Hamad Alrahmani

Construction Management Option

Murur Mixed Use Complex

Ajman, United Arab Emirates

April 23, 2010

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Project Team:
Owner: Ajman Traffic Department
A/E: AJ Design
G/C: Ali Moosa & Sons Contracting
HVAC: AMS Contracting-MEP Division
Super-Structure Designer: Freysinnet
Landscaping Works: Lea

The Buildings:
The project has a shopping mall and 2 towers
The residential tower is 20 floors + penthouse
The office tower is 26 floors
The shopping mall is 3 floors
Total parking spaces are 1,357 spaces
3 Basement Parking + 2 upper level parking

The Project:
History: The Site was previously occupied by Ajman Traffic Department, and this is where the name comes from, since Murur means Traffic.
Size: 2,300,000 Square Feet
Delivery: Design-Bid-Build
Cost: 600 million AED = 164.4 million USD

Structural and MEP Systems:
Structure: Reinforced Concrete Building, 280 mm slabs, columns range from 300 mm to 1600 mm
Foundation: 2000 mm thick R.C.C. raft on friction pile foundation
MEP Systems: Power delivered by FEWA at 240/415V, 3 phase, 4 wires, 50 Hz.
Chilled water HVAC system

http://www.engr.psu.edu/ae/thesis/portfolios/2010/hma135/index.html

A. Executive Summary:

Technical Assignment 1 is a report that summarizes the main aspects and the general existing conditions of the Murur Mixed-use Complex. The Murur Mixed-use Complex is a 2.3 million square feet project that is located in Ajman, one of the seven Emirates of the United Arab Emirates. Murur in Arabic means traffic, and the Murur Complex is called by that name because it is being built in the location of the old Traffic Police Department in Ajman.

The mixed-use complex consists of three main parts, the shopping mall and parking building, a residential tower and an office tower. Both of the towers will be on top of the shopping mall and parking area. The project construction started on June 9, 2008 and the completion date is November 11, 2011. The project, like almost all other projects in the United Arab Emirates is a reinforced concrete project.

The biggest challenge that the Murur Complex faces is its location. The project is located in the heart of the city of Ajman, and the construction site itself is surrounded by roads from the four directions. Safety is a huge issue in a location like this where vehicles and pedestrians are all around the site. The contractor should pay big attention and have a good safety plan to ensure no harm happens.

The delivery system of the Murur Complex is design build, and the contract was a lump sum contract. The project is not seeking any LEED accreditation.

This technical report will also be providing a summarized project schedule, a brief introduction into each of the main building systems, and a cost evaluation study, in addition to a few other topics that will provide a basic idea about the Murur Mixed-use Complex.

B. Schedule summary:

Murur Mixed-use Complex's construction started on June 9, 2008. The project will need approximately 1,248 days from start to end, that is 1,070 working days since each week has 6 working days. The schedule summary attached in Appendix A show durations based on a 6 working days a week, with Friday the only day off. The only item on the schedule that did not have off days is dewatering due to the nature of the process, since dewatering only works when it is done at a single time period.

Due to the huge area of the project, the raft in foundation was divided into 7 stages. From basement 3 to the podium deck the area was divided into 6 stages. The office tower was not divided but the residential tower was divided into 2 phases. Figure 1 shows the 6 stages from basement 3 up to the podium deck.

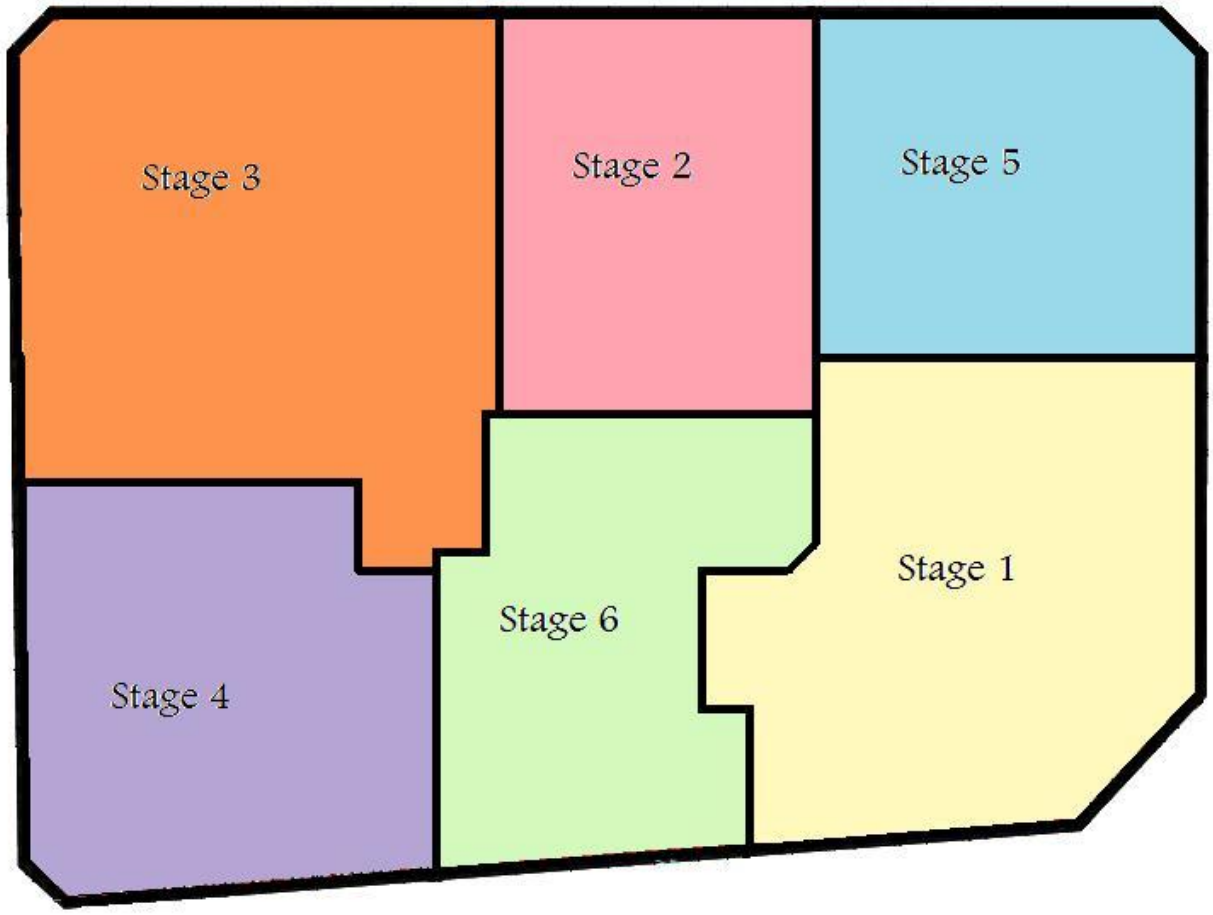


Figure 1. Parking and Shopping Mall Staging Plan

C. Building systems summary:

- Structural System:

The whole structure of the Murur Complex project is reinforced concrete. Different grades of concrete were used which are between 40Mpa to 70Mpa in concrete strength depending upon the design of structural element.

Substructure consists of friction pile foundation over which 2000mm (2m) thick R.C.C raft foundation to support the whole super structure. RCC is roller compacted concrete; it is a special blend of concrete that has the same ingredients as the conventional concrete but with different ratios. RCC is usually used in building water Dams and for the same reason they are used in this project in both the retaining walls, and the several water tanks in the project.

- Mechanical System:

The HVAC system in the project is a central Air-Conditioning system where chilled water comes from the Federal Electricity and Water Authority's distilled cooling plant. The heat exchanger room which is located on the podium deck from where the chilled water is circulated to the mall and to both residential and office towers. All of the HVAC equipment and all chilled water and fire fighting pump room is located on podium deck level.

There is also a fire fighting system on the project. The water tank for the fire fighting system is located in basement.

- Electrical System:

Power will be delivered to the site by FEWA (Federal Electricity and Water Authority) at 240/415V, 3 phase, 4 wires, 50 Hz.

The transformers on the project are oil immersed MV/LV distribution transformers, of 2000 kVA. The transformers on this project will be provided by the client and so it will not be in the General Contactor's scope of work.

The backup power generator is an Engine Generator of 1000 kVA capacity. It works on an Automatic Transfer Switch system which connects the standby generator to the buildings electrical system once the power is cut off from FEWA.

- Cast in Place Concrete:

To support the side soil in the basement, the reinforced cement concrete shoring piles were used as well an R.C.C retaining wall.

All the underground parking floor slabs are conventional flat slab with drop at the columns. The structural slabs above ground floor are post tensioned.

- Masonry Work:

Different sizes of masonry walls were used depending on the need at each area. All the interior walls are masonry walls, which is typical in the United Arab Emirates. The four sizes of walls are 100 mm, 150 mm, 200 mm, and 250 mm thick walls. The type of blocks used was Lightweight Thermal Insulating Clay Blocks.

- Curtain Wall:

White powder coated aluminum curtain wall frames, glazed panel system is used. The fixed double glazed aluminum curtain wall panel system consists of 6mm thick clear tempered glazing panel as an inner panel, a 12mm air gap is between the two panels, and 6mm thick High performance tinted tempered glazing panel is used as an outside panel.

- Support of Excavation:

Since water level is only about 6 feet under the ground level, the contractor carried out the dewatering for around one and half years. R.C.C shoring piles were used in order to protect the side earth from falling during the foundation work.

D. Cost Evaluation:

An actual construction cost was not provided to me but I was given an estimated cost of 600 million United Arab Emirates Dirhams which is approximately 164.4 United States Dollars. No actual costs are shown in this report.

The cost of the Murur Complex was evaluated performing these 2 tasks:

- A square foot estimate using 2010 RS Means
- A parametric estimate using the D4 Cost Estimating software

But first, to make a clearer picture about the project evaluated, here are the building parameters:

Total project area: 2,301,238 square feet

Total project perimeter: 1,575 feet

Project components

Project part	Number of stories
Underground parking garage	3
Shopping Mall	3
Upper parking garage	2 + podium deck
Residential tower	20 + 2 level penthouse
Office tower	26

Table 1

- RS Means Square foot estimate:

The Murur Mixed-use Complex is a huge project that contains huge sub-projects. There is no section in the RS Means for such complex projects so I have divided the whole project into 5 different smaller projects to be able to estimate their cost using RS Means.

