October 4th, 2010

TECHNICAL ASSIGNMENT ONE

PENN STATE SENIOR THESES

UNIVERSITY SCIENCES BUILDING

NORTHEASTERN U.S.

JUSTIN GREEN

CONSTRUCTION MANAGEMENT
ADVISOR: DR. RILEY

PENNSTATE

1855

Turner

TECHNICAL ASSIGNMENT ONE

Justin Green - CM

EXECUTIVE SUMMARY

Technical Assignment One is intended to familiarize an individual with the conditions under which the University Sciences Building is constructed and the scope of work required for completion. This report will provide a background of the existing conditions and project constraints that affect both the design and construction process.

The University Sciences Building is a mixed use facility that will house both students and faculty of the university. It includes 39 research and teaching laboratories for bio-medical engineering, biology, chemistry, and fossil preparation. This 138,000 square foot building also houses 8 educational classrooms, a small auditorium seating 240 students, and a wing dedicated to both administrative and faculty support.

This report will take an in depth view of the building's basic systems, including a unique type of precast concrete used in combination with cast-in-place concrete, as well as a living, breathing biowall that spans the entire height of the facility's atrium space. A cost and schedule breakdown will be given on these systems as well as any client concerns that may be present. Along with building system information, this report will also touch on the existing and local site conditions that are present and the challenges that come with construction in a major U.S. city.

After analyzing the information within the report, a major emphasis has been placed on the description of building systems and the sequencing of these systems. Existing conditions have a huge influence on the planning and success of construction.

The largest challenge present with construction lies in pleasing the owner and meeting the sustainable goals set towards achieving LEED Gold Certification.

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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

Figure 1: Building Systems

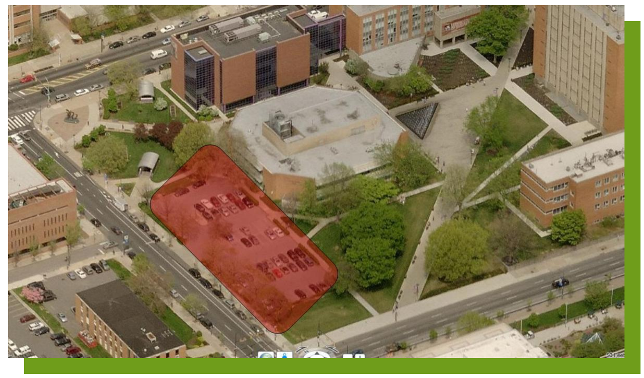


Figure 2: Arial View of the Site

Demolition

The only demolition required for the University Sciences Building project was the existing parking lot that covered most of the building's footprint. The shaded area in *Figure 2* above shows the size and positioning of the parking lot to be demolished.

Structural Steel Frame

While most of the building is supported by a concrete frame and shear walls, the upper penthouse levels are supported by a steel frame with moment connections *(see Figure 3)*. Sizes of members include W8x40, W8x48, W8x67, and W12x65. Connection details are shown in *Figures 3, 5, and 6*.

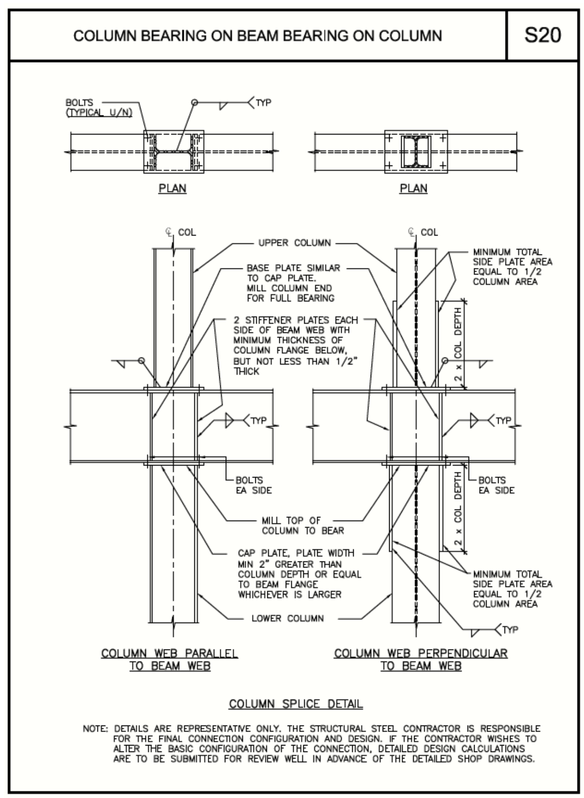


Figure 3: Steel Connection Details

Figure 4:

Northern Facing Exterior

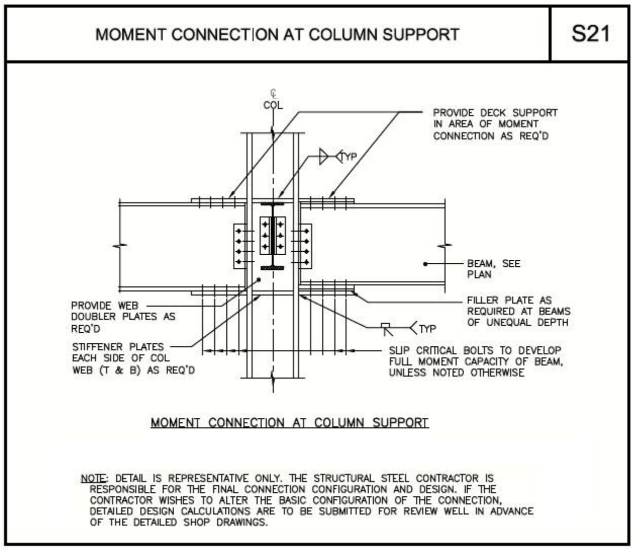


Figure 5: Moment Connection @ Column Support

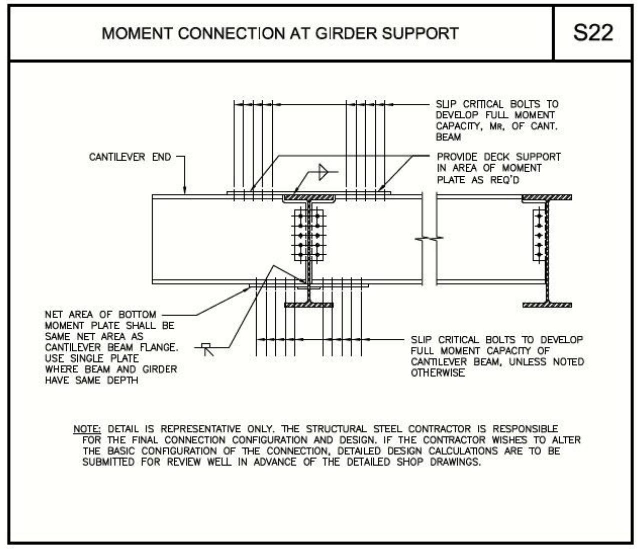


Figure 6: Moment Connection @ Girder Support

One feature that is typically present in buildings today is the use of a composite floor slab. The University Sciences Building utilizes this construction technique in situations where steel decking is present with cast-in-place concrete resting on top. By rigidly joining the two systems together (steel and concrete), the resulting system is stronger than if the two were independent of one another. While concrete is great in compression but poor in tension, the steel members are strong when in tension. See the composite slab detail in *Figure 7* below.

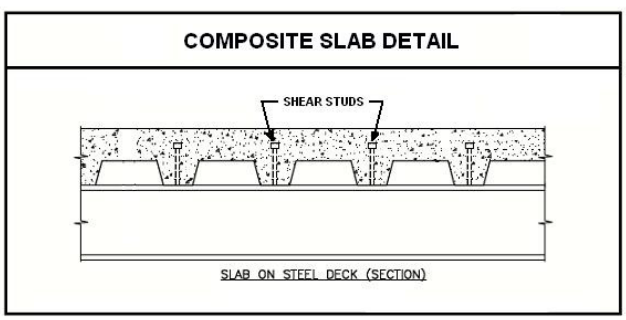


Figure 7: Composite Slab Detail

A tower crane was utilized on this project to erect all of structural steel members. This tower crane was also used for the cast-in-place concrete. It was located in the center of the University Sciences Building's atrium space.

Cast-In-Place Concrete

Reinforced cast-in-place concrete was used for the University Sciences Building's drilled caissons, grade-beams, foundation walls, slab-on-grade, columns, beams, and elevated slabs.

A smoothed-formed finish was used for all of the building's cylindrical columns because they will remain exposed to public view when the project is completed. Any other permanently exposed concrete within the building also require a smooth finish and that all corners/edges be chamfered.

All of the elevated slabs within the building are supported by the filigree precast slabs *(see precast concrete directly below for description)*. These filigree slabs replace the need for any wooden or metal formwork when placing concrete.

As stated earlier, a tower crane (and bucket) was used when placing the concrete.

