TECHNICAL REPORT ONE

CHEMISTRY BUILDING

October 4, 2010

Michael Gallagher

Construction Management

Dr. Riley

EXECUTIVE SUMMARY

Technical Report One includes all the elements that are key to the beginning of a project. For this 265,000 SF unique Chemistry building there were two years of design, preconstruction, and BIM coordination to provide the owner with a building that best suited their needs and desires. The biggest problem with the project was everything was custom and the materials were from all over the world. Because of this there were long lead-times and caused major problems/delays when items were received broken or broke during construction. The glass for the curtain wall was manufactured in Italy and it too around two months to get a replacement piece. Another problem was constant design changes due to the fact new faculty members were hired. Numerous labs needed to be demoed, redesigned, and reconstructed because of this even after the space was already completed and punched out.

Although the building does not have a LEED rating associated with it, this Chemistry Building has many sustainable features. One of the major reasons why Hopkins Architects were chosen for this project was for their experience in designing sustainable buildings. Many of these sustainable features like the glass façade, PV trays, and mechanical systems drove the cost of this building up. Because it has a lot of complex systems a very large and experienced project team was required to successfully execute this project.

After completing all of the analysis for this report it would be very interesting to spend more time investigating other building materials currently on the market. Finding products that are in a close vicinity of the project are a huge advantage. It is better for the environment, cheaper transportation costs, and allows for shorter lead-time.

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PROJECT SCHEDULE SUMMARY

***See Appendix A for the Project Summary Schedule**

The project started off with the Owner choosing Hopkins Architects to be the design Architect. Soon after they were selected, Turner Construction was brought on for preconstruction planning. The owner, Hopkins Architects, Turner Construction, and ARUP worked together for roughly two years before construction started. The design process was very long and complex based upon the sustainable requirements, overall interior and exterior aesthetics, and technology requirements that must be contained within the building.

The site for the building was occupied by a large parking lot and armory building that were required to be demoed as the first stage of construction on the site. There was also a gas line that ran through the site that the owner moved before Turner Construction mobilized onsite. Besides demo before new construction could start, the geotechnical reports showed there was a lot of rock that needed to be blasted in order for the foundation to be formed.

The way the Chemistry Building is set it, it almost allowed for two separate schedules. The lab portion and Office portions of the building could both be erected at the same time and not interfere with each other. The atrium could then be erected and connect the two. The Lab building started first. The steel erection and CIP concrete all started at the South end of the building and worked towards the North. The CIP reinforced concrete cores that house the elevators and mechanical shafts were completed first and then steel was erected next. When the exterior façade and roof were completed the interior fit out started on the third floor and worked down until the ground floor was completed.

BUILDING SYSTEMS SUMMARY

Yes	No	Work Scope	If yes, address these questions / issues
X		Demolition Required?	Types of materials, lead paint, or asbestos
X		Structural Steel Frame	Type of bracing, composite slab?, crane size / type / locations
X		Cast in Place Concrete	Horiz. And Vert. Formwork types, Concrete placement methods
	X	Precast Concrete	Casting location, connection methods, crane size / type / locations
X		Mechanical System	Mech. Room locations, system type, types of distribution systems, types of fire suppression
X		Electrical System	Size / capacity, redundancy
	X	Masonry	Load bearing or veneer, connection details, scaffolding
X		Curtain Wall	Materials included, construction methods, design responsibility
	X	Support of Excavation	Type of excavation support system, dewatering system, permanent vs. temporary

DEMO

The building that was torn down in order to build the Chemistry Building was an armory. When it was originally built it was a barn with horse stables. Before its demolition its use was storage for ROTC, clubs, and other university organization's equipment. There was a large asphalt parking lot that also needed to be demoed in order to build the Chemistry Building. The material that was hauled off-site from this demo comprised mostly of wood and asphalt.

STURCTURAL STEEL FRAME

The building has structural steel framing. The entire atrium is framed with structural steel. The Lab building is broken up into 4 different steel framing systems separated by three concrete cores that act as shear walls. The office building is split up into three different steel framing systems and each framing system contains a concrete core that acts as a shear wall. All the steel has composite metal decking with 4000psi concrete topping. In the Office building the beams and girders are both wide flanges with a depth of 27". The beams along the curtain walls on the office side are wide flanges with a depth of 21". The beams and girders in the Lab building are all 24" depth wide flanges. Just like the Office building the beams along the curtain wall are 21" depth wide flanges. All the connections with the columns are moment connections.

CAST IN PLACE CONCRETE

The foundation walls and concrete cores are all reinforced 5000psi cast in place concrete. The concrete cores and foundation walls required vertical formwork. The formwork used for this job are reusable forms. One level was completed and the forms were removed and the installed on the next level for the next pour. This can be seen in the picture below. The first floor of the building is also a cast in place slab. Scaffolding from the basement level held up the formwork to place this concrete on Level A. Some areas of the building were capable of being placed directly from the concrete truck and the rest of the concrete was placed using a pump truck.

MECHANICAL SYSTEM

There mechanical system for the lab building is located in the penthouse on top of the building. This part of the building houses five air handler units with a heat recovery system and VAV boxes. The return system for the fume hoods exits the building through six exhaust towers on top of the lab penthouse roof. The entire east side of the basement is mechanical rooms. One of the rooms is for a greywater system for the building that is hooked up to a 12,000 gallon tank. The northwest corner of the basement contains another seven air handler units that service the rest of the building. These all also have a heat recovery system and all the offices are tempered by chilled beams and individual thermostats. These twelve air handler units produce a total of 478,160cfm. The building also has a sprinkler system throughout the entire building. By code the exterior colonnade is required to be sprinkled and as a result there are wet and dry systems incorporated in this building. The Atrium is a large open space and 4 stories high the three penthouses on top of the office building each have a large fan that sucks the all the smoke and air out of this space. Once the smoke alarm goes off and these fans start up the smoke hatch that each fan's ductwork hooks up to pops open.

ELECTRICAL SYSTEM

The electrical system has an emergency generator with a max rating of 1000 kw, 480/277 volts. It is also sized to connect (4) 400 amp connectors per phase, (4) 400 amp cam connectors for neutral and (1) 400 amp cam connector to grounded. All the panel boards are 3 phase, 4 wires. The building also has PV trays covering the atrium skylight and occupancy and daylight sensors to help reduce the electricity usage of the building.

CURTAIN WALL SYSTEM

The curtain wall system is composed of aluminum framing with glazing. The glazing was designed based upon a wind speed of 100 mph, an importance factor of 1.15, and in the Exposure B category. The glazing is a high efficient glass manufactured just outside of Venice, Italy. Curtain wall consultants, Hopkins Architects, and members in charge of the sustainable design decided on this type of glass and how it was going to be installed. The glass picked by a crane and then installed by workers in a boom lift. Each piece of glass was fastened down with toggles. It was then tightened down to the correct torque and a gasket and caulking were installed. The device that was attached to the crane to pick the glass was shaped in an X and each arm had two suction cups on it. Two similar ones are pictured below.

