Technical Assignment #1

77 K STREET

Washington, DC

Todd Povell
Dr. John Messner
October 5, 2007

77 K Street

Technical Assignment #1

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Executive Summary

The 77 K Street project is a class A core and shell office base building project consisting of 11 above grade levels and 3 levels of below grade parking garage. The site is located at the intersection of 1st and K Streets in Washington, DC in the North of Massachusetts development district north of the Capitol Building. The project includes approximately 350,000 gross square feet of above grade office space and an additional 100,000 square feet of below grade parking.

The project is not pursuing LEED certification though the idea was considered. ING Clarion approached Brookfield Properties with the idea of looking into obtaining a LEED rating. After conducting a LEED benchmark survey, the design team realized that the building only achieved a 4.8% energy savings, significantly shy of the 14% minimum LEED prerequisite requirement. Because the idea was first considered late in the project and significant time and cost implications would be incurred, the project team opted not to pursue certification though minor LEED items are being pursued for the sake of sustainability and efficiency.

The following report provides a comprehensive overview of the 77 K Street project. Delivery method, contractual relationships, major building systems, schedule, and cost are all explored in an effort to both study the existing project conditions and explore alternative methods. Of particular interest for future study is the sequencing of the project, in particular the building envelope.

Client Information

The owner of this project, 77 K Street LLC, is a joint venture between Brookfield Properties and ING Clarion. The original partnership at project startup was between Cafritz Company and ING Clarion but in July 2006 Brookfield Properties replaced Cafritz Company and the partnership as it is today was born.

Brookfield Properties is a New York City based real estate company with buildings in twelve major cities in the United States and Canada. In June 2006, Brookfield Properties purchased Trizec Properties, Inc. and Trizec Canada, Inc. for a price of US $8.9 billion. As part of the company's expansion, they saw an opportunity to enter the Washington, DC construction and development market by buying into the 77 K Street partnership in July 2006, one month after the merger. They believed that their investment in a project already underway would prove more beneficial than starting on a new development project.

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

Tenant: Though none have been named to date, the developer is seeking to lease the building to either a government or private sector tenant on a minimum ten year lease.

Cost: The firm is extremely determined to finish the project within budget. Their decision to abandon contract negotiations with a general contractor in favor of opening up the project to a competitive bid in an effort to drive down the costs is a testament to this.

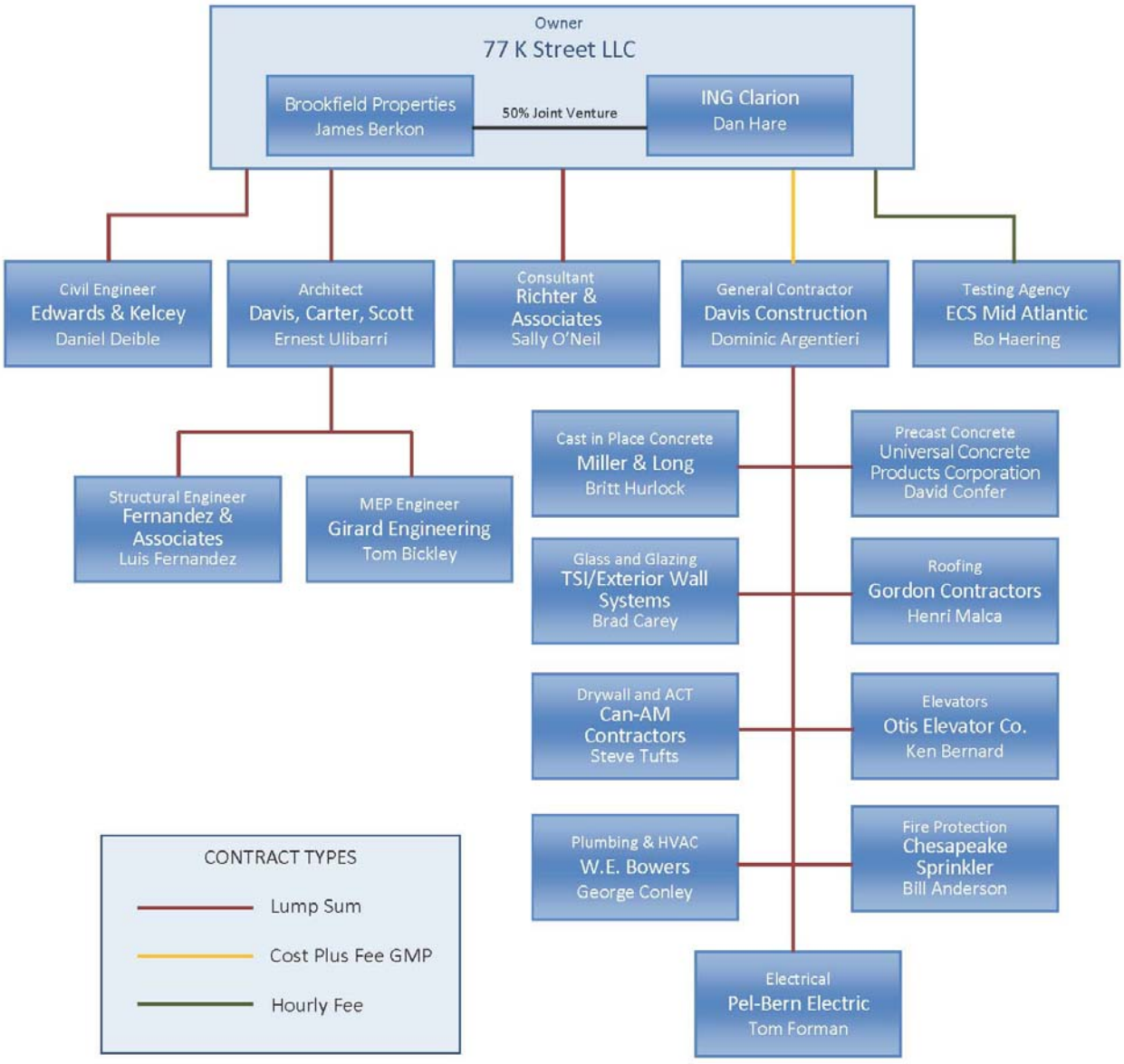
Quality: The building is class A construction. The owner wants high quality finishes and a first class commercial environment.

