

TECHNICAL ASSIGNMENT TWO
NOVEMBER 2, 2007

Virginia Commonwealth University

School of Business and School of Engineering
Richmond, VA

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CONSTRUCTION MANAGEMENT

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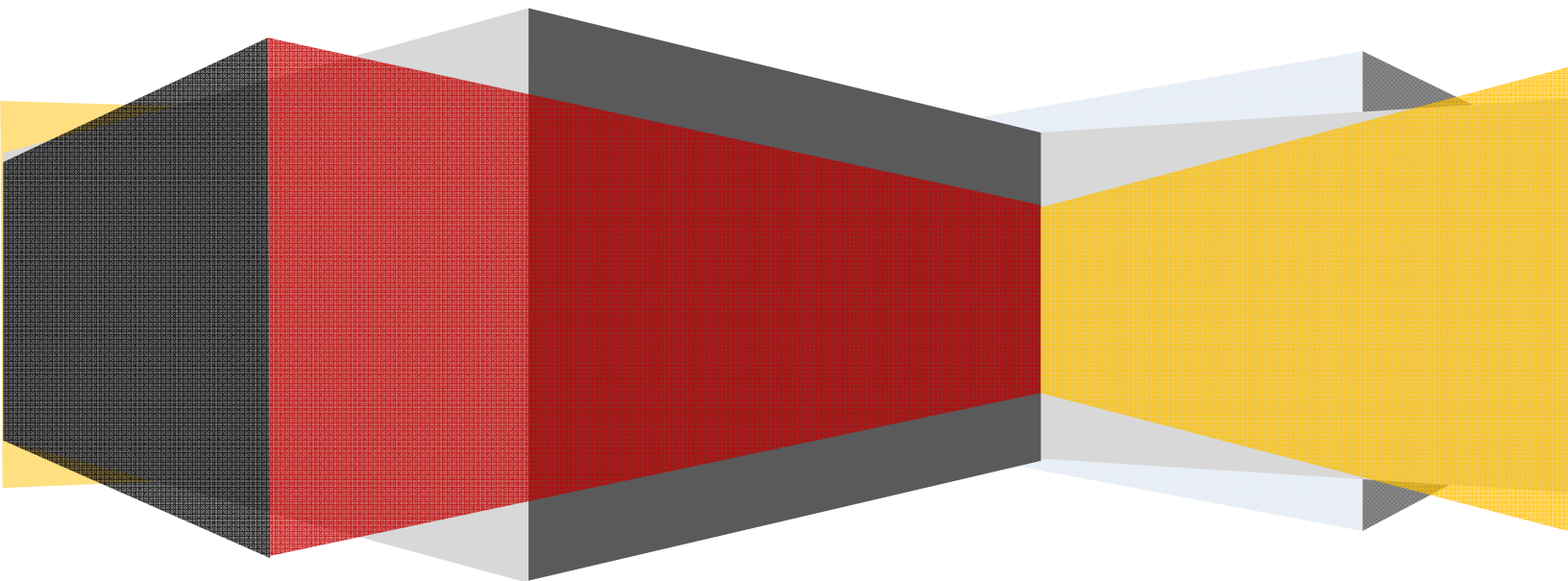


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EXECUTIVE SUMMARY

Technical assignment two begins with an in-depth expansion of the original VCU project summary schedule. This level of detail exposes the true sequencing and order of activities that are dependent on each other for the smooth flow of the construction process. Through this process I was able to determine which activities required the most attention and coordination by way of their duration.

This assignment then progresses into the project site layout logistics where the site organization is critiqued. The represented phase of construction is that of the steel superstructure erection along with lay down areas of steel and crane locations. After reviewing potential layout styles, it was found that the current arrangement is best suited for the building location.

A cost analysis then follows, beginning with an assemblies estimate. The chosen assembly was the Mansford Standing Seam Roof Screen and the accompanying materials. This assembly was chosen due to its uniqueness and the ultimate estimate came to a total of **\$1,257,525**.

