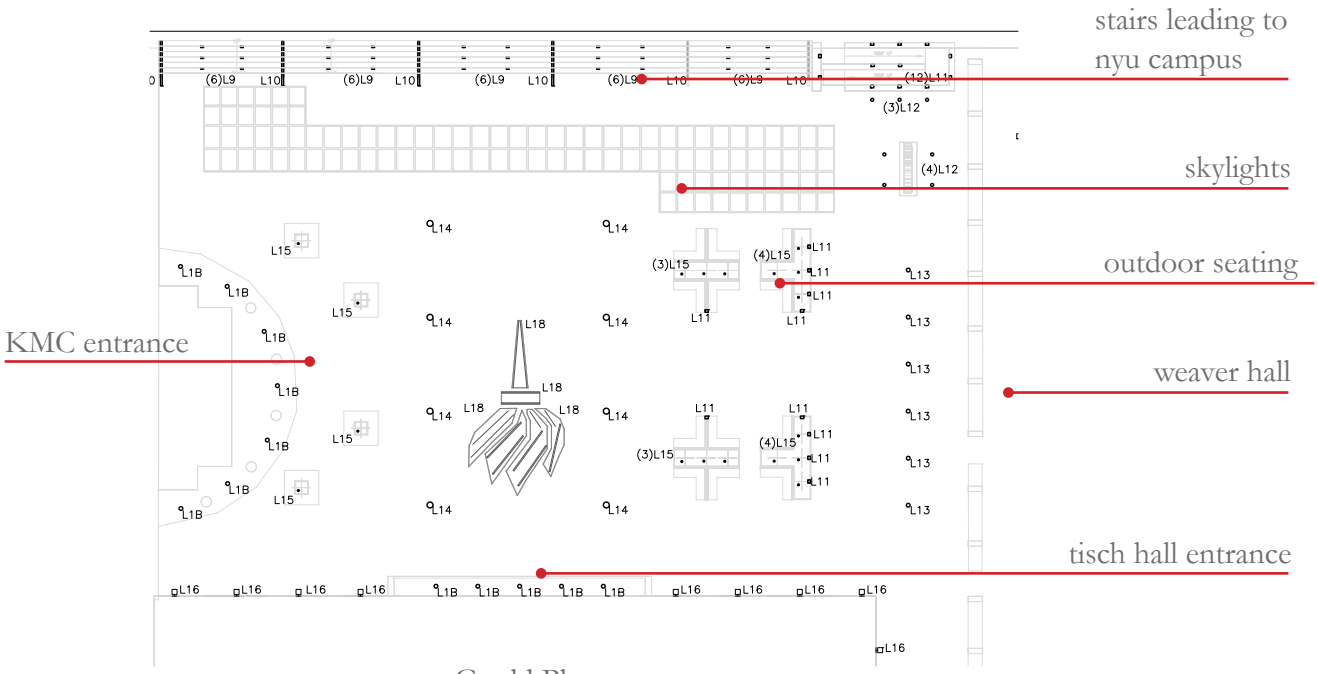
Gould Plaza: Electrical Redesign

Background Information

The 27,360 sq. ft. plaza consists of benches and tress for social gathering. Gould plaza is surrounded by Tisch Hall, Weaver Hall, and the Kaufman Center. The space is used to provide a relaxing environment for students to interact.

Lighting Design

The lighting design encompasses a mixture of light poles, light rails, step lights, downlights, and custom ingrade NYU logo. The backlit NYU logo is created to reinforce the NYU school identity and pride. The lighting in Gould Plaza focuses on light the entrance/exits of the surrounding buildings to provide a safe environment for students to walk at night.



Gould Plaza

Electrical Design

The electrical redesign involves dividing the lighting into different zones. Instead of creating a new panelboard for the outdoor lighting, the lighting loads will share the same panelboard as the Tisch Lobby lighting. A total of 9 circuits will be designed for this space.

Electrical Panel

	VOLTAGE:	277/480	PHASE:	3	WIRE:	4				TOTAL WATTS, L1	9,080	PANEL NO.	LP1A				
	MAIN BUS:	100	AMPS							TOTAL WATTS, L2	8,980						
	MAIN BREAKER:		A FRAME			A TRIP				TOTAL WATTS, L3	9,020	LOC.	ELEC. CLOSET				
	MOUNTING:	SURFACE		NOTES:						TOTAL WATTS	27,080						
		WATTS LOAD						L1 Y	L2 Y	L3 Y				WATTS LOAD				
	DIRECTORY	L1	L2	L3	CKT.	AMPS					AMPS	CKT.	L1	L2	L3	DIRECTORY	
L	SPARE				1	20		•				2				SPACE	L
L	SPARE				3	20			•			4				SPACE	L
L	SPARE				5	20				•		6				SPACE	L
L	SPARE				7	20		•				8				SPACE	L
L	SPARE				9	20			•			10				SPACE	L
L	SPARE				11	20				•		12				SPACE	L
L	SPARE				13	20		•				14				SPACE	L
L	SPARE				15	20			•			16				SPACE	L
L	SPARE				17	20				•		18				SPACE	L
L	SPARE				19	20		•				20				SPACE	L
L	SPARE				21	20			•			22				SPACE	L
L	SPARE				23	20				•		24				SPACE	L
L	SPARE				25	20		•				26				SPACE	L
L	SPARE				27	20			•			28				SPACE	L
L	SPARE				29	20				•		30				SPACE	L
L	SPARE				31	20		•				32				SPACE	L
L	SPARE				33	20			•			34				SPACE	L
L	SPARE				35	20				•		36				SPACE	L
R	PNL RP-1A	9080			37	80/3P		•				38				SPACE	L
R	-		3,980		39	-			•			40				SPACE	L
R	-			9,020	41	-				•		42				SPACE	L
	SUBTOTAL	9080	3,980	9,020									0	0	0	SUBTOTAL	

Existing Panel LP1A (includes revised Lobby lighting)

PANELBOARD SCHEDULE

VOLTAGE: 277/480,3PH,4W SIZE/TYPE BUS: 100A SIZE/TYPE MAIN: 100A/3P C/B	PANEL TAG: LP1A PANEL LOCATION: ELEC CLOSET PANEL MOUNTING: SURFACE	MIN. C/B AIC: OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Lighting	LOBBY	216	20A/1P	1	*			2	20A/1P	180	LOBBY	Lighting
Lighting	LOBBY	180	20A/1P	3		*		4	20A/1P	180	LOBBY	Lighting
Lighting	LOBBY	216	20A/1P	5			*	6	20A/1P	252	LOBBY	Lighting
Lighting	LOBBY	546	20A/1P	7	*			8	20A/1P	546	LOBBY	Lighting
Lighting	LOBBY	184	20A/1P	9		*		10	20A/1P	1521	LOBBY	Lighting
Lighting	LOBBY	975	20A/1P	11			*	12	20A/1P	81	LOBBY	Lighting
Lighting	PLAZA	1073	20A/1P	13	*			14	20A/1P	260	PLAZA	Lighting
Lighting	PLAZA	312	20A/1P	15		*		16	20A/1P	480	PLAZA	Lighting
Lighting	PLAZA	459	20A/1P	17			*	18	20A/1P	234	PLAZA	Lighting
Lighting	PLAZA	180	20A/1P	19	*			20	20A/1P	459	PLAZA	Lighting
Lighting	PLAZA	392	20A/1P	21		*		22	20A/1P	0		
		0	20A/1P	23			*	24	20A/1P	0		
		0	20A/1P	25	*			26	20A/1P	0		
		0	20A/1P	27		*		28	20A/1P	0		
		0	20A/1P	29			*	30	20A/1P	0		
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
PNL RP-1A	LOBBY	9080	80/3P	37	*			38	20A/1P	0	0	0
PNL RP-1A	LOBBY	8980	-	39		*		40	20A/1P	0	0	0
PNL RP-1A	LOBBY	9020	-	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A	12.54	TOTAL DESIGN LOAD (KW)	43.21
CONNECTED LOAD (KW) - B	12.23	POWER FACTOR	0.80
CONNECTED LOAD (KW) - C	11.24	TOTAL DESIGN LOAD (AMPS)	65

Revised Panel LP1A

Electrical Panel

PANELBOARD SIZING WORKSHEET

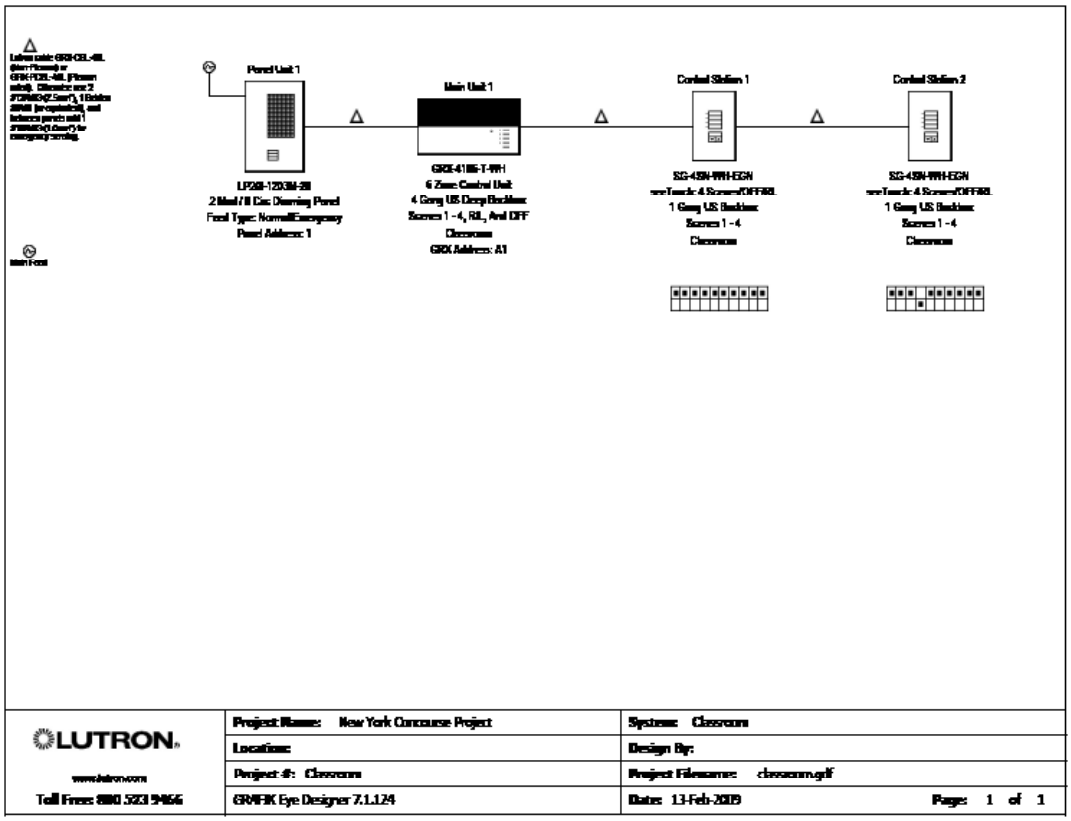
Panel Tag---------->				LP1A	Panel Location:			ELEC CLOSET			
Nominal Phase to Neutral Voltage------->				277	Phase:			3			
Nominal Phase to Phase Voltage-------->				480	Wires:			4			
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	Lighting	3	LOBBY	216	w		216	270		
2	A	Lighting	3	LOBBY	180	w		180	225		
3	B	Lighting	3	LOBBY	180	w		180	225		
4	B	Lighting	3	LOBBY	180	w		180	225		
5	C	Lighting	3	LOBBY	216	w		216	270		
6	C	Lighting	3	LOBBY	252	w		252	315		
7	A	Lighting	3	LOBBY	546	w		546	683		
8	A	Lighting	3	LOBBY	546	w		546	683		
9	B	Lighting	3	LOBBY	184	w		184	230		
10	B	Lighting	3	LOBBY	1521	w		1521	1901		
11	C	Lighting	3	LOBBY	975	w		975	1219		
12	C	Lighting	3	LOBBY	81	w		81	101		
13	A	Lighting	3	PLAZA	1073	w		1073	1341		
14	A	Lighting	3	PLAZA	260	w		260	325		
15	B	Lighting	3	PLAZA	312	w		312	390		
16	B	Lighting	3	PLAZA	480	w		480	600		
17	C	Lighting	3	PLAZA	459.2	w		459	574		
18	C	Lighting	3	PLAZA	234	w		234	293		
19	A	Lighting	3	PLAZA	180	w		180	225		
20	A	Lighting	3	PLAZA	459	w		459	574		
21	B	Lighting	3	PLAZA	391.8	w		392	490		
22	B				0	w		0	0		
23	C				0	w		0	0		
24	C				0	w		0	0		
25	A				0	w		0	0		
26	A				0	w		0	0		
27	B				0	w		0	0		
28	B				0	w		0	0		
29	C				0	w		0	0		
30	C				0	w		0	0		
31	A				0	w		0	0		
32	A				0	w		0	0		
33	B				0	w		0	0		
34	B				0	w		0	0		
35	C				0	w		0	0		
36	C				0	w		0	0		
37	A	PNL RP-1A	9	LOBBY	9080	w		9080	11350		
38	A					w		0	0		
39	B	PNL RP-1A	9	LOBBY	8980	w		8980	11225		
40	B					w		0	0		
41	C	PNL RP-1A	9	LOBBY	9020	w		9020	11275		
42	C				0	w		0	0		
PANEL TOTAL								36.0	45.0	Amps=	54.2

PHASE LOADING		kW	kVA	%	Amps
PHASE TOTAL	A	12.5	15.7	37%	56.6
PHASE TOTAL	B	12.2	15.3	36%	55.2
PHASE TOTAL	C	11.2	11.8	28%	42.6

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.70	0.0	0.0			
2	computers		0.0	0.0	0.90	0.0	0.0			
3	fluorescent lighting		8.9	11.2	1.00	8.9	11.2	0.80		
4	HID lighting		0.0	0.0	1.00	0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0	0.80	0.0	0.0			
7	heating		0.0	0.0	1.25	0.0	0.0			
8	kitchen equipment		0.0	0.0	0.80	0.0	0.0			
9	unassigned		27.1	33.9	1.00	27.1	33.9	0.80		
Total Demand Loads						36.0	45.0			
Spare Capacity			20%			7.2	9.0			
Total Design Loads						43.2	54.0	0.80	Amps=	65.0

