

The Barnes Foundation  
2025 Benjamin Franklin Parkway, Philadelphia, PA 19130

# Thesis Proposal, Update I

Senior Project Proposal for Spring Semester

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## Executive Summary

The Barnes Foundation in Philadelphia is an art education facility that houses a large collection of artwork obtained by Dr. Albert Barnes. This building will be the focus of the thesis proposal to follow. The main depth being studied with this facility is a Lighting and Electrical study. There will be a lighting redesign for the following spaces:

- | Site (Public Garden and Entrance Walkway)
- | Light Box
- | Light Court
- | Lower Lobby
- | Open Office

These spaces throughout the building will be redesigned to express that light is trying to escape through the cracks of the building; expressing the concept of erosion. The Electrical depth will consist of a branch circuit redesign of the five spaces mentioned above, a short circuit analysis of the new design, and an emergency power study. The emergency power study will include a backup generator study and an emergency lighting study.

There will also be three further breadths involved in the building. The first being a Daylight analysis of the open office area to create skylight apertures to allow more daylight into the workspace. This will then result in the need for both a Structural and Mechanical breadth. The Structural breadth will include a steel structure redesign of the office area to accommodate the skylights. The Mechanical breadth will include a mechanical layout redesign to avoid the new skylights and an analysis of the mechanical system to ensure that it can handle the new conditions in the space.

Located at the end of the report is a proposed schedule for the Spring semester that culminates in a final presentation on the week of April 13<sup>th</sup>.

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## Building Overview

### Building Name

The Barnes Foundation  
Philadelphia Campus

### Location

2025 Benjamin Franklin Parkway, Philadelphia, PA 19130

### Building Occupant Name

The Barnes Foundation

### Occupancy or Function Types

Assembly (A-3), Business (B)  
Conference Rooms, Auditorium, Lounges, Library

### Size (Total square feet)

91,748 GSF

### Number of Stories Above Grade / Total Levels

2 Stories above ground | 61' above ground  
3 Stories total

### Dates of Construction

11/10/2009 – 2/23/2012

### Cost Information

Total Cost - \$75,890,374

### Project Delivery Method

Guaranteed Maximum Price (GMP)

## Primary Project Team

### Owner

The Barnes Foundation | <http://www.barnesfoundation.org/>

### Architect

Tod Williams Billie Tsien Architects | <http://www.twbta.com/>

### Associate Architect/LEED

Ballinger Architects | <http://www.ballinger-ae.com/>

### Landscape Architect

Olin Partnership | <http://www.theolinstudio.com/>

### MEP Engineer

Altieri Sebor Wieber | <http://www.altieriseborwieber.com/>

### Lighting Designer

Fisher Marantz Stone | <http://www.fmsp.com/>

## Lighting Depth

A lighting redesign will be conducted at specific locations on the Barnes Foundation's Philadelphia campus. These spaces include:

- | Site (Public Garden and Entrance Walkway)
- | Light Box
- | Light Court
- | Lower Lobby
- | Open Office



## Concept

When designing The Barnes Foundation, Tod Williams and Billie Tsien drew inspiration from Mrs. Barnes and the 12-acre arboretum that she cultivate around the Barnes' home in Merion, PA. They created the concept of a gallery in a garden and a garden in a gallery. However, this concept was not allowed to be used within the main gallery space of the museum. In Albert Barnes' will it states that if his artwork is to be moved it must be displayed in the same manner and position as it was on the day he died.

This combination of the constancy of the artwork and the natural aspect of the building led to the concept of erosion for the new lighting design of The Barnes Foundation. While we see the physical world as a constant, erosion reveals an area's history and accentuates the form of an object. The lighting design will act as the erosion of the space, seeping out from the cracks.

## Site

The public garden area will be designed to be more inviting to pedestrians walking past the Barnes at night. Pole lighting will create ambient light in the area to provide vertical illuminance to visitors. The fountain will have underwater fixtures at specific locations and the benches surrounding the fountain will be underlit. This will cause light to emulate from within each structure and leak out of any opening.

The main objective for the entrance walkway will be wayfinding. This will first be accomplished by highlighting the retaining walls that lead visitors from the garden to the entrance plaza. From here, in-grade linear fixtures will be placed in a random fashion along the walkway to lead visitors directly to the main entrance.

### Light Box

Acting as the symbol for the Barnes at night, the Light Box will be softly lit to mimic a lantern like appearance. This will be done by placing linear RGB LED fixtures around the Light Box to illuminate the form of the Light Court that the box encases. Furthermore, projection systems will be placed at either end of the Light Box to advertise special exhibits that are currently taking place inside the building. In coordination with this, the LED fixtures will change to colors that resemble those typically used by the artist being exhibited. For the majority of the time, however, the Light Box will be illuminated with white light.

