Exterior Façade – Lighting Design

Picture EXT.1

Duques Hall is located on George Washington campus in downtown Washington DC. It is located amidst some other university buildings, however, the façade is very visible from both directions down the street. Being a newer building on campus, Duques Hall is meant to stand out from it's surroundings. The façade has many unique architectural features that help it stand out among its surroundings. Two classrooms on the first floor are clad in glass so that the contents of the room are visible from the outside. Also, there is a set back above the main entrance of the building, that adds a unique look to the building. The most defining characteristic of the building, however, is the tower in the south east corner. Study rooms were placed on the second through the sixth floor of this tower and all exterior facing walls are covered in glass. This allows for these study rooms to be lit up at night and create a pillar of light shinning onto the surrounding area.

Being in the city, there is not a lot of separation between the building and it's surrounding areas. There are several planters and benches placed in front of the entrance of the building before the walkway steps down onto the main sidewalk. There is also a small plaza on the corner of the square between Duques hall and the existing business school. The plaza is just a simple paved area on the corner between the buildings.

The building is clad in a tan concrete, with steel and glass at each of the windows. The plaza and area around the sidewalk is set in a darker stone, and the sidewalk around the building is brick.

Picture EXT.1

Design Considerations

The primary concern for the design of the exterior façade was to create a design that is memorable and dynamic. Creating an image that is not only impressive but memorable adds a note of credibility to the building that would not be there if a few wall washers were thrown on the exterior façade to provide a modicum of light. Another consideration was to utilize the light that would be placed on street level over the surrounding area. It is not only important to provide light for people that will be traveling to, from, and past the building at night, but it is also important to not provide an over abundance of light. Light trespass, particularly into surrounding buildings is a nuisance and not acceptable.

To light the space, one of the ideas that were considered was how the switching of the interior lights would affect the overall aura of the building. A study was performed with a setting of just exterior lights and compared to a setting that involved lights on the interior of the façade switched on and dimmed when possible.

Design Criteria

All design criteria is based upon the standards set forth in the IESNA Lighting Handbook, and the following criteria was taken from it.

The building has many very unique architectural features as were discussed above in the narrative. Highlighting these features was the biggest concern in lighting the façade, and it was on these areas that the design was focused around. Utilizing the light tower on the corner of the building was particularly important.

Utilizing the interior lights along with the exterior lights was also a thought that was taken into account. Leaving the interior lights off leaves the interior dark and creates a dark and uninviting space. Using the interior fixtures to help brighten the building will help to create a more welcoming aura around the building.

Avoiding as much light trespass and pollution while providing adequate light levels is a very important consideration. Careful selection of luminaries, and proper placement on the façade of the building should help to eliminate these two unwanted characteristics. Placing enough light for safety concerns is more important than the amount of trespass, but does not negate the importance of limiting as much trespass as possible.

Although the intent could possibly be misplaced, my biggest design goal was to create a unique and impressive lighting layout. Making a system that would truly stand out and create a lasting memory was a big consideration.

Design Standards

Horizontal Illumination
Building Entrance – 5 - 10 fc
Prominent Structure – 5 - 10 fc
Walkways – 6 - 10 fc

Vertical Illumination
Building Entrance – 3 - 5 fc
Prominent Structure – 3 - 5 f
Walkways – 11 - 22 fc

Power Density requirements
Building Entries 30w/linear foot door entrance
Building Façade .5w/ft^2 or 5.0W/linear foot
(Ashrae Standard 90.1 standards)

System Designs

The light tower on the corner of the building was the first part of the façade that was looked at. This space is meant to be lit at full output through the entire of the night so that a portion of the building will always be glowing. To create this glowing affect, it was important to choose surfaces that would reflect light outward. A pendant fixture was designed to throw light up onto the ceiling, while that was supplemented with downlights to provide the necessary footcandle values on the ground. Perimeter lights were placed around the sides of the room to create glowing walls that would compliment the glowing ceiling.

