Westinghouse Electric Company
Nuclear Power Engineering Campus

Final Proposal

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EXECUTIVE SUMMARY

The following report proposes three analysis topics to research next semester. These 3 topics include LEED implementation, the concrete floor system, and the use of building information modeling. These topics will be looked at from four distinct areas. These areas include critical industry issue research, constructability review, value engineering, and schedule reduction.

Analysis 1, the implementation of LEED, will look at the embodied energy of the finishes and attempt to lower the values. Also, other LEED ideas will be implemented, especially those affecting the mechanical systems as this will be included as a breadth study. A life cycle cost will be calculated and will hopefully add value to the project.

Next, an analysis will be performed looking at the concrete slab system. Precast slabs will be looked at as an alternative to the poured in place slabs used on the project. Potential schedule savings will be reviewed and a cost analysis will be performed. Also, the structural ramifications will be looked at as part of a structural breadth.

Finally, the third analysis will look at implementing BIM on the project. A 3D and 4D models will be developed and the project team will be interviewed for their reaction to the models and their views on BIM. Potential issues which could have been avoided will be identified as well as areas where BIM may have been able to reduce the schedule.

An appendix has also been included with the breadth studies specifically identified.

ANALYSIS ONE: LEED

Problem Statement

The Westinghouse Headquarters Campus is pursuing and should achieve a LEED Certified status. However, this was primarily due to a well designed building. Minimal effort was put forth to actually achieve this certification. As an energy company, I believe Westinghouse has an opportunity to raise the standard by including more energy saving ideas and materials into their building. Also, as Westinghouse is not the owner of the building, lower lifecycle costs resulting from more energy saving ideas could be an attractive option.

Goal

Westinghouse chose to spend a large amount of money on high end finishes on the interior of the building. My goal will be to look at the embodied energy of these materials and attempt to reduce it while maintaining the original budget. I will also look at other obtainable LEED points in order to achieve a higher rating above the accreditation the campus is currently on pace to earn. The goal of this analysis will not only to increase the LEED rating but also to explore the cost and construction schedule impacts implementing the changes will have. Also, the mechanical systems may be affected by seeking more LEED points. This will be the basis for one of the breadths.

Steps

- Determine current finishes placed within Building One
- Calculate embodied energy of the current finishes
- Calculate cost of replacing finishes with green products
- Calculate potential embodied energy saving from implementing green product
- Research LEED requirements
- Determine impact on mechanical systems from implementing LEED points
- Determine life cycle cost savings
- Calculate potential payback period of implementing ideas

Expected Outcome

I would expect that implementing more LEED ideas would increase the initial cost of the building. However, as an energy company these upfront costs may provide value to the tenant. Also, with more energy efficient systems the costs could be offset and eventually pay for themselves thus adding value to the owner.

ANALYSIS 2: CONCRETE SLABS

Problem Statement

The Westinghouse Headquarters Campus was constructed on a compressed schedule. The original schedule of 22 months was reduced to a 15 month schedule. With the compressed schedule, a large emphasis was placed on the pouring of the slabs which were on the critical path. The slab on grade was crucial to start bracing the foundation wall and continuing with the frame of the building. The slab-on-decks needed to be poured and cured so the crews could begin interior work as soon as possible. The impact these items had on the schedule were vast. Because the work needed to be completed so fast a large amount of overtime was needed in order to complete the project. If the schedule could be reduced the additional cost of the overtime could be lessened.

Goal

My goal will be to reduce the schedule by reducing the amount of time spent on pouring the slab-on-grade and the slab-on-decks. I will look at the cost of using prefabricated concrete slabs as opposed to these poured slabs. If the prefabricated slabs could be put into place in an efficient manner the schedule could be reduced. This could allow the workers to start on the interior work quicker and perhaps reduce the schedule or the amount of overtime used on the project. My goal will be to reduce both the cost and schedule by using prefabricated slabs. This analysis will include the structural ramifications of changing the system and will encompass another breadth.

Steps

- Determine current schedule and cost of slabs
- Contact local prefabricated concrete slab manufacturer to determine cost and time needed
- Develop schedule for delivery and placing of precast slabs
- Calculate potential schedule and cost reduction
- Determine structural ramifications of changing floor systems
- Overall cost and schedule analysis including structural changes

Expected Outcome

I would expect that changing to precast slabs will save time and reduce the schedule. However, the system itself will become more expensive. This will be especially true if the structural system will need to be drastically changed in order to install the slabs. However, the reduction of the schedule and ultimately the reduction in the amount of overtime may make up for the additional costs.

ANALYSIS 3: IMPLEMENTATION OF BIM

Problem Statement

There has recently been a large push towards the implementation of building information modeling (BIM) throughout the construction industry. BIM can provide great value during the construction process by enhancing coordination, reducing change orders, and communicating ideas. BIM was not implemented on the Westinghouse Headquarters Campus project,

Goal

Although no major coordination issues were encountered, the shortened construction schedule may have benefited from the use of building information modeling (BIM). The use of BIM could not only prevent coordination issues from occurring, but could have made these processes more efficient. Through the use of BIM the subcontractors would have a definitive idea of exactly what they were supposed to get done and where, before the day began. My goal will be to analyze the effects BIM would have on the schedule and in turn the cost of the project. I will also explore the effects on the Turner staff and their views towards BIM.