### Light Court

After you pay the entrance fee to the facility, you enter the Light Court, a three-story tall atrium space with a large daylight aperture overhead. This space is used for various events at night for multiple nights per week. The daylight aperture will be lit by using linear fixtures hidden above what is referred to as the “knife edge”. These lights will simulate daylight during the night.

The walls of the Light Court are covered in limestone tiles with small gaps in between. Along the horizontal portions of these gaps, linear LED lights will be placed to resemble light seeping from the cracks of the walls. Furthermore, certain objects, such as portions of the wall that are a different material and the large bronze structure that acts as a vestibule between the interior and exterior light court, will be accented to create focus in the space.

### Lower Lobby

Acting as the lobby to the auditorium, library, gift shop, and back-of-house staff area, the lower lobby acts as a lounge space and also contains the interior garden of the Barnes. This area will have both public and private scenes in the space. For the public setting, a grid (resembling that of the Light Court walls) of linear recessed fixtures will supply ambient light to the lobby with downlights as supplemental lighting. Spot lights will illuminate the interior garden from both ends to lessen the mirror-like effect of that glass at night.

For the private setting, the grid of linear fixtures will be fully addressable. This will allow the space to be customized to any placement of furniture that the Barnes Foundation or any event would like. The interior garden will then be lit with specific spotlights to create more contrast within the garden space.

### Open Office

Roof monitors resembling those found throughout the gallery will be included in the new open office plan. Cove lighting will be hidden in the roof monitors to create indirect lighting for the employees. The main ambient lighting of the space will be supplied by semi-indirect linear fixtures. Cove lighting will supply the cubicles along the west end of the room, and the walkway along the east end of the room, with indirect lighting. The lighting design in this space is still subject to change following further development of the daylight apertures. This is further discussed in the MAE Daylighting Breadth.

## Schematic Design Presentation Feedback

### Richard Mistrick (Before Lutron Presentation)

- Tie erosion into the design more
- Research if the projection system of the Light Box will work properly
- Expand on wall construction of the Light Court
- Are lights necessary during daylight hours?
- Glass will act as a mirror in the Lower Lobby
- Cove lighting idea may be better than linear fixture idea, more quiet ceiling
- Roof monitor in open office, not a skylight

### Shawn Good (Before Lutron Presentation)

- Have pole lights accent the walkway more
- Create a focus from the garden to the walkway
- Is the Light Box bright enough that it will accent the surrounding area?
- Tie concepts back to erosion

### Lee Brandt

- Tie in the concept better with some spaces, the site in particular
- Erosion is more of a negative word, try to see if you can use a more positive sounding word/phrase
- Since the materials are very important use more colors in plans and renderings
- Use yellow instead of white to express light in perspective views
- The plan is much better for the site than the renderings
- Proposed in-grade fixtures for site lighting will not run continuous as desired
- Pool light will need space, show section to show the exact placement
- Make the Light Box section clearer to show how the indirect light works
- Make the colors of the Light Box more subtle; two instead of three colors
- Didn't like the "Vertical" scheme
- Possibly a combination of the "Garden" and "Horizontal" schemes
- Say when the building is open at night during the presentation
- Color changing fixtures above the knife edge may be interesting
- Consider daylight in the lower lobby and how it will affect the lighting
- Offices are nice

### Tony Esposito

- Likes the style of the renderings but use yellow instead of white for the light to make it more legible
- Does the color changing light work with the idea of "natural elements"
- Not a fan of lighting the large ceiling

## Areas to Revisit

### General

- Look into a more positive phrasing to the same concept
- Tie the concept back into every space
- Use colors to express materials in plans and renderings
- Use yellow instead of white to express light in renderings

### Site

- Connect the garden area to the walkway more
- Create sections to show the placement of certain fixtures
- Have the plan larger, it's easier to read for that size of an area

### Light Box

- Create a clearer section to show how the space is illuminated
- Look into placement of projection system
- Have the color change more subtle

### Light Court

- Create a comprised design using the “Garden” and “Horizontal” schemes
- Expand upon the wall construction

### Lower Lobby

- Consider how daylight will affect the electric lighting
- Grid may be too busy, look into cove solution

### Open Office

- Tie the concept more into this area

## Tasks & Tools

### Schematic Design

A mixture of hand sketches and Photoshop images will be used to express the schematic design of the spaces above.

