

Technical Assignment 1
Existing Lighting Conditions and Design Criteria



Villanova University: School of Law
Villanova, PA

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Lighting/Electrical Option

AGI Files: P:\AE 481\Technical Assignment 1\AGI Files

October 5, 2007

Villanova University: School of Law
Villanova, PA

Technical Report 1

Date: October 5, 2007

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Executive Summary

The following report analyses and critiques the existing lighting design of the Villanova University: School of Law. The report below analyses in detail four spaces on the law school as well as gives a general analysis of the lighting design of the building as a whole. The report analyses the luminaires, ballasts, lamps, and other equipment that was involved in the initial design. Design criteria were established for the four individual spaces that will be redesigned in at a later date. The four spaces that were looked at in depth were: a 135 seat classroom located on the first floor, a moot courtroom located on the second floor, a double high atrium space with a glass wall facing the courtyard which was the fourth space that will be redesigned.

Each space has multiple uses and the design criteria reflected that. Some of the most important criteria that were present in most spaces were flexibility and control, appearance of space, color appearance and surface characteristics. Others were also considered on a more individual basis. In the days of LEED and the concern for reducing a buildings negative environmental impact, controls stood out as one of the most important criterion for the design.

In general, the design criteria laid out was met in each space that was analyzed. The one area that could have been pursued further was the amount of flexibility in the spaces. Flexibility and controls is an issue that could always be taken further. The more flexible the space, the more usage and better performance users can get out of a space. As a whole, the lighting design was very good. A law school must uphold the traditions of excellence and prestige that goes hand in hand with the legal institution in America and I believe that the current lighting design does that quite well.

The last part of the analysis was the verification that the spaces meet the ASHRAE 90.1 standards for power density. Each space was successfully designed to meet that criterion. Some spaces even had room to add more power to the space and perhaps improve upon the current lighting design.

This is a great architectural design and it leaves the lighting designer with the fun and challenging task of finding a way to allow that terrific architecture to be brought to the forefront and portray the excellence that an institution such as this deserves.

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Building Design

The Villanova University: School of Law was designed to serve a multitude of purposes. The building has two separate wings that are joined with a double height atrium. One wing houses the law library and the chapel, while the other houses faculty offices, classrooms, dining facilities and other student activity areas. The atrium space is predominantly glass and opens into a west facing courtyard. This feature of the building faces the entrance and is designed to be an inviting area that will draw students and faculty to the entrance. The lighting design will portray the elegance and importance of the legal institution.

Lighting Design

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

Control Devices

In almost every space that is accessed on a normal basis, at least one occupancy sensor is 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 being used.

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.

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Designed Lighting Levels

The lighting system was designed around the 9th Edition of “The IESNA Lighting Handbook”, and is as follows:

- 50fc - Classrooms, courtrooms, lecture rooms, library reading room
- 30fc – Conference rooms, classrooms, jury deliberations, library, offices, lobbies
- 15fc – Corridor, some entry areas, restrooms

Existing Lighting Conditions and Hardware – 135 Seat Classroom

The current lighting system that is being implemented in the 135 seat classroom is a fluorescent lighting system that consists of both direct and indirect luminaires. When one first enters the space, the lighting overhead is 6” compact fluorescent can-lights. The cans are used to illuminate the floor that is at the level of the corridor. Further into the room is the area with tiered seating. This area is illuminated with fluorescent pendants that are oriented with the long dimension of the lamp parallel to the side walls. The white boards that are located on the front wall are illuminated by surface mounted T5 luminaires. In the rear of the room, in each corner, there are two small rooms that serve as storage and a media space. In these small spaces, one recessed 2x2 troffer that houses two 40W T5 Biax lamps.

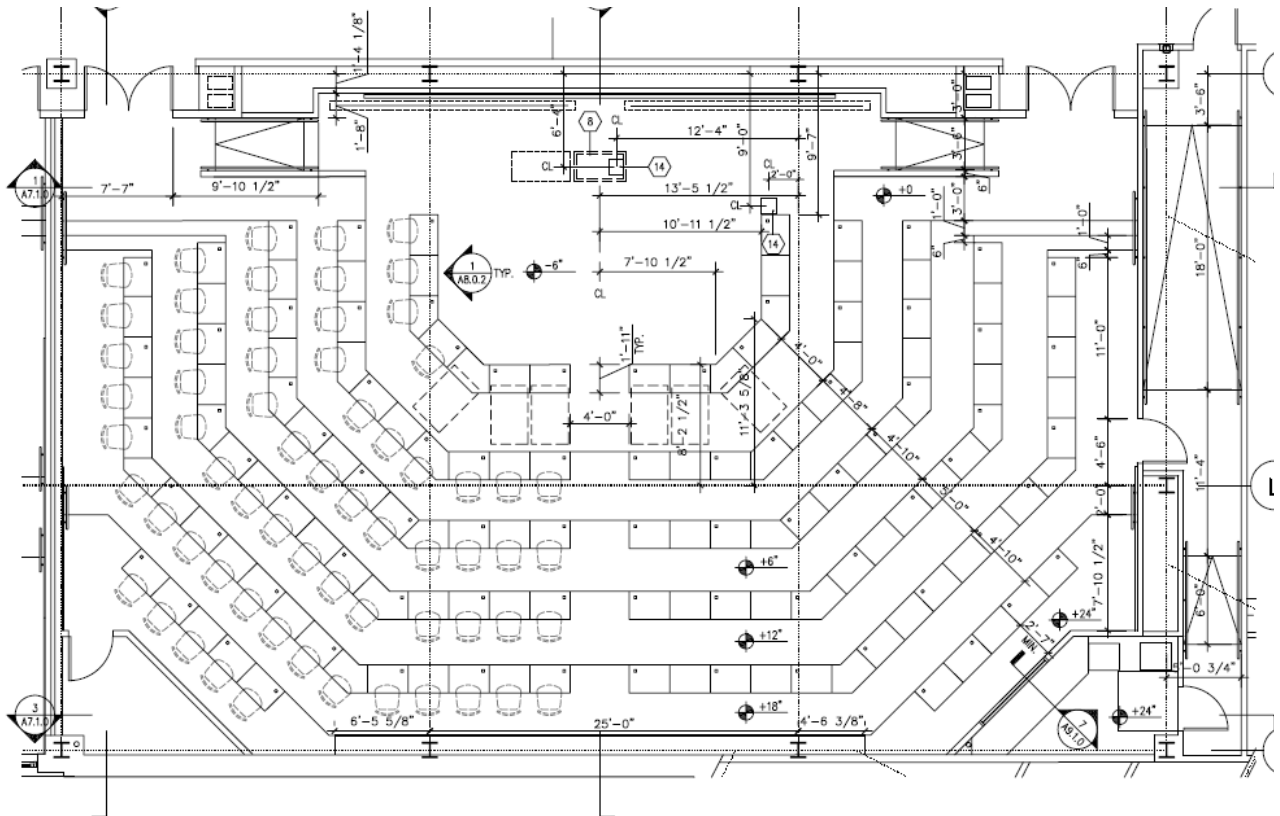


Figure 1.1 – 135 Classroom Floor Plan

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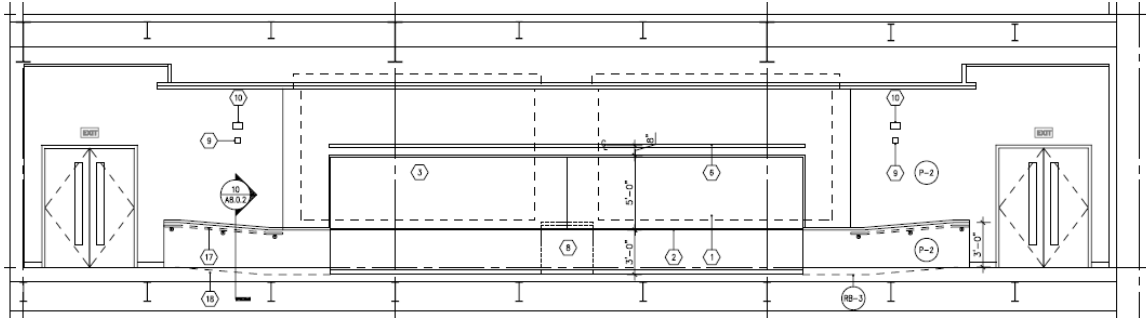


Figure 1.2 – 135 Classroom Front Elevation/Section

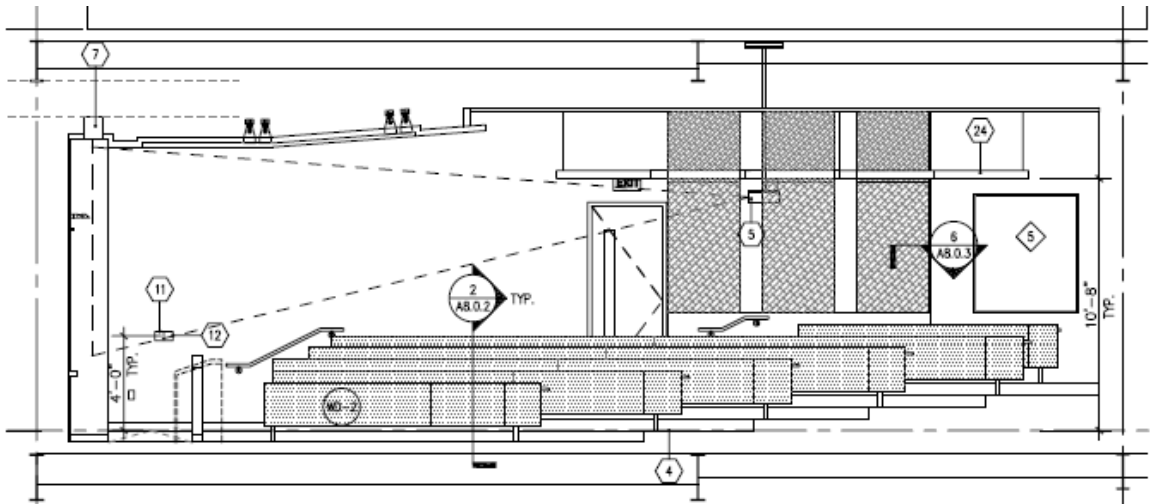


Figure 1.3 – 135 Classroom North Elevation/Section

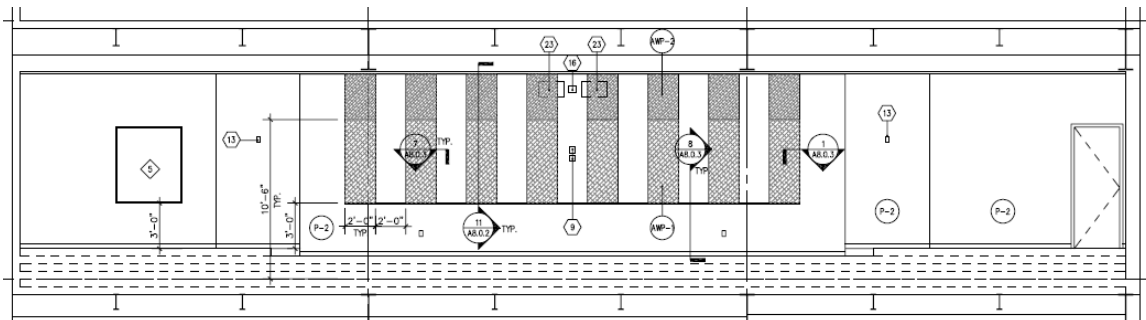


Figure 1.4 – 135 Classroom Back Elevation/Section

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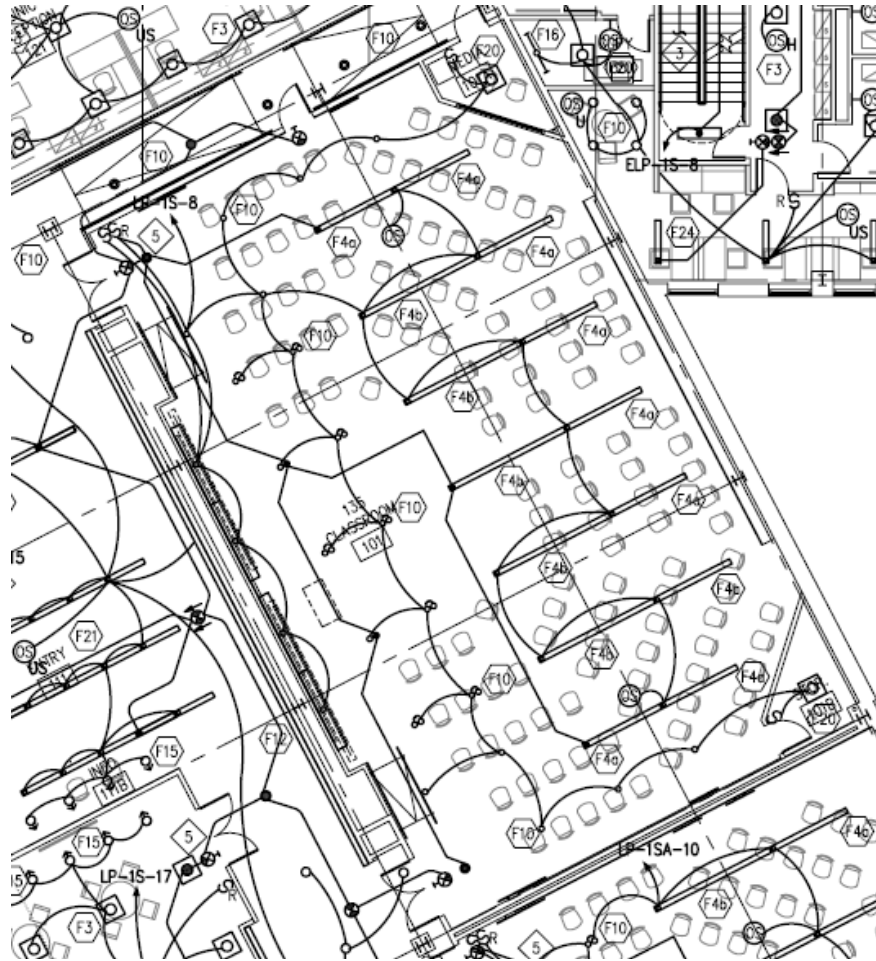


