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Construction Management
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Canton Crossing Tower
1501 S. Highland Avenue
Baltimore, Maryland 21224

Existing Construction Conditions

Table of Contents

Executive Summary

The Canton Crossing Tower is the first of 14+ buildings being built in Hale Properties' Planned Unit development of the 65 acre campus in Canton. The southeastern portion of Baltimore City is changing from an industrial area to a thriving commercial area where individuals can "live, work, and play." From the architect; "this project is one of the most significant projects to be developed in Baltimore since the Inner Harbor Development created by the Rouse Company and will contain over $150 million in development to the area." (www.wbcm.com)

In the following technical assignment, topics such as schedule, cost, and existing conditions were analyzed. A better understanding of the project as a whole was gained. A few major issues researched are highlighted below.

The contract the owner had with Gilbane was merely for the core and shell construction of the building. After completion of the core and shell, the tenant space on each floor was bid out as a separate construction project. Great communication between the owner, CM, and tenant GC's allowed this situation to remain a positive.

The only major dilemma the team faced with the 18-month schedule in the early stages was the existing soil conditions. The site, at one time, had been used as an Exxon Terminal that handled heavy-weight oils which classified the soils as contaminated. A Corrective Action Plan (CAP) was then put into place for the soils on the project. The CAP declares that each person working in the soils must complete a 40 hour hazardous training class, as well as the soils must be transferred offsite once removed. This caused the foundation contractors to begin a couple weeks later than planned, but this time was made up through added manpower and longer work days early in the project.

Project Schedule Summary

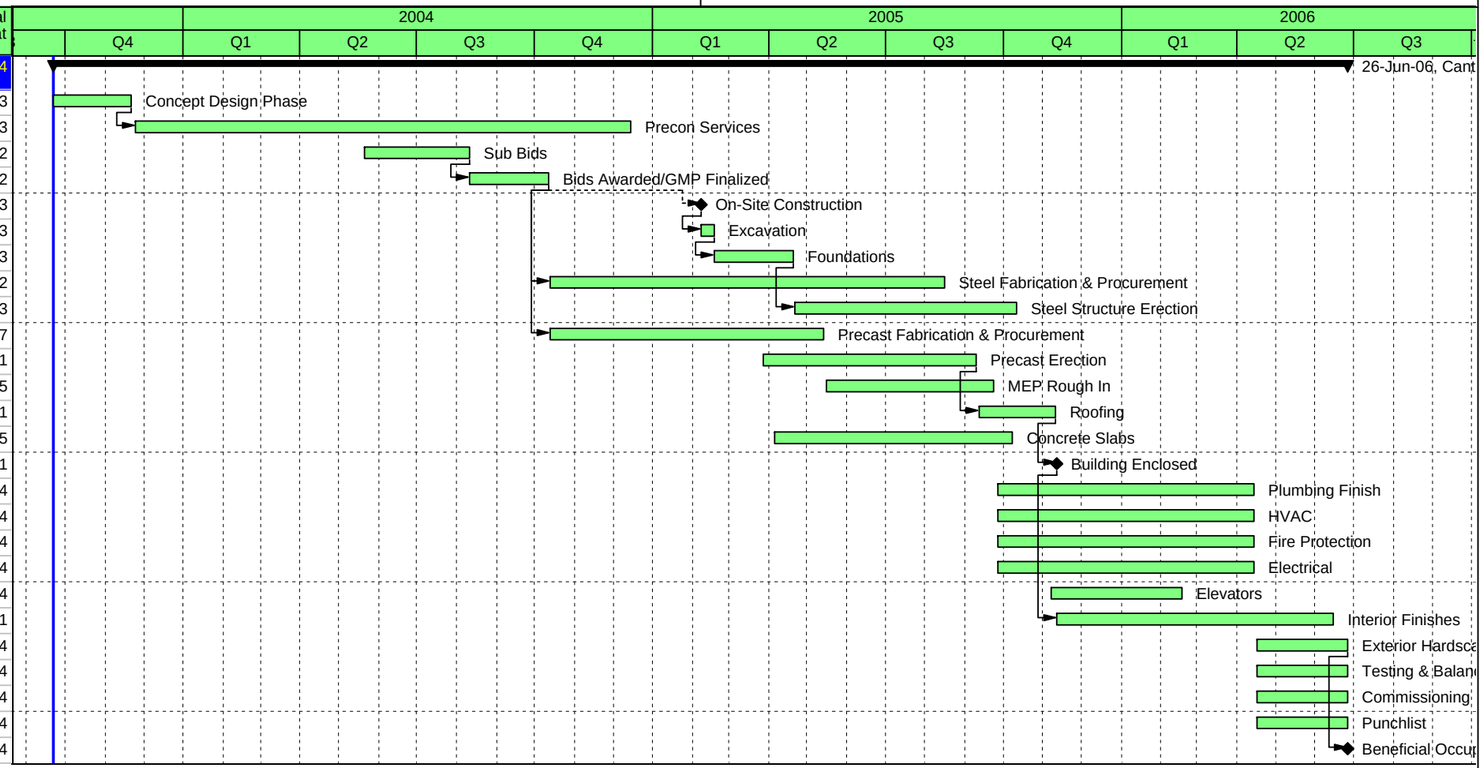
**Corresponding Primavera Schedule is shown on the following page

