



# Technical Report 1

Pennsylvania State Employees Credit Union Corporate Headquarters  
Harrisburg, PA

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## Executive Summary

Pennsylvania State Employees Credit Union (PSECU) Corporate Headquarters combines sustainability and modernity through design and materials. The variety of materials and textures across the building spaces provide interesting lighting opportunities. In redesigning the PSECU Corporate Headquarters, a theme of fluidity, transparency, and sustainability will be present in each of the redesigned spaces. The following report will analyze the existing conditions, design criteria, and current lighting design of four separate spaces, which include:

Large Work Space | Marketing Office

Special Purpose Space | Board Room

Circulation Space | Lobby

Outdoor Space | Building Façade and Entry Plaza

In order to analyze the four spaces, the Illuminating Engineering Society Lighting Handbook, Tenth Edition, ASHRAE Standard 90.1-2010 Edition, and LEED for New Construction Version 2.2 were consulted in order to find the technical requirements for each of the selected spaces. The design criteria were then analyzed to find how the criteria is incorporated into the current lighting design and how it will be incorporated into the redesigned lighting schemes.

In evaluating technical requirements for each space, only two of the four spaces met ASHRAE Standard 90.1 Power Density Requirements, though PSECU Corporate Headquarters is assumed to meet power density. This is a feasible assumption because the two spaces that exceeded power density are tradable spaces. In addition, the lighting conditions in the Marketing Office and Board Room were analyzed through AGI32 and found to exceed horizontal illuminance. Controls prevent any discomfort, but lowering the average horizontal illuminance will enhance the space through emphasizing sustainability.

Overall, the current lighting designs of the four spaces to be redesigned are aesthetically pleasing and technically based, though the possibility for improvements exist and will be addressed in the redesign.

## Table of Contents

Executive Summary.....	2
General Building Information .....	4
Primary Project Team.....	4
Large Work Space   Marketing Office.....	5
Existing Conditions .....	5
Design Criteria .....	10
Evaluation of Existing Conditions.....	13
Special Purpose Space   Board Room.....	16
Existing Conditions .....	16
Design Criteria .....	21
Evaluation of Existing Conditions.....	24
Circulation Space   Lobby.....	28
Existing Conditions .....	28
Design Criteria .....	38
Evaluation of Existing Conditions.....	41
Outdoor Space   Building Façade and Entry Plaza.....	42
Existing Conditions .....	42
Design Criteria .....	47
Evaluation of Existing Conditions.....	49
Overall Evaluation of Lighting Systems.....	50
Appendix A   LEED.....	51

## General Building Information

Location | Harrisburg, PA

Building occupant | Pennsylvania State Employee Credit Union

Type of building | mixed use

Size | 234,000 square feet + 1,000 square foot maintenance storage building

Number of stories above grade | three

Dates of construction | August 2011 – August 2013

Project delivery method | design-bid-build

## Primary Project Team

Owner | Pennsylvania State Employee Credit Union

Architect | Crabtree, Rohrbaugh & Associates Architects

Construction manager | Quandel Construction Services

Mechanical, Electrical, Plumbing Engineers | BALA Consulting Engineers

Fire Protection | Protection Engineering Group

Lighting | Grenald Waldron Associates

Structural Engineer | Centerpoint Engineering Inc

## Large Work Space | Marketing Office

The large work space to be redesigned is the Marketing Office due to its south facing orientation. The marketing department of the Pennsylvania State Employees Credit Union will occupy the space.

### Existing Conditions

#### Description

- Area: 5330 sq. ft.
- Length: 86 ft.
- Width: 67 ft.
- Ceiling Height: 10 ft.

Occupying the south facing side of the building and located on the third floor, the Marketing Office is a large open office space with high VDT and reading and writing usage. The south facing glass curtain wall provides views to the exterior while incorporating daylight penetration. Small offices line the western and eastern sides of the space. To the north of the space is the large corridor with common spaces.

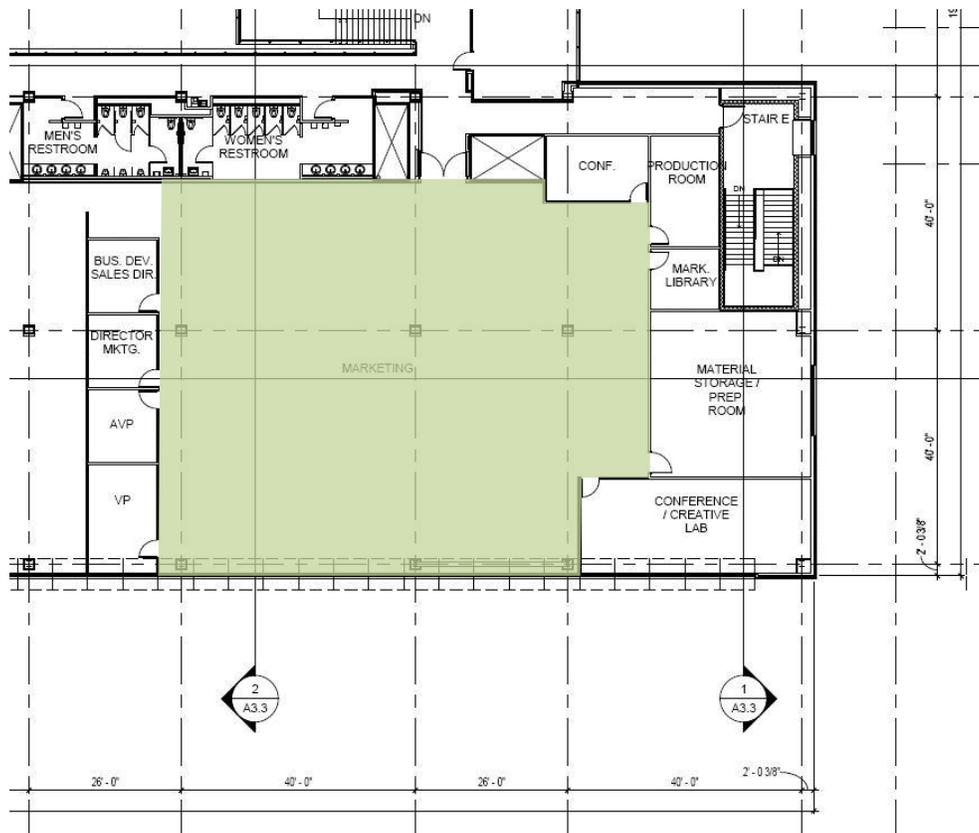
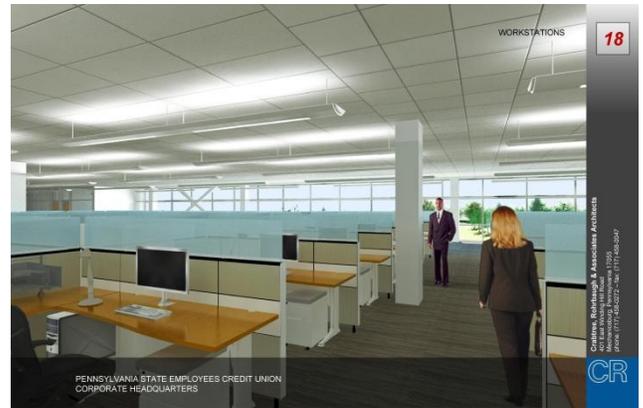


Figure 1: Marketing Office Floor Plan with coloring of proposed space

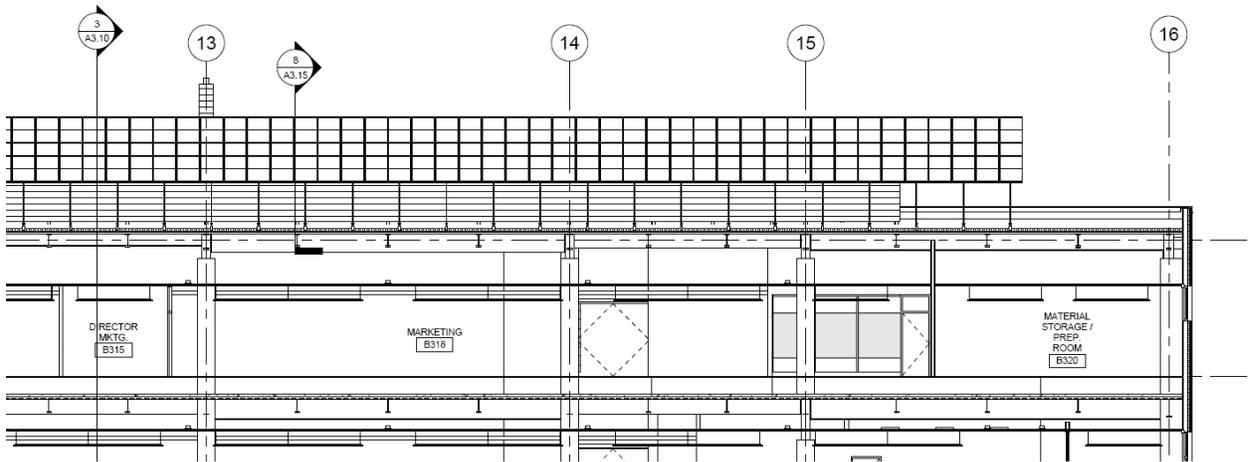


Figure 2: Marketing Office Section

*Open Office Material Finishes*

Glazing, overhangs on the exterior, a light shelf on the interior, and roller shades for further protection encompass the exterior materials of the space. The flooring is a combination of three different carpet types and the walls are painted gypsum wall board. 2X2 and 2X4 acoustical ceiling tiles are oriented in order to emphasize the cubicle area.

**Flooring**



Shaw Contract Laser Cut Illuminate Carpet Tile



Shaw Contract Blur Tile Illuminate Carpet Tile



Shaw Contract Illuminate Carpet Tile

<b>Glazing Schedule</b>						
<b>Type</b>	<b>Description</b>	<b>T<sub>vis</sub></b>	<b>R<sub>ext</sub></b>	<b>U<sub>w</sub></b>	<b>SC</b>	<b>SHGC</b>
IG-1	1" thick Insulating Vision Insulated Glass with Low E coating	0.7	0.11	0.32	0.43	0.37
IG-2	1" thick Insulating Vision Insulated Glass with Low E coating	0.35	0.07	0.32	0.31	0.27
SPANDREL	1" thick Insulating Spandrel Glass with Low E coating	0	0.07	0.33	0.31	0.23

<b>Finishes</b>				
<b>Type</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Color</b>	<b>Reflectance</b>
PNT	ProGreen 200 Low VOC Interior Latex Eg-Shel Deep Base	Sherwin Williams ProGreen 200 Low VOC	Flat White Egg Shell	0.85
CPT1	Laser Cut Illuminate Carpet Tile	Shaw Contract		0.35
CPT1	Blur Tile Illuminate Carpet Tile	Shaw Contract		0.35
CPT1	Illuminate Carpet Tile	Shaw Contract		0.35
	Office Cubicle	N.A.	N.A.	0.5
Light Shelf	36" Projected light shelf system	YKK AP Americas Inc. Thermashade	nonspecular aluminum finish	0.7
Roller Blinds	Motorized vertical roll-up window shade, 1% open	Draper, Inc.	off-white	0.5

<b>Ceiling Finishes</b>							
<b>Type</b>	<b>Ceiling Description</b>	<b>Color</b>	<b>Reflectance</b>	<b>NRC</b>	<b>Sound Transmission</b>	<b>AC</b>	<b>Thickness</b>
ACT3	2' x 4' Acoustical Ceiling Tile	White	0.85	0.75	35	170	7/8"
ACT2	2' x 2' Acoustical Ceiling Tile	White	0.89	0.75	35	170	3/4"

*Furnishings*

Thirty-three work stations are arranged in the center of the space with one designated as a Business Center. A second Business Center is located in the north eastern section of the space, which also consists of a copier, fax, printer, and base cabinets. The work stations have partial glass partitions. Wall furnishings include a 12 ft. x 4 ft. marker board and a 20 ft. x 4 ft. tack board. Both are mounted three feet above finished floor. Located in the south eastern section of the space is a Team Area with chairs and tables. Below is a Furniture Plan of the space.

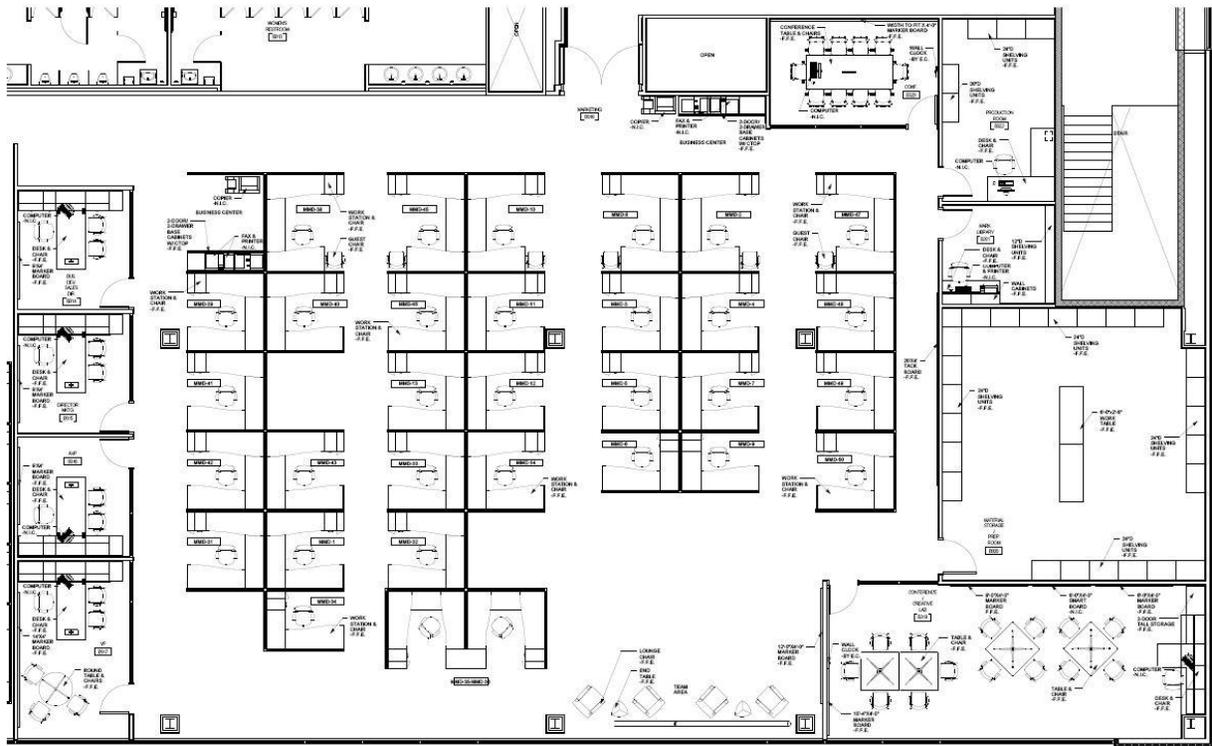


Figure 3: Marketing Office Furniture Plan

*Tasks*

Each workstation includes a u-shaped desk, a chair, and a computer. Desk work includes reading, writing, and heavy VDT usage. Although the cubicles will mainly emphasize individual work, work environments also focus on incorporating collaboration. Therefore, tasks such as reading faces should be considered in the design. Additionally, circulation will occur around and through the cubicles.

*Existing Lighting and Controls*

The Marketing Office lighting layout utilizes semi-indirect fluorescent pendant mounted fixtures along with LED downlights. Pathways are highlighted with downlights, while fluorescent pendants serve as task lighting. The semi-indirect pendants provide a general glow for the space, while also preventing glare issues. Refer to Fixture Schedule and Lighting Plans below to see the configuration. Lighting controls for the open office include both daylighting and occupancy sensors. In an open space, daylight harvesting will create a more pleasing environment for users.

Fixture Schedule							
Type	Description	Ballast	Manufacturer	Voltage	Lamp	Mounting	Remarks
DL3	4" Aperture, 1000 lumen LED downlight	Integral electronic driver	Lightolier-C4L10 Series	277V	20 Watt, 3500K, 80+ CRI	Recessed	
PF1	8' linear fluorescent	Integral electronic power supply	Finelite-S14 Series	277V	(2) 32 Watt T8, 3500K, 85 CRI	Pendant	Mount fixture 9' A.F.F.

