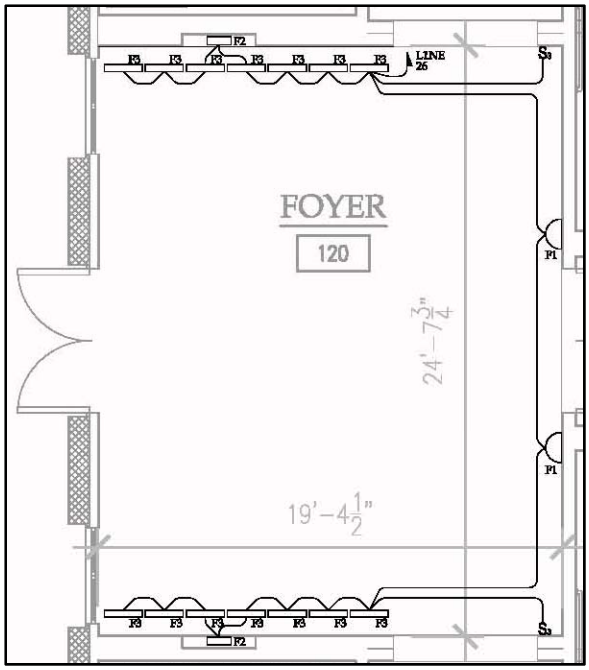
ELECTRICAL

FOYER:

The foyer is located in the center of the East side of the Friary. It circulates the traffic from the remainder of the building into the Chapel. The new lighting design proposed in this thesis uses two sconces on either side of the main door to the vestibule to create a break in the line of pendants in the adjacent hallway and to indicate the direction to the chapel. Floor mounted fluorescent wall washers wash the North and South walls while metal halide sources accent the pictures in the recesses. Two electric candles complete the design in the foyer as well as continue the design of the inner courtyard which has candles evenly placed in the windows along the perimeter. A three way switching system will be used with switches located in each of the entrances to the foyer from the East Hall. These switches will control the sconces, wall washers, and accent lights collectively. The candles will be battery powered to avoid the use of unsightly chords.

FLOOR PLAN:

The floor plan below shows the circuiting for the foyer. All of the lighting will be served from one circuit. Load calculations are provided to prove this to be feasible.



FOYER LIGHTING PLAN
SCALE: 1/8"=1'-0"

LOAD CALCULATIONS:

The load calculations provided determine the change in electrical lighting loads for the foyer. The lighting loads of the surrounding areas are still remaining on the circuit as well. The loads for the space lessened due to the use of fluorescent and metal halide sources.

ELECTRICAL

ORIGINAL DESIGN LIGHTING LOAD (L1NE(1) CKT 26)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
C	1	3	75 W	1.00	225 VA
D	2	3	75 W	1.00	450 VA
				Total:	675 VA

NEW DESIGN LIGHTING LOAD

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F1	2	1	60 W	1.00	120 VA
F2	2	1	35 W	1.00	70 VA
F3	14	1	11 W	0.97	149 VA
				Total:	339 VA

Original Circuit Load: 1146 VA

Remaining Loads: 1146 VA – 675 VA = 471 VA

New Circuit Load: 471 VA + 339 VA = *810 VA*

PANELBOARD SCHEDULE:

The panelboard below, L1NE, is located in the basement mechanical room of the Friary. The highlighted circuit serves the lighting in the foyer as well as the mail and storage room. The load shown is the calculated load for the existing mail and storage room design and the new foyer lighting design.

REDESIGN OF FOYER: REVISED LIGHTING LOADS ON L1NE

PANEL DESCRIPTION: L1NE(1) | LOCATION: BASEMENT MECH RM | MOUNTING: SURFACE | ENTRY: TOP | SECTION: 1 OF 2

BUS: 200A | VOLTAGE: 208 /120 | PHASE: 3 | WIRE: 4 | POLES: 84

MAIN: MLO | NEUTRAL: | AIC: 10,000 | IG BUS: NO | NOTES:

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-OFFICE	20	2#12+#12G 3/4"C	1440	474	4#12+#12G 3/4"C	15	FCU	2
3	R-OFFICE	20	2#12+#12G 3/4"C	1440	473			-	4
5	R-RECREATION	20	2#12+#12G 3/4"C	1440	473			-	6
7	R-OFFICE	20	2#12+#12G 3/4"C	1440	720	2#12+#12G 3/4"C	20	R-WORKROOM	8
9	R-CORRIDORS	20	2#12+#12G 3/4"C	1440	1200	2#12+#12G 3/4"C	20	R-KITCHENETTE	10
11	R-OFFICE	20	2#12+#12G 3/4"C	1440	1200	2#12+#12G 3/4"C	20	R-KITCHENETTE	12
13	R-PARLOR	20	2#12+#12G 3/4"C	1440			20	SPARE	14
15	R-WORK RM	20	2#12+#12G 3/4"C	1060			20	SPARE	16
17	R-CONF	20	2#12+#12G 3/4"C	1260	1426	2#12+#12G 3/4"C	20	L-OFFICES, RECREATION	18
19	WATER COOLERS	20	2#12+#12G 3/4"C	1020	1647	2#12+#12G 3/4"C	20	L-FOYER, PARLOR	20
21	SPARE	20			998	2#12+#12G 3/4"C	20	L-WORK ROOM, OFFICES	22
23	SPARE	20			1300	2#12+#12G 3/4"C	20	L-1ST FLOOR, CORRIDOR	24
25	SPARE	20			810	2#12+#12G 3/4"C	20	L-FOYER, MAIL, STORAGE	26
27	R-CORRIDORS	20	2#12+#12G 3/4"C	1440	1100	2#12+#12G 3/4"C	20	L-ARCADE	28
29	R-FOYER, CORRIDOR	20	2#12+#12G 3/4"C	1260	700	2#12+#12G 3/4"C	20	L-ARCADE	30
31	R-MAIL OFFICE	20	2#12+#12G 3/4"C	1260	600	2#12+#12G 3/4"C	20	L-ARCADE	32
33	R-OFFICE	20	2#12+#12G 3/4"C	720	200	2#12+#12G 3/4"C	20	L-PORTICO FLOOD LIGHT	34
35	R-PRINTER	20	2#12+#12G 3/4"C	300			20	SPARE	36
37	R-COPIER	20	2#12+#12G 3/4"C	1000			20	SPARE	38
39	-						20	SPARE	40
41	R-SHREDDER	20		300			20	SPARE	42

TOTAL CONNECTED KVA =	34	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	93.7
			11.9	10.1	11.8		

ELECTRICAL

PANEL DESCRIPTION	LOCATION: BASEMENT MECH RM	MOUNTING: SURFACE	ENTRY: TOP	SECTION: 2 OF 2
L1NE(2)	BUS: 200A VOLTAGE:208 /120 PHASE: 3		WIRE: 4	POLES: 84
	MAIN: MLO NEUTRAL:YES	AIC: 10,000	IG BUS:NO	NOTES:

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	A B C	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	L-DRIVEWAY	20	2#8+#12G 3/4"C	800	1 2	600	2#10+#10G 3/4"C	20	ACCESSIBLE DOOR	2
3	-			800	3 4			20	SPARE	4
5	L-PARKING	20	2#8+#20G 3/4"C	500	5 6	360	2#12+#12G 3/4"C	20	FCU-28	6
7	-			500	7 8			20	SPARE	8
9	L-LANDSCAPE	20	2#10+#10G 3/4"C	900	9 10			20	SPARE	10
11	R-BASEMENT	20	2#10+#10G 3/4"C	1260	11 12			20	SPARE	12
13	R-BASEMENT	20	2#10+#10G 3/4"C	1260	13 14			20	SPARE	14
15	SPARE				15 16				SPACE	16
17	SPARE				17 18				SPACE	18
19	SPARE				19 20				SPACE	20
21	SPARE				21 22				SPACE	22
23	SPACE				23 24				SPACE	24
25	SPACE				25 26				SPACE	26
27	SPACE				27 28				SPACE	28
29	SPACE				29 30				SPACE	30
31	SPACE				31 32				SPACE	32
33	SPACE				33 34				SPACE	34
35	SPACE				35 36				SPACE	36
37	SPACE				37 38				SPACE	38
39	SPACE				39 40				SPACE	40
41	SPACE				41 42				SPACE	42

TOTAL CONNECTED KVA =	7	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	19.4
			3.2	1.7	2.1		

Panel L1NE(1)	=	93.7 A
Panel L1NE(2)	=	19.4 A
Total L1NE	=	113.1 A
Fuse size:		
131.1A*1.25	=	141A (Resize the fuse to 150A)
Feeder size:		(4)3/O+#4G – 2”C*

*Based on the use of aluminum feeders

FEEDER SIZE:

L1NE is sized at 200A though the load on the panelboard will allow for a smaller overcurrent protection device. The new fuse will be 150A. The feeder size based upon NEC 2005 Table 310.16, will be (3)3/O phase wires (1)3/O neutral and a #4 ground conductor in a 2” EMT conduit.

