THESIS PROPOSAL

New Jersey Center for Science, Technology, and Mathematics Education

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LIGHTING/ELECTRICAL
DANNERTH/HOUSER
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I. EXECUTIVE SUMMARY

This paper is a proposal for work to be conducted in the Spring Semester of 2009 for AE 482. This work includes redesigns for the New Jersey Center for Science, Technology, and Mathematics Education. The lighting depth is a redesign of four spaces: Lower Lobby, Outside the south façade, auditorium, and a typical classroom. The electrical depth includes a branch circuit redesign of all the lighting systems which were altered and a protective device coordination study. It also includes a cost analysis of changing the feeders to aluminum and using conduit and wire instead of bus duct.

There are also two breadths outside the lighting/electrical option that will be performed next semester. A restaurant core and shell will have a layout designed and finishes as well as its HVAC system designed. Common kitchen equipment will be selected and all feeders and panels for the space will be designed.

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II. BUILDING BACKGROUND

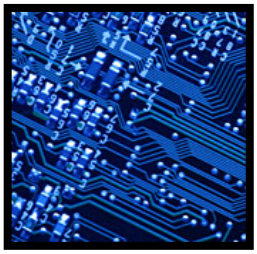
The New Jersey Center for Science, Technology, and Mathematics Education is a 117, 000 SF college laboratory and classroom building.. The building construction broke ground in September 2008 on the Kean University campus in Union, NJ. The building's modern and irregular form make it stand out amongst the older buildings on this campus. In addition to labs and classrooms, there is a 280 seat lecture hall, 3D Cave, offices for faculty, computer labs, double height lobby, and a restaurant core and shell for a future tenant.

III. LIGHTING DEPTH

The lighting system design that is being constructed is mostly composed of linear fluorescent, compact fluorescent, and halogen lighting. There are no indirect luminaires other than cove fixtures. There is a low voltage control panel on every floor for the purpose of dimming. Most spaces do not meet the power density criteria set forth by ASHRAE Standard 90.1. Many spaces such as the classrooms are designed to illuminate above and beyond what is recommended by the IESNA at 100% output. Meeting power density criteria should have been an important goal from the start because Kean University desires a LEED® Gold Rating for their building.

The redesign of the lighting system will take place in four spaces of the building. The outdoor space in front of the south façade was chosen for this breadth. This includes the area underneath the portico and the path lighting leading up to the building. The second space is the lower lobby which is entered from the south façade entrance. A typical classroom was chosen as well as the 280 seat lecture hall.

The concept of the lighting design is similar to a circuit board. A circuit board is extremely flat and has linear paths for electricity. This theme translates into the lighting design as using mostly recessed lighting. This will not take away from the architecture of the ceilings. The linear fixtures will provide paths of light to guide visitors through this irregular layout. The luminaires chosen will have a modern aesthetic to match the modern architecture.



III. LIGHTING DEPTH (cont'd)

The main concerns with the lobby space is flexibility for different functions. It is a general lobby during the day. However at night galas are held in this space which will require a drastically different lighting scene. There needs to be dimming controls for daylight integration as well as lower light levels at night during gala functions. Daylight integration will be a major concern with the classroom space as well. The auditorium will require flexibility with controls as well for different functions. There will be general lectures as well as presentations on a large screen.

Sketches and AutoCAD 3D will be used to model the spaces. After the conceptual and schematic design phases are finalized, luminaires will be selected and incorporated into AGI32 to visualize initial renderings. Calculations will then be conducted in reference to the criteria listed in Tech Report #1 in order to insure compliance. Once the design is settled, documentation and final renderings will start to complete the process.

