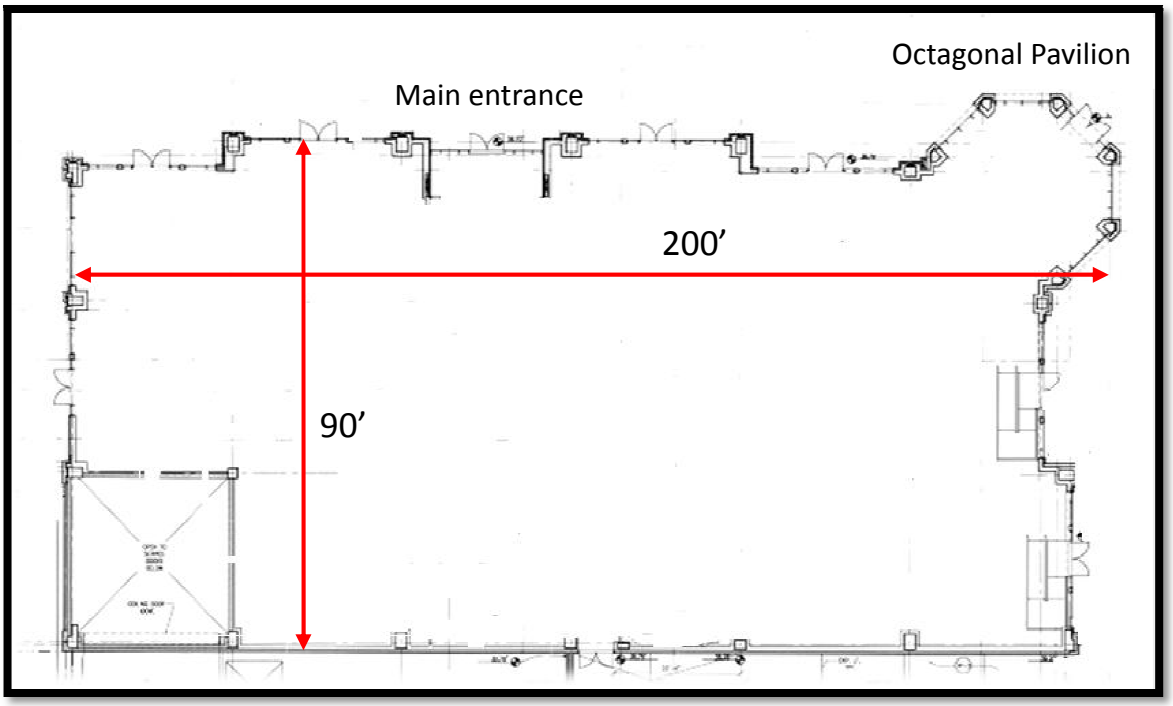
1. Building Façade

Spatial Overview

The Ballenger East Building is located at one corner of the Ballenger Avenue crossing John Carlyle Street, where the main entrances and the retail stores are located mostly on north and east facades, therefore it is apparent that those two sides receive more exposure than the other two. There are planters along the perimeter of the building and a pocket garden on the west side of the building. At the north-east corner of the building, there is an octagonal pavilion; it is the entrance to the retail spaces, and it is also the most significant visual element on the façade, especially during night-time when the building exterior is lit-up.

The building dimension is approximately 200’ (length) x 90’ (width) x 60’ (height), with four stories above grade. The key materials used on the building façade are bricks, precast concrete and glass.



Materials & Finishes

Materials	Reflectance (%)	Transmittance (%)
Brick	35	-
Precast Concrete	38	-
Glass	-	90

Existing Luminaire Overview

There are planting areas all along the north and east side of the building, where tall pole-mounted luminaires are used to provide illumination for the trees, shrubs, groundcover plantings and pedestrians around. On the west side, there is a pocket garden where pole-mounted luminaires and bollard lightings are used for security reasons, while spotlights are used to accent the trees. Wall-mounted luminaires are used throughout the north and east face of the building façade to provide uplight, downlight, or a combination of both. Yet on the south face of the building façade, where it mainly serves as a loading area to the building, only wall sconces are used for illumination.

[Note: refer to luminaire schedule for luminaire details]

Luminaire Schedule								
Luminaire type	**Manufacturer**	**Catalog Number**	**Lamps**	**Lumens**	**Volts**	**LLF**	**Mounting/ Mounting height**	**Remarks**
9	Hadco	R54BA-T-150H	150W HPS	16000	120	0.8	Pole/14’	Street lights
10	Hadco	V2702-B5-D-100H-H	100W MH	6600	277	0.8	Pole/12’	Pole lights
11	Cooper	720-39PAR20-FL	39W MH	2000	277	0.8	Recessed/ at grade	Tree accent
12	Se’lux	COR-4-H070-BK-277	70W MH	4800	277	0.8	Surface/ at grade	Bollard lights
OA	Winona	4103-WL-28-277-CM F	F17 T8/830K	1325	277	0.8	Wall/ 8’ to center	Building lights
OE	Gardco	111-MT-32-TRF-277-NP	32W TRF	2400	277	0.8	Wall/varies	Wall sconce
OE1	Gardco	111-,T-70-MH-277-N P	70W MH	6000	277	0.8	Wall/varies	Wall sconce
OF	Cooper	914-100PA-R38-FL	150W HALO.	2030	120	0.8	Wall/ 11’ to bottom	Building lights

Note:

a. LLFs are from Engineering Drawings Sheet C-23A

b. Color information for lamps is not found in drawings.

