JOHNS HOPKINS HOSPITAL
NEW CLINICAL BUILDING

Baltimore, Maryland

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Architectural Engineering, 5th Year

Construction Management Option

Technical Assignment 1

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1.1 Executive Summary

Clark/Banks, A Joint Venture is the general contractor constructing the New Clinical Building for Johns Hopkins Hospital in Baltimore, Maryland. The $950 million modernization project will be completed by Christmas of 2010 at a construction cost of $573 million. Totaling over 1.5 million square feet with two - 15 story towers, it is currently the largest hospital project in the United States.

Design by Perkins+Will began in the middle of 2003 with constructuction beginning in October of 2006. The two phase project is divided into two construction zones, the Children's Tower and the Adult Tower. The Children's Tower will be the new home of the JHH's Children Hospital and the Adult Tower will house the cardiovascular, critical care, and emergency care unit.

The braced frame structural steel system will support the building with 12,500 tons of steel. Two tower cranes located in each tower along with a 250 ton luffer crane and a 150 ton crawler crane are being used to erect the steel. A cast-in-place concrete composite floor system is used to tie it all together. The building envelope is being enclosed with 57% curtain wall and 43% precast. The MEP systems are some of the most complicated and technically advanced systems on the market. Accounting for more than 44% of the total construction cost, the MEP systems are supported by an offsite central plant that supplies chilled water and high pressure steam. Chilled water is transported to 19 air handling units located in the main mechanical rooms of the 6^{th} and 7^{th} floor. A Variable-Air-Volume (VAV) system is used to provide conditioned air to all building locations. All of this is being powered by 2-15kV, 3 phase electrical feeders that are stepped down to 120/208/240/277V, 3 phase on the 6^{th} and 7^{th} floor by 8 transformers.

The project is being delivered by a design-bid-build method with a guarantee maximum price (GMP) contract. The 50 person project management staff of Clark/Banks is utilizing a contractor controlled insurance program (CCIP) to provide a more competitive insurance rate. Construction coordination is being done with the aid of a Building Information Model (BIM).

Delivering a world-class hospital is the top priority for the owner. In order to do this there are many challenges that must be overcome. A strained labor pool due to many large projects in the area makes it difficult to provide the necessary 1,200 workers at peak construction. Coordinating with the JHH's medical professionals, designers, and consultants to provide the most state-of-the-art medical equipment in an efficient manner that will not delay construction has presented some sequencing issues. Building a job of this magnitude in downtown Baltimore with a site that is located very close to the medevac heliport and the emergency care unit of the existing Johns Hopkins Hospital presents site safety concerns.

For this Thesis project I will concentrate my studies on Phase II of this project which includes all construction from level 1 to the roof. This is due to the fact that Phase I was awarded to a construction management company who was terminated approximately half way through the phase because of disputes with the owner. Clark/Banks was brought in to complete Phase I and to construct Phase II.

1.2 Project Schedule Summary

1.2.1 Project Phasing

The project is divided into 2 phases. Phase I includes the demolition of existing structures, excavation, foundation, site utilities, and all work for B3, B2, and B1 basement levels. Phase II includes all work to complete the project from level 1 to the roof as well as site landscaping.

By design, the project is divided into two distinct towers – the Children's Hospital, referred to as the Children's Tower (CT) and the Cardiovascular and Critical Care Hospital, referred to as the Adult Tower (AT). The Adult Tower includes all work west of the expansion joint, N/P line. This includes the high-rise structure of the Cardiovascular and Critical Care Hospital and the "Connector" which houses the emergency care unit. The Connector is defined as the 8 story structure that connects the CT and AT between J and N line. The Children's Tower includes all work east of N/P line. This includes the high-rise structure of the Children's Hospital.

Figure 1:Rendering of the NCB Showing the Different Building Areas

1.2.2 Schedule Overview

Design began in the middle of 2003 and reached 95% Design Development on January 1, 2007. Currently the design is not complete and Clark/Banks is receiving Construction Change Directives (CCD) on average every two weeks. The design phase of a hospital is a long drawn out process as compared to other types of projects. Architects and engineers need to spend time meeting with a wide array of different hospital departments and specialists to determine the space and use requirements. Final design is assumed to be complete by January 1, 2009.

Notice to proceed for this project was given on October 16, 2006 and is scheduled to be complete by December 23, 2010. This duration includes Phase I and II.

Procurement of the demolition subcontractor began with the previous CM on July 6, 2005. They continued to procure subs for Phase I until June 13, 2006. Clark/Banks was then brought in to complete the project. They chose to keep some of the same subs and to re-bid some of the work. The foundation and concrete work was awarded to subsidiary companies of Clark for a more competitive price. On October 1, 2006, Clark/Banks began to procure subs for Phase II starting with long lead subs such as the steel, mechanical, electrical, fire protection, and elevator subs. The large majority of the 55 subcontracts were awarded by August 1, 2007.

The nature of a hospital requires extensive mechanical, electrical, and plumbing (MEP) systems. Due to this reason, the MEP systems drive the schedule and are the most critical activities.

The following are key milestone dates that are of interest:

- Notice to Proceed – October 16, 2006
- CT Phase I Substantial Completion – August 9, 2007
- AT Phase I Substantial Completion – December 28, 2007
- CT Toping Out of Concrete – September 10, 2008
- AT Toping Out of Concrete – December 31, 2008
- CT Water Tight – May 8, 2009
- AT Water Tight – September 30, 2009
- CT Phase II Substantial Completion – September 17, 2010
- AT Phase II Substantial Completion – December 23, 2010
- Hospital Activation – June 21, 2011

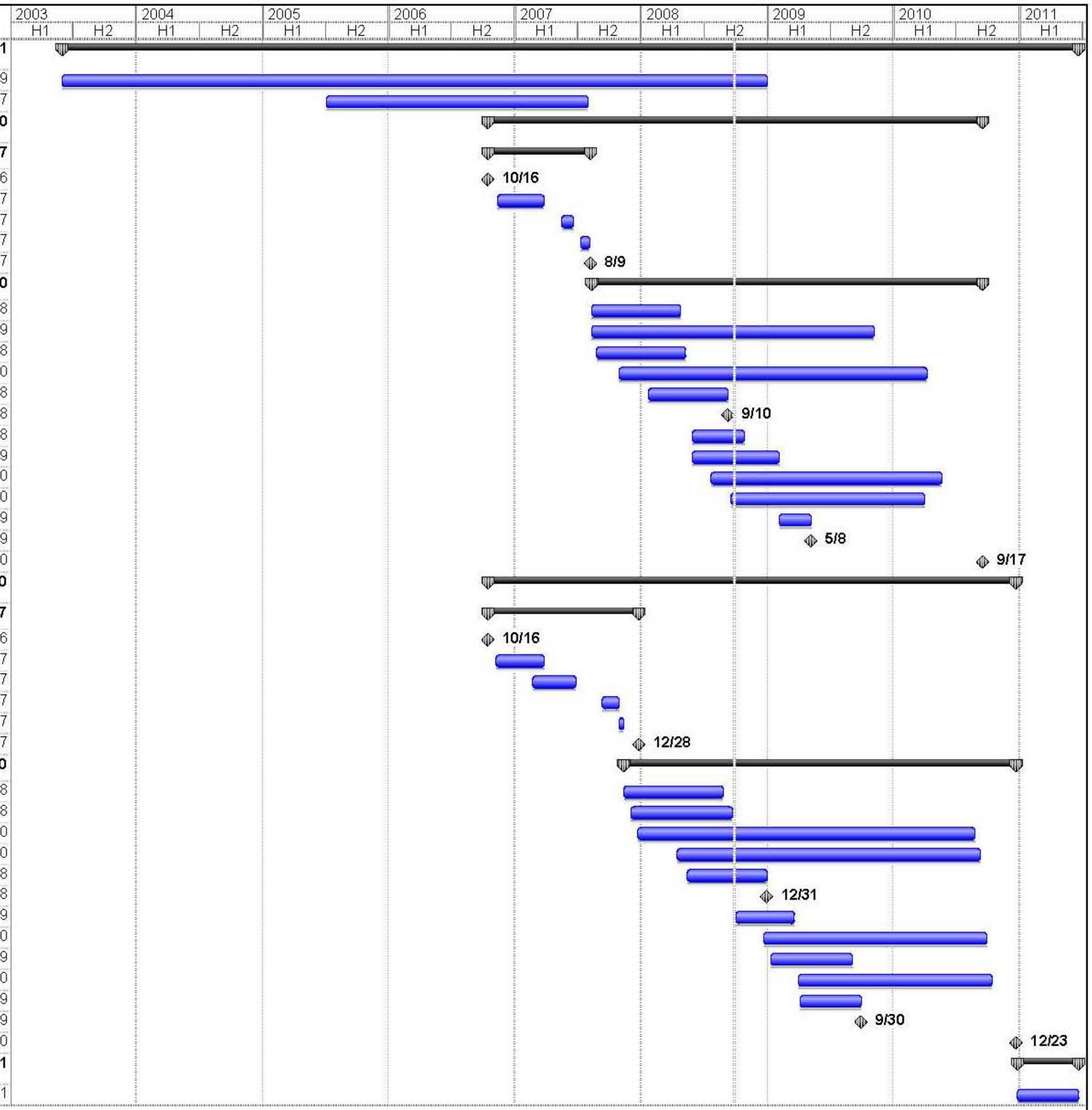
The Children's Tower is scheduled to be complete about 3 months before the Adult Tower. This was done to spread resources across the entire duration of the project. If both towers would have started at the same time it could have caused a shortage in the labor and materials market in the area. By staggering the completion of each tower, it also spreads out the punch-list items. On a project of this magnitude, a large punch-list would be expected which if not managed properly could put a large strain on the A/E and CM staff.