LIBRARY:

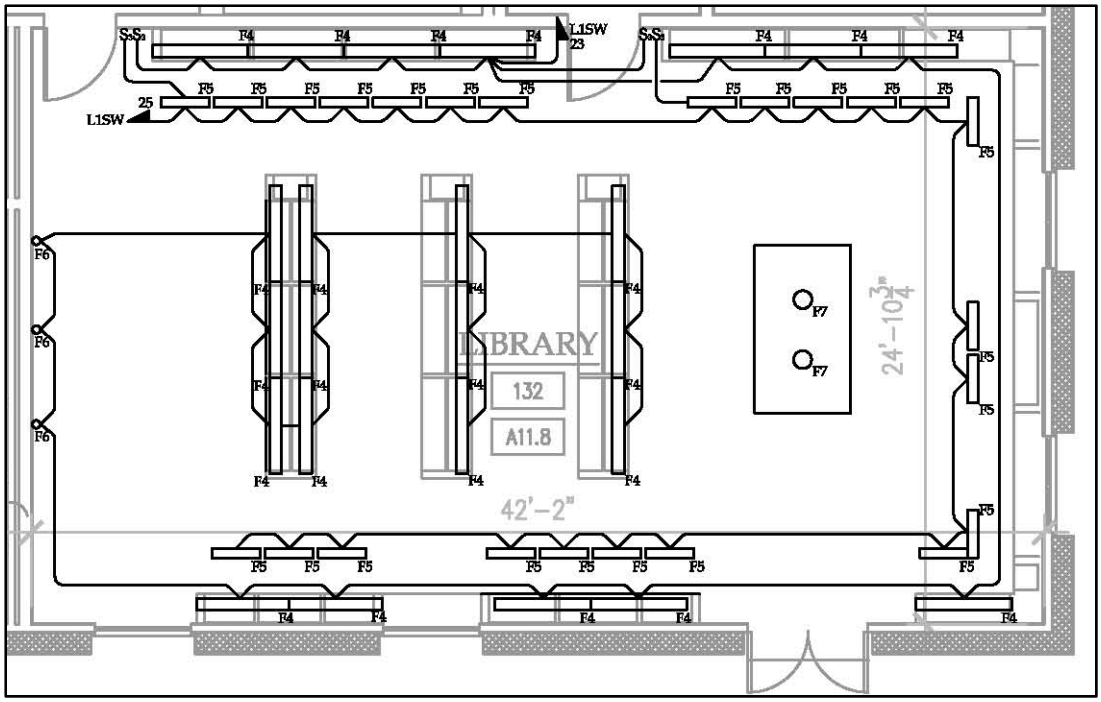
The library is located in the southeast corner of the Friary. Built-in bookshelves line three of the four walls and stand alone bookshelves are placed in the center of the west side of the room. A table is located in the center of the room on the east side. The new lighting design uses fluorescent wall washers to illuminate the walls of books. Cove lighting is tucked above the bookshelves and used to uplight the coffered wood ceiling. Table lamps are provided as task light on the table. These lamps will use receptacles and be manually switched. Battery powered candles will be placed in the windows as in the foyer.

The booklights will be served by their own 3-way switch with a switch at each of the hallway entrances. This will allow the booklights to be turned off when they are unnecessary thus lowering the book’s exposure to harmful rays. The coves and sconces will all be placed on a second 3-way switch.

ELECTRICAL

FLOOR PLAN:

The lighting in the library will need two circuits. The coves which operate on their own switch will be on one circuit while the remainder of the lighting loads will be served by another circuit.



LIBRARY LIGHTING PLAN
SCALE: 1/8"=1'-0"

LOAD CALCULATIONS:

ORIGINAL DESIGN LIGHTING LOAD (L1SW(2) CKTS 23,25)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
C	10	3	75 W	1.00	2250 VA
				Total:	2250 VA

NEW DESIGN LIGHTING LOAD

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F5	24	1	39 W	1.02	955 VA
F6	40	1	24 W	1.02	979 VA
F7	3	1	13 W	0.97	38 VA
				Total:	1972 VA

Original Circuit Load: 1125 VA/circuit (2 circuits)

New Circuit Load: 955 VA (bookshelf lights)
1017 VA (cove/sconce lights)

ELECTRICAL

PANELBOARD SCHEDULE:

The panelboard below, L1SW, is located on the southwest of the first floor of the Friary. The highlighted circuits serve the lighting in the library. The load shown is the calculated load for the new lighting design. Calculations can be found on the previous page.

REDESIGN OF LIBRARY: REVISED LIGHTING LOADS ON L1SW

PANEL DESCRIPTION	LOCATION: 1ST FLOOR SW		MOUNTING: SURFACE	ENTRY: TOP		SECTION: 1 OF 2
L1SW(1)	BUS: 225A	VOLTAGE:208 /120	PHASE: 3	WIRE: 4	POLES: 84	
	MAIN: 225A	NEUTRAL: YES	AIC: 10,000	IG BUS: NO	NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-REFECTORY	20	2#12+#12G 3/4"C	1080	1 2	560	3#12+#12G 1/2"C	20	FCU-	2
3	R-LIB COMPUTERS	20	2#12+#12G 3/4"C	1200	3 4	560		20	-	4
5	R-LIBRARY	20	2#12+#12G 3/4"C	900	5 6			20	SPACE	6
7	SPARE	20			7 8	363	4#12+#12G 3/4"C	20	FCU-10	8
9	SPARE	20			9 10	363		20	-	10
11	WASHER, DRYER	20	2#12+#12G 3/4"C	1800	11 12	363		20	-	12
13	R-RECREATION	20	2#12+#12G 3/4"C	1440	13 14			20	SPARE	14
15	R-CORRIDOR	20	2#12+#12G 3/4"C	1440	15 16			20	-	16
17	R-CORRIDOR	20	2#12+#12G 3/4"C	1260	17 18			20	-	18
19	R-HOBBY RM	20	2#12+#12G 3/4"C	360	19 20			20	SPARE	20
21	R-HOBBY RM	20	2#12+#12G 3/4"C	1200	21 22			20	-	22
23	R-HOBBY RM	20	2#12+#12G 3/4"C	1200	23 24			20	-	24
25	R-EXERCISE	20	2#12+#12G 3/4"C	1000	25 26	474	4#12+#12G 3/4"C	20	FCU-23	26
27	R-EXERCISE	20	2#12+#12G 3/4"C	1250	27 28	473		20	-	28
29	R-EXERCISE	20	2#12+#12G 3/4"C	1000	29 30	473		20	-	30
31	R-TREADMILL	20	2#12+#12G 3/4"C	1000	31 32			20	SPARE	32
33	R-TREADMILL	20	2#12+#12G 3/4"C	1000	33 34			20	-	34
35	R-TREADMILL	20	2#12+#12G 3/4"C	1000	35 36			20	-	36
37	L-COURTYARD	20	2#12+#12G 3/4"C	140	37 38	474	4#12+#12G 3/4"C	20	FCU-22,16	38
39	R-CORRIDOR,STORAGE	20		1080	39 40	473		20	-	40
41	SPARE	20			41 42	473		20	-	42