The sub-projects are the same five sections I have already mentioned in Table 1 above. Table 2 shows the estimated cost calculated from RS Means for each of the sub-projects.

RS Means cost estimates

Sub-project	RS Means estimated cost in million USD
Underground parking garage	24.2
Shopping Mall	46
Upper parking garage	16.1
Residential tower	131
Office tower	51.5
Total estimated Cost	268.8

Table 2

See Appendix B for RS Means Cost Works 2009 Square Foot Cost Estimate Reports

Additional hand calculations can be provided upon request.

- D4 Cost estimate:

The same problem faced in the RS Means estimating process was faced with the D4COST estimating software. There are no mixed-use complexes that can be compared to the Murur Complex. Moreover, there are no projects of the size of the Murur Complex to compare them with it. The building I finally chose to compare with is a 6 story residential building that was built in 2001 in Detroit, MI. It is a 111,510 square feet building that cost $17.5 Million.

The total estimated cost that the D4COST Estimate Software calculated was $335 million.

See Appendix C for a D4COST Estimate Report.

- Cost estimates comparison:

Table 3 shows a comparison of the costs obtained.

Cost estimates comparison

Cost type	Estimate provided	RS Means estimate	D4COST estimate
Total cost	$164.4 million	$268.8 million	$335 million
Cost /SF	$71.48	$116.87	$145.6

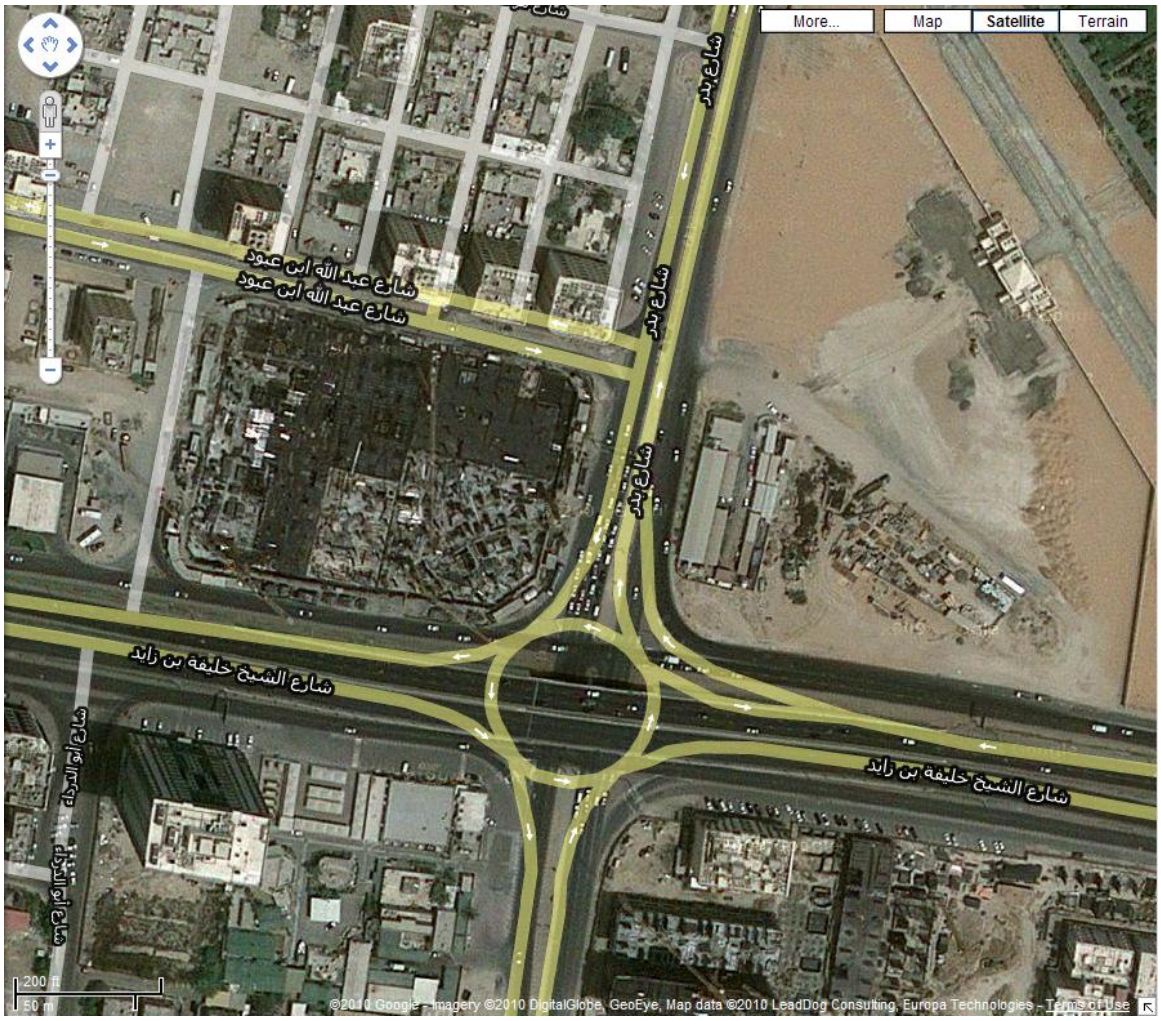
Table3

The first thing to mention is that the cost I already have is an estimated number, I do not have an actual cost of the project. The estimated cost I was provided is 600 million United Arab Emirates Dirhams which is about $164.4 million. The project is also located in the United Arab Emirates, were the construction industry is different than what it is in the United States so it is not fair to compare the cost of buildings in the UAE with buildings in the United State.

From Table 3, we see that the estimates obtained are not close to the estimated actual cost of the project. First I will be discussing the RS Means estimate which is $268.8 million. This is a much higher number than the estimate provided of $164.4. The direct cause that raised the estimate too much is that the estimate was made after dividing the whole project into 5 different projects. Each of those projects was treated as a separate project and it has its own estimated cost. There was no possible way of estimating the whole project as one project because the RS Means does not have a category for such a project.

D4Cost estimate was also at a much higher cost. It is again not an accurate estimate since the Murur project is a complex one, unlike any of the projects in D4COST database. But the big difference in the estimates versus the provided price shows the differences in construction cost between two different countries.

E. Site Plan of Existing Conditions:



Google Earth view of the project site

The Site of the Murur Mixed-use Complex is located in the heart of Ajman City. It is surrounded by a populated area and main roads all around. In such cases, construction of high-rise towers is always a challenge for the contractor. Luckily, there is an empty plot on the other side of the main road that the contractor was able to lease. This plot is used for the trailers, staff parking, and for storing materials that are needed for this fast track project.

See Appendix D for a site plan of the existing conditions.

F. Local Conditions:

The Murur Mixed-use Complex is located in the heart of Ajman City. Heavy vehicular and pedestrian traffic impact the area and have to been taken into consideration. There is almost no construction parking due to the roads on all four sides. Ali Moosa and sons was able to lease the plot across the main road and use it as trailers and staff parking area, and a short term storage for needed material.

Almost all of the construction in the United Arab Emirates is reinforced concrete. And most of the towers in the past few years have curtain walls. So this project's towers are typical UAE towers.

In many areas in the UAE, the soil has low bearing capacity and the water level is high. Murur Complex's location is no better than any other area in the UAE; in fact, it has a higher water level. The water level in the site is around 6 feet under the ground level, which made it a big challenge for the contractors to work with.

G. Contractor Information:

Ali Moosa and Sons Contracting Company is one of the companies of Ali Moosa and Sons (AMS) Group that was found in 1978. The AMS Group includes an Aluminum and Glass Factory that complements the contracting division in the company. The Aluminum and Glass Factories help AMS Group in winning many contracts because the group owns those factories and will not need subcontractors to do Aluminum and Glass work which is needed in almost every construction job.

In addition, The AMS Group opened a Real Estate business in 2001 to satisfy the increasing demand of real estate in the UAE. The Group also established an International Trading Office in Dubai to maximize their exposure to local and international markets. All those features make The AMS Group one of the very competitive contracting companies in the United Arab Emirates.

H. Project delivery system:

The contract between the client and the General contractor, Ali Moosa and Sons is a lump sum contract. The delivery system in the project is design-build. Ali Moosa and Sons only had tender drawings when they got the job; they designed the whole structural system and execution. **Figure 2** is a simple diagram of the relationship of the different parties on the project.

