



# Proposal

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## Executive Summary

This proposal is comprised of the Outpatient Medical Center general building information and three analysis areas that I will be using for my research next semester. The three analysis ideas for my research and analytical development improve; cost, constructability, and schedule reduction/acceleration and they are as followed:

### Analysis 1: Structural System

This analysis focuses on the changing the structural system from cast in place concrete to structural steel. This analysis will illustrate the effects the steel structure has on the cost and schedule for the project, as well as site, quality, and transportation issues. With this analysis is a breadth study of the re-designing of the structural system and re-design the mechanical, electrical, and plumbing systems if needed.

### Breadth Study 1:

This analysis will include a structural breadth by redesigning the structural system and examining the impacts it has on the mechanical, electrical, and plumbing system. Impacts of the mechanical, electrical, and plumbing system may result in redesigning sections of the systems and could illustrate new areas of coordination due to clashes in systems.

### Analysis 2: Mechanical System

This analysis looks at adding a heat recovery system to the mechanical system to improve the air quality and to reduce energy cost. This analysis will look at the cost effects from adding this into the system and the overall cost effects of utilizing it. This analysis has a breadth study of the mechanical system and the effects of adding a heat recovery system.



## Breadth Study 2:

This analysis will include a breadth study of the mechanical system and the impacts of adding heat recovery system into the building. A redesign of the mechanical system will include the sizing of the heat recovery system and the mechanical system if needed. The redesign will also include impacts and placement of all the proper equipment needed to be installed and utilized in the building. This breadth study will illustrate the cost impacts a heat recovery system has on the project cost.

## Analysis 3: 3D Design Coordination (Critical Issues Research)

This analysis includes the research ideas for understanding the construction industries challenges with implementing and utilizing 3D design coordination. How does it impact the project and what does it take to implement it on the construction project. What are the coordination issues with other subcontractors and contractor?



## Building Introduction

The Kennedy Krieger Institute Outpatient Medical Center is a 6 story cast in place structure. It is located in downtown Baltimore on the corner of East Madison Avenue and North Broadway and is next to the Existing Kennedy Krieger Institute and the John Hopkins Medical University. This building includes 30 exam rooms, 15 treatment rooms, several conference rooms, 54 offices and a physical therapy/occupational therapy gym, a spinal cord gym, and a physical therapy Natatorium, which includes two pools varying in size. In order to start excavation and construction, an existing parking lot will need to be first removed. Once the parking lot is removed, construction on site will begin. The Outpatient Medical Center is being constructed beside the Kennedy Krieger Institute Parking Garage which was recently built and it will utilize parking for the two Kennedy Krieger buildings in that location. The project is currently under construction. It is a 24 month long project which began on January 1, 2007 and is schedule to be completed on January 22, 2009.

### *Building Cost*

The Outpatient Medical Center is budgeted to cost \$35,156,010 which is \$305.70 per square foot. The construction cost alone was \$32,840,888 which is \$285.57 per square foot. Other system costs can be seen in the table below.

<b>Building Cost Breakdown</b>		
<b>Division</b>	<b>Square Foot Cost</b>	<b>Projected Cost</b>
General Requirements	10.08	1,159,700
Concrete	36.36	4,181,700
Metals	12.52	1,440,265
Wood, Plastics	5.11	587,953
Thermal & Moisture Protection	2.41	277,700
Finishes	22.02	2,531,970
Specialties	0.28	32,000
Fire Suppression	4.34	498,788
HVAC	49.21	5,658,700
Electrical	29.41	3,382,300



### *Demolition/Excavation*

Demolition was needed to remove an existing parking lot. Once the parking lot was removed, excavation took place. Excavation at the south side was about 50 feet below the street level and the rest was surface grading from the north side toward the area where the foundation system would be installed (at the south end of the site). All site soils that were excavated were permanently removed from site.