TOTAL CONNECTED KVA =	24	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 67.8
			6.9	9.0	8.5	

PANEL DESCRIPTION	LOCATION: 1ST FLOOR SW		MOUNTING: SURFACE	ENTRY:		SECTION: 2 OF 2
L1SW(2)	BUS: 225A	VOLTAGE: 208 /120	PHASE: 3	WIRE: 4	POLES: 84	
	MAIN: MLO	NEUTRAL: YES	AIC: 10,000	IG BUS: NO	NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-CELLS	20	2#12+#12G 3/4"C	1080	1 2	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	2
3	R-CELLS	20	2#12+#12G 3/4"C	1080	3 4	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	4
5	R-CELLS	20	2#12+#12G 3/4"C	1440	5 6	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	6
7	SPARE	20	2#12+#12G 3/4"C		7 8	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	8
9	SPARE	20	2#12+#12G 3/4"C		9 10	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	10
11	SPARE	20	2#12+#12G 3/4"C		11 12	720	2#12+#12G 3/4"C	20	R-2ND FL CORR	12
13	R-STUDY (EF)	20	2#12+#12G 3/4"C	720	13 14	720	2#12+#12G 3/4"C	20	R-STUDY 277	14
15	R-MUSIC RM	20	2#12+#12G 3/4"C	1080	15 16	1080	2#12+#12G 3/4"C	20	R-CORR	16
17	R-PORCH,HALL	20	2#12+#12G 3/4"C	720	17 18	720	2#12+#12G 3/4"C	20	R-CELL	18
19	FF-3	20	2#12+#12G 3/4"C	720	19 20	540	2#12+#12G 3/4"C	20	R-CELL BRS, CLO	20
21	L-1ST FL CORR-S	20	2#12+#12G 3/4"C	1200	21 22	360	2#12+#12G 3/4"C	20	R-CELL BRS	22
23	L-1ST FL LIB	20	2#12+#12G 3/4"C	955	23 24	1080	2#12+#12G 3/4"C	20	R-CELL	24
25	L-1ST FL LIB	20	2#12+#12G 3/4"C	1017	25 26	600	2#12+#12G 3/4"C	20	L-ATTIC	26
27	L-RECREATION	20	2#12+#12G 3/4"C	1086	27 28	1268	2#12+#12G 3/4"C	20	L-LAUNDRY	28
29	L-EXERCISE	20	2#12+#12G 3/4"C	1503	29 30	1319	2#12+#12G 3/4"C	20	L-MUSIC, STUDY	30
31	L-ARCADE	20	2#12+#12G 3/4"C	600	31 32	1500	2#12+#12G 3/4"C	20	L-CELLS	32
33	L-ARCADE	20	2#12+#12G 3/4"C	600	33 34	1275	2#12+#12G 3/4"C	20	L-CELLS	34
35	L-ARCADE	20	2#12+#12G 3/4"C	800	35 36	1275	2#12+#12G 3/4"C	20	L-CELLS	36
37	L-LANDSCAPE	20	2#8+#10G 3/4"C	1300	37 38	1275	2#12+#12G 3/4"C	20	L-CELLS	38
39	FCU-26	20	2#12+#12G 3/4"C	360	39 40	1480	2#10+#10G 3/4"C	20	L-DRIVEWAY	40
41	SPARE	20			41 42	1480			-	42

TOTAL CONNECTED KVA =	35	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 96.6
			10.8	11.6	12.4	

Panel L1SW(1)	=	67.8A
Panel L1SW(2)	=	96.6 A
Total L1SW	=	177.4 A
Fuse Size:		
177.4A*1.25(growth)	=	221.75A

FEEDER SIZE:

The fuse for L1SW was originally sized for 225A. The new lighting load will not impact this calculation and the fuse and feeder should remain the same.

ELECTRICAL

CHAPEL:

The chapel is located to the far east of the footprint. Three sides of the chapel open to the outdoors and the fourth side of the chapel is where the main entrance to the chapel, accessed by a central foyer, lies. The proposed lighting design consists of 6 pendant fixtures that provide the main ambient light, indirect fixtures that uplight the archways, and spotlights that highlight some of the key elements. All circuits will have a main switch at the main entrance through the foyer. The pendant fixtures will have a fourway switch allowing for them to be turned on or off at every main entrance. The spot lights will have their switch located at the front of the chapel next to the pulpit allowing for the circuit to be turned on and off locally.

ORIGINAL DESIGN LIGHTING LOAD (LCHAP CKT 1)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
AA	2	14	40 W	1.00	1120 VA
				Total:	1120 VA

ORIGINAL DESIGN LIGHTING LOAD (LCHAP CKT 3)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
BB	5	1	60 W	1.00	300 VA
HH	2	1	100 W	1.00	200 VA
K1	2	1	50 W	1.00	100 VA
				Total:	600 VA

ORIGINAL DESIGN LIGHTING LOAD (LCHAP CKT 5)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
BB	5	1	60 W	1.00	300 VA
HH	2	1	100 W	1.00	200 VA
K1	2	1	50 W	1.00	100 VA
				Total:	600 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 1)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F10	12	1	35 W	1.00	420 VA
F13	6	1	20 W	1.00	120 VA
				Total:	540 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 3)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F9	5	1	35 W	1.00	175 VA
F12	1	1	20 W	1.00	20 VA
				Total:	195 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 5)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F11	6	8	35 W	1.00	1680 VA
F8	4	1	26 W	1.00	104 VA
				Total:	1784 VA

ELECTRICAL

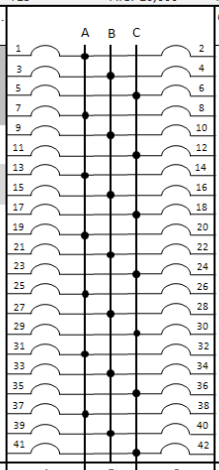
PANELBOARDS:

The LCHAP panelboard is designated to serve the chapel. It is the only panelboard that will be affected by the redesign. The panelboard below displays the new calculated loads.

REDESIGN OF CHAPEL: REVISED LIGHTING LOADS ON LCHAP

PANEL DESCRIPTION: LCHAP	LOCATION: SACRISTY I			MOUNTING: FLUSH	ENTRY: TOP			SECTION: 1 OF 1
	BUS: 200 A	VOLTAGE: 208	/120 PHASE: 3		WIRE: 4		POLES: 30	
	MAIN: 200A	NEUTRAL: YES		AIC: 10,000	IG BUS: NO		NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	PENDANT LTG	20	2#10+#10 1/2"C	540	720	2#12+#12G 1/2"C	20	RECEPTACLES	2
3	CHAPEL SCONCES	20	2#10+#10 1/2"C	195	720	2#12+#12G 1/2"C	20	RECEPTACLES	4
5	CHAPEL SCONCES	20	2#10+#10 1/2"C	1784	500	2#12+#12G 1/2"C	20	RECEPTACLES	6
7	ALTER LIGHTING	20	2#10+#10 1/2"C	0	580	2#12+#12G 1/2"C	20	L-BALCONY	8
9	L-SACRISTY/VESTRY	20	2#10+#10 1/2"C	1425	900	2#10+#10G 3/4"C	20	R-ALTER	10
11	L-SACRISTY/VESTRY	20	2#10+#10 1/2"C	675	1500	2#10+#10G 3/4"C	20	INSTAHOT	12
13	L-FLOOD	20	2#10+#10 1/2"C	1750	1500	2#10+#10G 3/4"C	20	INSTAHOT	14
15	L-BELL TOWER	20	2#10+#10 1/2"C	60	300	2#12+#12G 3/4"C	20	UC FRIDGE	16
17	L-FLOOD LIGHTS	20	2#10+#10 1/2"C	600	300	2#12+#12G 3/4"C	20	UC FRIDGE	18
19	L-FLOOD LIGHTS	20	2#10+#10 1/2"C	300			20	SPARE	20
21	INSTAHOT	20	2#10+#10 1/2"C	1500			20	SPARE	22
23	SPARE	20						SPACE	24
25	SPACE							SPACE	26
27	SPACE							SPACE	28
29	SPACE							SPACE	30
31									32
33									34
35									36
37									38
39									40
41									42



TOTAL CONNECTED KVA =	16	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 44.0
			5.4	5.1	5.4	

Panel LCHAP	=	44.9 A
Fuse Size:		
44.9A*1.25(growth)	=	56.1 A(Resize the fuse to 100A)
Feeder size:		(4)#1+#6G – 1 ½”C*

*Based on the use of aluminum feeders

FEEDER SIZE:

The LCHAP panelboard is sized at 200A though the load on the panelboard will allow for a smaller overcurrent protection device. The new fuse will be 100A. The feeder size based upon NEC 2005 Table 310.16, will be (3)#1 phase wires (1)#1 neutral and a #6 ground conductor in a 1 ½ ” EMT conduit.