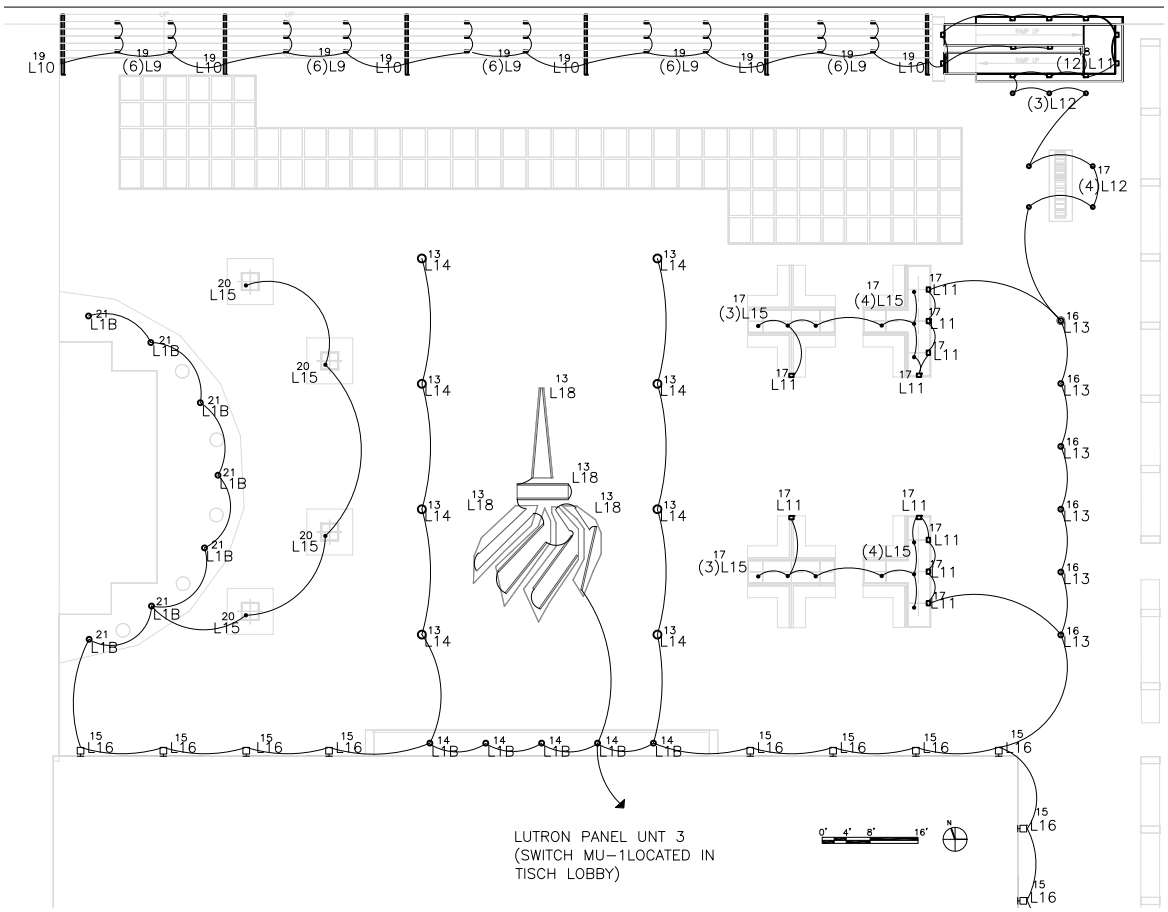
Default Power Factor = 0.80
Default Demand Factor = 1.00

Lutron Control



LUTRON DIMMING CONTROL PANEL 2				LOCATION: LEVEL 1		
ZONE	IXTURE TYP	VOLTAGE	SOURCE	CIRCUIT NO.	LOAD VA	CONTROL
1	L5A	277	NORMAL	LP1A-1	216	GRAFIK 3000
2	L5A	277	NORMAL	LP1A-2	180	GRAFIK 3000
3	L5A	277	NORMAL	LP1A-3	180	GRAFIK 3000
4	L5A	277	NORMAL	LP1A-4	180	GRAFIK 3000
5	L5A	277	NORMAL	LP1A-5	216	GRAFIK 3000
6	L5A, L5B	277	NORMAL	LP1A-6	252	GRAFIK 3000
7	L8	277	NORMAL	LP1A-7	184	GRAFIK 3000
8	L4	277	NORMAL	LP1A-8	546	GRAFIK 3000
9	L4	277	NORMAL	LP1A-9	546	GRAFIK 3000
10	L7	277	NORMAL	LP1A-10	1521	GRAFIK 3000
11	L2	277	NORMAL	LP1A-11	975	GRAFIK 3000
12	L6	277	NORMAL	LP1A-12	81	GRAFIK 3000

Gould Plaza Circuiting



Electrical Plan

*Larger lighting plan can be found in Appendix I : E101

Feeder Sizing

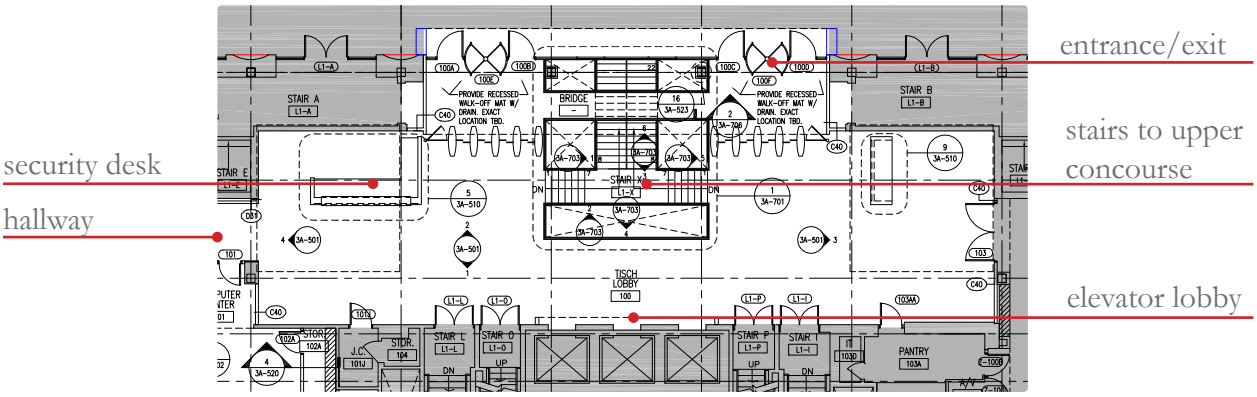
Design Load: 54.2A
Design Load with 20% spare: 65A
Protection Device for Feeder: 85A
Wires: (4)#4
2 1/2"CU THW

Tisch Lobby: Electrical Redesign

The 3535 sq. ft lobby consists of various walkways that leads to the various compartments in the building. The two revolving doors and side doors are the entrance and exits of the building. The center of the lobby consists of stairs leading to the upper and lower concourse of the building. At the sides of the lobby, hallways lead to the computer labs and classrooms of the building. The elevator lobby is located at the south of the lobby with stairwells that lead to the upper and lower floors of the building.

Lighting Design

The lighting design encompasses a mixture of downlights, wallwashers, recessed fluorescent lamps, and pendants. The main objective of the lighting design is to use light as a guide to lead people to the various compartments in the building. At each entrance or walkway, a linear fluorescent is recessed into the wall to provide as a guide. The custom pendants at the center of the lobby lead occupants down to the lower level.



Lobby Plan

Electrical Design

The lighting in the lobby is divided into different zones. Daylight sensors will be incorporated into the design for dimming when sufficient daylight is available. The Lutron Grafik control system will help control the two lighting zones, daytime zone and nighttime zone light. A total of 12 circuits are in this space.

	VOLTAGE:	277/480	PHASE:	3	WIRE:	4				TOTAL WATTS, L1	9,080	PANEL NO.	LP1A				
	MAIN BUS:	100	AMPS							TOTAL WATTS, L2	8,980						
	MAIN BREAKER:		A FRAME			A TRIP				TOTAL WATTS, L3	9,020	LOC.	ELEC. CLOSET				
	MOUNTING:	SURFACE		NOTES:						TOTAL WATTS	27,080						
		WATTS LOAD						L1 Y	L2 Y	L3 Y				WATTS LOAD				
	DIRECTORY	L1	L2	L3	CKT.	AMPS					AMPS	CKT.	L1	L2	L3	DIRECTORY	
L	SPARE				1	20		•				2				SPACE	L
L	SPARE				3	20			•			4				SPACE	L
L	SPARE				5	20				•		6				SPACE	L
L	SPARE				7	20		•				8				SPACE	L
L	SPARE				9	20			•			10				SPACE	L
L	SPARE				11	20				•		12				SPACE	L
L	SPARE				13	20		•				14				SPACE	L
L	SPARE				15	20			•			16				SPACE	L
L	SPARE				17	20				•		18				SPACE	L
L	SPARE				19	20		•				20				SPACE	L
L	SPARE				21	20			•			22				SPACE	L
L	SPARE				23	20				•		24				SPACE	L
L	SPARE				25	20		•				26				SPACE	L
L	SPARE				27	20			•			28				SPACE	L
L	SPARE				29	20				•		30				SPACE	L
L	SPARE				31	20		•				32				SPACE	L
L	SPARE				33	20			•			34				SPACE	L
L	SPARE				35	20				•		36				SPACE	L
R	PNL RP-1A	9080			37	80/3P		•				38				SPACE	L
R	-		3,980		39	-			•			40				SPACE	L
R	-			9,020	41	-				•		42				SPACE	L
	SUBTOTAL	9080	3,980	9,020									0	0	0	SUBTOTAL	

Existing Panel LP1A

PANELBOARD SCHEDULE

VOLTAGE: 277/480,3PH,4W
SIZE/TYPE BUS: 100A
SIZE/TYPE MAIN: 100A/3P C/B

PANEL TAG: LP1A
PANEL LOCATION: ELEC CLOSET
PANEL MOUNTING: SURFACE

MIN. C/B AIC:
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Lighting	LOBBY	648	20A/1P	1	*			2	20A/1P	720	LOBBY	Lighting
Lighting	LOBBY	546	20A/1P	3		*		4	20A/1P	108	LOBBY	Lighting
Lighting	LOBBY	546	20A/1P	5			*	6	20A/1P	975	LOBBY	Lighting
Lighting	LOBBY	184	20A/1P	7	*			8	20A/1P	0	0	0
0	0	0	20A/1P	9		*		10	20A/1P	0	0	0
0	0	0	20A/1P	11			*	12	20A/1P	0	0	0
		0	20A/1P	13	*			14	20A/1P	0		
		0	20A/1P	15		*		16	20A/1P	0		
		0	20A/1P	17			*	18	20A/1P	0		
		0	20A/1P	19	*			20	20A/1P	0		
		0	20A/1P	21		*		22	20A/1P	0		
		0	20A/1P	23			*	24	20A/1P	0		
		0	20A/1P	25	*			26	20A/1P	0		
		0	20A/1P	27		*		28	20A/1P	0		
		0	20A/1P	29			*	30	20A/1P	0		
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
PNL RP-1A	LOBBY	9080	80/3P	37	*			38	20A/1P	0	0	0
PNL RP-1A	LOBBY	8980	-	39		*		40	20A/1P	0	0	0
PNL RP-1A	LOBBY	9020	-	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A	10.63	TOTAL DESIGN LOAD (KW)	36.97
CONNECTED LOAD (KW) - B	9.63	POWER FACTOR	0.80
CONNECTED LOAD (KW) - C	10.54	TOTAL DESIGN LOAD (AMPS)	56

Revised Panel LP1A

Electrical Panel

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				LP1A	Panel Location:			ELEC CLOSET			
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	Lighting	3	LOBBY	648	w		648	810		
2	A	Lighting	3	LOBBY	720	w		720	900		
3	B	Lighting	3	LOBBY	546	w		546	683		
4	B	Lighting	3	LOBBY	108	w		108	135		
5	C	Lighting	3	LOBBY	546	w		546	683		
6	C	Lighting	3	LOBBY	975	w		975	1219		
7	A	Lighting	3	LOBBY	184	w		184	230		
8	A					w		0	0		
9	B					w		0	0		
10	B					w		0	0		
11	C					w		0	0		
12	C					w		0	0		
13	A				0	w		0	0		
14	A				0	w		0	0		
15	B				0	w		0	0		
16	B				0	w		0	0		
17	C				0	w		0	0		
18	C				0	w		0	0		
19	A				0	w		0	0		
20	A				0	w		0	0		
21	B				0	w		0	0		
22	B				0	w		0	0		
23	C				0	w		0	0		
24	C				0	w		0	0		
25	A				0	w		0	0		
26	A				0	w		0	0		
27	B				0	w		0	0		
28	B				0	w		0	0		
29	C				0	w		0	0		
30	C				0	w		0	0		
31	A				0	w		0	0		
32	A				0	w		0	0		
33	B				0	w		0	0		
34	B				0	w		0	0		
35	C				0	w		0	0		
36	C				0	w		0	0		
37	A	PNL RP-1A	9	LOBBY	9080	w		9080	11350		
38	A					w		0	0		
39	B	PNL RP-1A	9	LOBBY	8980	w		8980	11225		
40	B					w		0	0		
41	C	PNL RP-1A	9	LOBBY	9020	w		9020	11275		
42	C				0	w		0	0		
PANEL TOTAL								30.8	38.5	Amps=	46.3

PHASE LOADING		kW	kVA	%	Amps
PHASE TOTAL	A	10.6	13.3	37%	48.0
PHASE TOTAL	B	9.6	12.0	33%	43.5
PHASE TOTAL	C	10.5	10.9	30%	39.4

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.70	0.0	0.0			
2	computers		0.0	0.0	0.90	0.0	0.0			
3	fluorescent lighting		3.7	4.7	1.00	3.7	4.7	0.80		
4	HID lighting		0.0	0.0	1.00	0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0	0.80	0.0	0.0			
7	heating		0.0	0.0	1.25	0.0	0.0			
8	kitchen equipment		0.0	0.0	0.80	0.0	0.0			
9	unassigned		27.1	33.9	1.00	27.1	33.9	0.80		
Total Demand Loads						30.8	38.5			
Spare Capacity			20%			6.2	7.7			
Total Design Loads						37.0	46.2	0.80	Amps=	55.6

Default Power Factor = 0.80
Default Demand Factor = 1.00

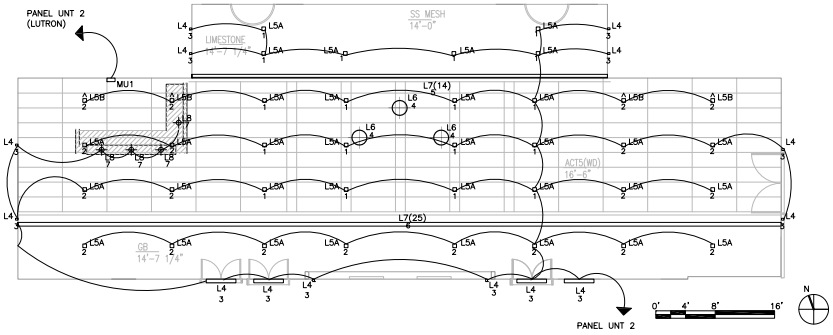
Lobby - Different Control Modes

For the daytime mode, lights will be dimmed to save power and use daylight to provide illumination to the space.

For the nighttime mode, all of the lights will be on

Daytime Mode

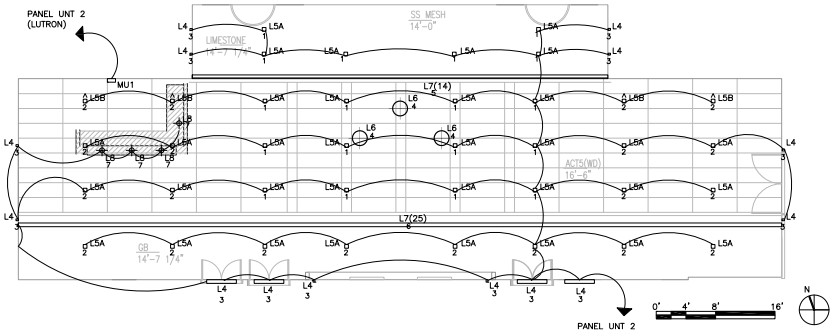
Dimming will be determined by the daylight sensor.