PROJECT COST EVALUATION

***See Appendix B and C for cost reports**

ACTUAL PROJECT COSTS

	COST $	COST $/SF
Excavation & Foundation	6,169,320	23.28
Structural Frame	32,598,375	123.01
Exterior Wall	45,771,677	172.72
Interior Finishes	37,465,187	141.38
Lab Casework & Equipment	13,983,731	52.77
Roofing	3,387,678	12.78
Plumbing	17,302,389	65.29
HVAC	31,235,041	117.87
Electrical	24,552,292	92.65
Controls	4,918,466	18.56
Site work	3,928,702	14.83
GC's (only surveying, parking, and Hoisting)	972,526	3.67
Elevators	2,790,204	10.53
Fire Protection (Sprinkler System)	2,739,360	10.34
Furniture	4,864,650	18.36
Total	**232,679,598**	**878.04**

These costs are based on the GMP costs from the information provided by Turner Construction

General Building Information:
265,000 SF
4 Floors above grade, plus basement and Penthouse
16' =rough floor height
Curtain Wall
CIP Concrete and Structural Steel Framing
Spread Footings

RS Means CostWorks

College Laboratory
Total Cost: $31,561,000
Cost/SF: $119.10 / SF

Office, 2-4 Story with Glass and Metal Curtain Wall / Steel Frame
Total Cost: $38,244,000
Cost/SF: $144.32 / SF

D4 Cost Estimating

University Chemistry Building
Total Cost: $56,516,739
Cost/SF: $213.27 / SF

Texas A&M Science Education Center
Total Cost: $33,751,516
Cost/SF: $127.36 /SF

The actual cost of the project and the estimates generating using D4 cost estimating software and RS Means CostsWorks are so different for multiple reasons. One of the major reasons is the curtain wall system of this building is comprised of an extremely high quality glass from Italy. It is suppose to be more energy efficient and have green aspects. The cost of this system alone is 40 million dollars. This alone is more than or right around the estimates produced. Another reason why they differ is a lot of the materials and equipment for this building are from all over the world. The louvers on the penthouses are from Mexico, glass from Italy, fume hoods from Germany, and many of the doors and metals from Italy. The cost to get these items to the jobsite drives up the cost of all of them. The main reason for the extreme difference in these costs is the owner desired the highest quality equipment and material which is not accounted for in the estimating software. Estimating software is based on average costs and do not account for unique products that manufactures designed and produced only for a particular job. A good example of this is the PV trays that are above the atrium. The architect and owner did not want a typical solid panel. Together they worked with a manufacturer to produce a panel that would allow light to pass through it but would still have parts of it that would collect the sunlight and produce energy. This system alone cost over a million dollars and was only produced for this particular building. One of major contributing factor to the cost difference is the owner wanted a green and energy efficient building. To achieve this there are a lot of upfront costs that the typical building does not have. Because this building is so unique almost no estimating software will come close to generating the actual cost of this building. Because none of the estimates I produced were even close I tried two estimates for both RS Means CostsWorks and two for the D4 software. For D4 I tried another University Science Complex and also a University Chemistry Building. For the RS Means, I tried a Lab and an Office because the building is half research labs and the other half is an office building.

EXISTING CONDITIONS SITE PLAN SUMMARY

***See Appendix D for the Existing Conditions Site Plan**

The site is not an overly large site, but is not as confined as a jobsite in a major city. The parking for the workers is within walking distance down the road labeled "main road" on the site plan in appendix D. In the beginning of the project there are two entrances until the road coming off of the main road into the jobsite is closed. This road will be closed when construction starts on the bridge that will connect the Chemistry Building to a group of other buildings which will all be called the science complex when completed. There are already utilities coming into the site that will be used during the construction process and eventually tied into the new building. These can all be seen on the site plan. There are a lot of buildings around the Chemistry's Building site that will remain occupied and functional during the construction process. Because of this it will be important for the fence gates to be monitored and kept shut to keep pedestrians from entering the jobsite for their safety. There are also athletic fields and a stadium very close to the stadium and the owner will not permit work to be going on during any meats, games, competitions, etc.

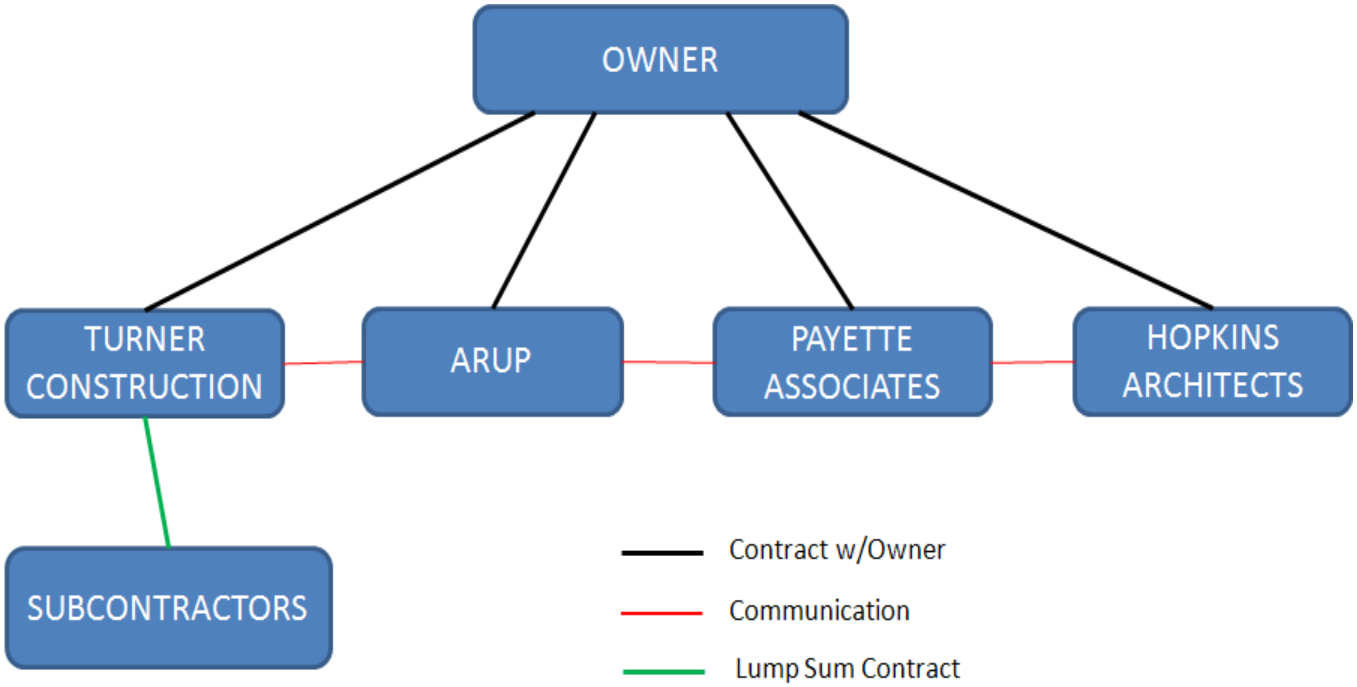
LOCAL CONDITIONS

In the area most buildings are structural steel with a curtain wall system. However, there are many other methods of construction in this area. This is why the Chemistry Building was designed with a wide verity of systems. It has the following systems: cast-in-place concrete columns and floor system, a structural steel system with composite metal decking and concrete topping, and then a curtain wall system. The building next to it is stucco and the one next to that is completely brick. On the campus buildings range from and ancient gothic style building to a futuristic Frank Gehry building. This area is not like Washing, DC where there is basically only one means of construction unless you go outside of the city. This area is more of a rural setting, therefore there is a little bit more room on the site. Yet, there is still not enough room for the contractors and everyone to park onsite. Everyone is bused into the project and the bus runs back and forth from the parking lot all day. The average cost for disposal is $77.50 a ton while the average cost for recycling of a ton is only $50. In this region there is a lot of rock. This required almost 50,000 CY or rock blasting for the foundation of the Chemistry Building. The water table is also high and the geotechnical report recommended that the entire foundation be wrapped in waterproofing along with multiple full time working sub-pumps. There is also a major highway that is less than two miles from the jobsite. There are other major roads around the site also can be used to reach the site for deliveries.

