

Thesis Proposal (Revised)

University Medical Center of Princeton

Plainsboro Road, Township of Plainsboro, New Jersey



David Bodnar CM
Chris Magent
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Executive Summary

The proposal is four analysis topics that I will do research on in the spring of 2010 semester for Senior Thesis. The four topics that I am looking into are a more efficient curtain wall, gray water system, precast concrete foundation system, and green roof. A more efficient curtain wall system will focus on value engineering and constructability with a breadth analysis in mechanical due to the change in mechanical load from a new curtain wall system. The gray water system will focus on sustainable design research and look at cost benefits. The precast concrete foundation system will focus on the potential of schedule acceleration and constructability. Last the analysis on the green roof will many focus on the critical industry issue and a breadth analysis in structural will be done on the structural system of a typical bay to check and see if a typical bay will be able to support a green roof.

Analysis I – More Efficient Curtain Wall

Problem

The south face of the University Medical Center of Princeton is a complete curtain wall system as you can see in Figure 1. Since this curtain wall system is facing south there is potential for significant uses of solar heating and energy making the building more sustainable. An analysis in the use of a more efficient curtain wall system that could lower energy cost and lower heating and cooling loads could lower the indirect and direct cost on the building. There is cost savings on the mechanical system with lower heating and cooling loads since the system could be smaller if a more efficient curtain wall system is put in.



Figure 1-South Entrance of University Medical Center of Princeton

There is cost savings on the mechanical system with lower heating and cooling loads since the system could be smaller if a more efficient curtain wall system is put in.

Methods

First thing that would need to be done is to look at the heating and cooling load along with the mechanical equipment used in one specific area of the building and then take a look into the glazing on the curtain wall system that is already in place. Research would be done by talking to design professionals and different people who have previously done work on curtain wall systems to find new state of the art systems that are more efficient. Cost impact will be analyzed to see how the system will pay off directly and indirectly mainly due to sizing down the mechanical system.

There are few questions that will need to be answered in doing this.

1. What is the initial cost increase on the new system?
2. Will the cost of sizing down the mechanical system offset the price of the new system?
3. How long will the new system pay for itself?
4. How will it affect constructability?

This will also impact a breadth study in mechanical in calculating a new load in a specific area of the building due to a change in the curtain wall system.

Expected Results

Implementing a new curtain wall system I feel will be more sustainable and cost efficient. Some of the direct cost could be a little higher but not greatly affected due to sizing down of the mechanical system. Overall savings on energy could be where cost is mostly benefited from and could bring about some huge savings in the long run.

Analysis II – Gray Water System

Problem

The construction team for the University Medical Center of Princeton implemented many sustainable design ideas, but one idea that they did not look at is the use of a gray water treatment system. With the site being so big (approx 80 acres) there is a lot of storm water runoff that could be collected and treated for reuse. Sustainability is a critical industry issue and the use of gray water treatment system is very beneficial in recycling water. There is cost lost upfront for installing the system but there is definitely cost savings down the road on water.

Methods

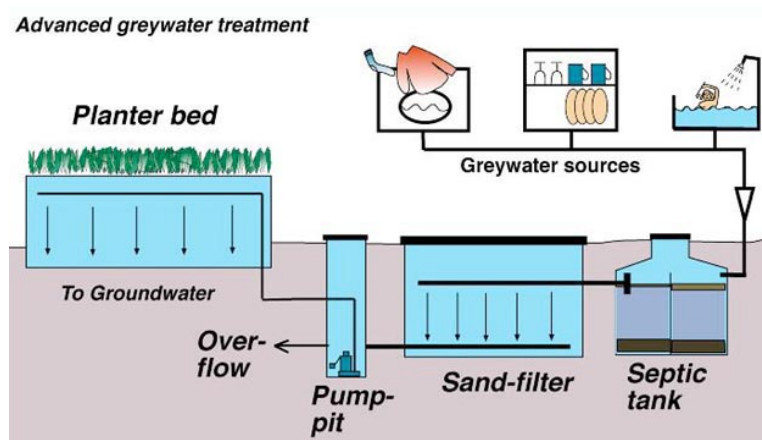


Figure 2 - Grey Water Treatment System

<http://bigsustainablelife.files.wordpress.com/2009/08/greysystem.jpg>

who have installed grey water systems before. The most important things the need to be analyzed is the affect that the system will have on the initial cost of the building. The key thing to look at this will be how long will it take for the system to pay for itself.

Expected Results

I feel that the initial cost of the system will be high but the overall recovery will offset the doubts of implementing the system. A gray water system can be effectively used in recycling water to be used for washing and toilets and lower the cost of water used in the building which makes it more of a sustainable building. The design of sustainable buildings is very important industry issue and the ways of recycling water are just as important as energy saving and materials savings.

