2009

Technical Assignment I

Marymount University 26th St Project
Arlington, VA

10/5/2009

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Construction Management
Consultant: Dr. Riley

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Executive Summary

Technical Assignment I involves an investigation into various aspects of the design and construction of the Marymount University 26th Street Project, located in Arlington, Virginia. This report is intended to provide an in-depth analysis of background information relating to the project. Areas of investigation include milestones within the project schedule, systems incorporated into the design of the building, project costs, project constraints, existing conditions, the project delivery system, and the project staffing plan.

The Marymount University 26th Street Project is a $ 42 million, 267,000 SF addition to the campus of Marymount University. The project includes a 52,000 square foot academic building and laboratory, 77,000 square feet of suite-style housing with accommodations for up to 239 students, and 137,000 square feet of underground parking. With the acquisition of this facility, the university hopes to expand and strengthen their reputation for excellence.

The university has taken a strong interest in cost, the 17 month project schedule and sustainable design practices. The university and project architect, Davis, Carter, Scott, LTD. have worked side by side to incorporate sustainability into the project. The 26th Street project is participating in the United State Green Building Council's Leadership in Energy and Environmental Design (LEED®) program and is striving for a LEED® Certified rating. To accommodate the constraints of the project schedule and project costs, Marymount has added the experience of the James G. Davis Construction to the project team. Together, the entire project team looks to make the project a success.

A. Project Schedule Summary

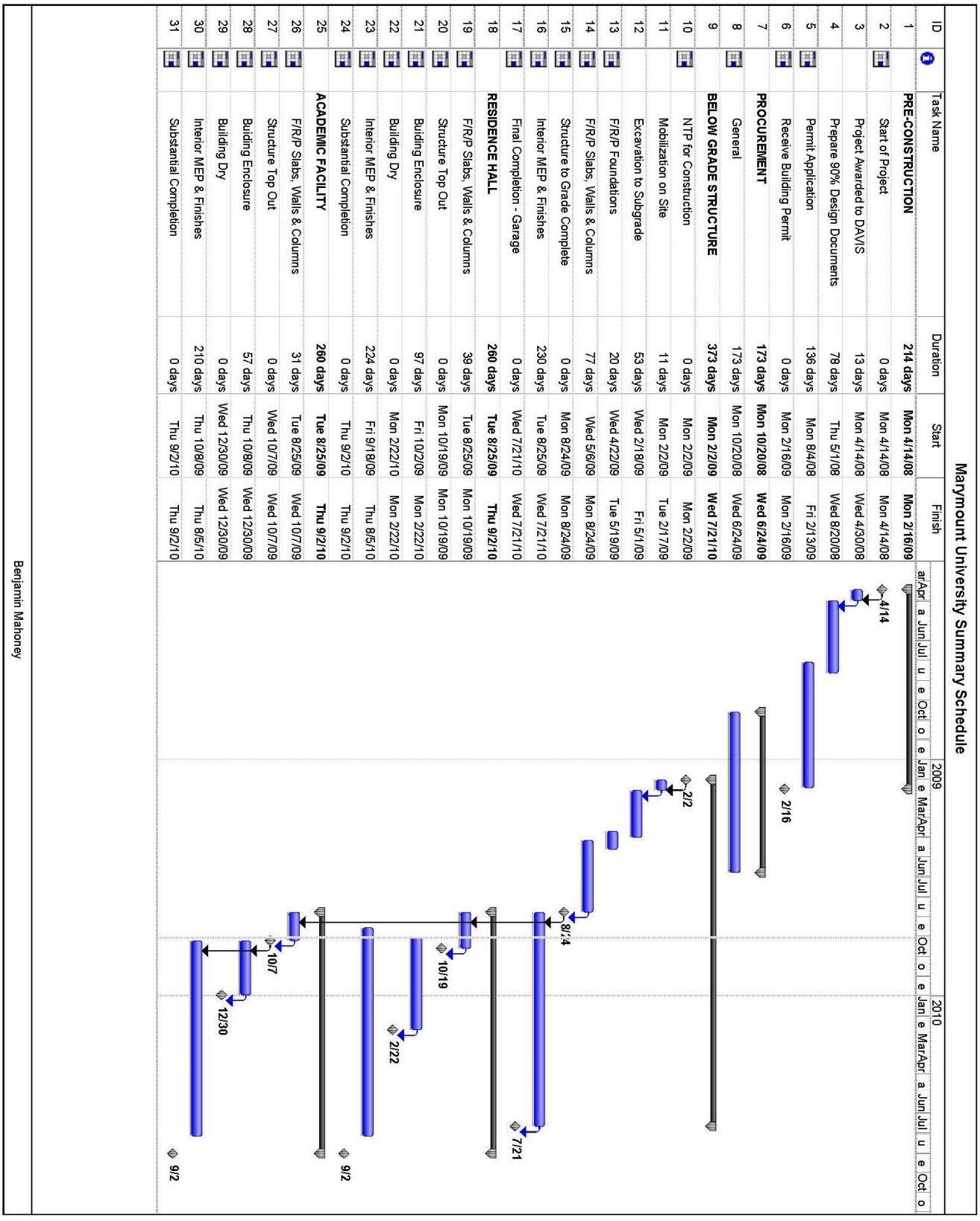
James G. Davis Construction Corporation is to be awarded the General Contracting responsibilities for the Marymount University 26th Street Project in April of 2008. This will provide the company with approximately 10 months to complete their preconstruction services. Services that include permit acquisition, procurement of materials, and completion of the Guaranteed Maximum Price contract.

Construction operations are scheduled to commence in February of 2009 when James G. Davis Construction is supplied with the Notice to Proceed from Marymount University. Mobilization of Davis field personnel as well as the Excavation/Demolition Contractor will follow directly after receiving the Notice to Proceed. Major construction activities that are to take place during this time include clearing of the existing parking, undergrounding of overhead utilities, installation of the excavation support system, and major excavation.

The major excavation/demolition activities are scheduled to kick-off in May of 2009, placing all of the foundation-to-grade activities directly in line with the critical path. This work will involve forming, reinforcing, and pouring the concrete mat foundations, spread footings, foundation walls, shear walls, columns, and floor slabs. The remaining concrete superstructure will be separated into two towers once it reaches the elevation at grade. One tower will be an academic facility, while the other tower will be a residence hall. The structures of both towers are sequenced to be constructed at the same time and are to top-out in October, 2009.

Both the academic facility and the residence hall will be enclosed with precast architectural concrete panels and aluminum framed windows. This enclosure system will provide the academic facility and the residence hall with a water tight status in December of 2009 and February of 2010, respectively.

The achievement of a water tight status will permit the start of the interior MEP rough-in and interior finishes in both the academic facility and the residential units. The completion of satisfactory inspections will allow the Marymount University 26th Street Project to achieve its final milestone, substantial completion, in early September of 2010. This will allow Marymount University students and personnel to inhabit their new facilities.