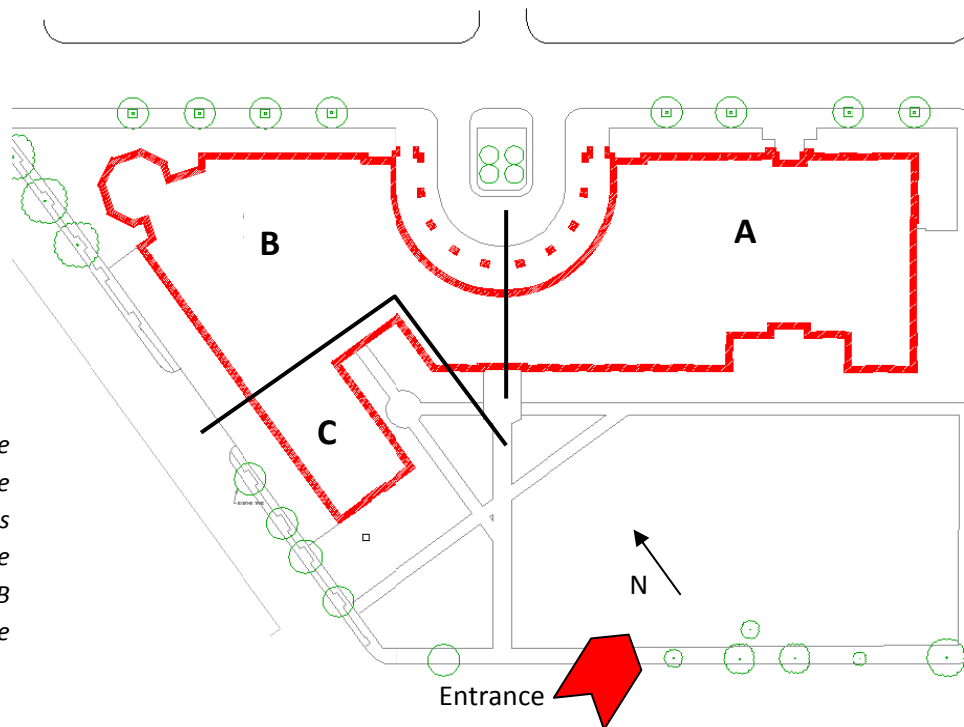
Delving further into the cost methods, a detailed estimate was done on the two structural systems of the VCU School of Business and Engineering. For this particular project, the estimation includes the steel framing system as well as the concrete. The findings of this cost approximation came to a total of **\$3,252,949** and **\$1,925,019** respectively.

Lastly, this assignment explores the General Conditions estimate, using items similar to those that Gilbane enforced when building their estimate. After tabulating the items based off a 24-month work period, the total was found to be **\$1,577,100**, roughly 2% of the contract amount.

DETAILED PROJECT SCHEDULE

Finished building plan-view of the Virginia Commonwealth University School of Business and Engineering

In developing the project schedule, the VCU building was broken into three sub-sections A, B and C (as seen to the right).



The Virginia Commonwealth University School of Business and Engineering is a 4-story building, with structural steel framing in areas A and B, and concrete framing in sector C. Not only does this tri-division make it easier to administer the overall building, but it also addresses the two opposite structural systems that make the skeleton of this building.

Due to the detail of this project schedule, all sections were incorporated in the overall timeframe, as opposed to the two separate schedules submitted in assignment one, that addressed the schools of business and engineering as separate entities.

DETAILED PROJECT SCHEDULE

The schedule initiates with the excavation of foundations in section A, then proceeding to section B, and finally to section C. This order was typical for most activities. Once the circular path has been completed, the trades can then exit the site without being compromised and having to reroute through the site. A summary of trade durations and significant focal dates are as follows:

Summary of Select Events	Summary of Key Dates
Site Work <ul style="list-style-type: none">• Foundation Excavation - 106 Days	Notice to Proceed <ul style="list-style-type: none">• January 16, 2006
Cast In Place Concrete <ul style="list-style-type: none">• Foundations and Slabs - 200 Days	Roof Available (Section C) <ul style="list-style-type: none">• August 23, 2006
Structural Steel <ul style="list-style-type: none">• 81 Days	Section A Dry <ul style="list-style-type: none">• August 29, 2006
Roof Installation <ul style="list-style-type: none">• 61 Days	School of Business Dry <ul style="list-style-type: none">• November 28, 2006
Masonry/Precast <ul style="list-style-type: none">• Sheathing and Brick Veener - 181 Days	Comission Building HVAC <ul style="list-style-type: none">• August 28, 2007
Mechanical and Plumbing <ul style="list-style-type: none">• Rough-in HVAC and Plumbing - 102 Days	Owner FFE <ul style="list-style-type: none">• November 28, 2007
Electrical <ul style="list-style-type: none">• Rough-in Electrical - 379 Days	Substantial Completion <ul style="list-style-type: none">• November 28, 2007
Elevators <ul style="list-style-type: none">• Install (4) Elevators - 195 Days	Spring Semester Begins <ul style="list-style-type: none">• January 14, 2008

Please view the full Detailed Project Schedule (Appendix A) which includes 200 activities and their corresponding duration.

