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# Final Proposal (Revised)

Inova Fairfax Hospital South Patient Tower

Falls Church, VA

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# Executive Summary

In the final proposal, four analyses for the Inova Fairfax Hospital South Patient Tower have been performed. Many new strategies and new technologies are addressed into these analyses in order to improve the constructability and efficiency of the project.

## *Analysis #1: Increase Building Information Modeling(BIM) services for the Owner.*

The first Analysis topic is the critical industry issue that will be pursued based on the experience, interests at the PACE Roundtable meeting. So far, the only usage of BIM into the South Patient Tower is the coordination of the MEP system. The purpose of this analysis is to maximize the implementation of BIM into the project to benefit the owner in terms of cost and time savings by reducing the change orders and coordinating the work at an early stage of the process and also through out the whole construction process.

## *Analysis #2: Short Interval Production Schedules (SIPS)-Schedule Acceleration*

Base on the previous study and research, since the South Patient Tower is located on the Inova Fairfax Hospital campus tying to the existing building tower and is surrounded by other buildings such as Heart and Vascular Institue, Emergency Department, Women's center and Children's Hospital. This results the expectation of minimum impact to the neighborhood. For this reason, a more accurate and efficient schedule is expected to avoid the potential mistakes, delays and unforeseen changes of the project. SIPS is the main study focus for this Patient Tower to smooth the construction process, maintain and even accelerate the schedule.

## *Analysis #3: Net Zero Energy Building- Sustainability*

The design and project team for South Patient Tower are striving to achieve LEED silver certification on this project. The major sustainable features include green roof, rain gardens, water cisterns and so on. A higher level of sustainability can be pursued to achieve the Net Zero Energy goal which is becoming a more and more popular issue in building construction industry.

*Analysis #4: Integrated Project Delivery (IPD)*

Integrated Project Delivery (IPD) is a project delivery approach which integrated people, system, business structures and practices into one process that collaboratively harnesses the talents and insights of all participants to optimize the project results. There is a potential possibility to accelerate the schedule and increase the constructability of the South Patient Tower by implement the IPD principles. A study on the IPD Guide from The American Institute of Architects was done to help complete the analysis on IPD.

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# Analysis Descriptions

## **Analysis #1 Increase BIM services for the Owner**

### ***Background Research and Problem Identification***

Turner Construction has implemented Building Information Modeling(BIM) into South Patient Tower only for the coordination of its MEP system. Since the South Patient Tower is designed to be connected to the Existing Tower Building (ETB), which was built early in the 1950's when high ceiling space were not considered for the complex MEP system. Therefore, the implementation of BIM in this project was not achieved to its full extension.

### ***Potential Solution***

As a new innovated healthcare project, South Patient Tower has the potential capability and should pursue a higher level of technology implementation. There are still space that can be explored for additional BIM usage on other portion of the building.

### ***Research Goals(steps to achieve the analysis/research)***

The technological capability and the user adoption must be considered from the owner and the General Contractor' s perspective. Besides the technology consideration, the related increase in budget must also be considered. The research goals can be achieved by following steps:

- The first step is to target and define the area in which BIM can be implemented properly based on the analysis and research of the South Patient Tower.
- The second step is to discover the potential benefit for owners, general contractor, subcontractors.
- The third step is to exam the practicality of the proposal with the experts in construction industry, the owner and the personnel from Turner Construction.

- Interview with industry expertise to learn more broad and insight use of BIM especially on the BIM performance for both pre and pos construction phase and also for facilities management, which can extend the life cycle of building over decades to enhance buildings' performance and manage operations more efficient.

### ***Expected Outcome***

It is expected that the analysis will identified the most practical and beneficial usages of BIM for the South Patient Tower project to benefit the owners and the project team and help to accomplish the work at its highest level of efficiency. A better understanding and a more familiar operating skill of the BIM tools such as 3D and 4D Modeling are expected at the same time. Owner benefit from fully developed strategy for future use

## **Analysis #2 Short Interval Production Schedules (SIPS)- Schedule Acceleration**

### ***Problem Identification***

Many delays due to the drawing mistakes for the two floor rotunda at the south side of the building, nature disasters happened in August 2011, and unforeseen changes for the east elevation light gage metal framing have occurred during the actual construction process, which should be able to avoided if additional pre-planning was made. Also, since the South Patient Tower is located on the Inova Fairfax Hospital campus tying to the existing building tower and is surrounded by other buildings such as Heart and Vascular Institute, Emergency Department, Women's center and Children's Hospital. This results the expectation of minimum impact to the neighborhood.