Precast Concrete

Filigree precast slabs have been implemented on this project. Filigree slabs are essentially really thin concrete precast panels with prestressed reinforcement throughout. They also act as the formwork for the cast-in-place concrete on site. The slabs are first made off-site and then shipped to the jobsite for assembly and shoring. Once secured, the second layer of concrete with reinforcing is placed on top of the precast panels. This process can effectively and efficiently accelerate the construction of structures with improved physical and aesthetic properties.

These precast slabs can also be considered as a sustainable feature because there are fewer materials wasted when forming the concrete slabs.

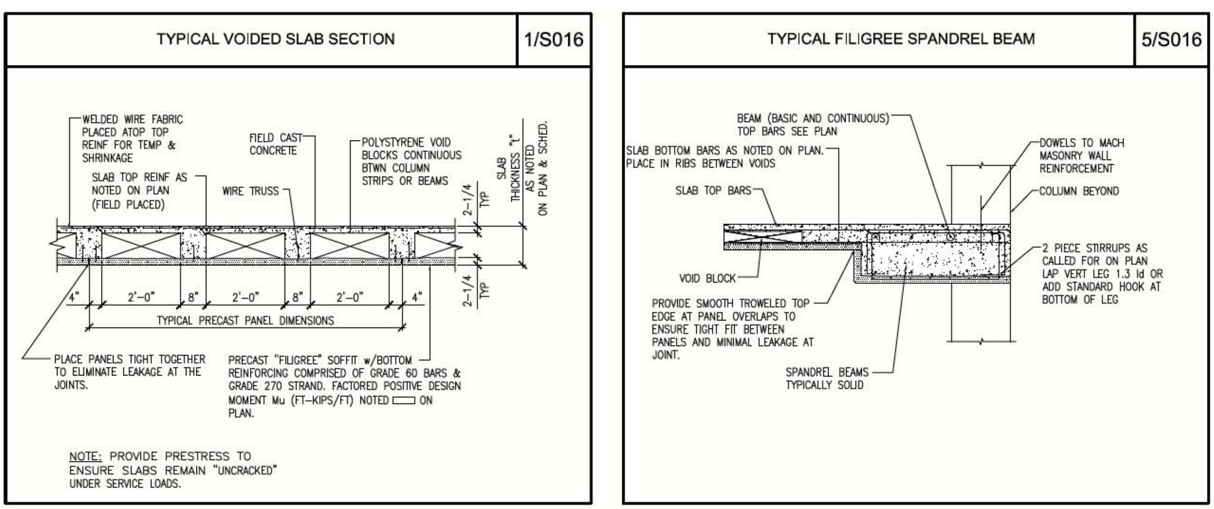


Figure 8: Typical Filigree and Voided Slab Details

These filigree slabs *(shown in Figure 8)* are cast by Mid-State Filigree Systems, Inc. in Cranbury, NJ and the contractor installing these panels is Madison Construction. Sequencing and connection details are a critical component of the installation of any type of precast concrete.

Shop drawings indicate the same sequencing as the rest of the trades and systems on the jobsite. Installation starts at the southwest corner of the building, and progresses in a clockwise manner around the site. These precast panels have also been installed using the tower crane located in the center of the atrium.

Mechanical System

There are 3 different areas of mechanical spaces with the University Sciences Building. One mechanical room is located in the basement of the building, another room is located on the 5th floor of the building, and another two out of three wings of the building on the penthouse level are dedicated to mechanical space.

All of this space is required to house the 2 Cooling Towers, 2 Chillers, 6 Heat exchangers, and 9 Air Handling Units (1 - auditorium, 4 - labs, 1 - offices, 1 - classrooms, 1 - atrium, and 1 - electrical/telecom).

The type of air distribution system used within the building is a Variable Air Volume (VAV) system, which feeds exhaust air through the living biowall to be cleaned and recycled.

The entire building will be sprinkled with a wet stand pipe system in place.

Electrical System

The power source for this building is coming from the adjacent university building (*see Appendix D for a map of existing conditions)* at 13.2 kV on a 15 kV medium voltage cable, and then stepped down to 480/277V, (3 phase, 4 wire).

The electrical system currently in place does not allow for many redundancies in power supply. However, if power were to go out for a limited period of time, there are emergency power and lighting distribution systems in place to continue feeding the building's critical systems.

Masonry

The masonry used for the University Sciences Building's exterior is non-load bearing. Instead, the CMU walls act as a barrier to the outside elements. Thicker and denser walls can better block the sounds of a major city. As a result, the space within the building becomes a more private and intimate space for its occupants.

The masonry walls will be covered with insulation and a thin aluminum cladding *(shown in Figure 9)*.

The masonry walls are tied into the structure by bolted steel connections from a 3”x15”x‘X’ continuous bent steel plate that have been embedded into the cast-in-place concrete slabs.

All masonry was placed using the typical tube and plank scaffolding methods.

Figure 9: On-site Mock-up of the Exterior Wall

Curtain Wall

Diamond and Schmitt Architects have designed most of the building’s exterior with the use of masonry block and strips of glazing throughout. However, there are a few places on the bottom floor and on the circular rotunda that have a curtain wall system. The circular rotunda has 1/8” clear cricursa curved glass with argon gas filler and the remaining curtain walls are comprised of an outer and inner layer of 1/4” clear tempered glass with a low-E coating and argon gas filler.

Support of Excavation

The only areas of the building that needed excavation were that of the northern wing of the building. Excavation in this area was needed for both the underground mechanical and electrical rooms, as well as the front half of the sloped auditorium. The remaining foundation work did not require much excavation because the foundation consists of drilled concrete caissons.

Excavation supports for the University Sciences Building consisted of steel soldier beams with wooden lagging. The soldier beams were set in previously drilled holes, grouted around the base, and then excavated downward.

Green Features / LEED Certification

The five story biowall located in the atrium of the building will act as a natural air filter to help remove harmful VOCs and CO_2 levels from the air. As air is passed through the wall, impurities are removed by the natural photosynthesis process of the plants.

Figure 10: Typical Filigree and Voided Slab Details

To feed the plants, water is pumped down the face of the wall and then collected in a basin at the bottom to be pumped back to the top of the biowall for recirculation. Nutrients will be added periodically, but this system of ventilation and air purifying requires a very minimal amount of maintenance.

The building was designed to feed the biowall with plenty of natural daylight. Skylights from above and windows on the south face of the building allow for healthy growth of the plants that will be used.

The biowall allows for air within the building to be constantly recycled. In many ways, this is better than most of the ventilation systems used today. The quality of the air is better because it will be cleaner then the city air that would typically be introduced into the “clean” air supply. You also no longer need to re-heat or re-cool the air within the space. With the air being cleaner and more comfortable, its occupants will feel healthier and possibly be more productive. The aesthetics of the space alone contribute to the comfort of the occupants.

The University Sciences Building is currently on pace to receive LEED Gold Certification upon completion.

PROJECT SUMMARY SCHEDULE

**See APPENDIX A for the Project Summary Schedule*

Design

The University Sciences Building was bid out in the traditional Design-Bid-Build fashion. This means that there was very little to no overlap between the design and construction phases of the project. It is because of this that Turner Construction is unaware of the specific details in the procurement and design of this facility. In comparison with other facilities of the same occupancy type and location, it was determined that the design phase of the project was in the vicinity of 1 year, or 260 work days.

Members of the construction team are also unaware of the exact time frame of when the design was put out to bid and when the team was awarded the project. Most construction projects have a typical contractor selection period of about a month and a half, resulting in the duration of 35 work days for the bid and award of the CM @ Risk *(For description, see project delivery system section of report)*.

Lastly, a major time commitment of any project startup is the permits and approvals needed to begin construction. When researching typical permit request and approval durations in the area, it was found that construction permits can take anywhere from 15 to 90 days depending on what type of permit is being requested. This is what you see in the final line item of the preconstruction phase *(Reference Appendix A)*.

Construction

Sequence

The major sequence of work on this project is such that construction starts on the first floor and raises one floor at a time in a clockwise rotation until the penthouse is reached *(see Figure 11)*. This is similar to a Short Interval Production Schedule (SIPS) schedule where each trade or task is given a particular area of the floor in which each individual trade is allowed 5 days to complete their particular task before moving onto the next area. This type of schedule brings an assembly line approach to construction. However, SIPS schedules only work if there is some kind uniformity to the floor layouts and square footage of each area.

