		400		1	20	WATER COOLER
SPARE	1	20				35		36			800	1	20	COFFEE MAKER
SPARE	1	20				37		38	400			1	20	REFRIGERATOR
SPARE	1	20				39		40		1000		1	20	MICROWAVE
FSD (3)	1	20			150	41		42			720	1	20	REC-RM C309
TOTALS			2500	2997	3005				5370	4916	5330			

MAIN BREAKER	225 AF / 150 AT	LINE AMPS	67.0
FEEDER SIZE	P175D	MINIMUM INTERRUPTING CAPACITY	
SOURCE	DB-S/4	BREAKERS RMS SYMMETRICAL AMPS	22000

Figure 48: Existing Office Panel

Office- New Lighting Circuits

Circuit						Unit		Subtotal	
No.	C/B Size	Location	Description	C/NC	Quantity	Watts	VA	Watts	VA
7	20	2nd Floor Office	A Luminaires	C	4	59	60	236	240
9	20	2nd Floor Office	A Luminaires	C	7	59	60	413	420
11	20	2nd Floor Office	A Luminaires	C	11	59	60	649	660
13	20	2nd Floor Office	A Luminaires	C	11	59	60	649	660
15	20	2nd Floor Office	A Luminaires	C	11	59	60	649	660
17	20	2nd Floor Office	A Luminaires	C	2	36	37.2	72	74.4
			B Luminaires	C	10	59	60	590	600
19	20	2nd Floor Office	A Luminaires	C	4	36	37.2	144	148.8
			B Luminaires	C	4	59	60	236	240

Table 24: New Office Circuits

Office- Panelboard Sizing Worksheet

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->				LP-C3		Panel Location:			LEVEL 3 ELEC CL		
Nominal Phase to Neutral Voltage------->				120		Phase:			3		
Nominal Phase to Phase Voltage-------->				208		Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	REC	1	RM C301	1080	VA	1.00	1080	1080		
2	A	REC	1	RM C301	540	VA	1.00	540	540		
3	B	REC	1	RM C301	1080	VA	1.00	1080	1080		
4	B	LIGHTING	3	MEETING	426	VA	1.00	426	426		
5	C	REC	1	RM C301	1080	VA	1.00	1080	1080		
6	C	REC	1	C301	720	VA	1.00	720	720		
7	A	LIGHTING	3	C301	240	VA	1.00	240	240		
8	A	REC	1	C301	1080	VA	1.00	1080	1080		
9	B	LIGHTING	3	C301	420	VA	1.00	420	420		
10	B	REC	1	C301	1080	VA	1.00	1080	1080		
11	C	LIGHTING	3	C301	660	VA	1.00	660	660		
12	C	REC	1	C301	1080	VA	1.00	1080	1080		
13	A	LIGHTING	3	C301	660	VA	1.00	660	660		
14	A	REC	1	C301	1080	VA	1.00	1080	1080		
15	B	LIGHTING	3	C301	74.4	VA	1.00	74	74		
16	B	REC	1	C301	720	VA	1.00	720	720		
17	C	LIGHTING	3	C301	674.4	VA	1.00	674	674		
18	C	REC	1	C301	1080	VA	1.00	1080	1080		
19	A	LIGHTING	3	C301	388.8	VA	1.00	389	389		
20	A	REC	1	MECH RM	770	VA	1.00	770	770		
21	B	SPARE		-	13	A	1.00	1560	1560		
22	B	REC	1	C306	540	VA	1.00	540	540		
23	C	SPARE		-	13	A	1.00	1560	1560		
24	C	REC	1	COPY RM	750	VA	1.00	750	750		
25	A	SPARE		-	13	A	1.00	1560	1560		
26	A	REC	1	COPY RM	750	VA	1.00	750	750		
27	B	SPARE		-	13	A	1.00	1560	1560		
28	B	REC	1	COPY RM	750	VA	1.00	750	750		
29	C	SPARE		-	13	A	1.00	1560	1560		
30	C	REC	1	COPY RM	750	VA	1.00	750	750		
31	A	SPARE		-	13	A	1.00	1560	1560		
32	A	REC	1	COPY RM	750	VA	1.00	750	750		
33	B	SPARE		-	13	A	1.00	1560	1560		
34	B	WATER COOLER	8	KITCH	400	VA	1.00	400	400		
35	C	SPARE		-	13	A	1.00	1560	1560		
36	C	COFFEE MAKER	8	KITCH	800	VA	1.00	800	800		
37	A	SPARE		-	13	A	1.00	1560	1560		
38	A	REFRIGERATOR	8	KITCH	400	VA	1.00	400	400		
39	B	SPARE		-	13	A	1.00	1560	1560		
40	B	MICROWAVE	8	KITCH	1000	VA	1.00	1000	1000		
41	C	SPARE		-	13	A	1.00	1560	1560		
42	C	REC	1	C309	720	VA	1.00	720	720		
PANEL TOTAL								39.7	39.7	Amps=	110.3
PHASE LOADING								kW	kVA	%	Amps
PHASE TOTAL			A					12.4	12.4	31%	103.5
PHASE TOTAL			B					12.7	12.7	32%	106.1
PHASE TOTAL			C					14.6	14.6	37%	121.3
LOAD CATAGORIES				Connected			Demand				Ver. 104
				kW	kVA	DF	kW	kVA	PF		
1		receptacles	1	16.4	16.4		16.4	16.4	1.00		
2		computers		0.0	0.0		0.0	0.0			
3		fluorescent lighting	3	3.5	3.5		3.5	3.5	1.00		
4		HID lighting		0.0	0.0		0.0	0.0			
5		incandescent lighting		0.0	0.0		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	8	2.6	2.6		2.6	2.6	1.00		
9		unassigned		17.2	17.2		17.2	17.2	1.00		
Total Demand Loads							39.7	39.7			
Spare Capacity				20%			7.9	7.9			
Total Design Loads							47.6	47.6	1.00	Amps=	132.3

Default Power Factor =	0.80
Default Demand Factor =	100 %

Figure 49: Panelboard Sizing Worksheet

Office- Updated Panelboard

PANELBOARD SCHEDULE												
VOLTAGE: 208Y/120V,3PH,4W SIZE/TYPE BUS: 225A SIZE/TYPE MAIN: 150A/3P C/B			PANEL TAG: LP-C3 PANEL LOCATION: LEVEL 3 ELEC CL PANEL MOUNTING: SURFACE						MIN. C/B AIC: 22K OPTIONS:			
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
REC	RM C301	1080	20A/1P	1	*			2	20A/1P	540	RM C301	REC
REC	RM C301	1080	20A/1P	3		*		4	20A/1P	426	MEETING	LIGHTING
REC	RM C301	1080	20A/1P	5			*	6	20A/1P	720	C301	REC
LIGHTING	C301	240	20A/1P	7	*			8	20A/1P	1080	C301	REC
LIGHTING	C301	420	20A/1P	9		*		10	20A/1P	1080	C301	REC
LIGHTING	C301	660	20A/1P	11			*	12	20A/1P	1080	C301	REC
LIGHTING	C301	660	20A/1P	13	*			14	20A/1P	1080	C301	REC
LIGHTING	C301	74	20A/1P	15		*		16	20A/1P	720	C301	REC
LIGHTING	C301	674	20A/1P	17			*	18	20A/1P	1080	C301	REC
LIGHTING	C301	389	20A/1P	19	*			20	20A/1P	770	MECH RM	REC
SPARE	-	1560	20A/1P	21		*		22	20A/1P	540	C306	REC
SPARE	-	1560	20A/1P	23			*	24	20A/1P	750	COPY RM	REC
SPARE	-	1560	20A/1P	25	*			26	20A/1P	750	COPY RM	REC
SPARE	-	1560	20A/1P	27		*		28	20A/1P	750	COPY RM	REC
SPARE	-	1560	20A/1P	29			*	30	20A/1P	750	COPY RM	REC
SPARE	-	1560	20A/1P	31	*			32	20A/1P	750	COPY RM	REC
SPARE	-	1560	20A/1P	33		*		34	20A/1P	400	KITCH	WATER COOLER
SPARE	-	1560	20A/1P	35			*	36	20A/1P	800	KITCH	COFFEE MAKER
SPARE	-	1560	20A/1P	37	*			38	20A/1P	400	KITCH	REFRIGERATOR
SPARE	-	1560	20A/1P	39		*		40	20A/1P	1000	KITCH	MICROWAVE
SPARE	-	1560	20A/1P	41			*	42	20A/1P	720	C309	REC
CONNECTED LOAD (KW) - A Ph.		12.42								TOTAL DESIGN LOAD (KW)		47.64
CONNECTED LOAD (KW) - B Ph.		12.73								POWER FACTOR		1.00
CONNECTED LOAD (KW) - C Ph.		14.55								TOTAL DESIGN LOAD (AMPS)		132

Figure 50: Updated Office Panel Schedule

Office- Feeder Schedule

Feeder Schedule	
Panelboard Tag	LP-C3
Panelboard Voltage	208Y/120
Calculated Design Load (kW)	47.6
Calculated Power Factor	0.87
Calculated Design Load (A)	110.2
Calculated Load (A) with spare	132.2
Feeder Protection Size	150A
Sets	1
Wire Size	
Phase (75°C THHN)	(3) #1/0 AWG
Neutral (75°C THHN)	(1) #1/0 AWG
Ground (75°C THHN)	(1) #6 AWG
Conduit (RMC)	2"
Power Factor	0.95
Length of Run (Ft)	85
Voltage Drop (V)	2.4
% Drop	1.1%

Figure 51: Office Feeder Schedule

Lobby & Façade

Street Level- Existing Panelboard

PANEL DESIGNATION	LP-CS	LOCATION	B'MNT EL. EQ. RM
SERVICE VOLTAGE	120 /208V, 3P, 4W+G	SERVING	CORBIN BUILDING
BUS RATING	225A	MOUNTING	SURFACE

DESCRIPTION	BREAKER		VOLTAMP			CKT	BUS	CKT	VOLTAMP			BREAKER		DESCRIPTION
	P	AMP	A	B	C				A	B	C	P	AMP	
LTG FSTC ENT	1	20	564			1		2	360			1	20	REC- STREET LEVEL
LTG FSTC ENT	1	20		564		3		4		360		1	20	REC- STREET LEVEL
LTG MEZZ LVL	1	20			458	5		6			360	1	20	REC- STREET LEVEL
UH-C-2	3	20	1700			7		8	360			1	20	REC- STREET LEVEL
-	-	20		1700		9		10		850		1	20	STREET LTG. & REC.
-	-	20			1700	11		12			540	1	20	REC- STREET LEVEL
UH-C-3	2	20	1000			13		14	360			1	20	REC- STREET LEVEL
-	-	20		1000		15		16				1	20	SPARE
EF-C-9	-	-			528	17		18				1	20	SPARE
UH-C1	3	20	1332			19		20				1	20	SPARE
-	-	-		1332		21		22				1	20	SPARE
-	-	-			1332	23		24				1	20	SPARE
SPARE	3	20				25		26	360			1	20	REC-RM C101
-	-	-				27		28		540		1	20	REC-RM C101
-	-	-				29		30				1	20	SPARE
FCU-C-7	2	20	1064			31		32				1	20	SPARE
-	-	-		1064		33		34				1	20	SPARE
FCU-C-1	2	20			250	35		36			748	2	20	FCU-C-3
-	-	-	250			37		38	748			-	-	-
FCU-C-2	2	20		250		39		40		748		2	20	FCU-C-4
-	-	-			250	41		42			748	-	-	-
TOTALS			5910	5910	4518				2188	2498	2396			

MAIN BREAKER	225 AF / 150 AT	LINE AMPS	65.1
FEEDER SIZE	P175D	MINIMUM INTERRUPTING CAPACITY	
SOURCE	DB-S/4	BREAKERS RMS SYMMETRICAL AMPS	22 000

Figure 52: Existing Street Level Panelboard

PANEL DESIGNATION	RP-EL5455				LOCATION	LVL 9 ELEV M/C RM
SERVICE VOLTAGE	120 /208V, 3P, 4W+G				SERVING	CORBIN BUILDING
BUS RATING	100A				MOUNTING	SURFACE

DESCRIPTION	BREAKER P	BREAKER AMP	VOLTAMP A	VOLTAMP B	VOLTAMP C	CKT	BUS	CKT	VOLTAMP A	VOLTAMP B	VOLTAMP C	BREAKER P	BREAKER AMP	DESCRIPTION
PIT LTG AND REC	1	20	280			1		2				3	60	SPARE
REC SMP PMP	1	20		840		3		4				-	-	-
REC M/C RM	1	20			360	5		6				-	-	-
CAB LTG, PE-54	1	20	400			7		8				1	20	SPARE
CAB LTG, PE-55	1	20		400		9		10				1	20	SPARE
LTG ELEV M/C RM	1	20			320	11		12				1	20	SPARE
EMERGENCY LGT	1	20	100			13		14				1	20	SPARE
EF-C8, ELEV M/C RM	1	20		528		15		16				1	20	SPARE
SPARE	1	20				17		18				1	20	SPARE
SPARE	1	20				19		20				1	20	SPARE
SPARE	1	20				21		22				1	20	SPARE
SPARE	1	20				23		24				1	20	SPARE
TOTALS			780	1768	680									

MAIN BREAKER	100 AF / 50 AT	LINE AMPS	9.0
FEEDER SIZE	P55D	MINIMUM INTERRUPTING CAPACITY	
SOURCE	DP-EL5455 VIA T2-EL54	BREAKERS RMS SYMMETRICAL AMPS	22 000

Figure 53: Existing Roof Level Panelboard

Lobby- New Lighting Circuits

Circuit						Unit		Subtotal	
No.	C/B Size	Location	Description	C/NC	Quantity	Watts	VA	Watts	VA
1	20	Lobby	D Luminaires	NC	9	30	30	270	270
3	20	Lobby	E Luminaires	NC	13	31	34.8	403	452.4
5	20	Lobby	C Luminaires	NC	2	45	48	90	96

Table 25: New Lobby Circuits

Façade- New Street Level Lighting Circuits

Circuit						Unit		Subtotal	
No.	C/B Size	Location	Description	C/NC	Quantity	Watts	VA	Watts	VA
16	20	Façade	H Luminaires	C	3	36	37.2	108	111.6
18	20	Façade	G Luminaires	C	13	36	37.2	468	483.6
			I Luminaires	C	3	50	50	150	150
20	20	Façade	G Luminaires	C	10	36	37.2	360	372
			I Luminaires	C	3	50	50	150	150
22	20	Façade	J Luminaires	C	2	428	441	856	881.92
24	20	Façade	J Luminaires	C	2	428	441	856	881.92

Table 26: New Façade Circuits

Façade- New Roof Level Lighting Circuits

Circuit						Unit		Subtotal	
No.	C/B Size	Location	Description	C/NC	Quantity	Watts	VA	Watts	VA
17	20	Façade	F Luminaires	C	2	37	37.2	74	74.4

Street Level- Panelboard Sizing Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag------------------------->	LP-CS	Panel Location:	B'MNT EL. EQ. RM
Nominal Phase to Neutral Voltage------->	120	Phase:	3
Nominal Phase to Phase Voltage-------->	208	Wires:	4

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	LIGHTING	3	FSTC LOBBY	240	VA	1.00	240	240	
2	A	REC	1	FSTC LOBBY	360	VA	1.00	360	360	
3	B	LIGHTING	3	FSTC LOBBY	403	VA	1.00	403	403	
4	B	REC	1	FSTC LOBBY	360	VA	1.00	360	360	
5	C	LIGHTING	4	FSTC LOBBY	403	VA	1.00	403	403	
6	C	REC	1	CS09	360	VA	1.00	360	360	
7	A	UNIT HEATER	7	C-2	1700	VA	1.00	1700	1700	
8	A	REC	1	CS09	360	VA	1.00	360	360	
9	B	UNIT HEATER	7	C-2	1700	VA	1.00	1700	1700	
10	B	REC	3	CORBIN ENTRY	850	VA	1.00	850	850	
11	C	-	7	-	1700	VA	1.00	1700	1700	
12	C	REC	1	CS08	540	VA	1.00	540	540	
13	A	UNIT HEATER	7	-	1000	VA	1.00	1000	1000	
14	A	REC	1	CS08	360	VA	1.00	360	360	
15	B	-	7	C-3	1000	VA	1.00	1000	1000	
16	B	FAÇADE- CORBIN	3	CORBIN ENTRY	111.6	VA	1.00	112	112	
17	C	EF-C-9	6	C-9	528	VA	1.00	528	528	
18	C	FAÇADE- FSTC	3	FSTC ENTRY	633.6	VA	1.00	634	634	
19	A	UNIT HEATER	7	C-1	1332	VA	1.00	1332	1332	
20	A	FAÇADE- RETAIL	3	RETAIL 1 ENTRY	522	VA	1.00	522	522	
21	B	-	7	-	1332	VA	1.00	1332	1332	
22	B	FAÇADE- LIGHTING	4	FAÇADE	881.92	VA	1.00	882	882	
23	C	-	7	-	1332	VA	1.00	1332	1332	
24	C	FAÇADE- LIGHTING	4	FAÇADE	881.92	VA	1.00	882	882	
25	A	SPARE		-	13	A	1.00	1560	1560	
26	A	REC	1	C101	360	VA	1.00	360	360	
27	B	-		-	13	A	1.00	1560	1560	
28	B	REC	1	C101	540	VA	1.00	540	540	
29	C	-		-	13	A	1.00	1560	1560	
30	C	SPARE		-	13	A	1.00	1560	1560	
31	A	FAN COIL UNIT		C-7	1064	VA	1.00	1064	1064	
32	A	SPARE		-	13	A	1.00	1560	1560	
33	B	-		-	1064	VA	1.00	1064	1064	
34	B	SPARE		-	13	A	1.00	1560	1560	
35	C	FAN COIL UNIT		C-1	250	VA	1.00	250	250	
36	C	FAN COIL UNIT		C-3	748	VA	1.00	748	748	
37	A	-		-	250	VA	1.00	250	250	
38	A	-		-	748	VA	1.00	748	748	
39	B	FAN COIL UNIT		C-2	250	VA	1.00	250	250	
40	B	FAN COIL UNIT		C-4	748	VA	1.00	748	748	
41	C	-		-	250	VA	1.00	250	250	
42	C	-		-	748	VA	1.00	748	748	
PANEL TOTAL								35.3	35.3	Amps= 98.0

PHASE LOADING		kW	kVA	%	Amps
PHASE TOTAL	A	11.4	11.4	32%	95.1
PHASE TOTAL	B	12.4	12.4	35%	103.0
PHASE TOTAL	C	11.5	11.5	33%	95.8

LOAD CATAGORIES			Connected			Demand				Ver. 104
			kW	kVA	DF	kW	kVA	PF		
1	receptacles	1	3.2	3.2		3.2	3.2	1.00		
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting	3	2.8	2.8		2.8	2.8	1.00		
4	HID lighting	4	2.2	2.2		2.2	2.2	1.00		
5	incandescent lighting		0.0	0.0		0.0	0.0			
6	HVAC fans	6	0.5	0.5		0.5	0.5	1.00		
7	heating	7	11.1	11.1		11.1	11.1	1.00		
8	kitchen equipment	8	0.0	0.0		0.0	0.0			
9	unassigned		15.5	15.5		15.5	15.5	1.00		
Total Demand Loads						35.3	35.3			
Spare Capacity			20%			7.1	7.1			
Total Design Loads						42.3	42.3	1.00	Amps=	117.6

Default Power Factor =	0.80
Default Demand Factor =	100 %

Figure 54: Street Level Panelboard Sizing Worksheet

Roof Level- Panelboard Sizing Worksheet

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					RP-EL5455	Panel Location:			LVL 9 ELEV M/C RM		
Nominal Phase to Neutral Voltage------->					120	Phase:			3		
Nominal Phase to Phase Voltage-------->					208	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	PIT LTG AND REC	1	PIT	280	VA	1.00	280	280		
2	A	SPARE		-	39	A	1.00	4680	4680		
3	B	REC SMP	1	PIT	840	VA	1.00	840	840		
4	B	-		-	39	A	1.00	4680	4680		
5	C	REC M/C RM	1	M/C RM	360	VA	1.00	360	360		
6	C	-		-	39	A	1.00	4680	4680		
7	A	CAB LTG PE-54	3	ELEV CAB	400	VA	1.00	400	400		
8	A	SPARE		-	3600	va	0.90	3240	3600		
9	B	CAB LTG PE-55	3	ELEV CAB	400	VA	1.00	400	400		
10	B	SPARE		-	3600	va	0.90	3240	3600		
11	C	LTG ELEV M/C RM	3	M/C RM	320	VA	1.00	320	320		
12	C	SPARE		-	3600	va	0.90	3240	3600		
13	A	EMERGENCY LGT	3	ELEV RM	100	VA	1.00	100	100		
14	A	SPARE		-	3600	va	0.90	3240	3600		
15	B	EF-CB ELEV M/C RM	6	M/C RM	528	VA	1.00	528	528		
16	B	SPARE		-	3600	va	0.90	3240	3600		
17	C	FAÇADE LTG	3	FAÇADE	74.4	VA	1.00	74	74		
18	C	SPARE		-	13	A	1.00	1560	1560		
19	A	SPARE		-	13	A	1.00	1560	1560		
20	A	SPARE		-	13	A	1.00	1560	1560		
21	B	SPARE		-	13	A	1.00	1560	1560		
22	B	SPARE		-	13	A	1.00	1560	1560		
23	C	SPARE		-	13	A	1.00	1560	1560		
24	C	SPARE		-	13	A	1.00	1560	1560		
25	A					w		0	0		
26	A					w		0	0		
27	B					w		0	0		
28	B					w		0	0		
29	C					w		0	0		
30	C					w		0	0		
31	A					w		0	0		
32	A					w		0	0		
33	B					w		0	0		
34	B					w		0	0		
35	C					w		0	0		
36	C					w		0	0		
37	A					w		0	0		
38	A					w		0	0		
39	B					w		0	0		
40	B					w		0	0		
41	C					w		0	0		
42	C					w		0	0		
PANEL TOTAL								44.5	46.3	Amps=	128.5
PHASE LOADING								kW	kVA	%	Amps
PHASE TOTAL			A					15.1	15.8	34%	131.5
PHASE TOTAL			B					16.0	16.8	36%	139.7
PHASE TOTAL			C					13.4	13.7	30%	114.3
LOAD CATAGORIES				Connected			Demand				Ver. 104
				kW	kVA	DF	kW	kVA	PF		
1	receptacles		1	1.5	1.5		1.5	1.5	1.00		
2	computers			0.0	0.0		0.0	0.0			
3	fluorescent lighting		3	1.3	1.3		1.3	1.3	1.00		
4	HID lighting			0.0	0.0		0.0	0.0			
5	incandescent lighting			0.0	0.0		0.0	0.0			
6	HVAC fans		6	0.5	0.5		0.5	0.5	1.00		
7	heating			0.0	0.0		0.0	0.0			
8	kitchen equipment			0.0	0.0		0.0	0.0			
9	unassigned			41.2	43.0		41.2	43.0	0.96		
Total Demand Loads							44.5	46.3			
Spare Capacity				20%			8.9	9.3			
Total Design Loads							53.4	55.5	0.96	Amps=	154.2

Default Power Factor =	0.80
Default Demand Factor =	100 %

Figure 55: Roof Level Panelboard Worksheet

Street Level- Updated Panelboard

PANELBOARD SCHEDULE												
VOLTAGE:	208Y/120V,3PH,4W			PANEL TAG:	LP-CS				MIN. C/B AIC:	22k		
SIZE/TYPE BUS:	225A			PANEL LOCATION:	B'MNT EL. EQ. RM				OPTIONS:			
SIZE/TYPE MAIN:	125A/3P C/B			PANEL MOUNTING:	SURFACE							
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
LIGHTING	FSTC LOBBY	240	20A/1P	1	*			2	20A/1P	360	FSTC LOBBY	REC
LIGHTING	FSTC LOBBY	403	20A/1P	3		*		4	20A/1P	360	FSTC LOBBY	REC
LIGHTING	FSTC LOBBY	403	20A/1P	5			*	6	20A/1P	360	CS09	REC
UNIT HEATER	C-2	1700	20A/3P	7	*			8	20A/1P	360	CS09	REC
UNIT HEATER	C-2	1700	-	9		*		10	20A/1P	850	CORBIN ENTRY	REC
-	-	1700	-	11			*	12	20A/1P	540	CS08	REC
UNIT HEATER	-	1000	20A/2P	13	*			14	20A/1P	360	CS08	REC
-	C-3	1000	-	15		*		16	20A/1P	112	CORBIN ENTRY	FAÇADE- CORBIN
EF-C-9	C-9	528	20A/1P	17			*	18	20A/1P	634	FSTC ENTRY	FAÇADE- FSTC
UNIT HEATER	C-1	1332	20A/3P	19	*			20	20A/1P	522	RETAIL 1 ENTRY	FAÇADE- RETAIL
-	-	1332	-	21		*		22	20A/1P	882	FAÇADE	FAÇADE- LIGHTING
-	-	1332	-	23			*	24	20A/1P	882	FAÇADE	FAÇADE- LIGHTING
SPARE	-	1560	20A/3P	25	*			26	20A/1P	360	C101	REC
-	-	1560	-	27		*		28	20A/1P	540	C101	REC
-	-	1560	-	29			*	30	20A/1P	1560	-	SPARE
FAN COIL UNIT	C-7	1064	20A/2P	31	*			32	20A/1P	1560	-	SPARE
-	-	1064	-	33		*		34	20A/1P	1560	-	SPARE
FAN COIL UNIT	C-1	250	20A/2P	35			*	36	20A/2P	748	C-3	FAN COIL UNIT
-	-	250	-	37	*			38	-	748	-	-
FAN COIL UNIT	C-2	250	20A/2P	39		*		40	20A/2P	748	C-4	FAN COIL UNIT
-	-	250	-	41			*	42	-	748	-	-
CONNECTED LOAD (KW) - A Ph.		11.42							TOTAL DESIGN LOAD (KW)			42.33
CONNECTED LOAD (KW) - B Ph.		12.36							POWER FACTOR			1.00
CONNECTED LOAD (KW) - C Ph.		11.49							TOTAL DESIGN LOAD (AMPS)			118

Figure 56: Updated Street Level Panel Schedule

Lobby- Feeder Schedule

Feeder Schedule	
Panelboard Tag	LP-CS
Panelboard Voltage	208Y/120
Calculated Design Load (kW)	42.3
Calculated Power Factor	0.88
Calculated Design Load (A)	98.0
Calculated Load (A) with spare	117.6
Feeder Protection Size	125A
Sets	1
Wire Size	
Phase (75°C THHN)	(3) #1 AWG
Neutral (75°C THHN)	(1) #1 AWG
Ground (75°C THHN)	(1) #6 AWG
Conduit (RMC)	1-1/2"
Power Factor	0.95
Length of Run (Ft)	6
Voltage Drop (V)	0.2
% Drop	0.1%

Figure 57: Lobby Feeder Schedule

Roof Level- Updated Panelboard

PANELBOARD SCHEDULE												
VOLTAGE: 208Y/120V,3PH,4W SIZE/TYPE BUS: 225A SIZE/TYPE MAIN: 175A/3P C/B				PANEL TAG: RP-EL5455 PANEL LOCATION: LVL 9 ELEV M/C RM PANEL MOUNTING: SURFACE					MIN. C/B AIC: 22k OPTIONS:			
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
PIT LTG AND REC	PIT	280	20A/1P	1	*			2	60A/3P	4680	-	SPARE
REC SMP	PIT	840	20A/1P	3		*		4	-	4680	-	-
REC M/C RM	M/C RM	360	20A/1P	5			*	6	-	4680	-	-
CAB LTG PE-54	ELEV CAB	400	20A/1P	7	*			8	20A/1P	3240	-	SPARE
CAB LTG PE-55	ELEV CAB	400	20A/1P	9		*		10	20A/1P	3240	-	SPARE
LTG ELEV M/C RM	M/C RM	320	20A/1P	11			*	12	20A/1P	3240	-	SPARE
EMERGENCY LGT	ELEV RM	100	20A/1P	13	*			14	20A/1P	3240	-	SPARE
EF-CB ELEV M/C RM	M/C RM	528	20A/1P	15		*		16	20A/1P	3240	-	SPARE
FAÇADE LTG	FAÇADE	74	20A/1P	17			*	18	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	19	*			20	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	21		*		22	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	23			*	24	20A/1P	1560	-	SPARE
CONNECTED LOAD (KW) - A Ph.		15.06								TOTAL DESIGN LOAD (KW)		53.35
CONNECTED LOAD (KW) - B Ph.		16.05								POWER FACTOR		0.96
CONNECTED LOAD (KW) - C Ph.		13.35								TOTAL DESIGN LOAD (AMPS)		154

Figure 58: Roof Level Panelboard Schedule

Roof- Feeder Schedule

Feeder Schedule	
Panelboard Tag	RP-EL5455
Panelboard Voltage	208Y/120
Calculated Design Load (kW)	53.4
Calculated Power Factor	0.85
Calculated Design Load (A)	128.5
Calculated Load (A) with spare	154.2
Feeder Protection Size	175A
Sets	1
Wire Size	
Phase (75°C THHN)	(3) #2/0 AWG
Neutral (75°C THHN)	(1) #2/0 AWG
Ground (75°C THHN)	(1) #6 AWG
Conduit (RMC)	2"
Power Factor	0.95
Length of Run (Ft)	160
Voltage Drop (V)	4.3
% Drop	2.1%

Figure 59: Roof Panelboard Schedule

Retail

Retail Level- No Existing Panelboard

The retail space was to be designed and constructed by tenant. Tenant is required to supply their own panelboard.

Retail- New Lighting Circuits

Circuit						Unit		Subtotal	
No.	C/B Size	Location	Description	C/NC	Quantity	Watts	VA	Watts	VA
1	20	Retail Space 1	K Luminaires	C	11	89	90	979	990
2	20	Retail Space 1	K Luminaires	C	2	89	90	178	180
3	20	Retail Space 1	N Luminaires	C	4	14	15.6	56	62.4
4	20	Retail Space 1	M Luminaires	C	11	170	189	1870	2078
5	20	Retail Space 1	N Luminaires	C	3	14	15.6	42	46.67
6	20	Retail Space 1	L Luminaires	C	9	13	13.1	117	118.2

Figure 60: New Retail Lighting Circuits

Retail Level- New Panelboard

PANELBOARD SIZING WORKSHEET

Panel Tag------------------------->	LP-RETAIL	Panel Location:	RETAIL 1 STORAGE
Nominal Phase to Neutral Voltage------->	120	Phase:	3
Nominal Phase to Phase Voltage-------->	208	Wires:	4

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	Lighting	4	Retail	979	w		979	1224	
2	A	Lighting	4	Retail	178	w		178	223	
3	B	Lighting	3	Window Case	56	w		56	70	
4	B	Lighting	3	Casework	1870	w		1870	2338	
5	C	Lighting	3	Mirror	42	w		42	53	
6	C	Lighting	3	Sales Area	117	w		117	146	
7	A	SPARE		-	13	A	1.00	1560	1560	
8	A	SPARE		-	13	A	1.00	1560	1560	
9	B	SPARE		-	13	A	1.00	1560	1560	
10	B	SPARE		-	13	A	1.00	1560	1560	
11	C	SPARE		-	13	A	1.00	1560	1560	
12	C	SPARE		-	13	A	1.00	1560	1560	
13	A	SPARE		-	13	A	1.00	1560	1560	
14	A	SPARE		-	13	A	1.00	1560	1560	
15	B	SPARE		-	13	A	1.00	1560	1560	
16	B	SPARE		-	13	A	1.00	1560	1560	
17	C	SPARE		-	13	A	1.00	1560	1560	
18	C	SPARE		-	13	A	1.00	1560	1560	
19	A	SPARE		-	13	A	1.00	1560	1560	
20	A	SPARE		-	13	A	1.00	1560	1560	
21	B	SPARE		-	13	A	1.00	1560	1560	
22	B	SPARE		-	13	A	1.00	1560	1560	
23	C	SPARE		-	13	A	1.00	1560	1560	
24	C	SPARE		-	13	A	1.00	1560	1560	
25	A					w		0	0	
26	A					w		0	0	
27	B					w		0	0	
28	B					w		0	0	
29	C					w		0	0	
30	C					w		0	0	
31	A					w		0	0	
32	A					w		0	0	
33	B					w		0	0	
34	B					w		0	0	
35	C					w		0	0	
36	C					w		0	0	
37	A					w		0	0	
38	A					w		0	0	
39	B					w		0	0	
40	B					w		0	0	
41	C					w		0	0	
42	C					w		0	0	
PANEL TOTAL								31.3	32.1	Amps= 89.3

PHASE LOADING		kW	kVA	%	Amps
PHASE TOTAL	A	10.5	10.8	34%	90.1
PHASE TOTAL	B	11.3	11.8	37%	98.1
PHASE TOTAL	C	9.5	9.6	30%	79.7

LOAD CATAGORIES			Connected			Demand				Ver. 104
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0		0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	LED lighting	3	2.1	2.6		2.1	2.6	0.80		
4	HID lighting	4	1.2	1.4		1.2	1.4	0.80		
5	incandescent lighting		0.0	0.0		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		28.1	28.1		28.1	28.1	1.00		
Total Demand Loads						31.3	32.1			
Spare Capacity			20%			6.3	6.4			
Total Design Loads						37.6	38.6	0.97	Amps=	107.1

Default Power Factor =	0.80
Default Demand Factor =	100 %

Figure 61: Retail Panelboard Sizing Worksheet

Retail- New Panelboard Schedule

PANELBOARD SCHEDULE													
VOLTAGE: 208Y/120V,3PH,4W SIZE/TYPE BUS: 225A SIZE/TYPE MAIN: 125A/3P C/B					PANEL TAG: LP-RETAIL PANEL LOCATION: RETAIL 1 STORAGE PANEL MOUNTING: RECESSED					MIN. C/B AIC: 22k OPTIONS:			
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION	
Lighting	Retail	979	20A/1P	1	*			2	20A/1P	178	Retail	Lighting	
Lighting	Window Case	56	20A/1P	3		*		4	20A/1P	1870	Casework	Lighting	
Lighting	Mirror	42	20A/1P	5			*	6	20A/1P	117	Sales Area	Lighting	
SPARE	-	1560	20A/1P	7	*			8	20A/1P	1560	-	SPARE	
SPARE	-	1560	20A/1P	9		*		10	20A/1P	1560	-	SPARE	
SPARE	-	1560	20A/1P	11			*	12	20A/1P	1560	-	SPARE	
SPARE	-	1560	20A/1P	13	*			14	20A/1P	1560	-	SPARE	
SPARE	-	1560	20A/1P	15		*		16	20A/1P	1560	-	SPARE	
SPARE	-	1560	20A/1P	17			*	18	20A/1P	1560	-	SPARE	
SPARE	-	1560	20A/1P	19	*			20	20A/1P	1560	-	SPARE	
SPARE	-	1560	20A/1P	21		*		22	20A/1P	1560	-	SPARE	
SPARE	-	1560	20A/1P	23			*	24	20A/1P	1560	-	SPARE	
CONNECTED LOAD (KW) - A Ph.		10.52								TOTAL DESIGN LOAD (KW)		37.59	
CONNECTED LOAD (KW) - B Ph.		11.29								POWER FACTOR		0.97	
CONNECTED LOAD (KW) - C Ph.		9.52								TOTAL DESIGN LOAD (AMPS)		107	

Figure 62: Retail Panelboard Schedule

Retail- Feeder Schedule

Feeder Schedule	
Panelboard Tag	LP-RETAIL
Panelboard Voltage	208Y/120
Calculated Design Load (kW)	37.6
Calculated Power Factor	0.90
Calculated Design Load (A)	89.1
Calculated Load (A) with spare	107.1
Feeder Protection Size	110A
Sets	1
Wire Size	
Phase (75°C THHN)	(3) #2 AWG
Neutral (75°C THHN)	(1) #2 AWG
Ground (75°C THHN)	(1) #6 AWG
Conduit (RMC)	1-1/4"
Power Factor	0.95
Length of Run (Ft)	25
Voltage Drop (V)	0.7
% Drop	0.3%

Figure 63: Retail Panelboard Feeder

Emergency

Emergency- Existing Panelboard Schedule

PANEL DESIGNATION	LP-CU	LOCATION	BSMT LVL ELEC
SERVICE VOLTAGE	120 /208V, 3P, 4W+G	SERVING	CORBIN BUILDING
BUS RATING	225A	MOUNTING	SURFACE

DESCRIPTION	BREAKER		VOLTAMP			CKT	BUS	CKT	VOLTAMP			BREAKER		DESCRIPTION
	P	AMP	A	B	C				A	B	C	P	AMP	
EMER/EXIT LTG	1	20	884			1		2	716			1	20	EMER/EXIT LTG
EMER/EXIT LTG	1	20		781		3		4		716		1	20	EMER/EXIT LTG
EMER/EXIT LTG	1	20			429	5		6			1050	1	20	EMER/EXIT LTG
EMER/EXIT LTG	1	20	346			7		8	716			1	20	EMER/EXIT LTG
EMER/EXIT LTG	1	20		284		9		10		716		1	20	EMER/EXIT LTG
EMER/EXIT LTG	1	20			716	11		12			1050	1	20	EMER/EXIT LTG
EMER/EXIT LTG	1	20	716			13		14	732			1	20	EMER/EXIT LTG
SP-C3	1	20		1176		15		16		716		1	20	EMER/EXIT LTG
P-C2	1	20			528	17		18			600	1	20	EMER/EXIT LTG
SPARE	1	20				19		20	700			1	20	LIGHTING
SPARE	1	20				21		22		611		1	20	EMER/EXIT LTG
SPARE	1	20				23		24			696	1	20	SF-C-4
SPARE	1	20				25		26				1	20	SPARE
SPARE	1	20				27		28				1	20	SPARE
SPARE	1	20				29		30				1	20	SPARE
SPARE	1	20				31		32				1	20	SPARE
SPARE	1	20				33		34				1	20	SPARE
SPARE	1	20				35		36				1	20	SPARE
SPARE	1	20				37		38				1	20	SPARE
SPARE	1	20				39		40				1	20	SPARE
SPARE	1	20				41		42				1	20	SPARE
TOTALS			1946	2241	1673				2864	2759	3396			

MAIN BREAKER	225 AF / 150 AT	LINE AMPS	41.3
FEEDER SIZE	P175D	MINIMUM INTERRUPTING CAPACITY	
SOURCE	CORBIN LTG UPS	BREAKERS RMS SYMMETRICAL AMPS	22000

Figure 64: Existing Emergency Panel

Emergency- Updated Panelboard Sizing Worksheet

PANELBOARD SIZING WORKSHEET										
Panel Tag------------------------->				LP-CU	Panel Location:			BSMT LVL ELEC		
Nominal Phase to Neutral Voltage------->				120	Phase:			3		
Nominal Phase to Phase Voltage-------->				208	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	EMER/EXIT LTG		SUB BSM	884	VA	1.00	884	884	
2	A	EMER/EXIT LTG		ELECT RM	716	VA	1.00	716	716	
3	B	EMER/EXIT LTG		BSM	781	VA	1.00	781	781	
4	B	EMER/EXIT LTG		LVL 4 OFFICE	716	VA	1.00	716	716	
5	C	EMER/EXIT LTG		MEZZ	429	VA	1.00	429	429	
6	C	EMER/EXIT LTG		MECH RM	1050	VA	1.00	1050	1050	
7	A	EMER/EXIT LTG		FSTC LOBBY	397	VA	1.00	397	397	
8	A	EMER/EXIT LTG		LVL 5 OFFICE	716	VA	1.00	716	716	
9	B	EMER/EXIT LTG		SECURITY RM	284	VA	1.00	284	284	
10	B	EMER/EXIT LTG		LVL 6 OFFICE	716	VA	1.00	716	716	
11	C	EMER/EXIT LTG		CORBIN STAIRS	716	VA	1.00	716	716	
12	C	EMER/EXIT LTG		LVL 2 OFFICE	1050	VA	1.00	1050	1050	
13	A	EMER/EXIT LTG		LVL 3 OFFICE	367	VA	1.00	367	367	
14	A	EMER/EXIT LTG		LEVEL 7 OFFICE	732	VA	1.00	732	732	
15	B	SP-C3		SECURITY RM	1176	VA	1.00	1176	1176	
16	B	EMER/EXIT LTG		LEVEL 8 OFFICE	715	VA	1.00	715	715	
17	C	P-C2		SECURITY RM	528	VA	1.00	528	528	
18	C	EMER/EXIT LTG		RETAIL 2	600	VA	1.00	600	600	
19	A	EMER/EXIT LTG		RETAIL 1	14	VA	1.00	14	14	
20	A	LIGHTING		ESC RM	700	VA	1.00	700	700	
21	B	SPARE		-	13	A	1.00	1560	1560	
22	B	EMER/EXIT LTG		ELEV RM	611	VA	1.00	611	611	
23	C	SPARE		-	13	A	1.00	1560	1560	
24	C	EMER/EXIT LTG		FSTC LOBBY	696	VA	1.00	696	696	
25	A	SPARE		-	13	A	1.00	1560	1560	
26	A	SPARE		-	13	A	1.00	1560	1560	
27	B	SPARE		-	13	A	1.00	1560	1560	
28	B	SPARE		-	13	A	1.00	1560	1560	
29	C	SPARE		-	13	A	1.00	1560	1560	
30	C	SPARE		-	13	A	1.00	1560	1560	
31	A	SPARE		-	13	A	1.00	1560	1560	
32	A	SPARE		-	13	A	1.00	1560	1560	
33	B	SPARE		-	13	A	1.00	1560	1560	
34	B	SPARE		-	13	A	1.00	1560	1560	
35	C	SPARE		-	13	A	1.00	1560	1560	
36	C	SPARE		-	13	A	1.00	1560	1560	
37	A	SPARE		-	13	A	1.00	1560	1560	
38	A	SPARE		-	13	A	1.00	1560	1560	
39	B	SPARE		-	13	A	1.00	1560	1560	
40	B	SPARE		-	13	A	1.00	1560	1560	
41	C	SPARE		-	13	A	1.00	1560	1560	
42	C	SPARE		-	13	A	1.00	1560	1560	
PANEL TOTAL								45.8	45.8	Amps= 127.2

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					13.9	13.9	30%	115.7
PHASE TOTAL	B					15.9	15.9	35%	132.7
PHASE TOTAL	C					16.0	16.0	35%	133.2

LOAD CATAGORIES			Connected			Demand			Ver. 104
			kW	kVA	DF	kW	kVA	PF	
1	receptacles	1	0.0	0.0		0.0	0.0		
2	computers		0.0	0.0		0.0	0.0		
3	fluorescent lighting	3	0.0	0.0		0.0	0.0		
4	HID lighting		0.0	0.0		0.0	0.0		
5	incandescent lighting		0.0	0.0		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	8	0.0	0.0		0.0	0.0		
9	unassigned		45.8	45.8		45.8	45.8	1.00	
Total Demand Loads						45.8	45.8		
Spare Capacity			20%			9.2	9.2		
Total Design Loads						55.0	55.0	1.00	Amps= 152.6

Default Power Factor =	0.80
Default Demand Factor =	100 %

Figure 65: Emergency Panelboard Worksheet

Emergency- Updated Panelboard Schedule

PANELBOARD SCHEDULE												
VOLTAGE: 208Y/120V,3PH,4W				PANEL TAG: LP-CU						MIN. C/B AIC: 22K		
SIZE/TYPE BUS: 225 A				PANEL LOCATION: BSMT LVL ELEC						OPTIONS:		
SIZE/TYPE MAIN: 175A/3P C/B				PANEL MOUNTING: SURFACE								
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
EMER/EXIT LTG	SUB BSM	884	20A/1P	1	*			2	20A/1P	716	ELECT RM	EMER/EXIT LTG
EMER/EXIT LTG	BSM	781	20A/1P	3		*		4	20A/1P	716	LVL 4 OFFICE	EMER/EXIT LTG
EMER/EXIT LTG	MEZZ	429	20A/1P	5			*	6	20A/1P	1050	MECH RM	EMER/EXIT LTG
EMER/EXIT LTG	FSTC LOBBY	397	20A/1P	7	*			8	20A/1P	716	LVL 5 OFFICE	EMER/EXIT LTG
EMER/EXIT LTG	SECURITY RM	284	20A/1P	9		*		10	20A/1P	716	LVL 6 OFFICE	EMER/EXIT LTG
EMER/EXIT LTG	CORBIN STAIRS	716	20A/1P	11			*	12	20A/1P	1050	LVL 2 OFFICE	EMER/EXIT LTG
EMER/EXIT LTG	LVL 3 OFFICE	367	20A/1P	13	*			14	20A/1P	732	LEVEL 7 OFFICE	EMER/EXIT LTG
SP-C3	SECURITY RM	1176	20A/1P	15		*		16	20A/1P	715	LEVEL 8 OFFICE	EMER/EXIT LTG
P-C2	SECURITY RM	528	20A/1P	17			*	18	20A/1P	600	RETAIL 2	EMER/EXIT LTG
EMER/EXIT LTG	RETAIL 1	14	20A/1P	19	*			20	20A/1P	700	ESC RM	LIGHTING
SPARE	-	1560	20A/1P	21		*		22	20A/1P	611	ELEV RM	EMER/EXIT LTG
SPARE	-	1560	20A/1P	23			*	24	20A/1P	696	FSTC LOBBY	EMER/EXIT LTG
SPARE	-	1560	20A/1P	25	*			26	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	27		*		28	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	29			*	30	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	31	*			32	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	33		*		34	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	35			*	36	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	37	*			38	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	39		*		40	20A/1P	1560	-	SPARE
SPARE	-	1560	20A/1P	41			*	42	20A/1P	1560	-	SPARE
CONNECTED LOAD (KW) - A Ph.		13.89								TOTAL DESIGN LOAD (KW)		54.95
CONNECTED LOAD (KW) - B Ph.		15.92								POWER FACTOR		1.00
CONNECTED LOAD (KW) - C Ph.		15.99								TOTAL DESIGN LOAD (AMPS)		153

Figure 66: Emergency Panelboard Schedule

Emergency- Feeder Schedule

Feeder Schedule	
Panelboard Tag	LP-CU
Panelboard Voltage	208Y/120
Calculated Design Load (kW)	55
Calculated Power Factor	0.85
Calculated Design Load (A)	127.1
Calculated Load (A) with spare	152.6
Feeder Protection Size	175A
Sets	1
Wire Size	
Phase (75°C THHN)	(3) #2/0 AWG
Neutral (75°C THHN)	(1) #2/0 AWG
Ground (75°C THHN)	(1) #6 AWG
Conduit (RMC)	2"
Power Factor	0.95
Length of Run (Ft)	15
Voltage Drop (V)	0.4
% Drop	0.2%

Figure 67: Emergency Panelboard Schedule

Electrical Depth 1- SKM Analysis

SKM Power Tools was used to study the safety and reliability of the electrical system design for the Corbin Building. SKM software is used to do a short circuit analysis, arc flash study coordination study of one branch. These studies are conducted to prove the electrical system will provide continuous electrical power during normal operation and coordinate breakers during short circuits. Also maintenance personal can know the electrical hazards known in the system during fixing the system.

SKM requires a single-line diagram to be imputed into the system which was created using the projects riser diagram. The emergency and elevator distribution panels were excluded from the model since they are separately derived systems in another building. All the equipment characteristics were imported from the SKM library. Cutler-Hammer products were used as the default equipment for the study.

Short Circuit Analysis

A short circuit analysis was conducted for the Corbin Building electrical system using SKM Power Tools. The study conducted provided the worst-case short circuit fault levels at all critical bus locations. A summary of the results can be found below. Table 28 compares SKM results with the original design ACI rating of the panels. All the panels were found to be sized correctly with assuming the utility provides a continuous amp rating of 100,000 Amps.

Short Circuit Analysis Summary					
Bus Name	Voltage	Available Fault Current			
	L-L	3 Phase	X/R	LINE/GRND	X/R
BUS-DB-5/8	208	7664.9	2	7840.56	2
BUS-DB-ESC5758	460	37523.9	1	0.03	1
BUS-DB-S/4	208	7628.3	2	7815	2
BUS-DBC	460	50444.7	1	0.03	1
BUS-LP-C2	208	5268.4	1.2	4417.42	1
BUS-LP-C3	208	4924.5	1.2	4016.54	0.9
BUS-LP-C4	208	4619.6	1.1	3679.08	0.9
BUS-LP-C5	208	4359.8	1.1	3396.37	0.8
BUS-LP-C6	208	4115.4	1	3148.57	0.8
BUS-LP-C7	208	3895.8	1	2933.47	0.8
BUS-LP-C8A	208	3697.4	1	2745.17	0.8
BUS-LP-C8B	208	3660	1	2710.3	0.8
BUS-LP-CP	208	3081.5	0.7	3115.04	0.7
BUS-LP-CS	208	7362.6	1.8	7376.39	1.8
BUS-PP-C3	460	17846	0.7	0.03	1
BUS-PP-C6	460	13253.8	0.6	0.03	1
BUS-PP-C8	460	11310.4	0.6	0.03	1
BUS-PP-CP	460	36558.2	0.9	0.03	1
BUS-RP-ESC5758	208	1702.3	0.5	1707.16	0.5

Table 27: Short Circuit Analysis Summary

Short Circuit Analysis Comparison			
Bus Name	Voltage	Available Fault Current Amps	Specified Rating AIC
	L-L		
BUS-DB-5/8	208	7664.9	100,000
BUS-DB-ESC5758	460	37523.9	65,000
BUS-DB-S/4	208	7628.3	100,000
BUS-DBC	460	50444.7	100,000
BUS-LP-C2	208	5268.4	22,000
BUS-LP-C3	208	4924.5	22,000

BUS-LP-C4	208	4619.6	22,000
BUS-LP-C5	208	4359.8	22,000
BUS-LP-C6	208	4115.4	22,000
BUS-LP-C7	208	3895.8	22,000
BUS-LP-C8A	208	3697.4	22,000
BUS-LP-C8B	208	3660	22,000
BUS-LP-CP	208	3081.5	22,000
BUS-LP-CS	208	7362.6	22,000
BUS-PP-C3	460	17846	22,000
BUS-PP-C6	460	13253.8	22,000
BUS-PP-C8	460	11310.4	22,000
BUS-PP-CP	460	36558.2	65,000
BUS-RP-ESC5758	208	1702.3	22,000

Table 28: Comparison SKM vs. Design

Load Flow Analysis

A load flow analysis was conducted to analyze the load and voltage drop on each wire in the system. The study found that all the wires were equal or under 3% voltage drop and were sized correctly.

