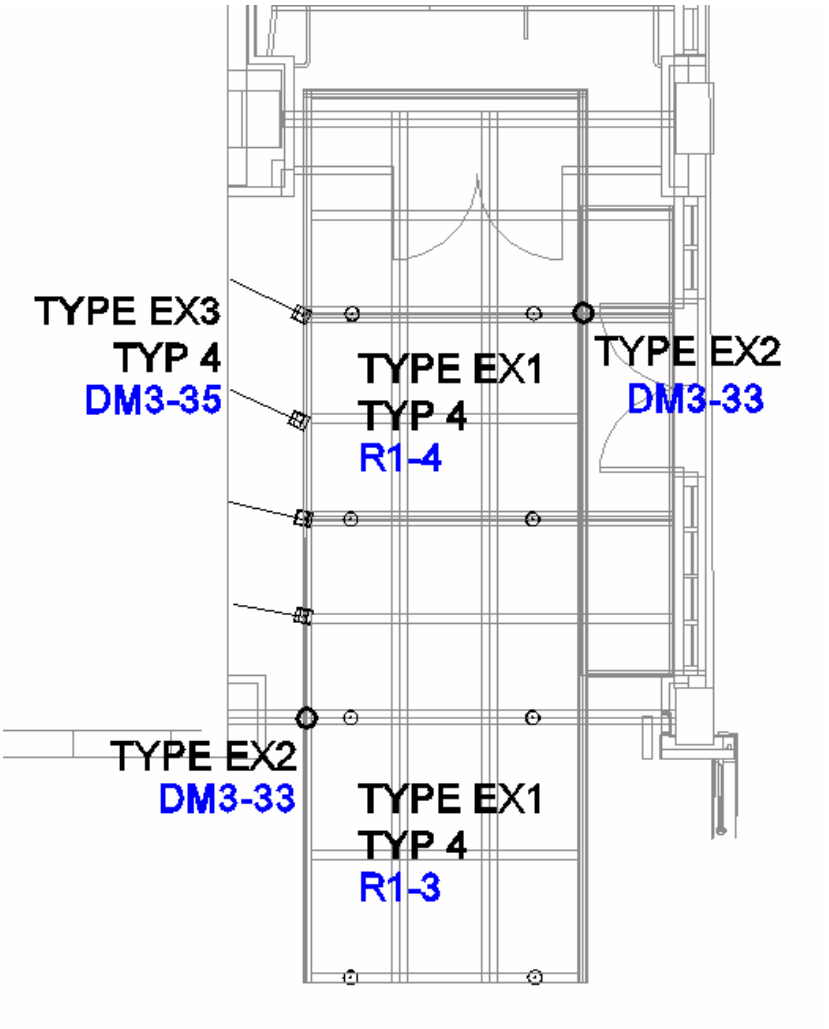
Electrical Depth

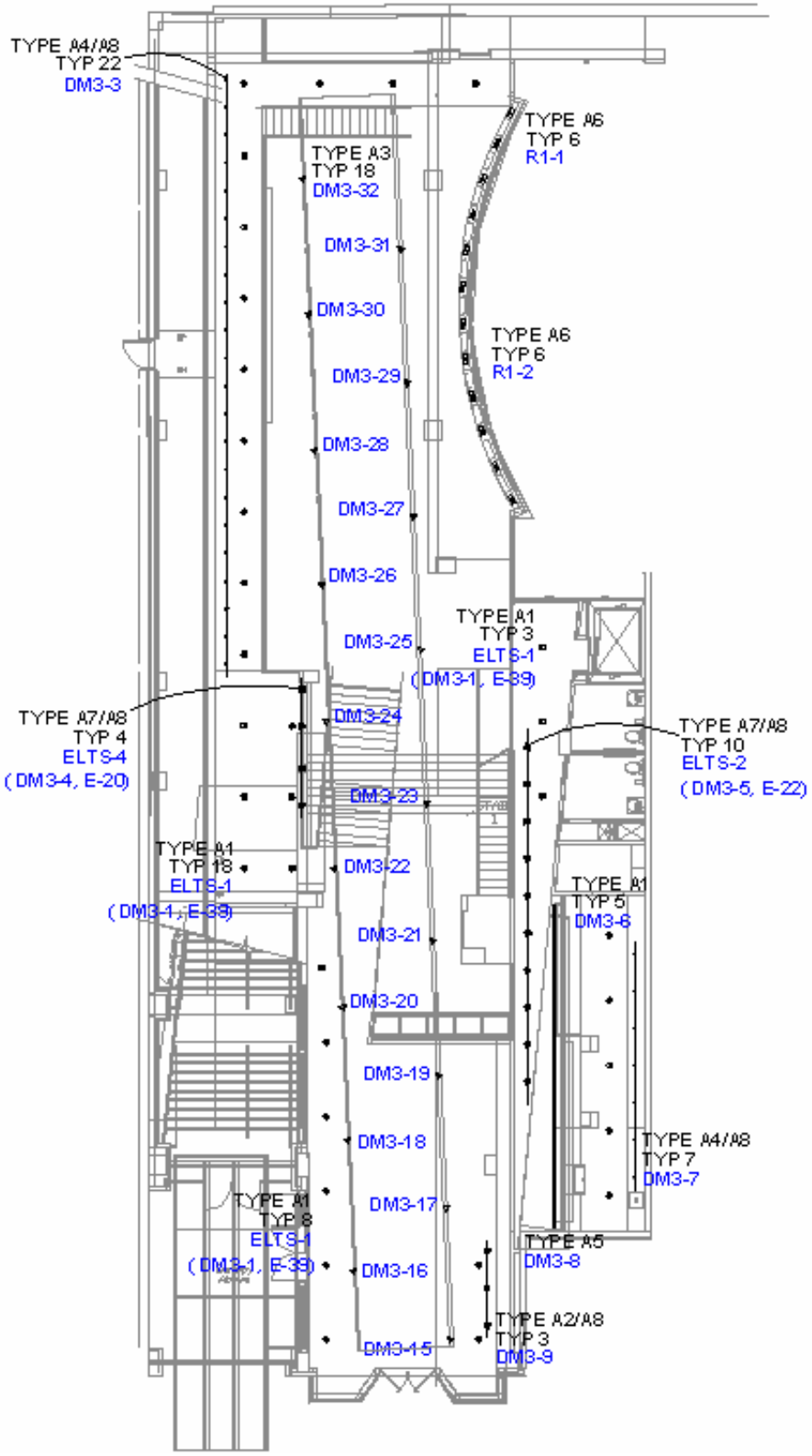
Electrical Depth

Electrical and Control Plans

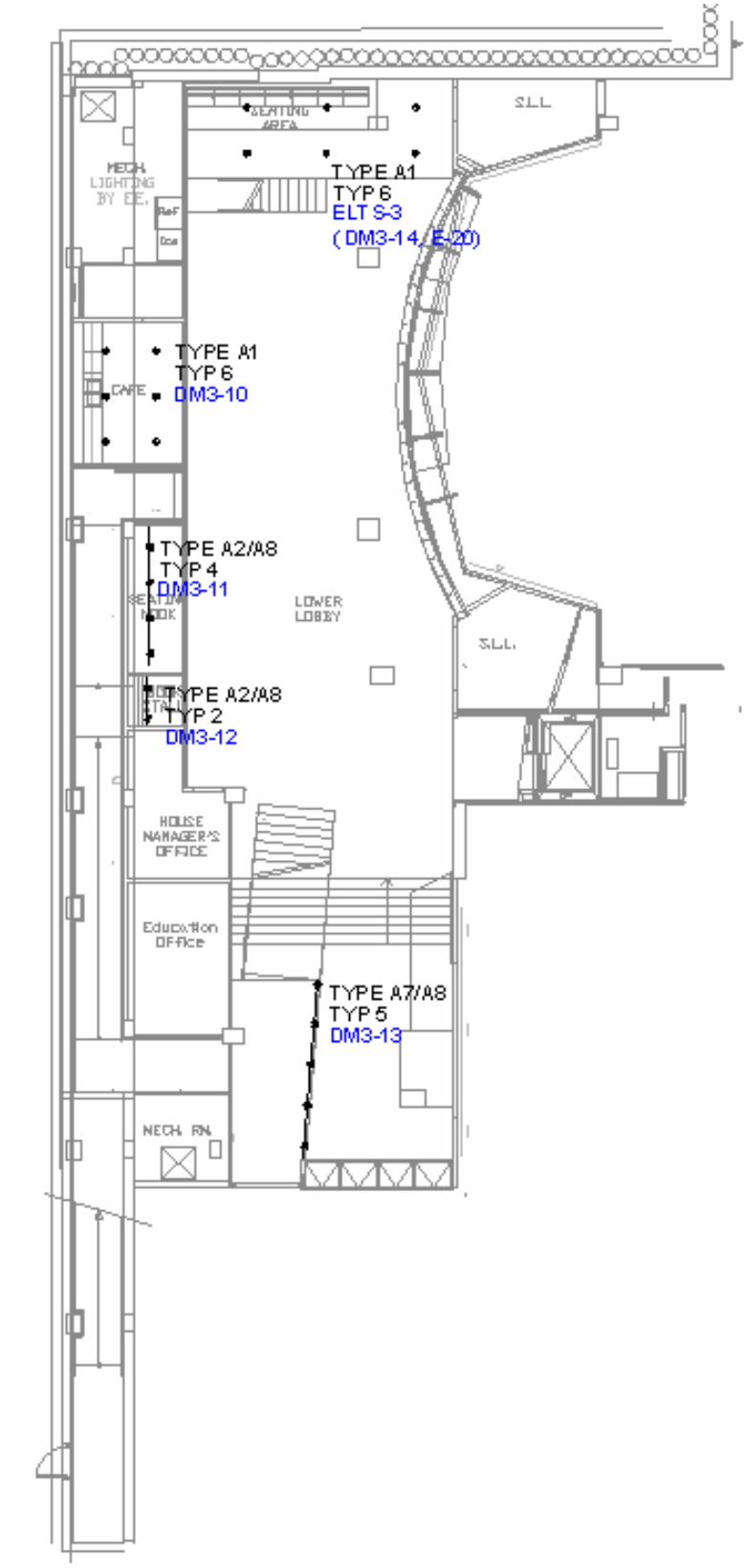
Canopy



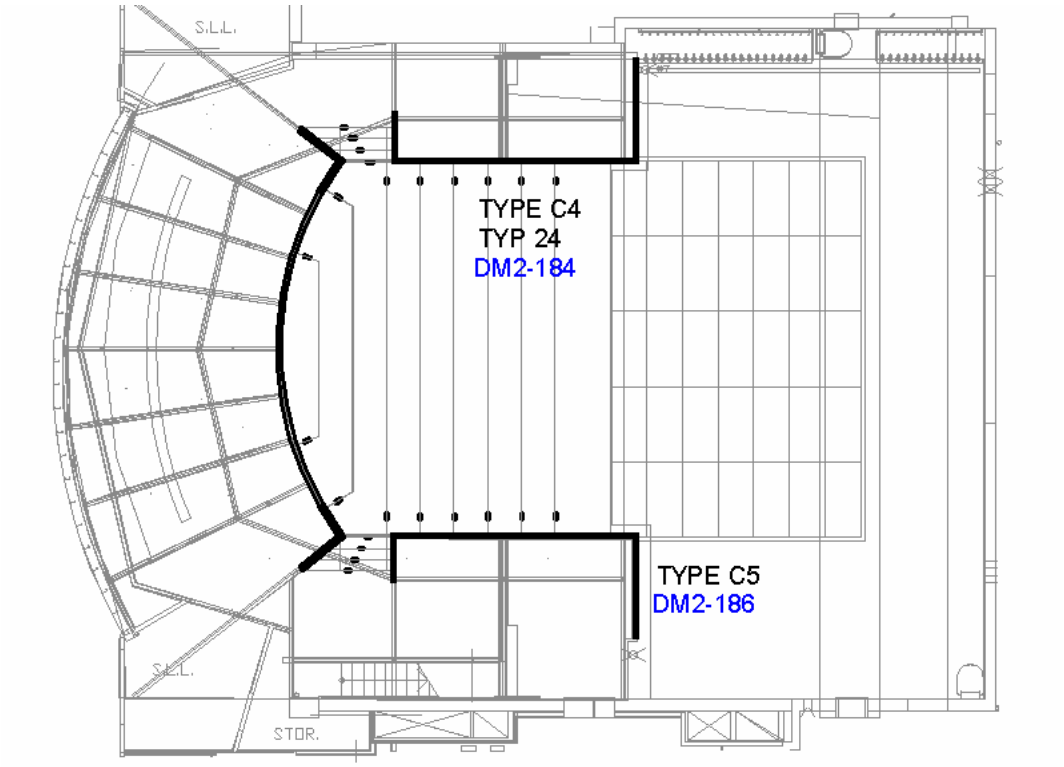
Lobby
Second Floor (Street Level) Plan



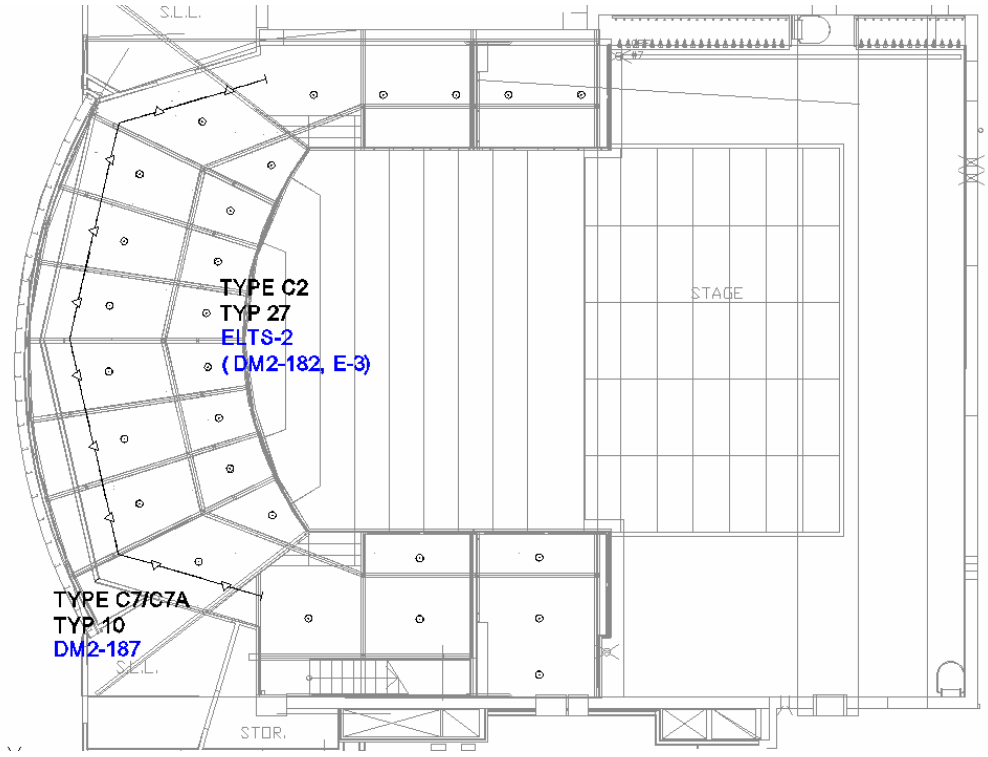
First Floor Plan



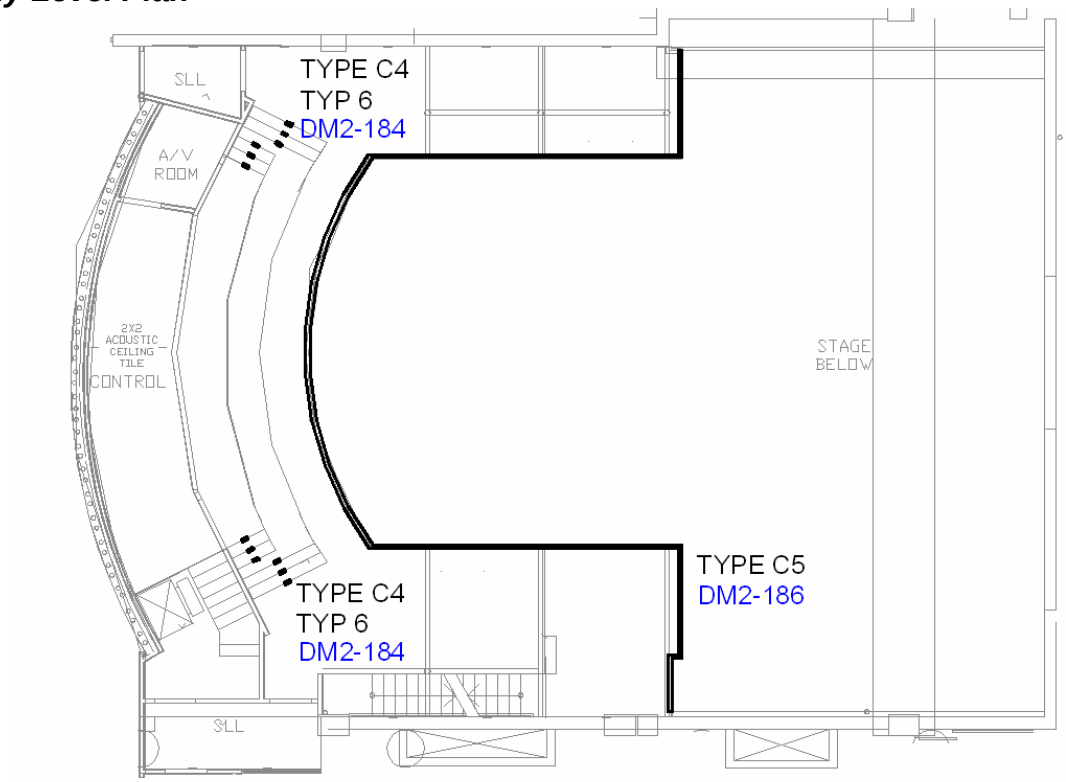
Theatre
Orchestra Level Plan



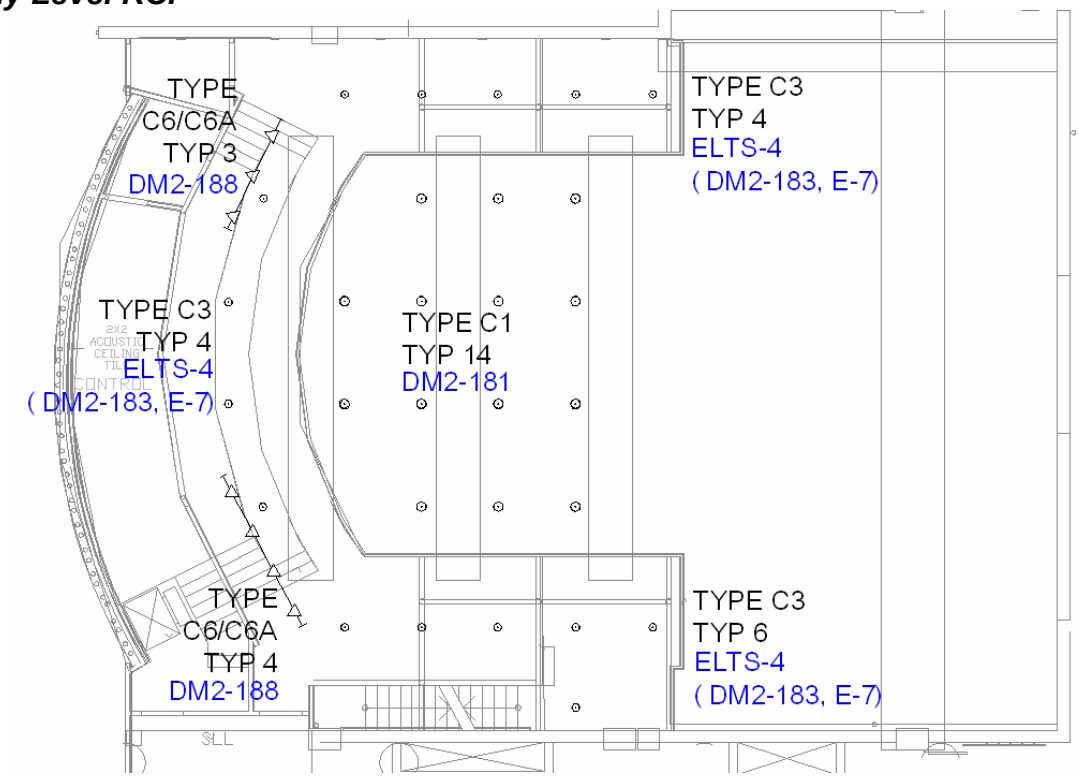
Orchestra Level RCP



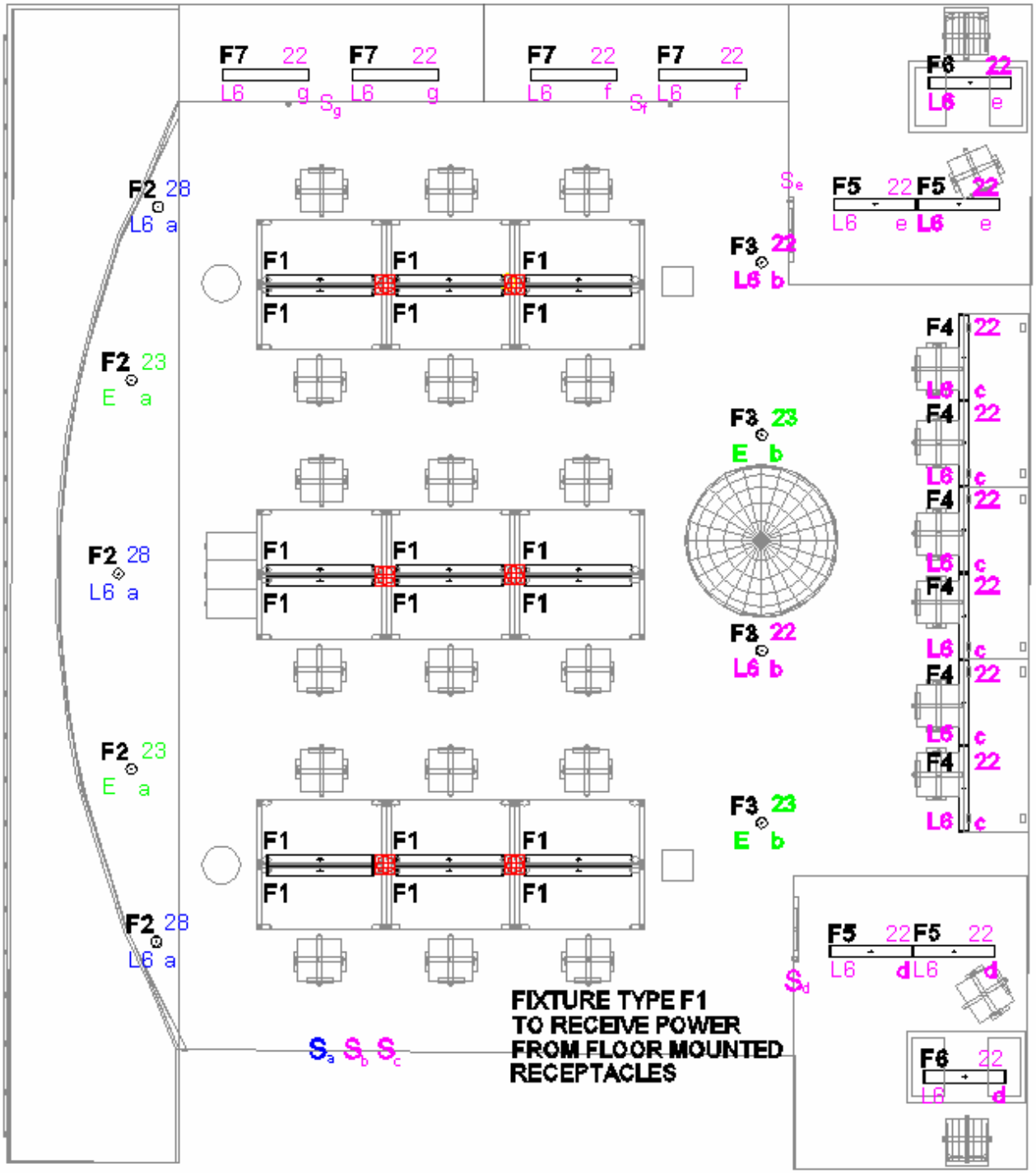
Balcony Level Plan



Balcony Level RCP



Office


F7 22 L6 g
F7 22 L6 g
F7 22 L6 f
F7 22 L6 f
F6 22 L6 e
F5 22 L6 e
F5 22 L6 e
F2 28 L6 a
F2 23 E a
F2 28 L6 a
F2 23 E a
F2 28 L6 a
F1
F3 22 L6 b
F3 23 E b
F3 22 L6 b
F3 23 E b
F4 22 L6 c
F5 22 L6 d
F5 22 L6 d
F6 22 L6 d
FIXTURE TYPE F1