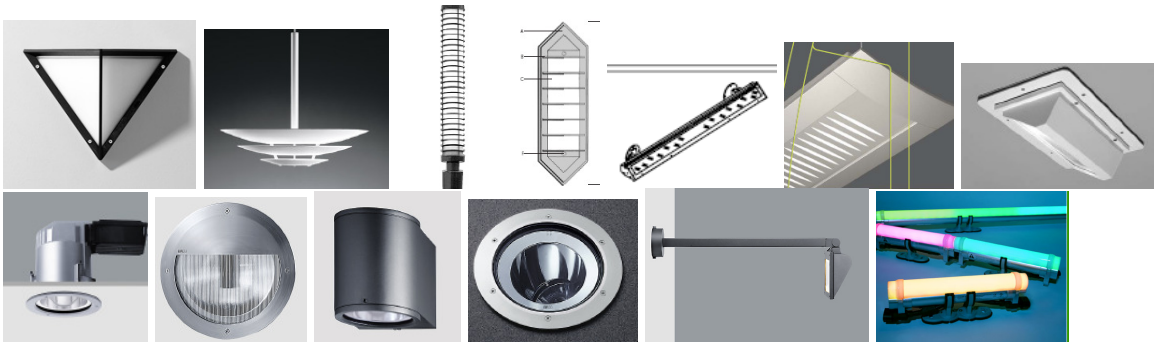
The entrance is probably the second most important part of the building. An entrance has to welcome a person into the space, and an entrance also has to be easy to determine from the rest of the façade. These ideas were kept in mind while trying to create an entrance that would stand out from the rest of the building.

Interior light supplementing the exterior design also plays into the scheme of the design. First it is determined how the interior lights will affect the exterior façade, and then it will be determined how to best take advantage of this light.

Fixture Schedule

Fixture cut sheets can be found in **(appendix L)**, while the lamp and ballast data that was used with each of the fixtures can be found directly after it.

Label	Description	Lamps	Manufacturer	Voltage	Wattage	Ballast
A13	Interior Pendant fixture with uplight and louvered down light, used in all classrooms	(3) T8 - T8B	Axis	277	96 W	Dimming
A14	2x2 interior recessed downlight, louvered shielding with silver frame	(2) T8 - U	Prudential	277	64 W	Electronic
B8	Poulsin interior 3 tiered pendant, circular, 2' mounting height	(2) TT - TT-c	Louis Polsen	277	90W	Electronic
W1	Exterior pole fixture, cylinder with diffusing section going 360 degrees	(4) T8 - T8-B	Se'lux	277	114W	Electronic
W2	Exteroir wall mounted fixture with lensed apperature, used to wash ceiling	(1) t5 ho	Insight Lighting	277	49w	Electronic
X1	Exterior Wall mounted fixture, diamond shaped with cylinder diffusing section	(1) TT - TT-B	Teka	277	35W	Electronic
X2	Trianglular wall mounted fixture, decorative sconce	(1) TT- TT-B	Bega	277	35W	Electronic
X3	Exterior wall wash, recessed, aluminum housing	(1) TT - TT-C	Eliptipar	277	35W	Electronic
X4	Exterior recessed fixture, circular with 6 inch fixture size	(1) TT - TT-D	Erco	277	18W	Electronic
Y1	Parascoop fixture, wall mounted with uplight distribution	(1) TH - TH-1	Erco	277	300W	-
Z1	Exterior wall mounted fixture, wide spread down and narrow beam up	(1) MH - MH-3	Erco	277	70W	-
Z2	Recessed wall fixture, lensed with shielded top to prevent uplight	(1) MH - MH-2	Erco	277	35W	-
Z3	In ground wall washing fixture, narrow distribution of up light	(1) MH - MH-2	erco	277	35W	-
LED1	Strip LED fixture, set up for continue run by attaching portions of LEDS	LED	Color Kinetic	24VDC	28.8W/4'	-



