

Granby Tower
515 Granby Street
Norfolk Virginia



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Construction Management
Technical Assignment #1
Faculty Advisor: Dr. Riley
October 5, 2007

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Executive Summary

This technical report gives an overview of the construction management process for the Granby Tower project in Norfolk, Virginia. The total time for construction is approximately 863 days in duration. In this report the following can be found: a summary schedule, a summary of the main building systems throughout the building, a cost evaluation, a site plan show the existing conditions, local conditions such as typical construction methods used in the area, information about the owner, the project delivery method, and a staffing plan employed by the General Contractor/Construction Manager.

When complete this building will be the tallest in Norfolk at 450 ft. tall (31 stories). Not only will it be the tallest building in Norfolk but it will be the second tallest building in the state of Virginia. With the project being in downtown Norfolk site congestion can be a big issue. Not only is it congest near the site, it is congested on the site where the building will take up the majority of site leaving a very limited amount of space for lay down areas and shakeout areas.

Project Schedule Summary

(Please refer to schedule on the following page.)

Foundation

The foundation for Granby Tower consists of deep mat foundations with pre-stressed concrete piles. There are 1233 piles in all throughout the foundation of the building. Approximately one month after the start of driving the piles the mat foundation begins. The slab-on-grade for the parking garage and retail structure is started first.

Structural

The structural system is mainly cast in place concrete with post-tensioned slabs. This make up the structure for the majority of the building. However there is some wood framed construction in the retail areas and the town homes. The structural sequence starts with the parking garage and the retail areas is started first. As this is completed the remaining floors are constructed.

Finishes

Once the MEP trades are finished on a certain level finishing can begin. Once again the finishes start in the lower level and move upwards as construction is being completed. This process can take a very long time since a lot of coordination is required and there are many inspections that take place to make sure everything is done correctly before the units are complete. The private living units are the first to be completed then the public spaces are completed.