TO RECEIVE POWER
FROM FLOOR MOUNTED
RECEPTACLES

Panelboards

Existing Panel M3

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: M3
PANEL LOCATION: xx
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 85K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
RECEPTACLE		160	20A/1P	1	*			2	20A/1P	1000		AHU-5
RECEPTACLE		320	20A/1P	3		*		4	20A/1P	1000		AHU-5
RECEPTACLE		320	20A/1P	5			*	6	20A/1P	1000		AHU-5
RECEPTACLE		160	20A/1P	7	*			8	20A/1P	1000		REFRIGERATOR
RECEPTACLE		160	20A/1P	9		*		10	20A/1P	400		ICEMAKER
RECEPTACLE		160	20A/1P	11			*	12	20A/1P	475		LIGHTS
RECEPTACLE		640	20A/1P	13	*			14	20A/1P	400		TRACK LIGHTS
RECEPTACLE		640	20A/1P	15		*		16	20A/1P	300		TRACK LIGHTS
RECEPTACLE		800	20A/1P	17			*	18	20A/1P	190		LIGHTS
RECEPTACLE		160	20A/1P	19	*			20	20A/1P	400		TRACK LIGHTS
DISPLAY LIGHTS		300	20A/1P	21		*		22	20A/1P	190		LIGHTS
RECEPTACLE		160	20A/1P	23			*	24	20A/1P	600		SUMP PUMP
RECEPTACLE		320	20A/1P	25	*			26	20A/1P	0		SPARE
RECEPTACLE		320	20A/1P	27		*		28	20A/1P	0		SPARE
RECEPTACLE		320	20A/1P	29			*	30	20A/1P	1000		BASEBOARD HEATER
RECEPTACLE		320	20A/1P	31	*			32	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	33		*		34	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	35			*	36	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	37	*			38	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	39		*		40	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	41			*	42	20A/1P	1000		BASEBOARD HEATER

CONNECTED LOAD (KW) - A	6.56	TOTAL DESIGN LOAD (KW)	20.96
CONNECTED LOAD (KW) - B	5.63	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C	7.03	TOTAL DESIGN LOAD (AMPS)	61

