TECHNICAL ASSIGNMENT 1

NORTHEAST HOSPITAL EXPANSION
123 Medical Lane, USA

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September 19, 2014

NORTHEAST HOSPITAL EXPANSION

EXECUTIVE SUMMARY

The Northeast Hospital Expansion project is located at 123 Medical Lane, USA. The project will consist of the construction of a new 10 story patient tower, new parking garage, renovation of select patient rooms in the existing hospital wings, and the relocation and upgrading of the central utility plant servicing the entire medical campus. Technical assignment 1 provides an analysis of the major project players, an overview of the project's design, and a detailed description of the existing site conditions.

CLIENT INFORMATION

Trinity Health is funding the Northeast Hospital Expansion project. As one of the largest multi-institutional Catholic health care providers in the United States, Trinity Health is looking to better support the growing elderly population through better quality of care and increasing the number of private patient rooms. With the additional patient rooms, the out dated utilities need to be updated and relocated, and additional parking will need to be provided. Trinity Health is primarily concerned with continuing to provide quality care, maintaining quick access to the existing hospital, and minimizing the disturbance to the neighboring community.

PROJECT DELIVERY METHOD

Obtaining an understanding about the contract types and roles of each company aids in understanding the flow of information and communication lines available to the different project team members. Trinity Health hired KLMK Group first, to act as the owner representative and provide insight during the architect and construction manager bid process. The design for the new hospital expansion came from Smith Group JJR along with several specialized engineering firms. Whiting-Turner was later picked as the construction manager at risk with a GMP contract. This decision came from Whiting-Turner's relationship with its subcontractors, Southland Industries and Dynalectric, who brought design assist and prefabrication abilities.

PROJECT STAFFING PLAN

Whiting-Turner's staffing plan consists of 12 individuals cooperating to deliver the Northeast Hospital Expansion on time and under budget. The Vice President is responsible for managing the overall project team, maintain client satisfaction, and assist in contract negotiations. The senior project manager's primary responsibility is to manage all the field staff to ensure a quality, cost sensitive, and timely delivery of the project. A full time safety officer ensures all safety practices are being followed as well as providing on-site safety trainings. A full time MEP manager has been allocated to work with the subcontractors to coordinate the sequencing and commissioning of the different systems. The remainder of the field staff is composed of three project managers, an assistant project manager, project engineer, head superintendent, superintendent, and an assistant superintendent.

PROJECT SCHEDULE SUMMARY

With Trinity Health's primary concerns in mind, Whiting-Turner determined the Northeast Hospital Expansion would need four main phases. The first phase would comprise of site preparation, development of access roads and construction of the new parking garage. The first phase is scheduled to last 17 months. After which the second phase will commence for six months to setup temporary utilities and move existing utilities. Once temporary utilities are tested and commissioned, phase three begins the construction of the new patient tower and new central utility plant located in the tower's basement. Phase three will last 30 months. After the new central utility plant is tested and commissioned, the fourth and final phase begins with the demolition of the existing utility plant lasting 18 months.

PROJECT COST EVALUATION

At this time an actual cost estimate has been request, but has not yet been received from Whiting-Turner for the new patient tower portion of the Northeast Hospital Expansion project. Based on an estimate located in a permit for the project, the actual cost of the patient tower is $71,570,968 with patient floors costing $339.85/SF. An RS Means estimate, using information for a four to eight story hospital, delivers a cost of $301.61/SF for a total cost of $64,744.549. The difference in cost can be attributed to several different factors. The main factors are the increased costs due to an extremely confined site, the close proximity to the existing hospital and neighboring community, the construction of the new central utility plant in the basement, and the effort to attain LEED Silver.

BUILDING SYSTEMS

The Northeast Hospital Expansion consists of 234,000 SF of new construction, 42,820 SF of renovated construction, and 106,688 SF of parking garage. The structure of the new patient tower will be primarily cast-in-place concrete with HSS steel columns for the mechanical penthouse floors. The floor will be composite slab-on-deck. The enclosure is mainly a triple pane curtain wall system to the south, metal cladding covering the north and metal louvers for the mechanical floors. The building is mainly heated and cooled by a typical boiler and chiller system located in the penthouse and fan coil units throughout the building. The majority of the air-handling units are located on the penthouse with the exception of the autopsy unit, which is located in the basement. Electric comes into the building through the primary utility switchgear in the basement and stepped down to 480/277V and distributed to three separate substations. These substations then distribute the power to the different electrical systems throughout the building including lighting, life safety, fire alarms, security, and controls. Independent transformers are located at each piece of equipment requiring a different voltage. A dry fire protection system has been implemented in case of a fire.