CLIENT INFORMATION

The current Chemistry building was built in 1927 and was not up to date with today's technology. The current labs were small and already cramped so there was no room to implement the new technology in the current labs. Because of this it was a must to build a new building. By building this new high-tech facility it was also a way to lure in more renowned researchers due to the fact they were looking to hire five more researchers. The Chemistry Building was funded by a percentage of the profits from an anti-cancer drug that was developed at the previous chemistry building. The owner was interested most in constructing a building that has the best technology and satisfies the needs and desires of the researchers in order to have a successful facility and team. This was clearly show by the number of times the design of the labs changed. When each new faculty member was hired they reviewed the lab designs and were able to make changes or add anything to the lab they would be working in. The original contract schedule showed the building was to be completed on November 2nd, 2010. However, after the contract was formed the owner decided they wanted the turnover to happen sooner. Because of this Turner worked extremely hard to achieve the TCO on July 13, 2010 and substantial completion in a short time after this. The owner wanted to start moving in on August 2nd, 2010, but would be phased and continue until April 5th, 2011. The keys to completing the project to the owner's satisfaction are to have the highest quality, state of the art facility and be completed on time.

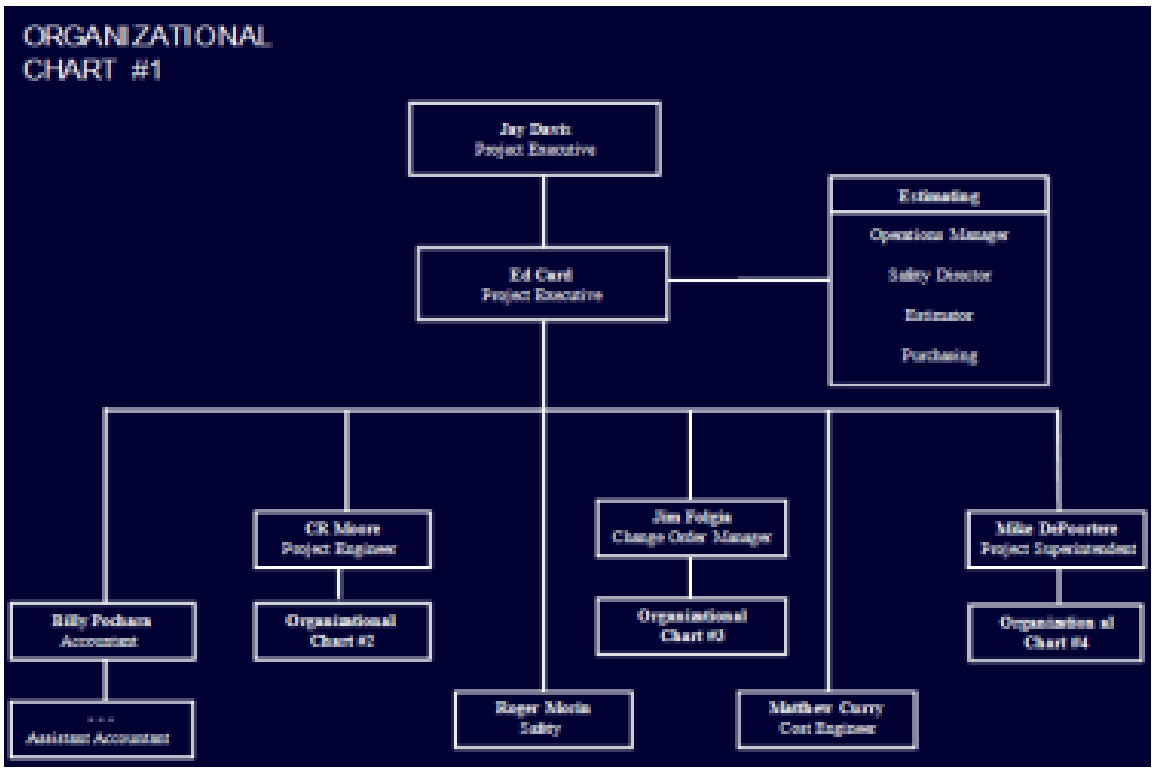
PROJECT DELIVERY SYSTEM

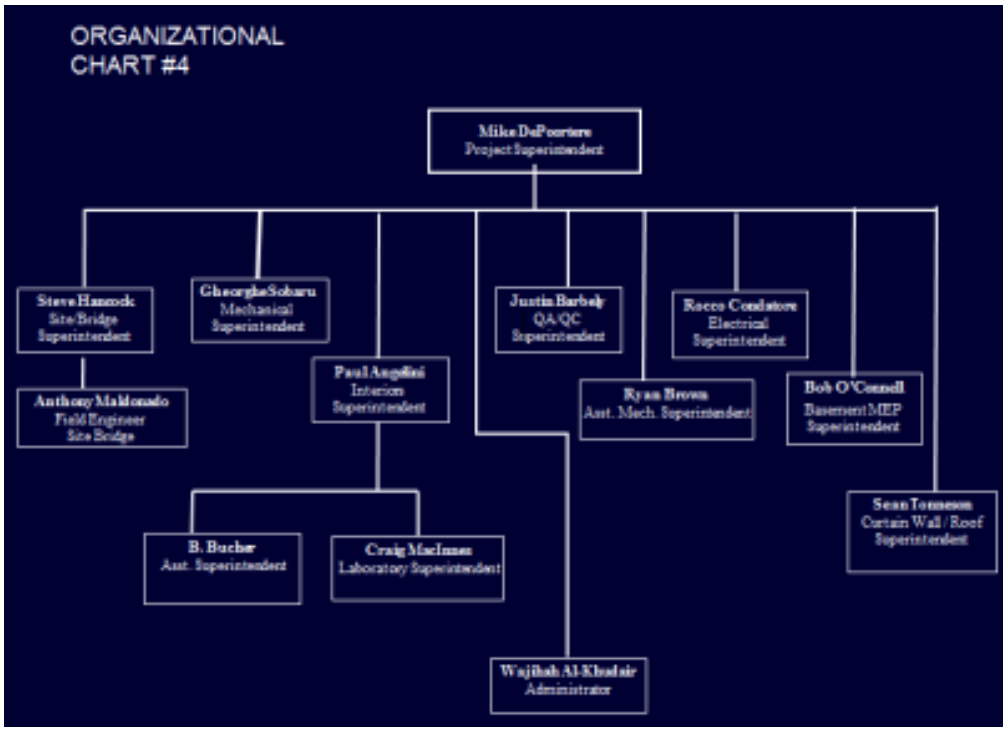


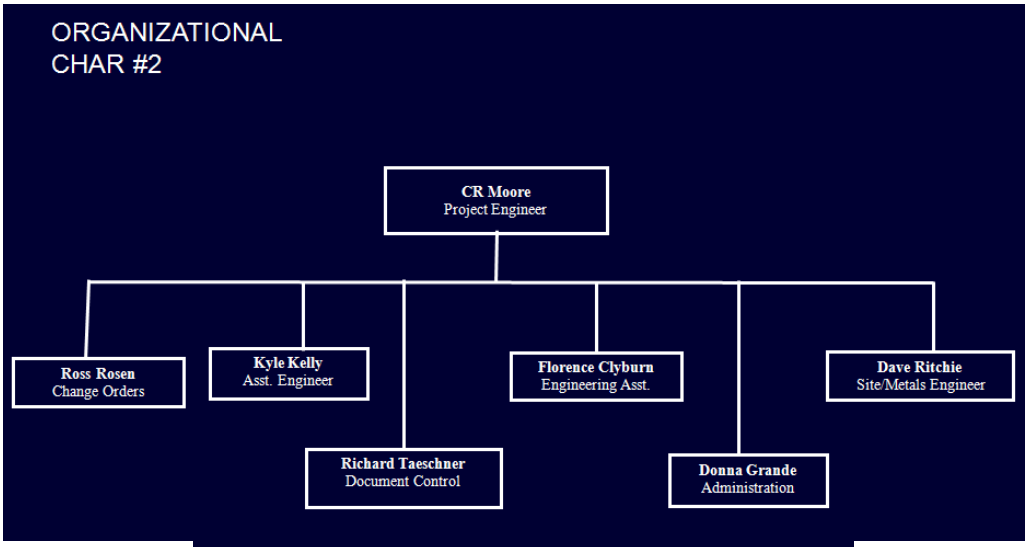
The project was a design-bid-build and started off with Hopkins Architects for the design process. This firm is a well-recognized London based UK Company. Their headquarters is a glass and steel building with a large courtyard and glass skylight covering it which is located right next to Parliament. This is a similar type style the owner was looking for. The main reason for choosing this firm is because of their expertise in designing high-efficiency and sustainable buildings. Turner construction was then brought on for preconstruction and worked with the owner, Hopkins, and engineers for 2 years before actual construction started. Payette associates were also brought on as the executive architect. With their expertise on design of high-end laboratories they did most of the interior design. ARUP did the engineering for the MEP and Structural systems of this building. The owner had individual contracts with Turner Construction, ARUP, Hopkins Architects, and Payette Associates. Even though there were no contracts between the CM firm, Architects, Engineers they all worked together through preconstruction and throughout the project. The owner and Turner Construction have a GMP contract. Turner then hired subcontractors, which were all approved by the owner, and they all had lump sum contracts. Turner also has a CCIP which covered all the subcontractors working onsite.