Schedule: Schedule is important and the contractor must meet the substantial completion date of July 18, 2008 and the final completion date of September 18 or face liquidated damages.

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. Of primary importance, the owner is targeting the exterior skin enclosure as a sequencing issue of particular importance. They are pushing Davis to get the facade erected soon after topping out the concrete in order to allow critical interior work to commence.

Project Delivery System



Contractual Arrangements

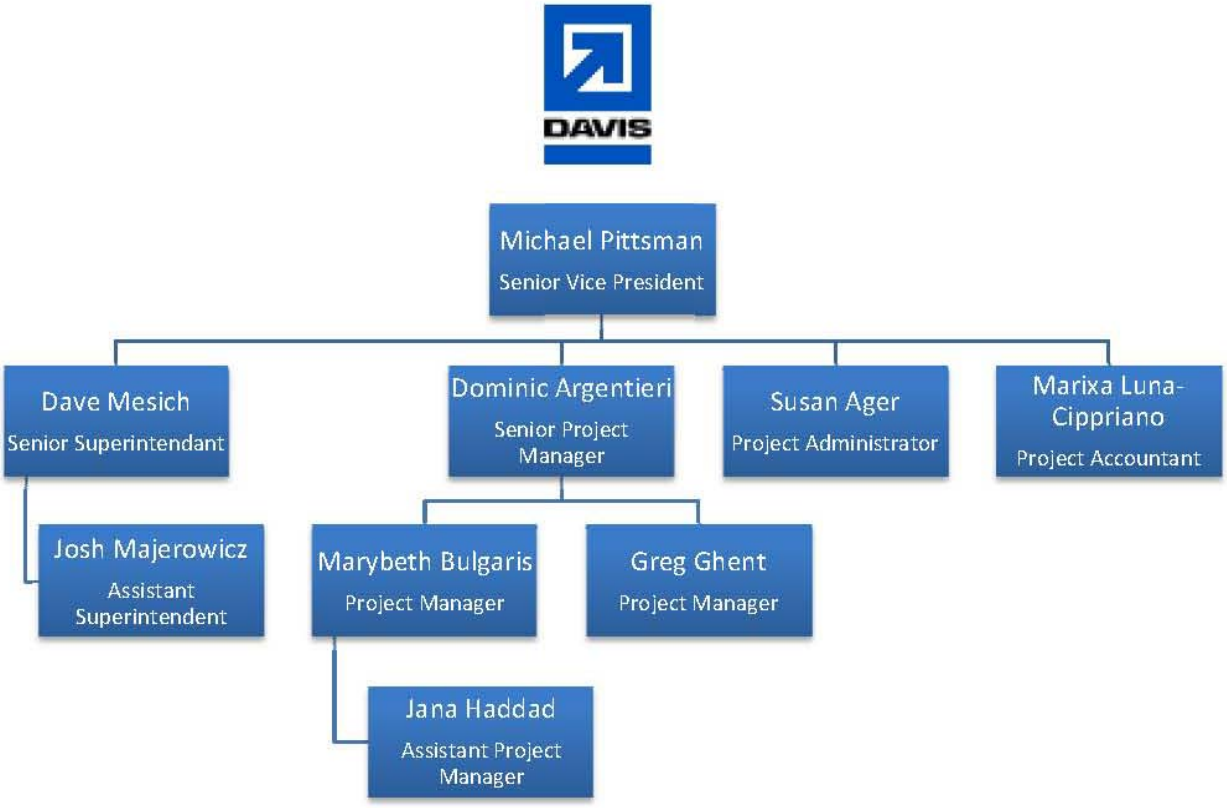
This project was developed via a design-bid-build delivery system. The ownership entity, 77 K Street LLC, sought to invest in a commercial development project in Washington, DC. After Davis, Carter, Scott developed a design the project was put out to bid. The initial general contractor selection was based on a negotiated contract but after the owner sought a cheaper bid, the project was put out for competitive bid to a group of three shortlisted contractors. The ultimate decision was based on a number of criteria including cost, schedule, contractor's team, reputation, and qualifications with similar sized projects. Davis won the job in November 2006.

The owner-general contractor agreement is AIA A111, a cost plus fee contract with a guaranteed maximum price. The guaranteed maximum price for the project is $41,005,150 with a stipulated, lump sum fee of $1,372,221. The contract includes clauses for increases in the fee based upon approved increases in the cost of construction. Additionally, there are stipulations for liquidated damages starting at $1,000 per day for delays in substantial completion.

The owner-general contractor agreement requires that James G. Davis Construction Corporation obtain the following insurance policies: Worker's Compensation, Employer Liability, Commercial General Liability, Automobile Liability, Umbrella Liability with a minimum limit of $50,000,000 per occurrence, Contractor's Pollution Liability, Pollution Legal Liability, Professional Liability, and All Risk. The contract does not require the purchase of payment or performance bonds though Davis Construction does require most subcontractors that furnish and install work to be bonded.

