URBN Center & URBN Center Annex

Philadelphia, PA

Final Thesis Report

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Option: Lighting/Electrical

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Executive Summary

This report provides a comprehensive synopsis of all the work and analysis of the PSU AE Senior Thesis. This entails a lighting depth, an electrical depth, an Architectural breadth, and a mechanical breadth. All of which have been conducted on the URBN Center and URBN Center Annex, home to the Antoinette Westphal College of Media Arts & Design at Drexel University. This report does not suggest that there are any fundamental problems with the existing design. The work being performed on this building is strictly for educational purposes only.

The lighting depth explains the design process that had been taken for four spaces located throughout the URBN Center and URBN Center Annex. These spaces include the main lobby and fashion design studio of the URBN Center and the exterior façade/patio and the Pearlstein art gallery of the URBN Center Annex. Design criterion has been assigned to each space and the redesign takes these aspects into consideration as well as uses computer software to validate that the final design would perform as intended.

The electrical depth will analyzes the branch circuiting that has been redesigned to accommodate for the newly designed lighting scenes. Panelboard layouts have been reconfigured and the newly defined circuits have had their wires and protection devices resized. A short circuit analysis follows the branch circuit redesign.

The architectural breadth and mechanical breadth go hand in hand with this project. The Annex's exterior façade and roof covering the lobby has been redesigned to reinforce the Architects goal of bringing the community and the artists of Drexel University together. This newly designed façade and roof are documented in Appendix E. This structure has also been analyzed to decipher how much the heating and cooling loads will fluctuate. Furthermore a daylight harvesting calculation sums up this breadth investigating whether or not the energy saved from implanting a daylight harvesting system into the lobby of the Annex will compensate for the added HVAC load.

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Building Overview

The URBN Center & URBN Center Annex was originally built in the 1970's and designed by the Architects of Venturi, Scott Brown and Associates. This building was first an office building for the Institute for Scientific Information and was known as the University City Science Center. The building has now been renovated and transformed into the URBN Center and is now the new home for the Antoinette Westphal College of Media Arts & Design. This building will house the most creative minds on campus including students enrolled in programs consisting of Architecture, Fashion Design and Merchandising, Digital Media, Interior Design, and Music Industry to name a few.

An iconic mosaic design of Venturi dominates the façade adjacent to Market Street providing the URBN Center with a strong presence to the daily passerby. While the buildings' exterior envelope has been left nearly untouched, besides the introduction of the expanded glazing, the interior spaces have been completely gutted and redesigned. What was a simple layout of classroom and office spaces has been turned into a geometrically complex piece of architecture. All ceilings have been left unfinished giving the interior an industrial impression. Exposed steel, metal panels, white partitions, and storefront glazing describe the materials throughout the structure reinforcing the modern and tectonic architecture (within the building). Flexibility and transformation also plays a large role in the character of this structure. Operable walls that slide and rotate are incorporated into the design, which reinforce the Architects goals for this building.

The Architect's goal for this newly designed space is to bridge the departments together providing the College of Media Arts and Design a facility for collaborative end creative work. As well, to introduce flexible spaces, which help to encourage the interaction between different programs and create spontaneous inspiring opportunities. Another design goal for the Architects at Meyer Scherer & Rockcastle was to have as minimal impact on the environment as possible, while keeping costs within the project budget. Strategies for green construction and design were adopted by Green Globe.

Building Statistics

GENERAL BUILDING DATA

Building name

URBN Center & URBN Center Annex

Location and Site

URBN Center

3501 Market Street
Philadelphia, PA 19104

URBN Center Annex

3401 Filbert Street
Philadelphia, PA

Figure 1: URBN Center | Market Street view (NW)

Building Occupant Name

Drexel University

Occupant Type

Group B (Educational occupancies for students above the 12th grade)

Size

145,917 ft^2

Stories above Grade | Total Levels

URBN Center

4 stories above grade (Roof Level – 56 ft.) | 4 total levels

URBN Center Annex

1 story above grade (Roof Level – 16.5 ft.) | 1 total level

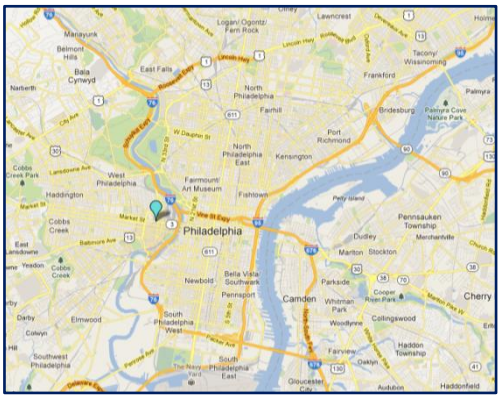


Figure 2: Location of site

Primary Project Team

Owner:	Drexel University	www.drexel.edu
Architect:	Meyer Scherer & Rockcastle Ltd Venturi, Scott Brown and Associates (Existing)	www.msrltd.com www.vsba.com
General Contractor:	Turner	www.turnerconstruction.com
MEP Firm:	PHY Inc.	www.phyinc.com
Acoustical Design:	Walters-Storyk Design Group	www.wsdg.com
Structural Engineer:	O'Donnel & Naccarto	www.o-n.com
Civil Engineers:	Advanced GeoServices, Inc.	www.agcinfo.com
Lighting Designer:	Gallina Design	www.emmanuel-gallina.com

Landscape Architect:	Oslund Associates	www.oaala.com/
Fire Consulting Firm:	Summit Fire Consulting	www.summitfire.com/

Dates of Construction

Start: August 2011 | Finish: September 2008

Actual Cost information

$31 Million

Project Delivery Method

Design-Build

ARCHITECTURE

The building's shape is a simple rectangular prism composed of brick veneers and glazing. The South façade includes a mosaic design by the original Architects Venturi Scott Brown and Associates. The original architecture within the building has been completely gutted and redesigned. Contrastingly the Exterior has been lightly modified with new windows making use of natural daylight. There are various murals throughout the building site which have all been preserved and incorporated into the design of the new URBN Center. The main entrance is positioned in the South-East Corner of the building along Market Street. The entrance leads into the main lobby which features lounge areas, student art work displays, and a café. The interior has a very modern and tectonic impression. In fact all of the mechanical, electrical, and plumbing systems have been left exposed. The materials used in both the URBN Center and the Annex consist of exposed steel, metal panels, plain white partitions, polished concrete, and storefront glazing. The atrium, running the nearly length of the building and stretching up through all four floors, is the main attraction upon the interior. There is a stepped floor system along the perimeter of this atrium. This design makes for a lot of interesting points of view, literally. The open floor layout encourages interaction between different departments all through the building. The architecture also includes operable walls. The operable walls consist of rotating walls and sliding walls. These walls allow for spaces that can transform. The fashion design studio for instance is a space that can be opened up to accommodate fashion shows or it can be separated into 4 smaller classrooms.

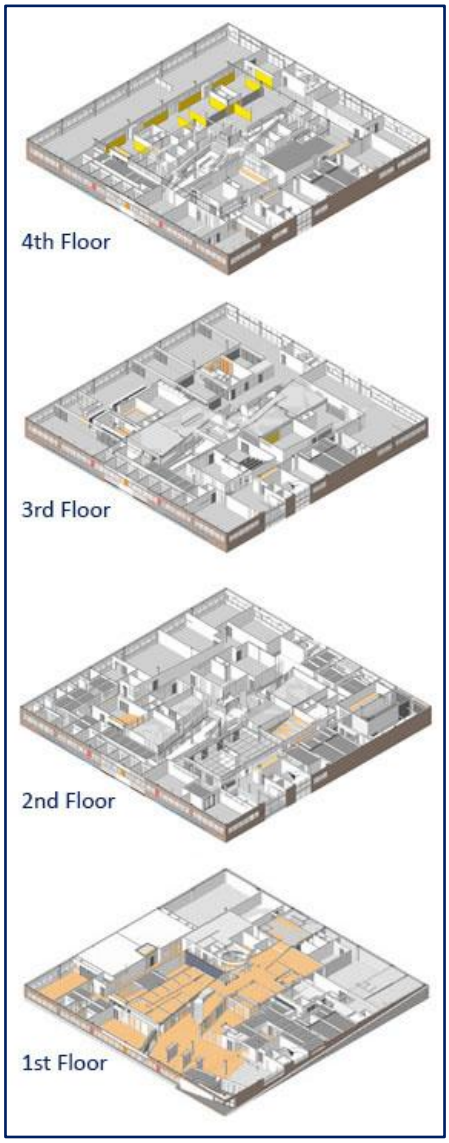


Figure 3: Isometric views

The URBN Center Annex is composed of three main spaces, a

black box theater, an art gallery, and a large screening room. The exterior of the Annex, unlike the URBN center, has been completely renovated. The South façade features storefront glazing systems with aluminum mullions, existing brick, and metal panels combining to create a fresh new look for the Annex. Similar architectural characteristics from the URBN Center can also be found in the Annex including operable walls. These operable walls are primarily located in the Pearlstein Art Gallery, which provide flexibility to this space. The materials used in the Annex are identical to the URBN Center.

Major national model codes

2006 International Building Code (IBC)

2007 Philadelphia Building Code

2005 National electric Code (NEC)

2006 ICC Electrical Code (ICC)

2006 International Energy conservation Code

2006 International Existing Building code

2006 International Fire Code

2006 International Fuel Gas Code

2006 International Mechanical Code

2006 International Plumbing Code

2003 ICC/ANSI A117.1-2003 Accessible and Usable Buildings and Facilities Standard

Zoning

URBN Center

Property Zoning C-4; 61,913 ft^2

BUILDING ENCLOSURE

Building Facades

Nearly the whole existing façade will be left untouched while the core of this structure will be stripped to the structural steel. The south façade adjacent to Market Street is the crown jewel for the URBN Center. Originally designed by the Architects of Venturi, Scott Brown and Associates; it is composed of square brick veneer and aluminum framed glazing. The individual bricks are glazed different colors and porcelain tiles are laid out in a symmetrical pattern across the entire south façade. Newly installed windows on the north and east side allow daylight to penetrate the spaces within the building. The facades of the Annex have also been renovated. The Annex façade consists of brick, glass, and a corrugated metals panel system.

Roofing

The main roof is constructed with an EPDM roof membrane on a lightweight insulating concrete slab, of which is on polystyrene insulation on a slope metal deck system. The estimated R-value of the roof is close to 19. A new skylight has been installed above the newly incorporated atrium. The Annex is quite similar, but it has 16 square skylights.

SUSTAINABILITY FEATURES

A majority of the spaces in the URBN Center feature daylight apertures. A great deal of effort was put into making these glazing systems effective by incorporating daylight harvesting control systems. These systems include mechanical shades, fluorescent dimming, and photosensors. All daylight harvesting equipment is controlled by Lutron's EcoSystem. The large skylight above the atrium allows natural daylight to penetrate the structure and provides efficient lighting to the offices close to the core of the building surrounding the atrium during the work day. The office/classroom walls lining the sides of the atrium were primarily constructed of glass welcoming the daylight into these spaces. Even the operable walls in many of the floors can be altered to let the daylight penetrate even further into the building reinforcing the daylight harvesting.

Figure 4: Atrium | 3rd Floor (looking SE)

Sustainability can also be recognized in what is not in the building. For instance, the building does not have drop ceilings in a majority of the spaces and the flooring is polished existing concrete. This decreases the amount of VOC's emitted into the air along with decreasing the amount construction costs and wastes. Another benefit to having concrete floors is the decreased maintenance costs.

PRIMARY ENGINEERING SYSTEMS

Construction

During early construction the structure was completely gutted on the inside, while the façade remained for the most part untouched, excluding the added glazing features and window replacement. The originally façade was designed by Robert Venturi and it has become an iconic building dominating the 1500th block of Market Street. It was clear from the start that this South façade was to remain untouched. The construction crew got started in December 2011. The steel framing within had to be chopped and revamped in order to make room for the new 4 story atrium. To make this process even more difficult, stepped floors engulf this atrium making for some very difficult steel framing construction/modification. A majority of the flooring is treated existing concrete. There are very few drop ceilings randomly located throughout the building, leaving most of the structure with exposed ceilings. Due to the unfinished ceilings, it was very important that the installation of all the mechanical

equipment, plumbing, and conduit work be done in a very organized and clean fashion, as to not diminish the aesthetic appeal. Construction was complete for the URBN Center in September 2012.

Electrical

The URBN Center features an electrical system with a radial design layout. This meaning there is a single entry point, located on the first floor of the building adjacent to Filbert Street, where the power system then branches out to serve the entire building. It is important to note that ground level is located at level 1A on the back side (North side) of the URBN Center and therefore the power enters below grade from beneath Filbert street. There are three main switchboards, with a combined power of 2,150 kVA, that provide power to the 2,100 kVA building load. One medium voltage switchboard provides 480/277V power to the HVAC equipment, lighting systems, and elevators. Another medium voltage switchboard provides 208/120V power to the receptacle loads. The final medium voltage switchboard provides 480/277V power to the fire pump and fire pump controller. Special needs include four dimming panels acquiring 600 Amps each. Emergency power is provided by a 500 kilowatt diesel generator.

Lighting

The lighting design concept for the URBN Center & URBN Center Annex can be described in one word, “linear.” Primarily linear fluorescent lighting is featured throughout the building creating strong rhythmic strokes of light. Daylighting is also a key feature of the lighting design for the URBN Center. As mentioned before, a four story atrium running the nearly the length of the building, in the North-South direction, is the central highlight and provides natural daylight to a majority of the buildings spaces. The offices neighboring the atrium make use of half walls allowing the daylight to penetrate into these spaces. Because of the geometry of this building, these offices will not encounter direct sunlight penetrating into the space.

Due to the transforming capabilities of this building the lighting system has been designed to allow for flexible control. The Lutron Quantum Total Light Management system controls the lighting for the URBN Center and URBN Center Annex. This system in combination with automated shades and dimming ballasts produces highly energy efficient lighting. Furthermore the linear fluorescent fixtures are fitted with high output T5 fluorescent tubes.

Mechanical

The URBN Center makes use of chilled beams for its primary heating and cooling systems. The chilled beams incorporate induction nozzles to transfer energy to and from the supply air. This type of system reduces the air velocities within the building, operating costs, and the amount of duct work running through the URBN Center. The URBN Center Annex contrastingly uses a combination of air handling units, electrical heaters, and air conditioning units for its primary heating and cooling systems. The Black Box Theater in the Annex introduces a high cooling load within the dimmer room where the dimmer racks are located. These dimmer racks produce a high cooling load and therefore this 177 square foot room is treated with two 810 CFM air-conditioning units alone.

Structural

The existing steel frame and curtain walls were two of the few aspects preserved from the original building. Seven main structural gridlines running east-west and north-south with equivalent spans of 30 feet generate the basis of the steel frame. The structural challenge for this project was introducing an atrium spanning the nearly the length and the full height of the structure and the stepped floor system surround it. The steel going through the atrium was cut out and the steel surrounding it was reinforced. Furthermore, the foundation had to be reinforced for the new distributed load, including added support for the elevator located in the atrium. The foundation consists of strip footings and column piers with 36" caissons with 48" square caps. The existing slab on metal deck makes up the typical floor structure.

Additional Systems

Fire Protection

The Fire Protection System makes use of upright, concealed and sidewall sprinkler heads in combination with vane type waterflow devices. The main water feed is provided through one 6" pipe located in the mechanical room in the North-East corner of the building. One 6" bi-directional standpipe, located in the North stairwell, and another 4" bi-directional standpipe, located in the West stairwell, feed the sprinkler system. The system consists of two main zones on each floor, the atrium zone and a general zone. The first floor includes another zone specified for the mechanical room and the server rooms are supplied with a pre-action sprinkler system. A 750 GPM electric fire pump with a 10 GPM jockey pump pressurizes the system.

Transportation

The main entrance of the URBN Center is located in the South-East corner of the building and leads in to the main lobby. Located in the main lobby are two elevators leading to the lounge for each floor. The lobby also leads to the atrium and from this point a complex series of stair cases lead from floor to floor generating some very interesting viewpoints. Also, within the atrium, another elevator can be found leading to each and every floor including the stepped floors. To conclude the vertical means of egress there are two main stairwells located centrally on the South and East sides of the structure. This building makes use of operable walls that rotate and slide generating different space layouts every day. These unique features make for interesting journey through this building.

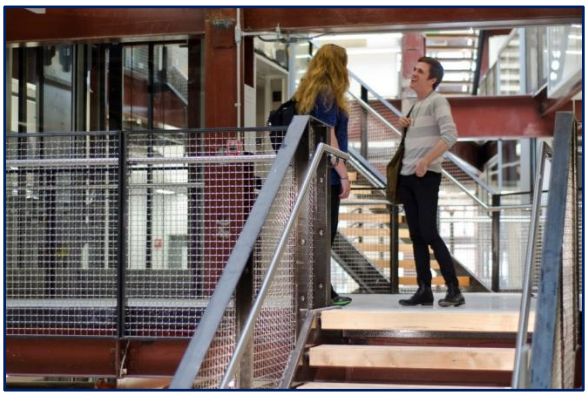


Figure 5: Stair system in atrium

Telecommunication Systems

The URBN center has an array of telecommunication systems. Card readers allow access to students for specific rooms, while 58 security cameras keep close surveillance throughout the building. The building also incorporates a hefty lighting control system, provided by Lutron. The system includes occupancy/vacancy censors, daylight sensors, EcoSystem switching modules, time clocks, dimming/switching ballasts, graphic eye interface modules, all of which are controlled by the Quantum Total Light Management system.

MIDI Audio System

Musical Instrument Digital Interface systems are located in all MIDI Studios (2 MIDI systems). These systems are composed of a variety of audio equipment including amplifiers, preamplifiers, audio signal processing equipment, equipment racks, powered speakers, mixers, and switches.

Lighting Depth

The lighting design for the URBN Center will be integrated into the architecture and building systems, while contributing to the goals of Meyer Scherer and Rockcastle and that of Drexel University. Energy and cost savings will be researched and analyzed to achieve a realistic and applicable design. Green building design and sustainability will also take a large role in the lighting design. The scope of this analysis includes four spaces:

Circulation Space | ***Main Lobby***
Large Work Space | ***Fashion Design Studio***
Outdoor Space | ***Annex Exterior Façade and Patio***
Special Purpose Space | ***Pearlstein Art Gallery***

It was evident from the start of this project that the university wanted the newly renovated URBN Center to be a place for students to connect, collaborate, and create. For example, here are some quotes from the URBN Center website:

> *"The URBN Center will become Drexel University's hub for **creative** minds to **gather, share** ideas and **work together** to bring those ideas **from the mind to the page**, and into the world of tomorrow."*

> *"The Robert Venturi-designed building is being transformed into a bold new center for **imagination** and high-end production. With the intention of **sharing** the URBN Center with the **community**, students will enjoy newfound **collaboration** with industry professional in addition to other Drexel schools and colleges."*

As one reads through this text, it becomes evident that this building is to inspire and connect the students of the Antoinette Westphal College. The words that have been highlighted share a familiar theme of connectivity, collaboration, and creation. The dean of the college agrees with the overall goal for the URBN Center as well:

> *"At Westphal College, we boldly re-imagine the world through inspired design, media and the arts. And our **imagination is boundless**. Our faculty members, distinguished leaders in their fields, challenge our students to push the boundaries of their **creativity** in order to **transform the world around us**. The new URBN Center will greatly enhance our students' educational experiences by offering more resources and **opportunities to create** than ever before."*
>
> *-Allen Sabinson, Dean*

The lighting design in each space will strive to reinforce the idea of collaboration and connectivity between the departments who share this facility. The architecture itself already reinforces this idea of connectivity and collaboration. The client's intent will be reinforced through the lighting design.

Overview

Full luminaire and lamp configurations are specified and described in detail for the final lighting designs in the specified spaces. Lighting scenes and control systems have been developed for all four spaces. Through the use of computer programs, ranging from AGI32 to Comfen, the designs will be technically analyzed to achieve the desired design criteria. Guidelines established by the IESNA handbook and ASHRAE energy standard 90.1 will be upheld for all lighting designs.

Design Concept

Connection

Collaboration

Creation

CIRCULATION SPACE | MAIN LOBBY

Description

The Lobby serves as the main gateway for the building and receives that highest volume of traffic throughout the day. The lobby not only leads to the four-story tall atrium, but there is also an opening to the second floor right as you come through the double doors at the main entrance. A feeling of compression and expansion is imposed on the occupants as they would move through the vestibule and into the lobby. These openings reinforce this idea of connection between departments as well as introduce daylight into the space. The Lobby features a café with its own seating area along the south façade looking out onto Market Street. Operational walls (rotating) are weaved into the design of this space and provide a showcase for the students work. Materials in the space include exposed structural steel members, storefront glass, polished concrete flooring, decorative metal panels, and plain white partition walls. The main lobby encompasses just under 3,500 square feet stretching 90 feet from West to East and 53 feet from North to South.

Area (ft^2)	Length (ft)	Width (ft)	Ceiling Height (ft)
3,483	69	88	16.5

Table 1: Lobby dimensions

Location/Orientation

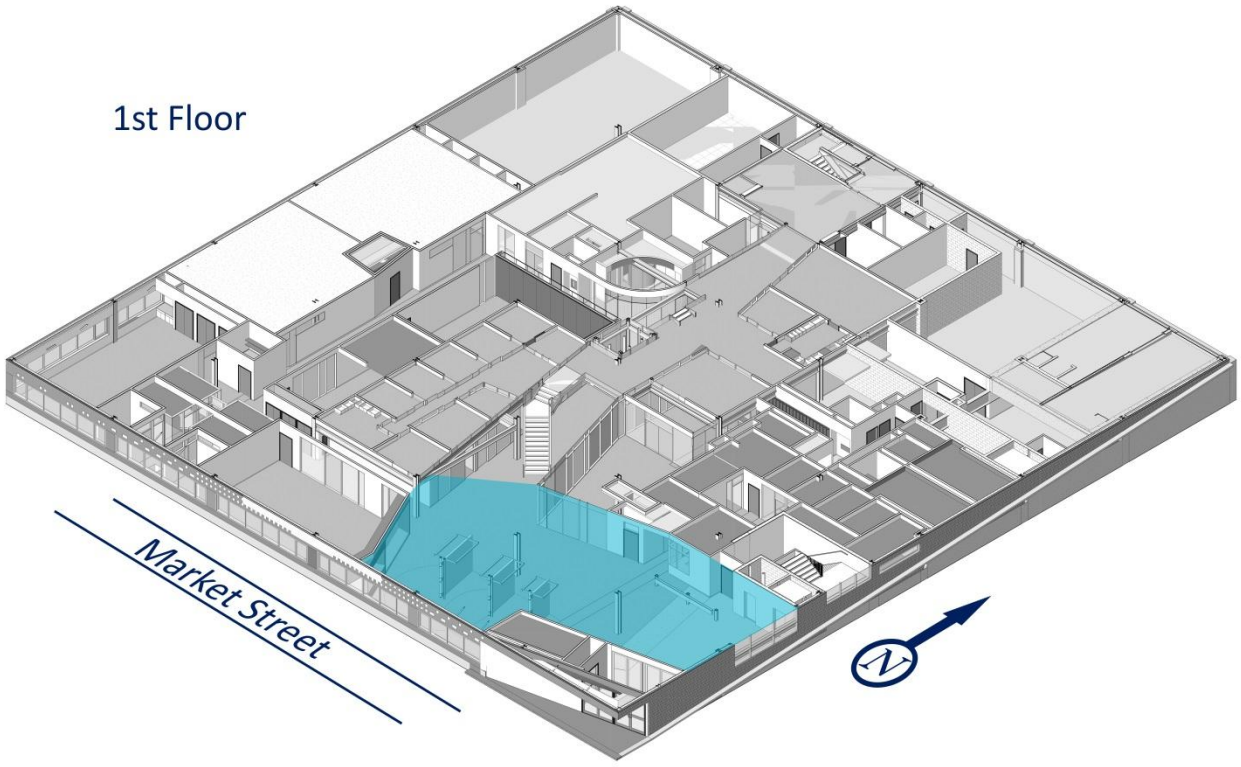


Figure 6: Location of main lobby on first floor

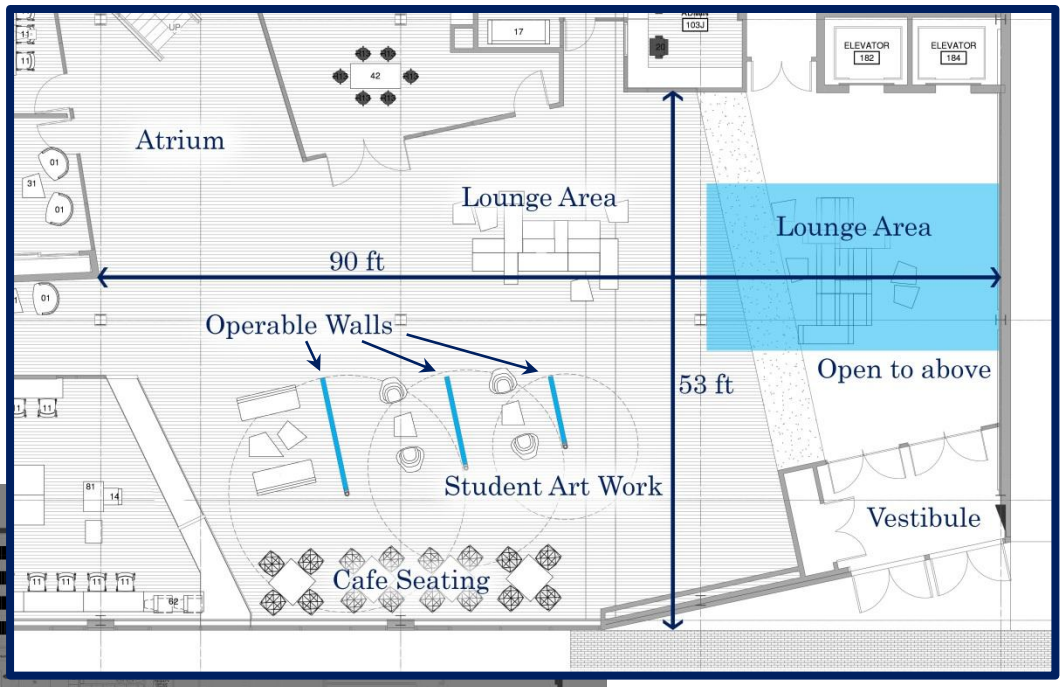


Figure 8B: Enlarged lobby plan

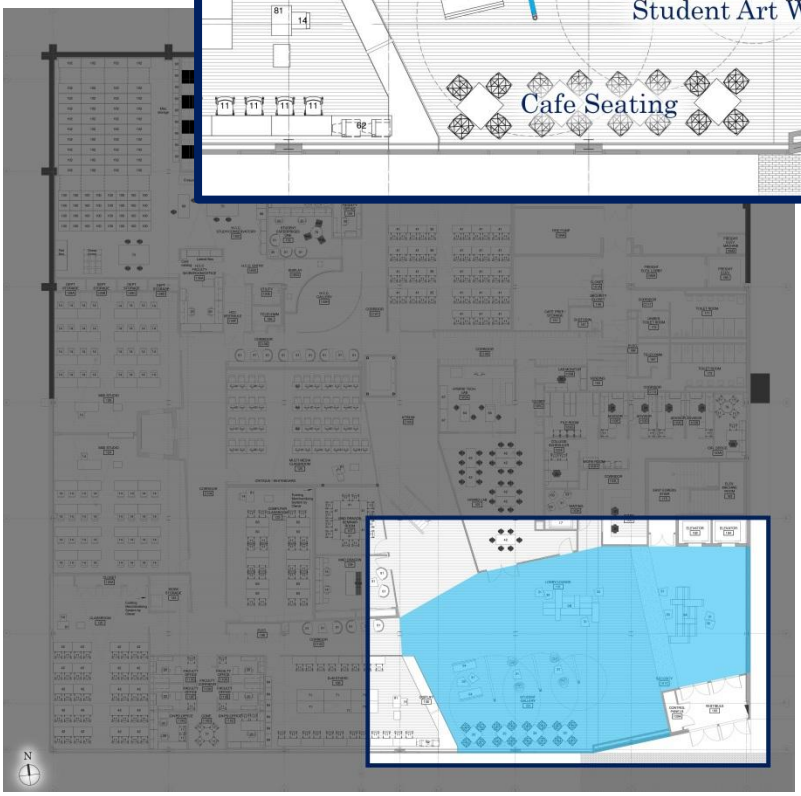


Figure 8A: Orientation of lobby to first floor plan

Materials & Finishes

Similar to most of the architecture in the URBN Center and URBN Center Annex, the finishes throughout the Lobby have attained the 'shades of grey" theme. The Gypsum wall board and storefront glass partitions outline this space. The ceiling has been left unfinished exposing the structural steel beams, polished aluminum duct system, cable trays, piping, and acoustical panels. The acoustical panels run along the bottom of the exposed metal decking between steel framing above all HVAC and lighting equipment. The operable walls are fitted with cork board panels and are steel framed. A minimalist approach has been taken to the selection of furnishings. Clean lines and simple shapes describe the lounge area and café furniture.