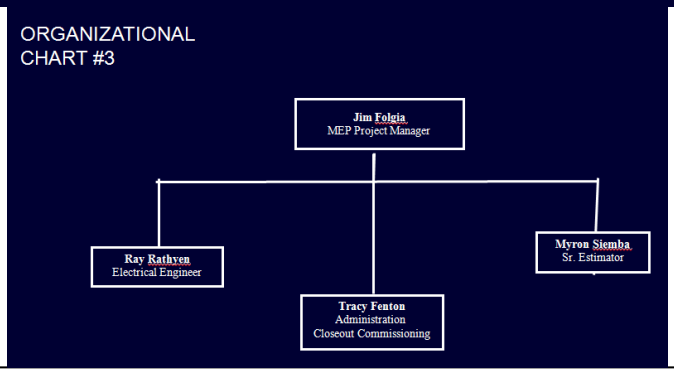
STAFFING PLAN

The Chemistry building was a very large and unique project which resulted in Turner construction having a large project team. The building was broken into sections and assigned members to manage. Each section had a project engineer and engineering team, a superintendent, and an assistant superintendent. The sections were the basement, office building, lab building, the project site, and the exterior façade and roof of the building. This was a more efficient way to manage the project instead of their typical approach where each team was in charge of certain subcontractors. It was a lot easier to coordinate because there were less people involved in the communication process to complete a certain task. For example, if a bathroom needed to be completed it was easier for one superintendent to contact the electrical contractor, carpenters, plumbing contractor, and floor contractor and coordinate the work between those trades. If the job was being managed by staff being assigned to certain trades there would have to be multiple superintendents involved in the communication and coordination process along with all the trades. It is more efficient, takes less time, and there are better results when the task is communicated directly to the subcontractor instead of being communicated through multiple people. This is why the staffing plan was designed out how it is pictured in the organizational chart. Also, because the project was insured as a CCIP it was required to have a safety manager and EMS person on staff.




ORGANIZATIONAL
CHART #4
Mike DePoortere
Project Superintendent
Steve Hancock
Site/Bridge
Superintendent
Gheorghe Sobaru
Mechanical
Superintendent
Justin Barbuk
QA/QC
Superintendent
Rocco Condatore
Electrical
Superintendent
Paul Angelini
Interiors
Superintendent
Ryan Brown
Asst. Mech. Superintendent
Bob O'Connell
Basement MEP
Superintendent
Anthony Maldonado
Field Engineer
Site/Bridge
Sean Tomeson
Curtain Wall / Roof
Superintendent
B. Bucher
Asst. Superintendent
Craig MacInnes
Laboratory Superintendent
Wajihah Al-Khadair
Administrator


ORGANIZATIONAL
CHAR #2
CR Moore
Project Engineer
Ross Rosen
Change Orders
Kyle Kelly
Asst. Engineer
Florence Clyburn
Engineering Asst.
Dave Ritchie
Site/Metals Engineer
Richard Taeschner
Document Control
Donna Grande
Administration


ORGANIZATIONAL
CHART #3
Jim Folgia
MEP Project Manager
Ray Rathyen
Electrical Engineer
Myron Siemba
Sr. Estimator
Tracy Fenton
Administration
Closeout Commissioning