1.2.3 Project Summary Schedule

On the following page is the project summary schedule. The schedule is broken down into the two construction zones and phases.

Note that this schedule may not be the most current schedule as design changes and donor enhancements have continuously changed it.

ID		Task Name	Duration	Start	Finish
1		**JHH New Clinical Building**	**2102 days**	**Jun 2 '03**	**Jun 21 '11**
2		Design	1459 days	Jun 2 '03	Jan 1 '09
3		Procurement	541 days	Jul 6 '05	Aug 1 '07
4		**Childrens Tower**	**1024 days**	**Oct 16 '06**	**Sep 17 '10**
5		**Phase I**	**214 days**	**Oct 16 '06**	**Aug 9 '07**
6		Notice To Proceed	0 days	Oct 16 '06	Oct 16 '06
7		Caissons	96 days	Nov 13 '06	Mar 26 '07
8		Structural Steel	24 days	May 18 '07	Jun 20 '07
9		Slab on Grade	19 days	Jul 11 '07	Aug 6 '07
10		Phase I Substantial Completion	0 days	Aug 9 '07	Aug 9 '07
11		**Phase II**	**809 days**	**Aug 13 '07**	**Sep 17 '10**
12		Structural Steel	185 days	Aug 13 '07	Apr 25 '08
13		MEP	585 days	Aug 13 '07	Nov 6 '09
14		Metal Decking	185 days	Aug 27 '07	May 9 '08
15		Finishes	638 days	Oct 30 '07	Apr 8 '10
16		Concrete Decking	165 days	Jan 24 '08	Sep 10 '08
17		Top Out Concrete	0 days	Sep 10 '08	Sep 10 '08
18		Precast Panels	107 days	May 30 '08	Oct 27 '08
19		Curtain Wall	180 days	May 30 '08	Feb 5 '09
20		Commissioning	478 days	Jul 23 '08	May 21 '10
21		Elevators	400 days	Sep 19 '08	Apr 1 '10
22		Roofing	66 days	Feb 6 '09	May 8 '09
23		Water Tight	0 days	May 8 '09	May 8 '09
24		Phase II Substantial Completion	0 days	Sep 17 '10	Sep 17 '10
25		**Adult Tower**	**1093 days**	**Oct 16 '06**	**Dec 23 '10**
26		**Phase I**	**314 days**	**Oct 16 '06**	**Dec 28 '07**
27		Notice To Proceed	0 days	Oct 16 '06	Oct 16 '06
28		Demolition of Jefferson Bldg	99 days	Nov 9 '06	Mar 27 '07
29		Caissons	89 days	Feb 23 '07	Jun 27 '07
30		Structural Steel	35 days	Sep 12 '07	Oct 30 '07
31		Slab on Grade	9 days	Oct 31 '07	Nov 12 '07
32		Phase I Substantial Completion	0 days	Dec 28 '07	Dec 28 '07
33		**Phase II**	**811 days**	**Nov 14 '07**	**Dec 23 '10**
34		Structural Steel	205 days	Nov 14 '07	Aug 26 '08
35		Metal Decking	210 days	Dec 4 '07	Sep 22 '08
36		MEP	698 days	Dec 24 '07	Aug 25 '10
37		Finishes	628 days	Apr 16 '08	Sep 10 '10
38		Concrete Decking	165 days	May 15 '08	Dec 31 '08
39		Top Out Concrete	0 days	Dec 31 '08	Dec 31 '08
40		Precast Panels	121 days	Oct 3 '08	Mar 20 '09
41		Commissioning	461 days	Dec 23 '08	Sep 28 '10
42		Curtain Wall	170 days	Jan 12 '09	Sep 4 '09
43		Elevators	400 days	Apr 2 '09	Oct 13 '10
44		Roofing	127 days	Apr 7 '09	Sep 30 '09
45		Water Tight	0 days	Sep 30 '09	Sep 30 '09
46		Phase II Substantial Completion	0 days	Dec 23 '10	Dec 23 '10
47		**Hospital Activation**	**127 days**	**Dec 27 '10**	**Jun 21 '11**
48		Hospital Activation - Phase II	127 days	Dec 27 '10	Jun 21 '11



Project: JHH NEW CLINICAL BUILDING

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary | Group By Summary | Deadline

Page 1

1.3 Building Systems Summary

1.3.1 Demolition

All demolition of existing structures on site were performed by the previous contractor during Phase I. No information is available for this thesis.

1.3.2 Support of Excavation

Most of the support of excavation was performed by the previous contractor during Phase I. No information is available for this thesis.

1.3.3 Foundation System

Design

- 275 caissons support the building
  - Diameter: 3'-10'
  - Depth: 30'-50'
  - 3,000 psi reinforced concrete
- Cast-in-place concrete foundation walls
- Strip footing around the perimeter of building
- Grade beams at high load areas – vehicle ramps, high axial load from columns, etc.

1.3.4 Structural Steel

Design

- 12,500 tons of structural steel
- 28'-8" typical bay size
- 16' floor-floor height from levels B3 – 8
- 14' floor-floor height from levels 9-Roof
- Braced frame shear system
- Minimum moment connections – mainly used on cantilever structure
- 18'-4"W x 143'-4"L radial cantilever from levels 4-Roof
- W16x26 typical beam
- 2 large plate girders on level 3 of the Ambulance Bay area in the Children's Tower
  - 1 – 40' long x 78" deep I-Shape, 1 7/8" x 34" flange, 1 1/4" thick web
  - 1 – 57'-4" long x 72" deep I-Shape, 2 1/2" x 44" flange, 1" thick web

Construction

- 2 – Comansa Model 21LC550 tower cranes
  - 39,670 lbs maximum lift capacity
  - 1 tower crane located in the north-center of the Children's Tower

    - 1 tower crane located in the center of the Adult Tower
- 250 ton Kobelco luffer crane
    - Used to erect areas that cannot be reached by the tower cranes or for critical picks
    - Mainly used on the south elevation of the Adult Tower
- 150 ton Link-Belt crawler crane
    - Used to erect areas that cannot be reached by the tower cranes and/or to work simultaneously with other cranes
    - Mainly used on the east elevation of the Children's Tower

1.3.5 Cast-in-Place Concrete

<u>Design</u>

- Cast-in-place composite floor decks
- 5 1/2" – 11" normal weight reinforced concrete slabs from levels B3 – 8
- 4 1/4" – 6 1/4" light weight reinforced concrete slabs from levels 9-Roof

<u>Construction</u>

- No formwork was required
- Primary method of placing was with a pump truck
    - A slick line was used for areas that could not be reached by the pump truck
- Secondary method of placing was with a buggy
    - Used for smaller pours where it was not feasible to bring in a pump truck

1.3.6 Precast Concrete

<u>Design</u>

- 1,350 large pieces weighting up to 32,000 lbs.
- 6" thick precast concrete panels with brick veneer
- 43% of building exterior = 201,000 sq. ft.
- Panels are manufactured in Toronto, Canada
- Bricks are manufactured in Germany
- Design by subcontractor - Artex

<u>Construction</u>

- Erection is by the steel erector
    - Uses the same cranes as the steel erection (see Structural Steel Frame – Construction above)
- Bolted connections
- Panels are delivered by truck just in time for erection

1.3.7 Masonry

There is no masonry on this project.

