Technical Assignment 1

Voorhees Replacement Facility | Voorhees, NJ

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10/5/2009

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Executive Summary

Virtua Health is a non-profit healthcare organization that has decided to construct a replacement hospital for their current Voorhees facility. The decision to construct the new hospital was made to accommodate both the increasing demand of the community and the ever-changing technology in hospitals.

This technical assignment provides insight into the existing conditions of the Voorhees Replacement Facility, systems being put in place, construction management techniques, project delivery techniques including project staffing and a cost and schedule analysis.

Through completing a general schedule analysis of about thirty items it was found that Turner commenced the buyout of certain subcontractors before the completion of design development to allow for a fast tracked schedule. It was also found that the fit-out of the bed tower building becomes the critical path once steel erection has been completed. The fit-out of the bed tower is something that may be worth looking at in the future to see if it would be possible to shorten the schedule.

From carrying out a cost comparison it was found that using the rough estimate tools, RS Means Square Foot Cost Data and D4 Cost estimating software provides a estimate construction cost much less then the actual construction. It was found that the D4 Cost estimating software was more accurate to actual construction costs due to the fact that the envelope systems more closely matched that of the Voorhees Replacement Facility then what was offered in RS Means Square Foot Cost Data.

Lastly the project is being delivered via the traditional design-bid-build approach in which Turner acts as the CM@ Risk to the owner Virtua Health. Turner holds a GMP contract with the owner and also with all of its subcontractors. The owner on this project holds an OCIP that allows them to be sure every subcontractor has the proper insurance covered. It was also found from examining the Turner staffing plan that the building was split up between the bed tower building and ancillary spaces to ensure that the superintendents were not overwhelmed with responsibility.

Schedule Summary

Please see Appendix A for project schedule summary.

As seen from the project schedule summary the total duration from schematic design to building turnover of the project spans from November 2006 to March 2011. It is important to note however that the owner Virtua Health had owned the site before bringing in the Architect to conceptualize a design. During this time Virtua did site evaluations including bringing in the geo-technical engineer to assess the site conditions.

The schematic design process unlike most design-bid-build projects was used to create bid documents for the construction manager bidding process because of such a fast tracked schedule. Turner Construction was awarded the project and then authorized to commence their duties on March 26, 2007. Again due to the fast tracked schedule, design packages were scheduled to release in different phases starting with the structural package so that Turner could buyout a subcontractor and start the long procurement time of structural steel. Throughout a good portion more of the design development stage the remainder of the design packages were released from the architecturals all the way to electrical and telecommunications. The end date of the design development phase shown on the schedule summary is when the last major design change was released.

As shown on the schedule summary contractor buyouts and engineering/ procurement are very long duration tasks. This is because contractors that do not commence work until the final stages of construction are not bought out immediately.

The key element of the foundation and site work are the geo-piles. As described in a later section almost 4,000 stone piles were installed around the site. This was the critical path at this point in construction because without the geo-piles installed in the ground foundation work could not start. It was important to get the site cleared and start installing the geo-piles as early as possible.

During the structural steel erection the key element is simply to keep on schedule. There were no space limitations due to such a large sites so keeping on schedule and to the erection plan was key to completing the steel erection on time.

During the finishing stages the fit-out of the bed tower become the critical path. The fit-out of the bed tower does not complete until nearly the end of the project, any

delays in the schedule will push back the completion date. As the construction manager it is important to manage our resources during this fit-out. With the numerous trades coming and going from the space it is extremely important to make sure that trades do not overlap and get in the way of each other. By making sure each trade has enough space to complete their work as well as making sure each trade knows the project schedule the fit-out can go smoothly and to schedule.

Building Systems Summary

Demo

Since any buildings did not previously occupy the location of the Replacement Hospital, the only demolition that was required to allow for construction to start was the clearing of trees and prepping the site for breaking ground.

Structural Steel Frame

The main structural system of the Replacement Hospital is composite steel framing for the floors and non-composite steel framing for the roofs. Typical bay sizes are approximately 30'x32' in the bed tower and 31'-4"x29'-4" in the ancillary portion of the building. Elevated floors use a 3" thick by 18 gauge galvanized composite steel deck while the roofs consist of a 3" thick by 20 gauge galvanized roof deck. Beam to beam and beam to column connections are typical bolt shear connections except in areas where lateral forces are being resisted. At these locations where lateral forces are being resisted welded connections were used.

Lateral loads on the building are resisted by steel braced frames and steel moment frames. It was a particular design challenge to design the lateral systems of the building without compromising the buildings appearance. Some basement walls also act as shear walls to transfer lateral loads to the building foundation.

To erect the steel, 3 300-ton crawler cranes were used.

Cast in Place Concrete

All cast in place concrete used on the job was placed using a pump truck and plywood formwork. Typical elevated floors have 3 ½" of 3500 psi lightweight concrete on top of the metal decking. Elevated slabs are reinforced with fiber reinforcing. Typical slab on grade concrete is 5" and has a strength of 4000 psi reinforced with welded wire fabric.

Precast Concrete

No precast concrete on this project.

Mechanical System

The main mechanical equipment is located in 2 different locations throughout the building. The main chiller equipment is located in the central utility plant with the

main electrical and emergency electrical equipment. The remainder of the mechanical equipment is located in the spine portion of the building between floors 5 and 8.

Building heating, HVAC humidification, domestic water heating, and auxiliary steam is being provided primarily from the 5th floor utility plant in the spine. The system consists of saturated steam boilers, condensing hot water boilers, a chiller heat recovery system, and space for future domestic hot water heaters.

Facility cooling will be provided by a centralized chilled water system. The chilled water generation will take place in the Central Utility Plant area. The chilled water will be generated by electric drive, water-cooled, centrifugal water chillers. Cooling heat will be rejected through 4 induced cooling tower cells.

There are a total of 3 sets of AHUs that service all of the hospital and are located on the 7th floor of the spine. AHU-1 consists of 2 50,000 CFM VAV units stacked on each other. This AHU will serve non-patient care areas such as dietary, environmental services, receiving, and lab and maintenance. AHU-2 consists of 2 50,000 CFM VAV units stacked on each other. This AHU will service the emergency department, pediatric emergency, surgery, c-section operating rooms, the pharmacy and the NICU. AHU-3 consists of 6 75,000 CFM VAV units stacked on each other. AHU-3 will service all of the patient care areas in the ancillary and bed tower.

Electrical

The electrical service to the building is being provided at 12,470 volts where it is distributed to 6 main substations of the building located in the main electrical room in the central utility plant. Already put in place is an extra set of concrete encased PVC conduit for a second service to the building when the hospital expands in the future.

At the substations a transformer brings down the power to 480/277 3 phase 4 wire. The substations are broken down into 3 sets of 2 to create redundancy in the system. If one of the substations fails, the paired substation is sized large enough to take on the full load of both substations until the substation is repaired.

From the substations, power is carried to each floor via cables and either kept at the 480/277 voltage or dropped down even further to 120/208 for certain building functions. Most lighting will be 277V because this allows for more lights per circuit and lower voltage drops across long lengths of wire.

For emergency standby power, there are 3 1,500 KW diesel generators that will service all life safety and building functions that cannot afford to lose power. There is space to provide a 4th generator when the hospital expands in the future. The fuel tank for the generators is sized to provide 96 hours of backup.

To provide uninterrupted backup power before the generators kick in if power failure occurs there is a 900 KW rotary UPS installed. The rotary UPS is sized to provide about 36 seconds of run time, long enough to provide power to the building during the 10-second lag time until the generators kick in.