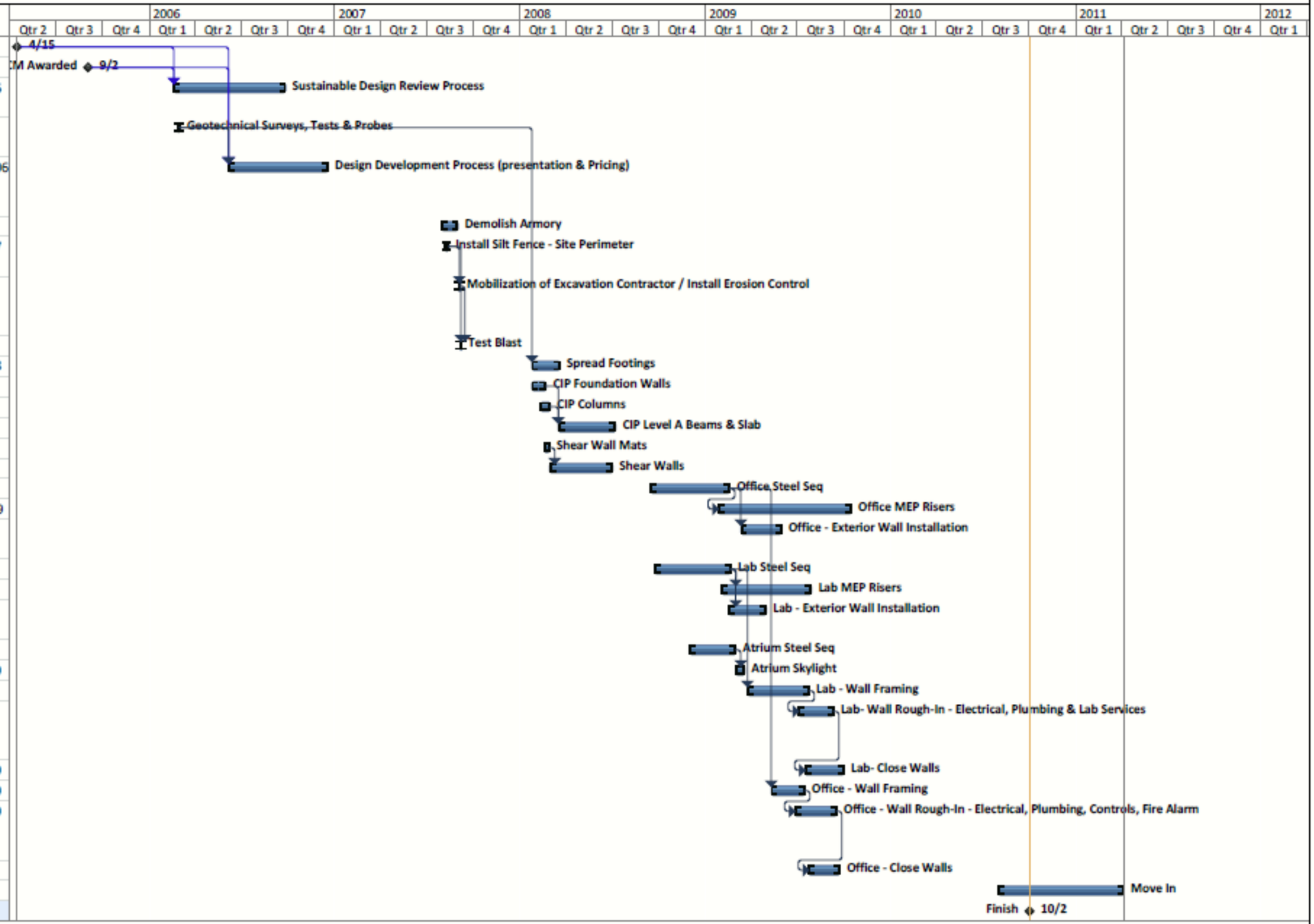
Appendix A – Project Schedule Summary

Chemistry Building

Michael Gallagher
Construction Option

Tech One - Project Schedule Summary
October 4, 2010

Task Name	Duration	Start	Finish
Architect Selected	0 days	Fri 4/15/05	Fri 4/15/05
CM Awarded	0 days	Fri 9/2/05	Fri 9/2/05
Sustainable Design Review Process	157 days	Sat 2/18/06	Mon 9/25/06
Geotechnical Surveys, Tests & Probes	4 days	Sat 2/25/06	Wed 3/1/06
Design Development Process (presentation & Pricing)	140 days	Tue 6/6/06	Mon 12/18/06
Demolish Armory	24 days	Tue 7/31/07	Fri 8/31/07
Install Silt Fence - Site Perimeter	6 days	Mon 8/6/07	Mon 8/13/07
Mobilization of Excavation Contractor / Install Erosion Control	1 day	Tue 9/4/07	Tue 9/4/07
Test Blast	1 day	Fri 9/7/07	Fri 9/7/07
Spread Footings	39 days	Fri 1/25/08	Wed 3/19/08
CIP Foundation Walls	20 days	Fri 1/25/08	Thu 2/21/08
CIP Columns	15 days	Mon 2/11/08	Fri 2/29/08
CIP Level A Beams & Slab	81 days	Mon 3/17/08	Mon 7/7/08
Shear Wall Mats	9 days	Mon 2/18/08	Thu 2/28/08
Shear Walls	88 days	Fri 2/29/08	Tue 7/1/08
Office Steel Seq	112 days	Mon 9/15/08	Tue 2/17/09
Office MEP Risers	189 days	Mon 1/26/09	Thu 10/15/09
Office - Exterior Wall Installation	58 days	Thu 3/12/09	Sat 5/30/09
Lab Steel Seq	108 days	Tue 9/23/08	Thu 2/19/09
Lab MEP Risers	127 days	Mon 2/2/09	Tue 7/28/09
Lab - Exterior Wall Installation	54 days	Mon 2/16/09	Thu 4/30/09
Atrium Steel Seq	66 days	Mon 12/1/08	Sun 3/1/09
Atrium Skylight	13 days	Mon 3/2/09	Wed 3/18/09
Lab - Wall Framing	88 days	Wed 3/25/09	Fri 7/24/09
Lab- Wall Rough-In - Electrical, Plumbing & Lab Services	50 days	Fri 7/3/09	Thu 9/10/09
Lab- Close Walls	55 days	Thu 7/16/09	Wed 9/30/09
Office - Wall Framing	48 days	Mon 5/11/09	Wed 7/15/09
Office - Wall Rough-In - Electrical, Plumbing, Controls, Fire Alarm	59 days	Fri 6/26/09	Wed 9/16/09
Office - Close Walls	44 days	Thu 7/23/09	Tue 9/22/09
Move In	177 days	Mon 8/2/10	Tue 4/5/11
Finish	0 days	Sat 10/2/10	Sat 10/2/10



Scheduled Tasks Milestones

Appendix B

Square Foot Cost Estimate Report #1

Building Type:	College, Laboratory with Decorative Concrete Block / Steel Frame
LaborType	Union
Basement Included:	Yes
Data Release:	Year 2010 Quarter 3
Cost Per Square Foot	$119.10
Total Building Cost	$31,561,000

		% of Total	Cost Per SF	Cost
A Substructure		4.0%	4.79	$1,269,000
A1010	Standard Foundations		1.02	$270,000
	Strip footing, concrete, reinforced, load 11.1 KLF, soil bearing capacity 6 KSF, 12" deep x 24" wide			
	Spread footings, 3000 PSI concrete, load 100K, soil bearing capacity 6 KSF, 4' - 6" square x 15" deep			
A1030	Slab on Grade		1.33	$353,000
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	Basement Excavation		1.08	$285,500
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	Basement Walls		1.36	$360,500
	Foundation wall, CIP, 12' wall height, pumped, .444 CY/LF, 21.59 PLF, 12" thick			
B Shell		17.2%	20.44	$5,416,000
B1010	Floor Construction		6.94	$1,840,000
	Cast-in-place concrete column, 12" square, tied, 200K load, 12' story height, 142 lbs/LF, 4000PSI			
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 P			
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and column, 35'x35' bay, 41" deep, 125 PSF su			
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and column, 35'x35' bay, 41" deep, 125 PSF su			
	Fireproofing, gypsum board, fire rated, 2 layers, 1" thick, 8" steel column, 3 hour rating, 14 PLF			
B1020	Roof Construction		1.66	$440,500
	Floor, steel joists, beams, 1.5" 22 ga metal deck, on columns, 25'x30' bay, 25" deep, 40 PSF superimposed load, 60			
B2010	Exterior Walls		4.62	$1,223,500
	Concrete block (CMU) wall, split rib, 8 ribs, hollow, regular weight, 8x8x16, reinforced, vertical #5@16", grouted			
B2020	Exterior Windows		3.48	$923,500
	Aluminum flush tube frame, for 1/4"glass,1-3/4"x4", 5'x6' opening, no intermediate horizontals			
	Glazing panel, plate glass, 1/4" thick, clear			
B2030	Exterior Doors		2.24	$593,000
	Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening			
	Door, aluminum & glass, with transom, non-standard, hardware, 3'-0" x 10'-0" opening			
B3010	Roof Coverings		1.44	$381,500