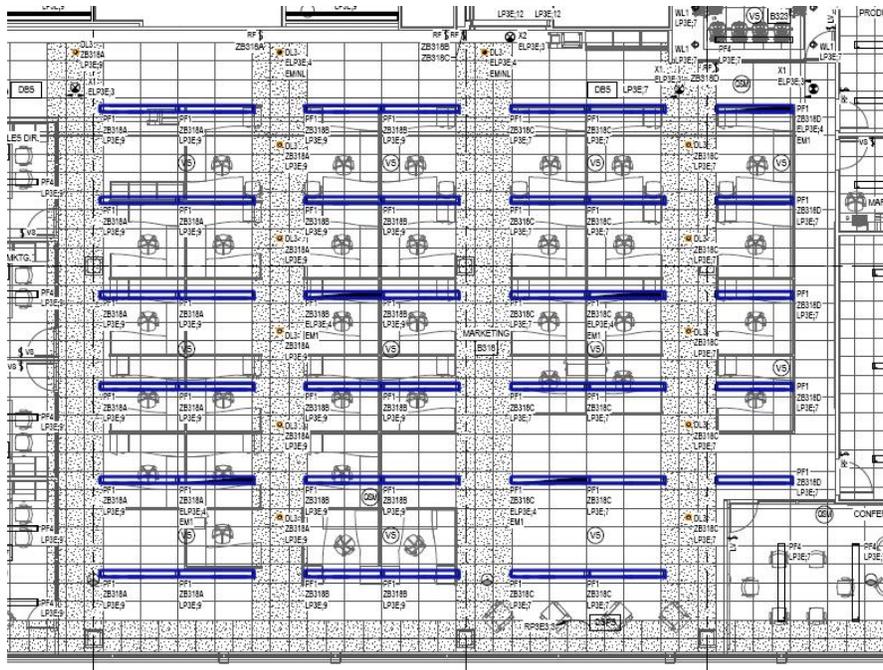


Figure 4: Marketing Office Reflected Ceiling Plan

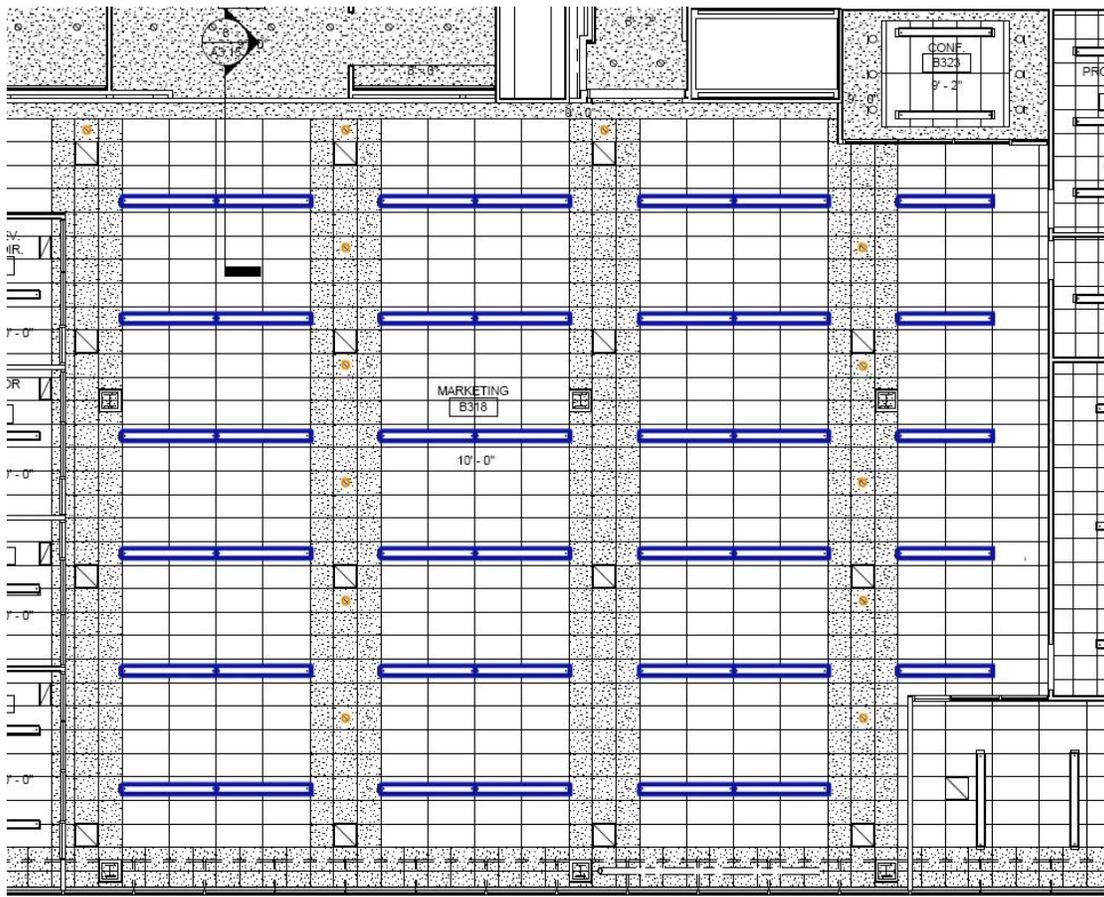


Figure 5: Marketing Office Enlarged Reflected Ceiling Plan

## Design Criteria

The design criteria below are an accumulation of Illuminating Engineering Society Lighting Handbook Tenth Edition, ASHRAE Standard 90.1-2010 Edition, and LEED for New Construction Version 2.2.

### ***Illuminating Engineering Society Design Criteria***

#### **Accent Opportunities - Important**

Accenting certain facets of the space will affect how employees perceive the brightness and it will offer visual relief. Through accenting other aspects other than the task plane, the workspace will be perceived as more comfortable. Task boards and the seating area should be highlight to attract users and help achieve tasks.

#### **Aesthetic Considerations - Important**

As a result of the card key access to the Marketing Open Office, the space will only be occupied with Marketing Department employees. Therefore, the space is not considered to need to be aesthetically appealing. Despite this, it is a place where employees will spend the majority of their day and therefore creating a comfortable environment through selecting appropriate luminaires, distributions, and optics are important considerations.

#### **Color Appearance and Color Contrast - Important**

VDT usage is the primary task of Marketing employees, but reading and writing will also occur. Therefore, color contrast must be integrated into the design. Color contrast and appearance emphasizes materials and surfaces. As a result of the Marketing Office facing south, good color rendering and cooler color temperatures should be incorporated in order to reduce any contrast between electric and daylight.

#### **Daylight Integration and Controls - Very Important**

The design of PSECU Corporate Headquarters is based around integrating daylight into the majority of the spaces, therefore designing conscious of daylighting penetration is necessary. As a result of the Marketing Office facing south, the design must consider direct sunlight and the implementation of shading and dimming. Currently, overhangs, light shelves, and roller blinds provide shading for the space. Implementing daylight dimming will create a comfortable environment through continuing to have good uniformity throughout the space. Shading will control the harsh sun beams, which will help to prevent any glare issues.

#### **Direct Glare - Very Important**

Minimizing glare allows for a more comfortable work environment. When VDT usage is high, such as with a work space, glare must be minimized in order to allow for users to perform tasks with little to no discomfort. Glare is created through too high or too low luminance ratios. Therefore, considering luminance ratios is important in order to minimize glare. Through carefully selecting high quality luminaires and distributions, direct view of the lamps are avoided and therefore direct glare is minimized.

#### **Flicker - Important**

Flicker can be distracting for employees, especially with high VDT usage within the space. In order to minimize this, electronic ballasts will be incorporated into the design.

**Light Distribution Across Task Plane – *Very Important***

Uniformity across the work plane for illuminance values is an important consideration because it can adversely affect the performance of tasks if uniformity is ignored. Integrating luminaires with a wider distribution and semi-indirect luminaires will allow increase uniformity and therefore enhance the design. In considering the walkways between cubicles and surrounding the cubicles, lower uniformity will not adversely affect the design.

**Luminances of Room surfaces – *Very Important***

Incorporating similar luminance levels between the ceiling, floor, and walls will decrease contrast and glare. A maximum luminance task to light source ratio for the Marketing office is 1:40 in order to maintain visual comfort.

**Maintenance – *Somewhat Important***

Accessibility and ease of maintenance of the luminaires is important in order to have a successful design. If a lamp burned out, maintenance must be able to easily change the lamp. If maintenance cannot easily change the lamp, the design can be altered due to shadows and low light levels in the area.

**Modeling of Faces - *Important***

Collaboration between employees is encouraged in an open office environment. Therefore good color rendering properties and surface materials should be considered in order to encourage collaboration.

**Psychological Impressions - *Important***

The Flynn Impression of public vs. private will be incorporated into the lighting design of the open office. Low light levels within the cubicles will create a private environment. Higher light levels in the surrounding spaces and walkways will create a public space, which will be the areas in which collaboration will occur. Additionally, higher light levels at the perimeters of the space will create the impression of spaciousness within the Marketing Office.

**Reflected Glare – *Very Important***

Reflected glare can create discomfort of the users while performing tasks. In order to minimize this, luminaire placement, luminaire distributions, and optics will be considered in the lighting design.

**Room Surface Characteristics - *Important***

Surface characteristics are important for the design because integrating higher reflectance values with low specularities will be more feasible to achieve the uniformity ratios than with high specular materials. Glazing is also important to consider due to its high specularities and as a result of the entire exterior wall being a glass curtain wall.

**Shadows - *Important***

To maintain uniformity on the work plane, shadows should be minimized. Shadows affect contrast ratios and make certain tasks difficult to complete.

### **Source-Task-Eye Geometry – *Very Important***

Source-task-eye geometry enhances task visibility. In order to incorporate this into the design, luminaires will be located away from the offending zone in order to enhance source-task-eye geometry and avoid veiling reflections.

### **System Flexibility and Controls - *Important***

Open offices must be flexible in order to rearrange the furniture layout. Therefore, the lighting must also be flexible if this were to happen.

Controls are an important criterion in order to create an energy efficient design. Occupancy sensors along with control of the lighting system in the space will reduce energy consumption and create a more feasible design.

### **Horizontal Illuminance – *Very Important***

CSA/ISO Types I and II: Negative Polarity: 150 lux

Horizontal Illuminance is the primary plane for the open office. It is very important in order for employees to perform tasks. The work plane surface is measured at a height of 2'-6". Not only should electric lighting be considered, but also a daylight harvesting system.

### **Vertical Illuminance –*Important***

CSA/ISO Types I and II: Negative Polarity: 50 lux

Vertical illuminance enhances task viewing flexibility and performing secondary tasks, such as collaboration. Therefore, lighting faces and other vertical surfaces is important in order to perform necessary tasks.

## ***ASHRAE Design Criteria***

Space-by-Space Method: Allowance: Open Office Plan: 0.98 W/sq.ft.

## ***LEED Design Criteria***

\*See Appendix A for complex listing of LEED credits

Credit 6.1      **Controllability of Systems, Lighting**

Credit 8.1      **Daylight & Views, Daylight 75% of Spaces**

Incorporating lighting controls, such as control panels, occupancy and vacancy sensors, and daylight harvesting sensors will reduce energy consumption and enhance occupant satisfaction through controlling light levels through dimming.

A glass curtain wall and skylights provide daylight to the space. This enhances occupant satisfaction through bringing the outside into the space. This is especially critical in work spaces where occupants are in the space for long periods of time.

## Lighting Proposal

In order to prevent glare while facilitating collaboration between employees, a task ambient system will be integrated. This type of lighting design reinforces the overall lighting theme of fluidity and transparency. Task lighting will allow users to have the impression of privacy through the task lighting being user operable and dimmable. Uplight will prevent glare and support the impression of a public space through higher remote light levels. Avoiding direct view into the lamp will also be considered in order to avoid glare and discomfort. Highlighting the peripheral will create a spacious environment, which can seem cluttered with cubicles.

Another important aspect of the redesign is to redesign the layout of cubicles. Currently, the cubicles are set far back from the glass curtain wall. Through decreasing this gap and through using higher reflectance materials near the curtain wall, daylight harvesting will be better incorporated into the space. Also, I will look into the aluminum overhang and light shelf system to see if aluminum is the best material and to test the successfulness of the design.

## Evaluation of Existing Conditions

Without incorporating daylight, AGI32 calculations were conducted in order to analyze the performance of the Marketing Office. A task plane height of 2'-6" was utilized.

Light Loss Factors (DL3)	
LLF	0.7

Reference: AE466

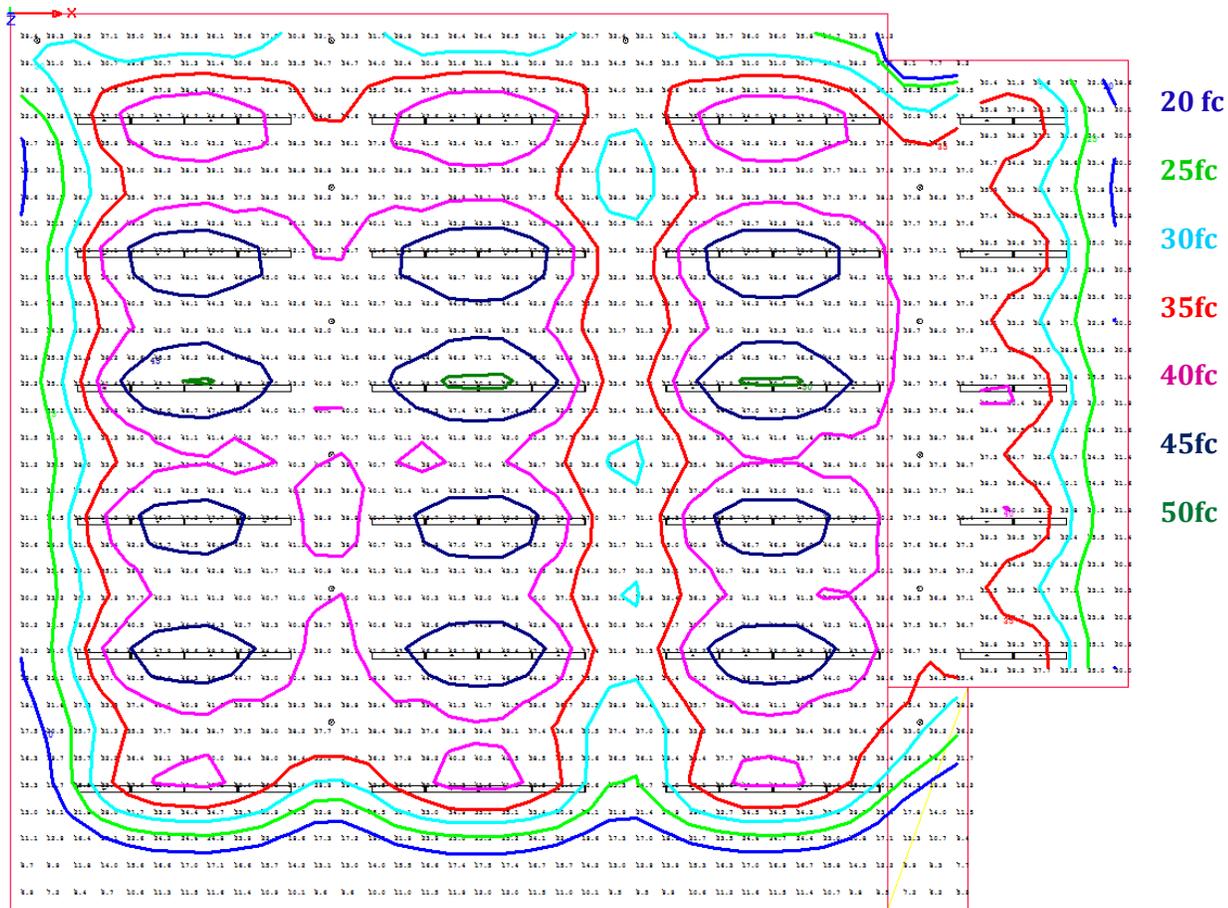
Light Loss Factors (PF1)	
<b>LDD</b>	0.9
Clean Environment	
Open/Unventilated	
Semi-Indirect	
12 month cleaning cycle	
<b>LLD</b>	0.94
Mean Lumens:	2915
Initial Lumens:	3100
<b>BF</b>	1.0
<b>Total LLF:</b>	0.85

Reference: Illuminating Engineering Society Lighting Handbook Tenth Edition

Open Office	
Average Illuminance	34.9 fc
Maximum Illuminance	49.8 fc
Minimum Illuminance	7.2 fc
Max/Avg	1.42
Coefficient of Variation	0.26
Actual Power Density	0.46 W/sq.ft.

When comparing the actual light output to that of the IES criteria for horizontal Illuminance, the actual horizontal Illuminance is extremely high. This could be due to PSECU design criteria and the owner’s desire to have higher light output. Despite the space using a much higher light output, the space is well under power density allowances. Therefore, the design is energy efficient. Glare will not be an issue in the space due to the semi-indirect distribution of the majority of the luminaires. Also, high color rendering is incorporated which will provide good skin color rendering and object rendering, along with help to facilitate collaboration. Daylight and occupancy sensors are integrated in order to use daylight harvesting and in order to save on energy usage. The maximum Illuminance to average Illuminance value is low, which verifies that the distribution of light across the task plane is highly uniform. Uniformity will also decrease shadows throughout the workspace, but shadows may appear on the walls due to the lack of peripheral lighting, which is undesirable. Therefore, the materials have low specularly and similar reflectances, which promotes good luminance ratios.

Overall, the design is successful in achieving both light levels and uniformity in order to facilitate a successful work environment.



The above isolines display the uniformity across the work plane. Higher horizontal Illuminance values are at the luminaires while lower horizontal illuminances are at the perimeter. Despite this variation, the space has good uniformity across the work plane.

As a result of the visibility of the space from the exterior of the building, the below renderings express the impression the space will give. Despite, the angle not being correct, the overall horizontal illuminance is quite uniform despite the hot spots due to semi-indirect distribution of the luminaires. Also, uniformity across the work plane is expressed through both the realistic and pseudo-color renderings.