### 3D Modeling | Design Development | Lighting Analysis

AutoCAD and 3D Studio Max will be used to create precise models of each space. A combination of both 3D Studio Max and AGi32 will then be used to analyze the lighting design of each space and ensure it meets the criteria set for the area.

### Daylight Analysis

AGi32 will be used to analyze the amount of daylight entering a space. Daysim will then be used to create year-round daylighting data of the different rooms.



## Electrical Depth

Power enters The Barnes Foundation at 13.2kV where it is then converted to 480/277V, 3PH as the building utilization voltage. A 2500A switchgear distributes the power to five distribution panels; four of these panels are converted to 208/120V while the remaining panel is 480/277V.

Emergency power to the building is supplied by a 400 kW / 500 kVA diesel generator running at 480Y/277V, 3PH, 4W. The generator supplies power to two of the five distribution panels. From here a Building Management System determines critical loads during power failure and will ensure that those loads are supplied with power before others.

## Branch Circuit Analysis

With the new lighting design in portions of the building, the branch circuiting will be redesigned to guarantee that panelboards, feeders, and wiring are able to handle the new loads.

## Short Circuit Analysis

Using short circuit calculations, a protective device coordination study will be done by addressing a single path through the distribution system.

## Emergency Power Analysis

The current generator is paired with a Building Management System that is capable of controlling which loads on the emergency panels receive power. A study will be conducted to analyze if this is an efficient system during emergency situations or if a larger emergency generator is needed. The generator will then be sized appropriately. Furthermore, a redesign of the emergency lighting will be conducted for the spaces mentioned above to reduce energy usage during critical operation.

## MAE Daylighting Breadth

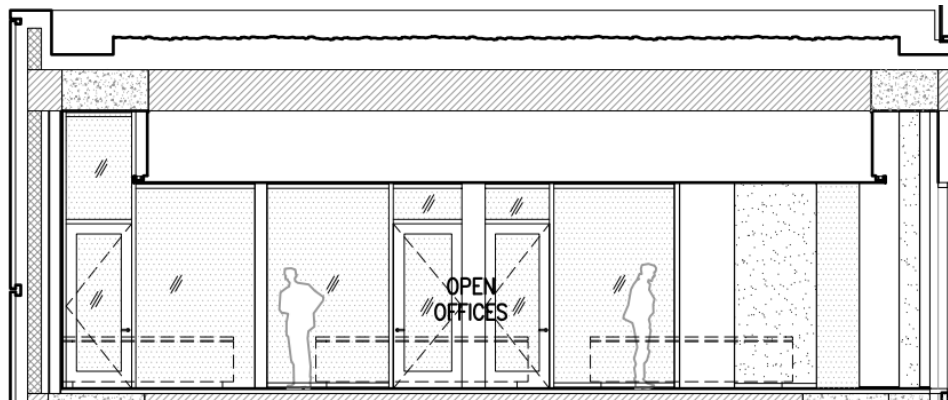
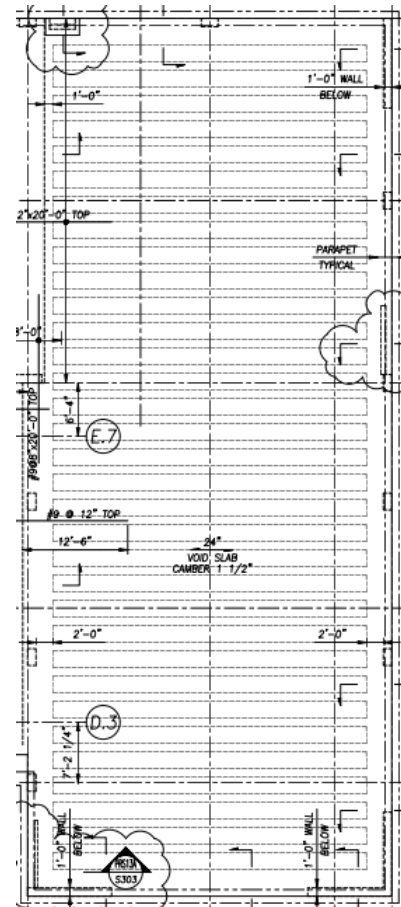
The current office space located on the top floor of the east portion of the facility receives a minimal amount of daylight. To liven up the space and increase the happiness of employees a daylight study will be connected to allow more daylight to enter the space through the roof. Different daylight apertures will be tested to see which will create the optimal amount of daylight in the office.

