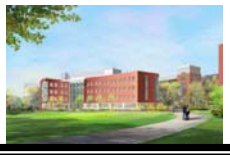

Executive Summary

The intent of this thesis is to examine design and construction issues associated with laboratory buildings. Designing and constructing a LEED (Leadership in Energy and Environmental Design) certified building is not only good for the environment, but it can save the owner money over the life of the building. Laboratories inherently use larger amounts of energy making it more difficult to obtain a LEED certification. One way to save energy and work towards a LEED certification is to utilize a Variable Air Volume (VAV) system, but again laboratories pose some unique mechanical system problems that must be addressed. The many systems mechanical, electrical and plumbing systems needed for a laboratory space, especially when using advanced systems such as VAV, require careful coordination. This time consuming process can be eased by utilizing an immersive virtual model.

Analyzing the LEED potential for the Forest Resources building showed that the initial design goal of a LEED certification is a good start, but the building has potential to achieve higher levels of LEED certification. Laboratory spaces have high mechanical and electrical loads due to the large amounts of equipment. Reducing the energy usage for the labs is one of the keys to achieving a high LEED certification.

In order to reduce energy costs associated with heating and cooling a VAV system could be utilized. Designing and installing a VAV system for a laboratory requires special arrangements to ensure that a safe exhaust air flow is maintained as well as a proper supply air flow to maintain negative room pressure. In practice, VAV systems can save upwards of 20% on energy costs for laboratory spaces. With the reduced energy costs and only a slight increase in initial cost and maintenance costs, VAV systems have a lower life-cycle cost compared to a constant volume system.

Using an immersive virtual model for MEP coordination can reduce the time needed for coordination and allow the installation to progress quickly and uninterrupted. Collisions among systems can easily be seen before installation begins. All industry professionals surveyed agree that the immersive model would be beneficial to use on an MEP intensive project.