Lamp Data

Label	Type	CRI	CCT	W	Initial Lumen	Mean Lumen	Manufactuer
T8-B	T8	80	3500	32	2950	2800	Philips
TT-B	TT	80	3500	35	2400	-	Philips
TT-C	TT	80	3500	45	3200	-	Philips
TT-D	TT	80	3500	18	1200	1130	Philips
T5ho-A	T5Ho	80	3500	49	4900	4606	GE
MH-2	MH	83	3000	35	3300	2600	Philips
MH-3	MH	830	3000	70	6600	4950	Philips
TH-1	TH	-	-	300	5000	-	Philips

Ballast Data

Label	W	Lamp	Dimming	BF	Manuf
BL-1b	54	t5ho	no	1	Advanced
BL-3	32	T8	yes	1*	Lutron
Btt-2	35	TT	yes	1*	Lutron
Btt-3	45	TT	yes	1*	Lutron
Btt-4	18	TT	no	1	Advanced

* Exact ballast data was not given so one was used.

Light Loss Factor

Numerous assumptions were made to help calculate the light loss factors for the exterior of the building. RSDD values were assumed using a RC value of 2.5 for each of the spaces, because the height and area of the rooms varied in each instance. The RSDD value for the exterior was simply assumed to be .8 as this is a low value for RSDD and the outside of a building that will not necessarily be clean. LLD for the façade was assumed to be under medium dirt conditions. BF was placed at one for each of the luminaries. The ballasts were picked as close to one, already, and with so much variability in the assumptions for the other factor, I wanted this to remain constant.

Label	Maintenance Category	LLD	RSDD	LDD	BF	LLF
A13	II	0.8	0.95	0.95	1	0.722
A14	IV	0.8	0.95	0.9	1	0.722
B8	V	0.8	0.95	0.88	1	0.722
W1	V	0.8	0.8	0.82	1	0.512
W2	VI	0.8	0.8	0.8	1	0.512
X1	V	0.8	0.8	0.82	1	0.512
X2	V	0.8	0.8	0.82	1	0.512
X3	V	0.9	0.8	0.82	1	0.576
Y1	VI	0.9	0.8	0.8	-	0.576
Y2	III	0.9	0.8	0.85	-	0.612
Z1	III	0.9	0.8	0.85	-	0.612
Z2	IV	0.9	0.8	0.81	-	0.5832
Z3	IV	0.9	0.8	0.81	-	0.5832

Power Density

Tower Study Rooms

Label	Wattage	Quantity	Power Density
A8	32	5	160
B7	35	4	140
B8	90	4	360
		Total = 660 w/ft2 = 1.51	

The interior of the tower may not be on the façade of the building, but it plays an important part in the lighting design for the space. The wattage per square foot value is slightly high for this space, but this can be negated by eliminating the lighting on the exterior portion of the façade, and if this is not substantial then savings can also be made up in other portions of the building.

Entrance Area

Label	Wattage	Quantity	Power Density
W2	49	4	196
X3	35	2	70
X4	18	4	72
Z2	35	4	140
		Total =	478

The power densities for this portion of the space is dependant on how long the horizontal run of the doors is. In this case, the run is 14' long which allows for a power density of 420 watts across the length of the entrance. The value obtained for the wattage in the entrance slightly exceeds the standards set by the ASHRAE codes. However, the wattage that I factored into this situation includes lights in a vestibule located directly behind the entrance. This extra space should allow for extra factor to be taken into consideration.

Building Façade

Label	Wattage	Quantity	Power Density
Entry	478	-	478
Z1	70	12	840
X2	35	2	70
Y1	300	2	600
LED1	28.4	21	596.4
		Total =	2584.4

According to ASHRAE standards, with 5W/ linear foot allowed on the façade, my building has a length of 165' which allows for 825W on the façade. Going by the .2w/ft^2 on the façade, my building is allowed to have 2706 W/ft^2 because of it's 13530 ft^2 of façade area. My façade design fulfills the second requirement.