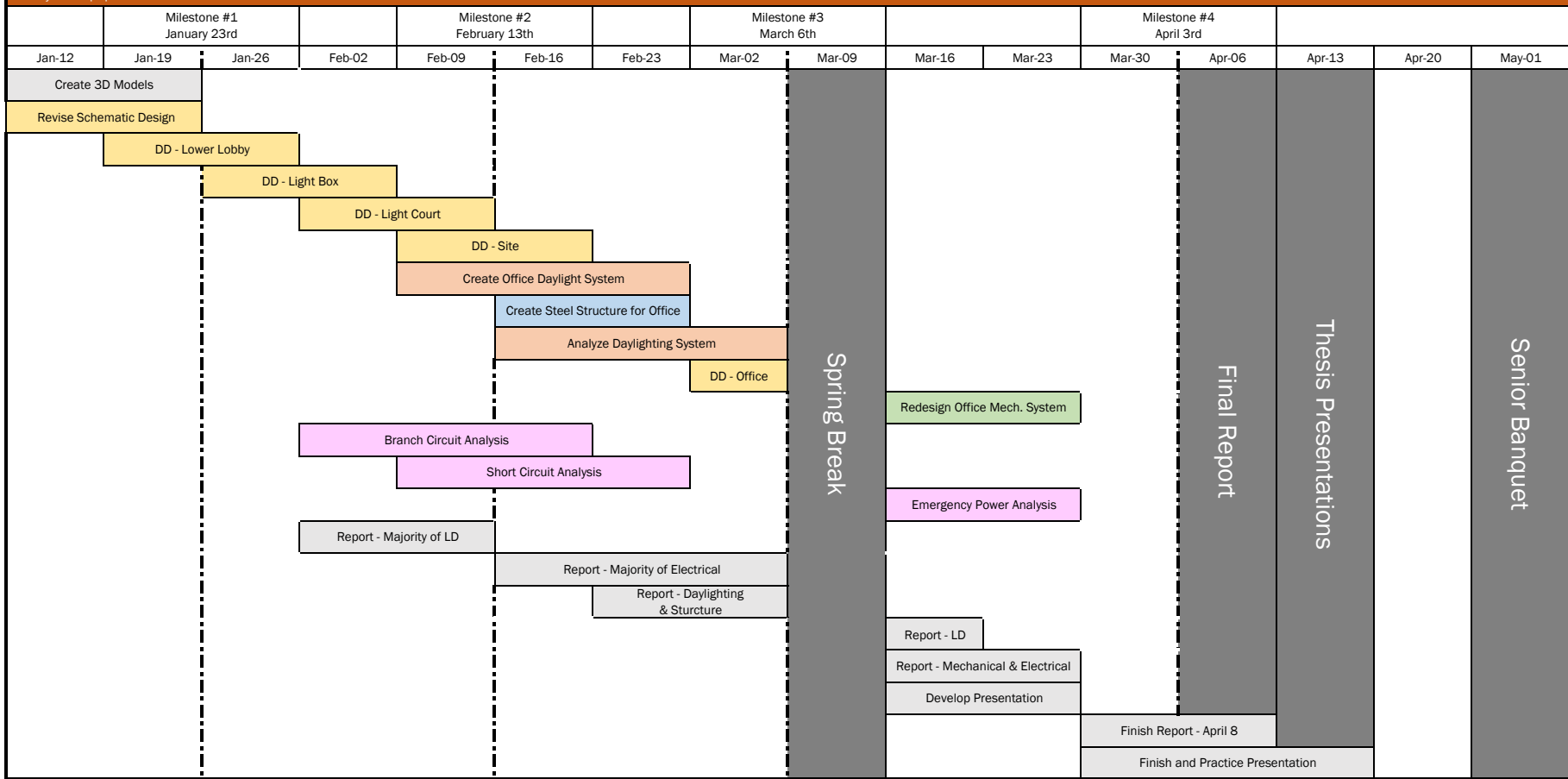
## Structural Breadth

With the inclusion of new daylight apertures in the open office area, a new structural system will be necessary to support the new ceiling/roof geometry and the added weight of the apertures. The current concrete cambered structure (shown right) will be replaced with a steel structure to better accommodate the location of skylights. Columns will be added along the center of the space to allow for smaller beams spanning the area. Roof loads including snow and green roof loads will be analyzed for beam and column sizing; if necessary, the green roof will be reduced or removed to allow for a more efficient design.

## Mechanical Breadth

Furthermore, the addition of these skylights will result in the need for a new mechanical layout of the space. This system will be redesigned around the skylights and calculations will be conducted to ensure the new system will be able to handle the extra load caused by these apertures. If necessary, the mechanical equipment will be resized to manage this new load.





Schedule Legend	
Lighting	
Electrical	
Daylighting	
Structural	
Mechanical	
General   Report	