Power Plan

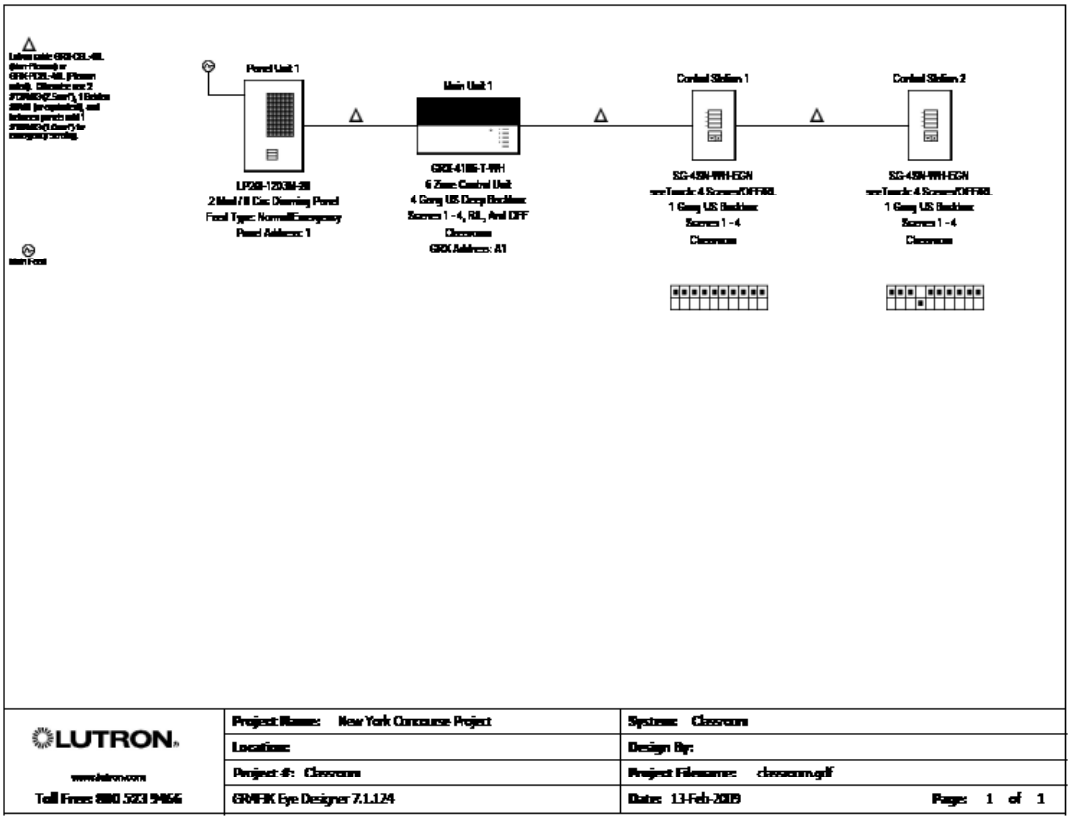
Nighttime Mode

All lighting will be on.



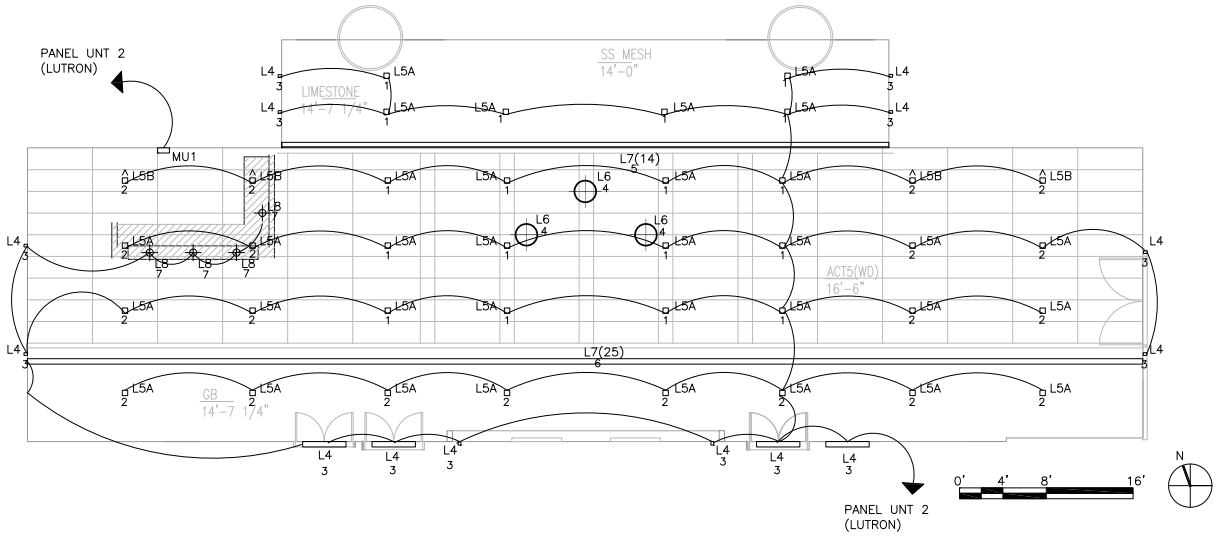
Power Plan

Lutron Controls



LUTRON DIMMING CONTROL PANEL 2					LOCATION: LEVEL 1	
ZONE	FIXTURE TYPE	Voltage	SOURCE	CIRCUIT NO.	LOAD VA	CONTROL
1	L13,L18	277	NORMAL	EXT 1 -1	216	GRAFIK 3000
2	L17	277	NORMAL	EXT 1 -2	180	GRAFIK 3000
3	L16	277	NORMAL	EXT 1 -3	180	GRAFIK 3000
4	L14	277	NORMAL	EXT 1 -4	180	GRAFIK 3000
5	L15,L17	277	NORMAL	EXT 1 -5	216	GRAFIK 3000
6	L16	277	NORMAL	EXT 1 -6	252	GRAFIK 3000
7	L12	277	NORMAL	EXT 1 -7	184	GRAFIK 3000
8	L12, L11	277	NORMAL	EXT 1 -8	546	GRAFIK 3000
9	L9, L10	277	NORMAL	EXT 1 -9	546	GRAFIK 3000

Lobby Circuiting



Eletrical Plan

*Larger lighting plan can be found in Appendix I : E201

Feeder Sizing

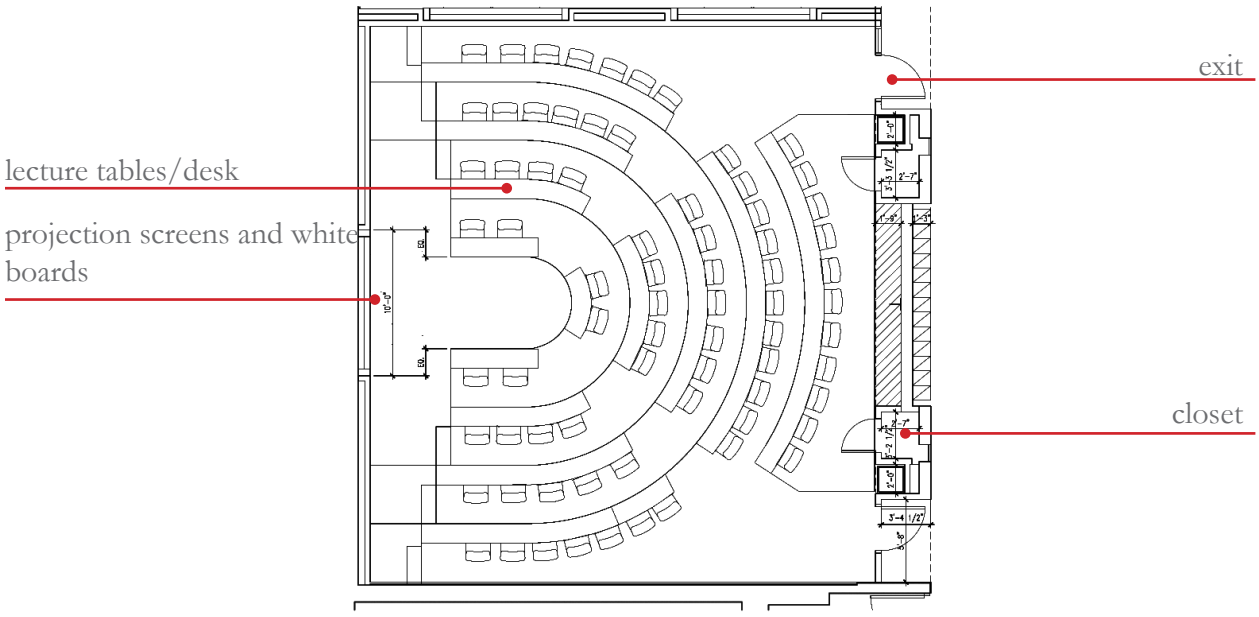
Design Load: 48.4A
Design Load with 20% spare: 58A
Feeder Protection Device: 60A
Wire Size: (4)#4
2 1/2", CU THW

Classroom: Electrical Redesign

The 1324 sq. ft classroom has a seating capacity of 73 occupants. The classroom is divided into five tiers. At the front of the room, there are three white boards, with the side white boards have a sliding component which can be adjusted into a projection screen. The ceiling are 2'x2' armstrong panels. The materials in the classroom are dry wall with an eggshell finish to it.

Lighting Design

The lighting design encompasses a mixture of downlights, wallwashers, and wall sconces. The main objective of the lighting design is to provide sufficient light levels on the reading/writing surface of the student desks as well as the white boards at the front of the classroom. At the same time, the wall sconces will provide visual interest on the side walls of the classroom.



Classroom Plan

Electrical Design

The lighting in the classroom is divided into different zones. The control is based on the Lutron 3000 Grafik control system. A total of two lighting zones will be designed for the classroom: presentation and general lecture mode. There will be a total of 6 circuits in the room.

PANEL SCHEDULE

VOLTAGE	277/480	3PH, 4W	TAG							TYPE PANEL			
MOUNTING	SURFACE		LP4-UC1A							C/B MIN	AIC	FEED	
SIZE/TYPE BUS	100 AMPS		LOCATION							OPTIONS/ACCESSRS			
SIZE/TYPE MAINS	A FRAME		ELEC. CLOSET UC19							REMARKS			
LOAD DESCRIPTION	LOCATION	LOAD WATTS	C/B SIZE	POS NO	A PH	B PH	C PH	POS NO	C/B SIZE	LOAD WATTS	LOCATION	LOAD DESCRIPTION	
Lighting	UC14- LTG	1800	20A	1	*			2	20A	1700.0	LVPUC - R1,2,3,5	Low voltage lighting control	
Lighting	UC15- LTG	1300	20A	3		*		4	20A	1160.0	LVPUC - R4,6,7,8	Low voltage lighting control	
Lighting	UC17- LTG	1400	20A	5			*	6	20A	1160.0	LVPUC - R9, 10	Low voltage lighting control	
Lighting	UC18- LTG	2100	20A	7	*			8	20A	950.0	LVPUC - R11,12	Low voltage lighting control	
				9		*		10	20A	1050.0	LTG TOILET/CP CENTER	Lighting	
				11			*	12	20A	1400.0	LVPUC-R13,14,15,16,17	Low voltage lighting control	
				13	*			14	20A	600.0	LVPUC - R18,19	Low voltage lighting control	
				15		*		16					
				17			*	18					
				19	*			20					
				21		*		22					
				23			*	24					
				25	*			26					
				27		*		28					
				29			*	30					
				31	*			32					
				33		*		34					
				35			*	36					
				37	*			38					
				39		*		40					
				41			*	42					
SUB-TOTAL	A PHASE	7150.0		B PHASE						3510.0	C PHASE	3960.0	
TOTAL CONNECTED LOAD (WATTS)		14620.0									DEMAND LOAD	13158.0	

Existing Panel LP4-UC1A

PANELBOARD SCHEDULE

VOLTAGE: 277/480,3PH,4W	PANEL TAG: LP4-UC1A	MIN. C/B AIC: 10K
SIZE/TYPE BUS: 100A	PANEL LOCATION: ELEC CLOSET UC19	OPTIONS: PROVIDE FEED THR
SIZE/TYPE MAIN: 100A/3P C/B	PANEL MOUNTING: SURFACE	FOR PANELBOARD 1

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DE
Lighting	UC18	180	20A/1P	1	*			2	20A/1P	180	UC18	
Lighting	UC18	612	20A/1P	3		*		4	20A/1P	273	UC18	
Lighting	UC18	669	20A/1P	5			*	6	20A/1P	1800	UC14	
Lighting	UC15	1300	20A/1P	7	*			8	20A/1P	1400	UC17	
Low volt light control	LVPUC-R1,2,3,5	1700	20A/1P	9		*		10	20A/1P	1160	LVPUC-R4,6,7,8	Low
Low volt light control	LVPUC-R9,10	1160	20A/1P	11			*	12	20A/1P	950	LVPUC-R11,12	Low
Lighting	TOILET	1050	20A/1P	13	*			14	20A/1P	1400	PUC-R13,14,15,16	Low
Low volt light control	LVPUC-R18,19	600	20A/1P	15		*		16	20A/1P	0		
		0	20A/1P	17			*	18	20A/1P	0		
		0	20A/1P	19	*			20	20A/1P	0		
		0	20A/1P	21		*		22	20A/1P	0		
		0	20A/1P	23			*	24	20A/1P	0		
		0	20A/1P	25	*			26	20A/1P	0		
		0	20A/1P	27		*		28	20A/1P	0		
		0	20A/1P	29			*	30	20A/1P	0		
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
0	0	0	20A/1P	37	*			38	20A/1P	0	0	
0	0	0	20A/1P	39		*		40	20A/1P	0	0	
0	0	0	20A/1P	41			*	42	20A/1P	0		
CONNECTED LOAD (KW) - A		5.51								TOTAL DESIGN LOAD (KW)		
CONNECTED LOAD (KW) - B		4.35								POWER FACTOR		
CONNECTED LOAD (KW) - C		4.58								TOTAL DESIGN LOAD (AMPS)		

Revised Panel LP4-UC1A

Electrical Panel

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				LP4-UC1A	Panel Location:		ELEC CLOSET UC19				
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	Lighting	3	UC18	180	w		180	225		
2	A	Lighting	3	UC18	180	w		180	225		
3	B	Lighting	3	UC18	612	w		612	765		
4	B	Lighting	3	UC18	273	w		273	341		
5	C	Lighting	3	UC18	669	w		669	836		
6	C	Lighting	3	UC14	1800	w		1800	2250		
7	A	Lighting	3	UC15	1300	w		1300	1625		
8	A	Lighting	3	UC17	1400	w		1400	1750		
9	B	Low volt light control	9	/PUC-R1,2,3	1700	w		1700	2125		
10	B	Low volt light control	9	/PUC-R4,6,7	1160	w		1160	1450		
11	C	Low volt light control	9	,VPUC-R9,1	1160	w		1160	1450		
12	C	Low volt light control	9	VPUC-R11,1	950	w		950	1188		
13	A	Lighting	3	TOILET	1050	w		1050	1313		
14	A	Low volt light control	9	C-R13,14,15	1400	w		1400	1750		
15	B	Low volt light control	9	VPUC-R18,1	600	w		600	750		
16	B				0	w		0	0		
17	C				0	w		0	0		
18	C				0	w		0	0		
19	A				0	w		0	0		
20	A				0	w		0	0		
21	B				0	w		0	0		
22	B				0	w		0	0		
23	C				0	w		0	0		
24	C				0	w		0	0		
25	A				0	w		0	0		
26	A				0	w		0	0		
27	B				0	w		0	0		
28	B				0	w		0	0		
29	C				0	w		0	0		
30	C				0	w		0	0		
31	A				0	w		0	0		
32	A				0	w		0	0		
33	B				0	w		0	0		
34	B				0	w		0	0		
35	C				0	w		0	0		
36	C				0	w		0	0		
37	A					w		0	0		
38	A					w		0	0		
39	B					w		0	0		
40	B					w		0	0		
41	C					w		0	0		
42	C				0	w		0	0		
PANEL TOTAL								14.4	18.0	Amps=	21.7

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					5.5	6.9	38%	24.9
PHASE TOTAL	B					4.3	5.4	30%	19.6
PHASE TOTAL	C					4.6	5.7	32%	20.7

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.70	0.0	0.0			
2	computers		0.0	0.0	0.90	0.0	0.0			
3	fluorescent lighting		7.5	9.3	1.00	7.5	9.3	0.80		
4	HID lighting		0.0	0.0	1.00	0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0	0.80	0.0	0.0			
7	heating		0.0	0.0	1.25	0.0	0.0			
8	kitchen equipment		0.0	0.0	0.80	0.0	0.0			
9	unassigned		7.0	8.7	1.00	7.0	8.7	0.80		
Total Demand Loads						14.4	18.0			
Spare Capacity			20%			2.9	3.6			
Total Design Loads						17.3	21.7	0.80	Amps=	26.1

Default Power Factor = 0.80
Default Demand Factor = 1.00

Classroom - Different Control Modes

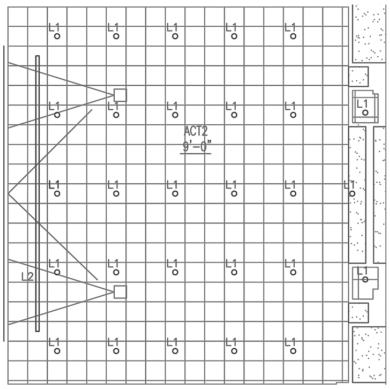
For the general mode, all of the lighting in the room will be turned on.