Figure 1.5 – 135 Classroom Lighting Floor Plan

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Luminaire Schedule

TAG	DESCRIPTION	LAMP TYPE	NO. LAMPS	BALLAST	MOUNTING	MANUFACTURER(S)	CATALOG NO.	VOLT	NOTES
F4a	PENDANT LIGHT FOR CLASSROOMS	T5 28W	4	ELECTRONIC	PENDANT	AXIS LIGHTING ALERA LIGHTING FOCAL POINT	CU PL 4 T5 W ** E 277 1 SA	277	PROVIDE (2) TWO LAMP BALLAST PER FIXTURE. PROVIDE (1) TWO LAMP EMERGENCY BALLAST AND (1) NORMAL BALLAST WHEN DESIGNATED AS EMERGENCY
F4b	PENDANT LIGHT FOR CLASSROOMS	T5 28W	6	ELECTRONIC	PENDANT	AXIS LIGHTING ALERA LIGHTING FOCAL POINT	CU PL 4 T5 W ** E 277 1 SA	277	PROVIDE (3) TWO LAMP BALLAST PER FIXTURE. PROVIDE (1) TWO LAMP EMERGENCY BALLAST AND (2) NORMAL BALLAST WHEN DESIGNATED AS EMERGENCY
F5	ADJUSTABLE FLUORESCENT BOARD LIGHT	T5 28W	1	ELECTRONIC	SURFACE	INSIGHT	CF5 SMS 4 270 W LV5	277	-
F10	6" COMPACT FLUORESCENT DOWNLIGHT WITH VERTICAL LAMP AND FLANGE INTEGRAL TO REFLECTOR.	CFL 32W	1	ELECTRONIC	RECESSED	GOTHAM CALCULITE KURT VERSEN	AFV SERIES 8021 SERIES P926 SERIES	277	CLEAR FINISH
F20	RECESSED LOURVERED 2X2	T5 40W BIAx	2	ELECTRONIC	RECESSED	LITHONIA METALUX PRUDENTIAL	2PM3N G A 2 CF40 12 277	277	-

* Multiple manufacturers are listed to allow the contractor the option of substituting a luminaire that has been previously approved by the engineer/lighting designer.



F4a/F4b



F5



F10



F20

Light Loss Factors

TAG	MAINTENANCE CATEGORY	DIRT CONDITIONS	CLEANING INTERVAL	INITIAL LUMENS	MEAN LUMENS	BALLAST FACTOR	LLD	RSDD	LDD	LLF
F4a	II	Very Clean	12 months	2900	2660	1.30	0.92	0.95	0.96	1.09
F4b	II	Very Clean	12 months	2900	2660	1.30	0.92	0.95	0.96	1.09
F5	V	Very Clean	12 months	2900	2660	1.40	0.92	0.98	0.93	1.17
F10	IV	Very Clean	12 months	2200	1850	1.00	0.84	0.98	0.94	0.77
F20	IV	Very Clean	12 months	3150	2840	0.95	0.90	0.98	0.94	0.79

Controls

This space is controlled primarily controlled by occupancy sensors that provide the automatic shutoff as required by ASHRAE 90.1. The occupancy sensors do not control different zones in this space however. Each occupancy sensors are circuited together and to the luminaires in the space. If one sensor sees movement, all lights will be controlled by that sensor, and vice versa.

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This is one of the spaces that are controlled using the lighting control panels which were discussed in the *Building Overview*. This space is a space that will be used primarily during business hours and is set to be lighted from 8 am through 6 pm.

Daylighting

This space has limited glazing so daylighting does not play a significant role in lighting this space. The daylighting entering the space is currently not being utilized in any manner because it would not provide much lighting. The daylighting is conversely not shaded from the space in anyway either.

Furnishings

This classroom is setup much like most other classroom at large universities. The students will be seated on tiered seating. The tables are attached to the floor and are birch wood stained a medium color (reflectance approx. = 40%). The instructors table in the front of the room is the same wood as the students' tables. There are two white boards in the front, each of which has a reflectance of approximately 90%.

Architectural Materials

- Flooring
 - Carpet; Cool Color, Reflectance approx. = 25%
- Walls
 - Painted Gyp Board; Heron White, Reflectance = 85%
 - Acoustical Wall Panel; Reflectance approx. = 60%
- Ceiling
 - Painted Gyp Board; Reflectance = 80%
 - Acoustical Ceiling Tile; Reflectance = 89%

Design Criteria

- **Appearance of Space and Luminaires (Important)**

The appearance of space and luminaires is important in this classroom even though it may not be in other classrooms because of the image the Villanova School of Law wishes to portray. The legal institution has long been an institution of excellence and prestige. The space should integrate the great tradition of the legal institution with the look of modern technology.

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- **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. The CCT of the sources is also important because of the wood again. A warmer color is desired as the red wavelengths will help bring out the warm tones in the wood.
- **Daylighting Integration and Control (Not Important)**
This space has very little glazing and therefore the amount of daylighting entering the space is limited. Controls are not necessary for the same reasons.
- **Direct Glare (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 from direct glare. Also, when the students are looking from the tiered seats, if the intensity of light from high angles is too intense, 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 which will be utilizing new technology (i.e. electronic ballasts) flicker will not be an issue.
- **Light Distribution on Surfaces (Important)**
Again, because of the amount of wood in the space light distribution on those wood surfaces is very important. Also, the white boards in the front of the room will require light to be distributed evenly over those 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 (Somewhat 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 down light casts on the face.

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- **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. Again, if the acoustic panels on the walls will be accented, the texture of those has the potential to add an interesting element to the walls.

- **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 white board which will require a relatively high level. Lectures can also be presented with the help of projector, and in this case the lighting levels will have to be reduced greatly 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.

ASHRAE 90.1 Energy Criteria

Allowable Power Density for Classrooms	1.4 W/SF
Total Watts	3455 W
Square Footage	3180 SF
Designed Power Density	1.09 W/SF

This building was designed to meet ASHRAE 90.1. This space meets the requirements set forth by the criteria.

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Existing Lighting Conditions Analysis

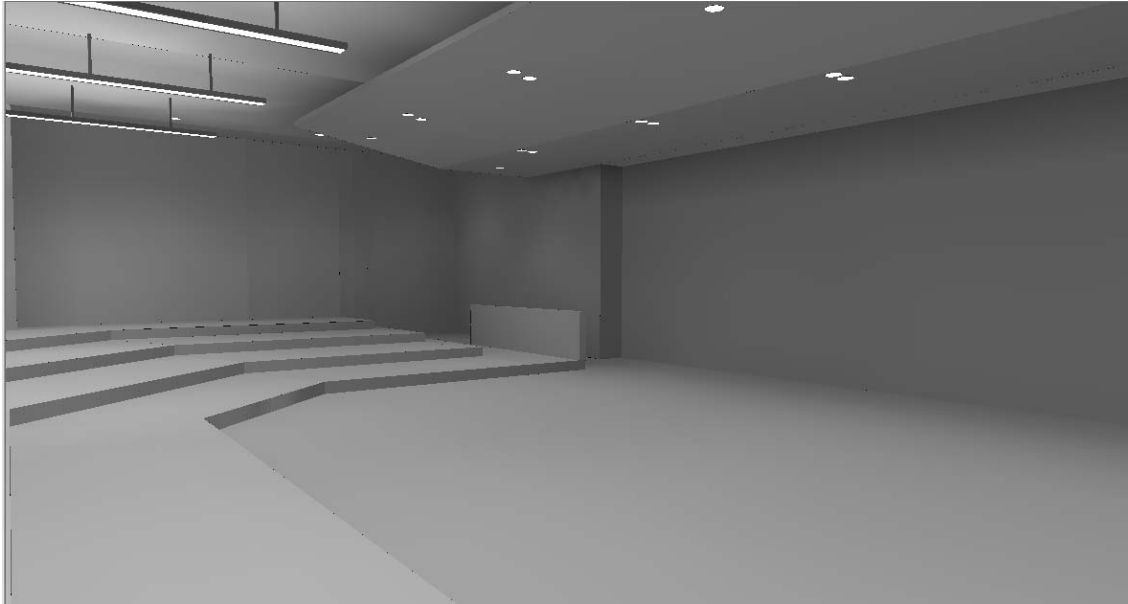


Figure 1.6 – 135 Seat Classroom Existing Condition Rendering

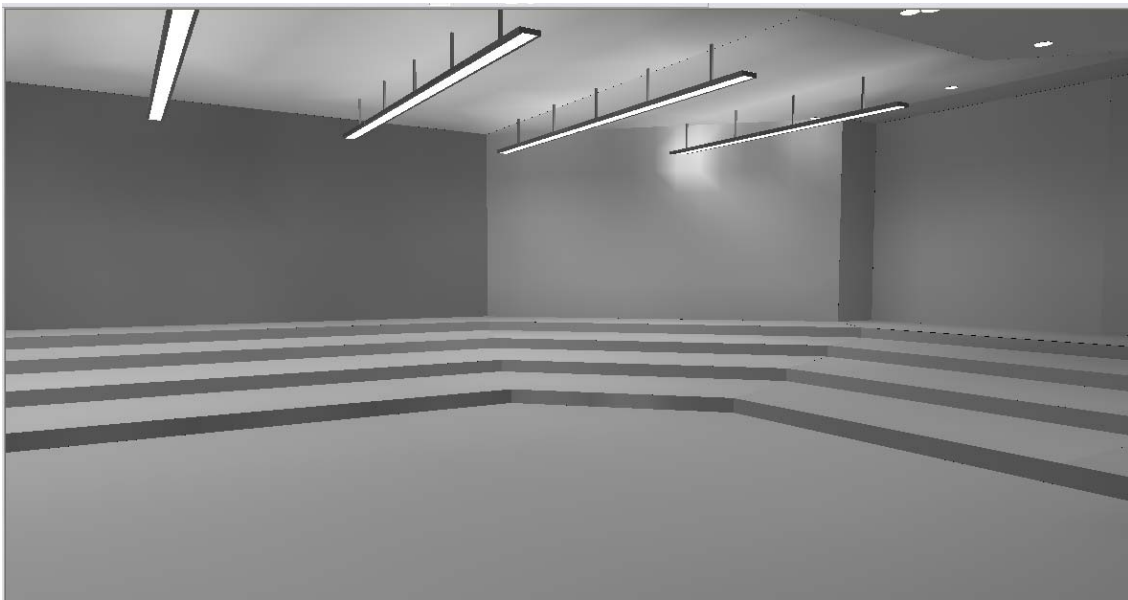


Figure 1.7 – 135 Seat Classroom Existing Condition Rendering

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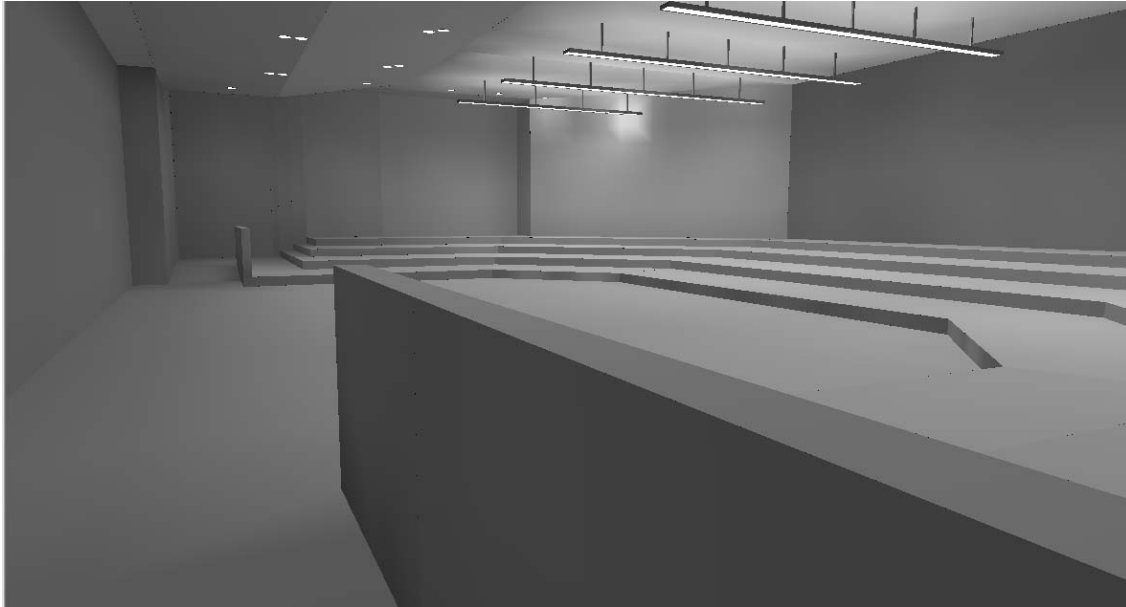