1.3.8 Curtain Wall

Design

- Aluminum unitized curtain wall system
- Various color glazing with random pattern
- 57% of building exterior = 275,000 sq. ft.
- Detail design by subcontractor - Harmon Inc.

Construction

- Connection is by halfin anchors embedded in the concrete slabs
- Erected by a 150 ton mobile hydraulic crane
- Delivered in large preassembled sections just in time for erection

1.3.9 Mechanical System

Air Conditioning System

- Offsite central plant supplies chilled water and high pressure steam
  - 24" Chilled water supply and return
  - 8" High pressure steam supply and return
  - Supply located on level B3 in the south-west corner of the Adult Tower
- Main mechanical room locations are levels 6 and 7
- 19 Air Handling Units (AHU)
  - CFM: 11,000 – 133,000
  - Provides 50^{0}F cooled air at all times
  - Located on levels B1, 6, and 7
- Variable Air Volume (VAV) system with VAVs in every room
  - VAV heats supplied air from AHU to temperature controlled by thermostat in room
  - Hot water supply heats air through reheat coil
- Rectangular and round ductwork distribute conditioned air throughout building

Hot Water System

- High pressure steam is used for heating hot water
  - Shell and tube heat exchangers on the 6th floor conditions water
- High pressure steam is also used for humidifying air and sterilizing hospital equipment

Domestic Water

- 2 – 8" domestic water supplies
  - Main supply at north-east corner of the Children's Tower on level B1

- Redundant supply at south-west corner of the Adult Tower on level B1

Medical Gases

- Oxygen gas is stored offsite in liquid bulk
- Medical air and vacuum are produced on level 6 in the mechanical room
- Very sophisticated control and alarm system

1.3.10 Electrical System

Power

- 2 – 15kV, 3 phase feeders
  - 15kV, 3 phase feeder located on level 1 of each tower
- Primary electrical rooms on levels 6 and 7
- 15kV power is distributed to levels 6 and 7 to step down voltage
  - 3 transformers on level 6 in each tower
  - 2 transformers on level 7 in each tower
  - Transformers step down power to 460V, 3 phase
- 460V, 3 phase power is distributed to electrical rooms on each floor
  - 2 electrical rooms per floor in each tower
  - Power is stepped down to 120/208/240/277V, 3 phase
- 120/208/240/277V, 3 phase power is distributed about the floor to various electrical closets
- Distribution is by copper or aluminum wire and bus ducts.

Redundancy

- Emergency generators are located at offsite central plant
- Double ended switchboards are used to tie transformers together to provide redundancy
- Uninterrupted Power Systems (UPS) are used to provide immediate power in the case of a power outage
  - Batteries are used to store power
  - Provides power for a short amount of time until emergency generators can provide power

1.3.11 Fire Protection

Design

- Primarily a wet sprinkler system
- Pre-action sprinkler system in electrical rooms
- Fire pumps are located on level B2

1.4 Project Cost Evaluation

1.4.1 Construction Cost

Clark/Banks is contracted to deliver the construction at a guarantee maximum price of $573 million. The cost includes the completion of Phase 1 and the construction of Phase 2. This cost does not include any change orders due to design changes and donor enhancements.

The construction square foot cost for this project is approximately $382/ sq. ft.

1.4.2 Total Project Cost

Johns Hopkins Hospital will invest $950 million to complete the New Clinical Building. This cost includes design, construction, equipment, and fit-out of the hospital. JHH already owned the land for this project so this is not included in the cost.

The total project square foot cost is approximately $633/ sq. ft.

This cost does not include recent donor enhancements which add approximately [redacted]

1.4.3 Building Systems Cost

Below is a summary of the major building systems cost. Note that the MEP packages account for approximately 44.4% of the construction cost. This is not uncommon for a hospital project given the complexity of the MEP systems.

Trade	Approximate Cost (Millions)	S.F. Cost ($/SF)	% of Construction Cost
Mechanical/Plumbing	[redacted]	[redacted]	[redacted]
Electrical	[redacted]	[redacted]	[redacted]
Fire Protection	[redacted]	[redacted]	[redacted]
Steel	[redacted]	[redacted]	[redacted]
Concrete	[redacted]	[redacted]	[redacted]
Curtain Wall	[redacted]	[redacted]	[redacted]
Precast	[redacted]	[redacted]	[redacted]
Framing/Drywall	[redacted]	[redacted]	[redacted]
Elevator	[redacted]	[redacted]	[redacted]

Table 1: Building Systems Approximate Cost

1.4.4 D4Cost Estimate

A D4Cost estimate was performed for this project by comparing the cost of similar hospital projects across the country. Projects were selected from the D4Cost database based on scope of work, materials, new type construction, and size. The software then analyzed the cost information from the database projects and created a "smart average" amongst all the projects. A time and location multiplier was used to correct for date of construction and location of project.

Below is a summary of the D4Cost Estimate. Notice that the total construction cost is 1.5% lower than the actual construction cost.

A detail summary of the D4Cost estimate can be found in Appendix A.

CSI Code	Divison Name	%	SF Cost	Amount
0	Bidding Requirements	3.27	$ 12.29	$ 18,441,532
1	General Requirements	4.6	$ 17.29	$ 25,931,508
2	Site Work	4.7	$ 17.68	$ 26,520,727
3	Concrete	6.26	$ 23.56	$ 35,346,940
4	Masonry	1.74	$ 6.53	$ 9,794,926
5	Metals	5.86	$ 22.03	$ 33,047,250
6	Wood & Plastics	1.81	$ 6.79	$ 10,185,793
7	Thermal & Moisture Protection	2.86	$ 10.75	$ 16,130,747
8	Doors & Windows	4.56	$ 17.15	$ 25,719,311
9	Finishes	8.38	$ 31.52	$ 47,276,748
10	Specialties	0.86	$ 3.24	$ 4,859,663
11	Equipment	1.21	$ 4.55	$ 6,830,295
12	Furnishings	0.77	$ 2.90	$ 4,351,066
13	Special Construction	0.32	$ 1.21	$ 1,813,335
14	Conveying Systems	1.27	$ 4.76	$ 7,142,406
15	Mechanical	17.48	$ 65.76	$ 98,642,796
16	Electrical	9.74	$ 36.65	$ 54,975,548
21	Fire Suppression	1.09	$ 4.11	$ 6,159,440
22	Plumbing	0.01	$ 0.03	$ 48,536
23	HVAC	13.77	$ 51.81	$ 77,716,587
26	Electrical	6.04	$ 22.73	$ 34,088,629
31	Earthwork	0.9	$ 3.38	$ 5,064,384
32	Exterior Improvements	1.5	$ 5.62	$ 8,436,528
33	Utilities	1.01	$ 3.81	$ 5,719,300
Total Construction Cost		**100**	**$ 376.16**	**$ 564,243,993**

Table 2: D4Cost Estimate Summary of Construction Costs

1.4.5 R.S. Means Square Foot Estimate

A R.S. Means Square Foot estimate was performed using the M.340 Hospital, 4-8 Story cost data. Given the project square footage of 1.5 million, a building perimeter of 2,200 ft, precast concrete exterior wall, steel structure, and a location multiplier of 0.92, a total cost was estimated to be $402,462,500. This cost includes construction *and* design.

It should be noted that the R.S. Means cost data used was for a 4-8 story hospital, not a 15 story hospital. However, R.S. Means did have cost data for a 2-3 story hospital and by comparing the costs of both data, it was clear that the cost did increase with height, all else equal. Furthermore, the largest area that R.S. Means had listed was 300,000 sq. ft. which is 1/5 the size of this project. The 300,000 sq. ft. cost was assumed to be most accurate because the trend in cost went down with larger sq. ft. area. Instead an adjustment was made in cost for the larger building footprint. Also, common additives such as cabinets, televisions, nurses call stations, etc. were not included due to time restraints. To compensate for all of these variables an additional 10% was added to the square foot cost.

Below is a summary of the R.S. Means Square Foot estimate.

