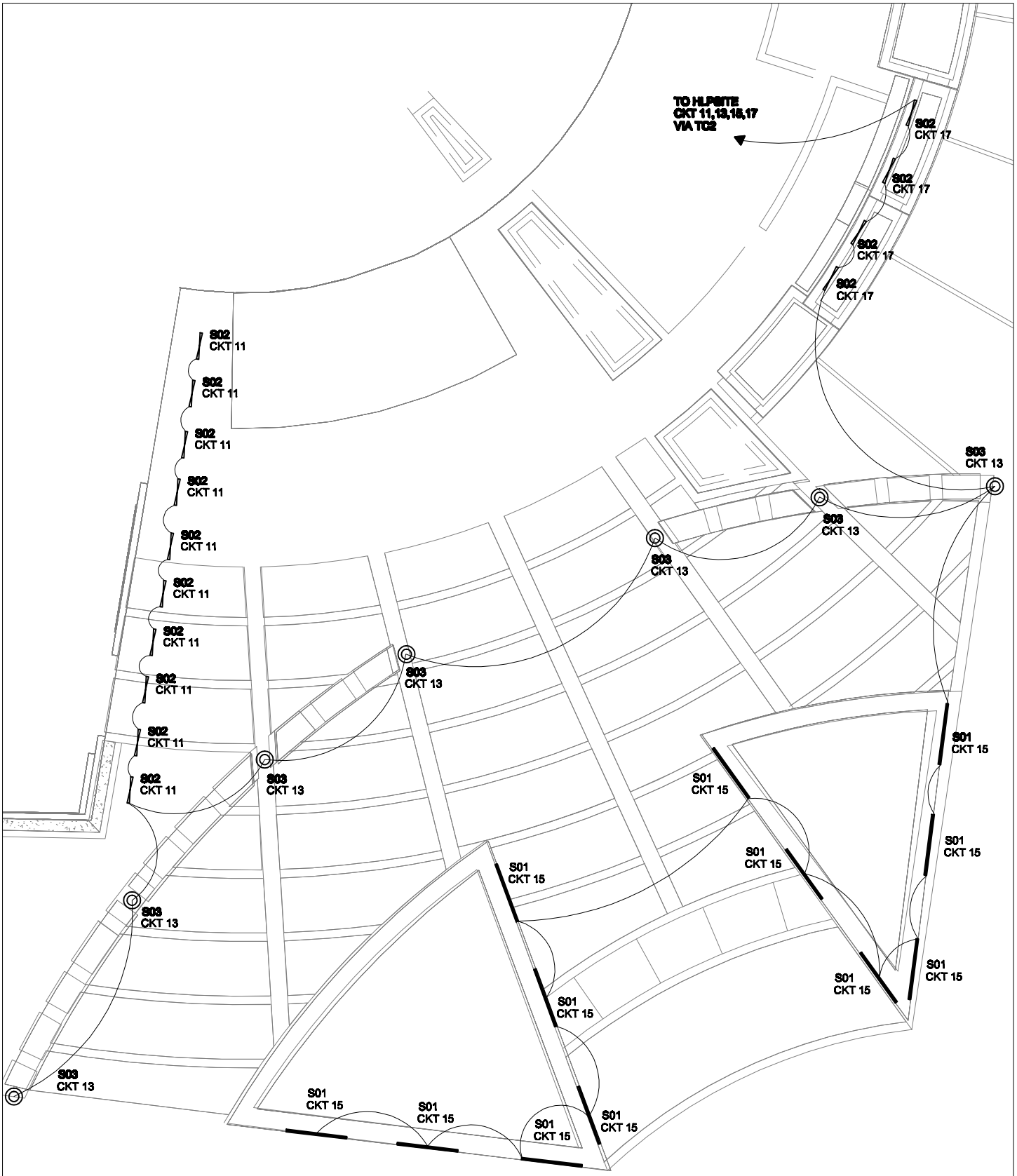
ELECTRICAL REDESIGN – NORTH FAÇADE AND PLAZA

The main entry to UCI Natural Science Unit II is marked by a four-story glass curtain wall, an outdoor stair feature and a 5875 square foot landscaped plaza. The scope of the proposed lighting redesign includes the inner plaza area, the curtain wall, the adjacent office wall, and stair wall at the west side of the plaza. Stairway lighting is not in scope.

Control Scheme

The outdoor lighting of the building is to be controlled by a simple time clock device which will save energy and prolong lamp life by shutting off and/or lowering the lighting levels in the plaza and the exterior of the building when it is not in use.



UCI Nat. Sci. Unit II Irvine, California	Electrical Consultant: Prof. T. Dannerth, PE	Grant Kightlinger L/E Option	Penn State University AE 882 Senior Thesis	PLAZA ELECTRICAL PLAN 3/32" = 1'-0"

Existing Panel Schedule

PANEL HLPSITE

MOUNTING	SURFACE	DOUBLE LUG	NO	VOLTS	277/480	MAIN	M.L.O.
NEMA 3R	NO	200% NEUTRAL	NO	PHASE	3	BUS	100A
FEED THRU	NO	I/G BUS	NO	WIRE	4	A.I.C.	SEE SC REPORTS

NOTES	LOCATION	A	B	C	LTG	CONV	KIT	RECP	MISC	BKR	CIRC		CIRC	BKR	MISC	RECP	KIT	CONV	LTG	A	B	C	LOCATION	NOTES
	EXTERIOR LTG	2698			19					20/1	1		2	20/1									SPARE	
	EXTERIOR LTG		720		8					20/1	3		4	20/1									SPARE	
	HIGH BAY EXT LTG			1988	14					20/1	5		6	20/1									SPARE	
	EXTERIOR LTG	750			15					20/1	7		8	20/1									SPARE	
	EXTERIOR LTG		192		6					20/1	9		10	20/1									SPARE	
	EXTERIOR LTG			910	9					20/1	11		12	20/1									SPARE	
	EXTERIOR LTG	1000			4					20/1	13		14	20/1									SPARE	
	EXTERIOR LTG		804		14					20/1	15		16	20/1									SPARE	
	EXTERIOR LTG			250	5					20/1	17		18	20/1									SPARE	
	SPARE									20/1	19		20	20/1									SPARE	
	SPARE									20/1	21		22	20/1									SPARE	
	SPARE									20/1	23		24	20/1									SPARE	
	SPACE										25		26										SPACE	
	SPACE										27		28										SPACE	
	SPACE										29		30										SPACE	

A= 4448 B= 1716 C= 3148

TOTAL VA=	9312	W/LCL=	11640	AMPS=	**14**	TOTAL LCL=	9312	X .25 =	2328
HIGH PHASE VA=	4448	W/LCL=	5560	HIGH PHASE AMPS=	**20.1**	HIGH PHASE LCL=	4448	X .25 =	1112

New Panelboard Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HLPSITE	Panel Location:			Elec. Rm. 1282	
Nominal Phase to Neutral Voltage------->					277	Phase:			3	
Nominal Phase to Phase Voltage-------->					480	Wires:			4	
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	EXTERIOR LTG	3	SITE	2698	va	0.95	2563	2698	
2	A	SPARE		-	3600	va	1.00	3600	3600	
3	B	EXTERIOR LTG	3	SITE	720	va	0.95	684	720	
4	B	SPARE		-	3600	va	1.00	3600	3600	
5	C	HIGH BAY EXT LTG	3	SITE	1988	va	0.95	1889	1988	
6	C	SPARE		-	3600	va	1.00	3600	3600	
7	A	EXTERIOR LTG	3	SITE	750	va	0.95	713	750	
8	A	SPARE		-	3600	va	1.00	3600	3600	
9	B	EXTERIOR LTG	3	SITE	192	va	0.95	182	192	
10	B	SPARE		-	3600	va	1.00	3600	3600	
11	C	EXTERIOR LTG	3	SITE	260	w	0.95	260	274	
12	C	SPARE		-	3600	va	1.00	3600	3600	
13	A	EXTERIOR LTG	3	SITE	322	w	0.95	322	339	
14	A	SPARE		-	3600	va	1.00	3600	3600	
15	B	EXTERIOR LTG	3	SITE	462	w	0.95	462	486	
16	B	SPARE		-	3600	va	1.00	3600	3600	
17	C	EXTERIOR LTG	3	SITE	104	w	0.95	104	109	
18	C	SPARE		-	3600	va	1.00	3600	3600	
19	A	SPARE		-	3600	va	1.00	3600	3600	
20	A	SPARE		-	3600	va	1.00	3600	3600	
21	B	SPARE		-	3600	va	1.00	3600	3600	
22	B	SPARE		-	3600	va	1.00	3600	3600	
23	C	SPARE		-	3600	va	1.00	3600	3600	
24	C	SPARE		-	3600	va	1.00	3600	3600	
25	A	SPACE		-		va	1.00	0	0	
26	A	SPACE		-		va	1.00	0	0	
27	B	SPACE		-		va	1.00	0	0	
28	B	SPACE		-		va	1.00	0	0	
29	C	SPACE		-		va	1.00	0	0	
30	C	SPACE		-		va	1.00	0	0	
31	A					va	1.00	0	0	
32	A					va	1.00	0	0	
33	B					va	1.00	0	0	
34	B					va	1.00	0	0	
35	C					va	1.00	0	0	
36	C					va	1.00	0	0	
37	A					va	1.00	0	0	
38	A					va	1.00	0	0	
39	B					va	1.00	0	0	
40	B					va	1.00	0	0	
41	C					va	1.00	0	0	
42	C					va	1.00	0	0	
PANEL TOTAL								61.2	61.6	Amps= 74.1

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					21.6	21.8	35%	78.7
PHASE TOTAL	B					19.3	19.4	32%	70.0
PHASE TOTAL	C					20.3	20.4	33%	73.5

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.80	0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		7.2	7.6	0.95	6.8	7.2	0.95		
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0		0.0	0.0			
7	heating		0.0	0.0		0.0	0.0			
8	kitchen equipment		0.0	0.0		0.0	0.0			
9	unassigned		54.0	54.0		54.0	54.0	1.00		
Total Demand Loads						60.8	61.2			
Spare Capacity			20%			12.2	12.2			
Total Design Loads						73.0	73.4	0.99	Amps=	88.3

New Panelboard Schedule

PANELBOARD SCHEDULE

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

PANEL TAG: HLPSITE
PANEL LOCATION: Elec. Rm. 1282
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
EXTERIOR LTG	SITE	2563	20A/1P	1	*			2	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	684	20A/1P	3		*		4	20A/1P	3600	-	SPARE
HIGH BAY EXT LTG	SITE	1889	20A/1P	5			*	6	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	713	20A/1P	7	*			8	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	182	20A/1P	9		*		10	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	260	20A/1P	11			*	12	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	322	20A/1P	13	*			14	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	462	20A/1P	15		*		16	20A/1P	3600	-	SPARE
EXTERIOR LTG	SITE	104	20A/1P	17			*	18	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	19	*			20	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	21		*		22	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	23			*	24	20A/1P	3600	-	SPARE
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
0	0	0	20A/1P	31	*			32	20A/1P	0	0	0
0	0	0	20A/1P	33		*		34	20A/1P	0	0	0
0	0	0	20A/1P	35			*	36	20A/1P	0	0	0
0	0	0	20A/1P	37	*			38	20A/1P	0	0	0
0	0	0	20A/1P	39		*		40	20A/1P	0	0	0
0	0	0	20A/1P	41			*	42	20A/1P	0	0	0

CONNECTED LOAD (KW) - A	21.60	TOTAL DESIGN LOAD (KW)	72.98
CONNECTED LOAD (KW) - B	19.33	POWER FACTOR	0.99
CONNECTED LOAD (KW) - C	20.25	TOTAL DESIGN LOAD (AMPS)	88