Masonry

A majority of the masonry on the project is veneer masonry. The only load bearing masonry is located at the loading dock and has a concrete masonry unit veneer. Veneer masonry is located mainly on the bed tower and is made up of both calcium silicate building stone and limestone. Typical veneer masonry connection can be seen in figure 1. The masonry is being installed by using both hex scaffolding and swing stages.

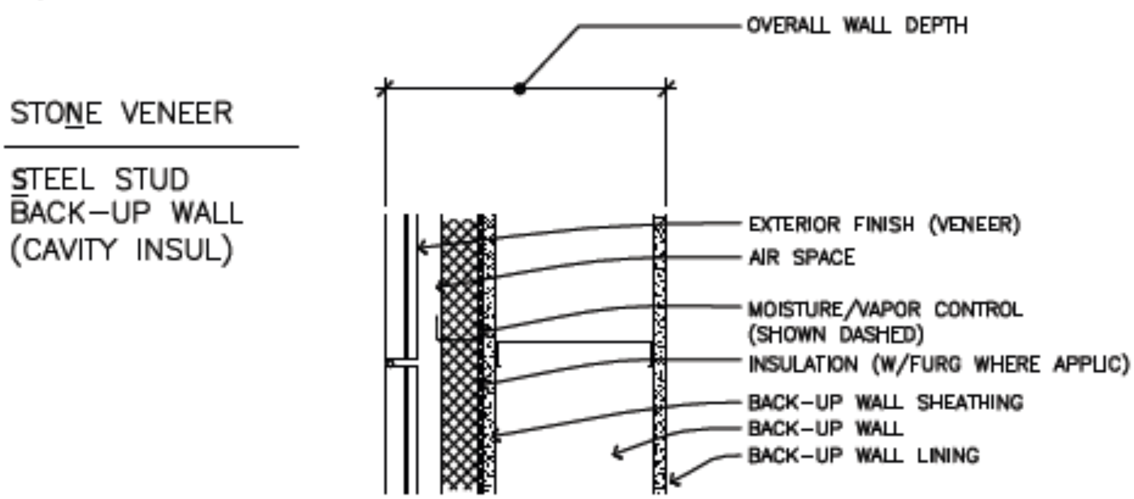


Figure 1

Curtain Wall

Along the bed tower portion of the replacement hospital is a curtain wall system. The system is made up of exposed aluminum finishes and concealed steel reinforcement. The glass in the curtain wall system includes vision and spandrel glass, fritted in some locations to provide natural sunshade to the patient rooms.

The curtain wall is stick built and is put in place using hex scaffolding. A typical curtain wall connection detail can be seen in figure 2.

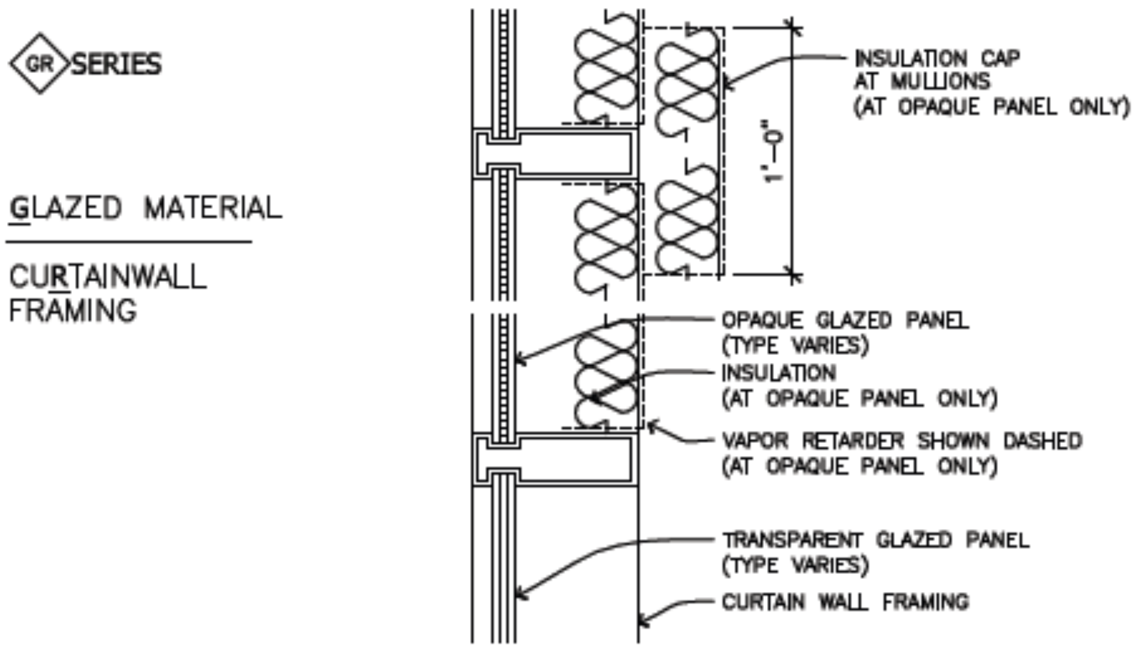


Figure 2

Support of Excavation

There was no major excavation on this project so no major temporary or permanent support systems were necessary. However the geotechnical engineer determined that the site consisted of mostly loose sands, which do not perform well under seismic conditions. In order to stabilize the ground to allow for typical spread footings to be installed a process of installing stone columns was recommended. Almost 4,000 stone columns, each about 45 feet deep were installed under the building footprint to get the soil to an allowable pressure of 6000 psf. Over 100 million pounds of stone was used in this soil stabilization.

Since the water table in the location of the building was determined to be 8 feet below the surface dewatering was necessary to allow for the stone column installation. Since the footprint of the building is so large dewatering was done in multiple phases, this allowed for the stone columns to be installed more quickly and reduce the cost of providing a dewatering system over the entire footprint.

Project Cost Evaluation

Actual Project Costs

Cost Type	Total Cost	Cost / SF
Construction Cost	$294,561,141.00	$436.39/SF
Total Project Cost	$450,000,000.00	$666.66/SF
Structural Steel	$25,466,126.00	$37.73/SF
Rough Carpentry & Drywall	$21,677,690.00	$32.11/SF
Windows, Storefronts and Curtain Wall Systems	$10,376,859.00	$15.37/SF
Plumbing, HVAC Piping/Sheet Metal/Equipment and Medical Gas	$64,952,583.00	$96.22/SF
Electrical Core/Shell and Fit-Out	$35,765,769.00	$52.98/SF

Table 1

Please see the above table 1 for all actual costs regarding the Voorhees Replacement Facility. For a full breakdown of actual costs by bid package please see Appendix B.

Construction cost as shown in table 1 is defined as all of the direct costs to the project. This does not include any general conditions, insurance, contingency or construction management or architect fees. Sitework was left in the construction cost price due to the large majority of the sitework bid package including the geo-piles to create a more stable ground.

Total project cost as shown in table 1 is defined as the total of every cost incurred by both construction and indirect fees.

Parametric Estimate Using D4Cost Software

Project	Size (SF)	Total Cost	Dates of Construction
Baylor Regional Medical Center	342,000	$63,916,839.00	Mar 2003-Nov 2004
Alamance Regional Medical Center	347,000	$44,308,500.00	Aug 1992-Jul 1995
Connecticut Children's Hospital	332,979	$53,764,000.00	Dec 1993-Feb 1996
Average Today Vs. Voorhees Replacement Facility	675,000	$223,356,057.00	Mar 2008-Mar 2011

Table 2

Please see table 2 above for a quick comparison of the D4 project used to reach the estimate for the Voorhees Replacement Hospital. For a full statement of probable cost generated by the D4 software please see Appendix C.

In order to create a comparison based estimate using D4 software three similar projects were chosen from the program and averaged together using adjustments for time and differing square footage of the building. The three projects used to generate the estimate can be seen in table 2. Some similarities between the three buildings chosen that resemble the Voorhees Replacement Facility are listed below.

