ALYSON LARIMER

SENIOR THESIS FINAL REPORT
SPRING 2011

LIGHTING | ELECTRIAL

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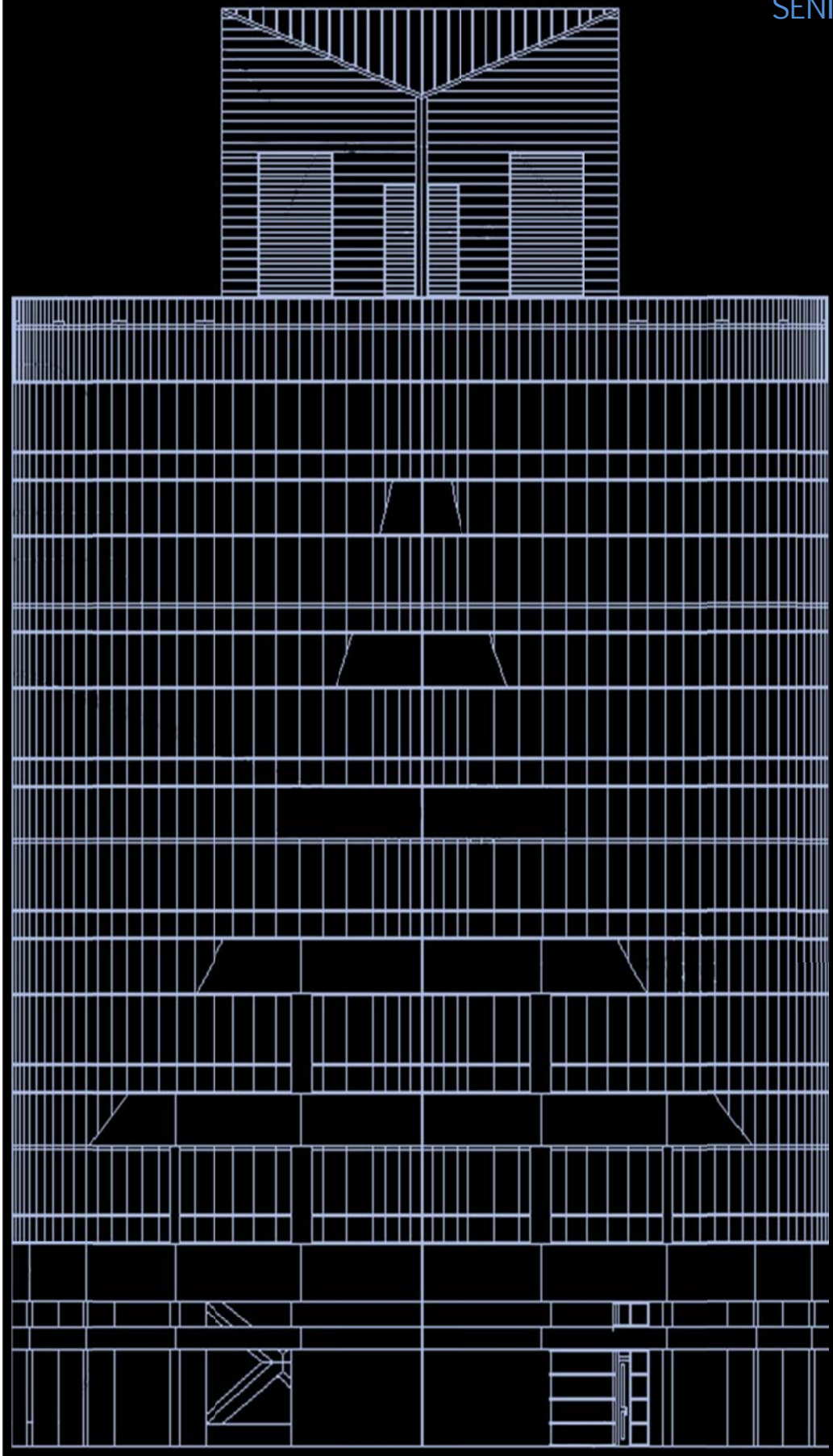

Virginia Advanced Shipbuilding Carrier and Integration Center

Virginia Advanced Shipbuilding and Carrier Integration Center

Newport News, Virginia

Project Team

A/E/M/S: Clark Nexsen

Architecture and Engineering

Building Statistics

Occupancy: Shipbuilding/Office
Size: 241000 sqft
Levels: 8 Max
Construction: 1999-2002
Delivery: Design-Bid-Build
Cost: $58 Million

Alyson Larimer

lighting / electrical

www.engr.psu.edu/ae/thesis/portfolios/2011/azl5017

Architecture

The VASCIC Facility consists of two main building components; the laboratory with integrated parking garage, and the office Tower. The laboratory forms the backbone for the VASCIC facility, which was designed to house assembly and integration of electronics and power systems for aircraft carriers.

Mechanical

The primary air provided to the Laboratory is served from 4 VAV roof top air handling units and the Office is conditioned from the Tower Penthouse. The Penthouse contains 3 VAV air handling units utiliizing oval and rectangular duct.

Structural

The entire facility was built with a precast, prestressed concrete foundation system. The framing system utilizes precast concrete load bearing wall panels and interior columns, or a wide-flange structural steel system integrating braced frames and shear walls.

Electrical

Virginia Power provided four 5MVA pad mounted transformers with secondary voltage of 13800V. Electrical service to the facility enters at the Laboratory wing and is then connected to the Office Tower. The service entrance consists of four seperate switchgear set in main-tie-main configuration. Three 5MVA transformers suppy power to the Laboratory Power Lab and one 5MVA transformer supplies the rest of the VASCIC facility. Normally the tie breaker will be open but may need to be closed to perform laboratory experiments requiring over 15MVA. The fifth 5MVA transformer is designated specifically for the fire pump station.

Lighting

Within the Facilities' buildings, there are multiple functions in a single building. The Office Tower utilizes a task/ambient lighting system. In the conference rooms and display areas, recessed and accent lighting is used. The Laboratory wing contains an auditorium which also utilizes a task/ambient lighting design along with adjustable accent lighting.

Throughout the main laboratory space, a high bay metal halide system is used. Daylighting was alos a consideration in the design process due to the facade materials chosen.

EXECUTIVE SUMMARY

The Virginia Advanced Shipbuilding and Carrier Integration Center is the leading researcher in nuclear-powered aircraft carriers and obtains a well-deserved signature structure that is visible from the distance. The Technology Tower stands approximately 135 feet in the air. The VASCIC Facility is architecturally influenced by water, most importantly, the ship industry. The façade is mainly a curtain wall system with detailing of horizontal precast concrete bands.

This report is a final documentation of the facility primarily focusing on lighting and electrical redesign of four spaces located either in the Technology Tower of the Laboratory Wing. In addition to these two main depths of study, two other breadths of study outside of lighting and electrical design were performed to further enhance the design of the facility. These breadths include an architectural landscape design of an exterior space as well as an acoustical study performed in response to a ceiling material change in the auditorium space.

The lighting depth comprises a redesign of the lighting systems. Prior to finalizing designs, preliminary design concepts and criteria were compiled in order to properly design the lighting for each individual space. Furthermore, surface materials were accounted for when determining where and how to place light throughout the facility. Luminaire layouts, mounting details, performance summaries, and final renderings of each new design are included. The four spaces that were considered for these redesigns are the main lobby, the open office located on the fourth floor of the Technology Tower, the auditorium located on the second floor of the Laboratory Wing, and finally an exterior gathering space that was first designed architecturally.

In response to the lighting design changes, the electrical depth considers the lighting load changes on each panelboard. These changes directly affect the sizing of branch circuits, panelboards, feeders, and protective devices. In addition, voltage drop calculations, short circuit calculations, and a protective device coordination study were conducted to confirm equipment and feeders were properly sized. Furthermore, two electrical breadths were conducted. A motor control center was designed for the laboratory main electrical room to easily compile all the motors of the space in one location for maintenance purposes, as well as a cost analysis of busducts verses conduit and feeders for the Laboratory Wing.

This report is intended to demonstrate an integrative approach to building design process and analysis providing a more comprehensive understanding of the architectural engineering design process.

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PROJECT BACKGROUND

The Virginia Advanced Shipbuilding and Carrier Integration Center is a state-of-the-art facility designed to enhance and promote the quality and competitiveness of the ship building industry. Teams of experts including Northrop Grumman Shipbuilding, electronic system suppliers, software suppliers, U.S. Navy laboratories and program representatives, and many other advanced shipbuilding programs conjure within the VASCIC facility to explore and research new technologies. This facility is the leading researcher in nuclear-powered aircraft carriers, being responsible for the design of Nimitz – and – Ford class aircraft carriers, Virginia – Class attack submarines, U.S Coast Guard Security Cutters along with many others.

There are two main building components of the facility; center stage is a seven-story Technology Tower and adjoining is a three-story Laboratory Wing, which is all situated between 23rd Street and the James River of Newport News. Within the Technology Tower, 400 personnel are situated here primarily for coordination and support of new technologies implemented into aircraft carriers. On each end of the tower there are conference rooms, small meeting rooms, as well as technology displays. The Laboratory wing contains a three-story parking garage, a 180-seat auditorium, a few small offices that overlook the ship building process, modeling and simulation rooms, as well as a few secure video and teleconference rooms. The rest of the space is open laboratory reserved for the ship building process.

BUILDING STATISTICS:

BUILDING NAME: The Virginia Advanced Shipbuilding and Carrier Integration Center

LOCATION AND SITE: 2401 West Avenue, Newport News, Virginia

BUILDING OCCUPANT: Northrop Grumman Newport News Shipbuilding

BUILDING FUNCTION: Commercial Office/Research and Design

SIZE: 241,000 sq. ft.

NUMBER OF STOR IES: 7 story Office Tower

3 story Laboratory Wing

PRIMARY PROJECT TEAM:

OWNER: Clark Nexsen Architecture and Engineering

http://www.vascic.com/

ARCHITECTS: Clark Nexsen Architecture and Engineering

http://clarknexsen.com/

STRUCTURAL ENGINEER: Clark Nexsen Architecture and Engineering

http://clarknexsen.com/

MEP/FIRE PROTECTION: Clark Nexsen Architecture and Engineering

http://clarknexsen.com/

CIVIL ENGINEER: Clark Nexsen Architecture and Engineering

http://clarknexsen.com/

CONSTRUCTION/GENERAL CONTRACTOR: W.M Jordan Company

http://www.wmjordan.com/

DATES OF CONSTRUCTION: December 1999 – February 2002

ACTUAL COST: $58 million building cost

PROJECT DELIVERY METHOD: Design – Bid – Build

ARCHITECTURE:

Design:

The VASCIC facility consists of two main building components; the Technology Tower and the Laboratory Wing. The laboratory forms the backbone for the VASCIC facility, which was designed to enhance the competitiveness of the shipbuilding industry. The VASCIC facility is the leading researcher in nuclear-powered aircraft carriers and therefore deserves to obtain unique architecture style. From an elevation standpoint, the Technology Tower appears to be a ship sailing through water. Reflecting pools surround the ground floor and extend past the building edge to further enhance the appearance of a ship in water. Additionally, precast concrete bands are placed horizontally up the building in a rhythm that imitates the contours water would possess as a ship sails through water.

Codes:

BOCA National Building Code, International Mechanical Code, International Plumbing Code, NFPA 70 National Electric Code, ASME A17.1-93 Safety Code for Elevators and Escalators.

Historical Requirements: Not Applicable

Building Envelope:

Through the utilization of different façade materials, there is a distinct visual separation between the two main functions of the building. The office tower is enclosed primarily of curved reflective glass panels of two main glass types (below), IG-2 and IG-3. Type IG-2, the larger glass panels, are reflective insulated glass manufactured by Viracon with visible light transmittance of 12%, a winter u-value of 0.40, a summer day u-value of 0.46, a solar gain coefficient of 0.17, and an outdoor visible reflectance of 32%. Type IG-3, the smaller bands of glass panels, are ceramic-coated spandrel insulating glass with a medium gray frit pattern. Also integrated into the front façade of the building are sections of pre-cast concrete that are lightly sand blasted for texture.

The research and laboratory wing connected to the office wing has a façade primarily made of tilt-in-place insulated concrete wall panels that are lightly sand blasted with recessed pre-cast concrete panels that are heavily sand blasted. The view shown above is a typical east or west bay that contains glazing and pre-cast concrete sections. The glazing, like the office tower, consists of two different types of CSG-1 and IG-3. Type CSG-1 is a low emissive insulating glass also manufactured by Viracon. Its visual light transmittance is not less than 70%, winter night u-value of not more than 0.29, summer day u-value not more than 0.28, solar heat gain coefficient of not more than 0.37, and outdoor visible reflectance of 11%. Type IG-3 is the same ceramic-coated spandrel insulating glass as used for the office tower façade.

The roofing of the two building sections is rather simple and less complex as the façade. The office tower utilizes EPMD on the roof while the research laboratory is a painted sloping metal roof deck. All exposed metal is required to be painted with color fluoropolymer or a polyester finish.

ELECTRICAL:

Power to the Virginia Advanced Shipbuilding and Carrier Integration Center is provided directly from Virginia Power at 23,000 volts in plastic conduit encased in concrete. At the service entrance, five transformers are present. Virginia Power is responsible for all five transformers, two Square D Powerlogic metering equipment, and one switchgear. Four transformers are utilized for facility power each pad mounted and rated at 5 MVA, 23.0/12.2 KV, Y primary, and 13.8/7.9 KV, Y secondary. The fifth transformer is designated for the fire pump which is also pad mounted and rated at 23.0/13.2 KV, Y primary, and 480Y/277 secondary.

The service entrance is located outside of the Laboratory/Parking Building in the South East section of the building. The main switchgear SGA is located here and is connected to the secondary switchgear SGB inside the Laboratory/Parking Building in the Electrical Integration Lab. Switchgear SGA is a metal clad type with draw out vacuum circuit breakers rated at 15 KV, 500 MVA, 1200 A continuous current and switchgear SGB has draw-out type DS power circuit breakers. These two switchgears are connected through underground conduits utilizing four sets of 15 KV cables that are plastic conduit encased in concrete. Switchgear SGB is in main-tie-main configuration which is left open for the majority of the time. It is only closed when specialty testing in the Laboratory is being conducted to provide a common 10 MVA to the facility. Switchgear SGB distributes power to switchboards SBPA, SBPB, and SBPC. Switchboard SBPA distributes power to another smaller switchboard TSB in the Office Tower. Switchboard TSB distributes power to the left hand side of the Office Tower while switchboard SBPB distributes power to the right hand side via distribution panel PDP. It also distributes power to the main mechanical equipment located on the rooftop penthouse of the Office Tower. Switchboard SBPC distributes power to all lighting and receptacle loads utilizing a bus duct riser system in the Electronic Integration Lab.

LIGHTING:

The lighting utilizes lamp types of linear fluorescent, compact fluorescent, incandescent, halogen, metal halide, and high intensity discharge. Linear fluorescent ballasts are multi-lamp electronic type with total harmonic distortion rating less than 20%. Compact fluorescent ballasts are electronic type with power factor greater than 90%. High intensity discharge ballasts are constant wattage autotransformer single-lamp type with starting temperature at a minimum of -22 degrees Fahrenheit.

The Auditorium contains an extensive dimming control system to cater to the needs of the occupant. The dimming system contains three lighting scene controllers, two dimming panels, and three entry controllers.

The lighting scene controllers contain a four scene preset module and a separate four scene accessory control allowing for a total of eight scene presets. The preset module has eight control zones with a raise/lower switch to control each zone separately. These modules are Grafik Eye 4000 Series manufactured by Lutron.

Each dimming panel has main lugs for incoming power, a 20 A single-pole circuit breaker for each zone, plug-in dimmer cards, and filter chokes. The dimming cards are capable of dimming electronic fluorescent ballasts and incandescent loads.

The three entry controllers are two-button, single scene ("on"/"off"), that are Grafik Eye NTGRX-2S series manufactured by Lutron.

MECHANICAL:

The Office Tower primary air is provided by the penthouse mechanical room located on the roof that houses 3 VAV AHU's. The required primary air is provided through round or oval duct utilizing a vertical chase.
The Laboratory/Parking Building primary air is provided by 4 VAV AHU's located in the center of this building. The required primary air is provided through galvanized, round straight runs of duct to each end of the Laboratory.

The estimated cooling load for the entire facility is 1000 tons provided by high efficiency water cooled centrifugal chillers. The design consists of one 350 ton chiller and one 650 ton chiller with a 12 degrees temperature difference.

The estimated heating load for the entire facility is 7,500,000 btu/hr. A gas hot water system is utilized with gas fired boilers that are high efficiency condensing type to generate hot water. This hot water is distributed throughout the facility by two way valves at heating coils and perimeter hydronic heat at glass wall locations.

STRUCTURAL:

The foundation system for both the Technology Tower and the Laboratory Wing is a deep foundation system consisting of precast, pre-stressed concrete driven piles. The sizes and lengths of the piles are based on the required load capacities. The piles support a concrete pile cap and grade beam system that supports each building superstructure. The material of the concrete piles and foundation is 5000 psi minimum compressive strength concrete.

The flooring system of the Laboratory Wing is constructed of precast, pre-stressed concrete double “tees” spanning (+/-) 60 feet, supported by precast, pre-stressed concrete beams. The load capacity of the floor system is 300 psf, based on criteria provided by Newport News Shipbuilding. A concrete topping slab is placed over the double “tees”. The flooring system of the Technology Tower is a composite system consisting of a formed steel deck with a concrete infill supported by structural steel beams. Each beam as steel studs welded to the top flange as required to achieve the composite action with the concrete deck. The double “tee” material is 6000 psi minimum compressive concrete and the structural slab is 5000 psi minimum compressive strength concrete.

FIRE PROTECTION:

The sprinkler system is based on the height of the Technology Tower and is required to have a fire pump station. The fire pump is electric motor driven and includes a controller that is a power transfer switch for connection to the facility generation in emergency situations. The sprinklers throughout the facility are pendant heads where suspended ceilings are utilized and upright sprinkler heads where exposed ceilings are utilized.

The fire alarm system is an automated detection system including smoke detectors, duct smoke detectors, and a sprinkler system. In spaces of assembly type occupancies, voice automated fire alarm systems are utilized.

COMMUNICATION SYSTEMS:

Access Control:

Access to the facility is controlled by a card access system. Car readers are either swipe or proximity type and are located on the entrance side of all exterior doors. Exit monitoring is not required in the facility. Access to the parking facility is controlled by card readers and motorized gates. This entire security system is placed on uninterruptible power supply.

Another component of the access control system is video imaging system integration. This integration system provides a single database on the main host computer of every cardholder data and image fields; including photo, fingerprint, and signature.

CCTV:

A closed circuit television system is provided to monitor the parking facility and entrance doors. Monitors are located in the reception/security desk on the ground floor of the Office Tower. Both the CCTV System and Access Control System are part of the main security system of the facility.

CCTV equipment include video cameras, camera outlets and controls, monitors, signal-processing equipment, control stations, distribution components, and videotape recorders to generate video images for processing and distribution.

Telecommunications:

The main telecommunications room is located in the Facility Support Wing of the Office Tower. Each floor of the Office Tower contains a telecommunications room on either end of the floor. Each room has a 19: rack with modular patch panels housing multiple connections. In these rooms are 20 amp emergency disconnects and voice/data outlets designated for administrative LAN lines. There are also separate outlets for voice only. Horizontal wiring connected to each work station is installed in cable trays above the lay-in ceiling tile system. Cable extends from the ceilings down the columns to connect system furniture to power.

LIGHTING DEPTH

INTRODUCTION:

The Virginia Advanced Shipbuilding and Carrier Integration Center is situated along one of the most influential components of the architecture and lighting design of the facility, water. Being the leading researcher in nuclear powered aircraft carriers, the state-of-the-art facility must obtain visual authority not only through the architecture, but also through lighting. It is important to have interesting, yet practical design in this situation because the buildings are not accessible to the public.

The lighting design throughout the facility will follow the concept of water, from a literal and design stand point. Situated along the James River, the Technology Tower appears as a sailing ship cutting through water, being reinforced by reflecting pools surrounding the main entrance to the lobby on the ground floor. Because there are multiple visual components reflecting the concept of water, the objective is to reflect the characteristics of water through the lighting design. By understanding how water actually benefits, or controls us rather, is how the schematic design process was approached. Recognizing that a human can only walk where water is not, and a ship can only sail where it is present represents the big picture of where to place lights throughout the four design spaces. The lighting is designed to control you in the exact way that water controls humans and sailing ships. It is designed such that the user can easily define where to go or what to focus on in that particular space. Different elements and designs were utilized in each space in order to easily execute the task at hand. In addition, different materials and surfaces were emphasized, disregarded, or changed in order to create contrast allowing for key elements to stand out among the rest of the surroundings.

The four spaces to be analyzed and redesigned will include:

1. Circulation Space | Lobby and Main Staircase
2. Large Work Space | Open Office
3. Multi-Purpose Space | Auditorium
4. Exterior Space | Gathering Space Design

Each space will include a space description, preliminary design concepts, surface materials, design criteria and considerations, luminaire equipment schedule, light loss factor classifications, luminaire mounting details where applicable, performance and calculation summary, renderings, concluding with a final evaluation of the space.

The architectural lighting for these spaces must be designed to meet the established design criteria, both quantitatively and qualitatively. This will encompass guidelines from IESNA Handbook 9th Edition and ASHRAE Standard 90.1. The lighting analysis for each space will include a summary of the space, design criteria and considerations, a luminaire equipment schedule, light loss factors, lighting plans, pertinent details, performance data, and renderings.

CIRCULATION SPACE | LOBBY AND MAIN STAIRECASE

SPACE DESCRIPTION:

The main lobby to the facility is located on the ground floor of the Technology Tower. It is the only asset to the building placed on the ground floor due to the high water table of the area. Located within the lobby are one main entrance, two side entrances, and main staircase and elevator column that runs vertically through the building. It occupies approximately 2,981 square feet with a ceiling height of 13' 6" as the main staircase extends through the ceiling up into the second floor where a technology display is located.

Influencing the accessibility into the lobby, reflecting pools surround the lobby to contribute to the design influence of the facility. As you walk between the reflecting pools along the east side of the building to the entrance, you are greeted by the reception desk as well as the over-sized main staircase.

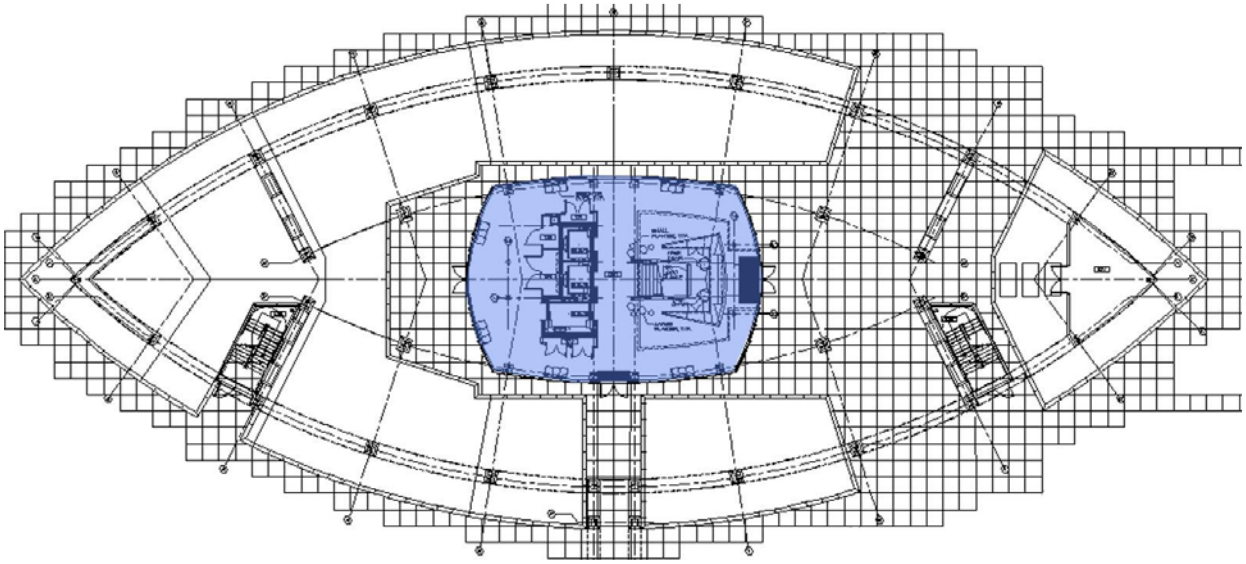


Figure 1.1: Lobby Floor Plan

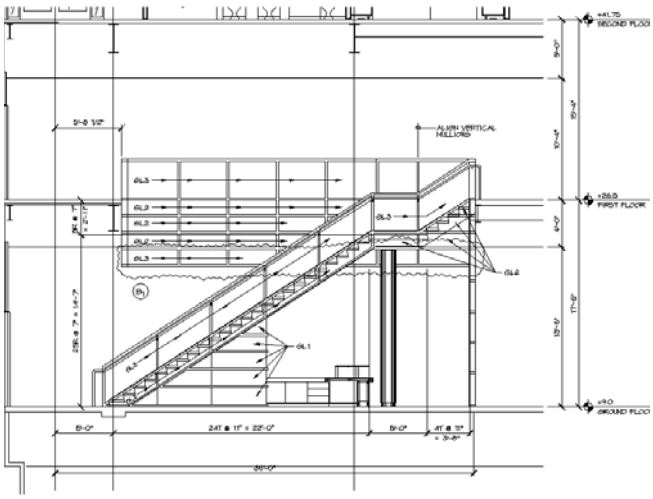


Figure 1.2: Lobby Stair Section

SCHEMATIC DESIGN:

Beginning the schematic design phase, recognizing the task of the space is focused on. By highlighting the two circulation elements, the grand staircase and elevator column, within the space would provide the user with a highly recognizable path to traverse vertically through the building. Also, generally highlighting the receptionist desk is important. However, since more employees will enter compared to visitors, no special lighting was addressed.

In order to create a visual circulation path, washing vertical surfaces opposed to illuminating the horizontal surfaces demonstrated this concept. Washing frosted glass surrounding the staircase, washing columns around the perimeter, and washing four walls enveloping the elevator creates a sense of height and direction. Washing frosted glass also occurs around the opening in the ceiling to the second floor. Both instances of washing the perimeter columns and elevator bank are intended to appear as though they are piercing through the ceiling into the floor above. This is done by creating openings surrounding the elements at the ceiling level to recess luminaires while concealing them from the observer's eye. Additional downlighting throughout the space is utilized for safe circulation while in the space as well as security purposes.

Figure 1.3: Lobby Preliminary Schematic

SURFACE MATERIALS:

MATERIAL SCHEDULE		
SURFACE	DESCRIPTION	PROPERTIES
Exterior Wall	Clear, insulated curtain wall glass	τ=0.85
Interior Walls	Grey paint, matte finish	ρ=0.78
Stair riser/tread	Marble	ρ=0.19
Stair Railing	Aluminum	ρ=0.21
Stair Glass Infill	Translucent glass	ρ=0.43
Floor	Marble	ρ=0.19
Desk	Marble	ρ=0.19
Desk Glass Infill	Translucent Grey Glass	ρ=0.43
Ceiling	2 x 4 ACT	ρ=0.64

DESIGN CRITERIA + CONSIDERATIONS:

Task Considerations

Throughout the lobby space, there are many tasks that must be considered, and therefore properly illuminated. Since it is classified as a circulation space, the primary task planes that must be illuminated include the main flooring as well as the staircase. Additionally, a reception desk is present within the space and, too, must have the task plane illuminated accordingly. There are three entrances from the exterior into the lobby. One entrance is treated as the main entrance; however the other two entrances need to be illuminated in order to be noticed as well.

Because the entire lobby of the Technology Tower is enclosed in a curtain wall system of clear insulated glass, it is important to be sure there is no glare or reflections present on the glossy marble floor. Although the upper six floors of the Technology tower overhang the lobby exterior walls by 26'9", it is still important that daylighting does not affect the user's ability to see their pathway.

Quantitative visual Performance

General Lobby:

- Horizontal: 10 fc
- Vertical: 3 fc

General Stairs/Corridor:

- Horizontal: 5 fc

Overall Room Brightness

Considering the design concepts of the lobby space, contrast throughout the lobby is desired. The lobby will have an overall illumination to it; however the key elements of the space will appear to stand out more. In addition, the overall feel of the lobby is cool and appearing crisp and modern. Materials and surfaces throughout the lobby are very smooth, some being dull to the eye; therefore utilizing higher color temperatures emphasizing white or light colored elements to achieve the desired feel.

Lighting Controls

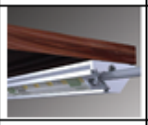
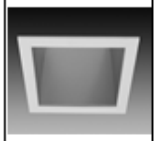
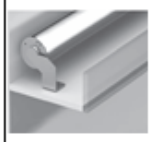
The Technology Tower is only in operation from 8am until 5pm. During times of occupancy, the lighting in the lobby will remain on. When the building is generally not in use, only mandatory lighting will be utilized to reduce energy costs. Multiple switches for the space will be located at the reception desk for easy controllability.

ASHRAE 90.1 | Power Density Allowance

The lighting power density required by ASHRAE 90.1-2007 Section 9.6: Space-By-Space Method for lobby areas is 1.3W/ft^2.

TYPE	FIXTURE QUANTITY	FIXTURE WATTAGE	TOTAL WATTAGE	UNITS
DN	24	21.6	518.4	WATTS
HR	18	11	198	WATTS
TS	8	19.8	158.4	WATTS
CW	21	64	1344	WATTS
EC	14	42.1	589.4	WATTS
		TOTAL SQ. FT.	2981	SQ.FT.
	TOTAL LPD ALLOWABLE		1.3	W/FT^2
		TOTAL LPD	0.37	W/FT^2

LUMINAIRE EQUIPMENT SCHEDULE:

TYPE		MANUFACTURER	CATALOGUE NUMBER	DESCRIPTION
DN		Focal Point	FL44-13LED-L30-120-SO-T L44-S0-DN-TD-TS	4.5" X 4.5" downlight LED module with remote phosphor technology, powered by Philips' Fortimo LED and AdvanceXitanium LED driver, aluminum heat sink incorporated into die-cast aluminum housing, clear acrylic reflector cone for superior brightness control and 55 degree cutoff, easy replacement, 70% luminaire efficiency.
HR		iO by Cooper Lighting	0.06.SSS.2.PM.NR.65.3K.GB3.120	Handrail integrated LED chips delivers functional outputs effectively illuminating paths of egress, available in two rail diameters and three beam spread angles, constructed of steel and aluminum, practical for indoor and outdoor applications, ADA and ANSI compliant, proper LED thermal management in accordance with LED manufacture specifications, generally provided in
TS		iO by Cooper Lighting	0.09.I.3K.NG.1.6.1.1	1.39" W X .66" D X 36" L shelf integrated task light, LEDge is a part of the iO linear LED-based family, low voltage, neoprene gasketed, housing made of extruded aluminum, finished in anodized
CW		Focal Point	FL44-13LED-L30-120-SO-T L44-S0-TD-TS	4.5" X 4.5" wall washing LED module with remote phosphor technology generating high system efficacy, luminaire design maintains form factors, lumen output, and thermal management for module and driver components, intelligent driver technology, flicker free. Housing made of die-cast aluminum incorporated with an angled MicroGlow lens redirecting light delivering asymmetric
EC		The Lighting Quotient	S301-R06G-S-00-1-00-0-30-00	Cove LED system of extruded aluminum integrated with proper heat sinks, impact-resistant extruded acrylic lens and holographic diffuser, rotating/locking hinges to allow for proper alignment, Philips Lumiled LUXEON LEDs, remote driver in aluminum enclosure, mounting L-brackets can be interlocked for continuous acting luminaire, luminaire provides uniform asymmetric distribution utilizing reflection and inter-

*See Appendix A | Lighting for full luminaire fixture schedule.

LIGHT LOSS FACTORS:

CALCULATIONS					TOTAL LLF
TYPE	MAINTENANCE CATEGORY	BALLAST FACTOR	LUMINAIRE DIRT DEPRECIATION	LAMP LUMEN DEPRECIATION	
DN	Clean	1.0	0.93	0.70	0.651
HR	Clean	1.0	0.93	0.70	0.651
TS	Clean	1.0	0.93	0.70	0.651
CW	Clean	1.0	0.93	0.70	0.651
EC	Clean	1.0	0.93	0.70	0.651

*Assumptions: Clean environment with 18 month cleaning cycle, calculations performed using IESNA 10th Edition 2011.

LIGHTING PLAN:

*See Appendix A for Lighting Plan.

DETAILS:

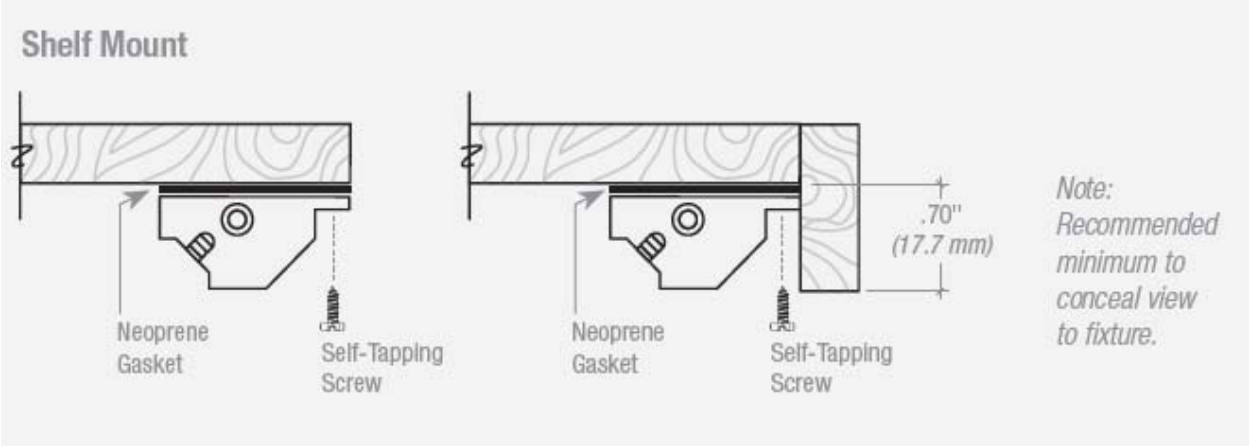


Figure 1.4: Lobby Desk Task Light Mounting Detail

Figure 1.5: Lobby Handrail Detail

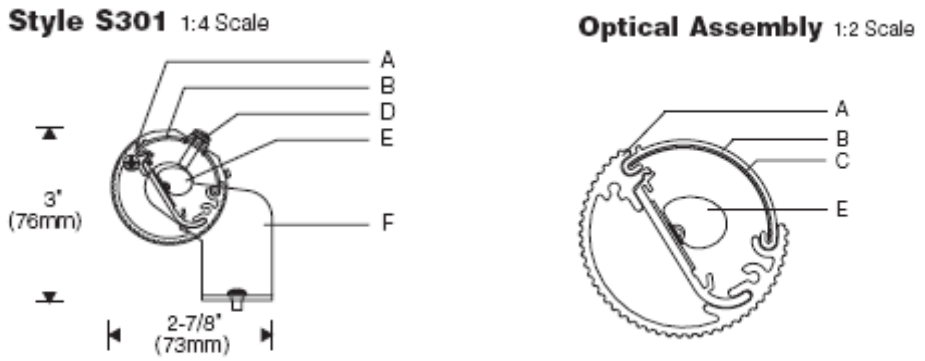
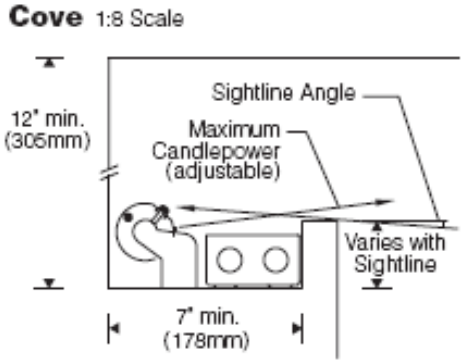


Figure 1.6: Lobby Elevator Optical Assembly Detail



Specifications

- **A** Extruded aluminum exterior, heat sink/ housing
- **B** Impact-resistant extruded lens
- **C** Holographic diffuser
- **D** Rotation locking tab/ screw
- **E** Removable light engine assembly with fraqtir™ acrylic refractor
- **F** L-shaped mounting feet, one pair per optical assembly (fasteners by others)
- **G** Remote driver in aluminum enclosure

Figure 1.7: Lobby Elevator Cove Detail

PERFORMANCE DATA:

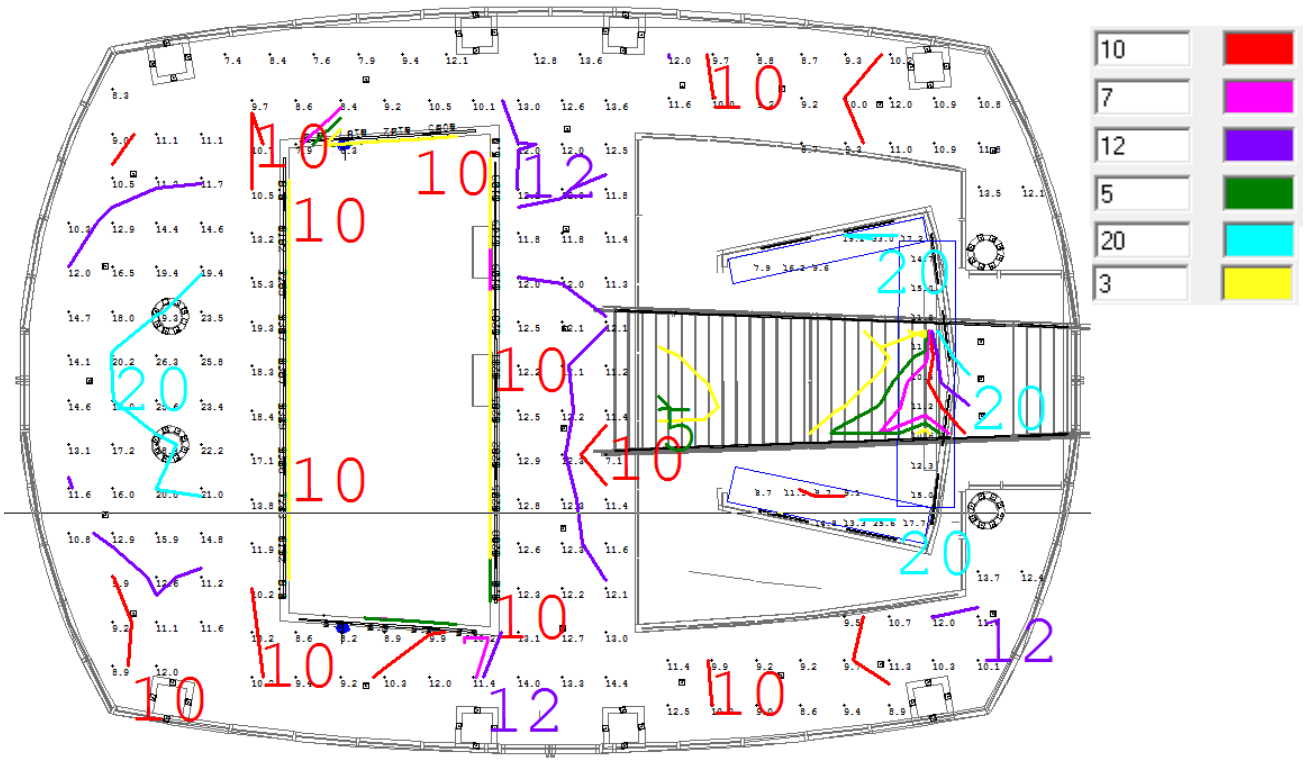


Figure 1.8: Lobby Floor Plan Isometric Contour Lines

Figure 1.9: Lobby Exterior RGB AGi32 Render

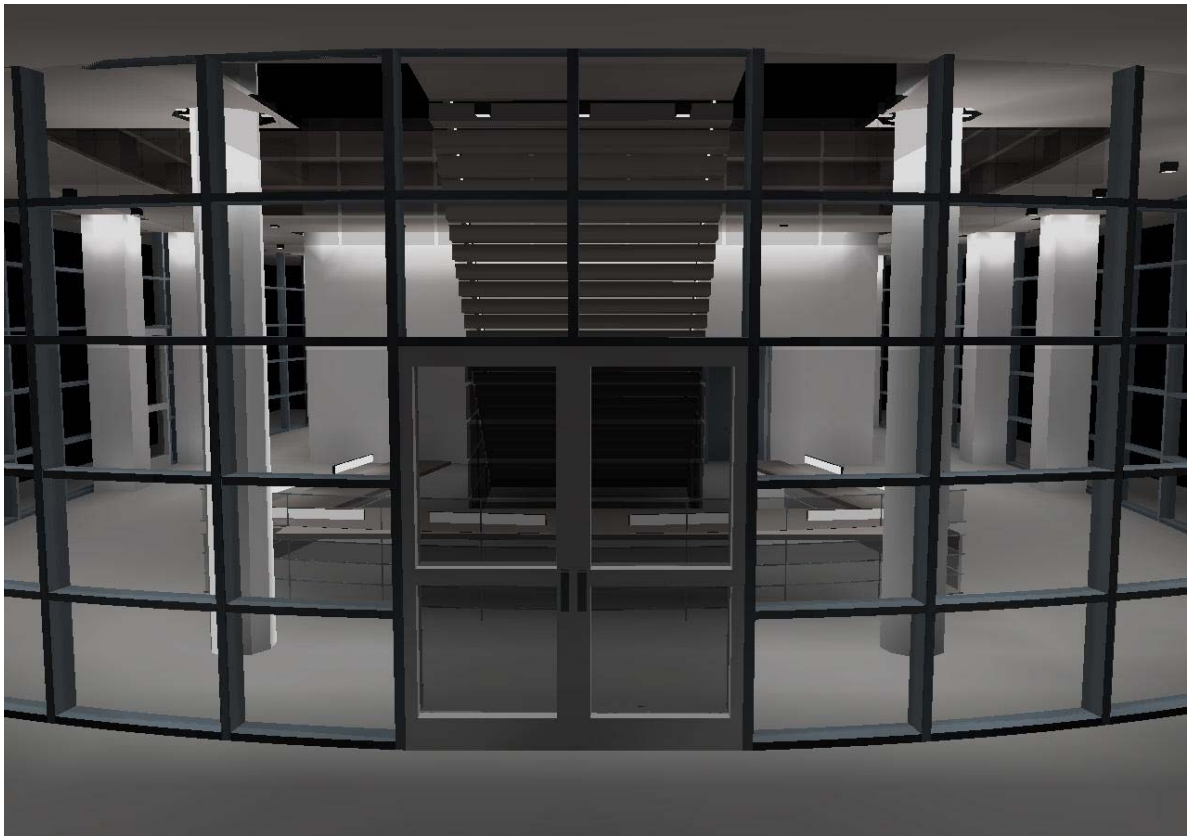


Figure 1.10 Lobby Main Entrance RGB AGi32 Render

Figure 1.11: Lobby Horizontal Exterior RGB AGi32 Render

Figure 1.12: Lobby Interior Stair/Elevator RGB AGi32 Render

Figure 1.13: Lobby Elevator Column RGB AGi 32 Render

Figure 1.14: Lobby Exterior RGB AGi32 Render

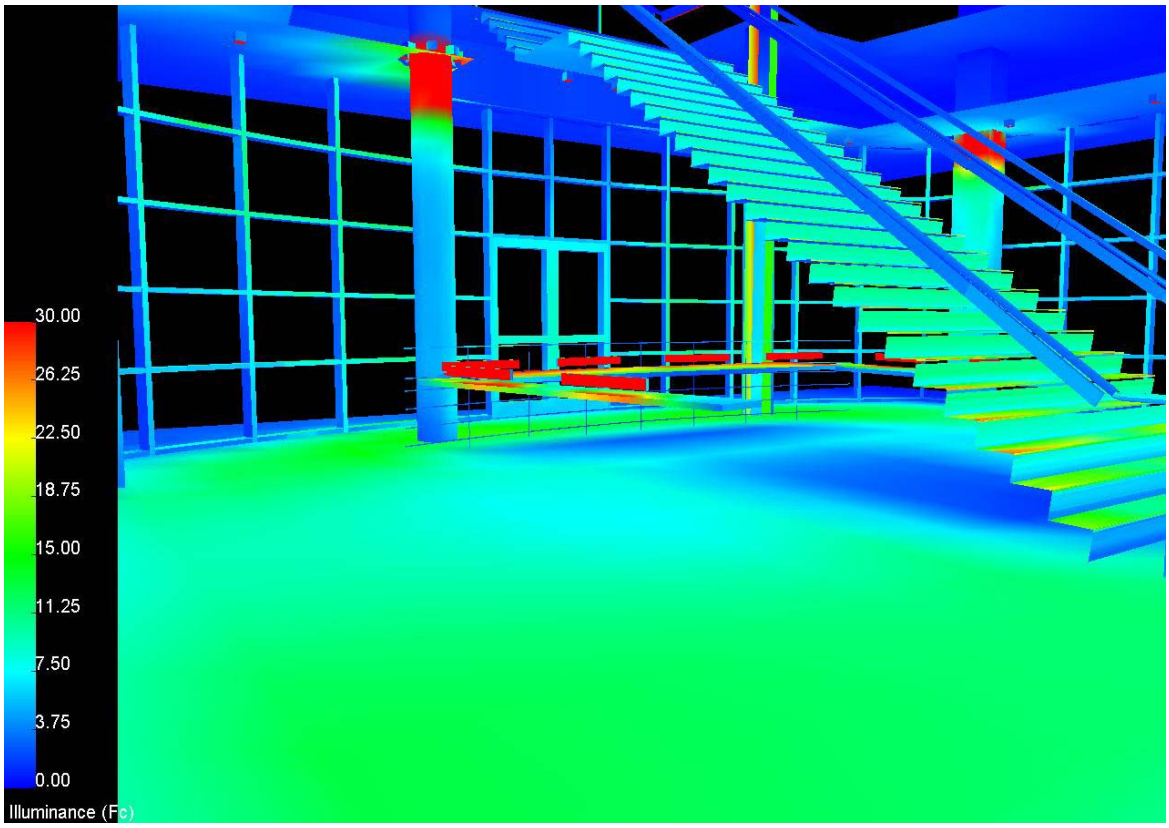


Figure 1.15: Lobby Pseudo Color AGi32 Render

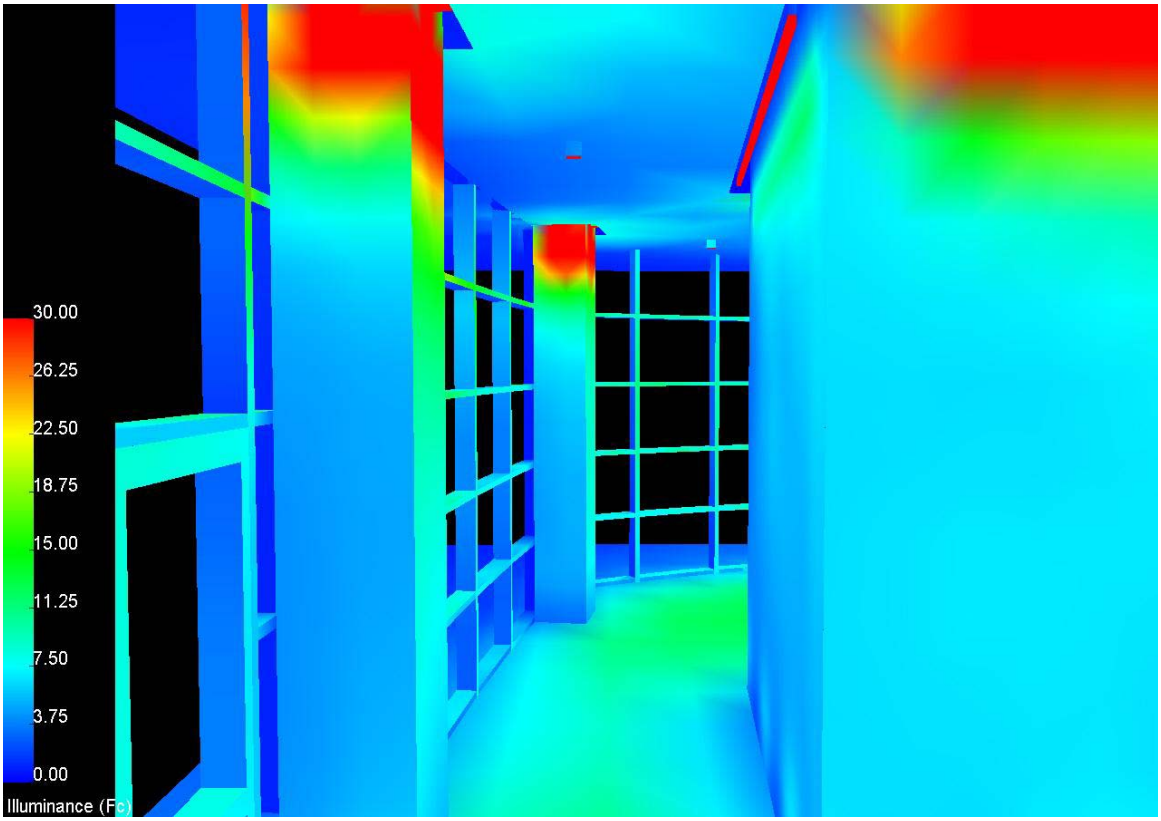


Figure 1.16: Lobby Side Pseudo Color AGi32 Render

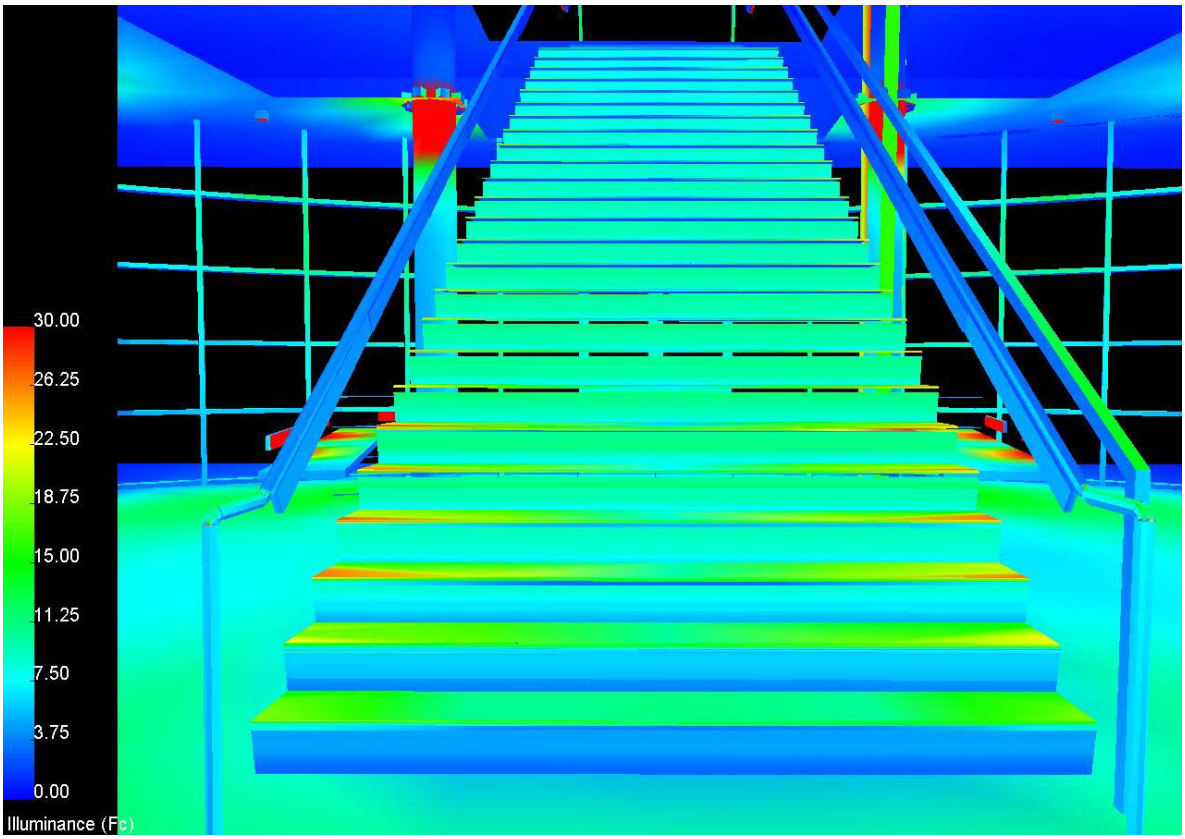


Figure 1.17: Lobby Interior Pseudo Color Render

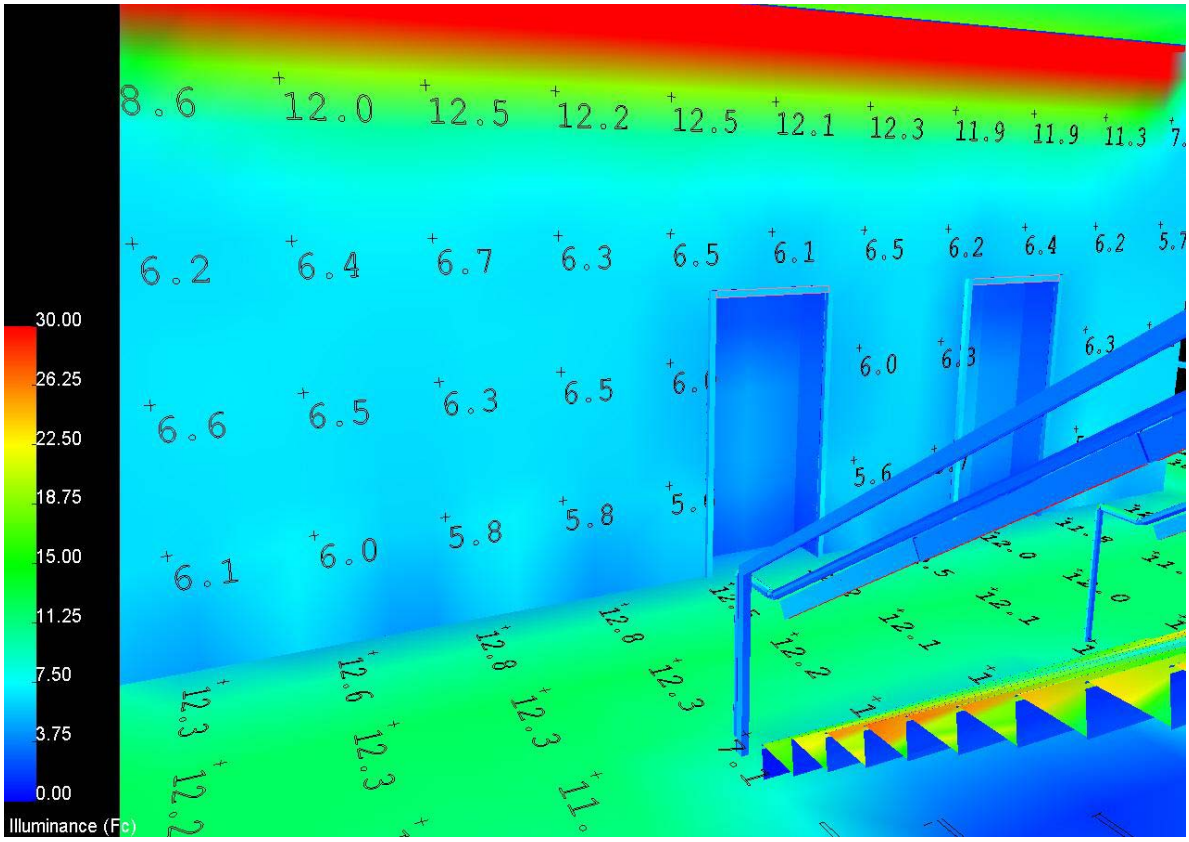


Figure 1.18: Lobby Interior Pseudo Color Render

FINAL RENDERINGS:

Figure 1.19: Lobby Exterior Final 3ds Max Render

Figure 1.20: Lobby Interior Final 3ds Max Render

Figure 1.21: Lobby Stairs and Elevator Column Final 3ds Max

CALCULATION SUMMARY:

Lobby Calculation Summary					
	Desk	**Stairs**	**Floor**	**Elevator**	**Columns**
Avg. Illuminance	14.4	6.0	11.68	5.94	6.3
Avg/Min	1.64	6.67	3.50	4.43	12.8
CRITERIA	10.0	5.0	10.0	3.0	3.0
COMPLIANCE?	YES	YES	YES	YES	YES

EVALUATION:

Utilizing all LED sources, the lobby redesign adequately illuminaites all important features. In addition, hierarchy of light was addressed creating contrast within the space to achieve the design goals. Light was strategically placed throughout the lobby in order to direct occupants attention, mainly the staircase and elevator column. By illuminating each of these elements correctly, visitors are able to identify where to go from the exterior due to the lobby envelope consisting of a clear glass façade. Once you have entered the space, large columns are washed with light downlight wall washers recessed in a cove system to conceal the luminaire. This technique of washing highlights the vertical component of the space and demonstrates contrast between itself and the glass façade it sits adjacent to. As you approach the reception desk, self-illuminating panels outline the contours of the desk. Also, integrated LED task lighting is mounted on the underside of the top tier countertop illuminating the desk top. As you approach the center of the lobby, the elevator column is washed with a cove system and the stairs are illuminated utilizing an integrated LED handrail system. Throughout the rest of the lobby, square downlights are utilized providing general illumination on the floor.

After performing calculations, the lighting design provides adequate illuminance values for safe circulation complying with IESNA recommendations. In addition, lighting power densities provided by ASHRAE Standard 90.1-2007 requirements were met. The space provides an good first impression to visitors while maintaining a practical lighting design.

LARGE WORK SPACE | OPEN OFFICE

SPACE DESCRIPTION:

The open office spaces are located within the Technology Tower on floors three through six. Each floor houses 80 cubicle work stations occupying 12,752 square feet total with a ceiling height of 9'4". The open office space is separated by two interior column lines allowing 40 cubicle work stations in 6,376 square feet on each side. Directly in the center of each floor is the center column of movement with two elevators and a main staircase led up through the building from the lobby. Two additional staircases are located on either side of the open office.

The entire Office Tower is enclosed in a glass curtain wall system that contains two different glass types manufactured by Virakon. Originally, the curtain wall system obtained mirrored insulating glass in the middle pane with a grey fritted glass above and below of smaller panes. Because the transmittance value was only 12% for both curtain wall components, new low-e insulated fritted glass was chosen with the same solar heat gain coefficient with a higher transmittance value of 39% for the top and bottom portions and 30% for the middle glass section.

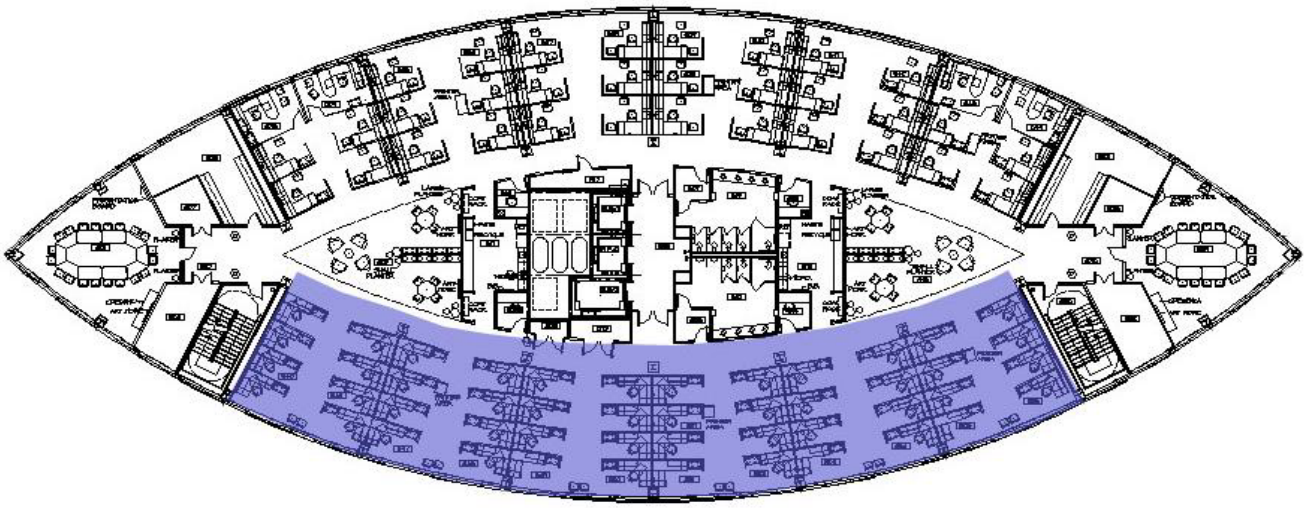


Figure 2.1: Open Office Floor Plan

SCHEMATIC DESIGN:

Preliminary designs began with utilizing a task-ambient lighting system. In addition, illuminating vertical surfaces as well as the ceiling creates an open and comfortable environment for the occupants. Because the entire Technology Tower envelope is a curtain wall façade system, daylight infiltration of the space is a large concern not only for control purposes, but also in regards to the occupant. It is important to be sure there is not irritating glare or veiling reflections to the occupant.

The open office space was originally designed to utilize indirect pendant fixtures with a small component of direct light along with integrated task lighting along the cubicle walls. In addition, sconces were placed on opposite sides of the interior column lines surrounding the central column of travel.

The final lighting design of the space uses the Tambient system from The Lighting Quotient with integrated daylight harvesting for cubicles located along with curtain wall. Also, shading devices will be necessary to reduce unwanted glare throughout the year. Like the preliminary design, sconces are placed on the interior columns. Because the design intent of the space is to create an open and spacious work environment, a cubicle redesign lowered the height while implementing a 3' glass element along walls with adjoining cubicles.