ID	Task Name	Duration	Start	Finish
1	**PRE-CONSTRUCTION**	**214 days**	**Mon 4/14/08**	**Mon 2/16/09**
2	Start of Project	0 days	Mon 4/14/08	Mon 4/14/08
3	Project Awarded to DAVIS	13 days	Mon 4/14/08	Wed 4/30/08
4	Prepare 90% Design Documents	78 days	Thu 5/1/08	Wed 8/20/08
5	Permit Application	136 days	Mon 8/4/08	Fri 2/13/09
6	Receive Building Permit	0 days	Mon 2/16/09	Mon 2/16/09
7	**PROCUREMENT**	**173 days**	**Mon 10/20/08**	**Wed 6/24/09**
8	General	173 days	Mon 10/20/08	Wed 6/24/09
9	**BELOW GRADE STRUCTURE**	**373 days**	**Mon 2/2/09**	**Wed 7/21/10**
10	NTP for Construction	0 days	Mon 2/2/09	Mon 2/2/09
11	Mobilization on Site	11 days	Mon 2/2/09	Tue 2/17/09
12	Excavation to Subgrade	53 days	Wed 2/18/09	Fri 5/1/09
13	F/R/P Foundations	20 days	Wed 4/22/09	Tue 5/19/09
14	F/R/P Slabs, Walls & Columns	77 days	Wed 5/6/09	Mon 8/24/09
15	Structure to Grade Complete	0 days	Mon 8/24/09	Mon 8/24/09
16	Interior MEP & Finishes	230 days	Tue 8/25/09	Wed 7/21/10
17	Final Completion - Garage	0 days	Wed 7/21/10	Wed 7/21/10
18	**RESIDENCE HALL**	**260 days**	**Tue 8/25/09**	**Thu 9/2/10**
19	F/R/P Slabs, Walls & Columns	39 days	Tue 8/25/09	Mon 10/19/09
20	Structure Top Out	0 days	Mon 10/19/09	Mon 10/19/09
21	Building Enclosure	97 days	Fri 10/2/09	Mon 2/22/10
22	Building Dry	0 days	Mon 2/22/10	Mon 2/22/10
23	Interior MEP & Finishes	224 days	Fri 9/18/09	Thu 8/5/10
24	Substantial Completion	0 days	Thu 9/2/10	Thu 9/2/10
25	**ACADEMIC FACILITY**	**260 days**	**Tue 8/25/09**	**Thu 9/2/10**
26	F/R/P Slabs, Walls & Columns	31 days	Tue 8/25/09	Wed 10/7/09
27	Structure Top Out	0 days	Wed 10/7/09	Wed 10/7/09
28	Building Enclosure	57 days	Thu 10/8/09	Wed 12/30/09
29	Building Dry	0 days	Wed 12/30/09	Wed 12/30/09
30	Interior MEP & Finishes	210 days	Thu 10/8/09	Thu 8/5/10
31	Substantial Completion	0 days	Thu 9/2/10	Thu 9/2/10

B. Building Systems Summary

Building System Summary		
YES	NO	Scope of Work
×		Demolition Required
	×	Structural Steel Frame
×		Cast-in-Place Concrete
×		Precast Concrete
×		Mechanical System
×		Electrical System
×		Masonry
x		Curtain Wall
×		Support of Excavation

Table 1. Building System Summary

Demolition

The site of the Marymount University 26th Street Project was previously utilized by the university as a surface parking lot. Before any excavation work could begin, all of the asphalt, debris, and vegetation needed to be cleared and grubbed from the 1.45 acre site.

The overall area of excavation is approximately 63,000 square feet and the depth of excavation ranges from 45' to 25' deep as a result of the slope of the existing site. Due to the depth of the excavation, roughly 80,000 CY of soils need to be hauled from the site by the excavation contractor. The excavated soils will be directly relocated to numerous other project sites in the Washington, D.C. metropolitan area.

Structural Steel Frame

There is no structural steel incorporated into the frame of the building.

Cast-in-Place Concrete

The entire superstructure, supporting foundation, and lateral systems consist of steel reinforced, cast-in-place concrete. The foundation is comprised of 34"-54" mat foundations, found along the perimeter of the building, while 32"-54" spread footings support the interior

columns. These same columns will support the concrete slab above and any other loads found within their tributary area.

Different areas of the structure will be utilized for different types of occupancy; academic, residential, and storage/garage. Each of the corresponding slabs will have separate design specifications. The storage/garage slabs will have a monolithic thickness of 8" with 5½" drop panels at each of the columns. The residential and academic slabs will incorporate a post-tensioning system to help manage the tensile loads. The residential slabs will have a monolithic thickness of 7" with 6" drop panel at the columns. Lastly, the slabs found in the academic space will have a monolithic thickness of 9" with 8" drop panels at the columns.

The lateral system consists of reinforced, cast-in-place concrete shear walls and grade beams. Concrete shear walls can be found the perimeter of the building and extend up through the four levels of underground parking. Additional lateral support is provided by walls of the four stairwells that span from the lowest garage level up to the roof level. The last component of the later system includes grade beams. The beams provide addition support and tie individual spread footings to each other and to the perimeter mat foundation.

All of the work involved with placing the cast-in-place concrete will be performed by Brothers Concrete Construction, Inc. Brothers will utilize the two tower cranes on site to place the concrete via crane and bucket. Brother will utilize the PERI® SKYDECK Aluminum Slab Formwork System for horizontal slabs and PERI® TRIO Panel Formwork for vertical walls and columns.

Figure 1. PERI®SKYDECK (www.peri.ca)

Figure 2. PERI®TRIO (www.peri.ca)

Precast Concrete

The entire exterior façade of the Marymount University 26th Street Project is to be comprised of precast architectural panels. The panels will be connected to the concrete structure with steel embeds. These embeds will be placed into the precast panels and into the edges of the concrete slab. The connections are designed to withstand gravity, lateral, and earthquake loads. The panels will be delivered to the site from an offsite casting plant that the installer, Arban and Carosi, Inc., utilizes. Once the panels arrive on site, they will be laid and set into place by one of the two tower cranes.

Mechanical System

The Mechanical system is comprised of an air-water system containing both variable and constant volume rooftop air handling units. Along with the primary air that is supplied by the air handling units, the individual fan coil units are supplied with both chilled and hot water. The hot water is to be supplied from boilers found in the G3 Level Mechanical Room and the chilled water is to be supplied from pumps that are located within the G4 Level Mechanical Room. These fan coils units will provide individual control of heating and cooling to separate zones within the building. Also located on the roof, are two 500 ton cooling towers that help to dissipate the heat generated by the system.

Due to the different classes of occupancies of the building, the fire suppression system consists of both a wet and a dry pipe system. The wet pipe system will provide immediate fire suppression to each of the residential units while the dry pipe systems services the rest of the building.

Electrical System

Marymount University is supplied with electrical service by Dominion Virginia Power, which services regions of both Virginia and North Carolina. The incoming service is to be stepped down by a transformer located outside of the building and brought into the building with 3∅, 4 wire, 480/277V. The electrical system will also be accompanied with emergency power supplied by a 350kW, 3∅, 4 wire, 480V, continuous power supply generator. The diesel powered generator will be supplied from a 50-gallon day tank and a 500-gallon reserve tank.

Masonry

The extent of masonry incorporated into the project at Marymount University is concrete masonry units (CMUs). The CMUs will serve as partition walls that provide a 2-hour fire rated wall. The CMUs will be non-load bearing and tie into the concrete structure with No. 5 steel reinforcing bars that are 48" high and spaced on 16" centers.

The mortar that will be used consists of Portland cement, hydrated lime, and aggregate. A mixing station will be located on site to mix the mortar with potable water as it is needed.

Curtain Wall

The curtain wall system found on this project is minimal as the façade is mainly constructed of architectural precast panels. The system consists of aluminum framed operable and non-operable Low-E Clear Vision Glass windows. The windows are located throughout the academic and residential facilities to allow daylight to penetrate into the space. Aluminum framed storefront doors are also found where the vestibules and entrances are located.

Support of Excavation

A sheering and shoring system will be utilized as the method of excavation support at Marymount University. The main components of this system include soldier piles, lagging boards, and tiebacks. The sheeting and shoring will not only serve to support the soils outside of the excavated area, but will also serve as one face of the formwork for the foundation walls.

The system will use a total of 132 soldier piles that are spaced approximately 8' on center. The vibratory method will be the main means of installation. Once the piles contact bedrock and reach refusal, they will have to be impact-driven to the proper design elevation.