The key schedule element in the construction of the foundation was the condition of the existing soils. Since the soils were classified as contaminated and had to be transported offsite, the schedule was delayed at the beginning of the project. Every individual who worked on the excavation and foundation system had to go through a 40-hour Hazardous Material course. The 40-hour course caused a few trade contractors began their work later than planned, but the time was made up through added manpower and longer work days. Therefore, the team handled the complicated situation without allowing the scheduled completion date to be jeopardized.

The initial schedule allowed steel erection to be completed at exactly one floor per week. Also, immediately following the steel, the metal decking and concrete were being placed. The demanding pace forced steel crew sizes to be increased, as well as extra safety measures to be followed during the structure's erection. The erection of the structure directly affected the building close-in milestone. This milestone had to be reached before any finish work could begin.

The finish work subcontractors, due to the demanding schedule, were forced to work together. Good communication through weekly superintendent meetings and accurate two-week look ahead schedules was a key to the success of construction.

Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	Start	Finish	Total Float
Canton Crossing Tower		701	701	0%	22-Sep-03	26-Jun-06	4
A1000	Concept Design Phase	45	45	0%	22-Sep-03	21-Nov-03	393
A1005	Precon Services	267	267	0%	24-Nov-03*	14-Dec-04	393
A1010	Sub Bids	56	56	0%	21-May-04*	10-Aug-04	222
A1020	Bids Awarded/GMP Fina...	43	43	0%	11-Aug-04*	11-Oct-04	222
A1030	On-Site Construction	0	0	0%	07-Feb-05*		183
A1040	Excavation	9	9	0%	07-Feb-05*	17-Feb-05	183
A1050	Foundations	44	44	0%	18-Feb-05	20-Apr-05	183
A1060	Steel Fabrication & Proc...	215	215	0%	12-Oct-04*	16-Aug-05	222
A1070	Steel Structure Erection	121	121	0%	21-Apr-05*	11-Oct-05	183
A1080	Precast Fabrication & Pr...	150	150	0%	12-Oct-04*	13-May-05	287
A1090	Precast Erection	117	117	0%	28-Mar-05*	09-Sep-05	11
A1100	MEP Rough In	92	92	0%	16-May-05*	23-Sep-05	195
A1110	Roofing	44	44	0%	12-Sep-05*	10-Nov-05	11
A1120	Concrete Slabs	130	130	0%	06-Apr-05*	07-Oct-05	185
A1130	Building Enclosed	0	0	0%	11-Nov-05*		11
A1140	Plumbing Finish	141	141	0%	26-Sep-05*	14-Apr-06	54
A1150	HVAC	141	141	0%	26-Sep-05*	14-Apr-06	54
A1160	Fire Protection	141	141	0%	26-Sep-05*	14-Apr-06	54
A1170	Electrical	141	141	0%	26-Sep-05*	14-Apr-06	54
A1180	Elevators	71	71	0%	07-Nov-05*	17-Feb-06	94
A1185	Interior Finishes	150	150	0%	11-Nov-05*	15-Jun-06	11
A1190	Exterior Hardscape	50	50	0%	17-Apr-06*	26-Jun-06	4
A1195	Testing & Balancing	50	50	0%	17-Apr-06*	26-Jun-06	4
A1200	Commissioning	50	50	0%	17-Apr-06*	26-Jun-06	4
A1205	Punchlist	50	50	0%	17-Apr-06*	26-Jun-06	4
A1210	Beneficial Occupancy	0	0	0%		26-Jun-06	4