Feeder Size

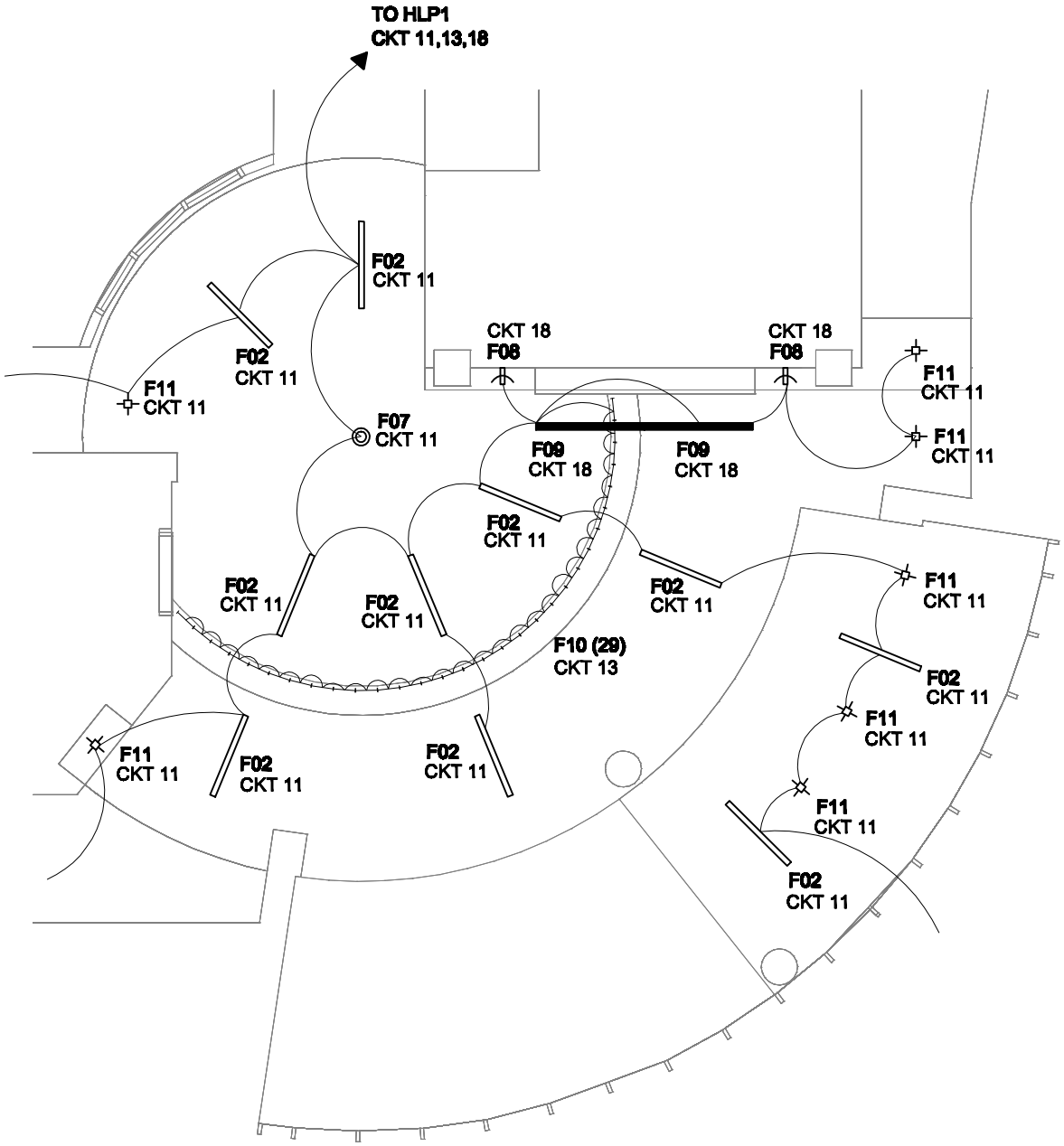
DESIGN LOAD (WITH 20% SPARE)	88 A
CIRCUIT BREAKER SIZE	90 A
x 125% FOR 4 CCC'S	112.5 A
PHASE CONDUCTORS	(3) #2 AWG, 75° CU THWN
NEUTRAL CONDUCTOR	(1) #2 AWG, 75° CU THWN
GROUND CONDUCTIOR	(1) #8 AWG, 75° CU THWN

ELECTRICAL REDESIGN – LOBBY

The lobby space adjacent to the north façade is the main entry point for the building. The lobby measures approximately 1230 square feet and features a large curved glass curtain wall to the north. This space is the primary access to classrooms and circulation. Above the main doorway, a double height atrium space connects the first and second floor lobbies. The main conference room is directly adjacent to the lobby on the first floor, and each level provides access to the main outdoor stair of the building.

Control Scheme

Since the lobby is a public circulation space, easy access to user-customizable controls are not necessarily desired. The lobby system should be discreet and should serve the lighting needs of the space throughout the day without the need for any manual adjustment. However, a dimming system has also been specified to allow adjustments for special events within the lobby and the adjacent main conference room. One special feature within the room is an RGB led cove fixture which requires a separate controller to create visual effects for special events within the space. The fixtures in this space are divided into three zones: general ambient downlights, peripheral accent, and cove lighting.



UCI Nat. Sci. Unit II Irvine, California	Electrical Consultant: Prof. T. Dannerth, PE	Grant Kightlinger L/E Option	Penn State University AE 882 Senior Thesis	1F LOBBY ELEC RCP 1/8" = 1'-0"

Existing Panel Schedule

PANEL HLP1

MOUNTING	SURFACE	DOUBLE LUG	NO	VOLTS	277/480	MAIN	225A
NEMA 3R	NO	200% NEUTRAL	NO	PHASE	3	BUS	225A
FEED THRU	NO	I/G BUS	NO	WIRE	4	A.I.C.	SEE SC REPORTS

NOTES	LOCATION	A	B	C	LTG	CONV	KIT	RECP	MISC	BKR	CIRC		CIRC	BKR	MISC	RECP	KIT	CONV	LTG	A	B	C	LOCATION	NOTES
	OFFICE LTG.	2520			21					20/1	1		2	20/1					15	1123			CORRIDOR LTG.	
	OFFICE LTG.		2818		24					20/1	3		4	20/1					30		2220		LAB 1128,1130 LTG.	
	OFFICE LTG.			3120	26					20/1	5		6	20/1					28			2220	LAB 1124,1122 LTG.	
	CONF. RM. LTG.	2328			39					20/1	7		8	20/1					29	2280			LAB 1118,1120 LTG.	
	OFFICE RESTROOM LTG.		2664		38					20/1	9		10	20/1					22		1740		LAB 1114,1112,1110,1105 LTG.	
	LOBBY LTG.			1548	43					20/1	11		12	20/1					7			868	LAB 1150 LTG.	
	LOBBY LTG.	561			33					20/1	13		14	20/1									SPARE	
	CORRIDOR LTG.		331		6					20/1	15		16	20/1									SPARE	
	CORRIDOR/RECEPTION LTG.			863	20					20/1	17		18	20/1									SPARE	
A	EXIT SIGNS - OFFICE WING	36			12					20/1	19		20	20/1									SPARE	
A	EXIT SIGNS - LAB WING		30		10					20/1	21		22	20/1									SPARE	
	SPARE									20/1	23		24	20/1									SPARE	
	SPARE									20/1	25		26	131313									SPARE	
	SPARE									20/1	27		28	20/1									SPARE	
	SPARE									20/1	29		30	20/1									SPARE	
	FUTURE SPARE									20/1	31		32	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	33		34	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	35		36	20/1									FUTURE SPARE	
	SPACE										37		38										SPACE	
	SPACE										39		40										SPACE	
	SPACE										41		42										SPACE	

		A= 8848				B= 9803				C= 8619	
	TOTAL VA=	27270	W/LCL=	34088		AMPS=	**41**		TOTAL LCL=	27270	X .25 = 6818
	HIGH PHASE VA=	9803	W/LCL=	12254		HIGH PHASE AMPS=	**44.2**		HIGH PHASE LCL=	9803	X .25 = 2451

New Panelboard Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HLP1	Panel Location:			Elec. Rm. 1282	
Nominal Phase to Neutral Voltage------->					277	Phase:			3	
Nominal Phase to Phase Voltage-------->					480	Wires:			4	
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	OFFICE LTG	3	1F	2520	va	0.95	2394	2520	
2	A	CORR. LTG	3	1F	1123	va	0.95	1067	1123	
3	B	OFFICE LTG	3	1F	2818	va	0.95	2677	2818	
4	B	LAB LTG	3	1F	2220	va	0.95	2109	2220	
5	C	OFFICE LTG	3	1F	3120	va	0.95	2964	3120	
6	C	LAB LTG	3	1F	2220	va	0.95	2109	2220	
7	A	CONF RM LTG	3	1F	2328	va	0.95	2212	2328	
8	A	LAB LTG	3	1F	2280	va	0.95	2166	2280	
9	B	FFICE RESTRM LT	3	1F	2664	va	0.95	2531	2664	
10	B	LAB LTG	3	1F	1740	va	0.95	1653	1740	
11	C	LOBBY LTG	3	1F	945	w	0.95	945	995	
12	C	LAB LTG	3	1F	868	va	0.95	825	868	
13	A	LOBBY LTG	3	1F	87	w	0.95	87	92	
14	A	SPARE		-	3600	va	0.95	3420	3600	
15	B	CORRIDOR LTG	3	1F	331	va	0.95	314	331	
16	B	SPARE		-	3600	va	0.95	3420	3600	
17	C	ORR/RECEPTION L	3	1F	863	va	0.95	820	863	
18	C	LOBBY LTG	3	1F	136	w	0.95	136	143	
19	A	EXIT SIGNS OFFICE	3	1F	36	va	0.95	34	36	
20	A	SPARE		-	3600	va	1.00	3600	3600	
21	B	XIT SIGNS LAB WIN	3	1F	30	va	0.95	29	30	
22	B	SPARE		-	3600	va	1.00	3600	3600	
23	C	SPARE		-	3600	va	1.00	3600	3600	
24	C	SPARE		-	3600	va	1.00	3600	3600	
25	A	SPARE		-	3600	va	1.00	3600	3600	
26	A	SPARE		-	3600	va	1.00	3600	3600	
27	B	SPARE		-	3600	va	1.00	3600	3600	
28	B	SPARE		-	3600	va	1.00	3600	3600	
29	C	SPARE		-	3600	va	1.00	3600	3600	
30	C	SPARE		-	3600	va	1.00	3600	3600	
31	A	FUTURE SPARE		-	0	va	1.00	0	0	
32	A	FUTURE SPARE		-	0	va	1.00	0	0	
33	B	FUTURE SPARE		-	0	va	1.00	0	0	
34	B	FUTURE SPARE		-	0	va	1.00	0	0	
35	C	FUTURE SPARE		-	0	va	1.00	0	0	
36	C	FUTURE SPARE		-	0	va	1.00	0	0	
37	A	SPACE		-	0	va	1.00	0	0	
38	A	SPACE		-	0	va	1.00	0	0	
39	B	SPACE		-	0	va	1.00	0	0	
40	B	SPACE		-	0	va	1.00	0	0	
41	C	SPACE		-	0	va	1.00	0	0	
42	C	SPACE		-	0	va	1.00	0	0	
PANEL TOTAL								67.9	69.6	Amps= 83.7

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					22.2	22.8	33%	82.2
PHASE TOTAL	B					23.5	24.2	35%	87.4
PHASE TOTAL	C					22.2	22.6	32%	81.6

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.80	0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		25.1	26.4	0.95	23.8	25.1	0.95		
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0		0.0	0.0			
7	heating		0.0	0.0		0.0	0.0			
8	kitchen equipment		0.0	0.0		0.0	0.0			
9	unassigned		42.8	43.2		42.8	43.2	0.99		
Total Demand Loads						66.7	68.3			
Spare Capacity			20%			13.3	13.7			
Total Design Loads						80.0	81.9	0.98	Amps=	98.6

New Panelboard Schedule

PANELBOARD SCHEDULE

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

PANEL TAG: HLP1
PANEL LOCATION: Elec. Rm. 1282
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
OFFICE LTG	1F	2394	20A/1P	1	*			2	20A/1P	1067	1F	CORR. LTG
OFFICE LTG	1F	2677	20A/1P	3		*		4	20A/1P	2109	1F	LAB LTG
OFFICE LTG	1F	2964	20A/1P	5			*	6	20A/1P	2109	1F	LAB LTG
CONF RM LTG	1F	2212	20A/1P	7	*			8	20A/1P	2166	1F	LAB LTG
FFICE RESTRM LT	1F	2531	20A/1P	9		*		10	20A/1P	1653	1F	LAB LTG
LOBBY LTG	1F	945	20A/1P	11			*	12	20A/1P	825	1F	LAB LTG
LOBBY LTG	1F	87	20A/1P	13	*			14	20A/1P	3420	-	SPARE
CORRIDOR LTG	1F	314	20A/1P	15		*		16	20A/1P	3420	-	SPARE
ORR/RECEPTION LT	1F	820	20A/1P	17			*	18	20A/1P	136	1F	LOBBY LTG
EXIT SIGNS OFFICE	1F	34	20A/1P	19	*			20	20A/1P	3600	-	SPARE
XIT SIGNS LAB WIN	1F	29	20A/1P	21		*		22	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	23			*	24	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	25	*			26	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	27		*		28	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	29			*	30	20A/1P	3600	-	SPARE
FUTURE SPARE	-	0	20A/1P	31	*			32	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	33		*		34	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	35			*	36	20A/1P	0	-	FUTURE SPARE
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	22.18	TOTAL DESIGN LOAD (KW)	79.99
CONNECTED LOAD (KW) - B	23.53	POWER FACTOR	0.98
CONNECTED LOAD (KW) - C	22.20	TOTAL DESIGN LOAD (AMPS)	99

*NOTE: Approximately 400 watts of fixture load exist outside the scope of the lobby lighting redesign on circuit 11 and have therefore been included in addition to the actual fixture load as designed.