- Steel Frame
- Glass Curtain Wall
- Similar Finishes
- Bed Towers /Inpatient Care and Offices
- Similar types of medicine practiced (equipment)
- Contained outdoor courtyards
- High Cost
- Larger Square Footage
- # of Stories

Reviewing the D4 estimate for the Voorhees Replacement Facility one can see that the D4 estimate is significantly lower then the actual construction cost of the building. This 70 million dollar difference might be explained by a few different factors. First the projects chosen from D4 did not mention any soil strengthening techniques used. There was a large cost to install the geo-piles before footing construction started that is included in the construction costs.

Next, even though each of the three projects chosen had a glass curtain wall incorporated into the building, the enormous curtain wall of the Replacement

Facility belittles them. This immense curtain wall along the bed tower with a plethora of metal panels and louvers on the exterior of the spine could cause a spike in construction cost.

Subsequently the actual mechanical cost of the building compared to the D4 estimate is about 20 million higher when one adds fire protection to the cost given in the actual cost section. This could be explained by the large amount of rooms located in the bed tower. The hospitals chosen for the estimate in D4 did not include an amount of beds close to the 270 in the Replacement Hospital. This statistic coupled with the fact that every overnight patient gets his or her own room could not only increase the amount of sheet metal needed but also the size of the air handling units needed to provide clean air to patients.

Lastly one can see that the actual cost of the electrical work is greater then the D4 cost estimate. The changing medical technology and single patient rooms could explain this difference in price along with the addition of large generators and a UPS system. The hospitals chosen for the D4 estimate may not have been attempting to make their building highly based around technology. The Voorhees Replacement Facility is attempting to become virtually paperless and this requires extensive and expensive telecommunication work.

R.S. Means Cost Data

RS Means Square Foot Costs 2009 was used to create a rough estimate of the Voorhees Replacement Facility based upon its square footage. After completing the appropriate square foot cost adjustments, adding in lump sum additions and applying the location modifier the total cost came out to be $199,817,102.

It is important to note that the square footage of the Voorhees Replacement Facility is much greater then the largest square foot given in RS Means. Because of this the largest square footage data was used when calculating the estimate. The perimeter adjustment was an addition of $11.8 per square foot. Since RS Means assumes that each floor has the same perimeter, the perimeter of each floor was averaged together to obtain a perimeter to use for the adjustment. The height adjustment was an addiction of $3.37 per square foot. Again about half of the hospital has floor heights of 15 feet while the other half has 14 foot floor heights. Using the average floor height of 14.5 feet, the height adjustment was found. Please see Appendix D for a copy of the RS Means pages used in the calculation.

One can see that the RS Means estimate is almost 100 million dollars less then the actual construction costs of the building. I believe that there is three main factors that account for this giant gap in cost.

The first factor is the building envelope. RS Means defines a more traditional approach to hospital construction with the only options being face brick and precast panels. This typical construction does not have a high cost and can be installed fairly easily. The building envelope of the Voorhees Replacement Facility is made up of a giant glass curtain wall system at the bed tower, stone veneer, metal panels and solid phenolic panels. All of these systems are considerably more expensive then the typical face brick as defined in the RS Means estimate.

The second factor is the mechanical systems of the building. Like the D4 Cost estimate, it is probable that the RS Means estimate does not take into account each overnight patient having his or her own room. This alone could greatly increase the amount of sheet metal needed as well as increase the mechanical load on the building causing an increase in mechanical equipment size.

The last factor is the electrical system of the building. RS Means does include an emergency generator and UPS system in the estimate but the actual emergency generator in the building is twice the size and there are three of them. Secondly there are extra substations being provided in the building to create redundancy that are probably not accounted for in the RS Means estimate. Lastly the low voltage systems of the building are much more in depth then the RS Means data makes them out to be. Virtua will be running nearly everything on their network and there is a large, expensive telecommunication system to go with it.

D4 vs. RS Means

In this particular case the D4 estimate was more accurate when attempting to do a rough estimate of the new hospital. The D4 estimate was more accurate because with such a specialized hospital both MEP wise and building enclosure wise the D4 estimate allowed for the averaging of hospitals with similar characteristics where RS Means's only commonality between buildings is the buildings function and Superstructure. Because of this D4 was the more accurate estimating method in this case.

Site Plan of Existing Conditions

Please see Appendix E for the site plan of existing conditions.

The site for the Voorhees Replacement Facility is located in Voorhees, New Jersey located between Dutchtown Road and Route 73. There are no buildings immediately surrounding the site that would constrain any construction operations. In Figure 3 one can see the location of the new hospital. The dotted red line indicates the property boundary.

Figure 3 (Courtesy of Google Maps)

LOCAL CONDITIONS

Since this is a private project, the preferred method of construction is really defined by an owner's needs and wants. In the case of Virtua Health (owner) they knew that they didn't want just low bid. They wanted to select each company involved with the management and design of the project that would provide the best value, a combination of both cost and healthcare experience.

Since the site as explained earlier is very large and does not have any restrictions due to proximity to other buildings, site parking was able to be provided for all trades. After the site was prepared the base build of the main hospital parking lot was put down so that subcontractors could set up their trailers and have space to park.

Currently the project is not seeking LEED certification but Turner has made an effort to ensure that all trash leaving the project is sorted and materials that are able to be recycled are done so properly.

Over the course of June 2006, Virtua hired a geo-technical engineer to run tests to determine the soil conditions of the site. A sample copy of one test location can be viewed in Appendix F. From the geo-technical report it was found that in depths up to 35 feet the soil was only made up of sand and silts. Due to this discovery it was the recommendation of the geo-technical engineer to provide ground improvements under the entire building pad to mitigate potential for excessive settlements during a seismic event. The ground solution that was recommended was the installation of stone columns described earlier in tech 1.

From the geo-technical report it was also reported that groundwater showed up an average of about 8 feet below the surface. This discovery required dewatering during the stone column installation as described earlier in tech 1.

CLIENT INFORMATION

Virtua Health is a non-profit organization employing about 7,900 clinical and administrative personnel and over 1,800 physicians as medical staff members. Virtua consists of four hospitals: Virtua Memorial, Berlin, Marlton and Voorhees. Virtua delivers nearly 7,600 babies a year, more then any other healthcare organization in its region. Virtua's hospitals also provide the latest technology and treatments for all types of cancer.

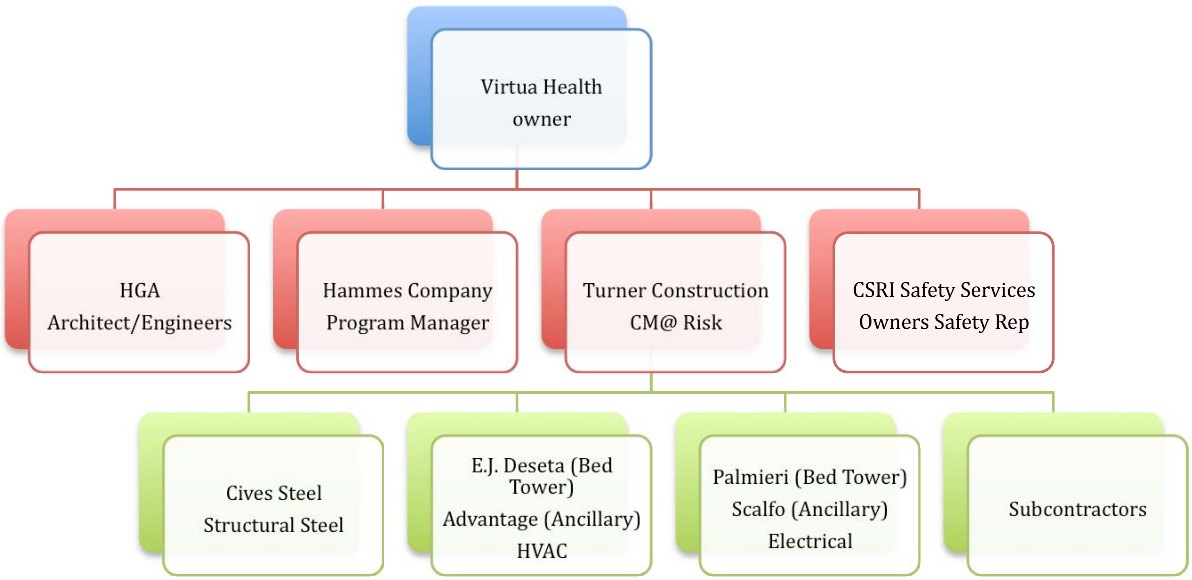
Currently Virtua owns a hospital located in the same town, Voorhees, NJ that has reached its capacity and does not have space to accommodate the growing needs of the community. The current hospital was also designed on outdated technology and is not able to implement future technology along with Virtua's new and improved workflow plan.

