

Introduction

The four spaces that have redesigned lighting solutions are:

- Façade (facing Ballenger Avenue)
- Main Lobby
- President Office
- Training Room

The lighting panelboards that service these existing spaces could be summarized as follows:

Panelboard	Façade	Main Lobby	President Office	Training Room
HHA	X	X		
EHP1	X	X		

Note:

In the existing lighting plans, they show there is no lighting loads in president office (4th floor) and training room (3rd floor). Therefore all lighting loads in these two spaces are new to the panelboards.

Design Objectives

The main goal of the following section is to analyze how the new/redesign lighting solutions in the four spaces listed above affect the existing electrical systems, while the main focus is drawn on the panelboards and feeders resizing.

Design Approach

Since the Ballenger East Building has an empty layout in all floors except the main lobby and most of the existing panelboards are either fully loaded or barely loaded for future occupancy.

The general design approach is summarized as follows:

- Locate the existing panelboards that have lighting loads in any of the four spaces listed.
- Remove the existing lighting loads and replace with the new lighting loads.
- In anticipation, most new lighting loads would be added on those

panelboards that are barely loaded.

- Resize the affected feeders.

The rationalization behind this design approach could be summarized as follows:

- Avoid adding new panelboards as many of existing panelboards are intended for occupancy use.
- Most of the new lighting loads are in 120V, while some panelboards are designated at 480Y/277V. Therefore, it is important to locate the lighting loads correspondingly, in terms of voltage system.

Space 1: Building Façade

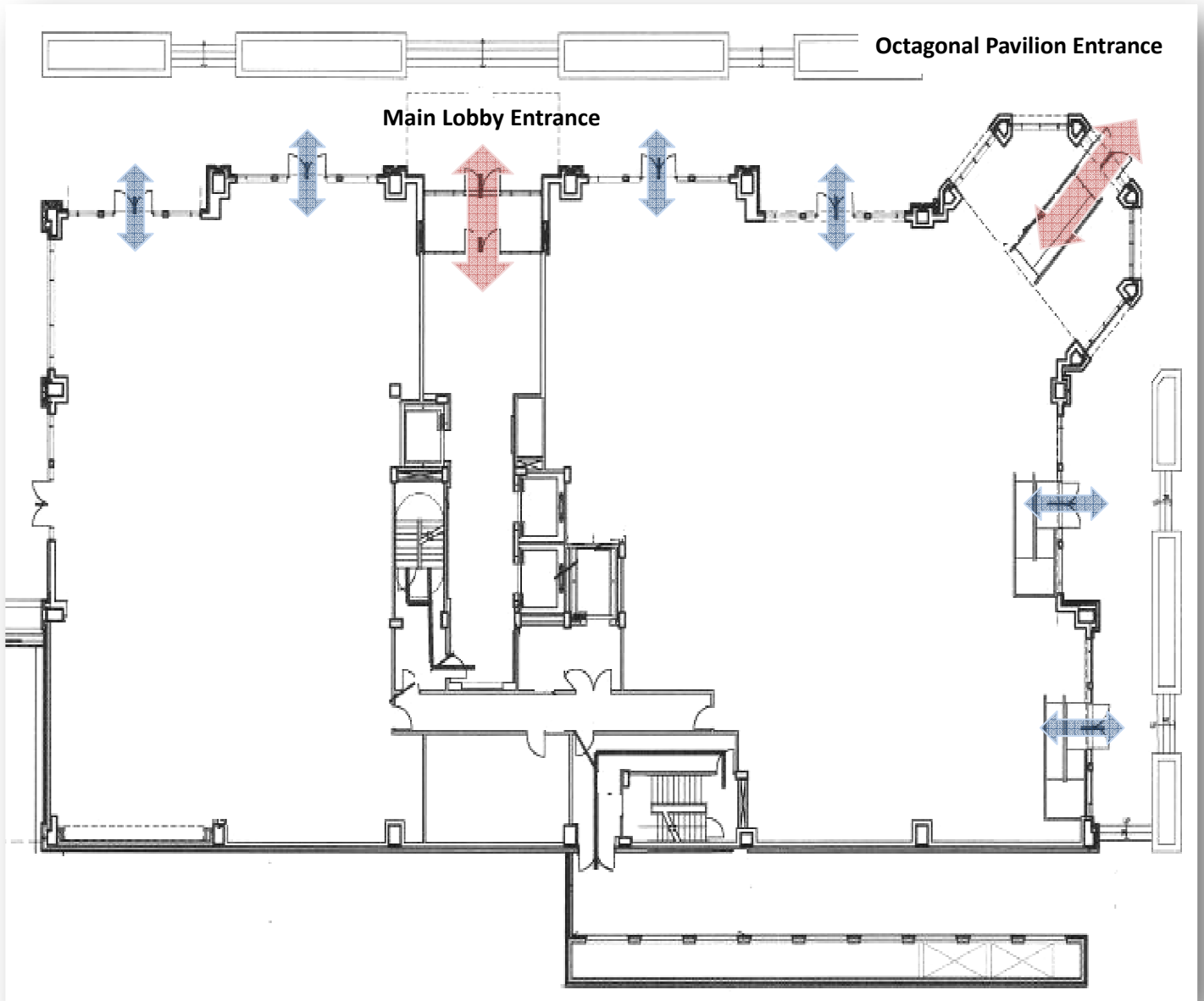
Spatial Overview

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 façades, and these two sides of façade act as access points where one would most probably enter the building through these two sides, and this also makes the two sides significant in terms of presenting the image of the building as a whole.

In the exterior spaces, there are planters located all along the perimeter of the building where one could sit on and get relaxed. At the north-east corner of the building, there is an octagonal pavilion which is the main entrance leading to the retail spaces.

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.





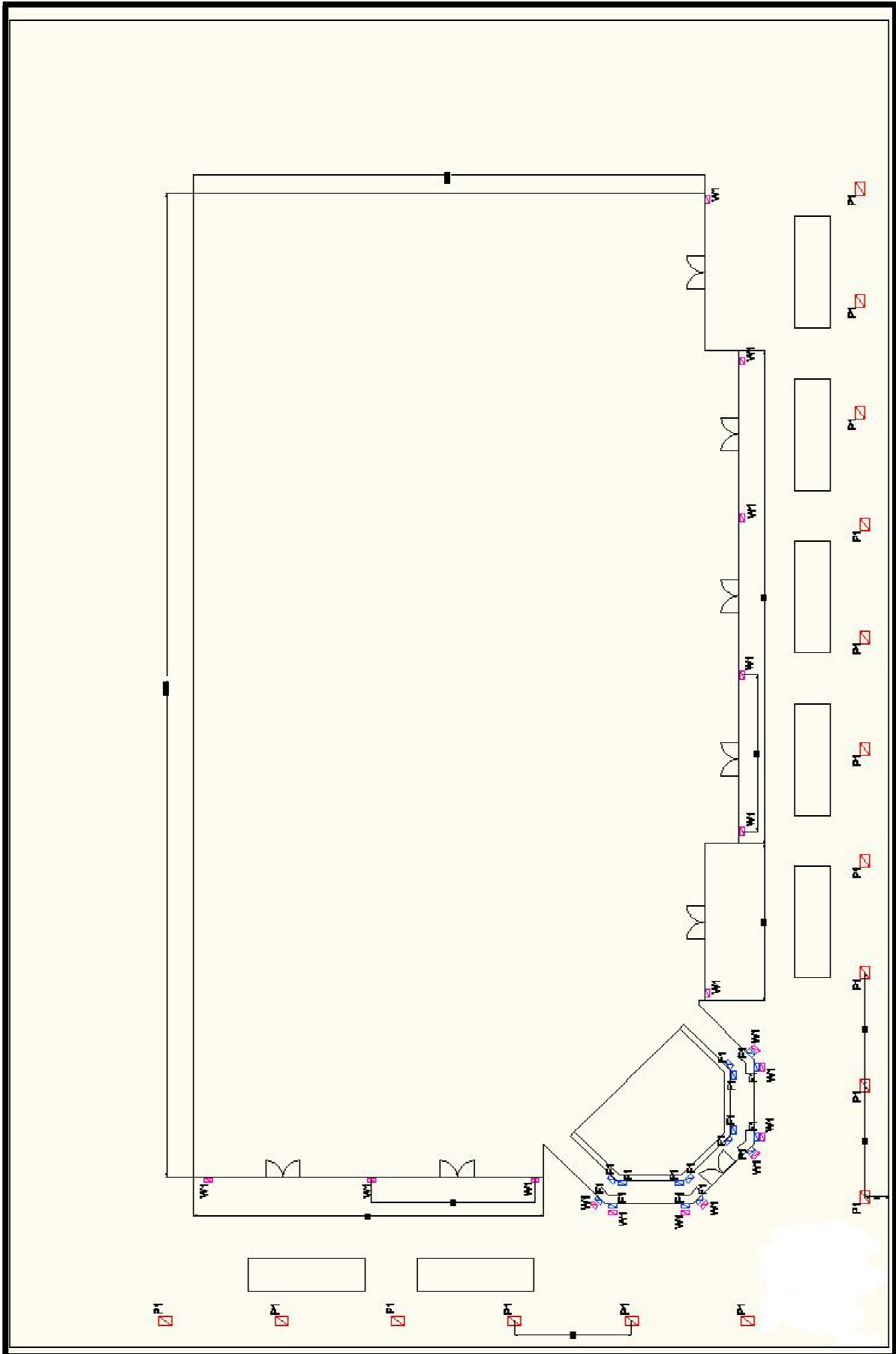
[Red arrows indicate major entrances, Blue arrows indicate retail entrances]

Proposed Luminaire Layout

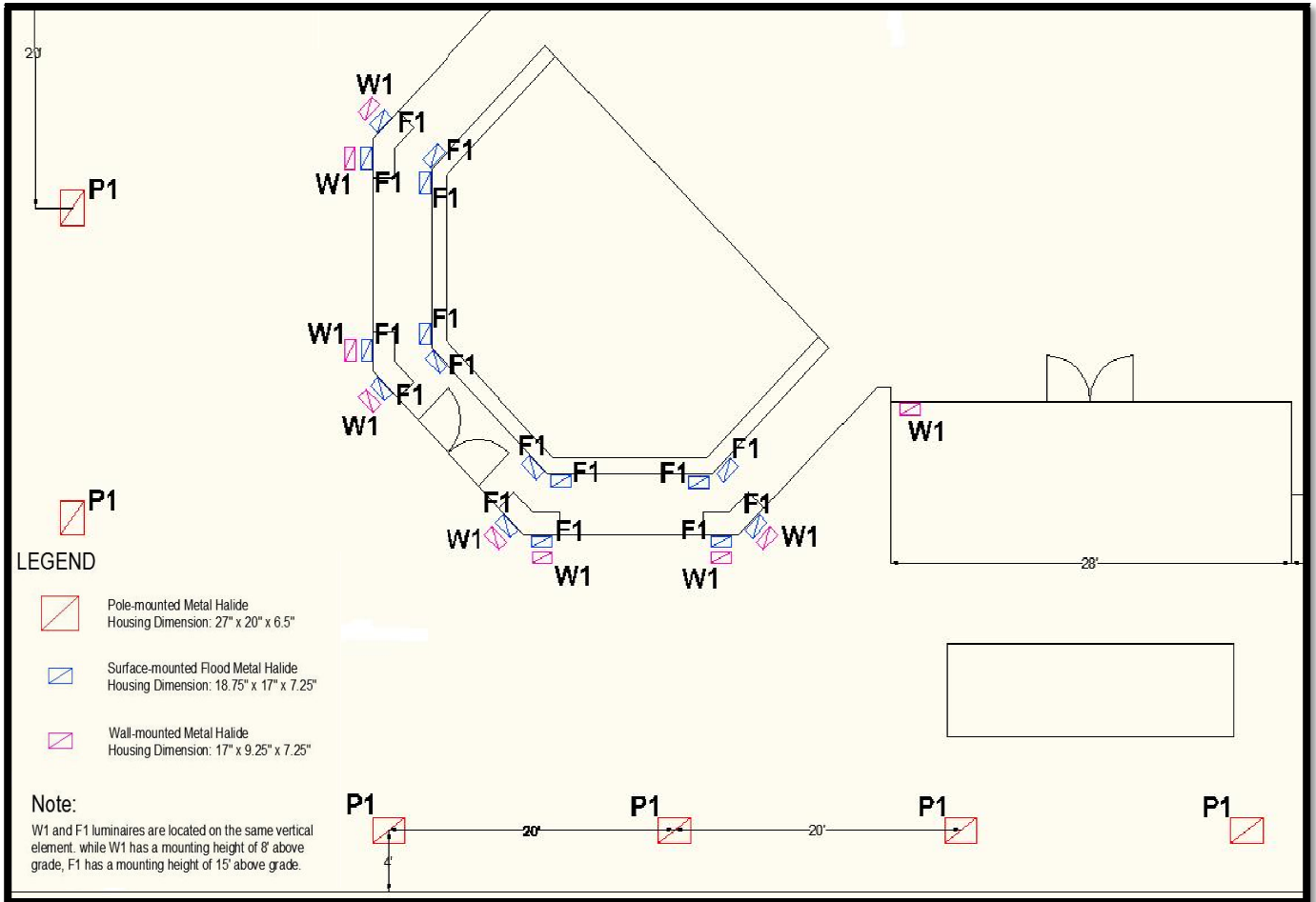
At the corner pavilion, there are metal halide flood lights washing the concrete columns from beneath. There are also wall-mounted metal halides located on the vertical elements made of brick.

