TECHNICAL ASSIGNMENT ONE

OCTOBER 5, 2007

Virginia Commonwealth University

School of Business and School of Engineering

Richmond, VA

Lori E. Farley

CONSTRUCTION MANAGEMENT

Dr. J. Messner

Not only will this progress the School of Engineering's expansion, but will also provide a technology-centered business education for the School of Business.

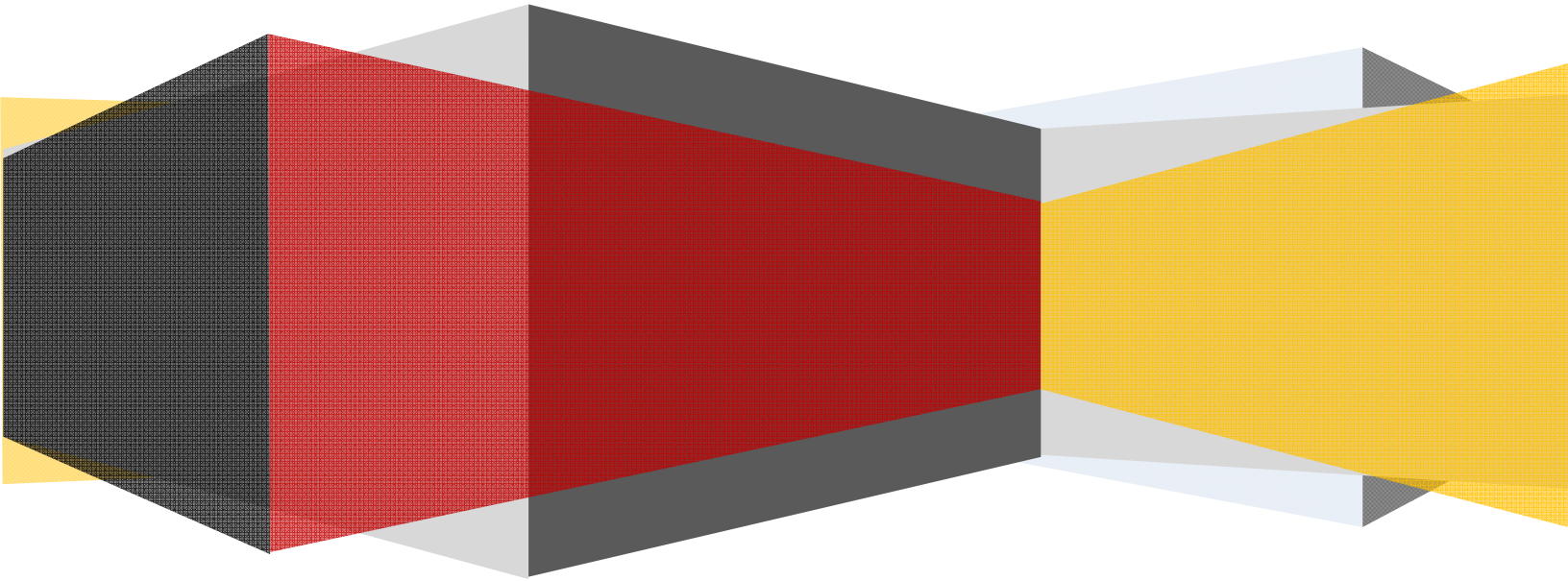


TABLE OF GUIDANCE

EXECUTIVE SUMMARY

Technical Assignment One aims to explore the construction methods enforced at Virginia Commonwealth University's School of Business and Engineering in Richmond, Virginia. It also focuses on the scope of work to be completed through a summarized project schedule, with several key milestones, an overview of the building system and two forms of cost-comparative analysis using D4 Cost and R.S. Means.

In addition to these items, it is necessary to properly assess the current local conditions, the owner's needs and requirements, and lastly the location of the project site. All these factors combined, including the delivery method and staffing plan, make the construction process a whole. This assignment targets and gages each of the stated matters.

The Virginia Commonwealth University School of Business and School of Engineering is scheduled to open the doors to students for the start of the spring 2008 semester.