Virtua's vision for the new Voorhees Replacement Facility is to create a warm and comfortable environment that promotes positive human interaction through personalized service and enhances healing through the use of light, space and the application of the advanced technology being showcased in the new hospital.

Since this is a new hospital there is no phased occupancy requirements that Virtua has. However with the opening of the replacement facility all patients of the existing hospital will be transported to the new hospital. This creates an emphasis on completing construction on time. Virtua wanted a fast-tracked schedule and in order to get the 3-year construction schedule started as soon as possible steel and foundation packages were issued long before the rest of the design was complete.

The key to completing the Voorhees Replacement Facility on time is to manage the subcontractors efficiently. With such a large volume project it is easy to have setbacks due to subcontractors getting in the way of one another due to the excessive number of workers on site at any time. This with a combination of proper engineering and project management will ensure that Turner can deliver the hospital on time to Virtua.

PROJECT DELIVERY SYSTEM



The Voorhees Replacement Facility is being delivered using the traditional design-bid-build approach. Virtua Health hired each company using the "best value" approaching meaning they took into account both price and experience when selecting each company they hold contracts with. As seen above in the organizational chart Virtua holds contracts with the A/E, Program Manager, Construction Manager, and their Safety Rep. Virtua also holds other contracts such as their medical equipment planner and food service consultant however the 4 companies shown in the chart are the main players during construction. The contract that Virtua holds with Turner Construction is a GMP contract which means that Turner has guaranteed that per the drawings given to them they can do the work for no more then their bid price.

Since Turner Construction is acting as a CM@ Risk, they hold all the subcontractor contracts. Turner, like Virtua did not just select their subcontractors by low price but used their prequalification system to select the right subcontractor for each bid package. The contract type between Turner and all of the subcontractors is a GMP contract. Since the project is utilizing BIM to do MEP coordination one of important contract terms to note is that all the subcontractors that are used in the coordination process are required to submit and update a 3D model so that Turner can utilize 3D coordination.

Lastly it is important to note that Virtua holds an OCIP on this particular project. An OCIP is an Owner Controlled Insurance Program and provides insurance to all participants on the project have insurance coverage. An advantage to having an OCIP is it allows for both the owner and the construction manager to hire the best subcontractors for the project without having to worry about the availability of insurance coverage for any subcontractor. Having an OCIP also reduces the cost of the project for the owner as well as reduces the number of claims.

STAFFING PLAN

Please see Appendix G for a copy of the staffing plan.

The Staffing plan of Turner Construction for the Voorhees Replacement Facility is set up like any large construction project. One can see from the staffing plan in Appendix F, Senior Project Manager Bill Swanson is the highest up full time employee on site. Under Bill comes the Project Engineers and the Superintendents.

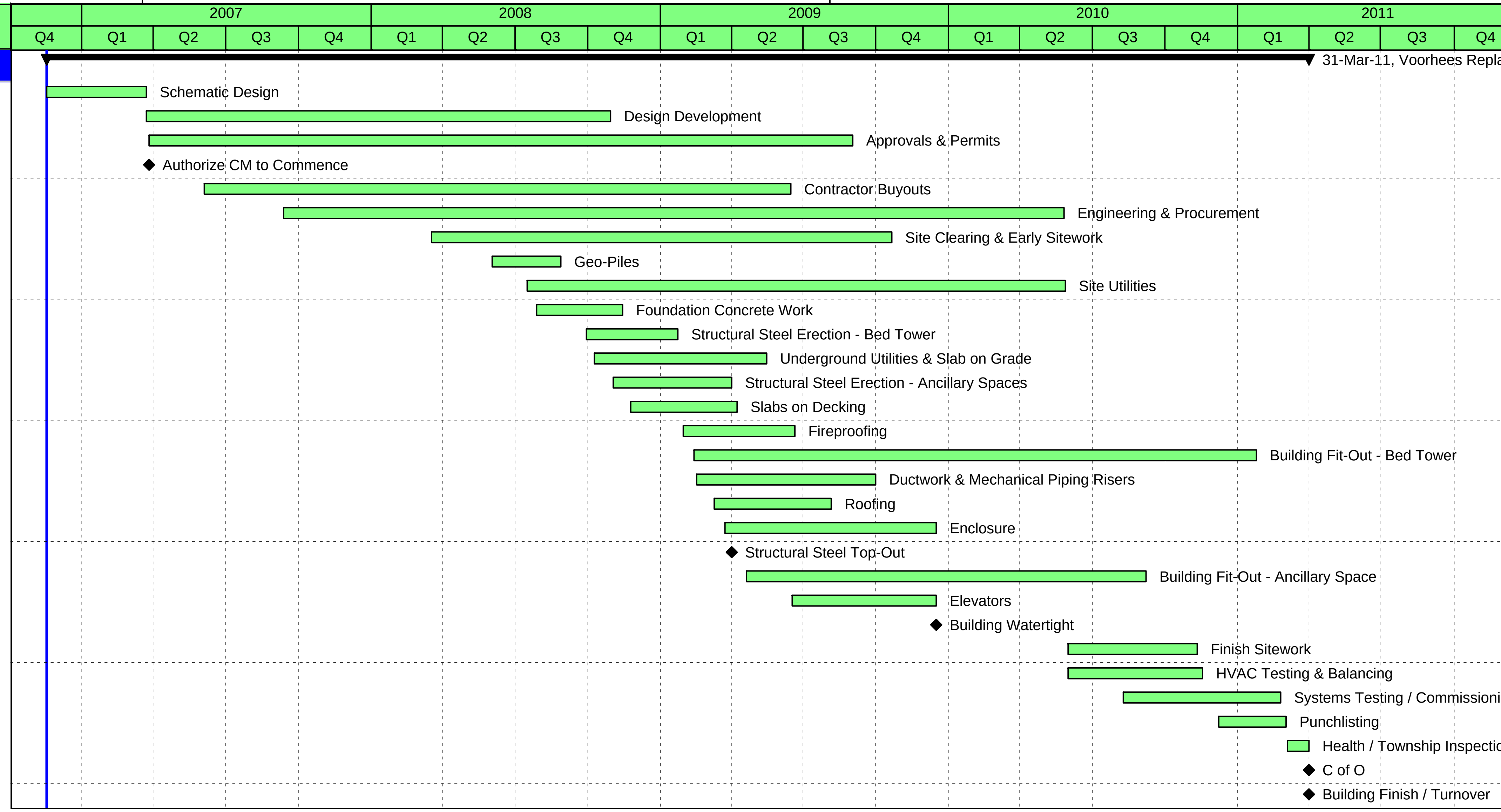
To make the workload on the Superintendents manageable the building was split into 2 different areas, the bed tower building and ancillary building. A Superintendent was placed in charge of each of these areas and given Assistant Superintendents and Field Engineers to work under them. Separately there is a Superintendent in charge of MEP over the entire hospital who also has Assistant Superintendents working under him.