MATERIALS/FINISHES					
Type	**Location**	**Description**	**Manufacturer**	**Color**	**Reflectance**
Gypsum Wall Board	Partitions	Main paint finish | Eggshell/Satin Latex Paint	Benjamin Moore	Decorators White	0.85
Gypsum Wall Board	Partitions	Eggshell/Satin Latex Paint	Benjamin Moore, Affinity Colors	Gray Owl	0.60
Cast-in-Place Concrete	Floor	Exposed concrete | Floor seal SL-1			
Existing Concrete	Floor	Burnished treated | Level 2 polished concrete - 800 Sheen	--	--	0.47
Acoustical Ceiling Tile	Ceiling	Thickness: 1-1/2"| Size: 5' X 5' | NRC: 0.9 | Capz Color: Silver Smooth	Existing Fiberglass Tiles	White	--
Concrete Masonry Units	South Curtain Wall	Concrete Masonry Units | Hollow	Existing	White	--
Metal Wall Panels	North Egress Stairs	Factory formed, single skin, face-fastened metal wall, liner, and soffit panels | Thickness: 0.8 mm	Rheinzink	Blue-Bray	--
Type	**Location**	**Description**	**Manufacturer**	**Color**	**Transmittance**
Interior glazing	Above partitions and operable walls | Storefront	1/4" Clear float glass | Glass access panels	Viracon	Clear	0.91
Interior glazing	Interior storefronts	3/8" Clear float glass | Tempered glass	Viracon	Clear	--
Exterior glazing	Exterior curtain walls	1" Insulated float glass | Tempered Glass	Viracon	Clear	0.65

Table 2: Lobby materials/finishes

Tasks/Activities

Activities in the lobby include eating, lounging, studying, and people conversing with one another. A majority of the occupants in this space are just walking through on their way to class. This space does include a small display area where students can observe other students work and generate conversation.

Overall Design Goals

Because of the size of the lobby and different areas within the space, the lighting will change from one area to the next. I have divided the lobby into two zones and each zone will have a specific lighting impression. Area 1 will attain a public feel to it. This way when the students enter the building they will immediately feel invited. As studies show, high uniform light levels will give this area a public feel. The next are, area 2, is where the impression of playfulness will be reinforced with patters of sparkle through the lighting design. This impression of playfulness will encourage the students to interact with one another. The uniformity of this lighting design will be outweighed by patterns of sparkle because creating this feeling of connection is more important than creating a public space. It will be hard to balance these to themes within one space because the lighting characteristics of a public feel contradict characteristics of a playful impression. The student art display area, small café, and atrium entrance will be accentuated destinations within the lobby. The lighting design must be able to draw the eyes of the viewers to these areas in the lobby.

Design Criteria/Considerations

Illuminance Recommendations | IESNA Lighting Handbook 10th Edition

Lighting for Education | Transition Spaces | Lobbies | Circulation, Elevator Lobbies

Recommended Maintained Illuminance Targets		
Avg. Horizontal | at 0' (lux)	**Avg. Vertical (lux)**	**Uniformity Ratio (Hor.)**
100 (Day)	30 (Day)	4
50 (Night)	20 (Night)	4

Table 3: Recommended maintained illuminance targets

ASHRAE/IESNA 90.1 -2007

Table 9.5.1 | Building Area Method

Lighting Power Densities	
Building Area Type	**LPD (W/ft^2)**
School/University	0.99

Table 4: ASHRAE 90.1 | Table 9.5.1

Table 9.6.1 | Space-by-Space Method

Lighting Power Densities	
Common Space Type	**LPD (W/ft^2)**
Lobby	0.90

Table 5: ASHRAE 90.1 | Table 9.6.1

Appearance of Space and Luminaires

The appearance of the luminaires and the overall architectural impression is important in all spaces, but is especially important in the lobby. The lighting in the lobby is one of the first opportunities to set the mood for the URBN Center. Occupants should gain a feeling of playfulness and excitement as they enter the URBN Center. The luminaire selection should be chosen to reflect the simplistic architecture and clean cut lines of the furniture that accentuate the lobby.

Daylight Integration and Control

The Philadelphia area experiences many cloudy days, which is actually quite admirable for daylight harvesting. The Lobby features glazing on the east and south facades. Photosensors in combination with dimmable LEDs will be used to ensure that the appropriate light levels will be maintained throughout this space.

Light Distribution on Surfaces

It will be important to distribute the light in the lobby in such a way, that occupants will easily be able to navigate through this space. Daylight will flood into the floor space near the atrium, which will act as the main focal point for first time occupants. The operable walls, which act as display surfaces, should receive a considerable amount of the distributed light in this space drawing observers close and encouraging student interaction.

Modeling of Faces or Objects

Facial recognition will be crucial in the lobby space for security purposes. Psychologically the modeling of faces will also be important. Social interaction is increased when the spaces are bright and uniform (Flynn).

Points of Interest

The points of interest within the lobby include the operable walls (student art display area), the small café seating area, and the welcome desk. These areas will exhibit higher contrast ratios to their counter parts within the lobby.

Fixtures/Equipment

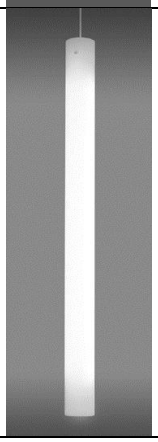
Luminaire Schedule			
Type		Description	Manufacturer
	 A1[E]	Circular LED pendant fixture. Extruded aluminum outer housing with white frosted acrylic diffuser (inner surface). 3' diameter.	Delray Lighting
	A2[E]	Circular LED pendant fixture. Extruded aluminum outer housing with white frosted acrylic diffuser (inner surface). 4’ diameter.	Delray Lighting
	 B[E]	Circular LED decorative pendant fixture. Extruded aluminum inner housing with white frosted acrylic diffuser (outer surface). 2' diameter.	Delray Lighting
	 C	12" linear LED cove fixture. Dark-gray injected-molded plastic housing with clear polycarbonate lens.	Color Kinetics
	 D	Low-voltage LED adjustable spotlight track fixture. Low UV cool beam. Matte chrome finish. Compatible with wall mount track system.	Tech Lighting
	 F	Recessed LED downlight with 1.75" aperture. Steel/Aluminum housing with granulated powder coat finish.	Lucifer
	 G1	2' inverted linear fluorescent pendant fixture. Matte white acrylic diffuser.	Delray Lighting
	G2	3' inverted linear fluorescent pendant fixture. Matte white acrylic diffuser.	Delray Lighting
	G3	4' inverted linear fluorescent pendant fixture. Matte white acrylic diffuser.	Delray Lighting

Table 6: Lobby luminaire schedule

*Note: For full luminaire schedule including lamp and power source information, see Appendix A.

Lighting Plan

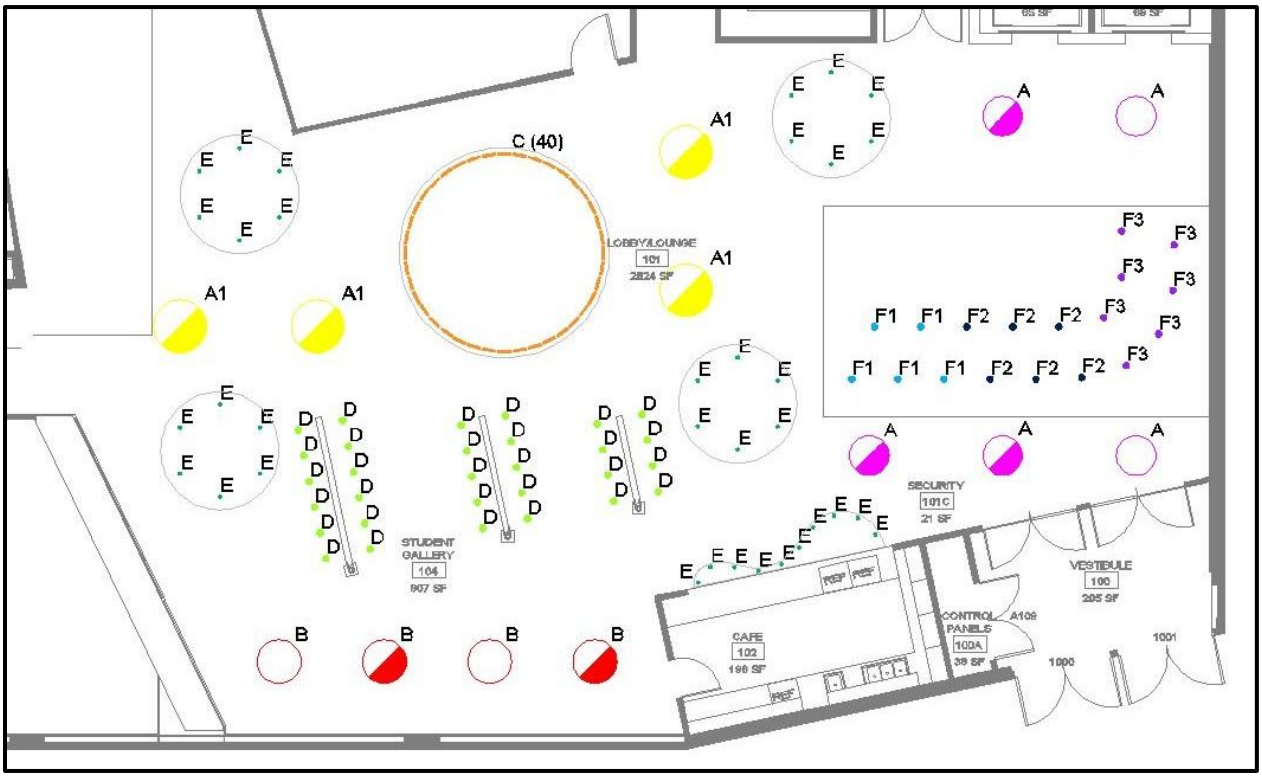


Figure 9: Lobby lighting plan

Light Loss Factors						
Type	Lamp Lumens		LLD	LDD	BF	Total
	Initial	Mean				
A	--	--	--	--	--	0.70
A1	--	--	--	--	--	0.70
B	--	--	--	--	--	0.70
C	--	--	--	--	--	0.70
D	--	--	--	--	--	0.70
E	--	--	--	--	--	0.70
F1	1200	1115	0.93	0.94	1.00	0.70
F2	1900	1765	0.93	0.94	1.00	0.87
F3	2600	2420	0.93	0.94	1.00	0.87

Table 7: Lobby luminaire light loss factors

*The above light loss factors were calculated using the method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the 2010 IESNA handbook. A luminaire/lamp maintenance schedule of twelve months along with a clean environment (CIE-W Classification) was assumed.

Renderings

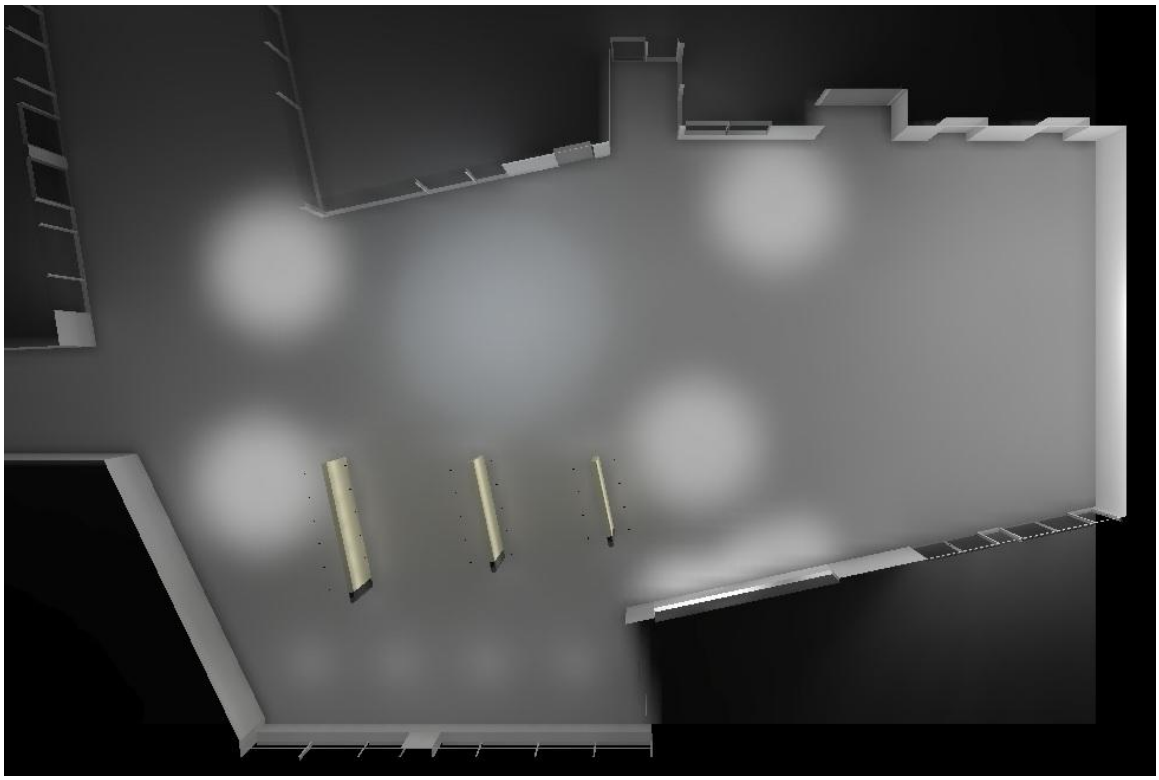


Figure 10: Lobby rendering (daytime) | Aeiral view

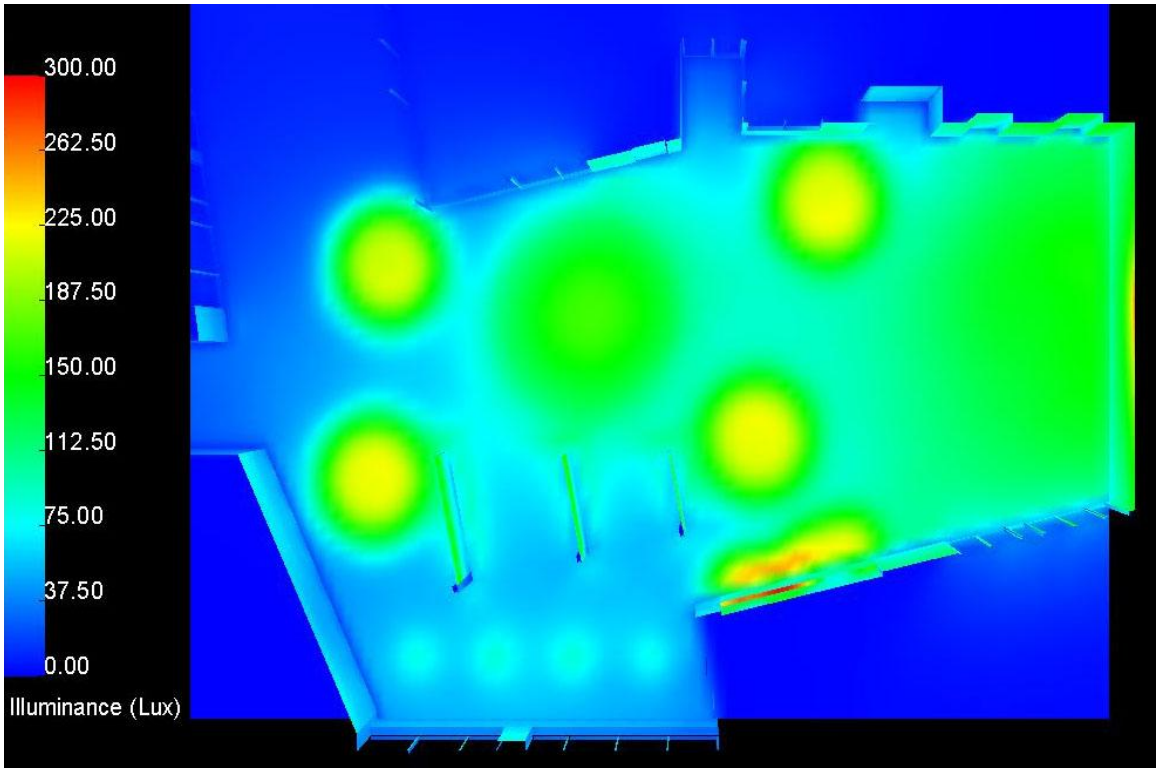


Figure 11: Lobby pseudo rendering (daytime) | Aerial view

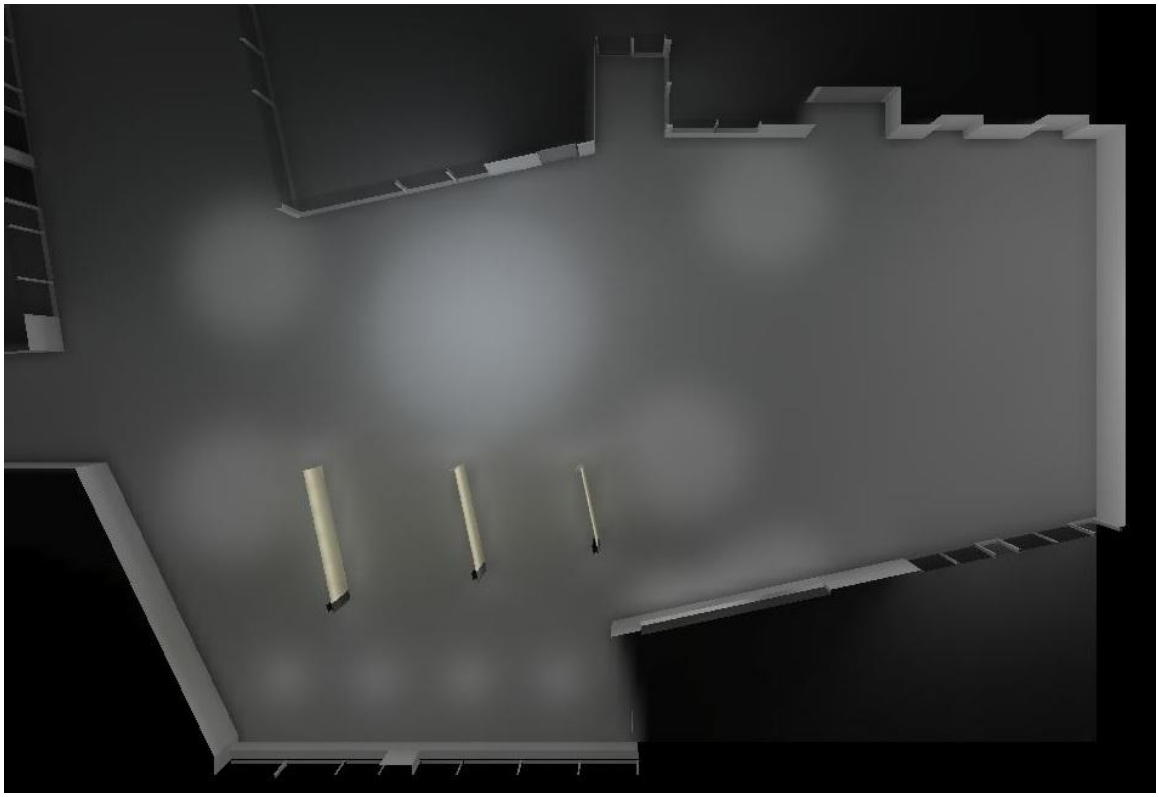


Figure 12: Lobby rendering (night time) | Aeiral view

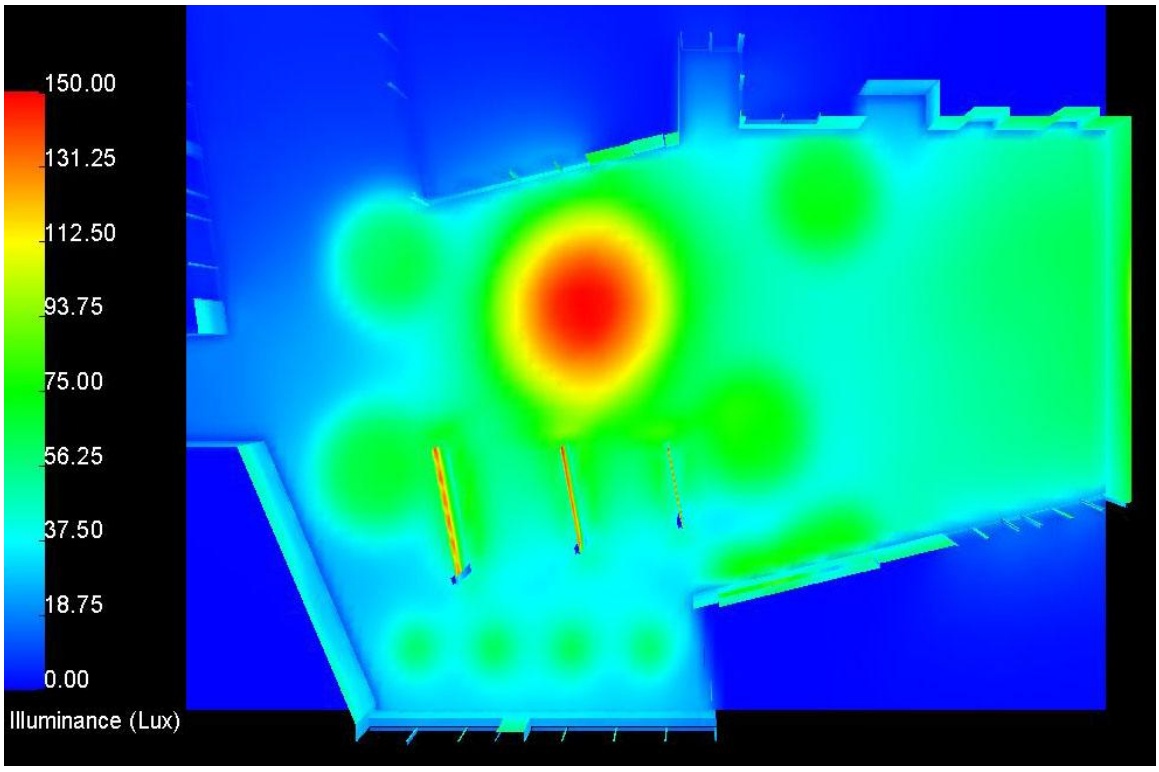


Figure 13: Lobby pseudo rendering (nighttime) | Aerial view

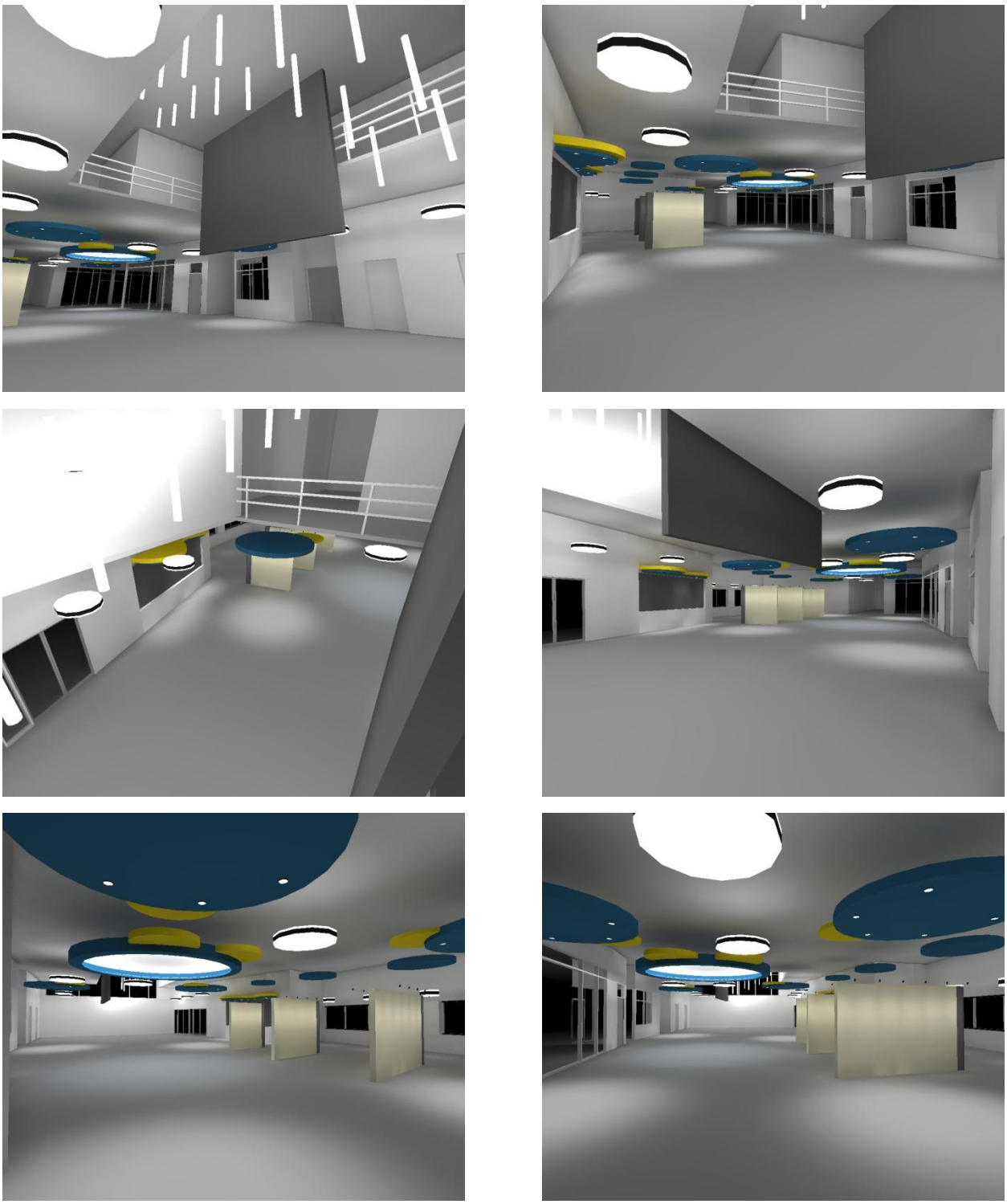


Figure 14: Renderings of various viewpoints throughout lobby (day)

