Office Building

Washington, D.C

Katey Andaloro

Construction Management

Dr. John Messner

Technical Assignment #1

September 29, 2009

Office Building

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Project Information:

Building Name: Office Building
Location: Washington, DC
Occupancy types: B1 - Business; Commercial Office Building
Size: 529,000 SF, 10 stories
Dates of Construction: August 2006 - April 2009
Base Building Cost: $99,000,000
Project Delivery Method:
Design-Bid-Build

Project Team:

Construction Manager:
Balfour Beatty Construction

Architecture:

- State-of-the-art technology
- Three paver terraces
- Three levels of parking
- Well-located core services
- Flexibility to meet the needs of small, medium, and large space users
- LEED Silver certified
- Direct access to MACR Train Service, Virginia Railway Express trains, Amtrak, Metrobus and Washington's Metrorail.
- Offer tenants high visibility, access to natural light and air, and spectacular views of Washington, DC.

Structural:

- 4'-6" Reinforced Mat slab with a "false slab" underneath to aid in water proofing
- 12" Post-tensioned Concrete Floors
- Building Envelope features a glass curtain wall system with granite stone panels on three elevations.
- Thermoplastic single-ply roofing membranes (TPO)
- 9" thick two-way reinforced concrete slabs on the underground and ground levels

Electrical:

- 4000A at 480/277V 3 phase
- (3) 4 Wire Switchboards
- Transformers provide step down voltage from 480/277 to 120/208 volt power for panels on every level of the each riser
- 750Kw, 208/120V back-up generator will provide power to all emergency systems
- Fluorescent lighting throughout the building

Mechanical:

- (4) Chillers with a capacity of 500 tons, located on the P3 Level
- (4) Cooling Towers located on the Roof
- (30) Air-Handling Units service the building with CFM values ranging from 4000 to 23400
- VAV fan powered terminal units with electric heat serve multiple ducts

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Executive Summary

This new office building is the third and final structure of a three phase project that will help with the continued revitalization of the local area. The 10-story building provides efficient and productive work spaces, state-of-the-art technology, one main lobby, two secondary lobbies, three paver terraces (located on the second, third, and fourth levels), and includes three levels of parking. With well-located core services, the office building has the flexibility to meet the needs of small, medium, and large space users. This LEED Silver certified building offers tenants direct access to MACR Train Service, Virginia Railway Express trains, and Amtrak, as well as Metrobus systems and Washington's Metrorail. Existing low-scale surroundings also offer tenants high visibility, access to natural light and air, and spectacular views of Washington, DC.

Balfour Beatty Construction (BBC), being one of the most experienced firms in the country, was hired by the owner to complete the project within the budget and on schedule. The delivery method used in this project was Design-Bid-Build where the contracts with the subcontractors were lump sum. Balfour Beatty Construction is working under a Guaranteed Maximum Price (GMP) type of contract that was presented to the owner. They are the ones who hold all of the contracts with the subcontractors. Therefore, Balfour Beatty Construction is in charge of managing the entire project from start to finish.

This document is intended to familiarize the audience with the project and analyze the current status of the project. This technical assignment analyzes the Office Building on eight levels. This analysis covers the project schedule, building systems, project cost in D4Cost 2002 and R.S. Means, the project's site plan, local conditions, client information, project delivery systems, and current staffing plan.

