

Waynesburg Central High School



Thesis Proposal (Revised)

Robert O. Brennan
Construction Management
Adviser: Dr. Riley

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Executive Summary

Construction projects consistently become more and more complicated to manage and deliver; adding LEED certification to a project only makes it more complex. LEED certification requires that certain items be tracked to ensure the proper percentages are met for certification. Tracking these items means that there needs to be a paper trail and results in more work for the project manager. Central Greene School district did not choose to construct a LEED certified project but this analysis will analyze some of the steps that would have been taken to achieve certification and provide other school districts in western Pennsylvania with a guide for achieving certification. A series of four analyses will be done all to further understand the complications that come with LEED certification.

Analysis 1: Construction Scheduling

Scheduling is challenging enough when there is only one thing that needs to be addressed but in the case of Waynesburg Central High School there are twelve phases. This analysis will look at the schedule changes as a result of pursuing LEED certification with the hope of ultimately shortening the construction time by a more structured approach to construction. Site layout plans to include changes incurred by LEED will also be developed.

Analysis 2: LEED Certification

LEED is a topic that is common in the industry it has now been around for several years but owners are still not sure if it is worth pursuing a LEED certified project. This analysis will result in a guide that will be useful to school districts in western Pennsylvania to help them determine the challenges that may be faced if choosing to pursue or should the site be more conducive the ease at which LEED certification can be achieved.

Analysis 3: Recycling and Waste Management (Breadth #1)

Waynesburg Central High School does not currently have a recycling plan. This analysis will analyze the feasibility of implementing a recycling plan. It will look at the constructability challenges that are related to the implementation of a recycling plan and also tie into the scheduling challenges and be shown on the revised site layout plans from analysis 1.

Analysis 4: Energy Savings Analysis (Breadth #2)

Energy savings for any building will result in a cost benefit for the owner. This analysis will analyze the lighting system that is being installed in Waynesburg Central High School and do a cost comparison to several other lighting alternatives to determine if a more efficient and cost effective system could be implemented.

Project Introduction

Waynesburg Central High School is located in Waynesburg, Pennsylvania. Central Greene School District is the owner of the project. Waynesburg Central High School is primarily a renovation project with two minor additions; the renovation work is about 154,000 square feet and the addition work approximately 24,000 square feet. The original school building was constructed in 1969, Central Greene School District desires to expand and gain more educational space while bringing all areas of the building to modern learning standards.

Sequencing is of particular interest to the district, because construction will last two years; all the while the school will be occupied. Waynesburg Central High School is broken up into twelve different phases. This poses concerns while creating a schedule and creates several critical activities to insure that students are able to occupy each phase of the building on time.

Waynesburg Central High School is a public project and therefore requires specific protocol to be followed. In the pre-construction phase of public school projects pricing must be submitted for state approval. Pennsylvania government also sets standards on the delivery method. A multiple prime with a construction management agency will be utilized on the high school. Public school projects in Pennsylvania also require a hard bid to take place with contractors submitting a lump sum bid, the lowest bidder is then awarded the contract.



Figure 1: Waynesburg Central High School logo

One of the more unusual things on this construction project not often implemented on schools in western Pennsylvania is the use of precast concrete for the structural system. A series of precast concrete columns and beams comprise the primary structural system on the additions. Precast concrete buildings are not common practice requiring special attention be paid to the connections.

Renovation work on Waynesburg Central High School is only cosmetic and infrastructure related, no significant structural modifications are being made to the existing building. The project will provide Central Greene School District with a facility equipped with modern amenities such as wireless internet, new mechanical system, and completely remodeled lighting and electrical system. Construction on Waynesburg Central High School will provide the owner the desired space along with updating all systems from what was in the existing building.