The R.S. Means Square Foot cost data sheet used for this estimate can be found in Appendix B

Divison Name	%	SF Cost	Amount
Substructure	2.1	$ 4.05	$ 6,203,092
Superstructure	10.1	$ 19.48	$ 29,833,917
Exterior Enclosure	7.3	$ 14.08	$ 21,563,128
Roofing	0.7	$ 1.35	$ 2,067,697
Interiors	24.5	$ 47.27	$ 72,369,404
Conveying	3.3	$ 6.37	$ 9,747,716
Plumbing	6.7	$ 12.93	$ 19,790,817
HVAC	19.2	$ 37.04	$ 56,713,982
Fire Protection	1.5	$ 2.89	$ 4,430,780
Electrical	15.6	$ 30.10	$ 46,080,110
Equipment & Furnishings	9	$ 17.36	$ 26,584,679
Special Construction	N/A	-	-
Building Sitework	N/A	-	-
Subtotal	**100**	**$ 196.92**	**$ 295,385,321**
Contractor Fees	25	$ 49.23	$ 73,846,330
Architect Fees	9	$ 22.15	$ 33,230,849
Total Cost	**-**	**$ 268.31**	**$ 402,462,500**

Table 3: R.S. Means Square Foot Summary

1.4.6 Cost Comparisons

A cost comparison of the actual costs, D4Cost estimate, and R.S. Means Square Foot estimate shows some discrepancies. The D4Cost estimate proved to be within 1.5% of the actual cost which is very good. The R.S. Means estimate was less than the actual cost by 30% which is not very accurate at all.

The D4Cost estimate was very accurate when comparing total cost and somewhat accurate when comparing costs for each division. If you compare the D4Cost mechanical costs with the actual mechanical costs you see they are within 5.6%. The electrical costs are within 13%. This is very good considering that this type of estimate would most likely be done either in the schematic or early design document phase. Typically you would expect to see accuracy that early in the project within 10-15% or more. The accuracy of the D4Cost estimate can be attributed by the large database of similar projects that were averaged to arrive at this cost.

The R.S. Means Square Foot estimate was not accurate by any standard. This could have been caused by not having a cost sheet with a 15 story hospital, not using the correct square foot area, and not adding in common additives. Also, this building is one of the most advanced and sophisticated hospitals in the world which would add cost over a typical hospital project.

It should be noted if you extrapolate the costs for a 15 story hospital, 1.5 million sq. ft. area, and adjust for perimeter; the cost is even more inaccurate.

1.5 Site Plan of Existing Conditions

1.5.1 Site Plan Overview

The NCB is located in downtown Baltimore, Maryland along Rt. 40 (Orleans St.). Rt. 40 is a 4 lane street that runs through downtown Baltimore and connects to the beltway (I-695) on the east and west side. The main construction entrance is located off this road. The access road has a horseshoe design that provides efficient flow of traffic. The left east-bound lane of Rt. 40 is used as a staging lane for deliveries. All material deliveries are expected to access the jobsite by way of Rt. 40.

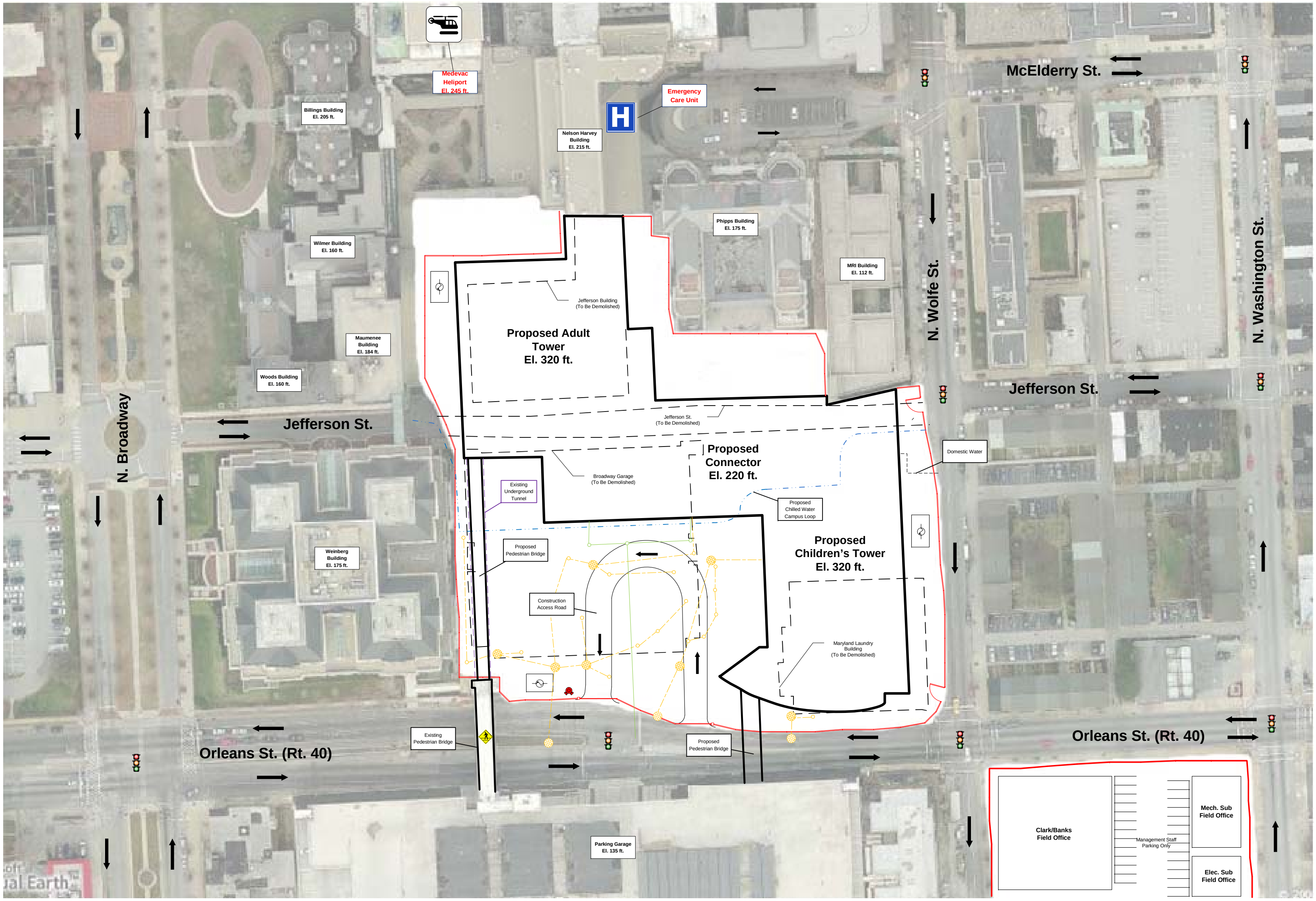
The project is surrounded on the north by the existing Johns Hopkins Hospital. During construction this hospital will remain fully functional. The hospital has a very active helipad on the roof at an elevation of 245 ft. OSHA regulations require that the tower cranes (or the highest part of the building) have marking lights so that the helicopter pilots can avoid any safety hazards. The helicopter flight patterns have been changed to land from the east or the west. The hospital also has an emergency care unit located just to the north-east side of the site. North Wolfe Street is a one-way street traveling south which forces the ambulances to come from the north. Fortunately this will not disrupt the jobsite significantly.

A large number of the JHH's staff park in the parking garage just south of the site. An overhead pedestrian bridge connects the parking garage to the south side of the site. The sidewalks are closed around the entire site to avoid any safety hazards. Pedestrians traveling across the bridge must turn west which avoids the site.

The existing site conditions show that 3 buildings are to be demolished in Phase I. There are no existing utilities shown on the site plan. It is assumed that all new utilities will be installed under Phase I work. The new utilities include storm waste, sanitary, domestic water, and chilled water loop. High pressure steam, chilled water, and electricity will travel through the underground tunnel to the Adult Tower from the central plant located to the south of the site.

1.5.2 Existing Conditions Site Plan

On the following page is an existing conditions site plan. The drawing shows the proposed building site, utilities, temporary structures, vehicle traffic patterns, and neighboring buildings.



0 30 60 90 120

SCALE IN FEET

N

LEGEND

- Temporary Power Shed
- Traffic Signal
- Pedestrian Walk
- Fire Hydrant
- Hospital
- Proposed Storm Water Manhole
- Proposed Storm Water Inlet
- Proposed Storm Water Line
- Proposed Sanitary Line
- Proposed Chilled Water Line
- Proposed Domestic Water
- Construction Limits

Date:	Revision

EXISTING CONDITIONS SITE PLAN

C1.01

Prepared by: Dan Weiger

Date: 9.29.08

1.6 Local Conditions

1.6.1 Local Construction and Labor Market

The Baltimore construction market is busy with government and private projects. The metro area has been expanding at a faster rate than the Washington, D.C. area as it outgrows its limits. Nearby is the nation's capital which has given the area a steady supply of government work.

