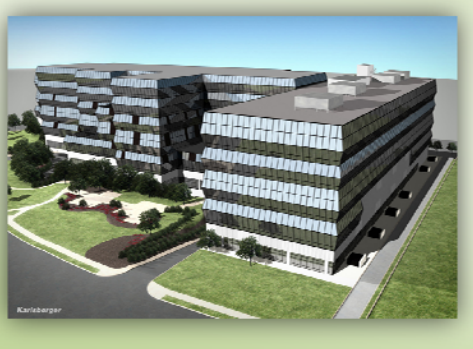

Surgery Expansion Phase 1

Children's National Medical Center

111 Michigan Avenue, NW • Washington, DC 20010

Andrea Klein • Construction Management • Advised By Dr. Messner

Thesis Proposal

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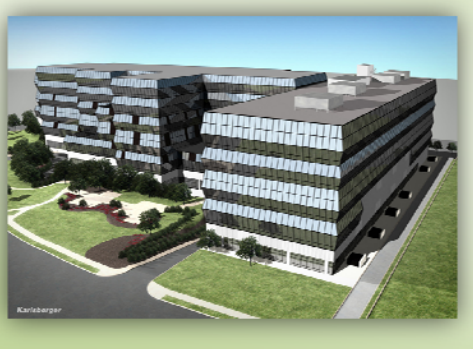

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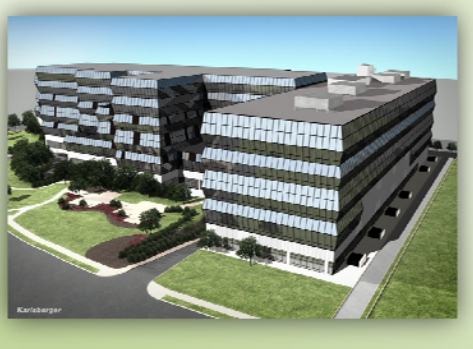
Executive Summary

This thesis proposal is for the analysis work and industry research portion of the AE Senior Thesis. It includes the details for what my research on prefabrication in relation to the Infection Control Risk Assessment (ICRA) put forth by the American Institute of Architects (AIA), an analysis for prefabricating the mechanical systems and interior partitions, and an analysis of the acoustics of the Neonatal Intensive Care Unit (NICU), Critical Intensive Care Unit (CICU) and the two new operating rooms.

The industry research on prefabrication is a study of what contractors can prefabricate to reduce the risk of patient infection. It is an attempt to determine how much can actually be prefabricated off site. Using surveys, a list of the largest concerns of hospital owners and staff will be comprised. The list will allow for more detailed research into specific systems and products. Ultimately, the result of this research will be a guide for owners, contractors and designers to use in supplement to the ICRA regulations and help them determine what extra measures they can take.

Prefabrication will also be used as the main analysis tool of the mechanical system. In an effort to reduce the project schedule and costs, I am going to examine applying prefabrication to the HVAC ductwork. The mechanical detail will be a breadth study, to include the selection of a prefabrication method and the redesign of the ductwork. All elements requiring redesign will be examined and calculations shown as necessary. Constructability reviews, schedule adjustment and cost savings will be examined.

Fire protection for the operating room is the second breadth of this project. Focusing on the operating rooms and the interstitial spaces above and below, the fire protection plan will be redesigned. This is primarily a value adding exercise to maintain the high standards of the hospital. Schedule and cost impact will be calculated to determine if this design could be a possible alternate in future construction bids.



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A. Introduction

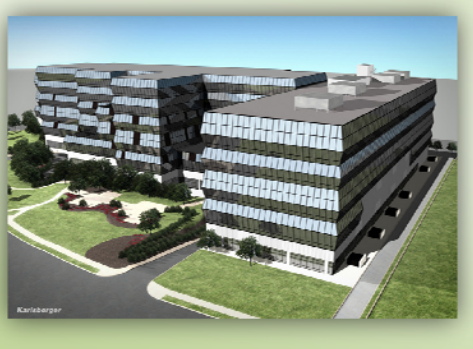
Children's National Medical Center (CNMC) was originally built in the 1970s with the addition of the west wing in the 1990s. Within the past two years it has expanded again to include the east wing patient tower and decontamination wing. The overall building is 902,972 gsf, and has six (6) occupied floors, five (5) interstitial floors, and four (4) underground parking levels.

The addition of the east wing provided space for renovations within the original hospital footprint. The Surgery Expansion Phase 1 project is a conversion of office space to two (2) new surgical suites and their support. It also includes some renovation of a waiting room area, a floor of the decontamination building, and a new elevator. All the renovation is on the second floor and its subsequent renovation of floors 1.5 and 2.5 to alter the electrical and mechanical systems. The entire area of renovation is 45,512 sf and will cost approximately $10.2 million.