EXISTING CONDITIONS

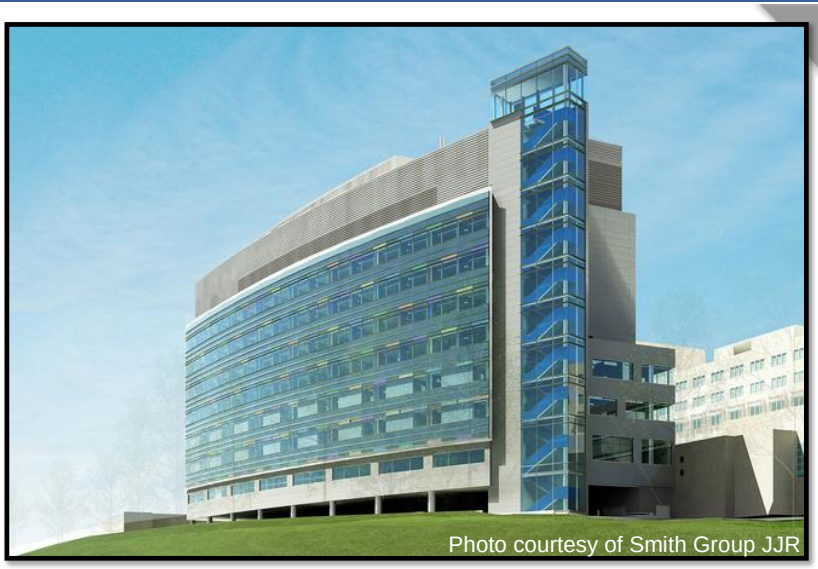
The site surrounding the Northeast Hospital Expansion is quite constrained with several challenging factors. The site of the new patient tower is located at the south most part of the campus and is attached to the existing hospital, which will continue to operate through the duration of construction. Also located to the east of the patient tower is the ambulance bay. The ambulance bay must be allowed to operate as usual and all crane lifts and deliveries sharing the ambulance access routes must halt or be rerouted. In addition to these requirements, the hospital is surrounded by residential area with an enforced noise ordinance.

Time of Week	Time of Day	Max. Allowable Noise Level (dBs)
Week Days	7am-5pm	85
	5pm-9pm	65
	9pm-7am	55
Weekends	9pm-9am	55

Table 1: Maximum Allowable Noise Level in Residential Zonings from county ordinance

TABLE OF CONTENTS

APPENDIX – TECHNICAL ASSIGNMENT 1 PRESENTATION



NORTHEAST HOSPITAL EXPANSION
123 MEDICAL LANE, USA

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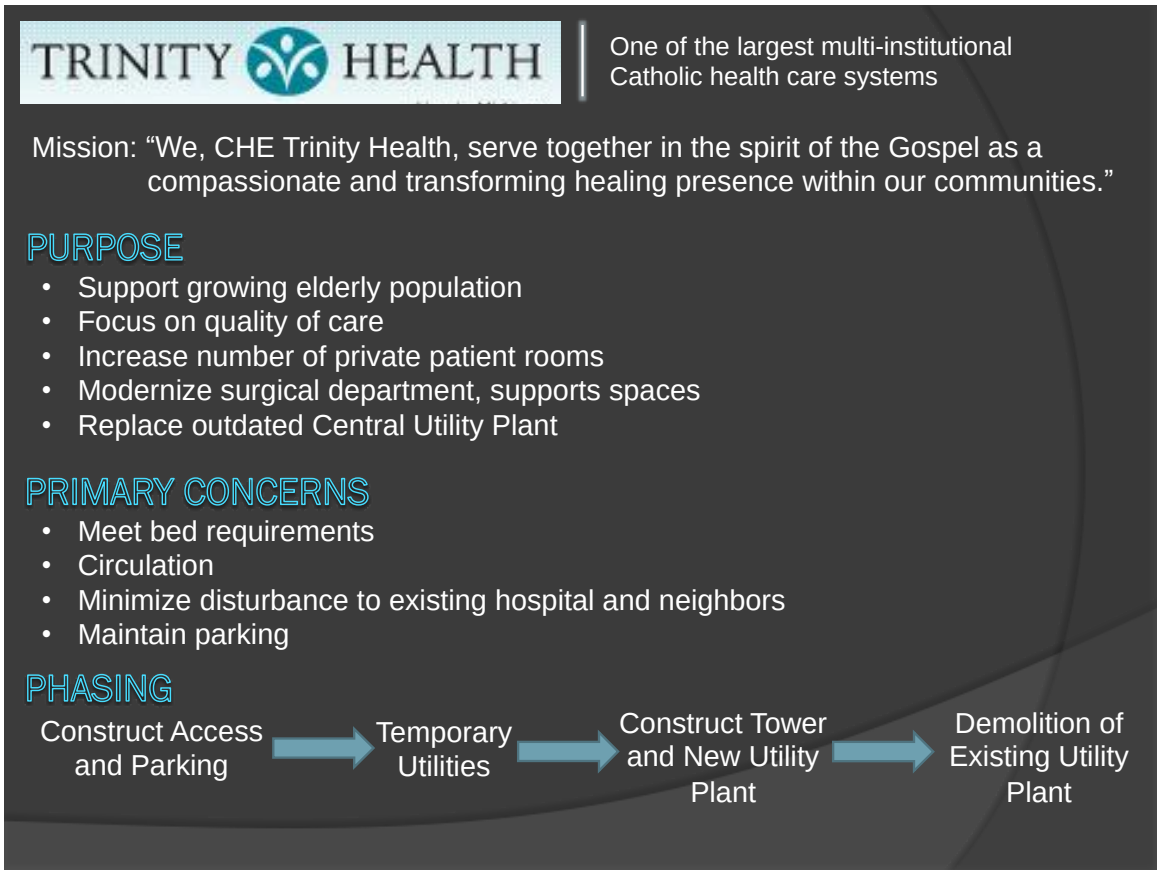
09/14/2014

