An Investigation of Alternative Lighting and Electrical Systems With Additional Mechanical and Acoustical Studies



Villanova University: School of Law Villanova, PA

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architecture

- 2 "L-shaped" superimposed plans create a 3-sided courtyard that faces west
- a double height atrium joins the two wings and faces west toward the couryard
- one wing houses classrooms, the atrium, dining facilities, and other student activity areas
- the other wing houses the law library, faculty offices and the chapel

lighting

- lighting system is almost entirely 277V fluorescent lighting
- most spaces utilize occupancy sensors to allow for automatic shutoff
- rooms with a large amount of glazing have photocells to reduce energy use when ample natural light is available
- faculty offices, the library, classrooms and other select spaces are controlled with a time clock to ensure energy is not wasted during off hours

electrical

- service connected to villanova university's 13.2kV underground primary distribution system with a 15kV primary loop switch
- a 1500 kVA, 13.2 kV to 480/277 volt, 3 phase, 4-wire, pad mounted x-fmr located outside
- emergency power provided by a 150 kW, 480/277V, 3ph, 4w, deisel generator (13 hrs)



the people

owner: villanova university general contractor: gilbane

cm: smithgroup architect: smithgroup mep: smithgroup

landscape architect: ml baird & co civil engineer: yerkes associates inc

structural engineer: o'donnell & naccarato inc

the statistics

size: 170,000 sf

levels: 3 above grade/1.5 below grade construction begins: November 2, 2007 owner occupancy: August 20, 2009 project delivery method: GMP

cost: \$56.5M estimated total construction cost



mechanical

- 1 300-ton water-cooled, centrifugal chiller and 1 300-ton two-stage direct fired twostage absorption chiller located in lower level main mechanical room system with a 15kV primary loop switch
- 1 primary, constant volume, endsuction chilled water pump for each chiller
- · 2 secondary chilled water pumps will distribute water at 42 deg F to cooling coils throughout building
- heat will be provided using campus central steam plant

structural

foundations: columns will bear on spread footings columns: wide flange w/ a typical size of W12x72 ground floor: the ground floor will be SOG floor framing: composite structural steel wide flange beams and girders support-

ing light weight concrete on metal

deck

floor framing: w-beams and girders supporting wide rib metal deck

jason a greer | lighting/electrical option www.engr.psu.edu/ae/thesis/portfolios/2008/jag454

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Executive Summary

The Villanova University School of Law thesis project looked at a number of different system redesign and how each would affect the existing systems in the building, the energy properties, the initial and long term cost as well as other construction issues.

The lighting depth focused on the redesign of four spaces in the law school. The four spaces that were redesigned were the courtyard, the atrium, the 135-seat classroom and the moot courtroom. Each design was created in accordance with the criteria set fourth by the IESNA Lighting Handbook and ASHRAE 90.1. The lighting designs for the interior of the building were designed to be flexible, functional educational spaces with an emphasis on some of the key architectural elements. The more exterior spaces were designed to shine like a beacon at night for the rest of the campus to see. As a part of the lighting depth, a daylight study was done for the atrium to determine the benefits of specifying a new glazing system.

The electrical depth focused on the coordination between the new lighting systems and the existing electrical system. This was done through panelboard, feeder, and over-protection sizing. Another area of focus in the electrical depth was the redesign of the distribution system. A more centralized system was explored which implements distribution panels to feed panels rather than lighting and receptacle panels feeding other lighting and receptacle panels. This resulted in a reduction of the number of transformers. A cost analysis was done comparing the new and old systems to determine the best option for the law school. The other areas the electrical depth focuses on are a redesign of the power supply to a rooftop air handling unit that was resized per the mechanical breadth, a payback study to determine the feasibility of implementing energy efficient transformers over standard K-rated transformers and lastly an over-current device coordination study was done on one path through the building.

A mechanical analysis was studied as a breadth topic. The focus of this was determining the mechanical load reduction that resulted from specifying new glass in the atrium. A cost analysis was done to determine how much the new system would cost initially and what kind of energy saving would result.

The final study in this report is an acoustical study that focuses on the 135-seat classroom and the moot courtroom. Initial reverberation time was calculated and materials were modified as a result in an effort to get the reverberation time within the recommended range. Finally, a cost analysis was performed to determine the cost of getting these spaces to fall within the recommended reverberation time range.

Introduction & Background

The Villanova University School of Law is a 170,000 square foot facility that integrates classrooms, student services, a law library, faculty offices, administrative offices, dining facilities and a legal clinic into a single state of the art facility. Construction was set to begin in November of 2007 with owner occupancy being set for August of 2009. Upon completion, the building will provide a centralized space for law students and faculty to complete their work.

Building Overview

Building Name: Villanova University: School of Law

Location and Site: Villanova University campus, Villanova, PA.

Building Occupant: Villanova University: School of Law

Occupancy & Function:

Library, classrooms, student services, faculty and administrative offices, chapel, dining facilities and legal clinic.

Size: 170,000 SF

Number of Stories:

Three stories above grade. Two stories below grade (basement, sub-basement).

Primary Project Team:

Owner: Villanova University General Contractor: Gilbane

CM: SmithGroup Architect: SmithGroup MEP: SmithGroup

Landscape Architect: ML Baird & CO Landscape Architects

Civil Engineer: Yerkes Associates, Inc.

Structural Engineer: O'Donnell & Naccarato, Inc.

Construction Dates: November, 2007 through August, 2009.

Cost Information:

Estimated total construction cost including accepted value engineering: \$56.57M

Project Delivery Method: Guaranteed Maximum Price (GMP)

Architecture:

The building is organized in two "L" shaped plans which create a three sided courtyard that faces west. One wing or "L" is occupied entirely by the law library, faculty offices, and the chapel. The other wing houses the classrooms, the atrium, the dining facility and other student activity areas. The floor to floor height for the law library and offices is a typical 14' while the classrooms on the first, second and third floors have a floor to floor height of 17' which allows for the tiered classrooms.

Major National Codes: IBC 2003

Building Envelope:

Punched windows will be constructed of 5" deep extruded aluminum frames with 1" insulated low-e glazing.

The window-wall system will be constructed of 7.5" aluminum mullions with 1" low-e glazing units and opaque spandrel glass units. Portions of the glazing on the atrium will be fitted with a ceramic frit screen pattern.

The roof will be constructed of a modified bitumen system over corrugated structural roof deck. The steel structure will be sloped to roof drains located along the center bay of each wing. There will be tapered insulation crickets to direct rain water toward drains between collection areas.

The roof assembly will consist of the following:

- Structural steel deck
- 4" rigid insulation pinned to deck
- 1" recover board adhered to insulation
- Modified base sheet adhered to recover board
- Modified roof membrane and cap sheet adhered to base sheet

Structural System:

The structural system consists of spread footings that will bear the columns. The columns are 12" deep wide flange with a typical size of W12x72. The ground floor is SOG while the other floors are typical elevated floor framing and is constructed of composite structural steel wide flange beams and girders supporting 3-1/4" light weight concrete. The concrete is placed on top of composite metal deck with a span width of 8'. The roof framing consists of wide flange structural beams and girders supporting galvanized wide rib metal deck. The steel beams are spaced 6' o.c.

Electrical:

The power distribution system for the Villanova University School of Law is a simple radial system. The electric service is connected to the university's 13.2Kv underground primary distribution system with a 15Kv primary loop switch. The service is provided by a 2000Kva, 13.2Kv primary voltage to 480Y/277V secondary voltage, 3 phase, 4 wire transformer located outside the building. A 3000A, 480Y/277V, 3 phase, 4 wire switchboard is located in the sub-basement and will distribute power to

the building. The switchboard provides power to elevators, the chiller plant, AHUs, and the lighting and receptacle panels. The receptacle panels are supplied through 480V to 208V transformers.

Lighting:

In an ongoing effort to lessen the impact construction has on the environment, the law school utilizes mostly fluorescent lighting. In the larger spaces (i.e. classrooms, lecture spaces, courtrooms and the stacks in the library) fluorescent pendant lighting is used to provide the ambient lighting. In smaller spaces such as faculty offices and egress corridors, recessed compact fluorescent luminaires are used. In areas of interest throughout the building, some incandescent lighting is used. In the hallways, there are coves above each door which are illuminated with tubular fluorescent luminaires that draw your eye to the entrance of the space.

Occupancy sensors are used as a way to ensure that energy is not used during unnecessary times. Some spaces have time switches at the entrance that serve the same purpose. These spaces are mostly spaces that are not used for extended periods of times. Photocells have been utilized in areas with a large amount of glazing. This is yet another way to ensure that all possible energy savings are taken advantage of.

In addition to these localized controls, the building has three lighting control panels that control the times of operation of the lighting throughout the building. Spaces such as offices are turned on at 8 am and shut off at 6 pm, unless of course the occupancy sensor prevents it. The areas that will be used by students for longer periods of time will be switched on at 7 am and shut off at 10 pm. Again this will not affect a space if it is being used because the occupancy sensors will relay that information back to the LCP.

Mechanical Cooling:

The Villanova University School of Law utilizes one 300-ton water-cooled, centrifugal chiller and one 300-ton two-stage direct fired absorption chiller which are located in the lower level main mechanical room. The chilled water system is a primary-secondary system. One primary constant volume, base-mounted, end suction chilled water pump is provided for each chiller. Two secondary, variable volume, base-mounted, end-suction chilled water pumps are provided and each is sized for 100% flow.

Two induced-draft, cross flow, single-cell cooling towers are located on the roof. Each tower serves an individual chiller. One serves the absorption chiller and is sized at 4.0 gpm/ton. The other tower serves the centrifugal chiller and is sized at 2.5 gpm/ton.

Mechanical Heating:

Heat is provided using Villanova University's central steam plant. Steam is provided year round to the facility. A 4-inch, 125 psig steam line enters the main mechanical room on the lower level. The steam line is sized to provide approximately 10,350 MBH or 8,990 lb/hr.

Fire Protection:

The fire alarm system is a solid state, multiplex, addressable fire alarm system that consists of graphic annunciation panels at the entrance lobby. Manual pull stations, audio/visual devices, flow switches, tamper switches and smoke and heat detectors are located throughout the building.

The fire alarm system is connected between the building security system and the campus central security console. The fire alarm system can be monitored through any computer and a printer can output all fire alarm activity. The smoke and heat detectors for the elevator system are interfaced with the elevator controllers for elevator recall and shut down requirements.

Telecommunications:

A duct bank for telecommunication service to the law school is provided from Villanova University's campus telecommunication network. A main telecom demarcation room is located in the basement. Two telecom rooms are located on each additional floor. A complete telecom raceway system consisting of back boxes, conduits, and ladder trays are run throughout the building on each floor.

All voice and data cables are provided by others as part of a separate contract. Card access system equipment is also provided as part of a separate contract.

Finally, a complete security raceway system is provided throughout the building where needed.

Transportation:

The main stair case is located at the meeting point of the two wings of the law school. Located beside this main stair case are the three main elevators that serve all levels. At each end of the two wings there is a small stair case that serves each floor as well. There are no elevators in these areas however.

Lighting Depth

Introduction

The Villanova University School of Law has been designed to be a hub for legal studies. Students and faculty alike will have the privilege to access the brand new law library, moot courtroom, classrooms and computer labs. Aside from learning, there are many student service spaces to be taken advantage of. Because of these excellent features, the law school should be a building that makes a statement both inside and out. Ideally, students and faculty will be welcomed upon arriving at the building through the architecture and lighting, and be in no hurry to leave once inside.

The lighting depth focuses on the creation and analysis of lighting designs for the following spaces:

- 1. Courtyard
- 2. Atrium adjacent to the courtyard
- 3. 135-Seat Classroom
- 4. Moot Courtroom

The lighting analysis for each space discusses goals, design criteria, controls, performance and power density. Each space that was redesign was done so in accordance with the ASHRAE 90.1 space by space method for calculating power densities.

In addition to the analysis for each lighting design, a daylight study is done for the atrium. This space has a significant amount of glazing and as part of the mechanical breadth, that glazing was replaced in hopes of achieving better mechanical performance. The two types of glazing are studied from a daylight standpoint in the lighting section of this report.

COURTYARD

Introduction

Upon arriving at the Villanova University School of Law, the first space one will encounter is the courtyard. The main function of the courtyard is a circulation space. People will mostly walk from their car into the law school through the courtyard. Aside from the circulation of pedestrians, this space has the opportunity to offer a greeting to all guests. The atrium just beyond makes the space quite interesting and inviting. Because of this, the lighting in the courtyard will be subtle, with just enough light to provide adequate security for persons walking through. This will allow the atrium to make its statement.

Space Layout

The following figure illustrates the layout of the courtyard. The bottom of Figure 1.1 would be the parking lot, and one would progress to the building from there.



Figure 1.1.1 – School of Law Courtyard

Architectural Finishes

Walkways



Unfinished Concrete Gray Reflectance: 35%



Unfinished Limestone Tan Reflectance: 35%

Building Façade



Mullions Dark Gray Reflectance: 10%



Brick Beige Reflectance: 39%



Brick Red Reflectance: 24%



Unfinished Limestone Reflectance: 35%



Fieldstone Gray Reflectance: 29%

Target Illuminance Values

Entrance – 5 fc horizontal Walkways – 1-5fc

Design Criteria

Appearance of Space and Luminaires (Important)

This space needs to portray the same excellence that the spaces do inside. The luminaires need to be high quality and architecturally attractive. While the space as a whole must be attractive, the space must not take away from the atrium, which is the true focal point.

• Color Appearance (Important)

Color rendering is important in terms of façade lighting and landscape lighting. The space will be relatively dark, but the accents need to bring out the colors of the materials being accented.

• Daylighting Integration and Control (Somewhat Important)

The lighting should only be on when it is needed.

• Direct Glare (Important)

This will most likely not be an issue because of the luminaires selected. The low height bollards and the high mounted accent lights will not have a glaring effect.

• Light Distribution on Surfaces (Important)

There is a fair amount of glazing so façade lighting will be limited. However, where there is façade lighting, it is important that it gives the intended effect.

• Uniform Light Distribution on Task Plane (Not Important)

The main goal of this space is to provide a safe environment to walk from the parking lot to the building or vice versa. Uniform lighting over the whole space is not necessary.

• Modeling of Faces (Not Important)

This space will rarely be used at night other than for walking purposes. Rarely will a person be in the space for an extended period of time during the evening. The one space people could be for a longer time is near the entrance. In that area, a fair amount of light will be leaking from the atrium which will help with facial rendering.

• Points of Interest (Not Important)

The biggest point of interest in the courtyard will be the glass atrium. This will be illuminated from the inside so there is no need to try to put focus on something else in the space.

• System Control and Flexibility (Important)

It is important that the luminaires in the courtyard are burning only when it is dark out. This is accomplished using a time clock system.

The overall design goal of this space is to provide a space with adequate security lighting and still allow the atrium to dominate. The focus upon arriving at the school of law should be the atrium which lies directly beyond the courtyard.

Luminaire Schedule

Image	Tag	Description	Volt	Manuf.	Cat. No.	L	amp	Mounting
						No.	Type	
	F2a	Recessed	277	Zumtobel	S5D7704-U-7703L-C	2	26W	Recessed
		Downlight					CFL	
		(Wet)						
Ĭ	H1	32" Full	277	Erco	33353.023	1	70W	Surface
		Cutoff					MH	
		Bollard						
	H3	11"	277	Gotham	CW11100MCAR277	1	100W	Wall
		Cylinder					MH	
		Downlight						
and A	H4	Landscape	277	Allscape	S1-51-20MH-PAR20-277-	1	20W	Tree
		Flood			FLD-BK		МН	
^	Н6	Surface	277	Lumiere	710MH39PAR20277WRBK	1	20W	Surface
		Mount					MH	
		Projector						

Table 1.1.1 – Courtyard Luminaire Schedule

^{*}See Appendix A for all ballast, and luminaire cut sheets.

Lighting Layout

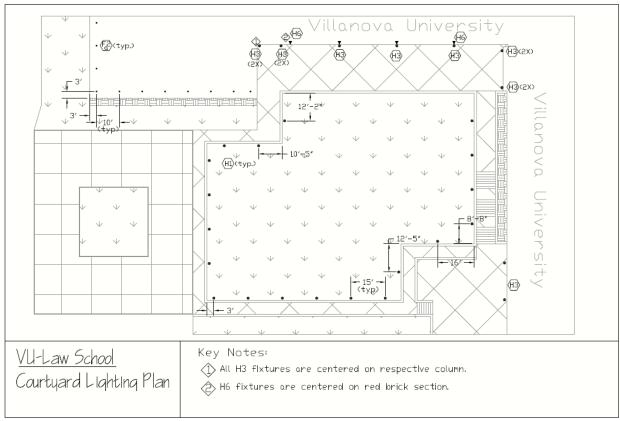


Figure 1.1.2 – Courtyard Lighting Plan Full-size plan located in Appendix B

Controls

The controls for the courtyard are 100 percent time based. As an effort to save energy and reduce electricity costs, all luminaires will be controlled using a time clock. Each day all luminaires will switch on at sunset and switched off at sunrise the next morning. The law school was originally designed with a control panel designated to do the same thing with the exterior lighting and this system will simply be circuited to the existing control system. Please refer to electrical depth page 73 for control details.

Light Loss Factors

Tag	Descr.	Dirt	Exposure	LDD	LLD	BF	LLF
	Recessed						
	Downlight						
F2a	(wet)	Dirty	1 Year	0.80	0.88	0.95	0.67
H1	Bollard	Dirty	3 Years	0.77	0.81	1.00	0.62
	11" Cylinder						
Н3	Downlight	Dirty	3 Years	0.77	0.67	1.00	0.51
	Landscape						
H4	Flood	Dirty	3 Years	0.77	0.71	1.00	0.55
	Surface						
	Landscape						
Н6	Projector	Dirty	3 Years	0.77	0.71	1.00	0.55

Table 1.1.2 – Courtyard Light Loss Factors

Power Density

Room:	Courtyard	Desired WP FC:	1-5fc	
Square Footage:	24014	Ashrae Allow:	0.2	
Total Watts Allowed:	4802.8			
TAG	DESCRIPTION	WATTS	NO. USED	TOTAL WATTS
F2a	Recessed Downlight (Outdoor)	34	11	374
H1	Bollard	94	19	1786
H3	11" Cylinder Downlight	129	13	1677
H4	Landscape Flood	26	7	182
H6	Exterior Surface Mount Projector	53	4	212
TOTAL ROOM WATTS:	3857	Power Density:	0.16	
ROOM WATTS REMAINING:	945.8	Actual to Allowed:	80.31%	

Table 1.1.3 – Courtyard Power Density

The courtyard uses roughly 80 percent of the energy allowed by ASHRAE 90.1. Therefore, this design is acceptable and if there were spaces elsewhere in the building that do not meet their specific power density requirements, the leftover watts from this space would be helpful.

Design Performance

While the safety of pedestrians at night is the number one priority in this space, that can be accomplished with fairly low light levels. The IES recommendation for illuminance levels for a walkway is between one and five foot-candles.

The lighting design for this space was fairly simple. Bollards are used to light the walkway that winds around the grassy area of the courtyard. Façade lighting, and light from inside light the patio. There is a single landscape luminaire mounted in each of the seven trees to provide some accent and more interest to the center of the courtyard.

Courtyard Illuminance Data (fc)									
Patio Near Walkway									
Average	6.01	Average	3.07						
Max	19.4	Max	6.7						
Min	0.9	Min	0.5						
Avg/Min	6.68	Avg/Min	6.14						
Max/Min	21.56	Max/Min	13.4						

Table 1.1.4 – Courtyard Illuminance Data

The farther walkways were not reported in numerical form due to the difficulty of placing a calculation plane on a sloped surface. The illuminance values will be similar to what was reported above based on similar spacing. The next image shows a pseudo color renderings which illustrates all walkways illuminance levels.

Renderings

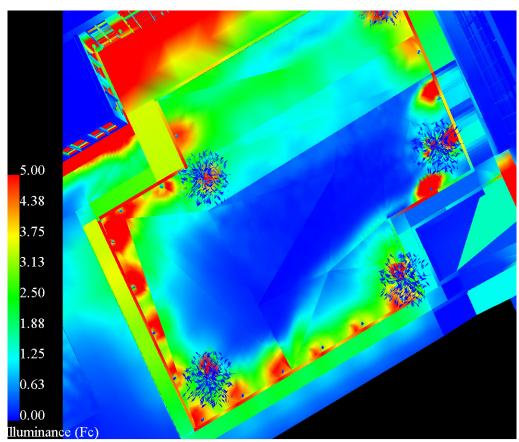


Image 1.1.1 – Courtyard Plan View Pseudo Color Rendering

Image 1.1.1 shows that the walkways are between 1fc and 5fc in most locations.



Image 1.1.2 – View from parking lot

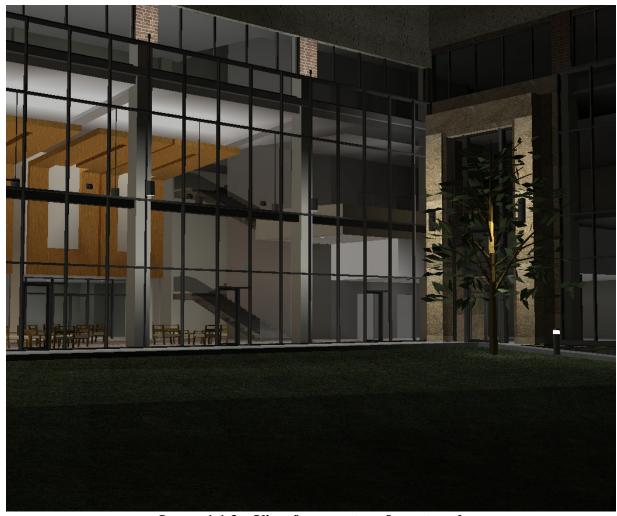


Image 1.1.3 – View from center of courtyard



Figure 1.1.4 – View of entrance



Image 1.1.5 – Raytraced image from center of courtyard

Conclusion

The courtyard successfully provides a safe passage way from the parking lot to the entrance of the law school. The lighting design is subtle enough as to not take away from the glowing atrium just beyond it. The accented trees provide some excitement in the center of the courtyard just before you reach the atrium. This is an exterior that provides the necessary safety lighting while drawing one toward the corner stone of the law school's lighting design.

ATRIUM

Introduction

The atrium is the predominant feature that will be seen when arriving at the law school. In the evening hours, the atrium will glow from within. The atrium will draw attention to the building's entrance and leave no question of where to enter. This space will be used mainly as a transition space as it connects the two wings of the law school. There is some seating in the atrium but the majority of users will simply pass through the space.

Space Layout

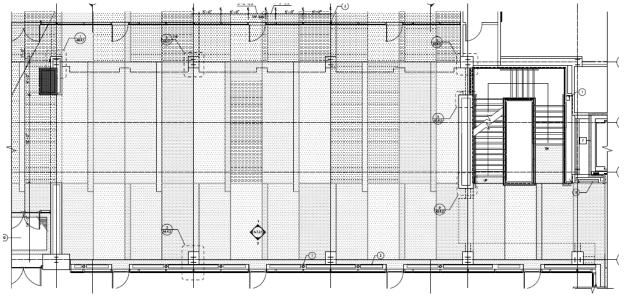


Figure 1.2.1 – Atrium Floor Plan (original floor design)

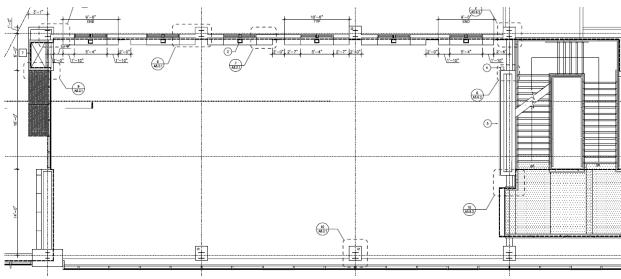


Figure 1.2.2 – Atrium Floor Plan

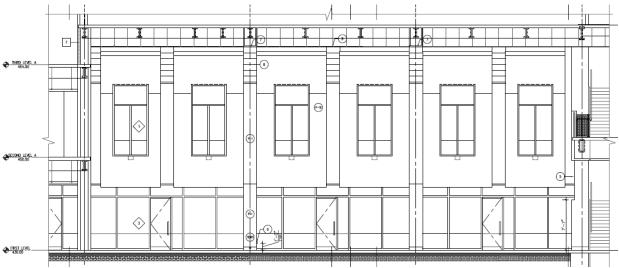


Figure 1.2.3 – Atrium North-West Elevation

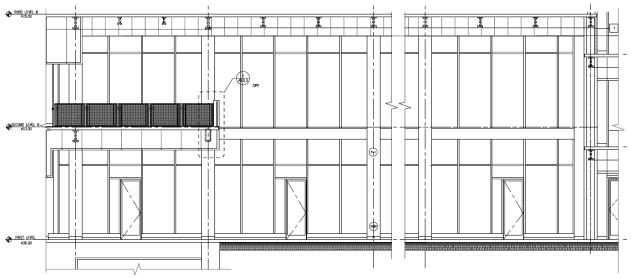


Figure 1.2.4 – Atrium South-East Elevation

Architectural Finishes

Floor



Carpet Beige/Gray Reflectance: 37%

Walls



Painted Gyp Board White Finish: Matte Reflectance: 95%



Painted Gyp Board White Finish: Matte Reflectance: 82%



Wood Paneling Light Stain Reflectance: 42%

Ceiling



Design Goals

The main goal in the atrium is to provide a space that attracts the attention of passersby in the evening hours. The atrium will glow and serve as a beacon of the new campus skyline. The wood panels in the atrium are the predominant feature of the space and will be accented. This space will guide people, both from outside to in, and from wing to wing. Photo sensors will be used to control the lighting when there is ample daylight entering the space.

Target Illuminance Values

Floor – 10 fc (horizontal)

Design Criteria

Appearance of Space and Luminaires (Important)

This space will be the focal point of the law school. The appearance of the space and luminaires is important. The atrium is going to make the first impression to all who enter the law school and all aspects should be attractive.

• Color Appearance (Important)

The color appearance of the space and luminaires is important. There are very prominent wood panels in the space. The luminaires being used have good color rendering characteristics which will allow the wood to be accented properly.

• Daylighting Integration and Control (Important)

This is the space in the building that has the most daylight entering and therefore requires the most control. The daylight entering the space gives the opportunity to shed some lighting load during sunny days but it also provides a problem in terms of lighting lexibility. Shutting off certain lights to allow the natural light to illuminate the space is a must in today's construction world.

• <u>Direct Glare (Somewhat Important)</u>

In a space like this, direct glare is usually not an issue because of the mounting height. In a double high space, it will be hard to have direct glare because of the distance away from the people in the space as they will not likely be looking straight up very often. However, it has to be addressed that the people overlooking the space may have a more direct line of sight to the light sources. In that case, direct glare must be considered more closely.

• Light Distribution on Surfaces (Very Important)

The surfaces in this space need to be illuminated correctly to avoid undesired results. The wood on the walls needs to be illuminated well in order to allow the wood to stand out and compliment the rest of the room in the desired way. Lighting the surfaces is also what is going to allow the atrium to glow at night and be seen from the outside.

The glass façade is a surface that should also be addressed. It is important that the light that is intended to bring out the architecture does not produce strong reflections and glaring situations. Strong glare and reflections can ruin the comfort of any space.

• Uniform Light Distribution on Task Plane (Somewhat Important)

The task plane in this space is going to be the floor. The floor obviously needs enough light to for people walk through the space comfortably and most importantly safely. Because people will either be walking through or reading leisurely, the ambient light level can be lower than it would be for typical reading tasks (approximately 10 fc) and does not need to be totally uniform.

Secondly, this is a space that will serve as a relaxing space in the evenings and uniform light levels will not provide such a space. Non-uniform lighting along the periphery will provide the greatest degree of relaxation.

• Points of Interest (Important)

The points of interest in the atrium are the wood panels that will be accented. From the outside, the atrium as a whole will be serving as the point of interest.

• Surface Characteristics (Important)

The amount of wood in this space requires attention. Illuminating the wood will be attractive to those in the space, but more importantly allow the space to glow from the outside and draw the attention of those passing by.

• System Control (Important)

It is important that this space be controlled when it comes to daylight. With the large amount of glazing, many times throughout the year, the lights in this space will not need to be switched on. Automatic switching will be done using photo sensors.

Luminaire Schedule

Image	Tag	Description	Volt	Manuf.	Cat. No.	L	amp	Mounting
						No.	Type	
	F2	Recessed Downlight	277	Zumtobel	S5D-U-6308R-C	1	32W CFL	Recessed
	F5	Cove Light	277	Lightolier	CL-1-4-T5-2	1	28W T5	Surface
	F8	Recessed Linear Fluorescent WW	277	Focal Point	FAVA-NS-1T5-1C- 277-S-F	1	28W T5	Recessed
	H2	11" Cylinder Downlight	277	Gotham	CW11100MCAR277	1	100W MH	Pendant
	H5	Surface Mount Projector	277	Se'lux	PRO20-SM- HO70T6-830-BK- 277-FG	1	70W CMH	Surface

Table 1.2.1 – Atrium Luminaire Schedule

Lighting Layout

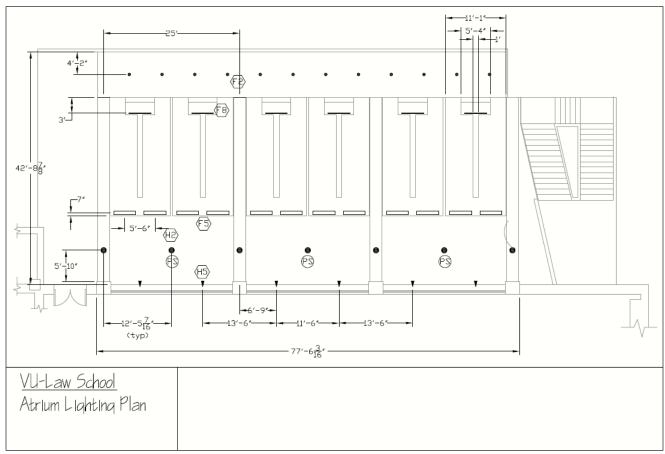


Figure 1.2.5 – Atrium Lighting Layout

Controls

The atrium is controlled using a dimming controller with a photo sensor such as the WattStopper LightSaver LCD-203 Dimming Controller. This dimmer can control three zones each of which can be dimmed or switched. The pendant HID fixtures will be simply switched on or off depending on the amount of daylight in the space. The fluorescent lighting will dimmed based on the daylight. Please refer to electrical depth page 85 for control details.

Light Loss Factors

Tag	Descr.	Cat.	Class	Dirt	Cleaning	LDD	RSDD	LLD	BF	LLF
	Recessed									
F2	Downlight	VI	Direct	Clean	12 mos.	0.88	0.98	0.84	0.95	0.69
			Indirect							
F5	Cove Light	V		Clean	12 mos.	0.88	0.92	0.92	1.00	0.74
	Recessed									
	Linear									
	Fluorescent									
F8	WW	V	Direct	Clean	12 mos.	0.88	0.97	0.92	1.00	0.79
	11" Cylinder									
H2	Downlight	IV	Direct	Clean	12 mos.	0.88	0.97	0.72	1.00	0.62
	Surface									
	Mount									
H5	Projector	V	Direct	Clean	12 mos.	0.88	0.97	0.71	1.00	0.61

Table 1.2.2 – Atrium Light Loss Factors

Power Density

Room:	Atrium	Desired WP FC:	10	
Square Footage:	3274	Ashrae Allow:	1.2	
Total Watts Allowed:	3928.8			
TAG	DESCRIPTION	WATTS	NO. USED	TOTAL WATTS
F2	Recessed Downlight	36	12	432
F5	Cove Light	34	12	408
F8	Recessed Linear Fluor. Wall Wash	37	6	222
H2	11" Cylinder Downlight	129	7	903
H5	Surface Mount Projector	94	6	564
TOTAL ROOM WATTS:	2529	Power Density:	0.77	
ROOM WATTS REMAINING:	1399.8	Actual to Allowed:	64.37%	

Table 1.2.3 – Atrium Power Density

The atrium uses roughly 65 percent of its allowed 3929 watts. By hitting the target illuminance levels and obtaining the intended design while staying under the required power density the law school can either use those watts in another space that needs them, or it can simply use the unused watts to lessen its environmental impact.

Design Performance

The target illuminance level for the atrium was 10fc. Since the space is used primarily as a transition space, a low light level is acceptable. In order for the space to glow from within during the evening hours, illumination of surfaces was an important design criterion. The wood panels were highlighted using spot lights will allows them to be quite visible from outside at night.

Because of the high ceiling, some HID fixtures were necessary to allow sufficient light to strike the floor. Because of this, the ability to dim the entire space was lost but those luminaires can simply be switched off at certain times.



Figure 1.2.6 – Illuminance Contours

Atrium Illuminance Data (fc)							
Floor							
Average	12.07						
Max	22.6						
Min	3						
Avg/Min	4.02						
Max/Min	7.53						

Table 1.2.4 – Atrium Illuminance Data

The target illuminance on the atrium floor was reach with the proposed lighting design.

Renderings

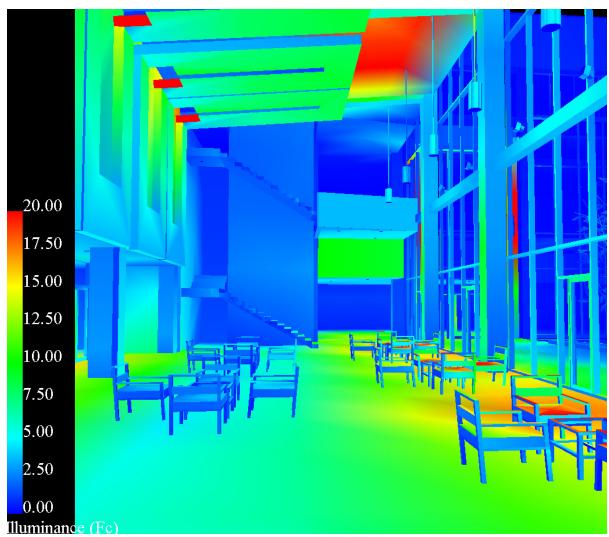


Image 1.2.1 – Atrium Pseudo Color Rendering



Image 1.2.2 – Raytraced image looking into atrium



Image 1.2.3 – Raytraced image inside atrium

Conclusion

The lighting design for the atrium allows it to be used as a transition space or a place to relax. The low light levels provide a nice atmosphere to be in while allowing people passing through to get to their destination easily. The ends of the space are bright which will draw pedestrians through the space.

From the outside, the atrium does what it was designed to do: grab peoples' attention. The illuminated surfaces really glow at night from the outside which makes the space interesting and inviting.

ATRIUM DAYLIGHT STUDY

Introduction

It will be seen later in this report that the glass in the atrium was studied as a way to reduce heating and cooling loads. After that was completed, it became clear that it was necessary to see how the new glazing would affect the direct daylight entering the space at various times of the year. The atrium faces south-east which would raises a concern about sunlight penetration into the space at certain times of the year. The daylight study focuses strictly on direct daylight (i.e. clear sky). The days that were studied were March 20, June 21, September 21, and December 21. Each day was studied at 9am, 12pm, and 3pm.

The study focuses on direct sunlight entering the space and how that affects illuminance levels. Also, the glare in the space was looked at in a qualitative manner.

	Original Atrium Glazing											
		Transmittance				Reflectance			E U-Value			
		Vis.	Solar	Ultra-	Vis.	Vis.	Solar	Winter	Summer	Shading	Relative	
Viracon No.	Description	Light	Energy	Violet	Light-Ext.	Light-Int.	Energy	Night	Day	Coeff.	Heat Gain	Area (SF)
VRE 1-38	Solarscreen (clear)	36%	19%	12%	44%	21%	46%	0.25	0.21	0.26	55	880
VRE 1-38 Frit	Silkscreen (dots)	25%	13%	7%	40%	25%	13%	0.30	0.26	0.21	46	2592
VE 1-2M w/												
Metallic Opac	Spandrel	0%	Not Avail.	Not Avail.	Not Avail.	Not Avail.	Not Avail.	0.07	0.07	N/A	Not Avail.	674
					New Atrium	Glazing						
·			Transmitta	ince		Reflectance	•	ASHRA	E U-Value			
		Vis.	Solar	Ultra-	Vis.	Vis.	Solar	Winter	Summer	Shading	Relative	
Viracon No.	Description	Light	Energy	Violet	Light-Ext.	Light-Int.	Energy	Night	Day	Coeff.	Heat Gain	Area (SF)
VRE 7-38	Solarscreen (clear)	28%	11%	9%	28%	21%	14%	0.25	0.21	0.19	41	880
VRE 1-38 Frit	Silkscreen (dots)	19%	8%	5%	26%	24%	13%	0.30	0.26	0.17	37	1795
VE 1-2M w/												
Metallic Opac	Spandrel	0%	Not Avail.	Not Avail.	Not Avail.	Not Avail.	Not Avail.	0.07	0.07	N/A	Not Avail.	1471

Table 1.3.1 – Atrium Glazing Comparison *See Appendix E for Glazing Cutsheets

Original Glazing – March



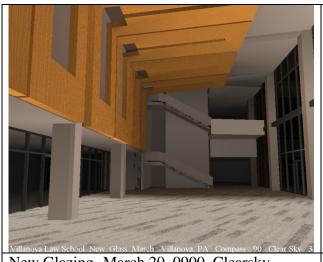
Original Glazing- March 20, 1500, Clearsky

Images 1.3.1,2,3 – March 20th Daylighting w/ Original Glazing

	Original Glazing - March 20th Illuminance Data								
090	0	120	00	15	00				
Average	663.73	Average	788.96	Average	36.92				
Maximum	1952.00	Maximum	2845.00	Maximum	4639.00				
Minimum	8.70	Minimum	8.20	Minimum	0.20				
Avg/Min	76.29	Avg/Min	96.21	Avg/Min	184.60				
Max/Min	224.32	Max/Min	346.93	Max/Min	23194.00				

Table 1.3.2 – March Original Glazing Illuminance Data

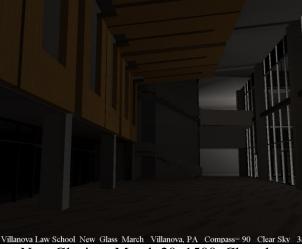
New Glazing – March





New Glazing- March 20, 0900, Clearsky

New Glazing- March 20, 1200, Clearsky



New Glazing- March 20, 1500, Clearsky

Images 1.3.4,5,6 – March 20th Daylighting w/ New Glazing

New Glazing - March 20th									
	Illuminance Data								
0900 1200 1500									
Average	456.24	Average	506.98	Average	26.40				
Maximum	1491.00	Maximum	2179.00	Maximum	4625.00				
Minimum	6.50	Minimum	3.90	Minimum	0.10				
Avg/Min	70.22	Avg/Min	129.99	Avg/Min	264.00				
Max/Min	229.38	Max/Min	558.72	Max/Min	46248.00				

Table 1.3.3 – March New Glazing Illuminance Data

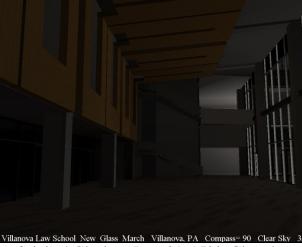
Original Glazing – June





Original Glazing- June 21, 0900, Clearsky

Original Glazing- June 21, 1200, Clearsky



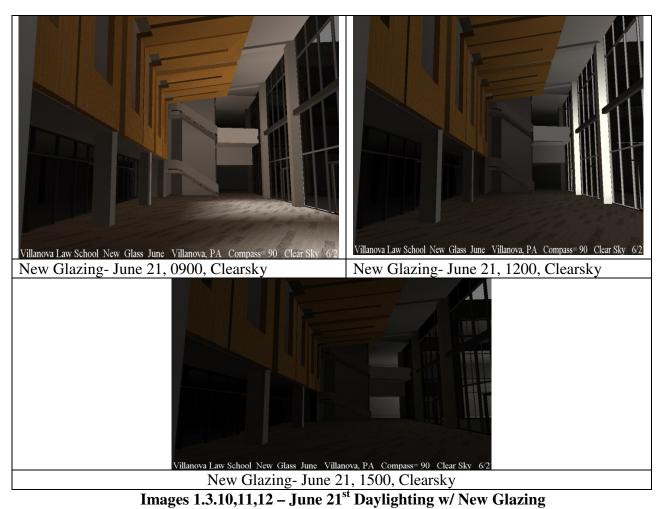
Original Glazing- June 21, 1500, Clearsky

Images 1.3.7,8,9 – June 21st Daylighting w/ Original Glazing

Original Glazing - June 21st					
Illuminance Data					
0900		1200		1500	
Average	296.00	Average	182.25	Average	30.29
Maximum	2432.00	Maximum	8884.00	Maximum	88.70
Minimum	0.60	Minimum	0.10	Minimum	0.10
Avg/Min	493.33	Avg/Min	1823.00	Avg/Min	302.90
Max/Min	4053.00	Max/Min	88839.00	Max/Min	887.00

Table 1.3.4 – June Original Glazing Illuminance Data

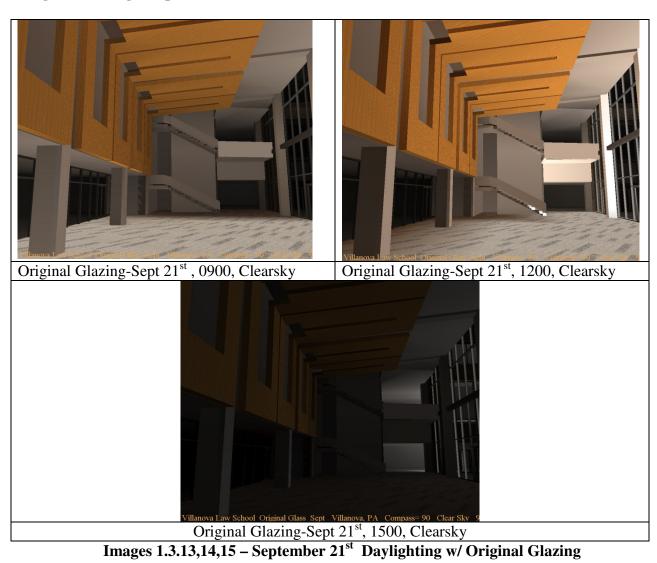
New Glazing – June



New Glazing - June 21st									
Illuminance Data									
090	00 12	00	1500						
Average	190.68 Average	105.35	Average	21.61					
Maximum	1871.00 Maximum	8871.00	Maximum	68.20					
Minimum	0.50 Minimum	0.10	Minimum	0.10					
Avg/Min	381.36 Avg/Min	1054.00	Avg/Min	216.10					
Max/Min	3743.00 Max/Min	88711.00	Max/Min	682.00					

Table 1.3.5 – June New Glazing Illuminance Data

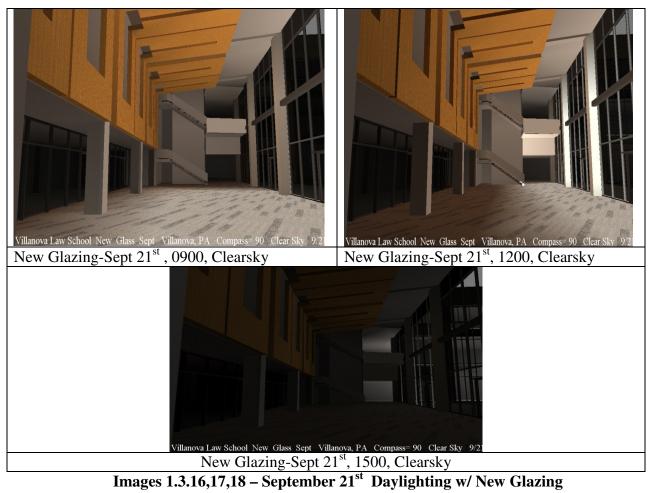
Original Glazing – September



Original Glazing - September 21st Illuminance Data								
090	00	120	00	1500				
Average	794.90	Average	682.48	Average	33.54			
Maximum	2052.00	Maximum	2856.00	Maximum	4209.00			
Minimum	24.70	Minimum	6.60	Minimum	0.10			
Avg/Min	32.18	Avg/Min	103.41	Avg/Min	335.40			
Max/Min	83.06	Max/Min	432.67	Max/Min	42085.00			

Table 1.3.6 – September Original Glazing Illuminance Data

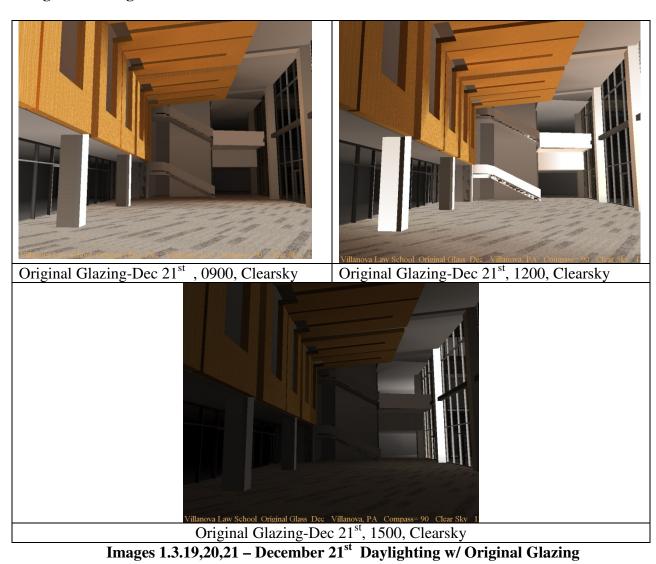
New Glazing – September



	New Glazing - September 21st Illuminance Data									
090	0	120	00	15	00					
Average	526.58	Average	442.46	Average	24.41					
Maximum	1562.00	Maximum	2193.00	Maximum	4202.00					
Minimum	3.20	Minimum	3.80	Minimum	0.10					
Avg/Min	164.56	Avg/Min	116.44	Avg/Min	244.10					
Max/Min	488.09	Max/Min	577.05	Max/Min	42022.00					

Table 1.3.7 – September New Glazing Illuminance Data

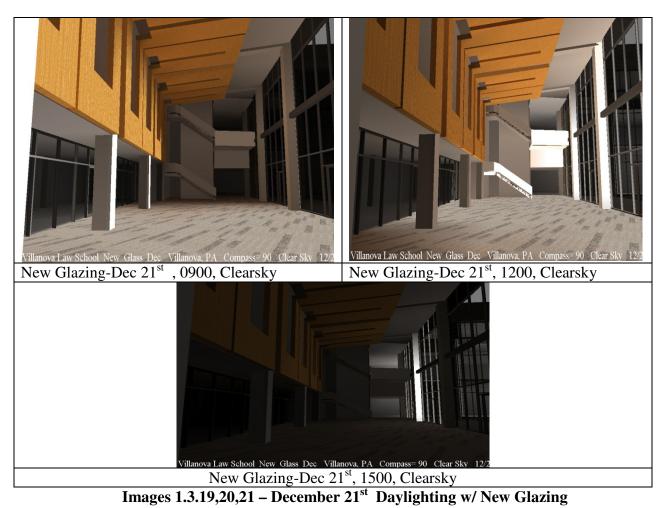
Original Glazing – December



Original Glazing - December 21st Illuminance Data									
0900)	12	200	15	500				
Average	382.62	Average	766.31	Average	38.70				
Maximum	818.00	Maximum	1725.00	Maximum	506.00				
Minimum	10.00	Minimum	25.20	Minimum	0.20				
Avg/Min	38.26	Avg/Min	30.41	Avg/Min	193.50				
Max/Min	81.76	Max/Min	68.47	Max/Min	2530.00				

Table 1.3.8 – December Original Glazing Illuminance Data

New Glazing - December



New Glazing - December 21st									
Illuminance Data									
0900		120	00	150	00				
Average	286.23	Average	550.30	Average	27.27				
Maximum	618.00	Maximum	1320.00	Maximum	387.00				
Minimum	7.50	Minimum	16.00	Minimum	0.20				
Avg/Min	38.16	Avg/Min	34.39	Avg/Min	136.20				
Max/Min	82.35	Max/Min	82.53	Max/Min	1937.00				

Table 1.3.8 – December New Glazing Illuminance Data

Daylight Analysis

In each case, the new glazing system lowers the illuminance level on the floor of the atrium. Also, in each case, the new glass prevents the direct sunlight from penetrating as deeply into the space as it did with the original glazing system. Looking at the images of the original glazing versus the new glazing, one can imagine that the new glazing system would make the atrium more comfortable to sit in. Both the lower illuminance levels and shallower penetration would result in a less harshly daylight lit space.

