REDLAND TECHNOLOGY CENTER

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Construction Management

Thesis Proposal
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TABLE OF CONTENTS

4.1 EXECUTIVE SUMMARY

This thesis proposal is intended to outline the topics I plan to research in the Spring 2009 semester. Four separate analyses will be conducted, all focused on possible improvements made to the Redland Tech Center project in areas of sustainability and energy efficiency. Through these analyses, I hope to improve value of the project to the owner through value engineering, constructability review, schedule reduction, and research of topics identified at the PACE Roundtable.

Analysis I – LEED Rating Goal for Project

This analysis will determine the costs associated with achieving a LEED Gold rating for the Redland Tech project rather than the Silver rating currently targeted. I will also determine the added value to the owner for achieving the higher rating. Currently the project has 36 LEED credits that the project is targeting to obtain. A LEED Gold rating requires at least 39 credits.

Analysis II – Alternative Mechanical System

This analysis will determine the feasibility of using a chilled beam HVAC system as an alternative to the split system forced air HVAC system currently used for the project. Chilled beams have been used in Europe and Australia for over a decade and have been proven to be more efficient, save material costs, use less labor to install, and can decrease the plenum space needed for the HVAC system ductwork.

Analysis III – Electrical Energy Efficiency

This analysis will involve research and recommendations of energy efficient electrical components. One method that will be pursued in my analysis will be upsizing the electrical wiring one size larger than the NEC code minimum to achieve less power loss in the wires. This has been proven to have a payback period of less than 3 years. I will look for other electrical components that can have a payback period of less than 5 years.

Analysis IV – Parking Garage Construction Sequence

The parking garage for the Redland Tech project was constructed in two phases with a 60 day gap in the two phases of precast erection. In this analysis I will determine whether a different, more efficient construction sequence could have been used to erect the parking garage.

4.2 Analysis I – LEED Rating Goal for Project

Background & Goal

The Redland Tech project is seeking to obtain a LEED Silver designation from the United States Green Build Council (USGBC). Currently, the project is on track to obtain 36 LEED credits based on the LEED Version 2.1 Rating System. My goal for this analysis would be to quantify the costs and benefits of achieving at least 39 LEED points, which would enable the project to obtain a LEED Gold designation.

Methods

- Conduct survey with owner to establish perceived value added by achieving LEED Gold rating.
- Review the Redland Tech LEED Credit Checklist for areas of possible improvement.
- Consult with the projects LEED consultant to gain knowledge on project specific points already targeted and possible additional credits that could be pursued.
- Select credits to research further.
- Analyze selected credits for difficulty to obtain and costs associated.
- Establish best choice of credits that can be pursued to obtain LEED Gold rating.

Resources

- Perseus Realty (project owner)
- Lorax Partnerships (LEED consultant for project)
- Clark Construction Group
- USGBC Version 2.1 Reference Guide
- CM faculty

Expected Outcome

Through this analysis, I expect to find the costs associated with pursuing a LEED Gold rating for the Redland Tech project. A more sustainable building for the project owner will make the new office buildings more environmentally friendly and marketable to future tenants. I expect there to be increased costs with obtaining a LEED Gold rating, but may be acceptable by the value added to the owner.

Thesis Requirements Fulfilled

- Critical Issues Research
- Value Engineering

4.3 Analysis II – Alternative Mechanical System

Background & Goal

Electricity prices over the past 5 years have increased by close to 75% at peak times in July 2008. As a result of this, the energy efficiency of buildings has become more scrutinized. Inefficient buildings result in not only costing the owner of the building more to operate, but also puts the owner more at risk to price fluctuations and increases, decreasing their bottom line profits. Europe, which consistently has much higher energy costs than the United States, has more efficient technologies for the systems of buildings. In this analysis, I will look at chilled beams as a potential alternative HVAC system. Chilled beams have been used in Europe and Australia for over a decade. Chilled beams use far less energy than the HVAC system used for the Redland Tech project and require less ductwork and other material. Labor costs are lower to install a chilled beam system. My goal is to determine the costs, schedule, and sustainability impacts associated with redesigning the HVAC to a chilled beam system.