Special thanks to Holy Trinity, Whiting-Turner, and Southland Industries for all their cooperation and allowing me to use the Northeast Hospital Expansion for my Senior Thesis.



Purpose

Trinity Health is one of the largest multi-institutional Catholic run health care systems in the USA. Currently, the senior citizen population continues to grow in the Northeast Hospitals location and hospital must expand to keep up with their population. Furthermore, senior citizens make up the hospitals number one client base. Beyond just focusing on the demographics, quality of care is always a main focus for Trinity health and they look to increase this quality through more private patient rooms and modernizing the surgery department. The existing central utility plant is also out dated and no longer sufficient for the new expansion and needs to be upgraded and relocated in the basement of the new patient tower

Primary Concerns

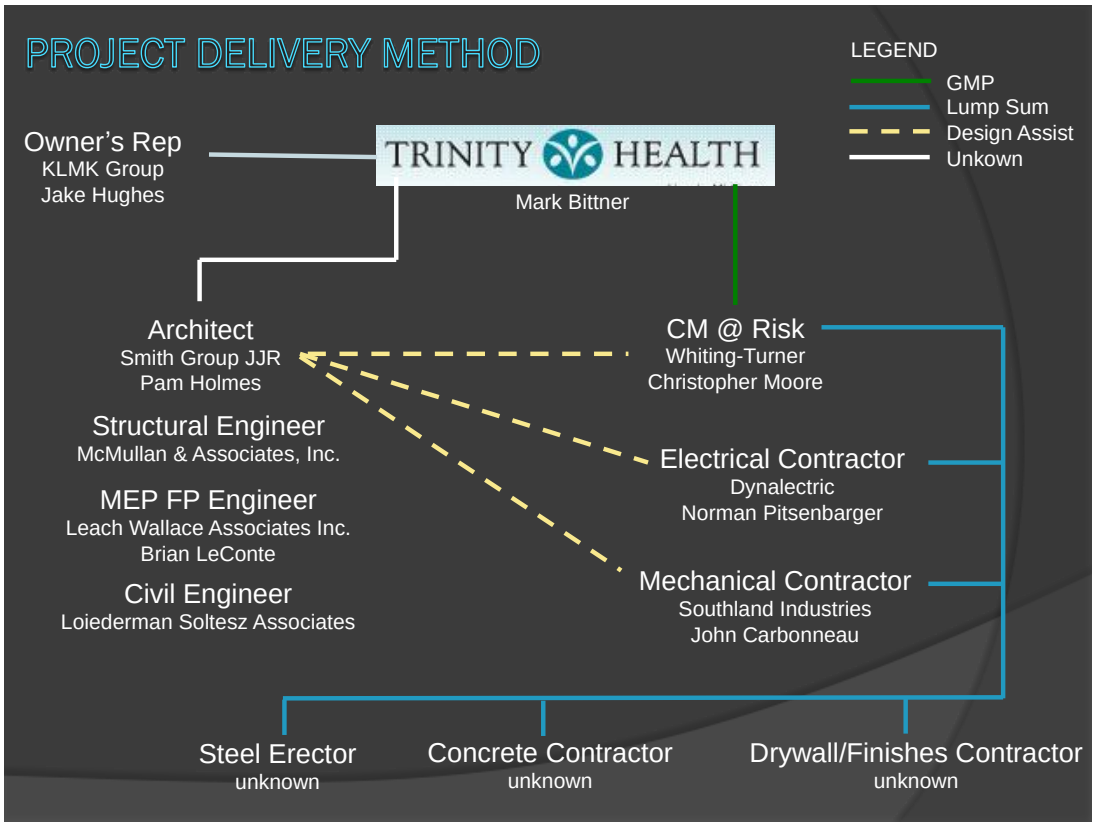
New construction and renovation projects present a number of concerns to Holy Trinity. While construction is underway, the existing hospital and neighboring community must remain minimally effected. This means all access ways for the emergency ambulance and regular parking lot must remain open. The utilities must continuous supply the hospital during the transition from existing central utility plant to the new upgraded central utility plant. The hospital must also be able to meet all patient bed needs during the renovations. The design for the hospital also

includes an extra patient bed floor that will remain unfinished until the need for 30 additional beds arises.

