

# Technical Assignment 2: Cost and Methods of Analysis



Plaza East  
Chantilly, Virginia

Steve Miller  
Construction Management  
Dr. David Riley

## Table of Contents

Executive Summary.....	3
Detailed Project Schedule.....	4
Site Layout Planning.....	5
Assemblies Estimate.....	6
Detailed Structural Estimate.....	7
General Conditions Estimate.....	8

### Appendices:

Appendix A – Project Schedule.....	9-12
Appendix B.1 & B.2 – Site Layout Plans.....	13-15
Appendix C – Assemblies Estimate (Building Envelope).....	16-18
Appendix D – Structural Estimate.....	19-20
Appendix E – General Conditions Estimate.....	21-23

## **Executive Summary**

The following report examines a few of Plaza East's costs and methods of construction analysis'. Detailed analyses of the projects schedule, site layout, curtain wall, structural system, and general conditions are displayed here to demonstrate how Plaza East's plans were put into reality.

Differing from the first Technical Assignment, the project schedule contained in this report is far more detailed, consisting of 143 items. A summary of key project dates will also be listed in this section. The site plans involved in this report show how the site was utilized during the excavation and superstructure phase. The superstructure phase shows much more detail considering how the site was utilized during the majority of the project. This project had a custom made curtain wall system which will be broken down into subsections including precast concrete, spandrel and visual glass, and aluminum mullions. These will be then used to perform the detailed assemblies estimate. Further estimates including a detailed construction systems and general conditions estimate are also included. All of these will be summarized in each section and then further explained in the Appendices of the report.

## **Detailed Project Summary**

Plaza East is a fairly simple project. The duration for this project was planned to span less than 58 weeks. There was no need for multiple complex phases to the project. Each building was being erected at the same time, with building 1 slightly ahead of building 2. Below are some key dates from the original schedule put together back in 10/24/2005. The Notice to Proceed came later than expected which pushed some of the dates back. The project still has not been handed over to a tenant for occupancy yet and is still owned by Tishman Speyer.

**For the Detailed Project Schedule see Appendix A**

### **Key Project Dates**

Notice to Proceed	3/13/06
Complete Excavation	3/27/06
Concrete Complete on Tower #1	6/15/06
Concrete Complete on Tower #2	7/13/06
Complete MEP Risers	11/13/06
Complete All Façade Installation	11/23/06
Complete Main Lobby	12/26/06
Complete All Finishes	12/26/06
Complete All Site Works	2/8/07
Substantial Completion	3/7/07
Building #1 Complete	4/13/07*
Building #2 Complete	5/14/07*

\*Project Dates have changed from original schedule

## **Site Layout Planning**

Plaza East was built on a very large lot with no close surrounding buildings. This in turn gave the project plenty of room for what was needed during each aspect of the project. There was always plenty of room for parking, material storage, equipment, trailers, etc.

### **For Excavation Site Plan See Appendix B.1**

The first site layout is the site work and excavation plan. There wasn't much excavation for these two buildings. The excavation included shallow footings and leveling of the earth for the SOG. This in turn made this first phase fairly quick and simple. During excavation, materials were being brought in to begin the structural aspects of the buildings. The majority of materials consisted of cables (for post-tensioning), rebar, and formwork. The traffic was not as strict during this phase and had plenty of room to move around. Cars would enter the site and head left to park. Some cars parked in front of the trailers the entire duration of the project.

### **For Superstructure Site Plan See Appendix B.2**

The second site layout plan demonstrates where everything was placed for the majority of the project. The materials were placed in the same areas as before. After the parking lot was paved, there was plenty of area for all transportation. During this phase you can see the traffic direction became stricter, which eventually helped keep the path as a one-way traffic area. Temporary utilities along with the main power were added during this phase.

## Assemblies Estimate

Plaza East’s building envelope consists of precast concrete slabs, mullions, combined with vision and spandrel glass. This estimate will also include the precast concrete panels used on the architectural wall protruding out of each building. There were some assumptions involved in the calculations.

The square foot area of each elevation in terms of precast, vision glass, tempered vision glass, and spandrel glass were first calculated. The precast was tricky because there were a few different shaped slabs involved. Taking a few measurements to come to a general size of 8’ x 8’ with an 8” thickness was assumed. This first calculation also included the 2” thick insulation behind the precast. These precast panels were taken from under the *Fluted Window or Mullion Precast Concrete, Section B2010 103*. This was to be sure the mullions would be accounted for because they were not included on the curtain wall panels. Next were the window panels which were taken from *Section B2020 220 under 1” thick units, 2 lites, ¼” float, clear, ½” thick tempered, and plate glass, spandrel glass, panels, ¼” plate glass insulation w/ fiberglass, 1” thick*. Last is the roof, which was a typical built up design under *Section B3010 105, flashing under Section B3010 430, and insulation under B3010 0350*. Below is a summary of the calculations using RS Means 2007.

