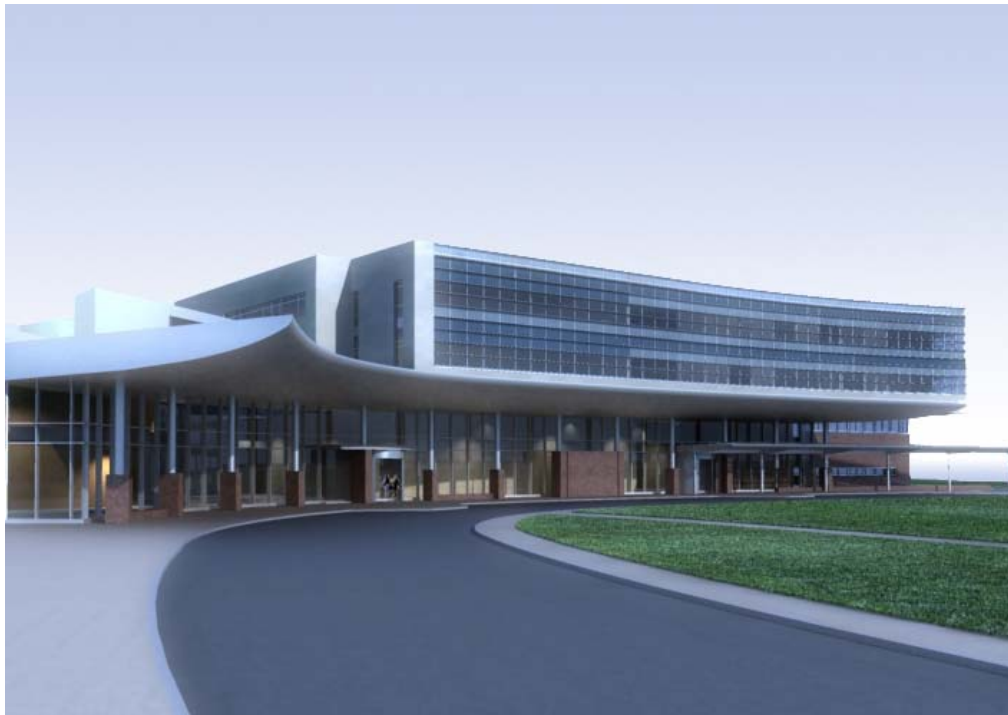


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## **FINAL RESEARCH PROPOSAL**

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## **Executive Summary**

The following proposal examines the four critical analyses planned for research on the PSHMC Cancer Institute and the construction industry as a whole. These ideas were initially presented in Technical Assignment 3, and reworked to incorporate ideas generated through the feedback phase. Research will begin over the winter break and will continue through to April, with results to be presented at the final Thesis presentations.

The first analysis looks at the industry issue of subcontractor bid markups, and how they have been personalized for individual construction managers and general contractors. A survey-based analysis will lead to the formation of a matrix which will aid these companies in reevaluating their subcontractor management methods and how to better their relationships and bid competition.

The first technical analysis looks at the Emergency Delivery renovation and the impact of the redesign on the ICRA plan. Research will examine how the sequencing of the job was reworked to facilitate the ICRA plan, and will involve a constructability review to identify opportunities for cost or schedule improvements.

Next, an analysis on the radiotherapy equipment and enclosures will be performed, examining the possibility of modular installation. The recently completed PSHMC Oncology Treatment Building had planned for prefabricated elements with its equipment. However, the plan was changed due to subcontractor shortcomings. This analysis will be based on value engineering and schedule reduction aspects of construction.

The third analysis is a short study of the early phasing plan and how it could have been better managed to facilitate the helipad construction and ED renovation. A number of unforeseen problems arose that impacted the overall schedule of the project, and these will be examined further through schedule and constructability. Lastly, a weighted matrix is provided to show the distribution of effort among these four analyses over the research phase.

## **Critical Issues Research – Subcontractor Bid Markups**

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### **35% of Total: 35% Research**

The industry issue I will research this upcoming semester was identified during my internship with Gilbane this past summer at PSHMC. Though the topics discussed above do not directly correlate to this problem, the contacts made will become an asset to the research.