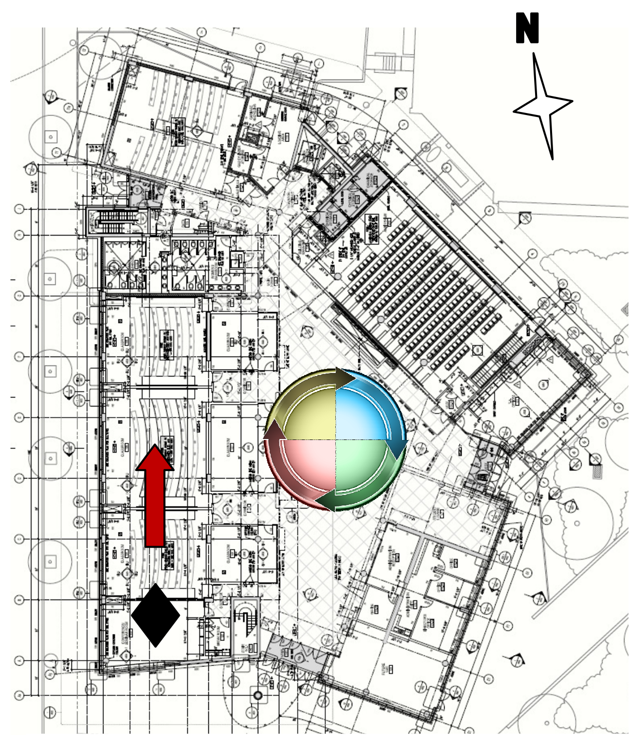


Figure 11: First Floor Layout Showing Sequence

Activity Breakdowns

Foundation work has been broken down into Concrete Piles, Grade Beams & Pile Caps, and Foundation Walls for the purposes of this first Technical Assignment. These make up the majority of the University Sciences Building foundation work. The foundation itself is comprised of 75 drilled caisson piers with grade beams resting on top.

Superstructure can be broken down into concrete slabs & columns and steel located in the penthouse level(s). The concrete slab process in this building is unlike most. Turner utilizes a filigree precast slab and beam system with a layer of cast-in-place concrete on top *(see Building Systems for more detail)*.

Finishes have been broken down into Electrical, Lighting, Mechanical, Plumbing, Fire Protection, Drywall, Paint, and Elevator subtasks. This is the bulk of any construction project and coordination between the different trades is critical.

Key Milestones / Impacts

Duration of construction for the University Sciences Building is from September 9th, 2009 (notice to proceed), to July 1st, 2011. This is a total duration of 473 days of construction and 385 days for preconstruction activities.

To date, no major schedule impacts have been noted, and Turner is on track to have the building fully enclosed before this coming winter. This is critical because building close-in before the winter months can equate to less money wasted in trying to heat the various spaces within the building. Another sequencing strategy to note is that Turner will be filling the entire atrium space with scaffolding. This can affect the time required to perform interior finishes by reducing the amount of time workers spend adjusting their positions in order to finish the work. Less time spent moving around means more time working and better productivity levels.

PROJECT COST EVALUATION

The actual building construction cost for the University Sciences Building is currently around $50 Million. This cost is a close approximate of Turner's lump sum value plus any change orders that have been accumulated to date.

Project Parameters

Total Square Footage:	138,000 SF
Total Building Perimeter:	750 LF

Construction Cost

Actual:	$ 50,000,000
Per Square Foot:	$ 362.32 per SF

Total Project Cost

Actual:	$ 70,000,000
Per Square Foot:	$ 507.25 per SF

Major Building Systems Costs and Cost per Square Foot

MAJOR BUILDING SYSTEMS		
SYSTEM	ACTUAL COST	COST PER SF
Concrete	$ 5,800,000	$ 42.03
Steel	$ 800,000	$ 5.80
Mechanical & Plumbing	$ 14,000,000	$ 101.45
Electrical	$ 6,000,000	$ 43.48

Figure 12: Building System Totals

R.S. Means Square Foot Estimate

**See APPENDIX B for the R.S. Means Costworks 2010 Breakdown*

Total Construction Cost

Actual:	$ 31,046,000
Per Square Foot:	$ 224.97 per SF

**These numbers exclude design and construction fees.*

D4 Cost Estimate

**See APPENDIX C for the D4 COST V9.5 Estimate Reports*

D4 Cost estimation is a database of differing project types, sizes, costs, and locations that can be used in comparing, adjusting, and scaling estimate values to better fit a project's unique conditions. Two case studies most resembling the University Sciences Building have been selected from the database and altered to best fit the conditions on this project.

Case Study #1 - Law Enforcement Lab and Office Facility

Total Construction Cost

Actual:	$ 24,648,762
Per Square Foot:	$ 178.61 per SF

Total Project Cost

Actual:	$ 25,495,012
Per Square Foot:	$ 184.75 per SF

Case Study #2 - Ezra Taft Benson Science Building

Total Construction Cost

Actual:	$ 17,592,308
Per Square Foot:	$ 127.48 per SF

Total Project Cost

Actual:	$ 18,682,490
Per Square Foot:	$ 135.38 per SF

Cost Comparison

The difference in actual construction cost and the estimated cost of construction can be contributed to a variety of reasons.

A difference of $18 Million in construction costs can be contributed to the degree of difficulty that comes with this type of facility. The filigree precast slabs used in the University Sciences Building is a special type of floor/beam construction that requires a higher level of expertise. The implementation of a 5-story living biowall along with other LEED accreditation points can also increase the overall cost of design and construction.

Other factors that can contribute to the difference in pricing include location and occupancy type. The 39 research and teaching laboratories require a large mechanical system to handle the HVAC loads within the spaces. A mechanical system with 9 Air Handling Units could be a large reason for the difference in pricing. From a location and site logistical point of view, the fact that the building is located in a major city in the Northeastern United States puts a premium on the cost of labor and materials used.

RS Means online Costworks estimate was the closest to the actual cost of construction. However, limited selection of facility types and building systems decreases the overall accuracy of the estimate. Furthermore, it was difficult to accurately determine the proper building additives and their corresponding quantities. Things like the number of desks, counters, sinks, etc. have a huge impact on the cost of building materials used in a facility that houses both classrooms and laboratories.

The D4 COST estimate was the farthest form the real cost of construction. This is due in part to the limited selection of projects in the database, the lack of comparable projects to this type of facility, and the fact that the program doesn't account for mixed use facilities.

In general, a Square Foot Estimate's degree of accuracy is +/- 10% of the real cost of construction. If the estimates performed could account for the factors mentioned above, these estimates would be closer to 10% of the final building cost.

SITE PLAN OF EXISTING CONDITIONS

**See APPENDIX D for the Existing Conditions Site Plan created using AutoCAD.*

Figure 13: Bing Map of USB in Northeastern U.S.

The site for the University Sciences Building is located in the heart of the University's campus. This means that vehicular and pedestrian traffic will be a concern during all phases of the project. Whether it means blocking of street lanes or installing overhead protection, site safety has to be taken into serious consideration.

Being in a city has its advantages and disadvantages. One perk of this building's location is the easy access to nearby utility lines. Only a minimal amount of utility relocation is required for this facility. Existing utilities can be seen on the Site Plan under *Appendix D*. Some of the major disadvantages include limited space for site storage and material deliveries. This means that more thought has to be put into scheduling and material staging. Less space outside of the building also typically equates to more congestion within the building.

LOCAL CONDITIONS

This university is located in one of the largest cities in the Northeastern United States. Cities are well known for their stick-built steel buildings and large curtain wall facades. This building is different in the fact that it is against the norm by utilizing a heavy concrete and masonry type structure with punch out windows.

To make room for the new facility, old parking had to be demolished. As with any city environment, site logistical planning at the start of the job is critical. Employees must either ride the bus into work, or take the subway train that runs adjacent to the site.

Site congestion and site traffic is another consideration that needs to be taken into account. Turner must coordinate with the city and campus officials about when deliveries or construction will require street and sidewalk closings.

The subsurface conditions for this site were explored by Geosystems Consultants, Inc. using a total of eight test borings *(shown in Figure 14)*.

The borings encountered fill at the surface, underlain by alluvium, residual soil/decomposed rock, and relatively intact bedrock. Fill at the surface extended to depths ranging from 4 to 6 feet, but as much as 8 feet. Alluvail soils are soils which were deposited by the action of moving water. The amount of alluvium was found to be variable. Residual soil is the result of complete in-place weathering and decomposition of the parent bedrock. Samples showed thicknesses of residual soil in the range of 5 to 12 feet. Decomposed rock is derived from less developed in-place weathering/decomposition of the parent bedrock, and ranged from 4 to 11 feet in depth between boring samples. Finally, bedrock was encountered at depths ranging from 25 to 34 feet.

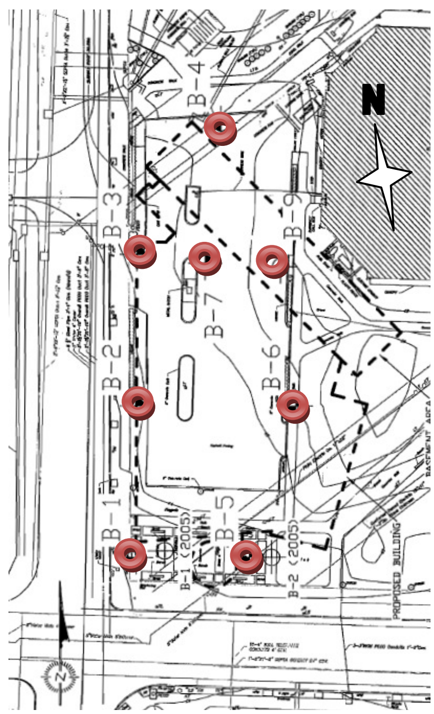


Figure 14: Soil Boring Locations

Groundwater depths were measured to be 13.7 feet and 18.4 feet in boring numbers B-1 and B-9, respectively. The corresponding elevations are +28.6' and 28.1', respectively.