Proposal Overview

Central Greene School District did not set out to gain any LEED certification on the Waynesburg Central High School project. This is a point where I could do some research and see the necessary changes that would be made to attain a LEED certification. I will do this by first analyzing the feasibility of attaining different points, I will do this through a variety of methods one of which would be correspondence with professionals in the region that have completed LEED certified projects in the past. Another way I will determine feasibility of various LEED points is by doing research for the region as a whole to discover the options of things such as the availability to recycle materials. Recycling is a point of particular interest because Waynesburg Central High School is not an urban location so points like recycling and the public transportation may not be possible to attain. After a thorough analysis of each possible LEED accreditation point the goal is to create a simple spread sheet to explain those points that are feasible and those that are unattainable.

All areas of study through the topic will in some way be tied to achieving or confirming the feasibility of gaining LEED accreditation on the Waynesburg Central High School project. In order to achieve LEED certification there is a wide array of topics that can be met. The reason for not striving for anything greater than LEED certification is strictly based upon the geographic location. Being a rural site with public transportation not available and having the occupants so far from the facility cause for several of the points to be unattainable. LEED certification is something that not only has a title but the more important factor to LEED is that it is a more environmentally friendly way to construct a building. Traditional methods are more prevalent especially in western Pennsylvania, but several buildings have been constructed and met LEED certification. Several school buildings have been able to attain LEED certification and the construction manager that is on Waynesburg Central High School has been a part of some of these projects. With the construction manager having experience in the construction of a few LEED rated school buildings this will allow for a point of contact to examine some of the items that were easily attained compared to those that are unattainable and should be foregone before starting.



Figure 13: LEED certified logo

Though Central Greene School District did not elect to construct a LEED certified building it could have been an item that would have been more appealing to the taxpayers and resulted therefore in an increased budget and ultimately a product that may have been more desirable to the occupants. LEED certification requires more careful planning and a closer look at the products that are being installed to insure that they are in compliance and meet the specifications set forth by the United States Green Building Council. As a result of the increased work and attention to detail and often higher quality products to meet these specifications an increased cost is often associated. At the conclusion of this project the goal is to not only determine the feasibility of LEED certification but to also determine if LEED certification would be economical.

Analysis 1: Construction Scheduling

A. Problem: Multiple Phase construction projects create a need for elaborate schedules, resulting in congested work sites.

Waynesburg Central High School is a multiple phase construction project having 12 separate phases. On a construction project that has several areas under construction at the same time the lay down area is a large point of concern, because multiple contractors will have items being delivered for different phases of the project. Deliveries for each of the contractors need to be kept separate and accessible at all times as to not impede the construction process. LEED construction projects are no different from a traditional multi phase construction project there is simply more lead time necessary for several of the items.

B. Goal: To compare the site plans and phasing sequence that exist with what is necessary for a LEED certified project, and create a modified schedule and series of site plans.

C. Research Steps:

Step 1: Analyze the existing schedule and site plans.

Step 2: Research the common schedule alterations that are incurred on a LEED project.

Step 3: Contact a contractor that has worked on a LEED certified construction project in the western Pennsylvania area.

Step 4: Develop a revised schedule including the alterations caused by LEED compliance.

Step 5: Develop the series of site layout plans in concordance with the schedule.

D. Expected Outcome: I am expecting that the mechanical items for LEED certification will have a large lead time and cause the schedule to be longer. I also expect that items like recycling and waste management will have a large impact on the site layout. Over all though I expect the schedule to remain generally as it is, as well as the site plans except maybe for some alterations for recycling.

Analysis 2: LEED Certification

A. Problem: Public high schools often have a hard time deciding whether or not it is worthwhile to pursue LEED certification.

Public high schools are publicly funded projects and as a result must be approved by the state and the taxpayers in the district. LEED certification today is often viewed as a bragging right in today's public education system, but it can also be used to help educate the general public of some simple cost effective ways to be more energy efficient. In any LEED certified project there are some simple steps that can greatly reduce the life cycle cost of a product, should a public school facility be constructed in a manner like this it allows for students that are attending the facility the opportunity to see the difference first hand and possibly study some of these techniques in science class. The most effective way to change the amount of energy consumption the country is using is not to change regulations, but to educate the next generation on the cost effective ways they can reduce energy consumption and ultimately save themselves some money.