Phasing

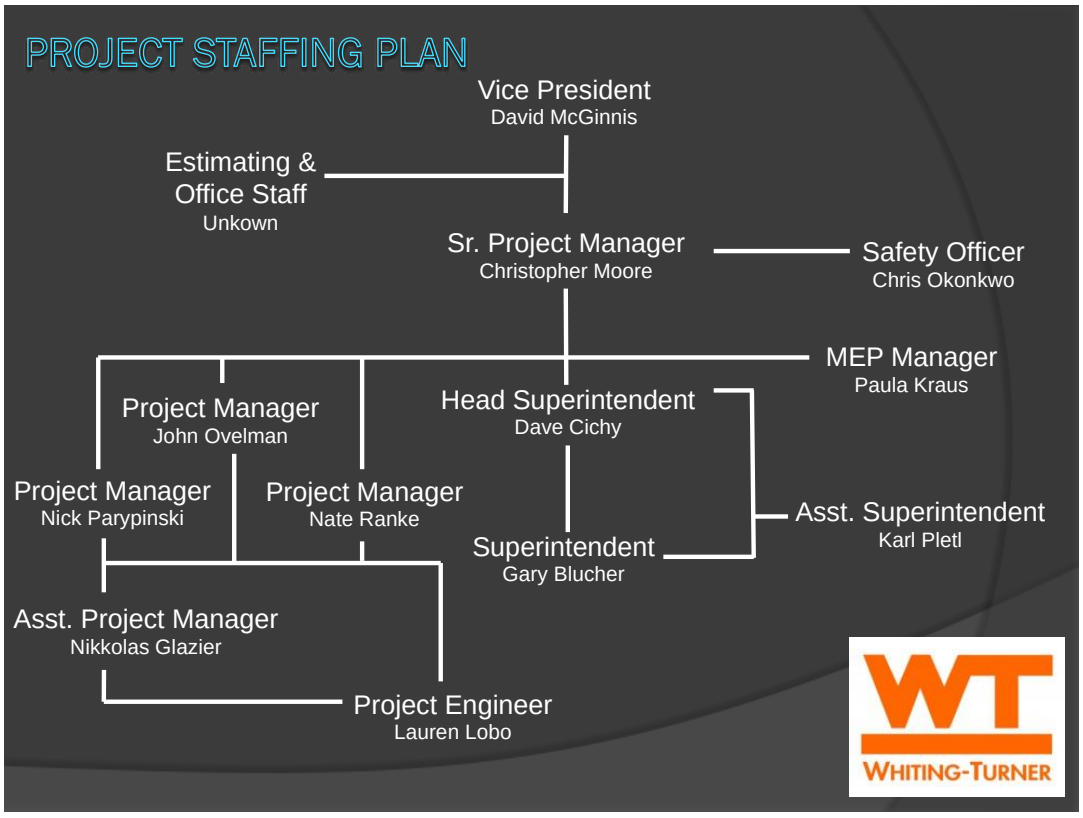
The project consists of four phases:

- Construction access and Parking
- Installation/Moving of existing Utilities
- Constructing the Patient Tower and new central utility plant
- Demolition of the existing Utilities



