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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Lighting/Electrical Option

Lighting Consultant: Dr. Kevin Houser
Electrical Consultant: Professor Ted Dannerth

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villanova university

school of law villanova pa

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

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

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

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)

mechanical

- 1 300-ton water-cooled, centrifugal chiller and 1 300-ton two-stage direct fired two-stage absorption chiller located in lower level main mechanical room
  system with a 15kV primary loop switch
- 1 primary, constant volume, end-suction 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 supporting light weight concrete on metal deck
floor framing: w-beams and girders supporting wide rib metal deck

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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.

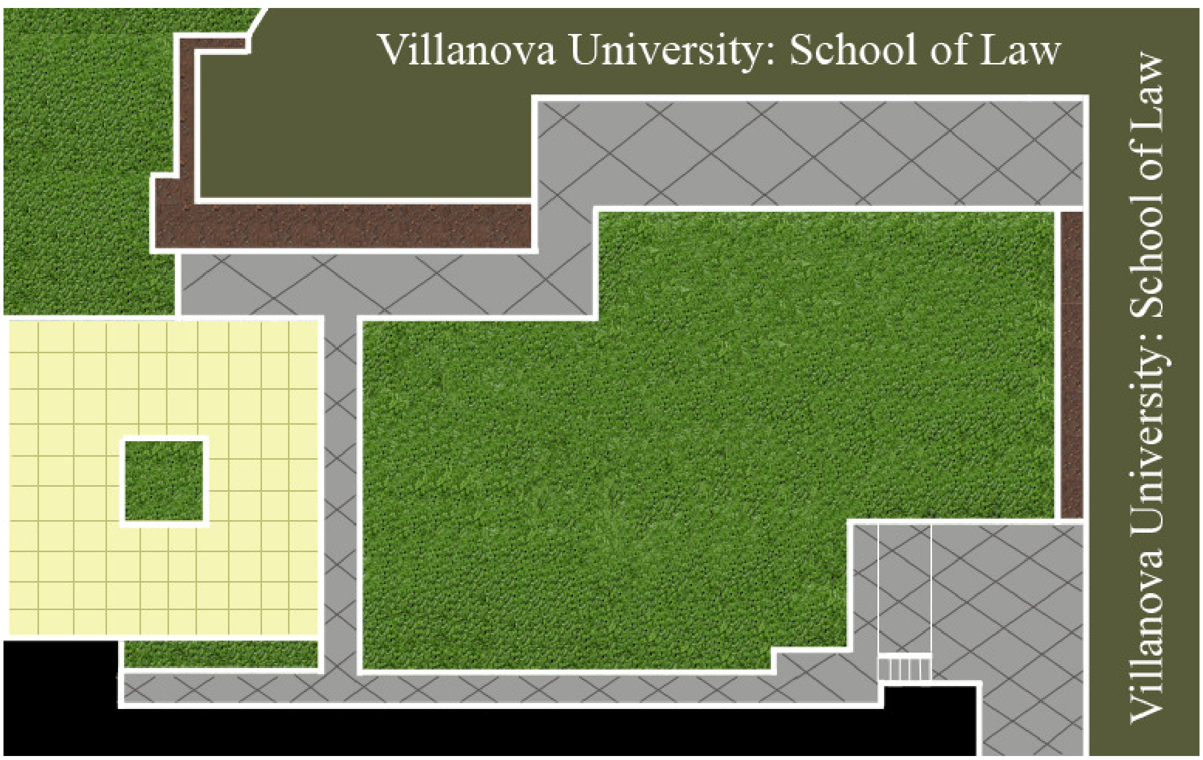


Figure 1.1.1 – School of Law Courtyard

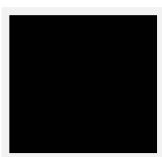
Architectural Finishes

Walkways

Unfinished Concrete
Gray
Reflectance: 35%

Unfinished Limestone
Tan
Reflectance: 35%

Building Façade

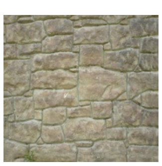


Mullions
Dark Gray
Reflectance: 10%

Brick
Beige
Reflectance: 39%

Brick
Red
Reflectance: 24%

Unfinished Limestone
Tan
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.

- <u>System Control and Flexibility (Important)</u>
  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

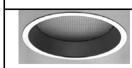
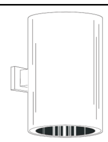
Image	Tag	Description	Volt	Manuf.	Cat. No.	Lamp		Mounting
						No.	Type	
	F2a	Recessed Downlight (Wet)	277	Zumtobel	S5D7704-U-7703L-C	2	26W CFL	Recessed
	H1	32” Full Cutoff Bollard	277	Erco	33353.023	1	70W MH	Surface
	H3	11” Cylinder Downlight	277	Gotham	CW11100MCAR277	1	100W MH	Wall
	H4	Landscape Flood	277	Allscape	Sl-51-20MH-PAR20-277-FLD-BK	1	20W MH	Tree
	H6	Surface Mount Projector	277	Lumiere	710MH39PAR20277WRBK	1	20W MH	Surface

Table 1.1.1 – Courtyard Luminaire Schedule
*See Appendix A for all ballast, and luminaire cut sheets.

Lighting Layout

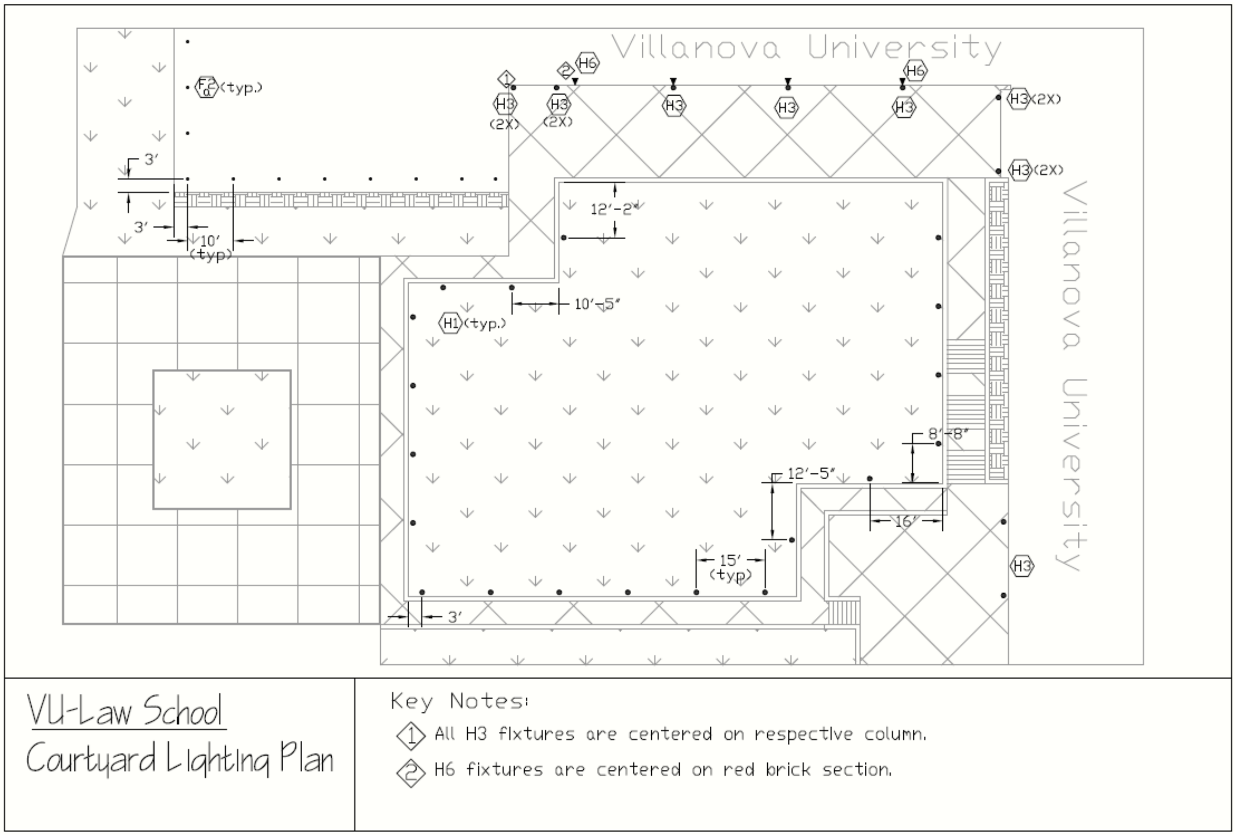


Figure 1.1.2 – Courtyard Lighting Plan
Full-size plan located in Appendix B

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
F2a	Recessed Downlight (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**
H3	11" Cylinder Downlight	Dirty	3 Years	0.77	0.67	1.00	**0.51**
H4	Landscape Flood	Dirty	3 Years	0.77	0.71	1.00	**0.55**
H6	Surface Landscape 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

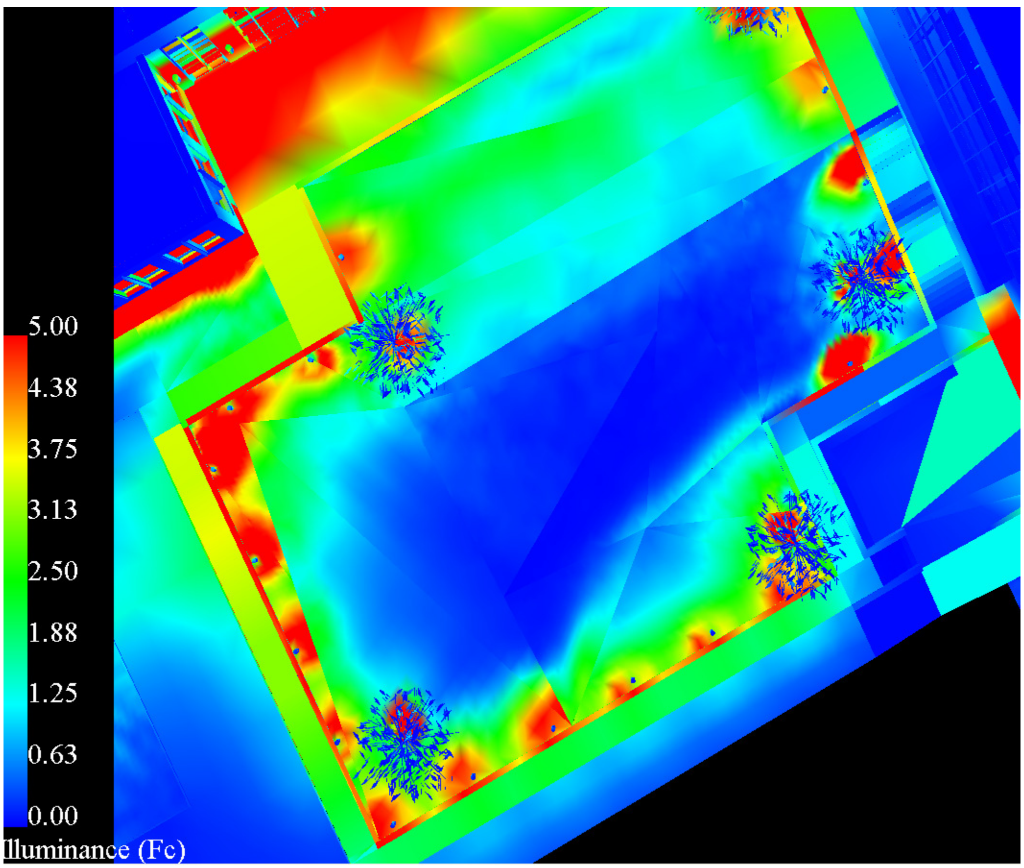


Image 1.1.1 – Courtyard Plan View Pseudo Color Rendering

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

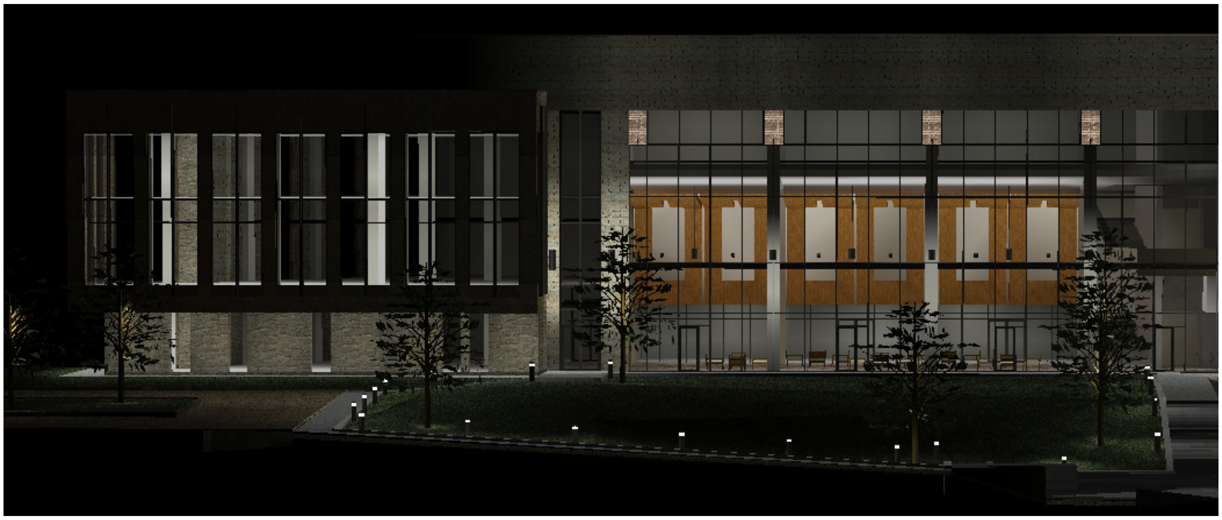


Image 1.1.2 – View from parking lot

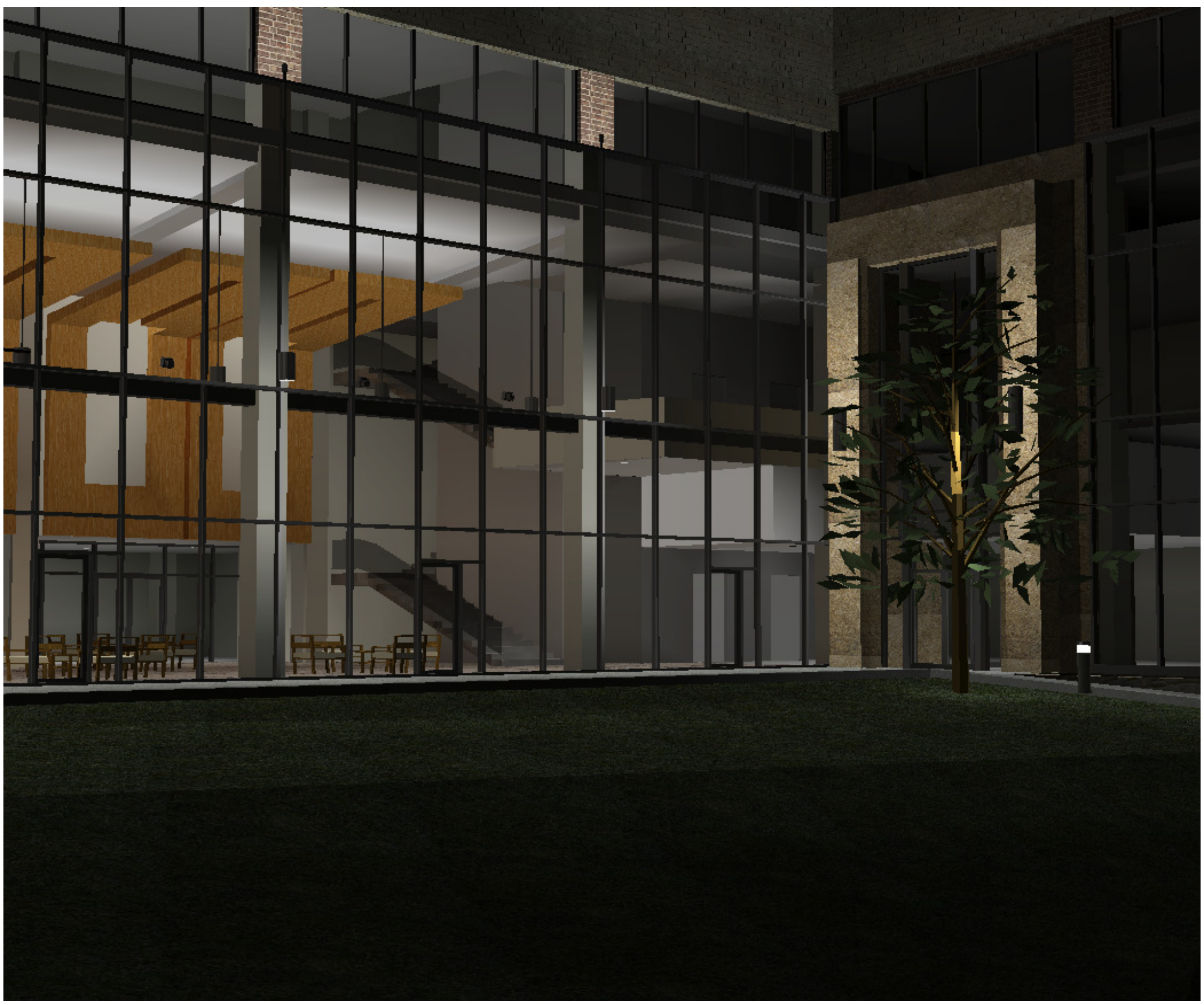


Image 1.1.3 – View from center of courtyard

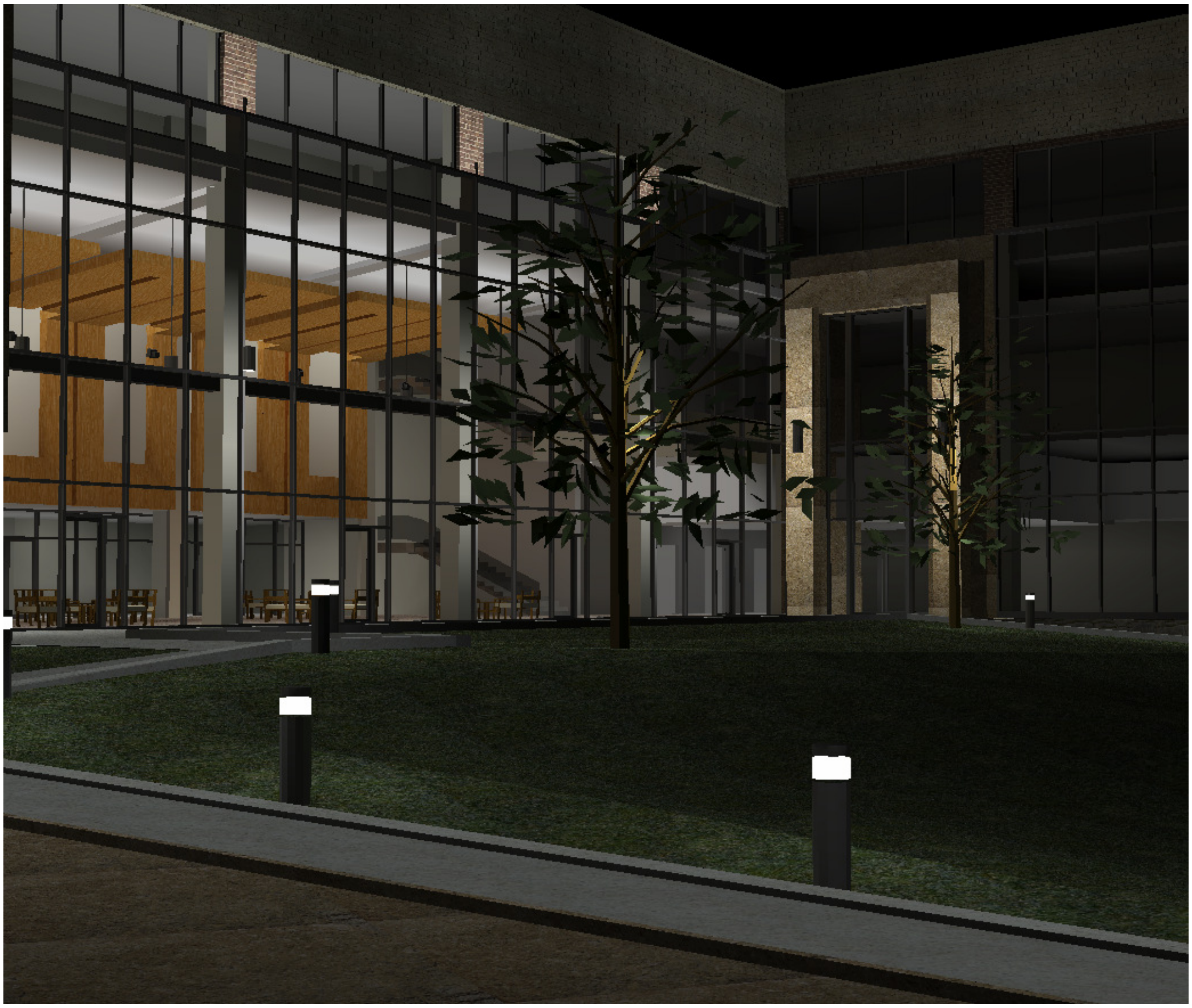


Figure 1.1.4 – View of entrance

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

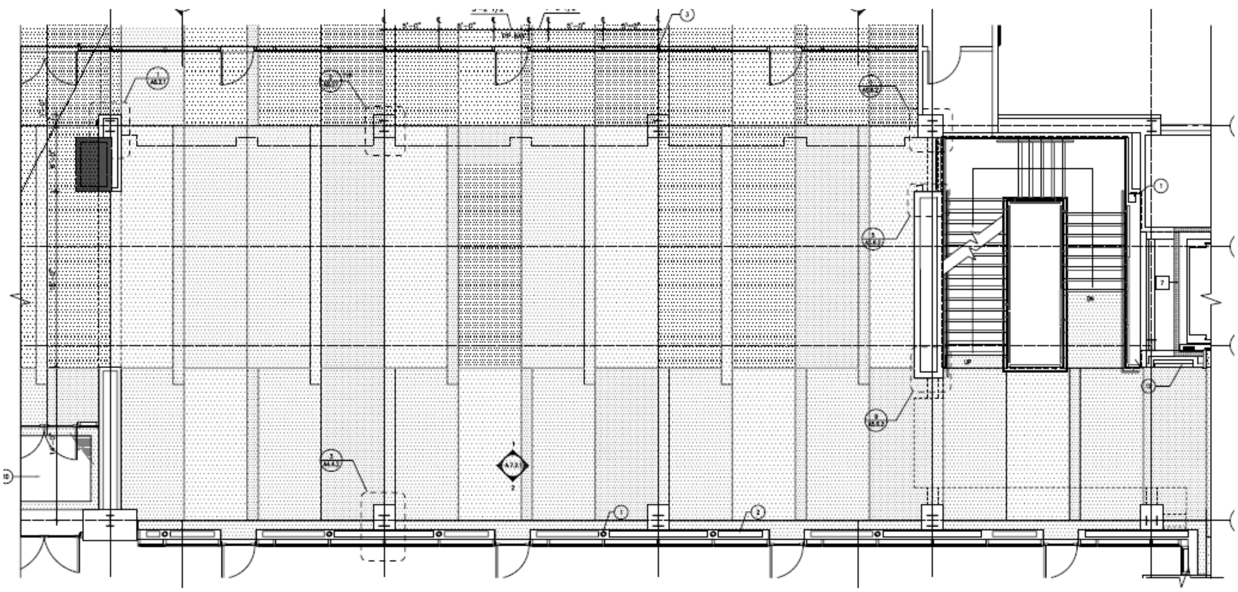


Figure 1.2.1 – Atrium Floor Plan (original floor design)

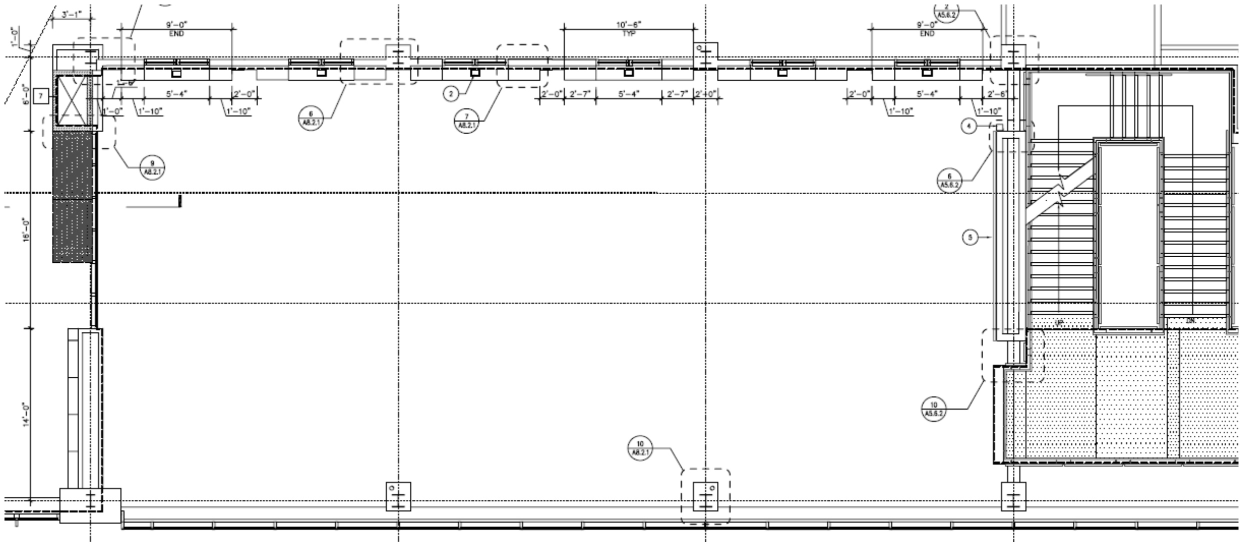


Figure 1.2.2 – Atrium Floor Plan

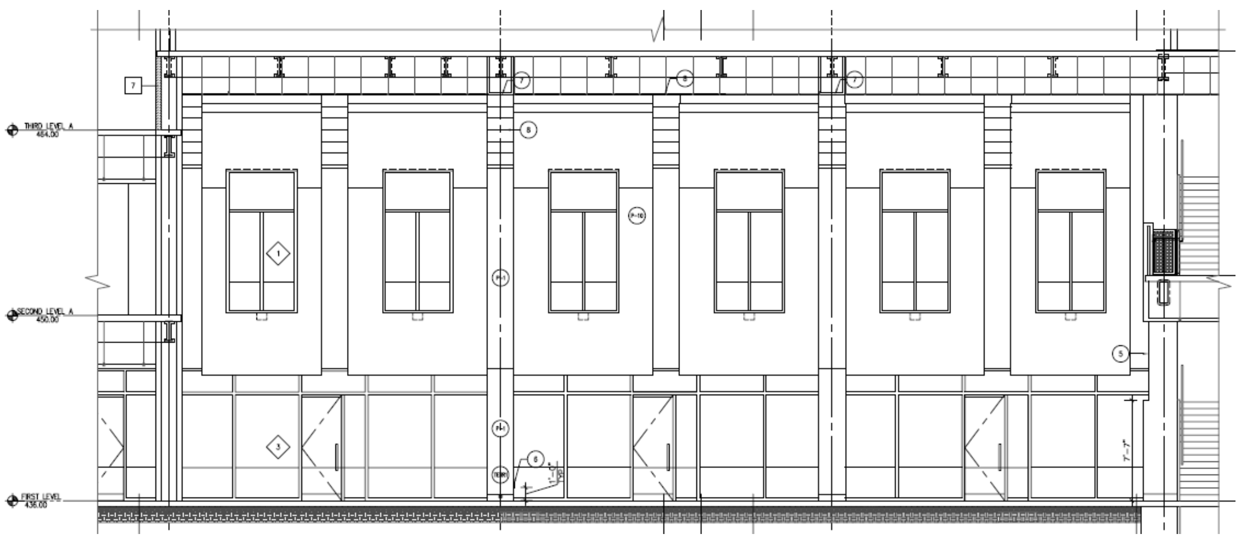


Figure 1.2.3 – Atrium North-West Elevation

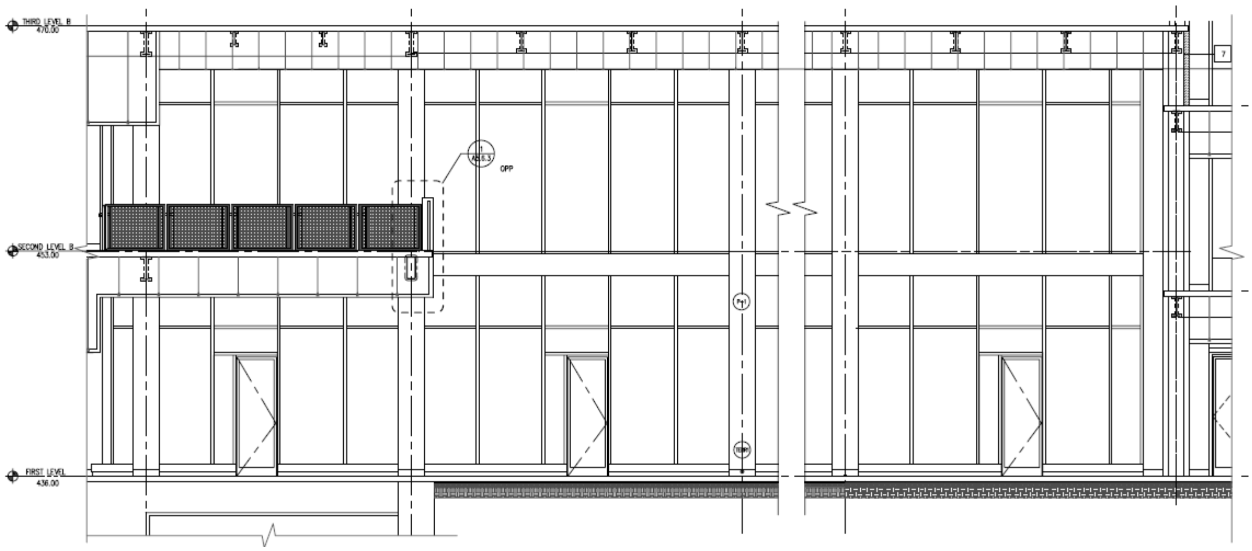
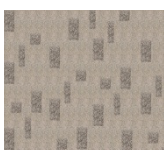


Figure 1.2.4 – Atrium South-East Elevation

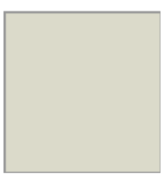
Architectural Finishes

Floor



Carpet
Beige/Gray
Reflectance: 37%

Walls

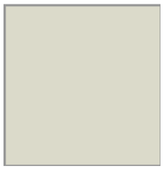


Painted Gyp Board
White
Finish: Matte
Reflectance: 95%

Painted Gyp Board
White
Finish: Matte
Reflectance: 82%

Wood Paneling
Light Stain
Reflectance: 42%

Ceiling



Painted Gyp Board
Heron White
Finish: Matte
Reflectance: 92%

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

- <u>Appearance of Space and Luminaires (Important)</u>
  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.

- <u>Color Appearance (Important)</u>
  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.

- <u>Daylighting Integration and Control (Important)</u>
  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

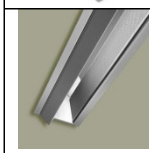
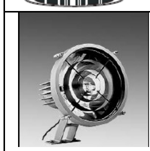
Image	Tag	Description	Volt	Manuf.	Cat. No.	Lamp		Mounting
						No.	Type	
	F2	Recessed Downlight	277	Zumtobel	S5D-U-6308R-C	1	32W CFL	Recessed
	F5	Cove Light	277	Lightolier	CL-1-4-T5-2	1	28W T5	Surface
	F8	Recessed Linear Fluorescent WW	277	Focal Point	FAVA-NS-1T5-1C-277-S-F	1	28W T5	Recessed
	H2	11” 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

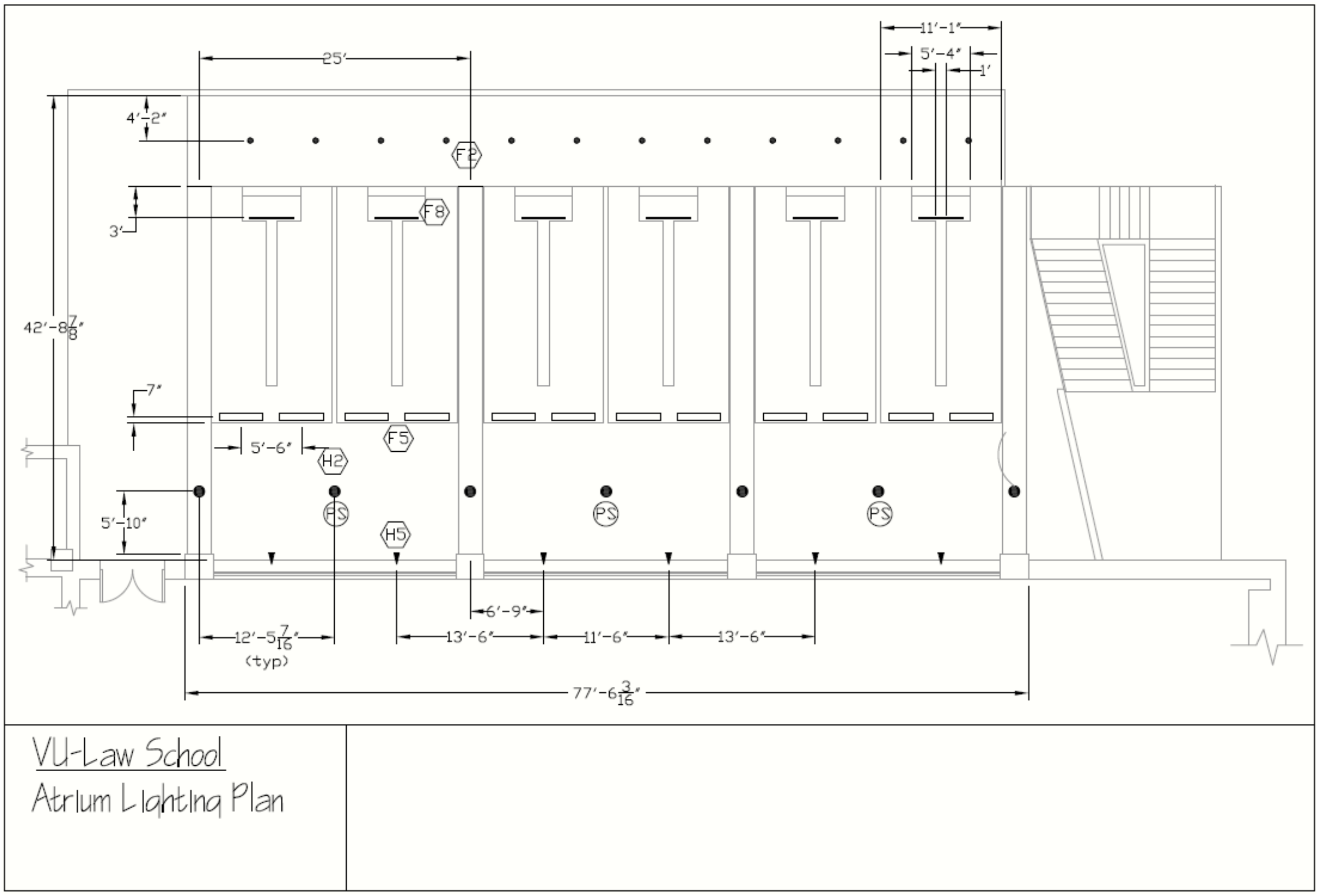


Figure 1.2.5 – Atrium Lighting Layout

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
F2	Recessed Downlight	VI	Direct	Clean	12 mos.	0.88	0.98	0.84	0.95	**0.69**
F5	Cove Light	V	Indirect	Clean	12 mos.	0.88	0.92	0.92	1.00	**0.74**
F8	Recessed Linear Fluorescent WW	V	Direct	Clean	12 mos.	0.88	0.97	0.92	1.00	**0.79**
H2	11" Cylinder Downlight	IV	Direct	Clean	12 mos.	0.88	0.97	0.72	1.00	**0.62**
H5	Surface Mount 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.