*For a detailed breakdown of the Assemblies Estimate see Appendix C*

<b>Building Envelope for Building 1</b>			
Item	Quantity	\$/SF	Amount
Precast Concrete (insulated)	23,663	29.55	\$699,241.65
Glass and Glazing (Visual)	17,013	27.55	\$468,708.15
Glass and Glazing (Visual Tempered)	258	39.40	\$10,165.20
Glass and Glazing (Spandrel)	5,118	20.50	\$104,919.00
Built Up Roof	25,200	2.14	\$53,928.00
Flashing	1,344	4.28	\$5,752.32
Roof Insulation	25,200	1.46	\$36,792.00
Total =			\$1,379,506.32
Location Factor =			0.94
Inflation Factor (1 year) =			1.03
Total for Both Buildings =			\$2,659,908.91
Actual Project Total =			\$5,530,000.00
Difference - Estimate vs Actual =			\$2,870,091.09

The difference in the amount estimated in R.S. Means and with the amount given to by DAVIS Construction could be from multiple reasons. Specifics were not given on a few items, which were then generalized. The concrete may also have been considered architectural which could have raised the value of the material. The concrete panels were many different shapes and sizes, so an average was taken which could have been less than the actual amount. If the mullions were not included in the concrete they could possibly raise the amount of the building envelope. In conclusion the numbers were off, but all aspects are accounted for under the R.S. Means estimate breakdown.

### **Detailed Structural Systems Estimate**

Plaza East has a cast-in-place concrete structure consisting of shallow foundation footings, columns, and post-tensioned elevated slabs and beams. A take off was performed and a summary of the estimate is below using R.S. Means 2008.

*For a detailed breakdown of the Structural System Estimate see Appendix D*

<b>Detailed Structural Estimate Summary</b>		
CSI Division	Placement	Total
03300	Concrete Foundations	\$3,823,555.96
03300	Concrete Slabs & Beams	\$662,566.00
03300	Concrete Columns	\$593,122.12
Total Cost with Factors		\$4,196,026.30
Both buildings		\$8,392,052.60

The actual cost of the superstructure for the entire project was said to be around \$5,980,000. There were a few factors that may have put the R.S. Means estimate off. The roof slab was calculated even though it was considered to be under the contract of the water proofing. Small values of concrete were taken off twice, being calculated in both the slabs and the post

tensioned beams. When looking back at the proposal from DAVIS this number is close to the concrete number they predicted which was \$8,510,000.

### **General Conditions Estimate**

Plaza East had a combination of general conditions, insurance and taxes, bonds, and a general contractor fee estimate equaling \$3,265,638 in its proposal. This comes out to be 11.8% of the total construction cost according to their proposal. The breakdown of the General Conditions was done by dividing the total cost given by the weeks of the project. Anything not divided by the duration of the project was considered a Lump Sum. Below is a summary of the General Conditions Estimate.

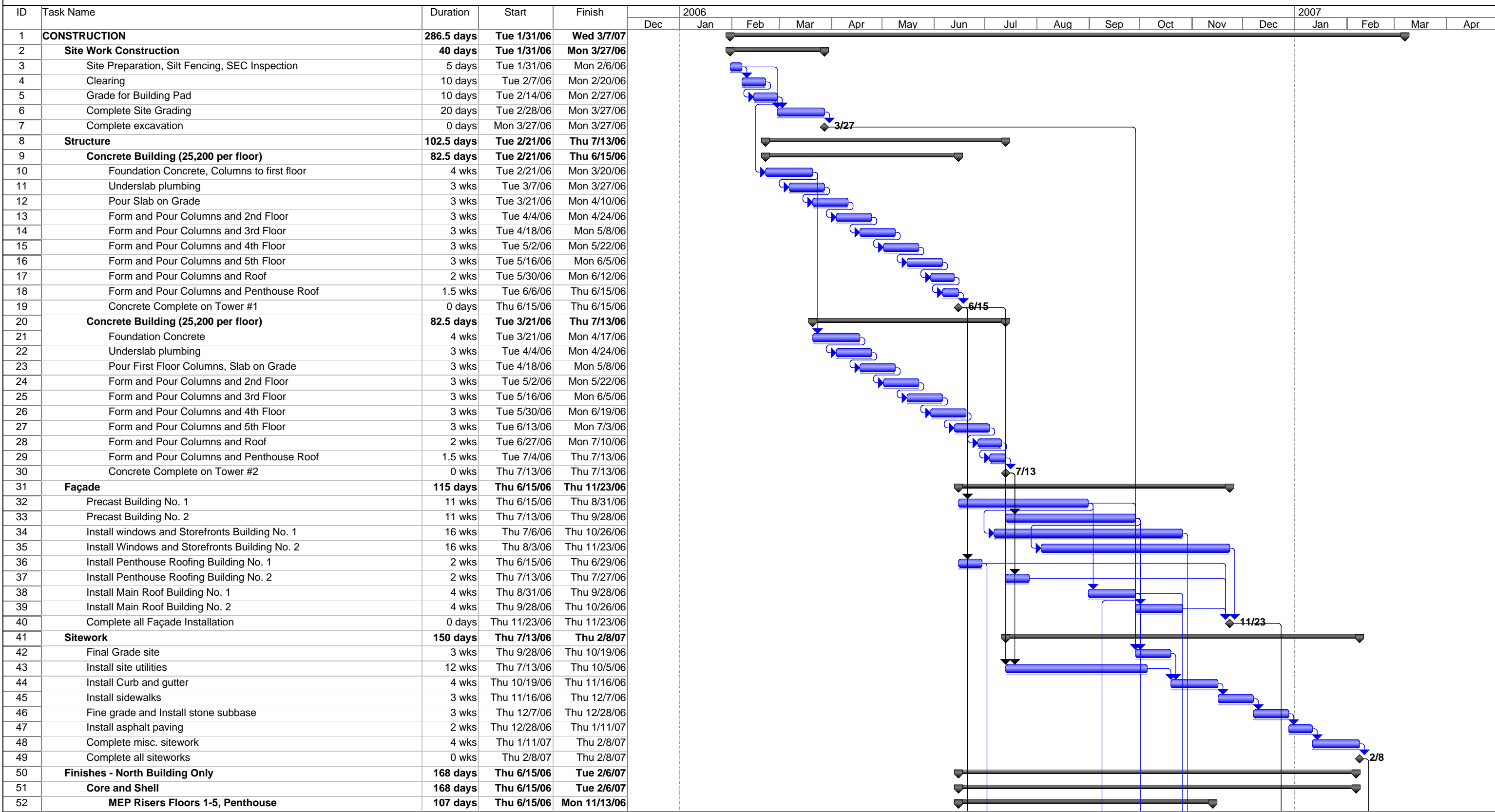
*For a detailed breakdown of the General Conditions Estimate see Appendix E*