For the presentation mode, the first row of downlights will dim to 20%, followed by the second row of downlights dim to 50%, and the rest of the downlights at 70%. The wall washers and wall sconces will be turned off.

General mode

No Dimming for any of the luminaires in the space.

plan not to scale



reflected ceiling plan

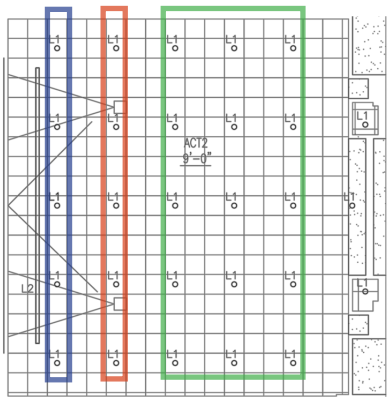
Presentation Mode

20% Dimming

50% Dimming

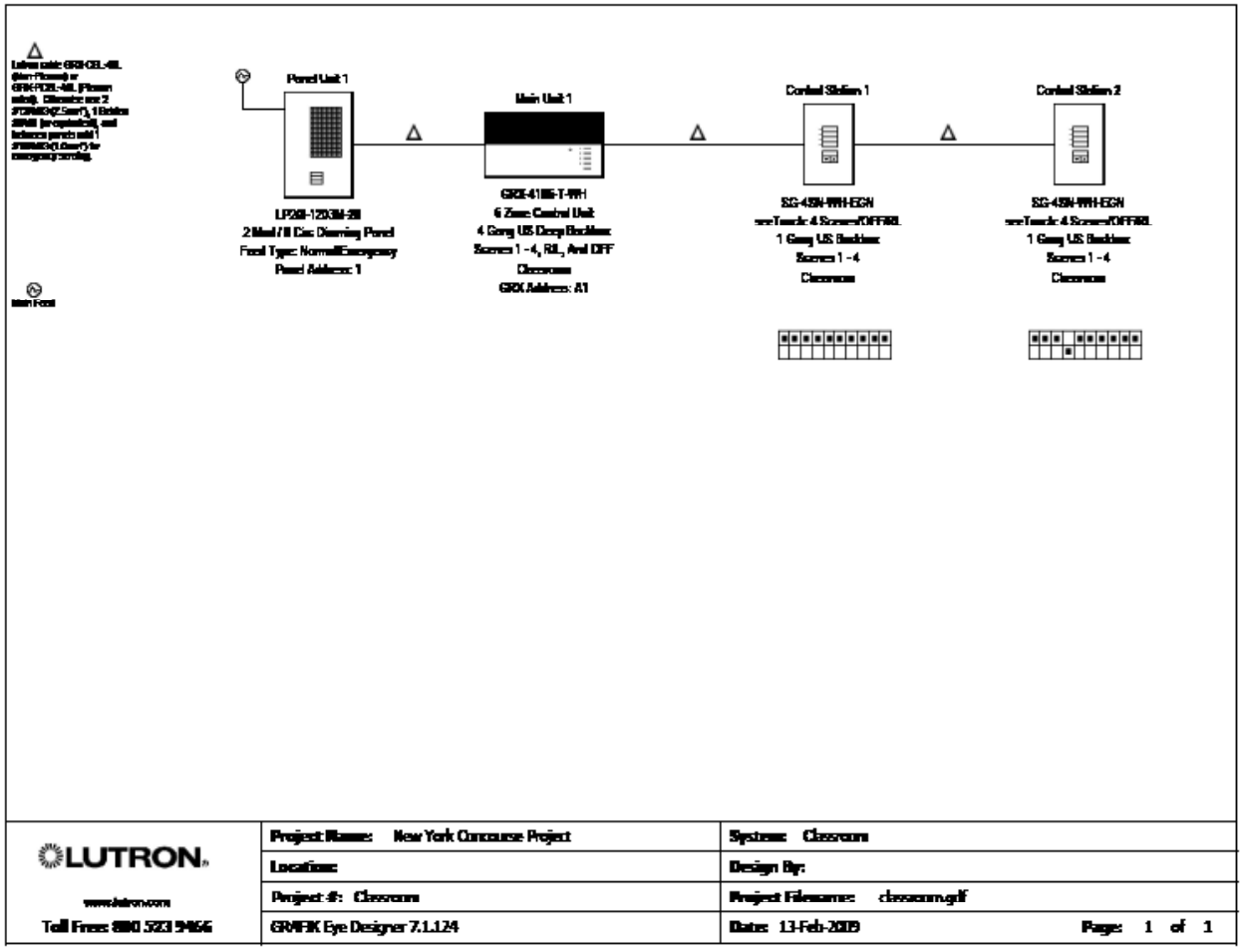
70% Dimming

plan not to scale



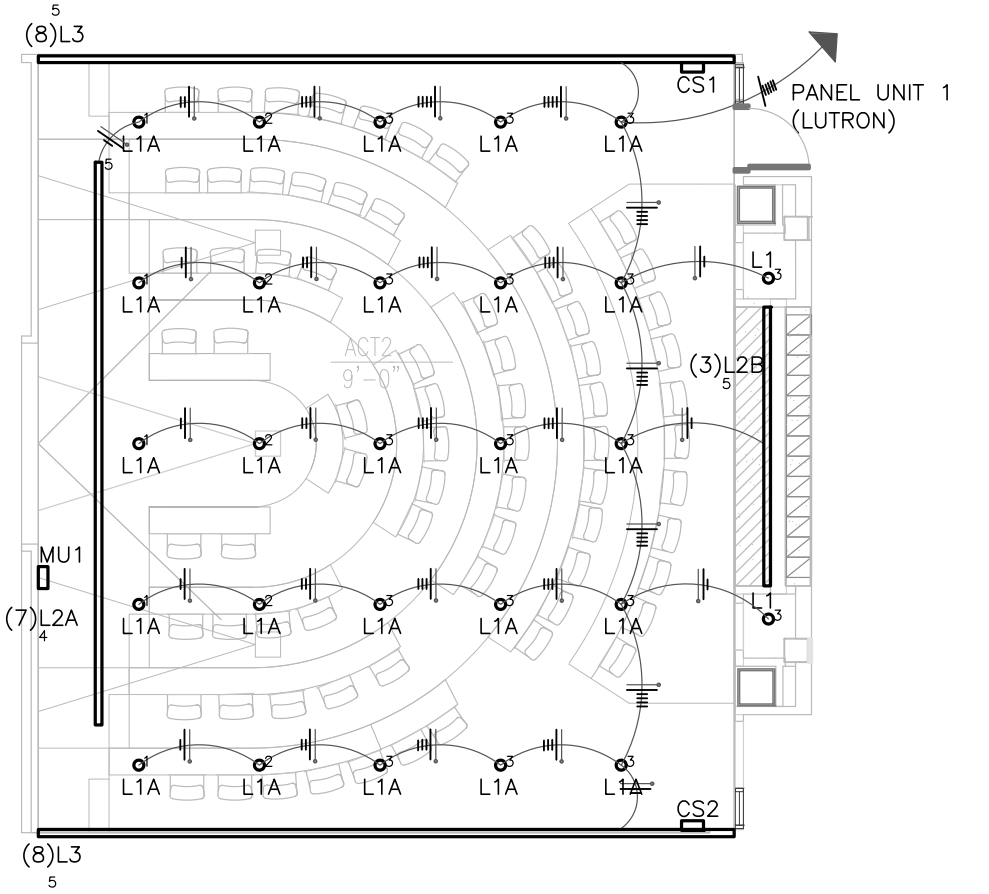
reflected ceiling plan

Lutron Light Control



LUTRON DIMMING CONTROL PANEL 1				LOCATION: LEVEL 1		
ZONE	FIXTURE TYPE	Voltage	SOURCE	CIRCUIT NO.	LOAD VA	CONTROL
1	L1A	277	NORMAL	LP4-UC1A-1	180	GRAFIK 3000
2	L1A	277	NORMAL	LP4-UC1A-2	180	GRAFIK 3000
3	L1A, L2B	277	NORMAL	LP4-UC1A-3	612	GRAFIK 3000
4	L2A	277	NORMAL	LP4-UC1A-4	273	GRAFIK 3000
5	L3	277	NORMAL	LP4-UC1A-5	669	GRAFIK 3000

Classroom Circuiting



Electrical Plan

*Larger lighting plan can be found in Appendix I : E301

Feeder Sizing

Design Load: 118A
Design Load with 20% spare: 142A
Feeder Protection Device: 150A
Wire Size: (4)#1/0
2" CU THW

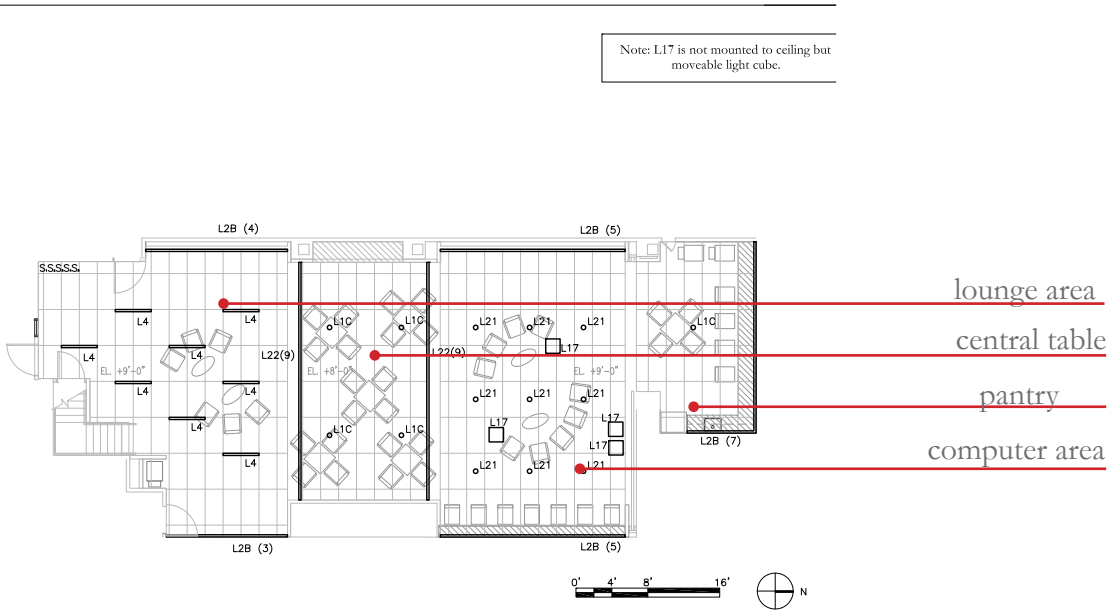
MBA Student Lounge: Electrical Redesign

Background Information

The MBA student lounge is located in the upper concourse of Tisch Hall. The student lounge is used as a place for students to do work and relax. The 2,100 sq.ft space is divided into four sections, a pantry in the back, computer counter and lounge area, tables area, and another lounge area in the front.

Lighting Design

The lighting consist a combination of wallwashers, recessed fluorescents, LEDs, and surface mount luminaires. The objective of the lighting design is to provide a relaxing and pleasant atmosphere for students to enjoy.



MBA Student Lounge

*Larger lighting plan can be found in Appendix I : E401

Electrical Design

The electrical design involves dividing up the lighting into 5 zones with 5 switches. The lounge does not need any dimming. A total of 5 circuits will be designed for this space.

