

Thesis Proposal for Spring Research



ANN AND RICHARD BARSHINGER LIFE SCIENCES & PHILOSOPHY BUILDING
FRANKLIN & MARSHALL COLLEGE
LANCASTER, PA

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Lighting/Electrical Option
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Executive Summary

The following proposal will detail the means, methods, and points of emphasis in the redesign phase of the thesis project. I have selected some different goals than the original design of the Barshinger Life Sciences & Philosophy Building, but in the end I hope to create spaces that match the quality of the original design, with distinct advantages over that design. This project will involve two depth studies (in lighting systems and electrical systems) as well as two breadth studies (in acoustics and sustainability).

The lighting depth will study four spaces in detail. This includes a lecture hall, laboratory classroom, atrium/lobby, and the main exterior entry. The particular goals of the redesign are to create more exciting spaces (or in the case of the lab, more task-specific lighting throughout the space), to maintain aesthetic appeal, and to be energy and cost-efficient. The lecture hall ceiling will be re-designed to remove the coves, and attention needs to be made to the light distribution on the desks below and the presentation area. The laboratory will be a layout that is more conducive to learning and is more flexible during after hours. In the atrium, another cove will be removed, and a custom chandelier/decorative fixture will be designed specifically for the space. Finally, the entry and façade will emphasize the elements of the building that set it apart from the other buildings at Franklin & Marshall College, and create a secure & pleasing nighttime environment.

The electrical depth will cover two main topics. The first is an analysis on using one or two transformers from 480V to 208Y/120V would be more beneficial than the current layout of multiple transformers per floor. The second will be an analysis and re-design of one of the emergency distribution panels (EQD4P), which currently contains the emergency dimming panel for the spaces being redesigned and therefore must be looked at. In addition, I plan to redesign the branch circuits for the lighting in the four re-designed spaces, and to conduct a protective device coordination study from the main switchboard to the new downlights in the atrium, which will be on an emergency panel.

The acoustics breadth will study the impact of the new dropped ceiling in the lecture hall on the acoustical quality of the space. The study will help determine what materials the dropped ceiling needs to be made of, as well as any additional aspects the space to have a reasonable reverberation time.

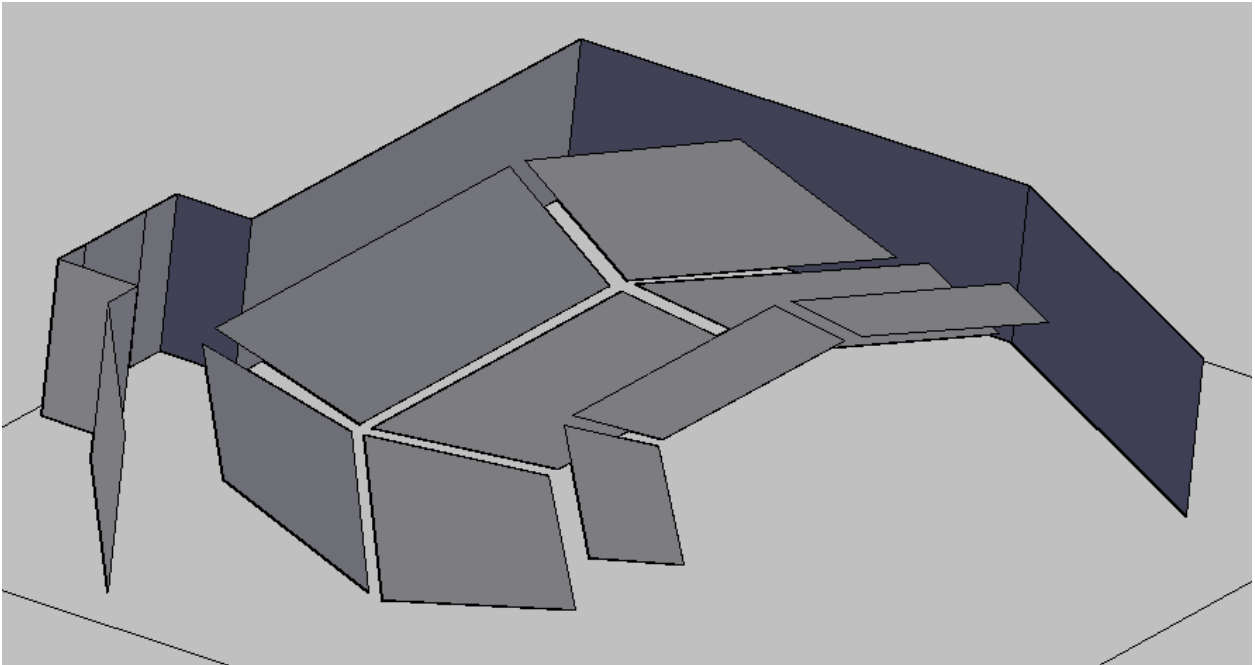
The sustainable breadth will study changing the major materials in the building to more rapidly renewable and environmentally-friendly ones. While no attempt will be made to attain LEED certification, I will use LEED as a guideline for material choices, such as standards for rapidly-renewable resources, low-VOC materials, and locally manufactured materials. The goal is to maintain the high aesthetic quality of the building while making changes that are better for the environment.



