October 4, 2010

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CONSTRUCTION MANAGEMENT

Moore Building Addition & Renovation
University Park, PA 16802

Technical Assignment One

Penn State AE Senior Thesis

Executive Summary

This technical report outlines the major systems, challenges and techniques that will be used to construct the Moore Building Addition and Renovation through its initial phase (named Phase I), which includes the addition of a 57,000sf addition and the renovation of the north wing, which is 16,000SF. The north wing will tie into the existing structure and will be attached using its existing steel structure.

The structure began construction on June 4th 2010, and the intended substantial completion is on November 25th 2011 and will be officially turned over to the owner, the Pennsylvania State University, on December 30th 2011. The structure is a laterally braced, steel structure that wraps around the original north wing of the existing building. The existing building will be underpinned for extra support due to change in load-bearing characteristics. This is explained in more detail in this report along with major milestones, detailed systems descriptions and values attributed to major equipment.

For this building, as with any new building being built on the University Park campus, L.E.E.D. certification is required. The minimum standard for this building in terms of L.E.E.D. is certification, although 34 points have been identified, making the building, as of current standing, qualified for a Silver rating.

The project delivery method is not unusual for projects on the University Park campus, as the Office of Physical Plant oversee a lot of the construction and quality aspects of the project, while also hiring a CM to be liable for performing the work.

Several estimates were produced in this report using D4 Cost estimating software to compare the actual cost of the building with that of a similar project. This turned out to be the most effective method for estimating the cost of the building due to its specialized nature. The next method used was based on RSMeans values for square footage estimates and that was used in a similar fashion to the D4 Cost report, in order to come up with an estimate based on projects that are similar in nature. RSMeans' shortcoming was in its options for similar projects.

Finally, this report focuses on factors including the site, the owner's expectations and factors of the area that may make construction a challenge. This includes a site plan to map out an overall view of what the project will look like and detailed accounts of what is expected of this project as a whole.

Attention will be focused on aspects including scheduling challenges as well as managing the site of construction as they are exceedingly important to the owner and all those involved in the project, in order to make sure it turns out to be a success, as well as meeting the stringent safety concerns of the owner of this project.

Contents

Schedule Summary Narrative

The construction of the Moore building addition consists of removing the original brick façade of the existing building and asbestos abatement of the original structure. This will be done for all floors in the beginning and will allow for the removal of the existing concrete and asphalt on the ground level. The structure and foundation will be done in two sections; West, followed by North and East as one section. This will occur for the basement and first floors since the basement is only on the west side and the first floor consists of slab-on-grade. After the first floor is done, the building will be done together.

The **foundation** will consist of initially demolishing the slabs and areaway walls, after which excavation of the basement location will take place. This will be followed by the underpinning of the existing structure's steel as well as shoring the excavated area. Also, the grade beams of the existing structure will need to be removed before further work can be done. Once this is completed, the foundation of the new building will begin to be poured, as it is cast in place concrete.

The **structural steel** will be erected west to east in sections. This will be followed by the pouring of the deck slabs, which will start in the *west* (levels 1-R) section of the building followed by the *north and east* sections (levels 2-R [due to the different in structure of first floor mentioned in building statistics Construction section]). The final steps will be backfilling the west, followed by the north and east foundation walls and finally the masonry and curtain wall system of the first floor will be put in place.

The **finishing** on the job will be started once each floor is ready for the finishes. This means that once a floor is completed, the finishing crew will begin the process in sections. So, once the track is laid on the first floor, the same crew will start the same process on the floor above, while the stud framing crew are starting their process on the first floor (framing the first floor is from 1 Feb 2011 to 21 Feb 2011, whilst framing the second floor is immediately followed from 22 Feb 2011 to 14 Mar 2011 and so forth). This will continue up until the building is completely finished.

Site finishes and work will occur during the renovation phase (phase II) as well as new sidewalks and landscaping.

SEE APPENDIX A

Figure 1

Building Systems Summary

YES	NO	Work Scope
X		Demolition Required?
X		Structural Steel Frame
X		Cast-in-Place Concrete
	X	Precast Concrete
X		Mechanical System
X		Electrical System
X		Masonry
X		Curtain wall
X		Support of Excavation

Table 1

Demolition

In order for construction to begin demolition must occur at the site of the original structure. This is due to the fact that the Moore Building Addition and Renovation must tie into the old building, and the old building's façade must be removed to allow for this to happen. This will be followed by removal and asbestos abatement of the original building before the new structure can be erected. Another large demolition requirement is the removal of the existing building's asphalt parking lot and concrete walkways, which have to be removed so that excavation can take place. This process suffered two sinkholes occurring during first weeks of construction.

Structural Steel Frame

Moore Building Addition and Renovation consists of a typical structural steel system. The structure consists of a predominantly structural steel system that is cross-braced from north to south and from east to west of the building. The typical structure is followed through from the 2nd to 4th floors, as they are very similar. The first floor and basement and the high roof have a few structural differences than the rest of the building. The cross bracing system includes HSS7x7x.25 from the 3rd floor to the high roof, and HSS8x8x.25 from the basement floor to the 3rd floor, with a few exceptions for some of the pieces. The north side of the building's steel is sloped downward for bracing purposes.

The existing building's north wing's structural system was taken down to its structural steel elements and that will be used and built around as a cost-saving method. It also helps tie in with the existing building.

Although a crane and boom size has not yet been specified, the planned and approved location for a crane will be the north side of the building. However, there is a higher possibility that this will be substituted for two cranes on the east and west sides of the building in order to increase productivity and for safety reasons. This also makes transporting the cranes easier as they are smaller in size.

Cast in Place Concrete

Cast-in-place concrete will be used for the strip footings, spread footings, foundation walls, basement slab, SOG, composite decks from the first floor up to the high roof.

The pouring method that will be used to place the concrete will be pump trucks. Typical formwork will be used for the foundations with plywood and steel used. Also, the wood used will be recycled after the limited number of uses in order to comply with the 70% recycling goal for the project.

Mechanical System

In the basement level of the Moore building are chilled/hot water pumps along with the secondary chilled water pumps, all raised 4" on a concrete pad of their own. Two of the Chilled Water Pumps produce a flow of 905GPM, whilst the last produces a flow of 130GPM. The secondary chilled water pumps' flow is rated at 245GPM and the hot water pumps' flow is rated at 500GPM. There also exists a condensate pressure pump as well as several unit heaters. The Hot water supply and return pipes are capped for future phase II. They are located in the basement as well.

There are two main air handling units. The first is supplying a chilled beam system (19,000CFM AHU 29.85BHP @ 1800RPM) whilst the other is supplying the VAVs in the building (31,000CFM AHU 48.80BHP @ 1800RPM). The building consists of both variable and constant air volume systems. The new AHUs are located in the basement level of the new building. There is an existing AHU in the penthouse of the existing structure as well.

Electrical System

The electrical system is quite sophisticated in Moore Building Addition. The main equipment panel board has a distribution of 3 Phase 480V. The demand on this panel board is 336KVa. Most if the rest of the panel boards are 480Y/277V 3 Phase wiring with some 240Y/120V three and single phase wiring.

Electrical connection is made in manhole #201. Also at manhole #201 is an emergency connection rated at 4160V. A 1000KVA transformer is used with 12.47KV Primary and 480/277V Secondary coils which provides power to the building and is provided by Office of Physical Plant. Main Switchgear has a rating of 42,000 AIC. Also, there are both a standby service voltage switch and standby distribution panels for the addition.

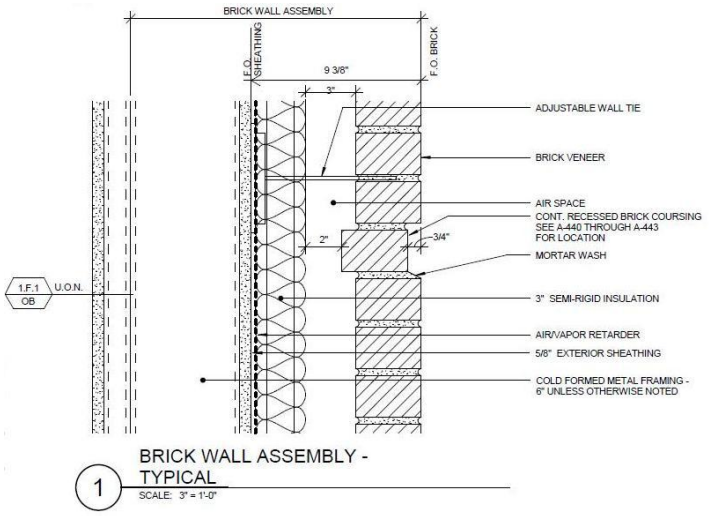


Figure 2

Masonry

The Moore Building Addition and Renovation consists of a brick façade accompanied by glass and aluminum in order to both retain a traditional look as well as to suggest growth and foresight. This means that the brick is a veneer setup as opposed to load-bearing, which it is not. As shown in figure 2 the assembly consists of the brick veneer separated from the insulation by an air space and tied to the building using an adjustable wall tie. The brick is surrounded by both glass and metal panels of aluminum, and although it may seem to cover a lot of surface area, the typical installation is the same throughout the entire façade except for a few special brick types for the edges of the building.