Figure 1.8 – 135 Seat Classroom Existing Condition Rendering

Project 1
Calc Pts
Task Plane
Illuminance Values (Fc)
Average=59.07
Maximum=106
Minimum=12.6
Avg/Min=4.69
Max/Min=8.37

Figure 1.9 – 135 Seat Classroom Existing Condition Calc

This classroom has a somewhat typical classroom lighting design. This space will have a great amount of wood when furnished so I believe a slightly different approach needs to be taken. The use of more incandescent has the ability of bringing out the wood. The pendants do a good job of providing the ambient light in the space. They are a good choice for a law classroom because many students will be using laptops and direct-indirects do a good job of reducing glare on the screens. However, the pendants are mounted too close to the angled part of the walls. This creates a hot spot in each corner which distracts from the rest of the room.

The overhead lighting in the front of the room is also undesirable. The person standing there will have strong shadows on his or her face. Track lighting from multiple angles will improve facial rendering.

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The light levels in this space are a little high. This could be because the ballast factor for the ballast chosen was 1.3. A ballast with a lower BF will reduce the amount of light in the room which would bring it closer to the desired 50 fc.

Lastly, the controls in this space are limited to automatic shutoff by way of occupancy sensors. This is a space that has a lot of area and has potential to waste light if it is not fully occupied. I feel that a preset controller would improve the flexibility and functionality of this space. Any time we can shed some lighting load, that's desirable.

Existing Lighting Conditions and Hardware – Moot Courtroom

This space implements many different types of lighting to create the atmosphere of excellent that a courtroom demands. In the area of the judge's bench and the witness stand, the lighting is direct. The luminaires directly overhead are slot type luminaires that are a combination T5 fixture and 37W MR-16s. Behind the judges bench is a row of compact fluorescent can lights. In order to illuminate the wall directly behind the judge is a row of can wall washers. The direct lighting in this area creates very sharp shadows which bring out the wood furniture that dominates this area of the space.

In the area the audience and or class will sit, both halogen downlights and indirect T5 pendants are utilized. These provide the layer of light for the audience and the jury. The lighting here is partially indirect so the diffuse light will be less sharp than the direct light in the front of the room. This creates the layering of light that is necessary for the audience to be able to gaze toward the front in a more comfortable manner.

The back wall has wall mounted indirect luminaires that illuminate the upper part of the wall and contribute to the diffuse ambient light in the audience area of the space. In the smaller spaces around the courtroom, such as the robe room, the conference room and storage spaces, downlights and troffers are used.

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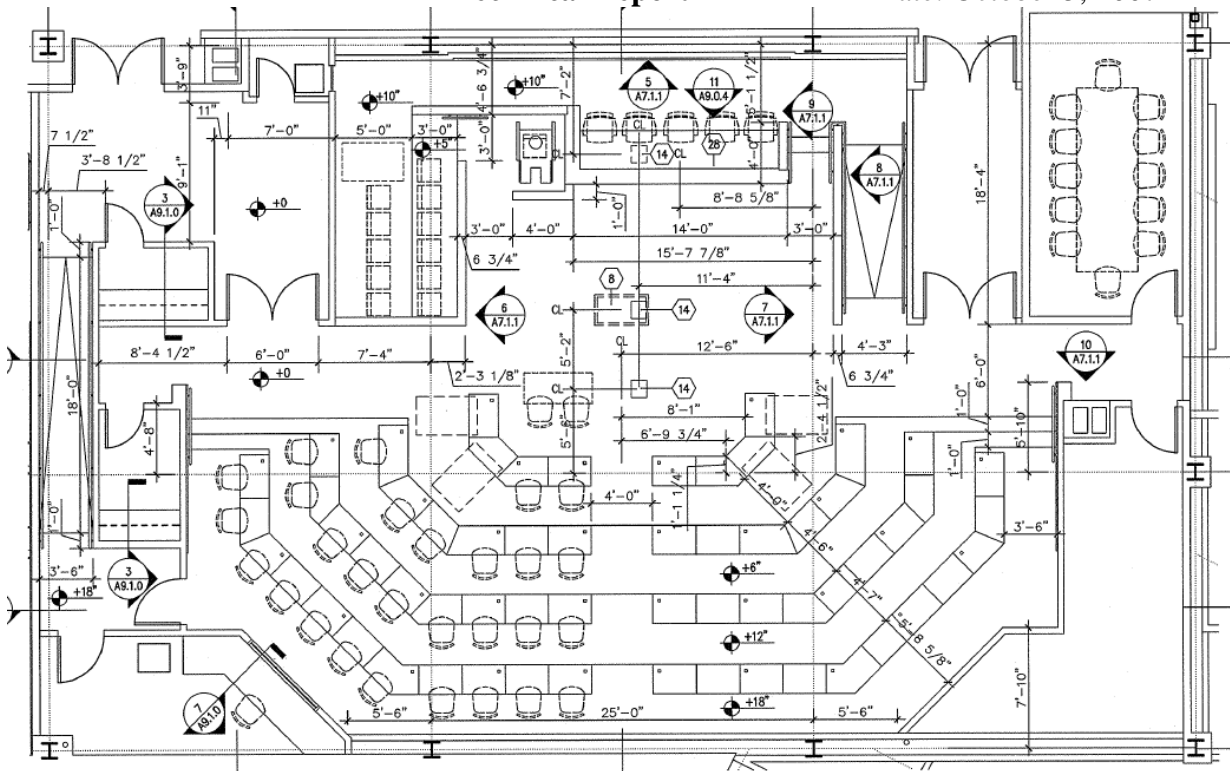


Figure 2.1 – Moot Court Floor Plan

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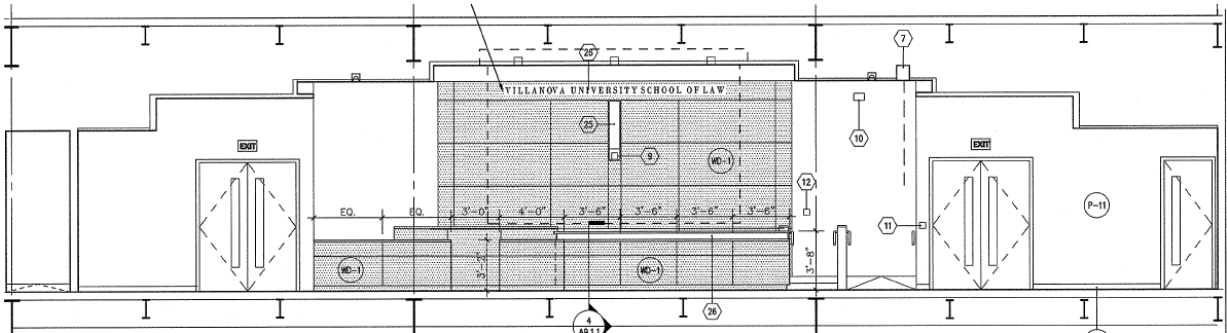


