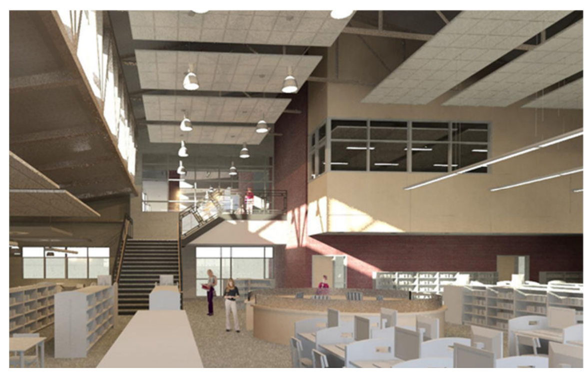
Landis Run Intermediate School

Lancaster, PA



Proposal

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Table of Contents

Executive Summary

The purpose of this proposal is to inform the reader of the analyses of the Landis Run Intermediate Project that will be performed during the spring semester of 2012. The reasons for performing the analyses, the goal of each analyses, and the methodology of each analysis will be discussed. In addition, a semester schedule for all the analyses is provided in the back of this document. The theme for all the analysis is efficiency which is meant in the general sense of the word. Further explanation of the theme can be found in the conclusion.

Analysis 1/Geothermal Heat Pumps: The quantity and life cycle cost of geothermal heat pumps on LRI will be determined. Their load capacity will then be calculated and used to calculate if the existing mechanical equipment could be downsized. The impact on the schedule from the installation of the heat pumps will be analyzed. Finally, taking into account life cycle cost, impact on schedule and constructability, and effect on existing mechanical equipment it will be determined whether or not the heat pumps would have increased the efficiency of the building at a reasonable cost to the owner.

Analysis 2/Feasibility and Design of a Modular Classroom: The dimensions of a modular classroom will be determined, after investigation of which prefabrication method to use, based on input from manufacturer's as well as the project requirements and architects. After ensuring that the design can be efficiently shipped to the job site and that it fits the project requirements the savings in design and construction time will be calculated and compared against actual durations on the site. Lastly, state requirements and other data will be analyzed to determine if the classroom could be used in other areas of the state.

Analysis 3/Effect of Electrical Rough-In Method on Productivity: The amount of time and cost that is associated with underground versus overhead electrical rough-in will be analyzed based on a single classroom. Once the cost and schedule impacts are known for that classroom that data will be extrapolated to the entire school. The results will be analyzed to determine which method is cheaper and which method would have allowed the school to be dried in at an earlier date. Lastly, through interviews with electrical contractors the popularity of one method versus another for similar project types will be analyzed in order to identify any trend.

Analysis 4/Alternative Project Delivery Method: The state law regarding delivery method will be researched and any loopholes for obtaining an alternative delivery method will be identified. Through investigation of case studies and interviews with project managers on those projects, the means, methods, and people that were used to obtain an exemption to the law will be compiled. The data will be analyzed in order to try to identify a typical path to exemption. Through interviews with the project management staff, estimates of differences in cost and schedule between the project delivery method used and multiple prime will be analyzed. Lastly, based on the findings of the case studies it will be determined whether or not an alternate delivery system could have improved the efficiency of Landis Run Intermediate.

Project Background

Landis Run Intermediate School, seen in Figure 1, is a $28 Million, 210,000 SF school located in Lancaster, PA which will serve grades 5 and 6 in the Manheim Township School District. The notice to proceed was given on December 10th, 2010 and has an anticipated completion date in August of 2012. The project duration is approximately 20 months and the project deadline is the driver of the project due to the fact that the district has nowhere else to place the 5th and 6th grade students scheduled to occupy the building. The school is one of four school buildings on a large campus, which is surrounded by homes located on the other side of a landscape buffer. The building itself is a load-bearing masonry design with brick veneer. The building is striving for LEED Silver certification. The project will utilize a combination of design features and construction practices in order to achieve the LEED Silver rating. BIM was utilized heavily in the planning and design phase of the projet. However, BIM was not used during the construction phase of the project and although it is supposed to be implement during the occupancy phase of the project it is still unclear to what extent.

Figure 1: Landis Run Intermediate School While Under Construction

Analysis 1: Geothermal Heat Pumps

Potential Opportunity

Although Landis Run Intermediate is striving for a LEED Silver rating with a total of 54 points there are a few credits that may have improved the environmental impact of the building and made sense to implement from a financial standpoint. One of these credits is on-site renewable energy. With a site as large as the one LRI sits on there are ample types of renewable energy that can be installed on site and operate successfully. Also, since schools are designed to have a life span of 50-60 years they can withstand larger payback periods. In addition, having on-site renewable energy presents another opportunity for the school district to educate the population on an ever increasingly important topic, sustainability.