Based upon the "Project Delivery Selection System" developed by Victor Sanvido, the model would suggest that the project be delivered via a traditional design-bid-build arrangement with a lump sum contract between the owner and the general contractor. Though the traditional arrangement was utilized on the 77 K Street project, the owner opted for a cost plus fixed lump sum fee contract with a guaranteed maximum price. Overall, I would agree that the traditional delivery method was the best choice for this project but I would disagree with the model and suggest that a cost plus fee contract, as was utilized, allowed the owner to achieve a reduced construction cost and minimize their financial risk. The "Project Delivery Selection System" decision tree can be found in Appendix A.

General Contractor Staffing Plan



The general contractor's staffing is appropriate for the scope of the work being performed. As with most companies, the senior project manager as well as the administrator, accountant, and vice president do not work exclusively on this project. The two project managers, one assistant project manager, and two superintendents on the other hand do devote one hundred percent of their time to the 77 K Street project. Two field employees overseeing the trades in addition to three management staff devoted to this project is an adequate level of staffing. Of note, during the course of the project Greg Ghent was promoted from the position of Assistant Project Manager to the position of Project Manager.

A staff to volume ratio was calculated yielding a result of 0.022.

$$SV\ Ratio = \frac{Staff\ Base\ Salary}{Volume}$$

A general contractor's goal is to have a SV ratio between 2 and 3 percent. Thus, the project is adequately staffed.

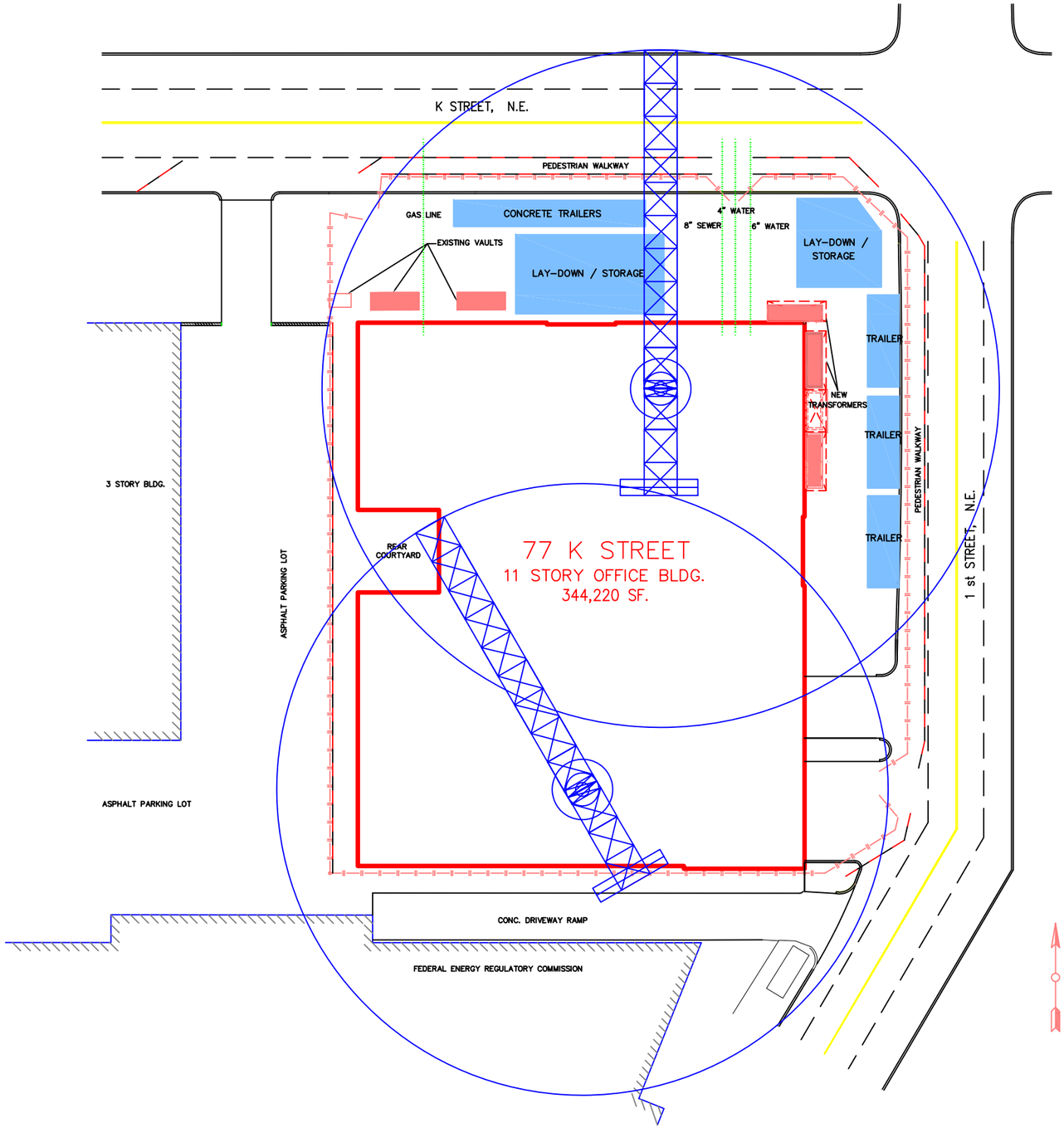
Local Conditions

Washington, DC has an ordinance restricting the height of all buildings in order to prevent any structure from standing taller than the nation's capitol building. Consequently, designers have turned to concrete design to maximize their design potential. Cast in place concrete allows for long spans with a decreased floor to floor height as compared to steel construction. When concrete is post tensioned, even longer spans are possible, such is the case in the 77 K Street project. By reducing floor heights and providing open floor plans, developers are able to maximize their rental space square footage in the district. Consequently, nearly every newly constructed building within Washington, DC will have a concrete structural system.

