# Thesis Proposal

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# Executive Summary

## Depth Work:

The depth topics to be analyzed are both in **lighting** and **electrical** designing. For the lighting proposals, the lighting systems of the gymnasium/stage, cafeteria, façade, media center/library, and entrance & corridors will be redesigned. Lighting fixtures will be selected as appropriate to meet the lighting designing goals and criteria and power density requirements although cost of installation/maintenance has to be considered. Needless to say, aesthetic part of designing is one of the most important issues to be considered. From each space, at least two photorealistic rendering images will be created by aid of either Lightscape, AGI32 or Radiance.
For the electrical proposals, imaginary situation of the Brecht Elementary School as a community evacuation space in case of emergency will be designed so that stand-by electrical system can afford appropriate cooling, heating and necessary energy requirements. This includes sizing of panelboard schedules, protective devices configuration, and circuit layouts.

## Breadth Work:

The breadth topics in this thesis are **daylighting** analysis and **mechanical** system redesigning after daylighting system was designed. Daylighting redesigning of the gymnasium and stage space will be done as appropriate and heat gain calculation as outcome of it will be used to redesign appropriate HVAC system to afford the heat gain from solar energy.

# Depth Work Proposal:

## Lighting:

The design goal of the lighting system redesign is to design the lighting systems of the selected spaces aesthetically pleasing and attractive to the students, faculties and visitors of Brecht Elementary School to have friendly, comfortable and welcoming feel into these selected spaces. There are five spaces to be designed, which are:

1. **Gymnasium and Stage**
2. **Cafeteria/Kitchen**
3. **Façade**
4. **Media Center/Library**
5. **Entrance/Corridors**

For the redesign of **gymnasium and stage** space, efficiency of lighting is the most important issue; therefore, metal halide high bay fixtures will be applied in the gymnasium space. Integration with daylighting in this space will be mentioned in "Breadth Work Proposal" Daylighting section. The stage space should have flexible lighting in case of theatrical plays and musical performances held in this entire space.

For the **cafeteria** space, warm lighting with diffused paper fixture described in "Schematic Lighting Proposal Presentation", which is the technical assignment #3 in this thesis. Considering the high ceiling with architectural wooden beams running throughout the space, to highlight these beams will be a design goal in this space also. For the **kitchen** space, efficiency will be achieved by application of fluorescent lensed troffers on the 2x4 ceiling tiles. If necessary, task lighting will be applied for supplemental lighting at the workplace for special tasks, most importantly, cooking.

The **façade** of Brecht Elementary School is the most important space when considering the impression of the entire building. Therefore, special lighting design with custom fixtures "flower of light" will be applied to illuminate the lower walls of the façade. On the other hand, to achieve welcoming feel into the building, the main entrance of the façade will be lighted with cove lighting to highlight the upper entrance, while side walls will be highlighted with recessed uplights to emphasize the side walls. Also to emphasize the architectural characteristics of the beams above the entrance, highlighting lights along the beams will be applied.

**Media Center/Library** has three parts total; the reception area with high ceiling with architectural beams, the book-browsing area with lower ceiling, and the reading area with again high ceiling. Reception area will have spotlights to emphasize the clarity of the reception and the tasks while high ceiling will be highlighted with recessed uplights along the architectural columns. The book browsing area should have efficient fluorescent fixtures to have vertical illuminance needed for browsing books. At last, the reading area will be decorated with another custom fixture with diffusing light with paper materials hanging from the high ceiling with long cables. This luminaire is inspired by traditional Japanese lanterns; however, it also has high lumen output because of the reflector attached above the compact fluorescent lamp to cast high lumens onto the workplane to supply comfortable reading tasks. Again architectural beams on the high ceilings will be highlighted with supplemental lighting along the beams.

At last, to be the main circulation space of Brecht Elementary School, the **entrance and corridor** will be lighted with special fixtures. One of them is "water running fixture", which holds fluorescent T8 lamps inside of the pipes where water runs through. Water is running simply because of the different height of the placement of this fixture, which will result in another theme of "motion of nature". Other walls of the corridors will be lighted with another special fixture with bent reflectors with concealed fluorescent T8 lamps running along the side walls of the corridors. This fixture reflects the light back onto the side walls with coloring from the reflectors to show another playful scheme. Downlights may be applied to have supplemental lighting for the center of the

corridors.