Lighting Plan

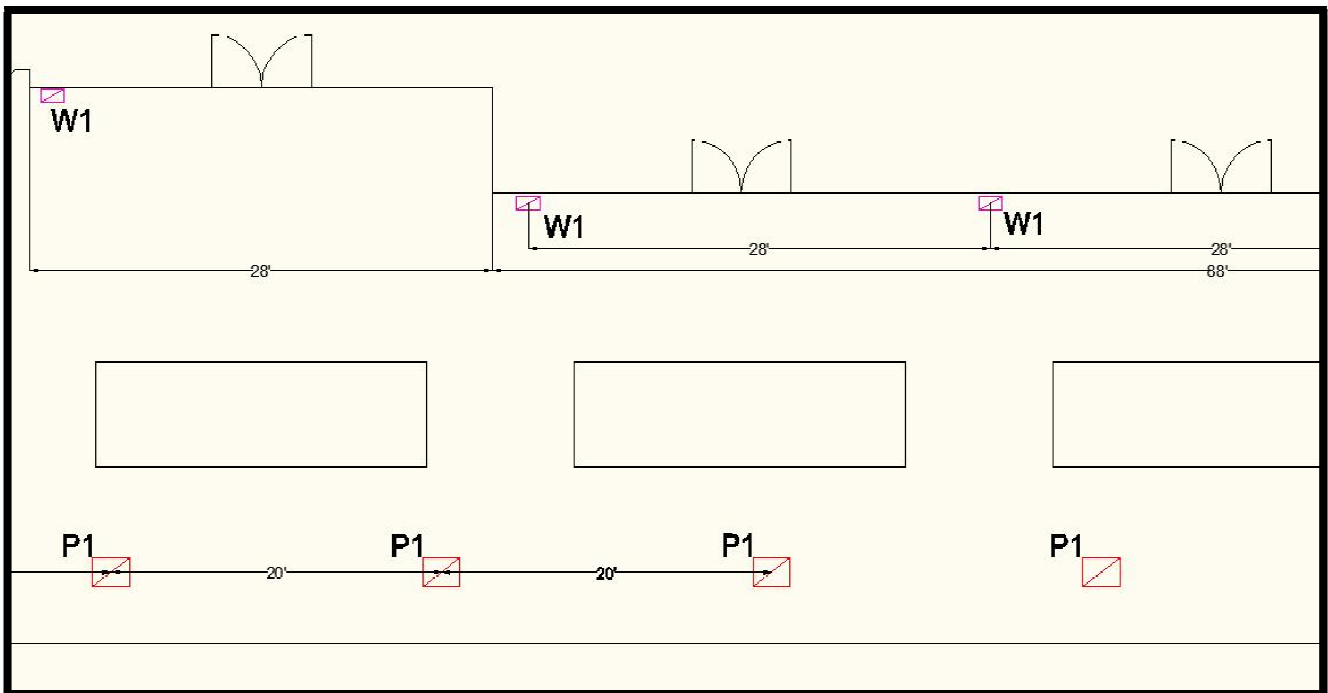
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[Overview of north & east facing facade]



[Partial Plan at corner pavilion]



[Partial Plan at north facing façade]

Proposed Luminaire Schedule:

Ballenger East Building Facade – Luminaire Schedule							
Type	Image	Luminaire Description	Manufacturer	Catalog Number	Lamp(s)	Input Watts	Volts
P1		<p>Pole Mounted Metal Halide. One-piece extruded aluminum housing. Corrosion resistant polyester powder coated finish. Clear tempered glass lens sealed by extruded high-temperature gasket. Field rotatable stepped or faceted reflector of anodized high-grade specular aluminum</p>	ExeLine	PAM255MA	(1) 250W MH 4100K	250 W	120- 277
W1		<p>Wall Mounted Metal Halide. Heavy duty die cast aluminum housing and hinged door. Corrosion resistant polyester powder coated finish. Stainless steel tamperproof hardware. Full 90° horizontal cutoff on all distributions. Formed and polished and/or segmented specular aluminum reflectors.</p>	ExeLine	GS1U172MA	(1) 150W MH 4200K	150 W	120- 277
F1		<p>Surface Mounted Flood Light. Heavy duty die cast aluminum housing and hinged door. Corrosion resistant polyester powder coated finish. Stainless steel tamperproof hardware. Formed and polished and/or segmented specular aluminum reflectors</p>	ExeLine	GF1F400MA	(1) 400W MH. 4200K	400 W	120- 277

Note:

Please refer luminaire cut-sheets to Appendix A.

Proposed Lamp Schedule:

Ballenger East Building Facade - Lamp Schedule						
Type	Manufacturer	Catalog Number	Rated Watts	CRI/CCT	Initial Lumens	Rated Life (hrs)
P1	GE	48432-CMH250/C/V/PA/O	250 W	90/4100 K	22000	20000
W1	GE	31068-CMH150CU942MED/O	150 W	90/4200 K	11000	15000
F1	GE	17260-CMH400/C/V/PA/O	400 W	90/4200 K -	36000	20000

Proposed Ballast Schedule:

Ballenger East Building Facade - Ballast Schedule						
Type	Manufacturer	Catalog Number	Rated Watt	Ballast type	Start Method	Ballast Factor
P1	GE	29377-GE-MH-250-4 00-MA	269 W	Electronic	Rapid	1.0
W1	GE	86711-GEM15048TL C3D-5	185 W	Magnetic	Core & Coil	1.0
F1	GE	29377-GE-MH-250-4 00-MA	428 W	Electronic	Pulse	0.94

Existing Panelboard HHA Schedule:

NAME	LOCATION	MOUNTING	SUPPLIED FROM	VOLTAGE		BUS AMP SIZE	MAIN O. C. DEVICE
HHA	MAIN ELEC ROOM	SURFACE	SWBD 'A'	480/277V, 3Ø, 4W WITH GROUND		400A	MLO
PROVIDE FEED THRU LUGS FOR PANEL HHB				65,000 AIC SERIES RATED			
DESCRIPTION	FULL LOAD (KVA)	BRANCH BRKR. SIZE	CIRCUIT AND PHASE		BRANCH BRKR. SIZE	FULL LOAD (KVA)	DESCRIPTION
STARWELL LTG.	0.6	20 / 1	1A	2A	20 / 1	2.0	WALL HEATER (WH)
STARWELL LTG.	0.6	/	3B	4B	/	2.0	WALL HEATER (WH)
LIGHTING (MEZZ)	0.9	/	5C	6C	/	0.7	HEAT TAPE (P3)
LTG (LOADING DOCK)	0.8	/	7A	8A	/	0.7	HEAT TAPE (P3)
LIGHTING (1ST)	1.4	/	9B	10B	/	0.7	HEAT TAPE (P2)
	2.2	/	11C	12C	/	0.7	HEAT TAPE (P2)
	0.3	/	13A	14A	/	0.7	HEAT TAPE (P1)
EXTERIOR LTG (1ST)	0.6	/	15B	16B	/	0.7	HEAT TAPE (P1)
WALL HEATER (WH)	2.0	/	17C	18C	/	4.0	WALL HEATER (WH)
	4.0	/	19A	20A	15 / 3	6.0	UH-1
	4.0	/	21B	22B	/		
	2.0	/	23C	24C	/		
	3.0	/	25A	26A	20 / 3	10.0	UH-1
	2.0	/	27B	28B	/		
INSTA-HOT WATER HTR	4.1	/	29C	30C	/		
UH-1	6.0	15 / 3	31A	32A	15 / 3	6.0	UH-1
		/	33B	34B	/		
		/	35C	36C	/		
UH-1	6.0	15 / 3	37A	38A	25 / 3	11.2	FCU-1
		/	39B	40B	/		
		/	41C	42C	/		

* INDICATES GROUND FAULT EQUIPMENT PROTECTION (GFEP-30mA) BRANCH CIRCUIT BREAKER.
** PROVIDE TIME CLOCK CONTROL. PROVIDE RELAYS AS REQUIRED TO ACCOMMODATE SINGLE TIME CLOCK CONTROL.

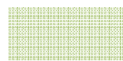
LOAD:	CONNECTED	DEMAND	CONTINUOUS	DEMANDED LOAD
EQUIPMENT:	140.6	1.0	1.0	140.6 KVA
LIGHTING:	10.1	1.0	1.25	12.6 KVA
TRANSFORMER:	23.6	1.0	1.0	23.6 KVA
TOTAL (COINCIDENTAL LOADS - VAV HEAT + FANS, SCU FAN):				176.8 KVA = 213 AMPS



Existing Lighting Loads in the Façade and Main Lobby

Proposed Panelboard HHA Schedule:

PANELBOARD SCHEDULE													
VOLTAGE: 480Y/277V,3PH,4W			PANEL TAG: HHA						MIN. C/B AIC: 65K				
SIZE/TYPE BUS: 225A			PANEL LOCATION: Main Electrical Room						OPTIONS: PROVIDE FEED THRU LUGS				
SIZE/TYPE MAIN: 225A/3P MLO			PANEL MOUNTING: SURFACE						FOR PANELBOARD HHB				
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION	
stairwell ltg	Stairwell	570	20A/1P	1	*			2	20A/1P	2000	1st floor	wall heater(WH)	
stairwell ltg	Stairwell	570	20A/1P	3		*		4	20A/1P	2000	1st floor	wall heater(WH)	
Lighting	Mezzanine	855	20A/1P	5			*	6	20A/1P	700	P3	Heat tape	
Lighting	Loading Dock	760	20A/1P	7	*			8	20A/1P	700	P3	Heat tape	
Pole Lights	Exterior	2500	20A/1P	9		*		10	20A/1P	700	P2	Heat tape	
Flood Lights	Facade	3200	20A/1P	11			*	12	20A/1P	700	P2	Heat tape	
Flood Lights	Facade	1600	20A/1P	13	*			14	20A/1P	700	P1	Heat tape	
Wall Sconce	Facade	1200	20A/1P	15		*		16	20A/1P	700	P1	Heat tape	
wall heater(WH)	1st floor	2000	20A/1P	17			*	18	20A/1P	4000	1st floor	wall heater(WH)	
wall heater(WH)	1st floor	4000	20A/1P	19	*			20	20A/1P	0		0	
wall heater(WH)	1st floor	4000	20A/1P	21		*		22	15A/3P	6000	1st floor	UH-1	
wall heater(WH)	1st floor	2000	20A/1P	23			*	24	20A/1P	0			
wall heater(WH)	1st floor	3000	20A/1P	25	*			26	20A/1P	0		0	
wall heater(WH)	1st floor	2000	20A/1P	27		*		28	20A/3P	10000	1st floor	UH-1	
Insta-hot water htr	1st floor	4100	20A/1P	29			*	30	20A/1P	0			
UH-1	1st floor	6000	15A/3P	31	*			32	15A/3P	6000	1st floor	UH-1	
		0	20A/1P	33		*		34	20A/1P	0			
		0	20A/1P	35			*	36	25A/3P	10304	1st floor	FCU-1	
UH-1	1st floor	6000	15A/3P	37	*			38	20A/1P	0		0	
		0	20A/1P	39		*		40	20A/1P	0			
		0	20A/1P	41			*	42	20A/1P	0			
CONNECTED LOAD (KW) - A		31.33							TOTAL DESIGN LOAD (KW)		124.35		
CONNECTED LOAD (KW) - B		29.67							POWER FACTOR		0.98		
CONNECTED LOAD (KW) - C		27.86							TOTAL DESIGN LOAD (AMPS)		152		



Proposed lighting loads

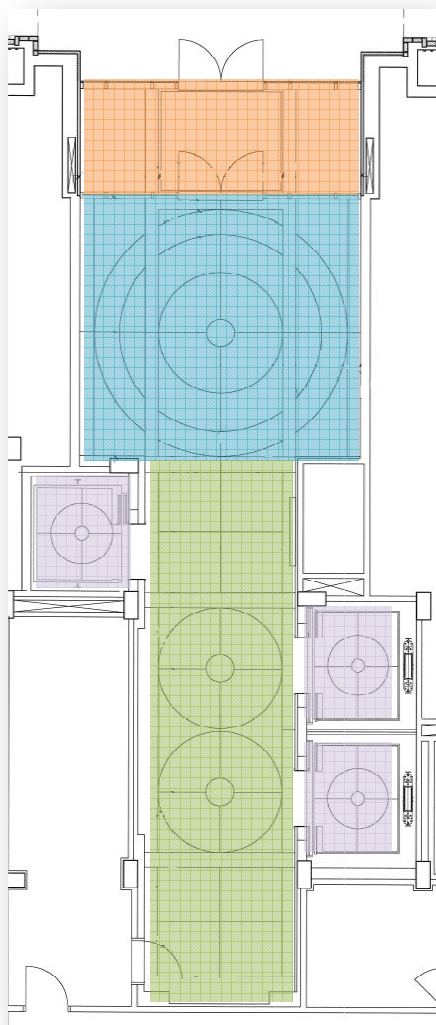
The new total design load (amps) is 152A, the new feeder size would be AWG #2/0 copper and the new conduit size would be 3" copper EMT.

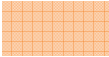

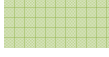

Space 2: Main Lobby

Spatial Overview

The main lobby is located on 1st floor at the north side of the building, and it directs circulation flow through both the vestibule and the entrance lobby to the elevator lobby. All these spaces appear in rectangular shape and have a total area of about 850 ft², with a breakdown of two main components: entrance lobby with the vestibule (450 ft²), and the elevator lobby (400 ft²). There are three elevators in total, one of them leads to the underground parking levels, and the other two brings circulation to office spaces on upper levels.

The main lobby is not only an access point for entering or leaving the building, it also provides an option where people could socialize with one another. Besides, there are always art work pieces or graphic arts displaying at the end of the elevator lobby, which might possibly keep the circulation stay in the area and take pleasure from looking at the arts.