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

Building Systems Summary

Primary Engineering Systems

Architecture (Design and Functional Components):

The Canton Crossing Tower is the first of many new additions to the 65-acre Canton Crossing campus. The campus is located in the Southeastern portion of Baltimore City just outside of Baltimore's Inner Harbor, known as Canton. Developer, Edwin F. Hale Sr. of Hale Properties, envisions Canton Crossing as "The City within the City". The tower spearheads the construction of the campus that will ultimately consist of more than 1 million square feet of Class-A office space, 250,000 square feet of retail space, 500 condominiums, a 450-unit upscale hotel, and a marina pier. The tower itself has been designed as a 17-story building that will house over 475,000 square feet of commercial space.

Fig 1 – Canton Crossing Master Plan

The octagonal shaped building's exterior architectural features are highlighted by the hipped roof with a metal roofing cap that towers 77' above top floor. The core and shell design provides nearly 30,000 square feet of rentable office space per floor. To maximize the buildings leasable space and accompany the unique hipped roof design, a 2-story Utility Distribution Center (UDC) was built across the street from the tower. The UDC houses the main mechanical and electrical systems that power the building.

With its unique location, the tower provides breathtaking views of Baltimore's Inner Harbor, as well the city's entire skyline. Even as Canton Crossing continues to grow, the Canton Crossing Tower will remain the tallest building throughout the campus. Since it is easily visible from busy locations such as the Inner Harbor, Fort McHenry, and Interstate 95 & 895, the Canton Crossing Tower is sure to put Canton on the map.

Building Envelope:

The building envelope of the tower is quite unique. The tower has an octagonal shaped shell. The four largest sides of the building are comprised of precast concrete panels with thin face brick and 6" deep aluminum window wall systems. The top of these four sides are completed with a triangular peak which is home to the 1st Mariner Bank name and symbol in gold. Two of the smaller sides are the grand entrances, located on either side of the building. These walls are designed with a 7 ½" deep aluminum curtain wall system. The final two sides of the tower are designed the same as the four large ones with the 6" deep aluminum window wall systems. The four smaller sides are all capped off with balconies on the 17th floor.

Fig 2 – Building Rendering

The roof of the Canton Crossing Tower is what makes this high-rise building distinctive. The hipped roof design towers 77' above the top floor. Each of the four hips is covered by a standing seam metal roof. In between the four hips, the core is covered

by insulated aluminum panels that then meet the standing seam metal roof cap. The peak of the 17-story building is complimented by a flag pole.

Construction:

The site for Canton Crossing Tower caused dilemmas for the construction team from day one. The site, the former location of an Exxon terminal, was bid as a clean site but was far from it. The soil on the site was classified as contaminated soil and required a Corrective Action Plan (CAP) for the remediation of light non-aqueous phase liquids (LNAPL). The plan included the excavation and transportation of the contaminated soils to an offsite location. Also, before anyone was permitted to work in the contaminated soils they must first complete a 40 hour Hazardous Awareness Training.

Fig 3 – Existing Site Aerial View

Once the project broke ground the concrete piles began to be placed. The steel structure was erected at a very rapid pace. The construction manager followed a demanding schedule of one floor per week. The one floor per week included all of the following; structural steel placed, metal decking placed, and the suspended concrete slab poured. Also, as a safety measure, 75% of the above floor metal decking had to be placed before work began on the floor below. At times the schedule

Fig 4 – Steel & Precast Erection with a view of fireproofing plastic

seemed in jeopardy, but by the aggressive management of many individuals the schedule was able to be attained.

The site logistics were in the favor of the construction team for this project. The large site footprint made steel staging a manageable task. Other positive site features were the two surrounding public roadways running on either side of the tower. These, along with the immediate access to Interstate 95, gave some leeway to the delivery methods. Two tower cranes were used for the steel erection and the concrete slabs were placed by pump. The construction team also had two material hoists that ran the length of the 17-story tower during construction. These hoists were crucial to the project because with no elevators, production would have been seriously affected.