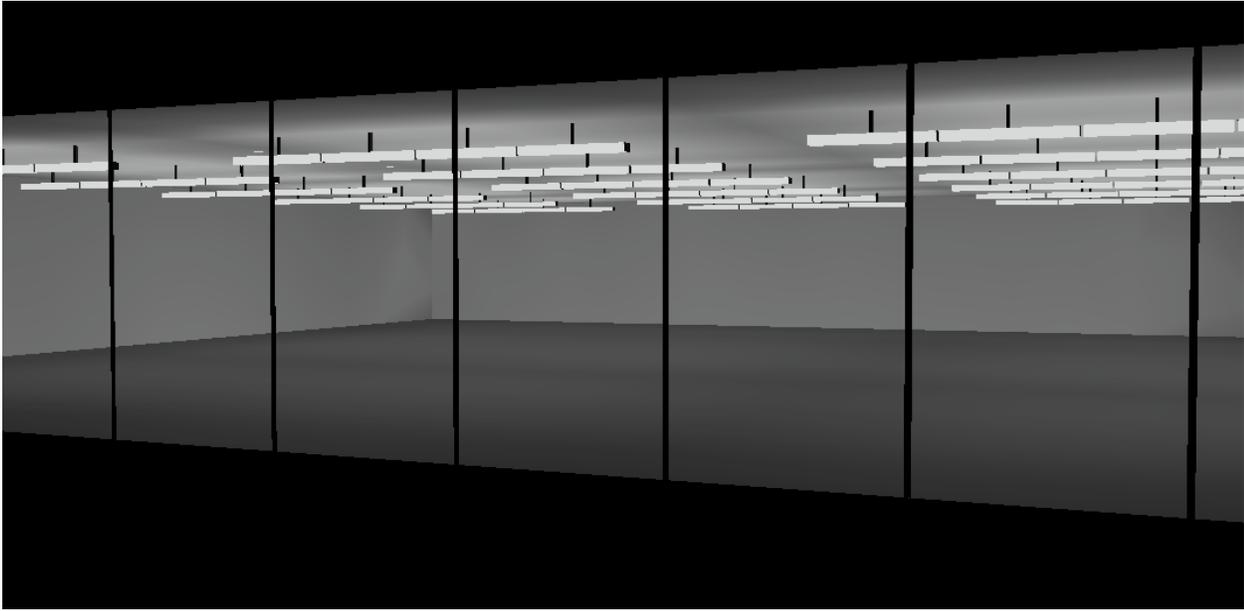


Figure 6: Marketing Office AGI32 Rendering

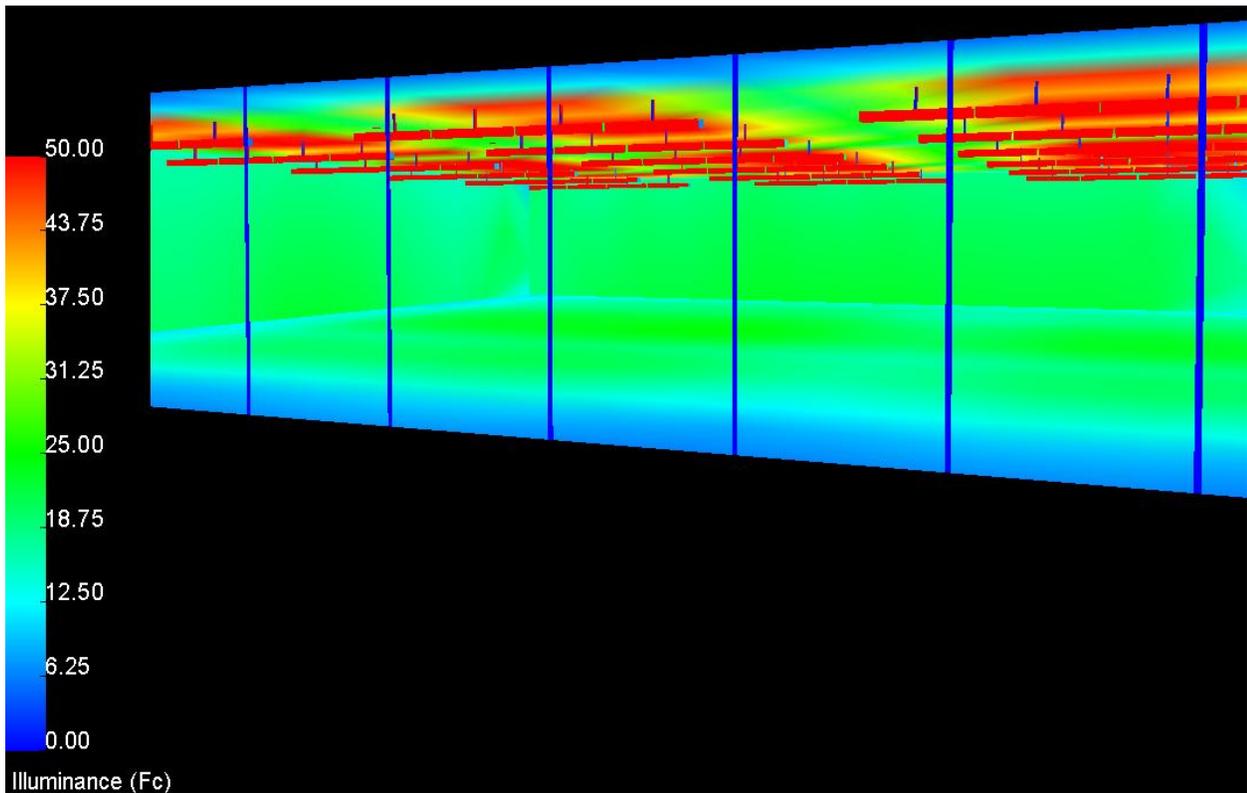


Figure 7: Marketing Office AGI32 Pseudo color Rendering

## Special Purpose Space | Board Room

Typical activities in the Board Room include conferences and meetings with the executives of PSECU. The Board Room is included in the Administrative Office where the Chief of Administration and President have their private offices.

### Existing Conditions

#### Description

- Area: 1485 sq. ft.
- Length: approximately 40'-7"
- Width: approximately 45'-0"
- Ceiling Height: 10'-8" and 12'

Located on the southwestern side of the building and on the third floor is the Board Room. In the Board Room, the cove mimics the shape of the conference table and adds drama and intensity to the space. A glass curtain wall looks out to the vegetative roof garden, which is accessible through the space. Walkways within the vegetative roof garden provide a space of tranquility, which contrasts the intense atmosphere of the Board Room. The large oval conference table is the centerpiece of the space and faces a marker board. From the administrative office there are two entry points, which include through the President's office and through the Administration office.

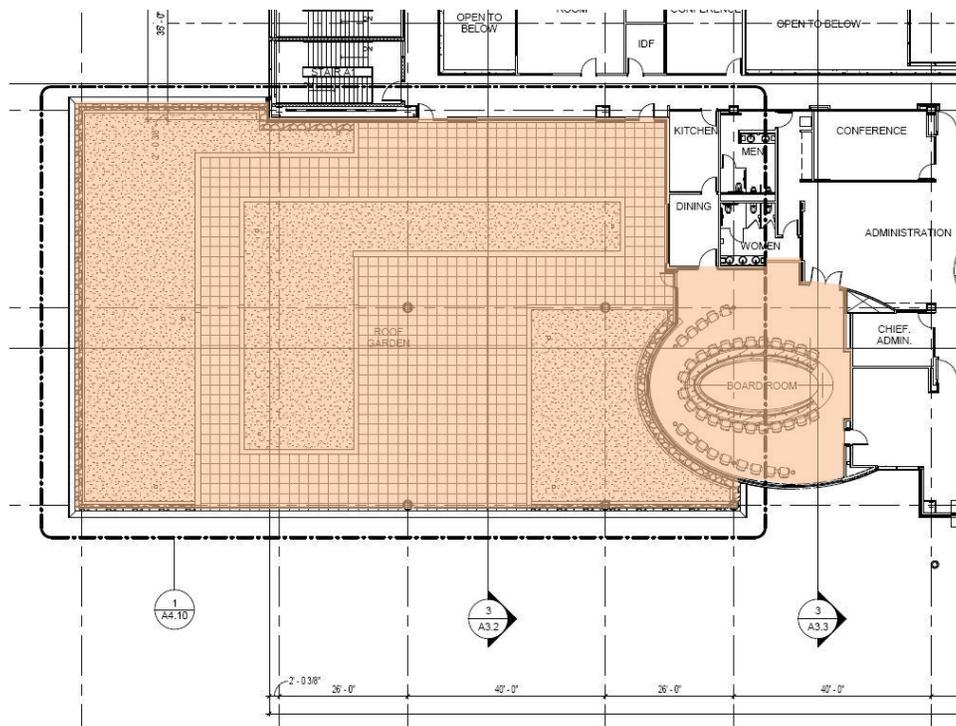


Figure 8: Board Room Floor Plan with coloring of proposed space

*Board Room Material Finishes*

Materials on the exterior of the space include a glass curtain wall. The ceiling consists of gypsum wall board and a 2' x 8' wood panel system. Gypsum wall board makes up the cove with a center strip of wood paneling through the center. Other than the outermost section of the Board Room, which is gypsum wall board, the majority of the 10'-8" ceiling is a wood panel ceiling system.

Flooring



Shaw Contract Hill Tribe Ashlar Weave Accent Carpet Tile

Wall finish



Maharam Abalone Textile Wall Covering



Maharam Barley Textile Wall Covering



Wood panels are beech steamed quartered with Eggers' Gardall finish

Ceiling Finish



Natural Beech Wood Ceiling System

<b>Type</b>	<b>Description</b>	<b>Color</b>	<b>Reflectance</b>
CPT3	Shaw Contract Hill Tribe Ashlar Weave Accent Carpet Tile	Ashlar Weave	0.25
TWC2	Maharam Abalone Textile Wall Covering	Abalone	0.5
	Maharam Barley Textile Wall Covering	Barley	0.3
WD	Beech steamed quartered with Eggers' Gardall finish Wood Panels	Beech	0.35
PNT	ProGreen 200 Low VOC Interior Latex Eg-Shel Deep Base	Flat White Egg Shell	0.85
WD2	Natural Beech Wood Ceiling System	Beech	0.35

Glazing Schedule						
Type	Description	T <sub>vis</sub>	R <sub>ext</sub>	U <sub>w</sub>	SC	SHGC
IG-2	1" thick Insulating Vision Insulated Glass with Low E coating	0.35	0.07	0.32	0.31	0.27

Ceiling Finishes								
Type	Description	Color	R	NRC	Sound Transmission	AC	Edge Detail	t
ACT2	2' x 2' Acoustical Ceiling Tile	White	0.89	0.75	35	170	tegular	3/4"

*Furnishings*

A large oval conference table is the focal point of the space. The Board Room seats 24 executives and the surrounding chairs seat 14 executives. The opening of the conference table faces a 10' x 4' marker board. On the northern side of the space are a wall clock, mailbox unit, and credenza. Most of the wall surface is glazing, therefore little wall furnishings are within the space.

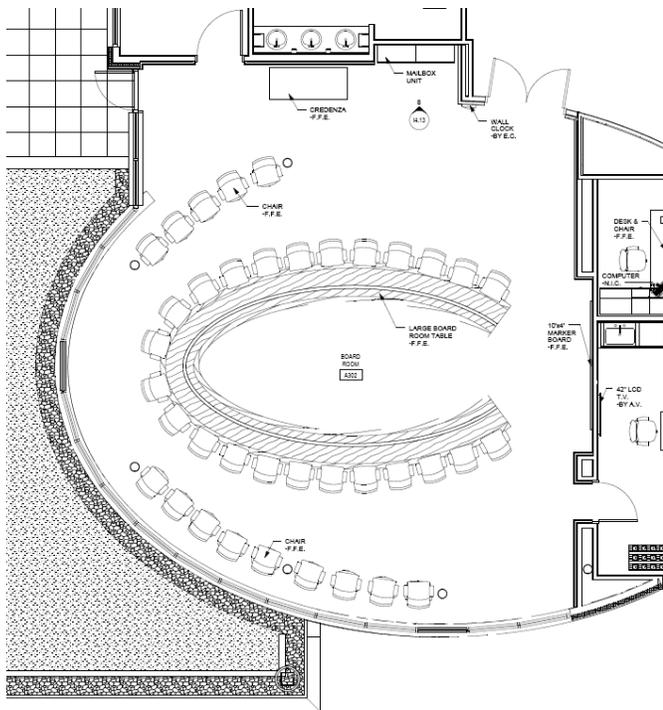


Figure 9: Board Room Furniture Plan

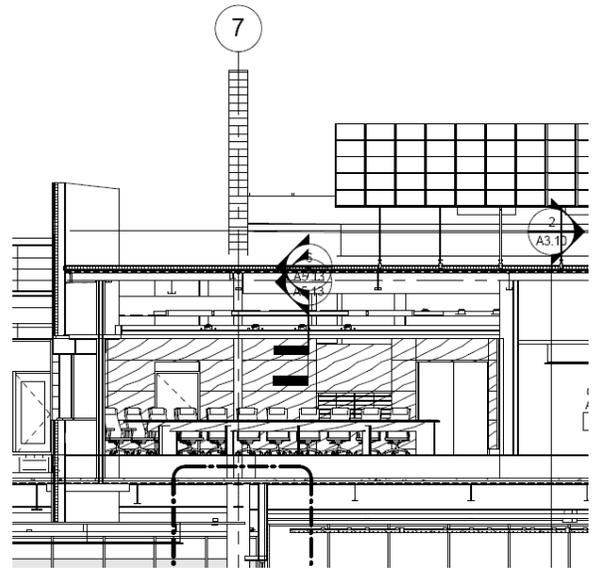


Figure 10: Board Room Section

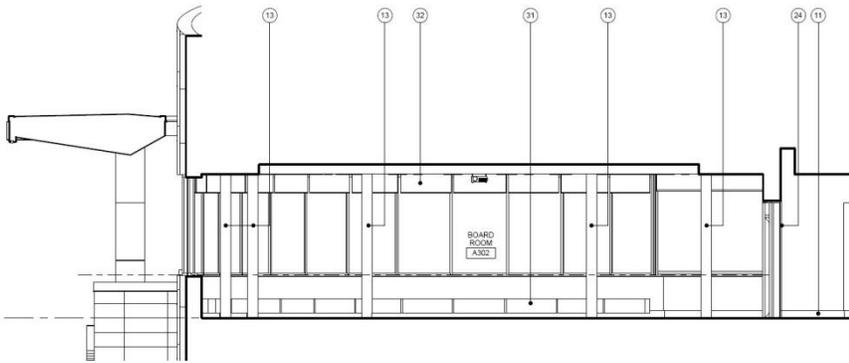


Figure 11: Board Room Exterior Elevation

### *Tasks*

The majority of the tasks involve a conference setting; therefore facial recognition and glare are very important. Tasks include reading, writing, video conferences, and dining. As a result of the differing types of tasks, many different types of design criteria must be considered, along with scene controls.

### *Existing Lighting and Controls*

The lighting design of the Board Room consists of downlights, along with fluorescent cove and wall wash fixtures. LED Downlights frame the space and conference table to provide facial recognition lighting. Fluorescent surface mounted cove fixtures provide a general glow and highlight the architectural feature of the Board Room. Along the dining room wall, fluorescent wall wash fixtures accent the wall and provide general lighting for the side space. Adjustable halogen downlights shape the conference table and highlight the center of the conference table in order to decrease contrast. Towards the marker board, adjustable halogen downlights accent and provide vertical illuminance on the board. Below is a schedule of the fixtures.

The controls for the Board Room include ceiling mounted vacancy sensors and a scene control device, which allows for five scenes for different types of meetings. Wireless daylight sensors dim under certain daylight conditions. I will explore the daylight sensors further in order to find how the daylight sensor will be calibrated.

<b>Fixture Schedule</b>						
<b>Type</b>	<b>Description</b>	<b>Ballast</b>	<b>Manufacturer</b>	<b>Voltage</b>	<b>Lamp</b>	<b>Mounting</b>
<b>AV1</b>	6" aperture adjustable accent with polished flange	Integral electronic control gear	Lightolier- C4 Series	277V	(1) 37 Watt MR16 Halogen, 85 CRI, 3500K	Recessed
<b>CL1</b>	LED white powder coat cove fixture	Integral electronic control gear	Color Kinetics- 523 Series	277V	13.5 Watt white LED array, 80+ CRI, 2700K	Surface Mount
<b>DL1</b>	6" aperture, 1500 lumen LED downlight with polished flange	Integral electronic control gear	Lightolier- C6L15 Series	277V	27 Watt white LED array, 3500K, 80+ CRI	Recessed
<b>DL5</b>	6" aperture, 2000 lumen LED downlight with polished flange and clear glass decorative ring	Integral electronic control gear	Lightolier- C6L15 Series	277V	39 Watt white LED array, 80+ CRI, 3500K	Recessed
<b>RM1</b>	Illuminating 13' column with translucent acrylic lens	Integral electronic control gear	Hess- SE4000 Series	277V	70 Watt Ceramic metal halide, 85 CRI, 3500K	Pad Mounted
<b>SC1</b>	Quarter Sphere Sconce with clear tempered glass lens	Integral electronic control gear	Gardco- 106EM Series	277V	(2) 32 Watt triple tube compact fluorescent, 3500K	Wall mounted
<b>SL2</b>	4' linear symmetric graze	Integral electronic transformer	Philips- eW Graze Powercore	277V	60 Watt LED array, 80+ CRI, 4000K	Wall mounted
<b>WF2</b>	White direct wall wash	Integral electronic control gear	Cooper Neoray- 79PF Series	277V	(1) 32 Watt T8 Fluorescent, 85 CRI, 3500K	Recessed

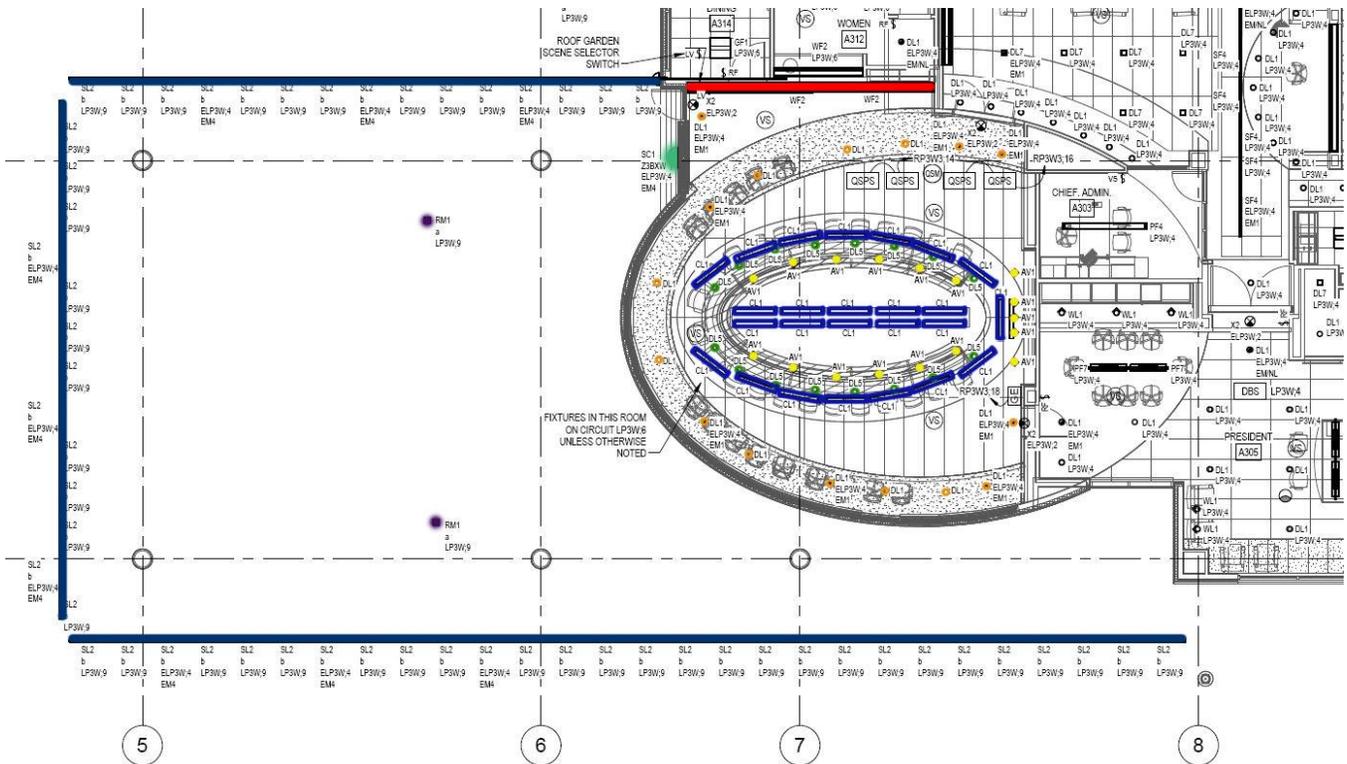


Figure 12: Board Room Reflected Ceiling Plan

**Design Criteria**

The design criteria below are an accumulation of Illuminating Engineering Society Lighting Handbook Tenth Edition, ASHRAE Standard 90.1-2010 Edition, and LEED for New Construction Version 2.2.