The amount of excavation will require roughly 26,000 square feet of lagging boards, installed in lifts of roughly 10', and 188 tie-backs. Once a lift is completed, the tie-backs, found at the soldier beams, can be drilled, installed, and grouted. The grout will need to cure for five days from the time of installation. After the five days expires, the tie-backs will be tested for integrity by a third-party testing agency. If the tie-backs are found to meet or exceed the design criteria, excavation can continue below and the process repeats itself until the proper elevation at sub-grade is reached.

In an effort to keep the site as dry as possible, a dewatering system with 12 dewatering wells will be utilized. The water that is removed from the ground will be pumped into a sediment tank to allow the silt and any other debris to settle out before it is pumped off of the construction site.

C. Project Cost Evaluation

The cost evaluation for this project was based off of the estimates from James G. Davis Construction Corporation. The numbers were altered slightly and in no way indicate the actual costs from their bid.

Floor	Area	Use
G4 Level	40,400 SF	Parking
G3 Level	45,780 SF	Parking/Residential
G2 Level	45,820 SF	Parking/Residential
G1 Level	45, 900 SF	Parking/Residential
1st Floor	29,900 SF	Academic/Residential
2nd Floor	29,600 SF	Academic/Residential
3rd Floor	29, 600 SF	Academic/Residential

Table 2. Gross Area by Floor

Building Type	Area
Square Footage of Academic Building	52,000 SF
Square Footage of Residential Building	77,0000 SF
Square Footage of Parking Garage	138, 000 SF
Total Square Footage:	267,000 SF

Table 3. Total Building Area

Type	Cost	Cost Per SF
Construction Cost	$36,630,000	$137.20/SF
Total Project Cost	$41,900,000	$156.93/SF

Table 4. Project Costs

Building System	Cost	Cost Per SF
Excavation Support	$1,105,000	$4.14/SF
Cast-in-Place Structure	$7,341,000	$27.50/SF

Precast Facade	$3,141,000	$11.76/SF
HVAC/Plumbing	$7,482,000	$28.02/SF
Electrical	$3,320,000	$12.43/SF
Fire Protection	$520,000	$1.95/SF
Elevators	$805,000	$3.01/SF

Table 5. Building Systems Cost

RS Means Square Foot Estimate

To create a basis of comparison for the Marymount University 26th Project costs, three separate case studies had to be analyzed. The studies included a reinforced concrete, underground parking structure, a university classroom facility, and an apartment building. An apartment building was chosen over a college dormitory due to the features that the actual residential facility contains. The units are set up in suites, similar to a two bedroom apartment complex, with each room containing an individual bathroom, kitchen, and shared living space.

For each estimate, the factors that remained constant were as follows:

- Location: Arlington, VA
- Date: Year 2009, Quarter 3
- Contractor Fees: 0.0%
- Architectural Fees: 0.0%

Building Feature	Parking Garage	Academic Facility	Residential Facility
Model	Underground, Reinforced Concrete	College Classroom, Concrete Block/Bearing Walls	Apartment w/ Precast Panels and Reinforced Concrete Frame
Stories	3	3	6
Perimeter	1100’	600’	750’
Story Height	11’	11’	11’
Floor Area	137,000 SF	52,000 SF	77,000 SF
Additives			
Parking Accessories	$44,500	N/A	N/A
Elevators	N/A	$278,500	$822,500
Appliances	N/A	N/A	$92,000
Cost Per SF	**$47.08**	**$118.28**	**$116.39**

Table 6. RS Means Cost Analysis

Type	Cost Per SF	Total Cost
Parking Garage	$47.08	$6,449,960
Academic Facility	$118.28	$6,150,500
Residential Facility	$116.39	$8,962,030
Total	$80.76/SF	**$21,562,550**

Table7. RS Means Building Cost Summary

D4 Cost Analysis

Again, when determining an appropriate cost comparison, three separate case studies had to be analyzed. All the case studies were adjusted to match the actual design specifications of the Marymount University 26th Street Project.

Building Feature	Parking Garage	Academic Facility	Residential Facility
Case Number	CM000111	EU050932	RS040728
Case Study	Mercy Health Parking Garage	Wabash College – Hays Hall; Science Laboratory	Eagle Hill School; Residence Hall
Floor Area	137,000 SF	52,000 SF	77,000 SF
Cost per SF	**$49.13/SF**	**$207.36**	**$108.09/SF**

Table 8. D4 Cost Analysis

Type	Cost Per SF	Total Cost
Parking Garage	$49.13/SF	$6,731,305
Academic Facility	$207.36/SF	$10,782,570
Residential Facility	$108.09/SF	$8,322,930
Total	**$96.77/SF**	**$25,836,805**

Table 9. D4 Building Cost Summary

Type	Cost Per SF	Total Cost
RS Means Cost Estimate	$80.76/SF	$21,562,550
D4 Cost Estimate	$96.77/SF	$25,836,805
Actual Construction Cost	$137.20/SF	$36,630,000

Table 10. Cost Comparison Summary

When comparing the estimates, it can be seen that both RS Means and D4 Cost estimating software produce considerably lower results than the actual costs of construction. The actual costs of construction were used as a basis for comparison rather than the total project costs due to the fact that the estimating software does not account for site work, contingencies, insurance, fees, etc.

The estimate from RS Means was generated from their CostWorks software. The estimate produced a significantly lower cost in both the cost per square foot ($80.76/SF RS Means vs. $137.30/SF Actual) and the total cost ($21,562,550 RS Means vs. $36,630,000 Actual). After analyzing the estimate, it was determined that there are two possible areas involving the academic facility where the error may have occurred. First, when searching for a similar building for comparison, a college classroom with concrete block bearing walls was utilized. However, the actual structure of the building is reinforced concrete, but there was no such project with this type of structure within the database. Second, the facility has a very complex mechanical system to service the high tech laboratories and there is no way for the software to account for the added costs of these systems. The result of combining these two issues is directly reflected in significantly lower costs of construction.

The D4 Cost estimating software also produced lower results in both the cost per square foot ($96.77/SF D4 vs. $137.30/SF Actual) and the total cost ($25,836,805 D4 vs. $36,630,000). After analyzing the estimate, it was determined that a major source of error occurred when selecting the case studied that was used as a basis for comparison with the parking garage. Due to the limited availability of parking facilities within the database, an above ground parking garage was utilized. It is felt that the costs of the parking garage are extremely low. This is a direct result of the software not being able to account for the cost of excavating and supporting the excavation four stories below grade.

In conclusion, it is felt that estimating software is a good resource to utilize, but is often inaccurate when dealing with unique facilities with complex systems. To determine more accurate costs, it is best to utilize company historical data along with quantity take-offs and market rate prices.

D. Site Plan of Existing Conditions

Refer to Appendix A.

E. Local Conditions

The 26th Street Project is located at Marymount University in Arlington, Virginia. The project site is triangular in shape and bordered by Old Dominion Drive, 26th Street, and Yorktown Boulevard.

Figure 3. Aerial view of project site. (Davis, Carter, Scott, LTD.)

The campus of Marymount University is adjacent to numerous areas that are zoned for residential use. This has the potential to create some problems when dealing with the issue of construction parking. On-site parking is not an option due to the congested nature of the site. On-street parking is available; however, it is very limited. Also, a majority of on-street parking spaces are for use by the residents and require a parking permit between the hours of 8:00 AM and 5:00 PM. As a solution to this problem, James G. Davis Construction will provide construction parking at a local shopping mall, Ballston. The mall is roughly 2 miles from the project site, so a shuttle will serve to transport workers to and from their vehicles. This will be

the means of construction parking until the structure reaches a point where the below grade parking can be utilized.