COURTYARD:

The exterior courtyard lighting design is comprised of mainly two parts. The first part of the design is the façade. The façade is washed with flood lights and sconces are located at the entrances. The lighting design was based upon providing the friars with a sense of security. The second part is the statues that line the outer edge of the property. These statues will be lit with a flood light from the ground. As well a pole lamp across the sidewalk will provide some general lighting. All lighting will be switched on by an automatic time switch. The floorplans can be found in the electrical appendix.

ELECTRICAL

LOAD CALCULATIONS:

ORIGINAL DESIGN LIGHTING LOAD (LINE(2) CKT 9)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
S-4	8	1	20 W	1.00	160 VA
S-5	10	1	35 W	1.00	350 VA
				Total:	510 VA

ORIGINAL DESIGN LIGHTING LOAD (LISW(2) CKT 37)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
S-4	20	1	20 W	1.00	400 VA
S-5	20	1	35 W	1.00	700 VA
				Total:	1100 VA

ORIGINAL DESIGN LIGHTING LOAD (LCHAP CKT 13)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
S-6	10	1	75 W	1.00	750 VA
				Total:	750 VA

NEW DESIGN LIGHTING LOAD (LINE(2) CKT 9)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F16	12	1	35 W	1.00	420 VA
				Total:	420 VA

NEW DESIGN LIGHTING LOAD (LISW(2) CKT 37)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F14	12	1	70 W	1.00	840 VA
				Total:	840 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 13)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F18	2	1	30 W	1.00	60 VA
				Total:	60 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 15)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F17	21	1	70 W	1.00	1470 VA
F19	8	1	35 W	1.00	280 VA
				Total:	1750 VA

ELECTRICAL

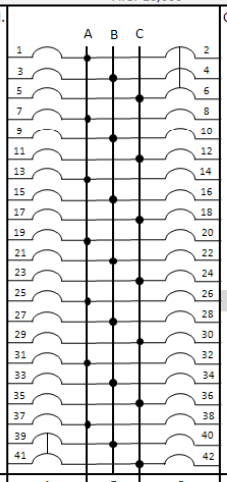
PANELBOARDS:

The panelboard below, L1SW, is located on the southwest of the first floor of the Friary. Panelboard LCHAP is located in the chapel, and panelboard L1NE is located in the northeast of the basement. All three panelboards serve the courtyard lighting. Panelboard L1SW serves the statue spotlights. Panel L1NE serves the statue pole fixtures. Panelboard LCHAP serves the façade lighting. The highlighted circuits show the calculated loads for the new design. Calculations can be found on the previous page.

REDESIGN OF COURTYARD: REVISED LIGHTING LOADS ON L1NE

PANEL DESCRIPTION: L1NE(1) | LOCATION: BASEMENT MECH RM | BUS: 200A | MAIN: MLO | VOLTAGE: 208 /120 | NEUTRAL: | MOUNTING: SURFACE | PHASE: 3 | AIC: 10,000 | ENTRY: TOP | WIRE: 4 | IG BUS: NO | POLES: 84 | NOTES: | SECTION: 1 OF 2

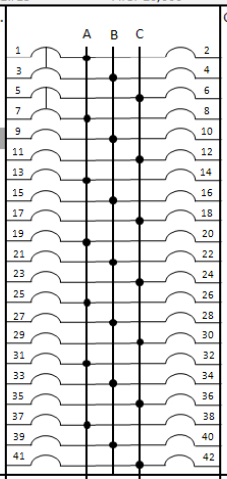
CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-OFFICE	20	2#12+#12G 3/4"C	1440	474	4#12+#12G 3/4"C	15	FCU	2
3	R-OFFICE	20	2#12+#12G 3/4"C	1440	473			-	4
5	R-RECREATION	20	2#12+#12G 3/4"C	1440	473			-	6
7	R-OFFICE	20	2#12+#12G 3/4"C	1440	720	2#12+#12G 3/4"C	20	R-WORKROOM	8
9	R-CORRIDORS	20	2#12+#12G 3/4"C	1440	1200	2#12+#12G 3/4"C	20	R-KITCHENETTE	10
11	R-OFFICE	20	2#12+#12G 3/4"C	1440	1200	2#12+#12G 3/4"C	20	R-KITCHENETTE	12
13	R-PARLOR	20	2#12+#12G 3/4"C	1440			20	SPARE	14
15	R-WORK RM	20	2#12+#12G 3/4"C	1060			20	SPARE	16
17	R-CONF	20	2#12+#12G 3/4"C	1260	1426	2#12+#12G 3/4"C	20	L-OFFICES, RECREATION	18
19	WATER COOLERS	20	2#12+#12G 3/4"C	1020	1647	2#12+#12G 3/4"C	20	L-FOYER, PARLOR	20
21	SPARE	20			998	2#12+#12G 3/4"C	20	L-WORK ROOM, OFFICES	22
23	SPARE	20			1300	2#12+#12G 3/4"C	20	L-1ST FLOOR, CORRIDOR	24
25	SPARE	20			810	2#12+#12G 3/4"C	20	L-FOYER, MAIL, STORAGE	26
27	R-CORRIDORS	20	2#12+#12G 3/4"C	1440	1100	2#12+#12G 3/4"C	20	L-ARCADE	28
29	R-FOYER, CORRIDOR	20	2#12+#12G 3/4"C	1260	700	2#12+#12G 3/4"C	20	L-ARCADE	30
31	R-MAIL OFFICE	20	2#12+#12G 3/4"C	1260	600	2#12+#12G 3/4"C	20	L-ARCADE	32
33	R-OFFICE	20	2#12+#12G 3/4"C	720	200	2#12+#12G 3/4"C	20	L-PORTICO FLOOD LIGHT	34
35	R-PRINTER	20	2#12+#12G 3/4"C	300			20	SPARE	36
37	R-COPIER	20	2#12+#12G 3/4"C	1000			20	SPARE	38
39	-						20	SPARE	40
41	R-SHREDDER	20		300			20	SPARE	42



TOTAL CONNECTED KVA =	34	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	93.7
			11.9	10.1	11.8		

PANEL DESCRIPTION: L1NE(2) | LOCATION: BASEMENT MECH RM | BUS: 200A | MAIN: MLO | VOLTAGE: 208 /120 | NEUTRAL: YES | MOUNTING: SURFACE | PHASE: 3 | AIC: 10,000 | ENTRY: TOP | WIRE: 4 | IG BUS: NO | POLES: 84 | NOTES: | SECTION: 2 OF 2