Methods

- Conduct literature reviews and interviews about chilled beam HVAC systems.
- Contact META Engineers (project MEP engineer) for building loads that will need to be met by the chilled beam system.
- Establish schematic chilled beam HVAC design and layout through help by consultants.
- Analyze effects of changed HVAC system on other building systems such as structure, electrical, architecture, building comfort. Estimate cost and schedule changes to these systems.
- Estimate costs to new HVAC system. Calculate how chilled beam installation will affect the schedule and constructability of the project.
- Run a lifecycle analysis on new HVAC system.
- Determine all pros and cons to redesigned system.

Resources

- META Engineers
- SmithGroup (engineers on Constitution Center, largest chilled beam project in U.S.A.)
- Davis Construction (construction managers on Constitution Center)
- Mechanical faculty and other engineers familiar to chilled beam HVAC systems
- R.S. Means

Expected Outcome

I expect to find the chilled beam redesign will be a much more sustainable and energy efficient system than the split system forced air HVAC system used currently for the project. Initial costs of the system will probably be more than the current system, but I expect to find that a lifecycle analysis will show that the new system has a short payback period and that it should be used on the project. The main reason chilled beams are more efficient than normal forced air system is because water is used to deliver the cooling and heating rather than air. Pumps can move the water required with much less energy than the fans that move the air. The chilled beam system will result in using fewer materials for the project, labor savings, and potential space gains. Plenum space can be decreased due to the smaller duct size, resulting in higher ceilings or reduced floor-to-floor height. This system can be installed faster than the forced air system and will help reduce the schedule. This analysis may contribute additional LEED points for energy efficiency to help the project achieve the LEED Gold rating addressed in Analysis I.

Thesis Requirements Fulfilled

- Critical Issues Research
- Value Engineering
- Constructability Review
- Schedule Reduction
- MAE Requirement – AE 597D Sustainable Building Methods
- Mechanical Breadth Study

4.4 Analysis III – Electrical Energy Efficiency

Background & Goal

Like Analysis II, I will address rising energy costs in this analysis by looking for more energy efficient electrical systems. Electrical product selection will be a main focus in this analysis. One method I will pursue is the technique of upsizing the wire used by one size larger than the NEC requires. This has been proven to have payback periods of less than 3 years in many cases. I will search for products which have a payback period of less than 5 years.

Methods

- Conduct literature reviews and interviews of electrical engineers to research for electrical systems that can increase electrical energy efficiency.
- Consult with faculty members on energy efficient electrical system.
- Specify and size new electrical systems.
- Determine energy efficiency improvements.
- Estimate costs of new electrical systems and determine schedule, constructability impacts.
- Run lifecycle analysis on new electrical systems.

Resources

- Case studies
- META Engineers
- Electrical faculty and L/E students
- R.S. Means

Expected Outcome

I expect to find several different electrical systems that can improve the electrical energy efficiency of the Redland Tech Project. My analysis will focus on systems that have a payback period of less than 5 years. This analysis may contribute additional LEED points for energy efficiency to help the project achieve the LEED Gold rating addressed in Analysis I.

Thesis Requirements Fulfilled

- Critical Issues Research
- Value Engineering
- Constructability Review
- MAE Requirement – AE 597D Sustainable Building Methods
- Electrical Breadth Study

4.5 Analysis IV – Parking Garage Construction Sequence

Background & Goal

The parking garage for the Redland Tech project was constructed in two phases. The first phase included 90% of the foundation work excluding the southeast corner of the garage. This corner was constructed in the second phase; it was left out because this allowed an access point to the basement of the garage for structural precast member deliveries and crane movement. The crane erected the first phase of precast members from the basement of the garage. After the crane was finished erecting the precast members of the first phase, it was dismantled and taken offsite to another project. Whenever the first phase was complete, the foundation crew finished constructing the last 10% of the garage foundation. Once the foundation was finished, the precast erectors brought another crane back to the site and erected the remaining 10% of precast members. There was a 60 day gap in the erection of precast panels. My goal for this analysis will be to determine if there was a more efficient method to constructing the parking garage. The garage is currently finished and waiting for the rest of the project to be opened but the sequencing method used was not ideal and caused many problems for the entire project team.

Methods

- Consult with Precast Erectors (the erection company) to determine other possible techniques to construct garage.
- Consult with Clark Construction to determine the feasibility of recommended techniques.
- Develop plan and size crane as necessary.
- Determine schedule impacts and cost savings with new sequencing method.