Potential Solution

Due to their relatively cheap initial cost when compared with other sources of renewable energy as well as the size of the site, geothermal heat pumps appear to be the most logical choice of renewable energy for the project.

Research Goal

The goal of this research is to determine if geothermal heat pumps would improve the project based on whether or not they would provide:

- A significant cost savings to the owner in utilities cost
- A more sustainable building
- A minimal impact on the construction schedule
- A worthwhile payback period

Methodology

The following research tasks will be performed:

- Determine the quantity of heat pumps
- Calculate the impact on the construction schedule
- Determine the effects on other building systems and trades
- Analyze life-cycle cost and payback period
- Analyze the impact on the LEED rating

Expected Outcome

The expected outcome of this analysis is that geothermal heat pumps will make fiscal sense to utilize on site and will improve the energy efficiency of the building. In addition, it is expected that the installation of geothermal heat pumps will not alter the construction schedule to an extent that workforce over time, significant additional construction costs, or a later completion date would be necessary.

Analysis Sources: Project Manager on LRI, Robert Leicht

Analysis 2: Feasibility and Design of a Modular Classroom

Potential Opportunity

Given the seemingly identical requirements of classrooms, it seems redundant and wasteful to repeatedly redesign every classroom for a new school that is constructed. Construction budgets for schools could shrink substantially if the repetitive design of classrooms could be cut from the building process. In addition, if a common classroom design was created it might also cut construction costs as familiarity with the design increases.

Potential Solution

The design of a standardized modular classroom that could be shipped to the jobsite would reduce the need for design time related to classrooms and greatly reduce associated construction costs. In addition, if small changes could be made to this standardized classroom to accommodate small differences in climate, site, aesthetics, and other miscellaneous differences from job to job than it could be used throughout the entire state.

Research Goal

The goal of this research is to determine the cost and schedule implications of utilizing a standardized modular classroom on LRI as oppose to the stick built classrooms which were constructed on site and designed specifically for this project. In addition, the analysis will research the feasibility of taking the standardized modular classroom to be used on LRI and applying it to other schools throughout the state.

Methodology

The following research tasks will be performed:

- Research type of modular construction to be used and associated capabilities of prefabrication methods by contacting manufacturer's and reading online literature
- Determine the dimension of the modular classroom based on manufacturing capabilities and project requirements
- Calculate savings in terms of design time, schedule, and construction cost associated with the construction of the classroom wings.
- Research typical requirements and other data to see if the classroom could be used on other projects in the state.

Expected Outcome

The expected outcome of this analysis is that a standardized modular classroom could be used throughout the classroom wings of the project which would result in considerable amounts of time and money. In addition, the classroom would meet the typical requirements of classrooms across the state allowing it to be used repetitively.

Analysis Sources: Richard S. Fiore

Analysis 3: Effect of Electrical Rough-In Method on Productivity

Potential Problem

The superstructure on LRI was a large part of the critical path and the project team is now in a race to dry in the building before the brunt of winter hits. The electrical prime chose to do underground rough-ins which prolonged the time before slabs could be poured or before the load bearing walls could be grouted. The decision to do underground rough-in could have potentially delayed the critical path and made it hard to get the building dried in before winter.

Potential Solution

Overhead electrical rough-in would have allowed slabs to be poured earlier as well as earlier grouting of walls. This in turn would allow the structure to be completed earlier ultimately allowing the building to be dried in earlier.

Research Goal

The goal of this research is to determine whether or not underground electrical rough-in is common for similar project types. In addition, this research will determine how changing to overhead rough-in would affect the cost and schedule of that activity.

Methodology

The following research tasks will be performed:

- Interview the electrical prime on LRI and other electrical primes that have experience with schools to determine the amount of underground versus overhead rough-in they perform
- Interview electrical contractor superintendents on the time it takes to perform underground rough-in versus overhead rough-in on one typical classroom and extrapolate those time differences to the entire school
- Calculate dry-in date using overhead rough-in duration and compare with the actual dry-in date
- Perform two detailed estimates on a single classroom, one assuming underground RI and the other assuming overhead RI, and convert the costs to a SF cost to extrapolate the overall cost to the entire school in order to see which method is cheaper

Expected Outcome

The expected outcome of this analysis is that the difference in costs of overhead rough-in versus underground rough-in is negligible and that the duration of overhead rough-in is slightly longer than that of underground rough-in. However, it is expected that the overhead rough-in would have allowed the building to be dried in at a sooner date and that the longer duration of overhead rough-in would not affect the completion date.