### ***Problem Statement***

Bid package markups of individual subcontractors are typically consistent from one project to the next, provided there is similar risk associated to the jobs. However, a much different relationship exists between a subcontractor's markup and the construction manager or general contractor that is on the job. This variation results from the practices and structure of different CM and GC companies as perceived by the subcontractor. Not only does this impact the overall bid of a CM or GC to an owner, but it also creates tension in the industry when contractors have difficulty of subs returning to them for work on later projects.

### ***Research Plan***

Research will begin by developing a comprehensive survey for the CM/GC, with questions designed to elicit the aspects that impact their management methods and ultimately the bid package markups. The questions will be based on an initial survey of key contacts with Gilbane at PSHMC so as to narrow the target on the key aspects related to subcontractor markups. Sample questions for the CM/GC can be found in Figure 1 of page 6.

After retrieving a majority of the CM/GC surveys, an initial side-by-side comparison of five to ten CM and GC companies will be performed to show the correlation between their common or uncommon practices that influence a subcontractor's markup. These case-study companies will remain anonymous so as to avoid any ethical conflict; a

successful comparison relies only on their company structure and practices, not on their company name. A preliminary weighted matrix will then be formed to determine how influential certain attributes are to the markup.

With a basic matrix in place, a second survey will be developed for the subcontractors (see page 6, Fig. 2). This will be a combination of general survey questions and case study analyses. The general survey questions will evaluate the relevance of certain CM/GC characteristics on their markups. The second part of the survey will be comprised of several case study companies, both real and fictional, as determined in the CM/GC survey. The subcontractor will be presented a company description as related to their structure and management methodologies, and will then be asked to provide a typical markup that they would use for such a company. Whereas all companies will remain anonymous in the case-study evaluation, several actual companies will be used in combination with theoretical company profiles, with the theoretical companies conjured through combining varied characteristics of CM/GC companies.

It is the hope of this second survey that the subcontractor's projected markups for the case study companies will align with the actual markups of the surveyed CM's and GC's. Further, this will determine the accuracy of the initial weighted matrix in predicting the fictional companies' markups as stated by the subcontractors.

After all the results have been tabulated, the initial weighted matrix will be modified based on the results of the subcontractor survey, so as to more accurately reflect the influence of each specific attribute. An industry average as well as outlier situation will be provided to show the range of markup possibilities. Multipliers for each characteristic will influence the actual markup of a company profile as compared to the industry average.

The research will conclude with a qualitative evaluation of why subcontractors vary their bid markups, and will assess the accuracy of the matrix in determining a markup. The results will be highly subjective, and thus it is important to retrieve a large number of

results so as to identify the key aspects of CM's and GC's that influence a subcontractor's markup decision.

### ***Research Goal***

To aid CM companies in evaluating their bid package markups, I will attempt to identify the key elements of their organizations that differentiate themselves in the eyes of the subcontractor. Through two different surveys, one tailored to the CM and GC companies and one to the subcontractors, I expect to discover the defining characteristics that cause subs to vary their markups dependent upon the CM or GC that is on the job. It is my ultimate goal that companies will take this matrix and internally examine their subcontractor management methods so as to identify areas where they can reduce their markups or increase the competition of bids on future projects.

### ***Data Collection Tools***

The following sample surveys are preliminary only, but contain the general format planned for each. Much further refinement will be done after the initial survey of the Gilbane project team. It is important to take notice of the structure of each survey. Whereas the CM/GC survey will be a user-intensive, written evaluation, the subcontractor survey will use a weighting scale to determine the impact of certain CM/GC characteristics on their markup procedure. The subcontractor survey also contains a case study evaluation of several companies to gauge their thinking process when determining markups. This case study will be much more specific in its company profile so as to cover all of the major characteristics of the CM/GC companies that impact markups.