Also, with the original glazing, particularly in December, the direct sunlight reaches the coffee bar and seating areas which are directed adjacent to the atrium. The new glazing system prevents that which would make for a more comfortable experience for the people who are in the rooms next to the atrium.

Overall, the new glazing system performs better when it comes to daylighting. Later in this report, mechanical loading is addressed along with cost analysis of the new glazing system. At that time, this report will weigh the cost versus benefits of this new glazing system.

135-SEAT CLASSROOM

Introduction

The 135-seat classroom is the largest lecture space in the law school. The space is laid out in a "U-shape" which allows for a lot of seating without forcing the back row to be very far from the front. The seating in the space is tiered to allow for clean sight lines. In the front of the space there is a large presentation area equipped with a retractable projection screen and permanent white boards. This space will provide several different functions for the law students. The functions include: lecturing, presenting, classroom discussion and reading tasks such as exam taking.

Space Layout

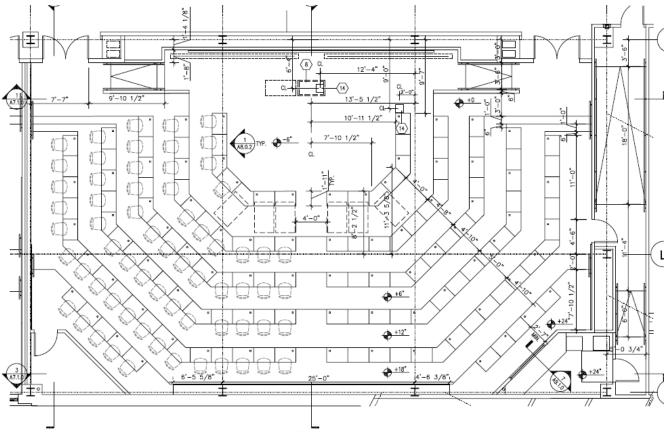


Figure 1.4.1 – 135-Seat Classroom Floor Plan

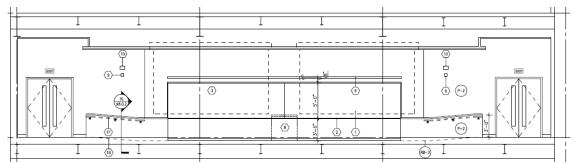


Figure 1.4.2 – 135-Seat Classroom Front Elevation/Section

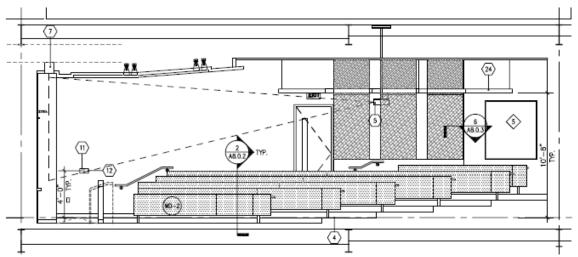


Figure 1.4.3 – 135-Seat Classroom North Elevation/Section

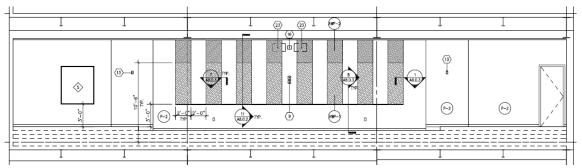


Figure 1.4.4 – 135-Seat Classroom Back Elevation/Section

Architectural Finishes

Floor



Carpet Blue/Gray Reflectance: 33%

Walls



Painted Gyp Board Heron White Finish: Matte Reflectance: 85%



Acoustical Fabric Tan Reflectance: 54%



Wood Framing Dark Stain Reflectance: 14%

Ceiling



Painted Gyp Board Heron White Finish: Matte Reflectance: 85%



Acoustical Ceiling Tile White Reflectance: 89%

Desks



Wood Dark Stain Reflectance: 14%

Design Goals

The goal for the lighting system in the large classroom is to provide a functional space that is flexible and user friendly. The lighting system should provide the required illuminance values, allow each task to be completed comfortably, and be able to be changed by any user desiring to do so. Aside from meeting the required lighting levels, the system should be attractive and add to the excellence of the law school.

Target Illuminance Values

Work Plane (Desks) – 30 fc (horizontal) White Board – 5 fc (vertical)

Design Criteria

• Color Appearance (Very Important)

Color appearance is very important in this space because of the amount of wood that is present in the architecture. In order to show off the sharpness of the medium-toned wood, a high CRI is needed.

• Daylighting Integration and Control (Not Important)

This space has no glazing and therefore no daylight.

• <u>Direct Glare (Very Important)</u>

This space is a reading intensive space and therefore it is important that the students can read comfortably without having to strain their eyes as a result of direct glare. Also, when the students are looking from the tiered seats, if the intensity of light from high angles is too high, the students will again be straining to shield their eyes while they gaze upon the instructor in the front of the room.

• Flicker (Not Applicable)

This problem is mostly applicable to HID sources and older fluorescent sources. As this is new construction, new fluorescent technology does not present a problem in this area.

• <u>Light Distribution on Surfaces (Important)</u>

Again, because of the amount of wood in the space, light distribution on those wood surfaces is important. Also, the white boards in the front of the room will require light to be distributed evenly to allow all students in the room the opportunity to read the boards easily.

<u>Uniform Light Distribution on Task Plane (Important)</u>

This criterion is important because of the amount of work that takes place on the desk tops. These tasks include taking notes, taking exams, reading from text books and perhaps typing on a laptop.

Modeling of Faces (Important)

This is somewhat important in the entire room but mostly important in the front of the room where the instructor will be standing. The students will need to be able to see the instructor and it is much more pleasant to see a face that is illuminated from the front as opposed to straight down because of the strong shadows strong downlight cast on the face.

Points of Interest (Somewhat Important)

This room does not have many points of interest, but it may be possible to accent the acoustical panels on the wall since they are a darker color than the adjacent walls and would allow yet another way to bring the wood in the room out. Lighting these in a strategic manner could add to the overall look of the room.

Surface Characteristics (Important)

This will be important on surfaces with texture. Accenting the acoustical panels will add an interesting element while breaking up the painted wall.

System Control and Flexibility (Important)

This is important as this room has the potential to be used in multiple ways. The room will most often be used for lectures. These lectures could be based around the whiteboard which will require a high level to allow all occupants to read what has been written. Lectures can also be presented with the help of projector, and in this case the lighting levels will have to be reduced to allow for the audience to see the screen. Lastly, if the lecture takes the form of a demonstration, different light levels may be desired than the other two scenarios. Automatic shut-off will be provided using occupancy sensors to comply with ASHRAE 90.1.

VDT Use (Somewhat Important)

This space has potential for laptop use which will require a limitation of high light angles.

Luminaire Schedule

Image	Tag	Description	Volt	Manuf.	Cat. No.	L	amp	Mounting
						No.	Type	
>	F1	Direct/Indirect Pendant	277	Zumtobel	AQ-2545-4-T-DS-U-C1	2	28W T5	Pendant
	F2	Recessed Downlight	277	Zumtobel	S5D-U-6308R-C	1	32W CFL	Recessed
	F3	Recessed Downlight WW	277	Zumtobel	S5D-U-7309HW-C	1	42W CFL	Recessed
	F4	Board Light	277	Insight	VO-T51-KXS-8-277-N- PLV	1	28W T5	Wall
	F5	Cove Light	277	Lightolier	CL-1-4-T5-2	1	28W T5	Surface

Table 1.4.1 – 135-Seat Classroom Luminaire Schedule

Lighting Layout

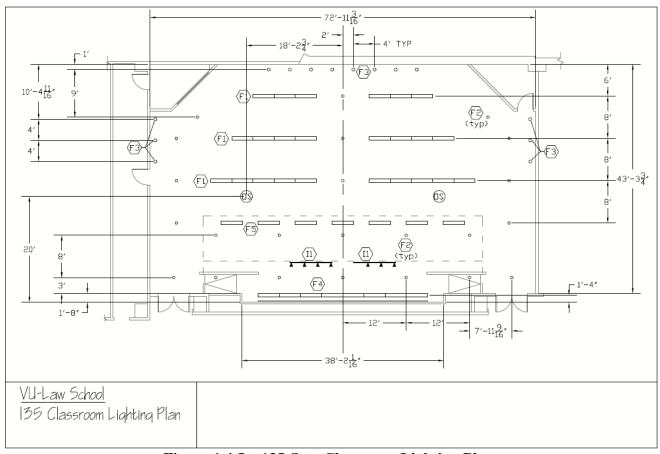


Figure 1.4.5 – 135-Seat Classroom Lighting Plan

Controls

The controls in the 135-seat classroom will consist of occupancy sensors in order to meet ASHRAE 90.1 standard for automatic shut-off. The lighting will be controlled by a scene controller such as Lutron's Grafik Eye 3000. Scenes will be set based on use of the space. Please refer to electric depth, page 94 for details on classroom controls.

Light Loss Factors

Tag	Descr.	Cat.	Class	Dirt	Cleaning	LDD	RSDD	LLD	BF	LLF
F1	Pendant	VI	Semi-	Clean	12 mos.					
	Lighting		Indirect			0.85	0.92	0.92	1.00	0.72
F2	Recessed	IV	Direct	Clean	12 mos.					
	Downlight					0.88	0.98	0.84	0.95	0.69
F3	Recessed	IV	Direct	Clean	12 mos.					
	Downlight									
	WW					0.88	0.98	0.84	0.95	0.69
F4	Board Light	V	Direct	Clean	12 mos.	0.88	0.98	0.92	1.05	0.83
F5	Cove Light	V	Indirect	Clean	12 mos.	0.88	0.92	0.92	1.00	0.74

Table 1.4.2 – 135-Seat Classroom Light Loss Factors

Power Density

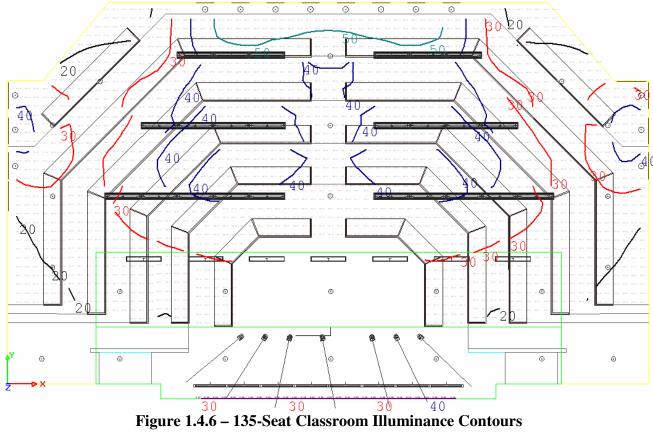
Room:	Classroom	Desired WP FC:	30	
Square Footage:	3085	Ashrae Allow:	1.4	
Total Watts Allowed:	4319			
TAG	DESCRIPTION	WATTS	NO. USED	TOTAL WATTS
F1	Pendant Lighting	68	24	1632
F2	Recessed Downlight	36	23	828
F3	Recessed Downlight Wall Wash	46	14	644
F4	Board Light	34	8	272
F5	Cove Light	34	7	238
l1	Track Lighting	100	7	700
TOTAL ROOM WATTS:	4314	Power Density:	1.40	
ROOM WATTS REMAINING:	5	Actual to Allowed:	99.88%	

Table 1.4.3 – 135-Seat Classroom Power Density

The 135-Seat Classroom uses almost one hundred percent of its allotted watts for lighting. This room serves many functions and has multiple lighting systems including incandescent track lighting which pushes the power density up. The use of fluorescent fixtures for the other sources however, keeps the power density at an acceptable level. Many of the fixtures will either be dimmed or switched off depending on the preset scene so this space will not always be using 1.4 watts per square foot.

Design Performance

The lighting system that was designed for the classroom is one that is subtle yet interesting. Architecturally attractive indirect/direct luminaires provide the majority of the general lighting in the space. Recessed downlights are used in conjunction with the pendants to meet the necessary task plane light levels. Cove lighting is used to break the ceiling and add another interesting element to the architecture. The acoustical panels that are located on the perimeter are accented using recessed wall wash fixtures. The presentation area is lighted using track fixtures to illuminate the face of the presenter while fluorescent fixtures are used to illuminate the white board.



135-Seat Classroom	Illuminance Data (fc)		135-Seat Classroom II	lluminance Data (fc)
Desks:	Row 1		Desks: I	Row 2
Average	verage 32.32		Average	36.00
Max	38.90		Max	45.30
Min	24.30		Min	19.50
Avg/Min	1.33		Avg/Min	1.85
Max/Min	1.60		Max/Min	2.32
Table 1.4.4 – Classroo	om Row 1 Illum. Dat	a T	able 1.4.5 – Classroo	m Row 2 Illum. Data
135-Seat Classroom	Illuminance Data (fc)		135-Seat Classroom II	lluminance Data (fc)
Desks:	Row 3		Desks: I	Row 4
Average	36.18		Average	33.94
Max	46.80		Max	45.80
Min	20.20		Min	19.10
Avg/Min	1.79		Avg/Min	1.78
Max/Min	2.32		Max/Min	2.40
Table 1.4.6 – Classroo	Table 1.4.6 – Classroom Row 3 Illum. Data			m Row 4 Illum. Data

	135-Seat Classroom	Illuminance Data (fc)		135-Seat Classroo	om Illuminance Data (fc)
	Desks:	Row 5		Des	sks: Row 6
	Average	32.79		Average	26.62
	Max	55.00		Max	45.50
	Min	13.90		Min	13.60
	Avg/Min	2.36		Avg/Min	1.96
	Max/Min	3.96		Max/Min	3.35
T	able 1.4.8 – Classroo	om Row 5 Illum. Dat	a [Гable 1.4.9 – Class	sroom Row 6 Illum. Data
		135-Seat Classroo	om Illu	minance Data (fc)	
		Wł	nite Bo	ard	
		Average		47.65	
		Max		100.00	
		Min		21.00	

Max/Min

Table 1.4.10 - Classroom White Board Illum. Data

4.84

A few of the previous reports are slightly misleading. Each calculation plane extends from the front edge of the desk back to the next level (whether that is another desk or a wall.) Because of this, some of the minimum foot-candle values are skewed slightly low. Also, the white board calculation was performed with the luminaires at full output. In reality, these luminaires have dimming ballasts and would be dimmed to an appropriate level based on the needs of the users. The reason the illuminance on the surface is so high is in order to have uniform lighting, the luminaires are place side by side for the length of the board.

Renderings

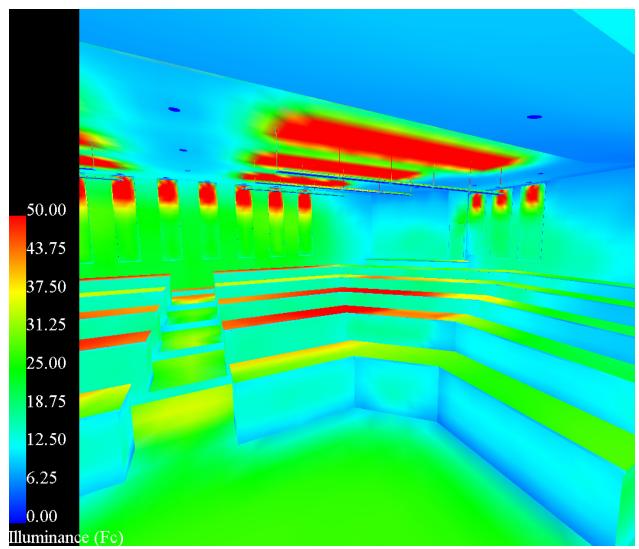


Image 1.4.1 – 135-Seat Classroom Pseudo Color Rendering



Image 1.4.2 – 135-Seat Classroom Lecturer's View



Image 1.4.3 – 135-Seat Classroom Student's View



Image 1.4.4 – 135-Seat Classroom Raytraced Rendering

Conclusion

The lighting system for the classroom successfully provided necessary light levels. The desks that are partially under the low ceiling are not as uniformly lighted as the others because parts are being lighted with a different type of lighting. For the most part however, the lighting levels are fairly uniform. The accenting on the acoustical panels provides some very nice visual interest on the perimeter while the cove makes for an interesting element on the ceiling. The flexibility of this space makes it easy to change the lighting based on the task that is being completed.

MOOT COURTROOM

Introduction

The moot courtroom is a functional courtroom that will be used for mock trial proceedings. The space consists of tiered seating, a presentation area, a judges' bench, a jury box, a witness stand and counselors' tables. The space, at times, will be used much like a classroom. There will be lectures, presentations, classroom discussion and exam taking. Students have the unique opportunity of experiencing a true courtroom setting while learning the ways of a trial lawyer. The lighting in this space will be flexible to allow for all tasks to be completed successfully as well as to enhance the many interesting architectural elements of the courtroom.

Space Layout

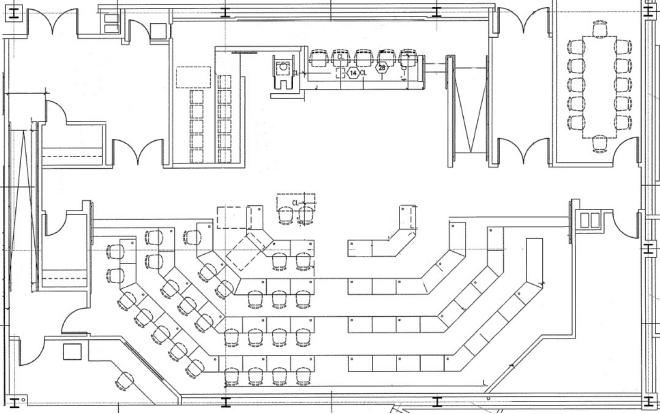


Figure 1.5.1 – Moot Court Floor Plan

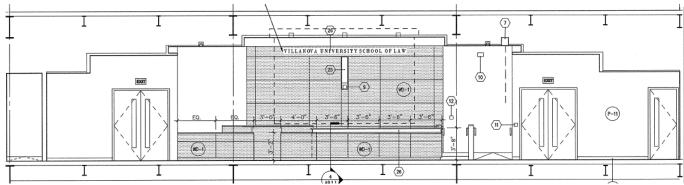


Figure 1.5.2 – Moot Court Front Elevation/Section

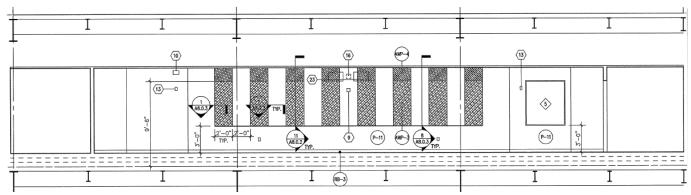


Figure 1.5.3 – Moot Court Rear Elevation/Section

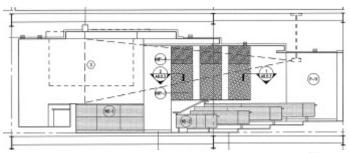


Figure 1.5.4 – Moot Court North Elevation/Section

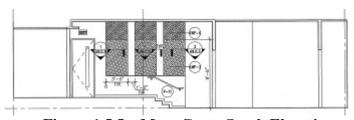


Figure 1.5.5 – Moot Court South Elevation

Architectural Finishes

Floor



Carpet Blue/Gray Reflectance: 33%

Walls



Painted Gyp Board Heron White Finish: Matte Reflectance: 85%



Acoustical Fabric Tan Reflectance: 54%



Wood Framing Dark Stain Reflectance: 14%



Wood Paneling Dark Stain Reflectance: 14%

Ceiling



Painted Gyp Board Heron White Finish: Matte Reflectance: 85%



Acoustical Ceiling Tile White Reflectance: 89%



Painted Gyp Board Simply White Finish: Matte Reflectance: 80%

Design Goals

The main goal in the courtroom is to provide a learning space that can meet all the demands of the users. The space must be able to be used as a typical classroom as well as a courtroom. The courtroom setting should be as realistic as possible. The controls in the space should allow the users to change scenes quickly and easily.

Target Illuminance Levels

Work Plane (Desks) – 30 fc (horizontal)

Design Criteria

• Appearance of Space and Luminaires (Very Important)

This space is one of the most important spaces in the law school because this is where the mock proceedings take place. This space needs to be every bit as impressive and perhaps intimidating as a normal courtroom. The appearance of the space and the luminaires needs to show the law students just how impressive a space like this can be so they are ready for it when they experience the real thing.

• Color Appearance (Very Important)

Like in the classroom, this is so important because of the amount of wood in the space. This space has even more wood that the classroom so the color appearance of the space is critical if the wood is going to stand out in the way the architect intended.

• Daylighting Integration and Control (Not Important)

There is no daylighting in this space.

• <u>Direct Glare (Important)</u>

The audience will be seated higher toward the back of the room, so if the light from high angles is very intense they will have a difficult time looking past that toward the proceedings in the front of the room. In a real court room, a jury could be there for many days at a time, and comfortable lighting is critical if one expects them to pay attention and be comfortable for the time they are there.

• Flicker (Not Applicable)

This problem is mostly applicable to HID sources and older fluorescent sources. As this is new construction, new fluorescent technology does not present a problem in this area.

• Light Distribution on Surfaces (Important)

The wood in this room demands attention and distributing light on those surfaces is a way to give the wood the attention it deserves.

• <u>Uniform Light Distribution on Task Plane (Important)</u>

This space is not a very reading intensive space other than in the front of the room. The judge will be reading and the prosecution and defense will surely be reading, while the audience will often times just be observing. However, the audience will need to be able to read when this space is being used as a classroom and therefore the task plane distribution can be addressed by the different scenes that the control panel provides.

• Modeling of Faces (Important)

This is important in the area of the courtroom where the proceedings or lecture will be taking place. The jury and audience need to see the judges' and witness' faces well. On the other hand, the jury and judge also need to be able to see the counselors' and the defendant's faces well so the front of the space will need to be illuminated well vertically from the sides and not from directly forward.

• Points of Interest (Important)

In this courtroom the biggest point of interest will be the bench and the logo behind it. This is an area that you want everyone looking. Illuminating this area effectively is very important.

• Surface Characteristics (Important)

This again relates mostly to the amount of wood in the room. The wood throughout the room certainly needs to be lighted, but the wood on the front wall now has the opportunity to bring even more visual interest to the space so the illumination of that needs to be addressed.

• System Control and Flexibility (Very Important)

This is a space that will serve as an instructional area in multiple ways. A typical classroom setting has to be provided, along with a traditional courtroom environment. There are many high quality materials in this space so the space needs to be able to be controlled to a high quality lighting design at times as well.

Luminaire Schedule

Image	Tag	Description	Volt	Manuf.	Cat. No.	L	amp	Mounting
						No.	Type	
	F1	Direct/Indirect Pendant	277	Zumtobel	AQ-2545-4-T-DS-U-C1	2	28W T5	Pendant
	F3	Recessed Downlight WW	277	Zumtobel	S5D-U-7309HW-C	1	42W CFL	Recessed
	F5	Cove Light	277	Lightolier	CL-1-4-T5-2	1	28W T5	Surface
	F6	Recessed Parabolic Downlight	277	Zumtobel	S5D-U-7703T-C	2	18W CFL	Recessed
	F7	Recessed Linear Fluorescent	277	Se'lux	M6R2-1T5-SD-SH-004- WH-277	1	28W T5	Recessed
	F8	Recessed Linear Fluorescent WW	277	Focal Point	FAVA-NS-1T5-1C- 277-S-F	1	28W T5	Recessed

Table 1.5.1 – Moot Court Luminaire Schedule

Lighting Layout

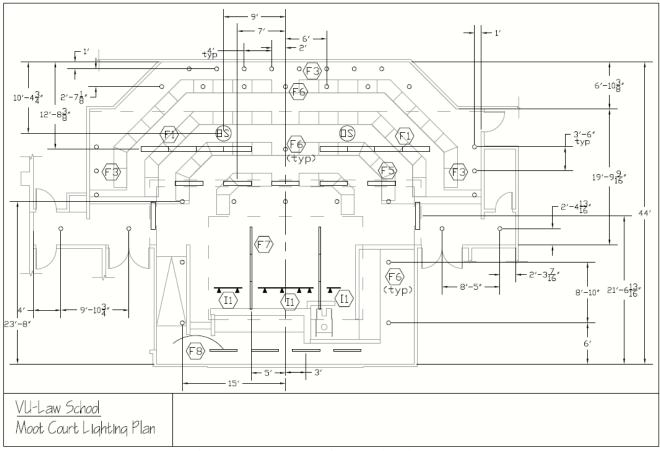


Figure 1.5.6 – Moot Court Lighting Plan

Controls

The controls in the moot court will consist of occupancy sensors in order to meet ASHRAE 90.1 standard for automatic shut-off. The lighting will be controlled by a scene controller such as Lutron's Grafik Eye 3000. Scenes will be set based on use of the space. Please refer to electric depth, page 103 for details on classroom controls.

Light Loss Factors

Tag	Descr.	Cat.	Class	Dirt	Cleaning	LDD	RSDD	LLD	BF	LLF
F1	Direct/Indirect		Semi-	Clean	12 mos.					
	Pendant	VI	indirect			0.85	0.92	0.92	1.00	0.72
F3	Recessed			Clean	12 mos.					
	Downlight									
	WW	IV	Direct			0.88	0.98	0.84	0.95	0.69
F5	Cove Light	٧	Indirect	Clean	12 mos.	0.88	0.92	0.92	1.00	0.74
F6	Recessed			Clean	12 mos.					
	Parabolic									
	Downlight	IV	Direct			0.88	0.98	0.81	0.95	0.66
F7	Recessed			Clean	12 mos.					
	Linear									
	Fluorescent	V	Direct			0.88	0.97	0.92	1.00	0.79
F8	Recessed			Clean	12 mos.					
	Linear									
	Fluorescent									
	WW	V	Direct			0.88	0.97	0.92	1.00	0.79

Table 1.5.2 – Moot Court Light Loss Factors

Power Density

Room:	Moot Courtroom	Desired WP FC:	30	
Square Footage:	2134	Ashrae Allow:	1.9	
Total Watts Allowed:	4054.6			
TAG	DESCRIPTION	WATTS	NO. USED	TOTAL WATTS
F1	Pendant Lighting	68	8	544
F3	Recessed Downlight Wall Wash	46	14	644
F5	Cove Light	34	7	238
F6	Recessed Downlight Parabolic	41	21	861
F7	Recessed Linear Fluorescent	34	6	204
F8	Recessed Linear Fluor. Wall Wash	34	4	136
[1	Track Lighting	100	7	700
TOTAL ROOM WATTS:	3327	Power Density:	1.56	
ROOM WATTS REMAINING:	727.6	Actual to Allowed:	82.05%	

Table 1.5.3 – Moot Court Power Density

The courtroom performs very well on the energy side. Only 82 percent of the watts allowed by ASHRAE are being used in the lighting design. This is a space that will help the law school save energy or meet the ASHRAE requirement because of its low energy consumption. The incandescent spots that are used to illuminate the judges' and witnesses' faces are the reason the power density is as high as it is. Without those, the power density would be around 65% of what is allowed by ASHRAE. Incandescents perform very well for facial rendering and it was determined that that fact justified using the inefficient incandescent sources.

Design Performance

The lighting in the courtroom is similar to that of the classroom and performs much the same way. The desks are relatively uniform, the walls are accented and provide a nice pattern and there is some interest on the ceiling. The courtroom differs greatly from the classroom at the front of the space. This space is lighted with low profile recessed linear strips and incandescent spot lights. The judges' bench has an average of 20fc which seems low but because this will be used much less often than the rest of the space, individual task lighting would add a nice touch and increase the illuminance on the judges' bench. Many courtroom images show a judge looking at evidence under a task-light. This will help add to the realism. The architecture in the front of the room is the main focal point and is lighted accordingly.

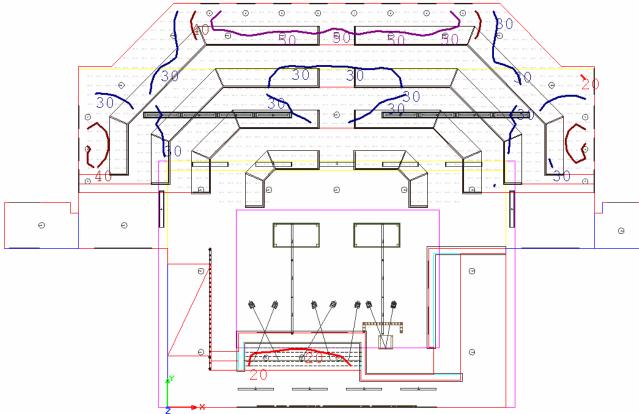


Figure 1.5.7 – Moot Court Illuminance Contours

Moot Court Illuminance Data (fc)			Moot Court II	luminance Data (fc)		
Desks: Row 1			Des	sks: Row 2		
Average	36.01		Average	32.72		
Max	39.10		Max	38.90		
Min	31.80		Min	26.50		
Avg/Min	1.13		Avg/Min	1.23		
Max/Min	1.23		Max/Min	1.47		
Table 1.5.4 - Moot Court Row 1 Illum. Data			Table 1.5.5 – Moot Court Row 2 Illum. Data			
Moot Court Illuminance Data (fc)			Moot Court Illuminance Data (fc)			
Desks: Row 3			Des	sks: Row 4		
Average	31.32		Average	37.81		
Max	38.40		Max	56.00		
Min	23.10		Min	18.90		
Avg/Min	1.36		Avg/Min	2.00		
Max/Min	1.66		Max/Min	2.96		
Table 1.5.6 - Moot Court Row 3 Illum. Data Table 1.5.7 - Moot Court Row 4 Illum. Data						
Moot Court Illuminance Data (fc)						
	Judges					
	Average		20.27			
	Max		24.30			
	Min		11.20			
	Avg/Min		1.81			
	Max/Min		2.17			
Table 1.5.8 – Moot Court Judges' Bench Illum. Data						

The uniformity of this lighting system is better than that of the classroom. The reason for this is the high ceilings. The light has the ability to spread out more and hits the plane more evenly.

Renderings

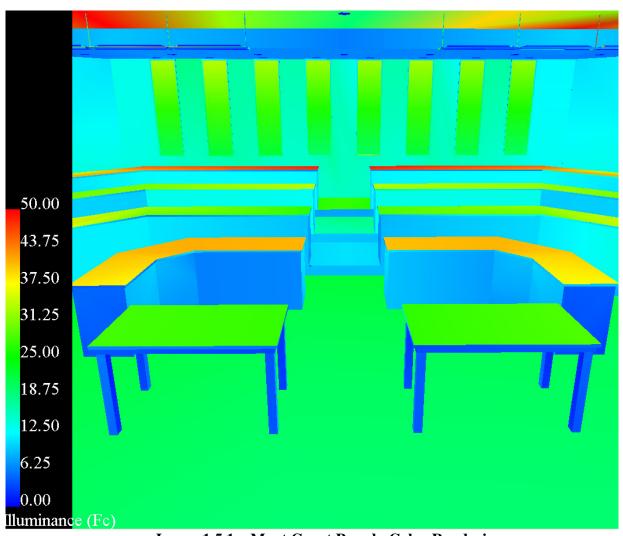


Image 1.5.1 – Moot Court Pseudo Color Rendering



Image 1.5.2 – Moot Court View from Presentation Area



Image 1.5.3 – Moot Court Student View

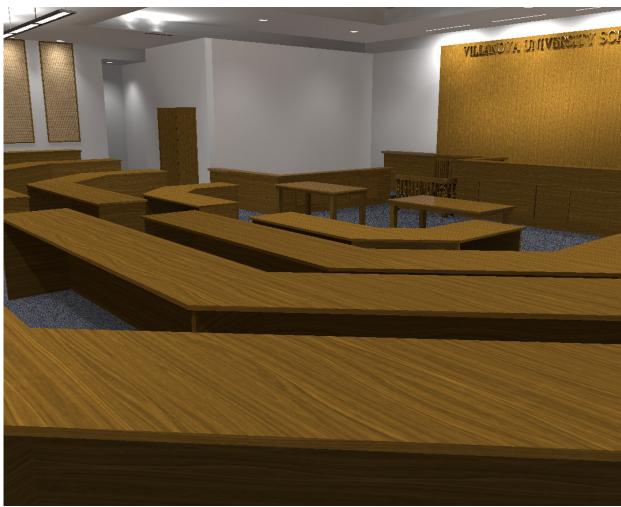


Image 1.5.4 – Moot Court Raytraced Student View

Conclusion

The lighting system in the moot court successfully provides sufficient light levels and does so in a uniform fashion. The lighting system also does a good job of providing illumination to the judges' and witnesses' faces while still accenting the architecture in the front of the room. The panels on the side wall once again provide some perimeter interest while the different ceiling heights provide visual interest above. The flexibility of the room will allow it to be used as a classroom, lecture hall, courtroom or whatever else is needed.

Electrical Depth

ELECTRICAL COORDINATION OF LIGHTING DESIGN

Introduction

The electrical coordination of the four lighting designs will be explored in this section. For each lighting space, the existing lighting panelboards are evaluated and redesigned in accordance with the lighting changes. Each original panelboard that is affected by the new lighting designs is shown with the affected circuits highlighted in gray. A panelboard worksheet will be provided which aided in the resizing of the panelboard. A feeder worksheet and an updated panelboard will be shown as well.

A few of the existing panels are not sized correctly according to the panelboard worksheets. This may because the correct loads were never entered into the spreadsheet or the correct sizing information was not entered into the spreadsheets until the final release. I did not resize the original panels to meet the demand load; my redesigned panelboards however will be resized to ensure they can carry the necessary load.

Feeder and conduit sizes for each revised panelboard are determined using NEC 2005.

Courtyard

The courtyard lighting redesign was meant to be subtle and mostly serve the purpose of allowing people to get from the building to the parking lot or vice versa. The atrium, which is the cornerstone of the law school's lighting design, lies directly beyond the courtyard. Because of this the courtyard was designed to allow the atrium to make the statement that was meant to be made.

The panels that will be affected by the courtyard lighting redesign are as follows: LP-1N which is located in Electric Room 188 on the first floor, LP-3N which is located in Electric Room 366 on the third floor and LP-BS which is located in B02 in the sub-basement.

The control system for the courtyard will be an existing lighting control panel. The luminaires in the courtyard will operate on a time clock. All luminaires will be switched on in the evening and switch off the next morning. This system will play an important role in saving energy.

Affected Courtyard Panels												
		Feeder										
Panelboard	Breaker	Sets	Phase	Neutral	Ground	Conduit						
LP-1N	400A, 3P	2	3#3/0	1#3/0	1#6	(2) 2"						
LP-3N	150A, 3P	1	3#1/0	1#1/0	1#6	2"						
LP-BS	225A, 3P	1	3#4/0	1#4/0	1#4	2-1/2"						

Table 2.1.1 – Courtyard Affected Panelboard Information

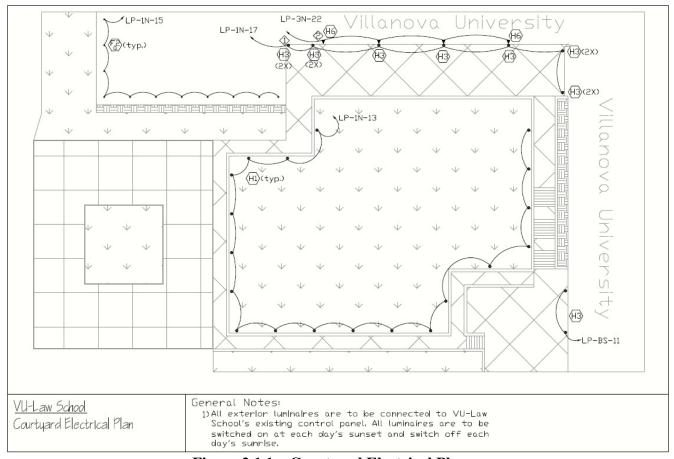


Figure 2.1.1 – Courtyard Electrical Plan *Please refer to Appendix B for full size plan

	Original L	_CP-1
		Time
Relay	Circuit	Schedule
1	LP-1N-8	8AM-6PM
2	LP-1N-9	7AM-10PM
3	LP-1N-12	7AM-10PM
4	LP-1S-15	7AM-10PM
5	LP-1S-20	PHOTOCELL
6	ELP-1N-S	PHOTOCELL
7	LP-BS-9	PHOTOCELL
8	LP-1N-14	PHOTOCELL

Figure 2.1.2 – Existing Control Panel Schedule

	Revised L	-CP-1
		Time
Relay	Circuit	Schedule
1	LP-1N-13	6PM-6AM
2	LP1N-15	6PM-6AM
3	LP-1N-17	6PM-6AM
4	LP-3N-22	6PM-6AM
5	LP-BS-11	6PM-6AM
6	SPARE	
7	SPARE	
8	SPARE	

Figure 2.1.3 – Existing Control Panel Schedule

				PANI	ELBO	ARD S	CHE	DULE			
ANEL: OCATION:	LP-1N ELEC.RM.(188)-1ST FL	_	ISOLAT	GND. BUS	BUS:					GE: IRCUIT BKI	480/277 VOLT, 3PH, 4W
IOUNTING: ED FROM:	SURFACE SWBD 'MDB'	-	NEUTRA A.I.C.:		100%		200%	Ш	MLO: BUS RA	TING:	400
LOAI	DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A B	. с	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
				1	3,713	_					
					1,275			2			
	SF-1-3	30	3	3		3,713					RF-1-3
				_		1,275		4	3	15	
				5			3,713	6			
	LIGHTING	20	1	7	4.000		1,275	- 6			LIGHTING
	FFICE SPACE	20	-	-	3,176			8	1	20	OFFICE CORRIDOR
	LIGHTING	20	1	9	5,176	2,500				20	LIGHTING
MA	IN CORRIDOR					1,400		10	1	20	OFFICE SPACE
	LIGHTING	20	1	11			1,400				LIGHTING
MAIN	SEATING AREA						1,800	12	1	20	CHAPEL
	SPARE	20	1	13							LIGHTING
					1,250			14	1	20	EXTERIOR READING ROOM
	SPARE	20	1	15				40			SPARE
	SPARE	20	1	17				16	1	20	SPARE
	SPARE	20	1	17				18	1	20	SPARE
	SPARE	20	1	19				10	1	20	SPARE
	OI AILE	- 20						20	1	20	or Aire
	SPARE	20	1	21							SPARE
								22	1	20	
	SPARE	20	1	23							SPARE
								24	1	20	
	SPARE	20	1	25							SPARE
								26	1	20	
	SPARE	20	1	27				28	1	20	SPARE
	SPARE	20	1	29				20	1	20	SPARE
	SPARL	20	-	25				30	1	20	SPARL
	SPARE	20	1	31				30		20	
					40,313			32	3	150	
	SPARE	20	1	33	,						PANEL 'LP-3N'
						37,544		34			
LIGHTING	3 CONTROL PANEL	20	1	35			1,000				
	LCP-1B						36,920	36			
	NEL IDD ANAL	125	3	37	23,511					450	
	NEL 'RP-1NA'			39	26,681	40.045		38	3	150	DANEL II D ON
(/:	5 KVA XFMR)			39		18,645 28,445		40			PANEL 'LP-2N'
				41		20,445	18,837	40			
				71			25,239	42			
		TOTAL	VA		103,919	93,522		TOTAL	KVA		287.6
			AMP/PHA	ASE	375	338		TOTAL			346

Figure 2.1.4 – LP-1N Existing Panelboard Schedule

		F	PAN	ELBOARI	SIZING	WOF	RKSHE	ET			
		Panel Tag	>	•	LP-1N	Pa	anel Loc	ation:	EL	EC ROOM	1 188
		ominal Phase to Neutral Volt	_		277		Phase		3		
		ominal Phase to Phase Volta	ıge	>	480		Wires		4		
Pos		Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Rer	narks
1	Α	SF-1-3	6		3713	w	1.00	3713	3713		
3	A B	RF-1-3 SF-1-3	6		1275 3713	W	1.00	1275 3713	1275 3713		
4	В	RF-1-3	6		1275	w	1.00	1275	1275		
5	C	SF-1-3	6		3713	w	1.00	3713	3713		
6	Č	RF-1-3	6		1275	w	1.00	1275	1275		
7	Α	Lighting Office	3		4000	w	1.00	4000	4000		
8	Α	Lighting Office Corr.	3		3176	w	1.00	3176	3176		
9	В	Lighting Main Corr.	3		2500	w	1.00	2500	2500		
10	В	Lighting Office	3		1400	W	1.00	1400	1400		
11 12	С	Lighting Main Seating Lighting Chapel	3		1400 1800	w	1.00	1400 1800	1400 1800		
13	A	Courtyard Ltg Bollards	4		1786	W	1.00	1786	1786		
14	Α	Lighting Reading Rm	3		1250	w	1.00	1250	1250		
15	В	Courtyard Ltg Downlights	3		374	w	1.00	374	374		
16	В	Spare			0	w	1.00	0	0		
17	С	Courtyard Ltg Façade	4		1419	w	1.00	1419	1419		
18	С	Spare	Ш		0	w	1.00	0	0	ļ	
19	Α	Spare			0	W	1.00	0	0		
20	A B	Spare			0	w	1.00	0	0		
21	В	Spare Spare			0	w	1.00	0	0		
23	С	Spare			0	W	1.00	0	0		
24	С	Spare			0	w	1.00	0	0		
25	A	Spare			0	w	1.00	0	0		
26	Α	Spare			0	w	1.00	0	0		
27	В	Spare			0	w	1.00	0	0		
28	В	Spare			0	w	1.00	0	0		
29	С	Spare			0	w	1.00	0	0		
30	C A	Spare Spare			0	W	1.00	0	0		
31	A	Panel LP-3N	9		40313	w	1.00	40313	40313		
33	В	Spare	9		0	w	1.00	0	0		
34	В	Panel LP-3N	9		37756	w	1.00	37756	37756		
35	С	LCP-1B	9		1000	w	1.00	1000	1000		
36	С	Panel LP-3N	9		36920	w	1.00	36920	36920		
37	Α	Panel RP-1NA	9		23511	w	1.00	23511	23511		
38	Α	Panel LP-2N	9		26681	w	1.00	26681	26681		
39	В	Panel RP-1NA	9		18645	W	1.00	18645	18645		
40	В	Panel LP-2N Panel RP-1NA	9		28445	W	1.00	28445	28445		
41 42	C	Panel LP-2N	9		18837 25239	w	1.00	18837 25239	18837 25239		
		OTAL	J		_5_5	. **	1.00	291.4	291.4	Amps=	350.7
PHA	SEL	OADING BHASE TOTAL	_					kW	kVA	%	Amps
-		PHASE TOTAL PHASE TOTAL	A B					105.7 94.1	105.7 94.1	36% 32%	381.6 339.7
		PHASE TOTAL	С					94.1	91.6	32%	339.7
	D 0 1			0					01.0	0.70	
LUA	U CA	TAGORIES		Conne kW	ected kVA	DF	kW	mand kVA	PF		Ver. 1.02
1		receptacles		0.0	0.0	DL	0.0	0.0	FF		
2		computers		0.0	0.0		0.0	0.0			
3		fluorescent lighting		15.9	15.9	0.90	14.3	14.3	1.00		
4		HID lighting		3.2	3.2		3.2	3.2	1.00		
5		incandescent lighting		0.0	0.0		0.0	0.0			
6		HVAC fans		15.0	15.0	0.95	14.2	14.2	1.00		
7		heating		0.0	0.0	0.95	0.0	0.0			
8		kitchen equipment		0.0	0.0		0.0	0.0			
9		unassigned	-	257.3	257.3		257.3	257.3	1.00		
-	I	otal Demand Loads		20%			289.1	289.1			
-	-	Spare Capacity Total Design Loads		ZU70			57.8 346.9	57.8 346.9	1.00	Amps=	417.4
		i otai Design Luaus					U-U.9	U-U.9	1.00	ha≡	⊤।/. +

Figure 2.1.5 – LP-1N Panelboard Worksheet

NEL:	LP-1N		EQUIP. 0	SND. BUS	:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(188)-1ST FL.		ISOLAT	ED GND E	BUS:	Ħ			MAIN C	IRCUIT BKF	₹:
OUNTING:	SURFACE	•	NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	SWBD 'MDB'	•	A.I.C.:	42000		_			BUS RA		600
		BKR.	BKR.	CKT.	L	OAD - V.A		CKT.	BKR.	BKR.	
LOAI	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713						
	CE 4.3	20	-	2	1,275	0.740		2			RF-1-3
	SF-1-3	30	3	3		3,713 1,275		4	3	15	KF-1-3
				5		1,275	3,713	_		10	
							1,275	6			
	LIGHTING	20	1	7	4,000						LIGHTING
OF	FFICE SPACE				3,176			8	1	20	OFFICE CORRIDOR
	LIGHTING	20	1	9		2,500		10	1	20	LIGHTING
MA	IN CORRIDOR LIGHTING	20	1	11		1,400	1,400	10	1	20	OFFICE SPACE LIGHTING
MAIN	SEATING AREA	20					1,400	12	1	20	CHAPEL
	TYARD LIGHTING	20	1	13	1,786		1,000				LIGHTING
	BOLLARDS				1,250			14	1	20	EXTERIOR READING ROOM
	TYARD LIGHTING	20	1	15		374					SPARE
	OWNLIGHTS		_	47				16	1	20	004.05
	TYARD LIGHTING CADE LIGHTS	20	1	17			1,419	18	1	20	SPARE
IA	SPARE SPARE	20	1	19				10	-	20	SPARE
	OI / II L	20	·					20	1	20	SI / II.E
	SPARE	20	1	21							SPARE
								22	1	20	
	SPARE	20	1	23				- 24		20	SPARE
	SPARE	20	1	25				24	1	20	SPARE
	SPARL	20	-	20				26	1	20	SPARE
	SPARE	20	1	27							SPARE
								28	1	20	
	SPARE	20	1	29							SPARE
	CDADE	20		24				30	1	20	
	SPARE	20	1	31	40,313			32	3	150	
	SPARE	20	1	33	40,313			JE	,	150	PANEL 'LP-3N'
						37,756		34			
LIGHTING	3 CONTROL PANEL	20	1	35			1,000				
	LCP-1B	105					36,920	36			
DA.	NEL 'RP-1NA'	125	3	37	23,511			38	3	150	
	5 KVA XFMR)			39	26,681	18,645		30	3	150	PANEL 'LP-2N'
(1)	······································					28.445		40			TAMEE ELECT
				41		22,	18,837				
							25,239	42			
		TOTAL			105,705	94,108	91,603	TOTAL			291.4
EMARKS:		TOTAL	AMP/PH/	ASE	382	340	331	TOTAL	AMP		351

Figure 2.1.6 – LP-1N Revised Panelboard Schedule

			PANELBOARD SCHEDULE												
ANEL:	LP-3N	_	EQUIP. 0	SND. BUS	:				VOLTA	GE:	480/277 VOLT, 3PH, 4W				
OCATION:	ELEC.RM.(366)-3RD FL	_	ISOLAT	ED GND E	BUS:				MAIN C	IRCUIT BKF	₹:				
MOUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:						
ED FROM:	PANEL 'LP-1N'	_	A.I.C.:		42,000				BUS RA	TING:	225				
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.					
LOAD	D DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION				
				1	5,570 2,015			2							
	SF-3-3	40	3	3	2,013	5,570					RF-3-3				
						2,015		4	3	15					
				5			5,570								
				_			2,015	6	_		LIGHTING				
				7	3,713 2.000			8	1	20	LIGHTING READING ROOM				
	SF-R-1	30	3	9	2,000	3,713				20	LIGHTING				
			_	_		1,600		10	1	20	SEATING AREA				
				11			3,713				LIGHTING				
				- 10			2,024	12	1	20	DEAN'S SUITE				
	LIGHTING E SPACE NORTH	20	1	13	2,056			14	1	20	LIGHTING MECHANICAL ROOM				
	LIGHTING	20	1	15	600	2,520		14	1	20	LIGHTING				
	STACKS	20		10		800		16	1	20	DEAN'S SUITE HALLWAY				
	LIGHTING	20	1	17			2,576				373				
	STACKS						1,524	18	1	20	HAND DRYER				
	LIGHTING	20	1	19	2,912			20		20	SPARE				
	STACKS SPARE	20	1	21		_		20	1	20	SPARE				
	STARL	20	_	1				22	1	20	31 AILE				
	SPARE	20	1	23							SPARE				
								24	1	20					
	SPARE	20	1	25				20		20	SPARE				
	SPARE	20	1	27		_		26	1	20	SPARE				
	OI AILE	20						28	1	20	SI AILE				
	SPARE	20	1	29							SPARE				
								30	1	20					
	SPARE	20	1	31				32	1	20	SPARE				
	SPARE	20	1	33				32	1	20	SPARE				
	OI ARL	20	-	33				34	1	20	SPARE				
LIGHTING	G CONTROL PANEL	20	1	35			1,000				SPARE				
	LCP-3B							36	1	20					
	NEL IDD ONAL	70	3	37	21,447			20		20	SPARE				
	NEL 'RP-3NA' 5 KVA XFMR)			39		21,326		38	1	20	SPARE				
(43	A IVA AFIIIK)			Ja		21,326		40	1	20	STARE				
				41			18,498				SPARE				
								42	1	20					
		TOTAL	VA AMP/PHA		40,313 146	37,544 136		TOTAL			114.8 138				