View of the Office Building from M Street Ramp

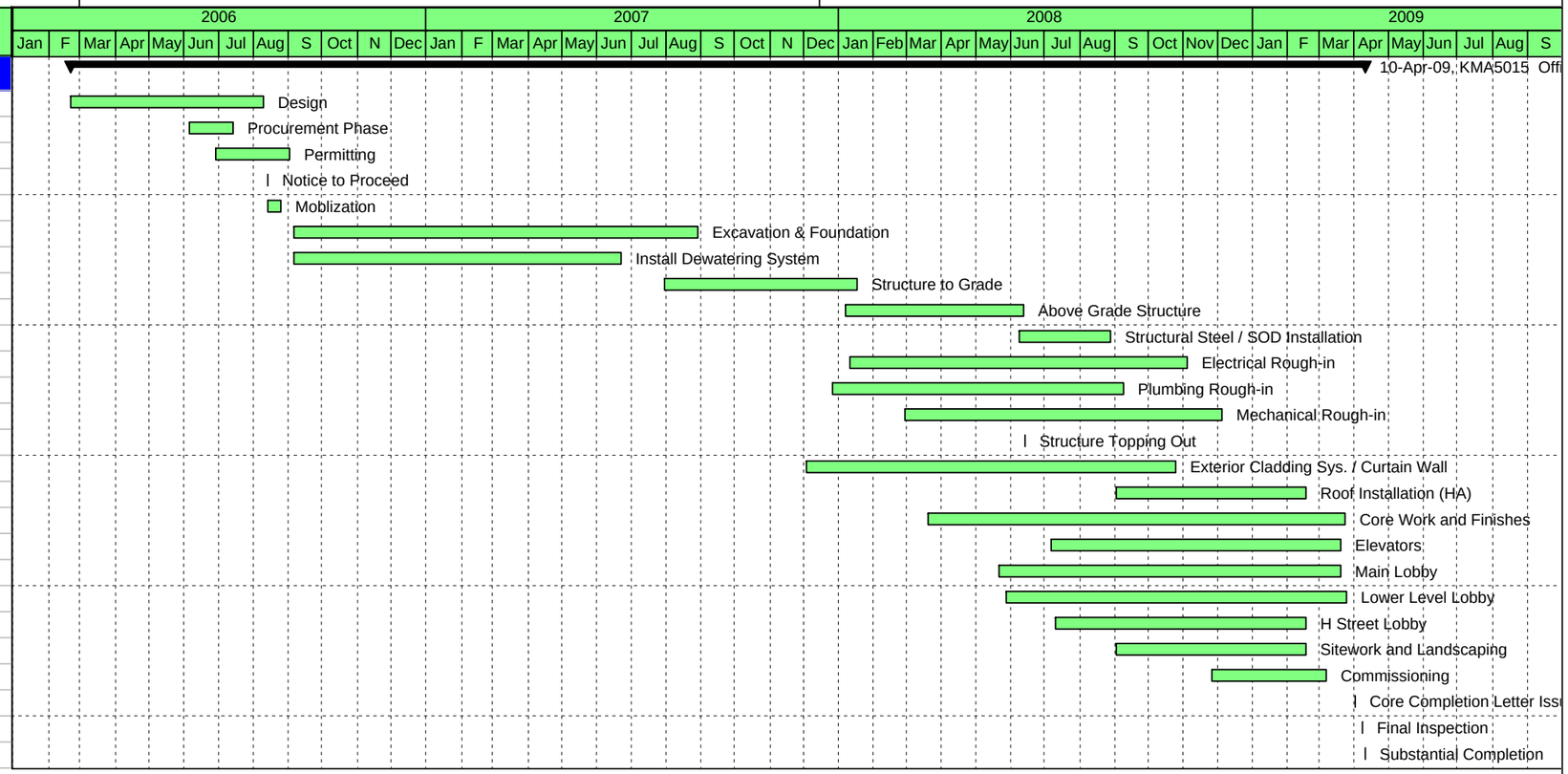
Project Schedule Summary

Notice to proceed for the project was given by the owner to the general contractor on Monday, August 14, 2006. After receipt of the notice to proceed, the general contractor began its mobilization of the site, and excavation and dewatering activities began in early September of 2006. The project required the excavating crew to remove soil at an approximate depth of forty-five feet below existing grade to reach the bottom of the project's foundation. Given limited site space and depth of the excavation to the mat foundation, a sheeting and shoring system with tie backs was used. As a result of the water table being approximately 25 feet above the bottom of the scheduled excavation and the soil content of the site having heavy clay content, installing the dewatering system prior to the beginning of excavation was critical to maintain the project's schedule. In August, 2008, work on the cast in place mat foundation system began. The forming and pour sequence for the mat foundation was broken into ten pours, proceeding from the south end of the site to north end of the site.

Once the foundation was complete, the concrete crews worked their way vertically towards the top of the building. The concrete operation reached original Ground Floor in January of 2008. Once above the Ground Floor, the concrete's reinforcement switched from mild steel reinforcement (rebar) to post tension cables. One of the most important factors in completing the post tension concrete floors was the time needed to cure the concrete to a proper strength, so that the cables could be stressed. Because of this factor, concrete pours were often schedule around when its adjacent pour could be stressed. The structural engineer's project specifications required that shoring and occupying four levels below to the floor being poured to ensure that the weight of the freshly poured concrete floors could be supported until the concrete of the floor obtained the specified strength. The completion of the above grade structured occurred in June of 2008.

Interior finishes in the bathrooms, main lobby, lower level lobby, and M Street lobby are to begin in March of 2008. The remaining tenant build out of the project will commence outside of BBC's contact with the owner.

Activity ID	Activity Name	Original Duration	Start	Finish
KMA5015	**Office Building**	811	21-Feb-06	10-Apr-09
A201	Design	121	21-Feb-06	10-Aug-06
A202	Procurement Phase	28	05-Jun-06	13-Jul-06
A203	Permitting	47	28-Jun-06	01-Sep-06
A204	Notice to Proceed	0	14-Aug-06	14-Aug-06
A205	Moblization	10	14-Aug-06	25-Aug-06
A206	Excavation & Foundation	252	06-Sep-06*	29-Aug-07
A207	Install Dewatering System	204	06-Sep-06	22-Jun-07
A208	Structure to Grade	122	31-Jul-07	16-Jan-08
A209	Above Grade Structure	114	07-Jan-08	12-Jun-08
A210	Structural Steel / SOD Installation	59	09-Jun-08	28-Aug-08
A211	Electrical Rough-in	213	11-Jan-08	04-Nov-08
A212	Plumbing Rough-in	184	26-Dec-07	08-Sep-08
A213	Mechanical Rough-in	201	28-Feb-08	04-Dec-08
A214	Structure Topping Out	0	13-Jun-08	13-Jun-08
A215	Exterior Cladding Sys. / Curtain Wall	235	03-Dec-07	24-Oct-08
A216	Roof Installation (HA)	121	02-Sep-08	17-Feb-09
A217	Core Work and Finishes	263	20-Mar-08*	23-Mar-09
A218	Elevators	185	07-Jul-08*	20-Mar-09
A219	Main Lobby	217	22-May-08	20-Mar-09
A220	Lower Level Lobby	215	28-May-08	24-Mar-09
A221	H Street Lobby	159	10-Jul-08	17-Feb-09
A222	Sitework and Landscaping	120	02-Sep-08	16-Feb-09
A223	Commissioning	73	26-Nov-08	06-Mar-09
A224	Core Completion Letter Issued	0	02-Apr-09	02-Apr-09
A225	Final Inspection	1	08-Apr-09	08-Apr-09
A226	Substantial Completion	0	10-Apr-09	10-Apr-09



Actual Work | Remaining Work | Critical Remaining Work | Summary | Milestone

TASK filter: All Activities

Building Systems Summary

YES	NO	WORK SCOPE
	x	Demolition Required
x		Structural Steel Frame
x		Cast in Place Concrete
	x	Precast Concrete
x		Mechanical System
x		Electrical System
	x	Masonry
x		Curtain Wall
x		Support of Excavation

Structural Steel Frame

The structural steel for this building is located on the West side and is positioned directly above the M Street Ramp. This portion of the building was designed to fit the ramp's form, thus clear spanning was used to allowing for two way traffic underneath of the steel structure. The structure steel will utilize the ramp's current foundation and structural system to support its loads on one side. The ramp was pre-engineered to compensate for the steel's load during the construction of the first building. In order for the steel structure to connect to the ramp, seven (7) wide flange beams encased in concrete (W14X257) must brace diagonally four (4) wide flange columns encased in concrete (W 14X120) thus transferring the loads down to the ramp's foundation. See Figure 1 below for reference.