### ***Potential Solutions***

SIPS is a highly detailed method to schedule a repetitive construction projet. The South Patient Tower include 174 private intensive care and medical/surgical patient rooms for a total of 236,000 square feet. The floor plans are relatively repeatable. Therefore SIPS is considered as a potential solution to the problem. The probability of the implementation of SIPS still needs to be further studied and researched.



Figure1. South Patient Tower Floor Plan

## ***Research Goals (steps to achieve the analysis/research)***

The study and research are based on the following three phases:

### 1 Operation - work to be done

Schedule - time available

Budget - dollars available

Set goals - crew size to meet schedule and budget

### 2 Physical constraints

Resource requirements

Sequence - coordination - balance

### 3 communicate plan

gather feedback

follow through

- Research on other projects is performed to have a better understand on SIPS
- Identify the specific work into which SIPS can be implemented.
- Interview with the construction and engineering team to decide the best sequence for the project
- Make new schedule based on the time availability
- Study for the results in terms of schedule reduction and the consideration of value engineering issues.

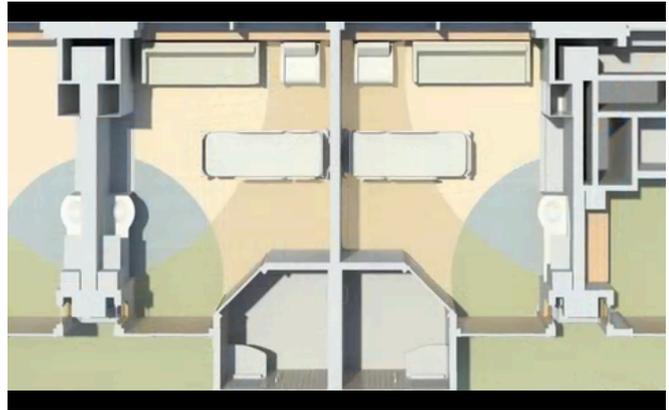


Figure2 Private Patient Room

## ***Expected Outcome***

The expected outcome of the analysis is to identify if the implementation of SIPS into the South Patient Tower is suitable and if so, what would be the best way to develop SIPS to make sure that the project will be complete on time and within the budget.

## **Analysis #3 Net Zero Energy Building- Sustainability**

### ***Problem Identification***

Acting as a big energy consumer, South Patient Tower has the demand to perform better in sustainability and energy savings. The design and project team for South Patient Tower are striving to achieve LEED silver certification on this project. The major sustainable features include green roof, rain gardens, water cisterns and so on. A higher level of sustainability can be pursued.

### ***Potential Solutions***

The Zero Net Energy (ZNE) goal with the idea of buildings producing as much energy as they use has become a more and more popular issue in building construction industry, which is considered to be the next big movement in green design.

### ***Research Goals (steps to achieve the analysis/research)***

- Focus on the study and research on the Net Zero Energy building concepts which is relatively new topic in the construction industry. Based on the statement from Net Zero Energy Building Certification, “Net Zero Energy is quickly becoming a sought after goal for many buildings around the globe - each relies on exceptional energy conservation and then on-site renewables to meet all of its heating, cooling and electricity needs. Yet the true performance of many developments is overstated – and actual Net Zero Energy buildings are still rare.”
- Identify the energy that can be used on-site.

- Find the possibility to change, add and even improve the current designed sustainable features.
  
- Come up with additional energy efficient solutions which can be investigated into the South Patient Tower.

### ***Expected Outcome***

The Net Zero Energy will help to save the energy cost for the Inova Fairfax Hospital in the means of cutting greenhouse gas emission. It is more important to gain the idea and have better understanding on the future potential develop situation of energy efficiency and building sustainability.