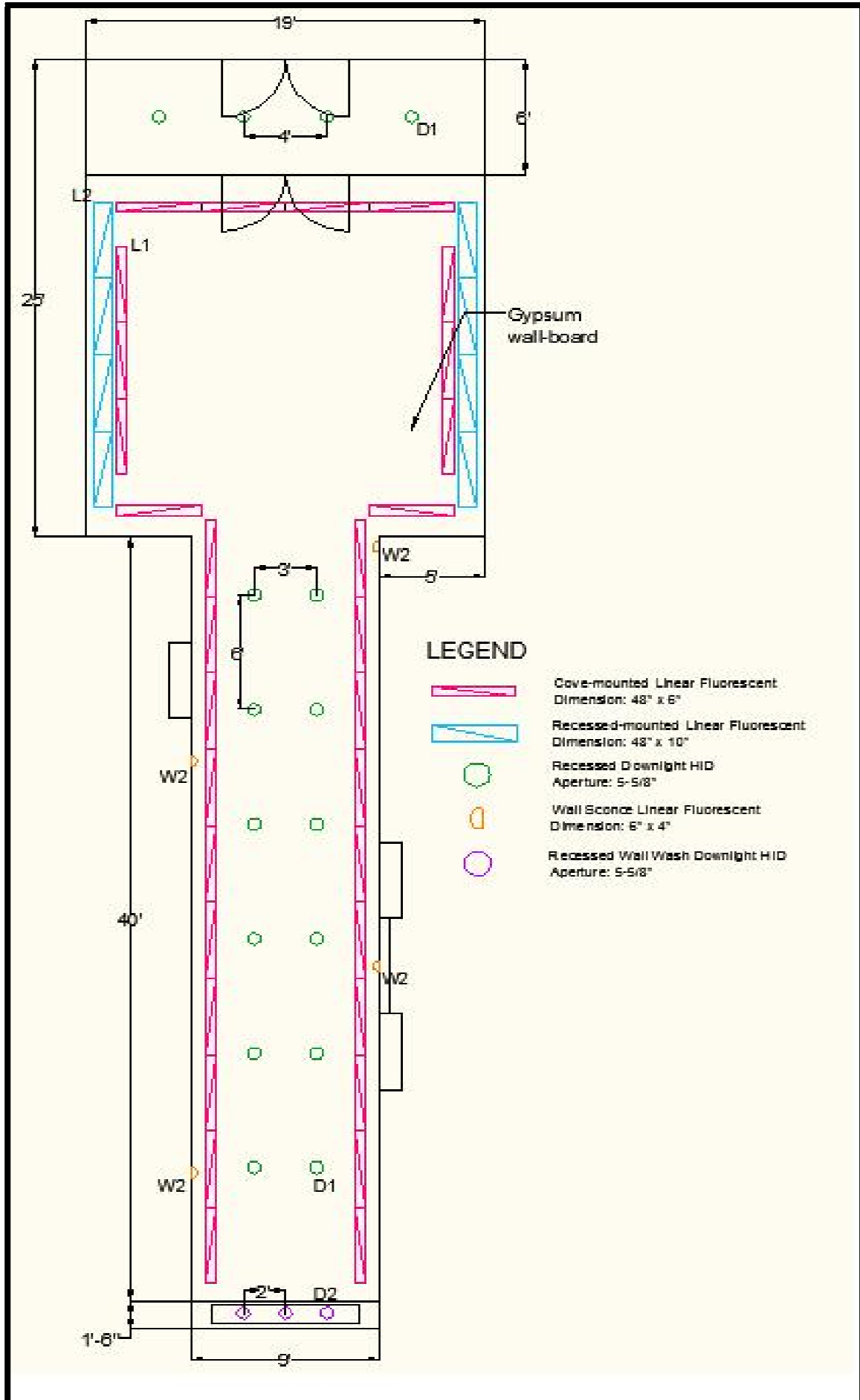
-  Vestibule – 120 ft²
-  Entrance lobby – 320 ft²
-  Elevator lobby – 400 ft²
-  Elevators – 40 ft² each

Proposed Luminaire Layout

There are two ceiling-mounted downlights in the vestibule. Then there are cove-mounted luminaires located at the perimeter of the entrance lobby and extend all the way down to the end of the elevator lobby. On the side walls of the entrance lobby, there are also recessed-mounted luminaires washing the stone walls beneath. There are downlights separated evenly along the ceiling of the elevator lobby. At the end of the elevator lobby, there are accent lights for the art work displaying in the alcove.

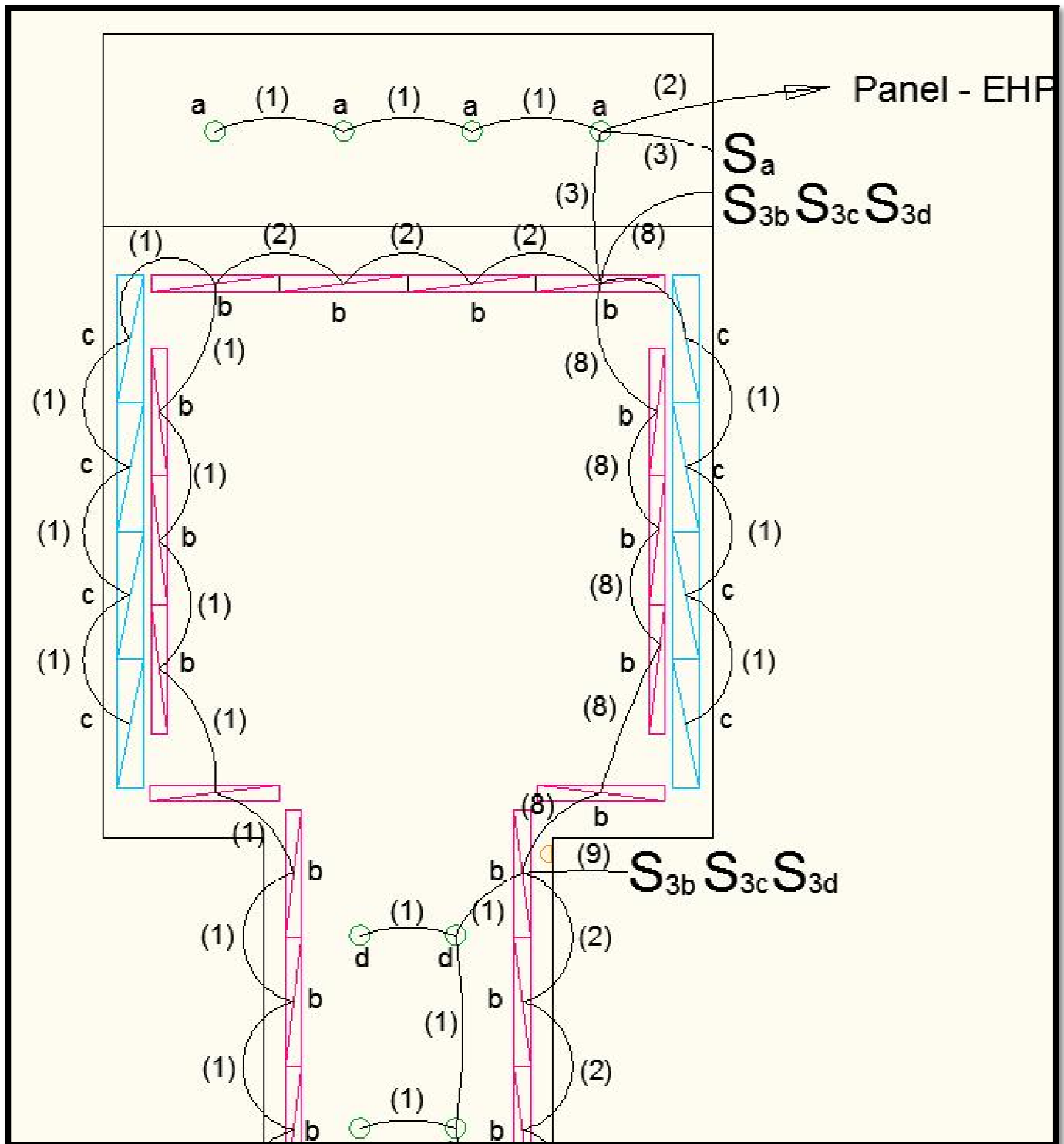
Reflected Ceiling Plan

-Scale: NTS

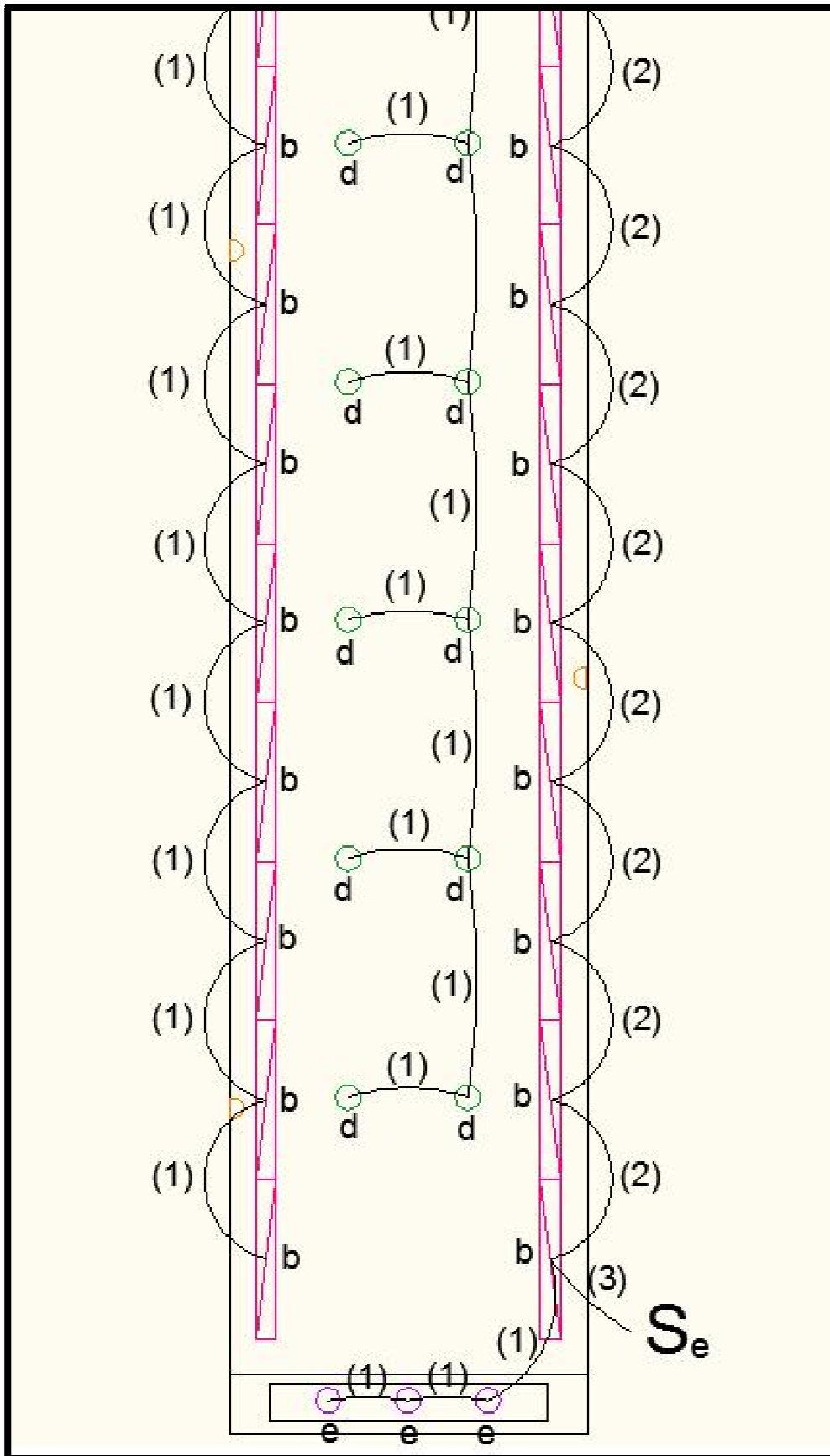


Switching Plan

-Scale: NTS





[Upper Part of Main Lobby]



[Lower Part of Main Lobby]

Proposed Luminaire Schedule:

Ballenger East Building Main Lobby – Luminaire Schedule							
Type	Image	Luminaire Description	Manufacturer	Catalog Number	Lamp(s)	Input Watts	Volts
L1		<p>Cove-mounted Linear Fluorescent.</p> <p>Die-formed 20 Ga. cold-rolled steel painted white finish. Weight is 3 lb/ft. Optical system constructed of highly specular Miro IV aluminum and 20 Ga. steel to produce asymmetric distribution. Fixtures can be screwed down in multiple positions and orientations.</p>	Ledalite	3808-T01-E-N-40-7-1-E-W	(1) 32W T8 3500K	32 W	277
L2		<p>Perimeter Wall-washer Linear Fluorescent.</p> <p>One-piece die form 20 Ga. cold rolled steel with extruded aluminum ceiling trim. Standard length up to 8 ft. All fixtures are self-flanged. Front reflector is die formed 0.025 semi-specular anodized aluminum, rear reflector is specular aluminum. Fixture housing and components are finished in baked white enamel.</p>	Day-O-Lite	JB-132T8-F-4-W-120-DIM	(1) 32W T8 3500K	32 W	277
W1		<p>Wall Sconce Compact Fluorescent.</p> <p>ADA compliant. 20 Ga. steel housing/reflector. Lamps shielded by detachable 22 Ga. steel perforated lamp shield with acrylic lens insert. Die-cast aluminum end caps complete shield assembly. 20 Ga. C.R.S. reflector finished in high reflectance white powder coat.</p>	Focal Point	F26-2-1Bx40-1 C-120-D-WM-L 835-WH	(1) 40W Biax. 3500K	40 W	277

<p>D1</p>		<p>Recessed Downlight Halogen. Medium base porcelain socket with nickel plated copper screw shell. IC rated and sealed Air-Loc housing. White baked enamel on steel for trim ring. 0.04" aluminum reflector with haze finish. 5-5/8" Alzak deep cone aperture. 50° lamp and lamp image cutoff.</p>	<p>Juno</p>	<p>IC62-627HZ-W H</p>	<p>(1) 75W PAR30 3500K</p>	<p>75W</p>	<p>277</p>
<p>D2</p>		<p>Recessed Downlight Halogen. Medium base porcelain socket with nickel plated copper screw shell. White baked enamel on steel for trim ring. 0.05 aluminum angle-cut reflector with haze finish. 50 lamp and lamp image cut-off. Specular clear kicker reflector directs light towards wall surface. Sealed Air-Loc housing eliminates leak-paths. 5-5/8" frosted prismatic lens wall wash aperture attached to top of trim provides maximum and even illumination.</p>	<p>Juno</p>	<p>IC62-629HZ-W H</p>	<p>(1) 75W PAR30 3500K</p>	<p>75W</p>	<p>277</p>

Note:

Please refer luminaire cut-sheets to Appendix A.