Panel Layout

The following figures contain the luminaire layout for the auditorium. Each luminaire is labeled in the similar manner:

X1 – PXX – X – X

The first number represents the fixture's representation in the luminaire plan. The second number is the panel on which the circuit can be found, the third number is the branch circuit on the panel, and finally, the final number is in correspondence to the dimming zone of the room when dimming is applicable.

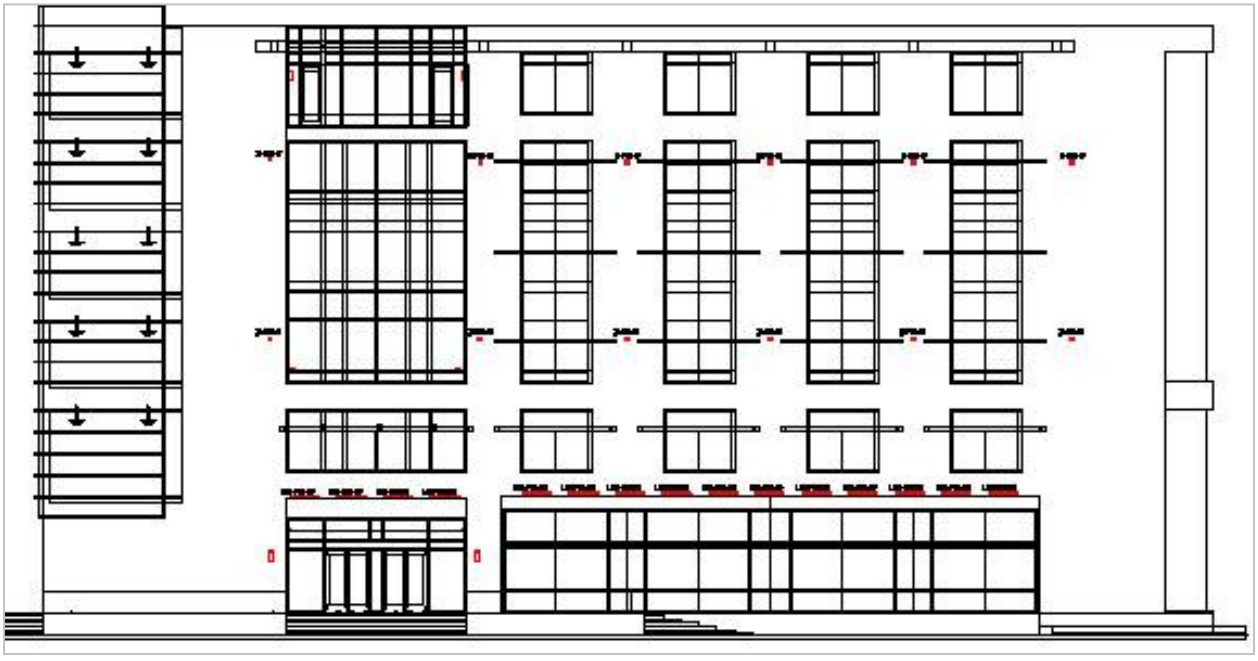


Figure EXT.1

Figure EXT.2

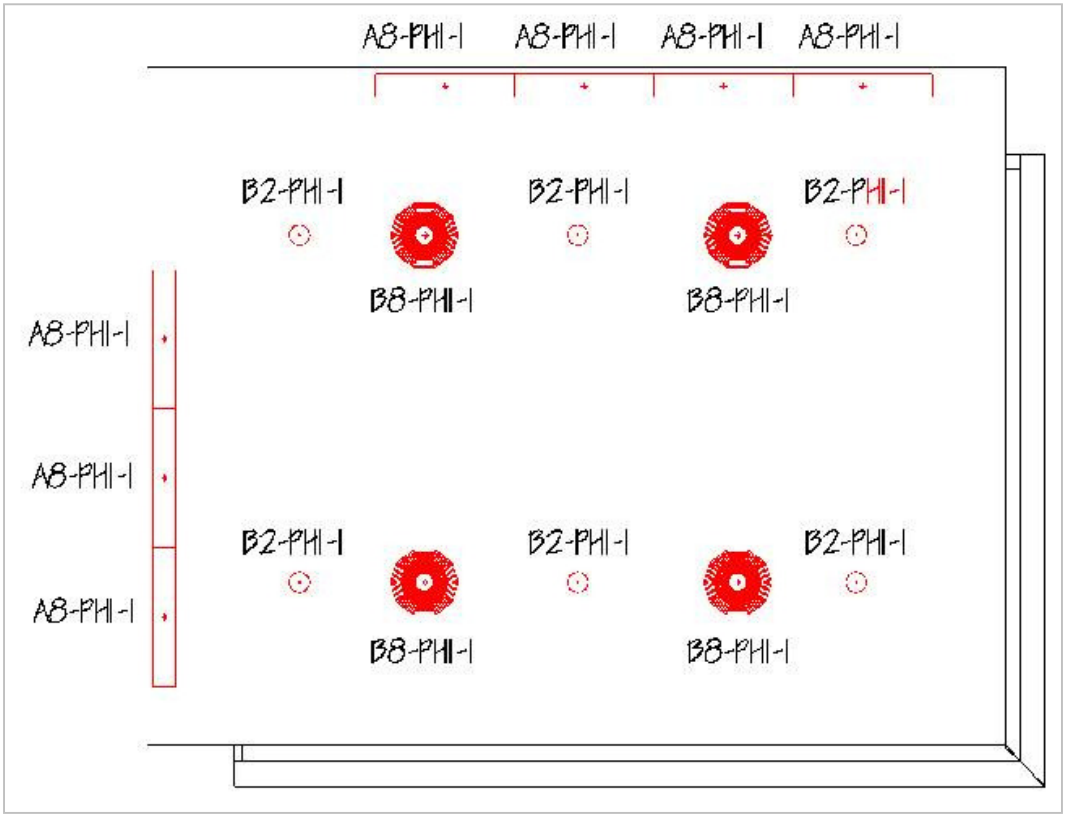


Figure EXT.3

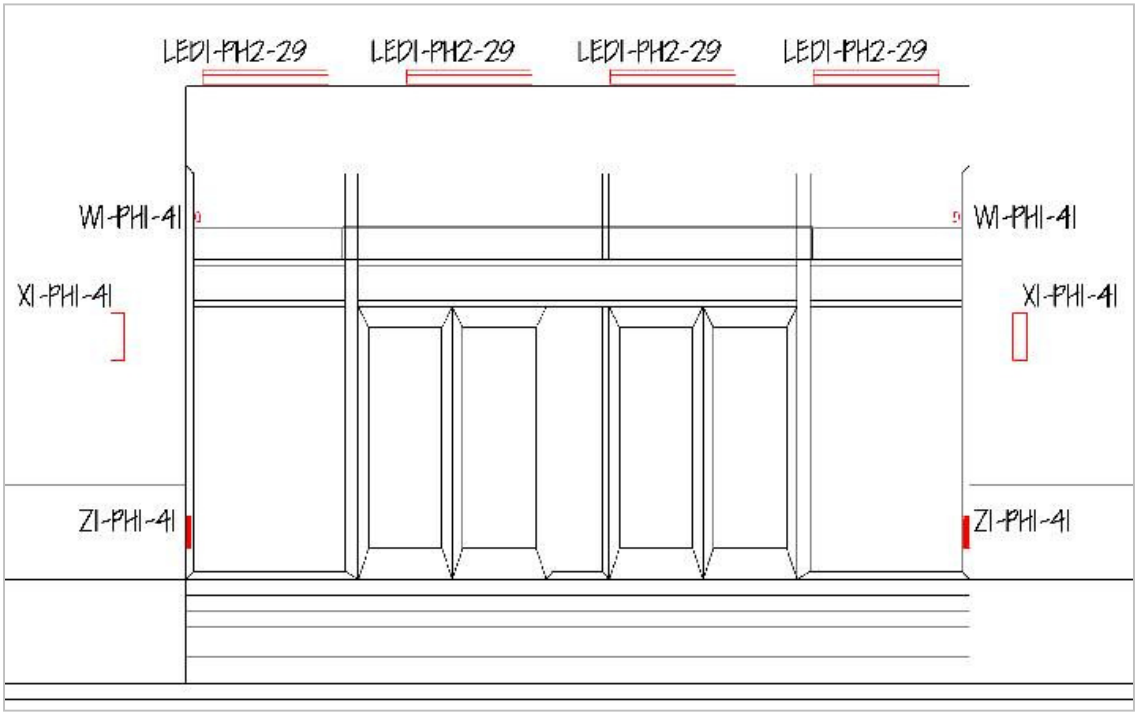
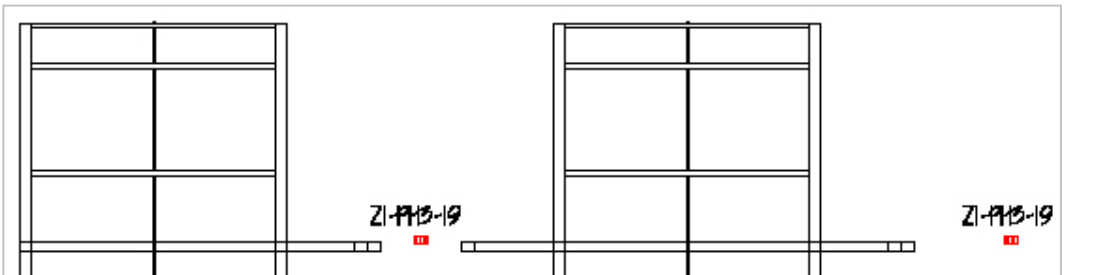