Do to the project's location and congested site space, parking is not provided on site for subcontractors. This was clearly outlined in the general scope of work provided to each contractor during the bidding process. Numerous pay parking facilities are in the surrounding area though.

Tipping fees for garbage disposal are approximately $850 per 20 CY dumpster. This includes pickup, disposal, and return of the dumpster. Dumpsters 40 CY in size are approximately double this cost. Recycling efforts were not pursued on this project.

The project is located in what is known as the Coastal Plain Physiographic Province of Washington, DC which contains mostly sedimentary soil materials. Stratum I which extends to a depth of between 13 and 22 feet below site grade consists of old fill predominantly composed of silty, clayey, and gravelly sand with varying amounts of organics, rock fragments, and gravel, as well as soils with stiff consistencies, classified as sandy clay. Stratum II which is first encountered at a depth between 13 and 22 feet below site grade consists of loose to dense silty and clayey sand with varying amounts of gravel and rock fragments. It also consists of cohesive soils classifying as clay with varying amounts of silt and sand. Such soil conditions in combination with groundwater conditions encountered at a depth between 18 and 39 feet below grade warranted the design of a mat foundation system.



SENIOR THESIS

77 K STREET

77 K Street, NE – WASHINGTON, DC

Technical Assignment #1

SCALE: NTS

October 5, 2007

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 Excavation

Demolition

The project is being constructed on the lot of the former 65 K Street building. 65 K Street was a two story masonry building with a basement. The building sat on 16,486 SF at the northwest corner of the lot. A fifty-two car asphalt parking lot wrapped around the south and east sides of the building. Demolition of the existing building was not included in the scope of work for the 77 K Street contract. The removal of 65 K Street, the asphalt parking lot, select utility lines, and certain site features took place prior to the general contractor selection for the new building.

Cast in Place Concrete

77 K Street is a cast in place concrete structure with a foundation system composed of 60" diameter concrete caissons and a mat foundation, each constructed with 4,000 psi concrete. Typical columns have a compressive strength of 5,000 psi with select columns having increased capacity up to 10,000 psi. Slab capacities range from 3,000 psi at the lowest garage level to 5,000 psi for above grade slabs. Additionally, all slabs are post tensioned with a force of between 130 and 1290 kips. Concrete is placed using two tower cranes, both staged within the footprint of the building.

Precast Concrete

The facade of the structure is a precast and glazing system. Precast panels are either exposed architectural cladding or support units with stone veneer. Precast pieces are being casted by Universal Concrete Products Corporation in Stowe, Pennsylvania and being erected by E.E. Marr Erectors. The southern and western facades will be erected utilizing the tower cranes already mobilized on site by the cast in place concrete contractor, Miller & Long. The precast on the northern and eastern facades will be erected using a mobile crane stationed on the sidewalk within the project worksite. Precast panels will be connected to the structure by embeds cast into the concrete during slab pours.

Mechanical System

The base building project has mechanical rooms located in the core of each floor with the primary mechanical equipment located on the roof of the building. Three 91,560 CFM cooling tower units supply chilled air to the building. Each floor contains a 27,000 CFM air conditioning unit for distribution to VAV boxes located in the tenant spaces. In order to reduce the fire risk to the building, above grade levels have a wet pipe fire suppression system, whereas the garage and loading dock areas have a typical dry pipe suppression system.

Electrical System

77 K Street contains a standard 408/277V and 208/120V electrical system. The main switchgear room, located on the P1 level, contains three 4000A switchboards. Two of which power the normal operations of the building with the third dedicated to emergency systems. A 750kW diesel powered generator located on the roof powers the emergency systems in case of a power outage. Power is distributed throughout the building by 4000A plug-in feeder busways and panelboards ranging in size from 150 to 400 amps.

Curtain Wall

The exterior of the building is a precast cladding and glass curtain wall system. Precast panels are attached at each slab level and extend both horizontally as well vertically throughout the building. Insulating vision glass windows and shadow boxes contain metal mullions with metal mullions extending through precast elements to create a linear visual appearance. At the lower lobby entrances precast panels support a granite veneer. Precast and glazing system design will be closely coordinated between Universal Concrete Products Corporation and TSI Exterior Wall Systems, Inc. The curtain wall will be constructed using the tower cranes, mobile cranes, and from within the building.

Support of Excavation

In order to support the excavation of the three level underground parking garage, a system of piles, soldier beams, lagging, and tiebacks was utilized. Testing by ECS Mid Atlantic estimated that groundwater would be found between 18 an 39 feet below site grade, thus a temporary dewatering system was installed during excavation and construction with a discharge on the southeast corner of the building on 1st street. Discharge rates in the range of 50 to 100 gallons per minute were to be expected and additional sump pumps were needed as excavation progressed. A permanent sump pump is to be installed in the building as well.

Schedule Summary

Excavation of the lot began in mid-December 2006. The project required that the excavating crew remove soil to an approximate depth of thirty-four feet below street level. Given the limited site space and the need for an open excavation pit to pour the mat foundation, a pile, lagging, soldier beam, and tie back system was used. In late March work on the foundation system began. The forming and pour proceeded from the north to the south. Soon after the mat pour, erection of the tower cranes began.