B. Goal: Create a guide for school districts in western Pennsylvania that would help them decide if LEED certification is worth pursuing.

C. Research Steps:

Step 1: Research points needed to achieve LEED certification.

Step 2: Analyze the feasibility of each point based on the region.

Step 3: Conduct an interview with three industry professionals that have participated on LEED certified projects before.

Step 4: Contact and interview three school districts in the region and understand why they decided to build a green project.

Step 5: Conduct an interview with Waynesburg Central High School to understand why they chose to not construct a LEED project.

Step 6: Create a spreadsheet showing the commonly attained LEED points in the western Pennsylvania area.

D. Expected Outcome: I expect that LEED certification in western Pennsylvania will be rather easy to achieve. Some of the points in the LEED system are not possible to be attained in certain geographic locations. The goal is to create a spreadsheet showing the commonly attained LEED points in Western Pennsylvania. As a part of this analysis a plan for recycling will be done and the plan for completing this is covered in the section titled Analysis 2.1.

Interview Questionnaire

- 1) How many LEED certified construction projects have you worked on?
- 2) How many of these projects were school buildings in the western Pennsylvania area?
- 3) What levels of LEED certification did these projects receive?
- 4) What was the largest challenge on the LEED projects?
- 5) How cooperative were contractors in participating with LEED certification? If there was any resistance to participation how was it handled?
- 6) Was there any sort of incentive program to encourage contractor participation?
- 7) What was the easiest LEED point to obtain? Why?
- 8) In western Pennsylvania how easy was it to attain points for recycling and waste management?
- 9) Were there any special steps taken to ensure points for recycling were attained?
- 10) Which area was the hardest to attain points in for LEED certification? What made this section more difficult to attain points?
- 11) Have you ever worked on a LEED certified project not in western Pennsylvania? If so which points were easier to attain in other regions?
- 12) Go through several of the LEED points with the professional and ask them to describe what was challenging about receiving the point or what made that point easily attainable.
- 13) How much harder was it to manage a LEED project compared to a traditional construction project?
- 14) Do you think it is worth it to the school district to do a LEED certified project?

Analysis 2.1: Recycling and Waste Management

(Constructability Breadth)

A. Problem: Construction projects produce large quantities of waste.

Construction projects today produce large quantities of waste that could be mitigated with the proper precautionary steps. Waynesburg Central High School currently has no recycling plan in place, and as a result all waste is placed in the same dumpster and removed from the site. LEED projects often implement a multiple dumpster system where debris of the same nature is placed in the corresponding dumpster. Waynesburg Central High School is a rural location in south western Pennsylvania which may cause for recycling to be more challenging to do than other locations where the practice is more common. In this region recycling companies may not be readily available as in most regions.

B. Goal: Implement a waste management plan that promotes recycling resulting in waste reduction.

C. Research Steps:

Step 1: Analyze LEED requirements to achieve the points associated with recycling and waste management.

Step 2: Research the availability of recycling in the western Pennsylvania area as well as the associated costs.

Step 3: Comprise a plan to attain LEED points for recycling and waste management.

D. Expected Outcome: I expect the cost of recycling will be high due in part to the lack of recycling in the area. I expect that while contacting and finding local recycling plants there will be a minimal cost variation between companies, should there even be multiple companies. In the plan there will have to be some sort of incentive program to encourage the subcontractors to participate in the program, otherwise recycling will not be a success.