Lighting Depth

Space 1 – Lecture Hall

The key part of the re-design efforts here will be the change of the ceiling from a linear cove to a dropped ceiling that better matches the layout of the furnishings below. A current schematic of the proposed ceiling is below:



At present, the design will involve downlighting (linear, in line with the furnishings and ceiling) recessed into the dropped ceiling, round downlights over the back paths, ramp, and exits, and directional lights specifically for lighting the speaker and chalkboard. This last one will have to be studied thoroughly, as the light on the projection screen here must be kept to a minimum.

Space 2 – Atrium

The major new design feature of this space will be a chandelier / decorative fixture as the focal point of the space. At present, the design concept involves using luminous discs, with a theme of three coming together as one to represent the departments coming together in one building for the first time. Also in the plans are a layout of HID downlights for 24-hour use, and accent lighting on the artwork and recognition wall.



Space 3 – Laboratory

The basic design here will be fairly simple: recessed/semi-recessed linear downlights over all workstations, wall-washing for the cabinetry, and a chalkboard light in the front. The key design here will be the switching/zones of the system. The goal is to get a design that can be replicated in all of the labs of the building (which are all of similar size and layout), and that allows a user to turn on a limited zone of lighting rather than every light in the rooms.

Space 4 – Façade/Entry

Here, I want to emphasize the key elements of the façade that set it apart from the other buildings around it (besides the sheer size), as well to focus on the elements that made it a strong example of Georgian-revival architecture. This includes uplighting the pilasters, making the pediment glow, and putting a good amount of light on the main entrance. In addition, I plan to look at a more cut-off luminaire for lighting the paths leading to the building, replicating that on the smaller scale to light the entry area, and recessed linear fluorescent into the ramp side walls for even lighting of the ramp.

Means and Methods for All:

Preliminary analysis of approximate sources and lighting needs will be done using the IESNA Handbook, the print version of the plans, and Excel. Full calculation analysis will primarily be done in AGI, and imaging will be done using AGI32 and Autodesk VIZ. Design of spaces and custom luminaires will be done with sketching and AutoCAD.

For any further details on schematic design or the architecture of the space, please see the Technical Assignments on my website:

<http://www.engr.psu.edu/ae/thesis/portfolios/2008/jpw202/tech%20assign.htm>



Electrical Depth

Part 1 – Four Spaces to be Redesigned

The four spaces that I will be focusing on will be a 3-story atrium, a first-floor lecture hall, a second-floor laboratory, and the main entry/façade.

Part 2 – Extent of the Short Circuit Analysis

I want to perform a protective device coordination and short circuit analysis starting from the main switchboard to the new HID lighting in the atrium. This lighting will be on the emergency system (and will be supported by an HID backup ballast to maintain the arc during the switch from normal to emergency). Therefore, the path will be from the main switchboard to the 400A automatic transfer switch to the emergency distribution panel (EQD4P) to the HID lighting (with the possibility of a lighting panel in between).