		% of Total	Cost Per SF	Cost
	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			
	Flashing, aluminum, no backing sides, .019"			
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick			
B3020	**Roof Openings**		0.05	$14,000
	Skylight, plastic domes, insulated curbs, 30 SF to 65 SF, single glazing			
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs			
	Smoke hatch, unlabeled, galvanized, 2'-6" x 3', not incl hand winch operator			
C Interiors		27.6%	32.85	$8,705,000
C1010	**Partitions**		10.79	$2,859,500
	Concrete block (CMU) partition, light weight, hollow, 6" thick, no finish			
	Concrete block (CMU) partition, light weight, hollow, 8" thick, no finish			
C1020	**Interior Doors**		1.36	$360,500
	Door, single leaf, kd steel frame, kalamein fire, commercial quality, 3'-0" x 7'-0" x 1-3/4"			
C1030	**Fittings**		0.05	$12,500
	Lockers, steel, single tier, 5' to 6' high, per opening, minimum			
C3010	**Wall Finishes**		6.79	$1,800,000
	2 coats paint on masonry with block filler			
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	Wall coatings, epoxy coatings, maximum			
C3020	**Floor Finishes**		6.26	$1,658,000
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 35 oz			
	Composition flooring, epoxy, minimum			
	Vinyl, composition tile, maximum			
C3030	**Ceiling Finishes**		7.60	$2,014,500
	Acoustic ceilings, 3/4"mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid, suspended support			
D Services		49.9%	59.40	$15,741,500
D2010	**Plumbing Fixtures**		14.63	$3,878,000
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, PE on CI, 18" x 15"			
	Lab sink w/trim, polyethylene, single bowl, double drainboard, 54" x 24" OD			
	Service sink w/trim, vitreous china, wall hung 22" x 20"			
	Shower, stall, fiberglass 1 piece, three walls, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		0.44	$116,000
	Gas fired water heater, commercial, 100< F rise, 600 MBH input, 576 GPH			
D2040	**Rain Water Drainage**		0.69	$182,500
	Roof drain, CI, soil,single hub, 6" diam, 10' high			
	Roof drain, CI, soil,single hub, 6" diam, for each additional foot add			
D3050	**Terminal & Package Units**		21.43	$5,678,500
	Rooftop, multizone, air conditioner, schools and colleges, 25,000 SF, 95.83 ton			
D4010	**Sprinklers**		3.30	$874,000
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 50,000 SF			
D4020	**Standpipes**		0.30	$80,000
	Wet standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor			
D5010	**Electrical Service/Distribution**		0.39	$104,000
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208V, 1000 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 1000 A			

		% of Total	Cost Per SF	Cost
	Switchgear installation, incl switchboard, panels & circuit breaker, 1200 A			
D5020	**Lighting and Branch Wiring**		13.57	$3,596,500
	Receptacles incl plate, box, conduit, wire, 8 per 1000 SF, .9 W per SF, with transformer			
	Wall switches, 2.0 per 1000 SF			
	Miscellaneous power, 1 watt			
	Central air conditioning power, 3 watts			
	Fluorescent fixtures recess mounted in ceiling, 1.6 watt per SF, 40 FC, 10 fixtures @32watt per 1000 SF			
D5030	**Communications and Security**		4.52	$1,197,500
	Communication and alarm systems, fire detection, addressable, 50 detectors, includes outlets, boxes, conduit and w			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		0.13	$34,500
	Generator sets, w/battery, charger, muffler and transfer switch, gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 1			
	Uninterruptible power supply with standard battery pack, 15 kVA/12.75 kW			
E Equipment & Furnishings		1.4%	1.62	$429,500
E1020	**Institutional Equipment**		1.62	$429,500
	Architectural equipment, laboratory equipment glassware washer, distilled water, deluxe			
	Architectural equipment, laboratory equipment glove box, fiberglass, radio isotope			
	Architectural equipment, laboratory equipment, cabinets, wall, open			
	Architectural equipment, laboratory equipment, cabinets, base, drawer units			
	Architectural equipment, laboratory equipment fume hoods, not including HVAC, deluxe including fixtures			
E1090	**Other Equipment**		0.00	$0
F Special Construction		0.0%	0.00	$0
G Building Sitework		0.0%	0.00	$0
Sub Total		**100%**	**$119.10**	**$31,561,000**
Contractor's Overhead & Profit		**0.0%**	**$0.00**	**$0**
Architectural Fees		**0.0%**	**$0.00**	**$0**
User Fees		**0.0%**	**$0.00**	**$0**
Total Building Cost			**$119.10**	**$31,561,000**

Square Foot Cost Estimate Report # 2

Building Type:	Office, 2-4 Story with Glass and Metal Curtain Wall / Steel Frame
Stories Count (L.F.):	4.00
Stories Height	16.00
Floor Area (S.F.):	265,000.00
LaborType	Union
Basement Included:	Yes
Data Release:	Year 2010 Quarter 3
Cost Per Square Foot	$144.32
Total Building Cost	$38,244,000

		% of Total	Cost Per SF	Cost
A Substructure		3.9%	5.60	$1,485,000
A1010	Standard Foundations		1.83	$486,000
	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		1.33	$353,000
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	Basement Excavation		1.08	$285,500
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	Basement Walls		1.36	$360,500
	Foundation wall, CIP, 12' wall height, pumped, .444 CY/LF, 21.59 PLF, 12" thick			
B Shell		29.7%	42.89	$11,365,500
B1010	Floor Construction		20.68	$5,479,500
	Cast-in-place concrete column, 12" square, tied, 200K load, 12' story height, 142 lbs/LF, 4000PSI			
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 P			
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and column, 25'x25' bay, 26" deep, 75 PSF sup			
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and column, 25'x25' bay, 26" deep, 75 PSF sup			
	Fireproofing, gypsum board, fire rated, 2 layer, 1" thick, 14" steel column, 3 hour rating, 22 PLF			
B1020	Roof Construction		2.06	$546,500
	Floor, steel joists, beams, 1.5" 22 ga metal deck, on columns, 25'x25' bay, 20" deep, 40 PSF superimposed load, 60			
	Floor, steel joists, beams, 1.5" 22 ga metal deck, on columns, 25'x25' bay, 20" deep, 40 PSF superimposed load, 60			
B2020	Exterior Windows		17.65	$4,677,000
	Windows, aluminum, awning, insulated glass, 4'-5" x 5'-3"			
	Aluminum flush tube frame, thermo-break frame, 2.25" x 4.5", 5'x6' opening, no intermediate horizontals			
	Glazing panel, insulating, 5/8" thick units, 2 lites 3/16" float glass, tinted			
B2030	Exterior Doors		1.06	$281,500
	Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening			
	Door, aluminum & glass, with transom, bronze finish, hardware, 3'-0" x 10'-0" opening			
	Door, steel 18 gauge, hollow metal, 1 door with frame, no label, 3'-0" x 7'-0" opening			

		% of Total	Cost Per SF	Cost
B3010	**Roof Coverings**		1.44	$381,000
	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			
	Flashing, aluminum, no backing sides, .019"			
	Gravel stop, aluminum, extruded, 4", duranodic, .050" thick			
C Interiors		21.8%	31.41	$8,323,500
C1010	**Partitions**		3.21	$851,500
	Metal partition, 5/8" water resistant gypsum board face, no base layer, 3-5/8" @ 24" OC framing ,same opposite face			
	1/2" fire ratedgypsum board, taped & finished, painted on metal furring			
C1020	**Interior Doors**		5.36	$1,420,000
	Door, single leaf, kd steel frame, hollow metal, commercial quality, flush, 3'-0" x 7'-0" x 1-3/8"			
C1030	**Fittings**		1.14	$303,000
	Toilet partitions, cubicles, ceiling hung, plastic laminate			
C2010	**Stair Construction**		4.57	$1,210,000
	Stairs, steel, cement filled metal pan & picket rail, 16 risers, with landing			
C3010	**Wall Finishes**		1.28	$339,500
	Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats			
	Vinyl wall covering, fabric back, medium weight			
C3020	**Floor Finishes**		8.25	$2,185,000
	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, minimum			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		7.60	$2,014,500
	Acoustic ceilings, 3/4"mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid, suspended support			
D Services		44.6%	64.42	$17,070,000
D1010	**Elevators and Lifts**		12.92	$3,422,500
	Hydraulic passenger elevator, 3000 lb, 3 floors,12' story height, 2 car group,125 FPM			
D2010	**Plumbing Fixtures**		3.58	$950,000
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, vanity top, PE on CI, 20" x 18"			
	Service sink w/trim, PE on CI,wall hung w/rim guard, 24" x 20"			
	Water cooler, electric, wall hung, 8.2 GPH			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		0.44	$116,500
	Gas fired water heater, commercial, 100< F rise, 100 MBH input, 91 GPH			
D2040	**Rain Water Drainage**		0.66	$176,000
	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**		18.22	$4,827,500
	Rooftop, multizone, air conditioner, offices, 25,000 SF, 79.16 ton			
D4010	**Sprinklers**		3.97	$1,052,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 5000 SF			
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 5000 SF			
	Standard High Rise Accessory Package 3 story			
D4020	**Standpipes**		0.94	$249,000
	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			