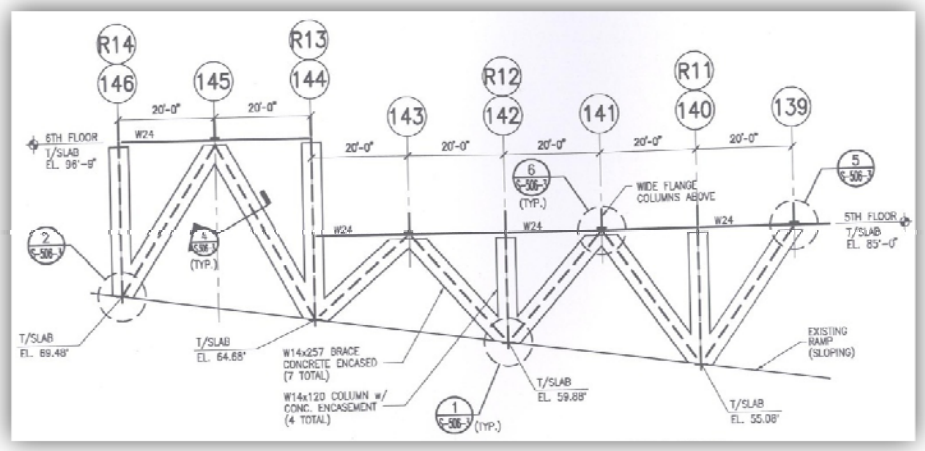


Figure 1: Wide Flange Beams and Columns

The composite decking for the 5th and 6th Floor in the steel structure utilizes two different methods of floor systems. Flooring north of line 144 use 5" lightweight concrete fill reinforced with #6 @ 6" E.W. at mid-depth over 1-1/2" composite metal deck (gal., 19 GA. Min) and flooring south of the 144 uses 3-1/4" lightweight concrete fill over 1-1/2" composite metal deck (gal. 20 GA. min.) reinforced with W.W.F. 6x6 – W2.1xW2.1. These two methods are used to provide adequate blast resistance in case of terrorist threats from the road, such as car booms. All other floors in the steel structure utilize the 3-1/4" lightweight concrete method.

Both cranes used on the job site were Peiner SK-415 Tower Cranes. The South crane has a jib height of 224'-5", weighs about 20 ton, and has a maximum hook radius of 180'-5". The North Crane has a jib height of 203'-5", weighs about 20 ton, and has a maximum hook radius of 213'-5". The locations of both tower cranes are shown on the site plan on page 14.

Cast in Place Concrete

The mat slab foundation, the four underground levels, and the post tensioned floor decks are made of cast in place concrete. The mat slab is 4'-6" thick at 5000psi normal weight reinforced concrete and has a minimum 4" thick mud slab at 4000psi normal weight concrete underneath it to aid in stopping water penetration. Directly on top of the mat slab is an 8" layer of granular fill with a 6" minimum topping slab as the floor's finish. The underground level and ground level floors are of 9" thick two-way reinforced concrete slab with 3-1/2" thick drop panels at 500psi normal weighted concrete. The post tension floor above grade is 12" thick at 5000 psi normal weight concrete and once the strength reaches 3000psi tensioning of the cables can occur. Most of the concrete was placed with crane and bucket or by direct chute. The Plywood was used to form the post tension slabs, columns, and walls.

Mechanical System

The majority of the mechanical equipment is located on the P3 Level in the Chiller Plant and on the Roof. The Chiller Plant contains four (4) chillers with a nominal capacity of 500 tons, five (5) condenser water pumps, five (5) primary chilled water pumps, two (2) secondary chilled water pumps, and one (1) heat exchanger. The Roof has four (4) cooling towers with a nominal capacity of 650 tons, one (1) condenser water pump, two (2) primary chilled water pumps, one (1) secondary chilled water pump, and one (1) heat exchanger. On both sides of the building core from the Lower Level to 10th Floor are three (3) water cooled air conditioning units (AHU) per a floor ranging from 4000 CFM to 23400 CFM supply, thus totaling thirty (30) AHU in the building.

The mechanical system for this building is split into two systems, the primary and the secondary. The primary system's cooled condenser water is pumped through the chillers and used to cool the water in the chilled water system. The used hot condenser water is sent back to the cooling towers to remove heat, and then the process is repeated. The secondary condenser water system provides water to the AHU throughout the building and then returns the hot water to the cooling towers to remove the heat, and then the process is once again repeated. From then on the AHUs cool the outside air, brought in through outdoor air riser supply vents, and distribute it to the VAVs found throughout each floor in the building.

The building's sprinkler system was designed and installed in accordance with NFPA 13. The office building, Ground Floor to the 10th Floor, is fully sprinkled with an automatic wet pipe system pressurized at 175 psig. Class 1 standpipes are also present in the stairwells of the office building. The below grade parking garage, P3 Level to the Lower Level, is fully sprinkled as well with a pre-action system that is pressurized at the same psig as the wet pipe system. A pre-action sprinkler system employs the basic concept of a dry pipe system, in that the water is not normally contained within the pipes, thus the water is held from the piping by an electronic operated valve. Furthermore, all of the main structural, as well as all interior framing members have various layers of spray-on fireproofing.

Electrical System

The building's electricity runs through three switchboards, each of 4000 A, 265/460 volts, 3 phase, and 4 wire systems. Power is fed from the PEPCO transformer vaults, located underground outside the building's foundation wall, into the switchgear room on the Lower Level. Transformers, located on every level of each riser, provide step down voltages from 480/277 volts to 120/208 volts power, thus making it suitable for normal use of computers, vacuum cleaners, and corridor lighting. Most lighting fixtures in the building are fluorescent because it adds efficiency to the design and helps to attain the appropriate LEED points.

The backup generator is sized at 750 kw and 208/120 volts, this would provide power to all emergency lighting, fire alarms, stair pressure fans, smoke removal fans, fire pump, emergency for elevators, and selected circuits for security if the power should ever fail.

Curtain Wall

The office building's envelope features a glass curtain wall system with granite stone panels on three elevations. The East elevation displays a different curtain wall pattern than the West elevation; however the two designs converge on the North elevation of the building. Furthermore the South wall is shared with the adjacent second building of the three phase project, thus no exterior envelope is present. The one-story high glass and granite panels are put into place by crane, starting at one end of the building and making its way across to the other side. In the field, the curtain wall units connect into their specified places by using male and female extrusions that snap together to form a continuous envelope. The remainder of the building envelope consists of handset stone between the curtain wall units and exterior columns of the building. The design responsibility is held in part by the architect and curtain wall consultant, but the curtain wall subcontractor is required to submit calculations and the connection details required to properly attach the units to the structure.

Support of Excavation

Since there are four levels of the building underground, support was needed for a deep excavation. Sheeting and shoring along with tiebacks were used for the support system. This support system avoids having a congested site. The absence of interior obstructions makes the excavation process much easier. This support system is mainly used in projects where space is limited and congestion needs to be avoided.

Ground water levels were found to be at about 13 to 35 feet below the existing surface grades. Thus during excavation a temporary dewatering system was installed and will not be removed until the building structure is complete.