New Panel M3

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: M3
PANEL LOCATION: xx
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 85K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
RECEPTACLE		160	20A/1P	1	*			2	20A/1P	1000		AHU-5
RECEPTACLE		320	20A/1P	3		*		4	20A/1P	1000		AHU-5
RECEPTACLE		320	20A/1P	5			*	6	20A/1P	1000		AHU-5
RECEPTACLE		160	20A/1P	7	*			8	20A/1P	1000		REFRIGERATOR
RECEPTACLE		160	20A/1P	9		*		10	20A/1P	400		ICEMAKER
RECEPTACLE		160	20A/1P	11			*	12	20A/1P	0		SPARE
RECEPTACLE		640	20A/1P	13	*			14	20A/1P	0		SPARE
RECEPTACLE		640	20A/1P	15		*		16	20A/1P	0		SPARE
RECEPTACLE		800	20A/1P	17			*	18	20A/1P	0		SPARE
RECEPTACLE		160	20A/1P	19	*			20	20A/1P	400		TRACK LIGHTS
SPARE		0	20A/1P	21		*		22	20A/1P	190		LIGHTS
RECEPTACLE		160	20A/1P	23			*	24	20A/1P	600		SUMP PUMP
RECEPTACLE		320	20A/1P	25	*			26	20A/1P	0		SPARE
RECEPTACLE		320	20A/1P	27		*		28	20A/1P	0		SPARE
RECEPTACLE		320	20A/1P	29			*	30	20A/1P	1000		BASEBOARD HEATER
RECEPTACLE		320	20A/1P	31	*			32	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	33		*		34	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	35			*	36	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	37	*			38	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	39		*		40	20A/1P	1000		BASEBOARD HEATER
SPARE		0	20A/1P	41			*	42	20A/1P	1000		BASEBOARD HEATER

CONNECTED LOAD (KW) - A	6.16	TOTAL DESIGN LOAD (KW)	19.23
CONNECTED LOAD (KW) - B	5.03	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C	6.36	TOTAL DESIGN LOAD (AMPS)	56

Panel M3 Sizing

Note: All wires to be sized 75 degrees C, THWN, CU wire
Design Load: 56 Amps
Circuit Breaker Size: 60 Amps
Feeder Size: #8 AWG
Neutral: #8 AWG
Ground: #10 AWG
Conduit Size: 1 inch

Existing Panel L5

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: L5 SECTION A
PANEL LOCATION: xx
PANEL MOUNTING: RECESSED

MIN. C/B AIC: 85K
OPTIONS: DOUBLE SECTION PANEL WITH CABLE TIES BETWEEN MAIN LUGS

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
RECEPTACLE	0	800	20A/1P	1	*			2	20A/1P	1425	0	WH-1
RECEPTACLE	0	800	20A/1P	3		*		4	20A/1P	1425	0	WH-1
RECEPTACLE	0	320	20A/1P	5			*	6	20A/1P	1425	0	WH-1
RECEPTACLE	0	640	20A/1P	7	*			8	20A/1P	1300	0	LIFT
RECEPTACLE	0	320	20A/1P	9		*		10	20A/1P	320	0	RECEPTACLE
RECEPTACLE	0	320	20A/1P	11			*	12	20A/1P	190	0	LIGHTS
RECEPTACLE	0	320	20A/1P	13	*			14	20A/1P	0	0	SPARE
RECEPTACLE	0	640	20A/1P	15		*		16	20A/1P	700	0	TRACK LIGHTS
RECEPTACLE	0	320	20A/1P	17			*	18	20A/1P	300	0	TRACK LIGHTS
RECEPTACLE	0	320	20A/1P	19	*			20	20A/1P	500	0	TRACK LIGHTS
RECEPTACLE	0	320	20A/1P	21		*		22	20A/1P	0	0	SPARE
RECEPTACLE	0	160	20A/1P	23			*	24	20A/1P	0	0	SPARE
RECEPTACLE	0	160	20A/1P	25	*			26	20A/1P	160	0	RECEPTACLE
RECEPTACLE	0	160	20A/1P	27		*		28	20A/1P	160	0	RECEPTACLE
RECEPTACLE	0	160	20A/1P	29			*	30	20A/1P	160	0	RECEPTACLE
RECEPTACLE	0	160	20A/1P	31	*			32	20A/1P	100	0	CARD READER
RECEPTACLE	0	800	20A/1P	33		*		34	20A/1P	100	0	PROCESSOR PANEL
REFRIGERATOR	0	800	20A/1P	35			*	36	20A/1P	0	0	SPARE
REFRIGERATOR	0	800	20A/1P	37	*			38	20A/1P	0	0	SPARE
RECEPTACLE	0	160	20A/1P	39		*		40	20A/1P	0	0	SPARE
COUNTER LIGHTS	0	190	20A/1P	41			*	42	20A/1P	0	0	SPARE

CONNECTED LOAD (KW) - A	6.69	TOTAL DESIGN LOAD (KW)	17.61
CONNECTED LOAD (KW) - B	5.91	POWER FACTOR	0.90
CONNECTED LOAD (KW) - C	4.35	TOTAL DESIGN LOAD (AMPS)	54

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: L5 SECTION B
PANEL LOCATION: xx
PANEL MOUNTING: RECESSED

MIN. C/B AIC: 85K
OPTIONS: DOUBLE SECTION PANEL WITH CABLE TIES BETWEEN MAIN LUGS

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
TRACK UP	1000	500	20A/1P	43	*			44	20A/1P	1000	1500	PERF. LTS
TRACK UP	1000	500	20A/1P	45		*		46	20A/1P	1000	1500	PERF. LTS
TRACK UP	400	500	20A/1P	47			*	48	20A/1P	500	1500	TRACK
TRACK DOWN	800	500	20A/1P	49	*			50	20A/1P	0	1300	LIGHT-WALL
TRACK DOWN	400	500	20A/1P	51		*		52	20A/1P	800	400	LIGHT-WALL
TRACK DOWN	400	500	20A/1P	53			*	54	20A/1P	800	200	LIGHT-WALL
TRACK	400	800	20A/1P	55	*			56	20A/1P	800		LIGHT-WALL
TRACK	800	800	20A/1P	57		*		58	20A/1P	800	700	LIGHT-WALL
SPARE	400	0	20A/1P	59			*	60	20A/1P	800	300	LIGHT-WALL
SPARE	0	0	20A/1P	61	*			62	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	63		*		64	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	65			*	66	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	67	*			68	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	69		*		70	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	71			*	72	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	73	*			74	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	75		*		76	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	77			*	78	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	79	*			80	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	81		*		82	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	83			*	84	20A/1P	0	0	SPARE

CONNECTED LOAD (KW) - A	3.60	TOTAL DESIGN LOAD (KW)	10.66
CONNECTED LOAD (KW) - B	4.40	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	3.10	TOTAL DESIGN LOAD (AMPS)	30

New Panel L5

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: L5 SECTION A
PANEL LOCATION: xx
PANEL MOUNTING: RECESSED

MIN. C/B AIC: 85K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
RECEPTACLE	0	800	20A/1P	1	*			2	20A/1P	1425	0	WH-1
RECEPTACLE	0	800	20A/1P	3		*		4	20A/1P	1425	0	WH-1
RECEPTACLE	0	320	20A/1P	5			*	6	20A/1P	1425	0	WH-1
RECEPTACLE	0	640	20A/1P	7	*			8	20A/1P	1300	0	LIFT
RECEPTACLE	0	320	20A/1P	9		*		10	20A/1P	320	0	RECEPTACLE
RECEPTACLE	0	320	20A/1P	11			*	12	20A/1P	1000	0	PERF. LTS
RECEPTACLE	0	320	20A/1P	13	*			14	20A/1P	0	0	SPARE
RECEPTACLE	0	640	20A/1P	15		*		16	20A/1P	1000	0	PERF. LTS
RECEPTACLE	0	320	20A/1P	17			*	18	20A/1P	300	0	LIGHTWALL
RECEPTACLE	0	320	20A/1P	19	*			20	20A/1P	300	0	LIGHTWALL
RECEPTACLE	0	320	20A/1P	21		*		22	20A/1P	140	0	CANOPY
RECEPTACLE	0	160	20A/1P	23			*	24	20A/1P	140	0	CANOPY
RECEPTACLE	0	160	20A/1P	25	*			26	20A/1P	160	0	RECEPTACLE
RECEPTACLE	0	160	20A/1P	27		*		28	20A/1P	160	0	RECEPTACLE
RECEPTACLE	0	160	20A/1P	29			*	30	20A/1P	160	0	RECEPTACLE
RECEPTACLE	0	160	20A/1P	31	*			32	20A/1P	100	0	CARD READER
RECEPTACLE	0	800	20A/1P	33		*		34	20A/1P	100	0	PROCESSOR PANEL
REFRIGERATOR	0	800	20A/1P	35			*	36	20A/1P	0	0	SPARE
REFRIGERATOR	0	800	20A/1P	37	*			38	20A/1P	2978	0	DIM 3
RECEPTACLE	0	160	20A/1P	39		*		40	20A/1P	2977	0	DIM 3
COUNTER LIGHTS	0	190	20A/1P	41			*	42	20A/1P	2977	0	DIM 3

CONNECTED LOAD (KW) - A	9.46	TOTAL DESIGN LOAD (KW)	29.76
CONNECTED LOAD (KW) - B	9.32	POWER FACTOR	0.94
CONNECTED LOAD (KW) - C	8.27	TOTAL DESIGN LOAD (AMPS)	88

All loads were removed from Panel L5 Section B. Therefore it was removed from the system.