Figure 1- CM / GC Survey

1	Name: Company: Position:
2	What is the typical markup you receive for bid packages?
3	What do you feel is the major determinant of this markup?
4	Are markups typically the same from subcontractor to subcontractor on bid packages?
5	How would you rate yourself in terms of having subcontractors return for future work?
6	How would you define your negotiating practices for subcontractor change-orders?
7	How would you characterize your client base- one-shot deals or repeat clients?
8	How would you characterize your project teams- a lot of change or keep them together?

Figure 2- Subcontractor Survey

Part 1					
Issue	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Past experiences with a CM/GC influence a bid markup.	1	2	3	4	5
"Nickel-and-diming" practices of a CM/GC cause an increase in a markup.	1	2	3	4	5
The specific CM/GC personnel used for a job influences a markup.	1	2	3	4	5
"One-shot jobs" result in a higher markup.	1	2	3	4	5
The organizational structure of a CM/GC company influences markup.	1	2	3	4	5
Change-order negotiation strategies of a CM/GC impact markup.	1	2	3	4	5
Part 2					
<p><b>Case Study 1:</b> Alpha Construction Company is a large CM company that is dealing with a repeat client. You have had a few past experiences with the CM, though the last job had a number of complications that led to frustration when change orders for work were being negotiated. With the exception of the project engineer and general superintendent, you are familiar with the project team of the CM and are comfortable working with them. Despite this team chemistry, you are not very confident in the accuracy of design and expect design changes...</p>					
<b>Answer the following questions:</b>		What markup would you assign for the bid package?			
		What is the key deciding factor(s) for this decision?			

## Technical Analysis 1: Emergency Delivery Renovation

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**25% of Total: 5% Value Engineering**

**10% Constructability Review**

**10% Schedule Reduction**

### *Problem Statement*

The current emergency delivery renovation sequence has had difficulty in getting off the ground, mainly due to redesign of the basement and complications with relocating the existing ED department. Also of major concern is adhering to the ICRA plan to ensure no contamination of sensitive areas occurs during the demolition and construction. The current schedule has been pushed back significantly to facilitate the plan changes.

### *Research Plan*

The issue of the ED renovation will be analyzed from the perspective of a value engineering and constructability review, with special attention paid to the ICRA plan and its impact on the cost of the sequence. Research will begin by comparing the original plan and the recent changes. It will be important to identify the major mechanical and structural redesign elements associated with the basement and the applicable changes that were made to the ICRA plan for this new construction.



**Fig. 3- Future ED Main Entrance**

### *Research Goal*

Through this research, I expect to find further areas in the mechanical sequencing that could better facilitate the ICRA requirements. Though it will be too late in materializing to impact the current construction, the analysis will be beneficial to PSHMC when considering the ICRA plan developed for the Children's Hospital construction and its tie-in to the Cancer Institute.

## Technical Analysis 2- Modular Radiotherapy Enclosures

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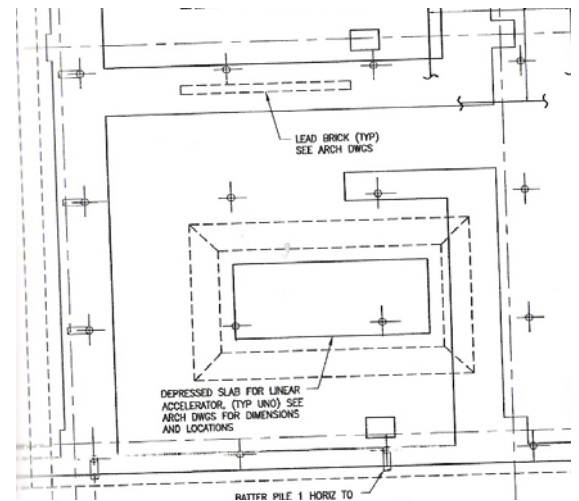
**25% of Total: 15% Value Engineering**  
**10% Schedule Reduction**

### *Problem Statement*

The recently completed Oncology Treatment Building had planned for modular installation of its equipment, but had difficulties in the procurement and pre-fabrication processes. On-site installed enclosures and equipment had to be used, greatly impacting the overall cost. The radiotherapy equipment for the Cancer Institute, and in particular the enclosures, is a highly intensive portion of the project, and will employ the on-site method of construction. The four Linear Accelerator units require 4' thick walls with encased lead bricks, as well as a 5' thick ceiling. The risk of form blow-out and unsuitable concrete for the enclosure pours present the potential for increased costs and schedule delays.