All the lighting system in each space must be equipped with appropriate lighting control system and the detailed report of control system will be addressed.

To visualize the special lighting designing of these spaces mentioned above, it may be better to view the technical assignment #3 posted on the same website. The URL of the website is:

http://www.arche.psu.edu/thesis/eportfolio/current/portfolios/tqt105/tech-assign.htm

All the redesigning processes will include modeling of 3D models of each space with AutoCAD, drawings of new luminaire layouts (reflected ceilings plans), appropriate selection of luminaires and control equipments required to achieve the design, importing 3D models into lighting software applications (Lightscape, AGI32 or Radiance) and running calculation, which will result in obtaining photorealistic rendering images of each lighting design.

Branch circuit layout of all new lighting is going to be included in this report so that the result of new lighting system can be discussed in the electrical depth work.

# Depth Work Proposal:

## Electrical:

Overall electrical systems of Brecht Elementary School do not have significant problems since it was redesigned recently by an excellent electrical company. Therefore, electrical depth work proposal is to design electrical systems to make Brecht Elementary School an evacuation space in case of natural disasters and so on. In order to become an evacuation space for people from the surrounding areas of Lancaster, the entire system has to be able to offer appropriate loads for cooling, heating, lighting and so on with a redesigned stand-by system. Currently the emergency system has
Distribution and protective devices will be redesigned according to the new system requirements, which include sizing of panelboards and protective devices, replace the existing transformers to size smaller ones, and drawing new circuit layouts. A fault analysis and protective device coordination study will be performed. All calculations will be documented.

Newly designed system must comply with National Electrical Code 2002, article 700.1 to 702.10 as reference of electrical system for backup and emergency systems.

# Breadth Work Proposal:

## Daylighting:

Current daylighting system of the Gymnasium and Stage space has been already analyzed (available in Technical Assignment #1) and as mentioned above, daylighting is not sophisticated in order to provide full-daylighting system during daytime throughout the year. As mentioned in Technical Assignment #3, special fixture called "honey comb" fixture already analyzed with TracePro, will take place in this space to disperse direct sunlight onto the sloped ceiling and sidewalls. Illuminance/luminance values in this space will be calculated with either AGI32 or Radiance, and should be optimized after a few runs of different conditions (seasons, sky conditions, etc). At last, at least two photorealistic rendering images will be generated by the software program used to calculate the values above. Evaluation of the system is to be done by analyzing 1) if the illuminance vales on the workplanes are sufficient for tasks of these spaces 2) if this system caused hot spots or glares 3) how much heat gain this space will have because of the daylighting system introduced to these spaces. This heat gain calculation will be used in the other breadth work, Mechanical.

## Mechanical:

As mentioned above, currently the space "gymnasium and stage" does not have sophisticated daylight systems such as skylights. After introduction of honey comb systems into this space, heat gain calculation is to be done for the use of this Mechanical Breadth Work.
Calculation outputs from Breadth Work: Daylighting will be used in this section to optimize the cooling/heating loads during different seasons. All the equipments necessary to achieve thermal comfort in this space will be selected.

| Week of | Scheduled Tasks |
|---|---|
| January 16 – 22 | Build 3D models in CAD |
| January 23 – 29 | Complete 3D models in CAD<br>Apply surface materials |
| January 30 – February 5 | Build luminaires with appropriate IES files, ballasts, and lamps<br>Place all the luminaires into the lighting software applications<br>Run test calculations |
| February 6 – 12 | Calculate electrical loads for new layouts<br>Size panel boards for the new layouts |
| February 13 – 19 | Complete electrical depth work |
| February 20 – 26 | Complete daylighting breadth work |
| February 27 – March 5 | Complete mechanical breadth work |
| March 6 – 12 | Spring Break |
| March 13 – 19 | Finalize reflected ceiling plans and specification sheets for lighting depth work |
| March 20 – 26 | Finalize lighting renderings |
| March 27 – April 2 | Write thesis report |
| April 3 - 9 | Prepare thesis presentation<br>Prepare thesis paper copy |
| April 10 | Thesis Presentation |