Ballast Information (Advanced)				
Luminaire type	**Ballast Catalog No.**	**Ballast watts**	**Ballast Factor**	**Power Factor**
9	71A8107	170w	0.95	0.9
10	71A5237BP	85w	0.95	0.9
11	IMH-39-G	45w	0.9	0.95
12	71A5237BP	85w	0.95	0.9
OA	VEL-2P32-LW-SC	27w	0.9	0.98
OE	ICF-2S26-H1-LD	36w	0.9	0.98
OE1	IMH-70-G	79w	0.95	0.9

Existing Luminaires Features

Luminaire 9

There are 22 street lights in total surround the building. The 150W high pressure sodium luminaires are pole-mounted at 14 ft tall and they provide illumination for pedestrian passing by or near the planters. They also provide security lighting to the area.

Luminaire 10

These 12' tall pole lights located at the pocket garden on the west side of the building are equipped with full specular, floodlighting optical system with flush, clear tempered glass shield. They provide illumination in the garden area.

Luminaire 11

The 39W metal halide luminaires are intended to provide accent lighting to the trees in the pocket garden. The luminaire stem is fully adjustable from all mounting positions and features a mechanism to ensure positive fixture aiming.

Luminaire 12

The bollard lightings are 70W metal halide luminaires, mounted on ground with a height of 4', providing illumination in the pocket garden. They also contribute to the security lighting to that area.

Luminaire OA

The wall-mounted luminaires are mostly located at the pavilion, providing accent lighting to the vertical elements on the pavilion.

Luminaire OE & OE1

They are both wall-mounted cutoff sconces with rain-tight, dust-tight and corrosion resistant housing. The luminaires are located on the rear side (south) of the building, providing illumination to the loading area.

Luminaire OF

The 150W halogen luminaires are wall-mounted to provide a combination of up and downlight. They are mainly located in pairs at various entrances, providing illumination for the circulation in and out of the building.

Overall Design Objectives

The Ballenger East Building does not only provide a location for offices/companies, more importantly it has created a landmark of architecture for the society and the citizens. In order to complement the architecture properly, how to light up the octagonal pavilion would be crucial. The corner pavilion is one of the main entrances that lead to the retail spaces, and the polygonal shape has made itself one special piece of architecture from the building, especially when the building is lit up at night-time.

The major components on the pavilions are concrete columns and huge storefront windows. While putting emphasize on the entrance door, washing/grazing the concrete columns from beneath would make the pavilion stand out even better. Even though the main entrance which leads to office levels is supposed to be closed after office-hour in the evening, it is always good to give recognition to the building by lighting up the logo/address number on the façade.

As mentioned before, there are planters/planting areas along the north and east perimeter of the building, and there is a pocket garden on the west side. These spaces are intended not only for plants to grow, but also provide a resting area for one to relax and take their feet up from daily hectic work. Besides giving a good modeling of the plants, ensuring a sense of security does exist in these spaces are essential, because it directly determines if one would feel relaxed or calm or not. Therefore, a lighting pattern that would keep the impression of relaxation around should be put on top of provision of adequate illumination. Moreover, the exterior lighting should function up to aid orientation, especially at night-time. One should be able to comprehend their way entering or leaving the building quickly and safely. Visual comfort often directly relates to glare problems and they should be avoided at all cost, no matter direct glare created by bare lamps or reflected glare created by reflection of glass.

Last but not least, light trespass/pollution issues always come along with exterior lightings, yet they should be taken good care of at all time. Minimizing the use of luminaires having light distribution above the horizontal plane can reduce the light pollution brought to nearby properties, it would also help in maintaining a more efficient lighting practice.

Design Considerations

Appearance of Space and Luminaires

Emphasize should be placed on illuminating entrances, because it can enhance and enforce the architectural elements, which in this case would be the corner pavilion. The impression of security should be perceived anywhere within the building footprint. Besides, the lighting hardware used for exterior should be in consistent style.

Glare *[IESNA 10-5]*

Direct glare might be caused by the pole-mounted luminaires: avoid using luminaires where the bare lamps can be seen.

Light Pollution/Trespass *[IESNA 10-5]*

Avoid using luminaires that emit light above horizontal plane.

Minimize non-target illumination, if the concrete columns would be washed from underneath, be sure the aiming angles of the luminaires are targeting the columns. This also applies to the logo on top of the canopy at the main entrance. If possible, turn off the outdoor lighting system during the times of low use. A better result should be obtained with the use with photo-sensors.

Recommended Illuminance Level *[IESNA Outdoor-1]*

Location	Horizontal Illuminance (fc.)	Vertical Illuminance (fc.)
Entrance (active)	50	30
Garden general lighting	5	2
Paths (away from building)	30	30
Emphasized trees	10	3
Security lighting	-	5-20 on façade

Point of Interests

Make sure the important visual elements are highlighted in contrast to its surroundings, such as the octagonal pavilions, entrances to the retail spaces, and the pocket garden on the west side. Highlighting these elements does not only complement the architecture, the contrast it creates help aid orientations into/out of the building.