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	L-DRIVEWAY	20	2#8+#12G 3/4"C	800	600	2#10+#10G 3/4"C	20	ACCESSIBLE DOOR	2
3	-			800			20	SPARE	4
5	L-PARKING	20	2#8+#20G 3/4"C	500	360	2#12+#12G 3/4"C	20	FCU-28	6
7	-			500			20	SPARE	8
9	L-LANDSCAPE	20	2#10+#10G 3/4"C	420			20	SPARE	10
11	R-BASEMENT	20	2#10+#10G 3/4"C	1260			20	SPARE	12
13	R-BASEMENT	20	2#10+#10G 3/4"C	1260			20	SPARE	14
15	SPARE							SPACE	16
17	SPARE							SPACE	18
19	SPARE							SPACE	20
21	SPARE							SPACE	22
23	SPACE							SPACE	24
25	SPACE							SPACE	26
27	SPACE							SPACE	28
29	SPACE							SPACE	30
31	SPACE							SPACE	32
33	SPACE							SPACE	34
35	SPACE							SPACE	36
37	SPACE							SPACE	38
39	SPACE							SPACE	40
41	SPACE							SPACE	42



TOTAL CONNECTED KVA =	7	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	18.1
			3.2	1.2	2.1		

Panel L1NE(1)	=	93.7A
Panel L1NE(2)	=	18.1 A
Total L1NE	=	111.8 A(Resize to 150A)

ELECTRICAL

REDESIGN OF COURTYARD: REVISED LIGHTING LOADS ON L1SW

PANEL DESCRIPTION	LOCATION: 1ST FLOOR SW			MOUNTING: SURFACE	ENTRY: TOP		SECTION: 1 OF 2
L1SW(1)	BUS: 225A	VOLTAGE: 208	/120	PHASE: 3	WIRE: 4	POLES: 84	
	MAIN: 225A	NEUTRAL: YES		AIC: 10,000	IG BUS: NO	NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-REFECTORY	20	2#12+#12G 3/4"C	1080	1	560	3#12+#12G 1/2"C	20	FCU-	2
3	R-LIB COMPUTERS	20	2#12+#12G 3/4"C	1200	3	560		20	-	4
5	R-LIBRARY	20	2#12+#12G 3/4"C	900	5			20	SPACE	6
7	SPARE	20			7	363	4#12+#12G 3/4"C	20	FCU-10	8
9	SPARE	20			9	363		20	-	10
11	WASHER, DRYER	20	2#12+#12G 3/4"C	1800	11	363		20	-	12
13	R-RECREATION	20	2#12+#12G 3/4"C	1440	13			20	SPARE	14
15	R-CORRIDOR	20	2#12+#12G 3/4"C	1440	15			20	-	16
17	R-CORRIDOR	20	2#12+#12G 3/4"C	1260	17			20	-	18
19	R-HOBBY RM	20	2#12+#12G 3/4"C	360	19			20	SPARE	20
21	R-HOBBY RM	20	2#12+#12G 3/4"C	1200	21			20	-	22
23	R-HOBBY RM	20	2#12+#12G 3/4"C	1200	23			20	-	24
25	R-EXERCISE	20	2#12+#12G 3/4"C	1000	25	474	4#12+#12G 3/4"C	20	FCU-23	26
27	R-EXERCISE	20	2#12+#12G 3/4"C	1250	27	473		20	-	28
29	R-EXERCISE	20	2#12+#12G 3/4"C	1000	29	473		20	-	30
31	R-TREADMILL	20	2#12+#12G 3/4"C	1000	31			20	SPARE	32
33	R-TREADMILL	20	2#12+#12G 3/4"C	1000	33			20	-	34
35	R-TREADMILL	20	2#12+#12G 3/4"C	1000	35			20	-	36
37	L-COURTYARD	20	2#12+#12G 3/4"C	140	37	474	4#12+#12G 3/4"C	20	FCU-22,16	38
39	R-CORRIDOR,STORAGE	20		1080	39	473		20	-	40
41	SPARE	20			41	473		20	-	42

TOTAL CONNECTED KVA =	24	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 67.8
			6.9	9.0	8.5	

PANEL DESCRIPTION	LOCATION: 1ST FLOOR SW			MOUNTING: SURFACE	ENTRY:		SECTION: 2 OF 2
L1SW(2)	BUS: 225A	VOLTAGE: 208	/120	PHASE: 3	WIRE: 4	POLES: 84	
	MAIN: MLO	NEUTRAL: YES		AIC: 10,000	IG BUS: NO	NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-CELLS	20	2#12+#12G 3/4"C	1080	1	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	2
3	R-CELLS	20	2#12+#12G 3/4"C	1080	3	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	4
5	R-CELLS	20	2#12+#12G 3/4"C	1440	5	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	6
7	SPARE	20	2#12+#12G 3/4"C		7	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	8
9	SPARE	20	2#12+#12G 3/4"C		9	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	10
11	SPARE	20	2#12+#12G 3/4"C		11	720	2#12+#12G 3/4"C	20	R-2ND FL CORR	12
13	R-STUDY (EF)	20	2#12+#12G 3/4"C	720	13	720	2#12+#12G 3/4"C	20	R-STUDY 277	14
15	R-MUSIC RM	20	2#12+#12G 3/4"C	1080	15	1080	2#12+#12G 3/4"C	20	R-CORR	16
17	R-PORCH,HALL	20	2#12+#12G 3/4"C	720	17	720	2#12+#12G 3/4"C	20	R-CELL	18
19	EF-3	20	2#12+#12G 3/4"C	720	19	540	2#12+#12G 3/4"C	20	R-CELL BRS, CLO	20
21	L-1ST FL CORR-S	20	2#12+#12G 3/4"C	1200	21	360	2#12+#12G 3/4"C	20	R-CELL BRS	22
23	L-1ST FL LIB	20	2#12+#12G 3/4"C	955	23	1080	2#12+#12G 3/4"C	20	R-CELL	24
25	L-1ST FL LIB	20	2#12+#12G 3/4"C	1017	25	600	2#12+#12G 3/4"C	20	L-ATTIC	26
27	L-RECREATION	20	2#12+#12G 3/4"C	1086	27	1268	2#12+#12G 3/4"C	20	L-LAUNDRY	28
29	L-EXERCISE	20	2#12+#12G 3/4"C	1503	29	1319	2#12+#12G 3/4"C	20	L-MUSIC, STUDY	30
31	L-ARCADE	20	2#12+#12G 3/4"C	600	31	1500	2#12+#12G 3/4"C	20	L-CELLS	32
33	L-ARCADE	20	2#12+#12G 3/4"C	600	33	1275	2#12+#12G 3/4"C	20	L-CELLS	34
35	L-ARCADE	20	2#12+#12G 3/4"C	800	35	1275	2#12+#12G 3/4"C	20	L-CELLS	36
37	L-LANDSCAPE	20	2#8+#10G 3/4"C	840	37	1275	2#12+#12G 3/4"C	20	L-CELLS	38
39	FCU-26	20	2#12+#12G 3/4"C	360	39	1480	2#10+#10G 3/4"C	20	L-DRIVEWAY	40
41	SPARE	20			41	1480			-	42

TOTAL CONNECTED KVA =	34	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 95.3
			10.3	11.6	12.4	

Panel L1SW(1)	=	67.8A
Panel L1SW(2)	=	95.3 A
Total L1SW	=	163.1 A
Fuse size:		
163.1A * 1.25(growth)	=	204.4A