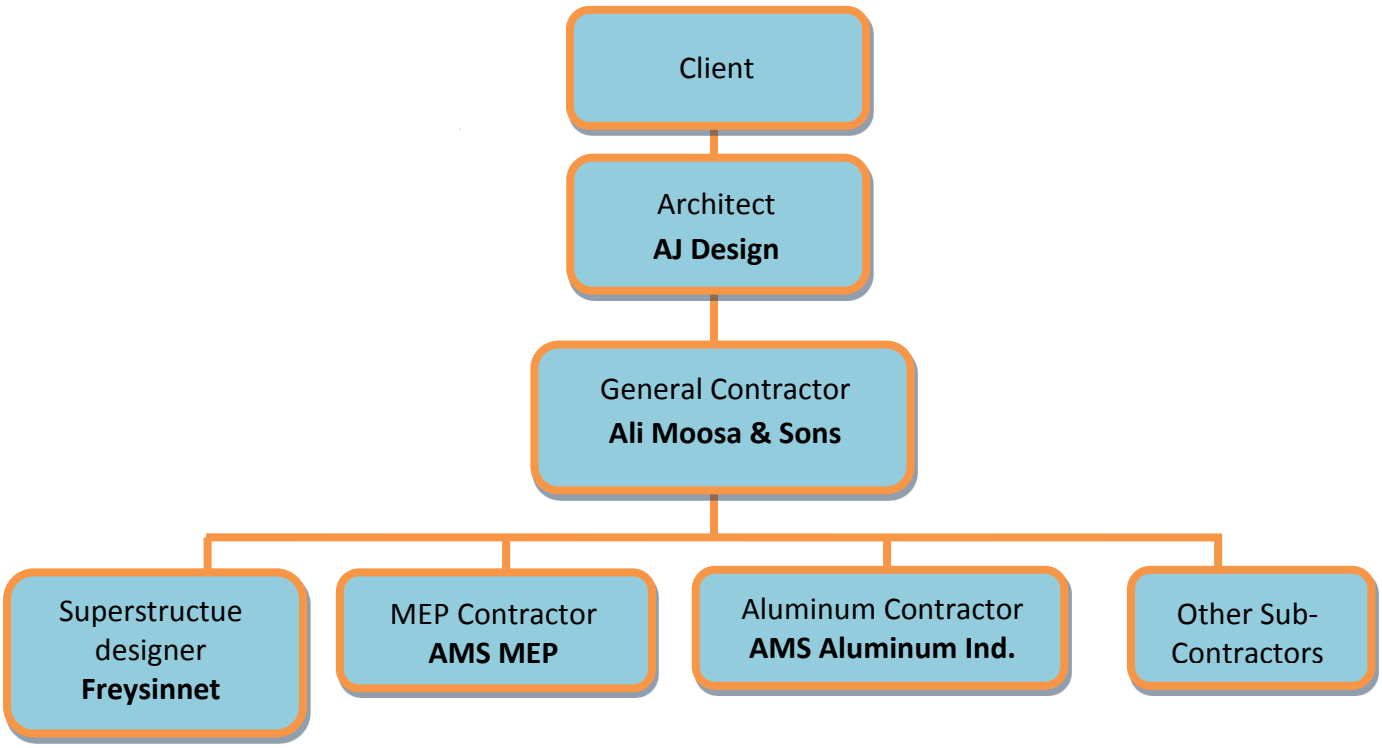


Figure 2. Murur Project Organizational Chart

The contract between Ali Moosa and Sons and the sub-contractors is a remeasurable contract, which means that the sub-contractors quote the rate of the work based on the design provided by the general contractor. This is called a remeasurable contract since the project is a huge project and many of the designs and details change while the project progresses.

Table 4 shows the General contractor and sub-contractors on the Murur Complex each with their scope of work.

Murur Project contractors

Sl No	Name of Contractor/Companies	Type of Contractor/Companies	Scope of work
1	Ali Moosa & Sons Contracting	General Contractor	Whole work
2	Ali Moosa & Sons Contracting-MEP Division	Sub Contractor	MEP works
3	Ali Moosa & Sons Joinery	Sub Contractor	Joinery works
4	Ali Moosa & Sons Aluminum Industries	Sub Contractor	Aluminum & Glazing work
5	Freysinnet	Sub Contractor	Super structure Designer
6	Elevator Tech	Sub Contractor	Conveying System
7	Prisma	Sub Contractor	Metal Works
8	Al Hamy	Sub Contractor	Metal Works
9	Bin Ghurair	Sub Contractor	Steel Doors Works
10	Fiobco	Sub Contractor	Sky Light & Tent works
11	Al Hamad	Sub Contractor	Garbage Chute Works
12	Danway	Sub Contractor	Façade Cleaning System
13	Belhasa	Sub Contractor	Swimming pool, Steam Bath & Sauna Works
14	Lea	Sub Contractor	Landscaping Works
15	Askof	Sub Contractor	False Ceiling works
16	RAK	Supplier	Ceramic
17	RAK	Supplier	Sanitary Ware

Table 4

I. Staffing plan:

Staffing Plan

ROLE	ASSIGN PERSON	PROJECT RESPONSIBILITY	SKILLED REQUIRED	START DATE	FINISH DATE
PROJECT DIRECTOR	ENG.EHAB ANWAR SALEH	MANAGING PROJECT	PROJECT MANAGEMENT	9-Jun-08	11-Nov-11
CONSTRUCTION MANAGER	ENG.ISMAIL,ENG.NAJEEB,ENG.JAMAL	MANAGING EXECUTION WORKS	CONST. EXECUTION ,REVIEWING CONST. DRAWING, SUBMITTALS	9-Jun-08	11-Nov-11
PLANNING ENGINNER	ENG.MOHAMMED SALEH	PROJECT PLANNING MONITORING & PROJECT CONTROL	PROJECT MANGEMENT & CONTROL	9-Jun-08	11-Nov-11
ARCHITECT	ENG.MOHAMMED WALEED	ALL ARCHITECTURAL ISSUE AND DESIGN ISSUE	READING DRAWING DESIGN, ISSUING RFI, APPROVALS OF MATERIAL AND SUPPLIER	9-Jun-08	11-Nov-11
QUANTITY SURVEYOUR	Mr. SIGISH	QUANTITY TAKE MEASUREMENT	MAKING BILLS, TAKING OFF QUANTITY,CLAIMING VARIATION ETC	9-Jun-08	11-Nov-11
PROJECTS ENGINEER	ENG.SHRIEF. ENG.JAMAL.ENG.MAHMOUD	EXECUTION OF WORKS	CONSTRUCTION EXECUTION WORK, REVIEWING DRAWING ETC.	9-Jun-08	11-Nov-11
QA/QC	ENG.ABDULLAH	QUALITY CONTROL	CONTROLLING AND ASSURING QUALITY OF WORKS	9-Jun-08	11-Nov-11

Table 5

Table 5 shows the main Ali Moosa and Sons staff working on the Murur Complex project. It briefly describes the responsibilities of each of the personnel in the project. The hardest responsibility that is not mentioned in the table but is the most important task that every single one of them needs to do is communicating with each other. In a complicated project like the Murur Complex a single change or a simple change of approach that one of them might think is negligible to mention could cost the project a big problem.