	VOLTAGE:	120/208	PHASE:	3	WIRE:	4				TOTAL WATTS, L1	4,200		PANEL NO.		RPSA SECT. 2
	MAIN BUS:	100 AMPS								TOTAL WATTS, L2	4,200				
	MAIN BREAKER:	100 A FRAME			100 A TRIP					TOTAL WATTS, L3	4,200		LOC.		SEE FLOOR PLAN
	MOUNTING:	SURFACE	NOTES:							TOTAL WATTS	12,600				
		WATTS LOAD					L1 Y	L2 Y	L3 Y				WATTS LOAD		
	DIRECTORY	L1	L2	L3	CKT.	AMPS				AMPS	CKT.	L1	L2	L3	DIRECTORY
R	FURNITURE FEED	1,000			43	20				15	44	1,000			FURNITURE FEED
R	FURNITURE FEED		1,000		45	20				15	46		1,000		FURNITURE FEED
R	FURNITURE FEED			1,000	47	20				15	48			1,000	FURNITURE FEED
R	FURNITURE FEED	1,000			49	20				15	50	1,000			FURNITURE FEED
R	FURNITURE FEED		1,000		51	20				15	52		1,000		FURNITURE FEED
R	FURNITURE FEED			1,000	53	20				15	54			1,000	FURNITURE FEED
R	WAP REC	200			55	20				15	56				SPARE
R	WAP REC		200		57	20				15	58				SPARE
R	WAP REC			200	59	20				15	60				SPARE
R	SPARE				61	20				15	62				SPARE
R	SPARE				63	20				15	64				SPARE
R	SPARE				65	20				15	66				SPARE
R	SPARE				67	20				15	68				SPARE
R	SPARE				69	20				15	70				SPARE
R	SPARE				71	20				15	72				SPARE
R	SPARE				73	20				15	74				SPARE
R	SPARE				75	20				15	76				SPARE
R	SPARE				77	20				15	78				SPARE
R	SPARE				79	20				15	80				SPARE
R	SPARE				81	20				15	82				SPARE
R	SPARE				83	20				15	84				SPARE
	SUBTOTAL	2,200	2,200	2,200								2,000	2,000	2,000	

Existing Panel RPSA (includes revised Lobby lighting)

PANELBOARD SCHEDULE

VOLTAGE: 120/208,3PH,4W
SIZE/TYPE BUS: 100A
SIZE/TYPE MAIN: 100A/3P C/B

PANEL TAG: RPSA SEC. 2
PANEL LOCATION: ELEC CLOSET
PANEL MOUNTING: SURFACE

MIN. C/B AIC:
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Furniture Feed	UC31	1000	20A/1P	43	*			44	20A/1P	1000	UC31	Furniture Feed
Furniture Feed	UC31	1000	20A/1P	45		*		46	20A/1P	1000	UC31	Furniture Feed
Furniture Feed	UC31	1000	20A/1P	47			*	48	20A/1P	1000	UC31	Furniture Feed
Furniture Feed	UC31	1000	20A/1P	49	*			50	20A/1P	1000	UC31	Furniture Feed
Furniture Feed	UC31	1000	20A/1P	51		*		52	20A/1P	1000	UC31	Furniture Feed
Furniture Feed	UC31	1000	20A/1P	53			*	54	20A/1P	1000	UC31	Furniture Feed
WAP Rec	UC31	200	20A/1P	55	*			56	20A/1P	0	0	0
WAP Rec	UC31	200	20A/1P	57		*		58	20A/1P	0	0	0
WAP Rec	UC31	200	20A/1P	59			*	60	20A/1P	0		
		0	20A/1P	61	*			62	20A/1P	0		
		0	20A/1P	63		*		64	20A/1P	0		
Lighting	UC31	248	20A/1P	65			*	66	20A/1P	0		
Lighting	UC31	144	20A/1P	67	*			68	20A/1P	502	UC31	Lighting
Lighting	UC31	1031	20A/1P	79		*		70	20A/1P	253	UC31	Lighting
		0	20A/1P	71			*	72	20A/1P	0		
		0	20A/1P	73	*			74	20A/1P	0		
		0	20A/1P	75		*		76	20A/1P	0		
		0	20A/1P	77			*	78	20A/1P	0		
0	0	0	80/3P	79	*			80	20A/1P	0	0	0
0	0	0	-	81		*		82	20A/1P	0	0	0
0	0	0	-	83			*	84	20A/1P	0	0	

CONNECTED LOAD (KW) - A	4.85	TOTAL DESIGN LOAD (KW)	17.73
CONNECTED LOAD (KW) - B	5.48	POWER FACTOR	0.80
CONNECTED LOAD (KW) - C	4.45	TOTAL DESIGN LOAD (AMPS)	62

Revised Panel RPSA

PANELBOARD SIZING WORKSHEET

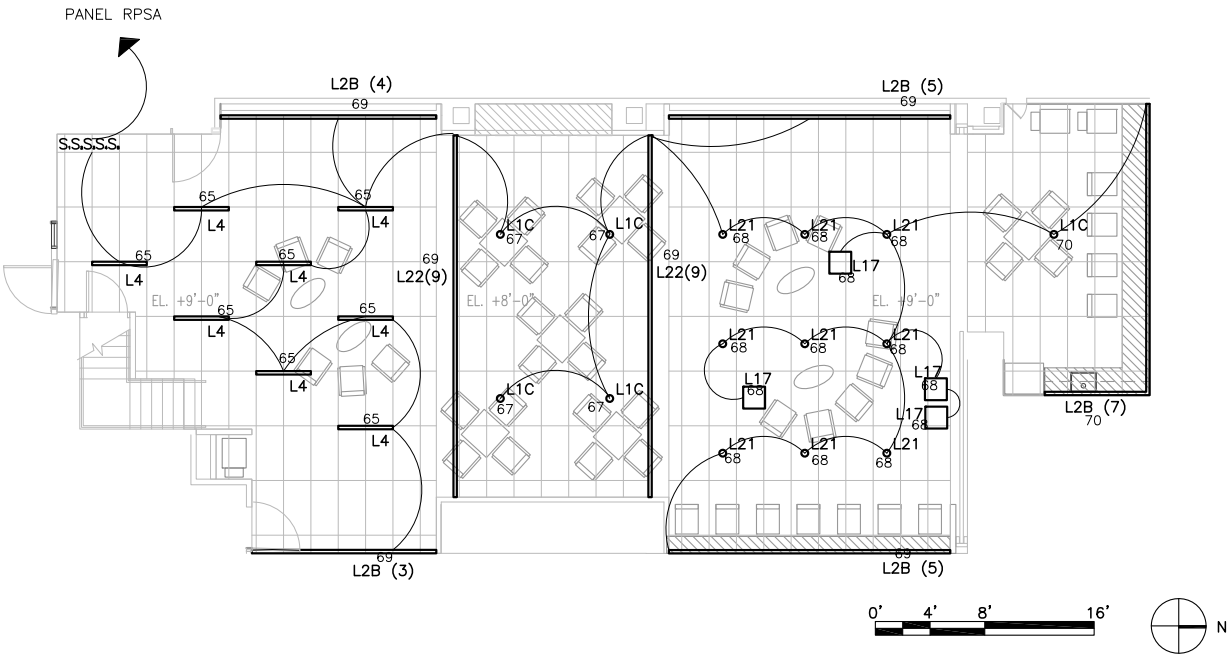
Panel Tag---------->				RPSA	Panel Location:			ELEC CLOSET				
Nominal Phase to Neutral Voltage------->				120	Phase:			3				
Nominal Phase to Phase Voltage-------->				208	Wires:			4				
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks		
43	A	Furniture Feed	9	UC31	1000	w		1000	1250			
44	A	Furniture Feed	9	UC31	1000	w		1000	1250			
45	B	Furniture Feed	9	UC31	1000	w		1000	1250			
46	B	Furniture Feed	9	UC31	1000	w		1000	1250			
47	C	Furniture Feed	9	UC31	1000	w		1000	1250			
48	C	Furniture Feed	9	UC31	1000	w		1000	1250			
49	A	Furniture Feed	9	UC31	1000	w		1000	1250			
50	A	Furniture Feed	9	UC31	1000	w		1000	1250			
51	B	Furniture Feed	9	UC31	1000	w		1000	1250			
52	B	Furniture Feed	9	UC31	1000	w		1000	1250			
53	C	Furniture Feed	9	UC31	1000	w		1000	1250			
54	C	Furniture Feed	9	UC31	1000	w		1000	1250			
55	A	WAP Rec	9	UC31	200	w		200	250			
56	A					w		0	0			
57	B	WAP Rec	9	UC31	200	w		200	250			
58	B					w		0	0			
59	C	WAP Rec	9	UC31	200	w		200	250			
60	C				0	w		0	0			
61	A				0	w		0	0			
62	A				0	w		0	0			
63	B				0	w		0	0			
64	B				0	w		0	0			
65	C	Lighting	3	UC31	248	w		248	310			
66	C				0	w		0	0			
67	A	Lighting	3	UC31	144	w		144	180			
68	A	Lighting	3	UC31	502	w		502	628			
69	B	Lighting	3	UC31	1031	w		1031	1289			
70	B	Lighting	3	UC31	253	w		253	316			
71	C				0	w		0	0			
72	C				0	w		0	0			
73	A				0	w		0	0			
74	A				0	w		0	0			
75	B				0	w		0	0			
76	B				0	w		0	0			
77	C				0	w		0	0			
78	C				0	w		0	0			
79	A					w		0	0			
80	A					w		0	0			
81	B					w		0	0			
82	B					w		0	0			
83	C					w		0	0			
84	C				0	w		0	0			
PANEL TOTAL								14.8	18.5	Amps=	51.3	

PHASE LOADING		kW	kVA	%	Amps	
PHASE TOTAL	A	4.8	6.1	33%	50.5	
PHASE TOTAL	B	5.5	6.9	37%	57.1	
PHASE TOTAL	C	4.4	5.6	30%	46.3	

LOAD CATAGORIES			Connected			Demand				Ver. 1.03
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.70	0.0	0.0			
2	computers		0.0	0.0	0.90	0.0	0.0			
3	fluorescent lighting		2.2	2.7	1.00	2.2	2.7	0.80		
4	HID lighting		0.0	0.0	1.00	0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0	0.80	0.0	0.0			
7	heating		0.0	0.0	1.25	0.0	0.0			
8	kitchen equipment		0.0	0.0	0.80	0.0	0.0			
9	unassigned		12.6	15.8	1.00	12.6	15.8	0.80		
Total Demand Loads						14.8	18.5			
Spare Capacity			20%			3.0	3.7			
Total Design Loads						17.7	22.2	0.80	Amps=	61.6

Default Power Factor = 0.80
Default Demand Factor = 1.00

MBA Lounge Circuiting



Electrical Plan

*Larger lighting plan can be found in Appendix : E401

Feeder Sizing

Design Load: 48.4A
Design Load with 20% spare: 58A
Feeder Protection Device: 60A
Wire Size: (4)#4 - 2 1/2" CU THWN

Backup Generator Design: Electrical Breadth

The current electrical system of Tisch Hall does not contain a backup generator. The current emergency generator is located in another building. Electrical Depth 1 proposes the installation of a backup generator that will supply power to the Ground, Upper, and Lower Concourse of Tisch Hall. The backup generator will need to supply power to the emergency lighting system, elevator shaft, security, and fire alarm system.
Electrical depth 1 will involve picking out a backup generator to supply adequate emergency power to Tisch Hall. The study also involves finding a location for the backup generator to be placed.

Emergency Loads

Overall Emergency Load	
Load	33832 W 33.83 kW
Design with 20% Spare	40.60 kW

Emergency Lighting Load							
Type	L	UC	LC	Sum	Lamp Description	Watt	Total Watt
L38		12		12	37MR16/IR/NFL/C	87	1044
L27			6	6	37MR16/IR/NFL/CFPC40/830	46	276
L47			2	2	CF32DT/E/IN/830	36	72
L1B	2	12	8	22	(2) FP21/830/ECO	48	1056
L24K			42	42	FP28/830/ECO	32	1344
L24L			12	12	FP28/830/ECO	32	384
L24		29		29	FP28/830/ECO	32	928
L24C		10		10	FP28/830/ECO	32	320
L16			11	11	CF26DT/E/IN/830	29	319
L25		16	6	22	FP28/830/ECO	33	726
L4			5	5	CF32DT/E/IN/830	36	180
L31			6	6	CF32DT/E/IN/830	36	216
L6B			1	1	CF26DT/E/IN/830	29	29
L6A		5	8	13	CF26DT/E/IN/830	29	377
L6		2		2	CF26DT/E/IN/830	29	58
L9C	14			14	MP50/C/U/MED	58	812
L23B	6			6	CDM70/PAR38/FL/3K/	78	468
L50	4			4	FP28/830/ECO	33	132
L12A	2			2	CMH39PAR20/FL	45	90
L28		12		12	CF32DT/E/IN/830	46	552
L28C		1		1	CF32DT/E/IN/830	46	46
L28A		8		8	CF32DT/E/IN/830	46	368
L46		3		3	CMH39/UPAR20/FL25	23	69
L15		12		12	FP28/830/ECO	33	396
						Total	10262

Other Loads		
Type	Description	Total Watt
Traction Elevator	30 hp elevator	22370
Fire Alarm System		200
Security		1000
	Total	23570

Emergency Panelboard Schedule

PANELBOARD SCHEDULE

VOLTAGE: 277/480 ,3PH,4W
SIZE/TYPE BUS: 1000A
SIZE/TYPE MAIN: 1000A/3P C/B

PANEL TAG: EMR-1
PANEL LOCATION: ELEC CLOSET UC19
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
Lighting	UC	2868	20A/1P	1	*			2	20A/1P	1000	All Level	Security
Lighting	LC	3634	20A/1P	3		*		4	20A/1P	200	All Level	Fire Alarm System
Lighting	UC	2606	20A/1P	5			*	6	20A/1P	1598	Level 1	Lighting
Elevator	All Level	7457	20A/1P	7	*			8	20A/1P	0	0	0
Elevator	All Level	7457	20A/1P	9		*		10	20A/1P	0	0	0
Elevator	All Level	7457	20A/1P	11			*	12	20A/1P	0	0	0
0	0	0	20A/1P	13	*			14	20A/1P	0	0	0
0	0	0	20A/1P	15		*		16	20A/1P	0		0
0		0	20A/1P	17			*	18	20A/1P	0		
		0	20A/1P	19	*			20	20A/1P	0		
		0	20A/1P	21		*		22	20A/1P	0		
		0	20A/1P	23			*	24	20A/1P	0		
		0	20A/1P	25	*			26	20A/1P	0		
		0	20A/1P	27		*		28	20A/1P	0		
		0	20A/1P	29			*	30	20A/1P	0		
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A	11.33	TOTAL DESIGN LOAD (KW)	41.13
CONNECTED LOAD (KW) - B	11.29	POWER FACTOR	0.05
CONNECTED LOAD (KW) - C	11.66	TOTAL DESIGN LOAD (AMPS)	977

Emergency Panelboard

PANELBOARD SIZING WORKSHEET

Panel Tag---------->				EMR-1	Panel Location:			ELEC CLOSET UC19			
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	Lighting	3	UC	2868	w	0.95	2868	3019		
2	A	Security	9	All Level	1000	w	1.00	1000	1000		
3	B	Lighting	3	LC	3634	w	0.95	3634	3825		
4	B	Fire Alarm System	9	All Level	200	w	1.00	200	200		
5	C	Lighting	3	UC	2606	w	0.95	2606	2743		
6	C	Lighting	3	Level 1	1598	w	0.95	1598	1682		
7	A	Elevator	9	All Level	7457	w	1.00	7457	7457		
8	A				0	w		0	0		
9	B	Elevator	9	All Level	7457	w	1.00	7457	7457		
10	B				0	w		0	0		
11	C	Elevator	9	All Level	7457	w	1.00	7457	7457		
12	C				0	w		0	0		
13	A				0	w		0	0		
14	A				0	w		0	0		
15	B				0	w		0	0		
16	B				0	w		0	0		
17	C				0	w		0	0		
18	C				0	w		0	0		
19	A				0	w		0	0		
20	A				0	w		0	0		
21	B				0	w		0	0		
22	B				0	w		0	0		
23	C				0	w		0	0		
24	C				0	w		0	0		
25	A				0	w		0	0		
26	A				0	w		0	0		
27	B				0	w		0	0		
28	B				0	w		0	0		
29	C				0	w		0	0		
30	C				0	w		0	0		
31	A				0	w		0	0		
32	A				0	w		0	0		
33	B				0	w		0	0		
34	B				0	w		0	0		
35	C				0	w		0	0		
36	C				0	w		0	0		
37	A				0	w		0	0		
38	A				0	w		0	0		
39	B				0	w		0	0		
40	B				0	w		0	0		
41	C				0	w		0	0		
42	C				0	w		0	0		
PANEL TOTAL								34.3	34.8	Amps=	41.9

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					11.3	11.5	33%	41.4
PHASE TOTAL	B					11.3	11.5	33%	41.5
PHASE TOTAL	C					11.7	11.9	34%	42.9