Balanced Voltage Drop and Load Flow Branch Data Summary

Name			Type	Voltage Drop	Amps	KVA	Rating %
Branch	**From**	**To**					
CBL-0001	BUS-0002	BUS-DBC	FDR	0	646.09	508.18	50.08
CBL-0002	BUS-DBC	BUS-0004	FDR	0.05	130.45	102.61	30.34
XF2-T6-C5/8	BUS-0004	BUS-0005	TX2	3.06	130.45	102.56	69.29
CBL-0003	BUS-0005	BUS-DB-5/8	FDR	0.03	288.5	99.38	49.74
CBL-0004	BUS-DB-5/8	BUS-LP-C8A	FDR	1.35	89.06	30.67	45.67
CBL-0005	BUS-LP-C8A	BUS-LP-C8B	FDR	0.02	72.81	24.72	37.34
CBL-0006	BUS-DB-5/8	BUS-LP-C7	FDR	0.98	71.4	24.59	36.62
CBL-0007	BUS-DB-5/8	BUS-LP-C6	FDR	0.71	57.44	19.78	29.46
CBL-0008	BUS-DB-5/8	BUS-LP-C5	FDR	0.77	70.6	24.31	36.21
CBL-0009	BUS-DBC	BUS-0013	FDR	0.05	97.34	76.56	22.64
XF2-T6-CS/4	BUS-0013	BUS-0014	TX2	2.28	97.34	76.52	51.7
CBL-0010	BUS-0014	BUS-DB-S/4	FDR	0.02	215.26	74.75	37.11
CBL-0011	BUS-DB-S/4	BUS-LP-C4	FDR	0.66	69.95	24.28	35.87
CBL-0012	BUS-DB-S/4	BUS-LP-C3	FDR	0.56	69.87	24.26	35.83
CBL-0013	BUS-DB-S/4	BUS-LP-C2	FDR	0.5	75.44	26.19	38.69

CBL-0014	BUS-DB-S/4	BUS-LP-CS	FDR	0	0	0	0
CBL-0015	BUS-DBC	BUS-PP-C8	FDR	0.45	65.06	51.17	33.36
CBL-0016	BUS-DBC	BUS-PP-C6	FDR	0.29	51.65	40.63	26.49
CBL-0017	BUS-DBC	BUS-PP-C3	FDR	0.24	66.47	52.28	34.08
CBL-0018	BUS-DBC	BUS-DB-ESC5758	FDR	0.09	128.31	100.92	44.24
CBL-0019	BUS-DB-ESC5758	BUS-0024	FDR	0.21	51.15	40.19	39.34
CBL-0020	BUS-DB-ESC5758	BUS-0025	FDR	0.25	51.17	40.21	39.36
CBL-0021	BUS-DB-ESC5758	BUS-0026	FDR	0.03	26	20.43	34.66
XF2-T2-CP	BUS-0026	BUS-0027	TX2	3.22	26	20.42	69.04
CBL-0022	BUS-0027	BUS-RP-ESC5758	FDR	0.03	57.49	19.76	29.48
CBL-0023	BUS-DBC	BUS-0029	FDR	0.07	25.13	19.76	19.33
XF2-T3-CP	BUS-0029	BUS-0030	TX2	1.65	25.13	19.75	44.49
CBL-0024	BUS-0030	BUS-LP-CP	FDR	0.03	55.57	19.42	28.49
CBL-0025	BUS-DBC	BUS-PP-CP	FDR	0.06	81.71	64.26	41.9

Table 29: Load Flow Summary

Arc Fault Study

The arc fault study calculates the available short circuit level at each bus and through each protective device from the short circuit analysis. The arc fault current is calculated from the bolted fault current and is used to find the time duration of the arc from the time current coordination curve. Arc flash boundaries are based on the arcing fault currents and protective device operating times. When working on the main switchboard arc-rated shirt and pants are required.

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Ground	Equip Type	Gap (mm)	Arc Flash Boundary (in)	Working Distance (in)	Incident Energy (cal/ cm2)	Required Protective FR Clothing Category	Label #	Cable Length From Trip Device (ft)
BUS-DB-5/8	PD-DB-5/8	0.208	7.66	3.61	7.66	3.61	0.09	0.000	Yes	PNL	25	16	18	0.99	Category 0	# 0001	
BUS-DBC	PD-DBC	0.46	50.44	24.90	49.98	24.67	0.034	0.000	No	PNL	25	37	18	4.0	Category 1	# 0004	
BUS-DB-ESC5758	PD-DBC-11	0.46	37.52	19.40	37.07	19.16	0.01	0.000	No	PNL	25	15	18	0.89	Category 0	# 0002	25.00
BUS-DB-S/4	PD-DB-S/4	0.208	7.63	3.60	7.63	3.60	0.1	0.000	Yes	PNL	25	17	18	1.1	Category 0	# 0003	
BUS-LP-C2	PD-DB-S/4-3	0.208	5.27	2.77	5.27	2.77	0.065	0.000	Yes	PNL	25	11	18	0.54	Category 0	# 0005	70.00
BUS-LP-C3	PD-DB-S/4-2	0.208	4.92	2.65	4.92	2.65	0.065	0.000	Yes	PNL	25	11	18	0.51	Category 0	# 0006	85.00
BUS-LP-C4	PD-DB-S/4-1	0.208	4.62	2.53	4.62	2.53	0.065	0.000	Yes	PNL	25	10	18	0.49	Category 0	# 0007	100.00
BUS-LP-C5	PD-DB-5/8-4	0.208	4.36	2.43	4.36	2.43	0.065	0.000	Yes	PNL	25	10	18	0.47	Category 0	# 0008	115.00
BUS-LP-C6	PD-DB-5/8-3	0.208	4.12	2.33	4.12	2.33	0.065	0.000	Yes	PNL	25	10	18	0.45	Category 0	# 0009	130.00
BUS-LP-C7	PD-DB-5/8-2	0.208	3.90	2.24	3.90	2.24	0.065	0.000	Yes	PNL	25	10	18	0.43	Category 0	# 0010	145.00
BUS-LP-C8A	PD-DB-5/8-1	0.208	3.70	2.16	3.70	2.16	0.065	0.000	Yes	PNL	25	9	18	0.41	Category 0	# 0011	160.00
BUS-LP-C8B	PD-DB-5/8-1	0.208	3.66	2.15	3.66	2.15	0.065	0.000	Yes	PNL	25	9	18	0.41	Category 0	# 0012	163.00
BUS-LP-CP	PD-DBC-12	0.208	3.08	1.90	3.08	1.90	0.09	0.000	Yes	PNL	25	11	18	0.50	Category 0	# 0013	44.00
BUS-LP-CS	PD-DB-S/4-4	0.208	7.36	3.51	7.36	3.51	0.065	0.000	Yes	PNL	25	13	18	0.70	Category 0	# 0014	6.00
BUS-PP-C3	PD-DBC-7	0.46	17.85	10.37	17.85	10.37	0.013	0.000	No	PNL	25	12	18	0.57	Category 0	# 0015	85.00
BUS-PP-C6	PD-DBC-6	0.46	13.25	8.07	13.25	8.07	0.016	0.000	No	PNL	25	11	18	0.55	Category 0	# 0016	130.00
BUS-PP-C8	PD-DBC-5	0.46	11.31	7.06	11.31	7.06	0.018	0.000	No	PNL	25	11	18	0.52	Category 0	# 0017	160.00
BUS-PP-CP	PD-DBC-14	0.46	36.56	18.98	36.56	18.98	0.01	0.000	No	PNL	25	15	18	0.87	Category 0	# 0018	18.00
BUS-RP-ESC5758	PD-DB-ESC5758-5	0.208	1.70	1.25	1.70	1.25	0.1	0.000	Yes	PNL	25	9	18	0.35	Category 0	# 0019	12.00

Table 30: Arc Flash Summary Table

Coordination Study

The coordination study below (highlighted in blue) is for the general lighting and receptacle panel on the fourth floor. The study was conducted from the main breaker in the DBC switchboard to the breaker in the lighting panelboard. As shown below the breakers are coordinated so the panel on the fourth floor trips first and the last breaker to trip is the main switchboard.

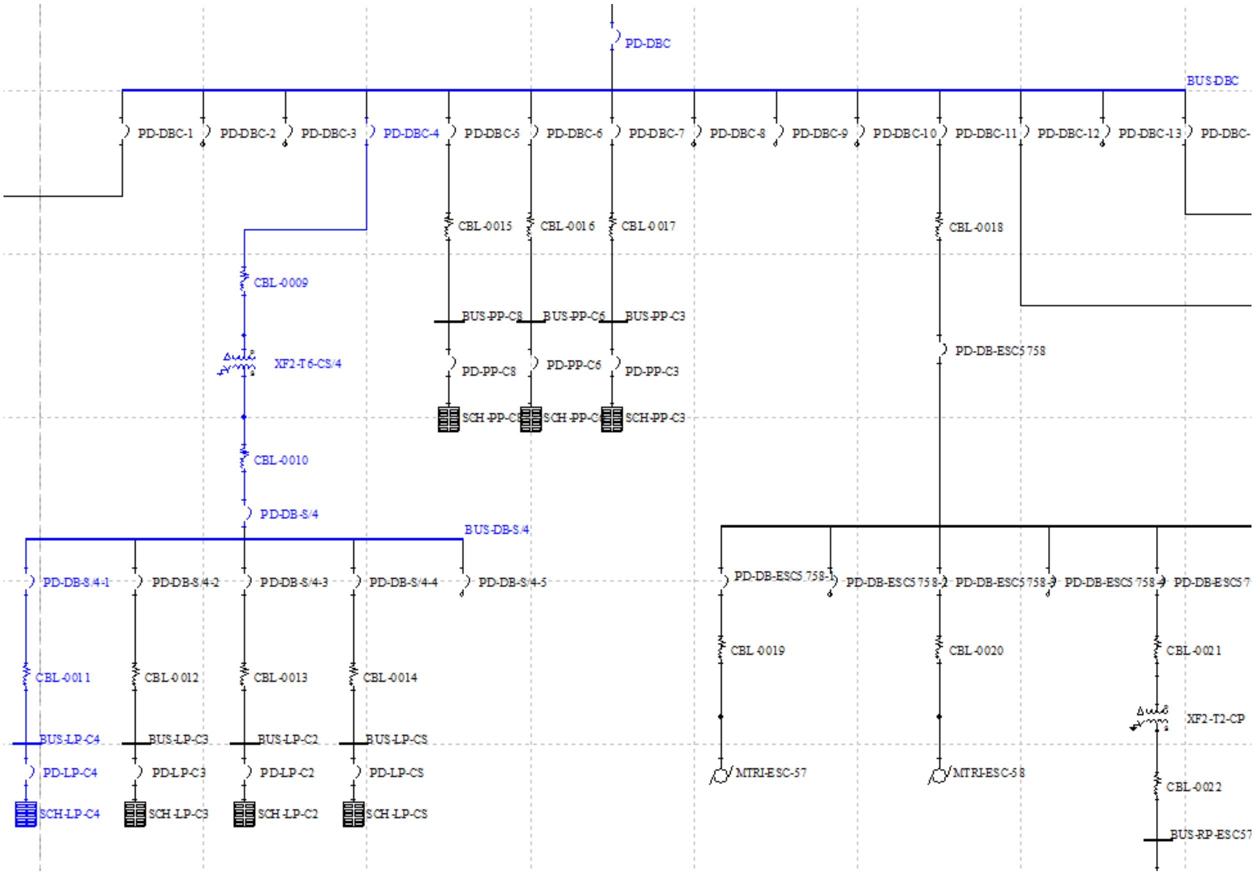


Figure 68: Coordination Branch

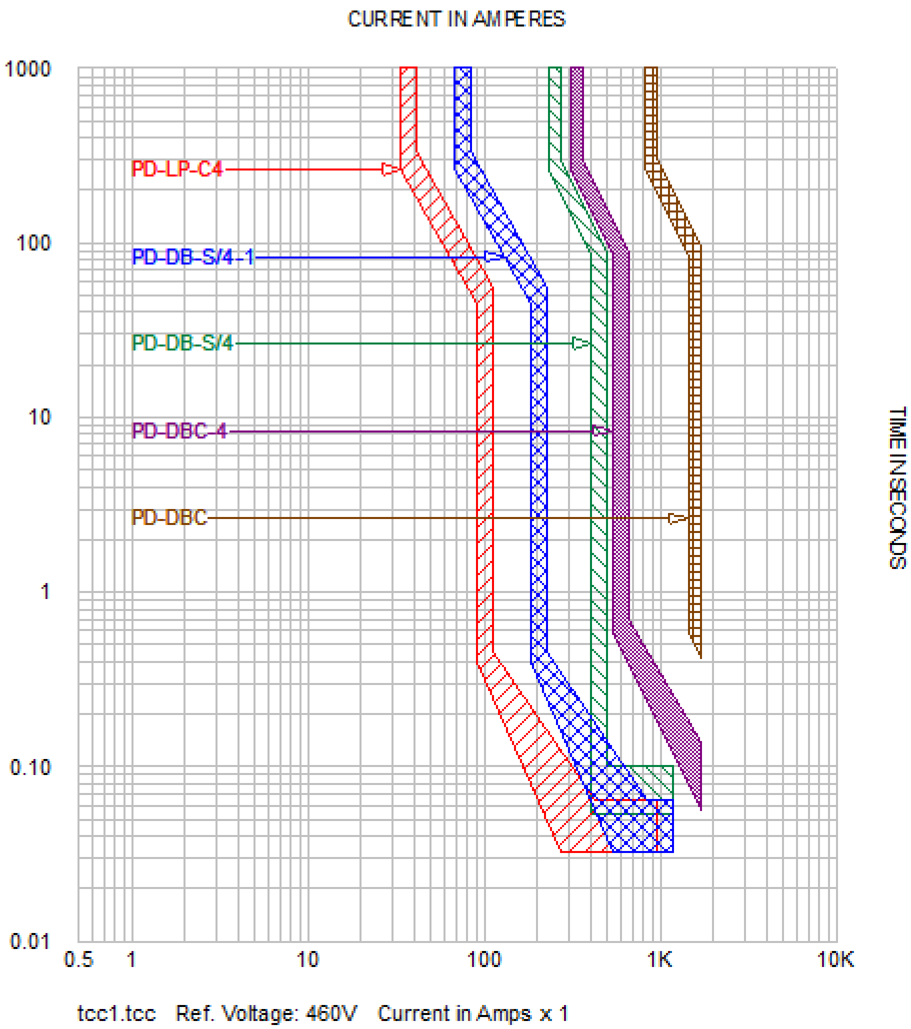


Figure 69: Coordination Study

Electrical Depth 2- Conduit and Wire vs. Bus Duct

Conduit and wire vs. bus duct investigated the cost difference between the two different methods used to feed the main switchboard. The feed from the electrical room in the Fulton Street Transit Center on the fifth floor feed the main switchboard in the basement in the Corbin Building. The main pathway was through a vertical duct bank for the most direct route. On the tables 8-13 below each letter represents a starting, ending or turn in the pathway. I used this as a location marker to compare data. Material and labor cost came from *RSMeans Electrical Cost Data 2012.*

Rigid galvanized steel conduit and copper wire is specified for all electrical distribution in the Corbin Building. The conduit followed Article 344 in the *National Electric Code.* As stated in the code conduit shall not make more than 360 bends between pull points. I have taking this in to account by placing pull boxes in the appropriate locations. Every connection to a pull box or piece of equipment used a box connector, locknut and plastic bushing. The code also stated that conduit shall be supported no more than every three feet.

The bus duct bars used in the comparison were copper with a 800 Amp capacity. The bus duct used the same number of turns and rose thought the same vertical shaft that the conduits used. The bus duct was designed to comply with Article 368 in the *National Electric Code.* The support spacing from the NEC is no more than five feet. Each ten feet of bus duct was supplied with one support hanger. Some extra hangers were added into the cost for when lengths were less than ten feet.

Wire																		
Pathway			No. Of	Total	Phase & Neutral Conductors			Cost per Foot			Ground Conductors			Cost per Foot			Total Cost per	
Start	End	Length	Sets	Length	No.	Size	Type	Material	Labor	Total	No.	Size	Type	Material	Labor	Total	Path	Total Cost
DBC	A	5	3	15													$ 955.20	
A	B	12	3	36													$ 2,292.48	
B	C	26	3	78													$ 4,967.04	
C	D	88	3	264													$ 16,811.52	
D	E	4	3	12	4	500	THHN	$ 11.50	$2.58	$14.08	1	250	THHN	$ 5.30	$2.06	$7.36	$ 764.16	**$ 39,545.28**
E	F	22	3	66													$ 4,202.88	
F	G	15	3	45													$ 2,865.60	
G	H	25	3	75													$ 4,776.00	
H	SS-3	10	3	30													$ 1,910.40	

Table 31: Wire Cost

Conduit Straight Runs											
Pathway			No. Of	Total	Conduit		Cost per Foot			Total Cost	
Start	End	Length	Sets	Length	Size	Type	Material	Labor	Total	per Path	Total Cost
DBC	A	2	3	6						$ 236.10	
A	B	12	3	36						$ 1,416.60	
B	C	26	3	78						$ 3,069.30	
C	D	88	3	264						$ 10,388.40	
D	E	4	3	12	4	RGS	$ 23.50	$ 15.85	$ 39.35	$ 472.20	**$23,491.95**
E	F	22	3	66						$ 2,597.10	
F	G	15	3	45						$ 1,770.75	
G	H	25	3	75						$ 2,951.25	
H	SS-3	5	3	15						$ 590.25	

Table 32: Conduit Cost

Conduit Parts						
Location	Part	No.	Material	Labor	Total Cost	Total Cost
DBC	Box Connector	1	$ 296.00	$ 41.00	$ 337.00	$22,834.15
DBC	Lock Nut	1	$ 17.85	$ -	$ 17.85	
DBC	Plastic Bushing	1	$ 10.35	$ 46.00	$ 56.35	
A	Elbow	3	$ 106.00	$ 68.50	$ 523.50	
A	Coupling	6	$ 278.00	$ 41.00	$1,914.00	
B	Elbow	3	$ 106.00	$ 68.50	$ 523.50	
B	Coupling	6	$ 278.00	$ 41.00	$1,914.00	
C	Box Connector	6	$ 296.00	$ 41.00	$2,022.00	
C	Lock Nut	6	$ 17.85	$ -	$ 107.10	
C	Plastic Bushing	6	$ 10.35	$ 46.00	$ 338.10	
C	Pull Box (24x24x8)	1	$ 103.00	$ 137.00	$ 240.00	
D	Box Connector	6	$ 296.00	$ 41.00	$2,022.00	
D	Lock Nut	6	$ 17.85	$ -	$ 107.10	
D	Plastic Bushing	6	$ 10.35	$ 46.00	$ 338.10	
D	Pull Box (24x24x8)	1	$ 103.00	$ 137.00	$ 240.00	
E	Elbow	3	$ 106.00	$ 68.50	$ 523.50	
E	Coupling	6	$ 278.00	$ 41.00	$1,914.00	
F	Elbow	3	$ 106.00	$ 68.50	$ 523.50	
F	Coupling	6	$ 278.00	$ 41.00	$1,914.00	
G	Elbow	3	$ 106.00	$ 68.50	$ 523.50	
G	Coupling	6	$ 278.00	$ 41.00	$1,914.00	
H	Box Connector	6	$ 296.00	$ 41.00	$2,022.00	
H	Lock Nut	6	$ 17.85	$ -	$ 107.10	
H	Plastic Bushing	6	$ 10.35	$ 46.00	$ 338.10	
H	Pull Box (24x24x8)	1	$ 103.00	$ 137.00	$ 240.00	
Hangers w/ bolt & 12" rod, 1/2" Dia.		67	$ 19.75	$ 11.80	$2,113.85	

Table 33: Conduit Parts Cost

Conduit and Wire	
Item	**Cost**
Wire	$ 39,545.28
Conduit	$ 23,491.95
Conduit Fittings	$ 22,834.15
Total Cost	**$ 85,871.38**

Table 34: Conduit and Wire Total Cost

Copper Bus Duct 800 Amp Straight Section							
Pathway			Cost per Foot				
Start	End	Length	Material	Labor	Total Cost	Cost Per Run	Total Cost
DBC	A	2	$ 239.00	$ 37.50	$ 276.50	$ 553.00	$55,023.50
A	B	12				$ 3,318.00	
B	C	26				$ 7,189.00	
C	D	88				$ 24,332.00	
D	E	4				$ 1,106.00	
E	F	22				$ 6,083.00	
F	G	15				$ 4,147.50	
G	H	25				$ 6,912.50	
H	SS-3	5				$ 1,382.50	

Table 35: Bus Duct Cost

Copper Bus Duct 800Amp Fittings						
Location	Fittings	Number of Fittings	Material	Labor	Cost	Total Cost
A	Switchboard Stub	1	$1,625.00	$258.00	$1,883.00	$17,476.75
B	Elbow	1	$1,450.00	$295.00	$1,745.00	
C	Elbow	1	$1,450.00	$295.00	$1,745.00	
D	Elbow	1	$1,450.00	$295.00	$1,745.00	
E	Elbow	1	$1,450.00	$295.00	$1,745.00	
F	Elbow	1	$1,450.00	$295.00	$1,745.00	
G	Elbow	1	$1,450.00	$295.00	$1,745.00	
H	Elbow	1	$1,450.00	$295.00	$1,745.00	
SS-3	Cable Tap Box	1	$1,675.00	$410.00	$2,085.00	
-	Hangers	23	$ 18.75	$ 37.50	$1,293.75	

Table 36: Bus Duct Fittings Cost

Bus Duct	
Item	Cost
Bus Duct	$ 55,023.50
Bus Duct Fittings	$ 17,476.75
Total Cost	**$ 72,500.25**

Table 37: Bus Duct Total Cost

Conduit and Wire vs. Bus Duct	
Item	Cost
Conduit and Wire	$ 85,871.38
Bus Duct	$ 72,500.25
Difference	**$ (13,371.13)**

Table 38: Cost Difference

Summary

Using the detailed cost estimate above there is cost savings by using bus duct instead of conduit and wire. There is about a $13,370 dollar savings by choosing the bus duct. There was a significant cost for the bus duct in the turns, but the conduit cost more for a turn since there are three parallel runs. Since, the bus duct is one section there is less work installing which provides some of the cost savings. The bus duct cross-sectional area that it uses in the vertical shaft and ceilings is less than the three conduits providing more space for mechanical and other services in the building.

Protective Device Coordination

The protective device coordination was conducted for a 20A branch circuit on lighting panel on the fourth floor LP-C4 at 150 amps, the protection at the distribution panel DB-S/4 at 500A and the switchboard protection at 300A and the main switchboard breaker at 800A. The coordination shows that the breakers will trip in the correct order if there is a short circuit on a branch circuit and isolate the fault at the local panel rather shutting down more equipment at the distribution boards.

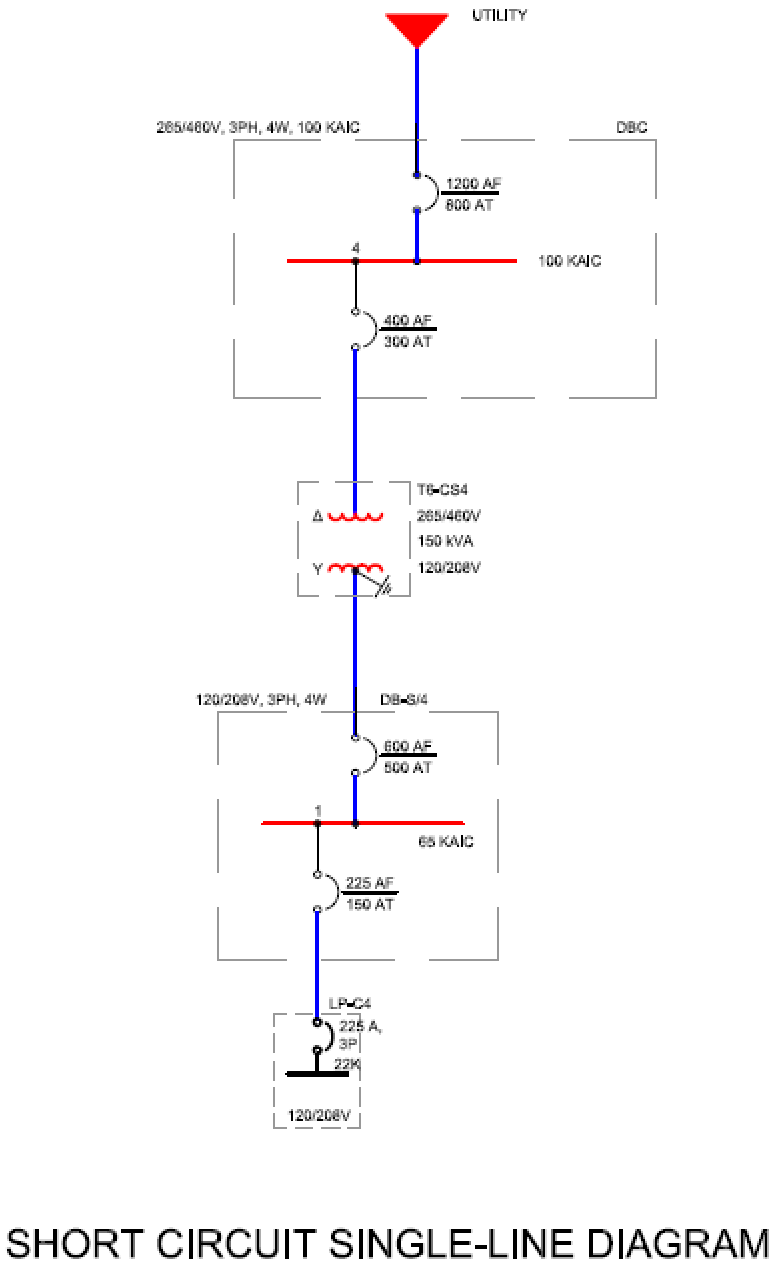


Figure 70: Protective Device Coordination Path

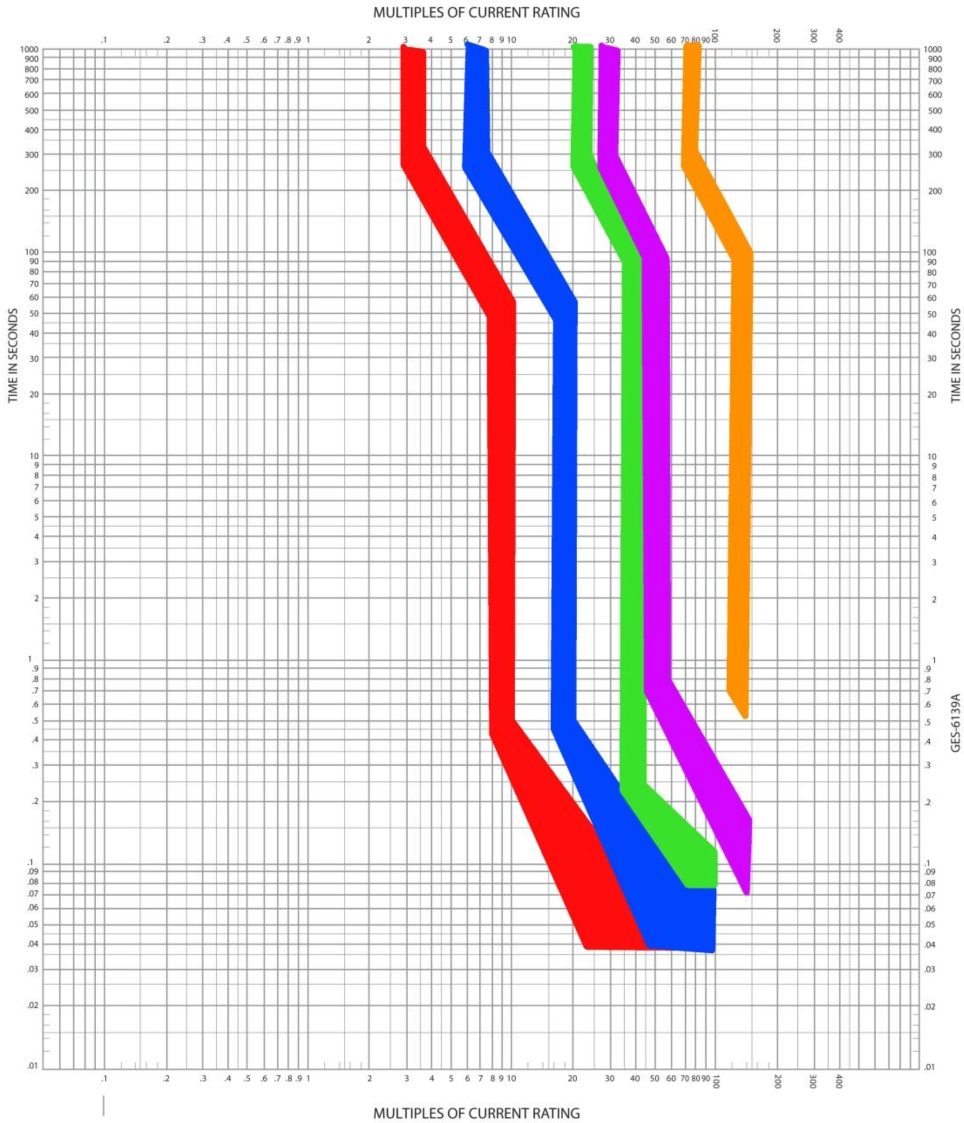


Figure 71: Coordination Study

Red= 20A
Blue=150A
Green= 500A
Purple= 300A
Orange=800A

Short Circuit Analysis

The following short circuit analysis determines the minimum required interrupting capacities of each component in a distribution system. The short circuit capacity at the utility, switchboard DBC, transformer T6-CS4, and distribution panel DB-S/4 is provided in the calculations below using the per unit method. The utility short circuit is not provided in the drawings and is assumed to be 100,000 kVA.

Short Circuit Analysis- Per Unit Method							
		System Voltage	460	Σ X	Σ R	Σ Z	Isc (Amps)
		Base kVA	956				
		Available Fault (kVA)- Utility Company	100000				
Utility Primary							
		X(p.u.) = (kVAbase) / (Utility S.C. kVA) =		0.01	0.00	0.01	6317.1849
Switchboard DBC							
Wire=	500	X = (L/1,000) * XL * (1/sets) =	0.003				
Length=	200	R = (L/1,000) * RL * (1/sets) =	0.00196	0.0127	0.0020	0.0146	4128.9167
Sets=	3						
X=	0.0466						
R=	0.0294						
Switchboard DBC							
Wire=	500	X = (L/1,000) * XL * (1/sets) =	0.003				
Length=	200	R = (L/1,000) * RL * (1/sets) =	0.00196	0.0158	0.0039	0.0197	3066.6361
Sets=	3						
X=	0.0466						
R=	0.0294						
Transformer Secondary							
%Z=	5.30	X(p.u.) = (%X * kVAbase) / (100 * kVAxfmr)=	0.0280				
X/R=	1.46	R(p.u.) = (%R * kVAbase) / (100 * kVAxfmr)=	0.0191	0.0438	0.0230	0.0669	903.31889
%X=	4.40						
%R=	3.00						
kVA=	150						
Switchboard DB-S/4							
Wire=	250	X(p.u.) = (L * XL * KVAbase) / (1000^2 * Sets * KV^2)=	0.001				
Length=	30	R(p.u.) = (L * R * KVAbase) / (1000^2 * Sets * KV^2)=	0.000828	0.0446	0.0239	0.0684	882.58624
Sets=	2						
X=	0.0495						
R=	0.0552						

Figure 72: Short Circuit Analysis

The short circuit is under the kAIC rating of each panel. The ratings on the lighting panels are 22 kAIC and the calculated value was lower than that.

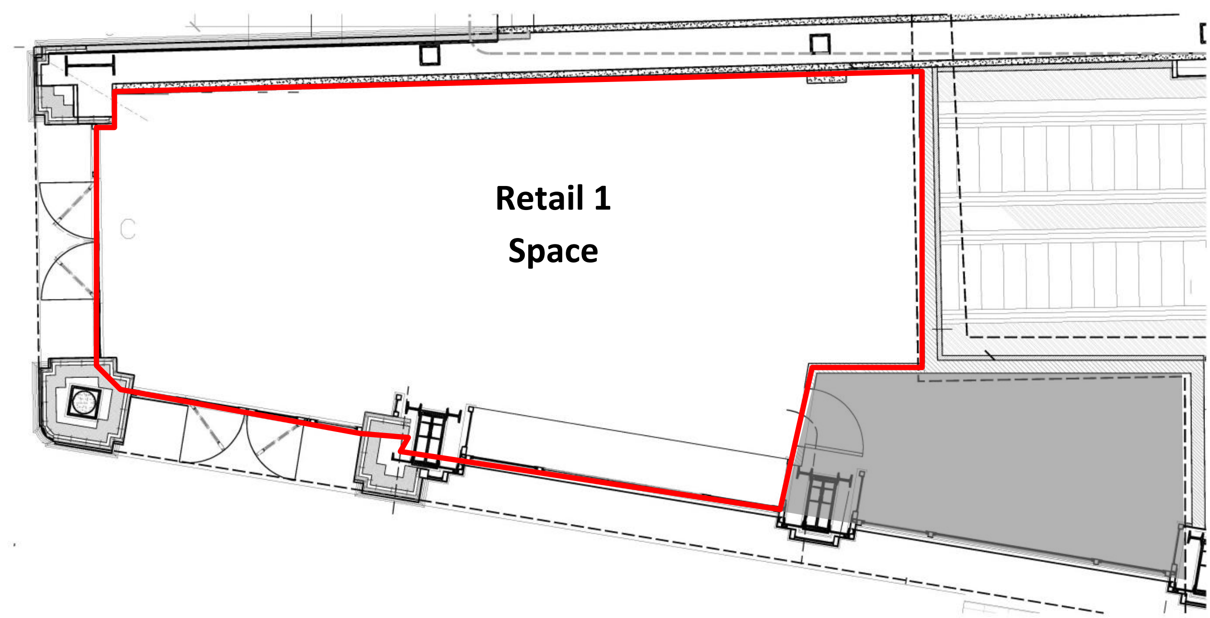
Architectural Breadth – Retail Space

Design Goal surroundings

The design goal was to create a luxury boutique retail space to sell a few articles of clothing and accessories such as sunglasses, shoes and bags. The integration of lighting and mechanical systems are very important in the design consideration to create a clean modern architectural style.

Existing Conditions

The retail space 1 is currently unfinished and is intended for tenant fit out. The store has about 840 square feet of usable area for floor space. The retail space has two entrances on the west (Broadway) and south façade (John Street). On south wall there is currently a window display. The space has a ceiling height of eight feet. The walls and ceiling materials are gypsum wall board with white paint. The floor is an unfinished concrete slab.



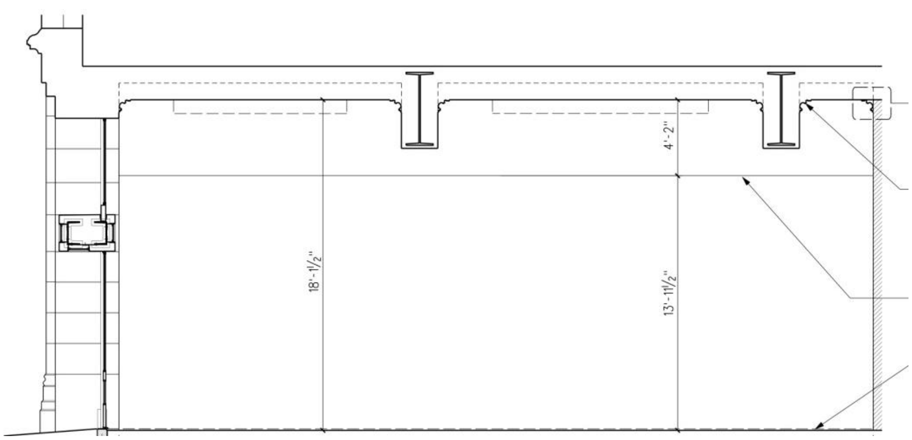


Figure 73: North Elevation

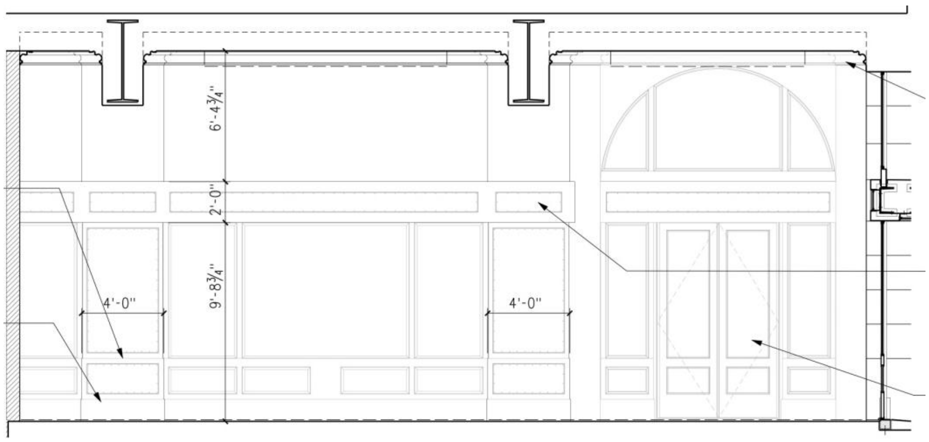


Figure 74: South Elevation

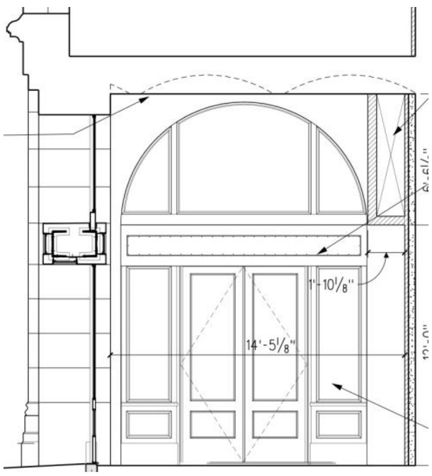


Figure 75: West Elevation

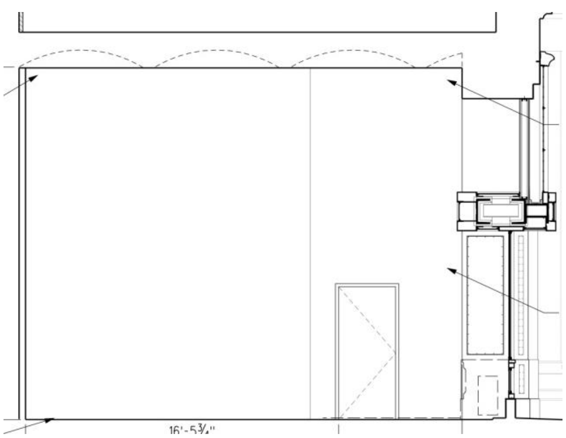


Figure 76: East Elevation

Architectural Redesign

The retail space is for a client that sells high end designer clothing. The customer has a very high expectation when walking into a luxury boutique retail store. The client wants to design a modern luxury atmosphere that the customer feels comfortable when entering the space. It is critical for the first impression created by the architecture and design of the sore clearly expresses this vision.

The design incorporates built in casework along the north wall. The displays were organized for larger and then also smaller item and had appropriate sized mirrors located next to them. There are cases for large clothing items to be hung and above those there are shelves to place other times such as bags or shoes. Also there are large mirrors for the customers to view themselves in. Each display is going to be outlined with a white box frame to show the clothing as piece or artwork and the display is the frame. Each frame is going to be white with a translucent backlight panel. There is also a glass display case in the middle of the store to show off watches and jewelry that needs special lighting to make the jewels sparkle. Tall thin vertical cases have been incorporated to display sunglasses with mirrors located adjacent.

A center display was placed to be used as a highlight display for manikins. The display has been raised off the floor to create a runway and will incorporate lights in the center create a small runway for the Mannequins. Mannequins will be lined up to suggest a fashion runway and provide a significant fola feature. This display will be used for new products lines and also will be scene from both entrances and will draw people into the store. In all luxury designer stores want to make sure the customer is as comfortable as possible, which is why seating is incorporated into the interior design.

The ceiling will have all recessed lighting and linear slot diffusers. The lighting and mechanical systems incorporating the modern clean design, by not creating clutter on the ceiling. Adjustable recessed lighting will be used to provide easy adjustment if displays change and the lighting needs to be adjusted.

New Floor Plans

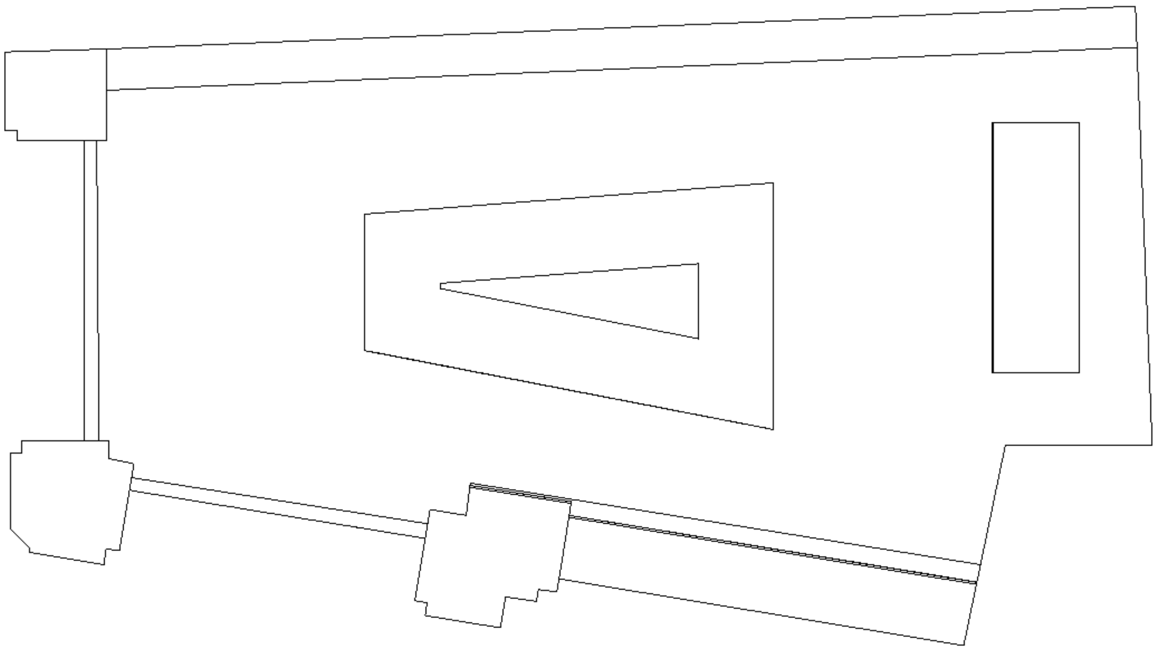


Figure 77: Retail Floor Plan

Figure 78: Retail Design Floor Plan

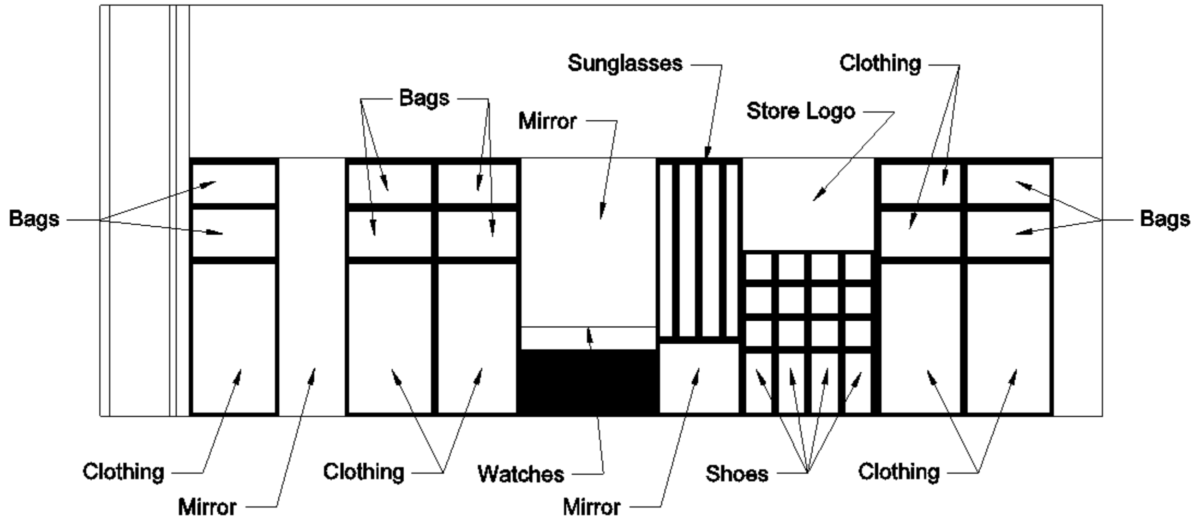


Figure 79: North Elevation Section

Figure 80: North Wall Design Plan

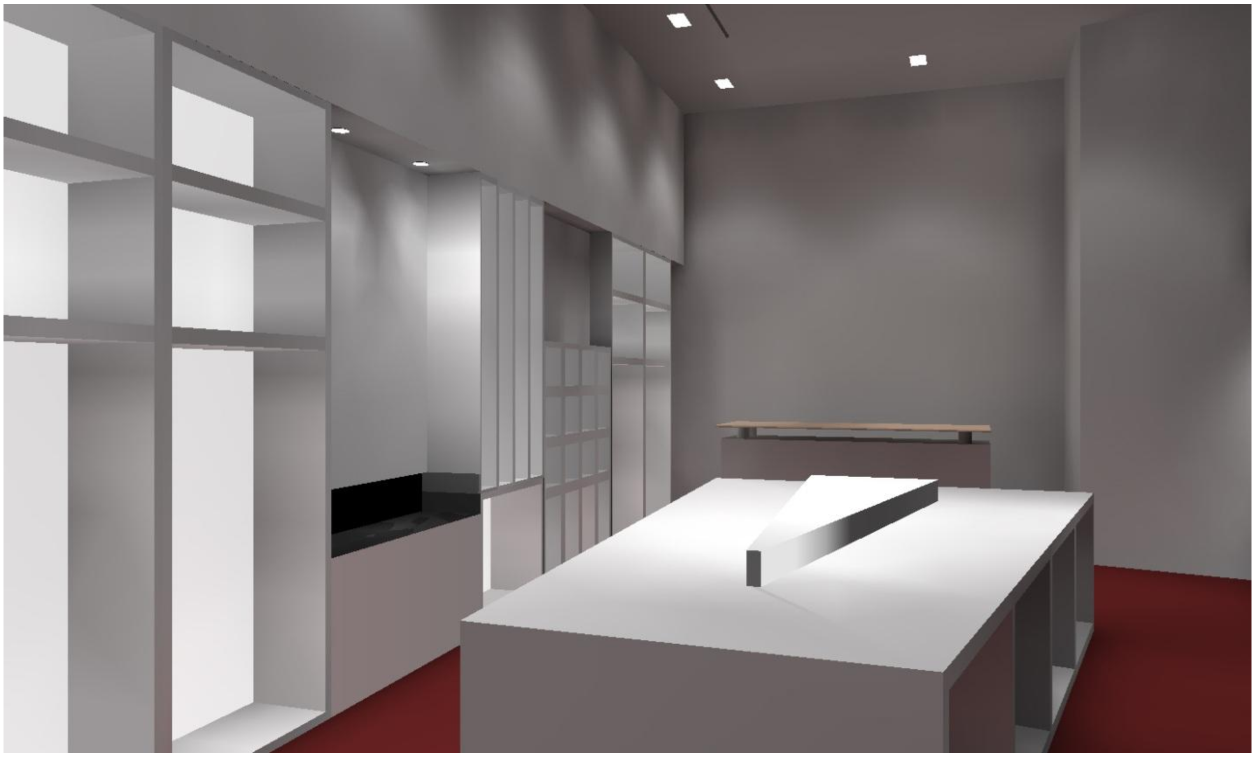


Figure 81: Interior Rendering Looking West

Figure 82: Render View of Casework Looking Northeast

Mechanical Breadth – Mechanical Integration

Design Goal

The goal of the design was to eliminate ceiling clutter and relocate the diffusers to a location where they fit seamlessly into architecture and lighting design of the space.

Existing Conditions

The existing mechanical duct does not fit in with the clean modern architectural style. The mechanical duct for the retail space was designed as one large bulky oval duct. The duct enters the space as 38x7 oval duct and then is stepped down to a 28x7 oval duct. 1,500 CFM's of air is disturbed into the room from the middle of the room. The large oval duct provides an efficient amount of air but does not fit into the architectural redesign.