Calculation Summary

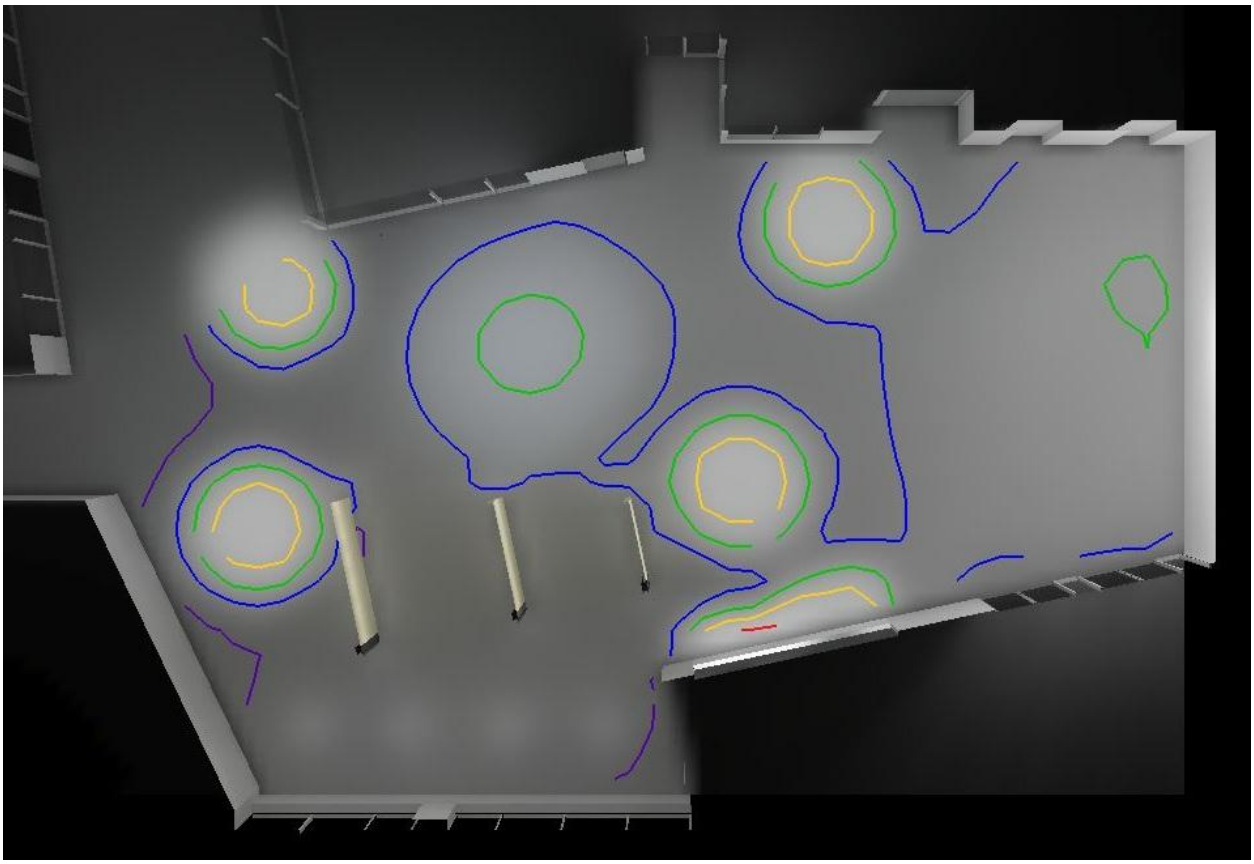


Figure 15: Illuminance isoline overlay on lobby rendering

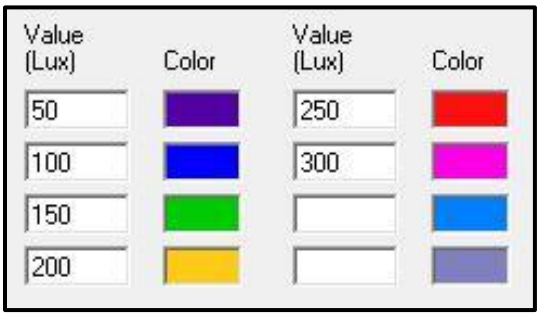


Figure 16: Illuminance value legend

Illuminance Summary		
Calculation	**Horizontal at 0' (lux)**	**Target**
Average	107	100
Maximum	263	--
Minimum	37	--
Avg./Min	2.91	4

Table 8: Lobby illuminance summary

Illuminance Summary | Night		
Calculation	**Horizontal at 0' (lux)**	**Target**
Average	55	50
Maximum	145	--
Minimum	20	--
Avg./Min	2.73	4

Table 9: Lobby illuminance summary

Power Density			
Luminaire	**Watts/Luminaire**	**Quantity**	**Total Watts/Luminaire Type**
A	38	5	190
A1	49	4	196
B	75.3	4	301.2
C	12.5	40	500
D	3	31	93
E	18	33	594
F1	19	5	95
F2	25	6	150
F3	32	7	224.00
		Total Watts	2343.20
		Area (ft^2)	3483.00
		LPD	**0.67**

Table 10: Lobby lighting power density

Evaluation

The selected luminaires of this space go well with the architectural style in the lobby space. The selected luminaires have a simple clean look that complements the surrounding architecture. The added drop pods with recessed LED downlights, that are situated radial around the central drop pod with an inverted cove lighting system, provide the patterns of light that will generate a playful impression in this space. The pendant fixtures (Lum. G) located in the section of the lobby that is open to above produce a very uniform light distribution in Zone 1, which give this space a very open look and public feel. These luminaires provide a high vertical illuminance, given their light distribution properties; while at the same time these fixtures don't create a glare problem because of their high mounting position and their large light emitting surface area. The track lighting used to accentuate the operable wall generates enough illuminance to make these surfaces a focal point in the room. The surrounding area has the lowest illuminance values in the lobby creating a high contrast ratio between the surface and its surroundings. The ambient lighting fixtures (Lum. A & B) succeeded in providing enough light to meet the average target illuminance value within 10 %. Overall the lighting system for the Lobby has met the design criteria and it blows the LPD out of the waterhole. LED lighting makes up for over 90% of the lighting load in the Lobby explaining the low LPD that was achieved for this space. The achieved LDP of 0.63 W/ft^2 is 32 % less than the recommended power allowance of 0.99 W/ft^2. A color temperature of 4000K was chosen for all lamps, because of a couple reasons. Number one, the rest of the building uses lamps with a Correlated Color Temperature (CCT) of 4000K and this brighter CCT plays into the look of this renovated building. The exposed ceiling, clean lines, heavy glazing, and grayscale color scheme generate a clean, tectonic look and feel and the higher CCT value helps to reinforce these attributes.

LARGE WORK SPACE | FASHION DESIGN STUDIO

Description

The Fashion Design Studio dominates the West side of the third floor of the URBN Center. The studio will primarily be utilized as a large working design studio for students and for class lectures. Fashion shows will also accommodate this space every so often. The layout of this space can vary from an open plan to an organized and divided arrangement of spaces. This flexibility is made possible with 'operable' walls. These panels double as art showcases and wall partitions (see Fig.3). Large windows located on the North Façade of the studio bring in natural light providing the opportunity for daylight harvesting, while excluding direct sunlight. Glazing continues to wrap around the entire studio offering exterior views to the students regardless of their location within the space.

Area (ft^2)	Length (ft)	Width (ft)	Ceiling Height (ft)
8,928	135	Varies (see Fig.2)	13.5

Table 11: Studio dimensions

Location/Orientation

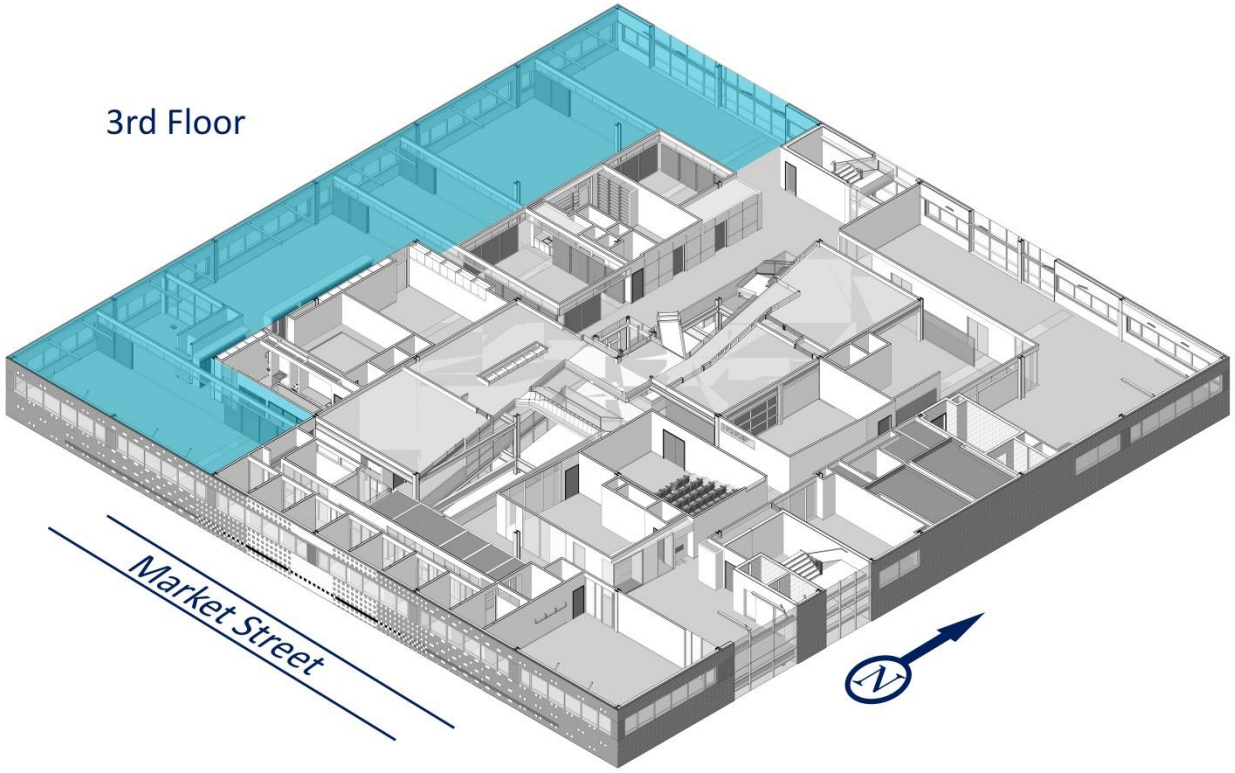


Figure 17: Location of fashion design studio

Figure 18B: Enlarged studio plan

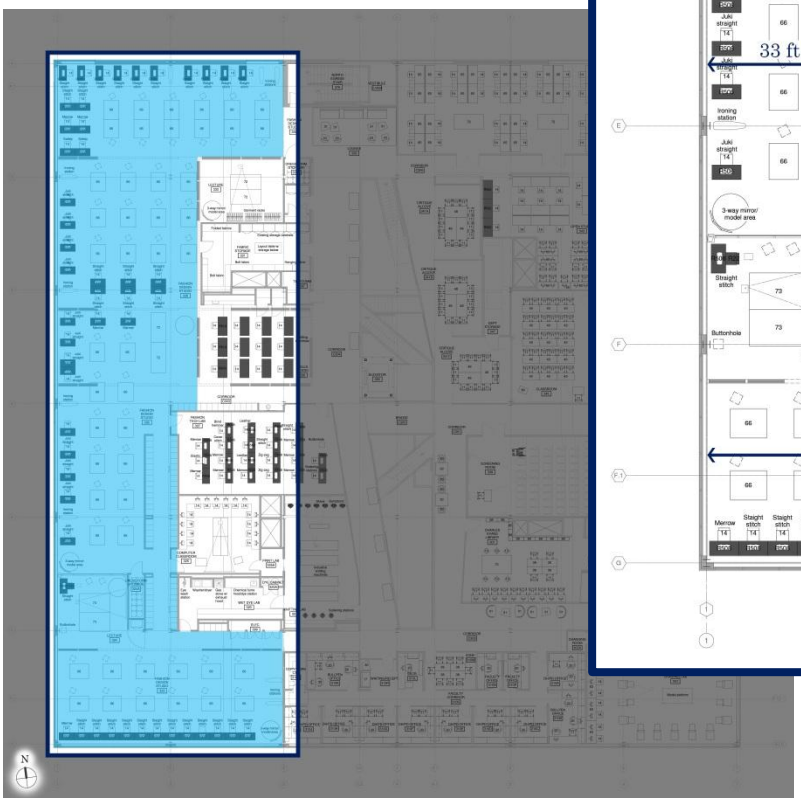


Figure 18A: Orientation of studio to third floor plan

Materials & Finishes

Like most floors throughout the URBN Center, existing polished concrete describes the surface of the floor. The ceiling is left bare exposing all of the HVAC and lighting equipment, pluming, etc. This type of ceiling demands that these systems be laid out in an organized and appealing manner. The partitions are all finished with gypsum wall board (GWB) and painted white. Acoustic ceiling panels line the bottom of the exposed deck providing some acoustical buffering within the large space. The tack board also provides some acoustical cushioning. The acoustical panels run along with the steel framing of the Fashion Studio. The operable walls double as a visual display surface running primarily East-West. Partitions are primarily made up of Gypsum Wall Board (GWB). Storefront partitions exist throughout the space as well (see Fig. 19). In the corridor shelves made of white translucent acrylic house the students belongings.

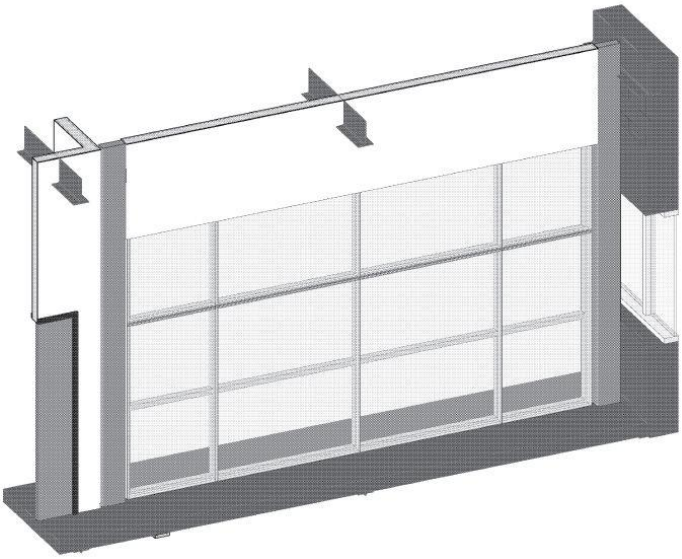


Figure 19: Storefront partition

MATERIALS/FINISHES					
Type	**Location**	**Description**	**Manufacturer**	**Color**	**Reflectance**
Gypsum Wall Board	Partitions	Main paint finish | Eggshell/Satin Latex Paint	Benjamin Moore	Decorators White	0.85
	Accent Paint	Accent paint finish | Eggshell/Satin Latex Paint	Benjamin Moore	Fashion Rose	--
Existing Concrete	Floor	Burnished treated | Level 2 polished concrete - 800 Sheen	--	--	0.47
Visual Display Surface	Partitions / Operable Walls	Tackable cork	Forbo	--	0.59
Metal Wall Panels	North Egress Stairs	Factory formed, single skin, face-fastened metal wall, liner, and soffit panels | Thickness: 0.8 mm	Rheinzink	Blue-Bray	--
Acoustical Ceiling Tile	Ceiling	Thickness: 7/8" | Size: 4' X 4' | NRC: 0.9 | Capz Color: Silver Smooth	Existing Fiberglass Tiles	White	--
Acoustical Ceiling Tile	Ceiling	Thickness: 1-1/2" | Size: 5' X 5' | NRC: 0.9 | Capz Color: Silver Smooth	Existing Fiberglass Tiles	White	--
Structural Steel Framing	Ceiling	Existing interior structural steel framing | Cleaned as required | Existing primer to remain	--	--	--
Cabinets - Upper Sliding Panels	Corridor	Resin Panel | Cabinets - Upper sliding panels	3Form Varia, Color Weave	--	--
Type	**Location**	**Description**	**Manufacturer**	**Color**	**Transmittance**
Interior glazing	Above partitions and operable walls | Storefront	1/4" Clear float glass | Glass access panels	Viracon	Clear	0.91
Exterior glazing	Exterior curtain walls	1" Insulated float glass | Tempered Glass	Viracon	Clear	0.65

Table 12: Studio materials/finishes

Tasks/Activities

During normal operation activities in the Studio include sketching, sowing, art critiquing, and lecturing. This space will also be used to hold small in house fashion shows.

Overall Design Goals

The most important design criteria for the Fashion studio is color rendering. Only lamps with a CRI rating of 90 or greater will be chosen for the fixtures in this space. This space will give the students the feeling of being on the run way. This impression will be reinforced with the use of theatrical trusses. These trusses will also provide the necessary support needed to hang the par lamps needed for the fashion shows. Finally this space will have to be flexible. The operable walls in this space can generate a variety of different setups and the lighting will have to adapt to the geometry of the space. These operable walls act as a display surface as well. For this reason controls will be a sensitive issue.

Design Criteria/Considerations

Illuminance Recommendations | IESNA Lighting Handbook 10th Edition

Lighting for Education | Transition Spaces | Lobbies | Circulation, Elevator Lobbies

Recommended Maintained Illuminance Targets		
Avg. Horizontal | at 2'-6" (lux)	**Avg. Vertical (lux)**	**Uniformity Ratio (Hor.)**
500	300	3

Table 13: Recommended maintained illuminance targets

ASHRAE/IESNA 90.1 – 2007

Table 9.6.1 | Space-by-Space Method

Lighting Power Densities	
Common Space Type	**LPD (W/ft^2)**
Classroom/Lecture/Training	1.24

Table 14: ASHRAE 90.1 | Table 9.6.1

Table 9.6.2 | Additional Control Method

Automatic continuous daylight dimming in primary sidelighted areas when sidelighting effective aperture is greater than 0.15 and when primary sidelighted area is less than 250 ft^2.

- **LPD (W/ft^2) = 1.24 + 0.2 = 1.44**

Color Appearance (and Color Contrast)

It is important for the design studio to have good color rendering, because color coordination is crucial in fashion design. If the colors are not correctly rendered in the studio the final product may be visually distorted when rendered on the run way or for a critique.

Daylight Integration and Control

The control of daylight is crucial in the design studio. The studio is exposed to exterior glazing to the North, West, and South. Proper shades integrated with photosensors will have to be deployed in this environment. The electric lights will have to be dimmed to assure adequate lighting levels are maintained during typical weather changes.

The use of daylighting in a space such as and art studio can be very beneficial in the following categories if the system is integrated into the lighting design. In order to achieve an effective lighting system, the precise coordination and control of the daylighting and electric lighting must be integrated together. The IES Handbook identifies 9 categories in which particular attention should be addressed for pleasing results.

1. *Automate dimming or brief client on stepped-dimming functionality*
2. *Avail instructors of simple dimming overrides to brighten or darken rooms on demand*
3. *Care in the design of any east- and west-elevation daylighting relative to glare*
4. *Automate window treatment or avail instructors of convenient manual operation and expected time of use*
5. *Introduce daylight apertures on orientations different from primary or secondary instruction positions or display/presentation positions*
6. *Arrange glazing to allow sufficient wall space for posting teaching aids, student work, etc.*
7. *Maintain some degree of exterior view*
8. *Avoid daylight designs requiring near-continual or complete shade deployment*
9. *Perform daylight simulations to limit areas of over lighting and assist with glazing transmittance and shading treatment selections*

Source/Task/Eye Geometry

It is vital that the geometrical coordination between the viewer's eye, task, and light source be set up in such a way that veiling reflections are reduced to a minimum. The Fashion Studio displays art on the operable walls, which divvy this large space into smaller learning areas. This application introduces the need for quality vertical illuminance on these operable walls. These vertically-oriented panels are made of cork, but virtually any material may be pinned to this surface. Therefore, veiling reflections are possible making the selection and orientation of the light source critical.

Fixtures/Equipment

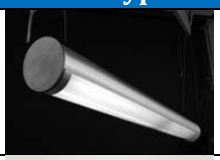
Lighting Equipment			
Type		Description	Manufacturer
	H	4' linear fluorescent pendant fixture. Extruded die-cast aluminum housing. Formed steel reflectors with white finish. Prismatic virgin acrylic lenses with exterior longitudinal prisms.	Peerless
	J	4' linear LED suspended wall-wash fixture. Extruded die-cast aluminum housing with 2-3/4" diameter. Acrylic lens and metal reflector.	Peerless
	K	Circular fluorescent downlight. Heavy-gauge aluminum housing. 8" diameter with 6" aperture. Matte white textured polyester powder paint finish.	Gotham

Table 15: Studio luminaire schedule

*Note: For full luminaire schedule including lamp and power source information, see Appendix A.

Light Loss Factors						
Type	Lamp Lumens		LLD	LDD	BF	Total
	Initial	Mean				
H	2600	2420	0.93	0.94	1	0.87
J	--	--	--	--	--	0.70
K	1165	1000	0.86	0.94	0.95	0.77

Table 16: Studio luminaire light loss factors

*The above light loss factors were calculated using the method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the 2010 IESNA handbook. A luminaire/lamp maintenance schedule of twelve months along with a clean environment (CIE-W Classification) was assumed.