As the contract with the owner was for simply the core and shell of the building, the tenant fit-out brought the most challenging aspect of managing the project. Gilbane, the base building CM, was not awarded any of the tenant's CM contracts. Therefore while Gilbane was attempting to complete the base building, tenant hired CM's were beginning their work on the rented floors. Intense coordination and good cooperation had to be implemented for the parties to work side by side.

Electrical:

The tower's electric systems begin at the Central Plant building where the power is housed. In the electrical room of the plant is the Main Service Switchgear (13.2 kV) and the substation with two 3,500 kVA transformers. The power is transferred to the power through 2 – 9-way ductbanks, one for normal power and one for emergency power. The 15 kV switchgear located in the Ground Floor Electrical Room of the tower is where the

13.8 kV normal open loop feeders enter from the Central Plant Ductbanks. The power runs vertically through the entire building through 7 main busways, with one more optional plug-in busway. The busways run through electrical rooms that are located on each side of the tower's core. The one room houses a lighting busway (600A, 480/277V, 3θ, 4W), computer busway (1600A, 480V, 3θ, 3W), emergency life safety busway (600A, 480/277V, 3θ, 4W), and an emergency standby busway (600A, 480/277V, 3θ, 4W). The opposite electrical room houses the HVAC busway (2000A, 480/277V, 3θ, 4W), computer busway (1600A, 480V, 3θ, 3W), lighting busway (1600A, 480/277V, 3θ, 4W), and the optional standby busway (800A, 480V, 3θ, 4W). Each electrical room is also equipped with 3 transformers and six electrical panels. On the 18th floor, the electrical systems floor, the busways come to six ATS's, two main substations, and an emergency substation.

Fig 5 – Typical Floor Electrical Rm showing bust ducts and a transformer

Lighting:

The tower's interior lighting fixture schedule is mostly comprised of 277 V recess mounted fluorescent lamps. The lighting of the building is

Fig 6 – Architectural Lighting in main lobby

served via 480/277, 3-phase, 4 wire panels. On the ground floor, the lighting was designed with more of an architectural purpose. This floor's lighting ranges from polished brass wall mounted fixtures to ceiling recessed compact fluorescent downlights. The typical floors contain 2'x2' parabolic fluorescent fixtures in the core areas and 4' heavy duty industrial fluorescents in the tenant shell areas. On the exterior hardscape of the tower, pole mounted light fixtures, in-grade up lights, and bollard lights combine to beautify the surrounding area.

Mechanical:

Fig 7 – Mechanical Room showing Air Handling Unit

The mechanical design in the tower is based on two air handling units located on each floor. The units are constant volume vertical air units (8500 cfm), each consisting of a mixing box, chilled water cooling coil and fan. The feeds from these units are predominantly routed down each corridor in the ceiling space of the tower's core. The ducts from the corridor also branch out to the shell area.

The shell is equipped with 8 different VAV boxes. Due to the tower being a tenant fit out building, the ducts are run to the shell and then capped off. This allows tenants to design and construct the mechanical system for their unique spaces. The mechanical

room floor, located on the 19th floor, is where the two Energy Recovery Ventilators (ERVs) are positioned. The two ERV units are fed from the ventilation air supply and return ducts that run vertically up the building through the designed duct shafts located beside the mechanical rooms. The Central Plant designed to power the building will house the 2500 ton chiller, three hot water boilers, and two cooling towers. The plant has been designed for future expansion of the Canton campus as well, for example, locations for 3 additional 2500 ton chillers and 3 more hot water boilers.

Structural:

The structural system in the Canton Crossing Tower starts with a foundation comprised of precast, prestressed concrete piles. The 20" square piles, which use 7000 psi concrete, are situated underneath pile caps. These pile caps are located on the column grid and each covers roughly 4-10 piles.

Fig 8 – Aerial view showing poured pile caps and beginning of column erection

The structure of the tower is made up of a composite steel framing system. Each floor has 3" composite metal decking with a 6-1/4" thick lightweight concrete (3500 psi). The reinforcing used is the new high strength billet steel. A typical bay in the tenant shell space, sized at 37' x 43'3", is laid out with beams at W18x35 and girders ranging from W24x62 to W33x118. In the core area, beams are typically W16x26 and W16x31 while

the girders range from W14x22 to W40x249. With floor heights at 13'4", the columns are all designed as W14's. The weights of the columns vary from 82 lb/ft to 605 lb/ft. The columns ultimately rest on top of the pile caps at the foundation level.