Proposed Lamp Schedule:

Ballenger East Building Main Lobby – Lamp Schedule						
Type	Manufacturer	Catalog Number	Rated Watts	CRI/CCT	Initial Lumens	Rated Life (hrs)
L1	GE	10326-F32T8XLSPX35HLEC	28 W	85/3500K	3100	36000
L2	GE	10326-F32T8XLSPX35HLEC	28 W	85/3500K	3100	36000
W1	GE	16648-F40/30BX/SPX35	40 W	82/3500K	3150	20000
D1	GE	73346-Vio/3.6W/841	75 W	80/3500K	1010	3000
D2	GE	73346-Vio/3.6W/841	75 W	80/3500K	1010	3000

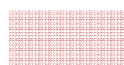
Proposed Ballast Schedule:

Ballenger East Building Main Lobby– Ballast Schedule						
Type	Manufacturer	Catalog Number	Rated Watt	Ballast type	Start Method	Ballast Factor
L1	GE	80353-B132R120V5	32 W	Electronic-Dimming	Rapid	0.88
L2	GE	80353-B132R120V5	32 W	Electronic-Dimming	Rapid	0.88
W1	GE	80683-C240PUNVHP-B-IP	40 W	Electronic	Program/Rapid	1.00

Existing Panelboard EHP1 Schedule:

NAME	LOCATION	MOUNTING	SUPPLIED FROM	VOLTAGE		BUS AMP SIZE	MAIN O. C. DEVICE
EHP1	MAIN ELEC ROOM	SURFACE	ATS	480/277V, 3 ϕ , 4W WITH GROUND		400A	MLO
PROVIDE FEED THRU LUGS FOR PANEL EHP2						65,000 AIC SERIES RATED	
DESCRIPTION	FULL LOAD (KVA)	BRANCH BRKR. SIZE	CIRCUIT AND PHASE		BRANCH BRKR. SIZE	FULL LOAD (KVA)	DESCRIPTION
PARK LTG (P3)	1.3	20 / 1	1A	2A	20 / 1	1.4	PARK LTG (P2)
PARK LTG (P1)	1.7	/	3B	4B	/	0.6	STAIRWELL LTG.
STAIRWELL LTG.	0.7	/	5C	6C	/	1.1	LIGHTING (MEZZ)
LIGHTING (1ST)	2.2	/	7A	8A	/	0.2	RETAIL LIGHTING
LIGHTING (1ST)	0.3	/	9B	10B	/	0.2	
LIGHTING (2ND)	0.4	/	11C	12C	/	0.2	
LIGHTING (PENT)	0.6	/	13A	14A	/	0.2	
LIGHTING (PENT)	0.6	/	15B	16B	/	0.2	
SPARE		/	17C	18C	/	0.2	
JACKET HEATER	1.0	20 / 3	19A	20A	/	0.2	
		/	21B	22B	/		TENANT LIGHTING
		/	23C	24C	/		TENANT LIGHTING
SPARE		20 / 1	25A	26A	/		SPACE
A/C-4 (OUTDOOR)	4.9	20 / 2	27B	28B	/		
		/	29C	30C	/		
FAN F-22 (STAIRWELL PRES.)	4.0	15 / 3	31A	32A	15 / 3	4.0	FAN F-23 (STAIRWELL PRES.)
		/	33B	34B	/		
		/	35C	36C	/		
DUPLEX SUMP PUMP	5.7	15 / 3	37A	38A	35 / 3	18.3	DUP. SEWAGE EJECTOR
		/	39B	40B	/		
		/	41C	42C	/		

LOAD:	CONNECTED	DEMAND	CONTINUOUS	DEMANDED LOAD
EQUIPMENT:	46.5	1.0	1.0	167.0 KVA
LIGHTING:	8.0	1.0	1.25	10.0 KVA
TRANSFORMER:	29.0	1.0	1.0	29.0 KVA
TOTAL:				206.0 KVA = 247.9 AMPS



Existing Lighting Loads in Main Lobby & Facade

Proposed Panelboard EHP1 Schedule:

PANELBOARD SCHEDULE												
VOLTAGE: 480Y/277V,3PH,4W			PANEL TAG: EHP1						MIN. C/B AIC: 65K			
SIZE/TYPE BUS: 225A			PANEL LOCATION: Main Electrical Room						OPTIONS: PROVIDE FEED THRU LUGS			
SIZE/TYPE MAIN: 225A/3P MLO			PANEL MOUNTING: SURFACE						FOR PANELBOARD EHP2			
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
0	0	0	20A/1P	1	*			2	20A/1P	0	0	0
Park Ltg	P1	1615	20A/1P	3		*		4	20A/1P	570	Stairwell	General Ltg
General Ltg	Stairwell	665	20A/1P	5			*	6	20A/1P	0	0	0
0	0	0	20A/1P	7	*			8	20A/1P	190	1st floor	Retail Lighting
Lighting(stonewall)	Main Lobby	320	20A/1P	9		*		10	20A/1P	190	1st floor	Retail Lighting
Lighting	2nd floor	380	20A/1P	11			*	12	20A/1P	190	1st floor	Retail Lighting
Lighting	Penthouse	570	20A/1P	13	*			14	20A/1P	190	1st floor	Retail Lighting
Lighting	Penthouse	570	20A/1P	15		*		16	20A/1P	190	1st floor	Retail Lighting
Spare		0	20A/1P	17			*	18	20A/1P	190	1st floor	Retail Lighting
Jacket Heater	1st floor	1000	20A/3P	19	*			20	20A/1P	190	1st floor	Retail Lighting
Cove Lights	Main Lobby	1024	20A/1P	21		*		22	20A/1P	0	1st floor	Tenant Lighting
		0	20A/1P	23			*	24	20A/1P	0	1st floor	Tenant Lighting
Spare		0	20A/1P	25	*			26	20A/1P	0		Space
A/C-4	Outdoor	4410	20A/2P	27		*		28	20A/1P	1125	Main Lobby	Downlights
		0	20A/1P	29			*	30	20A/1P	0		Space
Fan F-22	Stairwell	3600	15A/3P	31	*			32	15A/3P	3600	Stairwell	Fan F-23
Park Ltg	P3	1235	20A/1P	33		*		34	20A/1P	1330	P2	Park Ltg
		0	20A/1P	35			*	36	20A/1P	0		
Duplex Sump Pump	1st floor	5130	15A/3P	37	*			38	20A/1P	0	1st floor	0
Wall Sconce	Main Lobby	160	20A/1P	39		*		40	20A/1P	1045	Mezzanine	Lighting
		0	20A/1P	41			*	42	35A/3P	16470	1st floor	Dup. Sew. Ejector
CONNECTED LOAD (KW) - A		14.47							TOTAL DESIGN LOAD (KW)			52.86
CONNECTED LOAD (KW) - B		13.78							POWER FACTOR			0.92
CONNECTED LOAD (KW) - C		17.90							TOTAL DESIGN LOAD (AMPS)			69



Proposed Lighting Loads

Note:

Because of the imbalanced connected loads, some of the loads have been rearranged to different circuits.

The bus amp size is still kept 225A because there are circuits for future use.

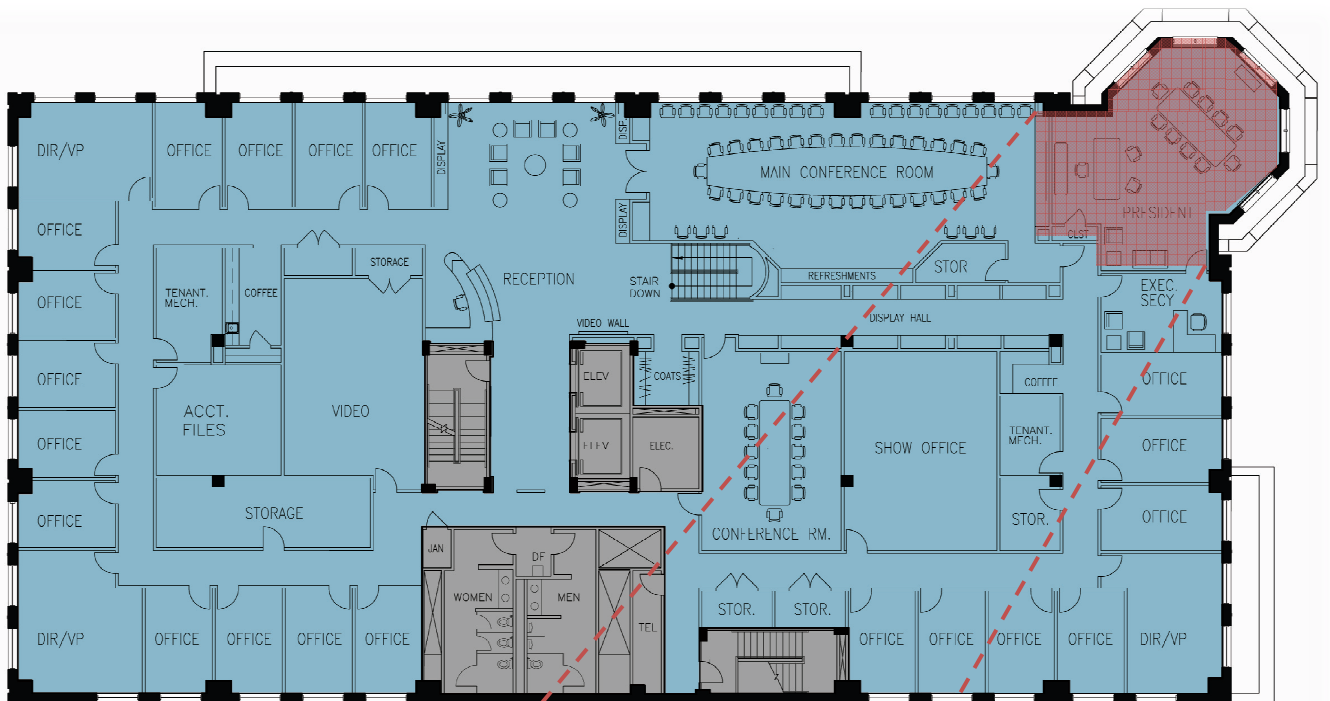
The new total design load (amps) is 69A, then the new feeder size would be AWG #4 copper and the new conduit size would be 3" copper EMT.

Space 3: President Office

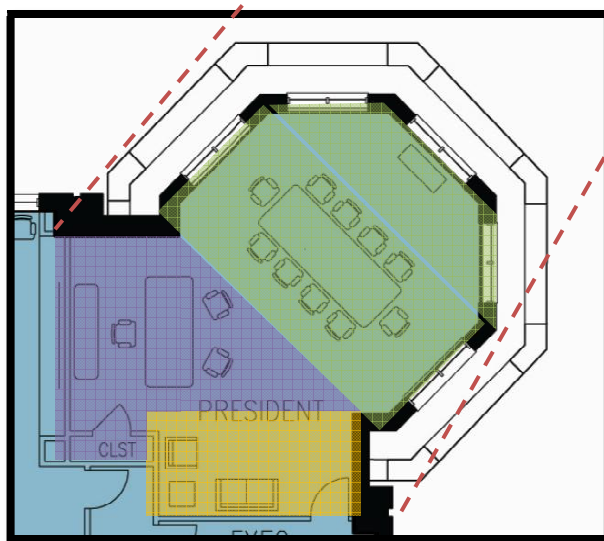
Spatial Overview

The president's office is located at the north-east corner on the 4th floor, sitting on top of the corner pavilion and because of that, the space has a non-rectangular shape. The room has an approximate 900 ft² with a ceiling height of 13.5'.

There are five huge windows, each of about 40 ft², located on the pavilion walls. Therefore daylight could be integrated with the new lighting system.