Geosystems Consultants, Inc. determined that a conventional shallow-based spread footing would not be suitable for the University Sciences Building due to the magnitude of the column loads and the presence of uncontrolled fill, as well as, the underlying compressible alluvium and medium dense upper portion of the residual soil. Thus, they recommended a deep foundation for the project.

Geosystems concluded that drilled piers bearing on rock would be the most suitable foundation type. Drilled caissons can be installed with essentially no vibrations and would not exert any significant stresses on the adjacent subway tunnels.

Recycling and waste removal capabilities are readily accessible within the city. Because this is a LEED job, I would expect there to be some level of recycling and material re-use, however, I did not observe any substantial efforts applied during my site visit on 8/18/2010.

CLIENT INFORMATION

University Sciences Building will be another important addition to a university that is well known and well respected across the nation. With the addition of this facility, the university will take one step closer to the forefront of universities taking an initiative in being more environmentally responsible with their buildings and their energy usage.

The addition of this facility shows the university's commitment to educational growth and learning. The research generated from the facility will contribute to a better understanding of materials and systems on this planet.

Cost, quality, schedule, and safety are some of the key areas of focus for this project. Educational facilities have a very tight budget and a limited amount of governmental funding. It is important that this building has a finial cost that reflects a high level of quality and craftsmanship at an originally agreed upon price of $70 million or less. To meet this budget, the building must also finish by the summer of next year so that the building can be utilized for the following school year. While cost, quality, and schedule are important, nothing is more important to this client than the safety of its students and the workers on site.

As stated previously, the main concern for this owner is when the project will finish and if it will finish on time (before the next school year). To do this, key sequencing tasks of the owner's interest might include the timely installation of foundations, the placement of floor slabs, installation of key MEP systems and the lead time required for equipment, building close-in, and system commissioning.

Keeping on schedule and under budget at a high level of quality will be the ultimate key to owner satisfaction. A good owner relationship is crucial to the success of any construction project.

PROJECT DELIVERY SYSTEM

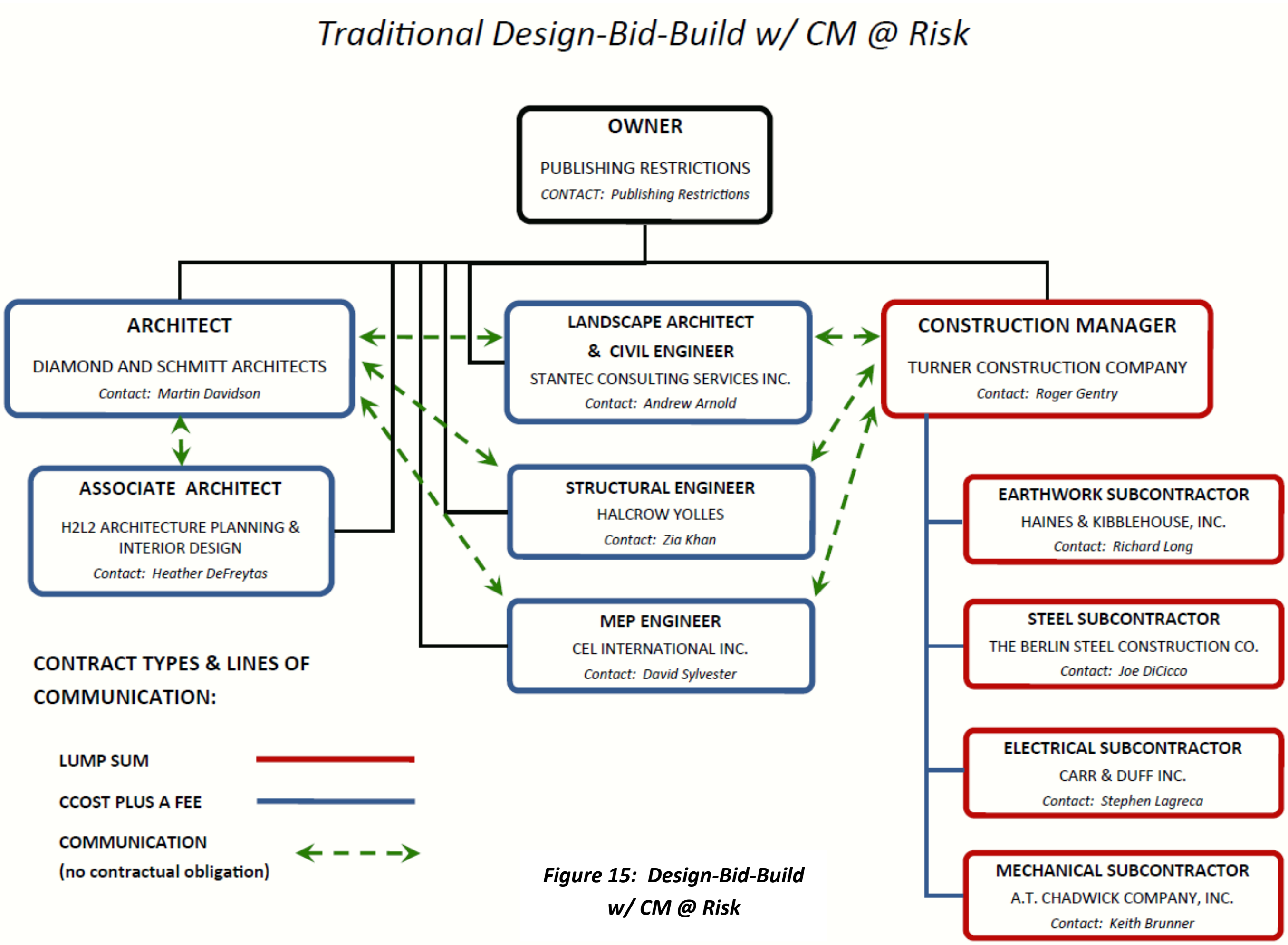


Figure 15: Design-Bid-Build w/ CM @ Risk

The project delivery system for the University Sciences Building is a traditional Design-Bid-Build with a Construction Manager (CM) at Risk. In this process, Diamond and Schmitt Architects prepares a complete set of contract documents before bids are sent out for construction.

Design-Bid-Build Advantages:

Familiarity with the system, improving overall coordination between parties.
The owner can get a firm fixed price before any work even begins.
Allows for good competitive prices from the open market.
Large design/construction staffs are typically unnecessary.

Design-Bid-Build Disadvantages:

No contractor feedback during the design phase.
Can't fast track the project, longer schedule durations.

The contractual relationships between the owner and the architects/engineers are that of a Cost-Plus-A-Fee. This simply means that the architect/engineer agrees to furnish a design for the project, and will be reimbursed a percentage of the overall cost of the building for their profit. The remaining contracts are all considered Lump Sum. These contracts allow for the lowest, most pre-qualified bidders on the market. It is an agreement to perform the work for a fixed price regardless of the cost to the contractor.

Turner and all of their subcontractors are required to provide proof of insurance, payment bonds, and performance bonds.

This delivery system seems appropriate for this type of facility and this type of owner. When an owner has the proper time to fully develop a set of plans, they can achieve the best possible pricing for the university. This is a plus because of the limited funding universities receive from local and state governments. Design-Bid-Build would not be very effective if there was a strict time frame for construction and for projects that need to be *fast tracked* (the start of construction before design is fully complete).