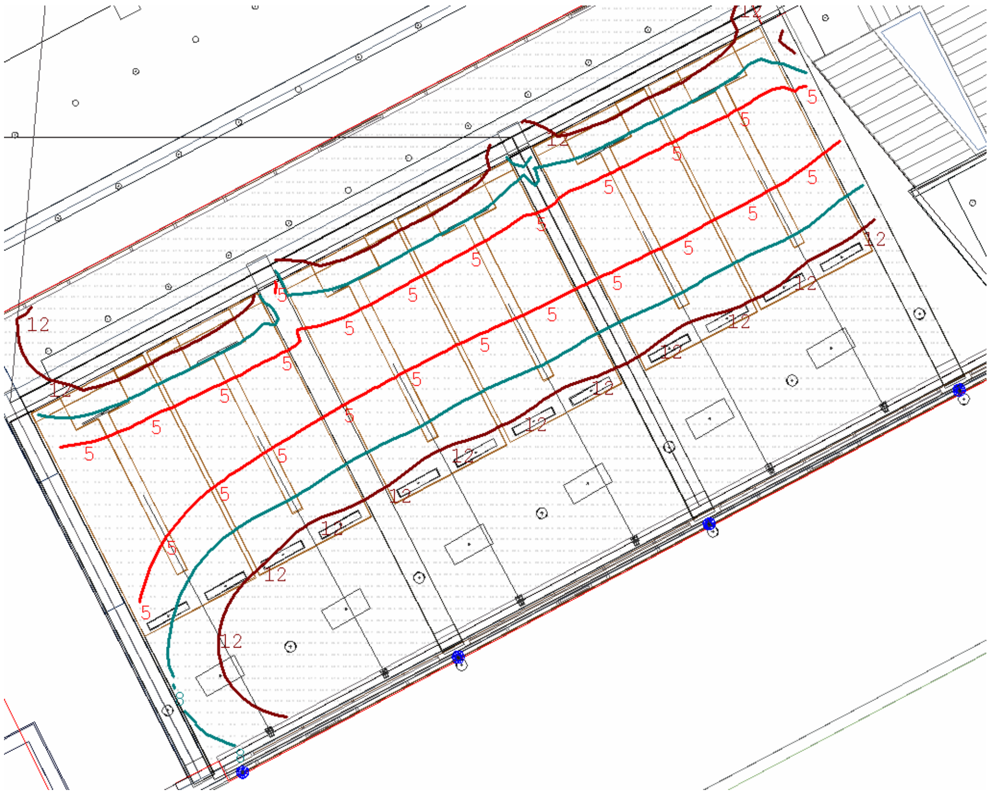


Figure 1.2.6 – Illuminance Contours

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

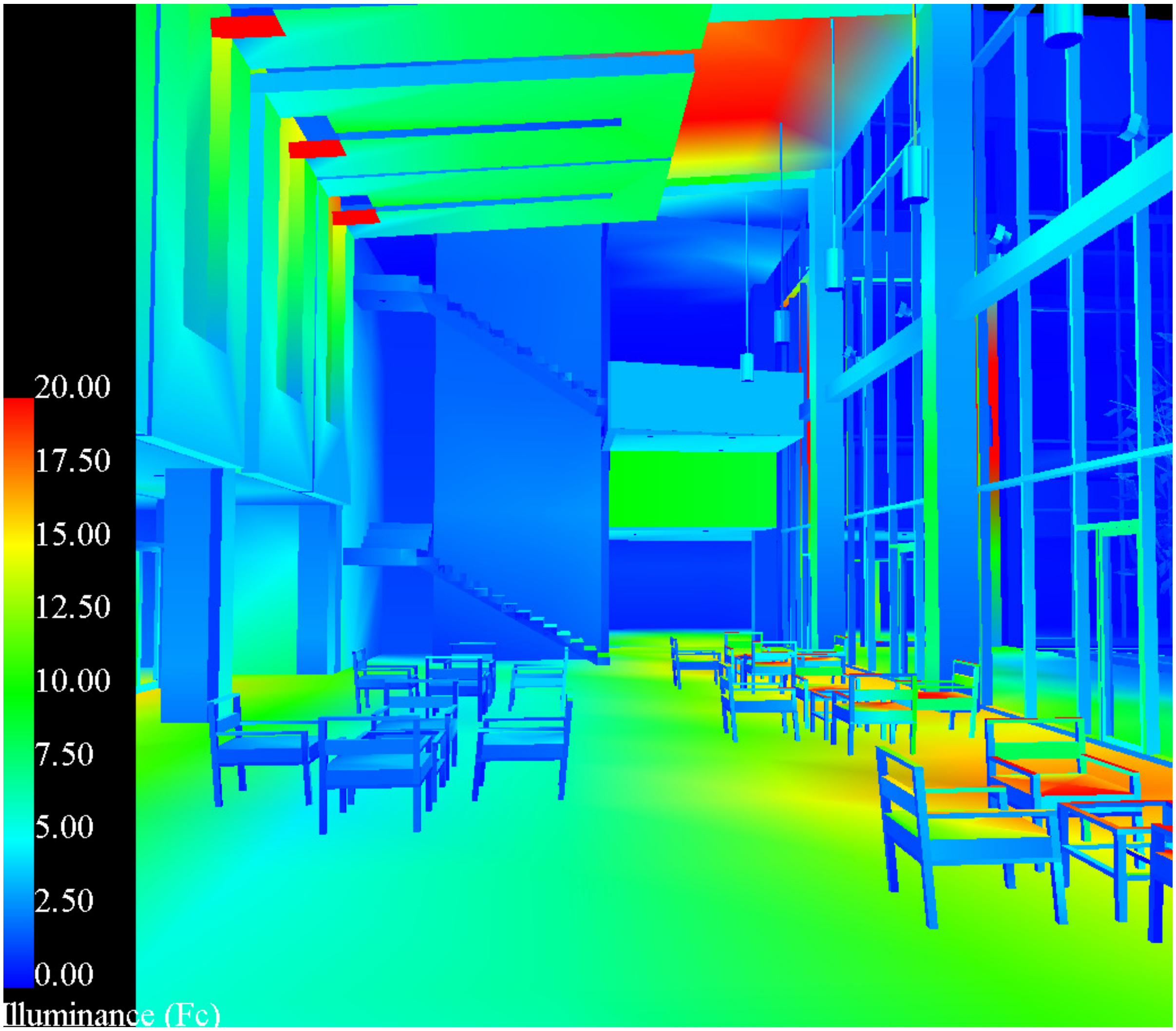


Image 1.2.1 – Atrium Pseudo Color Rendering

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

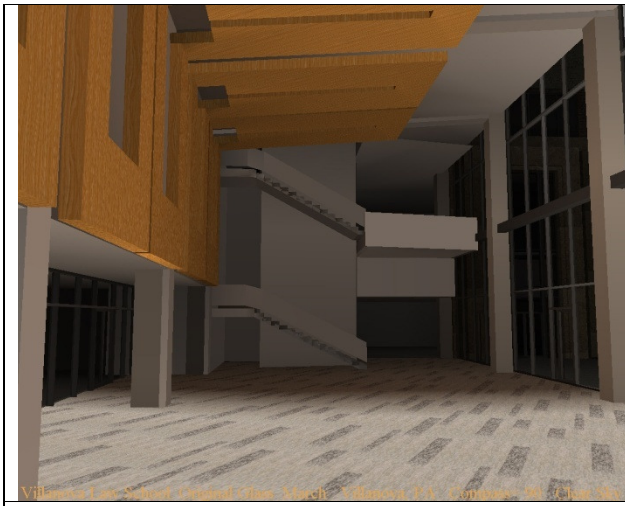
It will be seen later in this report that the glass in the atrium was studied as a way to reduce heating and cooling loads. After that was completed, it became clear that it was necessary to see how the new glazing would affect the direct daylight entering the space at various times of the year. The 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			ASHRAE U-Value				
Viracon No.	Description	Vis. Light	Solar Energy	Ultra-Violet	Vis. Light-Ext.	Vis. Light-Int.	Solar Energy	Winter Night	Summer Day	Shading Coeff.	Relative 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												
		Transmittance			Reflectance			ASHRAE U-Value				
Viracon No.	Description	Vis. Light	Solar Energy	Ultra-Violet	Vis. Light-Ext.	Vis. Light-Int.	Solar Energy	Winter Night	Summer Day	Shading Coeff.	Relative 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

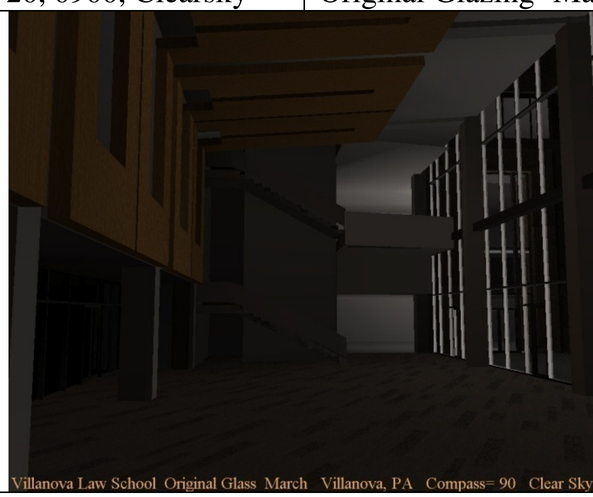
Table 1.3.1 – Atrium Glazing Comparison
*See Appendix E for Glazing Cutsheets

Original Glazing – March



Original Glazing- March 20, 0900, Clearsky

Original Glazing- March 20, 1200, Clearsky



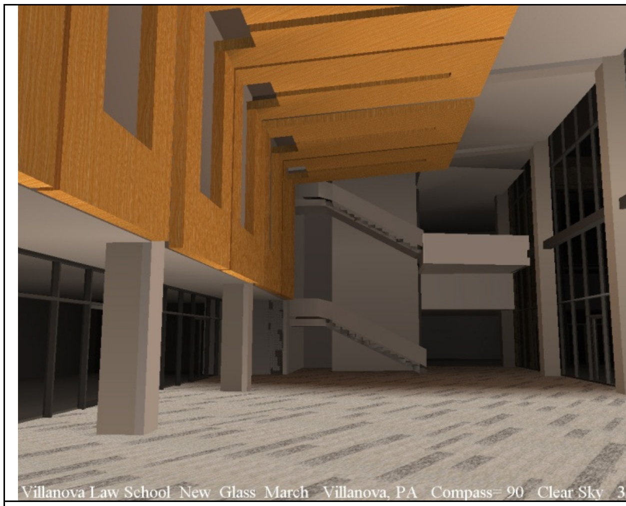
Original Glazing- March 20, 1500, Clearsky

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

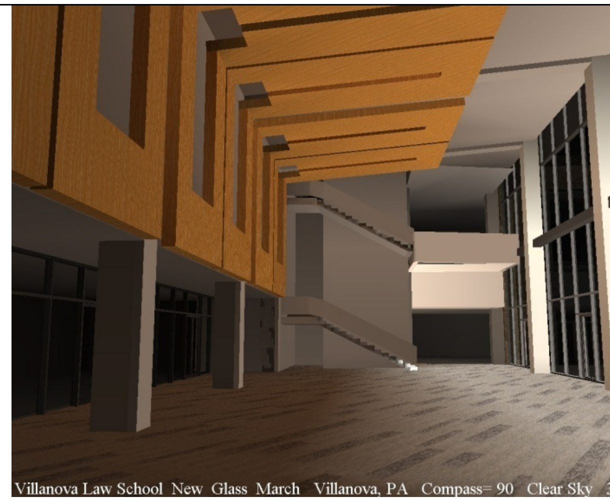
Original Glazing - March 20th Illuminance Data					
0900		1200		1500	
Average	663.73	Average	788.96	Average	36.92
Maximum	1952.00	Maximum	2845.00	Maximum	4639.00
Minimum	8.70	Minimum	8.20	Minimum	0.20
Avg/Min	76.29	Avg/Min	96.21	Avg/Min	184.60
Max/Min	224.32	Max/Min	346.93	Max/Min	23194.00

Table 1.3.2 – March Original Glazing Illuminance Data

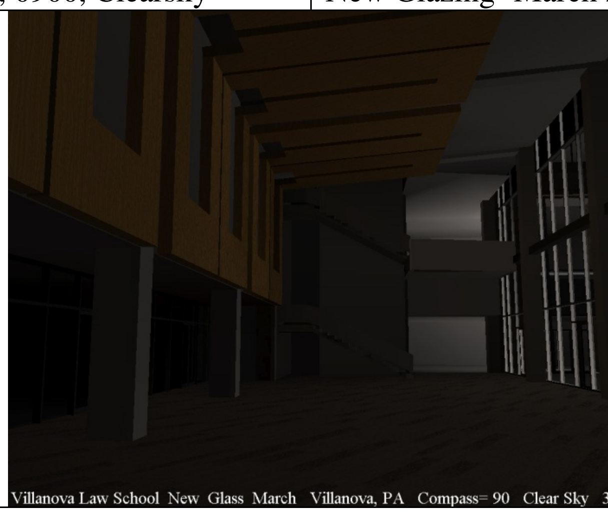
New Glazing – March



New Glazing- March 20, 0900, Clearsky



New Glazing- March 20, 1200, Clearsky



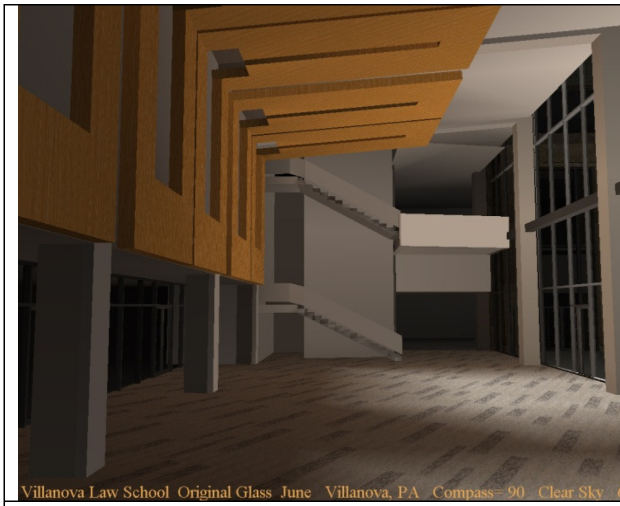
New Glazing- March 20, 1500, Clearsky

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

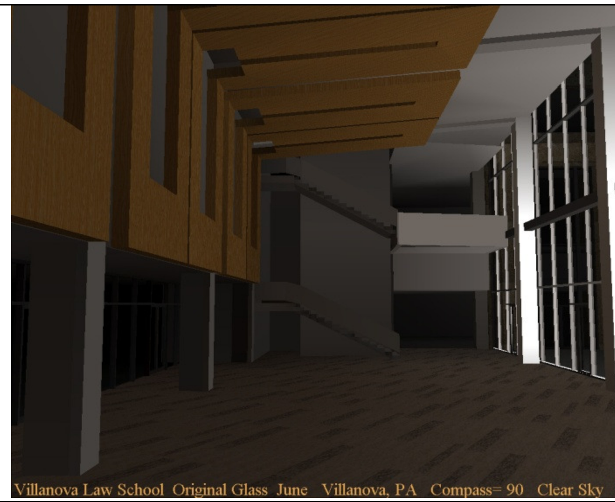
New Glazing - March 20th Illuminance Data					
0900		1200		1500	
Average	456.24	Average	506.98	Average	26.40
Maximum	1491.00	Maximum	2179.00	Maximum	4625.00
Minimum	6.50	Minimum	3.90	Minimum	0.10
Avg/Min	70.22	Avg/Min	129.99	Avg/Min	264.00
Max/Min	229.38	Max/Min	558.72	Max/Min	46248.00

Table 1.3.3 – March New Glazing Illuminance Data

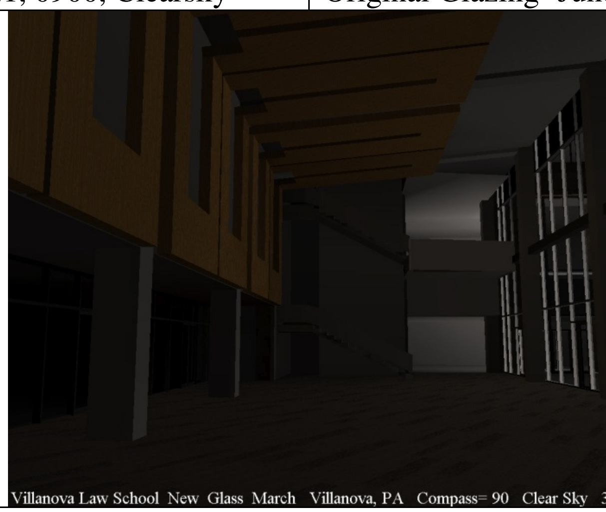
Original Glazing – June



Original Glazing- June 21, 0900, Clearsky



Original Glazing- June 21, 1200, Clearsky



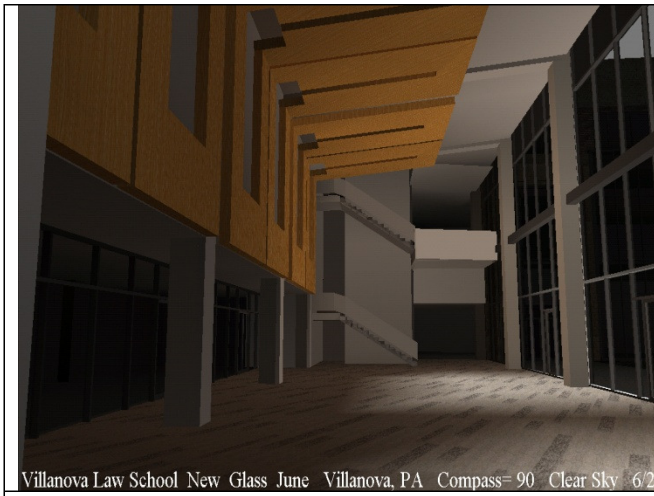
Original Glazing- June 21, 1500, Clearsky

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

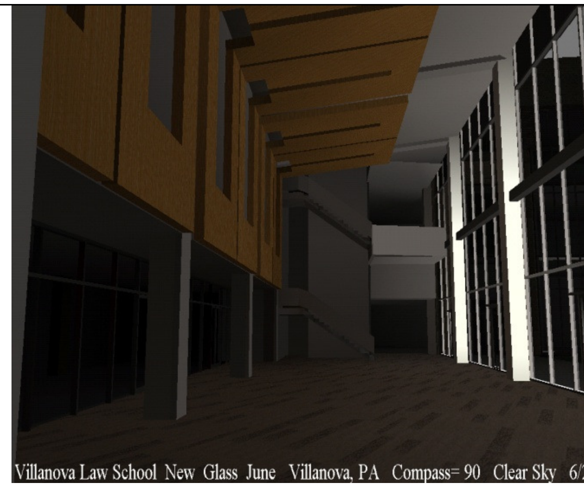
Original Glazing - June 21st Illuminance Data					
0900		1200		1500	
Average	296.00	Average	182.25	Average	30.29
Maximum	2432.00	Maximum	8884.00	Maximum	88.70
Minimum	0.60	Minimum	0.10	Minimum	0.10
Avg/Min	493.33	Avg/Min	1823.00	Avg/Min	302.90
Max/Min	4053.00	Max/Min	88839.00	Max/Min	887.00

Table 1.3.4 – June Original Glazing Illuminance Data

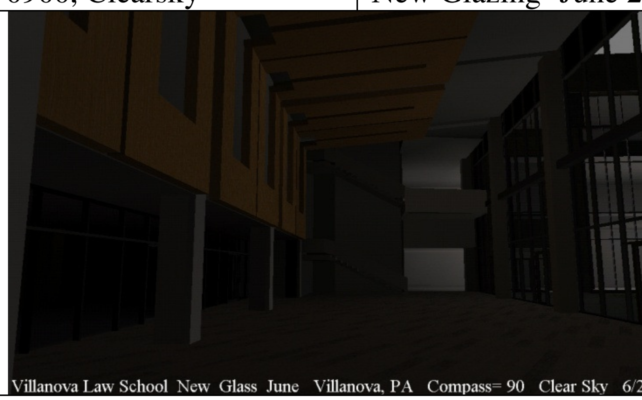
New Glazing – June



New Glazing- June 21, 0900, Clearsky



New Glazing- June 21, 1200, Clearsky



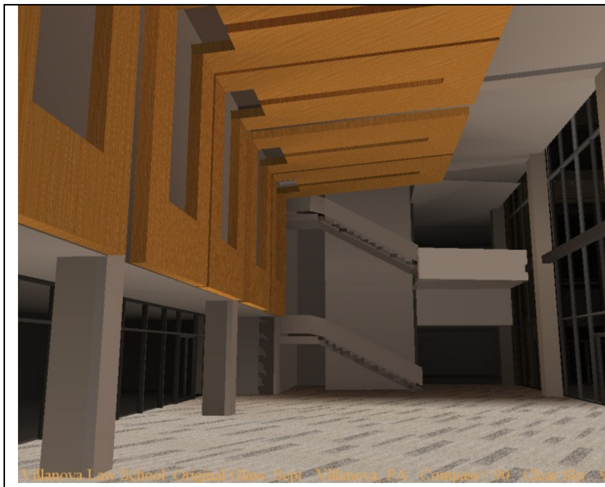
New Glazing- June 21, 1500, Clearsky

Images 1.3.10,11,12 – June 21st Daylighting w/ New Glazing

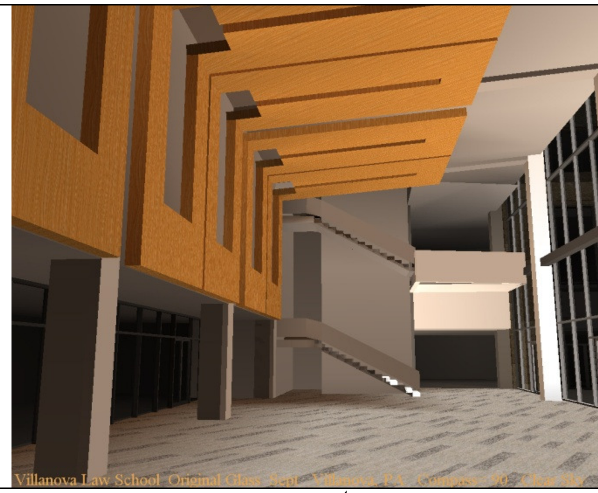
New Glazing - June 21st Illuminance Data					
0900		1200		1500	
Average	190.68	Average	105.35	Average	21.61
Maximum	1871.00	Maximum	8871.00	Maximum	68.20
Minimum	0.50	Minimum	0.10	Minimum	0.10
Avg/Min	381.36	Avg/Min	1054.00	Avg/Min	216.10
Max/Min	3743.00	Max/Min	88711.00	Max/Min	682.00

Table 1.3.5 – June New Glazing Illuminance Data

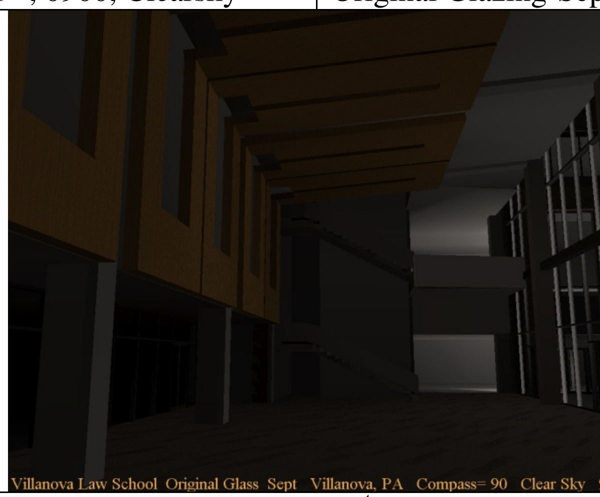
Original Glazing – September



Original Glazing-Sept 21st , 0900, Clearsky



Original Glazing-Sept 21st, 1200, Clearsky



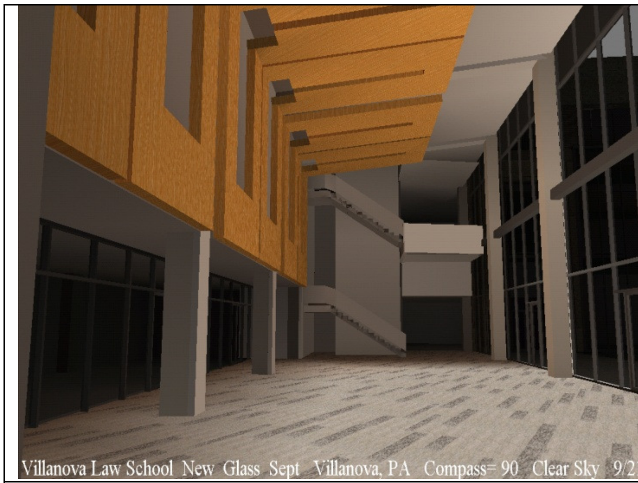
Original Glazing-Sept 21st, 1500, Clearsky

Images 1.3.13,14,15 – September 21st Daylighting w/ Original Glazing

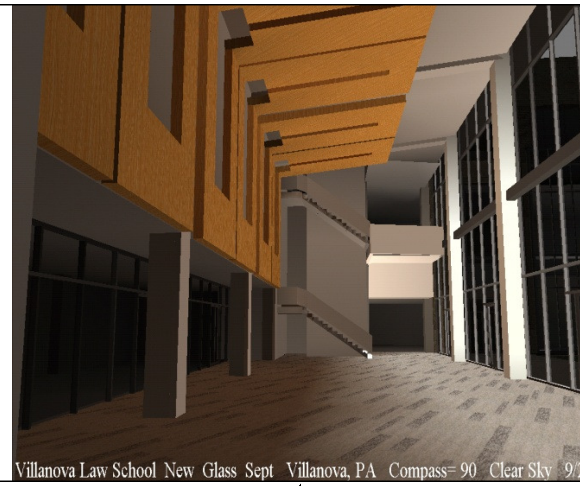
Original Glazing - September 21st Illuminance Data					
0900		1200		1500	
Average	794.90	Average	682.48	Average	33.54
Maximum	2052.00	Maximum	2856.00	Maximum	4209.00
Minimum	24.70	Minimum	6.60	Minimum	0.10
Avg/Min	32.18	Avg/Min	103.41	Avg/Min	335.40
Max/Min	83.06	Max/Min	432.67	Max/Min	42085.00

Table 1.3.6 – September Original Glazing Illuminance Data

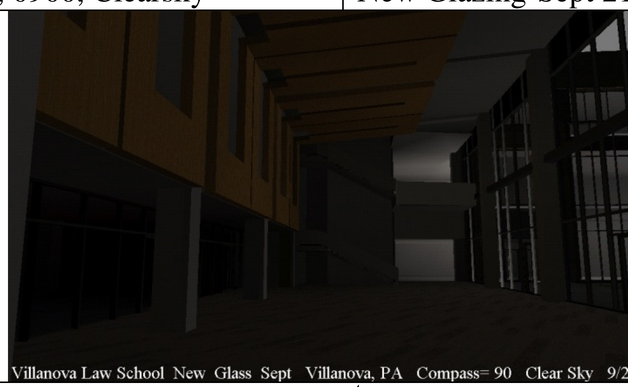
New Glazing – September



New Glazing-Sept 21st , 0900, Clearsky



New Glazing-Sept 21st, 1200, Clearsky



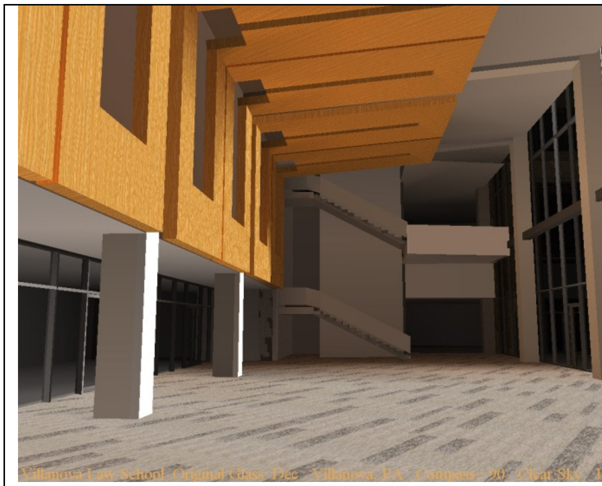
New Glazing-Sept 21st, 1500, Clearsky

Images 1.3.16,17,18 – September 21st Daylighting w/ New Glazing

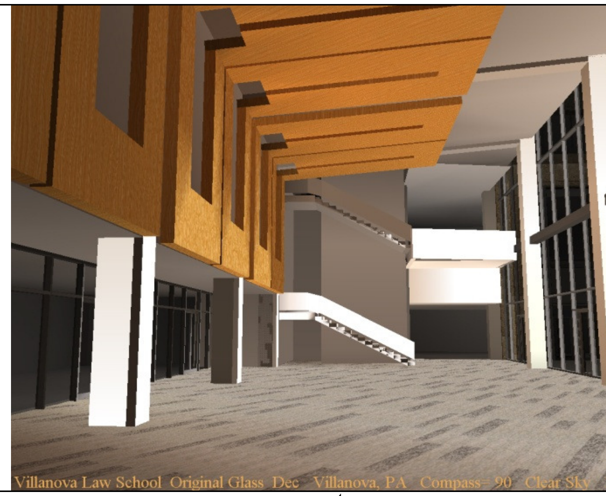
New Glazing - September 21st Illuminance Data					
0900		1200		1500	
Average	526.58	Average	442.46	Average	24.41
Maximum	1562.00	Maximum	2193.00	Maximum	4202.00
Minimum	3.20	Minimum	3.80	Minimum	0.10
Avg/Min	164.56	Avg/Min	116.44	Avg/Min	244.10
Max/Min	488.09	Max/Min	577.05	Max/Min	42022.00

Table 1.3.7 – September New Glazing Illuminance Data

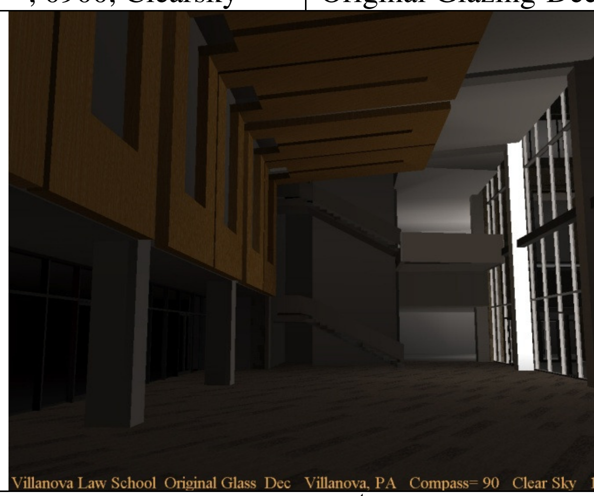
Original Glazing – December



Original Glazing-Dec 21st , 0900, Clearsky



Original Glazing-Dec 21st, 1200, Clearsky



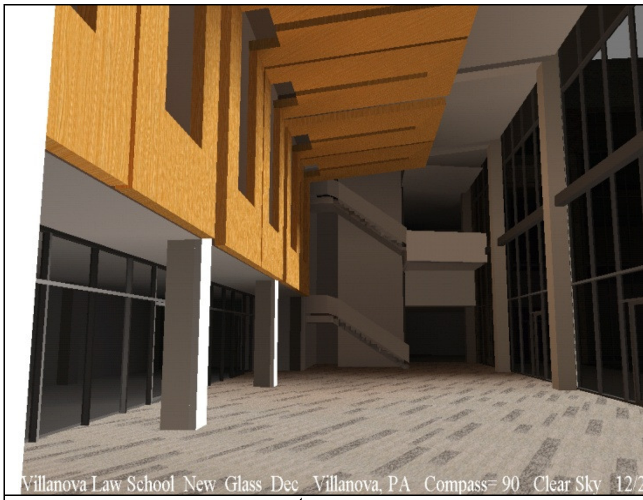
Original Glazing-Dec 21st, 1500, Clearsky

Images 1.3.19,20,21 – December 21st Daylighting w/ Original Glazing

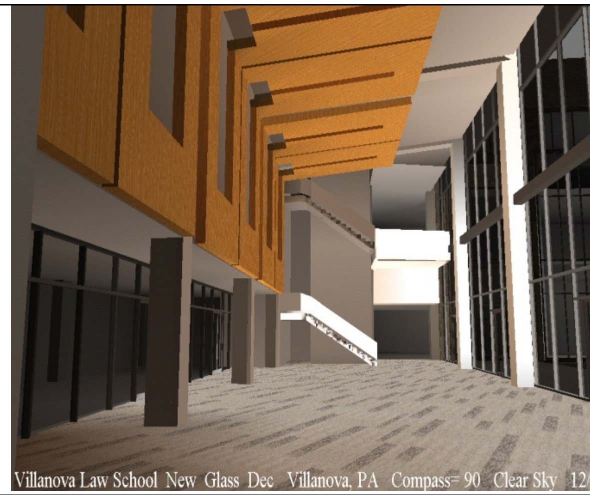
Original Glazing - December 21st Illuminance Data					
0900		1200		1500	
Average	382.62	Average	766.31	Average	38.70
Maximum	818.00	Maximum	1725.00	Maximum	506.00
Minimum	10.00	Minimum	25.20	Minimum	0.20
Avg/Min	38.26	Avg/Min	30.41	Avg/Min	193.50
Max/Min	81.76	Max/Min	68.47	Max/Min	2530.00

Table 1.3.8 – December Original Glazing Illuminance Data

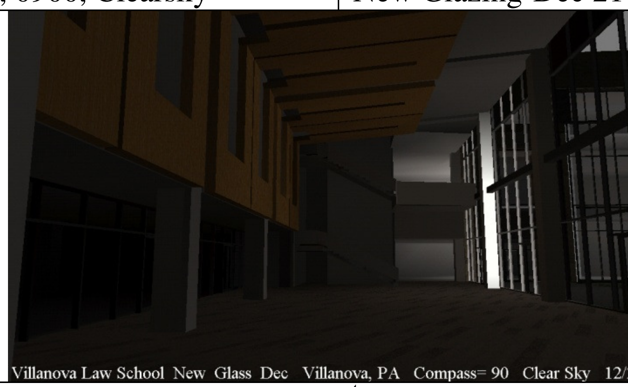
New Glazing – December



New Glazing-Dec 21st , 0900, Clearsky



New Glazing-Dec 21st, 1200, Clearsky



New Glazing-Dec 21st, 1500, Clearsky

Images 1.3.19,20,21 – December 21st Daylighting w/ New Glazing

New Glazing - December 21st Illuminance Data					
0900		1200		1500	
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

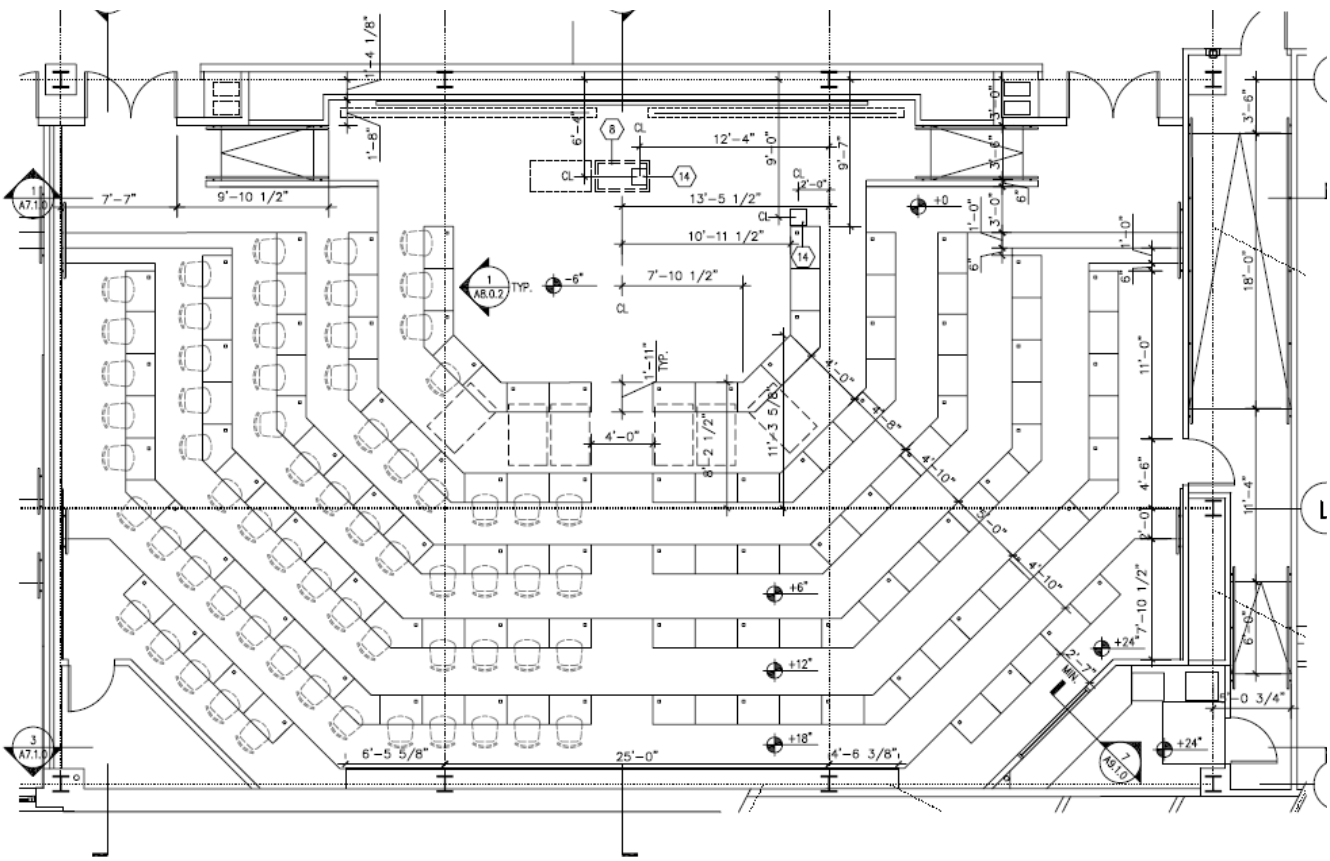


Figure 1.4.1 – 135-Seat Classroom Floor Plan

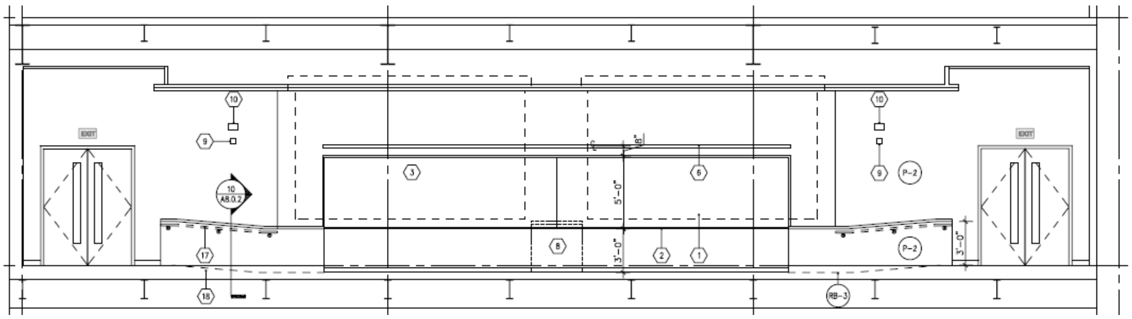


Figure 1.4.2 – 135-Seat Classroom Front Elevation/Section

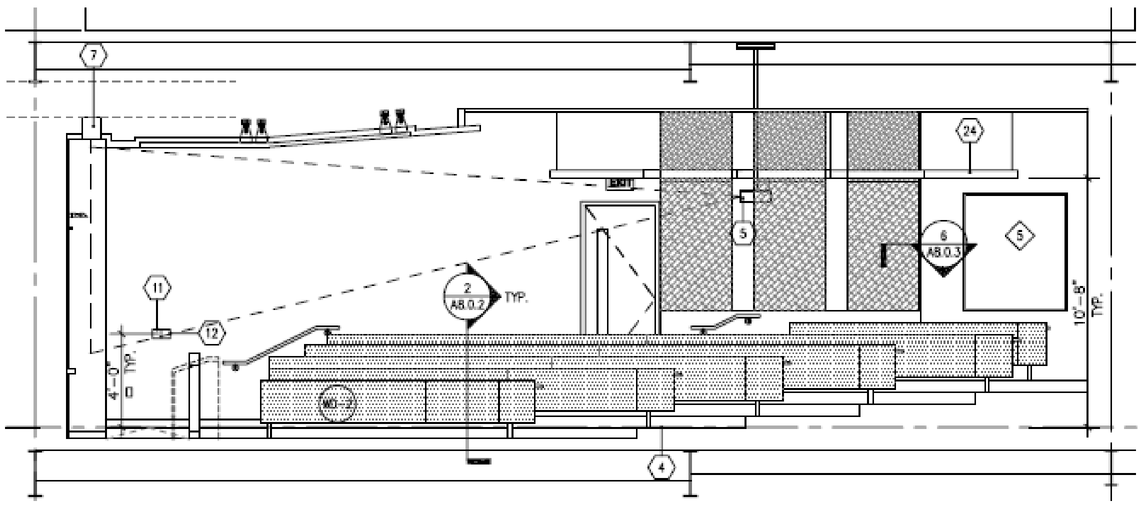


Figure 1.4.3 – 135-Seat Classroom North Elevation/Section

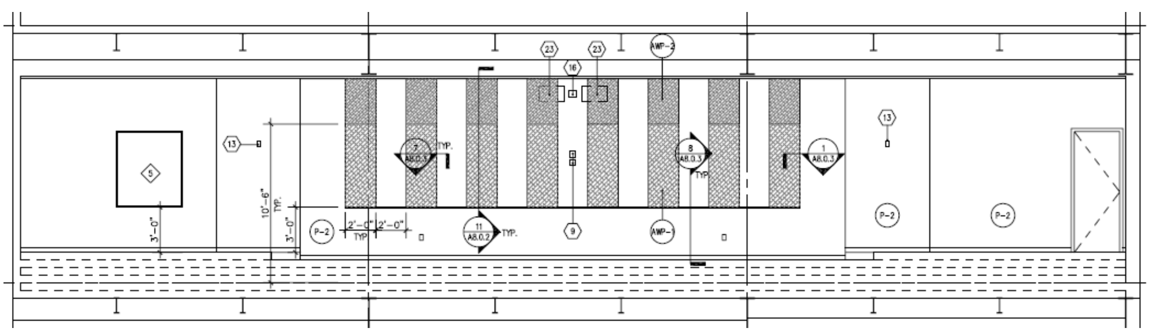


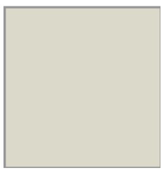
Figure 1.4.4 – 135-Seat Classroom Back Elevation/Section

Architectural Finishes

Floor

Carpet
Blue/Gray
Reflectance: 33%

Walls



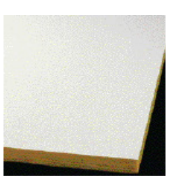
Painted Gyp Board
Heron White
Finish: Matte
Reflectance: 85%

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.