<b>General Conditions Summary</b>	
Labor	\$1,107,214.00
Material	\$692,152.00
Equipment	\$71,670.00
Insurance and Taxes	\$165,514.00
Bonds	\$175,141.00
General Contractors Fee	\$1,053,947.00
<b>Total =</b>	<b>\$3,265,638.00</b>



## Appendix A

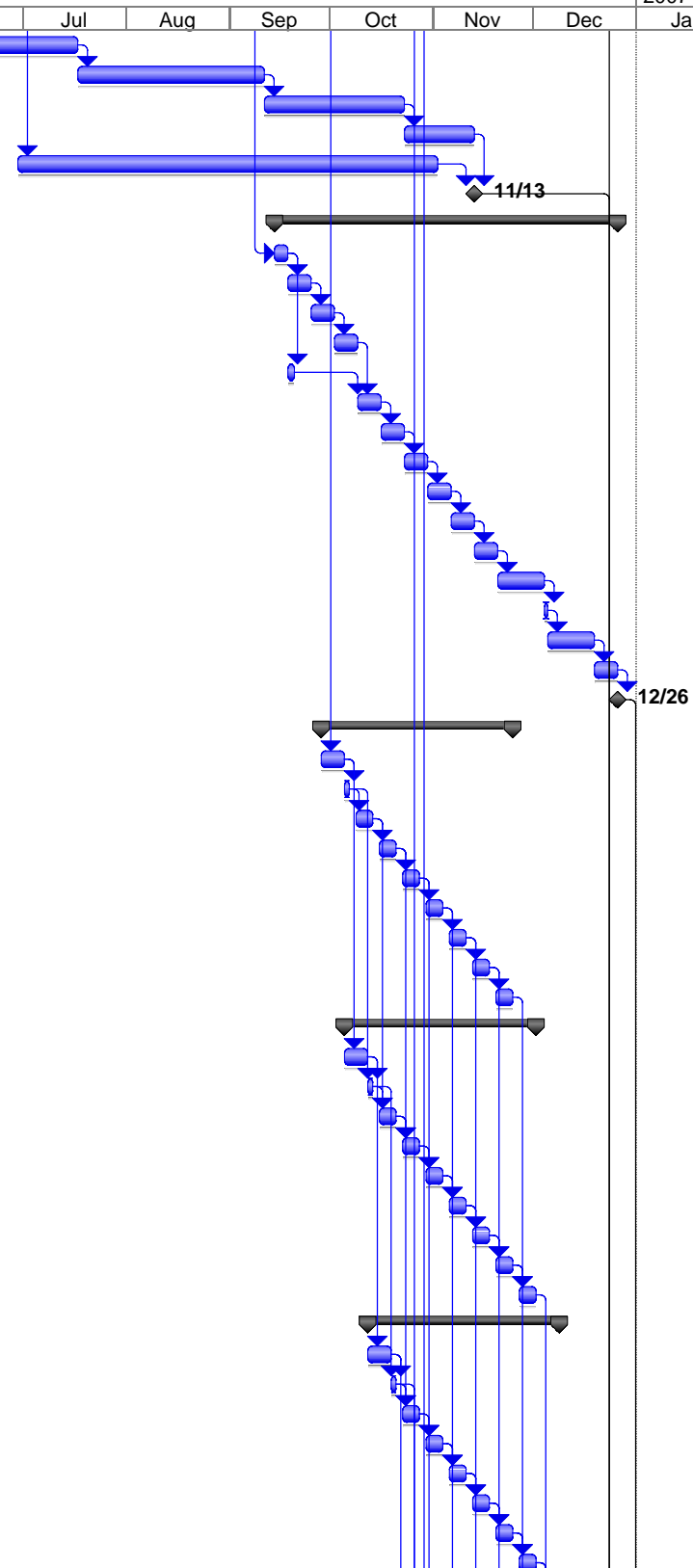
### Project Schedule



Date: Fri 11/2/07

Task		Progress		Summary		External Tasks		Deadline	
Split		Milestone		Project Summary		External Milestone			

ID	Task Name	Duration	Start	Finish	2006												2007							
					Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr			
53	Mechanical - Ductwork Risers, Condenser Water	22 days	Thu 6/15/06	Mon 7/17/06									██████████											
54	Electrical - Buss Duct, Conduit, Panels	40 days	Mon 7/17/06	Mon 9/11/06								██████████												
55	Plumbing - Storm, Sewer, Water	30 days	Mon 9/11/06	Mon 10/23/06								██████████												
56	Sprinkler - Standpipe	15 days	Mon 10/23/06	Mon 11/13/06								██████████												
57	Elevators	18 wks	Thu 6/29/06	Thu 11/2/06								██████████												
58	Complete MEP Risers	0 days	Mon 11/13/06	Mon 11/13/06																				
59	<b>Main Lobby</b>	<b>73 days</b>	<b>Thu 9/14/06</b>	<b>Tue 12/26/06</b>																				
60	Layout Lobby Walls	2 days	Thu 9/14/06	Mon 9/18/06																				
61	Install Ductwork above ceiling	5 days	Mon 9/18/06	Mon 9/25/06																				
62	Install Sprinkler above ceiling	5 days	Mon 9/25/06	Mon 10/2/06																				
63	Install Lighting above ceiling	5 days	Mon 10/2/06	Mon 10/9/06																				
64	Install Elevator Entrances	2 days	Mon 9/18/06	Wed 9/20/06																				
65	Frame Lobby Walls	5 days	Mon 10/9/06	Mon 10/16/06																				
66	Frame Ceilings and Bulkheads	5 days	Mon 10/16/06	Mon 10/23/06																				
67	Roughin MEP to Ceilings and Bulkheads	5 days	Mon 10/23/06	Mon 10/30/06																				
68	Close in Inspections	5 days	Mon 10/30/06	Mon 11/6/06																				
69	Hang Drywall Ceilings, Walls, Bulkheads	5 days	Mon 11/6/06	Mon 11/13/06																				
70	Finish Drywall	5 days	Mon 11/13/06	Mon 11/20/06																				
71	Install stone flooring and base	2 wks	Mon 11/20/06	Mon 12/4/06																				
72	Finish Paint	1 day	Mon 12/4/06	Tue 12/5/06																				
73	Install Millwork Panels	2 wks	Tue 12/5/06	Tue 12/19/06																				