Figure 2.2 – Moot Court Front Elevation/Section

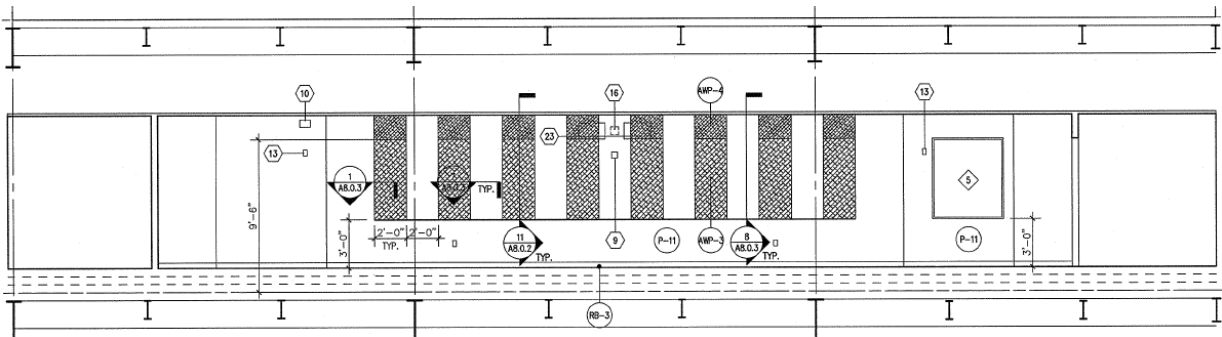


Figure 2.3 – Moot Court Front Rear Elevation/Section

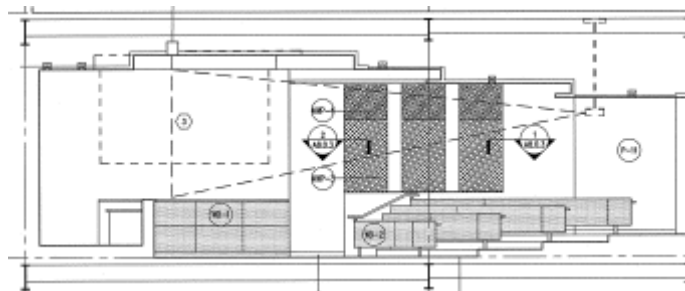


Figure 2.3 – Moot Court Front North Elevation/Section

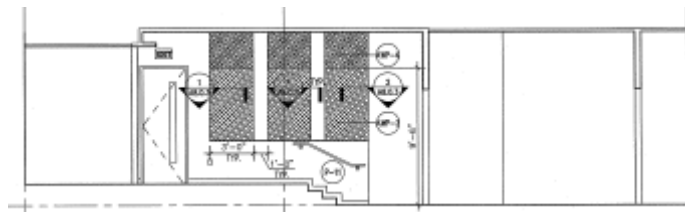


Figure 2.3 – Moot Court Front South Elevation

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Luminaire Schedule

TAG	DESCRIPTION	LAMP TYPE	NO. LAMPS	BALLAST	MOUNTING	MANUFACTURER(S)	CATALOG NO.	VOLT	NOTES
F2b	PENDANT LIGHT FOR CONFERENCE/MEETING AREAS	T5 28W	6	ELECTRONIC	PENDANT	AXIS LIGHTING ALERA LIGHTING FOCAL POINT	LT PL 4 T5 W ** E 277 1 SA	277	PROVIDE (3) TWO LAMP BALLASTS PER FIXTURE. PROVIDE (1) TWO LAMP EMERGENCY BALLAST AND (2) NORMAL BALLASTS WHEN DESIGNATED AS EMERGENCY
F3	RECESSED 2X2 FLUORESCENT	T5 40W BIAx	2	ELECTRONIC	RECESSED	FOCAL POINT AXIS LIGHTING ALERA LIGHTING	FMA2 22 2 BX40 1C 277 E G WH	277	-
F10	6" COMPACT FLUORESCENT DOWNLNG W/ VERTICAL LAMP	CFL 32W	1	ELECTRONIC	RECESSED	GOTHAM CALCULITE KURT VERSEN	AFV SERIES 8021 SERIES P926 SERIES	277	CLEAR FINISH
F10a	6" COMPACT FLUORESCENT DOWNLNG W/ VERTICAL LAMP	CFL 32W	1	DIMMING	RECESSED	GOTHAM CALCULITE KURT VERSEN	AFV SERIES 8021 SERIES P926 SERIES LIGHTEDGE	277	CLEAR FINISH
F11	LINEAR FLUORESCENT INDIRECT SURFACE MOUNTED FIXTURE	T5 28W	2	DIMMING	SURFACE	PEERLESS		277	SATAIN ANODIZED FINISH
F15	6" DIAMETER RECESSED OPEN WALLWASH W/ VERTICAL LAMP	CFL 32W	1	ELECTRONIC	RECESSED	GOTHAM CALCULITE KURT VERSEN	AFVW 8021WW P905	277	CLEAR FINISH
F15a	6" DIAMETER RECESSED OPEN WALLWASH W/ VERTICAL LAMP	CFL 32W	1	DIMMING	RECESSED	GOTHAM CALCULITE KURT VERSEN	AFVW 8021WW P905	277	CLEAR FINISH
F17a	6" WIDTH LOW PROFILE LINEAR FLUORESCENT ASYMMETRIC COVE	T5 28W	2	DIMMING	SURFACE	LEDALITE FOCAL POINT	IN-COVE LP COVELIGHT 26	277	WHITE FINISH
F20	RECESSED LOUVERED 2X2 LINEAR FLUORESCENT W/ ACRYL. DIFFUSER	T5 40W BIAx	2	ELECTRONIC	RECESSED	LITHONIA METALUX PRUDENTIAL	2PM3N G A 2 CF40 12 277	277	-
F23	AND MR16 DOWNLIGHT COMBO FIXTURE W/ SEPARATE CIRCUITS	T5 28W, 37 MR16 IR	(2) T5, (3) MR16	DIMMING	RECESSED	MARK ARCHITECTURE	SLOT 6	277/120	-
T2	4" DIA. RECESSED ADJUSTABLE MR-16 ACCENT W/ 2" APERTURE, LOCABLE AIMING, STD SOFTENING LENS, TAPERED CUT FOR ANGLES 25-45.	37 MR-16 IR	1	-	RECESSED	GOTHAM AMERLUX	DLV EVOKE	120	CLEAR FINISH

* Multiple manufacturers are listed to allow the contractor the option of substituting a luminaire that has been previously approved by the engineer/lighting designer.



F2b



F3



F10/F10a/F15/F15a



F11



F17a



F20

Unavailable

F23



T2

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Light Loss Factors

TAG	MAINTENANCE CATEGORY	DIRT CONDITIONS	CLEANING INTERVAL	INITIAL LUMENS	MEAN LUMENS	BALLAST FACTOR	LLD	RSDD	LDD	LLF
F2b	II	Very Clean	12 months	2900	2660	1.30	0.92	0.95	0.96	1.09
F3	IV	Very Clean	12 months	3150	2840	0.95	0.90	0.98	0.94	0.79
F10	IV	Very Clean	12 months	2200	1850	1.00	0.84	0.98	0.94	0.77
F10a	IV	Very Clean	12 months	2200	1850	1.00	0.84	0.98	0.94	0.77
F11	VI	Very Clean	12 months	2900	2660	1.30	0.92	0.91	0.92	1.00
F15	IV	Very Clean	12 months	3150	2840	0.95	0.90	0.98	0.94	0.79
F15a	IV	Very Clean	12 months	3150	2840	0.95	0.90	0.98	0.94	0.79
F17a	V	Very Clean	12 months	2900	2660	1.30	0.92	0.92	0.93	1.02
F20	IV	Very Clean	12 months	3150	2840	0.95	0.90	0.98	0.94	0.79
F23	IV	Very Clean	12 months	2900	2660	1.30	0.92	0.98	0.94	1.10
T2	IV	Very Clean	12 months	-	-	1.00	1.00	0.98	0.94	0.92

Controls

This space will be used for multiple uses. The primary use will be instruction, whether through a classroom type instruction, or a demonstration of courtroom proceedings. This court can also be used as a courtroom along that will allow for an entire trial to take place for students to observe from beginning to end. In order for this to be as realistic as possible for the latter, the lighting has to be able to be adjusted from typical classroom lighting to a scene more suitable to a courtroom. This space has been broken into zones and those zones will be able to be dimmed using either a Crestron or Lutron dimming panel.

The automatic shutoffs will be like the rest of the building. Occupancy sensors will be responsible for turning lights on when someone enters the space. Again, the occupancy sensors are zoneless. When one detects movement, the room will illuminate to the default scene as programmed into the control panel.

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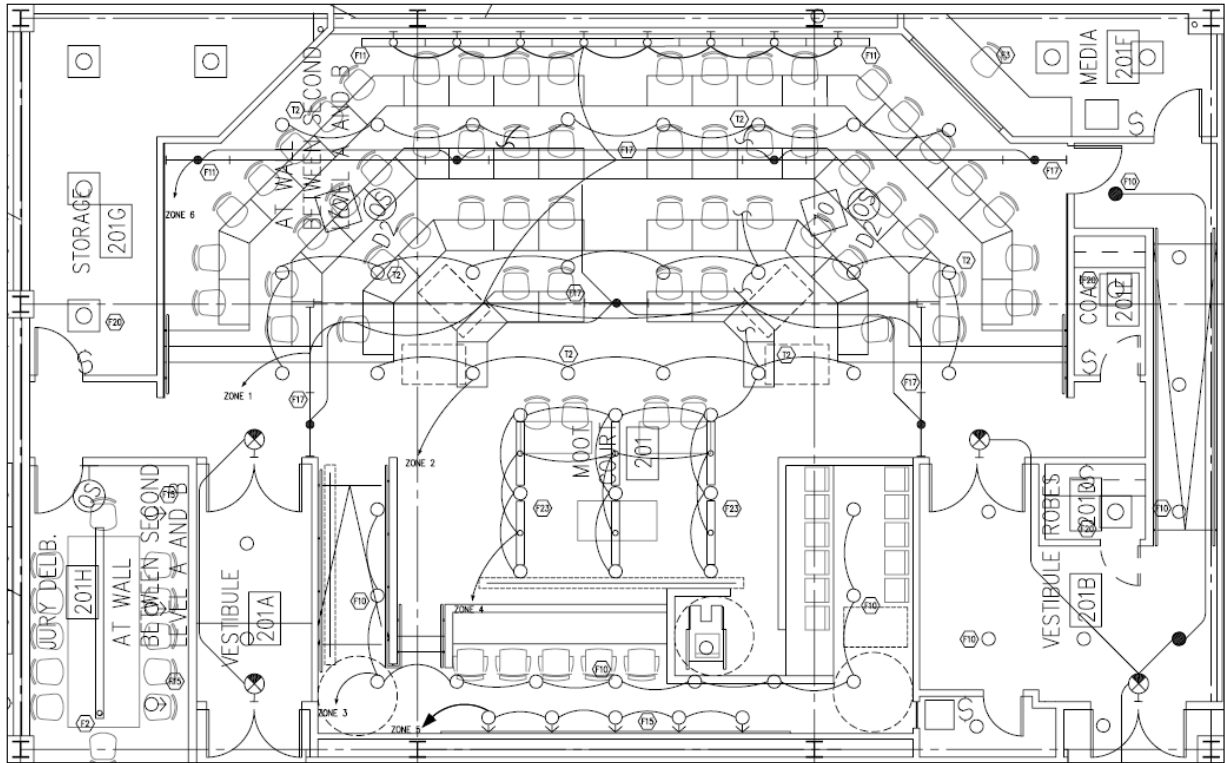


Figure 2.4 – Moot Court Lighting Zones

DIMMING PANEL SCHEDULE					
ZONE	ZONE DESCRIPTION	PANEL	CIRCUIT	LOAD	POWER PACK
1	BACK OF CLASSROOM WALL WASH	LP-2S	13	225 A	LEPB-3
2	FLUORESCENT COVE LIGHTS	LP-2S	15	1306 A	LEPB-3
3	INCANDESCENT DOWNLIGHTS	RP-2SA-1	15	1330 A	LEPB-1
4	FRONT OF CLASSROOM FLUORESCENT LIGHTS	LP-2S	17	400 A	LEPB-3
5	EMERGENCY LIGHTS	ELP-3S	9	400 A	LEPB-3
6	-	-	-	-	-

Figure 2.5 – Moot Court Dimming Panel Schedule

Daylighting

This space, like the large classroom does not have a significant of daylight entering the space. There is only one exterior wall and it stretches for only part of the room. Because of this, the room does not require day lighting controls and special shading is not needed.

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Furnishings

The furniture in this space is for the most part built into the room. The judge's bench, the witness stand, the jury box and the audience seating is all part of the room. The prosecution and defense tables are not, however, built into the floor.

As in most courtrooms, the room is dominated by strong wood tones. Wood is the material used on all of the above mentioned furnishings. The wood is located at the front of the room, primarily the judge's bench, witness stand and the jury box are a darker wood (reflectance approx.=20%) than what is found on the audience seating (reflectance approx. 30%).

Architectural Materials

- Flooring
 - Carpet; Cool Color), Reflectance approx. = 25%
- Walls
 - Painted Gyp Board; Simply white, Reflectance = 88%
 - Wood Paneling; Matches judge's bench, Reflectance approx. = 20%
 - Acoustic Wall Panel; Reflectance approx. = 60%
- Ceiling
 - Painted Gyp Board; Reflectance = 80%
 - Acoustical Ceiling Tile; Reflectance = 89%

Design Criteria

- **Appearance of Space and Luminaires (Very Important)**

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

Like in the classroom, this is so important because of the amount of wood in the space. This space has even more wood than the classroom so the color appearance of the space is critical if the wood is going to stand out in the way it was designed. CCT is also important if the intent is to bring the wood out more. In this case, I think a cooler CCT is acceptable because of the amount of wood. With so much wood, it will bring itself out. However, the lighting designer in this space has used more incandescent sources than in most other spaces in the building so I'm sure this was one of the considerations.

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- **Daylighting Integration and Control (Not Important)**
This space has very little glazing and therefore the amount of daylight entering the space is limited. Controls are not necessary for the same reasons.
- **Direct Glare (Important)**
The audience will be again 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 is to expect them to pay attention and be comfortable for the time they are there and this space is to be designed as a real courtroom would be.
- **Flicker (Not Applicable)**
This problem is mostly applicable to HID sources and older fluorescent sources. As this is new construction which will be utilizing new technology (i.e. electronic ballasts) flicker will not be an issue.
- **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. Also, many times behind the judge are either the court's logo, or in this case could be the law school's logo and that is a surface that will need to be illuminated.
- **Uniform Light Distribution on Task Plane (Somewhat 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, but 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 plan distribution can be addressed by the different scenes that the control panel provides.
- **Modeling of Faces (Important)**
Again, 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 judge's and the witness' face well. On the other hand, the jury and judge also need to be able to see the councilors' and the defendant's faces well so the front of the space will need to be illuminated well vertically in both directions.
- **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 affectively is very important.

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- **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 walls 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 needs to serve as an instructional area in multiple ways. A typical classroom setting has to be provided, along with a more 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.

ASHRAE 90.1 Energy Criteria

Allowable Power Density for Courtroom	1.9 W/SF
Total Watts	5540 W
Square Footage	2915 SF
Designed Power Density	1.9 W/SF

This space was designed per ASHRAE 90.1 energy criteria. The space meets the code exactly however no decorative lighting was taken into account. The decorative lighting that would be present would be whatever is accenting the logo behind the judge and perhaps some of the wood paneling on the walls.