- Direct Glare (Very Important)
  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.

- Light Distribution on Surfaces (Important)
  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.

- Uniform Light Distribution on Task Plane (Important)
  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

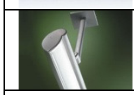
Image	Tag	Description	Volt	Manuf.	Cat. No.	Lamp		Mounting
						No.	Type	
	F1	Direct/Indirect Pendant	277	Zumtobel	AQ-2545-4-T-DS-U-C1	2	28W T5	Pendant
	F2	Recessed Downlight	277	Zumtobel	S5D-U-6308R-C	1	32W CFL	Recessed
	F3	Recessed Downlight WW	277	Zumtobel	S5D-U-7309HW-C	1	42W CFL	Recessed
	F4	Board 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

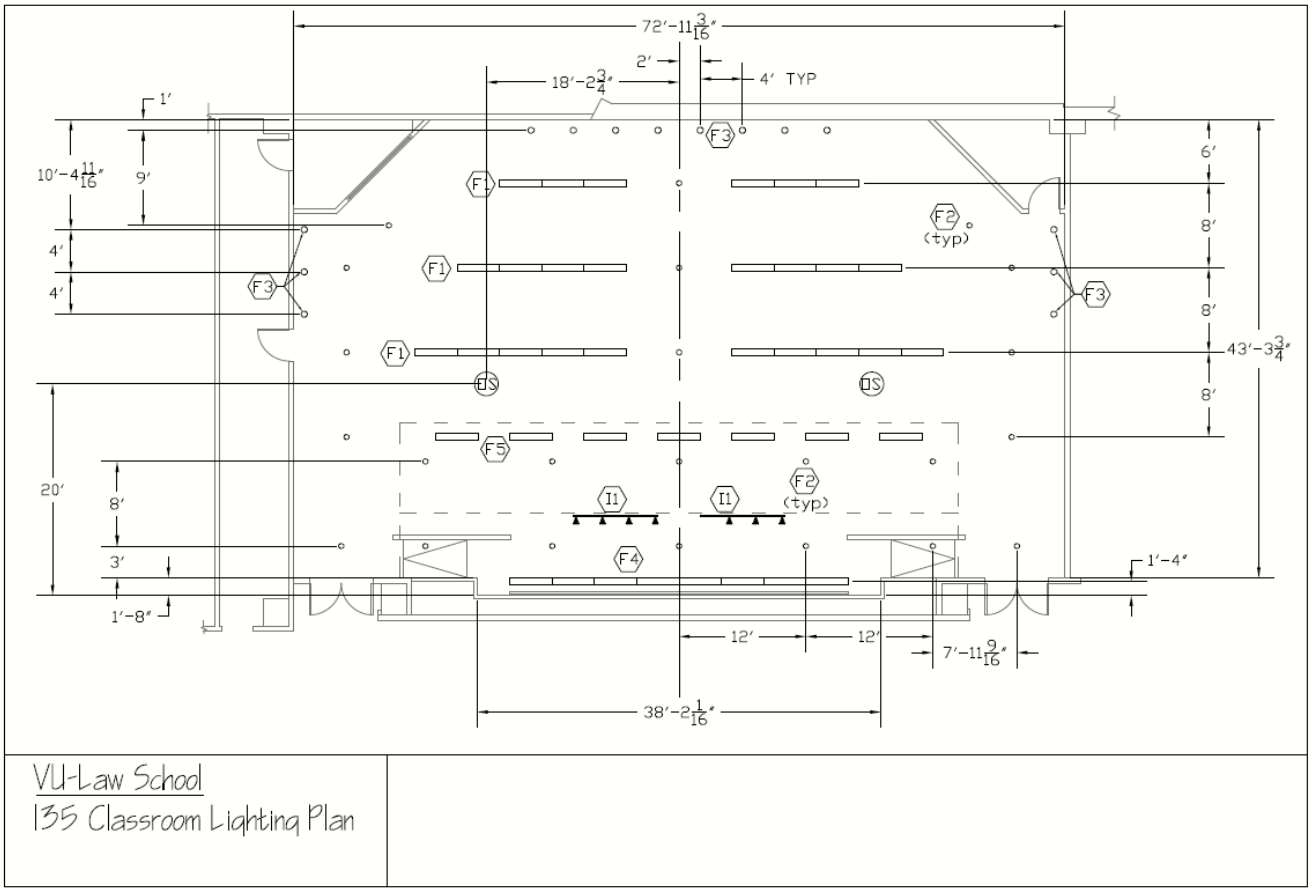


Figure 1.4.5 – 135-Seat Classroom Lighting Plan

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 Lighting	VI	Semi-Indirect	Clean	12 mos.	0.85	0.92	0.92	1.00	**0.72**
F2	Recessed Downlight	IV	Direct	Clean	12 mos.	0.88	0.98	0.84	0.95	**0.69**
F3	Recessed Downlight WW	IV	Direct	Clean	12 mos.	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
I1	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.

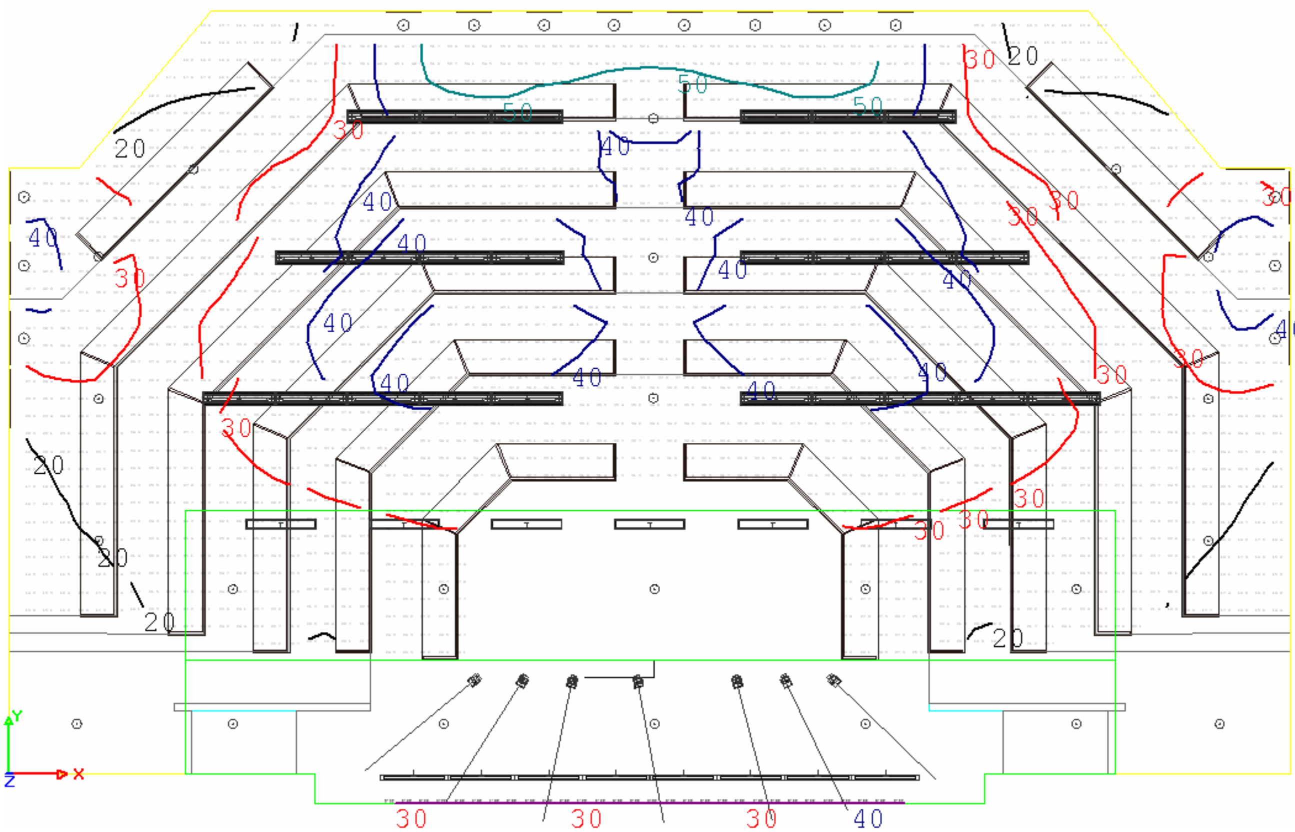


Figure 1.4.6 – 135-Seat Classroom Illuminance Contours

135-Seat Classroom Illuminance Data (fc)	
Desks: Row 1	
Average	32.32
Max	38.90
Min	24.30
Avg/Min	1.33
Max/Min	1.60

Table 1.4.4 – Classroom Row 1 Illum. Data

135-Seat Classroom Illuminance Data (fc)	
Desks: Row 2	
Average	36.00
Max	45.30
Min	19.50
Avg/Min	1.85
Max/Min	2.32

Table 1.4.5 – Classroom Row 2 Illum. Data

135-Seat Classroom Illuminance Data (fc)	
Desks: Row 3	
Average	36.18
Max	46.80
Min	20.20
Avg/Min	1.79
Max/Min	2.32

Table 1.4.6 – Classroom Row 3 Illum. Data

135-Seat Classroom Illuminance Data (fc)	
Desks: Row 4	
Average	33.94
Max	45.80
Min	19.10
Avg/Min	1.78
Max/Min	2.40

Table 1.4.7 – Classroom Row 4 Illum. Data

135-Seat Classroom Illuminance Data (fc)	
Desks: Row 5	
Average	32.79
Max	55.00
Min	13.90
Avg/Min	2.36
Max/Min	3.96

Table 1.4.8 – Classroom Row 5 Illum. Data

135-Seat Classroom Illuminance Data (fc)	
Desks: Row 6	
Average	26.62
Max	45.50
Min	13.60
Avg/Min	1.96
Max/Min	3.35

Table 1.4.9 – Classroom Row 6 Illum. Data

135-Seat Classroom Illuminance Data (fc)	
White Board	
Average	47.65
Max	100.00
Min	21.00
Avg/Min	2.27
Max/Min	4.84

Table 1.4.10 – Classroom White Board Illum. Data

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

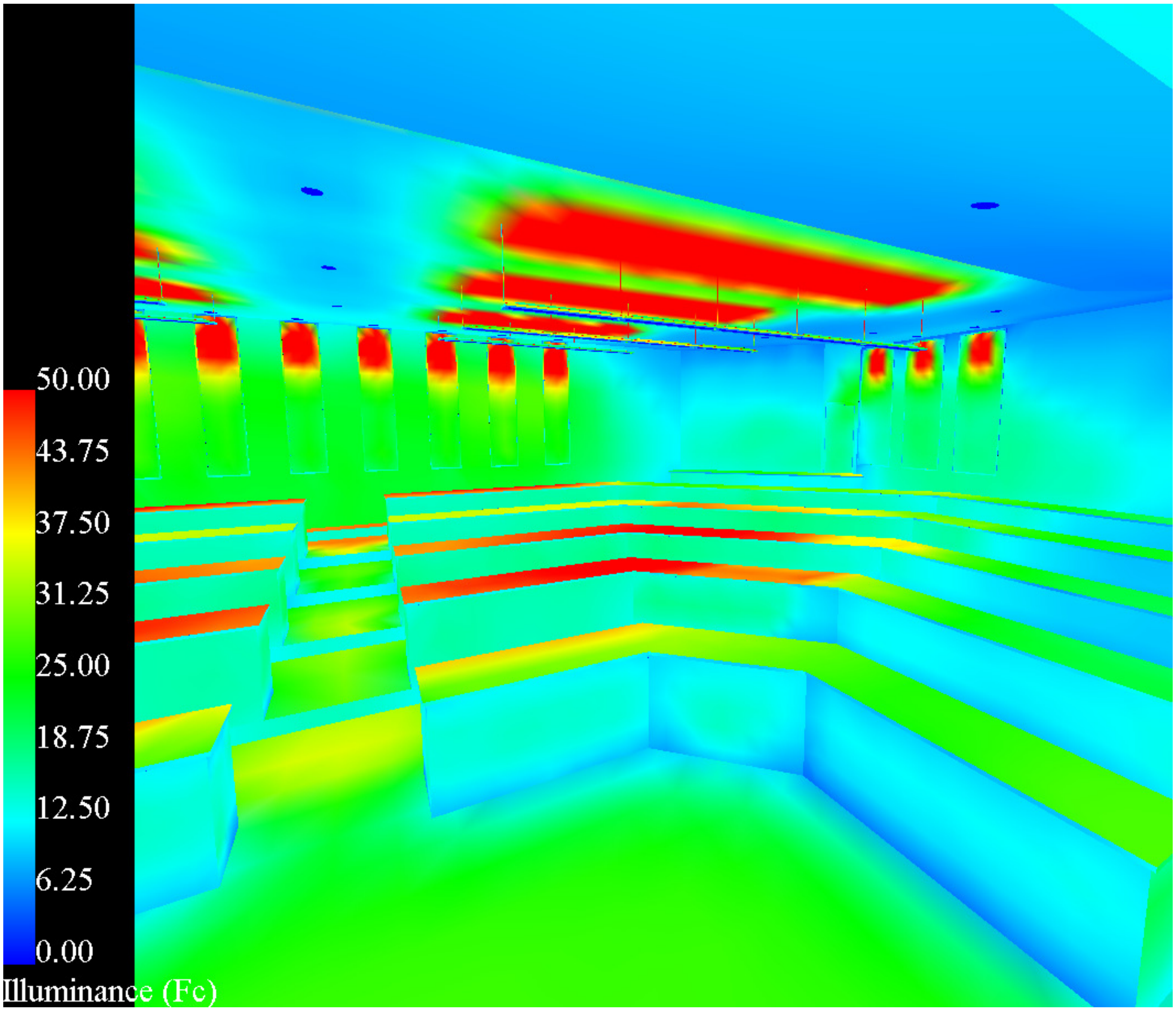


Image 1.4.1 – 135-Seat Classroom Pseudo Color Rendering


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

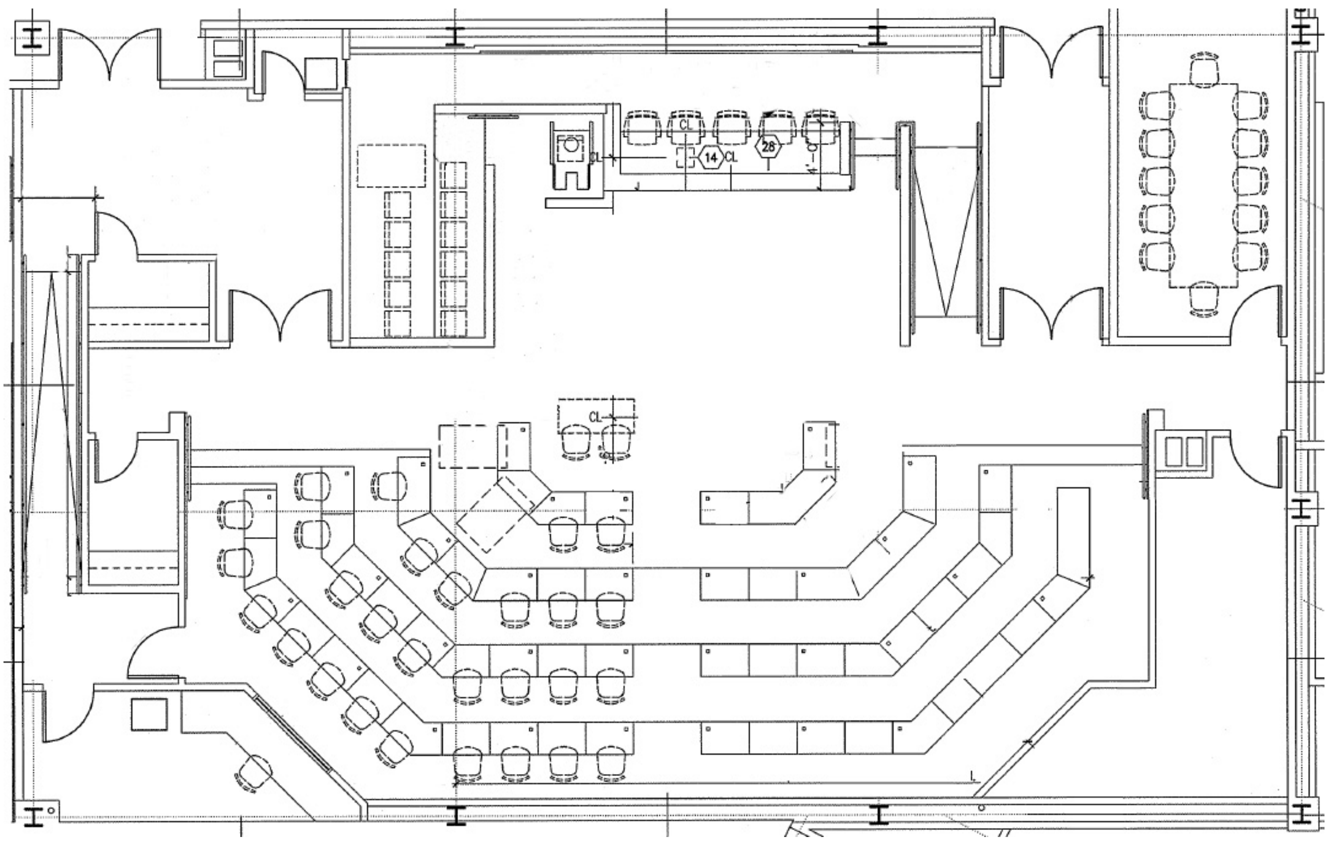


Figure 1.5.1 – Moot Court Floor Plan

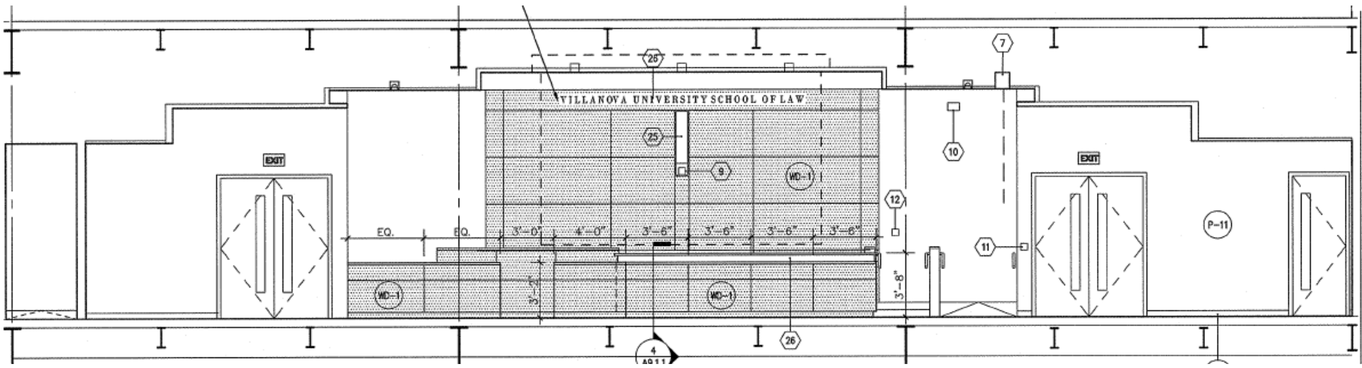


Figure 1.5.2 – Moot Court Front Elevation/Section

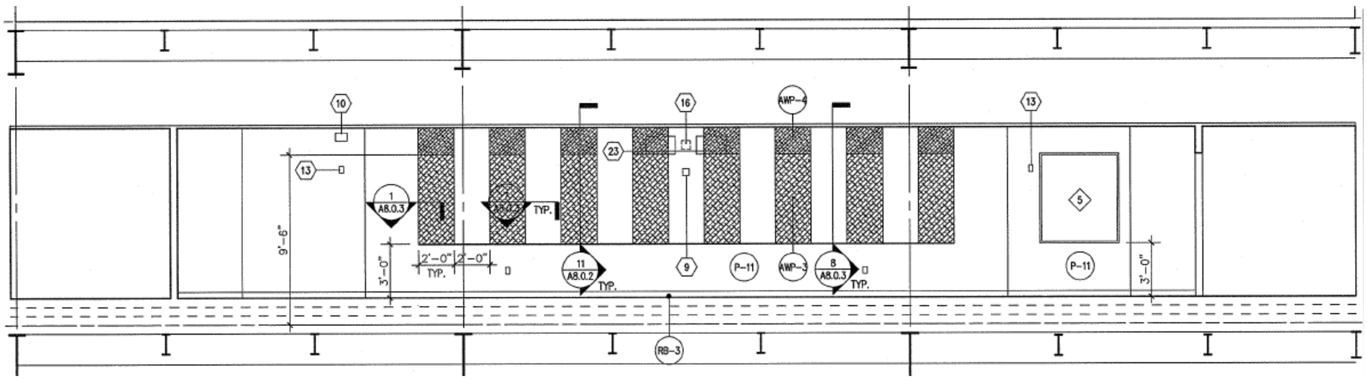


Figure 1.5.3 – Moot Court Rear Elevation/Section

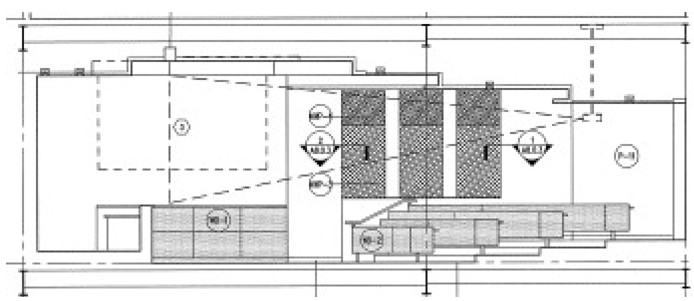


Figure 1.5.4 – Moot Court North Elevation/Section

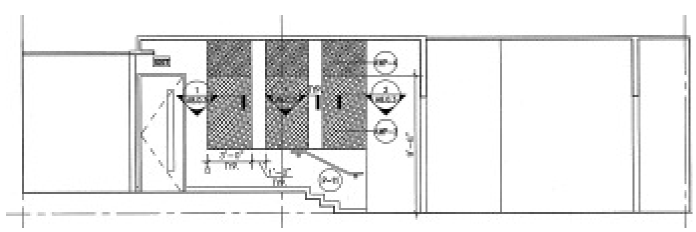


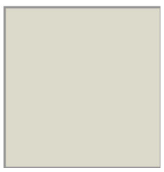
Figure 1.5.5 – Moot Court South Elevation

Architectural Finishes

Floor

Carpet
Blue/Gray
Reflectance: 33%

Walls



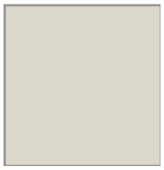
Painted Gyp Board
Heron White
Finish: Matte
Reflectance: 85%

Acoustical Fabric
Tan
Reflectance: 54%

Wood Framing
Dark Stain
Reflectance: 14%

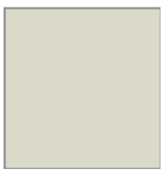
Wood Paneling
Dark Stain
Reflectance: 14%

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

- <u>Appearance of Space and Luminaires (Very Important)</u>
  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.

- <u>Color Appearance (Very Important)</u>
  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.

- Direct Glare (Important)
  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.

- Uniform Light Distribution on Task Plane (Important)
  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

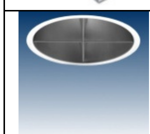
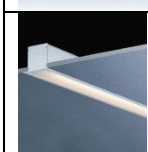
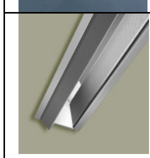
Image	Tag	Description	Volt	Manuf.	Cat. No.	Lamp		Mounting
						No.	Type	
	F1	Direct/Indirect Pendant	277	Zumtobel	AQ-2545-4-T-DS-U-C1	2	28W T5	Pendant
	F3	Recessed Downlight WW	277	Zumtobel	S5D-U-7309HW-C	1	42W CFL	Recessed
	F5	Cove Light	277	Lightolier	CL-1-4-T5-2	1	28W T5	Surface
	F6	Recessed Parabolic 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

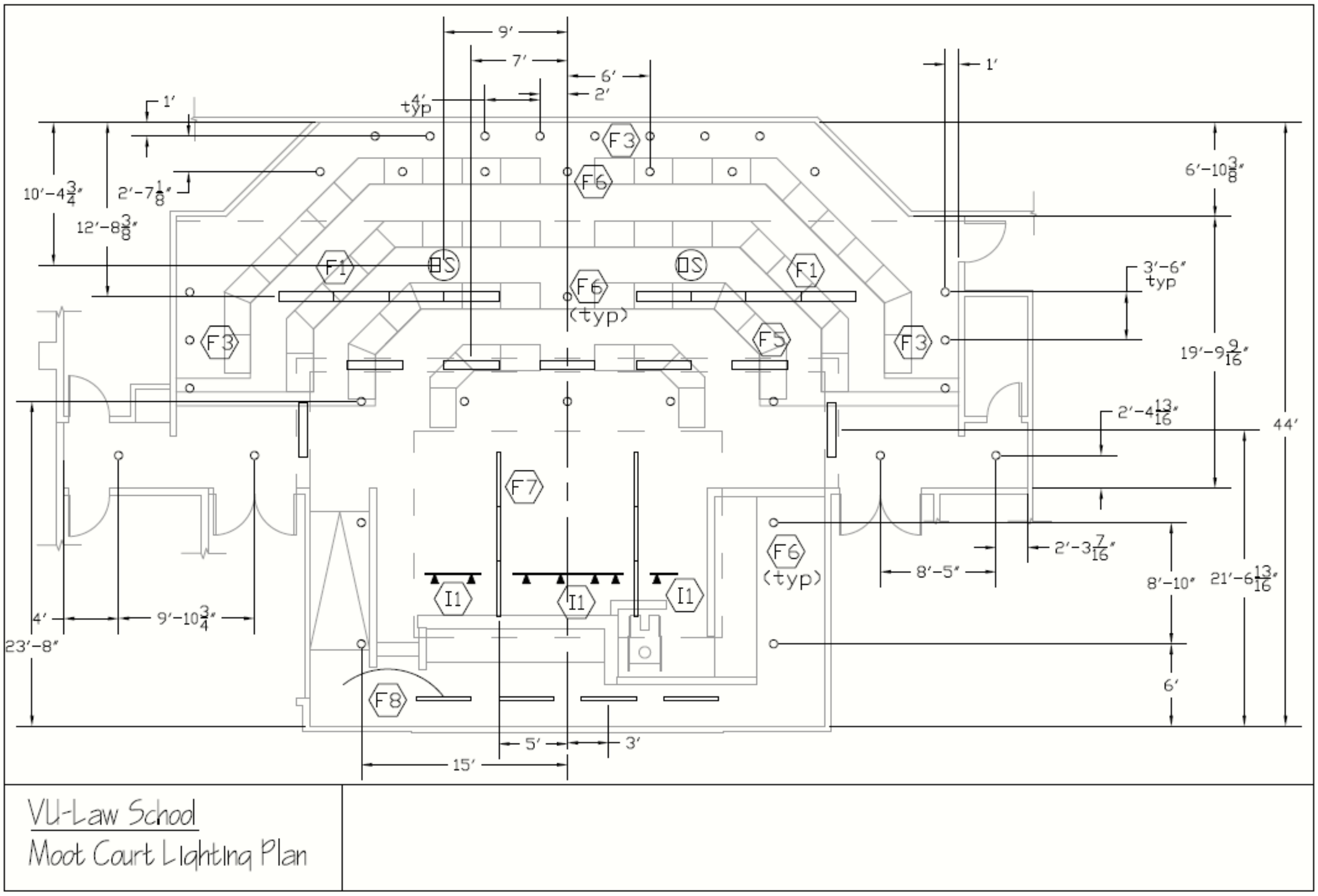


Figure 1.5.6 – Moot Court Lighting Plan

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 Pendant	VI	Semi-indirect	Clean	12 mos.	0.85	0.92	0.92	1.00	**0.72**
F3	Recessed Downlight WW	IV	Direct	Clean	12 mos.	0.88	0.98	0.84	0.95	**0.69**
F5	Cove Light	V	Indirect	Clean	12 mos.	0.88	0.92	0.92	1.00	**0.74**
F6	Recessed Parabolic Downlight	IV	Direct	Clean	12 mos.	0.88	0.98	0.81	0.95	**0.66**
F7	Recessed Linear Fluorescent	V	Direct	Clean	12 mos.	0.88	0.97	0.92	1.00	**0.79**
F8	Recessed Linear Fluorescent WW	V	Direct	Clean	12 mos.	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
I1	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.

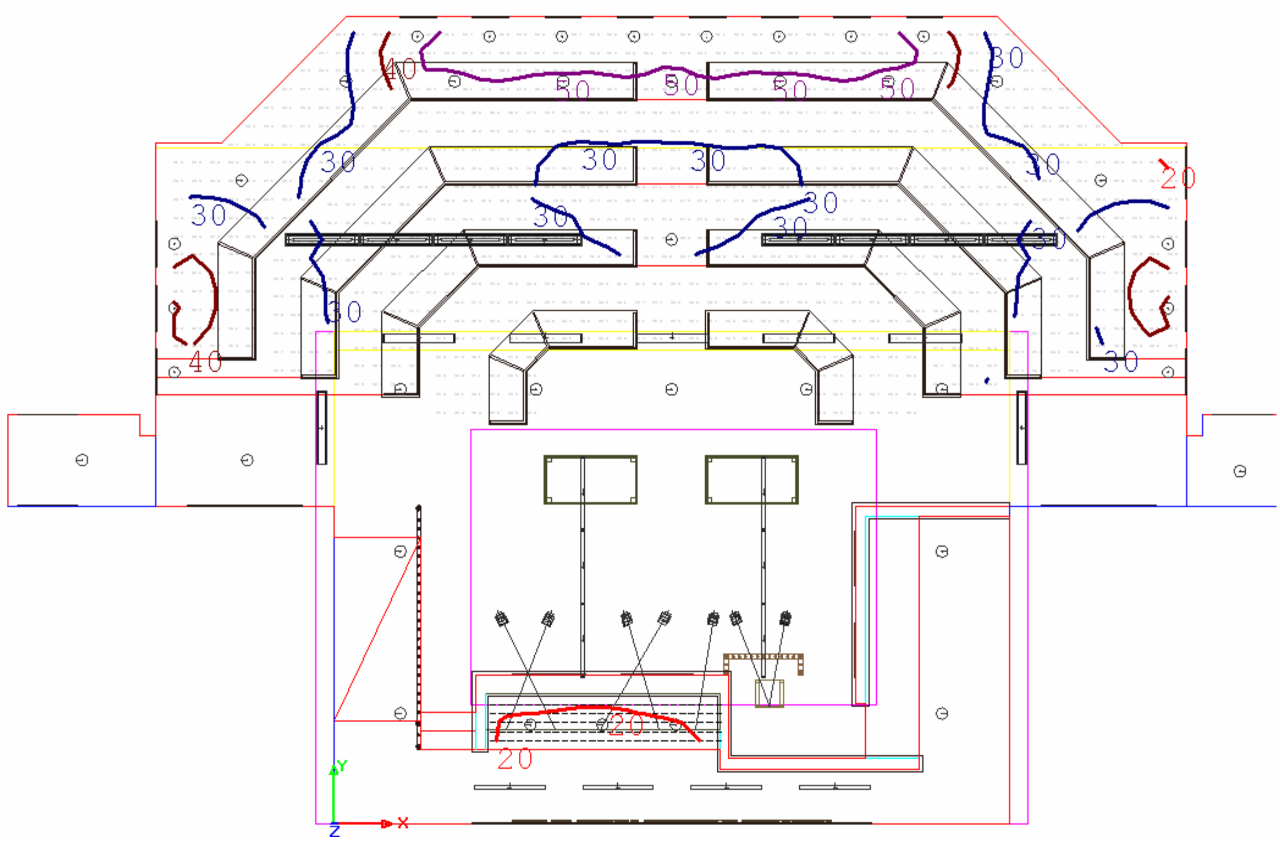


Figure 1.5.7 – Moot Court Illuminance Contours

Moot Court Illuminance Data (fc)	
Desks: Row 1	
Average	36.01
Max	39.10
Min	31.80
Avg/Min	1.13
Max/Min	1.23

Table 1.5.4 – Moot Court Row 1 Illum. Data

Moot Court Illuminance Data (fc)	
Desks: Row 2	
Average	32.72
Max	38.90
Min	26.50
Avg/Min	1.23
Max/Min	1.47

Table 1.5.5 – Moot Court Row 2 Illum. Data

Moot Court Illuminance Data (fc)	
Desks: Row 3	
Average	31.32
Max	38.40
Min	23.10
Avg/Min	1.36
Max/Min	1.66

Table 1.5.6 – Moot Court Row 3 Illum. Data

Moot Court Illuminance Data (fc)	
Desks: Row 4	
Average	37.81
Max	56.00
Min	18.90
Avg/Min	2.00
Max/Min	2.96

Table 1.5.7 – Moot Court Row 4 Illum. Data

Moot Court Illuminance Data (fc)	
Judges' Bench	
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

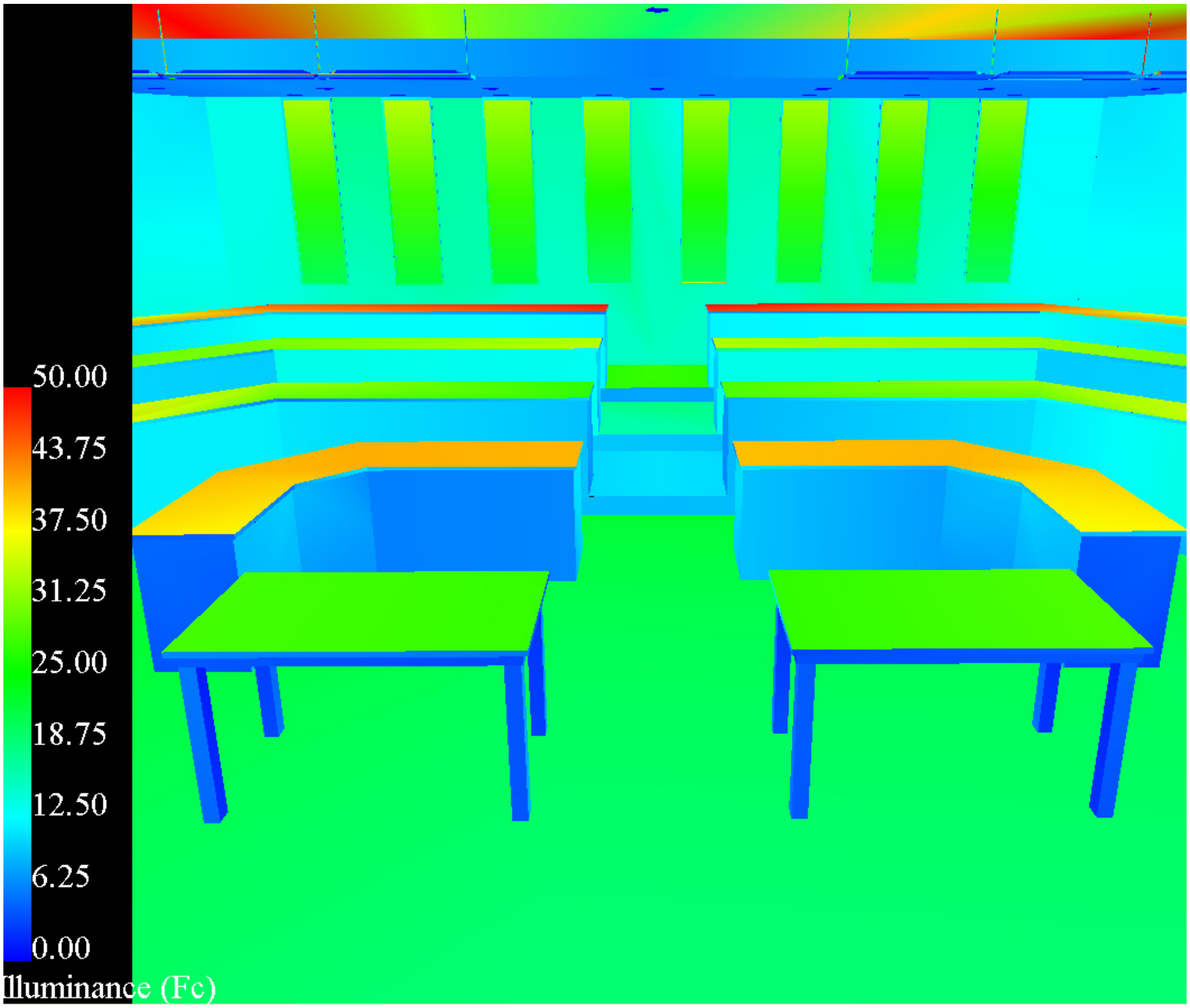


Image 1.5.1 – Moot Court Pseudo Color Rendering

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.

The following table outlines the overprotection, feeder and conduit information for the existing panels for the courtyard.