As the summer progressed the concrete crew worked its way out of the hole and made its way up to street level by mid-July. From this point forward, the concrete crew is given ten days to complete each floor, though anticipated production was expected to only take eight. A critical sequencing date occurs on November 16th. Concrete shoring and reshoring occupies five levels below the current work crew. On the 16th of November the concrete crew is scheduled to begin work on level 11. This will allow a mobile crane to begin erecting precast on the east elevation on levels 1 through 5. If the reshoring is still in place because of a delay in the concrete crew, there will be a delay in the enclosure of the building. Window installation will follow a similar procession as the precast installation.

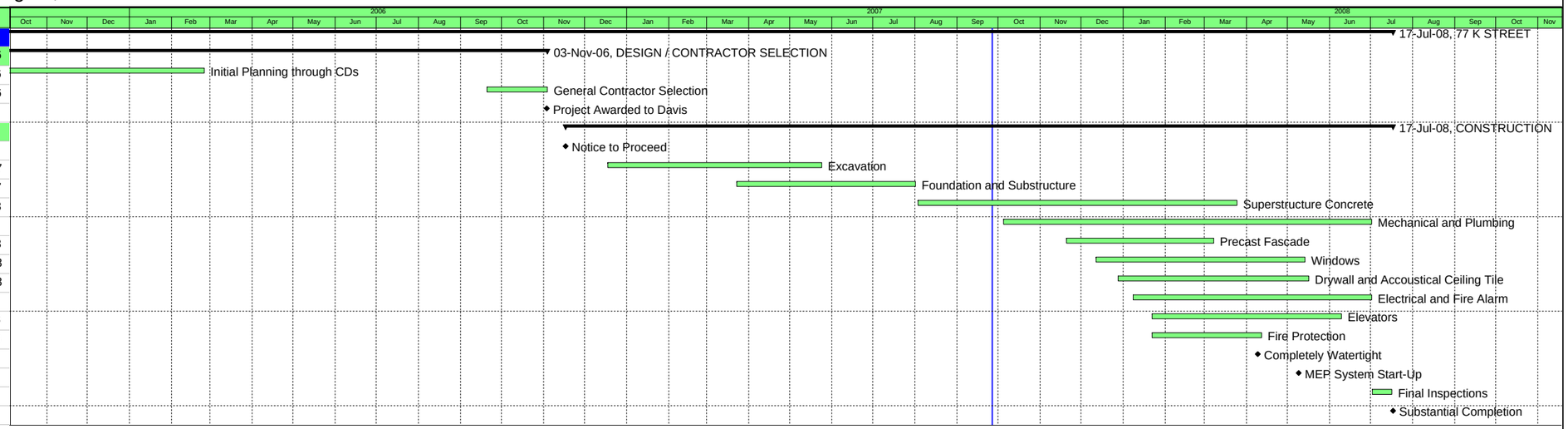
Mechanical and plumbing installation will begin in October 2007 with the installation of plumbing risers followed by ductwork, mechanical piping, plumbing, fixtures, and finally VAV boxes. Electrical installation will begin in January 2008 followed by the fire protection sprinkler contractor soon thereafter.

Also beginning in January 2008 the drywall and masonry contractors will begin their work on the second level with the stone, miscellaneous metals, ceramic tile, painting and specialty contractors following soon thereafter. The drywall contractor is allotted approximately forty days per floor but will essentially be working throughout the entire building from January through late March 2008.

Substantial completion is July 17, 2008 with a two month punchlist period following. The final completion date is September 18, 2008.

77 K STREET Office/Retail Building - Washington, D.C.

Activity ID	Activity Name	Duration	Start	Finish
	77 K STREET	909	03-Jan-05	17-Jul-08
	DESIGN / CONTRACTOR SELECTION	470	03-Jan-05	03-Nov-06
A1130	Initial Planning through CDs	293	03-Jan-05	24-Feb-06
A1120	General Contractor Selection	33	20-Sep-06	03-Nov-06
A1140	Project Awarded to Davis	0	03-Nov-06	
	CONSTRUCTION	430	17-Nov-06	17-Jul-08
A0990	Notice to Proceed	0	17-Nov-06	
A1000	Excavation	112	18-Dec-06	24-May-07
A1010	Foundation and Substructure	94	23-Mar-07	01-Aug-07
A1020	Superstructure Concrete	167	03-Aug-07	24-Mar-08
A1080	Mechanical and Plumbing	193	05-Oct-07	01-Jul-08
A1030	Precast Fascade	79	20-Nov-07*	07-Mar-08
A1035	Windows	110	12-Dec-07	13-May-08
A1042	Drywall and Accoustical Ceiling Tile	101	28-Dec-07	16-May-08
A1100	Electrical and Fire Alarm	126	08-Jan-08	01-Jul-08
A1040	Elevators	100	22-Jan-08	09-Jun-08
A1090	Fire Protection	59	22-Jan-08	11-Apr-08
A1050	Completely Watertight	0	09-Apr-08	
A1095	MEP System Start-Up	0	09-May-08	
A1150	Final Inspections	11	02-Jul-08	16-Jul-08
A1110	Substantial Completion	0	17-Jul-08	