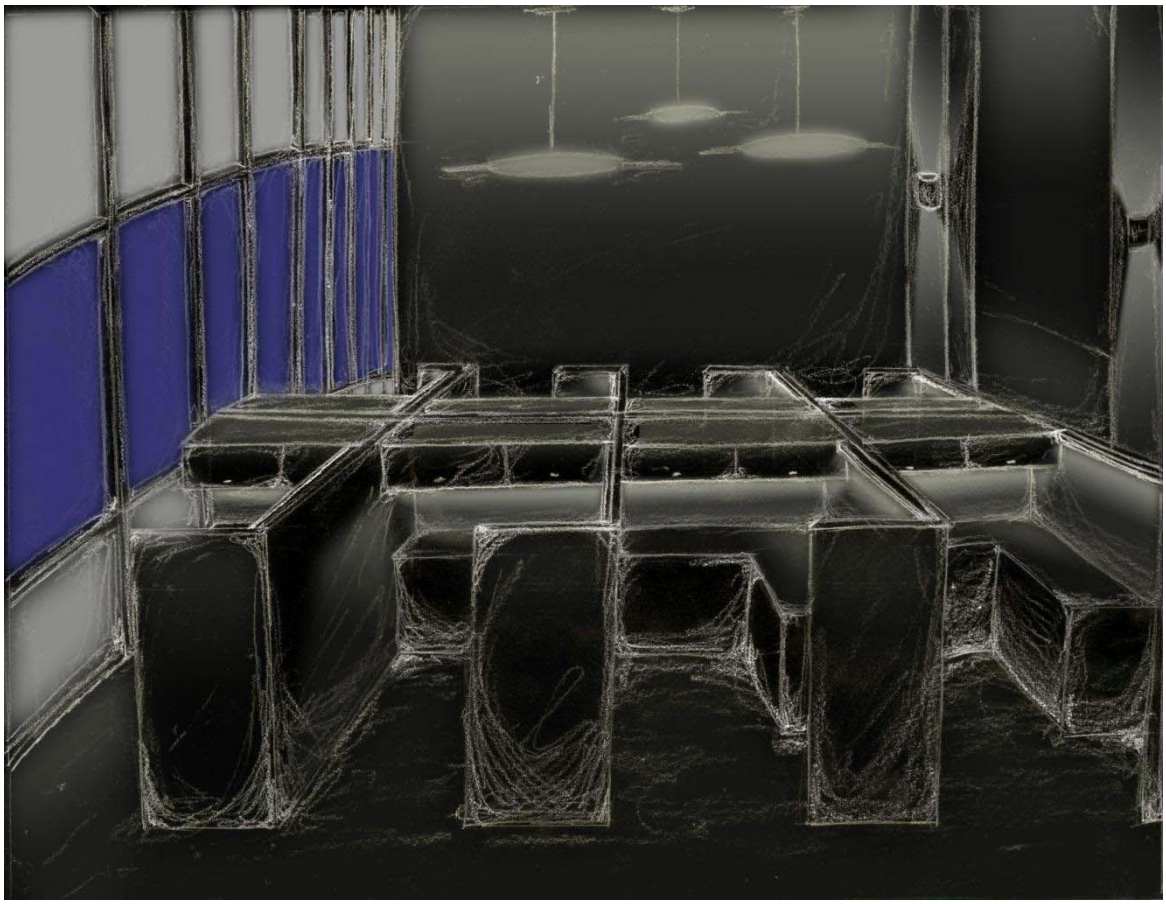


Figure 2.2: Open Office Preliminary Lighting Design

SURFACE MATERIALS:

MATERIAL SCHEDULE		
SURFACE	DESCRIPTION	PROPERTIES
Floor	Navy carpet	ρ=0.12
Lower Cubicle Partition	Medium Green Paint	ρ=0.60
Upper Cubicle Partition	Frosted glass	ρ=0.75
Desk Top	Medium grey desk top	ρ=0.67
Upper/Lower Curtain Wall Panel	Low-e insulating fritted glass	ρ=0.39
Middle Curtain Wall Panel	Low-e insulating fritted glass	ρ=0.30
Ceiling	2'x4' ACT	ρ=0.73

DESIGN CRITERIA + CONSIDERATIONS:

Task Considerations

There are many factors to consider in a lighting design for a task-oriented space such as an office. Uniformity on the task plane is most important in order to not cause unwanted shadows. Patterns of light can affect visibility, comfort, and perception of the task plane. Reflected glare and veiling reflections are also are a large contributor to decreased task visibility. In addition to uniformity, the task plane should have a higher illuminance than surrounding surfaces; however, too much illuminance can cause visual fatigue. When workstation task planes are illuminated higher than their surroundings, occupants are drawn to their work and experience fewer distractions. Other lighting design issues include direct glare, vertical illuminance, and room surface luminances.

Quantitative Visual Performance

- Horizontal | 40 FC
- Vertical | 5 FC
- Uniformity | 1:4

Overall Room Brightness

Highlighting vertical surfaces as well as the ceiling can create an environment with an open feeling contributing to a pleasant and functional work space for the occupant. Utilizing a direct/indirect luminaire can contribute to the overall brightness of the room by highlighting the ceiling while illuminating the task surface at the same time. However, it is important to consider hot spots on the ceiling generated by the indirect component. The direct component should provide diffuse lighting and adequate shielding for good visual comfort while avoiding glare.

Lighting Controls

Because the Office Tower is completely enclosed in a curtain wall system, it is important to consider solutions preventing discomfort to the occupant. Two types of fritted glass are used with differing transmittance values to accommodate for glare that may occur on the task plane. The top and bottom glass is a grey fritted low-e glass with a transmittance value of 39%. The middle portion of the curtain wall is a low-e insulating glass with transmittance value of 30%. In addition to the fritted glass, photosensors and occupancy sensors will be incorporated with the luminaires throughout the open office. Shading devices will also be necessary because of the building's west facing orientation.

The Tambient system from The Lighting Quotient offers a control hub called the Tambient Control Hub that mounts to the underside of workstations. This control hub can control up to 50 dimming ballasts through five ports on the backside of the hub. Each zone of luminaires is controlled in unison, however all the control hubs can be networked together to be controlled as one uniform zone. Each hub is plug-and-play with the luminaires that are connected to it. The Tambient Control Hub communicates with the photosensors and occupancy sensors wirelessly utilizing the EnOcean wireless protocol. The sensors themselves are wireless modules with dual solar cells and utilize self-sustaining power capabilities by operating off the energy generated from a click of a light switch. One photosensor and occupancy sensor is able to communicate with more than one control hub. Each sensor has a 98.5' range typical for indoors and each control hub can control up to a range of 150'; through doors, partitions, ceilings, and furniture. Further information, such as specification sheets and photosensor coverage and placement diagrams are located in Appendix A | Lighting.

ASHRAE 90.1 | Power Density Allowance

The lighting power density required by ASHRAE 90.1-2007 Section 9.6: Space-By-Space Method for open office areas is 1.1W/ft^2.

TYPE	FIXTURE QUANTITY	FIXTURE WATTAGE	TOTAL WATTAGE	UNITS
TA	240	25	6000	WATTS
SC	12	5	60	WATTS
		TOTAL SQ. FT.	6376	SQ.FT.
	TOTAL LPD ALLOWABLE		1.1	W/FT^2
		TOTAL LPD	0.95	W/FT^2

LUMINAIRE EQUIPMENT SCHEDULE:

TYPE		MANUFACTURER	CATALOGUE NUMBER	DESCRIPTION
TA		The Lighting Quotient	L201-36S3-M-EL15-T-30	Task ambient luminaire 34.75" long with integral hang-on mounting, 1 21W T5 luminaire, high performance louver on top for maximum uplight coverage and minimal glare at eye height, clear prismatic acrylic task lens reducing veiling reflections,housed in extruded aluminum with downlight reflector.
SC		Ivalo Lighting Inc. by Lutron	LNN-27SNL-2WNUMT	27" interior decorative sconce, direct/indirect, ADA compliant (3-7/8" off of wall), white LED strings, incorporated reflector within housing of luminaire, finished in case aluminium, mounts on wall from base bracket with locking screws.

*See Appendix A | Lighting for full luminaire fixture schedule.

LIGHT LOSS FACTORS:

CALCULATIONS					**TOTAL LLF**
TYPE	MAINTENANCE CATEGORY	BALLAST FACTOR	LUMINAIRE DIRT DEPRECIATION	LAMP LUMEN DEPRECIATION	
TA	Clean	1.0	0.93	0.92	0.86
SC	Clean	1.0	0.93	0.70	0.65

*Assumptions: Clean environment with 18 month cleaning cycle, calculations performed using IESNA 10th Edition 2011.

LIGHTING PLAN:

*See Appendix A for Lighting Plan.

DETAILS:

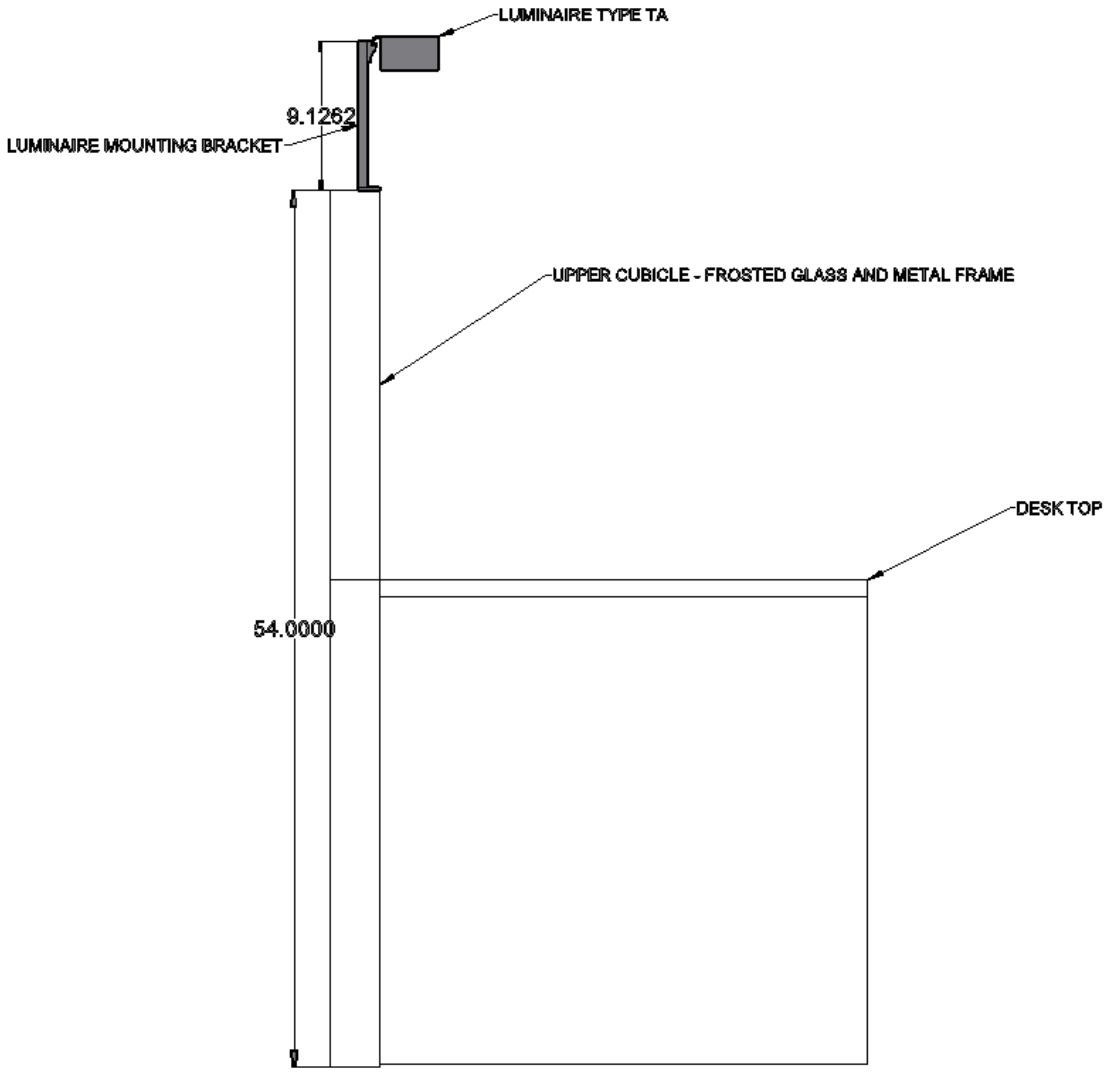


Figure 2.3: Cubicle Luminaire Mounting Detail

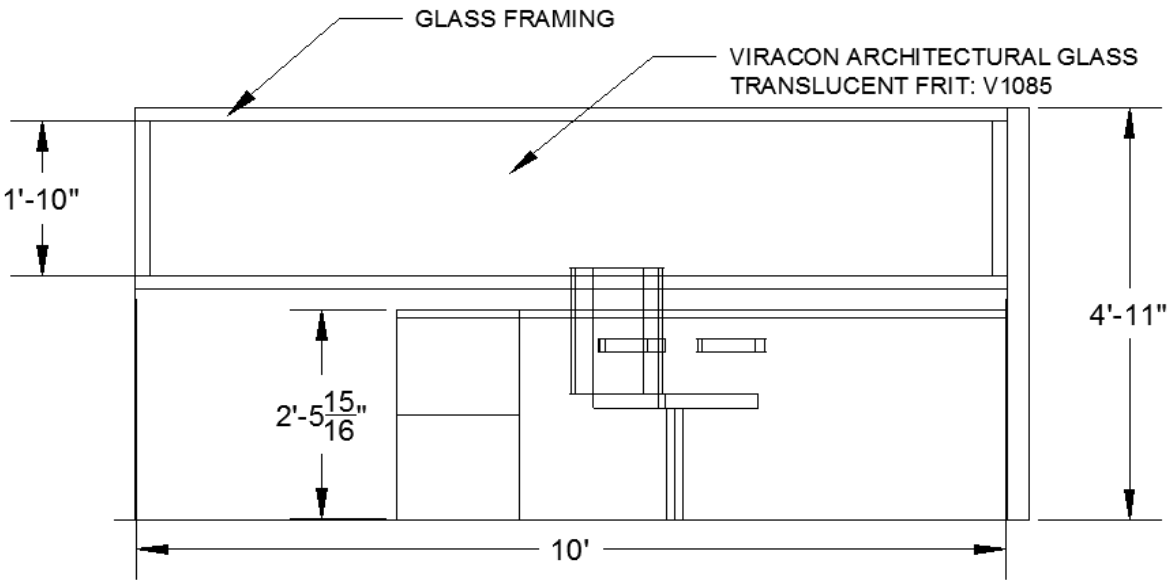


Figure 2.4: Cubicle Material Detail

PERFORMANCE DATA:

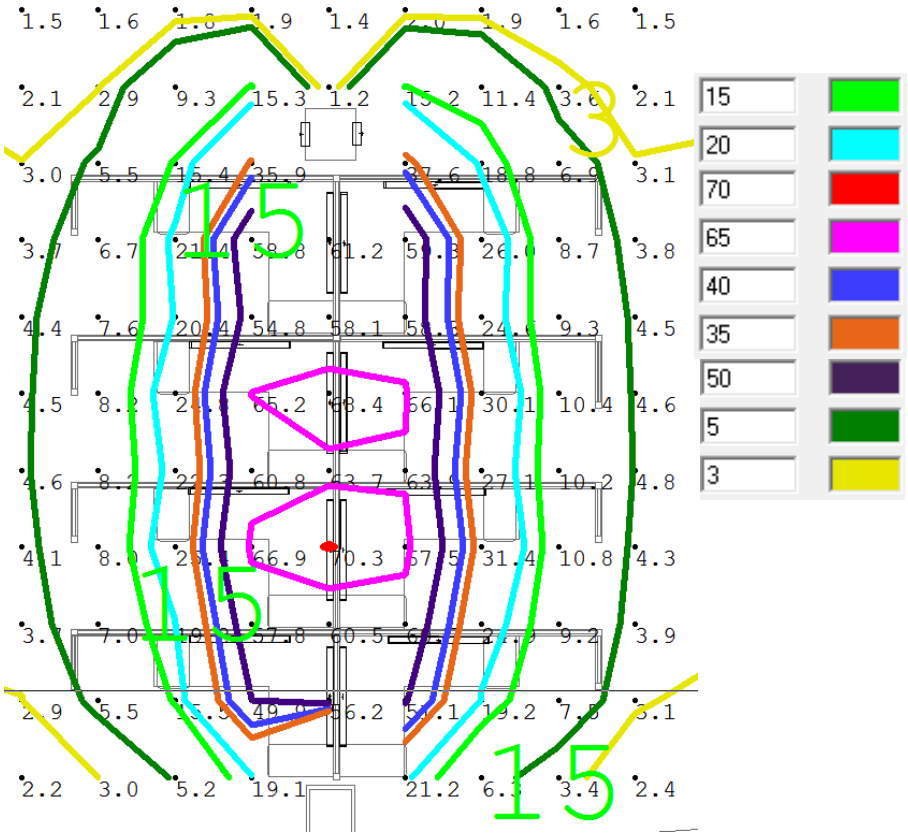


Figure 2.5: Office Ceiling Isometric Contour Lines

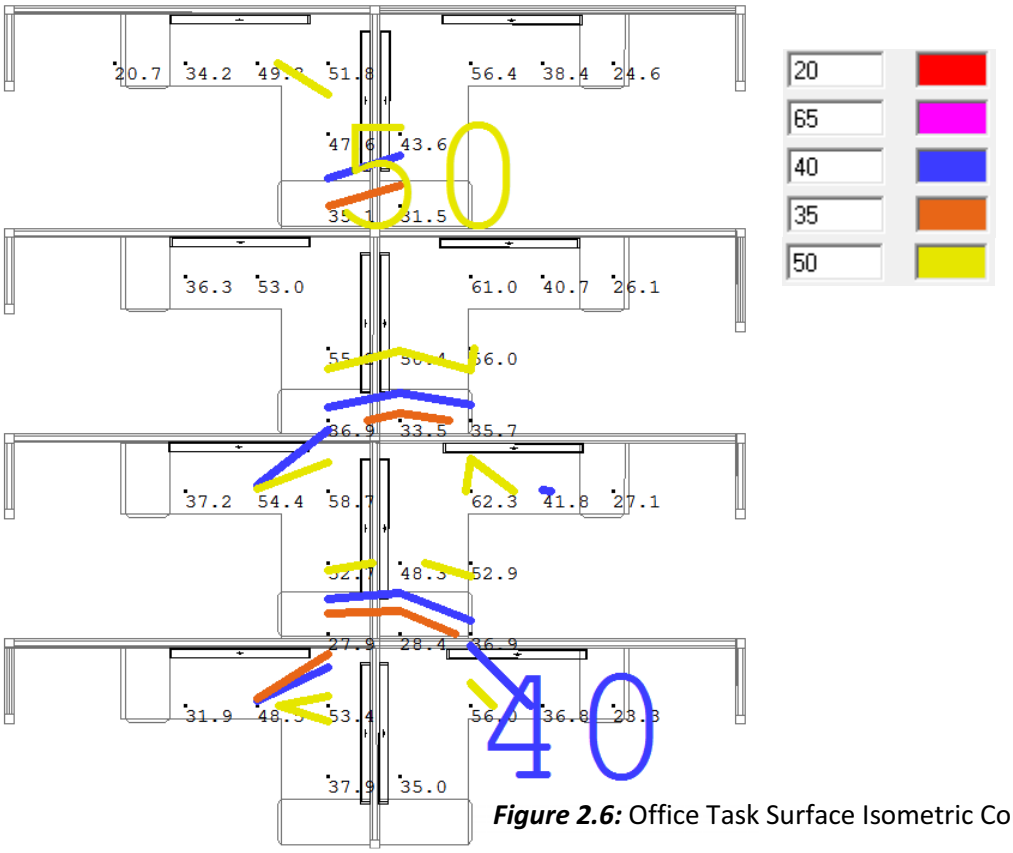


Figure 2.6: Office Task Surface Isometric Contour Lines

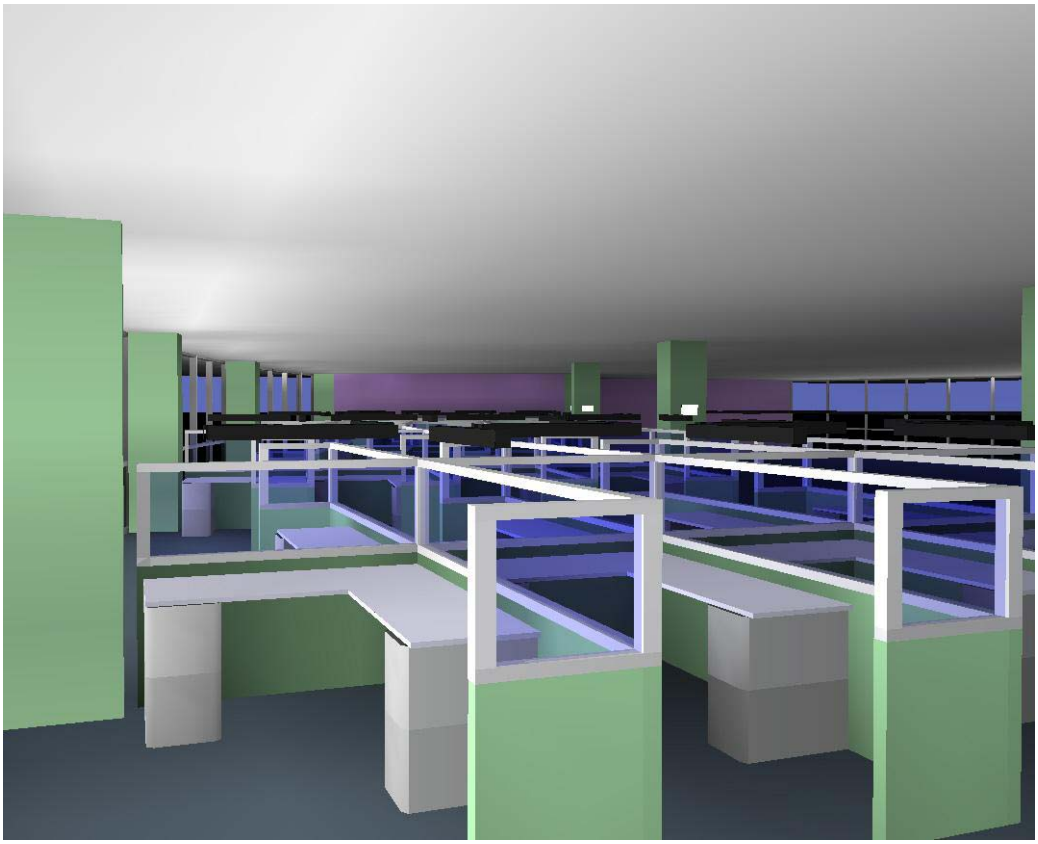


Figure 2.7:Office Daylight |June 21, 1:46 pm

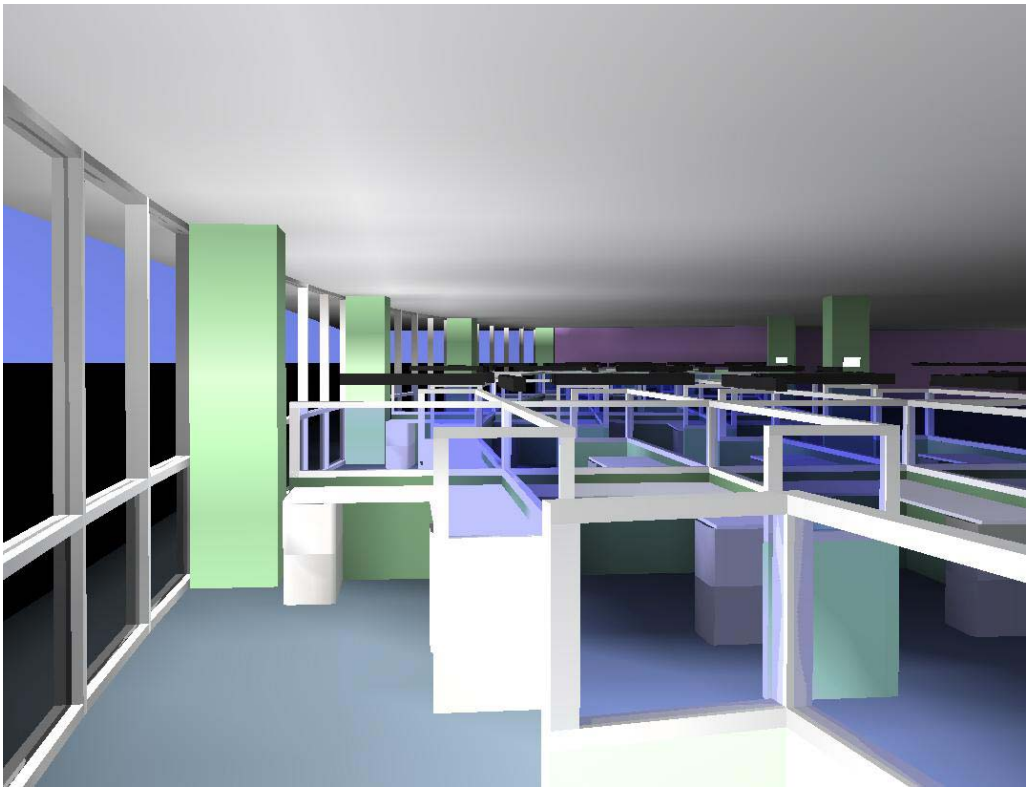


Figure 2.8: Office Daylight |December 22, 11:46 am

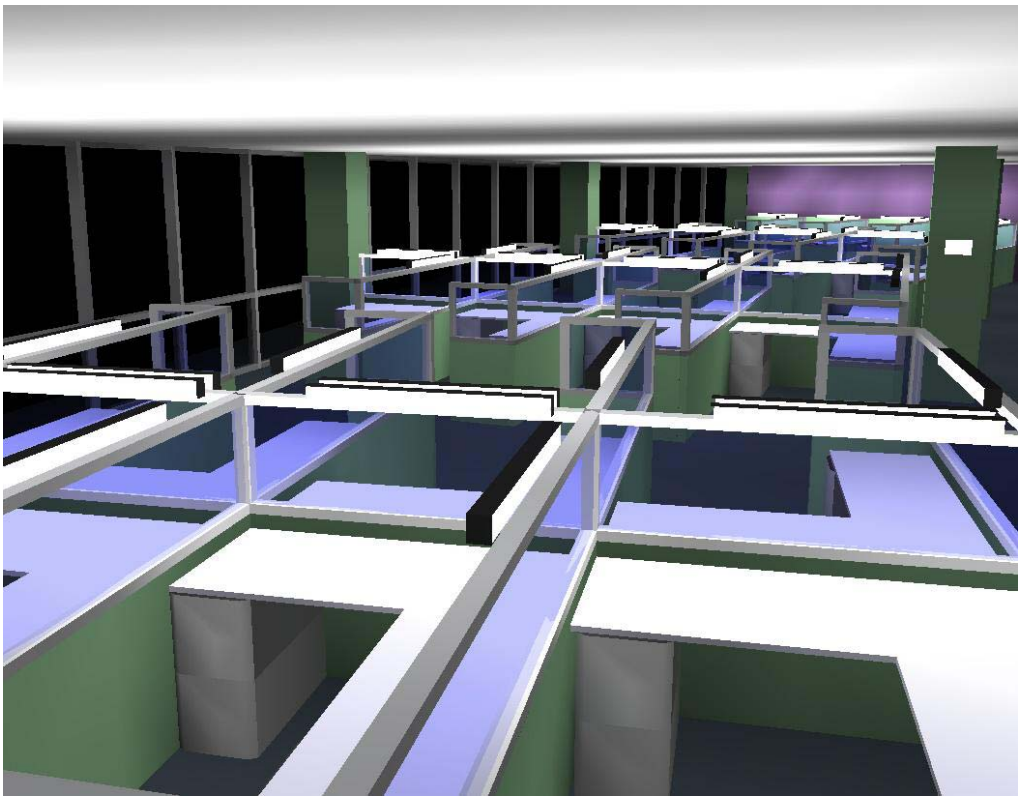


Figure 2.9: Office Daylight |December 22, 11:46 am

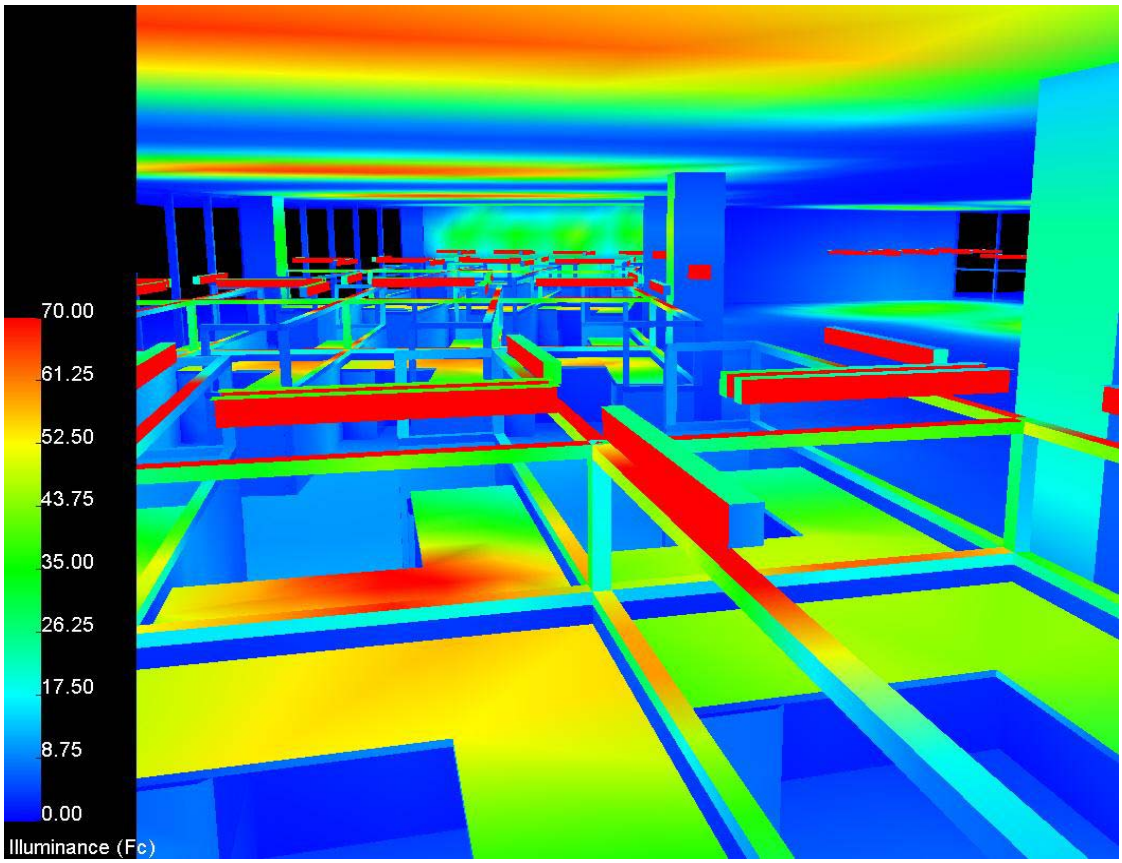


Figure 2.10: Office Electric Lighting Pseudo Color AGi32 Render

CALCULATION SUMMARY:

Open Office Calculation Summary				
	Electric Lighting		Daylighting	
	Task Plane	Ceiling	21-Jun Task/Ceiling	22-Dec Task/Ceiling
Avg. Illuminance	40.62	20.57	110.85/98.87	350.23/138.47
Avg/Min	4.00	17.14	4.66/4.21	17.51/8.34
CRITERIA	30-50	15-25	–	–
COMPLIANCE?	YES	YES	–	–

EVALUATION:

The lighting design of the office adequately provides a stimulating work environment. By illuminating the space using a task ambient approach, a more comfortable space is created. Tambient luminaires manufactured by The Lighting Quotient uses a single T5 linear fluorescent with louvers to shield direct glare from the source. Originally, cubicle heights were standard at 66" high. With the new lighting design, there also was a cubicle design change. Firstly, the cubicle height was reduced to 54" high. Secondly, the upper 18" of cubicle wall was

changed to a frosted glass. This change was implemented to create a more open feeling while still providing privacy between cubicles. The Tambient fixtures are mounted 6" above the top of the cubicle wall on mounting brackets. All three walls of the cubicle are now designed with frosted glass, but only two adjacent walls have luminaire mountings, over the desk areas.

In addition to the new lighting design, daylighting was also considered in the space. Daylight studies proved to be an issue; however it can be beneficial to daylight harvest. Daylight harvesting controls are integrated into the fixtures using a Tambient Control Hub controlling one grouping of cubicle luminaires within the daylight zone closest to the window. Shading devices are also necessary for low angled daylight that potential could cause high glare on the work surface. Occupancy sensors were also installed in the space to help increase energy savings.

Along the interior corridor of the office, LED wall sconces are mounted on either side of the columns for illumination of this space. These luminaires are utilized to emphasize the vertical components of the space and create and open atmosphere for the occupants.

After performing calculations, the lighting design provides adequate illuminance values for the work space as well as adequate ceiling illuminances providing to open the space up. IESNA recommendations were met for task illuminances, and a reasonable ceiling illuminance was assumed. Additionally, lighting power densities provided by ASHRAE Standard 90.1-2007 requirements were met.

MULTI-PURPOSE SPACE | AUDITORIUM

SPACE DESCRIPTION:

The auditorium is located on the second floor of the Laboratory Wing and seats 180 people in twelve rows occupying 7500 sq. ft. This space is mainly used for meeting situations utilizing a podium speaker and projection screen environment. Located on the long dimension of the west wall are a series of 14' high windows looking out to a patio. Another interesting feature to note is the exterior walls of the auditorium curve slightly until terminating at the back wall. Originally the ceiling was a drop ceiling with 2'x4' acoustical ceiling tiles at 25' 8". Part of the redesign of this space includes a new ceiling that is curved imitating a smooth water wave with a mean ceiling height still of 25' 8".

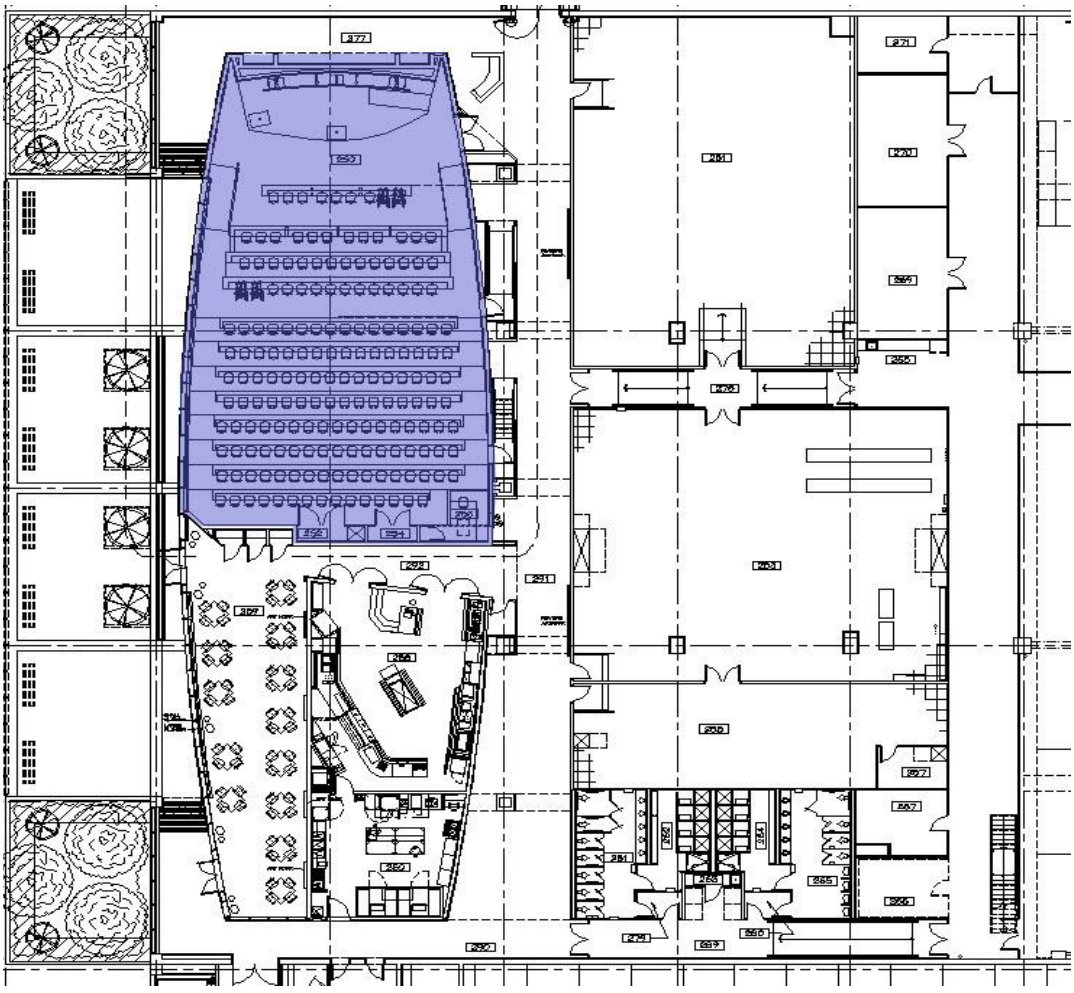


Figure 3.1: Auditorium Floor Plan

SCHEMATIC DEISIGN:

Because the auditorium is considered a multi-purpose space, many activities could potentially take place here. It is important to consider each of these activities to properly design the lighting. The preliminary design process began with assessing each of these situations and deciding an adequate level of illuminaition needed. The largest design change within the space was the ceiling contour and material. Originally, the ceiling was designed with a 2'x4' acoustical ceiling type system. A redesign implemented a curved acrylic system that is back lit with linear fluorescent industrial luminaires. This ceiling system is intended to act as an architectural element while contributing to the overall ambient lighting within the space. The luminaires are mounted 18" above the ceiling system. The mounting height and spacing of each row of luminaires behind the acrylic causes the ceiling to be non-uniformly lit creating shadows within the ceiling system itself. Because this element is intended to imitate a wave, the shadowed portions against the higher illuminated portions give the ceiling a sense of depth and motion just as a wave possesses.

In addition to the ceiling illuminance, other lighting systems are located throughout the space. The objective was to conceal the luminaires and show off the architecture of the space. Recessed LED step lights are placed in each riser. Integrated LED task lights are mounted on the underside of the counters of each pew. Compact fluorescent wall mounted cylinders are located above each door. Recessed LED downlights are located at the stage behind the speaker for general stage lighting. LED spot lights highlight the speaker at either of the podium locations.

Below is a section view of the preliminary design for the auditorium.

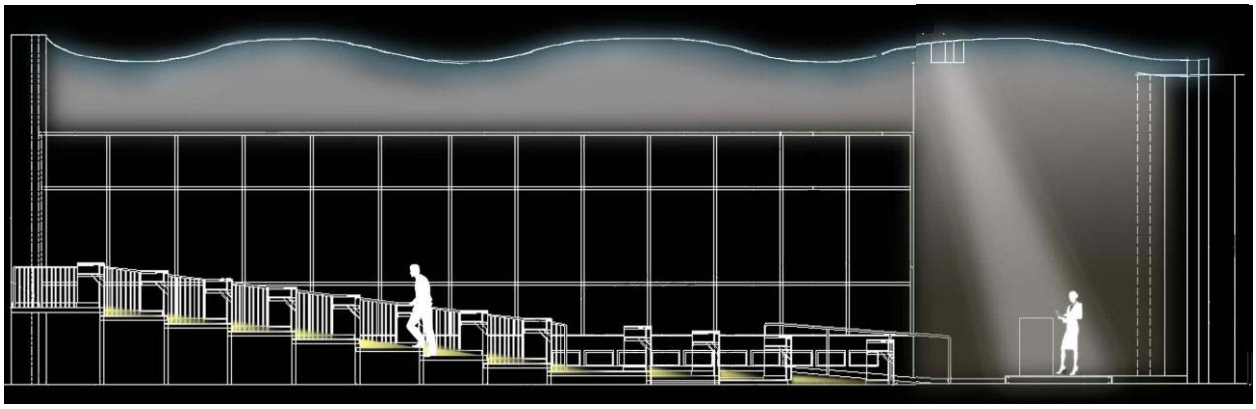


Figure 3.2: Auditorium Preliminary Schematic Design

SURFACE MATERIALS:

MATERIAL SCHEDULE		
SURFACE	DESCRIPTION	PROPERTIES
Floor	Blue/Yellow pattern carpet	ρ= 0.3
Stage	Dark blue carpet	ρ= 0.2
South Wall	Light Tan Paint	ρ= 0.85
North Wall	Light Tan Paint	ρ= 0.85
East Wall	Light Tan Paint	ρ= 0.85
West Wall	Light Tan Paint	ρ= 0.85
Glass 1	Grey Frit	ρ= 0.5, τ= 0.12
Glass 2	Blue Frit	ρ= 0.3, τ= 0.17
Projection Screen	–	ρ=
Doors	Oak	ρ= 0.22
Desk/Podium(s)	Oak	ρ= 0.22
Countertop	Linoeum Blue	ρ= 0.3
Door Frame/Mullions	Metal	ρ= 0.08
Ceiling	Acrylic	ρ= 0.5

DESIGN CRITERIA + CONSIDERATIONS

Task Considerations

There is no set task for this space; however, reading material and watching presentations will take place most often. It is therefore important to properly illuminate the task surface as well as vertical illuminance to render the speaker's face well. In addition, it is crucial there is no glare generated on the projection screen during a presentation as well as adequate shading devices on the west wall glazing. Surrounding spaces also require illuminance, such as the steps, ceiling, and exit doors for ease of egress.

Quantitative Visual Performance

- Assembly | Horizontal: 10 fc
- Social Activity | Horizontal: 5 fc

Stated in the IESNA Lighting Design handbook, task plane illumination is not considered important; however, the versatility of the space may require appropriate lighting for such tasks. Therefore, task plane illumination will be considered and targeted between 20-30 fc being controlled using scene controllers in the space.

Lighting Controls

Controllability of this space is considered a driving factor for luminaire placement and selection. Selecting proper zones must be catered to the use of the space as well as integrating shading devices for privacy and irritation from daylighting.

The auditorium is controlled by two scene controllers; one located adjacent to the lower entrance and the second located at the top of the auditorium adjacent to the sound booth. Each scene controller is a *Grafik Eye 4000* manufactured by Lutron with integrated shade controls as well as an added architectural wall station for general lighting switched on and off. The *Grafik Eye* is specified with four individual scenes comprised of different intensity values from each of the five zones. Below is a table representing the intensity percentage contributed from each zone.

SCENE	STEPS	TASK	DOOR	STAGE SPOT	STAGE DOWNLIGHTS	CEILING
1	50%	60%	50%	FULL	FULL	OFF
2	50%	60%	50%	FULL	FULL	50%
3	FULL	30%	FULL	OFF	OFF	FULL
4	50%	60%	50%	FULL	OFF	OFF

ASHRAE 90.1 | Power Density Allowance

The lighting power density required by ASHRAE 90.1-2007 Section 9.6: Space-By-Space Method for auditorium and seating areas is 0.9W/ft^2.

TYPE	FIXTURE QUANTITY	FIXTURE WATTAGE	TOTAL WATTAGE	UNITS
ST	40	8	320	WATTS
SP	5	43	215	WATTS
SB	12	11.9	142.8	WATTS
TL	89	19	1691	WATTS
C	20	117	2340	WATTS
DS	5	17	85	WATTS
		TOTAL SQ. FT.	7500	SQ.FT.
	TOTAL LPD ALLOWABLE		0.900	W/FT^2
		TOTAL LPD	0.639	W/FT^2

LUMINAIRE EQUIPMENT SCHEDULE:

TYPE		MANUFACTURER	CATALOGUE NUMBER	DESCRIPTION
ST		iO LED-Cooper	0.01.SL.3K.N.100.3.0	5.9"x5.9" square LED step light for interior or exterior applications, UL listed for wet/damp locations, gasketed and corrosion resistant metal casting, polycarbonate lens, LED replaceable.
SP		ERCO	EN-1-ERCO-72086-000	4.9" track spot light, powder coated cast aluminium with 180˚ tilt capabilities,able to connect with a DALI track system, LED module replaceable
SB		CREE LED LIGHTING	LR6C-DR1000	6" recessed architectural downlight, Cree True White Technology LED, delivers 80 lumens/W, CRI 90
TS		iO by Cooper Lighting	0.09.I.3K.NG.1.6.1.1	1.39" W X .66" D X 36" L shelf integrated task light, LEDge is a part of the iO linear LED-based family, low voltage, neoprene gasketed, housing made of extruded aluminum, finished in anodized aluminum.
C		METALUX-COOPER LIGHTING	MBF-2-54T5FB	4' (2)T5 industrial fixture die formed channel from 20 gauge rolled steel with pretreated iron phosphate for rust inhibitor, reflector minimum 95% total reflectivity, mounted with suspension cables or surface mounted, integral occupancy sensor available.
DS		PRESCOLITE-HUBBELL LIGHTING	CF8W26QEB	8" wall mounted sylinder, 26W CFL, quad tube, electronic ballast

*See Appendix A | Lighting for full luminaire fixture schedule.

LIGHT LOSS FACTORS:

CALCULATIONS					**TOTAL LLF**
TYPE	MAINTENANCE CATEGORY	BALLAST FACTOR	LUMINAIRE DIRT DEPRECIATION	LAMP LUMEN DEPRECIATION	
ST	Clean	1.0	0.93	0.70	0.65
SP	Clean	1.0	0.93	0.70	0.65
SB	Clean	1.0	0.93	0.70	0.65
TL	Clean	1.0	0.93	0.70	0.65
C	Clean	1.1	0.93	0.92	0.94
DS	Clean	1.0	0.93	0.85	0.80

*Assumptions: Clean environment with 18 month cleaning cycle, calculations performed using IESNA 10th Edition 2011.

LIGHTING PLAN:

*See Appendix A for Lighting Plan.

DETAILS:

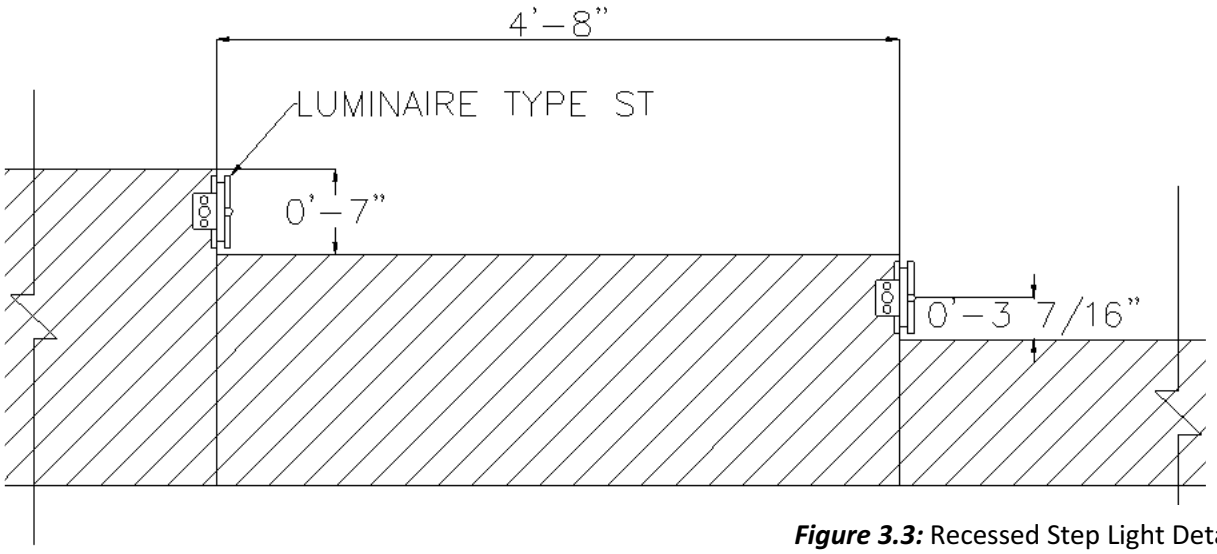


Figure 3.3: Recessed Step Light Detail

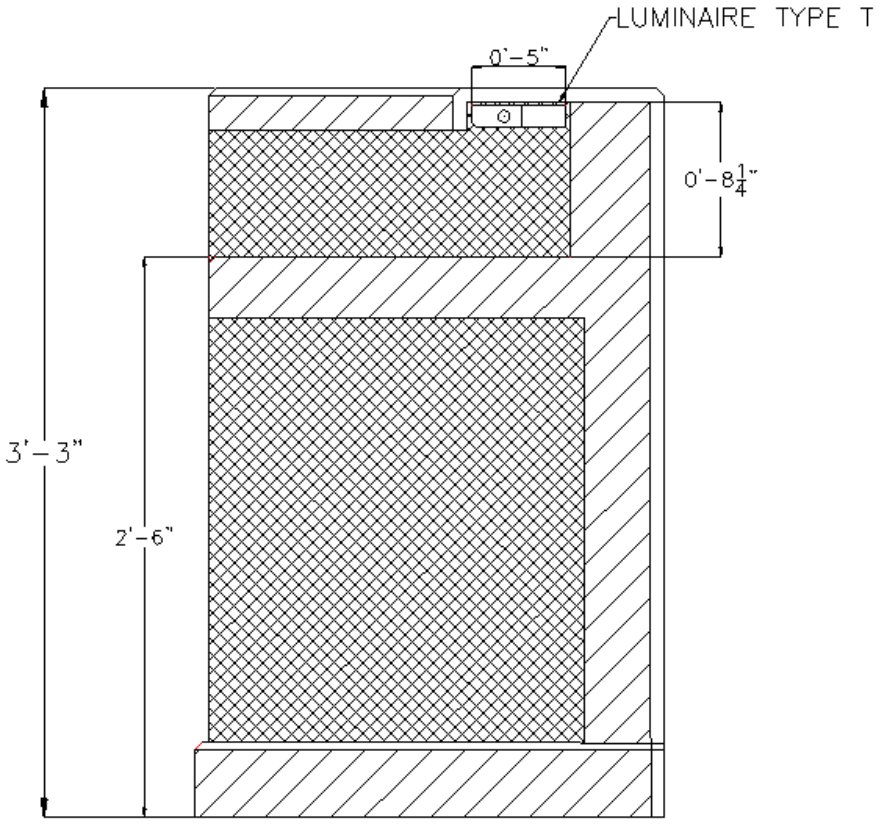


Figure 3.4: Integrated Task Light Detail

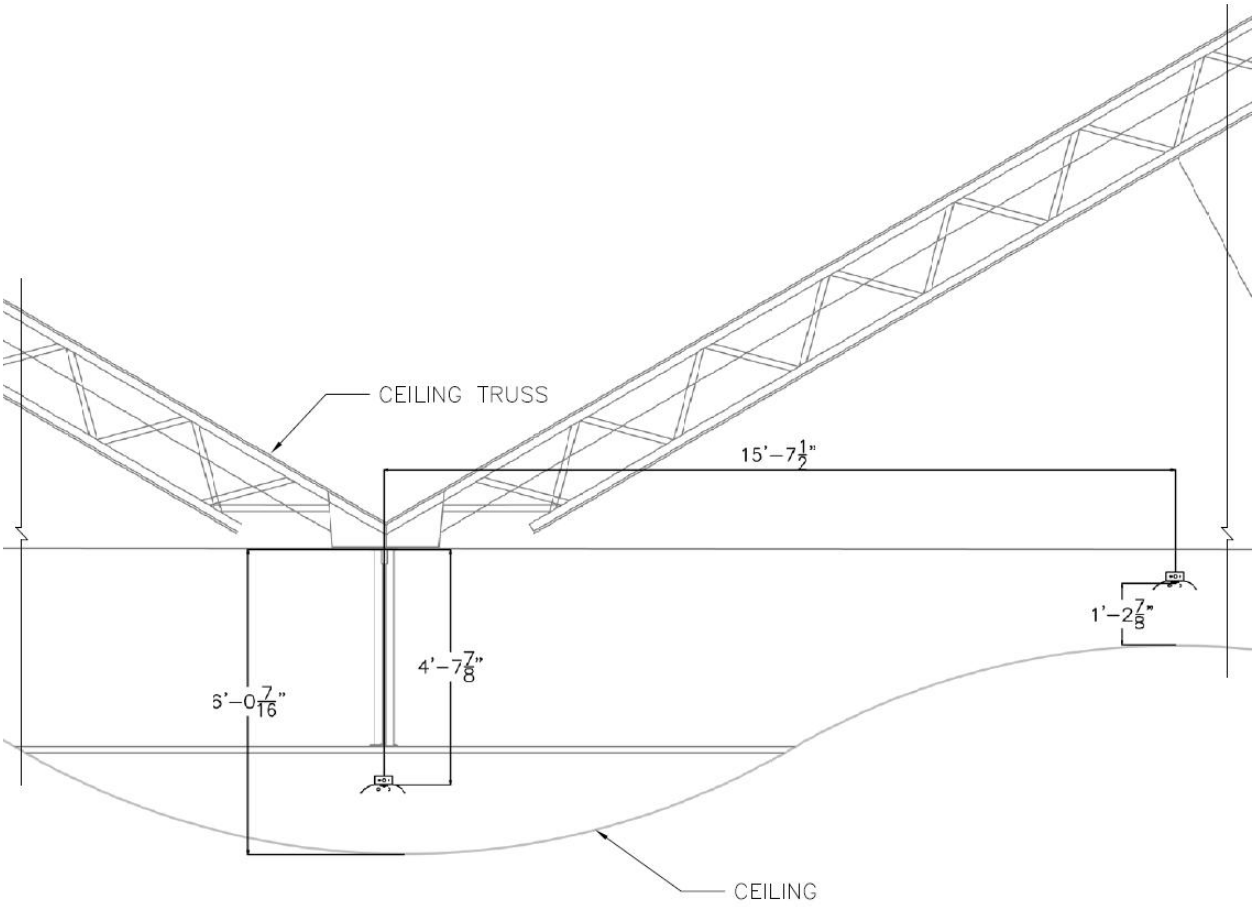


Figure 3.5: Auditorium Ceiling Luminaire Mounting Detail

*NOTE: Full specification sheets of ceiling system and translucent infill panels are located in Appendix A | Lighting

PERFORMANCE DATA:

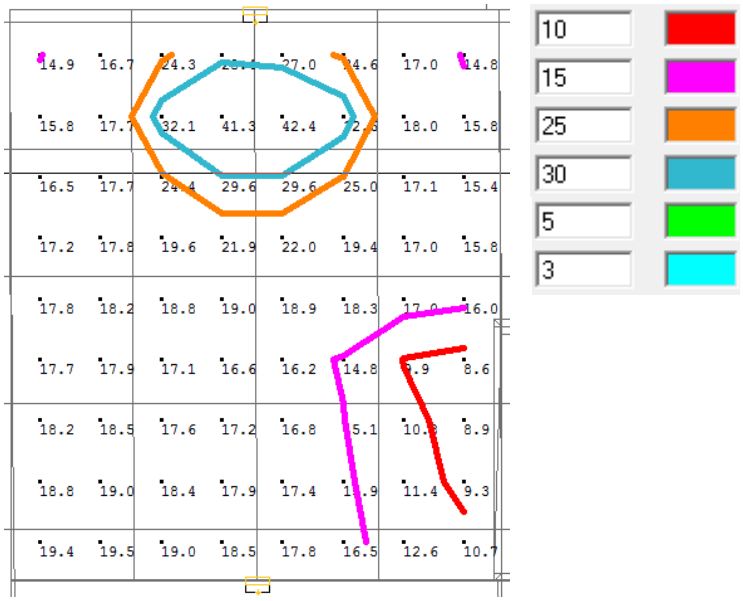


Figure3.6: Auditorium Step Calculation Isometric Contour

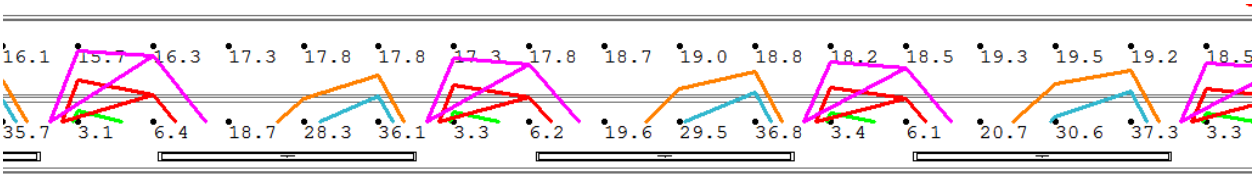
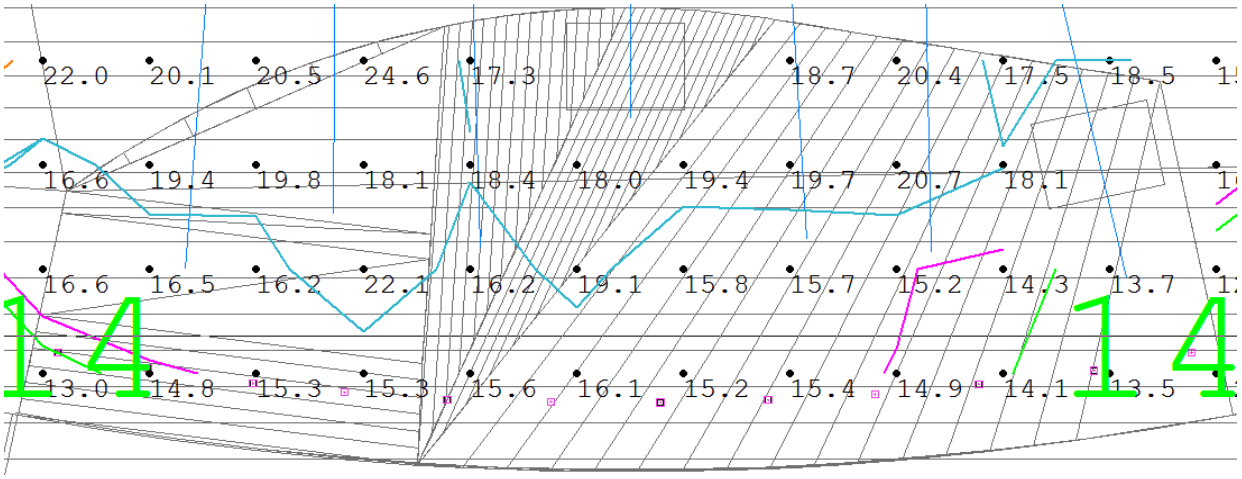


Figure 3.7: Auditorium Desk Calculation Isometric Contour Lines



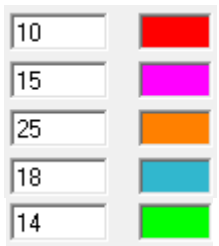
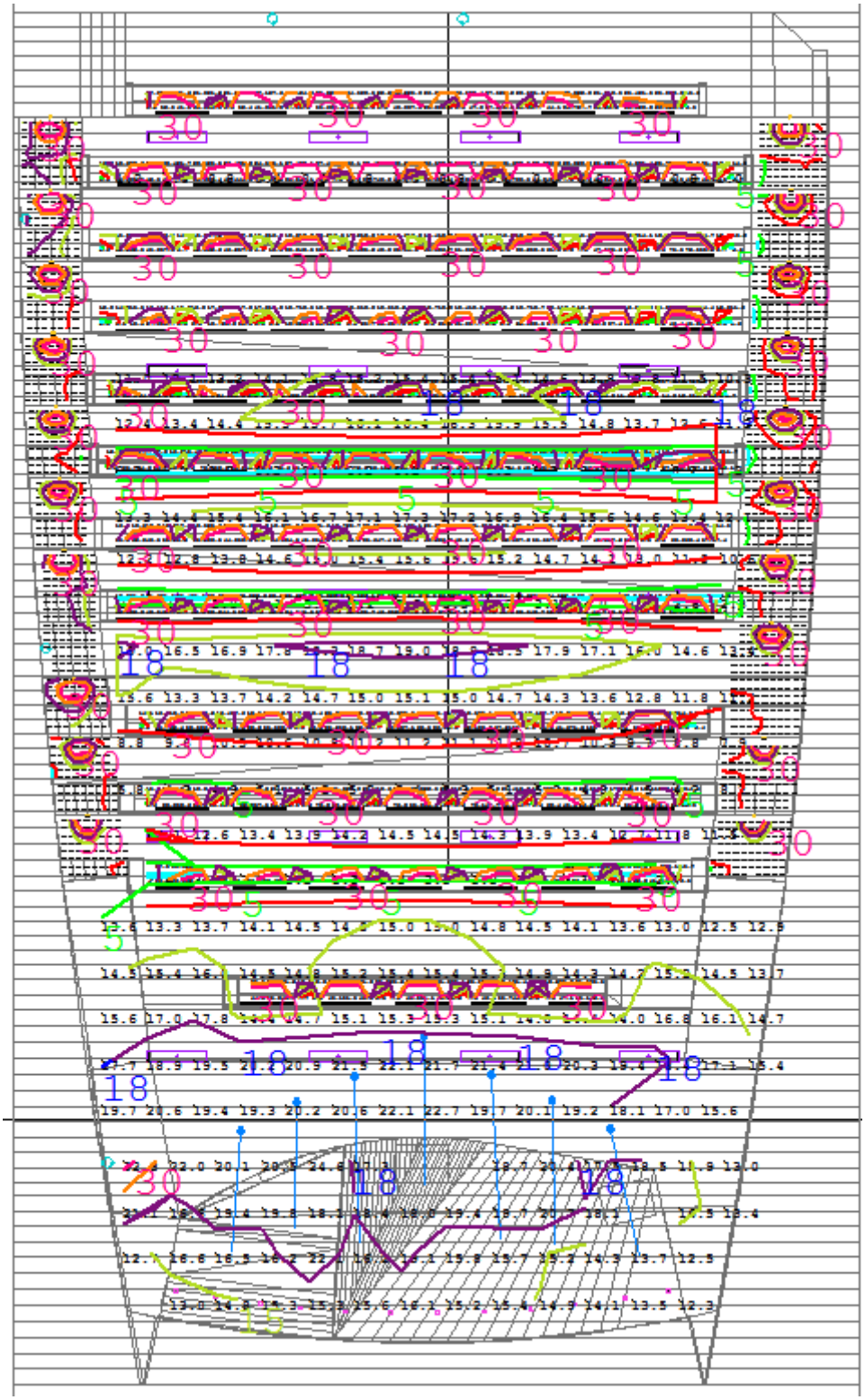


Figure 3.8: Auditorium Stage Calculation Isometric Contour Lines



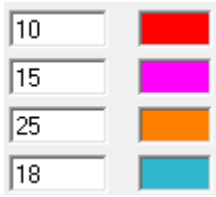


Figure 3.9: Auditorium Calculation Isometric Contour Lines

Figure 3.10: Auditorium RGB AGi32 Render

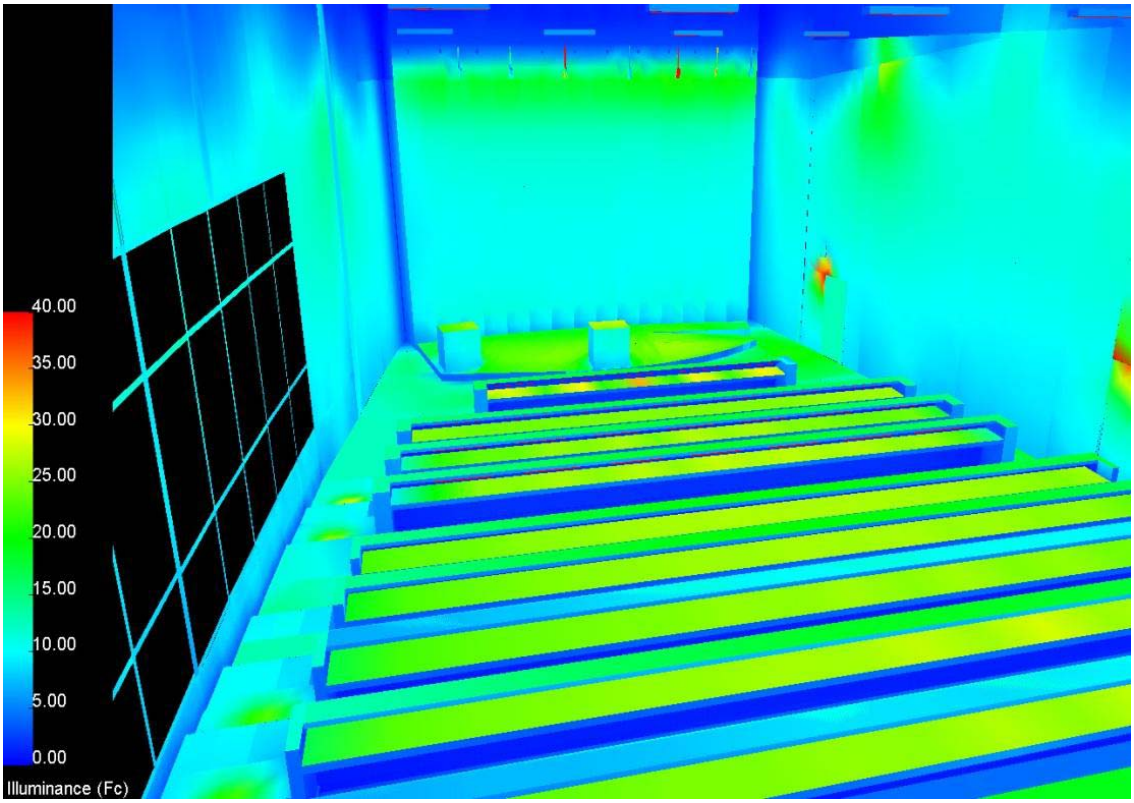


Figure 3.11: Auditorium Pseudo AGi32 Render

DAYLIGHT RENDERINGS:

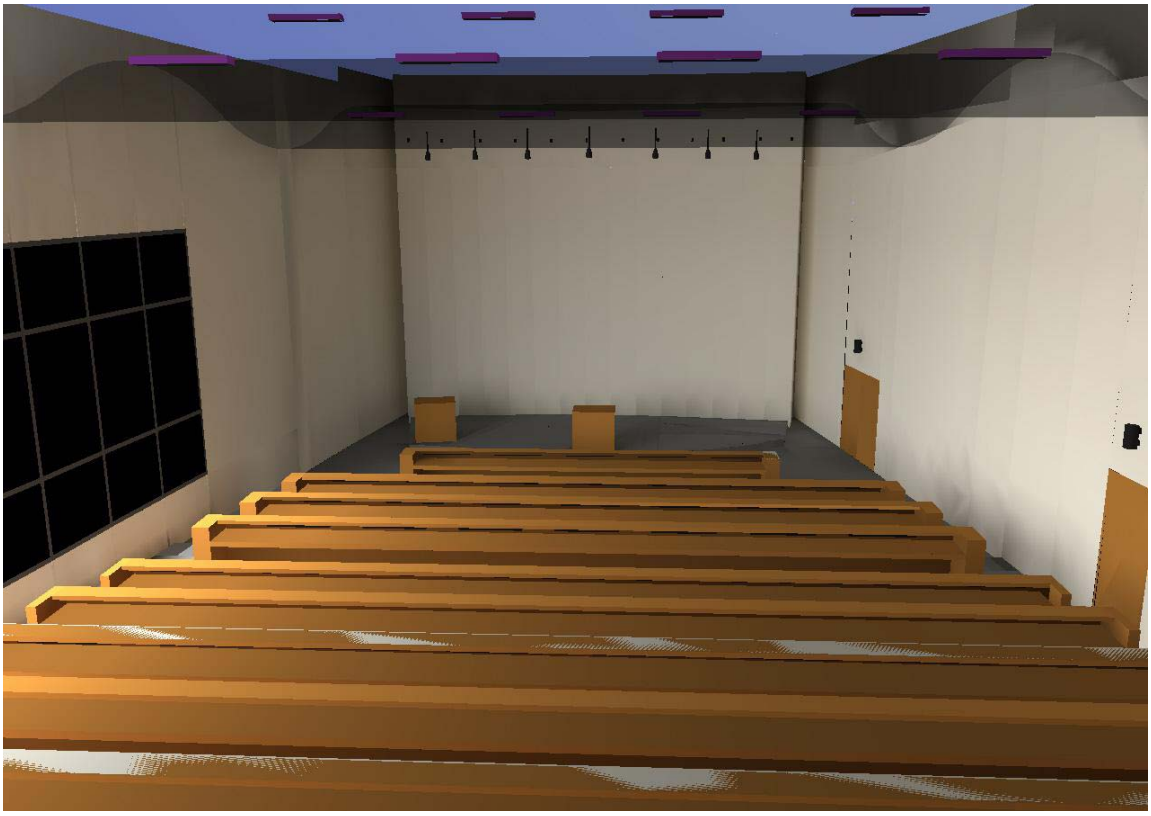


Figure 3.12: Auditorium Daylight June 21st RGB AGi21 Render

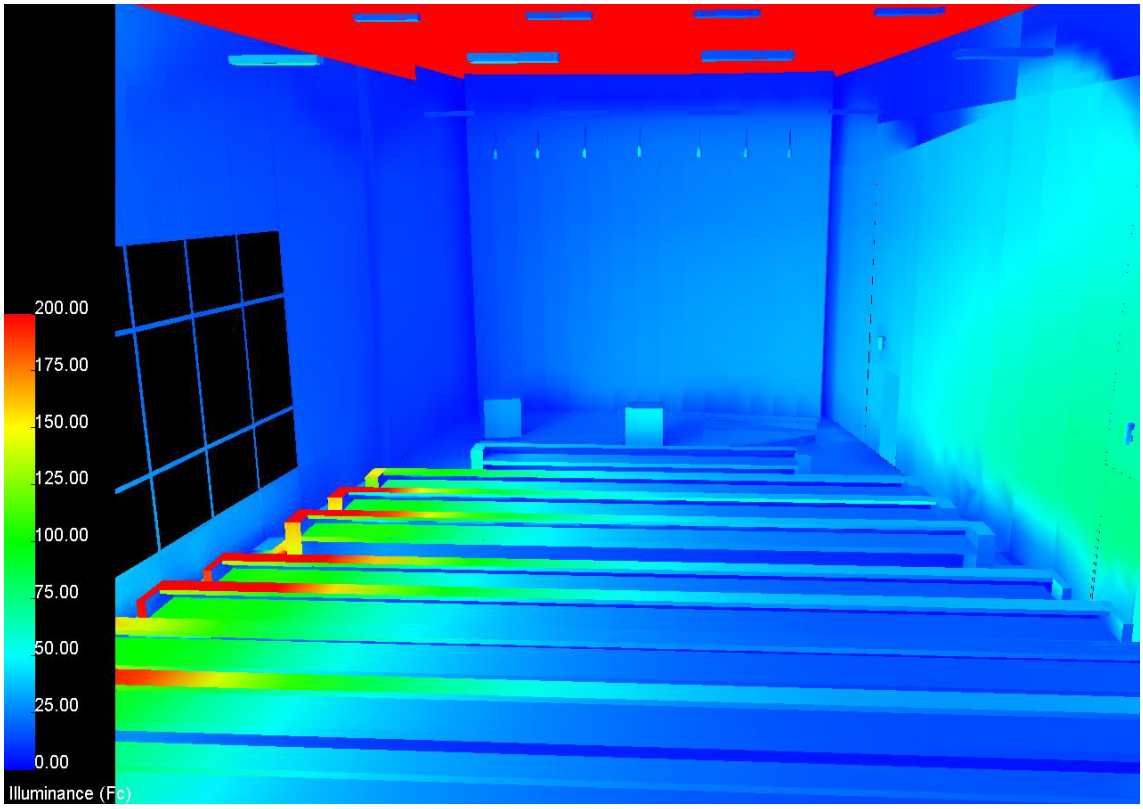


Figure 3.13: Auditorium Daylight June 21st Pseudo Color AGi32 Render

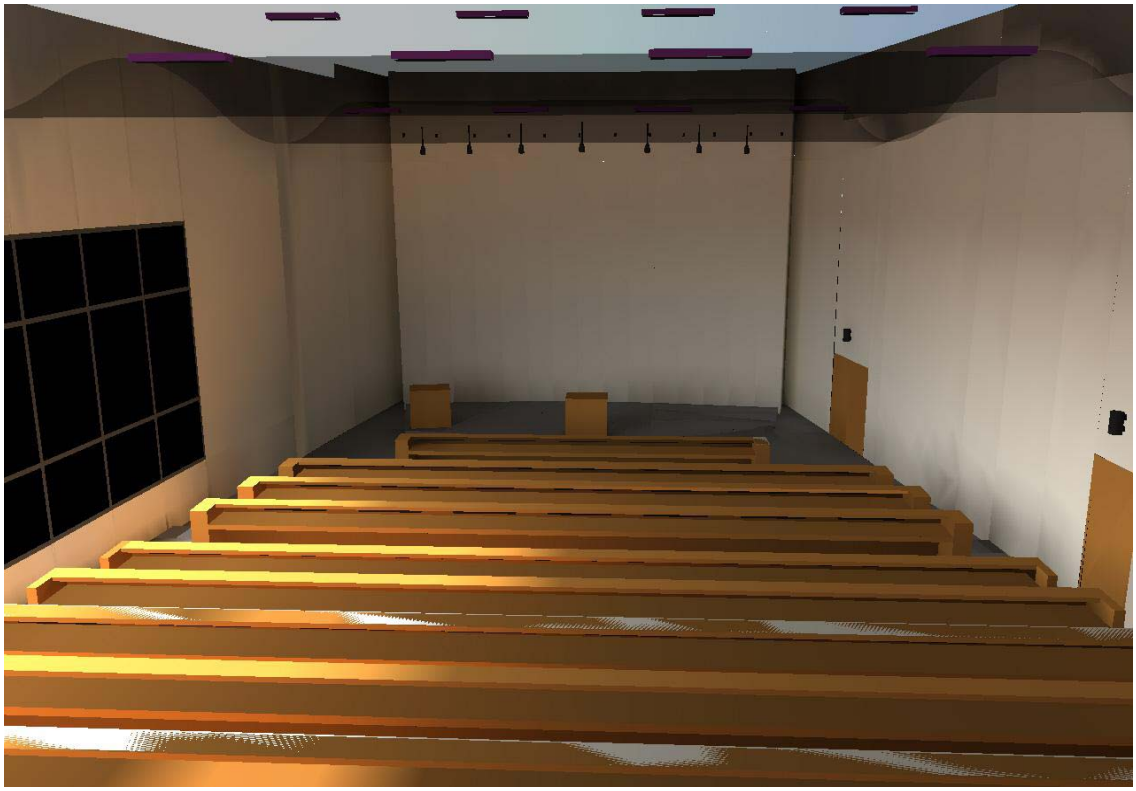


Figure 3.14: Auditorium Daylight Dec 22nd RGB AGi32 Render

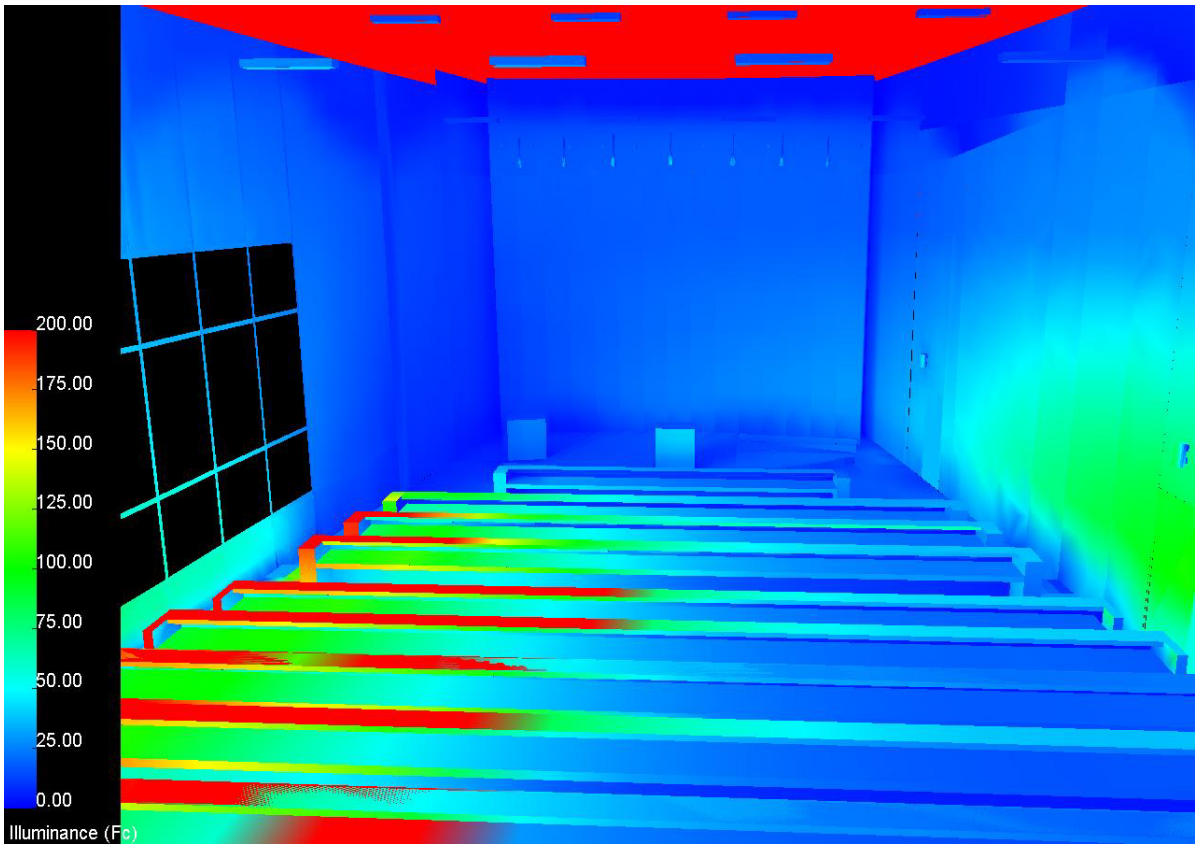


Figure 3.15: Auditorium Daylight Dec 22nd Pseudo Color AGi32 Render

SCENE CONTROL RENDERS:

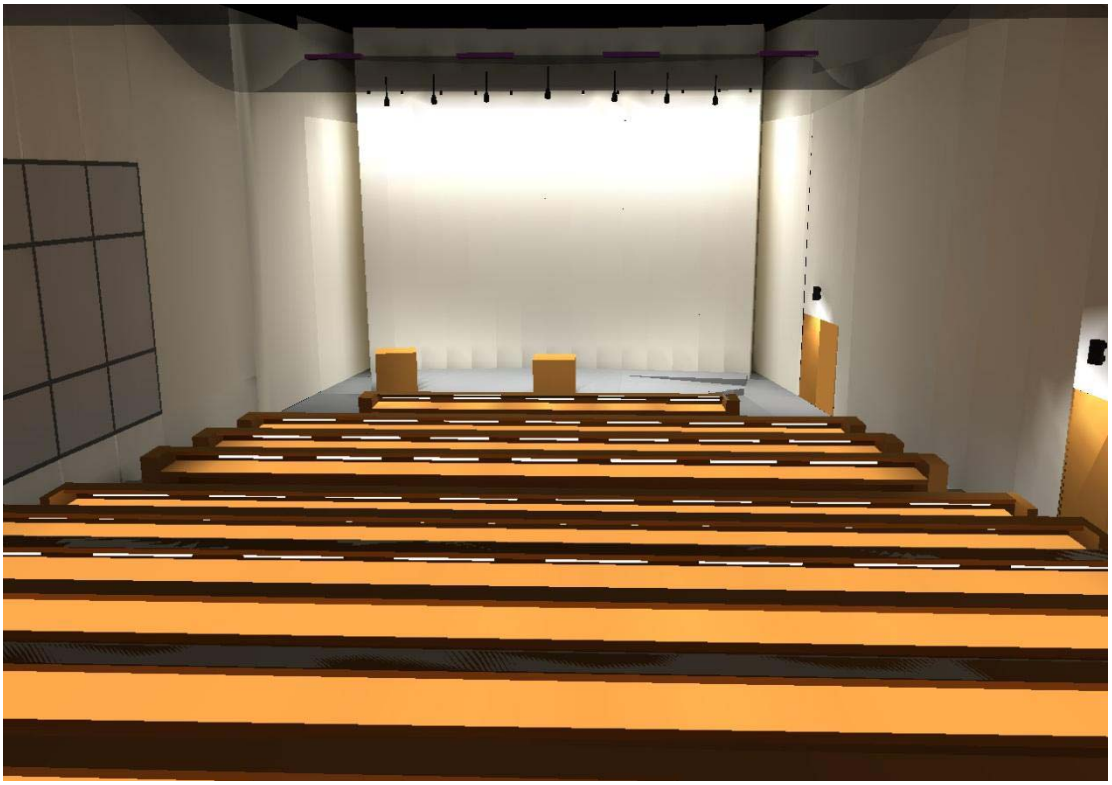


Figure 3.16: Scene 1 | Formal Presentation RGB AGi32 Render

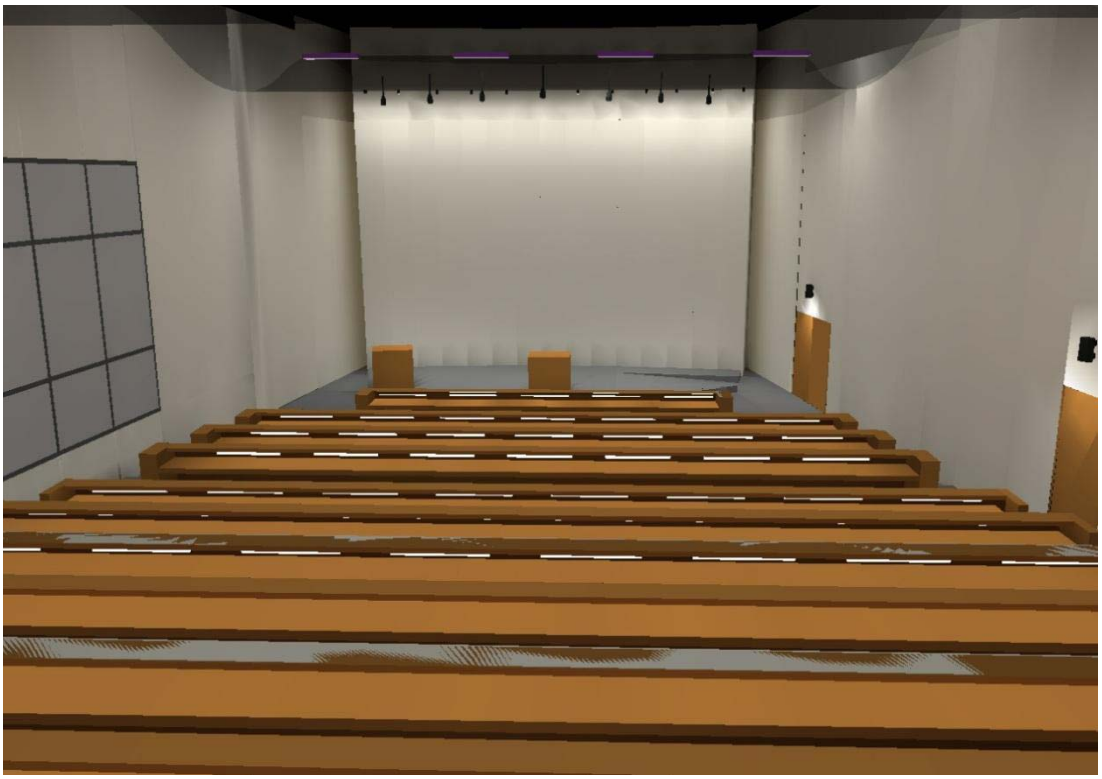


Figure 3.17: Scene 2 | Informal Presentation RGB AGi32 Render

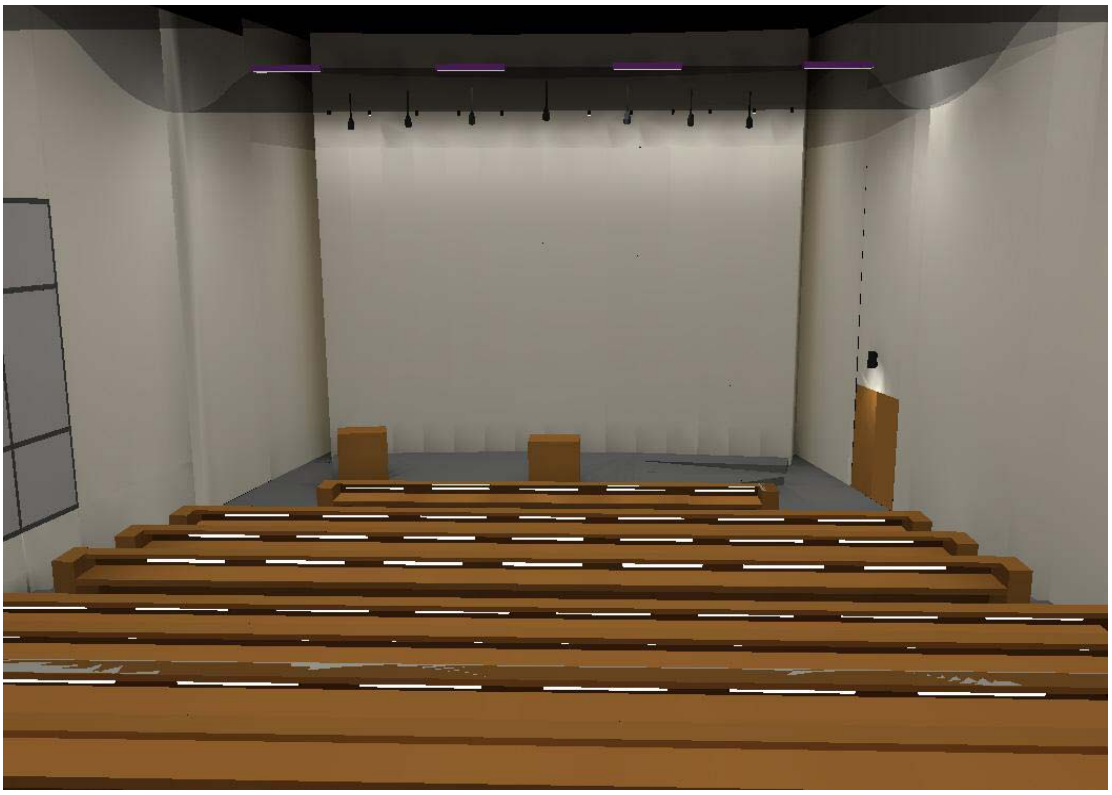


Figure 3.18: Scene 3 | Pre Presentation RGB AGi32 Render

Figure 3.19: Scene 3 | Podium Speaker RGB AGi32 Render

CALCULATION SUMMARY:

Auditorium Calculation Summary				
	Stage	**Steps**	**Desk**	**Floor**
Avg. Illuminance	17.3	14.4	24.8	11.17
Avg/Min	1.4	2.9	5.3	4.25
CRITERIA	15.0	10.0	15.0	10.0
COMPLIANCE?	YES	YES	YES	YES

	DESK		FLOOR		STAGE		STEP	
	Avg	Avg/Min	Avg	Avg/Min	Avg	Avg/Min	Avg	Avg/Min
Scene 1- Formal Presentation	17.6	7.6	4.8	2.7	9.5	1.4	14.7	3.1
Scene 2- Informal Presentation	14.9	8.5	6.8	2.1	12.9	1.6	7.3	2.6
Scene 3- Pre Presentation	24.7	8.3	8.8	4.1	9.5	1.9	14.2	2.7
Scene 4/5- Podium Speaker and Projection	6.6	15.1	1	0.1	10.8	2.9	2.9	5.8

FINAL RENDERINGS:

Figure 3.20: Auditorium Side Podium 3ds Max Render

Figure 3.21: Auditorium Front Stage 3ds Max Render

EVALUATION:

The lighting design for the auditorium adequately addresses the multiple activities performed within the space while considering daylight. Within the space, 4 lighting scenes are available with separate screen controls. To further enhance the experience of the occupant, a curved back-lit ceiling was designed. It is illuminated with linear fluorescent strip fixtures 18" above the ceiling material. The mounting height and spacing both contribute to the appearance of a water wave by creating areas of shadows and highlight to illustrate the depth and movement of a wave. The entire auditorium instills a mix of LEDs and fluorescent sources primarily for their output and low power consumption qualities. Although LED sources are known not to be well dimmable, dimming to low levels is where the characteristics of LEDs tend to go astray. When the wattage and lighting scenes were designed, it was purposefully designed so the LED sources within the space would not be affected by dimming to low levels. LED sources within the space include all stage lighting, recessed step lighting, and integrated task lighting at each desk area. Compact fluorescent luminaires are wall mounted above each door.

The lighting design for the space adequately complies with IESNA recommendations in addition to lighting power densities from ASHRAE Standard 90.1-2007. It properly tailors to the needs of the space as well as providing a visually interesting environment for the occupant.

EXTERIOR | LANDSCAPE ARCHITECTURE BREADTH AND LIGHTING DESIGN

LANDSCAPE ARCHITECTURE BREADTH

INTRODUCTION:

Currently at the VASCIC facility, there is no exterior gathering space present. In 1993, the City Council adopted a code called the "*Framework for the Future 2030*". This comprehensive document was created in order to properly manage a vastly growing community such as Newport News, Virginia. It addresses issues of physical growth and planning, goals and policies, and specific plans of action to address different aspects of the City's development. Every five years, the code calls upon a citizen task force to re-evaluate how the city is coordinating economic, physical, and social development of the Newport News area.

Figure 4.1: Victory Landing Park Promenade

Newport News, and the VASCIC facility, is situated along 47 miles of the James River shoreline running parallel to Hampton Roads. Decided by the City Council and citizen task force, provided public access to the waterfront is the most essential change they could implement providing a Segway for future waterfront developments. When the VASCIC facility was being designed, the City Council required Northrop Grumman of Newport News Shipbuilding to redesign their bulkhead in order to contribute to the new code and begin providing the community a means of accessing the waterfront. Because Northrop Grumman was not responsible for designing an exterior gathering space, the City Council was therefore taking charge to instill a park along the waterfront behind the facility. However, with the economic downfall, the design was never executed and remains vacant. Another major issue the City Council has been having for years is of the 47 miles of shoreline, the city only owns 1.3 miles, or 2.6%. The rest of the shoreline is privately owned and creates a problem for docking boats at the various marinas along the coast. In addition to providing for the community, the new code also is trying to generate more attraction to the area by being able to accommodate tour boats along this promenade. In 2004, Victory Landing Park was designed alongside the VASCIC facility also making a connection to the main street and the historical arch commemorating veterans of all types.

PROBLEM:

Figure 4.2: Proposed Gathering Area

Because this promenade has become such a public attraction, designing a functional space for the employees of the VASCIC facility as well as the public would provide a more enjoyable atmosphere and, too, would generate more attraction to the area. In addition, implementing this space would in turn promote a higher quality of residential life, increase property values, and begin to build up areas of the city that have been vacant for some time. As a result, the community would begin to learn more about the shipbuilding industry, what this state-of-the-art facility does, and how it contributes to the industry. This makeover would generate a balance between the traditional amenities of the area while providing an attractive and unique experience in the center of an active industrial waterfront.

ARCHITECTURAL SCHEMATIC DESIGN:

The design of the exterior gathering space encompasses influences from many aspects of the facility. It pulls elements from the facility and what it does, design considerations of the water element throughout the lighting design, and the physical element of water surrounding the lobby space.

Figure 4.3: Docked ships

Facility influence on the design considered what the actually facility complex is designed for; it's all about water vessels. When designing the exterior area, four elements were drawn. Along the Victory Landing Park pathway, the entrance to the gathering space begins with a seating area that resembles a docked aircraft carrier. Also placed surrounding the majority of this space is a reflecting pool designed to resemble the stagnant water along the other side of a socked ship.

As you continue along the pathway, it widens and obtains different paver patterns. From an aerial view, this widened section is actually the floor plan of the USS Dwight D. Eisenhower aircraft carrier and the different patterned pavers are the individual markings of runways on the deck of the ship.

Figure 4.4: Fleet of ships

Surrounding the implementation of the aircraft carrier walkway are three additional smaller seating areas. When doing preliminary research, most all photographs of large aircraft carriers were pictured with a handful of smaller ships surrounding. Assuming this is the case all the time, designing a small fleet of ships was the idea. The smaller seating areas are more secluded than the other seating areas; however they themselves also resemble a portion of a ship. Almost identical to the footprint of the Technology Tower, the

seating area resembles the bow of a ship with reflecting pools surrounding this shape to imitate the bow cutting through water as the ship sails.

Lastly, as you navigate through the walkway of ships, you end your journey along the section of Victory Landing Park waterfront promenade. At this point there is another large seating area. Originally when the city was created, the first ship to be built was a small boat named Dorthy. The city still has this boat and is very proud of this historic element. Because it is the icon of the city, original designs of this space had plans to incorporate this structure. This seating area structure is designed to be an iconic structure. For future ships entering the marina, looking head on at this structure, it obtains a profile of a ship sailing through water. Since the city has future plans to coordinate tour boats along the coast, this could direct the boats into the marina and onto land.

Figure 4.5: "Dorthy"

LANDSCAPE DESIGN:

Reinforcing the space designed architecturally, landscape elements are placed throughout to create more of an exterior environment. Coniferous trees of two different heights along with small shrubbery surround the small, enclosed seating areas to reinforce the private feeling without completely enclosing the user. Also in the middle of the connecting pathways are two rows of trees imitating the pattern of a wake behind a ship.

LANDSCAPE ARCHITECTURE LAYOUT:

*See Appendix C for plans and details of space.

LIGHTING DESIGN:

SCHEMATIC DESIGN:

The design intent of the space is to create and enhance the new architecture and landscaping. Creating private and public environments is not only created with the physical elements but also through lighting. At the same time, these public and private areas are treated as "destinations" along the pathway to the water. Choosing luminaires that do not appear to be luminaires and integrate with the landscaping or act as its own element is the main idea of the space. Illuminating the environment around the user and not necessarily directly down on them is a key design concept for this space. By highlighting trees and other landscaping around the seating areas as well as using glowing orbs sitting on the reflecting pools illuminates the environment around the seating but is still able to provide adequate levels for safety purposes.

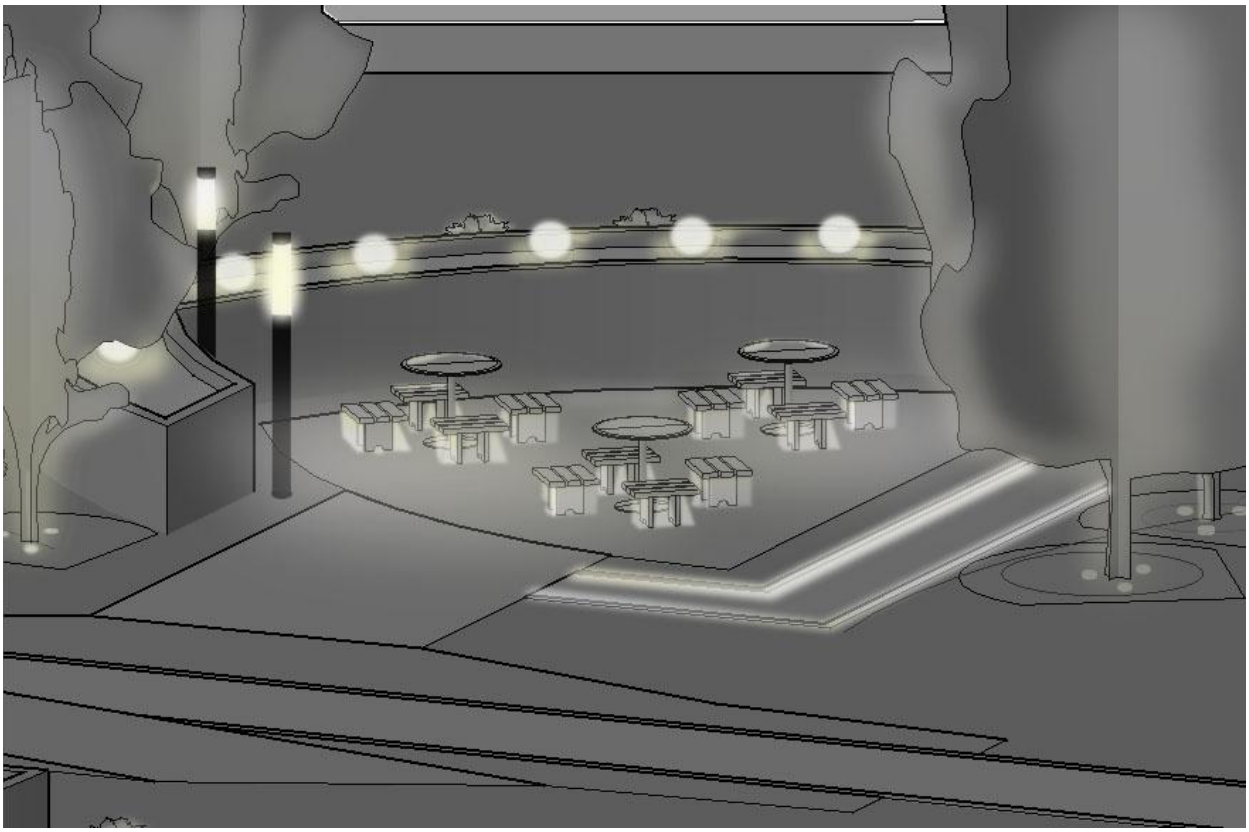


Figure 4.6: Exterior Gathering Schematic Design

SURFACE MATERIALS:

MATERIAL SCHEDULE		
SURFACE	DESCRIPTION	PROPERTIES
Hardscape 1-Main pathways	Houndstooth Brick	ρ=0.10
Hardscape 2- Cross pathway	Granite Stone	ρ=0.32
Hardscape 3- Pathway Outline	Dirty Sandstone	ρ=0.28
Hardscape 4- Aircraft Carrier Outline	Running Brick	ρ=0.26
Small Seating Area	Dirty Sandstone	ρ=0.28
Large Seating Area	Sandstone	ρ=0.32
Round Seating Area	Sandstone	ρ=0.32
Pool Walls	Granite Stone	ρ=0.32
Ground	Grass	ρ=0.09
Water	Liquid	ρ=0.12
Round Seating Bench (concrete structure)	Brown Exposed Aggregate	ρ=0.26
Straight Benches	Brown Exposed Aggregate	ρ=0.26

DESIGN CRITERIA + CONSIDERATION:

TYPE	FIXTURE QUANTITY	FIXTURE WATTAGE	TOTAL WATTAGE	UNITS
GG	33	7	231	WATTS
PS	45	40	1800	WATTS
TT	55	17	935	WATTS
		TOTAL SQ. FT.	29888	SQ.FT.
	TOTAL LPD ALLOWABLE		0.2	W/FT^2
		TOTAL LPD	0.10	W/FT^2

LUMINAIRE EQUIPMENT SCHEDULE:

TYPE		MANUFACTURER	CATALOGUE NUMBER	DESCRIPTION
GG		Bega	5014	17.7" in diameter, portable garden luminaire with stainless steel base plate, white synthetic safety glass sphere housing one lamp, sphere distributes light siftly and uniformly over surface.
PS		Bega	7785MH	1.3' W x 1.3' L x 1.5 H, two piece die-cast aluminum construction providing a symmetrical distribution, construction robust enough for human weight, spun aluminum lamp housing location inside lower top covering shielded, anchored with secured plates to lower casting with four stainless steel rods, finished in black, UL listed for wet locations.
TT		Bega	7502	1.3"W x 1.5"L x 8.85" H LED floorlight, housed in aluminum alloy, stainless steel, and clear safety glass, silicone gasketed, inner reflector made of anodised pure aluminum, mounting bos with 2 fixing holes for permanent locking, UL label for wet locations

LIGHT LOSS FACTORS:

CALCULATIONS					**TOTAL LLF**
TYPE	MAINTENANCE CATEGORY	BALLAST FACTOR	LUMINAIRE DIRT DEPRECIATION	LAMP LUMEN DEPRECIATION	
GG	Clean	1.0	0.93	0.89	0.83
PS	Clean	1.0	0.93	0.81	0.75
TT	Clean	1.0	0.93	0.70	0.65

LIGHTING PLAN:

*See Appendix A for Lighting Plan.

PERFORMANCE DATA:

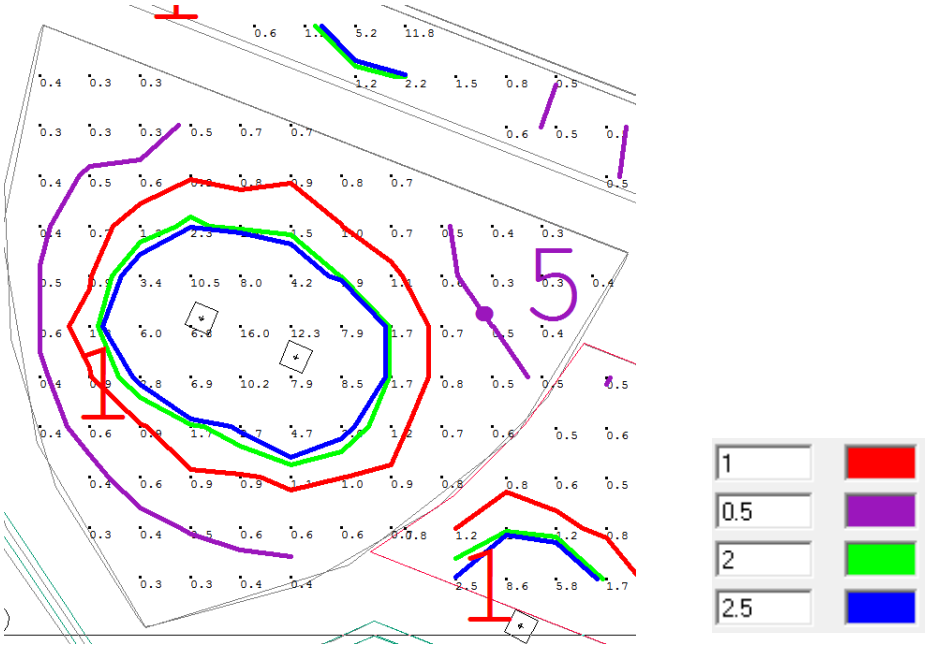


Figure 4.7: Exterior Small Seating Isometric Contour Lines

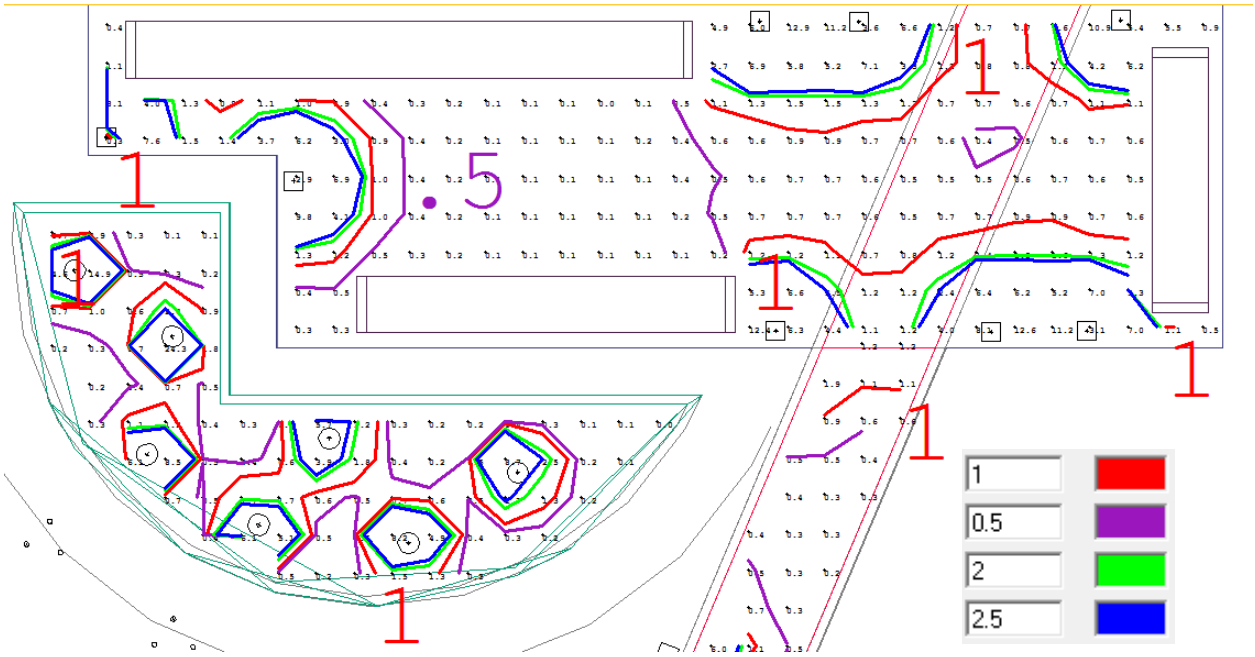


Figure 4.8: Exterior Large Seating Isometric Contour Lines

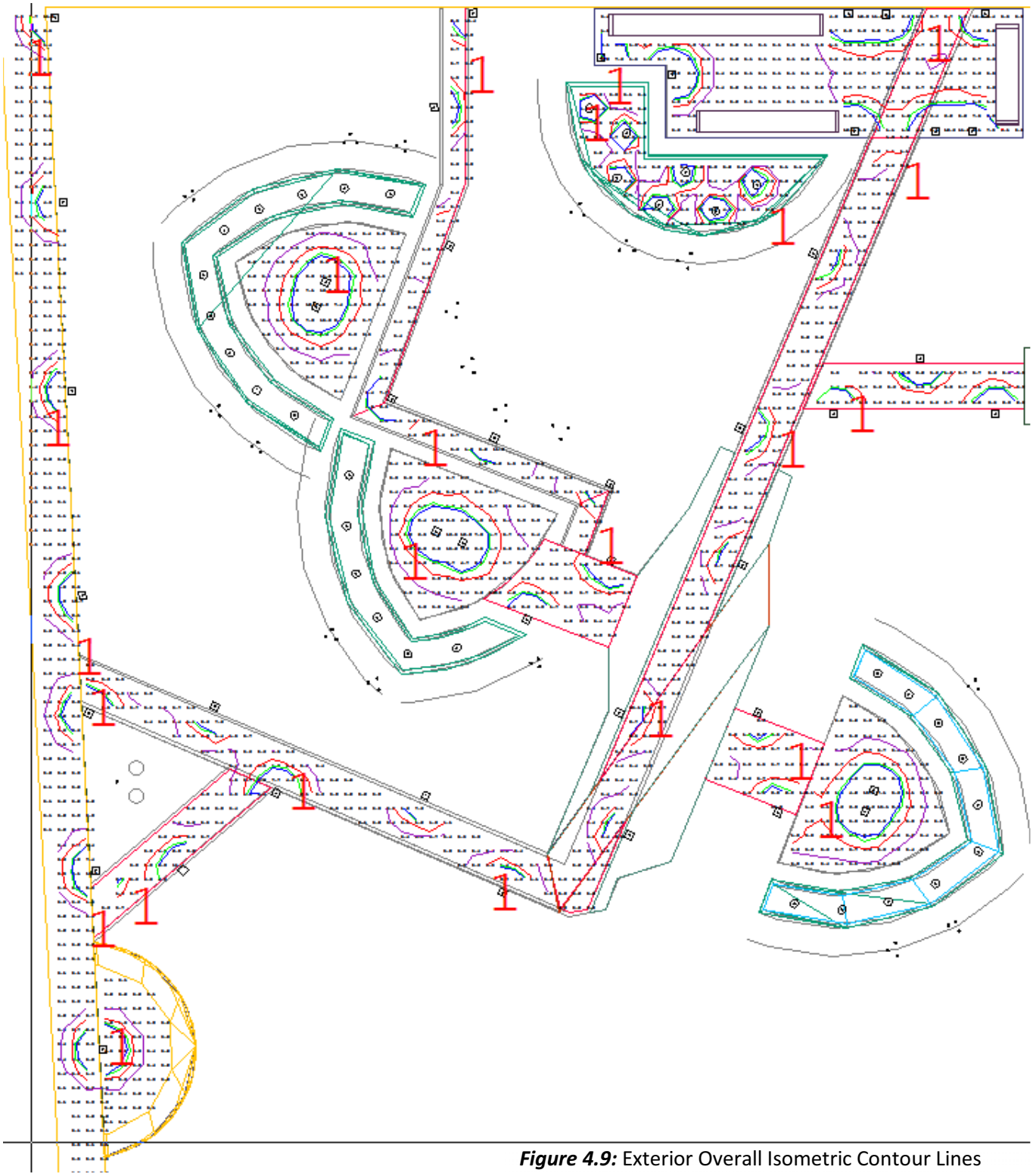


Figure 4.9: Exterior Overall Isometric Contour Lines

CALCULATION SUMMARY:

Exterior Gathering Space					
	Main Pathway	**Intermediate Pathway**	**Small Seating**	**Large Seating**	**Round Seating**
Avg. Illuminance	1.09	1.73	1.95	2.03	1.00
Avg/Min	10.0	4.80	8.60	12.9	10.0
CRITERIA	1.0	1.0	1.5	2.0	1.0
COMPLIANCE?	YES	YES	YES	YES	YES

FINAL RENDERINGS:

Figure 4.10: Exterior Pathway 3ds Max Final Render

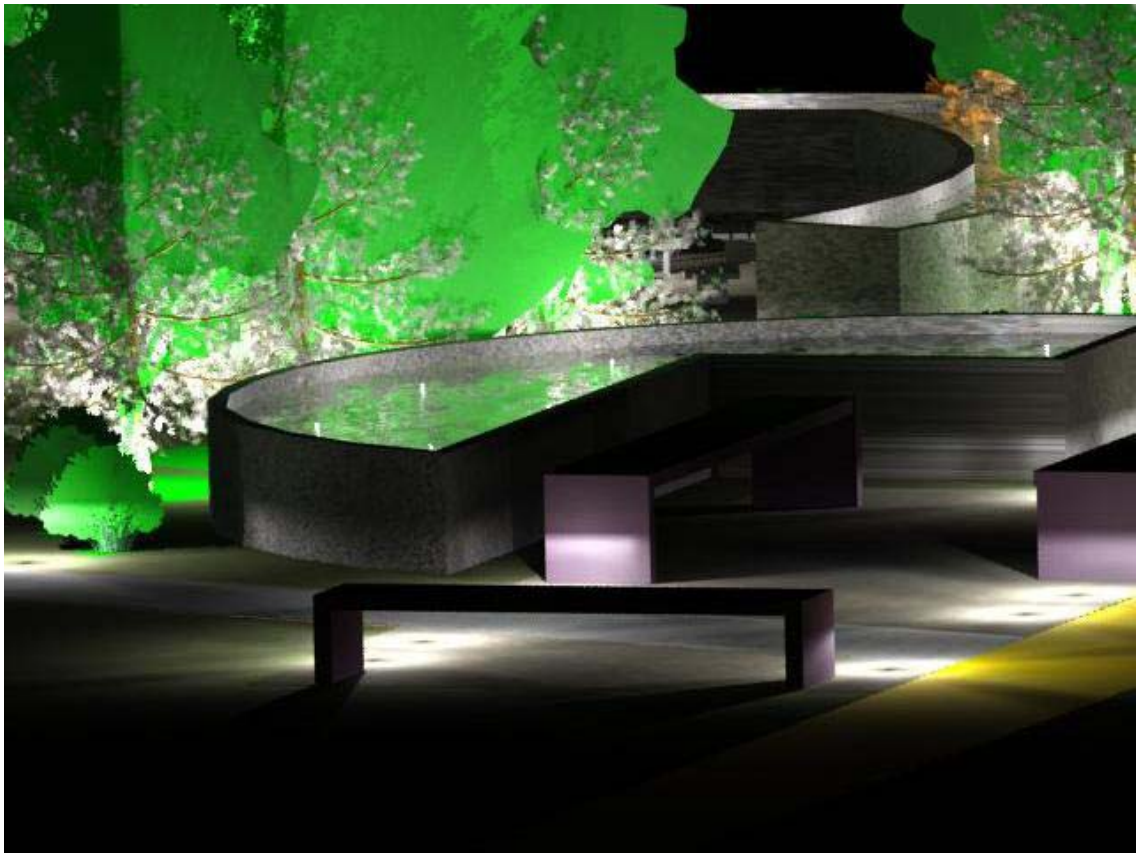


Figure 4.11: Exterior Large Seating Area , 3ds Max Final Render

EVALUATION:

The design of the exterior space meets the needs and hopefully the expectations of Newport News Shipbuilding and their efforts to enhance the waterfront of the James River. This exterior space is considered a great location to begin the enhancements of Newport News because there are many local parks surrounding the site that the VASCIC Facility is situated on. Creating an environment that is both public and obtains private areas tailors to the wants of everyone who may potentially utilize this space. There are multiple pathways and five individual seating areas available, all which incorporate water elements and visually aesthetic luminaires. The idea behind the lighting design was to create an environment where the equipment became part of the landscape. By utilizing glowing spheres in the reflecting pools generates an interesting environment to sit in. Also, square pathway luminaires were chosen to imitate "stepping stones" along the pathway to the water. The luminaires are able to hold the weight of a human while illuminating the landscape you walk on. Additionally, landscaping is placed throughout the site to create enclosed spaces while being in the open-ness of the outdoors. These taller elements are illuminated using LED spot lights also contributing to vertical illuminance throughout.

The lighting design for the space adequately complies with IESNA recommendations in addition to lighting power densities from ASHRAE Standard 90.1-2007. It properly tailors to the needs of the space as well as providing a visually interesting environment for the occupant. The lighting design also contributes to the aesthetic of the landscaping by becoming elements within the space.

ACOUSTICAL BREADTH | ACRYLIC CEILING REDESIGN

INTRODUCTION:

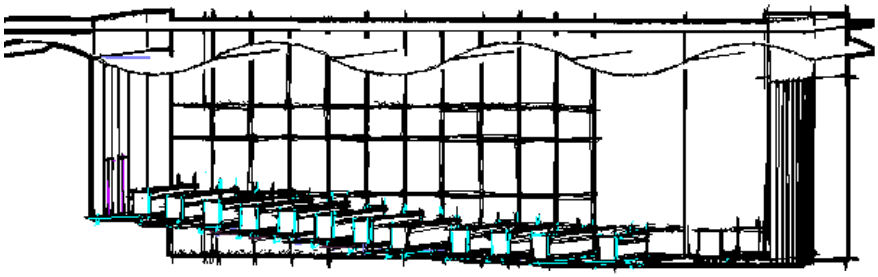


Figure 5.1: Auditorium 3D section

The auditorium is located on the second floor of the Laboratory Wing and seats 180 people in twelve rows occupying 7500 sq. ft. This space is mainly used for meeting situations utilizing a podium speaker and projection screen environment. To enhance to aesthetics of the space, a new ceiling was designed to imitate a wave form. However, the existing ceiling installed is a 2'x4' acoustical ceiling tile system. After redesigning the ceiling, an acrylic material was chosen. This new design could potentially cause problems.

PROBLEM:

Figure 5.2: Auditorium Ceiling System

Because the ceiling ungulates in form in order to imitate a wave of water, echoing may occur due to sound reverberating off the different ceiling heights throughout the space. In addition to the shape of the ceiling, the material change can have a large effect on the reverberation time of sound. Both of these considerations could potentially destroy an aesthetically pleasing space by not being a functional space. Therefore, these problems must be addressed in order to plausibly design the new ceiling in such a way.

In order to analyze the new ceiling, the following equations were used to calculate reverberation time. The acceptable range for reverberation time is between 1.4 seconds and 1.9 seconds.

$\mathrm{T\ (seconds)} = (0.05)(\frac{\mathrm{V}}{\mathrm{a}})$, where "T" is the reverberation time, "V" is the volume of the entire space, and "a" is the square foot area of absorption material.

$\mathrm{a(sabins)} = \sum \mathrm{S}\alpha$, where "α" is the absorption value for each material in the space and "S" is the surface area of that material.

The following table provides the total room volume, the materials considered, their surface area, as well as their absorption value for sound waves at 500 Hz and 1000 Hz. For the reverberation time calculation, "a" will be taken as an average of values at 500 Hz and 1000 Hz to acquire a value in a mid-frequency range.

	Volume: 94259.84 ft^3			
Location	Material	α		Surface Area (sq ft.)
		500 Hz	1000 Hz	
existing ceiling	ACT 3/4" suspension hang	0.83	0.99	27590.8
new ceiling	Actrylic 3/4" suspension hang	0.04	0.03	40187.2
walls	GWB 1/2" thick	0.08	0.04	4287.86
windows	Glass 1" thick pane	0.18	0.12	927.81
doors	wood 1/4" thick paneling with airspace	0.10	0.08	103.56
furniture	wooden chairs	0.22	0.39	per unit
furniture	wooden desks	0.75	0.86	per unit
audience	in upholstered seating	0.8	0.94	per unit

SOLUTION:

The following calculations prove the new acrylic material is not an acceptable material for the auditorium ceiling redesign. However, adding acoustical panels to the east interior wall, the reverberation time is within the acceptable range for the space in question.

	New		Old: medium weight	
Sound Absorption Material	a_{500}	a_{1000}	a_{500}	a_{1000}
Light Weight	1297.03	1423.35	1900.51	3085.96
Heavy Weight	1519.84	1705.19		

$T_{existing} = (0.05)(V)/(\alpha_{MW})$ = 1.8 seconds → T must be between 1.4 seconds and 1.9 seconds: acceptable

$T_{new} = (0.05)(V)/(\alpha_{LW})$ = 3.5 seconds → T must be between 1.4 seconds and 1.9 seconds: not acceptable

$T_{new} = (0.05)(V)/(\alpha_{HW})$ = 2.9 seconds → T must be between 1.4 seconds and 1.9 seconds: not acceptable

$T_{sound\ material} = (0.05)(V)/(\alpha_{HW})$ = 1.7 seconds → T must be between 1.4 seconds and 1.9 seconds: acceptable

CONCLUSION:

In order to reduce the reverberation time of the new acrylic material, the existing acoustical paneling on the south rear wall must be changed to a heavy weight wall covering as well as the addition of more heavy weight wall coverings along the east interior wall. The wall coverings are available in the same color as the paint within the space to the visibility of the wall panels will be reduced and not affect the aesthetics of the space.

ELECTRICAL DEPTH

INTRODUCTION:

As a result of the new lighting design reducing electrical lighting loads throughout the building, consequently the electrical equipment will need to be redesigned to better fit the system. The spaces in throughout the building that were redesigned include the main lobby and staircase, the fourth floor open office located in the Technology Tower, the multi-purpose auditorium on the second floor of the Laboratory Wing, and a newly designed exterior space located between the VASCIC facility and the waterfront promenade.

The electrical equipment that will be considered for resizing is the lighting panelboards and perspective feeders for each space. In addition, voltage drop calculations, short circuit calculations, and a protection device coordination study will be performed. If necessary, electrical feeders will be resized per results of the calculations.

Two other breadth studies will include the design of a motor control center located in the large electrical room of the Laboratory Wing and a cost analysis study of busduct verses conduit and feeders in the Laboratory Wing.

The following table provides a breakdown of which panels will be affected in each space to be redesigned:

PANELBOARDS						
PANEL TAG	VOLTAGE	SYSTEM	AUDITORIUM	OFFICE	LOBBY	EXTERIOR
LLA	208Y/120, 3P, 4W	N	X			
EDHB	480Y/277, 3P, 4W	N/E	X			
H2A	480Y/277, 3P, 4W	N		X		
EH4A	480Y/277, 3P, 4W	N/E		X		
LGB	208Y/120, 3P, 4W	N			X	
EH4A	480Y/277, 3P, 4W	N/E			X	
HGA	480Y/277, 3P, 4W	N				X

CIRCULATION SPACE | LOBBY ATRIUM

SPACE DESCRIPTION:

The main lobby and staircase is located on the ground floor of the Office Tower occupying approximately 2981 sq. ft. Because of a high water table and floor plane, the reception desk, security, elevators and stairs are the only assets to this space. The reception desk is the main focal point when you walk through the main entrance of the lobby, followed by the grand staircase rising overhead of the desk. The lobby is enclosed in a curtain wall system with reflecting pools surrounding the exterior of the lobby only permitting you to follow certain pathways to the entrances.

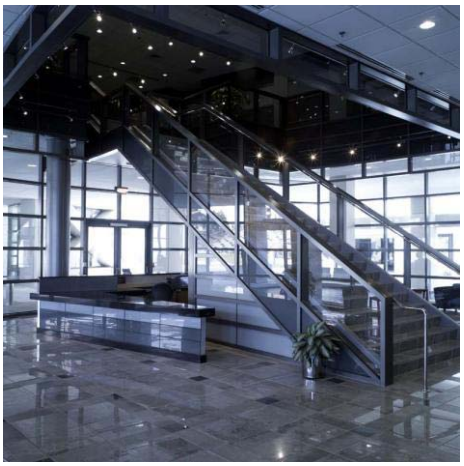


Figure 6.1: Existing Lobby

LIGHTING DESIGN:

The redesigned lighting in the lobby space is tailored towards the design concepts discussed in the Lighting Depth of this report. The main design goal is to illuminate key elements adequately while trying to utilizing more energy efficient fixtures and sources. Throughout the lobby, the entire space is illuminated using LED sources with high color rendering indices and highly efficient luminaires to produce the best environment possible.

Four fixture types are utilized in the lobby in order to create the environment desired. Downlights are evenly spaced throughout the circulation space to illuminate the horizontal surface. Square wall washers highlight the vertical columns emphasizing the vertical element in the space. In addition to the square wall washers, linear recessed wall washers in the ceiling illuminate the central column walls and elevator location for ease of navigation of the occupant. Integrated lighting in the handrail system of the main staircase illuminates the pathway to the upper floors. Lastly, the reception desk utilizes task lighting mounted to the underside of the counter concealing the fixture while illuminating the task surface.

ELECTRICAL DESIGN OBJECTIVES:

The lobby redesign with LED sources is intended to reduce the load on the panelboards and, as a result, the feeder sizes. The lighting loads will remain on the same panelboard, however some existing circuits may not be used used as a consequence of the new lighting design.

CONTROLS:

The lighting design in the lobby space is controlled by three one-way switches located at the reception desk.

EXISTING PANELBOARD SCHEDULES:

The following are the existing panelboard schedules for panel LGB (208Y/120V) and normal-emergency panel EH4A (480Y/277V). The modified circuits are highlighted in pink.

PANELBOARD LGB SCHEDULE

100 AMP BUS 100 AMP MCB 208Y/120 VOLTS 3 PH, 4 W, SN, MIN. 10 KAIC SURFACE MOUNTED

LOAD SERVED	LOAD (AMPS) A	B	C	BKR. TRIP	WIRE SIZE	CKT. NO.	PHASE A B C	CKT. NO.	WIRE SIZE	BKR. TRIP	LOAD (AMPS) A	B	C	LOAD SERVED
RECEPTACLES	7.5			20	12	1		2	12	20	10.0			TRACK LIGHTING XFMR
RECEPTACLES		4.5		20	12	3		4	12	20		10.0		TRACK LIGHTING XFMR
RECEPTACLES			6.0	20	12	5		6	12	20			10.0	TRACK LIGHTING XFMR
RECEPTACLES	6.0			20	12	7		8	12	20	10.0			TRACK LIGHTING XFMR
CCTV CAMERA REC		5.0		20	12	9		10	12	20		10.0		TRACK LIGHTING XFMR
CCTV CAMERA REC			5.0	20	12	11		12	12	20			10.0	TRACK LIGHTING XFMR
CCTV MULTIPLEX, PWR	2.0			20	12	13		14	12	20	3.0			LIGHTS - ELEV. PIT
SPARE				20		15		16		20				SPARE
SPARE				20		17		18		20				SPARE
SPARE				20		19		20		20				SPARE
SPARE				20		21		22		20				SPARE
SPARE				20		23		24		20				SPARE
TOTAL	15.5	9.5	11.0								23.0	20.0	20.0	TOTAL

TOTAL CONNECTED AMPS A: 38.5 B: 29.5 C: 31.0

PANELBOARD EH4A SCHEDULE

100 AMP BUS 70 AMP MCB 480Y/277 VOLTS 3 PH, 4 W, SN, MIN. 14 KAIC SURFACE MOUNTED

LOAD SERVED	LOAD (AMPS) A	B	C	BKR. TRIP	WIRE SIZE	CKT. NO.	PHASE A B C	CKT. NO.	WIRE SIZE	BKR. TRIP	LOAD (AMPS) A	B	C	LOAD SERVED
LIGHTING - 1ST FLR	9.5			20	12	1		2	12	20	5.0			LIGHTING - 4TH FLOOR
LIGHTING - 1ST FLR		3.0		20	12	3		4	12	20		5.0		LIGHTING - 5TH FLOOR
ENCL CB FOR FACP			6.3	20	12	5		6	12	20			5.0	LIGHTING - 6TH FLOOR
VIA 3 KVA XFMR	6.3							8	12	20				STAIRWELL LIGHTING
LIGHTING - 2ND FLOOR		5.0		20	12	9		10	12	20				STAIRWELL LIGHTING
LIGHTING - 3RD FLOOR			5.0	20	12	11		12		20				SPARE
SPARE				20		13		14		20				SPARE
SPARE	(K2)			20		15		16		20				SPARE
SPARE				20		17		18		20				SPARE
		(K28)								(K29)				
TOTAL	15.8	8.0	11.3								5.0	5.0	5.0	TOTAL

TOTAL CONNECTED AMPS A: 20.8 B: 13.0 C: 16.3

PANELBOARD REDESIGN:

Below are the redesigned panel boards and their corresponding panelboard sizing worksheet. The modified circuits are highlighted in pink.