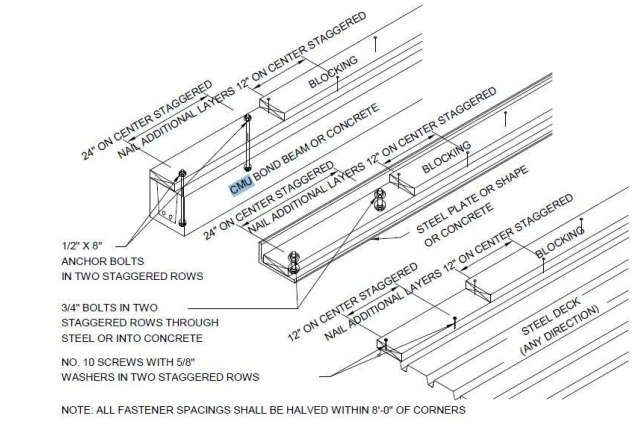


Figure 3

The other instance where masonry used is in the roof assembly where the steel deck meets the edge of the wall and a CMU bond beam can be used for the blocking as shown in figure 3.

Curtain Wall

There is an aluminum curtain wall system that covers most of the first floor. This same curtain wall system is used throughout the façade of the building on the higher levels and is surrounded by glass and brick veneer assemblies, held by mullions. The transition between the lower and higher façades is separated by ornamental metal. The top of the curtain wall system that is held by the mullions is braced for lateral loads, in order to prevent it from being damaged.

Support of Excavation

As support for the excavation shoring will be used to keep the excavated area in place. This process is succeeded by foundation work and, more importantly, the underpinning of the existing structure, which requires care and extra support to keep the existing building from collapsing.

For dewatering systems, there are two standby pumps to remove water should it become a problem. So far, they have not been utilized as there hasn't been a problem with the area in terms of water table. This makes the pumps a safety measure, and they are temporary.

Project Cost Summary

Building Areas	
Addition	57,000 Sq. Ft.
Renovation	16,000 Sq. Ft.
Total Area	73,000 Sq. Ft.

Building Costs	
Construction Cost (CC)	$19,200,000
CC/SF	$263.01/SF
Total Cost (TC)	$26,100,000
TC/SF	$357.53/SF

Building Systems Costs*	
Roofing	$433,170
Curtain Wall	$1,293,556
Asbestos Abatement	$210,365
Excavation, Shoring, Demolition, Concrete, Waterproofing, Landscaping, Site Furnishings, etc.	$1,778,000
Masonry	$314,000
Structural Steel	$1,228,500
Windows, Metal Panels, Curtainwall	$1,283,886
Interior Walls	$3,284,000
Elevator	$361,800
Fire Protection	$288,688
Plumbing	$769,000
HVAC, BAS Controls	3,494,000
Electrical	$1,987,000

*Data obtained from bid results

D4 Cost Estimate

The first part of the cost estimate was created using D4 Cost software. The main issue with this is that there were very few comparable projects in the D4 database. There does not seem to be many other options pertaining to psychology related buildings especially. However, a very similar total cost seems to come up when estimating based on the data from the Biopsychological Sciences Building. The Mental Health Clinic example is used as a second comparison in order to be able to determine the accuracy presented by this type of estimate.

The reason for the similarity in cost when estimating with the Biopschological Sciences Building is that a lot of the functions will likely be similar. The only difference may be the newer equipment that is going to be used in Moore Building. Although this estimate comes up very close, that may simply be a coincidence considering that these buildings are very specialized and cater to a very specific program provided by the owner. Another reason that suggests that the similarity in cost is coincidental is that the mechanical system cost for the actual building is about $4.54 M (including FP and pluming), whereas in the D4 estimate, this cost is over $9 M. The same is the case with the electrical system which is almost tripled as well in the D4 estimate. This shows that the estimate is close to the actual estimate coincidentally.

The following data shows an estimate of the Moore Building Addition based on the comparisons from D4:

D4 Case Number	D4 Case Name	D4 Case Total Cost	D4 Case TC/SF
EU000546	Biopsychological Sciences Building Addition	$28,482,214	$390.18/SF
MD020762	Mental Health Clinic	$19,765,748	$270.76/SF

The following data shows the actual building data for the case studies from D4 Cost software:

D4 Case Number	D4 Case Name	D4 Case Total Cost	D4 Case SF	D4 Case TC/SF
EU000546	Biopsychological Sciences Building Addition	$7,660,300	30,000 SF	$255.34/SF
MD020762	Mental Health Clinic	$3,034,896	16,078 SF	$188.66/SF

SEE APPENDICIES B-C

RS Means Cost Estimate

The second part of the estimate was done using Costworks Software online. The building type was chosen as a medical office because the Moore Building is a Psychology building with laboratories, patient examination rooms, and other specialty rooms that may be similar to those of a medical office, but not as sophisticated as a Hospital. A hospital model was used as a second comparison, and can be seen in the appendix, but will not be talked about further for this comparison.

The estimate has been done with all adjustment factors accounted for, including inflation and location rates. The model also takes into account the different SF of the building along with the perimeter and floor to floor height. The final cost also includes extra equipment, including smoke detectors and elevators, which are the only pieces of information that can be obtained from the drawings at this point in time, as final furniture layouts have not been provided and are not finalized. This means that cabinet materials, sizes, and quantities are not available and could not be added to the estimate. However, these would not bump the price up significantly enough to compensate for the additional ten million dollars that is the difference between the actual cost and the RSMeans estimate.

Also, the RSMeans estimate does not have a model option for a renovation or an addition, nor does it take account for any site work that has to be done. So, this significantly changes the cost due to the difference in site work, demolition, asbestos abatement and other factors that cannot be entered into RSMeans Costworks. Finally, RSMeans does not recommend the parameters entered. This is because the recommended story height is two stories, and the only other option is a one story building, which will not suffice for Moore Building Addition as it is a four story building.

See Appendices D-E for details and assumptions included in the reports

RSMeans CostWorks V. Actual Comparison	
RSMeans Total Project Cost	$15,120,000
RSMeans TC/SF	$207.12/SF
Actual Total Project Cost	$26,100,000
Actual TC/SF	$357.53/SF

In conclusion, D4 Cost software produced a much more reliable result than RSMeans did using CostWorks online software. This is mainly due to the fact that D4 Cost had a more direct comparison to the Moore Building, including the options to say that it is an addition/renovation which requires demolition etc., yet it can still be argued that the D4 Estimate had a factor of luck involved to produce such an accurate result. Whereas the RSMeans estimate had neither a good building to compare to nor did it have an option to select that the building is an addition or renovation or both. The last major factor as to why RSMeans' estimate was so low is that site conditions were not accounted for in the RSMeans estimate and that is a significant cost to the project.

Site Plan of Existing Conditions

The Moore Building Addition lies on the north-east side of the Pennsylvania State University's main campus. Although this area of the campus is less crowded with pedestrian traffic than the core of campus, it still receives some traffic. However, the site is much easier to manage in terms of pedestrians as the buildings here are more sparsely laid out and re-routing is an easier task here. The main construction trailer site will be directly opposite to the project's site. This makes it more convenient for the project managers and personnel. It also provides more space for laydown areas where the "Existing Asphalt Parking Lot and Landscaping" is, as that has been removed and will be used for major laydown for when materials reach the site.

The North Wing of the Moore Building has been intentionally shown as it will be "renovated" as part of the addition phase since it has been stripped to its steel structure and that structure will be incorporated into the addition.

The existing utilities have been shown and most connections will be made in the manholes including electrical connections whose details are contained in the Building Systems Summary portion of this report. There are no gas lines mapped out in this section of campus that are included in the drawings as this building uses steam instead. The boundaries of the site are not defined as the area involved is Penn State owned land. The maximum area of disturbance coincides with the fence lines, and they may be considered "property lines."

