Technical Report 1: Existing Conditions and Design Criteria

Princeton Theological Seminary Library

Princeton, NJ

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Lighting | Electrical

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09/17/2012

AGI calculation files location: Y:\sld5202

Executive Summary

The Princeton Theological Seminary Library creates a unique experience that combines creative architectural elements with sustainable practices for a memorable and sustainable building. In redesigning the Princeton Theological Seminary Library, a theme of verticality and sparkle, translated as reaching for the heavens, will be present in each of the redesigned spaces. This is meant to represent the studying and research performed by the occupants of the space that are trying to be closer to god and better understand the Christian faith. The following report summarizes the existing conditions, design criteria, and evaluates the existing conditions for the following spaces:

Large Work Space | Reference Reading Room

Special Purpose Space | Café

Circulation Space | Atrium

Building Façade | South Façade and Grounds

The design criteria was evaluated based on information from the Illuminanting Engineering Society Lighting Handbook 10th Edition, ASHRAE Standard 90.1 2010 and LEED Major Renovations Version 2.2. The design criteria were then evaluated through calculations in AGI 32 and the detailed study of the plans, sections and elevations. The results of which will be incorporated into the redesign of each space.

Based on the evaluation performed, all four of the spaces being studied accurately address the most important design criteria for that individual space with a few exceptions. Illuminance values in the Reference Reading Room are lower than the recommendation from the IES Handbook but are supplemented by the addition of task lights. The reoccurring issue throughout all the spaces is the lack of attention paid to the contribution of daylight and how this can create problems or be used to save energy. Lower window transmittance values on certain facades combined with different shade conditions will be studied in the redesign process to find the ideal combination that will maximize the space performance.

Overall, the existing lighting designs of the four spaces to be redesigned create an atmosphere that focuses less on the decorative aspects of the spaces and more on the tasks being performed in those spaces. Unless otherwise noted, all floor plans, elevations and renderings in this report are courtesy of EwingCole.

Table of Contents

General Building Information

Building Name | Princeton Theological Seminary Library

Site | 64 Mercer St, Princeton, NJ

Building Occupant Name | Princeton Theological Seminary

Occupancy Type | Group A-3 Assembly

Size | 99,585 ft^2

Stories | 4 + 1 basement

Project Team

Owner | Princeton Theological Seminary

Construction Manager | Barr & Barr

Design Architects | EinhornYaffee Prescott

Architect of Record | EwingCole

Engineers | EwingCole

Landscape Architect | Andropogon Associates

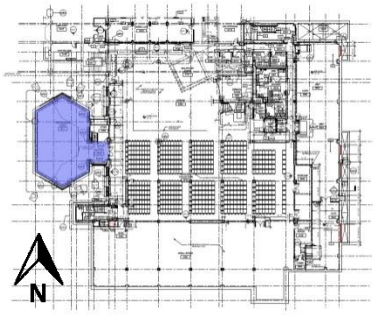
Civil Engineer | Van Note Harvey Associates

Reference Reading Room

The Reference Reading Room is an open and welcoming area for reading that is unlike any other space in the library. Set apart from the rest of the building, the room has an elongated hexagonal shape with windows on the north, south and western walls making daylight a very large portion of the lighting in the space.

Existing Conditions

The Reference Reading Room is located on the south-west side of the building broken up onto two floors. The lower level includes 10 desks seating 4 people each, as well as two areas for lounge seating. The book shelves are located along the perimeter on all four sides recessed into the walls and in the center of the room in stacks 3 ft in height. The balcony on the first floor contains bookshelves recessed into the walls and along the glass railing as well as a few desks and lounge areas with seating.



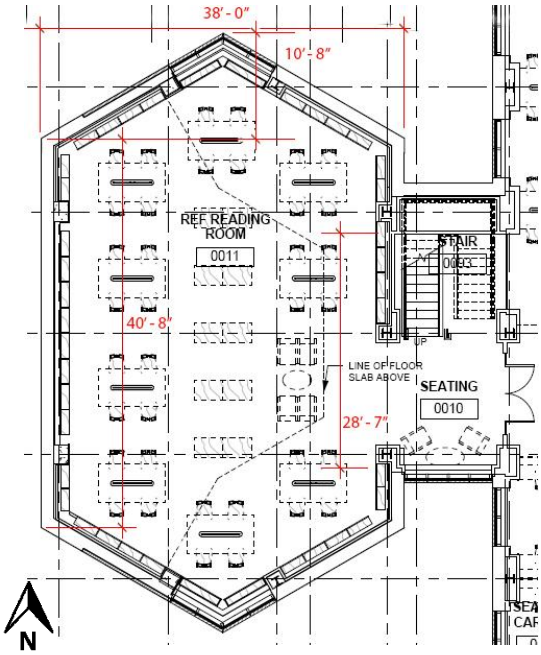


Figure 1 | Reference Reading Room - Lower Level Plan

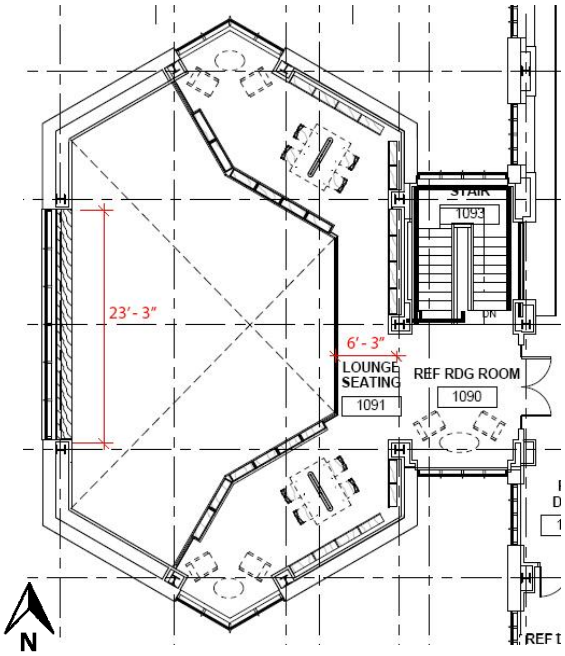


Figure 2 | Reference Reading Room - First Floor Plan

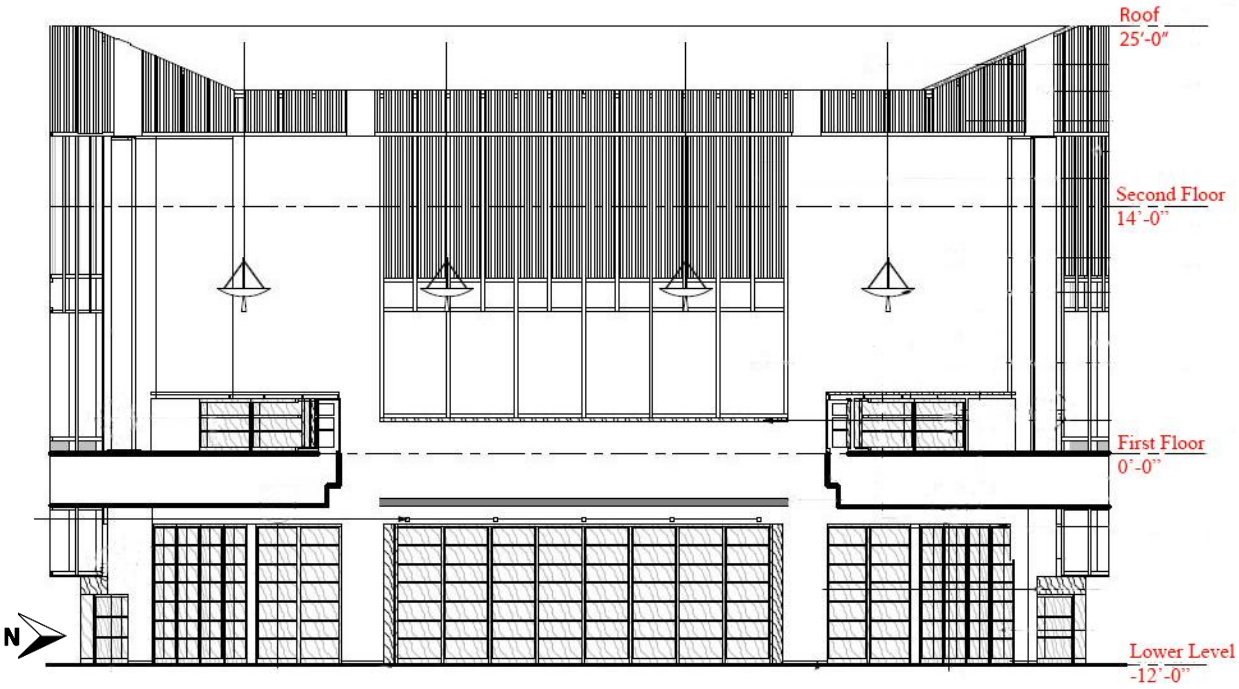


Figure 3 | Reference Reading Room - West Elevation

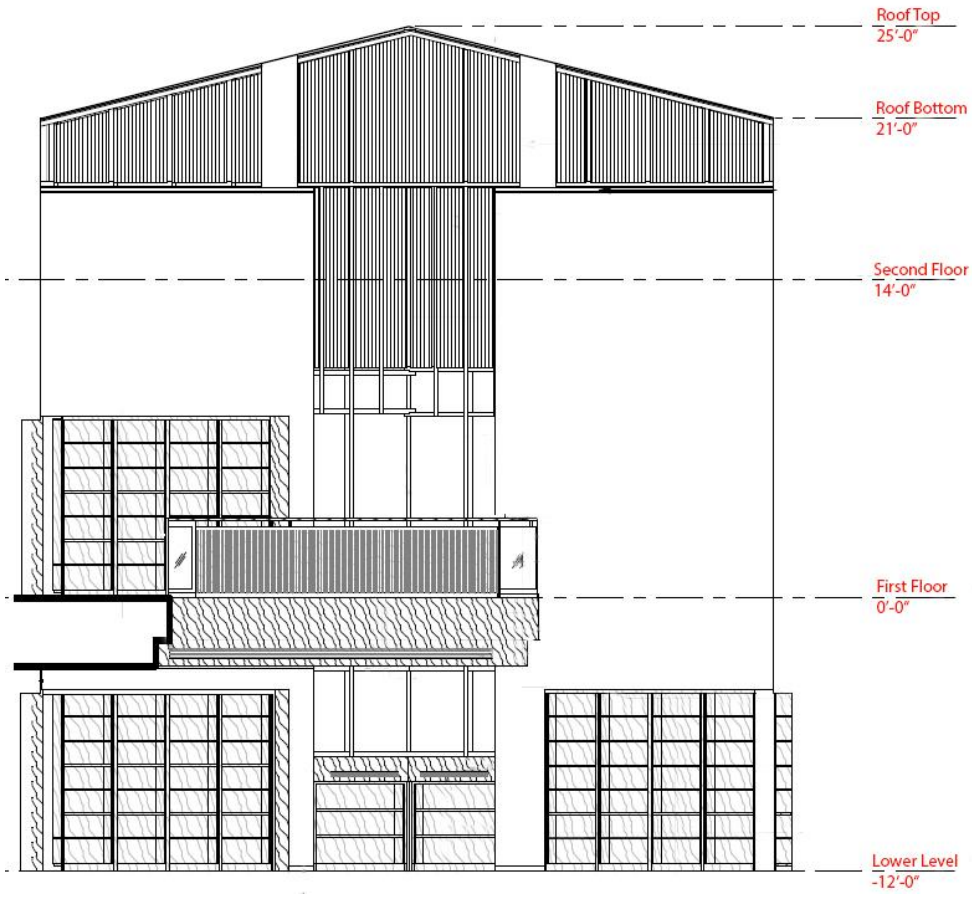


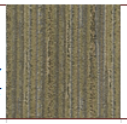
Figure 4 | Reference Reading Room - South Elevation

Figure 5 | Reference Reading Room Rendering - West

Figure 6 | Reference Reading Room Rendering - South

Finishes

The charts below describe the finishes and window types included in the Reference Reading Room. The white walls and ceiling will make the space feel bright and spacious while the glass types chosen will regulate the amount of sun in the room by varying transmittances based on the height location of the window. The lower transmittance windows are located higher in the space as shown in the elevation.