Baltimore has benefited from the Base Realignment and Closure (BRAC) projects which are expected to result in as many as 60,000 defense and related jobs in the area. This has resulted in a high demand for residential and office space. Several projects are under construction nearby at Fort Meade and Aberdeen Proving Grounds.

Tourism has been growing steadily with local attractions such as the Inner Harbor, National Aquarium, Fort McHenry, and Fells Point. This has driven a recent boom in hotel construction. The Hilton Baltimore, a 757 room hotel near the Baltimore Convention Center and the Ritz-Carlton Hotel and Residences located in the Inner Harbor just finished construction. A $500 million, 715 ft. mixed-use skyscraper has been approved for construction but has not yet broke ground. This will be the tallest building between Philadelphia and Charlotte, NC.

Currently, the hospital construction market is the largest in Baltimore. In addition to the New Clinical Building at Johns Hopkins, Mercy Hospital is undergoing a $400 million expansion just miles away. Other projects in the area include a $57 million addition to Maryland General Hospital, $45 million New Medical Education Building at Johns Hopkins, and the New Patient Tower at St. Anges Hospital. A 12-15 year urban renewal project is underway north of the Johns Hopkins Medical Campus. This is a 31-acre Science and Technology Park with 1.1 million sq. ft. of lab and office space which is budgeted at $800 million.

The local labor pool has been a large concern for this project because of all the projects under construction at the same time. The local labor pool includes the Baltimore, Philadelphia, and Washington, D.C. area because of their proximity. The projects in those regions directly impact the labor conditions in Baltimore. Washington, D.C. has numerous large projects underway that are straining the labor force such as the Walter Reed Medical Center ($640 million), National Geospacial Agency East Coast Headquarters ($1.2 billion), the Intercounty Connector Highway ($2.4 billion) and various other projects.

Skilled workers, particularly MEP trades are the largest concern for this job. The NCB will have over 1,200 workers on site at peak construction. There will be a strong demand for MEP crafts with the Mercy Hospital project so close. Clark/Banks hope to have the best shot at the labor pool because it is ahead of schedule of the other major projects.

1.6.2 Local Construction Methods

A traditional building in the region uses a concrete structure with a mix of curtain wall and precast façade. The D.C. area predominately uses concrete due to height restrictions on buildings. Concrete structures have smaller floor to floor height which could allow owners to add another level. This project uses a steel structure for larger bay sizes and to increase floor to floor height. By increasing the floor to floor height it will provide a larger ceiling plenum space for the extensive MEP systems.

A CM-at-Risk is the primary delivery method in the area. A negotiated GMP contract is usually used to provide a best value approach.

1.6.3 Project Resources

The NCB is located in downtown Baltimore with buildings and roads surrounding the perimeter. There is no room onsite for parking or jobsite trailers. All construction workers must find parking on nearby streets or parking garages.

Adjacent to the project is a city block that is being used as a jobsite trailer complex. Clark/Banks' Project Management and Field Management trailers as well as all of the subcontractors' trailers are located there.

Recycling is being used for office paper waste from the jobsite trailers. Metal construction waste is being separated onsite for recycling purposes. There are no contractual requirements (such as LEED) to recycle building materials.

All construction waste is being removed by onsite dumpsters that are pulled daily. Currently there are about 10 dumpster pulls a week. At peak construction this number is expected to grow to 20 pulls per week. Each pull costs on average [redacted]

1.6.4 Soil and Subsurface Water Conditions

Soil boring logs indicated that the soil was a combination of sand and clay with little rock. Clark/Banks did not encounter any rock during excavation and no blasting was required. However, the soil was not generally suitable for backfill. RC6, a combination of recycled crushed concrete, imported soil, and #57 stone was used for backfill.

Building near the harbor raised concerns about hitting water during excavation. However, Clark/Banks did not expect to hit water because the building site sits on a small hill (EL. +100ft.) north of the harbor. No dewatering was required for this project.

1.7 Client Information

1.7.1 Owner Overview

Johns Hopkins Medicine is the parent name that unites The Johns Hopkins University School of Medicine and The Johns Hopkins Hospital to make up the broad Johns Hopkins Health System. The $4 billion organization was founded in Baltimore, MD in 1876.

The Johns Hopkins School of Medicine is consistently ranked one of the top two medical schools in the country. The Johns Hopkins Hospital has been ranked the #1 hospital in the United States since 1992 by U.S. News & World Report.

Below is a summary profile of the organization according to statisics in 2007.

A JOHNS HOPKINS MEDICINE PROFILE

Economics and Funding	
Annual Operating Budget	$4.1 billion
NIH Research Funding	$607.2 million
State Research Funding (Cancer Research Program)	$1.2 million
Number of Patents Filed (for new discoveries)	243
Royalty Income	$13.5 million
Health Care	
Admissions	82,523
Inpatient Days	414,144
Outpatient Visits	820,716
Outpatient Surgeries	43,231
Inpatient Surgeries	29,566
Emergency Department Visits	205,034
Births	6,499
More Facts	
Philanthropic Contributions Received (FY06)	$258.1 million
Total Employees	25,949
Net Square Feet of Building Space	4,169,470
Economic Impact on Maryland	$6.4 billion
Uncompensated Care	$208.5 million

Table 4: Johns Hopkins Pocket Guide, 2007

1.7.2 Building Objective

The current campus dates back to 1889 with outdated buildings that are regarded as pre-WWII. The hospital's physical plant is 50% older than the average hospital in the U.S. In research, JHH generates 62% more revenue per sq. ft. than comparable facilities which is a sign of overcrowding not efficiency. Fixing these outdated facilities has begun a 10 year campus redevelopment plan that will modernize the facilities.

New facilities are needed for pediatric and adult acute, critical, and surgical care. State-of-the-art technologies and information systems are needed to provide the best patient care as possible. A new central plant is necessary to serve the utility needs of the new infrastructure.

Johns Hopkins Hospital New Clinical Building is the flagship building for the new master plan. This building will address patient care needs and maintain the high quality standard that JHH has become known for.

1.7.3 Project Goals

The owner would like to complete this project on or under budget without sacrificing safety, schedule, or quality. JHH would be pleased to bring the project in under budget so they can spend the money on other campus improvement projects. An undisclosed portion of the project savings will be shared with the contractor to provide an incentive.

Safety is one of the primary goals because the owner is a medical hospital. Not only does JHH and Clark/Banks want to have a high reputation for safety and health, but they also want to minimize claims. Clark/Banks has provided an onsite medical triage trailer with a full-time medical professional on staff to help meet this goal.

Activating the hospital as soon as possible is very important to JHH so they can begin receiving revenue. Even with design changes and donor enhancements, Clark/Banks' completion date has not been extended. To address the aggressive project schedule a consultant was used to help optimize the project schedule. Also, a full time project scheduler and one of the most experienced and successful general superintendents that Clark/Banks has is overseeing the schedule. Failure to meet this schedule will result in liquidated damages of [redacted]

A reputation of the best hospital in the country demands a quality hospital. Extensive efforts have been taken and are currently underway to ensure this project is delivered with the best quality available. Clark/Banks has a quality control team that ensures the construction meets the contract documents' specifications. In addition, the contractor has a team coordinating the medical equipment with the MEP systems. There is also an extensive commissioning plan being developed by the MEP engineers, JHH, and Clark/Banks.

1.7.4 Sequencing Issues

Providing the most advanced medical facility in the country presents sequencing challenges. JHH's team of designers, consultants, and medical professionals are working together to determine the most state-of-the-art equipment to install. This is challenging because technology is continuously changing and when the original design was complete it was the best available. As construction continues, better technology becomes available and it is very important to JHH to stay on the cutting edge. However, the CM needs to make decisions as early as possible on any equipment or fit out requirements so they can incorporate it in the field. This is very challenging because the decisions must be made quickly to provide the best technology and to keep pace with construction.

The NCB does not have any joint, dual, or phased occupancy requirements. Clark/Banks will finish substantial completion on December 23, 2010 and JHH will begin the activation phase. The hospital will begin service in late June of 2011.

1.7.5 Keys to a Successful Project

Highest quality of construction in order to provide the best care available is the key to completing a successful project. The entire project team must be committed to this idea and must all work towards this common goal.