74	Final Touch up of all finishes	1 wk	Tue 12/19/06	Tue 12/26/06																				
75	Complete Main Lobby	0 days	Tue 12/26/06	Tue 12/26/06																				
76	<b>1st Floor</b>	<b>41.5 days</b>	<b>Thu 9/28/06</b>	<b>Fri 11/24/06</b>																				
77	Frame Cores	1 wk	Thu 9/28/06	Thu 10/5/06																				
78	Rough in / Close in	1.5 days	Thu 10/5/06	Fri 10/6/06																				
79	Hang and Finish Drywall	1 wk	Mon 10/9/06	Fri 10/13/06																				
80	Frame Ceilings	1 wk	Mon 10/16/06	Fri 10/20/06																				
81	Hang and Finish Ceilings	1 wk	Mon 10/23/06	Fri 10/27/06																				
82	Bathroom Tile	1 wk	Mon 10/30/06	Fri 11/3/06																				
83	Bathroom Paint	1 wk	Mon 11/6/06	Fri 11/10/06																				
84	Bathroom Fixtures and Partitions	1 wk	Mon 11/13/06	Fri 11/17/06																				
85	Accessories and Trim	1 wk	Mon 11/20/06	Fri 11/24/06																				
86	<b>2nd Floor</b>	<b>41.5 days</b>	<b>Thu 10/5/06</b>	<b>Fri 12/1/06</b>																				
87	Frame Cores	1 wk	Thu 10/5/06	Thu 10/12/06																				
88	Rough in / Close in	1.5 days	Thu 10/12/06	Fri 10/13/06																				
89	Hang and Finish Drywall	1 wk	Mon 10/16/06	Fri 10/20/06																				
90	Frame Cilings	1 wk	Mon 10/23/06	Fri 10/27/06																				
91	Hang and Ceilings	1 wk	Mon 10/30/06	Fri 11/3/06																				
92	Bathroom Tile	1 wk	Mon 11/6/06	Fri 11/10/06																				
93	Bathroom Paint	1 wk	Mon 11/13/06	Fri 11/17/06																				
94	Bathroom Fixtures and Partitions	1 wk	Mon 11/20/06	Fri 11/24/06																				
95	Accessories and Trim	1 wk	Mon 11/27/06	Fri 12/1/06																				
96	<b>3rd Floor</b>	<b>41.5 days</b>	<b>Thu 10/12/06</b>	<b>Fri 12/8/06</b>																				
97	Frame Cores	1 wk	Thu 10/12/06	Thu 10/19/06																				
98	Rough in / Close in	1.5 days	Thu 10/19/06	Fri 10/20/06																				
99	Hang and Finish Drywall	1 wk	Mon 10/23/06	Fri 10/27/06																				
100	Frame Cilings	1 wk	Mon 10/30/06	Fri 11/3/06																				
101	Hang and Ceilings	1 wk	Mon 11/6/06	Fri 11/10/06																				
102	Bathroom Tile	1 wk	Mon 11/13/06	Fri 11/17/06																				
103	Bathroom Paint	1 wk	Mon 11/20/06	Fri 11/24/06																				
104	Bathroom Fixtures and Partitions	1 wk	Mon 11/27/06	Fri 12/1/06																				