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: L5 SECTION B
PANEL LOCATION: xx
PANEL MOUNTING: RECESSED

MIN. C/B AIC: 85K
OPTIONS: DOUBLE SECTION PANEL WITH CABLE TIES BETWEEN MAIN LUGS

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
SPARE	0	0	20A/1P	43	*			44	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	45		*		46	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	47			*	48	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	49	*			50	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	51		*		52	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	53			*	54	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	55	*			56	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	57		*		58	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	59			*	60	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	61	*			62	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	63		*		64	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	65			*	66	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	67	*			68	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	69		*		70	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	71			*	72	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	73	*			74	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	75		*		76	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	77			*	78	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	79	*			80	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	81		*		82	20A/1P	0	0	SPARE
SPARE	0	0	20A/1P	83			*	84	20A/1P	0	0	SPARE

CONNECTED LOAD (KW) - A	0.00	TOTAL DESIGN LOAD (KW)	0.00
CONNECTED LOAD (KW) - B	0.00	POWER FACTOR	
CONNECTED LOAD (KW) - C	0.00	TOTAL DESIGN LOAD (AMPS)	0

Panel L5 Sizing

Note: All wires to be sized 75 degrees C, THWN, CU wire
Design Load: 88 Amps
Circuit Breaker Size: 90 Amps
Feeder Size: #4 AWG
Neutral: #4 AWG
Ground: #8 AWG
Conduit Size: (4) #4 AWG, (1) #8 AWG

(4) * 0.0824 + 0.0366 = 0.03662 inches squared
40% * 1.526” = 0.614” > 0.03662”
Conduit to be 1 ¼” RMC

Emergency Lighting Transfer Switch Panel

EMERGENCY LIGHTING TRANSFER SWITCH (ELTS) PANEL - LOBBY		
20 AMP RATED, 4-WIRE INPUT, 2-POLE TRANSFER, 2-WIRE OUTPUT		
ALT #	**NORMAL/RELAY/DIMMING CKT**	**EMERGENC CKT**
1	DM3-1	E-39
2	DM3-5	E-22
3	DM3-14	E-37
4	DM3-4	E-20
5	SPARE	
6	SPARE	
7	SPARE	
8	SPARE	
9	SPARE	
10	SPARE	
11	SPARE	
12	SPARE	

New Panel DM3

LOBBY/CANOPY DIMMER SCHEDULE DM3 SCHEDULE						
ZONE. NO	**CKT NO.**	**FIXTURE TYPE**	**DESCRIPTION**	**WATTS/ FIXTURE**	**QTY.**	**LOAD (W)**
1	**1**	A1	CFL PENDANTS	39	29	1,131
2	**2**		SPARE			
3	**3**	A4	TRACK- CATWALK	50	22	1,100
4	**4**	A7	TRACK- MAIN STAIRS	100	4	400
5	**5**	A7	TRACK- MAIN STAIRS	100	10	1,000
6	**6**	A1	CFL PENDANTS- TICKET BOOTH	39	5	195
7	**7**	A4	TRACK- TICKET BOOTH	50	7	350
8	**8**	A5	LED STRIP- TICKET BOOTH	1	230	230
9	**9**	A2	TRACK- ENTRANCE WALL	50	3	150
10	**10**	A1	CFL PENDANTS- CAFÉ	39	6	234
11	**11**	A2	TRACK- SEATING NOOK	50	4	200
12	**12**	A2	TRACK- BOOK STALL	50	2	100
13	**13**	A7	TRACK- UNDER MAIN STAIRS	100	5	500
14	**14**	A1	CFL PENDANTS- SEATING AREA	39	6	234
15	**15**	A3	ACCENT- GYPSUM PANEL	71	1	71
16	**16**	A3	ACCENT- GYPSUM PANEL	71	1	71
17	**17**	A3	ACCENT- GYPSUM PANEL	71	1	71
18	**18**	A3	ACCENT- GYPSUM PANEL	71	1	71
19	**19**	A3	ACCENT- GYPSUM PANEL	71	1	71
20	**20**	A3	ACCENT- GYPSUM PANEL	71	1	71
21	**21**	A3	ACCENT- GYPSUM PANEL	71	1	71
22	**22**	A3	ACCENT- GYPSUM PANEL	71	1	71
23	**23**	A3	ACCENT- GYPSUM PANEL	71	1	71
24	**24**	A3	ACCENT- GYPSUM PANEL	71	1	71
25	**25**	A3	ACCENT- GYPSUM PANEL	71	1	71
26	**26**	A3	ACCENT- GYPSUM PANEL	71	1	71
27	**27**	A3	ACCENT- GYPSUM PANEL	71	1	71
28	**28**	A3	ACCENT- GYPSUM PANEL	71	1	71
29	**29**	A3	ACCENT- GYPSUM PANEL	71	1	71
30	**30**	A3	ACCENT- GYPSUM PANEL	71	1	71
31	**31**	A3	ACCENT- GYPSUM PANEL	71	1	71
32	**32**	A3	ACCENT- GYPSUM PANEL	71	1	71
33	**33**	EX2	SOURCE 4 JR- CANOPY	375	2	750

34	**34**		SPARE			
35	**35**	EX3	CYLINDER ACCENT- CANOPY	50	4	200
36			SPARE			
37			SPARE			
38			SPARE			
39			SPARE			
40			SPARE			
41			SPARE			
42			SPARE			
43			SPARE			
44			SPARE			
45			SPARE			
46			SPARE			
47			SPARE			
48			SPARE			
				TOTAL LOAD (W)		**8,052**

Panel DM3 Sizing

Note: All wires to be sized 75 degrees C, THWN, CU wire
Design Load: 23 Amps
Circuit Breaker Size: 30 Amps
Feeder Size: #10 AWG
Neutral: #10 AWG
Ground: #10 AWG
Conduit Size: ¾ “

New Relay R1

RELAY R1 PANEL SCHEDULE			
ATS #	**AMPACITY**	**ZONE (DMX 512 CONTROL)**	**FROM CKT**
1	20 A	LIGHTWALL	L5-18
2	20 A	LIGHTWALL	L5-20
3	20 A	CANOPY	L5-22
4	20 A	CANOPY	L5-24
5	20 A	SPARE	
6	20 A	SPARE	
7	20 A	SPARE	
8	20 A	SPARE	
9	20 A	SPARE	
10	20 A	SPARE	
11	20 A	SPARE	
12	20 A	SPARE	
13	20 A	SPARE	
14	20 A	SPARE	
15	20 A	SPARE	
16	20 A	SPARE	
17	20 A	SPARE	
18	20 A	SPARE	
19	20 A	SPARE	
20	20 A	SPARE	
21	20 A	SPARE	
22	20 A	SPARE	
23	20 A	SPARE	
24	20 A	SPARE	

Existing Emergency Lighting Transfer Switch Panel

EMERGENCY LIGHTING TRANSFER SWITCH (ELTS) PANEL- THEATRE		
20 AMP RATED, 4-WIRE INPUT, 2-POLE TRANSFER, 2-WIRE OUTPUT		
ALT #	**NORMAL/RELAY/DIMMING CKT**	**EMERGENCY CKT**
1	SPARE	SPARE
2	DM2-183	E-3
3	DM2-184	E-5
4	DM2-185	E-7
5	SPARE	SPARE
6	T1-2	E-11
7	T1-6	E-13
8	R-13	E-19
9	R-12	E-21
10	R-16	E-27
11	T1-14	E-24
12	SPARE	SPARE
13	SPARE	SPARE
14	SPARE	SPARE
15	SPARE	SPARE
16	SPARE	SPARE
17	SPARE	SPARE
18	SPARE	SPARE
19	SPARE	
20	SPARE	
21	SPARE	
22	SPARE	
23	SPARE	
24	SPARE	
25	SPARE	

New Emergency Lighting Transfer Switch Panel

EMERGENCY LIGHTING TRANSFER SWITCH (ELTS) PANEL-THEATRE		
20 AMP RATED, 4-WIRE INPUT, 2-POLE TRANSFER, 2-WIRE OUTPUT		
ALT #	**NORMAL/RELAY/DIMMING CKT**	**EMERGENCY CKT**
1	SPARE	SPARE
2	DM2-182	E-3
3	DM2-184	E-5
4	DM2-183	E-7
5	SPARE	SPARE
6	T1-2	E-11
7	T1-6	E-13
8	R-13	E-19
9	R-12	E-21
10	R-16	E-27
11	T1-14	E-24
12	SPARE	SPARE
13	SPARE	SPARE
14	SPARE	SPARE
15	SPARE	SPARE
16	SPARE	SPARE
17	SPARE	SPARE
18	SPARE	SPARE
19	SPARE	
20	SPARE	
21	SPARE	
22	SPARE	
23	SPARE	
24	SPARE	
25	SPARE	

Existing Panel DM2

THEATER DIMMER PANEL DM2 SCHEDULE		
DIMMER #	**DIMMING MODULE**	**ZONE (512 CONTROL)**
181	2.4 KW	BACK WALL 1ST FLR. LIGHTS
182	2.4 KW	BACK WALL 1ST FLR. LIGHTS
183	2.4 KW	UNDER BALCONY 1ST FLR LIGHTS
184	2.4 KW	SLL AND STAIR LIGHTS
185	2.4 KW	2ND FLR LIGHTS
186	2.4 KW	BACK WALL 2ND FLR. LIGHTS
187	2.4 KW	HOUSE LIGHTS
188	2.4 KW	HOUSE LIGHTS

New Panel Dim2

THEATER DIMMER PANEL DM2 SCHEDULE					
ZONE. NO	**FIXTURE TYPE**	**DESCRIPTION**	**WATTS/ FIXTURE**	**QTY.**	**LOAD (W)**
181	C1	CFL PENDANTS	148	7	1,036
181	C1	CFL PENDANTS	148	7	1,036
182	C2	CFL CYLINDERS- FIRST FLOOR	39	27	1,053
183	C3	CFL PENDANT CYLINDERS- BALCONY FLOOR	50	15	750
184	B, B1, B2	SLL AND STAIR LIGHTS			650
185	C4	STEPLIGHTS	20	24	480
186	C5	LED RAILING	2	240	480
187	C7	TRACK- BACK WALL 1ST FLR.	50	10	500
188	C6	SUSPENDED TRACK- BACK WALL 2ND FLR.	120	7	840

Feeders for Panel DM2 could not be sized due to the unknown loads of Zone No. 1 - 180.