***Illuminating Engineering Society Design Criteria***

**Accent Opportunities - Important**

Accenting varies the perceived brightness of the space. It also brings attention to important aspects of the space. For example, the marker board is important to highlight, along with faces in order to bring attention to them.

**Aesthetic Considerations - Very Important**

Although the Board Room is a private conference space, aesthetics are extremely important due to the Board Room being the location where the executives meet. Fabric covers the majority of the walls, which adds texture and a cove mimics the conferences table to draw attention to the center of the space. Therefore, developing well designed lighting for the space is crucial. The lighting should enhance the architecture of the space while addressing the necessary tasks.

**Color Appearance and Color Contrast – *Very Important***

Due to communication between executives being the most important aspect of the space, color appearance and contrast is an essential aspect of the design. Warm color temperatures and good color rendering will enhance the space due to the deeper color tones of the materials throughout the space.

**Daylight Integration and Controls – *Very Important***

Daylight has an important function in the space due to the curtain wall onto the vegetative roof garden. Direct sun is shielded through a large overhang, but diffuse daylight will still penetrate the Board Room. Incorporating daylight dimming into the design will create a comfortable environment through continuing to have good uniformity throughout the space and preventing glare.

**Direct Glare - *Important***

Discomfort glare and disability glare should both be avoided in order to create a comfortable environment. Glare can have negative effects in spaces where reading and writing are essential. This can be achieved through minimizing the luminance ratios between fixtures and surfaces.

**Flicker - *Important***

Flicker is distracting and bothersome in situations where intense concentration is essential. Minimizing this through using electronic ballasts will enhance the overall appearance and impression of the space.

**Light Distribution Across Task Plane – *Very Important (on conference table), Somewhat Important (other areas)***

Uniformity is important criterion when tasks are primarily reading and writing. It is also important because seats are movable and therefore the exact location of furniture is not always known. Through incorporating luminaires with wide distributions and indirect fixtures allows for uniformity to be enhanced.

**Luminances of Room surfaces - *Important***

Incorporating similar luminance levels between the ceiling, floor, and walls will decrease contrast and glare. Incorporating the luminances of the room surfaces with daylight is important in order to avoid discomfort, such as the high specularities of glazing against a matte carpet.

**Maintenance – *Somewhat Important***

Maintaining the fixtures is important in order to continue the original lighting design. Ease of accessibility of the fixtures is important in order to allow for this to happen.

**Modeling of Faces – *Very Important***

Discussion is the primary task of the Board Room, thus modeling of faces is essential around the conference table and surrounding chairs. High color rendering properties are essential. It is less essential in the area surrounding the conference table due to it being mainly circulation space.

**Psychological Impressions - Important**

The impression of tension will be incorporated in order to facilitate the tense discussions and decisions that will occur in the Board Room. Visual clarity will also be incorporated through uniform light levels and brightness at the perimeter. Relaxation will enhance the appearance of the roof garden and create a contrast between spaces.

**Reflected Glare - Important**

Reflected glare can create discomfort of the users while performing tasks. In order to minimize this, luminaire placement, luminaire distributions, and optics will be considered in the lighting design.

**Room Surface Characteristics - Important**

Surface characteristics are important for the design because integrating higher reflectance values with low specularities will be more feasible to achieve the uniformity ratios than with high specular materials. Glazing is also important due to its high specularities.

**Shadows - Important**

Harsh shadows can be disabling when trying to read and write. Therefore, the lighting design must incorporate both lighting in front of faces and behind the conference table to minimize shadows, but lighting in front of the user must be done carefully as to not cause glare.

**Source-Task-Eye Geometry - Important**

Source-task-eye geometry enhances task visibility. In order to incorporate this into the design, luminaires will be located away from the offending zone. This will avoid any veiling reflections.

**System Flexibility and Controls - Very Important**

Moving furniture is unlikely in the space, but scene controls are necessary. Through scene controls different types of meetings will be feasible. For example, for meetings using the marker board, it can be highlighted with dimmed lights at the conference table. For meetings that are discussion based, higher light levels at the conference table and on faces will encourage discussion.

**Horizontal Illuminance - Very Important**

Conferencing: Meeting: Discourse: 300 lux

Achieving appropriate horizontal illuminance across the task plane allows for users to more successfully achieve tasks. It also provides walkway light. In considering the tasks to be performed in the Board Room, uniformity in the horizontal illuminance will be an important criterion. The work plane surface is measured at a height of 2'-6". Not only should electric lighting be considered, but also a daylight harvesting system.

**Vertical Illuminance - Very Important**

Conferencing: Meeting: White Boards: Analog or Digital Reading: 150 lux

Facial recognition is an extremely important aspect of the Board Room for presentations and discussion. Therefore, minimizing facial shadows and maintaining vertical brightness will allow for a more comfortable environment.

## ***ASHRAE Design Criteria***

Space-by-Space Method: Allowance: Conference/Meeting/Multipurpose: 1.23 W/sq.ft.

## ***LEED Design Criteria***

\*See Appendix A for complex listing of LEED credits

- Credit 6.1      **Controllability of Systems, Lighting**
- Credit 8.1      **Daylight & Views, Daylight 75% of Spaces**
- Credit 8.0      **Light Pollution Reduction**

Incorporating lighting controls, such as control panels, occupancy and vacancy sensors, and daylight harvesting sensors will reduce energy consumption and enhance occupant satisfaction through controlling light levels through dimming.

A glass curtain wall and skylights provide daylight to the space. This enhances occupant satisfaction through bringing the outside into the space. This is especially critical in work spaces where occupants are in the space for long periods of time.

Light pollution is extremely undesirable when designing for a LEED accredited building. Therefore, optics and distributions will be carefully selected in order to prevent uplight.

## ***Lighting Proposal***

In order to improve the current design, illuminance levels and the number of luminaires will be lowered. Fluidity and transparency will be incorporated through emphasizing the cove. Cove lighting will also prevent glare. Most of the drywall in the space is covered in fabric, which will be grazing to highlight it. The fabric if a darker color, so warmer colors will enhance its color.

As mentioned before, the psychological impression to be integrated into the design is tension. Therefore, emphasis will be primarily on the conference table with contrast to the surrounding areas. Uniformity of the task plane and vertical illuminance will allow users to complete the necessary tasks.

## **Evaluation of Existing Conditions**

<b>Light Loss Factors (AV1)</b>	
<b>LDD</b>	0.94
Clean Environment	
Open/Unventilated	
Direct: W	
12 month cleaning cycle	
<b>LLD</b>	0.88
<b>Total LLF:</b>	0.83

Reference: Illuminating Engineering Society Lighting Handbook Tenth Edition

<b>Light Loss Factors (DL1)</b>	
LLF	0.7

Reference: AE 466

<b>Light Loss Factors (DL5)</b>	
LLF	0.7

Reference: AE 466

<b>Light Loss Factors (WF2)</b>	
<b>LDD</b>	0.94
Clean Environment	
Open/Unventilated	
Direct	
12 month cleaning cycle	
<b>LLD</b>	0.94
Mean Lumens:	2820
Initial Lumens:	3000
<b>BF</b>	1.0
<b>Total LLF:</b>	0.88

Reference: Illuminating Engineering Society Lighting Handbook Tenth Edition

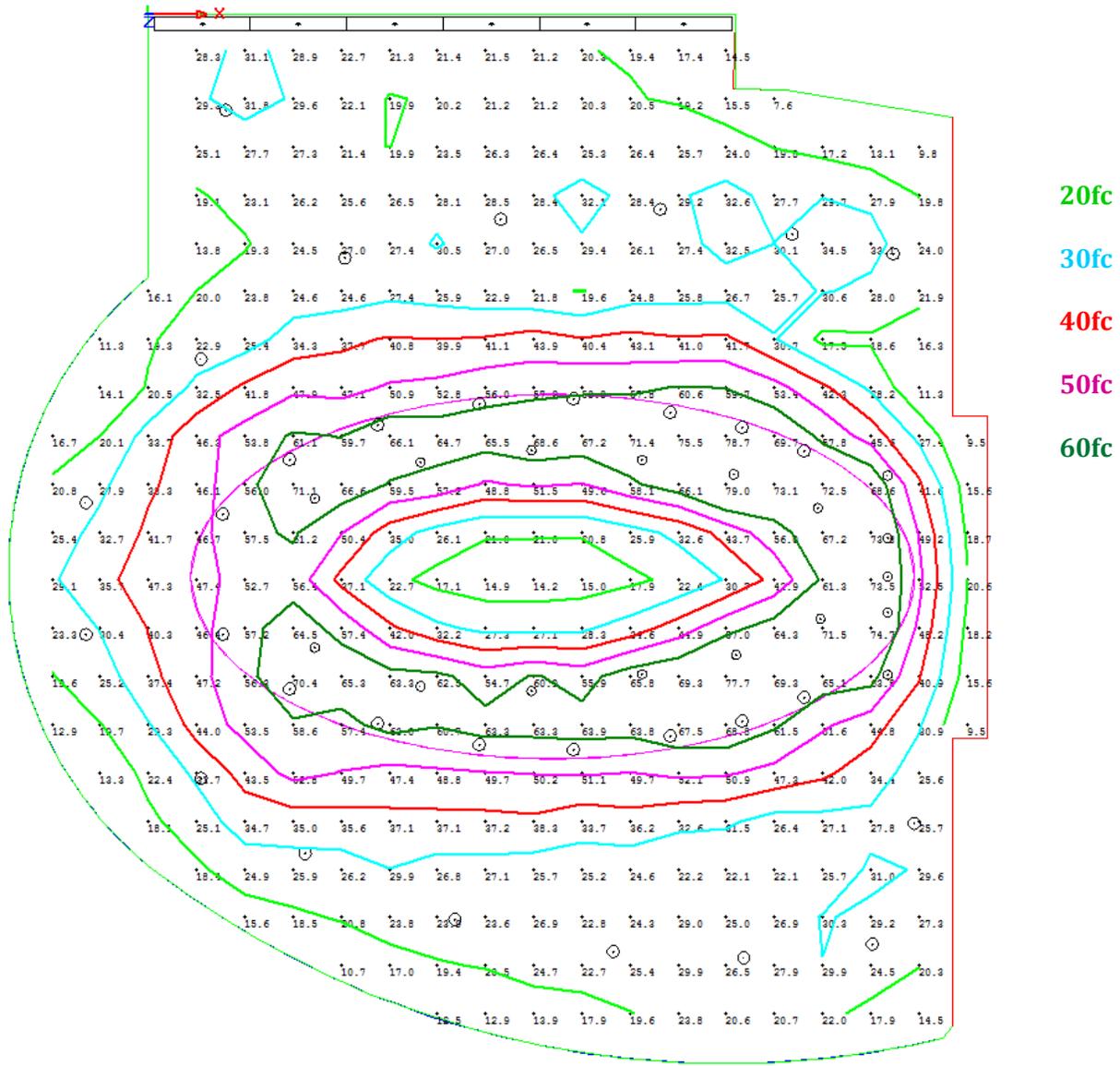
\*Other fixtures were not incorporated for simplicity purposes. Some are outdoor fixtures for roof garden and others are cove lighting.

<b>Board Room</b>	
Average Illuminance	35.7 fc
Maximum Illuminance	79.0 fc
Minimum Illuminance	7.6 fc
Max/Avg	2.21
Coefficient of Variation	0.48
Actual Power Density	1.42 W/sq.ft.

In considering the actual power density to the allowable power density, the space is well over the allowable requirement. Despite this, the building is assumed to meet ASHRAE Standard 90.1 because the Board Room is a tradable space. Also, as a result of the AGI32 calculations not incorporating the cove fixtures around the conference table, light levels would have been higher. The above horizontal illuminance is the average across the space. When considering the average horizontal illuminance across the conference table, the value will increase to 64 footcandles. Therefore, the amount of light within the space is extremely high.

The overall uniformity on the task plane is low with a maximum to average horizontal illuminance of 1.2 and a coefficient of variance of 0.11. Glare may be an issue in the space if the adjustable halogen fixtures are not aimed correctly. Also, due to the downlights adjacent to the curved glass curtain wall, reflected glare may occur. The downlights located between the users will provide good modeling of faces and the high color rendering indexes used in the space will promote the appearance of color and objects. As this is an important space with high end materials and finishes, high color rendering is critical. Highlighting these surfaces has been incorporated, which provides focal points to vary the light levels. Shadows are unlikely around the conference table, but some wall shadows and scalloping may occur. Scene controls will provide flexibility in the space, but to what extent is unknown.

Overall, the Board Room portrays a high end lighting scheme, but areas for improvement exist.



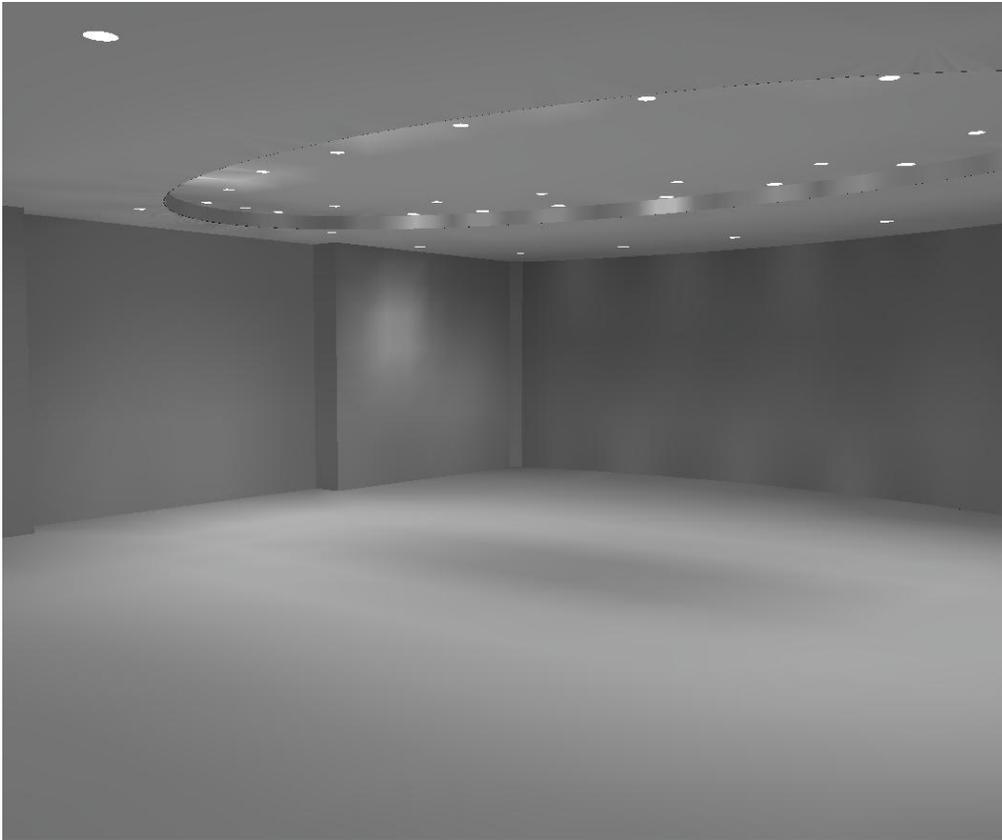


Figure 13: Board Room AGI32 Rendering

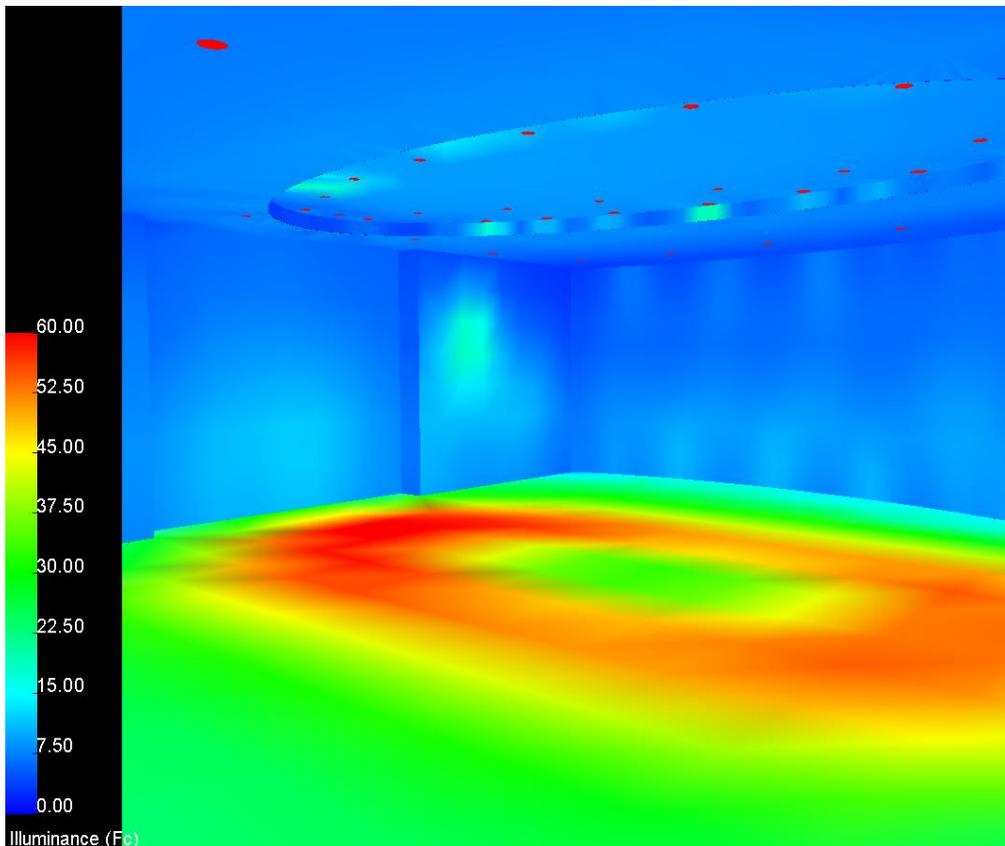
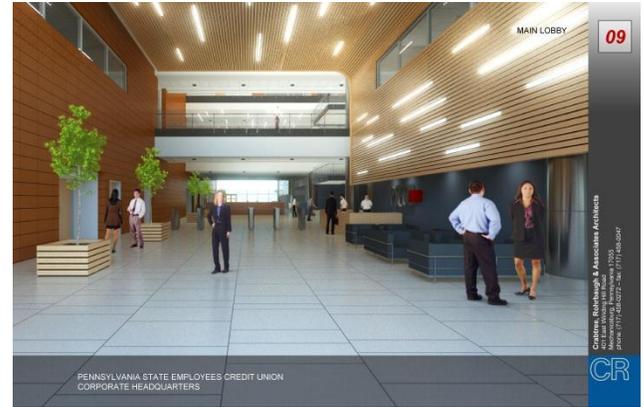