Analysis 3: Structural Redesign

(Structural Breadth)

A. Problem: Precast concrete was chosen as a structural system and caused several constructability issues.

Precast concrete is a structural system that is not common practice in Western Pennsylvania. Waynesburg Central High School was designed with a precast concrete structural system which caused for several problems during the construction project. The primary construction method in western Pennsylvania is a structural steel system with a block infill. As a result of contractors not being familiar with the unique construction techniques required for precast concrete erection, many of the columns were set incorrectly.

B. Goal: Analyze and compare a structural steel system to the implemented precast concrete system, to determine the constructability issues associated with both as well as determining the most economic system.

C. Research Steps:

Step 1: Redesign building G to a steel structure.

Step 2: Determine cost differences between the structural steel system and the precast concrete structure.

Step 3: Analyze differences in the construction method between both structural systems.

Step 4: Create a detailed spreadsheet for cost comparison and do a final suggestion based on the findings from the cost analysis.

Step 5: Create multiple site plans for the construction of Waynesburg Central High School for a steel structure.

D. Expected Outcome: Through the analysis of a structural steel alternative I expect to find that a steel structure will cost less. I expect to find that since the steel structure is more common in western Pennsylvania I expect there will be fewer mistakes during the construction process. After finding the constructability issues associated with each I do not expect there to be any sequence changes required because each material requires about equal lead time. After analyzing the data obtained through the analysis I expect to find that a steel structure in western Pennsylvania will be a better option than precast concrete.

Analysis 4: Energy Savings Analysis

(Lighting/Electrical Breadth)

B. Problem: Energy consumption in a building is a large cost.

LEED certification focuses on a few main areas of a building in order to achieve certification; one of the emphasized areas is energy consumption. With energy consumption being emphasized as an area of focus in the LEED certification process this is an area that needs to be further looked at on most projects. Though manufacturers are becoming more consistent and there is less deviation in the performance of products, some products still perform better than others do in terms of energy consumption. Lighting systems is not the only system that should be analyzed on a construction project for energy efficiency; mechanical systems are often the largest single consumer of energy in a building. This analysis will analyze the lighting system chosen at Waynesburg Central High School because this system is more visible and can be used more easily as an educational tool.

B. Goal: Choose a luminaire that will result in an energy reduction from the previously chosen one if possible, and then create a spreadsheet to calculate the energy savings.

C. Research Steps:

Step 1: Research luminaires and find the most cost effective.

Step 2: Compare possible luminaire options to the specified.

Step 3: Determine Energy savings with new luminaire.

D. Expected Outcome: I expect to find a florescent lighting fixture that will save about 5 percent in energy compared to the specified luminaire. The type will stay a florescent to ensure that the entire lighting system does not have to change as well as the service that is feeding them. At the end of this analysis I should have a spreadsheet with 3 possible lighting fixture alternatives and the originally specified fixture, along with the performance energy specifications, annual energy consumption, annual energy cost, and the initial cost for each luminaire type.

Summary and Weight Matrix

Through a series of analysis in differing areas of study the ultimate goal for the thesis project is to determine if a structural steel system would be a better system than precast concrete. LEED certification is to be analyzed not only from a practicality stand point but also from an economic side to determine whether or not some of the points are economically wise to strive for. Value engineering will be done on for the Waynesburg Central High School project to determine if different lights could have been used to save on the operating cost and if the operating cost savings would outweigh the initial investment cost. Scheduling is a complicated affair on construction projects and Waynesburg Central High School is no different in fact it has more phases than most construction projects because it is a renovation and the building will be occupied throughout construction. An analysis of the effect of LEED to the schedule will be done also incorporating some of the coordination challenges that would be faced by implementing a series of site layout plans to help mitigate congestion.

Weight Matrix

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Analysis 1: Construction Scheduling	5		5	10	20%
Analysis 2: LEED Certification	5	10	5		20%
Analysis 2.1: Recycling and Waste Management	5		5		10%
Analysis 3: Structural Redesign	5	10	5	10	30%
Analysis 4: Energy Savings Analysis	5	15			20%
Total	25%	35%	20%	20%	100%