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Existing Lighting Conditions Analysis

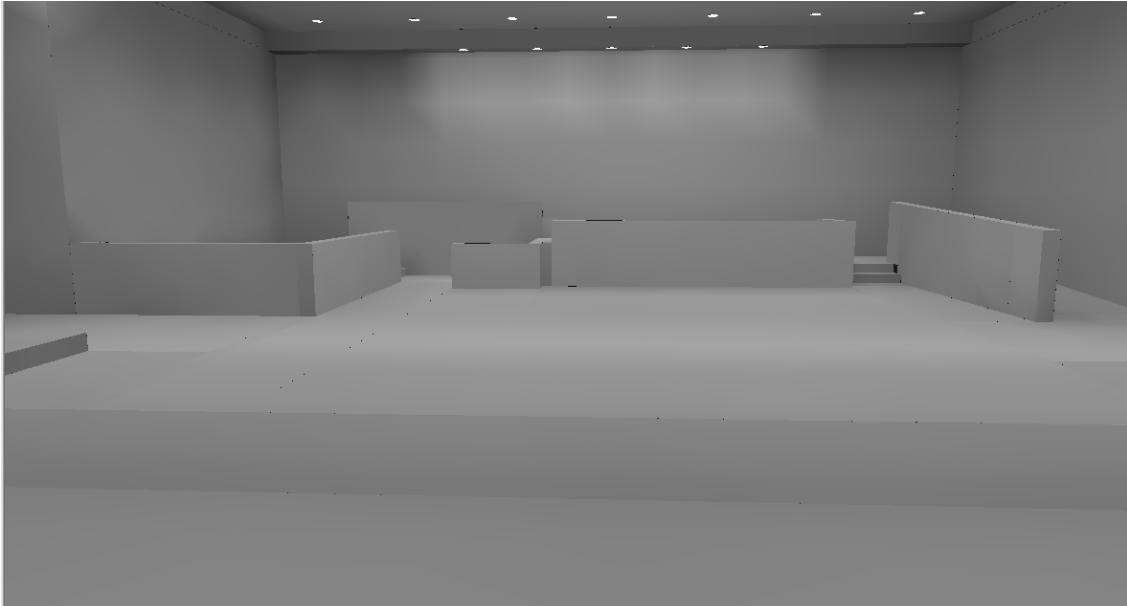


Figure 2.6 – Moot Court Existing Conditions Rendering

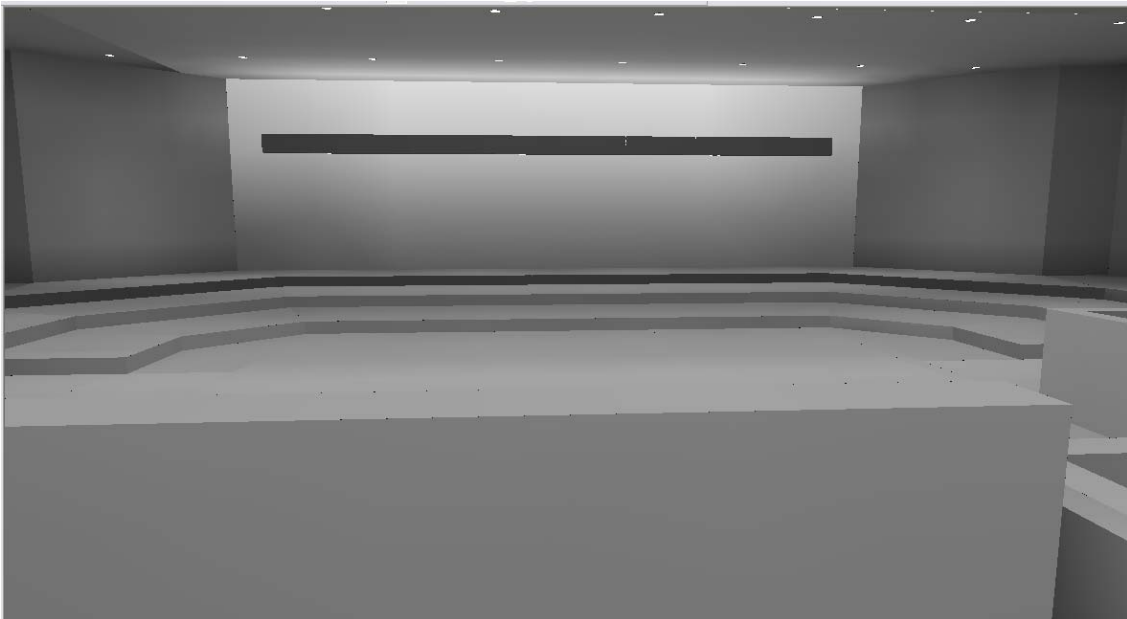


Figure 2.7 – Moot Court Existing Conditions Rendering

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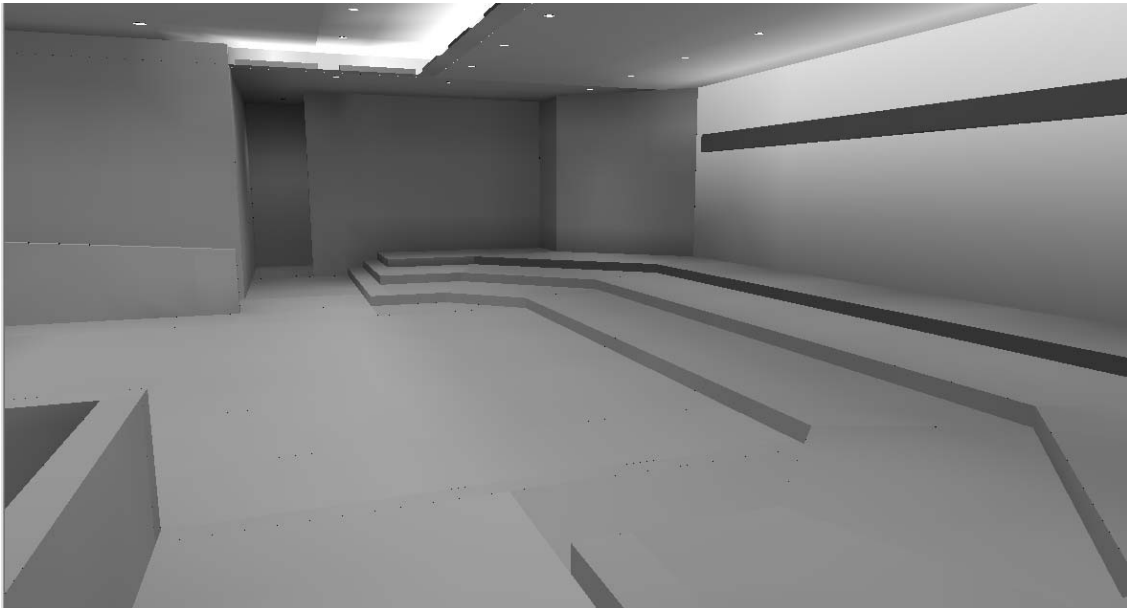


Figure 2.8 – Moot Court Existing Conditions Rendering

Project 1	
Calc Pts	
CalcPts	
Illuminance Values (Fc)	
Average=	32.22
Maximum=	62.9
Minimum=	0.9
Avg/Min=	35.80
Max/Min=	69.89

Figure 2.8 – Moot Court Existing Conditions Calc

Currently the design of this space is very good. The light levels are where they should be according to the IES Handbook. The reason the level is in the 30s and not the 50s as is desired is because in the model a row of a cove lights are missing. The ceiling became quite difficult to model. However, the lighting that is in the room still provides enough foot candles for the tasks to be performed effectively. The addition of the cove lights will only increase this level.

The space has many interesting features such as the judge's bench, the wall behind the bench and the space itself has many interesting architectural features. This lighting design does a good job of providing a uniform light level while still having some non-uniform light on the walls to add some visual interest.

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The current control system is also quite good. In this space, there is a controller that allows for different preset scenes to be used. Since this space will have multiple uses this is absolutely desirable.

The incandescent down lights will do a good job of bringing out the wood that dominates the room. This is a good looking lighting design that will serve this space very well.

The one problem I foresee is the amount of downlight directly above the judge's bench. This is a space where facial rendering is very important as you will have an entire audience focused on the front of the room. Perhaps more of a vertical illuminator would serve this space better.

Existing Lighting Conditions and Hardware – Atrium

The atrium is a double high space with a glass wall that faces west toward the entrance and parking lot. Included in this existing conditions section will be the atrium as a whole (both levels) and the elevator lobby on the first floor. Along the glass wall is a row of in-grade low voltage halogen MR-16 fixtures. These fixtures are placed at the mullions which will graze their faces. These mullions will be visible from the outside. The vertical feature is going to give emphasis to the height of the space to the onlookers outside. Around the outside of the atrium is an area with a ceiling. These areas, including the elevator lobby have CFL downlights to help fill in the ambient light under those overhangs.

The majority of the lighting in the atrium comes from either wall mounted fixtures mounted high up, or ceiling mounted fixtures. The ambient light in the space is mostly provided by ceiling mounted T5 strip lights and metal halide wall washers that are mounted high on the walls. There is adjustable track lighting mounted on the ceiling that allows the space some flexibility. Lastly, there is a row of decorative pendants that hang approximately 6 feet from the ceiling that will glow at night and will be visible to people outside.

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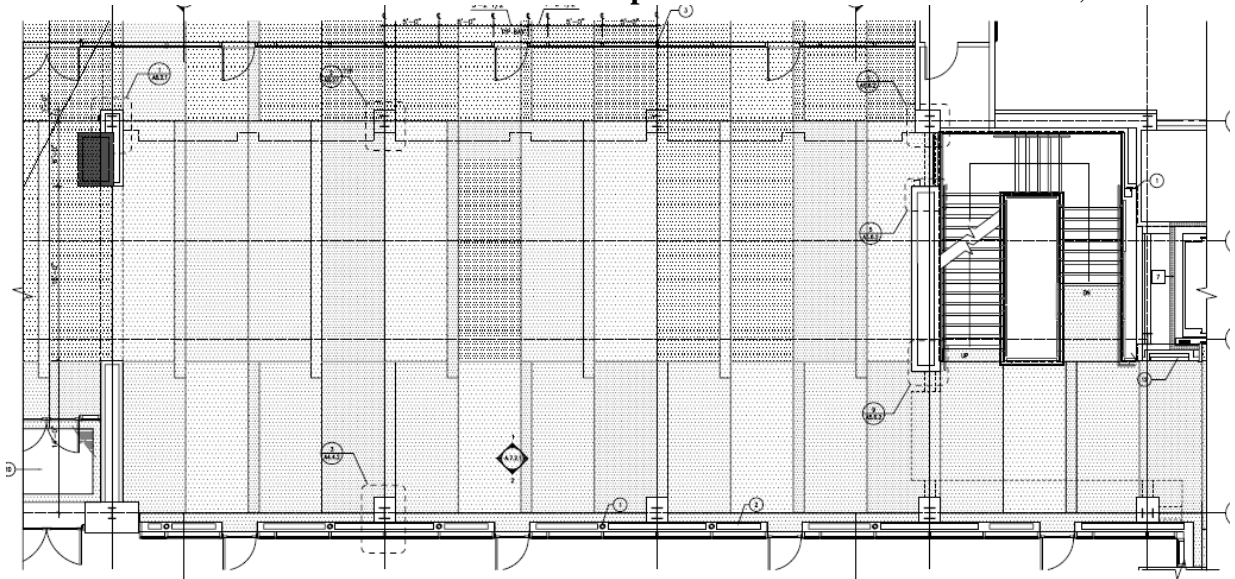