Due to renovation being done in an occupied space there are several extra measures which will be implemented as part of the construction. There is a large concern for infection control, primarily due to the dust generated during construction and the frailty of the patients' health. The construction site will be completely contained and isolated from the operating sections of the hospital. A tunnel will be constructed the hallway that runs the length of the site for construction access and ease. The tunnel will run from the bottom of the deck at interstitial level 2.5 to the finished floor at level 2. Inside the boundaries of the site will be a negative air flow machine to draw air into all leak spaces and keep the dust within the site. As an extra precaution walk-off sticky mats will be placed at the entrance door to the site to clean off the shoes of anyone who exits the site into the functioning hospital.

Another main issue with construction in this occupied space is to cause as little damage to the existing structure. To maintain the integrity of the façade curtain wall the construction team will only remove several panels of tempered glass, and louvers. All materials will be delivered through a hoist into the building at level 2. Other materials not able to be brought onto site using the hoist may use the service elevators located through the loading dock with special permission and under certain time restrictions.

Construction in hospitals is especially unique due to the regulations for contamination. Infection Control Risk Assessments (ICRAs) are required by law prior to beginning construction. The extra measures used to maintain a safe environment for the patients affect the project on many levels. The intricate nature of the spaces and patients at CNMC require even more care. For these reasons, the following research proposal and analysis topics will focus on making it easier to reduce contamination in the hospital. The research will focus on the ICRA regulations and the possibility of using prefabrication to aid in meeting them.



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Prefabrication has many implications for schedule and cost reductions, as well as value engineering if applied correctly. The first analysis will focus on the possibility of prefabricating the mechanical system and possibly some interior partitions as options for improvement. Seeing another main concern of the hospital is noise and vibrations traveling to Intensive Care Units (ICUs), the second analysis will help determine what steps can be taken prior to construction to eliminate disturbances. Limiting these issues may cause a schedule and cost reduction due to delays for stopped work when there are problems. It will also evaluate the acoustic design for the two operating rooms to determine if more measures should be taken now to prevent noise penetration during future construction projects.

B. Analysis 1: Industry Research

Problem Statement:

Hospital renovations and expansions are an integral part of maintaining the health care system in the United States. Unfortunately, to meet to the continual needs of the public, these projects must typically be conducted while the rest of the hospital continues to operate. Working in partially occupied spaces is not a new concept for the construction industry however the risk of contamination and infection in an occupied hospital is a particular cause for concern. While the implementation of ICRAs, in hospital construction has alleviated many of the problems, there are new technologies which may provide more or better solutions.

Prefabrication is one possible solution to alleviate contamination in occupied spaces but there remains little to no information on what extent of prefabrication can be used, and what possible cost and schedule savings may also result.

Research Goal:

It is the goal of this research to examine the effects of prefabrication on hospital renovation projects in relation to the ICRA regulations. The focus of this research is to see if there is evidence in support of using prefabrication methods to reduce infection risks, and if so, which methods are the most beneficial. Possible benefits are better isolation and reduced contamination, schedule reduction, onsite labor reduction, and cost savings.

The intent of this research over the coming semester is to create a guide with prefabrication ideas to implement on hospital construction projects where infection control is a major concern. There are practices already in place by certain contracting trades which will provide examples and experience to compare to newer ideas. The guide will be for the use of owners, contractors and facility managers to aid in using prefabrication as a means of better meeting the ICRA guidelines set forth by the American Institute of Architects (AIA).

Research Steps:

1. To obtain a true understanding of the current ICRA regulations. Read the guideline established, and make contact with contractors to ask questions confirm the feasibility of the research goal.

2. Research statistics on hospital renovation and expansion projects to create a firm basis of need and verify the target audience.

3. Make contact with owners and owner's representatives to establish what concerns they have about the ICRA regulations and which issues prefabrication may help address. This will hopefully provide target areas of research to best benefit the end user.

4. Contact contractors who are familiar with hospital renovation, specifically HVAC ductwork design to obtain different means and methods of construction and prefabrication.

5. Compile data from these contacts to determine how best to format a guide, and to provide further direction on which trades to focus on.

6. Create the guide for prefabrication in healthcare projects using language friendly to owners, designers, and contractors. The hope for this guide is to create something which can be implemented early in a project for the maximum benefit.

7. Establish credibility of the guide by asking members of the target audiences, both experienced and inexperienced, to review the guide and answer questions. These interviews would include questions about how easy the guide is to understand and implement, and if they would use it in practical applications.

8. Using the results from the interviews and comments from industry members, the guide will be reevaluated and adjustments made as required.

Sample Interview Questions:

Preliminary Interview to Owners

Are you familiar with the 2006 ICRA guidelines established by the AIA?