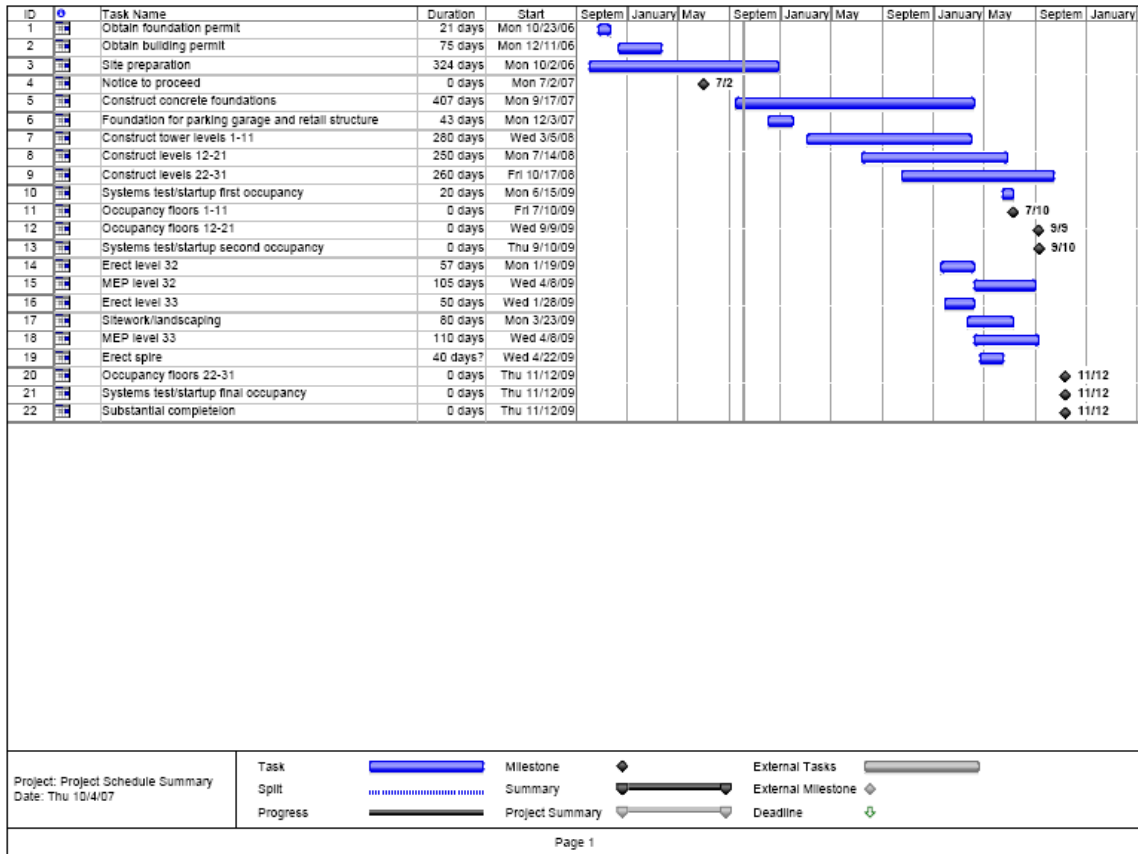


Figure 1- Project Schedule

Building Systems Summary

Yes	No	Work Scope	If yes, address these questions / issues
X		Demolition Required?	Types of materials, lead paint, or asbestos?
X		Structural Steel Frame	Type of bracing, composite slab?, crane size / type / location(s)
X		Cast in Place Concrete	Horiz. And Vert. Formwork types, concrete placement methods
	X	Precast Concrete	Casting location, connection methods, crane size / type / location (s)
X		Mechanical System	Mech. room locations, system type, types of distribution systems, types of fire suppression
X		Electrical System	Size/ capacity, redundancy
X		Masonry	Load bearing or veneer, connection details, scaffolding
X		Curtain wall	Materials included, construction methods, design responsibility
X		Support of Excavation	Type of excavation support system, dewatering system, permanent vs. temporary

Demolition: Some demolition was required before construction could begin. There were two one to two story buildings located within the construction limits. The property also consisted of a paved parking area.

Structural Steel Frame: Consists of structural tubing, w-shapes, other rolled plates/shapes, connection bolts, and anchor rods. Connections consist of shear connections and fillet welds.

Cast in Place Concrete: Vertical formwork was used for this part of the project. Concrete was placed via direct pour for the bottom floors and via chute for the upper floors.

Mechanical System: The mechanical rooms are located on the top two floors of the building. The main mechanical system is a four pipe system. Some fans and air-conditioning units are located on the roof.

Electrical System: Riser system has sub panels every three floors. Units run on 120A/208V circuits while the equipment runs on 277A/480V circuits. Has a 500KW diesel emergency generator.

Masonry: Hollow load-bearing masonry units shall conform to ASTM C 90 and be made with lightweight aggregate.

Curtain Wall: The façade is comprised of a curtain wall system with metal panels. The curtain wall will be hand set for most of the skin and the part that is to be constructed as the store front will be constructed in place. The façade will also contain operable aluminum framed windows.

Support of Excavation: Dewatering could arise as an issue as construction progresses. The groundwater on site can fluctuate, causing the issue of not knowing whether or not dewatering is completely necessary.

Project Cost Evaluation

Actual Building Construction Cost

- \$110,030,520
- At 717,233 sq.ft - \$153.41/sq.ft

Total Project Cost

- \$180,000,000
- At 717,233 sq.ft - \$250.96/sq.ft

Major Building Systems Costs

- Mechanical/Plumbing Systems
 - \$17,631,324
 - \$24.58/sq.ft
- Electrical System
 - \$7,969,594
 - \$11.11/sq.ft
- Structural System
 - \$30,542,142
 - \$42.58/sq.ft

D4 Parametric Cost Analysis (refer to Appendix A)