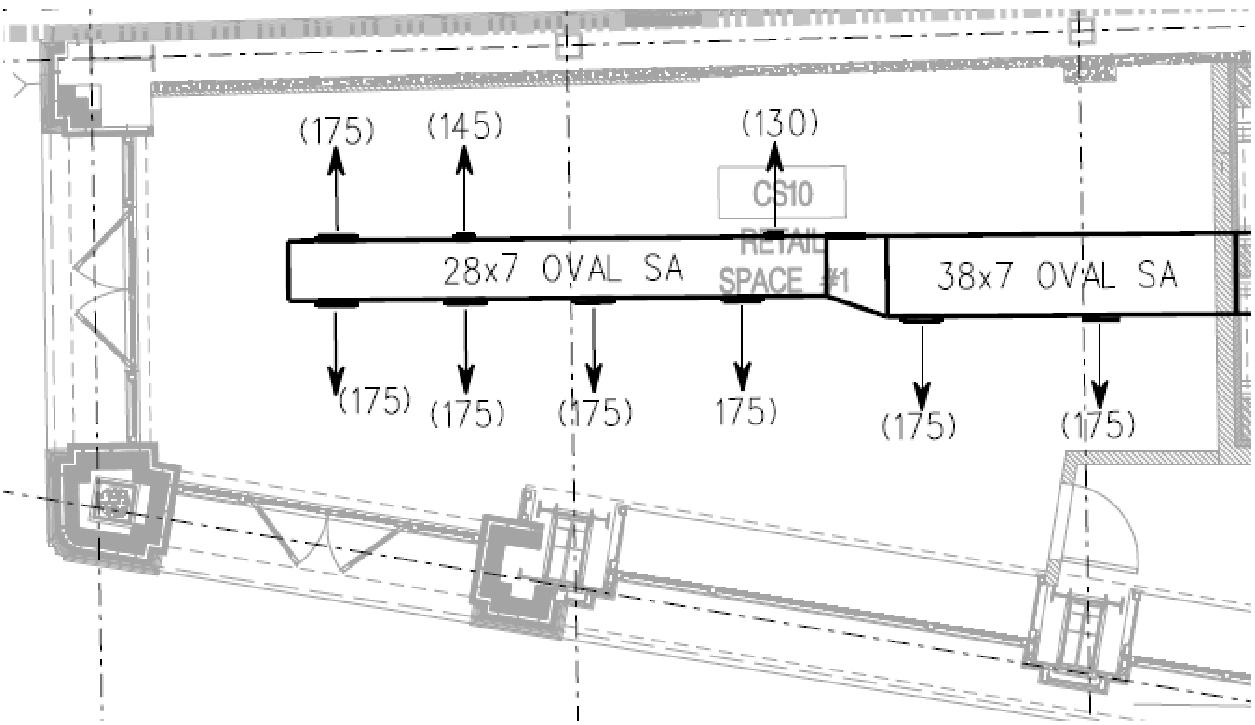


Figure 83: Mechanical Existing Conditions

Mechanical Redesign

The mechanical redesign is going to require the mechanical system duct layout to be changed to be concealed in the space. To provide the air to the space while blending into the architecture the duct be split into two branches and distribute air from both north and south walls. The new diffuser layout will use linear diffusers to blend with the clean and modern style of the retail space. These diffusers that were chosen are slim and rectangular, so they blend into the ceiling with the rectangular recessed lighting fixtures. The diffuser that was chosen was the Titus FlowBar with a 1.5" slot and a white border. The white border will blend into the white ceiling and draw less attention to the HVAC system.

The current design delivers 1,500 cmf of air to the space, which was determined to be adequate and was not changed. The number of diffusers required was based on the amount of air being delivered into the space and the capacity of the four foot length of diffuser. The 1.5” slot provides 30 cfm/ft with a noise criteria <10.

The ducts have also been resized to coordinate with the new linear diffusers. The calculations were based on the volume of air moving thought the ducts. The main duct entering the retail space is 38x7 oval duct and provides 1500 cfm and then branches into two 20x9 ducts and supplies 750 cfm each. The ducts were size with 0.8 friction per 100 feet of duct and then used a ductulator to find duct dimensions sizes. The ductwork plan is shown below with the new sizes and diffusers.

Figure 84: Linear Diffuser- Titus Flowbar

Calculations

ASHRAE 62.1- 2007

Minimum Retail Ventilation Rate:

- People Outdoor Air Rate- 7.5 cfm/person
- Area Outdoor Air Rate- 0.12 cfm/ft^2
- Occupant Density- 15 people/ 1000 ft^2

Calculate minimum ventilation (V_{oz}):

Area= 840 ft^2

$$V_{oz} = Area * \left(\frac{cfm}{ft^2}\right) + N_{people} * \left(\frac{cfm}{person}\right)$$

$$N_{people} = \frac{15\ people}{1000\ ft^2} * Area = \frac{15\ people}{1000\ ft^2} * 840\ ft^2 = 12.6 \approx 13\ People$$

$$V_{oz} = 840\ ft^2 * \left(\frac{0.12\ cfm}{ft^2}\right) + 13_{people} * \left(\frac{7.5\ cfm}{person}\right) = 100.8 + 97.5 = 198.3\ cfm$$

Ventilation in Retail Space= 1500 cfm > minimum ventilation 198.3 cfm

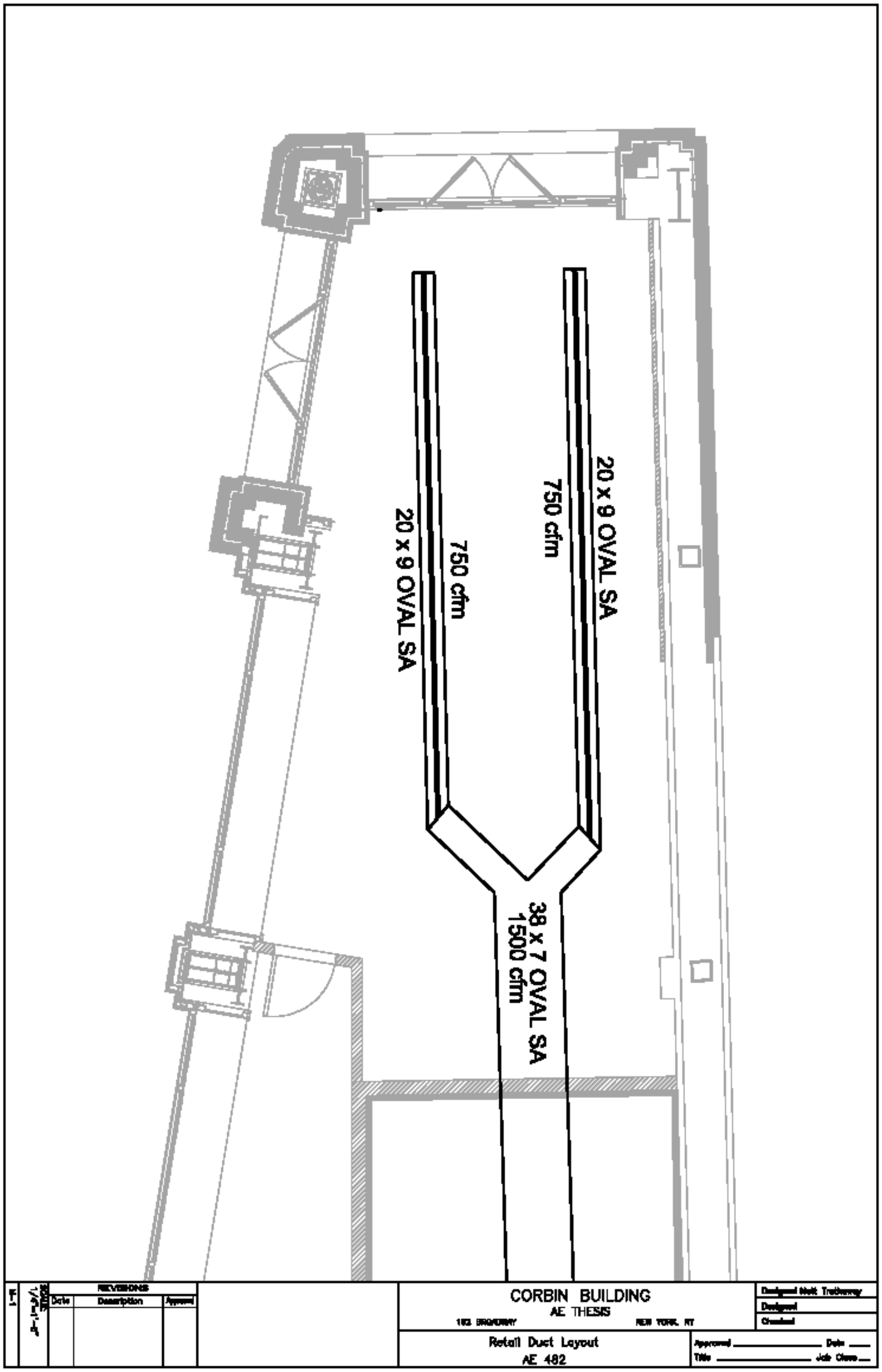


Figure 85: Mechanical Duct Layout


Figure 86: Render Ceiling Looking East


Figure 87: Render Ceiling Looking West

Daylighting Analysis 3rd floor office- MAE Focus Topic

Daysim Analysis

A comprehensive hourly simulation was completed for the third floor office using Daysim, a daylighting calculation software tool. The program task was to see how much daylight enters the space at winter solstice, spring equinox and summer solstice. The open office was broking into two different zones. Zone 1 consisted of the direct-indirect pendants lighting the open office and zone 2 was the recessed compact fluorescents around the entrance and copy room. Zone 1 was selected for the dimming zone. A calculation grid of 2.5 feet above the finished floor was used for calculation the illuminance.

The exterior surroundings was modeled on both the south and east blocks. The buildings on the south side are much taller than the Corbin Building and causes shadows on most of the building façade. Below is the model of the Corbin Building in blue and you are able to see the tall buildings on the south.

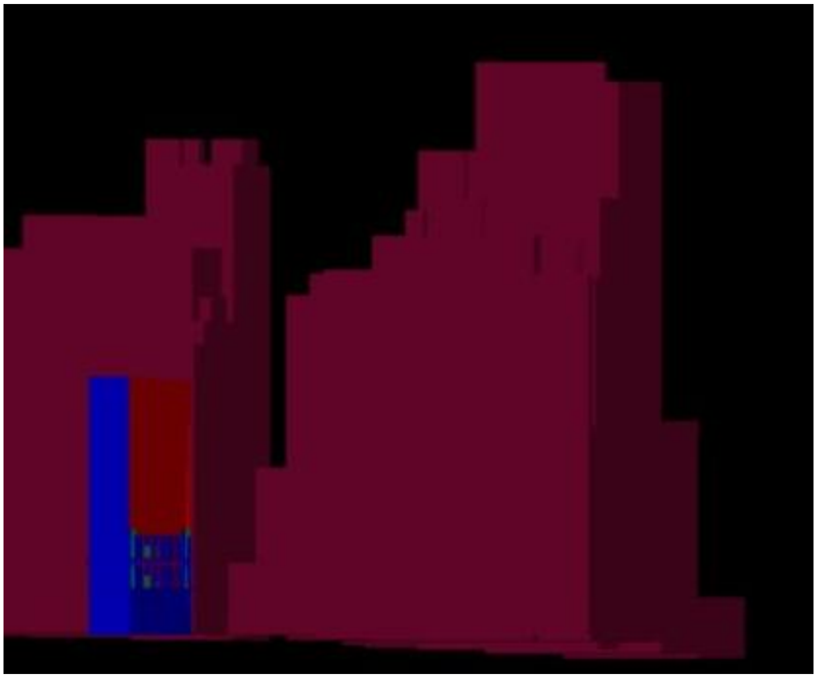


Figure 88: Corbin Building Highlighted in Blue

Occupancy

The office space was assumed to have standard working hours from 8:00AM to 6:00PM at full occupancy and weekends 8:00AM to 6:00PM at 10% occupancy. Some weekends there might be zero occupancy and other weekends higher so this averaged of the year should give an approximate occupancy.

Materials

A simplified façade was created to be imported into Daysim to be able to be run. The model had a detailed façade model for the 3rd floor. The materials and the reflectances that was used in the .rad file:

```
void plastic l_brick 0 0 5 0.5881 0.5881 0.5881 0.0000 0.0000
void plastic l_ceiling 0 0 5 0.8000 0.8000 0.8000 0.0000 0.0000
void plastic l_floor 0 0 5 0.2000 0.2000 0.2000 0.0000 0.0000
void glass l_glass 0 0 3 0.500 0.500 0.500
void plastic l_iron 0 0 5 0.2238 0.2238 0.2238 0.0000 0.0000
void plastic l_limestone 0 0 5 0.5881 0.5881 0.5881 0.0000 0.0000
void plastic l_blds_surronding 0 0 5 0.3000 0.3000 0.3000 0.0000 0.0000
void plastic l_walls 0 0 5 0.5000 0.5000 0.5000 0.0000 0.0000
void plastic l_corbin 0 0 5 0.5000 0.5000 0.5000 0.0000 0.0000
```

Figure 89: Material .rad File

Layout

Type	IES File	Descript...	BF MAX	BF MIN	POWER MAX	POWER MIN	OTHER LLF's	TOTAL LLF	LUMENS /LAMP
A	EGSCM4-2-54T5HO.ies		1.0	0.03	125.0	24.0	0.81	0.81	5000
B	p926p.ies		1.0	0.05	31.0	8.0	0.81	0.81	2400

Figure 90: Luminaire Table

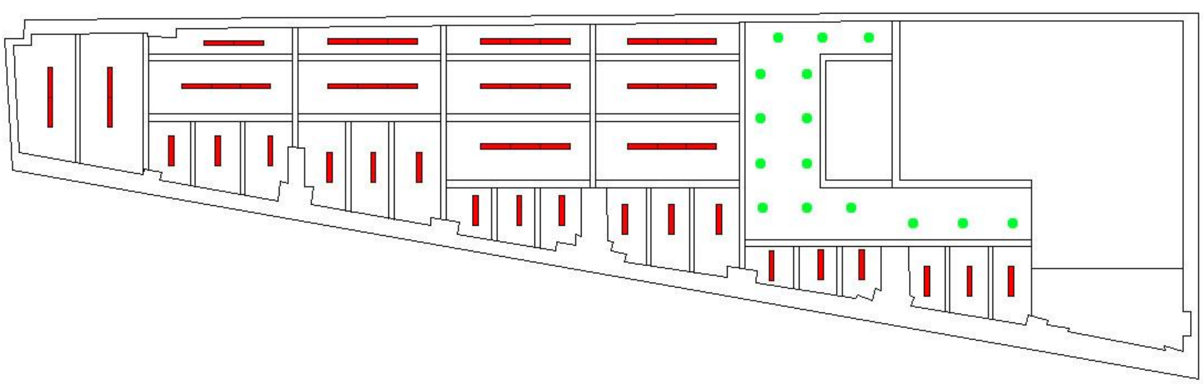


Figure 91: Luminaire Layout Table

Zone 1- Red- Direct/Indirect T5 Pendants
Zone2- Green- Recessed Compact Fluorescent

Illuminance Contours- Daylight Only

The illuminance plots show hour by hour calculations exactly how the office is affected by daylight at each hour of the work day. The days considered were December 21st, March 20th, and June 21st. All plots are displaying Lux.

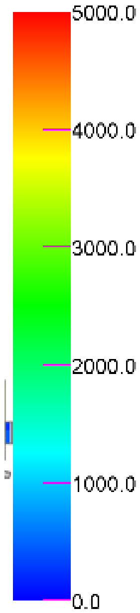
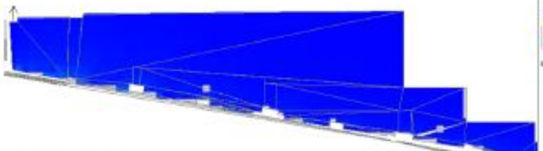


Figure 92: Scale Used for Illuminance (Lux) Plots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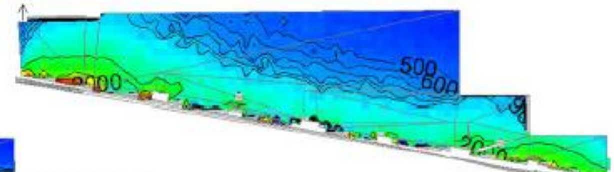
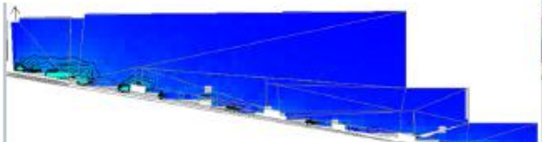
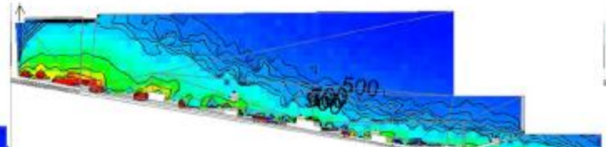
Mar 20th—8:00 AM


Jun 21st—8:00 AM


Dec 21st—9:00 AM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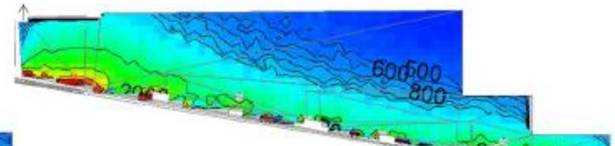
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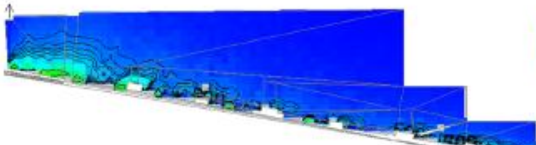
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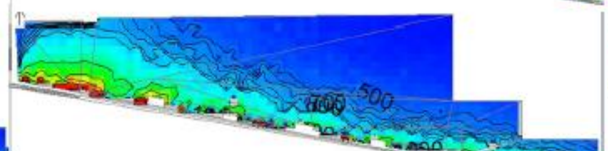
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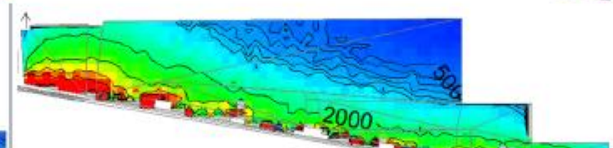
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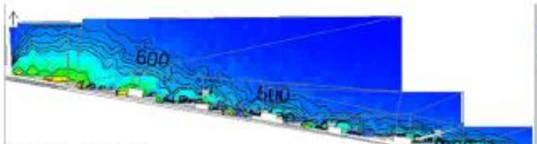
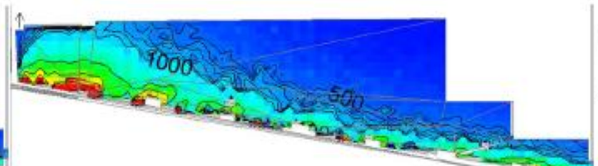

Dec 21st—11:00 AM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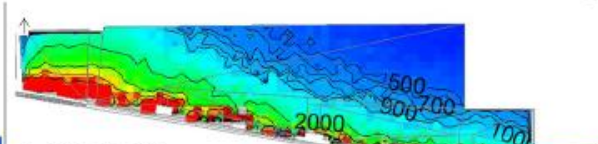
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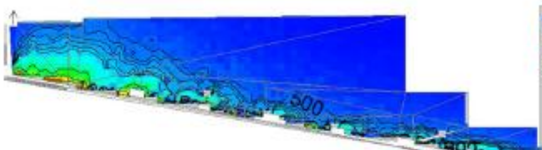
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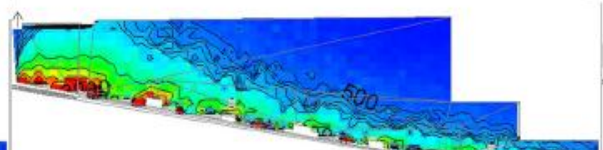
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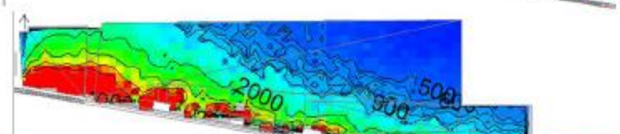
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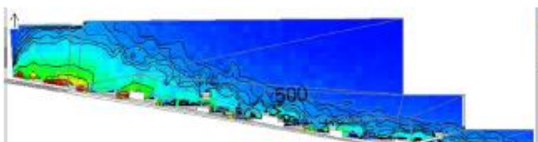
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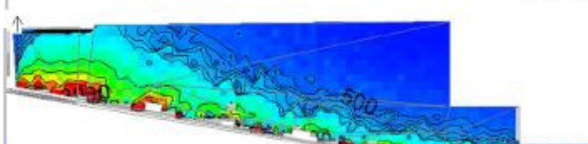
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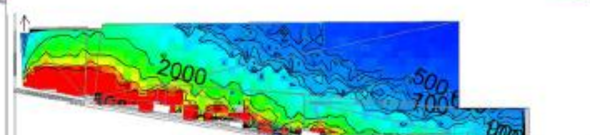
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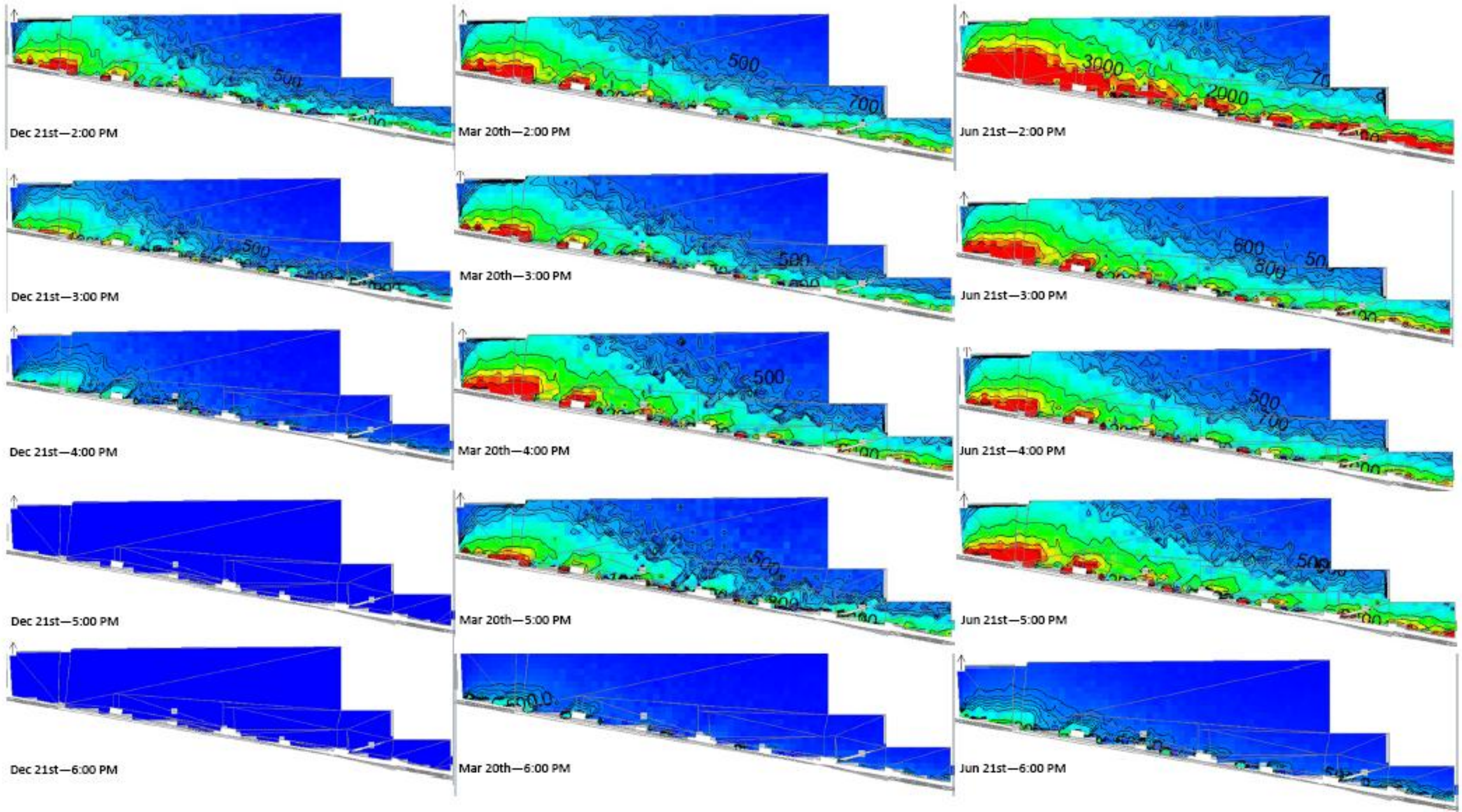
Dec 21st—2:00 PM
Mar 20th—2:00 PM
Jun 21st—2:00 PM
Dec 21st—3:00 PM
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Jun 21st—3:00 PM
Dec 21st—4:00 PM
Mar 20th—4:00 PM
Jun 21st—4:00 PM
Dec 21st—5:00 PM
Mar 20th—5:00 PM
Jun 21st—5:00 PM
Dec 21st—6:00 PM
Mar 20th—6:00 PM
Jun 21st—6:00 PM

Conclusion

The office receives most of its sunlight in the far west side of the office, while the rest of the office does not get very deep sun penetration during most of the year. During the summer months the office gets more sunlight since the sun is higher in the sky and the sun's rays are able to make it over the top of the neighboring buildings. The plots show a clear definition that the buildings on the east side is blocking majority of the sun from entering the space.

Shades would be best used on the west end of the south façade to block the high levels of sun. The shades would not be needed during the winter months since the illuminance entering the space is under 500 lux for most the space. Shades might be used in the late afternoon in the winter on the west side if a desk is place close to the window since about 1000 lux enters the space. Right next to the window, during the fall/spring and summer months the office has an illuminance above 1000 lux and could cause an unpleasant work environment. Workers at desk near the windows may require some kind of shading device such as blinds or shades.

In the spring/ fall and summer months dimming could be used on the luminaires closes to the windows and a zone on the far west side of the office. By dimming these two zones would cause an energy savings to occur. The office has an illumiance from daylight deeper into the space above 500 lux with a target illumiance of 300 lux, which would allow for dimming some luminaries to a lower level.

Summary and Conclusions

The purpose of this thesis was to design and analysis the lighting and electrical system, but to also integrate all building system together to improve energy consumption, cost savings, efficiency and aesthetics. The changes in this thesis were to improve the overall performance and enhance the visual aesthetics of the Corbin Building without changing the historical renovation.

The redesigned lighting solutions provide viable alternatives to the existing system by highlighting the architecture and improving the overall functionality of the building. The office lighting enhances the historical arched vaulted ceilings while not comprising performance. The lobby incorporates a lighting design to create spaciousness, while highlighting the copper panels on the wall. The façade had the greatest improvement from going unlit and dark to both towers grazed bringing out the details in the restored façade. The entrances were also illuminated and varied illumination to give a wayfinding device for the subway entrance. The retail space was fit out with lighting to incorporate a modern luxury clothing store. The lighting created a clean design to improve the retail merchandise and incorporate light into the casework.

To incorporate the new lighting designs, the electrical system was also redesigned at the branch circuit level and then feeders were resized. A short circuit and protective device coordination study was conducted to guarantee the safety of the overcurrent protection thought the distribution center using SKM. An alternative way was reviewed for the main feeders to the switchboard using duct bank and proved to be a cost- effective and feasible solution.

The architectural design of the retail space incorporated a luxury boutique clothing store to be designed in retail space 1. The store incorporated a center focal display and casework on the north wall. The mechanical duct work was redesigned to be integrated into the architecture by using small slotted duct.

Even though surrounding buildings are taller than the Corbin Building daylight is able to penetrate though the windows. Analyzing the daylight in the office provided that the office receives enough daylight in the space that using shades or dimming could be a valid option.

References

Handbooks/Text

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DiLaura, Houser, Mistrick, and Stefy. The IESNA Lighting Handbook: Reference & Application. 10th ed. New York, NY: Illuminating Engineering Society of North America, 2011.

National Fire Protection Association. NFPA-70 – National Electric Code. 2011 Edition. Quincy, Massachusetts: National Fire Protection Association, 2008. Print.

RS Means Electrical Cost Data 2012. 35th Annual Edition. Kingston, Massachusetts: RS Means Co., 2011. Print.

Software Tools

AGi32
Autodesk AutoCAD 2011
Autodesk 3D Studio Max Design 2011
DAYSIM Penn State Version
Adobe Photoshop CS5
SKM Power Tools Version 6.5

Acknowledgements

I would like to thank the following individuals for the time and effort every one provided me, without your help I would never have been able to finish my thesis.

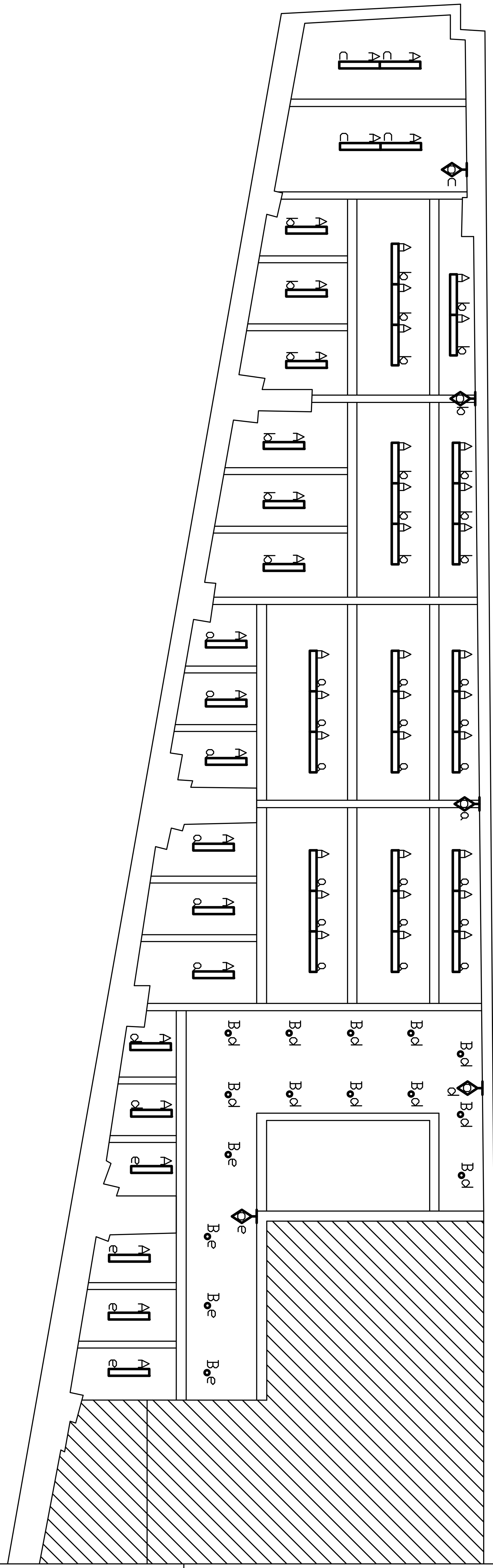
Thank you to the Pennsylvania State University Architectural Engineering faculty for the past five years, especially:

Dr. Kevin Houser Thesis Advisor
Dr. Richard Mistrick Lighting Consultant
Prof. Ted Dannerth Electrical Consultant
Prof. Sean Good

Thank you to all my fellow 5th year classmates for all the memories, headaches and hours spent in the computer lab together.

Appendix A

Drawings



LP-1

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REVISIONS

Date	Description	Approved

CORBIN BUILDING

AE THESIS

192 BROADWAY NEW YORK, NY

OPEN OFFICE 3RD FLOOR

AE 482

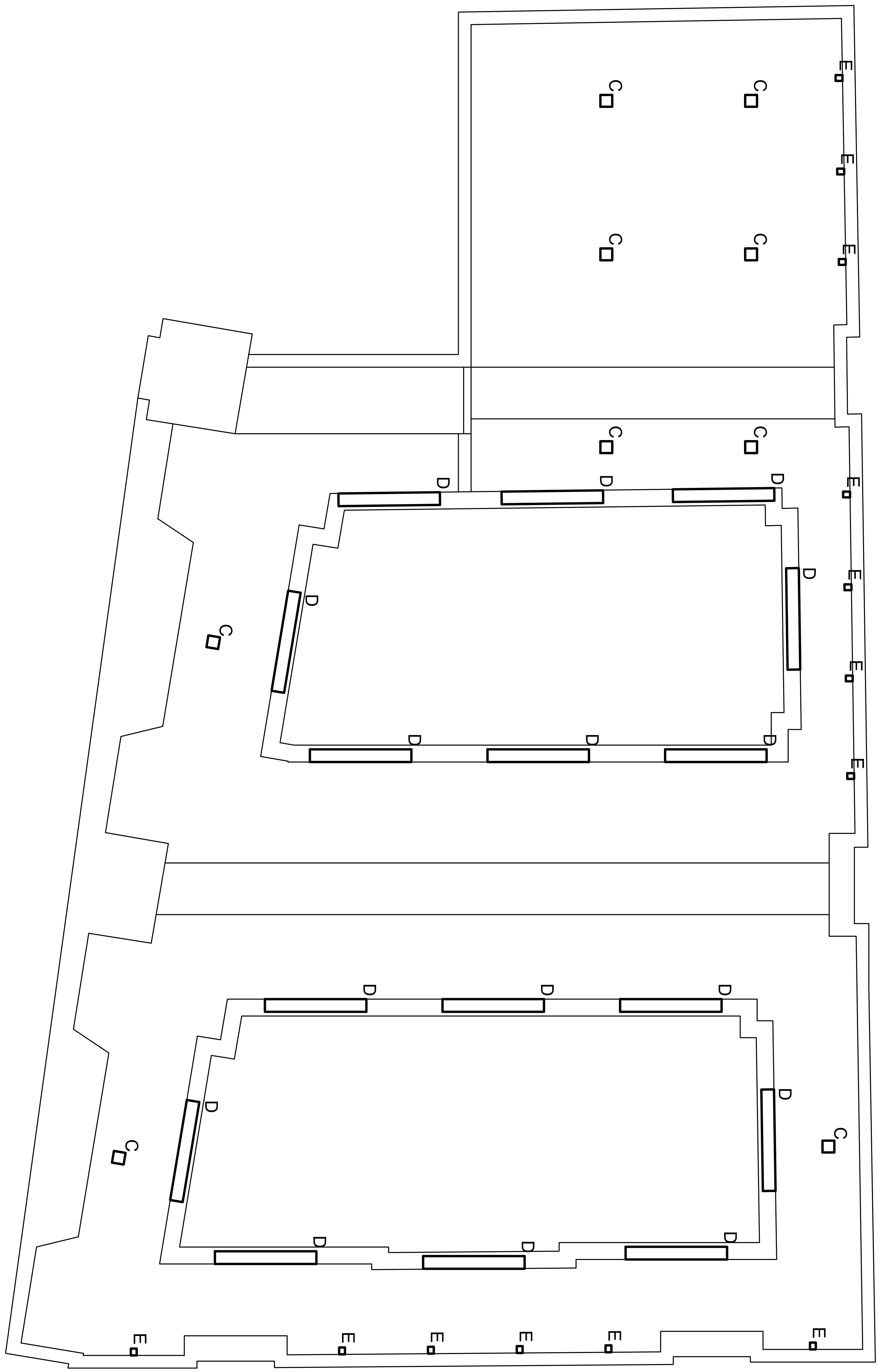
Designed Matt Trethaway

Date 1/31/2012

Checked

Approved ______ Date ____

Title ______ Job Class ____



LP-2

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REVISIONS		
Date	Description	Approved

CORBIN BUILDING

AE THESIS

192 BROADWAY NEW YORK, NY

LOBBY LIGHTING PLAN

AE 482

Designed Matt Trethaway

Designed 2/28/2012

Checked

Approved ______ Date ____

Title ______ Job Class ____

LIGHTING EQUIPMENT KEY

- F
- G
- H
- I
- J

8' 4' 0 8' 16'

Designed Matt Trethaway
Designed
Checked
Approved
Date
Title
Job Class

CORBIN BUILDING
AE THESIS
192 BROADWAY NEW YORK, NY

FACADE LIGHTING PLAN
AE 482

REVISIONS

Date	Description	Approved

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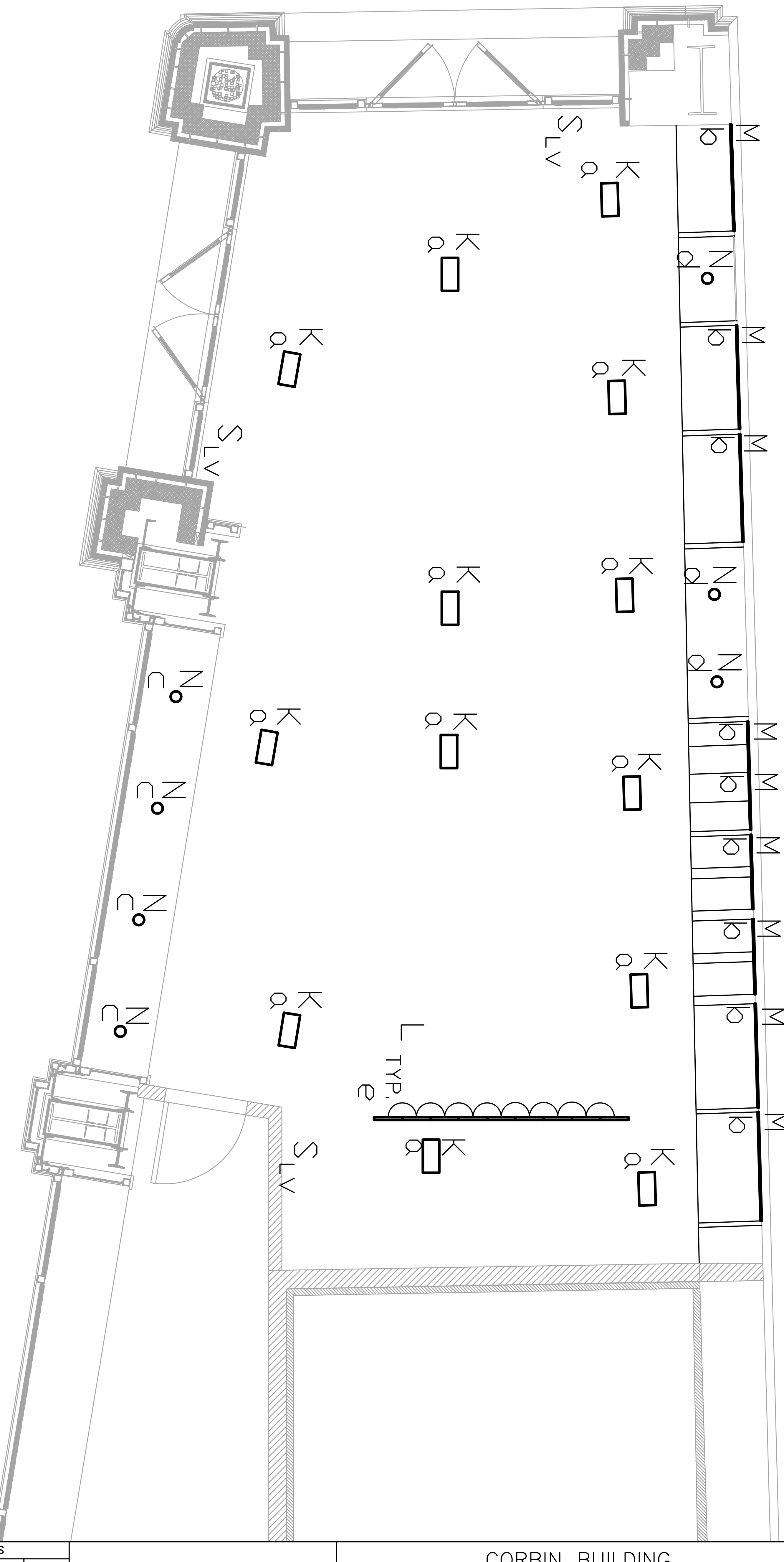
LP-3



LP-4

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REVISIONS		
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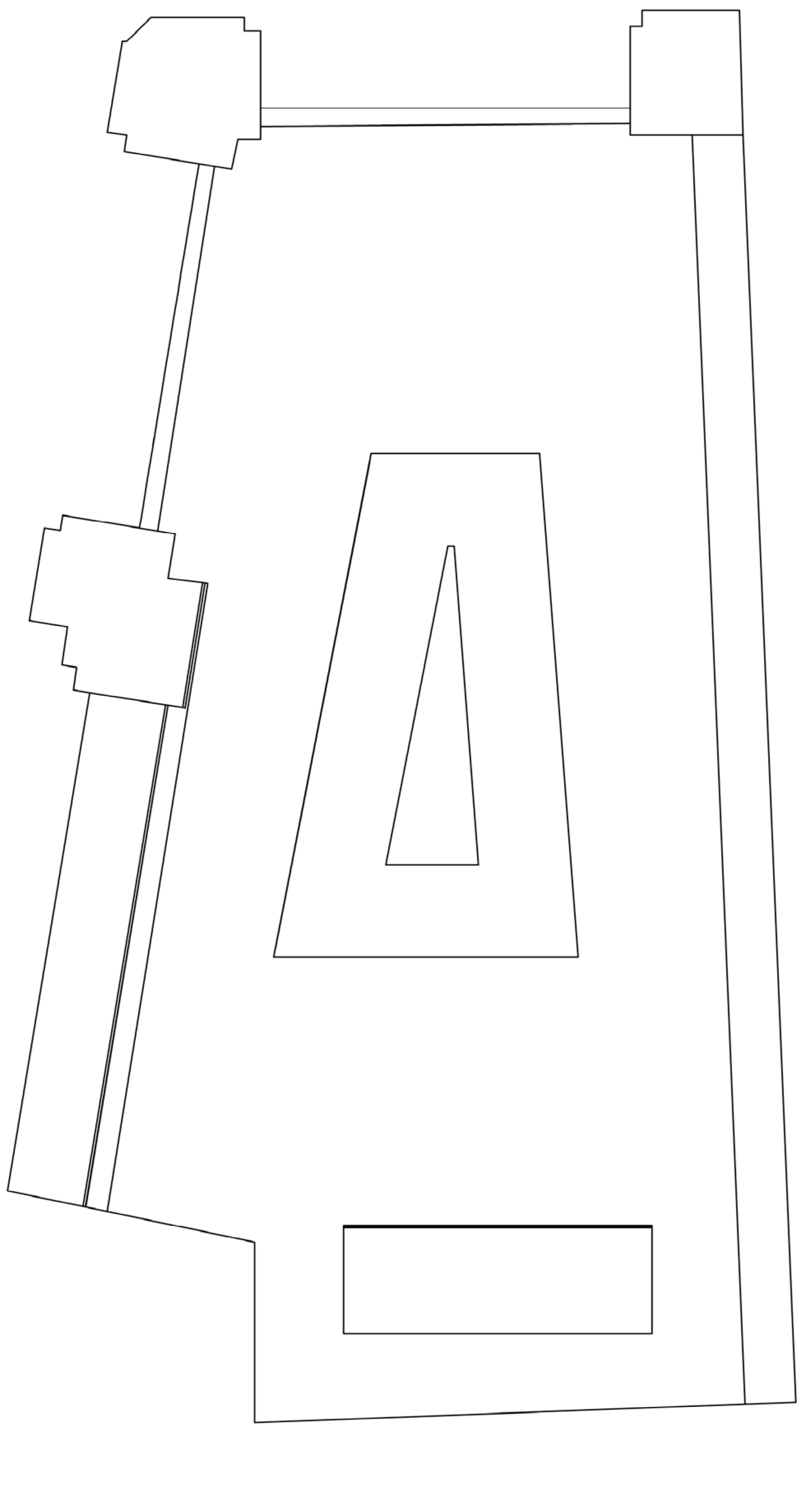
CORBIN BUILDING
AE THESIS
192 BROADWAY NEW YORK, NY

LIGHTING PLAN
AE 482

Designed Matt Trethaway
Designed
Checked
Approved ______ Date ____
Title ______ Job Class ____



A-1

SCALE: 1/4"=1'-0"

REVISIONS		
Date	Description	Approved

CORBIN BUILDING

AE THESIS

192 BROADWAY NEW YORK, NY

FLOOR PLAN

AE 482

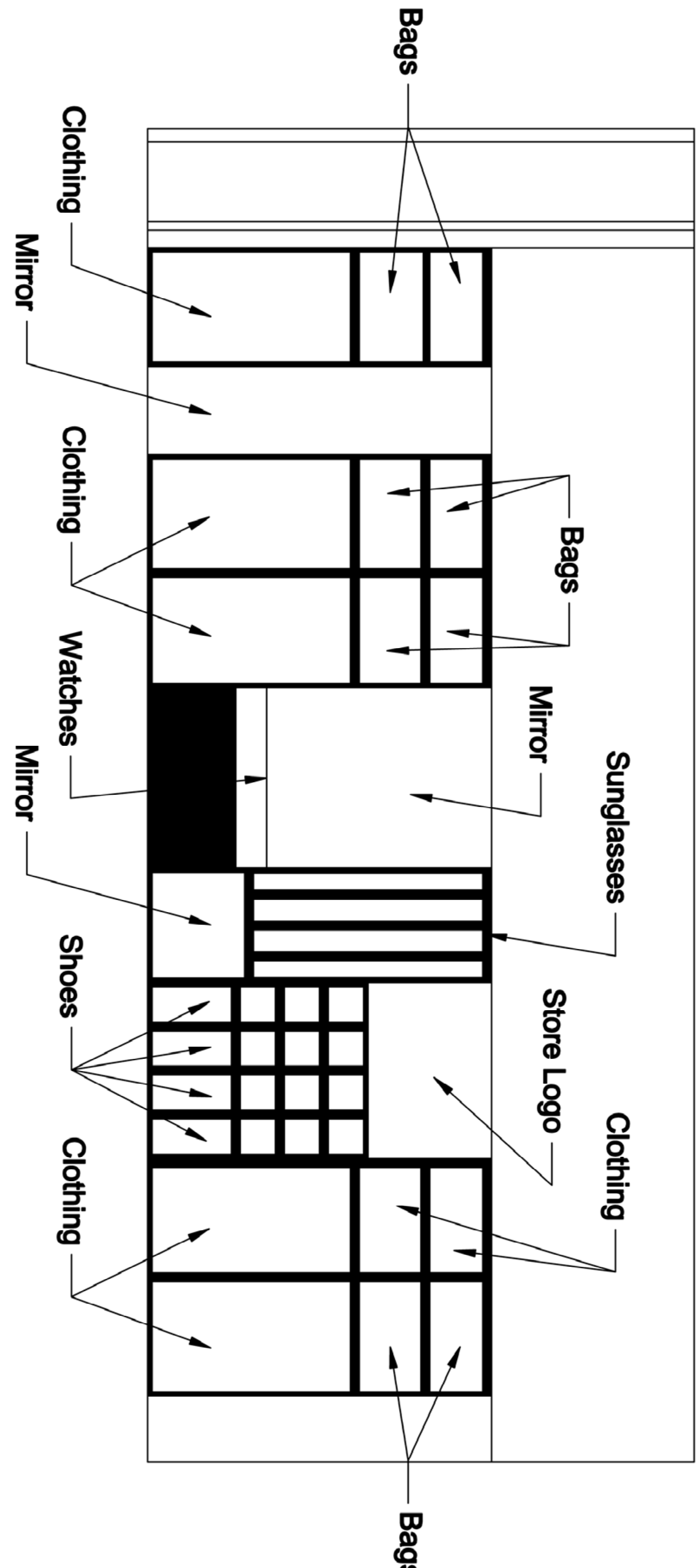
Designed Matt Trethaway

Designed

Checked

Approved ____________ Date ____

Title ____________ Job Class ____

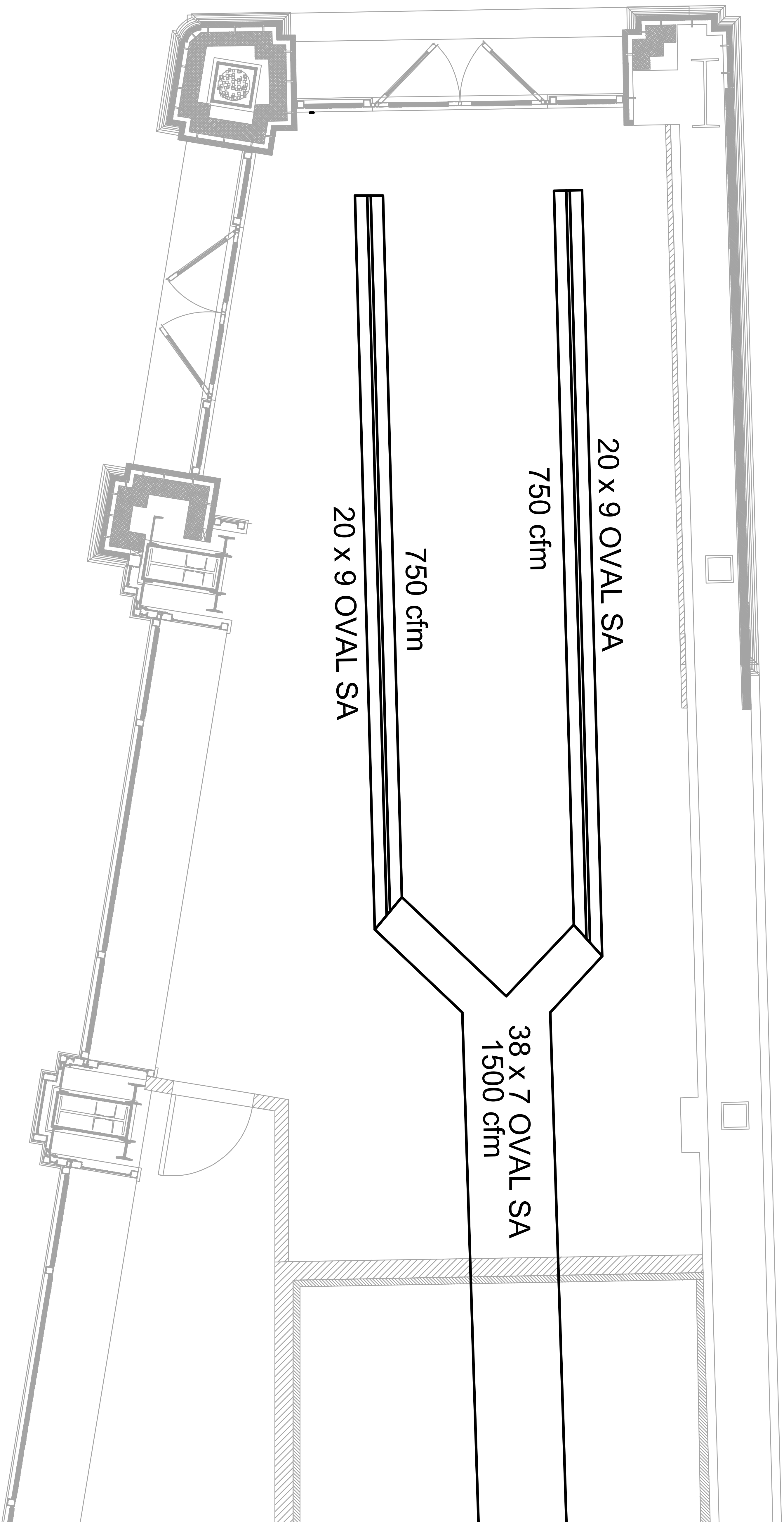


A-2	SCALE: 1/4"=1'-0"	REVISIONS	
	Date	Description	Approved

CORBIN BUILDING
AE THESIS
192 BROADWAY NEW YORK, NY

NORTH ELEVATION
AE 482

Designed Matt Trethaway
Designed
Checked
Approved ______ Date ____
Title ______ Job Class ____



M-1

SCALE: 1/4"=1'-0"

REVISIONS		
Date	Description	Approved

CORBIN BUILDING

AE THESIS

192 BROADWAY NEW YORK, NY

Retail Duct Layout

AE 482

Designed Matt Trethaway

Designed

Checked

Approved ____________ Date ____

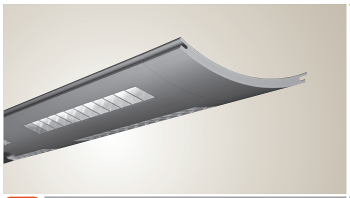
Title ____________ Job Class ____

Appendix B

Lighting Specifications

Manufacturer:	Peerless Lighting	**Lamp:**	(2) F28T5/841
Catalog Number:	EGSCM4-2-28T5-SSB-R4-120-GEB10-1SE-EC-SCT-LP835-FC2-24-C100	**Ballast/Transformer:**	Electronic 120V

PEERLESS®



Lightedge®

Indirect / Direct T5 / T5HO

Type: A

Project: Corbin Building

SPECIFICATIONS Pendant Mount — Modular / 8" x 2" Shallow Curved **EGSCM4**

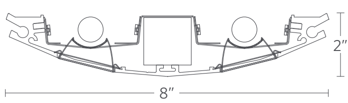
CATALOG NUMBER

EGSCM4 2 28T5 SSB 12 FT R4 120 GEB10 1SE EC SCT LP841 F2 24 C100

Examples: EGSCM4 2 54T5HO 40FT R8 120 GEB10 2SE EL SCT LP835 F1/24 C100 — EGSCM4 2 54T5HO 32FT R8 277 GEB10 DCT L/LP F2/15 C100 ACG

AVAILABLE FIXTURES

☐ **EGSCM4 - 2**



SPECIFICATIONS

Construction
Housing and endcap AA 6063 T6 extruded aluminum forming an 8" x 1½" curvilinear channel.