		% of Total	Cost Per SF	Cost
D5010	**Electrical Service/Distribution**		0.39	$104,000
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 1000 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 1000 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 1200 A			
D5020	**Lighting and Branch Wiring**		14.56	$3,857,500
	Receptacles incl plate, box, conduit, wire, 16.5 per 1000 SF, 2.0 W per SF, with transformer			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	Fluorescent fixtures recess mounted in ceiling, 1.6 watt per SF, 40 FC, 10 fixtures @32watt per 1000 SF			
D5030	**Communications and Security**		8.47	$2,245,000
	Telephone wiring for offices & laboratories, 8 jacks/MSF			
	Communication and alarm systems, fire detection, addressable, 50 detectors, includes outlets, boxes, conduit and w			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		0.26	$69,500
	Generator sets, w/battery, charger, muffler and transfer switch, gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 7			
	Uninterruptible power supply with standard battery pack, 15 kVA/12.75 kW			
E Equipment & Furnishings		0.0%	0.00	$0
E1090	Other Equipment		0.00	$0
F Special Construction		0.0%	0.00	$0
G Building Sitework		0.0%	0.00	$0
Sub Total		100%	$144.32	$38,244,000
Contractor's Overhead & Profit		0.0%	$0.00	$0
Architectural Fees		0.0%	$0.00	$0
User Fees		0.0%	$0.00	$0
Total Building Cost			$144.32	$38,244,000

Appendix C

D4 Cost Estimate #1

Prepared By:

Bailey Architects
4100 S. Shepherd
Houston, TX 77098
Fax:

Building Sq. Size:	265000
Bid Date:	1/19/2007
No. of floors:	4
No. of buildings:	1
Project Height:	100
1st Floor Height:	16
1st Floor Size:	44167

Prepared For:

Fax:

Site Sq. Size:	152460
Building use:	Educational
Foundation:	SOF
Exterior Walls:	GLA
Interior Walls:	OTH
Roof Type:	BUP
Floor Type:	TER
Project Type:	NEW

Texas A&M Science Ed. Center

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**4.73**	**5.76**	**1,525,358**
	Bonds & Certificates	3.55	4.32	1,145,287
	General Conditions	1.18	1.43	380,071
01	**General Requirements**	**1.77**	**2.16**	**571,619**
	Field Engineering	0.73	0.89	235,602
	Constr. Fac. & Temp. Controls	1.04	1.27	336,017
03	**Concrete**	**16.99**	**20.69**	**5,483,232**
	Formwork	3.10	3.77	999,105
	Reinforcement	7.10	8.64	2,290,507
	Cast-In-Place	6.80	8.28	2,193,620
04	**Masonry**	**7.77**	**9.47**	**2,508,471**
	Masonry	7.77	9.47	2,508,471
05	**Metals**	**5.92**	**7.21**	**1,909,386**
	Structural Framing	4.84	5.90	1,563,584
	Fabrications	0.12	0.14	37,125
	Ornamental	0.94	1.14	301,957
	Expansion Control	0.02	0.03	6,719
06	**Wood & Plastics**	**2.57**	**3.13**	**828,597**
	Rough Carpentry	0.22	0.27	71,815
	Architectural Woodwork	2.34	2.86	756,783
07	**Thermal & Moisture Protection**	**3.09**	**3.77**	**998,685**
	Dampproofing	0.91	1.11	293,138
	Insulation	0.59	0.71	188,986
	Fireproofing	0.43	0.53	139,849
	Firestopping	0.06	0.07	19,739
	Membrane Roofing	0.90	1.09	289,358
	Flashing and Sheet Metal	0.05	0.06	16,799
	Roof Specialties and Accessories	0.03	0.03	8,399
	Joint Sealers	0.13	0.16	42,417
08	**Doors & Windows**	**3.41**	**4.15**	**1,099,103**
	Metal Doors & Frames	0.26	0.32	84,876
	Wood & Plastic Doors	0.25	0.30	80,214
	Special Doors	0.01	0.01	3,675
	Hardware	1.00	1.22	323,901
	Glazing	0.06	0.08	19,948
	Glazed Curtainwalls	1.82	2.21	586,490

09	**Finishes**	**10.06**	**12.26**	**3,248,350**
	Lath & Plaster	0.21	0.25	67,195
	Gypsum	4.65	5.67	1,501,282
	Tile	0.42	0.51	134,390
	Terrazzo	1.19	1.45	384,691
	Acoustical Treatment	0.82	1.00	264,580
	Wood Flooring	0.19	0.23	61,315
	Carpet	1.14	1.39	367,052
	Special Flooring	0.18	0.23	59,636
	Painting	1.26	1.54	408,209
10	**Specialties**	**0.89**	**1.08**	**287,258**
	Visual Display Board	0.21	0.25	66,355
	Louvers & Vents	0.05	0.06	17,219
	Pest Control	0.04	0.05	12,599
	Identifying Devices	0.08	0.10	26,038
	Fire Protection	0.03	0.04	9,659
	Protective Covers	0.05	0.06	17,219
	Storage Shelving	0.03	0.04	10,079
	Telephone	0.02	0.03	7,979
	Toilet & Bath Accessories	0.37	0.45	120,111
11	**Equipment**	**1.01**	**1.23**	**326,735**
	Audio-Visual	0.58	0.71	188,146
	Food Service	0.43	0.52	138,590
12	**Furnishings**	**2.03**	**2.47**	**655,571**
	Window Treatment	0.09	0.11	29,818
	Multiple Seating	1.94	2.36	625,753
14	**Conveying Systems**	**1.88**	**2.29**	**606,913**
	Elevators	1.88	2.29	606,913
15	**Mechanical**	**23.53**	**28.66**	**7,595,694**
	Insulation	0.68	0.82	218,384
	Fire Protection	2.57	3.12	827,947
	Plumbing	4.21	5.12	1,357,716
	HVAC	13.40	16.32	4,326,094
	Controls	2.68	3.27	865,555
16	**Electrical**	**14.35**	**17.48**	**4,632,460**
	Electrical	14.35	17.48	4,632,460
Total Building Costs		**100.00**	**121.80**	**32,277,433**
02	**Site Work**	**100.00**	**9.67**	**1,474,083**
	Demolition	2.56	0.25	37,800
	Preparation	32.02	3.10	471,963
	Earthwork	23.06	2.23	339,900
	Piles and Caissons	6.25	0.60	92,090
	Paving and Surfacing	13.50	1.30	198,950
	Water Distribution	5.15	0.50	75,950
	Sewerage and Drainage	7.66	0.74	112,900
	Power and Communications	1.11	0.11	16,330
	Improvements	0.17	0.02	2,500
	Landscaping	8.53	0.82	125,700
Total Non-Building Costs		**100.00**	**9.67**	**1,474,083**
Total Project Costs		--	--	**33,751,516**