Figures 4 and 5 show aerial views of the site of the Moore Building Addition. The construction trailer shown in figure 5 is a temporary site for the duration of the project only.

Figure 4: Bing Map Aerial View

Figure 5: Bing Map Aerial View

Parking for the project workers will be a combination of the parking lot on the west side of the construction trailer site as well as off-site parking (the stadium lots on the east side of campus).

SEE APPENDIX F

Local Conditions

The Moore Building Addition is located on the North-East side of the University Park campus and is part of a construction initiative that aims to better the quality of the facilities at Penn State University as well as expand them. The benefits of construction projects on the University Park campus include the relative leniency with the construction site, availability of laydown areas off-site especially if the project is in an area of high density pedestrian traffic. For the Moore Building Addition the project location is at an advantage.

Building methods at the Pennsylvania State University campus are focused on quality structures that can withstand the cold temperatures as well as the hot temperatures, and typically consist of structural steel for the buildings skeleton. This is mainly due to cost and keeping them down than any other factor alone. This is especially true for this project as there is state-funds (DGS Money) involved so low bidders are chosen for some of the building systems.

Recycling and tipping fees have not yet been established for this project.

The subsurface water condition of the site is typical of what is seen on the University Park campus and although there are standby pumps as a safety measure, excavation is not expected to reach the water table.

Seven test borings were used for the Moore Building Addition and were performed by CMT Labs, inc. and ranged from depths of 36 to 55 feet below grade. A groundwater table was not established during these tests but it was possible that the fluctuation in water tables occur due to change in season. This is why there were standby pumps on site. The surface of the site where the parking lot consists of 6 inches of asphalt which lays on top of gravel subbase that is 6 inches deep as well. The areas not covered in asphalt contain a topsoil layer 6 inches thick, and is organic in nature and is highly compressible. There is also fill material around the site which starts at about 2.5 to 5 feet below grade and consists of clay, gravel and shale fragments. Under all different fills there is a consistent layer of natural residual cohesive soils which include silty clay, sand, gravel and weathered dolomite. This layer extends to depths varying between 20 to 36 feet below grade.

The results conclude that the recommended foundations will be conventional shallow foundations consisting of spread footings as well as continuous wall footings.

Client Information

One of the main reasons of this project is to expand the abilities of Penn State's psychology departments and, in turn, its collective abilities. With the departments of Psychology being one of the largest departments on the University Park Campus and the expected tenure-track faculty number to grow from 42 to 50, the addition will be a fitting one for this department.

"A building that effectively serves the varied research activities of the Department is a central goal of the addition to and remodeling of Moore. This will require different lab sizes and configurations, with an eye toward flexibility to accommodate future changes in faculty and research programs."

--Moore Building Program

As the quote above states, Moore Building Addition will aid in research efforts and help the department grow substantially over the coming years. This is in part due to the fact that cramped space for research and makeshift research areas have strangled the efforts of those here at the department of psychology. This addition plans to provide new facilities that keeps in mind all the needs of the department and has a specific goal in mind to provide more and more to the department.

At the Pennsylvania State University there are people who are very particular about the quality, progress and, most importantly, the safety of all construction projects on their campus. These people range from those at OPP to the board of trustees to the students themselves. The bettering of the campus is an interconnected web of relationships between everyone who shares any experience in or at Penn State.

Safety goes a long way at Penn State and could sometimes be considered the number one factor on many projects; Moore Building Addition is no exception and every effort has and is being made to keep that standard. This is reflected on both the university and the contractor so no chances are taken in this department. A strict selection of pre-qualified companies may even bid. The criteria here include EMR ratings among other things.

Cost of the project, as with any project, is a defining factor as well. This is mainly due to the fact that state funding is being used for the Moore Building Addition and so, a low bidder has to be chosen. This means that although Penn State would like to have the utmost in quality, they are also bound to choosing a low bidder for this job for some of the systems. This is especially true because at the Moore Building there are state of the art communications and laboratories equipment included in the specifications and job requirements. So, a low cost will be favored but quality will also be pursued as that is also part of the job's specifications and Penn State's values as a research institute.

The factors above rely on a trust placed by the owner (PSU) in the companies involved in the project as well as their active participants from OPP ensuring that the project proceeds with as few "hiccups" as possible. There is a mutual responsibility. The building will be turned over and occupied while as soon as it is done and the renovation phase will begin on the existing building in a phased occupancy strategy that allows work to be done in one building while the other is being worked on.

Project Delivery System

The Project delivery system being used on this project is a Design-Bid-Build. This is due to the fact that a design has to be agreed on by the board of trustees as well as the university architect, David Zenghut, before a design can be cleared for building. This process ensures that the university's vision of the campus design and theme can be maintained. Also, a defined program can be achieved with more confidence before building even begins.

This method was also chosen because of the way that construction works on Penn State's campuses; it is overseen by the Office of Physical Plant (OPP), and they have a big hand in keeping costs down as they are an owners representative that is capable of a lot of in-house maintenance and minor construction and act as a much more competent owner side. This cuts costs of tuition, which is another goal for construction on budget.

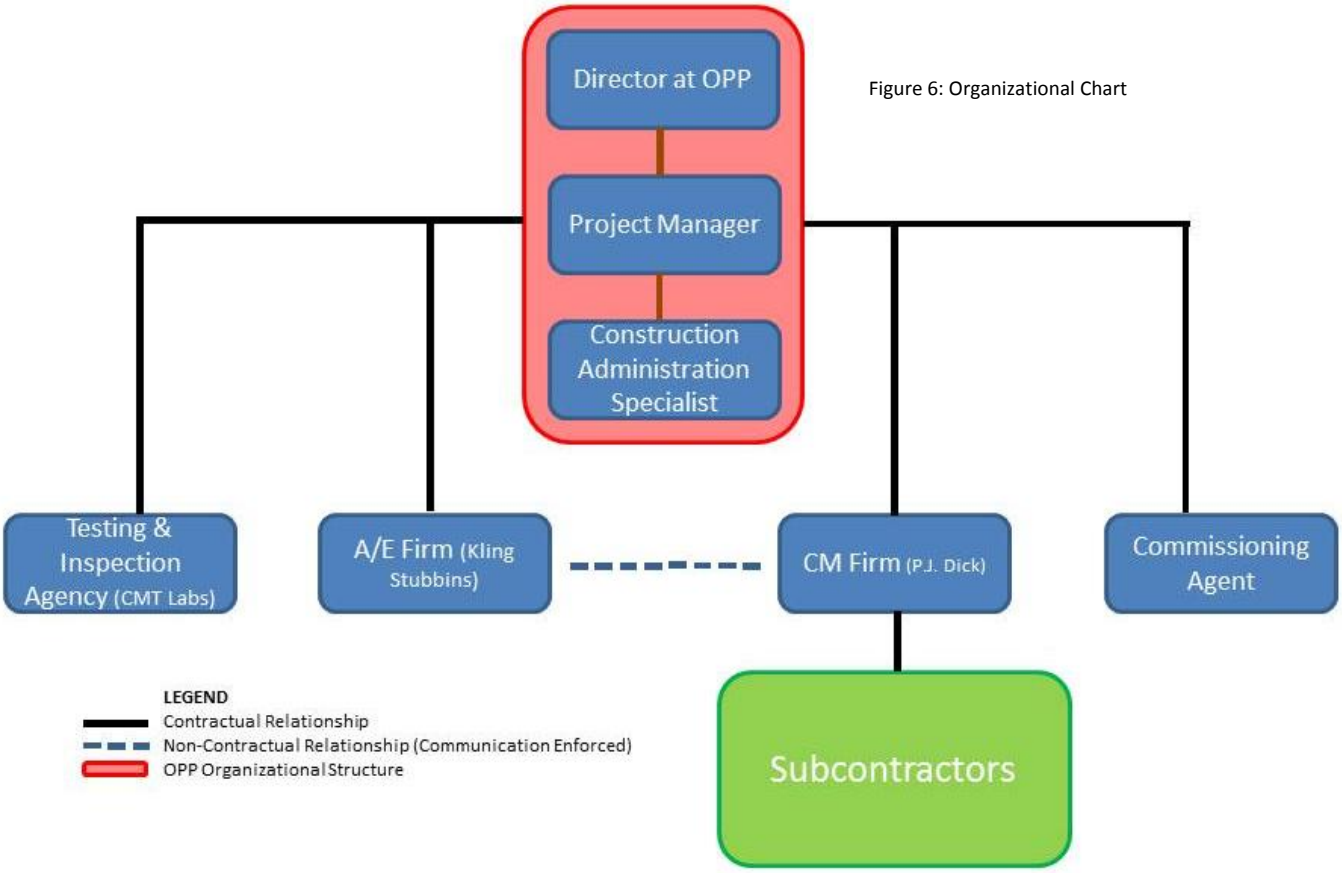


Figure 6: Organizational Chart

Organization structure includes a project manager from OPP, who oversees the Architect/Engineer Firm (Kling Stubbins) as well as the contractor (P.J. Dick) as well as the Geotechnical Firm (CMT) on the project. All these entities are contractually bound to the university and the project manager ensures and facilitates communication between the three. This is done with the project manager's team of in-house engineers at OPP. The main assistant to the OPP project manager is the construction administration

specialist, who oversees the project site and handles RFIs and such, in order to keep a better “flow” on the project.

