

**To:** Professor Riley, December 13<sup>th</sup>, 2007

**Concerning:** Liberty Walk at East Gate  
Mt. Laurel Township, New Jersey

# Thesis Proposal



330 Fellowship Road

A Liberty Property Group Project

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## **Executive Summary**

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In this proposal, the three different research areas that were picked will be discussed. For each of the analyses, background information will be given so that even those not in the construction industry can start to understand the problem, followed by a problem statement, a generalized problem solution, and the specific steps to follow for the research of the topic.

The first topic discussed will be **Work Force Problems**. With many trades lacking skilled workers, they often have to replace them with multiple unskilled laborers. A few different trades will be researched, some similar in type of work, and the third more complex and difficult in order to see if a set of unskilled workers can be as cost and schedule effective as the standard skilled crew.

The next topic discussed will be about **Fire Protection Problems**. With the current sprinkler systems being prioritized to only maintain the life of the building so long as the occupants can escape, any advancement to extend the life of the structure would be welcome, provided the cost is not too high. This next section will describe how a new system would be designed in order to greatly extend the life of the structure, and as such, the safety to any fire fighters who would protect the building. This topic will also host a **breadth study** for a demonstration of Architectural Engineering competency.

Last topic to be discussed will be about **Curtain Wall Problems**. The curtain wall helps to keep the heat inside the building. A problem appeared in order to accelerate the schedule of the Curtain Wall, however this situation also presented itself to pick better more efficient glass pieces. This will also be a **breadth study** for demonstration of AE knowledge.

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## **Introduction**

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The Project being researched is on 330 Fellowship Road in Mount Laurel, New Jersey. It is a 103,700 square foot, 4 story office building. The owner of the building is Liberty Property Trust. They are a Realty Development company based out of Philadelphia. Liberty has offices through most of the Mid Atlantic states, as well as the area around Michigan and a few other states as well. They develop property, and then lease out office space. Currently, they have 2,100 clients.

Problems with the Work Force have always drawn my attention. Through many construction management classes and experience in the industry, the value of skilled workers versus unskilled has interested me. Through my desire to perform the best job for employers, I've also always been interested in making my work more efficient and better for the Boss. With this, I have been interested in making the curtain wall construction process go well for this particular project, as well as possibly even picking better glass sections.

In taking a class on Fire Protection methods, I learned briefly about an interesting idea in changing how the sprinkler lines are run. It's possible that by changing the path of the lines (but not the area of coverage) that the lines could pull heat away from any steel columns, extending their lifespan in a fire.

## **Work Force Problems**

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### **Background**

In the Construction Industry, it is a perceived problem that some trades are lacking skilled laborers. This drives up the value of these trades when it comes to wages, as well as possible schedules needing to be extended. On the other hand, with a flood of often illegal immigrants into this country, there are many unskilled workers in the work force.

The Bureau of Labor Statistics estimates that at least 1/3<sup>rd</sup> of the construction work force is undocumented immigrants. Recently there have been laws passed that will detect workers using faulty / duplicate Social Security Numbers and tell the employers about it. After they are told, they have 90 days to update to the correct information, or face heavy fines for retaining the workers. With this act being questioned in court, many construction companies may suddenly find themselves out of a lot of workers.

### **Problem Statement**

With the lack of skilled workers in some trades specifically like electricians, it is harder to obtain tradesmen to perform the tasks of a job. Conversely, with a flood of workers in this country who may or may not be forced out, there are many unskilled laborers with which to perform a job. Which choice presents a better value for an owner or general contractor? Does the same

### **Proposed Solution**

The solution to this problem is to quantify the value and ability of a skilled worker versus an unskilled worker.

### **Solution Methods**

- 1.) Locate various projects throughout the immediate area to have a basis of comparison against my own project. Goal of 5.
- 2.) Pick two or three trades to compare throughout the projects. Best choices of Carpenters, Electricians, and Masons.
- 3.) Collect information regarding scheduling, costs and quality.
- 4.) Perform take offs, and estimates. Try to estimate unit cost of the work being performed.
- 5.) Try to remove all factors except for skilled or unskilled that could skew the findings.
- 6.) Report Findings.

## **Work Force Problems**

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### **Expected Outcomes**

The expected solution that I foresee would for the speed and cost of a set of unskilled workers against one set of skilled workers to cut just about even. I believe that the skilled workers may be a better value for the owners. However, in issuing a report like this stating that the skilled workers are a better value, it may drive up the demand for them, and even it out.

## **Fire Protection**

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### **Background**

Any given building can have several Fire Protection Systems. The most visual and noticeable system is the Alarm System. Any smoke or extreme heat can set off an electric system which will give audible warnings to all inside, and with new systems, a strobe light activation. The next system deals with smoke evacuation. Most people know that fire causes smoke. However, what is not known is how dangerous the smoke alone is. Not only can it reduce visibility, but it allows for slightly better heat transfer, is unhealthy to breathe in, but worst of all, it signals reduced oxygen levels. As the oxygen levels start coming down, a person's decision making abilities soon follow to a point where they can't even remember how to use a door handle.

The biggest protection system is the Sprinkler System. While a sprinkler can put out a minor fire, this is not its main purpose. Since the ban of CFC's, some very potent airborne chemicals that could easily put out the fire without any detriment to health have also been banned. The main purpose of this system is to keep up the stability of a structure to allow the evacuation of the occupants, and depending on reaction time, the entrance of firemen to specifically fight the fire.