PROJECT SUMMARY SCHEDULE

The construction schedule for the Virginia Commonwealth School of Business and Engineering was unique in the sense that two schedules were encompassed into one. The School of Business and the School of Engineering each had their own agenda, mainly to address the concrete structural system in the School of Engineering and the steel structural system in the School of Business. While the tasks for both buildings were concurrently taking place, the two separate schedules help to illustrate the progress of each building.

Using Microsoft Project, two installation summary schedules were developed, one for the SOB and one for the SOE, by the grouping of trades. The trades begin at the School of Business and continue to the School of Engineering (i.e. excavation for foundations will start at the SOB and then proceed to the SOE; foundations will be placed beginning with the SOB and subsequently the SOE…etc). The schedules show the duration that each trade will be on site throughout the extent of the project. The parametric schedules can be found at the end of this report.

The table below is a project status summary of key phases regarding the owner.

2004	2005	2006	2007
PLANNING			
CM SELECTION & PRICING			
	CONSTRUCTION		

In addition to the Planning, CM Selection and Pricing, and Construction phases, key milestones include the following dates:

- **Notice to Proceed on 01.16.06**
- **School of Business dry on 11.28.06**
- **School of Engineering dry on 11.06.06**
- **Owner FFE on 9.28.07**
- **Substantial Completion on 11.28.07**
- **Spring Semester begins on 01.14.08**

PLEASE SEE APPENDIX A FOR PARAMETRIC SCHEDULES

BUILDING SYSTEMS SUMMARY

DEMOLITION

Several brick buildings, a maximum of 2-stories, had to be demolished before the construction of the Virginia Commonwealth University's School of Business and Engineering could take place. In addition to these buildings, a number of asphalt parking lots and existing sidewalks outlining the site also had to be removed. Portions of the property are owned by the university and therefore the campus construction services were responsible for the demolition of those structures.

STRUCTURAL STEEL FRAME

The building is comprised of a structural steel frame in sectors A and B (School of Business). Sectors A and B entail wide flange beams, which are spaced equally within the dimensioned bays, as well as wide flange columns with all splicing occurring on the third floor (at 5-ft) when necessary. At the crescent however, curved HSS-Tube steel was used for the beams and, for connection purposes, was also used for the columns. The bracing in these two sectors include diagonal, k, and vee, all using HSS-Tube steel (46 ksi).

CAST IN PLACE CONCRETE

For this project, the typical slab-on-grade consisted of 4-inch, normal weight concrete and a 5-1/2-inch thickness for steel framing floor deck construction. Concrete framing was also used in the northwest portion of sector C (School of Engineering). This sector consists of 20-inch deep concrete joists, with a typical pan width of 53-inches, as well as concrete columns and beams. In addition to these features, there are several full-height shear walls, ranging from 8-inches to 12-inches in thickness. Formwork, shores and reshores will be enforced.

PRECAST CONCRETE

The building will feature decorative pre-cast panels at the first floor, between the third and fourth floor and two figures on the roof overlooking the crescent and courtyard below. The panels will be connected by steel shapes and plates, carbon steel bolts and studs, welded headed studs and deformed steel wire-bar anchors. The panels will be distributed around the perimeter of the building at stages where they will then be picked.

MECHANICAL SYSTEM

The mechanical system is housed on the rooftop of the building and is an all-water variable volume air-handling system. There is a total of 10 (ten) roof-top units meeting the following design criteria; 5 dedicated to the School of Engineering with a maximum SA of 20,800 CFM and a minimum OA of 8,000 CFM and 5 dedicated to the School of Business with a maximum SA of 26,000 CFM and a minimum OA of 10,000 CFM. There is also an AHU to service the chiller room. In addition to the mentioned RHU's, there is 1 (one) double cross-flow cooling tower, with two cells at 500 nominal tons/cell, and 2 (two) centrifugal water-cooled chillers with a maximum capacity of 500 tons. All rooftop equipment and associated ductwork and piping are mounted so they, nor their supports, are exposed above the top of the architectural roof screen.