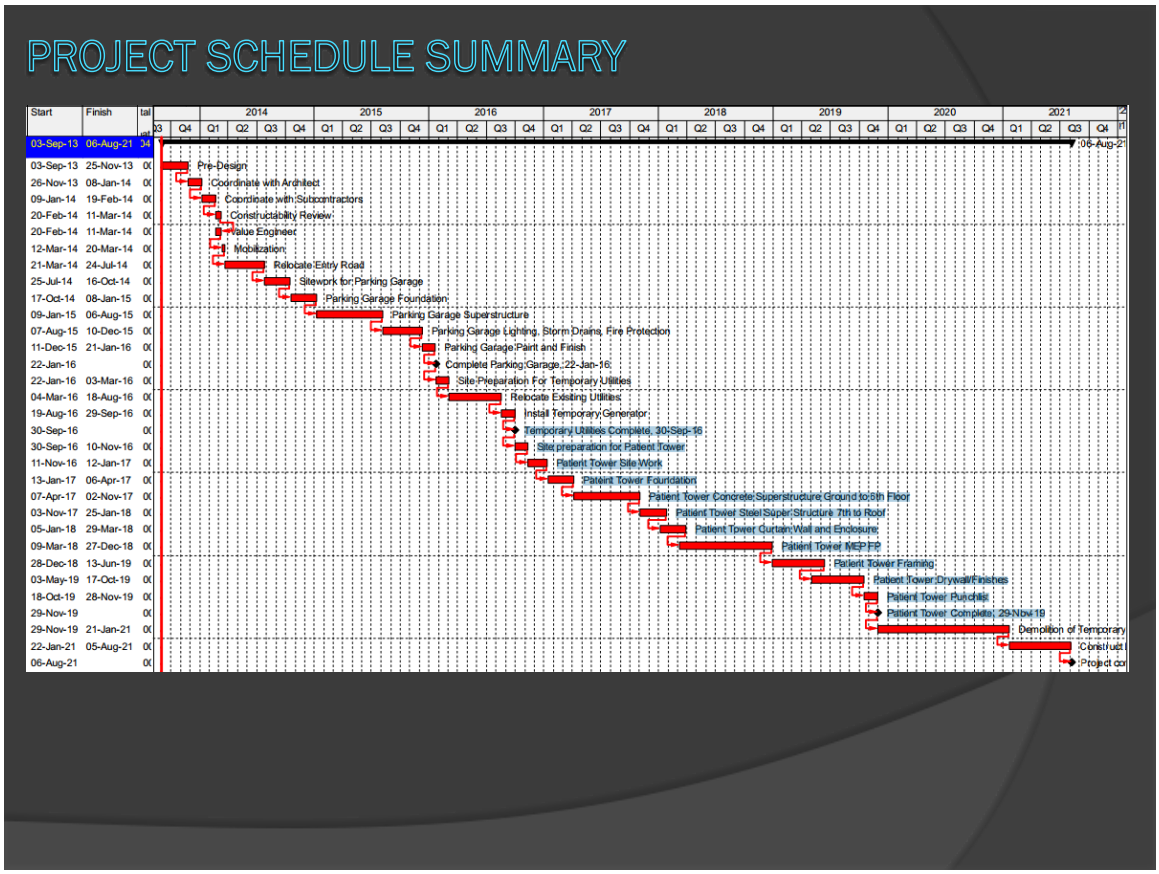
Project Delivery Method

In order to satisfy the purpose and concerns of constructing the Northeast Hospital Expansion, Trinity Health needed to first hire KLMK Group, to act as the owner representative. KLMK consulted and advised Trinity Health during the architect and construction manager bid process. The design for the new hospital expansion came from Smith Group JJR through a contract type unknown at this time. Along with Smith Group JJR, McMullan & Associates were brought on to design the concrete and steel structure. Loiederman Soltesz Associates designed the site work and retention walls to the south of the site. Leach Wallace Associates designed all the mechanical, electrical, plumbing and fire protection throughout the new patient tower. Whiting-Turner was later picked as the construction manager at risk with a GMP contract. This decision came from Whiting-Turner's relationship with its subcontractors, Southland Industries and Dynalectric, who brought design assist and prefabrication abilities. Though design assist and design build appear similar, the two contract types remain different in that the contractor provides full design services in design build, but in design assist the contractor and specialty trades provide early input to the designer on matters such as ways to improve the overall design and efficiencies, constructability, and sequencing.



Project Staffing Plan

When delivering a complex project of this size, it is the utmost importance to provide the necessary staff. Whiting-Turner's staffing plan consists of 12 individuals cooperating to deliver the Northeast Hospital Expansion on time and under budget. Starting from the top the Vice President who is responsible for managing the overall project team, maintaining client satisfaction, and assisting in major contract negotiations. The senior project manager's primary responsibility is to manage all the field staff to ensure a quality, cost sensitive, and timely delivery of the project. A full time safety officer ensures all safety practices are being followed as well as providing on-site safety trainings. Due to the vast mechanical and electrical equipment necessary for this project a full time MEP manager has been allocated to work with the subcontractors to coordinate the sequencing and commissioning of the different systems. Though it is uncertain as to the exact job description of the remaining staff and the information has been requested from Whiting-Turner, it is expected that each of the three project managers focus on a different phase of the project; one for the parking garage construction, one for the construction and demo of temporary utilities, and one for the patient tower. The head superintendent is not expected to be full time and only provide mentoring to the regular superintendent and assistant.