Figure EXT.4

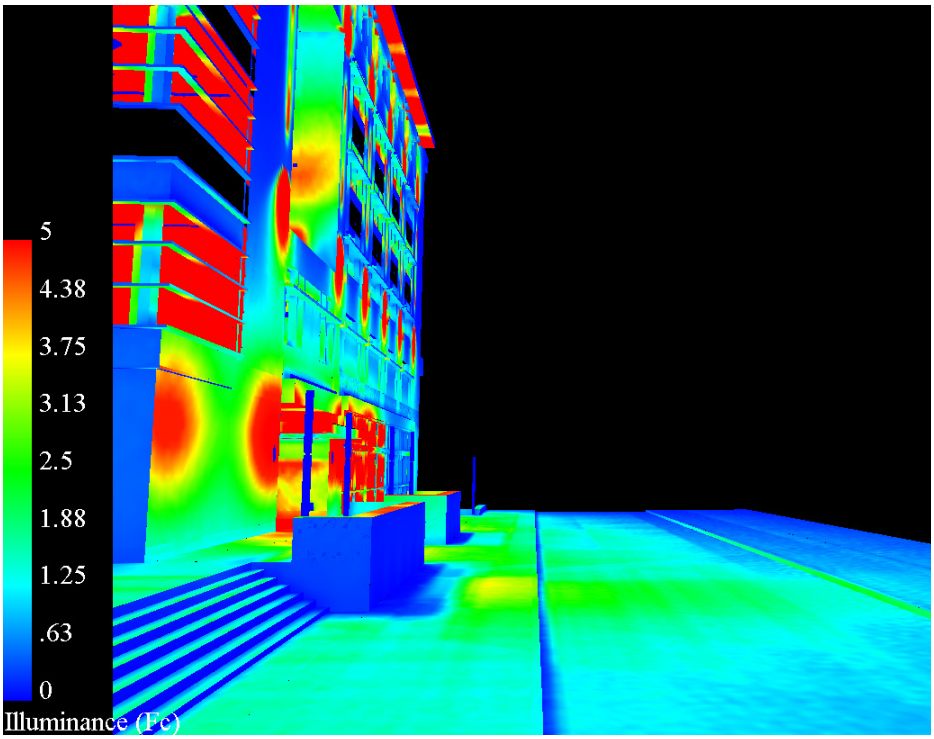


ZI-PH3-19
ZI-PH3-19
LEDI-PH2-29
LEDI-PH2-29
LEDI-PH2-29
LEDI-PH2-29
LEDI-PH2-29

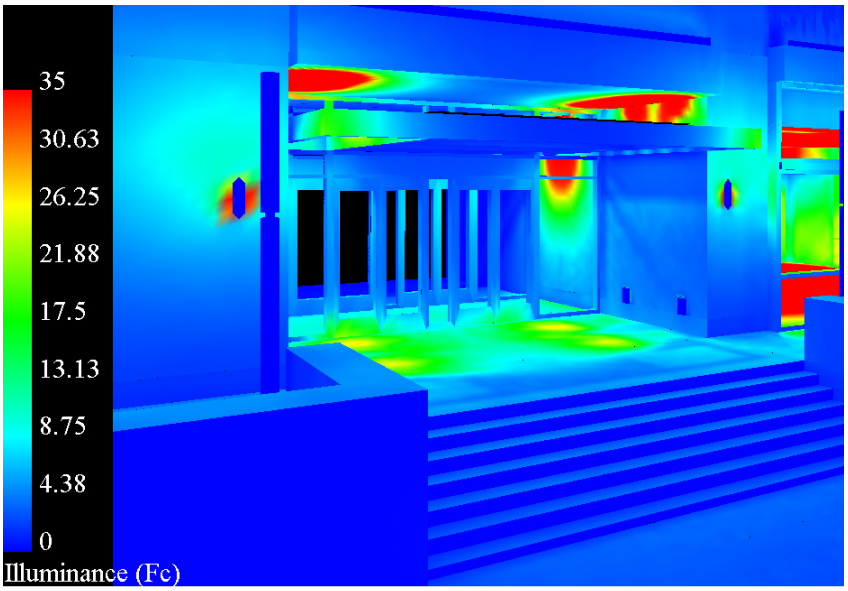
Figure EXT.5

Calculation Data –

Despite being placed in the city, there are few buildings around Duques hall that will actually be affected by any type of light trespass. As you can see in the pseudo color renderings below, the values on the road from reflected light never exceed 5 fc.



Rendering EXT.1



Rendering EXT.2

Relamping

One of the challenges for the lighting of the façade is ensuring that the lamps placed on the façade are accessible so that they can be relamped when they finally burn out. In this case, the luminaries were placed near the windows of the building. There is not direct access, and this is not a small distance for a person to reach across, but it is a possibility. The second, more logical option is to relamp the windows when the exterior part of the windows are washed. With a building that provides daylight into the interior, it would not be uncommon to have the windows cleaned at least once a year. The lamp life of the exterior fixtures should be long enough that they can be replaced when window washing occurs.

Light Tower

Rendering EXT.3

Design considerations for this part of the building begin to contradict themselves as the purpose of the light tower is to create a glowing portion of the building, while you want to eliminate throwing too much light onto the surrounding areas. The biggest area that is affected by the light tower is a portion of Funger Hall, the old business school building that is placed right next to Duques Hall. The façade that is washed by the light tower lacks window, and receives little affect from the light tower.