BUILDING SYSTEMS SUMMARY

ELECTRICAL SYSTEM

The electrical system has a 480/277V, 3-phase service utility feed, which supplies the 4000A main switch board for the building (distributed radially). There is a total of four 208/120V transformers; one to service each floor. The system is backed up with a 1000kW, 3-phase480/277V diesel-powered generator.

MASONRY

The masonry on this project consists of the following areas; Concrete Brick, the CMU foundation walls for the School of Business Face Brick, Building (common). The concrete brick will have a minimum compressive strength of 3500 psi and the concrete masonry units are to be fully grouted with a 28-day net compressive of 1500 psi. The building brick must match the face brick where exposed.

CURTAIN WALL

The curtain wall framing system will consist of structural extruded tube sections, glazing pressure plate, and mullion caps for nominal 6-inch total section depth. In addition, there will be insulating glass on the interior and exterior. The total width will be 2.5-inches.

SUPPORT OF EXCAVATION

The excavation support system included sheeting and shoring. There was no temporary de-watering system, only the permanent waterproofing that took place after the concrete was cast.

D4 COST ESTIMATE - $70MM

D4 Cost 2002 Estimating software was used to produce a parametric estimate for this project. The selection process began by comparing the building costs of the available educational projects to the cost of VCU's School of Business and Engineering contract amount ($65 MM). The search resulted in a project with a cost of roughly $50 MM and 6-stories high. This building was chosen because it was the only project that reflected the magnitude of VCU and included laboratories. The search was then reverted to the comparisons of total square-feet (245,000 SF) and levels above grade (4). Overall, three projects that best represented the overall magnitude of VCU were included when averaging the cost.

Division Name	%	Sq. Cost	Projected Amount
Procurement & Contracting Require	6.34	18.13	$4,441,674
General Requirements	4.63	13.23	$3,242,506
Site Work	3.68	10.53	$2,579,156
Concrete	5.56	15.9	$3,896,170
Masonry	3.41	9.76	$2,391,838
Metals	5.22	14.92	$3,655,206
Woods and Plastics	1.05	3.0	$734,608
Thermal & Moisture Protection	2.42	6.91	$1,692,463
Doors & Windows	3.24	9.27	$2,271,450
Finishes	6.78	19.37	$4,746,724
Specialties	1.10	3.13	$767,385
Equipment	2.32	6.65	$1,628,234
Furnishings	0.85	2.44	$596,588
Special Construction	0.16	0.46	$113,064
Conveying Systems	0.40	1.16	$283,506
Mechanical	14.97	42.79	$10,484,071
Electrical	8.98	25.68	$6,292,346
Fire Suppression	0.84	2.40	$586,778
Plumbing	4.57	13.06	$3,199,081
HVAC	10.65	30.44	$7,458,234
Electrical	7.10	20.29	$4,971,594
Communications	0.88	2.52	$617,733
Electronic Safety and Security	0.36	1.03	$252,410
Earthwork	1.86	5.32	$1,303,878
Exterior Improvements	1.53	4.38	$1,074,289
Utilities	1.09	3.12	$764,178
TOTAL BLDG COSTS	**100**	**285.90**	**$70,045,166**

*The result of the D4 data is displayed to the left. Please see **Appendix B** for the full report.*

R.S. MEANS ESTIMATE

R.S. Means was used to create a square-foot cost estimate of the building by comparing the functionality of the building and the appropriate square feet. Although this project is classified as a university or college, the School of Engineering contains a large amount of laboratories that need to be considered for an accurate estimate. So for this matter, the SOE was evaluated as "College-Laboratory" and the SOB was evaluated simply as "College 2-3 Story." The remaining portion that is deemed as a shared space for both schools was averaged and subsequently distributed. The square-footages to work off of are as follows:

- The School of Business (College): 128,318 SF
  - Base Cost of $150.25/SF
  - Modification Factor of 0.85
  - Additional Story Height at $9.80 (14-ft)
  - **SUB-TOTAL ESTIMATE OF $137.50/SF**
- The School of Engineering (Labs): 115,399 SF
  - Base Cost of $142.50/SF
  - Modification Factor of 0.85
  - Additional Story Height at $8.40 (14-ft)
  - **SUB-TOTAL ESTIMATE OF $129.52/SF**

Combined Estimate of

$267.02/SF

Due to owner confidentiality, the only pricing that was released was the contract amount of $65 MM. In regards to this amount and the total square-footage of 245,000, the estimate comes to be $265.31/SF; less than a two dollar difference per square foot.