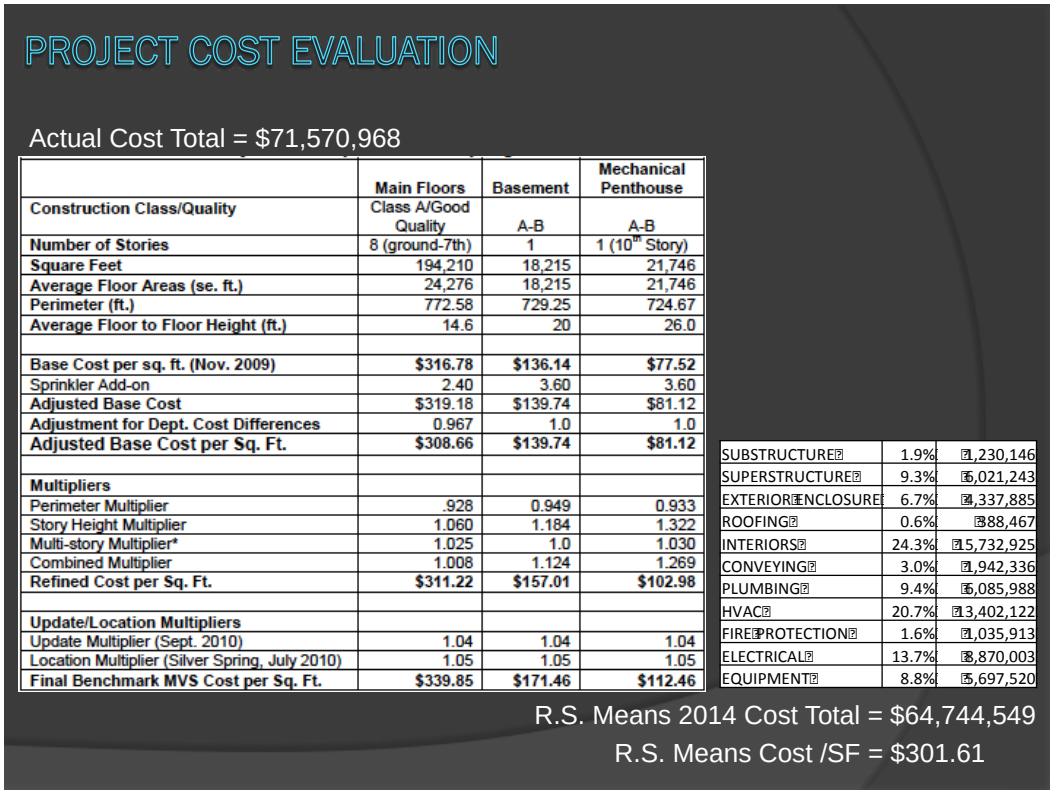
Project Summary Schedule

The above summary schedule is not the actual schedule and has been created to give a general idea of how this project may have been scheduled. A possible design phase portion of the schedule has also been included. The actual schedule and schedule summary have been requested for from Whiting-Turner, but have not been received yet.

The activities highlighted in blue make up the actual construction of the new patient tower expansion and last for 30 months.

The four major phases can be seen in the above schedule

Construction of the Parking Garage – 17 months
Moving of Existing Utilities – 6 months
Patient Tower and Central Plant Construction – 30 months
Demolition of existing utility plant – 18 months



	Main Floors	Basement	Mechanical Penthouse
Construction Class/Quality	Class A/Good Quality	A-B	A-B
Number of Stories	8 (ground-7th)	1	1 (10th Story)
Square Feet	194,210	18,215	21,746
Average Floor Areas (se. ft.)	24,276	18,215	21,746
Perimeter (ft.)	772.58	729.25	724.67
Average Floor to Floor Height (ft.)	14.6	20	26.0
Base Cost per sq. ft. (Nov. 2009)	$316.78	$136.14	$77.52
Sprinkler Add-on	2.40	3.60	3.60
Adjusted Base Cost	$319.18	$139.74	$81.12
Adjustment for Dept. Cost Differences	0.967	1.0	1.0
Adjusted Base Cost per Sq. Ft.	$308.66	$139.74	$81.12
Multipliers			
Perimeter Multiplier	.928	0.949	0.933
Story Height Multiplier	1.060	1.184	1.322
Multi-story Multiplier*	1.025	1.0	1.030
Combined Multiplier	1.008	1.124	1.269
Refined Cost per Sq. Ft.	$311.22	$157.01	$102.98
Update/Location Multipliers			
Update Multiplier (Sept. 2010)	1.04	1.04	1.04
Location Multiplier (Silver Spring, July 2010)	1.05	1.05	1.05
Final Benchmark MVS Cost per Sq. Ft.	$339.85	$171.46	$112.46

SUBSTRUCTURE	1.9%	$1,230,146
SUPERSTRUCTURE	9.3%	$6,021,243
EXTERIOR ENCLOSURE	6.7%	$4,337,885
ROOFING	0.6%	$388,467
INTERIORS	24.3%	$15,732,925
CONVEYING	3.0%	$1,942,336
PLUMBING	9.4%	$6,085,988
HVAC	20.7%	$13,402,122
FIRE PROTECTION	1.6%	$1,035,913
ELECTRICAL	13.7%	$8,870,003
EQUIPMENT	8.8%	$5,697,520

Project Cost Evaluation

This cost evaluation only takes into consideration the new patient tower portion of construction and excludes the construction of the parking garage due to availability of information on the patient tower and not the parking garage. Cost information has been requested from Whiting-Turner and has yet to have been received. This

information is based on cost information found within the patient tower building permit.