Reflectors
Die-formed reflectors with baked white enamel finish (nominal reflectance 90%) and hammertone specular aluminum.

Shielding
18" parabolic semi-specular aluminum baffles with or without perforated shield. Four per 4-foot section.

Finish
Satin anodized standard; custom colors available.

Electrical
Specify 120 volt, 277 volt, or 347 volt. C-UL listed and labeled. For special circuiting, consult factory.

Fixture Length
4' and 8' lengths in a single section for exact suspension spacing of 4' and 8.' For total fixture length add 4" for each end-cap. Using internal joiners, 4' and 8' sections can be joined to form longer-length fixtures.

ORDERING LOGIC

Use guide below to order complete fixture runs from four feet to one-hundred feet in increments of four.

EGSCM4	2	28T5	SSB	12 FT	R4	120	GEB10	1SE ▸▸▸
Fixture	**# of Lamps in Cross Section**	**Lamp Type**	**Baffle**	**Nominal Row Length**[1]	**Maximum Section Length**	**Voltage**	**Ballast Type**	**# of Emergency Modules**[2]
EGSCM4	2	**54T5HO** 54W 4' T5HO **28T5** 28W 4' T5	**SSB** Semi-Specular **SSBP** Semi-Specular w/ Perforated Shield		**R4** 4' section **R8** 8' section	**120** **277** **347**	**GEB10** <10% THD ELECTRONIC **ADEZ**[4,5] Advance Mark 10 dimming **ECO10**[4] Lutron ECO-10 dimming **OSDIM**[4,5] Osram 0-10v dimming *Reference Ballast Chart on website or consult factory for other options.*	**Blank** **1SE** 1 section **2SE** 2 sections **XSE** X sections

▸▸ EC	SCT	LP841	F2 / 24		C100	
Emergency Type[3]	**Switching**	**Lamp Color**	**Mounting Type** /	**Overall Suspension**	**Finish**	**Options**
Blank **EL** Emergency Battery Pack **EC** Emergency Circuit **EN** Emergency Battery Pack w/ Night Light Circuit	**SCT** Single Circuit **DCT** Dual Circuit	**L/LP** No Lamp **LP830** 3000k 80+ CRI **LP835** 3500k 80+ CRI **LP841** 4100k 80+ CRI Available with T5 only **LP830P**[6] 3000k 80+ CRI Premier Lamp **LP835P**[6] 3500k 80+ CRI Premier Lamp **LP841P**[6] 4100k 80+ CRI Premier Lamp *Reference Lamp Chart on website or consult factory for other options.*	**F1** T-Bar Ceiling (Universal Mounting Bracket) **F1A** T-Bar Ceiling (UMB with Integrated J-Box) **F2** Hard Ceiling Horizontal J-box **F4A** Grid Ceiling IDS 15/16" **F4B** Grid Ceiling IDS 9/16" **F4C** Grid Ceiling IDS Screw Slot	**12** 12" overall suspension **15** 15" overall suspension **18** 18" overall suspension **21** 21" overall suspension **24** 24" overall suspension **XX** XX" overall suspension	**C100** Satin Anodized Finish (Standard) **C099** Custom Color (consult factory) **C200** Peerless Standard White (Low Gloss) **C005** Soft White (Low Gloss) **C032** White White (Gloss) **C041** White White (Low Gloss)	**ACG** Adjustable Cable Grippers **APF** Alternate Power Feed **CP** Chicago Plenum **DL** Damp Location Label **DU** Dust Cover **ELH** EM Through wire w/ Separate Feed **ELS** EM Through Wire w/ Single Feed **GLR** Fusing (Fast blow) **GMF** Fusing (Slow Blow)

Notes:
1 Must be in 4' increments.
2 Sections per run; optional.
3 EL, EN and EC not available with DCT in 4' sections.
4 Not available in 347 volt.
5 Not available with 28T5 Lamp Type.
6 Not available with 54T5HO Lamp Type.

PEERLESS LIGHTING • 2246 5th St., Berkeley, CA 94710 • **Tel:** 510.845.2760 • **Fax:** 510.845.2776 • www.peerless-lighting.com An Acuity Brands Company

PENNSTATE 1855

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE: A

Lightedge®

Indirect / Direct T5 / T5HO

Type: A

Project: Corbin Building

PHOTOMETRICS | Pendant Mount — Modular / 8″ x 2″ Shallow Curved | **EGSCM4**

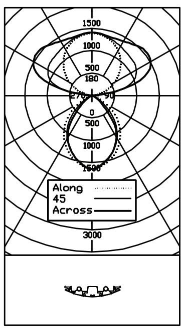
2-LAMP T5HO

FAR–FIELD PHOTOMETRY

DATE: 1–22–2003

REPORT NUMBER: 5778

CATALOG NUMBER: EGSCM4–2–54T5HO
LUMINAIRE: 8 "W X 1 1/2"H ALUMINUM INDIRECT/DIRECT LIGHT WITH WHITE PAINTED AND HAMMERTONE REFLECTOR AND BAFFLE
LAMP(S): 2–FP54/835/HO RATED @ 5000 LUMENS
BALLAST: QT 2X54/120PHO
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS =120.5 AT 120.0 VOLTS
THE 0 DEGREE PLANE IS PARALLEL WITH THE LAMPS.



CANDELA DISTRIBUTION

	0.0	22.5	45.0	67.5	90.0	FLUX
0	1648	1648	1648	1648	1648	
5	1611	1630	1624	1612	1609	153
15	1500	1479	1443	1438	1440	410
25	1325	1271	1234	1217	1222	575
35	1096	1034	970	929	923	614
45	819	751	644	485	437	485
55	487	423	269	181	155	268
65	134	127	66	20	14	78
75	16	16	8	7	6	14
85	2	3	3	3	3	3
90	1	2	2	2	2	
95	39	187	194	183	175	193
105	228	516	838	944	946	750
115	455	684	1078	1347	1426	1000
125	685	828	1178	1447	1550	1022
135	897	973	1206	1437	1526	934
145	1083	1120	1241	1380	1435	785
155	1228	1243	1294	1350	1377	600
165	1330	1337	1346	1360	1367	382
175	1383	1393	1394	1399	1400	133
180	1404	1404	1404	1404	1404	

ZONAL LUMEN SUMMARY

ZONE	LUMENS	%LAMP	%FIXT
0– 30	1138	11.4	13.5
0– 40	1752	17.5	20.9
0– 60	2504	25.0	29.8
0– 90	2600	26.0	31.0
90–120	1943	19.4	23.1
90–130	2965	29.7	35.3
90–150	4684	46.8	55.8
90–180	5799	58.0	69.0
0–180	8398	84.0	100.0

LUMINANCE DATA IN FOOTLAMBERTS

ANGLE IN DEG	AVERAGE 0–DEG	AVERAGE 45–DEG	AVERAGE 90–DEG
45	18531.	12550.	7455.
55	13346.	6363.	3257.
65	4625.	2065.	386.
75	703.	373.	267.
85	129.	210.	194.

TOTAL LUMINAIRE EFFICIENCY = 84.0 %
CIE TYPE – SEMI–INDIRECT

APPROVED BY: REGISTERED PROFESSIONAL ENGINEER PETER YI YAN NGAI No. E9667 ELECTRICAL STATE OF CALIFORNIA

BARE LAMP LUMEN VALUE IS RATED AT LAMP OPERATING TEMPERATURE INSIDE THE LUMINAIRE. FOR DETAILS, PLEASE SEE PEERLESS PUBLICATION # A62

*Use a 0.58 multiplier for T5.

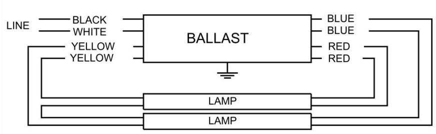
PHILIPS
ADVANCE

Electrical Specifications

IOP2S2895SC@120	
Brand Name	OPTANIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

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	2	14	0/-18	0.25	30	0.95	15	0.98	1.7	3.17
F21T5	1	21	0/-18	0.19	23	0.95	15	0.98	1.7	4.13
F21T5	2	21	0/-18	0.37	44	0.95	10	0.98	1.7	2.16
F28T5	1	28	0/-18	0.25	30	0.95	10	0.98	1.7	3.17
* F28T5	2	28	0/-18	0.50	59	0.95	10	0.98	1.7	1.61
F28T5/ES (25W)	1	25	0/-18	0.22	27	0.95	10	0.98	1.7	3.52
F28T5/ES (25W)	2	25	0/-18	0.45	54	0.95	10	0.98	1.7	1.76
F35T5	1	35	0/-18	0.31	37	0.95	10	0.98	1.7	2.57

Wiring Diagram



Diag . 74

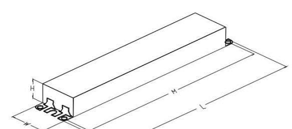
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	22	55.9
White	22	55.9
Blue	26	66
Red	26	66
Yellow	36	91.4
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

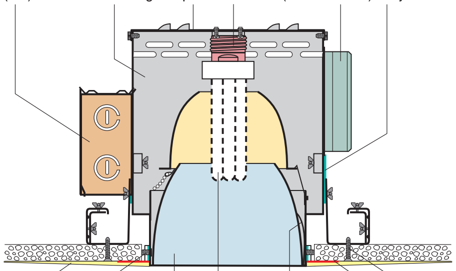
OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.7 "	1.18 "	8.90 "
9 1/2	1 7/10	1 9/50	8 9/10
24.1 cm	4.3 cm	3 cm	22.6 cm

Revised 01/12/2012

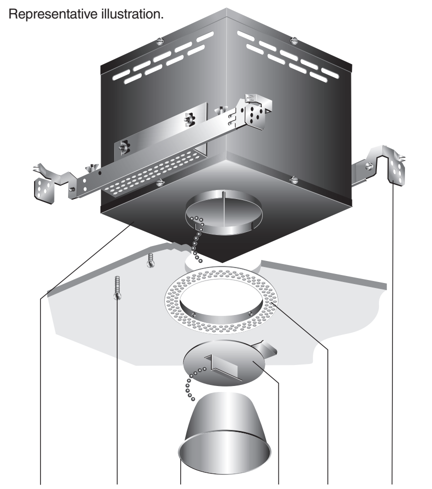
Data is based upon tests performed by Philips Lighting Electronics N.A. in a controlled environment and is representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

Manufacturer: Kurt Versen
Catalog Number: P926FM-SP
Lamp: (1)-CFL32TR/841
Ballast/Transformer: Electronic 120V



Representative illustration.



P926FM One 26W or 32W Triple Tube Lamp
P927FM One 42W Triple Tube Lamp

FM 1-9

Flush Mount Downlights
5 7/8" Round Conoid Apertures

Flush Mount
Kurt Versen's flush mount fixtures eliminate overlapping flanges and lock into the ceiling for a unique, finished appearance. A clean, uncluttered ceiling emphasizes the attention to detail, enhancing the impact of the interior environment. It is a factory installed option with a proven installation technique.

Optics and Applications
Distribution from a single vertically mounted triple tube lamp is for general lighting. Use in corridors, entries, work stations or open area lighting in low to medium height ceilings.

Design Features
A steel housing maintains the reflectors in the proper relationship to protect the optical system. A twist and lock socket prevents the lamp from falling. Flush mount design resists cracking and chipping by mechanically fastening fixture to drywall. To simplify installation, three adjustment mechanisms adapt the fixture to ceiling conditions. Adjustable mounting rails fit different support systems and accommodate ceiling thicknesses from 3/8" to 7/8". Maximum extension is 26". Top or bottom service.

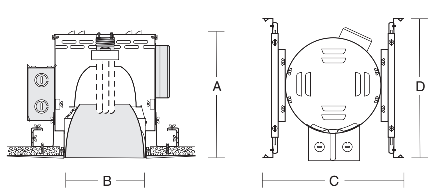
Finish
Specular clear Alzak cones are standard. Optional colors and Softglow® finishes are available. Housings and structural parts are painted optical matte black to suppress stray light leaks. Steel parts are phosphate conditioned for corrosion resistance before painting.

Ballast
Programmed rapid start, microprocessor controlled for rated lamp life and end of lamp life protection. Input voltage range is from 120V through 277V. Operates 26W, 32W or 42W triple tube lamps. Power factor .98. Starting temperature 0°F (-18°C), THD <10%.

General
Fixtures are pre-wired, UL and C-UL listed for damp location and eight wire 75°C branch circuit wiring. Union made IBEW.

Accessories
- B Black cone.
- G Gold cone.
- H Mocha cone.
- P Graphite cone.
- T Titanium cone.
- W Wheat cone.
- Y Pewter cone.
- Z Bronze cone.
- F Fuse.
- V347 347 volt ballast.
- WR White cone return.
- WHT White complete trim.
- FMW Flush mount wood, contact factory.
- S Softglow® finishes: add S before color letters. e.g. SW for Softglow® wheat cone, SC for Softglow® clear cone.
- DM Dimming, 5% minimum, specify watts and volts.
- DM1 Dimming, 1% minimum 26-32W, specify watts and volts.
- EM Emergency power includes integral charger light and test switch visible through aperture. Single lamp operation for 90 minutes. Specify volts.
- WRL Wattage restriction label, specify wattage.

Dimensions and Lamps



Number	A Depth	B Aperture	C Width	D Length	Lamp
P926FM	9 3/4" 248mm	5 7/8" 149mm	14 3/8" 391mm	14 1/4" 362mm	26 or 32W Triple Tube
P927FM	10 1/4" 260mm	5 7/8" 149mm	14 3/8" 391mm	14 1/4" 362mm	42W Triple Tube

*Recess depth increases to 12 1/2" with EM accessory.

kurt versen
Kurt Versen Company
Point Source Lighting
Westwood, New Jersey 07675

PENNSTATE 1855

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE: B

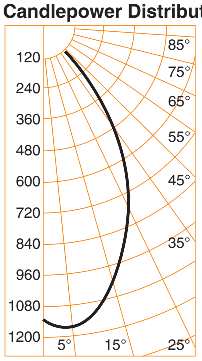
FM 1-9 P926FM P927FM

Performance Datachart

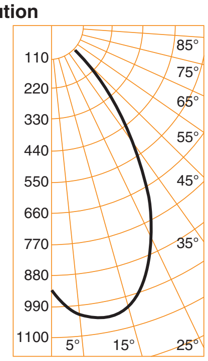
Single Unit Initial Footcandles, 30" Work Plane							Ceiling to Floor	Multiple Units Initial Footcandles, 30" Work Plane			
P926FM One 32W Osram Triple Tube Read Top P927FM One 42W Osram Triple Tube Read Bottom								Ceiling 80% Walls 50% Floor 20%			
Nadir	10°		20°		30°			Spacing is Maximum Over Work Plane			
FC	FC	Diam	FC	Diam	FC	Diam		Spacing	RCR 1	RCR 3	RCR 8
37	35	2'	25	4'	13	6'	8'	5'	49	42	30
47	42	2'	30	4'	17	6'		5'	66	56	39
27	25	2'	18	5'	10	8'	9'	6'	35	30	21
33	30	2'	21	5'	12	8'		6'	47	40	28
20	19	3'	14	5'	7	9'	10'	7'	26	23	16
25	23	3'	16	5'	9	9'		7'	36	30	21
13	12	3'	8	7'	4	11'	12'	9'	17	14	10
16	14	3'	10	7'	6	11'		9'	22	19	13
9	8	4'	6	8'	3	13'	14'	11'	11	10	7
11	10	4'	7	8'	4	13'		11'	15	13	9

See notes 4, 5 and 6.

Candlepower Distribution



P926FM 32W Osram
Eff. 50% S/M .95



P926FM 32W Philips
Eff. 50% S/M 1.11

Candelas

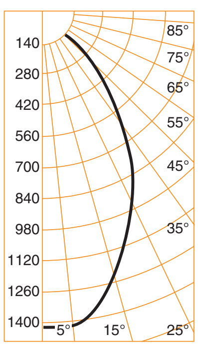
°	O 32W	P 32W
	2400*	2400*
0	1134	938
5	1152	1021
10	1109	1055
15	1023	1020
20	916	956
25	789	837
30	625	667
35	460	467
40	353	321
45	212	173
50	19	16
55	7	6
60	0	0
65	0	0
70	0	0
75	0	0
80	0	0
85	0	0
90	0	0

° Vertical Angles
* Initial Lamp Lumens

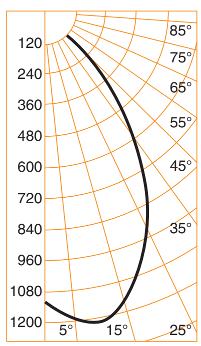
Coefficients of Utilization

Ceiling	80%				70%		50%		30%		0
Wall %	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal Cavity Method - Floor Reflectance 20%										
1	.57	.56	.55	.53	.55	.52	.53	.51	.51	.49	.47
2	.54	.52	.50	.48	.51	.47	.49	.46	.48	.45	.43
3	.51	.48	.45	.43	.47	.43	.46	.42	.45	.41	.40
4	.48	.44	.41	.39	.44	.39	.43	.38	.42	.38	.37
5	.46	.41	.38	.36	.41	.36	.40	.35	.39	.35	.34
6	.43	.38	.35	.33	.38	.33	.37	.33	.36	.32	.31
7	.41	.36	.33	.30	.35	.30	.35	.30	.34	.30	.29
8	.39	.34	.30	.28	.33	.28	.33	.28	.32	.28	.27
9	.37	.31	.28	.26	.31	.26	.31	.26	.30	.26	.25
10	.35	.30	.26	.24	.29	.24	.29	.24	.28	.24	.23

P926FM One 32W Triple Tube Osram Sylvania
P926FM One 32W Triple Tube Philips x .98



P927FM 42W Osram
Eff. 48% S/M .93



P927FM 42W Philips
Eff. 44% S/M 1.07

°	O 42W	P 42W
	3200*	3200*
0	1412	1104
5	1403	1188
10	1328	1211
15	1176	1154
20	1092	1063
25	958	919
30	789	747
35	611	583
40	487	441
45	355	253
50	75	23
55	10	8
60	0	0
65	0	0
70	0	0
75	0	0
80	0	0
85	0	0
90	0	0

° Vertical Angles
* Initial Lamp Lumens

Ceiling	80%				70%		50%		30%		0
Wall %	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal Cavity Method - Floor Reflectance 20%										
1	.56	.55	.54	.53	.54	.52	.52	.50	.50	.49	.46
2	.53	.51	.49	.47	.50	.47	.48	.46	.47	.45	.43
3	.51	.47	.45	.43	.47	.42	.45	.42	.44	.41	.39
4	.48	.44	.41	.39	.43	.38	.42	.38	.41	.38	.36
5	.45	.41	.38	.35	.40	.35	.39	.35	.39	.35	.34
6	.43	.38	.35	.33	.38	.32	.37	.32	.36	.32	.31
7	.40	.35	.32	.30	.35	.30	.34	.30	.34	.30	.29
8	.38	.33	.30	.28	.33	.28	.32	.28	.32	.27	.27
9	.36	.31	.28	.26	.31	.26	.30	.26	.30	.26	.25
10	.34	.29	.26	.24	.29	.24	.29	.24	.28	.24	.23

P927FM One 42W Triple Tube Osram Sylvania
P927FM One 42W Triple Tube Philips x .89

Brightness

Number	Lamps	85°	75°	65°	55°	45°
P926FM	32W Osram Sylvania Triple Tube	10	33	66	150	12837
	32W Philips Triple Tube	12	34	62	151	10756
P927FM	42W Osram Sylvania Triple Tube	14	45	91	208	17796
	42W Philips Triple Tube	15	45	82	203	14468

Data in footlamberts. Photometer readings, Maximum Brightness Method.

Notes

1 Data on all charts calculated with a clear specular cone finish.
2 Specular cone multipliers: Wheat x .84, Pewter x .79, Mocha x .78, Graphite x .75, Titanium x .75, Bronze x .72.
3 Softglow® cone multipliers: Wheat x .71, Mocha x .68, Pewter x .65, Graphite x .64, Titanium x .64, Bronze x .61.
4 Single unit Datachart pattern diameters are determined by the number of degrees from each side of nadir. Therefore a 20° diameter represents a total 40° pattern width at the work plane 30" above the floor. Footcandle values are at the edge of that diameter.
5 Datachart spacing is rounded off to the nearest foot.
6 Data by IES methods. Compact fluorescent data vary due to lamp differences, power input, burning position, ambient temperature and ballast characteristics. Apply a modification factor.

Kurt Versen Company, Westwood, New Jersey

PENNSTATE
1855

Project: AE 482- Corbin Building
Date: April 4, 2012

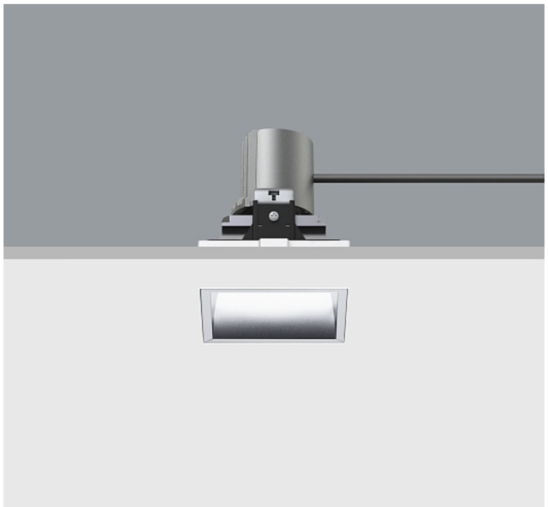
TYPE:
B

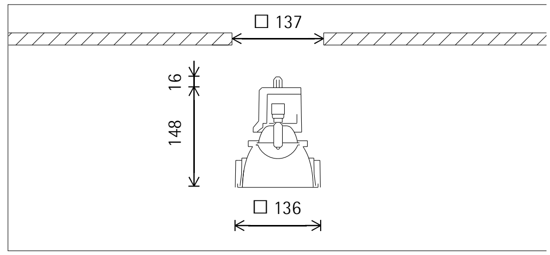
Manufacturer:	ERCO Lighting	**Lamp:**	(1)-35W-CMH 35W GU6.5
Catalog Number:	37420	**Ballast/Transformer:**	Electronic 120V

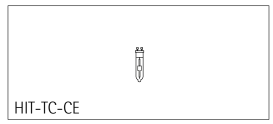
ERCO

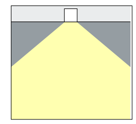
Quintessence Downlight

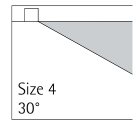
for metal halide lamps

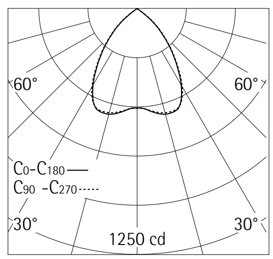






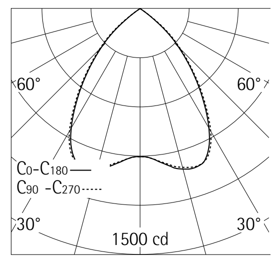






HIT-TC-CE 20W GU6.5 1800lm

LOR	0.56
UGR C0	20.2
UGR C90	20.5
65° <	200 cd/m^2



HIT-TC-CE 35W GU6.5 3400lm

LOR	0.55
UGR C0	22.5
UGR C90	22.7
65° <	200 cd/m^2

37420.000 Reflector silver
HIT-TC-CE 20W GU6.5 1800lm
HIT-TC-CE 35W GU6.5 3400lm
Flush mounting detail
Wide diffuser

Product description
Lampholder carrier: cast aluminium, designed as heat sink. Fixing frame: plastic, black.
Mounting frame: plastic, white (RAL9002). Mounting for ceiling thicknesses of 1-30mm with covered mounting detail and 12.5-25mm with flush mounting detail.
Cable with plug, L 500mm.
Spherolit technology upper reflector: aluminium, silver, mirror-finish anodised.
Darklight reflector: aluminium, satin matt anodised. Cut-off angle 30°.
Diffuser: glass, frosted.
Control gear to be ordered separately.
Weight 0.55kg

PENNSTATE 1855	**Project:**	AE 482- Corbin Building
	Date:	April 4, 2012

TYPE:
C

ERCO

Quintessence Downlight

Planning data

37420.000	HIT-TC-CE 20W GU6.5 1800lm
Connected load without control gear	P: 20 W
Connected load per 100lx	P*: 1.9 W/m^2
Number of luminaires per 100lx	n*: 9.7 1/100m^2

37420.000	HIT-TC-CE 35W GU6.5 3400lm
Connected load without control gear	P: 35 W
Connected load per 100lx	P*: 1.8 W/m^2
Number of luminaires per 100lx	n*: 5.2 1/100m^2

37420.000	HIT-TC-CE 20W GU6.5 1800lm			
Number of luminaires per 100m^2 for	100lx	200lx	300lx	500lx
	10	20	30	49

37420.000	HIT-TC-CE 35W GU6.5 3400lm			
Number of luminaires per 100m^2 for	100lx	200lx	300lx	500lx
	6	11	16	27

37420.000	HIT-TC-CE 20W GU6.5 1800lm			
Module (m)	1.2x1.8	1.8x1.8	1.8x2.4	2.4x2.4
Illuminance E_n (lx)	475	317	238	178

37420.000	HIT-TC-CE 35W GU6.5 3400lm			
Module (m)	1.2x1.8	1.8x1.8	1.8x2.4	2.4x2.4
Illuminance E_n (lx)	887	591	444	333

Correction table

Ceiling		0.70	0.70	0.70	0.50	0
Wall		0.70	0.50	0.20	0.20	0
Floor		0.50	0.20	0.20	0.10	0
k	0.6	79	60	51	50	47
k	1.0	101	78	70	68	65
k	1.5	117	91	84	81	78
k	2.5	129	100	95	90	86
k	3.0	133	103	99	93	89

Cleaning (a)	1				2				3			
Ambient conditions	P	C	N	D	P	C	N	D	P	C	N	D
LMF	0.94	0.88	0.82	0.77	0.91	0.83	0.77	0.71	0.89	0.79	0.73	0.65
RSMF	0.96	0.92	0.87	0.81	0.96	0.92	0.87	0.81	0.96	0.92	0.87	0.81

Hours of operation (h)	2000	4000	6000	8000	10000	12000	15000
LLMF	0.94	0.90	0.87	0.85	0.83	0.82	0.80
LSF	1	1	1	1	1	1	1

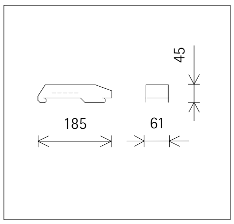
MF	LMFxRSMFxLLMFxLSF
MF	Maintainance Factor
LMF	Lumiaire Maintenance Factor
RSMF	Room Surface Maintenance Factor
LLMF	Lamp Lumens Maintenance Factor
LSF	Lamp Survival Factor
P	Room pure
C	Room clean
N	Room normal
D	Room dirty

ERCO

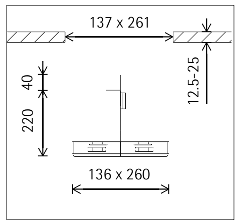
Quintessence Downlight

Accessories

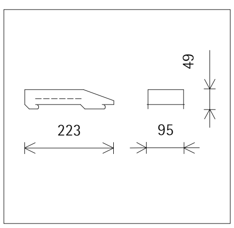
83669.000
Control gear
for HIT-TC-CE 20W, G8.5 and GU6.5 and HIT-CE 20W, G12 and HIPAR51-CE-P 20W, GX10.
Metal, black powder-coated.
Electronic control gear 220-240V, 50-60Hz. Strain relief. Through-wiring possible. 5-pole terminal block. Luminaire connection cable with plug connection, L 200mm.
Weight 0.36kg



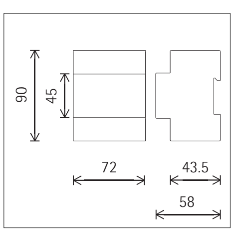
83969.000
Mounting frame, 2x
Plastic, white (RAL9002). Mounting for ceiling thicknesses of 12.5-25mm. Flush mounting detail.
Recess depth: 260mm for directional luminaires and 220mm for downlights and recessed spotlights.
Weight 0.30kg



83655.000
Control gear
for HIT-TC-CE 35W, G8.5 and GU6.5 and HIT-CE 35W, G12.
Metal, black powder-coated.
Electronic control gear 220-240V, 50-60Hz. 5-pole terminal block. Strain relief. Through-wiring possible. Connection cable with plug, L 200mm.
Weight 0.65kg



83816.000
DALI switch actuator, double, 16A
Two voltage-free contacts for switching ohmic, inductive and capacitive loads max 16A.
DALI interface with two independent addresses.
Mounting on DIN rail.
Weight 0.21kg



PENNSTATE

Project: AE 482- Corbin Building
Date: April 4, 2012

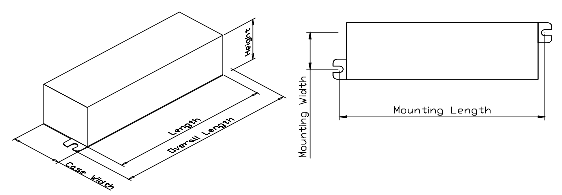
TYPE:
C

Revised: 11/10/2011

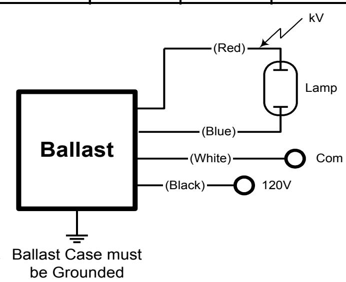
PHILIPS ADVANCE	e-Vision® Electronic Ballast for Metal Halide Lamps	Catalog Number: RMH-39-K For 39W Metal Halide Lamps ANSI C130/M130 or M179/C179 120V 50/60Hz Electronic Status: RELEASED

DIMENSIONS AND DATA

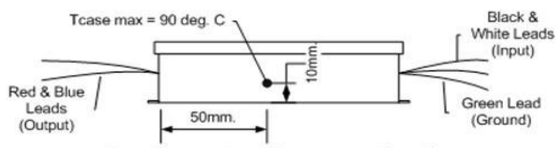
Lamp Number	Lamp Watts	Input Volts	Catalong Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
39W Watt Lamp, ANSI Code C130/M130, or C179/M179 Minimum Starting Temp -20°C/-4°F										
1	39	120	RMH-39-K-XXX	0.4	45	0.9	4	K	0.4	6



Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width
K	119mm [4.74"]	104mm [4.1"]	33mm [1.1"]	30mm [1.2"]	114mm [4.5"]	13.5mm [0.5"]



Wiring Diagram 4



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 90°C. See figure above for measurement location
2. Ignition pulse is 2 kV max
3. All leads are 9 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp
6. Connect the red lead to the center terminal of lamp when using screw base lamps

***Ordering Information**

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet, Leads exit either end
-LFS	Ballast with side exit leads and mounting feet, Leads exit same end
-BLS	Ballast with top exit leads and mounting studs

Data is based on tests performed by Philips Advance 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.

Philips Lighting Electronics N.A.

10275 West Higgins Road • Rosemont, IL 60018 • www.philips.com/advance

Tel: 800-322-2086 • Fax: 800-423-1882 • Customer Support: 800-372-3331 • OEM Support: 866-915-5886

Manufacturer:	Cooper Lighting	**Lamp:**	(1)-F32T8/841
Catalog Number:	CD-SN-1T8-1C-120	**Ballast/Transformer:**	Electronic 120V

CORELITE™

DESCRIPTION

Corelite's medium scale Cove Duo is an asymmetric lighting solution for the interior environment that offers flexibility in application and installation. The Cove Duo optimizes 2T5 and 1T8 performance and efficiency with an engineered optical system, which produces a smooth even gradient of light across the illuminated surface. This luminaire is ideal to accent architectural details or simply create an ambient layer of the illumination.

Catalog #	CD-SN-1T8-1C-120	Type	D
Project			
Comments		Date	
Prepared by			

SPECIFICATION FEATURES

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

B ... Reflectors
Die-formed reflectors are highly specular anodized aluminum.

C ... Electrical
Fixtures are prewired with quick wire connectors and use UL listed Class P, 265ma T8 instant start universal voltage electronic ballasts. Power factor of 95% with less than 10% THD. Fixtures and electrical components certified to UL and CUL standards.

D ... Finish
Reflector pans are anodized aluminum. Ballast channels are corrosion resistant steel.

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

Aiming
Plus5 Adjustable Aiming System (tm) allows for 5 degree incremental adjustments.

Cove Duo

1T8

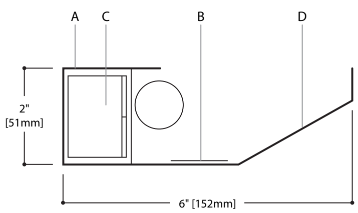
Architectural Cove

Asymmetric Indirect

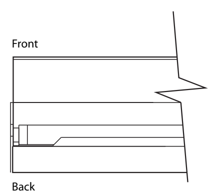
Light Distribution

Indirect - 100.0%

Direct - 0.0%



TOP VIEW



MODULES AND DIMENSIONS

24" [610mm]

36" [914mm]

48" [1219mm]

96" [2438mm]

Front Mount	Degree of Lift	Back Mount
2 x 6	0 (Standard)	2 x 6
2 1/2 x 6 1/8	5	2 1/2 x 6 1/8
3 x 6 1/4	10	3 x 6 1/4
3 1/2 x 6 1/4	15	3 1/2 x 6 1/4
4 x 6 1/4	20	3 7/8 x 6 1/4
4 3/8 x 6 1/4	25	4 1/4 x 6 1/4
4 3/4 x 6 1/4	30	4 3/4 x 6 1/4

plus5 aiming system™

ORDERING INFORMATION

Series
CD= Cove Duo

Optics Up
S= Specular

Optics Down
N= None

Number of Lamps
1= 1 Lamp

Lamp Type
T8= T8 Normal Output

Number of Circuits [1]
1= 1 Circuit

Wiring [1]
B= Battery Pack
C= Standard Circuit
D= Dimming
E= Emergency
T= Nightlight
Y= Daylight

Voltage [1]
120= 120V
277= 277V
347= 347V
UNV= Universal (120V-277V)

Run Length

Individually Mounted
Luminaires may be 2', 3', 4' or 8' in length

Continuously Mounted
Standard row configurations over 8' consist of 4' and 8' sections. 2' and 3' sections will be used for row lengths other than in 4' increments

Options
P5= Plus 5 Aiming System (tm)

Notes: 1 Not all options available. Please consult your Cooper Lighting Representative for availability. Specifications and dimensions subject to change without notice.

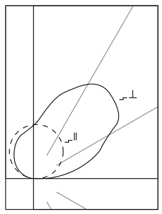
COOPER Lighting
www.cooperlighting.com

Specifications and Dimensions subject to change without notice.
Consult your representative for additional options and finishes.

ADE050068
10/07/2011 5:06:49 PM

Project:	AE 482- Corbin Building	TYPE: D
Date:	April 4, 2012	

PHOTOMETRICS **Corelite**



CD-SN-1T8
(1) F32T8/TL835
3000 Lumens

Efficiency 81.7%

Test Report
#ITL56067

Coefficients of Utilization

Effective floor cavity reflectance	20%																	
rc	80%				70%				50%			30%			10%			0%
rw					70	50	30	10				50	30	10	50	30	10	0
RCR																		
0	78	78	78	78	66	66	66	66	45	45	45	26	26	26	08	08	08	00
1	71	67	65	62	60	58	55	53	39	38	37	23	22	21	07	07	07	00
2	64	59	54	50	55	50	47	44	35	32	30	20	19	18	06	06	06	00
3	59	52	46	42	50	44	40	36	30	28	25	18	16	15	06	05	05	00
4	53	45	40	35	45	39	34	30	27	24	21	16	14	13	05	05	04	00
5	49	40	34	30	42	35	30	26	24	21	18	14	12	11	04	04	04	00
6	45	36	30	25	38	31	26	22	21	18	16	12	11	09	04	03	03	00
7	41	32	26	22	35	28	23	19	19	16	14	11	09	08	04	03	03	00
8	38	29	23	19	32	25	20	17	17	14	12	10	08	07	03	03	02	00
9	35	26	20	17	30	22	18	15	16	12	10	09	07	06	03	02	02	00
10	33	24	18	15	28	20	16	13	14	11	09	08	07	05	03	02	02	00

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-90	0	0.0	0.0
90-120	718	24.3	29.8
90-130	1148	38.9	47.6
90-150	1939	65.7	80.5
90-180	2410	81.7	100.0
0-180	2410	81.7	100.0

Candela

Angle	Along II	45 degrees	Across⊥
180	496	496	496
175	570	544	497
170	668	613	490
165	770	676	481
160	860	738	466
155	937	799	449
150	1018	850	429
145	1048	882	404
140	1050	902	378
135	1043	907	346
130	1005	886	313
125	939	835	279
120	787	776	240
115	679	683	200
110	573	539	160
105	449	419	115
100	280	298	72
95	124	141	29
90	0	16	1

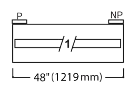
COMMON CIRCUIT CONFIGURATIONS FOR ONE LAMP WALL MOUNT FIXTURES

1C =Single circuit luminaire
1E =Single circuit luminaire with emergency circuit
1B =Single circuit luminaire with battery pack

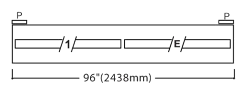
/1/ =Circuit 1
/E/ =Emergency Circuit
/B/ =Battery Circuit

P =Power Mount
NP =Non-Power Mount

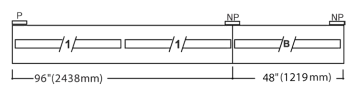
1C



1E



1B



STANDARD ROW CONFIGURATIONS (2' and 3' sections will be used for row lengths other than in 4' increments)

FIXTURE LENGTH	4'	8'	12'	16'	20'	24'	28'	32'	36'	40'	44'	48'	52'	56'	60'	64'	68'	72'	76'	80'	84'	88'	92'	96'	100'	104'	108'
4'	1		1		1		1		1		1		1		1		1		1		1		1		1		1
8'		1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13

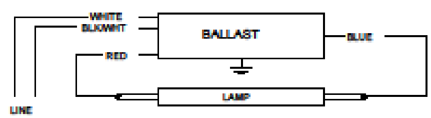
PHILIPS ADVANCE

ICN-132-MC@120V	
Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant 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.
F17T8	1	17	0/-18	0.14	17	0.88	10	0.98	1.7	5.18
F25T8	1	25	0/-18	0.19	23	0.88	10	0.98	1.7	3.83
* F32T8	1	32	0/-18	0.25	30	0.88	10	0.98	1.7	2.93
F32T8/ES (30W)	1	30	60/16	0.23	27	0.88	10	0.98	1.7	3.26

Wiring Diagram



Diag. 63

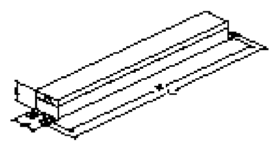
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25	63.5
Blue	31	78.7
Red	37	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 03/02/2010

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.

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

Manufacturer:	Cooper Lighting	**Lamp:**	(1)-F28T5/841
Catalog Number:	SNF-128T5-120V-EBT1N	**Ballast/Transformer:**	Electronic 120V

COOPER LIGHTING - METALUX®

Catalog #	SNF-128T5-120V-EBT1N	Type: E
Project	Corbin Building	
Comments		Date
Prepared by		

DESCRIPTION

The SNF Series is a functional and multi-purpose narrow strip family that incorporates premium performance and construction durability. Designed with our easy-to-use Flip-Up socket design, the SNF significantly reduces installation time. The performance and application versatility of this series can be increased by incorporating symmetrical or asymmetrical reflectors. The SNF Series can be installed using various mounting methods and numerous options and accessories are available. The small size of the SNF makes it an ideal choice for size-restricted architectural applications. The SNF Series can be the illumination solution in commercial, industrial, retail and residential applications. Fixtures can be used in storage/utility areas,

SPECIFICATION FEATURES

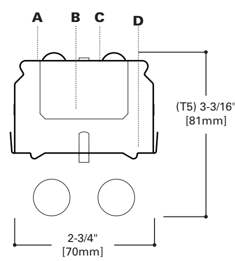
DESCRIPTION (Cont'd)
coves, display cases, shops, task and general area lighting.

A ... Construction
Channel is die formed cold-rolled steel with numerous KOs for ease of installation. Groove for Tong Hanger. End plate quickly converts to snap-in channel connector for continuous row alignment. Lamp holder bracket flips in place. Channel/wireway cover secured with quarter-turn fasteners.

B ... Electrical*
Ballasts are CBM/ETL Class "P" and are positively secured by mounting bolts. Rotor Lock lampholders. UL/CUL listed. Suitable for damp locations.

C ... Finish
Multistage iron phosphate pretreatment ensures maximum bonding and rust inhibitor. Lighting upgrade, baked white enamel finish. Prepainted material is standard, PAF optional.

D ... Channel/Wireway Cover
Die formed heavy gauge steel. Tight fit for ease of maintenance. Easily removed without use of tools. Optional reflector available incorporating silver technology enhancements (Silver Lining). Consult Pre Sales Technical Support.

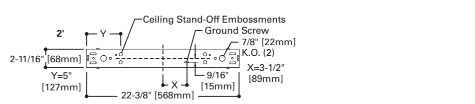


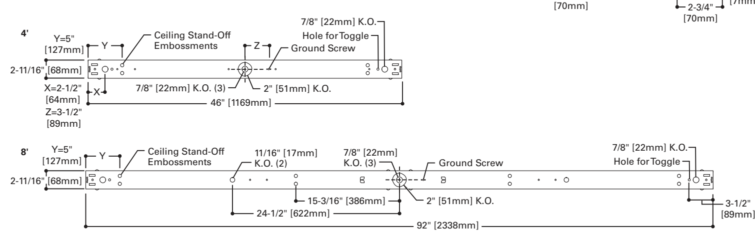
SNF
114T5
124T5
128T5
154T5
214T5
224T5
228T5
254T5

2' or 4' STRIP
1 OR 2 T5 OR T5HO LAMPS
Narrow Striplite

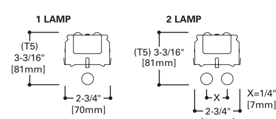
Flip-up Socket

MOUNTING DATA





LAMP CONFIGURATIONS



ENERGY DATA
Input Watts:
Electronic Ballast & STD Lamps
114 (19), 214 (38), 124 (25), 224 (52), 128 (34), 228 (68), 154 (54), 254 (106)

Luminaire Efficacy Rating
LER = FS-75
Catalog Number: SNF-228T5

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $3.20

*Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements.
[1] One lamp only.

LAMPS CONTAIN MERCURY. DISPOSE ACCORDING TO LOCAL, STATE OR FEDERAL LAWS

LINEAR DISCONNECT
Safe and convenient means of disconnecting power

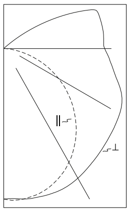
COOPER Lighting
www.cooperlighting.com

Specifications and Dimensions subject to change without notice.
Consult your representative for additional options and finishes.

ADF081659
05/18/2009 6:48:12 PM

PENNSTATE 1855

Project:	AE 482- Corbin Building	TYPE: E
Date:	April 4, 2012	



SNF-128T5-UNV-EBT1
Electronic Ballast

F28T5/835 Lamps
2600 Lumens

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

Efficiency 100.9%

Test Report: 122P110

LER = FS-75

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $3.20

Candlepower

Angle	Along ǁ	45°	Across ⊥
0	484	484	484
5	489	487	485
10	485	488	490
15	477	485	491
20	463	478	491
25	444	468	487
30	420	455	480
35	392	438	469
40	361	418	460
45	326	395	450
50	290	374	442
55	251	352	435
60	211	333	428
65	170	314	418
70	129	296	400
75	88	272	375
80	51	242	355
85	20	221	339
90	1	206	323

Coefficients of Utilization

Effective floor cavity reflectance 20%

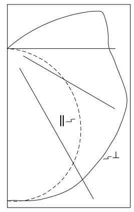
rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	115	115	115	115	110	110	110	110	100	100	100	92	92	92	84	84	84	80
1	101	95	89	84	96	91	86	81	82	78	75	75	72	69	68	65	63	59
2	91	81	73	66	86	77	70	63	70	64	59	63	59	54	57	54	50	47
3	82	70	61	53	77	67	58	51	61	54	48	55	49	44	50	45	41	38
4	74	61	52	44	70	58	50	43	53	46	40	48	42	37	44	39	34	31
5	68	54	44	37	64	52	43	36	47	40	34	43	37	32	39	34	29	26
6	63	48	39	32	59	46	38	31	42	35	29	39	32	27	35	30	25	23
7	58	44	34	28	55	42	33	27	38	31	25	35	29	24	32	26	22	20
8	54	40	31	25	51	38	30	24	35	28	23	32	26	21	29	24	20	18
9	50	36	28	22	48	35	27	21	32	25	20	29	23	19	27	22	18	16
10	47	33	25	20	45	32	24	19	30	23	18	27	21	17	25	20	16	14

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	400	15.4	15.2
0-40	672	25.8	25.6
0-60	1289	49.6	49.1
0-90	2080	80.0	79.2
90-180	545	20.9	20.8
0-180	2624	100.9	100.0

Typical VCP Percentages

	Height Along		Height Across	
Room Size (Ft.)	8.5′	10.0′	8.5′	10.0′
20 x 20	34	46	19	30
30 x 30	23	30	10	16
30 x 60	19	24	3	5
60 x 30	18	24	13	19
60 x 60	13	18	4	6



SNF-154T5-UNV-EBT1
Electronic Ballast

F54T5/835 Lamps
4400 Lumens

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

Efficiency 94.6%

Test Report: 122P112

LER = FS-67

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $3.51

Candlepower

Angle	Along ǁ	45°	Across ⊥
0	764	764	764
5	768	770	767
10	763	772	774
15	750	767	776
20	728	756	776
25	698	740	771
30	662	721	757
35	619	694	739
40	570	661	725
45	517	626	711
50	461	593	699
55	403	560	686
60	342	530	673
65	280	500	659
70	216	471	631
75	152	434	591
80	90	386	557
85	34	353	532
90	1	328	507

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	108	108	108	108	103	103	103	103	94	94	94	86	86	86	79	79	79	75
1	95	89	84	79	90	85	80	76	77	73	70	70	67	64	64	61	59	55
2	85	76	68	62	80	72	65	59	66	60	55	59	55	51	54	50	47	44
3	77	65	57	50	73	62	54	48	57	50	45	51	46	41	47	42	38	35
4	70	57	48	41	66	55	46	40	50	43	37	45	39	35	41	36	32	29
5	64	51	42	35	60	48	40	34	44	37	32	40	34	29	37	31	27	25
6	59	45	36	30	56	43	35	29	40	33	27	36	30	25	33	28	24	21
7	54	41	32	26	51	39	31	25	36	29	24	33	27	22	30	25	21	19
8	50	37	29	23	48	36	28	22	33	26	21	30	24	20	27	22	19	16
9	47	34	26	20	45	33	25	20	30	23	19	28	22	18	25	20	17	15
10	44	31	23	18	42	30	23	18	28	21	17	25	20	16	23	19	15	13

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	631	14.3	15.2
0-40	1062	24.1	25.5
0-60	2041	46.4	49.0
0-90	3304	75.1	79.4
90-180	858	19.5	20.6
0-180	4161	94.6	100.0

Typical VCP Percentages

	Height Along		Height Across	
Room Size (Ft.)	8.5′	10.0′	8.5′	10.0′
20 x 20	23	33	12	20
30 x 30	14	19	6	10
30 x 60	11	15	2	3
60 x 30	11	16	7	12
60 x 60	8	11	2	3

ORDERING INFORMATION

SAMPLE NUMBER: SNF-228T5-UNV-EBT1-U

Tandem
Blank=2' or 4' Length
8T=8' Length

Series
SNF=Commercial Narrow Striplite

Number of Lamps
1=1 Lamp
2=2 Lamp
(Not Included)

Wattage
14T5=14W T5 (24")
24T5=24W T5HO (24")
28T5=28W T5 (48")
54T5=54W T5HO (48")

Voltage (1)
120V=120 Volt
277V=277 Volt
347V=347 Volt
UNV=Universal Voltage 120-277

Options(1)
GL=Single Element Fuse
GM=Double Element Fuse
EL5LP=Emergency Installed(3), (4)
EL5HOLP=Emergency Installed for T5HO

Ballast Type(1), (4)
EBT = T5 or T5HO Linear Electronic Program Rapid Start. Total Harmonic Distortion < 10%

No. of Ballast
1 or 2

Ballast Factor/Type
(For 28W T5 and 14WT5 Lamps Only)
N=Normal Light Output .95 BF(1)
H=High Light Output 1.15 BF(1), (6)
NDIM=Normal .95-1.0 BF Step Dimming(7)
HDIM=High 1.15 BF Step Dimming(6), (7)

Options
RIF1=Radio Interference Suppressor
6-3/18 SJT-C&P-515P= Cord & Plug (120V) (15 AMP)(5)
6-3/18 SJT-C&P L715P= Cord & Plug (277V) (15 AMP)(5)
PI/CPI=Plug-In Option(5)

Packaging
U=Unit Pack
6B=6 Bulk Packing (96")

ACCESSORIES (Order Separately)

AYC-Chain/Set=36" Chain Hanger (Use 1 Set Per Fixture)
SCF=Fixed Stem Set (Specify Length)
SCS=Swivel Stem Set (Specify Length)
SCA=Adjustable 48" Stem Set
EYE-CHAIN/SET-B=Eye Bolt Chain (Use 1 Set Per Fixture)
SNF-ASY-4T5(2)=3" Asymmetric Reflector (Specify 2' or 4')
SNF-SYM-4T5(2)=6" Symmetric Reflector (Specify 2' or 4')
SNF-REV-4T5(2)=Reverse Asymmetric Reflector (Specify 2' or 4')
WG/SNFT5-4FT=Wire Guard
A1B/Spacer-U=Spacer 1-1/2" to 2-1/2" from ceiling (Use 2 Per Fixture)
TOGGLE=Single Toggle NO. 2 (Specify Length)
Y-TOGGLE=Y Toggle NO. 2 (Specify Length)

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

NOTES: (1)Products also available in non-US voltages and frequencies for international markets. (2)For SilverLining reflector add SS in Catalog Number, Example: SNF-ASY-SS-4T5. (3)Not available for 2' version. (4)Maximum width clearance for ballast in channel is 2-7/32". (5)Socket brackets left uninstalled. (6) 1-Lamp ballast in the High Ballast factor not available. 2-Lamp ballast will not operate 1-Lamp. (7) Step Dimming ballast available for 28W T5 and 14WT5 lamps only.