Marymount University is considered to be located within the Washington, DC metro area and the project's construction methods fit into the local preferred methods of construction. A majority of buildings found within this area are constructed with reinforced concrete. This method is preferred in this area over steel structures as a direct result of the benefits they deliver. These benefits include larger floor-to-ceiling heights, elimination of fireproofing costs, and elimination of the construction involved in complex connections. The popularity of this construction method also supplies extensive amounts of experience to the field of contractors in the area.

The 1.45 acre site was examined by ECS Mid-Atlantic, LLC in August of 2005. The scope of their work included drilling four test bores to explore the subsurface soil and ground water conditions. The subsurface soil conditions were determined to be sufficiently dense. This allowed the building to be supported by shallow foundations. Foundation systems that include conventional spread footings and mat foundations. When establishing the elevation of ground water, it was determined that the water table exists between 21' and 25' below the existing grade.

F. Client Information

The owner of this project is Marymount University, a catholic university located in Arlington, VA. The university offers associate's, bachelor's, master's, and doctoral degrees, undergraduate and graduate certification, and pre-professional programs in teaching, law, medicine, and physical therapy. With the addition of the 26th Street Project, Marymount University hopes to attract world class students and faculty.

The 26th Street Project is the most significant construction effort that the university has undertaken in nearly four decades. The project addresses three main concerns that are held by the leaders of the university; expanding academic space, student housing, and parking.

Throughout the construction of this project, the university is very concerned with being an outstanding citizen and neighbor to the surrounding residential communities. Marymount University feels strongly about keeping the local community informed and responding in a timely manner to any issues that may arise affecting the community. In order to keep the lines of communication open at all times, the university has established a project web site with information regarding the project. The web site can be found at www.marymount.edu/26thstreetproject/.

Marymount University feels strongly that the project should be turned over on-time and under budget. Time is an extremely critical issue as part of this project involves the construction of a new residential facility. If for whatever reason students cannot move in for the start of the fall 2010 semester, the students who are scheduled to move in will be without housing. If this were to occur, the students would be forced to reside in local hotels until the completion of the project.

The Marymount University project is striving to achieve Construction Waste Management credits within the Materials & Resources category of LEED®. To help achieve these credits, separate recyclable material dumpsters are to be located on site. Once full, they can be replaced and hauled off at a price of around $300.00.

G. Project Delivery System

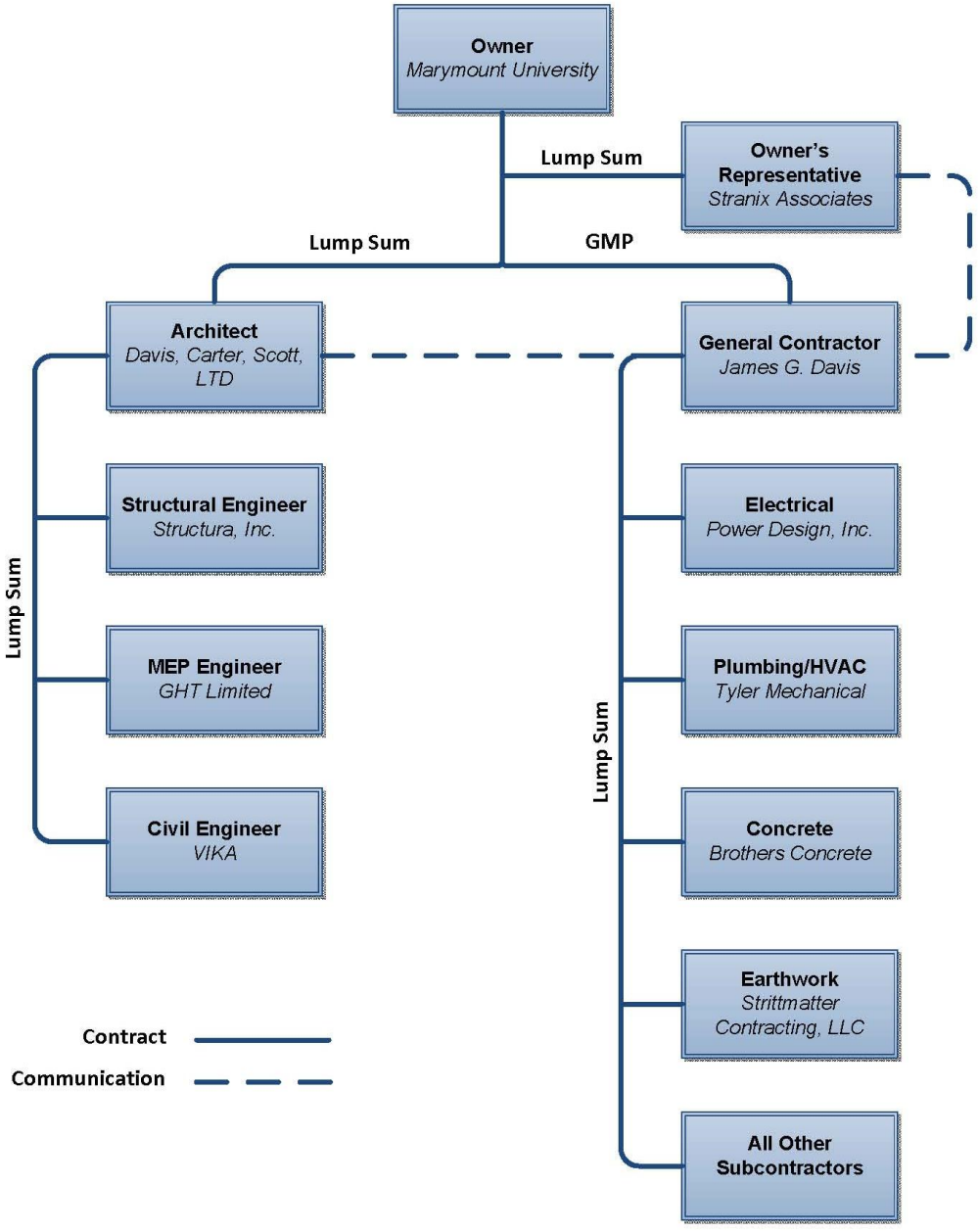


Figure 4. Marymount University 26th Street Project Team Organization Chart

To initiate the Marymount University 26th Street Project, the university entered into an AIA B151, standard form of Agreement between themselves and the architect, Davis, Carter, Scott, LTD. The architect was tasked with contracting the rest of the design consultants that will be a part of the project team. Aiding the owner throughout the duration of the design and construction, Stranix Associates, was brought on as an Owner's Representative at a fixed fee. Other key members of the project team include the constructors of the project. In this situation, James G. Davis Construction Corporation was awarded the preconstruction and construction services at a Guaranteed Maximum Price. The contractor holds an AIA 121 CMc, Standard Form between the Owner and the Construction Manager where the Construction Manager is the Constructor. As a General Contractor, Davis is responsible for the providing the General Liability Insurance, while the owner is responsible for providing the Builder's Risk Insurance.

Marymount University has not previously undertaken a project of this magnitude and with the assistance of an Owner's Representative, look to make the project a success. The inexperience of the owner and tight project schedule makes the selection of the project delivery system appropriate for this particular situation. The Owner's Representative will be able to provide independent advice to the owner on both design and construction related issues.