The site office is an existing house that was purchased with the property. This allowed Turner to have all utilities already provided and made their mobilization easier.

Appendix A

Primavera Schedule Summary

Activity Name	Original Duration	Start	Finish
Voorhees Replacement F	1136	17-Nov-06	31-Mar-11
Schematic Design	87	17-Nov-06	23-Mar-07
Design Development	420	23-Mar-07	30-Oct-08
Approvals & Permits	636	26-Mar-07	31-Aug-09
Authorize CM to Commence	0	26-Mar-07	
Contractor Buyouts	531	04-Jun-07	15-Jun-09
Engineering & Procurement	706	12-Sep-07	26-May-10
Site Clearing & Early Sitework	417	17-Mar-08	20-Oct-09
Geo-Piles	63	03-Jun-08	28-Aug-08
Site Utilities	487	17-Jul-08	28-May-10
Foundation Concrete Work	79	29-Jul-08	14-Nov-08
Structural Steel Erection - Bed Tower	85	29-Sep-08	23-Jan-09
Underground Utilities & Slab on Gra	156	10-Oct-08	15-May-09
Structural Steel Erection - Ancillary S	108	03-Nov-08	01-Apr-09
Slabs on Decking	97	24-Nov-08	07-Apr-09
Fireproofing	102	29-Jan-09	19-Jun-09
Building Fit-Out - Bed Tower	508	12-Feb-09	24-Jan-11
Ductwork & Mechanical Piping Risers	163	16-Feb-09	30-Sep-09
Roofing	107	10-Mar-09	05-Aug-09
Enclosure	191	24-Mar-09	15-Dec-09
Structural Steel Top-Out	0		01-Apr-09
Building Fit-Out - Ancillary Space	362	20-Apr-09	07-Sep-10
Elevators	131	17-Jun-09	16-Dec-09
Building Watertight	0		15-Dec-09
Finish Sitework	117	01-Jun-10*	10-Nov-10
HVAC Testing & Balancing	122	01-Jun-10*	17-Nov-10
Systems Testing / Commissioning	144	09-Aug-10*	24-Feb-11
Punchlisting	62	08-Dec-10*	03-Mar-11
Health / Township Inspections	20	04-Mar-11*	31-Mar-11
C of O	0		31-Mar-11
Building Finish / Turnover	0		31-Mar-11



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

Appendix B

Breakdown of Actual Costs by Bid Package

BID PACKAGE SUMMARY REPORT

Bid Package	681,395 Total	Subcontractor Name
BP01 Structural Steel	25,466,126	Cives Steel Company
BP02 Sitework	13,054,422	Haines & Kibblehouse
BP04 Site Concrete	W/ BP09	Molly Construction Company
BP05 Site Electric	762,648	Carr & Duff
BP06 Soil Improvements	6,393,024	Hayward & Baker
BP07 Concrete Foundations and Slab-on-Grade	5,550,159	Mega Construction Company
BP08 Superstructure Concrete	5,760,715	B. Pietrini & Sons
BP09 Masonry	7,313,191	Molly Construction Company
BP11 Metal Fabrications	2,983,654	Central Metals
BP12 Expansion Joint Covers and Slab Edge Firestopping	973,719	Struc-tite Restoration, Inc.
BP13 Exterior Backup Wall	6,463,399	Philadelphia D&M, Inc.
BP14 Carpentry and Drywall: Ancillary Building	10,169,955	Dale Construction Company
BP15 Carpentry and Drywall: Bed Tower	11,507,735	Thomas Building Group
BP17 Millwork and Finish Carpentry	7,404,340	Legere Group, Ltd.
BP18 Lab, Metal and Pharmacy Casework	628,142	Dancker, Sellew & Douglas
BP19 Spray Fireproofing	2,073,575	Philadelphia Fireproofing, Inc.
BP20 Phenolic Panels	2,142,256	Philadelphia D&M, Inc.
BP21 Waterproofing	W/ BP22	Hamada, Inc.
BP22 Roofing and Waterproofing	5,089,076	Hamada, Inc.
BP23 Louvers and Insulated Metal Panels	5,735,013	AC Dellovade
BP24 Caulking	628,652	Struc-tite Restoration, Inc.
BP25 Doors, Frames and Hardware	2,577,646	Tru-fit Frame & Door Company
BP26 Interior Glass and Glazing	2,884,416	National Glass & Metal Compnay
BP26A Plastic Screen Wall	265,000	Sign Spec, Inc.
BP27 Windows, Storefronts and Curtainwall Systems	10,376,859	National Glass & Metal Company
BP29 Ceramic Tile	1,862,172	Roman Mosaic & Tile
BP30 Carpet and Resilient Flooring	3,210,754	Commerical Flooring
BP31 Specialty Flooring	11,228	Speciality Flooring
BP32 Painting and Special Coatings	1,417,567	Hispanic Ventures
BP33 Acoustic Wall Panels	W/ BP14	Dale Construction Company
BP34 Specialties	1,779,890	Material Distributors
BP35 Wall Protection	1,068,210	Dale Construction Company
BP36 Lockers	386,393	Material Distributors
BP37 Window Treatment	245,384	Kay & Sons
BP38 Raised Access Floors	49,814	ARI Products
BP39 Operable Folding Partitions	39,814	Modernfold/Styles, Inc.
BP40 Food Service Equipment	2,000,473	Singer Equipment Company
BP41 Loading Dock Equipment and Overhead Doors	155,560	Modern Handling Equipment (Loading Dock) & Precisions Door Co (OH doors)
BP42 RF Shielding	129,118	TBD
BP43 Pneumatic Tube Systems	730,809	Swisslog Translogic
BP44 Chutes	139,385	March, Inc.
BP45 Special Construction and Allowances		
BP46 Elevators	5,479,162	Quality Elevator
BP47 Fire Protection	3,239,800	Majek Fire Protection
BP48 Plumbing, HVAC Piping and Medical Gas	43,094,153	Falasca Mechanical
BP49 Underground Plumbing	W/ BP48	Falasca Mechanical
BP50 Medical Gas	W/ BP48	Falasca Mechanical
BP51 HVAC Piping	W/ BP48	Falasca Mechanical
BP52 HVAC Sheetmetal: Ancillary Building	9,607,657	Advantage/ADS, JV
BP53 HVAC Sheetmetal: Bed Tower	6,413,759	E.J. Deseta Company, Inc.