In order for Clark/Banks to be successful on this project they need to do several things:

1. Maintain the schedule and adapt quickly to design changes and donor enhancements
2. Work closely with the design team so they can complete construction documents as soon as possible
3. Minimize ongoing changes to reduce repeat work
4. Need to get paid fairly and promptly for changes
    a. Subcontractors cannot fund large portions of work; they need to get paid for completed change orders in a timely manner to maintain cash flow
5. Maintain a safe work environment
6. Work closely with local labor unions and associations to provide adequate labor supply
7. Provide superior construction quality by managing and documenting work closely
8. Maintain building enclosure schedule
    a. Delays in enclosing the building will delay the MEP work, finishes, controls, and commissioning which would push the schedule
    b. Cost impacts for added temporary heating
9. Coordinate with city inspection officials to efficiently work through the inspection process
10. Timely and complete coordination of MEP systems and medical equipment to avoid impacting the MEP schedule

1.8 Project Delivery System

1.8.1 Delivery Method

The project delivery method is design-bid-build. Originally it was structured as a CM-at-Risk with preconstruction and construction services, however the first contractor was terminated early in Phase I. Clark/Banks, A Joint Venture was brought in as a general contractor to complete the construction services for Phase I and II.

Control over the design was the primary reason for selecting this delivery method. The original contractor was used in the preconstruction phase to provide constructability analysis, cost estimates, value engineering, and scheduling. JHH felt that using this method had less risk because there is one party responsible for construction, a check-and-balance system, and less chance of cost growth.

1.8.2 Contractor Selection Process

The first contractor was procured by a competitive bidding process. Clark/Banks was procured by a negotiated GMP. The selection was based on experience, cost, capabilities, and staff.

Clark/Banks procured all of the subcontractors through a competitive bid. Selection was determined by cost, experience with Clark/Banks, JHH and healthcare projects. Input from JHH was considered as well.

1.8.3 Project Team Organization Chart

Below is an organization chart for the project team. Solid lines indicate direct contractual agreements and dashed lines show direct communication. The design team and the owner's consultants did not wish to disclose their contracting method.

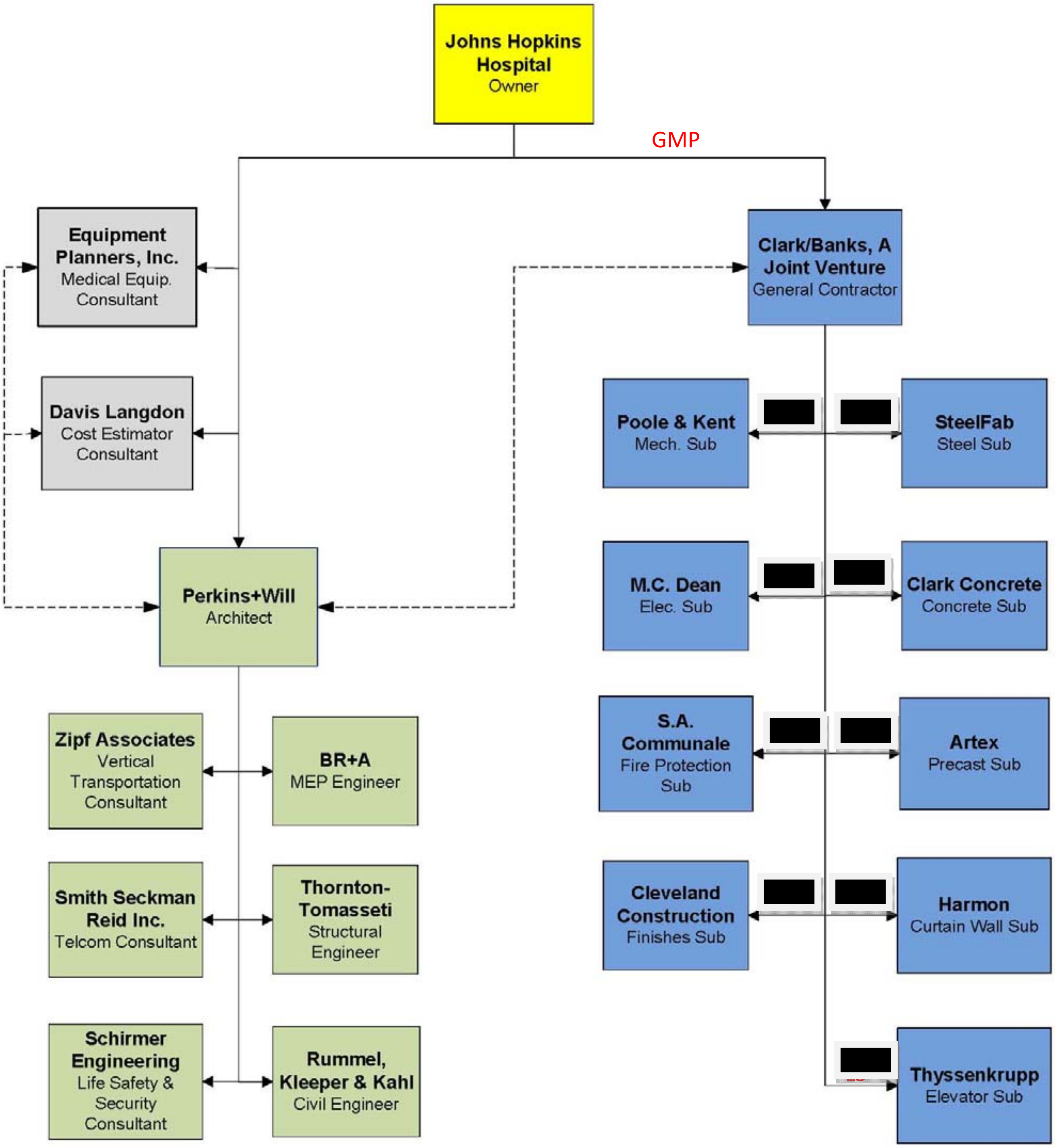


Figure 2: Project Team Organization Chart

1.8.4 Contractual Agreements

The general contractor holds a guarantee maximum price (GMP) contract with the owner. If the cost comes in over the GMP, the contractor is liable for all costs. Any savings will be shared between the contractor and the owner.

A minority participation of 15% is required for this project. There are no wage scale or Buy America requirements. The GMP does include a contingency and weather day allowances.

The joint venture contract between Clark Construction Group, LLC and Banks Contracting Company, LLC requires each party to provide staffing comparable to their stake in the project. Clark/Banks would not disclose the stake each party holds.

All subcontractors with the exception of one hold a lump sum contract with the GC. [redacted]

1.8.5 Bond and Insurance Requirements

Clark/Banks requires all subcontractors with a contract over [redacted] to provide a payment and performance bond. JHH does not require the general contractor to carry a bond.

Every subcontractor (and their subcontractors) must be enrolled in the Contractor Controlled Insurance Program (CCIP) if they provide onsite labor. The advantage to a CCIP is that Clark/Banks can purchase coverage at a more competitive rate than individual subcontractors. This is due to the size of Clark/Banks which allows them to purchase better coverage and higher limits of insurance than individual subcontractors for less cost.

1.8.6 Project Delivery Assessment

JHH's motivation for using this delivery system is understandable. Managing the risk for such a large project must be considered as well as the cost and quality. However, I feel that the project could have been delivered in a more efficient manner.

The MEP design was finished behind schedule and has begun to impact the construction schedule. I believe this could have been avoided (or minimized) if all of the project team members would have been working as a team from the beginning. Dealing with a very complicated building that has many different team players which have their own interest and goals may not serve the project the best.

I would consider an Integrated Project Delivery system for this project. This would foster teamwork, provide early involvement, set early goals, enhance communication, and could provide shared technology such as Building Information Modeling. This could solve a lot of the problems that have been encountered using the current delivery method. Further investigation of this delivery system may be explored in my thesis research.

1.9 Staffing Plan

1.91 Staff Structure

A functional organization structure is used for this project. Individuals have clear roles and special assigned tasks that have been prepared by the management staff. Individuals report to their superiors with set lines of communication.

The project's executive management staff consists of Clark Construction's President of the Mega Projects Division and the President of Banks Contracting. The Project Director reports directly to those individuals on a weekly basis.

Under the management of the Project Director, the staff is broken into 7 departments. The departments include Project Administration, Engineering Design/Coordination, MEP, Field Supervision, Quality Control, Safety, and Field Office Management.