Project Cost Evaluation

Cost Summary

BUILDING CONSTRUCTION	
Building Cost	$77,000,000
Cost Per Square Foot	$133.57

TOTAL PROJECT	
Project Cost	$99,000,000
Cost Per Square Foot	$103.89

BUILDING SYSTEM OVERAL AND SQUARE FOOT COSTS			
3300	Cast in Place Concrete	$34.40	$25,496,500
5100	Structural Steel	$2.03	$1,507,742
8910	Curtain Wall	$16.12	$11,949,250
9250	Drywall	$3.00	$2,220,900
14200	Elevators	$6.70	$4,963,000
15000	Mechanical	$17.95	$13,301,000
15300	Fire Protection	$1.70	$1,261,500
16000	Electrical	$8.89	$6,585,800

D4Cost 2002 Estimate

Please reference Appendix B for original D4Cost Data.

D4 Cost 2002 Estimate				
Code	**Division Name**	**%**	**Sq. Cost**	**Projected**
00	Bidding Requirements	4.67	$6.18	$4,581,205.00
01	General Requirements	4.47	$5.91	$4,379,911.00
02	Site Work	4.73	$6.26	$4,637,096.00
03	Concrete	13.04	$17.25	$12,782,384.00
04	Masonry	2.56	$3.38	$2,506,310.00
05	Metals	6.68	$8.83	$6,544,552.00
06	Wood, Plastics, and Composites	0.49	$0.65	$481,758.00
07	Thermal and Moisture Protection	2.48	$3.28	$2,430,767.00
08	Openings	4.69	$6.20	$4,596,309.00
09	Finishes	5.92	$7.82	$5,799,472.00
10	Specialties	1.05	$1.39	$1,028,425.00
11	Equipment	0.21	$0.28	$210,652.00
12	Furnishings	1.06	$1.40	$1,036,175.00
13	Special Construction	0.19	$0.25	$182,922.00
14	Conveying Systems	1.66	$2.19	$1,626,478.00
15	Mechanical	10.83	$14.33	$10,617,964.00
16	Electrical	11.61	$15.35	$11,374,770.00
21	Fire Suppression	1.82	$2.41	$1,783,436.00
22	Plumbing	1.6	$2.12	$1,570,989.00
23	HVAC	5.99	$7.92	$5,872,991.00
26	Electrical	5.71	$7.55	$5,598,030.00
27	Communications	2.62	$3.47	$2,568,774.00
31	Earthwork	2.47	$3.27	$2,423,567.00
32	Exterior Improvements	2.43	$3.21	$2,378,540.00
33	Utilities	1.01	$1.34	$989,899.00
Total Building Costs		**100**	**$132.22**	**$98,003,372**

R.S. Means 2008 Estimate

Please reference Appendix A for R.S. Means sources for square foot costs.

Office Building Space

10 Floors, 554,812 SF, 1,172 LF Perimeter, 12'-0" Floor Height Avg.

Exterior Wall	S.F. Area	250,000	554,812	300,000
	L.F. Perimeter	640	1,006	700
Precast Concrete Panel	R/Conc. Frame	$125.60	$117.07	$124.20
	Perimeter Adjustment	$2.15	-$0.29	$1.75
	Story Height Adjustment	$1.10	$0.49	$1.00

Square Footage Estimate	$117.07
Perimeter Adjustment	-$0.48
Story Height Adjustment	$0.49
Adjusted Square Foot Cost	$117.08

Underground Parking Garage Space

4 Floors, 186,388 SF, 1,172 LF Perimeter, 12'-0" Floor Height Avg.

Exterior Wall	S.F. Area	150,000	186,388	175,000
	L.F. Perimeter	1,100	1,224	1,185
Precast Concrete Panel	R/Conc. Frame	$62.35	$61.40	$61.70
	Perimeter Adjustment	$0.75	$0.46	$0.55
	Story Height Adjustment	$0.70	$0.63	$0.65

Square Footage Estimate	$61.40
Perimeter Adjustment	-$0.24
Story Height Adjustment	$0.63
Adjusted Square Foot Cost	$61.79

	SQUARE FOOTAGE	COST/SF	TOTAL COST
Office Building Space	554,812	$117.08	$64,957,400
Underground Parking Garage Space	186,388	$61.79	$11,517,000
		Elevators	$2,854,300
			$79,328,700
		R.S. Means Location Factor (Washington, DC)	0.98
		Total Estimate	**$77,742,126**

The D4Cost estimate and R.S. Means estimate proved to be roughly accurate. The D4Cost estimate wavered from the actual project cost by only -$1,000,000 and the R.S. Means wavered from the actual building cost by +$740,000. But neither of these estimates were accurate when it came to the building's square foot cost, both were drastically less than the actual.

However, comparing D4's individual system costs with project's actual individual systems cost shows that, though D4 can be use to estimate the total cost, it is not accurate in estimating the individual system costs. Therefore, D4 should only be used to get approximate estimate of the overall building cost and not for the individual systems cost. Overall the D4Cost estimate was still pretty accurate and shows how potentially useful the software package can be.

R.S. Means on the other hand should only be used to estimate the building cost. This method does not account for greater building areas then listed, LEED designs, or various other features of the building. R.S. Means also does not account for post tensioned concrete, which can increase the cost, as well as a very expensive curtain wall system.