Figure 14: Board Room AGI32 Pseudo color Rendering

## Circulation Space | Lobby

Located in the center of the building and on the southern side is the lobby, which will be the circulation space to be redesigned. The lobby is the central entrance into the Pennsylvania State Employees Credit Union Corporate Headquarters. It consists of two lobbies, the outer and inner lobbies, which are divided through security turnstiles.



## Existing Conditions

The outer lobby is accessible by the public and includes the entrance to the daycare. Wood panels create a focal point for the space through framing the eastern wall and continuing along the ceiling. Focus is placed on this wall in order to direct patrons to the security desk area. Terracotta brick adds contrast to the space. Daylight enters the outer lobby through the glass walkway above the entry vestibule.

As employees enter the inner lobby, large skylights frame the ceiling, which allows for daylight penetration. A glass barrier separates the space from the cafeteria. From the inner lobby, employees can access the stairwells in order to enter the upper floors. A water feature, which is located beneath the stairwell, brings tranquility to this hectic circulation space. In order to access the stairwells and office spaces, employees must enter through additional security turnstiles.

### Description

Area: 4425 sq.ft.

Length: 101'-9"

Width: 38'11"

Outer Lobby Ceiling Height: 28'-6"

Wood Panels Ceiling Height: 26'-11"

Under Overpass Ceiling Height: 10'-0"

Vestibule Ceiling Height: 9'-11"

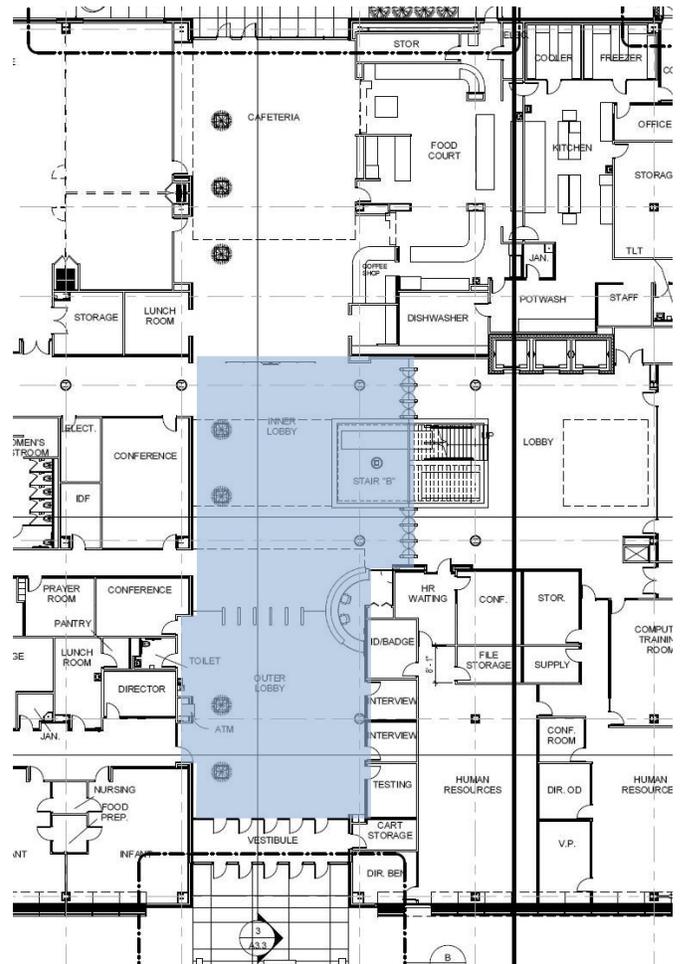


Figure 15: Lobby Floor Plan with coloring of proposed space

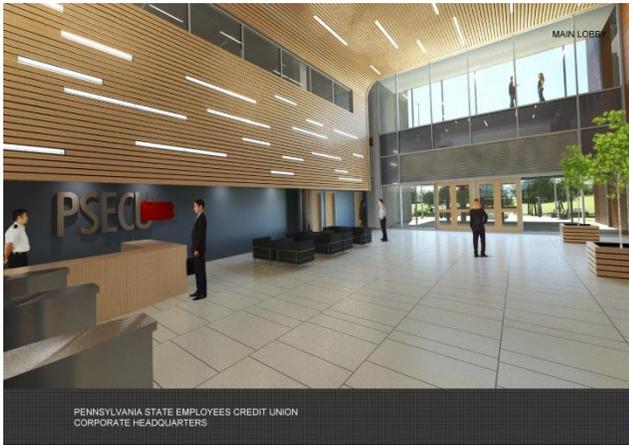


Figure 16: Outer Lobby Rendering of entrance



Figure 17: Inner Lobby Rendering



Figure 18: Inner Lobby Rendering of water feature



Figure 19: Building Section:  
\*Note Lobby is located at bottom right of top both section views

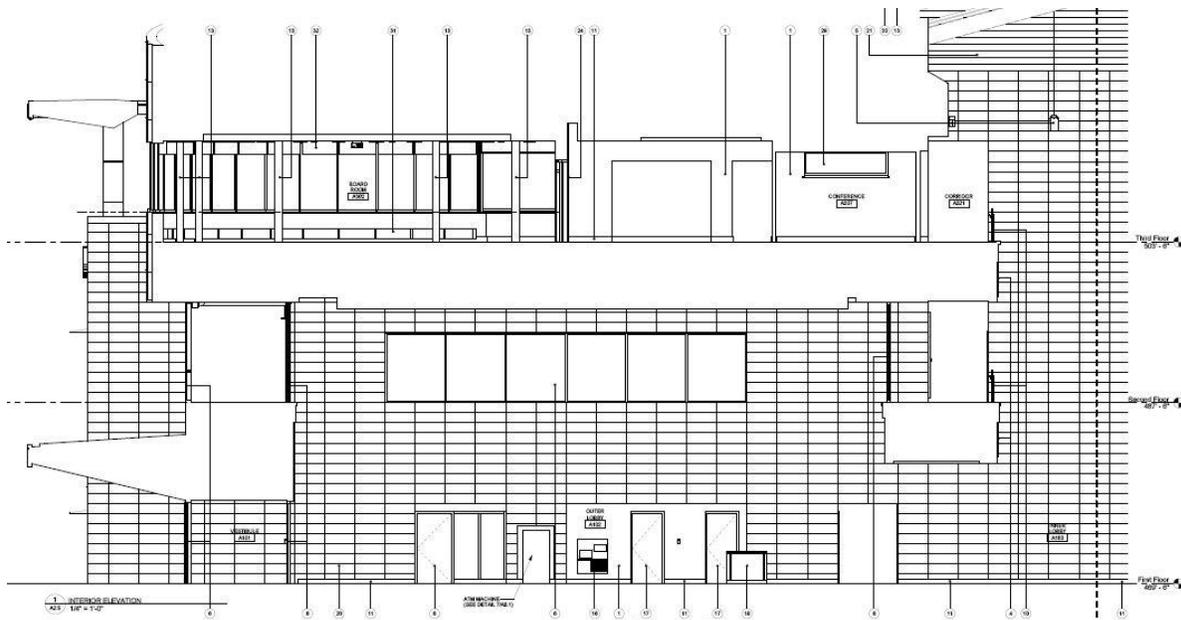


Figure 20: Outer Lobby Section facing west



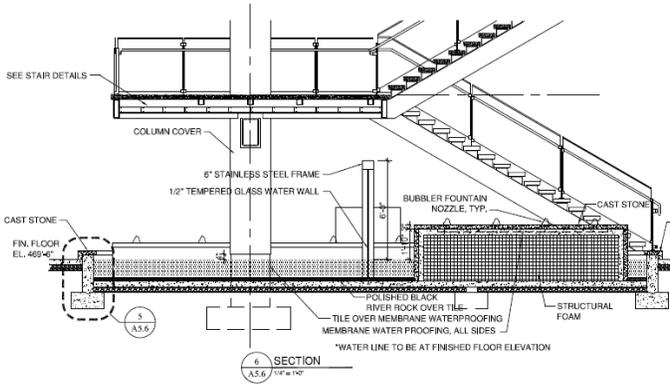


Figure 23: Section of Inner Lobby water feature

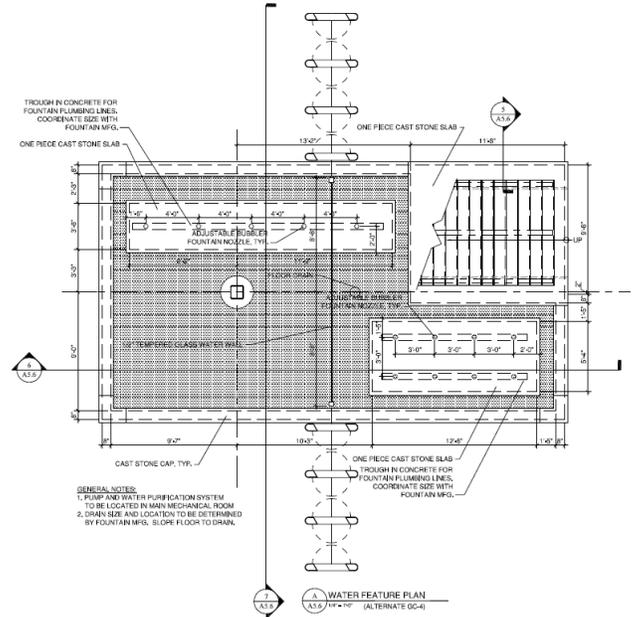


Figure 24: Plan of Inner Lobby water feature

*Lobby Material Finishes*

Lobby materials include wood panels, ceramic tiles, and terracotta brick tiles. The mixture of materials focuses the eye on different aspects of the space and directs employees through the lobby.

Flooring

-  Porcelain Anthracite Lappato Rettificato Ceramic Tile

The right image explains how the ceramic tile will define different spaces within the lobby.

-  Rubber-Tire Entrance Mat

Wall finishes

-  Terracotta Brick

-  Wood panels are beech steamed quartered with Eggers' Gardall finish

Ceiling finishes

-  Wood panels are beech steamed quartered with Eggers' Gardall finish

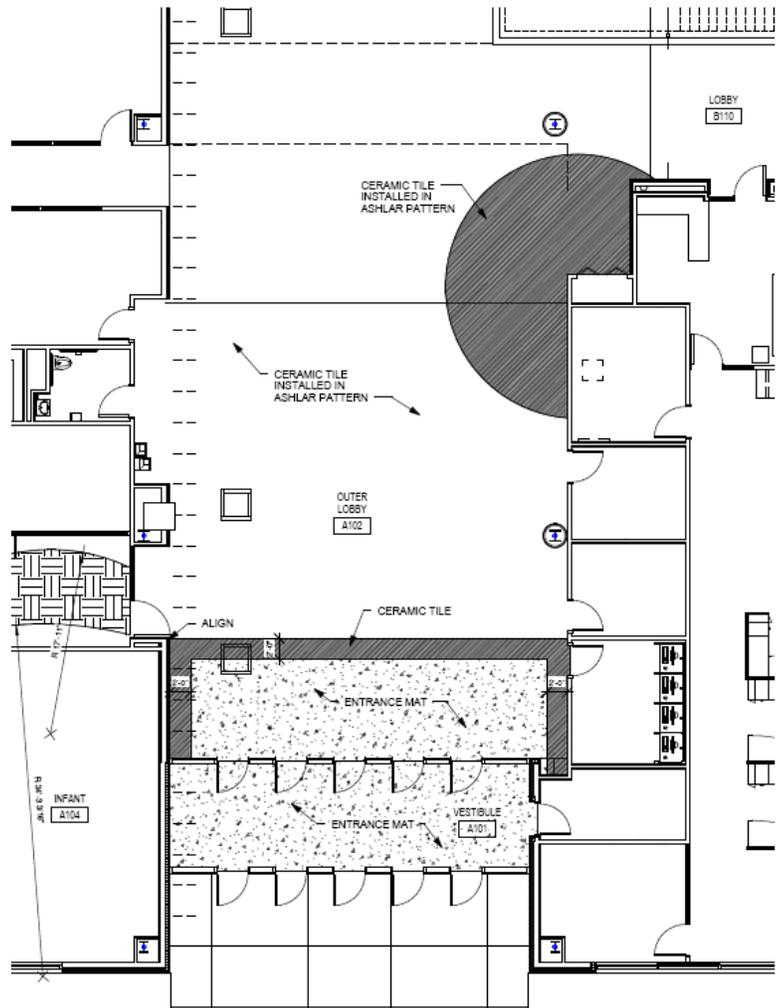


Figure 25: Floor Plan of Floor Finishes

<b>Floor Finishes</b>				
<b>Type</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Color</b>	<b>Reflectance</b>
EM1	Rubber-Tire Entrance Mat	American Floor Products Co.	Century Flooring	0.5
CT1	Porcelain Tile	Emil Silverstone	Anthracite Lappato Rettificato	0.7
CT2	Porcelain Tile	Emil Silverstone	Bianco Naturale Pettificato	0.7

<b>Wall Finishes</b>				
<b>Type</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Color</b>	<b>Reflectance</b>
BRK	Terracotta Brick	Terreal North America	Red Brick	0.15
WD	Beech steamed wood panels quartered with Eggers' Gardall finish	Armstrong World Industries, Inc.	Beech	0.26
PNT	Interior Latex Eg-Shel Deep Base	Sherwin Williams ProGreen 200 Low VOC	Dovetail	0.6

<b>Ceiling Finishes</b>				
<b>Type</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Color</b>	<b>Reflectance</b>
MTL	Smooth, flat finish aluminum panels	N.A.	Aluminum	0.7
WD1	Beech steamed wood panels quartered with Eggers' Gardall finish	Armstrong World Industries, Inc.	Beech	0.26
PNT	Interior Latex Eg-Shel Deep Base	Sherwin Williams ProGreen 200 Low VOC	Dovetail	0.6

<b>Glazing Schedule</b>						
<b>Type</b>	<b>Description</b>	<b>T<sub>vis</sub></b>	<b>R<sub>ext</sub></b>	<b>U<sub>w</sub></b>	<b>SC</b>	<b>SHGC</b>
IG-2	1" thick Insulating Vision Insulated Glass with Low E coating	0.35	0.07	0.32	0.31	0.27
LG-1	Laminated Insulated Glass	0.34	0.24	0.28	0.32	0.28
SPANDREL	1" thick Insulating Spandrel Glass with Low E coating	0	0.07	0.33	0.31	0.23

*Furnishings*

As a result of the space serving as the main circulation space, not many furnishings are within the space. A small seating area is located adjacent to the main desk. The curved main desk serves as an information and security area for patrons. Seating is also located behind the curved desk. Exposed steel columns surround the open stairwell.

*Tasks*

The main task in the lobby is circulation; therefore horizontal and vertical illuminances are both important factors. Another key feature of the lobby is it serves as the main security hub. Facial recognition will be important in order to recognize faces. Casual meetings will also occur in the space, which again requires modeling of faces. A small seating area is located next to the main desk, so reading will occur here. The space may also hold company parties and gatherings, so different lighting scenes will be important in the lobby.