Have you used ICRA guidelines for past or present projects in your facility?

Did you have difficulties in maintaining any of the procedures outlined in you program? If so, what were they, and how did you attempt to solve them?

Was prefabrication used to any extent during your project?

Do you think fabricating materials and systems off site is a viable option to help maintain the ICRA guidelines?

Did you have problems with construction interfering with the occupied spaces? If so, what were they, and how large was the impact?

Post Guideline Interview

Was the guide easy to understand and follow?

Did the guide provide sufficient information on prefabrication practices and implementation?

Do you feel the topics outlined covered issues prevalent in healthcare construction?

Do you feel this guide would be useful to future project owners and construction teams?

Do you have any suggestions for ways to better the guide or the ideas for prefabrication outlined within the guide? Examples: newer technologies, workforce issues, etc…

Are there any suggestions you wish to make for material the guide is missing?

Would you use this guide in future projects either alone or in conjunction with the ICRA regulations?

C. Analysis 2: Prefabrication Implementation

Problem Statement:

The primary goal for Surgery Expansion Phase 1 is the construction of two (2) new operating rooms and their support areas. Operating rooms provide a large portion of revenue for hospitals, and an earlier completion would allow the owner to make a faster return on their investment. Implementing prefabrication as a construction method may possibly reduce the cost and onsite project schedule.

Research Goal:

This analysis will focus on prefabrication of the HVAC ductwork. What type of prefabrication is most applicable would be determined. Mechanical contractors already use prefabrication to a large extent in most of their projects. The ductwork would then be redesigned for construction with the chosen prefabrication technique.

The prefabrication and redesign will be analyzed for cost reduction, schedule reduction, constructability, and a possible quality increase. It will also be examined to see if demolition for future projects would be easier as well.

Research Steps: Mechanical

1. Contact mechanical contractors who are known for hospital work and discuss what amount of prefabrication they typically use and what they recommend. Ask for lessons learned.

2. Select a prefabrication method different from any being used on site, based on the recommendations of the contractors.

3. Examine design as is, and redesign what is in place including ductwork, hangers, and insulation.

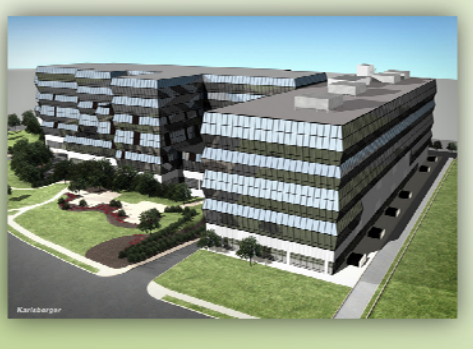
4. Determine constructability of desired elements. Check to ensure they can be moved into the building and placed. Examine schedule of construction with other trades.

5. Calculate schedule for fabrication and installation.

6. Calculate cost and compare system to what is currently designed and being built.

Expected Outcomes:

The expected outcome of this analysis is primarily schedule reduction. Removing workers from the site will allow the hospital to use the renovated spaces sooner and gain the revenue the operating rooms will provide. Removing workers from site will also help reduce the amount of noise coming from the construction site and



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interfering with the operating hospital. Possible cost reductions will result from not having laborers on site, and from fewer restrictions on the hours construction can be performed. An increase in quality is also expected due to better controls in fabrication.

D. Analysis 3: Fire Protection

Problem Statement:

Operating rooms are the main focus of this renovation, and due to the delicate nature of the work being performed, isolating the room is key. The construction documents as of now are not complete is the fire protection of the spaces. This analysis will focus on designing the operating room to remain separate from the surrounding areas, in case of a fire.

Research Goal:

It is the goal of this analysis to determine what measures should be taken at CNMC to ensure the operating rooms are isolated in case of a fire. Taking the rooms as one entity, partitions and penetrations will be redesigned to meet code and add more security in case a fire occurs. I will be focusing especially on the possible spread of a fire through the interstitial spaces above and below.

Research Steps: Operating Room

1. Examine the design as is, and the fire protection code.
2. Gather data on materials in place in the interstitial floors.
3. Select partitions for fire rating.
4. Redesign penetrations and insulation for materials in the interstitial space.
5. Calculate the cost and schedule difference.
6. Examine the cost/benefit ratio to determine if the new design is cost effective.

Expected Outcomes:

The redesign of the fire protection system results will show an added value to the project and hopefully some cost reduction due to the selected materials. The primary focus is saving the lives of the occupants and this design will show how to maintain a safe are within the operating rooms. A constructability review will also be performed to ensure the practicality of the implement systems.

E. Weight Matrix

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
HVAC Ductwork Design	10	5	10	10	35
Fire Protection		15		10	25
Prefabrication and ICRA	20		10	10	40
Total	30	20	20	30	100