### *Structural Steel*

Structural steel is used on the sixth floor penthouse area. Wide flange structural steel is carbon steel, ASTM A992, Grade 50. High strength bolts, nuts, and washers are ASMT 325 and have a mechanically deposited zinc-coating ASTM B695, class 50. Cold formed structural steel tubing is ASTM A500, Grade B material. The Structural steel is for the cooling tower framing, elevator connections, and to enclose the roof area.

### *Cast In Place*

The entire Medical center is cast in place concrete; this includes the foundation mat system, floors, and columns but excludes the 6<sup>th</sup> floor roof system which consists of structural steel. The foundation system consists of several mat slabs which are placed under the elevators, the columns, and exterior walls. Foundations are approximately 3 feet thick and vary in surface area depending on the item it is supporting. The floors are a pan and joist system with a floor thickness of 6 inches and joist spacing about every 8 inches on center. The columns are an average size of 30 inches in diameter and are located about every 24 feet from north to south and about every 29 feet east to west. Concrete compressive strength used throughout the building is 4000 psi concrete.

### *Precast Concrete*

The exterior façade is made up of architectural precast concrete panels. Panels are made with a minimum of 5000 psi concrete, 28 day strength, and air entrained 5 to 7 percent. Connection devices are all stainless steel, which are connected to embedded plates, and angels. Grout is to be of a minimum strength of 10,000 psi, 28 day strength and will be tinted to coordinate with panels.



### *Mechanical System*

The mechanical system consists of 3 air handling units with 40,000 cfm. There is also 1 air handling unit for the natatorium which has a 5,500 cfm. There are 2 chiller units with a 245 ton capacity. The chiller towers are located in the penthouse. Mechanical rooms are located in the basement and one mechanical room is located on the fifth floor and is for the natatorium units only.

### *Electrical System*

The Outpatient Medical Center uses 2500 amp power source that enters the building at its main switch board. The building also has twenty one 480/270 3 phase distribution switch boards and forty four 208/120 3 phase distribution switch boards and a 1500kVA transformer. The lighting in the building is mainly 277 volt lighting fixtures.

### *Curtain wall*

The curtain wall consists of aluminum frames with vision glazing and glass infill panels at the building's exterior as well as the canopy at the front entrance. The glazing used is one of five different types of glazing, some are tempered and some are filter, all are tinted.

### *Support for excavation*

Standard sheeting and shoring is used, which includes steel wide flange piles, with wood inlay to hold back the ground, and a several wailers to provide more structural support.