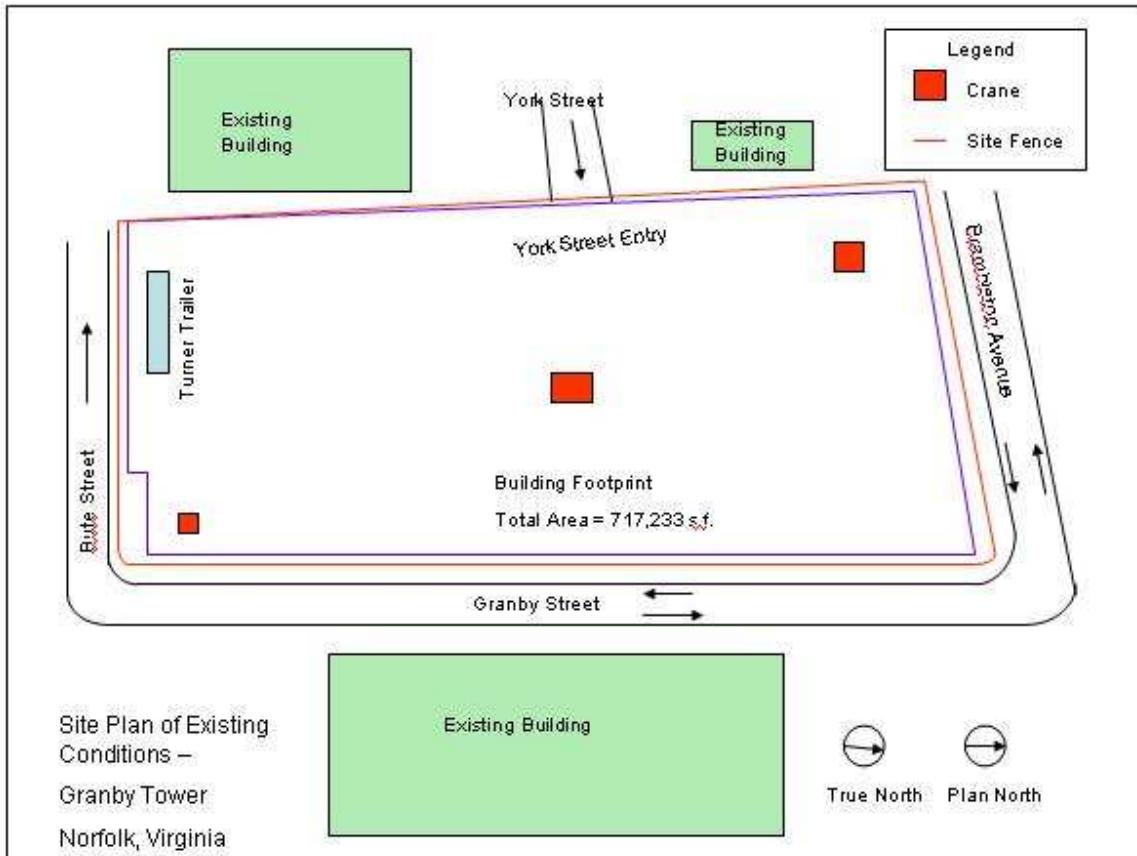
- \$118.43/sq.ft
- \$84,941,052 – total cost

2007 RS Means Square Foot Estimate (refer to Appendix B)

- Used a M.030 apartment, 8-24 story
- \$141.65/sq.ft
- Location factor for Norfolk, Virginia: 0.88
- \$124.65/sq.ft with change for location
- \$89,404,528 – total cost

The main reason why there is such a big difference between the actual costs and the ones determined by RS Means and D4 is because neither one has an estimate for a mixed use building such as Granby Tower. I compared it with an apartment building using RS Means and a condominium using D4, because the majority of the building is comprised of townhouses and condominiums. Also they don't consider as much of the details that would be taken into consideration when comprising an estimate.

Site Plan



Local Conditions

Regional Construction:

In the Norfolk, Virginia area deep foundations are a preferred method of construction. This is true because of the soil conditions in the area. Norfolk is very close to the Chesapeake Bay and the soil allows for settling.

Soil/Subsurface Water Conditions:

There are four different layers of soil on site. The first layer consists of clay with varying amounts of silt and sand. The second layer consists of sand with varying amounts of silt and clay. The third layer consists of clay with varying amounts of silt, sand, and marine shell fragments. The fourth and final layer consists of sand with varying amounts of silt, clay and marine shell fragments. There are also paving and fill material near the soil surface above the previous four layers of soil. However these materials vary throughout the site and are inconsistent. They include asphalt paving, concrete paving; the types of fill include a very loose to medium dense sand and soft clay with varying amounts of silt, clay, construction debris, and organics. As mentioned above these materials change throughout the site, however the four layers of soil are consistent throughout the site. The groundwater table is six to seven feet below grade.

Recycling/Tipping Fees:

Recycling fees in the Norfolk area are about \$11.20 for a 95 gallon container. The tipping fees for waste materials differ depending on what the material is. Yard waste taken to the Norfolk Transfer Station is \$39/ton. Solid waste is only accepted at the regional landfill. Construction and demolition waste is \$7.25/cy.

Parking:

Parking can be an issue since the construction is taking place in downtown Norfolk; however there are several parking garages in the area. Also there is meter parking along the street.