SITE PLAN LOGISTICS

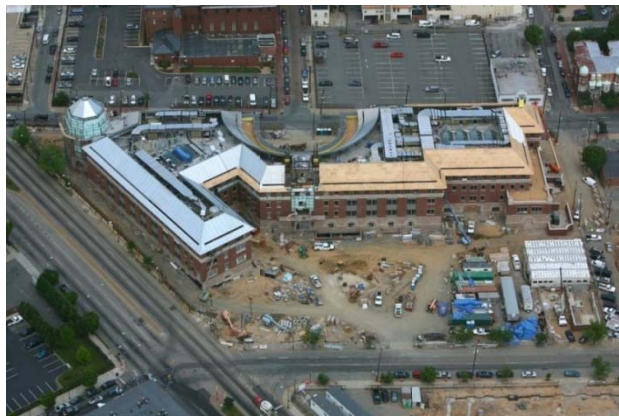
The Virginia Commonwealth University, Monroe Park Campus is located in Richmond, Virginia, off of South Madison Street. The site is bounded by South Belvidere Street on the east, West Main Street on the north, South Madison Street on the east and West Cary Street on the south. Of these three roadways, Belvidere is the only two-way traffic street; the rest are limited to one-way.

In organizing the site layout, the management had to consider such factors for delivery situations and create a solution to the lack of accessibility that the one-way streets incurred. The main entrance is on the south side of the construction site, just off of W. Cary Street. The project site does not contain sufficient area for the Contractor's personnel vehicles. Parking for contractor employees will be by temporary permit only, in areas that were designated by the owner.

Upon entering the site, another problem surfaced: the project site itself, in accordance with the structure mimicking the unique site shape, was very limited to the options of setting up management, subcontractors and other necessities. Gilbane elected to situate the project trailers and a mass amount of other site structures to the far left of the site, leaving a central area open for deliveries.

This set up at first did not seem ideal; there was no real flow of traffic through the site. The deliverers had to turn around, which can be chaotic when other deliveries are trying to come in. Large semis were having to back out onto a busy one-way street; deliverers were impatiently waiting their turn to exit the site; and personnel had to continually address and coordinate vehicle relocation. After the scrutiny passed, this was however a more efficient option (given the amount of space allotted for Gilbane personnel and underlings) and has been working since the start of the project.

In addition to showing the housing of management, the site plan, **Appendix B**, is also showing the superstructure phase of the project. Recognize that in regards to the schedule, the steel erection began at the octagon on the north corner and continued to section A, then B and lastly C. Two 50-ton cranes were used and remobilized to complete the erection. Also displayed are dumpsters, restrooms and temporary power locations.



Aerial view of the VCU construction site

Gilbane

Virginia Commonwealth School of Business
and School of Engineering

5-10-07

ASSEMBLIES ESTIMATE

For the assemblies estimate, I chose to price the Standing Seam Metal Roof Screen that is used to conceal the rooftop mechanical system. This is a unique, cost bearing aesthetic feature at a 10:12 pitch that also supports a certain amount of the rooftop ductwork. In order of layer, the screen is comprised of steel channels and w-shapes, 22 GA galvanized metal decking, treated wood blocking and lastly the standing seam metal panels (aluminum-zinc alloy coated steel). The majority of this assembly was priced using R.S. MEANS 2008 Construction Cost Data. Below is a description of the calculation method and any assumptions made.

- R.S. MEANS was used in the cost calculation of the roof deck, the standing seam panels and the beam sizes.
- Beam sizes that were not listed in R.S. Means were taken to the next largest size to produce a more conservative cost.
- MC shapes were estimated through Discount Steel. The maximum length provided is 20-ft. and an additional \$12.05/ft was added to the channels surpassing the 20-ft length. There was no labor or equipment cost associated with the material cost, hence they were assumed.
- Treated plywood panel pricing came (from Home Depot) and the tabulated square footage was used to achieve a panel quantity. This value has no labor or installation cost within its estimate.
- All square footages and beam counts came from drawing plans.

The final total for this system came to be **\$1,257,525.68**. The take off and relating calculations can be found in **Appendix C**.

DETAILED STRUCTURAL SYSTEM ESTIMATE

The structural system of the School of Business and Engineering consists of both concrete and steel skeletons. A detailed estimate was done on both systems, using R.S. MEANS 2007 Cost Construction Data and is summarized below. Due to the fact that the buildings superstructure is not consistent in the beam sizes and is comprised of two framing systems, there is no “typical” bay that can be easily calculated without a massive amount of averaging that may not reflect the true cost. For this matter, the full take off was done **by floor** and can be found in **Appendix D** which displays the material, labor and equipment costs used to finalize the steel estimate.