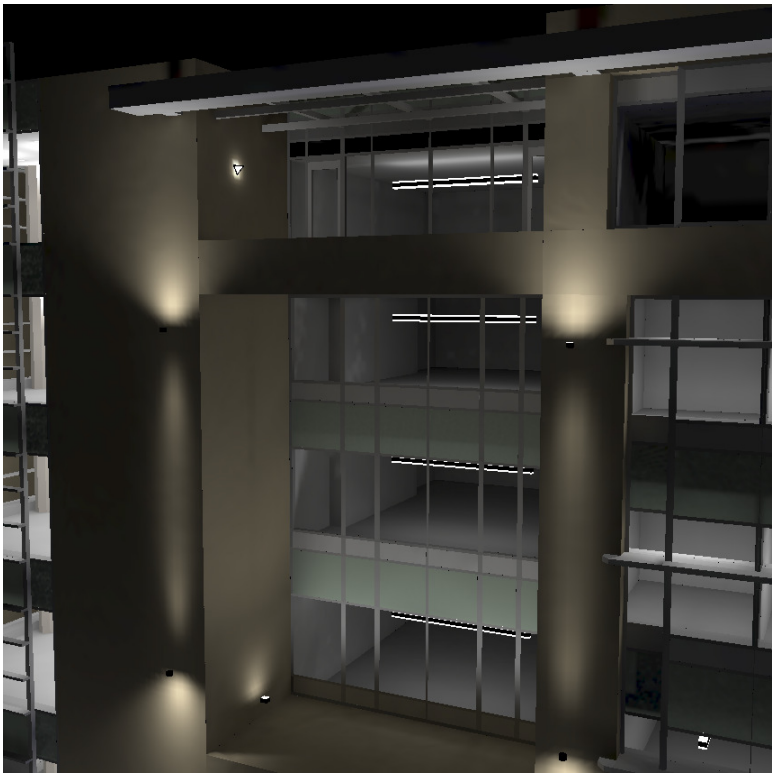
The solution of lighting the ceilings and the walls within the space did an excellent job of providing the desired light output. Glowing walls translated into a glowing tower, and the result became a dynamic façade for people to view, while creating a glow that seriously affect the surrounding areas.

Building Entrance

Rendering EXT.4

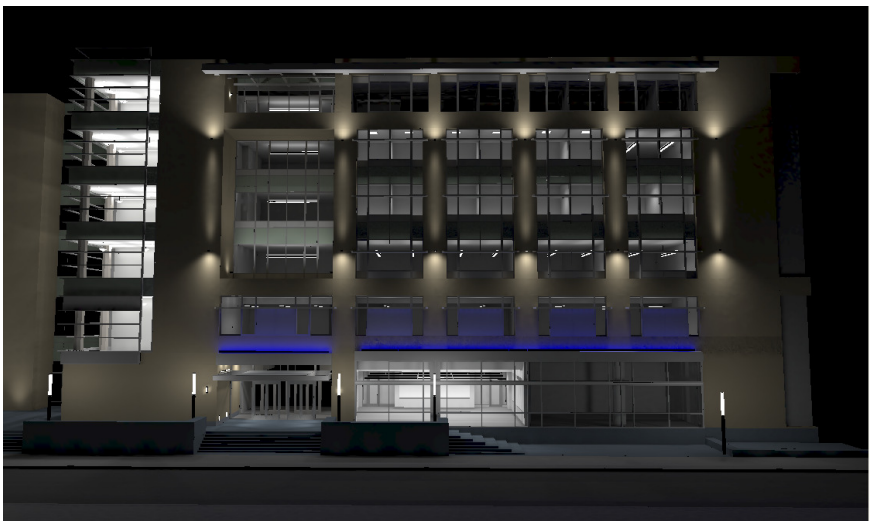
The main design consideration for the building entrance was to create a design that would stand out amongst the rest of the building while also becoming a space that would appear welcoming. Washing the ceiling above the doors, and the floor below helped to create a feeling of height to the space, while lighting the vestibules behind the doorway would help to create would add to this affect and help to make the space appear larger and brighter. The two fixtures in front of the door act as beacons, drawing your attention toward the space.

Architectural Highlights



Rendering EXT.5

The indentation above the entrance, along with the balcony area above it, is one of the more interesting aspects of the façade. By selecting a fixture with the varying spread on either side of it, a unique affect could be utilized to highlight this area. The long run of light on either side of the indentation helps to frame the area while the upligths on the inside create glowing walls that separate it from the rest of the façade.



Rendering EXT.6

Rendering EXT.7