Feeder Size

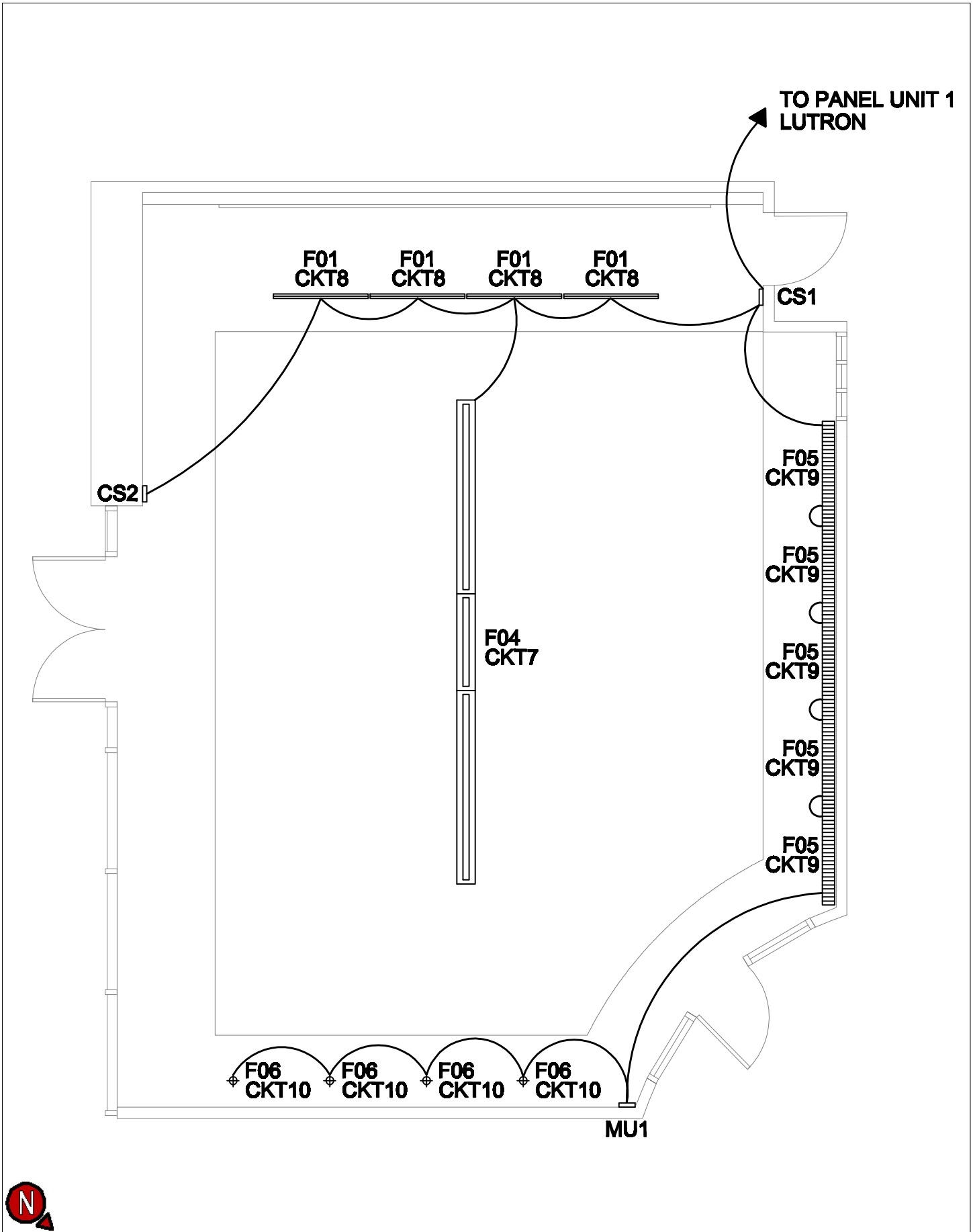
DESIGN LOAD (WITH 20% SPARE)	99 A
CIRCUIT BREAKER SIZE	100 A
x 125% FOR 4 CCC'S	125 A
PHASE CONDUCTORS	(3) #1 AWG, 75° CU THWN
NEUTRAL CONDUCTOR	(1) #1 AWG, 75° CU THWN
GROUND CONDUCTIOR	(1) #6 AWG, 75° CU THWN

ELECTRICAL REDESIGN – CONFERENCE ROOM

The main conference room is located on the first floor of the building. It measures approximately 1050 square feet. The room can be accessed through a main door connecting to the lobby to the north, and also through a secondary interior door to the west. Windows and doors on the southeast side of the room open to an outdoor patio space. On the southwest wall, a whiteboard is framed by a white maple wall. A credenza runs along the wall between the two interior entries, and a large conference table sits in the center of the room.

Control Scheme

Flexibility of use is one of the most important design goals in this space. The lighting system should be able to adapt to several uses including face-to-face meetings, whiteboard lectures, A/V presentations and social gatherings. The overall aesthetic appearance is also crucial in this space. A Lutron control system has been selected to offer more streamlined user control over the lighting environment and to allow for more dramatic lighting transitions.



UCI Nat. Sci. Unit II Irvine, California	Electrical Consultant: Prof. T. Dannerth, PE	Grant Kightlinger L/E Option	Penn State University AE 882 Senior Thesis	CONF ROOM ELEC RCP 3/16" = 1'-0"

Existing Panel Schedule

PANEL HLP1

MOUNTING	SURFACE	DOUBLE LUG	NO	VOLTS	277/480	MAIN	225A
NEMA 3R	NO	200% NEUTRAL	NO	PHASE	3	BUS	225A
FEED THRU	NO	I/G BUS	NO	WIRE	4	A.I.C.	SEE SC REPORTS

NOTES	LOCATION	A	B	C	LTG	CONV	KIT	RECP	MISC	BKR	CIRC		CIRC	BKR	MISC	RECP	KIT	CONV	LTG	A	B	C	LOCATION	NOTES
	OFFICE LTG.	2520			21					20/1	1		2	20/1					15	1123			CORRIDOR LTG.	
	OFFICE LTG.		2818		24					20/1	3		4	20/1					30		2220		LAB 1128,1130 LTG.	
	OFFICE LTG.			3120	26					20/1	5		6	20/1					28			2220	LAB 1124,1122 LTG.	
	CONF. RM. LTG.	2328			39					20/1	7		8	20/1					29	2280			LAB 1118,1120 LTG.	
	OFFICE RESTROOM LTG.		2664		38					20/1	9		10	20/1					22		1740		LAB 1114,1112,1110,1105 LTG.	
	LOBBY LTG.			1548	43					20/1	11		12	20/1					7			868	LAB 1150 LTG.	
	LOBBY LTG.	561			33					20/1	13		14	20/1									SPARE	
	CORRIDOR LTG.		331		6					20/1	15		16	20/1									SPARE	
	CORRIDOR/RECEPTION LTG.			863	20					20/1	17		18	20/1									SPARE	
A	EXIT SIGNS - OFFICE WING	36			12					20/1	19		20	20/1									SPARE	
A	EXIT SIGNS - LAB WING		30		10					20/1	21		22	20/1									SPARE	
	SPARE									20/1	23		24	20/1									SPARE	
	SPARE									20/1	25		26	20/1									SPARE	
	SPARE									20/1	27		28	20/1									SPARE	
	SPARE									20/1	29		30	20/1									SPARE	
	FUTURE SPARE									20/1	31		32	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	33		34	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	35		36	20/1									FUTURE SPARE	
	SPACE										37		38										SPACE	
	SPACE										39		40										SPACE	
	SPACE										41		42										SPACE	

		A= 8848				B= 9803				C= 8619	
	TOTAL VA=	27270	W/LCL=	34088	AMPS=	**41**	TOTAL LCL=	27270	X .25 =	6818	
	HIGH PHASE VA=	9803	W/LCL=	12254	HIGH PHASE AMPS=	**44.2**	HIGH PHASE LCL=	9803	X .25 =	2451	

New Panelboard Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HLP1	Panel Location:			ELEC RM 1282	
Nominal Phase to Neutral Voltage------->					277	Phase:			3	
Nominal Phase to Phase Voltage-------->					480	Wires:			4	
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	OFFICE LTG	3	1F	2520	va	0.95	2394	2520	
2	A	CORRIDOR LTG	3	1F	1123	va	0.95	1067	1123	
3	B	OFFICE LTG	3	1F	2818	w	0.95	2818	2966	
4	B	LAB 1128,1130 LTG	3	1F	2220	va	0.95	2109	2220	
5	C	OFFICE LTG	3	1F	3120	va	0.95	2964	3120	
6	C	LAB 1124,1122 LTG	3	1F	2220	va	0.95	2109	2220	
7	A	CONF RM LTG	3	1F	160	w	0.95	160	168	
8	A	CONF RM LTG	3	1F	128	w	0.95	128	135	
9	B	CONF RM LTG	3	1F	160	w	0.95	160	168	
10	B	CONF RM LTG	3	1F	140	w	0.95	140	147	
11	C	LAB 1118,1120 LTG	3	1F	2280	va	0.95	2166	2280	
12	C	SPARE	3	1F	3600	va	0.95	3420	3600	
13	A	LAB LTG	3	1F	1740	va	0.95	1653	1740	
14	A	LOBBY LTG	3	1F	1548	va	0.95	1471	1548	
15	B	LAB 1150 LTG	3	1F	868	va	0.95	825	868	
16	B	LOBBY LTG	3	1F	561	va	0.95	533	561	
17	C	SPARE	3	-	3600	va	0.95	3420	3600	
18	C	CORRIDOR LTG	3	1F	331	va	0.95	314	331	
19	A	EXIT SIGNS-OFFICE	3	1F	36	va	0.95	34	36	
20	A	CORRIDOR LTG	3	1F	863	va	0.95	820	863	
21	B	SPARE	3	-	3600	va	0.95	3420	3600	
22	B	SPARE	3	-	3600	va	0.95	3420	3600	
23	C	SPARE		-	3600	va	1.00	3600	3600	
24	C	EXIT SIGNS-LAB	3	1F	30	va	0.95	29	30	
25	A	SPARE		-	3600	va	1.00	3600	3600	
26	A	SPARE		-	3600	va	1.00	3600	3600	
27	B	OFFICE/RSTRM LTG	3	1F	2664	va	0.95	2531	2664	
28	B	SPARE		-	3600	va	1.00	3600	3600	
29	C	SPARE		-	3600	va	1.00	3600	3600	
30	C	SPARE		-	3600	va	1.00	3600	3600	
31	A	SPARE		-	3600	va	1.00	3600	3600	
32	A	SPARE		-	3600	va	1.00	3600	3600	
33	B	SPARE		-	3600	va	1.00	3600	3600	
34	B	FUTURE SPARE		-	0	va	1.00	0	0	
35	C	FUTURE SPARE		-	0	va	1.00	0	0	
36	C	FUTURE SPARE		-	0	va	1.00	0	0	
37	A	FUTURE SPARE		-	0	va	1.00	0	0	
38	A	FUTURE SPARE		-	0	va	1.00	0	0	
39	B	FUTURE SPARE		-	0	va	1.00	0	0	
40	B	FUTURE SPARE		-	0	va	1.00	0	0	
41	C	SPACE		-	0	va	1.00	0	0	
42	C	SPACE		-	0	va	1.00	0	0	
PANEL TOTAL								70.5	72.5	Amps= 87.3

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					22.1	22.5	31%	81.3
PHASE TOTAL	B					23.2	24.0	33%	86.6
PHASE TOTAL	C					25.2	26.0	36%	93.8

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.80	0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		38.1	40.1	0.95	36.2	38.1	0.95		
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0		0.0	0.0			
7	heating		0.0	0.0		0.0	0.0			
8	kitchen equipment		0.0	0.0		0.0	0.0			
9	unassigned		32.4	32.4		32.4	32.4	1.00		
Total Demand Loads						68.6	70.5			
Spare Capacity			20%			13.7	14.1			
Total Design Loads						82.3	84.6	0.97	Amps=	101.8

New Panelboard Schedule

PANELBOARD SCHEDULE

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

PANEL TAG: HLP1
PANEL LOCATION: ELEC RM 1282
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
OFFICE LTG	1F	2394	20A/1P	1	*			2	20A/1P	1067	1F	CORRIDOR LTG
OFFICE LTG	1F	2818	20A/1P	3		*		4	20A/1P	2109	1F	LAB 1128,1130 LTG
OFFICE LTG	1F	2964	20A/1P	5			*	6	20A/1P	2109	1F	LAB 1124,1122 LTG
CONF RM LTG	1F	160	20A/1P	7	*			8	20A/1P	128	1F	CONF RM LTG
CONF RM LTG	1F	160	20A/1P	9		*		10	20A/1P	140	1F	CONF RM LTG
LAB 1118,1120 LTG	1F	2166	20A/1P	11			*	12	20A/1P	3420	1F	SPARE
LAB LTG	1F	1653	20A/1P	13	*			14	20A/1P	1471	1F	LOBBY LTG
LAB 1150 LTG	1F	825	20A/1P	15		*		16	20A/1P	533	1F	LOBBY LTG
SPARE	-	3420	20A/1P	17			*	18	20A/1P	314	1F	CORRIDOR LTG
EXIT SIGNS-OFFICE	1F	34	20A/1P	19	*			20	20A/1P	820	1F	CORRIDOR LTG
SPARE	-	3420	20A/1P	21		*		22	20A/1P	3420	-	SPARE
SPARE	-	3600	20A/1P	23			*	24	20A/1P	29	1F	EXIT SIGNS-LAB
SPARE	-	3600	20A/1P	25	*			26	20A/1P	3600	-	SPARE
OFFICE/RSTRM LTG	1F	2531	20A/1P	27		*		28	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	29			*	30	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	31	*			32	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	33		*		34	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	35			*	36	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	37	*			38	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	39		*		40	20A/1P	0	-	FUTURE SPARE
SPACE	-	0	20A/1P	41			*	42	20A/1P	0	-	SPACE