Part 3 – Electrical Depth Topics

Topic A – Analysis / Redesign of Distribution Panel

I have selected to analyze the main emergency distribution panel (EQD4P), as this is the main panel that keeps the entire building functioning during power failure, and will experience a change in loading as a result of the redesign of the lighting systems. I will look at the sizing of all loads on this panel, and using Excel, the NEC, and manufacturer's data, will find the appropriate size of the panel and the feeder. I will use calculation procedures and demand factors as set forth in the NEC.

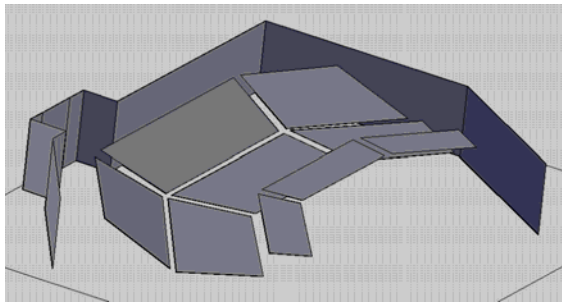
Topic B – Using a Central Transformer vs. Distributed Transformers

The current design uses multiple transformers on each floor converting the voltage from a 480V Delta system to a 208Y/120 system. In an attempt to lower costs and simplify the system, I am proposed using only two: one for normal power and one for normal/emergency power. The normal transformer would be located in the main electrical room, and the n/e transformer would be located in the penthouse electrical room. This involved analyzing voltage drop and the main bus ducts more thoroughly.



Acoustics Breadth

The acoustics breadth will study the impact of the new dropped ceiling in the lecture hall on the acoustical quality of the space. This space is critical to the building, as all guest lectures will be heard in this space, as well as many normal lecture courses. Sound waves need to carry to the very ends of the space (overflow seating is along the back wall) and reverberation time needs to be limited to a reasonable amount. The study will help determine what materials the dropped ceiling needs to be made of, as well as any additional aspects the space to have a reasonable reverberation time. A preliminary concept for the ceiling is below.



Sustainability Breadth

The sustainable breadth will study changing the major materials in the building to more rapidly renewable and environmentally-friendly ones. While no attempt will be made to attain LEED certification, I will use LEED as a guideline for material choices, such as standards for rapidly-renewable resources, low-VOC materials, and locally manufactured materials. Emphasis will be placed on rapid-renewable wood, recyclable materials for wall construction, and alternative flooring options throughout. Cost will also be a factor in the selection of materials, but it is understood upfront that first costs are likely to be higher. The goal is to maintain the high aesthetic quality of the building while making changes that are better for the environment.



Proposed Schedule

<u>Dates</u>	<u>Objectives</u>
January 7th-January 13th	Review schematic design concepts Complete AutoCAD for all spaces (minus ceiling in Lecture Hall) Perform concept sketches for custom chandelier in atrium
January 14th-January 16th	Meet with Dr. Mistrick concerning schematic designs and custom fixture Meet with Dr. Riley concerning sustainable materials Meet with Prof. Ling concerning schematic design for dropped ceiling
January 17th-January 22th	IES Trip to New York THON Family Birthday Party Hershey Medical Center Visit
January 23th-January 29th	Research and perform sustainable materials breadth
January 30th-February 6th	Insert materials into all models in AGI32 Perform acoustical breadth
February 7th	Personal day
February 8th-February 16th	Lecture Hall and Front Façade Designs and Modeling
February 17th-February 21th	Design Review Finalization of Custom Fixture in Atrium
February 22th-February 24th	THON Weekend
February 25th-March 2th	Atrium and Laboratory Designs and Modeling
March 3th-March 7th	Analysis of Branch Circuits and Control Systems for all spaces
March 8th-March 16th	Spring Break - Catch Up Work, Prepare for Move
March 17th-March 22th	Analyze/design EQD4P panel
March 23th-March 29th	Analyze central transformer system vs. distributed
March 30th-April 2th	Conduct protective device coordination / short circuit study
April 3th-April 6th	Catch-Up / Design Review
April 7th	Self-imposed Deadline for Thesis Paper Copy completed
April 8th-April 12th	PowerPoint Presentation preparation
April 13th	Review and run through presentation
April 14th-April 18th	Presentation Week
April 19th-April 30th	Complete any reflection exercises