Figure 2.1.7 – LP-3N Original Panelboard Schedule

			PA	NELBOAF	RD SIZIN	G WC	RKSH	IEET			
		Panel Tag		>	LP-3N	Pa	anel Loc	ation:	EL	EC ROOM	1 366
		ninal Phase to Neutral V	_		277		Phase		3		
		ninal Phase to Phase Vo	_		480		Wires		4		
-		Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Rer	narks
1	A	SF-3-3 RF-3-3	6		5750	w	1.00	5750 2015	5750		
3	A B	SF-3-3	6		2015 5750	w	1.00	5750	2015 5750		
4	В	RF-3-3	6		2015	w	1.00	2015	2015		
5	С	SF-3-3	6		5750	w	1.00	5750	5750		
6	С	RF-3-3	6		2015	W	1.00	2015	2015		
7	Α	SF-R-1	6		3713	w	1.00	3713	3713		
8	A	Ltg Reading Room	3		2000	W	1.00	2000	2000		
9	B B	SF-R-1 Ltg Seating	6 3		3713 1600	w	1.00	3713 1600	3713 1600		
11	C	SF-R-1	6		3713	w	1.00	3713	3713		
12	С	Ltg Dean's Suite	3		2024	w	1.00	2024	2024		
13	Α	Ltg North Office	3		2056	W	1.00	2056	2056		
14	Α	Ltg Mech Room	3		600	w	1.00	600	600		
15	В	Ltg Stacks	3		2520	w	1.00	2520	2520		
16 17	B C	Ltg Dean's Hall Ltg Stacks	3		800 2576	w	1.00	800 2576	800 2576		
18	C	Hand Dryer	9		1524	w	1.00	1524	1524	1	
19	A	Ltg Stacks	3		2912	w	1.00	2912	2912		
20	Α	Spare			0	w	1.00	0	0		
21	В	Spare			0	w	1.00	0	0		
22	В	Courtyard Ltg Spots	4		212	w	1.00	212	212		
23 24	С	Spare Spare			0	W	1.00	0	0		
25	C A	Spare			0	w	1.00	0	0		
26	A	Spare			0	w	1.00	0	0		
27	В	Spare			0	w	1.00	0	0		
28	В	Spare			0	W	1.00	0	0		
29	С	Spare			0	w	1.00	0	0		
30	C A	Spare			0	w	1.00	0	0		
31	A	Spare Spare			0	w	1.00	0	0		
33	В	Spare			0	w	1.00	0	0		
34	В	Spare			0	w	1.00	0	0		
35	С	LCP-3B	9		1000	W	1.00	1000	1000		
36	С	Spare			0	w	1.00	0	0		
37	Α	Panel RP-3NA	9		21447	w	1.00	21447	21447		
38 39	A B	Spare Panel RP-3NA	9		0 21326	w	1.00	0 21326	0 21326		
40	В	Spare	9		0	w	1.00	0	0		
41	C	Panel RP-3NA	9		18498	w	1.00	18498	18498		
42	С	Spare			0	w	1.00	0	0		
PAN	EL T	OTAL						115.5	115.5	Amps=	139.0
РНА		OADING						kW	kVA	%	Amps
		PHASE TOTAL	Α					40.5	40.5	35%	146.2
<u> </u>		PHASE TOTAL	В					37.9	37.9	33%	137.0
		PHASE TOTAL	С					37.1	37.1	32%	133.9
LOA	D CA	TAGORIES		Conne				mand			Ver. 1.02
4 1		rocontacles	\vdash	kW	kVA	DF	kW	kVA	PF		
2		receptacles computers		0.0	0.0		0.0	0.0			
3		fluorescent lighting		17.1	17.1	0.90	15.4	15.4	1.00		
4		HID lighting		0.2	0.2		0.2	0.2	1.00		
5	iı	ncandescent lighting		0.0	0.0		0.0	0.0			
6		HVAC fans		34.4	34.4	0.95	32.7	32.7	1.00		
7		heating		0.0	0.0	0.95	0.0	0.0			
8		kitchen equipment unassigned	\vdash	0.0 63.8	0.0 63.8		0.0 63.8	0.0 63.8	1.00		
9	Tot	al Demand Loads		00.0	03.0		112.1	112.1	1.00		
		Spare Capacity		20%			22.4	22.4			
		tal Design Loads					134.5	134.5	1.00	Amps=	161.9

Figure 2.1.8 – LP-3N Panelboard Worksheet

				PANI	ELBO	ARD S	CHE	DULE			
ANEL:	LP-3N		EQUIP. 0	SND. BUS	S:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(366)-3RD FL	-	ISOLAT	ED GND E	BUS:				MAIN C	IRCUIT BKF	<u></u>
OUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	PANEL 'LP-1N'	_	A.I.C.:		42,000				BUS RA	TING:	225
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAI	DESCRIPTION	AMPS	POLE	NO.	A	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	5,570 2,015			2			
	SF-3-3	40	3	3	2,010	5,570					RF-3-3
						2,015		4	3	15	
				5			5,570	_			
				7	3,713		2,015	6			LIGHTING
					2,000			8	1	20	READING ROOM
	SF-R-1	30	3	9		3,713					LIGHTING
						1,600		10	1	20	SEATING AREA
				11			3,713	42		20	LIGHTING
	LIGHTING	20	1	13	2.056		2,024	12	1	20	DEAN'S SUITE LIGHTING
	E SPACE NORTH	20		13	600			14	1	20	MECHANICAL ROOM
	LIGHTING	20	1	15		2,520					LIGHTING
	STACKS					800		16	1	20	DEAN'S SUITE HALLWAY
	LIGHTING	20	1	17			2,576	40			373
	STACKS LIGHTING	20	1	19	2.912		1,524	18	1	20	HAND DRYER SPARE
	STACKS	20		13	2,912			20	1	20	SPARL
	SPARE	20	1	21							COURTYARD LIGHTING
						212		22	1	20	FAÇADE SPOTS
	SPARE	20	1	23				24	1	20	SPARE
	SPARE	20	1	25				24	1	20	SPARE
	SPARE	20	-	23				26	1	20	SPARE
	SPARE	20	1	27							SPARE
								28	1	20	
	SPARE	20	1	29				30		20	SPARE
	SPARE	20	1	31				30	1	20	SPARE
		20	•	٥.				32	1	20	VIANE
	SPARE	20	1	33							SPARE
								34	1	20	
LIGHTING	G CONTROL PANEL LCP-3B	20	1	35			1,000	36	1	20	SPARE
	LUT-JD	70	3	37	21,447			30	1	20	SPARE
PA	NEL 'RP-3NA'		_		21,747			38	1	20	0.711
(45	KVA XFMR)			39		21,326					SPARE
								40	1	20	
				41			18,498	42	1	20	SPARE
		TOTAL	VA		40.313	37.756	36,920		KVA	20	115.0
			AMP/PHA	ASE	146	136		TOTAL			138

Figure 2.1.9 – LP-3N Revised Panelboard Schedule

				PANI	ELBO	ARD S	CHE	DULE	•		
PANEL:	LP-BS		EQUIP. 0	SND. BUS	i:	$\overline{}$			VOLTA	GE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM (B02)-SUB	RESMT	ISOLAT			H				IRCUIT BI	, ,
MOUNTING:	SURFACE		NEUTRA		100%		200%		MLO:		
FED FROM:	SWBD 'MDB'	_			10076		20070	Ш	BUS RA	TINC	225
FED FROM:	2MDD MDD	_	A.I.C.:							TING:	225
		BKR.	BKR.	CKT.		.OAD - V.A		CKT.	BKR.	BKR.	
LOA	D DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	5,570			_			
	SF-1-2	40	3	3	2,920	5 570		2			RF-1-2
	3F-1-2	40	3	3		5,570 2,920		4	3	30	RF-1-2
				5		2,520	5,570	-		- 30	
							2,920	6			
	SPARE	20	1	7			_,				SPARE
								8	1		
	SPARE	20	1	9							SPARE
	00105	- 00						10	1	15	00.105
	SPARE	20	1	11				42			SPARE
				13	7.400			12	1		
				13	7,160 2,920			14			
	SF-1-2	60	3	15	2,920	7,160		14			RF-1-2
	01-1-2		_	-10		2.920		16	3	30	14 -1-2
				17		2,020	7.160				
							2,920	18			
				19	5,570						
					2,920			20			
	SF-2-2	40	3	21		5,570					RF-2-2
						2,920		22	3	30	
				23			5,570 2,920	24			
				25			2,920	24			
				23				26			
	SF-3-2	20	3	27				20			RF-3-2
								28	3	20	
				29							
								30			
	LIGHTING	20	1	31	2,016				L.,		LIGHTING
LIQUEN	G CONTROL PANEL	20		33	3,500	4.000		32	1	20	DINING AREA
LIGHTING	LCP-0B	20	1	33		1,000 2,280		34	1	20	LIGHTING SERVING
	SPARE	20	1	35		2,280		34	1	20	LIGHTING
	OI / IIIL	20		- 55				36	1	20	KITCHEN/SURROUNDING SPACES
		125	3	37	25,880						LIGHTING
PA	ANEL 'RP-BS'				1,440			38	1	20	LOCKERS
(3)	0 KVA XFMR)			39		21,833					L16A,L16B
						3,048		40	1	20	HAND DRYERS
				41			21,370				L09A,B
		TOTAL					3,048	42	1	20	HAND DRYERS
		TOTAL		A CE	59,896	55,221		TOTAL			166.6
		TOTAL	AMP/PH	4 SE	216	199	186	TOTAL	AWP		200

Figure 2.1.10 – LP-3N Original Panelboard Schedule

		P/	ANE	LBOARD	SIZING	WOR	KSHEI	ΞT			
		Panel Tag	>		LP-BS	P	anel Loc	ation:	EL	EC ROOM	1 B02
		Nominal Phase to Neutral Volta		>	277		Phase	e:	3		
		Nominal Phase to Phase Voltag	e	>	480		Wires	S:	4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Rer	narks
1	Α	SF-1-1	6		5570	w	1.00	5570	5570		
2	A	RF-1-1	6		2920	w	1.00	2920	2920		
3	В	SF-1-1	6		5570	W	1.00	5570	5570		
<u>4</u> 5	B C	RF-1-1 SF-1-1	6		2920 5570	w	1.00	2920 5570	2920 5570		
6	Č	RF-1-1	6		2920	w	1.00	2920	2920		
7	A	Spare	Ť		0	w	1.00	0	0		
8	Α	spare			0	w	1.00	0	0		
9	В	Spare			0	w	1.00	0	0		
10	В	Spare			0	w	1.00	0	0		
11	С	Courtyard Ltg Low Entrance	4		258	W	1.00	258	258		
12	C	Spare			0	W	1.00	7100	7100		
13	A	SF-1-2	6		7160	W	1.00	7160 2920	7160 2920		
14 15	В	RF1-2 SF-1-2	6		2920 7160	w	1.00	7160	7160		
16	В	RF1-2	6		2920	W	1.00	2920	2920		
17	Ċ	SF-1-2	6		7160	w	1.00	7160	7160		
18	С	RF1-2	6		2920	w	1.00	2920	2920		
19	Α	SF-2-2	6		5570	w	1.00	5570	5570		
20	Α	RF-2-2	6		2920	w	1.00	2920	2920		
21	В	SF-2-2	6		5570	w	1.00	5570	5570		
22	В	RF-2-2	6		2920	w	1.00	2920	2920		
23 24	C	SF-2-2 RF-2-2	6		5570 2920	w	1.00	5570 2920	5570 2920		
25	A	SF-3-2	6		5570	w	1.00	5570	5570		
26	A	RF-3-2	6		2920	w	1.00	2920	2920		
27	В	SF-3-2	6		5570	w	1.00	5570	5570		
28	В	RF-3-2	6		2920	w	1.00	2920	2920		
29	С	SF-3-2	6		5570	w	1.00	5570	5570		
30	С	RF-3-2	6		2920	w	1.00	2920	2920		
31	A	General Ltg	3		2016	W	1.00	2016	2016		
32	A	Lighting Dining LCP-0B	3		3500	W	1.00	3500	3500		
33 34	B B	Lighting Serving	3		1000 2280	w	1.00	1000 2280	1000 2280		
35	C	Spare	3		0	W	1.00	0	0		
36	č	Lighting Kitchen	3		2000	w	1.00	2000	2000		
37	Α	RP-BS	9		25880	w	1.00	25880	25880		
38	Α	Lighting Lockers	3		1440	w	1.00	1440	1440		
39	В	RP-BS	9		21833	w	1.00	21833	21833		
40	В	Hand Dryers	9		3048	w	1.00	3048	3048		
41 42	C	RP-BS	9		21370 3048	w	1.00	21370 3048	21370 3048		
		Hand Dryers OTAL	9		3046	W	1.00	194.3	194.3	Amps=	233.8
										· · · · · ·	233.0
PHA	SE L	OADING						kW	kVA	%	Amps
		PHASE TOTAL	A			-		68.4	68.4	35%	246.9
		PHASE TOTAL	B C			-		63.7	63.7	33%	230.0
		PHASE TOTAL	U .		<u> </u>			62.2	62.2	32%	224.6
LOA	D CA	ATAGORIES		Conne				mand			Ver. 1.02
4		recentacies		kW	kVA	DF	kW	kVA	PF		
2		receptacles computers	\vdash	0.0	0.0		0.0	0.0			
3		fluorescent lighting		11.2	11.2	0.90	10.1	10.1	1.00		
4		HID lighting		0.3	0.3	0.00	0.3	0.3	1.00		
5		incandescent lighting		0.0	0.0		0.0	0.0			
6		HVAC fans		106.7	106.7	0.95	101.3	101.3	1.00		
7		heating		0.0	0.0	0.95	0.0	0.0			
8		kitchen equipment	$oxed{oxed}$	0.0	0.0		0.0	0.0			
9		unassigned		76.2	76.2		76.2	76.2	1.00		
		Total Demand Loads		000/			187.9	187.9			
-		Spare Capacity Total Design Loads		20%			37.6 225.4	37.6 225.4	1.00	Amps=	271.3
		rotat Design Loads					223.4	223.4	1.00	Amps=	11.3

Figure 2.1.11 – LP-BS Panelboard Worksheet

LIGHTING	D DESCRIPTION RF-1-1
NEUTRAL BUS: 100%	D DESCRIPTION
ED FROM: SWBD MDB' A.I.C.: 65000 BUS RATING: 400 CKT. BKR. BKR. AMPS LOV A B C NO. A B C NO. POLE AMPS LOV 1 5.570 2.920 2 SF-1-1 40 3 3 3 5.570 4 3 30 5 6 2.920 4 3 30 SPARE 20 1 7 2 8 1 10 1 15 COURTYARD LIGHTING 20 1 11 2258 1 10 1 15 COURTYARD LIGHTING 20 1 11 2258 1 10 1 15 COURTYARD LIGHTING 20 1 11 2258 1 10 1 15 SF-1-2 60 3 15 7,160 1 3 30 SF-2-2 40 3 21 2,920 18 1 19 5,570 2 2,920 18 SF-2-2 40 3 21 2,920 2 2 3 30 SF-3-2 20 3 27 2,920 24 3 3 20 SF-3-2 20 3 27 2,920 24 3 3 20 LIGHTING 20 1 31 2,016 3 3 20	
BKR. BKR. AMPS POLE NO. A B C NO. A B C NO. POLE AMPS LOW	
LOAD DESCRIPTION	
LOAD DESCRIPTION	
SF-1-1 40 3 3 3 5.570 2 920 4 3 30 5.570 5 92920 6 5 92920 6 5 92920 6 9 92920 6 9 92920 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	RF-1-1
SF-1-1 40 3 3 3 5.570 4 3 30 5.570 5.570 5 5.570 6 5 5.570 7 2.920 6 6 5 5.570 7 2.920 6 6 7 5.570 7 7.160 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	RF-1-1
SPARE 20 1 7 2,920 6 SPARE 20 1 9 10 1 15 COURTYARD LIGHTING LOWER ENTRANCE 113 7,160 12,920 14 SF-1-2 60 3 15 7,160 12,920 16 3 30 15 7,160 17 7 1,160 17 16 3 30 17 16 17 17 17 16 17 16 17 17 16 1	RF-1-1
SPARE 20 1 7	
SPARE 20 1 7 8 1 15 SPARE 20 1 9 10 1 15 COURTY/ARD LIGHTING LOWER ENTRANCE 13 7,160 12 1 1 1 15 SF-1-2 60 3 15 7,160 16 3 30 17 17 7,160 16 3 30 17 160 16 3 30 17 17 160 16 3 30 17 17 160 16 3 30 17 17 160 16 3 30 17 17 160 16 3 30 17 17 17,160 16 3 30 17 17 17,160 16 17 18 18 18 18 19 19 5,570 18 18 18 19 5,570 18 18 18 19 5,570 18 18 18 19 5,570 18 18 18 18 18 18 18 18 18 18 18 18 18	
SPARE 20 1 7 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
SPARE 20 1 9 10 1 15 COURTYARD LIGHTING LOWER ENTRANCE 111 258 12 1 SF-1-2 60 3 15 7,160 14	SPARE
COURTYARD LIGHTING LOWER ENTRANCE 13 7,160 2,920 14 37 7,160 2,920 16 3 30 17 7,160 2,920 16 3 30 17 7,160 2,920 18 19 5,570 2,920 20 5F-2-2 40 3 21 5,570 2,920 22 3 30 5F-3-2 SF-3-2 20 3 27 5,570 2,920 26 2,920 26 2,920 26 2,920 26 2,920 27 2,920 28 3 20 29 5,570 2,920 28 3 20 29 5,570 2,920 30 LIGHTING 20 1 31 2,016	
COURTYARD LIGHTING LOWER ENTRANCE 13 7,160 2,920 14 5 7,160 2,920 16 3 30 17 7,160 2,920 16 3 30 17 7,160 2,920 18 19 5,570 2,920 20 20 20 20 20 20 20 20 20 20 20 20 2	SPARE
13	
SF-1-2 13	SPARE
SF-1-2 60 3 15 7,160 16 3 30 17 7,160 2,920 18 2,920 18 19 5,570 20 20 SF-2-2 40 3 21 5,570 20 20 30 30 27 5,570 20 30 20 30 30 30 30 30 30 30 30 30 30 30 30 30	
SF-1-2 60 3 15 7,160 2,920 16 3 30 17 7,160 2,920 18 19 5,570 2,920 20 SF-2-2 40 3 21 5,570 2,920 22 3 30 23 5,570 2,920 24 25 5,570 2,920 24 SF-3-2 SF-3-2 20 3 27 5,570 2,920 26 3 20 LIGHTING 20 1 31 2,016	
SF-2-2 40 3 21 5,570 22 3 30 SF-3-2 20 3 27 5,570 26 SF-3-2 20 3 27 5,570 28 3 20 SF-3-2 20 3 10 SF-3-2 20 SF-3-2 20 10 SF-3-2 20 SF-3-2 20 10 SF-3-2 20 SF-3-2 20 10 SF-3-2 20 10 SF-3-2 20	RF-1-2
SF-2-2 40 3 21 5,570 20 30 3 27 5,570 26 5,570 29 5,570 20 30 2,920 24 3 3 20 3 27 5,570 20 3 3 27 5,570 20 3 3 27 5,570 20 3 29 5,570 20 3 29 5,570 20 3 29 5,570 20 3 20 3 27 5,570 20 3 20 3 27 5,570 20 3 20 3 27 5,570 20 3 20 3 20 20 3 20 3 20 3 20 3 20 3	
SF-2-2 40 3 21 5,570 20 30 30 30 30 30 30 30 30 30 30 30 30 30	
SF-2-2 40 3 21 5,570 22 3 30 23 5,570 22 3 30 23 5,570 24 2,920 24 25 5,570 26 2,920 26 2,920 26 2,920 26 2,920 26 2,920 26 2,920 26 2,920 26 2,920 26 2,920 27 2,920 28 3 20 29 5,570 2,920 20 20 20 20 20 20 20 20 20 20 20 20 2	
SF-2-2 40 3 21 5,570 22 3 30 23 5,570 24 29 24 25 5,570 26 2,920 24 26 2,920 26 27 2,920 26 27 2,920 27 2,920 27 2,920 28 3 20 29 5,570 2,920 20 20 20 20 20 20 20 20 20 20 20 20 2	
SF-3-2 23 2,920 3,000 2,920 2,920 3,000 2,920 2,920 3,000 2,920 2,920 3,000 2,920 2,920 3,000 2,92	RF-2-2
SF-3-2 20 3 27 5,570 26 29 26 27 29 20 28 3 20 29 29 29 29 29 29 29 29 29 29 29 29 29	KF-2-2
SF-3-2 20 1 31 2,016 2,920 24 2,920 24 2,920 26 2,920 28 3 20 29 2,920 28 3 20 2,920 30 2,920	
SF-3-2 20 3 27 5,570 28 3 20 29 5,570 29 5,570 29 5,570 29 5,570 29 5,570 2,920 30 LIGHTING 20 1 31 2,016	
SF-3-2 20 3 27 5,570 28 3 20 29 5,570 28 3 20 29 5,570 20 20 30 20 20 20 20 20 20 20 20 20 20 20 20 20	
29 29 5,570 290 200 200 200 200 200 200 200 200 20	
29 5,570 2,920 30 LIGHTING 20 1 31 2,016	RF-3-2
LIGHTING 20 1 31 2,016 2,920 30	
LIGHTING 20 1 31 2,016	
	LIGHTING
	DINING AREA
LIGHTING CONTROL PANEL 20 1 33 1,000	LIGHTING
LCP-0B 2.280 34 1 20	SERVING
SPARE 20 1 35 2.000 36 1 20 KITCHEN/S	LIGHTING
125 3 37 25,880 2,000 36 1 20 KITCHEN/S	URROUNDING SPACE LIGHTING
PANEL 'RP-BS' 1.440 38 1 20	LOCKERS
(30 KVA XFMR) 39 21,833	L16A,L16B
41 21,370	AND DRYERS
	L09A,B
TOTAL VA 68,386 63,711 62,226 TOTAL KVA 194.3 TOTAL AMP/PHASE 247 230 225 TOTAL AMP 234	

Figure 2.1.12 – LP-BS Revised Panelboard Schedule

Courtyard Feed	er Sizing Wo	orksheet	
Panelboard Tag	LP-1N	LP-3N	LP-BS
Panelboard Voltage	480Y/277	480Y/277	480Y/277
Calculated Design Load (kw)	346.9	134.5	225.4
Calculated Design Load (kva)	346.9	134.5	225.4
Resultant Power Factor	1	1	1
Calculated Design Load (amps)	417.4	161.9	271.3
Feeder Protection Size	450	175	300
Sets	2	1	1
Wire Size			
Phase	3#4/0	3#3/0	3#400MCM
Neutral	1#4/0	1#3/0	1#400MCM
Ground	#2	#6	#4
Conduit Size	(2) 2"	2"	2-1/2"

Figure 2.1.13 – Courtyard Feeder Sizing Worksheet

Atrium

The atrium lighting design is meant to serve as the beacon of the law school. With the extensive glazing looking out to the parking lot, everyone will always know where the entrance is. The atrium serves as both a transition space between the two wings of the building and a place to relax. The light levels are low enough to relax but the surfaces are illuminated to a level that allows them to glow outside.

The panels that are affected by the lighting redesign are as follows: LP-1S which is located in Electric Room 119 on the first floor, and LP-2S which is located in Electric Room 219A on the second floor.

This space will be controlled through the use of photo sensors that will be connected to a dimming panel in an electrical room. The HID fixtures will be connected to the same panel but will simply be switched by the photo sensor.

	Affected Atrium Panels									
		Feeder								
Panelboard	Breaker	Sets	Sets Phase Neutral Ground (
LP-1S	400A, 3P	1	3#350MCM	1#350 MCM	1#4	3"				
LP-2S	225A, 3P	1	3#4/0	1#4/0	1#4	2-1/2"				

Figure 2.2.1 – Atrium Affected Panelboard Information

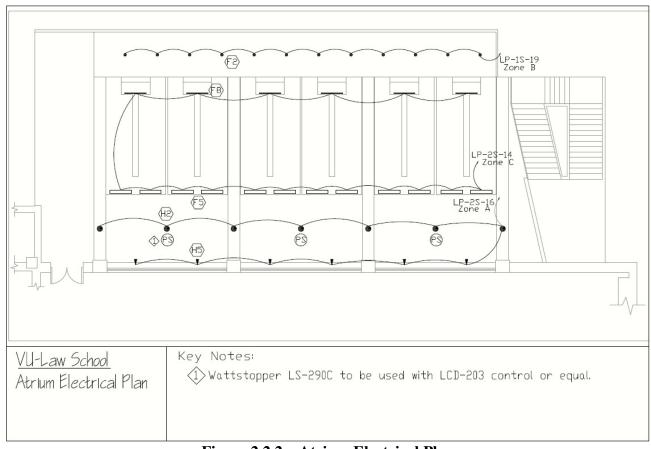


Figure 2.2.2 – Atrium Electrical Plan *Please see Appendix B for full size plan

LCD-203 Controller									
Zone	Circuit	Control							
Α	LP-2S-16	Photo (Switch)							
В	LP-1S-19	Photo (Dim)							
С	LP-2S-14	Photo (Dim)							

Figure 2.2.3 – Proposed Photo Sensor Control *See Appendix C for control specifications

				PANE	ELBO	ARD S	CHE	DULE			
ANEL: LP-1	1S		EQUIP. (SND. BUS	:	\Box			VOLTA	GE:	480/277 VOLT, 3PH, 4W
OCATION: ELE	C.RM.(119A)-1ST	FL.	ISOLAT	ED GND E	BUS:	\sqcap			MAIN C	IRCUIT BKR	:
MOUNTING: SUF	RFACE		NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM: SW	BD 'MDB'	_	A.I.C.:	42000					BUS RA	TING:	600
		BKR.	BKR.	CKT.	L	OAD - V.A		CKT.	BKR.	BKR.	
LOAD DESC	RIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713						
					2,015			2			
SF-1-	-1	30	3	3		3,713				45	RF-1-1
				5		2,015	3,713	4	1	15	
				5			2.015	6			
LIGHT	ING	20	1	7	3.056		2,013				LIGHTING
CORE A	REA				2,576			8	1	20	135 CLASSROOM
LIGHT		20	1	9		3,040					LIGHTING
OFFIC						1,902		10	1	20	90 CLASSROOM
LIGHTI		20	1	11			1,840			00	LIGHTING
OFFIC LIGHT		20	1	13	4.000		2,008	12	1	20	55 CLASSROOM LIGHTING
OFFICE COF		20	1	13	1,800 2.500			14	1	20	MAIN STAIRS
LIGHT		20	1	15	2,500	2.800		14	<u> </u>	20	LIGHTING
MAIN CORRIDOR		- 20				2,500		16	1	20	SOUTH STAIRS
LIGHT		20	1	17		2,000	3,200				LIGHTING
OFFICE S	PACE						1,250	18	1	20	NORTH STAIRS
LIGHTI		20	1	19	350						ENTRY LIGHTING
ATRIL					800			20	1	20	
VERTICAL CO		20	1	21		1,000					SPARE
BASEMENT THRU 151A,B J-I		20	1	23			3.048	22	1	20	SPARE
HAND DR		20	-	23			3,040	24	1	20	SPARE
118B J-B		20	1	25	3.048				<u> </u>	20	SPARE
HAND DR	YERS				5,510			26	1	20	
118A J-B		20	1	27		3,048					SPARE
HAND DR								28	1	20	
SPAF	RE	20	1	29				20		20	SPARE
SPAF	DE .	20	1	31				30	1	20	
SPAF	KE	20	1	31	62.786			32	3	100	
SPAF	RE	20	1	33	02,700			JE		100	PANEL 'LP-3S'
0171	_					63,772		34			
LIGHTING CONT	TROL PANEL	20	1	35			1,000				
LCP-1	IA						60,769	36			
		125	3	37	38,782				L _		
PANELS 'RP-1SA-				20	50,808	40.51-		38	3	50	DANEL II D CO.
(75 KVA	AFMK)			39		40,015 49,414		40			PANEL 'LP-2S'
				41		49,414	36,606	40			
				71			50.186	42			
		TOTAL	VA		172,234	173,219			KVA		511.1
			AMP/PH	ASE	622	625	598	TOTAL			615

Figure 2.2.4 – LP-1S Existing Panelboard Schedule

			PAN	IELBOAR	D SIZINO	ow £	RKSH	EET			
		Panel Tag			LP-1S	Pa	anel Loc	ation:	EL	EC ROOM	1119
		ominal Phase to Neutral Vo			277		Phase		3		
		minal Phase to Phase Volt	_		480		Wires		4		
-	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Rer	narks
2	A	SF-1-1 RF-1-1	6		3713 2015	w	1.00	3713 2015	3713 2015		
3	В	SF-1-1	6		3713	w	1.00	3713	3713		
4	В	RF-1-1	6		2015	w	1.00	2015	2015		
5	C	SF-1-1	6		3713	w	1.00	3713	3713		
6	C	RF-1-1	6		2015	w	1.00	2015	2015		
7 8	A	Lighting Core Area 135Class Wallwash	3		3056 644	w	1.00	3056 644	3056 644		
9	В	Lighting Offices	3		3040	w	1.00	3040	3040		
10	В	Lighting 90 Class	3		1902	w	1.00	1902	1902		
11	С	Lighting Offices	3		1840	w	1.00	1840	1840		
12	C	Lighting 55 Class	3		2008	W	1.00	2008	2008		
13 14	A	Lighting Office Corr. Lighting Main Stair	3		1800 2500	w	1.00	1800 2500	1800 2500		
15	В	Lighting Main Lobby	3		2800	w	1.00	2800	2800		
16	В	Lighting South Stair	3		2500	w	1.00	2500	2500		
17	С	Lighting Office	3		3200	w	1.00	3200	3200		
18	С	Lighting North Stair	3		1250	w	1.00	1250	1250		
19 20	Α	Lighting Atrium Down	3		408 800	w	1.00	408 800	408 800		
21	A B	Lighting Entrance Lighting General	3		1000	w	1.00	1000	1000		
22	В	Lighting 135 Class Amb	3		2028	w	1.00	2028	2028		
23	С	Hand Dryers	9		3048	w	1.00	3048	3048		
24	O	Lighting 135 Class Cove	3		238	w	1.00	238	238		
25	Α	Hand Dryers	9		3048	w	1.00	3048	3048		
26	A B	135 Class Front Cans	3 9		432 3048	w	1.00	432 3048	432		
27 28	В	Hand Dryers 135 Class Board	3		272	w	1.00	272	3048 272		
29	С	Spare	Ŭ		0	w	1.00	0	0		
30	С	Spare			0	w		0	0		
31	Α	Spare			0	w		0	0		
32	Α	Panel LP-3s	9		62786	W	1.00	62786	62786		
33	B B	Spare Panel LP-3s	9		0 63772	w	1.00	0 63772	0 63772		
35	С	LCP-1A	9		1000	W	1.00	1000	1000		
36	Č	Panel LP-3s	9		60769	w	1.00	60769	60769		
37	Α	Panels RP-1SA-1,2	9		38783	w	1.00	38783	38783		
38	Α	Panel LP-2S	9		50156	w	1.00	50156	50156		
39	В	Panels RP-1SA-1,2	9		40015	w	1.00	40015	40015		
40 41	B C	Panel LP-2S Panels RP-1SA-1,2	9		50543 36606	w	1.00	50543 36606	50543 36606		
42	C	Panel LP-2S	9		51047	w	1.00	51047	51047		
PAN	IEL T	OTAL						513.5	513.5	Amps=	618.0
		.OADING			1			kW	kVA	%	Amps
17/	OL L	PHASE TOTAL	Α					170.1	170.1	33%	614.2
		PHASE TOTAL	В					176.6	176.6	34%	637.7
		PHASE TOTAL	С					166.7	166.7	32%	601.9
LOA	D CA	ATAGORIES		Conne	ected		Dei	mand			Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
1		receptacles		0.0	0.0		0.0	0.0			
2		computers	<u> </u>	0.0	0.0		0.0	0.0	1.00		
3		fluorescent lighting HID lighting		31.7 0.0	31.7 0.0		31.7 0.0	31.7 0.0	1.00		
5		incandescent lighting		0.0	0.0		0.0	0.0			
6		HVAC fans		17.2	17.2		17.2	17.2	1.00		
7		heating		0.0	0.0		0.0	0.0			
8		kitchen equipment		0.0	0.0		0.0	0.0			
9	<u> </u>	unassigned	—	464.6	464.6	0.90	418.2	418.2	1.00		
\vdash	10	otal Demand Loads Spare Capacity		20%			467.1 93.4	467.1 93.4			
	Т	otal Design Loads		£U /0			560.5	560.5	1.00	Amps=	674.5
\vdash		9									

Figure 2.2.5 – LP-1S Panelboard Worksheet

NEL:	LP-1S		EQUIP. 0	SND. BUS	i:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(119A)-1ST	FL.	ISOLAT	ED GND I	BUS:	\sqcap			MAIN C	IRCUIT BK	R:
OUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%	П	MLO:	_	
ED FROM:	SWBD 'MDB'	-	A.I.C.:	42000		-		Ш	BUS RA	TING	800
ED I IIOIIII	OVIDD IIIDD										
	PEROPRETION	BKR.	BKR.	CKT. NO.		OAD - V.A		CKT.	BKR.	BKR.	LOAD DECODINE
LOAL	DESCRIPTION	AMPS	POLE		A 0.740	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 2.015			2	1		
	SF-1-1	30	3	3	2,015	3,713					RF-1-1
	31-1-1	- 50	-	_		2.015		4	1	15	141-1-1
				5		2,010	3,713				
							2.015	6			
	LIGHTING	20	1	7	3,056						135 CLASSROOM LIGHTING
С	ORE AREA				644			8	1	20	WALLWASH
	LIGHTING	20	1	9		3,040					LIGHTING
	OFFICES				oxdot	1,902		10	1	20	90 CLASSROOM
	LIGHTING	20	1	11			1,840		.		LIGHTING
	OFFICES		_	40			2,008	12	1	20	55 CLASSROOM
	LIGHTING	20	1	13	1,800			14	1	20	LIGHTING
	CE CORRIDORS LIGHTING	20	1	15	2,500	2.000		14	1	20	MAIN STAIRS LIGHTING
	RIDOR AND LOBBY	20	1	15		2,800 2,500		16	1	20	SOUTH STAIRS
	LIGHTING	20	1	17		2,500	3,200	10	-	20	LIGHTING
	FICE SPACE	20		- "			1.250	18	1	20	NORTH STAIRS
	NUM LIGHTING	20	1	19	408		1,200		<u> </u>		ENTRY LIGHTING
LOW CEIL	LING DOWNLIGHTS				800			20	1	20	
	AL COVE LIGHTS	20	1	21		1,000					135 CLASSROOM LIGHTING
BASEMEN	T THRU 3RD FLOOR					2,028		22	1	20	AMBIENT
151	A,B J-BOXES	20	1	23			3,048				135 CLASSROOM LIGHTING
	AND DRYERS						238	24	1	20	COVE
	8B J-BOXES	20	1	25	3,048						135 CLASSROOM LIGHTING
	AND DRYERS				432			26	1	20	FRONT CANS
	8A J-BOXES	20	1	27		3,048		- 00			135 CLASSROOM LIGHTING
HA	AND DRYERS SPARE	20	1	29		272		28	1	20	BOARD LIGHTS SPARE
	SPARE	20	1	29				30	1	20	SPARE
	SPARE	20	1	31				30	<u> </u>	20	
	SPARE	20	-	31	62,786			32	3	100	
	SPARE	20	1	33	02,700				Ť	100	PANEL 'LP-3S'
						63,772		34			
LIGHTING	CONTROL PANEL	20	1	35			1,000				
	LCP-1A						60,769	36			
		125	3	37	38,782						
	P-1SA-1' & 'RP-1SA-2'				51,062			38	3	50	
(75	KVA XFMR)			39		40,015					PANEL 'LP-2S'
				- 44		49,149		40			
				41			36,606	42			
		TOTAL	1/4		474.040	475.051	49,973	42	I/V/A	ш	512.0
			VA AMP/PH/	V CE	171,046 617	175,254 633	165,660 598	TOTAL			616

Figure 2.2.6 – LP-1S Revised Panelboard Schedules

NEL:	LP-2S	_	EQUIP. 0						VOLTA	_	480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(219A)-2ND	FL.	ISOLAT		BUS:				MAIN C	IRCUIT BKR	<u> </u>
IOUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	PANEL 'LP-1S'	_	A.I.C.:	42000					BUS RA	TING:	225
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO.	A	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 1,275			2			
	SF-2-1	30	3	3	1,270	3,713					RF-2-1
						1,275		4	3	15	
				5			3,713				
							1,275	6			LIGHTING
	LIGHTING CORE AREA	20	1	7	3,840 1.902			8	1	20	LIGHTING 90 CLASSROOM
	LIGHTING	20	1	9	1,902	3,800				20	LIGHTING
	OFFICES	20		,		2.008		10	1	20	50 CLASSROOM
	LIGHTING	20	1	11			2,750				LIGHTING
	AND MAIN CORRIDOR						3,696	12	1	20	OFFICE AREAS
	LIGHTING	20	1	13	1,200						LIGHTING
	OOT COURT	- 00		45	336			14	1	20	ATRIUM
	LIGHTING OOT COURT	20	1	15		600 900		16	1	20	LIGHTING ATRIUM
	LIGHTING	20	1	17		900	160	10	1	20	LIGHTING
	OOT COURT						900	18	1	20	ATRIUM
	LIGHTING	20	1	19	300						LIGHTING
M	OOT COURT				924			20	1	20	220A CORRIDOR
	LIGHTING	20	1	21		1,450					SPARE
OFFI	ICE CORRIDOR		_					22	1	20	004.05
шл	218A AND DRYERS	20	1	23			3,048	24	1	20	SPARE
11/2	218B	20	1	25	3.048			24		20	SPARE
нд	AND DRYERS			20	5,040			26	1	20	0.7.1.2
	248A,B	20	1	27		3,048					SPARE
HA	AND DRYERS							28	1	20	
	251A,B	20	1	29			3,048				SPARE
H.A	ND DRYERS	20		24				30	1	20	CDADE
	SPARE	20	1	31				32	1	20	SPARE
	SPARE	20	1	33				JE	<u> </u>		SPARE
								34	1	20	
LIGHTING	G CONTROL PANEL	20	1	35			1,000				SPARE
	LCP-1A							36	1	20	
DANIEL CURS	2004 41 9 100 204 21	125	3	37	34,270			20		20	SPARE
	P-2SA-1' & 'RP-2SA-2' SKVA XFMR)			39		22.020		38	1	20	SPARE
(/5	NVM ALIIIN)			29		32,620		40	1	20	JPARE
				41			30.596				SPARE
								42	1	20	
		TOTAL			50,808	49,414	50,186	TOTAL			150.4
EMARKS:		TOTAL	AMP/PHA	A SE	183	178	181	TOTAL	AMP		181

Figure 2.2.7 – LP-2S Original Panelboard Schedule

			PA	NELBOA	RD SIZIN	IG W	ORKS	HEET			
		Panel Tag		>	LP-2S	Pa	anel Loc	ation:	Ele	ec. Room 2	219A
		ninal Phase to Neutral V			277		Phase		3		
		inal Phase to Phase Vo			480		Wires		4		
Pos	Ph.	Load Type SF-2-1	Cat.	Location	Load 3713	Units	I. PF 1.00	Watts 3713	VA 3713	Ren	narks
2	A	RF-2-1	6		1275	va w	1.00	1275	1275		
3	В	SF-2-1	6		3713	w	1.00	3713	3713		
4	В	RF-2-1	6		1275	w	1.00	1275	1275		
5	С	SF-2-1	6		3713	w	1.00	3713	3713		
6	С	RF-2-1	6		1275	w	1.00	1275	1275		
7 8	A	Lighting Core Area 90 Classroom Ltg	3		3840 1902	w	1.00	3840 1902	3840 1902		
9	В	Lighting Offices	3		3800	w	1.00	3800	3800		
10	В	50 Classroom Ltg	3		2008	w	1.00	2008	2008		
11	С	Lighting Main Lobby	3		2750	w	1.00	2750	2750		
12	С	Lighting Offices	3		3696	w	1.00	3696	3696		
13 14	A	Moot Ltg Ambient Atrium Ltg. Cove/WW	3		1276 666	W	1.00	1276 666	1276 666		
15	В	Moot Ltg Front	3		398	w	1.00	398	398		
16	В	Atrium Ltg. Pendant	4		903	w	1.00	903	903		
17	C	Moot Ltg Accent/Cove	3		847	w	1.00	847	847		
18	С	Atrium Projectors	4		564	w	1.00	564	564		
19	Α	Moot Ltg Front WW	3		148	w	1.00	148	148		
20 21	A B	Lighting 220A	3		924 1450	w	1.00	924 1450	924 1450		
22	В	Lighting Office Corr. Spare	3		0	w	1.00	0	0		
23	C	Hand Dryers	9		3048	w	1.00	3048	3048		
24	C	Spare			0	w	1.00	0	0		
25	Α	Hand Dryers	9		3048	w	1.00	3048	3048		
26	Α	Spare			0	w	1.00	0	0		
27	В	Hand Dryers	9		3048	W	1.00	3048	3048		
28 29	B C	Spare Hand Dryers	9		0 3048	w	1.00	0 3048	0 3048		
30	C	Spare	9		0	W	1.00	0	0		
31	Α	Spare			0	w	1.00	0	0		
32	Α	Spare			0	w	1.00	0	0		
33	В	Spare			0	w	1.00	0	0		
34	В	Spare	_		0	W	1.00	0	0		
35 36	C	LCP-1A Spare	9		1000 0	w	1.00	1000 0	1000 0		
37	A	Panels RP-2SA-1,2	9		34270	w	1.00	34270	34270		
38	Α	Spare			0	w	1.00	0	0		
39	В	Panels RP-2SA-1,2	9		31990	W	1.00	31990	31990		
40	В	Spare			0	w	1.00	0	0		
41 42	C	Panels RP-2SA-1,2 Spare	9		30596 0	W	1.00	30596 0	30596 0		
		OTAL			U	W	1.00	150.2		Amps=	180.7
PHA		OADING PHASE TOTAL	Α					kW 51.1	kVA 51.1	% 34%	Amps 184.3
		PHASE TOTAL	В					48.6	48.6	34%	175.4
		PHASE TOTAL	C					50.5	50.5	34%	182.4
104		ATAGORIES		Conne	acted		Da.	mand		· · · · · ·	
LOA	U CF	TAGONILO		kW	kVA	DF	kW	kVA	PF		Ver. 1.02
1		receptacles		0.0	0.0		0.0	0.0			
2		computers		0.0	0.0		0.0	0.0			
3	1	fluorescent lighting		23.7	23.7	0.90	21.3	21.3	1.00		·
4		HID lighting		1.5	1.5		1.5	1.5	1.00		
5	ır	ncandescent lighting HVAC fans		0.0 15.0	0.0 15.0		0.0 15.0	0.0 15.0	1.00	 	
7		heating		0.0	0.0	0.95	0.0	0.0	1.00	 	
8		kitchen equipment		0.0	0.0	3.00	0.0	0.0			
9		unassigned		110.0	110.0		110.0	110.0	1.00		
		al Demand Loads					147.8	147.8			
		Spare Capacity		20%			29.6	29.6	1.00	A	010.1
	10	tal Design Loads					177.4	177.4	1.00	Amps=	213.4

Figure 2.2.8 – LP-2S Panelboard Worksheet

NEL:	LP-2S		EQUIP. 0	SND. BUS	:	\Box			VOLTA	GE:	480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(219A)-2ND	L.	-	ED GND E		H				IRCUIT BKI	
OUNTING:	SURFACE	_	NEUTRA		100%		200%		MLO:	_	
ED FROM:	PANEL 'LP-1S'	-	A.I.C.:		100%		20070	Ш	BUS RA	TINC	225
ED FROM:	PANEL LF-13	-								_	223
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 1,275			2			
	SF-2-1	30	3	3	1,2/5	3,713					RF-2-1
	01-2-1	30	-	,		1.275		4	3	15	101-2-1
				5		1,270	3,713				
							1,275	6			
	LIGHTING	20	1	7	3,840						LIGHTING
	ORE AREA				1,902			8	1	20	90 CLASSROOM
	LIGHTING	20	1	9		3,800					LIGHTING
	OFFICES	20		- 44		2,008		10	1	20	50 CLASSROOM
	LIGHTING	20	1	11			2,750	12	1	20	LIGHTING
	AND MAIN CORRIDOR COUR LIGHTING	20	1	13	1,276		3,696	12	1	20	OFFICE AREAS ATRIUM LIGHTING
	AMBIENT	20		13	666			14	1	20	COVE/WALLWASH
	COUR LIGHTING	20	1	15	000	398		- 17	<u> </u>		ATRIUM LIGHTING
	FRONT					1,467		16	1	20	HID
MOOT	COURT LIGHTING	20	1	17			847				SPARE
	ACCENT/COVE							18	1	20	
	LIGHTING	20	1	19	148						LIGHTING
	IT WALL WASH				924			20	1	20	220A CORRIDOR
	LIGHTING	20	1	21		1,450		22		20	SPARE
UFFI	ICE CORRIDOR 218A	20	1	23			3.048	22	1	20	SPARE
μΔ	AND DRYERS	20	-	23			3,048	24	1	20	SPARL
11/2	218B	20	1	25	3.048					20	SPARE
HA	AND DRYERS				3,0.0			26	1	20	
	248A,B	20	1	27		3,048					SPARE
HA	AND DRYERS							28	1	20	
	251A,B	20	1	29			3,048				SPARE
HA	ND DRYERS	20		2.4				30	1	20	00405
	SPARE	20	1	31				32	1	20	SPARE
	SPARE	20	1	33				32	1	20	SPARE
	OI PARE	20		33				34	1	20	OI AILE
LIGHTING	G CONTROL PANEL	20	1	35			1,000				SPARE
	LCP-1A						.,	36	1	20	
		125	3	37	34,270						SPARE
	P-2SA-1' & 'RP-2SA-2'							38	1	20	
(75	KVA XFMR)			39		31,990			L.,		SPARE
				44			00.555	40	1	20	CDARE
				41			30,596	42	1	20	SPARE
		TOTAL	VΔ		51,062	49.149	49.973	TOTAL		20	150.2
			AMP/PH	A SF	184	177	180	TOTAL			181

Figure 2.2.9 – LP-2S Revised Panelboard Schedule

Atrium Feeder Sizin	g Worksheet	
Panelboard Tag	LP-1S	LP-2S
Panelboard Voltage	480Y/277	480Y/277
Calculated Design Load (kw)	560.5	177.4
Calculated Design Load (kva)	560.5	177.4
Resultant Power Factor	1	1
Calculated Design Load (amps)	674.5	213.4
Feeder Protection Size	700	225
Sets	2	1
Wire Size		
Phase	3#400MCM	3#4/0
Neutral	1#400MCM	1#4/0
Ground	#1/0	#4
Conduit Size	(2) 2-1/2"	2"

Figure 2.2.10 – Atrium Feeder Sizing Worksheet

135-Seat Classroom

The 135-seat classroom is the largest classroom in the law school and is used for everything from lectures, to presentations, to exams and more. The lighting in the space must be flexible to allow for all of those things to take place. The lighting also is designed to bring out the architectural features of the space such as the panels on the walls and the cove in the ceiling.

The panels that are affected by the lighting design are as follows: LP-1S which is located in Electric Room 119A on the first floor and RP-1SA-3 which is also located in 119A.

The controls in the classroom will be a scene controller that is equivalent to Lutron's Grafik Eye 3000. There are four zones in the space, each of which will be controlled according to whichever scene has been selected. Occupancy sensors will also be used to meet ASHRAE 90.1 automatic shutoff criteria.