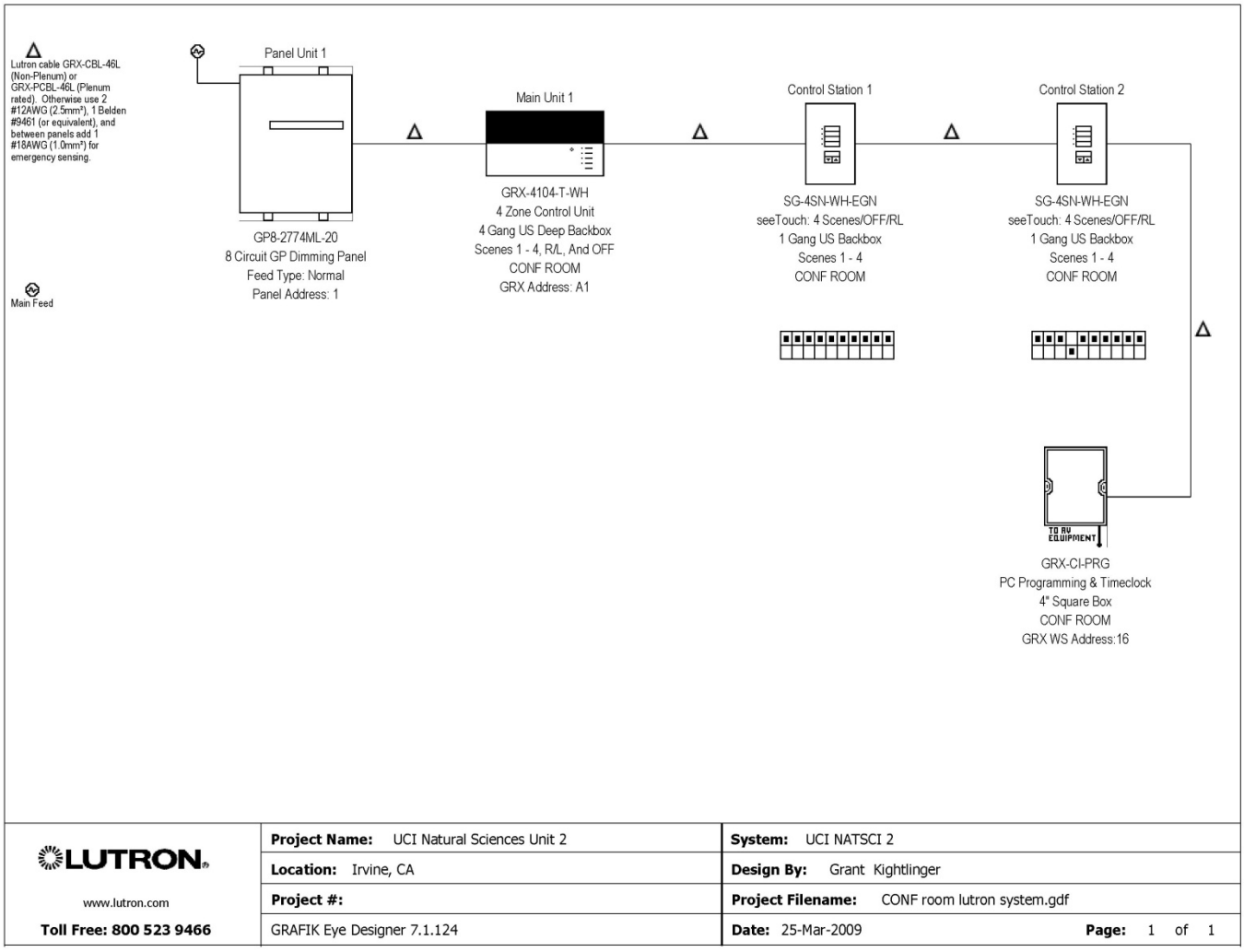
CONNECTED LOAD (KW) - A	22.13	TOTAL DESIGN LOAD (KW)	82.32
CONNECTED LOAD (KW) - B	23.16	POWER FACTOR	0.97
CONNECTED LOAD (KW) - C	25.22	TOTAL DESIGN LOAD (AMPS)	102

Feeder Size

DESIGN LOAD (WITH 20% SPARE)	102 A
CIRCUIT BREAKER SIZE	110 A
x 125% FOR 4 CCC'S	137.5 A
PHASE CONDUCTORS	(3) 1/0 AWG, 75° CU THWN
NEUTRAL CONDUCTOR	(1) 1/0 AWG, 75° CU THWN
GROUND CONDUCTIOR	(1) #6 AWG, 75° CU THWN

LUTRON Control System Specifications

*NOTE: See lighting design section for scene dim levels, etc.



Description:

UCI Natural Sciences Unit 2

Design By: Grant Kightlinger

Company:

Address:

Phone:

Design For:

Company:

Address:

Phone:

Lutron Contact Information
USA +1 610 282 3800
UK +44 (0)20 7702 0657
Singapore +65 6220 4666
France +33 (0)1 41 05 42 80

COMMISSIONING / STARTUP OPTION:
LCP128 Systems, Softswitch128 Systems, and GRAFIK Eye 4000 Systems containing LP, XP, or GP Power Panels include factory commissioning. Factory commissioning is optional for GRAFIK Eye 3000 and RadioTouch Systems.

Systems purchased with factory commissioning include 1 on-site visit by a Lutron field service engineer during normal business hours (M-F, 7am-6pm). Visits will include a complete system function test as well as system operation and maintenance training for the facilities team.

Please contact Lutron or check www.lutron.com for specific details about your warranty and commissioning program.

SCHEDULING:
Lutron requires 10 working days notice prior to system commissioning. Visits scheduled outside normal business hours, multiple visits or additional time on site due to circumstances beyond Lutron's direct control, or visits scheduled with less than 10 days notice will result in additional charges.

DELIVERY:
All standard products as listed in the current price guide ship within 48 hours unless otherwise indicated. Consult Lutron Customer Service for lead time on all Custom products. Build-to-order systems take approximately 4-6 weeks to manufacture after release of order from the distributor. Any changes to order will result in rescheduling, longer manufacturing time, and/or additional engineering charges.

CANCELLATION:
There will be a minimum cancellation charge of 25% of the value of this equipment should this order be cancelled.

RETURNS:
Custom products and systems are not returnable unless there is a defect in workmanship by Lutron Electronics Co., Inc.

LUTRON
Toll Free: 800 523 9466

Project Type: School/University
Location: Irvine, CA
Project #:
Project Filename: NEW PROJECT
GRAFIK Eye Designer 7.1.124
Date: 25-Mar-2009

CONF ROOM Summary Load Schedule

Lutron Zone	Customer Zone	Zone/Circuit Description	Customer Circuit #	Voltage	Load Type	Actual Load (W/VA)
A1-1	Zone 1	IND/DIR	7	277V	FL - Eco-10	160
A1-2	Zone 2	WHITEBD	8	277V	FL - Eco-10	128
A1-3	Zone 3	WALL WASH	9	277V	FL - Eco-10	160
A1-4	Zone 4	MR16s	10	277V	Incandescent	140

LUTRON
Toll Free: 800 523 9466

Project Name: UCI Natural Sciences Unit 2
Location: Irvine, CA
Project #:
System: UCI NATSCI 2
Design By: Grant Kightlinger
Project Filename: NEW PROJECT
GRAFIK Eye Designer 7.1.124
Date: 25-Mar-2009
Page: 1 of 1

CONF ROOM GP Dimming Panel Load Schedule

Panel Name: Panel Unit 1
Lutron Model No.: GP8-2774ML-20
Panel Address / Location: 1 /

Area/Room	Customer Circuit #	Customer Zone	Lutron Circuit	Lutron Zone	Zone/Circuit Description	Load Type	Actual Load (W/VA)	Max. Load (W/VA)	BRKR Size	Phase
CONF ROOM	10	Zone 4	1	A1-4	MR16s	Incandescent	140	4432	20A-1P	A
CONF ROOM	7	Zone 1	2	A1-1	IND/DIR	FL - Eco-10	160	4432	20A-1P	B
CONF ROOM	9	Zone 3	3	A1-3	WALL WASH	FL - Eco-10	160	4432	20A-1P	C
CONF ROOM	8	Zone 2	4	A1-2	WHITEBD	FL - Eco-10	128	4432	20A-1P	A
			5		Spare		0	4432	20A-1P	
			6		Spare		0	4432	20A-1P	
			7		Spare		0	4432	20A-1P	
			8		Spare		0	4432	20A-1P	

Phase A: 268 W/VA
Phase B: 160 W/VA
Phase C: 160 W/VA

277/480V, 3Ø-4 Wire Main Lugs GP Dimming Panel containing 1 20A-1Pole branch breaker rated at 14,000AIC for each of the 8 dimming circuits. Max input feed = 60A

Feed Type: Normal

LUTRON
Toll Free: 800 523 9466

Project Name: UCI Natural Sciences Unit 2
Location: Irvine, CA
Project #:
System: UCI NATSCI 2
Design By: Grant Kightlinger
Project Filename: NEW PROJECT
GRAFIK Eye Designer 7.1.124
Date: 25-Mar-2009
Page: 1 of 1

CONF ROOM Equipment Schedule

Lutron Model No.	Device Name	Address	Description	Function	Location	Notes
GP8-2774ML-20	Panel Unit 1	Panel 1	277/480V, 3Ø-4 Wire Main Lugs GP Dimming Panel containing 1 20A-1Pole branch breaker rated at 14,000AIC for each of the 8 dimming circuits. Max input feed = 60A	-		
GRX-4104-T-WH	Main Unit 1	A1	4 Zone GRAFIK Eye 4000 Control Unit with Translucent Top Cover. For use with Lutron GP, LP, and XP Power Panels. 4 Gang US Backbox.	Scenes 1 - 4, R/L, And OFF		
SG-4SN-WH-EGN	Control Station 1	GRX WS 1	seeTouch series GRAFIK Eye wallstation. Recalls preset light levels for up to 4 scenes plus off. Fine-tuning of light levels with master raise/lower. Noninsert Version; Optional Backlighting. 1 Gang US Backbox.	Scenes 1 - 4		
SG-4SN-WH-EGN	Control Station 2	GRX WS 2	seeTouch series GRAFIK Eye wallstation. Recalls preset light levels for up to 4 scenes plus off. Fine-tuning of light levels with master raise/lower. Noninsert Version; Optional Backlighting. 1 Gang US Backbox.	Scenes 1 - 4		
GRX-CI-PRG		GRX WS 16	RS232 and Ethernet Interface. Allows for PC Programming with GRX-3500 and GRX-4500 Control Units. Can also be used as an astronomic timeclock for any GRAFIK Eye system. Surface mount.			