### *Research Plan*

Modular installation of the radiotherapy enclosures and equipment requires a great deal of back-study, not only in prefabrication of the specific models but also into the OTB project. A cost and schedule comparison of the proposed modular system versus the current cast-in-place enclosures and equipment will determine which is favorable in the long-run for PSHMC. This analysis could be of particular interest to other medical centers planning on installing similar equipment.



**Fig. 4- Plan View, Typical Linac Vault**

### *Research Goal*

The analysis will result in a short qualitative comparison of projects that used both methods, describing the benefits and challenges of each, as well as the lessons learned by the project teams.



## Technical Analysis 3- Early Phasing Plan

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**25% of Total: 5% Constructability Review**

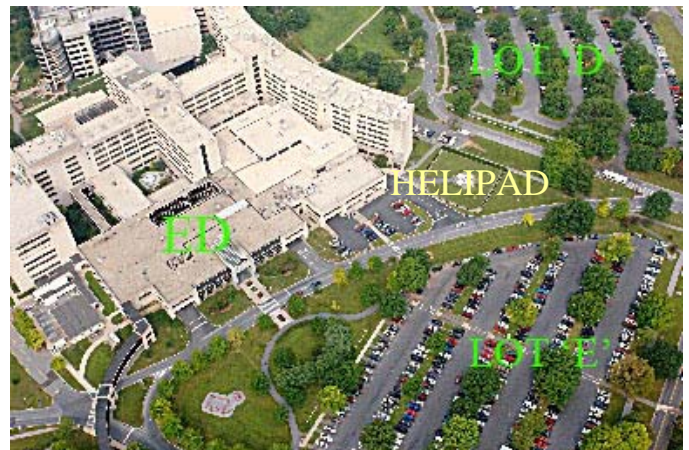
**10% Schedule Reduction**

### *Problem Statement*

The current phasing plan for the early stages of construction have become a nuisance, with schedule overruns being incurred already as a result of improper logistical planning for the parking lot takeovers, helipad construction, and ED renovation. Not only has this impacted the proposed schedule, but it places a hindrance on the PSHMC staff in coordinating the change-over for its employees, patients, and visitors. Coupled with the ED redesign issues, the schedule outlined by Gilbane has been significantly lengthened.

### *Research Plan*

The examination of the early phasing plans will focus on the potential for schedule reduction through a small constructability review of its particular construction activities. Analysis will focus on the joint plan developed by PSHMC and Gilbane, and will evaluate the sequencing of the helipad construction and ED renovation. This research will highlight the critical issues



**Fig. 5- Aerial View of East Campus**

during the early phasing of the job and will present opportunities to rework the transition from the early phases to the major construction phase of the Cancer Institute.

### *Research Goal*

This research will again be far too late to realize an actual impact on the job at hand. However, it will aid PSHMC and other hospitals in evaluating the manner in which they approach renovation projects to their facilities, identifying some of the intricacies that need to be considered for a smooth project.

## Weight Matrix

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The following table outlines the expected distribution of effort among the four research topics. It is broken down by the individual analyses and their attributed core investigation areas, as defined by the faculty. From left to right and abbreviated below, these areas are: Critical Issues Research, Value Engineering Analysis, Constructability Review, and Schedule Reduction/ Acceleration.

*Figure 6- Weight Matrix*

<b>Analysis Description</b>	<b>Research</b>	<b>Value Eng.</b>	<b>Const. Rev.</b>	<b>Sched. Red.</b>	<b>Total</b>
Sub Bid Markups	35%				35%
ED Renovation		5%	10%	10%	25%
Radiotherapy Area		15%		10%	25%
Early Phasing Plan			5%	10%	15%
Total	35%	20%	20%	30%	100%