Lighting Plan

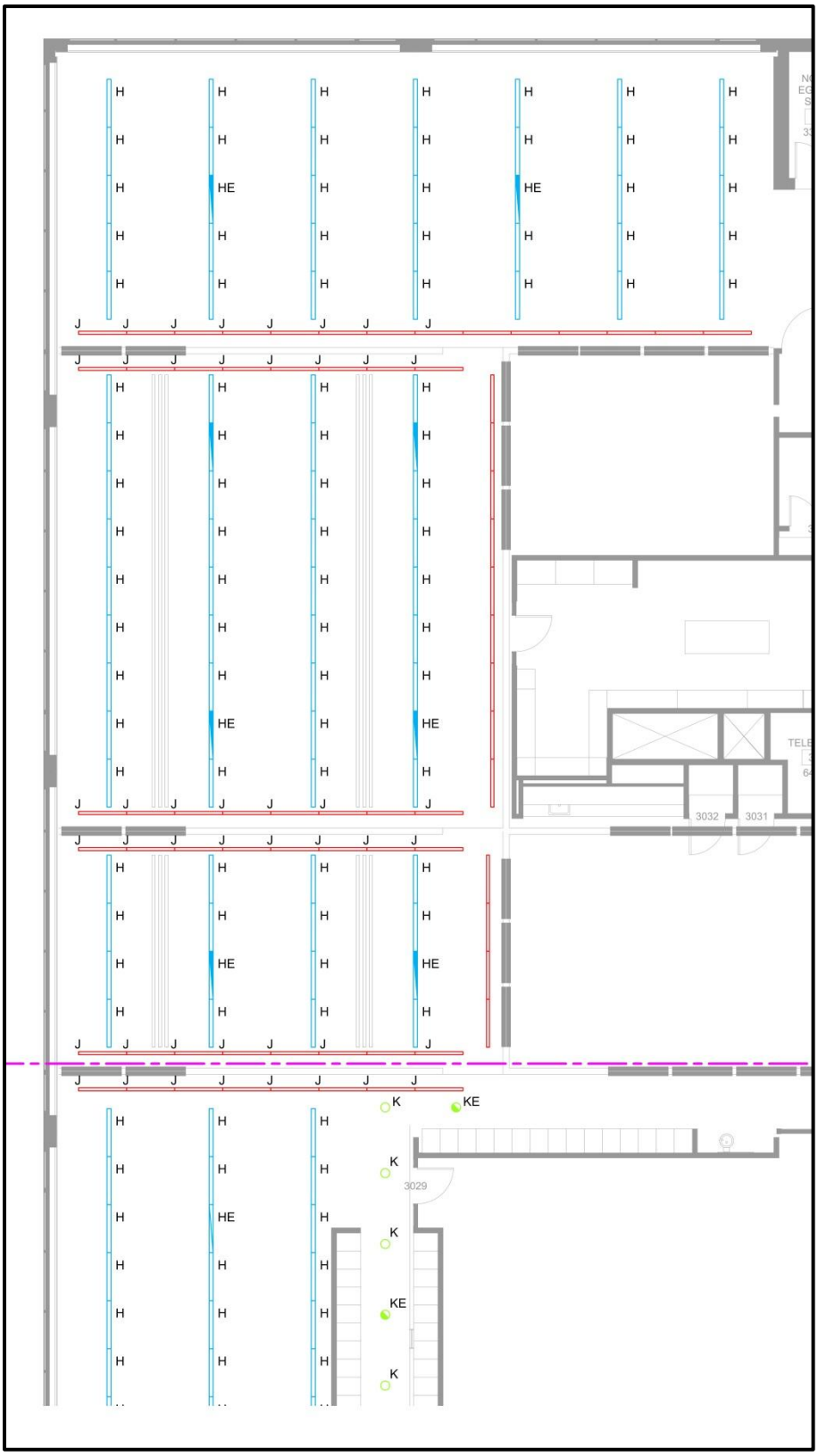


Figure 20: Studio lighting plan

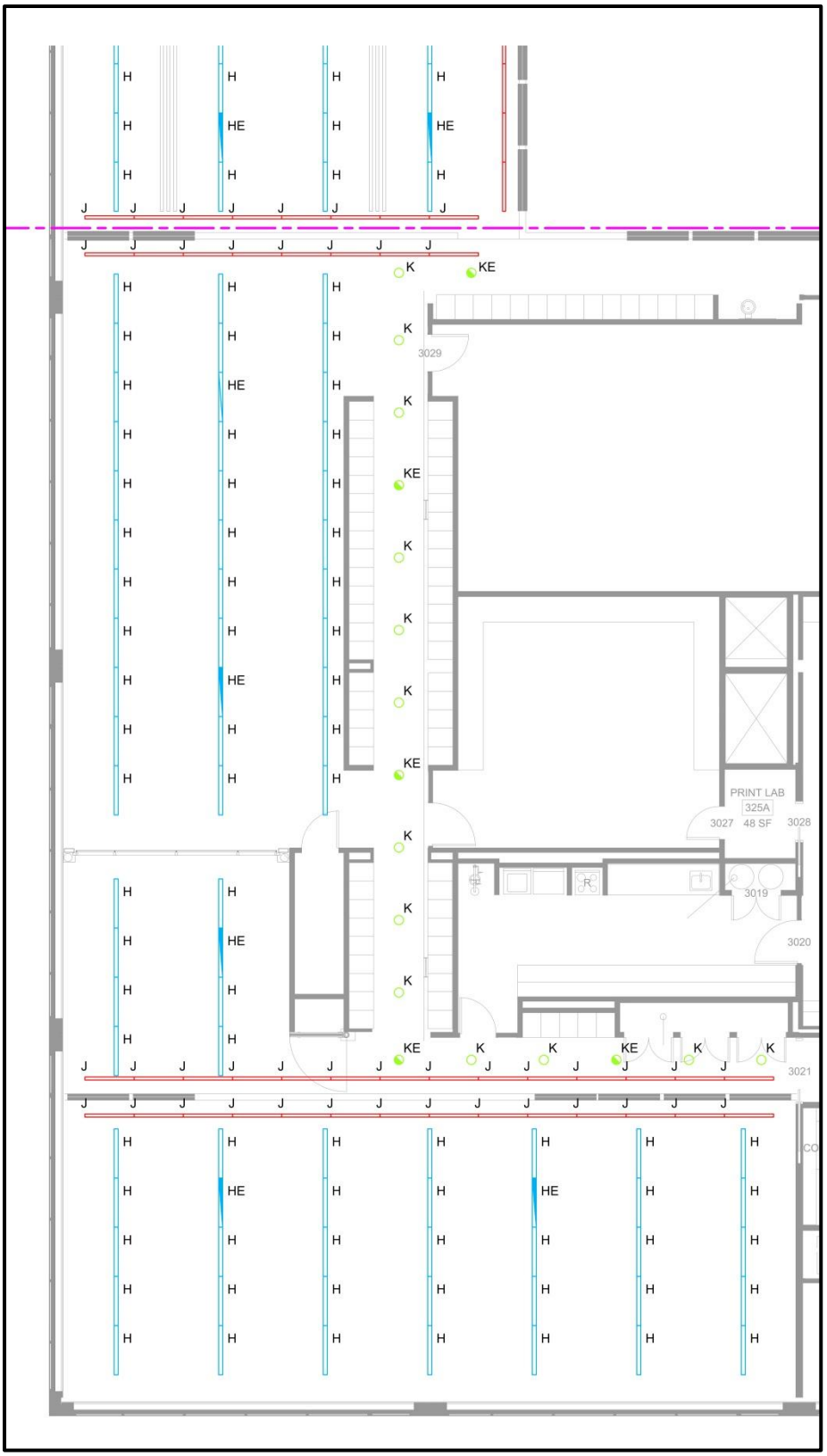


Figure 21: Studio Lighting Plan

Renderings

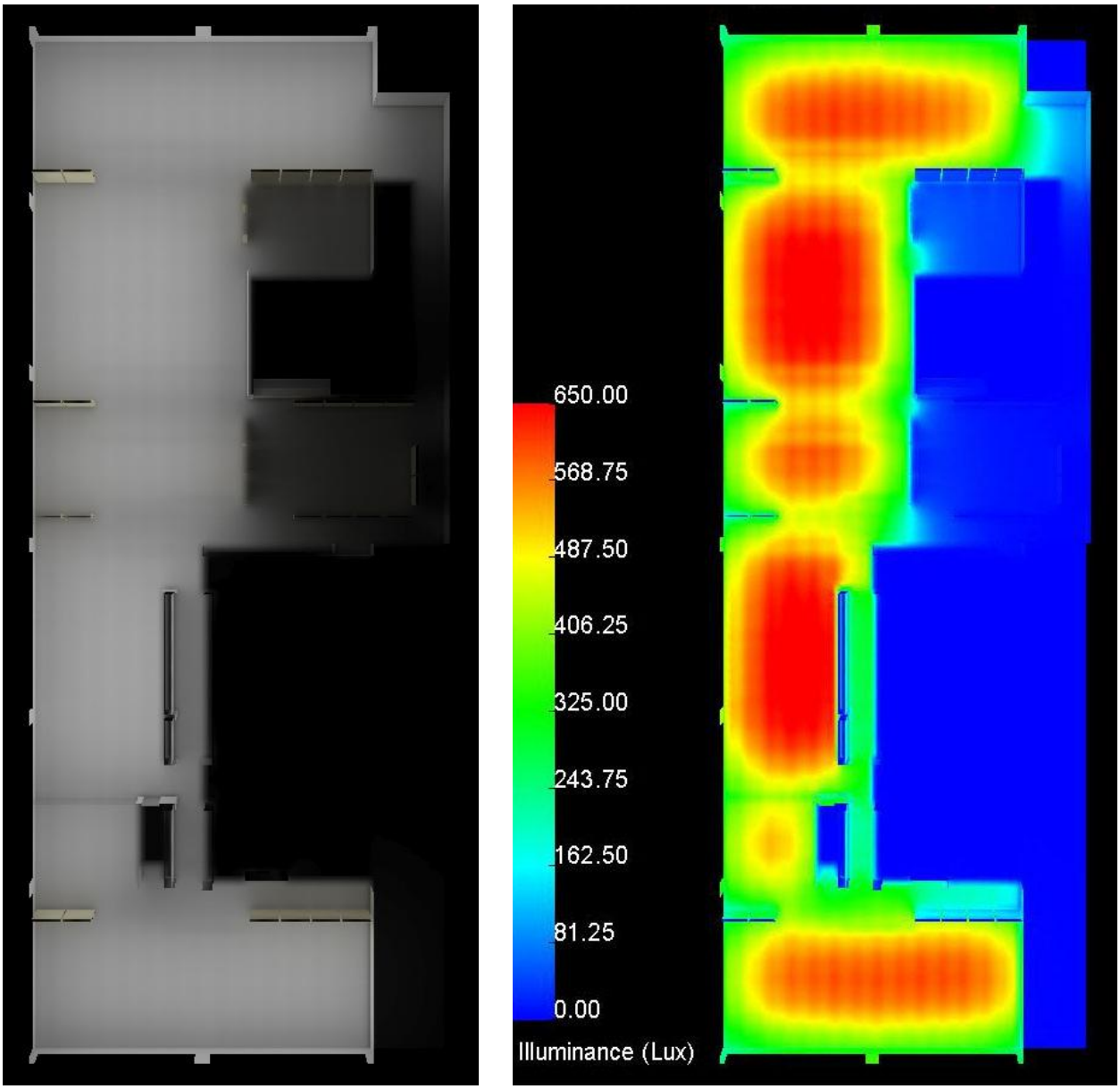


Figure 22: Studio pseudo rendering (daytime) | Aerial view

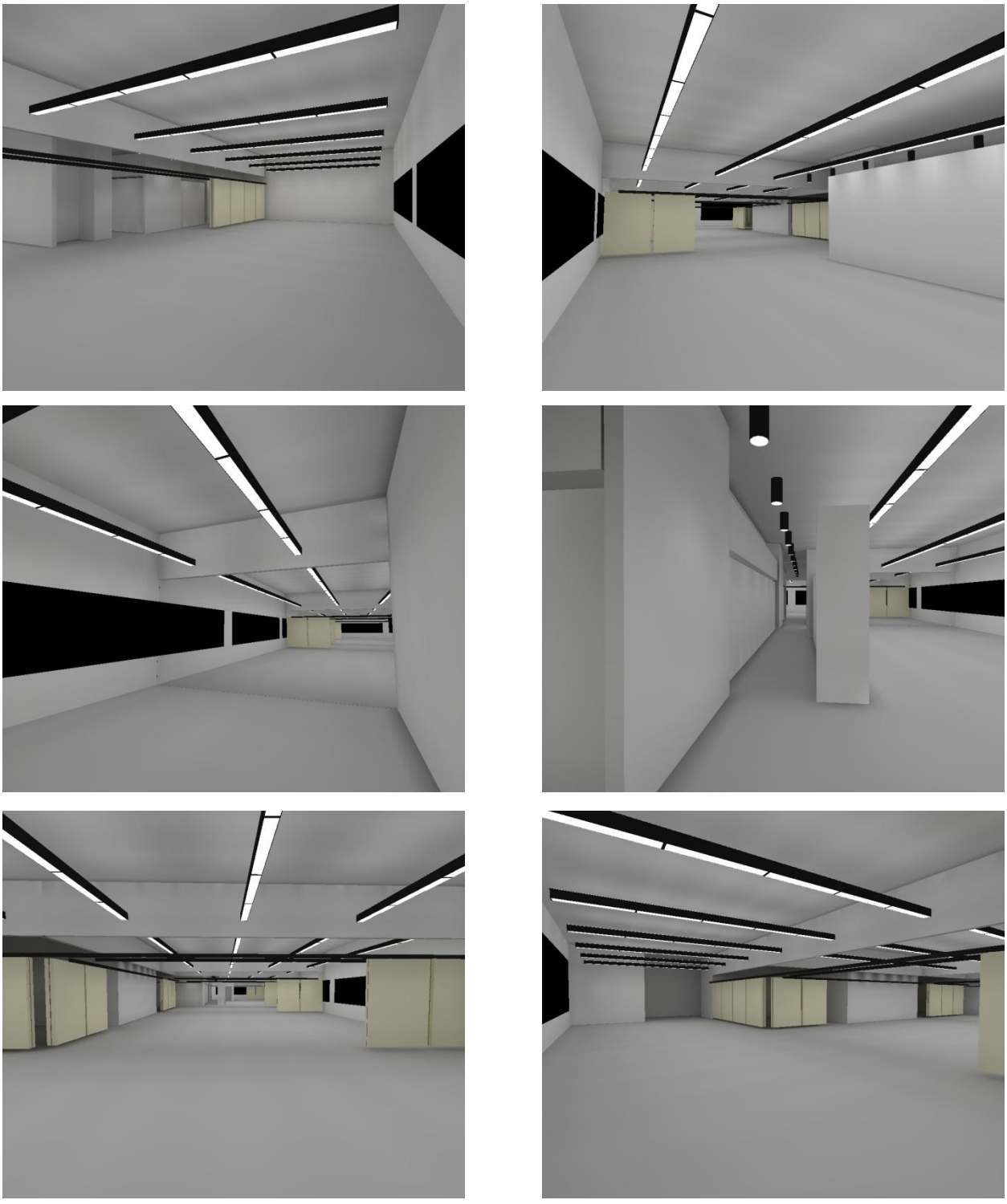


Figure 23: Renderings of various viewpoints throughout studio

Calculation Summary

Figure 24: Illuminance isoline overlay on studio rendering

Illuminance Summary		
Calculation	**Horizontal at 0' (lux)**	**Target**
Average Illuminance	535	500
Maximum Illuminance	719	--
Minimum Illuminance	229	--
Avg./Min	2.33	3

Table 17: Studio illuminance summary

Power Density			
Luminaire	**Watts/Luminaire**	**Quantity**	**Total Watts/Luminaire Type**
G	56.5	163	9210
H	30	95	2850
J	20.8	18	374
		Total Watts	12434
		Area (ft²)	7846
		LPD	**1.58**

Table 18: Studio lighting power density | Toal

9.6.2 | Additional Interior Lighting Power

For spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance or for highlighting art or exhibits, provided that the additional lighting power shall not exceed 1.0 W/ft^2 of such spaces.

Power Density			
Luminaire	**Watts/Luminaire**	**Quantity**	**Total Watts/Luminaire Type**
J	30	95	2850
		Total Watts	2850
		Area (ft²)	7846
		LPD	**0.36**

Table 19: Studio lighting power density | Art highlighting

- **LPD (W/ft^2) = 1.58 - 0.36 = 1.22**

Evaluation

The linear fluorescent lighting fixtures provided an average illuminance of 535 Lux which was within 10% of our target recommended average illuminance. The space was lit with a very uniform light distribution generating a low Avg./Min. value of 2.33. A theatrical lighting truss was introduced into this space, which gives a feeling as though you are on the runway itself. The truss is fully functional allowing the students to tweak with the lighting so that they can create different lighting scenes specific to the fashion show. The perimeter LED wall-wash fixtures work to accentuate the operable walls, which double as display surfaces for student work. This space saw great benefits in the control aspect. With 270 degrees of glazing and a floor reflectance of 0.47 this space can effectively reduce its lighting load throughout the day with daylight harvesting. Photosensors combined with the Lutron EcoSystem will save this space up to 40% in energy usage. Overall the design criterion for this space was met with the lighting solution provided.

EXTERIOR SPACE | ANNEX PATIO & FAÇADE

Description

The URBN Center Annex is located directly behind the URBN Center across Filbert Street. This space is primarily used as a transition space from the URBN Center to the URBN Center Annex. Due to the nature of this building, in that it houses a black box theater, an art gallery, and a large screening room, it is sure to attract attention on special event nights. My lighting design will focus on these specific nights and therefore my design will need to draw attention to the main entrance and provide a sense of security for the occupants. Furthermore I want to reinforce the goal of connection, in particular with the community surrounding this space.

Area (ft^2)	Length (ft)	Width (ft)	Ceiling Height (ft)
5494	53	20	--

Table 20: Exterior dimensions

Location/Orientation

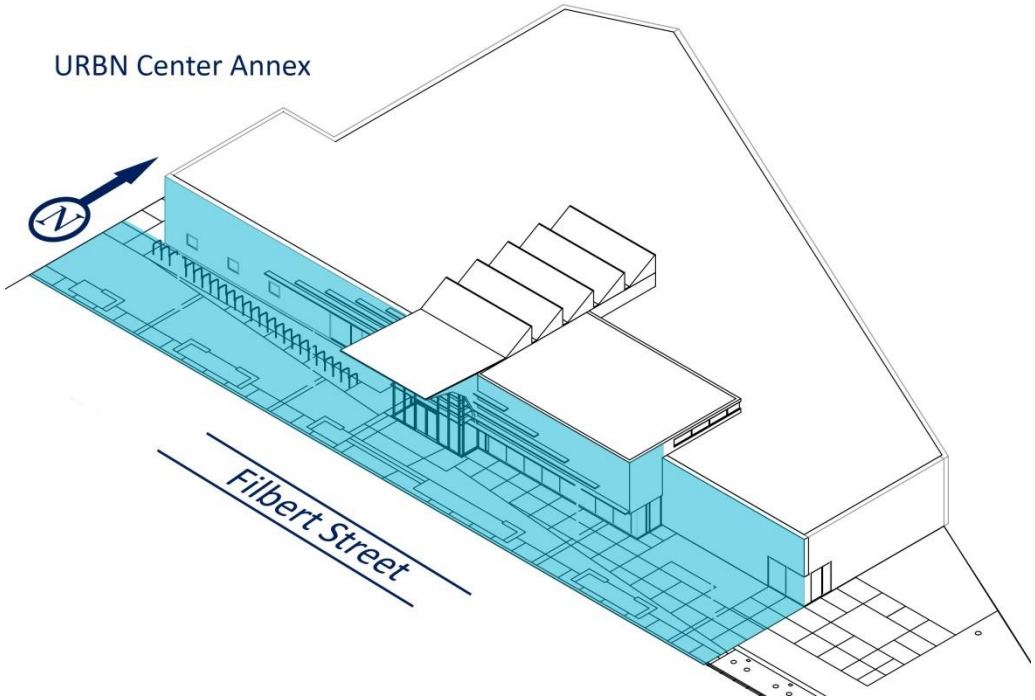


Figure 25: Location of gallery on first floor

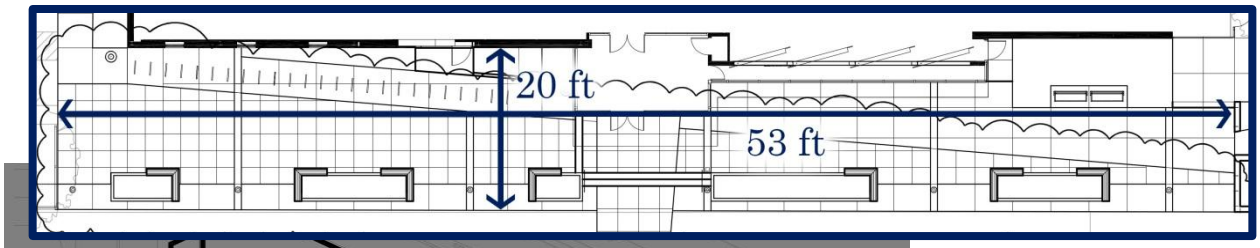


Figure 26B: Enlarged exterior plan

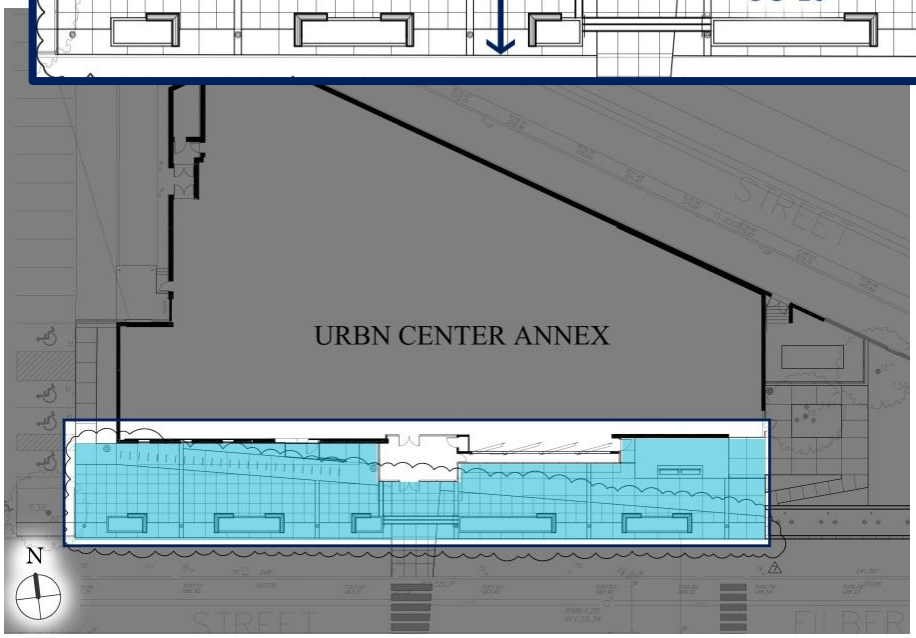


Figure 26A: Orientation of exterior to URBN Center Annex

Materials & Finishes

The surfaces of the Annex's patio and façade consist of factory-formed metal composite wall panels, existing terra cotta brick, and a store front aluminum framed glazing system. The patio is all concrete with raised flower beds. Just beyond the storefront glass west of the main entrance is a wall a with GWB finish creating a small plenum on which posters will be placed on.

MATERIALS/FINISHES					
Type	**Location**	**Description**	**Manufacturer**	**Color**	**Reflectance**
Glazed Aluminum Curtain Wall	Annex South Façade	Conventioanally glazed aluminum curtain walls | 2.5' X 2.25' Frame size | Insulated glazing	EFCO	--	--
Exterior Metal Wall Panels	Annex South Façade	Metal composite wall systems | Thickness: 4mm	Centria Architectural Systems	Chromium Gray	0.70
Existing Brick on CMU	Annex South Façade (West)	Terra cotta glazed brick	--	--	0.26
Cast-in-Place Concrete	Floor	Exposed concret			0.38
Aluminum-Framed Entrances and Storefronts	Entrance Door	Storefront framing			0.90
Type	**Location**	**Description**	**Manufacturer**	**Color**	**Transmittance**
Exterior glazing	Exterior curtain walls and doors	1" Insulated float glass | Tempered Glass	Viracon	Clear	0.72

Table 21: Exterior materials/finishes

Tasks/Activities

The patio and façade of the Annex will primarily serve as a transition space from the URBN Center to the URBN Center Annex. This space will also have to accompany the public and the ones who observe the fine arts. On special event nights, people will meet outside throughout this space before heading on in. When the occupants have arrived the goal is attract them to the main entrance, draw them together, while maintaining a sense of security along the way.

Overall Design Goals

Overall the goal for this space is to assemble a lighting design that embraces the idea of community and collaboration. The building should be a place where, people are not afraid to come together and observe the work of the talented students at Drexel University.

Design Criteria/Considerations

Illuminance Recommendations | IESNA Lighting Handbook 10th Edition

Façade | Details | surface Reflectance ≥ 0.5 |High Activity LZ3

Recommended Maintained Illuminance Targets		
Avg. Horizontal (lux)	Avg. Vertical (lux)	Uniformity Ratio (Hor.)
--	150	--

Table 22: Recommended maintained illuminance targets

Building Entries | Canopied Entries/Exits | High Activity LZ3

Recommended Maintained Illuminance Targets		
Avg. Horizontal | at 0' (lux)	Avg. Vertical (lux)	Uniformity Ratio (Hor.)
30	15	2

Table 23: Recommended maintained illuminance targets

Building Entries | Paths to Curb | High Activity LZ4

Recommended Maintained Illuminance Targets		
Avg. Horizontal | at 0' (lux)	Avg. Vertical (lux)	Uniformity Ratio (Hor.)
10	6	3

Table 24: Recommended maintained illuminance targets

ASHRAE/IESNA 90.1 -2007

Table 9.4.3A | Exterior Lighting Zones

LZ-3

Table 9.4.3B | Individual Lighting Power Allowances for Building Exteriors

Lighting Power Densities	
Type	**LPD (W/ft²)**
Building grounds – Walkways 10 ft. wide or greater	0.16
Building facades	0.15
Building entrances and exits – Entry Canopies	0.4
Type	**LPD (W/linear ft – door width)**
Building entrances and exits – Main Entries	30

Table 25: ASHRAE 90.1 | Table 9.4.3B

Door Width = 7' - 30*7 = 210 Watts

Façade Area = 4,666 ft²

Total Watts Allowed = 210 + (4954*0.15) + (5594*0.16) + (607*0.4) = 2,091 Watts

Appearance of Space and Luminaires

The appearance of the exterior space and its luminaires is very important, due to the nature and design goals of this renovation. The appearance of the luminaires used in this exterior space must maintain the simplistic and tectonic architectural feel. Simple curves and lines accompanied by low profile designs are to be sought after during the design of the exterior lighting.

Color Appearance

The color and appearance of the Annex's façade should identify itself as a place of security and excitement at the same time. In order to have success with this aspect the lighting design will incorporate new and exciting LED wall grazers that will be controllable thought the Lutron EcoSystem.

Direct Glare

Direct glare, which can cause disabling glare, discomfort glare, or even nuisance glare is a high possibility when it comes to outdoor lighting. While trying to provide enough vertical illuminance is important in order to provide a sense of security, it can also produce a lighting affect that is not inviting to the general public.

Modeling of Faces or Objects

As mentioned before, security and safety are at the peak of the criterion for exterior spaces, where people will gather. Therefore the ability to render faces and objects is also an important piece of the puzzle.

Points of Interest

During the special event nights, it will be important to make the main entrance of this structure the main focal point and lighting will be the most effective tool to make this a reality. The redesigned URBN Center Annex features more visible glazing systems, and therefore the highoutput lighting inside will be the overarching focal point. In order to keep this focal point at its peak, the exterior lighting will have generate an exciting design that leads your eye towards this point of interest, while meeting the criterion set forth by IESNA Handbook.

Fixtures/Equipment

Lighting Equipment			
Type		Description	Manufacturer
	N1	4' linear Led grazing fixture with adjustable mount. Extruded aluminum housing with natural anodized aluminum finish.	Winona
	N2	12" linear Led grazing fixture with adjustable mount. Extruded aluminum housing with natural anodized aluminum finish.	Winona
	P	12 V LED decorative sconce. Machined aluminum housing. 'Watershed lens	Winona

Table 26: Exterior luminaire schedule

*Note: For full luminaire schedule including lamp and power source information, see Appendix A.

Lighting Plan

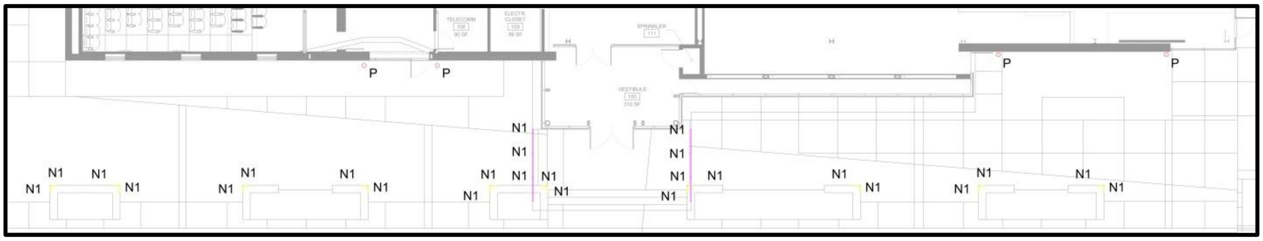


Figure 26: Exterior Site Lighting

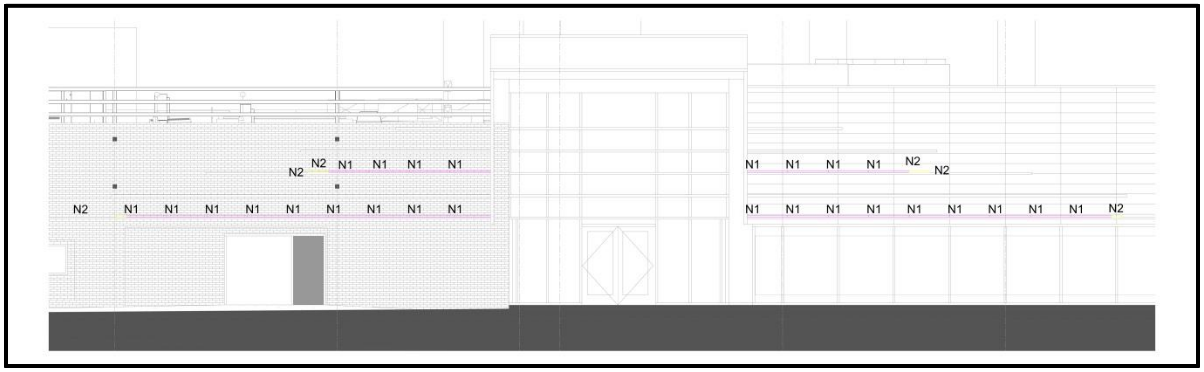


Figure 27: Exterior Site Lighting | Façade (Indirect Lighting)

Light Loss Factors						
Type	Lamp Lumens		LLD	LDD	BF	Total
	Initial	Mean				
N1	--	--	--	--	--	0.70
N2	--	--	--	--	--	0.70
P	--	--	--	--	--	0.70

Table 27: Exterior luminaire light loss factors

*The above light loss factors were calculated using the method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the 2010 IESNA handbook. A luminaire/lamp maintenance schedule of twelve months along with a clean environment (CIE-W Classification) was assumed.