Affected Courtyard Panels						
Panelboard	Breaker	Feeder				Conduit
		Sets	Phase	Neutral	Ground	
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

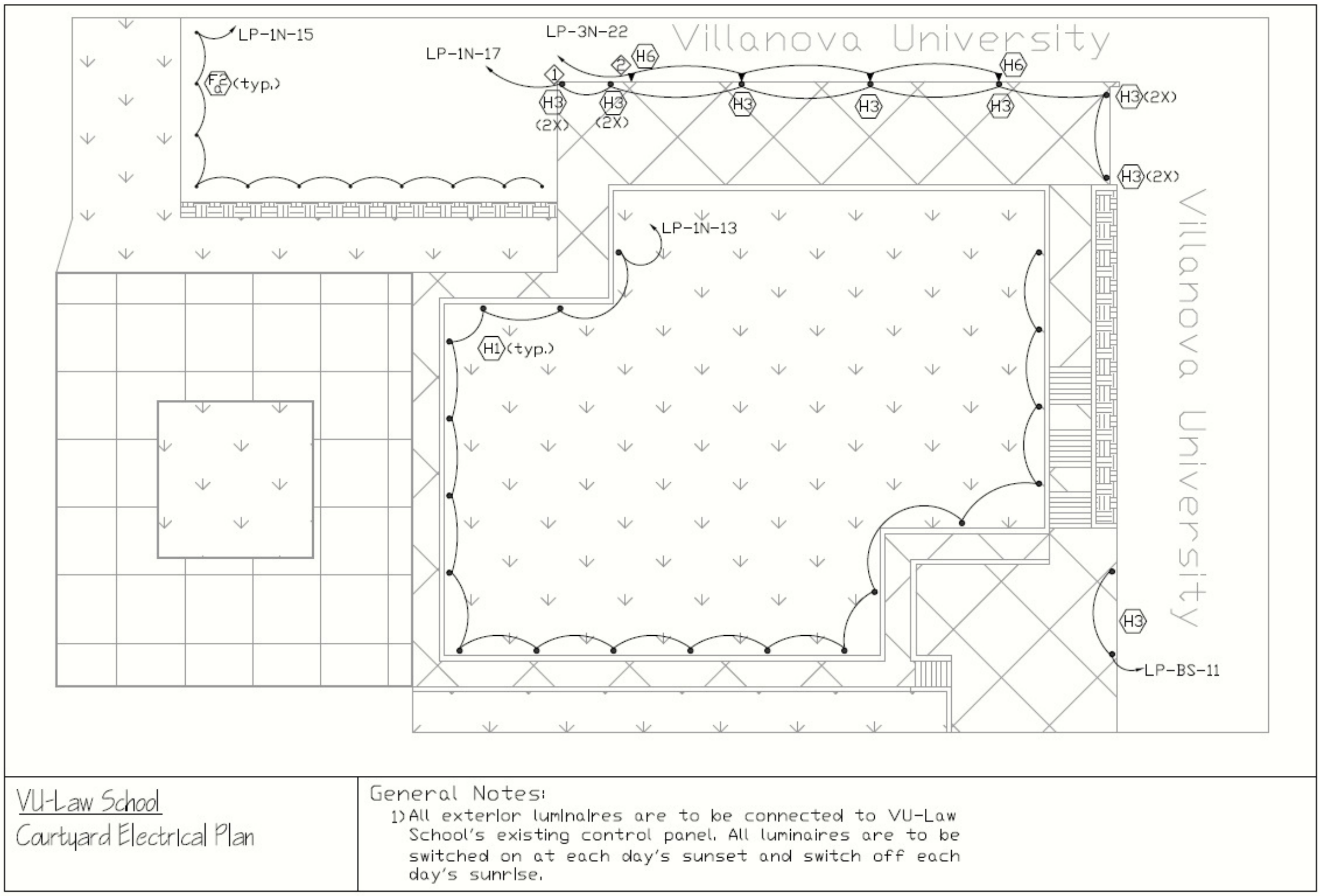


Figure 2.1.1 – Courtyard Electrical Plan

*Please refer to Appendix B for full size plan

Original LCP-1		
Relay	Circuit	Time 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 LCP-1		
Relay	Circuit	Time 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

PANELBOARD SCHEDULE										
PANEL:	LP-1N		EQUIP. GND. BUS:		☐		VOLTAGE:		480/277 VOLT, 3PH, 4W	
LOCATION:	ELEC.RM.(188)-1ST FL.		ISOLATED GND BUS:		☐		MAIN CIRCUIT BKR:			
MOUNTING:	SURFACE		NEUTRAL BUS:	100%	■	200% ☐	MLO:	■		
FED FROM:	SWBD 'MDB'		A.I.C.:	42000			BUS RATING:		400	
LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	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				
						1,275	6			
LIGHTING	20	1	7	4,000						LIGHTING
OFFICE SPACE				3,176			8	1	20	OFFICE CORRIDOR
LIGHTING	20	1	9		2,500					LIGHTING
MAIN 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							SPARE
							16	1	20	
SPARE	20	1	17							SPARE
							18	1	20	
SPARE	20	1	19							SPARE
							20	1	20	
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							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							
				40,313			32	3	150	
SPARE	20	1	33							PANEL 'LP-3N'
					37,544		34			
LIGHTING CONTROL PANEL	20	1	35			1,000				
LCP-1B						36,920	36			
	125	3	37	23,511						
PANEL 'RP-1NA'				26,681			38	3	150	
(75 KVA XFMR)			39		18,645					PANEL 'LP-2N'
					28,445		40			
			41			18,837				
						25,239	42			
	TOTAL VA			103,919	93,522	90,184	TOTAL KVA		287.6	
	TOTAL AMP/PHASE			375	338	326	TOTAL AMP		346	

Figure 2.1.4 – LP-1N Existing Panelboard Schedule

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					LP-1N	Panel Location:			ELEC ROOM 188		
Nominal Phase to Neutral Voltage------->					277	Phase:			3		
Nominal Phase to Phase Voltage-------->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	SF-1-3	6		3713	w	1.00	3713	3713		
2	A	RF-1-3	6		1275	w	1.00	1275	1275		
3	B	SF-1-3	6		3713	w	1.00	3713	3713		
4	B	RF-1-3	6		1275	w	1.00	1275	1275		
5	C	SF-1-3	6		3713	w	1.00	3713	3713		
6	C	RF-1-3	6		1275	w	1.00	1275	1275		
7	A	Lighting Office	3		4000	w	1.00	4000	4000		
8	A	Lighting Office Corr.	3		3176	w	1.00	3176	3176		
9	B	Lighting Main Corr.	3		2500	w	1.00	2500	2500		
10	B	Lighting Office	3		1400	w	1.00	1400	1400		
11	C	Lighting Main Seating	3		1400	w	1.00	1400	1400		
12	C	Lighting Chapel	3		1800	w	1.00	1800	1800		
13	A	Courtyard Ltg Bollards	4		1786	w	1.00	1786	1786		
14	A	Lighting Reading Rm	3		1250	w	1.00	1250	1250		
15	B	Courtyard Ltg Downlights	3		374	w	1.00	374	374		
16	B	Spare			0	w	1.00	0	0		
17	C	Courtyard Ltg Façade	4		1419	w	1.00	1419	1419		
18	C	Spare			0	w	1.00	0	0		
19	A	Spare			0	w	1.00	0	0		
20	A	Spare			0	w	1.00	0	0		
21	B	Spare			0	w	1.00	0	0		
22	B	Spare			0	w	1.00	0	0		
23	C	Spare			0	w	1.00	0	0		
24	C	Spare			0	w	1.00	0	0		
25	A	Spare			0	w	1.00	0	0		
26	A	Spare			0	w	1.00	0	0		
27	B	Spare			0	w	1.00	0	0		
28	B	Spare			0	w	1.00	0	0		
29	C	Spare			0	w	1.00	0	0		
30	C	Spare			0	w	1.00	0	0		
31	A	Spare			0	w	1.00	0	0		
32	A	Panel LP-3N	9		40313	w	1.00	40313	40313		
33	B	Spare			0	w	1.00	0	0		
34	B	Panel LP-3N	9		37756	w	1.00	37756	37756		
35	C	LCP-1B	9		1000	w	1.00	1000	1000		
36	C	Panel LP-3N	9		36920	w	1.00	36920	36920		
37	A	Panel RP-1NA	9		23511	w	1.00	23511	23511		
38	A	Panel LP-2N	9		26681	w	1.00	26681	26681		
39	B	Panel RP-1NA	9		18645	w	1.00	18645	18645		
40	B	Panel LP-2N	9		28445	w	1.00	28445	28445		
41	C	Panel RP-1NA	9		18837	w	1.00	18837	18837		
42	C	Panel LP-2N	9		25239	w	1.00	25239	25239		
PANEL TOTAL								291.4	291.4	Amps=	350.7
PHASE LOADING								kW	kVA	%	Amps
PHASE TOTAL			A					105.7	105.7	36%	381.6
PHASE TOTAL			B					94.1	94.1	32%	339.7
PHASE TOTAL			C					91.6	91.6	31%	330.7
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
1	receptacles			0.0	0.0		0.0	0.0			
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		
Total Demand Loads							289.1	289.1			
Spare Capacity				20%			57.8	57.8			
Total Design Loads							346.9	346.9	1.00	Amps=	417.4

Figure 2.1.5 – LP-1N Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	LP-1N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(188)-1ST FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000	BUS RATING:	600

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-1-3			1	3,713						RF-1-3
				1,275			2			
	30	3	3		3,713					
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING	20	1	7	4,000						LIGHTING
OFFICE SPACE				3,176			8	1	20	OFFICE CORRIDOR
LIGHTING	20	1	9		2,500					LIGHTING
MAIN CORRIDOR					1,400		10	1	20	OFFICE SPACE
LIGHTING	20	1	11			1,400				LIGHTING
MAIN SEATING AREA						1,800	12	1	20	CHAPEL
COURTYARD LIGHTING	20	1	13	1,786						LIGHTING
BOLLARDS				1,250			14	1	20	EXTERIOR READING ROOM
COURTYARD LIGHTING	20	1	15		374					SPARE
DOWNLIGHTS							16	1	20	
COURTYARD LIGHTING	20	1	17			1,419				SPARE
FAÇADE LIGHTS							18	1	20	
SPARE	20	1	19							SPARE
							20	1	20	
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							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							PANEL 'LP-3N'
				40,313			32	3	150	
SPARE	20	1	33							
					37,756		34			
LIGHTING CONTROL PANEL	20	1	35			1,000				
LCP-1B						36,920	36			
PANEL 'RP-1NA'	125	3	37	23,511						PANEL 'LP-2N'
(75 KVA XFMR)				26,681			38	3	150	
			39		18,645					
					28,445		40			
			41			18,837				
						25,239	42			
	TOTAL VA			105,705	94,108	91,603	TOTAL KVA		291.4	
	TOTAL AMP/PHASE			382	340	331	TOTAL AMP		351	

REMARKS:

Figure 2.1.6 – LP-1N Revised Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-3N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(366)-3RD FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1N'	A.I.C.:	42,000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-3-3			1	5,570						RF-3-3
				2,015			2			
	40	3	3		5,570					
					2,015		4	3	15	
			5			5,570				
						2,015	6			
SF-R-1			7	3,713						LIGHTING
				2,000			8	1	20	READING ROOM
	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
LIGHTING	20	1	13	2,056						LIGHTING
OFFICE 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				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							SPARE
							24	1	20	
SPARE	20	1	25							SPARE
							26	1	20	
SPARE	20	1	27							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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-3B							36	1	20	
PANEL 'RP-3NA' (45 KVA XFMR)	70	3	37	21,447						SPARE
							38	1	20	
			39		21,326					SPARE
							40	1	20	
			41			18,498				SPARE
							42	1	20	
	TOTAL VA			40,313	37,544	36,920	TOTAL KVA		114.8	
	TOTAL AMP/PHASE			146	136	133	TOTAL AMP		138	

Figure 2.1.7 – LP-3N Original Panelboard Schedule

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					LP-3N	Panel Location:			ELEC ROOM 366		
Nominal Phase to Neutral Voltage------->					277	Phase:			3		
Nominal Phase to Phase Voltage-------->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	SF-3-3	6		5750	w	1.00	5750	5750		
2	A	RF-3-3	6		2015	w	1.00	2015	2015		
3	B	SF-3-3	6		5750	w	1.00	5750	5750		
4	B	RF-3-3	6		2015	w	1.00	2015	2015		
5	C	SF-3-3	6		5750	w	1.00	5750	5750		
6	C	RF-3-3	6		2015	w	1.00	2015	2015		
7	A	SF-R-1	6		3713	w	1.00	3713	3713		
8	A	Ltg Reading Room	3		2000	w	1.00	2000	2000		
9	B	SF-R-1	6		3713	w	1.00	3713	3713		
10	B	Ltg Seating	3		1600	w	1.00	1600	1600		
11	C	SF-R-1	6		3713	w	1.00	3713	3713		
12	C	Ltg Dean's Suite	3		2024	w	1.00	2024	2024		
13	A	Ltg North Office	3		2056	w	1.00	2056	2056		
14	A	Ltg Mech Room	3		600	w	1.00	600	600		
15	B	Ltg Stacks	3		2520	w	1.00	2520	2520		
16	B	Ltg Dean's Hall	3		800	w	1.00	800	800		
17	C	Ltg Stacks	3		2576	w	1.00	2576	2576		
18	C	Hand Dryer	9		1524	w	1.00	1524	1524		
19	A	Ltg Stacks	3		2912	w	1.00	2912	2912		
20	A	Spare			0	w	1.00	0	0		
21	B	Spare			0	w	1.00	0	0		
22	B	Courtyard Ltg Spots	4		212	w	1.00	212	212		
23	C	Spare			0	w	1.00	0	0		
24	C	Spare			0	w	1.00	0	0		
25	A	Spare			0	w	1.00	0	0		
26	A	Spare			0	w	1.00	0	0		
27	B	Spare			0	w	1.00	0	0		
28	B	Spare			0	w	1.00	0	0		
29	C	Spare			0	w	1.00	0	0		
30	C	Spare			0	w	1.00	0	0		
31	A	Spare			0	w	1.00	0	0		
32	A	Spare			0	w	1.00	0	0		
33	B	Spare			0	w	1.00	0	0		
34	B	Spare			0	w	1.00	0	0		
35	C	LCP-3B	9		1000	w	1.00	1000	1000		
36	C	Spare			0	w	1.00	0	0		
37	A	Panel RP-3NA	9		21447	w	1.00	21447	21447		
38	A	Spare			0	w	1.00	0	0		
39	B	Panel RP-3NA	9		21326	w	1.00	21326	21326		
40	B	Spare			0	w	1.00	0	0		
41	C	Panel RP-3NA	9		18498	w	1.00	18498	18498		
42	C	Spare			0	w	1.00	0	0		
PANEL TOTAL								115.5	115.5	Amps=	139.0
PHASE LOADING								kW	kVA	%	Amps
		PHASE TOTAL	A					40.5	40.5	35%	146.2
		PHASE TOTAL	B					37.9	37.9	33%	137.0
		PHASE TOTAL	C					37.1	37.1	32%	133.9
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
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	HID lighting			0.2	0.2		0.2	0.2	1.00		
5	incandescent 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			0.0	0.0		0.0	0.0			
9	unassigned			63.8	63.8		63.8	63.8	1.00		
Total Demand Loads							112.1	112.1			
Spare Capacity				20%			22.4	22.4			
Total Design Loads							134.5	134.5	1.00	Amps=	161.9

Figure 2.1.8 – LP-3N Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	LP-3N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(366)-3RD FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1N'	A.I.C.:	42,000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	5,570						
				2,015			2			
SF-3-3	40	3	3		5,570					RF-3-3
					2,015		4	3	15	
			5			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				LIGHTING
						2,024	12	1	20	DEAN'S SUITE
LIGHTING	20	1	13	2,056						LIGHTING
OFFICE 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				373
STACKS						1,524	18	1	20	HAND DRYER
LIGHTING	20	1	19	2,912						SPARE
STACKS							20	1	20	
SPARE	20	1	21							COURTYARD LIGHTING
					212		22	1	20	FAÇADE SPOTS
SPARE	20	1	23							SPARE
							24	1	20	
SPARE	20	1	25							SPARE
							26	1	20	
SPARE	20	1	27							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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-3B							36	1	20	
	70	3	37	21,447						SPARE
PANEL 'RP-3NA'							38	1	20	
(45 KVA XFMR)			39		21,326					SPARE
							40	1	20	
			41			18,498				SPARE
							42	1	20	
	TOTAL VA			40,313	37,756	36,920	TOTAL KVA		115.0	
	TOTAL AMP/PHASE			146	136	133	TOTAL AMP		138	

Figure 2.1.9 – LP-3N Revised Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-BS	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM (B02)-SUB.BSMT	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	225
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	☐
FED FROM:	SWBD 'MDB'	A.I.C.:	65000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	5,570						
				2,920			2			
SF-1-2	40	3	3		5,570					
					2,920		4	3	30	RF-1-2
			5			5,570				
						2,920	6			
SPARE	20	1	7							SPARE
							8	1		
SPARE	20	1	9							SPARE
							10	1	15	
SPARE	20	1	11							SPARE
							12	1		
			13	7,160						
				2,920			14			
SF-1-2	60	3	15		7,160					
					2,920		16	3	30	RF-1-2
			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	RF-2-2
			23			5,570				
						2,920	24			
			25							
							26			
SF-3-2	20	3	27							
							28	3	20	RF-3-2
			29							
							30			
LIGHTING	20	1	31	2,016						LIGHTING
				3,500			32	1	20	DINING AREA
LIGHTING CONTROL PANEL	20	1	33		1,000					LIGHTING
LCP-0B					2,280		34	1	20	SERVING
SPARE	20	1	35							LIGHTING
							36	1	20	KITCHEN/SURROUNDING SPACES
	125	3	37	25,880						LIGHTING
PANEL 'RP-BS'				1,440			38	1	20	LOCKERS
(30 KVA XFMR)			39		21,833					L16A,L16B
					3,048		40	1	20	HAND DRYERS
			41			21,370				L09A,B
						3,048	42	1	20	HAND DRYERS
	TOTAL VA			59,896	55,221	51,478	TOTAL KVA			166.6
	TOTAL AMP/PHASE			216	199	186	TOTAL AMP			200

Figure 2.1.10 – LP-3N Original Panelboard Schedule

PANELBOARD SIZING WORKSHEET											
Panel Tag-------------------------->					LP-BS	Panel Location:			ELEC ROOM B02		
Nominal Phase to Neutral Voltage------->					277	Phase:			3		
Nominal Phase to Phase Voltage-------->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	SF-1-1	6		5570	w	1.00	5570	5570		
2	A	RF-1-1	6		2920	w	1.00	2920	2920		
3	B	SF-1-1	6		5570	w	1.00	5570	5570		
4	B	RF-1-1	6		2920	w	1.00	2920	2920		
5	C	SF-1-1	6		5570	w	1.00	5570	5570		
6	C	RF-1-1	6		2920	w	1.00	2920	2920		
7	A	Spare			0	w	1.00	0	0		
8	A	spare			0	w	1.00	0	0		
9	B	Spare			0	w	1.00	0	0		
10	B	Spare			0	w	1.00	0	0		
11	C	Courtyard Ltg Low Entrance	4		258	w	1.00	258	258		
12	C	Spare			0	w	1.00	0	0		
13	A	SF-1-2	6		7160	w	1.00	7160	7160		
14	A	RF1-2	6		2920	w	1.00	2920	2920		
15	B	SF-1-2	6		7160	w	1.00	7160	7160		
16	B	RF1-2	6		2920	w	1.00	2920	2920		
17	C	SF-1-2	6		7160	w	1.00	7160	7160		
18	C	RF1-2	6		2920	w	1.00	2920	2920		
19	A	SF-2-2	6		5570	w	1.00	5570	5570		
20	A	RF-2-2	6		2920	w	1.00	2920	2920		
21	B	SF-2-2	6		5570	w	1.00	5570	5570		
22	B	RF-2-2	6		2920	w	1.00	2920	2920		
23	C	SF-2-2	6		5570	w	1.00	5570	5570		
24	C	RF-2-2	6		2920	w	1.00	2920	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	B	SF-3-2	6		5570	w	1.00	5570	5570		
28	B	RF-3-2	6		2920	w	1.00	2920	2920		
29	C	SF-3-2	6		5570	w	1.00	5570	5570		
30	C	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	3		3500	w	1.00	3500	3500		
33	B	LCP-0B	9		1000	w	1.00	1000	1000		
34	B	Lighting Serving	3		2280	w	1.00	2280	2280		
35	C	Spare			0	w	1.00	0	0		
36	C	Lighting Kitchen	3		2000	w	1.00	2000	2000		
37	A	RP-BS	9		25880	w	1.00	25880	25880		
38	A	Lighting Lockers	3		1440	w	1.00	1440	1440		
39	B	RP-BS	9		21833	w	1.00	21833	21833		
40	B	Hand Dryers	9		3048	w	1.00	3048	3048		
41	C	RP-BS	9		21370	w	1.00	21370	21370		
42	C	Hand Dryers	9		3048	w	1.00	3048	3048		
PANEL TOTAL								194.3	194.3	Amps=	233.8
PHASE LOADING								kW	kVA	%	Amps
		PHASE TOTAL	A					68.4	68.4	35%	246.9
		PHASE TOTAL	B					63.7	63.7	33%	230.0
		PHASE TOTAL	C					62.2	62.2	32%	224.6
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
1		receptacles		0.0	0.0		0.0	0.0			
2		computers		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		0.3	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		0.0	0.0		0.0	0.0			
9		unassigned		76.2	76.2		76.2	76.2	1.00		
		Total Demand Loads					187.9	187.9			
		Spare Capacity		20%			37.6	37.6			
		Total Design Loads					225.4	225.4	1.00	Amps=	271.3

Figure 2.1.11 – LP-BS Panelboard Worksheet

PANELBOARD SCHEDULE										
PANEL: LP-BS		EQUIP. GND. BUS: ☐					VOLTAGE: 480/277 VOLT, 3PH, 4W			
LOCATION: ELEC.RM (B02)-SUB.BSMT		ISOLATED GND BUS: ☐					MAIN CIRCUIT BKR: 225			
MOUNTING: SURFACE		NEUTRAL BUS: 100% ■			200% ☐		MLO: ☐			
FED FROM: SWBD 'MDB'		A.I.C.: 65000					BUS RATING: 400			
LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	5,570						
				2,920			2			
SF-1-1	40	3	3		5,570					RF-1-1
					2,920		4	3	30	
			5			5,570				
						2,920	6			
SPARE	20	1	7							SPARE
							8	1		
SPARE	20	1	9							SPARE
							10	1	15	
COURTYARD LIGHTING	20	1	11			258				SPARE
LOWER ENTRANCE							12	1		
			13	7,160						
				2,920			14			
SF-1-2	60	3	15		7,160					RF-1-2
					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					RF-2-2
					2,920		22	3	30	
			23			5,570				
						2,920	24			
			25	5,570						
				2,920			26			
SF-3-2	20	3	27		5,570					RF-3-2
					2,920		28	3	20	
			29			5,570				
						2,920	30			
LIGHTING	20	1	31	2,016						LIGHTING
				3,500			32	1	20	DINING AREA
LIGHTING CONTROL PANEL	20	1	33		1,000					LIGHTING
LCP-0B					2,280		34	1	20	SERVING
SPARE	20	1	35							LIGHTING
						2,000	36	1	20	KITCHEN/SURROUNDING SPACES
	125	3	37	25,880						LIGHTING
PANEL 'RP-BS'				1,440			38	1	20	LOCKERS
(30 KVA XFMR)			39		21,833					L16A,L16B
					3,048		40	1	20	HAND DRYERS
			41			21,370				L09A,B
						3,048	42	1	20	HAND DRYERS
	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 Feeder Sizing Worksheet			
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.

The following table outlines the overprotection, feeder and conduit information for the existing panels for the courtyard.

Affected Atrium Panels						
		Feeder				
Panelboard	Breaker	Sets	Phase	Neutral	Ground	Conduit
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

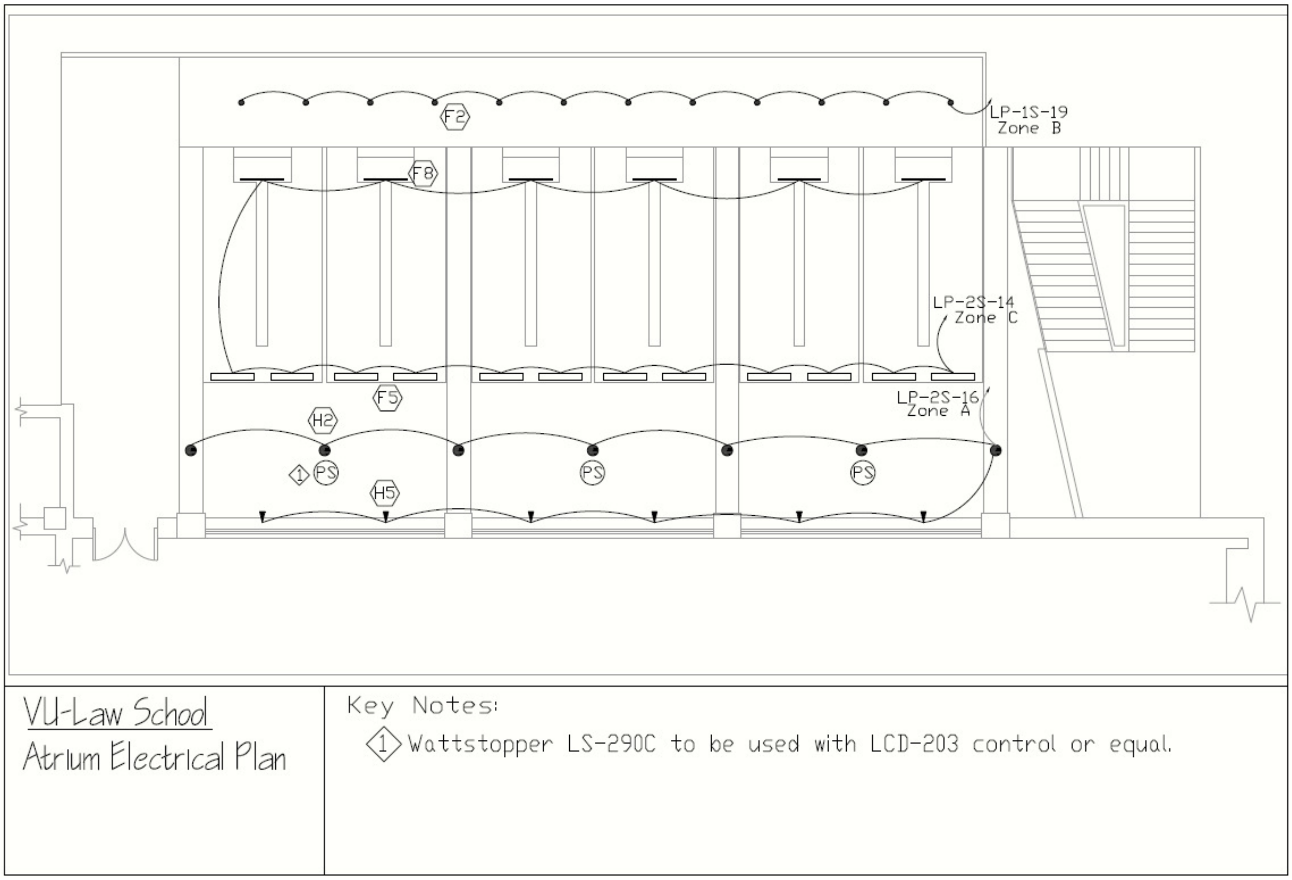


Figure 2.2.2 – Atrium Electrical Plan
*Please see Appendix B for full size plan

LCD-203 Controller		
Zone	Circuit	Control
A	LP-2S-16	Photo (Switch)
B	LP-1S-19	Photo (Dim)
C	LP-2S-14	Photo (Dim)

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

PANELBOARD SCHEDULE

PANEL:	LP-1S	EQUIP. GND. BUS:	☐			VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	ISOLATED GND BUS:	☐			MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■	200%	☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000			BUS RATING:	600

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-1-1			1	3,713						RF-1-1
				2,015			2			
	30	3	3		3,713					
					2,015		4	1	15	
			5			3,713				
						2,015	6			
LIGHTING CORE AREA	20	1	7	3,056						LIGHTING 135 CLASSROOM
				2,576			8	1	20	
LIGHTING OFFICES	20	1	9		3,040					LIGHTING 90 CLASSROOM
					1,902		10	1	20	
LIGHTING OFFICES	20	1	11			1,840				LIGHTING 55 CLASSROOM
						2,008	12	1	20	
LIGHTING OFFICE CORRIDORS	20	1	13	1,800						LIGHTING MAIN STAIRS
				2,500			14	1	20	
LIGHTING MAIN CORRIDOR AND LOBBY	20	1	15		2,800					LIGHTING SOUTH STAIRS
					2,500		16	1	20	
LIGHTING OFFICE SPACE	20	1	17			3,200				LIGHTING NORTH STAIRS
						1,250	18	1	20	
LIGHTING ATRIUM	20	1	19	350						ENTRY LIGHTING
				800			20	1	20	
VERTICAL COVE LIGHTS BASEMENT THRU 3RD FLOOR	20	1	21		1,000					SPARE
							22	1	20	
151A,B J-BOXES HAND DRYERS	20	1	23			3,048				SPARE
							24	1	20	
118B J-BOXES HAND DRYERS	20	1	25	3,048						SPARE
							26	1	20	
118A J-BOXES HAND DRYERS	20	1	27		3,048					SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							PANEL 'LP-3S'
				62,786			32	3	100	
SPARE	20	1	33							
					63,772		34			
LIGHTING CONTROL PANEL LCP-1A	20	1	35			1,000				
						60,769	36			
PANELS 'RP-1SA-1' & 'RP-1SA-2' (75 KVA XFMR)	125	3	37	38,782						PANEL 'LP-2S'
				50,808			38	3	50	
			39		40,015					
					49,414		40			
			41			36,606				
						50,186	42			
	TOTAL VA			172,234	173,219	165,635	TOTAL KVA		511.1	
	TOTAL AMP/PHASE			622	625	598	TOTAL AMP		615	

Figure 2.2.4 – LP-1S Existing Panelboard Schedule

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					LP-1S	Panel Location:		ELEC ROOM 119			
Nominal Phase to Neutral Voltage------->					277	Phase:		3			
Nominal Phase to Phase Voltage-------->					480	Wires:		4			
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	SF-1-1	6		3713	w	1.00	3713	3713		
2	A	RF-1-1	6		2015	w	1.00	2015	2015		
3	B	SF-1-1	6		3713	w	1.00	3713	3713		
4	B	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	A	Lighting Core Area	3		3056	w	1.00	3056	3056		
8	A	135Class Wallwash	3		644	w	1.00	644	644		
9	B	Lighting Offices	3		3040	w	1.00	3040	3040		
10	B	Lighting 90 Class	3		1902	w	1.00	1902	1902		
11	C	Lighting Offices	3		1840	w	1.00	1840	1840		
12	C	Lighting 55 Class	3		2008	w	1.00	2008	2008		
13	A	Lighting Office Corr.	3		1800	w	1.00	1800	1800		
14	A	Lighting Main Stair	3		2500	w	1.00	2500	2500		
15	B	Lighting Main Lobby	3		2800	w	1.00	2800	2800		
16	B	Lighting South Stair	3		2500	w	1.00	2500	2500		
17	C	Lighting Office	3		3200	w	1.00	3200	3200		
18	C	Lighting North Stair	3		1250	w	1.00	1250	1250		
19	A	Lighting Atrium Down	3		408	w	1.00	408	408		
20	A	Lighting Entrance	3		800	w	1.00	800	800		
21	B	Lighting General	3		1000	w	1.00	1000	1000		
22	B	Lighting 135 Class Amb	3		2028	w	1.00	2028	2028		
23	C	Hand Dryers	9		3048	w	1.00	3048	3048		
24	C	Lighting 135 Class Cove	3		238	w	1.00	238	238		
25	A	Hand Dryers	9		3048	w	1.00	3048	3048		
26	A	135 Class Front Cans	3		432	w	1.00	432	432		
27	B	Hand Dryers	9		3048	w	1.00	3048	3048		
28	B	135 Class Board	3		272	w	1.00	272	272		
29	C	Spare			0	w		0	0		
30	C	Spare			0	w		0	0		
31	A	Spare			0	w		0	0		
32	A	Panel LP-3s	9		62786	w	1.00	62786	62786		
33	B	Spare			0	w		0	0		
34	B	Panel LP-3s	9		63772	w	1.00	63772	63772		
35	C	LCP-1A	9		1000	w	1.00	1000	1000		
36	C	Panel LP-3s	9		60769	w	1.00	60769	60769		
37	A	Panels RP-1SA-1,2	9		38783	w	1.00	38783	38783		
38	A	Panel LP-2S	9		50156	w	1.00	50156	50156		
39	B	Panels RP-1SA-1,2	9		40015	w	1.00	40015	40015		
40	B	Panel LP-2S	9		50543	w	1.00	50543	50543		
41	C	Panels RP-1SA-1,2	9		36606	w	1.00	36606	36606		
42	C	Panel LP-2S	9		51047	w	1.00	51047	51047		
PANEL TOTAL								513.5	513.5	Amps=	618.0
PHASE LOADING								kW	kVA	%	Amps
PHASE TOTAL			A					170.1	170.1	33%	614.2
PHASE TOTAL			B					176.6	176.6	34%	637.7
PHASE TOTAL			C					166.7	166.7	32%	601.9
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
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			0.0	0.0		0.0	0.0			
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	unassigned			464.6	464.6	0.90	418.2	418.2	1.00		
Total Demand Loads							467.1	467.1			
Spare Capacity				20%			93.4	93.4			
Total Design Loads							560.5	560.5	1.00	Amps=	674.5

Figure 2.2.5 – LP-1S Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	LP-1S	**EQUIP. GND. BUS:**	☐	**VOLTAGE:**	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	**ISOLATED GND BUS:**	☐	**MAIN CIRCUIT BKR:**	
MOUNTING:	SURFACE	**NEUTRAL BUS:**	**100%** ■ **200%** ☐	**MLO:**	■
FED FROM:	SWBD 'MDB'	**A.I.C.:**	42000	**BUS RATING:**	800

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	3,713						
				2,015			2			
SF-1-1	30	3	3		3,713					RF-1-1
					2,015		4	1	15	
			5			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					1,902		10	1	20	90 CLASSROOM
LIGHTING	20	1	11			1,840				LIGHTING
OFFICES						2,008	12	1	20	55 CLASSROOM
LIGHTING	20	1	13	1,800						LIGHTING
OFFICE CORRIDORS				2,500			14	1	20	MAIN STAIRS
LIGHTING	20	1	15		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 LIGHTING	20	1	19	408						ENTRY LIGHTING
LOW CEILING DOWNLIGHTS				800			20	1	20	
VERTICAL COVE LIGHTS	20	1	21		1,000					135 CLASSROOM LIGHTING
BASEMENT THRU 3RD FLOOR					2,028		22	1	20	AMBIENT
151A,B J-BOXES	20	1	23			3,048				135 CLASSROOM LIGHTING
HAND DRYERS						238	24	1	20	COVE
118B J-BOXES	20	1	25	3,048						135 CLASSROOM LIGHTING
HAND DRYERS				432			26	1	20	FRONT CANS
118A J-BOXES	20	1	27		3,048					135 CLASSROOM LIGHTING
HAND DRYERS					272		28	1	20	BOARD LIGHTS
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						60,769	36			
	125	3	37	38,782						
PANELS 'RP-1SA-1' & 'RP-1SA-2'				51,062			38	3	50	
(75 KVA XFMR)			39		40,015					PANEL 'LP-2S'
					49,149		40			
			41			36,606				
						49,973	42			
	TOTAL VA			171,046	175,254	165,660	TOTAL KVA		512.0	
	TOTAL AMP/PHASE			617	633	598	TOTAL AMP		616	

REMARKS:

Figure 2.2.6 – LP-1S Revised Panelboard Schedules

PANELBOARD SCHEDULE

PANEL:	LP-2S	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1S'	A.I.C.:	42000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-2-1			1	3,713						RF-2-1
				1,275			2			
	30	3	3		3,713					
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING CORE AREA	20	1	7	3,840						LIGHTING 90 CLASSROOM
				1,902			8	1	20	
LIGHTING OFFICES	20	1	9		3,800					LIGHTING 50 CLASSROOM
					2,008		10	1	20	
LIGHTING MAIN LOBBY AND MAIN CORRIDOR	20	1	11			2,750				LIGHTING OFFICE AREAS
						3,696	12	1	20	
LIGHTING MOOT COURT	20	1	13	1,200						LIGHTING ATRIUM
				336			14	1	20	
LIGHTING MOOT COURT	20	1	15		600					LIGHTING ATRIUM
					900		16	1	20	
LIGHTING MOOT COURT	20	1	17			160				LIGHTING ATRIUM
						900	18	1	20	
LIGHTING MOOT COURT	20	1	19	300						LIGHTING 220A CORRIDOR
				924			20	1	20	
LIGHTING OFFICE CORRIDOR	20	1	21		1,450					SPARE
							22	1	20	
218A HAND DRYERS	20	1	23			3,048				SPARE
							24	1	20	
218B HAND DRYERS	20	1	25	3,048						SPARE
							26	1	20	
248A,B HAND DRYERS	20	1	27		3,048					SPARE
							28	1	20	
251A,B HAND DRYERS	20	1	29			3,048				SPARE
							30	1	20	
SPARE	20	1	31							SPARE
							32	1	20	
SPARE	20	1	33							SPARE
							34	1	20	
LIGHTING CONTROL PANEL LCP-1A	20	1	35			1,000				SPARE
							36	1	20	
PANELS 'RP-2SA-1' & 'RP-2SA-2' (75 KVA XFMR)	125	3	37	34,270						SPARE
							38	1	20	
			39		32,620					SPARE
							40	1	20	
			41			30,596				SPARE
							42	1	20	
	TOTAL VA			50,808	49,414	50,186	TOTAL KVA		150.4	
	TOTAL AMP/PHASE			183	178	181	TOTAL AMP		181	

REMARKS:

Figure 2.2.7 – LP-2S Original Panelboard Schedule

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					LP-2S	Panel Location:			Elec. Room 219A		
Nominal Phase to Neutral Voltage------->					277	Phase:			3		
Nominal Phase to Phase Voltage-------->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	SF-2-1	6		3713	va	1.00	3713	3713		
2	A	RF-2-1	6		1275	w	1.00	1275	1275		
3	B	SF-2-1	6		3713	w	1.00	3713	3713		
4	B	RF-2-1	6		1275	w	1.00	1275	1275		
5	C	SF-2-1	6		3713	w	1.00	3713	3713		
6	C	RF-2-1	6		1275	w	1.00	1275	1275		
7	A	Lighting Core Area	3		3840	w	1.00	3840	3840		
8	A	90 Classroom Ltg	3		1902	w	1.00	1902	1902		
9	B	Lighting Offices	3		3800	w	1.00	3800	3800		
10	B	50 Classroom Ltg	3		2008	w	1.00	2008	2008		
11	C	Lighting Main Lobby	3		2750	w	1.00	2750	2750		
12	C	Lighting Offices	3		3696	w	1.00	3696	3696		
13	A	Moot Ltg Ambient	3		1276	w	1.00	1276	1276		
14	A	Atrium Ltg. Cove/WW	3		666	w	1.00	666	666		
15	B	Moot Ltg Front	3		398	w	1.00	398	398		
16	B	Atrium Ltg. Pendant	4		903	w	1.00	903	903		
17	C	Moot Ltg Accent/Cove	3		847	w	1.00	847	847		
18	C	Atrium Projectors	4		564	w	1.00	564	564		
19	A	Moot Ltg Front WW	3		148	w	1.00	148	148		
20	A	Lighting 220A	3		924	w	1.00	924	924		
21	B	Lighting Office Corr.	3		1450	w	1.00	1450	1450		
22	B	Spare			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	A	Hand Dryers	9		3048	w	1.00	3048	3048		
26	A	Spare			0	w	1.00	0	0		
27	B	Hand Dryers	9		3048	w	1.00	3048	3048		
28	B	Spare			0	w	1.00	0	0		
29	C	Hand Dryers	9		3048	w	1.00	3048	3048		
30	C	Spare			0	w	1.00	0	0		
31	A	Spare			0	w	1.00	0	0		
32	A	Spare			0	w	1.00	0	0		
33	B	Spare			0	w	1.00	0	0		
34	B	Spare			0	w	1.00	0	0		
35	C	LCP-1A	9		1000	w	1.00	1000	1000		
36	C	Spare			0	w	1.00	0	0		
37	A	Panels RP-2SA-1,2	9		34270	w	1.00	34270	34270		
38	A	Spare			0	w	1.00	0	0		
39	B	Panels RP-2SA-1,2	9		31990	w	1.00	31990	31990		
40	B	Spare			0	w	1.00	0	0		
41	C	Panels RP-2SA-1,2	9		30596	w	1.00	30596	30596		
42	C	Spare			0	w	1.00	0	0		
PANEL TOTAL								150.2	150.2	Amps=	180.7
PHASE LOADING								kW	kVA	%	Amps
PHASE TOTAL			A					51.1	51.1	34%	184.3
PHASE TOTAL			B					48.6	48.6	32%	175.4
PHASE TOTAL			C					50.5	50.5	34%	182.4
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
1	receptacles			0.0	0.0		0.0	0.0			
2	computers			0.0	0.0		0.0	0.0			
3	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	incandescent 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			0.0	0.0		0.0	0.0			
9	unassigned			110.0	110.0		110.0	110.0	1.00		
Total Demand Loads							147.8	147.8			
Spare Capacity				20%			29.6	29.6			
Total Design Loads							177.4	177.4	1.00	Amps=	213.4

Figure 2.2.8 – LP-2S Panelboard Worksheet

PANELBOARD SCHEDULE										
PANEL: LP-2S			EQUIP. GND. BUS: ☐				VOLTAGE: 480/277 VOLT, 3PH, 4W			
LOCATION: ELEC.RM.(219A)-2ND FL.			ISOLATED GND BUS: ☐				MAIN CIRCUIT BKR:			
MOUNTING: SURFACE			NEUTRAL BUS: 100% ■		200% ☐		MLO: ■			
FED FROM: PANEL 'LP-1S'			A.I.C.: 42000				BUS RATING: 225			
LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-2-1			1	3,713						RF-2-1
				1,275			2			
	30	3	3		3,713					
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING	20	1	7	3,840						LIGHTING
CORE 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
MAIN LOBBY AND MAIN CORRIDOR						3,696	12	1	20	OFFICE AREAS
MOOT COUR LIGHTING	20	1	13	1,276						ATRIUM LIGHTING
AMBIENT				666			14	1	20	COVE/WALLWASH
MOOT COUR LIGHTING	20	1	15		398					ATRIUM LIGHTING
FRONT					1,467		16	1	20	HID
MOOT COURT LIGHTING	20	1	17			847				SPARE
REAR ACCENT/COVE							18	1	20	
LIGHTING	20	1	19	148						LIGHTING
FRONT WALL WASH				924			20	1	20	220A CORRIDOR
LIGHTING	20	1	21		1,450					SPARE
OFFICE CORRIDOR							22	1	20	
218A	20	1	23			3,048				SPARE
HAND DRYERS							24	1	20	
218B	20	1	25	3,048						SPARE
HAND DRYERS							26	1	20	
248A,B	20	1	27		3,048					SPARE
HAND DRYERS							28	1	20	
251A,B	20	1	29			3,048				SPARE
HAND DRYERS							30	1	20	
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							36	1	20	
PANELS 'RP-2SA-1' & 'RP-2SA-2' (75 KVA XFMR)	125	3	37	34,270						SPARE
							38	1	20	
			39		31,990					SPARE
							40	1	20	
			41			30,596				SPARE
							42	1	20	
	TOTAL VA			51,062	49,149	49,973	TOTAL KVA			150.2
	TOTAL AMP/PHASE			184	177	180	TOTAL AMP			181
REMARKS:										

Figure 2.2.9 – LP-2S Revised Panelboard Schedule

Atrium Feeder Sizing 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.