PANELBOARD SCHEDULE

VOLTAGE:	208Y/120V,3PH,4W	PANEL TAG:	LGB	MIN. C/B AIC:	10K
SIZE/TYPE BUS:	100A	PANEL LOCATION:	Elec. Rm 104	OPTIONS:	
SIZE/TYPE MAIN:	60A/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
Receptacles	Rec. Desk	2565	20A/1P	1	*			2	20A/1P	1344	Lobby	New Lighting
Receptacles	Rec. Desk	1539	20A/1P	3		*		4	20A/1P	1116	Lobby	New Lighting
Receptacles	Lobby	2052	20A/1P	5			*	6	20A/1P	0	Rm 100	Track Lighting XFMR
Receptacles	Maintenance Closets	2052	20A/1P	7	*			8	20A/1P	0	Rm 100	Track Lighting XFMR
Receptacles CCTV	Outside Lobby	1710	20A/1P	9		*		10	20A/1P	0	Rm 100	Track Lighting XFMR
Receptacles CCTV	Outside Lobby	1710	20A/1P	11			*	12	20A/1P	0	Rm 100	Track Lighting XFMR
CCTV Camera Rec	Rm 104	684	20A/1P	13	*			14	20A/1P	1026	Elev 1-3	Lighting Elev Pit
SPARE		0	20A/1P	15		*		16	20A/1P	0		SPARE
SPARE		0	20A/1P	17			*	18	20A/1P	0		SPARE
SPARE		0	20A/1P	19	*			20	20A/1P	0		SPARE
SPARE		0	20A/1P	21		*		22	20A/1P	0		SPARE
SPARE		0	20A/1P	23			*	24	20A/1P	0		SPARE
		0	20A/1P	25	*			26	20A/1P	0		
		0	20A/1P	27		*		28	20A/1P	0		
		0	20A/1P	29			*	30	20A/1P	0		
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A Ph.	7.67	TOTAL DESIGN LOAD (KW)	18.96
CONNECTED LOAD (KW) - B Ph.	4.37	POWER FACTOR	0.94
CONNECTED LOAD (KW) - C Ph.	3.76	TOTAL DESIGN LOAD (AMPS)	56

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				LGB	Panel Location:			Elec. Rm 104		
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	Receptacles	1	Rec. Desk	2565	w	0.95	2565	2700	
2	A	Track Lighting XFMR	3	Rm 100	1344	w	0.90	1344	1493	nstalled above ceilin
3	B	Receptacles	1	Rec. Desk	1539	w	0.95	1539	1620	
4	B	Track Lighting XFMR	3	Rm 100	1116	w	0.90	1116	1240	nstalled above ceilin
5	C	Receptacles	1	Lobby	2052	w	0.95	2052	2160	
6	C	Track Lighting XFMR	3	Rm 100	0	w	0.95	0	0	nstalled above ceilin
7	A	Receptacles	1	Maintenance Closets	2052	w	0.95	2052	2160	
8	A	Track Lighting XFMR	3	Rm 100	0	w	0.95	0	0	nstalled above ceilin
9	B	Receptacles CCTV	1	Outside Lobby	1710	w	0.95	1710	1800	
10	B	Track Lighting XFMR	3	Rm 100	0	w	0.95	0	0	nstalled above ceilin
11	C	Receptacles CCTV	1	Outside Lobby	1710	w	0.95	1710	1800	
12	C	Track Lighting XFMR	3	Rm 100	0	w	0.95	0	0	nstalled above ceilin
13	A	CCTV Camera Rec	9	Rm 104	684	w	0.95	684	720	
14	A	Lighting Elev Pit	5	Elev 1-3	1026	w	1.00	1026	1026	
15	B	SPARE			0	w		0	0	
16	B	SPARE			0	w		0	0	
17	C	SPARE			0	w		0	0	
18	C	SPARE			0	w		0	0	
19	A	SPARE			0	w		0	0	
20	A	SPARE			0	w		0	0	
21	B	SPARE			0	w		0	0	
22	B	SPARE			0	w		0	0	
23	C	SPARE			0	w		0	0	
24	C	SPARE			0	w		0	0	
25	A				0	w		0	0	
26	A				0	w		0	0	
27	B				0	w		0	0	
28	B				0	w		0	0	
29	C				0	w		0	0	
30	C				0	w		0	0	
31	A				0	w		0	0	
32	A				0	w		0	0	
33	B				0	w		0	0	
34	B				0	w		0	0	
35	C				0	w		0	0	
36	C				0	w		0	0	
37	A				0	w		0	0	
38	A				0	w		0	0	
39	B				0	w		0	0	
40	B				0	w		0	0	
41	C				0	w		0	0	
42	C				0	w		0	0	
PANEL TOTAL								15.8	16.7	Amps= 46.4

PHASE LOADING		kW	kVA	%	Amps
PHASE TOTAL	A	7.7	8.1	48%	67.5
PHASE TOTAL	B	4.4	4.7	28%	38.8
PHASE TOTAL	C	3.8	4.0	24%	33.0

LOAD CATAGORIES		Connected			Demand				Ver. 1.04
		kW	kVA	DF	kW	kVA	PF		
1	receptacles	11.6	12.2		11.6	12.2	0.95		
3	lighting	2.5	2.7		2.5	2.7	0.90		
5	incandescent lighting	1.0	1.0		1.0	1.0	1.00		
9	unassigned	0.7	0.7		0.7	0.7	0.95		
Total Demand Loads					15.8	16.7			
Spare Capacity		20%			3.2	3.3			
Total Design Loads					19.0	20.1	0.94	Amps=	55.7

PANELBOARD SCHEDULE

VOLTAGE:	480Y/277V,3PH,4W	PANEL TAG:	EH4A	MIN. C/B AIC:	14K
SIZE/TYPE BUS:	100A	PANEL LOCATION:	Elec. Rm 510	OPTIONS:	
SIZE/TYPE MAIN:	60A/3P C/B	PANEL MOUNTING:	SURFACE		FOR PANELBOARD

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Lighting 1st Floor	1st Floor	360	20A/1P	1	*			2	20A/1P	1385	4th Floor	Lighting 4th Floor
Lighting 1st Floor	1st Floor	0	20A/1P	3		*		4	20A/1P	1385	5th Floor	Lighting 5th Floor
Encl CB for FACP	Rm 103	1745	20A/2P	5			*	6	20A/1P	4155	6th Floor	Lighting 6th Floor
Encl CB for FACP	Rm 103	1745	20A/2P	7	*			8	20A/1P	0	2-704	Stairwell Lighting
Lighting 2nd Floor	2nd Floor	1385	20A/1P	9		*		10	20A/1P	0	2-726	Stairwell Lighting
Lighting 3rd Floor	3rd Floor	1316	20A/1P	11			*	12	20A/1P	0		SPARE
SPARE		0	20A/1P	13	*			14	20A/1P	0		SPARE
SPARE		0	20A/1P	15		*		16	20A/1P	0		SPARE
SPARE		0	20A/1P	17			*	18	20A/1P	0		SPARE
		0	20A/1P	19	*			20	20A/1P	0		
		0	20A/1P	21		*		22	20A/1P	0		
		0	20A/1P	23			*	24	20A/1P	0		
		0	20A/1P	25	*			26	20A/1P	0		
		0	20A/1P	27		*		28	20A/1P	0		
		0	20A/1P	29			*	30	20A/1P	0		
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A Ph.	3.49	TOTAL DESIGN LOAD (KW)	16.17
CONNECTED LOAD (KW) - B Ph.	2.77	POWER FACTOR	0.98
CONNECTED LOAD (KW) - C Ph.	7.22	TOTAL DESIGN LOAD (AMPS)	20

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				EH4A	Panel Location:			Elec. Rm 510		
Nominal Phase to Neutral Voltage------->				277	Phase:			3		
Nominal Phase to Phase Voltage-------->				480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	Lighting 1st Floor	3	1st Floor	359.8	w	0.85	360	423	
2	A	Lighting 4th Floor	3	4th Floor	1385	w	1.00	1385	1385	
3	B	Lighting 1st Floor	3	1st Floor	0	w	0.85	0	0	
4	B	Lighting 5th Floor	3	5th Floor	1385	w	1.00	1385	1385	
5	C	Encl CB for FACP	9	Rm 103	1745	w	1.00	1745	1745	
6	C	Lighting 6th Floor	3	6th Floor	4155	w	1.00	4155	4155	
7	A	Encl CB for FACP	9	Rm 103	1745	w	1.00	1745	1745	
8	A	Stairwell Lighting	3	2-704	0	w	1.00	0	0	
9	B	Lighting 2nd Floor	3	2nd Floor	1385	w	1.00	1385	1385	
10	B	Stairwell Lighting	3	2-726	0	w	1.00	0	0	
11	C	Lighting 3rd Floor	3	3rd Floor	218	w	0.85	218	256	
12	C	SPARE			0	w		0	0	
13	A	SPARE			0	w		0	0	
14	A	SPARE			0	w		0	0	
15	B	SPARE			0	w		0	0	
16	B	SPARE			0	w		0	0	
17	C	SPARE			0	w		0	0	
18	C	SPARE			0	w		0	0	
19	A				0	w		0	0	
20	A				0	w		0	0	
21	B				0	w		0	0	
22	B				0	w		0	0	
23	C				0	w		0	0	
24	C				0	w		0	0	
25	A				0	w		0	0	
26	A				0	w		0	0	
27	B				0	w		0	0	
28	B				0	w		0	0	
29	C				0	w		0	0	
30	C				0	w		0	0	
31	A				0	w		0	0	
32	A				0	w		0	0	
33	B				0	w		0	0	
34	B				0	w		0	0	
35	C				0	w		0	0	
36	C				0	w		0	0	
37	A				0	w		0	0	
38	A				0	w		0	0	
39	B				0	w		0	0	
40	B				0	w		0	0	
41	C				0	w		0	0	
42	C				0	w		0	0	
PANEL TOTAL								12.4	12.5	Amps= 15.0

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					3.5	3.6	28%	12.8
PHASE TOTAL	B					2.8	2.8	22%	10.0
PHASE TOTAL	C					6.1	6.2	49%	22.2

LOAD CATAGORIES			Connected			Demand				Ver. 1.84
			kW	kVA	DF	kW	kVA	PF		
3	fluorescent lighting		8.9	9.0		8.9	9.0	0.99		
9	unassigned		3.5	3.5		3.5	3.5	1.00		
Total Demand Loads						12.4	12.5			
Spare Capacity			20%			2.5	2.5			
Total Design Loads						14.9	15.0	0.99	Amps=	18.0

FEEDER SIZING:

The data for the summary table below are from the redesigned panelboards LGB and EH4A. The sizing is referenced from the NEC handbook.

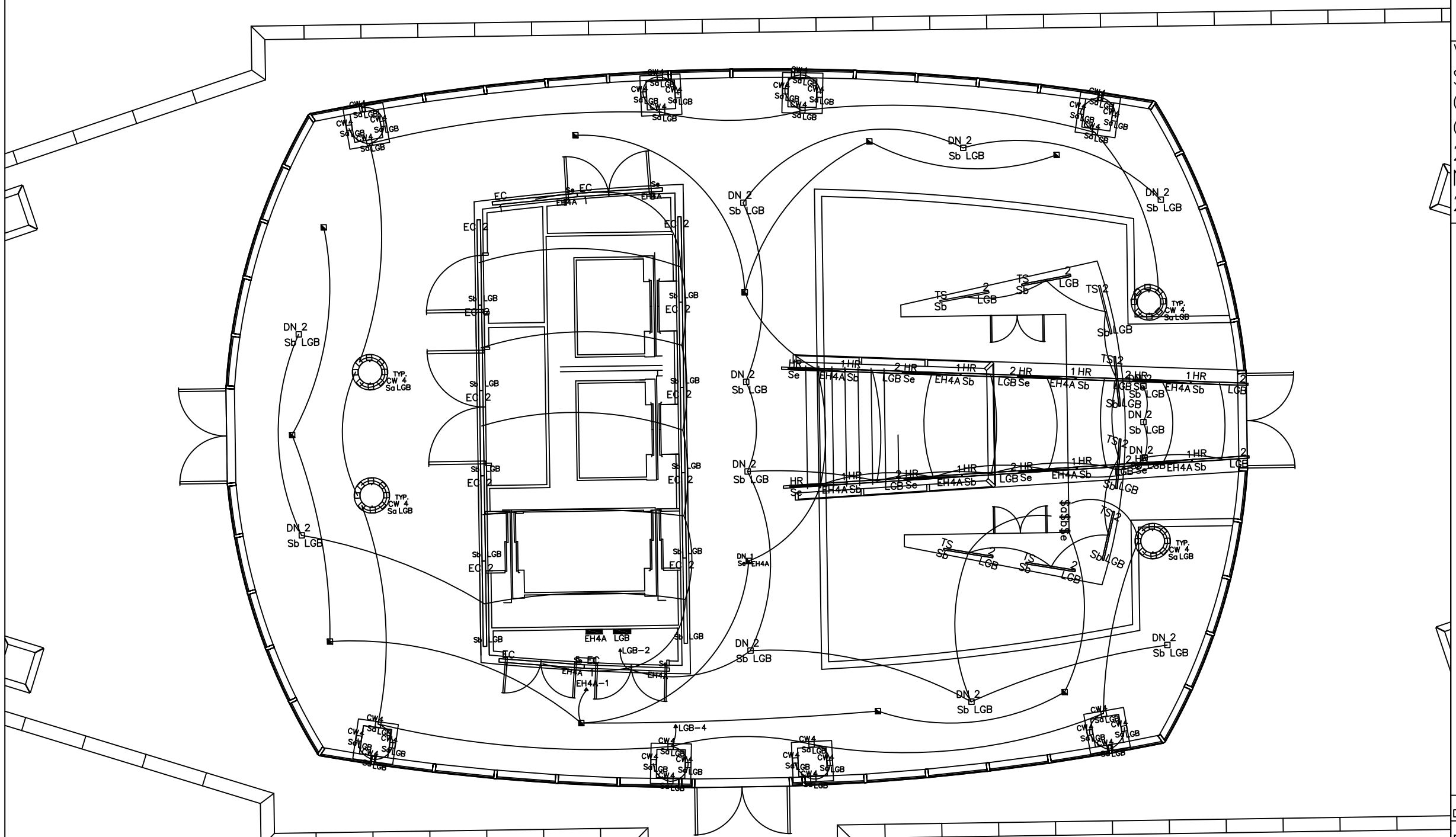
PANELBOARD	
TAG	LGB
VOLTAGE SYSTEM	208Y/120V
CALCULATED DESIGN LOAD (kW)	18.96
CALCULATED POWER FACTOR	0.95
CALCULATED DESIGN LOAD (kVA)	20.1
CALCULATED DESIGN LOAD (A)	55.0
FEEDER	
FEEDER PROTECTION SIZE	60
NUMBER OF SETS	1
WIRE SIZE	
PHASE	(3) #6 AWG
NEUTRAL	(1) #6 AWG
GROUND	(1) #10 AWG
WIRE AREA	
EACH PHASE	0.0507
TOTAL - ALL PHASES	0.1521
NEUTRAL	0.0507
GROUND	0.0211
TOTAL - ALL WIRES	0.2239
MINIMUM CONDUIT AREA	0.5598
CONDUIT SIZE	1" EMT
CONDUIT SIZE	1-1/4" EMT
FEEDER LENGTH	17’-6”
FINAL VOLTAGE DROP (V)	119.5V
FINAL VOLTAGE DROP (%)	0.4%
WAS FEEDER RESIZED?	NO

NOTE: *Wire sized for copper THHN at 75˚C

PANELBOARD	
TAG	EH4A
VOLTAGE SYSTEM	480Y/277V
CALCULATED DESIGN LOAD (kW)	14.9
CALCULATED POWER FACTOR	0.99
CALCULATED DESIGN LOAD (kVA)	15.0
CALCULATED DESIGN LOAD (A)	18.0
FEEDER	
FEEDER PROTECTION SIZE	60A
NUMBER OF SETS	1
WIRE SIZE	
PHASE	(3) #12
NEUTRAL	(1) #12
GROUND	(1) #10
WIRE AREA	
EACH PHASE	0.0133
TOTAL - ALL PHASES	0.0399
NEUTRAL	0.0133
GROUND	0.0211
TOTAL - ALL WIRES	0.0742
MINIMUM CONDUIT AREA	0.1855
CONDUIT SIZE	1/2" EMT
CONDUIT SIZE	3/4" EMT
FEEDER LENGTH	50’-4”
FINAL VOLTAGE DROP (V)	275.2V
FINAL VOLTAGE DROP (%)	.6%
WAS FEEDER RESIZED?	NO

NOTE: *Wire sized for copper THHN at 75˚C

WIRING DIAGRAM:


KEYNOTES
VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER
2401 W. AVENUS
NEWPORT NEWS, VA
23607
DRAWN BY: ALYSON LARIMER
PENN STATE AE SENIOR THESIS
ELECTRICAL CONSULTANT: PROF. TED DANNERTH
TITLE: LOBBY WIRING DIAGRAM
DATE: 7-APRIL-2011
SCALE: 1/8" = 1'-0"
N
E1-1

LARGE WORK SPACE | OPEN OFFICE

SPACE DESCTIRTION:

The Office Tower is comprised of 8 floors occupying 12,752 square feet, intended for coordination within new technology research. Floors three through seven utilize an open floor plan for workstation placement. The third floor will be the focus for the workspace requirement. Each floor can hold up to 80 work stations all having a clear view to the exterior due to the Office Tower being enclosed by a curtain wall system of fritted glasses. The office spaces utilize a task-ambient lighting approach to improve the comfort and production level of each employee. By illuminating the ceiling and vertical elements throughout the space produces an open-feeling environment. Additionally, integrated dimming controls at each workstation as well as daylight harvesting throughout the space are utilized.

Figure 7.1: Existing Open Office

LIGHTING DESIGN:

The redesign of the lighting in the open office is intended to adequately illuminate the task surface as well as highlighting the ceiling for ambient lighting. The primary design goal of the space is to illuminate the task surface from a task- ambient approach without hanging fixtures from the ceiling plane. By doing this, the ceiling is uninterrupted by objects but illuminated at the same time. This fixture utilizes an upward and downward component with a single T5 linear fluorescent source that is personally controllable to each occupant. The task-ambient fixtures are mounted to each cubicle on adjacent walls providing proper illumination on the task surface. In addition to the task- ambient lighting, LED wall sconces are mounted on the column walls located around the interior corridor of the Technology Tower.

ELECTRICAL DESIGN OBJECTIVES:

The open office is redesigned with LED and linear fluorescent sources intended to reduce the load on the panelboards and, as a result, the feeder sizes. The lighting loads will remain on the same panelboard, however some existing circuits may not be used as a consequence of the new lighting design.

CONTROLS:

Within the open office plan, it is divided into two zones in order to adequately daylight for increased energy savings. The luminaires chosen for the space offer an integrated wireless hub, Tambient Control Hub that communicates with the photosensors via EnOcean wireless technology throughout the space. Occupancy sensors are also located within the office space that is also a wireless control communicating with the Tambient

Control Hub. Each photosensor and occupancy sensor is capable of communicating with more than one hub due to their coverage range of 98.5'. The control hub has five ports located on the backside and is a plug-and-play module mounted to the underside of a workstation. Generally, the hub can control up to 50 dimming ballasts, however since there are only 5 ports, it is easiest to control 5 luminaires. Each Tambient Control Hub acts as a zone and controls the connected luminaires in unison. In addition, multiple hubs can also be networked together in order to control an entire floor plan as one zone if desired. The photosensors are wireless sensors with dual solar cells within the module and are placed on the ceiling within the daylight zone. Zone 1 controls the first two rows of workstations closest to the windows, which will be affected by daylight most frequently. Zone 2 will be electric light only containing the remaining two rows of workstations closest to the interior corridor. Because the contour of the building façade is a curve, it is best not to network all the Tambient Control Hubs together due to the path of the sun with respect to the shape of the building. Instead, two control hubs adjacent to one another will be networked together creating three uniformly operated zones along the glass façade.

EXISTING PANELBOARD SCHEDULES:

The following are the existing panelboard schedules for panel H2A (480Y/277V) and normal-emergency panel EH4A (480Y/277V). The modified circuits are highlighted in green.

PANELBOARD H2A SCHEDULE

225 AMP BUS 200 AMP MCB 480Y/277 VOLTS 3 PH, 4 W, SN, MIN. 35 KAIC SURFACE MOUNTED

LOAD SERVED	LOAD (AMPS) A	B	C	BKR. TRIP	WIRE SIZE	CKT. NO.	PHASE A B C	CKT. NO.	WIRE SIZE	BKR. TRIP	LOAD (AMPS) A	B	C	LOAD SERVED
PANELS L2A1 & L2A2	46.4			80	4	1		2	4	80	52.6			PANELS L2B1 & L2B2
VIA		51.9										49.9		VIA
DT TRANSFORMER			45.6										45.2	DT TRANSFORMER
LIGHTING	15.0			20	12	7		8	12	20	8.9			VAV UNIT
LIGHTING		9.0		20	12	9		10	12	20		9.4		VAV UNIT
LIGHTING			9.0	20	12	11		12	12	20			7.4	VAV UNIT
LIGHTING	12.0			20	12	13		14	12	20	5.9			VAV UNIT
LIGHTING		9.0		20	12	15		16	12	20		6.9		VAV UNIT
LIGHTING			9.0	20	12	17		18	12	20			6.3	VAV UNIT
SPARE				20		19		20	12	20	4.8			VAV UNIT
SPARE				20		21		22	12	20		7.4		VAV UNIT
SPARE				20		23		24		20				SPARE
SPARE				20		25		26		20				SPARE
SPARE				20		27		28		20				SPARE
SPARE				20		29		30		20				SPARE
SPARE				20		31		32		20				SPARE
SPARE				20		33		34		20				SPARE
SPARE				20		35		36		20				SPARE
SPACE						37		38						SPACE
SPACE						39		40						SPACE
SPACE						41		42						SPACE
TOTAL	73.4	69.9	63.6								72.2	73.6	58.9	TOTAL

TOTAL CONNECTED AMPS A: 145.6 B: 143.5 C: 122.5

PANELBOARD EH4A SCHEDULE

100 AMP BUS 70 AMP MCB 480Y/277 VOLTS 3 PH, 4 W, SN, MIN. 14 KAIC SURFACE MOUNTED

LOAD SERVED	LOAD (AMPS) A	B	C	BKR. TRIP	WIRE SIZE	CKT. NO.	PHASE A B C	CKT. NO.	WIRE SIZE	BKR. TRIP	LOAD (AMPS) A	B	C	LOAD SERVED
LIGHTING - 1ST FLR	9.5			20	12	1		2	12	20	5.0			LIGHTING - 4TH FLOOR
LIGHTING - 1ST FLR		3.0		20	12	3		4	12	20		5.0		LIGHTING - 5TH FLOOR
ENCL CB FOR FACP			6.3	20	12	5		6	12	20			5.0	LIGHTING - 6TH FLOOR
VIA 3 KVA XFMR	6.3							8	12	20				STAIRWELL LIGHTING
LIGHTING - 2ND FLOOR		5.0		20	12	9		10	12	20				STAIRWELL LIGHTING
LIGHTING - 3RD FLOOR			5.0	20	12	11		12		20				SPARE
SPARE				20		13		14		20				SPARE
SPARE				20		15		16		20				SPARE
SPARE				20		17		18		20				SPARE
TOTAL	15.8	8.0	11.3								5.0	5.0	5.0	TOTAL

TOTAL CONNECTED AMPS A: 20.8 B: 13.0 C: 16.3

PANELBOARD REDESIGN:

Below are the redesigned panel boards and their corresponding panelboard sizing worksheet. The modified circuits are highlighted in green.

PANELBOARD SCHEDULE

VOLTAGE:	480Y/277V,3PH,4W	PANEL TAG:	H2A	MIN. C/B AIC:	35K
SIZE/TYPE BUS:	225A	PANEL LOCATION:	Elec. Rm 310	OPTIONS:	
SIZE/TYPE MAIN:	200A/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
Panel L2A1 & L2A2	Rm 307	11567	80A/1P	1	*			2	80A/1P	13113	Rm 325	Panel L2B1 & L2B2
Panel L2A1 & L2A2	Rm 307	12939	80A/1P	3		*		4	80A/1P	12440	Rm 325	Panel L2B1 & L2B2
Panel L2A1 & L2A2	Rm 307	11369	80A/1P	5			*	6	80A/1P	11268	Rm 325	Panel L2B1 & L2B2
Lighting	Rm 331	3000	20A/1P	7	*			8	20A/1P	1849	Rm 331	VAV Unit
Lighting	Rm 331	3000	20A/1P	9		*		10	20A/1P	1953	Rm 331	VAV Unit
Lighting		0	20A/1P	11			*	12	20A/1P	1537	Rm 308	VAV Unit
Lighting		0	20A/1P	13	*			14	20A/1P	1226	Rm 332	VAV Unit
Lighting	Rm 332	6000	20A/1P	15		*		16	20A/1P	1433	Rm 312	VAV Unit
Lighting	Rm 332	0	20A/1P	17			*	18	20A/1P	1309	Rm 332	VAV Unit
SPARE		0	20A/1P	19	*			20	20A/1P	997	Rm 332	VAV Unit
SPARE		0	20A/1P	21		*		22	20A/1P	1537	Rm 318	VAV Unit
SPARE		0	20A/1P	23			*	24	20A/1P	0		SPARE
SPARE		0	20A/1P	25	*			26	20A/1P	0		SPARE
SPARE		0	20A/1P	27		*		28	20A/1P	0		SPARE
SPARE		0	20A/1P	29			*	30	20A/1P	0		SPARE
SPARE		0	20A/1P	31	*			32	20A/1P	0		SPARE
SPARE		0	20A/1P	33		*		34	20A/1P	0		SPARE
SPARE		0	20A/1P	35			*	36	20A/1P	0		SPARE
SPACE		0	20A/1P	37	*			38	20A/1P	0		SPACE
SPACE		0	20A/1P	39		*		40	20A/1P	0		SPACE
SPACE		0	20A/1P	41			*	42	20A/1P	0		SPACE

CONNECTED LOAD (KW) - A Ph.	31.75	TOTAL DESIGN LOAD (KW)	120.67
CONNECTED LOAD (KW) - B Ph.	39.30	POWER FACTOR	0.93
CONNECTED LOAD (KW) - C Ph.	25.48	TOTAL DESIGN LOAD (AMPS)	157

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				H2A	Panel Location:			Elec. Rm 310			
Nominal Phase to Neutral Voltage------->				277	Phase:			3			
Nominal Phase to Phase Voltage-------->				480	Wires:			4			
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	Panel L2A1& L2A2	9	Rm 307	11567	w	0.95	11567	12176		
2	A	Panel L2B1& L2B2	9	Rm 325	13113	w	0.95	13113	13803		
3	B	Panel L2A1& L2A2	9	Rm 307	12939	w	0.95	12939	13620		
4	B	Panel L2B1& L2B2	9	Rm 325	12440	w	0.95	12440	13095		
5	C	Panel L2A1& L2A2	9	Rm 307	11369	w	0.95	11369	11967		
6	C	Panel L2B1& L2B2	9	Rm 325	11268	w	0.95	11268	11861		
7	A	Lighting	3	Rm 331	3000	w	1.00	3000	3000		
8	A	VAV Unit	6	Rm 331	1849	w	0.75	1849	2465		
9	B	Lighting	3	Rm 331	3000	w	1.00	3000	3000		
10	B	VAV Unit	6	Rm 331	1953	w	0.75	1953	2604		
11	C	Lighting	3		0	w	1.00	0	0	NOT USED	
12	C	VAV Unit	6	Rm 308	1537	w	0.75	1537	2049		
13	A	Lighting	3		0	w	1.00	0	0	NOT USED	
14	A	VAV Unit	6	Rm 332	1226	w	0.75	1226	1635		
15	B	Lighting	3	Rm 332	6000	w	1.00	6000	6000	Other Side Office	
16	B	VAV Unit	6	Rm 312	1433	w	0.75	1433	1911		
17	C	Lighting	3	Rm 332		w	1.00	0	0	Other Side Office	
18	C	VAV Unit	6	Rm 332	1309	w	0.75	1309	1745		
19	A	SPARE			0	w		0	0		
20	A	VAV Unit	6	Rm 332	997	w	0.75	997	1329		
21	B	SPARE			0	w		0	0		
22	B	VAV Unit	6	Rm 318	1537	w	0.75	1537	2049		
23	C	SPARE			0	w		0	0		
24	C	SPARE			0	w		0	0		
25	A	SPARE			0	w		0	0		
26	A	SPARE			0	w		0	0		
27	B	SPARE			0	w		0	0		
28	B	SPARE			0	w		0	0		
29	C	SPARE			0	w		0	0		
30	C	SPARE			0	w		0	0		
31	A	SPARE			0	w		0	0		
32	A	SPARE			0	w		0	0		
33	B	SPARE			0	w		0	0		
34	B	SPARE			0	w		0	0		
35	C	SPARE			0	w		0	0		
36	C	SPARE			0	w		0	0		
37	A	SPACE			0	w		0	0		
38	A	SPACE			0	w		0	0		
39	B	SPACE			0	w		0	0		
40	B	SPACE			0	w		0	0		
41	C	SPACE			0	w		0	0		
42	C	SPACE			0	w		0	0		
PANEL TOTAL								96.5	104.3	Amps=	125.5

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					31.8	34.4	33%	124.2
PHASE TOTAL	B					39.3	42.3	41%	152.6
PHASE TOTAL	C					25.5	27.6	26%	99.7

LOAD CATAGORIES			Connected			Demand				Ver. 1.01
			kW	kVA	DF	kW	kVA	PF		
3	fluorescent lighting		12.0	12.0		12.0	12.0	1.00		
6	HVAC fans		11.8	15.8		11.8	15.8	0.75		
9	unassigned		72.7	76.5		72.7	76.5	0.95		
Total Demand Loads						96.5	104.3			
Spare Capacity			25%			24.1	26.1			
Total Design Loads						120.7	130.4	0.93	Amps=	156.9

PANELBOARD SCHEDULE

VOLTAGE:	480Y/277V,3PH,4W	PANEL TAG:	EH4A	MIN. C/B AIC:	14K
SIZE/TYPE BUS:	100A	PANEL LOCATION:	Elec. Rm 510	OPTIONS:	
SIZE/TYPE MAIN:	60A/3P C/B	PANEL MOUNTING:	SURFACE		FOR PANELBOARD

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Lighting 1st Floor	1st Floor	360	20A/1P	1	*			2	20A/1P	1385	4th Floor	Lighting 4th Floor
Lighting 1st Floor	1st Floor	0	20A/1P	3		*		4	20A/1P	1385	5th Floor	Lighting 5th Floor
Encl CB for FACP	Rm 103	1745	20A/2P	5			*	6	20A/1P	4155	6th Floor	Lighting 6th Floor
Encl CB for FACP	Rm 103	1745	20A/2P	7	*			8	20A/1P	0	2-704	Stairwell Lighting
Lighting 2nd Floor	2nd Floor	1385	20A/1P	9		*		10	20A/1P	0	2-726	Stairwell Lighting
Lighting 3rd Floor	3rd Floor	218	20A/1P	11			*	12	20A/1P	0		SPARE
SPARE		0	20A/1P	13	*			14	20A/1P	0		SPARE
SPARE		0	20A/1P	15		*		16	20A/1P	0		SPARE
SPARE		0	20A/1P	17			*	18	20A/1P	0		SPARE
		0	20A/1P	19	*			20	20A/1P	0		
		0	20A/1P	21		*		22	20A/1P	0		
		0	20A/1P	23			*	24	20A/1P	0		
		0	20A/1P	25	*			26	20A/1P	0		
		0	20A/1P	27		*		28	20A/1P	0		
		0	20A/1P	29			*	30	20A/1P	0		
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A Ph.	3.49	TOTAL DESIGN LOAD (KW)	14.85
CONNECTED LOAD (KW) - B Ph.	2.77	POWER FACTOR	0.99
CONNECTED LOAD (KW) - C Ph.	6.12	TOTAL DESIGN LOAD (AMPS)	18

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				EH4A	Panel Location:			Elec. Rm 510		
Nominal Phase to Neutral Voltage------->				277	Phase:			3		
Nominal Phase to Phase Voltage-------->				480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	Lighting 1st Floor	3	1st Floor	359.8	w	0.85	360	423	
2	A	Lighting 4th Floor	3	4th Floor	1385	w	1.00	1385	1385	
3	B	Lighting 1st Floor	3	1st Floor	0	w	0.85	0	0	
4	B	Lighting 5th Floor	3	5th Floor	1385	w	1.00	1385	1385	
5	C	Encl CB for FACP	9	Rm 103	1745	w	1.00	1745	1745	
6	C	Lighting 6th Floor	3	6th Floor	4155	w	1.00	4155	4155	
7	A	Encl CB for FACP	9	Rm 103	1745	w	1.00	1745	1745	
8	A	Stairwell Lighting	3	2-704	0	w	1.00	0	0	
9	B	Lighting 2nd Floor	3	2nd Floor	1385	w	1.00	1385	1385	
10	B	Stairwell Lighting	3	2-726	0	w	1.00	0	0	
11	C	Lighting 3rd Floor	3	3rd Floor	218	w	0.85	218	256	
12	C	SPARE			0	w		0	0	
13	A	SPARE			0	w		0	0	
14	A	SPARE			0	w		0	0	
15	B	SPARE			0	w		0	0	
16	B	SPARE			0	w		0	0	
17	C	SPARE			0	w		0	0	
18	C	SPARE			0	w		0	0	
19	A				0	w		0	0	
20	A				0	w		0	0	
21	B				0	w		0	0	
22	B				0	w		0	0	
23	C				0	w		0	0	
24	C				0	w		0	0	
25	A				0	w		0	0	
26	A				0	w		0	0	
27	B				0	w		0	0	
28	B				0	w		0	0	
29	C				0	w		0	0	
30	C				0	w		0	0	
31	A				0	w		0	0	
32	A				0	w		0	0	
33	B				0	w		0	0	
34	B				0	w		0	0	
35	C				0	w		0	0	
36	C				0	w		0	0	
37	A				0	w		0	0	
38	A				0	w		0	0	
39	B				0	w		0	0	
40	B				0	w		0	0	
41	C				0	w		0	0	
42	C				0	w		0	0	
PANEL TOTAL								12.4	12.5	Amps= 15.0

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					3.5	3.6	28%	12.8
PHASE TOTAL	B					2.8	2.8	22%	10.0
PHASE TOTAL	C					6.1	6.2	49%	22.2

LOAD CATAGORIES		Connected			Demand				Ver. 1.04
		kW	kVA	DF	kW	kVA	PF		
3	fluorescent lighting	8.9	9.0		8.9	9.0	0.99		
9	unassigned	3.5	3.5		3.5	3.5	1.00		
Total Demand Loads					12.4	12.5			
Spare Capacity		20%			2.5	2.5			
Total Design Loads					14.9	15.0	0.99	Amps=	18.0

FEEDER SIZING:

The data for the summary table below are from the redesigned panelboards H2A and EH4A. The sizing is referenced from the NEC handbook.

PANELBOARD		
TAG		H2A
VOLTAGE SYSTEM		480Y/277V
CALCULATED DESIGN LOAD (kW)		120.7
CALCULATED POWER FACTOR		0.92
CALCULATED DESIGN LOAD (kVA)		130.4
CALCULATED DESIGN LOAD (A)		156.9
FEEDER		
FEEDER PROTECTION SIZE		225A
NUMBER OF SETS		2
WIRE SIZE		
	PHASE	(3) #300 KCMIL
	NEUTRAL	(1) #300 KCMIL
	GROUND	#4 AWG
WIRE AREA		
	EACH PHASE	0.4608
	TOTAL - ALL PHASES	1.3824
	NEUTRAL	0.4608
	GROUND	0.0824
	TOTAL - ALL WIRES	1.9256
MINIMUM CONDUIT AREA		4.8140
CONDUIT SIZE		2.5"EMT
CONDUIT SIZE		2.5"EMT
FEEDER LENGTH		15’-4”
FINAL VOLTAGE DROP (V)		0.1V
FINAL VOLTAGE DROP (%)		0.0%
WAS FEEDER RESIZED?		NO

NOTE: *Wire sized for copper THHN at 75˚C

PANELBOARD	
TAG	EH4A
VOLTAGE SYSTEM	480Y/277V
CALCULATED DESIGN LOAD (kW)	14.9
CALCULATED POWER FACTOR	0.99
CALCULATED DESIGN LOAD (kVA)	15.0
CALCULATED DESIGN LOAD (A)	18.0
FEEDER	
FEEDER PROTECTION SIZE	60A
NUMBER OF SETS	1
WIRE SIZE	
PHASE	(3) #12 AWG
NEUTRAL	(1) #12 AWG
GROUND	(1) #10 AWG
WIRE AREA	
EACH PHASE	0.0133
TOTAL - ALL PHASES	0.0399
NEUTRAL	0.0133
GROUND	0.0211
TOTAL - ALL WIRES	0.0743
MINIMUM CONDUIT AREA	0.1858
CONDUIT SIZE	1/2" EMT
CONDUIT SIZE	3/4" EMT
FEEDER LENGTH	50’-4”
FINAL VOLTAGE DROP (V)	275.2V
FINAL VOLTAGE DROP (%)	0.6%
WAS FEEDER RESIZED?	NO

NOTE: *Wire sized for copper THHN at 75˚C

WIRING DIAGRAM:

KEY

Ⓒ OCCUPANCY SENSOR

Ⓟ PHOTOSENSOR

DRAWN BY: ALYSON LARIMER

PENN STATE AE SENIOR THESIS

ELECTRICAL CONSULTANT: PROF. TED DANNERTH

TITLE: OPEN OFFICE WIRING DIAGRAM

DATE: 07–APRIL–2011

SCALE: 1/8" = 1'–0"

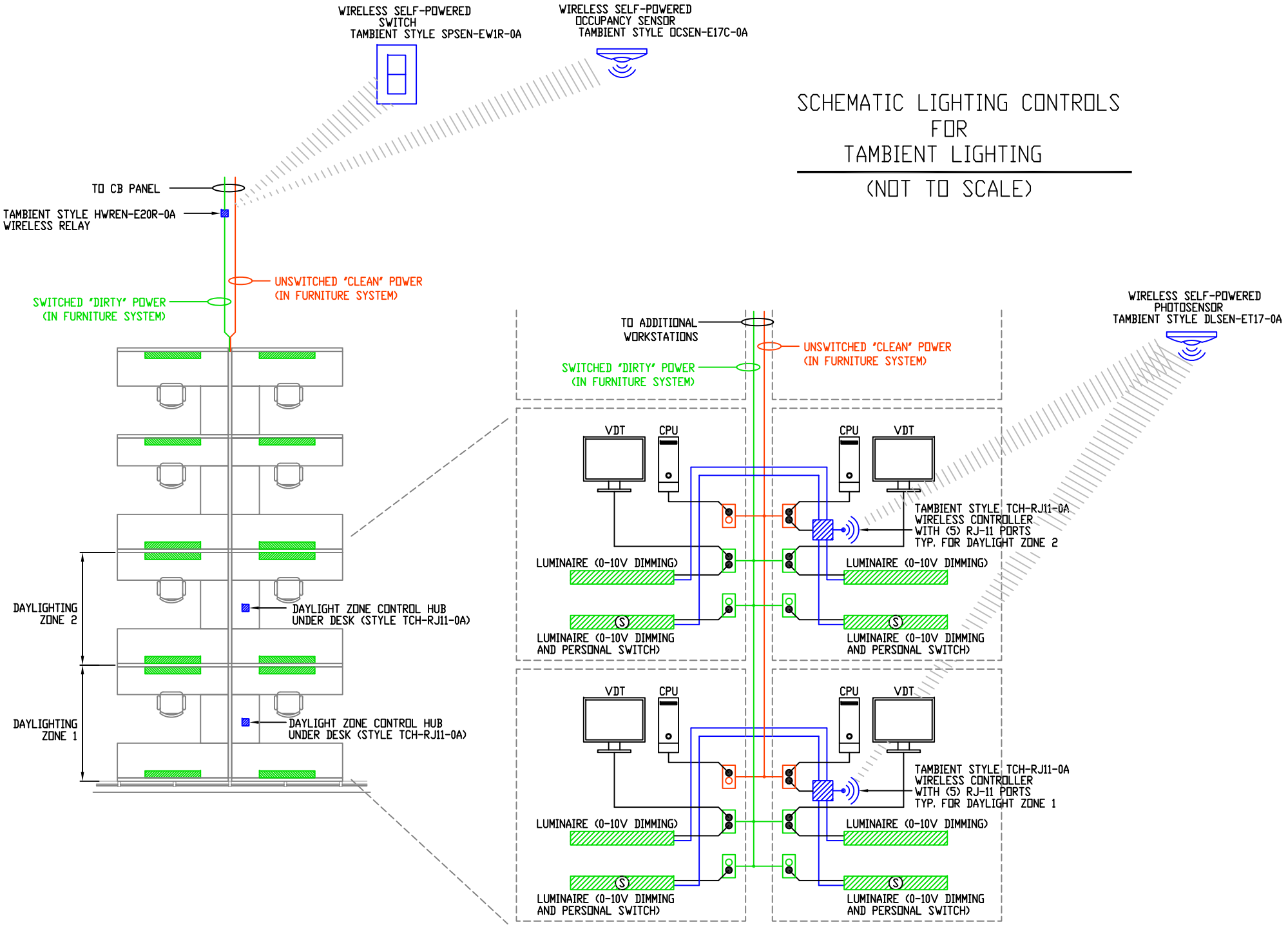
1/4" = 1'–0" 0 1' 5' 10' 15'

1/2" = 1'–0" 0 6" 1' 2' 3' 4' 5'

1" = 1'–0" 0 6" 1' 2' 3'

N

E2-1


WIRELESS SELF-POWERED
SWITCH
TAMBIENT STYLE SPSEN-EW1R-0A
WIRELESS SELF-POWERED
OCCUPANCY SENSOR
TAMBIENT STYLE OCSEN-E17C-0A
SCHEMATIC LIGHTING CONTROLS
FOR
TAMBIENT LIGHTING
(NOT TO SCALE)
TO CB PANEL
TAMBIENT STYLE HWREN-E20R-0A
WIRELESS RELAY
UNSWITCHED "CLEAN" POWER
(IN FURNITURE SYSTEM)
SWITCHED "DIRTY" POWER
(IN FURNITURE SYSTEM)
DAYLIGHTING
ZONE 2
DAYLIGHT ZONE CONTROL HUB
UNDER DESK (STYLE TCH-RJ11-0A)
DAYLIGHTING
ZONE 1
DAYLIGHT ZONE CONTROL HUB
UNDER DESK (STYLE TCH-RJ11-0A)
TO ADDITIONAL
WORKSTATIONS
UNSWITCHED "CLEAN" POWER
(IN FURNITURE SYSTEM)
SWITCHED "DIRTY" POWER
(IN FURNITURE SYSTEM)
WIRELESS SELF-POWERED
PHOTOSENSOR
TAMBIENT STYLE DLSEN-ET17-0A
VDT
CPU
CPU
VDT
TAMBIENT STYLE TCH-RJ11-0A
WIRELESS CONTROLLER
WITH (5) RJ-11 PORTS
TYP. FOR DAYLIGHT ZONE 2
LUMINAIRE (0-10V DIMMING)
LUMINAIRE (0-10V DIMMING)
S
S
LUMINAIRE (0-10V DIMMING
AND PERSONAL SWITCH)
LUMINAIRE (0-10V DIMMING
AND PERSONAL SWITCH)
VDT
CPU
CPU
VDT
TAMBIENT STYLE TCH-RJ11-0A
WIRELESS CONTROLLER
WITH (5) RJ-11 PORTS
TYP. FOR DAYLIGHT ZONE 1
LUMINAIRE (0-10V DIMMING)
LUMINAIRE (0-10V DIMMING)
S
S
LUMINAIRE (0-10V DIMMING
AND PERSONAL SWITCH)
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AND PERSONAL SWITCH)

MULTI-PURPOSE SPACE | AUDITORIUM

SPACE DESCIPTION:

The auditorium is located on the second floor of the Laboratory Wing consisting of 12 rows totaling 180 seats and 7,500 sq. ft. This space is mainly used for meeting situations utilizing podium and presentation style environments. To achieve the desired concept within this space, the ceiling is redesigned with a backlit curved acrylic system covering the entire auditorium. Throughout the space, the sources are all chosen at 3000K color temperature and are linear fluorescents, compact fluorescents, or LEDs.

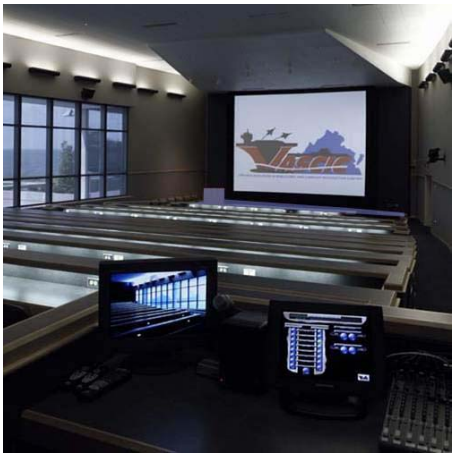


Figure 8.1: Existing Auditorium

LIGHTING DESIGN:

The lighting design of the auditorium is centered on the needs of the space. Since the auditorium is used for many different functions, it is important to have a functional lighting design that can tailor to each activity. In addition, a new architectural ceiling is developed for this space. Although it may seem as though the ceiling would be the focal point in the space, it was designed to generate the feeling of water overhead. The ceiling is back light with linear fluorescent strip fixtures either surface mounted at the peak of the "wave" or pendent mounted in the trough of the "wave". All the ceiling fixtures are mounted 18" above the curved acrylic ceiling. From the ceiling framing hang a track lighting system for stage spotlighting as well as downlighting for added illumination behind the speaker when the presentation screen is not being used. Integrated LED task lighting is mounted under the top counter of the desks for a meeting setting where reading is necessary. Wall mounted cylinders with compact fluorescent lamps are placed above each of the five exit doors in the auditorium and one recessed LED fixture is located in each step riser.

ELECTRICAL DESIGN:

Because the auditorium is considered a multi-purpose space, it is divided into five zones for easy control of lighting scenes within the space. The design goals of the space are to reduce the lighting loads on the designated panelboards of the space while enhancing the visual environment through controllable scene settings. The lighting loads of the auditorium will all remain on the existing panelboards.

CONTROL SCHEME:

There are five zones, which consist of LED step lighting, LED stage and spot lighting, linear fluorescent ceiling lighting, LED task lighting, and compact fluorescent exit door lighting. These five zones are controlled using two Grafik Eye scene controls manufactured by Lutron with integrated shade controllers on normal power and a four-button architectural wallstation on normal-emergency power. The scene controllers will be located at the front entrance next to the stage as well as in the rear of the auditorium next to the sound and maintenance booth.

EXISTING PANELBOARDS:

The following are the existing panelboard schedules for panel LLA (208Y/120V) and normal-emergency panel EDHB (480Y/277V). The modified circuits are highlighted in purple.

PANELBOARD LLA SCHEDULE

225 AMP BUS 225 AMP MLO 208Y/120 VOLTS 3 PH, 4 W, 5N, MIN. 10 KAIC SURFACE MOUNTED (M2)

LOAD SERVED	LOAD (AMPS) A	B	C	BKR. TRIP	WIRE SIZE	CKT. NO.	PHASE A B C	CKT. NO.	WIRE SIZE	BKR. TRIP	LOAD (AMPS) A	B	C	LOAD SERVED
RECEPTACLES	7.5			20	12	1		2	12	20	4.0			SYSTEMS FURNITURE
RECEPTACLES		4.5		20	12	3		4	12	20		2.0		SYSTEMS FURNITURE
RECEPTACLES			6.0	20	12	5		6	12	20			2.0	SYSTEMS FURNITURE
RECEPTACLES	7.5			20	12	7		8	12	20	4.0			SYSTEMS FURNITURE
RECEPTACLES		7.5		20	12	9		10	12	20		2.0		SYSTEMS FURNITURE
TRANSFER FANS (M1)			1.5	20	12	11		12	12	20			4.0	SYSTEMS FURNITURE
SPARE				20		13		14	12	20	2.0			SYSTEMS FURNITURE
RECEPTACLES		6.0		20	12	15		16	12	20		4.0		SYSTEMS FURNITURE
RECEPTACLES			7.5	20	12	17		18	12	20			4.0	SYSTEMS FURNITURE
UNIT HEATER	5.8			15	12	19		20	12	20	2.0			SYSTEMS FURNITURE
FLOOR RECPT		6.0		20	12	21		22	12	20		4.0		SYSTEMS FURNITURE
SPARE				20		23		24	12	20			4.0	SYSTEMS FURNITURE
SPARE				20		25		26	12	20	4.0			SYSTEMS FURNITURE
SPARE				20		27		28	12	20				LIGHTING - AUDITORIUM
LIGHTING - RM 291			10.0	20	12	29		30	12	20			11.3	LIGHTING - AUDITORIUM
LIGHTING - RM 291	10.0			20	12	31		32	12	20	11.7			LIGHTING - AUDITORIUM
LIGHTING - RM 291		10.0		20	12	33		34	12	20		4.0		SYSTEMS FURNITURE
LIGHTING - RM 291			10.0	20	12	35		36		20				SPARE
SPACE						37		38	10	30	20.0			OVERHEAD DOOR
SPACE						39						20.0		(B AND FL) (M3)
SPACE						41							20.0	
TOTAL	30.8	34.0	35.0								47.7	45.3	45.3	TOTAL

TOTAL CONNECTED AMPS A: 78.5 B: 79.3 C: 80.3

PANELBOARD REDESIGN:

Below are the redesigned panel boards and their corresponding panelboard sizing worksheet. The modified circuits are highlighted in purple.

PANELBOARDEDHB SCHEDULE

100 AMP BUS 100 AMP MLO 480Y/277 VOLTS 3 PH, 4 W, 5N, MIN. 25 KAIC SURFACE MOUNTED

LOAD SERVED	LOAD (AMPS) A	B	C	BKR. TRIP	WIRE SIZE	CKT. NO.	PHASE A B C	CKT. NO.	WIRE SIZE	BKR. TRIP	LOAD (AMPS) A	B	C	LOAD SERVED
LIGHTING - PRK. GAR. STR.	2.4			20	10	1		2	10	30	5.2			PANEL EDLA
LIGHTING - PRK. GAR. STR.		2.4		20	10	3						3.1		VIA 15 KVA XFMR
LIGHTING - PRK. GAR.			11.2	20	10	5							2.2	
LIGHTING - PRK. GAR.	10.7			20	10	7		8	12	20	4.3			LIGHTING-AUDITORIUM
						9		10	12	20		10.9		LIGHTING - RM 367
						11		12		20				SPARE
SPACE						13		14						SPACE
SPACE						19		20						SPACE
SPACE						25		26						SPACE
SPACE						31		32						SPACE
SPACE						37		38						SPACE
TOTAL	13.1	2.4	11.2								9.5	14.0	2.2	TOTAL

TOTAL CONNECTED AMPS A: 22.8 B: 16.4 C: 13.4

PANELBOARD SCHEDULE

VOLTAGE:	208Y/120V,3PH,4W	PANEL TAG:	LLA	MIN. C/B AIC:	10K
SIZE/TYPE BUS:	100A	PANEL LOCATION:	Elec. Rm. 367	OPTIONS:	
SIZE/TYPE MAIN:	100A/3P MLO	PANEL MOUNTING:	SURFACE		

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Recept.		855	20A/1P	1	*			2	20A/1P	456	Rm 251	Systems Furn.
Recept.	Rm 251	513	20A/1P	3		*		4	20A/1P	228	Rm 251	Systems Furn.
Recept.	Rm 251	684	20A/1P	5			*	6	20A/1P	228	Rm 251	Systems Furn.
Recept.	Rm 251	855	20A/1P	7	*			8	20A/1P	456	Rm 251	Systems Furn.
Recept.	Rm 251	855	20A/1P	9		*		10	20A/1P	228	Rm 251	Systems Furn.
Transfer Fan	Rm 272	153	20A/1P	11			*	12	20A/1P	456	Rm 251	Systems Furn.
SPARE		0	20A/1P	13	*			14	20A/1P	228	Rm 251	Systems Furn.
Recept.	Rm 367	661	20A/1P	15		*		16	20A/1P	456	Rm 251	Systems Furn.
Recept.	Rm 367	855	20A/1P	17			*	18	20A/1P	456	Rm 251	Systems Furn.
Unit Heater	Rm 367	522	15A/1P	19	*			20	20A/1P	228	Rm 251	Systems Furn.
Floor Recept.	Rm 367	684	20A/1P	21		*		22	20A/1P	465	Rm 251	Systems Furn.
SPARE		0	20A/1P	23			*	24	20A/1P	456	Rm 251	Systems Furn.
SPARE		0	20A/1P	25	*			26	20A/1P	456	Rm 251	Systems Furn.
SPARE		0	20A/1P	27		*		28	20A/1P	1869	Rm 250	Auditorium Lighting
Lighting Rm 291	Rm 291	1200	20A/1P	29			*	30	20A/1P	1755	Rm 250	Auditorium Lighting
Lighting Rm 291	Rm 291	1200	20A/1P	31	*			32	20A/1P	361	Rm 250	Auditorium Lighting
Lighting Rm 291	Rm 291	1200	20A/1P	33		*		34	20A/1P	456	Rm 251	Systems Furn.
Lighting Rm 291	Rm 291	1200	20A/1P	35			*	36	20A/1P	0		SPARE
SPACE		0	20A/1P	37	*			38	30A/3P	2280	Rm 277	Overhead Door
SPACE		0	20A/1P	39		*		40	30A/3P	2280	Rm 277	Overhead Door
SPACE		0	20A/1P	41			*	42	30A/3P	2280	Rm 277	Overhead Door

CONNECTED LOAD (KW) - A Ph.	7.90	TOTAL DESIGN LOAD (KW)	33.02
CONNECTED LOAD (KW) - B Ph.	9.90	POWER FACTOR	0.96
CONNECTED LOAD (KW) - C Ph.	9.72	TOTAL DESIGN LOAD (AMPS)	95

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				LLA	Panel Location:			Elec. Rm. 367			
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	Recept.	1	Rm 251	855	w	0.95	855	900		
2	A	Systems Furn.	1	Rm 251	456	w	0.95	456	480		
3	B	Recept.	1	Rm 251	513	w	0.95	513	540		
4	B	Systems Furn.	1	Rm 251	228	w	0.95	228	240		
5	C	Recept.	1	Rm 251	684	w	0.95	684	720		
6	C	Systems Furn.	1	Rm 251	228	w	0.95	228	240		
7	A	Recept.	1	Rm 251	855	w	0.95	855	900		
8	A	Systems Furn.	1	Rm 251	456	w	0.95	456	480		
9	B	Recept.	1	Rm 251	855	w	0.95	855	900		
10	B	Systems Furn.	1	Rm 251	228	w	0.95	228	240		
11	C	Transfer Fan	6	Rm 272	153	w	0.85	153	180		
12	C	Systems Furn.	1	Rm 251	456	w	0.95	456	480		
13	A	SPARE			0	w		0	0		
14	A	Systems Furn.	1	Rm 251	228	w	0.95	228	240		
15	B	Recept.	1	Rm 367	661	w	0.95	661	696		
16	B	Systems Furn.	1	Rm 251	456	w	0.95	456	480		
17	C	Recept.	1	Rm 367	855	w	0.95	855	900		
18	C	Systems Furn.	1	Rm 251	456	w	0.95	456	480		
19	A	Unit Heater	7	Rm 367	522	w	0.75	522	696		
20	A	Systems Furn.	1	Rm 251	228	w	0.95	228	240		
21	B	Floor Recept.	1	Rm 367	684	w	0.95	684	720		
22	B	Systems Furn.	1	Rm 251	465	w	0.95	465	489		
23	C	SPARE			0	w		0	0		
24	C	Systems Furn.	1	Rm 251	456	w	0.95	456	480		
25	A	SPARE			0	w		0	0		
26	A	Systems Furn.	1	Rm 251	456	w	0.95	456	480		
27	B	SPARE			0	w		0	0		
28	B	Auditorium Lightin	3	Rm 250	1869	w	1.00	1869	1869		
29	C	Lighting Rm 291	3	Rm 291	1200	w	1.00	1200	1200		
30	C	Auditorium Lightin	3	Rm 250	1755	w	1.00	1755	1755	NOT USED	
31	A	Lighting Rm 291	3	Rm 291	1200	w	1.00	1200	1200		
32	A	Auditorium Lightin	3	Rm 250	361	w	1.10	361	328	NOT USED	
33	B	Lighting Rm 291	3	Rm 291	1200	w	1.00	1200	1200		
34	B	Systems Furn.	1	Rm 251	456	w	0.95	456	480		
35	C	Lighting Rm 291	3	Rm 291	1200	w	1.00	1200	1200		
36	C	SPARE			0	w		0	0		
37	A	SPACE			0	w		0	0		
38	A	Overhead Door	9	Rm 277	2280	w	0.95	2280	2400		
39	B	SPACE			0	w		0	0		
40	B	Overhead Door	9	Rm 277	2280	w	0.95	2280	2400		
41	C	SPACE			0	w		0	0		
42	C	Overhead Door	9	Rm 277	2280	w	0.95	2280	2400		
PANEL TOTAL								27.5	28.6	Amps=	79.5

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					7.9	8.3	29%	69.5
PHASE TOTAL	B					9.9	10.3	36%	85.5
PHASE TOTAL	C					9.7	9.9	35%	82.6

LOAD CATAGORIES		Connected			Demand				Ver. 1.01
		kW	kVA	DF	kW	kVA	PF		
1	receptacles	11.2	11.8		11.2	11.8	0.95		
3	lighting	8.8	8.8		8.8	8.8	1.00		
6	HVAC fans	0.2	0.2		0.2	0.2	0.85		
7	heating	0.5	0.7		0.5	0.7	0.75		
9	unassigned	6.8	7.2		6.8	7.2	0.95		
Total Demand Loads					27.5	28.6			
Spare Capacity		20%			5.5	5.7			
Total Design Loads					33.0	34.4	0.96	Amps=	95.4

PANELBOARD SCHEDULE

VOLTAGE:	480Y/277V,3PH,4W	PANEL TAG:	EDHB	MIN. C/B AIC:	25K
SIZE/TYPE BUS:	100A	PANEL LOCATION:	Elec. Rm 367	OPTIONS:	
SIZE/TYPE MAIN:	40A/3P MLO	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 Prk Gar Str	Rm 380	632	20A/1P	1	*			2	30A/3P	4105	Rm 367	Panel EDLA
Lighting Prk Gar Str	Rm 381	632	20A/1P	3		*		4	30A/3P	2447	Rm 367	Panel EDLA
Lighting Prk Gar	3rd Flr Area A	2947	20A/1P	5			*	6	30A/3P	1737	Rm 367	Panel EDLA
Lighting Prk Gar	3rd Flr Area A	2816	20A/1P	7	*			8	20A/1P	880	Rm 250	Lighting Auditorium
		0	20A/1P	9		*		10	20A/1P	2868	Rm 367	Lighting Rm 367
		0	20A/1P	11			*	12	20A/1P	0		SPARE
SPACE		0	20A/1P	13	*			14	20A/1P	0		SPACE
SPACE		0	20A/1P	15		*		16	20A/1P	0		SPACE
SPACE		0	20A/1P	17			*	18	20A/1P	0		SPACE
SPACE		0	20A/1P	19	*			20	20A/1P	0		SPACE
SPACE		0	20A/1P	21		*		22	20A/1P	0		SPACE
SPACE		0	20A/1P	23			*	24	20A/1P	0		SPACE
SPACE		0	20A/1P	25	*			26	20A/1P	0		SPACE
SPACE		0	20A/1P	27		*		28	20A/1P	0		SPACE
SPACE		0	20A/1P	29			*	30	20A/1P	0		SPACE
SPACE		0	20A/1P	31	*			32	20A/1P	0		SPACE
SPACE		0	20A/1P	33		*		34	20A/1P	0		SPACE
SPACE		0	20A/1P	35			*	36	20A/1P	0		SPACE
SPACE		0	20A/1P	37	*			38	20A/1P	0		SPACE
SPACE		0	20A/1P	39		*		40	20A/1P	0		SPACE
SPACE		0	20A/1P	41			*	42	20A/1P	0		SPACE

CONNECTED LOAD (KW) - A Ph.	8.43	TOTAL DESIGN LOAD (KW)	22.88
CONNECTED LOAD (KW) - B Ph.	5.95	POWER FACTOR	0.94
CONNECTED LOAD (KW) - C Ph.	4.68	TOTAL DESIGN LOAD (AMPS)	29

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				EDHB	Panel Location:			Elec. Rm 367			
Nominal Phase to Neutral Voltage------->				277	Phase:			3			
Nominal Phase to Phase Voltage-------->				480	Wires:			4			
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	Lighting Prk Gar Str	4	Rm 380	632	w	0.95	632	665		
2	A	Panel EDLA	9	Rm 367	4105	w	0.95	4105	4321		
3	B	Lighting Prk Gar Str	4	Rm 381	632	w	0.95	632	665		
4	B	Panel EDLA	9	Rm 367	2447	w	0.95	2447	2576		
5	C	Lighting Prk Gar	4	3rd Flr Area A	2947	w	0.95	2947	3102		
6	C	Panel EDLA	9	Rm 367	1737	w	0.95	1737	1828		
7	A	Lighting Prk Gar	4	3rd Flr Area A	2816	w	0.95	2816	2964		
8	A	Lighting Auditorium	3	Rm 250	880	w	0.82	880	1073		
9	B				0	w		0	0		
10	B	Lighting Rm 367	3	Rm 367	2868	w	0.95	2868	3019		
11	C				0	w		0	0		
12	C	SPARE			0	w		0	0		
13	A	SPACE			0	w		0	0		
14	A	SPACE			0	w		0	0		
15	B	SPACE			0	w		0	0		
16	B	SPACE			0	w		0	0		
17	C	SPACE			0	w		0	0		
18	C	SPACE			0	w		0	0		
19	A	SPACE			0	w		0	0		
20	A	SPACE			0	w		0	0		
21	B	SPACE			0	w		0	0		
22	B	SPACE			0	w		0	0		
23	C	SPACE			0	w		0	0		
24	C	SPACE			0	w		0	0		
25	A	SPACE			0	w		0	0		
26	A	SPACE			0	w		0	0		
27	B	SPACE			0	w		0	0		
28	B	SPACE			0	w		0	0		
29	C	SPACE			0	w		0	0		
30	C	SPACE			0	w		0	0		
31	A	SPACE			0	w		0	0		
32	A	SPACE			0	w		0	0		
33	B	SPACE			0	w		0	0		
34	B	SPACE			0	w		0	0		
35	C	SPACE			0	w		0	0		
36	C	SPACE			0	w		0	0		
37	A	SPACE			0	w		0	0		
38	A	SPACE			0	w		0	0		
39	B	SPACE			0	w		0	0		
40	B	SPACE			0	w		0	0		
41	C	SPACE			0	w		0	0		
42	C	SPACE			0	w		0	0		
PANEL TOTAL								19.1	20.2	Amps=	24.3

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					8.4	9.0	45%	32.6
PHASE TOTAL	B					5.9	6.3	31%	22.6
PHASE TOTAL	C					4.7	4.9	24%	17.8

LOAD CATAGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
3	lighting		3.7	4.1		3.7	4.1	0.92		
4	HID lighting		7.0	7.4		7.0	7.4	0.95		
9	unassigned		8.3	8.7		8.3	8.7	0.95		
Total Demand Loads						19.1	20.2			
Spare Capacity			20%			3.8	4.0			
Total Design Loads						22.9	24.3	0.94	Amps=	29.2

FEEDER SIZING:

The data for the summary table below are from the redesigned panelboards LLA and EDHB. The sizing is referenced from the NEC handbook.

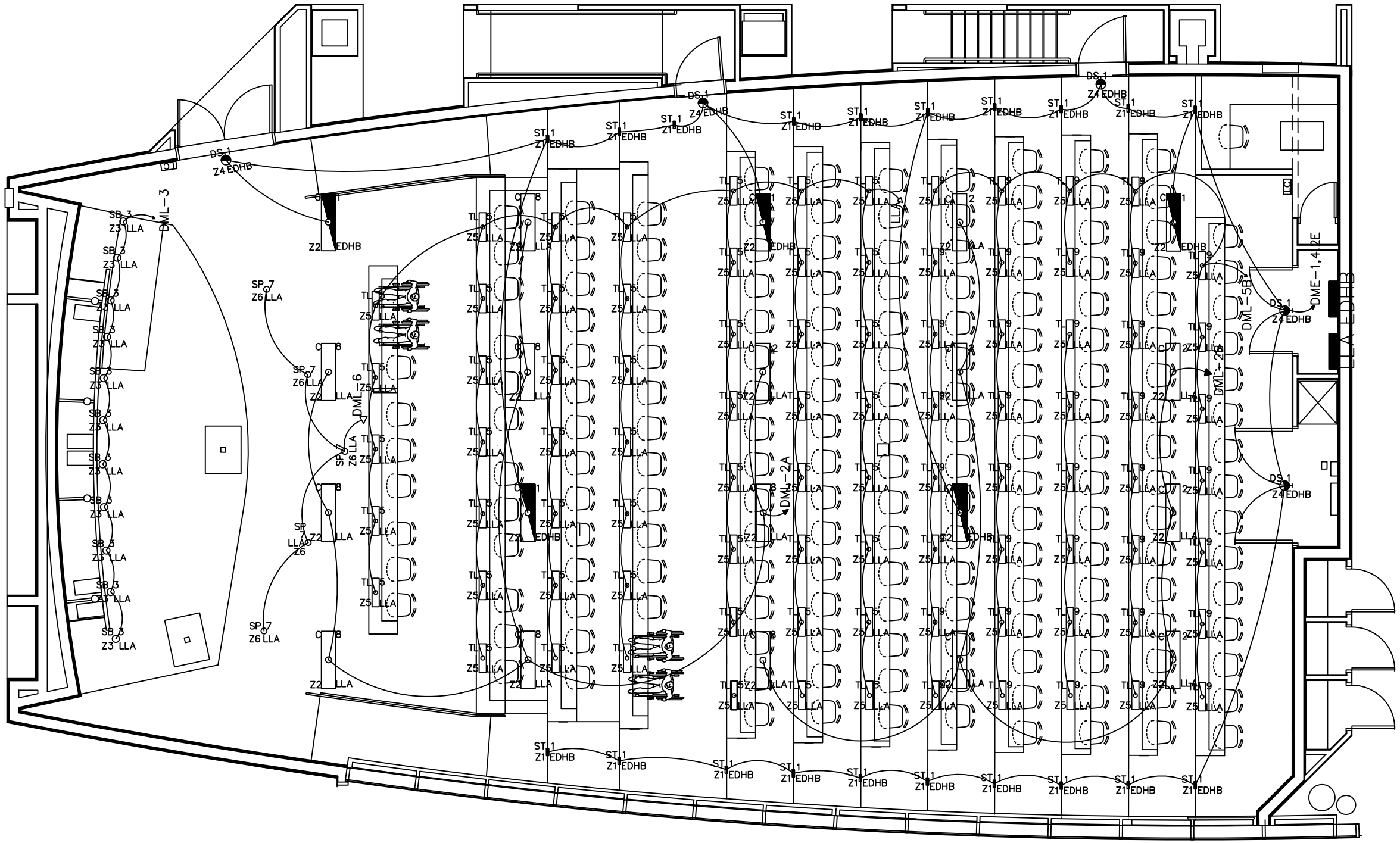
PANELBOARD	
TAG	LLA
VOLTAGE SYSTEM	208Y/120V
CALCULATED DESIGN LOAD (kW)	33.02
CALCULATED POWER FACTOR	0.096
CALCULATED DESIGN LOAD (kVA)	34.4
CALCULATED DESIGN LOAD (A)	95.4
FEEDER	
FEEDER PROTECTION SIZE	100
NUMBER OF SETS	1
WIRE SIZE	
PHASE	(3) #3 AWG
NEUTRAL	(1) #3 AWG
GROUND	(1) #8 AWG
WIRE AREA	
EACH PHASE	0.0973
TOTAL - ALL PHASES	0.2919
NEUTRAL	0.0973
GROUND	0.0211
TOTAL - ALL WIRES	0.4103
MINIMUM CONDUIT AREA	1.0258
CONDUIT SIZE	1" EMT
CONDUIT SIZE	1-1/2" EMT
FEEDER LENGTH	2’
FINAL VOLTAGE DROP (V)	0V
FINAL VOLTAGE DROP (%)	0%
WAS FEEDER RESIZED?	NO

NOTE: *Wire sized for copper THHN at 75˚C

PANELBOARD	
TAG	EDHB
VOLTAGE SYSTEM	480Y/277V
CALCULATED DESIGN LOAD (kW)	22.88
CALCULATED POWER FACTOR	0.94
CALCULATED DESIGN LOAD (kVA)	24.3
CALCULATED DESIGN LOAD (A)	29.2
FEEDER	
FEEDER PROTECTION SIZE	40A
NUMBER OF SETS	1
WIRE SIZE	
PHASE	(3) #10 AWG
NEUTRAL	(1) #10 AWG
GROUND	(1) #10 AWG
WIRE AREA	
EACH PHASE	0.0211
TOTAL - ALL PHASES	0.0633
NEUTRAL	0.0211
GROUND	0.0211
TOTAL - ALL WIRES	0.1055
MINIMUM CONDUIT AREA	0.2638
CONDUIT SIZE	1/2" EMT
CONDUIT SIZE	3/4" EMT
FEEDER LENGTH	
FINAL VOLTAGE DROP (V)	
FINAL VOLTAGE DROP (%)	
WAS FEEDER RESIZED?	