Site Plan of Existing Conditions

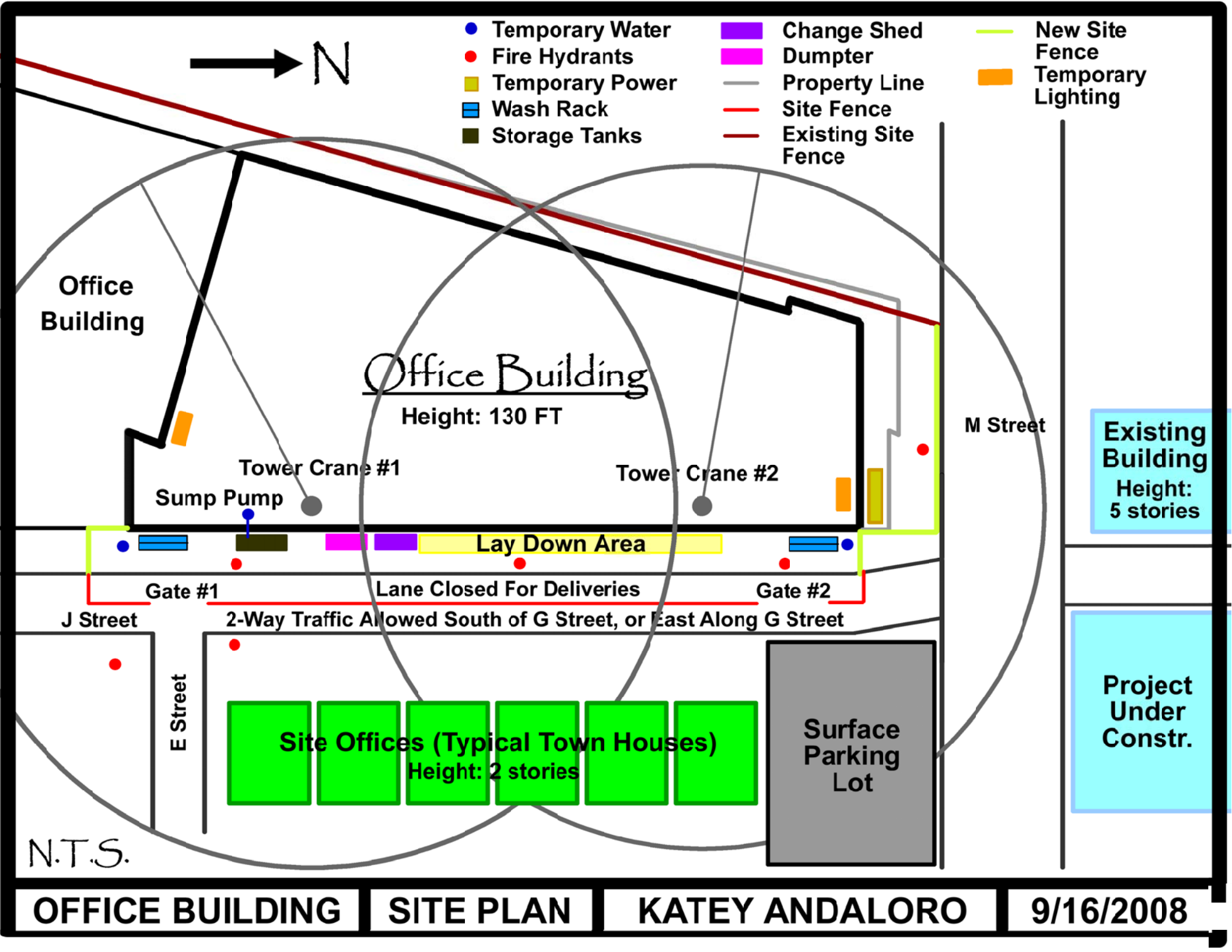
The Office Building is a 5.5 acre site located in Washington, DC and the third of three phases.

First Site Plan

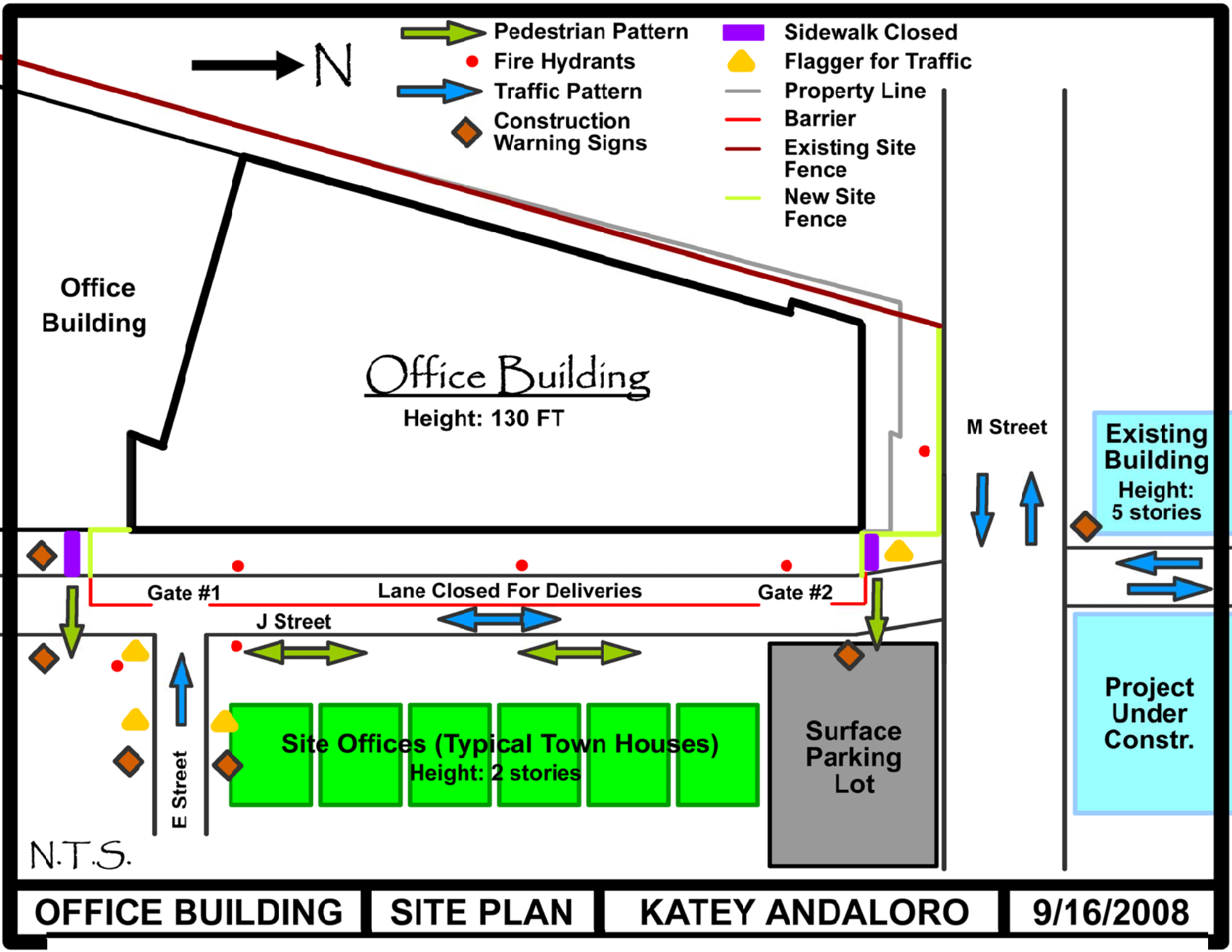
Due to the site's location, storage is limited to the east location of the site. To help limit site congestion the south bound lane on J Street will be closed for the duration of the project. This will allow for more flexibility in organizing the lay down area. Furthermore, as build construction progresses and with the completion of the parking levels, equipment and materials will be stored inside of the building until needed. Parking for this project is scarce, thus parking for the project team is located directly behind the townhouses and parking for the laborers is represented as Surface Parking as shown on the Site Plan. In the beginning of construction, the site offices are located in the town houses directly across J Street. After the topping out celebration in June of 2008, the site offices will move inside the building and relocate to the P1 and Lower Levels. This site plan also shows neighboring buildings, temporary utilities, and construction boundaries.