IV. LUTRON COMMENTS

1.) SHAWN GOOD

- Overall Presentation – Calm Down! Watch movement of body and engage the audience → Look at laptop not projector
- Don't get ahead of yourself, stay with presentation
- Limit text and include on graphic slides
- Good discussion of impression and design goals
- Take liberties with the architecture cause it's OK to make some changes e.g. coves
- Lower Lobby
    - Path concept is good
    - Turn challenges into opportunities
    - Maybe highlight the columns not view as obstruction
    - Bring layers of light up separately on slides

2.) MICHAEL BARBER

- Relax
- Getting lost between visual and slides
- Layer the light onto the image

2.) MICHAEL BARBER (cont'd)

- Summary? End seemed sudden
- Classroom Plan – Solar Shades maybe unclear on plan
- Circuit board is a cool idea but show how this is in the design
- Building façade probably cannot glow like that so show how would you achieve it
- Make architectural changes as necessary
- Lobby – Section would be helpful, perimeter cove
- Think visually about strong lines of light
- Don't force light or elements into a space
- Auditorium – Show scale of the space (ceiling)
- Hand sketches were cool
    - Points in auditorium section kind of look like light
- Auditorium track lighting in front stage lighting?

3.) ANDREA HARTRANFT

- Picture and text need to work together – limit the text and stay away from full sentences
- Consider the order of the slides so that the flow of information works – have the info there if you need it
- Don't assume there will be a podium
- Good sketch of the exterior
    - Establish the hierarchy and layer the light
- Spacing of wall wash fixtures – maybe some surface mounted fluorescent for whiteboard
- How does the projector affect the pendants?
- Outer cove creates ribbons of light, good!
- Uniformity will be tough
- Don't know , probably, Shouldn't be → Bad words
- Lower lobby
    - Use the circuit board idea maybe a way to deal with the columns
    - Make the space interesting
- More sections of the auditorium
- Ceiling fluorescents are not task lighting
- Track locations – multiple maybe necessary because speaker may move
- Light the back wall of stage
- Try out the aiming in scale

- Hand drawings are good, but computer text takes away
  - Maybe use a hand font or hand drawn
- Material properties
- Point sources for sparkle in the lobby
- Link design goals & concept & solution
  - How do they interact ? Tie them together

V. ELECTRICAL DEPTH

1.) BRANCH CIRCUIT REDESIGN

The lower lobby, auditorium, classroom, and outdoor space will be redesigned. The new fixture layout will require less energy than the previous design. This will change the load on each lighting branch circuit. However this should not change the panel sizes drastically. The feeders could potentially change as well but it is highly unlikely that the savings in energy will require a resizing.

2.) PROTECTIVE DEVICE COORDINATION STUDY

A protective device coordination study will be conducted for a path from the secondary service to a branch panel. The path will start with switchboard "1USSSHV1" and continue toward distribution panel "1PNH1". Then the path will continue along to a distributed transformer "1T1", and the study will end at branch panel "1LNL1". The calculations of short circuit current will be included.

3.) REDESIGN CHOICES

A.) USING CONDUIT AND FEEDER WIRES VS. BUSDUCT

The current design uses two bus ducts rising at opposite sides of the building. Bus duct "1PBP1" feeds the normal branch distribution panels on each floor while bus duct "1PBP2" feeds the option branch panels on each floor. The building is 6 stories high which, so it could be possible for conduit and wires to be more economically feasible. A cost estimate will be conducted for these two designs as well as for a situation of having just one bus duct.

V. ELECTRICAL DEPTH (cont'd)

B.) USING ALUMINUM FEEDERS TO REPLACE COPPER

The current design specifies copper for all of the feeders of the distribution system. There are 73 panels in this building not to mention long runs for large mechanical equipment. Changing the feeders to aluminum has a potential for substantial cost savings taking into consideration how many feeders there are in this building.

4.) SKM SOFTWARE ANALYSIS

The entire electrical distribution system will be analyzed using software provided by SKM. A short circuit study will be conducted by using this program.

VI. BREADTHS

1.) ARCHITECTURAL & HVAC

The NJCSTME Building has an auditorium/lecture hall on the ground level. The ceiling is going to be changed for the lighting design to be proposed. The ceiling height and shape will be changed substantially in order to necessitate a significant HVAC and architectural redesign.

AutoCAD 3D will be used for modeling the space and creating section details. Microsoft Excel will be used for tables and other various calculations. The HVAC breadth will require numerous hand calculations as well as help from energy modeling software.