NOTE: *Wire sized for copper THHN at 75˚C

WIRING DIAGRAM:



KEYNOTES

VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER

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NEWPORT NEWS, VA
23607

DRAWN BY: ALYSON LARIMER
PENN STATE AE SENIOR THESIS
ELECTRICAL CONSULTANT: PROF. TED DANNERTH
TITLE: AUDITORIUM LIGHTING LAYOUT
DATE: 7–APRIL–2011

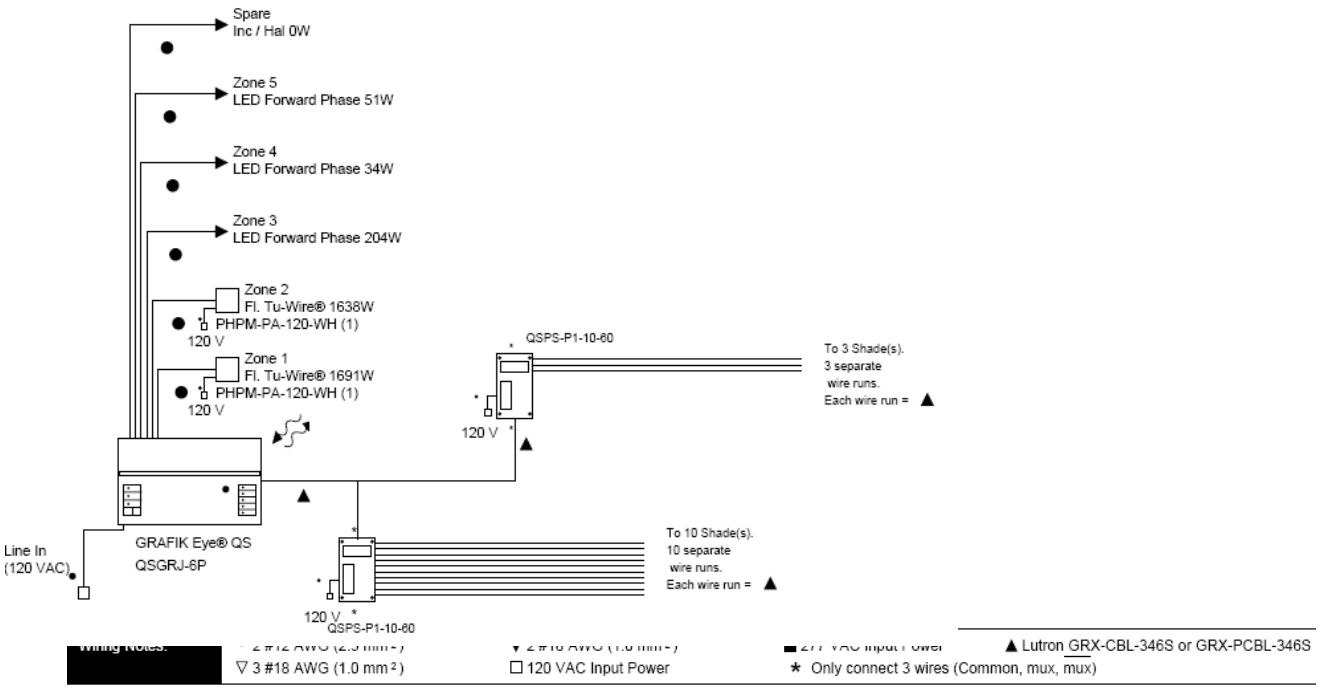
SCALE: 1/8" = 1'–0"
1/4" = 1'–0"
1/2" = 1'–0"
1" = 1'–0"

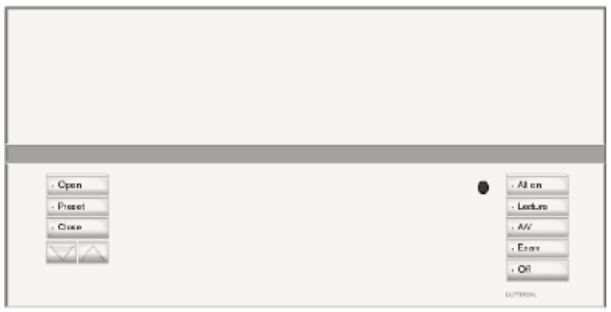
N

E3-1

DIMMING WIRING DIAGRAM:

The following is a wiring diagram for the Grafik Eye scene control and architectural wallstation.





EXTERIOR | GATHERING SPACE

Figure 9.1: Existing Exterior

SPACE DESCIPTION:

Originally, there was no gathering space designed along the Victory Landing Pathway promenade that follows the contour of the James River. After executing a landscape architecture design, the gathering space is intended to connect the 23rd Street pedestrian traffic to the waterfront and provide a functional space to enjoy. The new design encompasses 29,888 square feet with three private seating areas and two larger, open seating areas. Throughout the spaces, pools of water are placed around the seating areas imitating ship elements interacting with water.

LIGHTING DESIGN:

The main objective for the lighting design of the exterior space is to have lighting throughout the space that serves multiple purposes. Fixtures specified for this spaces act more as architectural elements within the space. Globe fixtures are located in the reflecting pools surrounding the seating areas providing a visual element to the space while creating a dividing wall of light from the other spaces. The pathways throughout are illuminated by square modular fixtures that are capable of holding human weight. These fixtures outline the contours of the pathways as well as surrounding the larger, more public seating areas. Uplighting highlight trees and shrubbery as well as two flag poles along the waterfront. Three different light sources are used within the space, which include LEDs, compact fluorescent, and metal halide.

ELECTRICAL DESIGN:

The panelboard designated for the exterior spaces of the building does not include this space because it does not currently exist. However, on the panelboard that does exist, there is extra room to add another circuit for this exterior space. The lighting design is intended to only add a minimal load onto this panelboard so it will not increase the energy significantly.

CONTOLS:

The exterior space is intended to be controlled with a time clock in order to reduce energy from lighting when it is not necessary.

EXISTING PANELBOARDS:

The following are the existing panelboard schedules for panel HGA (480Y/277V). The modified circuits are highlighted in blue.

PANELBOARD HGA SCHEDULE

225 AMP BUS 150 AMP MCB 480Y/277 VOLTS 3 PH, 4 W, SN, MIN. 14 KAIC SURFACE MOUNTED

LOAD SERVED	LOAD (AMPS) A	B	C	BKR. TRIP	WIRE SIZE	CKT. NO.	PHASE A B C	CKT. NO.	WIRE SIZE	BKR. TRIP	LOAD (AMPS) A	B	C	LOAD SERVED
PANEL LGA	44.1			80	4	1		2	12	20	5.0			LIGHTING-WALKWAY
VIA DT TRANSFORMER		34.7						4	12	20		5.0		LIGHTING-WALKWAY
			35.5					6	12	20			4.8	LIGHTING-SITE
VAV UNITS	7.8			20	12	7		8	8	20	1.0			LIGHTING-RM 107 (K21)
LIGHTING-GROUND FLR		8.6		20	12	9		10	12	20		7.8		LIGHTING-GROUND FLR
SPARE				20		11		12	12	20			3.0	UH-9
SPARE				20		13		14		20				SPARE
SPARE				20		15		16		20				SPARE
SPARE				20		17		18		20				SPARE
SPARE (K20)				20		19		20		20				SPARE
SPARE				20		21		22		20				SPARE
IN-LINE HEATER			7.2	15	12	23		24		20				SPARE
	7.2							26		20				SPARE
		7.2						28		20				SPARE
SPARE				20		29		30		20				SPARE
SPARE				20		31		32		20				SPARE
SPARE				20		33		34		20				SPARE
SPARE				20		35		36		20				SPARE (K23)
FILTER PUMP	27.0			40	8	37		38		15				SPARE
20 HP (K22)		27.0												
			27.6											
TOTAL	86.1	77.5	69.7								6.0	12.8	7.8	TOTAL

TOTAL CONNECTED AMPS A: 92.1 B: 90.3 C: 77.5

PANELBOARD REDESIGN:

Below are the redesigned panel boards and their corresponding panelboard sizing worksheet. The modified circuits are highlighted in blue.

PANELBOARD SCHEDULE

VOLTAGE:	480Y/277V,3PH,4W	PANEL TAG:	HGA	MIN. C/B AIC:	14K
SIZE/TYPE BUS:	100A	PANEL LOCATION:		OPTIONS:	
SIZE/TYPE MAIN:	100A/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
Panel LGA		10994	80A/3P	1	*			2	20A/1P	1246	Exterior	Lighting Walkway
Panel LGA		8651		3		*		4	20A/1P	1246	Exterior	Lighting Walkway
Panel LGA		8850		5			*	6	20A/1P	1197	Exterior	Lighting Site
VAV Units		1837	20A/1P	7	*			8	20A/1P	250	Room 107	Lighting
Lighting	Ground Floor	2144	20A/1P	9		*		10	20A/1P	1945	Ground Floor	Lighting
SPARE		0	20A/1P	11			*	12	20A/1P	789	0	UH-9
SPARE		0	20A/1P	13	*			14	20A/1P	1771	Gathering Space	EXTERIOR LIGHTING
SPARE		0	20A/1P	15		*		16	20A/1P	0		SPARE
SPARE		0	20A/1P	17			*	18	20A/1P	0		SPARE
SPARE		0	20A/1P	19	*			20	20A/1P	0		SPARE
SPARE		0	20A/1P	21		*		22	20A/1P	0		SPARE
In-Line Heater		1895	15A/3P	23			*	24	20A/1P	0		SPARE
SPARE		1895		25	*			26	20A/1P	0		SPARE
SPARE		1895		27		*		28	20A/1P	0		SPARE
SPARE		0	20A/1P	29			*	30	20A/1P	0		SPARE
SPARE		0	20A/1P	31	*			32	20A/1P	0		SPARE
SPARE		0	20A/1P	33		*		34	20A/1P	0		SPARE
SPARE		0	20A/1P	35			*	36	20A/1P	0		SPARE
SPARE		0	20A/1P	37	*			38	20A/1P	0		SPARE
SPARE		0	20A/1P	39		*		40	20A/1P	0		SPARE
SPARE		0	20A/1P	41			*	42	20A/1P	0		SPARE

CONNECTED LOAD (KW) - A Ph.	17.99	TOTAL DESIGN LOAD (KW)	55.93
CONNECTED LOAD (KW) - B Ph.	15.88	POWER FACTOR	0.91
CONNECTED LOAD (KW) - C Ph.	12.73	TOTAL DESIGN LOAD (AMPS)	74

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HGA	Panel Location:			xx		
Nominal Phase to Neutral Voltage------->					277	Phase:			3		
Nominal Phase to Phase Voltage-------->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	Panel LGA	9		10994	w	0.90	10994	12216		
2	A	Lighting Walkway	3	Exterior	1246	w	0.90	1246	1384		
3	B	Panel LGA	9		8651	w	0.90	8651	9612		
4	B	Lighting Walkway	3	Exterior	1246	w	0.90	1246	1384		
5	C	Panel LGA	9		8850	w	0.90	8850	9833		
6	C	Lighting Site	4	Exterior	1197	w	0.90	1197	1330		
7	A	VAV Units	6		1837	w	0.95	1837	1934		
8	A	Lighting	3	Room 107	250	w	0.90	250	278		
9	B	Lighting	3	Ground Floor	2144	w	0.90	2144	2382		
10	B	Lighting	3	Ground Floor	1945	w	0.90	1945	2161		
11	C	SPARE			0	w		0	0		
12	C	UH-9	6		789	w	0.95	789	831		
13	A	SPARE			0	w		0	0		
14	A	EXTERIOR LIGHTING	6	Gathering Space	1771	w	0.85	1771	2084		
15	B	SPARE			0	w		0	0		
16	B	SPARE			0	w		0	0		
17	C	SPARE			0	w		0	0		
18	C	SPARE			0	w		0	0		
19	A	SPARE			0	w		0	0		
20	A	SPARE			0	w		0	0		
21	B	SPARE			0	w		0	0		
22	B	SPARE			0	w		0	0		
23	C	In-Line Heater	6		1895	w	0.95	1895	1995		
24	C	SPARE			0	w		0	0		
25	A	SPARE	6		1895	w	0.95	1895	1995		
26	A	SPARE			0	w		0	0		
27	B	SPARE	6		1895	w	0.95	1895	1995		
28	B	SPARE			0	w		0	0		
29	C	SPARE			0	w		0	0		
30	C	SPARE			0	w		0	0		
31	A	SPARE			0	w		0	0		
32	A	SPARE			0	w		0	0		
33	B	SPARE			0	w		0	0		
34	B	SPARE			0	w		0	0		
35	C	SPARE			0	w		0	0		
36	C	SPARE			0	w		0	0		
37	A	SPARE			0	w		0	0		
38	A	SPARE			0	w		0	0		
39	B	SPARE			0	w		0	0		
40	B	SPARE			0	w		0	0		
41	C	SPARE			0	w		0	0		
42	C	SPARE			0	w		0	0		
PANEL TOTAL								46.6	51.4	Amps=	61.9

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					18.0	19.9	39%	71.8
PHASE TOTAL	B					15.9	17.5	34%	63.3
PHASE TOTAL	C					12.7	14.0	27%	50.5

LOAD CATAGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
3	fluorescent lighting		6.8	7.6		6.8	7.6	0.90		
4	HID lighting		1.2	1.3		1.2	1.3	0.90		
6	HVAC fans		10.1	10.8		10.1	10.8	0.93		
9	unassigned		28.5	31.7		28.5	31.7	0.90		
Total Demand Loads						46.6	51.4			
Spare Capacity			20%			9.3	10.3			
Total Design Loads						55.9	61.7	0.91	Amps=	74.2

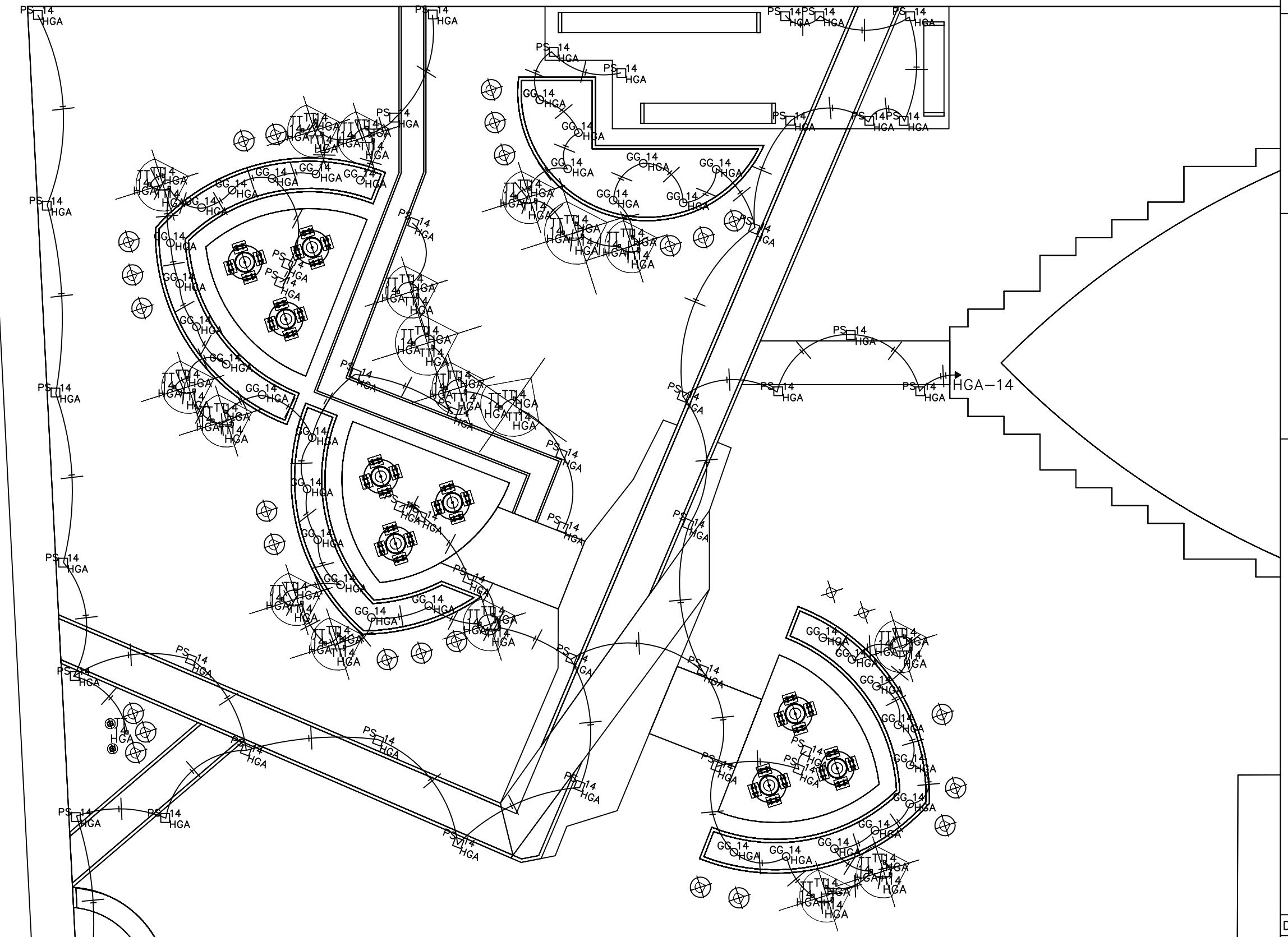
FEEDER SIZING:

The data for the summary table below are from the redesigned panelboard HGA. The sizing is referenced from the NEC handbook.

PANELBOARD		
TAG		HGA
VOLTAGE SYSTEM		480Y/277V
CALCULATED DESIGN LOAD (kW)		55.93
CALCULATED POWER FACTOR		0.91
CALCULATED DESIGN LOAD (kVA)		61.7
CALCULATED DESIGN LOAD (A)		74.2
FEEDER		
FEEDER PROTECTION SIZE		100A
NUMBER OF SETS		1
WIRE SIZE		
	PHASE	(3) #4 AWG
	NEUTRAL	(1) #4 AWG
	GROUND	(1) #8 AWG
WIRE AREA		
	EACH PHASE	0.0824
	TOTAL - ALL PHASES	0.2472
	NEUTRAL	0.0824
	GROUND	0.0366
	TOTAL - ALL WIRES	0.3662
MINIMUM CONDUIT AREA		0.9155
CONDUIT SIZE		1” EMT
CONDUIT SIZE		1-1/2” EMT
FEEDER LENGTH		135’-3/4”
FINAL VOLTAGE DROP (V)		273.9V
FINAL VOLTAGE DROP (%)		1.1%
WAS FEEDER RESIZED?		NO

NOTE: *Wire sized for copper THHN at 75˚C

WIRING DIAGRAM:



KEY NOTES:

THE VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER
NEWPORT NEWS, VIRGINIA

DRAWN BY: ALYSON LARIMER
PENN STATE AE SENIOR THESIS
CONSULTANT: PROF. TED DANNERTH
TITLE: EXTERIOR SPACE WIRING DIAGRAM
DATE: 7-APRIL-2011
SCALE: 1/16" = 1'-0"

N

E4-1

ELECTRICAL BREADTH #1 | MOTOR CONTROL CENTER

BREADTH DESCRIPTION:

The design of the motor control center is located in the mechanical room 366 of the Laboratory Wing. Within the space, there are multiple motors that could easily be consolidated into a motor control center to make maintenance easier. Also in this space are two large air handling units. In total, there are six out of the nine air handling units newly placed in the motor control center along with other exhaust fans, four pump sets, pressure boosters, and an air compressor. Each air handling unit contains two motors; one for supply air and another for the exhaust fan. The motor control center is designed for 480V loading and contains variable frequency motors and full voltage non-reversal motors. Each motor starter is an integral type starter containing a disconnect switch and is required to be a type NEMA 1A enclosure.

CONCLUSION:

The motor control center is designed utilizing the Freedom 2100 Series by Eaton Cutler-Hammer. The following is a schedule providing the unit tag corresponding with its location in the motor control center. It also provides the horse power of the motor as well as the NEMA motor size if applicable. For each unit, the dimensions and number of spaces it will occupy is documented. The motor control center is designed with 5 spare spaces noted on the isometric drawing and is fifteen feet long. Following the motor control center schedule is a floor plan noting the location within the mechanical room and a dimensioned isometric drawing of the station.

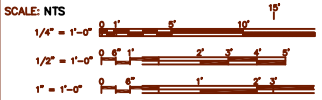
UNIT TAG	EQUIPMENT TAG	LOAD DESCRIPTION	LOAD (HP)	VOLTAGE	PHASE	PF	OVERCURRENT PROTECTION MCCB	STARTER TYPE	NEMA SIZE	SIZE (in.)	SPACES
A	AHU-SF-4	AIR HANDLING UNIT SUPPLY FAN	50	480	3	0.95	150	VFD	–	54	9
C	AHU-EF-4	AIR HANDLING UNIT EXHAUST FAN	15	480	3	0.95	50	VFD	–	24	4
F	AHU-SF-5	AIR HANDLING UNIT SUPPLY FAN	60	480	3	0.95	175	VFD	–	54	9
H	AHU-EF-5	AIR HANDLING UNIT EXHAUST FAN	25	480	3	0.95	80	VFD	–	36	6
J	AHU-SF-6	AIR HANDLING UNIT SUPPLY FAN	60	480	3	0.95	175	VFD	–	54	9
I	AHU-EF-6	AIR HANDLING UNIT EXHAUST FAN	20	480	3	0.95	60	VFD	–	36	6
L	AHU-SF-7	AIR HANDLING UNIT SUPPLY FAN	50	480	3	0.95	150	VFD	–	54	9
N	AHU-EF-7	AIR HANDLING UNIT EXHAUST FAN	20	480	3	0.95	60	VFD	–	36	6
O	AHU-SF-8	AIR HANDLING UNIT SUPPLY FAN	20	480	3	0.95	60	VFD	–	36	6
D	AHU-EF-8	AIR HANDLING UNIT EXHAUST FAN	7.5	480	3	0.75	25	VFD	–	24	4
E	AHU-SF-9	AIR HANDLING UNIT SUPPLY FAN	15	480	3	0.95	50	VFD	–	24	4
P	AHU-EF-9	AIR HANDLING UNIT EXHAUST FAN	5	480	3	0.95	15	VFD	–	24	4
G	PB-1	PRESSURE BOOST	10	480	3	0.95	150	FVNR	1	12	2
K	PB-2	PRESSURE BOOST	10	480	3	0.95	150	FVNR	1	12	2
M	A-COMP	AIR COMPRESSOR	10	480	3	0.95	150	FVNR	1	12	2
B	PS-1	PUMP SET #1	95	480	3	0.95	150	FVNR	4	18	3
Q	PS-2	PUMP SET #2	225	480	3	0.95	600	FVNR	6	48	8
R	PS-3	PUMP SET #3	20	480	3	0.95	150	FVNR	2	12	2
S	PS-4	PUMP SET #4	15	480	3	0.95	150	FVNR	2	12	2
T	EF-3	EXHAUST FAN #3	5	480	3	0.75	150	FVNR	1	12	2
U	EF-4	EXHAUST FAN #4	5	480	3	0.75	150	FVNR	1	12	2
V	EF-6	EXHAUST FAN #6	2	480	3	0.75	150	FVNR	1	12	2

KEYNOTES

VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER

2401 W. AVENUE
NEWPORT NEWS, VA 23607

DRAWN BY: ALYSON LARIMER
PENN STATE AE SENIOR THESIS
ELECTRICAL CONSULTANT: PROF. TED DANNERTH
TITLE: MOTOR CONTROL CENTER SCHEDULE
DATE: 11–FEB–2011
SCALE: NTS



E002

MCC

UH-4, 1/20HP, 120V

LLD-4

SBPB-B2, 3#6 & 1#8GND-3/4"C

SBPB-B3, 3#6 & 1#8GND-3/4"C

SBPB-B4, 3#6 & 1#8GND-3/4"C

PUMP SET #2 – 225HP, 480V, 3ø

SBPB-B11
3 – 400 KCMIL & 1 #3G – 2-1/2"C

CHILLER – 605FLA, 480V, 3ø

SBPB-B14
(2) SETS– 3 – 500 KCMIL & 1 #2/0G – 3"C

LLD-8

HMA-38
3 #1/0 & 1 #6G – 2"C

PUMP SET #1 – 95HP, 480V, 3ø

EXHAUST FAN EF-6, 2HP, 480V, 3ø

HMD-8

EXHAUST FAN EF-4, 5HP, 480V, 3ø

HMD-13

CHILLER – 349FLA, 480V, 3ø

SBPB-B15
(2) SETS – 3#4/0, 1#1G – 2-1/2"C

EXHAUST FAN EF-3, 5HP, 480V, 3ø

HMB-1

3-#12 & 1-#12GND

PUMP SET #4 – 15HP, 480V, 3ø

HMB-2
3-#8 & 1-#10GND, 3/4"C

AIR COMPRESSOR 10HP, 480V, 3ø

SF-6

LLD-1

AHU-9 EXHAUST 5HP, 480V, 3ø

AHU-9 SUPPLY FAN – 15HP, 480V, 3ø

HMA-32

HMA-26
3-#8 & 1-#10GND, 3/4"C

HMA-14
3-#4 & 1-#8GND, 1 1/4"C

3P 60 NF

PRESSURE BOOST 10HP, 480V, 3ø

HMA-20
3-#8 & 1-#10GND

AHU-8 SUPPLY FAN – 20HP, 480V, 3ø

AHU-8 EXHAUST FAN – 7.5HP, 480V, 3ø

VAV
1/3HP, 277V

HMC-13

HMB-8
3#8, 1#10 G, 3/4"C

PUMP SET #3 20HP, 480V, 3ø

LLD-15
3#10, 1#12 G, 1/2"C

LLD-21
3#10, 1#12 G, 1/2"C

LLD-27
3#10, 1#12 G, 1/2"C

B-1, 10 FLA, 208V, 3ø

LLD-6

LLD-23

LLD-20

BOILER MANAGEMENT CONNECTION, 120V

EWC COMPRESSOR

HMA HMB HMC HMD LLD

366

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KEYNOTES

VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER
2401 W. AVENUE
NEWPORT NEWS, VA
23607

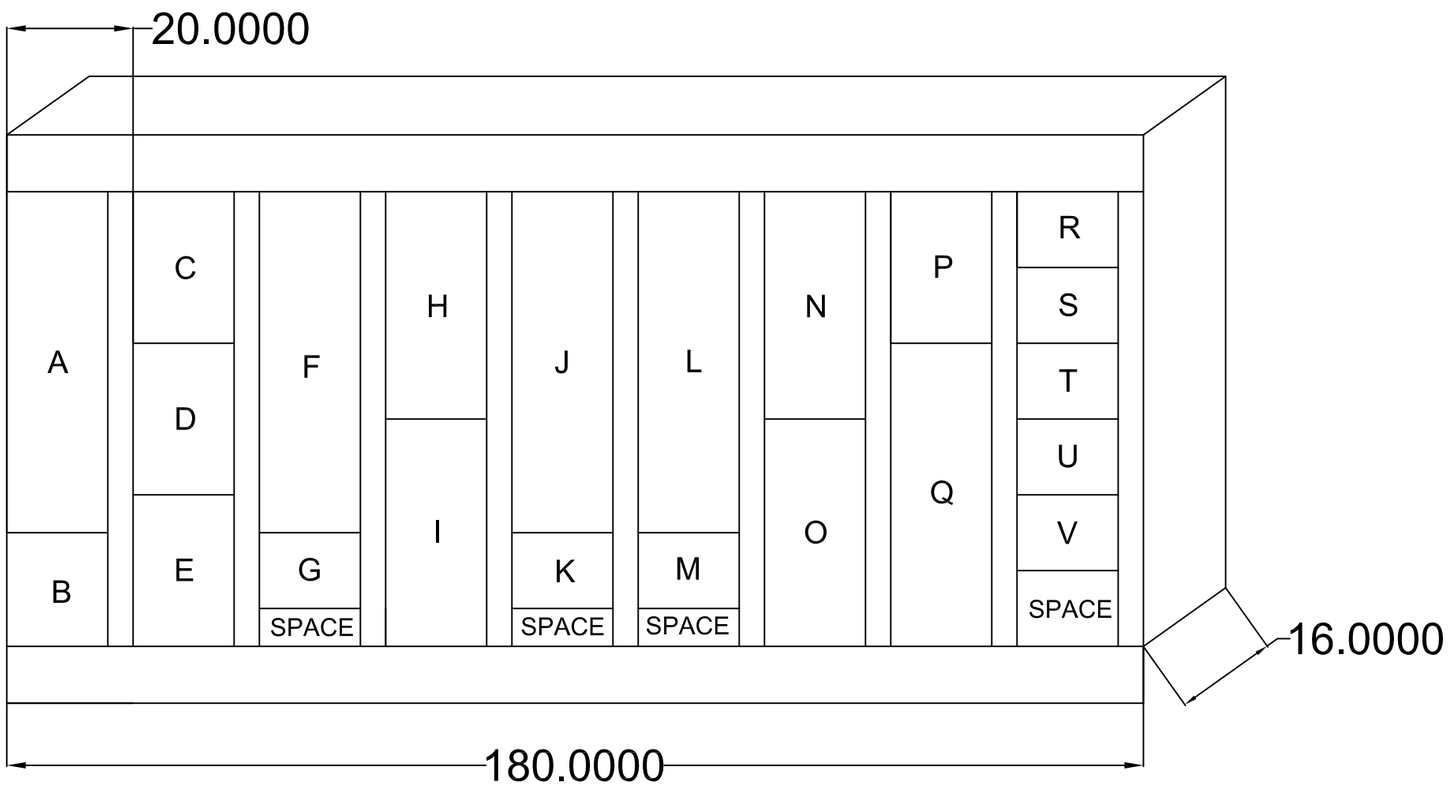
DRAWN BY: ALYSON LARIMER
PENN STATE AE SENIOR THESIS
ELECTRICAL CONSULTANT: PROF. TED DANNERTH
TITLE: AUDITORIUM LIGHTING CONTROL DIAGRAM
DATE: 11–FEB–2011
SCALE: 1/4" = 1'–0"

1/4" = 1'–0" 0 1' 5' 10' 15'
1/2" = 1'–0" 0 6" 1' 2' 3' 4' 5'
1" = 1'–0" 0 6" 1' 2' 3'

ENLARGED MECHANICAL ROOM PLAN

SCALE: 1/4"=1'–0"

E4-3



KEYNOTES

VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER

2401 W. AVENUE
NEWPORT NEWS, VA 23607

DRAWN BY: ALYSON LARIMER

PENN STATE AE SENIOR THESIS

ELECTRICAL CONSULTANT: PROF. TED DANNERTH

TITLE MOTOR CONTROL CENTER DETAIL

DATE: 11-FEB-2011

SCALE: 1/2" = 1'-0"

1/4" = 1'-0"

1/2" = 1'-0"

1" = 1'-0"

E001

ELECTRICAL BREADTH #2 | BUSDUCT VS. CONDUIT

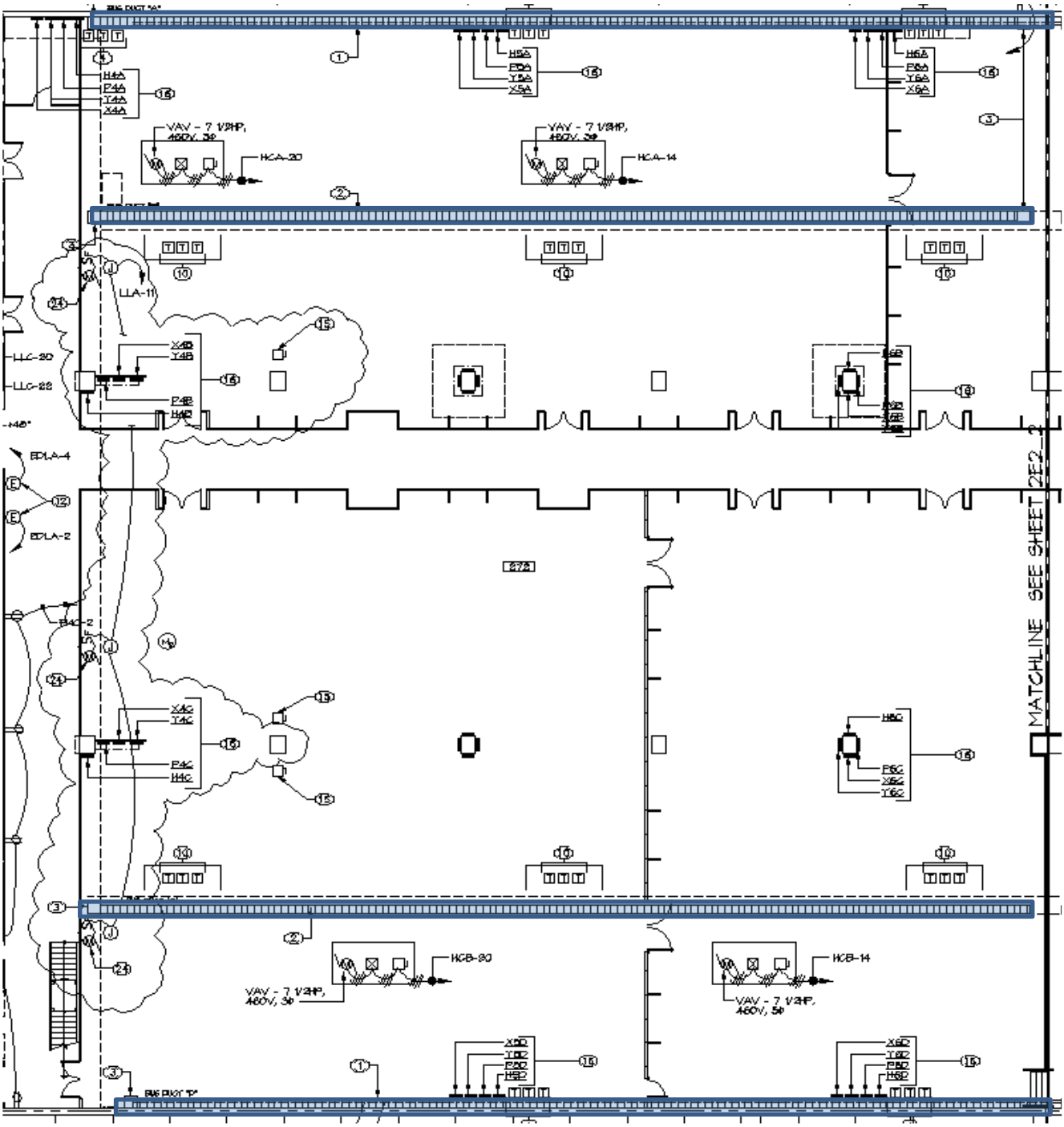
BREADTH DESCIPTION:

Located in the Laboratory Wing are eight existing sets of busduct. The busducts are plug-in type to accommodate for equipment changes within the space during the development and experimental phases of design in the facility. The goal of this coast analysis is to determine the most cost effective way to supply power to various pieces of equipment within the space. Although the busducts are wall mounted and out of the way, this space is the only location of busducts throughout the facility. This analysis will be solely based on cost excluding the practicality of the installation.

The following is a table of total cost for both installations and a floor plan highlighting the location of busducts throughout the Laboratory Wing.

ASSEMBLY NUMBER	DESCRIPTION	QYT	UNIT	COST PER UNIT		COST PER L.F
				UNIT	TOTAL	
DIVISION D50	SERVICES					
	ASSEMBLY METHOD					
SECT./NO.	**ELECTRICAL: BUSDUCT CONSTRUCTION**					
26 25 13.10 0220	ALUMINUM BUS DUCT (PER 10 FT): INTERIOR 3 POLE, 4 WIRE, STRAIGHT SECTION, 800 AMP	2200	L.F.	10	$ 262	$57,640
26 25 13.10 0440	FEEDER - 800A	8800	L.F.	1	$ 245	$2,156,000
26 25 13.10 1250	CABLE TAP BOXES - 800A	14	E.A	1	$ 1,800	$25,200
26 05 33.35 0400	FLEX CONDUIT - (2) 3-1/2"	54	L.F.	1	$ 41.50	$2,241
26 05 19.90 2800	500KCMIL COPPER STRANDED FEEDER IN FLEX CONDUIT (4)	54	C.L.F	100	$ 1,475	$797
26 05 19.90 1600	#1/0 COPPER STRANDED GROUND (1)	54	C.L.F	100	$ 420	$227
					TOTAL COST	$2,242,104
D50	**ELECTRICAL: CONDUIT/FEEDER CONSTRUCTION**					
26 05 19.90 2400	(4) 300 KCMIL THHN COPPER STRANDED FEEDER (PER SET)	15462	C.L.F	100	$ 980	$151,528
26 05 19.90 1600	(1) #1/0 STRANDED COPPER GROUND (PER SET)	15462	C.L.F	100	$ 420	$64,940
26 27 16.20 0680	JUNCTION BOX - SCREW COER, 5-1/2"H x 4"W x 4-15/16"D	124	E.A	1	$ 125	$15,500
26 28 16.10 0600	CIRCUIT BREAKER - 225A	90	E.A	1	$ 2,150	$193,500
26 28 16.10 0400	CIRCUIT BREAKER - 100A	30	E.A	1	$ 1,000	$30,000
26 28 16.10 1000	CIRCUIT BREAKER - 800A	24	E.A	1	$ 6,875	$165,000
26 05 33.13 5140	CONDUIT - 3" EMT PER SET	46387	L.F.	1	$ 26.50	$1,229,256
					TOTAL COST	$1,849,724

Figure 1.2: Busduct vs. conduit and feeder | NOTE: This cost analysis was computed using values from the Electrical Section of RSMeans 2011.


MATCHLINE SEE SHEET 2E2_2
VAV - 7 1/2HP, 480V, 3ø
HCA-30
HCA-14
HCB-30
HCB-14
LLA-11
LLC-30
LLC-22
EPLA-4
EPLA-2
272

CONCLUSION:

Gathered from the table above, the cost of installing conduit and feeders is less expensive compared to a busduct installation. The cost analysis was computed from RSMeans 2011. The total savings of a conduit and feeder installation would be $392,380. If this study was not focused just on cost but practicality, the better installation would be busducts because of the amount of large equipment needing power. Also, because there are many different types of ships designed at the VASCIC facility, different equipment may be necessary and the busducts allow for easy change of equipment.

PROTECTIVE DEVICE COORDINATION ANLYSIS | SHORT CIRCUIT CALCULATION

INTRODUCTION:

A protective device coordination study addressing a single-path from the service entrance, through a distribution panel, and ending at a redesigned panelboard was calculated using the Per Unit Short Circuit Method. The single-pathway analyzed starts at a utility transformer, through switchgear SGA and SGB, through switchboard SBPB, through emergency distribution panel EDP, and finally to emergency panel EHPA feeding panel EH4A.

Below illustrates the single-path taken from the service entrance through the distribution system of the building termination at a branch panel. In addition, a table following shows a breakdown of each component through the single-path for the short circuit calculation.

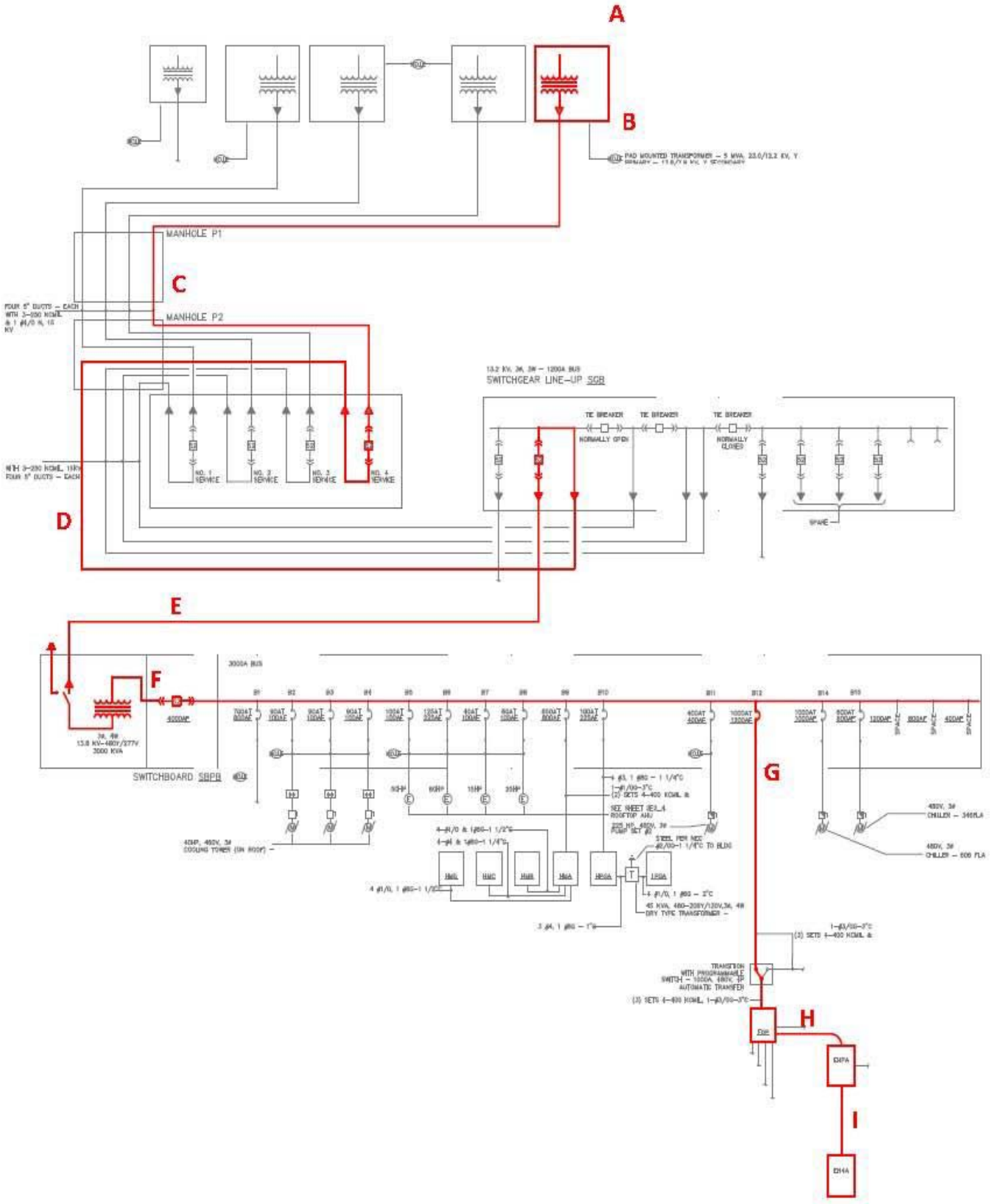


Figure 10.1: Single pathway of analysis

Equipment Characteristics											Per-Unit Value Table					
Mark	%X	%R	%Z	kVA	X/1000ft	R/1000ft	Z/1000ft	Length	# sets	3Ph Voltage (V)	Mark	Xu	Ru	Zu	Isc	Location
Utility	0.5			20000						23000	Utility	0.5000000		0.5000000		
															502.0437	A
MANHOLE-1 XFMR	6.928	1.000	7.000	5000.0							MANHOLE-1 XFMR	0.1385640	0.0200000	0.1399999		
															653.7028	B
FEEDER TO SGA					0.041	0.054	0.067	10	1.000	13800.000	FEEDER TO SGA	0.0000215	0.0000281	0.0000354		
															653.6667	C
SWITCHGEAR SGA											SWITCHGEAR SGA					
															653.6667	
FEEDER TO SGB					0.041	0.054	0.068	10	1.000	13800.000	FEEDER TO SGB	0.0000215	0.0000284	0.0000356		
															653.6303	D
SWITCHGEAR SGB											SWITCHGEAR SGB					
															653.6303	
FEEDER TO XFMR SBPB					0.041	0.054	0.068	286.98	1.000	13800.000	FEEDER TO XFMR SBPB	0.0006178	0.0008137	0.0010217		
															652.5886	E
XFMR SBPB	6.928	1.000	7.000	3000.0							XFMR SBPB	0.2309400	0.0333333	0.2333332		
															13755.4605	F
SWITCHBOARD SBPB											SWITCHBOARD SBPB					
															13755.4605	
FEEDER TO EDP					0.040	0.033	0.052	11.91	3.000	480.000	FEEDER TO EDP	0.0068924	0.0057034	0.0089462		
															13616.1551	G
PANEL EDP											PANEL EDP					
															13616.1551	
FEEDER TO EHPA					0.041	0.054	0.067	200	1.000	480.000	FEEDER TO EHPA	0.3559028	0.4644097	0.5851010		
															8190.9101	H
PANEL EDP											PANEL EDP					
															8190.9101	
FEEDER TO EH4A					0.048	0.321	0.325	35	1.000	480.000	FEEDER TO EH4A	0.0729167	0.4876302	0.4930518		
															6132.0308	I

A base kVA was assumed at 10000 and utility contribution of the service entrance is 20 MVA. The primary side of the utility transformer is 23000V, 3-phase.

Each component along the single-path was calculated using the following equations:

Component per unit, reactance, $X = \frac{(\text{m}\Omega\ \text{X})(\text{Base KVA})}{(1000)(\text{KV})^2}$

Component per unit, resistance, $R = \frac{(\text{m}\Omega\ \text{R})(\text{Base KVA})}{(1000)(\text{KV})^2}$

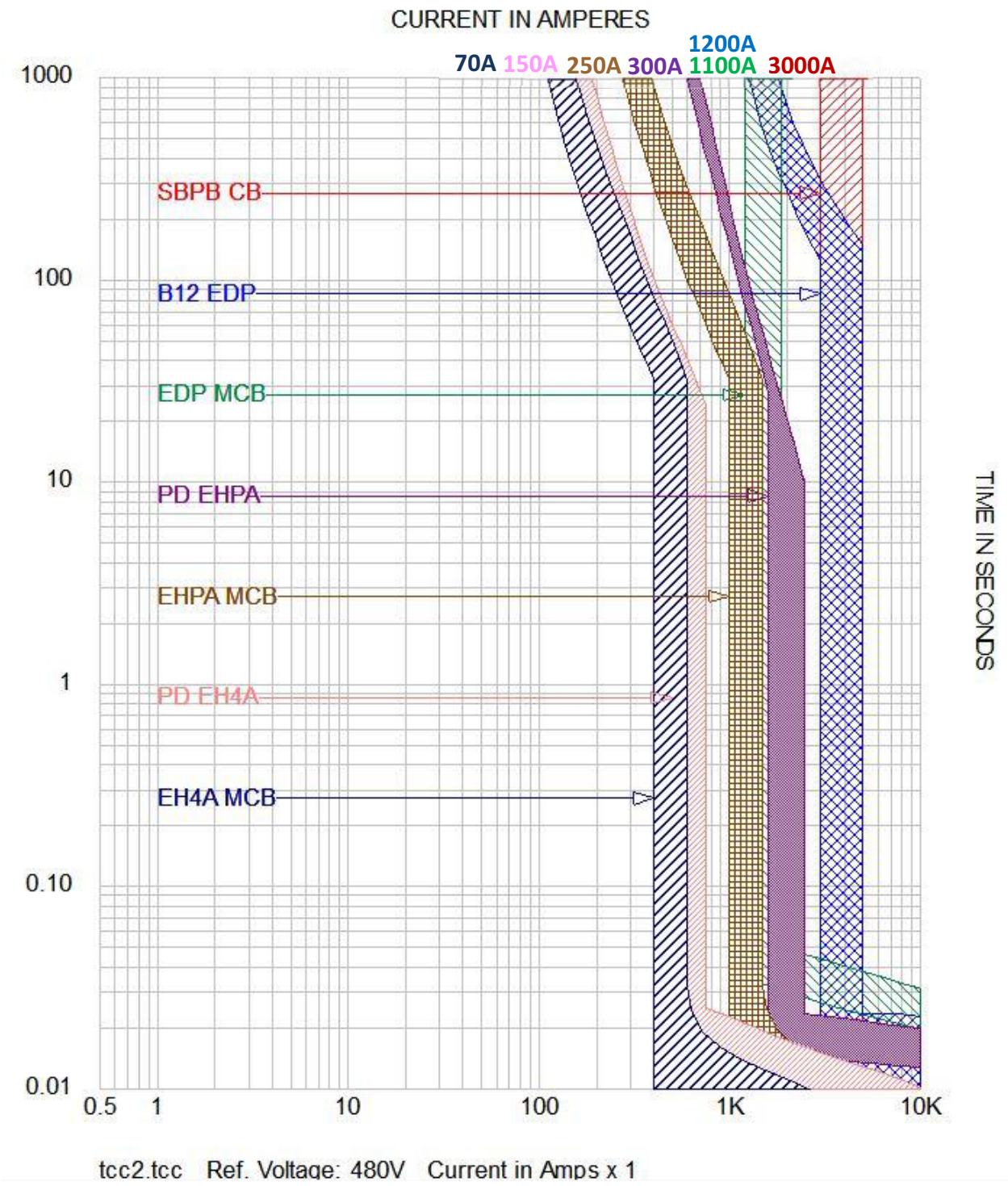
Total impedance, $Z = \sqrt{(X)^2 + (R)^2}$

For feeder calculations, resistance and reactance values were taken from Table 8 and 9 in Chapter 9 of the NEC code book.

The far right column shows the final short circuit current capacity at each point along the path considered.

Additionally, a protection device coordination study was performed to confirm the order of equipment tripping is correct.

Below is a compilation of circuit breakers considered for the short circuit calculation.


CURRENT IN AMPERES
70A
150A
250A
300A
1200A
1100A
3000A
1000
100
10
1
0.10
0.01
SBPB CB
B12 EDP
EDP MCB
PD EHPA
EHPA MCB
PD EH4A
EH4A MCB
0.5
1
10
100
1K
10K
TIME IN SECONDS
tcc2.tcc Ref. Voltage: 480V Current in Amps x 1

CONCLUSION:

The final trip curves were compiled on the same trip graph in order to easily analyze the system. According to the protective device coordination analysis, the 3000A circuit breaker located in the switchboard SBPB was properly sized. All other circuit breakers will trip before the 3000A breaker. However, there are some breakers that overlap within the system. This could become a problem between the 300A and 1100A circuit breaker. All other overlapping should not cause a problem within the system.

SUMMARY & CONCLUSIONS

The main objective of this thesis report was to determine how a single change within a building can affect multiple disciplines throughout the design process. Some changes can be beneficial; however others may jeopardize necessary requirements and therefore need critical thinking to derive a solution without sacrificing the aesthetics of the space.

Throughout the design process, an overall design concept was developed that provided a link between the architecture and the newly designed lighting. The lighting design intended to be functional while enhancing the overall aesthetics and visual environment. Compiling solid design criteria and considerations before implementing final designs was an established foundation throughout the lighting design process. While each lighting design obtained its own design concept and criteria, an integral approach for a quality lighting solution was necessary.

In response the redesigned lighting systems within each space, a reciprocal electrical redesign was necessary to address. In most cases, electrical components were downsized due to more efficient and efficacious luminaires and sources chosen for each space. This action not only reduces energy consumption, but it also provides reduced costs for electrical components. Through other electrical studies, it was found that it was more cost effective to install busduct throughout the Laboratory Wing rather than routing individual feeders and conduits to each piece of equipment. In addition, this installation allowed to equipment changes as well as additional pieces of equipment to be added to the laboratory area. After performing a motor control center design in the main electrical room of the Laboratory Wing, this solution provides an easy means to perform maintenance repairs.

Integrating design research further, an acoustical study performed in the auditorium due to a ceiling material and contour change proved to be inadequate. From this solution, it was necessary to derive a plausible solution to reduce the reverberation time within the acceptable range. By changing the existing acoustical wall panels to a heavy weight material and installing additional panels along the east wall provided a reverberation time within the acceptable range. Additionally, the aesthetics were not jeopardized within the space because the existing materials were used on an adjacent wall.

An addition of an exterior gathering space integrated the VASCIC facility with its surroundings further. This space provided a functional space for the city of Newport News to enjoy as well as the facility occupants. Lighting within this space was intended to be additional landscape elements and to not appear as lighting equipment. This approach led to an integrated design with the landscape and proved to be a successful installation as well as design. Seating areas throughout the space can be enjoyed publically or privately due to installations of taller landscaping framing the smaller seating areas. Also throughout the space, it was important to focus on the purpose of the facility and represent that through the design of the exterior.

Overall, the design process was executed smoothly focusing on the design concepts of the facility and implementing them through lighting. In addition, the lighting design proved to be a function and practical design in respect to the Virginia Advanced Shipbuilding and Carrier Integration Center Facility.

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Egan, M. David. *Architectural acoustics.* New York: McGraw-Hill Custom Pub., 20031988.

EATON. 2006 Consulting Application Guide, Solutions Focus (14th ed.), pg. 30.1- Moon Township, Pa.

National Electrical Code, 2008, Quincy, MA: National Fire Protection Association, Inc., 2008

Rea, Mark S. (2002). The IESNA Lighting Handbook: References & Application (10th ed.). Illumination Engineering Society of North America. New York, NY.

SOFTWARE:

Autodesk AutoCAD 2009, AGi32 version 2.1, 3DStudioMAX, Adobe Photoshop CS5.

ACKNOLEDGEMENTS

Thank you to the following professors and professionals for all their input and constructive criticism throughout my thesis project design:

Dr. Richard Mistrick
Dr. Kevin Houser
Professor Ted Dannerth
Professor Shawn Good
Professor Robert Holland
Professor Kevin Parfitt

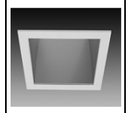
Mr. Mike Barber
Mrs. Lee Brandt
Mr. Luke Tigue

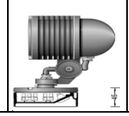
All AE Students, most importantly my fellow Lighting/Electrical Colleagues.

APPENDIX A | LIGHTING

The following pages include all lighting plans, a full luminaire equipment schedule specifying luminaires, lamps, and ballast characteristics, and luminaire cut sheets in order of the luminaire equipment schedule.

LUMINAIRE EQUIPMENT SCHEDULE

TYPE		MANUFACTURER	CATALOGUE NUMBER	DESCRIPTION	LAMP	CCT	BALLAST (OR DRIVER)	LOCATION	ELECTRICAL	INPUT WATTAGE	QUANTITY	PF
C		METALUX-COOPER LIGHTING	MBF-2-54T5FB	4' (2)T5 industrial fixture die formed channel from 20 gauge rolled steel with pretreated iron phosphate for rust inhibitor, reflector minimum 95% total reflectivity, mounted with suspension cables or surface mounted, integral occupancy sensor available.	(2) F54W/T5/835/ECO	3500	99651 – GE254MVPS90-F	AUDITORIUM	120/277	117	20	1.0
CW		FOCAL POINT	FL44-11LED-L40-277-SO-T L44-S0-TD-TS	4.5" X 4.5" wall washing LED module with remote phosphor technology generating high system efficacy, luminaire design maintains form factors, lumen output, and thermal management for module and driver components, intelligent driver technology, flicker free. Housing made of die-cast aluminum incorporated with an angled MicroGlow lens redirecting light delivering asymmetric distribution.	Fortimo LED TDLM 1100 21 W/840 277V MODULE: 929000613903	4000	LED-120A-0012V-21-F	LOBBY	120	21	64	0.9
DN		FOCAL POINT	FL44-11LED-L40-277-SO-T L44-S0-DN-TD-TS	4.5" X 4.5" downlight LED module with remote phosphor technology, powered by Philips' Fortimo LED and AdvanceXitanium LED driver, aluminum heat sink incorporated into die-cast aluminum housing, clear acrylic reflector cone for superior brightness control and 55 degree cutoff, easy replacement, 70% luminaire efficiency.	Fortimo LED TDLM 1100 21 W/840 277V MODULE: 929000613903	4000	LED-120A-0012V-21-F	LOBBY	120/277	21.6	24	0.9
DS		PRESCOLITE-HUBBELL LIGHTING	CF8W26QEB	8" wall mounted sylinder, 26W CFL, quad tube, electronic ballast	F26TBX/835/A/ECO	3500	97608 – F26DBX/835/ECO	AUDITORIUM	120/277	27	5	1.0
EC		THE LIGHTING QUOTIENT-FRAQTIR	S301-R06G-S-00-1-00-0-30-00	Cove LED system of extruded aluminum integrated with proper heat sinks, impact-resistant extruded acrylic lens and holographic diffuser, rotating/locking hinges to allow for proper alignment, Philips Lumiled LUXEON LEDs, remote driver in aluminum enclosure, mounting L-brackets can be interlocked for continuous acting luminaire, luminaire provides uniform asymmetric distribution utilizing reflection and inter-refraction of light.	LXM3-PW51	4000	LED-120A01400C0240F	LOBBY	120	42.1	14	0.9
GG		BEGA	5014	17.7" in diameter, portable garden luminaire with stainless steel base plate, white synthetic safety glass sphere housing one lamp, sphere distributes light siftly and uniformly over surface.	CF7EL/SUPER/830/BL	3000	SELF BALLASTED	EXTERIOR	120	7	33	1.0
HR		iO by Cooper Lighting	0.06.SSS.2.PM.NR.65.3K.GB3.120	Handrail integrated LED chips delivers functional outputs effectively illuminating paths of egress, available in two rail diameters and three beam spread angles, constructed of steel and aluminum, practical for indoor and outdoor applications, ADA and ANSI compliant, proper LED thermal management in accordance with LED manufacture specifications, generally provided in 4' OC.	LED PROVIDED BY Io	3000	DR200AM	LOBBY	120/277	11	18	0.9
PS		BEGA	7785MH	1.3' W x 1.3' L x 1.5 H, two piece die-cast aluminum construction providing a symmetrical distribution, construction robust enough for human weight, spun aluminum lamp housing location inside lower top covering shielded, anchored with secured plates to lower casting with four stainless steel rods, finished in black, UL listed for wet locations.	CMH39T/U/942/G12	4000	GEMH39-MC-120	EXTERIOR	120	40	45	1.0
SB		CREE LED LIGHTING	LR6C-DR1000	6" recessed architectural downlight, Cree True White Technology LED, delivers 80 lumens/W, CRI 90	LMR040-0700-35F9-10100TW	3500	LED-120A-0350C-33-F	AUDITORIUM	120	11.9	11	0.9
SC		IVALO INC.-LUTRON	LNN-27SNL-2WNUMT	27" interior decorative sconce, direct/indirect, ADA compliant (3-7/8" off of wall), white LED strings, incorporated reflector within housing of luminaire, finished in case aluminium, mounts on wall from base bracket with locking screws.	5W 27' LED STRING	4000	LED-UNIA-0700C-12-F	OPEN OFFICE	120	5	12	0.5

SP		ERCO	EN-1-ERCO-72086-000	4.9" track spot light, powder coated cast aluminium with 180˚ tilt capabilities,able to connect with a DALI track system, LED module replaceable	STANDARD WHITE LED	3200	LED-UNIA-0700C-12-F	AUDITORIUM	120	14	5	0.9
ST		iO LED-Cooper	0.01.SL.3K.N.100.3.0	5.9"x5.9" square LED step light for interior or exterior applications, UL listed for wet/damp locations, gasketed and corrosion resistant metal casting, polycarbonate lens, LED replaceable.	STANDARD WHITE LED	3500	LED-UNIA-0700C-12-F	AUDITORIUM	120/277	8	40	0.5
TA		THE LIGHTING QUOTIENT-TAMBIENT	L201-36S3-M-EL15-T-30	Task ambient luminaire 34.75" long with integral hang-on mounting, 1 21W T5 luminaire, high performance louver on top for maximum uplight coverage and minimal glare at eye height, clear prismatic acrylic task lens reducing veiling reflections,housed in extruded aluminum with downlight reflector.	F21T5/835/WM/ECO	3500	IDA-128-D	OPEN OFFICE	120	27	240	1.0
TS		iO by Cooper Lighting	0.09.I.3K.NG.1.6.1.1	1.39" W X .66" D X 36" L shelf integrated task light, LEDge is a part of the iO linear LED-based family, low voltage, neoprene gasketed, housing made of extruded aluminum, finished in anodized aluminum.	Standard LED	4000	DR20OS	LOBBY	24	19.8	8	0.9
TT		Bega	7502	1.3"W x 1.5"L x 8.85" H LED floorlight, housed in aluminum alloy, stainless steel, and clear safety glass, silicone gasketed, inner reflector made of anodised pure aluminum, mounting bos with 2 fixing holes for permanent locking, UL label for wet locations	Standard LED	5000	integral with fixture	exterior	120	17	55	0.9

KEYNOTES

VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER
2401 W. AVENUS
NEWPORT NEWS, VA
23607

DRAWN BY: ALYSON LARIMER

PENN STATE AE SENIOR THESIS

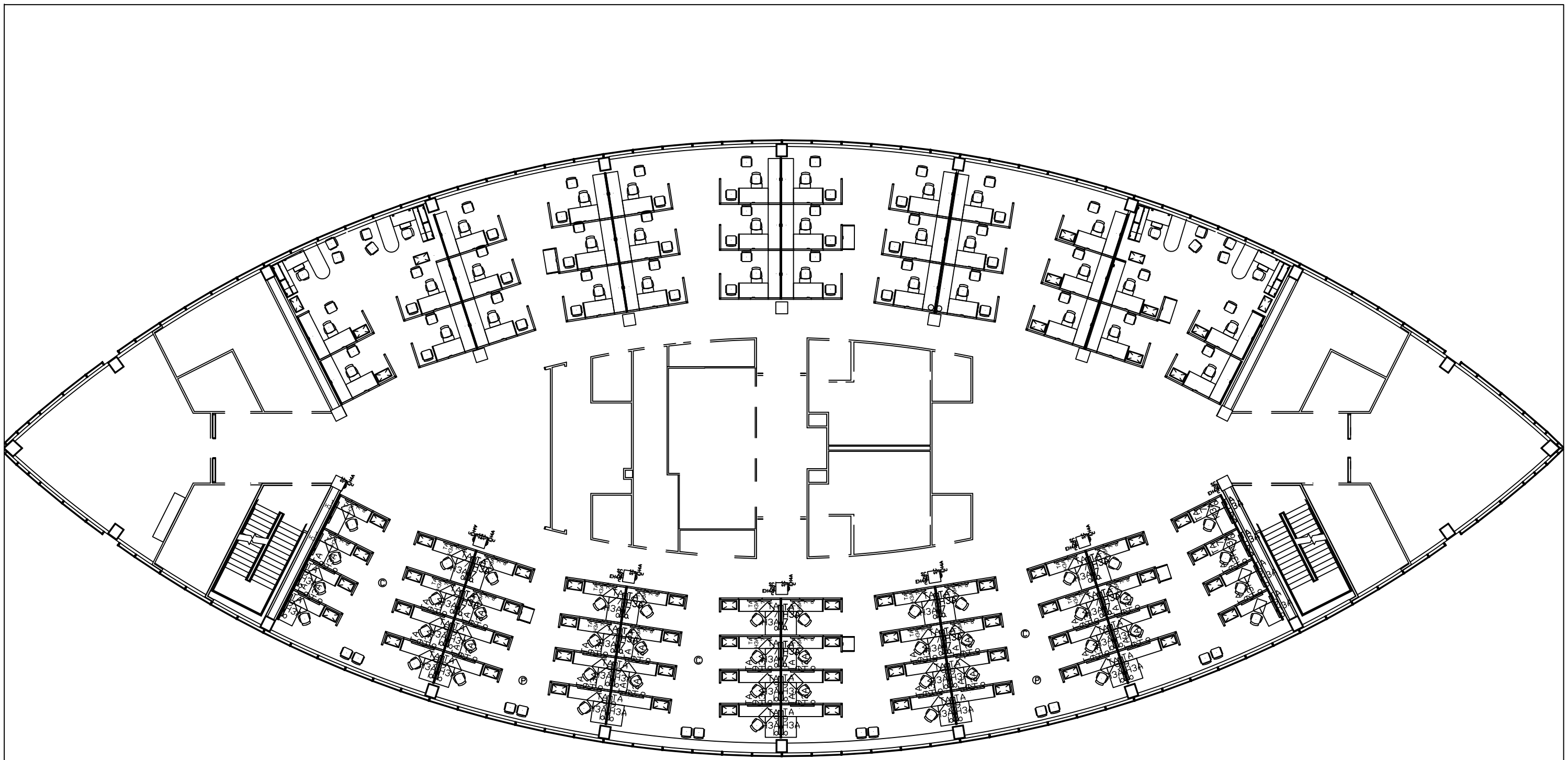
LIGHTING CONSULTANT: DR. RICHARD MISTRICK

TITLE: LOBBY LIGHTING PLAN

DATE: 7-APRIL-2011
SCALE: 1/8" = 1'-0"

N

L1-1



KEY

Ⓒ OCCUPANCY SENSOR

Ⓟ PHOTOSENSOR

DRAWN BY: ALYSON LARIMER

PENN STATE AE SENIOR THESIS

ELECTRICAL CONSULTANT: PROF. TED DANNERTH

TITLE: OPEN OFFICE LUMINAIRE LAYOUT

DATE: 07–APRIL–2011

SCALE: 1/8" = 1'–0"

1/4" = 1'–0" 0 1' 5' 10' 15'

1/2" = 1'–0" 0 6" 1' 2' 3' 4' 5'

1" = 1'–0" 0 6" 1' 2' 3'

N

L2-1

KEYNOTES

C:\Users\ast85017\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\8WGOCWM5\vasclk_logo[1].jpg

VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER

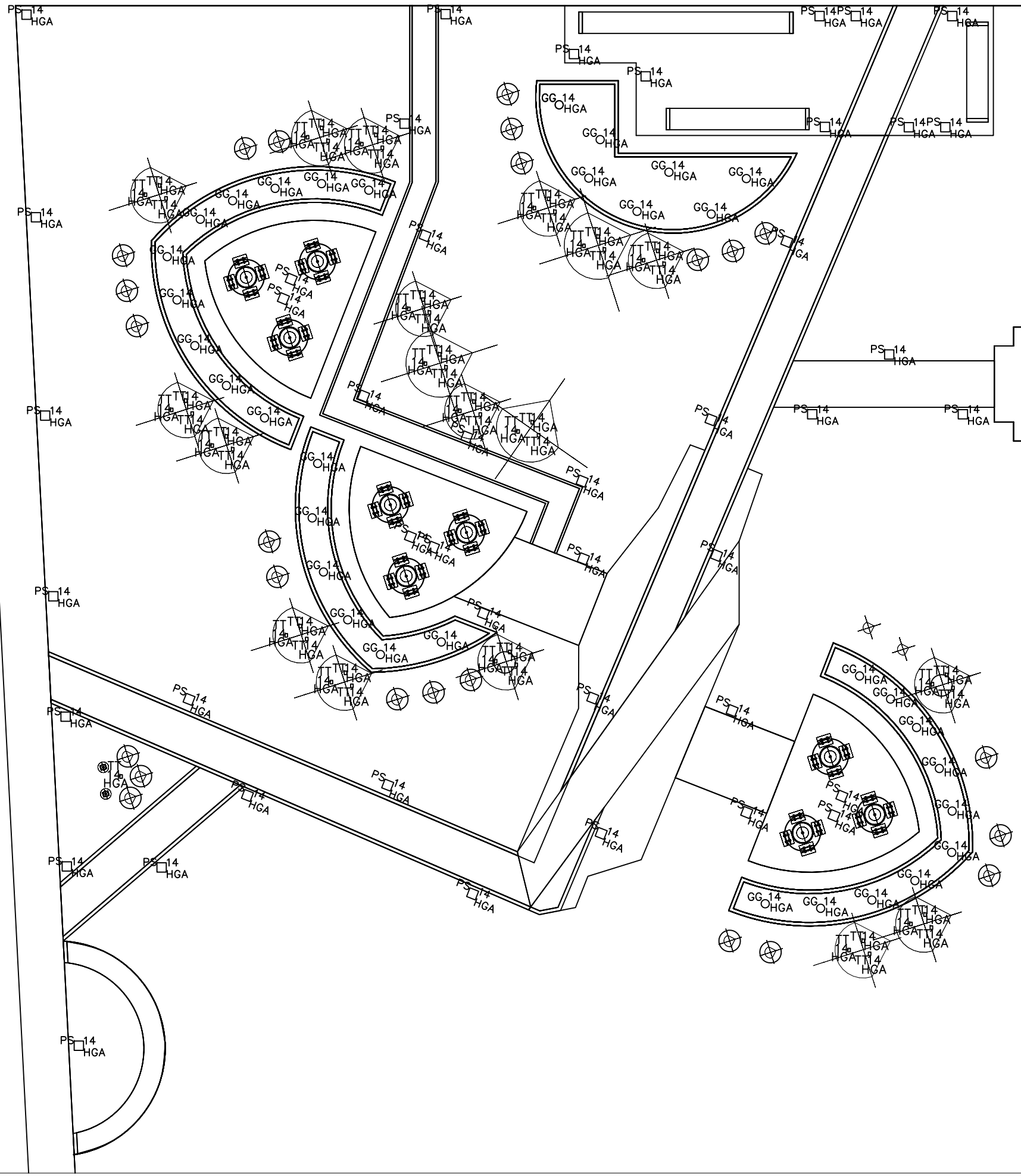
2401 W. AVENUE
NEWPORT NEWS, VA
23607

DRAWN BY: ALYSON LARIMER
PENN STATE AE SENIOR THESIS
LIGHTING CONSULTANT: DR. RICHARD MISTRICK
TITLE: AUDITORIUM LIGHTING LAYOUT
DATE: 7–APRIL–2011

SCALE: 1/8" = 1'–0"
1/4" = 1'–0"
1/2" = 1'–0"
1" = 1'–0"

N

L3-1



KEY NOTES:

THE VIRGINIA ADVANCED SHIPBUILDING AND CARRIER INTEGRATION CENTER
NEWPORT NEWS, VIRGINIA

DRAWN BY: ALYSON LARIMER
PENN STATE AE SENIOR THESIS
CONSULTANT: DR. RICHARD MISTRICK
TITLE: EXTERIOR SPACE LUMINAIRE LAYOUT
DATE: 7–APRIL–2011
SCALE: 1/16" = 1'–0"

N

L4-1

METALUX

DESCRIPTION

The Micro-Bay series is a functional and multi-purpose narrow profile fluorescent High-Bay that incorporates premium performance with durable construction. Designed for T5 fluorescent technology, the MBF series offers both high performance and application versatility with three optical configurations for general and aisle applications. Illumination solution in commerical, industrial and retail applications, MBF series can be used in warehouses and retail store distribution centers.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

A···Construction
Die formed channel from 20 gauge prime cold rolled steel. Numerous KOs for ease of installation. End plate quickly converts to snap-in channel connector for continuous row alignment. Push-in style lampholders snap in to installed tracks. Channel/wireway cover positively secured with mechanical fastener.