Project Administration deals with cost control, document control, purchasing, and scheduling. The Engineering Design/Coordination department controls all the coordination, material tracking, and documentation for the project with the exception of MEP. The MEP staff coordinates, tracks, and documents all work related to the MEP systems. Construction in the field is managed by the Field Supervision department. The Quality Control staff ensures that all of the installed work meets the specifications of the contract documents. The insurance, jobsite safety training, and onsite safety staff are controlled by the Safety department. Finally the Field Office Management department supports all of the previous departments as well as oversees day to day project administration.

1.9.2 Staff Organization Chart

On the following page the staff organization chart shows the functional structure of the general contractor. The lines indicate communication and the hierarchal relationship of the team.

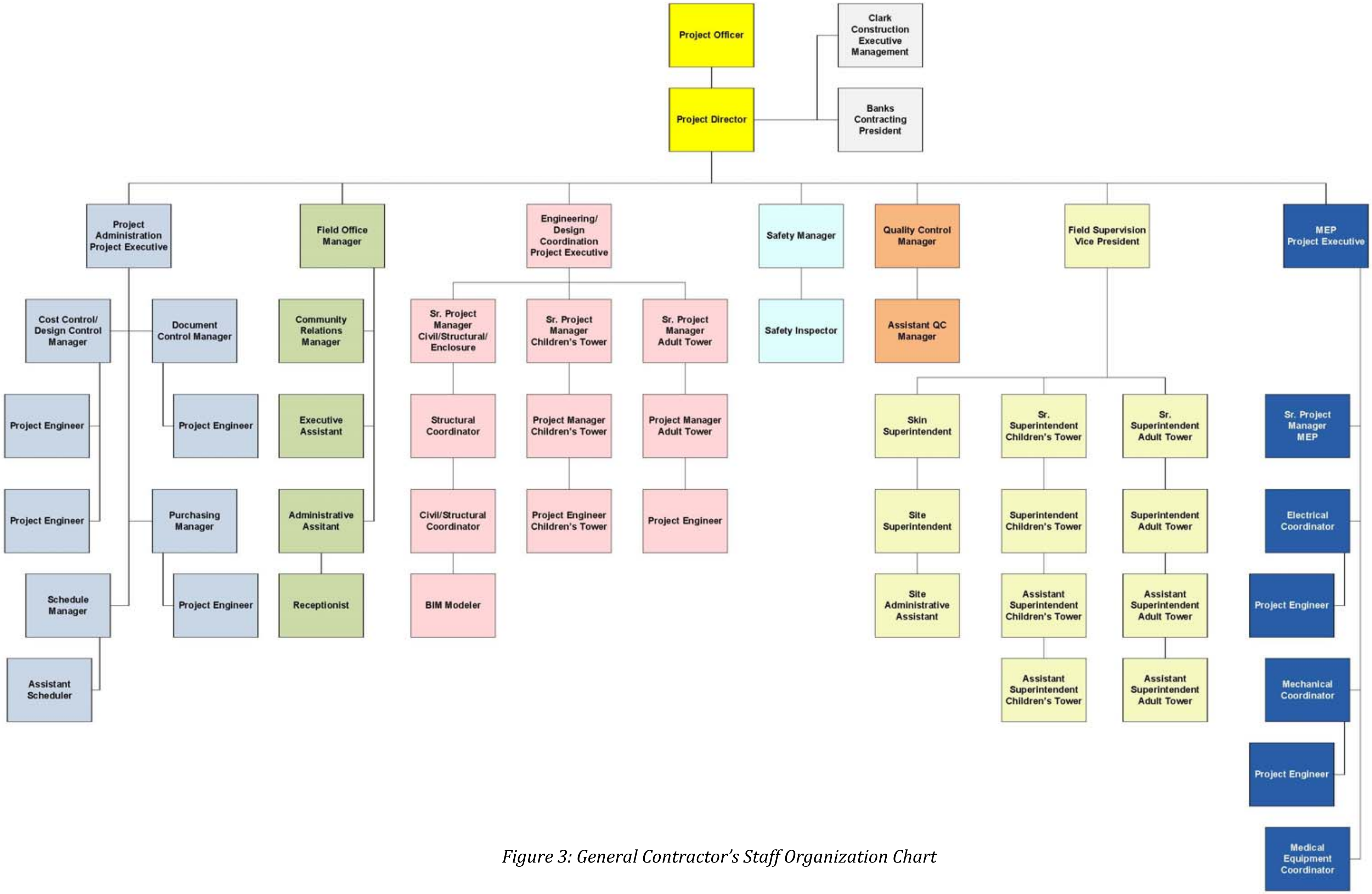


Figure 3: General Contractor's Staff Organization Chart

Detail Summary of D4Cost Estimate

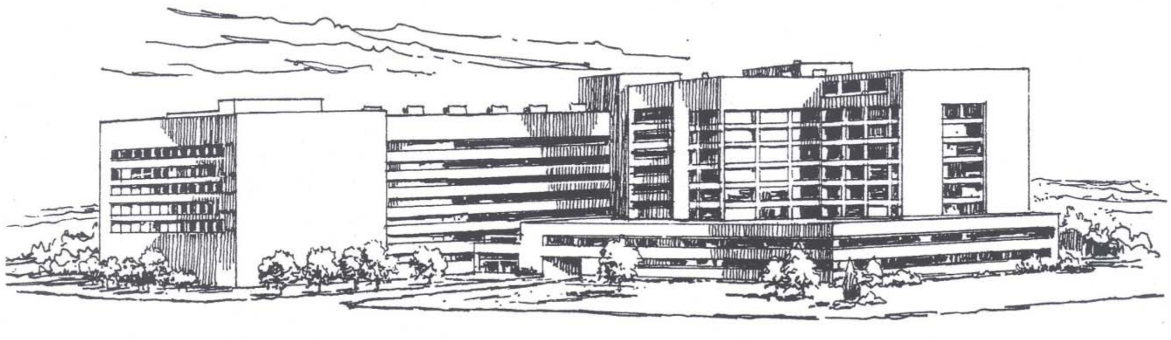
Statement of Probable Cost

JHH NCB - Dec 2010 - MD - Baltimore

Prepared By:		Prepared For:	
	Fax:		Fax:
Building Sq. Size:	1500000	Site Sq. Size:	1131453
Bid Date:		Building use:	Medical
No. of floors:	15	Foundation:	CAS
No. of buildings:	1	Exterior Walls:	PRE
Project Height:	225	Interior Walls:	GYP
1st Floor Height:	15	Roof Type:	BIT
1st Floor Size:	100000	Floor Type:	CON
		Project Type:	NEW

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**3.27**	**12.29**	**18,441,532**
	Bidding Requirements	3.27	12.29	18,441,532
01	**General Requirements**	**4.60**	**17.29**	**25,931,508**
	General Requirements	4.60	17.29	25,931,508
02	**Site Work**	**4.70**	**17.68**	**26,520,727**
	Site Work	4.70	17.68	26,520,727
03	**Concrete**	**6.26**	**23.56**	**35,346,940**
	Concrete	6.26	23.56	35,346,940
04	**Masonry**	**1.74**	**6.53**	**9,794,926**
	Masonry	1.74	6.53	9,794,926
05	**Metals**	**5.86**	**22.03**	**33,047,250**
	Metals	5.86	22.03	33,047,250
06	**Wood & Plastics**	**1.81**	**6.79**	**10,185,793**
	Wood & Plastics	1.81	6.79	10,185,793
07	**Thermal & Moisture Protection**	**2.86**	**10.75**	**16,130,747**
	Thermal & Moisture Protection	2.86	10.75	16,130,747
08	**Doors & Windows**	**4.56**	**17.15**	**25,719,311**
	Doors & Windows	4.56	17.15	25,719,311
09	**Finishes**	**8.38**	**31.52**	**47,276,748**
	Finishes	8.38	31.52	47,276,748
10	**Specialties**	**0.86**	**3.24**	**4,859,663**
	Specialties	0.86	3.24	4,859,663
11	**Equipment**	**1.21**	**4.55**	**6,830,295**
	Equipment	1.21	4.55	6,830,295
12	**Furnishings**	**0.77**	**2.90**	**4,351,066**
	Furnishings	0.77	2.90	4,351,066
13	**Special Construction**	**0.32**	**1.21**	**1,813,335**
	Special Construction	0.32	1.21	1,813,335
14	**Conveying Systems**	**1.27**	**4.76**	**7,142,406**
	Conveying Systems	1.27	4.76	7,142,406
15	**Mechanical**	**17.48**	**65.76**	**98,642,796**
	Mechanical	17.48	65.76	98,642,796
16	**Electrical**	**9.74**	**36.65**	**54,975,548**
	Electrical	9.74	36.65	54,975,548
21	**Fire Suppression**	**1.09**	**4.11**	**6,159,440**
	Fire Suppression	1.09	4.11	6,159,440
22	**Plumbing**	**0.01**	**0.03**	**48,536**
	Plumbing	0.01	0.03	48,536
23	**HVAC**	**13.77**	**51.81**	**77,716,587**
	HVAC	13.77	51.81	77,716,587
26	**Electrical**	**6.04**	**22.73**	**34,088,629**
	Electrical	6.04	22.73	34,088,629
31	**Earthwork**	**0.90**	**3.38**	**5,064,384**
	Earthwork	0.90	3.38	5,064,384
32	**Exterior Improvements**	**1.50**	**5.62**	**8,436,528**
	Exterior Improvements	1.50	5.62	8,436,528
33	**Utilities**	**1.01**	**3.81**	**5,719,300**
	Utilities	1.01	3.81	5,719,300
Total Building Costs		**100.00**	**376.16**	**564,243,993**
Total Non-Building Costs		**100.00**	**0.00**	**0**
Total Project Costs		--	--	**564,243,993**