Second Site Plan

This plan shows pedestrian and traffic flow around the construction site, as well as the location of people flagging traffic and construction warning signs.



OFFICE BUILDING	SITE PLAN	KATEY ANDALORO	9/16/2008



OFFICE BUILDING	SITE PLAN	KATEY ANDALORO	9/16/2008

Local Conditions

There is no mandatory method of construction used in Washington, DC, however in 1899 Congress passed a law that limited the height of all buildings constructed in this region. Thus the most common forms of construction are pre-cast, cast-in-place, and post tension, these methods use concrete to obtain more floors out of a building with a restricted height. Cast-in-place and post tension were the methods employed to build The Office Building, as well as structural steel for the portion of the building that canopies over the M Street ramp.

Due to a constricted site and its location there is limited parking on or near the site. The Office Building has direct access to MACR Train Service, Virginia Railway Express trains, and Amtrak, as well as Metrobus systems and Washington's Metrorail. Thus workers are encouraged to either take public transportation to work or they can park close by at a parking garage at their expense. It is also stated in Balfour Beatty Construction's subcontractor handbook and subcontract that onsite parking cannot be provided or allowed. Balfour Beatty Construction rents office space and associated parking spaces from the owner outside of the contract for the duration of the project.

When interior construction starts, two (2) thirty cubic yard dumpsters will be placed on-site and inside of the building. The waste in the dumpsters will be removed from the site by Northern Virginia Waste (NOVA) Company and taken to their recycling center. There, NOVA will recycle or salvage reusable materials contained in the waste that was created from the project. To help achieve LEED points the Office Building must recycle or salvage for re-use a minimum of 50% by weight of the waste generated on-site.

The soils found on-site ranged from three different types; high plasticity clay that generally consisted of sand with variable amounts of silt, clay and gravel, high plasticity clay with inter-bedded layers of low to high plasticity silt and clay, or high plasticity silt with loose to medium dense sands. The excavation required for the project is below the water table, thus there has been a lot of de-watering needed before pouring the mat slab foundation.

Client Information

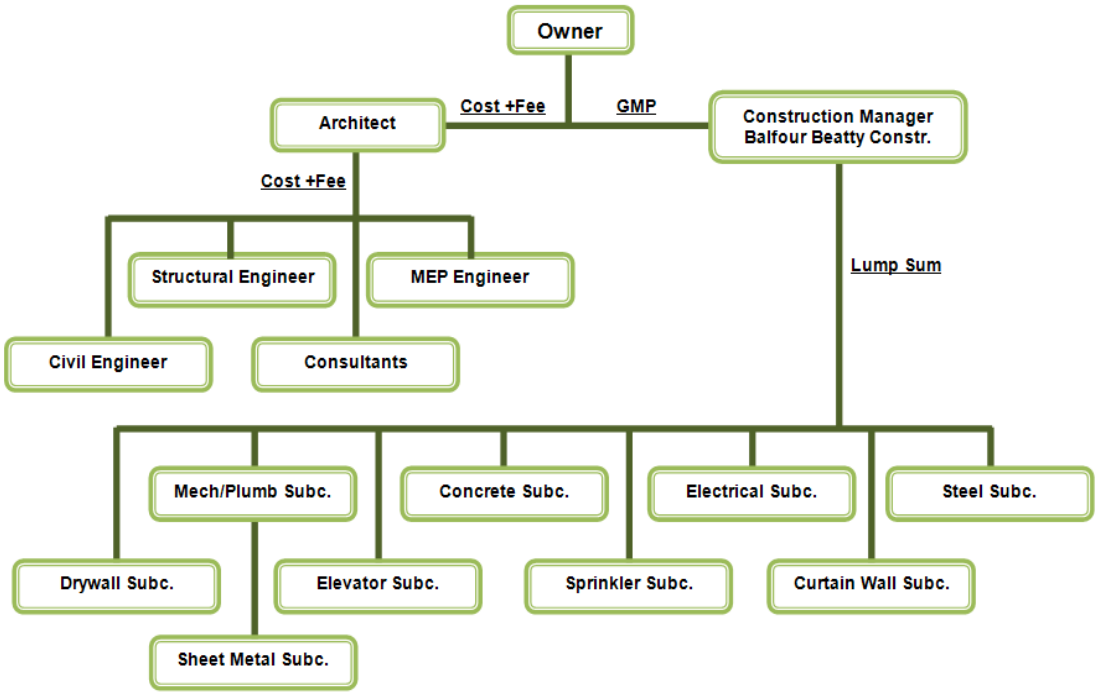
The owner of this project is a major commercial real estate developer who acquires, develops, and manages first class office buildings in North America and Europe. Their portfolio consists primarily of high quality, central business district and suburban office buildings with the majority of the properties characterized as Class A offices. The owner's primary goal in starting this three building development project was to continue establishing their presence in Washington, D.C.'s real estate market. However, currently, the owner's goal has changed to completing the final building and selling to make a profit. Thus the operation of the building is usually contracted to the tenant.

The owner had a number of goals and expectations that they sought to achieve on the project.

Tenant	Though none have yet to be named as of current, the owner is seeking to sell the building to either a government or private sector tenant.
Cost	The owner is extremely determined to finish the project within budget.
Quality	The building is a Class A office building. The owner wants high quality finishes and a first class commercial environment.
Schedule	Schedule is important and the contractor must meet the substantial completion date of April 2009.
Safety	Above all, the project must achieve the above objectives with a superb safety record and no accidents resulting in lost time or injury.

If the project team is able to successfully meet these objectives by providing a high quality end product within budget with a minimal number of change orders and on time, the owner will be a satisfied client. A sequencing issue of particular importance to the owner is enclosing the building prior to installing drywall and other finishes so that there is no risk of mold or sick-building syndrome.