Client Information

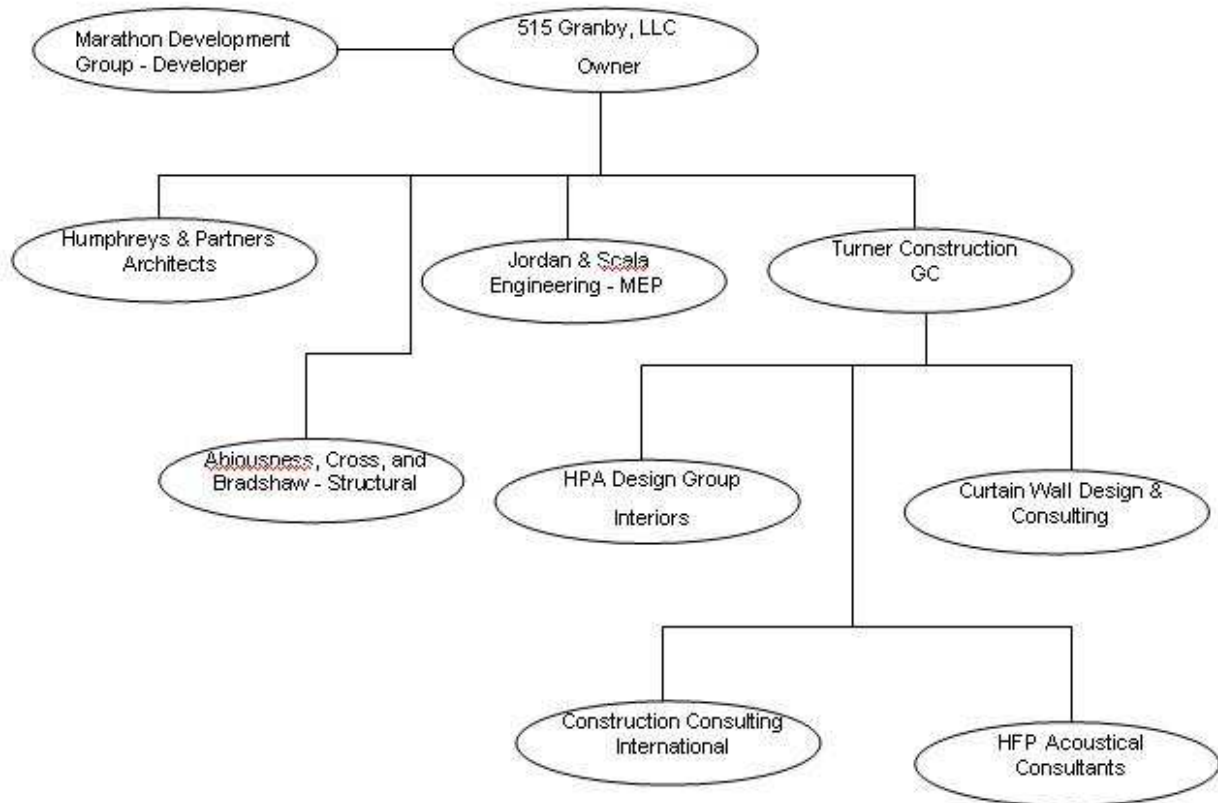
The owner of this project is 515 Granby, LLC. While they are the owner Marathon Development Group Inc. is the developer. Marathon has been involved in restoring historic landmarks in the area. Not only do they restore historic landmarks their goal is to provide a unique living experience for homeowners. They are building this building to give people a chance to live in a historic neighborhood in the largest building in Norfolk and the second largest in the state of Virginia.

Cost and schedule are a concern for the owner as they are on most any project. The owner wants the project to be done on time and on budget. Maintaining schedule is very critical for this project since approximately half of the 311 condominiums units have already been sold, so it is very critical that this project is completed on time. If the building is not finished on time the people who have already bought condominiums will most likely back and the owner will lose a good amount of money. The same can be said about staying within budget. If the project comes in over budget and the owner has to pay for it, most likely they will have to raise the price of the condominiums to make their money back. This could irritate buyers and will either keep people from buying or will force others to back out.

The keys to completing this project to the owner's satisfaction would be for it to be done on time and under budget. The owner will also expect quality work, these condominiums and town homes aren't exactly cheap. People are paying for a quality product and expect to get one in return.

Project Delivery Method

Turner Construction was hired for this project under a Guaranteed Maximum Price (GMP).