The following table outlines the overprotection, feeder and conduit information for the existing panels for the courtyard.

Affected 135-Seat Classroom Panels						
		Feeder				
Panelboard	Breaker	Sets	Phase	Neutral	Ground	Conduit
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

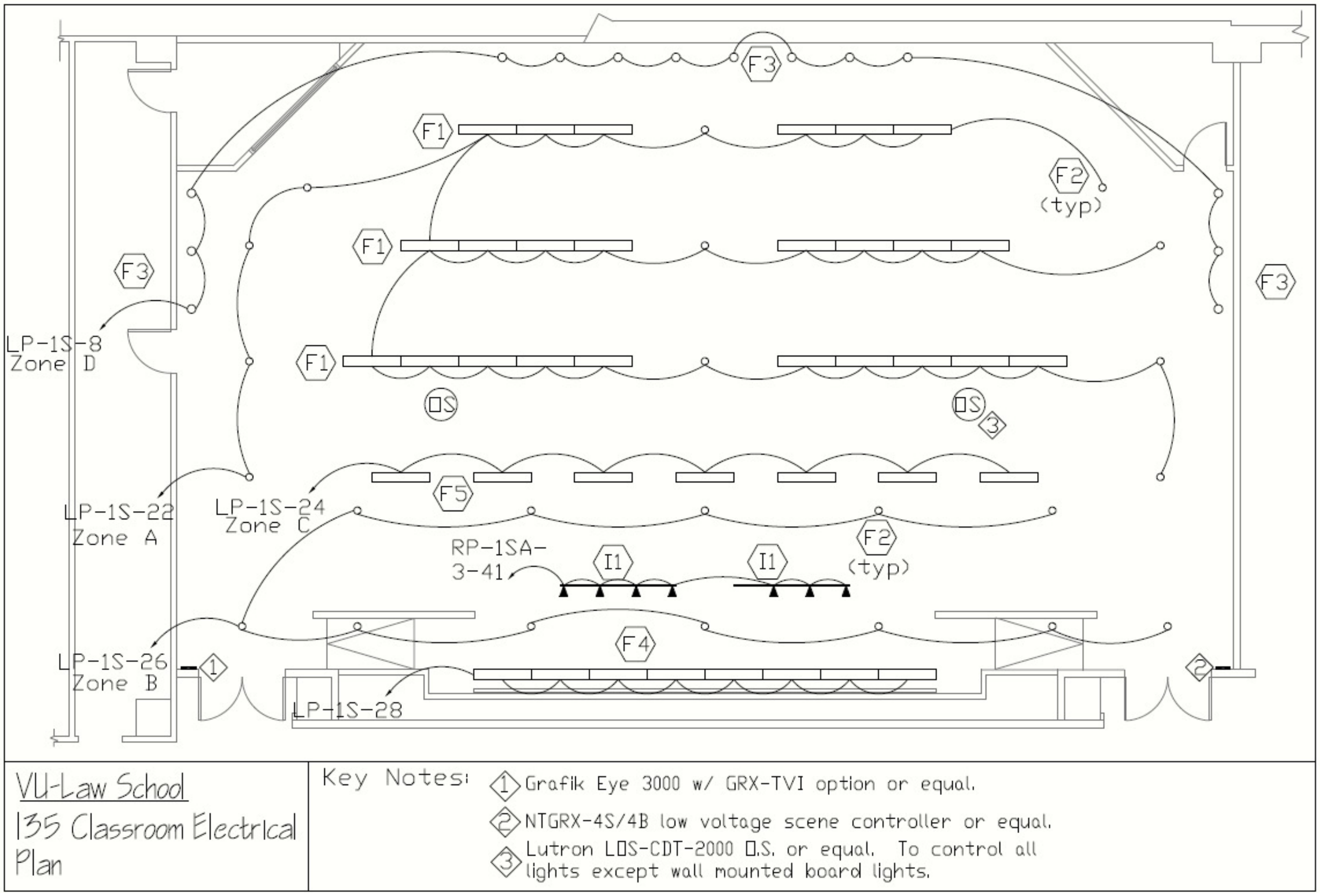


Figure 2.3.2 – 135-Seat Classroom Electrical Plan
*Please see Appendix B for full size plan

135-Seat Classroom Scene Matrix				
	Zone			
Scene	A	B	C	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

PANELBOARD SCHEDULE

PANEL:	LP-1S	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000	BUS RATING:	600

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	3,713						
				2,015			2			
SF-1-1	30	3	3		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					LIGHTING
OFFICES					1,902		10	1	20	90 CLASSROOM
LIGHTING	20	1	11			1,840				LIGHTING
OFFICES						2,008	12	1	20	55 CLASSROOM
LIGHTING	20	1	13	1,800						LIGHTING
OFFICE CORRIDORS				2,500			14	1	20	MAIN STAIRS
LIGHTING	20	1	15		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
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							24	1	20	
118B J-BOXES	20	1	25	3,048						SPARE
HAND DRYERS							26	1	20	
118A J-BOXES	20	1	27		3,048					SPARE
HAND DRYERS							28	1	20	
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						60,769	36			
	125	3	37	38,782						
PANELS 'RP-1SA-1' & 'RP-1SA-2'				50,808			38	3	50	
(75 KVA XFMR)			39		40,015					PANEL 'LP-2S'
					49,414		40			
			41			36,606				
						50,186	42			
	TOTAL VA			172,234	173,219	165,635	TOTAL KVA		511.1	
	TOTAL AMP/PHASE			622	625	598	TOTAL AMP		615	

Figure 2.3.4 – LP-1S Original Panelboard Schedule

PANELBOARD SIZING WORKSHEET										
Panel Tag------------------------->				LP-1S	Panel Location:			ELEC ROOM 119		
Nominal Phase to Neutral Voltage------->				277	Phase:			3		
Nominal Phase to Phase Voltage-------->				480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	SF-1-1	6		3713	w	1.00	3713	3713	
2	A	RF-1-1	6		2015	w	1.00	2015	2015	
3	B	SF-1-1	6		3713	w	1.00	3713	3713	
4	B	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	A	Lighting Core Area	3		3056	w	1.00	3056	3056	
8	A	135Class Wallwash	3		644	w	1.00	644	644	
9	B	Lighting Offices	3		3040	w	1.00	3040	3040	
10	B	Lighting 90 Class	3		1902	w	1.00	1902	1902	
11	C	Lighting Offices	3		1840	w	1.00	1840	1840	
12	C	Lighting 55 Class	3		2008	w	1.00	2008	2008	
13	A	Lighting Office Corr.	3		1800	w	1.00	1800	1800	
14	A	Lighting Main Stair	3		2500	w	1.00	2500	2500	
15	B	Lighting Main Lobby	3		2800	w	1.00	2800	2800	
16	B	Lighting South Stair	3		2500	w	1.00	2500	2500	
17	C	Lighting Office	3		3200	w	1.00	3200	3200	
18	C	Lighting North Stair	3		1250	w	1.00	1250	1250	
19	A	Lighting Atrium Down	3		408	w	1.00	408	408	
20	A	Lighting Entrance	3		800	w	1.00	800	800	
21	B	Lighting General	3		1000	w	1.00	1000	1000	
22	B	Lighting 135 Class Amb	3		2028	w	1.00	2028	2028	
23	C	Hand Dryers	9		3048	w	1.00	3048	3048	
24	C	Lighting 135 Class Cove	3		238	w	1.00	238	238	
25	A	Hand Dryers	9		3048	w	1.00	3048	3048	
26	A	135 Class Front Cans	3		432	w	1.00	432	432	
27	B	Hand Dryers	9		3048	w	1.00	3048	3048	
28	B	135 Class Board	3		272	w	1.00	272	272	
29	C	Spare			0	w		0	0	
30	C	Spare			0	w		0	0	
31	A	Spare			0	w		0	0	
32	A	Panel LP-3s	9		62786	w	1.00	62786	62786	
33	B	Spare			0	w		0	0	
34	B	Panel LP-3s	9		63772	w	1.00	63772	63772	
35	C	LCP-1A	9		1000	w	1.00	1000	1000	
36	C	Panel LP-3s	9		60769	w	1.00	60769	60769	
37	A	Panels RP-1SA-1,2	9		38783	w	1.00	38783	38783	
38	A	Panel LP-2S	9		50156	w	1.00	50156	50156	
39	B	Panels RP-1SA-1,2	9		40015	w	1.00	40015	40015	
40	B	Panel LP-2S	9		50543	w	1.00	50543	50543	
41	C	Panels RP-1SA-1,2	9		36606	w	1.00	36606	36606	
42	C	Panel LP-2S	9		51047	w	1.00	51047	51047	
PANEL TOTAL								513.5	513.5	Amps= 618.0

PHASE LOADING							kW	kVA	%	Amps
PHASE TOTAL	A						170.1	170.1	33%	614.2
PHASE TOTAL	B						176.6	176.6	34%	637.7
PHASE TOTAL	C						166.7	166.7	32%	601.9

LOAD CATAGORIES			Connected			Demand				Ver. 1.02
			kW	kVA	DF	kW	kVA	PF		
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		0.0	0.0		0.0	0.0			
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	unassigned		464.6	464.6	0.90	418.2	418.2	1.00		
Total Demand Loads						467.1	467.1			
Spare Capacity			20%			93.4	93.4			
Total Design Loads						560.5	560.5	1.00	Amps=	674.5

Figure 2.3.5 – LP-1S Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	LP-1S	**EQUIP. GND. BUS:**	☐	**VOLTAGE:**	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	**ISOLATED GND BUS:**	☐	**MAIN CIRCUIT BKR:**	
MOUNTING:	SURFACE	**NEUTRAL BUS:**	**100%** ■ **200%** ☐	**MLO:**	■
FED FROM:	SWBD 'MDB'	**A.I.C.:**	42000	**BUS RATING:**	800

LOAD DESCRIPTION	**BKR. AMPS**	**BKR. POLE**	**CKT. NO.**	**LOAD - V.A.** A	B	C	**CKT. NO.**	**BKR. POLE**	**BKR. AMPS**	**LOAD DESCRIPTION**
SF-1-1			1	3,713						RF-1-1
				2,015			2			
	30	3	3		3,713					
					2,015		4	1	15	
			5			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					1,902		10	1	20	90 CLASSROOM
LIGHTING	20	1	11			1,840				LIGHTING
OFFICES						2,008	12	1	20	55 CLASSROOM
LIGHTING	20	1	13	1,800						LIGHTING
OFFICE CORRIDORS				2,500			14	1	20	MAIN STAIRS
LIGHTING	20	1	15		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 LIGHTING	20	1	19	408						ENTRY LIGHTING
LOW CEILING DOWNLIGHTS				800			20	1	20	
VERTICAL COVE LIGHTS	20	1	21		1,000					135 CLASSROOM LIGHTING
BASEMENT THRU 3RD FLOOR					2,028		22	1	20	AMBIENT
151A,B J-BOXES	20	1	23			3,048				135 CLASSROOM LIGHTING
HAND DRYERS						238	24	1	20	COVE
118B J-BOXES	20	1	25	3,048						135 CLASSROOM LIGHTING
HAND DRYERS				432			26	1	20	FRONT CANS
118A J-BOXES	20	1	27		3,048					135 CLASSROOM LIGHTING
HAND DRYERS					272		28	1	20	BOARD LIGHTS
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						60,769	36			
PANELS 'RP-1SA-1' & 'RP-1SA-2'	125	3	37	38,782						
(75 KVA XFMR)				51,062			38	3	50	
			39		40,015					PANEL 'LP-2S'
					49,149		40			
			41			36,606				
						49,973	42			
	TOTAL VA			171,046	175,254	165,660	**TOTAL KVA**		512.0	
	TOTAL AMP/PHASE			617	633	598	**TOTAL AMP**		616	

REMARKS:

Figure 2.3.6 – LP-1S Revised Panelboard Schedules

PANELBOARD SCHEDULE

PANEL:	RP-1SA-3	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-1S'	A.I.C.:	22000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
101 SEAT POWER	20	1	1	1,620						102 VP
				435			2	1	20	
101 SEAT POWER	20	1	3		1,620					102 VP
					435		4	1	20	
101 SEAT POWER	20	1	5			1,440				103 SEAT POWER
						1,440	6	1	20	
101 SEAT POWER	20	1	7	1,260						103 SEAT POWER
				1,440			8	1	20	
101 SEAT POWER	20	1	9		1,080					103 SEAT POWER
					1,440		10	1	20	
101 SEAT POWER	20	1	11			1,260				102 SEAT POWER
						1,080	12	1	20	
101 SEAT POWER	20	1	13	1,800						102 SEAT POWER
				900			14	1	20	
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
						1,800	18	1	20	
101 SEAT POWER	20	1	19	1,620						102 SEAT POWER
				1,260			20	1	20	
101 SEAT POWER	20	1	21		1,620					102 SEAT POWER
					1,440		22	1	20	
101 SEAT POWER	20	1	23			1,440				102 SEAT POWER
						1,080	24	1	20	
101 SEAT POWER	20	1	25	1,260						102 SEAT POWER
				900			26	1	20	
101 SEAT POWER	20	1	27		1,080					102 SEAT POWER
					1,620		28	1	20	
101 SEAT POWER	20	1	29			1,260				102 SEAT POWER
						1,800	30	1	20	
101 SEAT POWER	20	1	31	1,800						102 SEAT POWER
				1,260			32	1	20	
101 SEAT POWER	20	1	33		1,260					102 SEAT POWER
					1,440		34	1	20	
101 SEAT POWER	20	1	35			1,800				103 SEAT POWER
						1,440	36	1	20	
ILUX CONTROLLER	20	1	37	1,000						103 SEAT POWER
				1,260			38	1	20	
CRESTRON POWER SUPPLY	20	1	39		276					SPARE
							40	1	20	
SPARE	20	1	41							SPARE
							42	1	20	
	TOTAL VA			17,815	16,191	17,640	TOTAL KVA		51.6	
	TOTAL AMP/PHASE			148	135	147	TOTAL AMP		143	

REMARKS:

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

PANELBOARD SIZING WORKSHEET										
Panel Tag-------------------------->				RP-1SA-3	Panel Location:			ELEC ROOM 119A		
Nominal Phase to Neutral Voltage------->				120	Phase:			3		
Nominal Phase to Phase Voltage-------->				208	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	101 Seat Power	1		1620	w	1.00	1620	1620	
2	A	102 VP	9		435	w	1.00	435	435	
3	B	101 Seat Power	1		1620	w	1.00	1620	1620	
4	B	102 VP	9		435	w	1.00	435	435	
5	C	101 Seat Power	1		1440	w	1.00	1440	1440	
6	C	103 Seat Power	1		1440	w	1.00	1440	1440	
7	A	101 Seat Power	1		1260	w	1.00	1260	1260	
8	A	103 Seat Power	1		1440	w	1.00	1440	1440	
9	B	101 Seat Power	1		1080	w	1.00	1080	1080	
10	B	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	A	102 Seat Power	1		900	w	1.00	900	900	
15	B	101 Seat Power	1		1260	w	1.00	1260	1260	
16	B	102 Seat Power	1		1260	w	1.00	1260	1260	
17	C	101 Seat Power	1		1800	w	1.00	1800	1800	
18	C	102 Seat Power	1		1800	w	1.00	1800	1800	
19	A	101 Seat Power	1		1620	w	1.00	1620	1620	
20	A	102 Seat Power	1		1260	w	1.00	1260	1260	
21	B	101 Seat Power	1		1620	w	1.00	1620	1620	
22	B	102 Seat Power	1		1440	w	1.00	1440	1440	
23	C	101 Seat Power	1		1440	w	1.00	1440	1440	
24	C	102 Seat Power	1		1080	w	1.00	1080	1080	
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	B	101 Seat Power	1		1080	w	1.00	1080	1080	
28	B	102 Seat Power	1		1620	w	1.00	1620	1620	
29	C	101 Seat Power	1		1260	w	1.00	1260	1260	
30	C	102 Seat Power	1		1800	w	1.00	1800	1800	
31	A	101 Seat Power	1		1800	w	1.00	1800	1800	
32	A	102 Seat Power	1		1260	w	1.00	1260	1260	
33	B	101 Seat Power	1		1260	w	1.00	1260	1260	
34	B	102 Seat Power	1		1440	w	1.00	1440	1440	
35	C	101 Seat Power	1		1800	w	1.00	1800	1800	
36	C	103 Seat Power	1		1440	w	1.00	1440	1440	
37	A	ILUX Controller	9		1000	w	1.00	1000	1000	
38	A	103 Seat Power	1		1260	w	1.00	1260	1260	
39	B	Crestron Power	9		276	w	1.00	276	276	
40	B	Spare			0	w	1.00	0	0	
41	C	135 Class Track Ltg	5		700	w	1.00	700	700	
42	C	Spare			0	w	1.00	0	0	
PANEL TOTAL								52.0	52.0	Amps= 144.4

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					17.8	17.8	34%	148.5
PHASE TOTAL	B					15.8	15.8	30%	131.9
PHASE TOTAL	C					18.3	18.3	35%	152.8

LOAD CATAGORIES			Connected			Demand				Ver. 1.02
			kW	kVA	DF	kW	kVA	PF		
1	receptacles		49.1	49.1		49.1	49.1	1.00		
2	computers		0.0	0.0		0.0	0.0			
3	fluorescent lighting		0.0	0.0	0.90	0.0	0.0			
4	HID lighting		0.0	0.0		0.0	0.0			
5	incandescent 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		
Total Demand Loads						51.9	51.9			
Spare Capacity			20%			10.4	10.4			
Total Design Loads						62.3	62.3	1.00	Amps=	172.9

Figure 2.3.8 – RP-1SA-3 Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	RP-1SA-3	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-1S'	A.I.C.:	22000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
101 SEAT POWER	20	1	1	1,620						102 VP
				435			2	1	20	
101 SEAT POWER	20	1	3		1,620					102 VP
					435		4	1	20	
101 SEAT POWER	20	1	5			1,440				103 SEAT POWER
						1,440	6	1	20	
101 SEAT POWER	20	1	7	1,260						103 SEAT POWER
				1,440			8	1	20	
101 SEAT POWER	20	1	9		1,080					103 SEAT POWER
					1,440		10	1	20	
101 SEAT POWER	20	1	11			1,260				102 SEAT POWER
						1,080	12	1	20	
101 SEAT POWER	20	1	13	1,800						102 SEAT POWER
				900			14	1	20	
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
						1,800	18	1	20	
101 SEAT POWER	20	1	19	1,620						102 SEAT POWER
				1,260			20	1	20	
101 SEAT POWER	20	1	21		1,620					102 SEAT POWER
					1,440		22	1	20	
101 SEAT POWER	20	1	23			1,440				102 SEAT POWER
						1,080	24	1	20	
101 SEAT POWER	20	1	25	1,260						102 SEAT POWER
				900			26	1	20	
101 SEAT POWER	20	1	27		1,080					102 SEAT POWER
					1,620		28	1	20	
101 SEAT POWER	20	1	29			1,260				102 SEAT POWER
						1,800	30	1	20	
101 SEAT POWER	20	1	31	1,800						102 SEAT POWER
				1,260			32	1	20	
101 SEAT POWER	20	1	33		1,260					102 SEAT POWER
					1,440		34	1	20	
101 SEAT POWER	20	1	35			1,800				103 SEAT POWER
						1,440	36	1	20	
ILUX CONTROLLER	20	1	37	1,000						103 SEAT POWER
				1,260			38	1	20	
CRESTRON POWER SUPPLY	20	1	39		276					SPARE
							40	1	20	
135 CLASSROOM LIGHTING TRACK	20	1	41			700				SPARE
							42	1	20	
	TOTAL VA			17,815	16,191	18,340	TOTAL KVA			52.3
	TOTAL AMP/PHASE			148	135	153	TOTAL AMP			145

REMARKS:

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

135-Seat Classroom Feeder Sizing Worksheet		
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.

The following table outlines the overprotection, feeder and conduit information for the existing panels for the courtyard.

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

Figure 2.4.1 – Moot Courtroom Affected Panelboard Information

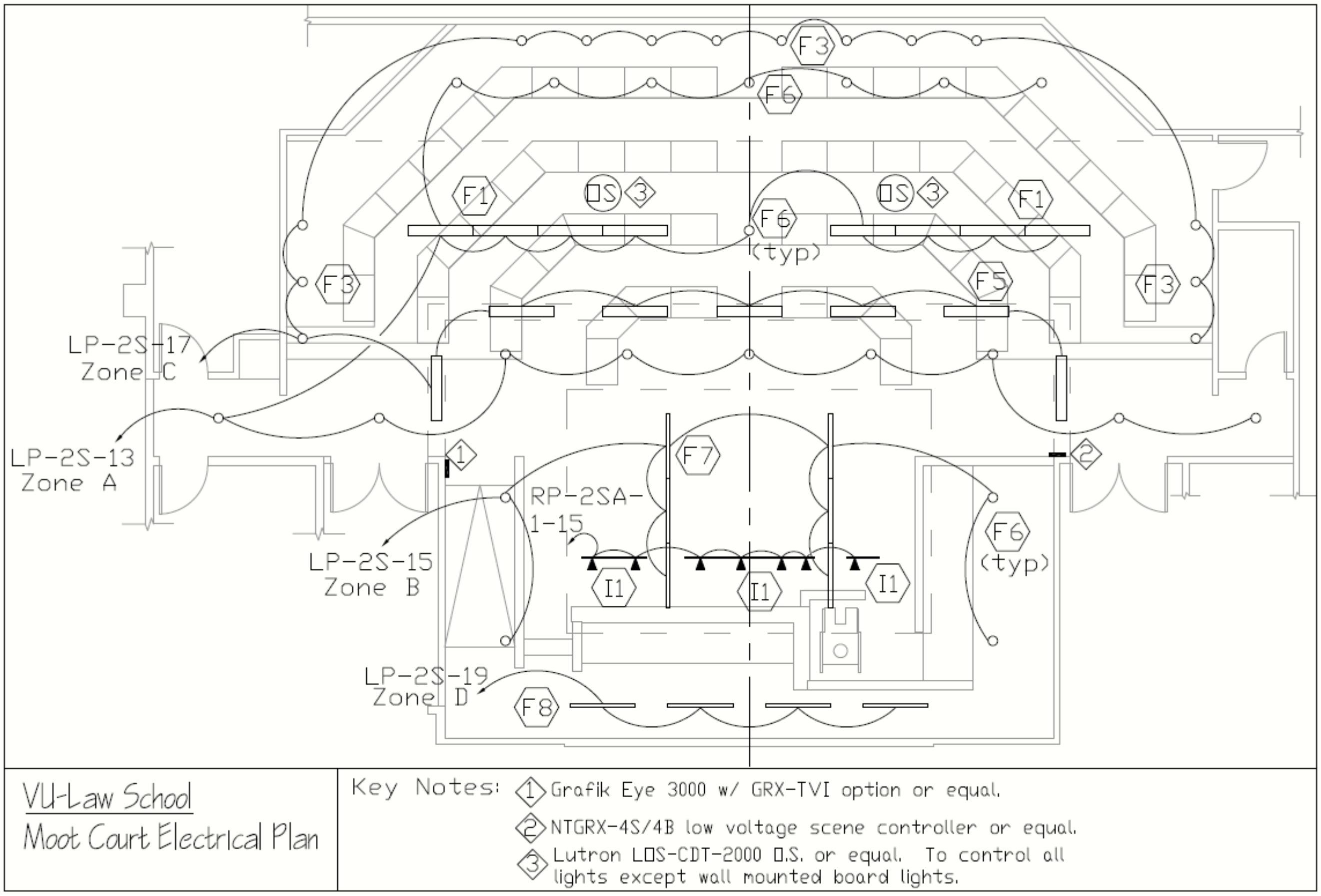


Figure 2.4.2 – Moot Courtroom Electrical Plan
*See Appendix B for full size plan

Moot Courtroom Scene Matrix				
	Zone			
Scene	A	B	C	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

PANELBOARD SCHEDULE

PANEL:	LP-2S	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1S'	A.I.C.:	42000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	3,713						
				1,275			2			
SF-2-1	30	3	3		3,713					RF-2-1
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING	20	1	7	3,840						LIGHTING
CORE 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
MAIN LOBBY AND MAIN CORRIDOR						3,696	12	1	20	OFFICE AREAS
LIGHTING	20	1	13	1,200						LIGHTING
MOOT COURT				336			14	1	20	ATRIUM
LIGHTING	20	1	15		600					LIGHTING
MOOT COURT					900		16	1	20	ATRIUM
LIGHTING	20	1	17			160				LIGHTING
MOOT COURT						900	18	1	20	ATRIUM
LIGHTING	20	1	19	300						LIGHTING
MOOT COURT				924			20	1	20	220A CORRIDOR
LIGHTING	20	1	21		1,450					SPARE
OFFICE CORRIDOR							22	1	20	
218A	20	1	23			3,048				SPARE
HAND DRYERS							24	1	20	
218B	20	1	25	3,048						SPARE
HAND DRYERS							26	1	20	
248A,B	20	1	27		3,048					SPARE
HAND DRYERS							28	1	20	
251A,B	20	1	29			3,048				SPARE
HAND DRYERS							30	1	20	
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							36	1	20	
	125	3	37	34,270						SPARE
PANELS 'RP-2SA-1' & 'RP-2SA-2'							38	1	20	
(75 KVA XFMR)			39		32,620					SPARE
							40	1	20	
			41			30,596				SPARE
							42	1	20	
	TOTAL VA			50,808	49,414	50,186	TOTAL KVA		150.4	
	TOTAL AMP/PHASE			183	178	181	TOTAL AMP		181	

REMARKS:

Figure 2.4.4 – LP-2S Original Panelboard Schedule

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					LP-2S	Panel Location:			Elec. Room 219A		
Nominal Phase to Neutral Voltage------->					277	Phase:			3		
Nominal Phase to Phase Voltage-------->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	SF-2-1	6		3713	va	1.00	3713	3713		
2	A	RF-2-1	6		1275	w	1.00	1275	1275		
3	B	SF-2-1	6		3713	w	1.00	3713	3713		
4	B	RF-2-1	6		1275	w	1.00	1275	1275		
5	C	SF-2-1	6		3713	w	1.00	3713	3713		
6	C	RF-2-1	6		1275	w	1.00	1275	1275		
7	A	Lighting Core Area	3		3840	w	1.00	3840	3840		
8	A	90 Classroom Ltg	3		1902	w	1.00	1902	1902		
9	B	Lighting Offices	3		3800	w	1.00	3800	3800		
10	B	50 Classroom Ltg	3		2008	w	1.00	2008	2008		
11	C	Lighting Main Lobby	3		2750	w	1.00	2750	2750		
12	C	Lighting Offices	3		3696	w	1.00	3696	3696		
13	A	Moot Ltg Ambient	3		1276	w	1.00	1276	1276		
14	A	Atrium Ltg. Cove/WW	3		666	w	1.00	666	666		
15	B	Moot Ltg Front	3		398	w	1.00	398	398		
16	B	Atrium Ltg. Pendant	4		903	w	1.00	903	903		
17	C	Moot Ltg Accent/Cove	3		847	w	1.00	847	847		
18	C	Atrium Projectors	4		564	w	1.00	564	564		
19	A	Moot Ltg Front WW	3		148	w	1.00	148	148		
20	A	Lighting 220A	3		924	w	1.00	924	924		
21	B	Lighting Office Corr.	3		1450	w	1.00	1450	1450		
22	B	Spare			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	A	Hand Dryers	9		3048	w	1.00	3048	3048		
26	A	Spare			0	w	1.00	0	0		
27	B	Hand Dryers	9		3048	w	1.00	3048	3048		
28	B	Spare			0	w	1.00	0	0		
29	C	Hand Dryers	9		3048	w	1.00	3048	3048		
30	C	Spare			0	w	1.00	0	0		
31	A	Spare			0	w	1.00	0	0		
32	A	Spare			0	w	1.00	0	0		
33	B	Spare			0	w	1.00	0	0		
34	B	Spare			0	w	1.00	0	0		
35	C	LCP-1A	9		1000	w	1.00	1000	1000		
36	C	Spare			0	w	1.00	0	0		
37	A	Panels RP-2SA-1,2	9		34270	w	1.00	34270	34270		
38	A	Spare			0	w	1.00	0	0		
39	B	Panels RP-2SA-1,2	9		31990	w	1.00	31990	31990		
40	B	Spare			0	w	1.00	0	0		
41	C	Panels RP-2SA-1,2	9		30596	w	1.00	30596	30596		
42	C	Spare			0	w	1.00	0	0		
PANEL TOTAL								150.2	150.2	Amps=	180.7
PHASE LOADING								kW	kVA	%	Amps
PHASE TOTAL			A					51.1	51.1	34%	184.3
PHASE TOTAL			B					48.6	48.6	32%	175.4
PHASE TOTAL			C					50.5	50.5	34%	182.4
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
1	receptacles			0.0	0.0		0.0	0.0			
2	computers			0.0	0.0		0.0	0.0			
3	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	incandescent 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			0.0	0.0		0.0	0.0			
9	unassigned			110.0	110.0		110.0	110.0	1.00		
Total Demand Loads							147.8	147.8			
Spare Capacity				20%			29.6	29.6			
Total Design Loads							177.4	177.4	1.00	Amps=	213.4

Figure 2.4.5 – LP-2S Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	LP-2S	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1S'	A.I.C.:	42000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-2-1			1	3,713						RF-2-1
				1,275			2			
	30	3	3		3,713					
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING	20	1	7	3,840						LIGHTING
CORE 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
MAIN LOBBY AND MAIN CORRIDOR						3,696	12	1	20	OFFICE AREAS
MOOT COUR LIGHTING	20	1	13	1,276						ATRIUM LIGHTING
AMBIENT				666			14	1	20	COVE/WALLWASH
MOOT COUR LIGHTING	20	1	15		398					ATRIUM LIGHTING
FRONT					1,467		16	1	20	HID
MOOT COURT LIGHTING	20	1	17			847				SPARE
REAR ACCENT/COVE							18	1	20	
LIGHTING	20	1	19	148						LIGHTING
FRONT WALL WASH				924			20	1	20	220A CORRIDOR
LIGHTING	20	1	21		1,450					SPARE
OFFICE CORRIDOR							22	1	20	
218A	20	1	23			3,048				SPARE
HAND DRYERS							24	1	20	
218B	20	1	25	3,048						SPARE
HAND DRYERS							26	1	20	
248A,B	20	1	27		3,048					SPARE
HAND DRYERS							28	1	20	
251A,B	20	1	29			3,048				SPARE
HAND DRYERS							30	1	20	
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							36	1	20	
PANELS 'RP-2SA-1' & 'RP-2SA-2' (75 KVA XFMR)	125	3	37	34,270						SPARE
							38	1	20	
			39		31,990					SPARE
							40	1	20	
			41			30,596				SPARE
							42	1	20	
	TOTAL VA			51,062	49,149	49,973	TOTAL KVA			150.2
	TOTAL AMP/PHASE			184	177	180	TOTAL AMP			181

REMARKS:

Figure 2.4.6 – LP-2S Revised Panelboard Schedule

PANELBOARD SCHEDULE					
PANEL:	RP-2SA-1	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-2S'	A.I.C.:	22000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
240/241 GENERAL RECEPTACLES	20	1	1	1,080						238/239 GENERAL RECEPTACLES
				1,080			2	1	20	
240/241 RECEPTACLES	20	1	3		720					238/239 RECEPTACLES
					720		4	1	20	
249/250 GENERAL RECEPTACLES	20	1	5			720				219C/220B GENERAL RECEPTACLES
						720	6	1	20	
242/243 GENERAL RECEPTACLES	20	1	7	1,080						220B ECW RECEPTACLE
				1,000			8	1	20	
242/243 RECEPTACLES	20	1	9		720					236/237 GENERAL RECEPTACLES
					1,080		10	1	20	
249 WALL QUAD RECEPTACLES	20	1	11			720				236/237 RECEPTACLES
						720	12	1	20	
249 RECEPTACLE	20	1	13	360						221 FLOOR QUAD RECEPTACLES
				720			14	1	20	
MOOT COURT LIGHTING	20	1	15		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							SPARE
							20	1	20	
221 FLOOR QUAD RECEPTACLE	20	1	21		360					234/235 RECEPTACLES
					720		22	1	20	
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
				360			26	1	20	
202 J2	20	1	27		1,500					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						230/231 GENERAL RECEPTACLES
				1,080			32	1	20	
202 VP	20	1	33		435					230/231 RECEPTACLES
					720		34	1	20	
202 VP	20	1	35			435				228/229 GENERAL RECEPTACLES
						1,080	36	1	20	
202 F2	20	1	37	750						PANEL 'RP-2SB'
				10,670			38	3	100	
MOOT COURT LIGHTING TRACK LIGHTING	20	1	39							
					10,420		40			
SPARE	20	1	41							
						8,886	42			
	TOTAL VA			19,930	20,525	18,201	TOTAL KVA		58.7	
	TOTAL AMP/PHASE			166	171	152	TOTAL AMP		163	

REMARKS:

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

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					RP-2SA-1	Panel Location:			ELEC ROOM 219A		
Nominal Phase to Neutral Voltage------->					120	Phase:			3		
Nominal Phase to Phase Voltage-------->					208	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	240/241 Recept	1		1080	w	1.00	1080	1080		
2	A	238/239 Recept	1		1080	w	1.00	1080	1080		
3	B	240/241 Recept	1		720	w	1.00	720	720		
4	B	238/239 Recept	1		720	w	1.00	720	720		
5	C	249/250 Recept	1		720	w	1.00	720	720		
6	C	219/220 Recept	1		720	w	1.00	720	720		
7	A	242/243 Recept	1		1080	w	1.00	1080	1080		
8	A	220B ECW Recept	1		1080	w	1.00	1080	1080		
9	B	242/243 Recept	1		720	w	1.00	720	720		
10	B	236/237 Recept	1		1080	w	1.00	1080	1080		
11	C	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	A	221 Recept	1		720	w	1.00	720	720		
15	B	Moot Ltg. Track	5		700	w	1.00	700	700		
16	B	221 Recept	1		720	w	1.00	720	720		
17	C	249 Recept	1		360	w	1.00	360	360		
18	C	234/235 Recept	1		1080	w	1.00	1080	1080		
19	A	Spare			0	w	1.00	0	0		
20	A	Spare			0	w	1.00	0	0		
21	B	221 Recept	1		360	w	1.00	360	360		
22	B	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	A	250A J Box	9		1000	w	1.00	1000	1000		
26	A	222/250A Recept	1		360	w	1.00	360	360		
27	B	202 J2	9		1500	w	1.00	1500	1500		
28	B	232/233 Recept	1		1080	w	1.00	1080	1080		
29	C	202 PS	9		1400	w	1.00	1400	1400		
30	C	232/233 Recept	1		720	w	1.00	720	720		
31	A	202 F2	9		750	w	1.00	750	750		
32	A	230/231 Recept	1		1080	w	1.00	1080	1080		
33	B	202 VP	9		435	w	1.00	435	435		
34	B	230/231 Recept	1		720	w	1.00	720	720		
35	C	202 VP	9		435	w	1.00	435	435		
36	C	228/229 Recept	1		1080	w	1.00	1080	1080		
37	A	202 F2	9		750	w	1.00	750	750		
38	A	Panel RP-2SB	9		10670	w	1.00	10670	10670		
39	B	Spare			0	w	1.00	0	0		
40	B	Panel RP-2SB	9		10420	w	1.00	10420	10420		
41	C	Spare			0	w	1.00	0	0		
42	C	Panel RP-2SB	9		8886	w	1.00	8886	8886		
PANEL TOTAL								58.1	58.1	Amps=	161.4
PHASE LOADING								kW	kVA	%	Amps
PHASE TOTAL			A					20.0	20.0	34%	166.8
PHASE TOTAL			B					19.9	19.9	34%	165.8
PHASE TOTAL			C					18.2	18.2	31%	151.7
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
1		receptacles		21.2	21.2		21.2	21.2	1.00		
2		computers		0.0	0.0		0.0	0.0			
3		fluorescent lighting		0.0	0.0	0.90	0.0	0.0			
4		HID lighting		0.0	0.0		0.0	0.0			
5		incandescent lighting		0.7	0.7		0.7	0.7	1.00		
6		HVAC fans		0.0	0.0	0.95	0.0	0.0			
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		36.2	36.2		36.2	36.2	1.00		
Total Demand Loads							58.1	58.1			
Spare Capacity				20%			11.6	11.6			
Total Design Loads							69.7	69.7	1.00	Amps=	193.7