Existing Panel L6

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: L6
PANEL LOCATION: SECOND LEVEL
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 85K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
SYSTEMS FURN		800	20A/1P	1	*			2	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	3		*		4	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	5			*	6	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	7	*			8	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	9		*		10	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	11			*	12	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	13	*			14	20A/1P	0		SPARE
SYSTEMS FURN		800	20A/1P	15		*		16	20A/1P	0		SPARE
SYSTEMS FURN		800	20A/1P	17			*	18	20A/1P	0		SPARE
RECEPTACLE		160	20A/1P	19	*			20	20A/1P	400		DISPOSAL
RECEPTACLE		160	20A/1P	21		*		22	20A/1P	1520		LIGHTS
RECEPTACLE		160	20A/1P	23			*	24	20A/1P	1520		LIGHTS
RECEPTACLE		160	20A/1P	25	*			26	20A/1P	760		LIGHTS
RECEPTACLE		160	20A/1P	27		*		28	20A/1P	0		SPARE
RECEPTACLE		960	20A/1P	29			*	30	20A/1P	1100		TRACK LIGHTS
RECEPTACLE		800	20A/1P	31	*			32	20A/1P	320		RECEPTACLE
RECEPTACLE		320	20A/1P	33		*		34	20A/1P	320		RECEPTACLE
RECEPTACLE		800	20A/1P	35			*	36	20A/1P	100		CHAIR LIFT
RECEPTACLE		960	20A/1P	37	*			38	20A/1P	100		CARD READER
RECEPTACLE		800	20A/1P	39		*		40	20A/1P	400		F-5
RECEPTACLE		320	20A/1P	41			*	42	20A/1P	0		SPARE

CONNECTED LOAD (KW) - A	6.70	TOTAL DESIGN LOAD (KW)	22.71
CONNECTED LOAD (KW) - B	6.72	POWER FACTOR	0.92
CONNECTED LOAD (KW) - C	8.00	TOTAL DESIGN LOAD (AMPS)	69

New Panel L6

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: L6
PANEL LOCATION: SECOND FLOOR
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 85K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
SYSTEMS FURN		800	20A/1P	1	*			2	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	3		*		4	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	5			*	6	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	7	*			8	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	9		*		10	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	11			*	12	20A/1P	320		RECEPTACLE
SYSTEMS FURN		800	20A/1P	13	*			14	20A/1P	864	OFFICE	QUAD RECEPTACLE
SYSTEMS FURN		800	20A/1P	15		*		16	20A/1P	864	OFFICE	QUAD RECEPTACLE
SYSTEMS FURN		800	20A/1P	17			*	18	20A/1P	0		SPARE
RECEPTACLE		160	20A/1P	19	*			20	20A/1P	400		DISPOSABLE
RECEPTACLE		160	20A/1P	21		*		22	20A/1P	926	OFFICE	OFFICE LIGHTS
RECEPTACLE		160	20A/1P	23			*	24	20A/1P	1520		LIGHTS
RECEPTACLE		160	20A/1P	25	*			26	20A/1P	760		LIGHTS
RECEPTACLE		160	20A/1P	27		*		28	20A/1P	664	OFFICE	OFFICE LIGHTS
RECEPTACLE		960	20A/1P	29			*	30	20A/1P	1100		TRACK LIGHTS
RECEPTACLE		800	20A/1P	31	*			32	20A/1P	320		RECEPTACLE
RECEPTACLE		320	20A/1P	33		*		34	20A/1P	320		RECEPTACLE
RECEPTACLE		800	20A/1P	35			*	36	20A/1P	100		CHAIR LIFT
RECEPTACLE		960	20A/1P	37	*			38	20A/1P	100		CARD READER
RECEPTACLE		800	20A/1P	39		*		40	20A/1P	400		F-5
RECEPTACLE		320	20A/1P	41			*	42	20A/1P	0		QUAD RECEPTACLE

CONNECTED LOAD (KW) - A	7.56	TOTAL DESIGN LOAD (KW)	23.76
CONNECTED LOAD (KW) - B	7.65	POWER FACTOR	0.91
CONNECTED LOAD (KW) - C	8.00	TOTAL DESIGN LOAD (AMPS)	73

Panel L6 Sizing

Note: All wires to be sized 75 degrees C, THWN, CU wire
Design Load: 73 Amps
Circuit Breaker Size: 80 Amps
Feeder Size: #6 AWG
Neutral: #6 AWG
Ground: #8 AWG
Conduit Size: 1 ¼"

Emergency Lighting Panelboards

Existing Panel E

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: E
PANEL LOCATION: SHOP
PANEL MOUNTING: SURFACE

MIN. C/B AIC: MATCHING EXISTING ATS
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
FACP		200	20A/1P	1	*			2	20A/1P	200		ELEV TROUGH
THEATER LIGHTS		300	20A/1P	3		*		4	20A/1P	1000		ELEV PIT
THEATER LIGHTS		1900	20A/1P	5			*	6	20A/1P	200		EXIT SIGNS
THEATER LIGHTS		1900	20A/1P	7	*			8	20A/1P	100		LIGHT
SPARE		0	20A/1P	9		*		10	20A/1P	200		EXIST SIGNS
ONTROL RM LIGHT		500	20A/1P	11			*	12	20A/1P	200		EXIT SIGNS
LIGHTS		300	20A/1P	13	*			14	20A/1P	200		FREIGHT ELEV TROUGH
LIGHTS		900	20A/1P	15		*		16	20A/1P	100		FREIGHT ELEV LIGHT
LIGHTS-1ST FL		600	20A/1P	17			*	18	20A/1P	1000		FREIGHT ELEV PIT
THEATER LIGHTS		300	20A/1P	19	*			20	20A/1P	400		TRACK LIGHTS
THEATER LIGHTS		200	20A/1P	21		*		22	20A/1P	1000		TRACK LIGHTS
LIGHTS OFFICE		500	20A/1P	23			*	24	20A/1P	0		STEP LIGHTS
LIGHTS OFFICE		300	20A/1P	25	*			26	20A/1P	0		SPARE
LIGHTS SLL		300	20A/1P	27		*		28	20A/1P	0		SPARE
LIGHTS CORR		1200	20A/1P	29			*	30	20A/1P	0		SPARE
LIGHTS CORR		1200	20A/1P	31	*			32	20A/1P	0		SPARE
LIGHTS-1ST FL		1500	20A/1P	33		*		34	20A/1P	0		SPARE
LIGHTS CORR		300	20A/1P	35			*	36	20A/1P	0		SPARE
LIGHTS-1ST FL		1300	20A/1P	37	*			38	20A/1P	4000		SPACE
LIGHTS-2ND FL		500	20A/1P	39		*		40	20A/1P	4000		SPACE
LIGHTS TRACK		700	20A/1P	41			*	42	20A/1P	4000		SPACE

CONNECTED LOAD (KW) - A	10.40	TOTAL DESIGN LOAD (KW)	18.74
CONNECTED LOAD (KW) - B	10.00	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	11.10	TOTAL DESIGN LOAD (AMPS)	52

New Panel E

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A/3P C/B

PANEL TAG: E
PANEL LOCATION: SHOP
PANEL MOUNTING: SURFACE

MIN. C/B AIC: MATCHING EXISTING ATS
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
FACP		200	20A/1P	1	*			2	20A/1P	200		ELEV TROUGH
THEATER LIGHTS		300	20A/1P	3		*		4	20A/1P	1000		ELEV PIT
THEATER LIGHTS		1900	20A/1P	5			*	6	20A/1P	200		EXIT SIGNS
THEATER LIGHTS		1900	20A/1P	7	*			8	20A/1P	100		LIGHT
SPARE		0	20A/1P	9		*		10	20A/1P	200		EXIT SIGNS
CONTROL RM LIGHTS		500	20A/1P	11			*	12	20A/1P	200		EXIT SIGNS
LIGHTS		300	20A/1P	13	*			14	20A/1P	200		FREIGHT ELEV TROUGH
SPARE		0	20A/1P	15		*		16	20A/1P	100		FREIGHT ELEV LIGHT
LIGHTS-1ST FL		600	20A/1P	17			*	18	20A/1P	1000		FREIGHT ELEV PIT
THEATER LIGHTS		300	20A/1P	19	*			20	20A/1P	400		TRACK LIGHTS
THEATER LIGHTS		200	20A/1P	21		*		22	20A/1P	1000		TRACK LIGHTS
LIGHTS OFFICE		205	20A/1P	23			*	24	20A/1P	0		SPARE
LIGHTS OFFICE		300	20A/1P	25	*			26	20A/1P	0		SPARE
LIGHTS SLL		300	20A/1P	27		*		28	20A/1P	0		SPARE
LIGHTS CORR		1200	20A/1P	29			*	30	20A/1P	0		SPARE
LIGHTS CORR		1200	20A/1P	31	*			32	20A/1P	0		SPARE
LIGHTS-1ST FL		1500	20A/1P	33		*		34	20A/1P	0		SPARE
LIGHTS CORR		300	20A/1P	35			*	36	20A/1P	0		SPARE
LIGHTS-1ST FL		234	20A/1P	37	*			38	20A/1P	4000		SPACE
LIGHTS-2ND FL		1131	20A/1P	39		*		40	20A/1P	4000		SPACE
LIGHTS TRACK		700	20A/1P	41			*	42	20A/1P	4000		SPACE