	Affected 135-Seat Classroom Panels									
	Feeder									
Panelboard	Breaker	Sets	Sets Phase Neutral Ground							
LP-1S	400A, 3P	1	3#350MCM	1#350 MCM	1#4	3"				
RP-1SA-3	225A, 3P	1	3#250MCM	1#250MCM	1#4	2-1/2"				

Figure 2.3.1 – 135-Seat Classroom Affected Panelboard Information

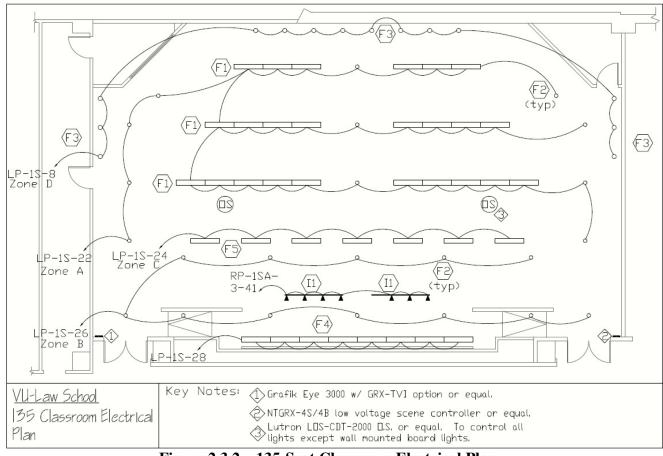


Figure 2.3.2 – 135-Seat Classroom Electrical Plan *Please see Appendix B for full size plan

135-Seat Classroom Scene Matrix										
Zone										
Scene	А	В	С	D						
General										
Lighting	100%	100%	100%	100%						
Lecture	80%	100%	50%	50%						
Electronic										
Presentation	10%	10%	80%	100%						

Figure 2.3.3. – 135-Seat Classroom Scene Control Matrix *See Appendix C for control specifications

			PANE	ELBO	ARD S	CHE	DULE	•		
PANEL: LP-1S .OCATION: ELEC.RM.(119A)-1S	Γ F L.		GND. BUS ED GND E					VOLTA MAIN C	GE: IRCUIT BKR	480/277 VOLT, 3PH, 4W
MOUNTING: SURFACE ED FROM: SWBD 'MDB'	_	NEUTRA A.I.C.:	42000	100%	-	200%		MLO: BUS RA	TING:	600
LOAD DESCRIPTION	BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	LOAD DEADDIDTION
LOAD DESCRIPTION	AMPS	POLE	NO.	A 2740	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
			1	3,713 2,015			2			
SF-1-1	30	3	3	2,010	3,713					RF-1-1
					2.015		4	1	15	
			5			3,713				
						2,015	6			
LIGHTING	20	1	7	3,056						LIGHTING
CORE AREA				2,576			8	1	20	135 CLASSROOM
LIGHTING	20	1	9		3,040		40		20	LIGHTING
OFFICES LIGHTING	20	1	11		1,902	4.040	10	1	20	90 CLASSROOM LIGHTING
OFFICES	20	1	11			1,840 2.008	12	1	20	55 CLASSROOM
LIGHTING	20	1	13	1,800		2,000	12	<u> </u>	20	LIGHTING
OFFICE CORRIDORS	20		10	2,500			14	1	20	MAIN STAIRS
LIGHTING	20	1	15	2,500	2.800		- 11	<u> </u>	20	LIGHTING
MAIN CORRIDOR AND LOBBY					2,500		16	1	20	SOUTH STAIRS
LIGHTING	20	1	17		2,000	3,200				LIGHTING
OFFICE SPACE						1,250	18	1	20	NORTH STAIRS
LIGHTING	20	1	19	350						ENTRY LIGHTING
ATRIUM				800			20	1	20	
VERTICAL COVE LIGHTS	20	1	21		1,000					SPARE
BASEMENT THRU 3RD FLOOR							22	1	20	
151A,B J-BOXES	20	1	23			3,048				SPARE
HAND DRYERS 118B J-BOXES	20	1	25	0.040			24	1	20	SPARE
HAND DRYERS	20	1	25	3,048			26	1	20	SPARE
118A J-BOXES	20	1	27		3.048		20	1	20	SPARE
HAND DRYERS	20				3,040		28	1	20	OI AILE
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							
				62,786			32	3	100	
SPARE	20	1	33							PANEL 'LP-3S'
					63,772		34			
LIGHTING CONTROL PANEL	20	1	35			1,000				
LCP-1A	405	_				60,769	36		$oxed{oxed}$	
PANELS 'RP-1SA-1' & 'RP-1SA-2'	125	3	37	38,782			38	3	50	
(75 KVA XFMR)			39	50,808	40.015		30	3	30	PANEL 'LP-2S'
(13 KVA AFMR)			28		49,414		40			FMNLL LF-23
			41		45,414	36,606	40			
			71			50,186	42			
	TOTAL	VA		172,234	173,219		TOTAL	KVA		511.1
		AMP/PH	ASF	622	625	598	TOTAL			615

Figure 2.3.4 – LP-1S Original Panelboard Schedule

			PAN	ELBOAR	D SIZINO	3 WO	RKSH	EET			
		Panel Tag		>	LP-1S	Pa	anel Loc	ation:	EL	EC ROOM	1119
		minal Phase to Neutral Vo			277		Phase		3		
_		minal Phase to Phase Volt			480		Wires		4		
Pos	_	Load Type	Cat.	Location	Load	Units	1. PF	Watts	VA	Rer	narks
2	A	SF-1-1 RF-1-1	6 6		3713 2015	w	1.00	3713 2015	3713 2015		
3	В	SF-1-1	6		3713	w	1.00	3713	3713		
4	В	RF-1-1	6		2015	w	1.00	2015	2015		
5	С	SF-1-1	6		3713	w	1.00	3713	3713		
<u>6</u> 7	C A	RF-1-1 Lighting Core Area	6 3		2015 3056	w	1.00	2015 3056	2015 3056		
8	A	135Class Wallwash	3		644	W	1.00	644	644		
9	В	Lighting Offices	3		3040	w	1.00	3040	3040		
10	В	Lighting 90 Class	3		1902	w	1.00	1902	1902		
11	С	Lighting Offices	3		1840	w	1.00	1840	1840		
12 13	C A	Lighting 55 Class Lighting Office Corr.	3		2008 1800	w	1.00	2008 1800	2008 1800		
14	A	Lighting Main Stair	3		2500	w	1.00	2500	2500		
15	В	Lighting Main Lobby	3		2800	w	1.00	2800	2800		
16	В	Lighting South Stair	3		2500	w	1.00	2500	2500		
17	С	Lighting Office	3		3200	W	1.00	3200	3200		
18 19	C A	Lighting North Stair Lighting Atrium Down	3		1250 408	w	1.00	1250 408	1250 408		
20	A	Lighting Entrance	3		800	w	1.00	800	800		
21	В	Lighting General	3		1000	w	1.00	1000	1000		
22	В	Lighting 135 Class Amb	3		2028	w	1.00	2028	2028		
23	С	Hand Dryers	9		3048	w	1.00	3048	3048		
24	C	Lighting 135 Class Cove	3		238	W	1.00	238	238		
25 26	A	Hand Dryers 135 Class Front Cans	9		3048 432	w	1.00	3048 432	3048 432		
27	В	Hand Dryers	9		3048	w	1.00	3048	3048		
28	В	135 Class Board	3		272	w	1.00	272	272		
29	С	Spare			0	w		0	0		
30	C	Spare			0	W		0	0		
32	A	Spare Panel LP-3s	9		62786	w	1.00	62786	62786		
33	В	Spare	Ť		0	w	1.00	0	0		
34	В	Panel LP-3s	9		63772	w	1.00	63772	63772		
35	С	LCP-1A	9		1000	w	1.00	1000	1000		
36	C	Panel LP-3s Panels RP-1SA-1,2	9		60769	W	1.00	60769	60769		
37 38	A	Panels RP-15A-1,2 Panel LP-2S	9		38783 50156	w	1.00	38783 50156	38783 50156		
39	В	Panels RP-1SA-1,2	9		40015	w	1.00	40015	40015		
40	В	Panel LP-2S	9		50543	w	1.00	50543	50543		
41	С	Panels RP-1SA-1,2	9		36606	w	1.00	36606	36606		
42	С	Panel LP-2S OTAL	9		51047	W	1.00	51047 513.5	51047 513.5	Amps=	618.0
								0.0.0			0.810
PHA	SE L	OADING	Щ					kW	kVA	%	Amps
-		PHASE TOTAL PHASE TOTAL	A B					170.1	170.1	33% 34%	614.2 637.7
-		PHASE TOTAL PHASE TOTAL	C					176.6 166.7	176.6 166.7	34%	601.9
100	D 0 1			0	actod		Dr		.00.7	OE /0	
LUA	U CF	TAGORIES		<u>Conne</u> kW	kVA	DF	kW	mand kVA	PF		Ver. 1.02
1		receptacles		0.0	0.0		0.0	0.0			
2		computers		0.0	0.0		0.0	0.0			
3		fluorescent lighting		31.7	31.7		31.7	31.7	1.00		
4		HID lighting	\vdash	0.0	0.0		0.0	0.0			
5		incandescent lighting HVAC fans	\vdash	0.0 17.2	0.0 17.2		0.0 17.2	0.0 17.2	1.00		
7		heating	\vdash	0.0	0.0		0.0	0.0	1.00		
8		kitchen equipment		0.0	0.0		0.0	0.0			
9		unassigned		464.6	464.6	0.90	418.2	418.2	1.00		
<u> </u>	To	otal Demand Loads	Щ	0001			467.1	467.1			
—	т	Spare Capacity otal Design Loads	\vdash	20%			93.4 560.5	93.4 560.5	1.00	Amns-	674.5
	ı	otat Design Loads					300.5	500.5	1.00	Amps=	074.5

Figure 2.3.5 – LP-1S Panelboard Worksheet

NEL: LP-1S		ΕΩI		ND. BUS	ELBO				VOLTA	SE.	480/277 VOLT, 3PH, 4W
	(119A)-1ST FL.			ED GND E		\vdash				IRCUIT BKR	
							2000/	_		KCUII BKK	
OUNTING: SURFACE				L BUS:	100%		200%		MLO:		
D FROM: SWBD 'M	DR.	A.I.	.C.:	42000					BUS RA	TING:	800
	BK		KR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD DESCRIPT	ION AM	PS PC	OLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
		+	-	1	3,713			2			
SF-1-1	30	_	3	3	2,015	3.713					RF-1-1
31-1-1			_	-		2.015		4	1	15	131-1-1
		-	\neg	5		2,010	3,713				
							2,015	6			
LIGHTING	20		1	7	3,056						135 CLASSROOM LIGHTING
CORE AREA					644			8	1	20	WALLWASH
LIGHTING	20		1	9		3,040					LIGHTING
OFFICES	-	_		- 44		1,902		10	1	20	90 CLASSROOM
LIGHTING OFFICES	20	-	1	11			1,840 2.008	12	1	20	LIGHTING 55 CLASSROOM
LIGHTING	20	_	1	13	1,800		2,008	12	1	20	LIGHTING
OFFICE CORRIDO			-	13	2.500			14	1	20	MAIN STAIRS
LIGHTING	20	_	1	15	2,500	2.800					LIGHTING
MAIN CORRIDOR AND	LOBBY					2,500		16	1	20	SOUTH STAIRS
LIGHTING	20		1	17			3,200				LIGHTING
OFFICE SPACE							1,250	18	1	20	NORTH STAIRS
ATRIUM LIGHTIN			1	19	408						ENTRY LIGHTING
LOW CEILING DOWN		_			800			20	1	20	
VERTICAL COVE LI		<u> </u>	1	21		1,000					135 CLASSROOM LIGHTING
BASEMENT THRU 3RD 151A.B J-BOXE		+	1	23		2,028	2.040	22	1	20	AMBIENT 135 CLASSROOM LIGHTING
HAND DRYERS			-	23			3,048 238	24	1	20	COVE
118B J-BOXES		_	1	25	3.048		230		<u> </u>	20	135 CLASSROOM LIGHTING
HAND DRYERS	5				432			26	1	20	FRONT CANS
118A J-BOXES	20		1	27		3,048					135 CLASSROOM LIGHTING
HAND DRYERS	3					272		28	1	20	BOARD LIGHTS
SPARE	20		1	29							SPARE
		_						30	1	20	
SPARE	20		1	31	00.705			22	3	100	
SPARE	20		1	33	62,786			32	3	100	PANEL 'LP-3S'
SFARE	20		•	33		63.772		34			FANLL LF-33
LIGHTING CONTROL	PANEL 20		1	35		05,172	1.000	, , , , , , , , , , , , , , , , , , ,			
LCP-1A							60,769	36			
	12	5	3	37	38,782						
PANELS 'RP-1SA-1' & 'F					51,062			38	3	50	
(75 KVA XFMR)	.)	\perp		39		40,015					PANEL 'LP-2S'
	_	_	_			49,149		40			
		+	\dashv	41			36,606	42			
	TOT	AL VA			171,046	175,254	49,973 165,660	TOTAL	KVΔ		512.0
		AL AMI	D/DH A	SF	617	633	598	TOTAL			616

Figure 2.3.6 – LP-1S Revised Panelboard Schedules

NEL:	RP-1SA-3		EQUIP. 0	SND. BUS	S:				VOLTA	GE:	120/208 VOLT, 3PH, 4W
CATION:	ELEC.RM.(119A)-1ST	FL.	ISOLAT	ED GND I	BUS:				MAIN C	RCUIT BKR:	125
OUNTING:	SURFACE	-	NEUTRA	L BUS:	100%	┌	200%		MLO:		
D FROM:	PANEL 'LP-1S'	-	A.I.C.:			ш		_	BUS RA		225
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO.	A	B	. с	NO.	POLE	AMPS	LOAD DESCRIPTION
	SEAT POWER	20	1	1	1,620						102 VP
101	SEAT POWER	20	1	3	435	1.620		2	1	20	102 VP
						435		4	1	20	
101	SEAT POWER	20	1	5			1,440				103 SEAT POWER
101	SEAT POWER	20	1	7	4.000		1,440	6	1	20	103 SEAT POWER
101	SEAT POWER	20	1	-	1,260 1,440			8	1	20	103 SEAT POWER
101	SEAT POWER	20	1	9	7,440	1,080		Ť			103 SEAT POWER
						1,440		10	1	20	
101	SEAT POWER	20	1	11			1,260	40		20	102 SEAT POWER
101	SEAT POWER	20	1	13	1,800		1,080	12	1	20	102 SEAT POWER
101	SEAT FOWER	20	-	13	900			14	1	20	102 SEAT FOWER
101	SEAT POWER	20	1	15		1,260					102 SEAT POWER
						1,620		16	1	20	
101	SEAT POWER	20	1	17			1,800				102 SEAT POWER
101	SEAT POWER	20	1	19	1,620		1,800	18	1	20	102 SEAT POWER
101	SEAT FOWER	20	1	19	1,620			20	1	20	102 SEAT FOWER
101	SEAT POWER	20	1	21	1,200	1,620					102 SEAT POWER
						1,440		22	1	20	
101	SEAT POWER	20	1	23			1,440 1,080	24	1	20	102 SEAT POWER
101	SEAT POWER	20	1	25	1,260		1,000	24	-	20	102 SEAT POWER
	52711 511211	20			900			26	1	20	102 027 11 0 11211
101	SEAT POWER	20	1	27		1,080					102 SEAT POWER
101	DE LE DOUIED					1,620		28	1	20	400 OF 4 T DOLLED
101	SEAT POWER	20	1	29			1,260 1,800	30	1	20	102 SEAT POWER
101	SEAT POWER	20	1	31	1,800		1,000	30	<u> </u>	20	102 SEAT POWER
					1,260			32	1	20	
101	SEAT POWER	20	1	33		1,260					102 SEAT POWER
404	SEAT POWER	20	1	35		1,440	4.000	34	1	20	103 SEAT POWER
1013	SEAT PUWER	20	7	35			1,800	36	1	20	103 SEAT POWER
ILUX	CONTROLLER	20	1	37	1,000		1,440	30			103 SEAT POWER
					1,260			38	1	20	
CRESTRO	N POWER SUPPLY	20	1	39		276		40	1	20	SPARE
	SPARE	20	1	41				40	1	20	SPARE
								42	1	20	OI / III E
		TOTAL			17,815	16,191	17,640	TOTAL			51.6
EMARKS:		TOTAL	AMP/PH/	ASE	148	135	147	TOTAL	AMP		143

Figure 2.3.7 – RP-1SA-3 Original Panelboard Schedule

			PA	NELBOA	RD SIZIN	IG W	ORKS	HEET			
		Panel Tag		>	RP-1SA-3	Pa	anel Loc	ation:	ELE	EC ROOM	119A
		inal Phase to Neutral \			120		Phase		3		
	Nom	inal Phase to Phase V	oltage	·>	208		Wires	3:	4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Rer	narks
1	Α	101 Seat Power	1		1620	w	1.00	1620	1620		
2	Α	102 VP	9		435	W	1.00	435	435		
3	В	101 Seat Power	1		1620	W	1.00	1620	1620		
4	В	102 VP	9		435	W	1.00	435	435		
5	С	101 Seat Power	1		1440	W	1.00	1440	1440		
6	С	103 Seat Power	1		1440	W	1.00	1440	1440		
7	Α	101 Seat Power 103 Seat Power	1		1260	W	1.00	1260	1260		
8 9	A B	101 Seat Power	1		1440 1080	W	1.00	1440 1080	1440 1080	1	
10	В	102 Seat Power	1		1440	w	1.00	1440	1440		
11	C	101 Seat Power	1		1260	w	1.00	1260	1260		
12	C	102 Seat Power	1		1080	w	1.00	1080	1080		
13	A	101 Seat Power	1		1800	w	1.00	1800	1800		
14	Α	102 Seat Power	1		900	w	1.00	900	900		
15	В	101 Seat Power	1		1260	w	1.00	1260	1260		
16	В	102 Seat Power	1		1260	w	1.00	1260	1260		
17	С	101 Seat Power	1		1800	W	1.00	1800	1800		
18	С	102 Seat Power	1		1800	w	1.00	1800	1800		
19	Α	101 Seat Power	1		1620	W	1.00	1620	1620		
20	Α	102 Seat Power	1		1260	W	1.00	1260	1260		
21	В	101 Seat Power	1		1620	w	1.00	1620	1620		
22 23	B C	102 Seat Power 101 Seat Power	1		1440 1440	w	1.00	1440 1440	1440 1440		
	C	102 Seat Power	1		1080	w	1.00	1080	1080		
24 25	A	101 Seat Power	1		1260	w	1.00	1260	1260		
26	A	102 Seat Power	1		900	w	1.00	900	900		
27	В	101 Seat Power	1		1080	w	1.00	1080	1080		
28	В	102 Seat Power	1		1620	w	1.00	1620	1620		
29	C	101 Seat Power	1		1260	w	1.00	1260	1260		
30	С	102 Seat Power	1		1800	w	1.00	1800	1800		
31	Α	101 Seat Power	1		1800	W	1.00	1800	1800		
32	Α	102 Seat Power	1		1260	W	1.00	1260	1260		
33	В	101 Seat Power	1		1260	w	1.00	1260	1260		
34	В	102 Seat Power	1		1440	W	1.00	1440	1440		
35	С	101 Seat Power	1		1800	W	1.00	1800	1800		
36	С	103 Seat Power	9		1440	w	1.00	1440	1440		
37 38	A	ILUX Controller 103 Seat Power	1		1000 1260	w	1.00	1000 1260	1000 1260		
39	В	Crestron Power	9		276	w	1.00	276	276		
40	В	Spare	۳		0	w	1.00	0	0		
41	C	135 Class Track Ltg	5		700	w	1.00	700	700		
42	Č	Spare Spare	Ť		0	w	1.00	0	0		
		OTAL						52.0	52.0	Amps=	144.4
DLIA	CE '	OADING						1,147			Λ και
PHA		OADING HASE TOTAL						kW 17.8	kVA 17.8	% 34%	Amps 148.5
		HASE TOTAL	A B					15.8	15.8	34%	131.9
		HASE TOTAL	C					18.3	18.3	35%	152.8
									10.0	00 /6	
LOA	D CA	TAGORIES	\vdash	Conne				mand	חר		Ver. 1.02
-		rooptodes	Н	kW	kVA	DF	kW	kVA	PF		
2		receptacles computers	\vdash	49.1 0.0	49.1 0.0		49.1 0.0	49.1 0.0	1.00		
3	f	luorescent lighting	\vdash	0.0	0.0	0.90	0.0	0.0			
4		HID lighting	H	0.0	0.0	0.30	0.0	0.0			
5	in	candescent lighting		0.7	0.7		0.7	0.7	1.00		
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		2.1	2.1	0.95	2.0	2.0	1.00		<u> </u>
		al Demand Loads					51.9	51.9			
		pare Capacity		20%			10.4	10.4			
	Tot	al Design Loads					62.3	62.3	1.00	Amps=	172.9

Figure 2.3.8 – RP-1SA-3 Panelboard Worksheet

ANEL:	RP-1SA-3		EQUIP. 0	SND. BUS	S:				VOLTA	GE:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(119A)-1ST	FL.	ISOLAT	ED GND I	BUS:				MAIN C	RCUIT BKR:	125
OUNTING:	SURFACE	_	NEUTRA	L BUS:	100%	−	200%	_	MLO:		
ED FROM:	PANEL 'LP-1S'	_	A.I.C.:	22000				-	BUS RA		225
		BKR.	BKR.	CKT.	L	OAD - V.A	١.	CKT.	BKR.	BKR.	
	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
101	SEAT POWER	20	1	1	1,620 435			2	1	20	102 VP
101	SEAT POWER	20	1	3	455	1,620					102 VP
						435		4	1	20	
101	SEAT POWER	20	1	5			1,440 1,440	6	1	20	103 SEAT POWER
101	SEAT POWER	20	1	7	1,260		1,440	-	'	20	103 SEAT POWER
					1,440			8	1	20	
101	SEAT POWER	20	1	9		1,080					103 SEAT POWER
101	SEAT POWER	20	1	11		1,440	1 200	10	1	20	102 SEAT POWER
101	SLAT FUWER	20	-	- 11			1,260 1.080	12	1	20	102 SEAT POWER
101	SEAT POWER	20	1	13	1,800		1,000				102 SEAT POWER
					900			14	1	20	
101	SEAT POWER	20	1	15		1,260 1,620		16	1	20	102 SEAT POWER
101	SEAT POWER	20	1	17		1,620	1,800	10	1	20	102 SEAT POWER
	our in one in						1,800	18	1	20	102 027 11 1 0 11211
101	SEAT POWER	20	1	19	1,620						102 SEAT POWER
101	SEAT POWER	20	1	21	1,260	4.000		20	1	20	102 SEAT POWER
101	SEAT POWER	20	1	21		1,620 1,440		22	1	20	102 SEAT POWER
101	SEAT POWER	20	1	23		1,440	1,440		·		102 SEAT POWER
							1,080	24	1	20	
101	SEAT POWER	20	1	25	1,260 900			26	1	20	102 SEAT POWER
101	SEAT POWER	20	1	27	900	1,080		20	1	20	102 SEAT POWER
						1,620		28	1	20	
101	SEAT POWER	20	1	29			1,260				102 SEAT POWER
404	SEAT POWER	20	1	31	4 000		1,800	30	1	20	102 SEAT POWER
101	JLAI PUWER	20	1	31	1,800 1,260			32	1	20	102 SEAT POWER
101	SEAT POWER	20	1	33	1,200	1,260					102 SEAT POWER
						1,440		34	1	20	
101	SEAT POWER	20	1	35			1,800 1,440	36	1	20	103 SEAT POWER
LIIX	CONTROLLER	20	1	37	1.000		1,440	30	1	20	103 SEAT POWER
.2070					1,260			38	1	20	
CRESTRO	ON POWER SUPPLY	20	1	39		276		40	1	20	SPARE
135 CLAS	SSROOM LIGHTING	20	1	41			700	40	1	20	SPARE
	TRACK							42	1	20	
		TOTAL			17,815	16,191	18,340	TOTAL			52.3
EMARKS:		TOTAL	AMP/PHA	ASE	148	135	153	TOTAL	AMP		145

Figure 2.3.9 – RP-1SA-3 Revised Panelboard Schedule

135-Seat Classroom Feede	r Sizing Worl	ksheet
Panelboard Tag	LP-1S	RP-1SA-3
Panelboard Voltage	480Y/277	208Y/120
Calculated Design Load (kw)	560.5	62.3
Calculated Design Load (kva)	560.5	62.3
Resultant Power Factor	1	1
Calculated Design Load (amps)	674.5	172.9
Feeder Protection Size	700	175
Sets	2	1
Wire Size		
Phase	3#400MCM	3#2/0
Neutral	1#400MCM	1#2/0
Ground	#1/0	#6
Conduit Size	(2) 2-1/2"	2"

Figure 2.3.10 – 135-Seat Classroom Feeder Sizing Worksheet

Moot Courtroom

The moot courtroom is a space that will be used for mock trials, and classroom tasks such as exam taking, lectures, presentations and general discussions. The lighting design for the space is flexible and functional. One of the main goals of the new lighting design is to accent the architecture that dominates the space. There is a substantial amount of wood and points of interest on the perimeter and the ceiling.

The panels that are affected by the lighting redesign are as follows: LP-2S which is located in Electrical Room 219A on the second floor and RP-2SA-1 which is also located in 219A.

The controls for the space will be similar to those in the classroom. A scene controller equivalent to Lutron's Grafik Eye 3000 will provide scene control. There are four zones in the space, each of which will be controlled depending on the scene selected. There are also occupancy sensors in the room as a means of meeting ASHRAE 90.1 automatic shutoff criteria.

	Affected Moot Courtroom Panels												
	Feeder												
Panelboard	Breaker	Sets											
LP-2S	225A, 3P	1	3#4/0	1#4/0	1#4	2-1/2"							
RP-2SA-1	125A, 3P	2	2 3#3/0 1#3/0 1#3										

Figure 2.4.1 – Moot Courtroom Affected Panelboard Information

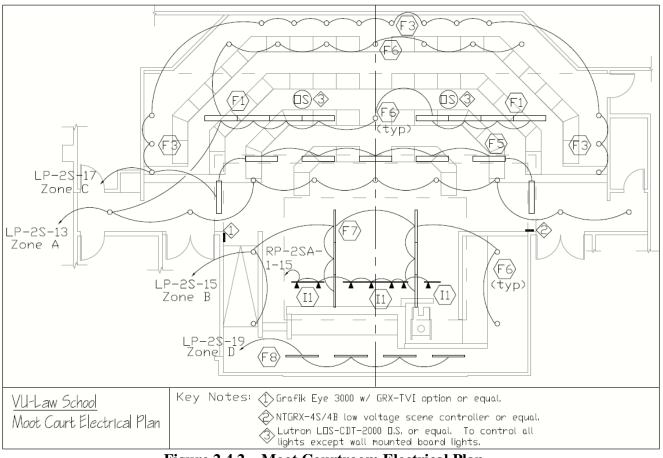


Figure 2.4.2 – Moot Courtroom Electrical Plan *See Appendix B for full size plan

	Moot Court	room Scene	Matrix	
		Zo	ne	
Scene	Α	В	С	D
General				
Lighting	100%	100%	100%	100%
Court	50%	100%	80%	100%
Lecture	80%	100%	50%	50%
Electronic				
Presentation	10%	10%	80%	0%

Figure 2.4.3 – Moot Courtroom Scene Control Matrix
*See Appendix C for control specifications

NEL:	LP-2S	_	EQUIP. (VOLTA	_	480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(219A)-2ND	FL.	ISOLAT		BUS:				MAIN C	IRCUIT BKR	<u> </u>
IOUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	PANEL 'LP-1S'	_	A.I.C.:	42000					BUS RA	TING:	225
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO. 1	A 240	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 1,275			2			
	SF-2-1	30	3	3	1,210	3,713		_			RF-2-1
						1,275		4	3	15	
				5			3,713				
							1,275	6			
	LIGHTING	20	1	7	3,840					20	LIGHTING
	ORE AREA LIGHTING	20	1	9	1,902	3,800		8	1	20	90 CLASSROOM LIGHTING
	OFFICES	20	-	3		2,008		10	1	20	50 CLASSROOM
	LIGHTING	20	1	11		2,000	2,750				LIGHTING
MAIN LOBBY	AND MAIN CORRIDOR						3,696	12	1	20	OFFICE AREAS
	LIGHTING	20	1	13	1,200						LIGHTING
	OOT COURT				336			14	1	20	ATRIUM
	LIGHTING	20	1	15		600		40		20	LIGHTING
	OOT COURT LIGHTING	20	1	17		900	160	16	1	20	ATRIUM LIGHTING
	OOT COURT	20	-	- "			900	18	1	20	ATRIUM
	LIGHTING	20	1	19	300		300	- 10		20	LIGHTING
M	OOT COURT				924			20	1	20	220A CORRIDOR
	LIGHTING	20	1	21		1,450					SPARE
OFFI	ICE CORRIDOR							22	1	20	
	218A	20	1	23			3,048	24	1	20	SPARE
HA	AND DRYERS 218B	20	1	25	3.048			24	1	20	SPARE
НΑ	AND DRYERS	20	-	23	3,040			26	1	20	3FAILE
-	248A,B	20	1	27		3.048					SPARE
HA	AND DRYERS							28	1	20	
	251A,B	20	1	29			3,048				SPARE
HA	AND DRYERS							30	1	20	
	SPARE	20	1	31				32	1	20	SPARE
	SPARE	20	1	33				32	1	20	SPARE
		20		30				34	1	20	SIANE
LIGHTING	G CONTROL PANEL	20	1	35			1,000				SPARE
	LCP-1A							36	1	20	
		125	3	37	34,270						SPARE
	P-2SA-1' & 'RP-2SA-2'			20		00.055		38	1	20	CDADE
(75	KVA XFMR)			39		32,620		40	1	20	SPARE
				41			30.596	40	_	20	SPARE
							30,330	42	1	20	OI / III C
		TOTAL	VA		50,808	49,414	50,186	TOTAL	KVA		150.4
		TOTAL	AMP/PH/	ASE	183	178	181	TOTAL	AMP		181

Figure 2.4.4 – LP-2S Original Panelboard Schedule

			PA	NELBOA	RD SIZIN	IG W	ORKS	HEET			
		Panel Tag		>	LP-2S	Pa	anel Loc	ation:	Ele	ec. Room 2	219A
		ninal Phase to Neutral V			277		Phase		3		
		inal Phase to Phase Vo			480	11-16-	Wires		4	D	
Pos 1	Ph.	Load Type SF-2-1	Cat.	Location	Load 3713	Units va	I. PF 1.00	Watts 3713	VA 3713	Ren	narks
2	A	RF-2-1	6		1275	va W	1.00	1275	1275		
3	В	SF-2-1	6		3713	w	1.00	3713	3713		
4	В	RF-2-1	6		1275	w	1.00	1275	1275		
5	С	SF-2-1	6		3713	w	1.00	3713	3713		
6	С	RF-2-1	6		1275	w	1.00	1275	1275		
7 8	A	Lighting Core Area 90 Classroom Ltg	3		3840 1902	w w	1.00	3840 1902	3840 1902		
9	В	Lighting Offices	3		3800	w	1.00	3800	3800		
10	В	50 Classroom Ltg	3		2008	w	1.00	2008	2008		
11	С	Lighting Main Lobby	3		2750	w	1.00	2750	2750		
12	С	Lighting Offices	3		3696	w	1.00	3696	3696		
13	Α	Moot Ltg Ambient	3		1276	W	1.00	1276	1276		
14	Α	Atrium Ltg. Cove/WW	3		666	w	1.00	666	666		
15 16	B B	Moot Ltg Front Atrium Ltg. Pendant	4		398 903	w	1.00	398 903	398 903		
17	С	Moot Ltg Accent/Cove	3		847	w	1.00	847	903 847		
18	C	Atrium Projectors	4		564	w	1.00	564	564		
19	Α	Moot Ltg Front WW	3		148	w	1.00	148	148		
20	Α	Lighting 220A	3		924	w	1.00	924	924		
21	В	Lighting Office Corr.	3		1450	W	1.00	1450	1450		
22	B C	Spare	9		0 3048	w	1.00	0 3048	0 3048		
23 24	C	Hand Dryers Spare	9		0	w w	1.00	0	0		
25	A	Hand Dryers	9		3048	w	1.00	3048	3048		
26	Α	Spare			0	w	1.00	0	0		
27	В	Hand Dryers	9		3048	w	1.00	3048	3048		
28	В	Spare			0	w	1.00	0	0		
29	C	Hand Dryers	9		3048	w	1.00	3048	3048		
30 31	C A	Spare Spare	\vdash		0	w	1.00	0	0		
32	Α	Spare			0	w	1.00	0	0		
33	В	Spare			0	w	1.00	0	0		
34	В	Spare			0	w	1.00	0	0		
35	С	LCP-1A	9		1000	w	1.00	1000	1000		
36	C	Spare			0	W	1.00	0	0		
37 38	A	Panels RP-2SA-1,2 Spare	9		34270 0	w w	1.00	34270 0	34270 0		
39	В	Panels RP-2SA-1,2	9		31990	w	1.00	31990	31990		
40	В	Spare	\vdash		0	w	1.00	0	0		
41	C	Panels RP-2SA-1,2	9		30596	w	1.00	30596	30596		
42	С	Spare			0	w	1.00	0	0		
PAN	IEL T	OTAL						150.2	150.2	Amps=	180.7
PHA	SE L	.OADING						kW	kVA	%	Amps
	F	PHASE TOTAL	Α					51.1	51.1	34%	184.3
		PHASE TOTAL	В					48.6	48.6	32%	175.4
	F	PHASE TOTAL	С		<u> </u>	<u></u>		50.5	50.5	34%	182.4
LOA	D CA	ATAGORIES		Conne				mand			Ver. 1.02
			Ш	kW	kVA	DF	kW	kVA	PF		
1		receptacles	\vdash	0.0	0.0		0.0	0.0			
3		computers fluorescent lighting	\vdash	0.0 23.7	0.0 23.7	0.90	0.0 21.3	0.0 21.3	1.00	 	
4		HID lighting	\vdash	1.5	1.5	0.90	1.5	1.5	1.00	 	
5	ir	ncandescent lighting		0.0	0.0		0.0	0.0			
6		HVAC fans		15.0	15.0		15.0	15.0	1.00		
7		heating		0.0	0.0	0.95	0.0	0.0			
8		kitchen equipment	Ш	0.0	0.0		0.0	0.0	4.00		
9	Tat	unassigned al Demand Loads	\vdash	110.0	110.0	-	110.0 147.8	110.0 147.8	1.00	 	
		Spare Capacity		20%			29.6	29.6		 	
		tal Design Loads		2070			177.4	177.4	1.00	Amps=	213.4

Figure 2.4.5 – LP-2S Panelboard Worksheet

NEL:	LP-2S		EQUIP. 0	SND. BUS	:	\Box			VOLTA	GE:	480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(219A)-2ND	L.	-	ED GND E		H				IRCUIT BKI	
OUNTING:	SURFACE	_	NEUTRA		100%		200%		MLO:	_	
ED FROM:	PANEL 'LP-1S'	-	A.I.C.:		100%		20070	Ш	BUS RA	TINC	225
ED FROM:	PANEL LF-13	-								_	223
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 1,275			2			
	SF-2-1	30	3	3	1,2/5	3,713					RF-2-1
	01-2-1	30	-	,		1.275		4	3	15	101-2-1
				5		1,270	3,713				
							1,275	6			
	LIGHTING	20	1	7	3,840						LIGHTING
	ORE AREA				1,902			8	1	20	90 CLASSROOM
	LIGHTING	20	1	9		3,800					LIGHTING
	OFFICES	20		- 44		2,008		10	1	20	50 CLASSROOM
	LIGHTING	20	1	11			2,750	12	1	20	LIGHTING
	AND MAIN CORRIDOR COUR LIGHTING	20	1	13	1,276		3,696	12	1	20	OFFICE AREAS ATRIUM LIGHTING
	AMBIENT	20		13	666			14	1	20	COVE/WALLWASH
	COUR LIGHTING	20	1	15	000	398		- 17	<u> </u>		ATRIUM LIGHTING
	FRONT					1,467		16	1	20	HID
MOOT	COURT LIGHTING	20	1	17			847				SPARE
	ACCENT/COVE							18	1	20	
	LIGHTING	20	1	19	148						LIGHTING
	IT WALL WASH				924			20	1	20	220A CORRIDOR
	LIGHTING	20	1	21		1,450		22		20	SPARE
UFFI	ICE CORRIDOR 218A	20	1	23			3.048	22	1	20	SPARE
μΔ	AND DRYERS	20	-	23			3,048	24	1	20	SPARL
11/2	218B	20	1	25	3.048					20	SPARE
HA	AND DRYERS				3,0.0			26	1	20	
	248A,B	20	1	27		3,048					SPARE
HA	AND DRYERS							28	1	20	
	251A,B	20	1	29			3,048				SPARE
HA	ND DRYERS	20		2.4				30	1	20	00405
	SPARE	20	1	31				32	1	20	SPARE
	SPARE	20	1	33				32	1	20	SPARE
	OI MALE	20		33				34	1	20	OI AILE
LIGHTING	G CONTROL PANEL	20	1	35			1,000				SPARE
	LCP-1A						.,	36	1	20	
		125	3	37	34,270						SPARE
	P-2SA-1' & 'RP-2SA-2'							38	1	20	
(75	KVA XFMR)			39		31,990			L.,		SPARE
				44			00.555	40	1	20	CDARE
				41			30,596	42	1	20	SPARE
		TOTAL	VΔ		51,062	49.149	49.973	TOTAL		20	150.2
			AMP/PH	A SF	184	177	180	TOTAL			181

Figure 2.4.6 – LP-2S Revised Panelboard Schedule

PANEL: RP-2SA-1 EQUIP. GND. BUS:								VOLTAGE: 120/208 VOLT, 3PH, 4W				
OCATION:	ELEC.RM.(219A)-2ND	FI	ISOLATED GND BUS:						MAIN C	, ,		
MOUNTING: SURFACE			NEUTRA		100%		200%					
ED FROM:	PANEL 'LP-2S'	-	A.I.C.:		10076	Ш	20070		BUS RA	TIMO	225	
ED FROM.	PANEL LF-23	-					•				223	
		BKR.	BKR.	CKT.		.OAD - V.A		CKT.	BKR.	BKR.		
LOAD DESCRIPTION 240/241 GENERAL RECEPTACLES		AMPS	POLE	NO.	A	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION 238/239 GENERAL RECEPTACLES	
		20	1	1	1,080 1,080			2	1	20	238/239 GENERAL RECEPTACLES	
240/241 RECEPTACLES		20	1	3	1,000	720		_		20	238/239 RECEPTACLES	
						720		4	1	20		
249/250 GENERAL RECEPTACLES		20	1	5			720				219C/220B GENERAL RECEPTACLE	
							720	6	1	20		
242/243 GENERAL RECEPTACLES		20	1	7	1,080					20	220B ECW RECEPTACLE	
242/243 RECEPTACLES		20	1	9	1,000	720		8	1	20	236/237 GENERAL RECEPTACLES	
		20	-	3		1.080		10	1	20	250/257 GENERAL RECEPTAGES	
249 WALL QUAD RECEPTACLES		20	1	11		1,000	720				236/237 RECEPTACLES	
							720	12	1	20		
249 RECEPTACLE MOOT COURT LIGHTING		20	1	13	360						221 FLOOR QUAD RECEPTACLES	
		20	_	45	720	4.000		14	1	20	221 GENERAL RECEPTACLES	
		20	1	15		1,330 720		16	1	20	221 GENERAL RECEPTACLES	
249 RECEPTACLE		20	1	17		120	360	10		20	234/235 GENERAL RECEPTACLES	
							1.080	18	1	20	20 11200 0211210 12 112021 17 10220	
SPARE		20	1	19			.,				SPARE	
								20	1	20		
221 FLOOR QUAD RECEPTACLE 222 RECEPTACLES		20	1	21		360					234/235 RECEPTACLES	
		20	1	23		720	360	22	1	20	222 COPIER RECEPTACLE	
		20	-	23			1.000	24	1	20	222 COPIER RECEPTACEE	
250A JUNCTION BOX		20	1	25	1,000		1,000				222/250A GENERAL RECEPTACLE	
					360			26	1	20		
202 J2		20	1	27		1,500					232/233 GENERAL RECEPTACLES	
202 PS		20	_	20		1,080	4 400	28	1	20	000/000 DECEDTA OLEO	
		20	1	29			1,400 720	30	1	20	232/233 RECEPTACLES	
202 F2		20	1	31	750		120	30		20	230/231 GENERAL RECEPTACLES	
					1.080			32	1	20	Educati delle de l'edel in dele	
202 VP 202 VP		20	1	33		435					230/231 RECEPTACLES	
						720		34	1	20		
		20	1	35			435	20	1	20	228/229 GENERAL RECEPTACLES	
	202 F2	20	1	37	750		1,080	36	1	20		
20212		20		31	10.670			38	3	100		
MOOT COURT LIGHTING		20	1	39	. 5,5,0						PANEL 'RP-2SB'	
TRACK LIGHTING						10,420		40]	
	SPARE	20	1	41								
		TOTAL	V/A		40.000	20.525	8,886	42	I/V/A		E0.7	
		TOTAL VA TOTAL AMP/PHASE			19,930 166	20,525 171	18,201 152	TOTAL		58.7 163		
REMARKS:	TOTAL AMP/PRASE			100	1/1	152	TOTAL	103				

Figure 2.4.7 – RP-2SA-1 Original Panelboard Schedule

			P	ANELBO	ARD SIZI	NG W	ORKS	SHEET			
	Р	anel Tag		>	RP-2SA-1	Pa	anel Loc	ation:	ELE	C ROOM	219A
		nal Phase to Neutral			120		Phase		3		
		nal Phase to Phase \	_		208		Wires		4		
Pos		Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Rem	narks
1	A	240/241 Recept 238/239 Recept	1		1080	w	1.00	1080	1080		
3	A B	240/241 Recept	1		1080 720	w	1.00	1080 720	1080 720		
4	В	238/239 Recept	1		720	w	1.00	720	720		
5	C	249/250 Recept	1		720	w	1.00	720	720		
6	С	219/220 Recept	1		720	w	1.00	720	720		
7	Α	242/243 Recept	1		1080	w	1.00	1080	1080		
8	A	220B ECW Recept	1		1080	w	1.00	1080	1080		
9 10	B B	242/243 Recept 236/237 Recept	1		720 1080	w	1.00	720 1080	720 1080		
11	С	249 Recept	1		720	W	1.00	720	720		
12	C	236/237 Recept	1		720	w	1.00	720	720		
13	A	249 Recept	1		360	w	1.00	360	360		
14	Α	221 Recept	1		720	w	1.00	720	720		
15	В	Moot Ltg. Track	5		700	w	1.00	700	700		
16	В	221 Recept	1		720	w	1.00	720	720		
17 18	С	249 Recept 234/235 Recept	1		360 1080	w	1.00	360 1080	360 1080	}	
19	A	Spare			0	w	1.00	0	0		
20	Α	Spare			0	w	1.00	0	0		
21	В	221 Recept	1		360	w	1.00	360	360		
22	В	234/235 Recept	1		720	w	1.00	720	720		
23	C	222 Recept	1		360	w	1.00	360	360		
24	C	222 Copier Recept	1		1000	w	1.00	1000	1000		
25 26	A	250A J Box 222/250A Recept	9		1000 360	w	1.00	1000 360	1000 360		
27	В	202 J2	9		1500	w	1.00	1500	1500		
28	В	232/233 Recept	1		1080	w	1.00	1080	1080		
29	С	202 PS	9		1400	w	1.00	1400	1400		
30	С	232/233 Recept	1		720	w	1.00	720	720		
31	Α	202 F2	9		750	w	1.00	750	750		
32	A	230/231 Recept 202 VP	9		1080 435	w	1.00	1080 435	1080 435		
33 34	B B	230/231 Recept	1		720	w	1.00	720	720		
35	С	202 VP	9		435	w	1.00	435	435		
36	C	228/229 Recept	1		1080	w	1.00	1080	1080		
37	Α	202 F2	9		750	w	1.00	750	750		
38	Α	Panel RP-2SB	9		10670	W	1.00	10670	10670		
39	В	Spare			0	w	1.00	0	0		
40	B C	Panel RP-2SB	9		10420	w	1.00	10420	10420		
41	C	Spare Panel RP-2SB	9		0 8886	w	1.00	0 8886	0 8886		
		OTAL	J		5500	VV	1.00	58.1	58.1	Amps=	161.4
					<u> </u>						
PHA		OADING HASE TOTAL	^					kW 20.0	kVA 20.0	% 34%	Amps
-		ASE TOTAL	A B					19.9	19.9	34%	166.8 165.8
		ASE TOTAL	С					18.2	18.2	31%	151.7
104		TAGORIES		Conne	acted		Da	mand		· · · · · I	
LOA	D 0F	TAGONIES		kW	kVA	DF	kW	kVA	PF	1	Ver. 1.02
1		receptacles		21.2	21.2		21.2	21.2	1.00		
2		computers		0.0	0.0		0.0	0.0			
3	flu	uorescent lighting		0.0	0.0	0.90	0.0	0.0			
4		HID lighting		0.0	0.0		0.0	0.0			
5	inc	andescent lighting		0.7	0.7	0.05	0.7	0.7	1.00	 	
<u>6</u> 7		HVAC fans heating		0.0	0.0	0.95 0.95	0.0	0.0		 	
8	l/i	tchen equipment		0.0	0.0	0.95	0.0	0.0		 	
9	N.	unassigned		36.2	36.2		36.2	36.2	1.00		
	Total	Demand Loads					58.1	58.1			
	Sp	are Capacity		20%			11.6	11.6			
	Tota	l Design Loads					69.7	69.7	1.00	Amps=	193.7

Figure 2.4.8 – RP-2SA-1 Panelboard Worksheet

PANEL:	RP-2SA-1		EQUIP. (ND BIIS					VOLTA	CE+	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(219A)-2ND	EI	-	ED GND I						IRCUIT B	, ,
		FL.					2000/	_			125
MOUNTING:	SURFACE	_	NEUTRA		100%		200%		MLO:		
ED FROM:	PANEL 'LP-2S'	_	A.I.C.:	22000					BUS RA	TING:	225
		BKR.	BKR.	CKT.		.OAD - V.A		CKT.	BKR.	BKR.	
	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
240/241 GE	NERAL RECEPTACLES	20	1	1	1,080 1.080			2	1	20	238/239 GENERAL RECEPTACLES
240/24	1 RECEPTACLES	20	1	3	1,000	720				20	238/239 RECEPTACLES
						720		4	1	20	
249/250 GE	NERAL RECEPTACLES	20	1	5			720			20	219C/220B GENERAL RECEPTACLE
242/243 CE	NERAL RECEPTACLES	20	1	7	1,080		720	6	1	20	220B ECW RECEPTACLE
242/243 GLI	NERAL RECEPTACEES	20	-	-	1,000			8	1	20	2200 LOW RECEPTAGE
242/24	3 RECEPTACLES	20	1	9	1,000	720					236/237 GENERAL RECEPTACLES
						1,080		10	1	20	
249 WALL	QUAD RECEPTACLES	20	1	11			720		L .		236/237 RECEPTACLES
240	RECEPTACLE	20	_	42	000		720	12	1	20	221 FLOOR QUAD RECEPTACLES
249	RECEPTAGLE	20	1	13	360 720			14	1	20	221 FLOOR QUAD RECEPTACLES
MOOT	COURT LIGHTING	20	1	15	120	700		- 17		20	221 GENERAL RECEPTACLES
TRA	ACK LIGHTING					720		16	1	20	
249	RECEPTACLE	20	1	17			360				234/235 GENERAL RECEPTACLES
	22.25			40			1,080	18	1	20	00.105
	SPARE	20	1	19				20	1	20	SPARE
221 FLOOR	QUAD RECEPTACLE	20	1	21		360		20	<u> </u>	20	234/235 RECEPTACLES
						720		22	1	20	20 11202 112021 11 10220
222	RECEPTACLES	20	1	23			360				222 COPIER RECEPTACLE
							1,000	24	1	20	
250A	JUNCTION BOX	20	1	25	1,000 360			26	1	20	222/250A GENERAL RECEPTACLE
	202 J2	20	1	27	300	1,500		20	<u> </u>	20	232/233 GENERAL RECEPTACLES
						1,080		28	1	20	
	202 PS	20	1	29			1,400				232/233 RECEPTACLES
							720	30	1	20	
	202 F2	20	1	31	750 1.080			32	1	20	230/231 GENERAL RECEPTACLES
	202 VP	20	1	33	1,000	435		JZ	<u> </u>	20	230/231 RECEPTACLES
						720		34	1	20	200,201,1202,171,0220
	202 VP	20	1	35			435				228/229 GENERAL RECEPTACLES
							1,080	36	1	20	
	202 F2	20	1	37	750			38	3	100	
	SPARE	20	1	39	10,670			30	3	100	PANEL 'RP-2SB'
	OI AINE	20		- 55		10.420		40			TANEE IN -200
	SPARE	20	1	41		. 5, .20					
							8,886	42			
		TOTAL			19,930	19,895	18,201	TOTAL			58.0
REMARKS:		TOTAL	AMP/PH	ASE	166	166	152	TOTAL	AMP		161

Figure 2.4.9 – RP-2SA-1 Revised Panelboard Schedule

Moot Courtroom Feeder	Sizing Works	heet
Panelboard Tag	LP-2S	RP-2SA-1
Panelboard Voltage	480Y/277	208Y/120
Calculated Design Load (kw)	177.4	69.7
Calculated Design Load (kva)	177.4	69.7
Resultant Power Factor	1	1
Calculated Design Load (amps)	213.4	193.7
Feeder Protection Size	225	200
Sets	1	1
Wire Size		
Phase	3#4/0	3#3/0
Neutral	1#4/0	1#3/0
Ground	#4	#6
Conduit Size	2"	2"

Figure 2.4.10 – Moot Courtroom Feeder Sizing Worksheet

ELECTRICAL DISTRIBUTION REDESIGN

Introduction

The current electrical distribution system for the Villanova University School of Law uses standard 42 circuit lighting and receptacle panels. Each receptacle panel is fed from a lighting panel through a transformer upstream. The existing system has nine transformers ranging in size from 30Kva to 112.5 Kva. There are eight 480V lighting panels and 21 208V receptacle panels. These components are part of the regular power system.