Renderings

Figure 28: Exterior rendering | Aeiral view

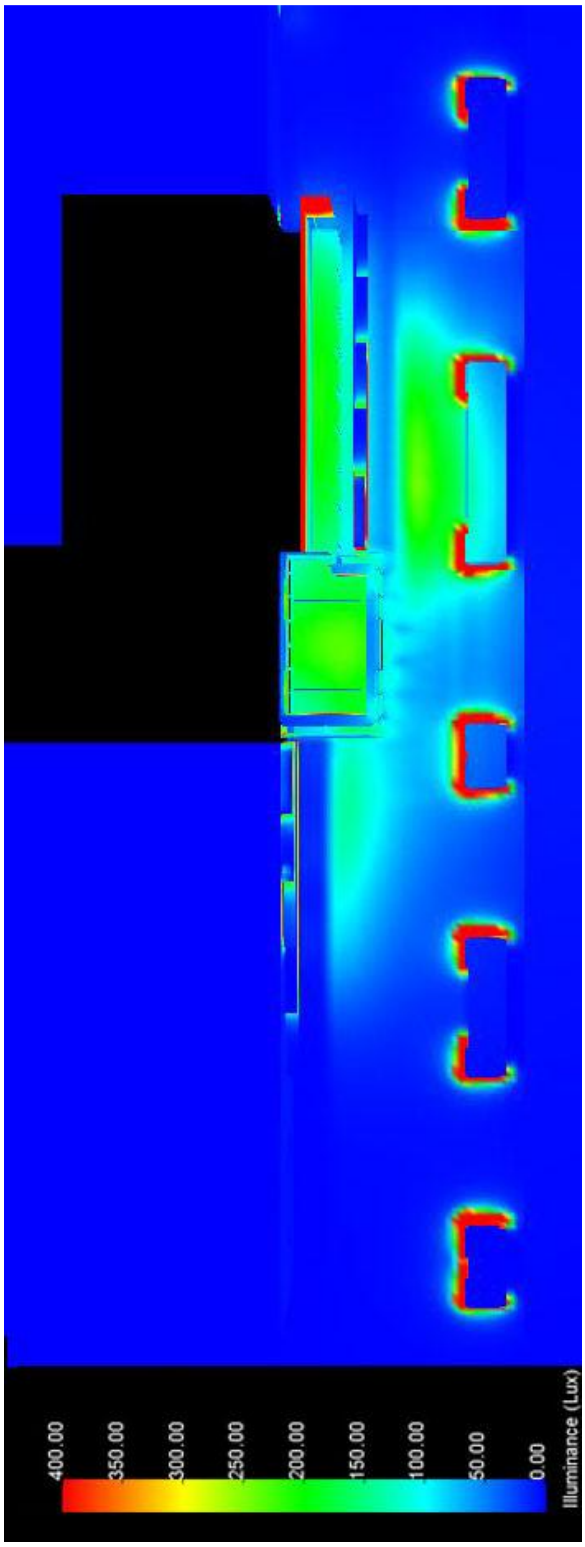
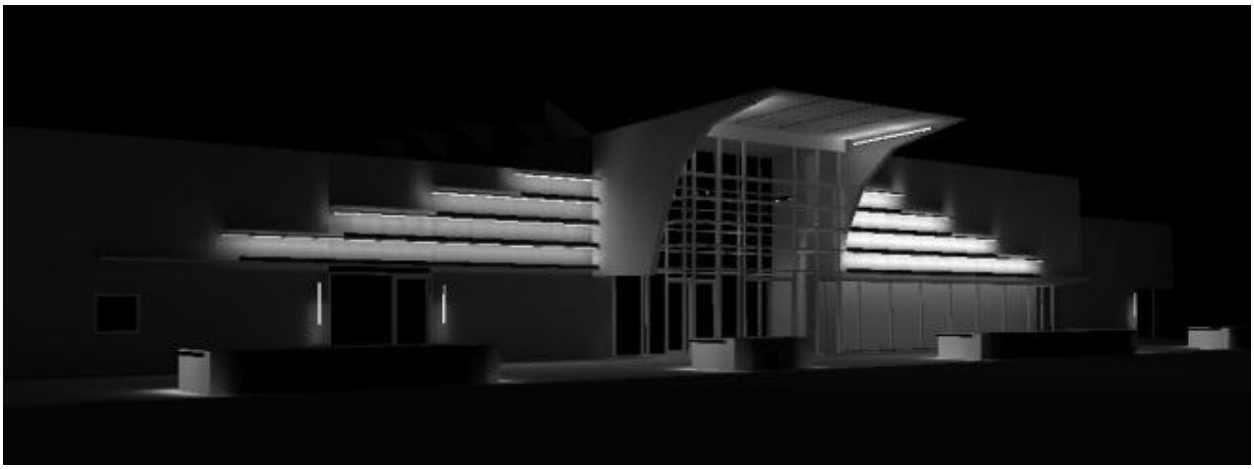
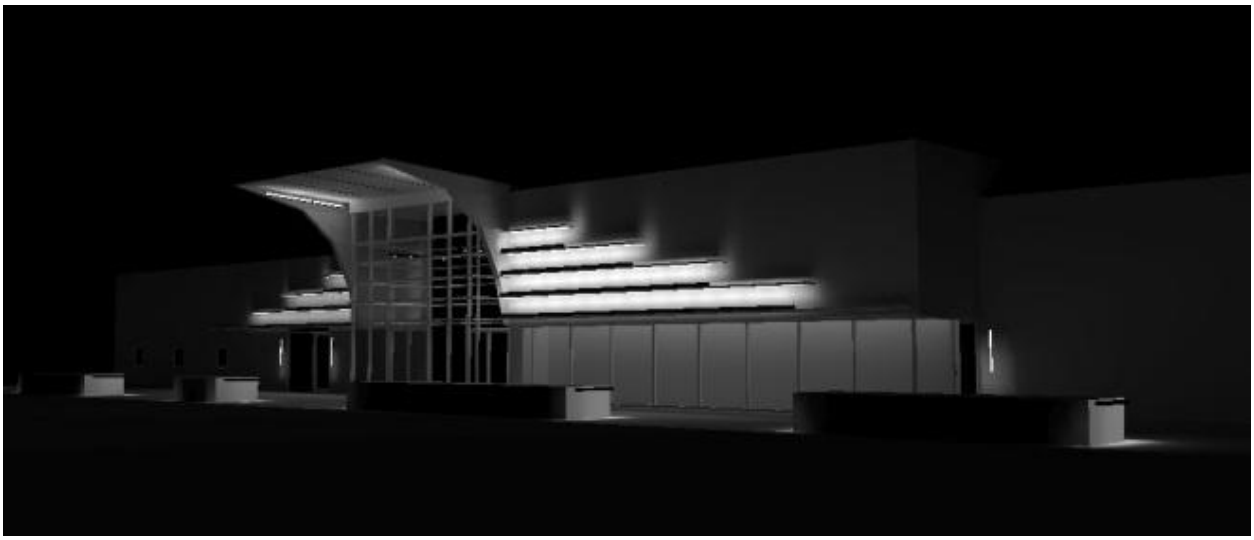
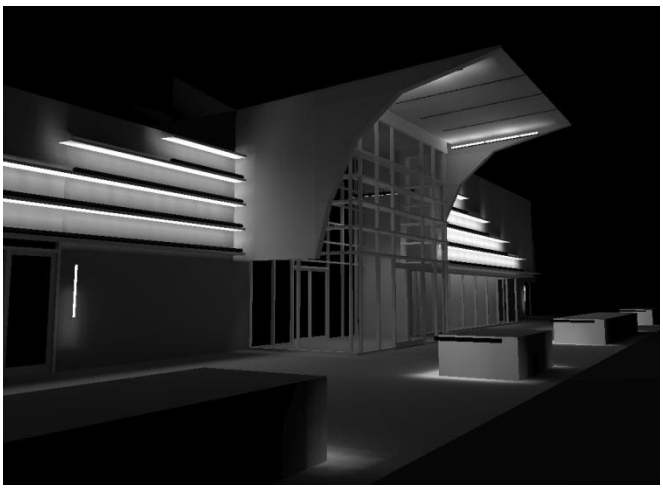


Figure 29: Exterior rendering | Aerial view







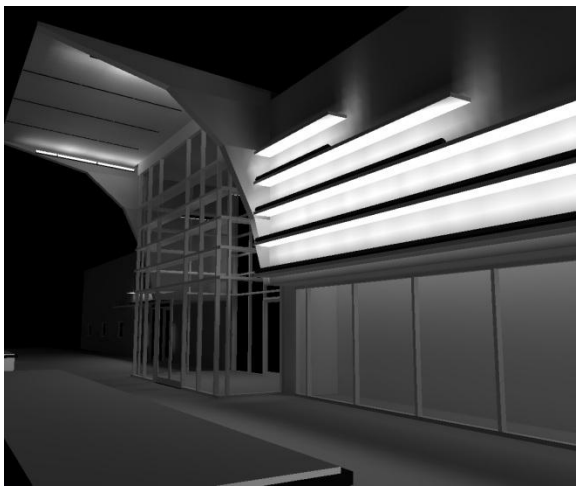


Figure 30: Renderings of the exterior from various viewpoints

Calculation Summary

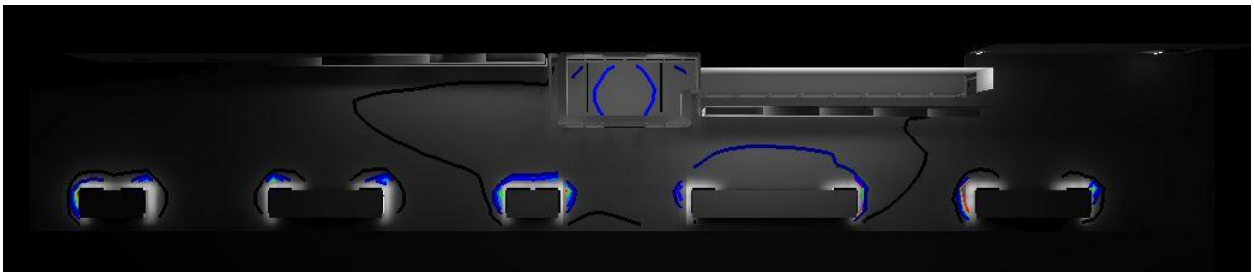


Figure 31: Illuminance isoline overlay on exterior rendering

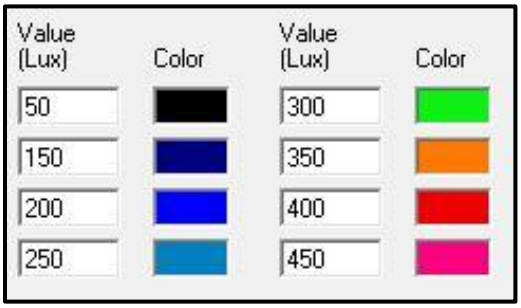


Figure 32: Illuminance value legend

Illuminance Summary | Canopy		
Calculation	**Horizontal at 0' (lux)**	**Target**
Average Illuminance	60	30
Maximum Illuminance	250	--
Minimum Illuminance	25	--
Avg./Min	2.21	2

Table 28: Exterior illuminance summary

Illuminance Summary | Transition		
Calculation	**Horizontal at 0' (lux)**	**Target**
Average Illuminance	45	--
Maximum Illuminance	248	--
Minimum Illuminance	0.3	--
Avg./Min	--	4

Table 29: Exterior illuminance summary

Power Density			
Luminaire	**Watts/Luminaire**	**Quantity**	**Total Watts/Luminaire Type**
N1	30	52	1560.0
N2	15	6	90.0
P	10.5	4	42.0
		Total Watts	2082.0
		Total Watts Allowed	2091.0

Table 30: Exterior lighting power density

Evaluation

The goal for the exterior patio and façade was to create an inviting space that drew people together and provided a sense of security. Again, the scope of the lighting design looks into the lighting design for special event nights only. Therefore this space was treated with a Nighttime Outdoor Lighting zone classification of LZ3. The lighting design produced a high level of illuminance compared to the recommended maintained illuminance. However, the space has become an inviting space, and the LED fixtures kept the LPD below the maximum allowable. The color kinetics 'eColor Graze Powercore' fixture provided this space with close to all of the lighting needs. This fixture projects the light onto the extruding light shelves that wrap around from the vestibule to the surrounding façade. The decorative sconce only had to fill in the spaces that did not acquire sufficient lighting. Looking at the space, your eye is immediately drawn to the main entrance. All of the lighting for the exterior space uses the other surfaces to bounce the light off of. The visibility of all the fixtures is close to zero. The idea of drawing people together has been accomplished through this indirect lighting design.

SPECIAL PURPOSE SPACE | PEARSTEIN ART GALLERY

Description

The Pearlstein Gallery is located on the East side of the URBN Center Annex's ground floor. The space also exhibits maneuvering architectural features that help keep the art gallery exciting and captivating. Large exposed steel members allow for a floor to ceiling height of 16.5 feet in the West section and in the far east section of the gallery the ceiling reaches up to 20 feet. The exposed ceiling and steel framing gives a tectonic and modern feel to the architecture. The south wall incorporates four pivoting walls that open up to a tall vestibule composed of all storefront framing. This feature allows for indirect daylight to enter the space.

Area (ft^2)	Length (ft)	Width (ft)	Ceiling Height (ft)
4,302	69	88	16.5

Table 31: Gallery dimensions

Location/Orientation

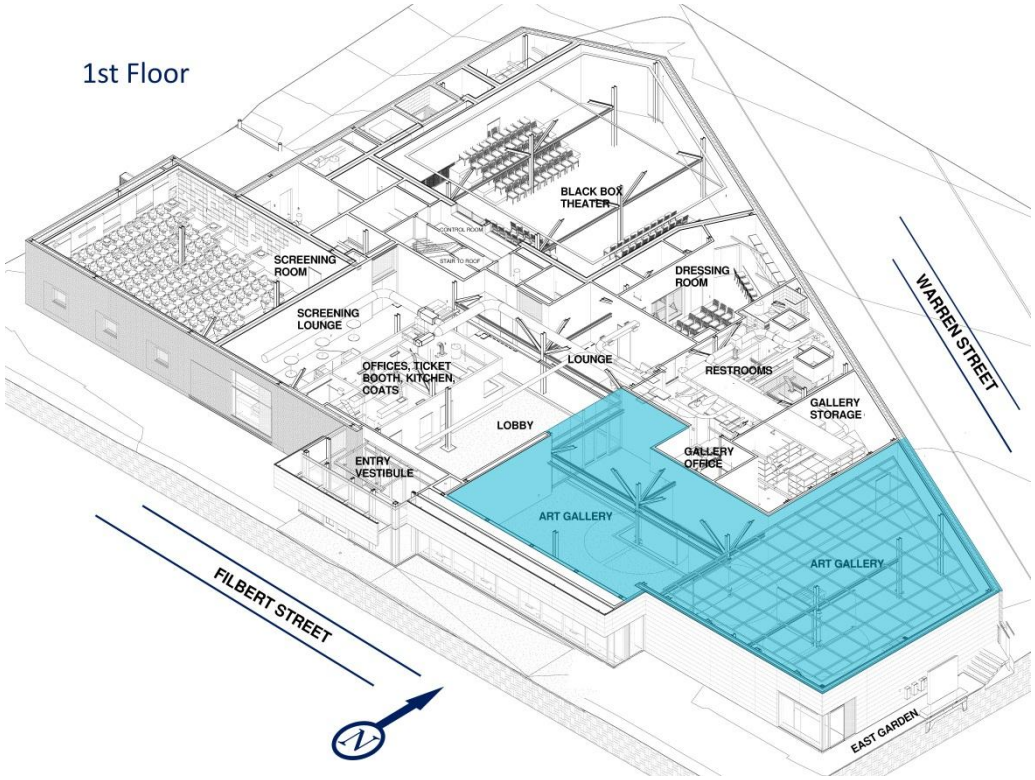


Figure 33: Location of gallery on first floor

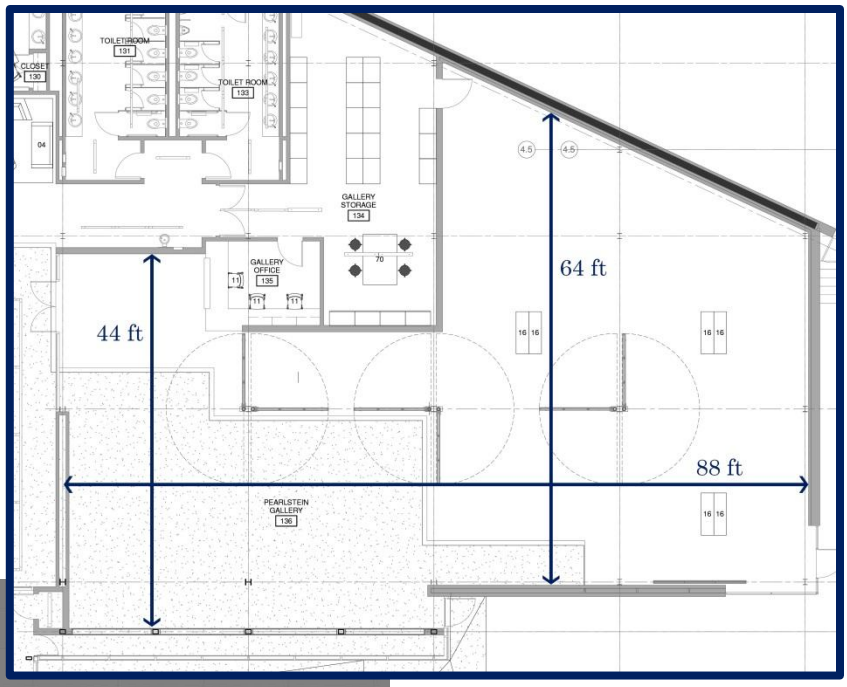


Figure34B: Enlarged gallery plan

Figure 34A: Orientation of gallery to first floor plan

Materials & Finishes

Similar to most of the architecture in the URBN Center and URBN Center Annex, the finishes throughout the gallery include gypsum wall board and storefront glass partitions along with an exposed ceiling and polished concrete floor. Large diagonal steel members cut through the upper plenum of the space. Furthermore this space, like many, incorporates operable walls (rotating) that function as display surfaces. The surface of these operable walls is GWB, unlike most of the operable walls used on this project, providing a clean look.

MATERIALS/FINISHES					
Type	**Location**	**Description**	**Manufacturer**	**Color**	**Reflectance**
Gypsum Wall Board	Partitions	Main paint finish | Eggshell/Satin Latex Paint	Benjamin Moore	Decorators White	0.85
Gypsum Wall Board	Partitions	Eggshell/Satin Latex Paint	Benjamin Moore, Affinity Colors	Gray Owl	0.60
Cast-in-Place Concrete	Floor	Exposed concrete | Floor seal SL-1	--	--	--
Existing Concrete	Floor	Burnished treated | Level 2 polished concrete - 800 Sheen	--	--	0.47
Metal Wall Panels	North Egress Stairs	Factory formed, single skin, face-fastened metal wall, liner, and soffit panels | Thickness: 0.8 mm	Rheinzink	Blue-Bray	--
Type	**Location**	**Description**	**Manufacturer**	**Color**	**Transmittance**
Interior glazing	Above partitions and operable walls | Storefront	1/4" Clear float glass | Glass access panels	Viracon	Clear	0.91
Exterior glazing	Exterior curtain walls	1" Insulated float glass | Tempered Glass	Viracon	Clear	0.72

Table 32: Gallery materials/finishes

Tasks/Activities

The gallery will serve as place where occupants can come, relax, and observe art work. The observers will stroll around the gallery stopping as they please to study a specific piece of art.

Overall Design Goals

Designing a flexible track lighting system that can accommodate any layout that the exhibit might

Design Criteria/Considerations

Illuminance Recommendations | IESNA Lighting Handbook 10th Edition

Lighting for Art | Exhibits and Galleries | Circulation/General | Subdued Focals | Object Reflectance ≥ 0.5

Recommended Maintained Illuminance Targets		
Avg. Horizontal | at 0' (lux)	**Avg. Vertical | (lux)**	**Uniformity Ratio (Hor.)**
Avg ≥ 0.5 times object E_h	Avg ≥ 0.5 times object E_v	2

Table 33: Recommended maintained illuminance targets

Lighting for Art | Exhibits and Galleries | Objects (Reflectance ≥ 0.5) | Low Sensitivity to Light

Recommended Maintained Illuminance Targets		
Avg. Horizontal (lux)	**Avg. Horizontal (lux)**	**Uniformity Ratio (Hor.)**
200	200	2

Table 34: Recommended maintained illuminance targets

Lighting for Art | Exhibits and Galleries | Objects (Reflectance ≥ 0.5) | No Sensitivity to Light

Recommended Maintained Illuminance Targets		
Avg. Horizontal (lux)	**Avg. Horizontal (lux)**	**Uniformity Ratio (Hor.)**
1000	1000	2

Table 35: Recommended maintained illuminance targets

ASHRAE/IESNA 90.1 -2007

Table 9.6.1 | Space-by-Space Method

Lighting Power Densities	
Common Space Type	**LPD (W/ft2)**
Museum - General Exhibition	1.05

Table 36: ASHRAE 90.1 | Table 9.6.1

Color Appearance (and Color Contrast)

It is obvious that color rendering is

Daylight Integration and Control

The control of daylight is crucial in the design studio. The studio is exposed to exterior glazing to the North, West, and South. Proper shades integrated with photosensors will have to be deployed in this environment. The electric lights will have to be dimmed to assure adequate lighting levels are maintained during typical weather changes.

Source/Task/Eye Geometry

It is vital that the geometrical coordination between the viewer's eye, task, and light source be set up in such a way that veiling reflections are reduced to a minimum.

Ambient/Circulation Lighting

The ambient lighting in an art gallery should create a background, on which the objects and displays will coincide. Focal points throughout the space can be magnified through the act of dimming the ambient light. This technique reduces increases the contrast between the background and the point of interest, the artwork, and deliver a more dramatic affect.

Accent Lighting

Accenting is a great way to induce attraction upon the viewer and can therefore be utilized to help guide the occupants through the gallery. The brightness perception of the occupants can be optimized to positively reduce visual strain and discomfort glare through different lighting techniques. Focal points come in to play when deigning accent lighting for a specific space. This layer of light is the final touch on a lighting design that can make or break the final outcome. Accent lighting has to be carefully and thoroughly planed out and take into concern the damaging effects of light. The next section describes the importance of damaging light.

Preservation Worthy Artwork

The design and control of optical radiation becomes a substantial aspect when objects within the space are deemed preservation-worthy. Exposure to visible and UV radiation can deteriorate specific materials causing harm to the art pieces.

Veiling Reflections

Objects with specular components are prone to veiling reflections. Along with that, display lighting will be affected by positioning of the displays and should take into account the different viewing positions from which occupants will generally be viewing from. Delivering light from specific points where the refracted light is directs away from viewing positions is key to satisfactory results.

Lamping

The CRI level of the lamps being utilized in the gallery should be greater than or equal to the value of 85. If the UV radiation exceeds 75 W/lumen bellow 400 nm then a filtering system should be integrated into the design.

Fixtures/Equipment

Lighting Equipment				
Type			Description	Manufacturer
		C	12" linear LED cove fixture. Dark-gray injected-molded plastic housing with clear polycarbonate lens.	Color Kinetics
		HE	4' linear fluorescent pendant fixture. Extruded die-cast aluminum housing. Formed steel reflectors with white finish. Prismatic virgin acrylic lenses with exterior longitudinal prisms.	Peerless
		L	15 watt LED track fixture. 20, 40, 60 degree beam interchangable reflectors. Machined cylindrical aluminum housing.	Bruck
		M	Decorative 3 watt LED pendant track fixture. Brushed aluminum finish.	Bruck

Table 37: Gallery luminaire schedule

*Note: For full luminaire schedule including lamp and power source information, see Appendix A.

Lighting Plan

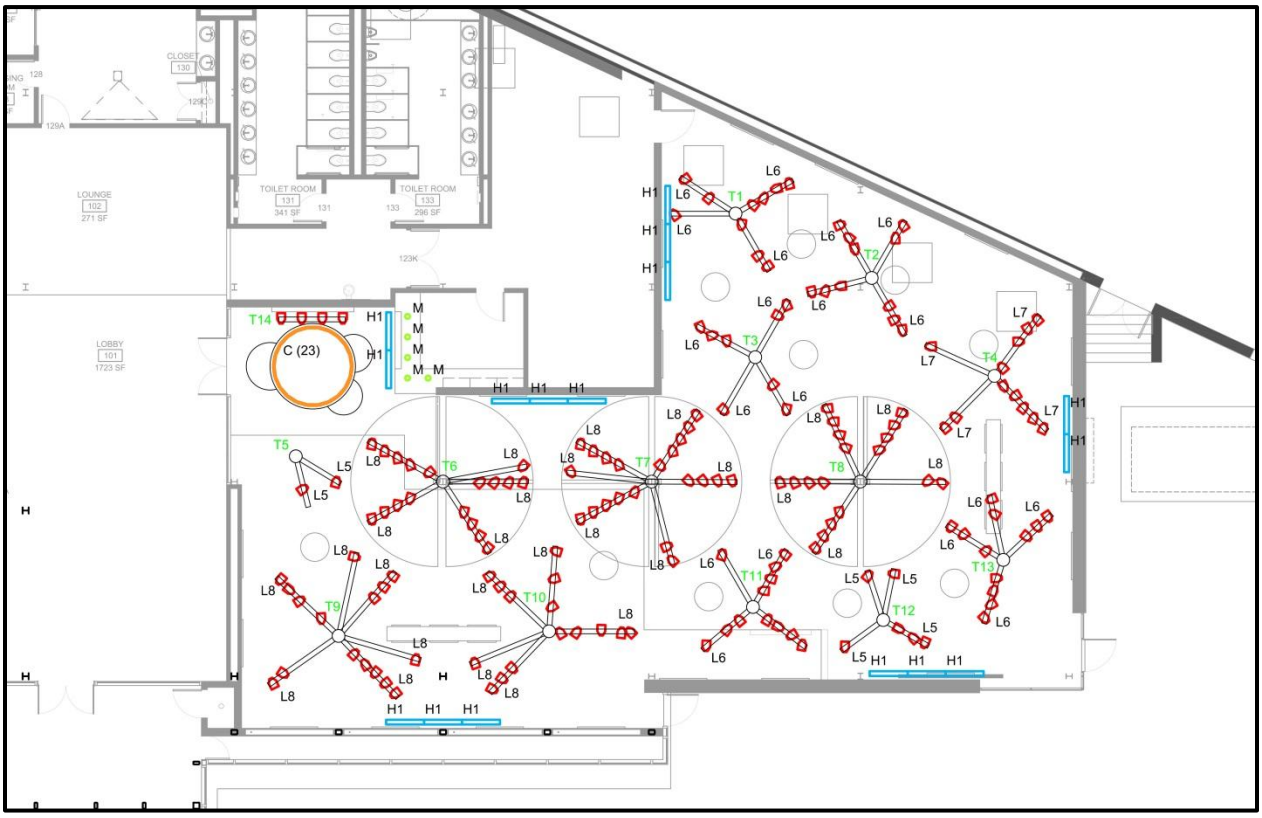


Figure 34: Gallery Lighting Plan

Light Loss Factors						
Type	Lamp Lumens		LLD	LDD	BF	Total
	Initial	Mean				
C	--	--	--	--	--	0.7
HE	2600	2420	0.930769	0.94	1	0.874923
L	--	--	--	--	--	0.7
M	--	--	--	--	--	0.7

Table 38: Gallery luminaire light loss factors

*The above light loss factors were calculated using the method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the 2010 IESNA handbook. A luminaire/lamp maintenance schedule of twelve months along with a clean environment (CIE-W Classification) was assumed.

