Executive Summary

This final thesis report is a result of several analysis conducted over the course of the Spring 2010 semester-long Architectural Engineering capstone project. The subject of analysis is the Phase 2 New Building at the John Tyler Community College's Midlothian Campus in Midlothian, VA just outside Richmond. The Phase 2 New Building is the campuses' most recent and headline project under the Virginia Community College System. This building is part of a new green initiative taken on by the John Tyler Community College and is the first project to be LEED® rated for the Virginia Community College System.

This final report contains three analyses that investigate areas of specific quality and constructability issues associated with this project. The first analysis investigates a high-quality alternative exterior façade taking the place of a hand-laid masonry brick wall and the cost and schedule benefits that occur. The second analysis looks into an alternative roofing system to determine whether a more cost-effective and high-quality system can replace the green roof system and inverted roof membrane assembly while comparing the quality and LEED® benefits of each. The third analysis incorporates research into building transformers and the steps in properly and sizing a safely operating transformer.

It has been determined that, through the first analysis, an alternative architectural precast panel system in lieu of the hand-laid masonry brick wall can provide similar aesthetic quality based on the proper selection of thin brick cast into the concrete panels. Also, it compares similarly in costs, resulting in a $15,883 reduction in upfront expenditure. Additionally, the building enclosure schedule can be reduced by 16 days and site congestion can be minimized.

The second analysis, dealing with an alternative roofing system, determined that a single-ply thermoplastic TPO "cool" roofing system can offer unique benefits to the owner, but may not stack up in comparison with the originally designed green roof and IRMA systems in terms of energy efficiency and potential LEED® credits. While the single-ply TPO "cool" roof investigated in this analysis is estimated to save $269,300 in upfront costs, the system does not offer the same long-term energy efficiency benefits as the green roof, resulting in an estimated 37% increase in summer heat gains and 65% increase in winter heat loss through the compared roof systems. Also, the green roof potentially offers 4 to 10 additional LEED® credits beyond what the alternative "cool" roofing system could.

Finally, the third analysis dealt with research into the buildings electrical system transformer. This analysis is mainly research into the building transformer and the process for properly sizing the transformer device to safely handle the predicted building loads. This process involves communication between both the electrical design engineer and the engineer with the electrical power company providing the equipment. Through research, quality issues and best practices were determined for the design, installation and maintenance of the building transformer.