The contract held by the OPP and the CM firm is a GMP (Guaranteed Maximum Price). The subcontractors hold a lump sum contract with the CM firm, PJ Dick.

The Testing and Inspection agency (CMT Labs) is responsible for a certain degree of quality control assurance including, but not limited to, compaction tests, concrete testing, rebar testing, bolts and welds testing and testing mortar samples in the brick. P.J. Dick, the CM firm holds official contracts between themselves and the subcontractors, and, the bidders for all subcontracting work are pre-qualified to the CM firm’s standards.

Staffing Plan

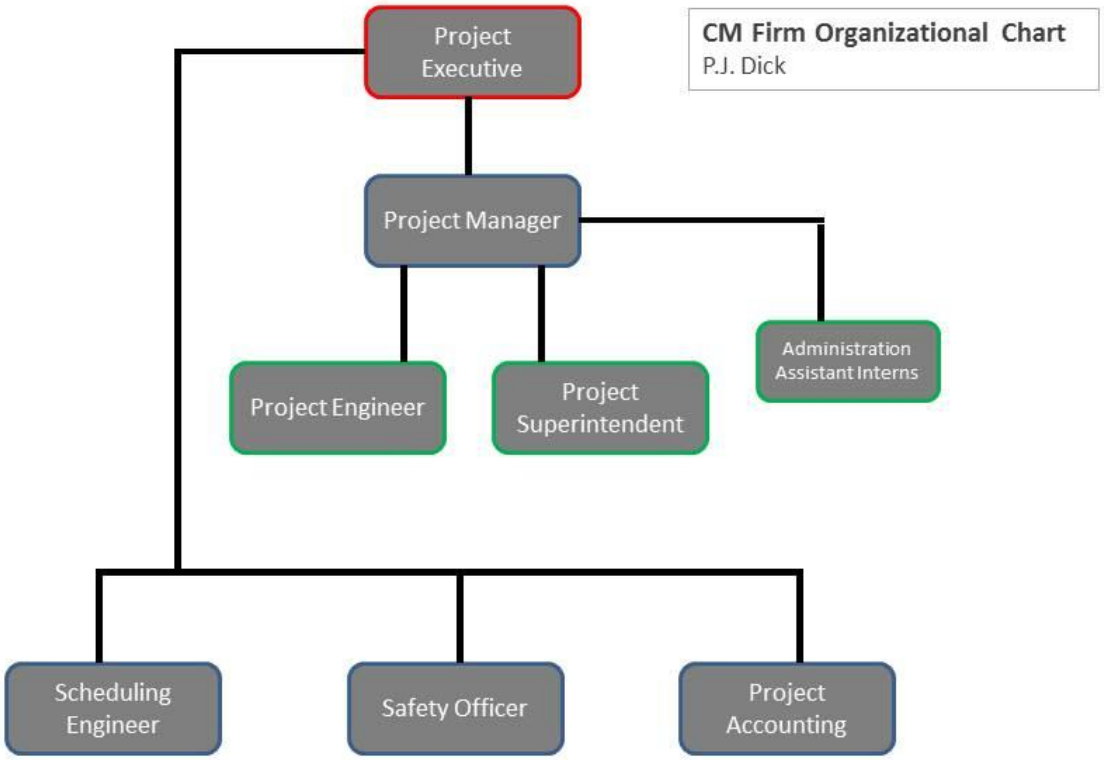


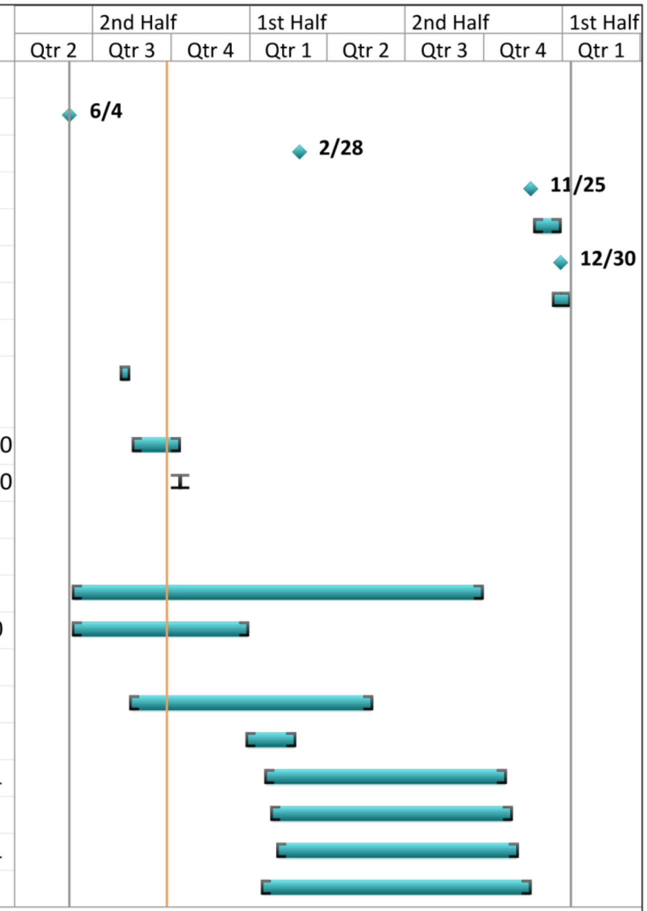
Figure 7: CM Firm Organizational Chart

The staffing plan for P.J. Dick is structured for efficiency. The project manager on this job is the main person communicating with the OPP, and the communication is mainly between the OPP Project Manager, the construction administration specialist at OPP and P.J. Dick's Project Manager. This is not to say that no other communication lines exist. The project Executive handles all major aspects of the project and can report to OPP when necessary, and coordinates communication between his team. This is because he is in charge of more than one project.

There is a meeting held at the OPP on a bi-weekly basis, and this includes the project manager of the CM firm as well as the project manager at OPP and his construction admin specialist. Other attendees to this meeting are the project architect as well as some OPP engineers. Another meeting is held by the OPP construction administration specialist and the CM firm and all its employees on the job. These sets of meetings facilitate all problem solving issues and get things resolved in a more timely manner and induce communication between all parties involved.

Appendix A – Schedule

ID	Task Name	Duration	Start	Finish
1	**Milestones**			
2	Ground Breaking Ceremony	0 days	Fri 6/4/10	Fri 6/4/10
3	Permanent Power	0 days	Mon 2/28/11	Mon 2/28/11
4	Project Substantial Completion	0 days	Fri 11/25/11	Fri 11/25/11
5	Punchlist and Commissioning	25 days	Mon 11/28/11	Fri 12/30/11
6	Project Complete 12-30-11	0 days	Fri 12/30/11	Fri 12/30/11
7	Department of Psychology Move-In	16 days	Tue 12/20/11	Tue 1/10/12
8	**Procurement**			
9	Submit Review & Approve Structural Steel Drawings	10 days	Mon 8/2/10	Fri 8/13/10
10	Fabricate Structural Steel	41 days	Mon 8/16/10	Mon 10/11/10
11	Deliver Structural Steel	1 day	Mon 10/11/10	Mon 10/11/10
12	**Construction**			
13	**Site Work Construction**			
14	Site Work Construction	345 days	Mon 6/7/10	Fri 9/30/11
15	Abatement & Demolition (Existing Structure)	149 days	Mon 6/7/10	Thu 12/30/10
16	**Building Construction**			
17	Foundations and Superstructure	203 days	Fri 8/13/10	Tue 5/24/11
18	Basement Construction	43 days	Mon 12/27/10	Wed 2/23/11
19	1st Floor Finishes	203 days	Tue 1/18/11	Thu 10/27/11
20	2nd Floor Finishes	203 days	Tue 1/25/11	Thu 11/3/11
21	3rd Floor Finishes	203 days	Tue 2/1/11	Thu 11/10/11
22	4th Floor Finishes	226 days	Fri 1/14/11	Fri 11/25/11