Analysis Source: Project Manager on LRI

Analysis 4: Alternate Delivery System

Potential Opportunity

As mandated by law, the project delivery system on LRI was design-bid-build with multiple prime. However, according to the project manager, the added amount of coordination between primes with that type of delivery system adds complexity and time to a project that could be cut out of the project if one contractor was in charge and had authority over the others.

Potential Solution

The single prime delivery method makes one contractor responsible for completing the project in whole. With one contractor having authority over means, methods, and scheduling, a great deal of coordination and debate can be cut out of the schedule and possibly reduce cost and increase quality.

Research Goal

The goal of this research is to analyze how government funded projects can obtain permission to use an alternative delivery system other than multiple prime.

Methodology

The following research tasks will be performed:

- Research the state law and any loopholes that may be present
- Research other projects that have been able to use alternative delivery methods and interview the project team about that experience, who was in charge of the effort, motivation for doing so, and estimated schedule difference given a multiple prime delivery method
- Compile interviews and state research into case studies stating how that permission is obtained and under what circumstances
- Determine whether or not an alternate delivery system would have benefited LRI based on findings.

Expected Outcome

The expected outcome of this research is that there is no common or accepted method to obtaining that permission as of yet but rather it is given on a project by project basis. In addition, it is expected that projects who have attempted to obtain this exemption to the law did so because they felt it would reduce the schedule and/or costs of the project.

Analysis Source: Project Manager on LRI, Project Engineer on LRI, Industry Professional

Analysis Weight Matrix

The analysis weight matrix, shown in Table 1, is a representation of the way my effort and time will be split up among the four main analysis areas in regards to the four main areas of research during the spring semester.

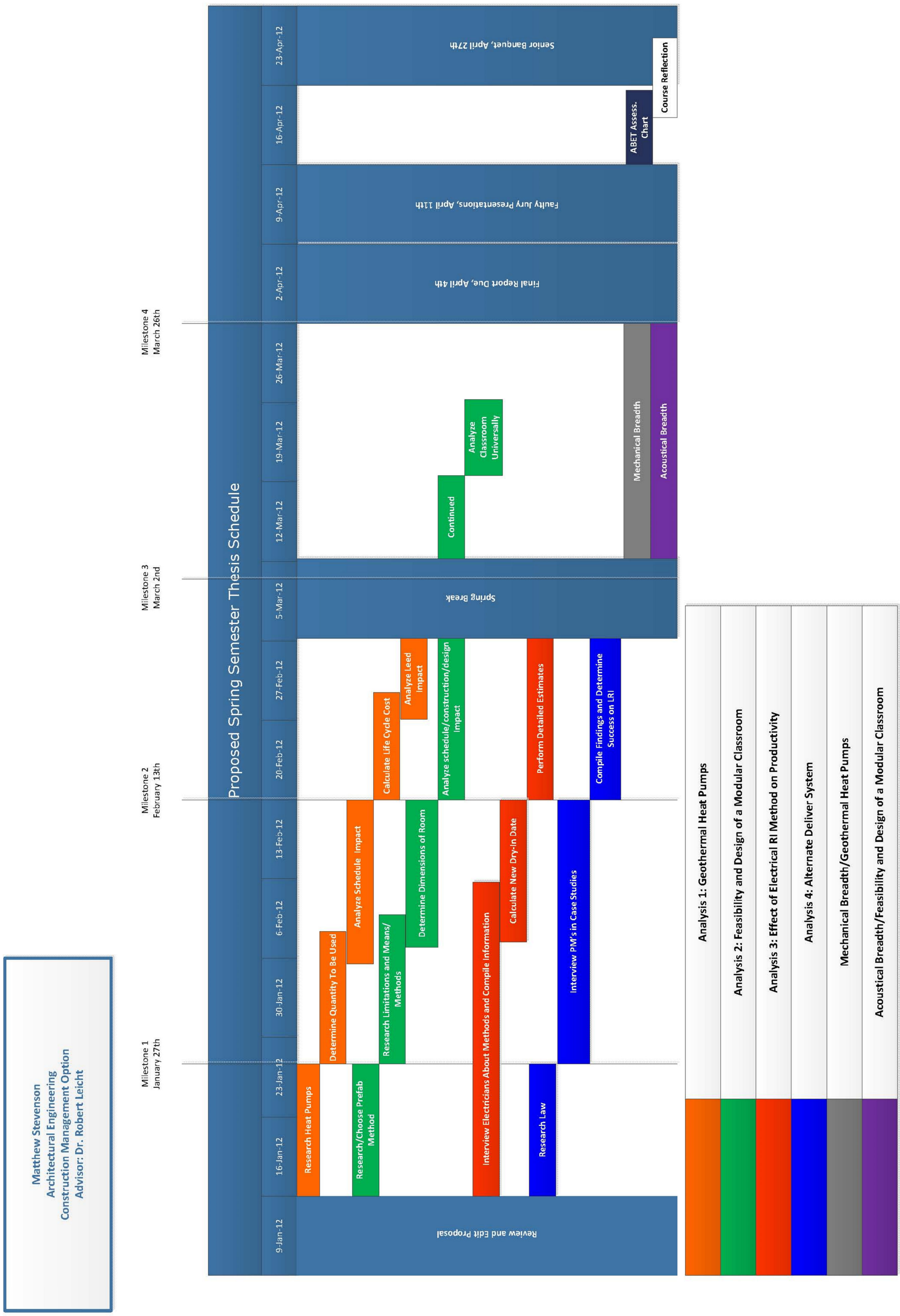
Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Geothermal Heat Pumps	5%	5%	5%	--	15%
Modular Classroom	10%	5%	5%	15%	35%
Electrical Rough-In Method	--	--	20%	10%	30%
Alternate Delivery System	15%	--	--	5%	20%
Total	30%	10%	30%	30%	100%