Project Delivery System



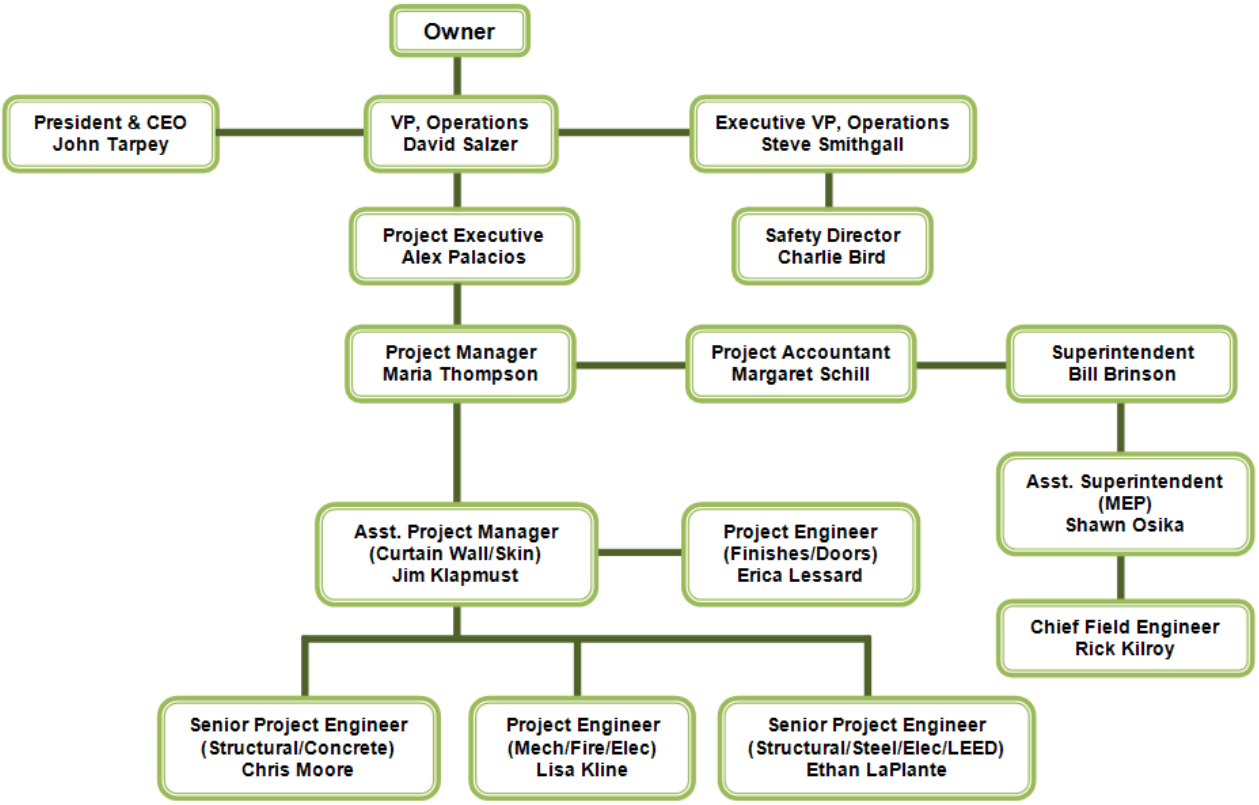
The project delivery method for this building is design-bid-build. First the owner hires design professionals to prepare a complete set of contract documents, which includes plans and specifications, for a set price. Once the project plans and specifications are complete and given to the owner, he/she pays the designers a fixed price. Then the owner will hire a Construction Manager (CM). Balfour Beatty Construction (BBC) was hired by the owner to manage the project. The owner negotiated, the contract with BBC, and they agreed on a Guaranteed Max Price (GMP) type of contract. However, the owner only has a contract with BBC, thus BBC must manage all of the subcontractor's contracts.

Once BBC was awarded the project, they had to hire every subcontractor for every trade. BBC bided the project, and a different contractor was selected for every trade, each being the lowest bidder. BBC then negotiated a lump sum contract with every subcontractor. The cost of the work for every trade was set before any work began. Moreover, every subcontractor needed insurance and bonds before starting any activity.

If an owner is not very experienced with the construction process or wishes to allocate construction responsibilities and risks to others, then the preferred delivery method would be design-bid-build. In this method the CM and designers acquire all the responsibilities and risks.

Also, designers and subcontractors who utilize this delivery method prefer contracts to be lump sum contracts. A lump sum contract will motivate the CM to do a better job, because if they complete the project for less than the contract amount, then they get to keep the money that was saved.

Staffing Plan

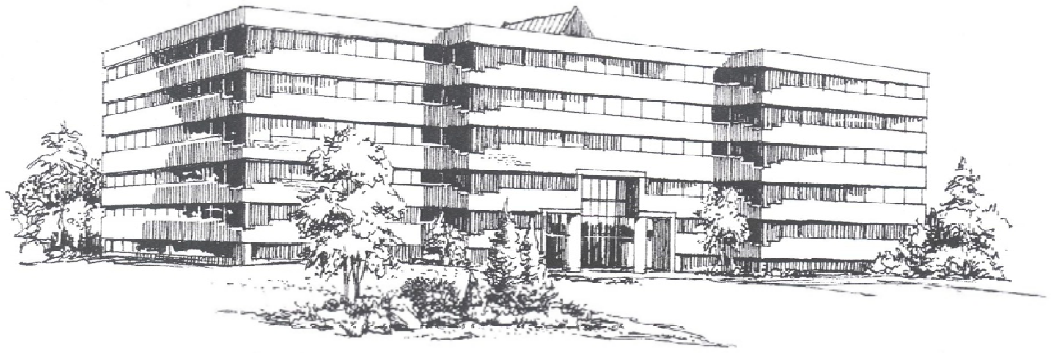


The construction management staffing plan of the office building, as outlined in the organizational chart below, involves several hierarchical relationships. First the Vice President of Operations acts as the "middle man" between the company executives and the Owner. The Project Manager and Superintendent each have important management roles and report directly to the Project Executive, who in turn reports to the Vice President of Operations over him. The Assistant Project Manager reports to the Project manager, and also helps to oversee the Senior Project Engineer and the Project Engineering positions. The responsibilities of the major trades of the project are divided amongst the five sub-positions of the Project Manager. The Superintendent is also assigned an Assistant Superintendent who oversees the Chief Field Engineer of the project. The accountant is also on site to perform and maintain all bookkeeping, pay subcontractors, and ensure that money is being spent correctly.