Specifications & dimensions subject to change without notice. Consult your Cooper Lighting Representative for availability and ordering information.

SHIPPING INFORMATION

Catalog No.	Wt.
SNF-114T5	4 lbs.
SNF-124T5	5 lbs.
SNF-128T5	5 lbs.
SNF-154T5	5 lbs.
SNF-214T5	6 lbs.
SNF-224T5	6 lbs.
SNF-228T5	6 lbs.
SNF-254T5	6 lbs.
8TSNF-228T5	14 lbs.

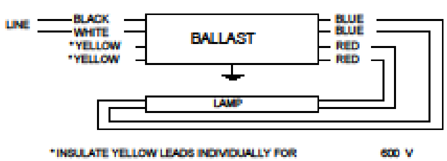
PHILIPS
ADVANCE

ICN-2S28-N@120	
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	0.14	17	1.07	10	0.98	1.7	6.29
F14T5	2	14	0/-18	0.28	33	1.04	10	0.98	1.7	3.15
F21T5	1	21	0/-18	0.22	25	1.06	10	0.98	1.7	4.24
F21T5	2	21	0/-18	0.39	47	1.00	10	0.98	1.7	2.13
* F28T5	1	28	0/-18	0.29	31	1.05	10	0.98	1.7	3.39
F28T5	2	28	0/-18	0.53	64	1.03	10	0.98	1.7	1.62
F28T5/ES (25W)	1	25	32/00	0.29	33	1.00	10	0.98	1.7	3.03
F28T5/ES (25W)	2	25	32/00	0.49	58	1.00	10	0.98	1.7	1.72
F35T5	1	35	0/-18	0.34	40	1.01	10	0.98	1.7	2.53

Wiring Diagram



Diag . 73

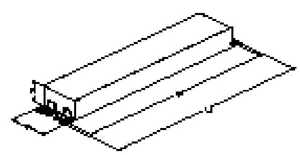
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

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 01/12/2012

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

HYDREL
An Acuity Brands Company

IP65

4750 SERIES

ADJUSTABLE WALL MOUNT T5-T5HO LINEAR FLUORESCENT

TYPE	JOB NAME

PART NUMBER

Model | Lamp Type | Voltage | Distribution | Mounting

Accessories | Options | Cord Set Length | Lamp | Finish | Listing

DESCRIPTION:

The Hydrel 4750 Series Linear Fluorescent Lighting fixtures bring the high performance of the T5 & T5HO lamp to the outdoors. With the 4750 Series patent pending Polar Pack™ cold weather option, full light output is now a reality to 0° F (-18°C). The T5 & T5HO lamp performance, the high output symmetrical and asymmetrical distributions, and the simple design lines make this 4750 Series fixture ideal for spreading soft, even illumination along walls, signs, and planters. The 4750 Series Linear Fluorescent T5 offers single and multiple lamp configurations. Five unique lighting distributions are offered with a variety of lamp wattages and sizes.

SPECIFICATIONS:

MATERIAL: Extruded 6063-T4 aluminum with die cast A360 aluminum end caps. All fasteners are stainless steel.

LAMP: Fluorescent, single or multiple T5 & T5HO to 54 Watt Max. per lamp(maximum). ***Lamp included unless L/LP is specified.***

SOCKET: G5 Miniature Bi-Pin.

VOLTAGE: Multi-Volt (120V – 277V 50/60 Hz) / 347.

DISTRIBUTIONS:
- WWD - Wall Wash
- NFL - Narrow Flood
- MFL - Medium Flood
- VFL - Vertical Flood
- WFL - Wide Flood

LENS: Curved high strength optical grade clear acrylic

MOUNTING: Adjustable Wall Mount with two (2) side mounting brackets and minimum 10 ft. of 16-3 STW (US) or 3GX1, 5mm HO7RN-F (IEC) flexible cord. Cord length must be specified.

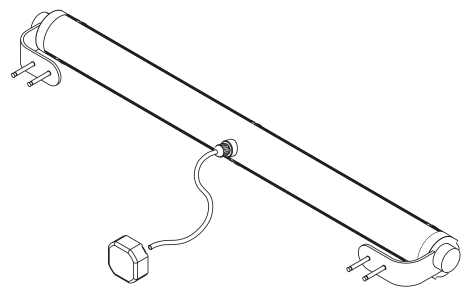
ACCESSORIES: External glare control available.

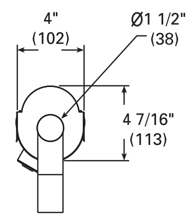
OPTIONS: Tamper-proof hardware and Polar Pack™ cold weather options available.

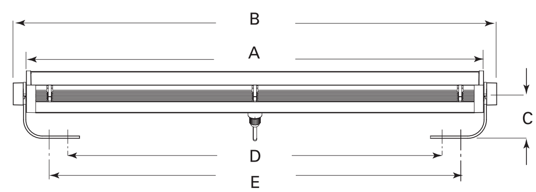
BALLAST: Integral Electronic multi-volt, 0°F (-18°C) minimum starting temperature. ***Optional:*** -20°F (-29°C) minimum starting temperature for 54T5HO lamps and select distributions.

FINISH: See ordering guide for color options.

LISTING: U.L. Wet Location, CUL







FIXTURE	A	B	C	D	E
4752	26″	28 7/8″	4 3/4″	17 1/8″	21 1/8″
4753	38″	40 7/8″	4 3/4″	29 1/8″	33 1/8″
4754	49″	51 7/8″	4 3/4″	40 1/8″	44 1/8″
4756	71 1/2″	74 3/8″	4 3/4″	52 5/8″	66 5/8″
4758	95 1/2″	98 3/8″	4 3/4″	86 5/8″	90 5/8″

NOTE: HYDREL RESERVES THE RIGHT TO MODIFY SPECIFICATION WITHOUT NOTICE. Any dimension on this sheet is to be assumed as a reference dimension: "Used for information purposes only. It does not govern manufacturing or inspection requirements." (ANSI Y14.5-1973)

APPROVALS

5/17/10
4750_AWM

20660 Nordhoff St., Suite B
Chatsworth, CA 91311
Phone: 866.533.9901
Fax: 866.533.5291
www.hydrel.com

HYDREL
An Acuity Brands Company

IP65

4750 ORDERING INFORMATION

60 Hz Application
Example shown is Hydrel recommended for faster service. *Indicates required selection.

PART NO.

EXAMPLE:

4754	54T5HO	MVOLT	MFL	AWM	FSS		CSL50	LPI	DNAT

Model*
- ☐ 4752
- ☐ 4753
- ☐ 4754
- ☐ 4756
- ☐ 4758

Voltage*
- ☐ MVOLT[2]
- ☐ 120[9]
- ☐ 277[9]
- ☐ 347[13]

Distribution*
- ☐ **WWD** Wall Wash
- ☐ **VFL** Vertical Flood
- ☐ **NFL** Narrow Flood
- ☐ **MFL** Medium Flood
- ☐ **WFL**[3] Wide Flood

Accessories

External
- ☐ **FSS**[4] Flush Source Shield
- ☐ **FVSR**[5] Full Visor
- ☐ **HVSR**[5] Half Visor

Internal
- ☐ **IDF** Internal Diffusion Film

Cord Set Length*
- ☐ **CSL__** 10' - 50' of cord, available in 5' increments

Finish*
- ☐ **BL** Black
- ☐ **BZ** Bronze
- ☐ **DDB** Dark Bronze
- ☐ **DNA** Natural Alum.
- ☐ **GN** Green
- ☐ **GR** Gray
- ☐ **SND** Sand
- ☐ **STG** Steel Gray
- ☐ **TVG** Terra Verde Green
- ☐ **WH** White
- ☐ **CF** Custom Finish

Lamp Type*

4752
- ☐ **14T5** T5 Miniature Bi-Pin
- ☐ **2/14T5**[1] Two (2) T5 Miniature Bi-Pin
- ☐ **24T5HO** T5 High Output Miniature Bi-Pin
- ☐ **2/24T5HO**[1] Two (2) T5 HO Miniature Bi-Pin

4753
- ☐ **21T5** T5 Miniature Bi-Pin
- ☐ **2/21T5**[1] Two (2) T5 Miniature Bi-Pin
- ☐ **39T5HO** T5, High Output Miniature Bi-pin
- ☐ **2/39T5HO**[1] Two (2) T5, High Output, Miniature Bi-pin

4754
- ☐ **28T5** T5 Miniature Bi-Pin
- ☐ **2/28T5**[1] Two (2) T5 Miniature Bi-Pin
- ☐ **54T5HO** T5, High Output Miniature Bi-pin
- ☐ **2/54T5HO**[1] Two (2) T5, High Output, Miniature Bi-pin

4756
- ☐ **2/21T5** Two (2) T-5 High Output Miniature Bi-Pin
- ☐ **4/21T5**[1] Four (4) T-5 High Output Miniature Bi-Pin
- ☐ **2/39T5HO** Two (2) T-5, High Output Miniature Bi-pin
- ☐ **4/39T5HO**[1] Four (4) T-5, High Output, Miniature Bi-pin

4758
- ☐ **2/28T5** Two (2) T5 Miniature Bi-Pin
- ☐ **4/28T5**[1] Four (4) T5 Miniature Bi-Pin
- ☐ **2/54T5HO** Two (2) T5, High Output, Miniature Bi-pin
- ☐ **4/54T5HO**[1] Four (4) T5, High Output, Miniature Bi-pin

Mounting*
- ☐ **AWM** Adjustable Wall Mount

Options
- ☐ **TPH** Tamper Proof Hardware
- ☐ **PLPKX**[12] Polar Pack™ Cold Weather Option 120 V
- ☐ **PLPKZ**[12] Polar Pack™ Cold Weather Option 208-277 V
- ☐ **PLPKY**[11,12] Polar Pack™ Cold Weather Option 347 V
- ☐ **CW20**[6,7] Cold Weather Ballast, -20°F (-29°C) starting temp. (PLPK_ required for lamp to work optimally with CW20.)
- ☐ **ELN**[6,8,10] Emergency Battery Backup half output

Lamp*
- ☐ **LPI** 3000K Lamp Included
- ☐ **LP35K** 3500K Lamp Included
- ☐ **LP41K** 4100K Lamp Included

Notes:
1. Available with WFL Distribution only.
2. MVOLT Multi-Volt ballast range: 120V-277V, 50/60 Hz.
3. WFL Distribution only available with multiple lamp options as specified with note 1.
4. Only available with NFL and MFL distributions (standard on WWD version).
5. Accessory is mutually exclusive, choose one only.
6. Only available with WWD and WFL distributions.
7. Only available with 54T5HO lamps.
8. Only available with 4754, 4756, 4758.
9. Only available with ELN
10. Must choose 120 or 277 volts, MVOLT and 347 NOT available.
11. Not available with ELN or MVOLT.
12. The 4750 luminaire utilizes an additional intermittent 19 Watts per unit at 347 volts for temperatures below 40°F (4°C) when using PolarPack™ Technology.
13. 347 only available with 54T5HO lamps.

5/17/10
4750_AWM

20660 Nordhoff St., Suite B
Chatsworth, CA 91311
Phone: 866.533.9901
Fax: 866.533.5291
www.hydrel.com

PENNSTATE 1855

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE: F

HYDREL
An Acuity Brands Company

IP65

4750 ORDERING INFORMATION

50 Hz Application

Example shown is Hydrel recommended for faster service. *Indicates required selection.

PART NO.

EXAMPLE:

4754	54T5HO	MVOLT	MFL	AWM	FSS		CSL50	LPI	DNAT	IEC

Model*
- ☐ 4752
- ☐ 4753
- ☐ 4754
- ☐ 4756
- ☐ 4758

Voltage*
- ☐ MVOLT[2]

Distribution*
- ☐ WWD Wall Wash
- ☐ VFL Vertical Flood
- ☐ NFL Narrow Flood
- ☐ MFL Medium Flood
- ☐ WFL[3] Wide Flood

Accessories
External
- ☐ FSS[4] Flush Source Shield
- ☐ FVSR[5] Full Visor
- ☐ HVSR[5] Half Visor

Internal
- ☐ IDF Internal Diffusion Film

Cord Set Length*
- ☐ CSL__ 10' - 50' of cord, available in 5' increments

Finish*
- ☐ BL Black
- ☐ BZ Bronze
- ☐ DDB Dark Bronze
- ☐ DNA Natural Alum.
- ☐ GN Green
- ☐ GR Gray
- ☐ SND Sand
- ☐ STG Steel Gray
- ☐ TVG Terra Verde Green
- ☐ WH White
- ☐ CF Custom Finish

Lamp Type*

4752
- ☐ 14T5 T5 Miniature Bi-Pin
- ☐ 2/14T5[1] Two (2) T5 Miniature Bi-Pin
- ☐ 24T5HO T5 High Output Miniature Bi-Pin
- ☐ 2/24T5HO[1] Two (2) T5 HO Miniature Bi-Pin

4753
- ☐ 21T5 T5 Miniature Bi-Pin
- ☐ 2/21T5[1] Two (2) T5 Miniature Bi-Pin
- ☐ 39T5HO T5, High Output Miniature Bi-pin
- ☐ 2/39T5HO[1] Two (2) T5, High Output, Miniature Bi-pin

4754
- ☐ 28T5 T5 Miniature Bi-Pin
- ☐ 2/28T5[1] Two (2) T5 Miniature Bi-Pin
- ☐ 54T5HO T5, High Output Miniature Bi-pin
- ☐ 2/54T5HO[1] Two (2) T5, High Output, Miniature Bi-pin

4756
- ☐ 2/21T5 Two (2) T-5 High Output Miniature Bi-Pin
- ☐ 4/21T5[1] Four (4) T-5 High Output Miniature Bi-Pin
- ☐ 2/39T5HO[1] Two (2) T-5, High Output Miniature Bi-pin
- ☐ 4/39T5HO[1] Four (4) T-5, High Output, Miniature Bi-pin

4758
- ☐ 2/28T5 Two (2) T5 Miniature Bi-Pin
- ☐ 4/28T5[1] Four (4) T5 Miniature Bi-Pin
- ☐ 2/54T5HO Two (2) T5, High Output, Miniature Bi-pin
- ☐ 4/54T5HO[1] Four (4) T5, High Output, Miniature Bi-pin

Mounting*
- ☐ AWM Adjustable Wall Mount

Options
- ☐ TPH Tamper Proof Hardware
- ☐ PLPKZ[8] Polar Pack™ Cold Weather Option 208-277 V
- ☐ CW20[6,7] Cold Weather Ballast, -20°F (-29°C) starting temp. (PLPK_ required for lamp to work optimally with CW20.)

Lamp*
- ☐ LPI 3000K Lamp Included
- ☐ LP35K 3500K Lamp Included
- ☐ LP41K 4100K Lamp Included

Listing
- ☐ IEC International Electro-technical Commission

Notes:

1 Available with WFL Distribution only.
2 MVOLT Multi-Volt ballast range: 120V-277V, 50/60 Hz.
3 WFL Distribution only available with multiple lamp options as specified with note 1.
4 Only available with NFL and MFL distributions (standard on WWD).
5 Accessory is mutually exclusive, choose one only.
6 Only available with WWD and WFL distributions.
7 Only available with 54T5HO lamps.
8 The 4750 luminaire utilizes an additional intermittent 19 Watts per unit at 347 volts for temperatures below 40°F (4°C) when using PolarPack™ Technology.

5/17/10
4750_AWM

20660 Nordhoff St., Suite B
Chatsworth, CA 91311
Phone: 866.533.9901
Fax: 866.533.5291
www.hydrel.com

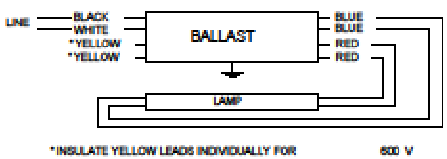
PHILIPS
ADVANCE

ICN-2S28-N@120	
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	0.14	17	1.07	10	0.98	1.7	6.29
F14T5	2	14	0/-18	0.28	33	1.04	10	0.98	1.7	3.15
F21T5	1	21	0/-18	0.22	25	1.06	10	0.98	1.7	4.24
F21T5	2	21	0/-18	0.39	47	1.00	10	0.98	1.7	2.13
* F28T5	1	28	0/-18	0.29	31	1.05	10	0.98	1.7	3.39
F28T5	2	28	0/-18	0.53	64	1.03	10	0.98	1.7	1.62
F28T5/ES (25W)	1	25	32/00	0.29	33	1.00	10	0.98	1.7	3.03
F28T5/ES (25W)	2	25	32/00	0.49	58	1.00	10	0.98	1.7	1.72
F35T5	1	35	0/-18	0.34	40	1.01	10	0.98	1.7	2.53

Wiring Diagram



Diag . 73

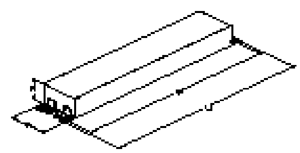
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

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

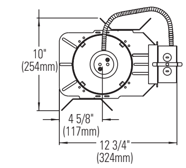
OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.5 "	1.3 "	1.0 "	8.9 "
9 1/2	1 3/10	1	8 9/10
24.1 cm	3.3 cm	2.5 cm	22.6 cm

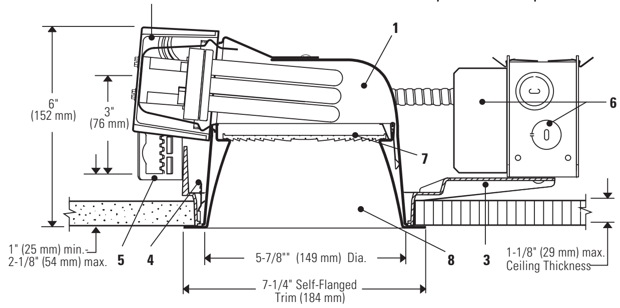
Revised 01/12/2012

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

LIGHTOLIER® Calculite® CFL Lensed Downlight 8091

6" Aperture Triple Tube Horizontal Lamp





Reflector Trim				Frame-In Kit
(Lens:)	**Fresnel**	**Clear**	**Prismatic**	**S6132BU** 6" aperture, 1 lamp 26/32W Triple Tube CFL (120/277V) 4-Pin (Amalgam)
Clear Cone, White Flange	**8091FCLW**	**8091CCLW**	**8091PCLW**	**Dimming Options:** **S6132B** ☐
Clear Cone, Polished Flange	**8091FCLP**	**8091CCLP**	**8091PCLP**	**CU3** Lightolier PowerSpec 3% Dimming (120/277V) **J1LD3** Lutron 5% Dimming (120V)
White Cone, White Flange	**8091FWHW**	**8091CWHW**	**8091PWHW**	**J2LD3** Lutron 5% Dimming (277V) **JUM7** Mark 7 Dimming (120/277V)
				J1MX Mark 10 Dimming (120V) **J2MX** Mark 10 Dimming (277V)
				Other dimming product available, please consult factory
	Opal Diffuser			**Remodeler Frame-In Kits**
Clear Cone, White Flange	**8091DCLW**			**6126BURM** 6" aperture, 1 lamp 26W Triple Tube CFL (120/277V) 4-Pin (Amalgam)
Clear Cone, Polish Flange	**8091DCLP**			**6132BURM** 6" aperture, 1 lamp 26/32W Triple Tube CFL (120/277V) 4-Pin (Amalgam)
White Cone, White Flange	**8091DWHW**			

Features

1. **Reflector:** 16 ga. Die-formed aluminum, Anobrite® finish.
2. **Socket Cup:** Effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
3. **Mounting Frame:** Galvanized steel for dry or plaster ceilings. Accepts other 6" Triple Tube reflectors (see S6132BU Spec Sheet).
4. **Retaining Springs:** Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
5. **Mounting Brackets:** 16 ga. steel. Adjust from inside of fixture. Use 3/4" or 1 1/2" lathing channel, 1/2" EMT, or optional mounting bars.
6. **Ballast/J-Box:** Electronic 120V-277V. UL listed for through branch circuit wiring with max of (8) No. 12AWG, 90°c supply conductors. Outboard-mounted to reduce heat transfer and maintain lamp efficacy and life. Service from below without tools.
7. **Shielding Media:** Molded acrylic. Available in fresnel lens, clear lens, or opal diffuser. Secured to aperture cone.
8. **Cone:** 16 ga. Alzak® aluminum. Clear Iridescence Free finish or Comfort Clear™ low iridescence finish. Retained by friction springs; no loose parts.

Electrical

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

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

Options and Accessories

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

[1]Specify desired flange. **W** White, **P** Polished

Options and Accessories (continued)

Emergency	Add suffix **EM***
Chicago Plenum	Use 6132BULC
Existing/Thk. Ceiling	**FA EC6***
Emergency Ltg. Kit	**FA EM3E***
	FA EM4E*
Fuse (Slow Blow)	Add suffix **F**

*See Spec. Sheets: FAEC, FAEM

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

IC Frame available; see **C6CFL32** specification sheet.

Labels

All units are UL listed for wet locations; Opal Diffuser is UL listed for damp locations.

Alzak® is a registered trademark of ALCOA.

Job Information **Type:** G
Job Name: Corbin Building
Cat. No.: 8091CCLP
Lamp(s):
Notes:

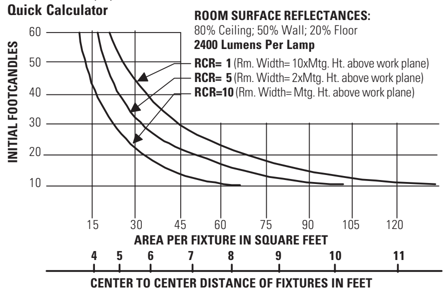
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

Lightolier is a Philips group brand

PHILIPS

32W Clear Cone (CL)

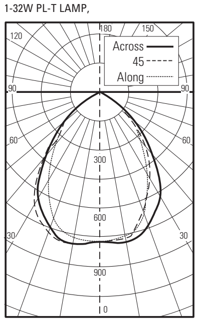
Quick Calculator



This quick calculator chart determines the number and spacing of 1 lt.- 32W PL-T units with fresnel lens and clear reflector, for any level of illumination. Conversion factors: Opal diffuser, fc x 0.8; Clear lens, fc x 1.0. 1 lt.- 26W PLT : Fresnel Lens, fc x 0.8; Opal Diffuser, fc x 0.65; Clear lens fc x 0.8.

Spacing Ratio = 1.2

CERTIFIED TEST REPORT NO. 0075FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
CALCULITE 6" DIAMETER RECESSED FLUORESCENT LENSED DOWNLIGHT
SEMI-SPECULAR REFLECTOR WITH CLEAR CONE AND FRESNEL LENS
LUMEN RATING = 2400 LMS.
1-32W PL-T LAMP,



CANDLEPOWER

ANGLE	ALONG	22.5	45	67.5	ACROSS	LUMENS
0	780	780	780	780	780	
5	773	778	779	782	785	37
10	758	768	774	781	790	
15	736	732	738	753	776	104
20	680	647	664	699	739	
25	589	552	591	633	688	140
30	499	489	530	572	630	
35	413	425	446	481	536	143
40	334	358	364	386	425	
45	268	286	288	304	323	115
50	210	232	232	239	244	
55	87	105	109	116	119	55
60	32	38	42	45	47	
65	6	8	9	9	11	7
70	1	1	1	2	2	
75	1	1	1	1	1	0
80	1	1	1	1	1	
85	0	1	1	0	1	0
90	0	1	1	0	1	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	585	24.40	47.62
0-40	886	36.92	72.06
0-60	1216	50.67	98.90
0-90	1229	51.24	100.00
40-90	343	14.32	27.94
60-90	13	.57	1.10
90-180	0	.00	.00
0-180	1229	51.24	100.00

**** EFFICIENCY = 51.2% ****

Coefficients Of Utilization

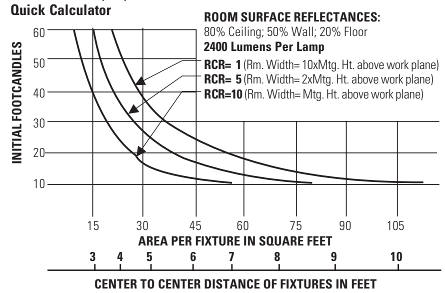
% EFFECTIVE CEILING CAVITY REFLECTANCE	80			70			50			30			10			0
ROOM CAVITY RATIO / % WALL REFLECTANCE	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.56	.55	.54	.56	.54	.53	.53	.52	.51	.51	.51	.50	.50	.49	.48	.48
2	.52	.50	.48	.51	.49	.48	.50	.48	.47	.48	.47	.46	.47	.46	.45	.44
3	.48	.46	.44	.48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

20% FLOOR CAVITY REFLECTANCE

Conversion Factors: 1 Lt-32W PLT: Opal Diffuser, CU x 0.8; Clear Lens, CU x 1.0.
1 Lt-26W PLT: Fresnel Lens, CU x 1.1; Opal Diffuser, CU x 0.9; Clear Lens, CU x 1.1.

32W White Cone (WH)

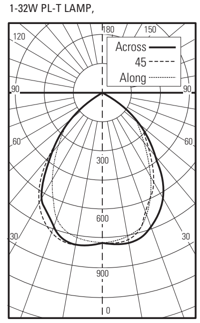
Quick Calculator



This quick calculator chart determines the number and spacing of 1 lt.- 32W PL-T units with fresnel lens and white cone, for any level of illumination. Conversion factors: Opal diffuser, fc x 0.8; Clear lens, fc x 1.0. 1 lt.- 26W PLT : Fresnel Lens, fc x 0.8; Opal Diffuser, fc x 0.65; Clear lens fc x 0.8.

Spacing Ratio = 1.1

CERTIFIED TEST REPORT NO. 0072FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
CALCULITE 6" DIAMETER RECESSED FLUORESCENT LENSED DOWNLIGHT
SEMI-SPECULAR REFLECTOR WITH WHITE CONE AND FRESNEL LENS
LUMEN RATING = 2400 LMS.
1-32W PL-T LAMP,



CANDLEPOWER

ANGLE	ALONG	22.5	45	67.5	ACROSS	LUMENS
0	656	656	656	656	656	
5	649	654	657	660	662	31
10	626	639	650	660	669	
15	588	605	622	639	654	87
20	525	546	567	592	617	
25	452	479	501	526	563	116
30	378	419	432	450	490	
35	312	363	361	370	405	114
40	256	303	290	297	322	
45	200	233	225	231	244	89
50	144	156	165	171	180	
55	99	115	115	117	120	53
60	66	74	76	77	79	
65	46	48	49	50	52	26
70	35	36	37	38	39	
75	26	27	27	27	29	14
80	16	17	17	19	19	
85	7	9	9	9	9	5
90	1	1	1	1	1	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	468	19.51	44.30
0-40	697	29.07	66.29
0-60	956	40.28	91.86
0-90	1052	43.86	100.00
40-90	354	14.76	33.71
60-90	85	3.57	8.14
90-180	0	.00	.00
0-180	1052	43.86	100.00

**** EFFICIENCY = 43.9% ****

Coefficients Of Utilization

% EFFECTIVE CEILING CAVITY REFLECTANCE	80			70			50			30			10			0
ROOM CAVITY RATIO / % WALL REFLECTANCE	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.48	.46	.45	.47	.46	.44	.45	.44	.43	.43	.43	.42	.42	.41	.41	.40
2	.44	.42	.40	.42	.41	.39	.41	.40	.38	.40	.39	.38	.39	.38	.37	.36
3	.40	.37	.35	.39	.37	.35	.38	.38	.34	.37	.35	.34	.36	.33	.33	.33
4	.37	.34.	32	.36	.34	.32	.35	.33	.31	.34	.32	.31	.34	.32	.30	.30
5	.34	.31	.29	.33	.31	.28	.33	.30	.28	.32	.30	.28	.31	.29	.28	.27
6	.31	.28	.26	.31	.28	.26	.30	.28	.26	.29	.27	.25	.25	.27	.25	.25
7	.29	.26	.23	.28	.25	.23	.25	.25	.23	.27	.25	.23	.27	.25	.23	.22
8	.26	.23	.21	.26	.23	.21	.26	.23	.21	.25	.23	.21	.25	.23	.21	.20
9	.24	.21	.19	.24	.21	.19	.24	.21.	19	.23	.21	.19	.23	.21	.29	.18
10	.23	.20	.18	.22	.20	.18	.22	.19	.18	.22	.19	.17	.21	.19	.19	.17

20% FLOOR CAVITY REFLECTANCE

Conversion Factors: 1 Lt-32W PLT: Opal Diffuser, CU x 0.8; Clear Lens, CU x 1.0.
1 Lt-26W PLT: Fresnel Lens, CU x 1.1; Opal Diffuser, CU x 0.9; Clear Lens, CU x 1.1.

Job Information	**Type:** G

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

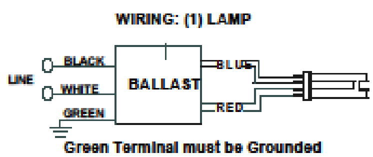
PHILIPS ADVANCE

Electrical Specifications

RCF-2S26-H1-LD-QS	
Brand Name	AMBISTAR
Ballast Type	Electronic
Starting Method	Rapid Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	60
Status	Active

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 .
CFQ26W/G24Q	1	26	0/-18	0.23	27	1.00	10	0.98	1.7	3.70
CFQ26W/G24Q	2	26	0/-18	0.43	51	1.00	10	0.98	1.7	1.96
CFTR26W/GX24Q	1	26	0/-18	0.24	29	1.10	10	0.98	1.7	3.79
CFTR26W/GX24Q	2	26	0/-18	0.45	54	1.00	10	0.98	1.7	1.85
* CFTR32W/GX24Q	1	32	0/-18	0.31	36	0.98	10	0.98	1.7	2.72
CFTR42W/GX24Q	1	42	0/-18	0.38	46	0.98	10	0.98	1.7	2.13

Wiring Diagram



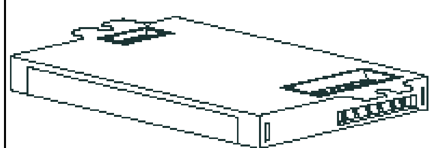
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	2.4 "	1.0 "	4.6 "
4 49/50	2 2/5	1	4 3/5
12.6 cm	6.1 cm	2.5 cm	11.7 cm

Revised 03/02/2010

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.

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

Manufacturer:	Gotham	**Lamp:**	(1)-CFL32TR/835
Catalog Number:	CFVL8-32TRT-6SB-T73-MVOLT-PM-DDB	**Ballast/Transformer:**	Electronic 120V

FEATURES

- Aluminum upper reflector coated with highly reflective white paint provides high efficiency.
- Available with tempered prismatic lens (T73), flat Fresnel lens (FFL) or flat opal lens (FOL).
- Regressed door (RW) or stepped black baffle (SB) are available.
- Door is retained by two self-aligning, torsion support springs.

HOUSING

- Heavy-gauge aluminum housing with top deck for clean appearance. Matte white textured polyester powder paint finish standard.
- Reflector edge sits flush with cylinder wall for clean, one-piece appearance.
- Reveal on standard ceiling and optional pendant mount give floating luminaire appearance.

MOUNTING

- Ceiling mount (standard) offers patented (U.S. Patent No. 4,300,190), quick mount attachment plate for direct installation to 4" square junction box.
- Wall mount or pendant mount available.

ELECTRICAL SYSTEM

- Vertically-mounted, four-pin positive-latch thermoplastic socket.
- Class P, thermally-protected, high-power factor electronic ballast.

LISTINGS

- Fixtures are UL Listed for wet locations. Wall and pendant mounted options are UL Listed for wet locations in non-covered ceiling installations. Listed and labeled to comply with Canadian Standards.

Type: **H**

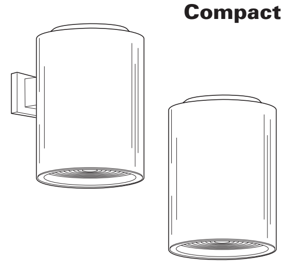
Catalog number: **CFVL8-32TRT-6SB-T73-MVOLT-F**

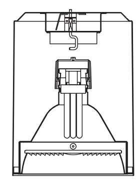
Compact Fluorescent Cylinders

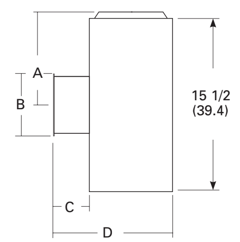
8" CFVL

Lensed Cylinders Wet Location

Vertical Lamp
Double Twin-Tube (DTT)
Triple-Tube (TRT)







Reflector Aperture: 6 (15.2)
Housing Diameter: 7-5/8 (19.4)

All dimensions are inches (centimeters).

A = 7-3/4 (19.7)
B = 5-5/16 (13.5)
C = 3-1/4 (8.3)
D = 10-7/8 (27.6)

Wall Mount Dimensions

ORDERING INFORMATION

Example: **CFVL8 26TRT 6RW T73 MVOLT DWHG**

Choose the boldface catalog nomenclature that best suits your needs and write it on the appropriate line.
Order accessories as separate catalog numbers (shipped separately).

CFVL8	32TRT	6SB	T73	MVOLT		PM-DDB
Series	**Wattage/Lamp**	**Door frame**	**Shielding**	**Voltage**	**Ballast**	**Options**
CFVL8	**26DTT**[1] **18TRT** **26TRT** **32TRT** **42TRT**	**6RW** Regressed door **6SB** Stepped black baffle	**T73** Tempered prismatic lens **FFL** Flat Fresnel lens **FOL** Flat opal lens	**120** **277** **347** **MVOLT**[2]	**(blank)** Electronic ballast (standard) **ECOS** EcoSystem electronic dimming ballast Minimum dimming level 5% **ADEZ**[3] Advance Mark 10® electronic dimming ballast	***Mounting*** **WM** Wall mount **PM**[4] Pendant 3/8" thread mount ***Housing Color*** **DWHG** Matte White (standard) **DDB** Dark Bronze **DBL** Black **DNA** Natural Aluminum **DWH** Gloss White **DTG** Tennis Green **DGC** Charcoal Grey **DSS** Sandstone

Accessories
Shipped Separately.

CYS[5] 3/8" stem and canopy with 5° "hang straight" swivel.
CRS[5] 3/8" stem and canopy with 45° swivel.

NOTES
1 Requires four-pin lamp, ships as a TRT fixture.
2 Multi-volt electronic ballast capable of operating on any line voltage from 120V through 277V, 50 or 60 Hz.
3 Available in 120V or 277V only.
4 Stem not included.
5 For use on pendant mount (PM) only. Specify length of stem (from 6" to 48" in 6" increments). Ex. CYS06 DWHG. **Consult factory for exterior use**. Stem and cylinder color will match when ordered on the same line.

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GOTHAM ARCHITECTURAL DOWNLIGHTING
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CFVL 8 SCF-280

PENNSTATE
1 8 5 5

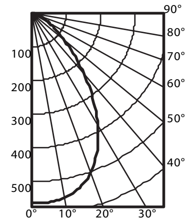
Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE: H

8" **CFVL** Lensed Cylinders

Distribution curve | **Distribution data** | **Output data** | **Coefficient of utilization** | **Single luminaire data 30" above floor**

CFVL8 32TRT 6RW T73, 32TRT lamp, 1.1 s/mh, 2400 rated lumens, Test no. LTL14208



From 0°	Ave	Lumens
0	563	
5	563	53
15	536	150
25	449	205
35	309	192
45	171	133
55	83	76
65	41	42
75	16	18
85	4	4
90	0	

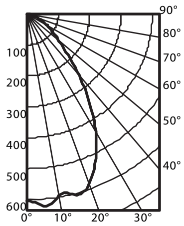
Zone	Lumens	% Lamp
0° - 30°	408.5	17.0
0° - 40°	600.8	25.0
0° - 60°	810.1	33.8
0° - 90°	873.8	36.4
90° - 180°	0.0	0.0
0° - 180°	873.8	*36.4

*Efficiency

pf	20%					
pc	80%		70%		50%	
pw	50%	30%	50%	30%	50%	30%
1	.39	.38	.39	.37	.37	.36
2	.36	.34	.35	.33	.34	.32
3	.32	.30	.32	.30	.31	.29
4	.29	.27	.29	.27	.28	.26
5	.27	.24	.26	.24	.26	.24
6	.25	.22	.24	.22	.24	.21
7	.23	.20	.23	.20	.22	.20
8	.21	.18	.21	.18	.20	.18
9	.20	.17	.19	.17	.19	.17
10	.18	.16	.18	.16	.18	.16

		50% beam angle 56.1°		10% beam angle 91.2°	
Mount height	Inital fc at beam center	Beam diameter	fc at beam edge	Beam diameter	fc at beam edge
8	18.6	5.9	9.3	11.2	1.9
10	10.0	8.0	5.0	15.3	1.0
12	6.2	10.1	3.1	19.4	0.6
14	4.3	12.3	2.1	23.5	0.4
16	3.1	14.4	1.5	27.6	0.3

CFVL8 32TRT 6RW FFL, 32TRT lamp, 1.1 s/mh, 2400 rated lumens, Test no. LTL14209



From 0°	Ave	Lumens
0	604	
5	624	58
15	605	169
25	517	236
35	348	216
45	184	144
55	99	90
65	54	54
75	21	22
85	4	5
90	0	

Zone	Lumens	% Lamp
0° - 30°	463.7	19.3
0° - 40°	679.7	28.3
0° - 60°	914.0	38.1
0° - 90°	995.1	41.5
90° - 180°	0.0	0.0
0° - 180°	995.1	*41.5

*Efficiency

pf	20%					
pc	80%		70%		50%	
pw	50%	30%	50%	30%	50%	30%
1	.45	.43	.44	.43	.42	.41
2	.40	.38	.40	.38	.38	.37
3	.37	.34	.36	.33	.35	.33
4	.33	.30	.33	.30	.32	.29
5	.30	.27	.30	.27	.29	.27
6	.28	.25	.28	.25	.27	.24
7	.26	.23	.25	.23	.25	.22
8	.24	.21	.24	.21	.23	.20
9	.22	.19	.22	.19	.22	.19
10	.21	.18	.21	.18	.20	.18

		50% beam angle 58.1°		10% beam angle 91.3°	
Mount height	Inital fc at beam center	Beam diameter	fc at beam edge	Beam diameter	fc at beam edge
8	20.0	6.1	10.0	11.3	2.0
10	10.7	8.3	5.4	15.3	1.1
12	6.7	10.6	3.3	19.4	0.7
14	4.6	12.8	2.3	23.5	0.5
16	3.3	15.0	1.7	27.6	0.3

NOTES:
1 For electrical characteristics consult Technical Bulletins tab.
2 Tested to current IES and NEMA standards under stabilized laboratory conditions. Various operating factors can cause differences between laboratory data and actual field measurements. Dimensions and specifications are based on the most current available data and are subject to change without notice.

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GOTHAM ARCHITECTURAL DOWNLIGHTING
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www.gothamlighting.com

PENNSTATE
1 8 5 5

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE:
H

PHILIPS ADVANCE

RCF-2S26-H1-LD-QS

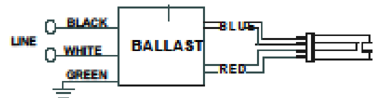
Brand Name	AMBISTAR
Ballast Type	Electronic
Starting Method	Rapid Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	60
Status	Active

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.
CFQ26W/G24Q	1	26	0/-18	0.23	27	1.00	10	0.98	1.7	3.70
CFQ26W/G24Q	2	26	0/-18	0.43	51	1.00	10	0.98	1.7	1.96
CFTR26W/GX24Q	1	26	0/-18	0.24	29	1.10	10	0.98	1.7	3.79
CFTR26W/GX24Q	2	26	0/-18	0.45	54	1.00	10	0.98	1.7	1.85
* CFTR32W/GX24Q	1	32	0/-18	0.31	36	0.98	10	0.98	1.7	2.72
CFTR42W/GX24Q	1	42	0/-18	0.38	46	0.98	10	0.98	1.7	2.13

Wiring Diagram

WIRING: (1) LAMP



Green Terminal must be Grounded

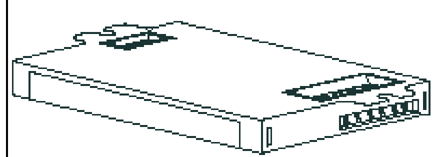
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	2.4 "	1.0 "	4.6 "
4 49/50	2 2/5	1	4 3/5
12.6 cm	6.1 cm	2.5 cm	11.7 cm

Revised 03/02/2010

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.

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
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Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

LUMIÈRE®

DESCRIPTION

The Boca 613 is a tiny 4-1/2" diameter inground fixture for use with a low voltage MR16 lamp. The adjustable lamp assembly provides up to 22° vertical tilt and 360° horizontal rotation for precision uplighting, wall washing or general illumination in constricted areas. Designed for recess mounting in concrete, brick, stone or dirt it is suitable drive-over applications.

Catalog #	613-50MR16-UNV-BK	Type: I
Project	Corbin Building	
Comments		Date
Prepared by		

SPECIFICATION FEATURES

A ... Material
Recessed housing is constructed from corrosion-resistant stainless steel. Trim ring is precision-machined from corrosion-resistant 6061-T6 aluminum, solid brass or solid bronze.

B ... Finish Painted
Solid brass and stainless steel parts are natural finish. Painted surfaces are double protected by a chromate conversion undercoating and a thermoplastic polyester powder coat for mar-resistance and extended weatherability.

C ... Gasket
Recessed housing and trim ring are sealed with a high temperature silicone o-ring gasket to prevent water intrusion.

D ... Lens
Minimum 1/4" thick tempered glass lens, factory sealed with high temperature adhesive to prevent water intrusion and breakage due to thermal shock. Suitable for drive-over applications.

E ... Hardware
Stainless steel hardware is standard to provide maximum corrosion-resistance.

F ... Socket
Ceramic socket with 250° C Teflon® coated lead wires and GU5.3 bi-pin base.

G ... Electrical
Remote 12V transformer required (not included). Available from Lumière as an accessory - see the Accessories & Technical Data section of this catalog for details. Bottom of fixture includes two 1/2-14 NPSM brass female conduit fittings for through wiring. Fixture also includes built-in wiring compartment.

H ... Thermal Cutoff Protection (Optional)
Fixture is suitable for recessed mounting in indoor or outdoor wood flooring (non-IC) when equipped with option T (changes UL/cUL wet label to damp label), and down-watted to 35W (max.), and connected with 150° C (min.) supply wire. Fixture is not suitable for inground or concrete pour applications when equiped with option T.

I ... Lamp
Not included. Available from Lumière as an accessory - see reverse side of this page.

J ... Labels & Approvals
UL and cUL listed, standard wet label. Fixtures equipped with option T (thermal cutoff protection) are UL/cUL listed, damp label. Manufactured to ISO 9001-2000 Quality Systems Standard. IBEW union made.

K ... Warranty
Lumière warrants its fixtures against defects in materials & workmanship for three (3) years. Auxiliary equipment such as transformers, ballasts and lamps carry the original manufacturer's warranty.

L ... Recessed Housing
Recessed housing is available to ship in advance of complete fixture for rough-in purposes. Specify option -LBB and order separately accompanying recessed housing from below:

613-xx-BB
recessed housing;

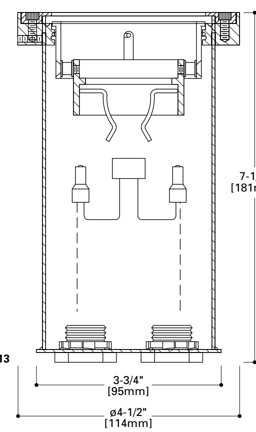
613-xx-T-BB
recessed housing w/T option;

NOTE: replace xx with desired finish- BK, BZ, CS, VE, WT, NBR, or NBZ

BOCA
613

50W (max.) MR16
Halogen
Low Voltage

Inground



Boca 613

Boca 613
Lamp=50MR16/NSP (EXT)
CBCP=11,000

Cone of Light

Distance to Illuminated Plane	Initial Nadir Footcandles	Beam Diameter
15'0"	45	4'0"
10'0"	102	3'0"
8'0"	159	2'0"
6'0"	283	1'6"
4'0"	638	1'0"
2'0"	2550	0'6"

Lamp Wattage Multiplier
20W x 0.32

Boca 613
Lamp=50MR16/NFL (EXZ)
CBCP=3200

Cone of Light

Distance to Illuminated Plane	Initial Nadir Footcandles	Beam Diameter
15'0"	13	10'0"
10'0"	29	6'6"
8'0"	45	5'0"
6'0"	81	4'0"
4'0"	181	2'6"
2'0"	725	1'0"

Boca 613
Lamp=50MR16/FL (EXN)
CBCP=2000

Cone of Light

Distance to Illuminated Plane	Initial Nadir Footcandles	Beam Diameter
15'0"	7	12'0"
10'0"	17	8'0"
8'0"	27	6'6"
6'0"	48	5'0"
4'0"	106	3'0"
2'0"	431	1'6"

Lamp Wattage Multiplier
20W x 0.30
35W x 0.57

Boca 613
Lamp=50MR16/WFL (FNV)
CBCP=1200

Cone of Light

Distance to Illuminated Plane	Initial Nadir Footcandles	Beam Diameter
15'0"	5	17'0"
10'0"	11	11'6"
8'0"	17	9'0"
6'0"	30	7'0"
4'0"	67	4'6"
2'0"	269	2'0"

LAMP INFORMATION

Lamp	ANSI Code	Watts	Beam Spread	CBCP	°K	Life (hrs.)	Base	Volts
50MR16/NSP	EXT	50	12°	11,000	3050	4000	GU5.3 bi-pin	12
50MR16/NFL	EXZ	50	25°	3200	3050	4000	GU5.3 bi-pin	12
50MR16/FL	EXN	50	40°	2000	3050	4000	GU5.3 bi-pin	12
50MR16/WFL	FNV	50	60°	1200	3050	4000	GU5.3 bi-pin	12
35MR16/SP	FRA	35	20°	3900	3000	4000	GU5.3 bi-pin	12
35MR16/FL	FMW	35	40°	1000	3000	4000	GU5.3 bi-pin	12

NOTE: Inferior quality lamps may adversely affect the performance of this product. Use only name brand lamps from reputable lamp manufacturers.

NOTES AND FORMULAS

- Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
- Footcandle values are initial. Apply appropriate light loss factors where necessary.
- Bare lamp data shown. Consult lamp manufacturers to obtain detailed specifications for their lamps.

