Project Design Overview

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

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

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 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 18^{th} 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 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.

Fig 6 – Architectural Lighting in main lobby

Mechanical:

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.

Fig 7 – Mechanical Room showing Air Handling Unit

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

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

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.

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

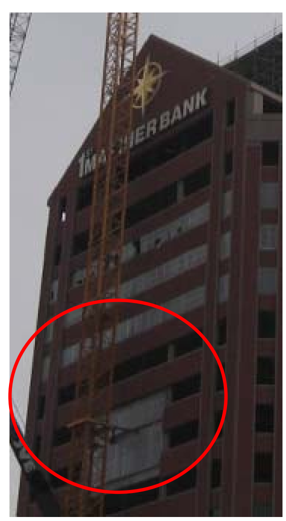

Fig 11 – Tower crane connection to building

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.

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

Fig 16 – Precast connections to steel columns

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