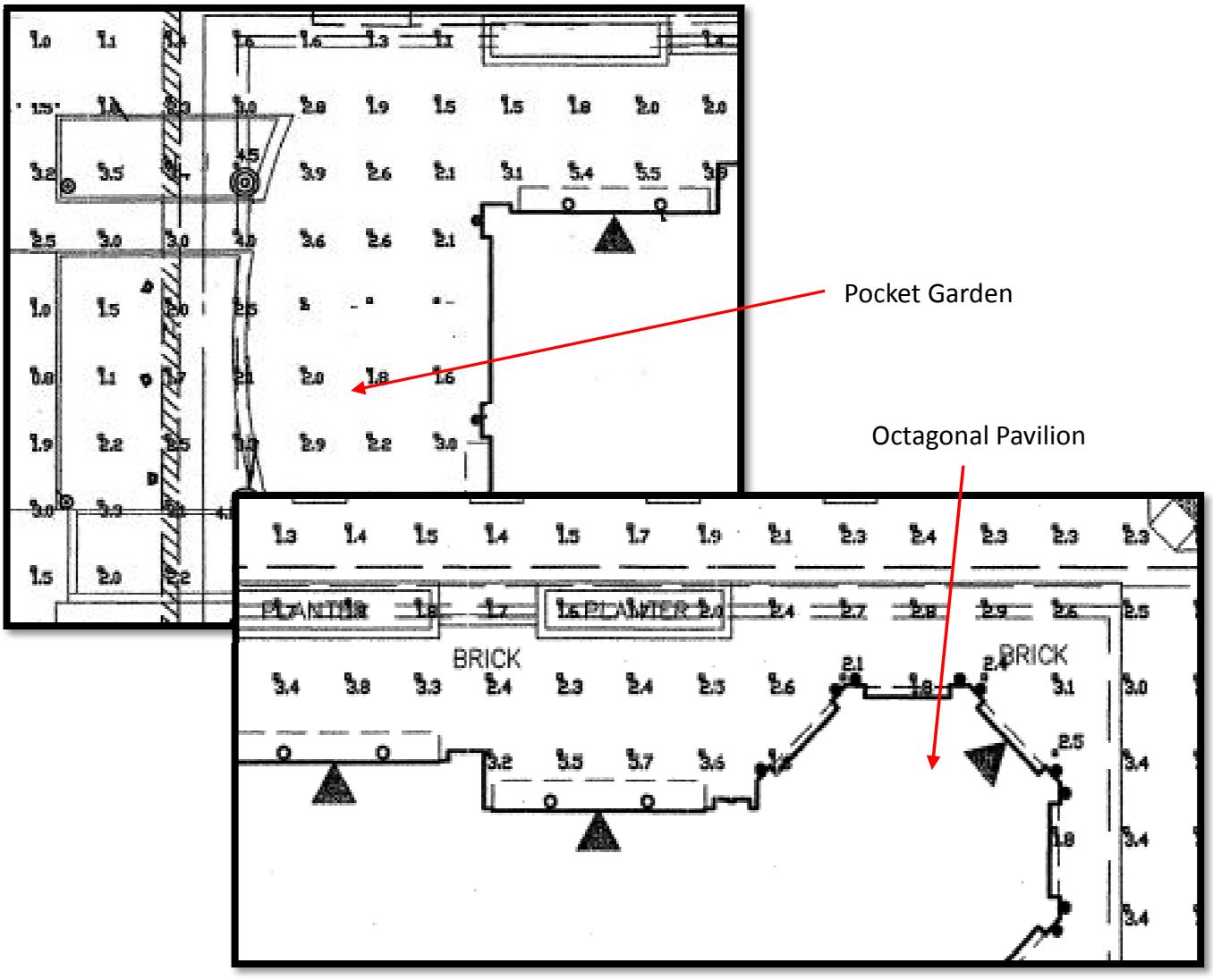
Power Allowance *[ASHRAE 90.1 table 9.4.5]*

Surface	Power density allowed (W/ft2)	Total power allowed (w)	Actual power used (W)	ASHRAE 90.1 compliance?
Building Façade	0.2	6886	3457	Yes
Walkways > 10 ft wide	Up to 0.2	3218	4560	No
Total		10104	8017	Yes

Evaluation of Existing Lighting Solution

The existing design solution is fairly good. All luminaires generally could perform to their functions. First of all, there were uplight/downlight luminaires washing the concrete columns at the corner pavilion, which could really highlight this piece of architecture. There were two kinds of pole-mounted luminaires along the perimeter of the building and in the pocket garden. Using different types of luminaires did add flavor to the visual interest, however those two types of pole-mounted luminaires were of different style. Those standing along the perimeter and the road were more traditional, more like those British style pole-mounted luminaires, while those in the pocket garden were quite modern in style; the poles were made of aluminum and they had a cutoff shield to prevent upward light distribution.

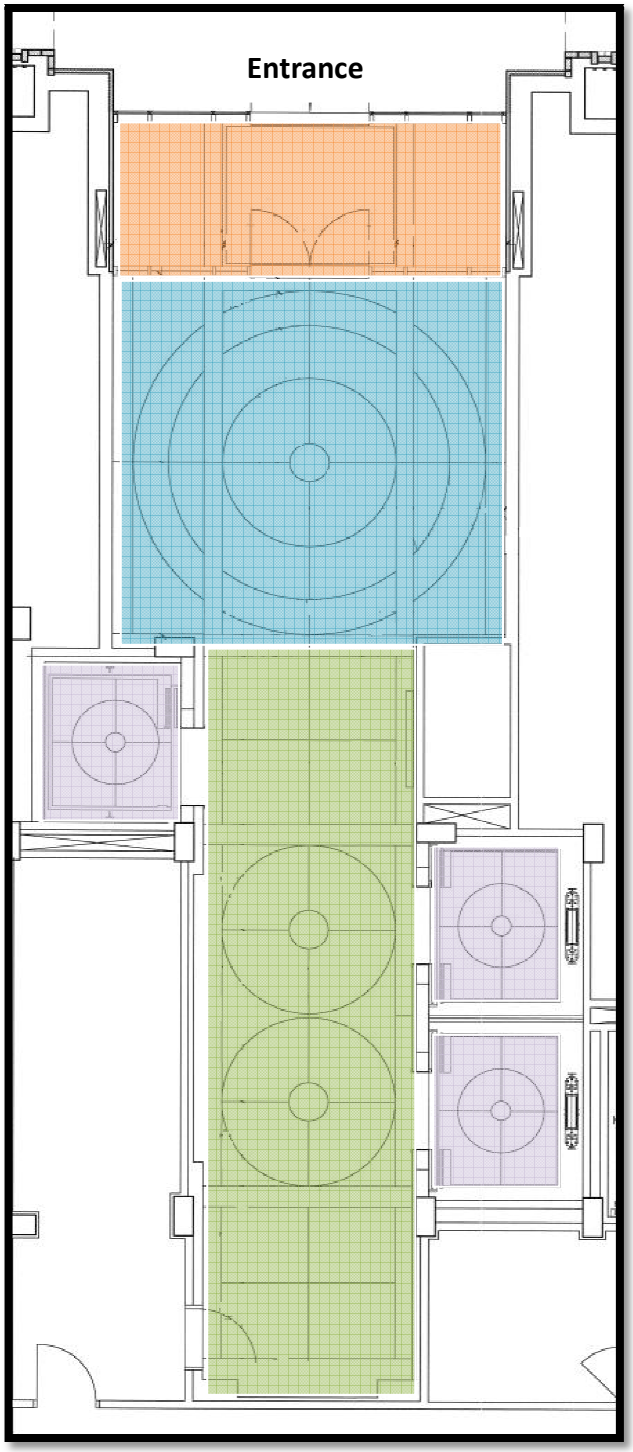
Despite the difference of luminaire styles, the rest of the luminaires fit well in their positions. The bollard luminaires and the pole-mounted luminaires did provide adequate illumination for the pocket garden, more importantly they could provide a sense of security around the area. The average illuminance level along the north and east façade is about 4-5 fc, while there was about 2-3 fc. near the pocket garden.