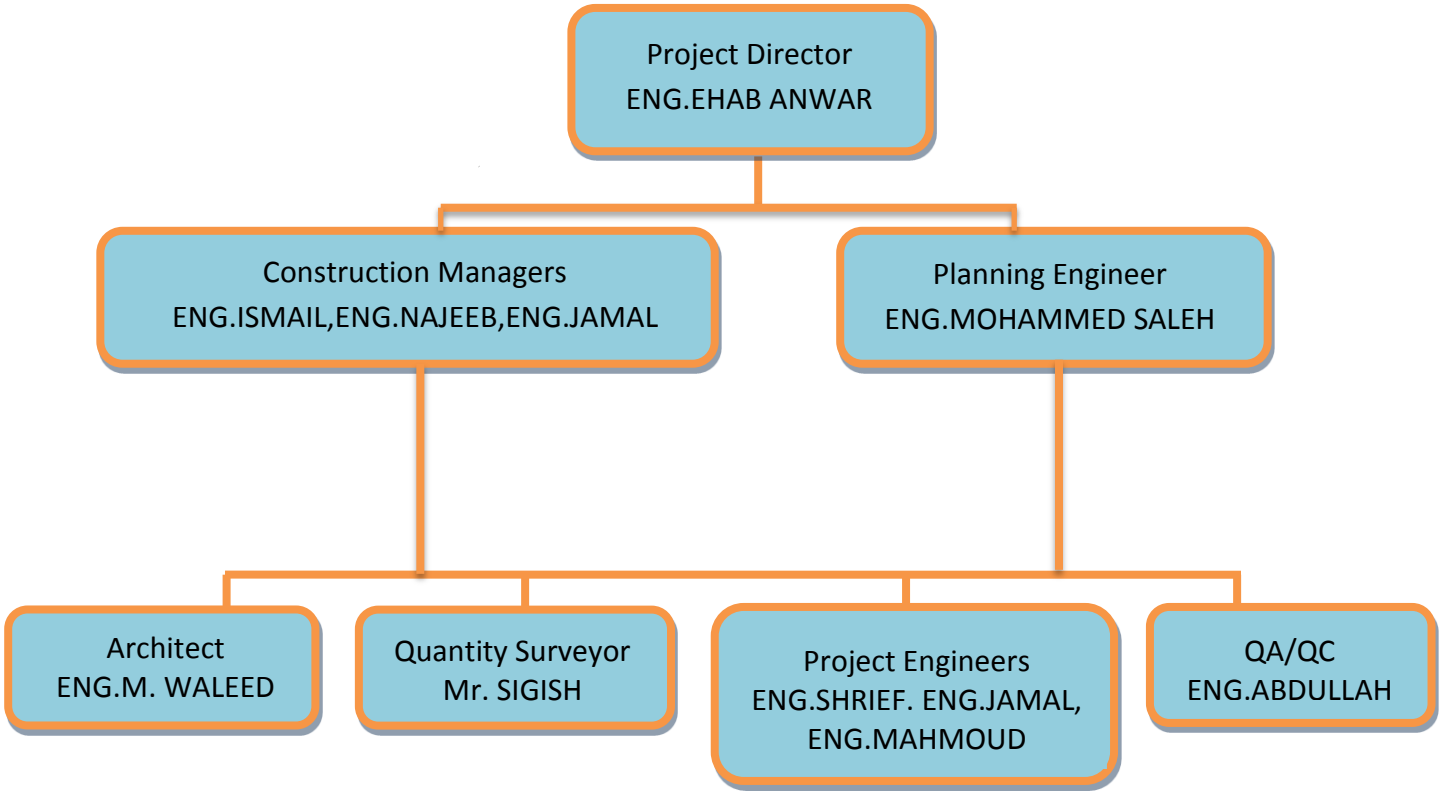


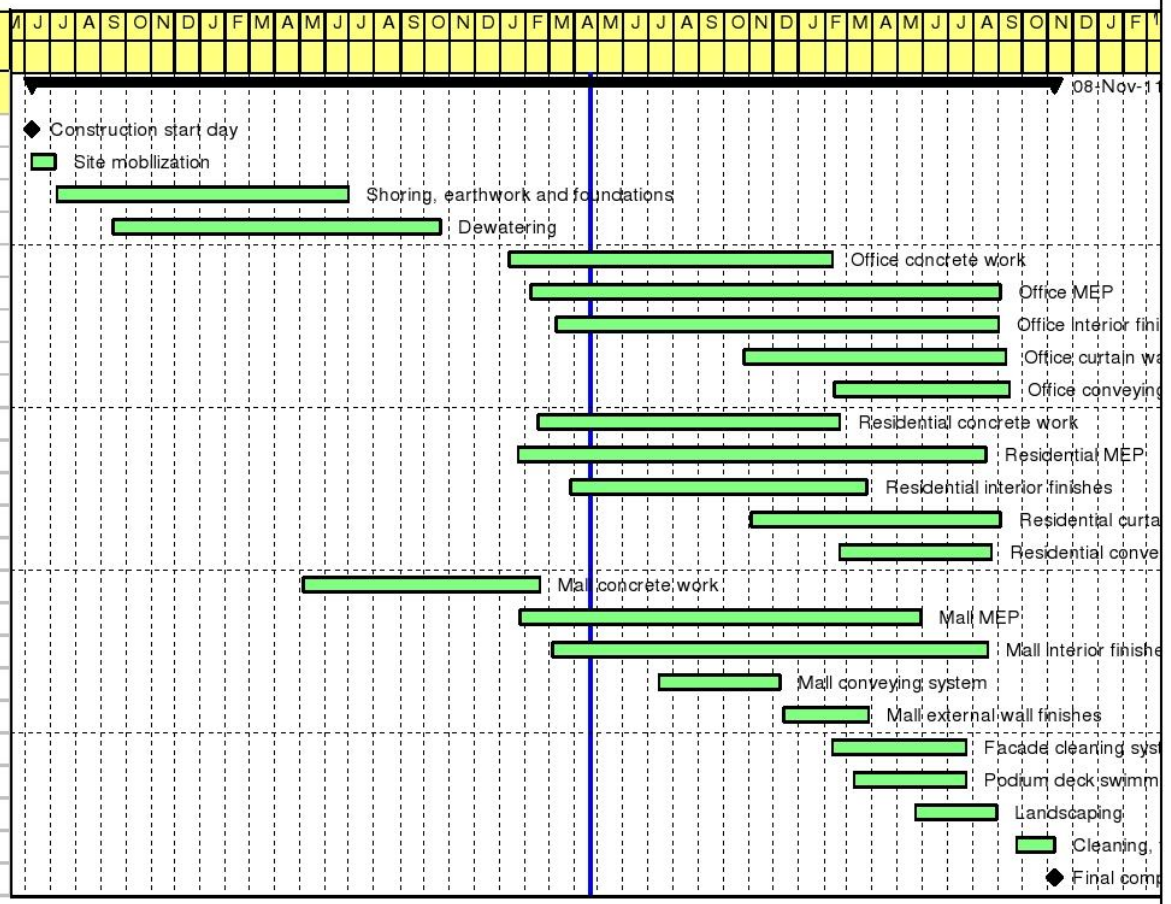
Figure 3. Staffing Chart

Appendix A

Schedule summary

Murur | 2 Week Lookahead | 21-Apr-10 03:52

Activity Name	Original Duration	Start	Finish
001 Murur	873	09-Jun-08	08-Nov-11
Construction start day	0	09-Jun-08	
Site mobilization	30	09-Jun-08	08-Jul-08
Shoring, earthwork and foundati	299	09-Jul-08	29-Jun-09
Dewatering	400	16-Sep-08	20-Oct-09
Office concrete work	338	13-Jan-10	10-Feb-11
Office MEP	491	08-Feb-10	03-Sep-11
Office interior finishes	462	11-Mar-10	31-Aug-11
Office curtain wall	274	26-Oct-10	10-Sep-11
Office conveying system	185	12-Feb-11	14-Sep-11
Residential concrete work	316	16-Feb-10	19-Feb-11
Residential MEP	490	24-Jan-10	17-Aug-11
Residential interior finishes	311	28-Mar-10	24-Mar-11
Residential curtain wall	261	04-Nov-10	04-Sep-11
Residential conveying system	160	20-Feb-11	24-Aug-11
Mall concrete work	246	06-May-09	17-Feb-10
Mall MEP	420	25-Jan-10	29-May-11
Mall interior finishes	456	06-Mar-10	18-Aug-11
Mall conveying system	126	15-Jul-10	08-Dec-10
Mall external wall finishes	90	12-Dec-10	26-Mar-11
Facade cleaning system	140	10-Feb-11	23-Jul-11
Podium deck swimming pool	117	10-Mar-11	24-Jul-11
Landscaping	85	24-May-11	30-Aug-11
Cleaning, testing and handing ov	40	24-Sep-11	08-Nov-11
Final completion	0		08-Nov-11



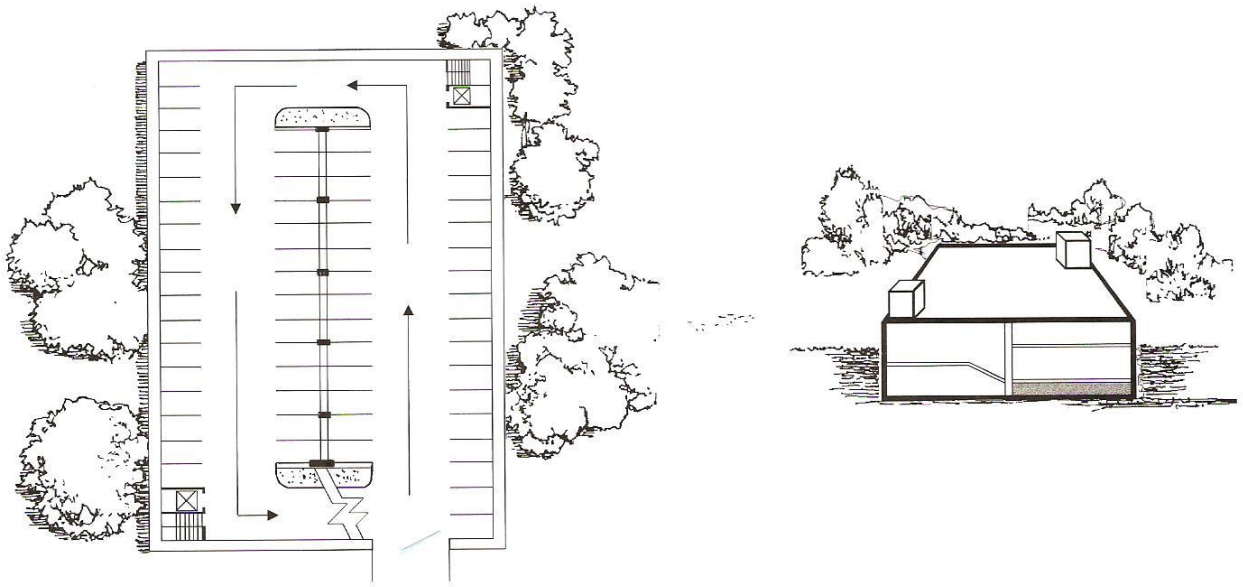
Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

Appendix B

RS Means Cost Works 2009

Square Foot Cost Estimate Reports



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	92.35	86.10	82.90	79.95	75.90	**73.90**	72.50	71.55	70.75
Perimeter Adj., Add or Deduct	Per 100 L.F.	5.55	3.60	2.80	2.15	1.50	1.05	0.85	0.75	0.65
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	2.15	1.75	1.55	1.35	1.10	0.90	0.85	0.75	0.75
Basement—Not Applicable										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $46.80 to $111.50 per S.F.

Common additives

Description	Unit	$ Cost
Elevators, Hydraulic passenger, 2 stops		
1500# capacity	Each	60,900
2500# capacity	Each	64,300
3500# capacity	Each	67,600
Barrier gate w/programmable controller	Each	4075
Booth for attendant, average	Each	12,600
Fee computer	Each	15,100
Ticket spitter with time/date stamp	Each	7125
Mag strip encoding	Each	21,000
Collection station, pay on foot	Each	126,500
Parking control software	Each	25,300 - 108,500
Painting, Parking stalls	Stall	13.70
Parking Barriers		
Timber with saddles, 4" x 4"	L.F.	6.10
Precast concrete, 6" x 10" x 6'	Each	80
Traffic Signs, directional, 12" x 18"	Each	84

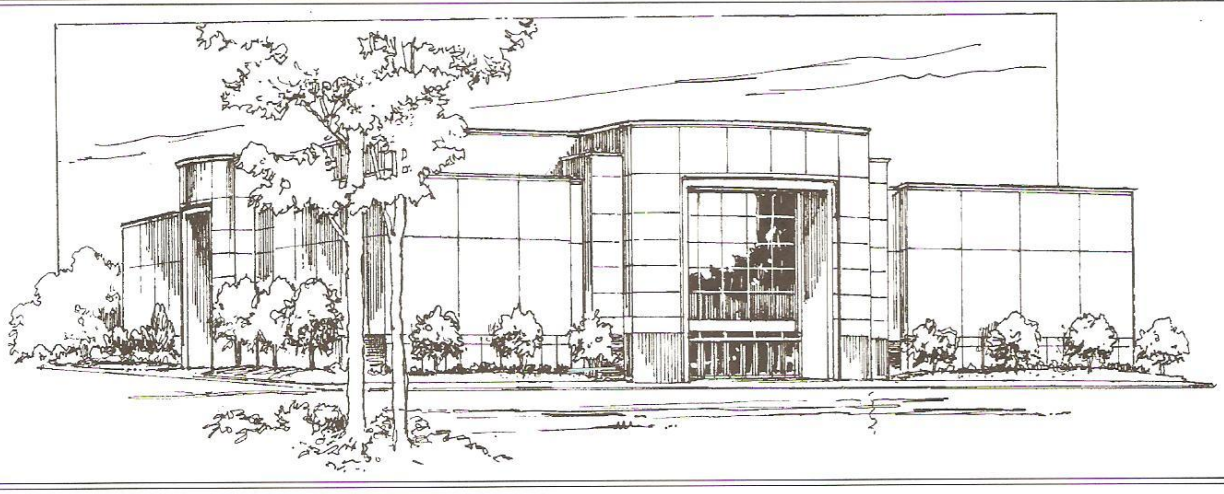
Important: See the Reference Section for Location Factors