The first thing I would look at would be how much area can be used on the site for storm water collection, and then look at what the rain fall amount is in Princeton, NJ. Research would then have to be done on cost analysis of the system and how much it would cost and how much it is to be install, once I have looked into the proper system for this building by talking to people

Analysis III – Pre-cast Foundation System

Problem

One of the major problems for the construction team on the University Medical Center of Princeton project was the construction of the Bed Tower since it is circular form. The odd shape

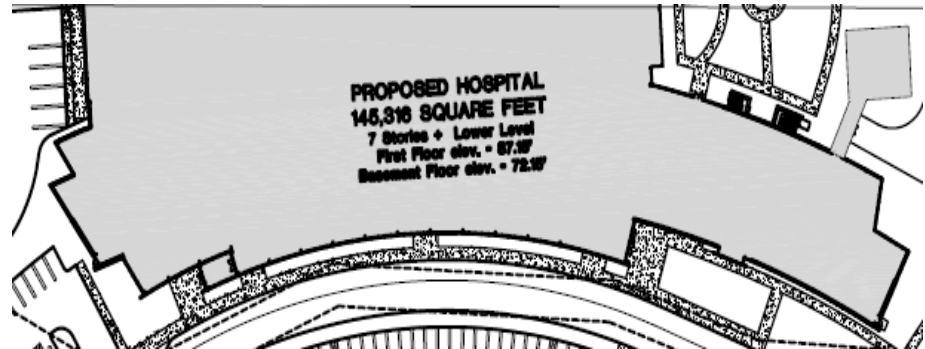


Figure 3 - Footprint of Bed Tower

leads to some difficulties with the foundation system in terms of construction. With the use of cast in place concrete there is potential for error in placement of footings that could affect cost and time on the project. Also there is more waste associated on site due to cast in place concrete as opposed to pre cast.

Methods

The first analysis that will have to be done on this topic will be to look at the cost difference due to less materials being used on site and the cost of manufacturing and shipping of precast system. This will be done by comparing the estimates of the two systems using RSMMeans. Schedule impact will also be analyzed to look at the potential schedule acceleration and the cost savings on general conditions. Research will also be done on other odd shaped buildings like mine to look into alternative foundation systems. The main topic of this point will be to look at the advantages and disadvantages of using a precast concrete foundation system on the project as opposed to a cast in place concrete foundation system.

Expected Results

It is expected that the schedule could be accelerated by using a precast concrete foundation system with savings on materials do to the foundation being manufactured off site. It is critical that the foundation system be in place on time and that there are no delays due to an error in placement of the footings. With using precast concrete foundation the constructability on the bed tower should be more efficient.

Analysis IV – Green Roof

Problem

On the University Medical Center of Princeton project there are not a lot of sustainable ideas implemented. One thing that could be looked at is a green roof that could be installed on the roof. Green roofs are very efficient in lowering mechanical loads and could be very useful in the collection of rain water runoff that could be collected to use in the grey water system. Green roofs are a growing trend in the industry that is being used more frequently now in sustainable design. The major question that remains though is why aren't more designs including green roofs in all of their projects.



Figure 4 - Green Roof
<http://www.inhabitat.com/images/greenroofs1.jpg>

Methods

Sustainable design is a critical issue in the construction industry and green roofs are becoming a very popular idea in the construction industry. Research will be done on the different kinds of green roofs that could be used on the building by talking to different design professionals and looking into which system will best fit the University Medical Center of Princeton. One question will be asked is why green roofs are not used more often and why green roofs and sustainable design are not implemented in the design phases of the project all of the time.

This analysis also goes along with a breadth analysis in structural since calculations will need to be done on the structural load on a bay to see how much load the roof could take from the green roof. This is very important in deciding on the proper green roof for the system.

Expected Results

Sustainable design is one of the biggest critical issues in the industry today and through this analysis research will be done in finding not only new state of the art green roofs more hopefully more efficient ways to incorporate them into design. Green roofs are very good in lowering heat transfer and collecting water for gray water treatment and there should be more focus on incorporating green roofs into all designs.

Weight Matrix

This chart is a percentage distribution on how I plan to spend distributing my time among my four different analysis topics.

Weight Matrix

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
More Efficient Curtain Wall	10%	10%	5%	-	25%
Grey Water System	5%	15%	-	-	20%
Pre-Cast Foundation System	-	5%	10%	15%	30%
Green Roof	20%	-	5%	-	25%
Total	35%	30%	20%	15%	100%

Breadth Topics

Mechanical

With looking at a new curtain wall system, mechanical calculations will have to be done on the load in a specific area of the building. This will be since the change in load in the specific area of the building will be different do to new curtain wall system and will affect the size of the mechanical system that will be needed.

Structural

While looking at a green roof system for the University Medical Center of Princeton project structural calculations will need to be done. The reason for doing this will be to see if the current typical bay will be able to support the weight of a green roof and if need be see what can be changed in the structural layout to support a green roof.