[4th Floor Plan]



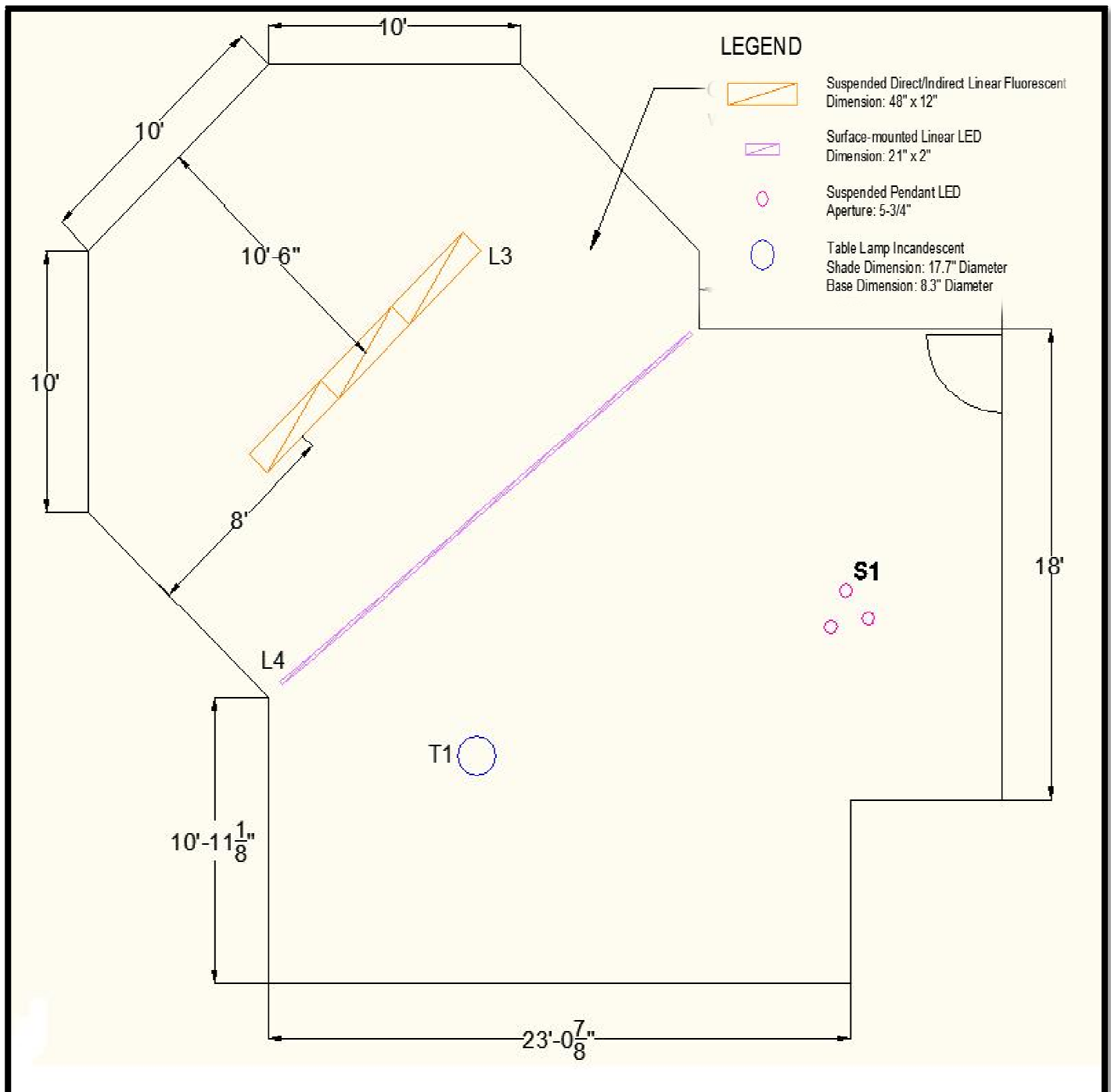
- Lounge area with sofas – 100 ft²
- President's working area – 350 ft²
- Conference area – 450 ft²

Proposed Luminaire Layout:

There are suspended luminaires providing illumination in the lounge area. There is a table lamp on the president's desk. The conference area is constructed on a raised platform, and there will be linear LEDs hidden in the slot to act as step lights. Finally, there will be suspended direct/indirect luminaires to provide ambient light for meetings in the conference area.

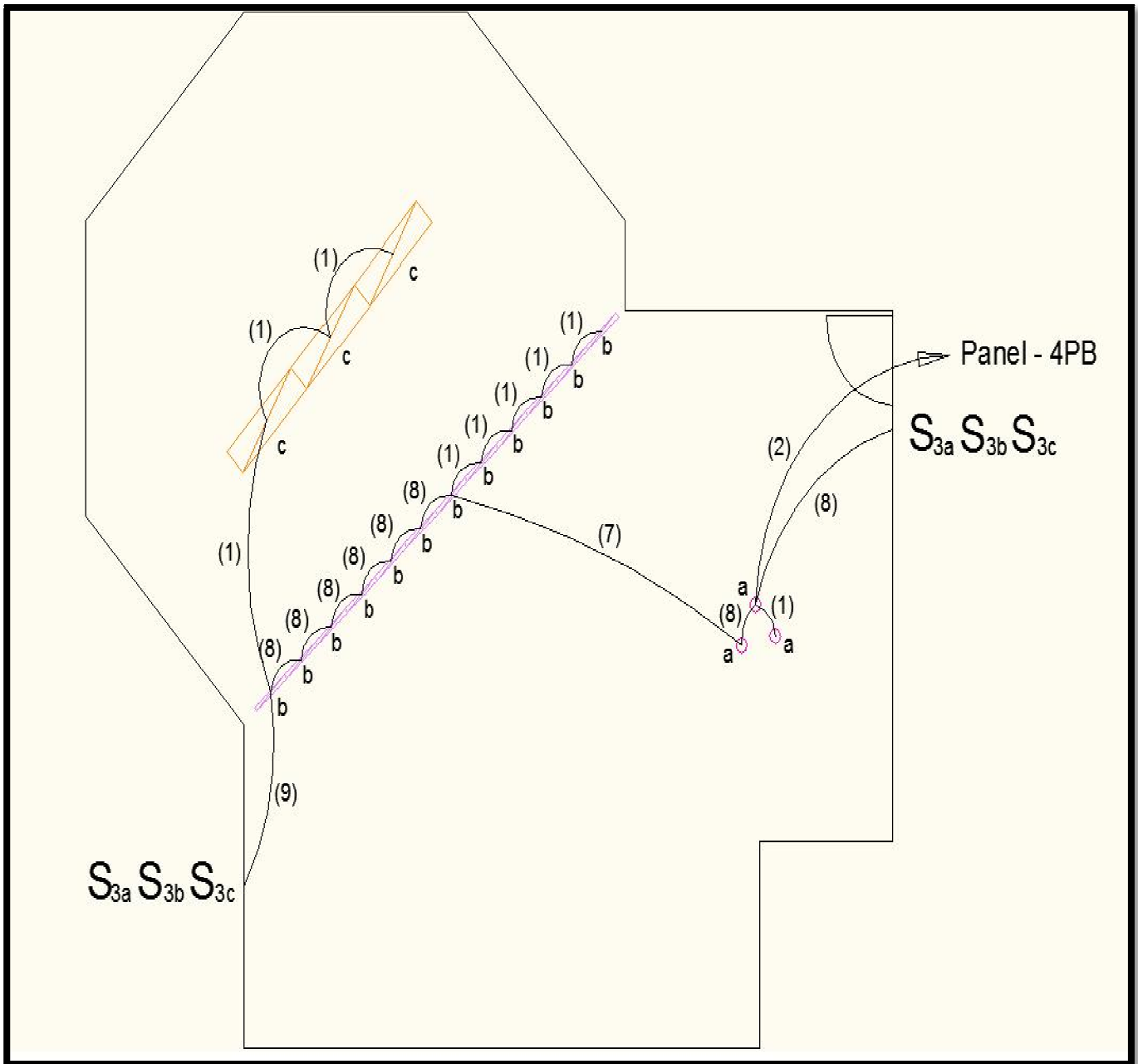
Reflected Ceiling Plan

-Scale: NTS



Switching Plan

-Scale: NTS



Proposed Luminaire Schedule:

Ballenger East Building President Office – Luminaire Schedule							
Type	Image	Luminaire Description	Manufacturer	Catalog Number	Lamp(s)	Input Watts	Volts
L3		Suspended direct/indirect fluorescent. Canopy finished in Matte Satin White with reflector and perforated lamp shield. One-piece 20 Ga steel housing. Die-cast aluminum, removable two-piece sculpted end caps allow continuous mounting of luminaires.	Focal Point	FS5S-PS-23T5-IC-1 20-D-C48-WH-4'	(4) 28W T5 4100K	32 W	120
L4		Surface-mounted LED. Extruded aluminum body with molded polycarbonate endcaps and lens. Polyester paint finish in a pearl finish on luminaire body.	Alkco	ARIS-21-40-120-P RL-HWC	(10) 1W LED 4000K	13 W	120
T1		Table lamp incandescent. White, wet painted finish. High luster chrome plated, spun brass on base and stem. Spun aluminum on shades. Black, injection molded bakelite on triangular piece.	Louis Poulsen	PH4.3-T	(1) 100W Incand.	100 W	120
S1		Suspended LED. Die-cast aluminum heat sink with hang-straight canopy/drive compartment and I.P. stem. Semi-specular, black alzak finished reflector.	Prescolite	SDPS6LED-DM-35 K-120V-B-SS-BL	(10) 3W LED 4100K	32 W	120

Note:

Please refer the luminaire cut-sheets to Appendix A

Proposed Lamp Schedule:

Ballenger East Building President Office - Lamp Schedule						
Type	Manufacturer	Catalog Number	Rated Watts	CRI/CCT	Initial Lumens	Rated Life (hrs)
L3	GE	46706-F28W/T5/841/ECO	28 W	85/4100K	2900	30000
L4	GE	74892-LC12/741/120V	6.5 W/ft	80/4100K	320/ft	50000
T1	GE	41034- 100A 48PK	100 W	80/ 4100K	1710	750
S1	GE	73346-Vio/3.6W/841	3.6 W	85/4100K	160	50000

Proposed Ballast Schedule:

Ballenger East Building President Office - Ballast Schedule						
Type	Manufacturer	Catalog Number	Rated Watt	Ballast type	Start Method	Ballast Factor
L3	GE	99655-GE228MVPS-A	37 W	Electronic	Program/Rapid	1.09

Existing Panelboard 4PB Schedule:

Since the president office has an empty layout as discussed at the beginning of the section, so there is no existing panelboard for this space. While the president office is located on the 4th floor, it will be logical to put the lighting loads in one of the panelboards located on 4th floor. Panelboard 4PB is selected mainly because the new lighting loads are in 120V, and that panelboard is designated for occupancy use, which perfectly fits the situation here.

NAME	LOCATION	MOUNTING	SUPPLIED FROM	VOLTAGE		BUS AMP SIZE	MAIN O. C. DEVICE
4PB	TENANT ELEC CLOS	SURFACE	PANEL 4PA	208/120V, 3 ϕ , 4W WITH GROUND		225	MLO
10,000 AIC SERIES RATED							
DESCRIPTION	FULL LOAD (KVA)	BRANCH BRKR. SIZE	CIRCUIT AND PHASE		BRANCH BRKR. SIZE	FULL LOAD (KVA)	DESCRIPTION
SPACE		/	1A	2A	/		SPACE
		/	3B	4B	/		
		/	5C	6C	/		
		/	7A	8A	/		
		/	9B	10B	/		
		/	11C	12C	/		
		/	13A	14A	/		
		/	15B	16B	/		
		/	17C	18C	/		
		/	19A	20A	/		
		/	21B	22B	/		
		/	23C	24C	/		
		/	25A	26A	/		
		/	27B	28B	/		
		/	29C	30C	/		
		/	31A	32A	/		
		/	33B	34B	/		
		/	35C	36C	/		
		/	37A	38A	/		
		/	39B	40B	/		
		/	41C	42C	/		

Proposed Panelboard 4PB Schedule:

PANELBOARD SCHEDULE												
VOLTAGE: 208Y/120V, 3PH, 4W			PANEL TAG: 4PB				MIN. C/B AIC: 10K					
SIZE/TYPE BUS: 225A COPPER			PANEL LOCATION: Tenant Electric Closet				OPTIONS: PROVIDE FEED THROUGH LUGS					
SIZE/TYPE MAIN: 225A/3P MLO			PANEL MOUNTING: SURFACE				FOR FUTURE PANELBOARD					
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Receptacles	Pred Office	918	20A/1P	1	*			2	20A/1P	918	Pred Office	Receptacles
Receptacles	Pred Office	918	20A/1P	3		*		4	20A/1P	918	Pred Office	Receptacles
Direct/Indirect	Pred Office	384	20A/1P	5			*	6	20A/1P	195	Pred Office	Step Light (LED)
Table Lamp	Pred Office	100	20A/1P	7	*			8	20A/1P	96	Pred Office	Suspended LED
Space			20A/1P	9		*		10	20A/1P			Space
Computer	Pred Office	1250	20A/1P	11			*	12	20A/1P			Space
Space			20A/1P	13	*			14	20A/1P			Space
Space			20A/1P	15		*		16	20A/1P			Space
Space			20A/1P	17			*	18	20A/1P			Space
Space			20A/1P	19	*			20	20A/1P			Space
Space			20A/1P	21		*		22	20A/1P			Space
Space			20A/1P	23			*	24	20A/1P			Space
Space			20A/1P	25	*			26	20A/1P			Space
Space			20A/1P	27		*		28	20A/1P			Space
Space			20A/1P	29			*	30	20A/1P			Space
Space			20A/1P	31	*			32	20A/1P			Space
Space			20A/1P	33		*		34	20A/1P			Space
Space			20A/1P	35			*	36	20A/1P			Space
Space			20A/1P	37	*			38	20A/1P			Space
Space			20A/1P	39		*		40	20A/1P			Space
Space			20A/1P	41			*	42	20A/1P			Space
CONNECTED LOAD (KW) - A		2.03							TOTAL DESIGN LOAD (KW)		5.36	
CONNECTED LOAD (KW) - B		1.84							POWER FACTOR		0.80	
CONNECTED LOAD (KW) - C		1.83							TOTAL DESIGN LOAD (AMPS)		19	