Date: Fri 11/2/07

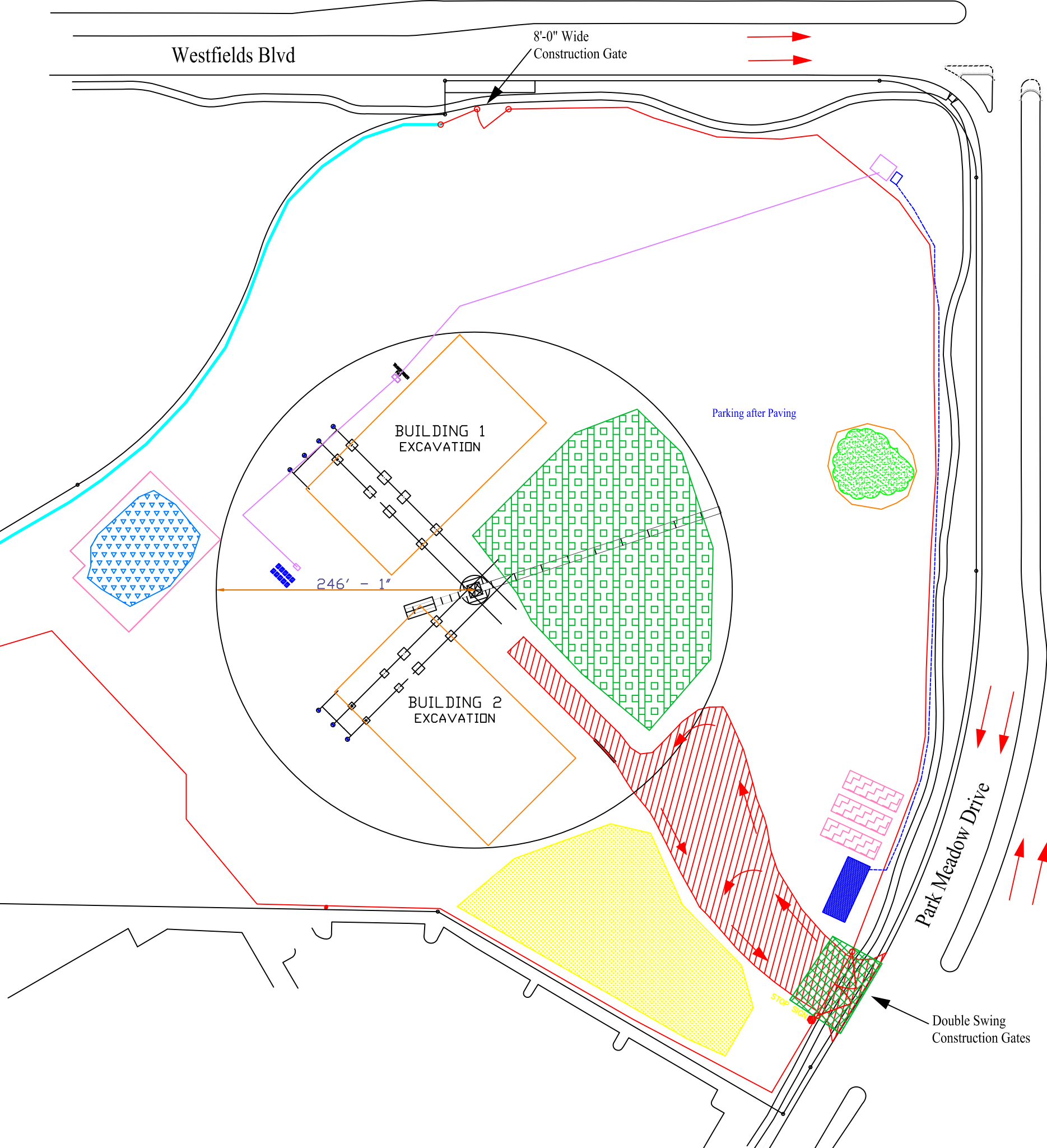
Task		Progress		Summary		External Tasks		Deadline	
Split		Milestone		Project Summary		External Milestone			