ORDERING INFORMATION

Series
613=4-1/2" Dia Adjustable 22° Vertical Tilt 360° Horizontal Rotation Boca Inground

Source
Halogen
35MR16=35W Max Halogen MR16, GU5.3 Base [1]
50MR16=50W Max Halogen MR16, GU5.3 Base

Voltage
UNV=120-277 Volts

Finish
Painted
BK=Black
BZ=Bronze
CS=City Silver
VE= Verde
WT= White
Metal
NBR= Brass
NBZ= Bronze

Options
T=Thermally rated for use in non-IC wood flooring (changes UL/cUL wet label to damp label) [2]
LBB=Housing Shipped in Advance (select LBB option and order 6000-BB Back Box Recessed Housing separately)

Recessed Housing (order separately)
Select housing from Recessed Housing section on previous page

Accessories
Filters
F71=Peach Dichroic Filter, 2.00" Dia
F72=Amber Dichroic Filter, 2.00" Dia
F73=Green Dichroic Filter, 2.00" Dia
F74=Medium Blue Dichroic Filter, 2.00" Dia
F75=Yellow Dichroic Filter, 2.00" Dia
F76=Red Dichroic Filter, 2.00" Dia
F77=Dark Blue Dichroic Filter, 2.00" Dia
F78=Light Blue Dichroic Filter, 2.00" Dia
F79=Neutral Density Dichroic Filter, 2.00" Dia
F80=Magenta Dichroic Filter, 2.00" Dia
F22=Red Color Filter, 2.00" Dia
F33=Blue Color Filter, 2.00" Dia
F44=Green Color Filter, 2.00" Dia
F55=Yellow Color Filter, 2.00" Dia
F66= Mercury Vapor Color Filter, 2.00" Dia

Optical Lenses
LSL= Linear Spread Lens (elongate standard beam spread), 2.00" Dia
OSL= Overall Spread Lens (increase beam spread), 2.00" Dia
DIF= Diffused Lens (provide even illumination), 2.00" Dia

Optical Louver
LVR= Hex Cell Louver (reduce glare), 2.00" Dia

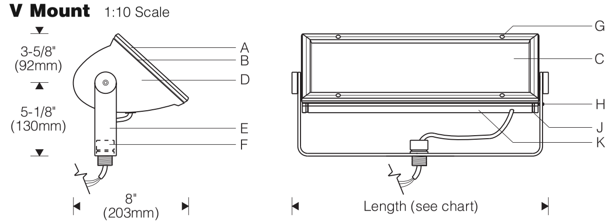
Lamps
EZX= 20W MR16 GU5.3 Bi-Pin Very Narrow Spot
ESX= 20W MR16 GU5.3 Bi-Pin Narrow Spot
BAB= 20W MR16 GU5.3 Bi-Pin Flood
FRB= 35W MR16 GU5.3 Bi-Pin Narrow Spot
FRA= 35W MR16 GU5.3 Bi-Pin Spot
FMW= 35W MR16 GU5.3 Bi-Pin Flood

Notes:
1 Use with T Option.
2 Available with 35MR16 Source (35W maximum) only.
* Lamp not included.
* 12V remote transformer required - not included.
* See ACCESSORIES & TECHNICAL DATA section of the Lumière catalog for Low Voltage Cable & Transformers.
* Consult your Cooper Lighting representative for additional options and finishes.

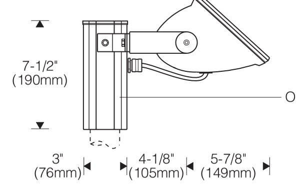
Manufacturer: Elliptpar
Catalog Number: M152-400C-V-06-1-000
Lamp: (1)-MH400/836
Ballast/Transformer: Electronic 208V

Lighting the Vertical
Large outdoor, remote — Metal Halide — Tungsten Halogen — **Style 152**

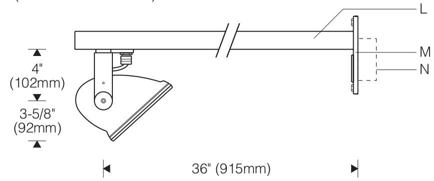
V Mount
1:10 Scale



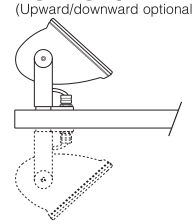
Side-Mount Slipfitter
(For use with **X** Mount)



Cantilever: Lighting Downward
1:12 Scale
(For use with **X** Mount)



Lighting Upward
(Upward/downward optional)



Wattage	*Source*	*Length*
150	MH	12-1/16" (306mm)
300-500	Halogen	
210-400	MH	17-13/16"* (452mm)
900, 1000	Halogen	24-7/8"* (632mm)
2x400	MH	

*Yoke includes (2) 9/32" diameter holes at 12" (305mm) centers for supplemental mounting support (1/4" fasteners by others).

Specifications

A Mitred extruded aluminum door frame
B Precured silicone door and lens gasket
C Clear, flat, thermal and impact resistant, tempered glass lens
D Die-cast aluminum end plates
E Aluminum yoke
F 1/2" NPT nipple
G Tamper-resistant captive door screws
H Locking set screw
J Aluminum reveal plates (black)
K Specular extruded aluminum reflector
L 1-1/2" x 2" aluminum arm
M Welded aluminum mounting plate with splice access cover
N Outlet box (by others)
O Accessory extruded aluminum slipfitter for 2-3/8" O.D. pole or tenon

Finish:
Exterior surfaces – 6 stage pretreatment and electrostatically applied thermoset polyester powder coating for a durable abrasion, fade and corrosion resistant finish. Choice of semi-gloss colors (see ordering information).

Reflector and internal end plates – extruded high purity aluminum with clear anodized specular finish. All hardware and components – non-corrosive stainless steel or aluminum. Door secured with captive tamper-resistant (#10 Torx) screws in stainless steel threaded reflector inserts to prevent seizing. Yoke attaches with recessed hex socket screws.

Mounting:
1/2" NPT nipple (wet location outlet box and outlet box cover or fitting by others).

Aluminum cantilever mounting assembly ordered separately; specify **X** mount. Suitable backing structure required.

Accessory slipfitter ordered separately. Top or side mount for single unit; specify **X** mount. Fits 2-3/8" O.D. stanchion, pole, or tenon (by others).

Electrical:
Use 90°C wire for supply connections. Leads exit reflector through watertight flush cord entry, silicone coated fiberglass sleeving; 8" exposed beyond nipple (60" leads on **X** mount).

Tungsten halogen – recessed single contact (RSC) lampholders in patented clamping supports for maximum heat dissipation.

Metal halide – Mogul lampholder is pulse rated for use with either horizontal or universal position reduced envelope pulse start lamps. End-of-lamp aligner ensures consistent optical performance, minimizes damage from shock or vibration.
Ballast – remote HPF constant wattage autotransformer (CWA) or electronic rated for -20°F/-29°C starting. Weatherproof aluminum enclosure includes three 7/8" dia. entries and one 3/8" liquidtight conduit connector. Optional remote ballast for dry indoor location.

For complete ballast specifications, see Accessories Section.

Standard:
UL listed or CSA certified for wet locations.

12/09

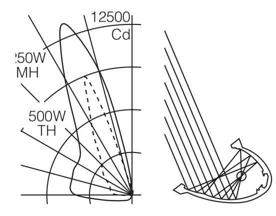
Features

V 6.0

- *Compact yet powerful – up to 1000W halogen, 2x400W metal halide for lighting across large facades, walls, signs*
- *Superior distribution for closer setbacks, greater spacings*
- *Lamp support on mogul base lamps ensures arc tube is in optical center*
- *Built to last – all aluminum and stainless steel components*

Performance

Two parabolic reflector sections drive light up (or down) the vertical plane from one edge. An elliptical section redirects its light to a parabola and shields the lamp. Asymmetry is maximized resulting in high beam efficiency and superior surface uniformity. The fast "runback" minimizes glare and spill light. Wide lateral distribution permits greater spacings.



For complete photometrics, visit ***thelightingquotient.com***

elliptipar® there is no equal™

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE: J

To Order — Style 152

To form a Catalog Number

M	1 5 2	-	400C	-	V	-	06	-	1	-	00	0
1	2		3		4		5		6		7	8

1 Source
M = Metal halide
T = Tungsten halogen

2 Style
152 = Large outdoor, **remote** ballast

3 Lamp

Lamp Code	*Wattage*	*Lamp Number*	*Voltages*	*Remote Distance*
Ceramic Arc Tube Pulse Start Metal Halide (90+ CRI)				
210C	210	CDM210/T9/930/U/E	**2, U**	30' (9m)
315C	315	CDM315/T9/930/U/E	**2, U**	30' (9m)
Ceramic Arc Tube Pulse Start Metal Halide (80+ CRI)*				
150G	150	CDM150/T6/830	**1, 2**	15' (4.5m)
			T, U	5' (1.5m)
250C	250	CMH250/U/830/R	**A, B**	50' (15m)
400C	400	CMH400/U/830/R	**A, B**	50' (15m)
240C	2x400	(2) CMH400/U/830/R	**A, B**	50' (15m)
Quartz Arc Tube Pulse Start Metal Halide (68 CRI)*				
250P	250	MS 250W/H75/ T15/PS/740	**A, B**	50' (15m)
			2, U	16' (4.8m)
320P	320	MS 320W/H75/ T15/S/PS/740	**A, B**	50' (15m)
			2, U	16' (4.8m)
350P	350	MS 350W/H75/ T15/PS/740	**A, B**	50' (15m)
			2, U	16' (4.8m)
Tungsten Halogen				
0300	300	Q300T3	**A**	
0350	350	Q350T3/CL/HIR	**A**	
0500	500	Q500T3	**A**	
0900	900	Q900T3/CL/HIR	**B, G**	
1000	1000	Q1000T3	**F, G**	

For complete lamp and ballast information, see Accessories Section.
* Use only clear metal halide horizontal or universal position lamp with compact envelope. Standard lamp colors are 3000K for Ceramic Arc Tube Pulse Start lamps and 4000K for Quartz Arc Tube Pulse Metal Halide lamps.

V 6.1

Project: Corbin Building

4 Mounting
V = External yoke with 1/2" NPT nipple (wet location outlet box and outlet box cover or fitting by others)
X = External yoke for use with accessory cantilever or side-mount slipfitter (order separately)

5 Finish
02 = Semi-gloss white
06 = Dark bronze
07 = Silver
08 = Semi-gloss black
12 = Green
99 = Custom RAL or computer matched color to be specified, consult sales representative.

6 Voltage/Ballast

Electronic (Metal Halide only):
1 = 120V
2 = 277V
T = 120V dim*
U = 208-277V dim*

Magnetic and Tungsten Halogen:
A = 120V
B = 277V
F = 220V (TH)
G = 240V (TH)

*100-50% dimming, 0-10V compatible controls by others. Consult factory for dimming the 210W lamp.

7 Option (see Accessories Section for specifications)
00 = No options
0R = Halogen standby lamp with relay field connected at remote ballast. 100W maximum (lamp included). Not available for 2x400W.
TL = Micro-prismatic tempered glass lens (replaces clear flat lens, offers smoother light pattern at reduced peak candlepower).
XX = For modification not listed, include detailed description. Consult factory prior to specification.

8 Destination Requirement
0 = UL listed or CSA certified for U.S.
J = UL listed or CSA certified for Canada

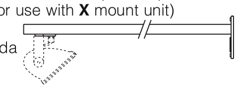
Example
M152 - 250C - X - 06 - B - 0D0

Large outdoor model for use with 250 watt ceramic arc tube pulse start metal halide lamp. External yoke for use with accessory cantilever or side-mounted slipfitter (order separately). Dark bronze powder coat finish. Remote 277V ballast for dry indoor location. UL listed or CSA certified for U.S.

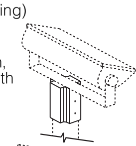
Type: J

Accessories
Order separately. See Accessories Section for specifications.

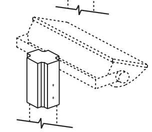
AC ☐ ☐ **36** ☐ = **Cantilever**, 36" (914mm) setback (for use with **X** mount unit)
0 = U.S.
J = Canada
5 Finish
L = single unit (downward or upward facing only)
U = double unit (down and upward facing)



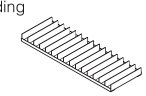
ASF ☐ **T10** = **Top-mount slipfitter**, for 2-3/8" O.D. stanchion, pole or tenon (for use with single **X** mount unit)
5 Finish



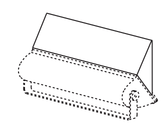
ASF ☐ **S10** = **Side-mount slipfitter**, for 2-3/8" O.D. pole, stanchion or tenon (for use with single **X** mount unit)
5 Finish



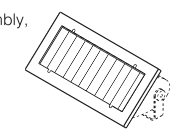
AE ☐ **V** ☐ **0D0** = External vertical blade **baffle**, black, for lengthwise shielding
2 = 25° shielding
4 = 45°
C = 300W, 350W TH; 150W MH
D = 210W-400W MH
F = 900W, 1000W TH; 2x400W MH



AV ☐ ☐ **0D0** = Cutoff **visor**
5 Finish
C = 300-500W TH; 150W MH
D = 210W-400W MH
F = 900W, 1000W TH; 2x400W MH



AXF = Wet location **color filter** assembly, interchangeable frame with stripped color glass.
Not suitable for all lamp wattages. Consult factory for complete specifications and ordering information.



AFK000X ☐ = Ballast **fuse** kit
0 = U.S., **J** = Canada

6/11

elliptipar® there is no equal™

elliptipar *from* **The Lighting Quotient**
114 Boston Post Road, West Haven, Connecticut 06516, USA
Voice 203.931.4455 • Fax 203.931.4464 • **thelightingquotient.com**

www.sylvania.com

QUICKTRONIC® Electronic Metal Halide Systems

RoHS compliant

Normal Ballast Factor

High Efficiency Series

QHE MH 208-277V

Lamp / Ballast Guide

QHE1x200MH 208-277V
C190

QHE1x250MH 208-277V
M153*

QHE1x320MH 208-277V
M154*

QHE1x350MH 208-277V
M131*

QHE1x400MH 208-277V
M155*

**or ceramic equivalent "C"*

Key System Features

- Constant power regulation
- High power factor
- Low harmonic distortion
- Compact size and lightweight
- 90ºC case temperature
- UL, FCC
- End-of-life shut down
- Internal IDTP (Insulation Detection Thermal Protector)
- QUICK 60+® warranty
- 120V auxillary circuit
- Low frequency square wave
- Suitable for both quartz and ceramic lamps
- Compliant with Energy Independence and Security Act of 2007
- RoHS compliant
- Lead-free solder, printed circuit board and manufacturing process

Application Information

SYLVANIA QUICKTRONIC High Efficiency MH
is ideally suited for:

- High bay
- Low bay
- Institutional
- Commercial
- Big box retail

SYLVANIA QUICKTRONIC MH High Efficiency electronic HID (eHID) ballasts feature a state of the art electronic design to deliver performance levels unattainable with standard magnetic lighting systems.

SYLVANIA QUICKTRONIC MH High Efficiency ballasts operate METALARC® and METALARC POWERBALL® CERAMIC lamps with maximum efficacy, high lumen output, and provides up to 25% energy savings when compared to magnetic ballasts.

Installation is simplified by a single-piece ballasts that incorporate the ballast, capacitor, ignitor and mounting brackets of conventional systems.

QUICKTRONIC MH eHID ballasts are RoHS compliant and feature lead-free solder, printed circuit boards and manufacturing process.

OSRAM SYLVANIA's QUICKTRONIC High Efficiency ballasts utilize a *low frequency square wave* lamp operation to avoid acoustic resonance issues. High frequency waveforms have been known to create mechanical vibrations within the lamp structure resulting in an audible noise or acoustic resonance. Acoustic resonance issues may cause visual flickering, lamp cycling, shortened lamp life, and in extreme cases may result in non-passive failure. This low frequency square wave approach is robust with respect to acoustic stabilities and is immune to variations in lamp geometry, fill chemistry and mercury dose.

This design is suitable for use with both quartz and ceramic lamps.

Setting the standard for quality, QUICKTRONIC MH is also covered by a QUICK 60+® warranty, the first and most comprehensive system warranty in the industry.

System Information

SYLVANIA QUICKTRONIC QHE MH ballasts and SYLVANIA METALARC® POWERBALL® CERAMIC lamps are perfectly matched to provide optimal system performance.

Our electronically controlled system delivers several advantages over conventional components, including improved lumen maintenance and extended photometric life.

The superior power regulation design produces consistently brilliant light output and color throughout the life of the lamp. This circuitry also provides constant light output during periods of fluctuating supply voltage.

All QUICKTRONIC MH electronic HID (eHID) ballasts are equipped with end-of-life shut down function. This prevents continuous starting after lamps extinguish which may cause permanent damage to the ballast.

All high wattage (>150W) QUICKTRONIC MH eHID ballasts are equipped with an internal IDTP (Insulation Detection Thermal Protector). The internal thermal protection feature affords an original equipment manufacturer (OEM) the ability to remove all external thermal protection devices. In order to maximize the benefits of this unique feature the ballast must be properly installed. (See "installation notes" for detail).

ECS123R1 – 9/2010

SEE THE WORLD IN A NEW LIGHT SYLVANIA

PENNSTATE 1855

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE: J

SPECIFICATION DATA

Catalog #	Date	Type
Project	Prepared by	
Comments		

High Efficiency Electronic Metal Halide Systems

RoHS compliant

Item Number	OSRAM SYLVANIA Description	Input Voltage (VAC)	Input Current (AMPS)	Lamp Type	Rated Lumens (lm)	No. of Lamps	Internal IDTP[3]	Ballast Factor (BF)	System Lumens	Input Wattage (W)[2]	System Efficacy (lm/W)
51980	QHE1x200MH 208-277V	208-277	1.06/0.79	200W E39[1]	21,000	1	Yes	1.0	21,000	215/214	98/98
51981	QHE1x250MH 208-277V	208-277	1.32/0.99	250W EX39[1]	24,000	1	Yes	1.0	24,000	267/266	90
51982	QHE1x320MH 208-277V	208-277	1.71/1.29	320W EX39[1]	37,500	1	Yes	1.0	37,500	343/341	109/110
51983	QHE1x350MH 208-277V	208-277	1.87/1.40	350W EX39	33,000	1	Yes	1.0	33,000	374/372	88/89
51984 ✪	QHE1x400MH 208-277V	208-277	2.12/1.58	400W E39	42,000	1	Yes	1.0	42,000	428/426	98/99

✪ New Product. Contact OSRAM SYLVANIA for product availability.
1: Data based on ceramic lamp types.
2: Input wattage shown @ 208V/277V
3: Internal IDTP - Insulation Detection Thermal Protector (see system information for detail)

Installation Notes

1. Proper ballast mounting must be followed to allow for maximum thermal dissipation:
   a. **F can ballast** should be mounted with the "feet" side placed tightly against the inside of the fixture
2. Lamp holders and conductors:
   a. Use minimum 4kV pulse rated lamp holder.
   b. Use minimum 4kV pulse rated or UL style 3561 wire for lamp connections. The red lead must be connected to center terminal of lamp. Do not connect any lamp lead to neutral or ground.
3. Grounding:
   a. The ballast case and fixture must always be grounded. The grounding helps assure safety, proper lamp starting, and acceptable EMI/RFI performance. Install ballast in accordance with national and local electrical codes.
4. Auto shut down function including end-of-life and thermal protection:
   a. Disconnect power when servicing. Cycle power to reset ballast after auto shutdown.
5. If connecting the ballast input to 208V line with two "hot" leads, be sure to wire per NEC code: Re-Mark (re-identify) the ballast white neutral wire to another color (i.e. black). Be sure to simultaneously disconnect all ungrounded line conductors per NEC codes (i.e. switch both hot legs).
6. Control: Do not operate with dimmer or occupancy sensor.

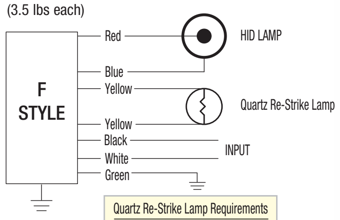
Line Input

208V	277V
Line (Black)	Line (Black)
Line (Black)	Neutral (White)

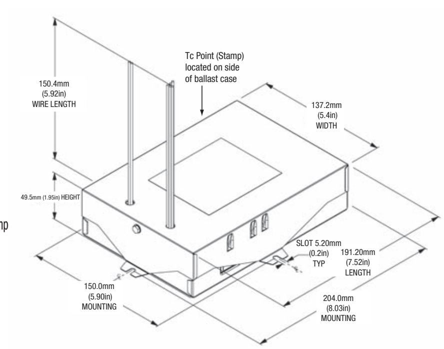
More installation considerations are in the QUICKANSWER section of the Ballast Technology and Specification Guide.

Wiring:
Lead Wires: Min. 6.0"

Packaging:
Quantity: 10 pieces per carton
Weight: 35 lbs per carton
(3.5 lbs each)



Quartz Re-Strike Lamp Requirements
120V ONLY; 200W MAX.
If not used, then cap off/insulate unused leads individually.



Item Number — **51980 QHE 1 x 200 MH 208-277V** — Line Voltage
QUICKTRONIC High Efficiency — Metal Halide
Number of Lamps (1) — Primary Lamp Wattage

Normal Ballast Factor

MH QUICKTRONIC®

High Efficiency

Performance Guide

Ballast shall be a metal halide SYLVANIA QUICKTRONIC MH electronic ballast.

QHE MH 208-277V

Specifications[3]

Input Voltage: 208-277V
Input Frequency: 50/60 Hz
Lamp Frequency: 160Hz Square Wave
Power Factor: >98%
Low THD: <10%
Starting Temp: -22°F/-30°C min.

UL listed and UL listed to Canadian safety standard, Type 1, Outdoor
90°C Max. Case Temperature, Thermally Protected
FCC 47CFR Part 18 Non-Consumer Sound Rated A
ANSI C62.41 Cat. A Transient Protection
Remote mounting capability[3]
Lamp current crest factor <1.2
RoHS Compliant[4]

3 Remote Mounting (max. wire length from ballast case to lampholder): Typically 6ft. but varies by application. For remote mounting distances up to 15 ft, use #18 AWG minimum 7.5kV pulse rated wire. Output wires should be enclosed in 1/2" metal conduit to minimize EMI (electro-magnetic interference). Wire and ground ballast, fixture, conduit & lighting system per NEC (National Electric Code).

4 Complies with European Union Restriction of Hazardous Substances Directive.

System Life / Warranty

QUICKTRONIC products are covered by the QUICK 60+ warranty, a comprehensive lamp and ballast system warranty. For additional details, refer to the QUICK 60+ warranty bulletin.

Max. Case Temp. Measured at

Tc Point (stamp)	Warranty Period
<70°C	5 years
<90°C	3 years

OSRAM SYLVANIA
National Customer Service and Sales Center
1-800-LIGHTBULB
(1-800-544-4828)
www.sylvania.com

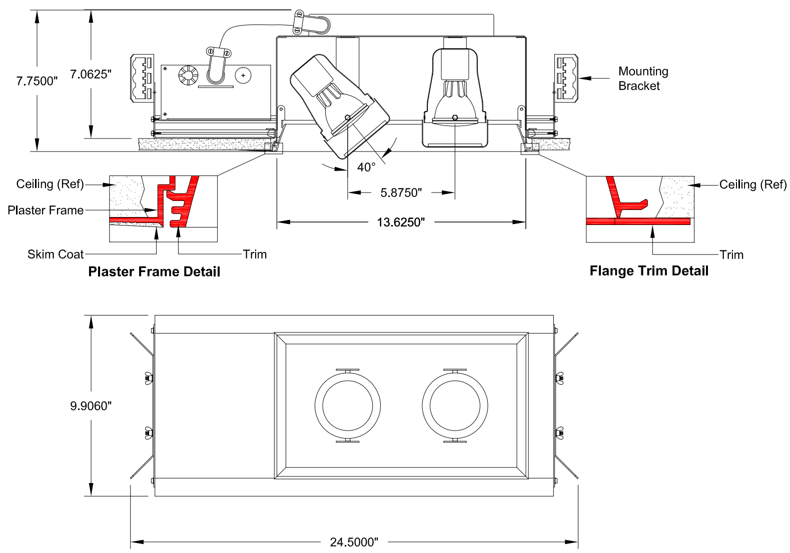
Specifications subject to change without notice.

VersaLux™ Series VA
ARCHITECTURAL LIGHTING SERIES

Job Name: Corbin Building
Fixture Type: K

Accentlight Open Aperture

PAR20



Ceiling Cut-out : 8.5000" x 14.375"
Trim Flange : 9.1250" x 15.0000"
Aperture: 7.7500" x 13.6250"

VAP-2-P2 35 - W /B- N -AD-1
(Trim Type, Wattage, Trim Finish, Lens)

Trim Type	Wattage	Trim Finish	Lens	Voltage
■ VAP Plaster	■ 35	■ W White	■ N None (Standard)	■ 1 (120V)
☐ VAF Flange	☐ 50	☐ B Black	☐ SO Solite	
			☐ FS Frosted Solite	
			☐ PR Prismatic	

Description
Recessed Open Aperture Accent fixture. Adjustable lampholders. Two PAR20 lamps. Flanged or plaster frame trim. Multiple lens and trim color options available.

Features
- The VersaLux system provides access from below the ceiling to the wiring compartment for servicing.
- Plaster frame trim provides 0.062" reveal to minimize skim coat cracking.
- Integral Thermal Protection.

Fixture Specifications
Dimensions: 24.500"L x 9.906"W x 7.062"H
Weight: Approx. 14 lbs.

Electrical
- Power consumption: 100 watts max.
- Ambient temperature 90° F. maximum.
- Through branch wiring capable.
- 120 VAC.
- UL listed.

Mounting
Universal mounting brackets included. Contact factory for special ceiling conditions.
Ceiling Cutout: 14.375"L x 8.500"W

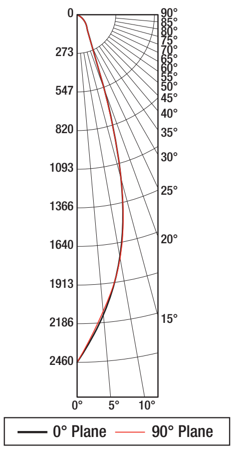
Photometry, refer to page 2.

NYC calendar #45760

starfire Starfire Lighting, Inc. 7 Donna Drive, Wood-Ridge, NJ 07075 P: 201.438.9540 F: 201.438.9541 www.starfirelighting.com
Rev.0611

VersaLux™ Series VA
Accentlight Open Aperture

PAR20

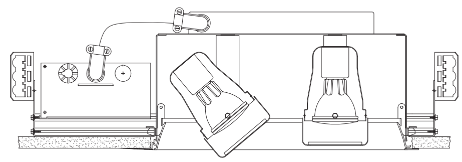


2 Lamp Photometrics

50 Watt PAR20, 25° Flood

Clear Lens

Photometry reports for other fixture configurations, consult factory



Total Luminaire Efficiency: 78.60%

Candela Distribution

	0	15	30	45	60	75	90
0	2460	2460	2460	2460	2460	2460	2460
5	2130	2118	2121	2122	2123	2132	2108
10	1741	1753	1750	1743	1754	1746	1750
15	1197	1200	1200	1195	1200	1200	1199
20	558	558	556	554	553	550	552
25	253	254	253	252	253	252	251
30	161	160	159	160	159	160	161
35	124	124	123	124	123	123	124
40	103	103	103	103	103	104	103
45	85	85	84	85	84	84	85
50	63	63	63	63	63	63	63
55	44	43	43	43	43	44	43
60	26	25	26	25	25	26	25
65	12	12	12	12	12	12	11
70	4	4	4	4	4	4	4
75	1	1	1	1	1	1	1
80	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0

Zonal Lumen Summary

5	101
10	166
15	170
20	104
25	59
30	44
35	39
40	36
45	33
50	27
55	19
60	12
65	6
70	2
75	0
80	0
85	0
90	0

Utilization

RC	80				70				50			30			10			Flux
RW	**70**	**50**	**30**	**10**	**70**	**50**	**30**	**10**	**50**	**30**	**10**	**50**	**30**	**10**	**50**	**30**	**10**	**0**
0	96	96	96	96	94	94	94	94	90	90	90	86	86	86	82	82	82	81
1	92	90	88	86	90	88	86	85	85	83	82	82	81	80	77	77	77	76
2	88	84	81	79	86	83	80	78	80	78	76	78	76	74	72	72	72	72
3	84	79	75	72	82	78	75	72	76	73	71	74	72	70	68	68	68	67
4	80	75	71	68	79	74	70	67	72	69	66	71	68	66	64	64	64	64
5	77	71	67	63	76	70	66	63	69	65	63	67	64	62	61	61	61	60
6	74	67	63	60	73	67	63	60	66	62	59	65	61	59	58	58	58	58
7	71	64	60	57	70	64	60	57	63	59	57	62	59	56	55	55	55	55
8	68	62	57	54	67	61	57	54	60	57	54	60	56	54	53	53	53	53
9	66	59	55	52	65	59	55	52	58	54	52	57	54	52	51	51	51	51
10	64	57	53	50	63	57	53	50	56	52	50	55	52	50	49	49	49	4

starfire Starfire Lighting, Inc. 7 Donna Drive, Wood-Ridge, NJ 07075 P: 201.438.9540 F: 201.438.9541 www.starfirelighting.com

PENNSTATE 1855

Project: AE 482- Corbin Building

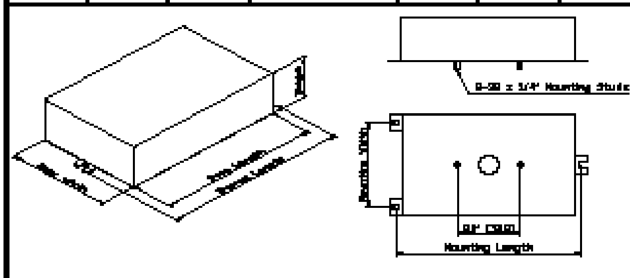
Date: April 4, 2012

TYPE: K

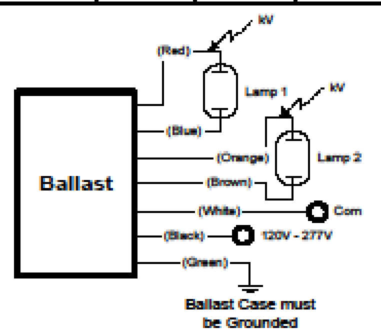
PHILIPS ADVANCE	e-Vision® Electronic Ballast for Metal Halide Lamps	Catalog Number: IMH-239-A For (2) 39W Metal Halide Lamps ANSI C130/M130 120-277 50/60Hz Electronic Status: RELEASED

DIMENSIONS AND DATA

Lamp Number	Lamp Watts	Input Volts	Catalong Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
39W Watt Lamp, ANSI Code C130/M130 Minimum Starting Temp -20°C/-4°F										
2	39	120	IMH-239-A-XXX	0.74	89	0.9	5	A/B	1.6	6
		277		0.31	86					

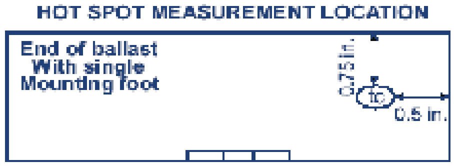


Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width
A/B	140mm [5.5"]	120mm [4.7"]	92mm [3.6"]	38mm [1.5"]	132mm [5.2"]	73mm [2.9"]



Wiring Diagram 5

HOT SPOT MEASUREMENT LOCATION



INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp
6. When one lamp fails, the other lamp remains lit
7. Connect the red and orange leads to the center terminals of their respective lamps when using screw base lamps

***Ordering Information**

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

Data is based on tests performed by Philips Advance 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.

Philips Lighting Electronics N.A.

10275 West Higgins Road • Rosemont, IL 60018 • www.philips.com/advance
Tel: 800-322-2086 • Fax: 800-423-1882 • Customer Support: 800-372-3331 • OEM Support: 866-915-5886

Date: ______________________ Type: ____________________

Firm Name: ____

Project: ____

eW Cove MX Powercore

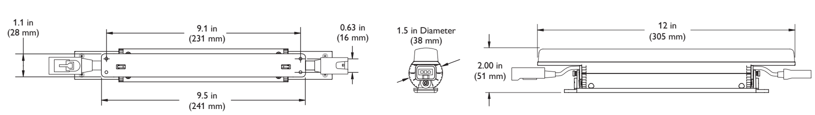
Medium Beam Angle (50° x 70°)

Maximum output linear LED fixture for cove, general, and accent lighting

Specifications

Due to continuous improvements and innovations, specifications may change without notice.

Item	Specification	Details
Output	Lumens*	384 (2700 K†) 446 (3000 K†) 476 (3500 K†) 518 (4000 K†)
	Efficacy	34.9 (2700 K) 36.9 (3000 K) 40.0 (3500 K) 43.5 (4000 K)
	CRI	83 (2700 K) 83 (3000 K) 84 (3500 K) 82 (4000 K)
	Lumen Maintenance‡	50,000 hours L_{70} @ 25° C 37,000 hours L_{70} @ 50° C 90,000 hours L_{50} @ 25° C 80,000 hours L_{50} @ 50° C
Electrical	Input Voltage	100 – 277 VAC, auto-ranging, 50 / 60 Hz
	Power Consumption	12.5 W maximum at full output, steady state
	Power Factor	.99 @ 120 VAC
Control	Dimming	Compatible with selected commercially available reverse-phase ELV-type dimmers§
Physical	Dimensions *(Height x Width x Depth)*	2 x 12 x 1.5 in (51 x 305 x 38 mm)
	Weight	1 lb (454 g)
	Housing	Die-cast aluminium, white powder-coated finish
	Lens	Polycarbonate
	Fixture Connections	Integral male / female connectors
	Temperature Ranges	-4° – 122° F (-20° – 50° C) Operating -4° – 122° F (-20° – 50° C) Startup -40° – 176° F (-40° – 80° C) Storage
	Humidity	0 – 95%, non-condensing
	Maximum Fixture Run Length‖	49 @ 100 VAC 59 @ 120 VAC 102 @ 208 VAC 108 @ 220 – 240 VAC 136 @ 277 VAC *Configuration: Fixtures installed end-to-end, 20 A circuit, standard 10 ft (3.1 m) Leader Cable*
Certification and Safety	Certification	UL / cUL, FCC, CE, CCC
	Environment	Dry / Damp Location, IP20



* Lumen measurement complies with IES LM-79-08 testing procedures.

† Color temperatures conform to nominal CCTs as defined in ANSI Chromaticity Standard C78.377A.

‡ L_{70} = 70% maintenance of lumen output (when light output drops below 70% of initial output). L_{50} = 50% maintenance of lumen output (when light output drops below 50% of initial output). Ambient temperatures specified. Based on measurements that comply with IES LM-80-08 testing procedures. Refer to www.colorkinetics.com/support/appnotes/lm-80-08.pdf for more information.

§ Refer to www.colorkinetics.com/support/appnotes/ for specific details.

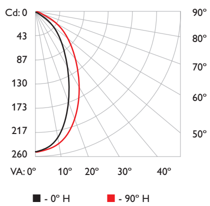
‖ These figures, provided as a guideline, are accurate for this configuration only. Changing the configuration can affect the fixture run lengths.

PHILIPS

Photometrics

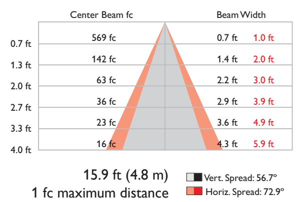
2700 K

Polar Candela Distribution



	0.0	22.5	45.0	67.5	90.0
0	253	253	253	253	253
5	248	248	249	250	250
15	205	209	216	224	226
25	146	151	164	178	184
35	94	99	113	128	134
45	59	62	72	83	88
55	36	39	45	51	54
65	22	23	27	30	31
75	13	13	14	14	14
85	7	7	6	4	3
90	5	5	4	2	0

Illuminance at Distance

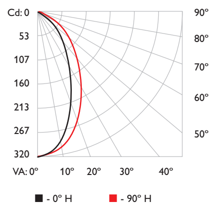


Lumens	384
Efficacy	34.9 lm / W

For lux multiply fc by 10.7

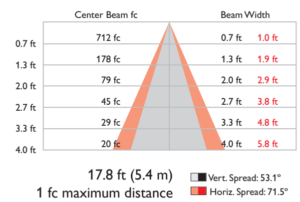
3000 K

Polar Candela Distribution



	0.0	22.5	45.0	67.5	90.0
0	317	317	317	317	317
5	311	311	312	313	314
15	250	255	268	279	284
25	169	177	198	220	230
35	105	112	131	154	163
45	63	68	81	97	104
55	38	41	48	57	61
65	22	24	28	32	34
75	13	13	15	16	15
85	7	7	6	5	3
90	5	5	4	2	0

Illuminance at Distance

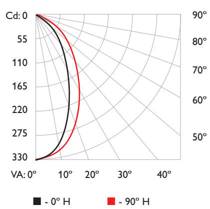


Lumens	446
Efficacy	36.9 lm / W

For lux multiply fc by 10.7

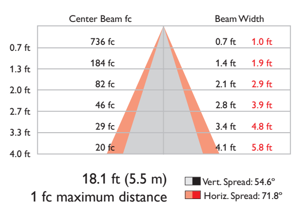
3500 K

Polar Candela Distribution



	0.0	22.5	45.0	67.5	90.0
0	327	327	327	327	327
5	320	322	323	323	324
15	262	266	278	288	292
25	181	188	208	228	237
35	114	121	139	161	169
45	70	74	87	103	109
55	42	45	53	61	65
65	25	27	31	35	36
75	15	15	16	17	17
85	8	8	7	5	3
90	6	6	5	2	1

Illuminance at Distance

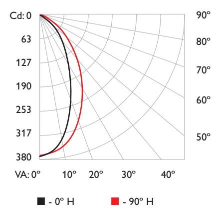


Lumens	476
Efficacy	40.0 lm / W

For lux multiply fc by 10.7

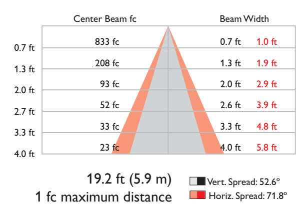
4000 K

Polar Candela Distribution



	0.0	22.5	45.0	67.5	90.0
0	370	370	370	370	370
5	362	363	366	366	365
15	292	298	313	326	332
25	197	206	231	258	269
35	121	128	152	180	192
45	72	78	94	113	120
55	43	46	56	66	70
65	26	27	32	37	38
75	15	15	17	18	18
85	8	8	7	5	4
90	6	6	5	2	1

Illuminance at Distance



Lumens	518
Efficacy	43.5 lm / W

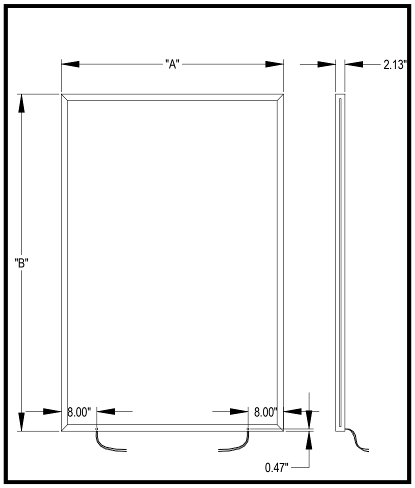
For lux multiply fc by 10.7

Philips Color Kinetics
3 Burlington Woods Drive
Burlington, Massachusetts 01803 USA
Tel 888.385.5742
Tel 617.423.9999
Fax 617.423.9998
www.philipscolorkinetics.com

INTERIOR ARCHITECTURAL DIGITAL SYSTEMS

SmartWall

REMOTE POWER SUPPLY



CATALOG NUMBER	DIM "A" WIDTH	DIM "B" LENGTH	TOTAL INPUT WATTAGE (W)	TOTAL INPUT WATTAGE (RGB)
SW2424	26.00	26.00	28W*	48W**
SW2436	26.00	38.00	42W*	70W**
SW2448	26.00"	50.00"	56W*	94W**
SW2460	26.00"	62.00"	70W*	118W**
SW2472	26.00"	74.00"	85W*	142W**
SW2496	26.00"	98.00"	114W*	188W**
SW3636	38.00"	38.00"	85W	70W**
SW3648	38.00"	50.00"	119W	94W**
SW3660	38.00"	62.00"	140W	118W**
SW3672	38.00"	74.00"	170W	142W**
SW3696	38.00"	98.00"	228W	188W**
SW4848	50.00"	50.00"	114W	94W**
SW4860	50.00"	62.00"	140W	118W**
SW4872	50.00"	74.00"	170W	142W**
SW4896	50.00"	98.00"	228W	188W**

*24" wide Smartwall with white and static color are illuminated from one side only. Contact factory for high output versions.
**DMX controller required, must be ordered separately.

ORDERING

PANEL SIZE	LED	PANEL TYPES	VOLTAGE	FINISH	OPTIONS
W X H **SW2424 -** 24"X24" **SW2436-** 24"X36" **SW2448 -** 24"X48" **SW2460 -** 24"X60" **SW2472 -** 24"X72" **SW2496 -** 24"X96" **SW3636 -** 36"X36" **SW3648 -** 36"X48" **SW3660 -** 36"X60" **SW3672 -** 36"X72" **SW3696 -** 36"X60" **SW4848 -** 48"X48" **SW4860 -** 48"X60" **SW4872 -** 48"X72" **SW4896 -** 48"X96"	**30K** 3000K **35K** 3500K **40K** 4000K **50K** 5000K **R** Static Red **G** Static Green **B** Static Blue **RGB** Color Changing	**TP** Transparent Panel **TL** Translucent Panel **OP** Opaque Panel	**1** 120Vac/24Vdc **2** 277Vac/24Vdc	**W** Semi-Gloss White **BL** Semi-Gloss Black **BR** Semi-Gloss Bronze **N** Semi-Gloss Natural **S** Semi-Gloss Satin (Default Finish) **SF** Specify Finish (See Color Chart) **CC** Custom Color (Contact Factory)	**APA** Architectural panel attachment (Contact factory) **WM** Wall mount (available in TL & OP panels only)

SPECIFICATIONS

Frame– An extruded aluminum frame encompasses the entire perimeter of the acrylic panel. All painted surfaces are pretreated with a phosphate wash and powder coated to a 3 mil thickness.

Transparent Panel- High performance clear acrylic (see through).

Translucent Panel- Translucent white acrylic on front side of the high Performance clear acrylic and a finished aluminum backplate (cannot see through).

Opaque Panel- A finished aluminum backplate behind the high performance clear acrylic is attached within the frame (cannot see through).

LED Platform– DMX compatible, static color, RGB color changing, and white light available in four color temperatures including 3000K, 3500K, 4000K, and 5000K, +/- 200K. For custom programming options, contact factory.

Electrical– A remote class 2 LED Power Supply is provided in 120V or 277V universal / 24VDC.

White LED SmartWall is standard with one dmx address per lit side. RGB SmartWall has three dmx addresses per every 12" of supplied LED.

Labels– ETL approved for dry locations.

Insight Lighting reserves the right to change specifications without notice due to product improvements.

ORDERING EXAMPLE: SW3636-50K / TP / 1 / S / APA

GRAPHIC SIZE	LED	PANEL TYPES	VOLTAGE	FINISH	OPTIONS
SW______					

TYPE: ______________________

JOB NAME: ______________________

APPROVED: ______________________

INSIGHT
Rio Rancho, NM 87144
TEL: 505 345-0888
www.insightlighting.com

08/10/10

Insight Lighting Digital LED Products

Limited Warranty
Insight Lighting warrants that products sold will, upon shipment, be free of defects in workmanship and materials under normal use and service provided the products are installed in suitable applications and installed per manufacturer's instructions. **Insight Lighting Digital products are shipped in a sealed condition to protect the integrity of the product. Any tampering and or penetration of these sealed fixtures will void all warranties. The use of non- Insight Lighting provided power supplies will void this warranty.**

Insight Lighting's obligation under this warranty shall be limited to the repair or exchange of any Insight Lighting **manufactured** parts which prove to be defective under normal use and service within **two (2)** years from the date of invoice, and which our examination shall disclose to our satisfaction to be thus defective. **(See Third Party Warranties below).** Should any product fail to conform to this warranty, Insight Lighting's obligation upon prompt written notification from the Purchaser, is limited to repair or replacement, at its option, without charge. Corrections in the manner provided above shall constitute a fulfillment of all liabilities of Insight Lighting. For purposes of clarity **"repair or replacement"** does not include labor or expense reimbursement of any kind at any time.

This warranty is void if the product is operating in ambient temperatures of -30C or lower or +50C or higher, or in inappropriate environments. This warranty does not apply to products that have been altered, repaired or installed contrary to Insight Lighting installation instructions. Insight Lighting's liability under this warranty shall be limited to repair or replacement only, and the purchaser agrees that no other remedy (including but not limited to, incidental or consequential damages for lost profits, liquidated damages, lost sales, injury to person or property, or any other loss) shall be available to Purchaser.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

THIRD PARTY WARRANTIES

With respect to products sold to the Purchaser by Insight Lighting but not manufactured by Insight Lighting. Insight Lighting **MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE**, but will make available to the Purchaser, to the extent permitted by law and relevant contracts, the warranties of the manufacturer of the relevant product upon the Purchaser's timely written request. Third party warranties include but are not limited to power supplies, dimming and color controls and all associated non Insight Lighting manufactured accessories.

Governing Law
These Terms and Conditions and terms of any sale or agreement between Insight Lighting and the Purchaser shall be governed by and construed in accordance with the laws of the state of New Mexico and the Purchaser hereby agrees to submit to the personal jurisdiction of federal and state courts located in the State of New Mexico.

2-2-09 REV 2

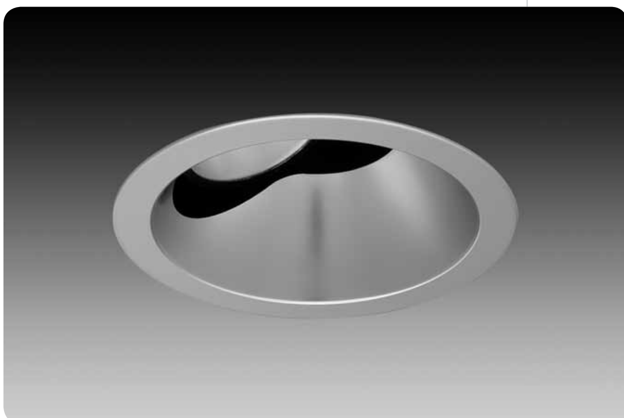
INSIGHT
Rio Rancho, NM 87144
TEL: 505 345-0888
www.insightlighting.com
SW 10FEB09

Manufacturer: Focal Point
Catalog Number: FLSA-4A-ESLED-L30-FL-120-RO-T
Lamp: LED
Ballast/Transformer:

4.5" aperture

id®

led



features

Future-proof LED system design maintains form factor, lumen output, and thermal characteristics of module and driver as technology advances, allows for easy replacement and upgrades.

25° beam is ideal for general accenting in commercial environments.

40° vertical tilt locks with screwdriver, 360° rotation locks manually.

Intelligent driver delivers specified lumen output regardless of color temperature.

Flicker-free 0-10V analog dimming capability standard.

Self-flanged Clear Diffuse reflector cone features superior brightness control.

options

accent snoot

companion luminaires

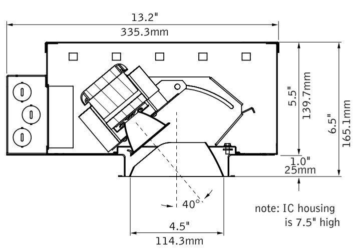
led downlight

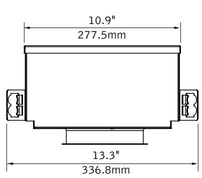
led wall wash

march 2012 A

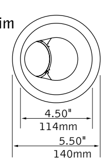
dimensional data

P 0-40° adjustable accent





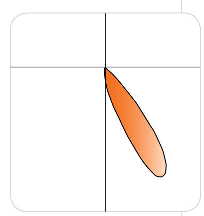
trim



performance

25° Narrow Flood at 30° tilt
3000K, 800 Lumen LED Module
Total Luminaire Output: 580lms
Photometric performance is measured in accordance with IESNA LM-79.

everGreen idea
Use in place of Halogen MR16 accent.



Visit focalpointlights.com for complete photometric data.

 B id basic S id spec P id pro

PENNSTATE 1855

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE: N

fixture:
project:

housing specifications

led system
Powered by Philips' Fortimo™ LED SLM, Advance Xitanium LED driver and communication cable. Aluminum heat sink provides appropriate thermal management. System is future-proof, allowing for easy replacement and upgrades as LED technology advances.

led module
Philips' Fortimo™ LED SLM features superior efficacy and color consistency. Module may be specified in 2700K, 3000K or 3500K, CRI>80. Color accuracy within 3 SDCM.

construction
(T& IC) Butterfly brackets allow mounting to ½ emt. Order bar hangers as an accessory. Die-cast aluminum heat sink designed for maximum thermal dissipation. Die-formed housing and integral junction box with (7) 1⁄2" pry outs. Accommodates ceiling thicknesses up to 1". For thicker ceiling consult factory. Fixture will not exceed 5 lb.

(T) Thermally protected housing for new construction applications. Insulation to be kept 3" away from housing.

(IC) Insulated ceiling housing for new construction applications with direct insulation contact.

adjustment
Manual locking 40˚ vertical tilt and 360˚ rotation.

electrical
Advance Xitanium multi-volt 120V-277V constant current driver includes standard 0-10V analog dimming. Power factor >.9 typical, 50/60Hz., 200-700mA, input power range. "Thermal Guard" offers protection from overheating in abnormal conditions; driver will dim DLM if necessary. Voltage specific thermal protectors included standard. 1100 lumen and 800 lumen IC housing integrate fanless active cooling solution designed for operation by the Fortimo LED System. UL listed for thru branch wiring, four #12 90°C conductors for T housing and two #14 90°C conductors IC housing.