Proposed New Loads

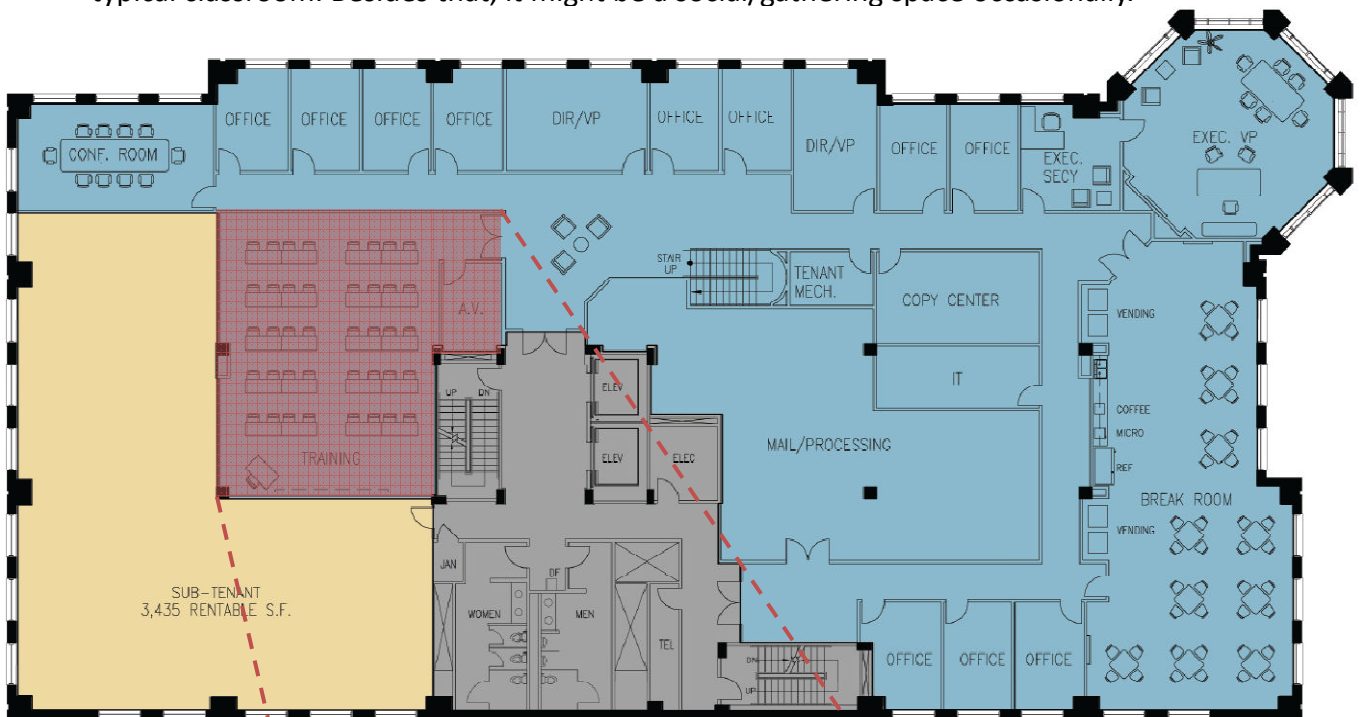
The bus amp size is still kept at 225A because there are still many loads and circuits left for future use. The new total design load (amps) is 19A. Since the power of panelboard 4PB is supplied from panelboard 4PA, therefore the new feeder size has to consider the loads in panelboard 4PA, which is 10.3 amps. Thus the new feeder size would be AWG #10 copper, and the new conduit size would be 2.5" copper EMT.

Space 4: Training Room

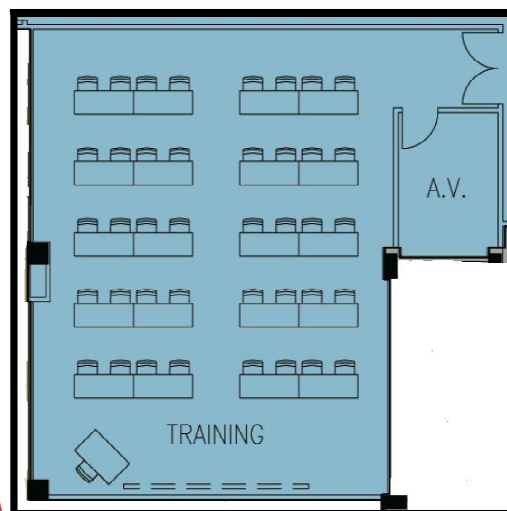
Spatial Overview

The training room is located near the west right beside the elevator lobby on 3rd floor and has a rectangular shape, with a dimension of 40' (length) x 30' (width) x 13.5 (height) and an area of about 1200 ft². From the floor plan below, there are 5 rows of benches and a podium at the corner next to the blackboard/screen. Since there is no window in this room, electric lighting is the only light source.

The primary activities included in this room would be teaching and learning like a typical classroom. Besides that, it might be a social/gathering space occasionally.



3rd Floor Plan

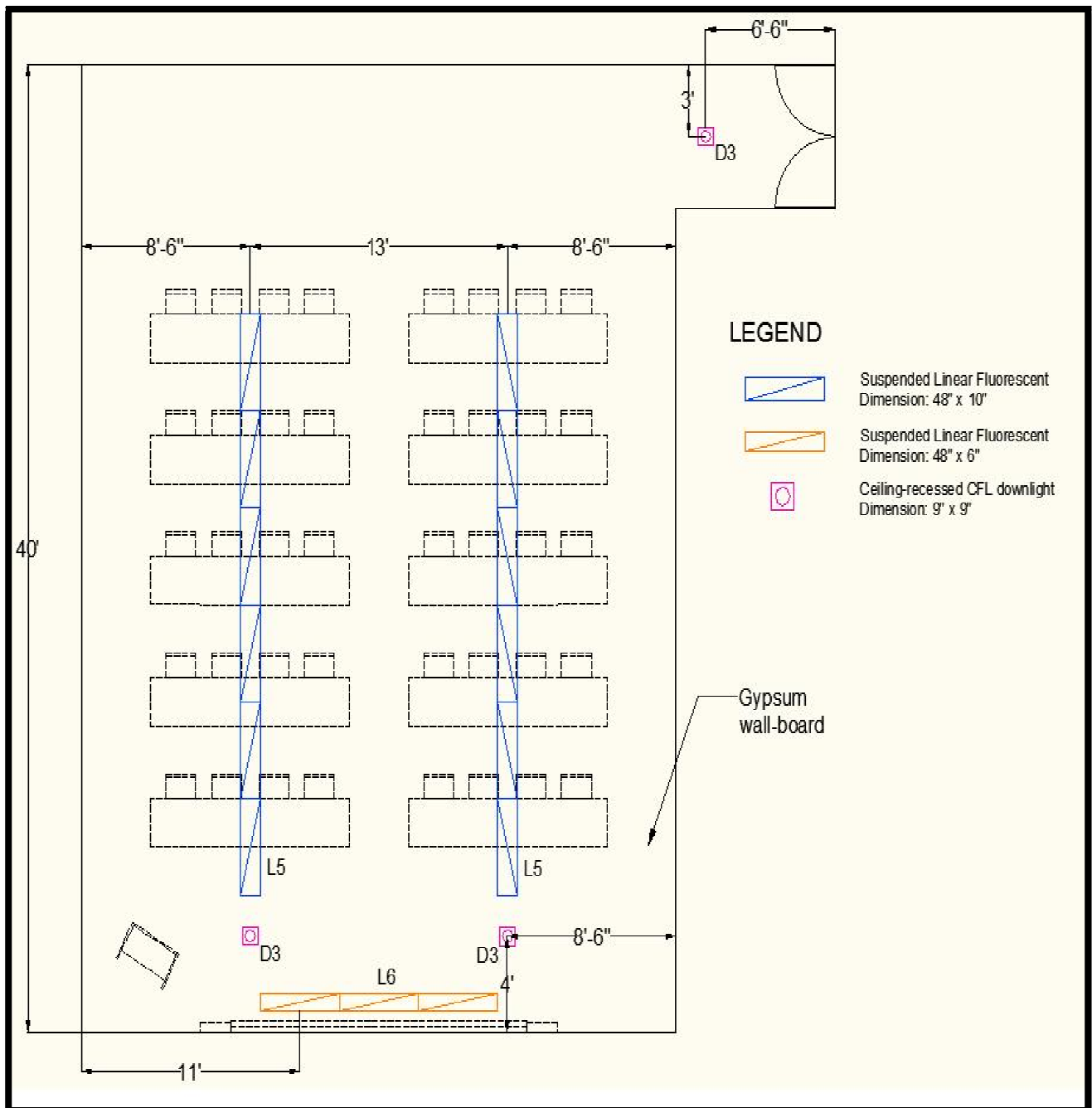


Proposed Luminaire Layout

There are 2 rows (12 fixtures, blue) of linear fluorescent luminaires suspended from the ceiling, and 1 row (3 fixtures, orange) of wall-mounted fluorescent luminaires right above the blackboard/screen. Besides, there are also recessed-mounted compact-fluorescent downlights (5 fixtures, purple) at the front and back of the room.

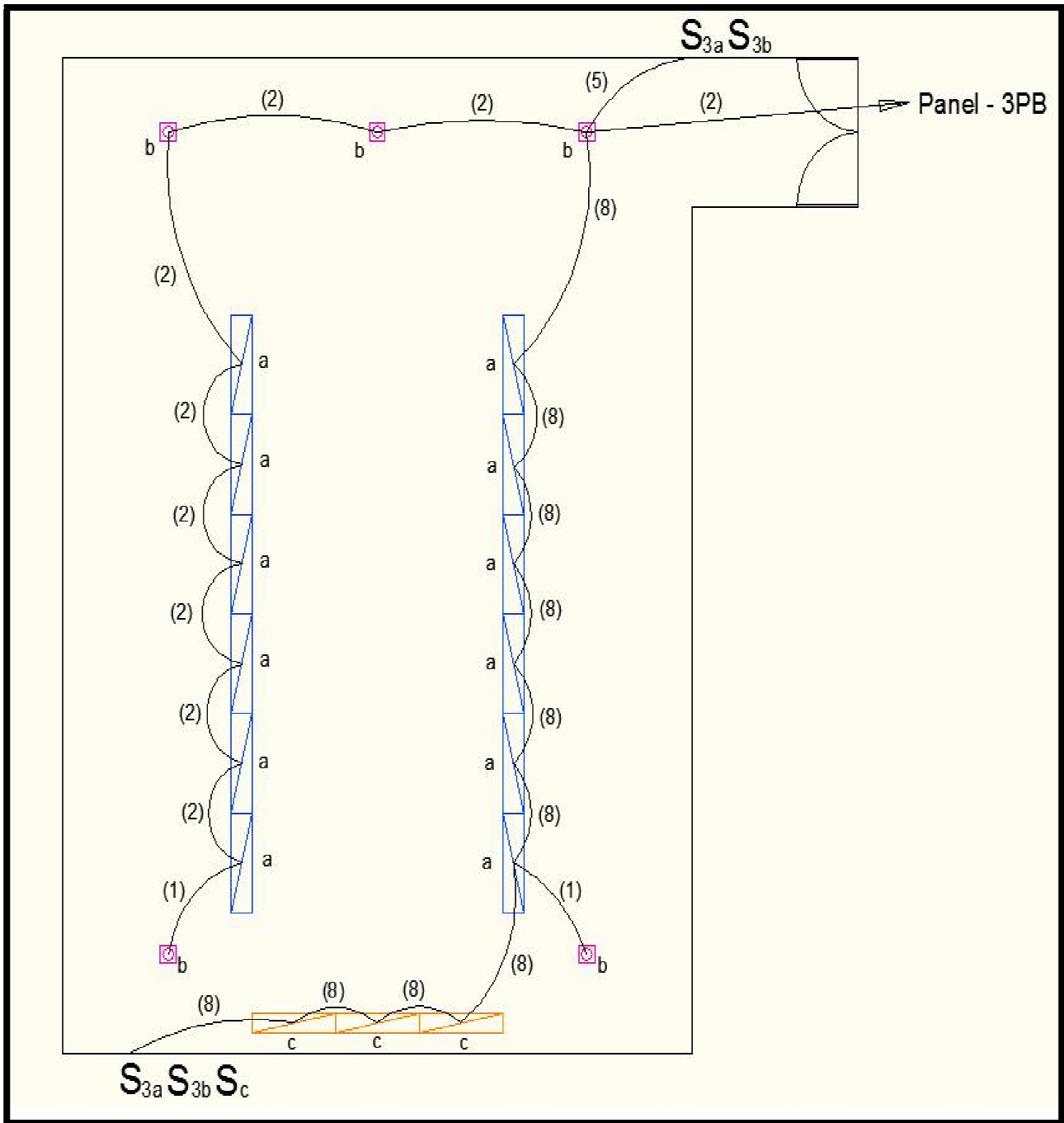
Lighting Plan

- Scale: 1" to 8'



Circuiting & Switching Plan

- Scale: 1" to 8'



Proposed Luminaire Schedule:

Ballenger East Building Training Room – Luminaire Schedule							
Type	Image	Luminaire Description	Manufacturer	Catalog Number	Lamp(s)	Input Watts	Volts
L5		<p>Suspended direct/indirect fluorescent.</p> <p>Adjustable reflectors allow combination of up/down light ranging from 50% up/50% down to 100% indirect. Zinc die-cast end caps with powdered coating. Semi-specular parabolic louvers with frosted acrylic lens for the optical infill panels. Socket brackets and all other internal metal components are die formed 18 Ga, steel, white powder coated.</p>	Axis	LT5B4T81W00E 1202CA36CD	(1) 32W T8 3500K	32 W	120
L6		<p>Suspended direct fluorescent.</p> <p>Hermetically sealed aluminum extrusion with die cast end caps and adjustable asymmetric louver with a clear cover ideal for directing light.</p>	Deco	RIVA-1-28-UNV- C60-DB	(1) 28W T5 3500K	36 W	120- 277
D3		<p>Recessed CFL downlights.</p> <p>A lensed (1/8") regressed acrylic shield combined with an open reflector with no visible lamp source. It is configured with 1" regressed flange in powder-coated white paint on die cast aluminum.</p>	Architectural Lighting Works	LUC1DM26120-S E5WH	(2) 26W PL-C CFL 3500K	56 W	120

Note:

Please refer luminaire cut-sheets to Appendix A

Proposed Lamp Schedule:

Ballenger East Building Training Room – Lamp Schedule						
Type	Manufacturer	Catalog Number	Rated Watt	CRI/CCT	Initial Lumens	Rated Life (hrs)
L5	GE	00268- F32T8XLSPX35HCVG	32 W	85/3500K	3100	24000
L6	GE	46705- F28W/T5/835/ECO	28 W	85/3500K	2900	30000
D3	Sylvania	20881- CF26DTEIN835ECO	26 W	82/3500K	1500	20000

Proposed Ballast Schedule:

Ballenger East Building Training Room – Ballast Schedule						
Type	Manufacturer	Catalog Number	Rated Watt	Ballast type	Start Method	Ballast Factor
L5	GE	80353-B132R120V5	32 W	Electronic-Dimming	Rapid	0.88
L6	GE	99655-GE228MVPS-A	36 W	Electronic	Program/Rapid	1.08
D3	GE	47506-C242UNVBES-IP	56 W	Electronic	Program/Rapid	1.02

Existing Panelboard 3PB Schedule:

Since the training room has an empty layout as discussed at the beginning of the section, therefore there is no existing panelboard for this space. While the training room is located on the 3rd floor, it will be logical to put the lighting loads in one of the panelboards located on 3rd floor. Panelboard 3PB is selected mainly because the new lighting loads are in 120V, and that panelboard is designated for occupancy use, which perfectly fits the situation here.