Model costs calculated for a 2 story building with 10′ story height and 100,000 square feet of floor area

Garage, Underground Parking

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings and waterproofing		S.F. Ground	8.14	4.07	
1020	Special Foundations	N/A		–	–	–	
1030	Slab on Grade	5" reinforced concrete with vapor barrier and granular base		S.F. Slab	6.33	3.17	22.4%
2010	Basement Excavation	Excavation 24′ deep		S.F. Ground	10.05	5.03	
2020	Basement Walls	N/A		–	–	–	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Cast-in-place concrete beam and slab, concrete columns		S.F. Floor	25.42	12.71	44.7%
1020	Roof Construction	Cast-in-place concrete beam and slab, concrete columns		S.F. Roof	23.52	11.76	
	B20 Exterior Enclosure						
2010	Exterior Walls	Cast-in place concrete		S.F. Wall	20.22	3.64	
2020	Exterior Windows	N/A		–	–	–	7.0%
2030	Exterior Doors	Steel overhead, hollow metal		Each	4095	.17	
	B30 Roofing						
3010	Roof Coverings	Neoprene membrane traffic deck		S.F. Roof	4.30	2.15	3.9%
3020	Roof Openings	N/A		–	–	–	
C. INTERIORS							
1010	Partitions	Concrete block		S.F. Partition	38.48	.74	
1020	Interior Doors	Hollow metal		Each	8008	.08	
1030	Fittings	N/A		–	–	–	
2010	Stair Construction	Concrete		Flight	6025	.31	2.2%
3010	Wall Finishes	Paint		S.F. Surface	2.34	.09	
3020	Floor Finishes	N/A		–	–	–	
3030	Ceiling Finishes	N/A		–	–	–	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Two hydraulic passenger elevators		Each	79,000	1.58	2.9%
1020	Escalators & Moving Walks	N/A		–	–	–	
	D20 Plumbing						
2010	Plumbing Fixtures	Drainage in parking areas, toilets, & service fixtures	*1 Fixture/5000 S.F. Floor*	Each	.04	.04	
2020	Domestic Water Distribution	Electric water heater		S.F. Floor	.11	.11	2.6%
2040	Rain Water Drainage	Roof drains		S.F. Roof	2.56	1.28	
	D30 HVAC						
3010	Energy Supply	N/A		–	–	–	
3020	Heat Generating Systems	N/A		–	–	–	
3030	Cooling Generating Systems	N/A		–	–	–	0.3 %
3050	Terminal & Package Units	Exhaust fans		S.F. Floor	.16	.16	
3090	Other HVAC Sys. & Equipment	N/A		–	–	–	
	D40 Fire Protection						
4010	Sprinklers	Dry pipe sprinkler system		S.F. Floor	3.68	3.68	7.0%
4020	Standpipes	Dry standpipe system, class 3		S.F. Floor	.14	.14	
	D50 Electrical						
5010	Electrical Service/Distribution	200 ampere service, panel board and feeders		S.F. Floor	.12	.12	
5020	Lighting & Branch Wiring	T-8 fluorescent fixtures, receptacles, switches and misc. power		S.F. Floor	3.11	3.11	6.3%
5030	Communications & Security	Addressable alarm systems and emergency lighting		S.F. Floor	.17	.17	
5090	Other Electrical Systems	Emergency generator, 11.5 kW		S.F. Floor	.06	.06	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		–	–	–	
1020	Institutional Equipment	N/A		–	–	–	0.7 %
1030	Vehicular Equipment	Ticket dispensers, booths, automatic gates		S.F. Floor	.37	.37	
1090	Other Equipment	N/A		–	–	–	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		–	–	–	0.0 %
1040	Special Facilities	N/A		–	–	–	
G. BUILDING SITEWORK		**N/A**					
					Sub-Total	54.74	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				25%	13.69	
	ARCHITECT FEES				8%	5.47	
					Total Building Cost	**73.90**	

M.620 Store, Department, 3 Story



Costs per square foot of floor area

Exterior Wall	S.F. Area	50000	65000	80000	95000	110000	125000	140000	155000	170000
	L.F. Perimeter	533	593	670	715	778	840	871	923	976
Face Brick with Concrete Block Back-up	Steel Frame	142.90	137.20	134.30	**131.40**	129.70	128.40	126.80	125.85	125.15
	R/Conc. Frame	144.40	138.75	135.75	132.90	131.20	129.90	128.30	127.40	126.65
Face Brick on Steel Studs	Steel Frame	138.00	133.05	130.45	127.95	126.45	125.30	123.90	123.15	122.50
	R/Conc. Frame	141.65	136.75	134.10	131.60	130.10	128.95	127.60	126.80	126.20
Precast Concrete Panels Exposed Aggregate	Steel Frame	146.75	140.55	137.30	134.15	132.30	130.90	129.10	128.15	127.30
	R/Conc. Frame	149.85	143.70	140.45	137.30	135.40	134.00	132.20	131.20	130.40
Perimeter Adj., Add or Deduct	Per 100 L.F.	4.85	3.75	3.00	2.55	2.20	1.95	1.75	1.60	1.40
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	1.45	1.30	1.10	1.05	0.95	0.90	0.80	0.85	0.75
For Basement, add $40.35 per square foot of basement area										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $57.60 to $154.15 per S.F.

Common additives

Description	Unit	$ Cost
Closed Circuit Surveillance, One station		
Camera and monitor	Each	1875
For additional camera stations, add	Each	1025
Directory Boards, Plastic, glass covered		
30" x 20"	Each	605
36" x 48"	Each	1325
Aluminum, 24" x 18"	Each	585
36" x 24"	Each	685
48" x 32"	Each	975
48" x 60"	Each	2025
Elevators, Hydraulic passenger, 2 stops		
1500# capacity	Each	60,900
2500# capacity	Each	64,300
3500# capacity	Each	67,600
Additional stop, add	Each	8250
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	287
Nickel cadmium	Each	845

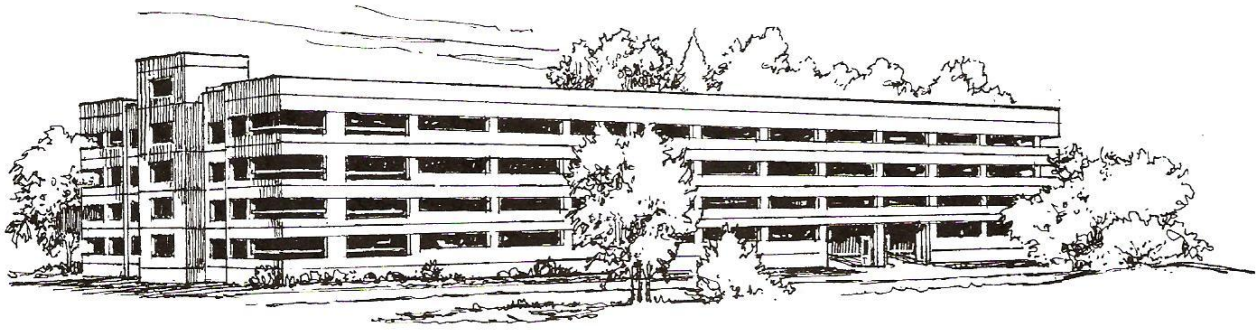
Description	Unit	$ Cost
Escalators, Metal		
32" wide, 10' story height	Each	139,700
20' story height	Each	168,000
48" wide, 10' story height	Each	148,200
20' story height	Each	176,000
Glass		
32" wide, 10' story height	Each	133,200
20' story height	Each	161,000
48" wide, 10' story height	Each	140,700
20' story height	Each	170,000
Safe, Office type, 1 hour rating		
30" x 18" x 18"	Each	2400
60" x 36" x 18", double door	Each	8975
Sound System		
Amplifier, 250 watts	Each	2400
Speaker, ceiling or wall	Each	196
Trumpet	Each	375

Important: See the Reference Section for Location Factors

Model costs calculated for a 3 story building with 16′ story height and 95,000 square feet of floor area