CONNECTED LOAD (KW) - A	9.33	TOTAL DESIGN LOAD (KW)	10.93
CONNECTED LOAD (KW) - B	9.73	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	10.81	TOTAL DESIGN LOAD (AMPS)	30

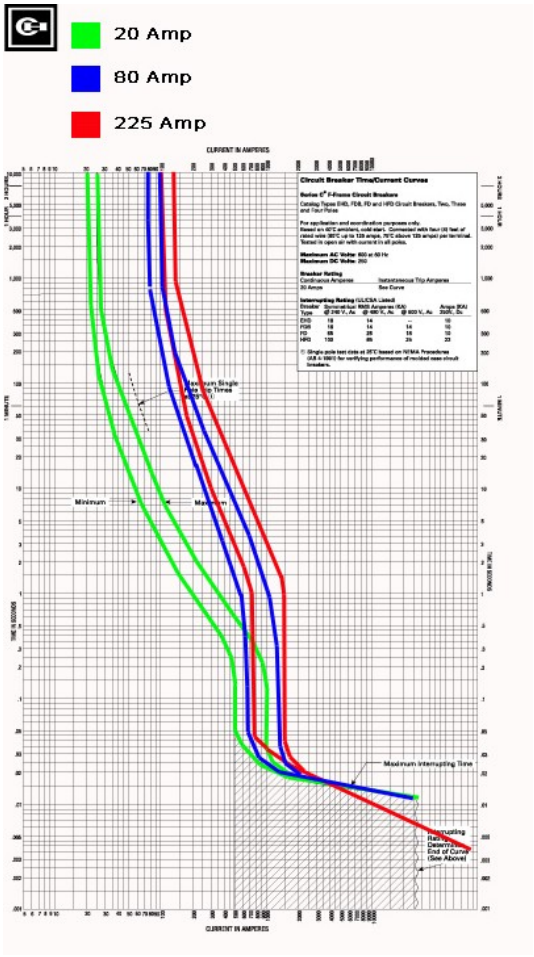
Panel E Sizing

Note: All wires to be sized 75 degrees C, THWN, CU wire
Design Load: 30 Amps
Circuit Breaker Size: 30 Amps
Feeder Size: #10 AWG
Neutral: #10 AWG
Ground: #10 AWG
Conduit Size: ¾”

Note: Voltage drop calculations did not need to be calculated for new design panels. All panels are located in electrical closets in the corresponding rooms. Therefore the distance of the runs was not long.

Device Coordination Study

All circuit breaker cut-sheets can be found in Appendix B-1



Conclusion

This diagram above shows three devices from the electrical system, a 20 A circuit breaker from a branch circuit and the 80 A circuit breaker from panel L6 and a 225 A circuit breaker from switchboard S1. The three devices are coordinated because the 20 A breaker will trip before the 80 A breaker, and the 80 A breaker will trip before the 225 A breaker.

Short Circuit

The utility for the Woolly Mammoth Theatre was contacted in order to obtain the existing information on short circuit current. The information was unavailable. Therefore the short circuit current calculation could not be carried out.

Copper versus Aluminum Wiring

FEEDER SCHEDULE					
FEEDER	**SERVING**	**SERVING FROM**	**WIRE**	**CONDUIT**	**GROUND**
1	L4	S1	4 #5000 KCMIL	3- 1/2 "	1 #3
2	M3, M2	S1	4 #5000 KCMIL	3- 1/2 "	1 #3
3	L5	S1	4 #4/0	2- 1/2"	1 #4
4	TP, 100 A AUDIO	S1	3 #250 KCMIL	2- 1/2"	1 #4
5	T1	S1	4 #1	1- 1/2"	1 #8
6	T	S1	4 #5000 KCMIL	3- 1/2 "	1 #3
7	DM1	S1	(2) 3 #400 KCMIL, 2 #400 KCMIL N	3- 1/2 "	1 #2
8	DM2	S1	(2) 3 #400 KCMIL, 2 #400 KCMIL N	3- 1/2 "	1 #2
9	M1	S2	4 #5000 KCMIL	3- 1/2 "	1 #3
10	CH-1	S2	(2) 3 #250 KCMIL	2- 1/2"	1 #1
11	ELEVATOR	S2	3 #1	1- 1/2"	1 #6
12	FREIGHT ELEVATOR	S2	3 #1/0	1- 1/2"	1 #6
13	WH	S2	3 #3/0	2"	1 #6
14	WH	S2	3 #3/0	2"	1 #6
15	PB	S2	4 #5000 KCMIL	3- 1/2 "	1 #3

COPPER TO ALUMINUM WIRING SIZING AND COST ANALYSIS											
FEEDER NUMBER	OCPD (AMPS)	COPPER WIRING								LENGTH (FT)	PRICE
		WIRE SIZE (AWG OR KCMIL)				PRICE PER LINEAR FOOT					
		CONDUCTORS	NEUTRAL	GROUND	CONDUIT	CONDUCTORS	NEUTRAL	GROUND	CONDUIT		
1	400	3 #500	1 #500	1 #3	3-1/2 "	$4.20	$4.20	$0.50	$19.65	120	$4,434.00
2	400	3 #500	1 #500	1 #3	3-1/2 "	$4.20	$4.20	$0.50	$19.65	140	$5,173.00
3	225	3 #4/0	1 #4/0	1 #4	2-1/2"	$1.81	$1.81	$0.41	$11.20	160	$3,015.20
4	250	3 #250		1 #4	2-1/2"	$2.16		$0.41	$11.20	65	$1,175.53
5	225	3 #1	1 #1	1 #8	1-1/2"	$0.80	$0.80	$0.80	$5.20	20	$184.00
6	400	3 #500	1 #500	1 #3	3-1/2 "	$4.20	$4.20	$0.50	$19.65	20	$739.00
7	600	(2) 3 #400	2 #400	1 #2	3-1/2 "	$3.40	$3.40	$0.63	$19.65	20	$949.60
8	600	(2) 3 #400	2 #400	1 #2	3-1/2 "	$3.40	$3.40	$0.63	$19.65	20	$949.60
9	400	3 #500	1 #500	1 #3	3-1/2 "	$4.20	$4.20	$0.50	$19.65	200	$7,390.00
10	550	(2) 3 #250		1 #1	2-1/2"	$2.16		$0.80	$11.20	25	$624.00
11	150	3 #1		1 #6	1-1/2"	$0.80		$0.27	$5.20	190	$1,494.35
12	200	3 #3/0		1 #6	1-1/2"	$0.94		$0.27	$7.10	160	$1,629.60
13	200	3 #3/0		1 #6	2"	$0.94		$0.27	$7.10	15	$152.78
14	200	3 #3/0		1 #6	2"	$0.94		$0.27	$7.10	20	$203.70
15	400	3 #500	1 #500	1 #3	3-1/2 "	$4.20	$4.20	$0.50	$19.65	115	$4,249.25
								TOTAL PRICE			$32,363.60

FEEDER NUMBER	OCPD (AMPS)	ALUMINUM WIRING								LENGTH (FT)	PRICE
		WIRE SIZE (AWG OR KCMIL)				PRICE PER LINEAR FOOT					
		CONDUCTORS	NEUTRAL	GROUND	CONDUIT	CONDUCTORS	NEUTRAL	GROUND	CONDUIT		
1	400	(2) 3 #4/0	2 #4/0	1 #1	3"	$1.00	$1.00	$0.51	$15.20	120	$2,840.40
2	400	(2) 3 #4/0	2 #4/0	1 #1	3"	$1.00	$1.00	$0.51	$15.20	140	$3,313.80
3	225	3 #250	1 #250	1 #2	3"	$1.22	$1.22	$0.35	$15.20	160	$3,268.80
4	250	3 #350		1 #2	3"	$1.71		$0.35	$15.20	65	$1,344.20
5	225	3 #250	1 #250	1 #2	3"	$1.22	$1.22	$0.35	$15.20	20	$104.60
6	400	(2) 3 #4/0	2 #4/0	1 #1	3"	$1.00	$1.00	$0.51	$15.20	20	$473.40
7	600	(2) 3 #400	2 #400	1 #2/0	5"	$2.00	$2.00	$0.72	$44.00	20	$1,214.40
8	600	(2) 3 #400	2 #400	1 #2/0	5"	$2.00	$2.00	$0.72	$44.00	20	$1,214.40
9	400	(2) 3 #4/0	2 #4/0	1 #1	3"	$1.00	$1.00	$0.51	$15.20	200	$1,694.00
10	550	(2) 3 #400		1 #2/0	3-1/2"	$2.00		$0.72	$19.65	25	$809.25
11	150	3 #2/0		1 #4	2"	$0.72		$0.26	$7.10	190	$1,807.85
12	200	3 #4/0		1 #4	2"	$1.00		$0.26	$7.10	160	$1,654.40
13	200	3 #4/0		1 #4	2"	$1.00		$0.26	$7.10	15	$155.10
14	200	3 #4/0		1 #4	2"	$1.00		$0.26	$7.10	20	$206.80
15	400	(2) 3 #4/0	2 #4/0	1 #1	3"	$1.00	$1.00	$0.51	$15.20	115	$2,722.05
								TOTAL PRICE			$22,823.45