Floor			Wall		Ceiling	
Finish		Reflectance	Finish	Reflectance	Finish	Reflectance
Bentley Prince Street – Really late Night TV #400290 Under the Covers		assume 20%	Benjamin Moore – Color Preview #OC-122 Cotton Balls	assume 80%	Benjamin Moore – Color Preview #OC-122 Cotton Balls	assume 80%

Windows			
Type	Glass Type	Transmittance	Manufacurer
W33	IG-1, Insulating glass	58%	Cardinal Glass Industries, LOE3- 366
	IG-2, insulating glass with frit	assume 29%	Cardinal Glass Industries, LOE3- 366

Tasks

The two purposes of the Reference Reading Room are finding books on the book shelves and reading them at the tables. Personal computers can also be used at the tables where veiling reflection criteria must be considered. There are circulation paths between the book shelves and tables as well as a set of stairs located on the east side of the room that connects the lower level to the first floor.

Existing Lighting and Controls

The lighting design for this room consists of a combination of task and area lights. Task lights are mounted to the walls above the book shelves and on the surface of each desk. Both include arms holding the fixture out from the surface so the light reaches the desired location on the books and the desk surfaces. The area lighting consists of downlights below the balcony and in the transition space between the main building on the lower level and first floor. There are also wall sconces located next to the north and south facing windows, meant to light up the façade from inside at night. The control devices, including the BMJ Lutron system and photosensors, are used as energy saving techniques that measure the amount of daylight in the space and dim the fixtures accordingly. There is also a Grafik Eye located on the lower level to change the scenes based on the occupancy in the space.

Lighting										
	Type	Description	Manufacturer	Lamp			Ballast		Voltage	Mounting
				No.	Type	Watts	No.	Type		
	DPAH	Existing decorative pendant	Existing	8	CF26DD/E/IN/835	26	1	Lutron Electronic Dimming Ballast	277	Pendant
				1	50AR111/SP8	50			120	
	DWA	Decorative wall sconce	Louis Poulsen	1	CF42DT/E/IN/835	42	1	Lutron Electronic Dimming Ballast	277	Wall Mount
	LTA	Table mounted task lamp	Vode Lighting		LED					Table Mount
	LWA	Wall mounted fixture above bookshelves	Vode Lighting	1	FP28/835/ECO/3500K	28	1	Electronic	277	Wall Mount
	RA	Recessed downlight	Gotham	1	CF26DD/E/IN/835	26	1	Electronic	277	Recessed
	RN	Recessed downlight	Omega Lighting		LED					Recessed

Control Devices		
Device	Manufacturer	Function
BMJ	Lutron	Dimming DPAH fixtures
Quantum Sensor Module	Lutron	
Grafik eye	Lutron	Zone Controller - Lower Level
Photocell		

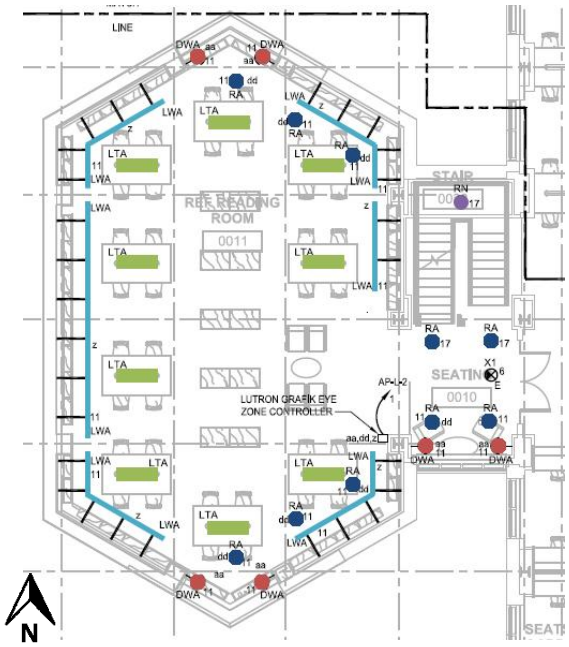


Figure 7 | Reference Reading Room - Lower Level Lighting Plan

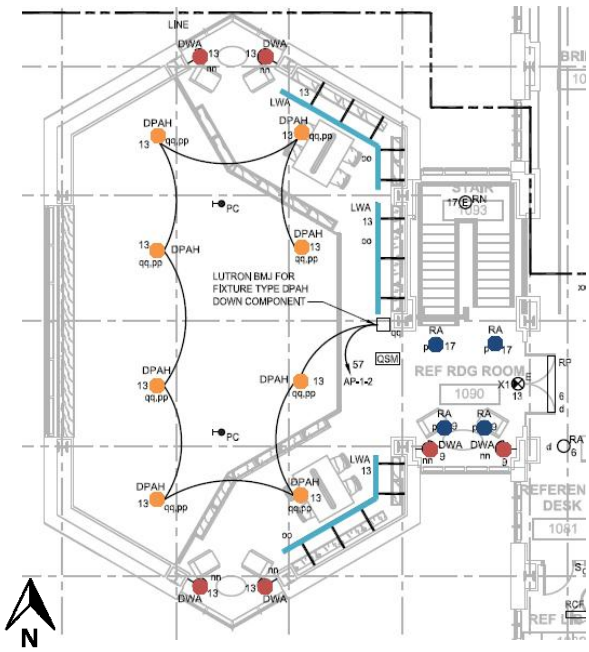


Figure 8 | Reference Reading Room - First Floor Lighting

Design Criteria and Considerations

The following design criteria are listed by importance based on information collected from the Illuminating Engineering Society Lighting Handbook 10th Edition, ASHRAE Standard 90.1 2010 and LEED Major Renovations Version 2.2.

Illuminating Engineering Society Lighting Handbook 10th Edition

Very Important:

Illuminance

As this is primarily a room used for reading, visual clarity on the table surfaces and the vertical surface of the bookshelves are the most important tasks in this room.

Illuminance Recommendations		
Task	Illuminance (lux)	
	Horizontal	Vertical
Book Stacks		
-at Floor	200	
-1' 0" AFF		100
-2' 6" AFF	300	200
Reading Areas		
-Tables and Chairs Eh @2'" AFF; Ev @4'0" AFF	500	200

Aesthetic Criteria

Aside from the atrium, the Reference Reading Room is one of the most memorable areas of the building and should be remembered as such. With the unique shape and multi-leveled characteristics it contains, it should be aesthetically pleasing and welcoming to visitors.

Daylight Integration and Controls

The majority of the reading areas consist of tables that seat 4 people. Task lights are going to be important at these locations because the number of people sitting at each desk will largely determine the amount of light needed on the surface and in what location on the surface. Also, during the daytime hours, controlling the amount of daylight in the space is going to be important to the comfort of the occupants. A dimming system should also be used to save energy when there is ample amount of sun in the space.

Important:

Glare

Given the large window area on the west façade, glare could be a potential problem at the desk areas on personal computer screens but because of the orientation of the desks this problem becomes less apparent.

Uniformity

Uniformity is important across the surface of the individual book stacks and tables for visual clarity purposes. This will also avoid changes in light levels to be a distraction for the people studying.

Somewhat Important:

Maintenance

If pendants are chosen to hang in the center of the room, changing the lamps could be an issue. To avoid this problem, lamps with a long life should be chosen to minimize relamping.

Psychological Aspects

Creating a psychological impression in this room would not be possible during the day due to the amount of sunlight in the room. Although, in the evening hours a natural feeling of privacy should occur with the use of individual task lights at the desks and lower over ambient light.

ASHRAE Standard 90.1 2010

Power Allowances for the Reference Reading Room	
Space Type	**LPD, W/ft2**
Library	
-Stacks	1.71

LEED Major Renovations Version 2.2

EQ Credit 6.1: Controllability of Systems: Lighting (1 point)

-Provide individual lighting controls for 90% of the building occupants.

-Provide lighting system controllability for all shared multi-occupant spaces to enable lighting adjustment that meets group needs and preferences.

EQ Credit 8.2: Daylight and Views: Views for 90% of Spaces (1 point)

-Provide a connection between indoor spaces and outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Evaluation of Existing Conditions

An illuminance calculation was performed in AGI 32 without daylight to evaluate the room based on the design criteria above. To calculate the illuminance values in the room, the existing pendant DPAH ies file could not be found and was instead modeled as a Delray Lighting fixture that contained 1 26W CFL lamp. The ies file was altered to change the amount of wattage so that it would perform like the existing fixture that contains 8 26W CFLs.

Light Loss Factors

Light Loss Factors (DPAH)	
LDD	0.94
-Clean Environment	
-Open/Unventilated	
-Direct	
-12 month cleaning cycle	
LLD	0.86
-Initial Lumens	1710
-Mean Lumens	1470
BF	1
Total LLF:	0.81

Light Loss Factors (DWA)	
LDD	0.94
-Clean Environment	
-Open/Unventilated	
-Direct	
-12 month cleaning cycle	
LLD	0.86
-Initial Lumens	3104
-Mean Lumens	2670
BF	1
Total LLF:	0.81

Light Loss Factors (LTA)	
Total LLF:	0.7

Light Loss Factors (LWA)	
LDD	0.94
-Clean Environment	
-Open/Unventilated	
-Direct	
-12 month cleaning cycle	
LLD	0.93
-Initial Lumens	2600
-Mean Lumens	2418
BF	1
Total LLF:	0.87

Light Loss Factors (RA)	
LDD	0.94
-Clean Environment	
-Open/Unventilated	
-Direct	
-12 month cleaning cycle	
LLD	0.86
-Initial Lumens	1710
-Mean Lumens	1470
BF	1
Total LLF:	0.81

Light Loss Factors (RN)	
Total LLF:	0.7

Results

Calculations were performed at a workplane height of 2'-6" for the horizontal illuminances and at the face of the book shelves for the vertical illuminances.