Appendix A

R.S. Means Source Data

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL | **M.470** | **Office, 5-10 Story**



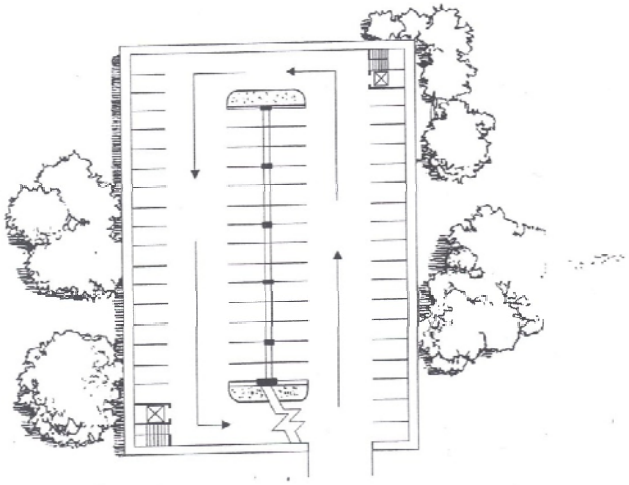
Costs per square foot of floor area

Exterior Wall	S.F. Area	20000	40000	60000	80000	100000	150000	200000	250000	300000
	L.F. Perimeter	260	360	400	420	460	520	600	640	700
Precast Concrete Panel	Steel Frame	193.70	166.10	151.60	143.05	138.95	132.15	129.30	126.65	125.30
	R/Conc. Frame	193.10	165.25	150.70	142.10	137.90	131.10	128.20	125.60	124.20
Face Brick with Concrete Block Back-up	Steel Frame	184.25	159.40	146.65	139.10	135.50	129.55	127.00	124.70	123.50
	R/Conc. Frame	183.10	158.30	145.55	138.05	134.40	128.45	125.85	123.65	122.40
Limestone Panel Concrete Block Back-up	Steel Frame	231.60	192.30	171.00	158.30	152.25	142.20	137.95	134.10	132.05
	R/Conc. Frame	230.55	191.15	169.85	157.20	151.15	141.10	136.80	132.95	130.90
Perimeter Adj., Add or Deduct	Per 100 L.F.	26.35	13.20	8.80	6.55	5.25	3.50	2.60	2.15	1.75
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	5.45	3.80	2.80	2.25	1.95	1.45	1.20	1.10	1.00

For Basement, add $33.50 per square foot of basement area

Reference R.S. Means 2008, Page 178

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL | **M.280** | **Garage, Underground Parking**



Costs per square foot of floor area

Exterior Wall	S.F. Area	20000	30000	40000	50000	75000	100000	125000	150000	175000
	L.F. Perimeter	400	500	600	650	775	900	1000	1100	1185
Reinforced Concrete	R/Conc. Frame	81.90	75.95	73.00	70.15	66.45	64.65	63.30	62.35	61.70
Perimeter Adj., Add or Deduct	Per 100 L.F.	5.05	3.35	2.45	2.05	1.35	0.95	0.75	0.70	0.55
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	1.95	1.60	1.45	1.25	1.00	0.80	0.70	0.70	0.65
Basement—Not Applicable										

Reference R.S. Means 2008, Page 138

Appendix B

D4Cost Data

Wednesday, September 24, 2008 — Statement of Probable Cost — Page 1

Office Building - Aug 2009 - District of Columbia

Prepared By:		Prepared For:	
	Fax:		Fax:
Building Sq. Size:	741200	Site Sq. Size:	283390
Bid Date:		Building use:	
No. of floors:	4	Foundation:	
No. of buildings:		Exterior Walls:	
Project Height:		Interior Walls:	
1st Floor Height:		Roof Type:	
1st Floor Size:		Floor Type:	
		Project Type:	

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**4.67**	**6.18**	**4,581,205**
	Bidding Requirements	4.67	6.18	4,581,205
01	**General Requirements**	**4.47**	**5.91**	**4,379,911**
	General Requirements	4.47	5.91	4,379,911
02	**Site Work**	**4.73**	**6.26**	**4,637,096**
	Site Work	4.73	6.26	4,637,096
03	**Concrete**	**13.04**	**17.25**	**12,782,384**
	Concrete	13.04	17.25	12,782,384
04	**Masonry**	**2.56**	**3.38**	**2,506,310**
	Masonry	2.56	3.38	2,506,310
05	**Metals**	**6.68**	**8.83**	**6,544,552**
	Metals	6.68	8.83	6,544,552
06	**Wood, Plastics, and Composites**	**0.49**	**0.65**	**481,758**
	Wood, Plastics, and Composites	0.49	0.65	481,758
07	***Thermal and Moisture Protection***	**2.48**	**3.28**	**2,430,767**
	Thermal and Moisture Protection	2.48	3.28	2,430,767
08	**Openings**	**4.69**	**6.20**	**4,596,309**
	Openings	4.69	6.20	4,596,309
09	**Finishes**	**5.92**	**7.82**	**5,799,472**
	Finishes	5.92	7.82	5,799,472
10	**Specialties**	**1.05**	**1.39**	**1,028,425**
	Specialties	1.05	1.39	1,028,425
11	**Equipment**	**0.21**	**0.28**	**210,652**
	Equipment	0.21	0.28	210,652
12	**Furnishings**	**1.06**	**1.40**	**1,036,175**
	Furnishings	1.06	1.40	1,036,175
13	**Special Construction**	**0.19**	**0.25**	**182,922**
	Special Construction	0.19	0.25	182,922
14	**Conveying Systems**	**1.66**	**2.19**	**1,626,478**
	Conveying Systems	1.66	2.19	1,626,478
15	**Mechanical**	**10.83**	**14.33**	**10,617,964**
	Mechanical	10.83	14.33	10,617,964
16	**Electrical**	**11.61**	**15.35**	**11,374,770**
	Electrical	11.61	15.35	11,374,770
21	**Fire Suppression**	**1.82**	**2.41**	**1,783,436**
	Fire Suppression	1.82	2.41	1,783,436

Reference D4Cost 2002

22	**Plumbing**	**1.60**	**2.12**	**1,570,989**
	Plumbing	1.60	2.12	1,570,989
23	**HVAC**	**5.99**	**7.92**	**5,872,991**
	HVAC	5.99	7.92	5,872,991
26	**Electrical**	**5.71**	**7.55**	**5,598,030**
	Electrical	5.71	7.55	5,598,030
27	**Communications**	**2.62**	**3.47**	**2,568,774**
	Communications	2.62	3.47	2,568,774
31	**Earthwork**	**2.47**	**3.27**	**2,423,567**
	Earthwork	2.47	3.27	2,423,567
32	**Exterior Improvements**	**2.43**	**3.21**	**2,378,540**
	Exterior Improvements	2.43	3.21	2,378,540
33	**Utilities**	**1.01**	**1.34**	**989,899**
	Utilities	1.01	1.34	989,899
Total Building Costs		**100.00**	**132.22**	**98,003,372**
Total Non-Building Costs		**100.00**	**0.00**	**0**
Total Project Costs		--	--	**98,003,372**

Reference D4Cost 2002