B···Electrical*
Ballasts are Class "P" and are positively secured. RotorHock lampholders ensure positive lamp retention. Optional pre-wired factory installed multiple circuit plug-in connectors. UL/CUL listed. Suitable for damp locations.

C···Finish
Multistage iron phosphate pretreatment ensures maximum bonding and rust inhibitor.

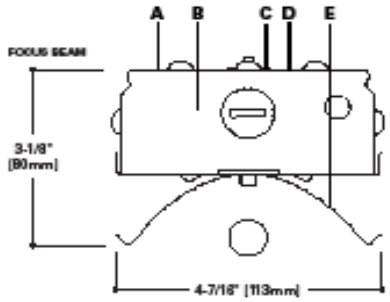
D···Channel/Wireway Cover
Heavy gauge prime cold rolled steel. Tight fit for ease of maintenance.

E···Reflector
Specular Miro reflectors for precise light control minimum 95% total reflectivity. Three optical distribution patterns are available:

Focus - SC < .5
Task - .5 ≤ SC < .9
Normal - .9 ≤ SC ≤ 1.2

Mounting
Suspension is convenient and flexible with the SS Aircraft Cable "Y" Toggle Mounting Kits. Adjustment for luminaire mounting height is provided at luminaire rather than structure. Order a rigid exterior connector/coupling with pre-punched holes facilitates easy installation of coupled sections up to 32' long.

Option
Integral occupancy sensor available and provides from 600 sq. ft. up to 1250 sq. ft. of coverage in a maximum mounting height of 40'.

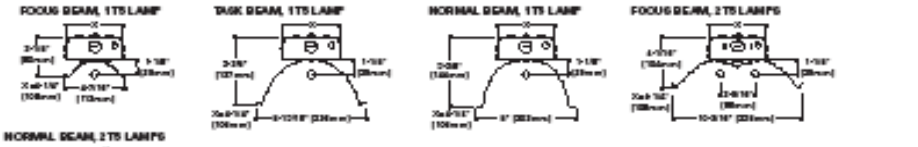


MBF
154
254

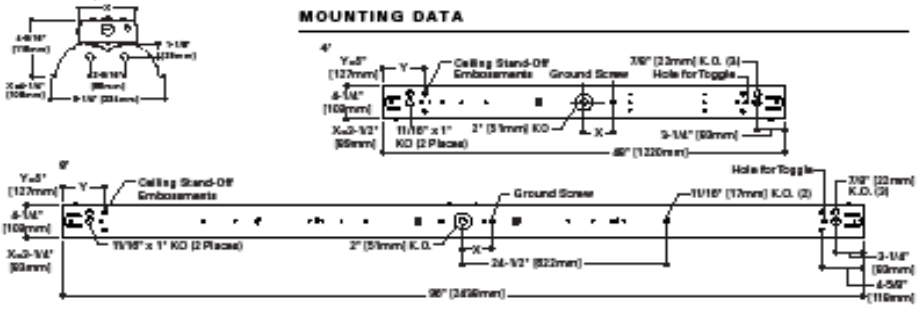
4' OR 8' MICROBAY*
1 OR 2 LAMP

T5 Lamp Technology
Task Beam
Focus Beam
Normal Beam

LAMP CONFIGURATIONS



MOUNTING DATA



ENERGY DATA

Input Watts @ 120V:
Electronic Ballast & STD Lamps
154 (62)
254 (117)
454 (229)
8T154 (117)
8T254 (229)

Luminaire Efficacy Rating
LER = 69
Catalog Number: MB-154T5

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = $3.47

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

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

Safe and convenient means of disconnecting power

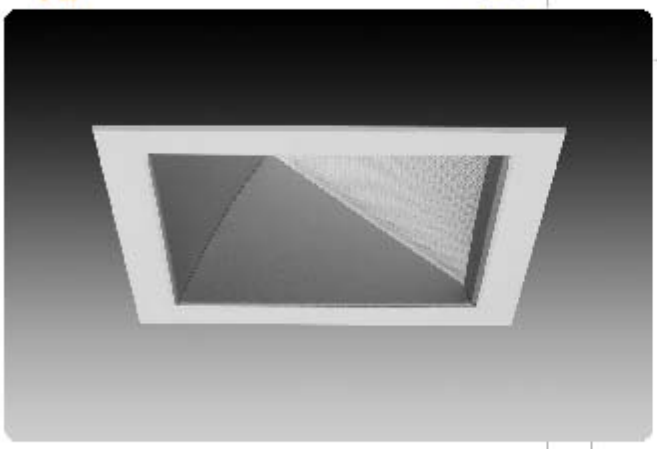
*Patent Pending

ADF080488

COOPER LIGHTING

4.5" x 4.5" – wall wash

id



Patent Pending

id The Intelligent Downlight

FOCAL POINT

features

LED module features remote phosphor technology enabling a high system efficacy and minimum 80 CRI.

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.

Rated life is 50,000 hours at 70% lumen maintenance (L70).

5 year limited warranty.

Intelligent driver delivers specified lumen output regardless of color temperature.

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

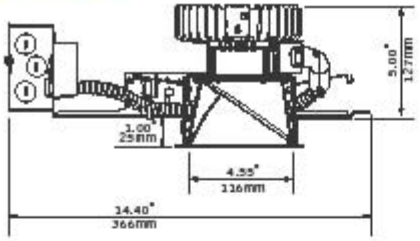
Low profile 5" housing.

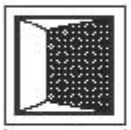
Housing design allows die-cast trim flange to rotate to align with architecture and adjacent luminaires.

Angled MicroGlow lens redirects light to deliver asymmetric distribution.

February 2010

dimensional data

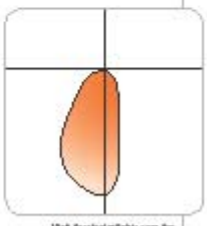




performance

23W, 3500K, 1100 Lumen LED Module
Clear Diffuse Reflector
Total Luminaire Output: 726lms

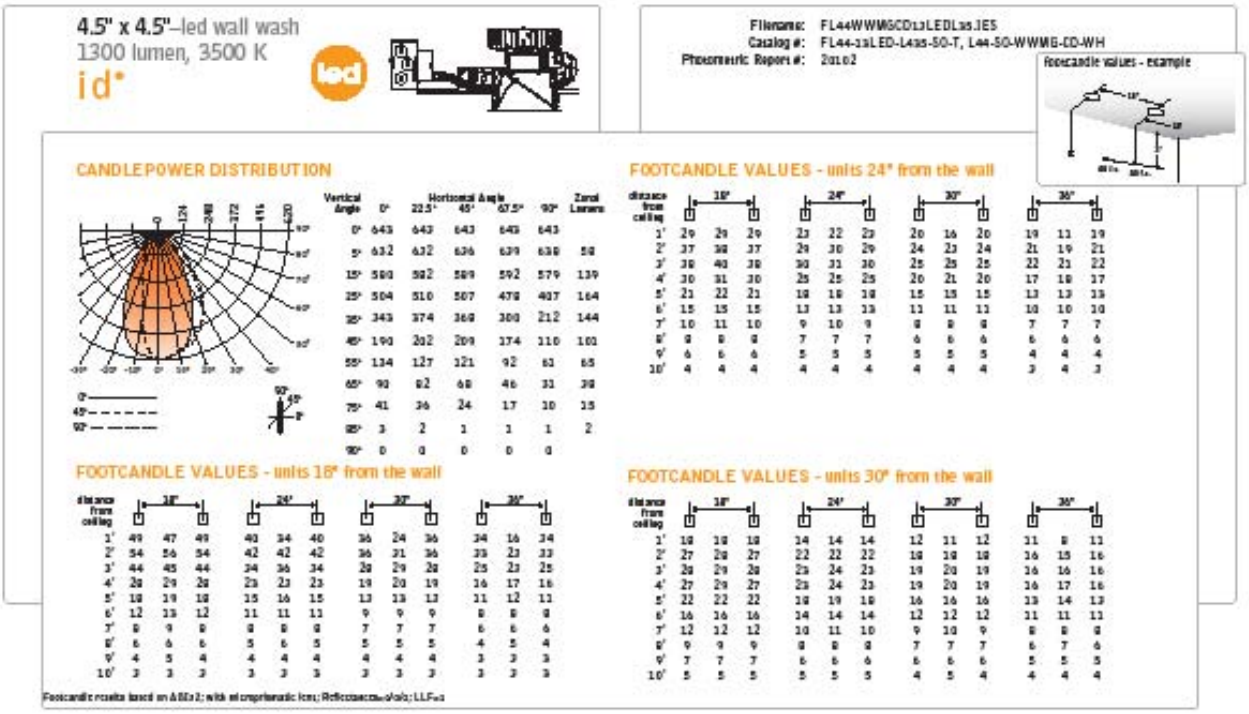
Photometric performance is measured in accordance with IESNA LM-79.



evergreen

Use 100 Lumen LED downlight in place of a 4" 42W compact fluorescent

Visit focalpointlights.com for complete photometric data.



4.5" x 4.5"–led wall wash
1300 lumen, 3500 K
id*

Filename: FL44WWMGCD13LEDL35.IES
Catalog #: FL44-13LED-L435-SO-T, L44-SO-WWMG-CD-WH
Photometric Report #: 20102

Footcandle values - example

CANDLEPOWER DISTRIBUTION

Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	643	643	643	643	643	
5°	632	632	636	639	638	58
15°	580	582	589	592	579	139
25°	504	510	507	478	407	164
35°	343	374	368	300	212	144
45°	190	202	209	174	110	101
55°	134	127	121	92	61	65
65°	90	82	68	46	31	38
75°	41	36	24	17	10	15
85°	3	2	1	1	1	2
90°	0	0	0	0	0	

FOOTCANDLE VALUES - units 24" from the wall

distance from ceiling	18"			24"			30"			36"		
1'	29	29	29	23	22	23	20	16	20	19	11	19
2'	37	38	37	29	30	29	24	23	24	21	19	21
3'	38	40	38	30	31	30	25	25	25	22	21	22
4'	30	31	30	25	25	25	20	21	20	17	18	17
5'	21	22	21	18	18	18	15	15	15	13	13	13
6'	15	15	15	13	13	13	11	11	11	10	10	10
7'	10	11	10	9	10	9	8	8	8	7	7	7
8'	8	8	8	7	7	7	6	6	6	6	6	6
9'	6	6	6	5	5	5	5	5	5	4	4	4
10'	4	4	4	4	4	4	4	4	4	3	4	3

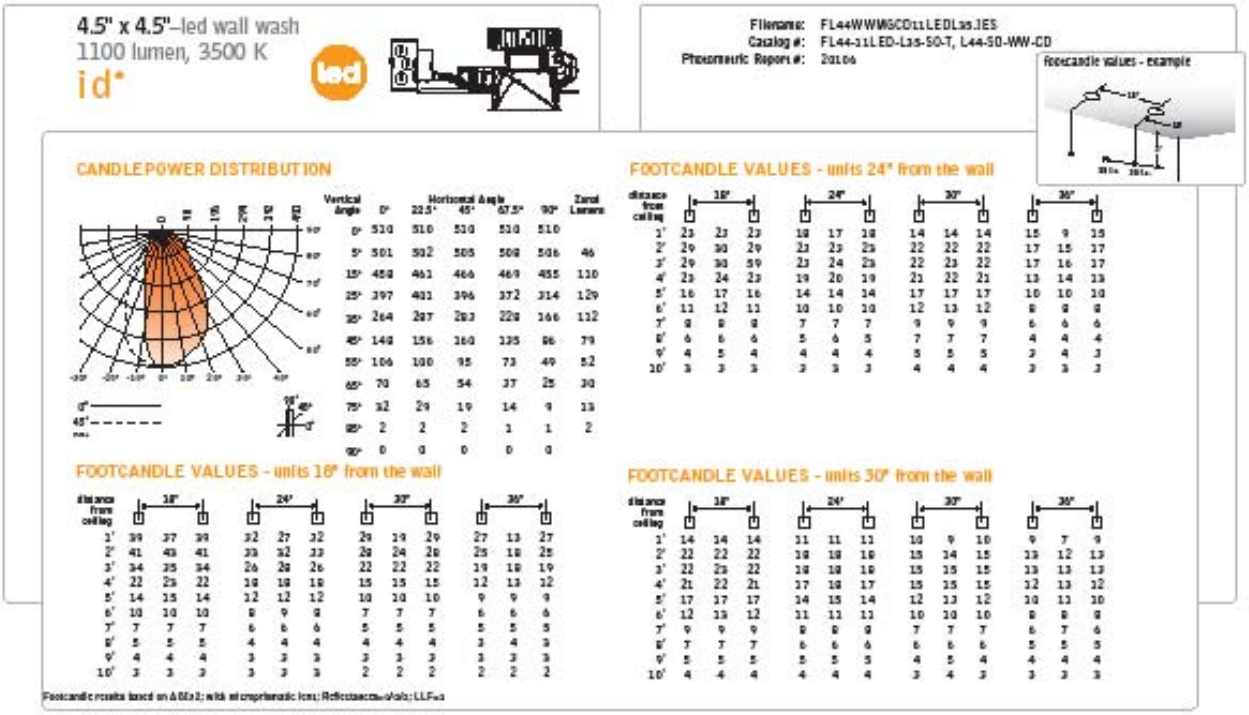
FOOTCANDLE VALUES - units 18" from the wall

distance from ceiling	18"			24"			30"			36"		
1'	49	47	49	40	34	40	36	24	36	34	16	34
2'	54	56	54	42	42	42	36	31	36	33	23	33
3'	44	45	44	34	36	34	28	29	28	25	23	25
4'	28	29	28	23	23	23	19	20	19	16	17	16
5'	18	19	18	15	16	15	13	13	13	11	12	11
6'	12	13	12	11	11	11	9	9	9	8	8	8
7'	8	9	8	8	8	8	7	7	7	6	6	6
8'	6	6	6	5	6	5	5	5	5	4	5	4
9'	4	5	4	4	4	4	4	4	4	3	3	3
10'	3	3	3	3	3	3	3	3	3	3	3	3

FOOTCANDLE VALUES - units 30" from the wall

distance from ceiling	18"			24"			30"			36"		
1'	18	18	18	14	14	14	12	11	12	11	8	11
2'	27	28	27	22	22	22	18	18	18	16	15	16
3'	28	29	28	23	24	23	19	20	19	16	16	16
4'	27	29	27	23	24	23	19	20	19	16	17	16
5'	22	22	22	18	19	18	16	16	16	13	14	13
6'	16	16	16	14	14	14	12	12	12	11	11	11
7'	12	12	12	10	11	10	9	10	9	8	8	8
8'	9	9	9	8	8	8	7	7	7	6	7	6
9'	7	7	7	6	6	6	6	6	6	5	5	5
10'	5	5	5	5	5	5	4	5	4	4	4	4

Footcandle results based on ANSI 2; with microprismatic lens; Reflectances=white; LLF=1



4.5" x 4.5"–led wall wash
1100 lumen, 3500 K
id*

Filename: FL44WWMGCD11LEDL35.IES
Catalog #: FL44-11LED-L35-SO-T, L44-SO-WW-CD
Photometric Report #: 20106

Footcandle values - example

CANDLEPOWER DISTRIBUTION

Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	510	510	510	510	510	
5°	501	502	505	508	506	46
15°	458	461	466	469	455	110
25°	397	401	396	372	314	129
35°	264	287	283	228	166	112
45°	148	156	160	135	86	79
55°	106	100	95	73	49	52
65°	70	65	54	37	25	30
75°	32	29	19	14	9	13
85°	2	2	2	1	1	2
90°	0	0	0	0	0	

FOOTCANDLE VALUES - units 24" from the wall

distance from ceiling	18"			24"			30"			36"		
1'	23	23	23	18	17	18	14	14	14	15	9	15
2'	29	30	29	23	23	23	22	22	22	17	15	17
3'	29	30	29	23	24	23	22	23	22	17	16	17
4'	23	24	23	19	20	19	21	22	21	13	14	13
5'	16	17	16	14	14	14	17	17	17	10	10	10
6'	11	12	11	10	10	10	12	13	12	8	8	8
7'	8	8	8	7	7	7	9	9	9	6	6	6
8'	6	6	6	5	6	5	7	7	7	4	4	4
9'	4	5	4	4	4	4	5	5	5	3	4	3
10'	3	3	3	3	3	3	4	4	4	3	3	3

FOOTCANDLE VALUES - units 18" from the wall

distance from ceiling	18"			24"			30"			36"		
1'	39	37	39	32	27	32	29	19	29	27	13	27
2'	41	43	41	33	32	33	28	24	28	25	18	25
3'	34	35	34	26	28	26	22	22	22	19	19	19
4'	22	23	22	18	18	18	15	15	15	12	13	12
5'	14	15	14	12	12	12	10	10	10	9	9	9
6'	10	10	10	8	9	8	7	7	7	6	6	6
7'	7	7	7	6	6	6	5	5	5	5	5	5
8'	5	5	5	4	4	4	4	4	4	3	4	3
9'	4	4	4	3	3	3	3	3	3	3	3	3
10'	3	3	3	3	3	3	2	2	2	2	2	2

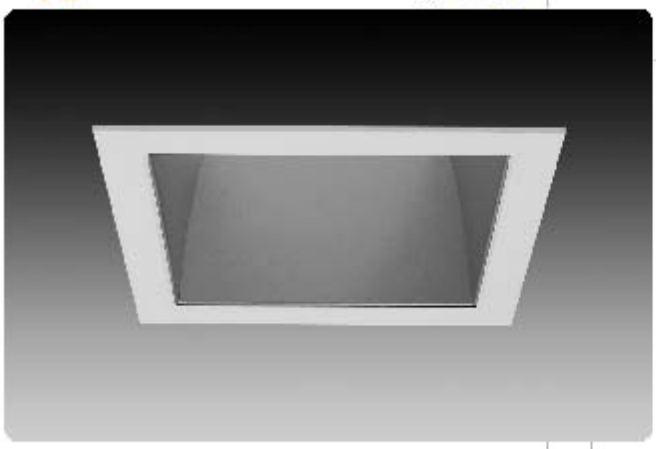
FOOTCANDLE VALUES - units 30" from the wall

distance from ceiling	18"			24"			30"			36"		
1'	14	14	14	11	11	11	10	9	10	9	7	9
2'	22	22	22	18	18	18	15	14	15	13	12	13
3'	22	23	22	18	18	18	15	15	15	13	13	13
4'	21	22	21	17	18	17	15	15	15	12	13	12
5'	17	17	17	14	15	14	12	13	12	10	11	10
6'	12	13	12	11	11	11	10	10	10	8	8	8
7'	9	9	9	8	8	8	7	7	7	6	7	6
8'	7	7	7	6	6	6	6	6	6	5	5	5
9'	5	5	5	5	5	5	4	5	4	4	4	4
10'	4	4	4	4	4	4	3	4	3	3	3	3

Footcandle results based on ANSI 2; with microprismatic lens; Reflectances=white; LLF=1

4.5" x 4.5" – led downlight

id



Patent Pending

id The Intelligent Downlight

FOCAL POINT

features

LED module features remote phosphor technology enabling a high system efficacy and minimum 80 CRI.

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.

1300 Lumen module is Energy Star qualified, 1100 Lumen module is built to Energy Star standards.

Rated life is 50,000 hours at 70% lumen maintenance (L70).

5 year limited warranty.

Intelligent driver delivers specified lumen output regardless of color temperature.

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

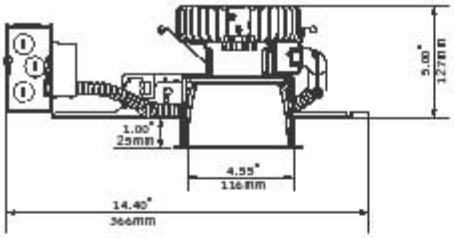
Low profile 5" housing.

Housing design allows die-cast trim flange to rotate to align with architecture and adjacent luminaires.

Clear Diffuse reflector cone features superior brightness control and 55 degree cutoff to light source and its image.

February 2011 E

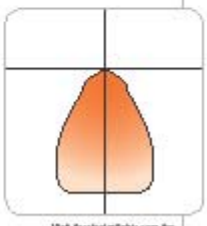
dimensional data



performance

23W, 3500K, 1100 Lumen LED Module
Clear Diffuse Reflector
Total Luminaire Output: 952lms

Photometric performance is measured in accordance with IESNA LM-79.



everGreen

Use 100 Lumen LED downlights in place of a 4" 42W compact fluorescent

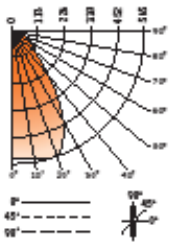
Visit focalpointlights.com for complete photometric data.

4.5" x 4.5"–led downlight

id•

Filename: FL44DNCD11LEDL35.IES
Catalog #: FL44-11LED-L35-12a-50-T, L44-50-DN-CD-WH
Photometric Report #: 20101

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	530	530	530	530	530	
5°	531	532	531	532	532	51
15°	547	547	548	546	547	155
25°	500	526	569	525	498	241
35°	326	374	417	370	321	229
45°	146	171	176	164	142	131
55°	106	94	53	93	106	77
65°	53	45	32	46	56	45
75°	21	17	14	18	23	19
85°	3	2	2	2	4	3
90°	0	0	0	0	0	

Spacing Criteria:
1.2

LUMEN SUMMARY

	Zone	Lumens	% Flux
	0°-30°	447	47.0
	0°-40°	676	71.1
	0°-60°	884	93.0
	0°-90°	952	100.0
Total Luminaire	0°-90°	952	100.0

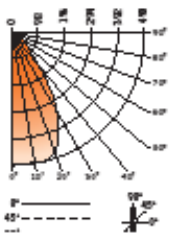
Go to www.focalpointlights.com for additional photometric data.

4.5" x 4.5"–led downlight

id•

Filename: FL44DNCD11LEDL35.IES
Catalog #: FL44-11LED-L35-12a-50-T, L44-50-DN-CD-WH
Photometric Report #: 20105

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	484	484	484	484	484	
5°	484	484	484	485	485	46
15°	483	485	487	486	486	137
25°	409	432	461	429	410	196
35°	233	264	293	261	229	162
45°	93	94	94	91	87	76
55°	59	49	31	49	58	42
65°	32	24	16	24	31	24
75°	14	10	7	9	12	10
85°	2	1	0	0	1	1
90°	0	0	0	0	0	

Spacing Criteria:
1.1

LUMEN SUMMARY

	Zone	Lumens	% Flux
	0°-30°	380	54.7
	0°-40°	543	78.0
	0°-60°	658.7	94.9
	0°-90°	694	100.0
Total Luminaire	0°-90°	694	100.0

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

Featuring Reflectors

8" Direct Wall Mount Cylinder

CF8W13QEB
CF8W18QEB
CF8W26QEB

One 13W, 18W, or 26W CFL
Quad Tube 4-Pin Lamp
Wet Location
120V–277V or 347V

DATE: TYPE:

FIRM NAME:

PROJECT:

LiteForms

For conversion to millimeters, multiply inches by 25.4
Not to Scale

APPLICATIONS:
The CF8W is an 8" wall mounted cylinder used to achieve direct illumination patterns on vertical walls or columns. The CF8W is ideal for a wide variety of commercial, retail, hospitality and institutional applications where the added energy benefit of compact fluorescent sources is required.

HOUSING:
.064" extruded aluminum cylinder featuring durable powder coat painted finish. Cast aluminum arm bracket canopy with extruded aluminum arm. Specify: brushed aluminum, matte black, bronze, matte white or Prescolite's exclusive Zet, metallic silver.

REFLECTOR:
Specify clear, champagne gold Alzak, or black baffle reflector. Virtual Source® optical system provides excellent glare and brightness control for visual comfort.

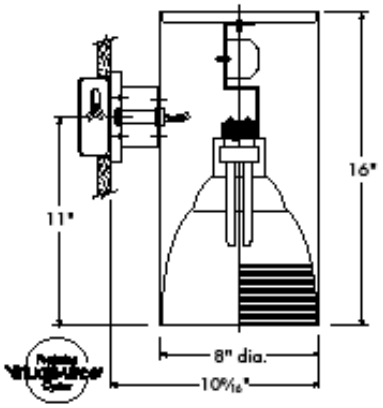
BALLAST:
One (1) 13W, 18W, or 26W compact fluorescent Class 'P' multi-watt, multi-volt electronic ballast. High power factor standard.

LAMP:
One (1) 13W (G24q-1base), 18W (G24q-2 base), or 26W (G24q-3 base) 4-pin quad tube compact fluorescent lamp. Lamp furnished by others.

SOCKET:
One (1) injection molded socket. Reflector/socket mounting bracket factory set for specified wattage.

INSTALLATION:
Easy installation onto standard J-box.

LABELS:
UL listed or UL/CSA listed with CDN option for damp locations



CATALOG NUMBER: EXAMPLE: CF8W26QEBCRBZ

CYLINDERS	CYLINDER OPTIONS	CYLINDER OPTIONS	REFLECTOR FINISHES	CYLINDER FINISHES
❑ **CF8W13QEB** 8" Direct wall mount cylinder, 13W CFL quad, electronic ballast (120–277V)	❑ **CDN** Canadian electrical code compliant ballast disconnect	❑ **XDM**[1,5] Advance Mark 10 Dimming Ballast to 5%, 2-wire line voltage	❑ **BB** Black Baffle	❑ **BA** Brushed aluminum
❑ **CF8W18QEB** 8" Direct wall mount cylinder, 18W CFL quad, electronic ballast (120–277V)	❑ **CDN 347V**[5] Canadian electrical code compliant ballast disconnect	❑ **SDM**[1,5] Lutron Compact SE Dimming Ballast to 5%, 3-wire low voltage	❑ **CR** Clear Alzak	❑ **BL** Matte black
❑ **CF8W26QEB** 8" Direct wall mount cylinder, 26W CFL quad, electronic ballast (120–277V)	❑ **MW26** Max Wattage label, 26W	❑ **2DM**[1,5] Lutron Tu-Wire Dimming Ballast to 5%, 2-wire line voltage	❑ **CG** Champagne gold	❑ **BZ** Bronze
	❑ **SYL**[4] Osram Sylvania Ballast (available only for standard EB option)			❑ **WH** Matte white
	❑ **DM** Electronic dimming ballast (contact factory for wall control system compatibility)			❑ **Z** "Zet" metallic silver
	❑ **7DM** Advance Mark 7 Dimming Ballast to 5%, 4-wire, 0-10V, analog (120V–277V)			

Special Reflector Finishes:
Refer to specification sheet #LFO-CFL-026 for reflector capabilities

1. Specify voltage and wattage
2. Not available for 13W or 18W
3. Not available for 13W
4. Available for Osram Sylvania Quick 60+® Limited Warranty when used with Osram lamp(s). See www.prescolite.com for details.
5. Dimming not available for 347V.

prescolite
A Division of Hubbell Lighting, Inc.

In a continuing effort to offer the best product possible we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product.
Web: **www.prescolite.com** • Tech Support: **(888) 777-4832**

LFO-CFL-005

PHOTOMETRIC DATA

LiteForms™ - 8" Direct Wall Mount Cylinder
CF8W13QEB/CF8W18QEB/CF8W26QEB

BALLAST DATA	13W			18W			26W		
	120V	277V	347V	120V	277V	347V	120V	277V	347V
Total System Watts	16W	17W	16W	20W	20W	20W	20W	29W	31W
Input Current (Amps)	0.13	0.06	0.08	0.17	0.08	0.06	0.17	0.11	0.09
Input Frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
Power Factor	>97%	>97%	>97%	>97%	>97%	>97%	>97%	>97%	>97%
Ballast Factor	>98%	>98%	1	>98%	>98%	1	>98%	>98%	1
Total Harmonic Distortion	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%
Minimum Starting Temp.	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)

LAMP DATA			
Rated Watts	13W Quad	18W Quad	26W Quad
Rated Lumens	860	1250	1800
Efficacy (LPW)	67	69	69
Rated Life	10,000 hours	10,000 hours	10,000 hours
CRI	82	82	82
Minimum Starting Temp.	0° F	0° F	0° F

LUMINANCE DATA IN CANDELA/SQ. METER

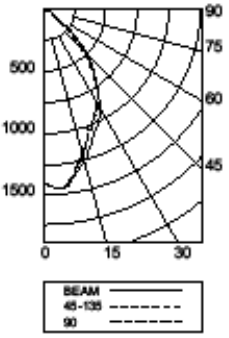
Angle in Vertical	Average 0°	Average 45°	Average 90°
45°	16421	17590	17770
55°	388	998	887
65°	0	0	0
75°	0	0	0
85°	0	0	0

CF8W26QEBCR
One 32W Triple
Spacing Criteria: 1.0
Efficiency: 70.9%

AVERAGE INITIAL FOOTCANDLES
Multiple Units (Square Array)
Ceiling 80% Wall 50% Floor 20%

32W Triple SPACING	RCR1	RCR3	RCR7
8.0	24	20	15
9.0	19	16	12
10.0	15	13	9
11.0	13	11	8
12.0	11	9	6

CANDLEPOWER DISTRIBUTION



Test No. ITL46587X

CANDLEPOWER SUMMARY

Angle	0°	45°	90°
0	1397	1397	1397
5	1443	1450	1443
15	1260	1210	1194
25	1012	961	940
35	707	712	707
45	365	391	395
55	7	18	16
65	0	0	0
75	0	0	0
85	0	0	0

COEFFICIENTS OF UTILIZATION Zonal Cavity Method

Zonal Cavity	% Effective Floor Cavity Reflectance: 80%				70%				50%				30%				10%			
	20% Effective Floor Cavity Reflectance																			
	% Wall Reflectance																			
	70	50	30	10	70	50	30	10	50	30	10		50	30	10		50	30	10	
1	.80	.76	.76	.74	.78	.76	.75	.73	.74	.73	.71		.71	.70	.68		.69	.68	.67	
2	.76	.72	.69	.66	.74	.71	.68	.65	.68	.66	.64		.66	.64	.63		.64	.63	.61	
3	.71	.66	.62	.59	.70	.65	.62	.59	.63	.60	.58		.62	.59	.57		.60	.58	.56	
4	.67	.61	.57	.53	.66	.60	.56	.53	.59	.55	.53		.57	.54	.52		.56	.53	.51	
5	.63	.57	.52	.49	.62	.56	.52	.48	.55	.51	.48		.53	.50	.47		.52	.49	.47	
6	.59	.52	.48	.44	.58	.53	.47	.44	.51	.47	.44		.50	.46	.43		.49	.46	.43	
7	.56	.49	.44	.41	.55	.48	.44	.40	.47	.43	.40		.46	.43	.40		.45	.42	.40	
8	.53	.45	.41	.37	.53	.45	.40	.37	.44	.40	.37		.43	.40	.37		.43	.39	.37	
9	.50	.42	.38	.35	.49	.43	.38	.34	.41	.37	.34		.41	.37	.34		.40	.37	.34	
10	.47	.40	.35	.32	.46	.39	.35	.32	.39	.35	.32		.39	.34	.32		.38	.34	.32	

CF8W26QEBCR Test No. ITL46587X

NOTES
Denotes a Virtual Source reflector.

Refer to www.prescolite.com for additional photometric tests (IES Files).

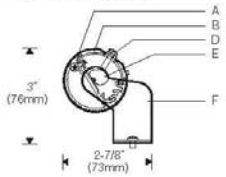
prescolite

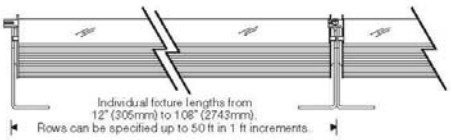
Web: www.prescolite.com • Tech Support: (888) 777-4832
701 Millennium Blvd., Greenville, SC 29607 U.S.A. • Phone (864) 678-1000

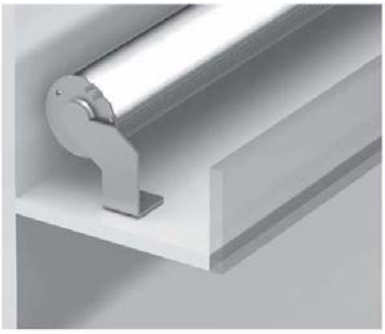
Hubbell Lighting, Inc.

Lighting the Ceiling Xtra small concealed, remote — Solid State (LED) — **fraqtir™ Style S301**

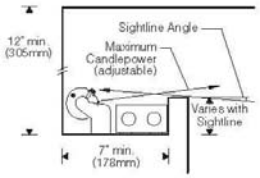
Style S301 1:4 Scale



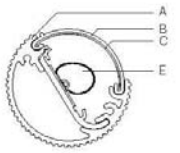




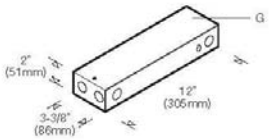
Cove 1:8 Scale



Optical Assembly 1:2 Scale



Remote Driver



Specifications

- **A** Extruded aluminum exterior, heat sink/housing
- **B** Impact-resistant extruded lens
- **C** Holographic diffuser
- **D** Rotation locking tab/screw
- **E** Removable light engine assembly with fraqtir™ acrylic refractor
- **F** L-shaped mounting feet, one pair per optical assembly (fasteners by others)
- **G** Remote driver in aluminum enclosure

Optic Assembly:
Two-piece extruded aluminum heat sink/optic housing. Exterior heat sink anodized for maximum emissivity. Removable interior extrusion treated to maximize thermal conductivity. Precision formed asymmetric optical light bar of high temperature, water-clear acrylic. Extruded impact resistant, high temperature, acrylic outer protective lens. Elliptical distribution holographic diffuser captured within outer protective lens, maximizes lateral distribution without disturbing asymmetric forward throw.

Finish:
Mounting brackets and driver enclosure – mill finish aluminum. All luminaire hardware – stainless steel.

Mounting:
L-shaped mounting brackets can be base or wall mounted. Two brackets are supplied for each optical assembly.Luminaires can be mounted individually or joined together to form a continuous row. Optical assembly aiming is fully adjustable and is fixed in position by rotation locking screws at each mounting bracket. When mounted in a continuous row, assemblies lock together allowing all in the row to be aimed together.

1/11 U.S. and foreign patents pending.

Electrical:
Use 90°C wire for supply connections. 5' (1.5m) wire leads exit center of the housing. 90° connector and 4' (1.2m) of flexible metal conduit are provided.

Remote electronic Class II driver. Aluminum driver enclosure includes (8) 7/8" dia. entries and a knockout for an accessory fuse. Maximum wire length between electronic driver and fixture is 12 feet. Optional electronic dimming driver, compatible dimming controls (by others). See website for dimming compatibility and specifications.

Standard:
UL listed or CSA certified for dry location.

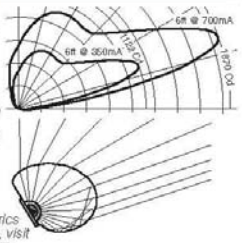
Features

- *fraqtir™ technology – combines several principles of refraction, including TIR, for precise asymmetric optical control*
- *Wide lateral distribution – no socket shadows*
- *Fully adjustable and lockable optic assembly*
- *Easily serviced – LED light engine assembly can be removed for service/upgrade*

C 18.4

Performance

fraqtir™ technology uses multiple refractive surfaces and total internal reflections to drive light across the ceiling from one edge. Glare is minimized and asymmetry of the beam is maximized, resulting in high beam efficiency and superior surface uniformity.



For complete photometrics including LM-79 results, visit ***thelightingquotient.com***

elliptipar There is no equal™

To Order

fraqtir™ Style S301

To form a Catalog Number

S 3 0 1 - R [ ] - S - 0 0 - [ ] - 0 0 - [ ] - 3 0 - [ ]

1 2 3 4 5 6 7 8 9 10

Project: Type:

1 Source
S = Solid state (LED)

2 Style
301 = Small concealed LED with remote driver

3 Row Length and Light Output
R [ ] [ ] = Row length and LED array configuration

Lumens per foot @ drive current
G = 300 lm/ft (350mA), 7 W/ft
H = 500 lm/ft (700mA), 15 W/ft

Row length (in feet) from 1 to 50 ft, examples:
01 = 1 ft (305mm) row
50 = 50 ft (15.24m) row

4 Mounting
S = Sidearms with mounting tabs

C 18.5

5 Finish
00 = Anodized optical housing/heat sink; mill finish brackets and remote driver enclosure; stainless steel luminaire hardware

6 Voltage/Driver

Electronic Driver	*Electronic Dimming Driver**
1 = 120V	T = 120V
2 = 277V	V = 277V

* Dimming not available for all input voltages and control types – see **thelightingquotient.com** for additional dimming specifications and limitations.

7 Option (See Accessories Section for specifications)
00 = No options

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

9 Color Temperature
30 = 3103-3197K, 82-83 CRI

10 Dimming
00 = Non-dimming
M7 = Advance Xitanium 0-10V analog dimming (controls by others)
RD= Roal Strato 0-10V analog dimming (controls by others)

Example
S301-R12G-S-00-1-00-0-30-00

Small concealed LED, 12 foot long (3.65m) continuous row driven at 300 lumens per foot. Aluminum sidearms with mounting tabs, anodized reflector, mill finish brackets and remote driver enclosure. 120V input, UL listed or CSA certified for U.S., dry location. 3103-3197K, 82-83 CRI.

"G" light output (below) is 300 lm/ft (350 mA), 7 W/ft.

fraqtir by The Lighting Quotient

lighting facts℠
A Program of the U.S. DOE

Light Output (Lumens)	1906
Watts	42.1
Lumens per Watt (Efficacy)	45
Color Accuracy (Color Rendering Index (CRI))	82
Light Color (Correlated Color Temperature (CCT))	3103 (Bright White)

Warm White | Bright White | Daylight
2700K 3000K 4500K 6500K

All results are according to IESNA LM-79-2008: *Approved Method for the Electrical and Photometric Testing of Solid-State Lighting.* The U.S. Department of Energy (DOE) verifies product test data and results.

Visit www.lightingfacts.com for the *Label Reference Guide.*

Registration Number: 3HVJ-V5PRL5
Model Number: S301/S305-R06G
Type: Cove light

"H" light output (below) is 500 lm/ft (700 mA), 15 W/ft.

fraqtir by The Lighting Quotient

lighting facts℠
A Program of the U.S. DOE

Light Output (Lumens)	1528
Watts	45.5
Lumens per Watt (Efficacy)	33
Color Accuracy (Color Rendering Index (CRI))	83
Light Color (Correlated Color Temperature (CCT))	3197 (Bright White)

Warm White | Bright White | Daylight
2700K 3000K 4500K 6500K

All results are according to IESNA LM-79-2008: *Approved Method for the Electrical and Photometric Testing of Solid-State Lighting.* The U.S. Department of Energy (DOE) verifies product test data and results.

Visit www.lightingfacts.com for the *Label Reference Guide.*

Registration Number: 3HVJ-ZY5M3Z
Model Number: S301/S305-R03H
Type: Cove light

10/10

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**

18.11 · Technische Änderungen vorbehalten · Technical amendments reserved · Sous réserve de modifications techniques

BEGA Lichttechnische Spezialfabrik
Hennenbusch · D - 58708 Menden

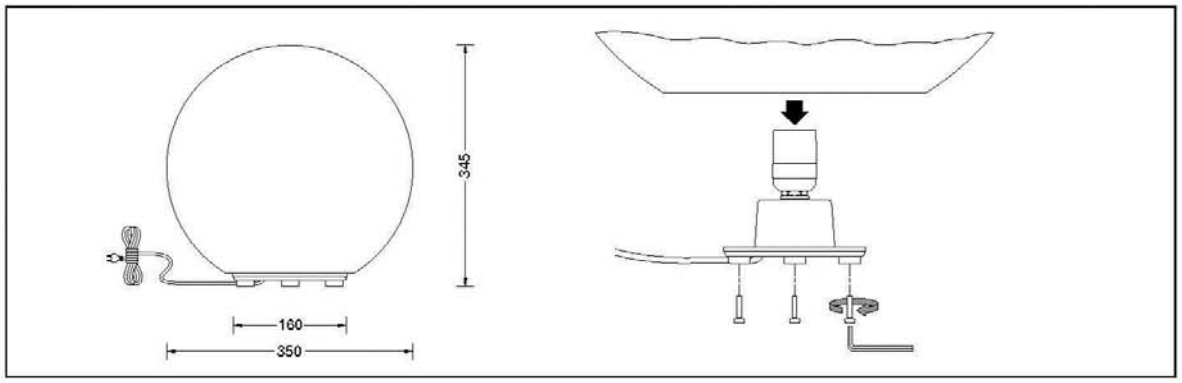
BEGA

Gebrauchsanweisung
Instructions for use
Fiche d'utilisation

Gartenleuchte
Garden luminaire
Luminaire de jardin

IP 65

5013



Anwendung

Ortsveränderliche Gartenleuchte mit Bodenplatte, Anschlussleitung und Netzstecker, die ohne Befestigung auf Bodenflächen steht.
Die weiße Kunststoffkugel verringert in einem erheblichen Maße die Leuchtdichte der Lampe und verteilt das Licht weich und gleichmäßig über die gesamte Oberfläche.
Für eine akzentuierende und effektvolle Beleuchtung am Haus oder im privaten Garten.

Application

Portable garden luminaire with bottom plate, mains supply cable and power plug, which is standing on the floorspace without any fixation.
The white plastic sphere reduces the luminance of the lamp to a considerable extent and distributes the light softly and uniformly over the whole surface.
For an accentuating and sensational illumination at the house or in the private garden.

Utilisation

Luminaire de jardin pouvant être déplacé, avec platine, câble de raccordement et fiche, et qui reste sur le sol sans fixation.
La boule synthétique blanche réduit de façon considérable la luminance de la lampe et répand un éclairage doux et uniforme sur toute la surface du verre.
Pour un éclairage plein d'effets permettant de mettre en valeur les abords de la maison ou le jardin privé.

Lampe

Leuchte mit Sockel E 27
Lampenleistung max. 75 W

Kompakt-Leuchtstofflampe · E 27
Osram:
Dulux Superstar Micro Twist 7 W 420 lm

Bitte beachten Sie die Betriebshinweise der Lampenhersteller.

Lamp

Luminaire with lampholder E 27
Lamp wattage max. 75 W

Compact fluorescent lamp · E 27
Osram:
Dulux Superstar Micro Twist 7 W 420 lm

Please note the lamp manufacturers' operating instructions.

Lampe

Luminaire avec douille E 27
Puissance de lampe max. 75 W

Lampes fluorescente compacte · E 27
Osram:
Dulux Superstar Micro Twist 7 W 420 lm

Veuillez respecter les instructions des fabricants de lampes.

Produktbeschreibung

Leuchte mit Bodenplatte aus Edelstahl
Werkstoff-Nr. 1.4301
Kunststoffkugel weiß
Anschlussfertig verdrahtet mit
5 m Anschlussleitung H05RN-F 3G1 □
und Netzstecker
Fassung E 27
Schutzklasse I
Schutzart · Schutzkontaktstecker IP X4
Schutz gegen Spritzwasser
Schutzart · Leuchte IP 65
Staubdicht und Schutz gegen Strahlwasser
▽ Zeichen – Leuchte ist für die Montage auf normal entflammbaren Befestigungsflächen geeignet
– Sicherheitszeichen
CE – Konformitätszeichen
Gewicht: 3,1 kg

Product description

Luminaire with bottom plate made of stainless steel
Steel grade no. 1.4301
White plastic sphere
Factory pre-wired with
5 m connecting cable H05RN-F 3G1 □
and power plug
Lampholder E 27
Safety class I
Protection class · safety plug IP X4
Protection against splash water
Protection class · luminaire IP 65
Dust tight luminaires and protected against water jets
▽ Symbol – Luminaire is suitable for mounting on normal inflammable fixing surfaces
– Safety mark
CE – Conformity mark
Weight: 3.1 kg

Description du produit

Luminaire avec platine en acier inoxydable
Matériau no. 1.4301
Boule blanche en matière synthétique
Prêt au raccordement avec 5 m de câble H05RN-F 3G1 □ et fiche
Douille E 27
Classe de protection I
Degré de protection · fiche IP X4
Protection contre les projections d'eau
Degré de protection · luminaire IP 65
Etanche à la poussière et protégé contre les jets d'eau
▽ Sigle – Luminaire approprié à l'installation sur des surfaces de fixation normalement inflammables
– Sigle de sécurité
CE – Sigle de conformité
Poids: 3,1 kg

Sicherheit

Für die Installation und für den Betrieb dieser Leuchte sind die nationalen Sicherheitsvorschriften zu beachten.
Der Hersteller übernimmt keine Haftung für Schäden, die durch unsachgemäßen Einsatz oder Montage entstehen.
Werden nachträglich Änderungen an der Leuchte vorgenommen, so gilt derjenige als Hersteller, der diese Änderungen vornimmt.

Montage

Die elektrische Verbindung zwischen Schutzkontaktstecker und Schutzkontaktsteckdose muss der Schutzart IP X4 entsprechen.
Innensechskantschrauben lösen und Bodenplatte mit elektrischer Einrichtung aus der Kunststoffkugel herausnehmen.
Lampe einsetzen.
Bodenplatte in die Kugel einsetzen und Schrauben gleichmäßig fest anziehen.
Auf richtigen Sitz der Dichtung achten.

Lampenwechsel · Wartung

Anlage spannungsfrei schalten.
Leuchte öffnen und reinigen.
Nur lösungsmittelfreie Reinigungsmittel verwenden.
Lampe auswechseln.
Dichtung überprüfen.
Die Anschlussleitung H05RN-F 3G 1,0□ ist zwischen Leuchte und Schutzkontaktstecker auf äußere Beschädigungen zu prüfen. Eine beschädigte Anschlussleitung muss ersetzt werden. Die Neumontage darf nur durch eine Elektro-Fachkraft erfolgen.
Für Reinigungsarbeiten dürfen keine Hochdruckreiniger verwendet werden.

Safety indices

The installation and operation of this luminaire are subject to national safety regulations.
The manufacturer is then discharged from liability when damage is caused by improper use or installation.
If any luminaire is subsequently modified, the persons responsible for the modification shall be considered as manufacturer.

Installation

The electrical connection between safety plug and safety socket outlet must correspond to protection class IP X4.
Undo hexagon socket head screws and remove bottom plate with electrical unit from the plastic sphere.
Insert lamp.
Insert bottom plate into the sphere and tighten screws evenly.
Make sure that gasket is positioned correctly.

Relamping · Maintenance

Disconnect the electrical installation
Open the luminaire and clean.
Use only solvent-free cleansers.
Change the lamp.
Check the gasket.
Inspect mains supply cable H05RN-F 3G 1.0□ between luminaire and plug regarding obvious damages.
Replace damaged cables.
The installation has to be carried out by a qualified electrician only.
When cleaning please do not use high pressure cleaners.

Sécurité

Pour l'installation et l'utilisation de ce luminaire, respecter les normes de sécurité nationales.
Le fabricant décline toute responsabilité résultant d'une mise en œuvre ou d'une installation inappropriée du produit.
Toutes les modifications apportées au luminaire se feront sous la responsabilité exclusive de celui qui les effectuera.

Installation

La connexion électrique de la fiche du luminaire à la prise de courant du réseau doit être conforme au degré de protection IP X4.
Desserrer les vis à six pans creux et retirer la platine avec appareillage électrique de la boule synthétique.
Installer la lampe.
Installer la platine dans la boule et serrer régulièrement et fort les vis.
Veiller au bon emplacement du joint.

Changement de lampe · Entretien

Travailler hors tension.
Ouvrir le luminaire et nettoyer.
N'utiliser que des produits d'entretien ne contenant pas de solvant.
Changer la lampe.
Vérifier le joint.
Vérifier si le câble de raccordement H05RN-F 3G 1,0□ n'est pas endommagé entre le projecteur et la fiche du câble.
Un câble endommagé doit être remplacé.
Le remontage ne doit être effectué que par un électricien professionnel.
Lors des travaux de nettoyage ne pas utiliser de nettoyeur haute pression.

Ersatzteile

Bezeichnung	Bestellnummer
Kunststoffkugel	150149.6
Anschlussleitung mit Netzstecker	620137
Fassung	630105
Dichtung Gehäuse	820325
Dichtung Kugel	830986

Spares

Description	Part no
Synthetic sphere	150149.6
Connecting cable with mains plug	620137
Lampholder	630105
Gasket housing	820325
Gasket sphere	830986

Pièces de rechange

Désignation	No de commande
Boule synthétique	150149.6
Câble de raccordement avec fiche	620137
Douille	630105
Joint du boîtier	820325
Joint de la boule	830986

luxrail™

For Amber only.

Application

ANSI and ADA compliant, **luxrail** is an indoor/outdoor LED-based handrail that delivers functional illumination. Two intensities may be specified: standard output and high output. The standard light output version delivers illuminance levels appropriate for exterior applications (2 footcandles at grade) as well as for dark interior environments with low ambient illumination levels (e.g., themed environments, theatres and residential areas). The high output version delivers illuminance levels applicable to interior environments – providing in excess of 10 footcandles along the path of egress (ANSI required for stair treads). Independent photometric test reports and IES Format data are available at **www.iolighting.com**.

luxrail's standard handrail gripping surfaces are circular in cross section and meet 2004 ADAAG (Americans with Disability Act Accessibility Guidelines). Patented optical assemblies deliver 10˚, 45˚ and 65˚ beam spreads. The 45˚ and 65˚ beam patterns are most suitable for illuminating pathways, while the 10˚ beam spread offers accent lighting for optional glass or stainless steel cable railing infills. Reference page 44 of this catalog for information regarding infill options. **io** ensures that each LED is provided thermal and electrical management properties in accordance with the LED manufacturers recommendations. Projected average rated life is 50,000 hours at 70% of lamp lumen output. Contact factory for IES LM-80 compliance. To ensure proper performance, architectural details should allow for ventilation and air flow around the fixture. Ambient temperature surrounding the fixture shall not exceed 120˚F *(48.9˚C)*.

Light Output

Two luminous intensities are available for white light. All values below are initial lumens per foot. IES LM-79 format files may be obtained from the factory or downloaded from **www.iolighting.com.**

	Standard Output	High Output
2700K White:	48 lms/ft	180 lms/ft
3000K White:	48 lms/ft	180 lms/ft
5000K White:	63 lms/ft	240 lms/ft

Construction

luxrail may be post mounted or wall mounted. Mounting hardware (post or wall) is typically required up to 5' O.C., depending on the handrail alloy. Final post and wall bracket spacing must be determined by a licensed architect or structural engineer. **io** can provide engineering upon request. **luxrail** is available in stainless steel and aluminum. **grab bars** are available in aluminum only. The lighting fixture component of the **luxrail** is a stand alone unit and is available in incremental nominal lengths that range from 6" to 60". Vandal resistant access chamber allows units to be removed for maintenance purposes.

All handrail component parts are engineered for quick installation. Field welding or cutting is typically not required. All parts are prefabricated to field dimensions and are assembled in the field with mechanical connection or epoxy. Contact **io** Lighting for recommended handrail installers.

The light fixture's housing is made of a light weight, yet durable aluminum, providing the recommended heat sink requirements for the LEDs. Housing, patented optical assembly and stainless steel end caps are bonded to prevent water infiltration.

Electrical

luxrail houses a low voltage LED-based light fixture that is integrated into the underside of the handrail. 24 volt 96 watt power supplies are provided as a standard. For detailed information regarding daisy chain limitations, remote distance limitations, power supply options, and dimming options consult the **io** website, the **io** catalog (pages 98-100) or an **io** representative.

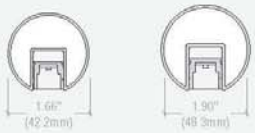
Dimming modules must be specified separately. For detailed information, see page 98 of this brochure or download the power supply specification sheet from **www.iolighting.com**.

Power Consumption

Standard Output: 1.44 w/ft **High Output: 7.62 w/ft**

Power consumption does not include power supply losses.

Dimensions

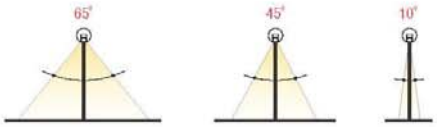


Label references 30° **luxrail** fixture with a 65° beam spread in High Output 3000K. Lighting Facts for additional beam spreads and light output levels may be obtained from **io** Lighting.

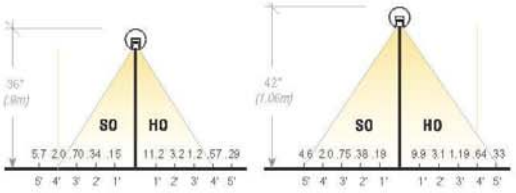
io Lighting 1100 Busch Pkwy Buffalo Grove, IL 60089 T 847.777.3900 F 847.777.3901 E info@iolighting.com W iolighting.com

Light Output / Distributions

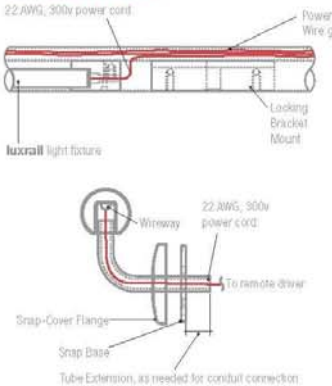
BEAM SPREAD OPTIONS



LIGHT OUTPUT - 65 DEGREE WARM WHITE



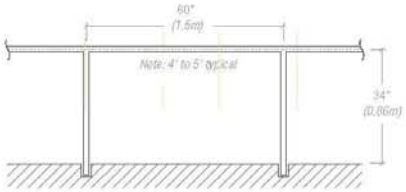
WALL MOUNT DETAILS*



* Wall mounted **luxrail** may be mounted to new or existing guardrail (by others).

Post and wall bracket spacing must be determined by a licensed architect or structural engineer.

POST MOUNT APPLICATION



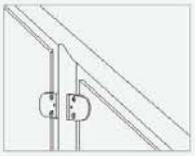
Wildlife Friendly Fixtures

IDA's Fixture Seal of Approval

Mounting / Infill Options

PM (post mounted)

WM (wall mount intermediate)



Glass infill
(glass provided by others)

Stainless steel cable infill
(only available on flat surfaces)

Order Code

0	06									
io	1	2	3	4	5	6	7	8	9	10

1. PRODUCT FAMILY
06 luxrail

2. ALLOY / FINISH
SSS Stainless steel satin
SSP Stainless steel polished
CAA Clear anodized aluminum[7]

3. SIZE
1 1.66" O.D. (1¼" pipe size)[6] (available for SS & CAA)
2 1.90" O.D. (1½" pipe size) (available for SS & CAA)

4. MOUNTING
PM Post mounted[1]
WM Wall or guard rail mounted

5. INFILL
AC Stainless steel cable[5]
GL Glass (provided by others)
C Custom
NR Not required

6. LIGHT DISTRIBUTION
10 10 Degree
45 45 Degree
65 65 Degree
NI Handrail only (not illuminated)

7. LIGHT COLOR
27K Warm White
3K Warm White[3]
5K Cool White[3]
27KHO Warm White
3KHO Warm White[3]
5KHO Cool White[3]
R Red[4]
G Green[4]
B Blue[4]
A Amber[4]

8. LENGTH
GB2 2' nominal[6]
GB3 3' nominal[6]
GB4 4' nominal[6]
GB5 5' nominal[6]
HR In Feet / Inches (provide overall length of each handrail section)[2][6]

9. VOLTAGE / DIMMING
1 120v
2 277v
3 120v w/dim
4 277v w/dim
5 Other

10. SPECIFY DRIVER / DIMMING[1]
*Note: If not specified otherwise, **io** will supply 96 watt drivers. Download Power Supply specifications sheet from **www.iolighting.com***

SSL Chromaticity Standard: ANSI C78.377		
Color	Nominal CCT	Target CCT & Tolerance (K)
White	2700K	2725 ±145
White	3000K	3045 ± 175
White	5000K	5028 ± 283

For Metric Conversion		
1"	1"	1'
25.4mm	2.54cm	0.3m

Footnotes

1. ***Power Supply Specification Sheet*** *may be downloaded from* ***www.iolighting.com***
2. *Each handrail application will be custom to accommodate varying field conditions and design requirements. Shop drawings will be required to manage specifics of each handrail section.*
3. *White light variance between LEDs within a single fixture will not exceed ANSI Binning Standards.*
4. *Only available in 7.6 w/ft.*
5. *Stainless Steel cable available for flat surfaces only.*
6. *Detailed elevation drawings of handrail section are required for quote.*
7. ***grab bars*** *available in aluminum only.*

c UL us

io Lighting 1100 Busch Pkwy Buffalo Grove, IL 60089 T 847.777.3900 F 847.777.3901 E info@iolighting.com W iolighting.com

Shielded bollards with symmetrical light output

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

Housing: Two piece die-cast aluminum construction consisting of a die-cast post and a die-cast top casting. The upper and lower castings are secured by four stainless steel fasteners which need to be removed for lamp access. The construction is robust enough for people to sit or stand on.