Renderings

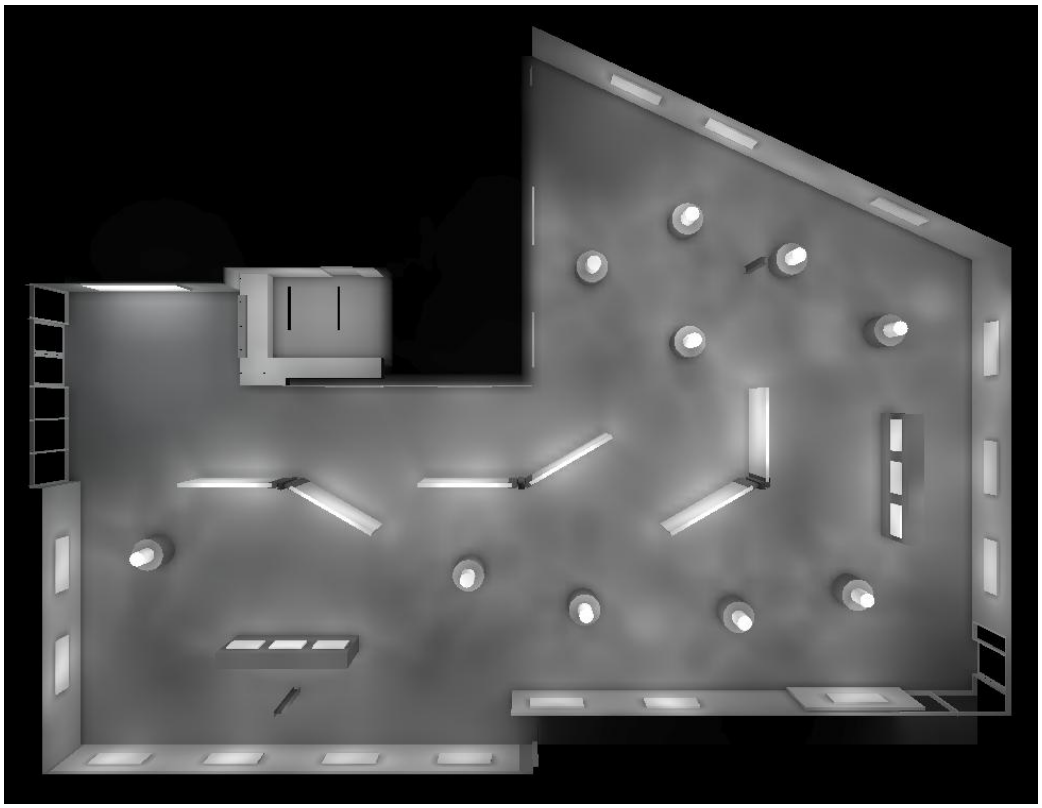


Figure 35: Gallery rendering (daytime) | Aeiral view

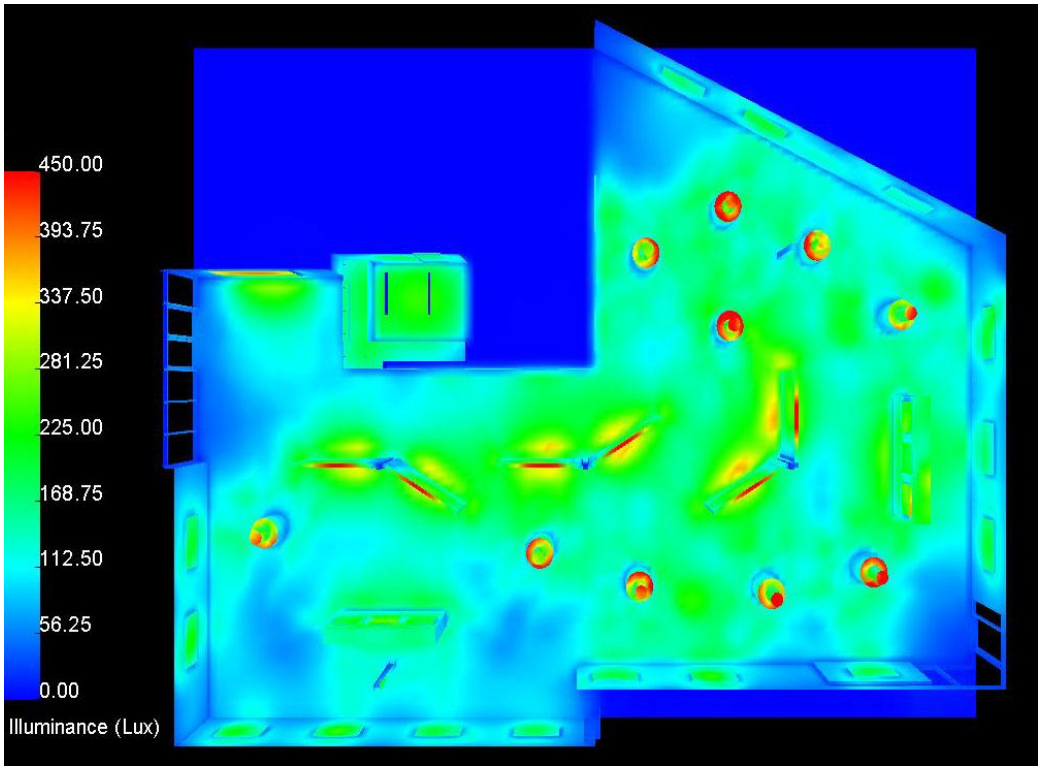


Figure 36: Gallery rendering (daytime) | Aerial view

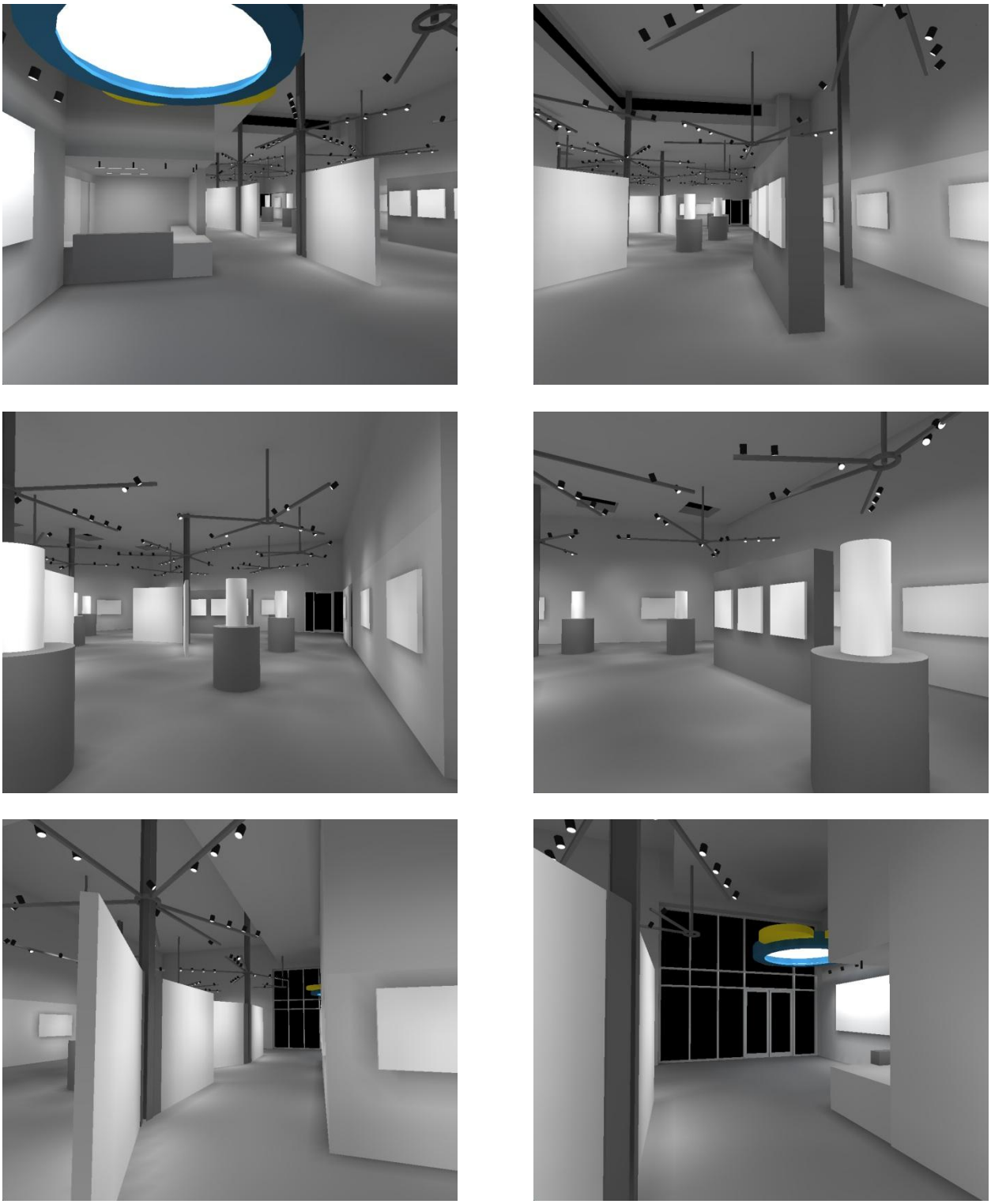


Figure 37 Renderings of various viewpoints throughout gallery (day)

Calculation Summary

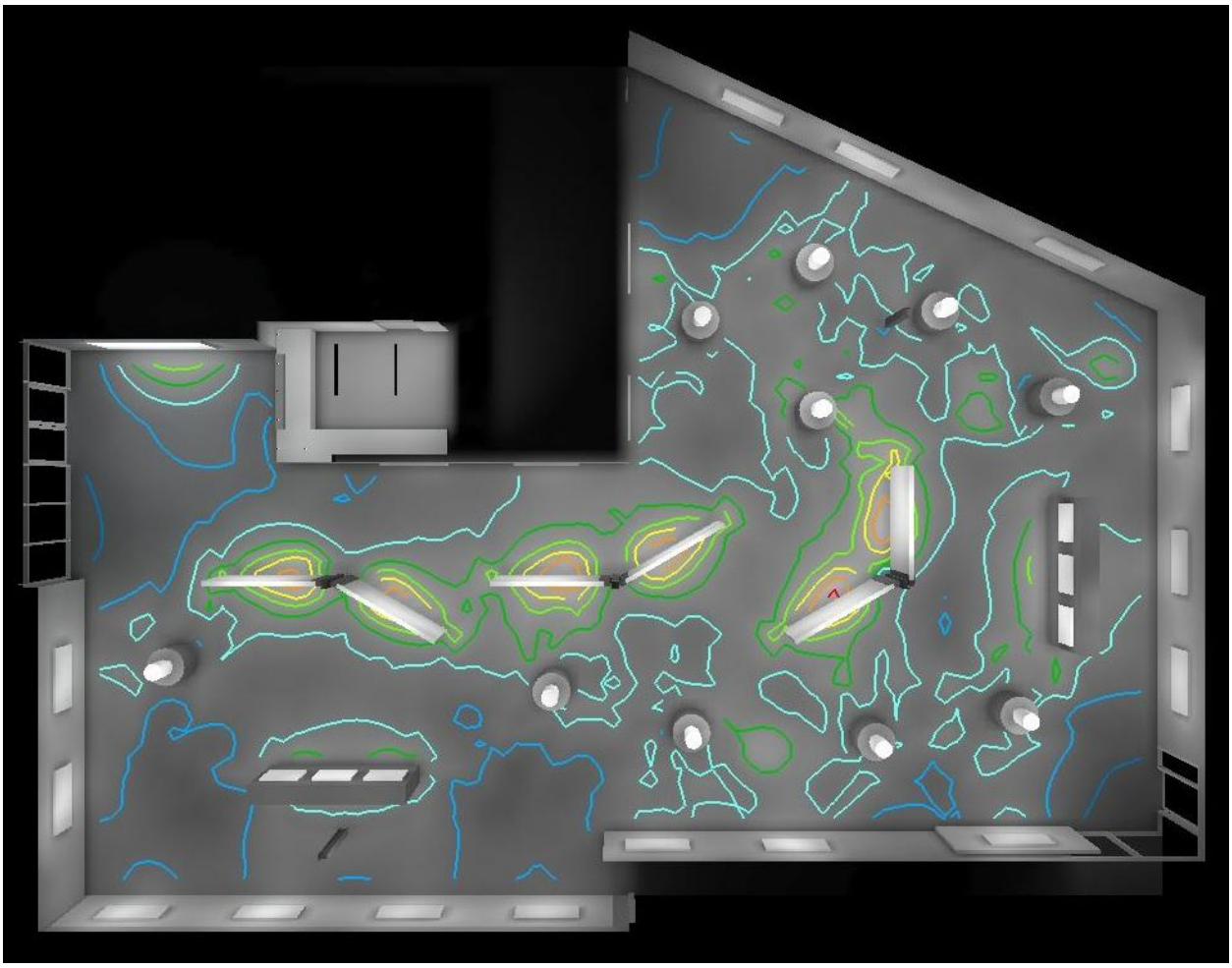


Figure 38: Illuminance isoline overlay on gallery rendering

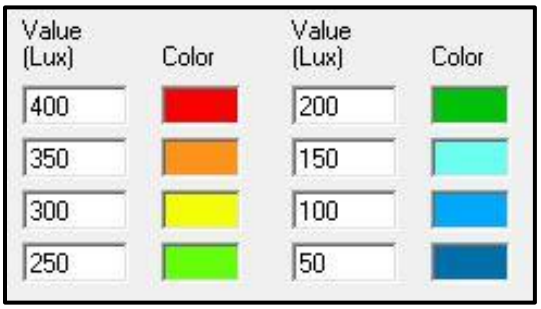


Figure 39: Illuminance value legend

Illuminance Summary		
Calculation	**Horizontal at 0' (lux)**	**Target**
Average Illuminance	148	100
Maximum Illuminance	421	--
Minimum Illuminance	36.7	--
Avg./Min	4	4

Table 39: Gallery illuminance summary

Power Density			
Luminaire	**Watts/Luminaire**	**Quantity**	**Total Watts/Luminaire Type**
C	12.5	23	287.5
HE	56.5	16	904.0
M	3	5	15.0
Luminaire	**Watts/Power Feed**	**Quantity**	**Total Watts/Luminaire Type**
L	--	13	4080.0
		Total Watts	4382.5
		Area (ft²)	4302.0
		LPD	**1.02**

Table 40: Gallery lighting power density

Evaluation

The Pearlstein Gallery proved to be the most exciting space to light in this report. The space was at first difficult to get a feel for, but the final result seems to be a great fit. This space was given an arbitrary/random exhibit and then from there the lighting design was put to the test. The radial track system that was designed reduced the total amount of track by 42% and was still able to provide a custom lighting layout that served its purpose by producing an illuminance on each and every object of up to 50 Lux. The fixtures in this space were chosen to reflect the clean simplistic look of the surrounding architecture. This space has also met the required power allowance provided by AHRAE 90.1. A lighting feature in this space can also be found in the lighting design for the lobby. The inverted cove drop pod located at the entrance of the gallery served as a point where people, students, or the public can meet up before shuffling about the exhibit space.

Electrical Depth

Introduction

The URBN Center makes use of a radial electrical system. A single 13.2 kV service located in the main electrical room provide power to the URBN Center. This service is then split and delivered to three different medium voltage service switchboards all located in the main electrical room on the North side of the first floor. Two of these switch boards are delivered 480Y/277V power for the lighting, fire pump controller, and HVAC systems. The last medium voltage service switchboard provides power to the receptacles.

Branch Circuit Distribution

The lighting loads for the four spaces, that have had their lighting systems reconfigured, will be calculated in this section. These loads will be divided up into smaller loads and then be assigned to a specific branch circuits. The branch circuits will then be sized. The following table outlines which panels have been affected by the lighting redesign.

Short Circuit Analysis

A short circuit analysis will be conducted between the medium voltage switchgear, supplying the lighting circuit panels pertaining to the redesigned lighting systems.

Modified Panelboards						
Panel Tag	**Voltage**	**Normal/Emergency**	**Lobby**	**Studio**	**Exterior**	**Gallery**
LP-11	277/480Y	Normal	X			
LP-31	277/480Y	Normal		X		
LP-1	120/208Y	Normal			X	
RP-12	277/480Y	Normal				X
ELP-12	277/480Y	Emergency	X			
ELP-32	277/480Y	Emergency		X		
ELP-1	277/480Y	Emergency			X	X

CIRCULATION SPACE | MAIN LOBBY

Electrical Redesign

Normal Power

Like all of the lighting panels in the URBN Center, Panelboard LP-11 is served from a medium sized switchboard located in the electrical room on the south side of the URBN Center on the first floor. The panelboard is protected with a 150A circuit breaker and has a A.I.C. rating of 25 kAIC. The new lighting design has decreased the lighting load within the lobby, using over 90% of the load to power energy efficient LED type fixtures. Below is a table out lining the load calculations for the lighting load in the lobby.

Normal Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
A1	5	277	0.39	108.03	135.04	0.675
A2	4	277	0.39	108.03	135.04	0.540
B	4	277	0.39	108.03	135.04	0.540
C	40	277	0.05	12.63	15.79	0.632
D	4	277	0.14	39.89	49.86	0.199
F	34	277	0.12	33.24	41.55	1.413
G1	5	277	0.12	33.24	41.55	0.208
G2	6	277	0.09	24.93	31.16	0.187
G3	7	277	0.07	19.39	24.24	0.170
					Total	4.564

The lighting load is now divided up to compensate for the recommended load per circuit. The NEC designates that 3.55 KVA be put on a lighting circuit, running at 277V on 20A circuits. The following tables outline which luminaries are on the same circuit and how much load is on that specific circuit.

CRK 10	
Luminaire Type	**Total kVA**
A1[E]	0.675
A2	0.540
B[E]	0.540
C	0.632
D	0.199
Total	2.587

CRK 12	
Luminaire Type	**Total kVA**
F	1.4127
G2	0.186975
G3	0.1696625
G1	0.20775
Total	1.9770875

Below you can find the panelboard that has been directly affected by the electrical redesign. Panelboard LP11 is located on the first floor in the west electrical closet. The lighting circuits that have been affected are highlighted in blue. The revised panelboard with the new lighting loads integrated into the loads follows after the original panelboard.

Branch Panel: LP11 Revised

Location: Level One West Elec. Closet | Volts: 480/277 Y | A.I.C. Rating: 25 kAIC
Supply From: LMPD | Phases: 3 | Mains Type: MLO
Mounting: Surface | Wires: 4 | Mains Rating: 100 A
Enclosure: Type 1 | MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	LTG. SWITCHED ROOMS	20A	1	2014 2298			1	20A	LTG. SWITCHED ROOMS	2	
	3	LTG. SWITCHED ROOMS	20A	1		3022 3213		1	20A	LTG. SWITCHED ROOMS	4	
	5	LTG. SWITCHED ROOMS	20A	1			2466 1413	1	20A	LTG. SWITCHED ROOMS	6	
	7	LTG. ZONES TZ11, TZ11U, TZ11D	20A	1	3386 500			1	20A	LTG. 1A, TZ1A, TZ1AU, TZ1AD	8	
	9	TMIRP1	45A			11780 2000		1	20A	LTG. GZ11, GZ15, GZ16	10	
	11	--	--	--			12690 2000	1	20A	LTG. GZ12	12	
	13	--	--	--	11340 2000			1	20A	LTG. GZ13	14	
	15	Spare	20A	1		0 2000		1	20A	LTG. GZ14	16	
	17	Spare	20A	1			0 0	1	20A	Spare	18	
	19	Spare	20A	1	0 0			1	20A	Spare	20	
	21	Spare	20A	1		0 0		1	20A	Spare	22	
	23	Spare	20A	1			0 0	1	20A	Spare	24	
	25	Spare	20A	1	0 0			1	20A	Spare	26	
	27	Spare	20A	1		0 0		1	20A	Spare	28	
	29	Spare	20A	1			0 0	1	20A	Spare	30	
	31	Spare	20A	1	0 0			1	20A	Spare	32	
	33	Spare	20A	1		0 0		1	20A	Spare	34	
	35	Spare	20A	1			0 0	1	20A	Spare	36	
	37	Spare	20A	1	0 0			1	20A	Spare	38	
	39	Spare	20A	1		0 0		1	20A	Spare	40	
	41	Spare	20A	1			0 0	1	20A	Spare	42	
				Total Load (VA)	21538	22015	18569					
				Total Amps (A)	78	79	67					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
Lighting	14321	100%	14321	Total conn. Load:	62122
Power	8000	80%	6400	Total Est. Demand:	49369
AV	9450	80%	7560	Total Conn. Current:	75
AV IG	26360	80%	21088	Total Est. Demand Current:	64

Branch Panel: LP11 Revised

Location: Level One West Elec. Close	Volts: 480/277 Y	A.I.C. Rating: 25 kAIC
Supply From: LMPD	Phases: 3	Mains Type: MLO
Mounting: Surface	Wires: 4	Mains Rating: 100 A
Enclosure: Type 1		MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	LTG. SWITCHED ROOMS	20A	1	2014 2298			1	20A	LTG. SWITCHED ROOMS	2	
	3	LTG. SWITCHED ROOMS	20A	1		3022 3213		1	20A	LTG. SWITCHED ROOMS	4	
	5	LTG. SWITCHED ROOMS	20A	1			2466 1413	1	20A	LTG. SWITCHED ROOMS	6	
	7	LTG. ZONES TZ11, TZ11U, TZ11D	20A	1	3386 500			1	20A	LTG. 1A, TZ1A, TZ1AU, TZ1AD	8	
	9	TMIRP1	45A			11780 2587		1	20A	LTG. LOBBY	10	
	11	--	--	--			12690 1977	1	20A	LTG. LOBBY	12	
	13	--	--	--	11340 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	20A	1			0 0	1	20A	Spare	18	
	19	Spare	20A	1	0 0			1	20A	Spare	20	
	21	Spare	20A	1		0 0		1	20A	Spare	22	
	23	Spare	20A	1			0 0	1	20A	Spare	24	
	25	Spare	20A	1	0 0			1	20A	Spare	26	
	27	Spare	20A	1		0 0		1	20A	Spare	28	
	29	Spare	20A	1			0 0	1	20A	Spare	30	
	31	Spare	20A	1	0 0			1	20A	Spare	32	
	33	Spare	20A	1		0 0		1	20A	Spare	34	
	35	Spare	20A	1			0 0	1	20A	Spare	36	
	37	Spare	20A	1	0 0			1	20A	Spare	38	
	39	Spare	20A	1		0 0		1	20A	Spare	40	
	41	Spare	20A	1			0 0	1	20A	Spare	42	
			Total Load (VA)		19538	20602	18546					
			Total Amps (A)		71	74	67					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
Lighting	14321	100%	14321	Total conn. Load:	58686
Power	8000	80%	6400	Total Est. Demand:	49369
AV	9450	80%	7560	Total Conn. Current:	71
AV IG	26360	80%	21088	Total Est. Demand Current:	60

Emergency Power

Emergency Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
A1	4	277	0.39	108.03	135.04	0.540
A2	4	277	0.39	108.03	135.04	0.540
B	4	277	0.39	108.03	135.04	0.540
					Total	1.620

Existing Emergency Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
A1 3'	6	277	0.18	49.86	62.33	0.374
A1 4'	1	277	0.22	60.94	76.18	0.076
					Total	0.450

Below you can find the emergency panelboard that has been directly affected by the electrical redesign. Panelboard ELP12 is located on the first floor in the auxiliary electrical room. The lighting circuits that have been affected are highlighted in blue. The revised emergency panelboard with the new lighting loads integrated into the loads follows after the original emergency panelboard.

Branch Panel: ELP12

Location: Auxiliary Elec. Room | Volts: 480/277 Y | A.I.C. Rating: 25 kAIC
Supply From: EDP | Phases: 3 | Mains Type: MLO
Mounting: Surface | Wires: 4 | Mains Rating: 100 A
Enclosure: Type 1 | MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	EMERG. LTG. LEVEL 1 EAST	20A	1	1865 2003			1	20A	EMERG. LTG. LEVEL 1 WEST	2	
	3	EMERG. LTG. LEVEL 1A	20A	1		500 3700		3	30A	TERP1-2	4	
	5	Spare	20A	1			0 4100	--	20A	--	6	
	7	Spare	20A	1	0 3900			--	20A	--	8	
	9	Spare	20A	1		0 0		1	20A	Spare	10	
	11	Spare	20A	1			0 0	1	20A	Spare	12	
	13	Spare	20A	1	0 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	--	--			0 0	--	--	Spare	18	
	19	Spare	--	--	0 0			--	--	Spare	20	
	21	Spare	--	--		0 0		--	--	Spare	22	
	23	Spare	--	--			0 0	--	--	Spare	24	
				Total Load (VA)	7768	4200	4100					
				Total Amps (A)	28	15	15					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
Lighting	4386	100%	4386	Total conn. Load:	16068
SEC.	1000	80%	800	Total Est. Demand:	5186
			0	Total Conn. Current:	19
			0	Total Est. Demand Current:	17

Branch Panel: ELP12 Revised

Location: Auxiliary Elec. Room	Volts: 480/277 Y	A.I.C. Rating: 25 kAIC
Supply From: EDP	Phases: 3	Mains Type: MLO
Mounting: Surface	Wires: 4	Mains Rating: 100 A
Enclosure: Type 1		MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	EMERG. LTG. LEVEL 1 EAST	20A	1	2630 2003			1	20A	EMERG. LTG. LEVEL 1 WEST	2	
	3	EMERG. LTG. LEVEL 1A	20A	1		500 3700		3	30A	TERP1-2	4	
	5	Spare	20A	1			0 4100	--	20A	--	6	
	7	Spare	20A	1	0 3900			--	20A	--	8	
	9	Spare	20A	1		0 0		1	20A	Spare	10	
	11	Spare	20A	1			0 0	1	20A	Spare	12	
	13	Spare	20A	1	0 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	--	--			0 0	--	--	Spare	18	
	19	Spare	--	--	0 0			--	--	Spare	20	
	21	Spare	--	--		0 0		--	--	Spare	22	
	23	Spare	--	--			0 0	--	--	Spare	24	
				Total Load (VA)	8533	4200	4100					
				Total Amps (A)	31	15	15					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
Lighting	4386	100%	4386	Total conn. Load:	16833
SEC.	1000	80%	800	Total Est. Demand:	5186
			0	Total Conn. Current:	20
			0	Total Est. Demand Current:	18

Electrical Redesign

Normal Power

Like all of the lighting panels in the URBN Center, Panelboard LP-31 is served from a medium sized switchboard located in the electrical room on the south side of the URBN Center on the first floor. The panelboard is protected with a 100A circuit breaker and has a A.I.C. rating of 25 kAIC. Below is a table out lining the load calculations for the lighting load in the studio. Below is a table out lining the load calculations for the lighting load in the studio.

Normal Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
H[E]	163	277	0.21	58.17	72.71	11.852
J	95	277	0.11	30.47	38.09	3.618
K[E]	18	277	0.08	22.16	27.70	0.499
					Total	15.969

Because not the entire load is one specific circuit and it is partially on a few of the circuits on Panelboard LP31 the load has to be calculated to figure out how much of the circuit load is feeding the studio.

Existing Normal Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
A	156	277	0.23	63.71	79.64	12.423
A2	10	277	0.23	63.71	79.64	0.796
A4	15	277	0.18	49.86	62.33	0.935
B1	10	277	0.11	30.47	38.09	0.381
E1	96	277	0.29	80.33	100.41	9.640
J	17	277	0.11	30.47	38.09	0.647
					Total	24.823

The lighting load is now divided up to compensate for the recommended load per circuit. The NEC designates that 3.55 KVA be put on a lighting circuit, running at 277V on 20A circuits. The following tables outline which luminaries are on the same circuit and how much load is on that specific circuit.

CRK 5			
Luminaire Type	**VA**	**Amount**	**Total kVA**
H[E]	72.7125	48	3.49

CRK 6			
Luminaire Type	**VA**	**Amount**	**Total kVA**
H[E]	72.7125	48	3.49

CRJ 4			
Luminaire Type	**VA**	**Amount**	**Total kVA**
H[E]	72.7125	34	2.47

CRK 3			
Luminaire Type	**VA**	**Amount**	**Total kVA**
H[E]	72.7125	33	2.40

CRK 2			
Luminaire Type	**VA**	**Amount**	**Total kVA**
J	38.0875	(48) J | (9) K[E]	2.08

CRK 1			
Luminaire Type	**VA**	**Amount**	**Total kVA**
K[E]	27.7	(47) J | (9) K[E]	2.04

On the following page you can find the panelboard that has been directly affected by the electrical redesign. Panelboard LP31 is located on the third floor in the west electrical closet. The lighting circuits that have been affected are highlighted in blue. The revised panelboard with the new lighting loads integrated into the loads follows after the original panelboard.