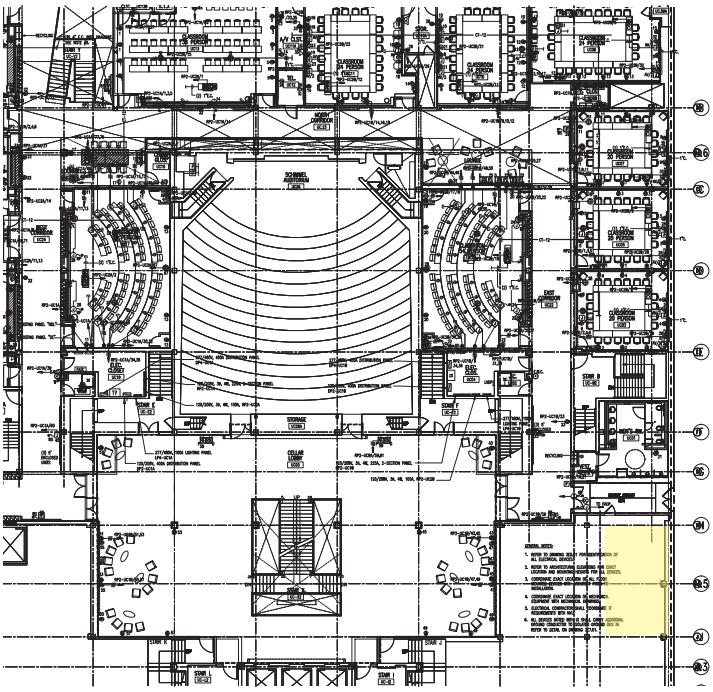
LOAD CATAGORIES			Connected			Demand				Ver. 1.02
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		0.0	0.0	0.70	0.0	0.0			
2	computers		0.0	0.0	0.90	0.0	0.0			
3	fluorescent lighting		10.7	11.3	1.00	10.7	120.7	0.09		
4	HID lighting		0.0	0.0	1.00	0.0	0.0			
5	incandescent lighting		0.0	0.0	1.00	0.0	0.0			
6	HVAC fans		0.0	0.0	0.80	0.0	0.0			
7	heating		0.0	0.0	1.25	0.0	0.0			
8	kitchen equipment		0.0	0.0	0.80	0.0	0.0			
9	unassigned		23.6	23.6	1.00	23.6	555.6	0.04		
Total Demand Loads						34.3	676.2			
Spare Capacity			20%			6.9	135.2			
Total Design Loads						41.1	811.5	0.05	Amps=	976.5

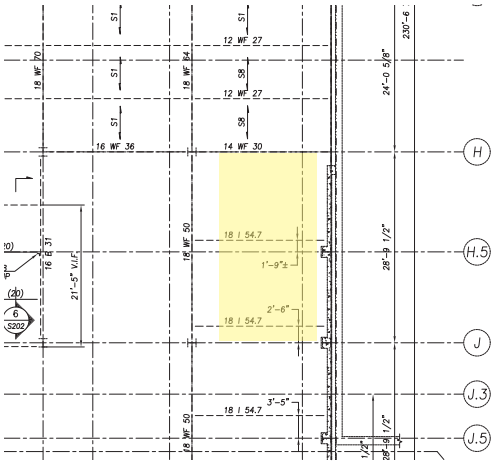
Default Power Factor = 0.80
Default Demand Factor = 1.00

Proposal Site for Backup Generator

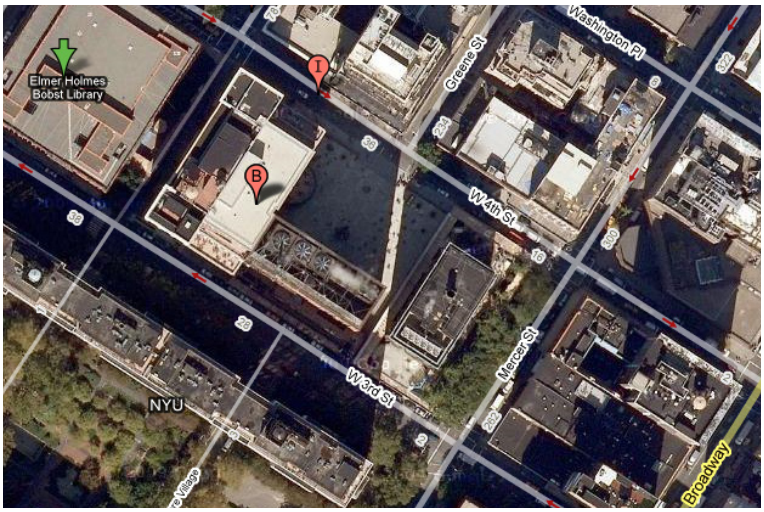
The existing space in Tisch Hall has no room for a backup generator and a fuel tank to be placed. A proposal to create an electrical room next to the men's room in the upper concourse would be an ideal location. The electrical room would hold both the backup generator and fuel tank. A fuel pipe line would then link the fuel tank to an outdoor fuel station at the corner of West 3rd Street and Mercer Street. If fuel is needed, fuel truck can make a stop to fuel up the tank.

The electrical room would be located between columns H and J which should provide sufficient space needed. There is no proposal to erect new columns or beams to support the room since there is already an existing structural system in place.





Proposal Site for Backup Generator

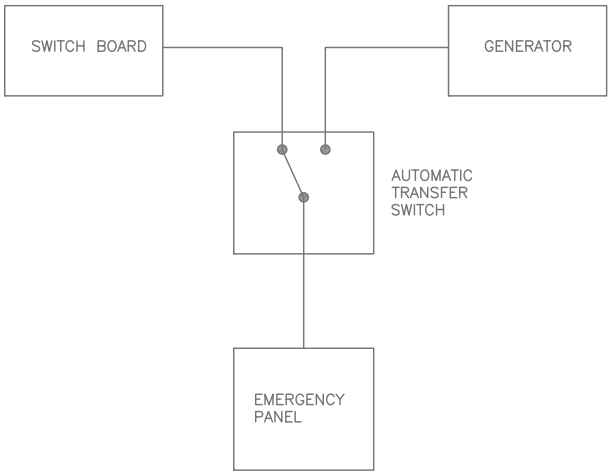


Proposed fuel stop location

Proposed fuel stop behind Tisch Hall

Corner of West 3rd Street and Mercer

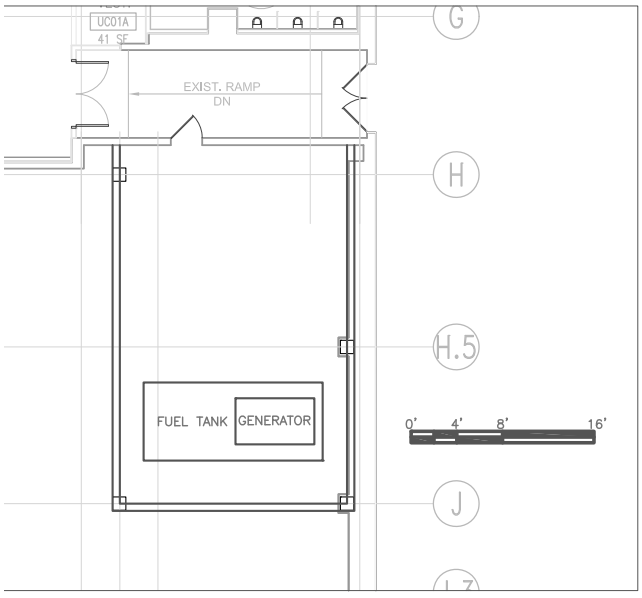
Proposal Site for Backup Generator



Proposed Generator System

The backup generator supplies power when the building power system turns off. The emergency panel sends signals to the automatic transfer switch to utilize the backup generator.

The emergency panel will be in the new electrical room. The automatic transfer switch will be located in electrical closet UC04.



Proposed Electrical Room

Generator:
4BT3.3 Series Engine - DGHE

Transfer Switch:
Transfer Switch OTEC Open

Fuel Tank
Enclosures and Tanks 230-500W

*Information on generator can be found in Appendix E.

Photovoltaic Analysis: Electrical Breadth

New York City is one of the largest cities in the world. The city is a big consumer of electricity compared to many cities. In recent years, New York City has focused on reducing the environmental impact. A study conducted in 2004 estimated that by 2008, New York City would need an extra 3,780 MW of electricity. The city is promoting new initiatives with energy efficient systems to provide electricity and enhance the quality of life for residents in New York City.

In the 2004 New York City Energy Policy prepared by the New York City Energy Policy Task Force, the city encourages various methods of energy efficiency to increase electricity resources. Renewable energy technologies such as solar photovoltaic panels are encouraged to increase the diversity of energy sources away from heavy reliance on fossil fuels.

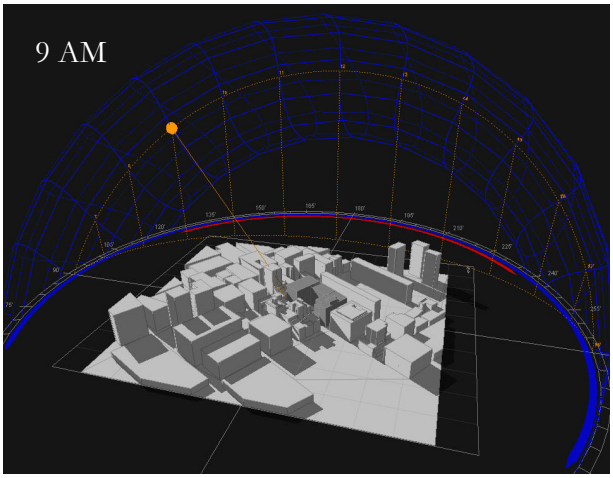
The New York University Concourse Project involves the renovation of the business campus. This electrical breadth study will explore the possibility for NYU to install photovoltaic panels to see if it is economical and beneficial. The study will look at potential places to mount photovoltaic panels. Also, a model of the NYU campus and surrounding buildings will be constructed to see if any of the surrounding buildings will block any sunlight on the rooftop of the NYU building. Last, the analysis will look at the financial benefits of installing photovoltaic panels.

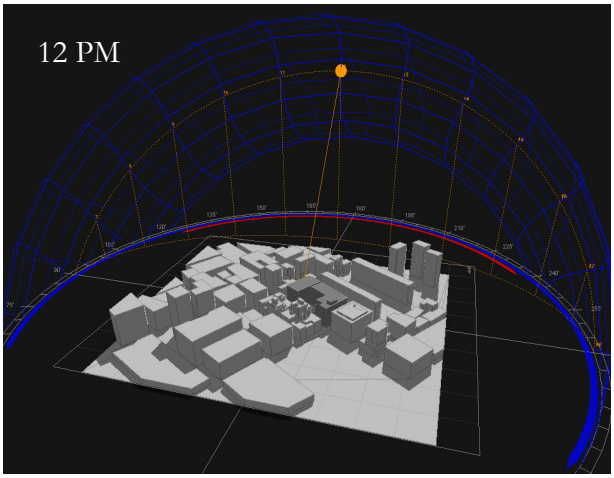
New York University Business Campus

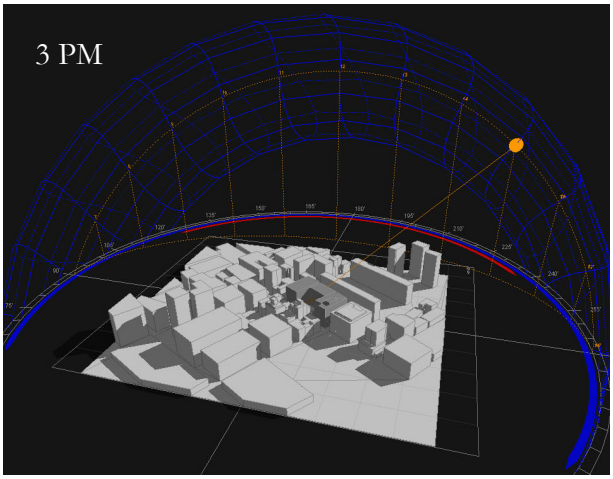
Areas in orange are proposed sites for installation of photovoltaic panels.

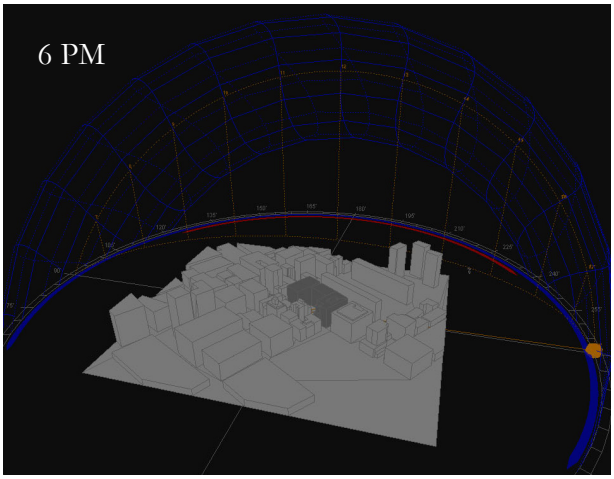
Equinox
September 21 & March 21

NYU buildings in darker gray.
The NYU buildings are Weaver Hall, Tisch Hall, and Kaufman Center.





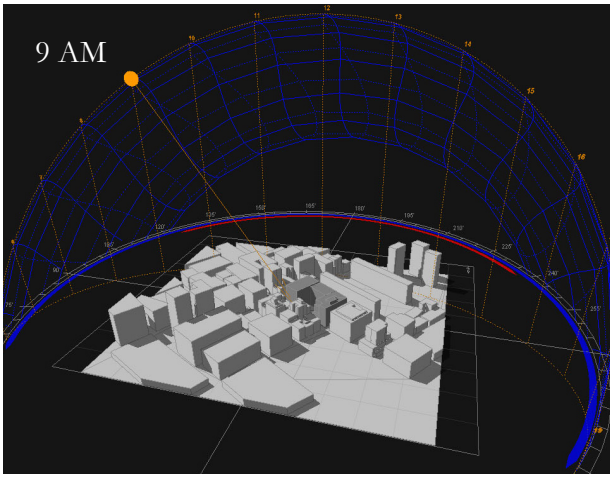


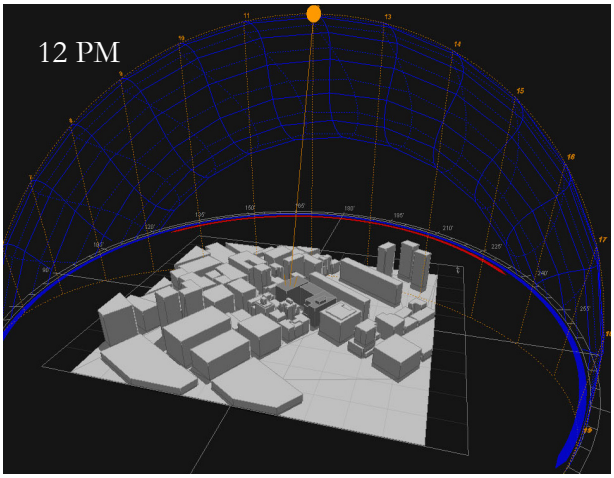


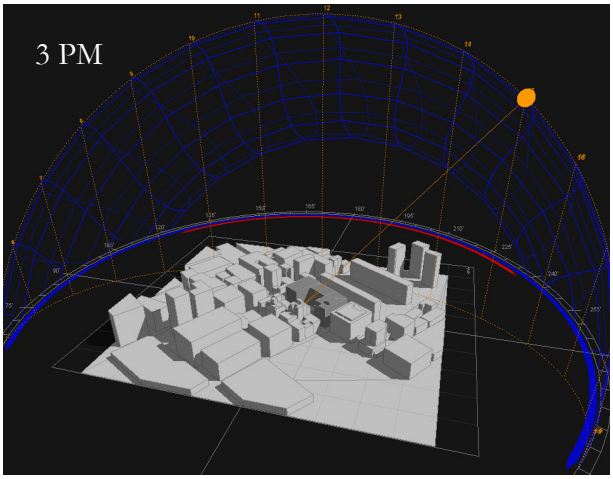
During the equinox, the surrounding buildings does not block any sunlight on the NYU buildings.