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL	M.340	Hospital, 4-8 Story



Costs per square foot of floor area

Exterior Wall	S.F. Area	100000	125000	150000	175000	200000	225000	250000	275000	300000
	L.F. Perimeter	594	705	816	783	866	950	1033	1116	1200
Face Brick with Structural Facing Tile	Steel Frame	252.95	246.70	242.50	236.10	233.70	231.80	230.35	229.15	228.10
	R/Conc. Frame	262.40	256.00	251.80	245.35	242.95	241.05	239.55	238.30	237.30
Face Brick with Concrete Block Back-up	Steel Frame	247.30	241.10	236.95	231.20	228.90	227.05	225.55	224.45	223.45
	R/Conc. Frame	258.50	252.35	248.20	242.45	240.10	238.30	236.85	235.70	234.65
Precast Concrete Panels With Exposed Aggregate	Steel Frame	249.85	243.65	239.50	233.55	231.20	229.40	227.90	226.75	225.75
	R/Conc. Frame	259.35	253.15	249.00	243.05	240.70	238.90	237.40	236.25	235.25
Perimeter Adj., Add or Deduct	Per 100 L.F.	4.15	3.30	2.75	2.35	2.05	1.90	1.60	1.50	1.40
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	1.85	1.75	1.70	1.40	1.35	1.35	1.30	1.30	1.30
***For Basement**, add $31.25 per square foot of basement area*										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $151.70 to $369.90 per S.F.

Common additives

Description	Unit	$ Cost
Cabinets, Base, door units, metal	L.F.	243
Drawer units	L.F.	480
Tall storage cabinets, 7' high, open	L.F.	455
With doors	L.F.	690
Wall, metal 12-1/2" deep, open	L.F.	180
With doors	L.F.	325
Closed Circuit TV (Patient monitoring)		
One station camera & monitor	Each	1750
For additional camera add	Each	940
For automatic iris for low light add	Each	2425
Hubbard Tank, with accessories		
Stainless steel, 125 GPM 45 psi	Each	26,800
For electric hoist, add	Each	2925
Mortuary Refrigerator, End operated		
2 capacity	Each	12,500
6 capacity	Each	22,500
Nurses Call Station		
Single bedside call station	Each	299
Ceiling speaker station	Each	136
Emergency call station	Each	182
Pillow speaker	Each	286
Double bedside call station	Each	365
Duty station	Each	310
Standard call button	Each	157
Master control station for 20 stations	Each	5775
Sound System		
Amplifier, 250 watts	Each	2225
Speaker, ceiling or wall	Each	181
Trumpet	Each	345
Station, Dietary with ice	Each	16,300
Sterilizers		
Single door, steam	Each	161,500
Double door, steam	Each	207,500
Portable, counter top, steam	Each	3875 - 6050
Gas	Each	40,000
Automatic washer/sterilizer	Each	55,500

150

Important: See the Reference Section for Location Factors

Model costs calculated for a 6 story building with 12′ story height and 200,000 square feet of floor area

Hospital, 4-8 Story

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings		S.F. Ground	13.08	2.18	2.1%
1020	Special Foundations	N/A		—	—	—	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	6.97	1.16	
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing		S.F. Ground	.15	.03	
2020	Basement Walls	4′ foundation wall		L.F. Wall	70	.30	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Concrete slab with metal deck and beams, steel columns		S.F. Floor	19.13	15.94	10.1%
1020	Roof Construction	Metal deck, open web steel joists, beams, interior columns		S.F. Roof	7.92	1.32	
	B20 Exterior Enclosure						
2010	Exterior Walls	Face brick and structural facing tile	*70% of wall*	S.F. Wall	39.09	8.53	7.3%
2020	Exterior Windows	Aluminum sliding	*30% of wall*	Each	523	3.26	
2030	Exterior Doors	Double aluminum and glass and sliding doors		Each	4770	.68	
	B30 Roofing						
3010	Roof Coverings	Built-up tar and gravel with flashing; perlite/EPS composite insulation		S.F. Roof	6.96	1.16	0.7%
3020	Roof Openings	Roof hatches		S.F. Roof	.18	.03	
C. INTERIORS							
1010	Partitions	Gypsum board on metal studs with sound deadening board	*9 S.F. Floor/L.F. Partition*	S.F. Partition	6.69	7.43	24.5%
1020	Interior Doors	Single leaf hollow metal	*90 S.F. Floor/Door*	Each	869	9.64	
1030	Fittings	Hospital curtains		S.F. Floor	.93	.93	
2010	Stair Construction	Concrete filled metal pan		Flight	9700	1.26	
3010	Wall Finishes	40% vinyl wall covering, 35% ceramic tile, 25% epoxy coating		S.F. Surface	3.19	7.08	
3020	Floor Finishes	60% vinyl tile, 20% ceramic, 20% terrazzo		S.F. Floor	9.84	9.84	
3030	Ceiling Finishes	Plaster on suspended metal lath		S.F. Ceiling	5.76	5.76	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Six geared hospital elevators		Each	187,667	5.63	3.3%
1020	Escalators & Moving Walks	N/A		—	—	—	
	D20 Plumbing						
2010	Plumbing Fixtures	Kitchen, toilet and service fixtures, supply and drainage	*1 Fixture/416S.F. Floor*	Each	2658	6.39	6.7%
2020	Domestic Water Distribution	Electric water heater		S.F. Floor	4.61	4.61	
2040	Rain Water Drainage	Roof drains		S.F. Floor	3.30	.55	
	D30 HVAC						
3010	Energy Supply	Oil fired hot water, wall fin radiation		S.F. Floor	3.13	3.13	19.2%
3020	Heat Generating Systems	Hot water boilers, steam boiler for services		Each	27,625	.34	
3030	Cooling Generating Systems	Chilled water units		S.F. Floor	2.67	2.67	
3050	Terminal & Package Units	N/A		—	—	—	
3090	Other HVAC Sys. & Equipment	Conditioned air with reheat, operating room air curtains		S.F. Floor	26.75	26.75	
	D40 Fire Protection						
4010	Sprinklers	Wet pipe sprinkler system		S.F. Floor	2.16	2.16	1.5%
4020	Standpipes	Standpipe		S.F. Floor	.46	.46	
	D50 Electrical						
5010	Electrical Service/Distribution	4000 ampere service, panel board and feeders		S.F. Floor	3.84	3.84	15.6%
5020	Lighting & Branch Wiring	Hospital grade light fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	17.11	17.11	
5030	Communications & Security	Alarm systems, internet wiring, communications system, emergency lighting		S.F. Floor	1.75	1.75	
5090	Other Electrical Systems	Emergency generator, 800 kW with fuel tank, uninterruptible power supply		S.F. Floor	4.11	4.11	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		—	—	—	9.0 %
1020	Institutional Equipment	Medical gases, curtain partitions		S.F. Floor	11.85	11.85	
1030	Vehicular Equipment	N/A		—	—	—	
2020	Other Equipment	Patient wall systems		S.F. Floor	3.65	3.65	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		—	—	—	0.0 %
1040	Special Facilities	N/A		—	—	—	
G. BUILDING SITEWORK	**N/A**						
					Sub-Total	171.53	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				*25%*	42.87	
	ARCHITECT FEES				*9%*	19.30	
					Total Building Cost	**233.70**	

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