LUTRON

Toll Free: 800 523 9466

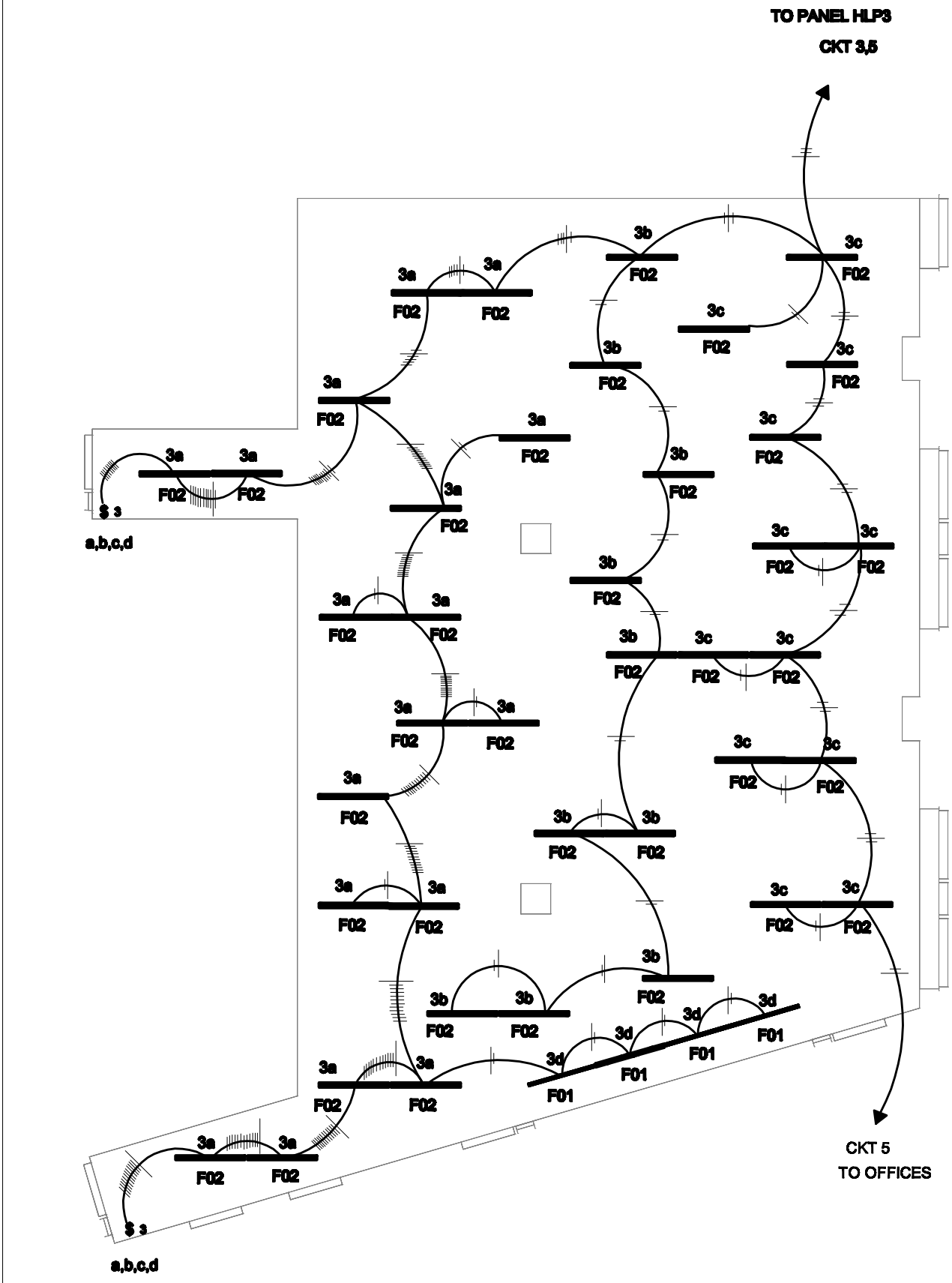
Project Name: UCI Natural Sciences Unit 2	**System:** UCI NATSCI 2	
Location: Irvine, CA	**Design By:** Grant Kightlinger	
Project #:	**Project Filename:** NEW PROJECT	
GRAFIK Eye Designer 7.1.124	**Date:** 25-Mar-2009	**Page:** 1 of 1

ELECTRICAL REDESIGN – OPEN OFFICE

Located on the third floor of the building, the open office contains workspaces for graduate students of the Biological Sciences department at UCI. The space measures approximately 1,840 square feet and features three large windows facing to the north-east. It is adjacent to two work rooms and several private faculty offices and is accessed through short corridors on the south wall.

Control Scheme

Although some flexibility of control is desired in the office, it has only one prevalent mode of use. The space is likely to be used at least 8 hours per day on weekdays, with intermittent use on weekends. Thus, the most important feature of the control system is simplicity. An occupancy sensor system is organized in such a way that it will maintain illumination whenever there are people working, even if they are not moving about the space. Please refer to the MAE daylight study section of this report for a more complete description of control details for this space.



UCI Nat. Sci. Unit II Irvine, California	Electrical Consultant: Prof. T. Dannerth, PE	Grant Kightlinger L/E Option	Penn State University AE 882 Senior Thesis	OPEN OFFICE ELEC. PLAN 1/8" = 1'-0"

Existing Panel Schedule

PANEL HLP3

MOUNTING	SURFACE			DOUBLE LUG	NO			VOLTS	277/480			MAIN	225A										
NEMA 3R	NO			200% NEUTRAL	NO			PHASE	3			BUS	225A										
FEED THRU	NO			I/G BUS	NO			WIRE	4			A.I.C.	SEE SC REPORTS										
NOTES	LOCATION	A	B	C	LTG	CONV	KIT	RECP	MISC	BKR	CIRC		CIRC	BKR	MISC	RECP	KIT	CONV	LTG	A	B	C	LOCATION	NOTES
	OFFICE LTG	3120			26					20/1	1		2	20/1					15	725			LAB CORRIDOR LTG	
	OPEN OFFICE LTG		2040		17					20/1	3		4	20/1					35		2760		LAB LTG	
	OFFICE LTG			3058	26					20/1	5		6	20/1					28			2160	LAB LTG	
	CONFERENCE RM LTG	2484			52					20/1	7		8	20/1					28	2160			LAB LTG	
	OFFICE/RESTRM LTG		2664		38					20/1	9		10	20/1					34		2640		LAB LTG	
	LOBBY LTG			1368	38					20/1	11		12	20/1					34			2640	LAB LTG	
	LOBBY LTG	561			33					20/1	13		14	20/1					25	1800			LAB LTG	
	CORRDOR LTG		331		6					20/1	15		16	20/1					34		2820		LAB LTG	
	CORRDOR LTG			1223	12					20/1	17		18	20/1					33			2460	LAB LTG	
A	EXIT SIGNS - OFFICE WING	45			15					20/1	19		20	20/1									SPARE	
A	EXIT SIGNS - LAB WING		45		15					20/1	21		22	20/1									SPARE	
	SPARE									20/1	23		24	20/1									SPARE	
	SPARE									20/1	25		26	20/1									SPARE	
	FUTURE SPARE									20/1	27		28	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	29		30	20/1									FUTURE SPARE	
	FUTURE SPARE									20/1	31		32	20/1									FUTURE SPARE	
	SPACE										33		34										SPACE	
	SPACE										35		36										SPACE	
	SPACE										37		38										SPACE	
	SPACE										39		40										SPACE	
	SPACE										41		42										SPACE	
		A= 10895								B= 13300										C= 12909				
	TOTAL VA=	37104	W/LCL=	46380						AMPS=	56								TOTAL LCL=	37104	X .25 =	9276		
	HIGH PHASE VA=	13300	W/LCL=	16625						HIGH PHASE AMPS=	60.0								HIGH PHASE LCL=	13300	X .25 =	3325		

New Panelboard Worksheet

PANELBOARD SIZING WORKSHEET

Panel Tag---------->					HLP3	Panel Location:			Elec. Rm. 3277	
Nominal Phase to Neutral Voltage------->					277	Phase:			3	
Nominal Phase to Phase Voltage-------->					480	Wires:			4	
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	OFFICE LTG	3	3F	3120	va	0.95	2964	3120	
2	A	LAB CORR. LTG	3	3F	725	va	0.95	689	725	
3	B	OPEN OFFICE LTG	3	3F	1408	w	0.95	1408	1482	
4	B	LAB LTG	3	3F	2760	va	0.95	2622	2760	
5	C	OFFICE LTG	3	3F	3058	va	0.95	2905	3058	
6	C	LAB LTG	3	3F	2160	va	0.95	2052	2160	
7	A	CONF RM LTG	3	3F	2484	va	0.95	2360	2484	
8	A	LAB LTG	3	3F	2160	va	0.95	2052	2160	
9	B	OFFICE/RSTRM LTG	3	3F	2664	va	0.95	2531	2664	
10	B	LAB LTG	3	3F	2640	va	0.95	2508	2640	
11	C	LOBBY LTG	3	3F	1368	va	0.95	1300	1368	
12	C	LAB LTG	3	3F	2640	va	0.95	2508	2640	
13	A	LOBBY LTG	3	3F	561	va	0.95	533	561	
14	A	LAB LTG	3	3F	1800	va	0.95	1710	1800	
15	B	CORRIDOR LTG	3	3F	331	va	0.95	314	331	
16	B	LAB LTG	3	3F	2820	va	0.95	2679	2820	
17	C	CORRIDOR LTG	3	3F	1223	va	0.95	1162	1223	
18	C	LAB LTG	3	3F	2460	va	0.95	2337	2460	
19	A	EXIT SIGNS - OFFIC	3	3F	45	va	0.95	43	45	
20	A	SPARE		-	3600	va	1.00	3600	3600	
21	B	EXIT SIGNS - LAB	3	3F	45	va	0.95	43	45	
22	B	SPARE		-	3600	va	1.00	3600	3600	
23	C	SPARE		-	3600	va	1.00	3600	3600	
24	C	SPARE		-	3600	va	1.00	3600	3600	
25	A	SPARE		-	3600	va	1.00	3600	3600	
26	A	SPARE		-	3600	va	1.00	3600	3600	
27	B	FUTURE SPARE		-	0	va	1.00	0	0	
28	B	FUTURE SPARE		-	0	va	1.00	0	0	
29	C	FUTURE SPARE		-	0	va	1.00	0	0	
30	C	FUTURE SPARE		-	0	va	1.00	0	0	
31	A	FUTURE SPARE		-	0	va	1.00	0	0	
32	A	FUTURE SPARE		-	0	va	1.00	0	0	
33	B	SPACE		-	0	va	1.00	0	0	
34	B	SPACE		-	0	va	1.00	0	0	
35	C	SPACE		-	0	va	1.00	0	0	
36	C	SPACE		-	0	va	1.00	0	0	
37	A	SPACE		-	0	va	1.00	0	0	
38	A	SPACE		-	0	va	1.00	0	0	
39	B	SPACE		-	0	va	1.00	0	0	
40	B	SPACE		-	0	va	1.00	0	0	
41	C	SPACE		-	0	va	1.00	0	0	
42	C	SPACE		-	0	va	1.00	0	0	
PANEL TOTAL								56.3	58.1	Amps= 70.0

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					21.2	21.7	37%	78.3
PHASE TOTAL	B					15.7	16.3	28%	59.0
PHASE TOTAL	C					19.5	20.1	35%	72.6

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.80	0.0	0.0			
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		34.7	36.5	0.95	33.0	34.7	0.95		
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0		0.0	0.0			
7	heating		0.0	0.0		0.0	0.0			
8	kitchen equipment		0.0	0.0		0.0	0.0			
9	unassigned		21.6	21.6		21.6	21.6	1.00		
Total Demand Loads						54.6	56.3			
Spare Capacity			20%			10.9	11.3			
Total Design Loads						65.5	67.6	0.97	Amps=	81.3

New Panelboard Schedule

PANELBOARD SCHEDULE

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

PANEL TAG: HLP3
PANEL LOCATION: Elec. Rm. 3277
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
OFFICE LTG	3F	2964	20A/1P	1	*			2	20A/1P	689	3F	LAB CORR. LTG
OPEN OFFICE LTG	3F	1408	20A/1P	3		*		4	20A/1P	2622	3F	LAB LTG
OFFICE LTG	3F	2905	20A/1P	5			*	6	20A/1P	2052	3F	LAB LTG
CONF RM LTG	3F	2360	20A/1P	7	*			8	20A/1P	2052	3F	LAB LTG
OFFICE/RSTRM LTG	3F	2531	20A/1P	9		*		10	20A/1P	2508	3F	LAB LTG
LOBBY LTG	3F	1300	20A/1P	11			*	12	20A/1P	2508	3F	LAB LTG
LOBBY LTG	3F	533	20A/1P	13	*			14	20A/1P	1710	3F	LAB LTG
CORRIDOR LTG	3F	314	20A/1P	15		*		16	20A/1P	2679	3F	LAB LTG
CORRIDOR LTG	3F	1162	20A/1P	17			*	18	20A/1P	2337	3F	LAB LTG
EXIT SIGNS - OFFIC	3F	43	20A/1P	19	*			20	20A/1P	3600	-	SPARE
EXIT SIGNS - LAB	3F	43	20A/1P	21		*		22	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	23			*	24	20A/1P	3600	-	SPARE
SPARE	-	3600	20A/1P	25	*			26	20A/1P	3600	-	SPARE
FUTURE SPARE	-	0	20A/1P	27		*		28	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	29			*	30	20A/1P	0	-	FUTURE SPARE
FUTURE SPARE	-	0	20A/1P	31	*			32	20A/1P	0	-	FUTURE SPARE
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	21.15	TOTAL DESIGN LOAD (KW)	65.50
CONNECTED LOAD (KW) - B	15.71	POWER FACTOR	0.97
CONNECTED LOAD (KW) - C	19.46	TOTAL DESIGN LOAD (AMPS)	81

Feeder Size

DESIGN LOAD (WITH 20% SPARE)	81 A
CIRCUIT BREAKER SIZE	90 A
x 125% FOR 4 CCC'S	112.5 A
PHASE CONDUCTORS	(3) #2 AWG, 75° CU THWN
NEUTRAL CONDUCTOR	(1) #2 AWG, 75° CU THWN
GROUND CONDUCTIOR	(1) #8 AWG, 75° CU THWN