Cost Summary

BUILDING CONSTRUCTION	
Construction Cost	$41,005,150
Cost Per Square Foot	$91.30

TOTAL PROJECT	
Project Cost	$125,000,000
Cost Per Square Foot	$278.32

BUILDING SYSTEM OVERALL AND SQUARE FOOT COSTS			
03300	Cast in Place Concrete	$11,296,000	$25.15
03450	Precast Concrete	$2,950,000	$6.57
08800	Curtainwall	$3,734,000	$8.31
09250	Drywall	$1,482,000	$3.30
14200	Elevators	$2,334,000	$5.20
15000	Mechanical & Plumbing	$4,764,000	$10.61
15300	Fire Protection	$605,000	$1.35
16000	Electrical System	$3,588,000	$7.99

D4Cost 2002 Estimate

77 K - Jan 2007 - District of Columbia

Prepared By:	**T. Povell**	Prepared For:	
	,		,
	Fax:		**Fax:**
Building Sq. Size:	**449130**	Site Sq. Size:	**159840**
Bid Date:	**9/1/2006**	Building use:	**Commercial**
No. of floors:	**14**	Foundation:	**CON**
No. of buildings:	**1**	Exterior Walls:	**PRE**
Project Height:	**130**	Interior Walls:	**GYP**
1st Floor Height:	**14**	Roof Type:	**MEM**
1st Floor Size:	**31173**	Floor Type:	**CON**
		Project Type:	**NEW**

Division		Percent	Sq. Cost	Amount
01	**General Requirements**	**3.75**	**3.18**	**1,426,838**
	General Requirements	3.75	3.18	1,426,838
	Untitled	0.00	0.00	0
03	**Concrete**	**23.75**	**20.14**	**9,044,484**
	Concrete	23.75	20.14	9,044,484
04	**Masonry**	**2.96**	**2.51**	**1,127,786**
	Masonry	2.96	2.51	1,127,786
05	**Metals**	**17.40**	**14.75**	**6,626,330**
	Metals	17.40	14.75	6,626,330
06	**Wood & Plastics**	**1.17**	**1.00**	**447,411**
	Wood & Plastics	1.17	1.00	447,411
07	**Thermal & Moisture Protection**	**1.27**	**1.08**	**482,829**
	Thermal & Moisure Protection	1.27	1.08	482,829
08	**Doors & Windows**	**5.76**	**4.89**	**2,194,545**
	Doors & Windows	5.76	4.89	2,194,545
09	**Finishes**	**15.70**	**13.31**	**5,979,316**
	Finishes	15.70	13.31	5,979,316
10	**Specialties**	**1.02**	**0.86**	**387,890**
	Specialties	1.02	0.86	387,890
11	**Equipment**	**0.29**	**0.25**	**111,354**
	Equipment	0.29	0.25	111,354
14	**Conveying Systems**	**2.64**	**2.24**	**1,005,525**
	Elevators	2.64	2.24	1,005,525
15	**Mechanical**	**12.71**	**10.78**	**4,840,115**
	Mechanical	12.71	10.78	4,840,115
16	**Electrical**	**11.58**	**9.82**	**4,409,753**
	Electrical	11.58	9.82	4,409,753
Total Building Costs		**100.00**	**84.80**	**38,084,177**
02	**Site Work**	**100.00**	**21.97**	**3,512,253**
	Site Work	100.00	21.97	3,512,253
Total Non-Building Costs		**100.00**	**21.97**	**3,512,253**
Total Project Costs		--	--	**41,596,430**

R.S. Means 2007 Estimate

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

Office Building Space
11 floors, 346,431 SF, 772 LF Perimeter, 11'-9" floor height

Exterior Wall	S.F. Area	260000	346,431	400000
	L.F. Perimeter	530	573	600
Precast Concrete Façade	R/Concrete Frame	$117.40	$113.02	$110.30
	Perimeter Adjustment	$3.65	$2.85	$2.35
	Story Height Adjustment	$1.85	$1.54	$1.35

Square Footage Estimate	$113.02
Perimeter Adjustment	$5.67
Story Height	$2.65
Adjusted Square Foot Cost	$121.34

Underground Parking Garage Space
3 floors, 102,699 SF, 737 LF Perimeter, 10' floor height

Exterior Wall	S.F. Area	100000	102,699	125000
	L.F. Perimeter	900	911	1000
Reinforced Concrete	R/Concrete Frame	$63.35	$63.20	$62.00
	Perimeter Adjustment	$1.00	$0.98	$0.85
	Story Height Adjustment	$0.85	$0.84	$0.80

Square Footage Estimate	$63.20
Perimeter Adjustment	-$1.71
Story Height	$0.00
Adjusted Square Foot Cost	$61.49

	SQUARE FOOTAGE	COST/SF	TOTAL COST
Office Building Space	346,431	$121.34	$42,035,900
Underground Parking Garage Space	102,699	$61.49	$6,315,000
			$48,350,900
R.S. Means Location Factor (Washington, DC)			0.98
		Total Estimate	$47,383,882