The owner is funding this project by the sale of 91.9% bonds, 6.6% fundraising, and 1.5% cash. Based on the above cost estimates it can be determined that the actual cost will be $71,570,968 with patient floors costing $339.85/SF, the basement costs $171.46/SF and the mechanical penthouse floors cost $112.46/SF. From RS Means 2014's data for four to eight story hospital project the SF cost is $301.61 for a total cost $64,744,549. The total actual cost and the R.S. Means cost differ since the new patient tower is an addition to an existing hospital on a confined site and located next to an operating hospital. The R.S. Means 2014 also does not take into consideration any LEED requirements included in this project and the relocation of an entire central utility plant. The cost breakdown by system was built by using the RS Means total with RS Means 2014 four to eight story hospital projects.

Foundation

The foundation is a caissons ranging from 4-7 feet in diameter that are 5 feet into bedrock. Spread footings are used at foundation walls and the concrete is to have strength of 4000psi.

Superstructure

The superstructure is composed of primarily concrete columns with composite decks and metal deck assemblies. All concrete floors are post-tensioned and have the location of their tendons painted on the bottom of the slab. The concrete structure switches to structural steel tubing at the mechanical pent house floors seven and higher.

Enclosure

The South, East and West walls from the ground floor to the sixth floor of the structure receives a curtain wall composed of 1 5/16" triple grazed insulated glass units (IGU) for noise reduction. Metal louvers clip fasten to 6" louver support framing and receive an insulated blank off panel. The east and west walls at this transition area obtain a 4" corrugated metal panel with fluid applied air barrier, 2" of insulation core material back up panel clip fastened to 8" of metal stud. The metal stud then gains 5/8" gypsum sheathing. On the north wall, primarily 3" of insulated metal panel clads the structure. The insulated metal panels clip fasten to 8" metal studs accompanied by a weather and air barrier, gypsum sheathing and ERS with 1 ½" rigid insulation.

Roof

The portions of the patient tower's roof used for the walkway toward the mechanical roof top units uses built-up asphalt with a vapor barrier and 3" of tapered insulation sloped at ¼" per foot towards the roof drains. The rest of the patient tower roof is covered in a green roof made from growing media, filter fabric drainage board, 3 ply cold applied roofing system, sheathing, 3" of rigid insulation and a vapor barrier.

Mechanical

The building is heated and cooled by a typical boiler and chiller system located in the mechanical penthouse. The chill water lines and hot water lines run out to fan coil units and radiant fin terminal units located through out the patient tower. High pressure steam and medium pressure steam are supplied to the rest of the campus by being piped from the mechanical penthouse down to the basement of the patient tower and through utility tunnels located to the north wall of the patient tower. Medical gas, nitrogen, oxygen, and carbon dioxide are also supplied to each patient room. The majority of AHU's are located in the mechanical penthouse with the exception of the autopsy unit. The autopsy unit is located in the basement and requires pre-filters and HEPA filters. The air supplied to the autopsy rooms is then 100% exhaust.