STAFFING PLAN

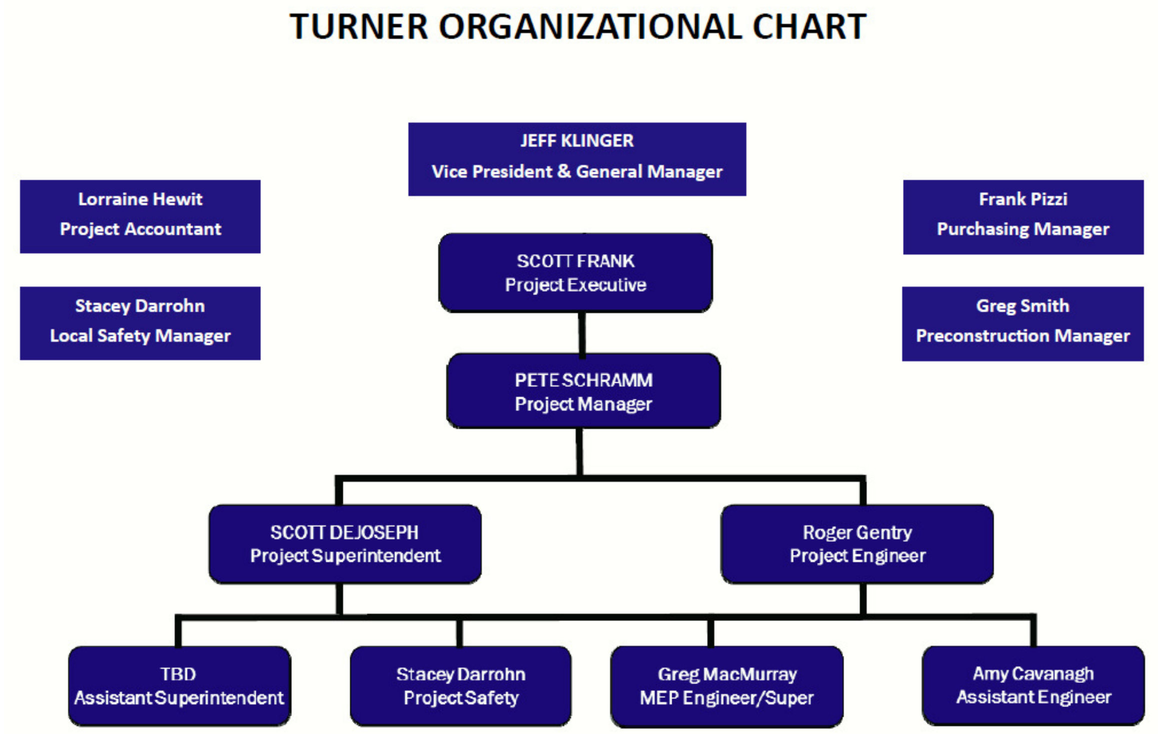


Figure 16: Turner Staffing Plan

Turner Construction staffs their projects differently from job to job depending on factors such as project type, cost, size, location, and experience. *Figure 16* shows the staffing for the University Sciences Building.

Most organizations have a similar type of layout but with slight differences in job titles or descriptions. This organizational structure starts from the top down. The Project Executive typically oversees a group of 3-5 projects in which they visit the jobsites on a weekly or monthly basis. The Project Manager and everyone below him work on-site for most of, if not the entire duration of the project. Some employees may get added as the work load increases, and some may be moved to other jobs when the project is coming to a close, but these individuals shown above are the core driver of the University Sciences Building.

**See APPENDIX E for the Phased Staffing Plan, showing durations of all staff members involved.*

Other key players involved on this job include an Accountant, a Purchasing Manager, and a Preconstruction Manager who play a much larger role during the start-up of a construction project. Lastly, one of the most important positions on any construction staff is the Project and/or Local Safety Managers. Nothing is more important than a workers safety and making sure that each worker gets home to his family at the end of the day.