## Appendix B.1 & B.2

### Site Layout Plans

LEGEND	
	Temporary Internet
	Temporary Power Supply
	6' High Construction Fence
	6' High Existing VDOT Fence
	DAVIS Jobsite Trailer
	Sub Jobsite Trailers & Laydown Areas
	Stabilized Construction Entrance
	Sub & Temporary Parking Areas
	Material Laydown Area
	Retention Pond
	Spoils & Topsoil Stockpiles With Erosion Control
	Construction Traffic / Loading & Unloading Zone
	Temporary Toilets



# Technical Assignment 2 - Site Plan Plaza East Site Work/Excavation 1/31/06 - 3/27/06

Steven M. Miller  
Construction Management  
Dr. Riley















$\frac{1}{32}'' = 1' - 0''$

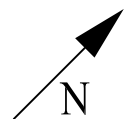
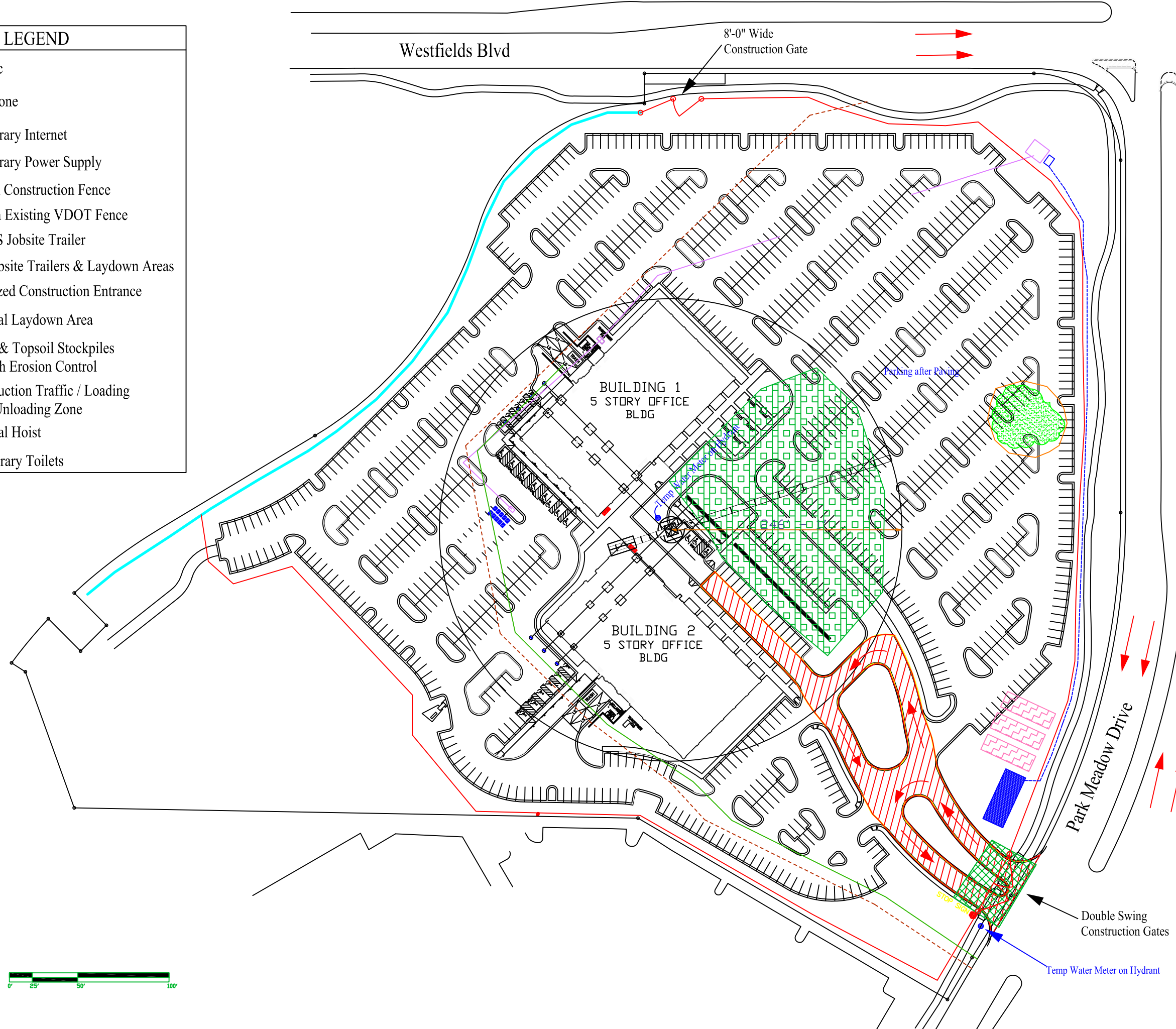