## **Analysis #4 The Integrated Project Delivery(IPD)**

### ***Problem Identification***

Due to the complexity of the MEP system of the South Patient Tower, Turner has spent more than one year to implement BIM to coordinate the MEP system after getting all the files from the subcontractors to make sure that everything fits in the tight ceiling of the SPT. Meetings are set up at least twice a week to figure out how everything will be routed in these tight conditions. Therefore, the availability of the personnel from each contract group. At the same time, Turner Construction cannot make an earlier contribution to the design phase and coordination process.

### ***Potential Solutions***

The utilization of Integrated Project Delivery(IPD) will provide the opportunity for the early contributions of knowledge and expertise, which allows all the team members to realize their highest potentials to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all design, fabrication, construction and post-construction processes.

### ***Research Goals (steps to achieve the analysis/research)***

- Technology has played an important role in the IPD. Traditional IT solutions may not be conducive to collaborative work among teams, which means the exploration of new collaborative software is extremely urgent.
- Study the Integrated Project Delivery Guide from The American Institute of Architects.
- Understand the issues that must be addressed in an IPD document

***Expected Outcome***

IPD method brings all participants such as Inova Fairfax Hospital, Turner Construction, and all other subcontractors together early with collaborative incentives to maximize the benefit of the project. The goal is to eliminate a great amount of waste in the design phase, and also allows data sharing directly between the design and construction team to eliminate the large barrier and increased productivity in construction at the same time.

# Weight Matrix

The following chart (Figure3 )is the weight matrix to illustrate how the effort is distributed amont the different analyses proposed for the Spring Semester based on the following core area of investigation:

1. Critical Issue Research
2. Value Engineering Analysis
3. Constructability Review
4. Schedule Reduction/ Acceleration Proposal

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Increase BIM servies	5%		15%	10%	30%
SIPS	5%	5%	10%	10%	30%
Net Zero Energy Building	15%	5%			20%
Integrated Project delivery	15%			5%	20%
Total	40%	10%	25%	25%	100%

Figure3 Weight Matrix

# Conclusions

All of the four in-depth analyses are relative to some currently popular and critical construction industry topics. The analyses involve changes to the original project based on many researches and investigations done through out the Fall semester. The employment of BIM uses, SIPS, IPD are expected to be implemented into the South Patient Tower project in order to optimize the constructability, accelerate the schedule, save the budget, and improve the building sustainability.

## **APPENDIX A- Breadth Studies**

## Breadth Topics

Two breadth Analyses are required to be accomplished in one or more of the four analyses topics above. The following two breadth topics will be discussed:

### **Breadth Analysis #1-Electrical**

With the consideration of making South Patient Tower a Net Zero Energy building, Breadth analysis on redesign of roofing system for the South Patient Tower can be achieved. So far, green roof, highly insulated white roofs, which can reduce the urban heat island effect and lower air conditioning costs are incorporated into the design to reduce the impact on human and wildlife habitat. Roofing system can be one of the most important component in building sustainable design. This will in long run reduce the overall energy costs of the tower. The following aspect can be considered:

- Photovoltaic panels for solar hot water and PV installation provide some percent of the lighting and electrical energy used in the hospital.
- Redesign the roofing system with properly chosen PV panels in a reasonable layout. Provide the cost and impact on the schedule.
- Calculate the cost savings in terms of electrical usage of the South Patient Tower and impact on the environment.

## **Breadth Analysis #2-Mechanical**

Snow and rainwater can be collected from the roof and be used for the green roofs, rain gardens, and landscape irrigation of the Inova Fairfax hospital.

For Breadth Analysis#2, I will look at the following aspects:

- Create Innovated design for the snow and rainwater collection system.
- Find out the changes need to be made for the mechanical system of the South Patient Tower
- Study and research the local climate and relate to the snow and rainwater resources
- Calculate the savings in terms of water energy and running of the mechanical system of the hospital.

# **APPENDIX B- SPRING SEMESTER THESIS PROPOSAL WORK SCHEDULE**