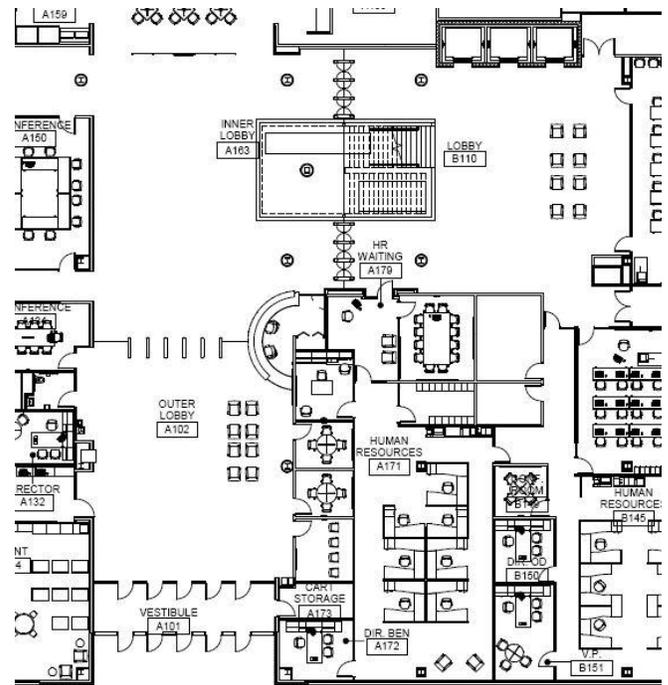


Figure 26: Furniture Plan of Outer and Inner Lobbies

*Existing Lighting and Controls*

Downlights provide general illuminance throughout the space, while adjustable downlights bring focus to the main desk back wall. But the main focal lighting is the fluorescent slot, which guides the patrons towards the security turnstiles. Ceramic metal halide pendants are mounted to the skylights in order to provide necessary light levels at night.

The lighting controls consist of ceiling and wall mounting occupancy sensors, along with a scene control device, which allows for five different scenes within the lobby. Wireless daylight sensors allow for daylight dimming. I will explore the daylight sensors further in order to find how the daylight sensor will be calibrated.

<b>Fixture Schedule</b>						
<b>Type</b>	<b>Description</b>	<b>Ballast</b>	<b>Manufacturer</b>	<b>Voltage</b>	<b>Lamp</b>	<b>Mounting</b>
AV1	6" aperture low voltage adjustable downlight with polished flange	Integral electronic control gear	Lightolier-C4 Series	277V	(1) 37 Watt MR16, 80+ CRI, 3500K	Recessed
DL1	6" aperture downlight with polished flange	Integral electronic transformer	Lightolier-C6 Series	277V	27 watt LED array, 80+ CRI, 3500K, 1500 lumen	Recessed
DL2	6" aperture downlight with polished flange, clear glass decorative ring	Integral electronic transformer	Lightolier-C6 Series	277V	27 watt LED array, 80+ CRI, 3500K, 1500 lumen	Recessed
DL5	6" aperture downlight with polished flange, clear glass decorative ring	Integral electronic transformer	Lightolier-C6 Series	277V	39 watt LED array, 80+ CRI, 3500K, 2000 lumen	Recessed
DL6	6" aperture downlight with polished flange	Integral electronic transformer	Lightolier-C6 Series	277V	27 watt LED array, 80+ CRI, 3500K, 1500 lumen	Recessed
PL1	Handblown, satin aluminum pendant with clear glass outer diffuser	Integral electronic transformer	Lightolier-PM02L Series	277V	20 Watt LED array, 80+ CRI, 3500K	Pendant
SF4	4" Narrow Slot with frosted acrylic lens	Integral electronic control gear	Focal Point-FAVB Series	277V	28 Watt, T5, 85 CRI, 3500K	Wall Mounted
SL4	5-7/8" ceramic metal halide cylinder with clear glass lens	Integral electronic transformer	Lightolier-C4CEX Series	277V	39 Watt ceramic metal halide, 85 CRI, 3500K	Wall Mounted
WL1	6" Aperture LED open wall wash with polished flange	Integral electronic transformer	Lightolier-C6 Series	277V	27 watt LED array, 80+ CRI, 3500K	Recessed

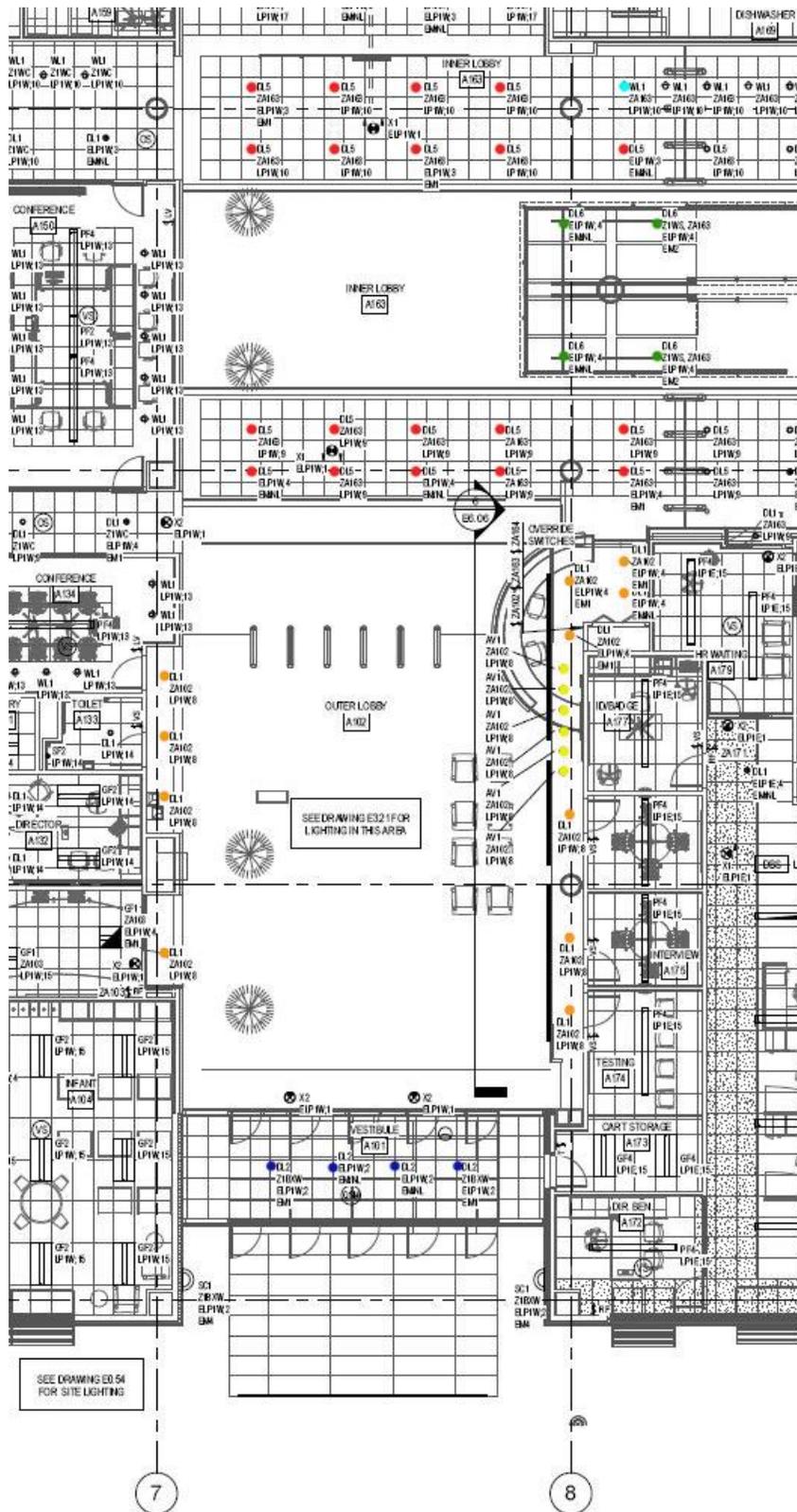


Figure 27: First Floor Reflected Ceiling Plan

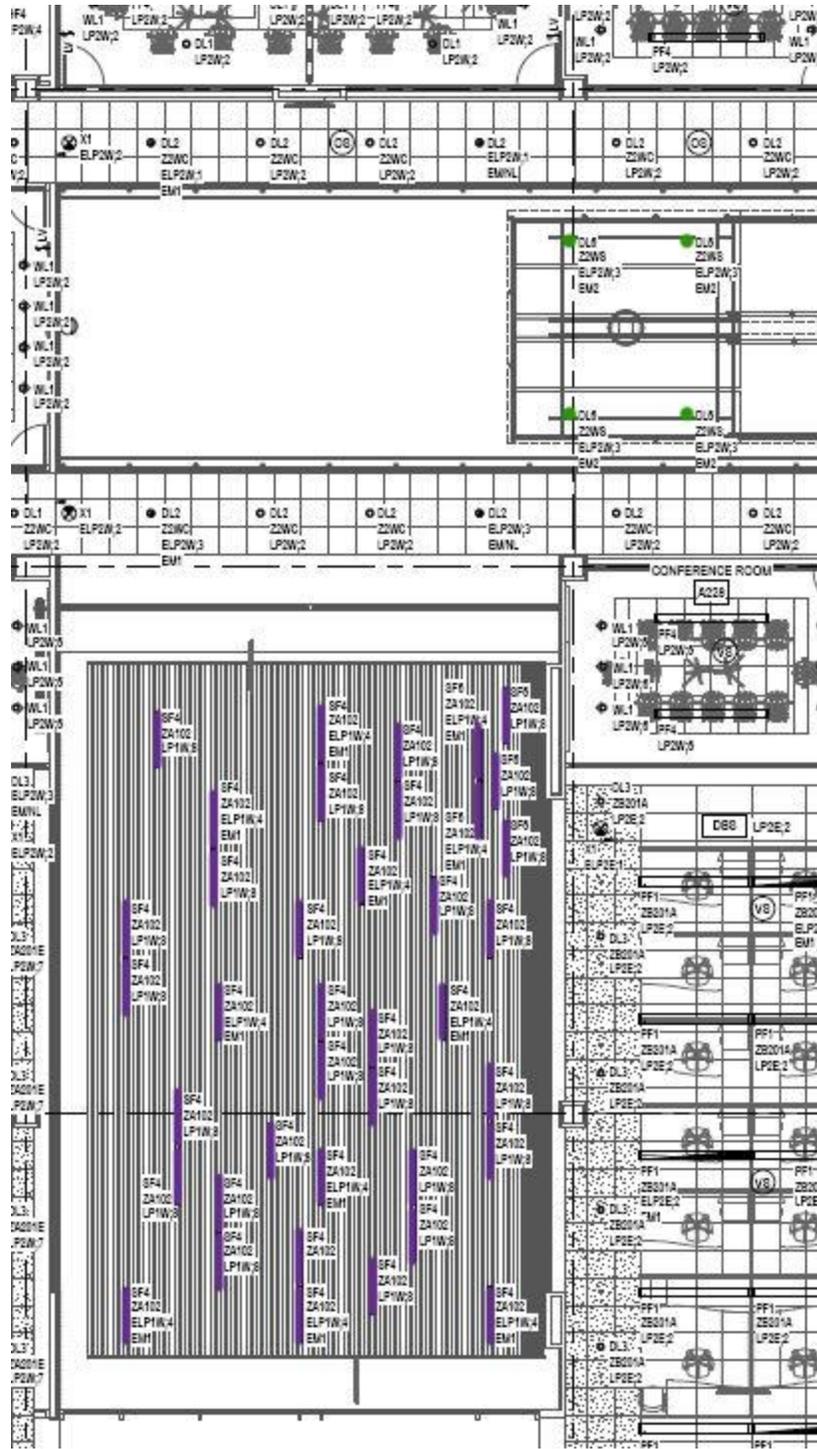


Figure 28: Second Floor Reflected Ceiling Plan

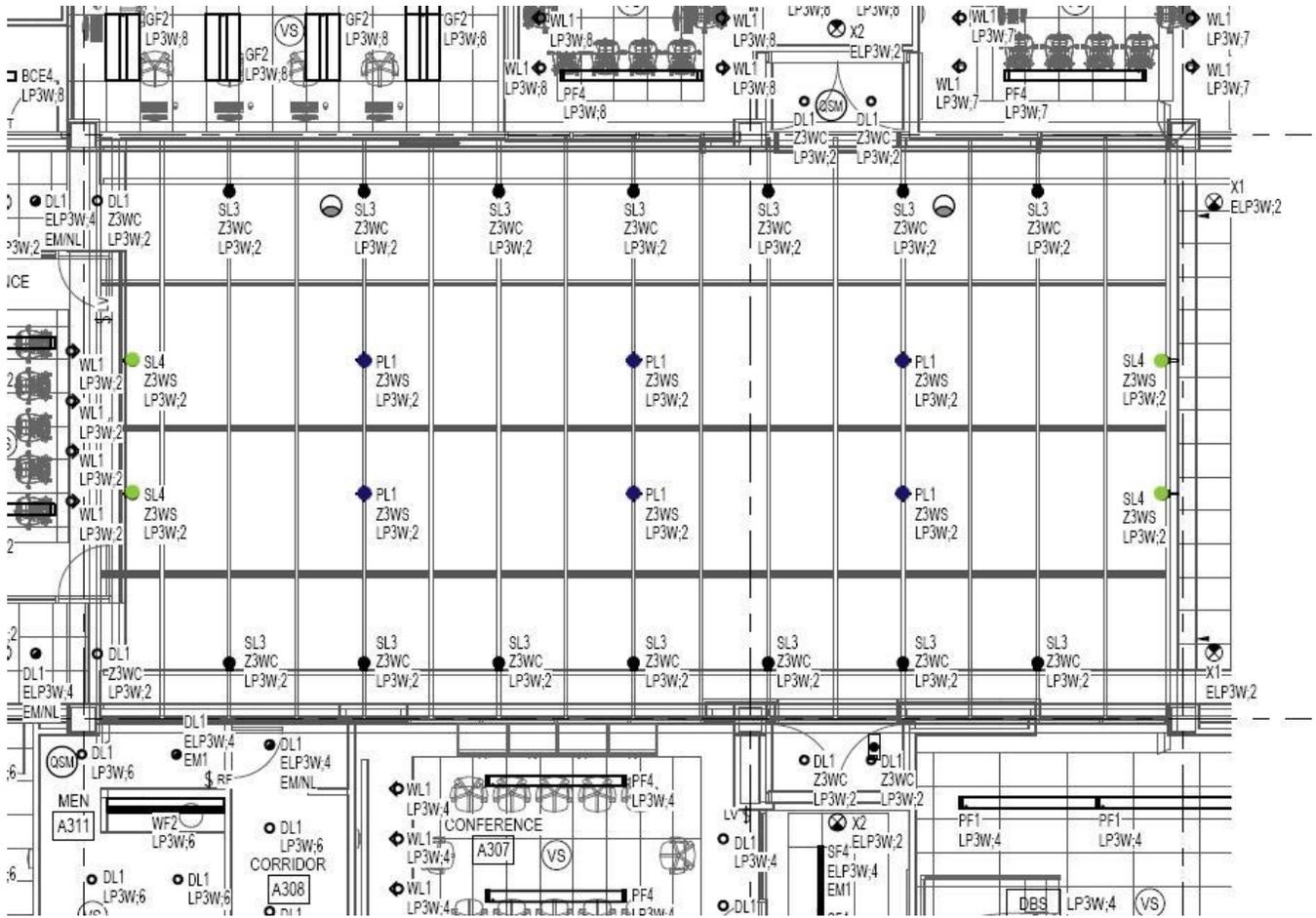


Figure 29: Third Floor Reflected Ceiling Plan of Skylight

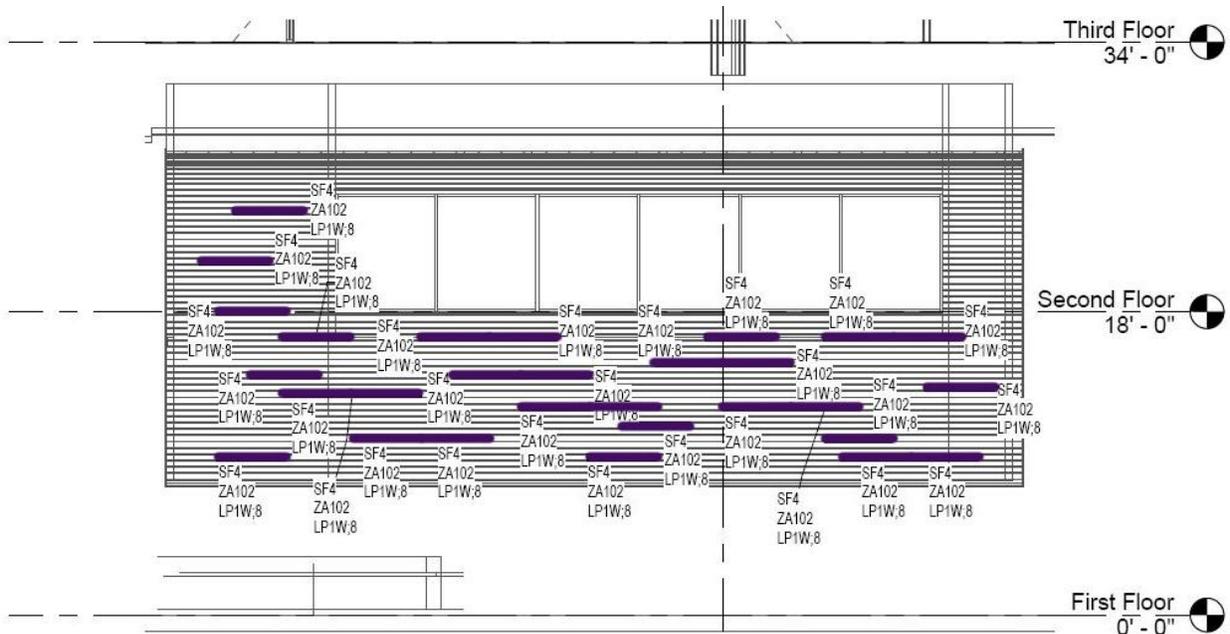


Figure 30: Outer Lobby Section facing west

## Design Criteria

The design criteria below are an accumulation of Illuminating Engineering Society Lighting Handbook Tenth Edition, ASHRAE Standard 90.1-2010 Edition, and LEED for New Construction Version 2.2.

### ***Illuminating Engineering Society Design Criteria***

#### **Accent Opportunities - Important**

Way finding can be enhanced through accenting different aspects of the space. It also highlights important aspects, such as signs and decorative detail. The PSECU sign should be highlighted along with the security desk.