Branch Panel: LP31

Location: Level Three West Elec. Closet
Supply From: LMPD
Mounting: Surface
Enclosure: Type 1
Volts: 480/277 Y
Phases: 3
Wires: 4
A.I.C. Rating: 25 kAIC
Mains Type: MLO
Mains Rating: 100 A
MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	LTG. SWITCHED ROOMS	20A	1	2987 3366			1	20A	LTG. SWITCHED ROOMS	2	
	3	LTG. SWITCHED ROOMS	20A	1		3497 4373		1	20A	LTG. SWITCHED ROOMS	4	
	5	LTG. SWITCHED ROOMS	20A	1			3914 4208	1	20A	LTG. SWITCHED ROOMS	6	
	7	LTG. ZONES TZ31	20A	1	2844 3366			1	20A	LTG. ZONE TZ31U, TZ31D	8	
	9	LTG. ZONES TZ3A, TZ3AU, TZ3AD	45A			2500 2500		1	20A	LTG. ZONE TZ31U, TZ31D	10	
	11	Spare	0A	--			0 2500	1	20A	LTG. ZONE TZ32U	12	
	13	Spare	20A	--	0 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	20A	1			0 0	1	20A	Spare	18	
	19	Spare	20A	1	0 0			1	20A	Spare	20	
	21	Spare	20A	1		0 0		1	20A	Spare	22	
	23	Spare	20A	1			0 0	1	20A	Spare	24	
	25	Spare	20A	1	0 0			1	20A	Spare	26	
	27	Spare	20A	1		0 0		1	20A	Spare	28	
	29	Spare	20A	1			0 0	1	20A	Spare	30	
			Total Load (VA)		12563	12870	10622					
			Total Amps (A)		45	46	38					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
Lighting	36055	100%	36055	Total conn. Load:	36055
				Total Est. Demand:	36055
				Total Conn. Current:	43
				Total Est. Demand Current:	43

Branch Panel: LP31 Revised

Location: Level Three West Elec. Closet
Supply From: LMPD
Mounting: Surface
Enclosure: Type 1
Volts: 480/277 Y
Phases: 3
Wires: 4
A.I.C. Rating: 25 kAIC
Mains Type: MLO
Mains Rating: 100 A
MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	LTG. SWITCHED ROOMS	20A	1	2039 2077			1	20A	LTG. SWITCHED ROOMS	2	
	3	LTG. SWITCHED ROOMS	20A	1		2399 2472		1	20A	LTG. SWITCHED ROOMS	4	
	5	LTG. SWITCHED ROOMS	20A	1			3490 3490	1	20A	LTG. SWITCHED ROOMS	6	
	7	LTG. ZONES TZ31	20A	1	2844 3366			1	20A	LTG. ZONE TZ31U, TZ31D	8	
	9	LTG. ZONES TZ3A, TZ3AU, TZ3AD	45A			2500 2500		1	20A	LTG. ZONE TZ31U, TZ31D	10	
	11	Spare	0A	--			0 2500	1	20A	LTG. ZONE TZ32U	12	
	13	Spare	20A	--	0 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	20A	1			0 0	1	20A	Spare	18	
	19	Spare	20A	1	0 0			1	20A	Spare	20	
	21	Spare	20A	1		0 0		1	20A	Spare	22	
	23	Spare	20A	1			0 0	1	20A	Spare	24	
	25	Spare	20A	1	0 0			1	20A	Spare	26	
	27	Spare	20A	1		0 0		1	20A	Spare	28	
	29	Spare	20A	1			0 0	1	20A	Spare	30	
			Total Load (VA)		10326	9871	9480					
			Total Amps (A)		37	36	34					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
Lighting	29677	125%	37096.25	Total conn. Load:	29677
				Total Est. Demand:	37096
				Total Conn. Current:	36
				Total Est. Demand Current:	45

Emergency Power

Emergency Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
H[E]	10	277	0.21	58.17	72.71	0.727
K[E]	5	277	0.08	22.16	27.70	0.139
					Total	0.727

Existing Emergency Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
A	5	277	0.23	63.71	79.64	0.398
					Total	0.398

Below you can find the emergency panelboard that has been directly affected by the electrical redesign. Panelboard ELP32 is located on the third floor in the auxiliary electrical room. The lighting circuits that have been affected are highlighted in blue. The revised emergency panelboard with the new lighting loads integrated into the loads follows after the original emergency panelboard.

Branch Panel: ELP32

Location: Auxiliary Elec. Room
Supply From: EDP
Mounting: Surface
Enclosure: Type 1

Volts: 480/277 Y
Phases: 3
Wires: 4

A.I.C. Rating: 25 kAIC
Mains Type: MLO
Mains Rating: 100 A
MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	EMERG. LTG. LEVEL 3 EAST	20A	1	2003 2003			1	20A	EMERG. LTG. LEVEL 3 WEST	2	
	3	EMERG. LTG. LEVEL 3A	20A	1		500 1000		3	30A	TERP32	4	
	5	Spare	20A	1			0 1000	--	20A	--	6	
	7	Spare	20A	1	0 1600			--	20A	--	8	
	9	Spare	20A	1		0 0		1	20A	Spare	10	
	11	Spare	20A	1			0 0	1	20A	Spare	12	
	13	Spare	20A	1	0 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	--	--			0 0	--	--	Spare	18	
	19	Spare	--	--	0 0			--	--	Spare	20	
	21	Spare	--	--		0 0		--	--	Spare	22	
	23	Spare	--	--			0 0	--	--	Spare	24	
				Total Load (VA)	5606	1500	1000					
				Total Amps (A)	20	5	4					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
Lighting	8874	100%	8874	Total conn. Load:	8106
SEC.	1000	80%	800	Total Est. Demand:	9674
			0	Total Conn. Current:	10
			0	Total Est. Demand Current:	9

Branch Panel: ELP32

Location: Auxiliary Elec. Room	Volts: 480/277 Y	A.I.C. Rating: 25 kAIC
Supply From: EDP	Phases: 3	Mains Type: MLO
Mounting: Surface	Wires: 4	Mains Rating: 100 A
Enclosure: Type 1		MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	EMERG. LTG. LEVEL 3 EAST	20A	1	2332 2003			1	20A	EMERG. LTG. LEVEL 3 WEST	2	
	3	EMERG. LTG. LEVEL 3A	20A	1		500 1000		3	30A	TERP32	4	
	5	Spare	20A	1			0 1000	--	20A	--	6	
	7	Spare	20A	1	0 1600			--	20A	--	8	
	9	Spare	20A	1		0 0		1	20A	Spare	10	
	11	Spare	20A	1			0 0	1	20A	Spare	12	
	13	Spare	20A	1	0 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	--	--			0 0	--	--	Spare	18	
	19	Spare	--	--	0 0			--	--	Spare	20	
	21	Spare	--	--		0 0		--	--	Spare	22	
	23	Spare	--	--			0 0	--	--	Spare	24	
				Total Load (VA)	5935	1500	1000					
				Total Amps (A)	21	5	4					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
Lighting	8874	100%	8874	Total conn. Load:	8435
SEC.	1000	80%	800	Total Est. Demand:	9674
			0	Total Conn. Current:	10
			0	Total Est. Demand Current:	9

Electrical Redesign

Normal Power

Panelboard LP-1 is served from a medium sized distribution panel, which is fed from the LMDP switchgear located in the UBN center's electrical room. The panelboard is protected with a 225A circuit breaker and has a A.I.C. rating of 25 kAIC. Below is a table out lining the load calculations for the lighting load in the studio. Below is a table out lining the load calculations for the lighting load for the Annex exterior.

Normal Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
N1	26	277	0.21	58.17	72.71	1.891
N2	32	277	0.05	13.85	17.31	0.554
P	4	277	0.04	10.53	13.16	0.053
					Total	2.497

The lighting load is now divided up to compensate for the recommended load per circuit. The NEC designates that 3.55 KVA be put on a lighting circuit, running at 277V on 20A circuits. The following tables outline which luminaries are on the same circuit and how much load is on that specific circuit.

CRK 21	
Luminaire Type	**Total kVA**
N1	1.891
Total	1.891

CRK 22	
Luminaire Type	**Total kVA**
N2	0.554
P	0.053
Total	0.607

On the following page you can find the panelboard that has been directly affected by the electrical redesign. Panelboard LP-1 is located on the first floor in the electrical room of the Annex. The lighting circuits that have been affected are highlighted in blue. The revised panelboard with the new lighting loads integrated into the loads follows after the original panelboard.

Branch Panel: LP1

Location: Elec Room	Volts: 480/277 Y	A.I.C. Rating: 25 kAIC
Supply From: FMDP	Phases: 3	Mains Type: MLO
Mounting: Surface	Wires: 4	Mains Rating: 225 A
Enclosure: Type 1		MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	LTG. ZONES Z1	20A	1	1100 1600			1	20A	LTG. ZONES Z1	2	
	3	LTG. ZONES Z1	20A	1		2800 1800		1	20A	LTG. ZONES Z5	4	
	5	LTG. ZONES Z3	20A	1			3400 1100	1	20A	LTG. ZONES Z6	6	
	7	LTG. ZONES Z4	20A	1	3400 3100			1	20A	LTG. ZONES Z8	8	
	9	LTG. ZONES Z7	45A			3100 3100		1	20A	LTG. ZONES Z8	10	
	11	LTG. ZONES Z7	--	--			3100 0	1	20A	Spare	12	
	13	LTG. ZONES Z9-13	--	--	1600 0			1	20A	Spare	14	
	15	Spare	20A	1		0 2650		1	20A	LTG. ZONES Z31-36	16	
	17	Spare	20A	1			0 2650	1	20A	LTG. ZONES Z31-36	18	
	19	LTG. ZONES Z37-38	20A	1	1020 3300			1	20A	LTG. ZONES Z41-46	20	
	21	LTG. BUILDING EXTERIOR	20A	1		1000 0		1	20A	Spare	22	
	23	LTG. SWITCHED RMS, EAST	20A	1			2000 2000	1	20A	LTG. SWITCHED RMS, WEST	24	
	25	Spare	20A	1	0 0			1	20A	Spare	26	
	27	Spare	20A	1		0 0		1	20A	Spare	28	
	29	Spare	20A	1			0 0	1	20A	Spare	30	
	31	Spare	20A	1	0 0			1	20A	Spare	32	
	33	Spare	20A	1		0 0		1	20A	Spare	34	
	35	Spare	20A	1			0 0	1	20A	Spare	36	
	37	T-RP1	125A	3	14577 0			--	20A	Spare	38	
	39	Spare	20A	--		15177 0		--	20A	Spare	40	
	41	Spare	20A	--			16807 0	--	20A	2	42	
				Total Load (VA)	29697	29627	31057					
				Total Amps (A)	107	107	112					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
	4550	75%	3412.5	Total conn. Load:	90381
	38160	80%	30528	Total Est. Demand:	79811
	400	75%	300	Total Conn. Current:	109
	1000	80%	800	Total Est. Demand Current:	89
	44770	100%	44770		

Branch Panel: LP1 Revised

Location: Elec Room	Volts: 480/277 Y	A.I.C. Rating: 25 kAIC
Supply From: fMPD	Phases: 3	Mains Type: MLO
Mounting: Surface	Wires: 4	Mains Rating: 225 A
Enclosure: Type 1		MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	LTG. ZONES Z1	20A	1	1100 1600			1	20A	LTG. ZONES Z1	2	
	3	LTG. ZONES Z1	20A	1		2800 1800		1	20A	LTG. ZONES Z5	4	
	5	LTG. ZONES Z3	20A	1			3400 1100	1	20A	LTG. ZONES Z6	6	
	7	LTG. ZONES Z4	20A	1	3400 3100			1	20A	LTG. ZONES Z8	8	
	9	LTG. ZONES Z7	45A			3100 3100		1	20A	LTG. ZONES Z8	10	
	11	LTG. ZONES Z7	--	--			3100 0	1	20A	Spare	12	
	13	LTG. ZONES Z9-13	--	--	1600 0			1	20A	Spare	14	
	15	Spare	20A	1		0 2650		1	20A	LTG. ZONES Z31-36	16	
	17	Spare	20A	1			0 2650	1	20A	LTG. ZONES Z31-36	18	
	19	LTG. ZONES Z37-38	20A	1	1020 3300			1	20A	LTG. ZONES Z41-46	20	
	21	LTG. BUILDING EXTERIOR	20A	1		1890 606		1	20A	LTG. BUILDING EXTERIOR	22	
	23	LTG. SWITCHED RMS, EAST	20A	1			2000 2000	1	20A	LTG. SWITCHED RMS, WEST	24	
	25	Spare	20A	1	0 0			1	20A	Spare	26	
	27	Spare	20A	1		0 0		1	20A	Spare	28	
	29	Spare	20A	1			0 0	1	20A	Spare	30	
	31	Spare	20A	1	0 0			1	20A	Spare	32	
	33	Spare	20A	1		0 0		1	20A	Spare	34	
	35	Spare	20A	1			0 0	1	20A	Spare	36	
	37	T-RP1	125A	3	14577 0			--	20A	Spare	38	
	39	Spare	20A	--		15177 0		--	20A	Spare	40	
	41	Spare	20A	--			16807 0	--	20A	2	42	
				Total Load (VA)	29697	31123	31057					
				Total Amps (A)	107	112	112					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
	4550	75%	3412.5	Total conn. Load:	91877
	38160	80%	30528	Total Est. Demand:	79811
	400	75%	300	Total Conn. Current:	111
	1000	80%	800	Total Est. Demand Current:	91
	44770	100%	44770		

Electrical Redesign

Normal Power

Panelboard RP-11 is served from LP-1 located in the electrical room in the Annex.. The panelboard is protected with a 250A circuit breaker and has a A.I.C. rating of 10 kAIC. Below is a table out lining the load calculations for the lighting load in the studio. Below is a table out lining the load calculations for the lighting load in the gallery.

Normal Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
C	23	120	0.11	12.60	15.75	0.362
T1	1	120	2.00	240	300.00	0.240
T2	1	120	2.00	240	300.00	0.240
T3	1	120	2.00	240	300.00	0.240
T4	1	120	2.00	240	300.00	0.240
T5	1	120	1.00	120	150.00	0.120
T6	1	120	4.00	480	600.00	0.480
T7	1	120	4.00	480	600.00	0.480
T8	1	120	4.00	480	600.00	0.480
T9	1	120	4.00	480	600.00	0.480
T10	1	120	4.00	480	600.00	0.480
T11	1	120	2.00	240	300.00	0.240
T12	1	120	1.00	120	150.00	0.120
T13	1	120	2.00	240	300.00	0.240
T14	1	120	0.67	80	100.00	0.080
M	5	120	0.03	3.00	3.75	0.019
					Total	4.541

The lighting load is now divided up to compensate for the recommended load per circuit. The NEC designates that 1.92 KVA be put on a lighting circuit, running at 120V on 20A circuits. The following tables outline which luminaries are on the same circuit and how much load is on that specific circuit.

CRK 47	
Luminaire Type	**Total kVA**
C	0.362
T1	0.240
T2	0.240
T3	0.240
T4	0.240
T5	0.120
Total	1.442

CRK 45	
Luminaire Type	**Total kVA**
T6	0.480
T7	0.480
T8	0.480
Total	1.440

CRK 43	
Luminaire Type	**Total kVA**
T9	0.48
T10	0.48
T11	0.24
T12	0.12
T13	0.24
T14	0.08
M	0.01875
Total	1.65875

On the following page you can find the panelboard that has been directly affected by the electrical redesign. Panelboard RP1-1 is located on the first floor in the electrical closet of the Annex. The lighting circuits that have been affected are highlighted in blue. The revised panelboard with the new lighting loads integrated into the loads follows after the original panelboard.

Branch Panel: RP11

Location: ELEC. CLOSET 109
Supply From: T-RP-1
Mounting: Surface
Enclosure: Type 1

Volts: 120/208Y
Phases: 3
Wires: 4

A.I.C. Rating: 10 Kaic
Mains Type: MCB
Mains Rating: 250 A
MCB Rating: 250 A

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	REC. ROOM 106, 107	20A	1	720 540			1	20A	REC. ELEC. CLOSET 109	2	
	3	REC. ROOM 103, 106, 107, 105	20A	1		1080 180		1	20A	REC. KITCHENETTE 104	4	
	5	REC. KITCHENETTE 104	20A	1			180 180	1	20A	REC. KITCHENETTE 104	6	
	7	REC. KITCHENETTE 104	20A	1	180 360			1	20A	REC. KITCHENETTE 104	8	
	9	REC. KITCHENETTE 104	20A	1		180 540		1	20A	REC. ROOM 101	10	
	11	REC. ROOM 101	20A	1			720 360	1	20A	REC. ROOM 103	12	
	13	REC. ROOM 103	20A	1	360 0			1	20A	Spare	14	
	15	Spare	20A	1		0 900		1	20A	REC. LARGE SR 110	16	
	17	REC. LARGE SR 110	20A	1			720 720	1	20A	REC. LARGE SR 110	18	
	19	REC. LARGE SR 110	20A	1	720 720			1	20A	REC. LARGE SR 110	20	
	21	REC. LARGE SR 110	20A	1		720 1080		1	20A	REC. LARGE SR 110	22	
	23	REC. LARGE SR 110	20A	1			720 720	1	20A	REC. LARGE SR 110	24	
	25	REC. LARGE SR 110	20A	1	720 720			1	20A	REC. LARGE SR 110	26	
	27	REC. LARGE SR 110	20A	1		720 900		1	20A	REC. LARGE SR 110	28	
	29	REC. LARGE SR 110	20A	1			720 950	1	20A	A/V LARGE SR	30	
	31	Spare	20A	1	0 1080			1	20A	REC. ROOM 115, 113, 101	32	
	33	REC. CHAIR/EQUIP. STRG.	20A	1		360 360		1	20A	REC CLOSET 117	34	
	35	REC. ROOM 125, 129B, 102	20A	1			720 720	1	20A	REC. BLACK BOX THEATER	36	
	37	REC. BLACK BOX THEATER	125A	1	720 900			1	20A	REC. ROOM 129B, 129A	38	
	39	AV DRESSING	20A	1		950 720		1	20A	REC. ROOM 129B, 102	40	
	41	REC. LOUNGE	20A	1			540 1080	1	20A	REC. ROOM 131, 133	42	
	43	Spare	125A	1	0 0			1	20A	Spare	38	
	45	Spare	20A	1		0 0		1	20A	Spare	40	
	47	Spare	20A	1			0 0	1	20A	Spare	42	
	49	Spare	125A	1	0 0			1	20A	Spare	38	
	51	Spare	20A	1		0 0		1	20A	Spare	40	
	53	Spare	20A	1			0 0	1	20A	Spare	42	
				Total Load (VA)	7740	8690	9050					
				Total Amps (A)	65	72	75					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
REC.	23580	80%	18864	Total conn. Load:	25480
A/V IG	400	75%	300	Total Est. Demand:	20289
AV	1500	75%	1125	Total Conn. Current:	71
				Total Est. Demand Current:	54

Branch Panel: RP11 Revised

Location: ELEC. CLOSET 109
Supply From: T-RP-1
Mounting: Surface
Enclosure: Type 1

Volts: 120/208Y
Phases: 3
Wires: 4

A.I.C. Rating: 10 Kaic
Mains Type: MCB
Mains Rating: 250 A
MCB Rating: 250 A

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	REC. ROOM 106, 107	20A	1	720 540			1	20A	REC. ELEC. CLOSET 109	2	
	3	REC. ROOM 103, 106, 107, 105	20A	1		1080 180		1	20A	REC. KITCHENETTE 104	4	
	5	REC. KITCHENETTE 104	20A	1			180 180	1	20A	REC. KITCHENETTE 104	6	
	7	REC. KITCHENETTE 104	20A	1	180 360			1	20A	REC. KITCHENETTE 104	8	
	9	REC. KITCHENETTE 104	20A	1		180 540		1	20A	REC. ROOM 101	10	
	11	REC. ROOM 101	20A	1			720 360	1	20A	REC. ROOM 103	12	
	13	REC. ROOM 103	20A	1	360 0			1	20A	Spare	14	
	15	Spare	20A	1		0 900		1	20A	REC. LARGE SR 110	16	
	17	REC. LARGE SR 110	20A	1			720 720	1	20A	REC. LARGE SR 110	18	
	19	REC. LARGE SR 110	20A	1	720 720			1	20A	REC. LARGE SR 110	20	
	21	REC. LARGE SR 110	20A	1		720 1080		1	20A	REC. LARGE SR 110	22	
	23	REC. LARGE SR 110	20A	1			720 720	1	20A	REC. LARGE SR 110	24	
	25	REC. LARGE SR 110	20A	1	720 720			1	20A	REC. LARGE SR 110	26	
	27	REC. LARGE SR 110	20A	1		720 900		1	20A	REC. LARGE SR 110	28	
	29	REC. LARGE SR 110	20A	1			720 950	1	20A	A/V LARGE SR	30	
	31	Spare	20A	1	0 1080			1	20A	REC. ROOM 115, 113, 101	32	
	33	REC. CHAIR/EQUIP. STRG.	20A	1		360 360		1	20A	REC CLOSET 117	34	
	35	REC. ROOM 125, 129B, 102	20A	1			720 720	1	20A	REC. BLACK BOX THEATER	36	
	37	REC. BLACK BOX THEATER	125A	1	720 900			1	20A	REC. ROOM 129B, 129A	38	
	39	AV DRESSING	20A	1		950 720		1	20A	REC. ROOM 129B, 102	40	
	41	REC. LOUNGE	20A	1			540 1080	1	20A	REC. ROOM 131, 133	42	
	43	Spare	125A	1	1659 0			1	20A	Spare	38	
	45	Spare	20A	1		1440 0		1	20A	Spare	40	
	47	Spare	20A	1			1442 0	1	20A	Spare	42	
	49	Spare	125A	1	0 0			1	20A	Spare	38	
	51	Spare	20A	1		0 0		1	20A	Spare	40	
	53	Spare	20A	1			0 0	1	20A	Spare	42	
			Total Load (VA)		9399	10130	10492					
			Total Amps (A)		78	84	87					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
REC.	23580	80%	18864	Total conn. Load:	30021
A/V IG	400	75%	300	Total Est. Demand:	24830
AV	1500	75%	1125	Total Conn. Current:	83
Lighting	4541	100%	4541	Total Est. Demand Current:	69

Emergency Power

Emergency Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
H[E]	16	277	0.21	58.17	72.71	1.163
					Total	1.163

Existing Emergency Power Load calculation						
Luminaire Type	**Amount**	**Operating Voltage**	**Input Current**	**VA**	**Continuous Loading**	**Total kVA**
F	9	277	0.12	31.99	39.99	0.360
					Total	0.360

Below you can find the emergency panelboard that has been directly affected by the electrical redesign. Panelboard ELP1 is located on the first floor in the electrical room of the Annex. The lighting circuits that have been affected are highlighted in blue. The revised emergency panelboard with the new lighting loads integrated into the loads follows after the original emergency panelboard.

Branch Panel: ELP1

Location: Elec room					Volts: 480/277Y			A.I.C. Rating: 25 Kaic				
Supply From: ATS-1					Phases: 3			Mains Type: MLO				
Mounting: Surface					Wires: 4			Mains Rating: 125 A				
Enclosure: Type 1								MCB Rating:				
Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	TERP1	30A	1	1000 3100			1	20A	EMERG. LTG. WEST	2	
	3	--	--	--		0 3100		1	20A	EMERG. LTG. EAST	4	
	5	--	--	--			0 0	1	20A	Spare	6	
	7	Spare	20A	1	0 0			1	20A	Spare	8	
	9	Spare	20A	1		0 0		1	20A	Spare	10	
	11	Spare	20A	1			0 0	1	20A	Spare	12	
	13	Spare	20A	1	0 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	20A	1			0 0	1	20A	Spare	18	
				Total Load (VA)	4100	3100	0					
				Total Amps (A)	15	11	0					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
LIGHTING	6200	100%	6200	Total conn. Load:	7200
SEC.	500	80%	400	Total Est. Demand:	7100
FACP	500	100%	500	Total Conn. Current:	9
				Total Est. Demand Current:	8

Branch Panel: ELP1 Revised

Location: Elec Room	Volts: 480/277Y	A.I.C. Rating: 25 Kaic
Supply From: ATS-1	Phases: 3	Mains Type: MLO
Mounting: Surface	Wires: 4	Mains Rating: 125 A
Enclosure: Type 1		MCB Rating:

Wire	CKT	Load Name	Trip	Poles	A (VA)	B (VA)	C (VA)	Poles	Trip	Load Name	CKT	Wire
	1	TERP1	30A	1	1000 3903			1	20A	EMERG. LTG. WEST	2	
	3	--	--	--		0 3100		1	20A	EMERG. LTG. EAST	4	
	5	--	--	--			0 0	1	20A	Spare	6	
	7	Spare	20A	1	0 0			1	20A	Spare	8	
	9	Spare	20A	1		0 0		1	20A	Spare	10	
	11	Spare	20A	1			0 0	1	20A	Spare	12	
	13	Spare	20A	1	0 0			1	20A	Spare	14	
	15	Spare	20A	1		0 0		1	20A	Spare	16	
	17	Spare	20A	1			0 0	1	20A	Spare	18	
		Total Load (VA)			4903	3100	0					
		Total Amps (A)			18	11	0					

Load Classification	Connected Load	Demand Factor	Estimated Load	Panel Totals	
LIGHTING	7003	100%	7003	Total conn. Load:	8003
SEC.	500	80%	400	Total Est. Demand:	7903
FACP	500	100%	500	Total Conn. Current:	10
				Total Est. Demand Current:	9

Architectural Breadth

Introduction

The original Façade and roof design of the URBN Center Annex makes use of a storefront glazing system with a curtain wall system combined, with a flat roof using an EDPM single-ply roof membrane (see original Annex Design – Fig. 40). I took in to account 'The Drexel Green Initiative' while redesigning the façade and roof. This initiative specifically states that architectural design is expected to be the primary component in making the structure energy efficient. Furthermore the initiative outlines the goal of improving natural lighting. Natural daylighting has been proven to increase the energy efficiency of buildings. In the case of the Annex there are considerable opportunities for daylight harvesting. The Annex for starters, is aligned on the North-South axis. The front façade faces due south, which allows for the daylight to be easily controlled as it enters the space due to the symmetry of the suns path in conjunction with the orientation of the Annex.

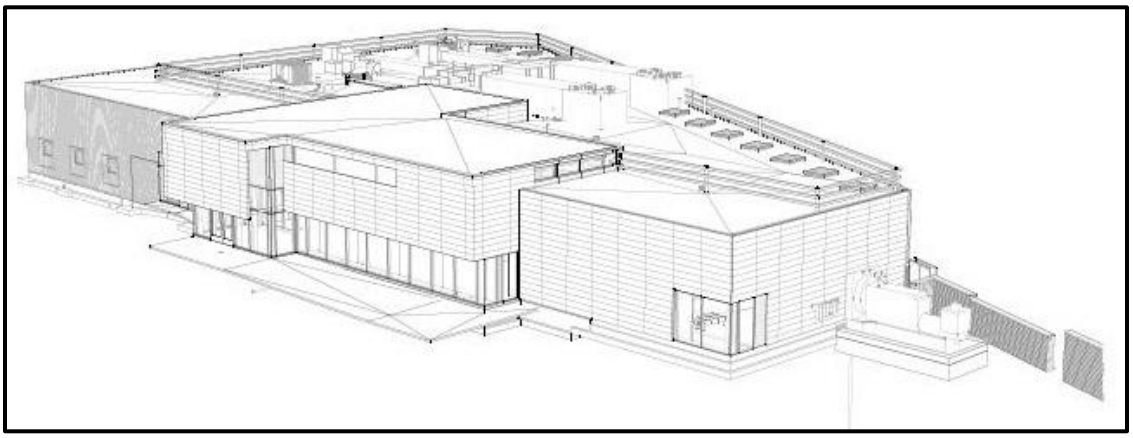


Figure 40: Original Annex design

Redesign

The exterior façade has been redesigned to increase the ability to harvest daylight. A saw-tooth skylight system has replaced the elevated roof that encompasses the Lobby. An important feature to be noted is that the EDPM has been changed for this section of the roof from a black finish to a white finish. This change will increase the amount of light that bounces off of the saw tooth roof and into the skylight. The skylights will face north allowing the reflected light from the atmosphere to penetrate deep into the space. This was not possible before with a flat roof system. As for the main entrance the Storefront glazing system was upgraded with the installation of light shelves. The light shelves help throw the direct sunlight up on into the ceiling producing an indirect daylighting system. These shelves will also help to reduce the direct sunlight, which can cause visual discomfort. The curtain wall system will be modified to allow for more daylight to enter the space from the south.