Figure 3.1 – Atrium First Floor Plan

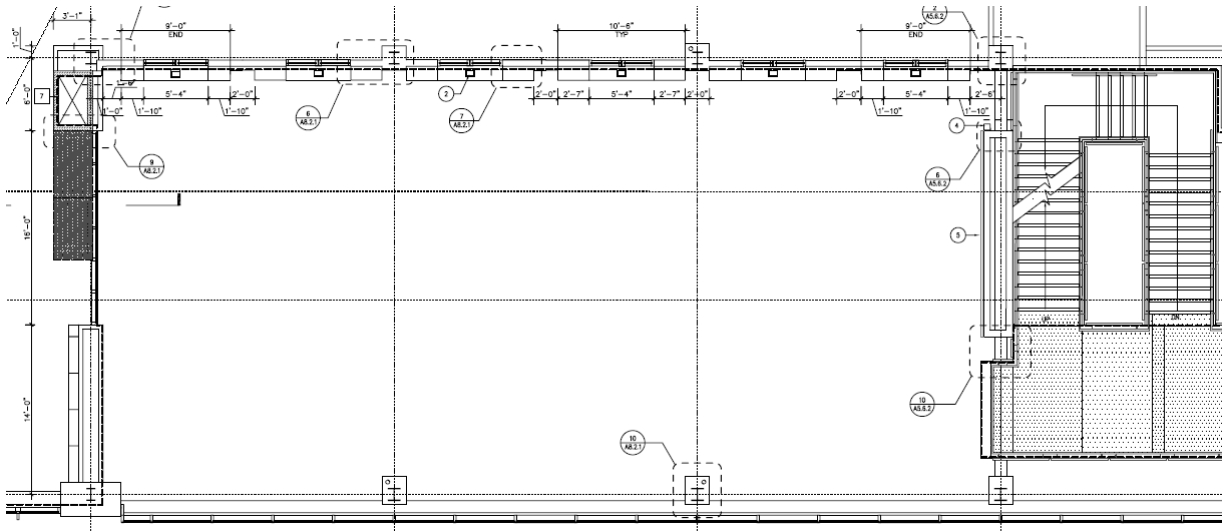


Figure 3.2 – Atrium Second Floor Plan

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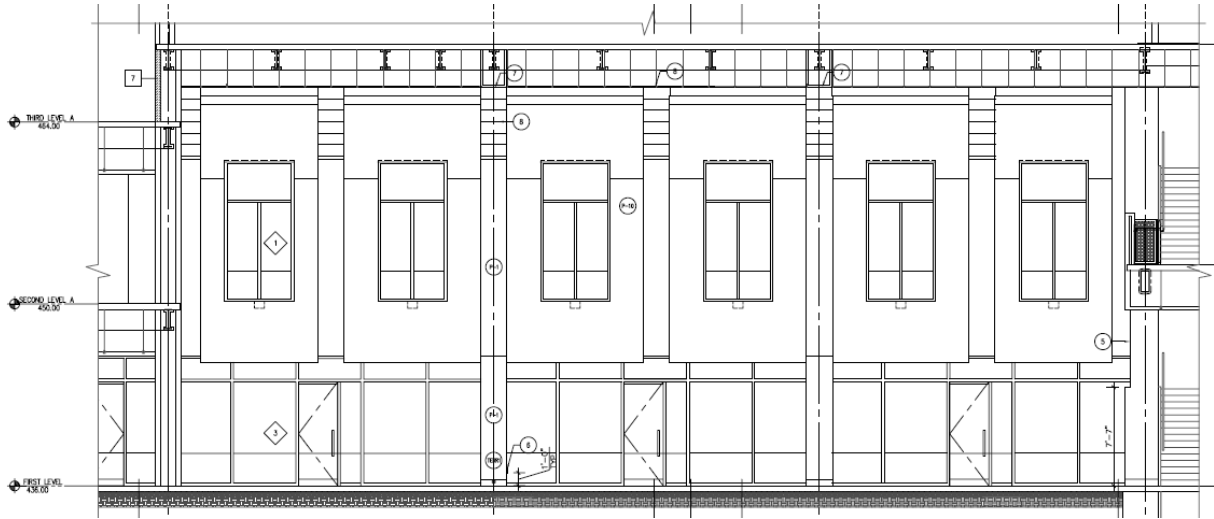


Figure 3.3 – Atrium North – West Elevation

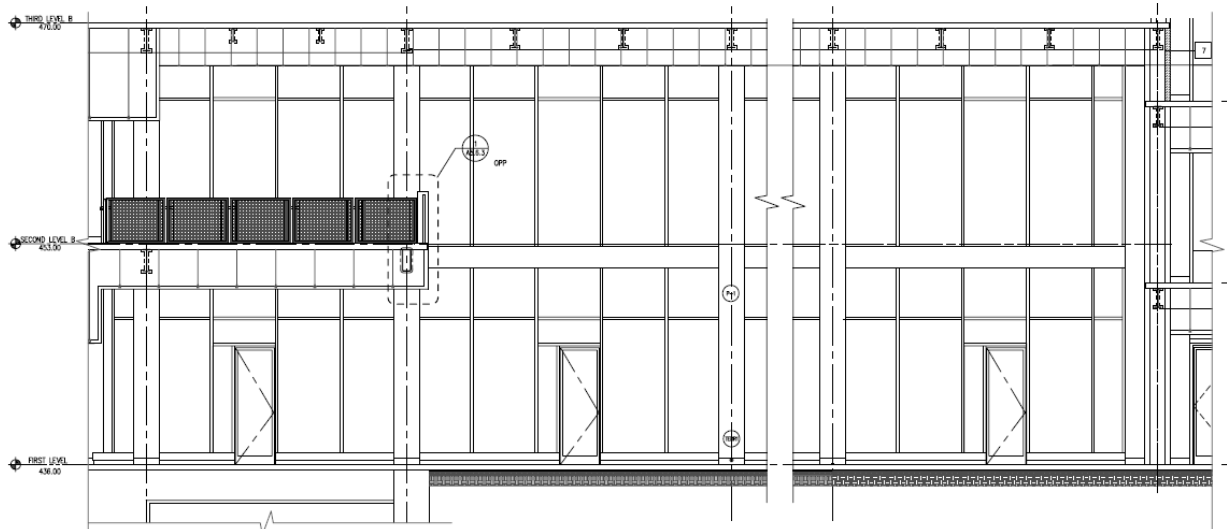


Figure 3.4 – Atrium South – Elevation Elevation

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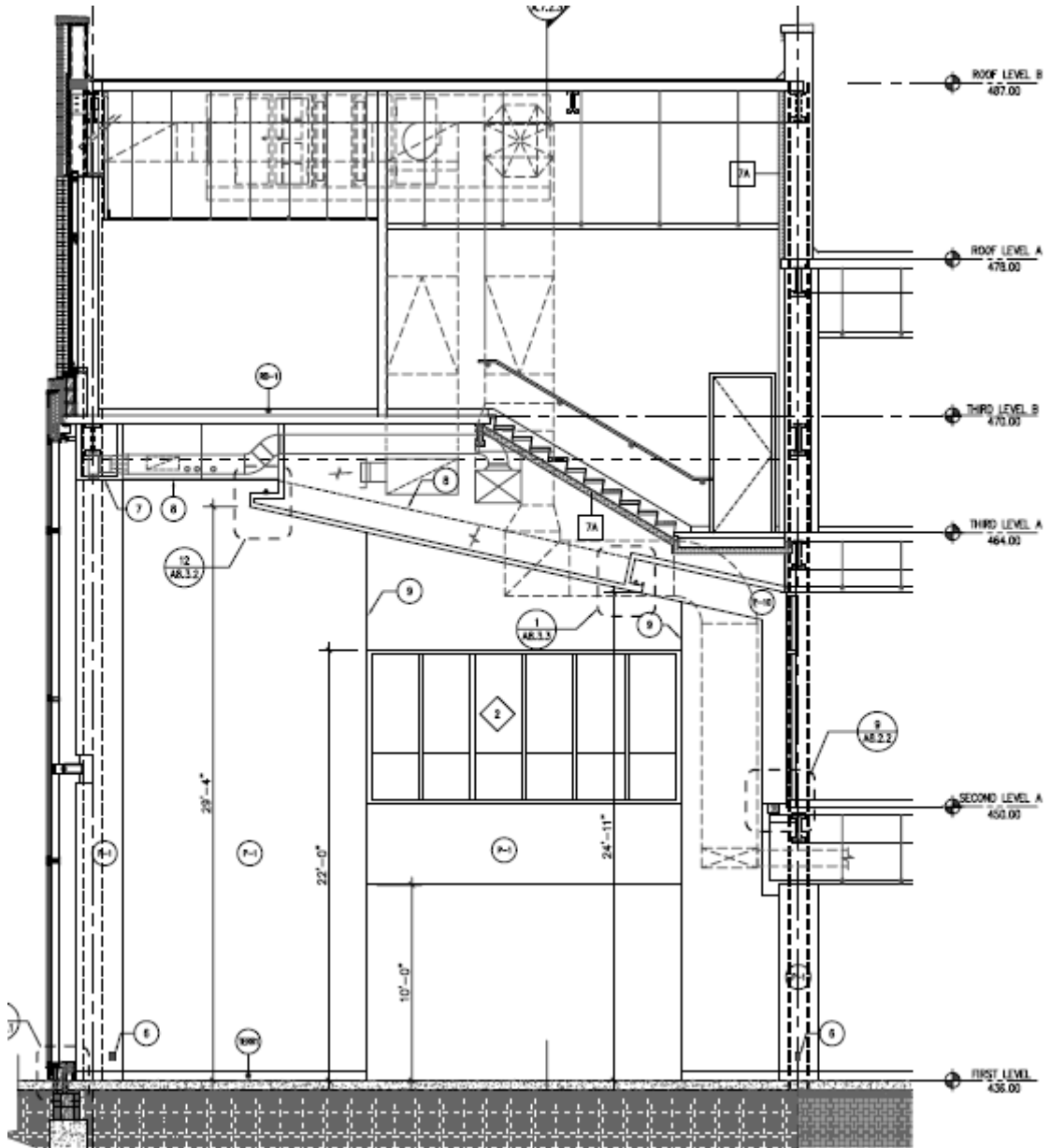


Figure 3.5 – Atrium South – West Section

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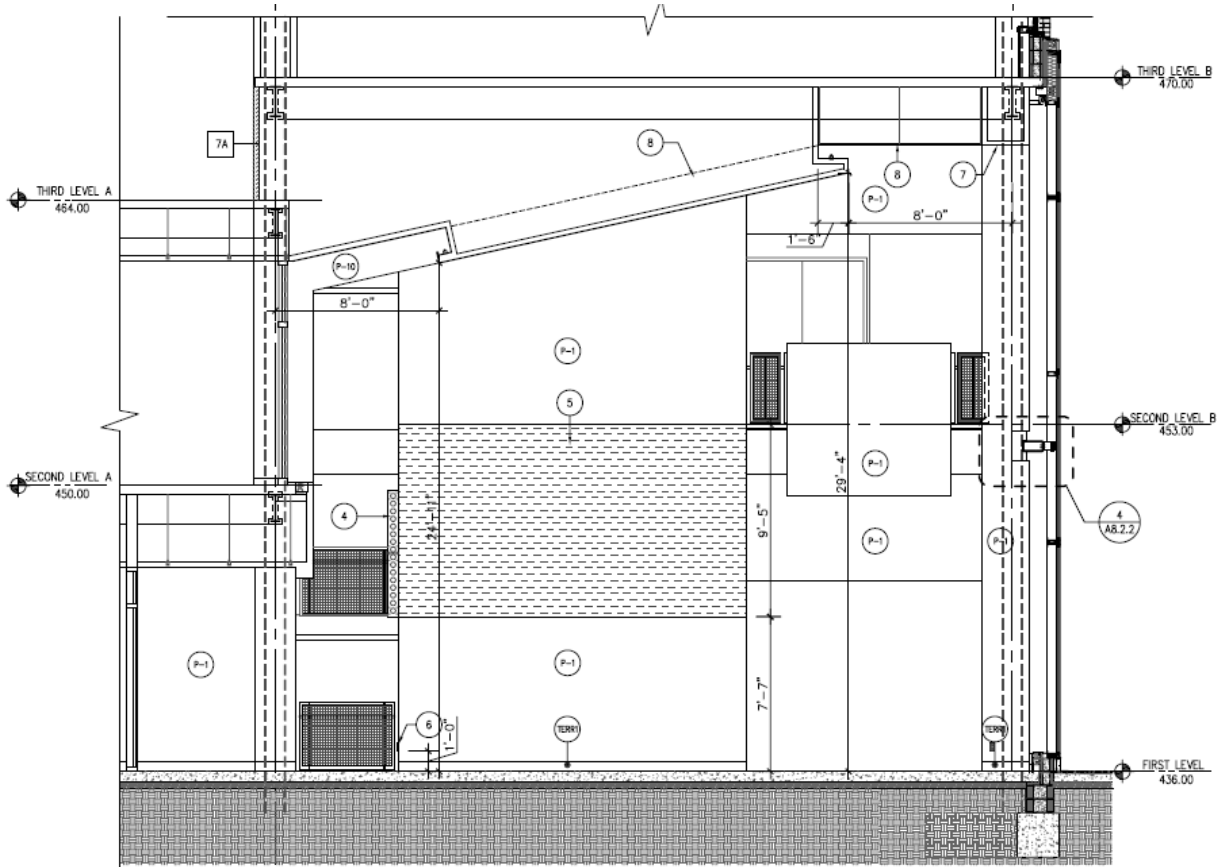