Steps

- Use the attached survey to assess the Westinghouse Turner staff's knowledge of BIM
- Determine areas where BIM could be applied
- Develop 3D and 4D models of selected areas
    - Basement mechanical space
    - Typical floor office area
- Show models to project team and assess their response using attached survey
- Assess potential effects on the schedule
- Perform a cost analysis

Expected Outcome

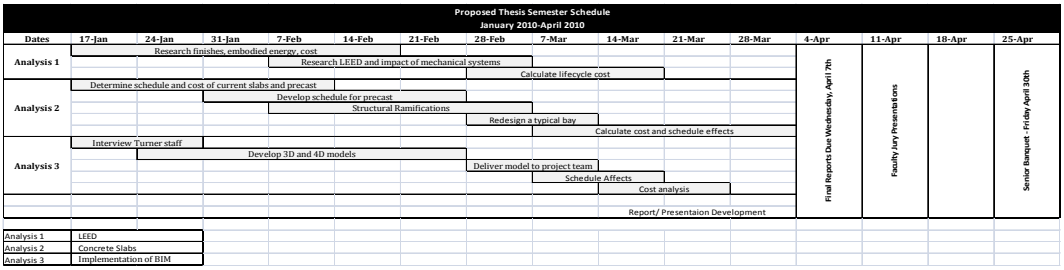
I would expect to obtain a large amount of feedback on the industry's views of BIM and its potential uses. I believe the Turner staff may have found BIM useful in the coordination of the construction process and also in aiding to reduce the number of change orders. Although, there is a higher cost associated with using BIM, I expect the value it adds to offset these costs.

CONCLUSION

Weight Matrix:

Description	Research	Value Eng.	Const. Rev.	Sched Red.	Total
Analysis 1	10	10	0	0	20
Analysis 2	0	0	25	15	40
Analysis 3	20	0	5	15	40
Total	30	10	30	30	**100%**

Time Table: A larger version can be seen in Appendix D



Conclusion

The goal of the proposed analysis topics will be to look at improving the construction process of the Westinghouse Headquarters Campus. This may be done by adding value to the project, reducing the schedule, or looking at implementing new ideas that are current industry issues. It is the goal that the cost and schedule will be reduced by changing the slab systems. In addition it is a goal that the life cycle cost will decrease by implementing more energy efficient LEED ideas, especially when looking at the mechanical systems.

APPENDIX A: BREADTH STUDIES

Mechanical Breadth Study

For the mechanical breadth study I will analyze the current mechanical systems and their efficiencies to determine if they meet LEED certified requirements. I will also analyze the actions which would need to be taken in order to achieve certification. If the mechanical systems already meet certified requirements, actions to increase their ranking will be examined. The changes should have a positive impact on the energy savings within the building, but may have an additional cost. I will compare these upfront costs with the life cycle cost and calculate the potential payback period of implementing more energy efficient systems.

Structural Breadth Study

In an effort to reduce the schedule, precast concrete slabs will be looked at as a potential area to save time. Implementing the precast slabs will have a large impact on the structural systems of Building One. A structural analysis will be performed to identify the changes which will be incurred. In accordance with this analysis, a structural redesign will be performed on a typical bay. The effects of making these changes to the structural system will be analyzed from both a cost and schedule standpoint.

APPENDIX B: INITIAL PROJECT TEAM SURVEY

Briefly describe your role on the project team.

Have you ever used BIM (3D or 4D) on any previous projects? If yes, what applications were used?

What areas of Building One lead to conflicts where a 3D or 4D may have been helpful?

Rank the following on a scale of 1-5.

I am familiar with using 3D or 4D software.

1 2 3 4 5

How effective could a computer model have been on the Westinghouse project?

1 2 3 4 5

How comfortable would you have been with BIM being applied to the Westinghouse project?

1 2 3 4 5

How apprehensive are you about the applying BIM to this or future projects?

1 2 3 4 5

APPENDIX C: POST MODEL PROJECT TEAM SURVEY

Briefly describe your role on the project team.

After seeing the models, what areas of the building could they have been helpful?

Rank the following on a scale of 1-5.

How effective would the BIM models have been in better conveying information?

1 2 3 4 5

How comfortable would you have been in navigating through the models?

1 2 3 4 5

Would you like to see these types of models be implemented on future projects?

1 2 3 4 5

How close was this to your previous views of BIM?

1 2 3 4 5

APPENDIX D: TIME TABLE

Proposed Thesis Semester Schedule
January 2010-April 2010

Dates	17-Jan	24-Jan	31-Jan	7-Feb	14-Feb	21-Feb	28-Feb	7-Mar	14-Mar	21-Mar	28-Mar	4-Apr	11-Apr	18-Apr	25-Apr
Analysis 1	Research finishes, embodied energy, cost			Research LEED and impact of mechanical systems								Final Reports Due Wednesday, April 7th	Faculty Jury Presentations		Senior Banquet - Friday April 30th
							Calculate lifecycle cost								
Analysis 2	Determine schedule and cost of current slabs and precast														
			Develop schedule for precast												
				Structural Ramifications											
							Redesign a typical bay								
								Calculate cost and schedule effects							
Analysis 3	Interview Turner staff														
		Develop 3D and 4D models													
							Deliver model to project team								
								Schedule Affects							
									Cost analysis						
									Report/ Presentaion Development						

Analysis 1	LEED
Analysis 2	Concrete Slabs