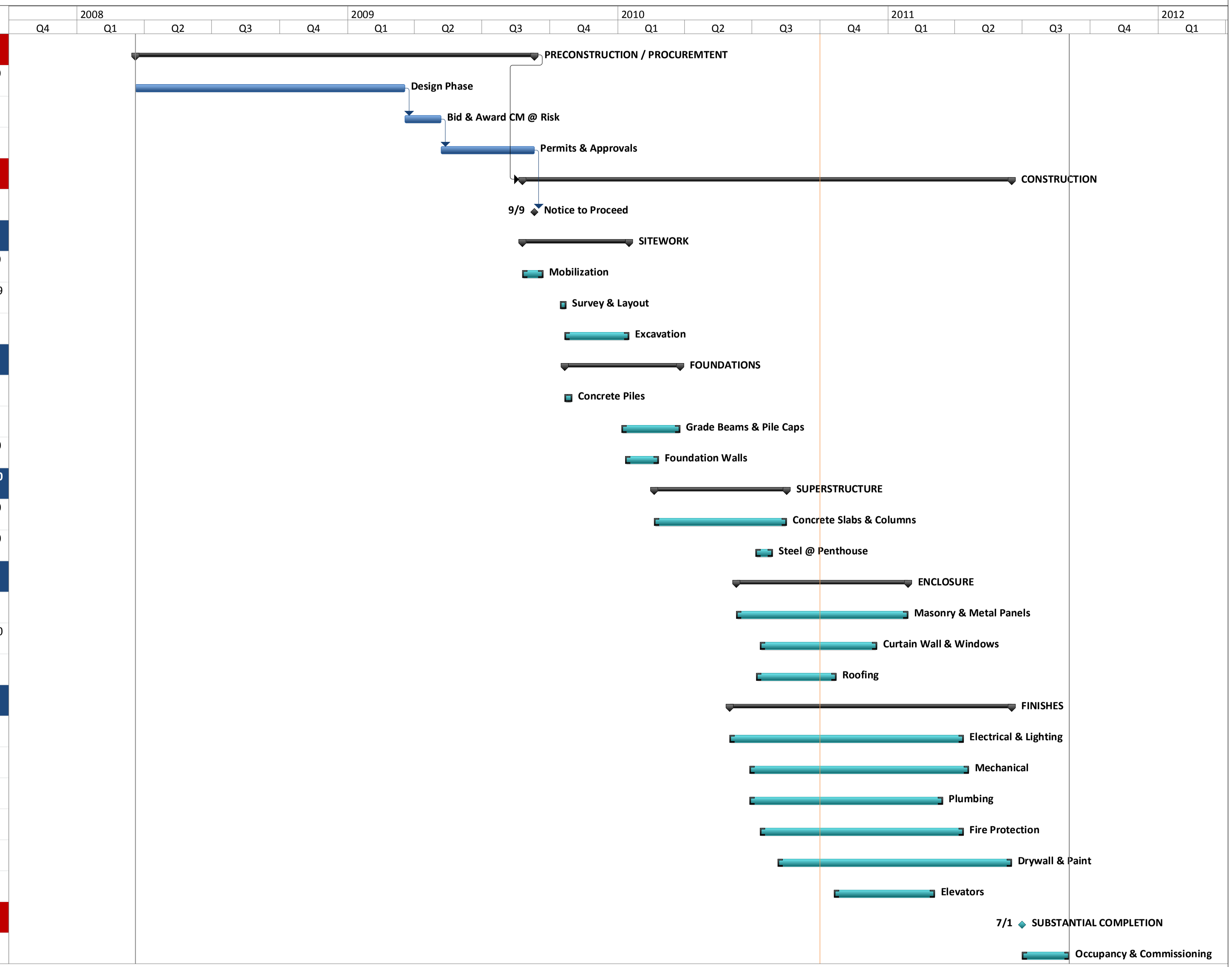
APPENDIX A - Summary Schedule

Tech Assignment #1

University Sciences Building

Justin Green

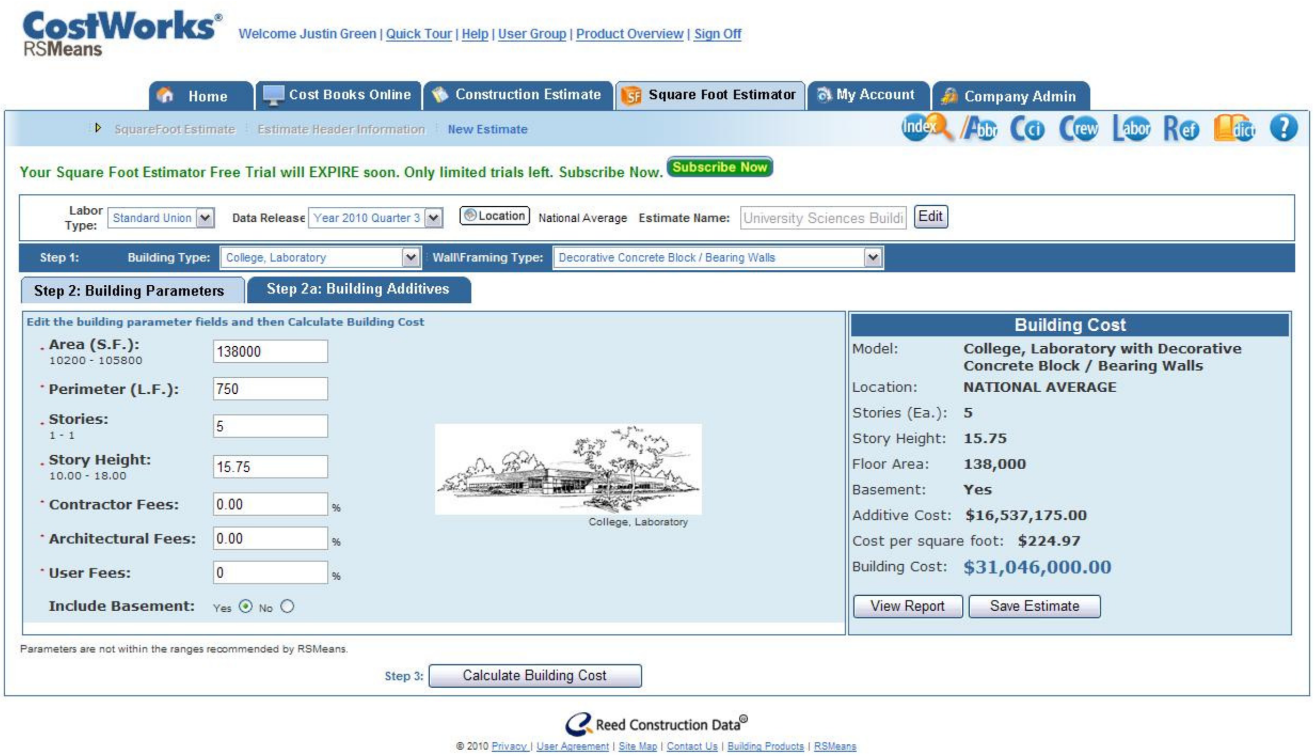
ID	Task Name	Duration	Start	Finish
1	**PRECONSTRUCTION / PROCUREMTENT**	**385 days**	**Thu 3/20/08**	**Wed 9/9/09**
2	Design Phase	260 days	Thu 3/20/08	Wed 3/18/09
3	Bid & Award CM @ Risk	35 days	Thu 3/19/09	Wed 5/6/09
4	Permits & Approvals	90 days	Thu 5/7/09	Wed 9/9/09
5	**CONSTRUCTION**	**473 days**	**Tue 8/25/09**	**Thu 6/16/11**
6	Notice to Proceed	0 days	Wed 9/9/09	Wed 9/9/09
7	**SITEWORK**	**104 days**	**Tue 8/25/09**	**Fri 1/15/10**
8	Mobilization	20 days	Tue 8/25/09	Mon 9/21/09
9	Survey & Layout	6 days	Thu 10/15/09	Thu 10/22/09
10	Excavation	63 days	Wed 10/21/09	Fri 1/15/10
11	**FOUNDATIONS**	**112 days**	**Wed 10/21/09**	**Thu 3/25/10**
12	Concrete Piles	8 days	Wed 10/21/09	Fri 10/30/09
13	Grade Beams & Pile Caps	57 days	Wed 1/6/10	Thu 3/25/10
14	Foundation Walls	33 days	Mon 1/11/10	Wed 2/24/10
15	**SUPERSTRUCTURE**	**127 days**	**Fri 2/19/10**	**Mon 8/16/10**
16	Concrete Slabs & Columns	127 days	Fri 2/19/10	Mon 8/16/10
17	Steel @ Penthouse	17 days	Tue 7/6/10	Wed 7/28/10
18	**ENCLOSURE**	**166 days**	**Thu 6/10/10**	**Thu 1/27/11**
19	Masonry & Metal Panels	166 days	Thu 6/10/10	Thu 1/27/11
20	Curtain Wall & Windows	114 days	Mon 7/12/10	Thu 12/16/10
21	Roofing	78 days	Wed 7/7/10	Fri 10/22/10
22	**FINISHES**	**273 days**	**Tue 6/1/10**	**Thu 6/16/11**
23	Electrical & Lighting	226 days	Tue 6/1/10	Tue 4/12/11
24	Mechanical	212 days	Mon 6/28/10	Tue 4/19/11
25	Plumbing	187 days	Mon 6/28/10	Tue 3/15/11
26	Fire Protection	197 days	Mon 7/12/10	Tue 4/12/11
27	Drywall & Paint	226 days	Thu 8/5/10	Thu 6/16/11
28	Elevators	98 days	Wed 10/20/10	Fri 3/4/11
29	**SUBSTANTIAL COMPLETION**	**0 days**	**Fri 7/1/11**	**Fri 7/1/11**
30	Occupancy & Commissioning	46 days	Fri 7/1/11	Fri 9/2/11



Project: Project Summary Schedu
Date: Fri 10/1/10

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

APPENDIX B - RS Means CostWorks Report



Square Foot Cost Estimate Report

Estimate Name:	**University Sciences Building**
	Northeastern U.S.
Building Type:	**College, Laboratory with Decorative Concrete Block / Bearing Walls**
Location:	National Average
Stories Count (L.F.):	**5.00**
Stories Height	**15.75**
Floor Area (S.F.):	**138,000.00**
LaborType	**Union**
Basement Included:	Yes
Data Release:	**Year 2010 Quarter 3**
Cost Per Square Foot	**$224.97**
Total Building Cost	**$31,046,000**

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		1.6%	3.59	$495,000
A1010	**Standard Foundations**		0.65	$89,500
	Strip footing, concrete, reinforced, load 11.1 KLF, soil bearing capacity 6 KSF, 12" deep x 24" wide			
	Spread footings, 3000 PSI concrete, load 100K, soil bearing capacity 6 KSF, 4' - 6" square x 15" deep			
A1030	**Slab on Grade**		0.95	$131,500
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		0.71	$98,500
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	**Basement Walls**		1.27	$175,500
	Foundation wall, CIP, 12' wall height, pumped, .444 CY/LF, 21.59 PLF, 12" thick			
B Shell		7.5%	16.91	$2,334,000
B1010	**Floor Construction**		3.92	$540,500
	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 bearing wall, 35' span, 20" deep, 125 PSF superimposed			
B1020	**Roof Construction**		0.72	$99,000
	Roof, steel joists, 1.5" 22 ga metal deck, on bearing walls, 35' bay, 25.5" deep, 40 PSF superimposed load, 60 PSF			
B2010	**Exterior Walls**		5.09	$702,000
	Concrete block (CMU) wall, split rib, 8 ribs, hollow, regular weight, 8x8x16, reinforced, vertical #5@16", grouted			
B2020	**Exterior Windows**		3.95	$545,500
	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**		2.01	$277,500
	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**		1.12	$155,000
	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", mill finish, .050" thick			
B3020	**Roof Openings**		0.11	$14,500
	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		13.4%	30.20	$4,167,500
C1010	**Partitions**		11.07	$1,528,000
	Concrere block (CMU) partition, light weight, hollow, 6" thick, no finish			
	Concrere block (CMU) partition, light weight, hollow, 8" thick, no finish			
	8" concrete block partition			
C1020	**Interior Doors**		1.22	$168,500
	Door, single leaf, kd steel frame, kalamein fire, commercial quality, 3'-0" x 7'-0" x 1-3/4"			
C1030	**Fittings**		0.04	$6,000
	Lockers, steel, single tier, 5' to 6' high, per opening, minimum			
C3010	**Wall Finishes**		5.86	$808,500
	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**		5.49	$758,000
	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**		6.51	$898,500
	Acoustic ceilings, 3/4"mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid, suspended support			

D Services		23.5%	52.96	$7,308,500
D2010	**Plumbing Fixtures**		15.27	$2,107,500
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, PE on CI, 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**		0.79	$109,000
	Gas fired water heater, commercial, 100< F rise, 600 MBH input, 576 GPH			
D2040	**Rain Water Drainage**		0.60	$82,500
	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**		18.40	$2,539,000
	Rooftop, multizone, air conditioner, schools and colleges, 25,000 SF, 95.83 ton			
D4010	**Sprinklers**		2.78	$383,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 50,000 SF			
D4020	**Standpipes**		0.26	$36,000
	Wet standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor			
D5010	**Electrical Service/Distribution**		0.65	$89,500
	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**		10.46	$1,444,000
	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**		3.62	$499,000
	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	$18,500
	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		53.9%	121.31	$16,741,000
E1020	**Institutional Equipment**		1.48	$204,000
	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**		119.83	$16,537,000
	10 - Laboratory equipment, titration unit, four 2000 ml reservoirs			
	5000 - Laboratory equipment, utility table, acid resistant top with drawers			
	150 - Laboratory equipment, sink, one piece plastic, flask wash, hose, free standing			
	5 - Laboratory equipment, safety equipment, deluge shower			
	30 - Laboratory equipment, safety equipment, eye wash, hand held			
	750 - School furniture, classroom, movable chair & desk type, maximum			
	250 - Auditorium chair, veneer back, padded seat			
	25 - Laboratory equipment, glassware washer, undercounter, maximum			
	60 - Laboratory equipment, fume hood, ductwork, maximum			
	1500 - Laboratory equipment, fume hood, with countertop & base, special, excl. HVAC, minimum			
	40000 - Laboratory Casework, counter tops, acid-proof, excl. base cabinets, maximum			
	4000 - Laboratory Casework, wall cabinets, with doors, 12" x 31"			
	4000 - Laboratory Casework, tall storage cabinets, with glazed doors, 7' high			
	5000 - Laboratory Casework, cabinets, base, drawer units, metal			
	5000 - Laboratory Casework, cabinets, base, door units, metal			
F Special Construction		0.0%	0.00	$0
G Building Sitework		0.0%	0.00	$0

Sub Total	100%	$224.97	$31,046,000
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		**$224.97**	**$31,046,000**

APPENDIX C - D4 Cost Reports

Case Study #1 - Law Enforcement Lab and Office Facility

University Sciences Building - Sep 2009 - PA - Other

Prepared By:	**Justin Green** **Penn State**	Prepared For:	**Technical Assignment #1**
Building Sq. Size:	**138000**	Site Sq. Size:	**0**
Bid Date:	**7/1/2009**	Building use:	**Educational**
No. of floors:	**6**	Foundation:	**PIL**
No. of buildings:	**1**	Exterior Walls:	**CMU**
Project Height:	**95**	Interior Walls:	**GYP**
1st Floor Height:	**15**	Roof Type:	**EPD**
1st Floor Size:	**23000**	Floor Type:	**CON**
		Project Type:	**NEW**