Figure 2.4.8 – RP-2SA-1 Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	RP-2SA-1	EQUIP. GND. BUS:	☐		VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	■		MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS: 100%	☐	200% ■	MLO:	☐
FED FROM:	PANEL 'LP-2S'	A.I.C.:	22000		BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
240/241 GENERAL RECEPTACLES	20	1	1	1,080						238/239 GENERAL RECEPTACLES
				1,080			2	1	20	
240/241 RECEPTACLES	20	1	3		720					238/239 RECEPTACLES
					720		4	1	20	
249/250 GENERAL RECEPTACLES	20	1	5			720				219C/220B GENERAL RECEPTACLES
						720	6	1	20	
242/243 GENERAL RECEPTACLES	20	1	7	1,080						220B ECW RECEPTACLE
				1,000			8	1	20	
242/243 RECEPTACLES	20	1	9		720					236/237 GENERAL RECEPTACLES
					1,080		10	1	20	
249 WALL QUAD RECEPTACLES	20	1	11			720				236/237 RECEPTACLES
						720	12	1	20	
249 RECEPTACLE	20	1	13	360						221 FLOOR QUAD RECEPTACLES
				720			14	1	20	
MOOT COURT LIGHTING	20	1	15		700					221 GENERAL RECEPTACLES
TRACK LIGHTING					720		16	1	20	
249 RECEPTACLE	20	1	17			360				234/235 GENERAL RECEPTACLES
						1,080	18	1	20	
SPARE	20	1	19							SPARE
							20	1	20	
221 FLOOR QUAD RECEPTACLE	20	1	21		360					234/235 RECEPTACLES
					720		22	1	20	
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
				360			26	1	20	
202 J2	20	1	27		1,500					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						230/231 GENERAL RECEPTACLES
				1,080			32	1	20	
202 VP	20	1	33		435					230/231 RECEPTACLES
					720		34	1	20	
202 VP	20	1	35			435				228/229 GENERAL RECEPTACLES
						1,080	36	1	20	
202 F2	20	1	37	750						
				10,670			38	3	100	
SPARE	20	1	39							PANEL 'RP-2SB'
					10,420		40			
SPARE	20	1	41							
						8,886	42			
	TOTAL VA			19,930	19,895	18,201	TOTAL KVA		58.0	
	TOTAL AMP/PHASE			166	166	152	TOTAL AMP		161	

REMARKS:

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

Moot Courtroom Feeder Sizing Worksheet		
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

ORIGINAL TRANSFORMER SCHEDULE								
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°C	(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°C**	**(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°C**	**(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°C**	**(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°C**	**(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°C	(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°C**	**(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°C**	**(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°C**	**(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°C**	**(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°C	(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°C	(6) 2.5% Taps (2) Up & (4) Dn	Pad mounted, vibration isolated	

Figure 3.1.1 – Original Distribution System Transformer Schedule

ORIGINAL FEEDER SCHEDULE															
			NO. OF	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF
						PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS			OVERCURRENT
TAG	FROM	TO	SETS	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	PROTECTION
1	UTILITY	XD-1	1	4"	PVC	3	4/0	--	--	--	--	1	2	--	--
2	UTILITY	XD-1	1	4"	PVC	3	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	Disc. Sw	Fire Pump	1	1.5"	EMT	3	1/0	CU THWN	1	1/0	CU THWN	1	6	CU THWN	800A Fuse
6	**MDB**	**LP-1N**	**2**	**2"**	**EMT**	**3**	**3/0**	**CU THWN**	**1**	**3/0**	**CU THWN**	**1**	**3**	**CU THWN**	**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	**RP-1NA**	**RP-1NB**	**1**	**1.5**	**EMT**	**3**	**1**	**CU THWN**	**1**	**1**	**CU THWN**	**1**	**8**	**CU THWN**	**100A, 3P**
10	**LP-1N**	**LP-2N**	**1**	**2**	**EMT**	**3**	**1/0**	**CU THWN**	**1**	**1/0**	**CU THWN**	**1**	**6**	**CU THWN**	**150A, 3P**
11	**LP-2N**	**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	**LP-1N**	**LP-3N**	**1**	**2**	**EMT**	**3**	**1/0**	**CU THWN**	**1**	**1/0**	**CU THWN**	**1**	**6**	**CU THWN**	**150A, 3P**
15	**LP-3N**	**XS-3**	**1**	**1.25**	**EMT**	**3**	**4**	**CU THWN**	**0**	**--**	**CU THWN**	**1**	**8**	**CU THWN**	**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	**MDB**	**LP-1S**	**1**	**3**	**EMT**	**3**	**350**	**CU THWN**	**1**	**350**	**CU THWN**	**1**	**4**	**CU THWN**	**400A, 3P**
19	**LP-1S**	**XS-4**	**1**	**1.5**	**EMT**	**3**	**1/0**	**CU THWN**	**0**	**--**	**CU THWN**	**1**	**6**	**CU THWN**	**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**	**RP-1SA-3**	**1**	**2.5**	**EMT**	**3**	**250**	**CU THWN**	**1**	**250**	**CU THWN**	**1**	**4**	**CU THWN**	**125A, 3P**
23	**RP-1SA-1**	**RP-1SB**	**1**	**1.5**	**EMT**	**3**	**1**	**CU THWN**	**1**	**1**	**CU THWN**	**1**	**8**	**CU THWN**	**100A, 3P**
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
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	**LP-BN**	**XS-6**	**1**	**0.75**	**EMT**	**3**	**6**	**CU THWN**	**0**	**--**	**CU THWN**	**1**	**10**	**CU THWN**	**50A, 3P**
29	**XS-6**	**RP-BN**	**1**	**1.5**	**EMT**	**3**	**1**	**CU THWN**	**1**	**1**	**CU THWN**	**1**	**8**	**CU THWN**	**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	**XS-7**	**RP-BS**	**1**	**2.5**	**EMT**	**3**	**250**	**CU THWN**	**1**	**250**	**CU THWN**	**1**	**4**	**CU THWN**	**400A, 3P**
34	**RP-BS**	**RP-BSA**	**1**	**1.5**	**EMT**	**3**	**1**	**CU THWN**	**1**	**1**	**CU THWN**	**1**	**8**	**CU THWN**	**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	**LP-2S**	**XS-8**	**1**	**1.5**	**EMT**	**3**	**1/0**	**CU THWN**	**0**	**--**	**CU THWN**	**1**	**6**	**CU THWN**	**125A, 3P**
39	**XS-8**	**RP-2SA-1**	**2**	**2**	**EMT**	**3**	**3/0**	**CU THWN**	**1**	**3/0**	**CU THWN**	**1**	**3**	**CU THWN**	**125A, 3P**
40	**RP-2SA-1**	**RP-2SA-2**	**2**	**2**	**EMT**	**3**	**3/0**	**CU THWN**	**1**	**3/0**	**CU THWN**	**1**	**3**	**CU THWN**	**125A, 3P**
41	**RP-2SA-2**	**RP-2SA-3**	**2**	**2**	**EMT**	**3**	**3/0**	**CU THWN**	**1**	**3/0**	**CU THWN**	**1**	**3**	**CU THWN**	**125A, 3P**
42	**RP-2SA-1**	**RP-2SB**	**1**	**1.5**	**EMT**	**3**	**1**	**CU THWN**	**1**	**1**	**CU THWN**	**1**	**8**	**CU THWN**	**100A, 3P**
43	**MDB**	**LP-3S**	**1**	**2.5**	**EMT**	**3**	**250**	**CU THWN**	**1**	**250**	**CU THWN**	**1**	**4**	**CU THWN**	**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	**RP-3SA-2**	**RP-3SA-3**	**1**	**2**	**EMT**	**3**	**3/0**	**CU THWN**	**1**	**3/0**	**CU THWN**	**1**	**6**	**CU THWN**	**125A, 3P**
48	**RP-3SA-1**	**RP-3SB**	**1**	**1.5**	**EMT**	**3**	**1**	**CU THWN**	**1**	**1**	**CU THWN**	**1**	**8**	**CU THWN**	**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	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	2..5	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	EDP-BS	ELP-1S	1	1.5	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	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	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	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	100A, 3P
65	ATS-NLS	GEN	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	70A, 3P
66	ATS-NLS	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	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	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	10	CU THWN	60A, 3P
73	ENP-1S	ENP-3S	1	1	EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	50A, 3P

NOTES:
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.

PANELBOARD SCHEDULE

PANEL:	LP-1N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(188)-1ST FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000	BUS RATING:	400

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	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				
						1,275	6			
LIGHTING	20	1	7	4,000						LIGHTING
OFFICE SPACE				3,176			8	1	20	OFFICE CORRIDOR
LIGHTING	20	1	9		2,500					LIGHTING
MAIN 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							SPARE
							16	1	20	
SPARE	20	1	17							SPARE
							18	1	20	
SPARE	20	1	19							SPARE
							20	1	20	
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							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							
				40,313			32	3	150	
SPARE	20	1	33							PANEL 'LP-3N'
					37,544		34			
LIGHTING CONTROL PANEL	20	1	35			1,000				
LCP-1B						36,920	36			
	125	3	37	23,511						
PANEL 'RP-1NA'				26,681			38	3	150	
(75 KVA XFMR)			39		18,645					PANEL 'LP-2N'
					28,445		40			
			41			18,837				
						25,239	42			
	TOTAL VA			103,919	93,522	90,184	TOTAL KVA		287.6	
	TOTAL AMP/PHASE			375	338	326	TOTAL AMP		346	

REMARKS:

Figure 3.2.1 – LP-1N Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-1NA	EQUIP. GND. BUS:	☐		VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(188)-1ST FL.	ISOLATED GND BUS:	■		MAIN CIRCUIT BKR:	250
MOUNTING:	SURFACE	NEUTRAL BUS: 100%	☐	200% ■	MLO:	☐
FED FROM:	PANEL 'LP-1N'	A.I.C.: 22000			BUS RATING:	400

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
181/182 GENERAL RECEPTACLES	20	1	1	1,080						186/187,A/S4-1 RECEPTACLES
				1,620			2	1	20	
181/182 COMPUTER RECEPTACLES	20	1	3		720					187 UCR
					500		4	1	20	
180 COMPUTER RECEPTACLES	20	1	5			720				185 GENERAL RECEPTACLES
						360	6	1	20	
180 GENERAL RECEPTACLES	20	1	7	720						183/184 COMPUTER RECEPTACLES
				720			8	1	20	
180 COPIER RECEPTACLE	20	1	9		1,000					178/179 COMPUTER RECEPTACLES
					720		10	1	20	
180 FAX RECEPTACLE	20	1	11			500				178/179 GENERAL RECEPTACLES
						1,260	12	1	20	
168/CORRIDOR RECEPTACLES	20	1	13	1,260						176/177 GENERAL RECEPTACLES
				1,080			14	1	20	
183 COPIER RECEPTACLE	20	1	15		1,000					CUH-1-2
					345		16	1	20	
183 COMPUTER RECEPTACLES	20	1	17			720				CUH-1-4
						345	18	1	15	
183 FAX RECEPTACLE	20	1	19	500						TF-1-1
				506			20	1	15	
168 COMPUTER RECEPTACLES	20	1	21		720					FP-1-3
					830		22	1	15	
169 RECEPTACLES	20	1	23			720				UH-1
						506	24	1	15	
168A COMPUTER RECEPTACLES	20	1	25	720						176/177 COMPUTER RECEPTACLES
				720			26	1	20	
168A COMPUTER RECEPTACLES	20	1	27		720					174/175 COMPUTER RECEPTACLES
					720		28	1	20	
170 RECEPTACLES	20	1	29			540				184 GENERAL RECEPTACLES
						900	30	1	20	
180 COMPUTER RECEPTACLE	20	1	31	180						168 JUNCTION BOX
				1,000			32	1	20	
170 COPIER RECEPTACLE	20	1	33		1,000					LIGHTING
					200		34	1	20	CHAPEL INCANDESCENT
170 COPIER RECEPTACLE	20	1	35			1,000				SPARE
							36	1	20	
SPARE	20	1	37							
				13,405			38	3	100	
114A OUTDOOR RECEPTACLE	20	1	39		180					PANEL 'RP-1NB'
					9,990		40			
114A/115/169 GEN. RECEPTACLES	20	1	41			720				
						10,546	42			
	TOTAL VA			23,511	18,645	18,837	TOTAL KVA		61.0	
	TOTAL AMP/PHASE			196	155	157	TOTAL AMP		169	

REMARKS:

Figure 3.2.2 – RP-1NA Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-2N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(266)-2ND FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1N'	A.I.C.:	42000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-2-3			1	5,570						RF-2-3
				1,275			2			
	40	3	3		5,570					
					1,275		4	3	15	
			5			5,570				
						1,275	6			
LIGHTING	20	1	7	1,800						LIGHTING
OFFICE NORTH				3,400			8	1	20	STACKS
LIGHTING	20	1	9		2,000					LIGHTING
READING ROOM					3,400		10	1	20	STACKS
LIGHTING	20	1	11			1,300				LIGHTING
SEATING						2,632	12	1	20	STACKS
LIGHTING	20	1	13	510						SPARE
MECHANICAL							14	1	20	
SPARE	20	1	15							SPARE
							16	1	20	
SPARE	20	1	17							SPARE
							18	1	20	
SPARE	20	1	19							SPARE
							20	1	20	
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							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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-2B							36	1	20	
PANEL 'RP-2NA' (45 KVA XFMR)	70	3	37	14,126						SPARE
							38	1	20	
			39		16,200					SPARE
							40	1	20	
			41			13,462				SPARE
							42	1	20	
	TOTAL VA			26,681	28,445	25,239	TOTAL KVA		80.4	
	TOTAL AMP/PHASE			96	103	91	TOTAL AMP		97	

REMARKS:

Figure 3.2.3 – LP-2N Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-2NA	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(266)-2ND FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	150
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-2N'	A.I.C.:	22000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
265 FLOOR QUAD RECEPTACLES	20	1	1	720						260B/264 RECEPTACLES
				1,080			2	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	3		720					264 WALL QUAD RECEPTACLES (COMP)
					720		4	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	5			720				264 WALL QUAD RECEPTACLES (COMP)
						720	6	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	7	720						264 WALL QUAD RECEPTACLES (COMP)
				720			8	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	9		720					264 WALL QUAD RECEPTACLES (COMP)
					720		10	1	20	
265 COMP. WALL RECEPTACLES	20	1	11			720				264 GEN RECEPTACLES
						900	12	1	20	
260B/265 RECEPTACLES	20	1	13	720						260 WALL QUAD RECEPTACLES
				720			14	1	20	
267 GENERAL RECEPTACLES	20	1	15		360					260A EWC RECEPTACLE
					500		16	1	20	
260B JUNCTION BOX	20	1	17			1,000				SPARE
							18	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	19	720						TF-2-1
				506			20	1	15	
265 FLOOR QUAD RECEPTACLES	20	1	21		720					FP-2-3
					830		22	1	15	
265 FLOOR QUAD RECEPTACLES	20	1	23			720				UH-1
						506	24	1	15	
265 WALL RECEPTACLES	20	1	25	540						SPARE
							26	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	27		360					SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							SPARE
							32	1	20	
SPARE	20	1	33							SPARE
							34	1	20	
SPARE	20	1	35							SPARE
							36	1	20	
SPARE	20	1	37							PANEL 'RP-2NB'
				7,680			38	3	100	
SPARE	20	1	39							
					10,550		40			
SPARE	20	1	41							
						8,176	42			
	TOTAL VA			14,126	16,200	13,462	TOTAL KVA		43.788	
	TOTAL AMP/PHASE			118	135	112	TOTAL AMP		122	

REMARKS:

Figure 3.2.4 – RP-2NA Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-3N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(366)-3RD FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1N'	A.I.C.:	42,000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-3-3			1	5,570						RF-3-3
				2,015			2			
	40	3	3		5,570					
					2,015		4	3	15	
			5			5,570				
						2,015	6			
SF-R-1			7	3,713						LIGHTING
				2,000			8	1	20	READING ROOM
	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
LIGHTING	20	1	13	2,056						LIGHTING
OFFICE 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				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							SPARE
							24	1	20	
SPARE	20	1	25							SPARE
							26	1	20	
SPARE	20	1	27							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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-3B							36	1	20	
PANEL 'RP-3NA'	70	3	37	21,447						SPARE
(45 KVA XFMR)							38	1	20	
			39		21,326					SPARE
							40	1	20	
			41			18,498				SPARE
							42	1	20	
	TOTAL VA			40,313	37,544	36,920	TOTAL KVA			114.8
	TOTAL AMP/PHASE			146	136	133	TOTAL AMP			138

REMARKS:

Figure 3.2.5 – LP-3N Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-3NA	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(366)-3RD FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	150A
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-3N'	A.I.C.:	22,000	BUS RATING:	225A

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
365 RECEPTACLES	20	1	1	360						ROOF RECEPTACLES
				360			2	1	20	
365 RECEPTACLES	20	1	3		360					365 RECEPTACLES
					1,440		4	1	20	
365 RECEPTACLES	20	1	5			720				367 RECEPTACLES
						1,440	6	1	20	
365 RECEPTACLES	20	1	7	720						360B RECEPTACLES
				1,260			8	1	20	
365 RECEPTACLES	20	1	9		720					360 RECEPTACLES
					1,440		10	1	20	
370/371 RECEPTACLES	20	1	11			1,260				372 RECEPTACLES
						1,440	12	1	20	
370 RECEPTACLES	20	1	13	1,080						368 RECEPTACLES
				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				TE-3-1
						299	18	1	15	
364 RECEPTACLES	20	1	19	720						TF-3-1
				500			20	1	15	
364 RECEPTACLES	20	1	21		720					FP-3-3
					830		22	1	15	
374 RECEPTACLES	20	1	23			720				UH-1
						506	24	1	15	
376 COPIER	20	1	25	1,000						J-BOX, VAV
				1,000			26	1	20	
360 RECEPTACLES	20	1	27		900					365 RECEPTACLES
					720		28	1	20	
360 RECEPTACLES	20	1	29			720				365 RECEPTACLES
						720	30	1	20	
360 RECEPTACLES	20	1	31	720						LIGHTING
				322			32	1	20	365 PENDANTS
360 RECEPTACLES	20	1	33		900					SPARE
							34	1	20	
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					PANEL 'RP-3NB'
					11,056		40			
SPARE	20	1	41							
						9,413	42			
	TOTAL VA			21,447	21,326	18,498	TOTAL KVA		61.271	
	TOTAL AMP/PHASE			179	178	154	TOTAL AMP		170	

REMARKS:

Figure 3.2.6 – RP-3NA Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-1S	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000	BUS RATING:	600

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	3,713						
				2,015			2			
SF-1-1	30	3	3		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					LIGHTING
OFFICES					1,902		10	1	20	90 CLASSROOM
LIGHTING	20	1	11			1,840				LIGHTING
OFFICES						2,008	12	1	20	55 CLASSROOM
LIGHTING	20	1	13	1,800						LIGHTING
OFFICE CORRIDORS				2,500			14	1	20	MAIN STAIRS
LIGHTING	20	1	15		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
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							24	1	20	
118B J-BOXES	20	1	25	3,048						SPARE
HAND DRYERS							26	1	20	
118A J-BOXES	20	1	27		3,048					SPARE
HAND DRYERS							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							
							32	3	100	
SPARE	20	1	33							SPARE
							34			
LIGHTING CONTROL PANEL	20	1	35			1,000				
LCP-1A							36			
	125	3	37	38,782						
PANELS 'RP-1SA-1' & 'RP-1SA-2'							38	3	50	
(75 KVA XFMR)			39		40,015					SPARE
							40			
			41			36,606				
							42			
	TOTAL VA			58,640	60,033	54,680	TOTAL KVA		173.4	
	TOTAL AMP/PHASE			212	217	197	TOTAL AMP		209	

REMARKS:

Figure 3.2.7 – LP-1S Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-1SA-1	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS: 100% ☐	200% ■	MLO:	☐
FED FROM:	PANEL 'LP-1S'	A.I.C.:	22500	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
143/144/146 GENERAL RECEPTS.	20	1	1	1,260						122/123 GENERAL RECEPTACLES
				1,080			2	1	20	
148/149A GENERAL RECEPTACLES	20	1	3		1,260					SPARE
							4	1	20	
141/142 COMPUTER RECEPTACLES	20	1	5			720				120B EWC RECEPTACLE
						500	6	1	20	
141/142 GENERAL RECEPTACLES	20	1	7	1,260						121/137 COMPUTER RECEPTACLES
				1,080			8	1	20	
148/149A,B COMPUTER RECEPTACLES	20	1	9		1,080					121 COMPUTER RECEPTACLES
					1,080		10	1	20	
147/149,B GENERAL RECEPTACLES	20	1	11			900				SPARE
							12	1	20	
140/139 GENERAL RECEPTACLES	20	1	13	1,080						121 FAX RECEPTACLE
				500			14	1	20	
139/140 COMPUTER RECEPTACLES	20	1	15		720					121 COPY RECEPTACLE
					1,000		16	1	20	
150 COMPUTER RECEPTACLES	20	1	17			720				CUH-1-3
						345	18	1	15	
138/150 GENERAL RECEPTACLES	20	1	19	1,080						SPARE
							20	1	20	
138/150 COMPUTER RECEPTACLES	20	1	21		720					122/123 COMPUTER RECEPTACLES
					720		22	1	20	
CONVENIANCE RECEPTACLE	20	1	23			360				124/125 GENERAL RECEPTACLES
COFFEE BAR						1,080	24	1	20	
119C/121,A/137 GENERAL RECEPTACLES	20	1	25	1,260						124/125 COMPUTER RECEPTACLES
				720			26	1	20	
138A JUNCTION BOX	20	1	27		1,000					126/127/128/129 GEN. RECEPTS
					1,260		28	1	20	
121A JUNCTION BOX	20	1	29			1,000				126/127 COMPUTER RECEPTACLES
						720	30	1	20	
SPARE	20	1	31							127/128 COMPUTER RECEPTACLES
				720			32	1	20	
149 AV	20	1	33		1,500					121B/129 COMPUTER RECEPTACLES
					540		34	1	20	
149 AV	20	1	35			1,500				130 COMPUTER RECEPTACLES
						540	36	1	20	
WIREMOLD 6000	20	1	37	1,260						PANEL 'RP-1SB'
				13,522			38	3	100	
WIREMOLD 6000	20	1	39		1,260					
					13,380		40			
SPARE	20	1	41							
						14,446	42			
	TOTAL VA			24,822	25,520	22,831	TOTAL KVA		73.2	
	TOTAL AMP/PHASE			207	213	190	TOTAL AMP		203	

REMARKS:

Figure 3.2.8 – LP-1S Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-BN	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(L29)-BSMT	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-L-1			1	3,713						RF-L-1
				2,920			2			
	30	3	3		3,713					
					2,920		4	3	30	
			5			3,713				
						2,920	6			
SPARE	20	1	7	900						SPARE
				265			8	1	20	
SPARE	15	3	9		900					SPARE
					265		10	1	20	
SPARE	20	1	11			922				SPARE
						265	12	1	20	
SP-1	15	1	13	795						SPARE
							14	1	20	
SP-2	15	1	15		795					SPARE
							16	1	20	
LIGHTING	20	1	17			920				SPARE
SITE CHECKING AND MECH ROOM							18	1	20	
LIGHTING	20	1	19	2,680						LIGHTING
BASEMENT STACKS				3,512			20	1	20	MAIL ROOM WORKSPACES
LIGHTING	20	1	21		2,744					LIGHTING
BASEMENT STACKS					2,000		22	1	20	MAIN LOBBY AREA
LIGHTING	20	1	23			2,000				SPARE
CLASSROOM SPACES							24	1	20	
LIGHTING	20	1	25	2,016						SPARE
CIRCULATION SPACE							26	1	20	
LIGHTING	20	1	27		2,880					SPARE
MOVING STACKS							28	1	20	
LIGHTING	20	1	29			1,400				LIGHTING
MAIN MECHANICAL ROOM						1,000	30	1	20	MECH ROOM AND RESTROOM
LIGHTING	20	1	31	2,824						
BASEMENT STACKS				2,500			32	1	20	EXTRA
LIGHTING CONTROL PANEL	20	1	33		1,000					SPARE
LCP-0A							34	1	20	
L24A,B	20	1	35			3,048				
HAND DRYERS						1,275	36	3	15	
	50	3	37	11,218						
PANEL 'RP-BN'				1,275			38			COMPACTOR
(30 KVA XFMR)			39		13,077					
					1,275		40			
			41			10,838				SPARE
							42	1	20	
	TOTAL VA			34,618	31,569	28,301	TOTAL KVA			94.5
	TOTAL AMP/PHASE			125	114	102	TOTAL AMP			114
REMARKS:										

Figure 3.2.9 – LP-BN Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-BS	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM (B02)-SUB.BSMT	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	225
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	☐
FED FROM:	SWBD 'MDB'	A.I.C.:	65000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	5,570						
				2,920			2			
SF-1-2	40	3	3		5,570					RF-1-2
					2,920		4	3	30	
			5			5,570				
						2,920	6			
SPARE	20	1	7							SPARE
							8	1		
SPARE	20	1	9							SPARE
							10	1	15	
SPARE	20	1	11							SPARE
							12	1		
			13	7,160						
				2,920			14			
SF-1-2	60	3	15		7,160					RF-1-2
					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					RF-2-2
					2,920		22	3	30	
			23			5,570				
						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						LIGHTING
				3,500			32	1	20	DINING AREA
LIGHTING CONTROL PANEL	20	1	33		1,000					LIGHTING
LCP-0B					2,280		34	1	20	SERVING
SPARE	20	1	35							LIGHTING
							36	1	20	KITCHEN/SURROUNDING SPACES
	125	3	37	25,880						LIGHTING
PANEL 'RP-BS'				1,440			38	1	20	LOCKERS
(30 KVA XFMR)			39		21,833					L16A,L16B
					3,048		40	1	20	HAND DRYERS
			41			21,370				L09A,B
						3,048	42	1	20	HAND DRYERS
	TOTAL VA			59,896	55,221	51,478	TOTAL KVA			166.6
	TOTAL AMP/PHASE			216	199	186	TOTAL AMP			200

REMARKS:

Figure 3.2.10 – LP-BS Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-BS	**EQUIP. GND. BUS:**	☐	**VOLTAGE:**	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM (B02)-SUB.BSMT	**ISOLATED GND BUS:**	■	**MAIN CIRCUIT BKR:**	200
MOUNTING:	SURFACE	**NEUTRAL BUS:**	**100%** ☐ **200%** ■	**MLO:**	☐
FED FROM:	PANEL 'LP-BS'	**A.I.C.:**	10000	**BUS RATING:**	450

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
L11 GENERAL RECEPTACLES	20	1	1	360						L13A/L14/L15A/OUTDOOR RECEPTACLES
				1,260			2	1	20	
L12 PRINTER RECEPTACLE	20	1	3		1,000					L14 COFF. RECEPTACLE
					720		4	1	20	
L10 RECPTACLES	20	1	5			540				L14 MICR. RECEPTACLE
						750	6	1	20	
L10 RECEPTACLES	20	1	7	720						L14 REF RECEPTACLE
				750			8	1	20	
L10 RECEPTACLES	20	1	9		720					L10/S2-L RECEPTACLES
					360		10	1	20	
L13 RECEPTACLES	20	1	11			900				B02,A GENERAL RECEPTACLES
						900	12	1	20	& MOTORIZED DAMPERS
L13A RECEPTACLES	20	1	13	900						
				1,650			14	2	20	
L13 RECEPTACLES	20	1	15		720					EUH-2
					1,650		16			
L13 RECEPTACLES	20	1	17			720				
						1,650	18	2	20	
L09A,B/L13,A RECEPTACLES	20	1	19	1,180						EUH-1
AUTO SENSORS				1,650			20			
L10 CORRIDOR EWC	20	1	21		500					FP-L-2
					830		22	1	15	
SPARE	20	1	23							UH-1
						506	24	1	15	
L12 J1	20	1	25	1,500						LIGHTING
				200			26	1	20	DINING/KITCHEN HALOGEN
L13 AV	20	1	27		1,100					SPARE
							28	1	20	
103 PS	20	1	29			1,400				102 J2
						1,500	30	1	20	
103 J2	20	1	31	1,500						102 PS
				1,400			32	1	20	
103 F2	20	1	33		750					102 F2
					750		34	1	20	
103 F2	20	1	35			750				102 VP
						435	36	1	20	
			37	12,610						LIGHTING (FUTURE)
				200			38	1	20	DRIVEWAY SIGN
PANEL 'RP-BSA'	100	3	39		12,001					MOTORIZED DOORS (L10, L10A, L13B)
					732		40	1	20	& MAGLOCKS (L13B, L13C)
			41			11,319				SPARE
							42	1	20	
	TOTAL VA			25,880	21,833	21,370	TOTAL KVA		69.1	
	TOTAL AMP/PHASE			216	182	178	TOTAL AMP		192	

REMARKS:

Figure 3.2.11 – RP-BS Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-2S	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1S'	A.I.C.:	42000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	3,713						
				1,275			2			
SF-2-1	30	3	3		3,713					RF-2-1
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING	20	1	7	3,840						LIGHTING
CORE 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
MAIN LOBBY AND MAIN CORRIDOR						3,696	12	1	20	OFFICE AREAS
LIGHTING	20	1	13	1,200						LIGHTING
MOOT COURT				336			14	1	20	ATRIUM
LIGHTING	20	1	15		600					LIGHTING
MOOT COURT					900		16	1	20	ATRIUM
LIGHTING	20	1	17			160				LIGHTING
MOOT COURT						900	18	1	20	ATRIUM
LIGHTING	20	1	19	300						LIGHTING
MOOT COURT				924			20	1	20	220A CORRIDOR
LIGHTING	20	1	21		1,450					SPARE
OFFICE CORRIDOR							22	1	20	
218A	20	1	23			3,048				SPARE
HAND DRYERS							24	1	20	
218B	20	1	25	3,048						SPARE
HAND DRYERS							26	1	20	
248A,B	20	1	27		3,048					SPARE
HAND DRYERS							28	1	20	
251A,B	20	1	29			3,048				SPARE
HAND DRYERS							30	1	20	
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							36	1	20	
	125	3	37	34,270						SPARE
PANELS 'RP-2SA-1' & 'RP-2SA-2'							38	1	20	
(75 KVA XFMR)			39		32,620					SPARE
							40	1	20	
			41			30,596				SPARE
							42	1	20	
	TOTAL VA			50,808	49,414	50,186	TOTAL KVA			150.4
	TOTAL AMP/PHASE			183	178	181	TOTAL AMP			181

REMARKS:

Figure 3.2.12 – LP-2S Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-2SA-1	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-2S'	A.I.C.:	22000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
240/241 GENERAL RECEPTACLES	20	1	1	1,080						238/239 GENERAL RECEPTACLES
				1,080			2	1	20	
240/241 RECEPTACLES	20	1	3		720					238/239 RECEPTACLES
					720		4	1	20	
249/250 GENERAL RECEPTACLES	20	1	5			720				219C/220B GENERAL RECEPTACLES
						720	6	1	20	
242/243 GENERAL RECEPTACLES	20	1	7	1,080						220B ECW RECEPTACLE
				1,000			8	1	20	
242/243 RECEPTACLES	20	1	9		720					236/237 GENERAL RECEPTACLES
					1,080		10	1	20	
249 WALL QUAD RECEPTACLES	20	1	11			720				236/237 RECEPTACLES
						720	12	1	20	
249 RECEPTACLE	20	1	13	360						221 FLOOR QUAD RECEPTACLES
				720			14	1	20	
MOOT COURT LIGHTING	20	1	15		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							SPARE
							20	1	20	
221 FLOOR QUAD RECEPTACLE	20	1	21		360					234/235 RECEPTACLES
					720		22	1	20	
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
				360			26	1	20	
202 J2	20	1	27		1,500					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						230/231 GENERAL RECEPTACLES
				1,080			32	1	20	
202 VP	20	1	33		435					230/231 RECEPTACLES
					720		34	1	20	
202 VP	20	1	35			435				228/229 GENERAL RECEPTACLES
						1,080	36	1	20	
202 F2	20	1	37	750						
				10,670			38	3	100	
SPARE	20	1	39							PANEL 'RP-2SB'
					10,420		40			
SPARE	20	1	41							
						8,886	42			
	TOTAL VA			19,930	20,525	18,201	TOTAL KVA		58.7	
	TOTAL AMP/PHASE			166	171	152	TOTAL AMP		163	

REMARKS:

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

PANELBOARD SCHEDULE

PANEL:	LP-3S	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(319A)-3RD FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1S'	A.I.C.:	42,000	BUS RATING:	100A

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-3-1			1	3,713						RF-3-1
				1,275			2			
	30	3	3		3,713					
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING	20	1	7	3,552						LIGHTING
OFFICE AREA				3,696			8	1	20	ADJUSTABLE CLASSROOMS
LIGHTING	20	1	9		4,080					LIGHTING
OFFICE AREA					3,096		10	1	20	90 & 55 CLASSROOM
LIGHTING	20	1	11			1,600				LIGHTING
OFFICE HALLWAY						3,050	12	1	20	LOBBY AND MAIN HALLWAY
LIGHTING	20	1	13	2,760						SPARE
OFFICE SPACE							14	3	20	
LIGHTING	20	1	15		1,200					SPARE
OFFICE HALLWAY							16	1	20	
348A,B	20	1	17			3,048				SPARE
HAND DRYERS							18	1	20	
351A,B	20	1	19	3,048						SPARE
HAND DRYERS							20	1	20	
318A	20	1	21		3,048					SPARE
HAND DRYERS							22	1	20	
318B	20	1	23			3,048				SPARE
HAND DRYERS							24	1	20	
SPARE	20	1	25							SPARE
							26	1	20	
SPARE	20	1	27							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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							36	1	20	
PANELS 'RP-3SA-1' & 'RP-3SA-2' (75 KVA XFMR)	125	3	37	44,742						SPARE
							38	1	20	
			39		47,360					SPARE
							40	1	20	
			41			44,035				SPARE
							42	1	20	
	TOTAL VA			62,786	63,772	60,769	TOTAL KVA			187.3
	TOTAL AMP/PHASE			227	230	219	TOTAL AMP			225

REMARKS:

Figure 3.2.14 – LP-3S Original Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-3SA-1	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(319A)-3RD FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-3S'	A.I.C.:	22000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
360 RECEPTACLES	20	1	1	720						J-BOX, VAV
				1,000			2	1	20	
362 RECEPTACLES	20	1	3		720					350 RECEPTACLES
					1,340		4	1	20	
363 RECEPTACLES	20	1	5			720				318B RECEPTACLES
						1,340	6	1	20	
349 RECEPTACLES	20	1	7	720						339 RECEPTACLES
				1,440			8	1	20	
349 RECEPTACLES	20	1	9		720					337 RECEPTACLES
					1,440		10	1	20	
340 RECEPTACLES	20	1	11			720				GE-R-1
						506	12	1	15	
340 RECEPTACLES	20	1	13	720						SPARE
							14	1	15	
337 RECEPTACLES	20	1	15		720					TE-R-2
					830		16	1	15	
335 RECEPTACLES	20	1	17			720				CE-R-2
						506	18	1	15	
333 RECEPTACLES	20	1	19	720						SPARE
							20	1	20	
331 RECEPTACLES	20	1	21		720					334 RECEPTACLES
					1,440		22	1	20	
329 RECEPTACLES	20	1	23			720				332 RECEPTACLES
						1,440	24	1	20	
327 RECEPTACLES	20	1	25	720						J-BOX, VAV
				1,000			26	1	20	
324 RECEPTACLES	20	1	27		720					326 RECEPTACLES
					1,440		28	1	20	
322 COPIER	20	1	29			1,000				323 RECEPTACLES
						1,440	30	1	20	
321 RECEPTACLES	20	1	31	1,080						321 RECEPTACLES
				1,440			32	1	20	
321 RECEPTACLES	20	1	33		360					302 RECEPTACLES
					1,440		34	1	20	
323 RECEPTACLES	20	1	35			360				302 RECEPTACLES
						1,440	36	1	20	
302 RECEPTACLES	20	1	37	1,440						
				17,802			38	3	100	
302 RECEPTACLES	20	1	39		1,440					PANEL 'RP-3SB'
					17,290		40			
327/328/329 GENERAL RECEPTS	20	1	41			1,260				
						15,883	42			
	TOTAL VA			28,802	30,620	28,055	TOTAL KVA		87.5	
	TOTAL AMP/PHASE			240	255	234	TOTAL AMP		243	

REMARKS:

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

Original Distribution System Single Line Diagram

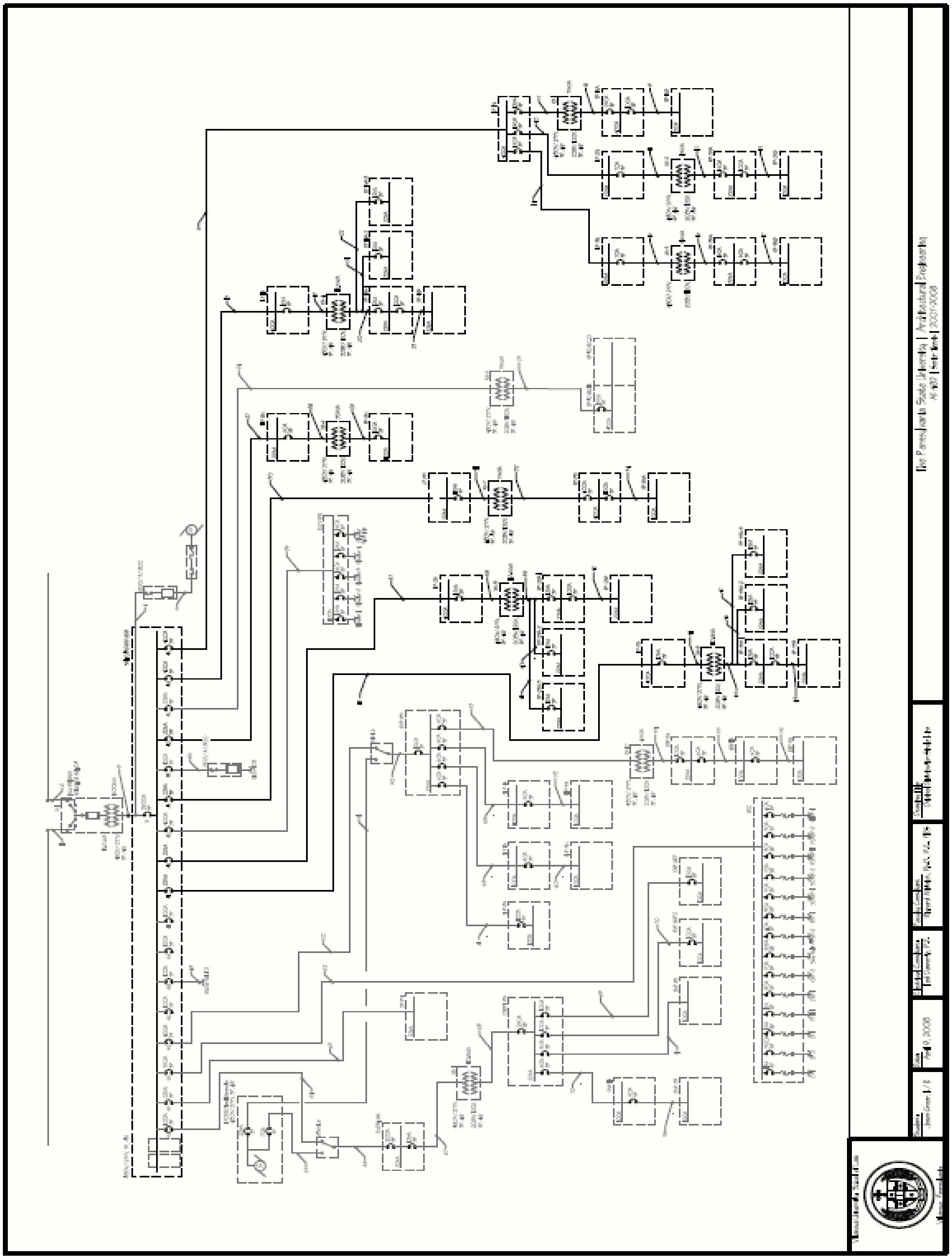


Figure 3.3.1 – Original Distribution System Single Line
*See Appendix D for full size single line