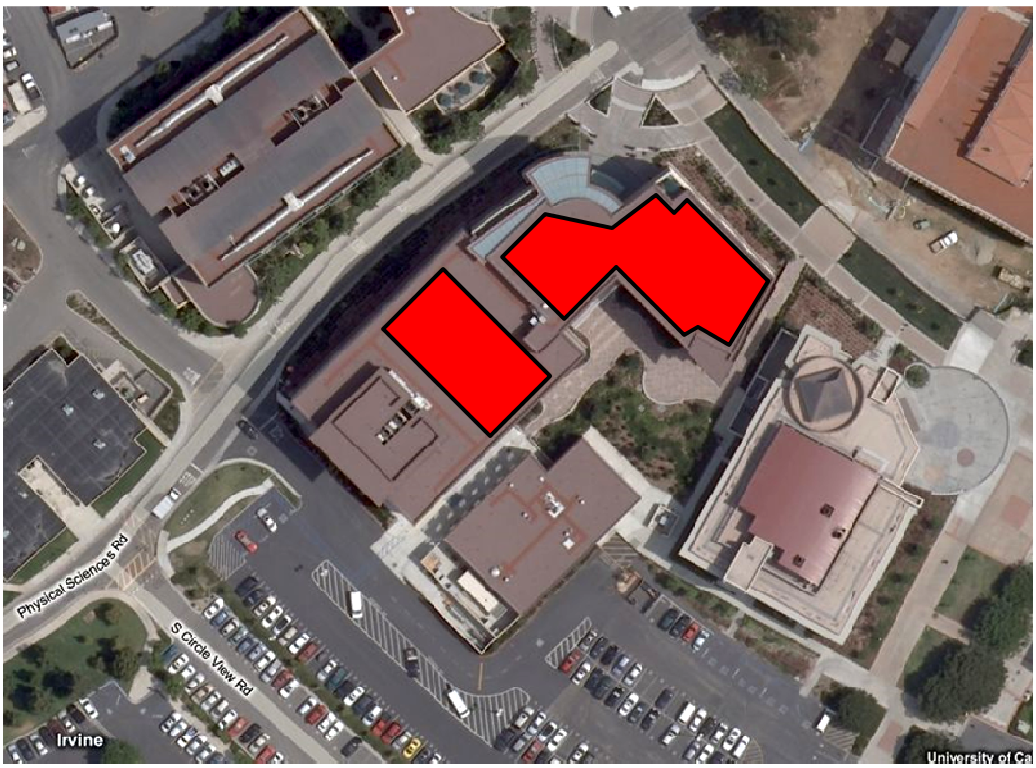
ELECTRICAL DEPTH: PHOTOVOLTAIC ARRAY STUDY

Heightened energy costs and increased environmental awareness in the building industry demand the consideration of alternative energy solutions for new construction. The University of California is a leader is sustainable technologies research, and seeks to maintain its image of environmental responsibility. This study is intended to determine the economic feasibility of implementing a roof-based photovoltaic array system UCI Natural Science Unit II. RETScreen 4 energy modeling software has been used to estimate the power production and climate data for this study.

System Scale

UCI Natural Science Unit II is taller than all surrounding buildings, and therefore is not in danger of shading from adjacent structures. The roof is vacant except for an equipment canopy area above the laboratory wing. This general area has been avoided due to possible shading. In addition, a roof area usability factor of 75% has been assumed for the analysis. This preserves enough extra space to allow for access to the panels for maintenance and repairs.

Unoccupied Roof Area:	21302 ft²
Usable Roof Area (assume 75%):	15976 ft²
PV Unit Frame Area:	13.6 ft²
Total Installable Units:	1174 panels



Available Roof Area
[maps.live.com]

Photovoltaic Equipment

The BP Solar 3165 photovoltaic panel has been used for this analysis. This particular model has been selected for its relatively high capacity (165 Watts) and also for its high module efficiency of 13.1%. Complete specifications for this equipment can be found at the end of this section.

Typical electrical characteristics	BP 3165	
	(STC)[1]	(NOCT)[2]
Rated power (P_{max})	165W	119W
Voltage at P_{max} (V_{mp})	35.2V	31.3V
Current at P_{max} (I_{mp})	4.7A	3.8A
Short circuit current (I_{sc})	5.1A	4.1A
Open circuit voltage (V_{oc})	44.2V	40.2V
Limiting reverse current	5.1A	
Module efficiency at STC	13.1%	
Efficiency reduction at 200W/m^2	< 3%	
Temperature coefficient of I_{sc}	(0.065±0.015)%/ºC	
Temperature coefficient of V_{oc}	-(0.36±0.05)%/ºC	
Temperature coefficient of P_{max}	-(0.5±0.05)%/ºC	
NOCT[3]	47±2ºC	
Maximum series fuse rating	15A (BP ####N) / 20A (BP ####J)	
Application class	Class A installation (IEC 61730)	
Maximum system voltage	1000V (IEC 61730) 600V (UL)	

[www.bp.com]

Climate Data

Climate information was unavailable for Irvine, California within the RETScreen database. Therefore, climate data for the nearby city of Long Beach was utilized for the purposes of this analysis. The following is a summary of the climate profile which was used.

	Unit	Climate data location	Project location
Latitude	°N	33.8	33.8
Longitude	°E	-118.2	-118.2
Elevation	ft	17	17
Heating design temperature	°F	6.2	
Cooling design temperature	°F	30.9	
Earth temperature amplitude	°F	13.5	

Month	Air temperature	Relative humidity	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days	Cooling degree-days
	°F	%	kWh/m²/d	kPa	mph	°F	°F-d	°F-d
January	55.2	64.4%	2.79	101.8	5.6	55.2	285	162
February	56.7	66.7%	3.61	101.7	6.3	56.8	217	186
March	57.9	67.2%	4.73	101.5	7.2	60.7	201	246
April	60.8	65.8%	5.99	101.4	7.4	65.5	108	324
May	63.5	68.3%	6.43	101.3	7.4	70.2	28	419
June	66.7	69.7%	6.71	101.2	7.2	75.2	0	502
July	70.9	68.9%	7.26	101.2	6.9	79.0	0	647
August	72.1	68.9%	6.67	101.2	6.7	79.5	0	686
September	70.5	69.5%	5.37	101.1	6.3	76.6	0	616
October	66.7	68.2%	4.16	101.4	5.8	70.2	0	519
November	60.3	66.3%	3.13	101.6	5.6	61.5	124	308
December	55.2	65.5%	2.59	101.7	5.1	55.5	285	162
Annual	63.1	67.5%	4.96	101.4	6.4	67.2	1,247	4,776
Measured at	ft				32.8	0.0		

System Performance

The estimated performance of the selected system was calculated using RETScreen software. The following results have been incorporated into the financial feasibility analysis.

Photovoltaic			
Power capacity	kW	193.71	
Manufacturer		BP Solar	
Model		poly-Si - BP 3165	1174 unit(s)

Financial Analysis

Initial Cost

RS Means 2009 section D5090 has been used to estimate the initial cost of the entire system described in this report. Cost figures include all necessary peripheral and installation equipment and labor for the proposed system. A similar 167 Watt, 60 unit array is priced at $112,810. Adjusted for the 1174 proposed panels, the initial system cost amounts to an estimated **$2,211,033** for the entire system.

Utility Savings

According to RETScreen, the 15,917 ft² array is expected to produce approximately 270.5 MWh annually. At a utility cost of $90.33 per MWh (or $0.09033 per kWh), the system will save an estimated utility cost of **$24,434** per year.

Month	Daily solar radiation - horizontal kWh/m²/d	Electricity ported to grid MWh
January	2.79	13.54
February	3.61	15.63
March	4.73	22.37
April	5.99	26.94
May	6.43	29.63
June	6.71	29.65
July	7.26	32.62
August	6.67	29.98
September	5.37	23.70
October	4.16	19.36
November	3.13	14.47
December	2.59	12.60
Annual	**4.96**	**270.48**
MWh/m²	1.81	

*NOTE: Utility costs are based on Southern California Edison's TOU-8 time-of-use based rate structure. A mid-peak summer seasonal rate has been selected for use in this estimation. For more information on the utility rates for the UCI campus, see the electrical appendix of this report.

Incentives – California Solar Initiative

The California Solar Initiative (CSI) is a program which rewards utility customers of Southern California Edison for the production solar power technologies. SCE non-residential rewards for systems with capacities greater than 50 kW are currently set at $0.22 per kWh produced. Using the incentive calculator provided by the CSI website at www.csi-epbb.com, the total anticipated incentive amount for this system was determined to be **$293,169**.

Site Specifications:	
Project Name	UCI Natural Science Unit II
ZIP Code	92612
City	Irvine
Utility	SCE
Customer Type	Commercial
Incentive Type	PBI
PV System Specifications:	
PV Module	BP Solar:SX3165I 165.0W STC, 146.1W PTC
Number of Modules	1174

Results	
Annual kWh	266,517
Summer Months	May-October
Summer kWh	164,464
CEC-AC Rating	**166.376 kW**
Capacity Factor[1]	18.286%
Prevailing Capacity Factor[2]	20.000%
Design Factor[3]	**91.430%**
Eligible Annual kWh[4]	**266,517**
Incentive Rate	**$0.22/kWh**
Incentive[5]	**$293,169**
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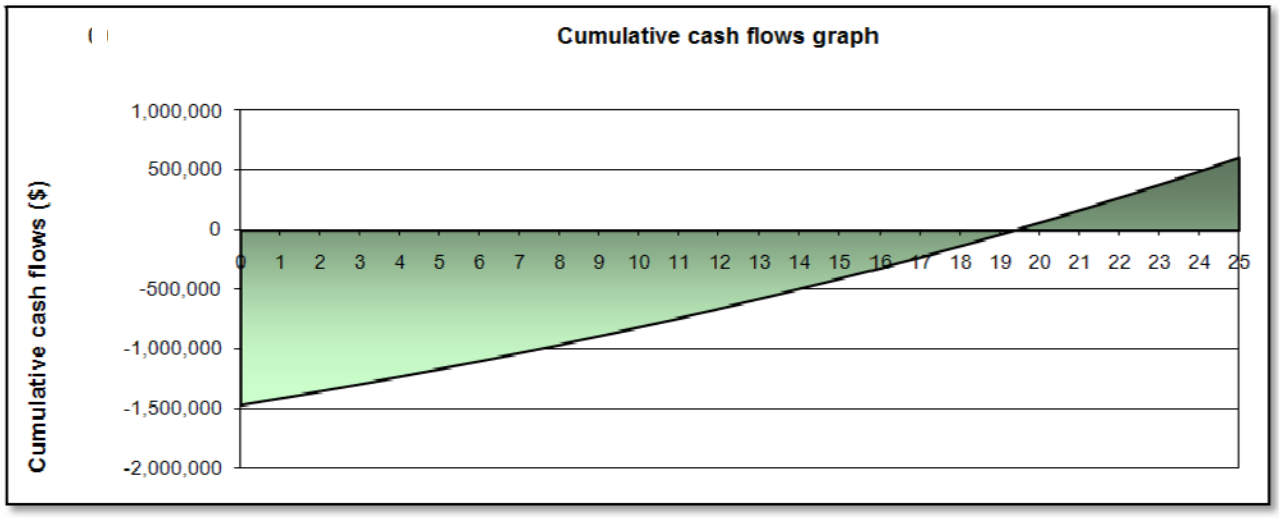
Incentives – Federal Tax Credit

An additional federal tax credit of approximately **$456,000** is also applicable to this project. This estimation was performed using the BP Solar Clean Power Estimator at bpsolar.cleanpowerestimator.com. The combination of these two incentives represents a total savings of $749,169 for this installation.

System Financial Details

The collected financial data has been entered into RETScreen and a cash flow analysis has been performed. The results predict an approximate equity payback period of 19.4 years for the proposed system.

Financial parameters		
Inflation rate	%	3.0%
Project life	yr	25
Debt ratio	%	0%
Initial costs		
Power system	$	2,211,033
Other	$	
Total initial costs	$	2,211,033
Incentives and grants	$	749,169
Annual costs and debt payments		
O&M (savings) costs	$	-24,434
Fuel cost - proposed case	$	0
	$	
Total annual costs	$	-24,434
Annual savings and income		
Fuel cost - base case	$	0
Electricity export income	$	30,656
	$	
Total annual savings and income	$	30,656
Financial viability		
Pre-tax IRR - assets	%	2.5%
Simple payback	yr	26.5
Equity payback	yr	19.4



Conclusions

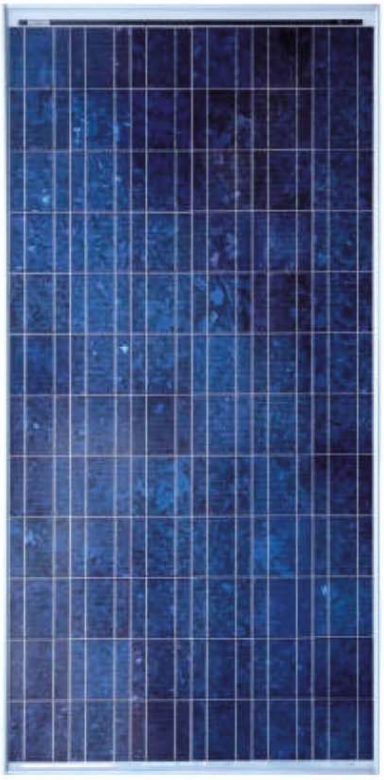
From the data collected in this study, the installation of a photovoltaic system on the roof of UCI Natural Science Unit II has been shown to be a viable option. Assuming a minimum 25 year system life (during which time the equipment is under warranty by BP Solar), a positive net result seems to be achievable for this project. The initial cost of installing the system represents a significant investment, but the overall economic value of the system needs to be considered.