The primary lateral system in the building are braced frames, both concentrically braced and eccentrically braced. Moment frames are also used as a lateral system around the perimeter of the building. The lower level of the hipped roof system has a typical beam size of W16x26 and a typical girder size of W24x76. The upper level of the roof use W12x26 beams and W33x118 girders.

Fig 9 – Steel Column Erection view from Gilbane's field trailer

The steel of the building was placed using two tower cranes positioned on the North and South ends of the towers exterior perimeter. The height of the tower cranes were 340 ft & 380 ft respectively. They have a concrete foundation with eight precast piles under each. The pieces of the cranes, known as "towers", were each approximately 20' tall. To remain structurally safe, the maximum free standing towers are nine or 180'. Once the cranes were above the 180' height limit, they had to be tied into the building structure.

Fig 10 – Tower cranes from afar

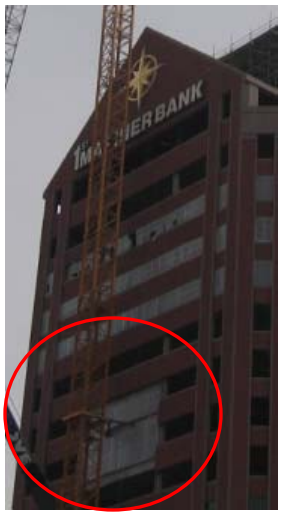


Fig 11 – Tower crane connection to building

Additional Engineering and Engineering Support Systems

Fire Protection:

Fig 12 – Fire Command Center

The tower was designed as a wet sprinkler system except in the loading dock area where a dry system was installed. The fire pump was reduced in size through value engineering to a 750 gpm pump. Each 20-story stairwell contains a 6" standpipe. A jockey pump is used to maintain the pressure in the building at 175 psi. The Fire Command Center is located on the Ground Floor near the West Entrance and houses the Fire Alarm Panel, Fireman's Override Panel, Fire Annunciator Panel, etc. Each typical floor, including core and shell, is equipped with manual pull stations, fire alarm strobes, ceiling mounted smoke detectors, and ceiling mounted fire alarm speakers.

Fig 13 – Fire Pump Room

Transportation:

The building consists of 8 traction elevators, four on each side of the lobby. One of the eight elevators will be used as a service elevator with a capacity of 4,500 lbs and speed of 700 f.p.m. The service elevator will stop on all floors up to the 19th floor. The other 7 elevators are strictly passenger elevators with a capacity of 3,500 lbs and a speed of 700 f.p.m. These elevators will stop

on all floors up to the 17th floor. The elevator pits are approximately 8'4" deep with a sump pump in each pit. The 20th floor of the tower houses the elevator machine room.

Fig 14 – Elevator Machine Room

Telecommunications:

Due to the 17-story office tower being designed as a tenant fit-out, the telecommunications aspect of the base building is somewhat minute. The Main Telecommunications Room on the ground floor is where the 12-way incoming ductbank enters from the Central Plant. Each of the typical floors is equipped with two Tele/Data Rooms. Under base building contract, these rooms are built so that each tenant may come in and fit-out their own telecommunications system.

The security system of the building is important because the main tenant of the tower is 1st Mariner Bank. The owner opted to hold the contract with the security subcontractor as opposed to Gilbane holding that contract. The tower is inaccessible to the public after hours, with a 24-hour security crew on board. The exterior entrances are equipped with a telecom system for entry during non-working hours. Each interior floor has been set up with four security cameras that monitor the entire core area.

Additional Building Systems Summary Form

Demolition Required

No demolition was required for the Canton Crossing Tower.

Cast in Place Concrete

The cast in place concrete for the composite floor slabs is lightweight with a minimum compressive strength of 3500 psi. The 3" metal decking will act as the horizontal formwork for the concrete, while the steel toe plate around the perimeter will act as the vertical formwork. The concrete is to be poured in strips perpendicular to the steel girders. The cast in place concrete is placed by the pump method.