LED Module	Temp	Rated System Watts	Module Output	Delivered Lumens	Narrow Flood Center Beam Candlepower
8SLED	2700K	11	800		
	3000K	12	800	580	2560
	3500K	13	800		
11SLED	2700K	16	1100		
	3000K	17	1100	705	3200
	3500K	18	1100		

*Lumen rating based on Clear Diffuse reflector cone
*Lumen output may vary +/- 5%
*Max input power 44W
*Inrush Current—74A$_{pk}$; 50% decay @ 120μs

dimming
0-10V DC low voltage dimming capability is included with the standard Advance Xitanium driver. Dimming range is to 10% light output, some dimmers may require high and/or low end trim adjustment for proper function. Consult the ID LED Technical Guide for compatible dimmers and control systems.

labels
UL and cUL Listed.

lifetime & warranty
LED system rated for 50,000 hours at 70% lumen output (L70). Rated life and lumen output based on maximum temperature of 65°C at Tc point on LED module. If Tc temperature rises above rated maximum due to end use conditions, lifetime and lumen output may decrease. 5 year limited warranty.

trim specifications

aesthetics
Parabolic reflector cone ensures glare free optics. Reflector is .040 spun aluminum. Torsion springs pull trim tight to the ceiling with no visible fasteners within the trim.
Overlap trims are self-flanged. Non-painted trim matches reflector finish. White painted flange may also be specified.

optics
Beamspreads achieved with optical filters that may be easily changed in field. Optional snoot boosts CBCP, reduces field light and provides narrow spot beam appearance.

housing ordering

housing series — FLS4A
ID LED Adjustable Accent — FLS4A

led module — 8SLED
800 Lumen LED Spot Module — 8SLED
1100 Lumen LED Spot Module — 11SLED

color temperature — L30
2700K — L27
3000K — L30
3500K — L35

distribution — FL
25° Narrow Flood — NFL
40° Flood — FL
Linear Spread Lens — LS

voltage — 120
120V — 120
277V — 277

trim type — RO
Round Overlap — RO

housing type — T
IC Rated (800 Lumen only) — IC
Thermally Protected, Non-IC — T

factory options
Bar Hangers — BH
Chicago Plenum — CP
25° Narrow Flood Kit — NFLK
40° Flood Kit — FLK
Linear Spread Lens Kit — LSK
Accent Snoot (use with NFL to reduce field light and create spot beam) — SN

trim ordering

aperture — LS4
4.5" Round Aperture — LS4

trim type — RO
Round Overlap — RO

optic — AA
Adjustable Accent — AA

reflector color — CD
Clear Diffuse — CD

flange finish — WP
Non-Painted — NP
White Painted — WP

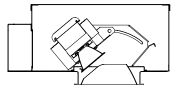
a complete unit consists of two line items, housing and trim
example: FLS4A-11SLED-L30-FL-120-RO-T | LS4-RO-AA-CD-NP

POWERED BY PHILIPS QUALITY COMPONENTS

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

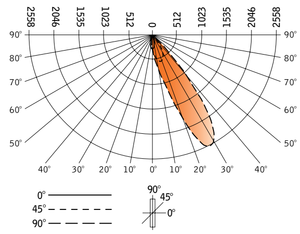
4.5" round led adjustable accent

id®

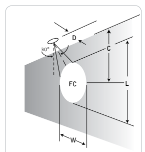


Luminaire:	800lm adjustable accent - 25˚ Narrow Flood
Filename:	FLS4AACD8SLEDL30NFL.IES
Catalog #:	FLS4A-8SLED-L30-NFL-120-RO-T
Photometric Report #:	16342.1

CANDLEPOWER DISTRIBUTION - 30° TILT



Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°
0°	283	283	283	283	283
5°	478	396	261	179	139
15°	1093	541	142	42	28
25°	2478	516	53	11	9
35°	2017	339	9	2	2
45°	494	44	0	0	0
55°	14	3	0	0	0
65°	0	0	0	0	0
75°	0	0	0	0	0
85°	0	0	0	0	0
90°	0	0	0	0	0



FOOTCANDLE VALUES

30° aiming angle - vertical surface

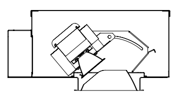
D	C	FC	L	W
18"	2.3'	152	1.7'	1.1'
24"	3.0'	88	2.7'	1.8'
30"	3.7'	55	2.7'	1.8'
36"	4.5'	39	4.2'	2.5'

Footcandle results based on AGI32; Reflectances=0/0/0; LLF=1

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

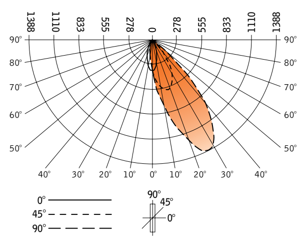
4.5" round led adjustable accent

id®

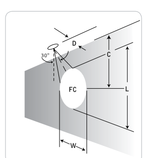


Luminaire:	800lm adjustable accent - 40˚ flood
Filename:	FLS4AACD8SLEDL30FL.IES
Catalog #:	FLS4A-8SLED-L30-FL-120-RO-T
Photometric Report #:	16341.1

CANDLEPOWER DISTRIBUTION - 30° TILT



Vertical Angle	Horizontal Angle 0°	45°	90°	135°	180°
0°	343	343	343	343	343
5°	542	452	328	234	207
15°	986	574	209	101	79
25°	1362	529	107	39	33
35°	1184	349	35	12	9
45°	594	109	11	0	0
55°	68	14	0	0	0
65°	4	0	0	0	0
75°	0	0	0	0	0
85°	0	0	0	0	0
90°	0	0	0	0	0



FOOTCANDLE VALUES

30° aiming angle - vertical surface

D	C	FC	L	W
18"	2.0'	101	1.8'	1.2'
24"	2.4'	58	2.0'	1.6'
30"	3.2'	37	2.7'	2.0'
36"	3.7'	26	5.0'	3.7'

Footcandle results based on AGI32; Reflectances=0/0/0; LLF=1

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

Appendix C

Control Specifications

COMMERCIAL OCCUPANCY SENSORS & CONTROLS

DT-200 Series Dual Technology Ceiling/Wall Sensors

PROJECT
LOCATION/TYPE

Product Overview

Description

WattStopper's DT-200 Series Dual Technology Ceiling Sensors combine PIR and ultrasonic technologies into one unit to achieve precise coverage in detecting occupancy.

Operation

Low voltage DT-200 Series Sensors utilize a WattStopper power pack to turn lights on when both PIR and ultrasonic technologies detect occupancy. They can also work with a low voltage switch for manual-on operation. PIR technology senses motion via a change in infrared energy within the controlled area, whereas ultrasonic uses 40 kHz high frequency ultrasound. Once on, detection by either technology holds lights on. When no occupancy is detected for the length of the time delay, lights turns off. DT-200 Series Sensors can also be set to trigger lights on when either technology or both detect occupancy, or to require both technologies to hold lighting on.

Auto set

The DT-200 requires no adjustment at installation. Auto set continuously monitors the controlled space to identify usage patterns. Based on these patterns, units automatically adjust time delay and sensitivity settings for optimal performance and energy efficiency. Sensors assign short delays (as low as five minutes) for times when the space is usually vacant, and longer delays (up to 30 minutes) for busier times.

Application

DT-200 Series Sensors have the flexibility to work in a variety of applications. Mounted at ten feet, the sensors can cover up to 2000 square feet of walking motion and 1000 square feet of desktop motion. The sensors are designed to control lighting in difficult applications where one technology alone could encounter false triggers. The DT-200 works well in classrooms, warehouses, large offices, open office spaces and computer rooms.

Features

- Advanced control logic based on RISC microcontroller provides:
  - Detection Signature Processing to eliminate false triggers and provides immunity to RFI and EMI
  - Walk-through Mode turns lights off three minutes after the area is initially occupied – ideal for brief visits, such as mail delivery
  - Available with built-in light level sensor featuring simple, one-step setup
- Sensors work with low-voltage momentary switches to provide manual control
- LEDs indicate occupancy detection
- Eight occupancy logic options provide the ability to customize control to meet application needs
- Available with isolated relay for integration with BAS or HVAC
- Swivel mounting bracket for convenient corner mounting to wall or ceiling
- Qualifies for ARRA-funded public works projects

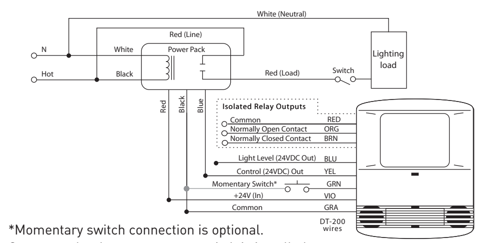
WattStopper®
www.wattstopper.com
800.879.8585

Specifications

- 24 VDC/VAC and halfwave rectified AC
- 40 kHz frequency ultrasonic transmission
- Time delays: Auto set, fixed (5, 10, 15, 20 or 30 minutes), Walk-through/Test Modes
- Sensitivity adjustment: Auto set; reduced sensitivity (PIR); variable with trim pot (ultrasonic)
- Built-in light level sensor: 2 to 200 footcandles (21 to 2,152 lux)
- Low voltage, momentary switch input for manual operation
- DT-200 contains an isolated relay with N/O and N/C outputs; rated for 1 Amp at 24 VDC/VAC
- 2000 ft² of walking motion mounted at 10 ft; 1000 ft² of desktop motion
- Max. DT-200s per power pack: B=2, BZ=3
  Max. DT-205s per power pack: B=3, BZ=4
- Dimensions: 4.4" x 3.4" x 2"
  (110.3mm x 85.9mm x 49.6mm) L x W x D
- UL and cUL listed
- Five year warranty

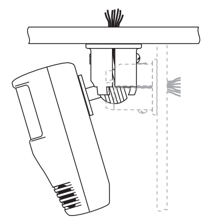
Wiring & Mounting

Wiring Diagram



*Momentary switch connection is optional.
Connect only when momentary switch is installed.

Mounting



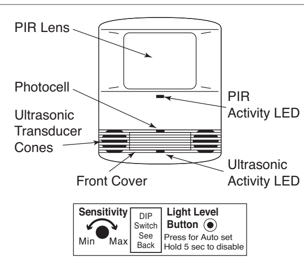
A swivel mounting bracket attached to the sensor allows the sensor to be angled for wall or ceiling mounting.

Grooves on the bracket help to achieve desired angle for coverage.

Mount to mud ring.

Controls & Settings

Product Controls



DIP Switch Settings

◄ = Factory Setting
● = ON
– = OFF

Occupancy Logic	Switch# 1	2	3	
Standard	–	–	–	◄
Option 1	●	–	–	
Option 2	–	●	–	
Option 3	●	●	–	
Option 4	–	–	●	
Option 5	●	–	●	
Option 6	–	●	●	
Option 7	●	●	●	

Occupancy Logic: Trigger	Initial Occupancy	Maintain Occupancy	Re-trigger (seconds duration)
Standard	Both	Either	Either(5)
Option 1	Either	Either	Either(5)
Option 2	PIR	Either	Either(5)
Option 3	Both	Both	Both(5)
Option 4	PIR	PIR	PIR(5)
Option 5	Ultra	Ultra	Ultra(5)
Option 6	Man.	Either	Either(30)
Option 7	Man.	Both	Both(30)

Time Delay	4	5	6	
5 sec/SmartSet 🚶	–	–	–	
5 minutes	–	–	●	
10 min. 🚶	–	●	–	
10 minutes	–	●	●	
15 min. 🚶	●	–	–	
15 minutes	●	–	●	
20 minutes	●	●	–	◄
30 min. 🚶	●	●	●	

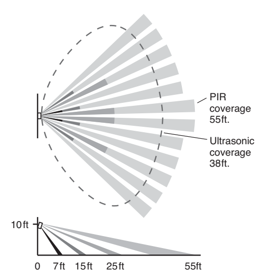
🚶 = walk-through mode

LEDs	7	
Disabled	–	
Enabled	●	◄

PIR Sensitivity	8	
Minimum	–	
Max./SmartSet	●	◄

Coverage

Coverage Pattern



Coverages shown are maximum and represent half-step walking motion. Under ideal conditions with no barriers or obstacles, coverage for half-step walking motion can reach up to 2000 ft², while coverage for typical desktop activity can reach up to 1000 ft².

Ordering Information

	Catalog No.	Voltage	Current	Coverage	Features
☐	DT-200	24 VDC	43 mA	2000 ft² (185.8 m²)	light level, isolated relay
☐	DT-205	24 VDC	35 mA	2000 ft² (185.8 m²)	

Sensors are white and use WattStopper power packs. Current consumption can be slightly higher when only one sensor per power pack is used.

B347D-P Power and Auxiliary Relay Packs

PROJECT
LOCATION/TYPE

Product Overview

Description

WattStopper B347D-P Power Packs provide 24VDC operating voltage to all WattStopper 24VDC occupancy sensors and daylighting controllers. Auxiliary Relay Packs are similar to power packs, but only have an isolated relay and no transformer power supply.

Operation

B347D-P Power Packs consist of a transformer and high-current relay combined in one small, powerful package. The transformer has a primary high voltage input and a secondary, low voltage output (24 VDC,114 mA with relay connected). The secondary voltage provides operating power to WattStopper sensors. When the occupancy sensors detect motion or daylighting sensors detect inadequate ambient light, they electrically close an internal circuit, which sends 24 VDC back to the Power or Auxiliary Relay Packs that control the lighting system.

Plenum Rated

The B347D-P Power Pack is UL 2043 plenum rated with teflon coated low voltage leads and plenum rated plastic. This means that the Power Packs do not need to be installed in the junction box, but can be installed in the plenum. They are housed in ABS, UL-rated 94V-0 plastic enclosures.

Applications

WattStopper Power and Auxiliary Relay Packs are designed to be flexible enough to control almost any lighting or HVAC load. For example, B347D-P Power Packs can control lighting circuits, self-contained air conditioners, pumps, fans, motors, VAV systems, motorized damper controls and setback thermostats. They are excellent for any application which requires high voltage switching through low voltage controls. By linking power packs and sensors, an almost unlimited number of configurations can be obtained.

Features

- Self-contained transformer relay system
- Available for 347 volt systems
- Capable of switching up to 20 Amps of electrical load (ballast)
- Low voltage leads are teflon coated for use in plenum applications
- Can be used as a low voltage switch for other applications or as stand-alone, low voltage switch
- 1/2 inch snap-in nipple attaches to standard electrical enclosures via 1/2 inch knockouts
- Installation in junction box not required
- Qualifies for ARRA-funded public works projects

WattStopper®
www.wattstopper.com
800.879.8585

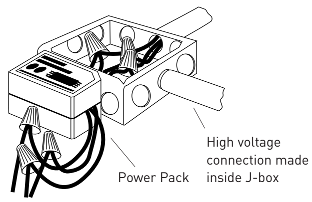
COMMERCIAL OCCUPANCY SENSORS & CONTROLS

Specifications

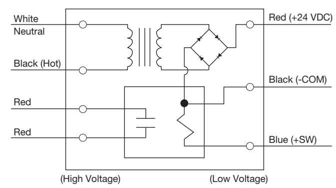
- Secondary voltage of 24 VDC
- Secondary output of 150 mA, 114 mA with relay connected
- Low voltage leads are rated for 300 volts
- UL-rated 94V-0 plastic enclosure
- UL 2043 plenum rated
- Dimensions: 1.7" x 2.91" x 1.62" (43.2mm x 73.9mm x 41.1mm) H x W x D with a 1/2" (12.7mm) snap-in nipple
- UL and cUL listed
- Five year warranty

System Layout

Power Pack Installation

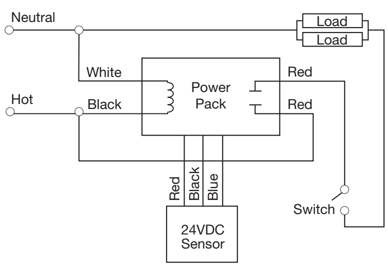


Power Pack Schematic

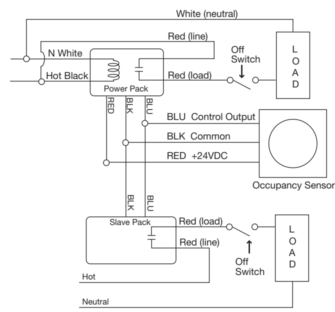


Wiring Diagrams

Power Pack with Ceiling Sensor



Auxiliary Relay Pack with Sensor



Ordering Information

Catalog No.	Description	Input Voltage	Load Ratings Ballast(A)	Incan(A)	Motor(HP)	Output
☐ B347D-P	Power Pack	347 VAC; 60 Hz	15	-	-	24 VDC; 150 mA*
☐ S120/277/347E-P ☐ S120/277/347E-P-U ☐ S120/277/347E-P-FTA	Aux. Relay Pack	120/277/347 VAC; 60 Hz	20/20/15	13/-/-	1/-/-	

*Output is 150 mA before relay is connected and 114 mA after relay is connected.
Power packs are white; auxiliary relay packs are black.

Installation Notes

1. All WattStopper power packs should be installed in accordance with state, local, and national electrical codes and requirements.
2. Power packs are designed to attach to existing or new electrical enclosures with 1/2 inch knockouts (check electrical codes in your area).
3. Most applications require UL listed, 18 AWG, 3-conductor, Class 2 cable for low voltage wiring. For plenum return ceilings use UL listed plenum-approved cables.

Project:

Location:

Product Type:

Contact/Phone:

Model #:

ET8000 Series

7-Day Electronic Astronomic Time Switch

The ET8000 Series 7-Day Astronomic Time Switches feature independent 7-Day programming to provide flexibility for applications where load switching differs each day of the week. These time switches provide dependable and uncomplicated performance, plus to-the-minute programming for accurate load control and reduced energy costs. Up to 28 ON/28 OFF (56 events) can be preset to automatically repeat. Each event can be applied to any combo of circuits and days. Each circuit is provided with an independently scheduled Astronomic ON event and Astronomic OFF event. The program can be disabled at an time by placing the time switch in the Manual operating mode. Control buttons provide manual control of each circuit independently regardless of the operating mode. All models come with two industrial-grade AAA alkaline batteries to provide time keeping and automatic carryover for a minimum of three years. The batteries are easily replaced in the field without requiring removal of the time switch mechanism or field wiring. Each time switch is housed in a lockable enclosure to protect from vandalism and unauthorized tampering.

ET8015C

ET8115CPD82

ET8215CR

Features

- Program can be repeated on a weekly basis
- Multi-volt operation from 120-277 VAC, 50/60 Hz
- To-the-minute programming for accurate load control and reduced energy costs
- Astronomic feature provides sunset ON and sunrise OFF settings to eliminate the need for separate photo control devices
- Astronomic programming can be combined with independent programs to provide a sunset ON and timed OFF program
- 2-circuit models are field (jumper) configurable for: 2 independent outputs, DPST output, or 1 channel ON pulse OFF pulse output
- Up to 28 ON/28 OFF setpoints or events and 4 Astronomic events
- Dusk/Dawn Astronomic events can be distributed throughout the days of the week
- Automatic Daylight Saving Time (DST) ON/OFF adjustment (factory enabled)
- Non-volatile EEPROM memory protects programming indefinitely
- Temporary override or permanent manual override available via control buttons

Ratings

Enclosure Options:	Standard: Type 1 Gray Painted Steel R-Option: Type 3R Gray Painted Steel PD82 Option: Type 3R Gray High-Impact UV Resistant Polycarbonate Plastic with Clear Cover
Knockouts:	Combination ½" & ¾" Knockouts Bottom: 2, Left: 1, Right: 1, Back: 1
Input Voltage:	120, 208, 240, or 277 VAC 50/60 Hz
Operating Temperature:	-40°F to 155°F (-40°C to 68°C)

CALIFORNIA TITLE 24 COMPLIANT

INTERMATIC

Energy Controls

ET8000 Series

INTERMATIC

ET8015, ET8215 Models

N.O. Contact Ratings:	Resistive: 30 Amps @ 120/240 VAC Resistive: 20 Amps @ 28 VDC Inductive: 30 Amps @ 120/240 VAC Tungsten: 5 Amps @ 120/240 VAC Ballast: 20 Amps @ 120-277 VAC Motor: 1 HP @ 120 VAC Motor: 2 HP @ 240 VAC

ET8115 Models

N.O./N.C. Contact Ratings:	Resistive: 20 Amps (N.O.), 10 Amps (N.C.) @ 120/240 VAC Inductive: 20 Amps (N.O.), 10 Amps (N.C.) @ 120/240 VAC Tungsten: 5 Amps (N.O.) @ 120/240 VAC Ballast: 20 Amps (N.O.), 3 Amps (N.C.) @ 120-277 VAC Motor: 1 HP (N.O.), ¼ HP (N.C.) @ 120 VAC Motor: 2 HP (N.O.), ½ HP (N.C.) @ 240 VAC
Pulse Feature:	2-circuit models feature 2-second pulse option for contactor and bell ringing applications.
Auto DST:	Automatic adjustment for Daylight Saving Time
Battery Backup:	Two field-replaceable AAA batteries maintain date and accurate time for a minimum of three years. Batteries can be replaced when power to mechanism is activated.
Wiring Terminals:	#18 to #10 AWG wire
Minimum ON/OFF Time:	1 minute
Maximum ON/OFF Time:	6 days, 23 hours 59 minutes
Warranty:	Limited 1 year

Model Number	Circuits	Switch	Volts AC	Rating	Enclosure	Shipping Weight
ET8015C	1	SPST	120, 208, 240, 277	30 Amps	Type 1 Steel	2.9 lbs. (1.3 kg)
ET8015CPD82	1	SPST	120, 208, 240, 277	30 Amps	Type 3R Plastic	3.6 lbs. (1.6 kg)
ET8015CR	1	SPST	120, 208, 240, 277	30 Amps	Type 3R Steel	3.6 lbs. (1.6 kg)
ET8115C	1	SPDT	120, 208, 240, 277	20/10 Amps	Type 1 Steel	2.9 lbs. (1.3 kg)
ET8115CPD82	1	SPDT	120, 208, 240, 277	20/10 Amps	Type 3R Plastic	3.6 lbs. (1.6 kg)
ET8115CR	1	SPDT	120, 208, 240, 277	20/10 Amps	Type 3R Steel	3.8 lbs. (1.7 kg)
ET8215C*	2	SPST	120, 208, 240, 277	30 Amps	Type 1 Steel	3.0 lbs. (1.4 kg)
ET8215CPD82*	2	SPST	120, 208, 240, 277	30 Amps	Type 3R Plastic	3.6 lbs. (1.6 kg)
ET8215CR*	2	SPST	120, 208, 240, 277	30 Amps	Type 3R Steel	3.7 lbs. (1.7 kg)

*Can be wired to DPST

Specification

The 7-Day Astronomic electronic-type time switch shall be capable of permitting up to 28 ON/28 OFF events. In addition, the time switch shall include selectable Astronomic (dusk/dawn) settings for each day and circuit to allow load switching at sunset and/or sunrise without a photo control device. The time switch shall provide a minimum ON or OFF time of 1 minute. The time switch to be powered by ___ (120)(208)(240)(277) VAC, ___ (50)(60) Hz power supply. The time switch mechanism features a snap-in design to provide easy mechanism removal for mounting the enclosure. The time switch enclosure shall be a _____ (Type 1 Steel)(Type 3R Steel)(Type 3R Plastic) lockable enclosure that shall be painted with an electrostatic process to eliminate the potential for corrosion. The time switch shall provide clear terminal identification on a see-through non-curling terminal insulator. Terminal connections shall be made using teeter-type terminal screws to provide secure connections for wire sizes up to #10 AWG. Switch configuration shall be _____ (SPST)(DPST)(SPDT) with a UL or CSA listed switch rating of:

(If SPST:)

- Resistive: 30 Amps @ 120/240 VAC
- Resistive: 20 Amps @ 28 VDC
- Inductive: 30 Amps @ 120/240 VAC
- Tungsten: 5 Amps @ 120/240 VAC
- Ballast: 20 Amps @ 120-277 VAC
- Motor: 1 HP @ 120 VAC
- Motor: 2 HP @ 240 VAC

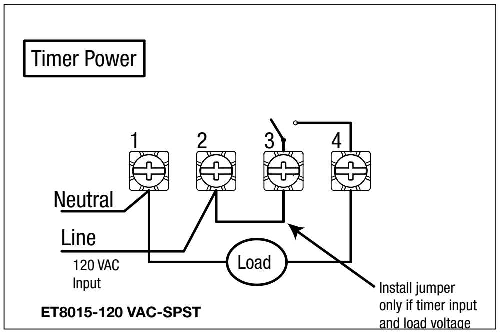
(If SPDT:)

- Resistive: 20 Amps (N.O.), 10 Amps (N.C.) @ 120/240 VAC
- Inductive: 20 Amps (N.O.), 10 Amps (N.C.) @ 120/240 VAC
- Tungsten: 5 Amps (N.O.) @ 120/240 VAC
- Ballast: 20 Amps (N.O.), 3 Amps (N.C.) @ 120-277 VAC
- Motor: 1 HP (N.O.), ¼ HP (N.C.) @ 120 VAC
- Motor: 2 HP (N.O.), ½ HP (N.C.) @ 240 VAC

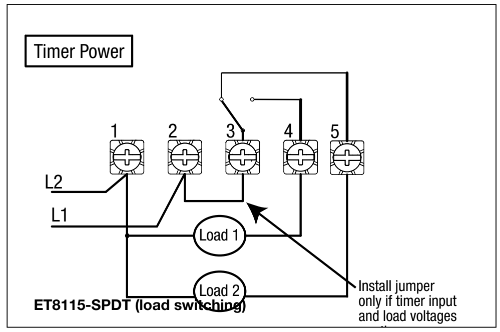
The time switch shall be UL or CSA listed under UL category 916 Energy Management Equipment and shall be Intermatic model _______________(See Model Numbers Listed).

ET8000 Series

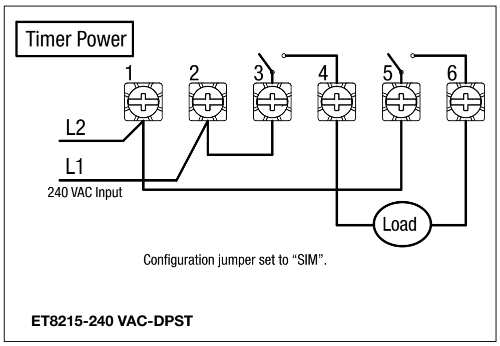
Diagrams



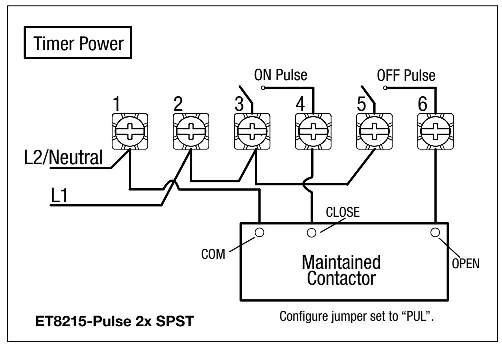
ET8015-120 VAC-SPST



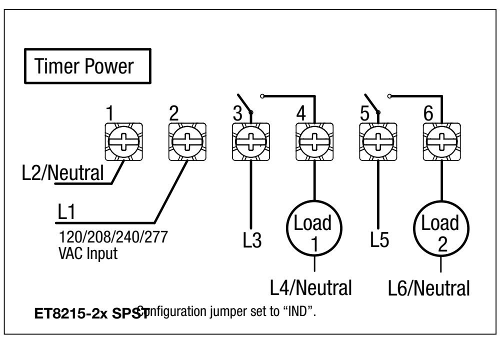
ET8115-SPDT (load switching)



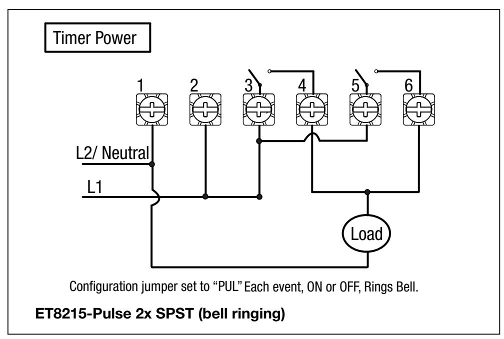
ET8215-240 VAC-DPST



ET8215-Pulse 2x SPST

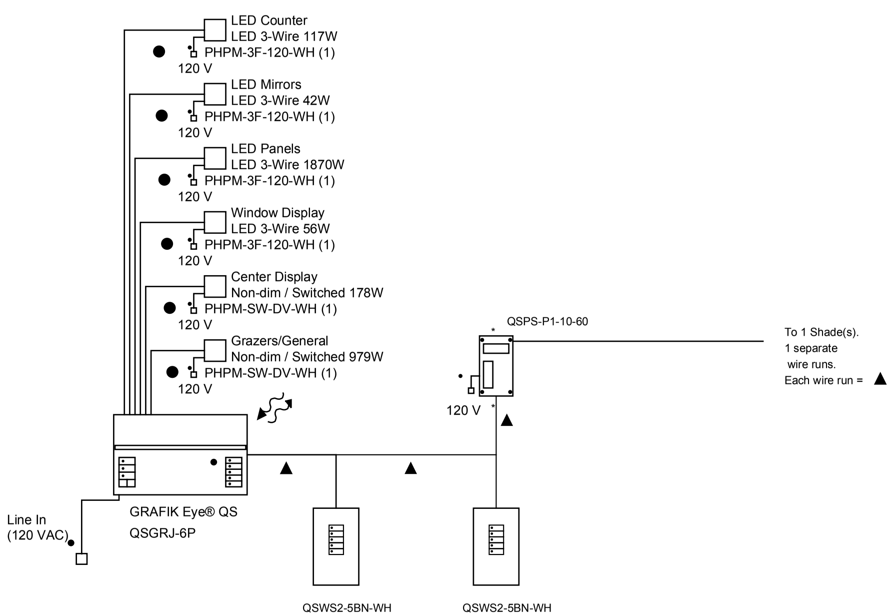


ET8215-2x SPST



ET8215-Pulse 2x SPST (bell ringing)

GRAFIK Eye® QS — One Line Diagram



Wiring Notes:	● 2 #12 AWG (2.5 mm²) ∇ 3 #18 AWG (1.0 mm²)	▼ 2 #18 AWG (1.0 mm²) □ 120 VAC Input Power	■ 277 VAC Input Power * Only connect 3 wires (Common, mux, mux)	▲ Lutron GRX-CBL-346S or GRX-PCBL-346S

Lutron

Project Name: New Project	
Project Number:	**Page:** 1

GRAFIK Eye. QS — Bill of Materials

Description	Model Number	Qty.
GRAFIK Eye® QS Wireless Control Unit	QSGRJ-6P	1
GRAFIK Eye® QS Faceplate Kit	QSGFP-1WH-NST	1
GRAFIK Eye® QS Stripe Kit	QSGS-BL	1
Power Module	PHPM-SW-DV-WH	2
Power Module	PHPM-3F-120-WH	4
QS 5-Button Wallstation, no insert	QSWS2-5BN-WH	2
Smart Panel Power Supply	QSPS-P1-10-60	1

Lutron

Project Name: New Project

Project Number: **Page:** 2

GRAFIK Eye® QS

Button Kit Engraving Form

Project Information
Project Name: New Project
Installer Company: ______
Installer Name: ______
Phone: ______

Shipping Information
Name: ______
Company: ______
Address: ______
City: ______ State: ______ Zip: ______
Phone: ______ Fax: ______

	Type:	Model Number:	Engraving Certificate Number:	Button color:
1	Scene Control			white (WH)
2	Shade Control			white (WH)

Lutron Electronics Co. Inc.
Dept 309 engraving
7200 Suter Road
Coopersburg, PA 18036
www.lutron.com
Phone: 610.282.3800

LUTRON

Project Name: New Project

Lutron Project #:

P.O.#:

Lutron Order #:

Page: 3

GRAFIK Eye. QS Load Schedule

Model Number: QSGRJ-6P

Phase Control Zones

Zone	Name	Load Type	No. Fixtures	Wattage/Fixture	Total Wattage
1	Grazers/General	Non-dim / Switched	11	89	979
2	Center Display	Non-dim / Switched	2	89	178
3	Window Display	LED 3-Wire	4	14	56
4	LED Panels	LED 3-Wire	11	170	1870
5	LED Mirrors	LED 3-Wire	3	14	42
6	LED Counter	LED 3-Wire	9	13	117

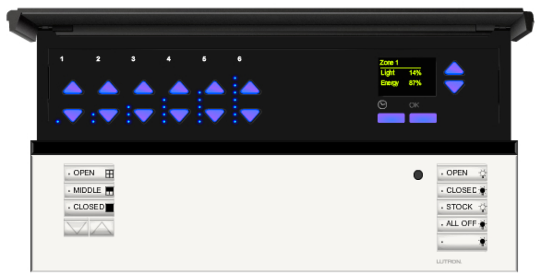
Lutron

Project Name: New Project

Project Number: **Page:** 4

GRAFIK Eye® QS — Preset Dimming Control

GRAFIK Eye® QS with lid closed.



GRAFIK Eye® QS with lid open.

Actual colors may vary slightly.

Light Zones:
6

Shade Groups:
1

Colors:	
Faceplate:	white (WH)
Stripe:	black (BL)
Buttons:	white (WH)

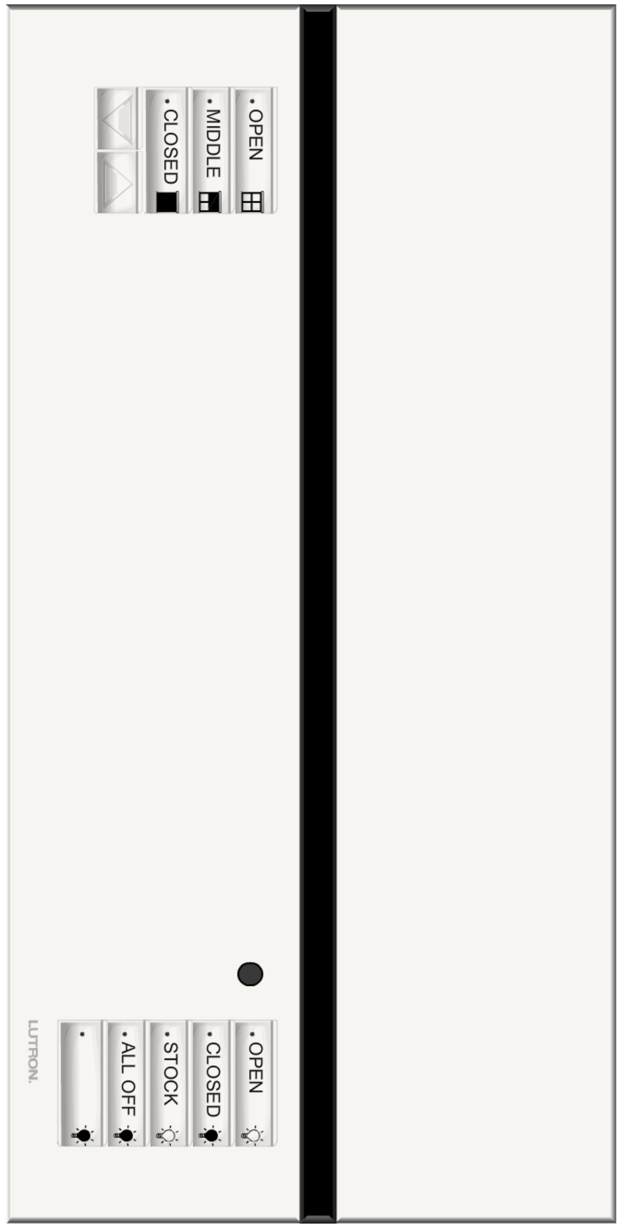
Model Number:			
Unit:	QSGRJ-6P	**Quantity:**	1
Stripe Kit:	QSGS-BL	**Quantity:**	1

LUTRON SPECIFICATION SUBMITTAL

Project Name: New Project

Project Number: **Page:** 5

GRAFIK Eye® QS — Full-size Image



Actual colors may vary slightly.

Selected Wall Color

Benjamin Moore® Paints

Affinity Colors:
Fusion
www.myaurapaints.com

*Actual color may differ slightly; please refer to paint chips for most accurate representation.

LUTRON®

Project Name:	New Project		
Project Number:		**Page:**	6

Appendix D

Electrical Specifications

Product Description

- 240 Vac maximum.
- 3-phase 4-wire, 3-phase 3-wire, 1-phase 3-wire, 1-phase 2-wire.
- 400 ampere maximum mains.
- 100 ampere maximum branch breakers.
- Bolt-on or plug-on branch breakers.
- Factory assembled.
- Refer to **Page 14-5** for additional information.

Type PRL1a

Application Description

- Lighting and appliance branch panelboard.
- Fully rated or series rated.
- Interrupting ratings up to 200 kA symmetrical.
- Suitable for use as Service Entrance Equipment, when specified on the order.
- See **Pages 14-5** through **14-18** for additional information.

Standards and Certifications

- UL 67, UL 50.
- Federal Specification W-P-115c.
- Refer to **Page 14-5** for additional information.

Options and Accessories

- Refer to **Page 14-46.**

Layout and Sizing

- Refer to **Page 14-22.**

Product Selection

Formula Pricing: Base Price + Branch Circuits + Modifications = Total Price U.S. $

Table 14-19. Base Prices — PRL1a

Ampere Rating	Interrupting Rating (kA Sym.) 240 Vac	Breaker Type	Price U.S. $ 3-Phase 4-Wire	Price U.S. $ 1-Phase 3-Wire, 1-Phase 2-Wire	Price U.S. $ 3-Phase 3-Wire
Main Lug Only					
100	—	—			
225	—	—			
400	—	—			
Main Breaker					
100	10	BAB			
100	18	EHD			
100	22	QBHW			
100	22	EDB			
100	42	EDS			
100	65	ED			
100	65	FD			
100	100	EDH			
100	100	HFD			
225	22	EDB			
225	42	EDS			
225	65	ED			
225	100	EDH			
250	65	JD			
250	100	HJD			
250	200	JDC			
400	65	DK			
400	65	KD			
400	100	HKD			
400	200	KDC			

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Table 14-20. Branch Circuit Breakers — PRL1a

Bolt-on = BAB, QBHW, QBGF, QBHGF, QBGFEP, QBHGFEP, QBAF, QBAG, QBHAF, QBHAG
Plug-on = HQP, QPHW, QPGF, QPHGF, QPGFEP, QPHGFEP

Ampere Rating	Interrupting Rating (kA Sym.) 240 Vac ①	Breaker Type	Price U.S. $ 1-Pole 120 V	Price U.S. $ 2-Pole 120/240 V	Price U.S. $ 2-Pole 240 V ②	Price U.S. $ 3-Pole 240 V
15 – 60	10	BAB, HQP				
70	10	BAB, HQP				
80 – 100	10	BAB, HQP				
15 – 50 ③	10	QBGF, QPGF ④				
15 – 50 ③	10	QBGFEP, QPGFEP ⑤				
15 – 20	10	QBAF ⑥				
15 – 20	10	QBAG ⑦				
15 – 60	10	BAB-D, HQP-D ⑧				
15 – 30	10	BAB-C, HQP-B ⑨				
15 – 30	10	BABRP ⑩				
15 – 30	10	BABRSP ⑩				
15 – 60	22	QBHW, QPHW				
70	22	QBHW, QPHW				
80 – 100	22	QBHW, QPHW				
15 – 30	22	QBHGF, QPHGF ④				
15 – 30	22	QBHGFEP, QPHGFEP ⑤				
15 – 20	22	QBHAF ⑥				
15 – 20	22	QBHAG ⑦				
Provision	—	—				

① 1-pole breakers are rated 120 Vac maximum.
② 240 volt breakers must be used on 3-phase, 3-wire, 240 volt delta systems or on the high leg of a midpoint delta grounded system.
③ 50 ampere devices are available as 2-pole only.
④ GFCI for 5 mA personnel protection.
⑤ GFP for 30 mA equipment protection.
⑥ Arc fault circuit breaker.
⑦ Arc fault circuit breaker with GFCI.
⑧ HID (High Intensity Discharge) rated breaker.
⑨ Switching Neutral Breaker. 1-pole device requires 2-pole space, 2-pole device requires 3-pole space.
⑩ Solenoid operated breaker.

Discount Symbol **CE9**

Box Sizing and Selection

Assembled Circuit Breaker Panelboards

Box size and box and trim catalog numbers for all standard panelboard types are found in **Table 14-21**.

Instructions

1. Using description of the required panelboard, select the rating and type of main required.
2. Count the total number of branch circuit poles, including provisions, required in the panelboard. Do not count main breaker poles. Convert 2- or 3-pole branch breaker to single-poles, i.e., 3-pole breaker, count as 3 poles. Determine sub-feed breaker or through-feed lug requirements.
3. Select the main ampere rating section from **Table 14-21**.
4. Select panelboard type from first column, main breaker frame, if applicable, from second column, and sub-feed breaker frame, if applicable, from the third column.
5. From Step #2, determine the number of branch circuits in Column 4.
6. Read box size, box and trim catalog numbers across columns to the right. Specify surface or flush mounting on the order.

Cabinets

Fronts are code-gauge steel, ANSI-61 light gray painted finish.

Boxes are code-gauge galvanized steel without knockouts. Standard depth is 5-3/4 inches (146.1 mm). Standard width is 20 inches (508.0 mm). An optional 28-inch (711.2 mm) wide box is available.

Top and Bottom Gutters

5-1/2 inches (139.7 mm) minimum.

Table 14-21. PRL1a Panelboard Sizing

Panelboard Types	Main Breaker Types & Mounting Position (H) = Horiz. (V) = Vert.	Sub-Feed Breaker Types & Mounting Position (H) = Horiz. (V) = Vert.	Maximum No. of Branch Circuits Including Provisions	Box Dimensions Inches ①② H	W	D	YS Box Catalog Number	LT Trim Catalog Number	EZ Box Catalog Number	EZ Trim Catalog Number
100 Ampere Maximum										
Main Breaker	BAB, QBHW (H)	—	15	36.00	20.00	5.75	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	27	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	39	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
Main Lugs or Main Breaker	EHD FD, HFD (V)	—	18	36.00	20.00	5.75	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	30	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
Main Lugs or Main Breaker with 100 A Thru-Feed Lugs or Sub- Feed Breaker	EHD FD HFD (V)	EHD FD HFD (V)	18	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			30	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			42	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
225 Ampere Maximum										
Main Lugs or Main Breaker	EDB, EDS, ED, EDH, FD, HFD (V)	—	18	36.00	20.00	5.75	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
		—	30	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
		—	42	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
	JD, HJD JDC (V)	—	18	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	30	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	42	72.00	20.00	5.75	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
Main Lugs or Main Breaker with 225 A Thru-Feed Lugs or Sub-Feed Breaker	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			30	48.00	20.00	5.75	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
			42	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
	JD, HJD JDC (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
			30	72.00	20.00	5.75	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
			42	72.00	20.00	5.75	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
400 Ampere Maximum										
Main Lugs or Main Breaker	DK, KD, HKD, KDC (V)	—	18	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	30	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
		—	42	72.00	20.00	5.75	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
Main Lugs or Main Breaker with 225 A Thru-Feed Lugs or Sub- Feed Breaker	DK, KD, HKD, KDC (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	60.00	20.00	5.75	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
			30	72.00	20.00	5.75	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
			42	72.00	20.00	5.75	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
Main Lugs or Main Breaker with 400 A Thru-Feed Lugs or Sub- Feed Breaker	DK, KD, HKD, KDC (V)	JD, HJD, JDC, DK, KD, HKD, KDC (V)	18	72.00	20.00	5.75	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
			30	90.00	20.00	5.75	**YS2090**	**LT2090S or F**	**EZB2090R**	**EZT2090S or F**
			42	90.00	20.00	5.75	**YS2090**	**LT2090S or F**	**EZB2090R**	**EZT2090S or F**

① Metric box dimensions:

Catalog Number		Dimensions in mm		
YS Box	**EZ Box**	**Height**	**Width**	**Depth**
YS2036	**EZB2036R**	914.4	508.0	146.1
YS2048	**EZB2048R**	1219.2	508.0	146.1
YS2060	**EZB2060R**	1524.0	508.0	146.1
YS2072	**EZB2072R**	1828.8	508.0	146.1
YS2090	**EZB2090R**	2286.0	508.0	146.1

② Smaller panelboard box sizes are available if required. Contact Eaton for application information.

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Product Description

- 600 Vac maximum (250 Vdc).
- 3-phase 4-wire, 3-phase 3-wire, 1-phase 3-wire, 1-phase 2-wire.
- 800 ampere maximum main lugs.
- 600 ampere maximum main breaker.
- 225 ampere maximum branch breakers.
- Bolt-on branch breakers.
- Factory assembled.
- Refer to **Page 14-5** for additional information.

Type PRL3a

Application Description

- Lighting and appliance branch panelboard or power distribution panelboard.
- Fully rated or series rated.
- Interrupting ratings up to 200 kA symmetrical.
- Suitable for use as Service Entrance Equipment, when specified on the order.
- See **Pages 14-5** through **14-18** for additional information.

Standards and Certification

- UL 67, UL 50.
- Federal Specification W-P-115c.
- Refer to **Page 14-5** for additional information.

Options and Accessories

- Refer to **Page 14-46**.

Layout and Sizing

- Refer to **Page 14-27**.

Product Selection

Formula Pricing: Base Price + Branch Circuits + Modifications = Total Price U.S. $

Table 14-25. Base Prices — PRL3a

Ampere Rating	Interrupting Rating (kA Symmetrical)				Breaker Type	Price U.S. $		
	240 Vac	480 Vac	600 Vac	250 Vdc		3-Phase 4-Wire	1-Phase 3-Wire, 1-Phase 2-Wire	3-Phase 3-Wire
Main Lug Only								
100	—	—	—	—	—			
250	—	—	—	—	—			
400	—	—	—	—	—			
600	—	—	—	—	—			
800 ①	—	—	—	—	—			
Main Breaker								
100	18	14	—	10	EHD			
100	18	14	14	10	FDB			
100	22	—	—	—	EDB			
100	42	—	—	—	EDS			
100	65	—	—	—	ED			
100	100	—	—	—	EDH			
100	65	35	18	10	FD			
100	100	65	25	22	HFD			
100	200	100	35	22	FDC			
100	200	150	—	—	FCL			
100	200	200	200	100 ②	FB-P ③			
225	22	—	—	—	EDB			
225	42	—	—	—	EDS			
225	65	—	—	—	ED			
225	100	—	—	—	EDH			
225	200	—	—	—	EDC			
225	65	35	18	10	FD			
225	100	65	25	22	HFD			
225	200	100	35	22	FDC			
250	65	35	18	10	JD			
250	100	65	25	22	HJD			
250	200	100	35	22	JDC			
400	65	—	—	10	DK			
400	65	35	25	10	KD			
400	100	65	35	22	HKD			
400	200	100	65	22	KDC			
400	200	200	—	—	LCL ④			
400	200	200	200	100 ②	LA-P ③④			
600	65	35	18	22	LGE			
600	100	65	35	22	LGH			
600	65	35	25	22	LD			
600	100	65	35	25	HLD			
600	200	100	50	25	LDC			
600	65	35	25	22	CLD ⑤			
600	100	65	35	25	CHLD ⑤			
600	200	100	50	25	CLDC ⑤			

① 800 ampere MLO requires 28-inch (711.2 mm) wide box.
② 100,000 based on NEMA test procedure.
③ Top feed only.
④ Requires 6-1/2-inch (165.1 mm) deep box. Not available in Type 3R, 12, 4 and 4X enclosures.
⑤ 100% rated circuit breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.

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Discount Symbol **CE9**

PENNSTATE 1855

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE:
Distribution Panels

Table 14-26. Branch Circuit Breakers — PRL3a

Ampere Rating	Interrupting Rating (kA Symmetrical)				Breaker Type	Price U.S. $								
	240 Vac	480 Vac	600 Vac	250 Vdc		Breaker			Space Only			Provision Only		
						1-Pole	2-Pole	3-Pole	1-Pole	2-Pole	3-Pole	1-Pole	2-Pole	3-Pole
15 – 60	10 ②③	—	—	—	BAB									
15 – 60	10	—	—	—	BAB-H									
70	10 ②③	—	—	—	BAB									
70	10	—	—	—	BAB-H									
80 – 100	10 ②③	—	—	—	BAB									
80 – 100	10	—	—	—	BAB-H									
15 – 50 ①	10 ②③	—	—	—	QBGF									
15 – 50 ①	10	—	—	—	QBGFEP									
15 – 20	10 ②③	—	—	—	QBAF ④									
15 – 20	10 ②③	—	—	—	QBAG ⑤									
15 – 60	10 ②③	—	—	—	BAB-D ⑥									
15 – 30	10 ②③	—	—	—	BAB-C ⑦									
15 – 30	10 ②	—	—	—	BABRP ⑧									
15 – 30	10 ②	—	—	—	BABRSP ⑧									
15 – 60	22 ②③	—	—	—	QBHW									
15 – 60	22	—	—	—	QBHW-H									
70	22 ②③	—	—	—	QBHW									
70	22	—	—	—	QBHW-H									
80 – 100	22 ②③	—	—	—	QBHW									
80 – 100	22	—	—	—	QBHW-H									
15 – 30	22	—	—	—	QBHGF									
15 – 30	22	—	—	—	QBHGFEP									
15 – 20	22 ②③	—	—	—	QBHAF ④									
15 – 20	22 ②③	—	—	—	QBHAG ⑤									
15 – 20	65	14 ⑨⑩	—	—	GHQ									
15 – 20	65	14 ⑨⑩	—	14	GHB									
25 – 60	65	14 ⑨⑩	—	14	GHB									
70 – 100	65	14 ⑨⑩	—	14	GHB									
15 – 30	65	25 ⑨⑩	—	—	HGHB									
15 – 20	65	14 ⑨⑩	—	14	GHQRSP ⑧									
15 – 30	65	14 ⑨⑩	—	14	GHBS ⑧									
15 – 60	—	14 ⑨⑩	—	—	GHBGFEP									
15 – 20	—	14 ⑨⑩	—	—	GHBHID ⑥									
15 – 60	18 ⑪	14 ⑨	—	10	EHD									
70 – 100	18 ⑪	14 ⑨	—	10	EHD									
15 – 60	18	V14	14	10	FDB									
70 – 100	18	14	14	10	FDB									
110 – 150	18	14	14	10	FDB									
15 – 60	65 ⑪	35 ⑨	18	10	FD									
70 – 100	65 ⑪	35 ⑨	18	10	FD									
110 – 225	65 ⑪	35	18	10	FD ⑫									
15 – 60	100 ⑪	65 ⑨	25	22	HFD									
70 – 100	100 ⑪	65 ⑨	25	22	HFD									
110 – 225	100 ⑪	65	25	22	HFD ⑫									
15 – 60	200	100	35	22	FDC									
70 – 100	200	100	35	22	FDC									
110 – 225	200	100	35	22	FDC ⑫									
100 – 225	22	—	—	—	EDB ⑫									
100 – 225	42	—	—	—	EDS ⑫									
100 – 225	65	—	—	—	ED ⑫									
100 – 225	100	—	—	—	EDH ⑫									
100 – 225	200	—	—	—	EDC ⑫									

① 50 ampere devices are available as 2-pole only.
② 1-pole breaker rated 120 Vac.
③ 2-pole breaker rated 120/240 Vac.
④ Arc fault circuit breaker.
⑤ Arc fault circuit breaker with GFCI.
⑥ HID (High Intensity Discharge) rated breaker.
⑦ Switching Neutral Breaker. 1-pole device requires 2-pole space, 2-pole device requires 3-pole space.
⑧ Solenoid operated breaker.
⑨ 1-pole breaker rated 277 Vac.
⑩ For use on 480Y/277 volt systems only.
⑪ AIC rating for 2- and 3-pole breakers only.
⑫ Maximum of six breakers per panel, 175 – 225 amperes.