Project: Project Schedule Summa
Date: Sun 9/26/10

Task
Split
Milestone
Summary
Project Summary
External Tasks
External Milestone
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Deadline
Progress

Page 1

Appendix B – D4 Cost Estimate 1

Statement of Probable Cost

Moore Buidling Addition - Jun 2010 - PA - State College

Prepared By:	**Mohammad Alhusaini** **PSU** **, 16801** **Fax:**	Prepared For:	**Tech Report 1** **,** **Fax:**
Building Sq. Size:	**73000**	Site Sq. Size:	**13005**
Bid Date:	**1/1/2010**	Building use:	**Commercial**
No. of floors:	**4**	Foundation:	**CAS**
No. of buildings:	**1**	Exterior Walls:	**CUR**
Project Height:	**60**	Interior Walls:	**DRY**
1st Floor Height:	**12.5**	Roof Type:	**BUP**
1st Floor Size:	**18250**	Floor Type:	**CON**
		Project Type:	**ADD/REN**

Division		Percent	Sq. Cost	Amount
02	**Site Work**	**0.00**	**0.00**	**0**
03	**Concrete**	**13.05**	**50.26**	**3,668,951**
	Cast-In-Place	13.05	50.26	3,668,951
04	**Masonry**	**12.40**	**47.75**	**3,485,504**
	Masonry	12.40	47.75	3,485,504
05	**Metals**	**0.72**	**2.76**	**201,792**
	Metals	0.72	2.76	201,792
06	**Wood & Plastics**	**1.31**	**5.03**	**366,895**
	Wood & Plastics	1.31	5.03	366,895
07	**Thermal & Moisture Protection**	**9.14**	**35.20**	**2,569,367**
	Thermal & Moisture Protection	9.14	35.20	2,569,367
08	**Doors & Windows**	**2.61**	**10.05**	**733,790**
	Doors & Windows	2.61	10.05	733,790
09	**Finishes**	**9.14**	**35.21**	**2,570,100**
	Finishes	9.14	35.21	2,570,100
10	**Specialties**	**0.06**	**0.23**	**16,510**
	Specialties	0.06	0.23	16,510
11	**Equipment**	**1.31**	**5.03**	**366,895**
	Equipment	1.31	5.03	366,895
12	**Furnishings**	**3.26**	**12.56**	**917,238**
	Furnishings	3.26	12.56	917,238
14	**Conveying Systems**	**1.31**	**5.03**	**366,895**
	Conveying Systems	1.31	5.03	366,895
15	**Mechanical**	**33.94**	**130.67**	**9,539,273**
	Mechanical	33.94	130.67	9,539,273
16	**Electrical**	**11.75**	**45.23**	**3,302,056**
	Electrical	11.75	45.23	3,302,056
Total Building Costs		**100.00**	**385.00**	**28,105,267**
01		**100.00**	**28.98**	**376,947**
	Site Work	100.00	28.98	376,947
Total Non-Building Costs		**100.00**	**28.98**	**376,947**
Total Project Costs		**--**	**--**	**28,482,214**

Appendix C – D4 Cost Estimate 2

Statement of Probable Cost

Moore Building Addition 2 - Jun 2010 - PA - State College

Prepared By:	**Mohammad Alhusaini**	Prepared For:	**Tech 1**
	, 16801		**,**
	Fax:		**Fax:**
Building Sq. Size:	**73000**	Site Sq. Size:	**49600**
Bid Date:	**1/1/2010**	Building use:	**Medical**
No. of floors:	**4**	Foundation:	**CAS**
No. of buildings:	**1**	Exterior Walls:	**CUR**
Project Height:	**60**	Interior Walls:	**DRY**
1st Floor Height:	**12.5**	Roof Type:	**ASP**
1st Floor Size:	**18250**	Floor Type:	**CON**
		Project Type:	**ADD/REN**

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**5.10**	**13.53**	**987,561**
	General Conditions	4.52	11.99	875,433
	Performance Bonds	0.58	1.54	112,128
01	**General Requirements**	**2.19**	**5.81**	**424,108**
	Change Orders	2.19	5.81	424,108
03	**Concrete**	**11.61**	**30.82**	**2,249,522**
	Reinforcing	0.78	2.06	150,432
	Footings	1.10	2.91	212,416
	Walls	2.42	6.41	468,012
	Slabs	0.48	1.28	93,324
	Topping	0.90	2.39	174,808
	Exterior	0.84	2.24	163,665
	Precast	5.09	13.52	986,864
04	**Masonry**	**8.64**	**22.94**	**1,674,257**
	Masonry	8.64	22.94	1,674,257
05	**Metals**	**3.97**	**10.53**	**768,877**
	Structural Steel	3.28	8.72	636,552
	Steel Erection	0.68	1.81	132,325
06	**Wood & Plastics**	**4.10**	**10.88**	**793,949**
	Rough Carpentry	2.63	6.98	509,799
	Finish Carpentry	1.47	3.89	284,150
07	**Thermal & Moisture Protection**	**4.99**	**13.24**	**966,668**
	Waterproofing	0.54	1.43	104,467
	Firestopping	0.08	0.20	14,625
	Shingles	0.82	2.18	158,790
	Sheet Roofing Metal	2.76	7.33	534,871
	Skylight	0.53	1.41	103,074
	Caulking	0.26	0.70	50,841
08	**Doors & Windows**	**4.87**	**12.93**	**943,685**
	Steel Doors & Frames	0.50	1.32	96,110
	Wood Doors	0.81	2.16	157,397
	Coiling Shutters	0.33	0.88	64,073
	Overhead Doors	0.06	0.15	11,143
	Aluminum Entrances	0.76	2.02	147,647
	Aluminum Windows	1.11	2.96	215,898
	Door Hardware	0.82	2.18	158,790
	Automatic Doors	0.48	1.27	92,627
09	**Finishes**	**14.82**	**39.34**	**2,872,145**
	Drywall Plaster Framing	10.91	28.97	2,115,108
	Ceramic Tile	0.90	2.39	174,808
	Acoustical Ceilings	0.54	1.44	105,163
	Resilient Flooring	0.38	1.01	73,823
	Carpet	1.30	3.44	251,417
	Painting VWC	0.78	2.08	151,825

10	**Specialties**	**1.79**	**4.74**	**346,134**
	Chalkboards Tackboards	0.06	0.16	11,840
	Cubical Track	0.08	0.21	15,322
	Toilet Partitions	0.12	0.32	23,679
	Louvers	0.38	1.00	73,127
	Wall Guard Handrail	0.81	2.14	156,004
	Interior Signs	0.15	0.40	29,251
	Exterior Signs	0.06	0.16	11,840
	Fire Devices	0.01	0.02	1,393
	Toilet Accessories	0.12	0.32	23,679
11	**Equipment**	**0.72**	**1.90**	**138,593**
	Service Windows	0.32	0.86	62,680
	Projection Screen	0.01	0.02	1,393
	Scissor Lift	0.29	0.76	55,716
	TV Brackets	0.10	0.26	18,804
12	**Furnishings**	**1.12**	**2.99**	**217,988**
	Modular Furniture	0.95	2.51	183,165
	Floor Mats	0.10	0.28	20,197
	Window Blinds	0.08	0.20	14,625
13	**Special Construction**	**0.73**	**1.93**	**140,682**
	Modular Shelter	0.73	1.93	140,682
15	**Mechanical**	**26.02**	**69.07**	**5,042,272**
	Fire Protection	1.24	3.30	240,970
	Mechanical GC	0.26	0.68	49,448
	Rigging	0.06	0.16	11,840
	Pipe & Fittings	1.18	3.13	228,434
	Drains & Carries	0.28	0.73	53,626
	Pumps & Tanks	0.14	0.37	27,161
	Water Heaters	0.55	1.45	105,860
	Plumbing Fixtures	0.51	1.35	98,199
	Hydronic Pipe	1.66	4.42	322,455
	Hydronic Pumps	0.84	2.23	162,968
	Heat Exchangers	0.17	0.46	33,429
	Heating Terminals	0.41	1.09	79,395
	Glycol	0.09	0.24	17,411
	Chiller System	1.22	3.23	236,095
	Plumbing Labor	1.43	3.80	277,186
	Hydronic Labor	2.11	5.60	408,814
	Air Handlers	1.92	5.09	371,206
	Exhaust Fans	0.10	0.26	18,804
	Filters	0.01	0.02	1,393
	Ductwork, Liner, Flex	0.53	1.40	102,378
	Ductwork, Hang, Clk	0.15	0.39	28,554
	Air Blenders	0.12	0.31	22,983
	Air Outlets, Inlets	0.38	1.01	73,823
	Smoke, Fire Dampers	0.05	0.12	9,054
	Misc. Vent	0.02	0.05	3,482
	HVAC Site Labor	1.71	4.55	332,205
	HVAC Shop Labor	0.63	1.68	122,575
	Pipe Covering	1.07	2.83	206,845
	Temperature Control	5.77	15.31	1,117,796
	Test & Balance	0.35	0.92	66,859
	Insulation	1.09	2.89	211,023
16	**Electrical**	**9.35**	**24.82**	**1,812,153**
	Electrical GC	0.46	1.21	88,449
	Electrical Primary	0.28	0.75	55,019
	Electrical Secondary	4.23	11.24	820,414
	Panelboards	0.12	0.32	23,679
	Disconnects	0.10	0.27	19,500
	Trans. Switches	0.13	0.33	24,376
	Transformer	0.39	1.03	75,216
	Lighting	1.72	4.56	332,901
	Fire Alarm	0.43	1.14	82,877
	Communications	0.73	1.93	140,682
	Security	0.68	1.79	130,932
	Clean Up	0.09	0.25	18,108
Total Building Costs		**100.00**	**265.46**	**19,378,592**
02	**Site Work**	**100.00**	**7.81**	**387,156**

