EXECUTIVE SUMMARY

The following report is a detailed account of all work and analysis performed during the AE 897G senior thesis. This thesis provides a redesigned lighting and electrical solution for four spaces, one electrical depth, one architecture breadth, one mechanical breadth, and one MAE daylighting depth. It is the not the intent of this senior thesis to suggest that there are any problems with the existing design. This senior capstone project provides a unique opportunity to learn new methods of design and propose alternate design solutions, free of budget restrictions.

A redesigned lighting solution and electrical system addresses four spaces in the NBS Building: the scrim façade, lower lobby/lounge, main classroom, and underground lecture hall. Please reference the appropriate sections of this report for a detailed explanation of the lighting and electrical systems. Conceptually, the lighting solution hopes to convey connection and interaction through biomimicry of a deciduous tree.

Moreover, the electrical depth introduces a simple payback analysis for changing low-voltage distribution transformers from NEMA-TP1 Standard dry-type to NEMA Premium dry-type. In the same manner, an analysis concerned with replacing dry-type unit substation transformers with vegetable-based fluid transformers is presented. In summary, upgrading distribution transformers to Premium efficiency does not provide reasonable payback while using vegetable-based fluid transformers in the unit substation offers immediate payback: *savings of $17,171 in initial cost and $2,765 savings per year in owner operating costs*.

The architecture breadth consists of creating an open-office floor plan in a typical graduate student office area, adding Kalwall + Lumira Aerogel to the exterior façade to increase daylighting (MAE depth) and energy performance (mechanical breadth). *Rhino* is used as a common platform to model geometry while *DIVA* and *VIPER* through *Grasshopper* is utilized to parametrically design an optimized Kalwall system.

Informed by parametric design, a subjective design decision yields a solution that improves daylighting deep into the floor plan while slightly improving the energy efficiency of the space. *Simply stated, the proposed design offers $237.53 per year in energy savings at an increased initial cost of $10,975. Despite a 46 year payback, the proposed architecture does provide a more comfortable, inviting, and visually pleasing space*.