Turner

BID PACKAGE SUMMARY REPORT

Bid Package	681,395 Total	Subcontractor Name
BP54 Testing and Balancing	551,268	Fisher Balancing
BP55.1 Equipment Vendor: Cooling Towers	436,747	Turner Logistics
BP55.2 Equipment Vendor: Chillers	761,500	Turner Logistics
BP55.3 Equipment Vendor: Air Handlers	2,662,145	Turner Logistics
BP55.4 Equipment Vendor: Boilers	1,653,234	Turner Logistics
BP55.5 Equipment Vendor: VFD's	323,388	Turner Logistics
BP55.6 Equipment Vendor: Plumbing Fixtures	W/ BP48	Turner Logistics
BP56 ATC System	2,822,186	Johnson Controls
BP57 Electrical Core and Shell	11,271,176	Scalfo Electric, Inc.
BP58 Electrical Fitout: Bed Tower	11,906,034	R. Palmieri & Sons
BP59 Electrical Fitout: Ancillary Building	12,588,559	Petrocelli Electric Co., Inc.
BP60 Security, CCTV, Nurse Call, Paging	5,816,125	Johnson Controls
BP61 Tele/Data	4,005,540	Johnson Controls
BP62 Fire Alarm	3,183,960	Johnson Controls
BP63 Generator and ATS Supplier	2,766,238	Turner Logistics
BP64 Electrical Gear Supplier	1,918,066	Turner Logistics
BP65 UPS Equipment Supplier	W/ BP63	Turner Logistics
BP66 Lighting Fixture Vendor	3,663,350	Turner Logistics
BP67 Landscaping and Irrigation	2,918,683	Bustleton
BP68 Fences and Pergola	342,899	Delaware Valley Designers
BP69 Traffic Signals	NIC	
BP70 Roadway Improvements	NIC	
BP73 Garden Roof	W/ BP22	
BP98 General Requirements	7,617,616	
BP99 Miscellaneous Insurance	87,603	
TOTAL DIRECT COSTS	**294,561,141**	
GC'S/INSURANCE/CONTINGENCY/FEE	28,512,794	
TOTAL CONSTRUCTION COST	**323,073,935**	

Turner

Appendix C

D4 Statement of Probable Cost

Statement of Probable Cost

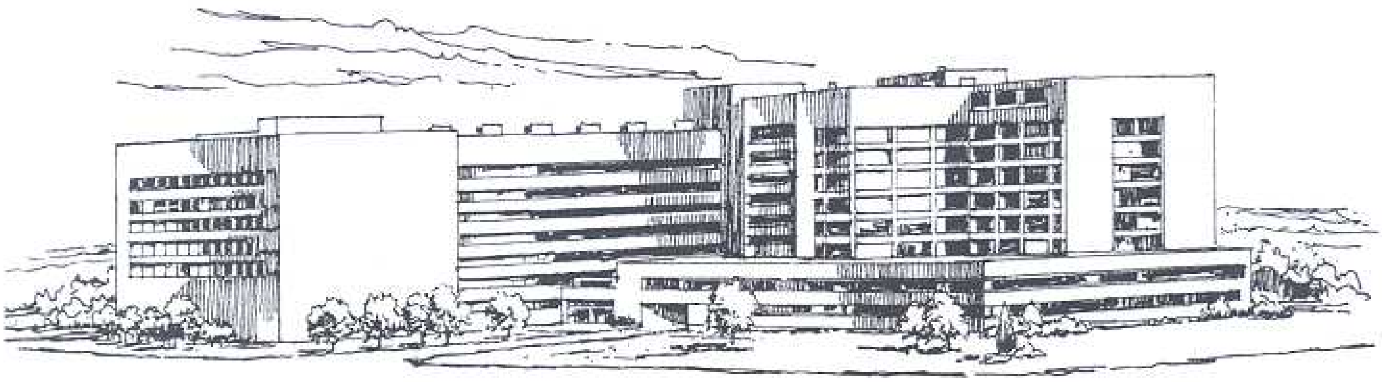
Voorhees Replacement Hospital - Sep 2009 - NJ - Camden

Prepared By:		Prepared For:	
	,		,
	Fax:		Fax:
Building Sq. Size:	675000	Site Sq. Size:	1494108
Bid Date:		Building use:	Medical
No. of floors:	8	Foundation:	
No. of buildings:		Exterior Walls:	
Project Height:		Interior Walls:	
1st Floor Height:		Roof Type:	
1st Floor Size:		Floor Type:	
		Project Type:	

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**0.96**	**3.18**	**2,148,032**
	Bidding Requirements	0.96	3.18	2,148,032
01	**General Requirements**	**6.87**	**22.73**	**15,340,790**
	General Requirements	6.87	22.73	15,340,790
02	**Site Work**	**6.61**	**21.88**	**14,772,339**
	Site Work	6.61	21.88	14,772,339
03	**Concrete**	**10.26**	**33.95**	**22,915,926**
	Concrete	10.26	33.95	22,915,926
04	**Masonry**	**2.88**	**9.53**	**6,434,851**
	Masonry	2.88	9.53	6,434,851
05	**Metals**	**6.76**	**22.37**	**15,097,100**
	Metals	6.76	22.37	15,097,100
06	**Wood & Plastics**	**2.38**	**7.88**	**5,321,922**
	Wood & Plastics	2.38	7.88	5,321,922
07	**Thermal & Moisture Protection**	**3.53**	**11.69**	**7,893,641**
	Thermal & Moisture Protection	3.53	11.69	7,893,641
08	**Doors & Windows**	**5.78**	**19.12**	**12,906,624**
	Doors & Windows	5.78	19.12	12,906,624
09	**Finishes**	**10.83**	**35.84**	**24,190,808**
	Finishes	10.83	35.84	24,190,808
10	**Specialties**	**1.09**	**3.62**	**2,444,160**
	Specialties	1.09	3.62	2,444,160
11	**Equipment**	**1.20**	**3.98**	**2,687,665**
	Equipment	1.20	3.98	2,687,665
12	**Furnishings**	**1.20**	**3.96**	**2,674,340**
	Furnishings	1.20	3.96	2,674,340
13	**Special Construction**	**0.55**	**1.80**	**1,217,958**
	Special Construction	0.55	1.80	1,217,958
14	**Conveying Systems**	**1.80**	**5.95**	**4,018,570**
	Conveying Systems	1.80	5.95	4,018,570
15	**Mechanical**	**24.33**	**80.52**	**54,351,458**
	Mechanical	24.33	80.52	54,351,458
16	**Electrical**	**12.96**	**42.87**	**28,939,874**
	Electrical	12.96	42.87	28,939,874
Total Building Costs		**100.00**	**330.90**	**223,356,057**

Appendix D

RS Means Data Sheets



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	280.75	277.00	274.45	268.85	267.35	266.20	265.20	264.40	263.85
	R/Conc. Frame	281.35	277.50	274.85	269.25	267.70	266.50	265.50	264.70	264.10
Face Brick with Concrete Block Back-up	Steel Frame	275.25	271.65	269.25	264.45	263.05	262.00	261.10	260.30	259.75
	R/Conc. Frame	276.00	272.40	269.95	265.15	263.75	262.70	261.80	261.05	260.50
Precast Concrete Panels With Exposed Aggregate	Steel Frame	276.05	272.40	269.95	265.00	263.65	262.55	261.60	260.85	260.30
	R/Conc. Frame	276.80	273.15	270.70	265.75	264.35	263.25	262.30	261.60	261.00
Perimeter Adj., Add or Deduct	Per 100 L.F.	4.65	3.70	3.10	2.60	2.30	2.00	1.85	1.75	1.50
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	2.10	1.90	1.90	1.55	1.45	1.40	1.45	1.45	1.35
For Basement, add $ 33.95 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 $ 164.90 to $ 402.10 per S.F.