Temporary Fence	2.38	0.19	9,203
Demolition	9.90	0.77	38,347
Excavation	24.09	1.88	93,261
Lawn Irrigation	3.68	0.29	14,265
Landscaping	7.88	0.62	30,525
Asphalt Paving	11.21	0.88	43,409
Curb & Cutter	2.93	0.23	11,351
Site Utilities	35.78	2.79	138,511
Retaining Walls	2.14	0.17	8,283
Total Non-Building Costs	**100.00**	**7.81**	**387,156**
Total Project Costs	**--**	**--**	**19,765,748**

Appendix D – RSMeans CostWorks Estimate (Medical Lab Model)

Square Foot Cost Estimate Report

Estimate Name:	**Moore Building Addition**
	PSU OPP
	University Park
	PA
	16802
Building Type:	**Medical Office, 2 Story with Brick Veneer / Wood Frame**
Location:	National Average
Stories Count (L.F.):	**4.00**
Stories Height	**12.50**
Floor Area (S.F.):	**73,000.00**
LaborType	**Union**
Basement Included:	Yes
Data Release:	**Year 2010 Quarter 3**
Cost Per Square Foot	**$207.12**
Total Building Cost	**$15,120,000**

Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.
Parameters are not within the ranges recommended byRSMeans.

		% of Total	Cost Per SF	Cost
A Substructure		**2.7%**	**4.04**	**$295,000**
A1010	**Standard Foundations**		**0.72**	**$52,500**
	Strip footing, concrete, reinforced, load 11.1 KLF, soil bearing capacity 6 KSF, 12" deep x 24" wide			
	Spread footings, 3000 PSI concrete, load 200K, soil bearing capacity 6 KSF, 6' - 0" square x 20" deep			
A1030	**Slab on Grade**		**1.19**	**$87,000**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**0.89**	**$65,000**
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	**Basement Walls**		**1.24**	**$90,500**
	Foundation wall, CIP, 12' wall height, pumped, .444 CY/LF, 21.59 PLF, 12" thick			
B Shell		**19.6%**	**29.71**	**$2,169,000**
B1010	**Floor Construction**		**18.31**	**$1,336,500**
	Cast-in-place concrete column, 12" square, tied, 200K load, 12' story height, 142 lbs/LF, 4000PSI			
	Steel column, 6" pipe concrete filled, 50 K, 20' unsupported length, 49 PLF			
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 P:			
	Wood beam and joist floor, 12"x16" girder, 8"x16" beam, 2x10 joists @ 16", 20'x20' bay, 75 PSF LL, 102 PSF total lc			
B1020	**Roof Construction**		**1.62**	**$118,000**
	Wood roof, truss, 4/12 slope, 24" O.C., 30' to 43' span			
B2010	**Exterior Walls**		**4.32**	**$315,000**
	Brick veneer wall, standard face, 2x6 studs @ 16" back-up, running bond			
B2020	**Exterior Windows**		**2.63**	**$192,000**
	Windows, aluminum, sliding, standard glass, 5' x 3'			
B2030	**Exterior Doors**		**1.51**	**$110,000**
	Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening			
B3010	**Roof Coverings**		**1.32**	**$96,500**
	Roofing, asphalt flood coat, gravel, base sheet, 3 plies 15# asphalt felt, mopped			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			

		% of Total	Cost Per SF	Cost
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick			
B3020	**Roof Openings**		0.01	$1,000
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs			
C Interiors		23.7%	36.08	$2,634,000
C1010	**Partitions**		10.26	$749,000
	Wood partition, 5/8" fire rated gypsum board face, 1/4"sound deadening gypsum board, 2x4 @ 16" OC framing, sam			
	1/2" fire ratedgypsum board, taped & finished, painted on metal furring			
C1020	**Interior Doors**		9.60	$701,000
	Door, single leaf, wood frame, 3'-0" x 7'-0" x 1-3/8", birch, solid core			
C2010	**Stair Construction**		0.72	$52,500
	Stairs, wood, prefab box type, oak treads, wood rails 3'-6" wide, 14 risers			
C3010	**Wall Finishes**		3.40	$248,000
	Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats			
	Vinyl wall covering, fabric back, medium weight			
C3020	**Floor Finishes**		6.58	$480,500
	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, maximum			
	Vinyl, composition tile, maximum			
C3030	**Ceiling Finishes**		5.52	$403,000
	Acoustic ceilings, 5/8" mineral fiber, 12" x 12" tile, 1" x 3" wood, 12" OC grid,wood support			
D Services		48.4%	73.64	$5,375,500
D1010	**Elevators and Lifts**		16.48	$1,203,000
	2 - Hydraulic, passenger elevator, 3500 lb, 2 floors, 100 FPM			
	Hydraulic hospital elevator, 4000 lb., 125 FPM			
D2010	**Plumbing Fixtures**		20.62	$1,505,500
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Lavatory w/trim, vanity top, vitreous china, 20" x 16"			
	Kitchen sink w/trim, countertop, stainless steel, 19" x 18" single bowl			
	Service sink w/trim, PE on CI,wall hung w/rim guard, 22" x 18"			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		0.27	$20,000
	Gas fired water heater, commercial, 100< F rise, 200 MBH input, 192 GPH			
D2040	**Rain Water Drainage**		0.92	$67,500
	Roof drain, CI, soil,single hub, 4" diam, 10' high			
	Roof drain, CI, soil,single hub, 4" diam, for each additional foot add			
D3050	**Terminal & Package Units**		13.75	$1,004,000
	Rooftop, multizone, air conditioner, medical centers, 10,000 SF, 23.33 ton			
D4010	**Sprinklers**		3.33	$243,000
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 5000 SF			
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 5000 SF			
D4020	**Standpipes**		1.56	$114,000
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, 1 floor			
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, additional floors			
	Cabinet assembly, includes. adapter, rack, hose, and nozzle			
D5010	**Electrical Service/Distribution**		0.23	$16,500
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 400 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 400 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 400 A			
D5020	**Lighting and Branch Wiring**		7.22	$527,000
	Receptacles incl plate, box, conduit, wire, 10 per 1000 SF, 1.2 watts per SF			