The emergency power system was not redesigned because it would not reduce the number of transformers. It would have only used more panels. The other branch that was not redesigned was the receptacle panels for the basement kitchen. A small transformer is dedicated to the kitchen so switching to a distribution panel would only require an additional piece of equipment and result in no reduction of transformers.

The idea behind the redesign is that by changing from standard lighting panels to distribution panels the number of transformers will be reduced from eight to three resulting in a reduction of cost. Also, the transformers can be installed in the room with the distribution panel which will significantly cut down the length of run for the large feeder that runs from the transformer to the first panel. The longest run can now be the primary side of the transformer which will be a smaller conductor because of the higher voltage.

The following pages will show the original and redesigned single line diagram, calculations, original and new schedules as well as a cost analysis. Finally, an analysis section will discuss the benefits of each section and present all conclusions. For figures that are illegible, see Appendix D for full size figures.

In the following schedules, the components in gray are the ones that were affected by the system redesign.

Original System Schedules

		OF	RIGINAL T	RANSFORMER	RSCHEDU	LE		
TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
XD-1	13.2kV, 3P, 3W	480Y/277V, 3P, 4W	1500kVA	Silicone-based dielectric filled	55℃	(4) 2.5% Taps (2) Up & (2) Dn	Concrete Pad Mount (outside)	
XS-1	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	75kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-2	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	45kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-3	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	45kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-4	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-5	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	75kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-6	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	30kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-7	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	75kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-8	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-9	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-10	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	45kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-11	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	

Figure 3.1.1 – Original Distribution System Transformer Schedule

				CON	IDUIT				CONDU	CTORS (PE	R SET)				SIZE OF
			NO. OF		SET)	PH/	ASE COND	UCTORS		TRAL CON		GROU	ND CC	NDUCTORS	
TAG	FROM	TO	SETS	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	PROTECTION
2	UTILITY	XD-1 XD-1	1	4" 4"	PVC PVC	3	4/0 4/0					1	2		
3	XD-1	MDB	7	4"	EMT	3	500	CU THWN	1	500	CU THWN	1	350	CU THWN	
4	XD-1	Disc. Sw	1	1.5"	EMT	3	1/0	CU THWN	1	3	CU THWN	1	6	CU THWN	
5 6	Disc. Sw MDB	Fire Pump LP-1N	1 2	1.5" 2"	EMT EMT	3 3	1/0 3/0	CU THWN	1	1/0 3/0	CU THWN	1	6 3	CU THWN	800A Fuse 400A, 3P
7	LP-1N	XS-1	1	1.5"	EMT	3	1/0	CU THWN	0		CU THWN	1	6	CU THWN	125A, 3P
8	XS-1	RP-1NA	1	2.5	EMT	3	250	CU THWN	1	250	CU THWN	1	4	CU THWN	250A, 3P
9 10	RP-1NA LP-1N	RP-1NB LP-2N	1	1.5 2	EMT EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	8	CU THWN	100A, 3P 150A, 3P
11	LP-IN	XS-2	1	1.25	EMT	3	4	CU THWN	0		CU THWN	1	8	CU THWN	70A, 3P
12	XS-2	RP-2NA	1	2	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	150A, 3P
13	RP-2NA	RP-2NB	1	1.5	EMT	3	1	CU THWN	1	1	CU THWN	1	8	CU THWN	100A, 3P
14 15	LP-1N LP-3N	LP-3N XS-3	1	1.25	EMT EMT	3	1/0 4	CU THWN	0	1/0	CU THWN	1	8	CU THWN	150A, 3P 70A, 3P
16	XS-3	RP-3NA	1	2	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	150A, 3P
17	RP-3NA	RP-3NB	1	1.5	EMT	3	1	CU THWN	1	1	CU THWN	1	8	CU THWN	50A, 3P
18 19	MDB LP-1S	LP-1S XS-4	1	3 1.5	EMT EMT	3	350 1/0	CU THWN	0	350	CU THWN	1	6	CU THWN	400A, 3P 125A, 3P
20	XS-4	RP-1SA-1	1	2.5	EMT	3	250	CU THWN	1	250	CU THWN	1	4	CU THWN	125A, 3P
21	RP-1SA-1	RP-1SA-2	1	2.5	EMT	3	250	CU THWN	1	250	CU THWN	1	4	CU THWN	125A, 3P
22	RP-1SA-2		1	2.5	EMT	3	250	CU THWN	1	250	CU THWN	1	4	CU THWN	125A, 3P
23	RP-1SA-1 MDB	RP-1SB XS-5	1	1.5 1.25	EMT EMT	3	3	CU THWN	0	1	CU THWN	1	8	CU THWN	100A, 3P 225A, 3P
25	XS-5	RP-K (Sec.1)	1	2.5	EMT	3	250	CU THWN	1	250	CU THWN	1	4	CU THWN	150A, 3P
26	RP-K (Sec.1)	RP-K (Sec.2)	1	2.5	EMT	3	250	CU THWN	1	250	CU THWN	1	4	CU THWN	150A, 3P
27	MDB	LP-BN	1	2.5	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	4	CU THWN	225A, 3P
28 29	LP-BN XS-6	XS-6 RP-BN	1	0.75 1.5	EMT EMT	3	<u>6</u>	CU THWN	<u>0</u>	1	CU THWN	1	10 8	CU THWN	50A, 3P 100A, 3P
30	MDB	LP-BS	1	2.5	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	4	CU THWN	225A, 3P
31	LP-BS	XS-7	1	1.5	EMT	3	1/0	CU THWN	0		CU THWN	1	6	CU THWN	125A, 3P
32 34	XS-7 RP-BS	RP-BS RP-BSA	1	2.5 1.5	EMT EMT	3	250 1	CU THWN	1	250 1	CU THWN	1	8	CU THWN	400A, 3P 100A, 3P
35	MDB	ELEV.	1	2	EMT	3	3/0	CU THWN	1	3/0	CU THWN	1	6	CU THWN	800A Fuse
36	MDB	Elev-BN	1	3	EMT	3	350	CU THWN	1	350	CU THWN	1	4	CU THWN	400A, 3P
37	MDB	LP-2S	1	2.5	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	4	CU THWN	225A, 3P
38 39	LP-2S XS-8	XS-8 RP-2SA-1	2	1.5 2	EMT EMT	3	1/0 3/0	CU THWN	<u>0</u>	3/0	CU THWN	1	3	CU THWN	125A, 3P 125A, 3P
40	RP-2SA-1		2	2	EMT	3	3/0	CU THWN	1	3/0	CU THWN	1	3	CU THWN	125A, 3P
41	RP-2SA-2		2	2	EMT	3	3/0	CU THWN	1	3/0	CU THWN	1	3	CU THWN	125A, 3P
42	RP-2SA-1 MDB	RP-2SB LP-3S	1	1.5 2.5	EMT EMT	3	1 250	CU THWN	1	1 250	CU THWN	1	8	CU THWN	100A, 3P 225A, 3P
44	LP-3S	XS-9	1	1.5	EMT	3	1/0	CU THWN	0		CU THWN	1	6	CU THWN	125A, 3P
45	XS-9	RP-3SA-1	1	2	EMT	3	3/0	CU THWN	1	3/0	CU THWN	1	6	CU THWN	125A, 3P
46	RP-3SA-1	RP-3SA-2	1	2	EMT	3	3/0	CU THWN	1	3/0	CU THWN	1	6	CU THWN	125A, 3P
47 48	RP-3SA-2 RP-3SA-1	RP-3SA-3 RP-3SB	1	1.5	EMT EMT	3	3/0 1	CU THWN	1	3/0 1	CU THWN	1	8	CU THWN	125A, 3P 100A, 3P
49	MDB	Snow Mlt.	1	1.5	EMT	3	1	CU THWN	1	1	CU THWN	1	8	CU THWN	100A, 3P
50	MDB	ATS-LS	1	2.5	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	4	CU THWN	400A, 3P
51 52	ATS-LS ATS-LS	GEN EDP-BS	1	2.5	EMT EMT	3	4/0 4/0	CU THWN	1	4/0 4/0	CU THWN	1	4	CU THWN	225A, 3P 400A, 3P
53	EDP-BS	XS-10	1	1.25	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	10	CU THWN	50A, 3P
54	XS-10	ERP-BS	1	2	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	100A, 3P
55 56	ERP-BS ERP-1S	ERP-1S	1	1 25	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	60A, 3P
56 57	EDP-BS	ERP-3S ELP-1S	1	1.25	EMT EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	50A, 3P 50A, 3P
58	ELP-3S	ELP-3S	1	1	EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	50A, 3P
59	EDP-BS	ELP-1N	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	10	CU THWN	60A, 3P
60 61	ELP-1N EDP-BS	ELP-3N ELP-BS	1	1	EMT EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	50A, 3P 60A, 3P
62	MDB	MCC	2	3	EMT	3	350	CU THWN	1	350	CU THWN	1	1	CU THWN	750A, 3P
63	MDB	DP-PH	1	2.5	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	4	CU THWN	225A, 3P
64 65	MDB ATS-NLS	ATS-NLS GEN	1	1.25	EMT EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	100A, 3P 70A, 3P
66		ENDPH-BS	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	100A, 3P
67	ENDPH-BS	XS-11	1	1.25	EMT	3	4	CU THWN	0		CU THWN	1	8	CU THWN	125A, 3P
68	XS-11	ENDPL-BS	1	2	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	250A, 3P
69 70	ENDPL-BS	ENP-MDF2	1	1.5 1.5	EMT EMT	3	1	CU THWN	1	1	CU THWN	1	8	CU THWN	100A, 3P 100A, 3P
71	ENDPL-BS		1	1.5	EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	50A, 3P
72	ENDPL-BS	ENP-1S	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	10	CU THWN	60A, 3P
73	ENP-1S	ENP-3S	1	4	EMT	3	6	CU THWN	1		CU THWN	1	10	CU THWN	50A, 3P

1. REFER TO RISER DIAGRAM FOR FEEDER TAGS
Figure 3.1.2 – Original Distribution System Feeder Schedule

Original System Panel Board Schedules

Below are the original panel board schedules for all panels that are used as a distributions panel. These are the panels that were affected by the redesign because of the elimination of the load from the downstream panel.

UEL.	LP-1N		EQUIP. (CHE		VOLTA	or.	400/077 VOLT 2011 414
NEL:						Ц				_	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(188)-1ST FL.		ISOLAT			Ш		_		IRCUIT BKR	<u></u>
OUNTING:	SURFACE		NEUTRA		100%		200%		MLO:		
D FROM:	SWBD 'MDB'		A.I.C.:	42000					BUS RA	TING:	400
LOAD	DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.		.OAD - V.A B	 C	CKT. NO.	BKR. POLE	BKR.	LOAD DESCRIPTION
LUAL	DESCRIPTION	AMPS	POLE	NO. 1	A 3,713	В	· ·	NO.	POLE	AMPS	LOAD DESCRIPTION
				-	1,275			2			
	SF-1-3	30	3	3	.,	3,713					RF-1-3
						1,275		4	3	15	
				5			3,713				
	LIGHTING	20	1	7	4.000		1,275	6			LIGHTING
	FICE SPACE	20	1	-	4,000 3,176			8	1	20	OFFICE CORRIDOR
	LIGHTING	20	1	9	3,176	2.500		Ů		20	LIGHTING
	IN CORRIDOR					1,400		10	1	20	OFFICE SPACE
	LIGHTING	20	1	11			1,400				LIGHTING
MAIN	SEATING AREA						1,800	12	1	20	CHAPEL
	SPARE	20	1	13	4.050				1	20	LIGHTING
	SPARE	20	1	15	1,250			14	1	20	EXTERIOR READING ROOM SPARE
	SPARL	20	-	13				16	1	20	SPARE
	SPARE	20	1	17							SPARE
								18	1	20	
	SPARE	20	1	19							SPARE
	00405			0.4				20	1	20	004.05
	SPARE	20	1	21				22	1	20	SPARE
	SPARE	20	1	23				22	1	20	SPARE
	OT / III.	20						24	1	20	017.112
	SPARE	20	1	25							SPARE
								26	1	20	
	SPARE	20	1	27				20		20	SPARE
	SPARE	20	1	29				28	1	20	SPARE
	SPARE	20	-	23				30	1	20	SPARE
	SPARE	20	1	31							
					40,313			32	3	150	
	SPARE	20	1	33							PANEL 'LP-3N'
LIGHTING	CONTROL PANEL	20	1	35		37,544	4.000	34			
LIGHTING	LCP-1B	20	1	35			1,000 36,920	36			
	25. 10	125	3	37	23,511		50,520				
PA	NEL 'RP-1NA'				26,681			38	3	150	
(75	KVA XFMR)			39		18,645					PANEL 'LP-2N'
						28,445	45.55	40			
				41			18,837 25,239	42			
		TOTAL	VA		103,919	93,522	90,184	TOTAL	KVA		287.6
			AMP/PH	V CE	375	338	326	TOTAL			346

Figure 3.2.1 – LP-1N Original Panelboard Schedule

PANEL:	RP-1NA		EQUIP. (SND. BUS):				VOLTA	GE:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(188)-1ST FL		ISOLAT	ED GND I	BUS:				MAIN C	IRCUIT BE	(R: 250
OUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	PANEL 'LP-1N'	_	A.I.C.:	22000				_	BUS RA	_	400
	<u> </u>	BKR.	BKR.	CKT.		OAD - V.A	١.	CKT.	BKR.	BKR.	
	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
181/182 GE	NERAL RECEPTACLES	20	1	1	1,080 1.620			2	1	20	186/187,A/S4-1 RECEPTACLES
181/182 COI	MPUTER RECEPTACLES	20	1	3	.,,	720 500		4	1	20	187 UCR
180 COMP	UTER RECEPTACLES	20	1	5		500	720				185 GENERAL RECEPTACLES
180 GENE	RAL RECEPTACLES	20	1	7	720		360	6	1	20	183/184 COMPUTER RECEPTACLE
180 CO	PIER RECEPTACLE	20	1	9	720	1,000		8	1	20	178/179 COMPUTER RECEPTACLE
						720		10	1	20	
180 F	AX RECEPTACLE	20	1	11			500 1,260	12	1	20	178/179 GENERAL RECEPTACLES
168/CORR	IDOR RECEPTACLES	20	1	13	1,260		1,200	12	<u> </u>	20	176/177 GENERAL RECEPTACLES
					1,080			14	1	20	
183 CO	PIER RECEPTACLE	20	1	15		1,000 345		16	1	20	CUH-1-2
183 COMP	UTER RECEPTACLES	20	1	17		545	720 345		1	15	CUH-1-4
183 F	AX RECEPTACLE	20	1	19	500		343				TF-1-1
168 COMP	UTER RECEPTACLES	20	1	21	506	720		20	1	15	FP-1-3
169	RECEPTACLES	20	1	23		830	720	22	1	15	UH-1
							506	24	1	15	
168A COM	PUTER RECEPTACLES	20	1	25	720 720			26	1	20	176/177 COMPUTER RECEPTACLE
168A COM	PUTER RECEPTACLES	20	1	27	120	720 720		28	1	20	174/175 COMPUTER RECEPTACLE
170	RECEPTACLES	20	1	29		720	540				184 GENERAL RECEPTACLES
180 COM	PUTER RECEPTACLE	20	1	31	180		900	30	1	20	168 JUNCTION BOX
100 001111	OTERTRESET FASEE	20		-	1,000			32	1	20	iso sononon box
170 CO	PIER RECEPTACLE	20	1	33		1,000 200		34	1	20	LIGHTING CHAPEL INCANDESCENT
170 CO	PIER RECEPTACLE	20	1	35		200	1,000				SPARE
	SPARE	20	1	37				36	1	20	
1144 0117	DOOR RECEPTACLE	20	1	39	13,405	400		38	3	100	PANEL 'RP-1NB'
114A 001	DOOK RECEPTACLE	20	1	28		180 9,990		40			PANEL RP-IND
114A/115/16	69 GEN. RECEPTACLES	20	1	41			720 10.546	42			
		TOTAL	VA		23,511	18,645	18,837	TOTAL	KVA		61.0
REMARKS:		TOTAL	AMP/PH	ASE	196	155	157	TOTAL	AMP		169

Figure 3.2.2 – RP-1NA Original Panelboard Schedule

10.00					ARD S	, UIII	- O L L		or.	400.077.1/OLT 05:: :::
EL: LP-2N		EQUIP. (\sqcup			VOLTA	_	480/277 VOLT, 3PH, 4W
ATION: ELEC.RM.(266)-2ND	FL.	ISOLAT			Ш		_		IRCUIT BKR	<u> </u>
UNTING: SURFACE	_	NEUTRA		100%		200%		MLO:		
PANEL 'LP-1N'	_	A.I.C.:	42000					BUS RA	TING:	225
	BKR.	BKR.	CKT.		.OAD - V.A		CKT.	BKR.	BKR.	
LOAD DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
			1	5,570			2			
SF-2-3	40	3	3	1,275	5,570					RF-2-3
0. 20		_			1,275		4	3	15	14 2 5
			5		.,	5,570				
						1,275	6			
LIGHTING	20	1	7	1,800						LIGHTING
OFFICE NORTH LIGHTING	20	1	9	3,400	2.000		8	1	20	STACKS LIGHTING
READING ROOM	20	1	9		2,000 3,400		10	1	20	STACKS
LIGHTING	20	1	11		3,400	1,300	10	<u> </u>	20	LIGHTING
SEATING						2,632	12	1	20	STACKS
LIGHTING	20	1	13	510						SPARE
MECHANICAL							14	1	20	
SPARE	20	1	15							SPARE
SPARE	20	1	17				16	1	20	SPARE
SPARE	20	1	17				18	1	20	SPARE
SPARE	20	1	19				- 10		20	SPARE
							20	1	20	
SPARE	20	1	21							SPARE
							22	1	20	
SPARE	20	1	23				24	1	20	SPARE
SPARE	20	1	25				24	1	20	SPARE
SPARE	20	-	23				26	1	20	SPARE
SPARE	20	1	27							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
00405		4	0.4				30	1	20	004.05
SPARE	20	1	31				32	1	20	SPARE
SPARE	20	1	33				JZ	1	20	SPARE
OI PAGE							34	1	20	OI MILE
LIGHTING CONTROL PANEL	20	1	35			1,000				SPARE
LCP-2B							36	1	20	
DANIEL ICE COLO	70	3	37	14,126					00	SPARE
PANEL 'RP-2NA'			39		40.000		38	1	20	SPARE
(45 KVA XFMR)			39		16,200		40	1	20	SPARE
			41			13,462	-10	<u> </u>	20	SPARE
						.5,.02	42	1	20	
	TOTAL			26,681	28,445	25,239	TOTAL			80.4
	TOTAL	AMP/PH/	ΔSF	96	103	91	TOTAL	ΔMP		97

Figure 3.2.3 – LP-2N Original Panelboard Schedule

PANEL:	RP-2NA		EQUIP. (SND. BUS	S:				VOLTA	GE:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(266)-2ND FL.		ISOLAT	ED GND E	BUS:				MAIN CI	RCUIT B	KR: 150
OUNTING:	SURFACE		NEUTRA	L BUS:	100%		200%	_	MLO:	П	
ED FROM:	PANEL 'LP-2N'			22000				-	BUS RA		225
LOAI	DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A B	 C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
265 FLOOR	QUAD RECEPTACLES	20	1	1	720 1.080			2	1	20	260B/264 RECEPTACLES
265 FLOOR	QUAD RECEPTACLES	20	1	3	1,000	720 720		4	1	20	264 WALL QUAD RECEPTACLES (COMP
265 FLOOR	QUAD RECEPTACLES	20	1	5		120	720 720	6	1	20	264 WALL QUAD RECEPTACLES (COMP
265 FLOOR	QUAD RECEPTACLES	20	1	7	720 720		120	8	1	20	264 WALL QUAD RECEPTACLES (COMP
265 FLOOR	QUAD RECEPTACLES	20	1	9	120	720 720		10	1	20	264 WALL QUAD RECEPTACLES (COMP
265 COMP.	WALL RECEPTACLES	20	1	11		120	720 900	12	1	20	264 GEN RECEPTACLES
260B/20	55 RECEPTACLES	20	1	13	720 720		300	14	1	20	260 WALL QUAD RECEPTACLES
267 GENE	RAL RECEPTACLES	20	1	15	720	360 500		16	1	20	260A EWC RECEPTACLE
260B	JUNCTION BOX	20	1	17		300	1,000	18	1	20	SPARE
265 FLOOR	QUAD RECEPTACLES	20	1	19	720 506			20	1	15	TF-2-1
265 FLOOR	QUAD RECEPTACLES	20	1	21	300	720 830		22	1	15	FP-2-3
265 FLOOR	QUAD RECEPTACLES	20	1	23		030	720 506	24	1	15	UH-1
265 WA	LL RECEPTACLES	20	1	25	540		500	26	1	20	SPARE
265 FLOOR	QUAD RECEPTACLES	20	1	27		360		28	1	20	SPARE
	SPARE	20	1	29				30	1	20	SPARE
	SPARE	20	1	31				32	1	20	SPARE
	SPARE	20	1	33				34	1	20	SPARE
	SPARE	20	1	35				36	1	20	SPARE
	SPARE	20	1	37	7.680			38	3	100	
	SPARE	20	1	39	.,	10.550		40			PANEL 'RP-2NB'
	SPARE	20	1	41			8.176	42			
		TOTAL			14,126	16,200	13,462	TOTAL			43.788
FMARKS:		TOTAL	AMP/PH/	ASE	118	135	112	TOTAL	AMP		122

Figure 3.2.4 – RP-2NA Original Panelboard Schedule

IEL:	LP-3N		EQUIP. (SND. BU	S:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(366)-3RD FL		ISOLAT			H				IRCUIT BK	
OUNTING:	SURFACE		NEUTRA		100%		200%		MLO:	_	
D FROM:	PANEL 'LP-1N'		A.I.C.:	L DOS.	42.000		20070	Ш	BUS RA	TING	225
D FROINI:	PANEL LP-IN		A.I.C.:							TING:	225
		BKR.	BKR.	CKT.	$\overline{}$	OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	5,570						
	SF-3-3	40	3	3	2,015	F F70		2			RF-3-3
	31-3-3	40	,	,		5,570 2,015		4	3	15	KI -3-3
				5		2,013	5,570	_		10	
							2,015	6			
				7	3,713		2,010				LIGHTING
					2,000			8	1	20	READING ROOM
	SF-R-1	30	3	9		3,713					LIGHTING
						1,600		10	1	20	SEATING AREA
				11			3,713				LIGHTING
							2,024	12	1	20	DEAN'S SUITE
OFFICE	LIGHTING	20	1	13	2,056					20	LIGHTING
	E SPACE NORTH LIGHTING	20	1	15	600	0.500		14	1	20	MECHANICAL ROOM LIGHTING
	STACKS	20	1	15		2,520 800		16	1	20	DEAN'S SUITE HALLWAY
	LIGHTING	20	1	17		800	2,576	10	1	20	373
	STACKS	20	-	- "			1,524	18	1	20	HAND DRYER
	LIGHTING	20	1	19	2,912		1,524	- 10	<u> </u>	20	SPARE
	STACKS				2,012			20	1	20	0.7.1.2
	SPARE	20	1	21							SPARE
								22	1	20	
	SPARE	20	1	23							SPARE
								24	1	20	
	SPARE	20	1	25							SPARE
	00100							26	1	20	00.405
	SPARE	20	1	27				20	-	20	SPARE
	SPARE	20	1	29				28	1	20	SPARE
	SPARE	20	1	29				30	1	20	SPARE
	SPARE	20	1	31				30		20	SPARE
								32	1	20	C1 7 11 12
	SPARE	20	1	33							SPARE
								34	1	20	
LIGHTING	CONTROL PANEL	20	1	35			1,000				SPARE
	LCP-3B							36	1	20	
		70	3	37	21,447						SPARE
	NEL 'RP-3NA'							38	1	20	
(45	KVA XFMR)			39		21,326				00	SPARE
				- 44			40.455	40	1	20	CDADE
				41			18,498	42	1	20	SPARE
		TOTAL	V/A		40.313	37.544	36,920	TOTAL		20	114.8
		TOTAL		A CF	146	136	133	TOTAL			138

Figure 3.2.5 – LP-3N Original Panelboard Schedule

ANEL:	RP-3NA		EQUIP. (GND. BUS	S:				VOLTA	GE:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(366)-3RD FL.		ISOLAT	ED GND I	BUS:				MAIN CI	IRCUIT BKR	: 150A
OUNTING:	SURFACE		NEUTRA	L BUS:	100%	┌	200%		MLO:		
ED FROM:	PANEL 'LP-3N'		A.I.C.:		22,000				BUS RA		225A
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
365	RECEPTACLES	20	1	1	360 360			2	1	20	ROOF RECEPTACLES
365	RECEPTACLES	20	1	3		360 1.440		4	1	20	365 RECEPTACLES
365	RECEPTACLES	20	1	5		1,440	720 1,440	6	1	20	367 RECEPTACLES
365	RECEPTACLES	20	1	7	720		1,440				360B RECEPTACLES
205	DECERTA OL EC	20	-	_	1,260	700		8	1	20	202 PEOEDTA OLEO
365	RECEPTACLES	20	1	9		720 1 440		10	1	20	360 RECEPTACLES
370/37	1 RECEPTACLES	20	1	11		1,440	1,260	,,			372 RECEPTACLES
							1,440	12	1	20	
370	RECEPTACLES	20	1	13	1,080						368 RECEPTACLES
200	RECEPTACLES	20	1	15	1,460	700		14	1	20	& DOOR HOLDERS FP-3-4
360	RECEPTACLES	20	1	15		720 800		16	1	15	FF-3-4
364	RECEPTACLES	20	1	17		500	720				TE-3-1
364	RECEPTACLES	20	1	19	720		299	18	1	15	TF-3-1
3041	NEGET TAGEES	20		10	500			20	1	15	11-0-1
364	RECEPTACLES	20	1	21		720 830		22	1	15	FP-3-3
374	RECEPTACLES	20	1	23		030	720	24	1	15	UH-1
3	376 COPIER	20	1	25	1.000		506	24	1	15	J-BOX, VAV
	oro our Ex	20			1,000			26	1	20	3 2011, 1711
360	RECEPTACLES	20	1	27	.,	900 720		28	1	20	365 RECEPTACLES
360	RECEPTACLES	20	1	29		120	720	20		20	365 RECEPTACLES
							720	30	1	20	
360	RECEPTACLES	20	1	31	720						LIGHTING
200	RECEPTACLES	20	1	33	322	000		32	1	20	365 PENDANTS SPARE
300	REGERIAGES	20	1	33		900		34	1	20	SPARE
375	RECEPTACLES	20	1	35			540				SPARE
								36	1	20	
365	RECEPTACLES	20	1	37	720 11,225			38	3	50	
365	RECEPTACLES	20	1	39		720 11.056		40			PANEL 'RP-3NB'
	SPARE	20	1	41		11,030					
		TOTAL	VΔ		21,447	21,326	9,413 18,498	42 TOTAL	KVΔ		61.271
			AMP/PH/	ΔSF	179	178	15,498	TOTAL			170

Figure 3.2.6 – RP-3NA Original Panelboard Schedule

NEL:	LP-1S		EQUIP. (SND. BUS	:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(119A)-1ST	_	-	ED GND E		H				RCUIT BKR	
OUNTING:	SURFACE	_	NEUTRA		100%	=	200%		MLO:	_	
		-			100 /6		200 /6			TING	600
D FROM:	SWBD 'MDB'	-	A.I.C.:	42000					BUS RA	TING:	600
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 2.015			2			
	SF-1-1	30	3	3	2,015	3,713					RF-1-1
	51-1-1	- 50	-	,		2.015		4	1	15	131 - 1 - 1
				5		2,010	3.713				
							2,015	6			
	LIGHTING	20	1	7	3,056						LIGHTING
	ORE AREA				2,576			8	1	20	135 CLASSROOM
	LIGHTING	20	1	9		3,040					LIGHTING
	OFFICES					1,902		10	1	20	90 CLASSROOM
	LIGHTING	20	1	11			1,840	42		20	LIGHTING
	OFFICES LIGHTING	20	1	13	4.000		2,008	12	1	20	55 CLASSROOM LIGHTING
	CE CORRIDORS	20	1	13	1,800 2.500			14	1	20	MAIN STAIRS
	LIGHTING	20	1	15	2,500	2,800		17		20	LIGHTING
	RIDOR AND LOBBY					2,500		16	1	20	SOUTH STAIRS
	LIGHTING	20	1	17		2,000	3,200				LIGHTING
OF	FICE SPACE						1,250	18	1	20	NORTH STAIRS
	LIGHTING	20	1	19	350						ENTRY LIGHTING
	ATRIUM				800			20	1	20	
	AL COVE LIGHTS	20	1	21		1,000					SPARE
	T THRU 3RD FLOOR							22	1	20	05.155
	A,B J-BOXES	20	1	23			3,048	24	1	20	SPARE
	ND DRYERS 8B J-BOXES	20	1	25	3.048			24	1	20	SPARE
	ND DRYERS	20		20	3,040			26	1	20	SPARL
	8A J-BOXES	20	1	27		3,048		20		20	SPARE
	ND DRYERS					0,010		28	1	20	
	SPARE	20	1	29							SPARE
								30	1	20	
	SPARE	20	1	31							
								32	3	100	
	SPARE	20	1	33							SPARE
LICHTING	CONTROL PANEL	20	1	35			4.000	34			
LIGHTING	LCP-1A	20	1	35			1,000	36			
	EGF-IA	125	3	37	38.782			30			
PANELS 'RP	-1SA-1' & 'RP-1SA-2'			J.	55,102			38	3	50	
	KVA XFMR)			39		40.015					SPARE
,	,					,		40			
				41			36,606				
								42			
		TOTAL			58,640	60,033	54,680	TOTAL			173.4
MARKS:		TOTAL	AMP/PH/	ASE	212	217	197	TOTAL	AMP		209

Figure 3.2.7 – LP-1S Original Panelboard Schedule

PANEL:	RP-1SA-1		FOUIP. (SND. BUS		$\overline{}$			VOLTA	GF:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(119A)-1ST FL	•		ED GND E	-					IRCUIT BI	
OUNTING:	SURFACE	•	NEUTRA		100%		200%	_	MLO:		120
ED FROM:	PANEL 'LP-1S'	•	A.I.C.:	22500	100%	Ш	20070	-	BUS RA		225
ED I NOIII.	TARLE EI-10										220
104	D DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A B	. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
	6 GENERAL RECEPTS.	20	1	1	1.260	D	C	NO.	PULE	AMPS	122/123 GENERAL RECEPTACLES
145/144/14	O CENEIO E NECEI 15.	20			1,200			2	1	20	122/123 GENERAL REGEL TAGEES
148/149A G	ENERAL RECEPTACLES	20	1	3	.,,	1,260					SPARE
								4	1	20	
141/142 CO	MPUTER RECEPTACLES	20	1	5			720 500	6	1	20	120B EWC RECEPTACLE
141/142 GF	NERAL RECEPTACLES	20	1	7	1,260		500	0		20	121/137 COMPUTER RECEPTACLES
	THE TENED TO THE T			-	1,080			8	1	20	121101 00111 0121112021 1110220
148/149A,B C	OMPUTER RECEPTACLES	20	1	9		1,080					121 COMPUTER RECEPTACLES
44704055	ENERAL DEGESTA OLES					1,080		10	1	20	004.05
14//149,B G	ENERAL RECEPTACLES	20	1	11			900	12	1	20	SPARE
140/139 GE	NERAL RECEPTACLES	20	1	13	1,080			12	<u> </u>	20	121 FAX RECEPTACLE
					500			14	1	20	
139/140 CO	MPUTER RECEPTACLES	20	1	15		720					121 COPY RECEPTACLE
450.0000	OUTED DECEDTA OLEO	20	1	17		1,000	700	16	1	20	CIIII 4 2
150 COMP	PUTER RECEPTACLES	20	1	1/			720 345	18	1	15	CUH-1-3
138/150 GE	NERAL RECEPTACLES	20	1	19	1.080		343	-10	<u> </u>	13	SPARE
					1,000			20	1	20	
138/150 CO	MPUTER RECEPTACLES	20	1	21		720					122/123 COMPUTER RECEPTACLES
CONVEN	IANCE RECEPTACLE	20	1	23		720	000	22	1	20	124/125 GENERAL RECEPTACLES
	COFFEE BAR	20	1	23			360 1.080	24	1	20	124/125 GENERAL RECEPTACLES
	7 GENERAL RECEPTACLES	20	1	25	1,260		1,000				124/125 COMPUTER RECEPTACLES
					720			26	1	20	
138∆	A JUNCTION BOX	20	1	27		1,000			L.		126/127/128/129 GEN. RECEPTS
1214	JUNCTION BOX	20	1	29		1,260	1,000	28	1	20	126/127 COMPUTER RECEPTACLES
1217	CONCION BOX	20		23			720	30	1	20	120/12/ COMPUTER RECEPTAGEES
	SPARE	20	1	31							127/128 COMPUTER RECEPTACLES
					720			32	1	20	
	149 AV	20	1	33		1,500 540		34	1	20	121B/129 COMPUTER RECEPTACLES
	149 AV	20	1	35		540	1,500	34	<u> </u>	20	130 COMPUTER RECEPTACLES
							540	36	1	20	55 572.17.1252. 17.0220
WI	REMOLD 6000	20	1	37	1,260						
	DEMOLD COOK			20	13,522	,		38	3	100	DANIEL IDD 1001
WI	REMOLD 6000	20	1	39		1,260 13.380		40			PANEL 'RP-1SB'
	SPARE	20	1	41		13,300		40			
							14,446	42			
		TOTAL			24,822	25,520	22,831	TOTAL			73.2
		TOTAL	AMP/PH/	ASE	207	213	190	TOTAL	AMP		203

Figure 3.2.8 – LP-1S Original Panelboard Schedule

ANEL:	LP-BN		EQUIP.		ELBO				VOLTA	CE.	480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(L29)-BSMT	-	ISOLAT			\vdash				IRCUIT BKR:	
IOUNTING:	SURFACE	-	NEUTRA		100%		2009/			_	
		-			100%		200%		MLO:	TINO	205
ED FROM:	SWBD 'MDB'	-	A.I.C.:	42000					BUS RA	TING:	225
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713						
	SF-L-1	30	3	3	2,920	3,713		2			RF-L-1
	31-1-1	30	,			2.920		4	3	30	KI-E-I
				5		2,020	3,713		Ť		
							2,920	6			
	SPARE	20	1	7	900						SPARE
					265			8	1	20	
	SPARE	15	3	9		900		40		20	SPARE
	SPARE	20	1	11		265	922	10	1	20	SPARE
	SPARE	20	1	- 11			265	12	1	20	SPARE
	SP-1	15	1	13	795		203	12	<u> </u>	20	SPARE
								14	1	20	
	SP-2	15	1	15		795					SPARE
								16	1	20	
	LIGHTING	20	1	17			920		.		SPARE
	ING AND MECH ROOM LIGHTING	20	1	19	0.000			18	1	20	LIGHTING
	EMENT STACKS	20	1	19	2,680 3.512			20	1	20	MAIL ROOM WORKSPACES
	LIGHTING	20	1	21	3,312	2,744		-20	<u> </u>	20	LIGHTING
BASE	MENT STACKS					2,000		22	1	20	MAIN LOBBY AREA
	LIGHTING	20	1	23			2,000				SPARE
	SROOM SPACES							24	1	20	
	LIGHTING	20	1	25	2,016				.	00	SPARE
	ILATION SPACE LIGHTING	20	1	27		2.000		26	1	20	SPARE
	VING STACKS	20	<u> </u>	21		2,880		28	1	20	SPARE
	LIGHTING	20	1	29			1,400	20		20	LIGHTING
	CHANICAL ROOM						1,000	30	1	20	MECH ROOM AND RESTROOM
	LIGHTING	20	1	31	2,824						
	MENT STACKS				2,500			32	1	20	EXTRA
LIGHTING	CONTROL PANEL	20	1	33		1,000				20	SPARE
	LCP-0A L24A.B	20	1	35			2.042	34	1	20	
нл	ND DRYERS	20	1	35			3,048 1,275	36	3	15	
n/A	ONT ENO	50	3	37	11,218		1,275	30		10	
PΑ	NEL 'RP-BN'				1,275			38			COMPACTOR
	KVA XFMR)			39	.,2.0	13,077					
						1,275		40			
				41			10,838			0.0	SPARE
		TOTAL			01.015	04.505	00.00:	42	1	20	04.5
		TOTAL	VA AMP/PH/	A CE	34,618 125	31,569 114	28,301 102	TOTAL TOTAL			94.5

Figure 3.2.9 – LP-BN Original Panelboard Schedule

ANEL:	LP-BS			SND. BUS	ELBO				VOLTA	GF:	480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM (B02)-SUE	R BSMT	-	ED GND E		H				IRCUIT BK	
OUNTING:	SURFACE	J.B3	NEUTRA		100%		200%		MLO:		
		_			100%		200%				225
ED FROM:	SWBD 'MDB'	_	A.I.C.:	65000					BUS RA	TING:	225
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAI	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	5,570						
	SF-1-2	40	3	3	2,920	E E70		2			RF-1-2
	31-1-2	40	3	3		5,570 2,920		4	3	30	RI - I-2
				5		2,020	5,570	<u> </u>	Ť	-	
							2,920	6			
	SPARE	20	1	7							SPARE
								8	1		
	SPARE	20	1	9					L.		SPARE
	SPARE	20	1	11				10	1	15	SPARE
	SPARE	20	1	11				12	1		SPARE
				13	7,160			12			
					2,920			14			
	SF-1-2	60	3	15	2,020	7,160					RF-1-2
						2,920		16	3	30	
				17			7,160				
							2,920	18	<u> </u>		
				19	5,570						
	SF-2-2	40	3	21	2,920	5.570		20			RF-2-2
	31-2-2	40	3	21		2,920		22	3	30	RF-2-2
				23		2,520	5,570	- 22		30	
							2,920	24			
				25							
								26			
	SF-3-2	20	3	27							RF-3-2
								28	3	20	
				29				30			
	LIGHTING	20	1	31	2,016			30			LIGHTING
	LIGHTING	20			3,500			32	1	20	DINING AREA
LIGHTING	CONTROL PANEL	20	1	33	5,500	1,000					LIGHTING
	LCP-0B					2,280		34	1	20	SERVING
	SPARE	20	1	35							LIGHTING
								36	1	20	KITCHEN/SURROUNDING SPACE
	WELLIDD DC:	125	3	37	25,880				L .	20	LIGHTING
	ANEL 'RP-BS'			39	1,440	24.000		38	1	20	LOCKERS L16A,L16B
(30	KVA XFMR)			28		21,833 3.048		40	1	20	HAND DRYERS
				41		3,040	21,370	-10		20	L09A.B
							3.048	42	1	20	HAND DRYERS
		TOTAL	VA		59,896	55,221	51,478	TOTAL			166.6
		TOTAL	AMP/PH	ASE	216	199	186	TOTAL	AMP		200

Figure 3.2.10 – LP-BS Original Panelboard Schedule

ANEL: F	RP-BS		EQUIP. (SND. BUS	:	\Box			VOLTA	GE:	120/208 VOLT. 3PH. 4W
_	ELEC.RM (B02)-SUB.	_	ISOLAT							RCUIT B	
_	SURFACE	_	NEUTRA		100%	\blacksquare	200%	_	MLO:		
_	PANEL 'LP-BS'	_	A.I.C.:	10000	100 /6	Ш	200 /6		BUS RA		450
D FROW:	PANEL LP-05	_								i iivG:	450
LOAD DE	SCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A	 C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
	L RECEPTACLES	20	1	1	360	U	·	no.	FULL	AMF3	L13A/L14/L15A/OUTDOOR RECEPTACL
ETT GENERA	E RECEPTACLES	20			1.260			2	1	20	E13A/E14/E13A/OUTDOOK RECEPTACE
L12 PRINTER	R RECEPTACLE	20	1	3	.,	1,000					L14 COFF. RECEPTACLE
						720		4	1	20	
L10 RE	CPTACLES	20	1	5			540		.		L14 MICR. RECEPTACLE
140 050	CEPTACLES	20	1	7	700		750	6	1	20	L14 REF RECEPTACLE
LIUREC	EPTACLES	20	1	-	720 750			8	1	20	L14 REF RECEPTAGE
L10 RFC	CEPTACLES	20	1	9	750	720				20	L10/S2-L RECEPTACLES
						360		10	1	20	
L13 REC	CEPTACLES	20	1	11			900				B02,A GENERAL RECEPTACLES
							900	12	1	20	& MOTORIZED DAMPERS
L13A RE	CEPTACLES	20	1	13	900						
1.12 DEC	CEPTACLES	20	1	15	1,650	700		14	2	20	EUH-2
LISKEO	EFIACLES	20	-	15		720 1.650		16			EUH-Z
L13 REC	CEPTACLES	20	1	17		1,000	720	- 10			
							1,650	18	2	20	
L09A,B/L13,A	A RECEPTACLES	20	1	19	1,180						EUH-1
	SENSORS				1,650			20			
L10 COR	RIDOR EWC	20	1	21		500		20		45	FP-L-2
91	PARE	20	1	23		830		22	1	15	UH-1
31	FARL	20		23			506	24	1	15	011-1
L	12 J1	20	1	25	1,500		300				LIGHTING
					200			26	1	20	DINING/KITCHEN HALOGEN
L1	3 AV	20	1	27		1,100					SPARE
	20.00		_	20				28	1	20	400.10
10	03 PS	20	1	29			1,400	30	1	20	102 J2
10	03 J2	20	1	31	1,500		1,500	30	1	20	102 PS
''					1,300			32	1	20	10210
10	03 F2	20	1	33	.,	750					102 F2
						750		34	1	20	
10	03 F2	20	1	35			750				102 VP
				37	40.040		435	36	1	20	LIGHTING (ELITHDE)
				31	12,610 200			38	1	20	LIGHTING (FUTURE) DRIVEWAY SIGN
PANFI	'RP-BSA'	100	3	39	200	12.001		30		20	MOTORIZED DOORS (L10, L10A, L138
.,						732		40	1	20	& MAGLOCKS (L13B, L13C)
				41			11,319				SPARE
								42	1	20	
		TOTAL			25,880	21,833	21,370	TOTAL			69.1
MARKS:		TOTAL	AMP/PH	ASE	216	182	178	TOTAL	. AMP		192

Figure 3.2.11 – RP-BS Original Panelboard Schedule

NEL:	LP-2S		EQUIP. 0	SND. BUS	:	\Box			VOLTA	GE:	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(219A)-2ND F	L.	ISOLAT	ED GND E	BUS:	H			MAIN C	IRCUIT BKE	₹:
OUNTING:	SURFACE	•	NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	PANEL 'LP-1S'	•	A.I.C.:			-		ш	BUS RA	_	225
LD I NOIIII	TARLE EI-10									_	220
1040	DESCRIPTION	BKR.	BKR. POLE	CKT. NO.		OAD - V.A		CKT.	BKR. POLE	BKR.	LOAD DESCRIPTION
LOAD	DESCRIPTION	AMPS	POLE		A 740	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 1,275			2			
	SF-2-1	30	3	3	1,275	3,713					RF-2-1
			_			1.275		4	3	15	
				5		.,	3,713				
							1,275	6			
l	IGHTING	20	1	7	3,840						LIGHTING
	DRE AREA				1,902			8	1	20	90 CLASSROOM
	IGHTING	20	1	9		3,800				0.5	LIGHTING
	OFFICES	20		44		2,008		10	1	20	50 CLASSROOM
	LIGHTING	20	1	11			2,750	12	1	20	LIGHTING OFFICE AREAS
	AND MAIN CORRIDOR JIGHTING	20	1	13	1,200		3,696	12	1	20	OFFICE AREAS LIGHTING
_	OT COURT	20		13	336			14	1	20	ATRIUM
	IGHTING	20	1	15	330	600					LIGHTING
MO	OT COURT					900		16	1	20	ATRIUM
L	IGHTING	20	1	17			160				LIGHTING
MO	OT COURT						900	18	1	20	ATRIUM
	IGHTING	20	1	19	300						LIGHTING
	OT COURT				924			20	1	20	220A CORRIDOR
_	IGHTING	20	1	21		1,450			.		SPARE
OFFIC	218A	20		23			0.040	22	1	20	SPARE
шл	ND DRYERS	20	1	23			3,048	24	1	20	SPARE
IIAI	218B	20	1	25	3.048			24	<u> </u>	20	SPARE
HAI	ND DRYERS				3,040			26	1	20	OI / III
	248A,B	20	1	27		3,048					SPARE
HAI	ND DRYERS							28	1	20	
	251A,B	20	1	29			3,048				SPARE
HAI	ND DRYERS							30	1	20	
	SPARE	20	1	31							SPARE
	004.05		_					32	1	20	004.05
	SPARE	20	1	33				34	1	20	SPARE
LIGHTIMO	CONTROL PANEL	20	1	35			1.000	34	1	20	SPARE
	LCP-1A	20		30			1,000	36	1	20	SPARE
		125	3	37	34,270			-			SPARE
PANELS 'RP-	2SA-1' & 'RP-2SA-2'		_		0.,270			38	1	20	
	KVA XFMR)			39		32,620					SPARE
-								40	1	20	
				41			30,596				SPARE
								42	1	20	
		TOTAL		. 0.5	50,808	49,414		TOTAL			150.4
EMARKS:		TOTAL	AMP/PH/	ASE	183	178	181	TOTAL	AMP		181