Common additives

Description	Unit	$ Cost
Cabinets, Base, door units, metal	L.F.	256
Drawer units	L.F.	505
Tall storage cabinets, 7' high, open	L.F.	480
With doors	L.F.	565
Wall, metal 12-1/2" deep, open	L.F.	192
With doors	L.F.	345
Closed Circuit TV (Patient monitoring)		
One station camera & monitor	Each	1850
For additional camera add	Each	1000
For automatic iris for low light add	Each	2600
Hubbard Tank, with accessories		
Stainless steel, 125 GPM 45 psi	Each	27,600
For electric hoist, add	Each	3000
Mortuary Refrigerator, End operated		
2 capacity	Each	13,600
6 capacity	Each	24,500
Nurses Call Station		
Single bedside call station	Each	310
Ceiling speaker station	Each	143
Emergency call station	Each	192
Pillow speaker	Each	296
Double bedside call station	Each	385
Duty station	Each	325
Standard call button	Each	169
Master control station for 20 stations	Each	6025
Sound System		
Amplifier, 250 watts	Each	2350
Speaker, ceiling or wall	Each	191
Trumpet	Each	365
Station, Dietary with ice	Each	16,800
Sterilizers		
Single door, steam	Each	166,000
Double door, steam	Each	213,500
Portable, counter top, steam	Each	3975 - 6225
Gas	Each	41,200
Automatic washer/sterilizer	Each	57,000

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

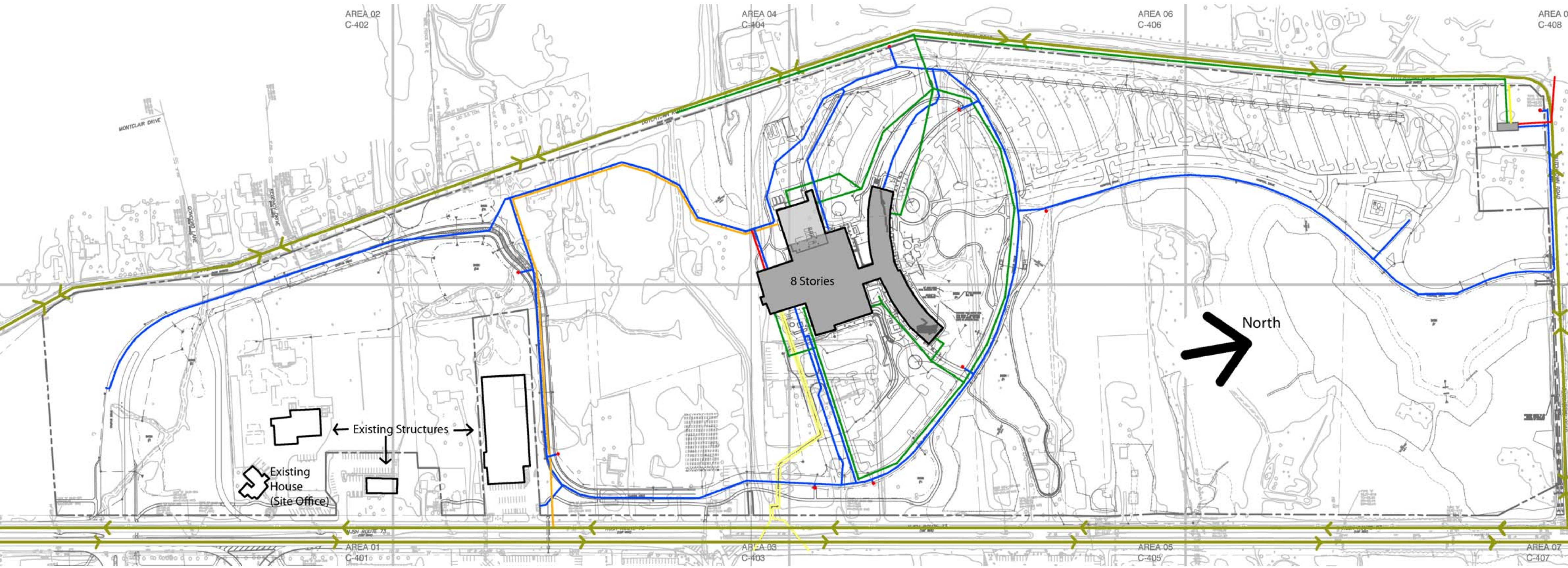
Hospital, 4-8 Story

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings		S.F. Ground	14.46	2.41	2.0%
1020	Special Foundations	N/A		—	—	—	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	7.29	1.22	
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing		S.F. Ground	.17	.03	
2020	Basement Walls	4' foundation wall		L.F. Wall	78	.34	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Concrete slab with metal deck and beams, steel columns		S.F. Floor	23.48	19.57	10.9%
1020	Roof Construction	Metal deck, open web steel joists, beams, interior columns		S.F. Roof	10.44	1.74	
	B20 Exterior Enclosure						
2010	Exterior Walls	Face brick and structural facing tile	70% of wall	S.F. Wall	43.99	9.60	7.0%
2020	Exterior Windows	Aluminum sliding	30% of wall	Each	552	3.45	
2030	Exterior Doors	Double aluminum and glass and sliding doors		Each	5115	.72	
	B30 Roofing						
3010	Roof Coverings	Built-up tar and gravel with flashing; perlite/EPS composite insulation		S.F. Roof	7.14	1.19	0.6%
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	7.71	8.57	23.6%
1020	Interior Doors	Single leaf hollow metal	90 S.F. Floor/Door	Each	904	10.03	
1030	Fittings	Hospital curtains		S.F. Floor	.95	.95	
2010	Stair Construction	Concrete filled metal pan		Flight	12,650	1.64	
3010	Wall Finishes	40% vinyl wall covering, 35% ceramic tile, 25% epoxy coating		S.F. Surface	3.36	7.47	
3020	Floor Finishes	60% vinyl tile, 20% ceramic, 20% terrazzo		S.F. Floor	10.20	10.20	
3030	Ceiling Finishes	Plaster on suspended metal lath		S.F. Ceiling	7.44	7.44	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Six geared hospital elevators		Each	215,333	6.46	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	4489	10.79	9.2%
2020	Domestic Water Distribution	Electric water heater		S.F. Floor	6.81	6.81	
2040	Rain Water Drainage	Roof drains		S.F. Floor	3.06	.51	
	D30 HVAC						
3010	Energy Supply	Oil fired hot water, wall fin radiation		S.F. Floor	4.01	4.01	17.8%
3020	Heat Generating Systems	Hot water boilers, steam boiler for services		Each	30,475	.38	
3030	Cooling Generating Systems	Chilled water units		S.F. Floor	2.70	2.70	
3050	Terminal & Package Units	N/A		—	—	—	
3090	Other HVAC Sys. & Equipment	Conditioned air with reheat, operating room air curtains		S.F. Floor	27.78	27.78	
	D40 Fire Protection						
4010	Sprinklers	Wet pipe sprinkler system		S.F. Floor	2.29	2.29	1.4%
4020	Standpipes	Standpipe		S.F. Floor	.49	.49	
	D50 Electrical						
5010	Electrical Service/Distribution	4000 ampere service, panel board and feeders		S.F. Floor	4.17	4.17	14.7%
5020	Lighting & Branch Wiring	High efficiency hospital grade light fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	18.32	18.32	
5030	Communications & Security	Addressable alarm systems, internet wiring, communications system, emergency lighting		S.F. Floor	2.20	2.20	
5090	Other Electrical Systems	Emergency generator, 800 kW with fuel tank, uninterruptible power supply		S.F. Floor	4.17	4.17	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		—	—	—	9.4 %
1020	Institutional Equipment	Medical gases, curtain partitions		S.F. Floor	14.75	14.75	
1030	Vehicular Equipment	N/A		—	—	—	
2020	Other Equipment	Patient wall systems		S.F. Floor	3.78	3.78	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		—	—	—	0.0 %
1040	Special Facilities	N/A		—	—	—	
G. BUILDING SITEWORK		**N/A**					
					Sub-Total	196.21	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				25%	49.07	
	ARCHITECT FEES				9%	22.07	
					Total Building Cost	**267.35**	