		% of Total	Cost Per SF	Cost
	Wall switches, 5.0 per 1000 SF			
	Miscellaneous power, 1 watt			
	Central air conditioning power, 3 watts			
	Fluorescent fixtures recess mounted in ceiling, 0.8 watt per SF, 20 FC, 5 fixtures @32 watt per 1000 SF			
D5030	**Communications and Security**		8.38	$612,000
	Telephone wiring for offices & laboratories, 8 jacks/MSF			
	Communication and alarm systems, fire detection, addressable, 25 detectors, includes outlets, boxes, conduit and w			
	Fire alarm command center, addressable without voice, excl. wire & conduit			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, intercom systems, 12 stations			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		0.86	$63,000
	Generator sets, w/battery, charger, muffler and transfer switch, gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 7			
E Equipment & Furnishings		5.6%	8.54	$623,500
E1020	**Institutional Equipment**		8.02	$585,500
	Architectural equipment, laboratory equipment, counter tops, acid proof, economy			
	Architectural equipment, laboratory equipment, cabinets, base, drawer units			
E1090	**Other Equipment**		0.52	$38,000
	1 - Medical equipment, utensil washer/sterilizer			
	3 - Detection Systems, smoke detector, duct type, excl. wires & conduit			
	103 - Detection Systems, heat detector, smoke detector, ceiling type, excl. wires & conduit			
F Special Construction		0.0%	0.00	$0
G Building Sitework		0.0%	0.00	$0
Sub Total		**100%**	**$152.01**	**$11,097,000**
Contractor's Overhead & Profit		**25.0%**	**$38.01**	**$2,774,500**
Architectural Fees		**9.0%**	**$17.10**	**$1,248,500**
User Fees		**0.0%**	**$0.00**	**$0**
Total Building Cost			**$207.12**	**$15,120,000**

Appendix E – RSMeans CostWorks Estimate (Hospital Model)

Square Foot Cost Estimate Report

Estimate Name: **Untitled**

Building Type:	**Hospital, 4-8 Story with Face Brick with Structural Facing Tile / Steel Frame**
Location:	National Average
Stories Count (L.F.):	**4.00**
Stories Height	**12.50**
Floor Area (S.F.):	**73,000.00**
LaborType	**Union**
Basement Included:	Yes
Data Release:	**Year 2010 Quarter 3**
Cost Per Square Foot	**$295.98**
Total Building Cost	**$21,606,500**

Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.
Parameters are not within the ranges recommended byRSMeans.

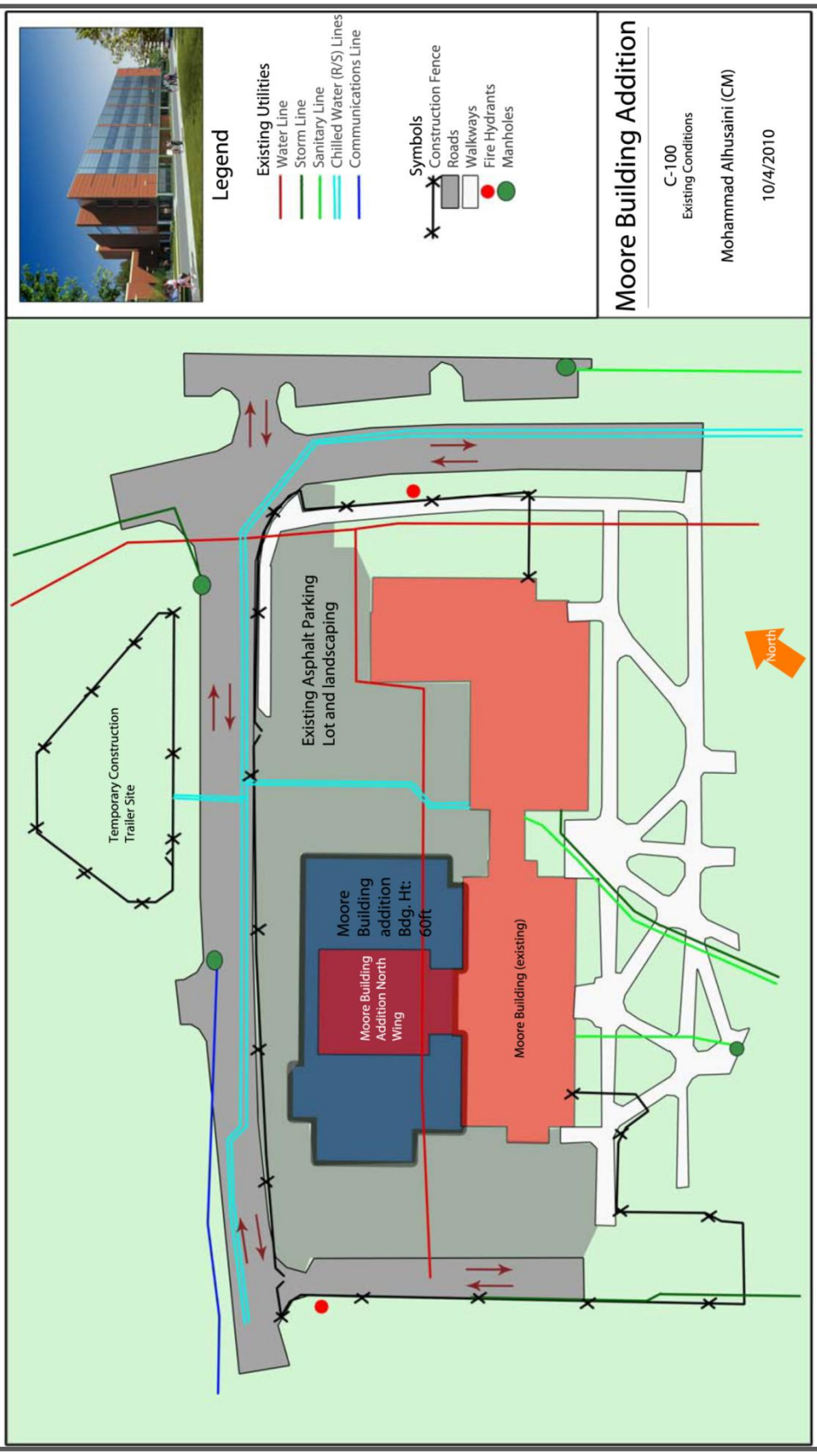
		% of Total	Cost Per SF	Cost
A Substructure		**3.3%**	**7.13**	**$520,500**
A1010	**Standard Foundations**		**3.05**	**$223,000**
	Strip footing, concrete, reinforced, load 14.8 KLF, soil bearing capacity 6 KSF, 12" deep x 32" wide			
	Spread footings, 3000 PSI concrete, load 400K, soil bearing capacity 6 KSF, 8' - 6" square x 27" deep			
A1030	**Slab on Grade**		**1.19**	**$87,000**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**0.89**	**$65,000**
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	**Basement Walls**		**1.99**	**$145,500**
	Foundation wall, CIP, 12' wall height, pumped, .52 CY/LF, 24.29 PLF, 14" thick			
B Shell		**18.6%**	**40.50**	**$2,956,500**
B1010	**Floor Construction**		**19.33**	**$1,411,000**
	Cast-in-place concrete column, 16" square, tied, 400K load, 12' story height, 251 lbs/LF, 4000PSI			
	Steel column, W10, 200 KIPS, 10' unsupported height, 45 PLF			
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 P			
	Floor, composite metal deck, shear connectors, 5.5" slab, 30'x30' bay, 26.5" total depth, 75 PSF superimposed load,			
	Fireproofing, gypsum board, fire rated, 2 layer, 1" thick, 10" steel column, 3 hour rating, 17 PLF			
B1020	**Roof Construction**		**1.81**	**$132,000**
	Floor, steel joists, beams, 1.5" 22 ga metal deck, on columns, 30'x30' bay, 28" deep, 40 PSF superimposed load, 62			
B2010	**Exterior Walls**		**12.27**	**$896,000**
	Brick wall, cavity, standard face, 4" glazed tile back-up, 10" thick, styrofoam cavity fill			
B2020	**Exterior Windows**		**4.53**	**$331,000**
	Windows, aluminum, sliding, insulated glass, 5' x 3'			
B2030	**Exterior Doors**		**0.74**	**$54,000**
	Door, aluminum & glass, with transom, full vision, double door, hardware, 6'-0" x 10'-0" opening			
	Door, aluminum & glass, with transom, non-standard, double door, hardware, 6'-0" x 10'-0" opening			
	Door, steel 18 gauge, hollow metal, 1 door with frame, no label, 3'-0" x 7'-0" opening			
B3010	**Roof Coverings**		**1.79**	**$130,500**