Resources

- Precast Erectors
- Clark Construction
- Manitowoc Crane Guide

Expected Outcome

Without consulting the project team about the sequencing of the garage, I can foresee one alternative construction sequencing method. It might be possible to erect the entire garage in one sequence with a larger crane located on the outside of the foundation walls. I'm confident that I will be able to find a method that would have been more efficient to erect the garage whenever I consult with the project team.

Thesis Requirements Fulfilled

- Value Engineering
- Constructability Review
- Schedule Reduction

4.6 WEIGHT MATRIX

Table 1 – Weight Matrix below shows a breakdown on how I plan to distribute my time and efforts between my four analysis topics.

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Analysis I	10	10			20
Analysis II	10	10	10	5	35
Analysis III	10	5	5		20
Analysis IV		5	10	10	25
Total	30	30	25	15	**100 %**

Table 1 – Weight Matrix

APPENDIX A – BREADTH STUDIES

Breadth One: Mechanical

This breadth study will be performed in my analysis of an alternative mechanical system for the Redland Tech project. For this analysis, I will use the design loads from the mechanical engineer to design a chilled beam system to replace the split system forced air HVAC system currently used on the project. Equipment and ductwork will be sized, efficiency gains calculated, and a lifecycle analysis will be conducted. This new system will be compared to the forced air system to determine whether or not it would have been feasible to use a chilled beam system on the Redland Tech project.

Breadth Two: Electrical

This breadth study will be performed in my analysis of alternative electrical systems that are energy efficient. For this analysis, I will be looking at all of the electrical components used on the project to determine alternate equipment and materials that could be use to save energy. This analysis could include new, more energy efficient transformers or upsizing electrical wires one size larger than the NEC minimum. In the latter case, I would need to calculate resistances of the wiring of the building, determine electrical loads, and calculate power lost due to resistance. It has been shown that just upsizing wires to the next larger size can have a payback period of less than 3 years, maybe even as short as 3 months. I will research electrical components that have a payback period of less than 5 years.

APPENDIX B – SPRING SEMESTER SCHEDULE

Jan 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12 A1: Conduct LEED Survy w/ Owner First Day of Classes	13 A1: Interview LEED Consultant	14 A1: Review LEED Checklist for New Points	15 A1: Select LEED Points to Pursue	16 A2: Research Chilled Beams	17
18 A2: Research Chilled Beams	19 No Classes	20 A2: Interview Chilled Beam Experienced Profesionals	21	22 A2: Contact META for Loads	23	24
25	26 A2: Establish Schematic Design	27	28 A2: Analyze New System Effects on Other Systems	29	30	31

Feb 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
	A2: Costs, Schedule, Constructability of System		A2: Conduct Lifecycle Analysis	A2: Pros and Cons	A3: Conduct Literature Reviews and Interviews	
8	9	10	11	12	13	14
A3: Conduct Literature Reviews and Interviews	A3: Consult Faculty Members		A3: Specify and Size New Systems	A3: Determine Energy Efficiency Improvements		
15	16	17	18	19	20	21
	A3: Conduct Lifecycle Analysis A3: Costs, Schedule, Constructability of New		A1: Analyze Selected Credits			
22	23	24	25	26	27	28
	A1: Establish Final	A4: Consult w/ Precast Erectors	A4: Consult w/ Clark Construction			

Mar 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
	A4: Develop Plan		A4: Costs, Schedule, Constructability			Spring Break
8	9	10	11	12	13	14
Spring Break						
15	16	17	18	19	20	21
Spring Break	Finilize Any Work Needed to be Done			Compile Information Into Report Format		
22	23	24	25	26	27	28
Compile Information Into Report Format			Write Report			
29	30	31	1	2	3	4
Write Report				Finalize Report	Work on Presentation	

Apr 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29	30	31	1	2	3	4
Write Report				Finalize Report	Work on Presentation	
5	6	7	8	9	10	11
Work on Presentation			Finalize Presentation		Practice Presentation	
			5pm - Final Summary			
12	13	14	15	16	17	18
Practice Presentation	Faculty Jury					
19	20	21	22	23	24	25
26	27	28	29	30	1	2
					Last Day of Classes	