Store, Department, 3 Story

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings		S.F. Ground	3.33	1.11	
1020	Special Foundations	N/A		—	—	—	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	4.77	1.59	3.4%
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing		S.F. Ground	.18	.06	
2020	Basement Walls	4′ foundation wall		L.F. Wall	71	.61	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Concrete slab with metal deck and beams, steel columns		S.F. Floor	25.40	16.93	19.8%
1020	Roof Construction	Metal deck, open web steel joists, beams, columns		S.F. Roof	8.22	2.74	
	B20 Exterior Enclosure						
2010	Exterior Walls	Face brick with concrete block backup	*90% of wall*	S.F. Wall	31.25	10.16	
2020	Exterior Windows	Storefront	*10% of wall*	Each	43.40	1.58	13.5%
2030	Exterior Doors	Revolving and sliding panel, mall-front		Each	10,915	1.60	
	B30 Roofing						
3010	Roof Coverings	Built-up tar and gravel with flashing; perlite/EPS composite insulation		S.F. Roof	5.43	1.81	1.9%
3020	Roof Openings	Roof hatches		S.F. Roof	.21	.07	
C. INTERIORS							
1010	Partitions	Gypsum board on metal studs	*60 S.F. Floor/L.F. Partition*	S.F. Partition	5.52	.92	
1020	Interior Doors	Single leaf hollow metal	*600 S.F. Floor/Door*	Each	1001	1.67	
1030	Fittings	N/A		—	—	—	
2010	Stair Construction	Concrete filled metal pan		Flight	17,125	1.81	25.6%
3010	Wall Finishes	70% paint, 20% vinyl wall covering, 10% ceramic tile		S.F. Surface	4.38	1.46	
3020	Floor Finishes	50% carpet tile, 40% marble tile, 10% terrazzo		S.F. Floor	13.02	13.02	
3030	Ceiling Finishes	Mineral fiber tile on concealed zee bars		S.F. Ceiling	6.51	6.51	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	One hydraulic passenger, one hydraulic freight		Each	322,050	3.39	9.6%
1020	Escalators & Moving Walks	Four escalators		Each	146,063	6.15	
	D20 Plumbing						
2010	Plumbing Fixtures	Toilet and service fixtures, supply and drainage	*1 Fixture/2570 S.F. Floor*	Each	3675	1.43	
2020	Domestic Water Distribution	Gas fired water heater		S.F. Floor	.38	.38	2.3%
2040	Rain Water Drainage	Roof drains		S.F. Roof	1.32	.44	
	D30 HVAC						
3010	Energy Supply	N/A		—	—	—	
3020	Heat Generating Systems	Included in D3050		—	—	—	
3030	Cooling Generating Systems	N/A		—	—	—	7.3 %
3050	Terminal & Package Units	Multizone rooftop unit, gas heating, electric cooling		S.F. Floor	7.23	7.23	
3090	Other HVAC Sys. & Equipment	N/A		—	—	—	
	D40 Fire Protection						
4010	Sprinklers	Sprinklers, light hazard		S.F. Floor	2.31	2.31	3.7%
4020	Standpipes	Standpipes		S.F. Floor	1.37	1.37	
	D50 Electrical						
5010	Electrical Service/Distribution	1200 ampere service, panel board and feeders		S.F. Floor	1.40	1.40	
5020	Lighting & Branch Wiring	High efficiency fluorescent fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	8.68	8.68	12.9%
5030	Communications & Security	Addressable alarm systems, internet wiring and emergency lighting		S.F. Floor	2.41	2.41	
5090	Other Electrical Systems	Emergency generator, 50 kW		S.F. Floor	.33	.33	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		—	—	—	
1020	Institutional Equipment	N/A		—	—	—	
1030	Vehicular Equipment	N/A		—	—	—	0.0 %
1090	Other Equipment	N/A		—	—	—	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		—	—	—	
1040	Special Facilities	N/A		—	—	—	0.0 %
G. BUILDING SITEWORK		**N/A**					
					Sub-Total	99.17	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				*25%*	24.79	
	ARCHITECT FEES				*6%*	7.44	
					Total Building Cost	**131.40**	



Costs per square foot of floor area

Exterior Wall	S.F. Area	85000	115000	145000	175000	205000	235000	265000	295000	325000
	L.F. Perimeter	529	638	723	823	923	951	1037	1057	1132
Face Brick with Concrete Block Back-up	Steel Frame	65.75	64.40	63.30	62.70	62.25	61.60	61.30	60.85	60.65
	R/Conc. Frame	54.05	52.60	**51.55**	50.95	50.55	49.85	49.60	49.10	48.90
Precast Concrete Precast Concrete	Steel Frame	70.20	68.35	66.95	66.20	65.65	64.70	64.30	63.65	63.45
	R/Conc. Frame	57.70	55.90	54.50	53.75	53.20	52.20	51.90	51.25	51.00
Reinforced Concrete Reinforced Concrete	Steel Frame	65.15	63.90	62.95	62.45	62.15	61.55	61.30	60.90	60.70
	R/Conc. Frame	52.35	51.10	50.20	49.70	49.35	48.75	48.50	48.10	47.95
Perimeter Adj., Add or Deduct	Per 100 L.F.	1.45	1.00	0.85	0.70	0.65	0.55	0.45	0.40	0.40
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	0.50	0.35	0.35	0.35	0.40	0.35	0.30	0.30	0.30
Basement—Not Applicable										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $32.20 to $124.54 per S.F.

Common additives

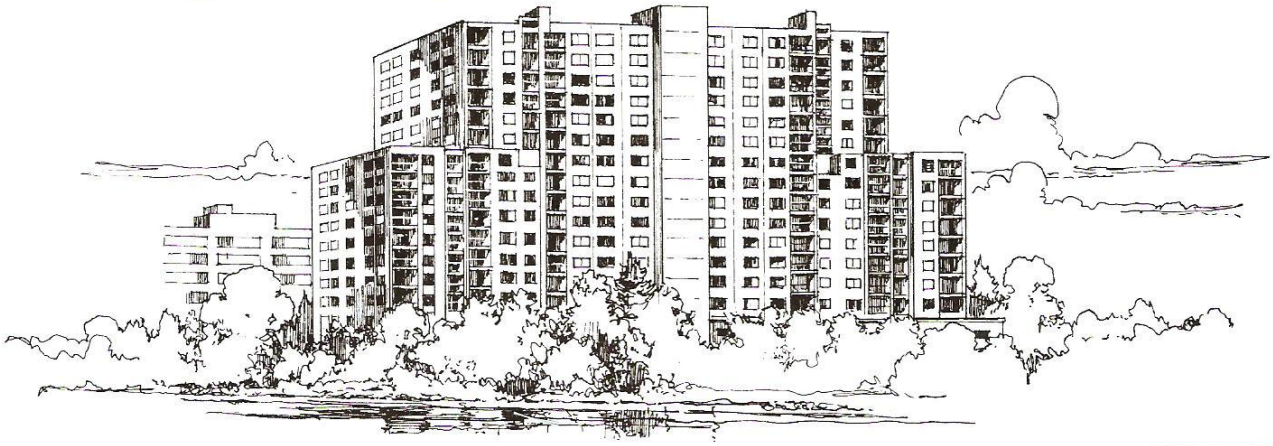
Description	Unit	$ Cost
Elevators, Electric passenger, 5 stops		
2000# capacity	Each	158,200
3500# capacity	Each	166,200
5000# capacity	Each	169,700
Barrier gate w/programmable controller	Each	4075
Booth for attendant, average	Each	12,600
Fee computer	Each	15,100
Ticket spitter with time/date stamp	Each	7125
Mag strip encoding	Each	21,000
Collection station, pay on foot	Each	126,500
Parking control software	Each	25,300 - 108,500
Painting, Parking stalls	Stall	13.70
Parking Barriers		
Timber with saddles, 4" x 4"	L.F.	6.10
Precast concrete, 6" x 10" x 6'	Each	80
Traffic Signs, directional, 12" x 18", high density	Each	84

Important: See the Reference Section for Location Factors

Model costs calculated for a 5 story building with 10′ story height and 145,000 square feet of floor area

Garage, Parking

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings		S.F. Ground	6.30	1.26	
1020	Special Foundations	N/A		–	–	–	
1030	Slab on Grade	6" reinforced concrete with vapor barrier and granular base		S.F. Slab	6.24	1.25	10.0%
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing		S.F. Ground	.18	.04	
2020	Basement Walls	4′ foundation wall		L.F. Wall	67	1.35	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Double tee precast concrete slab, precast concrete columns		S.F. Floor	22.45	17.96	46.2%
1020	Roof Construction	N/A		–	–	–	
	B20 Exterior Enclosure						
2010	Exterior Walls	Face brick with concrete block backup	*40% of story height*	S.F. Wall	30.28	3.02	
2020	Exterior Windows	N/A		–	–	–	7.8%
2030	Exterior Doors	N/A		–	–	–	
	B30 Roofing						
3010	Roof Coverings	N/A		–	–	–	0.0 %
3020	Roof Openings	N/A		–	–	–	
C. INTERIORS							
1010	Partitions	Concrete block		S.F. Partition	29.90	1.15	
1020	Interior Doors	Hollow metal		Each	20,020	.14	
1030	Fittings	N/A		–	–	–	
2010	Stair Construction	Concrete		Flight	3750	.26	4.3%
3010	Wall Finishes	Paint		S.F. Surface	1.56	.12	
3020	Floor Finishes	N/A		–	–	–	
3030	Ceiling Finishes	N/A		–	–	–	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Two hydraulic passenger elevators		Each	164,575	2.27	5.8%
1020	Escalators & Moving Walks	N/A		–	–	–	
	D20 Plumbing						
2010	Plumbing Fixtures	Toilet and service fixtures, supply and drainage	*1 Fixture/18,125 S.F. Floor*	Each	725	.04	
2020	Domestic Water Distribution	Electric water heater		S.F. Floor	.07	.07	4.6%
2040	Rain Water Drainage	Roof drains		S.F. Roof	8.40	1.68	
	D30 HVAC						
3010	Energy Supply	N/A		–	–	–	
3020	Heat Generating Systems	N/A		–	–	–	
3030	Cooling Generating Systems	N/A		–	–	–	0.0 %
3050	Terminal & Package Units	N/A		–	–	–	
3090	Other HVAC Sys. & Equipment	N/A		–	–	–	
	D40 Fire Protection						
4010	Sprinklers	Dry pipe sprinkler system		S.F. Floor	3.75	3.75	9.8%
4020	Standpipes	Standpipes and hose systems		S.F. Floor	.08	.08	
	D50 Electrical						
5010	Electrical Service/Distribution	400 ampere service, panel board and feeders		S.F. Floor	.23	.23	
5020	Lighting & Branch Wiring	T-8 fluorescent fixtures, receptacles, switches and misc. power		S.F. Floor	2.89	2.89	8.5%
5030	Communications & Security	Addressable alarm systems and emergency lighting		S.F. Floor	.11	.11	
5090	Other Electrical Systems	Emergency generator, 7.5 kW		S.F. Floor	.06	.06	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		–	–	–	
1020	Institutional Equipment	N/A		–	–	–	3.0 %
1030	Vehicular Equipment	Ticket dispensers, booths, automatic gates		S.F. Floor	1.17	1.17	
1090	Other Equipment	N/A		–	–	–	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		–	–	–	0.0 %
1040	Special Facilities	N/A		–	–	–	
G. BUILDING SITEWORK		**N/A**					
					Sub-Total	38.90	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				25%	9.73	
	ARCHITECT FEES				6%	2.92	
					Total Building Cost	**51.55**	



Costs per square foot of floor area

Exterior Wall	S.F. Area	95000	112000	129000	145000	170000	200000	275000	400000	600000
	L.F. Perimeter	345	386	406	442	480	510	530	570	630
Ribbed Precast Concrete Panel	Steel Frame	220.60	216.15	211.05	**208.70**	204.75	200.35	191.50	184.30	178.85
	R/Conc. Frame	215.25	210.95	206.15	203.85	200.10	196.00	187.65	180.85	175.80
Face Brick with Concrete Block Back-up	Steel Frame	195.05	191.20	187.15	185.15	181.95	178.50	171.75	166.25	162.15
	R/Conc. Frame	205.95	202.20	198.15	196.10	192.90	189.50	182.75	177.20	173.15
Stucco on Concrete Block	Steel Frame	184.85	181.60	178.35	176.60	174.00	171.40	166.35	162.25	159.25
	R/Conc. Frame	195.85	192.60	189.30	187.55	185.00	182.40	177.35	173.25	170.15
Perimeter Adj., Add or Deduct	Per 100 L.F.	11.50	9.75	8.50	7.50	6.40	5.45	4.00	2.70	1.90
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	3.65	3.50	3.20	3.05	2.80	2.55	1.95	1.40	1.05
***For Basement**, add $34.00 per square foot of basement area*										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $84.80 to $199.00 per S.F.