#### **Aesthetic Considerations – Very Important**

The lobby is the main egress area within the building. It serves as both a welcoming and inhibitory space as a result of the security. Despite this the lobby should positively impact any anyone who enters the space. Therefore, luminaires should be out of site and if this is not feasible, luminaires should be decorative and high quality.

#### **Color Appearance and Color Contrast – Very Important**

As the main circulation space within the building, color appearance and contrast will enhance the overall design. Both a circulation and a meeting place, the lobby should have good color rendering properties. Facial recognition will also be important. Wood panels line the wall and ceiling of the outer lobby, which will also need good color rendering properties to appropriately show detail and color properties.

#### **Daylight Integration and Controls – Very Important**

Sloped skylights that line the ceiling of the inner lobby and a glass curtain wall at the building entry provide daylight penetration to the lobby spaces. Therefore, daylight integration is an extremely important criterion. Through integrating daylight sensors, potential energy savings are possible, which is a key design feature of the PSECU Corporate Headquarters. Harsh sun rays need to be considered for the skylights in order to prevent any discomfort.

#### **Direct Glare - Important**

Controlling glare from luminaires is essential in order to maintain user comfort. Through selecting luminaires with sufficient optics and minimizing the view of the lamp will allow this to be achievable.

#### **Flicker – Somewhat Important**

Flicker can be distracting and bothersome to users. This can be preventing through usage of electronic ballasts.

#### **Light Distribution Across Task Plane - Important**

Lobby spaces do not need an even light distribution across the work plane. Non-uniformity will be incorporated as a means of path finding. Peripheral light wall also be utilized in order to incorporate a spacious impression.

**Luminances of Room surfaces - Important**

To create focal points, luminance ratios will be incorporated. Through highlighting aspects of the design, higher luminance values can be achieved, which will enhance the overall design. Incorporating the luminances of the room surfaces with daylight is important in order to avoid discomfort.

**Maintenance – Somewhat Important**

In order to maintain the lighting design, accessibility is important. This will be more difficult in the lobby due to the high ceiling heights. Therefore, the inaccessibility of these fixtures will need to be considered in order to maintain the design.

**Modeling of Faces – Very Important**

As a security hub, facial recognition is extremely important. Good skin color rendering and appropriate vertical illuminances will allow this to be achievable. Also, as a meeting place, facial recognition is important. Minimizing facial shadows will facilitate the lobby as a meeting place.

**Psychological Impressions - Important**

Impression including public vs. private and spaciousness will be incorporated into the design. The impressions of public and spaciousness will be incorporated into the normal workday lighting design, while private will be used for company functions. The design will highlight the perimeter surfaces and integrate non-uniformity into the illuminance levels. Lower light levels and perimeter emphasis will create a private environment.

**Reflected Glare - Important**

Reflected glare is important to consider when specular materials, such as the wood panels and ceramic floor, are used within the space. Through controlling both the electric lighting and daylighting will be able to minimize glare.

**Room Surface Characteristics - Important**

The lobby is the first impression of the building. Glass, wood panels, terracotta brick, and other specular materials are incorporated to present a high end impression. Through incorporating both specular and semi-specular materials in the space, light must be well controlled in order to minimize glare and reflections.

**Shadows – Somewhat Important**

Minimizing shadows on the walls and floor will enhance the impression of spaciousness. Also, through the use of wide distribution luminaires and well-spaced luminaires, shadows can be diminished.

**System Flexibility and Controls - Important**

Though little furniture is within the lobby, flexibility is critical. If the space were to be used as a venue for a company function, flexibility will be critical. Also, flexibility in the lighting is important in order to light under different situations. Scene controls will be incorporated for this effect.

**Horizontal Illuminance – Important**

Lobbies: Circulation: Day: 100 lux

Lobbies: Circulation: Night: 50 lux

Horizontal illuminance is important for circulation throughout the space. It can also create focus on certain aspects of the space, such as the security desk and security turnstiles.

**Vertical Illuminance - Important**

Lobbies: Circulation: Day: 50 lux

Lobbies: Circulation: Night: 20 lux

Highlighting the peripheral materials is through vertical illuminance. In order to highlight these aspects, higher vertical illuminances than IES recommends will be utilized.

***ASHRAE Design Criteria***

Space-by-Space Method: Allowance: Lobby: For Elevator: 0.64 W/sq.ft.

***LEED Design Criteria***

\*See Appendix A for complex listing of LEED credits

Credit 6.1      **Controllability of Systems, Lighting**

Credit 8.1      **Daylight & Views, Daylight 75% of Spaces**

Incorporating lighting controls, such as control panels, occupancy and vacancy sensors, and daylight harvesting sensors will reduce energy consumption and enhance occupant satisfaction through controlling light levels through dimming.

A glass curtain wall and skylights provide daylight to the space. This enhances occupant satisfaction through bringing the outside into the space.

***Lighting Proposal***

For Technical Report Three, three schematic designs will be developed for the Lobby. As with the other lighting designs, the overall theme of integration, fluidity, and transparency will again be integrated. As part of the design, I will look into the possibility to remove the strip of glazing through the wood panels and terracotta tile because through breaking these materials, fluidity is diminished. The three proposed schematic designs are the following:

Incorporate a ledge at the bottom of the wall of wood panels and graze the panels upward.

Uplighting the ceiling wood tiles will also be incorporated to further highlight the panels. This will either be a separate fixture or a wide distribution graze fixture.

Within the wood panels, longer slots of fluorescent lighting will decrease the cluttering of the wall and ceiling wood panel systems. I will also look into randomly placing smaller windows where they are now located. This may require structural analysis. The randomness of the windows will appear more consistent with random slots of light.

Redesigning the horizontal wood panels into a pattern of horizontally and vertically oriented wood

Sarah Wujcik | Lighting + Electrical | Faculty Advisor: Dr. Houser | Technical Report 1 | 9.23.11

panels. Using fluorescent slots to vary the eye and draw it both upward and horizontally as a means of way finding.

The focal point of the Inner Lobby is the skylights where additional lighting may not be needed during the day. Three schematic designs incorporated into the Outer Lobby schematic designs include the following:

I will look into the feasibility of placing a narrow and shallow cove on the underside of the overpass walkways. Through doing so, the area will focus more on ambient light than highlighting certain aspects to continue to highlight the skylights.

Place a small slot at the edges of the walkway in a random pattern to continue with the Outer Lobby design.

Wash the inner section of the overpasses to highlight the edges of the space subtly and also providing necessary light levels within the lobby.

All sources must be dimmable in the Lobby in order to implement daylight harvesting.

## Evaluation of Existing Conditions

Actual Power Density: 0.81 W/sq.ft.

Allowable Power Density: 0.64 W/sq.ft.

As you enter the outer lobby, the fluorescent slots within the wood panels create a unique impression of the space, which enhances the overall impression of the space. A frosted lens on the fluorescent slots prevents glare and creates ambient light for the space. Rendering qualities are extremely important in the space due to the use of high end materials. This is addressed through the use of high color rendering indexes. The color rendering also helps to promote modeling of faces, which is extremely important for security. Also, accent lights are added to the security desk in order to make facial recognition achievable. One aspect that is not highlighted is the terracotta tile, though it does provide a good contrast to the lighter wood panels. Large windows cut through the wood panels and terracotta tile, which negatively impact the fluidity of the design, though this may be necessary for LEED daylighting criteria.

Through hiding the glass curtain wall behind an overpass, it is a hidden surprise to the design, which provides diffuse daylight.

The overpass divides the outer and inner lobbies, which negatively impacts the fluidity of the spaces.

As the users enter the inner lobby, the atrium to the skylights creates the impression of spaciousness. Daylight harvesting is extremely important in this area although no daylight sensors are located in the corridors above. The inner lobby has little electrical lighting as a result of the vast daylight system. Some pendants are mounted to the skylight system, which could be improved. Overall, the space mainly incorporates downlights for circulation. Daylight in the space could create harsh shadows at certain times of the day, which is not addresses through daylight sensors.

Another important aspect to consider is the power density, which exceeds the allowable power density. The Lobby is a tradable space, therefore the PSECU Corporate Headquarters is assumed to meet ASHRAE Standard 90.1.

Overall, the space incorporates openness and fluidity, although improvements to the space are possible.

## Outdoor Space | Building Façade and Entry Plaza

Located on the southern facing side of the building, the façade is the key feature of the architectural design of the PSECU Corporate Headquarters. As a result of it being the primary means of egress, the entry area should be an important focal point.

### Existing Conditions

#### Description

Façade:  
 Length: 513'-0"  
 Height: 64'-0"

Entrance Plaza:  
 Length: 85'-0"  
 Width: 40'-0"  
 Area: 3400 sq.ft.

The main feature of the façade, incorporates curved metal panels, glass curtain walls, and overhangs to highlight the entry. The façade incorporates a vast amount of glazing, which adds an element of transparency to PSECU Corporate Headquarters. As employees approach the entrance, attention is drawn to the water feature, which brings tranquility to the space. Benches entice passerbyers to relax before the hectic workday. Highlighting the entrance is a large glass curtain wall with curved metal panels, which incorporates transparency into its design. Overhangs serve both a functional and architectural purpose through shielding the workspaces from harsh sun angles and adding a three-dimensionality to the façade. A large overhang shields the entrance curtain wall and serves as an architectural feature through its continuation down the building. Overall, the modern façade draws patrons in through its tranquil and transparent impression.

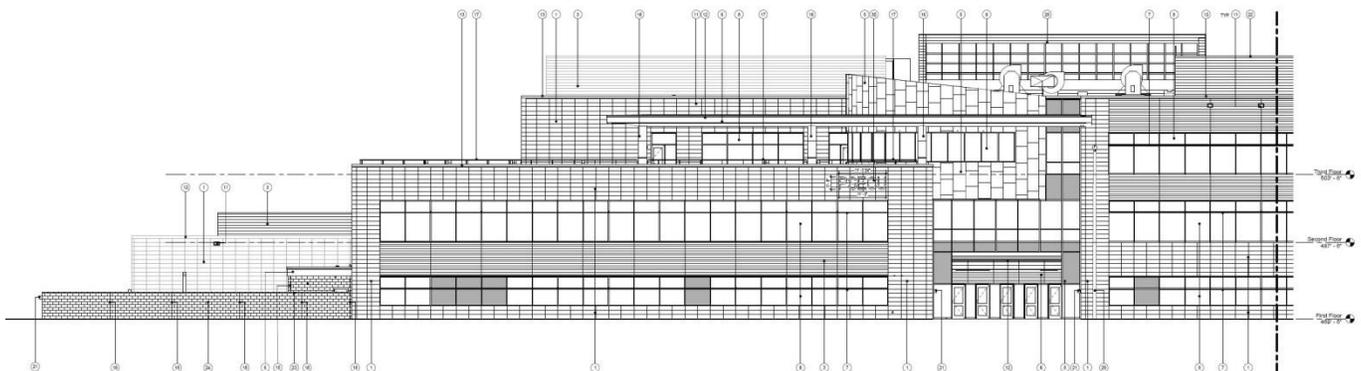


Figure 31: Enlarged West Building Elevation

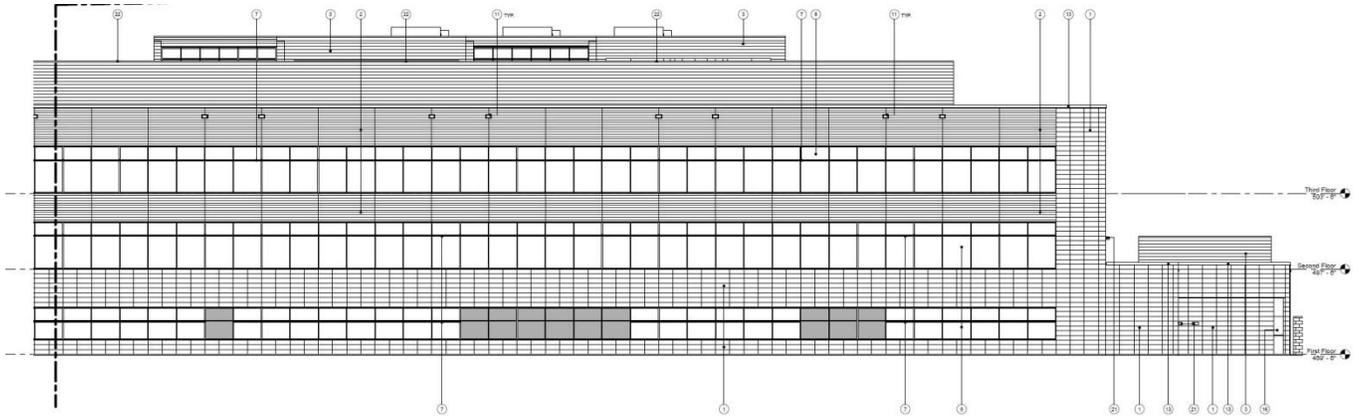


Figure 32: Enlarged East Building Elevation

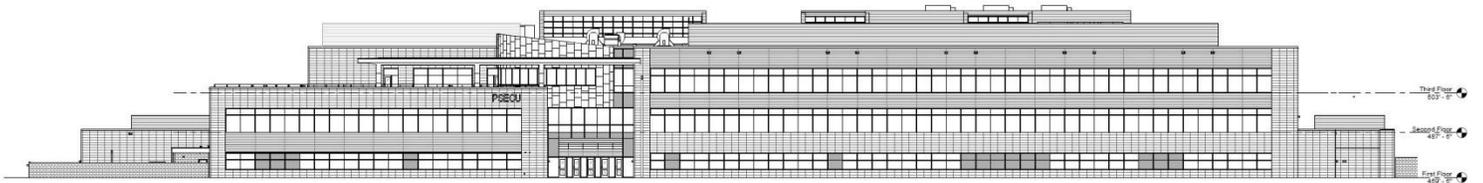


Figure 33: Building Elevation

*Facade Material Finishes*

The main façade materials are terra cotta brick and glazing. The mixture of materials creates a façade of voids through transparency. Overall, the design focuses on renewable materials and bringing the outside in, which is clearly displayed through curtain walls. Other materials on the façade include glazing and metal panels. The glazing has a low e-coating. Walkways are concrete pavers, aluminum flagpoles, and a translucent canopy system. The benches are transparent natural hardwood slats locked together.

 Terracotta Brick

Wall Finishes				
Type	Description	Manufacturer	Color	Reflectance
Terracotta	Terracotta brick tiles	Terreal North America	Red Brick	0.15
Metal Panel	Smooth, flat finish aluminum panels	N.A.	Aluminum	0.7
Aluminum Overhangs	36" projected sunshade system	YKK AP America Inc. Thermashade	Non specular aluminum finish	0.7

Finishes				
Type	Description	Manufacturer	Color	Reflectance
flagpole	aluminum flagpole	N.A.	aluminum	0.7
Benches	transparent natural hardwood slats	Hudson Benches by Forms+Surfaces	Penofin "Transparent Natural"	0.5

Floor Finishes				
Type	Description	Manufacturer	Color	Reflectance
Exposed Concrete	Concrete Pavers	N.A.	Grey	0.2

Glazing Schedule						
Type	Description	T <sub>vis</sub>	R <sub>ext</sub>	U <sub>w</sub>	SC	SHGC
IG-1	1" thick Insulating Vision Insulated Glass with Low E coating	0.7	0.11	0.32	0.43	0.37
IG-2	1" thick Insulating Vision Insulated Glass with Low E coating	0.35	0.07	0.32	0.31	0.27
SPANDREL	1" thick Insulating Spandrel Glass with Low E coating	0	0.07	0.33	0.31	0.23

*Furnishings*

Lining the entry plaza are natural hardwood benches. A metal flagpole is located on the eastern side of the plaza and a water feature is located in the center of the plaza. An elevation and plan of the outdoor water feature is below.