2. Main Lobby

Spatial Overview

The main lobby directs the circulation flow to the elevator lobby through the vestibule and the entrance lobby. All these spaces are in rectangular shape and it has approximately 950 ft^2, with breakdown of two components: vestibule with entrance lobby (450 ft^2), elevator lobby (400ft^2). There are three elevators in total, with one of them assigned for underground parking levels, and the rest of them lead to office spaces on upper levels.



Vestibule – 120 ft^2

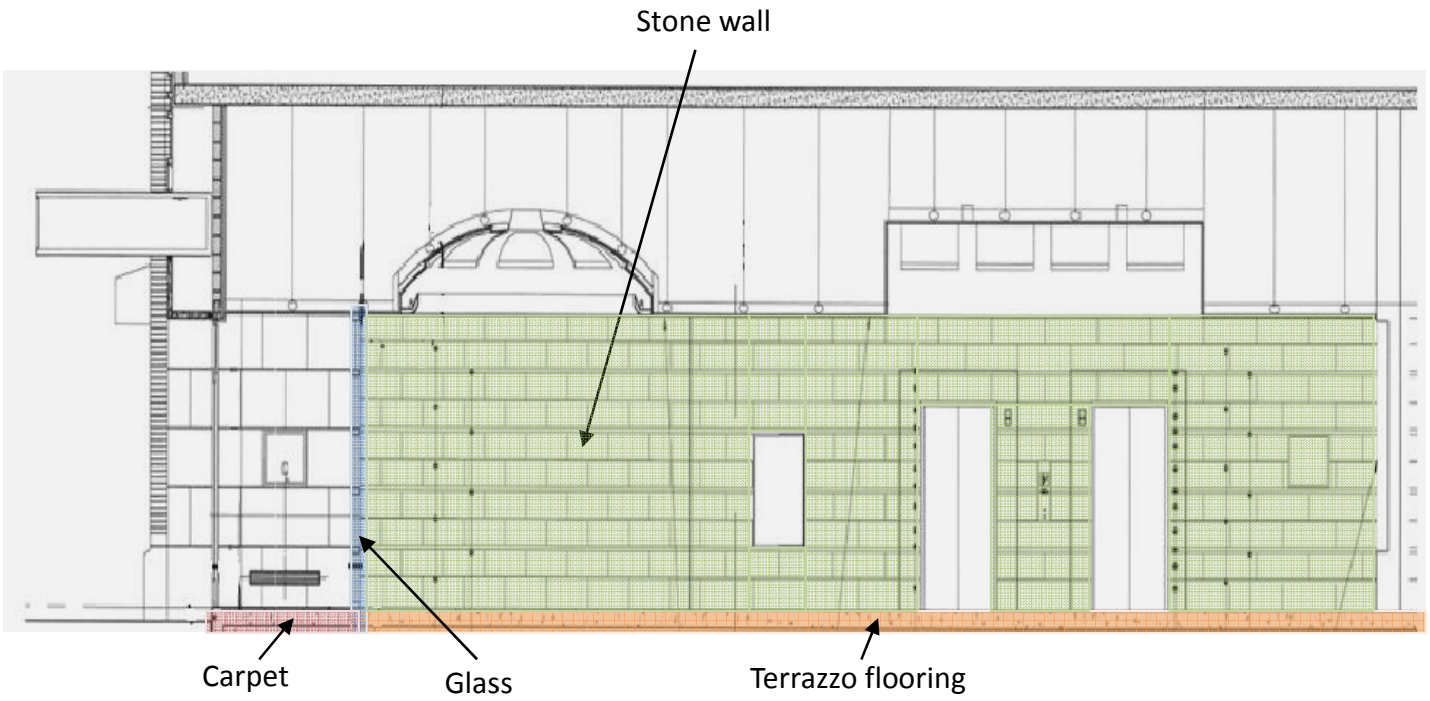
Entrance lobby – 320 ft^2

Elevator lobby – 400 ft^2

Elevators

Materials & Finishes

Materials	Reflectance (%)	Transmittance (%)
Carpet (dark color)	15	-
Terrazzo Flooring	30	-
Stone	50	-
Gypsum Wall Board	70	-
Tempered Glass	-	90



Existing Luminaire Overview

In the vestibule, HID recessed downlight luminaires are used for illumination provision. In the entrance lobby, there is a huge dome-shaped ceiling with a sky-dome luminaire placed at the center and some cold cathode lighting located along the perimeter acting as cove lights. Besides, there are wall washers illuminating the stone walls on the two sides. Under the recessed ceiling in the elevator lobby, fluorescent luminaires are used to provide ambient lightings, while there are also recessed downlight luminaires used to illuminate the front of the elevators. There is also a huge back lit decorative glass alcove at the end of the lobby, where graphical information is enclosed.