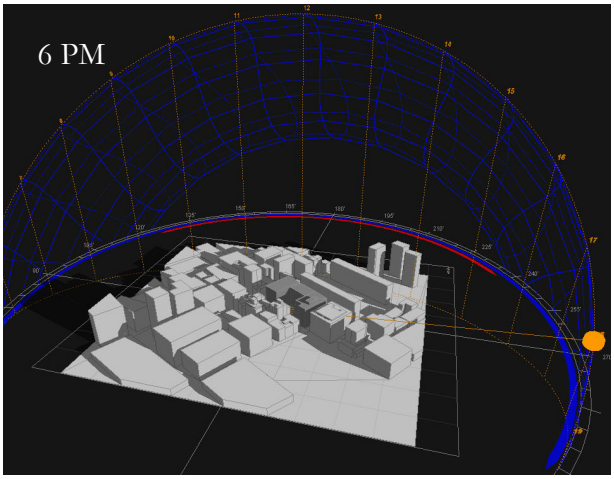
Summer Solstice
June 21

NYU buildings in darker gray.
The NYU buildings are Weaver Hall, Tisch Hall, and Kaufman Center.





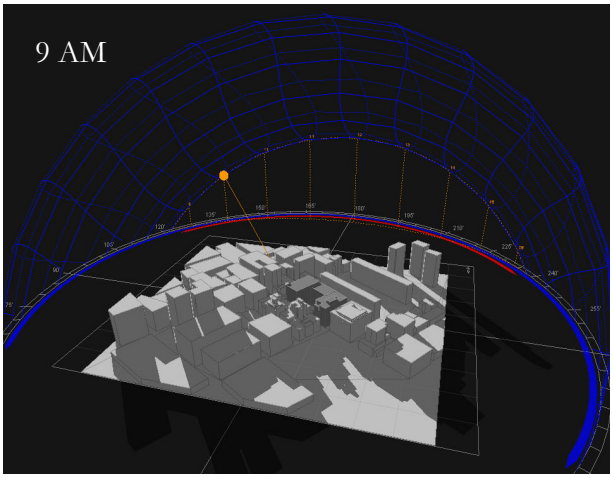


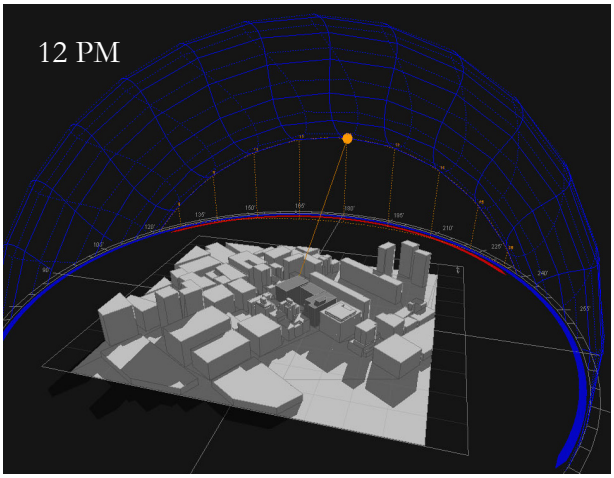


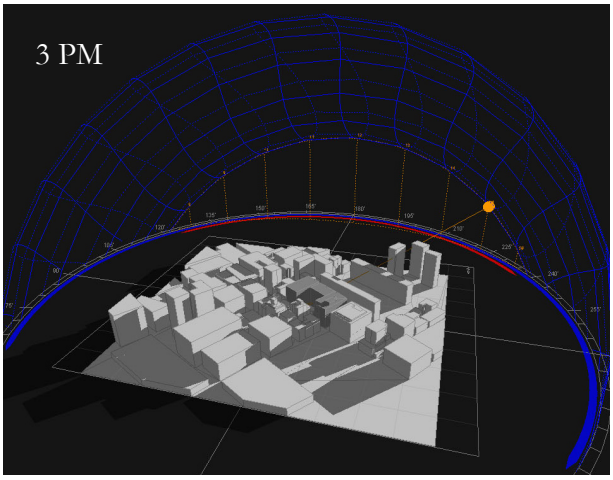
During the summer solstice, the sun is at the highest point. The surrounding buildings does not shade the rooftop of the NYU buildings.

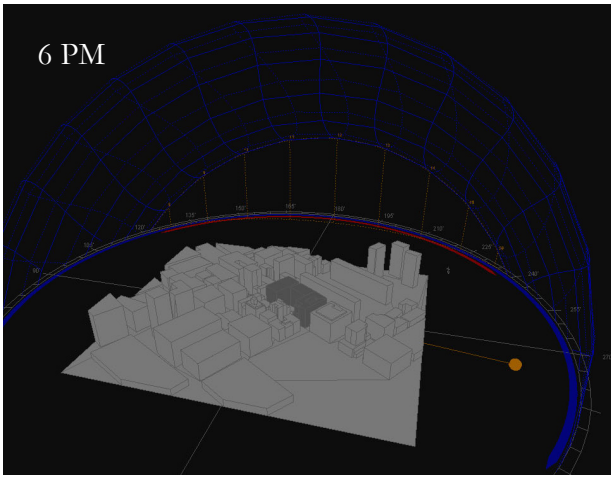
Winter Solstice
December 21

NYU buildings in darker gray.
The NYU buildings are Weaver Hall, Tisch Hall, and Kaufman Center.









During the winter solstice, the sun is at the lowest point. Again, the surrounding buildings do not shade the NYU buildings.

Photovoltaic System

For this study, the BP solar SX3200 is selected to perform the calculations. The BP solar SX3200 is small and produces up to 200W of electricity per panel. The maximum power generated is 278 kW. With rooftops of Weaver Hall, Tisch Hall, and the Kaufman Center utilized, a total of 21057 sq.ft. of space can be installed with photovoltaic panels. A total of 1392 panels is proposed.

PHOTO ARRAY ANALYSIS	
Location	New York City
Coordinates	40:40:11N 73:56:38W
Resource Assessment	
Solar Tracking Mode	Fixed
Slope	45°
Azimuth	315°
Photovoltaic	
Manufacture	BP Solar
Model	bp solar SX 3200
Efficiency	9%
Nominal Operating Temperatu	45°C
Solar Collecting Area	33293 sq. ft.
Miscellaneous Losses	10%

PHOTO ARRAY MOUNTING SPACE	
Space	**Area (sq.ft)**
Weaver Hall	6256
Ticsh Hall	1900
Kaufman Center	19919
Total Space	28075
75% of space used	21056
Photo Array	
Area per photo array	15.125 sq. ft
Number of Panels	1392
Power Generated (W)	278,430
Power Generated	**278 kW**

*Numbers calculated with the RETScreen Clean Energy Project Analysis Software

Grants

There are a number of economic incentive programs provided to help support photovoltaic systems. Some of these programs provide tax cut and state rebates to help pay for the photovoltaic panels.

NYSERDA – PV Incentive Program

The New York State Energy Research and Development Authority provide incentives of $2-$5 per watt (DC) for installation of approved photovoltaic systems. For school, the maximum capacity supported is $5/W up to a maximum of 25 kW per site meter. Incentives will only be available to eligible installers. New York University will quality for the program since Consolidated Edison Company of New York is one of the eligible utilities. Since the NYU photovoltaic panels will produce a maximum of 278 kW of power, the incentive will only cover about 10% of the cost.

- Incentive Type: State Rebate Program
- Eligible Renewable/Other Technologies: Photovoltaic
- Applicable Status: Institutions
- Incentive Amount: $2-$5/watt DC
- Eligible System Size: Schools: 25 kW per site meter
- Program Budget: $38.8 million (2008-2009)
- Potential Incentive: $125,000

NYSERDA – PV Incentive Program

New York State Energy Research and Development Authority (NYSERDA):
Peak Load Reduction Program

The Peak Load Reduction Program aims to reduce demand for electricity during peak periods. The incentive applies for PV systems of 20 kilowatts in size or larger. The performance based incentive targets applications which can reduce energy usage. These include lighting, hvac, chiller, commercial refrigeration, and kitchen equipment and motor loads that would apply for NYU.

- Incentive Type: Peak Load Reduction Program
- Eligible Renewable/Other Technologies: Photovoltaic
- Applicable Status: Institutions
- Incentive Amount: Up to 65% of cost, depends on type of load reducing technology
- Eligible System Size: PV systems 20 kilowatts in size or bigger, depend on load reducing technology
- Program Budget: $37 million (through June 2008)
- Potential Incentive: Depend on load reducing technology

Grants

New York Green Building Tax Credit Program: Corporate and Personal Tax Credits

The New York State passed the green building tax credit in 2000. The green building tax credit applies to owners eligible for building which meet certain 'green standards'. These green standards include increase energy efficiency, improve air quality, and reduce environmental impacts of large commercial buildings. The photovoltaic panels installed at NYU would quality for this program since it strives to produce green energy and help reduce environmental impact.

- Incentive Type: Tax Credit Reduction
- Eligible Renewable/Other Technologies: Photovoltaic
- Applicable Status: Institutions
- Incentive Amount: Varies with project, up to maximum of $2 million
- Eligible System Size: Photovoltaic Program Budget: Program expire at end of 2009

New York City – Property Tax Abatement for Photovoltaic (PV) Equipment Expenditures

The State of New York City enacted legislation to allow property tax abatements for photovoltaic systems for cities with a population over 1 million. NYU would certainly quality for the program.

- Incentive Type: Property Tax Assessment
- Eligible Renewable/Other Technologies: Photovoltaic. System must be located in city with a population of at least 1 million.
- Applicable Status: Institutions
- Incentive Amount: Installed from August 8, 2008 to December 31, 2010: 8.75% of system expenditures per year for 4 years (total of 35%).
- Maximum incentive is $62,5000 annually.
- Eligible System Size: Program expires on Dec 31, 2012

Grants

NYSERDA – Energy $mart New Construction Program

The Energy $mart New Construction Program promotes energy efficient and renewable-energy resource in commercial, industrial, institutional, and family buildings. This program might qualify for NYU. It seems that the program is more directed towards energy efficiency of certain qualified equipment. The program description is a little vague so NYU may be able to qualify for this program.

- Incentive Type: State Rebate Program
- Eligible Renewable/Other Technologies: Passive Solar Space Heat, Geothermal Heat Pumps, Daylighting
- Applicable Status: Institutions
- Incentive Amount: 50-75 % incremental costs, up to $1.65 million for Con Edison customers
- Eligible System Size: $24 million, up to March 31, 2009

Solar Energy Systems Property Tax Exemption

For this program, the property needs to contain a solar, wind, or farm energy system. The systems needs to be approved by the State Energy Research and Development Authority. The property will be specialty assessed to see if it fits the requirement of the building. NYU has a potential chance to be eligible for this program.

- Incentive Type: Property Tax Exemption
- Eligible Renewable/Other Technologies: Photovoltaic Panels
- Applicable Status: Institutions/Commercial
- Incentive Amount: 15 year exemption
- Eligible System Size:

Financial Analysis

PHOTOVOLTAIC POWER SYSTEM		
SYSTEM COMPONENTS	**Material Cost**	**Installation Cost**
PV modules, 200W, 24.5V	1,834,800	116,760
Mounting frame	333,600	31,970
Steel angle support	6,116	144,782
wire	4,670	5,671
AC Disconnect switch	15,707	7,061
Fuses	1,877	1,168
Module connection	1,112	8,896
Combiner box	4,921	3,892
Utility connection	7,645	2,516
Amp fuses	3,350	3,892
Enclosure	111,200	31,275
Inverter	202,245	23,352
Conduit w/fittings & support	11,231	27,077
DC Disconnect switch	29,190	8,618
Cost	**$2,567,664**	**$416,931**
Location Factor (New York City)	1.09	
Total Sum	**$3,253,208**	

*based on RS Means System D5090 430 0100 Photovoltaic Power System. This estimation is based on a grid connected 10kW system. An adjustment factor of 27.8 has being incorporated to adjust the cost for the NYU system.

Grants

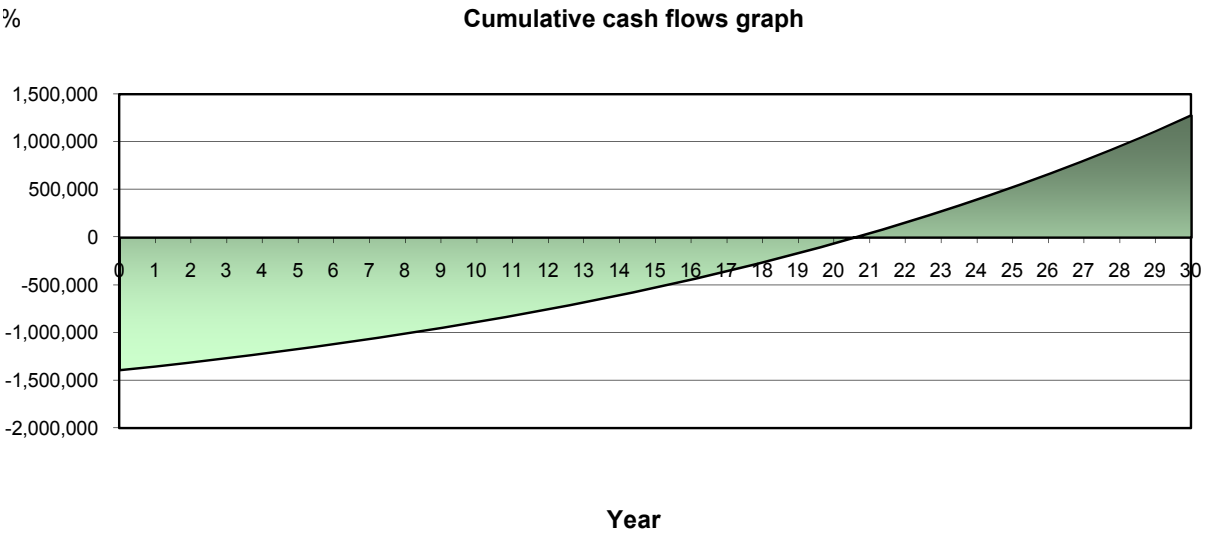
The grants are not guaranteed to go through. Of the six incentive programs, four of them have a high chance of obtaining financial support. The other two will depend on the criteria judged by the city officials. It is estimated that the grant sum would total $1,430,200.