Figure 3.2.12 – LP-2S Original Panelboard Schedule

PANEL:	RP-2SA-1		EQUIP. (ELBO				VOLTA	SE+	120/208 VOLT, 3PH, 4W
		-				\sqsubseteq				IRCUIT B	, ,
OCATION:	ELEC.RM.(219A)-2ND	FL.	ISOLAT					_			KR: 125
MOUNTING:	SURFACE	_	NEUTRA		100%		200%		MLO:		
ED FROM:	PANEL 'LP-2S'	_	A.I.C.:	22000					BUS RA	TING:	225
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
240/241 GE	NERAL RECEPTACLES	20	1	1	1,080 1.080			2	1	20	238/239 GENERAL RECEPTACLES
240/24	1 RECEPTACLES	20	1	3	1,000	720					238/239 RECEPTACLES
						720		4	1	20	
249/250 GE	NERAL RECEPTACLES	20	1	5			720 720	6	1	20	219C/220B GENERAL RECEPTACLES
242/243 GF	NERAL RECEPTACLES	20	1	7	1,080		720	0	1	20	220B ECW RECEPTACLE
212121002	TETO TE TIEGET TA TOLLED	20			1,000			8	1	20	EEOD EOW NEOE! IN OLE
242/24	3 RECEPTACLES	20	1	9	.,,,,,,	720					236/237 GENERAL RECEPTACLES
						1,080		10	1	20	
249 WALL	QUAD RECEPTACLES	20	1	11			720	40			236/237 RECEPTACLES
240	RECEPTACLE	20	1	13	360		720	12	1	20	221 FLOOR QUAD RECEPTACLES
243	RECEPTACEE	20		13	720			14	1	20	2211 LOOK GOAD RECEPTACEES
MOOT	COURT LIGHTING	20	1	15	120	1,330					221 GENERAL RECEPTACLES
						720		16	1	20	
249	RECEPTACLE	20	1	17			360				234/235 GENERAL RECEPTACLES
							1,080	18	1	20	
	SPARE	20	1	19				20	1	20	SPARE
221 FLOOR	QUAD RECEPTACLE	20	1	21		360		20	1	20	234/235 RECEPTACLES
22112001	WOYLD THEOET TY TOLL		•			720		22	1	20	EU II EU II
222	RECEPTACLES	20	1	23			360				222 COPIER RECEPTACLE
							1,000	24	1	20	
250A	JUNCTION BOX	20	1	25	1,000						222/250A GENERAL RECEPTACLES
	202 J2	20	1	27	360	4.500		26	1	20	232/233 GENERAL RECEPTACLES
	202 32	20	-	21		1,500 1.080		28	1	20	232/233 GENERAL RECEPTACEES
	202 PS	20	1	29		1,000	1,400				232/233 RECEPTACLES
							720	30	1	20	
	202 F2	20	1	31	750						230/231 GENERAL RECEPTACLES
	2021/2				1,080			32	1	20	000,004,050,0050
	202 VP	20	1	33		435		34	1	20	230/231 RECEPTACLES
	202 VP	20	1	35		720	435	34	1	20	228/229 GENERAL RECEPTACLES
	LUL VI	20		- 55			1.080	36	1	20	ELGILLO CENEIVAE NEGEFTAGEES
	202 F2	20	1	37	750		.,000				
					10,670			38	3	100	
	SPARE	20	1	39							PANEL 'RP-2SB'
	CDADE	20		- 44		10,420		40			
	SPARE	20	1	41			8.886	42			
		TOTAL	VA		19,930	20.525	18.201	TOTAL	KVA		58.7
			AMP/PH	ASF	166	171	152	TOTAL			163

Figure 3.2.13 – RP-2SA-1 Original Panelboard Schedule

NEL:	LP-3S		EQUIP. (SND. BUS	S:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
	ELEC.RM.(319A)-3RD F		ISOLAT			\vdash				IRCUIT B	, ,
	SURFACE	-				\perp	2000/	_		_	NA.
OUNTING:			NEUTRA	L DUS:	100%		200%		MLO:		
D FROM:	PANEL 'LP-1S'		A.I.C.:		42,000				BUS RA	TING:	100A
		BKR.	BKR.	CKT.	L	OAD - V.A		CKT.	BKR.	BKR.	
LOAD	ESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713						
	SF-3-1	30	3	3	1,275	2.742		2			RF-3-1
`	31-3-1	30	,	3		3,713 1,275		4	3	15	KI -3-1
				5		1,210	3,713	_		10	
							1,275	6			
LI	GHTING	20	1	7	3,552		.,				LIGHTING
	ICE AREA				3,696			8	1	20	ADJUSTABLE CLASSROOMS
_	GHTING	20	1	9		4,080					LIGHTING
	ICE AREA					3,096		10	1	20	90 & 55 CLASSROOM
_	GHTING	20	1	11			1,600	40	L .	20	LIGHTING
	HALLWAY GHTING	20	-	42	0.700		3,050	12	1	20	LOBBY AND MAIN HALLWAY SPARE
_	CE SPACE	20	1	13	2,760			14	3	20	SPARE
	GHTING	20	1	15		1,200		17		20	SPARE
_	HALLWAY		·			1,200		16	1	20	017112
	48A,B	20	1	17			3,048				SPARE
HAN	D DRYERS							18	1	20	
_	51A,B	20	1	19	3,048						SPARE
	D DRYERS							20	1	20	
	318A	20	1	21		3,048			.		SPARE
	D DRYERS	20	_	22			0.040	22	1	20	SPARE
	318B D DRYERS	20	1	23			3,048	24	1	20	SPARE
	SPARE	20	1	25				24		20	SPARE
`	317 tt L	20						26	1	20	Ol / III
ç	SPARE	20	1	27							SPARE
								28	1	20	
9	SPARE	20	1	29							SPARE
								30	1	20	
	SPARE	20	1	31	\vdash						SPARE
	SPARE	20	-	22				32	1	20	SPARE
	DEARE	20	1	33				34	1	20	SPARE
LIGHTING	CONTROL PANEL	20	1	35			1,000	34	<u> </u>	20	SPARE
	CP-1A						1,000	36	1	20	OI FIRE
		125	3	37	44,742						SPARE
PANELS 'RP-3	SA-1' & 'RP-3SA-2'							38	1	20	
(75 K	VA XFMR)			39		47,360					SPARE
								40	1	20	
				41			44,035		L.,		SPARE
		TOTAL	1/4		00.700	00.770	00.700	42	1	20	107.2
		TOTAL	VA AMP/PH/		62,786 227	63,772 230	60,769 219	TOTAL TOTAL			187.3 225

Figure 3.2.14 – LP-3S Original Panelboard Schedule

NEL:	RP-3SA-1		EQUIP. (SND. BUS	S:				VOLTA	GE:	120/208 VOLT, 3PH, 4W
CATION:	ELEC.RM.(319A)-3RD	FL.	ISOLAT	ED GND E	BUS:				MAIN C	RCUIT BK	
OUNTING:	SURFACE	_	NEUTRA		100%		200%	_	MLO:		
ED FROM:	PANEL 'LP-3S'	-	A.I.C.:		10070	Ш	20070		BUS RA		225
ED I KOIII.	TANEE E1-55									_	223
	PEROPRETION	BKR.	BKR.	CKT. NO.		OAD - V.A		CKT.	BKR.	BKR.	LOAD DESCRIPTION
	DESCRIPTION RECEPTACLES	AMPS 20	POLE		Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
360 R	RECEPTACLES	20	1	1	720 1,000			2	1	20	J-BOX, VAV
362 R	RECEPTACLES	20	1	3	1,000	720		_		20	350 RECEPTACLES
						1,340		4	1	20	
363 R	RECEPTACLES	20	1	5			720				318B RECEPTACLES
							1,340	6	1	20	
349 R	RECEPTACLES	20	1	7	720			_		20	339 RECEPTACLES
340 D	RECEPTACLES	20	1	9	1,440	720		8	1	20	337 RECEPTACLES
343 K	RECEPTACEES	20	-	3		1.440		10	1	20	337 RECEPTACLES
340 R	RECEPTACLES	20	1	11		1,770	720				GE-R-1
							506	12	1	15	
340 R	RECEPTACLES	20	1	13	720						SPARE
								14	1	15	
337 R	RECEPTACLES	20	1	15		720		40		45	TE-R-2
225 0	RECEPTACLES	20	1	17		830	720	16	1	15	CE-R-2
333 K	RECEPTACEES	20	•	- 17			506	18	1	15	CL-R-2
333 R	RECEPTACLES	20	1	19	720		300				SPARE
								20	1	20	
331 R	RECEPTACLES	20	1	21		720					334 RECEPTACLES
						1,440		22	1	20	
329 R	RECEPTACLES	20	1	23			720			00	332 RECEPTACLES
327 D	RECEPTACLES	20	1	25	720		1,440	24	1	20	J-BOX, VAV
327 N	RECEPTACEES	20	-	2.0	1.000			26	1	20	3-BOX, VAV
324 R	RECEPTACLES	20	1	27	1,000	720					326 RECEPTACLES
						1,440		28	1	20	
32	22 COPIER	20	1	29			1,000				323 RECEPTACLES
							1,440	30	1	20	004 8505554 0150
321 R	RECEPTACLES	20	1	31	1,080 1,440			32	1	20	321 RECEPTACLES
321 R	RECEPTACLES	20	1	33	1,440	360		32	1	20	302 RECEPTACLES
02111	LOCI INOLLO		•			1.440		34	1	20	OUL NEGET PROCES
323 R	RECEPTACLES	20	1	35		.,	360				302 RECEPTACLES
							1,440	36	1	20	
302 R	RECEPTACLES	20	1	37	1,440						
200.0	RECEPTACLES	20		20	17,802	4.415		38	3	100	DANEL IDD 2021
302 R	RECEPTACLES	20	1	39		1,440 17.290		40			PANEL 'RP-3SB'
327/328/329	GENERAL RECEPTS	20	1	41		17,290	1.260	40			
32113201323	OLINEIVAL NEGET 13	20		71			15.883	42			
		TOTAL	VA		28,802	30,620	28,055	TOTAL	KVA		87.5
		TOTAL	AMP/PH/	ASE	240	255	234	TOTAL	AMP		243

Figure 3.2.15 – RP-3SA-1 Original Panelboard Schedule

Original Distribution System Single Line Diagram

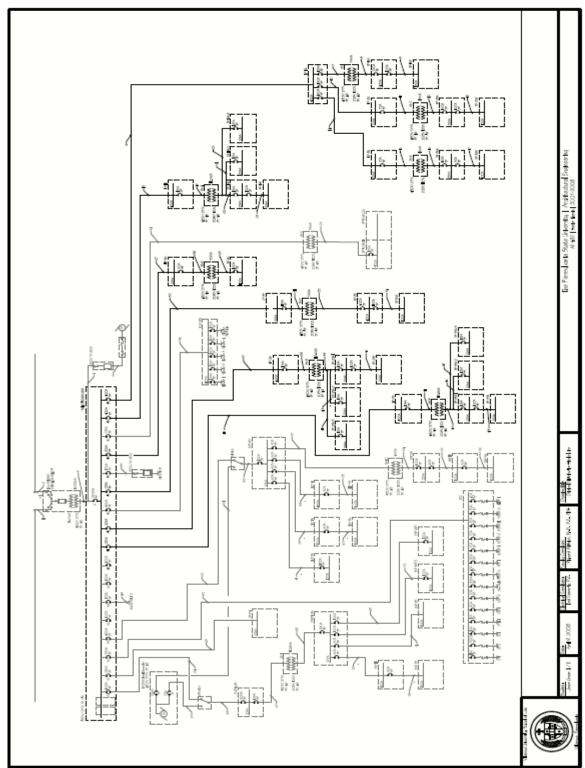


Figure 3.3.1 – Original Distribution System Single Line
*See Appendix D for full size single line

Redesign Calculations

	DL-1 Redesign Equipment Sizing														
	Amps														
PANEL	kVA	Amps	(growth)	Brk.	Bus	Feeder (THWN)	Grnd.	Conduit							
LP-BN															
LP-1N	31.5	38	43.6	50	100	(4) #8	#10	3/4" EMT							
LP-2N	36.6	44	50.6	60	100	(4) #6	#10	3/4" EMT							
LP-3N	53.5	64	74.0	80	100	(4) #4	#8	1' EMT							
Total	181	218	250	300	400	(4) 300 MCM	#4	2-1/2" EMT							

Figure 3.4.1 – Design Calculation for DL-1

	DL-2 Redesign Equipment Sizing														
	Amps														
PANEL	kVA	Amps	(growth)	Brk.	Bus	Feeder	(THWN)	Grnd.	Conduit						
LP-BS	97.5	117	134.9	150	225	(4) 1/0		#6	1-1/2" EMT						
LP-1S	58.0	70	80.2	90	100	(4) #3		#8	1-1/4" EMT						
LP-2S	52.9	64	73.2	80	100	(4) #4		#8	1" EMT						
LP-3S	51.2	62	70.8	80	100	(4) #4		#8	1" EMT						
Total	260	312	359	400	400	(4) 500	MCM	#3	3" EMT						

Figure 3.4.2 – Design Calculation for DL-2

	DR-1 Redesign Equipment Sizing														
	Amps X-FMR X-Prim X-Sec I														
PANEL	kVA	Amps	(growth)	Brk.	Bus	Feeder (THWN)	Grnd.	Conduit	(kVA)	Prot	Prot	Primary Feeder	Ground		
RP-BN	35.1	98		125	225	(4) #1	#6	1-1/4" EMT							
RP-1NA	27.1	75	86.4	90	100	(4) #3	#8	1-1/4" EMT							
RP-1NB	33.9	94	108.3	110	225	(4) #2	#6	1-1/4" EMT							
RP-2NA	17.4	48	55.5	60	100	(4) #6	#10	3/4" EMT							
RP-2NB	26.4	73	84.3	90	100	(4) #3	#8	1-1/4" EMT							
RP-3NA	29.6	82	94.4	100	100	(4) #3	#8	1-1/4" EMT							
RP-3NB	31.7	88	101.2	110	225	(4) #2	#6	1-1/4" EMT		302	698				
Total	201	558	642	700	800	2 sets (4) 350MCM	1/0	(2) 2-1/2" EMT	225	300	700	(3) 350MCM	#4		

Figure 3.4.3 – Design Calculation for DR-1

	DR-2 Redesign Equipment Sizing														
	Amps X-FMR X-Prim X-Sec Primary														
PANEL	kVA	Amps	(growth)	Brk.	Bus	Feeder (THWN)	Grnd.	Conduit	(kVA)	Prot	Prot	Primary Feeder	Ground		
RP-1SA-1	31.8	88			225							-			
RP-1SA-2	42.2	117	134.8	125	225										
RP-1SA-3	50.6	141	161.7	150	225										
SubTotal	124.7	346.1		350		(4) 500MCM	#3	3" EMT							
RP-2SA-1	28.7	80	91.5	80	225										
RP-2SA-2	38.8	108	123.9	110	225										
RP-2SA-3	41.3	115	131.8	125	225										
SubTotal	108.8	302.0		350		(4) 350 MCM	#3	2-1/2" EMT							
RP-3SA-1	36.5	101	116.5	110	225										
RP-3SA-2	48.7	135	155.3	150	225										
RP-3SA-3	38.1	106	121.5	110	225					887	2048				
SubTotal	123.2	342.0		350		(4) 500MCM	#3	3" EMT							
Total	590	1638	1139	1200	1200	3 sets (4) 500MCM	3/0	(3) 3" EMT	500	600	1200	2 Sets (3) 350MCM	#1		

Figure 3.4.4 – Design Calculation for DR-2

*Note: Growth was not used in this calculation because the panels are completely full. There is not physical room for growth.

	DR-3 Redesign Equipment Sizing													
			Amps						X-FMR	X-Prim	X-Sec		Primary	
PANEL	kVA	Amps	(growth)	Brk.	Bus	Feeder (THWN)	Grnd.		(kVA)	Prot	Prot	Primary Feeder	Ground	
RP-BS	33.2				225	(4) #2	#6	1-1/4" EMT						
RP-BSA	35.9	100	114.7	125	225	(4) #1	#6	1-1/4" EMT						
RP-1SB	41.3	115	132.0	150	225	(4) 1/0	#6	1-1/2" EMT						
RP-2SB	30.0	83	95.7	100	100	(4) #3	#8	1-1/4" EMT						
RP-3SB	51.0	141	162.7	175	225	(4) 2/0	#6	2' EMT		288	664			
Total	191	531	611	700	800	2 sets (4) 350MCM	1/0	(2) 2-1/2" EMT	225	300	700	(3) 350MCM	#4	

Figure 3.4.5 – Design Calculation for DR-3

Redesign System Schedules

		REDESIGN	N TRANSI	FORMER SCH	IEDULE		
TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING
XD-1	13.2kV, 3P, 3W	480Y/277V, 3P, 4W	1500kVA	Silicone-based dielectric filled	55℃	(4) 2.5% Taps (2) Up & (2) Dn	Concrete Pad Mount (outside)
XS-5	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	75kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated
XS-10	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	45kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated
XS-11	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated
XS-12	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	225kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated
XS-13	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	300kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated
XS-14	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	225kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated

Figure 3.5.1 – Redesign Distribution System Transformer Schedule

				COI	NDUIT			CON	DUCTO	DRS (PE	R SET)				SIZE OF
			NO. OF	(PEF	R SET)	PHASE CO	NDUCTORS	NEUT	RAL C	ONDUC	TORS	GROU	ND CO	NDUCTORS	OVERCURRE
TAG	FROM	TO	SETS	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	PROTECTIO
1	UTILITY	XD-1	1	4"	PVC	3	4/0					1	2		
3	UTILITY XD-1	XD-1 MDB	7	4" 4"	PVC EMT	3	4/0 500	CU THWN	1	500	CU THWN	1	2 350	CU THWN	
4	XD-1	FP	1	1.5"	EMT	3	1/0	CU THWN	1	3	CU THWN	1	6	CU THWN	
5	Disc. Sw	Fire Pump	1	1.5"	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	800A Fuse
24	MDB	XS-5	1	1.25	EMT	3	3	CU THWN	0		CU THWN	1	8	CU THWN	225A, 3P
25	XS-5	RP-K (Sec.1)	1	2.5	EMT	3	250	CU THWN	1	250	CU THWN	1	4	CU THWN	150A, 3P
26	RP-K (Sec.1)	RP-K (Sec.2)	1	2.5	EMT	3	250	CU THWN	1	250	CU THWN	1	4	CU THWN	150A, 3P
35	MDB	ELEV.	1	2	EMT	3	3/0	CU THWN	1	3/0	CU THWN	1	6	CU THWN	800A Fuse
36	MDB MDB	Elev-BN	1	3	EMT	3	350	CU THWN	1	350	CU THWN	1	4	CU THWN	400A, 3P
49 50	MDB	Snow Mlt.	1	1.5	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	8	CU THWN	100A, 3P 400A, 3P
51	ATS-LS	GEN	1	2.5	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	4	CU THWN	225A, 3P
52	ATS-LS	EDP-BS	1	25	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	4	CU THWN	400A, 3P
53	EDP-BS	XS-10	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	10	CU THWN	50A, 3P
54	XS-10	ERP-BS	1	2	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	100A, 3P
55	ERP-BS	ERP-1S	1	2	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	60A, 3P
56	ERP-1S	ERP-3S	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	50A, 3P
57 58	EDP-BS ELP-3S	ELP-1S ELP-3S	1	1.5	EMT	3	6	CU THWN	1	4	CU THWN	1	8 10	CU THWN	50A, 3P 50A, 3P
58	EDP-BS	ELP-3S	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	10	CU THWN	60A, 3P
60	ELP-1N	ELP-3N	1	1	EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	50A, 3P
61	EDP-BS	ELP-BS	1	1	EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	60A, 3P
62	MDB	MCC	2	3	EMT	3	350	CU THWN	1	350	CU THWN	1	1	CU THWN	750A, 3P
63	MDB	DP-PH	1	2.5	EMT	3	4/0	CU THWN	1	4/0	CU THWN	1	4	CU THWN	225A, 3P
64	MDB ATS-NLS	ATS-NLS	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	100A, 3P
65 66	ATS-NLS	GEN ENDPH-BS	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	70A, 3P 100A, 3P
67	ENDPH-BS	XS-11	1	1.25	EMT	3	4	CU THWN	0		CU THWN	1	8	CU THWN	125A, 3P
68	XS-11	ENDPL-BS	1	2	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	250A, 3P
69	ENDPL-BS	ENP-MDF	1	1.5	EMT	3	1	CU THWN	1	1	CU THWN	1	8	CU THWN	100A, 3P
70	ENDPL-BS	ENP-MDF2	1	1.5	EMT	3	1	CU THWN	1	1	CU THWN	1	8	CU THWN	100A, 3P
71	ENDPL-BS	ENP-BS	1	1	EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	50A, 3P
72	ENDPL-BS ENP-1S	ENP-1S ENP-3S	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	10	CU THWN	60A, 3P 50A, 3P
73 74	ENP-1S MDB	DL-1	1		EMT	3	6 300	CU THWN	1	6 300	CU THWN	1	10 4	CU THWN	,-
75	DL-1	LP-BN	1	_	EMT	3	3	CU THWN	1	3	CU THWN	1	_	CU THWN	
76	DL-1	LP-1N	1		EMT	3	8	CU THWN	1	8	CU THWN	1		CU THWN	
77	DL-1	LP-2N	1	0.75	EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	60A, 3P
78	DL-1	LP-3N	1	_	EMT	3	4	CU THWN	1	4	CU THWN	1		CU THWN	, -
79	MDB	DL-2	1	_	EMT	3	500	CU THWN	1	500	CU THWN	1		CU THWN	
80 81	DL-2 DL-2	LP-BS LP-1S	1	_	EMT	3	4/0 3	CU THWN	1	4/0 3	CU THWN	1		CU THWN	
82	DL-2 DL-2	LP-15 LP-2S	1		EMT	3	4	CU THWN	1	4	CU THWN	1		CU THWN	
83	DL-2	LP-3S	1		EMT	3	4	CU THWN	1	4	CU THWN	1		CU THWN	
84	MDB	XS-2	1		EMT	3	350	CU THWN	0		CU THWN	1	_	CU THWN	
85	XS-3	DR-1	2	2.5	EMT	3	350	CU THWN	1	350	CU THWN	1	1/0	CU THWN	700A, 3P
86	DR-1	RP-BN	1	1.25	EMT	3	1	CU THWN	1	1	CU THWN	1	_	CU THWN	
87	DR-1	RP-1NA	1		EMT	3	3	CU THWN	1	3	CU THWN	1		CU THWN	
88 89	DR-1	RP-1NB RP-2NA	1		EMT	3	2	CU THWN	1	2	CU THWN	1		CU THWN	
90	DR-1 DR-1	RP-2NA RP-2NB		0.75 1.25		3	3	CU THWN	1	_	CU THWN	1	_	CU THWN	
91	DR-1	RP-3NA		1.25	EMT	3	3	CU THWN	1		CU THWN	1		CU THWN	
92	DR-1	RP-3NB		1.25	EMT	3	2	CU THWN	1	2	CU THWN	1		CU THWN	
93	MDB	XS-3	2		EMT	3	350	CU THWN	0		CU THWN	1	1	CU THWN	
94	XS-3	DR-2	3		EMT	3	500	CU THWN	1		CU THWN	1			1200A, 3P
95	DR-2	RP-1SA-1	1		EMT	3	500	CU THWN	1		CU THWN	1		CU THWN	
96 97	RP-1SA-1		1		EMT	3	500	CU THWN	1	500	CU THWN	1		CU THWN	
98	RP-1SA-2 DR-2	RP-15A-3	1		EMT	3	500 350	CU THWN	1		CU THWN	1		CU THWN	
	RP-2SA-1		1		EMT	3	350	CU THWN	1		CU THWN	1		CU THWN	
	RP-2SA-2		1		EMT	3	350	CU THWN	1		CU THWN	1		CU THWN	
101	DR-2	RP-3SA-1	1	3	EMT	3	500	CU THWN	1	500	CU THWN	1	3	CU THWN	350A, 3P
102	RP-3SA-1		1		EMT	3	500	CU THWN	1		CU THWN	1		CU THWN	
	RP-3SA-2		1		EMT	3	500	CU THWN	1		CU THWN	1		CU THWN	
104	MDB	XS-4	1		EMT	3	350	CU THWN	0		CU THWN	1		CU THWN	
	XS-4	DR-3	2		EMT	3	350	CU THWN	1		CU THWN	1		CU THWN	
106 107	DR-3 DR-3	RP-BS RP-BSA		1.25	EMT EMT	3	1	CU THWN	1		CU THWN	1		CU THWN	
	DR-3	RP-BSA RP-1SB	1		EMT	3	1/0	CU THWN	1	1/0	CU THWN	1		CU THWN	
						3	3	CU THWN	1		CU THWN	1			100A, 3P
	DR-3	RP-2SB	1	1.25	EMT			I CO ILIVVIA							

Figure 3.5.2 – Redesign Distribution System Feeder Schedule

Redesign Panel Board Schedules

						ARD S	CHEL	JULE			
NEL:	LP-1N		EQUIP. 0						VOLTA	_	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(188)-1ST FL		ISOLAT	ED GND E	BUS:				MAIN C	IRCUIT BKR	:
OUNTING:	SURFACE		NEUTRA	L BUS:	100%		200%		MLO:		
D FROM:	SWBD 'MDB'		A.I.C.:	42000					BUS RA	TING:	100
LOAD	DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A B	С	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
LUAU	DESCRIPTION	AMF3	FULL	1	3,713	ь	_	110.	FULL	AWIF3	LOAD DESCRIPTION
					1,275			2			
	SF-1-3	30	3	3		3,713		4	_	45	RF-1-3
				5		1,275	3,713	4	3	15	
				,			1.275	6			
	LIGHTING	20	1	7	4,000						LIGHTING
	FICE SPACE				3,176			8	1	20	OFFICE CORRIDOR
	LIGHTING N CORRIDOR	20	1	9		2,500 1,400		10	1	20	LIGHTING OFFICE SPACE
	LIGHTING	20	1	11		1,400	1,400	-10	<u> </u>	20	LIGHTING
MAIN S	SEATING AREA						1,800	12	1	20	CHAPEL
	SPARE	20	1	13							LIGHTING
	SPARE	20	1	15	1,250			14	1	20	EXTERIOR READING ROOM SPARE
	SPARE	20	-	15				16	1	20	SPARE
	SPARE	20	1	17							SPARE
								18	1	20	
	SPARE	20	1	19				20	1	20	SPARE
	SPARE	20	1	21				20	<u>'</u>	20	SPARE
								22	1	20	
	SPARE	20	1	23							SPARE
	SPARE	20	1	25				24	1	20	SPARE
	SPARE	20	-	20				26	1	20	SPARE
	SPARE	20	1	27							SPARE
	00.105							28	1	20	00.05
	SPARE	20	1	29				30	1	20	SPARE
	SPARE	20	1	31				30	<u> </u>	20	
								32	3	150	
	SPARE	20	1	33							SPARE
LIGHTING	CONTROL PANEL	20	1	35			1,000	34			
	LCP-1B	20		35			1,000	36			
		125	3	37							
	004.05			-				38	3	150	
	SPARE			39				40			SPARE
				41				40			
								42			
	_	TOTAL			13,414	8,888	9,188	TOTAL			31.5
		ITOTAL.	AMP/PHA	ASE	48	32	33	TOTAL	AMP		38

Figure 3.6.1 – LP-1N Redesign Panelboard Schedule

					ELBO						
ANEL:	RP-1NA	_		GND. BUS					VOLTA		120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(188)-1ST FL	_		ED GND E					MAIN C	IRCUIT BI	KR: 250
MOUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	PANEL 'LP-1N'	_	A.I.C.:	22000					BUS RA	TING:	100
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
181/182 GEI	NERAL RECEPTACLES	20	1	1	1,080 1,620			2	1	20	186/187,A/S4-1 RECEPTACLES
181/182 COM	MPUTER RECEPTACLES	20	1	3	.,	720					187 UCR
400 00110	UTED DECERTA OL FO			_		500		4	1	20	405 051150 41 0505074 01 50
180 COMP	UTER RECEPTACLES	20	1	5			720 360	6	1	20	185 GENERAL RECEPTACLES
180 GENE	RAL RECEPTACLES	20	1	7	720		000				183/184 COMPUTER RECEPTACLE
					720			8	1	20	
180 CO	PIER RECEPTACLE	20	1	9		1,000 720		10	1	20	178/179 COMPUTER RECEPTACLE
180 FA	AX RECEPTACLE	20	1	11		720	500	10		20	178/179 GENERAL RECEPTACLES
			-				1,260	12	1	20	
168/CORR	IDOR RECEPTACLES	20	1	13	1,260						176/177 GENERAL RECEPTACLES
					1,080			14	1	20	
183 CO	PIER RECEPTACLE	20	1	15		1,000 345		16	1	20	CUH-1-2
183 COMP	UTER RECEPTACLES	20	1	17		343	720	-10	<u> </u>	20	CUH-1-4
							345	18	1	15	55
183 FA	AX RECEPTACLE	20	1	19	500						TF-1-1
400 00110	UTED DECEDTA OL CO	20		24	506	700		20	1	15	FD 4.2
168 COMP	UTER RECEPTACLES	20	1	21		720 830		22	1	15	FP-1-3
169	RECEPTACLES	20	1	23		000	720				UH-1
							506	24	1	15	
168A COMP	PUTER RECEPTACLES	20	1	25	720						176/177 COMPUTER RECEPTACLE
168A COM	PUTER RECEPTACLES	20	1	27	720	720		26	1	20	174/175 COMPUTER RECEPTACLE
100A COMP	FOTER RECEPTACEES	20	-	21		720		28	1	20	174/173 COMPOTER RECEPTAGE
170	RECEPTACLES	20	1	29			540				184 GENERAL RECEPTACLES
							900	30	1	20	
180 COM	PUTER RECEPTACLE	20	1	31	180 1.000			32	1	20	168 JUNCTION BOX
170 CO	PIER RECEPTACLE	20	1	33	1,000	1,000		JZ		20	LIGHTING
						200		34	1	20	CHAPEL INCANDESCENT
170 CO	PIER RECEPTACLE	20	1	35			1,000				SPARE
	SPARE		-	2.7				36	1	20	
	SPARE	20	1	37				38	3	100	
114A OUT	DOOR RECEPTACLE	20	1	39		180			Ť		SPARE
								40			
114A/115/16	9 GEN. RECEPTACLES	20	1	41			720	42			
		TOTAL	VA		10,106	8,655	8,291	TOTAL	KVA		27.1
	TOTAL AMP/PHASE					72	69				

Figure 3.6.2 – RP-1NA Redesign Panelboard Schedule

NEL:	LP-2N			SND. BUS	-				VOLTA	_	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(266)-2ND FL	•		ED GND E					MAIN C	IRCUIT BKR	·
OUNTING:	SURFACE		NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	PANEL 'LP-1N'		A.I.C.:	42000					BUS RA	TING:	100
		BKR.	BKR.	CKT.		.OAD - V.A		CKT.	BKR.	BKR.	
LOAI	DESCRIPTION	AMPS	POLE	NO.	A 5.570	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	5,570 1,275			2			
	SF-2-3	40	3	3	1,270	5,570					RF-2-3
						1,275		4	3	15	
				5			5,570	_			
	LIGHTING	20	1	7	1,800		1,275	6			LIGHTING
	FICE NORTH	20			3,400			8	1	20	STACKS
	LIGHTING	20	1	9	2,	2,000					LIGHTING
RE/	ADING ROOM					3,400		10	1	20	STACKS
	LIGHTING	20	1	11			1,300	12	1	20	LIGHTING
	SEATING LIGHTING	20	1	13	510		2,632	12	1	20	STACKS SPARE
М	ECHANICAL	20			310			14	1	20	OI AILE
	SPARE	20	1	15							SPARE
	00405							16	1	20	004.05
	SPARE	20	1	17				18	1	20	SPARE
	SPARE	20	1	19				10	'	20	SPARE
	017412							20	1	20	Ol / III.
	SPARE	20	1	21							SPARE
	00.00							22	1	20	00.05
	SPARE	20	1	23				24	1	20	SPARE
	SPARE	20	1	25				24	<u> </u>	20	SPARE
								26	1	20	
	SPARE	20	1	27							SPARE
	SPARE	20	1	29				28	1	20	SPARE
	SPARE	20	1	29				30	1	20	SPARE
	SPARE	20	1	31							SPARE
								32	1	20	
	SPARE	20	1	33				24		20	SPARE
LIGHTING	G CONTROL PANEL	20	1	35			1,000	34	1	20	SPARE
2.0111111	LCP-2B			50			1,000	36	1	20	SIANE
		70	3	37							SPARE
	OD A DE			20				38	1	20	ODA DE
	SPARE			39				40	1	20	SPARE
				41				-10	<u> </u>	20	SPARE
								42	1	20	
	_	TOTAL			12,555	12,245	11,777	TOTAL			36.6
MARKS:		TOTAL	AMP/PHA	ASE	45	44	43	TOTAL	AMP		44

Figure 3.6.3 – LP-2N Redesign Panelboard Schedule

				PAN	IELBC	ARD	<u>SCH</u> E	DUL	<u>E</u>		
ANEL:	RP-2NA		EQUIP. (GND. BUS):				VOLTA	GE:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(266)-2ND FL		ISOLAT	ED GND E	BUS:				MAIN C	IRCUIT B	KR: 150
OUNTING:	SURFACE		NEUTRA	L BUS:	100%	\sqcap	200%		MLO:		<u> </u>
ED FROM:	PANEL 'LP-2N'		A.I.C.:	22000				_	BUS RA	TING:	100
1.04	D DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A B	l.	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
	QUAD RECEPTACLES	20	1	1	720		·		TOLL	Aiiii 3	260B/264 RECEPTACLES
					1,080			2	1	20	
265 FLOOR	QUAD RECEPTACLES	20	1	3		720 720		4	1	20	264 WALL QUAD RECEPTACLES (COM
265 FLOOR	QUAD RECEPTACLES	20	1	5			720 720	6	1	20	264 WALL QUAD RECEPTACLES (COM
265 FLOOR	QUAD RECEPTACLES	20	1	7	720 720		720	8	1	20	264 WALL QUAD RECEPTACLES (COM
265 FLOOR	QUAD RECEPTACLES	20	1	9	720	720			1	20	264 WALL QUAD RECEPTACLES (COM
						720		10	1	20	
265 COMP.	WALL RECEPTACLES	20	1	11			720 900	12	1	20	264 GEN RECEPTACLES
260B/2	65 RECEPTACLES	20	1	13	720						260 WALL QUAD RECEPTACLES
					720			14	1	20	
267 GENE	ERAL RECEPTACLES	20	1	15		360 500		16	1	20	260A EWC RECEPTACLE
260B	JUNCTION BOX	20	1	17			1,000	18	1	20	SPARE
265 FLOOR	QUAD RECEPTACLES	20	1	19	720 506			20	1	15	TF-2-1
265 FLOOR	QUAD RECEPTACLES	20	1	21	300	720 830		22	1	15	FP-2-3
265 FLOOR	QUAD RECEPTACLES	20	1	23		630	720 506	24	1	15	UH-1
265 WA	ALL RECEPTACLES	20	1	25	540		506				SPARE
265 FLOOR	QUAD RECEPTACLES	20	1	27		360		26	1	20	SPARE
	SPARE	20	1	29				28	1	20	SPARE
								30	1	20	
	SPARE	20	1	31				32	1	20	SPARE
	SPARE	20	1	33				34	1	20	SPARE
	SPARE	20	1	35							SPARE
	SPARE	20	1	37				36	1	20	
	SPARE	20	1	39				38	3	100	SPARE
	SPARE	20		41				40			
	SPARE	20	1	41				42			
	TOTAL VA					5,650	5,286				17.382
	TOTAL AMP/PHASE						44				

Figure 3.6.4 – RP-2NA Redesign Panelboard Schedule

IEL:	LP-3N		EQUIP. 0	GND. BUS	:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(366)-3RD FL		ISOLAT	ED GND E	BUS:				MAIN C	IRCUIT BKR	<u> </u>
OUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:		
D FROM:	PANEL 'LP-1N'		A.I.C.:		42,000				BUS RA	TING:	100
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAI	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	5,570			2			
	SF-3-3	40	3	3	2,015	5,570					RF-3-3
	01-0-0		-	,		2,015		4	3	15	111-0-0
				5		2,010	5,570				
							2.015	6			
				7	3,713						LIGHTING
					2,000			8	1	20	READING ROOM
	SF-R-1	30	3	9		3,713					LIGHTING
						1,600		10	1	20	SEATING AREA
				11			3,713	42		20	LIGHTING
	LIGHTING	20	1	13	2,056		2,024	12	1	20	DEAN'S SUITE LIGHTING
	E SPACE NORTH	20	1	13	2,056			14	1	20	MECHANICAL ROOM
	LIGHTING	20	1	15	000	2,520		- '-	<u> </u>	20	LIGHTING
	STACKS		-			800		16	1	20	DEAN'S SUITE HALLWAY
	LIGHTING	20	1	17			2,576				373
	STACKS						1,524	18	1	20	HAND DRYER
	LIGHTING	20	1	19	2,912						SPARE
	STACKS							20	1	20	
	SPARE	20	1	21							SPARE
								22	1	20	
	SPARE	20	1	23				24	1	20	SPARE
	SPARE	20	1	25				24	1	20	SPARE
	SPARL	20	-	20		-		26	1	20	SPARL
	SPARE	20	1	27				20	<u> </u>	20	SPARE
								28	1	20	
	SPARE	20	1	29							SPARE
								30	1	20	
	SPARE	20	1	31							SPARE
					\Box			32	1	20	
	SPARE	20	1	33				24		20	SPARE
LICHTING	G CONTROL PANEL	20	1	35			4.000	34	1	20	SPARE
LIGHTING	LCP-3B	20	1	30			1,000	36	1	20	SPARE
	201-00	70	3	37				- 30	<u> </u>	20	SPARE
								38	1	20	
	SPARE			39							SPARE
								40	1	20	
				41							SPARE
								42	1	20	
		TOTAL			18,866	16,218	18,422	TOTAL			53.5
MARKS:		TOTAL	AMP/PHA	ASE	68	59	67	TOTAL	AMP		64

Figure 3.6.5 – LP-3N Redesign Panelboard Schedule

NEL:	RP-3NA		EQUIP. (SND. BUS	:				VOLTA	GE:	120/208 VOLT. 3PH. 4W
CATION:	ELEC.RM.(366)-3RD FL	•	ISOLAT	ED GND E	BUS:				MAIN C	RCUIT BKR:	
OUNTING:	SURFACE	•	NEUTRA		100%	♬	200%	_	MLO:		
ED FROM:	PANEL 'LP-3N'	•	A.I.C.:		22.000	Ш	20070		BUS RA		100A
	774122 27 011	- BIKB		OUT		010 1/1		01/7			10071
1.041	DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A B	. С	CKT.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
	RECEPTACLES	20	1	1	360				FOLL	Amra	ROOF RECEPTACLES
000	NEGET TAGEES	-20		•	360			2	1	20	NOOT NEGET TAGEES
365	RECEPTACLES	20	1	3		360					365 RECEPTACLES
				_		1,440		4	1	20	
365	RECEPTACLES	20	1	5			720 1.440	6	1	20	367 RECEPTACLES
365	RECEPTACLES	20	1	7	720		1,440	0	1	20	360B RECEPTACLES
000	NEGET TAGEES	-20			1,260			8	1	20	SOUD REGEL TAGEES
365	RECEPTACLES	20	1	9	,	720					360 RECEPTACLES
						1,440		10	1	20	
370/37	1 RECEPTACLES	20	1	11			1,260	12	1	20	372 RECEPTACLES
370	RECEPTACLES	20	1	13	1.080		1,440	12	1	20	368 RECEPTACLES
5,0	NEGET TAGEES	-20		- 10	1,460			14	1	20	& DOOR HOLDERS
360	RECEPTACLES	20	1	15	.,	720					FP-3-4
						800		16	1	15	
364	RECEPTACLES	20	1	17			720	40	1	45	TE-3-1
364	RECEPTACLES	20	1	19	720		299	18	1	15	TF-3-1
304	RECEPTACEES	20	_	13	500			20	1	15	11-5-1
364	RECEPTACLES	20	1	21		720					FP-3-3
						830		22	1	15	
374	RECEPTACLES	20	1	23			720	24	1	45	UH-1
	376 COPIER	20	1	25	1.000		506	24	1	15	J-BOX, VAV
,	oro cor let	20		20	1,000			26	1	20	3-BOX, *A*
360	RECEPTACLES	20	1	27		900					365 RECEPTACLES
						720		28	1	20	
360	RECEPTACLES	20	1	29			720	30	1	20	365 RECEPTACLES
360	RECEPTACLES	20	1	31	720		720	30	1	20	LIGHTING
300	The state of the s			-	322			32	1	20	365 PENDANTS
360	RECEPTACLES	20	1	33		900					SPARE
	DECEDE A CLES							34	1	20	05:55
375	RECEPTACLES	20	1	35			540	36	1	20	SPARE
365	RECEPTACLES	20	1	37	720			30	1	20	
					120			38	3	50	
365	RECEPTACLES	20	1	39		720					SPARE
	004.05							40			
	SPARE	20	1	41				42			
		TOTAL	VA		10,222	10.270	9.085	TOTAL	KVA		29.577
			AMP/PH/	ASE	85	86	76	TOTAL			82

Figure 3.6.6 – RP-3NA Redesign Panelboard Schedule

NEL:	LP-1S		EQUIP. 0	GND. BUS	:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(119A)-1ST F	L.	ISOLAT	ED GND E	BUS:				MAIN C	IRCUIT BKR	:
OUNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:		
D FROM:	SWBD 'MDB'	_	A.I.C.:	42000					BUS RA	TING:	100
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAI	DESCRIPTION	AMPS	POLE	NO. 1	A 2742	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 2,015			2			
	SF-1-1	30	3	3	2,010	3,713		_			RF-1-1
						2,015		4	1	15	
				5			3,713				
							2,015	6			
	LIGHTING	20	1	7	3,056						LIGHTING
	ORE AREA		_		2,576			8	1	20	135 CLASSROOM
	LIGHTING	20	1	9		3,040		40		20	LIGHTING
	OFFICES LIGHTING	20	1	11		1,902	4.040	10	1	20	90 CLASSROOM LIGHTING
	OFFICES	20	1	- 11			1,840 2.008	12	1	20	55 CLASSROOM
	LIGHTING	20	1	13	1,800		2,000	12		20	LIGHTING
OFFI	CE CORRIDORS				2,500			14	1	20	MAIN STAIRS
	LIGHTING	20	1	15	2,000	2,800					LIGHTING
MAIN COF	RRIDOR AND LOBBY					2,500		16	1	20	SOUTH STAIRS
	LIGHTING	20	1	17			3,200				LIGHTING
	FFICE SPACE						1,250	18	1	20	NORTH STAIRS
	LIGHTING	20	1	19	350						ENTRY LIGHTING
	ATRIUM				800			20	1	20	
	AL COVE LIGHTS	20	1	21		1,000				00	SPARE
	IT THRU 3RD FLOOR A.B J-BOXES	20	1	23			2.040	22	1	20	SPARE
	AND DRYERS	20	1	23			3,048	24	1	20	SPARE
	8B J-BOXES	20	1	25	3.048			24		20	SPARE
	AND DRYERS				3,040			26	1	20	OI / II L
	8A J-BOXES	20	1	27		3.048					SPARE
H.A	AND DRYERS							28	1	20	
	SPARE	20	1	29							SPARE
								30	1	20	
	SPARE	20	1	31						405	
	CDADE	20	_	22				32	3	100	CDADE
	SPARE	20	1	33				34			SPARE
LIGHTING	3 CONTROL PANEL	20	1	35			1,000	34			
LIGHTING	LCP-1A	20					1,000	36			
		125	3	37							
								38	3	50	
	SPARE			39							SPARE
								40			
				41							
								42			
		TOTAL			19,858	20,018	18,074	TOTAL			58.0
MARKS:		IUIAL	AMP/PHA	4 SE	72	72	65	TOTAL	AMP		70

Figure 3.6.7 – LP-1S Redesign Panelboard Schedule

				PANE	LBO/	ARD S	CHEL	ULE			
ANEL:	RP-1SA-1		EQUIP. (GND. BUS	S:				VOLTA	GE:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(119A)-1ST FL		ISOLAT	ED GND	BUS:				MAIN C	IRCUIT BE	KR: 125
MOUNTING:	SURFACE	_	NEUTRA	L BUS:	100%	\Box	200%		MLO:		
ED FROM:	PANEL 'LP-1S'		A.I.C.:	22500					BUS RA	TING:	100
104	AD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A B	. С	CKT.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
	46 GENERAL RECEPTS.	20	1	1	1.260	ь	-	no.	FOLL	AMES	122/123 GENERAL RECEPTACLES
140/144/1	TO OENEIVAE NEGET TO.	-20	•	<u> </u>	1,200			2	1	20	122/120 GENETONE NEGET TAGEED
148/149A G	GENERAL RECEPTACLES	20	1	3		1,260		4	1	20	SPARE
141/142 CC	MPUTER RECEPTACLES	20	1	5			720 500	6	1	20	120B EWC RECEPTACLE
141/142 G	ENERAL RECEPTACLES	20	1	7	1,260 1,080		300	8	1	20	121/137 COMPUTER RECEPTACLES
148/149A,B (COMPUTER RECEPTACLES	20	1	9	1,000	1,080					121 COMPUTER RECEPTACLES
147/149,B 0	GENERAL RECEPTACLES	20	1	11		1,080	900	10	1	20	SPARE
140/139 G	ENERAL RECEPTACLES	20	1	13	1,080			12	1	20	121 FAX RECEPTACLE
139/140 CC	MPUTER RECEPTACLES	20	1	15	500	720		14	1	20	121 COPY RECEPTACLE
						1,000		16	1	20	
150 COM	PUTER RECEPTACLES	20	1	17			720 345	18	1	15	CUH-1-3
138/150 G	ENERAL RECEPTACLES	20	1	19	1,080			20	1	20	SPARE
138/150 CC	MPUTER RECEPTACLES	20	1	21		720 720		22	1	20	122/123 COMPUTER RECEPTACLES
	NANCE RECEPTACLE COFFEE BAR	20	1	23		120	360 1.080	24	1	20	124/125 GENERAL RECEPTACLES
	7 GENERAL RECEPTACLES	20	1	25	1,260 720		1,000	26	1	20	124/125 COMPUTER RECEPTACLES
138/	A JUNCTION BOX	20	1	27	120	1,000 1,260		28	1	20	126/127/128/129 GEN. RECEPTS
121/	A JUNCTION BOX	20	1	29		1,200	1,000	30	1	20	126/127 COMPUTER RECEPTACLES
	SPARE	20	1	31			720				127/128 COMPUTER RECEPTACLES
	149 AV	20	1	33	720	1,500		32	1	20	121B/129 COMPUTER RECEPTACLE
	149 AV	20	1	35		540	1,500	34	1	20	130 COMPUTER RECEPTACLES
W	IREMOLD 6000	20	1	37	1,260		540	36	1	20	
W	IREMOLD 6000	20	1	39		1,260		38	3	100	SPARE
	SPARE	20	1	41		,,220		40			
	OI AINE	20						42			
		TOTAL	VA		11,300	12,140	8,385	TOTAL	KVA		31.8
		TOTAL	AMP/PH/	ASF	94	101	70	TOTAL	ΔMP		88

Figure 3.6.8 – RP-1SA-1 Redesign Panelboard Schedule

ANEL:	LP-BN	_	EQUIP. 0	SND. BUS	S:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
DCATION:	ELEC.RM.(L29)-BSMT		ISOLAT	ED GND I	BUS:	$\overline{\Box}$			MAIN C	IRCUIT BK	R:
OUNTING:	SURFACE	•	NEUTRA	L BUS:	100%		200%		MLO:		
ED FROM:	SWBD 'MDB'	_	A.I.C.:	42000					BUS RA		100
		BKR.	BKR.	CKT.	L	OAD - V.A		CKT.	BKR.	BKR.	
LOA	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713			2			
	SF-L-1	30	3	3	2,920	3,713					RF-L-1
						2,920		4	3	30	
				5			3,713				
	00.00						2,920	6			00.05
	SPARE	20	1	7	900 265			8	1	20	SPARE
	SPARE	15	3	9	205	900		0	1	20	SPARE
						265		10	1	20	
	SPARE	20	1	11			922				SPARE
							265	12	1	20	
	SP-1	15	1	13	795			14	1	20	SPARE
	SP-2	15	1	15		795		14	1	20	SPARE
	01-2	- 10				100		16	1	20	or Aire
	LIGHTING	20	1	17			920				SPARE
	ING AND MECH ROOM							18	1	20	
	LIGHTING	20	1	19	2,680			20	1	20	LIGHTING
	EMENT STACKS LIGHTING	20	1	21	3,512	2,744		20	1	20	MAIL ROOM WORKSPACES LIGHTING
	EMENT STACKS	- 20				2,000		22	1	20	MAIN LOBBY AREA
	LIGHTING	20	1	23			2,000				SPARE
CLAS	SROOM SPACES							24	1	20	
CIDCI	LIGHTING	20	1	25	2,016			20		20	SPARE
CIRCU	JLATION SPACE LIGHTING	20	1	27		2,880		26	1	20	SPARE
MO	VING STACKS	20	-	21		2,000		28	1	20	STARE
	LIGHTING	20	1	29			1,400				LIGHTING
	ECHANICAL ROOM						1,000	30	1	20	MECH ROOM AND RESTROOM
	LIGHTING	20	1	31	2,824						EVER 4
	EMENT STACKS G CONTROL PANEL	20	1	33	2,500	1,000		32	1	20	EXTRA SPARE
LIGITING	LCP-0A	20	-	33		1,000		34	1	20	SPARL
	L24A,B	20	1	35			3,048				
HA	AND DRYERS						1,275	36	3	15	
		50	3	37							COMPACTOR
	SPARE	\vdash		39	1,275			38			
	SPARE			28		1,275		40			
				41		1,213					SPARE
								42	1	20	
		TOTAL			23,400	18,492	17,463	TOTAL			59.4
MARKS:		TOTAL.	AMP/PHA	ASE	84	67	63	TOTAL	AMP		71