H. Staffing Plan

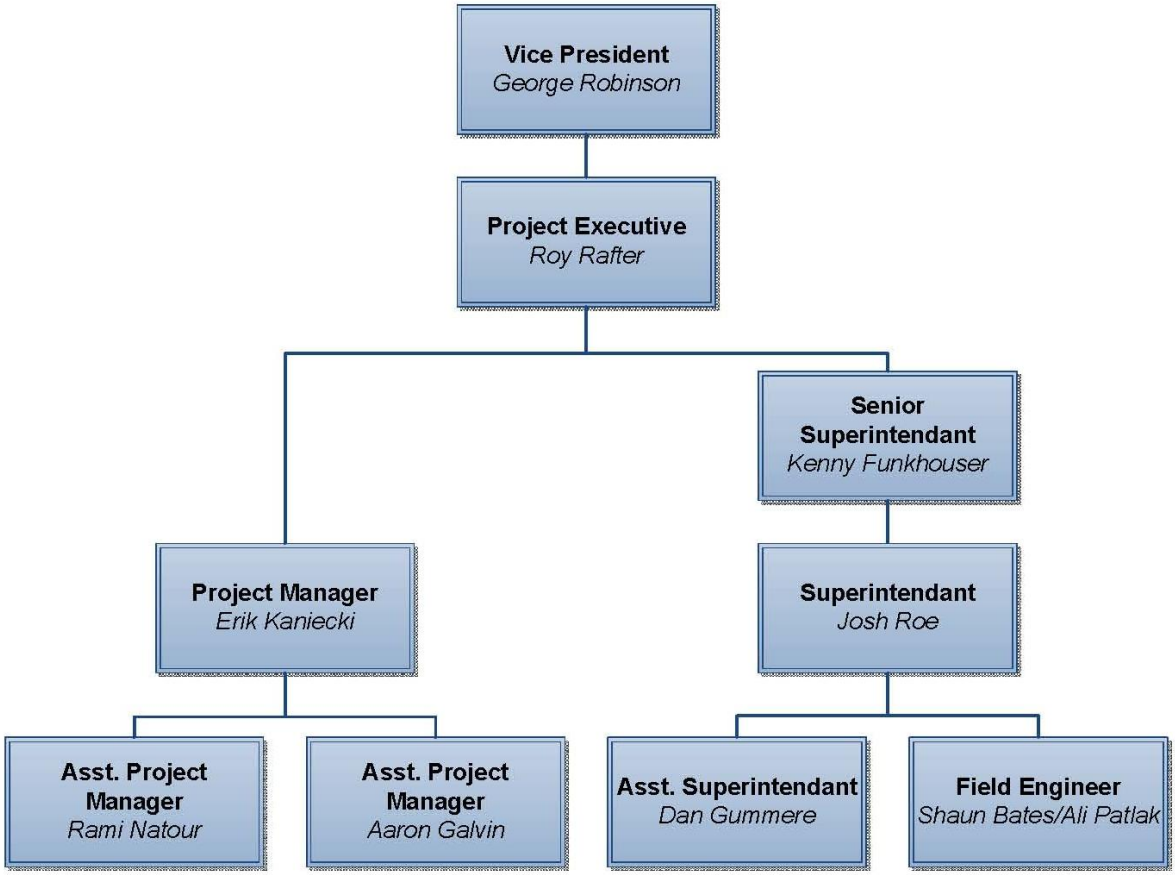


Figure 5. James G. Davis Project Team

The General Contractor, James G. Davis Construction Corporation is led by three main individuals; President and Chief Executive Officer, Jim Davis, Executive Vice President, Bill Moyer, and Executive Vice President, Dennis Cotter. Under the Corporate Leadership Team, fall individual divisional groups, all of which have a Vice President.

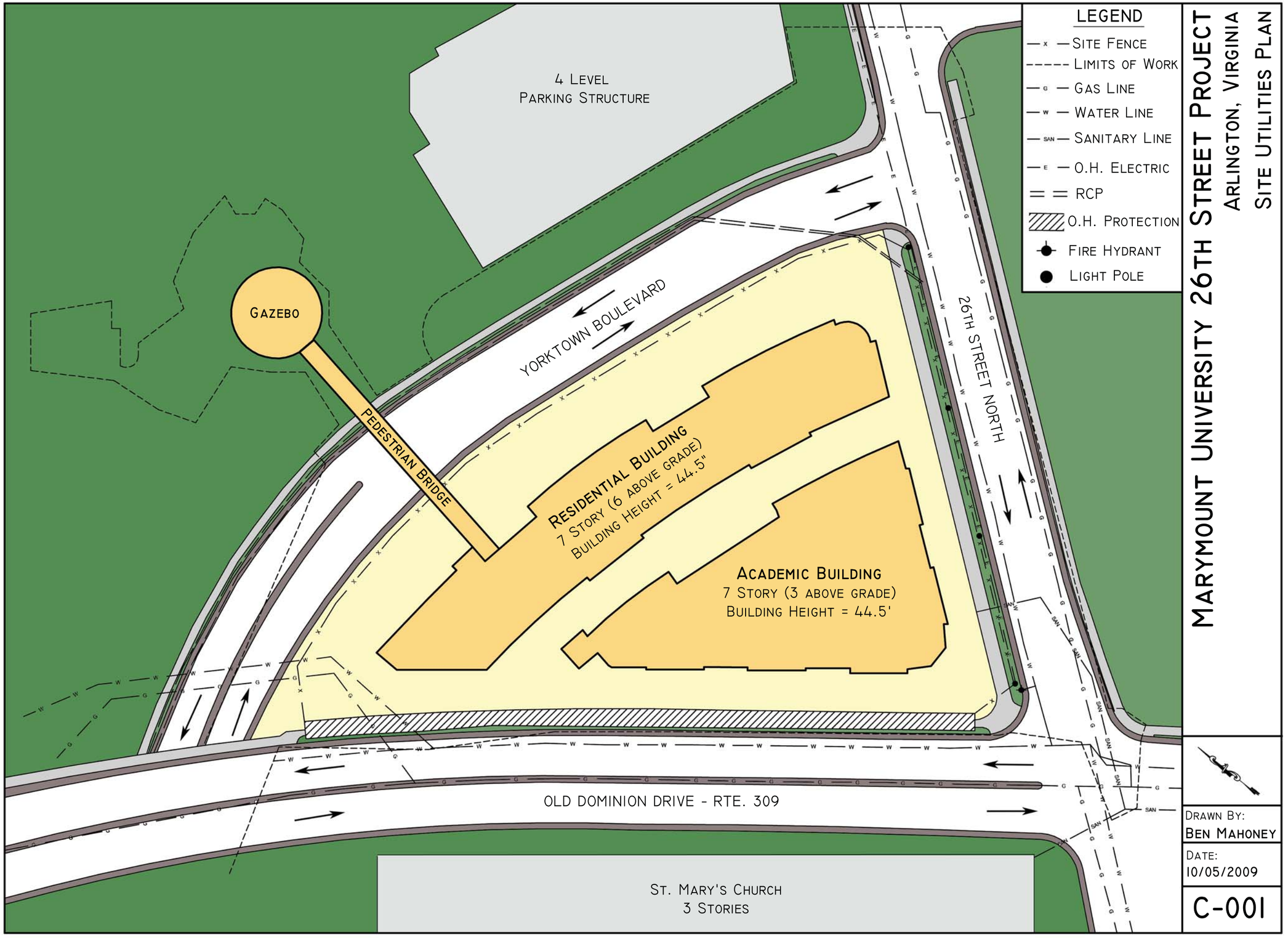
The 26th Street Project was awarded to Davis and put into the hands of their residential group, Davis Residential, led by Vice President, George Robinson. Each Vice President within the company generally has three Project Executives that answer directly to them. The Project Executives are usually responsible for 2 to 3 other projects at any given time. After George

Robinson's Residential Group was awarded the Marymount University Project, he appointed Roy Rafter as the Project Executive.

The next step involved assembling the Project Management and Field Supervision Teams. Based on past project experience and availability, Erik Kaniecki was appointed as the one and only Project Manager. Two Assistant Project Managers, Rami Natour and Aaron Galvin were appointed to aide Mr. Kaniecki with the project management responsibilities. Due to the limited availability of room on site, the Project Management team works from the James G. Davis office in Rockville, MD.

The Field Supervision Team on site consists of a full-time Senior Superintendant, Kenny Funkhouser, Superintendent, Josh Roe, and Assistant Superintendant, Dan Gummere. The team in the field also has two part-time Layout Engineers, Shaun Bates and Ali Patlak.