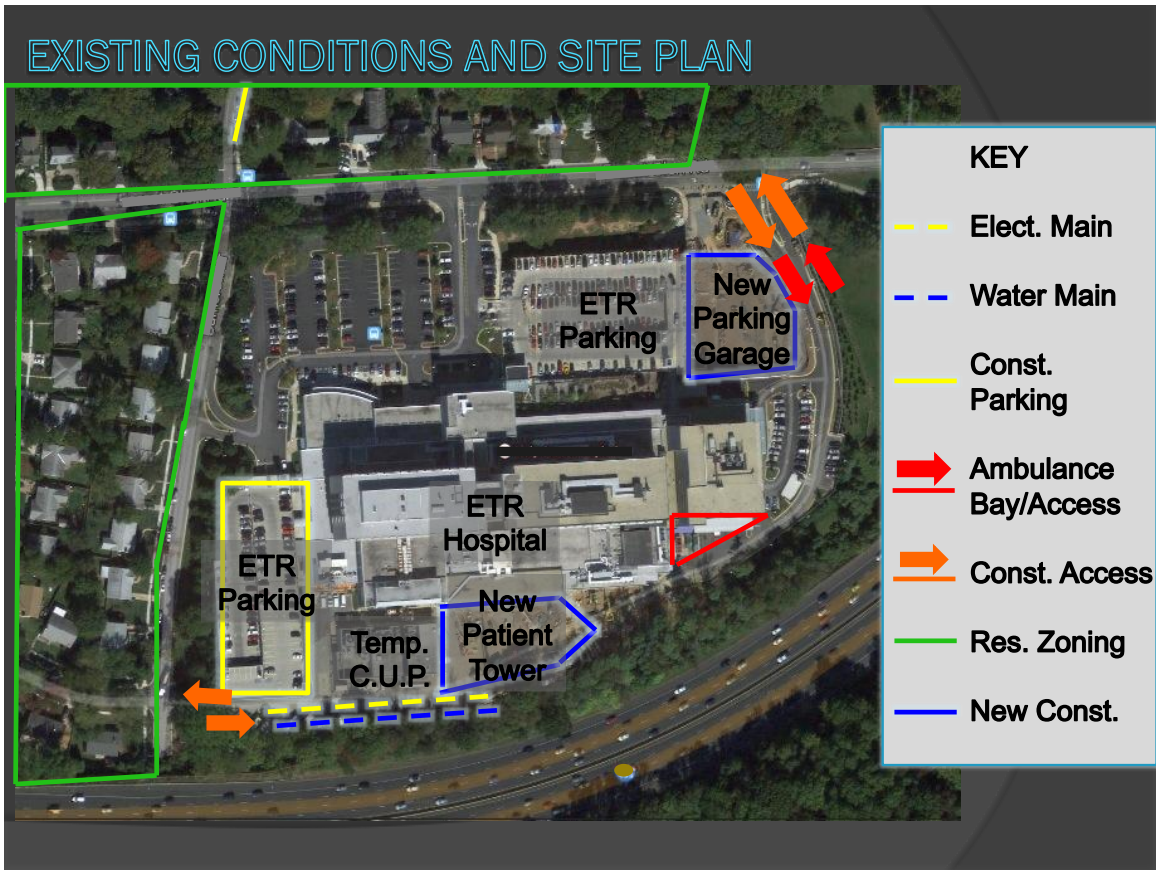
Electrical

Electrical distribution is accomplished by a 13.2kVA, 12000A, 750MVA, 3 phase, primary incoming utility switchgear located in the basement. The power is then stepped down to a 480/277V and distributed to three substations of 25000kVA, 480/277V and one substation of 2000kVA, 480/277V for the chillers in the pent house. From the substation electricity is distributed by separate lines to independent transformers at each piece of equipment or directly to the panels

located on each floor. Lighting is accomplished by basic fluorescent tube lighting with occupancy controls.

LEED

In an attempt to achieve LEED Silver, the project team will test and balance the HVAC equipment to verify compliance with ASHRAE 62.1 and 90.1, use regional materials and recycle construction waste. Composite woods may not contain any urea formaldehyde and insulation may adhere only by solvent cements and adhesive primers. The domestic water pumps must comply with ASHRAE/IESNA 90.1 and healthcare plumbing fixtures must consume water in compliance with credits WE 1 and WE 3 for water use reduction. A green roof covers the top of the building to reduce the heat island effect and aid in storm water treatment. Finally by implementing single door pharmacy refrigerators with high efficiency top mounted refrigeration, the project team aims for an innovation credit.



Existing Conditions

The conditions in which a project site is located can hide additional costs outside of the design documents. The site surrounding the Northeast Hospital Expansion is quite constrained with several challenging factors with this ability. The new patient tower is located at the south most part of the campus and is attached to the existing hospital, which will remain in operate through the duration of construction. Also located to the east of the patient tower is the ambulance bay. The ambulance bay must be allowed to operate as usual and all crane lifts and deliveries sharing the ambulance access routes must halt or be rerouted. This is because the only road that allows access for deliveries and construction vehicles shares the same road with the ambulance service. Parking for construction is also tight. There are limited parking spaces available in the ETR parking garage located to the west of the new patient tower. Any additional parking necessary will come from the residential neighborhood to the north. Since most construction workers will need to park in the residential neighborhood a shuttle will need to be utilized to save construction workers time traveling to and from site. In addition to these requirements, the hospital is surrounded by residential area with an enforced noise ordinance.

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	5pm-9pm	65
	9pm-7am	55
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Table 1: Maximum Allowable Noise Level in Residential Zonings from county ordinance

RS Means 2014
Hospital, 4-8 Story

Stories	9
SF Area	194210
SF area/fl	21579
Perimeter (ft)	772.58
Basement Area	18215

Avg Floor Height	14.6

			Interpulation
SF area	22500	25000	
LF Perimeter	705	816	
Cost Per SF	295.85	295	296.16
Perimeter Adj. (per 100LF)	3.85	3.2	3.45
Story Height Adj. (per 1ft)	2.05	1.95	1.99
Adjusted Base Cost (per SF)			301.61
Adjusted Basement Cost (per SF)	37.1	per SF	338.71

Total Cost	64,744,549

SUBSTRUCTURE	1.9%	1,230,146
SUPERSTRUCTURE	9.3%	6,021,243
EXTERIOR ENCLOSURE	6.7%	4,337,885
ROOFING	0.6%	388,467
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EQUIPMENT & FURNISHING	8.8%	5,697,520

Questions received from Technical Assignment 1 Presentation:
Q: What are the noise requirements for the residential neighborhoods or ordinances?
A: Please refer to the maximum allowable noise table located on page 17 under the existing conditions. These values come from the local noise ordinance.
Q: Did the owner representative just assist in contractor and designer selection?
A: Yes, the project delivery method chart has been updated to reflect this change.
Q: Why are there three project managers?
A: This question has been posed to the Whiting-Turner staff and is awaiting response. It is believed that each project manager is to manage a separate phase of the project.