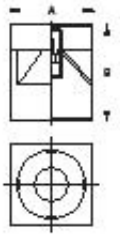
Lamp enclosure: One piece spun aluminum lamp housing is located inside the lower post. A clear fresnel, hand blown, crystal glass diffuser with a screw neck is also located inside of the housing to create a sealed lamp/ballast module independent of the outer castings.

Electrical: Lampholders are porcelain, G12 base with nickel plated contacts. Ballasts are located inside the lower casting and are electronic, universal voltage (120V through 277V).

Anchor base: Thick gauge aluminum plate provided with slotted holes. The plate secures to the lower casting with four stainless steel rods. The plate mounts to a BEGA #990E anchorage kit (supplied).

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

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



	Lamp			Lumen	A	B	Anchorage
7785MH	1	39W T6 G12 MH		3300	15¾	18	990E

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805)684-0533 FAX(805)566-9474

6" Recessed Downlight LR6-DR1000

Product Description

The LR6-DR1000 is a recessed architectural downlight that utilizes Cree TrueWhite® Technology to deliver 1,000 lumens of high quality light, with an unprecedented efficacy of 80 lumens per watt. Its exceptional CRI of 90 brings out the true beauty of applications ranging from offices, schools, hospitals, restaurants, airports, hotels, and homes. US Patent #7,213,940. Numerous patents pending.

Performance Summary

- Utilizes Cree TrueWhite® Technology
- Delivered Light Output = 1,000 lumens
- Input Power = 12.5 Watts
- CRI = 90
- CCT = 2700K or 3500K
- Dimmable to 20%
- Five Year Warranty

Ordering Information

Intended for use with Cree H6 Housing, may be retrofitted into 6" housings from select manufacturers using the supplied GU24 whip adapter.

Light Engine

- LR6-DR1000 - 120V, Incandescent Color (2700K), GU24 Base
- LR6C-DR1000 -120V, Neutral Color (3500K), GU24 Base

Accessories - Reference accessory product information sheets for more detail

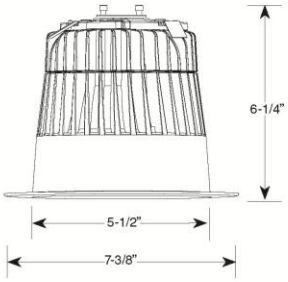
Accessory Trims

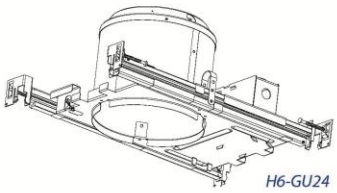
- LT6A-DR - Diffuse anodized
- LT6AW-DR - Wheat diffuse anodized
- LT6AP-DR - Pewter diffuse anodized
- LT6AB-DR - Black anodized
- LT6BB-DR - Flat black
- LT6WH-DR - Smooth white

Housings

- H6 - Architectural
- RC6 - New construction
- RR6 - Retrofit
- SC6 - Surface mount
- SC6-CM - Cord mount
- SC6-WM - Wall mount

LR6C-DR1000





H6-GU24

CREE TRUE WHITE TECHNOLOGY ENERGY STAR c UL us LISTED CREE LED Lighting

LR6-DR1000

6" Recessed Downlight

Product Information

Cree TrueWhite® Technology

- A better way to generate white light that utilizes a patented mixture of unsaturated yellow and saturated red LEDs.
- Tuned to optimal color point before shipment.
- Color management system maintains color consistency over time and temperature.
- Designed to last 50,000 hours and maintain at least 70% of initial lumen output in IC and non-IC installations.

Construction

- Durable die-cast aluminum upper housing, lower housing, and upper cover.
- Integrated thermal management system conducts heat away from LEDs and transfers it to the surrounding environment. LED junction temperatures stay below specified maximums.
- Designed for use with H6-GU24 housing from Cree, 6" recessed architectural housing with rugged, integral, extruded aluminum bar hangers (h = 7").

Optical System

- Proprietary optical system utilizes a unique combination of reflective and refractive optical components to achieve a uniform, comfortable appearance. Pixelation and direct view of unshielded LEDs are eliminated.
- White Lower Reflector balances brightness of refractor with the ceiling to create comfortable high-angle appearance. Works with refractor to deliver an optimized distribution that illuminates walls and vertical surfaces increasing the perception of spaciousness.

Electrical System

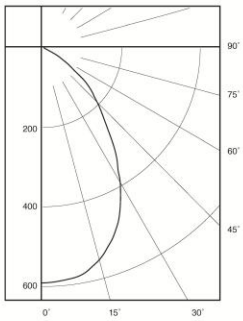
- Integral, high efficiency driver and power supply.
- Power factor > 0.9
- Input voltage = 120V, 60Hz.
- Dimmable to 20% with certain incandescent dimmers (reference www.CreeLEDLighting.com for recommended dimmers).

Regulatory and Voluntary Qualifications

- cULus Listed®. Suitable for damp locations.
- Utilize GU-24 base for new construction projects in California or other areas where high efficacy line voltage sockets are required.
- Exceeds California Title-24 high efficacy luminaire requirements.

Photometry

LR6 -DR1000 Based on OnSpex 30012426-F



Intensity (Candlepower) Summary

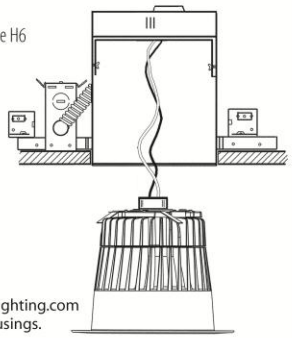
ANGLE	MEAN CP
0°	597
5°	593
15°	559
25°	463
35°	329
45°	207
55°	120
65°	61
75°	32
85°	7
90°	0

Zonal Lumen Summary

ZONE	LUMENS	%LAMP	%FIX
0° - 30°	424	42.42	42.42
0° - 40°	629	62.89	62.89
0° - 60°	897	89.71	89.71
0° - 90°	1000	100.00	100.00

Installation

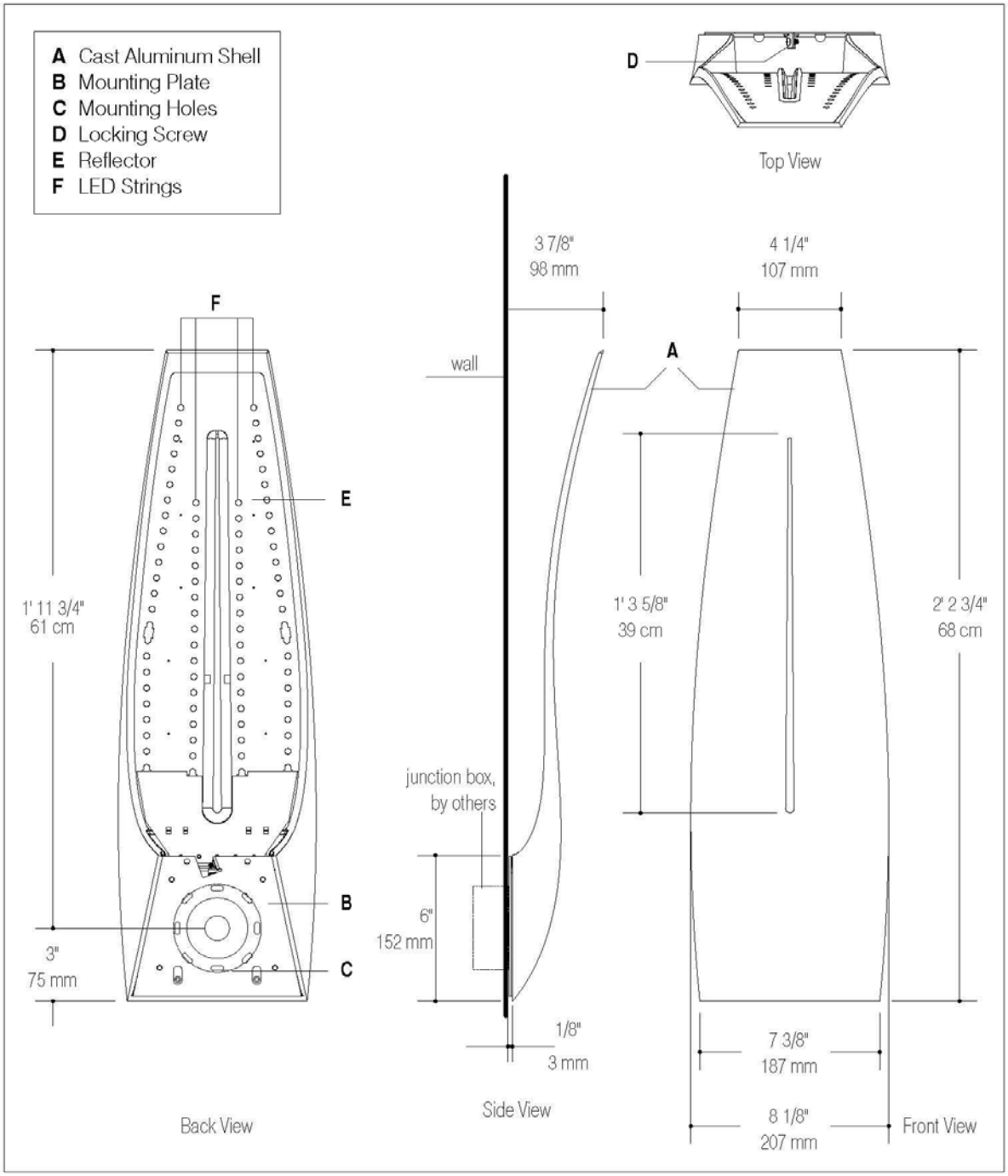
- Designed to easily install in Cree H6 and 6" housings from select manufacturers.*
- Quick install system utilizes a unique retention feature. Simply attach socket to LR6-DR1000. Move light to ready position and slide into housing.



* Reference www.CreeLEDLighting.com for a list of compatible housings.

CREE® LED Lighting

Cree LED Lighting
Morrisville • NC • 27560 • USA
1-919-287-7700 Fax 1-919-991-0730
www.CreeLEDLighting.com



L'ale®

Interior Sconce

Interior Sconce

27" long, direct/indirect, ADA compliant. For use on all walls, flanking doors, and between windows and elevators.
Lamp: white LED.

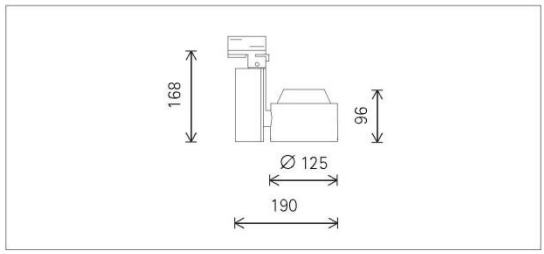
Standard colors: matte: Titanium, slate, graphite

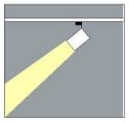
Custom automotive paint colors available on request, gloss or matte

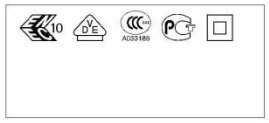
ERCO

Optec Spotlight

with LED and DALI adapter

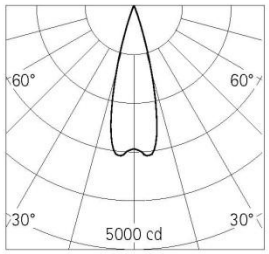






72086.000 White (RAL9002)
LED 14W 870lm 3200K warm white
DALI
Version 2
Spherolit lens, flood

Product description
Cylindrical light head: cast aluminium, powder-coated. 180° tilt. Peripheral groove for fixing accessories.
Housing: plastic, rotatable on DALI adapter through 360°.
Electronic control gear, with plug and play connectivity.
ERCO DALI adapter for DALI track: plastic.
Replaceable LED module: high-power LEDs on metal-core PCB. Collimating lens made of optical polymer.
Weight 1.25kg



LED 14W 870lm 3200K

h(m)	E(lx)	D(m) 29°
1	2935	0.52
2	734	1.03
3	326	1.55
4	183	2.07
5	117	2.59

Mounting
ERCO DALI track
Hi-trac DALI track
Monopoll DALI track
DALI singlet

ERCO GmbH
Brockhauser Weg 80-82
58507 Lüdenscheid
Germany
Tel.: +49 2351 551 0
Fax: +49 2351 551 300
info@erco.com

Technical Region: 230V/50Hz
We reserve the right to make technical and design changes.
Edition: 25.10.2010
Current version under
www.erco.com/72086.000

1/2

plane

STEP LIGHT

Application

The **plane** step light is an LED-based luminaire that offers a variety of different color combinations for edge glow accents and functional pathway lighting. For use in exterior and interior architectural applications. **plane** mounts directly to a recessed junction box for wall mount applications. UL listed for wet / damp locations.

Light Output

plane delivers illuminance levels that exceed the National Electrical Codes (NEC) requirement for emergency egress. Recommended mounting 18" to 24" A.G. IES format photometric data available at **www.iolighting.com**.

Construction

Environmentally sealed, enclosed and gasketed 5.9" sq. corrosion resistant metal casting (stainless steel optional). Mounts directly to a UV stable, optically clear, high strength polycarbonate housing. LED luminaire modules contained within the housing are replaceable.

Mounting Options

plane mounts directly to a junction box while the driver (power supply) resides within the junction box. Three types of junction box configurations are compatible with **plane**:

1) 1½" deep, 4" octagonal junction box. Hanger bars must be side mounted.
2) 2⅛" deep, 4" octagonal junction box with side mounted hanger bars.
3) 2⅛" deep, 4" square junction box with plaster ring.

Electrical

120v or 277v energy saving current limiting Class 2 power supply (driver) must be located within a 1½" or 2⅛" deep, 4" square junction box with plaster ring.

LED Magnetic Driver Specifications

Input voltage:	120v or 277v
Output Load:	8 watts including center and perimeter LEDs
Operating Temperature of the Luminaire:	-20°F + 140°F -30°C + 60°C
UL Class:	2
Surface Temperature:	25°C
Expected Life:	50,000 hours

Power Consumption

Standard Output: 8 w

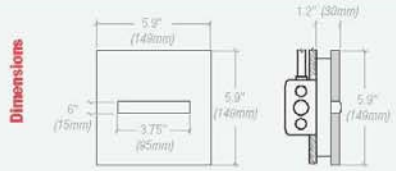
Step Optic

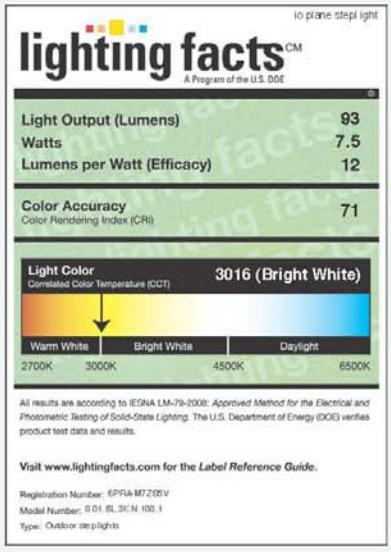
Precision molded polycarbonate lens with superior optical properties offers a 90° cut-off with 70% fixture efficiency. Full cut-off visor option is available. Visor option meets IDA Dark Sky requirements.

Finish

Metal die-cast face plate may be polyester powder coated or plated. Plated finishes are for interior applications only. Face plate may also be specified in stainless steel.

Dimensions





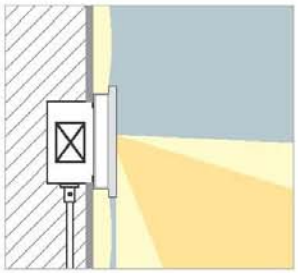
Label reference: **plane step light** in 3000K with no perimeter LEDs.

io Lighting 1100 Busch Pkwy Buffalo Grove, IL 60089 T 847.777.3900 F 847.777.3901 E info@iolighting.com W iolighting.com

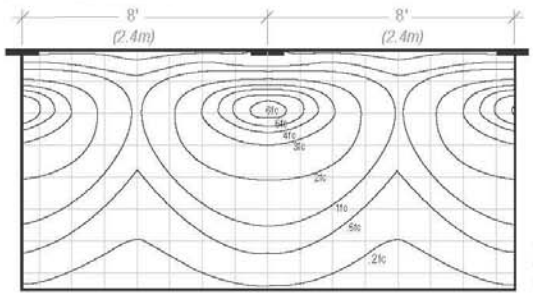
Color Options

Note: Any combination of Red, Green, Blue, Amber, 3000K White, and 5000K White may be specified for the center and perimeter accent.

Light Details



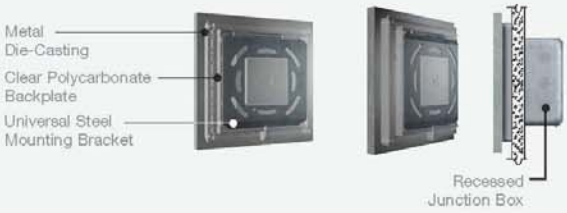
ISO FOOTCANDLE CHART



Note: Illuminance levels based on 24" mounting height above grade.

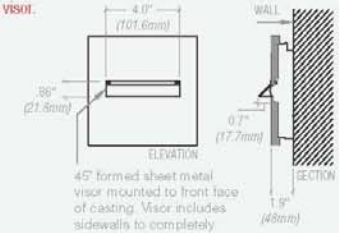
plane's step light optic has been designed to focus the luminous flux down onto a pathway keeping almost all light below 90°. **plane** may be spaced up to 8'-0" O.C. delivering footcandles that exceed the National Electrical Code's (NEC) requirement for emergency egress (1 FC AVE.). IES Format photometric data available on the **io** website.

MOUNTING OPTIONS



VISOR OPTION
Dark Sky compliancy requires visor.

Note: A visor may be specified for full visual cut-off.



45° formed sheet metal visor mounted to front face of casting. Visor includes sidewalls to completely shield view to lens.

0	.	01	.	SL	.		.		.		.		.		.	
io		1		2		3		4		5		6		7		8

Order Code

1. PRODUCT FAMILY
01 Plane

2. TYPE
SL Step light

3. CENTER COLOR
3K Warm White
5K Cool White
R Red
G Green
B Blue
A Amber

4. PERIMETER COLOR
3K Warm White
5K Cool White
R Red
G Green
B Blue
A Amber
N None

5. MOUNTING
100 J-Box
999 Custom

6. FINISH
METAL CASTING (POWDER COATED)
1 Black
2 Bronze
3 Satin Aluminum
4 White
METAL CASTING (PLATED)
INTERIOR APPLICATIONS ONLY
5 Satin Nickel
6 Chrome
7 Satin Brass
STAINLESS STEEL
8 Brushed
CUSTOM COLOR
9 Custom

7. VOLTAGE
0 120v
1 277v
Note: Consult factory for custom voltage options. Dimming not available.

8. SHIELDING
V Visor [1]
Note: Leave blank if visor is not required.

Footnotes

1. Visor only available in powder coated finishes.

For Metric Conversion		
1"	1"	1'
25.4mm	2.54cm	0.3m

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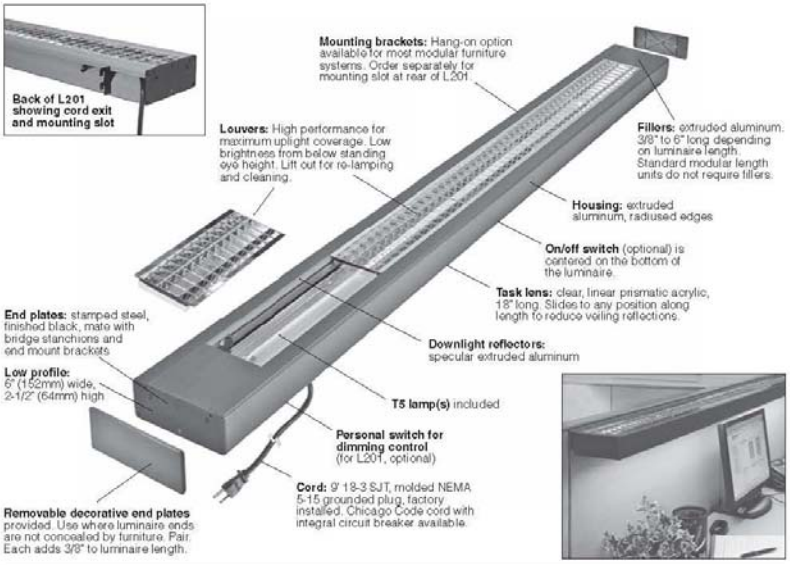
Task Ambient, Linear T5 Lamp

T5 Fluorescent

Styles L201, L202



Features

- *Task and ambient lighting from a single T5 lamp*
- *Typical energy consumption is 0.6 W/sf or less*
- *Integrates with embedded wireless controls (consult factory)*
- *Low profile; integrates with open plan office furniture systems*
- *Portable; may be reconfigured along with the furniture*
- *Reduces glare, eyestrain and visual distraction*

TA 1.0

Specifications

Finish:
Painted housing, fillers, decorative end plates, and mounting accessories (panel hooks, end mount rails, stanchions).

Painted surfaces – environmentally friendly 6-stage pretreatment and electrostatically applied thermoset powder coat provides a long lasting, scratch resistant finish. Choice of standard colors. RAL and computer matched colors available on request.

Reflector – extruded aluminum, chemically brightened and clear anodized.

Louver tiles – specular vacuum metalized polycarbonate with clear polymer topcoat for easy cleaning.

Mounting:
L201 has a continuous mounting slot along the rear of the unit, and can be mounted to a wall, furniture panel, or desk clamp stanchion. L201 cords are routed along the mounting slot and can be specified for right- or left-hand exit.

L202 has a smooth back surface for mounting with end mount rails (for 24" wide end panels) or with desk clamp stanchions. L202 cord exits are specified left or right, rear or bottom of unit, depending on mounting method. Stanchions feature a cord management slot.

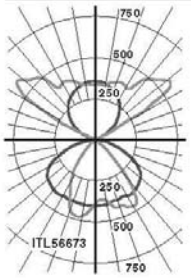
Electrical:
Integral electronic ballast is HPF thermally protected class P, 120 volt, BF > 0.98. Programmed start maximizes lamp life and minimizes energy use.

Cord – 9' 18-3 SJT, molded NEMA 5-15 grounded plug, factory installed. Chicago Code cord with integral circuit breaker available. Low profile grounded plug with 45° rotation is standard. Black is standard; gray and beige cords are available at additional cost.

Standard output T5 lamps are included. Choose from 3000K, 3500K and 4100K lamps.

Standard:
UL listed or CSA certified.

Performance



Lighter curve at left shows 180° to 0°. Darker curve shows 90° to 270°.

High lamp height position, see website for alternate positions. Illuminance based on a minimum of ten workstations. Light levels will be 5-10% greater in large rooms with more workstations. Ballast factor 0.98, input watts 52, maximum candlepower at 140° is 629 cd.

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

7/10

tambient
Green in any color™

To Order

Styles L201, L202

Project: Type:

Sample number: L201-71S6-M-EL15-1-1R-0S-35

L 2 0 – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] [ ] – [ ] – [ ]

Style | Length/Lamp(s) Code | Optic | Finish | Electrical | Cord | Cord Exit | Options | Lamp Color

Style

L201 Task ambient luminaire with integral hang-on mounting channel

L202 Task ambient luminaire with smooth back panel

Length/Lamps

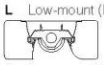
Code	Length (mm)	Lamp(s)	Input
24S2	24" (610)	1xF14T5	14W
36S3	35-3/4" (910)	1xF21T5	27W
48S4	47-1/2" (1205)	1xF28T5	33W
60S5	59" (1500)	1xF35T5	41W
71S6	70-3/4" (1800)	2xF21T5	49W
83S7	82-1/2" (2095)	1xF21T5 + 1xF28T5	60W
95S8	94-1/4" (2395)	2xF28T5	66W

Other lengths and lamping are available; consult factory.

TA 1.1

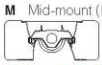
Optic

L Low-mount (L202 shown)



For low-mount IES information, consult factory.

M Mid-mount (L202 shown)



Download IES file.

H High-mount (L202 shown)

Download IES file.

To avoid glare, do not install below 48" or above 66".

Mounting Height	Worksurface Depth	
	24"	30"
48" – 50"	Low	Low
51" – 52"	Mid	Low
53" – 57"	Mid	Mid
58" – 61"	High	Mid
62" – 63"	High/(1)	High
64" – 66"	(1)	High

(1) Consult factory. Notation for height 62" – 63" is for L202.

Finish

EL02 Eggshell white
EL06 Dark bronze
EL07 Silver
EL08 Semi-gloss black
EL12 British racing green
EL15 Warm metallic
TASL Semi-gloss slate
XXXX Custom color (specify or submit sample)
or 4-digit RAL color code (color chart available)

Electrical

120 V only

1 Electronic ballast
T Dimming ballast for personal dimming control option (L201 only, specify with option **0D**). For other dimming applications, consult factory.

Cord

90° SW rotation plug, 9 feet:

1 Black
3 Gray
5 Beige
7 Chicago cord, integral circuit breaker, black

Straight plug, 9 feet (L202 only):

2 Black
4 Gray
6 Beige
8 Chicago cord, integral circuit breaker, black

Cord Exit

R Right rear (L201, L202)
L Left rear (L201, L202)
E Right bottom (L202 only)
W Left bottom (L202 only)

For L202, **R** and **L** are on dual stanchion only. **E** and **W** exits (L202) are 1-1/2" from end of luminaire.

Options

00 None
0S On/off switch
0D Dimming switch (L201, for use with dimming ballast only)
X0 Dual stanchion pre-drill (L202)
XS Dual stanchion pre-drill and integral on/off switch (L202)
XX Custom modification (specify)

Lamp Color

30 3000K, 85 CRI
35 3500K, 85 CRI
41 4100K, 85 CRI

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

7/10

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Green in any color™

Mounting Accessories

TPH

*For compatible furniture systems, see website.

TPH Panel Hooks, pair (L201)
TPR End Mount Rail Kit (L202)

T P [ ] [ ] – [ ]

System* Finish (at left)

TPH Panel Hooks mount to slotted panel frame. Stamped and formed CRS, pair.
TPR End Mount Rails (for 24" wide end panels) mount to slotted panel frames. Several models are available to interface with a variety of panel systems. Pair of rails, includes pair of black interface plates.

TPR

TPE End Mount Brackets, pair (P202)

Support the ends of the luminaire, black, pair.

TMHDW

TMHDW Wall Brackets, pair (L201)

T M H D W – E L 0 0

TMHDW Wall Brackets mount to stud framed walls, millwork, and other solid surfaces. Stamped and formed CRS, black, pair.

TSH

TSX

TSH Desk Clamp Stanchion (L201)
TSX Desk Clamp Stanchion (L202)

T S [ ] [ ] – [ ]

Height Finish (at left)

Desk Clamp Stanchions mount to edge of worksurface – 1/2" to 3-1/4" thick. Extruded aluminum post. Resilient pads resist slippage, protect surfaces. Integral cord management. **TSH19-/TSX19-** places top of luminaire 19-1/2" above worksurface. Sold individually; some luminaires require two stanchions.

L202 with TSX stanchion, back view

LEDge

Application

LEDge is a member of **io**'s **line**™ family of linear LED-based products. **LEDge** is a low voltage linear shelf light that offers exceptional warm and cool white light for a variety of different shelf and casework conditions. **LEDge** offers illumination levels equivalent to halogen and fluorescent-based alternates with significant benefits. **LEDge** delivers exquisite white light without the damaging ultra-violet (UV) and infrared (IR) wavelengths or radiant heat that conventional light sources produce. **LEDge** also offers superior definition to three-dimensional objects and sparkle to reflective surfaces. **io** ensures that each LED is provided thermal and electrical management properties in accordance with the LED manufacturers recommendations. Projected average rated life is 50,000 hours at 70% of lamp lumen output. Contact factory for IES LM-80 compliance. To ensure proper performance, architectural details should allow for ventilation and air flow around the fixture. Ambient temperature surrounding the fixture shall not exceed 120°F *(48.9°C)*.

Light Output

LEDge's beam spread and luminous intensities are perfect for shelf lighting applications. Two luminous intensities are available. All values below are initial lumens per foot. IES LM-79 format files may be obtained from the factory or downloaded from **www.iolighting.com**. Consult factory for High CRI options and availability.

	Standard Output	High Output
2700K White:	126 lms/ft	180 lms/ft
3000K White:	126 lms/ft	180 lms/ft
5000K White:	168 lms/ft	240 lms/ft

Construction

Available in two profiles, **LEDge** can either be mounted directly to ⅜" glass or surface mounted to the underside of any shelving unit provided the shelf materials can accept self-tapping screws. The **LEDge** housing is made of extruded aluminum, providing the recommended heat sink requirements for **io**'s proprietary printed circuit boards (PCBs). Both **LEDge** profiles are provided with neoprene gaskets, which isolate the majority of the heat from surfaces on which they are mounted. **LEDge** is UL listed for dry locations.

Electrical

LEDge is supplied with a field adjustable 4'-0" 20 AWG, 300 volt rated power cord. A 24 volt 96 watt power supply will be provided as a standard. For detailed information regarding daisy chain limitations, remote distance limitations, power supply options, and dimming options consult the **io** website, the **io** catalog (pages 98-100) or an **io** representative.

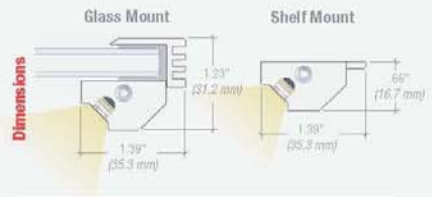
Power Consumption

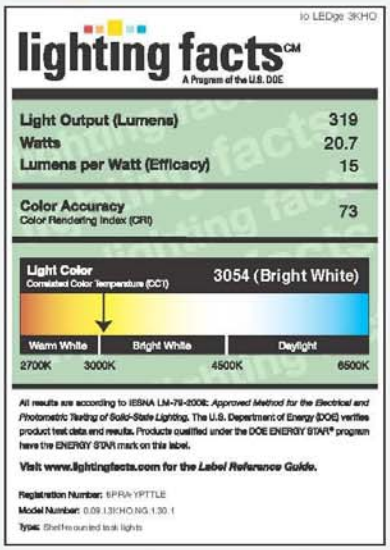
Standard Output: 5.34 w/ft **High Output: 7.62 w/ft**

Power consumption does not include power supply losses.

Finish

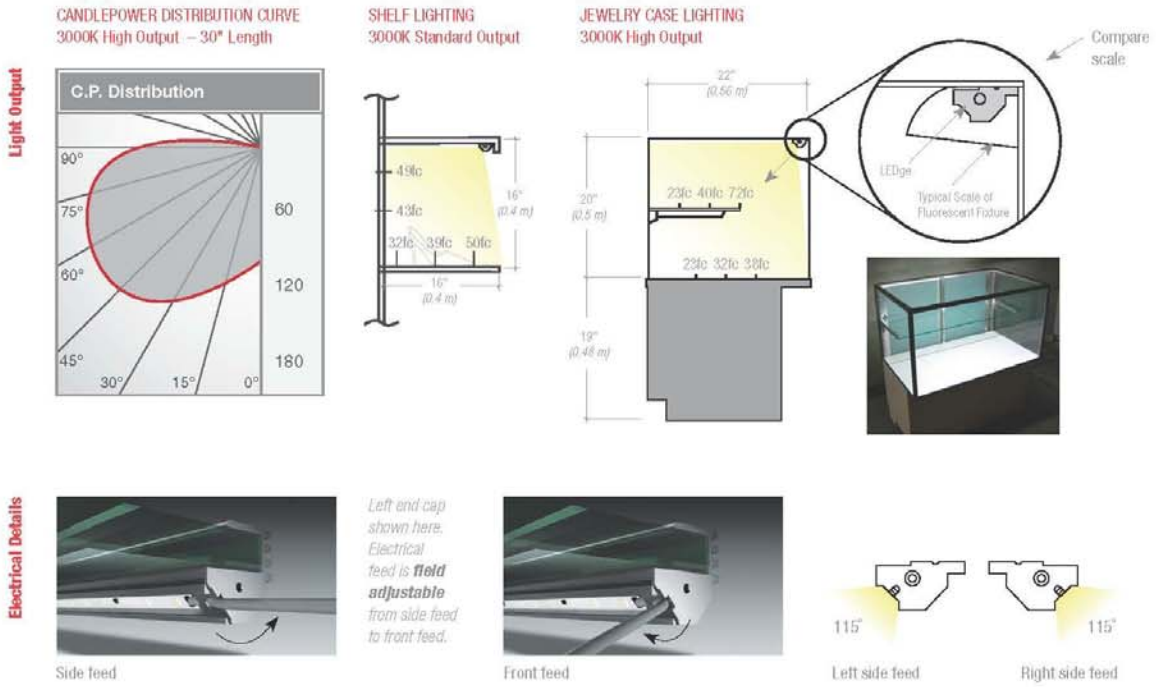
Anodized aluminum finish is standard. Custom finishes may be available upon request.

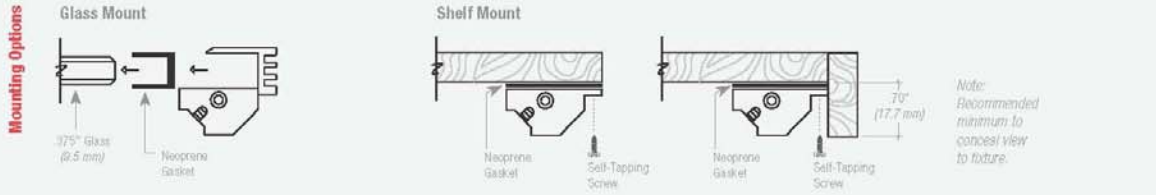




Label references 30" **LEDge** fixture in High Output 3000K. Lighting Facts for additional beam spreads and light output levels may be obtained from **io** Lighting.

io Lighting 1100 Busch Pkwy Buffalo Grove, IL 60089 T 847.777.3900 F 847.777.3901 E info@iolighting.com W iolighting.com





Order Code

io . 09 . I . 1 . 2 . 3 . 4 . 5 . 6 . 7 . 8 . 9

1. PRODUCT FAMILY
09 LEDge

2. LOCATION
I Interior only

3. COLOR
27K 2700K
27KHO 2700K High Output
3K 3000K
3KHO 3000K High Output
5K 5000K
5KHO 5000K High Output

4. MOUNTING
38 ⅜" glass
NG No glass

5. FINISH
1 Anodized aluminum
2 Anodized custom color

6. LENGTH
Specify as required to 1/8" between 6" and 84"

7. ELECTRICAL FEED
1 Right feed
2 Left feed
3 Right and left feed

8. VOLTAGE / DIMMING
1 120v
2 277v
3 120v w/dim
4 277v w/dim
5 Other

9. SPECIFY DRIVER / DIMMING
Note: If not specified otherwise, io will supply 96 watt drivers. Refer to pages 98-100 for Power Supply options or download Power Supply specification sheet from www.iolighting.com.

SSL Chromaticity Standard: ANSI C78.377		
Color	Nominal CCT	Target CCT & Tolerance (K)
White	2700K	2725 ±145
White	3000K	3045 ± 175
White	5000K	5028 ± 283

For Metric Conversion		
1"	1"	1'
25.4mm	2.54cm	0.3m

Footnotes

1. White light variance between LEDs within a single fixture will not exceed ANSI Binning Standards.
2. Printed Circuit Board (PCB) is available in 6" increments. Therefore, there will be no more than 3" of lampless space on either end of fixture.

io Lighting 1100 Busch Pkwy Buffalo Grove, IL 60089 T 847.777.3900 F 847.777.3901 E info@iolighting.com W iolighting.com

08.11 Technische Änderungen vorbehalten Technical amendments reserved Sous réserve de modifications techniques

BEGA Lichttechnische Spezialfabrik
Hennenbusch D 58708 Menden

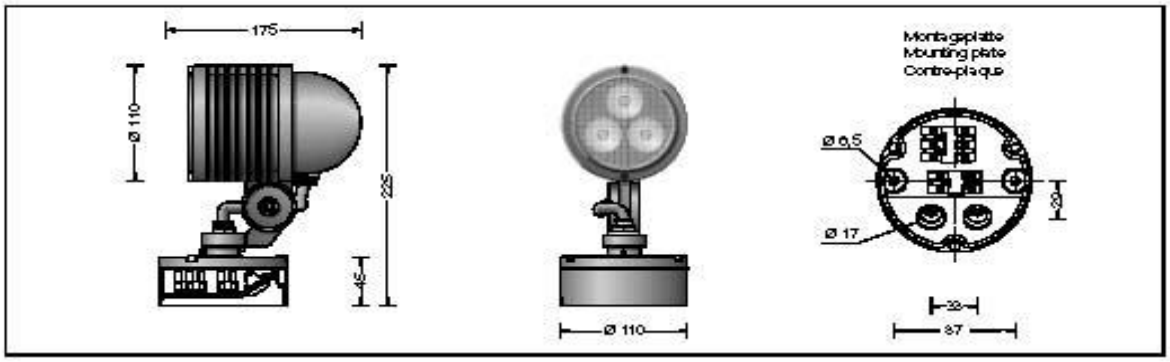
BEGA

Gebrauchsanweisung
Instructions for use
Fiche d'utilisation

LED Scheinwerfer
LED Floodlight
Projecteur à LEDs

IP 65

7502



Anwendung
LED-Scheinwerfer mit Montagedose für die ortsfeste Montage auf einer Wand, unter einer Decke oder auf einem Sockel.
Hohe Wirtschaftlichkeit durch lange Wartungsintervalle und hohe Lichtleistung bei niedrigem elektrischen Anschlusswert.

Application
LED-Floodlight with mounting box for permanent installations on a wall, under a ceiling or on a pillar.
High operating efficiency because of long maintenance intervals and high light output with low connected load.

Utilisation
Projecteur à LEDs avec boîte de montage pour l'installation fixe sur un mur, au plafond ou sur un pilier.
Installation économique grâce à une faible maintenance et un rendement élevé pour une faible consommation.

Lampe
LED 17 W 1000 lm
Anschlussleistung 17 W
Farbtemperatur 5000 K

Lamp
LED 17 W 1000 lm
Connected wattage 17 W
Colour temperature 5000 K

Lamp
LED 17 W 1000 lm
Puissance de raccordement 17 W
Colour temperature 5000 K

Produktbeschreibung
Leuchte besteht aus Aluminiumguss, Aluminium und Edelstahl
Sicherheitsglas klar
Silikondichtung
Reflektor aus eloxiertem Reinst-Aluminium
Drehbereich des Scheinwerfers 350°
Schwenkbereich des Scheinwerfers um die waagerechte Achse +90°/-45°
Montagedose mit 2 Befestigungsbohrungen ø 6,5 mm · Abstand 87 mm
2 Leitungseinführungen zur Durchverdrahtung der Netzanschlussleitung bis ø 10,5 mm max. 3 x 1,5²
Steckvorrichtung
Anschlussklemme 2,5²
Schutzleiteranschluss
Elektronisches Netzteil
100-230 V ~ 50-60 Hz
Dimmbar 1-10 V SELV
Schutzklasse I
Schutzart IP 65
Staubdicht und Schutz gegen Strahlwasser
▽ Zeichen – Leuchte ist für die Montage auf normal entflammbaren Befestigungsflächen geeignet
CE – Konformitätszeichen
Gewicht: 1,7 kg

Product description
Luminaire made of aluminium alloy, aluminium and stainless steel
Clear safety glass
Silicone gasket
Reflector made of anodised pure aluminium
Rotation range of floodlight 350°
Swivel range of the floodlight around the horizontal axis +90°/-45°
Mounting box with 2 fixing holes ø 6.5 mm 87 mm spacing
2 cable entries for through-wiring of mains supply cable up to ø 10.5 mm max. 3 x 1.5²
Plug connection
Connecting terminal 2.5²
Earth conductor connection
Electronic power supply unit
100-230 V ~ 50-60 Hz
Dimmable 1-10 V SELV
Safety class I
Protection class IP 65
Dust tight and protection against water jets
▽ Symbol – Luminaire is suitable for mounting on normal inflammable fixing surfaces
CE – Conformity mark
Weight: 1.7 kg

Description du produit
Luminaire fabriqué en fonte d'alu, aluminium et acier inoxydable
Verre de sécurité clair
Joint silicone
Réflecteur en aluminium pur anodisé
Projecteur orientable sur 350°
Réglage du projecteur sur l'axe horizontal +90°/-45°
Boîte de montage avec 2 trous de fixation ø 6,5 mm · Entraxe 87 mm
2 entrées de câble pour branchement en dérivation d'un câble de raccordement jusqu'à ø 10,5 mm max. 3 x 1,5²
Connecteur embrochable
Borrier 2,5²
Raccordement de mise à la terre
Bloc d'alimentation électronique
100-230 V ~ 50-60 Hz
Graduable 1-10 V SELV
Classe de protection I
Degré de protection IP 65
Etanche à la poussière et protégé contre les jets d'eau
▽ Sigle – Luminaire approprié à l'installation sur des surfaces de fixation normalement inflammables
CE – Sigle de conformité
Poids: 1,7 kg

Lichttechnik
Leuchtendaten für das lichttechnische Berechnungsprogramm DIALux für Außenbeleuchtung, Straßenbeleuchtung und Innenbeleuchtung, sowie Leuchtendaten im EULUMDAT und im IES-Format finden Sie auf der BEGA-Internetseite www.bega.de.

Light technique
Luminaire data for the light planning program DIALux for outdoor lighting, street lighting and indoor lighting as well as luminaire data in EULUMDAT and IES-format you will find on the BEGA web page www.bega.com.

Technique d'éclairage
DIALux est un programme de calcul d'éclairage pour l'éclairage extérieur, l'éclairage des rues et l'éclairage intérieur. Vous le trouverez sur le site BEGA www.bega.fr ainsi que les données des luminaires aux formats EULUMDAT et IES.

Sicherheit

Für die Installation und für den Betrieb dieser Leuchte sind die nationalen Sicherheitsvorschriften zu beachten.
Der Hersteller übernimmt keine Haftung für Schäden, die durch unsachgemäßen Einsatz oder Montage entstehen.
Werden nachträglich Änderungen an der Leuchte vorgenommen, so gilt derjenige als Hersteller, der diese Änderungen vornimmt.

Montage

Die Leuchte darf nur mit ihrer vollständigen Schutzabdeckung betrieben werden.
Montagedose öffnen.
Netzanschlussleitung durch die Leitungseinführung in die Montagedose führen.
Montagedose mit beiliegendem oder anderem geeigneten Befestigungsmaterial am Montagegrund befestigen.
Schutzleiterverbindung herstellen und elektrischen Anschluss an 3-poliger Steckverbindung vornehmen.
Zur analogen Dimmung ist der 2-polige Steckverbinder (1-10V) zu verwenden.
Die Dimmung 1-10 V darf nur mit einer Versorgungseinheit für 1-10 V SELV (Schutzkleinspannung) betrieben werden.
Bei Nichtbelegung dieser Klemme wird die Leuchte mit voller Lichtleistung betrieben.
Steckerteil in Steckvorrichtungen bis zum Anschlag eindrücken.
Auf richtigen Sitz der Dichtungen achten.
Scheinwerfereinheit auf Montagedose setzen und fest verschrauben.
Leitungsverschraubungen nachziehen.
Scheinwerfereinstellung vornehmen.

Reinigung · Pflege

Leuchte regelmäßig mit lösungsmittelfreien Reinigungsmitteln von Schmutz und Ablagerungen säubern.
Dafür keinen Hochdruckreiniger verwenden.
Ein gebrochenes Glas muss ersetzt werden.

Safety indices

The installation and operation of this luminaire are subject to national safety regulations.
The manufacturer is then discharged from liability when damage is caused by improper use or installation.
If any luminaire is subsequently modified, the persons responsible for the modification shall be considered as manufacturer.

Installation

The luminaire must only be operated with the complete protective cover.
Open mounting box.
Lead mains supply cable through the cable entry into the mounting box.
Fix the mounting box with enclosed or any other suitable fixing material onto the mounting surface.
Make earth conductor connection and electrical connection to the 3-pole plug connection.
In case of analogue dimming please use the 2-pole plug connector (1-10V).
Dimming 1-10 V must only be operated with a supply unit for 1-10 V SELV (safety extra low voltage).
In case this connector is not used the luminaire will be operated at full light output.
Push plug into couplers as far as they will go.
Make sure that gaskets are positioned correctly.
Place floodlight unit onto the mounting box and screw up tightly.
Retighten the screw cable glands.
Adjust floodlight.

Cleaning · Maintenance

Clean luminaire regularly with solvent-free cleansers from dirt and deposits.
Do not use high pressure cleaners.
A broken glass must be replaced.

Sécurité

Pour l'installation et l'utilisation de ce luminaire, respecter les normes de sécurité nationales.
Le fabricant décline toute responsabilité résultant d'une mise en œuvre ou d'une installation inappropriée du produit.
Toutes les modifications apportées au luminaire se feront sous la responsabilité exclusive de celui qui les effectuera.

Installation

Le luminaire ne doit jamais fonctionner sans son couvercle complet de protection.
Ouvrir la boîte de montage.
Introduire le câble de raccordement par l'entrée de câble dans la boîte de montage.
Fixer la boîte de montage sur la surface de montage avec le matériel de fixation fourni ou tout autre matériel approprié.
Mettre à la terre et procéder au raccordement électrique du connecteur embrochable tri-polaire.
Pour gradation analogique enfiler le connecteur embrochable 2-polaire (1-10V).
La gradation 1-10 V ne doit être effectuée qu'avec un bloc d'alimentation pour 1-10 V SELV (trés basse tension). Si ce bornier n'est pas raccordé le luminaire fonctionne sur la puissance maximale.
Enfoncer la fiche dans les connecteurs embrochables jusqu'à la butée.
Veiller au bon emplacement des joints.
Poser le projecteur sur la boîte de montage et visser fermement.
Resserrer les presse-étoupes.
Procéder au réglage du projecteur.

Nettoyage · Entretien approprié

Nettoyer régulièrement le luminaire et débarrasser le, des dépôts et des souillures.
N'utiliser que des produits d'entretien ne contenant pas de solvant.
Ne pas utiliser de nettoyeur haute pression.
Un verre endommagé doit être remplacé.

Ersatzteile

Bezeichnung	Bestellnummer
Ersatzglas	140757
Dichtung Montagedose	830462
Dichtung Glas	830488
Dichtung Gehäuse	830489

Spares

Description	Part no
Spare glass	140757
Gasket mounting box	830462
Glass gasket	830488
Gasket housing	830489

Pièces de rechange

Désignation	Référence
Verre de rechange	140757
Joint de la boîte de montage	830462
Joint du verre	830488
Joint du boîtier	830489

Curvatura™ 3-D System

USG

HRC
High Recycled Content

Two-Directional Curvatura System with Perforation/
Curvatura 15/16" Suspension System

LEED Credits
Recycled Content: Up to 90%

MR				EQ		
Waste Reduction	Recycled Content	Regional Materials[1]	Rapidly Renewable Materials	Low-Emitting Materials	Daylight and Views	Acoustical Performance[2]
●	●	●				●

Features and Benefits
- Create dramatic three-dimensional curved designs that combine shape, texture and lighting
- Curved main tee segments and flexible panels provide endless combinations
- Available in two configurations: One-Directional Curvatura™ with 2'x6' infill panels, and Two-Directional Curvatura™ with 2'x2' panels
- Two suspension profiles: traditional Curvatura (15/16" grid profile) and Curvatura Elite (9/16" profile with 5/32" reveal)
- Custom colors available

Applications
- Contemporary office environments
- Entertainment, gaming
- High-bay areas
- Retail space

To order samples, go to usg.com
See Metal Finishes selector for panel, suspension and trim color availability.

Painted Metals (HRC Finishes)
Flat White · Silver Satin 002 · Metallic Copper 1690 · Metallic Gold 1691 · Metallic Oyster 1652

Diamondflex[3]
Louvered Bright White · Louvered Bright Silver · Sheer Bright White · Sheer Bright Silver

Wood Tones[3] (HRC Finishes)
Cherry · Maple · Oak

Curvatura™ 3-D System

To order samples/literature:
– Web: usg.com
– E-mail: samplit@usg.com
– Fax: 888.874.2348
Technical Services: 800 USG.4YOU

Web Sites: usg.com
usgdesignstudio.com
sustainableceilings.com
seismicceilings.com

See usg.com for the most up-to-date product information.

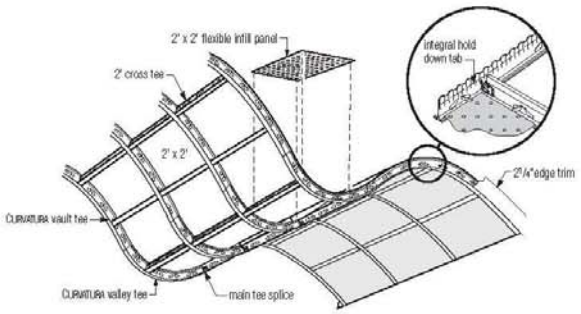
Product Information

Materials	Finishes
Panel: Available smooth or perforated, in Painted Metals and Diamondflex expanded metal! 2'x2' Translucents™ panels are also available.	Available with perforation and/or embossing

Perspective

Two-Directional System

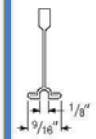
2' x 2' Panels



Available Grid Profile

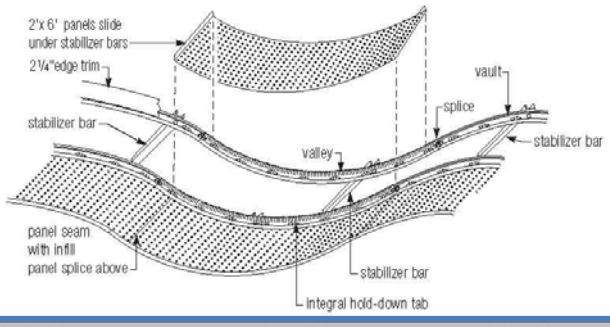
Standard

Curvatura Elite



One-Directional System

2' x 6' Panels



Curved Components (Available as vaults and valleys)

10' Length	8' Length	6' Length	4' Length
R = 229"	R = 183"	R = 138"	R = 92"
R =153"	R = 122"	R = 92"	R = 61"
R = 115"	R = 92"	R = 69"	R = 46"
R = 77"	R = 61"	R = 46"	R = 31"

High Recycled Content
Classified as containing greater than 50% total recycled content. Total recycled content is based on product composition of post-consumer and pre-consumer (post-industrial) recycled content per FTC guidelines.

For More Information

Product literature
System brochure: IC399
Data sheet: IC310
Design selector: IC36108
Perforation selector: IC425

Online tools
usgdesignstudio.com
usg.com/resources/onlinetools/CurvaturaDesignCenter.jsp

Recycled Content
Curvatura aluminum panels: up to 90% recycled content;
Steel panels: 25% recycled content.
Suspension: 25% recycled content.

Footnote
1. For details, see LEED report generator at usgdesignstudio.com.
2. Requires perforation and Acoustiform backer.
3. Diamondflex and Wood Tone panels available for Two-Directional Curvatura.

Manufactured by USG Interiors, Inc.
550 West Adams Street
Chicago, IL 60661

Safety First! Follow good safety/industrial hygiene practices during installation. Wear appropriate personal protective equipment. Read MSDS and literature before specification and installation.

IC310/rev. 4-10

Printed in U.S.A.

Translucents™

Translucents Luminous Infill Panels/
Centricitee DXT Suspension System

MR				EQ		
Waste Reduction	Recycled Content	Regional Materials	Rapidly Renewable Materials	Low-Emitting Materials	Daylight and Views	Acoustical Performance
●	●					

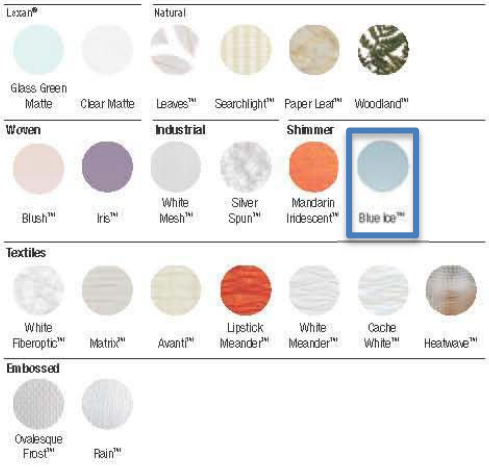
Features and Benefits

- Fully accessible translucent (luminous) infill panels
- Panels can be used with standard Donn® brand DX®/DXL™, Centricitee™ DXT, Curvatura™ 3-D System and GridWare™ suspension systems
- Available in 7 finishes: Lexan® (2 color choices), Natural (4 color choices), Woven (3 color choices), Industrial (2 color choices) Shimmer (2 color choices), Textiles (7 color choices) and Embossed (2 color choices)
- 2' x 2' panels (23-3/4" x 23-3/4") in all finishes
- 2' x 6' panels (23-3/4" x 71-3/4") in all finishes
- Woven, Shimmer, Textiles, Industrial and natural finishes contain a minimum 40% recycled content
- Embossed acrylic panels contain a minimum of 50% recycled content
- Class A finish rating only applies to the Lexan panels. Others are Class B
- Coordinating suspension and trim colors as well as larger color swatches can be found on the Translucents Finishes page (IC552)

Applications

- Lobbies
- Contemporary office environments
- Entertainment, gaming areas
- High-bay areas
- Retail stores

To order samples, go to usg.com



Translucents™

To order samples/literature:
– Web: usg.com
– E-mail: samplit@usg.com
– Fax: 888 874.2348
Technical Services: 800 USG.4YOU

Web Sites: usg.com
usgdesignstudio.com
sustainableceilings.com
seismicceilings.com

See usg.com for the most up-to-date product information.

Product Information

Materials	Typical Sizes		System Weight
	Nominal	Actual	
Glass Green, Clear – 0.060" Lexan	2'x 2'	23-3/4"x 23-3/4"	Approximately 0.7 lbs per sq. ft.
Woven, Shimmer, Textiles, Natural, Industrial – 0.118" PETG	2'x 2' 2'x 6'	23-3/4"x 23-3/4" 23-3/4"x 71-3/4"	Approximately 0.9 lbs per sq. ft.
Embossed Acrylic	2'x 2' 2'x 6'	23-3/4"x 23-3/4" 23-3/4"x 71-3/4"	Approximately 0.9 lbs per sq. ft.

Acoustics
This product does not offer any acoustical properties.

Lighting
For Translucents panels, fluorescent strip fixtures should be placed a minimum of 18" above the ceiling and 18" o.c. for best results.

Suspension Systems
Lays into standard DX/DXL, Centricitee DXT, Curvatura 3-D system and GridWare suspension systems.

For More Information

Product literature
Data sheet IC406

Online tools
usgdesignstudio.com

This product is produced to order and will vary from batch to batch–panels ordered at the same time will be produced together and will be identical. USG cannot guarantee batch to batch consistancy.

Code approval
Lexan infill panels meet Class A requirements for flame spread and smoke developed as defined by ASTM E1264, NFPA and IBC (UBC) as tested in accordance with ASTM E84. Translucents panels meet Class B requirements for flame spread and smoke developed as defined by ASTM 1264 and as tested in accordance with ASTM E84. (40/175) USG Translucents panels also meet Class A requirements of NFPA and IBC (UBC) as interior finishes, not to be part of an air supply/return system. Designers and installers are advised to consult a fire protection engineer, NFPA 13 and their local codes for guidance where automatic fire detection and suppression systems are present.

Weight
0.374 lb./sq. ft. (Lexan Glass Green Matte and Clear Matte)
0.900 lb./sq. ft. (Woven, Textiles, Shimmer, Natural, Industrial, Embossed)

Recycled content
Lexan panels: 0% recycled content. 100% recyclable.
Woven, Textiles, Shimmer, Natural, Industrial panels: min. 40% recycled content. 100% recyclable.
Embossed panels: 50% recycled content. 100% recyclable.

USG

Manufactured by USG Interiors, Inc.
550 West Adams Street
Chicago, IL 60661

The color names listed herein are trademarks of Lumicor, Inc and are used with permission.

Saftey First! Follow good safety/industrial hygiene practices during installation. Wear appropriate personal protective equipment. Read MSDS and literature before specification and installation.

IC406/rev. 4-10

Printed in U.S.A.

Wireless Task Ambient Photo Sensor

DLSEN-E17C-0A

Overview

Tambient lighting control devices are based on EnOcean wireless technology and include the features of other wireless control technologies like "peel and stick" installation of sensors, simple adaptation to a tenants changing needs, and reduced wiring costs.
With EnOcean technology, the radios require very little power allowing ambient energy sources to power the sensors eliminating the maintenance burden of replacing batteries and disposing of them. The push of a light switch or the light within an office is all that's needed to energize the sensor and broadcast the signal.
Tambient's DLSEN-E17C uses photo-sensors hidden behind a unique opaque lens to monitor the interior light level and transmit the value to tambient's portable TCH Control Hub. The TCH Control Hub in turn provides a corresponding 0-10V dimming signal to the associated dimming ballast(s) according to configured lighting set points. The same photo-sensors are used to absorb energy from the surrounding environment creating enough power to operate the DLSEN-E17C . The DLSEN-E17C is a key component in tambient's poertable, plug-and-play lighting applications that assist facility operators in controlling energy costs. For more information on this application, please contact applications@thelightingquotient.com.

Features

- Battery-free wireless light level sensing temperature set-point adjustment
- Provides accurate feedback to day-light harvesting controllers
- No mounting hardware needed → maximum space flexibility
- 100m line-of-sight transmission range, interior range typically 30m
- operates in low light conditions
- 0 - 510 lux range, optionally 0 - 1024 lux

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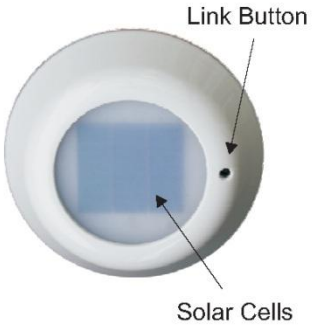
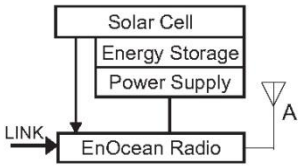
DLSEN-E17C-0A

Functional Diagram



Block Diagram



EnOcean Equipment Profiles	
EEP: 07-06-02, Light Sensor	DB_1: 0 lux - 1024 lux DB_2: 0 lux - 512 lux
Technical Specifications	
Power Supply	Dual Solar cell
Operational Light Level	40 lux minimum
Charging Period	6 hours full charge
Initial Operation	5 minutes in 40 lux
Full Charge Operation	8 hours in 0 lux
Telegram Transmission	2% change in lux of full scale range on 10 second intervals or on heartbeat period
Telegram Heartbeat Period	100 seconds ± 20 seconds
Communications	
Radio Type	315 EnOcean radio
Antenna	Integrated whip
Transmission Range	30m (100 ft.) - commercial office space
Inputs	LINK button for assignment to receiver
Mechanical Specifications	
Operating Temperature	-13°F to 145°F (-25°C to 65°C)
Relative Humidity	5% to 95% RH (non-condensing)
Weight	2.6 oz. (74 gms.)
Dimensions	4.0"round x 0.9" (100 mm x 23 mm)
Mounting	mount with screws or tape (Velcro®), not supplied

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The Lighting Quotient
114 Boston Post Road, West Haven, Connecticut 06516, USA
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enocean alliance
No Wires. No Batteries. No Limits.

Wireless SmartSpace Controller

HWREN-E20C-0A

Overview

Today's building owners are seeking solutions to drive-down their facilities energy footprint without enduring the expense and disruption of installing a networked automation system.

Tambient answers this need with the SmartSpace Controller that provides for manual and automatic occupancy response switching of 120V receptacle power circuits for controlling tambient plug-and-play luminaires. Tambient Smart Space Controllers can also switch and/or dim supplemental building integrated lighting in response to tambient self-powered wireless switches, occupancy sensors and photo sensors.

Tambient's SmartSpace Controllers communicate with nearby low-voltage and/or wireless sensors to monitor workstation occupancy, and they communicate wirelessly with each other. This eliminates much of the wiring normally required for multi-zone distributed control. This translates into quick installations with less disruption to occupants and simplified building infrastructures allowing facilities to accelerate retrofit schedules reduce embodied energy.

The SmartSpace Controllers have Switch Click technology which allows installers and facility operators to manage configuration settings without any tools reducing call-backs and installation expense.

All tambient's wall switches and sensors are developed entirely on EnOcean technology making them battery-free. By harvesting energy from the surrounding environment for power, these battery-free devices eliminate the maintenance burden of replacing and disposing of batteries.