ELECTRICAL

REDESIGN OF COURTYARD: REVISED LIGHTING LOADS ON LCHAP

PANEL DESCRIPTION	LOCATION: SACRISTY I			MOUNTING: FLUSH	ENTRY: TOP			SECTION: 1 OF 1
LCHAP	BUS: 200 A	VOLTAGE: 208	/120	PHASE: 3	WIRE: 4		POLES: 30	
	MAIN: 200A	NEUTRAL: YES		AIC: 10,000	IG BUS: NO		NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	PENDANT LTG	20	2#10+#10 1/2"C	350		720	2#12+#12G 1/2"C	20	RECEPTACLES	2
3	CHAPEL SCONCES	20	2#10+#10 1/2"C	350		720	2#12+#12G 1/2"C	20	RECEPTACLES	4
5	CHAPEL SCONCES	20	2#10+#10 1/2"C	440		500	2#12+#12G 1/2"C	20	RECEPTACLES	6
7	ALTER LIGHTING	20	2#10+#10 1/2"C	312		580	2#12+#12G 1/2"C	20	L-BALCONY	8
9	L-SACRISTY/VESTRY	20	2#10+#10 1/2"C	1425		900	2#10+#10G 3/4"C	20	R-ALTER	10
11	L-SACRISTY/VESTRY	20	2#10+#10 1/2"C	675		1500	2#10+#10G 3/4"C	20	INSTAHOT	12
13	L-FLOOD	20	2#10+#10 1/2"C	1750		1500	2#10+#10G 3/4"C	20	INSTAHOT	14
15	L-BELL TOWER	20	2#10+#10 1/2"C	60		300	2#12+#12G 3/4"C	20	UC FRIDGE	16
17	L-FLOOD LIGHTS	20	2#10+#10 1/2"C	600		300	2#12+#12G 3/4"C	20	UC FRIDGE	18
19	L-FLOOD LIGHTS	20	2#10+#10 1/2"C	300				20	SPARE	20
21	INSTAHOT	20	2#10+#10 1/2"C	1500				20	SPARE	22
23	SPARE	20							SPACE	24
25	SPACE								SPACE	26
27	SPACE								SPACE	28
29	SPACE								SPACE	30
31										32
33										34
35										36
37										38
39										40
41										42

TOTAL CONNECTED KVA =	15	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 41.1
			5.5	5.3	4.0	

Panel LCHAP = 41.1A

Fuse size:

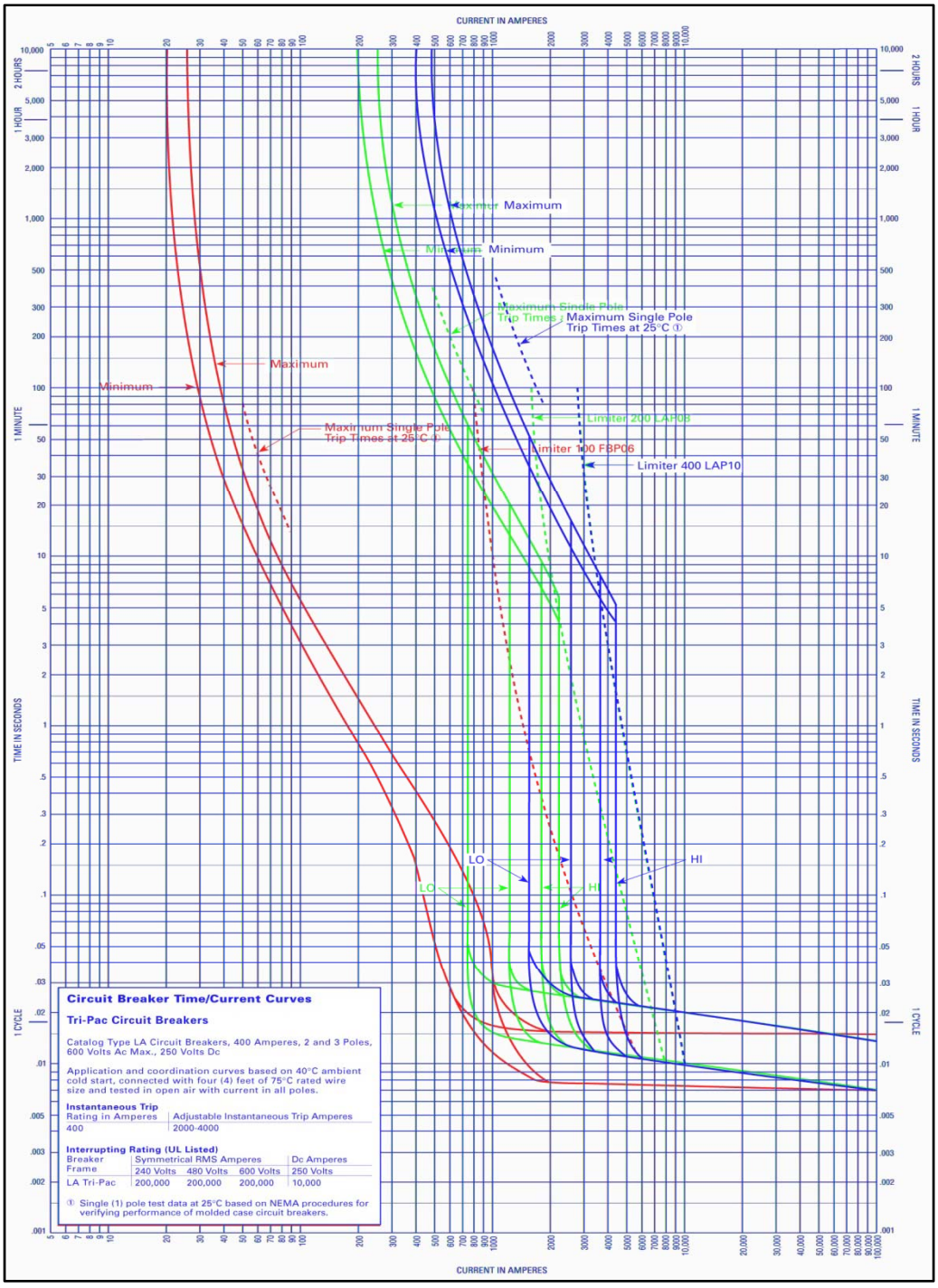
41.1A * 1.25(growth) = 51.3A(Resize to 100A)

FEEDER SIZING:

The feeders for the courtyard can be modified with the new lighting loads. The L1NE panelboard as discussed in previous sections can be resized to 150A. The L1SW panelboard can remain the same. Panel LCHAP can be downsized to 100A. All these modifications have been made in the calculations of the other three spaces.

ELECTRICAL

TIME/CURRENT CURVES:



*CUTLER-HAMMER OCTOBER 1997 CATALOG: AB DE-ION TRI PAC CIRCUIT BREAKERS

- Type FB, 20 Amps, 3 poles (Branch protection for lighting circuit on L-CHAP)
- Type LA, 200 Amps, 3 poles (Feeder Protection for L-CHAP)
- Type LA, 400 Amps, 3 poles (Feeder Protection for Emergency Distribution Panel)

ELECTRICAL

OVER-CURRENT DEVICE COORDINATION STUDY:

Over-current devices are specified and installed for 3 main reasons: 1)To prevent injuries, 2)To prevent fires, 3) to protect equipment. Over-currents can cause overloads, short circuits and ground faults to occur. An overload takes place when the load on a piece of equipment goes above the rating of the over-current device provided to protect the equipment. Short circuits are broken into two different categories; arc or bolted faults. They can occur either line to line or line to neutral. In the NEC 2005 Section 110.9,110.10, it states that the equipment chosen should be sufficient to handle high fault currents. Equipment selections should be based upon line to line bolted faults because these represent the maximum short circuit currents.

The time it takes to trip an over-current device under overload conditions is on a forced delay system to prevent devices from tripping due to minor load inflections. With short circuits, however, where the change in current is severe and sudden, the over-current device must have an immediate response time with no built-in delay.

An inverse time curve, provided by the manufacturer of the equipment, is used to determine the time it takes for the over-current device to respond to the additional current. In order for a distribution path to be most efficient and protected, the smallest breaker should be the first to trip in the event of an over-current. The path chosen to study the St. Francis Friary starts from the emergency distribution panelboard and travels through the LCHAP panel to a lighting circuit. As can be seen on the graph on the previous page, the lighting circuit with a 20 amp breaker will trip first, the LCHAP panelboard with a 200 amp rating will trip second, and the emergency distribution panelboard will trip last under overload conditions. However, if a fault were to occur at or above 800 amps in under 0.02 seconds, the 200 amp breaker on the LCHAP panel would trip before the panelboard. Likewise, if a fault were to occur at or above 2000 amps in under 0.015 seconds, the 400 amp breaker on the EDP panel would trip before the LCHAP and the lighting circuit. However, these both represent extreme condition that are unlikely to occur, thus the circuit breakers will be sufficient for the project.