01	General Requirements	18.61	33.25	4,588,255
03	Concrete	3.18	5.68	783,613
04	Masonry	0.89	1.59	219,330
05	Metals	2.21	3.95	544,554
06	Wood & Plastics	1.69	3.02	417,116
07	Thermal & Moisture Protection	3.44	6.14	847,827
08	Doors & Windows	1.33	2.37	327,651
09	Finishes	16.29	29.09	4,014,450
10	Specialties	1.38	2.46	339,508
11	Equipment	2.27	4.05	559,317
12	Furnishings	3.26	5.83	804,311
14	Conveying Systems	0.30	0.54	74,000
15	Mechanical	26.10	46.62	6,433,062
16	Electrical	19.05	34.03	4,695,768
Total Building Costs		100.00	178.61	24,648,762
02	Site Work	100.00	0.00	846,249
Total Non-Building Costs		100.00	N/A	846,249
Total Project Costs		--	--	25,495,012

Building Division Notes

University Sciences Building - Sep 2009 - PA - Other

General Requirements	Summary of work, measurement & payment, field engineering, regulatory requirements, project meetings, submittals, quality control, construction facilities & temporary controls, material & equipment, facility startup/commissioning, contract closeout.
Concrete	Formwork, reinforcement, accessories, cast-in-place, curing, precast.
Masonry	Masonry & grout, accessories, unit.
Metals	Materials, fastening, structural framing, decking, cold formed metal framing, fabrications.
Wood & Plastics	Fasteners & adhesives, rough carpentry, finish carpentry, architectural woodwork.
Thermal & Moisture Protection	Waterproofing, dampproofing, insulation, firestopping, membrane roofing, flashing & sheet metal, joint sealers.
Doors & Windows	Metal doors & frames, wood & plastic doors, entrances & storefronts, metal windows, hardware, glazing.
Finishes	Metal support systems, lath & plaster, gypsum board, tile, acoustical treatment, resilient flooring, carpet, painting, wall coverings.
Specialties	Visual display board, louvers & vents, identifying devices, fire protection, operable partitions, storage shelving, toilet & bath accessories.
Furnishings	Manufacturing casework, rugs & mats.
Elevators	One.
Mechanical	Basic materials & methods, insulation, fire protection, plumbing, HVAC, air distribution, controls, testing, adjusting & balancing.
Electrical	Basic materials & methods, power generation -- built-up systems, medium voltage distribution, service & distribution, lighting, special systems, controls, testing.

Non-Building Division Notes

University Sciences Building - Sep 2009 - PA - Other

Site Work	Demolition, preparation, earthwork, paving & surfacing, sewerage & drainage, improvements, landscaping.

Project Notes

University Sciences Building - Sep 2009 - PA - Other

Estimate Based On Case: CM000956 - Law Enforcement, Lab & Office Fac.
Location: FL - Orlando
Date: Jun 1998
Building Size: 80,656

Estimate Based On Case: CM000956 - Law Enforcement, Lab & Office Fac.
Location: FL - Orlando
Date: Jun 1998
Building Size: 80,656

* Florida Department of Law Enforcement, Laboratory & Office Facility
* Negotiated Bid Date
* Orlando, Florida
* Construction Period Feb 1998 to Aug 2000

Special Project Notes

The Orlando facility for the Florida Department of Law Enforcement has been over four years in the making. The Department of Management Services (DMS) Director of Building Construction, Deborah Whitehouse and the DMS Division of Facilities Management lead by Phil Maher working with FDLE, decided to expand the Florida Department of Law Enforcement, Orlando Facility, by adding onto, and also
renovating, the existing FDLE lab at the Hurston State Office Complex. This key decision made it possible for the design team and the construction manager to develop a facility that would meet the agency's needs within a very challenging budget. A key challenge for the owner, A/E and C/M was to successfully incorporate, and still keep within the budget, the recladding and reroofing of the existing building, that was necessitated by long existing moisture intrusion problems.

"A project such as this can only be successful with close teamwork and excellent communication between owner, construction manager, and architect", says Steve Krone, AIA, of HHCP Architects, Assistant Project Manager and Architect for the Project. "Welbro/Ellis-Don, led by Project Manager Randy Carroll has done an outstanding job of keeping the project on schedule and within budgetary limits and at the same time they have listened to the building users as they walk through the new addition and ask to be informed on the construction process and design intent."

Occupancy of the new 2-story addition took place in early December of 1999 at which time renovation began on the existing 2-story building. Final completion for all work including landscaping and interior improvements was August 2000.

MANUFACTURERS/SUPPLIERS

Exterior Walls - Entrances & Storefronts, Windows: Vistawall.
Interior Walls - Gypsum Board: United States Gypsum; Metal Studs: Dietrich.
Elevators - Miami Elevator.

Case Study #2 - Ezra Taft Benson Science Building

University Sciences Building - Sep 2009 - PA - Other

Prepared By:	**Justin Green** **Penn State**	Prepared For:	**Technical Assignment #1**
Building Sq. Size:	**138000**	Site Sq. Size:	**0**
Bid Date:	**7/1/2009**	Building use:	**Educational**
No. of floors:	**6**	Foundation:	**PIL**
No. of buildings:	**1**	Exterior Walls:	**CMU**
Project Height:	**95**	Interior Walls:	**GYP**
1st Floor Height:	**15**	Roof Type:	**EPD**
1st Floor Size:	**23000**	Floor Type:	**CON**
		Project Type:	**NEW**

Division		Percent	Sq. Cost	Amount
01	General Requirements	4.41	5.62	775,905
03	Concrete	14.09	17.97	2,479,228
04	Masonry	5.84	7.45	1,027,583
05	Metals	3.18	4.05	559,314
06	Wood & Plastics	1.87	2.38	328,649
07	Thermal & Moisture Protection	2.19	2.80	386,051
08	Doors & Windows	2.44	3.12	430,118
09	Finishes	4.15	5.29	729,377
10	Specialties	0.83	1.06	146,282
11	Equipment	16.86	21.49	2,965,757
14	Conveying Systems	1.06	1.35	186,106
15	Mechanical	33.43	42.61	5,880,401
16	Electrical	9.65	12.30	1,697,536
Total Building Costs		100.00	127.48	17,592,308
02	Site Work	100.00	0.00	1,090,182
Total Non-Building Costs		100.00	N/A	1,090,182
Total Project Costs		--	--	18,682,490

Case Study #2 - Ezra Taft Benson Science Building

Building Division Notes

University Sciences Building - Sep 2009 - PA - Other

General Requirements	Project meetings, submittals, quality control, constr. facilities & temp. controls, material & equipment, facility startup/commissioning, contract closeout.
Concrete	Formwork, reinforcement, accessories, cast-in-place.
Masonry	Masonry & grout, accessories, unit.
Metals	Structural framing, joists, decking, cold formed metal framing, fabrications, ornamental.
Wood & Plastics	Rough carpentry, finish carpentry.
Thermal & Moisture Protection	Waterproofing, insulation, EIFS, fireproofing, firestopping, membrane roofing, flashing & sheet metal, roof specialties & accessories, skylights, joint sealers.
Doors & Windows	Metal doors & frames, wood & plastic doors, special doors, entrances & storefronts, metal windows, hardware, glazing.
Finishes	Metal support systems, tile, gypsum board, acoustical ceilings, painting.
Specialties	Visual display board, lockers, partitions, toilet & bath accessories.
Equipment	Darkroom, laboratory.
Mechanical	Basic materials & methods, insulation, fire protection, plumbing, HVAC, heat transfer, air distribution, controls, testing, adjusting & balancing.
Electrical	Basic materials & methods, medium voltage distribution, service & distribution, lighting, communications, controls, testing.

Non-Building Division Notes

University Sciences Building - Sep 2009 - PA - Other

Site Work	Demolition, preparation, shoring & underpinning, paving & surfacing, utility piping materials, improvements.

Project Notes

University Sciences Building - Sep 2009 - PA - Other

Estimate Based On Case: EU960338 - Ezra Taft Benson Science Bldg.
Location: UT - Provo
Date: Mar 1993
Building Size: 191,310

*Provo, utah

Special Project Notes

The Ezra Taft Benson Science Building houses instructional laboratories for organic, analytical, and physical chemistry along with biochemistry, computer and tutorial labs, chemistry and biochemistry research labs, offices for faculty and graduate students and general classroom spaces.

The building includes 80 laboratories, 110 offices, three conference rooms, three lecture rooms, 12 classrooms, and a large study area.

A stringent budget and constricted site contributed to the design solution: a five level main laboratory and office wing, a two level east laboratory and office wing, and a two level west classroom wing, all connected. The laboratories are based on modules that are designed to accommodate current needs as well as unknown future requirements.

In the central wing, laboratories are organized along both sides of a double loaded corridor with support spaces and student offices interspersed between the labs. Teaching laboratories are located on the ground floor; research laboratories are on the upper levels; vibration and light sensitive laboratories are on the subterranean level. Faculty offices are concentrated at the south end for a magnificent view of the mountains and valley, and help to foster interaction. Environmental and biochemistry labs are combined in the east wing due to unique lab/support ratios and truck access requirements.