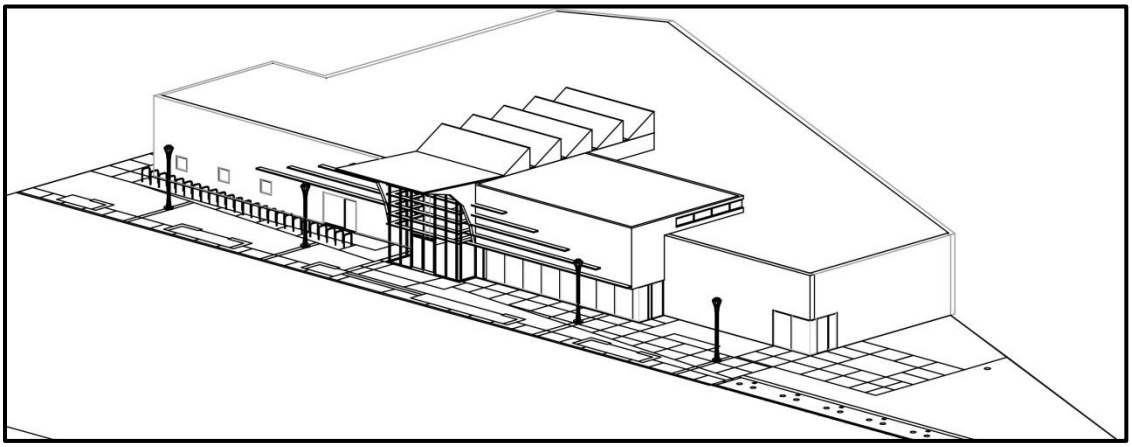


Figure 41: Annex redesign

The architectural changes that have been done to the annex will change its performance characteristics. A mechanical analysis on both the original design and new design can be found in the next section. Full architectural drawings have been created for the new design (See Appendix E).

Mechanical Breadth

Introduction

It can be assumed that the mechanical loads will change due to the increase in glazing surfaces. These changes will decrease the insulating performance of the building. Although the mechanical loads are almost sure to increase, it is possible to compensate for this increase in load by decreasing the lighting load within the lobby space. The next section will look into whether or not a daylight harvesting system can save enough electrical energy to compensate for the increase in the mechanical load.

Original Design Characteristics

Utility Power Information

Utility Power Company: Peco (An Exelon Company)

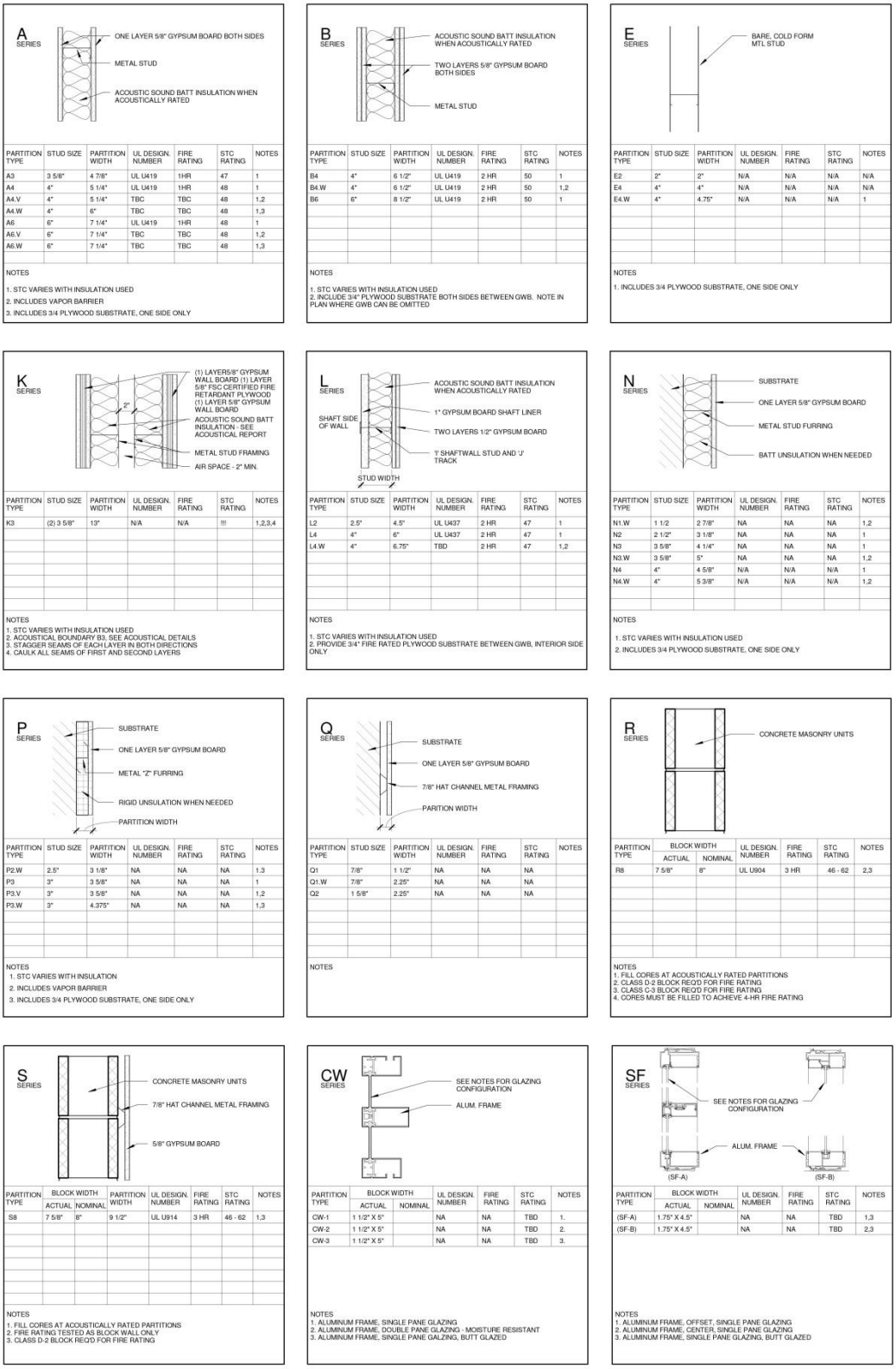
Address: 3020 Market Street
Philadelphia, PA 19104

Website: https://www.peco.com/Pages/Home.aspx

Rate Schedule: Rate-PD Primary-Distribution Power

RATE SCHEDULE - PD	
Charge Type	**Charge**
Fixed Distribution Charge	$295.15
Variable distribution Charge	$4.68 per kW of billing demand $0.32 per kWh for all kwh
Energy Efficiency Charge	$0.91 per kW of Peak Load Contribution

Wall/Partition Types



PARTITION TYPE	STUD SIZE	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
A3	3 5/8"	4 7/8"	UL U419	1HR	47	1
A4	4"	5 1/4"	UL U419	1HR	48	1
A4.V	4"	5 1/4"	TBC	TBC	48	1,2
A4.W	4"	6"	TBC	TBC	48	1,3
A6	6"	7 1/4"	UL U419	1HR	48	1
A6.V	6"	7 1/4"	TBC	TBC	48	1,2
A6.W	6"	7 1/4"	TBC	TBC	48	1,3

NOTES
1. STC VARIES WITH INSULATION USED
2. INCLUDES VAPOR BARRIER
3. INCLUDES 3/4 PLYWOOD SUBSTRATE, ONE SIDE ONLY

PARTITION TYPE	STUD SIZE	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
B4	4"	6 1/2"	UL U419	2 HR	50	1
B4.W	4"	6 1/2"	UL U419	2 HR	50	1,2
B6	6"	8 1/2"	UL U419	2 HR	50	1

NOTES
1. STC VARIES WITH INSULATION USED
2. INCLUDE 3/4" PLYWOOD SUBSTRATE BOTH SIDES BETWEEN GWB. NOTE IN PLAN WHERE GWB CAN BE OMITTED

PARTITION TYPE	STUD SIZE	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
E2	2"	2"	N/A	N/A	N/A	N/A
E4	4"	4"	N/A	N/A	N/A	N/A
E4.W	4"	4.75"	N/A	N/A	N/A	1

NOTES
1. INCLUDES 3/4 PLYWOOD SUBSTRATE, ONE SIDE ONLY

PARTITION TYPE	STUD SIZE	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
K3	(2) 3 5/8"	13"	N/A	N/A	!!!	1,2,3,4

NOTES
1. STC VARIES WITH INSULATION USED
2. ACOUSTICAL BOUNDARY B3, SEE ACOUSTICAL DETAILS
3. STAGGER SEAMS OF EACH LAYER IN BOTH DIRECTIONS
4. CAULK ALL SEAMS OF FIRST AND SECOND LAYERS

PARTITION TYPE	STUD SIZE	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
L2	2.5"	4.5"	UL U437	2 HR	47	1
L4	4"	6"	UL U437	2 HR	47	1
L4.W	4"	6.75"	TBD	2 HR	47	1,2

NOTES
1. STC VARIES WITH INSULATION USED
2. PROVIDE 3/4" FIRE RATED PLYWOOD SUBSTRATE BETWEEN GWB, INTERIOR SIDE ONLY

PARTITION TYPE	STUD SIZE	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
N1.W	1 1/2	2 7/8"	NA	NA	NA	1,2
N2	2 1/2"	3 1/8"	NA	NA	NA	1
N3	3 5/8"	4 1/4"	NA	NA	NA	1
N3.W	3 5/8"	5"	NA	NA	NA	1,2
N4	4"	4 5/8"	N/A	N/A	N/A	1
N4.W	4"	5 3/8"	N/A	N/A	N/A	1,2

NOTES
1. STC VARIES WITH INSULATION USED
2. INCLUDES 3/4 PLYWOOD SUBSTRATE, ONE SIDE ONLY

PARTITION TYPE	STUD SIZE	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
P2.W	2.5"	3 1/8"	NA	NA	NA	1,3
P3	3"	3 5/8"	NA	NA	NA	1
P3.V	3"	3 5/8"	NA	NA	NA	1,2
P3.W	3"	4.375"	NA	NA	NA	1,3

NOTES
1. STC VARIES WITH INSULATION
2. INCLUDES VAPOR BARRIER
3. INCLUDES 3/4 PLYWOOD SUBSTRATE, ONE SIDE ONLY

PARTITION TYPE	STUD SIZE	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
Q1	7/8"	1 1/2"	NA	NA	NA	
Q1.W	7/8"	2.25"	NA	NA	NA	
Q2	1 5/8"	2.25"	NA	NA	NA	

NOTES

PARTITION TYPE	BLOCK WIDTH ACTUAL	BLOCK WIDTH NOMINAL	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
R8	7 5/8"	8"	UL U904	3 HR	46 - 62	2,3

NOTES
1. FILL CORES AT ACOUSTICALLY RATED PARTITIONS
2. CLASS D-2 BLOCK REQ'D FOR FIRE RATING
3. CLASS C-3 BLOCK REQ'D FOR FIRE RATING
4. CORES MUST BE FILLED TO ACHIEVE 4-HR FIRE RATING

PARTITION TYPE	BLOCK WIDTH ACTUAL	BLOCK WIDTH NOMINAL	PARTITION WIDTH	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
S8	7 5/8"	8"	9 1/2"	UL U914	3 HR	46 - 62	1,3

NOTES
1. FILL CORES AT ACOUSTICALLY RATED PARTITIONS
2. FIRE RATING TESTED AS BLOCK WALL ONLY
3. CLASS D-2 BLOCK REQ'D FOR FIRE RATING

PARTITION TYPE	BLOCK WIDTH ACTUAL	BLOCK WIDTH NOMINAL	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
CW-1	1 1/2" X 5"		NA	NA	TBD	1.
CW-2	1 1/2" X 5"		NA	NA	TBD	2.
CW-3	1 1/2" X 5"		NA	NA	TBD	3.

NOTES
1. ALUMINUM FRAME, SINGLE PANE GLAZING
2. ALUMINUM FRAME, DOUBLE PANE GLAZING - MOISTURE RESISTANT
3. ALUMINUM FRAME, SINGLE PANE GALZING, BUTT GLAZED

PARTITION TYPE	BLOCK WIDTH ACTUAL	BLOCK WIDTH NOMINAL	UL DESIGN. NUMBER	FIRE RATING	STC RATING	NOTES
(SF-A)	1.75" X 4.5"		NA	NA	TBD	1,3
(SF-B)	1.75" X 4.5"		NA	NA	TBD	2,3

NOTES
1. ALUMINUM FRAME, OFFSET, SINGLE PANE GLAZING
2. ALUMINUM FRAME, CENTER, SINGLE PANE GLAZING
3. ALUMINUM FRAME, SINGLE PANE GLAZING, BUTT GLAZED

Figure 42: Wall and partition types in URBN Center Annex

Modeling

In order to calculate the mechanical loads of both the old and the new Annex's four models had to be created.

(2) Revit Models (One of both the old and new design)

Within each Revit model, all walls and partition types were defined and the R-Values for these walls were accounted for. Furthermore, spaces and rooms had to be defined and linked with the appropriate HVAC zone. Each HVAC zone was then redefined with a specific occupancy value (ex. Lobby | Occupancy Type: A-1 | Occupancy/NSF Value: 15).

1 - Original Design

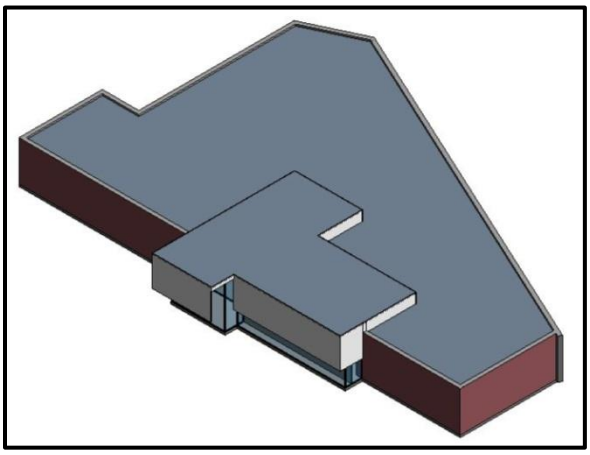


Figure 43: Revit model of URBN Center Annex

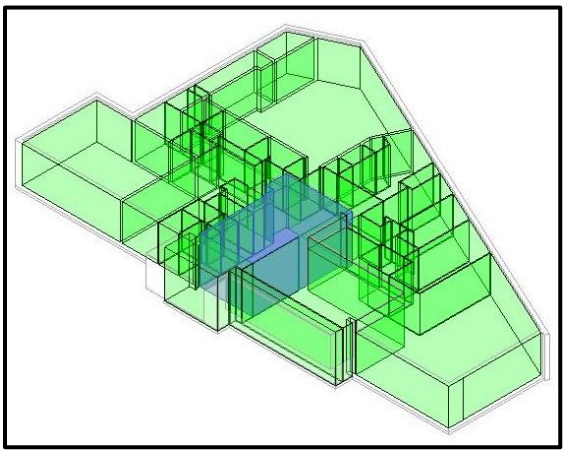


Figure 44: HVAC Zones of Annex with lobby highlighted

2 - Redesign

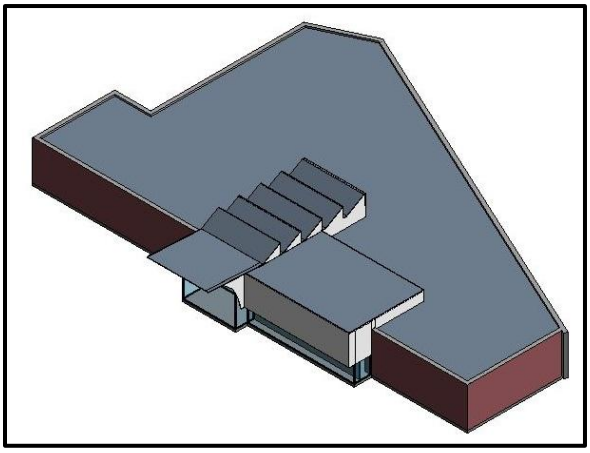


Figure 45: Revit model of URBN Center Annex

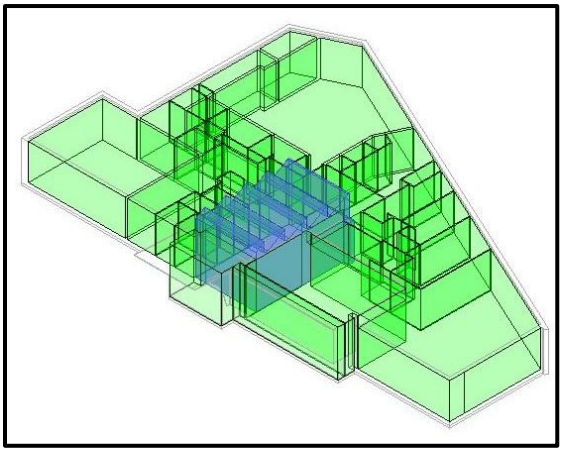


Figure 46: HVAC Zones of Annex with lobby highlighted

(2) AutoCAD Models (One of both the old and new design)

These AutoCAD models were created entirely out of 3d faces within the AutoCAD program to ensure that these models could be analyzed in both programs, AGI32 and DAYSIM. The reflectance values of each surface were assigned to the corresponding entity in each program.

3 & 4 – Original design and Redesign

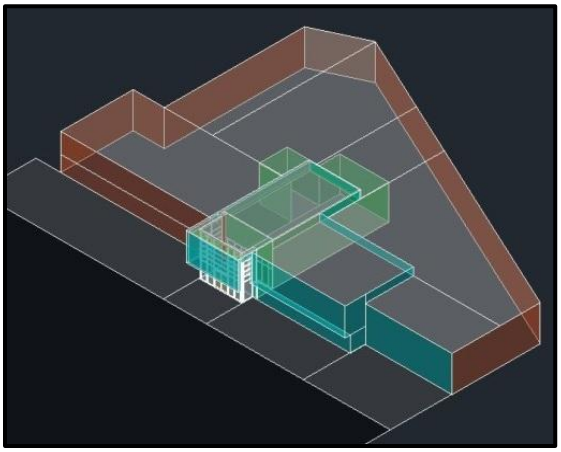


Figure 47: Revit model of URBN Center Annex

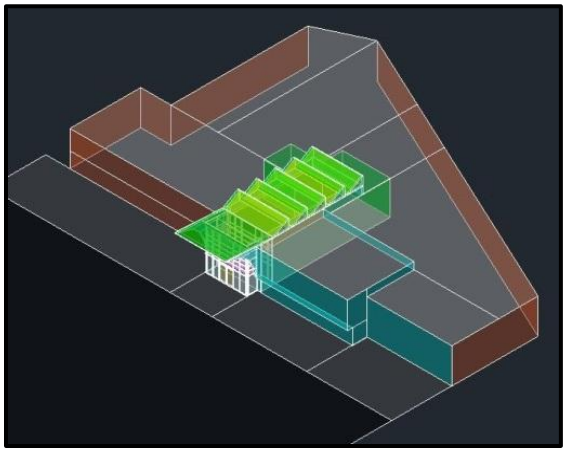


Figure 48: HVAC Zones of Annex with lobby highlighted

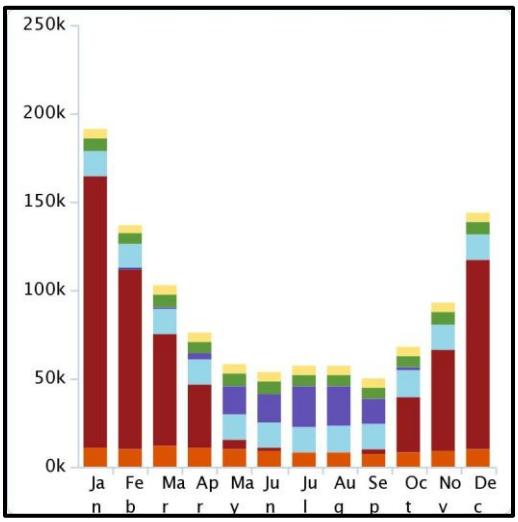
Here you can see where the roofing reflectance located and how it is different for the new design, highlighted in yellow/green in Fig. 48.

Green Building Studio

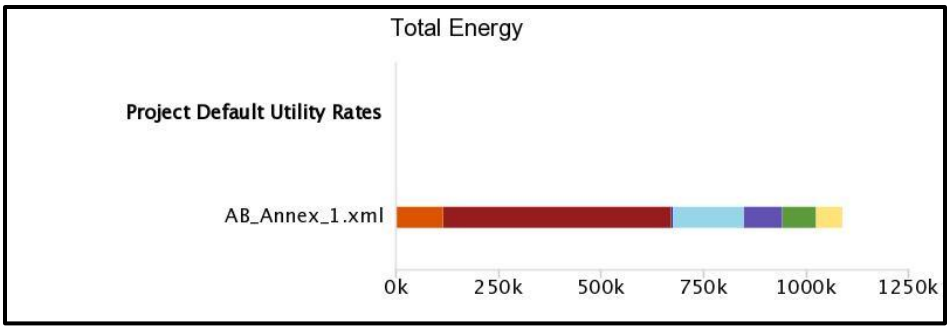
After the Revit models had been configured, the work was not over. Importing into Green Buildings Studio was a challenge, but once this was complete, the software proved to be quite user-friendly.

Original Annex Design

Month-to-Month Energy Consumption (KWh)

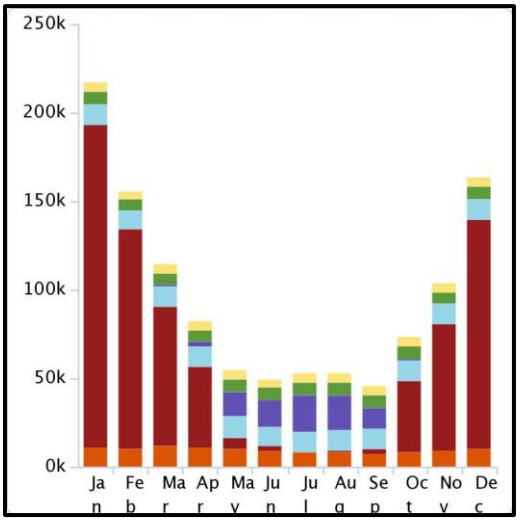


Total Annual Energy Consumption (KWh)

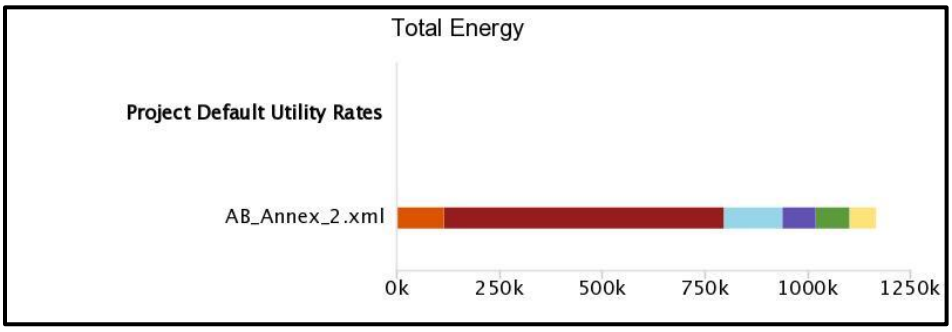


Annex Redesign

Month-to-Month Energy Consumption (KWh)



Total Annual Energy Consumption (KWh)



DAYSIM

The AutoCAD 3D models were imported into the program DAYSIM so that the electrical lighting load could be analyzed for both the original Annex design and the redesign. In Fig. 49 we can see that with the new design the Day Light Autonomy has increased going from the original design.

Results

Daylight Harvesting - Energy Analysis	
Design	**Annual KWh**
Original Design	4,658
Redesign	2,416
Savings	2,242

Space Heating/Cooling - Energy Analysis		
Design	**Annual KWh**	
	Space Cooling	**Space Heating**
Original Design	559,959	97,642
Redesign	683,174	85,685
Change	123,215	-11,957
	Total Difference	111,258

Evaluation

After conducting the energy modeling of each design it can be concluded that the energy savings form the daylight harvesting will not accommodate for the increase in HVAC load. The total lighting energy savings compensated for less than 5% of the mechanical load increase. While the mechanical load increased by 17%, the lighting load decreased by 48% in the lobby. The actual percentages are encouraging after finalizing my results from both computer modeling programs. In all, the accuracy of energy modeling software is still now the most accurate, but it can be confirmed that the mechanical load would increase in the lobby when poorly insulated materials are added, like glass. In conclusion, I would not recommend that this architectural redesign be implanted into the final design.

Summary and Conclusions

The intent of the AE Senior Thesis is to gather a better understanding for the integration between the electrical, mechanical, lighting, electrical, and structural systems that all have to coincide with one another to produce a safe and energy efficient building. In conclusion this report has shown that there are many different solutions to lighting and architectural design, electrical circuiting, and energy harvesting.

The redesigned lighting accomplished the goals set forth by the architect and the guidelines of IES. The lobby has been transformed into a two-faced design incorporating a public feel to the west and a playful impression to the east. The Studio puts the students on the runway, while providing a uniform light distribution. The Annex exterior façade and patio was color blasted after the façade went through a transformation of itself. The indirect lighting design provides a safe environment for the occupants visiting the Annex on special event nights. Finally the Pearlstein art gallery reflects the operable wall design in its lighting design with a unique radial track system that is still flexible. Overall in all the spaces, the lighting design theme has been accomplished in creating spaces that encourage social interaction.

The electrical branch circuit redesign proved to be a challenge, when LED fixtures are introduced into a space. However, the electrical lighting loads were decreased, by a total of 23% pertaining to the specific spaces. The architectural redesign of the Annex façade, was the most enjoyable task of this investigation. The final design invites people, more specifically the locals, to come and visit the gallery and see some of the students work.

References

Text

1. ASHRAE Standard 90.1-2007. Atlanta, GA: American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., 2007

2. Houser, Mistrick, and Stefy (2011) The IESNA Lighting Handbook: Reference & Application (10thed.). Illuminating Engineering Society of North America. New York, NY.

3. National Electric Code 2008, Quincy, MA: National Fire Protection Association, Inc., 2008 Rea, Mark S. (2002). The IESNA Lighting Handbook: Reference & Application (9th ed.). Illuminating Engineering Society of North America. New York, NY.

Software

1. Adobe Photoshop CS5
2. AGI32
3. Autodesk AutoCAD 2013
4. DAYSIM 2.1

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