Figure 3.6 – Atrium North – East Section

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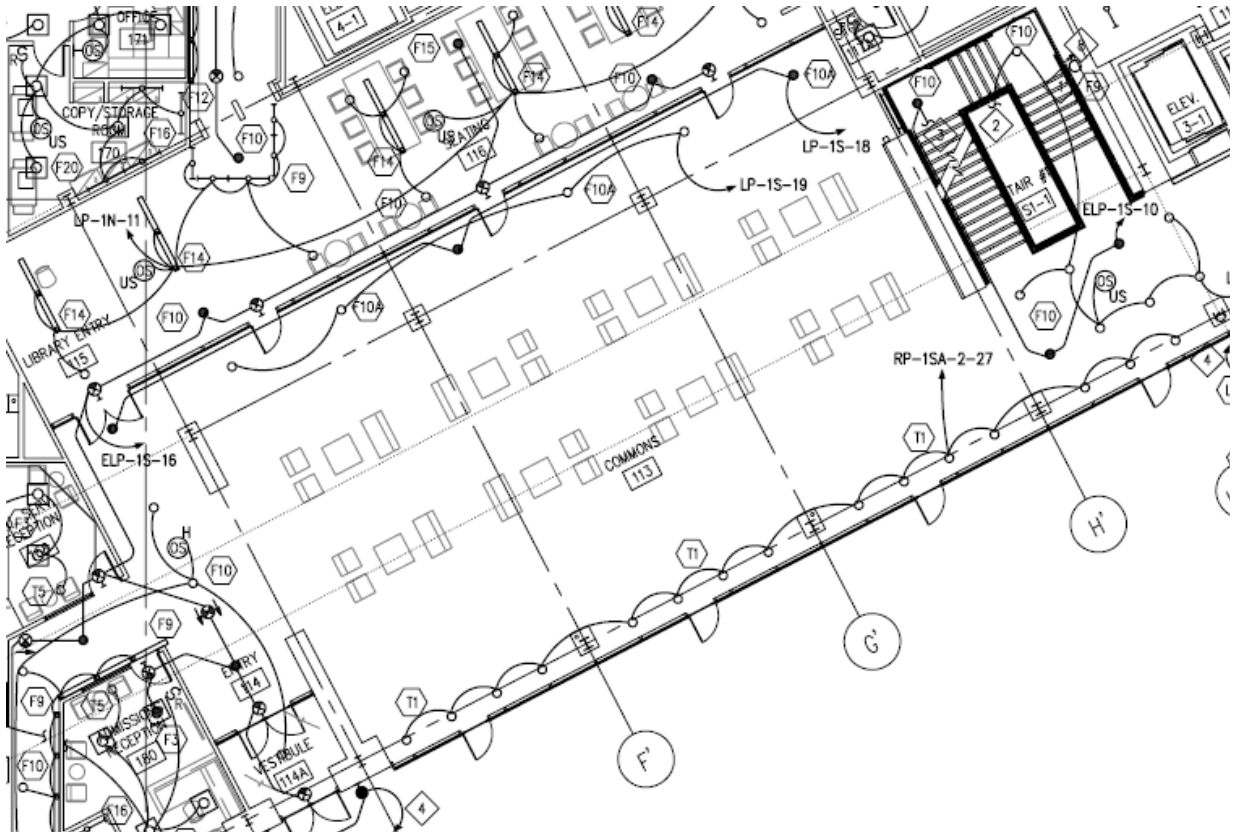


Figure 3.7 – Atrium Lighting Plan First Floor

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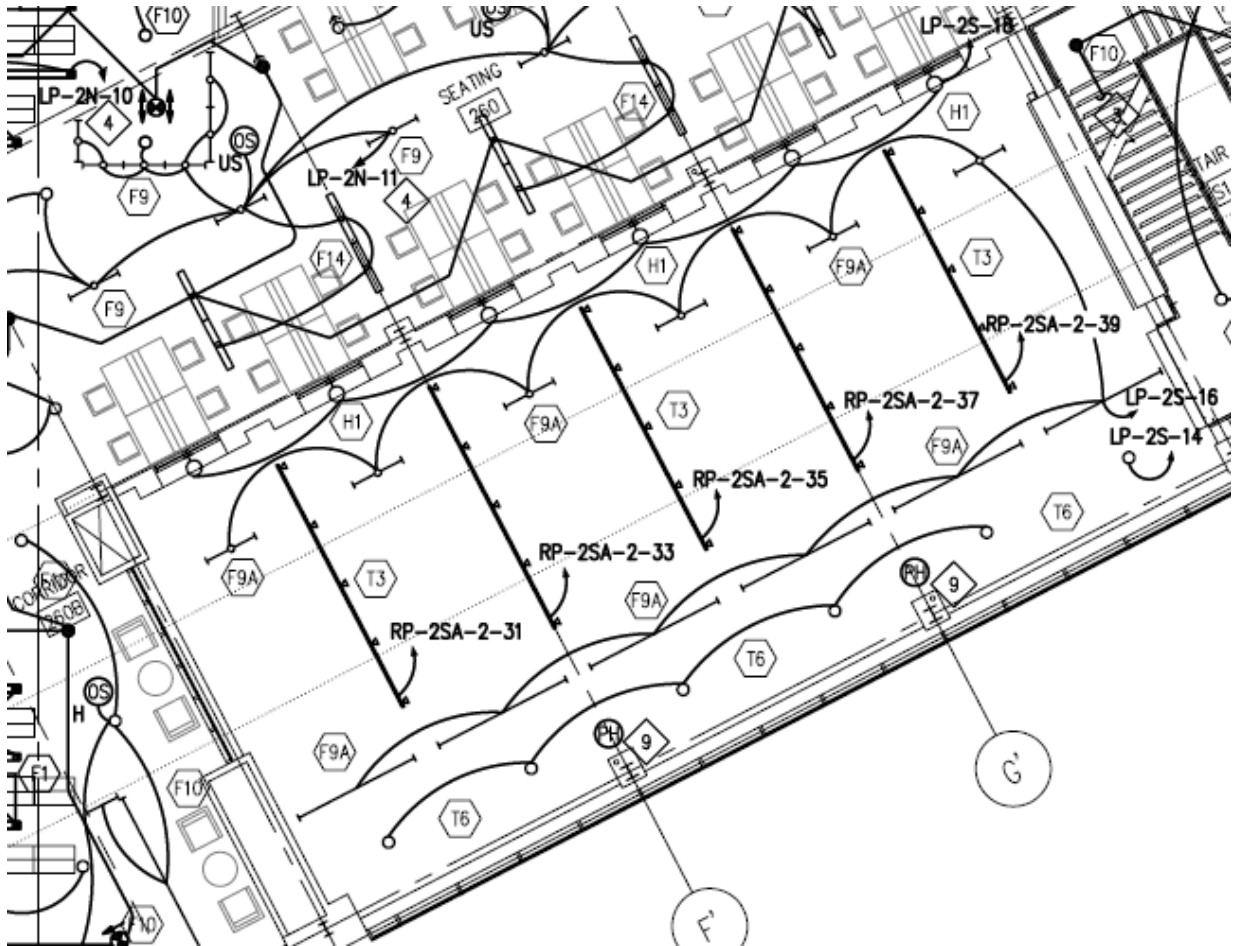


Figure 3.7 – Atrium Lighting Plan Second Floor

Luminaire Schedule

TAG	DESCRIPTION	LAMP TYPE	NO. LAMPS	BALLAST	MOUNTING	MANUFACTURER(S)	CATALOG NO.	VOLT	NOTES
F9a	LOW PROFILE LINEAR FLUORESCENT STRIP W/ INTEGRAL BALLAST. LENGTH AS INDICATED	T5 28W	1	DIMMING	SURFACE	BELFER LITHONIA METALUX	2820 SERIES WS5 SERIES CRICKET	277	WHITE FINISH. USE 3' AND 4' LENGTHS TO CONTINUOUSLY FILL COVE. ALL UNUSED SPACE SHALL BE WQUALLY DISTRIBUTED ON EACH END.
F10	6" COMPACT FLUORESCENT DOWNLING W/ VERTICAL LAMP	CFL 32W	1	ELECTRONIC	RECESSED	GOTHAM CALCULITE KURT VERSEN	AFV SERIES 8021 SERIES P926 SERIES	277	CLEAR FINISH
F10a	6" COMPACT FLUORESCENT DOWNLING W/ VERTICAL LAMP	CFL 32W	1	DIMMING	RECESSED	GOTHAM CALCULITE KURT VERSEN	AFV SERIES 8021 SERIES P926 SERIES	277	CLEAR FINISH
T1	6" DIA LOW VOLTAGE INGRADE W/ REMOTE TRANSFORMER. STRAIGHT EDGE TRIM LOW VOLTAGE ADJUSTABLE TRACK ON SINGLE CIRCUIT TRACK	37W MR-16	2	-	INGRADE	EXTERIEUR VERT LSI	PHENIX C1R SERIES LN16 SERIES	120/12	SILVER FINISH
T3	6" DIA LOW VOLTAGE INGRADE W/ REMOTE TRANSFORMER. STRAIGHT EDGE TRIM LOW VOLTAGE ADJUSTABLE TRACK ON SINGLE CIRCUIT TRACK	37W MR-16	1	-	TRACK	LSI LIGHTOLIER	ALYCON MINI CYLINDER	120	SILVER FINISH
T6	71.8" LENGTH CYLINDRICAL DECORATIVE PENDANT W/ SATIN ACRYLIC DIFFUSER LOW PROFILE METAL HALIDE SURFACE	T5 28W	2	DIMMING	PENDANT	SCHMITZ	TOOL	120	SATIN NICKLE FINISH
H1	MOUNTED CEILING WASH	39W MH T4	1	ELECTRONIC	SURFACE	ELLIPTIPAR	STYLE 105	277	ALUMINUM FINISH

*Multiple manufacturers are listed to allow the contractor the option of substituting a luminaire that has been previously approved by the engineer/lighting designer.

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F9a



F10/F10a



T1



T3



T6



H1

Light Loss Factors

TAG	MAINTENANCE CATEGORY	DIRT CONDITIONS	CLEANING INTERVAL	INITIAL LUMENS	MEAN LUMENS	BALLAST FACTOR	LLD	RSDD	LDD	LLF
F9a	V	Clean	12 months	2900	2660	1.30	0.92	0.97	0.88	1.02
F10	IV	Clean	12 months	2200	1850	1.00	0.84	0.97	0.89	0.73
F10a	IV	Clean	12 months	2200	1850	1.00	0.84	0.97	0.89	0.73
T1	V	Clean	12 months	-	-	1.00	1.00	0.92	0.88	0.81
T3	V	Clean	12 months	-	-	1.00	1.00	0.97	0.88	0.85
T6	IV	Clean	12 months	2200	1850	1.00	0.84	0.97	0.89	0.73
H1	VI	Clean	12 months	3300	2640	0.95	0.80	0.92	0.88	0.62

Controls and Daylighting

This space is a space that has the potential to set multiple moods. This is a space that could be used to draw attention to the building. It could also be used as a gathering space for parties or other events. During the day it is used at a commons area so the ambient light needs to be sufficient for that use.

The amount of glass on the front wall creates a challenge if the space is being used for special events during the day that need to have specific lighting and not a great amount of ambient light.

Because of the above reasons, the controls in this space have been designed to allow this space to accommodate multiple functions and to save as much energy as possible. There are photocells mounted toward the glass wall that control the ambient light fixtures in the space. When there is ample daylight in the space, certain light fixtures will be switched off as a way to conserve energy and to reduce the light levels in the space.

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The shading on the glazing in the current design is limited to a mesh that is applied to the shorter windows that the top of the windows on each level. The full length windows do not have any shading. This space does not have any kinds of motorized shading that can be adjusted for special events.

The other luminaires that can be controlled in the space are the adjustable track heads that are mounted to the ceiling. This allows for the space to accent specific things if a special event is ever held in the atrium or if there is a point of interest that is to be highlighted.



Figure 3.9 – Atrium Rendering (Furnishing/Materials)

Furnishings

This space is used mostly as a sitting area and a transition area from one wing to the other. The seating in the space is mostly light colored upholstery chairs (Reflectance approx. = 75%). The tables and backs of some chairs are a dark wood that has a reflectance of approximately 15%. The tables have a tinted glass top with a color that will compliment the others in the room.

Architectural Materials

As seen in the above rendering this space has quite a variety of architectural materials.

- Floor
 - Carpet; off-white w/ a darker pattern; Reflectance approx. = 65%
- Walls
 - Painted Gyp Board; Heron White, Reflectance = 85%

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- Wood Paneling; Light natural Stain, Reflectance approx. = 50%
- Glass Façade
 - Aluminum Mullions; Dark finish, Reflectance approx. = 25%
- Ceiling
 - See Walls

Design Criteria

- **Appearance of Space and Luminaires (Important)**

In a space such as an atrium that will draw people to the space, the appearance of the space and luminaires is important. The appearance of the space is more important, however, than the appearance of the luminaires. I say this because the luminaires will be mostly mounted on the ceiling of the second floor and will not be seen easily by the people in the space below. That being said, the luminaires still need to be attractive because they will be visible from the second floor spaces that look out into the atrium.

- **Color Appearance (Important)**

The color appearance of the space and luminaires is important once again because of the amount of wood in the space. The wood in this space is lighter than that in the courtrooms and there for doesn't require such a warm source to compliment it. The color of the carpet contrasted with the light wood on the wall and dark wood of the furniture is a feature that is important in this space, therefore the CRI of the lighting chosen should be sufficiently high to bring out the necessary colors.

- **Daylighting Integration and Control (Very Important)**

This is the space of 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 if the design intent is to allow for flexibility of the space during the day. The lighting needs to be controlled to accommodate that amount of daylight entering. Shutting off certain lights to allow the nature light to illuminate the space is a must in today's construction world. Green design is at the forefront and must always be addressed.