Luminaire Schedule								
Luminaire type	**Manufacturer**	**Catalog Number**	**Lamps**	**Lumens**	**Volts**	**LLF**	**Mounting/ Mounting height**	**Remarks**
AA	Lightolier	C4T4VM-CCDW-C420T4E2	20CDMT4 G8.5 BASE/830K	1700	277	0.8	Recessed	HID downlight
AA1	Lightolier	C4T4VM-CCDM-C439T4E2	39CDMT4 G8.5 BASE/830K	3300	277	0.8	Recessed	HID downlight
AB	Lightolier	C4T4A-ACCDW-C420T4E2	20CDMT4 G8.5 BASE/830K	1700	277	0.8	Recessed	HID adjacent wall washer
BA	Cathode light systems	BNPHO-R-1-30T C-D-277	Lamp included	700lms/ft	277	0.8	Recessed	Custom curve length
BB	Cathode light systems	BNPHO-R-1-30T C-D-277	Lamp included	700lms/ft	277	0.8	Recessed	Cold cathode lighting
CB	Ardee lighting	DL23AL-A30R-277-LLDF	Q50MR16-IR-25 FL-GU 5.3, BASE	850	277	0.8	Recessed	Downlight
EA	Belfer lighting	2505-12-S-F14-P-1292-01-70	Q50-PAR-30S-25 NFL-MED,BASE	8800	120	0.8	Surface	Coved-mounted
FA	Lightolier	SM4D2-28UNV	F28T5/830K.	5200	277	0.8	Surface	Fluorescent cove lighting
FB	Focal Point	FSD-22-D-4-T5-E-277-U-CR-L830-HW	F21T5/830K	8400	277		Recessed	Fluorescent of 24” diameter

Note:

a. LLFs are from Engineering Drawings Sheet C-23B

b. Color information for lamps is not found in drawings.

Ballast Schedule				
Luminaire type	**Ballast**	**Ballast watt**	**Ballast Factor**	**Power Factor**
AA	RMH-20-K	26	1.0	0.9
AA1	IMH-39-G	45	1.0	0.95
AB	RMH-20-K	26	1.0	0.9
FA	ICN-2S28@277	63	1.03	0.99
FB	ICN-2M32-MC@277	50 X 2	1.05	0.98

Existing Luminaire Features

Luminaire AA

The 20W HID downlight luminaires provide Illumination to both the directory display and the back lit glass alcove. Each luminaire is equipped with comfort clear reflector and white painted flange.

Luminaire AA1

The 39W HID downlight luminaires are equipped with comfort clear reflector and white painted flange. These luminaires are located in the vestibule.

Luminaire AB

The 20W HID luminaires are washing the stone walls in the atrium. Each luminaire is equipped with comfort clear reflector and white painted flange.

Luminaire BA

The cold cathode luminaires are made in custom curve length and located along the perimeter of the recessed dome-shaped ceiling in the entrance lobby.

Luminaire BB

The cold cathode luminaires are 18ft. in length. They are located on the recessed ceiling in the elevator lobby. Their watts are proportional to their luminaire length.

Luminaire FA

The 28W surface-mounted luminaires are intended to light the back-lit decorative glass alcove at the end of the elevator lobby.

Luminaire FB

The fluorescent luminaires are located at the center of the ‘sky-dome’ in the atrium space. The 21W luminaires are equipped with a 24” diameter lens.

Overall Design Objectives

Since the main lobby is the transitional space from exterior to interior of the building, it is essential to ensure the lighting would aid orientations, both visual orientation and physical orientation. Visual orientation includes reading the directory display, the signs on the elevators, and graphic information on the alcove, while physical orientation includes guiding the circulation to the elevators/stairs and to the entrance.

The main lobby does not only act as a key access to the building, it is also where one would make the first impression of the building, which might determine a potential return of clients in the future. Therefore, it is essential to light up the space right to create a grand and professional perception. Apart from that, a welcoming and cozy feeling of the space should also be pursued because it would definitely help drawing more circulation flow to the retail spaces.

Moreover, the main lobby is a public area where social communications are conducted. More often nonverbal communication is involved, it is important to make sure the pattern of light on faces enables clear recognition and interpretation of expressions by enhancing contrast in areas around the mouth and eyes.

Furthermore, in order to create a visual environment that is aesthetically appealing, the key to success is how to accentuate the architecture with lighting. In the lobby area, the most significant visual elements are the stone walls, the sky-dome ceiling, the directory display, and the back-lit alcove, etc. Applying the washing technique on the stone walls can possibly make the texture stand out, it can also provide an ambient illumination on the perimeter of the atrium space, and a sense of spaciousness can be built as well. The sky-dome ceiling itself is an elegant architecture, so the primary goal would be to light up the ceiling as one piece instead of separating the visual focus on different parts. The directory display conveys information both through texts and graphics, it is important to ensure provision of adequate vertical illumination for reading the directory as well as all kinds of glare is minimized. Besides, an appropriate visual contrast should be applied between the display and the surrounding in order to aid visual orientation, and more importantly to enhance the visual comfort while reading. Glare should also be avoided on the elevator doors when people are lining up/waiting in front of the elevators.