Appendix A: Site Utilities Plan



MARYMOUNT UNIVERSITY 26TH STREET PROJECT

ARLINGTON, VIRGINIA

SITE UTILITIES PLAN

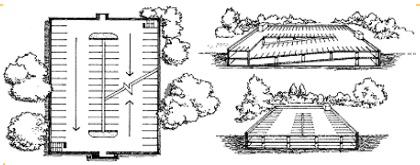
DRAWN BY:
BEN MAHONEY

DATE:
10/05/2009

C-001

Appendix B: Cost Analysis

	Square Foot Cost Estimate Report		
Estimate Name:	MMU Parking Garage		
Building Type:	Garage, Underground Parking with Reinforced Concrete / R/Conc. Frame		
Location:	ARLINGTON, VA		
Story Count:	3		
Story Height (L.F.):	11		
Floor Area (S.F.):	137000		
Labor Type:	Union		
Basement Included:	No		
Data Release:	Year 2009 Quarter 3		
Cost Per Square Foot:	$47.08		
Building Cost:	$6,449,500		



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 by RSMeans.

		% of Total	Cost Per S.F.	Cost
A Substructure		**19.20%**	**$9.05**	**$1,240,000**
A1010	**Standard Foundations**		**$4.73**	**$648,000**
	6 KSF, 12" deep x 24" wide			
	KSF, 8' -6" square x 20" deep			
	KSF, 10' - 6" square x 25" deep			
	Foundation dampproofing, asphalt with fibers, 1/8" thick, 8' high			
A1030	**Slab on Grade**		**$1.89**	**$259,000**
	Slab on grade, 5" thick, light industrial, reinforced			
A2010	**Basement Excavation**		**$2.43**	**$333,000**
	off site storage			
B Shell		**58.40%**	**$27.50**	**$3,767,000**
B1010	**Floor Construction**		**$14.59**	**$1,999,500**
	1000K load, 10'-14' story height, 740 lbs/LF, 4000PSI			
	35'x35' bay, 200 PSF superimposed load, 355 PSF total load			
	PSF superimposed load, 165 PSF total load			
B1020	**Roof Construction**		**$6.89**	**$943,500**
	load, 26" deep beam, 9" slab, 209 PSF total load			
B2010	**Exterior Walls**		**$4.64**	**$635,500**
	Concrete wall, reinforced, 8' high, 8" thick, plain finish, 4000 PSI			
B2030	**Exterior Doors**		**$0.17**	**$23,000**
	hardware, 6'-0" x 10'-0" opening			
	7'-0" opening			
B3010	**Roof Coverings**		**$1.21**	**$165,500**
	Vinyl and neoprene membrane traffic deck			
C Interiors		**1.70%**	**$0.82**	**$112,000**
C1010	**Partitions**		**$0.45**	**$61,500**
	Concrere block (CMU) partition, light weight, hollow, 8" thick, no finish			
	8" concrete block partition			
C1020	**Interior Doors**		**$0.05**	**$6,500**
	flush, 3'-0" x 7'-0" x 1-3/8"			
C2010	**Stair Construction**		**$0.27**	**$37,000**
	Stairs, CIP concrete, w/landing, 16 risers, with nosing			
C3010	**Wall Finishes**		**$0.05**	**$7,000**
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			

D Services		**19.20%**	**$9.05**	**$1,240,500**
D1010	**Elevators and Lifts**		**$1.47**	**$201,500**
	Hydraulic passenger elevator, 2500 lb., 2 floor, 125 FPM			
D2010	**Plumbing Fixtures**		**$0.04**	**$6,000**
	Water closet, vitreous china, bowl only with flush valve, floor mount			
	Lavatory w/trim, wall hung, PE on CI, 19" x 17"			
D2020	**Domestic Water Distribution**		**$0.10**	**$13,500**
	GPH			
D2040	**Rain Water Drainage**		**$0.89**	**$121,500**
	Roof drain, steel galv sch 40 threaded, 3" diam piping, 10' high			
	additional foot add			
D3050	**Terminal & Package Units**		**$0.14**	**$19,000**
	16000 CFM, 5 HP vane axial fan			
D4010	**Sprinklers**		**$3.09**	**$424,000**
	Dry pipe sprinkler systems, steel, ordinary hazard, 1 floor, 50,000 SF			
	floor, 50,000 SF			
D4020	**Standpipes**		**$0.11**	**$15,500**
	Dry standpipe risers, class III, steel, black, sch 40, 4" diam pipe, 1 floor			
	additional floors			
D5010	**Electrical Service/Distribution**		**$0.11**	**$15,500**
	phase, 4 wire, 120/208 V, 200 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 200 A			
	400 A			
D5020	**Lighting and Branch Wiring**		**$2.91**	**$399,000**
	SF			
	Miscellaneous power, to .5 watts			
	fixtures @32 watt per 1000 SF			
D5030	**Communications and Security**		**$0.13**	**$17,500**
	detectors, includes outlets, boxes, conduit and wire			
	Fire alarm command center, addressable without voice			
D5090	**Other Electrical Systems**		**$0.05**	**$7,500**
	gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 11.5 kW			
E Equipment & Furnishings		**1.40%**	**$0.66**	**$90,000**
E1030	**Vehicular Equipment**		**$0.33**	**$45,500**
	arm, 1 way			
	economy			
	rate computing			
E1090	**Other Equipment**		**$0.32**	**$44,500**
	1 - Parking control equipment, parking control software, min			
	1 - Parking equipment, ticket spitter with time/date stamp, standard			
	1 - Parking equipment, cashier booth, average			
	1 - Parking gates, barrier gate with programmable controller			
F Special Construction		**0.00%**	**$0.00**	**$0**
G Building Sitework		**0.00%**	**$0.00**	**$0**
SubTotal		**100%**	**$47.08**	**$6,449,500**
Contractor Fees (General Conditions,Overhead,Profit)		**0.00%**	**$0.00**	**$0**
Architectural Fees		**0.00%**	**$0.00**	**$0**
User Fees		**0.00%**	**$0.00**	**$0**
Total Building Cost			**$47.08**	**$6,449,500**

	Square Foot Cost Estimate Report			
Estimate Name:	**Untitled**			
Building Type:	**College, Classroom, 2-3 Story with Decorative Concrete Block / Bearing Walls**			
Location:	**ARLINGTON, VA**			
Story Count:	**3**			
Story Height (L.F.):	**11**			
Floor Area (S.F.):	**52000**			
Labor Type:	**Union**			
Basement Included:	**No**			
Data Release:	**Year 2009 Quarter 3**			
Cost Per Square Foot:	**$118.28**			
Building Cost:	**$6,150,500**			

Costs are derived from a building model with basic components.

Scope differences and market conditions can cause costs to vary significantly.