SHORT CIRCUIT CURRENT:

Short circuit currents put both mechanical and thermal stress on the electrical equipment. Mechanical stress is caused by the force that the fault applies to the conductors. If not properly braced, the conductors make break. Thermal stress is caused by the heat generated by the over-current. 75 degree rated conductors are generally used in order to withstand the extra heat. As discussed above, short circuits are placed under two main categories: 1) arcing fault and 2) bolted fault.

An arcing fault occurs when insulation on a conductor is worn and an arc is able to jump from one conductor to the next. The resistance between the conductors is very high and therefore the change in current is lower, and not as easy to detect. That combined with the fact that the over-current is confined to a small portion of the system causes arcing faults to be more dangerous and harmful than bolted faults.

ELECTRICAL

Bolted faults are less common since they should be able to avoided. Bolted faults occur when two conductors come into contact with each other or another piece of metal. Standard precaution should prevent this from happening. However, when bolted faults do occur, it is such a quick and apparent change in current, that the over-current protection should be quick to recognize and terminate the problem.

SHORT CIRCUIT CURRENT CALCULATIONS:

UTILITY

Base KVA	10000
Utility SC KVA	1000000
Z(utility)	0.01
%R(utility	0
%X(utility)	100

$R_{p.u.}$ (utility)	0 p.u.
$X_{p.u.}$(utility)	0.01 p.u.

TRANSFORMER

kV	0.208
kVA	1000
(Table 4)	
X/R(transformer)	2.38
%Z(transformer)	5.8
%R(transformer)	2.25
%X(transformer)	5.35

$R_{p.u.}$(transformer)	0.22 p.u.
$X_{p.u.}$(transformer)	0.53 p.u.
$Z_{p.u.}$(transformer)	0.59 p.u.
I_{SC}	47163 A

AIC RATING	85000 A

PANEL EDP

kV	0.208
kVA	100
Conductor Size	500kcmil
Length (ft)	150
# of sets	1
(Table 7)	
R	0.0294
X_L	0.0466
R(EDP)	0.00441
X(EDP)	0.00699

$R_{p.u.}$(EDP)	1.02 p.u.
$X_{p.u.}$(EDP)	1.62 p.u.
$Z_{p.u.}$(EDP)	2.49 p.u.
I_{SC}	11148 A

AIC RATING	22000 A

PANEL LCHAP

kV	0.208
kVA	25
Conductor Size	3/O
Length (ft)	110
# of sets	1
(Table 7)	
R	0.0805
X_L	0.0519

R(LCHAP)	0.01
X(LCHAP)	0.01
$R_{p.u.}$(LCHAP)	2.05 p.u.
$X_{p.u.}$(LCHAP)	0.00 p.u.
$Z_{p.u.}$(LCHAP)	3.47 p.u.
I_{SC}	8018 A

AIC RATING	10000 A

ELECTRICAL

CONCLUSION:

The AIC ratings listed after the calculations above are that of the equipment in the building. As determined in these calculations, the interrupting capacity rating of each piece of equipment analyzed is rated above the short circuit current and, in the event of a such, will interrupt. This concludes that the equipment and ratings chosen are adequate and will not need to be redesigned.

ELECTRICAL

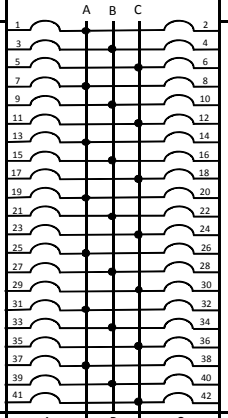
INTRODUCTION:

When changing the mechanical system from a constant volume 4-pipe system with a centralized chiller and boiler to a geothermal system, the centralized chiller and boiler were eliminated. Though heat pumps were added to the scope, the electrical load went down significantly due to the new system. The 600A load from the chiller was removed from the main distribution panel leaving an available spare for future growth. The heat pumps were added to panelboards that previously served the associated air handling units. Both panelboards affected by this additional load will require larger capacity busses as well as higher rated overcurrent protection devices. Another alternative would be to add a new panelboard served by the main distribution panel.

REDESIGN OF MECHANICAL SYSTEM: NEW LOADS ON LB2

PANEL DESCRIPTION: LB2(1) | LOCATION: MAIN ELECTRICAL ROOM | MOUNTING: SURFACE | ENTRY: TOP | SECTION: 1 OF 1
BUS: 400 | VOLTAGE: 208 /120 | PHASE: 3 | WIRE: 4 | POLES: 84
MAIN: MLO | NEUTRAL: YES | AIC: 10,000 | IG BUS: NO | NOTE:

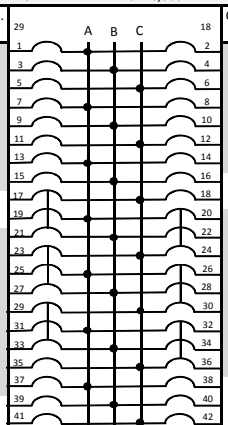
CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	HWP-2	30	3#10+#10G 3/4"C		1800	2#10+#10G 3/4"C	25	B-1	2
3	(STANDBY)				300	2#10+#10G 3/4"C	20	WATER HEATER WH-2	4
5	-				300	2#10+#10G 3/4"C	20	WATER HEATER WH-1	6
7	HWP-1	30	3#10+#10G 3/4"C	2020	1270	3#12+#12G 1/2"C	25	AIR COMPRESSOR	8
9	-			2020	1270			-	10
11	-			2020	1270			-	12
13	AHU-7	15	3#12+#12G 1/2"C	947	1130	2#12+#12G 3/4"C	20	CV-1	14
15	-			947	510	2#12+#12G 3/4"C	20	CV-2	16
17	-			946			20	SPARE	18
19	AHU-8	20	2#12+#12G 1/2"C	1130			20	SPARE	20
21	AHU-15	20	2#12+#12G 1/2"C	830			20	SPARE	22
23	AHU-14	20	3#12+#12G 1/2"C	473			20	SPARE	24
25	-	20		474				SPACE	26
27	-	20		474				SPACE	28
29	SPARE	20						SPACE	30
31	SPARE	20						SPACE	32
33	SPARE	20						SPACE	34
35	SPARE	20						SPACE	36
37	SPARE	20						SPACE	38
39	SPARE	20						SPACE	40
41	SPARE	20						SPACE	42



TOTAL CONNECTED KVA = 20 | VA / PHASE = A: 8.8 | B: 6.4 | C: 5.0 | TOTAL CONNECTED AMPERES = 55.9

PANEL DESCRIPTION: LB2(2) | LOCATION: MAIN ELECTRICAL ROOM | MOUNTING: SURFACE | ENTRY: TOP | SECTION: 1 OF 1
BUS: 400 | VOLTAGE: 208 /120 | PHASE: 3 | WIRE: 4 | POLES: 84
MAIN: MLO | NEUTRAL: YES | AIC: 10,000 | IG BUS: NO | NOTE:

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	HP-7	20	2#12+#12G 3/4"C	1200	1200	2#12+#12G 3/4"C	20	HP-14	2
3	HP-8	20	2#12+#12G 3/4"C	1200	732	2#12+#12G 3/4"C	20	HP-10	4
5	HP-15	15	2#12+#12G 3/4"C	732	732	2#12+#12G 3/4"C	20	HP-12	6
7	HP-11	30	2#12+#12G 3/4"C	2052	1200	2#12+#12G 3/4"C	20	HP-13	8
9	HP-9	20	2#12+#12G 3/4"C	1200	732	2#12+#12G 3/4"C	20	HP-20	10
11	HP-12	15	2#12+#12G 3/4"C	732	732	2#12+#12G 3/4"C	15	HP-18	12
13	HP-13	20	2#12+#12G 3/4"C	1200	732	2#12+#12G 3/4"C	15	HP-25	14
15	HP-19	30	2#12+#12G 3/4"C	2052			20	SPARE	16
17	SPARE	20					20	SPARE	18
19	SPARE	20			2880	3#10+#8G 1" C	30	HP-24	20
21	HP-6	50	3#6+#8G 1" C	4210	2880			-	22
23	-			4210	2880			-	24
25	-			4210	4210	3#6+#8G 1" C	50	HP-6	26
27	HP-6	50	3#6+#8G 1" C	4210	4210			-	28
29	-			4210	4210			-	30
31	-			4210	4210	3#6+#8G 1" C	50	HP-6	32
33	HP-6	50	3#6+#8G 1" C	4210	4210			-	34
35	-			4210	4210			-	36
37	-			4210				SPACE	38
39	SPACE							SPACE	40
41	SPACE							SPACE	42