Design Considerations

Transitional Adaptation

Adaptation by the visual system from the bright daylight condition to darker vestibule, vice versa, should be taken care of.

Color Appearance *[IESNA 10-4]*

Use high color-rendering lamps (CRI > 80) to provide better modeling on key architecture in the space, the sky-dome ceiling and the stone walls. This also helps to create a better first impression of the building perceived.

Glare

Locate the luminaires to minimize reflected glare on the directory display and elevator doors (aluminum). Avoid using luminaires that bare lamps can be seen directly to prevent direct glare. The terrazzo flooring might lead to reflected glare as well, it would be better if the downlight luminaires are equipped with diffuse lens.

Recommended Illuminance Level *[IESNA Interior-11 & 13]*

Location	Horizontal Illuminance (fc)	Vertical Illuminance (fc)
Entrance/vestibule	30	-
Lobby	10	3
Directory display	1000	30

Impression of Spaciousness *[IESNA 3-38]*

Continuous linear peripheral lighting should be used in the lobby area to create the sense of spaciousness. A higher ambient light level would reinforce this lighting mode better.

Power Allowance *[ASHRAE 90.1 table 9.6.1]*

Space	Power density allowed (W/ft^2)	Total Power allowed (W)	Actual power used (W)	ASHRAE 90.1 compliance
Vestibule	1.3	164	160	**Yes**
Entrance lobby	2.3	745	608	**Yes**
Elevator lobby	2.3	920	781	**Yes**
Total		1829	1549	**Yes**

Luminance Ratio *[IESNA 10-4]*

The luminance ratio between the directory display and the adjacent dark surroundings (wall surface) should be regarded as the same as a visual task, therefore a luminance ratio of 1:3 or 3:1 should be achieved.

Evaluation of existing lighting solution

The architectural style of the main lobby tends to be traditional. A storefront system separates the interior form the exterior. Once enter the lobby, there is a huge sky-dome in the middle of the ceiling, stone walls on the sides and terrazzo throughout the floor.

In general, the luminaires most likely performed to their functions. The sky-dome ceiling did create an elegant atmosphere for the entrance lobby, and generated a good first impression of the space. Besides, the curved cove lighting along the perimeter of the dome did bring up the dimension of the space, making the entrance lobby area look more spacious. The wall-washing luminaires on the side walls not only lit up the stone walls in the space, it also created a light path in the lobby for visual orientation. There were downlights at the around the sky-dome which contributed to the ambient light level in the entrance lobby and also expanded the visual interest.

There were only downlights providing ambient illumination near the directory display, it would be better to put lighting emphasis on it as it could offer a visual orientation. However, the cove-lighting did again bring up the dimensions of the space, it looks larger in volume. Besides, the ambient illumination was adequate in the elevator lobby which enables decent social communications.

3. President's Office

Note:

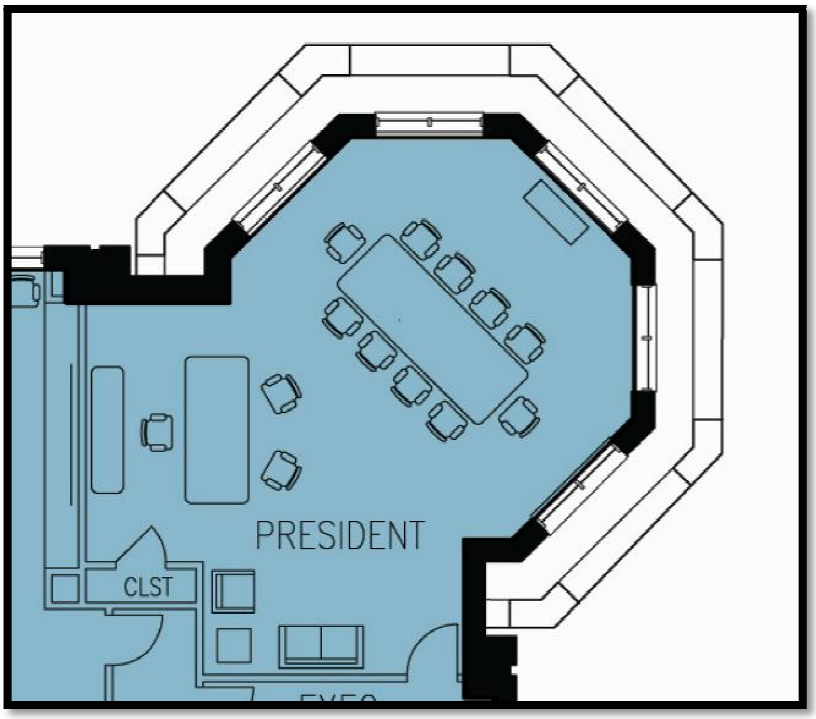
The Ballenger East Building currently has an empty layout on the president's office, for that reason only Spatial Overview, Materials & Finishes, Overall Design Objectives and Design Considerations will be discussed at this point.

Spatial Overview

The President's office is located on the 4th floor, sitting on top of the octagonal pavilion. The room is approximately 900ft^2 with a ceiling height of 13.5'.

From the picture below, we can see that the office can be divided into three parts:

1. Lounge area with couple sofas – 100 ft^2
2. President's working area – 350 ft^2
3. Conference area with long bench and chairs – 450 ft^2



Materials & Finishes

The key materials used in the president's office will be assumed to be similar to those in Business Building, where gypsum wall board on the ceiling, wood panels on the wall and carpeted floor. The tables will be in light color and chairs will be dark color.