STATE/ZIP	CITY	Residential	Commercial
MINNESOTA (CONT'd)			
559	Rochester	1.03	1.01
560	Mankato	1.01	.99
561	Windom	.82	.88
562	Willmar	.83	.90
563	St. Cloud	1.06	1.05
564	Brainerd	.96	.97
565	Detroit Lakes	.95	.96
566	Bemidji	.94	.97
567	Thief River Falls	.94	.95
MISSISSIPPI			
386	Clarksdale	.78	.81
387	Greenville	.84	.88
388	Tupelo	.79	.83
389	Greenwood	.80	.82
390-392	Jackson	.85	.87
393	Meridian	.83	.86
394	Laurel	.80	.84
395	Biloxi	.82	.83
396	Mccomb	.77	.81
397	Columbus	.78	.82
MISSOURI			
630-631	St. Louis	1.03	1.03
633	Bowling Green	.95	.94
634	Hannibal	.86	.89
635	Kirksville	.80	.88
636	Flat River	.94	.95
637	Cape Girardeau	.88	.94
638	Sikeston	.82	.88
639	Poplar Bluff	.83	.88
640-641	Kansas City	1.03	1.02
644-645	St. Joseph	.93	.95
646	Chillicothe	.87	.84
647	Harrisonville	.96	.96
648	Joplin	.83	.85
650-651	Jefferson City	.87	.92
652	Columbia	.87	.93
653	Sedalia	.85	.90
654-655	Rolla	.87	.85
656-658	Springfield	.87	.89
MONTANA			
590-591	Billings	.88	.90
592	Wolf Point	.84	.89
593	Miles City	.86	.88
594	Great Falls	.89	.91
595	Havre	.82	.89
596	Helena	.88	.90
597	Butte	.87	.90
598	Missoula	.85	.88
599	Kalispell	.83	.87
NEBRASKA			
680-681	Omaha	.91	.91
683-685	Lincoln	.87	.89
686	Columbus	.87	.88
687	Norfolk	.91	.90
688	Grand Island	.92	.91
689	Hastings	.93	.92
690	Mccook	.85	.88
691	North Platte	.92	.92
692	Valentine	.85	.88
693	Alliance	.85	.87
NEVADA			
889-891	Las Vegas	1.03	1.06
893	Ely	.85	.88
894-895	Reno	.93	.97
897	Carson City	.94	.97
898	Elko	.91	.90
NEW HAMPSHIRE			
030	Nashua	.94	.94
031	Manchester	.94	.94
032-033	Concord	.92	.92
034	Keene	.75	.78
035	Littleton	.81	.81
036	Charleston	.74	.76
037	Claremont	.75	.76
038	Portsmouth	.93	.94
NEW JERSEY			
070-071	Newark	1.12	1.10
072	Elizabeth	1.14	1.08
073	Jersey City	1.10	1.08
074-075	Paterson	1.11	1.09
076	Hackensack	1.10	1.08
077	Long Branch	1.11	1.07
078	Dover	1.11	1.08
079	Summit	1.11	1.08
080,083	Vineland	1.08	1.05
081	Camden	1.09	1.06
082,084	Atlantic City	1.11	1.05
085-086	Trenton	1.10	1.07
087	Point Pleasant	1.09	1.07
088-089	New Brunswick	1.11	1.08
NEW MEXICO			
870-872	Albuquerque	.85	.90
873	Gallup	.85	.90
874	Farmington	.85	.90
875	Santa Fe	.86	.91
877	Las Vegas	.85	.89
878	Socorro	.85	.89
879	Truth/Consequences	.84	.87
880	Las Cruces	.83	.85
881	Clovis	.85	.88
882	Roswell	.85	.89
883	Carrizozo	.85	.90
884	Tucumcari	.86	.89
NEW YORK			
100-102	New York	1.37	1.31
103	Staten Island	1.31	1.27
104	Bronx	1.33	1.26
105	Mount Vernon	1.14	1.14
106	White Plains	1.17	1.14
107	Yonkers	1.18	1.17
108	New Rochelle	1.18	1.14
109	Suffern	1.13	1.09
110	Queens	1.31	1.27
111	Long Island City	1.34	1.28
112	Brooklyn	1.35	1.28
113	Flushing	1.33	1.28
114	Jamaica	1.33	1.27
115,117,118	Hicksville	1.20	1.20
116	Far Rockaway	1.32	1.28
119	Riverhead	1.21	1.21
120-122	Albany	.94	.96
123	Schenectady	.95	.97
124	Kingston	1.02	1.06
125-126	Poughkeepsie	1.19	1.12
127	Monticello	1.04	1.06
128	Glens Falls	.88	.92
129	Plattsburgh	.92	.92
130-132	Syracuse	.96	.96
133-135	Utica	.94	.94
136	Watertown	.93	.96
137-139	Binghamton	.93	.93
140-142	Buffalo	1.04	1.02
143	Niagara Falls	1.00	.99
144-146	Rochester	.96	.97
147	Jamestown	.87	.90
148-149	Elmira	.85	.91
NORTH CAROLINA			
270,272-274	Greensboro	.83	.79
271	Winston-Salem	.83	.79
275-276	Raleigh	.84	.80
277	Durham	.83	.80
278	Rocky Mount	.73	.74
279	Elizabeth City	.75	.75
280	Gastonia	.84	.78
281-282	Charlotte	.85	.80
283	Fayetteville	.82	.81
284	Wilmington	.81	.77
285	Kinston	.74	.73
286	Hickory	.78	.75
287-288	Asheville	.81	.78
289	Murphy	.73	.71
NORTH DAKOTA			
580-581	Fargo	.78	.85
582	Grand Forks	.75	.82
583	Devils Lake	.78	.82
584	Jamestown	.73	.79
585	Bismarck	.78	.85

Appendix E

Site Plan of Existing Conditions



Site Plan of Existing Conditions

Scale: NTS

LEGEND

Water Lines

Electrical, Telephone, Cable Lines

Sanitary Sewer Lines

Gas Lines

Fire Lines

Traffic Flow

Property Line

Fire Hydrants

Steven Farrah

Technical Assignment #1

Voorhees Replacement Hospital

Voorhees, NJ

Appendix F

Boring Sample Report

Log of Test Boring

Lippincott & Jacobs Consulting Engineers
One Pavilion Avenue, Riverside, NJ 08075

Project No. 12680-100-12
Date: 06-05-06

Plate No. 1 of 116
Boring No. B-1
Sheet 1 of 2

Project: Final Investigation - Replacement Facility
Client: Virtua Health
Surface Elev. 113.6±
Location: SR-73 & Dutchtown Road - Voorhees, NJ
Drill Method: Hollow Stem Auger ID 4.25"
Casing ID
Grouted ☒ Date 06-05-06

Groundwater Data
Depth: 8.0 ft
Date: 06-05-06
Time: End of Boring

Depth (ft.)	Sample Type	Sample Number	Blow Count (Blows per 6 inches)	Lithology	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
0		S-1	2-2-2-2		Brown medium-fine SAND, little Silt	MS		
		S-2	3-2-4-4		Orange brown coarse-fine SAND, little Silt			
5		S-3	4-4-5-7					
		S-4	6-7-7-7		Orange brown coarse-fine SAND, little medium-fine Gravel, little Silt			
		S-5	5-5-5-6		Orange brown medium-fine SAND, some Silt, trace fine Gravel			
10								
					Orange brown coarse-fine SAND, some Silt			
		S-6	9-13-9-8					
15								
					Orange brown medium-fine SAND, some Silt			
		S-7	2-2-3-2					
20								
		S-8	3-2-4-4					
25								
					Gray fine SAND, little Silt			
		S-9	5-9-13-14					
30								
					Dark gray fine SAND and SILT	M		
		S-10	4-4-4-4					
35								

Inspector ______ Driller E. Blemings Helper D. Powell Equipment CME-55

Appendix G

Turner Staffing Plan

Turner
Building the Future

Proposed Team Organization

Virtua HEALTH