Reference Reading Room			
	Avg Illuminance	Uniformity	
		Max:Avg	Avg:Min
Lower Level			
-Workplane	233 lux	1.7:1	2.7:1
-Center Stacks	97 lux	1.2:1	1.2:1
-Recessed Wall Stacks	187 lux	2:1	1.6:1
First Floor			
-Workplane	388	1.6:1	2:1
-Center Stacks	80	1.5:1	1.4:1
-Recessed Wall Stacks	169	2:1	1.4:1

Actual Power Density = 1.1 W/ft^2

When comparing the calculations from AGI 32 with the recommendations, all of the task illuminances are below the suggested values. The illuminance criteria at the horizontal table plane, with the addition of task lights, will meet the criteria but the vertical illuminance at the book stacks is still too low. The actual uniformity requirements meet the recommendations from the IES Handbook except for the workplane on the lower level which could be explained by the calculation plane for the results above covering the entirety of the lower level and not just the area over the table surfaces.

The orientation of the desks is appropriate to avoid direct glare but the addition of shades is necessary in this room based on the façade orientations and window locations. How much of a problem the sun will be can only be determined by further evaluation which will take place later in the year for this project. Concerning the maintenance issue of changing the pendants in the center of the room, extensions were built into the system so the maintenance crew could lower the light and pull it toward them to change while standing on the first floor balcony. By using the existing DPAH pendants from the demolished Speer Building, an aesthetic connection between the addition and the existing Luce building is created.

The overall design of the Reference Reading Room is sufficient to the tasks being performed in the space and made possible in a very practical and energy efficient way.

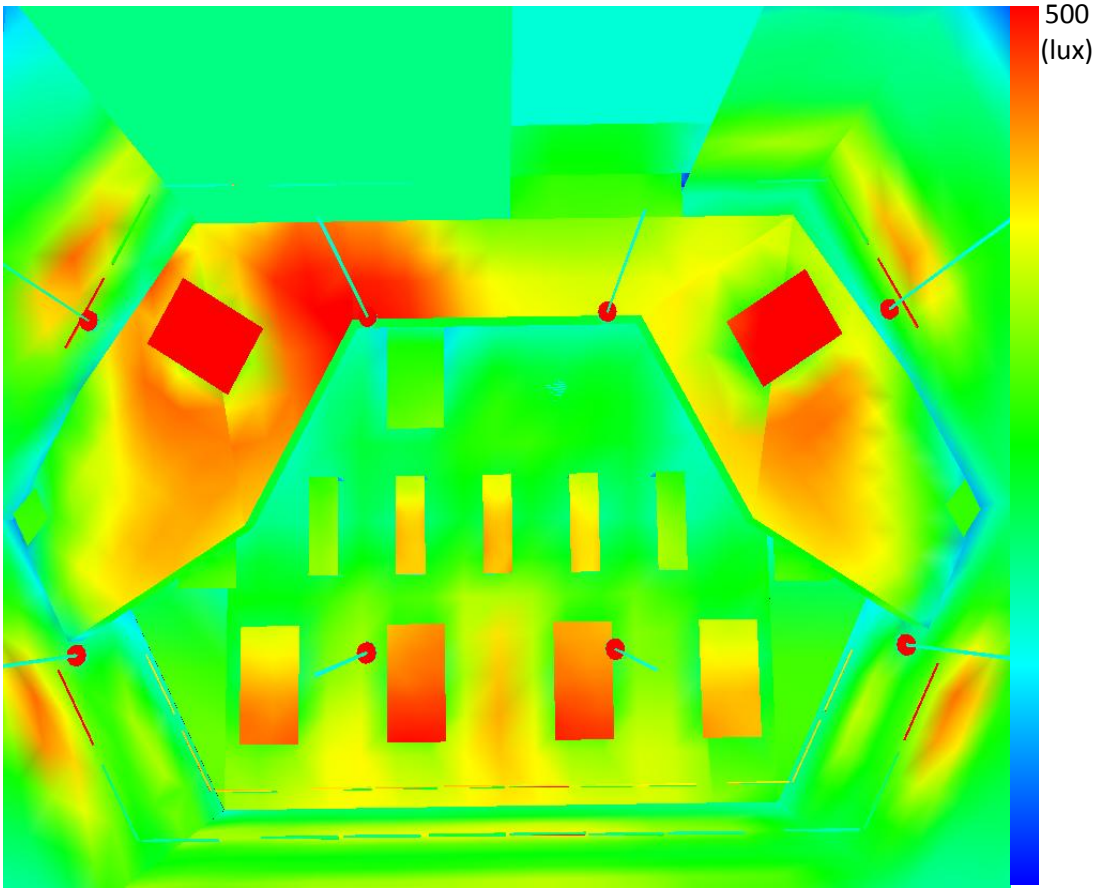


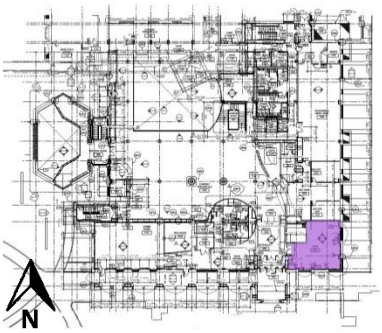
Figure 9 | Reference Reading Room - AGI Calculation

Café

The café is meant to be a room of leisure, set apart from the bright reading areas throughout the rest of the library. Located to the right of the main entrance, it is a convenient location for socializing and study breaks.

Existing Conditions

The café is located in the south-east corner of the building on the first floor next to the main entrance. The room consists on a general area with 7 sets of tables and chairs, a counter with two chairs and a kitchen located in the upper left corner of the room.



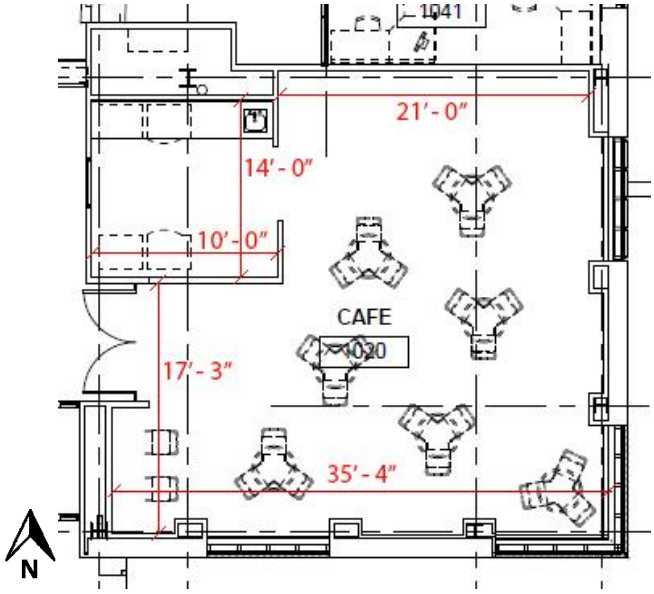


Figure 10 | Café – Floor Plan

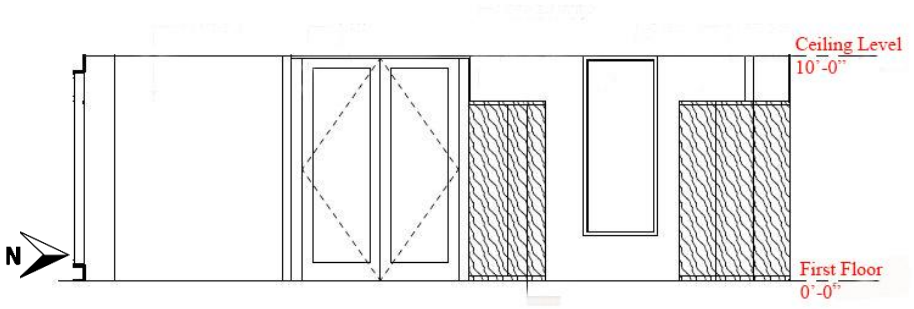
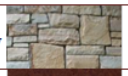
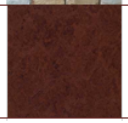


Figure 11 | Cafe – West Elevation

Figure 12 | Cafe Rendering

Finishes

The charts below describe the finishes and window types included in the Café. The two flooring materials define the room by creating an area for the entrance, with the stone flooring, and an area for the tables, with carpet. In contrast to the dark colors of the floor, the walls and ceiling are the typical white color that is used throughout the building. The window types chosen for the room also have very distinct purposes. The exterior windows are insulated glass for maximum daylight and the interior window in the kitchen is insulated glass with frit to create a connection to the lobby but maintain privacy.

Floor			Wall		Ceiling	
Finish		Reflectance	Finish	Reflectance	Finish	Reflectance
Champlain Stone – South Bay Quartzite		assume 20%	Benjamin Moore – Color Preview #OC-122 Cotton Balls	assume 80%	Benjamin Moore – Color Preview #OC-122 Cotton Balls	assume 80%
Forbo Lineoleum Flooring – Real #2784 Coffee		assume 20%	Benjamin Moore – Color Preview #OC-122 Cotton Balls	assume 80%	Benjamin Moore – Color Preview #OC-122 Cotton Balls	assume 80%

Windows			
Type	Glass Type	Transmittance	Manufacurer
W26	IG-1, insulating glass	58%	Cardinal Glass Industries, LOE3- 366
W2	IG-2, insulating glass with frit	assume 29%	Cardinal Glass Industries, LOE3- 366

Existing Lighting and Controls

There is only one luminaire type in the café, a semi-recessed downlight organized into groups of four across the ceiling. The three groupings in the café are located closely to the three sets of windows in the room for daylight control purposes.