# Technical Assignment 2 - Site Plan Plaza East Superstructure 2/21/06 - 7/13/06

Steven M. Miller  
Construction Management  
Dr. Riley

1/32" = 1' - 0"

LEGEND	
	Electric
	Telephone
	Temporary Internet
	Temporary Power Supply
	6' High Construction Fence
	6' High Existing VDOT Fence
	DAVIS Jobsite Trailer
	Sub Jobsite Trailers & Laydown Areas
	Stabilized Construction Entrance
	Material Laydown Area
	Spoils & Topsoil Stockpiles With Erosion Control
	Construction Traffic / Loading & Unloading Zone
	Material Hoist
	Temporary Toilets



## Appendix C

### Assemblies Estimate (Building Envelope)



Precast Concrete (Averaged panels to 8" thickness, 8'x8', 2 inch insul)						
	Quantity	Unit	Mat. Cost	Inst. Cost	Total Unit Cost	Total Cost
North Elevation	6,240	sf	16.4	13.15	29.55	\$184,392.00
East Elevation	5,236	sf	16.4	13.15	29.55	\$154,723.80
South Elevation	7,413	sf	16.4	13.15	29.55	\$219,054.15
West Elevation	4,774	sf	16.4	13.15	29.55	\$141,071.70
<b>Total</b>	<b>23,663</b>	<b>sf</b>				<b>\$699,241.65</b>

1" Vision Glass (1" thick units, 2 lites, ¼" float, clear)						
	Quantity	Unit	Mat. Cost	Inst. Cost	Total Unit Cost	Total Cost
North Elevation	5,428	sf	15.90	11.65	27.55	\$149,541.40
East Elevation	3,150	sf	15.90	11.65	27.55	\$86,782.50
South Elevation	5,237	sf	15.90	11.65	27.55	\$144,279.35
West Elevation	3,198	sf	15.90	11.65	27.55	\$88,104.90
<b>Total</b>	<b>17,013</b>	<b>sf</b>				<b>\$468,708.15</b>

1/2" Vision Glass Tempered						
	Quantity	Unit	Mat. Cost	Inst. Cost	Total Unit Cost	Total Cost
North Elevation	198	sf	23.50	15.90	39.40	\$7,801.20
East Elevation	-	sf	23.50	15.90	39.40	\$0.00
South Elevation	60	sf	23.50	15.90	39.40	\$2,364.00
West Elevation	-	sf	23.50	15.90	39.40	\$0.00
<b>Total</b>	<b>258</b>	<b>sf</b>				<b>\$10,165.20</b>

1/4" Spandrel Glass (spandrel glass, panels, 1/4" plateglass insul w/ fiberglass, 1" thick)						
	Quantity	Unit	Mat. Cost	Inst. Cost	Total Unit Cost	Total Cost
North Elevation	1,725	sf	13.20	7.30	20.50	\$35,362.50
East Elevation	780	sf	13.20	7.30	20.50	\$15,990.00
South Elevation	1,591	sf	13.20	7.30	20.50	\$32,615.50
West Elevation	1,022	sf	13.20	7.30	20.50	\$20,951.00
<b>Total</b>	<b>5,118</b>	<b>sf</b>				<b>\$104,919.00</b>

Roof Build-up, Flashing, and 2" Insulation						
	Quantity	Unit	Mat. Cost	Inst. Cost	Total Unit Cost	Total Cost
Roof	25,200	sf	0.69	1.45	2.14	\$53,928.00
Flashing	1,344	sf	1.30	2.98	4.28	\$5,752.32
Insulation	25,200	sf	0.92	0.54	1.46	\$36,792.00
<b>Total</b>						<b>\$96,472.32</b>

Total Building Envelop Cost \$1,379,506.32

Location Factor 0.936

Year Inflation 1.03

Total Building Envelop Cost \$1,329,954.45

**Total for both Buildings \$2,659,908.91**

## Appendix D

### Structural Estimate

Cast-In-Place Concrete R.S. Means Building Construction Cost Data 2008: Section 03 30

CSI Division		Location	Qty. (C.Y.)	Cost/Unit			Total, Including O&P	Total Cost
				Mat.	Labor	Equip		
3300	Columns	Floor 1-5	534.72	395.7	404.97	39.64	1109.22	\$593,122.12
3300	One Way Beam and Slab (27')	Floor 2-5 & Roof	490	246	281	26.5	740	\$362,600.00
3300	One Way Beam and Slab (45')	Floor 2-5 & Roof	2284.88	492	562	53	1480	\$3,381,622.40
3300	Footings (1 to 5 C.Y.)	Foundation	76.26	192	95.5	0.57	360	\$27,453.60
3300	Footings (Over 5 C.Y.)	Foundation	138.58	176	54.5	0.33	280	\$38,802.40
3300	Slab on Grade	Floor 1-5	388.89	119.5	45.5	0.34	204	\$79,333.56
Location Factor =							0.936	
Total Concrete Placement =							\$4,196,026.30	
Total Concrete for Both Buildings =							\$8,392,052.59	