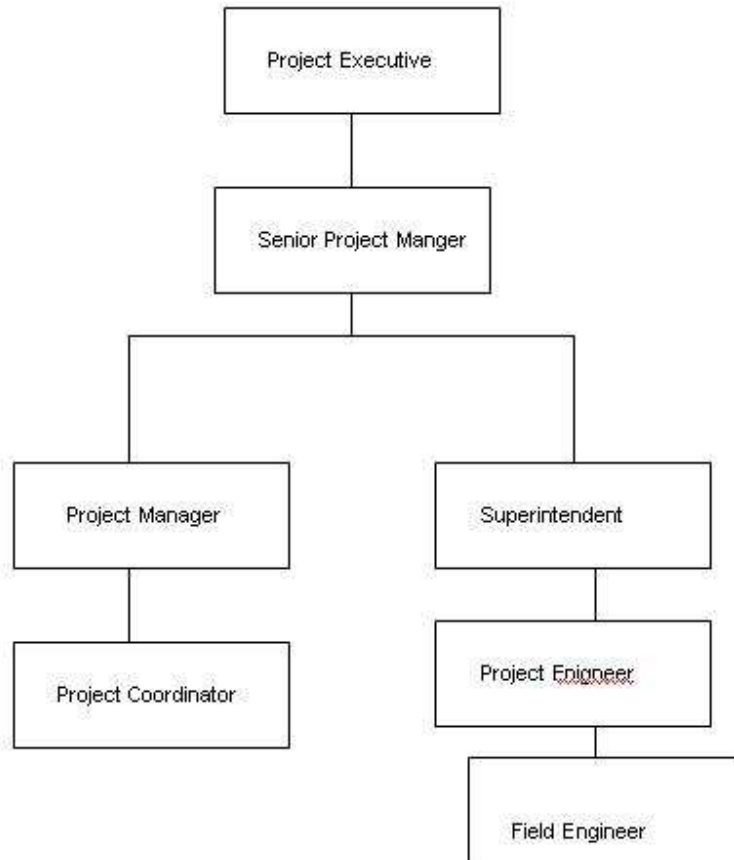


Contract types

- Contracts with owner
 - Humphreys and Partners Architect (Architect)
 - Lump sum
 - Abiousness, Cross, and Bradshaw (Structural Engineer)
 - Lump sum
 - Jordan and Scala Engineering (MEP Engineer)
 - Lump sum
 - Turner Construction (General Contractor/CM)
 - Guaranteed maximum price (GMP)
- Contracts with GC
 - HPA Design Group (Interior Subcontractor)
 - Lump sum
 - Curtain Wall Design and Consulting (Curtain wall Subcontractor)
 - Lump sum
 - Construction Consulting International (Waterproofing Subcontractor)
 - Lump sum
 - HFP Acoustical Consultants (Acoustics Subcontractor)
 - Lump sum

Staffing Plan

The following is the (assumed) staffing plan for the Granby Tower project for Turner Construction. Staff was determined based on class experience and work experience. Will update and make correction when information is received.



Granby Tower
Norfolk Virginia

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Construction Management

Appendix A (D4 Cost Estimate)

Estimate of Probable Cost

d - Sep 2007 - VA - Norfolk

Prepared By:		Prepared For:	
	Fax:		Fax:
Building Sq. Size:	717233	Site Sq. Size:	435600
Bid Date:	11/1/2003	Building use:	Residential
No. of floors:	4	Foundation:	PIL
No. of buildings:	1	Exterior Walls:	PRE
Project Height:	50.8	Interior Walls:	MAS
1st Floor Height:	11.8	Roof Type:	BUP
1st Floor Size:	15000	Floor Type:	CON
		Project Type:	NEW