Redesign Calculations

DL-1 Redesign Equipment Sizing								
PANEL	kVA	Amps	Amps (growth)	Brk.	Bus	Feeder (THWN)	Grnd.	Conduit
LP-BN	59.4	71	82.1	90	100	(4) #3	#8	1-1/4" EMT
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								
PANEL	kVA	Amps	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													
PANEL	kVA	Amps	Amps (growth)	Brk.	Bus	Feeder (THWN)	Grnd.	Conduit	X-FMR (kVA)	X-Prim Prot	X-Sec Prot	Primary Feeder	Primary Ground
RP-BN	35.1	98	112.1	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

PANEL	kVA	Amps	Amps (growth)	Brk.	Bus	Feeder (THWN)	Grnd.	Conduit	X-FMR (kVA)	X-Prim Prot	X-Sec Prot	Primary Feeder	Primary Ground
RP-1SA-1	31.8	88	~~101.6~~	90	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

PANEL	kVA	Amps	Amps (growth)	Brk.	Bus	Feeder (THWN)	Grnd.		X-FMR (kVA)	X-Prim Prot	X-Sec Prot	Primary Feeder	Primary Ground
RP-BS	33.2	92	105.8	110	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 TRANSFORMER SCHEDULE							
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°C	(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°C	(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°C	(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°C	(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°C**	**(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°C**	**(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°C**	**(6) 2.5% Taps (2) Up & (4) Dn**	**Pad mounted, vibration isolated**

Figure 3.5.1 – Redesign Distribution System Transformer Schedule

REDESIGN FEEDER SCHEDULE															
			NO. OF	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF
						PHASE CONDUCTORS		NEUTRAL CONDUCTORS				GROUND CONDUCTORS			OVERCURRENT
TAG	FROM	TO	SETS	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	PROTECTION
1	UTILITY	XD-1	1	4"	PVC	3	4/0	--	--	--	--	1	2	--	--
2	UTILITY	XD-1	1	4"	PVC	3	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	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	Elev-BN	1	3	EMT	3	350	CU THWN	1	350	CU THWN	1	4	CU THWN	400A, 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	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	2..5	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	EDP-BS	ELP-1S	1	1.5	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	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	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	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	100A, 3P
65	ATS-NLS	GEN	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	8	CU THWN	70A, 3P
66	ATS-NLS	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	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	1	1.25	EMT	3	4	CU THWN	1	4	CU THWN	1	10	CU THWN	60A, 3P
73	ENP-1S	ENP-3S	1	1	EMT	3	6	CU THWN	1	6	CU THWN	1	10	CU THWN	50A, 3P
74	**MDB**	**DL-1**	**1**	**2.5**	**EMT**	**3**	**300**	**CU THWN**	**1**	**300**	**CU THWN**	**1**	**4**	**CU THWN**	**300A, 3P**
75	**DL-1**	**LP-BN**	**1**	**1.25**	**EMT**	**3**	**3**	**CU THWN**	**1**	**3**	**CU THWN**	**1**	**8**	**CU THWN**	**90A, 3P**
76	**DL-1**	**LP-1N**	**1**	**0.75**	**EMT**	**3**	**8**	**CU THWN**	**1**	**8**	**CU THWN**	**1**	**10**	**CU THWN**	**50A, 3P**
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**	**1**	**EMT**	**3**	**4**	**CU THWN**	**1**	**4**	**CU THWN**	**1**	**8**	**CU THWN**	**80A, 3P**
79	**MDB**	**DL-2**	**1**	**3**	**EMT**	**3**	**500**	**CU THWN**	**1**	**500**	**CU THWN**	**1**	**3**	**CU THWN**	**400A, 3P**
80	**DL-2**	**LP-BS**	**1**	**1.5**	**EMT**	**3**	**4/0**	**CU THWN**	**1**	**4/0**	**CU THWN**	**1**	**6**	**CU THWN**	**150A, 3P**
81	**DL-2**	**LP-1S**	**1**	**1.25**	**EMT**	**3**	**3**	**CU THWN**	**1**	**3**	**CU THWN**	**1**	**8**	**CU THWN**	**90A, 3P**
82	**DL-2**	**LP-2S**	**1**	**1**	**EMT**	**3**	**4**	**CU THWN**	**1**	**4**	**CU THWN**	**1**	**8**	**CU THWN**	**80A, 3P**
83	**DL-2**	**LP-3S**	**1**	**1**	**EMT**	**3**	**4**	**CU THWN**	**1**	**4**	**CU THWN**	**1**	**8**	**CU THWN**	**80A, 3P**
84	**MDB**	**XS-2**	**1**	**2.5**	**EMT**	**3**	**350**	**CU THWN**	**0**	**--**	**CU THWN**	**1**	**4**	**CU THWN**	**300A, 3P**
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**	**6**	**CU THWN**	**125A, 3P**
87	**DR-1**	**RP-1NA**	**1**	**1.25**	**EMT**	**3**	**3**	**CU THWN**	**1**	**3**	**CU THWN**	**1**	**8**	**CU THWN**	**90A, 3P**
88	**DR-1**	**RP-1NB**	**1**	**1.25**	**EMT**	**3**	**2**	**CU THWN**	**1**	**2**	**CU THWN**	**1**	**6**	**CU THWN**	**110A, 3P**
89	**DR-1**	**RP-2NA**	**1**	**0.75**	**EMT**	**3**	**6**	**CU THWN**	**1**	**6**	**CU THWN**	**1**	**10**	**CU THWN**	**60A, 3P**
90	**DR-1**	**RP-2NB**	**1**	**1.25**	**EMT**	**3**	**3**	**CU THWN**	**1**	**3**	**CU THWN**	**1**	**8**	**CU THWN**	**90A, 3P**
91	**DR-1**	**RP-3NA**	**1**	**1.25**	**EMT**	**3**	**3**	**CU THWN**	**1**	**3**	**CU THWN**	**1**	**8**	**CU THWN**	**100A, 3P**
92	**DR-1**	**RP-3NB**	**1**	**1.25**	**EMT**	**3**	**2**	**CU THWN**	**1**	**2**	**CU THWN**	**1**	**6**	**CU THWN**	**110A, 3P**
93	**MDB**	**XS-3**	**2**	**2.5**	**EMT**	**3**	**350**	**CU THWN**	**0**	**--**	**CU THWN**	**1**	**1**	**CU THWN**	**600A, 3P**
94	**XS-3**	**DR-2**	**3**	**3**	**EMT**	**3**	**500**	**CU THWN**	**1**	**500**	**CU THWN**	**1**	**3/0**	**CU THWN**	**1200A, 3P**
95	**DR-2**	**RP-1SA-1**	**1**	**3**	**EMT**	**3**	**500**	**CU THWN**	**1**	**500**	**CU THWN**	**1**	**3**	**CU THWN**	**350A, 3P**
96	**RP-1SA-1**	**RP-1SA-2**	**1**	**3**	**EMT**	**3**	**500**	**CU THWN**	**1**	**500**	**CU THWN**	**1**	**3**	**CU THWN**	**350A, 3P**
97	**RP-1SA-2**	**RP-1SA-3**	**1**	**3**	**EMT**	**3**	**500**	**CU THWN**	**1**	**500**	**CU THWN**	**1**	**3**	**CU THWN**	**350A, 3P**
98	**DR-2**	**RP-2SA-1**	**1**	**2.5**	**EMT**	**3**	**350**	**CU THWN**	**1**	**350**	**CU THWN**	**1**	**3**	**CU THWN**	**350A, 3P**
99	**RP-2SA-1**	**RP-2SA-2**	**1**	**2.5**	**EMT**	**3**	**350**	**CU THWN**	**1**	**350**	**CU THWN**	**1**	**3**	**CU THWN**	**350A, 3P**
100	**RP-2SA-2**	**RP-2SA-3**	**1**	**2.5**	**EMT**	**3**	**350**	**CU THWN**	**1**	**350**	**CU THWN**	**1**	**3**	**CU THWN**	**350A, 3P**
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**	**RP-3SA-2**	**1**	**3**	**EMT**	**3**	**500**	**CU THWN**	**1**	**500**	**CU THWN**	**1**	**3**	**CU THWN**	**350A, 3P**
103	**RP-3SA-2**	**RP-3SA-3**	**1**	**3**	**EMT**	**3**	**500**	**CU THWN**	**1**	**500**	**CU THWN**	**1**	**3**	**CU THWN**	**350A, 3P**
104	**MDB**	**XS-4**	**1**	**2.5**	**EMT**	**3**	**350**	**CU THWN**	**0**	**--**	**CU THWN**	**1**	**4**	**CU THWN**	**300A, 3P**
105	**XS-4**	**DR-3**	**2**	**2.5**	**EMT**	**3**	**350**	**CU THWN**	**1**	**350**	**CU THWN**	**1**	**1/0**	**CU THWN**	**700A, 3P**
106	**DR-3**	**RP-BS**	**1**	**1.25**	**EMT**	**3**	**2**	**CU THWN**	**1**	**2**	**CU THWN**	**1**	**6**	**CU THWN**	**110A, 3P**
107	**DR-3**	**RP-BSA**	**1**	**1.25**	**EMT**	**3**	**1**	**CU THWN**	**1**	**1**	**CU THWN**	**1**	**6**	**CU THWN**	**125A, 3P**
108	**DR-3**	**RP-1SB**	**1**	**1.5**	**EMT**	**3**	**1/0**	**CU THWN**	**1**	**1/0**	**CU THWN**	**1**	**6**	**CU THWN**	**150A, 3P**
109	**DR-3**	**RP-2SB**	**1**	**1.25**	**EMT**	**3**	**3**	**CU THWN**	**1**	**3**	**CU THWN**	**1**	**8**	**CU THWN**	**100A, 3P**
110	**DR-3**	**RP-3SB**	**1**	**2**	**EMT**	**3**	**2/0**	**CU THWN**	**1**	**2/0**	**CU THWN**	**1**	**6**	**CU THWN**	**175A, 3P**

NOTES:
1. REFER TO RISER DIAGRAM FOR FEEDER TAGS

Figure 3.5.2 – Redesign Distribution System Feeder Schedule

Redesign Panel Board Schedules

PANELBOARD SCHEDULE

PANEL:	LP-1N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(188)-1ST FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	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				
						1,275	6			
LIGHTING	20	1	7	4,000						LIGHTING
OFFICE SPACE				3,176			8	1	20	OFFICE CORRIDOR
LIGHTING	20	1	9		2,500					LIGHTING
MAIN 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							SPARE
							16	1	20	
SPARE	20	1	17							SPARE
							18	1	20	
SPARE	20	1	19							SPARE
							20	1	20	
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							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							
							32	3	150	
SPARE	20	1	33							SPARE
							34			
LIGHTING CONTROL PANEL	20	1	35			1,000				
LCP-1B							36			
	125	3	37							
							38	3	150	
SPARE			39							SPARE
							40			
			41							
							42			
	TOTAL VA			13,414	8,888	9,188	TOTAL KVA		31.5	
	TOTAL AMP/PHASE			48	32	33	TOTAL AMP		38	
REMARKS:										

Figure 3.6.1 – LP-1N Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-1NA	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(188)-1ST FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	250
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-1N'	A.I.C.:	22000	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
181/182 GENERAL RECEPTACLES	20	1	1	1,080						186/187,A/S4-1 RECEPTACLES
				1,620			2	1	20	
181/182 COMPUTER RECEPTACLES	20	1	3		720					187 UCR
					500		4	1	20	
180 COMPUTER RECEPTACLES	20	1	5			720				185 GENERAL RECEPTACLES
						360	6	1	20	
180 GENERAL RECEPTACLES	20	1	7	720						183/184 COMPUTER RECEPTACLES
				720			8	1	20	
180 COPIER RECEPTACLE	20	1	9		1,000					178/179 COMPUTER RECEPTACLES
					720		10	1	20	
180 FAX RECEPTACLE	20	1	11			500				178/179 GENERAL RECEPTACLES
						1,260	12	1	20	
168/CORRIDOR RECEPTACLES	20	1	13	1,260						176/177 GENERAL RECEPTACLES
				1,080			14	1	20	
183 COPIER RECEPTACLE	20	1	15		1,000					CUH-1-2
					345		16	1	20	
183 COMPUTER RECEPTACLES	20	1	17			720				CUH-1-4
						345	18	1	15	
183 FAX RECEPTACLE	20	1	19	500						TF-1-1
				506			20	1	15	
168 COMPUTER RECEPTACLES	20	1	21		720					FP-1-3
					830		22	1	15	
169 RECEPTACLES	20	1	23			720				UH-1
						506	24	1	15	
168A COMPUTER RECEPTACLES	20	1	25	720						176/177 COMPUTER RECEPTACLES
				720			26	1	20	
168A COMPUTER RECEPTACLES	20	1	27		720					174/175 COMPUTER RECEPTACLES
					720		28	1	20	
170 RECEPTACLES	20	1	29			540				184 GENERAL RECEPTACLES
						900	30	1	20	
180 COMPUTER RECEPTACLE	20	1	31	180						168 JUNCTION BOX
				1,000			32	1	20	
170 COPIER RECEPTACLE	20	1	33		1,000					LIGHTING CHAPEL INCANDESCENT
					200		34	1	20	
170 COPIER RECEPTACLE	20	1	35			1,000				SPARE
							36	1	20	
SPARE	20	1	37							SPARE
							38	3	100	
114A OUTDOOR RECEPTACLE	20	1	39		180					
							40			
114A/115/169 GEN. RECEPTACLES	20	1	41			720				
							42			
	TOTAL VA			10,106	8,655	8,291	TOTAL KVA		27.1	
	TOTAL AMP/PHASE			84	72	69	TOTAL AMP		75	

REMARKS:

Figure 3.6.2 – RP-1NA Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-2N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(266)-2ND FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1N'	A.I.C.:	42000	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-2-3			1	5,570						RF-2-3
				1,275			2			
	40	3	3		5,570					
					1,275		4	3	15	
			5			5,570				
						1,275	6			
LIGHTING	20	1	7	1,800						LIGHTING
OFFICE NORTH				3,400			8	1	20	STACKS
LIGHTING	20	1	9		2,000					LIGHTING
READING ROOM					3,400		10	1	20	STACKS
LIGHTING	20	1	11			1,300				LIGHTING
SEATING						2,632	12	1	20	STACKS
LIGHTING	20	1	13	510						SPARE
MECHANICAL							14	1	20	
SPARE	20	1	15							SPARE
							16	1	20	
SPARE	20	1	17							SPARE
							18	1	20	
SPARE	20	1	19							SPARE
							20	1	20	
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							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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-2B							36	1	20	
SPARE	70	3	37							SPARE
							38	1	20	
			39							SPARE
							40	1	20	
			41							SPARE
							42	1	20	
	TOTAL VA			12,555	12,245	11,777	TOTAL KVA		36.6	
	TOTAL AMP/PHASE			45	44	43	TOTAL AMP		44	

REMARKS:

Figure 3.6.3 – LP-2N Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-2NA	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(266)-2ND FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	150
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-2N'	A.I.C.:	22000	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
265 FLOOR QUAD RECEPTACLES	20	1	1	720						260B/264 RECEPTACLES
				1,080			2	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	3		720					264 WALL QUAD RECEPTACLES (COMP)
					720		4	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	5			720				264 WALL QUAD RECEPTACLES (COMP)
						720	6	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	7	720						264 WALL QUAD RECEPTACLES (COMP)
				720			8	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	9		720					264 WALL QUAD RECEPTACLES (COMP)
					720		10	1	20	
265 COMP. WALL RECEPTACLES	20	1	11			720				264 GEN RECEPTACLES
						900	12	1	20	
260B/265 RECEPTACLES	20	1	13	720						260 WALL QUAD RECEPTACLES
				720			14	1	20	
267 GENERAL RECEPTACLES	20	1	15		360					260A EWC RECEPTACLE
					500		16	1	20	
260B JUNCTION BOX	20	1	17			1,000				SPARE
							18	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	19	720						TF-2-1
				506			20	1	15	
265 FLOOR QUAD RECEPTACLES	20	1	21		720					FP-2-3
					830		22	1	15	
265 FLOOR QUAD RECEPTACLES	20	1	23			720				UH-1
						506	24	1	15	
265 WALL RECEPTACLES	20	1	25	540						SPARE
							26	1	20	
265 FLOOR QUAD RECEPTACLES	20	1	27		360					SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							SPARE
							32	1	20	
SPARE	20	1	33							SPARE
							34	1	20	
SPARE	20	1	35							SPARE
							36	1	20	
SPARE	20	1	37							SPARE
							38	3	100	
SPARE	20	1	39							
							40			
SPARE	20	1	41							
							42			
	TOTAL VA			6,446	5,650	5,286	TOTAL KVA		17.382	
	TOTAL AMP/PHASE			54	47	44	TOTAL AMP		48	

REMARKS:

Figure 3.6.4 – RP-2NA Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-3N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(366)-3RD FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1N'	A.I.C.:	42,000	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-3-3			1	5,570						RF-3-3
				2,015			2			
	40	3	3		5,570					
					2,015		4	3	15	
			5			5,570				
						2,015	6			
SF-R-1			7	3,713						LIGHTING READING ROOM
				2,000			8	1	20	
	30	3	9		3,713					LIGHTING SEATING AREA
					1,600		10	1	20	
			11			3,713				LIGHTING DEAN'S SUITE
						2,024	12	1	20	
LIGHTING OFFICE SPACE NORTH	20	1	13	2,056						LIGHTING MECHANICAL ROOM
				600			14	1	20	
LIGHTING STACKS	20	1	15		2,520					LIGHTING DEAN'S SUITE HALLWAY
					800		16	1	20	
LIGHTING STACKS	20	1	17			2,576				373 HAND DRYER
						1,524	18	1	20	
LIGHTING STACKS	20	1	19	2,912						SPARE
							20	1	20	
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							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							SPARE
							32	1	20	
SPARE	20	1	33							SPARE
							34	1	20	
LIGHTING CONTROL PANEL LCP-3B	20	1	35			1,000				SPARE
							36	1	20	
SPARE	70	3	37							SPARE
							38	1	20	
			39							SPARE
							40	1	20	
			41							SPARE
							42	1	20	
	TOTAL VA			18,866	16,218	18,422	TOTAL KVA		53.5	
	TOTAL AMP/PHASE			68	59	67	TOTAL AMP		64	

REMARKS:

Figure 3.6.5 – LP-3N Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-3NA	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(366)-3RD FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	150A
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-3N'	A.I.C.:	22,000	BUS RATING:	100A

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
365 RECEPTACLES	20	1	1	360						ROOF RECEPTACLES
				360			2	1	20	
365 RECEPTACLES	20	1	3		360					365 RECEPTACLES
					1,440		4	1	20	
365 RECEPTACLES	20	1	5			720				367 RECEPTACLES
						1,440	6	1	20	
365 RECEPTACLES	20	1	7	720						360B RECEPTACLES
				1,260			8	1	20	
365 RECEPTACLES	20	1	9		720					360 RECEPTACLES
					1,440		10	1	20	
370/371 RECEPTACLES	20	1	11			1,260				372 RECEPTACLES
						1,440	12	1	20	
370 RECEPTACLES	20	1	13	1,080						368 RECEPTACLES & DOOR HOLDERS
				1,460			14	1	20	
360 RECEPTACLES	20	1	15		720					FP-3-4
					800		16	1	15	
364 RECEPTACLES	20	1	17			720				TE-3-1
						299	18	1	15	
364 RECEPTACLES	20	1	19	720						TF-3-1
				500			20	1	15	
364 RECEPTACLES	20	1	21		720					FP-3-3
					830		22	1	15	
374 RECEPTACLES	20	1	23			720				UH-1
						506	24	1	15	
376 COPIER	20	1	25	1,000						J-BOX, VAV
				1,000			26	1	20	
360 RECEPTACLES	20	1	27		900					365 RECEPTACLES
					720		28	1	20	
360 RECEPTACLES	20	1	29			720				365 RECEPTACLES
						720	30	1	20	
360 RECEPTACLES	20	1	31	720						LIGHTING 365 PENDANTS
				322			32	1	20	
360 RECEPTACLES	20	1	33		900					SPARE
							34	1	20	
375 RECEPTACLES	20	1	35			540				SPARE
							36	1	20	
365 RECEPTACLES	20	1	37	720						SPARE
							38	3	50	
365 RECEPTACLES	20	1	39		720					
							40			
SPARE	20	1	41							
							42			
	TOTAL VA			10,222	10,270	9,085	TOTAL KVA		29.577	
	TOTAL AMP/PHASE			85	86	76	TOTAL AMP		82	

REMARKS:

Figure 3.6.6 – RP-3NA Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-1S	EQUIP. GND. BUS:	☐		VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	ISOLATED GND BUS:	☐		MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■	200% ☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000		BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	3,713						
				2,015			2			
SF-1-1	30	3	3		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					LIGHTING
OFFICES					1,902		10	1	20	90 CLASSROOM
LIGHTING	20	1	11			1,840				LIGHTING
OFFICES						2,008	12	1	20	55 CLASSROOM
LIGHTING	20	1	13	1,800						LIGHTING
OFFICE CORRIDORS				2,500			14	1	20	MAIN STAIRS
LIGHTING	20	1	15		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
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							24	1	20	
118B J-BOXES	20	1	25	3,048						SPARE
HAND DRYERS							26	1	20	
118A J-BOXES	20	1	27		3,048					SPARE
HAND DRYERS							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
SPARE	20	1	31							
							32	3	100	
SPARE	20	1	33							SPARE
							34			
LIGHTING CONTROL PANEL	20	1	35			1,000				
LCP-1A							36			
	125	3	37							
							38	3	50	
SPARE			39							SPARE
							40			
			41							
							42			
	TOTAL VA			19,858	20,018	18,074	TOTAL KVA		58.0	
	TOTAL AMP/PHASE			72	72	65	TOTAL AMP		70	

REMARKS:

Figure 3.6.7 – LP-1S Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-1SA-1	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(119A)-1ST FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-1S'	A.I.C.:	22500	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
143/144/146 GENERAL RECEPTS.	20	1	1	1,260						122/123 GENERAL RECEPTACLES
				1,080			2	1	20	
148/149A GENERAL RECEPTACLES	20	1	3		1,260					SPARE
							4	1	20	
141/142 COMPUTER RECEPTACLES	20	1	5			720				120B EWC RECEPTACLE
						500	6	1	20	
141/142 GENERAL RECEPTACLES	20	1	7	1,260						121/137 COMPUTER RECEPTACLES
				1,080			8	1	20	
148/149A,B COMPUTER RECEPTACLES	20	1	9		1,080					121 COMPUTER RECEPTACLES
					1,080		10	1	20	
147/149,B GENERAL RECEPTACLES	20	1	11			900				SPARE
							12	1	20	
140/139 GENERAL RECEPTACLES	20	1	13	1,080						121 FAX RECEPTACLE
				500			14	1	20	
139/140 COMPUTER RECEPTACLES	20	1	15		720					121 COPY RECEPTACLE
					1,000		16	1	20	
150 COMPUTER RECEPTACLES	20	1	17			720				CUH-1-3
						345	18	1	15	
138/150 GENERAL RECEPTACLES	20	1	19	1,080						SPARE
							20	1	20	
138/150 COMPUTER RECEPTACLES	20	1	21		720					122/123 COMPUTER RECEPTACLES
					720		22	1	20	
CONVENIANCE RECEPTACLE	20	1	23			360				124/125 GENERAL RECEPTACLES
COFFEE BAR						1,080	24	1	20	
119C/121,A/137 GENERAL RECEPTACLES	20	1	25	1,260						124/125 COMPUTER RECEPTACLES
				720			26	1	20	
138A JUNCTION BOX	20	1	27		1,000					126/127/128/129 GEN. RECEPTS
					1,260		28	1	20	
121A JUNCTION BOX	20	1	29			1,000				126/127 COMPUTER RECEPTACLES
						720	30	1	20	
SPARE	20	1	31							127/128 COMPUTER RECEPTACLES
				720			32	1	20	
149 AV	20	1	33		1,500					121B/129 COMPUTER RECEPTACLES
					540		34	1	20	
149 AV	20	1	35			1,500				130 COMPUTER RECEPTACLES
						540	36	1	20	
WIREMOLD 6000	20	1	37	1,260						SPARE
							38	3	100	
WIREMOLD 6000	20	1	39		1,260					
							40			
SPARE	20	1	41							
							42			
	TOTAL VA			11,300	12,140	8,385	TOTAL KVA			31.8
	TOTAL AMP/PHASE			94	101	70	TOTAL AMP			88

REMARKS:

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

PANELBOARD SCHEDULE

PANEL:	LP-BN	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(L29)-BSMT	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	SWBD 'MDB'	A.I.C.:	42000	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	3,713						
				2,920			2			
SF-L-1	30	3	3		3,713					RF-L-1
					2,920		4	3	30	
			5			3,713				
						2,920	6			
SPARE	20	1	7	900						SPARE
				265			8	1	20	
SPARE	15	3	9		900					SPARE
					265		10	1	20	
SPARE	20	1	11			922				SPARE
						265	12	1	20	
SP-1	15	1	13	795						SPARE
							14	1	20	
SP-2	15	1	15		795					SPARE
							16	1	20	
LIGHTING	20	1	17			920				SPARE
SITE CHECKING AND MECH ROOM							18	1	20	
LIGHTING	20	1	19	2,680						LIGHTING
BASEMENT STACKS				3,512			20	1	20	MAIL ROOM WORKSPACES
LIGHTING	20	1	21		2,744					LIGHTING
BASEMENT STACKS					2,000		22	1	20	MAIN LOBBY AREA
LIGHTING	20	1	23			2,000				SPARE
CLASSROOM SPACES							24	1	20	
LIGHTING	20	1	25	2,016						SPARE
CIRCULATION SPACE							26	1	20	
LIGHTING	20	1	27		2,880					SPARE
MOVING STACKS							28	1	20	
LIGHTING	20	1	29			1,400				LIGHTING
MAIN MECHANICAL ROOM						1,000	30	1	20	MECH ROOM AND RESTROOM
LIGHTING	20	1	31	2,824						
BASEMENT STACKS				2,500			32	1	20	EXTRA
LIGHTING CONTROL PANEL	20	1	33		1,000					SPARE
LCP-0A							34	1	20	
L24A,B	20	1	35			3,048				
HAND DRYERS						1,275	36	3	15	
	50	3	37							COMPACTOR
				1,275			38			
SPARE			39							
					1,275		40			
			41							SPARE
							42	1	20	
	TOTAL VA			23,400	18,492	17,463	TOTAL KVA		59.4	
	TOTAL AMP/PHASE			84	67	63	TOTAL AMP		71	

REMARKS:

Figure 3.6.9 –LP-BN Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-BS	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM (B02)-SUB.BSMT	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	225
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	☐
FED FROM:	SWBD 'MDB'	A.I.C.:	65000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	5,570						
				2,920			2			
SF-1-2	40	3	3		5,570					RF-1-2
					2,920		4	3	30	
			5			5,570				
						2,920	6			
SPARE	20	1	7							SPARE
							8	1		
SPARE	20	1	9							SPARE
							10	1	15	
SPARE	20	1	11							SPARE
							12	1		
			13	7,160						
				2,920			14			
SF-1-2	60	3	15		7,160					RF-1-2
					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					RF-2-2
					2,920		22	3	30	
			23			5,570				
						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						LIGHTING
				3,500			32	1	20	DINING AREA
LIGHTING CONTROL PANEL	20	1	33		1,000					LIGHTING
LCP-0B					2,280		34	1	20	SERVING
SPARE	20	1	35							LIGHTING
							36	1	20	KITCHEN/SURROUNDING SPACES
	125	3	37							LIGHTING
				1,440			38	1	20	LOCKERS
SPARE			39							L16A,L16B
					3,048		40	1	20	HAND DRYERS
			41							L09A,B
						3,048	42	1	20	HAND DRYERS
	TOTAL VA			34,016	33,388	30,108	TOTAL KVA		97.5	
	TOTAL AMP/PHASE			123	121	109	TOTAL AMP		117	

REMARKS:

Figure 3.6.10 – LP-BS Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-BS	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM (B02)-SUB.BSMT	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	200
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-BS'	A.I.C.:	10000	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
L11 GENERAL RECEPTACLES	20	1	1	360						L13A/L14/L15A/OUTDOOR RECEPTACLES
				1,260			2	1	20	
L12 PRINTER RECEPTACLE	20	1	3		1,000					L14 COFF. RECEPTACLE
					720		4	1	20	
L10 RECPTACLES	20	1	5			540				L14 MICR. RECEPTACLE
						750	6	1	20	
L10 RECEPTACLES	20	1	7	720						L14 REF RECEPTACLE
				750			8	1	20	
L10 RECEPTACLES	20	1	9		720					L10/S2-L RECEPTACLES
					360		10	1	20	
L13 RECEPTACLES	20	1	11			900				B02,A GENERAL RECEPTACLES
						900	12	1	20	& MOTORIZED DAMPERS
L13A RECEPTACLES	20	1	13	900						
				1,650			14	2	20	
L13 RECEPTACLES	20	1	15		720					EUH-2
					1,650		16			
L13 RECEPTACLES	20	1	17			720				
						1,650	18	2	20	
L09A,B/L13,A RECEPTACLES	20	1	19	1,180						EUH-1
AUTO SENSORS				1,650			20			
L10 CORRIDOR EWC	20	1	21		500					FP-L-2
					830		22	1	15	
SPARE	20	1	23							UH-1
						506	24	1	15	
L12 J1	20	1	25	1,500						LIGHTING
				200			26	1	20	DINING/KITCHEN HALOGEN
L13 AV	20	1	27		1,100					SPARE
							28	1	20	
103 PS	20	1	29			1,400				102 J2
						1,500	30	1	20	
103 J2	20	1	31	1,500						102 PS
				1,400			32	1	20	
103 F2	20	1	33		750					102 F2
					750		34	1	20	
103 F2	20	1	35			750				102 VP
						435	36	1	20	
SPARE			37							LIGHTING (FUTURE)
				200			38	1	20	DRIVEWAY SIGN
	100	3	39							MOTORIZED DOORS (L10, L10A, L13B)
					732		40	1	20	& MAGLOCKS (L13B, L13C)
			41							SPARE
							42	1	20	
	TOTAL VA			13,270	9,832	10,051	TOTAL KVA		33.2	
	TOTAL AMP/PHASE			111	82	84	TOTAL AMP		92	

REMARKS:

Figure 3.6.11 – RP-BS Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	LP-2S	EQUIP. GND. BUS:	☐		VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	☐		MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■	200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1S'	A.I.C.:	42000		BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-2-1			1	3,713						RF-2-1
				1,275			2			
	30	3	3		3,713					
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING	20	1	7	3,840						LIGHTING
CORE 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
MAIN LOBBY AND MAIN CORRIDOR						3,696	12	1	20	OFFICE AREAS
LIGHTING	20	1	13	1,200						LIGHTING
MOOT COURT				336			14	1	20	ATRIUM
LIGHTING	20	1	15		600					LIGHTING
MOOT COURT					900		16	1	20	ATRIUM
LIGHTING	20	1	17			160				LIGHTING
MOOT COURT						900	18	1	20	ATRIUM
LIGHTING	20	1	19	300						LIGHTING
MOOT COURT				924			20	1	20	220A CORRIDOR
LIGHTING	20	1	21		1,450					SPARE
OFFICE CORRIDOR							22	1	20	
218A	20	1	23			3,048				SPARE
HAND DRYERS							24	1	20	
218B	20	1	25	3,048						SPARE
HAND DRYERS							26	1	20	
248A,B	20	1	27		3,048					SPARE
HAND DRYERS							28	1	20	
251A,B	20	1	29			3,048				SPARE
HAND DRYERS							30	1	20	
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							36	1	20	
SPARE	125	3	37							SPARE
							38	1	20	
			39							SPARE
							40	1	20	
			41							SPARE
							42	1	20	
	TOTAL VA			16,538	16,794	19,590	TOTAL KVA		52.9	
	TOTAL AMP/PHASE			60	61	71	TOTAL AMP		64	

REMARKS:

Figure 3.6.12 – LP-2S Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-2SA-1	EQUIP. GND. BUS:	☐
LOCATION:	ELEC.RM.(219A)-2ND FL.	ISOLATED GND BUS:	■
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■
FED FROM:	PANEL 'LP-2S'	A.I.C.:	22000
VOLTAGE:	120/208 VOLT, 3PH, 4W	MAIN CIRCUIT BKR:	125
MLO:	☐	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
240/241 GENERAL RECEPTACLES	20	1	1	1,080						238/239 GENERAL RECEPTACLES
				1,080			2	1	20	
240/241 RECEPTACLES	20	1	3		720					238/239 RECEPTACLES
					720		4	1	20	
249/250 GENERAL RECEPTACLES	20	1	5			720				219C/220B GENERAL RECEPTACLES
						720	6	1	20	
242/243 GENERAL RECEPTACLES	20	1	7	1,080						220B ECW RECEPTACLE
				1,000			8	1	20	
242/243 RECEPTACLES	20	1	9		720					236/237 GENERAL RECEPTACLES
					1,080		10	1	20	
249 WALL QUAD RECEPTACLES	20	1	11			720				236/237 RECEPTACLES
						720	12	1	20	
249 RECEPTACLE	20	1	13	360						221 FLOOR QUAD RECEPTACLES
				720			14	1	20	
MOOT COURT LIGHTING	20	1	15		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							SPARE
							20	1	20	
221 FLOOR QUAD RECEPTACLE	20	1	21		360					234/235 RECEPTACLES
					720		22	1	20	
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
				360			26	1	20	
202 J2	20	1	27		1,500					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						230/231 GENERAL RECEPTACLES
				1,080			32	1	20	
202 VP	20	1	33		435					230/231 RECEPTACLES
					720		34	1	20	
202 VP	20	1	35			435				228/229 GENERAL RECEPTACLES
						1,080	36	1	20	
202 F2	20	1	37	750						SPARE
							38	3	100	
SPARE	20	1	39							
							40			
SPARE	20	1	41							
							42			
	TOTAL VA			9,260	10,105	9,315	TOTAL KVA		28.7	
	TOTAL AMP/PHASE			77	84	78	TOTAL AMP		80	

REMARKS:

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

PANELBOARD SCHEDULE

PANEL:	LP-3S	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(319A)-3RD FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1S'	A.I.C.:	42,000	BUS RATING:	100

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-3-1			1	3,713						RF-3-1
				1,275			2			
	30	3	3		3,713					
					1,275		4	3	15	
			5			3,713				
						1,275	6			
LIGHTING	20	1	7	3,552						LIGHTING
OFFICE AREA				3,696			8	1	20	ADJUSTABLE CLASSROOMS
LIGHTING	20	1	9		4,080					LIGHTING
OFFICE AREA					3,096		10	1	20	90 & 55 CLASSROOM
LIGHTING	20	1	11			1,600				LIGHTING
OFFICE HALLWAY						3,050	12	1	20	LOBBY AND MAIN HALLWAY
LIGHTING	20	1	13	2,760						SPARE
OFFICE SPACE							14	3	20	
LIGHTING	20	1	15		1,200					SPARE
OFFICE HALLWAY							16	1	20	
348A,B	20	1	17			3,048				SPARE
HAND DRYERS							18	1	20	
351A,B	20	1	19	3,048						SPARE
HAND DRYERS							20	1	20	
318A	20	1	21		3,048					SPARE
HAND DRYERS							22	1	20	
318B	20	1	23			3,048				SPARE
HAND DRYERS							24	1	20	
SPARE	20	1	25							SPARE
							26	1	20	
SPARE	20	1	27							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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							36	1	20	
SPARE	125	3	37							SPARE
							38	1	20	
			39							SPARE
							40	1	20	
			41							SPARE
							42	1	20	
	TOTAL VA			18,044	16,412	16,734	TOTAL KVA		51.2	
	TOTAL AMP/PHASE			65	59	60	TOTAL AMP		62	

REMARKS:

Figure 3.6.14 – LP-3S Redesign Panelboard Schedule

PANELBOARD SCHEDULE

PANEL:	RP-3SA-1	EQUIP. GND. BUS:	☐	VOLTAGE:	120/208 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(319A)-3RD FL.	ISOLATED GND BUS:	■	MAIN CIRCUIT BKR:	125
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ☐ 200% ■	MLO:	☐
FED FROM:	PANEL 'LP-3S'	A.I.C.:	22000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
360 RECEPTACLES	20	1	1	720						J-BOX, VAV
				1,000			2	1	20	
362 RECEPTACLES	20	1	3		720					350 RECEPTACLES
					1,340		4	1	20	
363 RECEPTACLES	20	1	5			720				318B RECEPTACLES
						1,340	6	1	20	
349 RECEPTACLES	20	1	7	720						339 RECEPTACLES
				1,440			8	1	20	
349 RECEPTACLES	20	1	9		720					337 RECEPTACLES
					1,440		10	1	20	
340 RECEPTACLES	20	1	11			720				GE-R-1
						506	12	1	15	
340 RECEPTACLES	20	1	13	720						SPARE
							14	1	15	
337 RECEPTACLES	20	1	15		720					TE-R-2
					830		16	1	15	
335 RECEPTACLES	20	1	17			720				CE-R-2
						506	18	1	15	
333 RECEPTACLES	20	1	19	720						SPARE
							20	1	20	
331 RECEPTACLES	20	1	21		720					334 RECEPTACLES
					1,440		22	1	20	
329 RECEPTACLES	20	1	23			720				332 RECEPTACLES
						1,440	24	1	20	
327 RECEPTACLES	20	1	25	720						J-BOX, VAV
				1,000			26	1	20	
324 RECEPTACLES	20	1	27		720					326 RECEPTACLES
					1,440		28	1	20	
322 COPIER	20	1	29			1,000				323 RECEPTACLES
						1,440	30	1	20	
321 RECEPTACLES	20	1	31	1,080						321 RECEPTACLES
				1,440			32	1	20	
321 RECEPTACLES	20	1	33		360					302 RECEPTACLES
					1,440		34	1	20	
323 RECEPTACLES	20	1	35			360				302 RECEPTACLES
						1,440	36	1	20	
302 RECEPTACLES	20	1	37	1,440						
							38	3	100	
302 RECEPTACLES	20	1	39		1,440					SPARE
							40			
327/328/329 GENERAL RECEPTS	20	1	41			1,260				
							42			
	TOTAL VA			11,000	13,330	12,172	TOTAL KVA		36.5	
	TOTAL AMP/PHASE			92	111	101	TOTAL AMP		101	

REMARKS:

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

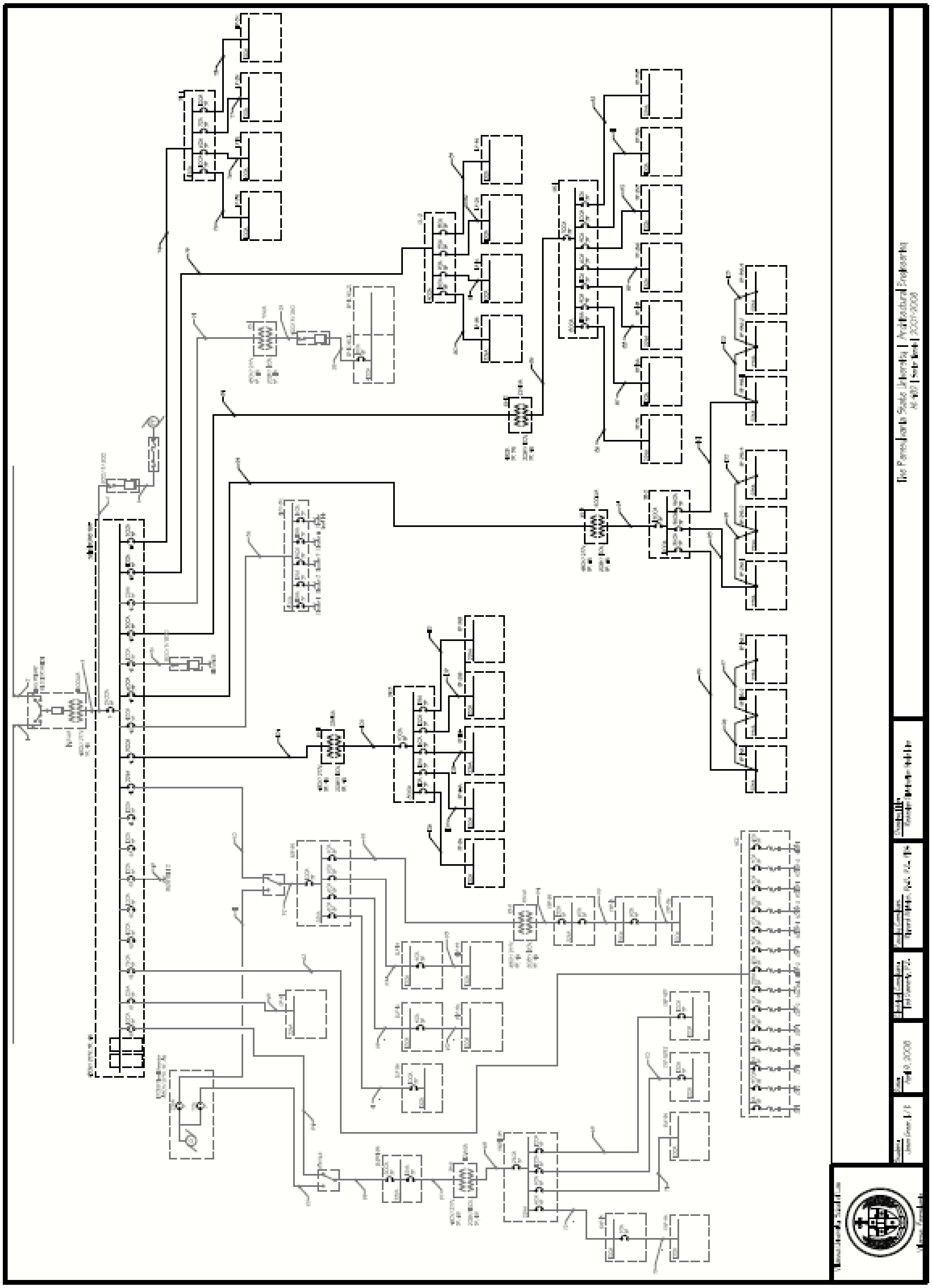


Figure 3.7.1 – Redesign Distribution System Single Line
*See Appendix D for full size single line

Cost Analysis

LP-1N Equipment Cost of Original System					
Equip	**Means No.**	**No. of Feeders**	**Feeder Length (CFL)**	**Per Unit Cost**	**Cost**
400A, 3P Breaker (480)	0430	N/A	N/A	$2,780.00	$2,780.00
2 Sets (4)1/0, #3G, (2) 2" EMT	1600	8	4	$344.00	$11,008.00
LP-1N (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
75kVA X-Fmr	4915	N/A	N/A	$7,000.00	$7,000.00
(4) 250 MCM, #4G, 2.5 EMT	2200	4	0.25	$727.00	$727.00
250A, 3P Breaker (208)	0430	N/A	N/A	$2,708.00	$2,708.00
RP-1NA (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) #1, #8G, 1.5 EMT	1550	4	0.25	$286.00	$286.00
RP-1NB (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	0.25	$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	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
50A, 3P Breaker (208)	0180	N/A	N/A	$365.00	$365.00
(4) #1, #8G, 1.5 EMT	1550	4	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					
Equip	**Means No.**	**No. of Feeders**	**Feeder 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					
Equip	**Means No.**	**No. of Feeders**	**Feeder 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					
Equip	**Means No.**	**No. of Feeders**	**Feeder 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					
Equip	**Means No.**	**No. of Feeders**	**Feeder 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					
Equip	**Means No.**	**No. of Feeders**	**Feeder 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

Original System	
Total Original Cost	**$220,281.25**

Figure 3.8.7 – Original Total Cost

DL-1 Equipment Costs for Redesign					
Equip	Means No.	No. of Feeders	Feeder 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

DL-2 Equipment Costs for Redesign					
Equip	Means No.	No. of Feeders	Feeder 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

DR-1 Equipment Costs for Redesign					
Equip	**Means No.**	**No. of Feeders**	**Feeder 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	3	967	$8,703.00
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	$3,580.00	$3,580.00
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	N/A	$955.00	$955.00
90A, 3P Breaker (208)	0320	N/A	N/A	$456.00	$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	$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	$365.00	$365.00
(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

DR-2 Equipment Costs for Redesign					
Equip	**Means No.**	**No. of Feeders**	**Feeder Length (CFL)**	**Per Unit Cost**	**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	$967.00	$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 Equipment Costs for Redesign					
Equip	**Means No.**	**No. of Feeders**	**Feeder 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

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					LP-3N	Panel Location:			ELEC. RM 366		
Nominal Phase to Neutral Voltage------->					277	Phase:			3		
Nominal Phase to Phase Voltage-------->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	SF-3-3	6		5570	w	1.00	5570	5570		
2	A	RF-3-3	6		2015	w	1.00	2015	2015		
3	B	SF-3-3	6		5570	w	1.00	5570	5570		
4	B	RF-3-3	6		2015	w	1.00	2015	2015		
5	C	SF-3-3	6		5570	w	1.00	5570	5570		
6	C	RF-3-3	6		2015	w	1.00	2015	2015		
7	A	SF-R-1	6		5570	w	1.00	5570	5570		
8	A	LTG-READING RM	3		2000	w	1.00	2000	2000		
9	B	SF-R-1	6		5570	w	1.00	5570	5570		
10	B	LTG-SEATING	3		1600	w	1.00	1600	1600		
11	C	SF-R-1	6		5570	w	1.00	5570	5570		
12	C	LTG-DEAN SUITE	3		2024	w	1.00	2024	2024		
13	A	LTG-NORTH OFF.	3		2056	w	1.00	2056	2056		
14	A	LTG-MECH RM	3		600	w	1.00	600	600		
15	B	LTG-STACKS	3		2520	w	1.00	2520	2520		
16	B	LTG-DEAN'S HALL	3		800	w	1.00	800	800		
17	C	LTG-STACKS	3		2576	w	1.00	2576	2576		
18	C	373-HAND DRY			1524	w	1.00	1524	1524		
19	A	LTG-STACKS	3		2912	w	1.00	2912	2912		
20	A	SPARE			0	w	0.95	0	0		
21	B	SPARE			0	w	0.95	0	0		
22	B	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	A	SPARE			0	w	0.90	0	0		
26	A	SPARE			0	w	0.95	0	0		
27	B	SPARE			0	w	0.90	0	0		
28	B	SPARE			0	w	0.95	0	0		
29	C	SPARE			0	w	0.90	0	0		
30	C	SPARE			0	w	0.95	0	0		
31	A	SPARE			0	w		0	0		
32	A	SPARE			0	w		0	0		
33	B	SPARE			0	w		0	0		
34	B	SPARE			0	w		0	0		
35	C	LCP-3B			1000	w	1.00	1000	1000		
36	C	SPARE			0	w		0	0		
37	A	RP-3NA			21447	w	1.00	21447	21447		
38	A	SPARE			0	w		0	0		
39	B	RP-3NA			21326	w	1.00	21326	21326		
40	B	SPARE			0	w		0	0		
41	C	RP-3NA			18498	w	1.00	18498	18498		
42	C	SPARE			0	w		0	0		
PANEL TOTAL								120.3	120.3	Amps=	144.8
PHASE LOADING								kW	kVA	%	Amps
		PHASE TOTAL	A					42.2	42.2	35%	152.2
		PHASE TOTAL	B					39.4	39.4	33%	142.2
		PHASE TOTAL	C					38.8	38.8	32%	140.0
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
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	HID lighting			0.0	0.0		0.0	0.0			
5	incandescent lighting			0.0	0.0		0.0	0.0			
6	HVAC fans			39.5	39.5	0.95	37.5	37.5	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			63.8	63.8		63.8	63.8	1.00		
Total Demand Loads							116.7	116.7			
Spare Capacity				20%			23.3	23.3			
Total Design Loads							140.0	140.0	1.00	Amps=	168.5

Figure 4.1.1 – LP-3N Original Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	LP-3N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(366)-3RD FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1N'	A.I.C.:	42,000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	B	C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
			1	5,570						
				2,015			2			
SF-3-3	40	3	3		5,570					RF-3-3
					2,015		4	3	15	
			5			5,570				
						2,015	6			
			7	5,570						LIGHTING
				2,000			8	1	20	READING ROOM
SF-R-1	40	3	9		5,570					LIGHTING
					1,600		10	1	20	SEATING AREA
			11			5,570				LIGHTING
						2,024	12	1	20	DEAN'S SUITE
LIGHTING	20	1	13	2,056						LIGHTING
OFFICE 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				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							SPARE
							24	1	20	
SPARE	20	1	25							SPARE
							26	1	20	
SPARE	20	1	27							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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-3B							36	1	20	
	70	3	37	21,447						SPARE
PANEL 'RP-3NA'							38	1	20	
(45 KVA XFMR)			39		21,326					SPARE
							40	1	20	
			41			18,498				SPARE
							42	1	20	
	TOTAL VA			42,170	39,401	38,777	TOTAL KVA		120.3	
	TOTAL AMP/PHASE			152	142	140	TOTAL AMP		145	

REMARKS:

Figure 4.1.2 – LP-3N Original Panelboard Schedule

PANELBOARD SIZING WORKSHEET											
Panel Tag------------------------->					LP-3N	Panel Location:			ELEC. RM 366		
Nominal Phase to Neutral Voltage------->					277	Phase:			3		
Nominal Phase to Phase Voltage-------->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	SF-3-3	6		5570	w	1.00	5570	5570		
2	A	RF-3-3	6		2015	w	1.00	2015	2015		
3	B	SF-3-3	6		5570	w	1.00	5570	5570		
4	B	RF-3-3	6		2015	w	1.00	2015	2015		
5	C	SF-3-3	6		5570	w	1.00	5570	5570		
6	C	RF-3-3	6		2015	w	1.00	2015	2015		
7	A	SF-R-1	6		2920	w	1.00	2920	2920		
8	A	LTG-READING RM	3		2000	w	1.00	2000	2000		
9	B	SF-R-1	6		2920	w	1.00	2920	2920		
10	B	LTG-SEATING	3		1600	w	1.00	1600	1600		
11	C	SF-R-1	6		2920	w	1.00	2920	2920		
12	C	LTG-DEAN SUITE	3		2024	w	1.00	2024	2024		
13	A	LTG-NORTH OFF.	3		2056	w	1.00	2056	2056		
14	A	LTG-MECH RM	3		600	w	1.00	600	600		
15	B	LTG-STACKS	3		2520	w	1.00	2520	2520		
16	B	LTG-DEAN'S HALL	3		800	w	1.00	800	800		
17	C	LTG-STACKS	3		2576	w	1.00	2576	2576		
18	C	373-HAND DRY			1524	w	1.00	1524	1524		
19	A	LTG-STACKS	3		2912	w	1.00	2912	2912		
20	A	SPARE			0	w	0.95	0	0		
21	B	SPARE			0	w	0.95	0	0		
22	B	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	A	SPARE			0	w	0.90	0	0		
26	A	SPARE			0	w	0.95	0	0		
27	B	SPARE			0	w	0.90	0	0		
28	B	SPARE			0	w	0.95	0	0		
29	C	SPARE			0	w	0.90	0	0		
30	C	SPARE			0	w	0.95	0	0		
31	A	SPARE			0	w		0	0		
32	A	SPARE			0	w		0	0		
33	B	SPARE			0	w		0	0		
34	B	SPARE			0	w		0	0		
35	C	LCP-3B			1000	w	1.00	1000	1000		
36	C	SPARE			0	w		0	0		
37	A	RP-3NA			21447	w	1.00	21447	21447		
38	A	SPARE			0	w		0	0		
39	B	RP-3NA			21326	w	1.00	21326	21326		
40	B	SPARE			0	w		0	0		
41	C	RP-3NA			18498	w	1.00	18498	18498		
42	C	SPARE			0	w		0	0		
PANEL TOTAL								112.4	112.4	Amps=	135.3
PHASE LOADING								kW	kVA	%	Amps
PHASE TOTAL			A					39.5	39.5	35%	142.7
PHASE TOTAL			B					36.8	36.8	33%	132.7
PHASE TOTAL			C					36.1	36.1	32%	130.4
LOAD CATAGORIES				Connected			Demand				Ver. 1.02
				kW	kVA	DF	kW	kVA	PF		
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	HID lighting			0.0	0.0		0.0	0.0			
5	incandescent lighting			0.0	0.0		0.0	0.0			
6	HVAC fans			31.5	31.5	0.95	29.9	29.9	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			63.8	63.8		63.8	63.8	1.00		
Total Demand Loads							109.1	109.1			
Spare Capacity				20%			21.8	21.8			
Total Design Loads							130.9	130.9	1.00	Amps=	157.6

Figure 4.1.3 – LP-3N Redesign Panelboard Worksheet

PANELBOARD SCHEDULE

PANEL:	LP-3N	EQUIP. GND. BUS:	☐	VOLTAGE:	480/277 VOLT, 3PH, 4W
LOCATION:	ELEC.RM.(366)-3RD FL.	ISOLATED GND BUS:	☐	MAIN CIRCUIT BKR:	
MOUNTING:	SURFACE	NEUTRAL BUS:	100% ■ 200% ☐	MLO:	■
FED FROM:	PANEL 'LP-1N'	A.I.C.:	42,000	BUS RATING:	225

LOAD DESCRIPTION	BKR. AMPS	BKR. POLE	CKT. NO.	LOAD - V.A. A	LOAD - V.A. B	LOAD - V.A. C	CKT. NO.	BKR. POLE	BKR. AMPS	LOAD DESCRIPTION
SF-3-3			1	5,570						RF-3-3
				2,015			2			
	40	3	3		5,570					
					2,015		4	3	15	
			5			5,570				
						2,015	6			
SF-R-1			7	2,920						LIGHTING
				2,000			8	1	20	READING ROOM
	30	3	9		2,920					LIGHTING
					1,600		10	1	20	SEATING AREA
			11			2,920				LIGHTING
						2,024	12	1	20	DEAN'S SUITE
LIGHTING	20	1	13	2,056						LIGHTING
OFFICE 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				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							SPARE
							24	1	20	
SPARE	20	1	25							SPARE
							26	1	20	
SPARE	20	1	27							SPARE
							28	1	20	
SPARE	20	1	29							SPARE
							30	1	20	
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-3B							36	1	20	
PANEL 'RP-3NA' (45 KVA XFMR)	70	3	37	21,447						SPARE
							38	1	20	
			39		21,326					SPARE
							40	1	20	
			41			18,498				SPARE
							42	1	20	
	TOTAL VA			39,520	36,751	36,127	TOTAL KVA		112.4	
	TOTAL AMP/PHASE			143	133	130	TOTAL AMP		135	

REMARKS:

Figure 4.1.4 – LP-3N Redesign Panelboard Schedule

Summary

	PANEL LP-3N SIZING SUMMARY Based on Redesign of AHU-R-1															
BRANCH CIRCUIT			Voltage		Motor Size		VA / Phase		Total VA		Breaker		Conductors		Conduit	
	Ckt. No	Equip.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.	Orig.	Redes.
	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
PANEL		Voltage	Load kVA		Load Amps		Design Amps		Bus Size		Breaker		Conductors		Conduit	
	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 K-rated transformers. An energy savings payback analysis will be done using PowerSmiths ESP Calculator.

The existing transformers in the law school are listed below:

ORIGINAL TRANSFORMER SCHEDULE								
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°C	(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°C	(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°C	(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°C	(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°C	(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°C	(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°C	(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°C	(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°C	(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°C	(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°C	(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°C	(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.

POWERSMITHS

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The ESP Calculator™

Energy Savings Payback Calculator

Project Description	**Villanova University: School of Law**
Date	**April 4, 2008**

Transformers on Project

Data Entry	QTY	kVA	Standard X-Frm Cost RS Means	PowerSmiths Cost (Additional 25%)
XS-1	1	75	$7,000	$8,750.0
XS-2	1	45	$5,110	$6,387.5
XS-3	1	45	$5,110	$6,387.5
XS-4	1	112.5	$13,439	$16,798.8
XS-5	1	75	$7,000	$8,750.0
XS-6	1	30	$4,385	$5,481.3
XS-7	1	75	$7,000	$8,750.0
XS-8	1	112.5	$13,439	$16,798.8
XS-9	1	112.5	$13,439	$16,798.8
XS-10	1	45	$5,110	$6,387.5
XS-11	1	112.5	$13,439	$16,798.8
				$0.0
				$0.0
				$0.0

Available Full Load kW	**840**		
Average kVA (calc)	**76**		
equipment operating hrs/ day	14		
equipment operating days/yr	365	Calc Load kW	Calc Annual kWh
Load during normal operating hours	40%	336	1,716,960
Load outside operating hours	15%	126	459,900
		Total Annual Load kWh:	**2,176,860**

Annual Cost to Operate Load Only

kWh rate	$ 0.044	Annual Consumption:	$ 96,435
demand rate ($/kW/mo) ex. $10.00	$4.99	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)	97.0%	
Transformer kW Losses (Normal Operation)	10.4	kW
Status quo Efficiency (Outside op. hrs)	92.0%	
Transformer kW Losses (Outside op. hrs)	11.0	kW
Annual addititional kWh from transformers	93,093	kWh
Annual Cost of Transformer Losses	$ 4,746	
A/C System Performance (kW/ton)	1.25	
Additional Tons of Cooling (on peak)	2.95	tons
Annual addititional kWh from A/C	33,059	kWh
Annual Cost of Associated A/C	$ 1,685	

Summary with Status Quo Transformer

Annual Cost of feeding Building Load	$ 116,555
Annual Cost of Transformer Losses	$ 4,746
Annual Cost of Associated A/C	$ 1,685
Electrical Bill (Status Quo Transformer)	**$ 122,986**

  doc#807-000440-110-A01 *1-Mar-07*

POWERSMITHS Page 2 **_The ESP Calculator™_**

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Energy Savings Payback Calculator

Using Powersmiths instead of status quo transformers

Powersmiths Efficiency (Normal Operation)	98.2%	
Powersmiths kW Losses (Normal Operation)	6.2	kW
Powersmiths Efficiency (Outside op. hrs)	97.6%	
Transformer kW Losses (Outside op. hrs)	3.1	kW
Annual addititional kWh from transformers	42,781	kWh
Annual Cost of Powersmiths Losses	$ 2,264	
Additional Tons of Cooling (on peak)	1.75	tons
Annual addititional kWh from A/C	15,192	kWh
Annual Cost of Associated A/C	$ 804	

Comparing Status Quo & Powersmiths

	Status Quo	Powersmiths	Reduction
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	
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)	3.0%
Annual Power Quality Benefit	$ -

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

Cost	**Cost**
Powersmiths Transformers	$118,089
Status Quo Transformers	$94,471

Payback on total cost	7.02	years	current kWh rate:
Cost of Energy Savings	$ 0.011	/kWh	$0.044
Cost - Benefit Ratio	4.1	**times less to save a kWh than to buy a kWh**	

Leasing Option	60 Month Term	48 Month Term	36 Month Term
Total Annual Leasing Payments	**$23,886**	**$29,135**	**$37,070**
Net Annual Cost with savings	$20,522	$25,771	$33,707

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	

IMPORTANT: By using the ESP Calculator™, you are agreeing the TERMS OF USE section on page 3

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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.

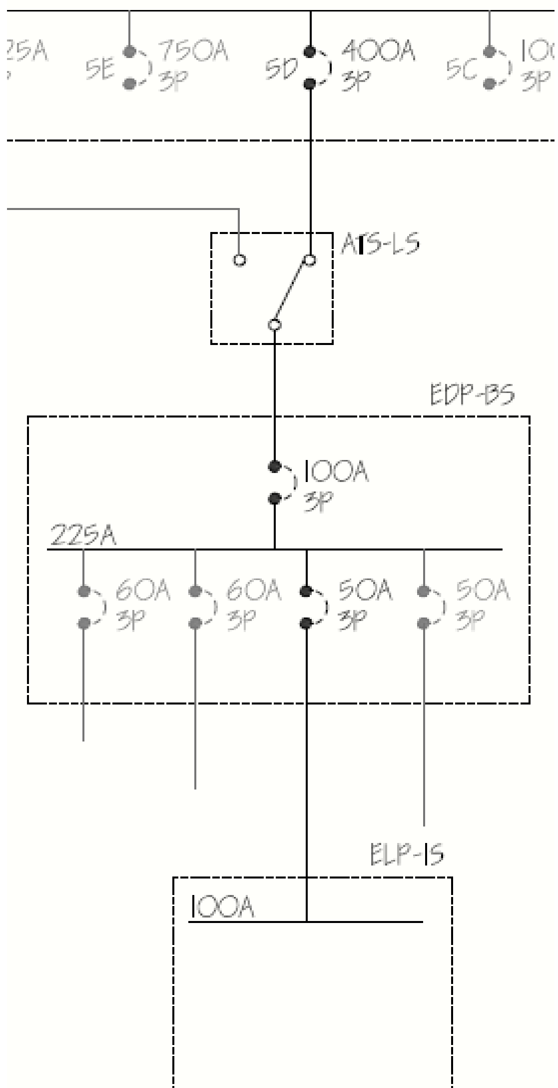

Figure 6.1.1 – Protection Coordination Path

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

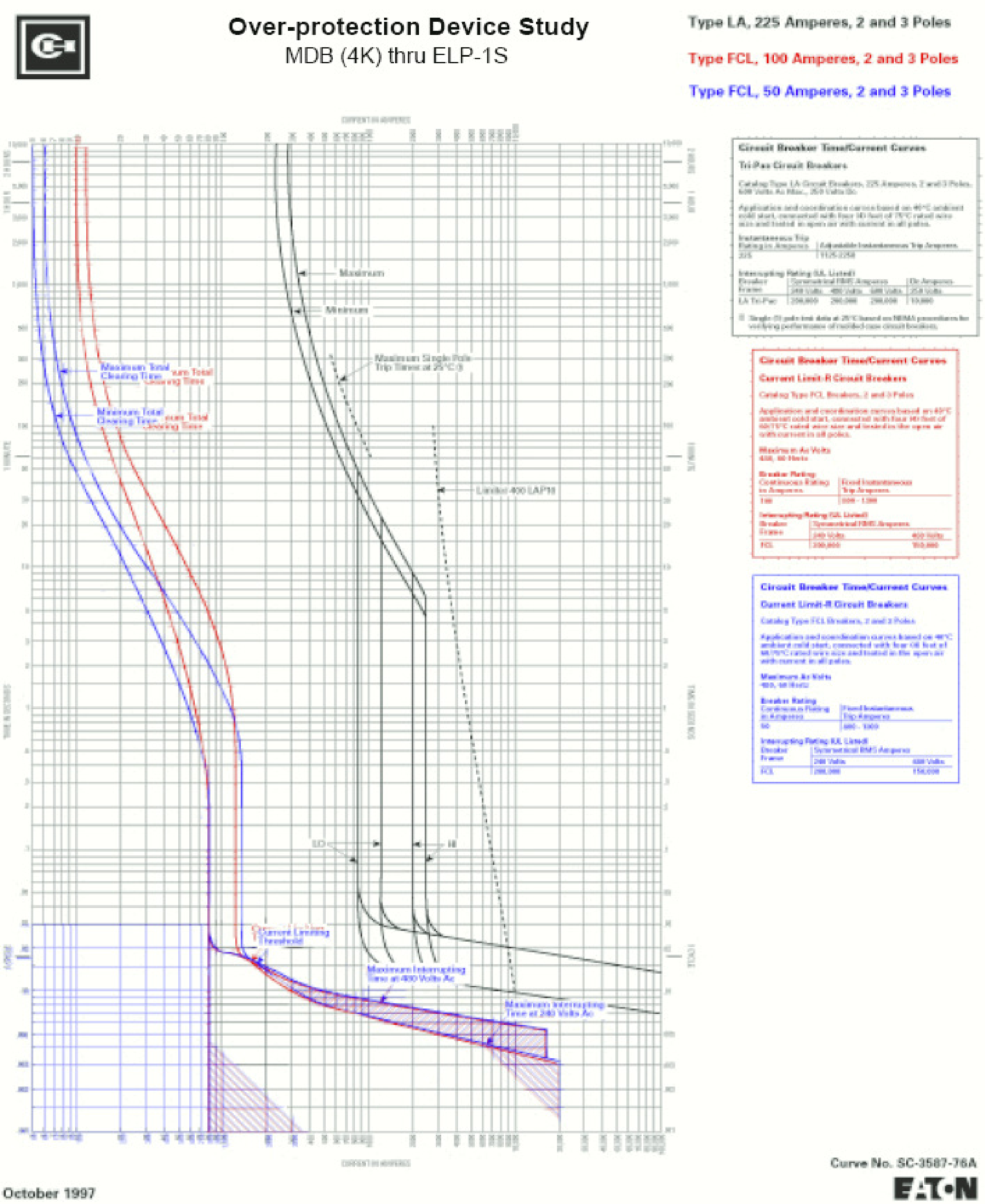

Figure 6.1.2 – Time/Current Overlay

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

Original Atrium Glazing												
		Transmittance			Reflectance			ASHRAE U-Value				
Viracon No.	Description	Vis. Light	Solar Energy	Ultra-Violet	Vis. Light-Ext.	Vis. Light-Int.	Solar Energy	Winter Night	Summer Day	Shading Coeff.	Relative 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												
		Transmittance			Reflectance			ASHRAE U-Value				
Viracon No.	Description	Vis. Light	Solar Energy	Ultra-Violet	Vis. Light-Ext.	Vis. Light-Int.	Solar Energy	Winter Night	Summer Day	Shading Coeff.	Relative 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.

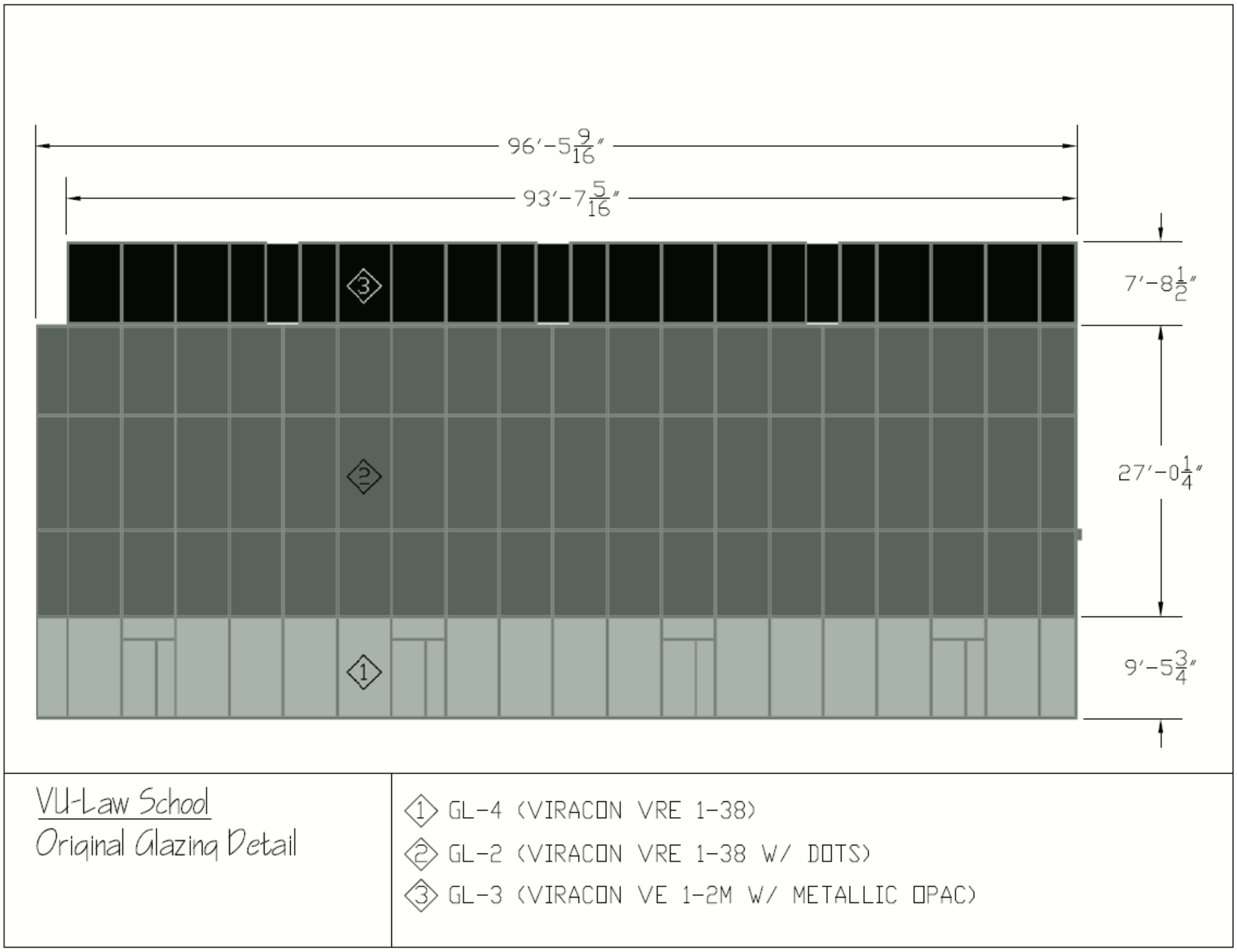

Figure 7.1.1 – Original Glazing Detail

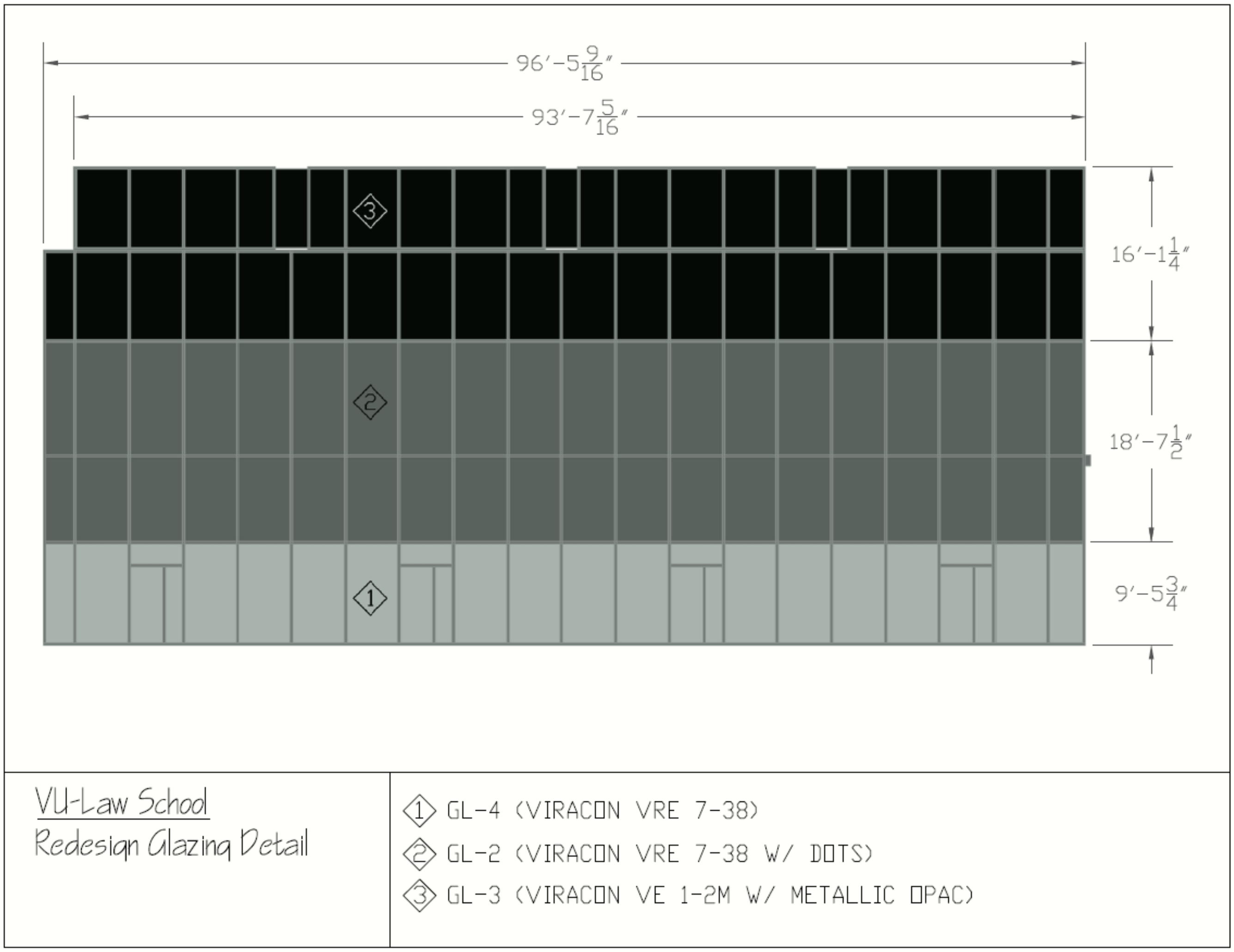

Figure 7.1.1 – Redesign Glazing Detail

VU Atrium Mechanical Cost Analysis												
Glass			**Viracon No.**			**Area (SF)**		**Unit Cost ($/SF)**		**Initial Cost**		
	Tag	Description	Original	Redesign	Add-ons	Original	Redesign	Original	Redesign	Original	Redesign	Cost Diff.
	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
	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
	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 Glass Cost		**$74,147.50**	**$85,086.00**	**-10,938.50**
AHU			**Trane Series**			**Initial Cost**						
	Tag	Description	Original	Redesign	Add-ons	Original	Redesign	Cost Diff.				
	AHU-R-1	Rooftop AHU	Trane T-25 (15hp)	Trane T-12 (7.5 hp)	N/A	**$25,990.00**	**$22,190.00**	**$3,800.00**				
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

AHU-1-R1		
Peak Design Cooling Load	Original Glazing 22.7 ton	Redesigned Glazing 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.

<u>Acoustical Breadth</u>

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

Moot Court Existing Reverberation Time														
Surface Description	Material	Surface Area	Absorption Coefficient and Sabins 125 Hz		250 Hz		500Hz		1000Hz		2000Hz		4000Hz	
			α	A	α	A	α	A	α	A	α	A	α	A
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	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
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	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
ΣA			**2047.31**		**2081.41**		**1941.62**		**2356.45**		**2696.74**		**2853.63**	
Volume (ft^3)	**26,675**													
Reverb Time (s)	**T_{60}=0.049V/ΣA**		**0.64**		**0.63**		**0.67**		**0.55**		**0.48**		**0.46**	
Target Time (s)	**0.7 - 1.1**		**Unacceptable**		**Unacceptable**		**Unacceptable**		**Unacceptable**		**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 Area**	**Absorption Coefficient and Sabins**											
			125 Hz		**250 Hz**		**500Hz**		**1000Hz**		**2000Hz**		**4000Hz**	
			α	**A**	**α**	**A**	**α**	**A**	**α**	**A**	**α**	**A**	**α**	**A**
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
ΣA			**1364.63**		**1286.21**		**1227.04**		**1593.20**		**1712.14**		**1950.58**	
Volume (ft^3)	**26,675**													
Reverb Time (s)	**$T_{60}=0.049V/\Sigma A$**		**0.96**		**1.02**		**1.07**		**0.82**		**0.76**		**0.67**	
Target Time (s)	**0.7 - 1.1**		**Acceptable**		**Acceptable**		**Acceptable**		**Acceptable**		**Acceptable**		**Unacceptable**	

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-Seat Classroom Reverberation Time Calculations														
Surface Description	**Material**	**Surface Area**	**Absorption Coefficient and Sabins**											
			125 Hz		**250 Hz**		**500Hz**		**1000Hz**		**2000Hz**		**4000Hz**	
			α	**A**	**α**	**A**	**α**	**A**	**α**	**A**	**α**	**A**	**α**	**A**
Floor	Carpet, light, 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
Walls	1/2" Gyp Board 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
Ramp Walls	1/2" Gyp Board 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
ΣA			**3403.39**		**3645.78**		**3507.59**		**4191.90**		**4810.54**		**4996.81**	
Volume (ft^3)	**40,105**													
Reverb Time (s)	**T_{60}=0.049V/ΣA**		**0.58**		**0.54**		**0.56**		**0.47**		**0.41**		**0.39**	
Target Time (s)	**0.7 - 1.1**		**Unacceptable**		**Unacceptable**		**Unacceptable**		**Unacceptable**		**Unacceptable**		**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-Seat Classroom Reverberation Time Calculations														
Surface Description	**Material**	**Surface Area**	**Absorption Coefficient and Sabins**											
			125 Hz		**250 Hz**		**500Hz**		**1000Hz**		**2000Hz**		**4000Hz**	
			α	**A**	**α**	**A**	**α**	**A**	**α**	**A**	**α**	**A**	**α**	**A**
Floor	Carpet, light, 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
Walls	1/2" Gyp Board 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
Ramp Walls	1/2" Gyp Board 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
ΣA			**2060.05**		**2074.68**		**2080.25**		**2668.50**		**2853.94**		**3199.81**	
Volume (ft^3)	**40,105**													
Reverb Time (s)	**T_{60}=0.049V/ΣA**		**0.95**		**0.95**		**0.94**		**0.74**		**0.69**		**0.61**	
Target Time (s)	**0.7 - 1.1**		**Acceptable**		**Acceptable**		**Acceptable**		**Acceptable**		**Unacceptable**		**Unacceptable**	

*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	Material		Surface Area		RS Means Unit Cost ($/SF)		RS Means 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	Material		Surface Area		RS Means Unit Cost ($/SF)		RS Means 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	$1.25	$4,218.00	$2,850.00	$1,368.00
Acoustic Wall Panels	2" Acoustic Panel	2" Acoustic Panel	248	86	$5.00	$5.00	$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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