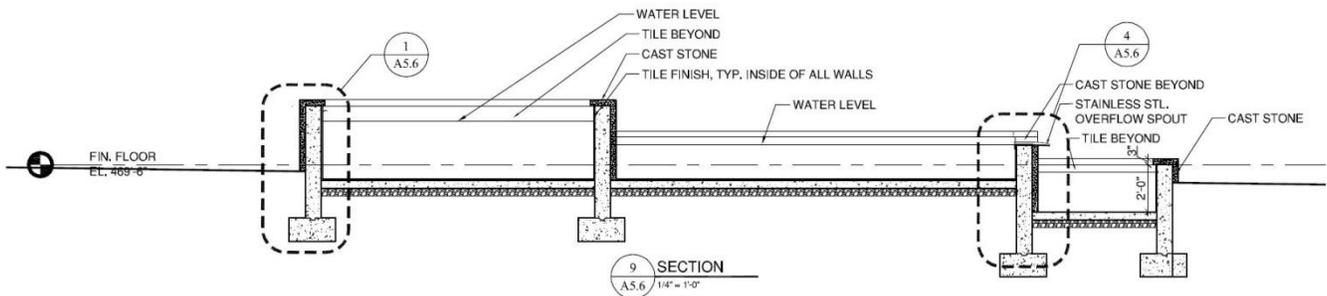


Figure 34: Section of Entry Plaza Water Feature

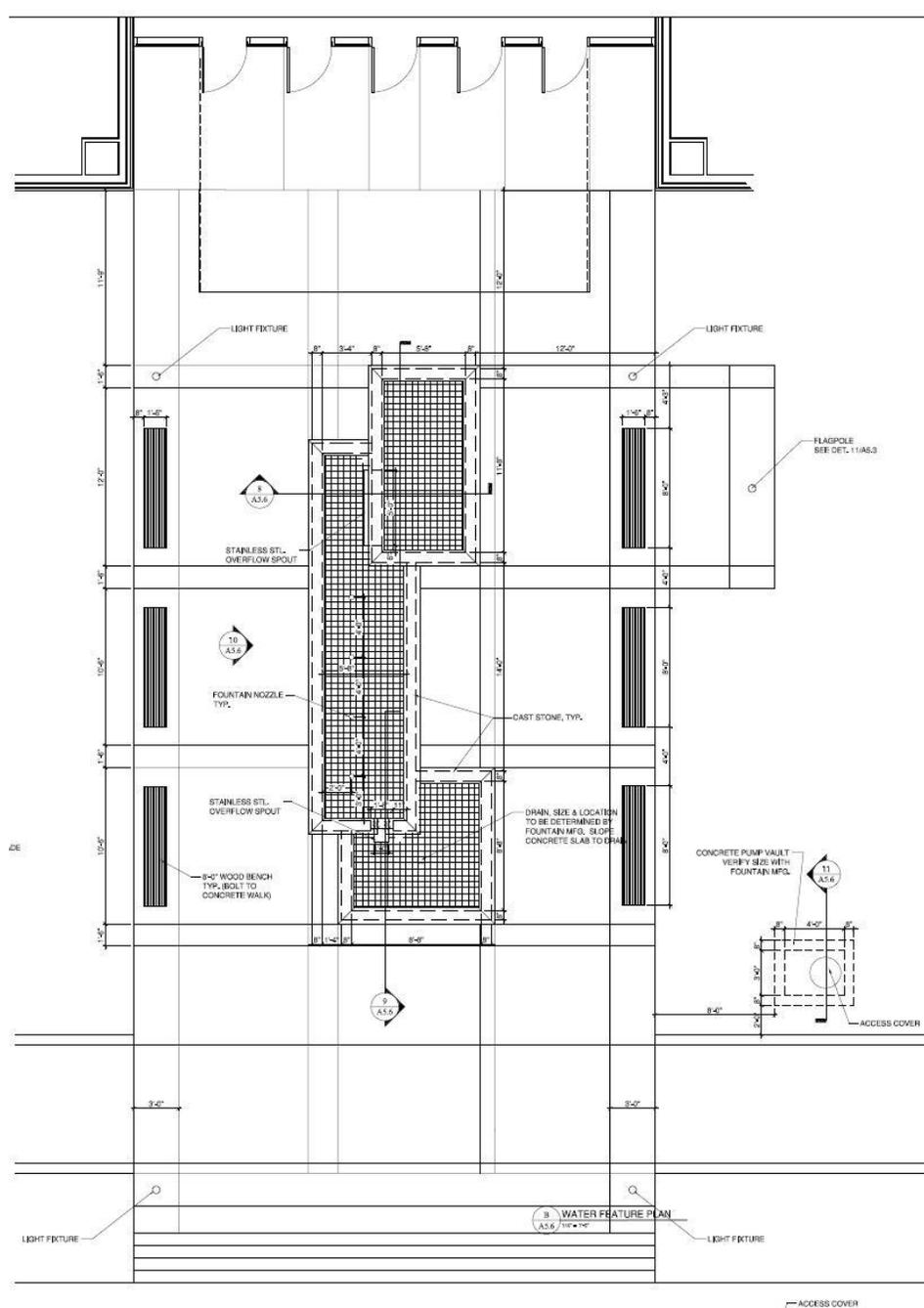


Figure 35: Furniture Plan of Entry Plaza

*Tasks*

The façade is the primary means of egress into the Pennsylvania State Employees Credit Union Corporate Headquarters. Therefore, highlighting the center entry façade is extremely important for directing patrons into the building. A road runs directly to the plaza for drop off purposes, thus highlighting the walkways will be important in order for the patrons to feel safe. Another important safety criterion is to highlight faces to allow patrons to see those around them.

*Existing Lighting and Controls*

The Pennsylvania State Employees Credit Union Corporate Headquarters has no major façade lighting. The entry plaza has two LED roadway fixtures to provide general illumination on the plaza and for safety. Roadway lighting also provides general illumination on the plaza and stairs. Two compact fluorescent sconces are located on both sides of the entrance and underneath the canopy. Flagpole lighting is planned, but not specified.

Control gear for the entry plaza includes Wattstopper motion sensors and an energy saver control device. A motion sensor is located at the main entrance.

Fixture Schedule							
Type	Description	Ballast	Manufacturer	Voltage	Lamp	Mounting	Remarks
RL4	Roadway luminaire, Type II distribution	Integral electronic transformer	Cooper InVUE Valmont- MSA Series	277V	80 Watt, 70+ CRI, 4000K	Pole Mounted	Mount at 20'
RL5	Walkway luminaire, Type II distribution	Integral electronic transformer	Cooper InVUE Valmont- MSA Series	277V	80 Watt, 70+ CRI, 4000K	Pole Mounted	Mount at 15'
SC1	Quarter Sphere Sconce with clear tempered glass lens	Integral electronic control gear	Gardco-106EM Series	277V	(2) 32 Watt triple tube compact fluorescent, 3500K	Wall mounted	

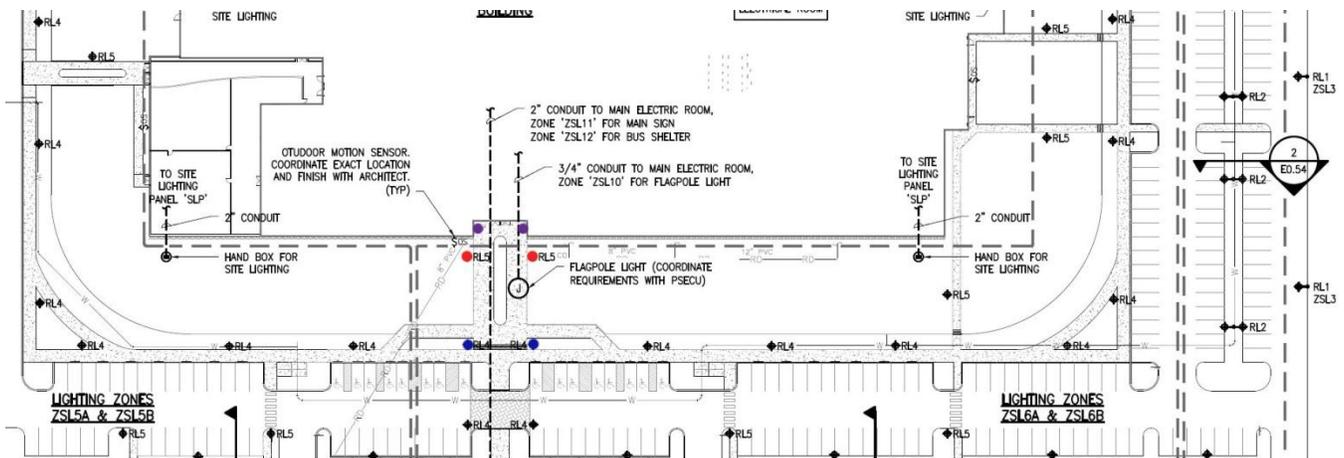


Figure 36: Site Lighting Plan

## Design Criteria

The design criteria below are an accumulation of Illuminating Engineering Society Lighting Handbook Tenth Edition, ASHRAE Standard 90.1-2010 Edition, and LEED for New Construction Version 2.2.

### ***Illuminating Engineering Society Design Criteria***

#### **Accent Opportunities – *Very Important***

Focusing on small aspects and details of the façade brings them to the forefront. For example, highlighting the overhang systems, despite a small detail will highlight the length of the building. Accenting is important in creating an impression of the building.

#### **Aesthetic Considerations – *Very Important***

As a result of the main façade materials being terracotta tile and glass, these materials must be highlighted. Through incorporating fixtures into the façade and not placing fixtures on the façade, PSECU Corporate Headquarters will have a high end impression. If fixtures must be visible, high end fixtures will be utilized.

#### **Color Appearance and Color Contrast – *Very Important***

Color Appearance is very important in order to not diminish the material colors. Using cooler color temperatures and good color rendering properties will enhance the façade materials through highlighting the terracotta, glass, and aluminum.

#### **Direct Glare – *Important***

Glare is an important factor to not affect any pedestrians. As a result of no road running along the façade, glare is not a critical criterion, but should still be considered to prevent any discomfort.

#### **Flicker – *Important***

Flicker can be distracting and bothersome to users. This can be prevented through usage of electronic ballasts.

#### **Light Distribution – *Very Important***

An even uniformity is not critical in designing the lighting for a façade, but using non-uniform lighting is critical in order to show depth. Also, uniformity should be incorporated in the entry in order to be a means of way-finding.

#### **Light Trespass – *Very Important***

As a result of the Pennsylvania State Employees Credit Union Corporate Headquarters applying for LEED Gold status upon completion, light trespass is critical to the design. Cutoff fixtures with good optics will be implemented into the design in order to focus on this criterion. Therefore, luminaires and optics must be carefully selected. The design will highlight aspects suddenly in order to abide by light trespass regulations.

#### **Maintenance – *Somewhat Important***

Maintenance is important in order to retain the original lighting design. Therefore, locality of fixtures should be considered.

Sarah Wujcik | Lighting + Electrical | Faculty Advisor: Dr. Houser | Technical Report 1 | 9.23.11

**Modeling of Faces** – *Somewhat Important (for facade), Very important (for entry plaza)*

Within the entry plaza and building entrance, modeling of faces is very important in order to enhance safety.

**Reflected Glare** - *Important*

Reflections from the glass curtain walls will be important in order to prevent any discomfort for pedestrians. This can be avoided through using luminaires with good optics and through modeling the space.

**Shadows** – *Very Important*

Shadows should be both highlighted and prevented. Highlighting shadows on the façade creates the impression of depth. In the entry plaza shadows should be minimized in order to promote safety. Therefore, uniformity on the plaza should be considered.

**Source-Task-Eye Geometry** - *Important*

In order to enhance the architecture, luminaires will not be visible and should have good cutoff in order to prevent direct view of lamps.

**Visual Tasks** – *Somewhat Important (for facade), Very Important (for entry plaza)*

In order to promote safety, highlighting the plaza will be important to prevent any accidents. This will be possible through focusing on horizontal illuminance. The stairs at the end of the plaza will be highlighted in order for pedestrians to clearly see them.

**Horizontal Illuminance** – *Somewhat Important (for facade), Very Important (for entry plaza)*

Building Entries: Canopied Entries: Medium Activity: LZ3: 15 lux  
Building Entries: General Areas: LZ3: 8 lux

In order to provide a safe pathway and means of circulation, horizontal illuminance should be met within the plaza and canopy areas.

**Vertical Illuminance** – *Somewhat Important (for facade), Very Important (for entry plaza)*

Façade Details or Features: With Surface Reflectance >0.5: Low Activity: LZ3: 40 lux  
Building Entries: Canopied Entries: Medium Activity: LZ3: 8 lux  
Building Entries: General Areas: LZ3: 8 lux

Vertical illuminance will enhance safety through modeling faces and highlighting objects, such as the water feature. Therefore, vertical illuminance should be a focal point of the lighting design of the plaza.

***ASHRAE Design Criteria***

Zone 3: Nontradable: Building facades: 0.15 W/sq.ft. for each illuminated wall  
Zone 3: Nontradable: Building facades: 3.75 W/linear ft. for each illuminated wall  
Zone 3: Tradable: Walkways >10ft.: 0.16 W/sq.ft.  
Zone 3: Tradable: Building entrances: Entry canopies: 0.4 W/sq.ft.

## ***LEED Design Criteria***

\*See Appendix A for complex listing of LEED credits

### **Credit 8.0 Light Pollution Reduction**

Reducing light pollution through incorporating cut-off fixtures and minimizing uplight will be critical in order to achieve this requirement.

## ***Lighting Proposal***

Entry Plaza:

Some lower wattage pole mounted fixtures will be incorporated for modeling of faces and safety. Also, either step lights will be mounted underneath the water feature to create a glow from the fountain, or inground fixtures will line the bottom of the water feature to present a strip of light.

Building Façade:

The proposed lighting design highlights the underside of the overhangs to emphasize the length of the building. Also, in order to emphasize the entry, the curved metal panels will be grazed and the canopy will also be grazed to draw attention to these elements. The PSECU sign will also be backlit to glow. Cooler color temperatures and good color rendering properties will emphasize the materials.

## **Evaluation of Existing Conditions**

Actual Plaza Power Density: 0.13 W/sq.ft.

Allowable Power Density: 0.16 W/sq.ft.

As a result of the façade not highlighted, the façade will not be evaluated.

No nighttime renderings are available and the building has not begun construction, so the evaluation of the plaza is through elevations and plans.

Walkways are highlighted through LED walkway fixtures. Wide distributions allow for uniformity across the surface, which is important for safety. Vertical illuminance is highlighted through lighting from above, which allows for modeling of faces. Cooler color temperatures and color rendering are incorporated for modeling of surfaces and materials. The water feature is not lit, which could be improved.

The plaza lighting design meets power density requirements, thus promoting the success of the design.

Overall, the simplistic lighting design has many possibilities for improvement in order to for the Pennsylvania State Employees Credit Union Corporate Headquarters to make a statement both during the day and at night.

## Overall Evaluation of Lighting Systems

The lighting systems within the Pennsylvania State Employees Credit Union Corporate Headquarters create aesthetically appealing spaces and enhance sustainability. Daylighting is an extremely important factor in the design; therefore each space to be redesigned has daylight penetration.

Each space was analyzed based on a set of technical criteria from the Illuminating Engineering Society Lighting Handbook Tenth Edition, ASHRAE Standard 90.1-2010 Edition, and LEED for New Construction Version 2.2. Two of the four spaces did not achieve ASHRAE Standard 90.1 power density, but the PSECU Corporate Headquarters is assumed to have achieved Standard 90.1 because the spaces that exceeded power density, the Board Room and Lobby, are tradable spaces. Despite this, the Board room illuminance levels must be lowered in order to be more energy efficient. Overall, designed illuminance values were higher than IES recommends, which could be due to specific PSECU requirements.

Controls are an important aspect of the lighting systems in order to save energy and create more appealing spaces. Daylight harvesting sensors, vacancy sensors, occupancy sensors, and room controls all enhance the spaces through ease of controllability and being sustainable.

In redesigning the four spaces, themes of integration, fluidity, transparency, and sustainability will be incorporated into each space in order to enhance the impression of the spaces. Overall, the most important design criteria for the spaces are modeling of faces, aesthetic appeal, and illuminance values. If each are incorporated into the spaces, each of the spaces will be pleasant environments, which promote necessary tasks.

Despite the Pennsylvania State Employees Credit Union Corporate Headquarters' advance lighting systems, there is still areas that need improvement, which will be addressed in the redesigns.

## Appendix A | LEED Credits

The Pennsylvania State Employees Credit Union will receive LEED Gold status upon completion. PSECU uses LEED 2009 for New Construction and Major Renovations for its criteria. Below is a list of all of the LEED credits PSECU is applying for.

### Sustainable Sites

- Prereq1 **Construction Activity Pollution Prevention**
- Credit 4.2 **Alternative Transportation**, Bicycle Storage & Changing Rooms
- Credit 4.3 **Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles
- Credit 4.4 **Alternative Transportation**, Parking Capacity
- Credit 5.2 **Site Development**, Maximize Open Space
- Credit 6.1 **Stormwater Design**, Quantity Control
- Credit 6.2 **Stormwater Design**, Quality Control
- Credit 7.2 **Heat Island Effect**, Roof
- Credit 8.0 **Light Pollution Reduction**

### Water Efficiency

- Credit 1.1 **Water Efficient Landscaping**, Reduce by 50%
- Credit 1.2 **Water Efficient Landscaping**, No Potable Use or Irrigation
- Credit 3.1 **Water Use Reduction**, 20% Reduction
- Credit 3.2 **Water Use Reduction**, 30% Reduction

### Energy & Atmosphere

- Prereq1 **Fundamental Commissioning of the Building Energy Systems**
- Prereq2 **Minimum Energy Performance**
- Prereq3 **Fundamental Refrigerant Management**
- Credit 1 **Optimize Energy Performance**
- Credit 2 **On-Site Renewable Energy**
- Credit 3 **Enhanced Commissioning**
- Credit 4 **Enhanced Refrigerant Management**
- Credit 5 **Measurement & Verification**

### Materials & Resources

- Prereq1 **Storage & Collection of Recyclables**
- Credit 2.1 **Construction Waste Management**, Divert 50% from Disposal
- Credit 2.2 **Construction Waste Management**, Divert 70% from Disposal
- Credit 4.1 **Recycled Content**, 10% (post-consumer + ½ pre-consumer)
- Credit 5.1 **Regional Materials**, 10% Extracted, Processed & Manufactured Regional
- Credit 5.2 **Regional Materials**, 20% Extracted, Processed & Manufactured Regional

### Indoor Environmental Quality

- Prereq1 **Minimum IAQ Performance**
- Prereq2 **Environmental Tobacco Smoke (ETS) Control**
- Credit 1 **Outdoor Air Delivery Monitoring**
- Credit 2 **Increased Ventilation**
- Credit 3.1 **Construction IAQ Management Plan**, During Construction

- Credit 3.2 **Construction IAQ Management Plan**, Before Occupancy
- Credit 4.1 **Low-Emitting Materials**, Adhesives & Sealants
- Credit 4.2 **Low-Emitting Materials**, Paints & Coatings
- Credit 4.3 **Low-Emitting Materials**, Carpet Systems
- Credit 6.1 **Controllability of Systems**, Lighting
- Credit 6.2 **Controllability of Systems**, Thermal Comfort
- Credit 7.1 **Thermal Comfort**, Design
- Credit 7.2 **Thermal Comfort**, Verification
- Credit 8.1 **Daylight & Views**, Daylight 75% of Spaces

Innovation & Design Process

- Credit 1.1 **Innovation in Design**
- Credit 2 **LEED Accredited Professional**

Project Total (pre-certification estimates): 40

*Possible Additional Credits*

Water Efficiency

- Credit 2 **Innovation Wastewater Technologies**

Energy & Atmosphere

- Credit 1 **Optimize Energy Performance**
- Credit 2 **On-Site Renewable Energy**

Materials & Resources

- Credit 4.2 **Recycled Content**, 20% (post-consumer + ½ pre-consumer)

Indoor Environmental Quality

- Credit 8.2 **Daylight & Views**, Views for 90% of Spaces

Possible Project Total (pre-certification estimates): 46