NAME	LOCATION	MOUNTING	SUPPLIED FROM	VOLTAGE	BUS AMP SIZE	MAIN O. C. DEVICE
3PB	TENANT ELEC CLOS	SURFACE	PANEL 3PA	208/120V, 3 ϕ , 4W WITH GROUND	225	MLO
10,000 AIC SERIES RATED						
DESCRIPTION	FULL LOAD (KVA)	BRANCH BRKR. SIZE	CIRCUIT AND PHASE	BRANCH BRKR. SIZE	FULL LOAD (KVA)	DESCRIPTION
SPACE		/	1A 2A	/		SPACE
		/	3B 4B	/		
		/	5C 6C	/		
		/	7A 8A	/		
		/	9B 10B	/		
		/	11C 12C	/		
		/	13A 14A	/		
		/	15B 16B	/		
		/	17C 18C	/		
		/	19A 20A	/		
		/	21B 22B	/		
		/	23C 24C	/		
		/	25A 26A	/		
		/	27B 28B	/		
		/	29C 30C	/		
		/	31A 32A	/		
		/	33B 34B	/		
		/	35C 36C	/		
		/	37A 38A	/		
		/	39B 40B	/		
		/	41C 42C	/		

Proposed Panelboard 3PB Schedule:

PANELBOARD SCHEDULE													
VOLTAGE: 208Y/120V,3PH,4W			PANEL TAG: 3PB						MIN. C/B AIC: 10K				
SIZE/TYPE BUS: 225A COPPER			PANEL LOCATION: Tenant Electric Closet						OPTIONS: PROVIDE FEED THROUGH LUGS				
SIZE/TYPE MAIN: 225A/3P MLO			PANEL MOUNTING: SURFACE						FOR FUTURE PANELBOARD				
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION	
Receptacles	Training Room	918	20A/1P	1	*			2	20A/1P	918	Training Room	Receptacles	
Receptacles	Training Room	918	20A/1P	3		*		4	20A/1P	918	Training Room	Receptacles	
Computer	Training Room	1250	20A/1P	5			*	6	20A/1P	96	Training Room	Direct/Indirect	
Space		0	20A/1P	7	*			8	20A/1P	0		Space	
Space		0	20A/1P	9		*		10	20A/1P	0		Space	
Suspended Direct	Training Room	36	20A/1P	11			*	12	20A/1P	168	Training Room	CFL Downlights	
Space		0	20A/1P	13	*			14	20A/1P	0		Space	
Space		0	20A/1P	15		*		16	20A/1P	0		Space	
Space		0	20A/1P	17			*	18	20A/1P	0		Space	
Space		0	20A/1P	19	*			20	20A/1P	0		Space	
Space		0	20A/1P	21		*		22	20A/1P	0		Space	
Space		0	20A/1P	23			*	24	20A/1P	0		Space	
Space		0	20A/1P	25	*			26	20A/1P	0		Space	
Space		0	20A/1P	27		*		28	20A/1P	0		Space	
Space		0	20A/1P	29			*	30	20A/1P	0		Space	
Space		0	20A/1P	31	*			32	20A/1P	0		Space	
Space		0	20A/1P	33		*		34	20A/1P	0		Space	
Space		0	20A/1P	35			*	36	20A/1P	0		Space	
Space		0	20A/1P	37	*			38	20A/1P	0		Space	
Space		0	20A/1P	39		*		40	20A/1P	0		Space	
Space		0	20A/1P	41			*	42	20A/1P	0		Space	
CONNECTED LOAD (KW) - A		1.84							TOTAL DESIGN LOAD (KW)		4.79		
CONNECTED LOAD (KW) - B		1.84							POWER FACTOR		0.79		
CONNECTED LOAD (KW) - C		1.55							TOTAL DESIGN LOAD (AMPS)		17		



Proposed New Loads

The bus amp size is still kept at 225A because there are still many loads and circuits left for future use. The new total design load (amps) is 17A. Since the power of panelboard 4PB is supplied from panelboard 4PA, therefore the new feeder size has to consider the loads in panelboard 4PA, which is 10.3 amps. Thus the new feeder size would be AWG #10 copper, and the new conduit size would be 2.5" copper EMT.

Depth: Photovoltaic Arrays Analysis

Introduction

Upon the energy crisis the world is facing nowadays, along with continuous surging energy costs, it is essential to look for alternate energy source, especially for a mix-used building where long operation hours of electrical and mechanical systems are required.

Therefore a study will be performed to analyze the impact of a newly designed photovoltaic system will bring, and an electrical saving cost will be estimated with the payback period involved if the system is implemented.

Objectives

- (a) To investigate the feasibility or amount of power generation from Photovoltaic Arrays.
- (b) To investigate the possible payback period.

Process

A software "RetScreen" is used to perform the analysis, with data input of building site information, electric rates, and photovoltaic arrays perimeter in computer simulation.

Results

The parameters and results of the computer simulation are summarized as follows:

Site Information

Area available to collect solar power: 9000 ft²

Average period of time for solar power collection: 3 hours/day

Photovoltaic Arrays Information

Power Capacity: 1,000 kW

Manufacturer: BP Solar

Model: a-Si-BP Millenia MST 50MV

Efficiency: 6%

Frame Area: 9 ft²

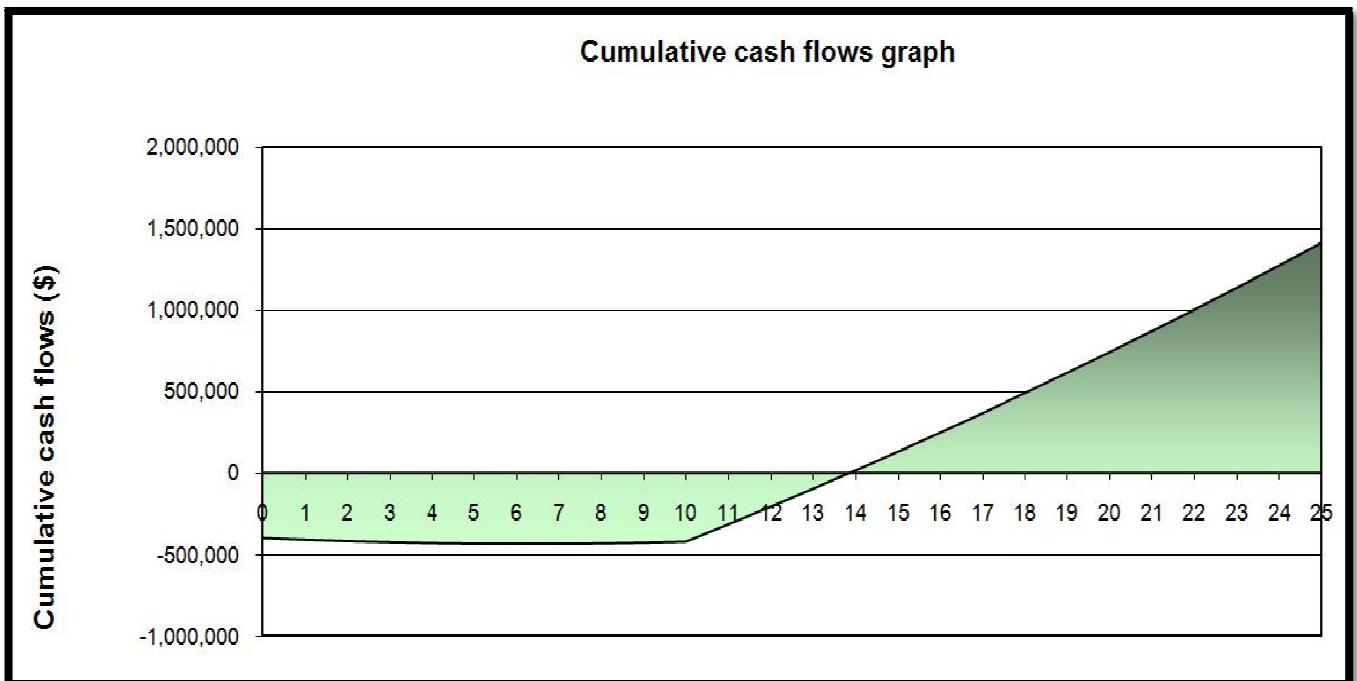
Capacity Factor: 15%

Financial Information

Inflation Rate: 2.0%
Project Life: 25 years
Debt Ratio: 60%
Debt interest rate: 10%
Initial Cost: \$1,000,000
Total Annual Costs: \$48,800
Total Annual Savings and Income: \$85,000

Simple payback: 11.7 years

Equity payback: 13.9 years



[Cumulative Cash Flow Curve]

Interpretation

The simple payback value means the number of years to recoup additional costs from annual savings, while the equity payback takes the cash outflows into account and that makes the payback years longer than simple payback. However, the equity payback should be a more accurate measure.

Depth: Central versus Distributed Transformers

Introduction

In the original design, there are five 480Y/277V to 208Y/120V transformers in their corresponding electrical room on different floors to step down voltage for receptacles, lightings, and other equipment loads. While two transformers are rated 75 KVA, one is rated 45 KVA and the rest two are rated 30 KVA, each of these transformers is connected to the building's distribution system through a 400A bus duct.

Objectives

To investigate the feasibility of replacing the distributed transformers by a central transformer in terms of cost differential.

Process & Results

The details of the transformers could be summarized in the following schedule:

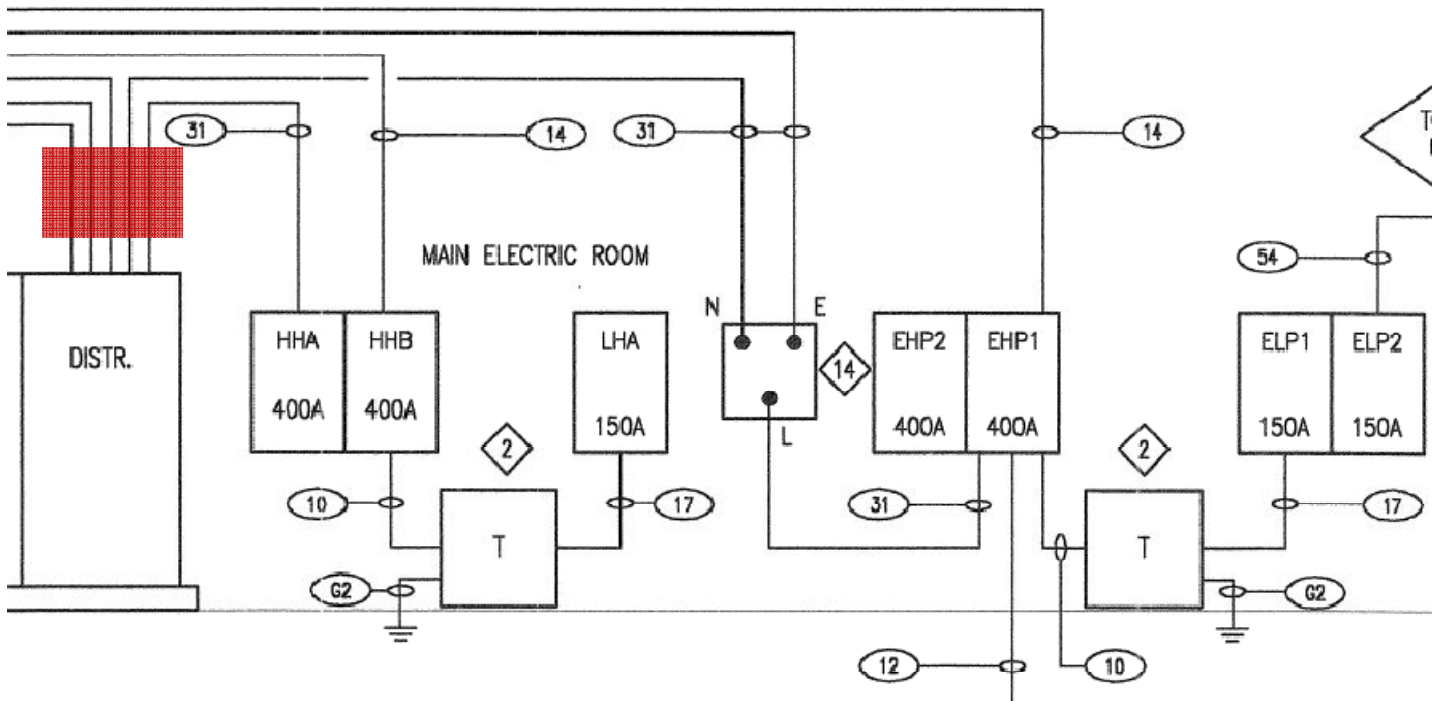
TRANSFORMER SCHEDULE								
Tag	Primary volt	Secondary volt	Size	Type	Temp. rise	Taps	Mounting	remarks
UT	--	--	--	--	--	--	--	Utility Transformer
T-1a	480V 3Ph, 3W	208Y/120V 3Ph, 4W	30KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	--
T-1b	480V 3Ph, 3W	208Y/120V 3Ph, 4W	30KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	--
2	480V 3Ph, 3W	208Y/120V 3Ph, 4W	45KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	--
T-3a	480V 3Ph, 3W	208Y/120V 3Ph, 4W	75KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	K-4 rated
T-3b	480V 3Ph, 3W	208Y/120V 3Ph, 4W	75KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	K-4 rated