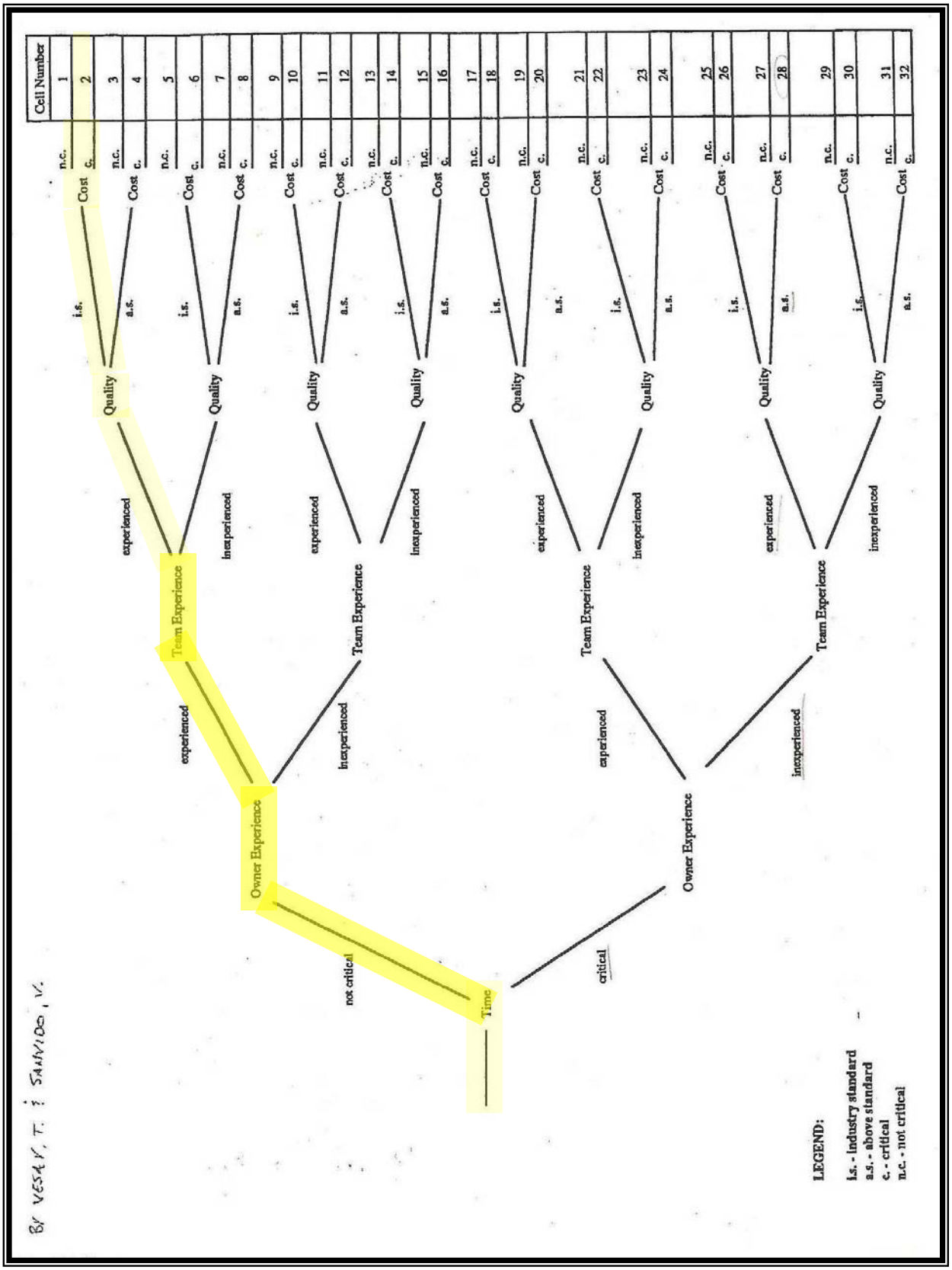
The D4Cost estimate proved to be extremely accurate, wavering from the actual GMP contract by only $600,000. Though the per square footage costs of the individual systems were not directly on par with the actual building system costs, the overall estimate was still very accurate and shows how potentially useful the software package can be.

R.S. Means on the other hand wavered quite substantially from the actual project costs. The estimate was nearly $6.5 million, or fifteen percent, over the project costs. Efforts were made to account for the underground parking structure of the 77 K Street project by combining estimates using two facility types, underground parking garage and 11-20 story office building. Nonetheless, the R.S. Means estimate of the office building square footage alone was over the actual project costs even without considering the additional space in the garage.

Of note though, the 77 K Street project is a base building job. Consequently, tenant build out is not included in the contract whereas the R.S. Means estimate does include the base building and tenant build out costs associated with office building construction. This discrepancy in the project scope is a likely factor in the cost discrepancy between the R.S. Means estimate and the actual project's costs.

APPENDIX A

Project Delivery Selection System


Cell Number
Time
critical
not critical
Owner Experience
experienced
inexperienced
Team Experience
Quality
Cost
n.c.
c.
i.s.
a.s.
LEGEND:
i.s. - industry standard
a.s. - above standard
c. - critical
n.c. - not critical