SITE PLAN OF EXISTING CONDITIONS

The Virginia Commonwealth University, Monroe Park Campus is located in Richmond, Virginia off of Interstate 95. The project site is located on South Madison Street and is closed in on three sides by one-way streets. The university previously had real-estate on the project site, but these and other structures and parking lots needed to be demolished.

The site plan, **Appendix C**, shows these structures and their accompanying parking lots. Other items to be removed from the site include existing sidewalks and existing site entrances**.** Present power poles and service had to be relocated and water meters had to be moved and laterally plugged during.

Parking is available on nearby side streets and a large parking lot to the east of the site. There is limited parking available on-site.

CLIENT INFORMATION AND LOCAL CONDITIONS

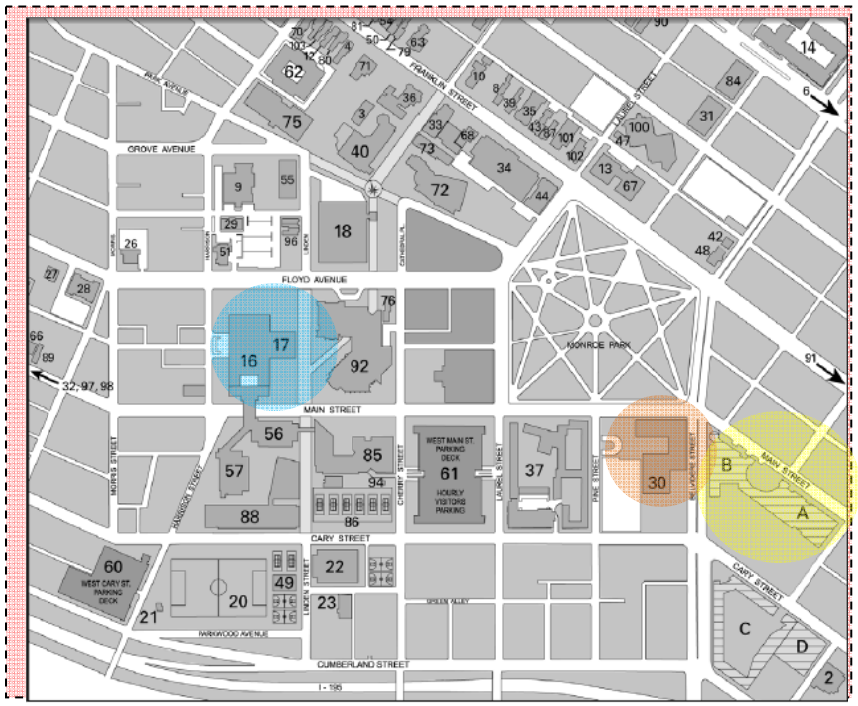
The Virginia Commonwealth University is comprised of two campuses, the Monroe Park Campus (88.2 Acres) and the MCV Campus (52.4 Acres). **To the left** is the map of the Monroe Park Campus, in Richmond, VA, where construction of the School of Business and Engineering is taking place.

Typical construction methods in this area consist of concrete structures, due to the fact this adds more floors and height to the building which is ideal in a city atmosphere. In regards to the project site being in a heavily populated area, there were several parking lots and garages available to the workers as well as side-street and on-site parking.

This four-story building is designed with the intent to merge the schools of business and engineering, blending the specialties for future intersect of course work.