D4 Estimate #2

University Chem. Building

Prepared By:

Holabird & Root
140 S. Dearborn Street Ste. 500
Chicago, IL 60603
Fax:

Building Sq. Size: 265000
Bid Date: 1/19/2007
No. of floors: 4
No. of buildings: 1
Project Height: 100
1st Floor Height: 16
1st Floor Size: 44167

Prepared For:

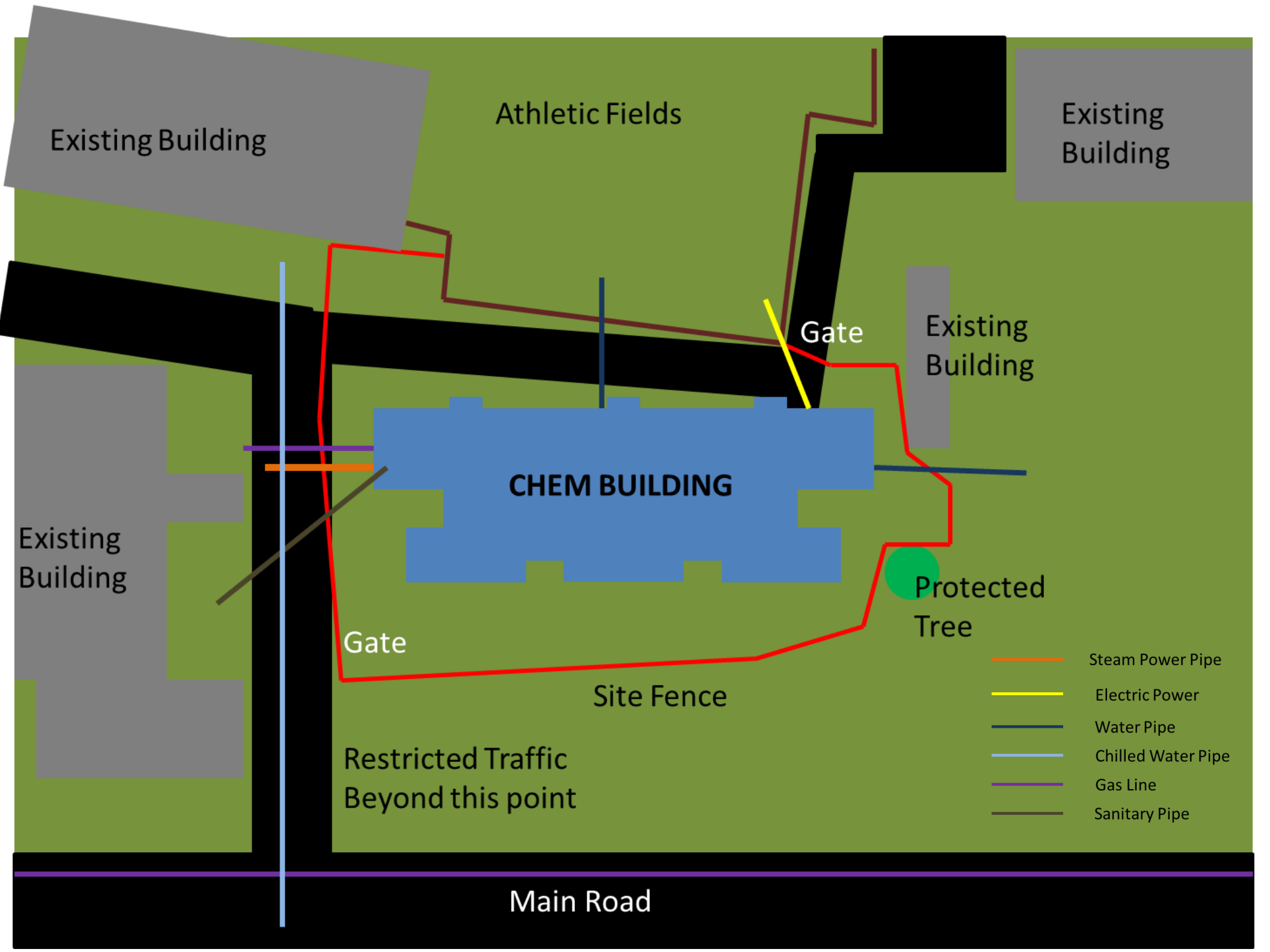
,
Fax:

Site Sq. Size: 85000
Building use: Educational
Foundation: SOF
Exterior Walls: GLA
Interior Walls: OTH
Roof Type: BUP
Floor Type: TER
Project Type: NEW

Division		Percent	Sq. Cost	Amount
01	**General Requirements**	**3.71**	**7.88**	**2,088,701**
	General Requirements	3.71	7.88	2,088,701
03	**Concrete**	**7.18**	**15.26**	**4,044,687**
	Concrete	7.18	15.26	4,044,687
04	**Masonry**	**1.78**	**3.78**	**1,002,856**
	Unit	1.78	3.78	1,002,856
05	**Metals**	**8.74**	**18.57**	**4,921,078**
	Metals	8.74	18.57	4,921,078
06	**Wood, Plastics, and Composites**	**8.27**	**17.58**	**4,659,529**
	Wood Plastics & Composites	8.27	17.58	4,659,529
07	**Thermal and Moisture Protection**	**3.91**	**8.32**	**2,204,936**
	Thermal & Moisture Protection	3.91	8.32	2,204,936
08	**Openings**	**4.90**	**10.41**	**2,757,525**
	Openings	4.90	10.41	2,757,525
09	**Finishes**	**8.85**	**18.82**	**4,986,807**
	Finishes	8.85	18.82	4,986,807
11	**Equipment**	**10.34**	**21.98**	**5,824,756**
	Educational & Scientific	10.34	21.98	5,824,756
12	**Furnishings**	**1.61**	**3.43**	**909,570**
	Multiple Seating	1.61	3.43	909,570
14	**Conveying Systems**	**1.73**	**3.68**	**975,210**
	Elevators	1.73	3.68	975,210
21	**Fire Suppression**	**1.37**	**2.91**	**769,825**
	Fire Suppression	1.37	2.91	769,825
23	**HVAC**	**21.47**	**45.63**	**12,091,801**
	HVAC	21.47	45.63	12,091,801
25	**Integrated Automation**	**5.67**	**12.05**	**3,193,236**
	Integrated Automation	5.67	12.05	3,193,236

26	**Electrical**	**9.07**	**19.27**	**5,106,798**
	Electrical	9.07	19.27	5,106,798
27	**Communications**	**0.35**	**0.74**	**196,173**
	Communications	0.35	0.74	196,173
28	**Electronic Safety and Security**	**1.06**	**2.25**	**597,200**
	Electronic Safety & Security	1.06	2.25	597,200
Total Building Costs		**100.00**	**212.57**	**56,330,690**
31	**Earthwork**	**100.00**	**2.19**	**186,049**
	Earthwork	100.00	2.19	186,049
Total Non-Building Costs		**100.00**	**2.19**	**186,049**
Total Project Costs		--	--	**56,516,739**

Appendix D – Existing Conditions Site Plan


Existing Building
Athletic Fields
Existing Building
Gate
Existing Building
CHEM BUILDING
Existing Building
Protected Tree
Gate
Site Fence
Restricted Traffic Beyond this point
Steam Power Pipe
Electric Power
Water Pipe
Chilled Water Pipe
Gas Line
Sanitary Pipe
Main Road