Fig 15 – Concrete Pump during foundation pours

Precast Concrete

The architectural precast panels that were designed for the tower were constructed by The Shockey Precast Group at their plant in Winchester, Virginia. The panels were then transferred by tractor and trailer to the construction site as needed for erection. The two tower cranes were used for the erection of the precast panels.

Precast connections were detailed by Shockey. The connections were a combination of L-shaped steel angles for lateral support, with bearing connection plates embedded in the concrete. The

Fig 16 – Precast connections to steel columns

angles were attached to the structure columns and welded to embedded plates in the precast.

Masonry

The masonry used in the tower was very minimal. At locations where masonry was used, it was non-load bearing.

Support of Excavation

The building required a minimal amount of excavation, therefore the only excavation support system needed was around the elevator pits where sheeting and shoring was used. There was no dewatering system used on the project due to the minor excavation.

Fig 17 – Shoring for elevator pits

Project Cost Evaluation

Building Details

Size (total square feet) = 519,401 ft^2

Number of stories = 17 stories occupied, 3 equipment and machine floors

Actual Building Construction Cost

Construction Cost = $ 42,199,783

- Note – Not including land costs, sitework, permitting, etc. Also note that no tenant work is considered in Gilbane's GMP with the owner.

Construction Cost/Sq. Ft. = $81.25/Sq. Ft.

Total Project Costs

Total Cost = $ 51,525,571

- Note – In addition to the actual building costs shown above, the **total project cost** includes the *overhead, profit, fee, and contingency*.

Total Cost/Sq. Ft. = $99.20/Sq. Ft.

Building Systems Cost

Site Work = $ 3,653,940

Cost/Sq. Ft. = $ 7.03/Sq. Ft.

Electrical = $ 4,290,094

Cost/Sq. Ft. = $ 8.26/Sq. Ft.

Mechanical = $ 7,557,051

Total Mechanical/Sq. Ft. = $ 14.55/Sq. Ft.

Plumbing/HVAC = $ 7,099,100

Cost/Sq. Ft. = $13.67/SF

Fire Protection = $ 457,951

Cost/Sq. Ft. = $0.88/SF

Structural = $ 13,713,806

Total Structural/SF = $ 26.40/SF

Concrete = $ 5,010,455

Cost/SF = $ 9.65/SF

Masonry = $ 35,300

Cost/SF = $ 0.07/SF

Steel = $ 8,668,051

Cost/SF = $16.69/SF

Parametric D4Cost Estimate

**Corresponding *D4Cost 2002* Estimate is shown on the following page

The D4Cost Database did not have any specific projects that matched Canton Crossing Tower closely, so the True Averaging Method was used on multiple similar projects. The five projects selected from the D4Cost Database were chosen because of their similarities to the Canton Crossing Tower. The subjects chosen were all office buildings, with the size of each varying greatly. The overall selection process was based on the square footage and number of stories with direct comparison to the cost. The spreadsheet shown below for reference gives the building names, square footages, number of stories, and costs.

Building Name	Square Footage	No. of Stories	Total Cost
Grand Tower	305,000 sq. ft.	15	$ 18,495,942
Preston Pointe	105,768 sq. ft.	8	$8,242,378
Ha-Lo Headquarters	267,334 sq. ft.	7	$ 37,643,382
Willow Oaks III	407,042 sq. ft.	7	$ 16,757,728
Westchase Corporate	308,500 sq. ft.	6	$10,492,634

The results yielded for Canton Crossing Tower:

*Total Cost = **$ 46,616,960***

Canton Crossing Tower - Oct 2004 - MD - Baltimore

Prepared By:	**Tyler Swartzwelder** **Penn State University** **236 South Barnard Street Apt 2** **State College, PA 16801** **Fax:**	Prepared For:	**Dr. John Messner** **Penn State University** **University Park, PA 16801** **Fax:**
Building Sq. Size:	**519401**	Site Sq. Size:	**145667**
Bid Date:		Building use:	**Office**
No. of floors:	**20**	Foundation:	**CAI**
No. of buildings:		Exterior Walls:	**PRE**
Project Height:		Interior Walls:	**GYP**
1st Floor Height:		Roof Type:	**MET**
1st Floor Size:		Floor Type:	**CON**
		Project Type:	**NEW**