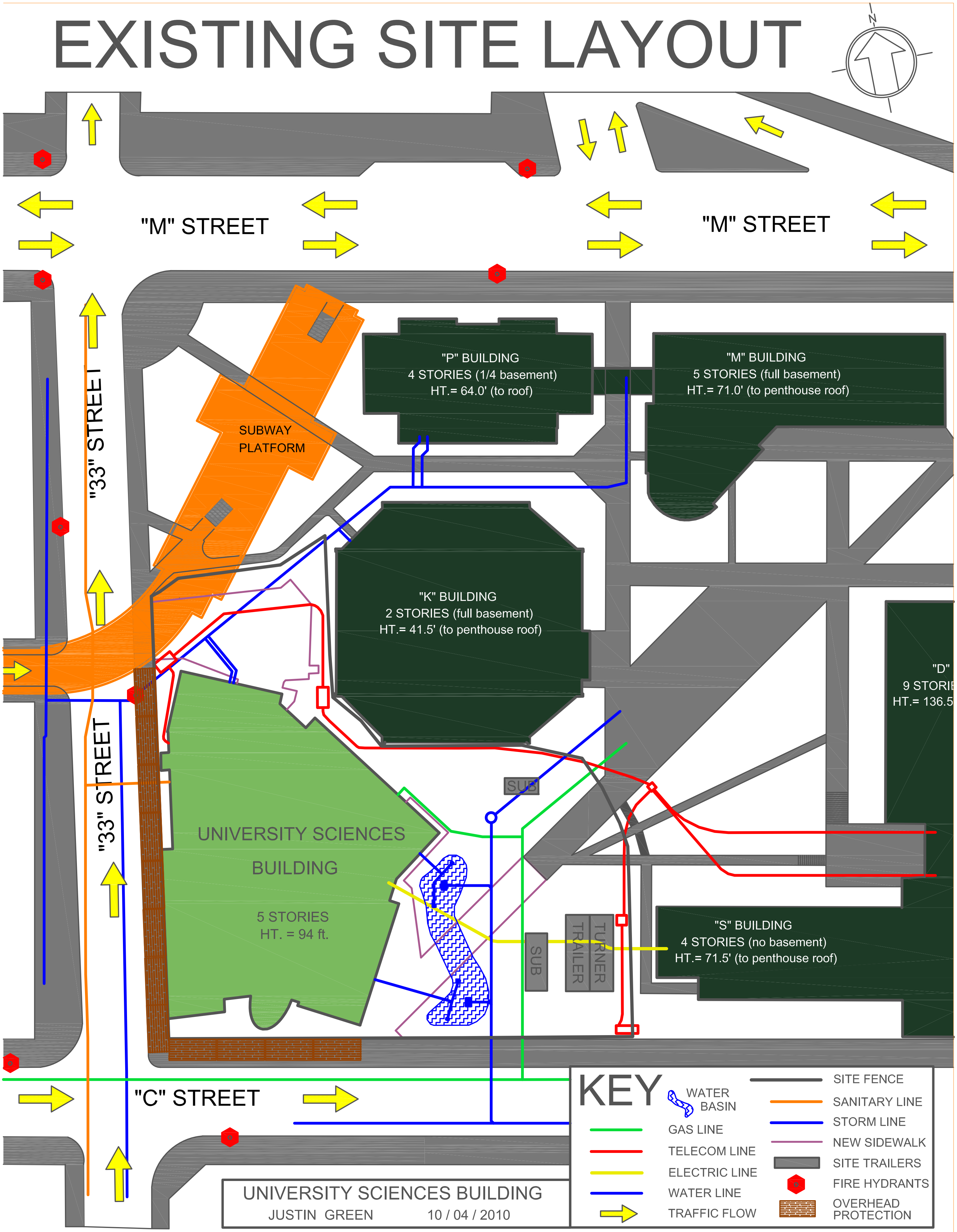
Classrooms, lecture rooms, and the large student commons/study area are located in the west wing. The study area, enclosed by glass, provides a north view into a main campus quadrangle. The site for the building provides an edge to this quadrangle.

Suppliers/Manufacturers

Exterior Walls -
  Masonry Veneer: Interstate Brick
  EIFS: Dryvit
  Aluminum Storefront & Windows: Vistawall
  Metal Doors: Curries
  Glazing: Viracon
Roof -
  Membrane: Firestone
  Skylights: Kalwall
Floors -
  Tile: Florida Tile
Interior Walls -
  Drywall: United States Gypsum
  CMU: Lehi Block
  Painting: Sherwin Williams
  Acoustical Ceilings: Armstrong
  Hardware: Schlage, Von Duprin
  Toilet & Bath Accessories: McKinney
  Lighting: Peerless
  Fireproofing: Isolatek International
  Firestopping: 3M
Elevators - U.S. Elevator

APPENDIX D - Existing Conditions Site Plan

EXISTING SITE LAYOUT



UNIVERSITY SCIENCES BUILDING

JUSTIN GREEN 10 / 04 / 2010

APPENDIX E - Phased Staffing Plan

Preconstruction and Construction Phase Staff Plan

Staff Position	Staff Name		Jan 2009	Feb 2009	Mar 2009	Apr 2009	May 2009	Jun 2009	Jul 2009	Aug 2009	Sep 2009 (1)	Oct 2009 (2)	Nov 2009 (3)	Dec 2009 (4)	Jan 2010 (5)	Feb 2010 (6)	Mar 2010 (7)	Apr 2010 (8)	May 2010 (9)	Jun 2010 (10)	Jul 2010 (11)	Aug 2010 (12)	Sep 2010 (13)	Oct 2010 (14)	Nov 2010 (15)	Dec 2010 (16)	Jan 2011 (17)	Feb 2011 (18)	Mar 2011 (19)	Apr 2011 (20)	May 2011 (21)	Jun 2011 (22)	Jul 2011 (23)	Aug 2011 (24)	Sep 2011	Oct 2011	Nov 2011	Dec 2011
Project Schedule																																						
Preconstruction																																						
Conceptual Design																																						
Schematic Design																																						
Design Development																																						
Construction Documents																																						
Lump Sum											1	1																										
Construction																																						
Fdtn & Structure											1	1	1	1	1	1	1	1	1	1	1	1																
Envelope and Core																					1	1	1	1	1	1	1											
Fitout																					1	1	1	1	1	1	1	1	1	1								
Commissioning																													1	1								
Close-Out																														0.5	1							
Preconstruction																																						
Management																																						
Operations Manager	Klinger	Jeff																																				
Project Executive	TBD																																					
Estimating																																						
Preconstruction Manager	Smith	Greg																																				
Secretary	Sorrells	Terri																																				
Sr. Estimator	Aldrich	Bill									87	87	87	26																								
Sr. Estimator	Best	Jim																																				
Estimator	O'Connor	Bob																																				
Estimator	Siemba	Myron																																				
Estimator	Edwards	Gabriella																																				
Estimator																																						
Sr. Mechanical Estimator	Betsch	Bob																																				
Sr. Electrical Estimator	Ward	Jim																																				
Scheduler	Smith	Brian																																				
Construction Phase																																						
Management																																						
Operations Manager	Klinger	Jeff																																				
Project Executive	Frank	Scott									20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20								
Project Manager	Schram	Pete									130	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173								
Purchasing																																						
Purchasing Manager	Pizzi	Frank																																				
Purchasing Agent	TBD	Average									80	80	80	80																								
Purchasing - Equipment	Jadico	Doug																																				
Purchasing - SPD	Yerrapathruni	Sai																																				
Secretary	Sorrells	Terri									8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8								
Supervision																																						
Project Superintendent	Dejoseph	Scott									130	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173								
Superintendent-MEP	TBD	Experienced																																				
PM MEP / Commissioning	O'Connor	Bill																																				
MEP - Assistant Superintendent	McConnel	Sean										173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173								
GC - Assistant Superintendent	TBD	Average											173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173								
Asst Super	TBD	Average																																				
Asst Super	TBD	Average																																				
Asst Super	TBD	Average																																				
Field Engineer	TBD	Average																																				
Field Engineer	Souchon	Alex																																				
Safety Director	Darrohn	Stacy																																				
Safety Engineer	TBD	Average											173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173									
Engineering																																						
Project Engineer	Gentry	Roger									173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173							
Engineer	TBD	Average																																				
Engineer	TBD	Average																																				
Asst Engineer	Kenny	Reginna										173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173							
Asst Engineer	Souchon	Alex																																				
Engineering Assistant	TBD	Average																																				
Engineering Assistant	TBD	Average																																				
Engineering Clerk	Veloski	Jim																																				
Director of Community Affairs	Young	Herb																																				
Financial																																						
Accountant	TBD										32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	34							
Cost Engineer	TBD										16	16	24	16	16	24	16	16	24	16	16	24	16	16	24	16	16	24	16	16	24							
Information Systems																																						
Systems Engineer	Laste	Bill																																				
Insurance Control	Hibbert	Cynthia									16	8	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2								
Clerical Support																																						
Administrative Assistant	TBD	Average									173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173								