GRANT AND INCENTIVES FOR PHOTOVOLTIC SYSTEM	
Grant	**Incentive ($)**
NYSERDA - PV Incentive Program	125,000
NYSERDA - Peak Load Reduction Program	2,114,585(assume 65% of cost)
New York State Tax Credit Program	200,000 (assumed)
New York City Property Tax Abatement for PV	250,000 (max 4 yrs)
NYSERDA - Energy $smart New Construction	Depends on energy efficient technology
Solar Energy Systems Property Tax Exemption	Need to be approved by NYSERDA
Grant Amount	**$2,689,585**

POWER CONSUMPTION			
Building Type: College Building - Classroom Building 12VA/sq.ft	**Area**	**VA/sq.ft**	**kW**
Power Consumption in building	70,000	12	840
ENERGY EXPORT			
Cost per kWH ($)	**Energy Produced (MWH)**	**Total Demand Cost**	
12.74	300.85	$38,328	

*electricity rate from Con Edison Service Classification No.9 - Rate II - General - Large - Time of Day, New York City, Monday through Friday, 8AM- 10 PM rate. Data from May 2008

Financial Analysis



FINANCIAL ANALYSIS	
Financial Parameters	
Inflation Rate	5%
Project Life	30
Initial Cost	$3,253,208
Incentives and grants	$2,689,585
Annual savings and income	$38,328
Pre-tax IRR - assets	2.60%
Simple payback	**14.7**

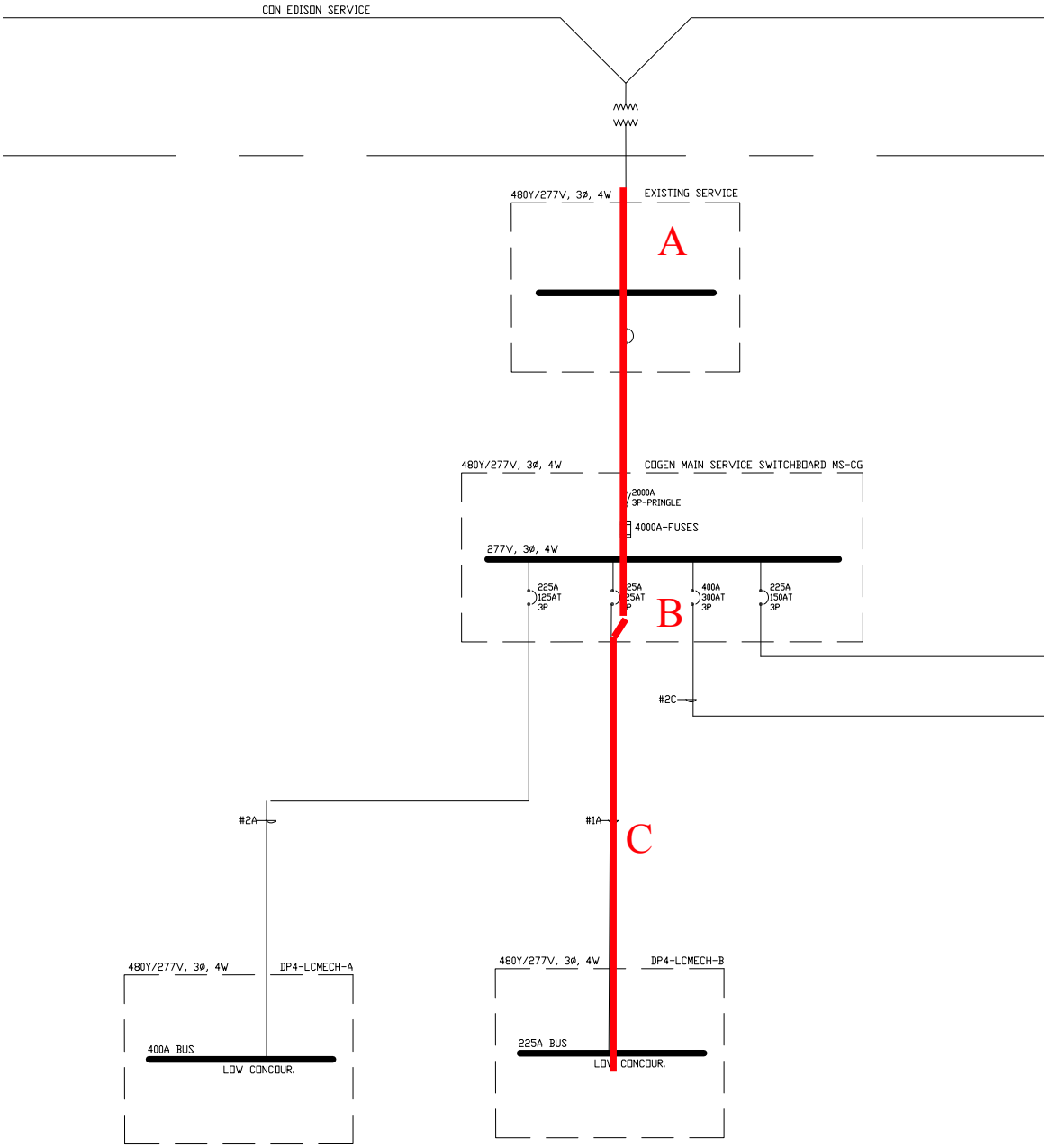
The photovoltaic system is able to generate 278kW of energy, which is equivalent to about 1/3 of the power consumed in Tisch Hall? The payback period for the photovoltaic system is 14.7 years with simple payback. If the six incentive programs can be utilized to the maximum, it would be ideal to install the photovoltaic system. At the current price, it would be very expensive to install the photovoltaic system. If the institution will not be renovated for another 15 years, then the photovoltaic system would be recommend.

Overcurrent Protection Device Coordination Study & Fault Current Analysis

The protective device coordination study involves addressing a single path through the distribution system. The three devices analyzed are the utility transformer, main service co-gen panel, and panelboard DP4-LCMECH-B.

Time current curves of 15A, 225A, and 2000A circuit breakers were overlaid on one graph. The 15A circuit breaker will trip first, followed by the 225A breaker, and then the 2000A circuit breaker.

Fault Current Analysis			
Point	Device	Available Fault Current (A)	Standard Breaker Rating (A)
A	Utility Transformer	15,418A	25,000 A
B	Main Service Co-gen MS-CG	14,657 A	25,000 A
C	Panelboard DP4-LCMECH-B	10,014A	14,000 A


CON EDISON SERVICE
480Y/277V, 3ø, 4W
EXISTING SERVICE
A
480Y/277V, 3ø, 4W
COGEN MAIN SERVICE SWITCHBOARD MS-CG
2000A
3P-PRINGLE
4000A-FUSES
277V, 3ø, 4W
225A
125AT
3P
400A
300AT
3P
225A
150AT
3P
B
#2C
#2A
#1A
C
480Y/277V, 3ø, 4W
DP4-LCMECH-A
400A BUS
LOW CONCOUR.
480Y/277V, 3ø, 4W
DP4-LCMECH-B
225A BUS
LOW CONCOUR.

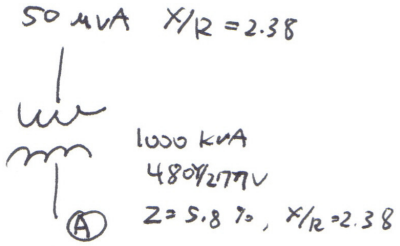
Utility System

50 MVA X/R = 2.38 (assumed)

Utility Transformer

1000 kVA Assumed

Z = 5.8% , X/R = 2.38 (Table 4)



- $Z_{util} = \frac{kV/\sqrt{3} \times 1000}{I_{sc}}\ \Omega = \frac{(0.480V)^2 \times 10^6}{50{,}000\ kVA} = 4.61\ m\Omega$

$R_{util} = Z_{util} \cos(\tan^{-1}\frac{X}{R}) = 4.61 \cos(\tan^{-1} 2.38) = 1.79\ m\Omega$

$X_{util} = Z_{util} \sin(\tan^{-1}\frac{X}{R}) = 4.61 \sin(\tan^{-1} 2.38) = 4.25\ m\Omega$

$R_{xfmr} = \frac{kV^2 \times \%Z \times 10^4 \times \cos(\tan^{-1}\frac{X}{R})}{kVA\ xfmr} = \frac{(0.480V)^2 \times 5.8 \times 10^4 \times \cos(\tan^{-1} 2.38)}{1000\ kVA}$

$= 5.2\ m\Omega$

$X_{xfmr} = kV^2 \times \%Z \times 10^4 \times \sin(\tan^{-1}\frac{X}{R}) = \frac{(0.480V)^2 \times 5.8 \times 10^4 \times \sin(\tan^{-1} 2.38)}{1000\ kVA}$

$= 12.3\ m\Omega$

- Total impedance

$Z_{total} = Z_{util} + Z_{xfmr} = (1.79 + j4.25) + (5.2 + j12.3) = 6.99 + 16.55\ m\Omega$

- $I_{sc} = \frac{V_{line-neutral} \times 1000}{|Z_{total}|} = \frac{277V \times 1000}{\sqrt{(6.99)^2 + (16.55)^2}} =$ **15,418 A @ point A.**

(B) Find fault at main distribution panel (main service to-gen MS-CG)

- Assume feeder from transformer through existing service to Co-gen panel is 70 ft. (Full set drawing of building unavailable since project involves renovation of 3 levels)
- assume also 4 sets of 4-#300 MCM-3"C, THW cu in rigid steel conduit.

Table 1 → R = 3.85 mΩ/100 ft
X_L = 4.14 mΩ/100 ft

$$R_{conductor} = \frac{L}{100} \times R \times \frac{1}{\#\text{ of sets}} = \frac{70'}{100} \times 3.85 \times \frac{1}{4} = 0.674\ m\Omega$$

$$X_{conductor} = \frac{L}{100} \times X_L \times \frac{1}{\#\text{ of sets}} = \frac{70'}{100} \times 4.14 \times \frac{1}{4} = 0.725\ m\Omega$$

- $Z_{\text{co-gen panel}} = Z_{sys} + Z_{feeder}$

$= (6.99 + 16.55\ m\Omega) + (0.674 + j0.725) = 7.664 + 17.275j\ m\Omega$

(6.99 + 16.55 mΩ: previous)

- $I_{sc} = \frac{V_{line\text{-}neutral} \times 1000}{Z_{co\text{-}gen\ panel}} = \frac{277V \times 1000}{\sqrt{(7.664)^2 + (17.275)^2}} =$ **14,659 A @ point B**

(c) find fault at panel DP4-LCMECH-13

panel DP4-LCMECH-13 served by run of 4 #3/0 THW Cu.

assume run is 120'

R = 6.68 mΩ/100 ft
X_L = 4.22 mΩ/100 ft } table 1

$$R_{conductor} = \frac{L}{100} \times R \times \frac{1}{\#\text{ of sets}} = \frac{120'}{100} \times 6.68 \times \frac{1}{4} = 8.02\ m\Omega$$

$$X_{conductor} = \frac{L}{100} \times X_L \times \frac{1}{\#\text{ of sets}} = \frac{120'}{100} \times 4.22 \times \frac{1}{4} = 5.06\ m\Omega$$

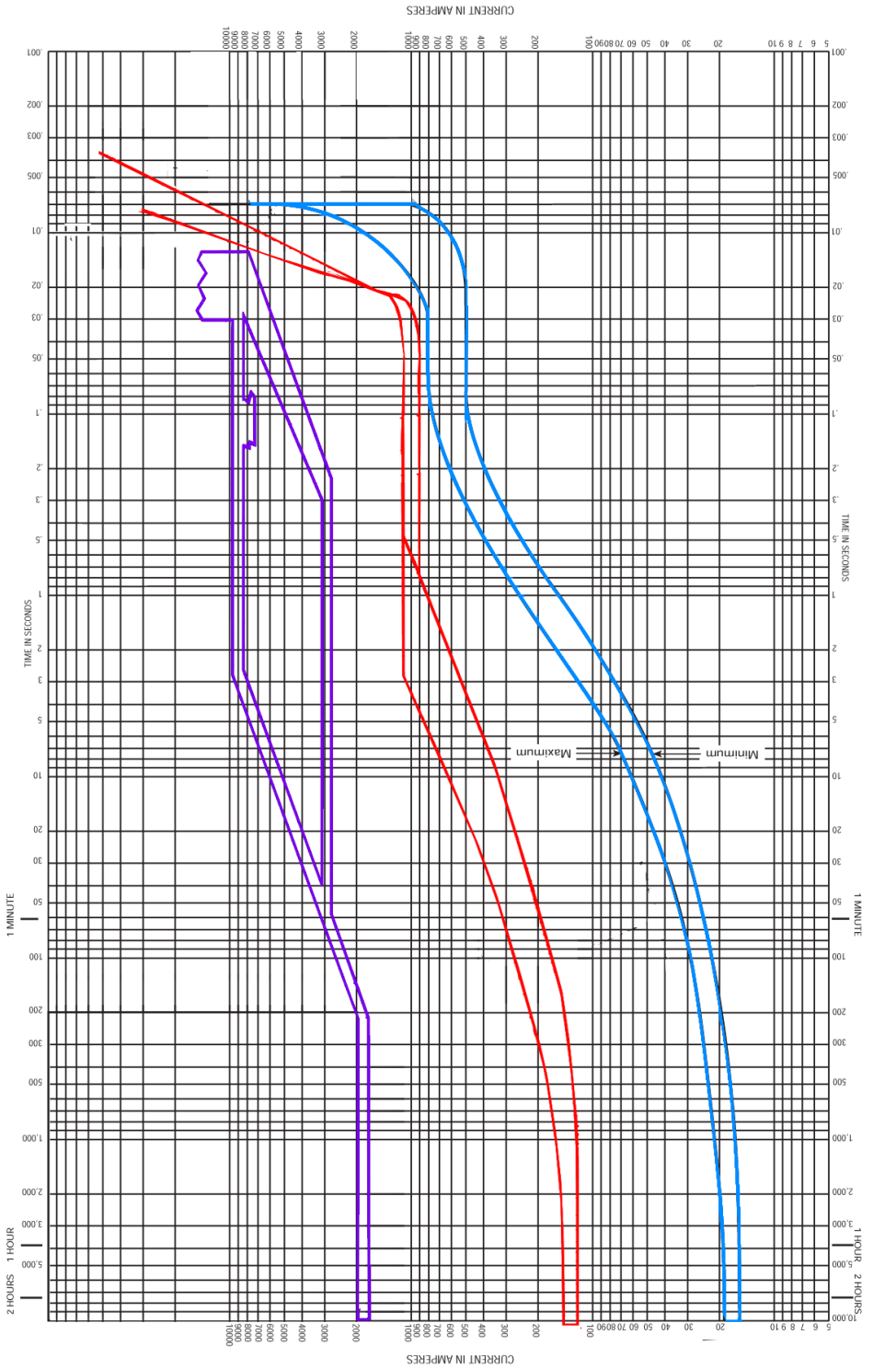
$$Z_{total} = Z_{\text{source panel}} + Z_{\text{feeder}}$$

$$= (7.664 + j17.275\ m\Omega) + (8.02 + j5.06)$$

$$= 15.684 + j22.785\ m\Omega$$

- $$I_{sc} = \frac{V_{line\ neutral} \times 1000}{|Z_{total}|} = \frac{277V \times 1000}{\sqrt{(15.684)^2 + (22.785)^2}}$$

= 10,014 A @ point C, panel PP4-LCMECH-13


CURRENT IN AMPERES
TIME IN SECONDS
Maximum
Minimum
1 MINUTE
1 HOUR
2 HOURS
15A Circuit Breaker
225A Circuit Breaker
2000A Fuse