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**1.94**	**1.75**	**906,400**
	Bidding Requirements	1.94	1.75	906,400
01	**General Requirements**	**8.23**	**7.39**	**3,838,154**
	General Requirements	8.23	7.39	3,838,154
02	**Site Work**	**2.46**	**2.21**	**1,145,367**
	Site Work	2.46	2.21	1,145,367
03	**Concrete**	**19.79**	**17.76**	**9,227,138**
	Concrete	19.79	17.76	9,227,138
04	**Masonry**	**2.04**	**1.83**	**949,142**
	Masonry	2.04	1.83	949,142
05	**Metals**	**12.56**	**11.28**	**5,856,836**
	Metals	12.56	11.28	5,856,836
06	**Wood & Plastics**	**0.43**	**0.38**	**198,982**
	Wood & Plastics	0.43	0.38	198,982
07	**Thermal & Moisture Protection**	**1.60**	**1.44**	**748,166**
	Thermal & Moisture Protection	1.60	1.44	748,166
08	**Doors & Windows**	**13.32**	**11.95**	**6,208,780**
	Doors & Windows	13.32	11.95	6,208,780
09	**Finishes**	**7.35**	**6.59**	**3,424,314**
	Finishes	7.35	6.59	3,424,314
10	**Specialties**	**1.57**	**1.41**	**733,660**
	Specialties	1.57	1.41	733,660
11	**Equipment**	**0.02**	**0.02**	**9,044**
	Equipment	0.02	0.02	9,044
12	**Furnishings**	**0.63**	**0.57**	**294,686**
	Furnishings	0.63	0.57	294,686
13	**Special Construction**	**0.01**	**0.01**	**6,670**
	Special Construction	0.01	0.01	6,670
14	**Conveying Systems**	**4.43**	**3.97**	**2,062,865**
	Conveying Systems	4.43	3.97	2,062,865
15	**Mechanical**	**8.77**	**7.87**	**4,088,216**
	Mechanical	8.77	7.87	4,088,216
16	**Electrical**	**4.53**	**4.07**	**2,113,677**
	Electrical	4.53	4.07	2,113,677
21	**Fire Suppression**	**0.75**	**0.67**	**350,243**
	Fire Suppression	0.75	0.67	350,243

22	**Plumbing**	**0.54**	**0.49**	**252,966**
	Plumbing	0.54	0.49	252,966
23	**HVAC**	**3.74**	**3.36**	**1,744,241**
	HVAC	3.74	3.36	1,744,241
26	**Electrical**	**2.89**	**2.59**	**1,346,284**
	Electrical	2.89	2.59	1,346,284
31	**Earthwork**	**0.52**	**0.47**	**243,727**
	Earthwork	0.52	0.47	243,727
32	**Exterior Improvements**	**1.27**	**1.14**	**590,545**
	Exterior Improvements	1.27	1.14	590,545
33	**Utilities**	**0.59**	**0.53**	**276,856**
	Utilities	0.59	0.53	276,856
Total Building Costs		**100.00**	**89.75**	**46,616,960**
Total Site Costs		**100.00**	**0.00**	**0**
Total Project Costs		**--**	**--**	**46,616,960**

RS Means Square Foot Estimate

**Source: *RS Means SQFT Cost – 27th Annual Addtion – 2006 (Page 180)*

The following Square Foot Estimate was completed through the RS Means source listed above. The tower was placed under the Commercial/Industrial/Institutional section as an Office, 11-20 Story. The Exterior Wall selection was chosen to be Precast Concrete Panel with Exposed Aggregate. The perimeter and story height adjustments were not necessary for the tower's estimate. The cost per square foot of floor area was found through interpolation to be $108.85. In order to make the estimate more accurate, the additional costs of the elevators and smoke detectors were estimated from the Common Additives section.