Lighting										
	Type	Description	Manufacturer	Lamp			Ballast			Voltage	Mounting
				No.	Type	Watts	No.	Type			
	RSH	Semi-recessed downlight	Delray	1	CF42DT/E/IN/835	42	1	Lutron Electronic Dimming Ballast		120	Recessed

Control Devices		
Device	Manufacturer	Function
Occupancy Sensor	Hubbell Lighting	
Quantum Sensor Module	Lutron	
Photocell		

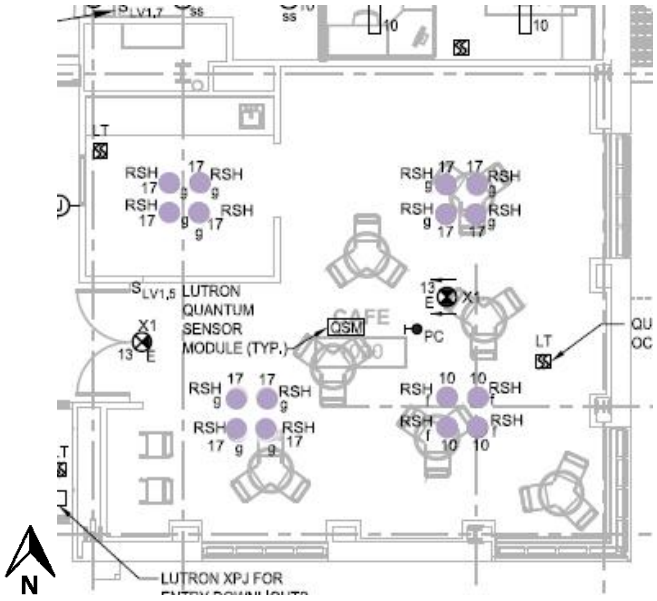


Figure 13 | Café - Lighting Plan

Design Criteria and Considerations

The following design criteria are listed by importance based on information collected from the Illuminating Engineering Society Lighting Handbook 10th Edition, ASHRAE Standard 90.1 2010 and LEED Major Renovations Version 2.2.

Very Important:

Psychological Aspects

To set the café apart from the rest of the building, light can be used to draw the guests in to relax during their study break. Although a difficult task during the day due to the changing sun patterns, the hours of the library make it possible that this task can be accomplished at night.

Daylight Integration and Controls

Due to the multiple façade orientations of the windows in the cafe, controlling the daylight coming into the space with either shades is very important. A dimming system should be implemented to save energy when there is enough daylight in the space. Photocells should be used to dim luminaires based on what window/façade orientation they are located near.

Important:

Aesthetic Criteria

To reinforce the psychological impression of relaxation, the room should be comfortable and inviting.

Glare

The recommendation for personal internet browsing in the café states that veiling reflections should be of medium concern to the lighting design. Glare must also be avoided on the television mounted on the northern wall of the café.

Illuminance

Illuminance Recommendations		
Task	Illuminance (lux)	
	Horizontal	Vertical
Café		
-General Eh@floor; Ev@5' AFF	100	50
-Personal Internet Browsing Eh @2'6" AFF; Ev @4'0" AFF	150	50
Kitchen		
-Food Preparation Eh and Ev at counter surface	500	200

Somewhat Important:

Luminance Ratio

Illuminance Recommendations	
Task	Luminance Ratio
Café	
-General Eh@floor; Ev@5' AFF	3:1
-Personal Internet Browsing Eh @2'6" AFF; Ev @4'0" AFF	2:1
Kitchen	
-Food Preparation Eh and Ev at counter surface	1.5:1

ASHRAE Standard 90.1 2010

Power Allowances for the Café	
Space Type	LPD, W/ft2
Dining Area	
-For Bar Lounge/Leisure Dining	1.31

Control Factors for Additional Power Allowance	
Control Method	Allowance W/ft2
Multi-level dimming control using programmable time scheduling	0.1
Automatic bi-level or multi-level switching in primary sidelighted areas when sidelighting effective aperture is greater than 0.15 and when primary sidelighted area is less than 250 ft2	0.1
Automatic contrinuous daylight dimming in primary sidelighted areas when sidelighting effective aperture is greater than 0.15 and when primary sidelighted area is less than 250 ft2	0.2

LEED Major Renovations Version 2.2

EQ Credit 8.2: Daylight and Views: Views for 90% of Spaces (1 point)

-Provide a connection between indoor spaces and outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

The Psychology of Lighting – Article 5: Attitude Reinforcement through Lighting Design

A feeling of relaxation can be created by combining low-intensity downlights with wall washers on two opposite walls.

Subjective Lighting: Power for Perception

By encouraging peripheral emphasis, keeping the luminance levels low and avoiding uniformity, the impression of relaxation can be created.

Evaluation of Existing Conditions

An illuminance calculation was performed in AGI 32 without daylight to evaluate the room based on the design criteria above.

Light Loss Factors

Light Loss Factors (RSH)	
LDD	0.94
-Clean Environment	
-Open/Unventilated	
-Direct	
-12 month cleaning cycle	
LLD	0.86
-Initial Lumens	3104
-Mean Lumens	2670
BF	1
Total LLF:	0.81

Results

Based on the illuminance recommendations above, calculations were performed at the horizontal plane of the floor and workplane level, as well as vertically at 5'-0" for face recognition. For the kitchen, calculations were performed at the horizontal plane of the counter and vertically above the counter.

Café			
	Avg Illuminance	Uniformity	
		Max:Avg	Avg:Min
Café			
-@floor	218	1.3:1	2:1
-@2'-6"	238	1.5:1	2.3:1
-@5'-0"	158	1.9:1	1.6:1
Kitchen			
-@counter height of 3'-0"	319	1.3:1	1.3:1
-vertical plane @ counter	279	1.2:1	1.2:1

Actual Power Density = 0.92 W/ft^2

When comparing the illuminance criteria to the performance of the café, the illuminance levels are a lot higher than they need to be. In contrast, the actual kitchen illuminance is too low on the horizontal surface of the counter.

The luminaires are placed strategically in the room to locate the groupings each near a different window so they can be dimmed based on the daylight coming through that specific window. There is a photosensor in the middle of the room that will perform this task. With the uniformity in furniture layout and illuminance, referencing the Flynn Impressions, the room gives an impression of closure. A café would be more comfortable with peripheral emphasis that will make the guests feel relaxed. Glare is not a problem with this design based on the location of the tables relative to the windows and the television on the north wall in relation to the downlights.

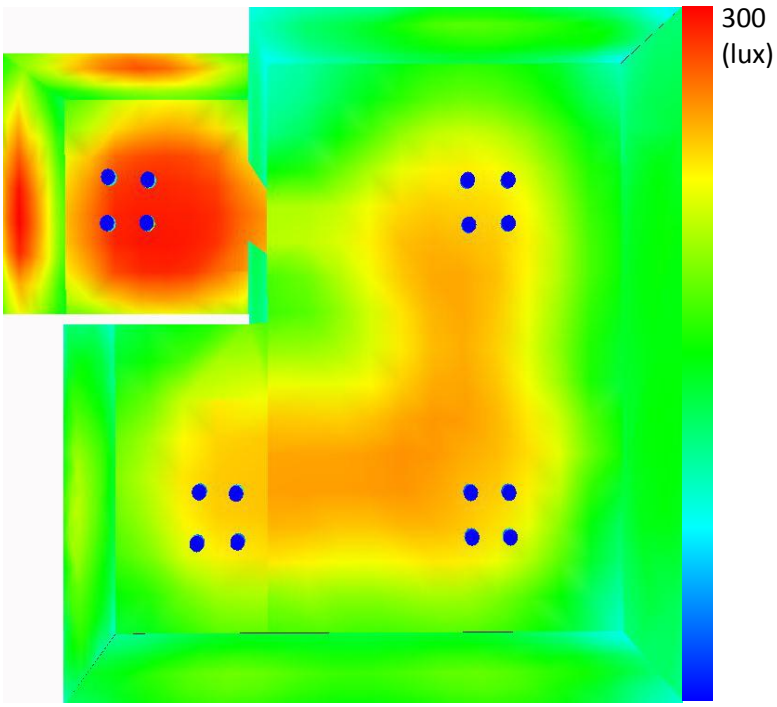


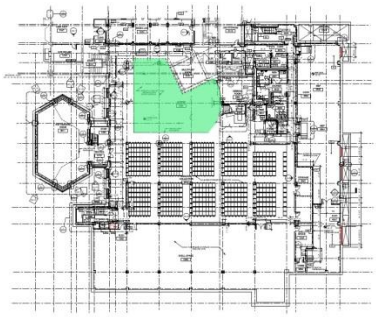
Figure 14 | Cafe - AGI Calculation

Atrium

The four story atrium in the Princeton Theological Seminary Library is the crowning center piece. Skylights and clerestory windows facing north make this a heavily day lit space that elongates the atrium and brightens the surrounding circulation spaces and stacks areas.

Existing Conditions

Located in the center of the building, the atrium extends 69 ft in height from the lower level to the roof. Through bridges on the first, second and third floors, the new addition is connected to the existing Luce Building. It also serves as a transition space between each of the floors in the addition through the use of a spiraling staircase on the east end of the atrium. The spaces around the atrium include the general collection, current periodicals, several multipurpose rooms and student workstations on the second and third floors.