## Appendix E

### General Conditions Estimate

<b>General Conditions</b>				
<b>Labor</b>	<b>Quantity</b>	<b>Units</b>	<b>Unit Price</b>	<b>Amount</b>
Superintendent	58	Wks	\$6,596.98	\$382,625.00
Layout Engineer	58	Wks	\$1,289.12	\$74,769.00
DAVIS Safety Personnel	58	Wks	\$344.83	\$20,000.00
DAVIS Carpentry	58	Wks	\$1,379.31	\$80,000.00
Project Manager	58	Wks	\$2,718.10	\$157,650.00
Assistant Project Manager	58	Wks	\$3,739.21	\$216,874.00
Project Administrator	58	Wks	\$524.93	\$30,446.00
DAVIS Courier	58	Wks	\$43.21	\$2,506.00
DAVIS Yard Delivery	58	Wks	\$149.57	\$8,675.00
DAVIS Carpentry - Mock	58	Wks	\$344.83	\$20,000.00
DAVIS Labor - Clean Up	58	Wks	\$1,196.55	\$69,400.00
Punchlist	1	LS	\$9,060.00	\$9,060.00
DAVIS Carpentry	58	Wks	\$607.05	\$35,209.00
<b>Labor Total =</b>				<b>\$1,107,214.00</b>

<b>Material</b>	<b>Quantity</b>	<b>Units</b>	<b>Unit Price</b>	<b>Amount</b>
Permits and Expediting	1	LS	\$500.00	\$500.00
Document Reproduction	58	Wks	\$301.72	\$17,500.00
Progress Photos	58	Wks	\$56.03	\$3,250.00
Travel and Road	58	Wks	\$86.21	\$5,000.00
Overnight & Hand	58	Wks	\$117.79	\$6,832.00
Davis Courier Vehicle	58	Wks	\$22.12	\$1,283.00
Field Office Equipment	58	Wks	\$183.84	\$10,663.00
Main Office Equipment	58	Wks	\$51.02	\$2,959.00
Temporary Site Office	58	Wks	\$86.21	\$5,000.00
Field Office Trailers	58	Wks	\$347.84	\$20,175.00
Field Telephone	58	Wks	\$135.12	\$7,837.00
Mobile Phones	58	Wks	\$216.97	\$12,584.00
Construction Signage	58	Wks	\$129.31	\$7,500.00
Construction Fence	58	Wks	\$488.28	\$28,320.00
Material Hoist	58	Wks	\$258.62	\$15,000.00
Temporary Power	58	Wks	\$1,262.48	\$73,224.00
Security Services	58	Wks	\$86.21	\$5,000.00
Vehicle Allowance	58	Wks	\$202.95	\$11,771.00
Final Cleaning	1	LS	\$37,950.00	\$37,950.00
Dumpsters	58	Wks	\$1,560.29	\$90,497.00
Trash Chute	58	Wks	\$199.57	\$11,575.00
Temporary Protection	58	Wks	\$88.14	\$5,112.00
Safety Incentives	58	Wks	\$86.21	\$5,000.00

First Aid Kit and Refill	1	LS	\$2,000.00	\$2,000.00
Temporary Fire	58	Wks	\$43.10	\$2,500.00
Temporary Toilets	58	Wks	\$280.17	\$16,250.00
Water Cooler for Trailer	58	Wks	\$56.03	\$3,250.00
Personal Protective	1	LS	\$10,250.00	\$10,250.00
Gross Receipts Tax	58	Wks	\$525.71	\$30,491.00
Punchlist	1	LS	\$5,000.00	\$5,000.00
General Liability	1	LS	\$110,699.00	\$110,699.00
Site Furnishings	58	Wks	\$155.17	\$9,000.00
Site Development	58	Wks	\$2,037.59	\$118,180.00
<b>Material Total =</b>				<b>\$692,152.00</b>

<b>Equipment</b>	<b>Quantity</b>	<b>Units</b>	<b>Unit Price</b>	<b>Amount</b>
DAVIS Tools and	58	Wks	\$144.36	\$8,373.00
Computer/LAN/Misc.	58	Wks	\$389.17	\$22,572.00
Field Staff Vehicle	58	Wks	\$292.91	\$16,989.00
Office Staff Vehicle	58	Wks	\$366.14	\$21,236.00
Survey/Layout	1	LS	\$2,500.00	\$2,500.00
<b>Equipment Total =</b>				<b>\$71,670.00</b>

Insurance and Taxes = \$165,514.00  
 Bonds = \$175,141.00  
 General Contractor  
 Fee = \$1,053,947.00  
**Total = \$3,265,638.00**