Floor Area

- Cost per square foot of floor area = $108.85
- Square Foot Cost = $108.85*519,401 sq. ft. = *$ 56,536,798.85*

Elevators

- 7 – 3500# capacity elevators with 17 stops @ $302,850 = *$ 2,119,950.00*
- 1 – 4500# capacity elevator with 20 stops @ $327,500 = *$ 327,500.00*

Smoke Detectors

- 3 – Ceiling Type per floor (20 floors) @ $164.00 = *$ 9,840.00*
- 6 – Duct Type per floor (20 floors) @ $430.00 = *$ 51,600.00*

Time and Location Factors Modifications

- Baltimore, Maryland Location Factor – 0.93
- 2005 Modification Factor – 1.06
- *Total Cost Estimate =* ***$ 58,207,240***

519,401

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	135.10	130.10	126.00	122.30	119.55	117.40	111.20	107.85	105.70
	R/Conc. Frame	135.25	129.15	124.35	119.95	116.70	114.25	107.00	103.00	100.60
Face Brick with Concrete Block Back-up	Steel Frame	134.55	129.20	125.00	121.20	118.40	116.25	110.05	106.60	104.55
	R/Conc. Frame	127.45	122.20	118.10	114.40	111.70	109.55	103.50	100.10	98.15
Precast Concrete Panel With Exposed Aggregate	Steel Frame	136.75	131.10	126.70	122.75	119.80	117.55	111.00	107.40	105.20
	R/Conc. Frame	129.95	124.40	120.10	116.25	113.35	111.10	104.75	101.15	99.00
Perimeter Adj., Add or Deduct	Per 100 L.F.	7.45	6.15	5.25	4.50	3.90	3.45	2.25	1.40	1.15
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	3.05	2.65	2.35	2.10	1.85	1.75	1.25	1.05	.90

For Basement, add $30.00 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 $77.10 to $188.05 per S.F.

Common additives

Description	Unit	$ Cost
Clock System		
20 room	Each	14,500
50 room	Each	35,300
Directory Boards, Plastic, glass covered		
30" x 20"	Each	560
36" x 48"	Each	1300
Aluminum, 24" x 18"	Each	530
36" x 24"	Each	610
48" x 32"	Each	820
48" x 60"	Each	1900
Elevators, Electric passenger, 10 stops	Each	252,500
3000# capacity	Each	254,500
4000# capacity	Each	259,500
5000# capacity	Each	7050
Additional stop, add		
Emergency Lighting, 25 watt, battery operated	Each	259
Lead battery	Each	765

Description	Unit	$ Cost
Escalators, Metal		
32" wide, 10' story height	Each	105,300
20' story height	Each	123,400
48" wide, 10' story height	Each	110,800
20' story height	Each	128,900
Glass		
32" wide, 10' story height	Each	103,800
20' story height	Each	123,400
48" wide, 10' story height	Each	110,800
20' story height	Each	128,900
Smoke Detectors		
Ceiling type	Each	164
Duct type	Each	430
Sound System		
Amplifier, 250 watts	Each	2025
Speaker, ceiling or wall	Each	166
Trumpet	Each	315
TV Antenna, Master system, 12 oulet	Outlet	272
	Outlet	173

Comparison of Actual Costs and Estimates

*Total Actual Cost = = **$ 51,525,571***

*D4Cost 2002 Parametric Estimate = **$ 46,616,960***

*RS Means Square Foot Estimate = **$ 58,207,240***

After both estimates were compiled and compared to the actual cost, a significant difference was shown. The D4 Cost estimate came in roughly 10% lower than the actual cost. D4 Cost's database has a limited number of source projects to select from. During the Canton Crossing Tower estimate, a few of the source buildings used had a smaller number of floors and square footage. The selection process for the source buildings used dealt with building use, size, number of floors, and building cost. The program then adjusted the time and location factors for construction. With more of a selection in the database of source projects, a more accurate estimate would have been possible.

The RS Means Square Foot Estimate came in 11.5% higher than the actual cost. The main reason for this drastically high estimate is that RS Means does not allow the estimate to be core and shell construction only with tenant fit out spaces. With the estimate incorporating the tenant areas under the same price, there is going to be a significant increase in the final number. The additives section of RS Means did help the estimate become more accurate, but this estimate is rather irrelevant for direct comparison to Canton Crossing Tower due to the tenant fit out situation. The tenant fit out estimated costs would need to be deducted from the estimate for the numbers to be directly compared.

Also, the demanding 18-month schedule probably is not typical of a building this size. Neither estimate took into account the duration of construction. The two estimate

types used are for preliminary estimating only, but proved they could be useful to an individual who wanted to get a quick and basic idea of their potential costs.