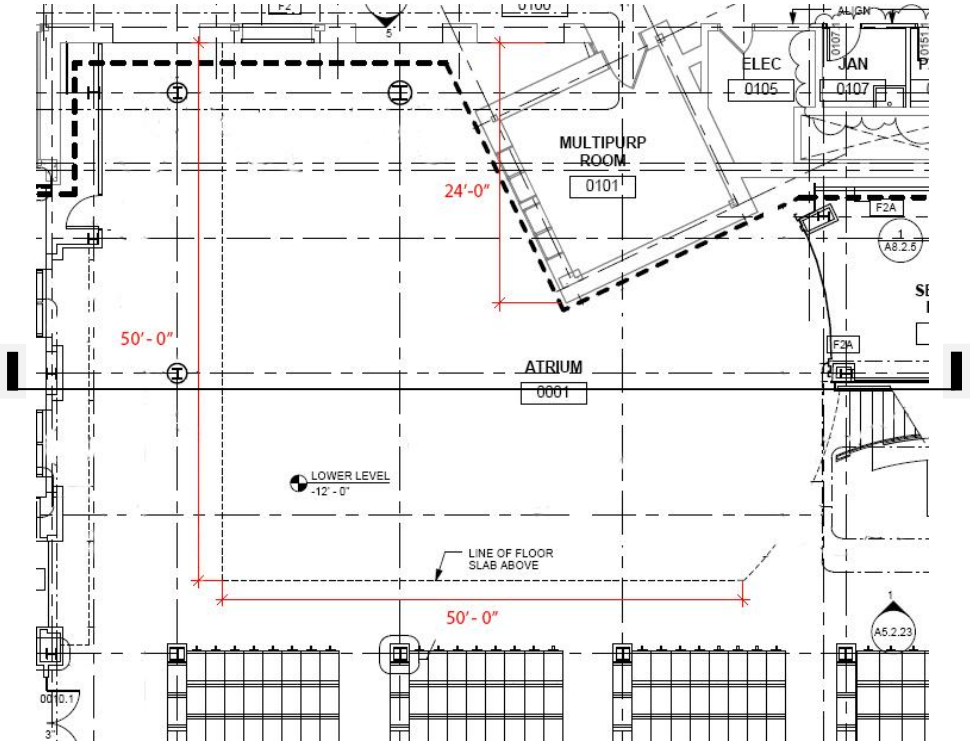


Figure 15 | Atrium - Lower Level

Figure 16 | Atrium - North Elevation

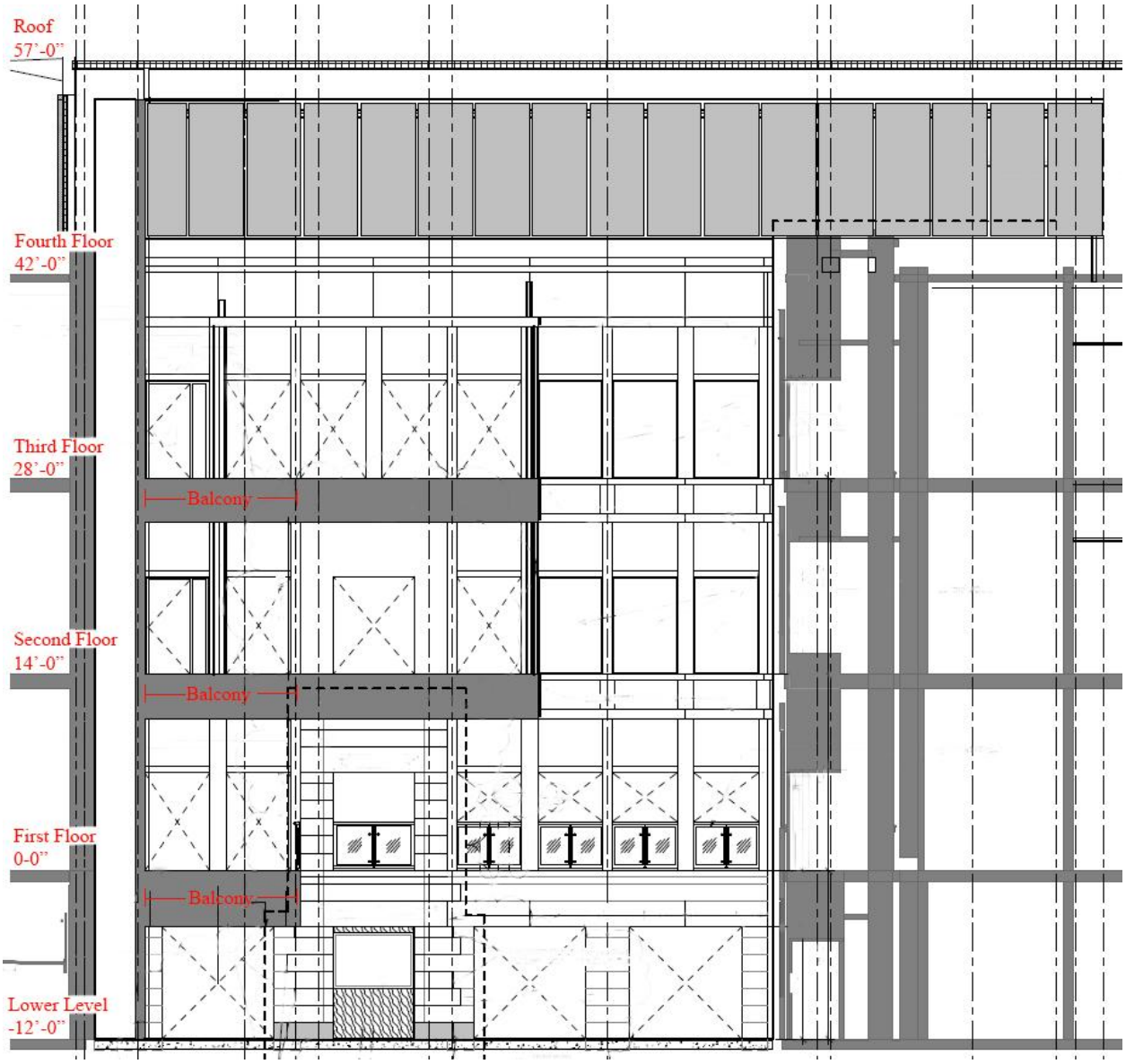


Figure 16 | Atrium – North Elevation

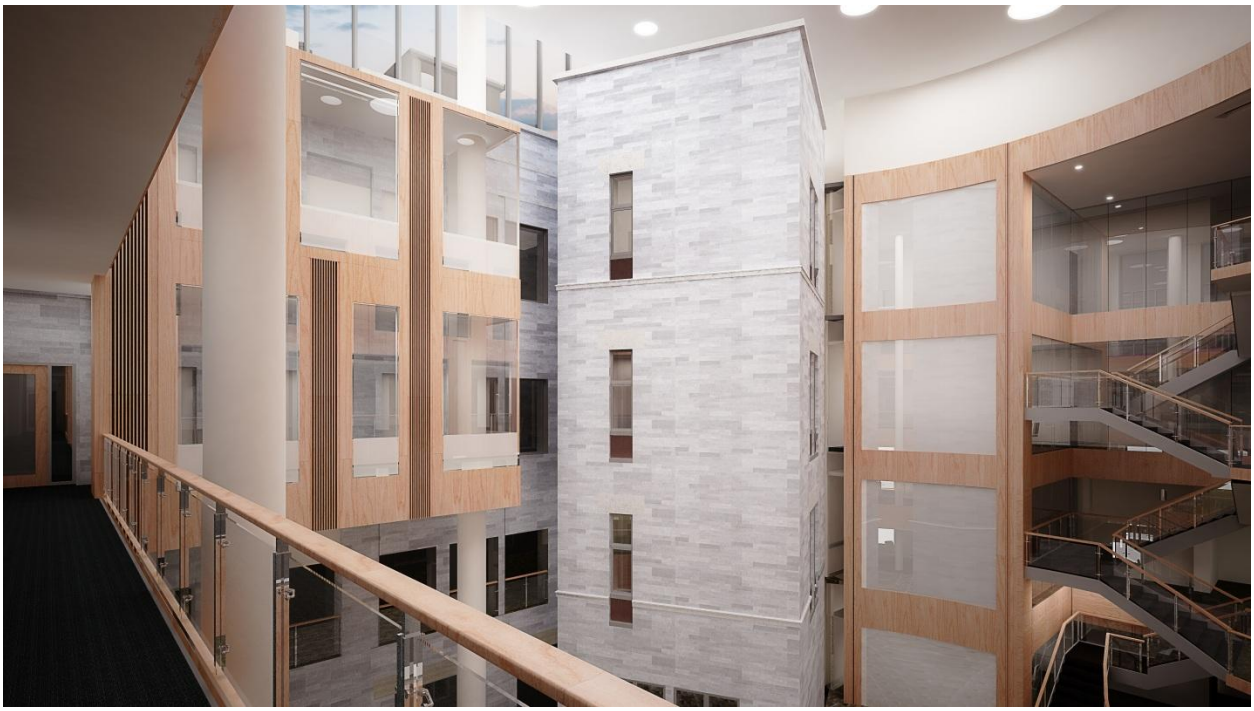
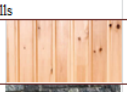


Figure 17 | Atrium Rendering - Northeast

Figure 18 | Atrium Rendering - Southeast

Finishes

The charts below describe the finishes and window types present in the Atrium. A balance of texture and color is used in the atrium, making this space unique in comparison to the finishes in the rest of the building. The combination of skylights and clerestory windows help to bring daylight into the atrium and the surrounding areas.

Floor			Wall			Ceiling		
Finish		Reflectance	Finish		Reflectance	Finish		Reflectance
Champlain Stone – South Bay Quartzite		assume 20%	Benjamin Moore – Color Preview #OC-122 Cotton Balls		assume 80%	Sherwin Williams - Essentials - SW 6217 Topsail		assume 70%
			Wood Paneling		assume 60%			
			Champlain Stone – Corinthian		assume 15%			

Windows			
Type	Glass Type	Transmittance	Manufacurer
Skylight Type 2	750 DS-C, Ray Bender 3000 optic prism	assume 25%	Solatube
W24	IG-2, insulating glass with frit	assume 29%	Cardinal Glass Industries, LOE3- 366

Existing Lighting and Controls

The spaces around the atrium also have this minimalist approach with mostly recessed downlights and simple task fixtures at the desks. Dimming ballasts were only used on two of the elevent fixture types around the atrium. The RAH type fixtures will dim based on the photosensor signal located on the southern area of the atrium while the DPEH type fixtures care controlled by the photosensor on the western side of the atrium.

Lighting										
	Type	Description	Manufacturer	Lamp			Ballast		Voltage	Mounting
				No.	Type	Watts	No.	Type		
	DPEH	Decorative cluster of 3 pendants	custom Metalcraft	12	FO32/835	32	1	Lutron Electronic Dimming Ballast	277	Pendant
	LWB	Up/downlight wall mounted fixture	custom Prolume		LED					Wall Mount
	RA	Recessed downlight	Gotham	1	CF26DD/E/IN/835	26	1	Electronic	277	Recessed
	RAH	Recessed downlight	Gotham	1	CF26DD/E/IN/835	26	1	Lutron Electronic Dimming Ballast	277	Recessed
	RB	Recessed downlight	Ledalite	1	CF26DD/E/IN/835	26	1	Electronic	120	Recessed
	RLH	Recessed downlight	Selux	1	F28T5	28	1	Electronic	277	Recessed
	RN	Recessed downlight	Omega Lighting		LED					Recessed
	RNH	Recessed downlight	Omega Lighting	1	LED					Recessed
	RP	Recessed Perimeter Wall Slot	Litecontrol	1	F32T8	32	1	Electronic	277	Recessed
	RQ	Recessed continuous channel	RSA Lighting	2	CMH	70	1		277	Recessed
				2	AR111	50	1		120	
	RR	Recessed adjustable fixture	RSA Lighting	2	CMH	70	1		277	Recessed
				2	AR111	50	1		120	