### Client Information

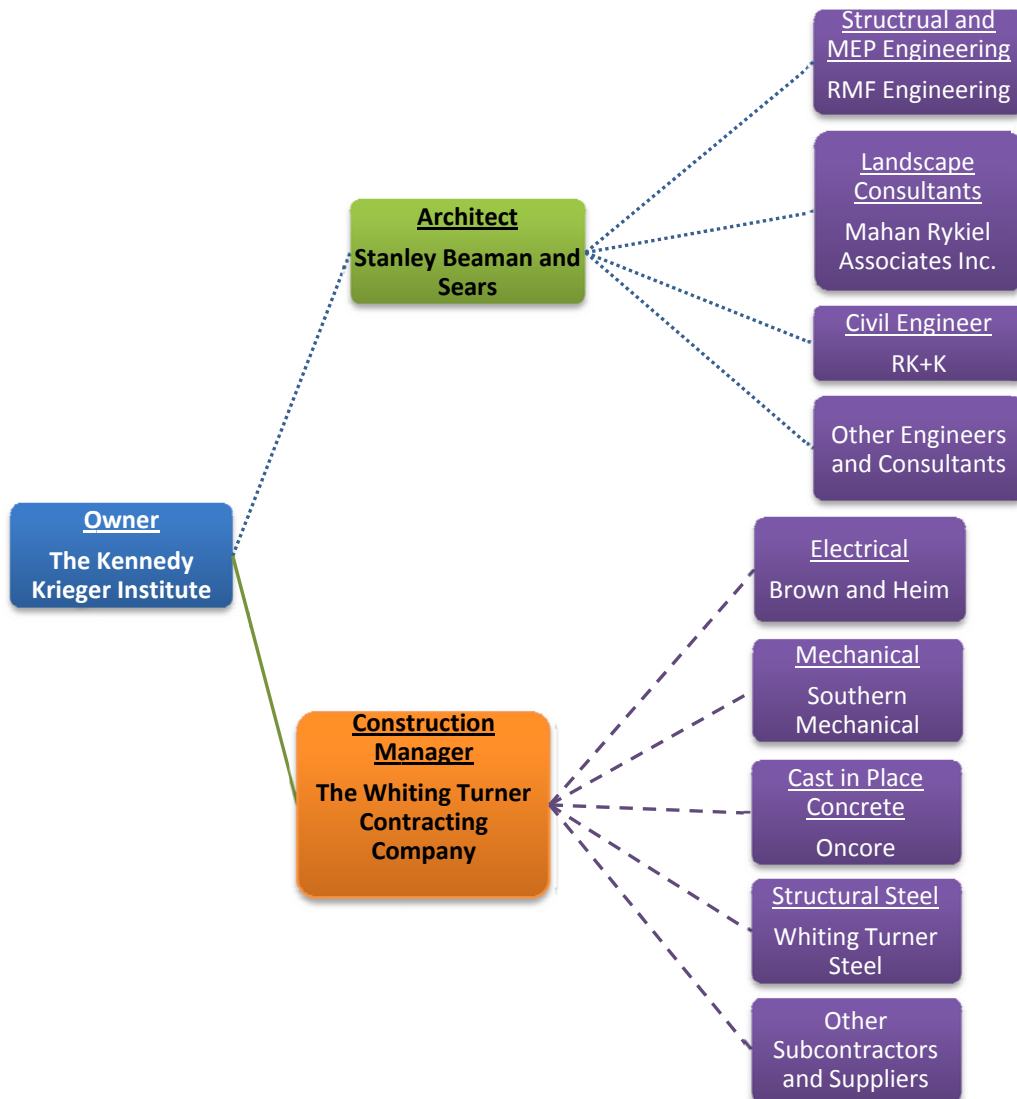
Kennedy Krieger Institute strives to help children and adolescents with development disabilities by providing personal patient care, professional training programs, research, and special education. Kennedy Krieger Institute is internationally known and provides its facilities with some of the world's leading experts in the development disabilities field of study. Kennedy Krieger Institute is located Baltimore, Maryland. Their mission statement is:

*"We at the Kennedy Krieger Institute dedicate ourselves to helping children and adolescents with disorders of the brain and spinal cord achieve their potential and participate as fully as possible in family, school and community life."*



The Outpatient Medical Center will house the developmental disabilities center. Once the project is complete, the building will have a large physical therapy occupational therapy gymnasium, therapy pools, many treatment and exam rooms, children life area, and a therapy garden that will be located near the entrance of the building. Kennedy Krieger is excited to be able to expand its institution and can't wait to occupy the new facility.

Contract types: ——— GMP    ..... Cost + Fee    - - - Lump Sum





# Analysis 1

## Structural System

### Problem Statement:

The cast in place concrete and structural steel can both provide the same structural function and with a comparison of the cost and constructability could exemplify the benefits or disadvantages of using a structural system over the cast in place system.



### Goal:

This analysis will explore the cost and constructability of using a structural steel building instead of the cast in place concrete. It will also illustrate techniques of improving the construction schedule and cost of the overall project.

### Breadth Study:

This analysis will include a structural breadth by redesigning the structural system and examining the impacts it has on the mechanical, electrical, and plumbing system. Impacts of the mechanical, electrical, and plumbing system may result in redesigning sections of the systems and could illustrate new areas of coordination due to clashes in systems.