Conclusion

In conclusion, by completing the four analyses that have been discussed the efficiency of the project will be addressed. The expectation of the analyses is that they would have improved the efficiency of the project. The term efficiency is used in the general sense.

The first analysis addresses energy efficiency. It will determine whether any gained efficiency from the heat pumps would have made sense to implement from a fiscal and construction standpoint. The second analysis addresses the construction efficiency of the project. The analysis will determine whether or not the use of modular classrooms could have improved upon the construction efficiency of the project. The third analysis also addresses the construction efficiency of the project, specifically the efficiency of the electrical rough in and the critical path. The analysis will determine whether or not overhead rough-in would have allows the cost of installation to remain similar while allowing the building to be dried in sooner. Lastly, the fourth analysis addresses the efficiency of the project delivery method. This analysis will determine whether or not using a single prime delivery method versus multiple prime delivery method could have led to less coordination issues and a more efficient project.

Semester Schedule



Appendix A

The following breadth topics are intended to show competency in other areas of study besides construction management. These areas have purposefully been tied into two of the four main analysis discussed earlier in order to provide a more robust study.

Mechanical Breadth/Geothermal Heat Pumps:

The geothermal heat pumps that have been proposed to be used on the project can take a significant load off of the building's mechanical systems. The building's mechanical systems may even be able to be downsized if the load capacity of the heat pumps is significant enough. This would greatly increase the sustainability of the building since conventional mechanical equipment produce more emissions than heat pumps. Determining whether or not this is feasible and to what extent if so is the topic of my first breadth study.

Once the quantity of the geothermal heat pumps has been determined their total load capacity will be calculated. Then, their load capacity will be used to calculate the remaining total load of the building that needs to be picked up by the conventional mechanical systems in the building. Once the new load for the conventional mechanical systems is calculated new equipment will be selected to be installed in the building. Any cost savings, difference in electrical requirements, and difference in size between the mechanical equipment being installed now and the newly proposed equipment will be tabulated.

Acoustical Breadth/Feasibility and Design of a Modular Classroom:

Modular construction allows for quicker and more efficient construction on site as well as a higher quality of work due to tighter tolerances in the factories. However, the design of the modules must be carefully thought out to ensure that they perform as well if not better than if the project was stick built. In addition, one of the most important aspects of a school is the learning environment is promotes. A large aspect of that is its acoustics which will determine how well the students can listen and therefore learn.

The amount of noise that passes through the walls of a modular classroom will be calculated and compared with the amount that would pass through the stick built walls being constructed to determine how the use of modular construction will affect the acoustical properties of the classrooms. In addition, the acoustical properties of a classroom will be analyzed to determine if it meets the LEED prerequisite "Minimum Acoustical Performance". This will determine whether or not the classroom would support the LEED rating that the project is striving for.