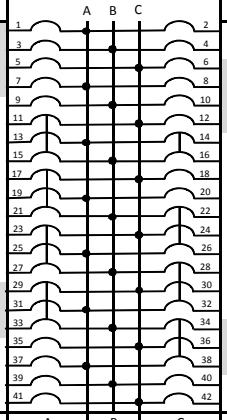
TOTAL CONNECTED KVA = 88 | VA / PHASE = A: 31.5 | B: 29.8 | C: 26.9 | TOTAL CONNECTED AMPERES = 245.2

ELECTRICAL

REDESIGN OF MECHANICAL SYSTEM: NEW LOADS ON LB1

PANEL DESCRIPTION	LOCATION: MAIN ELECTRICAL RO		MOUNTING: SURFACE	ENTRY: TOP	SECTION: 1 OF 1
LB1	BUS: 225	VOLTAGE: 208 /120	PHASE: 3	WIRE: 4	POLES: 42
	MAIN: MLO	NEUTRAL: YES	AIC: 10,000	IG BUS: NO	NOTE:

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	HP-2	15	2#12+#12G 1/2"C	900	600	2#12+#12G 1/2"C	20	ELEVATOR LIGHTING	2
3	HP-3	20	2#12+#12G 1/2"C	1200	300	2#12+#12G 1/2"C	20	R-CHILLER PAD, GENERATOR	4
5	HP-4	20	2#12+#12G 1/2"C	1200	1200	2#12+#12G 1/2"C	20	HP-13	6
7	HP-17	20	2#12+#12G 1/2"C	732	2052	2#10+#8G 1"C	30	HP-16	8
9	SUMP PUMP	20	2#12+#12G 1/2"C	1130	2052	2#10+#8G 1"C	30	HP-23	10
11	CHWP	60	3#6+#8G 1"C	2920	1200	2#12+#12G 1/2"C	20	HP-21	12
13	-			2920	1000	3#8+#10G 1"C	30	GENERATOR BATTERY	14
15	-			2920	1000			-	16
17	CHWP	60	3#6+#8G 1"C		100	2#12+#12G 1/2"C	20	TIME CLOCK	18
19	(STANDBY)				1800	2#10+#10G 1"C	20	HEAT TAPE	20
21	-				947	3#12+#12G 3/4"C	15	AHU 1	22
23	AHU-2	30	3#10+#10G 3/4"C	2020	947			-	24
25	-			2020	946			-	26
27	-			2020	947	3#12+#12G 3/4"C	15	AHU 3,4	28
29	HP-22	30	3#10+#10G 3/4"C	1919	946			-	30
31	-			1919	947			-	32
33	-			1919	4210	3#12+#12G 3/4"C	50	HP-1	34
35	SPARE	20			4210			-	36
37	SPARE	20			4210			-	38
39	SPARE	20					20	SPARE	40
41	SPARE	20					20	SPARE	42



TOTAL CONNECTED KVA =	55	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	153.8
			20.0	18.6	16.7		

REDESIGN OF MECHANICAL SYSTEM: NEW LOADS ON MDP

PANELBOARD: SWBD-1	BUS RATING:	2000A	MAIN DEVICE TYPE: DRAW-OUT CB	
MIN AIC: 85,000	VOLTS:	208/120V	PHASE: 3	WIRE: 4
ENCLOSURE NEMA: 1	MOUNTING:	FLOOR	LOCATION: MAIN ELEC RM	
GROUND BUS: FULL	ISOLATED GROUND BUS:	NO	BRANCH CIRCUIT DEVICE TYPE: BOLT-ON CB	
REMARKS				

CKT #	DESCRIPTION	BREAKER FRAME	TRIP	POLE	NOTE	VOLT-AMPERES A	B	C	FEEDER CONDUIT & WIRE
1	ELEVATOR	400	350	3		17320	17320	17320	2 SETS 4-#3/Okcmil + #4G 3"C
2	L1NE	225	200	3		15100	11800	13900	4-250kcmil + #4G 3"C
3	LB1	225	225	3		20000	18600	16700	4-300kcmil + #2G 3"C
4	LB2	400	400	3		40300	36200	31900	2 SETS 4-250kcmil + #4G 3"C
5	EDP	400	400	3		29900	28300	22600	2 SETS 4-250kcmil + #4G 3"C
6	WIRE TROUGH(KL1, L1SW)	400	400	3		42000	48000	43700	2 SETS 4-250kcmil + #4G 3"C
7	L2NE	225	150	3		12700	9920	9920	4#3/O + #4G 2 1/2" C
8	SPARE	600	600	3					
9	SPARE	400		3					
10	SPARE	400		3					
11	SPARE	225		3					
12	SPARE	225		3					
						CONNECTED LOAD		503.5 KVA	

*The over-current protection devices and the feeder ratings were based upon the MCA and the MOPD specified on the heat pump cutsheets. These cutsheets can be found in the Mechanical Appendix.

**Feeder sizing was based on NEC Table 310.16 in accordance with the aluminum feeder redesign in the following section.

CONCLUSION:

The mechanical redesign has a great impact on the electrical loads. Due to the elimination of the chiller, the building load decreased 5% . This decrease in load allows for the main switchboard, if desired, to be downsized to a 1600A frame. The benefits of the higher efficiency of the new mechanical equipment, as seen in the electrical load decrease, are significant.

ELECTRICAL

INTRODUCTION:

The original design for the St. Francis Friary utilizes copper conductors to carry electricity throughout the building. Copper is the most common choice for conductor material. Aluminum, the alternative material to copper, will be researched in this study to determine whether the use of aluminum conductors is a more cost efficient and practical proposal for the St Francis Friary.

COPPER FEEDERS:

The current system uses copper feeders for the design. Copper feeders are most frequently specified in buildings because of their many advantages over aluminum at a relatively competitive price. The advantages and disadvantages are as follows:

Advantages:

- Higher conductivity
- High tensile strength(can withstand more stress without breaking)
- Reliable (more easily and frequently installed)

Disadvantages:

- More expensive
- Heavier

ALUMINUM FEEDERS:

Aluminum feeders, though less conductive than copper, are more affordable. The cost benefit is one of the main advantages that aluminum has over copper. Some other advantages and disadvantages are mapped out below.

Advantages:

- More cost efficient
- Light weight
- Better for longer runs

Disadvantages:

- Larger wire sizes necessary to have the same ampacity rating as copper
- Requires larger conduit
- Around 60% of the conductivity as copper
- Poor connections

SCHEDULE:

A feeder schedule and single line diagram can be found in the electrical appendix of this report. This schedule and diagram show the comparison of the original feeder design and the redesign.

ELECTRICAL

COST DIFFERENCE:

Copper Feeders:	$94,684.42
Aluminum Feeders:	$78,447.09
Dollar Savings:	$16.237.33
Percent Savings:	17% savings

*Cost based upon RSMeans Version 2007.

CONCLUSION:

Aluminum was studied as an alternative to copper for conductor material. The savings alone are phenomenal, however, there are a few draw backs to using aluminum as discussed above. If installed, the aluminum will need to be cleaned immediately before installation to maximize the efficiency of the system. In addition, aluminum is more prone to breaking than copper wire, thus requiring the installer to be knowledgeable and experienced in order to account for the heightened risk involved during installation. If installed properly, however, aluminum should perform to a similar standard as the copper. This is purely an economic decision and as the price of copper continues to fluctuate this may want to be considered as a bid alternate.