In addition to the financial benefits of installing a photovoltaic system, social benefits for the university are also probable. A solar array on the roof of this building might allow students to perform unique hands-on studies of alternative energy solutions. Furthermore, the image of The University of California Irvine as an institution which is deeply committed to environmental issues and sustainable building methods will be highlighted. In turn, these opportunities may help to bring more students and faculty to the campus on a long-term level.

Based on these economic and social benefits, a photovoltaic array on the roof of UCI Natural Science Unit II is recommended.

165 watt photovoltaic module
BP 3165

The BP 3165 is an advanced 165 watt module utilising anti-reflective coatings on both its multicrystalline cells and glass. The module also features IntegraBus™ technology which is a printed circuit board with integrated diodes that has been designed to ensure reliability whilst conducting higher currents. The BP 3165 has been designed for grid-connected solar applications, such as large commercial roofs, residential systems and photovoltaic (PV) power plants, as well as remote off-grid applications such as telecommunications, water pumping and residential systems. This 72-cell module offers superior value – greater performance from a white polyester back-sheet and innovative, high-efficiency cells.



BP 3165

Performance	BP 3165	BP 3160
Rated power	165W	160W
Power tolerance	±3%	±3%
Nominal voltage	24V	24V
Warranty *	90% of minimum warranted power output over 12 years 80% of minimum warranted power output over 25 years Free from defects in materials and workmanship for 5 years	

Configuration

BP 3165N	Universal frame, a sealed junction box with output cables and polarised Multicontact (MC III) connectors.
BP 3165J	Universal frame with an accessible junction box for cable connection.

Qualification test parameters

Temperature cycling range	-40ºC to +85ºC
Damp heat test	85ºC and 85% relative humidity
Front and rear static load test (eg: wind)	2400Pa (equivalent to 245kg/m^2 load distributed)
Front load test (eg: snow)	5400Pa† (equivalent to 550kg/m^2 load distributed)
Hailstone impact test	25mm hail at 23m/s
Impulse voltage test	8000V waveform impulse according to high voltage test techniques IEC60060-1 standard
Reverse current overload test	135% of the overcurrent protection rating for two hours

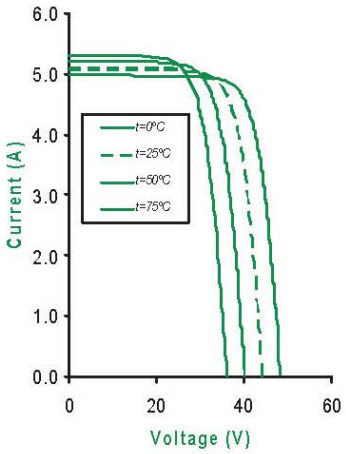
Quality and safety

- Certified according to the extended version of the IEC 61215:2005 (crystalline silicon terrestrial photovoltaic modules – design qualification and type approval).
- Certified according to IEC 61730-1 and IEC 61730-2 (photovoltaic module safety qualification, requirements for construction and testing).
- Listed by Underwriter's Laboratories for electrical and fire safety (Class C fire rating).
- Approved by Factory Mutual Research in NEC Class 1, Division 2, Groups C and D hazardous locations (BP ####J).
- Module electrical measurements are calibrated to world radiometric reference via third party international laboratories.
- Manufactured in ISO 9001 and ISO 14001 certified factories.

* Refer to BP Solar's warranty document for terms and conditions.

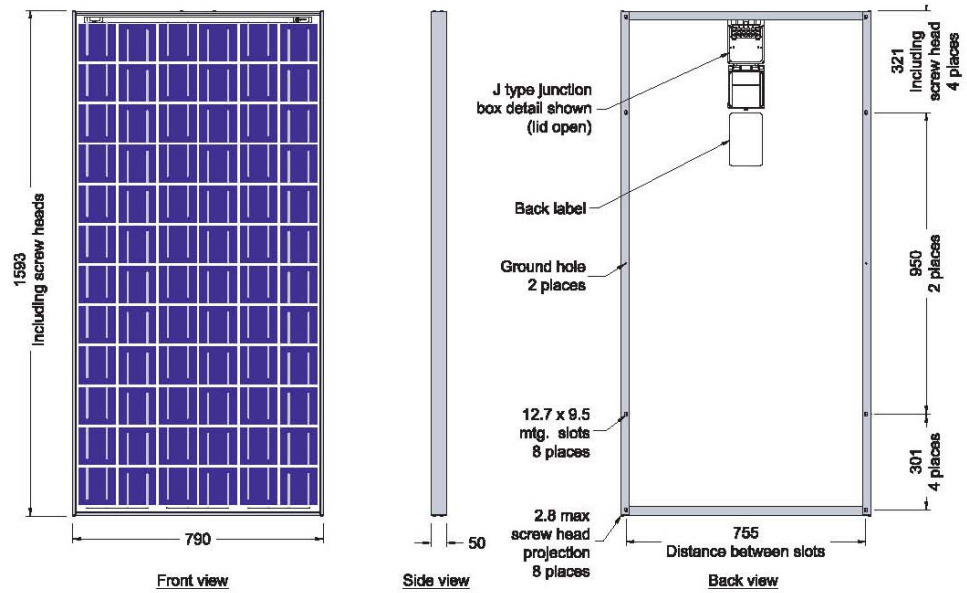
† When module mounted in accordance with BP Solar's installation instructions.

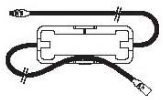
BP3165 I-V Curves



165 watt photovoltaic module
BP 3165

Module diagram





N type junction box detail with wire-hold feature (not to scale)

Typical electrical characteristics

	BP 3165		BP 3160	
	(STC)[1]	(NOCT)[2]	(STC)[1]	(NOCT)[2]
Rated power (P_{max})	165W	119W	160W	115W
Voltage at P_{max} (V_{mp})	35.2V	31.3V	35.1V	31.2V
Current at P_{max} (I_{mp})	4.7A	3.8A	4.55A	3.6A
Short circuit current (I_{sc})	5.1A	4.1A	4.8A	3.9A
Open circuit voltage (V_{oc})	44.2V	40.2V	44.2V	40.2V
Limiting reverse current	5.1A		4.8A	
Module efficiency at STC	13.1%		12.7%	
Efficiency reduction at 200W/m^2	< 3%			
Temperature coefficient of I_{sc}	(0.065±0.015)%/°C			
Temperature coefficient of V_{oc}	-(0.36±0.05)%/°C			
Temperature coefficient of P_{max}	-(0.5±0.05)%/°C			
NOCT[3]	47±2°C			
Maximum series fuse rating	15A (BP ####N) / 20A (BP ####J)			
Application class	Class A installation (IEC 61730)			
Maximum system voltage	1000V (IEC 61730) 600V (UL)			

Mechanical characteristics

Solar cells	72 multicrystalline cells (125 x 125mm) connected in series.
Construction	Front: high transmission 3.2mm tempered anti-reflective coated glass. Encapsulant: EVA. Rear: white polyester.
Frame	Clear anodised aluminium, alloy type 6063T6. Colour: silver.
Diodes	IntegraBus™ technology includes 3 Schottky bypass diode – one for every 24 cells – on a printed circuit board.
Output cables (N type)	RHW AWG# 12 (3.3mm^2) cable with polarised weatherproof DC-rated MC III connectors; asymmetrical lengths 1250mm (-) and 800mm (+).
Junction box (J type)	IP65 junction box with four terminal screw connection block, accepts PG 13.5, M20, 13mm conduit, or cable fittings accepting 6 – 12mm diameter cable. Terminals accept 2.5 – 10mm^2 (8 to 14 AWG) wire.
Dimensions	1593 x 790 x 50mm (overall tolerances ±3mm)
Weight	15.4kg

Your BP Solar Dealer:

1. Standard test conditions (STC), irradiance of 1000W/m^2 at an AM1.5G solar spectrum and a cell temperature of 25°C.
2. 800W/m^2, NOCT, AM 1.5G solar spectrum.
3. Normal operating cell temperature (NOCT) air temperature of 20°C; irradiance 800W/m^2; wind speed 1m/s.

ELECTRICAL DEPTH: COPPER VS. ALUMINUM FEEDERS

The focus of this depth study is to determine the economic and other impacts of changing the entire electrical feeder system from copper to aluminum conductors for UCI Natural Science Unit II. Basic advantages and disadvantages have been studied and are presented here, along with a calculation of the estimated financial impact of the change for this particular building project.

Copper Considerations

The existing system in the building uses Copper THWN conductors throughout. Copper feeders are preferable for several reasons over aluminum feeders and have probably been chosen in this case for their long-term value as opposed to an initial installation cost. The higher conductivity of copper allows the wires to be smaller than aluminum for the same load. This, in turn, means that they are easier and less expensive to install in terms of labor. In addition, conduit sizes can generally be smaller with copper feeders for the reason stated above, and this saves additional labor time and cost. Another advantage of copper conductors is their higher resiliency to physical stress which reduces maintenance cost for the system over its life. This type of feeder is generally preferred by contractors.

Aluminum Considerations

Perhaps the most obvious advantage of using aluminum feeders is their significantly lower material cost. This leads to attractive initial installation savings for project owners. Aluminum is also a lighter-weight metal than copper. However, notable disadvantages of aluminum conductors include lower conductivity which requires larger wire sizes and conduit sizes. This represents additional labor and material cost for the project. Generally, aluminum feeders are considered to be less resilient and do not last as long as a copper feeder system. Both feeder types are made of recyclable materials.

Cost Comparison

The following cost comparison utilizes RS Means version 2009 estimations for material and labor costs for conduit and conductors. The run lengths for each feeder have been estimated based on panel locations. A full feeder schedule is available in the electrical appendix of this report.

				EXISTING - COPPER FEEDERS				PROPOSED - ALUMINUM FEEDERS				
				PHASE	NEUTRAL	GROUND	CONDUIT	PHASE	NEUTRAL	GROUND	CONDUIT	
TAG	TOTAL FT	PROTECTION	TAG FT									
1	264	-	264	$14,890	$7,445	$3,622	$104	$6,716	$3,358	$2,661	$176	*
2	110	4000A	110	$51,183	$17,061	$17,061	$239	$23,087	$7,696	$11,447	$478	*
3	380	600A	800	$33,888	$0	$4,912	$138	$16,896	$0	$3,456	$267	
4	121	225A	2489	$51,224	$17,075	$4,406	$416	$29,719	$9,906	$3,099	$416	
5	279	400A	795	$22,419	$0	$1,662	$133	$10,112	$0	$1,550	$137	*
6	156	225A	156	$2,140	$0	$276	$11	$1,242	$0	$194	$13	
7	356	500A	356	$13,144	$0	$2,186	$62	$7,519	$0	$1,538	$119	
8	120	1000A	120	$11,437	$3,812	$1,638	$60	$5,702	$1,901	$990	$71	
9	135	225A	4844	$99,690	$66,460	$8,574	$809	$57,837	$38,558	$6,031	$957	
10	160	1200A	480	$60,998	$40,666	$10,752	$379	$30,413	$20,275	$6,106	$463	
11	428	700A	428	$36,209	$0	$3,193	$169	$16,332	$0	$2,773	$286	*
12	50	250A	50	$1,197	$0	$89	$8	$621	$0	$62	$8	
13	110	125A	110	$1,013	$0	$138	$8	$713	$0	$107	$10	
14	254	100A	254	$1,916	$639	$230	$15	$1,433	$478	$199	$22	
15	296	600A	672	$10,140	$3,380	$1,216	$78	$7,580	$2,527	$1,055	$116	
16	296	800A	672	$56,851	$18,950	$5,013	$265	$25,644	$8,548	$4,355	$449	*
17	888	2000A	888	$225,374	$75,125	$42,517	$1,284	$101,658	$33,886	$29,304	$1,780	*
18	148	350A	296	$12,521	$0	$619	$58	$5,648	$0	$577	$99	*
19	20	800A	20	$1,692	$0	$149	$8	$763	$0	$130	$13	*
20	148	175A	698	$9,528	$0	$876	$60	$5,759	$0	$681	$60	
21	82	25A	82	$154	$0	$51	$3	$140	$0	$47	$3	
22	82	60A	82	$435	$145	$51	$5	$306	$102	$47	$5	
23	75	70A	442	$2,347	$0	$400	$20	$1,651	$0	$347	$26	
24	75	150A	442	$4,946	$1,649	$555	$38	$3,342	$1,114	$347	$38	
25	112	50A	112	$422	$141	$70	$5	$328	$109	$64	$6	
26	135	150A	320	$3,581	$0	$402	$23	$2,419	$0	$312	$28	
27	75	400A	360	$15,228	$10,152	$752	$87	$6,869	$4,579	$702	$142	*
28	148	50A	296	$1,114	$0	$185	$13	$866	$0	$169	$13	
				$745,681	**$262,699**	**$111,594**	**$4,498**	**$371,313**	**$133,037**	**$78,349**	**$6,201**	
				TOTAL COPPER COST:				**TOTAL ALUMINUM COST:**				
				$1,124,472				**$588,900**				

NOTES:

- Tags marked with a * symbol have been split into additional runs to avoid feeder sizes over 500KCMIL conductors.
- Please see the full feeder schedule for specific run origins and destinations. This table is a summary of tag totals.