SCOPE DEFINITION →	WELL DEFINED SCOPE	UNDEFINED SCOPE	WELL DEFINED SCOPE	UNDEFINED SCOPE
	1	2	3	4
CELL NUMBER	ORGANIZATIONAL STRUCTURE	ORGANIZATIONAL STRUCTURE	CONTRACT STRATEGY	CONTRACT STRATEGY
1	TD	CMA, CMGC	LS	GMP, CPF
2	TD, D/B	CMGC, CMA	LS	GMP
3	TD	CMA, CMGC	LS	GMP, CPF
4	TD, D/B	CMGC	LS	GMP
5	TD	CMA	LS	GMP
6	TD	CMA	LS	GMP
7	TD, CMA	CMA	LS	GMP
8	TD, CMA	CMA	LS	GMP
9	TD	CMA, CMGC	LS	GMP
10	TD, D/B	CMGC, CMA	LS	GMP
11	TD	CMA, CMGC	LS	GMP
12	TD, D/B, CMGC	CMA, CMGC	LS	GMP
13	DON'T BUILD	DON'T BUILD	DON'T BUILD	DON'T BUILD
14	DON'T BUILD	DON'T BUILD	DON'T BUILD	DON'T BUILD
15	DON'T BUILD	DON'T BUILD	DON'T BUILD	DON'T BUILD
16	DON'T BUILD	DON'T BUILD	DON'T BUILD	DON'T BUILD
17	CMA, D/B	CMGC, CMA, D/B	GMP, CPF	CPF, GMP
18	CMGC, D/B	CMGC, CMA, D/B	GMP	CPF, GMP
19	D/B, CMA	CMGC, CMA	CPF	CPF, GMP
20	CMGC, D/B	CMGC, CMA	GMP	CPF, GMP
21	CMA	CMA	GMP, LS	GMP
22	CMA	CMA	GMP, LS	GMP
23	CMA	CMA	GMP	GMP
24	CMA	CMA	GMP	GMP
25	D/B, CMA	CMGC, D/B	GMP	CPF, GMP
26	D/B, CMGC	CMGC, D/B	GMP	CPF, GMP
27	D/B, CMA	CMA, D/B	GMP	CPF, GMP
28	D/B, CMGC	CMA, D/B	GMP	CPF, GMP
29	DON'T BUILD	DON'T BUILD	DON'T BUILD	DON'T BUILD
30	DON'T BUILD	DON'T BUILD	DON'T BUILD	DON'T BUILD
31	DON'T BUILD	DON'T BUILD	DON'T BUILD	DON'T BUILD
32	DON'T BUILD	DON'T BUILD	DON'T BUILD	DON'T BUILD

LEGEND (Organizational Structure):

TD- Traditional
D/B- Design-Build
CMA- Construction Management (Agency)
CMGC- Construction Management (General Contractor) → CM @ Risk

LEGEND (Contract Strategy):

LS - Lump Sum
GMP- Guaranteed Maximum Price
CPF- Cost Plus Fee

Table 5: The PDSS Model - Tabulated Solutions

APPENDIX B

R.S. Means Source Data

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL | **M.480** | **Office, 11-20 Story**

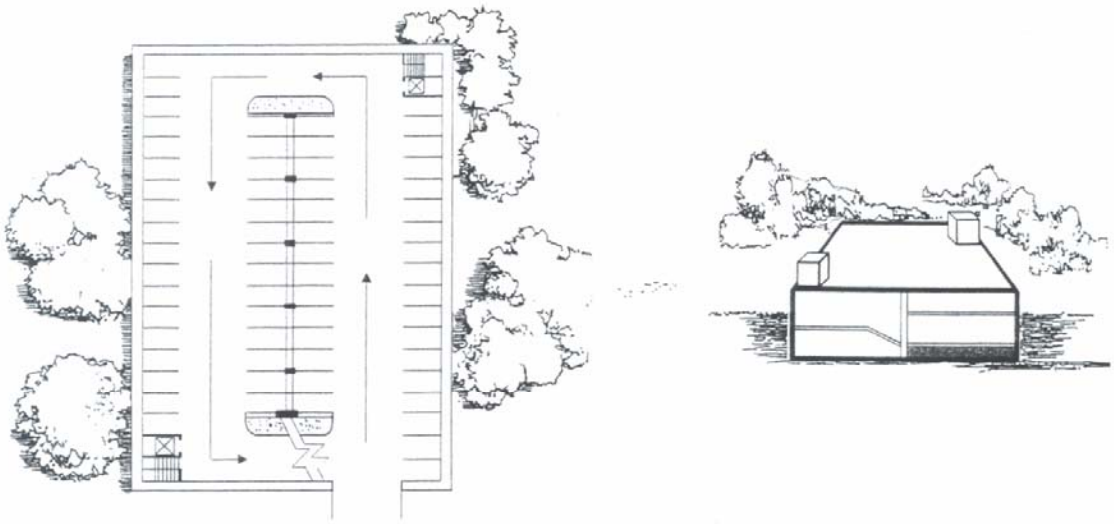
Costs per square foot of floor area

Exterior Wall	S.F. Area	120000	145000	170000	200000	230000	260000	400000	600000	800000
	L.F. Perimeter	420	450	470	490	510	530	600	730	820
Double Glazed Heat Absorbing Tinted Plate Glass Panels	Steel Frame	142.60	137.10	132.70	128.60	125.65	123.35	116.65	113.00	110.70
	R/Conc. Frame	142.80	136.20	131.00	126.25	122.75	120.10	112.30	107.95	105.35
Face Brick with Concrete Block Back-up	Steel Frame	142.15	136.30	131.75	127.65	124.60	122.25	115.55	111.80	109.55
	R/Conc. Frame	134.75	129.00	124.55	120.55	117.55	115.30	108.65	105.00	102.80
Precast Concrete Panel With Exposed Aggregate	Steel Frame	145.35	139.10	134.30	129.85	126.60	124.10	116.90	112.90	110.45
	R/Conc. Frame	138.20	132.10	127.35	123.05	119.85	117.40	110.30	106.40	104.00
Perimeter Adj., Add or Deduct	Per 100 L.F.	7.80	6.45	5.50	4.75	4.05	3.65	2.35	1.55	1.15
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	3.15	2.80	2.50	2.25	1.95	1.85	1.35	1.10	.90

For Basement, add $31.95 per square foot of basement area

Reference R.S. Means 2007, Page 180

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	80.25	74.50	71.60	68.85	65.20	63.35	62.00	61.15	60.55
Perimeter Adj., Add or Deduct	Per 100 L.F.	5.05	3.30	2.50	2.00	1.35	1.00	.85	.70	.55
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	1.90	1.55	1.40	1.25	.95	.85	.80	.75	.60
Basement—Not Applicable										

Reference R.S. Means 2007, Page 138