		% of Total	Cost Per S.F.	Cost
A Substructure		**2.90%**	**$3.44**	**$179,000**
A1010	**Standard Foundations**		**$0.61**	**$31,500**
	capacity 3 KSF, 8" deep x 16" wide			
	capacity 6 KSF, 12" deep x 24" wide			
A1030	**Slab on Grade**		**$1.42**	**$74,000**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**$0.07**	**$3,500**
	on site storage			
A2020	**Basement Walls**		**$1.35**	**$70,000**
	8" thick			
	12" thick			
B Shell		**20.20%**	**$23.84**	**$1,239,500**
B1010	**Floor Construction**		**$9.65**	**$502,000**
	wall, 35' span, 20" deep, 125 PSF superimposed load, 172 PSF total			
B1020	**Roof Construction**		**$2.94**	**$153,000**
	41.5" deep, 30 PSF superimposed load, 52 PSF total load			
B2010	**Exterior Walls**		**$3.76**	**$195,500**
	8x8x16, reinforced, vertical #5@32", grouted			
B2020	**Exterior Windows**		**$5.21**	**$271,000**
	intermediate horizontals			
	Glazing panel, plate glass, 1/4" thick, clear			
B2030	**Exterior Doors**		**$0.59**	**$30,500**
	hardware, 6'-0" x 10'-0" opening			
B3010	**Roof Coverings**		**$1.68**	**$87,500**
	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			

C Interiors		25.20%	$29.75	$1,547,000
C1010	Partitions		$5.61	$291,500
	finish			
	8" concrete block partition			
C1020	Interior Doors		$4.05	$210,500
	flush, 3'-0" x 7'-0" x 1-3/8"			
C1030	Fittings		$3.83	$199,000
	Chalkboards, liquid chalk type, wood frame & chalktrough			
	Cabinets, school, counter, wood, 32" high			
C2010	Stair Construction		$3.59	$186,500
	landing			
C3010	Wall Finishes		$2.96	$154,000
	2 coats paint on masonry with block filler			
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	filler			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	Floor Finishes		$4.35	$226,000
	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, maximum			
	Vinyl, composition tile, minimum			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	Ceiling Finishes		$5.38	$279,500
	channel grid, suspended support			
D Services		51.80%	$61.25	$3,185,000
D1010	Elevators and Lifts		$5.36	$278,500
	2 - Hydraulic, passenger elevator, 3500 lb, 2 floors, 100 FPM			
	Hydraulic passenger elevator, 2500 lb., 2 floor, 125 FPM			
D2010	Plumbing Fixtures		$12.56	$653,000
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, vitreous china, 19" x 17"			
	24" OD			
	Service sink w/trim, vitreous china, wall hung 22" x 20"			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	Domestic Water Distribution		$1.47	$76,500
	input, 768 GPH			
D2040	Rain Water Drainage		$0.62	$32,500
	Roof drain, DWV PVC, 4" diam, diam, 10' high			
	Roof drain, DWV PVC, 4" diam, for each additional foot add			
D3050	Terminal & Package Units		$17.06	$887,000
	95.83 ton			
D4010	Sprinklers		$1.88	$97,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 50,000 SF			
	50,000 SF			

D5010	**Electrical Service/Distribution**		**$4.13**	**$215,000**
	3 phase, 4 wire, 120/208 V, 2000 A			
	2000 A			
	2000 A			
D5020	**Lighting and Branch Wiring**		**$11.12**	**$578,000**
	SF, with transformer			
	Wall switches, 1.0 per 1000 SF			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	460 V 15 HP, 575 V 20 HP			
	15 fixtures @40 watt per 1000 SF			
D5030	**Communications and Security**		**$6.48**	**$337,000**
	and wire, sound systems, 30 outlets			
	50 detectors, includes outlets, boxes, conduit and wire			
	and wire, master clock systems, 20 rooms			
	and wire, master TV antenna systems, 30 outlets			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		**$0.58**	**$30,000**
	gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 100 kW			
E Equipment & Furnishings		**0.00%**	**$0.00**	**$0**
E1090	**Other Equipment**		**$0.00**	**$0**
F Special Construction		**0.00%**	**$0.00**	**$0**
G Building Sitework		**0.00%**	**$0.00**	**$0**

SubTotal	**100%**	**$118.28**	**$6,150,500**
Contractor Fees (General Conditions,Overhead,Profit)	**0.00%**	**$0.00**	**$0**
Architectural Fees	**0.00%**	**$0.00**	**$0**
User Fees	**0.00%**	**$0.00**	**$0**
Total Building Cost		**$118.28**	**$6,150,500**

	Square Foot Cost Estimate Report	
Estimate Name:	**MMU Residential**	
Building Type:	**Apartment, 4-7 Story with Precast Concrete Panels / R/Conc. Frame**	
Location:	**ARLINGTON, VA**	
Story Count:	**6**	
Story Height (L.F.):	**11**	
Floor Area (S.F.):	**77000**	
Labor Type:	**Union**	
Basement Included:	**No**	
Data Release:	**Year 2009 Quarter 3**	Costs are derived from a building model with basic components.
Cost Per Square Foot:	**$116.39**	Scope differences and market conditions can cause costs to vary significantly.
Building Cost:	**$8,962,000**	

		% of Total	Cost Per S.F.	Cost
A Substructure		**3.00%**	**$3.51**	**$270,500**
A1010	**Standard Foundations**		**$1.75**	**$134,500**
	capacity 6 KSF, 16" deep x 48" wide			
	6 KSF, 9' - 6" square x 30" deep			
A1030	**Slab on Grade**		**$1.05**	**$81,000**
	Slab on grade, 4" thick, light industrial, reinforced			
A2010	**Basement Excavation**		**$0.04**	**$3,000**
	on site storage			
A2020	**Basement Walls**		**$0.68**	**$52,000**
	12" thick			
B Shell		**30.10%**	**$34.99**	**$2,694,000**
B1010	**Floor Construction**		**$12.47**	**$960,000**
	height, 140 lbs/LF, 4000PSI			
	30'x35' bay, 40 PSF superimposed load, 158 PSF total load			
	30'x35' bay, 125 PSF superimposed load, 254 PSF total load			
B1020	**Roof Construction**		**$3.01**	**$232,000**
	load, 16" deep beam, 8" slab, 158 PSF total load			
B2010	**Exterior Walls**		**$14.56**	**$1,121,500**
	rise			
B2020	**Exterior Windows**		**$3.68**	**$283,000**
	Windows, aluminum, sliding, standard glass, 5' x 3'			
B2030	**Exterior Doors**		**$0.39**	**$30,000**
	x 7'-0" opening			
	door, hardware, 6'-0" x 7'-0" opening			
B3010	**Roof Coverings**		**$0.88**	**$67,500**
	felt, mopped			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Flashing, aluminum, no backing sides, .019"			
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick			

C Interiors		23.80%	$27.70	$2,133,000
C1010	**Partitions**		$6.19	$477,000
	deadening gypsum board, 2-1/2" @ 24", same opposite face, no furring			
C1020	**Interior Doors**		$5.58	$429,500
	Door, single leaf, wood frame, 3'-0" x 7'-0" x 1-3/8", birch, solid core core			
C1030	**Fittings**		$3.01	$231,500
	Cabinets, residential, wall, two doors x 48" wide			
C2010	**Stair Construction**		$3.19	$245,500
	landing			
C3010	**Wall Finishes**		$2.15	$165,500
	work, primer & 2 coats			
	Vinyl wall covering, fabric back, medium weight			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		$4.64	$357,000
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 24 oz			
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 35 oz			
	Carpet, padding, add to above, minimum			
	Carpet, padding, add to above, maximum			
	Vinyl, composition tile, minimum			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		$2.95	$227,000
	textured finish, 7/8"resilient channel furring, 24" OC support			
D Services		42.10%	$48.99	$3,772,500
D1010	**Elevators and Lifts**		$10.68	$822,500
	2 - Traction geared elevators, passenger, 3500 lb, 5 floors, 200 FPM group, 200 FPM			
D2010	**Plumbing Fixtures**		$9.73	$749,500
	Kitchen sink w/trim, countertop, PE on CI, 24" x 21", single bowl compt			
	Service sink w/trim, PE on CI, corner floor, 28" x 28", w/rim guard			
	Bathroom, lavatory & water closet, 2 wall plumbing, stand alone bathtub, stand alone			
D2020	**Domestic Water Distribution**		$3.10	$238,500
	Gas fired water heater, residential, 100< F rise, 30 gal tank, 32 GPH			
D2040	**Rain Water Drainage**		$0.14	$10,500
	Roof drain, DWV PVC, 4" diam, diam, 10' high			
	Roof drain, DWV PVC, 4" diam, for each additional foot add			
D3010	**Energy Supply**		$6.45	$496,500
	water, 30,000 SF area,300,000 CF vol			
D3030	**Cooling Generating Systems**		$7.47	$575,500
	40,000 SF, 93.33 ton			
D4010	**Sprinklers**		$2.06	$159,000
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF 10,000 SF			