Characteristics of Copper and Aluminum

CHARACTERISTICS	COPPER	ALUMINUM
Tensile strength (lb/in^2).	55,000	25,000
Tensile strength for same conductivity (lb).	55,000	40,000
Weight for same conductivity (lb).	100	48
Cross section for same conductivity (C.M.).	100	160
Specific resistance (Ω/mil ft).	10.6	17

Copper and aluminum are the two most commonly used conductors. Copper has the highest conductivity of all engineering metals. The ampacity of copper conductors is about 1.6 times that of aluminum conductors of the same size, because of the coppers higher conductivity. This means that copper wire is smaller than all equivalent ampacity aluminum cables. Smaller wire means it is easier and less expensive to install. The smaller diameter and less stiffness of the insulation allow flexibility and require less effort to bend into position during installation. Copper is hard and stronger than aluminum, which means it is more resistive to abuse during installation. Copper connections run cooler than the aluminum equivalent meaning that copper connections will have a longer life.

On a first look basis aluminum cable can be cheaper than copper cable. But the life-cycle cost, including cable life, cost of installation, materials, maintenance, repairs and possible replacement must be considered. Also the potential liability of poor performance must be taken into account. The most important aspect is “life”. The longest life has the lowest total cost and will provide the greatest value. The problem comes with predicting the life of an aluminum wire, because the predicting would be from short-term accelerated laboratory tests. The life of a copper wire is predicted through actual field performance.

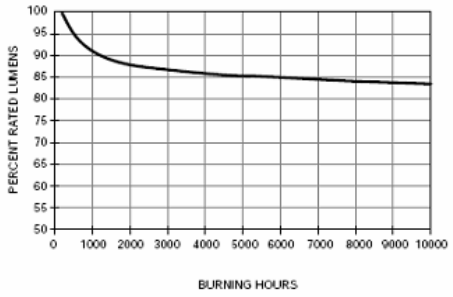
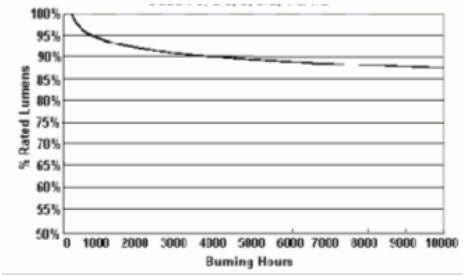
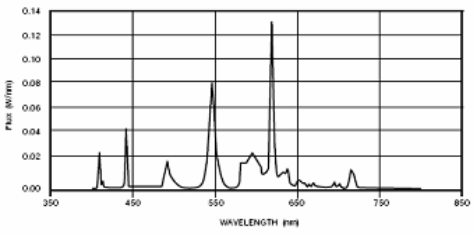
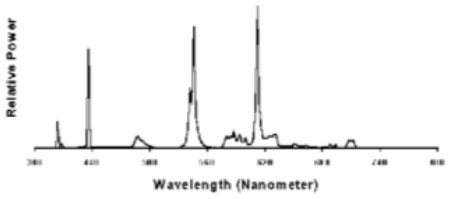
Conclusion

Commercial wiring is a long-term asset and is critical to the investment and performance that directly affects the profitability of a building. When weighing the advantages of copper and aluminum, copper is the better choice. Aluminum has a lower initial cost, but the many disadvantages outweigh the cost savings. Copper has unparalleled reliability for over a century, and should not be replaced by aluminum.

Compact Fluorescent Comparison

The following analysis is a comparison between screw base compact fluorescents and pin base compact fluorescents. The lamp and ballast cut-sheets can be found in Appendix B-2.

Statistics

CFL Comparison		
	Screw Base	**Pin Base**
Ballast	Integral	Remote
Wattage	23 W	26 W
Life	10,000 hr	12,000 hr
CRI	82	82
CCT	3000 K	3000 K
Initial Lumens at 25 C	1450	1710
Mean Lumens at 25 C	1160	1470
Maximum Overall Length	5.875"	6.5"
Lumen Maintenance Curve		
Spectral Power Distribution Curve		

As seen above, the two lamps are very similar in statistical information. The important difference in the two types of lamps is the ballast. Screw base CFLs are self ballasted, having the ballast inside the lamp. This makes it usable in retrofit applications where incandescent lamps were used. Pin base CFLs need a separate ballast to work properly. Therefore pin base CFLs only work in CFL fixtures made specifically for the pin based lamp.

Screw base compact fluorescents have been known to be finicky. This is due to their self-ballasting component. Ballast failure is a random process that can be compared with the standard failure profile for any electronic device. There is an initial small peak of failures, followed by a drop and steady increase over lamp life. The life of all electronics largely depends on the operating temperature. For every 10°C temperature rise, typical the life of the electronic is cut in half. This is why the quoted lamp life of CFLs is at 25°C. The average life of electronics is greater than this, so at this temperature most electronics will not fail due to failure of the electronics. A specific application of this is when screw base CFLs are run base-up. This results in hotter electronics and a shorter average life. Also when they are used in enclosed fixtures, the ambient temperature will rise dramatically due to the ballast.

There are also other problems with screw base compact fluorescents, noted by lighting designers in the industry. The screw base CFLs may not always fit in the luminaire. This is because the CFL is larger than a standard incandescent lamp, due to the ballast portion. Also if the lamp is viewable there may be a shadow due to the ballast compartment, depending where the base is in relation to the shade. The screw base CFL can only be run at 120 volts. Therefore it can not be used in many applications were voltages other than 120 volts are used. When re-lamping occurs, if the fixture is a screw base there is a good chance maintenance will re-lamp with an incandescent. This will drastically effect the power consumption in a building. If the luminaire is pin based, there can be no mistake of the lamp type to re-lamp with. Ecologically, when lamp life is taken into account the screw base CFL produces more waste going into the environment.

The main application for screw base compact fluorescents is for retrofit. When a screw base CFL is compared to an incandescent lamp, the CFL is much more efficient and will save the consumer money. Studies show that CFLs can save a consumer up to 66% on their energy bill and will last ten times longer than standard incandescent fixtures. In commercial applications, screw base CFLs are rarely specified in a new design. This is where the pin base CFLs are ideal. These CFLs are used when compact fluorescents are chosen for a design from the beginning.

Cost Comparison

Simple Life-Cycle Cost Estimator

Compare the life-cycle costs for two different lamps.

Enter the following information and click "calculate."
Your results will display below.

* Required

* Average number of hours on per year:	2912
* Electric cost per kilowatt hour:	0.10

Lamp 1

Lamp name:	Screw Base
* Watts (fixture watts/# of lamps):	23
* Cost (including disposal cost):	$ 10
* Life in hours:	6500
* Cost of labor to replace lamp:	$ 0
Mean lumens:	1160

Lamp 2

Lamp name:	Pin Base
* Watts (fixture watts/# of lamps):	26
* Cost (including disposal cost):	$ 3
* Life in hours:	12000
* Cost of labor to replace lamp:	$ 0
Mean lumens:	1470

CALCULATE

Results

	Lamp 1	Lamp 2
Lamp name:	Screw Base	Pin Base
Cost over lamp life:	$24.95	$34.2
Cost per 1,000 hours:	$3.84	$2.85
Cost per year:	$11.18	$8.3
Cost per million lumen hours:	$3.31	$1.94

Savings with Lamp 2: $2.88 /year

A cost comparison has been done of a screw base luminaire and lamp, versus a pin base luminaire, lamp and ballast. The luminaires are assumed to be used an average of 2912 hours per year. The electric cost per kilowatt hour is $0.10. The screw base CFL is assumed to only last 2/3 of its life.

According to the study, $2.88 per lamp will be saved per year. Now we will assume we have 25 luminaires. That is a savings of $72 per year, which is a savings of $1440 over twenty years. Yet ballast and luminaire cost have not been taken into account. Each ballast costs on average $30.00 and each luminaire will cost on average $20 more (to have pin-base). This is an initial cost of $1250. Therefore over the twenty year space, only $190 will be saved. With the pin base system, the lamp gives off more lumens, and consequently less luminaires will be needed. Or if the same number of luminaires were used, they could be dimmed to extend lamp life further.

Conclusion

In commercial applications, pin base compact fluorescents are almost always specified. This is due to reliability, voltage consideration, aesthetics, performance and cost. The screw base compact fluorescent should only be used in the application it was produced for, retrofit. The screw base CFL is a better option in many cases than an incandescent lamp. When it is used in the wrong application, its lamp life is shortened and it can be unreliable.