Executive Summary

The Duke University Medical School-Duke University School of Nursing Thesis Project is primarily an in-depth study of redesigning the lighting and electrical systems throughout the building. The report also looks at the design and analysis of multiple systems to potentially improve the quality of the building. Feasibility studies were performed for all the proposed designs based on building energy, cost of construction and operation cost.

An in-depth lighting design study was performed for several areas throughout the building based on IESNA design criteria. The design analysis focused on proper equipment selections and detailed light level calculations to reach the stated lighting design goals while staying within the allowed power densities set forth by ASHRAE 90.1. The four spaces that were redesigned are the Duke Main Tower Entrance Lobby, the Peter | Ginny Nicholas Auditorium | Learning Center, the Café DUSON Student Lounge, and the Champagne Outdoor Courtyard. The main design goal was to tie each unique space together with the lighting being the common thread. The intent for all the spaces was to utilize a simplistic yet aesthetically pleasing design that complements the unique Gothic architecture of the building while maintaining a conducive atmosphere for learning.

An in-depth electrical study verifying panelboard, feeder, and overcurrent protection device sizes for all the redesigned lighting spaces was conducted. In addition a feasibility-cost analysis was conducted for changing all the existing non-energy efficient transformers in the building with energy efficient transformers. The electrical depth also looked at replacing distribution transformers located on each floor with a large central transformer located on one floor, in order to decrease the overall system cost. Significant cost savings are able to be obtained by switching to a central transformer system. Finally, a short circuit analysis was conducted along with an overcurrent protection device coordination study. This coordination study looks at the protection devices along a single feeder to determine if each device will properly trip when overcurrent is detected.

Finally, two breadth topics, mechanical integration and acoustical redesign, were studied to determine their impact on improving the quality of the space. The Mechanical Breadth looked at modifying the mechanical duct system of the café in order to be able to integrate it with proposed lighting system. This integration of systems improved the visual appearance of the space, which equated to the improvement of the architectural integrity of the space. The Acoustical Breadth looked at reducing the reverberation times in the café, since this space is a study lounge and a large social gathering, the amount of noise and the quality of speech in the space are important elements. The breadth concluded that the quality of speech could be improved with the replacement of the fabric on the wrapped wall panels with thicker fabric, at a minimal cost difference.