Division		Percent	Sq. Cost	Amount
00	Bidding Requirements	0.31	0.37	263,893
	Permits	0.31	0.37	263,893
01	General Requirements	14.29	16.83	12,070,788
	Builder's Risk Insurance	0.12	0.14	102,625
	Building Permit Fees	0.43	0.51	366,518
	Change Orders	3.18	3.75	2,686,167
	Contractor's Fee	3.41	4.01	2,877,167
	Equipment Tools	0.14	0.16	118,019
	Field Labor, Safety, Clean-up	1.29	1.52	1,092,224
	Field Supervision	1.15	1.35	967,608
	General Conditions	1.14	1.34	963,209
	General Requirements	1.56	1.84	1,319,465
	Insurance (General Condition Items)	0.42	0.49	354,789
	MEP Consulting Fees	0.63	0.74	532,624
	MOT, Traffic Control	0.20	0.24	168,598
	Temporary Utilities	0.39	0.45	326,201
	Trash Removal/Hoisting	0.23	0.27	195,574
03	Concrete	36.01	42.41	30,417,097
	2nd FI Post Tension-1st FI Columns	4.25	5.01	3,591,877
	3rd FI Post Tension-2nd FI Columns	4.25	5.01	3,591,877
	4th FI Post Tension-3rd FI Columns	4.25	5.01	3,591,877
	Architectural Precast North Elevati on	2.60	3.07	2,199,108
	Architectural Precast South Elevati on	2.60	3.07	2,199,108
	Architectural Precast West Elevatio n	6.77	7.97	5,719,147
	Elevator Shaft	0.69	0.82	586,429
	Pile Caps/Foundations	3.47	4.09	2,932,144
	Retaining Wall	0.31	0.37	263,893
	Roof Post Tension-4th FI Columns	4.25	5.01	3,591,877
	Slab-On-Grade	1.24	1.46	1,050,206
	Stair Enclosures/Shear Wall	1.30	1.53	1,099,554
04	Masonry	1.04	1.23	879,643
	Masonry	1.04	1.23	879,643
05	Metals	3.38	3.98	2,855,176
	Exterior Handrails	1.52	1.79	1,286,478
	Metal Stairs (2)	1.13	1.33	952,947
	Misc. Metals	0.03	0.04	29,321
	Roof HVAC Screen Wall	0.69	0.82	586,429
06	Wood & Plastics	3.54	4.17	2,992,253
	Closets	0.22	0.26	185,458
	Millwork/Countertops	2.60	3.07	2,199,108
	Rough Carpentry-Blocking	0.46	0.54	389,975
	Wood Trim/Base	0.26	0.30	217,712
07	Thermal & Moisture Protection	2.32	2.73	1,957,719
	Balcony Coatings	0.29	0.34	244,101

Friday, October 5, 2007

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	Dampproofing/Caulking	0.49	0.58	416,218
	Modified Bituminous Roof System	1.54	1.81	1,297,401
08	Doors & Windows	4.72	5.56	3,991,088
	Aluminum Windows & Doors	2.67	3.15	2,256,725
	Doors, Frames & Hardware	1.63	1.92	1,375,176
	Mirrors	0.12	0.14	102,625
	Shower Doors	0.30	0.36	256,563
09	Finishes	15.89	18.71	13,420,117
	Carpet/VCT	1.08	1.27	908,965
	Drywall	4.06	4.78	3,430,609
	Floor Topping	0.38	0.45	322,536
	Metal Studs/Drywall/Plaster	4.76	5.61	4,024,368
	Painting	2.60	3.07	2,199,108
	Special Coating - Stain	0.12	0.15	105,191
	Stone Flooring	0.14	0.17	120,277
	Tile	0.78	0.92	659,732
	Wood Floor	1.95	2.30	1,649,331
10	Specialties	0.57	0.67	477,940
	Entrance Canopy	0.09	0.10	73,304
	Fire Extinguishers	0.02	0.02	15,394
	Lockers	0.03	0.04	26,389
	Mailboxes	0.07	0.08	58,643
	Signage	0.09	0.10	73,304
	Toilet Accessories	0.27	0.32	230,906
11	Equipment	1.28	1.50	1,079,029
	Appliances	1.28	1.50	1,079,029
12	Furnishings	0.33	0.39	278,480
	Garage Entrance Door	0.23	0.28	197,920
	Trash Chute	0.10	0.11	80,561
14	Conveying Systems	0.95	1.12	806,706
	Elevator System	0.95	1.12	806,706
15	Mechanical	8.93	10.52	7,544,407
	Fire Protection	1.29	1.51	1,086,359
	Fixtures	0.43	0.51	366,518
	HVAC/Ductwork/Piping	3.73	4.39	3,152,055
	Plumbing	3.48	4.10	2,939,475
16	Electrical	6.44	7.58	5,439,025
	CATV/Audio/Music	0.17	0.20	146,607
	Distribution Panels	0.26	0.31	219,911
	Electrical	3.75	4.42	3,167,449
	Fire Alarm	0.17	0.20	146,607
	Panel Boards	0.26	0.31	219,911
	Rough-In/Wire/Conduit	1.82	2.15	1,538,540
Total Building Costs		100.00	117.78	84,473,362
02	Site Work	100.00	1.07	467,689
	Asphalt Pavement/Striping	7.87	0.08	36,793
	Auger Cast Piling	38.20	0.41	178,649
	Building Demolition	4.89	0.05	22,873
	Chain Link Fence	0.79	0.01	3,709
	Concrete Sidewalks/Curbs	3.67	0.04	17,170
	Dewatering System	5.77	0.06	26,982
	Earthwork	6.82	0.07	31,887
	Gravity Wall	1.84	0.02	8,585
	Landscape Irrigation	6.56	0.07	30,661
	Utilities	23.60	0.25	110,380
Total Non-Building Costs		100.00	1.07	467,689
Total Project Costs		--	--	84,941,052