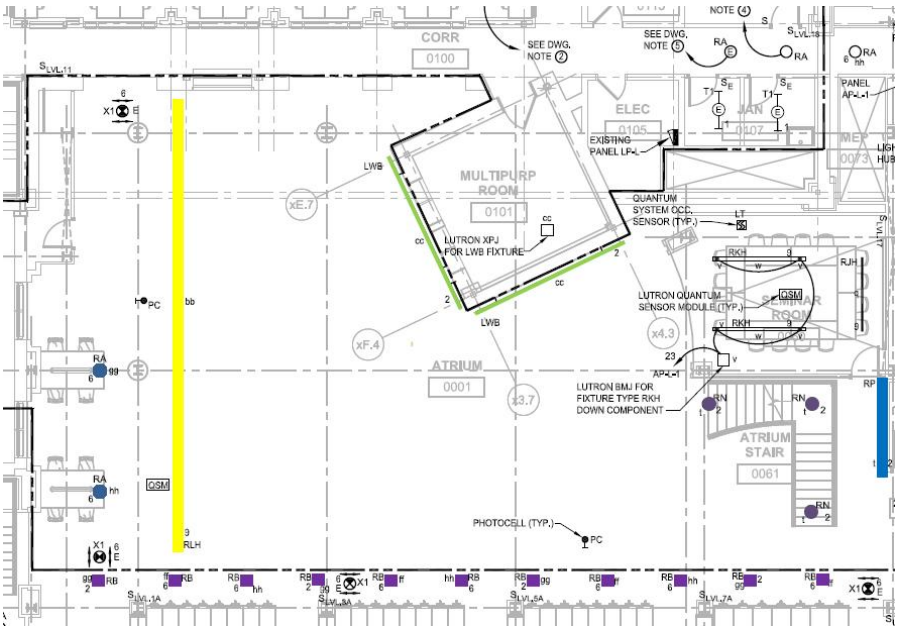


Figure 19 | Atrium - Lower Level Lighting Plan

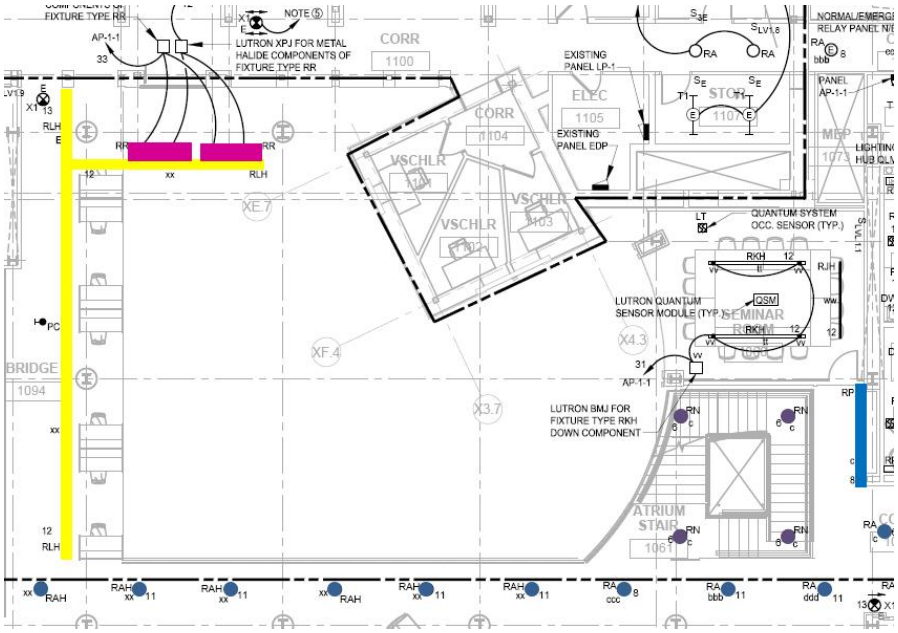


Figure 20 | Atrium - First Floor Lighting Plan

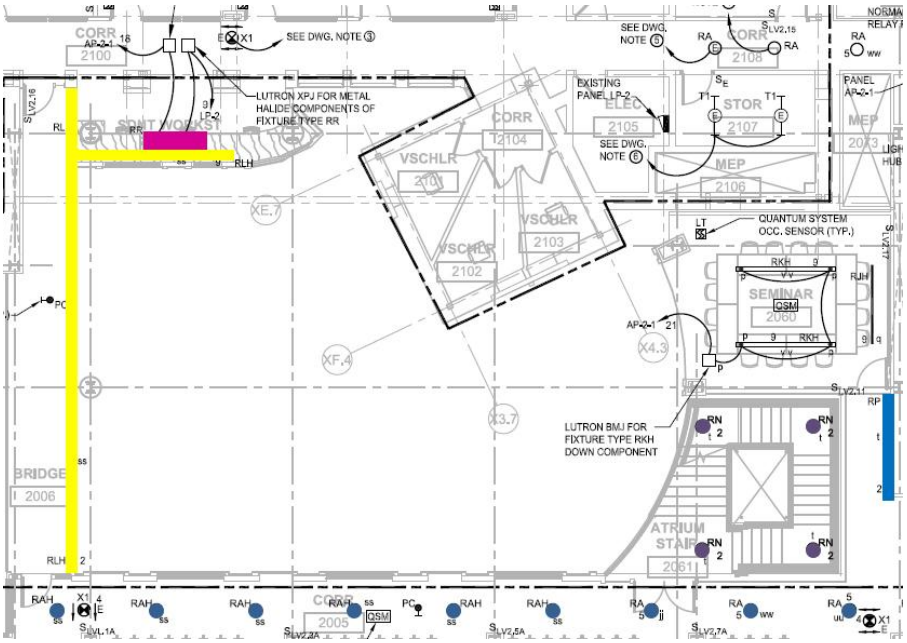


Figure 21 | Atrium - Second Floor Lighting Plan

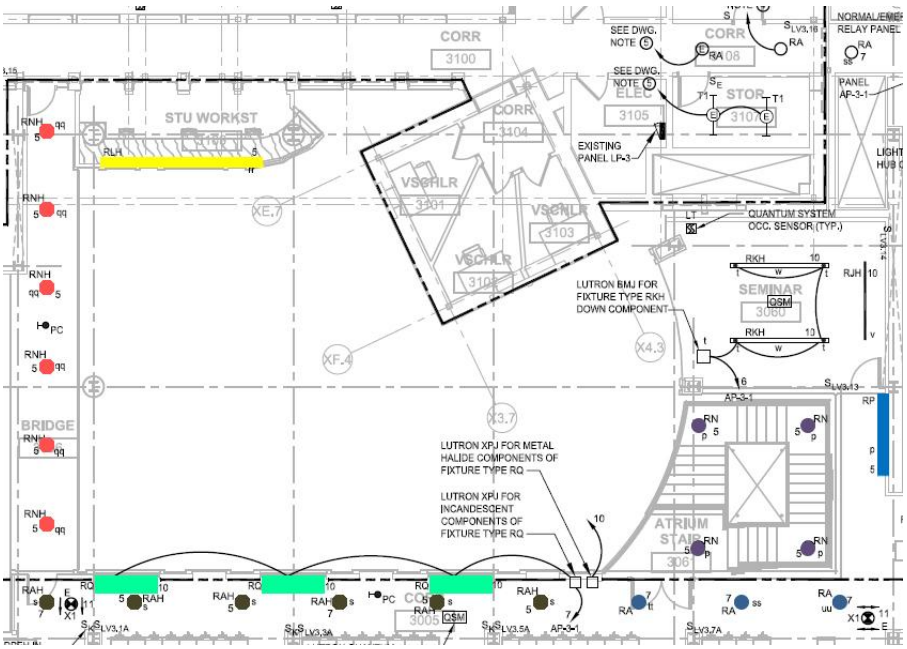


Figure 22 | Atrium - Third Floor Lighting Plan

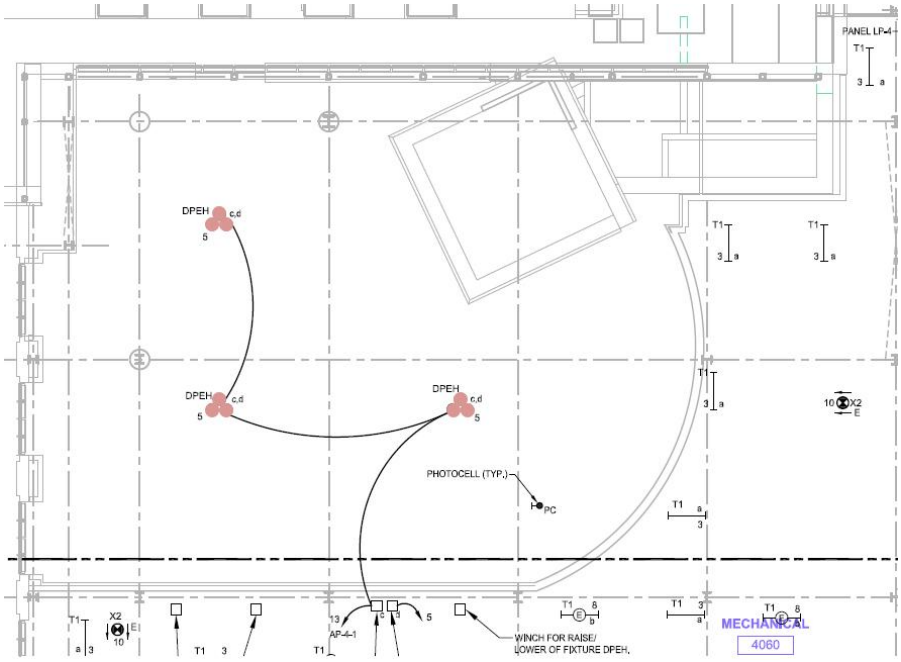


Figure 23 | Atrium - Fourth Floor Lighting Plan

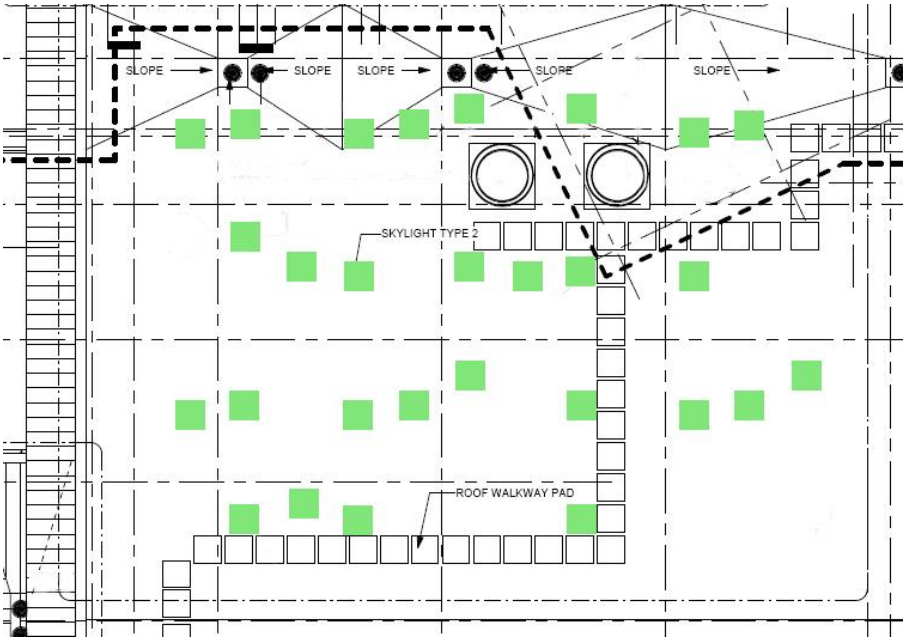


Figure 24 | Atrium - Skylight Plan

Design Criteria and Considerations

The following design criteria are listed by importance based on information collected from the Illuminating Engineering Society Lighting Handbook 10th Edition, ASHRAE Standard 90.1 2010 and LEED Major Renovations Version 2.2.