Steel Estimate Summary

Beams

W-Shapes \$1,561,738

HSS \$850,535

Columns

W-Shapes \$510,009

HSS \$98,006

Bracing

Hss \$41,443

Steel Decking \$461,218

TOTAL: \$3,252,949

Some assumptions and methods in the estimating process for the steel superstructure are as follows:

- W-shapes that were not listed in R.S. MEANS were taken to the next largest beam size to create a more conservative estimate.
- HSS shapes that were not listed in R.S. Means were extrapolated to obtain the needed values in this estimation.
- Values are based on a Linear Footage.
- This value does not include a takeoff for the stairs.
- The estimate does not include the proper factor for the arced beams around the crescent. Due to the fact that particular members are curved, the price would be much higher.

DETAILED STRUCTURAL SYSTEM ESTIMATE

Below is the summarization of the concrete framing takeoff. The cast-in-place concrete estimate was also done, like the steel, using R.S. Means Construction Data 2007.

- Section 03-30 of the book was used for the column and beam estimates because this portion was the most inclusive. It includes four (4) form uses, the concrete itself, the placement method, reinforcing steel and any concrete finishes that may be applicable.
- The joist estimate is not going to be accurate considering that R.S. Means had only one section pertaining to joist dimensions.
 - The joists for this project have a pan of 53", the takeoff using R.S. Means assumed a pan of 30".
 - The spans were rounded either up to 25' or down to 15'.
- For the footing takeoff, section 03-31 was used to address the different strengths that are required from the footings (3000 psi vs. the column compressive strength of 4000 psi).
- All shear walls were calculated based off an average thickness of 8".
- The slab estimate includes both slab on grade and slabs on deck. The slab on grade consisted of 4" thick normal weight concrete, while the slabs on deck were 5-1/2" thick lightweight concrete.

All takeoffs and calculations can be found in **Appendix D**, which are broken down by floor.

Concrete Estimate Summary	
Beams	\$371,928
Joists	\$406,529
Columns	\$404,606
Footings	\$181,931
Shear Walls	\$72,591
Slabs	\$487,434
	TOTAL: \$1,925,019

GENERAL CONDITIONS ESTIMATE

The General Conditions estimate below was built around items that Gilbane deemed appropriate for this project. The total duration of this project was taken to be a full 2 years, totaling 24 months of work. Values below were obtained through R.S. Means along with certain values from other projects similar in size and scope. The final estimated total came to \$1,557,100 which is about 2% of the \$65MM contract size. Seeing that the actual General Conditions Estimate was not provided to me and the total project cost remains confidential, it is difficult to say if this is an accurate estimate. This was done to the best of my ability and availability of resources.

GENERAL CONDITIONS ESTIMATE

Description	Quantity	Unit	Rate	Total
Temporary Facilities				
Field Offices, General	5	MO	\$465	\$55,800
Common-Use Field Offices	3	MO	\$201	\$14,472
Temporary Equipment				
Fire Extinguishers	20	EA	\$25	\$500
Heating Equipment	3	EA	\$500	\$1,500
Temporary Utilities				
Temp. Water	-	MO	\$150	\$3,600
Heating and Cooling	-	MO	\$35	\$840
Ventilation and Humidity Control	-	MO	\$20	\$312
Electric Power	-	MO	\$2000	\$48,000
Lighting	-	MO	\$400	\$9,600
Telephone	-	MO	\$200	\$4,800
Support Facilities				
Fencing – Perimeter 8’ Wire	1	LS	\$24,920	\$24,920
Parking	1	MO	\$500	\$120,000
Waste Disposal	1	MO	\$1,500	\$36,000
Crane (2 wks)	2	WK	\$800	\$25,600
Security and Protection Facilities				
Stormwater Control	1	LS	-	\$3,000
Signs	4	EA	\$400	\$1,600
Supervision				
Project Executive (50%)	1	YR	\$90,000	\$135,000
Project Manager (50%)	1	YR	75,000	\$112,500
Project Engineer (100%)	2	YR	\$55,000	\$110,000
Project Superintendent (100%)	2	YR	\$65,000	\$130,000
Safety Inspector (100%)	1	YR	\$80,000	\$160,000
Other				
Ceremonies	1	LS	-	\$1,000
Travel/Meal Charges	1	LS	-	\$5,000
Drawings	1	LS	-	\$10,000
Photos	1	MO	\$200	\$2,400
Totals				\$1,016,444
Bonds/Insurance	1	LS	-	\$500,000
With 4% Fee	1	LS	-	\$1,557,100

TOTAL GENERAL CONDITIONS ESTIMATE \$1,577,100

APPENDIX A

DETAILED PROJECT SCHEDULE

APPENDIX B

SITE LAYOUT

APPENDIX C

ASSEMBLIES ESTIMATE – MANSFORD ROOF SCREEN

APPENDIX D

DETAILED STRUCTURAL ESTIMATE