Figure 3.6.9 –LP-BN Redesign Panelboard Schedule

ANEL:	LP-BS				ELBO		OIII .		VOLTA	nr.	400/277 VOLT 2DU 4W
			EQUIP. GND. BUS:								480/277 VOLT, 3PH, 4W
OCATION:	ELEC.RM (B02)-SUB	.BSMT	ISOLATED GND BUS: NEUTRAL BUS: 100%			\sqcup	200%		MAIN CIRCUIT BKR:		KR: 225
OUNTING:	SURFACE				100%						
ED FROM:	SWBD 'MDB'		A.I.C.:	65000					BUS RA	TING:	225
		BKR.			LOAD - V.A.			CKT.	BKR.	BKR.	
LOAD DESCRIPTION AMPS		AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	5,570						
	SF-1-2	40	3	3	2,920	5,570		2			RF-1-2
	31-1-2	40	,	,		2,920		4	3	30	RI - 1-2
				5		2,020	5,570				
							2,920	6			
	SPARE	20	1	7							SPARE
	OD A DE							8	1		664.65
	SPARE	20	1	9				10	1	15	SPARE
	SPARE	20	1	11				10	1	15	SPARE
	OI AILE	20						12	1		SIANE
				13	7,160						
					2,920			14			
	SF-1-2	60	3	15		7,160					RF-1-2
				47		2,920		16	3	30	
				17			7,160 2.920	18	-		
				19	5,570		2,920	10			
				10	2,920			20	1		
	SF-2-2	40	3	21	_,	5,570					RF-2-2
						2,920		22	3	30	
				23			5,570				
				25			2,920	24	-		
				25				26	-		
	SF-3-2	20	3	27				20			RF-3-2
								28	3	20	
				29							
								30			
	LIGHTING	20	1	31	2,016				.		LIGHTING
LIGHTING	CONTROL PANEL	20	1	33	3,500	4.000		32	1	20	DINING AREA LIGHTING
LIGHTING	LCP-0B	20	-	33		1,000 2,280		34	1	20	SERVING
	SPARE	20	1	35		2,200		<u> </u>	<u> </u>		LIGHTING
								36	1	20	KITCHEN/SURROUNDING SPACE
		125	3	37							LIGHTING
					1,440			38	1	20	LOCKERS
SPARE				39		0.040		40		20	L16A,L16B
				41		3,048		40	1	20	HAND DRYERS L09A.B
				41			3,048	42	1	20	HAND DRYERS
		TOTAL	VA		34,016	33,388	30,108	TOTAL	_	20	97.5
			AMP/PH/	ASE	123	121	109	TOTAL AMP 117			

Figure 3.6.10 – LP-BS Redesign Panelboard Schedule

PANEL: LOCATION: MOUNTING:	RP-BS ELEC.RM (B02)-SUB. SURFACE	BSMT	ISOLAT NEUTRA				200%		MLO:	IRCUIT B	
ED FROM:	PANEL 'LP-BS'	_		10000					BUS RA		100
LOAD	DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	A	OAD - V.A B	 C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
	RAL RECEPTACLES	20	1	1	360		-	1101	FOLL	Aiiir 3	L13A/L14/L15A/OUTDOOR RECEPTACLE
	TED DECERT AL 5				1,260			2	1	20	
L12 PRIN	NTER RECEPTACLE	20	1	3		1,000 720		4	1	20	L14 COFF. RECEPTACLE
L10	RECPTACLES	20	1	5		120	540	Ė			L14 MICR. RECEPTACLE
1.40	DECEDTA OL EC	20	,	-	700		750	6	1	20	LAA DEE DECEDTA OLE
L101	RECEPTACLES	20	1	7	720 750			8	1	20	L14 REF RECEPTACLE
L10	RECEPTACLES	20	1	9	100	720					L10/S2-L RECEPTACLES
1.40	DECERTA OL FO					360		10	1	20	DOO A OFFICE ALL DESCRIPTA OLES
L131	RECEPTACLES	20	1	11	\vdash		900 900	12	1	20	B02,A GENERAL RECEPTACLES & MOTORIZED DAMPERS
L13A	RECEPTACLES	20	1	13	900		300				a mororazzo es um erro
1.40	DECERTA OL FO			45	1,650			14	2	20	51111.0
L131	RECEPTACLES	20	1	15	\vdash	720 1.650		16	-		EUH-2
L13	RECEPTACLES	20	1	17		1,000	720				
1001 01	40 A DEGERTA OLEO			40			1,650	18	2	20	5,000
	13,A RECEPTACLES TO SENSORS	20	1	19	1,180 1.650			20			EUH-1
	CORRIDOR EWC	20	1	21	1,030	500		- 20			FP-L-2
	00100					830		22	1	15	
	SPARE	20	1	23	\vdash		506	24	1	15	UH-1
	L12 J1	20	1	25	1,500		300				LIGHTING
	140.417			0.7	200			26	1	20	DINING/KITCHEN HALOGEN
	L13 AV	20	1	27	\vdash	1,100		28	1	20	SPARE
	103 PS	20	1	29			1,400	2.0		20	102 J2
	400.10			0.4			1,500	30	1	20	100.00
	103 J2	20	1	31	1,500 1,400			32	1	20	102 PS
	103 F2	20	1	33	7,700	750					102 F2
	102 F2	20		25		750		34	1	20	400.170
	103 F2	20	1	35			750 435	36	1	20	102 VP
				37			400				LIGHTING (FUTURE)
	CDADE	400	•	20	200			38	1	20	DRIVEWAY SIGN
	SPARE	100	3	39		732		40	1	20	MOTORIZED DOORS (L10, L10A, L13B & MAGLOCKS (L13B, L13C)
				41		7.52					SPARE
		TOTAL			40.076	0.000	40.05	42	1	20	22.2
		TOTAL	VA AMP/PH/	ΔSF	13,270 111	9,832 82	10,051 84	TOTAL			92 92

Figure 3.6.11 – RP-BS Redesign Panelboard Schedule

NEL:	LP-2S			SND. BUS	ELBO				VOLTA	SE.	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(219A)-2ND			ED GND E	-	님				IRCUIT BKR	
		<u>- L.</u>				\sqcup	2000/			- COLL DKK	
IOUNTING:	SURFACE	-	NEUTRA		100%		200%	Ш	MLO:		
ED FROM:	PANEL 'LP-1S'	_	A.I.C.:	42000					BUS RA	TING:	100
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713						
	SF-2-1	30	3	3	1,275	0.740		2			RF-2-1
	31-2-1	30	,	3		3,713 1,275		4	3	15	RI -2-1
				5		1,275	3,713	7		10	
							1,275	6			
	LIGHTING	20	1	7	3,840		1,210				LIGHTING
C	ORE AREA				1,902			8	1	20	90 CLASSROOM
	LIGHTING	20	1	9		3,800					LIGHTING
	OFFICES					2,008		10	1	20	50 CLASSROOM
	LIGHTING	20	1	11			2,750				LIGHTING
	AND MAIN CORRIDOR			- 10			3,696	12	1	20	OFFICE AREAS
	LIGHTING	20	1	13	1,200					20	LIGHTING
	DOT COURT LIGHTING	20	4	15	336	202		14	1	20	ATRIUM LIGHTING
	DOT COURT	20	1	15		600 900		16	1	20	ATRIUM
	LIGHTING	20	1	17		500	160	10	<u> </u>	20	LIGHTING
	OOT COURT	20	_				900	18	1	20	ATRIUM
	LIGHTING	20	1	19	300						LIGHTING
Me	OOT COURT				924			20	1	20	220A CORRIDOR
	LIGHTING	20	1	21		1,450					SPARE
OFFI	CE CORRIDOR							22	1	20	
	218A	20	1	23			3,048				SPARE
HA	ND DRYERS							24	1	20	
	218B	20	1	25	3,048			20		20	SPARE
HA	ND DRYERS 248A.B	20	1	27		3.048		26	1	20	SPARE
нд	ND DRYERS	20	-	21		3,040		28	1	20	SFARE
117	251A.B	20	1	29			3,048	20	<u> </u>	20	SPARE
HA	ND DRYERS						0,040	30	1	20	317.112
7.0	SPARE	20	1	31							SPARE
								32	1	20	
	SPARE	20	1	33							SPARE
								34	1	20	
LIGHTING	CONTROL PANEL	20	1	35			1,000				SPARE
	LCP-1A	405	_	27				36	1	20	00405
		125	3	37				38	1	20	SPARE
	SPARE	-		39				30	1	20	SPARE
	OI AIRE			35				40	1	20	SPARL
				41				-10		20	SPARE
								42	1	20	
		TOTAL	VA		16,538	16,794	19,590	TOTAL	KVA		52.9
		TOTAL	AMP/PH/	A SE	60	61	71	TOTAL			64

Figure 3.6.12 – LP-2S Redesign Panelboard Schedule

PANEL:	RP-2SA-1		EQUIP. (GND. BUS	:	$\overline{}$			VOLTA	GE:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(219A)-2ND	FL.	ISOLAT	ED GND E	BUS:				MAIN C	IRCUIT B	KR: 125
OUNTING:	SURFACE	•	NEUTRA	L BUS:	100%	\blacksquare	200%	_	MLO:		
ED FROM:	PANEL 'LP-2S'	-	A.I.C.:	22000				-	BUS RA	TING:	100
		BKR.	BKR.	CKT.	L	OAD - V.A		CKT.	BKR.	BKR.	_
	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
240/241 GE	NERAL RECEPTACLES	20	1	1	1,080 1.080			2	1	20	238/239 GENERAL RECEPTACLES
240/24	1 RECEPTACLES	20	1	3	1,000	720					238/239 RECEPTACLES
0.404050.05	UEDAL DEGERTAGIEG	- 00		_		720		4	1	20	OACONOCO OFNEDAL DECEDEA OLO
249/250 GE	NERAL RECEPTACLES	20	1	5			720 720	6	1	20	219C/220B GENERAL RECEPTACLE
242/243 GE	NERAL RECEPTACLES	20	1	7	1,080						220B ECW RECEPTACLE
242/24	3 RECEPTACLES	20	1	9	1,000	720		8	1	20	236/237 GENERAL RECEPTACLES
242124	3 RECEPTACLES	20	1	9		1.080		10	1	20	230/237 GENERAL RECEPTACLES
249 WALL	QUAD RECEPTACLES	20	1	11		1,000	720				236/237 RECEPTACLES
							720	12	1	20	
249	RECEPTACLE	20	1	13	360			14	1	20	221 FLOOR QUAD RECEPTACLES
MOOT	COURT LIGHTING	20	1	15	720	1,330		14	1	20	221 GENERAL RECEPTACLES
111001	COURT EIGHTING	20	•	10		720		16	1	20	221 OLNEIVAL RECEITAGES
249	RECEPTACLE	20	1	17			360				234/235 GENERAL RECEPTACLES
	CDADE	20	_	40			1,080	18	1	20	CDADE
	SPARE	20	1	19				20	1	20	SPARE
221 FL00F	QUAD RECEPTACLE	20	1	21		360					234/235 RECEPTACLES
222	RECEPTACLES	20	1	23		720	000	22	1	20	222 COPIER RECEPTACLE
222	RECEPTACLES	20	1	23			360 1.000	24	1	20	222 COPIER RECEPTAGE
250A	JUNCTION BOX	20	1	25	1,000		.,,				222/250A GENERAL RECEPTACLE
					360			26	1	20	
	202 J2	20	1	27		1,500 1.080		28	1	20	232/233 GENERAL RECEPTACLES
	202 PS	20	1	29		1,000	1,400	20	<u>'</u>	20	232/233 RECEPTACLES
							720	30	1	20	
	202 F2	20	1	31	750						230/231 GENERAL RECEPTACLES
	202 VP	20	1	33	1,080	425		32	1	20	230/231 RECEPTACLES
	202 VP	20	1	33		435 720		34	1	20	230/231 RECEPTACLES
	202 VP	20	1	35		120	435				228/229 GENERAL RECEPTACLES
							1,080	36	1	20	
	202 F2	20	1	37	750			38	3	100	
	SPARE	20	1	39				30		100	SPARE
								40			
	SPARE	20	1	41				42			
		TOTAL	VA		9,260	10.105	9.315	TOTAL	KVA		28.7
			AMP/PH/	ASE	77	84	78	TOTAL			80

Figure 3.6.13 – RP-2SA-1 Redesign Panelboard Schedule

IEL:	LP-3S		EQUIP.	GND. BUS	S:	$\overline{}$			VOLTA	GE:	480/277 VOLT, 3PH, 4W
ATION:	ELEC.RM.(319A)-3RD	FL.	ISOLAT	ED GND	BUS:	ī			MAIN C	IRCUIT BK	R:
UNTING:	SURFACE	_	NEUTRA	L BUS:	100%		200%		MLO:		
D FROM:	PANEL 'LP-1S'	-	A.I.C.:		42,000				BUS RA	TING:	100
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAD) DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	3,713 1,275			2	-		
	SF-3-1	30	3	3	1,213	3,713		-			RF-3-1
						1,275		4	3	15	
				5			3,713				
							1,275	6			110117010
	LIGHTING FFICE AREA	20	1	7	3,552 3,696			8	1	20	LIGHTING ADJUSTABLE CLASSROOMS
	LIGHTING	20	1	9	3,696	4,080		0	1	20	LIGHTING
	FFICE AREA					3.096		10	1	20	90 & 55 CLASSROOM
	LIGHTING	20	1	11			1,600				LIGHTING
	ICE HALLWAY						3,050	12	1	20	LOBBY AND MAIN HALLWAY
	LIGHTING	20	1	13	2,760						SPARE
	FICE SPACE LIGHTING	20	_	15		4.000		14	3	20	SPARE
	ICE HALLWAY	20	1	15		1,200		16	1	20	SPARE
OIII	348A.B	20	1	17			3.048	-10	<u> </u>	20	SPARE
HA	AND DRYERS						0,010	18	1	20	
	351A,B	20	1	19	3,048						SPARE
HA	AND DRYERS							20	1	20	
11.4	318A	20	1	21		3,048		22	1	20	SPARE
HA.	AND DRYERS 318B	20	1	23			3.048	22	1	20	SPARE
НΑ	AND DRYERS	20		20			3,040	24	1	20	SIARE
	SPARE	20	1	25							SPARE
								26	1	20	
	SPARE	20	1	27							SPARE
	SPARE	20	1	29				28	1	20	SPARE
	SPARE	20	1	29				30	1	20	SPARE
	SPARE	20	1	31							SPARE
								32	1	20	
	SPARE	20	1	33							SPARE
HOUTER	CONTROL PANEL	20		25			4.000	34	1	20	en a pr
LIGHTING	CONTROL PANEL LCP-1A	20	1	35			1,000	36	1	20	SPARE
	EVITIA	125	3	37				30		20	SPARE
								38	1	20	317 115
	SPARE			39							SPARE
								40	1	20	
				41				40		20	SPARE
		TOTAL	VΔ		18,044	16,412	16.734	42 TOTAL	KV/A	20	51.2
			AMP/PH	ASE	65	59	60	TOTAL			62

Figure 3.6.14 – LP-3S Redesign Panelboard Schedule

ANEL:	RP-3SA-1		EQUIP. (SND. BUS	i:				VOLTA	GE:	120/208 VOLT, 3PH, 4W
OCATION:	ELEC.RM.(319A)-3RD	FL.	ISOLAT	ED GND E	BUS:				MAIN C	IRCUIT BKR	: 125
OUNTING:	SURFACE	_	NEUTRA	L BUS:	100%	┌	200%		MLO:		
ED FROM:	PANEL 'LP-3S'	_	A.I.C.:	22000				-	BUS RA	TING:	225
		BKR.	BKR.	CKT.	L	OAD - V.A		CKT.	BKR.	BKR.	
	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
360	RECEPTACLES	20	1	1	720 1,000			2	1	20	J-BOX, VAV
362	RECEPTACLES	20	1	3	1,000	720				20	350 RECEPTACLES
						1,340		4	1	20	
363	RECEPTACLES	20	1	5			720 1.340	6	1	20	318B RECEPTACLES
349	RECEPTACLES	20	1	7	720		1,540	Ů		20	339 RECEPTACLES
					1,440			8	1	20	
349 1	RECEPTACLES	20	1	9		720 1.440		10	1	20	337 RECEPTACLES
340	RECEPTACLES	20	1	11		1,440	720	-10	<u> </u>	20	GE-R-1
			-				506	12	1	15	
340 (RECEPTACLES	20	1	13	720						SPARE
								14	1	15	
337 1	RECEPTACLES	20	1	15		720 830		16	1	15	TE-R-2
335	RECEPTACLES	20	1	17		030	720	l i			CE-R-2
							506	18	1	15	
333	RECEPTACLES	20	1	19	720			20		20	SPARE
331	RECEPTACLES	20	1	21		720		20	1	20	334 RECEPTACLES
3311	NECEL TACLES	20	-	21		1 440		22	1	20	334 NEGEL TAGEES
329	RECEPTACLES	20	1	23		.,	720				332 RECEPTACLES
							1,440	24	1	20	
327	RECEPTACLES	20	1	25	720 1.000			26	1	20	J-BOX, VAV
324	RECEPTACLES	20	1	27	1,000	720					326 RECEPTACLES
						1,440		28	1	20	
3	322 COPIER	20	1	29			1,000				323 RECEPTACLES
224 1	RECEPTACLES	20	1	31	1,080		1,440	30	1	20	321 RECEPTACLES
3211	NEGET I AGEES	20	-	31	1,080			32	1	20	JZ I REGEFTMOLES
321	RECEPTACLES	20	1	33	1,440	360					302 RECEPTACLES
						1,440		34	1	20	
323	RECEPTACLES	20	1	35			360	20		20	302 RECEPTACLES
3031	RECEPTACLES	20	1	37	1,440		1,440	36	1	20	
3021	NEGET TAGEES	20	_	31	1,440			38	3	100	
302	RECEPTACLES	20	1	39		1,440					SPARE
327/328/32	9 GENERAL RECEPTS	20	1	41			1.260	40			
SETTOEUTOE	o centione neocialo	20					1,200	42			
		TOTAL			11,000	13,330	12,172	TOTAL			36.5
EMARKS:		TOTAL	AMP/PH/	ASE	92	111	101	TOTAL	AMP		101

Figure 3.6.15 – RP-3SA-1 Redesign Panelboard Schedule

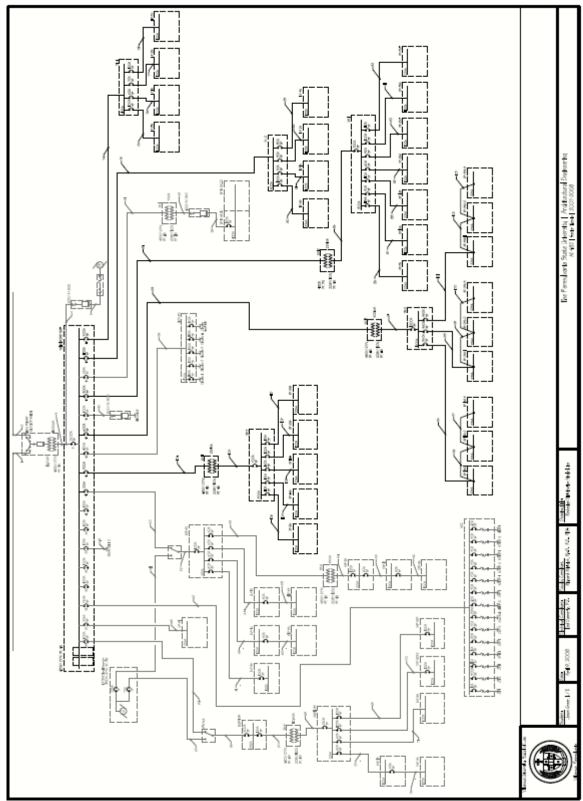


Figure 3.7.1 – Redesign Distribution System Single Line
*See Appendix D for full size single line

Cost Analysis

		LP-1N			
	Equipment C	ost of Ori	ginal System Feeder	<u> </u>	ı
Equip	Means No.			Per Unit Cost	Cost
400A, 3P Breaker (480)	0430		N/A	\$2,780.00	\$2,780.00
2 Sets (4)1/0, #3G, (2) 2" EMT	1600		4	\$344.00	\$11,008.00
LP-1N (400A)	3230		N/A		\$1,455.00
125A, 3P Breaker (480)	0420		N/A	\$1,239.00	\$1,239.00
(3) 1/0, #6G, 1.5 EMT	1600		0.25		\$258.00
75kVA X-Fmr	4915		N/A		\$7,000.00
(4) 250 MCM, #4G, 2.5 EMT	2200		0.25		\$727.00
250A, 3P Breaker (208)	0430		N/A	· ·	\$2,708.00
RP-1NA (400A)	3130		N/A	. ,	\$1,245.00
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00
(4) #1, #8G, 1.5 EMT	1550		0.25		\$286.00
RP-1NB (100A)	3110		N/A		\$673.00
150A, 3P Breaker (480)	0420	N/A	N/A		\$1,239.00
(4) 1/0, #6G, 2 EMT	1600	4	0.25	\$344.00	\$344.00
LP-2N (225)	3220	N/A	N/A	\$1,045.00	\$1,045.00
70A, 3P Breaker (480)	0370	N/A	N/A	\$606.00	\$606.00
(3) #4, #8G, 1.25 EMT	1400	3	0.25	\$166.50	\$124.88
45kVA X-Fmr	4910	N/A	N/A	\$5,110.00	\$5,110.00
(4) 1/0, #6G, 2 EMT	1600	4	0.25	\$344.00	\$344.00
150A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00
RP-2NA (225A)	3120	N/A	N/A	\$955.00	\$955.00
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00
(4) #1, #8G, 1.5 EMT	1550	4	2.5	\$286.00	\$2,860.00
RP-2NB (100A)	3110	N/A	N/A	\$673.00	\$673.00
150A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00
(4) 1/0, #6G, 2 EMT	1600	4	0.5	\$344.00	\$688.00
LP-3N (225A)	3220	N/A	N/A	\$1,045.00	\$1,045.00
70A, 3P Breaker (480)	0370	N/A	N/A	\$606.00	\$606.00
(3) #4, #8G, 1.25 EMT	1400	3	0.25	\$166.50	\$124.88
45kVA X-Fmr	4910	N/A	N/A	\$5,110.00	\$5,110.00
(4) 1/0, #6G, 2 EMT	1600		0.25		\$344.00
150A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00
RP-2NA (225A)	3120	N/A	N/A		\$955.00
50A, 3P Breaker (208)	0180	N/A	N/A	\$365.00	\$365.00
(4) #1, #8G, 1.5 EMT	1550		2.5	\$286.00	\$2,860.00
RP-3NB (100A)	3110	N/A	N/A	\$673.00	\$673.00
				Total	\$60,079.75

Figure 3.8.1 – Original Cost Information for LP-1N Panel

		LP-1S							
	Equipment Cost of Original System								
		No. of	Feeder						
Equip	Means No.	Feeders	Length (CFL)	Per Unit Cost	Cost				
400A, 3P Breaker (480)	0430	N/A	N/A	\$2,780.00	\$2,780.00				
(4)350MCM, #4G, 3 EMT	2600	4	2.5	\$967.00	\$9,670.00				
LP-1S (400A)	3230	N/A	N/A	\$1,455.00	\$1,455.00				
125A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00				
(3) 1/0, #6G, 1.5 EMT	1600	3	0.25	\$344.00	\$258.00				
112.5kVA X-Fmr	4920	N/A	N/A	\$13,439.00	\$13,439.00				
(4) 250 MCM, #4G, 2.5 EMT	2200	4	0.25	\$727.00	\$727.00				
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00				
RP-1SA-1 (225A)	3120	N/A	N/A	\$955.00	\$955.00				
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00				
(4) 250 MCM, #4G, 2.5 EMT	2200	4	2	\$727.00	\$5,816.00				
RP-1SB (225)	3120	N/A	N/A	\$955.00	\$955.00				
(4) 250 MCM, #4G, 2.5 EMT	2200	4	0.25	\$727.00	\$727.00				
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00				
RP-1SA-2 (225A)	3120	N/A	N/A	\$955.00	\$955.00				
(4) #1, #8G, 1.5 EMT	1550	4	0.25	\$286.00	\$286.00				
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00				
RP-1SA-3 (225A)	3120	N/A	N/A	\$955.00	\$955.00				
				Total	\$44,390.00				

Figure 3.8.2 – Original Cost Information for LP-1S Panel

		LP-BN								
	Equipment Cost of Original System									
		No. of	Feeder							
Equip	Means No.	Feeders	Length (CFL)	Per Unit Cost	Cost					
225A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(4)4/0, #4G, 2.5 EMT	2000	4	3	\$626.00	\$7,512.00					
LP-BN (225A)	3220	N/A	N/A	\$1,045.00	\$1,045.00					
50A, 3P Breaker (480)	0230	N/A	N/A	\$499.00	\$499.00					
(3) #6, #10G, 0.75 EMT	1350	3	0.25	\$118.00	\$88.50					
30kVA X-Fmr	4905	N/A	N/A	\$4,385.00	\$4,385.00					
(4) #1, #8G, 1.5 EMT	1550	4	0.25	\$286.00	\$286.00					
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00					
RP-BN (100A)	3110	N/A	N/A	\$673.00	\$673.00					
	-		-	-						
				Total	\$16,183.50					

Figure 3.8.3 – Original Cost Information for LP-BN Panel

		LP-BS								
	Equipment Cost of Original System									
		No. of	Feeder							
Equip	Means No.	Feeders	Length (CFL)	Per Unit Cost	Cost					
225A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(4)4/0, #4G, 2.5 EMT	2000	4	0.25	\$626.00	\$626.00					
LP-BS (225A)	3220	N/A	N/A	\$1,045.00	\$1,045.00					
225A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(3) 1/0, #6G, 1.5 EMT	1600	3	0.25	\$344.00	\$258.00					
75kVA X-Fmr	4915	N/A	N/A	\$7,000.00	\$7,000.00					
(4) 250MCM, #4G, 2.5 EMT	2200	4	0.25	\$727.00	\$727.00					
400A, 3P Breaker (208)	0430	N/A	N/A	\$2,780.00	\$2,780.00					
RP-BS (400A)	3130	N/A	N/A	\$1,245.00	\$1,245.00					
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00					
(4) 250MCM, #4G, 2.5 EMT	2200	4	1.5	\$727.00	\$4,362.00					
RP-BSA (100A)	3110	N/A	N/A	\$673.00	\$673.00					
	Total									
				Total	\$21,650.00					

Figure 3.8.4 – Original Cost Information for LP-BS Panel

		LP-2S									
Equipment Cost of Original System											
	No. of Feeder										
Equip	Means No.	Feeders	Length (CFL)	Per Unit Cost	Cost						
225A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00						
(4)4/0, #4G, 2.5 EMT	2000	4	2.75	\$626.00	\$6,886.00						
LP-2S (400A)	3230	N/A	N/A	\$1,455.00	\$1,455.00						
125A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00						
(3) 1/0, #6G, 1.5 EMT	1600	3	0.25	\$344.00	\$258.00						
112.5kVA X-Fmr	4920	N/A	N/A	\$13,439.00	\$13,439.00						
(4) 3/0, #3G, 2 EMT	1700	4	0.25	\$516.00	\$516.00						
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00						
RP-2SA-1 (225A)	3120	N/A	N/A	\$955.00	\$955.00						
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00						
(4) 3/0, #3G, 2 EMT	1700	4	2	\$516.00	\$4,128.00						
RP-1SB (225)	3120	N/A	N/A	\$955.00	\$955.00						
(4) 3/0, #3G, 2 EMT	1700	4	0.25	\$516.00	\$516.00						
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00						
RP-1SA-2 (225A)	3120	N/A	N/A	\$955.00	\$955.00						
(4) 3/0, #3G, 2 EMT	1700	4	0.25	\$516.00	\$516.00						
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00						
RP-1SA-3 (225A)	3120	N/A	N/A	\$955.00	\$955.00						
				Total	\$38,185.00						

Figure 3.8.5 – Original Cost Information for LP-2S Panel

		LP-3S								
	Equipment Cost of Original System									
		No. of	Feeder							
Equip	Means No.	Feeders	Length (CFL)	Per Unit Cost	Cost					
225A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(4)250MCM, #4G, 2.5 EMT	2200	4	3	\$727.00	\$8,724.00					
LP-3S (400A)	3230	N/A	N/A	\$1,455.00	\$1,455.00					
125A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(3) 1/0, #6G, 1.5 EMT	1600	3	0.25	\$344.00	\$258.00					
112.5kVA X-Fmr	4920	N/A	N/A	\$13,439.00	\$13,439.00					
(4) 3/0, #6G, 2 EMT	1700	4	0.25	\$516.00	\$516.00					
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
RP-3SA-1 (225A)	3120	N/A	N/A	\$955.00	\$955.00					
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00					
(4) 3/0, #6G, 2 EMT	1700	4	2	\$516.00	\$4,128.00					
RP-3SB (225)	3120	N/A	N/A	\$955.00	\$955.00					
(4) 3/0, #6G, 2 EMT	1700	4	0.25	\$516.00	\$516.00					
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
RP-3SA-2 (225A)	3120	N/A	N/A	\$955.00	\$955.00					
(4) #1, #8G, 1.5 EMT	1550	4	0.25	\$286.00	\$286.00					
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
RP-3SA-3 (225A)	3120	N/A	N/A	\$955.00	\$955.00					
				Total	\$39,793.00					

Figure 3.8.6 – Original Cost Information for LP-3S Panel

Origina	al System	
Total Original Cost	\$220,281.25	

Figure 3.8.7 – Original Total Cost

	DI	L-1			
	Equipment Cos	sts for Rec	design		
		No. of	Feeder		
Equip	Means No.	Feeders	Length (CFL)	Per Unit Cost	Cost
300A 3P, Breaker (480)	0430	N/A	N/A	\$2,708.00	\$2,708.00
(4) 300 MCM, #4G, 2.5 EMT	2400	4	0.25	\$847.00	\$847.00
DL-1 Panel (400A)	0190	N/A	N/A	\$2,365.00	\$2,365.00
90A, 3P Breaker (480)	0370	N/A	N/A	\$606.00	\$606.00
(4) #3, #8G, 1.25 EMT	1450	4	3	\$196.00	\$2,352.00
LP-BN (100A)	3210	N/A	N/A	\$763.00	\$763.00
50A, 3P Breaker (480)	0230	N/A	N/A	\$499.00	\$499.00
(4) #8, #10G, 0.75 EMT	1300	4	3	\$86.00	\$1,032.00
LP-1N (100A)	3210	N/A	N/A	\$763.00	\$763.00
60A, 3P Breaker (480)	0230	N/A	N/A	\$499.00	\$499.00
(4) #6, #10G, 0.75 EMT	1350	4	3.5	\$118.00	\$1,652.00
LP-2N (100A)	3210	N/A	N/A	\$763.00	\$763.00
80A, 3P Breaker (480)	0370	N/A	N/A	\$606.00	\$606.00
(4) #4, #8G, 1 EMT	1350	4	3.5	\$166.50	\$2,331.00
LP-3N (100A)	3210	N/A	N/A	\$763.00	\$763.00
				Total	\$18,549.00

Figure 3.8.8 – Redesign Cost Information for DL-1 Panel

	DI	L-2			
	Equipment Cos	sts for Rec	design		
		No. of	Feeder		
Equip	Means No.	Feeders	Length (CFL)	Per Unit Cost	Cost
400A 3P, Breaker (480)	0430	N/A	N/A	\$2,708.00	\$2,708.00
(4) 500 MCM, #3G, 3 EMT	2800	4	0.25	\$1,303.00	\$1,303.00
DL-2 Panel (400A)	0190	N/A	N/A	\$2,365.00	\$2,365.00
150A, 3P Breaker (480)	0420	N/A	N/A	\$1,239.00	\$1,239.00
(4) 1/0, #6G, 1.5 EMT	1600	4	0.25	\$344.00	\$344.00
LP-BS (225A)	3220	N/A	N/A	\$1,045.00	\$1,045.00
90A, 3P Breaker (480)	0370	N/A	N/A	\$606.00	\$606.00
(4) #3, #8G, 1.25 EMT	1450	4	3	\$196.00	\$2,352.00
LP-1S (100A)	3210	N/A	N/A	\$763.00	\$763.00
80A, 3P Breaker (480)	0370	N/A	N/A	\$606.00	\$606.00
(4) #4, #8G, 1EMT	1400	4	3.5	\$166.50	\$2,331.00
LP-2S (100A)	3210	N/A	N/A	\$763.00	\$763.00
80A, 3P Breaker (480)	0370	N/A	N/A	\$606.00	\$606.00
(4) #4, #8G, 1EMT	1400	4	3.5	\$166.50	\$2,331.00
LP-3S (100A)	3210	N/A	N/A	\$763.00	\$763.00
	_	•			
				Total	\$20,125.00

Figure 3.8.9 – Redesign Cost Information for DL-2 Panel

		₹-1			
E	quipment Cos				
			Feeder		
Equip	Means No.		• ,	Per Unit Cost	Cost
300A 3P, Breaker (480)	0430			. ,	\$2,708.00
(3) 350MCM, #4G, 2.5 EMT	2600				7-,
225kVA X-Fmr	4930	N/A	N/A	\$23,374.00	\$23,374.00
2 sets (4) 350MCM, 1/0G, (2) 2.5 EMT	2600	8	0.25	\$967.00	\$1,934.00
700A, 3P Breaker (208)	0470	N/A	N/A	\$5,780.00	\$5,780.00
DR-1 Panel (800A)	0300	N/A	N/A	. ,	, ,
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00
(4) #1, #6G, 1.25 EMT	1550	4	0.25	\$286.00	\$286.00
RP-BN (225A)	3120	N/A		¥	\$955.00
90A, 3P Breaker (208)	0320	N/A	N/A		\$456.00
(4) #3, #8G, 1.25 EMT	1450	4	2.25	\$196.00	\$1,764.00
RP-1NA (100A)	3110	N/A	N/A	\$673.00	\$673.00
110A, 3P Breaker (208)	0420	N/A	N/A	. ,	\$1,239.00
(4) #2, #6G, 1.25 EMT	1500	4	1.25	\$235.00	\$1,175.00
RP-1NB (225A)	3120	N/A	N/A	\$955.00	\$955.00
60A, 3P Breaker (208)	0180	N/A	N/A		
(4) #6, #10G, 0.75 EMT	1350	4	2.5	\$118.00	\$1,180.00
RP-2NA (100A)	3110	N/A	N/A	\$673.00	\$673.00
90A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00
(4) #3, #8G, 1.25 EMT	1450	4	1.5	\$196.00	\$1,176.00
RP-2NB (100A)	3110	N/A	N/A	\$673.00	\$673.00
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00
(4) #3, #8G, 1.25 EMT	1450	4	2.5	\$196.00	\$1,960.00
RP-3NA (100A)	3110	N/A	N/A	\$673.00	\$673.00
110A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00
(4) #2, #6G, 1.25 EMT	1500	4	1.5	\$235.00	\$1,410.00
RP-3NB (225A)	3120	N/A	N/A	\$955.00	\$955.00
				Total	\$66,037.00

Figure 3.8.10 – Redesign Cost Information for DR-1 Panel

	DI	₹-2			
E	quipment Cos				
		No. of	Feeder		
Equip	Means No.			Per Unit Cost	
600A, 3P Breaker (480)	0460	N/A	N/A	\$4,453.00	\$4,453.00
2 sets (3) 350MCM, #1G, (2) 2.5 EMT	2600	6	3		\$17,406.00
500kVA X-Fmr	4940	N/A	N/A	\$48,988.00	\$48,988.00
3 sets (4) 500MCM, 3/0G, (3) 3 EMT	2800	12	0.25	\$1,303.00	\$3,909.00
1200A, 3P Breaker (208)	0500	N/A	N/A	\$4,425.00	\$4,425.00
DR-2 Panel (1200A)	0500	N/A	N/A	\$4,425.00	\$4,425.00
350A, 3P Breaker (208)	0430	N/A	N/A	\$2,708.00	\$2,708.00
(4) 500MCM, #3G, 3 EMT	2800	4	0.25	\$1,303.00	\$1,303.00
RP-1SA-1 (225A)	3120	N/A	N/A	\$955.00	\$955.00
RP-1SA-2 (225A)	3120	N/A	N/A	\$955.00	\$955.00
RP-1SA-3 (225A)	3120	N/A	N/A	\$955.00	\$955.00
350A, 3P Breaker	0430	N/A	N/A	\$2,708.00	\$2,708.00
(4) 350 MCM, #3G, 2.5 EMT	2600	4	0.5	\$967.00	\$1,934.00
RP-2SA-1 (225A)	3120	N/A	N/A	\$955.00	\$955.00
RP-2SA-2 (225A)	3120	N/A	N/A	\$955.00	\$955.00
RP-2SA-3 (225A)	3120	N/A	N/A	\$955.00	\$955.00
350A, 3P Breaker	0430	N/A	N/A	\$2,708.00	\$2,708.00
(4) 500MCM, #3G, 3 EMT	2800	4	0.5	\$1,303.00	\$2,606.00
RP-3SA-1 (225A)	3120	N/A	N/A	\$955.00	\$955.00
RP-3SA-2 (225A)	3120	N/A	N/A	\$955.00	\$955.00
RP-3SA-3 (225A)	3120	N/A	N/A	\$955.00	\$955.00
				Total	\$106,168.00

Figure 3.8.11 – Redesign Cost Information for DR-2 Panel

DR-3										
Ed	quipment Cos	ts for Rec	design							
			Feeder							
Equip	Means No.	Feeders	Length (CFL)	Per Unit Cost	Cost					
300A 3P, Breaker (480)	0430	N/A	N/A	\$2,708.00	\$2,708.00					
(3) 350MCM, #4G, 2.5 EMT	2600	3	0.25	\$967.00	\$725.25					
225kVA X-Fmr	4930	N/A	N/A	\$23,374.00	\$23,374.00					
2 sets (4) 350MCM, 1/0G, (2) 2.5 EMT	2600	8	0.25	\$967.00	\$1,934.00					
700A, 3P Breaker (208)	0470	N/A	N/A	\$5,780.00	\$5,780.00					
DR-3 Panel (800A)	0300	N/A	N/A	\$3,580.00	\$3,580.00					
110A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(4) #2, #6G, 1.25 EMT	1500	4	0.25	\$235.00	\$235.00					
RP-BS (225A)	3120	N/A	N/A	\$955.00	\$955.00					
125A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(4) #1, #6G, 1.25 EMT	1550	4	1.5	\$286.00	\$1,716.00					
RP-BSA (225A)	3120	N/A	N/A	\$955.00	\$955.00					
150A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(4) 1/0, #6G, 1.5 EMT	1600	4	0.5	\$344.00	\$688.00					
RP-1SB (225A)	3120	N/A	N/A	\$955.00	\$955.00					
100A, 3P Breaker (208)	0320	N/A	N/A	\$456.00	\$456.00					
(4) #3, #8G, 1.25 EMT	1450	4	0.75	\$196.00	\$588.00					
RP-2SB (100A)	3110	N/A	N/A	\$673.00	\$673.00					
175A, 3P Breaker (208)	0420	N/A	N/A	\$1,239.00	\$1,239.00					
(4) 2/0, #6G, 2 EMT	1650	4	1	\$419.00	\$1,676.00					
RP-3SB (225A)	3120	N/A	N/A	\$955.00	\$955.00					
				Total	\$52,909.25					

Figure 3.8.12 – Redesign Cost Information for DR-3 Panel

System Redesign									
Total Redesign Cost:	\$263,788.25								

Figure 3.8.13 – Redesign Total Cost

Analysis

The goals of the redesign were met although the cost of the redesign is approximately \$43,000 more than the original design. The redesign did reduce the number of transformers. It also resulted in smaller lighting panels because they are no longer serving multiple panels downstream. The ability to now put the transformers in the same room as its distribution panel reduces the long runs on the larger feeders. The primary side now is the longer run. The area in which the redesign fails is economics. Even though the number of transformers was reduced by five, because the new transformers are so much larger than the originals the cost is much greater. Also, distribution panels were added to the system which added cost. This cost was offset some by the reduction in size of the lighting panels.

An area that was not analyzed but would definitely be an issue is the physical size of the new transformers. The weight would have to be discussed with the structural engineer to ensure the structure could support them. Also, the dimension could quite possibly be too large to fit into some of the smaller electrical closets.

Overall, this system is more centralized and would be perhaps easier to install but the economics do not allow it to be considered as a feasible replacement for the system that is in place.

ATRIUM HVAC EQUIPMENT POWER REDESIGN

Introduction

The mechanical study that was done on the glazing in the atrium was intended to significantly change the power requirements for the air handling unit that conditions the atrium. However, the only significant change was the air handler's fan was reduced in size from 15 horse power to 7.5 horse power. This does not translate into a significant opportunity to reduce the power requirements to the air handling unit.

This section will focus on the redesign of the electrical components that serve AHU-1-R1. The panelboard that is affected by the air handling unit resizing is LP-3N which is located in Electrical Room 366 on the third floor. Panelboards for both the original system and the redesigned system will be presented. Panelboard sizing worksheets and feeder worksheets are also provided in this section.