#### Procedure:

- Re-evaluating/ redesigning the structural system as a steel system by bay.
- Locating areas of impact from using a structural steel system, i.e. MEP clash detection.
- Redesigning areas of mechanical, electrical, and plumbing system where clashes occur.
- Evaluating the cost of the steel structure and the constructability
- Evaluating the cost of redesigning the mechanical, electrical, and plumbing system if necessary
- Comparing the Outpatient building to similar building in the area

#### Expected Outcome:

The outcome that I hope to show is that the structural steel system will decrease the construction schedule and decrease the project cost. Although there may be an increase in the mechanical, electrical, and plumbing system if redesigning the systems is needed.



## Analysis 2

### Mechanical System

#### Problem Statement:

Energy efficient buildings are becoming more of a standard in the building construction industry. Using a heat recovery system creates a more energy efficient mechanical systems and provides better air quality while reducing the building's energy costs. Better air quality is very important when providing warm/cool air to spaces inside of a medical center. The use of a heat recovery system would provide that quality air and reduce cost.

#### Goal:

This analysis will explore the use of a heat recovery system in the outpatient medical center and evaluate its advantages through a detailed research of the system. Adding this system to the building will increase the cost of the mechanical system but will reduce building costs over time. An analysis of the cost and possible construction impacts will be developed will be able to illustrates its positive impact.

#### Breadth Study:

This analysis will include a breadth study of the mechanical system and the impacts of adding heat recovery system into the building. A redesign of the mechanical system will include the sizing of the heat recovery system and the mechanical system if needed. The redesign will also include impacts and placement of all the proper equipment needed to be installed and utilized in the building. This breadth study will illustrate the cost impacts a heat recovery system has on the project cost.

#### Research:

- Researching the using of a heat recovery system in buildings
- How the heat recovery system works and will be maintained so that is continuously provides energy efficient air quality.
- Analysis of the size of heat recovery system needed for this size of project
- The cost to additional costs to install and maintain



- What the cost impacts are to the project
- Researching what the impacts are on the mechanical, electrical and plumbing systems
- Researching the maintenance issues to keep the heat recovery system working to its fullest capacity.
- Analysis of the effects of the structural system
- Analysis of space need for the system
- The addition cost (if needed) to create space for the system.

#### Expected Outcome:

In this Analysis I hope to illustrate the effectiveness of using a heat recovery system and how it could reduce energy costs while providing the building with quality clean air. Initial project cost will be higher by adding the heat recovery system to the building because of the cost of the system and the connection to the mechanical system.



## Analysis 3

### 3D Design Coordination (Critical Issues Research)

#### Problem Statement:

The use of 3D design coordination had been increasing greatly in the construction industry. 3D design coordination takes on many different aspects and the implementing of it takes on many challenges facing the construction industry.

#### Goal:

The goal to this analysis is to identify the use of 3D design coordination with the mechanical, electrical, and plumbing clash detection and implementing it during construction. Getting all project team members and trades is sometimes a difficult challenge. This analysis will develop research on how to implement it in the industry and what is needed to get contractors, subcontractors and owners all on the same page with using 3D design coordination on projects.

#### Research:

- Reviewing literature on the use of 3D design coordination
- Researching what is all involved with using 3D design coordination for mechanical, electrical, and plumbing clash detection.
- Interviewing project team on the Outpatient Building
- Interviewing project team members in the company who have used 3D design coordination on other projects
- Examine the Pro's and Con's of implementing it in the construction industry.
- Suggesting ways to get a start on implementing it
- Summarize results with sufficient information

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Adviser: Dr. Messner  
Jan. 2, 2008



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### Expected Outcome:

To understand the challenging issues of implementing 3D design coordination and to illustrate the functionality of using it for mechanical, electrical, and plumbing clash detection. And summarize the ways of implementing 3D design coordination for clash detection in the construction industry.

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## Weighted Matrix

### Weighted Matrix

Description	Research	Value. Eng	Const. Rev.	Sched. Rev.	Total
Analysis 1 - Structural System	-	5%	5%	30%	40%
Analysis 2 –Mechanical System	10%	5%	3%	20%	38%
Analysis 3 – 3D Design Coord.	20%	0%	2%	-	22%
<b>Total</b>	30%	10%	10%	50%	<b>100%</b>