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Discount Symbol. **CE9**

PENNSTATE 1 8 5 5

Project: AE 482- Corbin Building
Date: April 4, 2012

TYPE: Distribution Panels

		Poles 6 - 3X 12 - 5X 18 - 8X 24 - 10X 30 - 13X 36 - 15X 42 - 18X	BAB, QBHW, BABRP, BABRSP GHQ, GHB, HGHB ①
1-Pole / 2-Pole / 1-Pole / 2-Pole	1-Pole / 2-Pole / 3-Pole	1X 2X 3X	EDB, EDS, ED, EDH, EDC, EHD, FDB, FD, HFD, FDC 150 A Max. Per Branch Breaker (300 A Max. Per Connector)
2- or 3-Pole		2X 2-Pole 3X 3-Pole	EDB, EDS, ED, EDH, EDC FD, HFD, FDC ②
Neutral Section		5X	100 – 250 A
		8X	400 – 800 A
		11X	800A with Thru-feed Lug
Main Lug Section		2X	100 A
		5X	250 A
		8X	400 – 600 A
		14X	800 A
Main Breaker Section	Horizontal Mounting	2X 2-Pole	EHD, FDB, FD, HFD, FDC
		3X 3-Pole	EDB, EDS, ED, EDH, EDC ③
	Vertical Mounting	7X	EHD, FDB, FD, HFD, FDC, EDB, EDS, ED, EDH, EDC ④
		9X	FCL, FB-P ⑤
		14X	JD HJD, JDC
		15X	DK, KD HKD, KDC
		17X	LD, HLD, LDC CLD, CHLD, CLDC
		18X	LGE, LGH
		21X	LCL, LA-P ⑤⑥

Figure 14-4. PRL3a Layout

① GHB, HGHB and GHQ breakers cannot be mixed on same connector as BAB, QBHW, BABRP and BABRSP.
② Maximum of six breakers per panel.
③ Horizontal mounted 15 – 150 ampere main breakers EHD, FDB, FD, HFD and FDC, will be furnished as branch breaker construction. Branch breakers 1-, 2- or 3-pole as required, may be located opposite these main breakers.
④ If optional terminal kit 3TA225FDK is required, use 10X.
⑤ FB-P and LA-P top mounting only.
⑥ LCL or LA-P main breaker requires 6-1/2-inch (165.1 mm) deep box.

Panel Layout Instructions

1. Select:
   a. Required mains (lugs or breaker).
   b. Neutral where required.
   c. Branch circuits as required.
2. Layout panel as shown in **Figure 14-4**, using appropriate "X" dimensions.
3. Using total X units (panel height) find box height in inches (mm) and box catalog number from **Table 14-27**. (When total X units come out to an uneven number, use next highest number; i.e., if total X comes out 25X, use 31X.)

Layout Example

1. Description of Panel
   Type PRL3a 3-phase, 4-wire, 120/208 Vac flush mounting. Panel to have short circuit rating of 22,000 symmetrical amperes. Main breaker 400 amperes, 3-pole, bottom mounting. Branch circuits bolt-on as follows:

   12 – 20 ampere 1-pole QBHW
   1 – 200 ampere 3-pole ED
   1 – 225 ampere 3-pole ED
2. Layout Information from **Figure 14-4**:
   a. 400 ampere Neutral . . . . . . = 8X
   b. 12-poles of QBHW . . . . = 5X
   c. Two 3-pole ED breakers . . . . = 6X
   d. Main breaker, 400 amperes, 3-pole DK . . . . = 15X
   Total Height . . . . = 34X
3. From **Table 14-27**:
   a. 34X Height (use 40X box)
   b. Box Height . . . . 72 inches (1828.8 mm)
   c. Box Catalog Number . . . . **YS2072** . . . . or **EZB2072R**

Table 14-27. Box Tabulation — PRL3a

"X" Units	Box Height Inches	mm	YS Box Catalog Number	LT Trim Catalog Number	EZ Box Catalog Number	EZ Trim Catalog Number
100 – 400 Amperes						
14X	36	914.4	**YS2036**	**LT2036S or F**	**EZB2036R**	**EZT2036S or F**
23X	48	1219.2	**YS2048**	**LT2048S or F**	**EZB2048R**	**EZT2048S or F**
31X	60	1524.0	**YS2060**	**LT2060S or F**	**EZB2060R**	**EZT2060S or F**
40X	72	1828.8	**YS2072**	**LT2072S or F**	**EZB2072R**	**EZT2072S or F**
53X	90	2286.0	**YS2090**	**LT2090S or F**	**EZB2090R**	**EZT2090S or F**
600 Amperes						
23X	48	1219.2	**YS2048**	**LTV2048S or F**	**EZB2048R**	**EZTV2048S or F**
31X	60	1524.0	**YS2060**	**LTV2060S or F**	**EZB2060R**	**EZTV2060S or F**
40X	72	1828.8	**YS2072**	**LTV2072S or F**	**EZB2072R**	**EZTV2072S or F**
53X	90	2286.0	**YS2090**	**LTV2090S or F**	**EZB2090R**	**EZTV2090S or F**
800 Amperes						
23X	48	1219.2	**YS2848**	**LTV2848S or F**	—	—
31X	60	1524.0	**YS2860**	**LTV2860S or F**	—	—
40X	72	1828.8	**YS2872**	**LTV2872S or F**	—	—
53X	90	2286.0	**YS2890**	**LTV2890S or F**	—	—

Cabinets

Fronts are code-gauge steel, ANSI-61 light gray painted finish.

Boxes are code-gauge galvanized steel without knockouts. Standard depth is 5-3/4 inches (146.1 mm).

Standard widths are:

20-inch (508.0 mm) 100 – 600 amperes.
28-inch (711.2 mm) 800 amperes.

Standard Depth

5-3/4 inches (146.1 mm).

Top and Bottom Gutters

5-1/2 inches (139.7 mm) minimum.

Side Gutters

4 inches (101.6 mm) minimum.

Type PRL4

Type PRL4B Circuit Breaker Panelboard

Type PRL4F Fusible Panelboard

Product Description

- 600 Vac maximum (250 Vdc).
- 3-phase 4-wire, 3-phase 3-wire, 1-phase 3-wire, 1-phase 2-wire.
- PRL4B circuit breaker panelboard.
- PRL4F fusible switch panelboard.
- 1200 ampere maximum mains.
- 1200 ampere maximum branch devices.
- Bolt-on branch devices.
- Factory assembled.
- Refer to **Page 14-5** for additional information.

Application Description

- Power distribution panelboard.
- Fully rated or series rated.
- Interrupting ratings up to 200 kA symmetrical.
- Suitable for use as Service Entrance Equipment, when specified on the order.
- See **Pages 14-5** through **14-18** for additional information.

Standards and Certifications

- UL 67, UL 50.
- Federal Specification W-P-115c.
- Refer to **Page 14-5** for additional information.

Options and Accessories

- Refer to **Page 14-46**.

Layout and Sizing

- PRL4B — Refer to **Pages 14-33** through **14-35.**
- PRL4F — Refer to **Pages 14-36** through **14-38.**

Product Selection

Formula Pricing: Base Price + Branch Devices + Modifications = Total Price U.S. $

Table 14-28. Base Prices — PRL4 Main Lugs and Main Breakers

Ampere Rating	Interrupting Rating (kA Symmetrical)				Breaker Type	Price U.S. $		
	240 Vac	480 Vac	600 Vac	250 Vdc		3-Phase 4-Wire	1-Phase 3-Wire, 1-Phase 2-Wire	3-Phase 3-Wire
Main Lug Only								
250	—	—	—	—	—			
400	—	—	—	—	—			
600	—	—	—	—	—			
800	—	—	—	—	—			
1200	—	—	—	—	—			
Main Breaker ①								
250	65	35	18	10	JD			
250	100	65	25	22	HJD			
250	200	100	35	22	JDC			
250	200	200	—	—	LCL			
400	65	—	—	10	DK			
400	65	35	25	10	KD			
400	65	35	25	—	CKD ②③			
400	100	65	35	22	HKD			
400	100	65	35	—	CHKD ②③			
400	200	100	65	22	KDC			
400	200	200	—	—	LCL			
400	200	200	200	—	LA-P			
600	65	35	18	22	LGE			
600	100	65	35	22	LGH			
600	65	35	25	22	LD			
600	65	35	25	—	CLD ②			
600	100	65	35	25	HLD			
600	100	65	35	—	CHLD ②			
600	200	100	50	25	LDC			
600	200	100	50	—	CLDC ②			
800	65	50	25	22	MDL			
800	100	65	35	25	HMDL			
800	65	50	25	—	CMDL ②			
800	100	65	35	—	CHMDL ②			
800	200	200	200	—	NB-P			
800	65	50	25	—	ND			
800	100	65	35	—	HND			
800	200	100	65	—	NDC			
800	65	50	25	—	CND ②④			
800	100	65	35	—	CHND ②④			
800	200	100	65	—	CNDC ②④			
1200	65	50	25	—	ND			
1200	100	65	35	—	HND			
1200	200	100	65	—	NDC			
1200	65	50	25	—	CND ②④			
1200	100	65	35	—	CHND ②④			
1200	200	100	65	—	CNDC ②④			

① For ground fault protection on main devices, see **Modification 14 — Applies to 310 and 310+ Trip Units** or **Modification 15**, **Page 14-48**.
② 100% rated breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.
③ Breaker only available in 3-pole frame.
④ Requires 44-inch (1117.6 mm) wide box.

Table 14-29. Base Prices — PRL4 Main Fusible Switches

Ampere Rating	Interrupting Rating (kA Symmetrical)			Price U.S. $		
	240 Vac	480 Vac	Device Type	3-Phase 4-Wire	1-Phase 3-Wire, 1-Phase 2-Wire	3-Phase 3-Wire
Main Fusible Switch 240 Vac, 250 Vdc ⑤⑥⑦						
200	See **Table 14-32**		FDPB			
400			FDPW			
600 ⑧			FDPW			
800 ⑧			FDPW			
1200 ⑧			FDPW			
Main Fusible Switch 600 Vac ⑤⑥						
200	See **Table 14-32**		FDPB			
400			FDPW			
600 ⑧			FDPW			
800 ⑧			FDPW			
1200 ⑧			FDPW			

⑤ For ground fault protection on main devices, see **Modification 15**, **Page 14-48**.
⑥ Fuses not included. **Specify required fuse clips on all switches. For T fuse clips, add $308. per switch.**
⑦ Class J Fuse provisions are applicable only to 600 volt units. When required, use price and dimensions of 600 volt units for all voltages 600 and below.
⑧ No dc rating on 600, 800 and 1200 ampere switches.

Discount Symbol **CE9**

Table 14-30. Branch Devices — PRL4

Ampere Rating	Interrupting Rating (kA Symmetrical)				Breaker Type	Price U.S. $			Price U.S. $ Space Only ①			Price U.S. $
	240 Vac	480 Vac	600 Vac	250 Vdc		1-Pole	2-Pole	3-Pole	1-Pole	2-Pole	3-Pole	3-Pole Provision
15 – 60	10 ③④	—	—	—	BAB							
15 – 60	10	—	—	—	BAB-H							
70 – 100	10 ③④	—	—	—	BAB							
70 – 100	10	—	—	—	BAB-H							
15 – 50 ②	10 ③④	—	—	—	QBGF							
15 – 20	10 ③④	—	—	—	QBAF ⑤							
15 – 20	10 ③④	—	—	—	QBAG ⑥							
15 – 60	22 ③④	—	—	—	QBHW							
15 – 60	22	—	—	—	QBHW-H							
70 – 100	22 ③④	—	—	—	QBHW							
70 – 100	22	—	—	—	QBHW-H							
15 – 30	22 ③④	—	—	—	QBHGF							
15 – 20	22 ③④	—	—	—	QBHAF ⑤							
15 – 20	22 ③④	—	—	—	QBHAG ⑥							
15 – 20	65 ③	14 ⑦	—	—	GHQ ⑧							
15 – 60	65 ③	14 ⑦	—	14	GHB ⑧							
70 – 100	65 ③	14 ⑦	—	14	GHB ⑧							
15 – 30	65 ③	25 ⑦	—	—	HGHB ⑧							
15 – 60	18 ⑨	14 ⑦	—	10	EHD							
70 – 100	18 ⑨	14 ⑦	—	10	EHD							
15 – 60	18	14	14	10	FDB							
70 – 100	18	14	14	10	FDB							
110 – 150	18	14	14	10	FDB							
15 – 60	65 ⑨	35 ⑦	18	10	FD							
70 – 100	65 ⑨	35 ⑦	18	10	FD							
110 – 225	65 ⑨	35	18	10	FD							
15 – 60	100 ⑨	65 ⑦	25	22	HFD							
70 – 100	100 ⑨	65 ⑦	25	22	HFD							
110 – 225	100 ⑨	65	25	22	HFD							
15 – 60	200	100	35	22	FDC							
70 – 100	200	100	35	22	FDC							
110 – 225	200	100	35	22	FDC							
15 – 100	200	150	—	—	FCL							
100 – 225	22	—	—	—	EDB							
100 – 225	42	—	—	—	EDS							
100 – 225	65	—	—	—	ED							
100 – 225	100	—	—	—	EDH							
100 – 225	200	—	—	—	EDC							
70 – 225	65	35	18	10	JD							
250	65	35	18	10	JD							
70 – 225	100	65	25	22	HJD							
250	100	65	25	22	HJD							
70 – 225	200	100	35	22	JDC							
250	200	100	35	22	JDC							
125 – 250	200	200	—	—	LCL							
250 – 400	65	—	—	10	DK							
100 – 400	65	35	25	10	KD							
100 – 400	65	35	25	—	CKD ⑩⑪⑫							
100 – 400	100	65	35	22	HKD							
100 – 400	100	65	35	—	CHKD ⑩⑪⑫							
100 – 400	200	100	65	22	KDC							
200 – 400	200	200	—	—	LCL							
250 – 600	65	35	18	22	LGE							
300 – 600	65	35	25	22	LD							
300 – 600	65	35	25	—	CLD ⑩							

① Includes provisions for breaker types BAB, BAB-H, QBGF, QBHW, QBHW-H, QBHGF, GHQ, GHB, HGHB.
② 50 ampere devices are available as 2-pole only.
③ 1-pole breakers rated 120 Vac.
④ 2-pole breakers rated 120/240 Vac.
⑤ Arc fault circuit breaker.
⑥ Arc fault circuit breaker with GFCI.
⑦ 1-pole breakers rated 277 Vac.
⑧ At 480 volts, must be used on 480Y/277 volt grounded wye systems only.
⑨ AIC rating for 2- and 3-pole breakers only.
⑩ 100% rated breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.
⑪ Breaker only available in 3-pole frame.
⑫ Available in single branch mounting only.

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Table 14-30. Branch Devices — PRL4 (Continued)

Ampere Rating	Interrupting Rating (kA Symmetrical) 240 Vac	480 Vac	600 Vac	250 Vac	Device Type	Price U.S. $ 1-Pole	2-Pole	3-Pole	Price U.S. $ Space Only 1-Pole	2-Pole	3-Pole	Price U.S. $ 3-Pole Provision
250 – 600	100	65	35	22	LGH							
300 – 600	100	65	35	25	HLD							
300 – 600	100	65	35	—	CHLD ①							
300 – 600	200	100	50	25	LDC							
300 – 600	200	100	50	25	CLDC ①							
400 – 800	65	50	25	22	MDL							
400 – 800	100	65	35	25	HMDL							
400 – 800	65	50	25	—	CMDL ①							
400 – 800	100	65	35	—	CHMDL ①							
400 – 800	65	50	25	—	ND							
400 – 800	100	65	35	—	HND							
400 – 800	200	100	65	—	NDC							
400 – 800	65	50	25	—	CND ②③							
400 – 800	100	65	35	—	CHND ②③							
400 – 800	200	100	65	—	CNDC ②③							
600 – 1200	65	50	25	—	ND							
600 – 1200	100	65	35	—	HND							
600 – 1200	200	100	65	—	NDC							
600 – 1200	65	50	25	—	CND ②③							
600 – 1200	100	65	35	—	CHND ②③							
600 – 1200	200	100	65	—	CNDC ②③							
Integrally Fused, Current Limiting Circuit Breaker												
15 – 100	200	200	200	④	FB-P							
125 – 225	200	200	200	④	LA-P							
250 – 400	200	200	200	④	LA-P							
400 – 600	200	200	200	④	NB-P							
700 – 800	200	200	200	④	NB-P							
Fusible Switches 240 Vac, 250 Vdc ⑤												
30/30 ⑥	See **Table 14-32**				FDPW-Twin							
60/60 ⑥					FDPW-Twin							
100/100 ⑥					FDPW-Twin							
200/200					FDPB-Twin							
100					FDPW-Single							
200					FDPB-Single							
400	See **Table 14-32**				FDPW-Single							
600 ⑦					FDPW-Single							
800 ⑦					FDPW-Single							
1200 ⑦					FDPW-Single							
Fusible Switches 600 Vac ⑤												
30/30 ⑥	See **Table 14-32**				FDPW-Twin							
60/60 ⑥					FDPW-Twin							
100/100 ⑥					FDPW-Twin							
200/200 ⑧					FDPB-Twin							
100					FDPW-Single							
200					FDPB-Single							
400	See **Table 14-32**				FDPW-Single							
600 ⑦					FDPW-Single							
800 ⑦					FDPW-Single							
1200 ⑦					FDPW-Single							

① 100% rated breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.
② 100% rated breaker.
③ Requires 44-inch (1117.6 mm) wide box.
④ 100,000 AIC based on NEMA test procedure.
⑤ Fuses not included. **Specify required fuse clips on all switches. For T fuse clips, add $308. per switch (T fuse clips not available for 200/200 twin switches).**
⑥ When branches of a twin unit are of different ampere ratings, as a 30 – 60 twin unit, price and layout as a 60 – 60 twin unit; when a 60 – 100 twin unit, price and layout as a 100 – 100 twin unit.
⑦ No dc rating on 600, 800 and 1200 ampere switches.
⑧ Twin 200 ampere switches are not available with Class R fuse clips at 600 volts.

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Discount Symbol **CE9**

Table 19.1-17. Typical Data for 480V Class NEMA TP-1 Dry-Type Transformers, Aluminum Wound ①

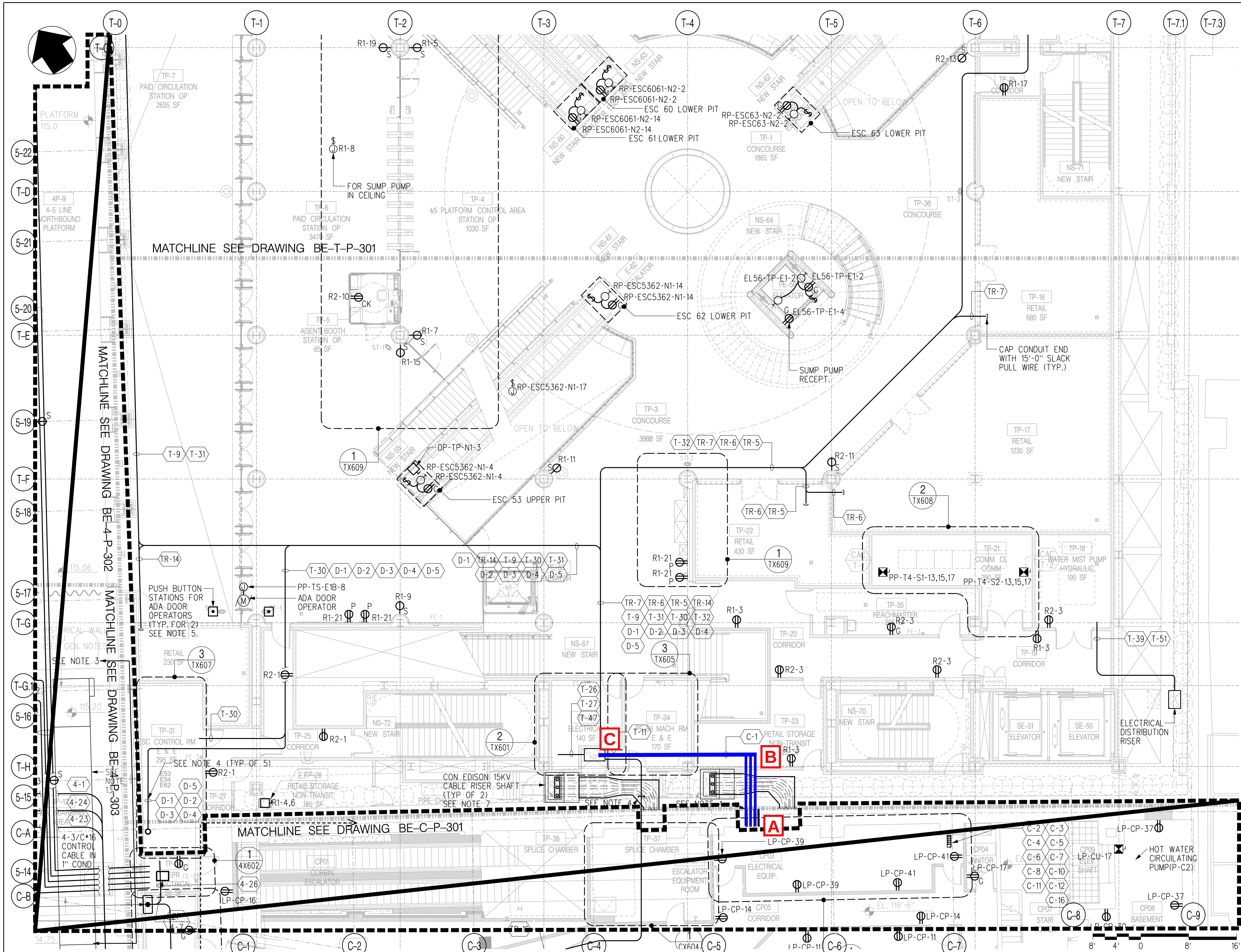
kVA	Frame	Weight	Losses in Watts		Efficiency (T Rise +20°)				% Regulation		% Imp. T Rise +20 ②	X T Rise +20	R T Rise +20	Sound Level dB	TP1 Efficiency	Inrush	
			No Load	Total at Rise +20	25%	50%	75%	Full Load	100% PF	80% PF						Absolute Max.	Practical Max.
Type DS-3 150°C Rise NEMA TP-1 Efficient Single-Phase																	
15	816	246	80	549	97.6	97.6	97.2	96.6	2.0	2.9	4.3	3.0	3.1	45	97.70	737	245
25	818	359	300	848	97.7	98.1	97.9	97.5	1.4	2.7	3.5	2.8	2.2	45	98.00	1139	379
37.5	818	374	125	1314	98.1	97.8	97.2	96.6	2.2	4.6	5.8	4.8	3.2	45	98.20	1066	355
50	819	555	300	1668	98.2	98.1	97.6	97.0	1.9	4.0	5.1	4.3	2.7	45	98.30	1585	528
75	820	740	170	2266	98.4	98.2	97.6	97.0	2.3	5.3	6.9	6.3	2.8	50	98.50	2105	701
100	821	841	260	2543	98.5	98.4	98.0	97.6	1.9	4.7	6.1	5.6	2.3	50	98.60	2834	944
167	814	1610	900	3987	68.7	98.7	98.4	98.0	1.4	6.8	9.7	9.5	1.8	55	98.70	1250	416
Type DS-3 115°C Rise NEMA TP-1 Efficient Single-Phase																	
15	816	246	80	519	97.8	97.8	97.3	96.8	2.1	3.1	3.9	2.6	2.9	45	97.70	773	244
25	818	373	300	766	97.7	98.1	98.0	97.7	1.4	2.8	3.3	2.8	1.9	45	98.00	1102	367
37.5	818	380	125	1182	98.2	98.4	98.1	97.8	2.0	3.1	4.1	2.9	2.8	45	98.20	616	205
50	819	590	300	417	98.4	98.3	97.9	97.4	1.8	4.1	5.2	5.2	0.2	45	98.30	1553	511
75	820	689	170	2356	98.5	98.2	97.6	97.0	2.7	5.6	6.9	6.3	2.9	50	98.50	1717	572
Type DS-3 80°C Rise NEMA TP-1 Efficient Single-Phase																	
15	818	360	115	269	97.4	98.3	98.4	98.4	0.8	1.7	2.0	1.8	1.0	45	97.70	1381	460
25	818	370	120	580	97.8	98.2	98.0	97.8	1.5	3.2	3.9	3.4	1.8	45	98.00	1046	348
37.5	819	565	150	834	98.1	98.4	98.1	97.8	1.5	3.3	4.1	3.6	1.8	45	98.20	1471	490
50	820	680	175	1014	98.4	98.5	98.4	98.1	1.5	3.4	4.2	3.9	1.7	45	98.30	1733	577
75	821	900	260	1387	98.3	98.6	98.5	98.2	1.4	3.5	4.3	4.0	1.5	50	98.50	2423	807
Type DT-3 150°C Rise NEMA TP-1 Efficient																	
15	912B	204	95	778	96.6	96.7	96.0	95.1	4.8	4.0	4.8	1.4	4.6	45	97.00	382	127
30	912B	291	165	1207	97.2	97.3	96.9	96.2	3.7	5.6	4.6	3.0	3.5	45	97.50	479	159
37.5	912B	381	210	1428	97.5	97.5	97.0	96.4	3.5	5.5	4.5	3.1	3.2	45	97.70	484	161
45	912B	351	210	1911	97.5	97.4	96.7	96.0	3.8	6.3	5.1	3.4	3.8	45	97.70	564	188
50	914D	531	270	1316	97.7	98.1	97.9	97.5	2.2	4.0	3.2	2.4	2.1	45	98.00	999	333
75	914D	553	300	2917	97.9	97.7	97.0	96.3	3.6	6.6	5.3	4.0	3.5	50	98.00	561	187
112.5	916A	793	400	3693	98.0	98.0	97.5	96.9	3.2	7.5	6.0	5.2	2.9	50	98.20	1049	350
150	916A	913	490	4923	98.2	98.0	97.5	96.9	3.2	6.5	5.3	4.4	3.0	50	98.30	1518	506
225	917	1343	650	6476	98.4	98.2	97.8	97.2	2.8	6.3	5.1	4.4	2.6	55	98.50	2204	734
300	918A	1597	750	8239	98.5	98.3	97.9	97.3	2.9	8.9	7.6	7.2	2.5	55	98.60	2097	699
500	919	2590	1400	9782	98.6	98.7	98.5	98.1	1.9	8.2	7.2	7.0	1.7	60	98.70	3769	1256
750	920	3340	1800	12,692	98.8	98.9	98.7	98.4	1.8	8.9	8.0	7.9	1.5	64	98.80	4521	1507
Type DT-3 115°C Rise NEMA TP-1 Efficient																	
15	912B	202	100	743	96.7	96.8	96.2	95.4	4.4	3.9	4.4	1.2	4.3	45	97.00	383	127
30	912B	311	165	1492	97.3	97.1	96.3	95.5	4.5	4.8	4.8	1.8	4.4	45	97.50	411	137
45	912B	418	220	1458	97.8	97.9	97.5	97.0	2.8	5.4	4.6	3.7	2.8	45	97.70	550	183
50	914D	556	270	1211	97.6	98.1	98.0	97.7	1.9	3.7	3.2	2.6	1.9	45	98.00	892	297
75	914D	581	300	2415	97.9	97.9	97.5	96.9	3.0	6.7	5.9	5.1	2.8	50	98.00	758	252
112.5	916A	829	440	3209	98.0	98.1	97.8	97.3	2.6	3.6	3.1	1.9	2.5	50	98.20	1301	433
150	916A	996	530	3781	98.1	98.3	97.9	97.5	2.4	5.8	5.2	4.7	2.2	50	98.30	1534	511
225	918A	1569	720	5205	98.4	98.4	98.1	97.8	2.2	6.8	6.2	5.8	2.0	55	98.50	1875	631
300	923	1908	830	6926	98.5	98.5	98.2	97.8	2.3	6.0	5.4	4.9	2.0	55	98.60	2678	872
500	920	3117	1650	6968	98.5	98.9	98.8	98.7	1.2	6.6	6.6	6.5	1.1	60	98.70	3930	1310
750	922	4884	2000	9335	98.9	99.1	99.0	98.8	1.3	8.7	9.0	8.9	1.0	64	98.80	4458	1486
Type DT-3 80°C Rise NEMA TP-1 Efficient																	
15	912B	276	165	551	96.7	97.4	97.2	96.8	3.4	3.9	3.5	2.3	2.6	45	97.00	358	119
30	912B	350	180	904	97.3	97.8	97.6	97.2	2.5	3.9	3.4	2.5	2.4	45	97.50	337	112
45	914D	540	290	1027	97.7	98.2	98.2	97.9	1.7	3.5	3.3	2.9	1.6	45	97.70	953	317
75	916A	810	360	1782	97.8	98.2	98.0	97.7	0.3	3.5	4.3	3.9	1.9	50	98.00	1006	355
112.5	916A	944	470	2521	98.2	98.4	98.2	97.9	1.9	4.4	4.1	3.7	1.8	50	98.20	1554	518
150	917	1438	650	2760	98.2	98.6	98.5	98.3	1.5	4.8	4.7	4.5	1.4	50	98.30	1665	555
225	923	1746	830	4047	98.3	98.6	98.5	98.3	1.6	5.5	5.6	5.4	1.4	55	98.50	2003	667
300	919	2400	1100	5338	98.6	99.0	99.0	98.9	1.6	5.9	6.1	5.9	1.4	55	98.60	2655	885
500	920	3418	1800	5858	98.6	99.0	99.0	98.9	0.9	4.9	5.4	5.3	0.8	60	98.70	4462	1487

① Typical values for aluminum windings. Refer to **Pages 19.1-26–19.1-28** for typical data for copper windings. Up-to-date design data is available at www.eaton.com.

② Actual impedance may vary ±7.5%.

Appendix E

Electrical Depth 1- Conduit Pathway



NOTES:

1. ALL 120/208V DEVICES CIRCUITED TO PANELS RP-TP-N1 AND RP-TP-N2, DESIGNATED AS R1 AND R2 RESPECTIVELY, U.O.N.
2. SEE DRAWINGS BE-T-X-821 AND BE-T-X-822 FOR MECHANICAL EQUIPMENT WIRING.
3. ALL CONDUITS CROSSING AT THIS LOCATION SHALL BE PROVIDED WITH DIELECTRIC UNIONS FOR STRAY CURRENT MITIGATION.
4. THIS CONTRACT TO PROVIDE CONDUIT FROM CAPPED END PROVIDED BY OTHERS. RUN CONDUCTORS TO CORRESPONDING EQUIPMENT AND PERFORM IR AND PHASE SEQUENCE TESTS PRIOR TO ENERGIZATION.
5. SEE ARCHITECTURAL DRAWINGS FOR MOUNTING OF DEVICES TO ARCHITECTURAL STANCHIONS.
6. SEE MECHANICAL DRAWINGS FOR LOCATIONS OF ALL FIRE SMOKE DAMPERS AND SMOKE DAMPERS. CONNECT NOT MORE THAN 10 FIRE SMOKE DAMPERS OR SMOKE DAMPERS TO EACH 20 AMP BRANCH CIRCUIT ON PANEL PP-TS-E1(A).
7. PROVIDE REINFORCED CONCRETE DUCT BANK BETWEEN SPLICE CHAMBER. DUCT BANK SHALL BE 3 CELL WITH 4" FRE DUCTS ENCASED IN MINIMUM 2" CONCRETE. SUPPORT DUCT BANK ON TOP OF SPLICE CHAMBER AT PLATFORM LEVEL. PROVIDE STRUCTURAL STEEL AND SUPPORT, AS REQUIRED. PROVIDE SHOP DRAWINGS AND STRUCTURAL CALCULATIONS FOR DUCT BANK PRIOR TO CONSTRUCTION

- DENOTES NOT IN CONTRACT

REVISION	DESCRIPTION	DATE	APPROVED
0	CONFORMED DRAWINGS	06-30-10	CC

KEY PLAN:

Fulton Street Transit Center
ARUP
MTA New York City Transit Capital Construction

IT IS A VIOLATION OF THE PROFESSIONAL LICENSE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANY WAY, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. IF ALTERED, THE ALTERING ENGINEER SHALL AFFIX HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SEAL AND DATE OF ALTERATION.

CONTRACT A-36125
TRANSIT CENTER ENCLOSURE

DRAWING TITLE:
BUILDING ELECTRICAL POWER PLAN
TRANSIT CENTER - PLATFORM LEVEL
SHEET 2

DRAWN: LB	DESIGNED: AE
CHECKED: HL	APPROVED: HL
SCALE: 1/8"=1'-0"	DATE: 01-29-10
SHT: 3-056	
DRAWING NO: 4F-BE-T-P-302	REVISION: 0

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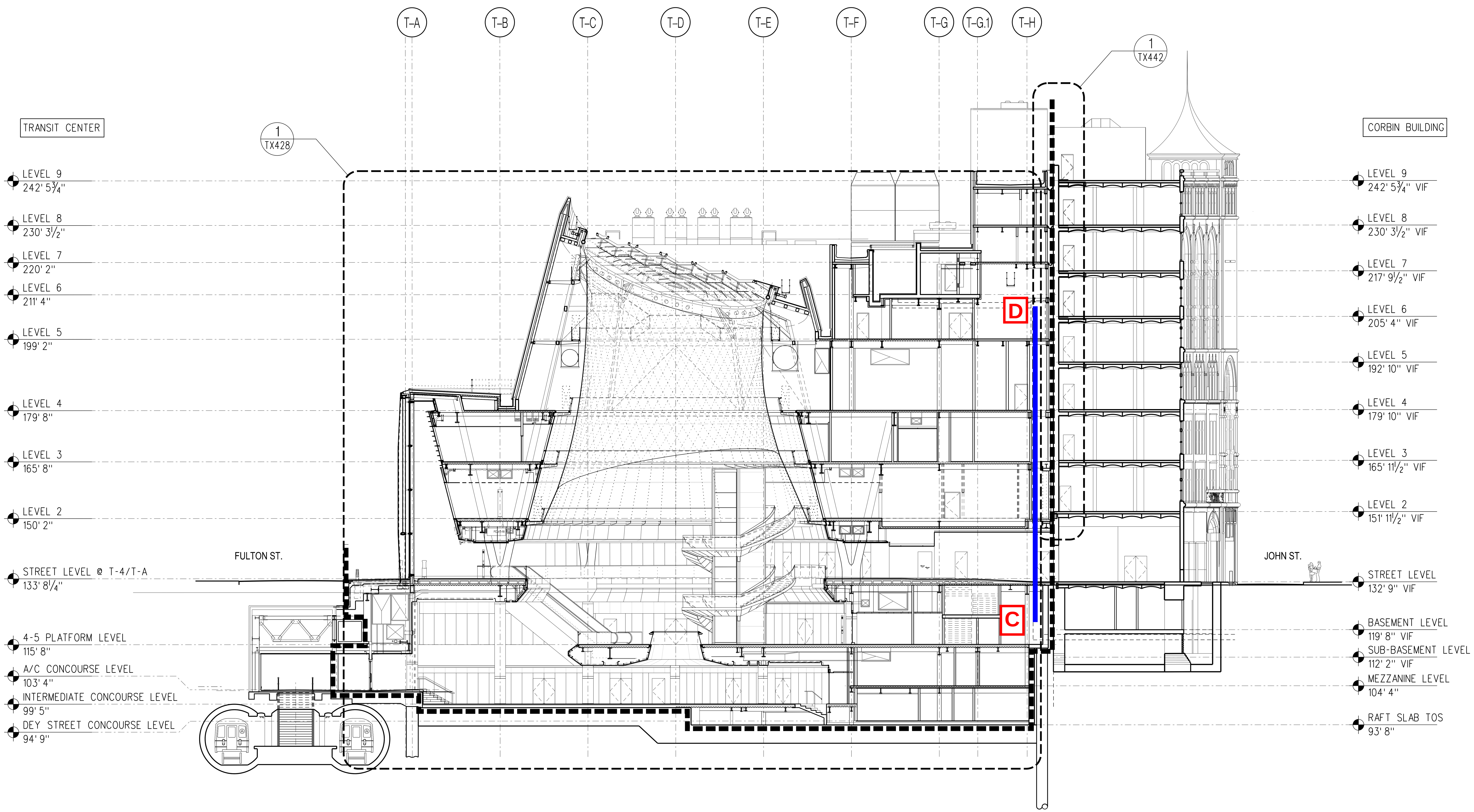

NOTES:

REVISION	DESCRIPTION	DATE	APPROVED
0	CONFORMED DRAWINGS	06-30-10	AW

KEY PLAN:

MTA

Fulton Street Transit Center

ARUP

New York City Transit Capital Construction

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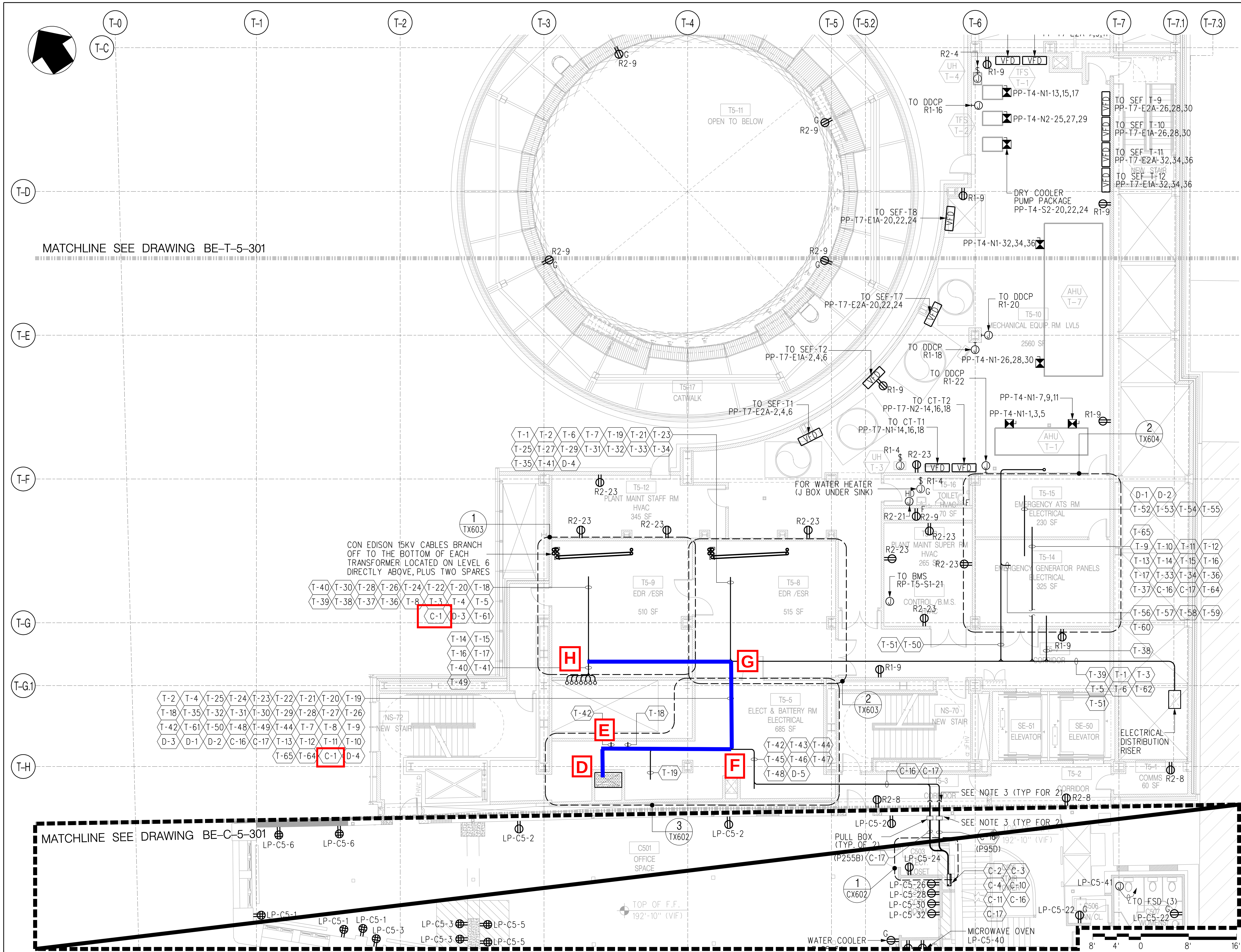
CONTRACT A-36125
TRANSIT CENTER ENCLOSURE

DRAWING TITLE:
BUILDING ARCHITECTURAL
TRANSIT CENTER
BUILDING SECTION @ T4
LOOKING EAST

DRAWN: RG		DESIGNED: VC	
CHECKED: NDH		APPROVED: AW	
SCALE: $\frac{1}{16}$"=1'-0"	DATE: 01-29-10	SHT: 1-155	
DRAWING NO: 4F-BA-T-X-421		REVISION: 0	



NOTES:

1. ALL 120/208V DEVICES CIRCUITED TO PANELS RP-T5-N1 AND RP-T5-N2, DESIGNATED AS R1 AND R2 RESPECTIVELY, U.O.N.
2. SEE DRAWINGS BE-T-X-821 AND BE-T-X-822 FOR MECHANICAL EQUIPMENT WIRING.
3. THIS CONTRACT TO PROVIDE CONDUIT FROM CAPPED END PROVIDED BY OTHERS. RUN CONDUCTORS TO CORRESPONDING EQUIPMENT AND PERFORM IR AND PHASE SEQUENCE TESTS PRIOR TO ENERGIZATION.
4. SEE MECHANICAL DRAWINGS FOR LOCATIONS OF ALL FIRE SMOKE DAMPERS AND SMOKE DAMPERS. CONNECT NOT MORE THAN 10 FIRE SMOKE DAMPERS OR SMOKE DAMPERS TO EACH 20 AMP BRANCH CIRCUIT ON PANEL PP-TS-E1(A).

- DENOTES NOT IN CONTRACT

REVISION	DESCRIPTION	DATE	APPROVED
0	CONFORMED DRAWINGS	06-30-10	CC

KEY PLAN:

Fulton Street Transit Center
ARUP
New York City Transit
Capital Construction

CONTRACT A-36125
TRANSIT CENTER ENCLOSURE

DRAWING TITLE:
BUILDING ELECTRICAL POWER PLAN
TRANSIT CENTER - LEVEL 5
SHEET 2

DRAWN: LB		DESIGNED: AE	
CHECKED: HL		APPROVED: HL	
SCALE: 1/8"=1'-0"	DATE: 01-29-10	SHT: 3-068	
DRAWING NO: 4F-BE-T-5-302		REVISION: 0	

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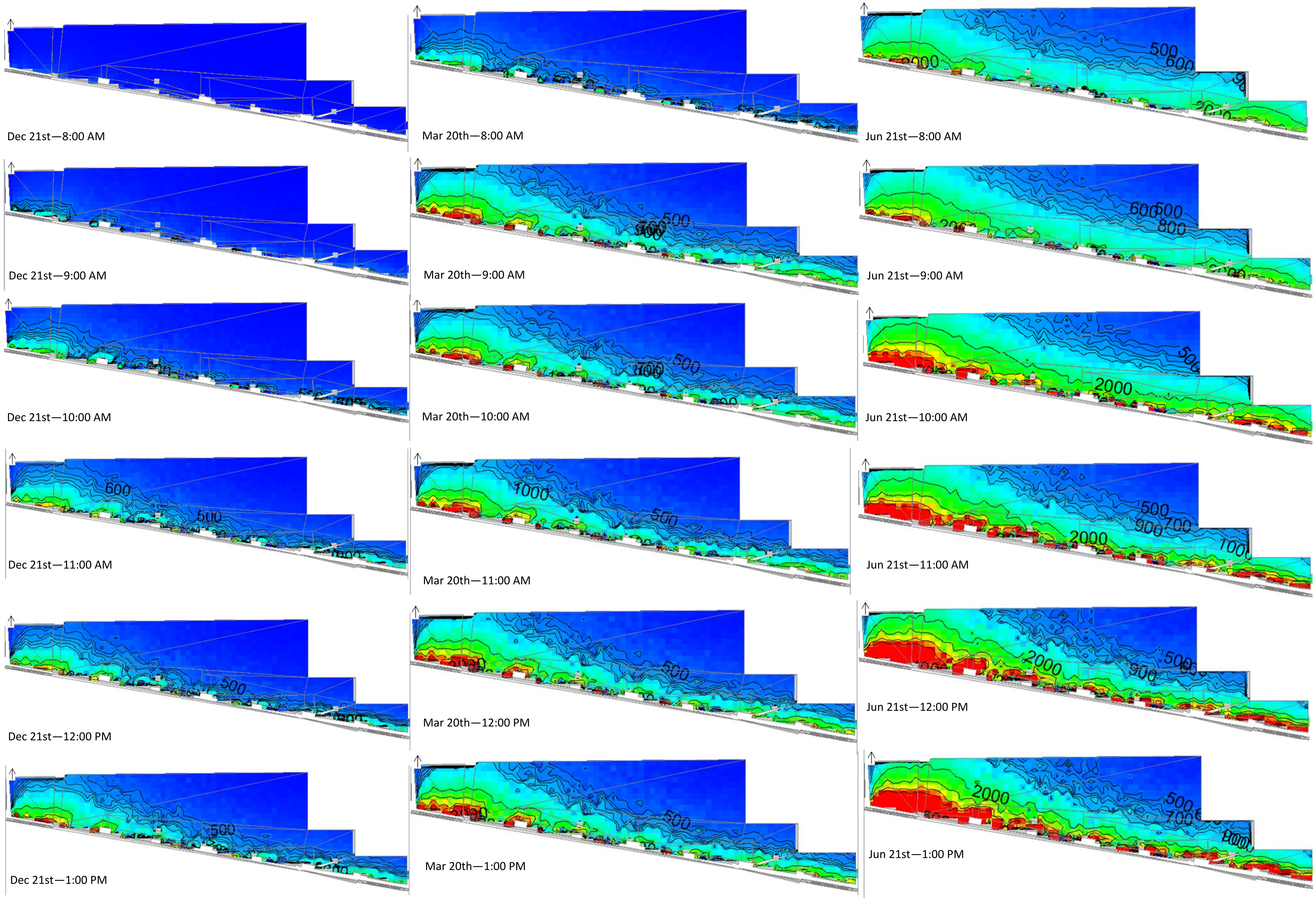
Appendix F

Daysim



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Jun 21st—8:00 AM
Dec 21st—9:00 AM
Mar 20th—9:00 AM
Jun 21st—9:00 AM
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Mar 20th—10:00 AM
Jun 21st—10:00 AM
Dec 21st—11:00 AM
Mar 20th—11:00 AM
Jun 21st—11:00 AM
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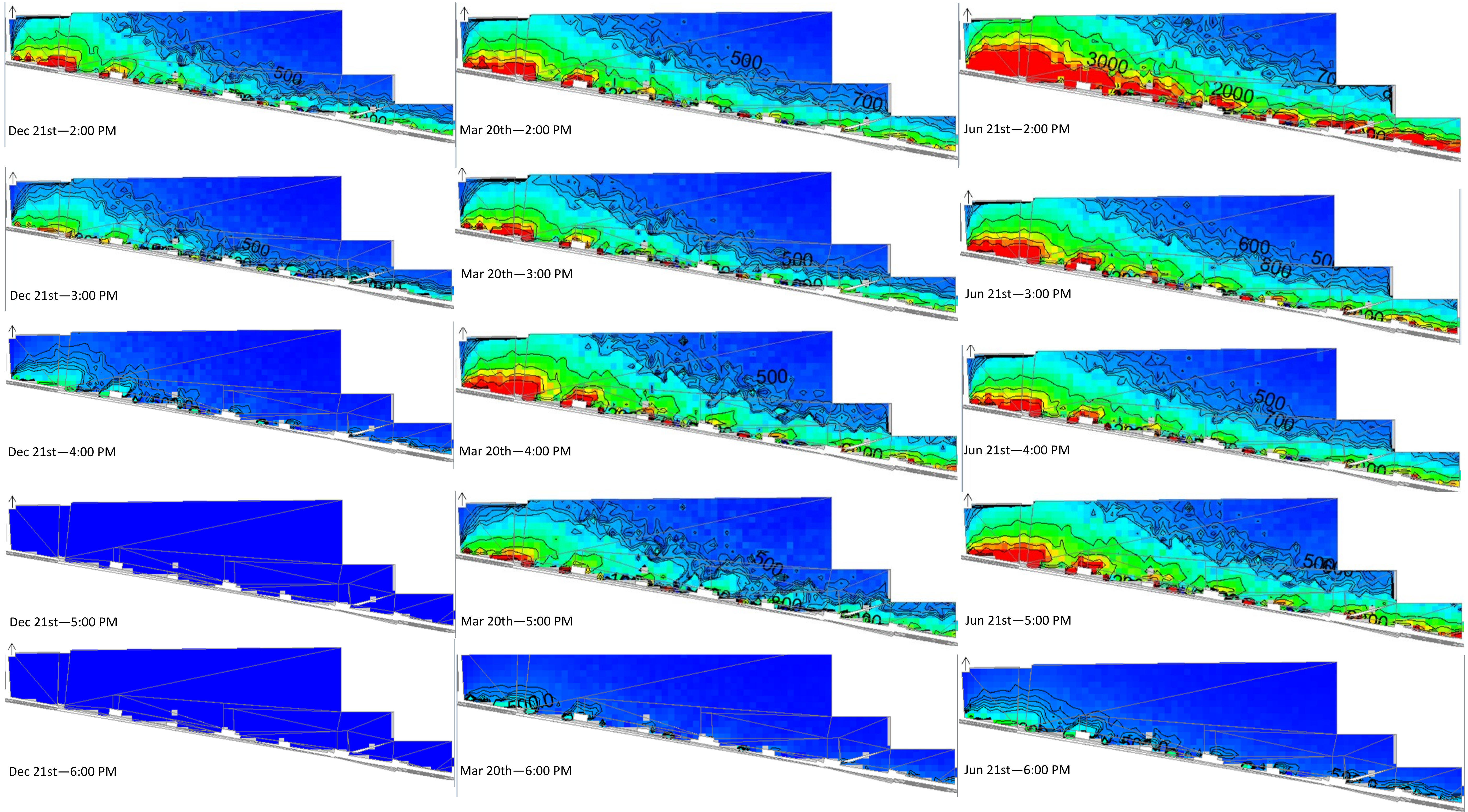
Jun 21st—1:00 PM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