Redesign Procedure

	D	anel Tag			ARD SIZI		anel Loc	ation:		LEC. RM 3	266
		nal Phase to Neutral			277	Г	Phase		3	LEC. NIVI S	000
		nal Phase to Phase \			480		Wires		4		
os	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Ren	narks
1	Α	SF-3-3	6		5570	w	1.00	5570	5570	_	
2	Α	RF-3-3	6		2015	w	1.00	2015	2015		
3	В	SF-3-3	6		5570	W	1.00	5570	5570		
4	В	RF-3-3	6		2015	w	1.00	2015	2015		
5	С	SF-3-3	6		5570	w	1.00	5570	5570		
6	С	RF-3-3	6		2015	w	1.00	2015	2015		
7	Α	SF-R-1	6		5570	w	1.00	5570	5570		
8	Α	LTG-READING RM	3		2000	w	1.00	2000	2000		
9	В	SF-R-1	6		5570	w	1.00	5570	5570		
0	В	LTG-SEATING	3		1600	W	1.00	1600	1600		
11	С	SF-R-1 LTG-DEAN SUITE	6 3		5570	w	1.00	5570	5570 2024		
12 13	A	LTG-DEAN SUITE	3		2024 2056	w	1.00	2024 2056	2056		
14	A	LTG-MECH RM	3		600	w	1.00	600	600		
5	В	LTG-MECH KM	3		2520	w	1.00	2520	2520		
6	В	LTG-DEAN'S HALL	3		800	w	1.00	800	800	1	
7	C	LTG-STACKS	3		2576	w	1.00	2576	2576	İ	
8	Č	373-HAND DRY			1524	w	1.00	1524	1524	ĺ	
9	A	LTG-STACKS	3		2912	w	1.00	2912	2912		
20	Α	SPARE			0	w	0.95	0	0		
21	В	SPARE			0	w	0.95	0	0		
22	В	SPARE			0	w	0.95	0	0		
23	С	SPARE			0	w	0.95	0	0		
24	С	SPARE			0	w	0.95	0	0		
25	Α	SPARE			0	w	0.90	0	0		
26	Α	SPARE			0	w	0.95	0	0		
27	В	SPARE			0	w	0.90	0	0		
28	В	SPARE			0	w	0.95	0	0		
29	С	SPARE			0	W	0.90	0	0		
30 31	C A	SPARE SPARE			0	w	0.95	0	0		
32	A	SPARE			0	w		0	0		
33	В	SPARE			0	w		0	0		
34	В	SPARE			0	w		0	0		
35	C	LCP-3B			1000	w	1.00	1000	1000		
36	Č	SPARE			0	w		0	0		
37	Α	RP-3NA			21447	w	1.00	21447	21447		
38	Α	SPARE			0	w		0	0		
39	В	RP-3NA			21326	w	1.00	21326	21326		
10	В	SPARE			0	w		0	0		
41	С	RP-3NA	╙	·	18498	w	1.00	18498	18498		
12	С	SPARE			0	w		0	0	<u> </u>	
AN	EL T	OTAL						120.3	120.3	Amps=	144.8
HΑ	SEI	OADING						kW	kVA	%	Amp
		HASE TOTAL	Α		İ			42.2	42.2	35%	152.2
		HASE TOTAL	В					39.4	39.4	33%	142.2
		HASE TOTAL	С					38.8	38.8	32%	140.0
ΩΔ	D C	ATAGORIES		Conne	ected		Der	mand		1	Ver. 1.0
<u></u>				kW	kVA	DF	kW	kVA	PF	 	+81. 1.0.
1		receptacles		0.0	0.0	 	0.0	0.0		† †	
2		computers		0.0	0.0		0.0	0.0		1	
3	flu	uorescent lighting		17.1	17.1	0.90	15.4	15.4	1.00		
4		HID lighting		0.0	0.0		0.0	0.0			
5	inc	andescent lighting		0.0	0.0		0.0	0.0			
6		HVAC fans		39.5	39.5	0.95	37.5	37.5	1.00		
		heating	$ldsymbol{\square}$	0.0	0.0	0.95	0.0	0.0		<u> </u>	
7		itaban anuinnaant		0.0	0.0	1	0.0	0.0	l		
7 8	k	itchen equipment	\vdash					_			
7 8 9		unassigned		63.8	63.8		63.8	63.8	1.00		
7 8 9	Total						63.8 116.7 23.3	63.8 116.7 23.3	1.00		

Figure 4.1.1 – LP-3N Original Panelboard Worksheet

NEL: CATION:	LP-3N ELEC.RM.(366)-3RD FL		EQUIP. (ED GND	BUS:					GE: IRCUIT BKR:	480/277 VOLT, 3PH, 4W
OUNTING: D FROM:	SURFACE PANEL 'LP-1N'		NEUTRA A.I.C.:	L BUS:	100% 42,000		200%		MLO: BUS RA	TING:	225
1001) DESCRIPTION	BKR. AMPS	BKR. POLE	CKT.	A	OAD - V.A B	. С	CKT.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
				1	5,570	_					
					2,015			2	\vdash		
	SF-3-3	40	3	3		5,570 2.015		4	3	15	RF-3-3
				5		2,015	5.570	-	-	15	
				_			2.015	6			
				7	5,570		_,_,_				LIGHTING
					2,000			8	1	20	READING ROOM
	SF-R-1	40	3	9		5,570		40	.		LIGHTING
				11		1,600	C C70	10	1	20	SEATING AREA LIGHTING
				11			5,570 2.024	12	1	20	DEAN'S SUITE
	LIGHTING	20	1	13	2.056		2,024		<u> </u>		LIGHTING
OFFIC	E SPACE NORTH				600			14	1	20	MECHANICAL ROOM
	LIGHTING	20	1	15		2,520					LIGHTING
	STACKS					800		16	1	20	DEAN'S SUITE HALLWAY
	LIGHTING	20	1	17			2,576	40		00	373
	STACKS LIGHTING	20	1	19	2.912		1,524	18	1	20	HAND DRYER SPARE
	STACKS	20	-	13	2,912			20	1	20	SPARE
	SPARE	20	1	21							SPARE
								22	1	20	
	SPARE	20	1	23							SPARE
	CDADE	20	_	25				24	1	20	CDARE
	SPARE	20	1	25				26	1	20	SPARE
	SPARE	20	1	27				20	<u> </u>	20	SPARE
								28	1	20	
	SPARE	20	1	29							SPARE
								30	1	20	
	SPARE	20	1	31				32		20	SPARE
	SPARE	20	1	33				32	1	20	SPARE
	OI AINE	20		33				34	1	20	SPARL
LIGHTING	CONTROL PANEL	20	1	35			1,000				SPARE
	LCP-3B							36	1	20	
		70	3	37	21,447				L		SPARE
	NEL 'RP-3NA'			20		04.000		38	1	20	SPARE
(45	KVA XFMR)			39		21,326		40	1	20	SPARE
				41			18,498	+0		20	SPARE
							10,100	42	1	20	
_		TOTAL			42,170	39,401	38,777	TOTAL			120.3
MARKS:		TOTAL A	AMP/PH/	ASE	152	142	140	TOTAL	AMP		145

Figure 4.1.2 – LP-3N Original Panelboard Schedule

			P	ANELBO	ARD SIZI	NG W	ORKS	SHEET			
	Р	anel Tag		>	LP-3N	Pa	anel Loc	ation:	E	LEC. RM 3	366
		nal Phase to Neutral			277		Phase	e:	3		
		nal Phase to Phase \	_		480		Wires		4		
Pos		Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Ren	narks
1	A	SF-3-3 RF-3-3	6		5570	W	1.00	5570	5570		
3	В	SF-3-3	6		2015 5570	w	1.00	2015 5570	2015 5570		
4	В	RF-3-3	6		2015	w	1.00	2015	2015		
5	C	SF-3-3	6		5570	w	1.00	5570	5570		
6	С	RF-3-3	6		2015	w	1.00	2015	2015		
7	Α	SF-R-1	6		2920	w	1.00	2920	2920		
8	Α	LTG-READING RM	3		2000	w	1.00	2000	2000		
9 10	B B	SF-R-1 LTG-SEATING	6 3		2920 1600	w	1.00	2920 1600	2920 1600		
11	С	SF-R-1	6		2920	w	1.00	2920	2920		
12	C	LTG-DEAN SUITE	3		2024	w	1.00	2024	2024		
13	Α	LTG-NORTH OFF.	3		2056	w	1.00	2056	2056		
14	Α	LTG-MECH RM	3		600	w	1.00	600	600		
15	В	LTG-STACKS	3		2520	w	1.00	2520	2520		
16	В	LTG-DEAN'S HALL	3		800	W	1.00	800	800		
17 18	C	LTG-STACKS 373-HAND DRY	3		2576 1524	w	1.00	2576 1524	2576 1524		
19	A	LTG-STACKS	3		2912	w	1.00	2912	2912		
20	Α	SPARE	Ŭ		0	w	0.95	0	0		
21	В	SPARE			0	w	0.95	0	0		
22	В	SPARE			0	w	0.95	0	0		
23	C	SPARE			0	w	0.95	0	0		
24	C	SPARE			0	W	0.95	0	0		
25 26	A	SPARE SPARE			0	w	0.90 0.95	0	0		
27	В	SPARE			0	w	0.90	0	0		
28	В	SPARE			0	w	0.95	0	Ö		
29	С	SPARE			0	w	0.90	0	0		
30	C	SPARE			0	w	0.95	0	0		
31	Α	SPARE			0	w		0	0		
32	A	SPARE			0	W		0	0		
33 34	B B	SPARE SPARE			0	w		0	0		
35	C	LCP-3B			1000	w	1.00	1000	1000		
36	C	SPARE			0	w		0	0		
37	Α	RP-3NA			21447	w	1.00	21447	21447		
38	Α	SPARE			0	w		0	0		
39	В	RP-3NA			21326	w	1.00	21326	21326		
40 41	B C	SPARE RP-3NA			0 18498	w	1.00	0 18498	0 18498		
42	C	SPARE			0	w	1.00	0	0		
		OTAL						112.4	112.4	Amps=	135.3
PHA		OADING HASE TOTAL	Α					kW 39.5	kVA 39.5	% 35%	Amps 142.7
		HASE TOTAL	В					36.8	36.8	33%	132.7
		HASE TOTAL	С					36.1	36.1	32%	130.4
LOA		ATAGORIES		Conne	ected		Dei	mand			Ver. 1.02
LOA	<u> </u>	THOOTILO		kW	kVA	DF	kW	kVA	PF		Ver. 1.02
1	1 receptacles			0.0	0.0		0.0	0.0			
2	computers			0.0	0.0		0.0	0.0			
3	fluorescent lighting			17.1	17.1	0.90	15.4	15.4	1.00		
4			0.0	0.0		0.0	0.0				
5	inc	andescent lighting		0.0	0.0	0.05	0.0	0.0	1.00	 	
6 7		HVAC fans heating		31.5 0.0	31.5 0.0	0.95	29.9 0.0	29.9 0.0	1.00	}	
8	l/	itchen equipment		0.0	0.0	0.95	0.0	0.0			
9	r\.	unassigned		63.8	63.8		63.8	63.8	1.00	†	
	Total Demand Loads			22.0	23.0		109.1	109.1	1		
	Spare Capacity 20%						21.8	21.8			
	Tota	l Design Loads					130.9	130.9	1.00	Amps=	157.6

Figure 4.1.3 – LP-3N Redesign Panelboard Worksheet

NEL:	LP-3N		EQUIP. (SND. BUS	S:				VOLTA	GE:	480/277 VOLT, 3PH, 4W
CATION:	ELEC.RM.(366)-3RD FL	_	ISOLAT	ED GND I	BUS:	H			MAIN C	RCUIT BKF	2:
OUNTING:	SURFACE	-	NEUTRA		100%	=	200%		MLO:	_	
D FROM:	PANEL 'LP-1N'	-	A.I.C.:	L 003.	42.000		20070		BUS RA	TINC.	225
D FROW:	PANEL LP-IN	-	A.I.C.:						DUS KA	TING:	225
		BKR.	BKR.	CKT.		OAD - V.A		CKT.	BKR.	BKR.	
LOAI	DESCRIPTION	AMPS	POLE	NO.	Α	В	С	NO.	POLE	AMPS	LOAD DESCRIPTION
				1	5,570						
	05.0.0	40	_	_	2,015	5.570		2			BE 0.0
	SF-3-3	40	3	3		5,570 2,015		4	3	15	RF-3-3
				5	\vdash	2,015	5,570	-	-	15	
				-			2.015	6			
				7	2,920		2,010				LIGHTING
					2,000			8	1	20	READING ROOM
	SF-R-1	30	3	9		2,920					LIGHTING
						1,600		10	1	20	SEATING AREA
				11			2,920				LIGHTING
				40			2,024	12	1	20	DEAN'S SUITE
OFFIC	LIGHTING	20	1	13	2,056			14	1	20	LIGHTING
UFFIC	E SPACE NORTH LIGHTING	20	1	15	600	0.500		14	1	20	MECHANICAL ROOM LIGHTING
	STACKS	20	1	15		2,520 800		16	1	20	DEAN'S SUITE HALLWAY
	LIGHTING	20	1	17		000	2,576	-10	<u> </u>	20	373
	STACKS	- 20					1.524	18	1	20	HAND DRYER
	LIGHTING	20	1	19	2.912		1,027				SPARE
	STACKS							20	1	20	
	SPARE	20	1	21							SPARE
								22	1	20	
	SPARE	20	1	23					.		SPARE
	CDADE	20	_	25				24	1	20	CDA DE
	SPARE	20	1	25	\vdash			26	1	20	SPARE
	SPARE	20	1	27				20	<u> </u>	20	SPARE
	STARL	20		21				28	1	20	SPARE
	SPARE	20	1	29					<u> </u>		SPARE
								30	1	20	
	SPARE	20	1	31							SPARE
								32	1	20	
	SPARE	20	1	33							SPARE
House	CONTROL PANEL	-00	_	25			,	34	1	20	00+05
LIGHTING	G CONTROL PANEL LCP-3B	20	1	35			1,000	36	1	20	SPARE
	LUY-JD	70	3	37	21,447			36	1	20	SPARE
PΔ	NEL 'RP-3NA'	70	J	31	21,44/			38	1	20	SPARE
	KVA XFMR)			39		21,326					SPARE
(10						21,020		40	1	20	3-7-11-2
				41			18,498				SPARE
							.,	42	1	20	
		TOTAL			39,520	36,751	36,127	TOTAL			112.4
MARKS:		TOTAL.	AMP/PH/	ASE	143	133	130	TOTAL	AMP		135

Figure 4.1.4 – LP-3N Redesign Panelboard Schedule

Summary

		PANEL LP-3N SIZING SUMMARY Based on Redesign of AHU-R-1														
CIRCUIT			Vo	ltage	Motor	Size	VA /	Phase	Tota	al VA	Bre	eaker	Cond	uctors	Cor	nduit
	Ckt. No	Equip.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.
BRANCH	7,9,11	AHU-R-1	480	480	15hp	7.5hp	5570	2920	16710	8760	40	30	(3) #10, #10G	(3) #12, #12G	3/4" EMT	3/4" EMT
ب																
PANEL		Voltage	Loa	d kVA	Load A	mps	Desig	n Amps	Bus	Size	Bre	eaker	Cond	uctors	Cor	nduit
₽ A	Panel	Both	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.
	LP-3N	480Y/277	120.3	112.4	144.8	135.3	168.5	157.6	225	225	175	175	(4) 2/0, #6G	(4) 2/0, #6G	2" EMT	2" EMT

Figure 4.1.5 – LP-3N Redesign Summary

Analysis

Even though the size of the air handling unit's fan was reduce by half from 15hp to 7.5hp, the effect on the electrical system was almost zero. The total reduction in design load amps was less than eleven which resulted in zero change for the breaker, conductors, or conduit.

Because of the simplicity of the previous electrical study and the lack of results it produced, I decided it would be worthwhile to explore an additional electrical topic in this report. The next section will focus on that.

ENERGY EFFICIENT TRANSFORMER STUDY

Introduction

The following section of this report explores the benefits and feasibility of implementing PowerSmiths T1000-C3 energy efficient transformers. The law school currently uses standard Krated transformers. An energy savings payback analysis will be done using PowerSmiths ESP Calculator.

The existing transformers in the law school are listed below:

		OF	RIGINAL T	RANSFORMER	R SCHEDU	LE		
TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
XD-1	13.2kV, 3P, 3W	480Y/277V, 3P, 4W	1500kVA	Silicone-based dielectric filled	55℃	(4) 2.5% Taps (2) Up & (2) Dn	Concrete Pad Mount (outside)	
XS-1	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	75kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-2	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	45kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-3	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	45kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-4	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-5	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	75kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-6	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	30kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-7	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	75kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-8	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-9	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-10	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	45kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	
XS-11	480Y/277V, 3P, 4W	208Y/120V, 3P, 4W	112.5kVA	Dry Type	115℃	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	

Figure 5.1.1 – Standard Transformer Schedule

The cost analysis was completed using a standard markup value of 25% for PowerSmiths transformers. This markup value was obtained from a PowerSmiths representative and was given as an estimated markup value.



The ESP Calculator™

Energy Savings Payback Calculator

Toll Free: 1-800-747-9627 or (905) 791-1493 **Project Description**

Date

Villanova University: School of Law April 4, 2008

Transformers on Project

Data Entry

XS-1
XS-2
XS-3
XS-4
XS-5
XS-6
XS-7
XS-8
XS-9
XS-10
XS-11

Available Full Load kW

Average kVA (calc) equipment operating hrs/ day equipment operating days/yr Load during normal operating hours Load outside operating hours

Annual Cost to Operate Load Only

kWh rate demand rate (\$/kW/mo) ex. \$10.00

	.0.0 0 1 10,000	Otamaland V From	1
		Standard X-Frm	
		Cost	PowerSmiths Cost
QTY	kVA	RS Means	(Additional 25%)
1	75	\$7,000	\$8,750.0
1	45	\$5,110	\$6,387.5
1	45	\$5,110	\$6,387.5
1	112.5	\$13,439	\$16,798.8
1	75	\$7,000	\$8,750.0
1	30	\$4,385	\$5,481.3
1	75	\$7,000	\$8,750.0
1	112.5	\$13,439	\$16,798.8
1	112.5	\$13,439	\$16,798.8
1	45	\$5,110	\$6,387.5
1	112.5	\$13,439	\$16,798.8
			\$0.0
			\$0.0
			\$0.0
840			

0.0	
76	
14	
005	

40%

15%

Calc Load kW	Calc Annual kWh
336	1,716,960
126	459,900
Total Annual Load kWh:	2,176,860

0.044 \$4.99

Annual Consumption: \$ 96,435 Annual Demand: \$ 20,120 Total Cost to run load \$ 116,555

Annual Cost of Status Quo Transformer Losses & Associated Air Conditioning (A/C) burden

Status quo Efficiency (Normal Operation) Transformer kW Losses (Normal Operation) Status quo Efficiency (Outside op. hrs) Transformer kW Losses (Outside op. hrs) Annual addititional kWh from transformers **Annual Cost of Transformer Losses**

A/C System Performance (kW/ton) Additional Tons of Cooling (on peak) Annual addititional kWh from A/C Annual Cost of Associated A/C

Summary with Status Quo Transformer

Annual Cost of feeding Building Load Annual Cost of Transformer Losses Annual Cost of Associated A/C Electrical Bill (Status Quo Transformer)

97.0%	
10.4	kW
92.0%	
11.0	kW
 93,093	kWh
\$ 4,746	

1.25	
2.95	tons
33,059	kW
\$ 1,685	

\$ 122,986
\$ 1,685
\$ 4,746
\$ 116,555

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The ESP Calculator™

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Energy Savings Payback Calculator

Using Powersmiths instead of status quo transformers

Powersmiths Efficiency (Normal Operation) Powersmiths kW Losses (Normal Operation) Powersmiths Efficiency (Outside op. hrs) Transformer kW Losses (Outside op. hrs) Annual addititional kWh from transformers

Annual Cost of Powersmiths Losses

Annual addititional kWh from A/C Annual Cost of Associated A/C

Additional Tons of Cooling (on peak)

98.2%	
6.2	kW
97.6%	
3.1	kW
 42,781	kWh
\$ 2,264]
1.75	tons
15,192	kWh

804

Comparing Status Quo & Powersmiths

	Si	tatus Quo	Powersmiths	
Annual Cost of feeding Building Load	\$	116,555	\$ 116,555	
Annual Cost of Transformer Losses	\$	4,746	\$ 2,264	
Annual Cost of Associated A/C	\$	1,685	\$ 804	Reduction
Annual estimated Electrical Bill	\$	122,986	\$ 119,623	3%

Peak kW reduction (normal op hours) 4.2 kW Annual kWh reduction 68,179 kWh Reduction in Air Conditioning Load (on peak) 1.20 tons

Cost Analysis (calc)

Energy Cost Escalation (above inflation) Annual Power Quality Benefit

3.0%

Status Quo Transformers
Powersmiths Transformers
Savings with Powersmiths

Annual	Life Cycle Operating Cost & Savings		
Operating Cost	20 years	32 years	
\$6,432	\$232,329	\$529,994	
\$3,068	\$110,821	\$252,807	
\$3,364	\$121,508	\$277,186	

Cost Powersmiths Transformers

\$118,089 Status Quo Transformers \$94,471

Pavback on total cost

	-	,	
Cost of Energy Savings	\$ 0.011	/kWh	\$0.044
Cost - Benefit Ratio	4.1	times less to save a kWh that	an to buy a kWh

Cost

Leasing Option

Total Annual Leasing Payments

Net Annual Cost with savings

60 Month Term	48 Month Term	36 Month Term
\$23,886	\$29,135	\$37,070
\$20,522	\$25,771	\$33,707

vears

Summary of Environmental Benefits

Annual Reduction in Greenhouse Gases (per EPA)	Equivalence
50 tons of CO2	9 Acres trees planted
163 tons of Coal	7 Car Emissions
394 kgs of SO2	7 homes heated
170 kgs of NOx	

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current kWh rate:

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doc#807-000440-110-A01

Conclusion

As a way to save energy, PowerSmiths T1000-C3 energy efficient transformers are a good option. The initial cost difference between the standard K-rated transformers that are currently in the building and the T1000-C3 series transformers is \$3,360. Thanks to the energy savings receive when using the T1000-C3 transformers, in just over seven years, the initial increase in cost will have been paid back.

Perhaps more importantly than the money that can be saved are the environmental savings. Each year, running the energy efficient transformers will reduce the CO2 released into the atmosphere by 50 tons or replaced 163 tons of burned coal. This translates into planting nine acres of trees or eliminating the emissions of seven cars for the year.

Implementation of the T1000-C3 transformers is a feasible design idea. Not only will the energy cost required to operate the law school be greatly reduced, the buildings annual environmental impact is greatly reduced.

PROTECTION DEVICE COORDINATION

Introduction

The protective device coordination focuses on the over-protection devices along the path from main switchgear through panel ELP-1S. The devices are studied to determine if they are coordinated correctly and will operate as planned in the case of a fault.

Partial Single Line of Path

The devices that are analyzed for this protective device coordination study are: a 400 amp circuit breaker located in the main switchboard (MDB), the 100 amp main circuit breaker in panel EDP-BS and through a 50 amp breaker in panel EDP-BS.

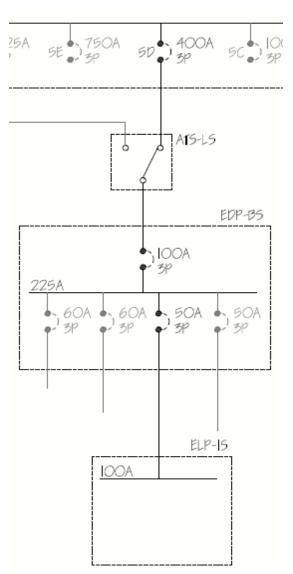


Figure 6.1.1 - Protection Coordination Path

The time/current trip curve for each device shown above was overlaid to illustrate the coordination of the devices.

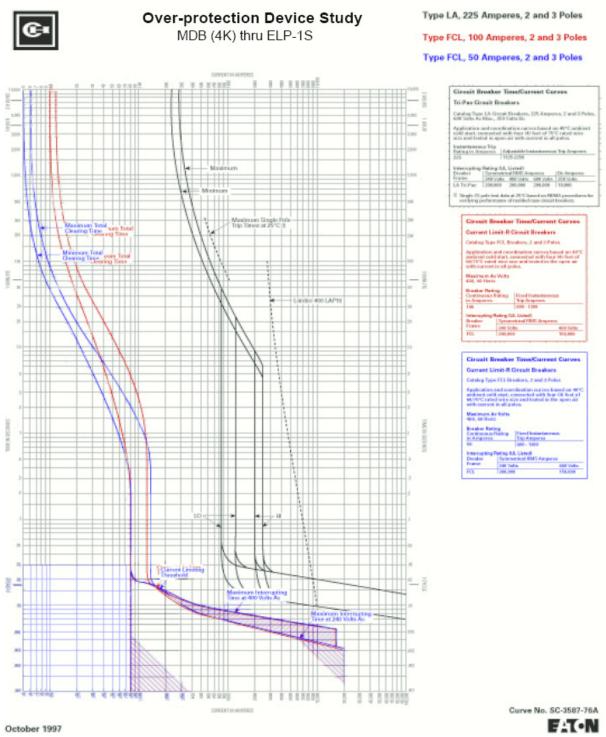


Figure 6.1.2 – Time/Current Overlay

Conclusion

The 225A circuit breaker is coordinated correctly; it will never trip before either of the smaller over-current devices. The 100A and 50A breakers however, are not coordinated quite right. At low currents the 50 amp breaker will always trip first as it should. When the current increases however, there comes a point where there is the possibility of the 100 amp breaker tripping before the 50 amp breaker. The point at which this occurs is where the red and blue curves intersect. At one point, the blue curve is further to the right than the red which means at that point, there is a real possibility of the larger breaker tripping first. This is a problem if there are other loads connected to the larger breaker because if that trips before the branch circuit, all loads will be lost, not just the one that has the fault.

Mechanical Breadth

Introduction

In an effort to lessen the harsh daylight glare and to reduce solar gains in the atrium, new glazing was assigned and a daylight and mechanical study was done. The daylight study can be seen starting on page 31 of this report. The following section focuses on the mechanical improvements the newly assigned glazing provides the law school.

The original mechanical engineer who modeled the building initially assumed that the spandrel glass would behave like a brick wall with a U-value of 0.0725 BTU/h-ft^2-F. Because Viracon does not list the properties of coating material (most likely because it is coated by an outside company), I continued that same assumption.

The redesigned glazing system implements glazing with lower transmittance values and lower shading coefficients. Both of these things result in a lower relative heat gain. The two glazing systems were calculated using Trane Trace 700. The reduction in loads and energy consumption will be discussed below. Finally, an annual energy savings is discussed along with the increase in construction cost due to the new glazing system.

Glazing

				0	riginal Atriu	m Glazing						
			Transmitta	nce		ASHRA	E U-Value					
		Vis.	Solar	Ultra-	Vis.	Vis.	Solar	Winter	Summer	Shading	Relative	
Viracon No.	Description	Light	Energy	Violet	Light-Ext.	Light-Int.	Energy	Night	Day	Coeff.	Heat Gain	Area (SF)
VRE 1-38	Solarscreen (clear)	36%	19%	12%	44%	21%	46%	0.25	0.21	0.26	55	880
VRE 1-38 Frit	Silkscreen (dots)	25%	13%	7%	40%	25%	13%	0.30	0.26	0.21	46	2592
VE 1-2M w/												
Metallic Opac	Spandrel	0%	Not Avail.	Not Avail.	Not Avail.	Not Avail.	Not Avail.	0.07	0.07	N/A	Not Avail.	674
					New Atrium	Glazing						
			Transmitta	nce		Reflectance		ASHRA	E U-Value			
		Vis.	Solar	Ultra-	Vis.	Vis.	Solar	Winter	Summer	Shading	Relative	
Viracon No.	Description	Light	Energy	Violet	Light-Ext.	Light-Int.	Energy	Night	Day	Coeff.	Heat Gain	Area (SF)
VRE 7-38	Solarscreen (clear)	28%	11%	9%	28%	21%	14%	0.25	0.21	0.19	41	880
VRE 1-38 Frit	Silkscreen (dots)	19%	8%	5%	26%	24%	13%	0.30	0.26	0.17	37	1795
VE 1-2M w/												
Metallic Opac	Spandrel	0%	Not Avail.	Not Avail.	Not Avail.	Not Avail.	Not Avail.	0.07	0.07	N/A	Not Avail.	1471

Table 7.1.1 – Glazing Properties

*See Appendix E for Glazing Cutsheets

Redesign Details

The redesign of the atrium glazing consisted of adding additional spandrel glass, which resulted in a reduction in fritted glass. The amount of clear glass remained the same. As seen in the table above, all VRE 1-38 glazing was replaced with VRE 7-38.

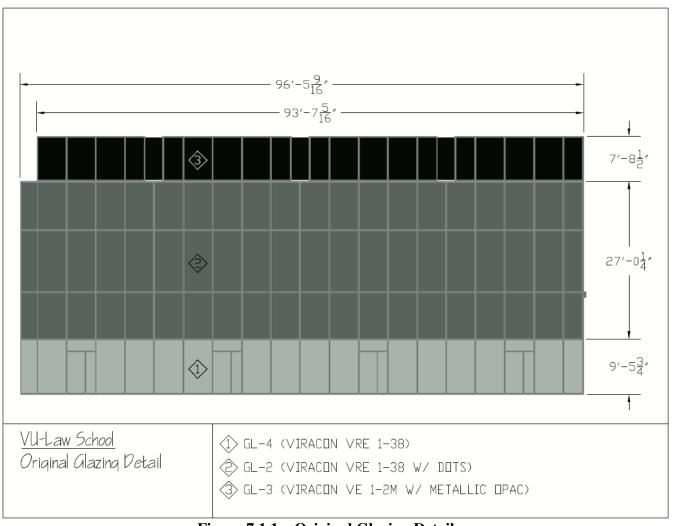


Figure 7.1.1 – Original Glazing Detail

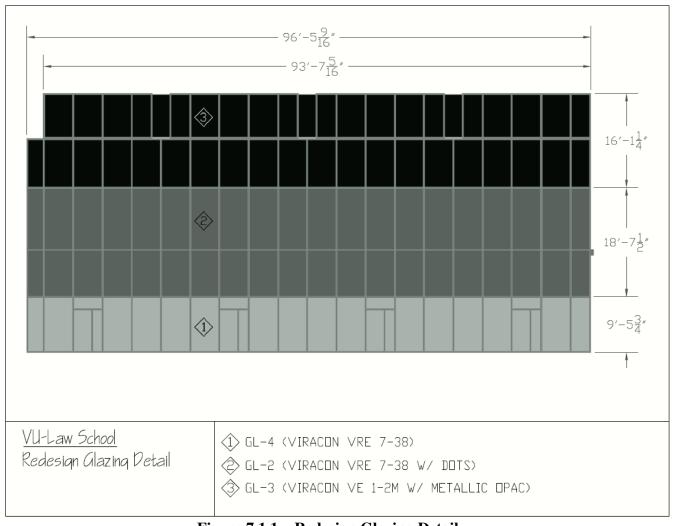


Figure 7.1.1 – Redesign Glazing Detail

					VU Atrium M	echanical Co	ost Analysis	;										
			Viraco	on No.		Area	(SF)	Unit Cos	t (\$/SF)	Initia	l Cost							
	Tag	Description	Original	Redesign	Add-ons	Original	Redesign	Original	Redesign	Original	Redesign	Cost Diff.						
Glass	GL-2	Silkscreen (dots)	VRE 1-38	VRE 7-38	Dots	2539	1742	\$18.50	\$21.00	\$46,971.50	\$36,582.00	10,389.50						
8	GL-3	Spandrel	VE 1-2M	VE 1-2M	Metallic Opac	674	1471	\$24.00	\$24.00	\$16,176.00	\$35,304.00	-19,128.00						
1	GL-4	Solarscreen(clear)	VRE 1-38	VRE 7-38	N/A	880	880	\$12.50	\$15.00	\$11,000.00	\$13,200.00	-2,200.00						
								Total Gla	ss Cost	\$74,147.50	\$85,086.00	-10,938.50						
			Trane	Series		Initial	Cost											
L	Tag	Description	Original	Redesign	Add-ons	Original	Redesign	Cost Diff.										
AHU			Trane T-25	Trane T-12														
٨	AHU-R-1	Rooftop AHU	(15hp)	(7.5 hp)	N/A	\$25,990.00	\$22,190.00	\$3,800.00										
					Const	ruction Cos	Construction Cost Difference -\$7,138.50											

Note: Glazing and AHU pricing was provide by Viracon and Trane representative respectively.

Table 7.1.2 – Construction Cost Analysis

P.	.HU-1-R1	
	Original Glazing	Redesigned Glazing
Peak Design Cooling Load	22.7 ton	16.2 ton
Peak Design Heating Load	147 MBh	108 MBh
Outside Airflow	1316 cfm	894 cfm
Cooling Airflow	8873 cfm	6059 cfm
Heating Airflow	8873 cfm	6059 cfm
Return Airflow	8873 cfm	6059 cfm
Exhaust Airflow	8873 cfm	6059 cfm
AHU Fan Size	15 hp	7.5 hp
% of Total Building Energy: Heating	37.20%	37.10%
% of Total Building Energy: Cooling	13.30%	13.40%
Total Building Energy	15172882 kBtu/yr	15058292 kBtu/yr
Total Energy Savings	114590	kBtu/yr
Total Electricity Cost	\$44,064	\$43,690
Total Electricity Cost Savings	\$374	per year

Table 7.1.3 – AHU Properties and Energy Savings

Conclusion

The change in glazing seems to have had more benefits for daylighting than the mechanical system. The reduction in shading coefficient and transmittance did make an impact, but it turned out to be small compared to the load of the rest of the building. The annual electricity savings only amounted to \$374. The law school is heated using steam like Penn State's buildings are. I could not estimate the annual savings for the steam because I did not know where or how the steam was produced. Judging by the electricity savings compared to the percentage change in cooling, I am confident saying that the savings would not be incredibly significant.

Implementation of the new glazing system would result in an increased construction cost of approximately \$11,000. This is a result of the VRE 7-38 being more expensive than the originally specified VRE 1-38 and the increase square footage of VE 1-2M. This cost was offset some by the reduction in air handler size. AHU-1-R1 was originally a Trane T-25 with a 15 horse power fan. The reduction in load for the atrium allowed the air handler to be reduced to a Trane T-12 with a 7.5 horse power fan. The cost difference between the two was estimated at \$3,800. The combination of the new glazing and new air handler result in a net construction cost increase of \$7,138.50.

Because the yearly energy savings is not significant, this cost would most likely have to be presented to the owner as a necessary cost to improve the daylight conditions in the atrium and not as a way to save money on energy costs. Because the VU law school costs upwards of \$56 million, a \$7,000 increase may be a justified price to improve the daylighting in the atrium.

Acoustical Breadth

Introduction

In both the moot courtroom and the 135-seat classroom, wood is a very dominant material. Because both spaces are used primarily for lectures and presentations, hearing the spoken word is very important for this space.

Because of the amount of wood, this acoustical breadth was decided upon on the assumption that the room would have a reverberation time that is higher than the recommended time. This report will show however, that the acoustical measures that were taken in the initial design lowered the reverberation time past the recommended range.

Once the materials that needed to be added or removed to reach the recommended reverberation time were determined, a cost analysis was done. The purpose of the cost analysis was to ensure that the changes that were necessary to bring each space back into the recommended range was feasible economically.

Moot Court

		Mc	oot Co	ourt Exi	stina	Reverb	eratio	n Time						
Surface Description	Material	Surface	,0. 0.	Juit Exi	oung					and Sabir	าร			
		Area	12	25 Hz	25	60 Hz	•	00Hz		000Hz		000Hz	4	000Hz
			α	Α	α	Α	α	Α	α	Α	α	Α	α	Α
	Carpet, light,													
Floor	foam-backed	2013	0.05	100.65	0.10	201.30	0.12	241.56	0.30	603.90	0.40	805.20	0.50	1006.50
Ceiling 1	5/8" Acoustical Tile	375	0.68	255.00	0.76	285.00	0.60	225.00	0.65	243.75	0.82	307.50	0.76	285.00
Ceiling 2	5/8" Acoustical Tile	790	0.68	537.20	0.76	600.40	0.60	474.00	0.65	513.50	0.82	647.80	0.76	600.40
Ceiling 3	1/2" Gyp Board	854	0.11	93.94	0.11	93.94	0.05	42.70	0.06	51.24	0.04	34.16	0.05	42.70
	1/2" Gyp Board	410	0.11	45.10	0.11	45.10	0.05	20.50	0.06	24.60	0.04	16.40	0.05	20.50
Ţ	1/2" Gyp Board													
Walls	on Studs	1758	0.27	474.66	0.10	175.80	0.05	87.90	0.04	70.32	0.03	52.74	0.03	52.74
Desk Tops	Wood	363	0.10	36.30	0.11	39.93	0.10	36.30	0.08	29.04	0.08	29.04	0.11	39.93
Desk Front/Sides	Wood	482	0.10	48.20	0.11	53.02	0.10	48.20	0.08	38.56	0.08	38.56	0.11	53.02
Bench Top	Wood	52	0.10	5.20	0.11	5.72	0.10	5.20	0.08	4.16	0.08	4.16	0.11	5.72
Chair	Light Upholstry	810	0.35	283.50	0.45	364.50	0.57	461.70	0.61	494.10	0.59	477.90	0.55	445.50
Door	Wood	168	0.10	16.80	0.11	18.48	0.10	16.80	0.08	13.44	0.08	13.44	0.11	18.48
Interior Walls	Wood	315	0.10	31.50	0.11	34.65	0.10	31.50	0.08	25.20	0.08	25.20	0.11	34.65
Tables	Wood	112	0.10	11.20	0.11	12.32	0.10	11.20	0.08	8.96	0.08	8.96	0.11	12.32
Front Wood Panelling	1" Wood Panelling	242	0.19	45.98	0.14	33.88	0.09	21.78	0.06	14.52	0.06	14.52	0.05	12.10
Witness Chair	Wood	12	0.10	1.20	0.11	1.32	0.10	1.20	0.08	0.96	0.08	0.96	0.11	1.32
Witness Railing	Wood	25	0.10	2.50	0.11	2.75	0.10	2.50	0.08	2.00	0.08	2.00	0.11	2.75
Railing	Wood	60	0.10	6.00	0.11	6.60	0.10	6.00	0.08	4.80	0.08	4.80	0.11	6.60
Acoustical Panels	2" Acoustic Panel	194	0.27	52.38	0.55	106.70	1.07	207.58	1.10	213.40	1.10	213.40	1.10	213.40
ΣΑ			20	47.31	20	81.41	19	41.62	23	56.45	26	96.74	2	853.63
Volume (ft ³)	26,675													
Reverb Time (s)	T ₆₀ =0.049V/∑A		0.64		0.63		0.67			0.55	(0.48		0.46
Target Time (s)	0.7 - 1.1		Unac	ceptable	Unac	ceptable	Unacceptable		le Unacceptabl		le Unacceptable		Unacceptable	

The existing conditions for the moot court for each frequency shown produce a reverberation time range from 0.46 seconds at 4000 Hz to 0.64 seconds at 125Hz. The acceptable range this space is 0.7 to 1.1 seconds. The courtroom has acoustical panels and acoustical ceiling tile. Those are the materials that will be changed in order to get this space inside the recommended reverberation time range.

	Moot Court Redesign Reverberation Time Calculations													
Surface Description	Material	Surface				Ab	sorpt	ion Coe	fficier	nt and S	abins	;		
		Area	12	25 Hz	25	0 Hz	50	00Hz	10	00Hz	20	00Hz	4	000Hz
			α	Α	α	Α	α	Α	α	Α	α	Α	α	Α
Floor	Carpet, light, foam-backed	2013	0.05	100.65	0.10	201.30	0.12	241.56	0.30	603.90	0.40	805.20	0.50	1006.50
Ceiling 1	1/2" Gyp Board	375	0.11	41.25	0.11	41.25	0.05	18.75	0.06	22.50	0.04	15.00	0.05	18.75
Ceiling 2	1/2" Gyp Board	790	0.11	86.90	0.11	86.90	0.05	39.50	0.06	47.40	0.04	31.60	0.05	39.50
Ceiling 3	1/2" Gyp Board	854	0.11	93.94	0.11	93.94	0.05	42.70	0.06	51.24	0.04	34.16	0.05	42.70
Ceiling 4	1/2" Gyp Board	410	0.11	45.10	0.11	45.10	0.05	20.50	0.06	24.60	0.04	16.40	0.05	20.50
Walls	1/2" Gyp Board on Studs	1758	0.27	474.66	0.10	175.80	0.05	87.90	0.04	70.32	0.03	52.74	0.03	52.74
Desk Tops	Wood	363	0.10	36.30	0.11	39.93	0.10	36.30	0.08	29.04	0.08	29.04	0.11	39.93
Desk Front/Sides	Wood	482	0.10	48.20	0.11	53.02	0.10	48.20	0.08	38.56	0.08	38.56	0.11	53.02
Bench Top	Wood	52	0.10	5.20	0.11	5.72	0.10	5.20	0.08	4.16	0.08	4.16	0.11	5.72
Chair	Light Upholstry	810	0.35	283.50	0.45	364.50	0.57	461.70	0.61	494.10	0.59	477.90	0.55	445.50
Door	Wood	168	0.10	16.80	0.11	18.48	0.10	16.80	0.08	13.44	0.08	13.44	0.11	18.48
Interior Walls	Wood	315	0.10	31.50	0.11	34.65	0.10	31.50	0.08	25.20	0.08	25.20	0.11	34.65
Tables	Wood	112	0.10	11.20	0.11	12.32	0.10	11.20	0.08	8.96	0.08	8.96	0.11	12.32
Front Wood Panelling	1" Wood Panelling	242	0.19	45.98	0.14	33.88	0.09	21.78	0.06	14.52	0.06	14.52	0.05	12.10
Witness Chair	Wood	12	0.10	1.20	0.11	1.32	0.10	1.20	0.08	0.96	0.08	0.96	0.11	1.32
Witness Railing	Wood	25	0.10	2.50	0.11	2.75	0.10	2.50	0.08	2.00	0.08	2.00	0.11	2.75
Railing	Wood	60	0.10	6.00	0.11	6.60	0.10	6.00	0.08	4.80	0.08	4.80	0.11	6.60
Acoustical Panels	2" Acoustic Panel	125	0.27	33.75	0.55	68.75	1.07	133.75	1.10	137.50	1.10	137.50	1.10	137.50
ΣΑ			13	64.63	12	86.21	12	27.04	15	93.20	17	12.14	19	950.58
Volume (ft ³)	plume (ft ³) 26,675													
Reverb Time (s)	T ₆₀ =0.049V/∑A		0.96		1.02		1.07		0).82	0).76		0.67
Target Time (s)	0.7 - 1.1		Acc	eptable	Acc	eptable	Acc	eptable	Acc	eptable	Acc	eptable	Unac	ceptable

By eliminating all acoustical ceiling tile and reducing the surface area of the acoustical panels on the perimeter from 194 square feet to 125 square feet, all frequencies except for 4000Hz now fall within the acceptable range of 0.7 to 1.1 seconds of reverberation time. Because lower frequencies resonate longer, it is easier to get those to fall into the recommended range. It is more difficult to do so with the higher frequencies because they die out much quicker than low pitched sounds.

In the acoustical redesign of the moot court, the 4000 Hz frequency was left at 0.67 seconds of reverberation time because it is close to the accepted value. Also, in order to have the 4000 Hz frequency fall within the recommended range, the 500 Hz frequency would have then been past the upper limit of the recommended range.

135-Seat Classroom

		135-Sea	t Clas	sroom F	Rever	beration	Time	e Calcula	ations	}				
Surface Description	Material	Surface						tion Coeffi			s			
		Area	12	25 Hz	250 Hz		•	00Hz		000Hz		000Hz	4000Hz	
			α	Α	α	Α	α	Α	α	Α	α	Α	α	Α
	Carpet, light,													
Floor	foam-backed	3085	0.05	154.25	0.10	308.50	0.12	370.20	0.30	925.50	0.40	1234.00	0.50	1542.50
High Ceiling	5/8" Acoustical Tile	2280	0.68	1550.40	0.76	1732.80	0.60	1368.00	0.65	1482.00	0.82	1869.60	0.76	1732.80
Low Ceiling	1/2" Gyp Board	866	0.11	95.26	0.11	95.26	0.05	43.30	0.06	51.96	0.04	34.64	0.05	43.30
	1/2" Gyp Board													
Walls	on Studs	2149	0.27	580.23	0.10	214.90	0.05	107.45	0.04	85.96	0.03	64.47	0.03	64.47
Desk Tops	Wood	1563	0.10	156.30	0.11	171.93	0.10	156.30	0.08	125.04	0.08	125.04	0.11	171.93
Desk Front/Sides	Wood	1028	0.10	102.80	0.11	113.08	0.10	102.80	0.08	82.24	0.08	82.24	0.11	113.08
Chair	Light Upholstry	1890	0.35	661.50	0.45	850.50	0.57	1077.30	0.61	1152.90	0.59	1115.10	0.55	1039.50
Door	Wood	126	0.10	12.60	0.11	13.86	0.10	12.60	0.08	10.08	0.08	10.08	0.11	13.86
	1/2" Gyp Board													
Ramp Walls	on Studs	85.5	0.27	23.09	0.10	8.55	0.05	4.28	0.04	3.42	0.03	2.57	0.03	2.57
Acoustical Panels	2" Acoustic Panel	248	0.27	66.96	0.55	136.40	1.07	265.36	1.10	272.80	1.10	272.80	1.10	272.80
ΣΑ			34	103.39	36	45.78	35	507.59	41	91.90	48	10.54	4	996.81
Volume (ft ³)	40,105													
Reverb Time (s)	T ₆₀ =0.049V/∑A		0.58		0.54		0.56		0.47		0.41		0.39	
Target Time (s)	0.7 - 1.1		Unac	ceptable	Unac	ceptable	Unac	Inacceptable Unacceptable		Unac	ceptable	Unacceptable		

The classroom has many of the same materials as the courtroom and therefore has similar acoustical problems. The reverberation time range for the classroom was calculated at 0.39 seconds for 4000 Hz frequencies up to 0.58 seconds at 125 Hz. Again, the means for getting the reverberation times into the acceptable range will be to reduce the amount of acoustical materials that are in the classroom.

		135-Sea	t Clas	sroom	Rever	beration	Time	Calcula	ations	;				
Surface Description	Material	Surface				Α	bsorp	tion Coeff	icient a	and Sabin	s			
•		Area	125 Hz		250 Hz		500Hz		1000Hz		2000Hz		4000Hz	
			α	Α	α	Α	α	Α	α	Α	α	Α	α	Α
	Carpet, light,													
Floor	foam-backed	3085	0.05	154.25	0.10	308.50	0.12	370.20	0.30	925.50	0.40	1234.00	0.50	1542.50
High Ceiling	1/2" Gyp Board	2280	0.11	250.80	0.11	250.80	0.05	114.00	0.06	136.80	0.04	91.20	0.05	114.00
Low Ceiling	1/2" Gyp Board	866	0.11	95.26	0.11	95.26	0.05	43.30	0.06	51.96	0.04	34.64	0.05	43.30
	1/2" Gyp Board													
Walls	on Studs	2149	0.27	580.23	0.10	214.90	0.05	107.45	0.04	85.96	0.03	64.47	0.03	64.47
Desk Tops	Wood	1563	0.10	156.30	0.11	171.93	0.10	156.30	0.08	125.04	0.08	125.04	0.11	171.93
Desk Front/Sides	Wood	1028	0.10	102.80	0.11	113.08	0.10	102.80	0.08	82.24	0.08	82.24	0.11	113.08
Chair	Light Upholstry	1890	0.35	661.50	0.45	850.50	0.57	1077.30	0.61	1152.90	0.59	1115.10	0.55	1039.50
Door	Wood	126	0.10	12.60	0.11	13.86	0.10	12.60	0.08	10.08	0.08	10.08	0.11	13.86
	1/2" Gyp Board													
Ramp Walls	on Studs	85.5	0.27	23.09	0.10	8.55	0.05	4.28	0.04	3.42	0.03	2.57	0.03	2.57
Acoustical Panels*	2" Acoustic Panel	86	0.27	23.22	0.55	47.30	1.07	92.02	1.10	94.60	1.10	94.60	1.10	94.60
ΣΑ			20	60.05	20	74.68	20	80.25	26	68.50	28	353.94	3	199.81
Volume (ft ³)	40,105													
Reverb Time (s)	T ₆₀ =0.049V/∑A			0.95	0.95		0.94		0.74		0.69		0.61	
Target Time (s)	0.7 - 1.1		Acc	eptable	Acc	eptable	Acc	eptable	Acc	eptable	Unac	ceptable	Una	cceptable

^{*}Note: Originally there were three 22SF panels on each side wall and eight 14.4SF panels on the back wall. The new design is one 14.4SF on each side wall with four 14.4SF panels on the back wall.

By replacing the acoustical ceiling tile with painted gyp board and reducing the number and size of acoustical panels on the side and back walls, the reverberation time was brought into the recommended range for the four lowest frequencies and much closer for 2000 and 4000 Hz. The 2000 Hz frequencies miss falling within the acceptable range by one one-hundredth of a second while 4000 Hz frequencies miss by nine one-hundredths of a second. If the acoustical panels would

have been eliminated all together, the 2000 Hz frequencies would have fallen in the range but because these are used as an architectural feature in the lighting design, they it was deemed important to leave a few of them. Even if they were eliminated all together, the 4000 Hz frequencies would have still be just outside the recommended range for reverberation time.

Cost Analysis

	Moot Court Redesign Cost Calculation												
Surface Description	Mat	erial	Surfa	ce Area	RS Mear	ns Unit Cost (\$/SF)	RS Mea	ns Cost	Redesign Saving				
	Original	Redesign	Original	Redesign	Original	Redesign	Original	Redesign					
Ceiling 1	5/8" Acoustical Tile	1/2" Gyp Board	375	375	\$1.85	\$1.25	\$693.75	\$468.75	\$225.00				
Ceiling 2	5/8" Acoustical Tile	1/2" Gyp Board	790	790	\$1.85	\$1.25	\$1,461.50	\$987.50	\$474.00				
Acoustic Wall Panels	2" Acoustic Panel	2" Acoustic Panel	194	125	\$5.00	\$5.00	\$970.00	\$625.00	\$345.00				
	Moot Court Redesign Total Savings Total Savings = \$1,044.00												

	135-Seat Classroom Redesign Cost Calculation												
Surface Description	Mat	Surfa	ce Area	RS Mean	s Unit Cost (\$/SF)	RS Mea	ans Cost	Redesign Saving					
	Original	Redesign	Original	Redesign	Original	Redesign	Original	Redesign					
High Ceiling	5/8" Acoustical Tile	1/2" Gyp Board	2280	2280	\$1.85	\$1.2	5 \$4,218.00	\$2,850.00	\$1,368.00				
Acoustic Wall Panels	2" Acoustic Panel	2" Acoustic Panel	248	86	\$5.00	\$5.0	0 \$1,240.00	\$430.00	\$810.00				
135-Seat Classroom Redesign Total Savings Total Savings = \$2,178.00													

Each acoustical redesign resulted in a net savings because of the reduction in acoustical material. If both redesigns would to be implemented into the construction of the law school, the total construction costs would be reduced by \$3,222.

Conclusion

Implementing the new design would meet the goals laid out in the initial plan. The room would perform better acoustically and it would actually be cheaper than the original system. This is a system that could feasibly be introduced into this building.

Summary and Conclusions

Lighting Depth

Each of the four spaces that were redesigned met ASHRAE 90.1 power density criteria. The overall lighting goals were based around the need to create functional education spaces. However, the architecture of the law school has some excellent features that were perfect for the focus of a lighting design. The atrium was transformed into a glowing beacon that will grace Villanova University as a new part of its skyline. The more interior spaces also had architectural features that presented some excellent lighting opportunities. The courtroom and classroom each have a great amount of wood as well as interesting ceilings. These two elements made lighting the space that much more challenging and as a result, the spaces are that much more interesting. Finally, from outside to inside, the emphasis on the rich materials and elegant architecture allows the prestige and excellence of the law school and the ideals of the legal profession to shine through.

A daylight study was conducted on the atrium because of the large amount of south-east facing glazing. The original glazing was replaced with glazing that had a lower shading coefficient and lower transmittance. Calculations were run and it was determined that the new glass would reduce the illuminance on the atrium floor as well as lessen the depth of the penetration of direct sunlight into the space.

Electrical Depth

The electrical depth explored a few different concepts including coordination of electrical system and the newly designed lighting systems, a distribution redesign, a mechanical equipment power redesign, a study of energy efficient transformers and a protective device coordination study.

The lighting coordination consisted of re-circuiting of lighting branch circuits and adjusting the panelboards accordingly. A few of the panels were not sized to adequately handle the loads that were listed according to the panelboard schedules that were used in sizing. As a result, a few of the panels increased in size. The majority of panelboards however, remained the same because the lighting loads that were changed were not changed significantly and the same panels were used whenever possible.

The distribution redesign had great potential but in the end, it turned out that the redesign reduced the number of transformers but increased the size of those transformers which does not translate into cost savings. Also, the addition of distribution panels and large circuit breakers increased the cost of the new system which turned out to be too expensive to be considered feasible.

The HVAC system redesign consisted of redesigning the power supply to a rooftop air handling unit. The air handling unit was resized per the mechanical breadth, but the resizing did not significantly affect the electrical system. The panel, breakers and feeders did not change in size as a result of the resizing of the air handler. As a result of these poor results, an additional study was performed.

The additional study that was performed was a payback calculation of replacing standard K-rated transformers with PowerSmiths energy efficient transformers. It was found that after only seven

years, the additional cost for the transformers would be reclaimed through the annual energy savings provided by the transformers.

Mechanical Breadth

The goal of the mechanical breadth was to reduce the mechanical loads of the building by changing the glazing in the atrium. After an analysis was performed, the glazing that was chosen did reduce mechanical loads, but it was not significant. The glass that was originally specified was actually very good so it was difficult to find something that performed much better. In the scope of the whole building, the reduction in mechanical loads produced by the substitution of atrium glass did not make much of an impact. The glazing did a better job for the daylight system than it did for the mechanical system.

Acoustical Breadth

The acoustical breadth was proposed because it was assumed that the amount of hard surfaces such as wood in the classroom and courtroom would have produced a reverberation time that was out of the recommended range on the high side. Upon completion of the study however, it was determined that the acoustical provisions that were designed into the building were keeping the reverberation time out of the recommended range on the low side. In each case, the amount of acoustical materials in the room was reduced and the reverberation time came much closer to falling in the recommended range. Lastly, a cost analysis was done and it was determined that replacing the acoustic ceiling tile and reducing the number of acoustical panels on the walls would save the project money.

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