Illuminating Engineering Society Lighting Handbook 10th Edition

Very Important:

Aesthetic Criteria

The atrium can be seen from the majority of the library addition on all floors. This grand space should be memorable and use light to help with circulation.

Illuminance

The reading areas should use supplemental task lighting on top of the ambient lighting to reach the light levels shown below.

Illuminance Recommendations		
Task	Illuminance (lux)	
	Horizontal	Vertical
Reading Areas		
-Tables and Chairs Eh @2'" AFF; Ev @4'0" AFF	500	200
Circulation Cooridor		
-Public Adjacency Passageways Eh @floor; Ev @5'0" AFF	Avg >= 0.2x task Eh of adjacent space, min >= 10lux	Avg >= 0.2x task Ev of adjacent space
Stairs		
-Typical Eh @floor; Ev @5'0" AFF	50	30

Important:

Daylight Integration and Controls

The areas surrounding the atrium should be dimmed when there is sufficient daylight in the space. At the desks on the second and third floors, individual controls for task lights should be implemented to supply enough light for reading.

Uniformity

Illuminance Recommendations		
Task	Uniformity	
	Max:Avg	Avg:Min
Reading Areas		
-Tables and Chairs Eh @2'" AFF; Ev @4'0" AFF		2:1
Circulation Cooridor		
-Public Adjacency Passageways Eh @floor; Ev @5'0" AFF		3:1
Stairs		
-Typical Eh @floor; Ev @5'0" AFF		2:1

ASHRAE Standard 90.1 2010

Power Allowances for the Atrium	
Space Type	LPD, W/ft2
Atrium	
-First 40 ft in height	0.03 per ft (height)
-height above 40 ft	0.02 per ft (height)
Corridor/Transition	0.66
Library Stacks	1.71

Control Factors for Additional Power Allowance	
Control Method	Allowance W/ft2
Multi-level dimming control using programmable time scheduling	0.1
Automatic continuous daylight dimming in primary sidelighted areas when sidelighting effective aperture is greater than 0.15 and when primary sidelighted area is greater than 250 ft2	0.1
Automatic continuous daylight dimming in daylighted areas under skylights when the total of those areas is less than 900 ft2 and whe nskylight effective aperture is greater than 0.01	0.2

Evaluation of Existing Conditions

Though assumptions made on the performance and light output of the luminaire types in and around the atrium, an assessment can be made on how well it meets the design criteria for the space. The openness of the space to encourage energy savings was not utilized to the full extent possible because only two of the eleven fixture types around the atrium are dimmable. Concerning circulation, the patterns created by the fixtures in the pathway appear to be successful, leading people from one space to the next. The lighting design in the atrium overall uses a minimalist approach, letting the architecture of the space speak for itself.

South Façade and Grounds

The south façade has many different elements working together and creates a historical character for the building. By reaching up toward the heavens, the tower could be interpreted as providing the entranceway to knowledge and understanding of the Christian faith.

Existing Conditions

There are 7 bay windows that extend the length of the façade bringing light into such rooms as the special collection workroom and browsing areas, PhD student offices and the scholar commons room. The main entrance to the building is located below the tower that rises almost 80 ft in the air. To the west of the tower, there is an arcade that provides a covered pathway to the entrance from Library Place.

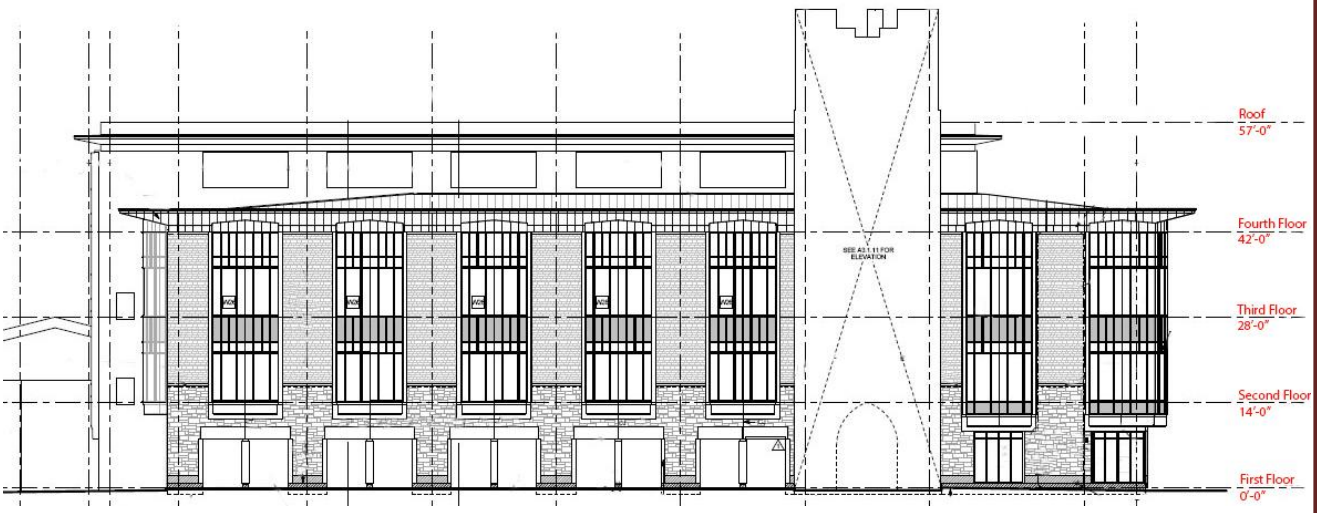


Figure 25 | South Facade

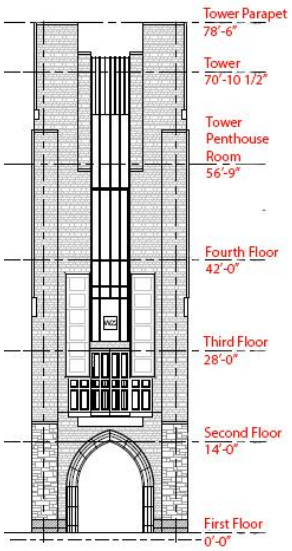


Figure 26 | South Facade Tower

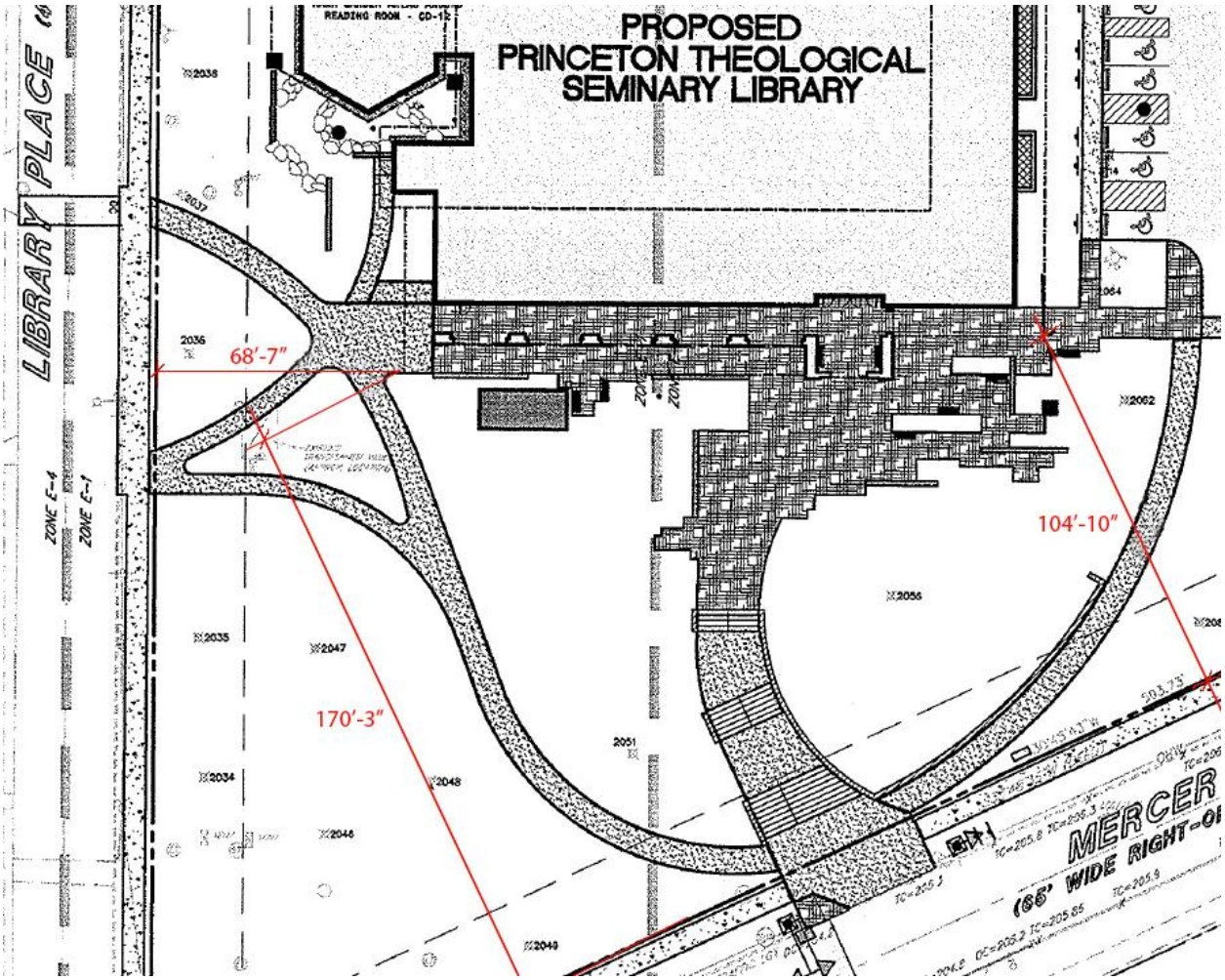


Figure 27 | South Facade Grounds

Figure 28 | South Facade Arcade Rendering

Figure 29 | South Facade Entrance Rendering

Figure 30 | South Facade Rendering

Finishes

The charts below describe the finishes and window types on the south façade. The stone type Corinthian is used on the first 16'-0" of the façade remaining 26'-0" is South Bay Quartzite. All of the two story bay windows contain three different glass types in the pattern shown below.