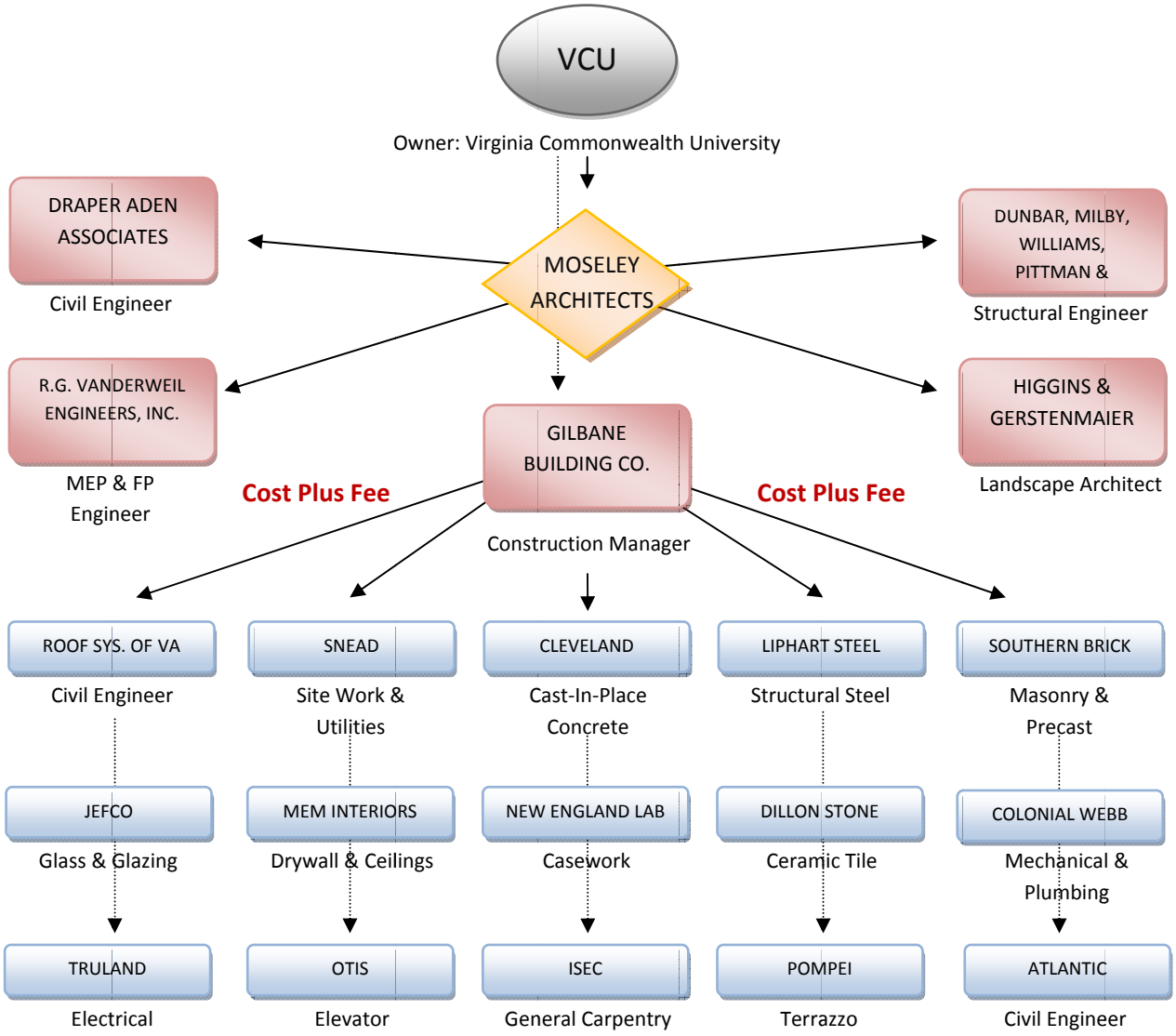
Funding for this project has come from several sources; $25.3 million from the state, $60 from University funding and income produced from student housing, parking and food services, and lastly private donations to the campaigns for the business and engineering schools.

The construction of this building will increase the number of enrolling students for both business and engineering schools. With completion set for the end of 2007, the university expects to open the doors to students for the start of the spring semester.