Common additives

Description	Unit	$ Cost
Appliances		
Cooking range, 30" free standing		
1 oven	Each	460 - 2300
2 oven	Each	1600 - 1850
30" built-in		
1 oven	Each	845 - 2150
2 oven	Each	1950 - 2025
Counter top cook tops, 4 burner	Each	425 - 855
Microwave oven	Each	267 - 750
Combination range, refrig. & sink, 30" wide	Each	1625 - 5250
72" wide	Each	5625
Combination range, refrigerator, sink, microwave oven & icemaker	Each	6400
Compactor, residential, 4-1 compaction	Each	685 - 1075
Dishwasher, built-in, 2 cycles	Each	535 - 955
4 cycles	Each	605 - 1750
Garbage disposer, sink type	Each	201 - 330
Hood for range, 2 speed, vented, 30" wide	Each	279 - 1275
42" wide	Each	475 - 2400
Refrigerator, no frost 10-12 C.F.	Each	570 - 630
18-20 C.F.	Each	750 - 1400

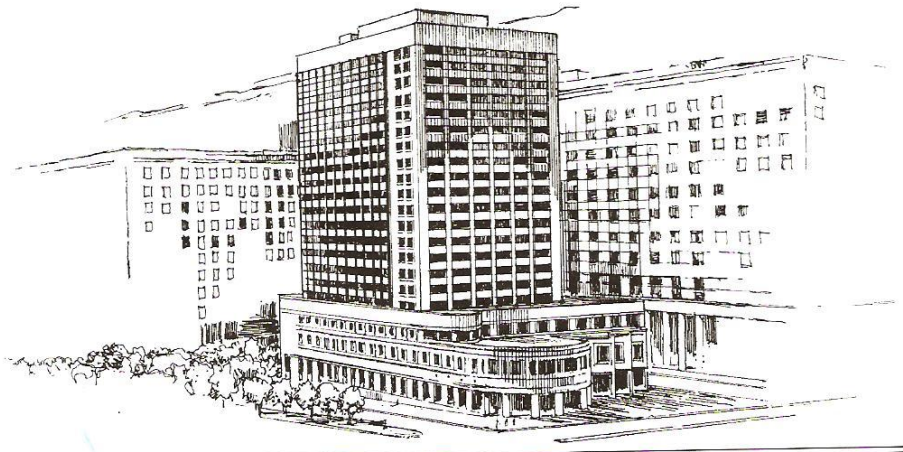
Description	Unit	$ Cost
Closed Circuit Surveillance, One station		
Camera and monitor	Each	1875
For additional camera stations, add	Each	1025
Elevators, Electric passenger, 10 stops		
3000# capacity	Each	430,000
4000# capacity	Each	433,000
5000# capacity	Each	437,000
Additional stop, add	Each	14,000
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	287
Nickel cadmium	Each	845
Laundry Equipment		
Dryer, gas, 16 lb. capacity	Each	900
30 lb. capacity	Each	3600
Washer, 4 cycle	Each	1100
Commercial	Each	1450
Smoke Detectors		
Ceiling type	Each	233
Duct type	Each	525

Important: See the Reference Section for Location Factors

Model costs calculated for a 15 story building with 10'-6" story height and 145,000 square feet of floor area

Apartment, 8-24 Story

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	CIP concrete pile caps		S.F. Ground	8.55	.57	
1020	Special Foundations	Steel H-piles, concrete grade beams		S.F. Ground	199	13.24	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	4.77	.32	9.1%
2010	Basement Excavation	Site preparation for slab, piles and grade beam		S.F. Ground	.28	.02	
2020	Basement Walls	4' Foundation wall		L.F. Wall	71	.26	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Open web steel joists, slab form, concrete, interior steel columns		S.F. Floor	19.18	17.90	11.6%
1020	Roof Construction	Open web steel joists with rib metal deck, interior steel columns		S.F. Roof	5.40	.36	
	B20 Exterior Enclosure						
2010	Exterior Walls	Ribbed precast concrete panel	*87% of wall*	S.F. Wall	45.54	19.02	
2020	Exterior Windows	Aluminum horizontal sliding	*13% of wall*	Each	497	2.07	15.1%
2030	Exterior Doors	Aluminum and glass		Each	3053	2.62	
	B30 Roofing						
3010	Roof Coverings	Built-up tar and gravel with flashing; perlite/EPS composite insulation		S.F. Roof	5.85	.39	0.2%
3020	Roof Openings	N/A		–	–	–	
C. INTERIORS							
1010	Partitions	Gypsum board on concrete block and metal studs	*10 S.F. of Floor/L.F. Partition*	S.F. Partition	13.06	13.06	
1020	Interior Doors	15% solid core wood, 85% hollow core wood	*80 S.F. Floor/Door*	Each	630	7.88	
1030	Fittings	Kitchen cabinets		S.F. Floor	3.51	3.51	
2010	Stair Construction	Concrete filled metal pan		Flight	9825	2.91	24.7%
3010	Wall Finishes	70% paint, 25% vinyl wall covering, 5% ceramic tile		S.F. Surface	1.44	2.87	
3020	Floor Finishes	60% carpet, 30% vinyl composition tile, 10% ceramic tile		S.F. Floor	5.02	5.02	
3030	Ceiling Finishes	Painted gypsum board on resilient channels		S.F. Ceiling	3.71	3.71	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Four geared passenger elevators		Each	483,938	13.35	8.5%
1020	Escalators & Moving Walks	N/A		–	–	–	
	D20 Plumbing						
2010	Plumbing Fixtures	Kitchen, bathroom and service fixtures, supply and drainage	*1 Fixture/210 S.F. Floor*	Each	2734	13.02	
2020	Domestic Water Distribution	Gas fired water heater		S.F. Floor	4.35	4.35	11.1%
2040	Rain Water Drainage	Roof drains		S.F Roof	2.55	.17	
	D30 HVAC						
3010	Energy Supply	Oil fired hot water, baseboard radiation		S.F.Floor	6.65	6.65	
3020	Heat Generating Systems	N/A		–	–	–	
3030	Cooling Generating Systems	Chilled water, air cooled condenser system		S.F. Floor	8.03	8.03	9.3%
3050	Terminal & Package Units	N/A		–	–	–	
3090	Other HVAC Sys. & Equipment	N/A		–	–	–	
	D40 Fire Protection						
4010	Sprinklers	Wet pipe sprinkler system		S.F. Floor	2.57	2.57	2.4%
4020	Standpipes	Standpipe		S.F. Floor	1.21	1.21	
	D50 Electrical						
5010	Electrical Service/Distribution	4000 ampere service, panel board and feeders		S.F. Floor	2.12	2.12	
5020	Lighting & Branch Wiring	Incandescent fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	7.31	7.31	7.9%
5030	Communications & Security	Alarm systems, internet wiring, emergency lighting, antenna, intercom and security television		S.F. Floor	2.80	2.80	
5090	Other Electrical Systems	Emergency generator, 80 kW		S.F. Floor	.19	.19	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		–	–	–	
1020	Institutional Equipment	N/A		–	–	–	0.0 %
1030	Vehicular Equipment	N/A		–	–	–	
1090	Other Equipment	N/A		–	–	–	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		–	–	–	0.0 %
1040	Special Facilities	N/A		–	–	–	
G. BUILDING SITEWORK		**N/A**					
					Sub-Total	157.50	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				25%	39.39	
	ARCHITECT FEES				6%	11.81	
					Total Building Cost	**208.70**	



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	169.40	163.75	159.10	154.95	151.85	**149.45**	142.50	138.65	136.25
	R/Conc. Frame	161.55	156.05	151.60	147.45	144.45	142.10	135.30	131.55	129.20
Face Brick with Concrete Block Back-up	Steel Frame	162.55	157.70	153.75	150.20	147.55	145.50	139.55	136.30	134.25
	R/Conc. Frame	179.20	174.45	170.65	167.15	164.65	162.65	156.80	153.65	151.60
Precast Concrete Panel With Exposed Aggregate	Steel Frame	168.40	162.85	158.35	154.25	151.25	148.90	142.10	138.30	135.90
	R/Conc. Frame	160.55	155.15	150.80	146.80	143.90	141.60	134.85	131.25	128.90
Perimeter Adj., Add or Deduct	Per 100 L.F.	8.45	7.05	6.05	5.15	4.45	3.95	2.55	1.65	1.25
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	3.40	3.00	2.70	2.40	2.15	2.05	1.40	1.20	1.00
For Basement, add $36.55 per square foot of basement area										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $93.95 to $229.25 per S.F.