Granby Tower
Norfolk Virginia

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Construction Management

Appendix B (RS Means Cost Data)

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL **M.030** **Apartment, 8-24 Story**



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	175.45	171.85	167.65	165.75	162.55	158.95	151.90	145.95	141.65
	R/Conc. Frame	163.05	159.50	155.60	153.75	150.65	147.30	140.60	135.05	131.00
Face Brick with Concrete Block Back-up	Steel Frame	156.40	153.15	149.60	147.85	145.10	142.05	136.25	131.30	127.75
	R/Conc. Frame	158.00	154.70	151.15	149.50	146.70	143.70	137.95	133.10	129.55
Stucco on Concrete Block	Steel Frame	147.35	144.50	141.70	140.25	138.00	135.65	131.35	127.75	125.10
	R/Conc. Frame	148.90	146.05	143.30	141.85	139.65	137.35	133.10	129.50	126.90
Perimeter Adj., Add or Deduct	Per 100 L.F.	9.20	7.70	6.75	5.95	5.05	4.35	3.05	2.15	1.40
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	3.05	2.75	2.65	2.45	2.25	2.05	1.50	1.15	.80

For Basement, add \$29.70 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 \$74.05 to \$173.85 per S.F.

Common additives

Description	Unit	\$ Cost	Description	Unit	\$ Cost
Appliances			Closed Circuit Surveillance, One station	Each	1675
Cooking range, 30" free standing			Camera and monitor	Each	910
1 oven	Each	370 - 1875	For additional camera stations, add		
2 oven	Each	1825 - 1975	Elevators, Electric passenger, 10 stops	Each	270,500
30" built-in			3000# capacity	Each	273,000
1 oven	Each	600 - 2050	4000# capacity	Each	278,000
2 oven	Each	1650 - 2250	5000# capacity	Each	7675
Counter top cook tops, 4 burner	Each	325 - 820	Additional stop, add		
Microwave oven	Each	225 - 720	Emergency lighting, 25 watt, battery operated	Each	265
Combination range, refrig. & sink, 30" wide	Each	1450 - 4000	Lead battery	Each	770
72" wide	Each	4300	Nickel cadmium		
Combination range, refrigerator, sink, microwave oven & icemaker	Each	5125	Laundry Equipment		
Compactor, residential, 4-1 compaction	Each	575 - 725	Dryer, gas, 16 lb. capacity	Each	320
Dishwasher, built-in, 2 cycles	Each	560 - 870	30 lb. capacity	Each	3525
4 cycles	Each	580 - 1125	Washer, 4 cycle	Each	995
Garbage disposer, sink type	Each	161 - 281	Commercial	Each	1400
Hood for range, 2 speed, vented, 30" wide	Each	242 - 980	Smoke Detectors		
42" wide	Each	465 - 1225	Ceiling type	Each	171
Refrigerator, no frost 10-12 C.F.	Each	520 - 670	Duct type	Each	440
18-20 C.F.	Each	670 - 1050			