		% of Total	Cost Per SF	Cost
	Roofing, single ply membrane, reinforced, PVC, 48 mils, fully adhered, adhesive			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			
	Flashing, copper, no backing, 16 oz, < 500 lbs			
B3020	**Roof Openings**		0.03	$2,000
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs			
C Interiors		21.4%	46.38	$3,385,500
C1010	**Partitions**		7.58	$553,500
	Metal partition, 5/8" vinyl faced gypsum board face, 5/8"fire rated gypsum board base, 3-5/8" @ 24",s ame opposite			
	Gypsum board, 1 face only, 5/8" with 1/16" lead			
C1020	**Interior Doors**		11.24	$820,500
	Door, single leaf, kd steel frame, hollow metal, commercial quality, flush, 3'-0" x 7'-0" x 1-3/8"			
	Door, single leaf, kd steel frame, metal fire, commercial quality, 3'-0" x 7'-0" x 1-3/8"			
C1030	**Fittings**		0.98	$71,500
	Partitions, hospital curtain, ceiling hung, poly oxford cloth			
C2010	**Stair Construction**		1.27	$93,000
	Stairs, steel, cement filled metal pan & picket rail, 12 risers, with landing			
C3010	**Wall Finishes**		7.56	$552,000
	Glazed coating			
	Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats			
	Vinyl wall covering, fabric back, medium weight			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		10.15	$741,000
	Composition flooring, epoxy terrazzo, maximum			
	Terrazzo, maximum			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		7.59	$554,000
	Plaster ceilings, 3 coat prl, 3.4# metal lath, 3/4" crc, 12"OC furring, 1-1/2" crc, 36" OC support			
	Acoustic ceilings, 3/4"mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid, suspended support			
D Services		48.6%	105.60	$7,709,000
D1010	**Elevators and Lifts**		6.44	$470,000
	Traction, geared hospital, 6000 lb, 6 floors, 12' story height, 2 car group, 200 FPM			
D2010	**Plumbing Fixtures**		11.94	$871,500
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, PE on CI, 19" x 17"			
	Kitchen sink w/trim, raised deck, PE on CI, 42" x 21" dual level, triple bowl			
	Laundry sink w/trim, PE on CI, black iron frame, 48" x 21" double compartment			
	Service sink w/trim, PE on CI,wall hung w/rim guard, 22" x 18"			
	Bathtub, recessed, PE on CI, mat bottom, 5'-6" long			
	Shower, stall, baked enamel, terrazzo receptor, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		6.90	$504,000
	Electric water heater, commercial, 100< F rise, 1000 gal, 480 KW 1970 GPH			
D2040	**Rain Water Drainage**		0.54	$39,500
	Roof drain, CI, soil,single hub, 5" diam, 10' high			
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add			
D3010	**Energy Supply**		3.55	$259,000
	Hot water reheat system for 200,000 SF hospital			

		% of Total	Cost Per SF	Cost
D3020	**Heat Generating Systems**		0.38	$28,000
	Boiler, electric, steel, steam, 510 KW, 1,740 MBH			
D3030	**Cooling Generating Systems**		2.75	$200,500
	Chiller, reciprocating, water cooled, standard controls, 100 ton			
	Chiller, reciprocating, water cooled, standard controls, 150 ton			
	Chiller, reciprocating, water cooled, standard controls, 200 ton			
D3090	**Other HVAC Systems/Equip**		33.13	$2,418,500
	Ductwork for 200,000 SF hospital model			
	Boiler, cast iron, gas, hot water, 2856 MBH			
	Boiler, cast iron, gas, hot water, 320 MBH			
	AHU, rooftop, cool/heat coils, VAV, filters, 5,000 CFM			
	AHU, rooftop, cool/heat coils, VAV, filters, 10,000 CFM			
	AHU, rooftop, cool/heat coils, VAV, filters, 20,000 CFM			
	VAV terminal, cooling, hot water reheat, with actuator / controls, 200 CFM			
	AHU, rooftop, cool/heat coils, VAV, filters, 30,000 CFM			
	Roof vent. system, power, centrifugal, aluminum, galvanized curb, back draft damper, 1500 CFM			
	Roof vent. system, power, centrifugal, aluminum, galvanized curb, back draft damper, 2750 CFM			
	Commercial kitchen exhaust/make-up air system, rooftop, gas, 5000 CFM			
	Plate heat exchanger, 400 GPM			
D4010	**Sprinklers**		2.68	$195,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF			
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 10,000 SF			
	Standard High Rise Accessory Package 8 story			
D4020	**Standpipes**		0.45	$33,000
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, 1 floor			
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, additional floors			
	Cabs, hose rack assembly, & extinguisher, 2-1/2" x 1-1/2" valve & hose, steel door & frame			
	Alarm, electric pressure switch (circuit closer)			
	Escutcheon plate, for angle valves, polished brass, 2-1/2"			
	Fire pump, electric, with controller, 5" pump, 100 HP, 1000 GPM			
	Fire pump, electric, for jockey pump system, add			
	Siamese, with plugs & chains, polished brass, sidewalk, 4" x 2-1/2" x 2-1/2"			
	Valves, angle, wheel handle, 300 lb, 2-1/2"			
	Cabinet assembly, includes. adapter, rack, hose, and nozzle			
D5010	**Electrical Service/Distribution**		11.06	$807,500
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 2000 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 2000 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 2000 A			
D5020	**Lighting and Branch Wiring**		19.09	$1,393,500
	Receptacles incl plate, box, conduit, wire, 20 per 1000 SF,2.4 W per SF, with transformer			
	Wall switches, 5.0 per 1000 SF			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	Motor feeder systems, three phase, feed to 200 V 5 HP, 230 V 7.5 HP, 460 V 15 HP, 575 V 20 HP			
	Fluorescent fixtures recess mounted in ceiling, 0.8 watt per SF, 20 FC, 5 fixtures @32 watt per 1000 SF			
D5030	**Communications and Security**		2.38	$174,000
	Communication and alarm systems, fire detection, addressable, 100 detectors, includes outlets, boxes, conduit and			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			

		% of Total	Cost Per SF	Cost
D5090	**Other Electrical Systems**		4.31	$314,500
	Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 100 kW			
	Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 400 kW			
	Uninterruptible power supply with standard battery pack, 15 kVA/12.75 kW			
E Equipment & Furnishings		8.1%	17.62	$1,286,500
E1020	**Institutional Equipment**		13.42	$979,500
	Architectural equipment, laboratory equipment glassware washer, distilled water, economy			
	Architectural equipment, sink, epoxy resin, 25" x 16" x 10"			
	Architectural equipment, laboratory equipment eye wash, hand held			
	Fume hood, complex, including fixtures and ductwork			
	Architectural equipment, medical equipment sterilizers, floor loading, double door, 28"x67"x52"			
	Architectural equipment, medical equipment, medical gas system for large hospital			
	Architectural equipment, kitchen equipment, commercial dish washer, semiautomatic, 50 racks/hr			
	Architectural equipment, kitchen equipment, food warmer, counter, 1.65 KW			
	Architectural equipment, kitchen equipment, kettles, steam jacketed, 20 gallons			
	Architectural equipment, kitchen equipment, range, restaurant type, burners, 2 ovens & 24" griddle			
	Architectural equipment, kitchen equipment, range hood, including CO2 system, economy			
	Special construction, refrigerators, prefabricated, walk-in, 7'-6" high, 6' x 6'			
	Architectural equipment, darkroom equipment combination, tray & tank sinks, washers & dry tables			
E1090	**Other Equipment**		0.25	$18,000
	14 - Closed circuit television system (CCTV), surveillance, for additional camera stations, add			
	2 - Closed circuit television system (CCTV), surveillance, one station (camera & monitor)			
E2020	**Moveable Furnishings**		3.96	$289,000
	Furnishings, hospital furniture, patient wall system, no utilities, deluxe , per room			
F Special Construction		0.0%	0.00	$0
G Building Sitework		0.0%	0.00	$0
Sub Total		**100%**	**$217.23**	**$15,858,000**
Contractor's Overhead & Profit		**25.0%**	**$54.31**	**$3,964,500**
Architectural Fees		**9.0%**	**$24.44**	**$1,784,000**
User Fees		**0.0%**	**$0.00**	**$0**
Total Building Cost			**$295.98**	**$21,606,500**

Appendix F – Existing Conditions Site Layout


Legend
Existing Utilities
Water Line
Storm Line
Sanitary Line
Chilled Water (R/S) Lines
Communications Line
Symbols
Construction Fence
Roads
Walkways
Fire Hydrants
Manholes
Moore Building Addition
C-100
Existing Conditions
Mohammad Alhusaini (CM)
10/4/2010
Existing Asphalt Parking Lot and landscaping
Temporary Construction Trailer Site
Moore Building addition Bdg. Ht: 60ft
Moore Building Addition North Wing
Moore Building (existing)
North