Cost Data

The following cost data was used for this analysis and was obtained from RS Means 2009.

	COPPER WIRE			ALUMINUM WIRE		
SIZE	MATL	LABOR	TOTAL	MATL	LABOR	TOTAL
-	0	0	0	0	0	0
#10	$25	$38	$63	$16	$21	$37
#8	$44	$47	$91	$23	$34	$57
#6	$68	$58	$126	$32	$47	$79
#4	$106	$71	$177	$40	$58	$98
#3	$134	$75	$209	$47	$65	$111
#2	$168	$84	$252	$54	$71	$125
#1	$213	$94	$307	$79	$84	$162
"1/0"	$259	$114	$373	$94	$94	$188
"2/0"	$325	$130	$455	$112	$104	$216
"3/0"	$410	$150	$560	$138	$114	$252
"4/0"	$515	$171	$686	$154	$121	$275
250KCMIL	$610	$188	$798	$188	$130	$318
300KCMIL	$725	$198	$923	$259	$139	$398
350KCMIL	$850	$209	$1,059	$264	$150	$414
400KCMIL	$970	$221	$1,191	$310	$163	$473
500KCMIL	$1,175	$235	$1,410	$340	$188	$528

	CONDUIT PRICING		
INCHES	MATL	LABOR	TOTAL
0.75	$1.05	$2.31	$3.36
1	$1.84	$2.62	$4.46
1.25	$2.81	$2.98	$5.79
1.5	$3.78	$3.34	$7.12
2	$4.88	$3.76	$8.64
2.5	$11.70	$5.00	$16.70
3	$13.75	$6.00	$19.75
3.5	$17.40	$6.70	$24.10

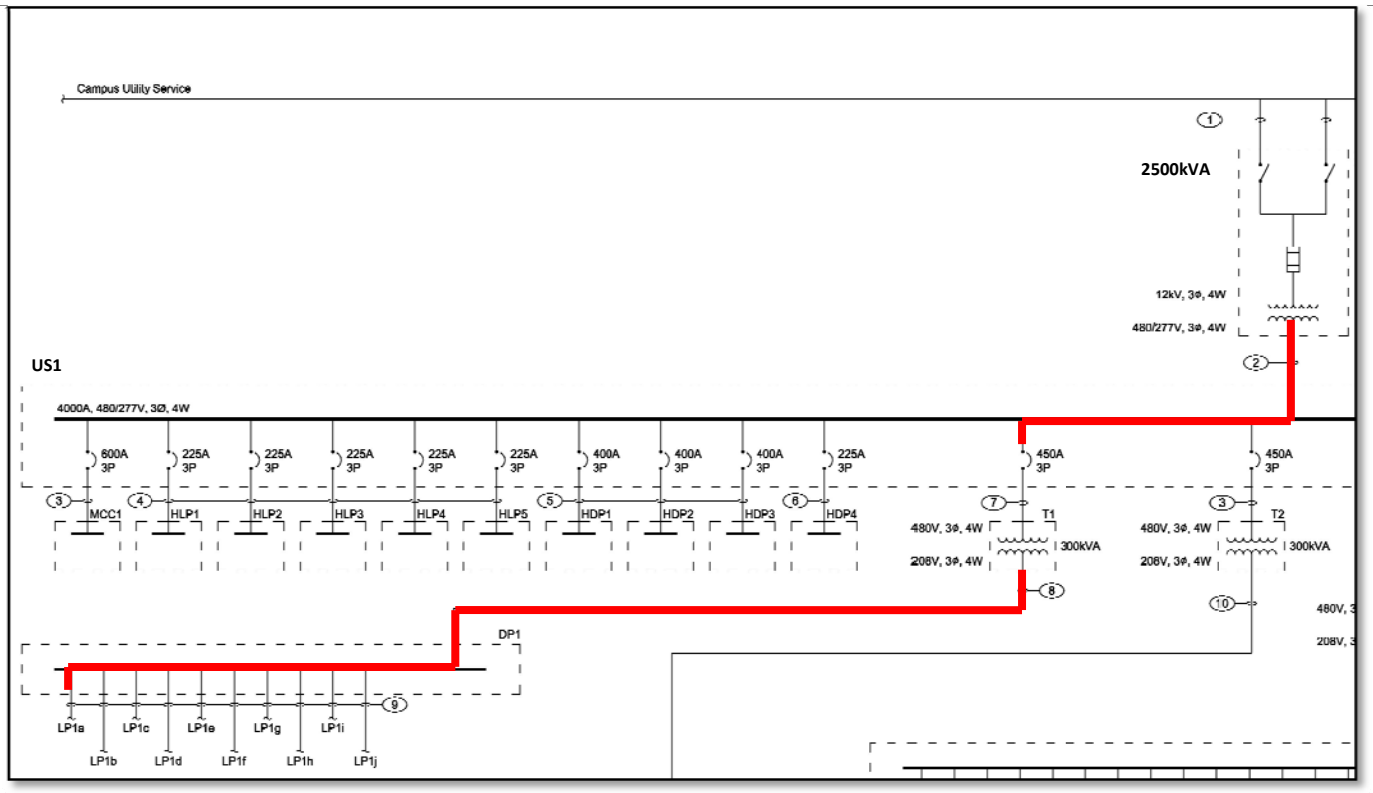
Conclusions / Recommendation

A total cost estimate of the existing system which uses copper feeders has been found to be $1,124,472. This is in comparison to approximately $588,900 for an all aluminum feeder system. The significant difference in these two figures is most likely a result of several long runs of feeders throughout the building which serve to amplify the price difference between the two wire types. An installation cost savings of $555,572 (approximately 48%) applies to the aluminum system.

Although this is a very significant savings, the higher maintenance cost of aluminum systems was not included in this analysis and would reduce this difference somewhat. The recommended course of action in this case would depend somewhat on the budget of the project. However, based on the potential for a 48% savings in this particular case, very serious consideration of using aluminum feeders is recommended.

SHORT CIRCUIT ANALYSIS

Short Circuit Analysis Path



Analysis Summary

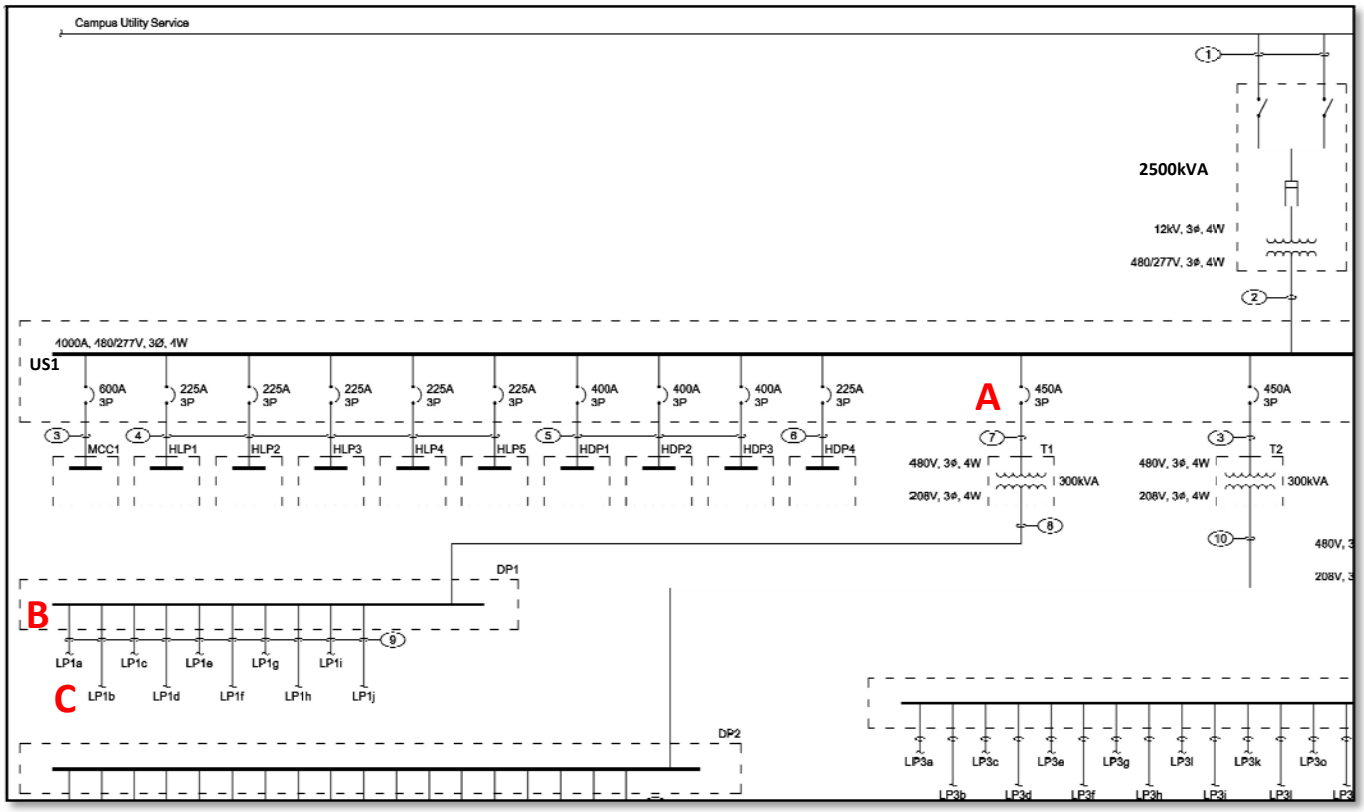
LOCATION	FAULT CURRENT	STANDARD BREAKER RATING
UTILITY XFMR SECONDARY	52,303 A	65,000A
SWITCHBOARD US1	48,680 A	50,000 A
PANEL DP1	12,415 A	14,000 A
PANEL LP1a	5,309 A	14,000 A

Analysis Details

UTILITY XFMR SECONDARY							
Base kVA (Assumed)	10000						
Avail. Utility Fault (kVA)	1000000						
System Voltage (kV)	0.48						
Utility Transformer (kVA)	2500.00	**X (p.u.)**	0.010000	(Base kVA / Utility S.C. kVA)			
Average % Z	5.50	**X (p.u.)**	0.219240	(%X * Base kVA) / (100 *XFMR kVA)			
Average X/R	12.00	**R (p.u.)**	0.018270	(%R * Base KVA) / (100 *XFMR kVA)			
R (%)	0.4568						
X (%)	5.4810	**ΣX(p.u.)**	0.229240				
		ΣR(p.u.)	0.018270				
		ΣZ(p.u.)	0.229967	$\sqrt{(\Sigma X(p.u.))^2+(\Sigma R(p.u.))^2}$			
SHORT CIRCUIT CURRENT (A)	**52303.73**						
US1							
Number of Sets	11	**X(p.u.)**	0.016189				
Length (Ft)	110.00	**R(p.u.)**	0.010286				
Wire Size	500KCMIL						
(TABLE 7) X_L	0.03730000						
(TABLE 7) R	0.02370000	**ΣX(p.u.)**	0.245429				
X	0.00037300	**ΣR(p.u.)**	0.028556				
R	0.00023700	**ΣZ(p.u.)**	0.247085	$\sqrt{(\Sigma X(p.u.))^2+(\Sigma R(p.u.))^2}$			
SHORT CIRCUIT CURRENT (A)	**48680.13**						
DP1							
Number of Sets	3	**X(p.u.)**	0.383691				
Length (Ft)	120.00	**R(p.u.)**	0.708210				
Wire Size	350KCMIL						
(TABLE 7) X_L	0.04150000						
(TABLE 7) R	0.07660000	**ΣX(p.u.)**	0.629120				
X	0.00166000	**ΣR(p.u.)**	0.736767				
R	0.00306400	**ΣZ(p.u.)**	0.968823	$\sqrt{(\Sigma X(p.u.))^2+(\Sigma R(p.u.))^2}$			
SHORT CIRCUIT CURRENT (A)	**12415.21**						
LP1a							
Number of Sets	1	**X(p.u.)**	0.623498				
Length (Ft)	65.00	**R(p.u.)**	1.150841				
Wire Size	4/0						
(TABLE 7) X_L	0.04150000						
(TABLE 7) R	0.07660000	**ΣX(p.u.)**	1.252618				
X	0.00269750	**ΣR(p.u.)**	1.887608				
R	0.00497900	**ΣZ(p.u.)**	2.265417	$\sqrt{(\Sigma X(p.u.))^2+(\Sigma R(p.u.))^2}$			
SHORT CIRCUIT CURRENT (A)	**5309.46**						

OVERCURRENT PROTECTION DEVICE COORDINATION STUDY

Overcurrent Protection Devices



A – 450A 3P Circuit Breaker at US1

B – 225A 3P Molded Case Circuit Breaker at DP1

C – 20A 1P Molded Case Circuit Breaker at LP1a

Coordination Study Results

As can be seen from the following figure, there is limited overlap between the three selected circuit breakers, and they appear to be properly coordinated with the protection device closes to the possible fault being the first to trip. All circuit breakers have been assumed to be Siemens molded-case style for this study.

Time-Current Curves