D4020	**Standpipes**		**$0.31**	**$24,000**
	floor			
	additional floors			
D5010	**Electrical Service/Distribution**		**$1.79**	**$138,000**
	3 phase, 4 wire, 120/208 V, 1600 A			
	1600 A			
	1600 A			
D5020	**Lighting and Branch Wiring**		**$6.27**	**$482,500**
	per SF			
	Wall switches, 2.5 per 1000 SF			
	Miscellaneous power, 2 watts			
	Central air conditioning power, 3 watts			
	Motor installation, three phase, 200 V, 15 HP motor size			
	fixtures per 1000 SF			
D5030	**Communications and Security**		**$0.83**	**$64,000**
	25 detectors, includes outlets, boxes, conduit and wire			
	Internet wiring, 2 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		**$0.16**	**$12,000**
	gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 11.5 kW			
E Equipment & Furnishings		**1.00%**	**$1.19**	**$92,000**
E1090	**Other Equipment**		**$1.19**	**$92,000**
	12 - Laundry equipment, washer, residential, 4 cycle, average			
	average			
	minimum			
F Special Construction		**0.00%**	**$0.00**	**$0**
G Building Sitework		**0.00%**	**$0.00**	**$0**
SubTotal		**100%**	**$116.39**	**$8,962,000**
Contractor Fees (General Conditions,Overhead,Profit)		**0.00%**	**$0.00**	**$0**
Architectural Fees		**0.00%**	**$0.00**	**$0**
User Fees		**0.00%**	**$0.00**	**$0**
Total Building Cost			**$116.39**	**$8,962,000**

Parking Garage: D4 Cost Estimate				
Code	Division Name	%	Sq. Cost	Projected
00	Bidding Requirements	5.91	2.91	397,991
	General Conditions	5.91	2.91	397991.25
03	Concrete	75.84	37.26	5,104,974
	Cast-In-Place	13.56	6.66	912606.14
	Grout	13.84	6.80	931597.16
	Precast	48.44	23.80	3260770.57
04	Masonry	0.32	0.16	21,752
	Masonry	0.32	0.16	21752.39
05	Metals	2.35	1.15	158,150
	Fabrications	2.35	1.15	158150.45
06	Wood & Plastics	0.09	0.04	6,136
	Wood & Plastics	0.09	0.04	6136.36
07	Thermal & Moisture Protection	2.83	1.39	190,619
	Thermal & Moisture Protection	2.83	1.39	190618.98
08	Doors & Windows	1.05	0.52	70,696
	Entrances & Storefronts	0.82	0.40	55227.27
	Special Doors	0.23	0.11	15468.75
09	Finishes	0.30	0.15	20,455
	Painting	0.30	0.15	20454.55
10	Specialties	0.44	0.22	29,694
	Identifying Devices	0.44	0.22	29693.86
11	Equipment	0.26	0.13	17,351
	Parking Control	0.26	0.13	17350.57
14	Conveying Systems	1.68	0.82	112,924
	Elevators	1.68	0.82	112924.43
15	Mechanical	3.64	1.79	245,246
	Mechanical	3.64	1.79	245245.91
16	Electrical	5.28	2.59	355,316
	Electrical	5.28	2.59	355315.91
	Total Building Costs	100.00	49.13	6,731,305

Academic Facility: D4 Cost Estimate				
Code	Division Name	%	Sq. Cost	Projected
01	General Requirements	0.31	0.64	33373.00
	Furnished Material	0.22	0.45	23467.59
	Thomas Hall Asbestos Abatement	0.09	0.19	9905.82
03	Concrete	10.88	22.56	1173295.00
	New Science Facility Concrete	10.88	22.56	1173295.27
04	Masonry	8.22	17.05	886588.00
	Masonry & Limestone	8.22	17.05	886588.48
05	Metals	10.59	21.97	1,142,376
	Misc Steel	2.83	5.86	304691.04
	New Science Facility Steel	7.77	16.11	837684.81
06	Wood & Plastics	1.88	3.89	202,187
	Woods & Plastics	1.88	3.89	202187.07
07	Thermal & Moisture Protection	5.40	11.21	582,796
	Roofing	3.53	7.32	380608.81
	Thermal & Moisture Protection	1.88	3.89	202187.07
08	Doors & Windows	4.32	8.97	466,333
	Doors & Windows	1.88	3.89	202187.07
	Glass & Glazing	2.45	5.08	264146.27
09	Finishes	12.48	25.88	1,345,567
	Carpet & VCT	0.90	1.87	97374.82
	Ceramic Tile & Terrazzo	1.17	2.43	126408.10
	Finishes	1.88	3.89	202186.50
	Metal Studs/Insulation/Drywall/Fireproofing	7.62	15.80	821731.25
	Painting	0.78	1.62	84283.01
	Resinous Flooring	0.13	0.26	13583.65
10	Specialties	0.04	0.09	4,477
	Interior Signage	0.04	0.09	4476.63
12	Furnishings	6.72	13.93	724,572
	Lab Casework	6.72	13.93	724571.83
13	Special Construction	0.83	1.72	89,474
	Greenhouse	0.83	1.72	89473.77
14	Conveying Systems	0.29	0.60	31,024
	Elevator	0.29	0.60	31024.23
15	Mechanical	28.25	58.57	3,045,605
	Fire Protection	1.16	2.40	124657.88
	HVAC Sheet Metal	6.19	12.83	667238.42
	Mechanical & Plumbing	16.69	34.60	1799379.59
	Phoenix Equipment	0.97	2.02	104945.86
	Temperature Controls	3.24	6.72	349383.00
16	Electrical	9.78	20.29	1,054,902
	Added Lab Lighting	0.19	0.40	20571.86
	Electrical	8.24	17.08	888315.67
	Technology	1.35	2.81	146014.14
	Total Building Costs	100.00	207.36	10,782,570

Residential Facility: D4 Cost Estimate				
Code	Division Name	%	Sq. Cost	Projected
00	Bidding Requirements	0.45	0.49	37,420
	Bidding Requirements	0.45	0.49	37420.05
01	General Requirements	7.28	7.86	605,532
	General Requirements	7.28	7.86	605531.90
03	Concrete	6.12	6.62	509,557
	Concrete	6.12	6.62	509556.76
04	Masonry	1.08	1.17	89,957
	Masonry	1.08	1.17	89957.44
05	Metals	8.71	9.42	725,129
	Metals	8.71	9.42	725129.47
06	Wood & Plastics	1.83	1.98	152,277
	Wood & Plastics	1.83	1.98	152276.76
07	Thermal & Moisture Protection	7.78	8.41	647,646
	Thermal & Moisture Protection	7.78	8.41	647646.03
08	Doors & Windows	6.22	6.73	518,035
	Doors & Windows	6.22	6.73	518034.56
09	Finishes	24.16	26.11	2,010,374
	Finishes	24.16	26.11	2010374.48
10	Specialties	1.22	1.32	101,644
	Specialties	1.22	1.32	101643.90
13	Special Construction	3.01	3.25	250,552
	Special Construction	3.01	3.25	250552.15
14	Conveying Systems	1.29	1.39	107,100
	Elevators	1.29	1.39	107100.18
15	Mechanical	22.36	24.16	1,860,603
	Mechanical	22.36	24.16	1860602.66
16	Electrical	8.49	9.18	706,784
	Electrical	8.49	9.18	706783.97
	Total Building Costs	100.00	108.09	8,322,610