Wall		
Finish		**Reflectance**
Champlain Stone – South Bay Quartzite		assume 20%
Champlain Stone – Corinthian		assume 15%

Windows			
Type	**Glass Type**	**Transmittance**	**Manufacurer**
W26/W27	IG-1, Insulating glass	58%	Cardinal Glass Industries, LOE3- 366
	IG-1, Insulating, tempered glass	assume 50%	Cardinal Glass Industries, LOE3- 366
	IG-1, Shadow box behind glass	assume 29%	Cardinal Glass Industries, LOE3- 366

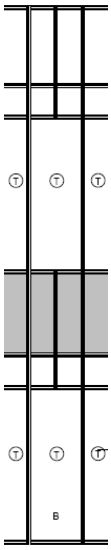


Figure 10 | South Facade Window

Existing Lighting and Controls

The arcade contains two luminaire types that are located on each of the exterior columns. Decorative sconces are mounted on the thicker columns between the bay windows and ceiling wash fixtures are mounted on the round, structural columns. The exterior area under the tower is brighter than arcade to draw people toward the entrance. Downlights, decorative wall sconces and wall washers create this effect. The second and third floors contain pendants on the interior that light the seating areas and create a pattern of light through the windows. A dimming system is used for the interior pendants based

on the daylight in that room. The luminaires outside are controlled by two switches and a time switch that turns all of the fixtures off when the building is closed.

Lighting

Type	Description	Manufacturer	Lamp			Ballast		Voltage	Mounting
			No.	Type	Watts	No.	Type		
DPBH	Decorative pendant (mounted interiorly)	Lightolier	1	CF26DD/E/IN/835	26	1	Electronic	277	Pendant
DWE	Wet location sconce	Hess Lighting	1	FT18DL/830/ECO	18	1	Electronic	277	Wall Mount
GWD	Semi-recessed wall mounted ceiling wash fixture	Windirect	1	CDM70/TC/830	70	1	Electronic	277	Wall Mount
HR	Linear strip fixture	Prolume		LED					Hand Rail Mounted
M4	Decorative pole	Sternberg	1	QU85W/4000k	85	1	Pulse Start	277	Pole Mounted
RA	Recessed downlight	Gotham	1	CF26DD/E/IN/835	26	1	Lutron Electronic Dimming Ballast	277	Recessed
RF	Recessed wall wash	Gotham	1	CF26DD/E/IN/835	26	1	Electronic	277	Recessed

Control Devices

Device	Manufacturer	Function
BMJ	Lutron	Dimming DPBH fixtures
XPJ	Lutron	Switches DWE and GWD fixtures
XPJ	Lutron	Switches RA and RF fixtures

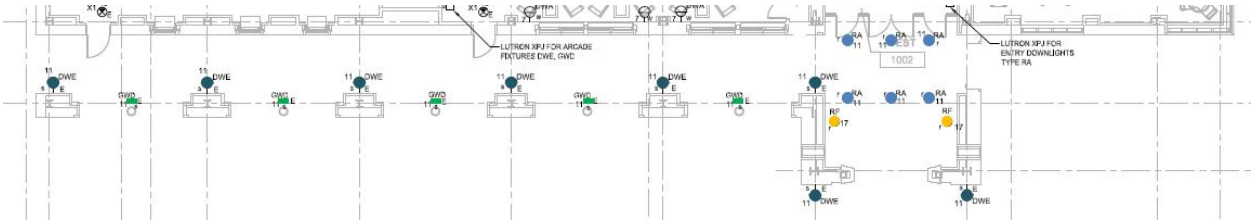


Figure 31 | First Floor - Lighting Plan

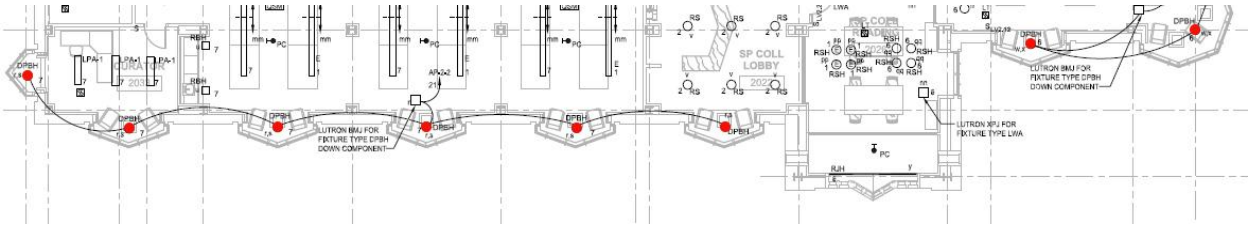


Figure 32 | Second Floor - Lighting Plan

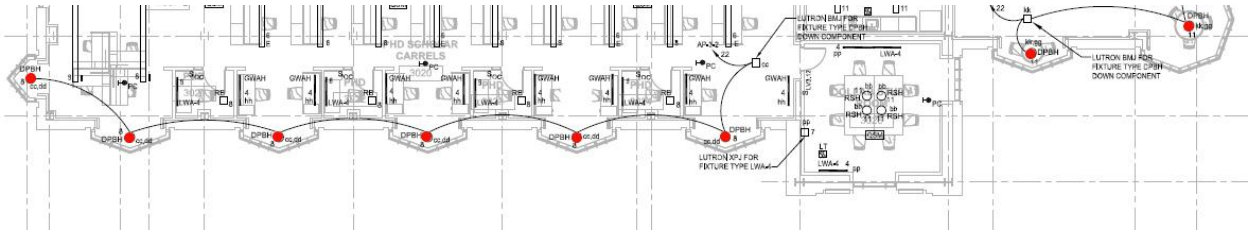


Figure 33 | Third Floor - Lighting Plan

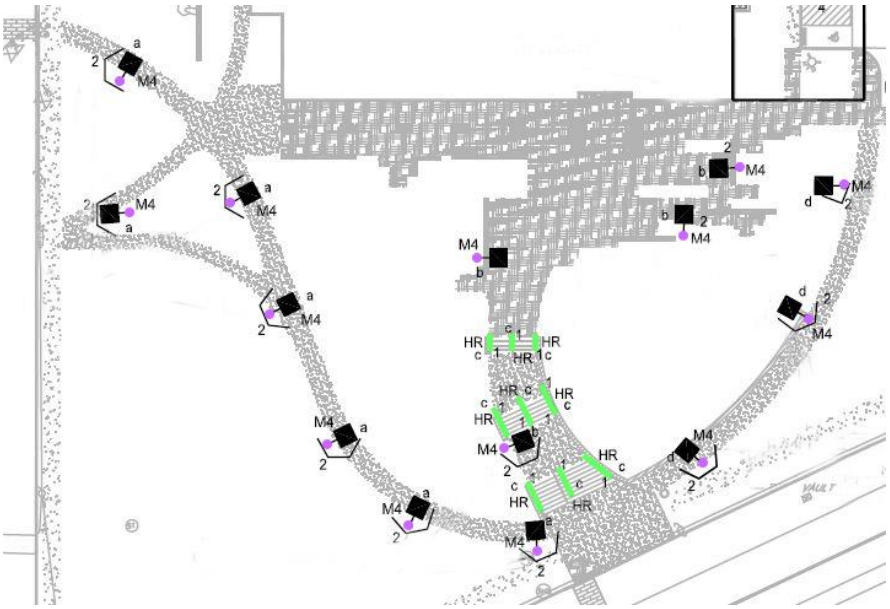


Figure 34 | South Facade Grounds - Lighting Plan

Design Criteria and Considerations

The following design criteria are listed by importance based on information collected from the Illuminating Engineering Society Lighting Handbook 10th Edition, ASHRAE Standard 90.1 2010 and LEED Major Renovations Version 2.2.

Illuminating Engineering Society Lighting Handbook 10th Edition

Very Important:

Aesthetic Criteria

The south façade, as the main entrance into the library, is the first impression of the building. The architecture should be highlighted with the use of light, especially the tower. Creating an elongated, larger than life appearance, the tower creates the introduction to the theme of reaching to the heavens.

Illuminance

Illuminance levels should be sufficient for circulation under the arcade and tower as well as on the pathways around the façade.

Illuminance Recommendations		
Task	Illuminance (lux)	
	Horizontal	Vertical
Façade		
-Medium Activity LZ2 Apply to <=15% of building façade		100 (max)
-Medium Activity LZ2 (curfew) Apply to <=10% of building façade		75 (max)
Canopied Entry		
-Medium Activity LZ2 Eh@grade; Ev @5' AFG	10	6
-Medium Activity LZ2 (curfew) Eh@grade; Ev @5' AFG	8	4

Important:

Daylight Integration and Controls

A time switch should be used to turn the exterior lighting off during the nighttime hours when the building is not open.

Accent Lighting

The entrance to the building under the tower should be brighter than the arcade to create a focal point. This will help with circulation into the building.

Uniformity

Uniformity is important under the arcade for safety purposes.

Illuminance Recommendations		
Task	Uniformity	
	Max:Avg	Avg:Min
Façade		
-Medium Activity LZ2 Apply to <=15% of building façade		
-Medium Activity LZ2 (curfew) Apply to <=10% of building façade		
Canopied Entry		
-Medium Activity LZ2 Eh@grade; Ev @5' AFG	3:1	Eh 2:1; Ev 4:1
-Medium Activity LZ2 (curfew) Eh@grade; Ev @5' AFG	3:1	Eh 2:1; Ev 4:1

ASHRAE Standard 90.1 2010

Power Allowances for Building Exteriors	
Task	**Allowance**
Building Grounds	
-Walkways less than 10 ft wide	0.7 W/linear foot
-Walkways 10 ft wide or greater	0.14 W/ft2
-Pedestrian tunnels	0.15 W/ft2
Building Entrance	
-Main entries	20 W/linear foot of door width
Building Façade	0.1 W/ft2 for each illuminated wall or surface of 2/5 W/linear foot for each illuminanted wall or surface length

Evaluation of Existing Conditions

Through assumptions made on the performance and light output of the luminaires contributing the illuminance around the south façade, an assessment can be made on how well it meets the design criteria listed above. The lighting design for the south façade does not highlight the architecture and it's grandeur as it should, which would exemplify not only the historical significance of the school but of the existing library it is attached to as well. The main purpose of the existing exterior lighting design is for safety and circulation purposes through the paths and arcade, to guide visitors toward the entrance. The exterior area under the tower, where the entrance is located, is brighter than the surrounding areas to alert guests where they can enter the building. A time switch is included in the existing design to switch off the exterior fixtures when the building is closed as a way to save energy.