Features

- Lighting circuit control with dimming ballast control output
- Embedded Switch Click configuration for fast and easy commissioning
- Occupancy based lighting controls with Auto-ON/OFF or manual ON , auto-OFF
- Integrated day-light harvesting control
- Listens for tambient battery-free wall switches, photo sensors and occupancy sensors
- Near-cross switching technology for long relay life
- Easy installation on electrical junction boxes with ½"mounting nipple
- Broadcasts controller status to BMS gateways
- Doubles as a telegram repeater

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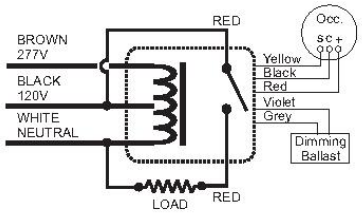
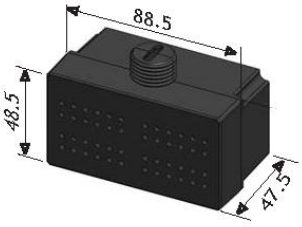
HWREN-E20C-0A

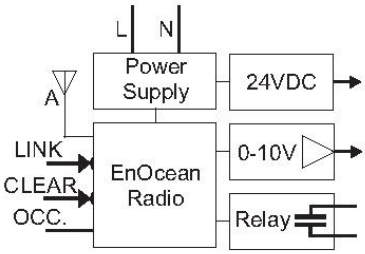
Wiring Diagram



Dimensional Drawing



Block Diagram



EnOcean Equipment Profiles - remote devices supported

EEP: 05-02-02	Light and Blinds Control - US/Canada application
EEP: 07-06-02	Light Sensor [range 0 - 1024 lux]
EEP: 07-07-01	Occupancy Sensor

Hardware Specifications

Power Supply	120/277 VAC, 60Hz
Power Consumption	4.25 W max. full load
Power Output	24 VDC @ 35 mA
Input	Optically Isolated 24VDC input
Outputs	N.O. Relay rating 20A@120 or 277 VAC
	0-10 VDC @ 25mA maximum, sinking current only
Inputs	LEARN and CLEAR buttons for sensor assignment
Communications	315 MHz EnOcean radio with whip antenna

Mechanical Specifications

Operating Temperature	14° F to 113° F (-10° C to 45° C)
Relative Humidity	5% to 95% RH (non-condensing)
Weight	13.5 oz. (385 gms.)
Dimensions	3.5" x 1.9" x 1.9" (88 mm x 48 mm x 48 mm)
Mounting	½" nipple

Agency Listing and Compliance

Safety	ETL Recognized Component 3188207
	Conforms to UL Standard 508
	Certified to CAN/CSA Std. C22.2 No.14
	UL 2043 Plenum rated
Radio Frequency	FCC Part 15.231 - Remote Control Transmitter
	IC RSS-210

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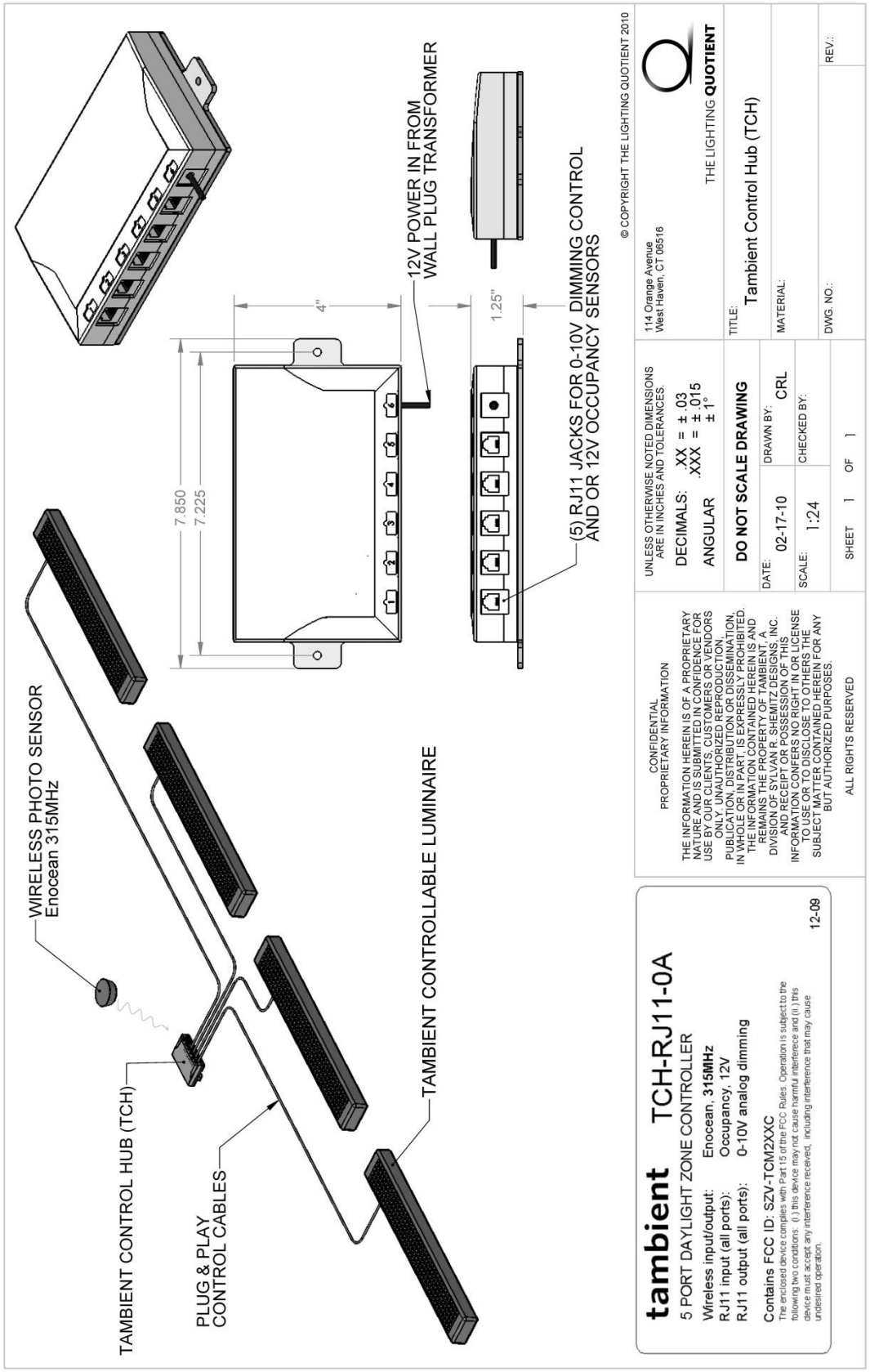
WIRELESS PHOTO SENSOR
Enocean 315MHz
TAMBIENT CONTROL HUB (TCH)
PLUG & PLAY
CONTROL CABLES
TAMBIENT CONTROLLABLE LUMINAIRE
7.850
7.225
4"
12V POWER IN FROM
WALL PLUG TRANSFORMER
1.25"
(5) RJ11 JACKS FOR 0-10V DIMMING CONTROL
AND OR 12V OCCUPANCY SENSORS
tambient TCH-RJ11-0A
5 PORT DAYLIGHT ZONE CONTROLLER
Wireless input/output: Enocean, 315MHz
RJ11 input (all ports): Occupancy, 12V
RJ11 output (all ports): 0-10V analog dimming
Contains FCC ID: SZV-TCM2XXC
The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation.
12-09
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DECIMALS: .XX = ± .03 .XXX = ± .015
ANGULAR ± 1°
DO NOT SCALE DRAWING
DATE: 02-17-10
DRAWN BY: CRL
SCALE: 1:24
CHECKED BY:
SHEET 1 OF 1
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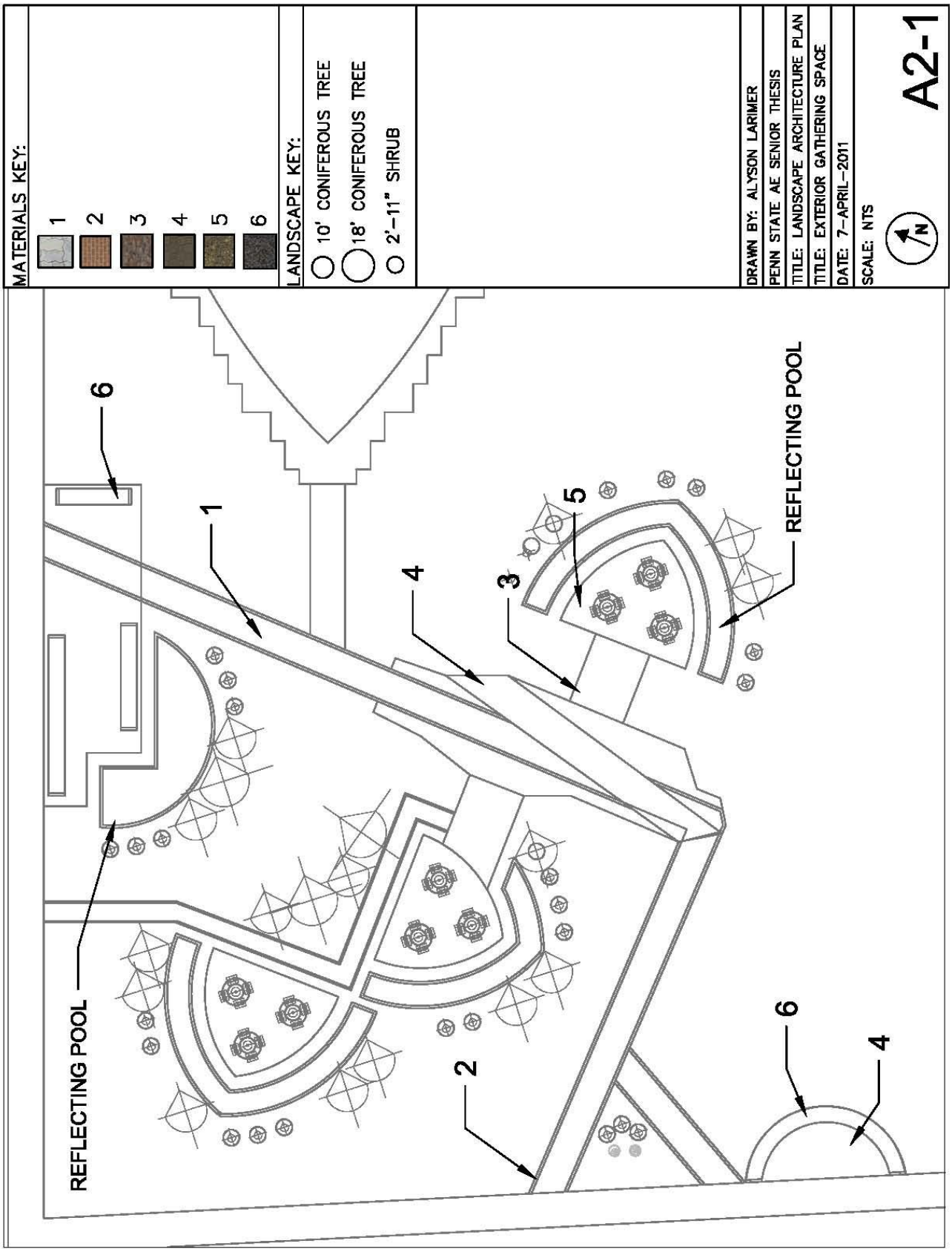
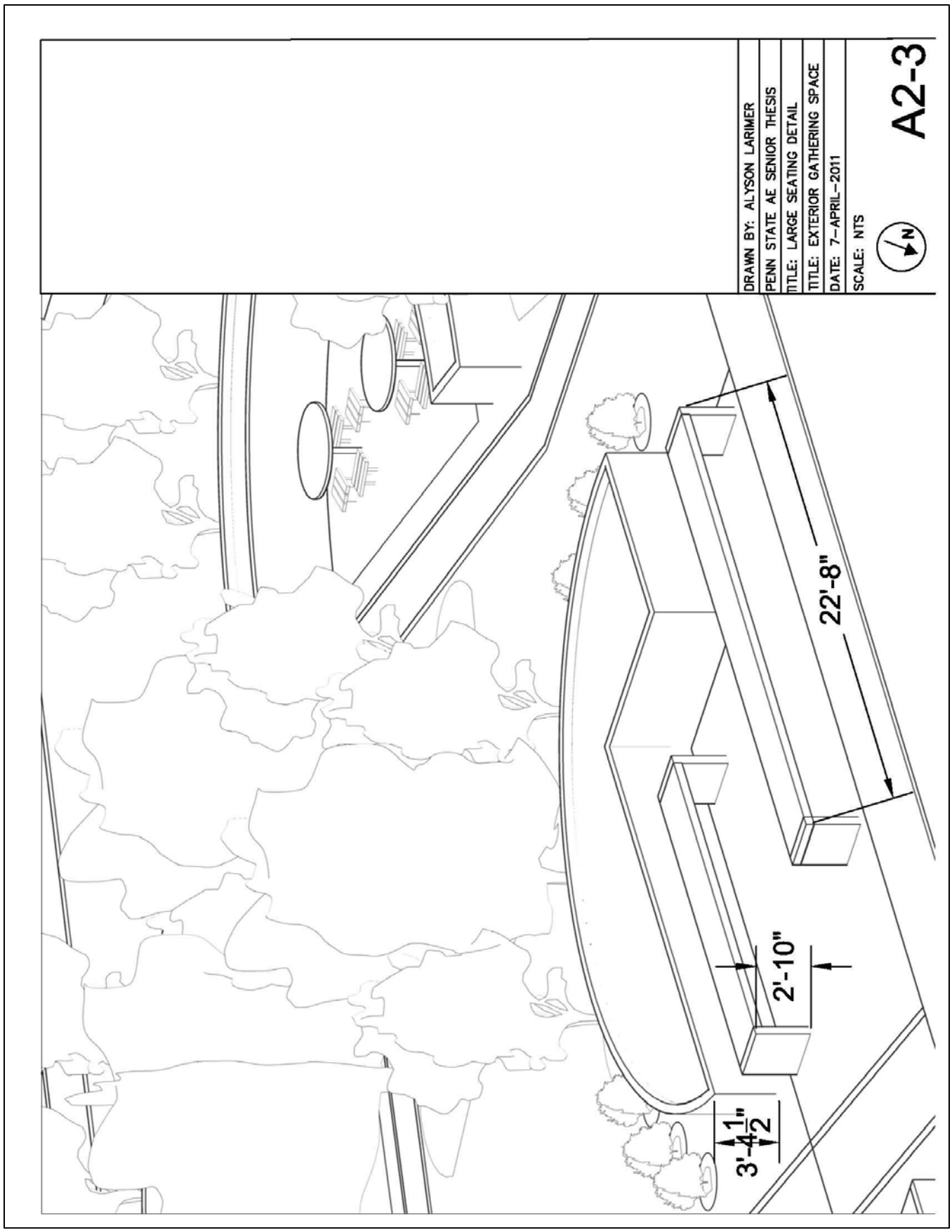
114 Orange Avenue
West Haven, CT 06516
THE LIGHTING QUOTIENT
TITLE: Tambient Control Hub (TCH)
MATERIAL:
DWG. NO.:
REV.:

APPENDIX B | LANDSCAPE

The following pages include all landscape plans and details.
Materials and landscape planning are noted as well as dimensions
of seating elements within the space.


MATERIALS KEY:
1
2
3
4
5
6
LANDSCAPE KEY:
10' CONIFEROUS TREE
18' CONIFEROUS TREE
2'-11" SHRUB
DRAWN BY: ALYSON LARIMER
PENN STATE AE SENIOR THESIS
TITLE: LANDSCAPE ARCHITECTURE PLAN
TITLE: EXTERIOR GATHERING SPACE
DATE: 7-APRIL-2011
SCALE: NTS
N
A2-1
REFLECTING POOL
REFLECTING POOL
1
2
3
4
5
6
6
4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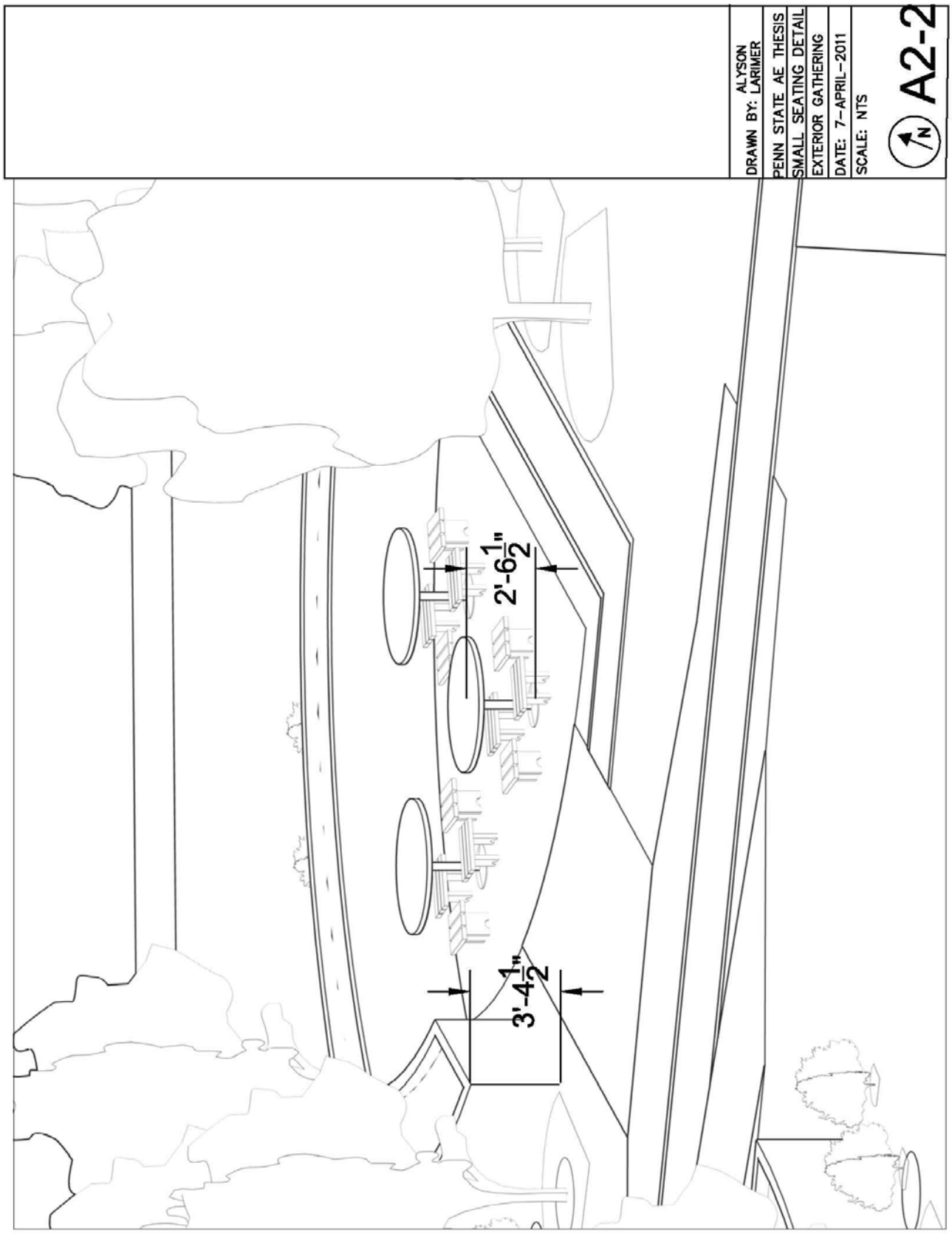
PENN STATE AE SENIOR THESIS
TITLE: LARGE SEATING DETAIL
TITLE: EXTERIOR GATHERING SPACE
DATE: 7-APRIL-2011
SCALE: NTS
A2-3
22'-8"
2'-10"
3'-4 1/2"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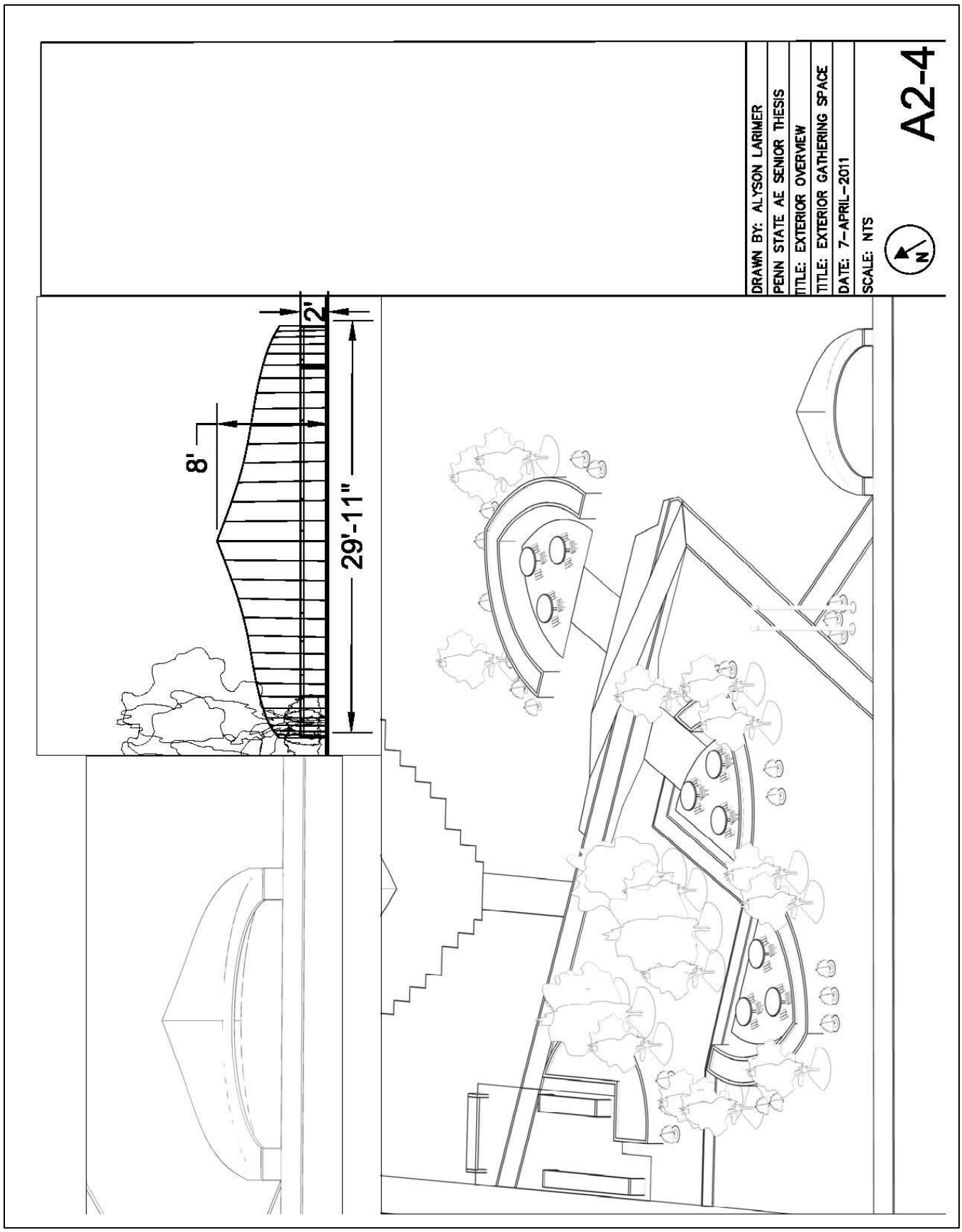
PENN STATE AE THESIS
SMALL SEATING DETAIL
EXTERIOR GATHERING
DATE: 7-APRIL-2011
SCALE: NTS
A2-2
2'-6 1/2"
3'-4 1/2"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PENN STATE AE SENIOR THESIS
TITLE: EXTERIOR OVERVIEW
TITLE: EXTERIOR GATHERING SPACE
DATE: 7-APRIL-2011
SCALE: NTS
A2-4
N
2"
8'
29'-11"

APPENDIX C | ELECTRICAL

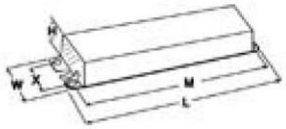
The following pages include all ballast and driver specification sheets in order of the luminaire equipment schedule found in Appendix A. Some ballasts were used for multiple fixtures but were not inserted twice.

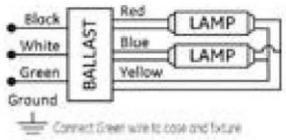
GE Lighting

99651 - GE254MVPS90-F

GE LFL UltraStart® Electronic Program / Rapid Start Ballast

- High Efficiency T5 ballast with Continuous Cathode Cutout Technology
- Lower Maintenance Costs with Parallel Lamp Operation
- Fast Starting Time <700ms
- Multi-Voltage technology means a single ballast handles voltage from 108V to 305V
- Auto-Restart withstands temporary losses in power without the need to cycle power
- UltraCool™ Operation 90C case rating
- Anti-Striation Control for better light quality, with no striations.





GENERAL CHARACTERISTICS

Application	2 or 1 - F54T5HO 120 to 277 UltraStart PRS Hight Temp F Can
Category	Linear Fluorescent
Ballast Type	Electronic - Program / Rapid Start
Starting Method	Programmed start
Lamp Wiring	Parallel
Line Voltage Regulation (+/-)	10 %
Case Temperature	90 °C(194 °F)
Ballast Factor	Normal
Power Factor Correction	Active
Sound Rating	A (20-24 decibels)
Enclosure Type	Metal
Additional Info	Auto-restart/End of Life Protection (EOL)/Thermally protected/Universal voltage

PRODUCT INFORMATION

Product Code	99651
Description	GE254MVPS90-F
Standard Package	Case
Standard Package GTIN	10043168996515
Standard Package Quantity	10
Sales Unit	Standard Pack
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168996518

DIMENSIONS

Case dimensions	
Length (L)	11.8 in(298.45 mm)
Width (W)	1.7 in(43.18 mm)
Height (H)	1.2 in(30.48 mm)
Mounting dimensions	
Mount Length (M)	11.1 in(282.96 mm)
Mount Slots (MS)	0.2 in(6.35 mm)
Weight	1.85 lb
Exit Type	Side
Remote Mounting Distance	8 ft
Remote Mounting Wire Gauge	18 AWG

Lead lengths	Qty	Exit	Length (± 1 in.)
Black	1	Left/Right	25.0 (635mm)
Blue	2	Left/Right	34.0 (864mm)
Green	1	Left/Right	3.5 (89mm)
Red	2	Left/Right	34.0 (864mm)
White	1	Left/Right	25.0 (635mm)
Yellow	1	Left/Right	45.0 (1143mm)
Yellow	2	Left/Right	45 (1143mm)

ELECTRICAL CHARACTERISTICS

Supply Current Frequency	50 Hz/60 Hz

SAFETY & PERFORMANCE

- CSA
- FCC - CLASS A Non-Consumer
- UL Class P
- UL Listed
- UL Type 1 Outdoor
- UL Type CC
- UL Type HL
- RoHs Compliant
- Meets ANSI Standard C82.11-Cons 2002
- Meets ANSI Standard C62.41-1991
- High Temperature Rated: Suitable for high temperature applications
- 70C max case temp 5 yr warranty or 90C max case temp 3 yr warranty

SPECIFICATIONS BY LAMP & WATTAGE

Lamp	# of Lamps	Line Volts	System Watts	Nom. Line Current	System Ballast Factor	Ballast Efficacy Factor	Power Factor% (>=)	Crest Factor (<=)	THD% (<=)	Min. Starting Temp (°F/°C)
FT55W/4P	1	120	67	0.56 A	1.04	1.55	99	1.6	6	5.0 / -15
FT55W/4P	2	120	106	0.89 A	0.86	0.81	99	1.7	9	5.0 / -15
FT55W/4P	1	277	67	0.25 A	1.04	1.55	97	1.6	6	5.0 / -15
FT55W/4P	2	277	105	0.39 A	0.86	0.82	98	1.7	7	5.0 / -15
FT50W/4P	1	120	72	0.61 A	1.21	1.68	99	1.6	5	5.0 / -15
FT50W/4P	1	277	72	0.27 A	1.21	1.68	97	1.6	7	5.0 / -15

For additional information, visit www.gelighting.com Page 1

FT50W/4P	2	120	117	0.99 A	1.05	0.90	99	1.7	10	5.0 / -15
FT50W/4P	2	277	115	0.43 A	1.05	0.91	98	1.7	8	5.0 / -15
FT39W/4P	1	120	51	0.43 A	1.29	2.53	99	1.6	4	5.0 / -15
FT39W/4P	1	277	51	0.19 A	1.28	2.51	96	1.6	7	5.0 / -15
FT39W/4P	2	120	85	0.71 A	1.17	1.38	99	1.6	4	5.0 / -15
FT39W/4P	2	277	84	0.31 A	1.17	1.39	98	1.6	8	5.0 / -15
FC12T5HO	1	120	69	0.58 A	1.04	1.51	99	1.6	6	5.0 / -15
FC12T5HO	1	277	69	0.26 A	1.04	1.51	97	1.6	7	5.0 / -15
FC12T5HO	2	120	111	0.92 A	0.90	0.81	99	1.7	7	5.0 / -15
FC12T5HO	2	277	109	0.4 A	0.90	0.83	98	1.7	7	5.0 / -15
F58T8	2	120	106	0.89 A	0.95	0.90	99	1.6	9	5.0 / -15
F58T8	1	120	65	0.55 A	1.09	1.68	99	1.6	5	5.0 / -15
F58T8	2	277	104	0.38 A	0.95	0.91	98	1.6	10	5.0 / -15
F58T8	1	277	65	0.24 A	1.09	1.68	97	1.6	7	5.0 / -15
F54T5/WM	2	277	107	0.4 A	1.00	0.93	97	1.7	8	5.0 / -15
F54T5/WM	1	277	66	0.25 A	1.12	1.70	97	1.6	7	5.0 / -15
F54T5/WM	2	120	109	0.91 A	1.00	0.92	99	1.7	8	5.0 / -15
F54T5/WM	1	120	66	0.56 A	1.12	1.70	99	1.6	5	5.0 / -15
F54T5/HO	1	120	71	0.6 A	1.11	1.56	99	1.6	4	5.0 / -15
F54T5/HO	1	277	71	0.26 A	1.11	1.56	97	1.6	7	5.0 / -15
F54T5/HO	2	120	116	0.98 A	1.00	0.86	99	1.7	10	5.0 / -15
F54T5/HO	2	277	114	0.43 A	1.00	0.88	98	1.7	8	5.0 / -15
F54T5/47W	1	120	64	0.54 A	1.10	NaN	99	1.7	8	32.0 / 0
F54T5/47W	1	277	63	0.24 A	1.10	1.75	99	1.6	5	32.0 / 0
F54T5/47W	2	120	105	0.9 A	1.00	0.95	97	1.7	8	32.0 / 0
F54T5/47W	2	277	103	0.38 A	1.00	0.97	97	1.6	7	32.0 / 0

WARRANTY INFORMATION

GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

Apr 5, 2011 2:33:59 AM
For additional information, visit www.gelighting.com

Page 2

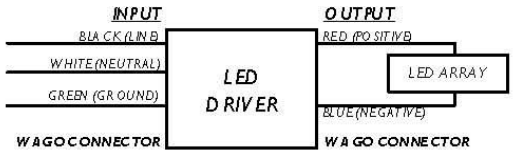
PHILIPS
ADVANCE

LED-120A-0012V-21-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120
Input Frequency	50/60Hz
RoHS	No
Status	Active

Electrical Specifications

Max. Output Power (W)	Output Voltage (V)	Output Current (A)	Operating Temp. Range (°F/°C)	Input Current at 120V (A)	Max. Input Power (W)	Inrush Current ($A_{pk}/\mu s$)	Max. THD (%)	Min. Power Factor	Surge Protection (KV)	Weight (Lbs)	IP Rating
25	2.8~12.0	2.1	-40°~140°F (-40~60°C)	0.25	30.5	-	20	0.9	2.0	0.6/275	IP20

Wiring Diagram



Input is Wago 3-position wire trap connector – use 18AWG solid or tinned stranded.
Output is Wago 4-pin wire trap connector – use 20AWG solid or tinned stranded.

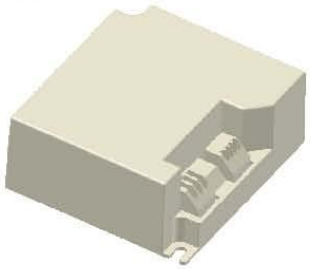
Standard Lead Length

	in.	cm.
Black		
White		
Blue		
Red		
Green		
Violet		

Maximum Wiring Distance (at full load)

Wire Size (AWG)	Distance (feet)
26	3
24	4
22	7
20	11
18	18
16	28
14	46
12	70
10	119

Enclosure



	in. (mm)
Case Length	3.30 (83)
Case Width	3.06 (77)
Case Height	1.34 (33.7)
Mounting Length	2.91 (73.4)
Mounting Width	2.67 (67.4)
Overall Length	3.29 (83)

c UL us — UL Class 2 E220165

c SP us — 7310_S-000 3426-32

Revised 10/19/2009

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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

PHILIPS
ADVANCE

LED-120A-0012V-21-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120
Input Frequency	50/60Hz
RoHS	No
Status	Active

Installation & Application Notes:

Section I – Physical Characteristics

1.1 LED Driver shall be installed inside an electrical enclosure.
1.2 Wiring inside electrical enclosure shall comply with 600V/105°C rating or higher.
1.3 Housing is made of UL94-V0 flame retardant plastic. White color.

Section II – Performance

2.1 LED Driver is UL Class 2 power unit as per UL1310. It is also listed in the UL Sign Accessory Manual.
2.2 LED Driver is certified by UL for use in a dry location.
2.3 LED Driver has Class A sound rating.
2.4 LED Driver tolerates sustained open circuit and short circuit output conditions without damage.
2.5 LED Driver maximum allowable case temperature is 85°C – see product label for measurement location.
2.6 LED Driver complies with FCC rules and regulations, as per Title 47 CFR Part 15 Non-Consumer (Class A) for EMI/RFI (conducted and radiated) at full load.

Section III – UL Conditions of Acceptability (File E220165)

When installed in the end product, consideration shall be given to the following:

3.1 This component has been judged on the basis of the required spacings in the Standard for Class 2 Power Units, UL 1310, Fourth Edition, which would cover the component itself if submitted for Listing.
3.2 The supply terminals and connectors are suitable for factory wiring only of solid or tinned stranded No. 18 AWG conductors.
3.3 The equipment was submitted and tested for a maximum manufacturer's recommended ambient (Tmra) of 40°C.
3.4 Leakage current measurements shall be performed when more than four LED drivers are used in the equipment or when the LED driver is used in combination with other equipment in the end-use product.
3.5 The drivers are intended for installation inside an electrical enclosure.
3.6 The ground connection is not suitable as the equipment ground for a sign. Separate provision for sign grounding must be provided.
3.7 The driver is suitable for dry location use.

Revised 10/19/2009

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GE Lighting

97608 - F26DBX/835/ECO

GE Ecolux® Biax® T4 - Facilities; Retail Display; Hospitality; Office; Restaurant; Warehouse

High Color Rendering

Photo Not Available

Energy Savings

GENERAL CHARACTERISTICS

Lamp Type	Compact Fluorescent - Plug-In
Bulb	T4
Base	G24d-3
Rated Life	10000 hrs
Starting Temperature	-9 °C (16 °F)
Cathode Resistance	2.7 Ohm
LEED-EB MR Credit	274 picograms Hg per mean lumen hour
Additional Info	TCLP compliant
Primary Application	Facilities;Retail Display;Hospitality;Office;Restaurant;Wa

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	1710
Mean Lumens	1460
Nominal Initial Lumens per Watt	65
Color Temperature	3500 K
Color Rendering Index (CRI)	82

ELECTRICAL CHARACTERISTICS

Wattage	26
Voltage	105
Open Circuit Voltage Across Starter	198 V
Lamp Current	0.325 A
Current Crest Factor	1.7
Supply Current Frequency	60 Hz

DIMENSIONS

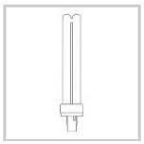
Maximum Overall Length (MOL)	6.6700 in(169.4 mm)
Nominal Length	6.700 in(170.2 mm)
Base Face to Top of Lamp	5.790 in(147.1 mm)

PRODUCT INFORMATION

Product Code	97608
Description	F26DBX/835/ECO
ANSI Code	60901-IEC-0526-2
Standard Package	BUNDLE
Standard Package GTIN	
Standard Package Quantity	50
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	50
UPC	043168976084

For additional information, visit www.gelighting.com

Page 1



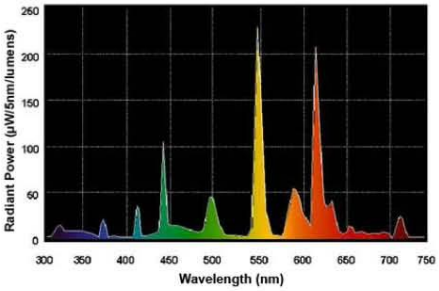
CAUTIONS & WARNINGS

Caution

•

GRAPHS & CHARTS

Spectral Power Distribution



NOTES

- Based on 60Hz reference circuit.
- Fluorescent lamp lumens decline during life

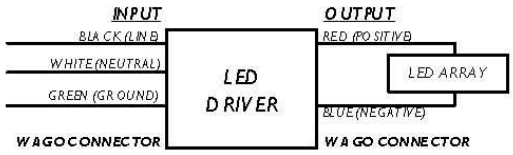
PHILIPS ADVANCE

LED-120A-1400C-24-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120
Input Frequency	50/60Hz
RoHS	No
Status	Active

Electrical Specifications

Max. Output Power (W)	Output Voltage (V)	Output Current (A)	Operating Temp. Range (°F/°C)	Input Current at 120V (A)	Max. Input Power (W)	Inrush Current ($A_{pk}/\mu s$)	Max. THD (%)	Min. Power Factor	Surge Protection (KV)	Weight (Lbs)	IP Rating
34	2.8~24.0	1.4	-40°~140°F (-40~60°C)	0.35	42	-	20	0.9	2.0	0.6/275	IP20

Wiring Diagram



Input is Wago 3-position wire trap connector – use 18AWG solid or tinned stranded.
Output is Wago 4-pin wire trap connector – use 20AWG solid or tinned stranded.

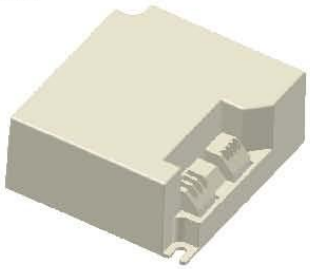
Standard Lead Length

	in.	cm.
Black		
White		
Blue		
Red		
Green		
Violet		

Maximum Wiring Distance (at full load)

Wire Size (AWG)	Distance (feet)
26	4
24	7
22	11
20	17
18	27
16	43
14	69
12	105
10	179

Enclosure



	in. (mm)
Case Length	3.30 (83)
Case Width	3.06 (77)
Case Height	1.34 (33.7)
Mounting Length	2.91 (73.4)
Mounting Width	2.67 (67.4)
Overall Length	3.29 (83)

c UL us — UL Class 2 E220165

c SP us — 7310_S-000 3426-32

Revised 09/15/2009

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Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

PHILIPS
ADVANCE

LED-120A-1400C-24-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120
Input Frequency	50/60Hz
RoHS	No
Status	Active

Installation & Application Notes:

Section I – Physical Characteristics

1.1 LED Driver shall be installed inside an electrical enclosure.
1.2 Wiring inside electrical enclosure shall comply with 600V/105°C rating or higher.
1.3 Housing is made of UL94-V0 flame retardant plastic. White color.

Section II – Performance

2.1 LED Driver is UL Class 2 power unit as per UL1310. It is also listed in the UL Sign Accessory Manual.
2.2 LED Driver is certified by UL for use in a dry location.
2.3 LED Driver has Class A sound rating.
2.4 LED Driver tolerates sustained open circuit and short circuit output conditions without damage.
2.5 LED Driver maximum allowable case temperature is 85°C – see product label for measurement location.
2.6 LED Driver complies with FCC rules and regulations, as per Title 47 CFR Part 15 Non-Consumer (Class A) for EMI/RFI (conducted and radiated) at full load.

Section III – UL Conditions of Acceptability (File E220165)

When installed in the end product, consideration shall be given to the following:

3.1 This component has been judged on the basis of the required spacings in the Standard for Class 2 Power Units, UL 1310, Fourth Edition, which would cover the component itself if submitted for Listing.
3.2 The supply terminals and connectors are suitable for factory wiring only of solid or tinned stranded No. 18 AWG conductors.
3.3 The equipment was submitted and tested for a maximum manufacturer's recommended ambient (Tmra) of 40°C.
3.4 Leakage current measurements shall be performed when more than four LED drivers are used in the equipment or when the LED driver is used in combination with other equipment in the end-use product.
3.5 The drivers are intended for installation inside an electrical enclosure.
3.6 The ground connection is not suitable as the equipment ground for a sign. Separate provision for sign grounding must be provided.
3.7 The driver is suitable for dry location use.

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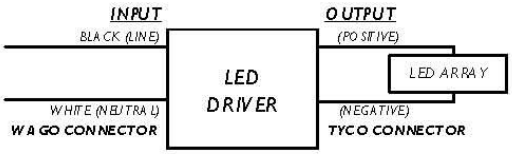
PHILIPS ADVANCE

LED-120A-0350C-33-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120
Input Frequency	50/60Hz
RoHS	No
Status	Active

Electrical Specifications

Max. Output Power (W)	Output Voltage (V)	Output Current (A)	Operating Temp. Range (°F/°C)	Input Current at 120V (A)	Max. Input Power (W)	Inrush Current ($A_{pk}/\mu s$)	Max. THD (%)	Min. Power Factor	Surge Protection (KV)	Weight (Lbs)	IP Rating
12	2.8~33.0	0.35	-40°~140°F (-40~60°C)	0.13	15.0	-	20	0.9	2.0	0.15/70	IP20

Wiring Diagram



Input is WAGO 2-position wire trap connector – use 18AWG solid or tinned stranded.
Output is Tyco 2mm AMP CT connector (292132-2) – recommend harness 1365323-1 (supplied via Future Lighting Solutions, 1-888-589-3662)

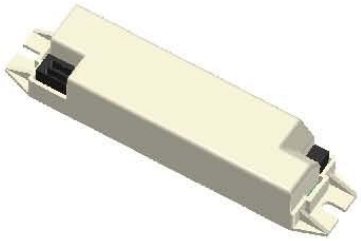
Standard Lead Length

	in.	cm.
Black		
White		
Blue		
Red		
Green		
Violet		

Maximum Wiring Distance (at full load)

Wire Size (AWG)	Distance (feet)
26	16
24	26
22	43
20	68
18	108
16	170
14	275
12	420
10	714

Enclosure



	in. (mm)
Case Length	4.33 (109)
Case Width	1.20 (30)
Case Height	0.87 (22)
Mounting Length	4.76 (120)
Mounting Width	0 (0)
Overall Length	5.24 (132)

UL Class 2
E220165

7310_S-000
3426-32

Revised 12/16/2010

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PHILIPS
ADVANCE

LED-120A-0350C-33-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120
Input Frequency	50/60Hz
RoHS	No
Status	Active

Installation & Application Notes:

Section I – Physical Characteristics

1.1 LED Driver shall be installed inside an electrical enclosure.
1.2 Wiring inside electrical enclosure shall comply with 600V/105°C rating or higher.
1.3 Housing is made of UL94-V0 flame retardant plastic. White color.

Section II – Performance

2.1 LED Driver is UL Class 2 power unit as per UL1310. It is also listed in the UL Sign Accessory Manual.
2.2 LED Driver is certified by UL for use in a dry location.
2.3 LED Driver has Class A sound rating.
2.4 LED Driver tolerates sustained open circuit and short circuit output conditions without damage.
2.5 LED Driver maximum allowable case temperature is 85°C – see product label for measurement location.
2.6 LED Driver complies with FCC rules and regulations, as per Title 47 CFR Part 15 Non-Consumer (Class A) for EMI/RFI (conducted and radiated) at full load.

Section III – UL Conditions of Acceptability (File E220165)

When installed in the end product, consideration shall be given to the following:

3.1 This component has been judged on the basis of the required spacings in the Standard for Class 2 Power Units, UL 1310, Fourth Edition, which would cover the component itself if submitted for Listing.
3.2 The supply terminals and connectors are suitable for factory wiring only of solid or tinned stranded No. 18 AWG conductors.
3.3 The equipment was submitted and tested for a maximum manufacturer's recommended ambient (Tmra) of 25°C.
3.4 This unit is provided with a Class 105(A) insulation system. A temperature test is required when the unit is installed within an electrical enclosure or raceway.
3.5 Leakage current measurements shall be performed when more than four LED drivers are used in the equipment or when the LED driver is used in combination with other equipment in the end-use product.
3.6 The unit is intended for installation inside an electrical enclosure.

Revised 12/16/2010

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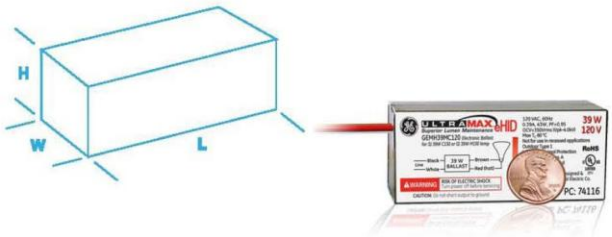
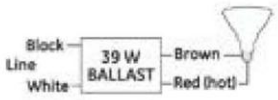
GE Lighting

74116 - GEMH39-MC-120

GE HID UltraMax™ eHID Electronic Low Frequency Ballast

- Light-weight, Low Profile Housing
- Superior low frequency square wave frequency design maximizes performance and life of ceramic metal halide lamps.
- Ultra slim can size for fixture design flexibility





GENERAL CHARACTERISTICS

Application	1- 39W M130 120V Micro Electronic HID
Category	High Intensity Discharge
Ballast Type	Electronic - Low Frequency
Line Voltage Regulation (+/-)	10 %
Ambient Temperature (MAX)	55 °C(13 °C)
Case Temperature	80 °C(176 °F)
Ballast Factor	Normal-High (1.0)
Sound Rating	A (20-24 decibels)
Enclosure Type	Plastic
Distance to Lamp	8 ft
Additional Info	End of Life Protection (EOL)/ Thermally protected

PRODUCT INFORMATION

Product Code	74116
Description	GEMH39-MC-120
Standard Package	Case
Standard Package GTIN	10043168741160
Standard Package Quantity	10
Sales Unit	Case
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168741163

DIMENSIONS

Case dimensions			
Length (L)		3.0 in(75.95 mm)	
Width (W)		1.3 in(33.02 mm)	
Height (H)		1.1 in(27.94 mm)	
Mounting dimensions			
Weight		0.38 lb	
Exit Type		Side	
Remote Mounting Distance		8 ft	
Remote Mounting Wire Gauge		18 AWG	
Lead lengths	Qty	Exit	Length (± 1 in.)
White	1	Left	6 (152mm)
Red	1	Left	6 (152mm)
Brown	1	Left	6 (152mm)
Black	1	Left	6 (152mm)

ELECTRICAL CHARACTERISTICS

Lamp Operating Frequency	133 Hz

SAFETY & PERFORMANCE

- cUL Listed
- UL Listed
- RoHs Compliant
- ANSI - C82.14-2006
- UL94V0 Flame Retardant
- Short Circuit Protection
- Inherent Thermal Protection

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	Specifications by Line Voltage	System Wattage	Nominal Current	Ballast Factor	Ballast Efficiency	Max.Input Current	Starting Current	Open Circuit Voltage	Drop Out Voltage	Power factor	Min.starting temperature	Fuse rating	UL bench top rise
M130	1	120	43.0		1	0.907	0.39A		4000V	96V	0.99	0.0°F	1 1/2	

CAUTIONS & WARNINGS

Caution

-
-

NOTES

- Not designed for recessed applications.
- 150C rated lead wires
- Short Circuit Protection
- Do not connect Brown or Red wires to ground

WARRANTY INFORMATION

GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

Apr 2, 2011 1:32:07 AM
For additional information, visit www.gelighting.com

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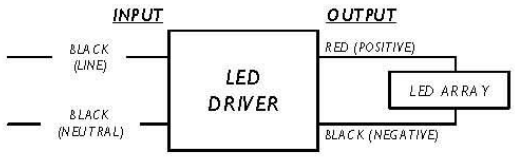
PHILIPS ADVANCE

LED-UNIA-0700C-12-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120~230V
Input Frequency	50/60 hZ
RoHS	Yes
Status	Active

Electrical Specifications

Max. Output Power (W)	Output Voltage (V)	Output Current (A)	Operating Temp. Range (°F/°C)	Input Current at 120V (A)	Max. Input Power (W)	Inrush Current ($A_{pk}/\mu s$)	Max. THD (%)	Min. Power Factor	Surge Protection (KV)	Weight (Lbs)	IP Rating
8.0	2.4~12	0.70	14°~104°F (-10~40°C)	0.25	15	-	20	0.5	-	0.13/60	IP20

Wiring Diagram



Input and Output use lead-wires.
Lead-wires are 20AWG 80C/300V stranded copper

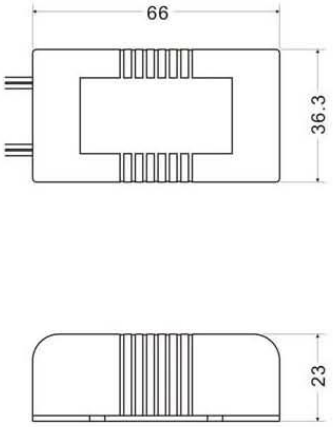
Standard Lead Length

	in.	cm.
Black	4	10
White		
Blue		
Red	4	10
Gray		
Violet		

Maximum Wiring Distance (at full load)

Wire Size (AWG)	Distance (feet)
26	8
24	13
22	21
20	34
18	54
16	85
14	137

Enclosure



c UL us

UL Class 2
E215167

Revised 06/15/2009

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PHILIPS
ADVANCE

LED-UNIA-0700C-12-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120~230V
Input Frequency	50/60 hZ
RoHS	Yes
Status	Active

Installation & Application Notes:

Section I – Physical Characteristics

1.1 LED Driver shall be installed inside an electrical enclosure.

1.2 Wiring inside electrical enclosure shall comply with 600V/105°C rating or higher.

Section II – Performance

2.1 LED Driver tolerates sustained open circuit and short circuit output conditions without damage.

2.2 LED Controller maximum allowable case temperature is 69°C.

Section III – UL Conditions of Acceptability (File E215167)

When installed in the end product, consideration shall be given to the following:

3.1 This component has been judged on the basis of the required spacings in the Standard for Class 2 Power Units, UL 1310, Par. 24.5 to Par. 24.9, UL840, Table 9.1 and the Canadian Standard for Power Supplies with Extra-Low-Voltage Class 2 outputs, CAN/CSA 22.2 No. 223-M91, Table 2 and Table 3.

3.2 This power supply was intended for use in indoor use equipment only.

3.3 This transformer employs Class 105(a) insulation.

3.4 These components shall be installed in compliance with the enclosure and mounting requirements of the ultimate application.

3.5 The input and output leads are minimum No. 20 AWG, rated 300V, 80°C. The suitability of input and output connections shall be determined in each end use application.

3.6 The strain relief, mold stress relief distortion and impact tests have not been investigated. The flammability of enclosure material under investigation is V-2. The suitability of the enclosure as ultimate enclosure shall be determined in the end-use application.

3.7 The maximum temperature measured on enclosure surface was 69°C during the Temperature test. The necessity of repeat Temperature Test shall be determined in each end-use application.

3.8 The necessity of repeated Leakage Current Test shall be determined in each end-use application.

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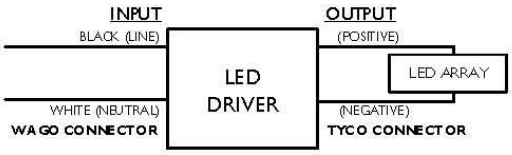
PHILIPS ADVANCE

LED-120A-0700C-24-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120
Input Frequency	50/60Hz
RoHS	No
Status	Active

Electrical Specifications

Max. Output Power (W)	Output Voltage (V)	Output Current (A)	Operating Temp. Range (°F/°C)	Input Current at 120V (A)	Max. Input Power (W)	Inrush Current (A_{pk}/µs)	Max. THD (%)	Min. Power Factor	Surge Protection (KV)	Weight (Lbs)	IP Rating
17	2.8~24.0	0.7	-40°~140°F (-40~60°C)	0.18	21.5	-	20	0.9	2.0	0.15/70	IP20

Wiring Diagram



Input is WAGO 2-position wire trap connector – use 18AWG solid or tinned stranded.
Output is Tyco 2mm AMP CT connector (292132-2) – recommend harness 1365323-1 (supplied via Future Lighting Solutions, 1-888-589-3662)

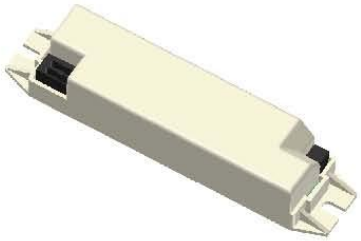
Standard Lead Length

	in.	cm.
Black		
White		
Blue		
Red		
Green		
Violet		

Maximum Wiring Distance (at full load)

Wire Size (AWG)	Distance (feet)
26	8
24	13
22	21
20	34
18	54
16	85
14	137
12	210
10	357

Enclosure



	in. (mm)
Case Length	4.33 (109)
Case Width	1.20 (30)
Case Height	0.87 (22)
Mounting Length	4.76 (120)
Mounting Width	0 (0)
Overall Length	5.24 (132)

c UL us — UL Class 2, E220165

C SP US — 7310_S-000, 3426-32

Revised 07/15/2009

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PHILIPS
ADVANCE

LED-120A-0700C-24-F	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120
Input Frequency	50/60Hz
RoHS	No
Status	Active

Installation & Application Notes:

Section I – Physical Characteristics

1.1 LED Driver shall be installed inside an electrical enclosure.
1.2 Wiring inside electrical enclosure shall comply with 600V/105°C rating or higher.
1.3 Housing is made of UL94-V0 flame retardant plastic. White color.

Section II – Performance

2.1 LED Driver is UL Class 2 power unit as per UL1310. It is also listed in the UL Sign Accessory Manual.
2.2 LED Driver is certified by UL for use in a dry location.
2.3 LED Driver has Class A sound rating.
2.4 LED Driver tolerates sustained open circuit and short circuit output conditions without damage.
2.5 LED Driver maximum allowable case temperature is 85°C – see product label for measurement location.
2.6 LED Driver complies with FCC rules and regulations, as per Title 47 CFR Part 15 Non-Consumer (Class A) for EMI/RFI (conducted and radiated) at full load.

Section III – UL Conditions of Acceptability (File E220165)

When installed in the end product, consideration shall be given to the following:

3.1 This component has been judged on the basis of the required spacings in the Standard for Class 2 Power Units, UL 1310, Fourth Edition, which would cover the component itself if submitted for Listing.
3.2 The supply terminals and connectors are suitable for factory wiring only of solid or tinned stranded No. 18 AWG conductors.
3.3 The equipment was submitted and tested for a maximum manufacturer's recommended ambient (Tmra) of 25°C.
3.4 This unit is provided with a Class 105(A) insulation system. A temperature test is required when the unit is installed within an electrical enclosure or raceway.
3.5 Leakage current measurements shall be performed when more than four LED drivers are used in the equipment or when the LED driver is used in combination with other equipment in the end-use product.
3.6 The unit is intended for installation inside an electrical enclosure.

Revised 07/15/2009

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For 55W FT5 Lamps

					Max/Min		Full Light Output				
No. of Lamps	Input Volts	Starting Method	Ballast Family	Catalog Number	Input Power ANSI (Watts)	Ballast Factor	THD %	Line Current (Amps)	Min. Starting Temp (F/C)	Dim.	Wiring Diagram
FT55W/2G11 - 55W Long Twin Tube Lamp (PL-L55W, F55BX, FT55DL)											
1	120-277	PS	ROVR	IDA-154	59/13	0.90/0.03	10	0.50-0.22	50/10	D	58B
2	120-277	PS	ROVR	IDA-2S54	114/24	0.90/0.03	10	0.96-0.42	50/10	D	59B

Ballasts utilizing poke-in connectors can accept wire gauge AWG 16-20.
Some lamp manufacturers recommend burning in new lamps 100 hours at full light output prior to dimming. Consult lamp manufacturer.

For 14W - 28W T5 Lamps

					Max/Min		Full Light Output				
No. of Lamps	Input Volts	Starting Method	Ballast Family	Catalog Number	Input Power ANSI (Watts)	Ballast Factor	THD %	Line Current (Amps)	Min. Starting Temp (F/C)	Dim.	Wiring Diagram
F14T5 (14W)											
1	120-277	PS	ROVR	IDA-128-D*	19/6	1.00/0.03	10	0.15-0.07	50/10	D	55B
2	120-277	PS	ROVR	IDA-2S28-D*	34/9	1.00/0.03	10	0.29-0.12	50/10	D	56B
F21T5 (21W)											
1	120-277	PS	ROVR	IDA-128-D*	25/6	1.00/0.03	10	0.20-0.09	50/10	D	55B
2	120-277	PS	ROVR	IDA-2S28-D*	49/10	1.00/0.03	10	0.42-0.18	50/10	D	56B
F25T5 (28W/ES)											
1	120-277	PS	ROVR	IDA-128-D*	30/7	1.00/00.3	10	0.25-0.11	50/10	D	55B
2	120-277	PS	ROVR	IDA-2S28-D*	59/12	1.00/00.3	10	0.51-0.21	50/10	D	56B
F28T5 (28W)											
1	120-277	PS	ROVR	IDA-128-D*	32/7	1.00/0.03	10	0.27-0.12	50/10	D	55B
2	120-277	PS	ROVR	IDA-2S28-D*	63/12	1.00/0.03	10	0.57-0.22	50/10	D	56B

Ballasts utilizing poke-in connectors can accept wire gauge AWG 16-20.
Some lamp manufacturers recommend burning in new lamps 100 hours at full light output prior to dimming. Consult lamp manufacturer.
*Consult factory for availability. Current specifications are subject to change please contact your local sales representative for further details.

Dimensions

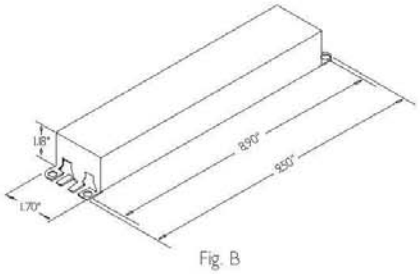


Fig. B

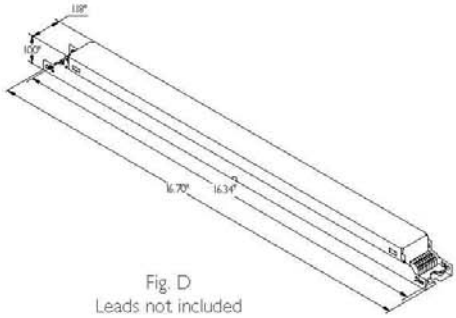


Fig. D
Leads not included

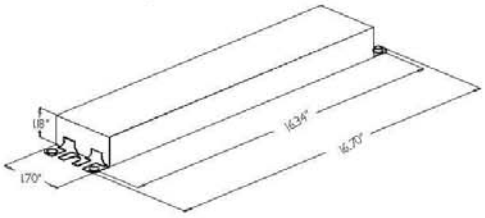
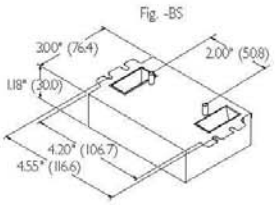
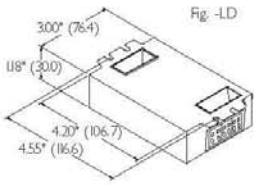


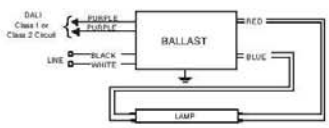
Fig. G



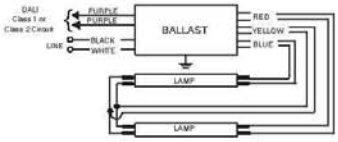


Size 5

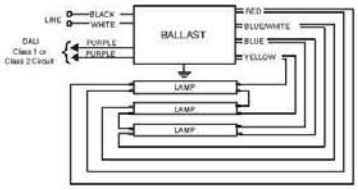
Wiring Diagrams



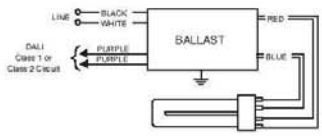
1-Lamp T8 & T5/HO Ballast - Fig. 55B



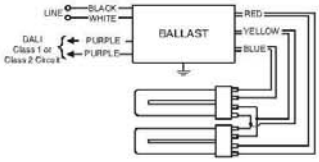
2-Lamp T8 & T5/HO Ballast - Fig. 56B



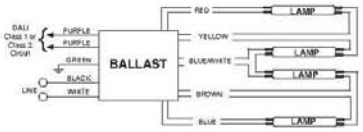
3-Lamp T8 Ballast - Fig. 57B



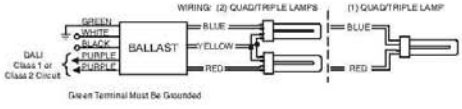
1-Lamp Long Twin Tube Ballast - Fig. 58B



2-Lamp Long Twin Tube Ballast - Fig. 59B



4-Lamp T8 Ballast - Fig. 167



1 & 2 -Lamp CFL Ballast - Fig. 165

Ballast Specification

Section I - Physical Characteristics

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

1.2 Ballast shall be available in a plastic/metal can or all metal can construction to meet all plenum requirements.

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

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start.

2.2 Ballast shall be provided with integral protection circuitry to withstand connection of low voltage control leads to mains power supply. In this event, ballast shall default to maximum light output.

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

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

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

2.6 Ballast shall have a Power Factor greater than 0.98 at full light output and greater than 0.90 throughout the dimming range for primary lamp.

2.7 Ballast shall have a minimum ballast factor of 1.00 at maximum light output and 0.03 at minimum light output for primary lamp.

2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less throughout the dimming range in accordance with lamp manufacturer recommendations.

2.9 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.

2.10 Ballast shall have a Class A sound rating.

2.11 Ballast shall have a minimum starting temperature of 10°C (50° F) for primary lamp.

2.12 Ballast shall provide Lamp EOL Protection Circuit for all T5, T5/HO, and CFL lamps.

2.13 Ballast shall control lamp light output from 100% - 3% relative light output for T8 and CFL lamps and 100% - 1% relative light output for T5/HO lamps.

2.14 Ballast shall ignite the lamps at any light output setting without first going to another output setting.

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

Section III - Regulatory Requirements

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

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

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

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

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

Section IV - Other

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

4.2 Ballast shall carry a ___ limited warranty from date of manufacture against defects in material or workmanship. This warranty is conditioned upon operation at a maximum case temperature of _____, among other items. (Go to our website for up-to-date warranty information, www.philips.com/advancewarranty).

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

4.4 Ballast shall be controlled by a Class 1 or Class 2 low voltage DALI controller.

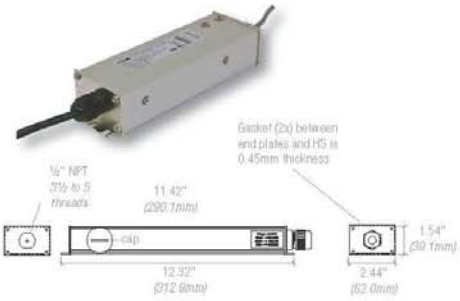
4.5 Ballast shall be Philips Advance part # _____ or approved equal.

Philips Lighting Electronics N.A.
10275 West Higgins Road
Rosemont, IL 60018
Tel: 800-322-2086 Fax: 888-423-1882
Customer Support/Customer Care: 800-372-3331
OEM Support: 866-915-5886
www.philips.com/advance

60-Watt Driver

WITH DIMMING OPTION
IO PART#: DR6ØMGD

WITHOUT DIMMING OPTION
IO PART#: DR6ØMGND



Note: For higher IP enclosure alternatives contact io Lighting for availability.

REMOTE DISTANCE

7'-0" (2.1m)	w/22AWG
18'-0" (5.5m)	w/18AWG
46'-0" (14m)	w/14AWG
71'-0" (21.6m)	w/12AWG

Key Features

- Integrated dimming available
- Requires separate enclosure
- Enclosure is 13"x 3"x 3"
- Built in wiring compartments for easy installation

Specifications

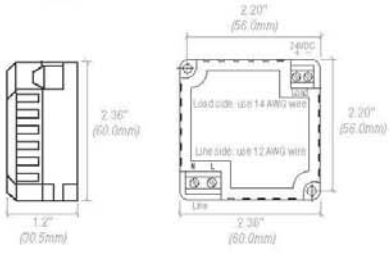
Location: **Wet IP66 w/ enclosure**
Output Voltage: **24v DC**
Output Power: **60w**
Input Voltage: **90 to 264 VAC**
Frequency: **47 to 63 HZ**
Ambient Temp: **-30°C to +70°C**
Dimming: **Integrated Available**

60W	Max Run Length in Series	Max Run Lengths in Parallel
line .75 - SO	16'	20.5'
line .75 - MO	9'	11'
line .75 - HO and color	6'	7.5'
line 1.5 - SO	15'	19.5'
line 1.5 - MO	7.5'	10.5'
line 1.5 - HO	6'	7.5'
LEDge - SO	9'	11'
LEDge - HO	6'	7.5'
luxrail - SO	33'	41.5'
luxrail - HO and color	6'	7.5'
line 2.0 - SO	10.5'	10.5'
line 2.0 - HO	7.5'	7.5'
line 2.0 - VHO	4.5'	4.5'

277 NOT AVAILABLE
ENCLOSURE REQUIRED

20-Watt Driver

IO PART#: DR2ØOS



Note: For higher IP enclosure alternatives contact io Lighting for availability.

REMOTE DISTANCE

7'-0" (2.1m)	w/22AWG
18'-0" (5.5m)	w/18AWG
46'-0" (14m)	w/14AWG
71'-0" (21.6m)	w/12AWG

Key Features

- Small enclosure size
- Light weight, low profile
- Short circuit and overload protection
- Low power supply losses

Specifications

Location: **Dry**
Output Voltage: **24v DC**
Output Power: **20w**
Input Voltage: **120 to 240 VAC**
Frequency: **50 to 60 HZ**
Ambient Temp: **-20°C to +50°C**
Weight: **.21 lbs**
Dimming: **Yes w/ 250IOXFDIM**

20W	Max Run Length in Series	Max Run Lengths in Parallel
line .75 - SO	6.5'	6.5'
line .75 - MO	3.5'	3.5'
line .75 - HO and color	2.5'	2.5'
line 1.5 - SO	6'	6'
line 1.5 - MO	3'	3'
line 1.5 - HO	3'	3'
LEDge - SO	3.5'	3.5'
LEDge - HO	2.5'	2.5'
luxrail - SO	13'	13'
luxrail - HO and color	2.5'	2.5'
line 2.0 - SO	3'	3'
line 2.0 - HO	1.5'	1.5'
line 2.0 - VHO	1.5'	1.5'

277 NOT AVAILABLE

io Lighting 1100 Busch Pkwy Buffalo Grove, IL 60089 T 847.777.3900 F 847.777.3901 E info@iolighting.com W iolighting.com