Key Materials	Reflectance (%)	Transmittance (%)
Carpet	35	-
Gypsum wall board	70	-
Wood panels	50	-
Desk/table	75	-
Chairs	20	-
Glass	-	90

Note:

The reflectance value are estimated to the closest possible with the use of a color-specifier.

Overall Design Objectives

The president is the leader of the company, he/she is the representative of the company in some ways, and therefore his /her office should well represent the image and character of the company. Professionalism and modernism would be the two kinds of impressions that fit right into any kind of firms.

There are often clients come visit the president's offices to discuss business. Some of the clients may take a more relaxing approach over business, they choose to talk over in the lounge area; but some of them will take a more formal approach, they will like to set up an appointment in the conference area. No matter what approach it takes, it is essential to provide a visually comfortable environment for both the president of the company and their important clients to think thoroughly about the business they are involved and reach an agreement. Therefore, on top of numerical illumination, the quality of lighting is even more significant to both parties.

Moreover, on behalf of the organization, the president is the role model within the company. He/she takes up great responsibilities as well as pressure upon daily business, both internally and externally. Since high-quality lighting could be essential to better productivity, so in order to facilitate the president's working process, a professional yet relaxing working environment should be maintained.

Design Considerations

Appearance of Space and Luminaires

The president's office can represent the image and character of the organization. Therefore, it is essential to create a layout that impression of professionalism and modernism would be perceived.

Color Appearance

Luminaires of CRI < 80 should be avoided, because there are often social activities in the space. It is important to give a good modeling on clients face and some potential merchandise products.

Recommended Illuminance Level *[IESNA Interior-13]*

The horizontal illuminance for private office seems very high; it is believed that the IESNA put the main focus on face recognition, facial expression. Hence a very high horizontal illuminance is required.

Location/Task	Horizontal Illuminance (fc.)	Vertical Illuminance (fc.)
Private Office	50	5
Lounge/Reception	10	3

Glare

The natural daylight might give direct glare in the morning, using some shielding device, such as blinds to block the unwanted/disturbing daylight.

Though the floor plan did not show, it should be normal that the president would use either a personal computer or laptop while at work. For that reason, avoid locating overhead luminaires that may give reflected glare on the computer screen and desk.

It seems there is no screen for presentation at the conference area, so it seems the only glare might be resulted should be from the natural daylight. Again, we can install some shielding devices to block the unwanted daylight.

Daylight Integration

It is always great to have natural light in the working space. Since there are 4 big windows at the north-east corner in the president's office, some electric light should be replaced by the natural light during daytime.

Impression of Relaxation & Pleasantness *[IESNA 3-38]*

Both of the lighting impressions require non-uniform, peripheral lighting emphasis. The priority of these two impressions should come before the illuminance level, because it is only a numerical reference. It does not reflect how one would feel about lighting of the space.

Zones

There are 3 different tasks involved in the president's office: reception in lounge area, personal daily task at the desk, and conferencing at the long bench. 3 zones of lighting should be maintained in order to create the most appropriate scene for different tasks.

Power Allowance *[ASHRAE 90.1]*

According to ASHRAE 90.1, the president's office is regarded as enclosed office which has a power allowance of 1.5W/ft^2. Thus, the total power allowed in the president's office is 1.5W/ft^2 x 900 ft^2 = 1350W.