### **Problem Statement**

With the cost of buildings being high enough to prevent them being casual decisions, no owner wants to see his building go up in flames. However, no owner wants to spend ten times the flat cost of the building alone to literally make it fire proof. The problem is increasing the stability and survivability of the building itself, without taking the cost of the fire protection system to factors of itself.

### **Problem Solution**

One proposed solution to the problem is not to change the spread of the sprinkler heads over the floor area, but how the sprinkler lines are run through the building. Currently the water lines are run to a central riser area, then rise up to each floor and split off. The proposal is to run the sprinkler lines to each column, and then rising up each and every column. The purpose of this would be to use the sprinkler lines on the steel columns as a heat sink. Around 600 degrees Fahrenheit, the steel has lost a significant amount of strength, possibly taking the capacity below the actual loading and safety factors. By running water past it, it is hoped that the water will absorb enough heat to extend the life of the column by two or possibly even three times. With the properties of water, the heat gained in the water will not be detrimental to the heat capacity capabilities.

## **Fire Protection**

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### **Solution Methods**

- 1.) Draw up plans for new system. Draw up plans for old system if current drawings aren't useable
- 2.) Design new system using Remote Hydraulic method to size pressure needed. Size pumps and pipes.
- 3.) Approach the ME department at Penn State to get contact for calculating Thermodynamics needed.
- 4.) Calculate heat transfer between steel column and sprinkler line.
- 5.) Calculate how extended the life of the column is.
- 6.) Estimate the costs of both systems
- 7.) Report Findings

### **Expected Outcomes**

This new method is expected to be better in all ways except for cost. The fire ratings given for most items are not meant to be taken literally, but only as a means for comparison. The expected value for fire rating is to be roughly 1.25x to 1.75x the previous lifespan. It is hoped to be higher than this, but currently not much is known in the way of thermodynamics nor as to what effect the sprinkler pipes would have.



## **Curtain Wall Problems**

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### **Background**

The basics of any building can be explained by most 5 year olds. It is to keep the insides in, and the outsides out. That is to say, it is to make the indoor environment as comfortable as possible, as the weather outside sometimes does its best to make us miserable. Buildings show the greatness of man. We're not exceptionally strong, fast or physical. Yet we still use our minds to convert rock and ore to great heights to be placed in the worst environments.

Still, it's very difficult to keep the energy we produce from bleeding to the outside. And with the use of windows to get awe inspiring view that everyone wants, it becomes harder still.

The Curtain Wall system is one in which through various means and temperature resistant materials, the amount of heat lost is kept to a minimum.

### **Problem Statement**

The main problem with the construction of the 330 Fellowship Road building was the delays in the assembly of the glass curtain wall. From what was seen, the curtain wall was delayed, pushing back the expected completion date. Had there have been signed leases, this delay would have been much more serious.

### **Problem Solution**

The main solution to this problem is to arrange for schedule acceleration. This can be accomplished several ways. One way is to arrange for the direct acceleration of the Curtain Wall Construction, be it through more efficient use of resources, or stacking double crews on site. Another more indirect way is to accelerate another portion of the project that is on the critical schedule path.

### **Solution Methods**

- 1.) Use RS Means to specifically calculate the Crew Sizes, and the man hours required per estimating unit for the curtain wall.
- 2.) Use RS Means to do the same for some other portion of the project on the critical path. Estimate/Schedule 2 other tasks.
- 3.) Modify crew sizes, and hours worked per day to obtain new schedule projections. Also modify construction process to try to make more efficient.
- 4.) Come to a conclusion about the best solution
- 5.) Report Results

## **Curtain Wall Problems**

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### **Expected Outcomes**

An expected outcome is for the schedule to be reduced in length. It should be easy to reduce the schedule by a week or so, however accelerating it further can be very difficult without incurring significant costs. What will be presented is several solutions, and the costs of each in comparison the cost of the original.

## **Breadth Analyses and Weight Matrix**

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### **Work Force Problem**

Currently, there are no breadth analyses for this portion of the research. The solutions will only span the construction option in value engineering.

### **Fire Protection Problem**

In the solution to the Fire Protection, there will be a plumbing breadth study. This study will show a new system which will require difficult pressure and hydraulic calculations in order to have sufficient flow at the most remote location in the building.

### **Curtain Wall Problem**

In the solution to this problem, there will be an architectural and mechanical breadth study. While the real cause of the problem is the extended schedule in construction of the curtainwall system, the situation presents itself to also present a better more efficient choice for the system.

<b>Description</b>	<b>Research</b>	<b>Value Eng.</b>	<b>Const. Rev.</b>	<b>Sched. Red.</b>	<b>Total</b>
Work Force	10	15		10	35
Fire Protection	20	10	10		40
Curtain Wall	10	5	5	5	25
<b>Total</b>	40	30	15	15	<b>100</b>

## **Summary**

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One of the biggest skills I expect to develop is a propensity for Value Engineering. With an ever growing knowledge base thanks to the AE department, it's becoming easier to pick ideas to run with, and much easier to actually see these ideas come to fruition.

The hardest skills to learn will be the mechanical skills. I already know the hydraulic calculations necessary to size the sprinklers, but it will be difficult to employ the thermodynamic equations to calculate heat loss to the water. Another difficult skill to practice will be in the calculations to pick better Glass for the Curtain wall.

As for the construction skills, I hope to merely refine all the skill areas necessary like scheduling, estimating and communications.