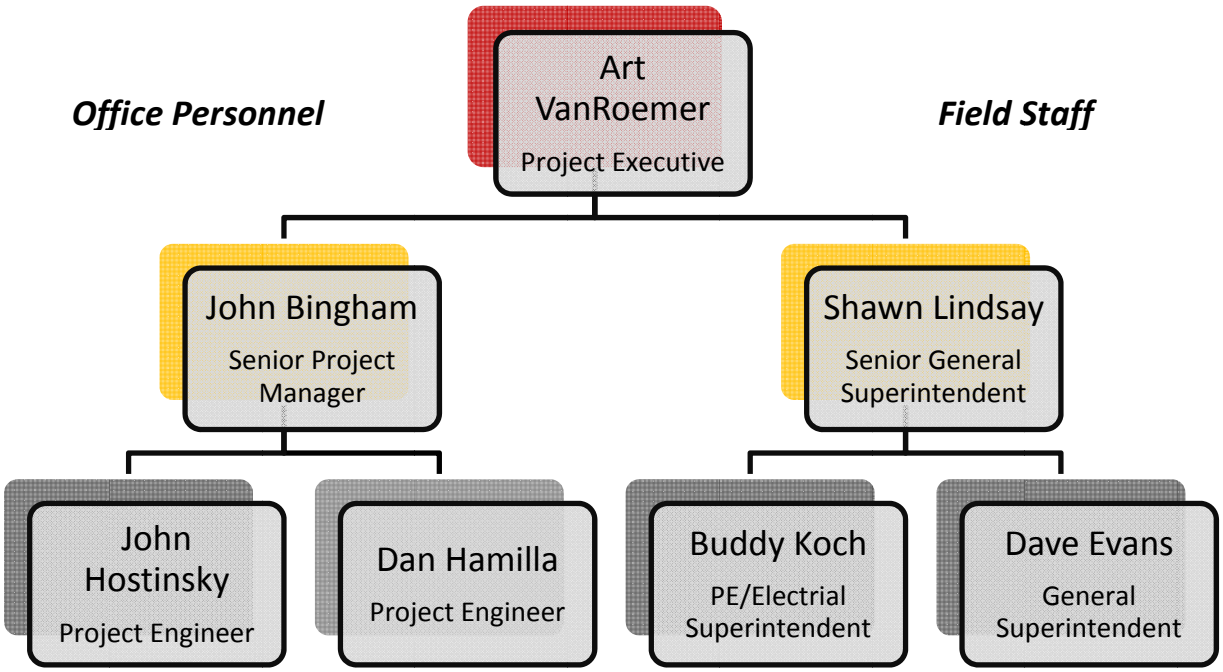


Above, in yellow, is the construction site with relevance to the Engineering Building (in orange) and the Business Building and Auditorium (in blue).

PROJECT DELIVERY SYSTEM



Candidates for trade-work were selected from the completion of a Contractor Qualification Form. Gilbane holds a Cost-Plus-Fee contract with their subs for this project. Gilbane required two types of insurance from their subcontractors: Trade Contractor's Liability Insurance and Property Insurance. Along with these two insurances, there were two types of bonds as well. They included a performance bond and a labor and material payment bond.



The Gilbane staffing plan begins at the top with the **Project Executive**, Art VanRoemer. The role of the project executive is to handle estimating, scheduling, and financial skills such as job cost forecasting. As the chart shows, he also oversees both field and office operations.

Below Art, there is the **Senior Project Manager** and the **Senior General Superintendent**. John and Shawn are on an equal status; John plans, directs and coordinates the construction activities and it is then Shawn's responsibility as the head field supervisor to see that these tasks are carried out correctly and in a timely fashion.

Below the Senior PM are John and Dan, who are the **Project Engineers**. They monitor construction for compliance, handle certain cost and coordination issues.

While the division between office and field is expressed through the chart above, all the team players are site-based which allows problems to be addressed and solved quickly.

APPENDIX A

SUMMARY SCHEDULES FOR THE SCHOOL OF BUSINESS AND THE SCHOOL OF ENGINEERING

APPENDIX B

D4 COST DATA

APPENDIX C

SITE PLAN OF EXISTING CONDITIONS