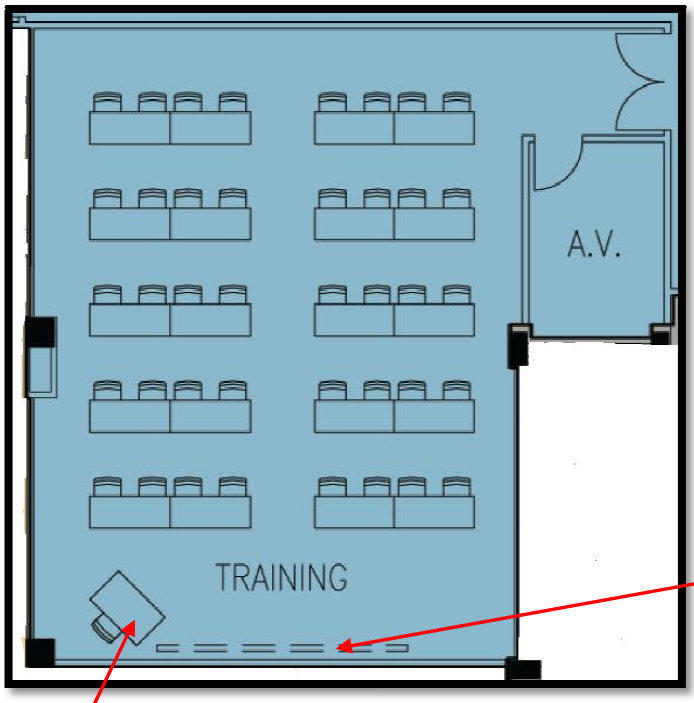
4. Training Room

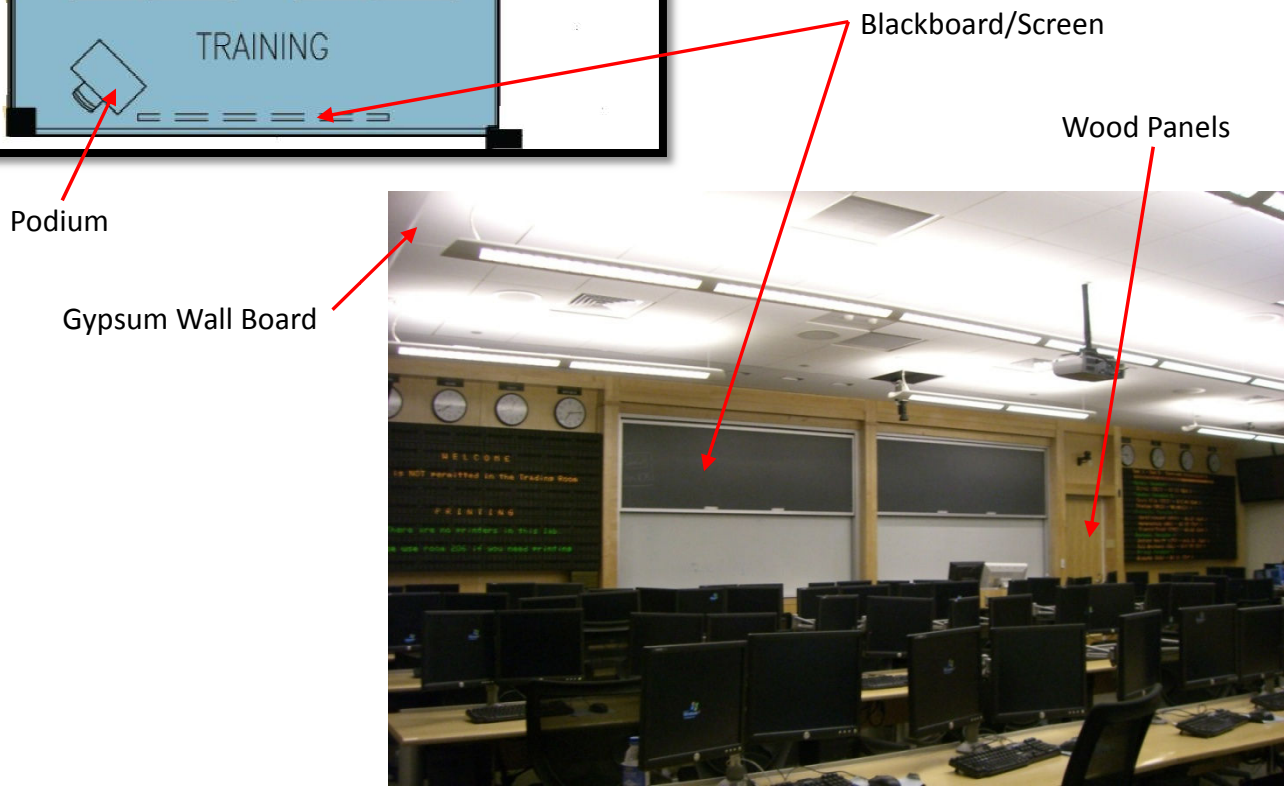
Note:

The Ballenger East Building currently has an empty layout on the training room, for that reason only Spatial Overview, Materials & Finishes, Overall Design Objectives and Design Considerations will be discussed at this point.

Spatial Overview

The training room is located near the west side on 3rd floor. Its shape is like a typical classroom, a rectangular box with dimension of 40' (length) x 30' (width) x 13.5 (height) and an area of about 1200 ft^2. From the floor plan below, there are 5 rows of benches and a podium at the corner next to the blackboard/screen. There is no window in this room: therefore electric lights have to be turned on at all time.





Materials & Finishes

The key materials used in the training room will be assumed to be similar to those in Business Building, where gypsum wall board on the ceiling, wood panels on the wall and carpeted floor. The tables will be in light color and chairs will be dark color.

Key Materials	Reflectance (%)	Transmittance (%)
Carpet	35	-
Gypsum wall board	70	-
Wood panels	50	-
Desk/table	75	-
Chairs	20	-

Note:

The reflectance value are estimated to the closest possible with the use of a color-specifier.

Overall Design Objectives

The training room is very similar to a typical classroom. There are long benches, chairs, a podium and a blackboard/screen. Since this is a place for learning, and usually the learning process in companies requires a faster pace than in schools and colleges, hence it is essential to provide the more enthusiastic environment for efficient learning. In other words, the most important criteria would be visual clarity, which would enhance their concentration on their work. Apart from provision of adequate illumination for typical tasks in the classroom: reading and writing, the training room is also a social place where the audience can discuss and exchange ideas. Therefore, it is also important for the lighting system to offer a good modeling of faces for better communication.

Furthermore, it is more likely that there will be video presentations in the room, and then two zones of lighting might be required to separate the different tasks. Even though it is just a training room, it should also be consistent with the character of the company in terms of lighting systems.

Design Considerations

Appearance of Space and Luminaires

The training room should look bright in general, which a bright environment usually generates a better concentration on work. Indirect luminaires should be used, they can minimize direct glare and also they can project light on the ceiling that can make the space looks larger.

Impression of Visual Clarity *[IESNA 3-38]*

Visual clarity requires high ambient light levels and uniform light patterns. Besides, the reflective wood panels can reinforce the lighting mode with the peripheral emphasis.

Glare

Avoid using luminaire that bare lamps can be seen which creates direct glare. Besides, when the white board is used, reflected glare might be projected on the screen which disables the audience from reading the texts on it. Thus, special attention should be put on the location or the aiming angles of the luminaires that illuminates the blackboard/screen.

Recommended Illuminance Level *[IESNA Interior-14]*

Tasks	Horizontal Illuminance (fc.)	Vertical Illuminance (fc.)
Reading from white-board	-	5
Reading from chalkboard	-	50
Task of using pencil or pen	50-100	-

Zones

Two lighting modes should be used for the two different tasks: (a) reading and writing tasks, (b) video presentations. For reading and writing tasks, the lighting mode can follow the requirements of visual clarity. However, when it comes to video presentations, the ambient light level should be very low, where there should be about 1fc. of background illumination for the white screen.

Maintenance

Since the electric lights are turned on all day in the training room, it will be more energy and cost efficient to use luminaires of longer life-span or use luminaires that is more easily replaced.