Common additives

Description	Unit	$ Cost
Clock System		
20 room	Each	16,000
50 room	Each	39,100
Directory Boards, Plastic, glass covered		
30" x 20"	Each	605
36" x 48"	Each	1325
Aluminum, 24" x 18"	Each	585
36" x 24"	Each	685
48" x 32"	Each	975
48" x 60"	Each	2025
Elevators, Electric passenger, 10 stops		
3000# capacity	Each	430,000
4000# capacity	Each	433,000
5000# capacity	Each	437,000
Additional stop, add	Each	14,000
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	287
Nickel cadmium	Each	845

Description	Unit	$ Cost
Escalators, Metal		
32" wide, 10' story height	Each	139,700
20' story height	Each	168,000
48" wide, 10' story height	Each	148,200
20' story height	Each	176,000
Glass		
32" wide, 10' story height	Each	133,200
20' story height	Each	161,000
48" wide, 10' story height	Each	140,700
20' story height	Each	170,000
Smoke Detectors		
Ceiling type	Each	233
Duct type	Each	525
Sound System		
Amplifier, 250 watts	Each	2400
Speaker, ceiling or wall	Each	196
Trumpet	Each	375
TV Antenna, Master system, 12 oulet	Outlet	320
30 oulet	Outlet	207
100 outlet	Outlet	199

Important: See the Reference Section for Location Factors

Model costs calculated for a 16 story building with 10′ story height and 260,000 square feet of floor area

Office, 11-20 Story

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	CIP concrete pile caps		S.F. Ground	9.12	.57	
1020	Special Foundations	Steel H-piles, concrete grade beams		S.F. Ground	61	3.79	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	4.77	.30	4.5%
2010	Basement Excavation	Site preparation for slab, piles and grade beams		S.F. Ground	.31	.02	
2020	Basement Walls	4′ foundation wall		L.F. Wall	76	.36	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Concrete slab, metal deck, beams		S.F. Floor	25.39	23.80	21.5%
1020	Roof Construction	Metal deck, open web steel joists, beams, columns		S.F. Roof	6.72	.42	
	B20 Exterior Enclosure						
2010	Exterior Walls	N/A		–	–	–	
2020	Exterior Windows	Double glazed heat absorbing, tinted plate glass wall panels	*100% of wall*	Each	42.60	13.89	12.9 %
2030	Exterior Doors	Double aluminum & glass doors		Each	5754	.61	
	B30 Roofing						
3010	Roof Coverings	Single ply membrane, fully adhered; perlite/EPS composite insulation		S.F. Roof	5.12	.32	0.3%
3020	Roof Openings	N/A		–	–	–	
C. INTERIORS							
1010	Partitions	Gypsum board on metal studs	*30 S.F. Floor/L.F. Partition*	S.F. Partition	9.90	2.64	
1020	Interior Doors	Single leaf hollow metal	*400 S.F. Floor/Door*	Each	1001	2.50	
1030	Fittings	Toilet partitions		S.F. Floor	.40	.40	
2010	Stair Construction	Concrete filled metal pan		Flight	14,675	1.97	17.3%
3010	Wall Finishes	60% vinyl wall covering, 40% paint		S.F. Surface	1.39	.74	
3020	Floor Finishes	60% carpet tile, 30% vinyl composition tile, 10% ceramic tile		S.F. Floor	4.70	4.70	
3030	Ceiling Finishes	Mineral fiber tile on concealed zee bars		S.F. Ceiling	6.51	6.51	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Four geared passenger elevators		Each	483,600	7.44	6.6%
1020	Escalators & Moving Walks	N/A		–	–	–	
	D20 Plumbing						
2010	Plumbing Fixtures	Toilet and service fixtures, supply and drainage	*1 Fixture/1345 S.F. Floor*	Each	4533	3.37	
2020	Domestic Water Distribution	Oil fired water heater		S.F. Floor	.28	.28	3.4%
2040	Rain Water Drainage	Roof drains		S.F. Roof	2.56	.16	
	D30 HVAC						
3010	Energy Supply	N/A		–	–	–	
3020	Heat Generating Systems	Boiler, heat exchanger and fans		Each	404,100	2.12	
3030	Cooling Generating Systems	Chilled water, fan coil units		S.F. Floor	13.87	13.87	14.2 %
3050	Terminal & Package Units	N/A		–	–	–	
3090	Other HVAC Sys. & Equipment	N/A		–	–	–	
	D40 Fire Protection						
4010	Sprinklers	Sprinkler system, light hazard		S.F. Floor	2.63	2.63	2.7%
4020	Standpipes	Standpipes and hose systems		S.F. Floor	.45	.45	
	D50 Electrical						
5010	Electrical Service/Distribution	2400 ampere service, panel board and feeders		S.F. Floor	1.07	1.07	
5020	Lighting & Branch Wiring	High efficiency fluorescent fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	11.26	11.26	16.8%
5030	Communications & Security	Addressable alarm systems, internet and phone wiring, emergency lighting		S.F. Floor	6.06	6.06	
5090	Other Electrical Systems	Emergency generator, 200 kW, uninterruptible power supply		S.F. Floor	.55	.55	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		–	–	–	
1020	Institutional Equipment	N/A		–	–	–	0.0 %
1030	Vehicular Equipment	N/A		–	–	–	
1090	Other Equipment	N/A		–	–	–	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		–	–	–	0.0 %
1040	Special Facilities	N/A		–	–	–	
G. BUILDING SITEWORK		**N/A**					
					Sub-Total	112.80	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				*25%*	28.19	
	ARCHITECT FEES				*6%*	8.46	
					Total Building Cost	**149.45**	

Appendix C

D4COST Estimating Software Report

Statement of Probable Cost

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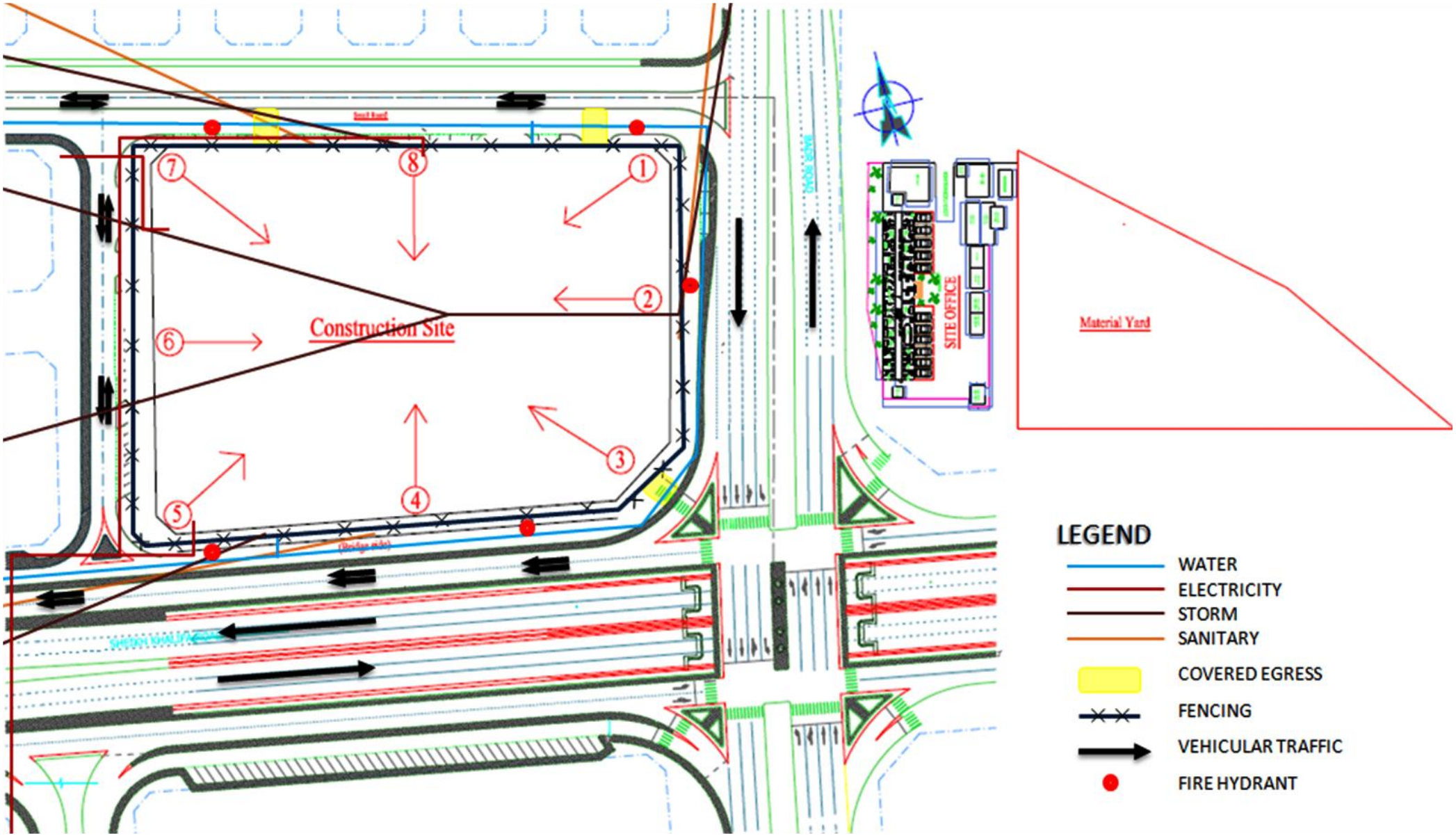
Division		Percent	Sq. Cost	Amount
00	Bidding Requirements	9.94	14.48	33,309,140
03	Concrete	9.63	14.02	32,246,903
04	Masonry	15.58	22.69	52,182,506
05	Metals	0.20	0.30	680,656
06	Wood & Plastics	1.87	2.72	6,257,605
07	Thermal & Moisture Protection	1.35	1.97	4,536,678
08	Doors & Windows	6.17	8.99	20,671,619
09	Finishes	14.52	21.15	48,653,178
10	Specialties	0.49	0.72	1,654,923
11	Equipment	0.06	0.09	206,260
12	Furnishings	0.37	0.54	1,237,557
14	Conveying Systems	3.15	4.59	10,562,757
15	Mechanical	23.09	33.63	77,358,214
16	Electrical	13.56	19.75	45,422,370
Total Building Costs		100.00	145.64	334,980,366

Appendix D

Site Plan of Existing Conditions


Construction Site
SITE OFFICE
Material Yard
LEGEND
WATER
ELECTRICITY
STORM
SANITARY
COVERED EGRESS
FENCING
VEHICULAR TRAFFIC
FIRE HYDRANT