Daylighting isn't always desirable however. If the space is needed for a special even during the day, the amount of light entering the space can easily wash out the atmosphere or make the task unattainable (a presentation using a projector). In this case, sufficient shading for the glazing is a must.

- **Direct Glare (Somewhat Important)**

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

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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. The goal of the lighting designer should always be to bring out what the architect was intending.

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 glares 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 in most instances. The floor obviously needs enough light to for people walk through the space comfortably and most importantly safely. The space is used as a common area that will have people sitting and reading among other things. The people will need enough light to take care of whatever task they are undertaking so the ambient light levels must be sufficient for most general tasks.

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.

- **Modeling of Faces (Very Important)**

A space that is going to serve as a space for people to sit with their friends and talk and have a good time, they need to see the people they are talking to. A comfortable feeling space is a natural feeling space. If people are thinking about why they don't like the lighting or why the person doesn't look quite right, they will not enjoy the time they are having because something doesn't feel quite right. This issue needs to be taken care of so the users of this space can enjoy their time there.

- **Points of Interest (Important)**

This space could very easily have points of interest. This space could have a sculpture, or art work or portraits displayed around the room. These need to be accented and highlighted in a way that makes the art work or whatever interesting piece easy to look at and adds to the attractiveness of the room.

- **Surface Characteristics (Important)**

The amount of wood in this space deserves attention. The texture of the wood has the potential to create an interesting aspect to the room. The glass is a surface that has some characteristics that could cause some undesirable affects if not addressed correctly.

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- **System Control and Flexibility (Very Important)**

As discussed before, the control and flexibility of this space is extremely important. The daylight controls are needed to allow the space to be used for all possible scenarios. The lighting controls are required to allow the flexibility that is desired for a multifunction space such as this. Lastly, the controls will allow the owner to use the natural light as a supplement for electric light that will save money on energy and in turn help lessen the buildings negative effect on the environment.

ASHRAE 90.1 Energy Criteria

Allowable Power Density for Atrium	1.2 W/SF
Total Watts	3785 W
Square Footage	5540 SF
Designed Power Density	0.68 W/SF

This space was designed to ASHRAE 90.1 standards and meets the criteria and used just over half of the allowable wattage. This is a space that can use well under the allowable watts because of the amount of sunlight entering the space.

Existing Lighting Condition Critique

Currently the atrium is designed to meet a few needs. The tracks are adjustable but they are not remotely adjustable. If those are to be moved to accent a certain piece, it will be difficult to do so. The light levels currently meet the function that will most often occur in the space which is gathering of people. This space has been designed well under the allowable power density for energy conservation reasons. I feel that the best way to save power and to still have the flexibility in light levels is to implement a dimming system for all luminaires.

The daylighting in the space will be abundant during sunny days. Because of this I feel that automatic window shades should be implemented into this space to allow for better flexibility during daylight hours. The photosensors that are being used is a good design feature to allow for shedding of load when there is plenty of daylight. I feel that this type of system should remain in the space.

I feel that the exterior glow of the space at night should also be addressed. Instead of mostly downlight, washing walls to create some vertical illuminance will be a good way to allow the space to glow brightly at night without using an unnecessary amount of light.

Existing Lighting Conditions and Hardware – Courtyard

Currently the lighting of the courtyard consists simply of full cutoff bollards along the walking paths. Much of the light to the courtyard is going to leak from the all glass façade of the atrium. There is a parking lot directly in front of the courtyard as well which will help to illuminate it.

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The bollards are controlled currently with a time clock that will turn the lights on at a certain time depending on the day of the year.

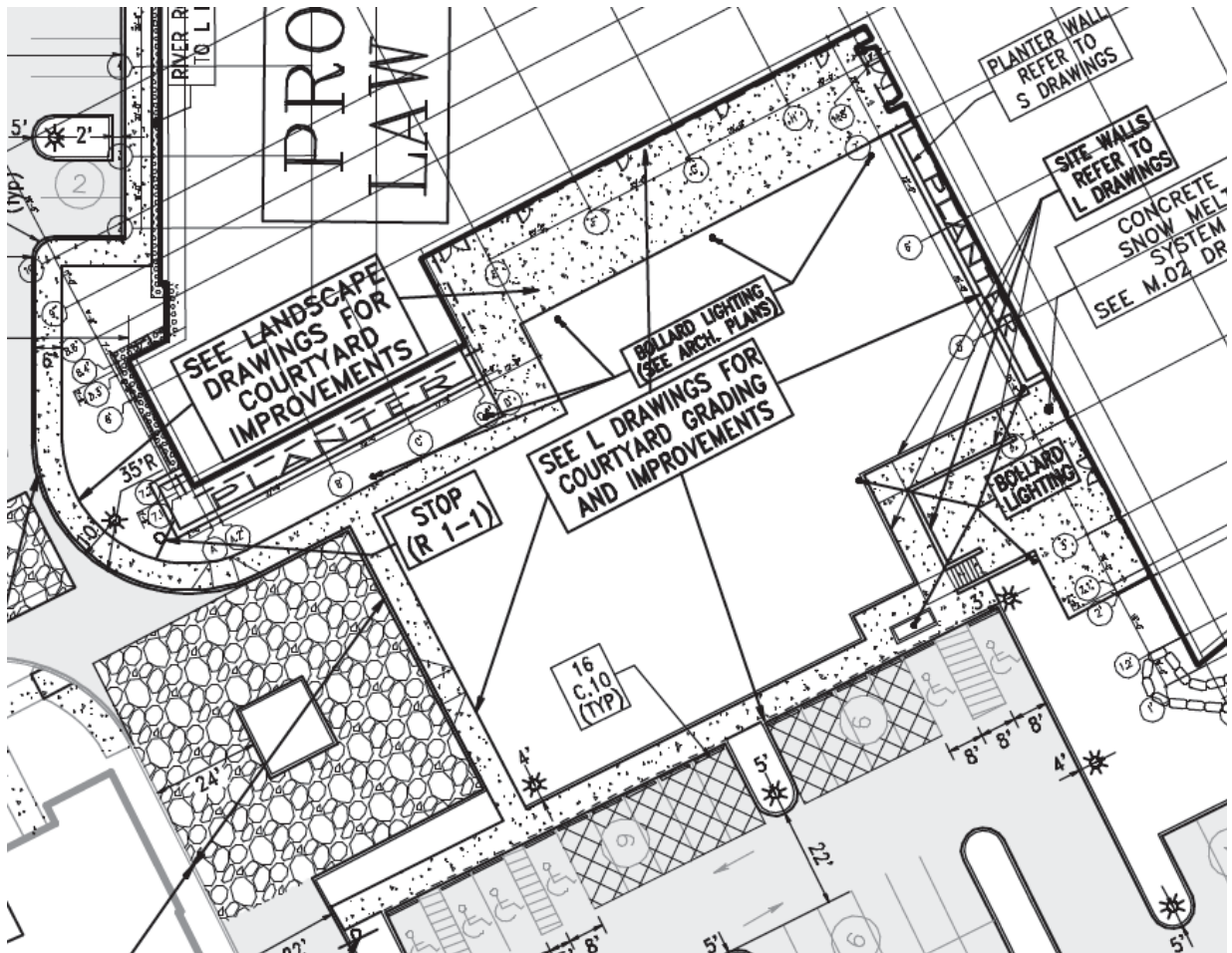


Figure 4.1 – Courtyard Civil Plan

Luminaire Schedule

TAG	DESCRIPTION	LAMP TYPE	NO. LAMPS	BALLAST	MOUNTING	MANUFACTURER(S)	CATALOG NO.	VOLT	NOTES
L3	FULL CUTOFF BOLLARD	39W MH	1	ELECTRONIC	GROUND	ERCO	PARANORMAL SERIES	277	DOUBLE POWDER COAT, BRUSHED NICKEL FINISH

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L3

Light Loss Factors

TAG	MAINTENANCE CATEGORY	DIRT CONDITIONS	CLEANING INTERVAL	INITIAL LUMENS	MEAN LUMENS	BALLAST FACTOR	LLD	LDD	LLF
L3	V	Dirty	6 months	3300	2640	0.95	0.80	0.83	0.63

Controls and Daylighting

The courtyard is a space that clearly needs daylighting controls. Currently, the exterior lighting is controlled by a time clock that will turn these bollards on at certain times depending on the time of year.

Design Criteria

In my redesign, I intend this space as a space that can be used to sit and relax outside on a cool night while you are studying in the library. It would make a great place to take a break and have a snack in the evening. My design criteria will reflect these ideas.

- Appearance of Space and Luminaires (Important)**
 This space needs to portray the same excellence that the spaces inside do. The luminaires need to be high quality and architecturally attractive. The appearance of the space as a whole is also important. If people are to sit outside and relax, they want to be in a place that is attractive and appealing.
- Color Appearance (Important)**
 In a space such as this, HPS lighting will not give the affect I'm looking for. The design should be something that is a cool color and have a high CRI to allow for the different materials (the building façade, the sidewalk, the tables and even the grass) to stand out.
- Daylighting Integration and Control (Somewhat Important)**
 This is obvious for an exterior space. The lighting should only be on when it is needed.

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- **Direct Glare (Important)**
Since people are to use this space, direct glare will be important. I plan to use more than just bollards in this space, so the post top lights need to not put direct glare into the people faces as the rest on the patio. Again, people will not use the space if they are uncomfortable.
- **Light Distribution on Surfaces (Somewhat Important)**
The surfaces outside are different and have textures that could be lighted but because of the amount of light leaving the atrium, it will be difficult to wash a wall or to bring out the texture of the stone on the building affectively.
- **Uniform Light Distribution on Task Plane (Not Important)**
The lighting out in the courtyard will be there to set a mood and to allow people to walk along the path safely. The light from the parking lot and the light leaving the atrium will help with that so the walkways do not necessarily need to be lit uniformly for people to find their way safely.
- **Modeling of Faces (Important)**
Modeling of faces is important in the areas that people could be sitting at night. In the areas that they will be walking through, safety is the biggest concern. Vertical illuminance is important for people to be able to see each other well and again, to make them feel comfortable and natural in the space.
- **Points of Interest (Not Important)**
The biggest point of interest in the courtyard will be the glass atrium. This will be illuminated from the inside so there is no need to try to put focus on something else in the space.
- **System Control and Flexibility (Important)**
This is important in such a space because of energy conservation. The lighting needs to only be used when necessary. Currently, the lighting is controlled by a time clock. I feel a more affective way to control this space would be a photocell for all lights in the courtyard that would turn them all on. After a certain time of night, when the foot traffic is at a minimum, a time clock should turn of select luminaires and allow just enough for safe passage to remain on.

ASHRAE 90.1 Energy Criteria

Allowable Power Density for Courtyard	0.2 W/SF
Total Watts	495 W
Square Footage	18,800 SF
Designed Power Density	0.03 W/SF

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This courtyard currently has one tenth the light that is allowed. The current design was intending to let the building speak for itself and provide just enough light for passage. This shows however that it is possible to increase the light levels considerably without going over that allowable power density.

Existing Lighting Critique

Currently the courtyard is designed allow the people to walk safely through the space. This space has a lot of potential to be an extremely interested space. The atrium behind the courtyard is going to serve as the point of interest and should not be taken away from. However, the current design misses some of the potential that this space has. The space uses far less power than allowed by ASHRAE which leaves a great amount of leeway for increased light levels, additional luminaires and an overall more usable space at night. The tables on the patio currently can not be used at night. This design feature should be embraced at night. On a nice night, people who are studying could use this space as a break space.

That said, the luminaires that were chosen were a great choice. There are currently full cutoff bollards along the walk way which abides by the current dark sky recommendations. The bollards are very attractive fixtures and definitely uphold the elegance of the law institution.

This space has great potential to be both a usable space as well as a space to help enhance the night time appearance of Villanova University.

Overall Building Lighting Critique

The lighting in the Villanova University: School of Law is done well. The lighting allows the architecture to speak for itself. There isn't a whole lot of flair, but in such an institution, the architecture is was should be the focus. The lighting should simply add to that.

The classrooms could be controlled better I believe by allowing for some dimming, and some preset scenes. This would add to the flexibility of the space. The courtrooms are done well. They are extremely flexible and the lighting does its job of enhancing the architecture.

As I've said earlier in this report, the institution of American law is one of prestige and excellence. Because of this, the lighting has to do a great job of showing that to all who inhabit this space.

This building will serve as a beacon for the University, both figuratively and literally. The atrium will glow at night and naturally draw people to the space. This space will be used at night so the lighting must be functional and attractive. I feel this was accomplished in the initial design and I look forward to attempting to improve upon an already great design.