Important: See the Reference Section for Location Factors

Location Factors

STATE/ZIP	CITY	Residential	Commercial
VIRGINIA			
220-221	Fairfax	1.02	.93
222	Arlington	1.04	.93
223	Alexandria	1.06	.94
224-225	Fredericksburg	.95	.89
226	Winchester	.93	.87
227	Culpeper	1.00	.89
228	Harrisonburg	.90	.86
229	Charlottesville	.92	.87
230-232	Richmond	1.01	.88
233-235	Norfolk	1.01	.88
236	Newport News	.92	.86
237	Portsmouth	.95	.89
238	Petersburg	.91	.82
239	Farmville	.99	.87
240-241	Roanoke	.86	.82
242	Bristol	.84	.81
243	Puaski	.93	.85
244	Staunton	.97	.87
245	Lynchburg	.85	.81
246	Grundy		
WASHINGTON			
980-981,987	Seattle	1.02	1.04
982	Everett	1.05	1.02
983-984	Tacoma	1.01	1.03
985	Olympia	1.01	1.01
986	Vancouver	.98	1.02
988	Wenatchee	.93	.96
989	Yakima	.97	.98
990-992	Spokane	.99	.95
993	Richland	.97	.97
994	Clarkston	.97	.95
WEST VIRGINIA			
247-248	Bluefield	.88	.89
249	Lewisburg	.89	.92
250-253	Charleston	.97	.95
254	Martinsburg	.86	.90
255-257	Huntington	1.01	.99
258-259	Beckley	.90	.93
260	Wheeling	.93	.97
261	Parkersburg	.92	.96
262	Buckhannon	.92	.96
263-264	Clarksburg	.93	.96
265	Morgantown	.92	.95
266	Gassaway	.88	.93
267	Romney	.90	.94
268	Petersburg		
WISCONSIN			
530,532	Milwaukee	1.07	1.02
531	Kenosha	1.04	1.00
534	Racine	1.02	1.00
535	Beloit	1.00	.98
537	Madison	.99	.97
538	Lancaster	.97	.94
539	Portage	.96	.95
540	New Richmond	1.00	.96
541-543	Green Bay	1.01	.97
544	Wausau	.95	.94
545	Rhinelander	.95	.96
546	La Crosse	.98	.97
547	Eau Claire	.99	.98
548	Superior	.99	.98
549	Oshkosh	.95	.94
WYOMING			
820	Cheyenne	.84	.86
821	Yellowstone Nat. Pk.	.75	.82
822	Wheatland	.75	.82
823	Rawlins	.76	.83
824	Worland	.75	.81
825	Riverton	.74	.81
826	Casper	.78	.83
827	Newcastle	.74	.81
828	Sheridan	.80	.84
829-831	Rock Springs	.79	.83

STATE/ZIP	CITY	Residential	Commercial
CANADIAN FACTORS (reflect Canadian currency)			
ALBERTA			
	Calgary	1.14	1.11
	Edmonton	1.13	1.12
	Fort McMurray	1.09	1.06
	Lethbridge	1.10	1.07
	Lloydminster	1.09	1.07
	Medicine Hat	1.10	1.06
	Red Deer	1.10	1.06
BRITISH COLUMBIA			
	Kamloops	1.08	1.09
	Prince George	1.08	1.09
	Vancouver	1.09	1.10
	Victoria	1.03	1.04
MANITOBA			
	Brandon	1.06	1.01
	Portage la Prairie	1.06	1.01
	Winnipeg	1.05	1.03
NEW BRUNSWICK			
	Bathurst	.97	.96
	Dalhousie	.97	.96
	Fredericton	1.05	.99
	Moncton	.98	.97
	Newcastle	.97	.96
	Saint John	1.05	1.00
NEWFOUNDLAND			
	Corner Brook	.99	.99
	St. John's	1.01	1.00
NORTHWEST TERRITORIES			
	Yellowknife	1.10	1.08
NOVA SCOTIA			
	Dartmouth	1.00	1.01
	Halifax	1.02	1.03
	New Glasgow	1.00	1.00
	Sydney	.99	.99
	Yarmouth	1.00	1.00
ONTARIO			
	Barrie	1.17	1.11
	Brantford	1.19	1.12
	Cornwall	1.19	1.11
	Hamilton	1.19	1.14
	Kingston	1.19	1.11
	Kitchener	1.11	1.06
	London	1.17	1.11
	North Bay	1.15	1.10
	Oshawa	1.17	1.11
	Ottawa	1.19	1.11
	Owen Sound	1.15	1.10
	Peterborough	1.16	1.10
	Sarnia	1.19	1.13
	Sudbury	1.09	1.05
	Thunder Bay	1.15	1.06
	Toronto	1.20	1.14
	Windsor	1.14	1.06
PRINCE EDWARD ISLAND			
	Charlottetown	.95	.96
	Summerside	.94	.96
QUEBEC			
	Cap-de-la-Madeleine	1.18	1.06
	Charlesbourg	1.18	1.06
	Chicoutimi	1.20	1.08
	Gatineau	1.16	1.06
	Laval	1.17	1.06
	Montréal	1.21	1.11
	Quebec	1.22	1.11
	Sherbrooke	1.17	1.06
	Trois Rivières	1.18	1.06
SASKATCHEWAN			
	Moose Jaw	.97	.97
	Prince Albert	.96	.95
	Regina	.99	.98
	Saskatoon	.97	.97
YUKON			
	Whitehorse	.96	.96