Central Transformer Sizing by summation of distributed loads:

Panelboard	Load (KVA)
HHA	126.4
HHB	87.1
LHA	23.6
EHP1	57.4
EHP2	142.4
ELP1	31
ELP2	2.1
HPP1	73.5
LPP1	11.1
3H	71.7
3PA	3.7
3PB	6.1
4H	95.7
4PA	3.7
4PB	6.8
Total	742.3

Total KVA	742.3
Demand Factor	0.7
Spare Capacity	15%
Total KVA	597.6
Transformer KVA Rating	750 KVA

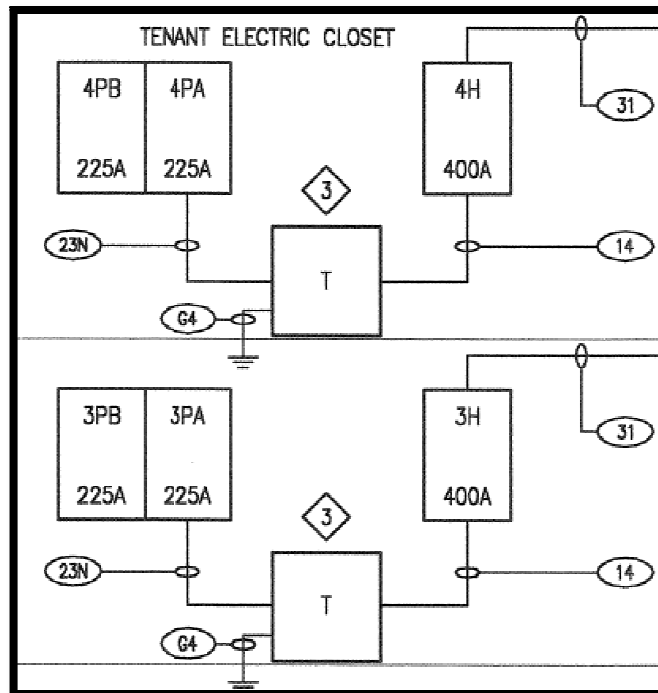
It is determined that a 750 KVA transformer would be most appropriate for handling these loads (including 15% spare capacity addition). This transformer would be located in the main electrical room in P1 level indicated by the shade red block.



[Partial Existing Riser Diagram: P1 level]

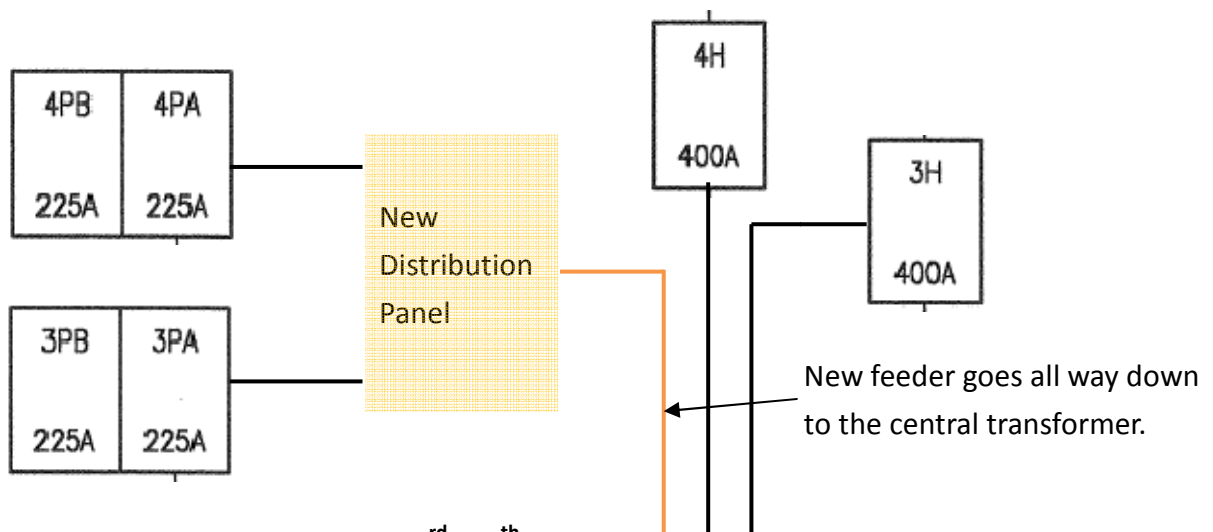
The installation of the proposed central transformer will lead to several changes to distribution panels and thus the corresponding feeders.

The panelboards 4PA, 4PB, 3PA and 3PB are at 208Y/120V voltage, while panelboards 4H and 3H are at 480Y/277V. The proposed change is to combine the 208Y/120V loads in a new distribution panel because they require the central transformer to step down the voltage. Panelboards 4H and 3H do not have to change as they would have the same power feed.



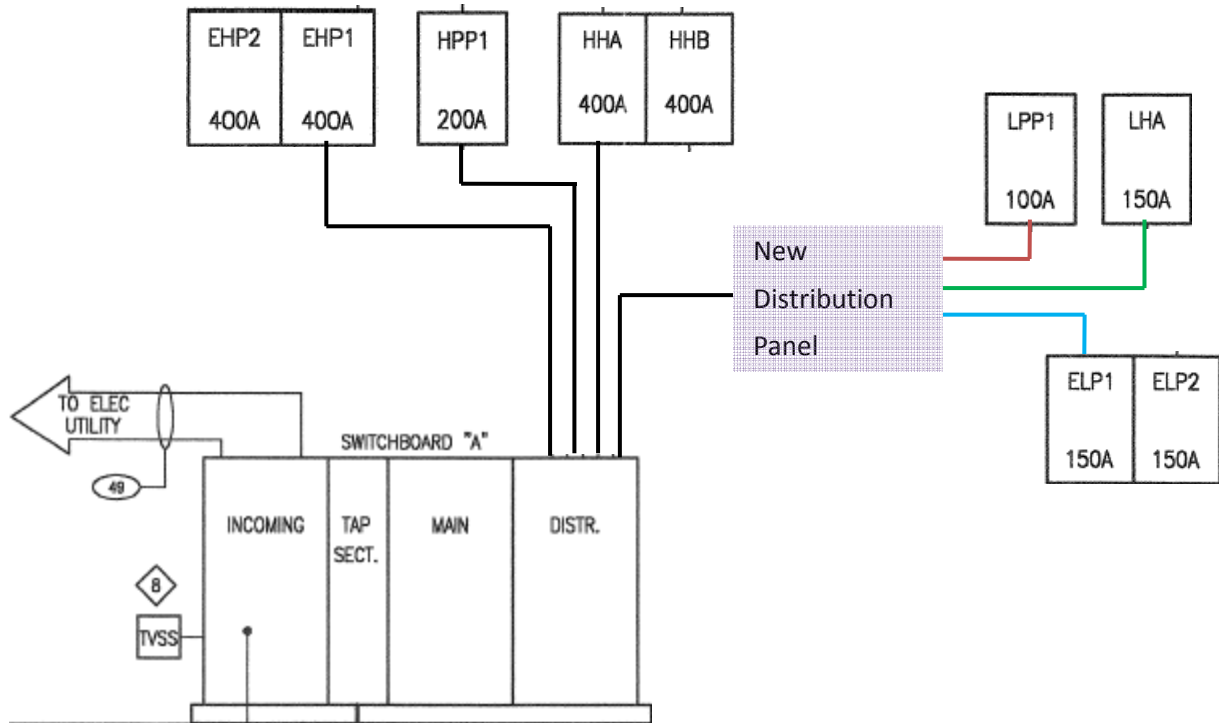
[Partial Existing Riser Diagram: 3rd & 4th levels]

The proposed change will look like the following with the shaded parts are the proposed new panels or feeders.



[Partial Proposed Riser Diagram: 3rd & 4th levels]

Similar change will be made to panelboards LPP1, LHA, ELP1 and ELP2. The proposed change will look like the following with the shaded parts are the proposed new panels or feeders.



The New Distribution Panel (Orange) will feature:

- Total design load: 56.6A
- Feeder load with 15% spare capacity: 65A
- Circuit breaker/pole: 70A/3P
- Insulation type: 75 degrees lugs, THHN
- Phase wire: AWG #4
- Neutral: AWG #4
- Ground: AWG #8
- Conduit size: 1.25" copper EMT.
- Bus amp size & type: 225A, MLO
- Feeder Size: AWG #4

The New Distribution Panel (Purple) will feature:

- Total design load: 176.3A
- Feeder load with 15% spare capacity: 203A
- Circuit breaker/pole: 225A/3P
- Insulation type: 75 degrees lugs, THHN
- Phase wire: AWG #4/0

- Neutral: AWG #4/0
- Ground: AWG #4
- Conduit size: 2.5" copper EMT.
- Bus amp size: 400A, M C/B

The New Feeder Size for panelboard LPP1 (**Maroon**) would be 75 degrees lugs, THHN, AWG #8 with conduit size of 0.75" EMT.

The New Feeder Size for panelboard LHA (**Green**) would be 75 degrees lugs, THHN, AWG #4 with conduit size of 1.25" EMT.

The New Feeder Size for panelboard ELP1 (**Blue**) would be 75 degrees lugs, THHN, AWG #3 with conduit size of 1.25" EMT.

Cost Analysis

Equipment	Cost Differential between Proposed and Existing Systems (Proposed – Existing)
Feeders	+ \$8570
Transformers	+ \$16600
Breakers	+ \$2460
Panelboards	+ 13000
Total	+ \$40630

Note:

Costs are referred to GE Buy Catalog

Interpretation

The table clearly shows the proposed system will bring up the cost by about \$46000 by applying the central transformer. In other words, as long as the existing systems run effectively, the proposed central transformer system is not recommended.

Protective Device Coordination Study

There is no information about the utility S.C KVA, a value of 100,000 KVA is assumed.
A sample fault current calculation is performed for the following system path:

Transformer (secondary) → Switchboard A → Distribution Panel 3H → Panelboard 3PA

Fault Current Analysis (Per Unit Method)					
System Voltage KV	0.48	ΣX	ΣR	ΣZ	I _{sc} (A)
Base KVA	1,000				
Utility CO. Available Fault.	100,000				
Utility (Primary)					
X(p.u) = KVA base/ Utility S. C. KVA	0.01	0.01	0.000	0.01	120,281
R(p.u)	0.000				

Transformer (Secondary)							
%Z	5.0	X(p.u) = %X * base KVA/ (100 * transformer KVA)	0.06	0.07	0.03	0.076	15,826
X/R	1.98	R(p.u) = %R * base KVA/(100 * transformer KVA)	0.03				
%X	4.5						
%R	2.27						
KVA	750						

Main Switchboard A							
# of sets	5	X = (L/1000) * X _L * (1/sets), X(p.u)	0.00049	0.0705	0.0304	0.077	15,668
Wire	400 kcmil	R = (L/1000) * R * (1/sets), R(p.u)	0.000356				
Length	50						
X _L	0.049						
R	0.0356						

Distribution Panel 3H							
# of sets	1	$X = (L/1000) * X_L * (1/sets), X(p.u)$	0.0028	0.0733	0.032	0.08	15,038
Wire	500 kcmil	$R = (L/1000) * R * (1/sets), R(p.u)$	0.0018				
Length	60						
X_L	0.0466						
R	0.0294						

Panelboard 3PA							
# of sets	1	$X = (L/1000) * X_L * (1/sets), X(p.u)$	0.000497	0.0738	0.033	0.081	14,906
Wire	4/0	$R = (L/1000) * R * (1/sets), R(p.u)$	0.00064				
Length	10						
X_L	0.0497						
R	0.0640						

Fault Analysis			
Point	Location	Available Fault	Standard Breaker Rating (A)
A	Transformer (Secondary)	15,826	22,000
B	Main Switchboard A	15,668	22,000
C	Distribution Panel 3H	15,308	22,000
D	Panelboard 3PA	14,906	22,000

The following graph shows the circuit breaker time or current curves for three circuit breakers used in Ballenger East Building:

- 20A/1P circuit breaker for a load in panelboard 3PA
- 150A/3P circuit breaker on the service elevator
- 400A/3P circuit breaker on the main switch gear

From the graph shown below, and looking at the current trip curves over each other, it shows the three circuit breakers are coordinating well because if there is a short circuit, the smallest (farthest) circuit breaker will trip first. In other words, the larger circuit breaker tends to trip last and avoid unnecessary potential to lose power.

