TURNBERRY TOWER ARLINGTON

ARLINGTON, VIRGINIA

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Construction Management

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Technical Assignment 1

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Executive Summary

This report has been created with the intention of familiarizing you with background information and construction data for the Turnberry Tower Arlington project in Arlington, Virginia. The building consists of 6 levels of below ground parking and 26 levels of residential units equating to approximately 740,000 square feet. The building is finished only in the below ground parking levels, lobby level, the kitchens and the bathrooms of the residential units.

In order for Turnberry Tower Arlington to attain a LEED Certified Certification for New Construction, certain points were obtained in designing the building as well as recycling materials during construction. All materials were sorted during demolition and sold to private parties so that it can all be reused. Luckily, no special measures were needed during demolition because no harmful asbestos or lead paint needed to be removed.

The project began in September of 2006 with the demolition of the existing hotel on site. Working through the SIPS schedule being utilized on this project and with the current work rate, a date of September 2009 has been set for the substantial completion.

Turnberry Tower Arlington's primary structural systems consist of two way post tension concrete with shear walls and columns. The building will house 11 elevators with almost 2 miles of rail. All units will have their own heat pumps with their own mechanical closets. A sovent system will be used for the plumbing that will help reduce the need for vent stacks.

The general contractor on the project is Facchina-McGaughan, with BBG-BBGM acting as the project architect and Turnberry Limited and Facchina Development as the owners. The project cost of $155 million is contracted under a guaranteed maximum price between Facchina-McGaughan and Turnberry Limited.

The following document will contain information including a project schedule summary, building systems summary, cost evaluations comparing a D4 Cost estimate and a R.S. Means estimate, a detailed plan of the site and utilities site plan, project delivery method for the project, and a staffing plan.

I. Project Schedule Summary

When the plans for 1881 North Nash Street were purchased by Turnberry Limited and Facchina Development in 2005, the process for developing a project schedule for the newly named Turnberry Tower Arlington began immediately. On September 26th, 2006, demolition on the existing building began. The schedule has a substantial completion date set for July 7th, 2009 and the owner expects to move in on September 4, 2009. The schedule that is attached in **Appendix A** breaks down the major activities into different phases including procurement, temporary construction, new construction, and project commissioning and testing.

Foundation

From the soil boring reports prepared by the geotechnical engineer, it was discovered that this site would have a significant amount of rock that would need to be removed. When the site was brought down to approximately elevation 70', dynamite was needed to bring the site down to approximately elevation 50'. Some over excavation was needed for the continuous footings that were poured for under the perimeter wall. After the extra rock was removed, 2500 PSI lean concrete was needed to be poured and this was used for leveling the excavated hole to place the perimeter walls. This has a major impact on the schedule because of the amount of rock that needed to be removed (approximately 4200 BCY) as well as the limitations on how much could be blasted each day. On blast days all roads around the site would have to be closed for a period of time which caused traffic on major highways and roads. On site, it would put a stop to excavation because of the placement of live explosives.

Structure

The structure of this building is designed in two different ways; one in the parking levels and one in the tower levels. In the parking levels, two tower cranes with two separate crews were used to erect the concrete structure. This footprint of the parking level has a large enough area that allowed two crews to work independently of one another and still be fully efficient. They worked in a clockwise matter going from one zone to another until the parking level was complete.

The tower level of the building was done utilizing only one of those crews from the parking level erection and the use of one tower crane. The slabs were split into three zones and each would be poured on a separate day. The columns would be poured on a fourth day. At the rate the project was going and with the available man power, the project was averaging about a floor a week.

Finishing Sequences

This job uses the Short Interval Production Schedule or SIPS method to complete the interior of the building. Refer to **Appendix B** for the SIPS schedule for Turnberry Tower Arlington. Some of the finish activities include:

- Install curtain wall and window wall
- HVAC / Plumbing rough-in
- Electrical rough-in
- Drywall
- Install plumbing fixtures
- Install lighting fixtures
- Install doors, hardware, and toilet accessories
- Testing and balancing

These activities were all done in a sequence agreed upon by all the subcontractors involved before the start of construction and was created to maximize productivity. Although tweaking was needed during the first few floors of construction, this schedule is helping to keep everyone on track and responsible for their own work. The subcontractors can schedule crews at their discretion because they know how much work they will need to complete during the week.

II. Building Systems Summary

Work Scope	Yes	No
Demolition Required?	✓	
Structural Steel Frame		✓
Cast in Place Concrete	✓	
Precast Concrete		✓
Mechanical System	✓	
Electrical System	✓	
Masonry	✓	
Curtain Wall	✓	
Support of Excavation	✓	

Demolition

Previously on this site was the Rosslyn Best Western which was 11 stories in height with an in-ground pool on the south of the site. The geotechnical engineer provided a Phase I and Phase II site assessment. In their findings there was no evidence of "recognized environmental conditions" as defined by ASTM were observed. The limited asbestos survey revealed the presence of Regulated Asbestos Containing Materials in the form of surface applied ceiling materials in the parking garage. Category I non-friable asbestos containing floor tiles were also detected in storage and linen rooms in the hotel structure. None of the asbestos found was harmful and out of regulatory limits so special precautions were not needed to remove it from the building.

In order to achieve a LEED certification, certain criteria needed to be met during demolition to achieve the required amount of LEED points. All the furniture and contents from the hotel were taken out of the building and sold off to private parties. The materials that made up the building including the structural steel and aluminum were recycled and sold off to be reused in another project. The concrete was also recycled where it was going to be made into new concrete.

Cast in Place Concrete

There are two different systems used in this project. In the parking levels, 5000 PSI concrete was used to form the walls and slabs while 10,000 PSI concrete was used for columns and shear walls. This project utilized a spread footing system where the size of the footings varied from 3'x3' up to 6'x6'. All footings needed to be 30" below the level of the finished exterior grade and all perimeter walls were placed on continuous footings.

The tower levels are using a two-way post-tension deck system with 5000 PSI concrete for slabs. The shear walls and columns vary on the level for what PSI concrete will be used. There are no typical bay

sizes for this building due to the unique layout out of the units on each floor. For this project a combination of shear walls along with the elevator and stair cores are used to provide lateral bracing for the building.

During erection of the building, a few different types of formworks were used. The central 4-pack elevator core was formed using a self climber called an Automatic Climbing System Wall (ACS) supplied by Universal Formwork as seen to the right. This formwork has hydraulic pistons and when it is done on one level the formwork slides out and the pistons lift it to the next level.

For the tower slabs a flying form system was used called Peri Girder Truss Tables supplied by Peri Formwork. These forms have shores already attached to them so when it was time for them to go to the next level, the shores would be shortened and the wheels attached to these tables would roll the table to the perimeter of the slab. Once at the perimeter, the tower crane had a device attached that would slide under the table. The table would roll of the slab where the tower crane would bring it to the next level it was needed. On this project, there were enough tables for two floors. Once the tables were removed the floor would be reshored by typical reshores until the slab achieved its desired strength.

The vertical elements of the building again used different types of formwork. The columns used Universal Hand Set forms and the shear walls used Peri Trio Wall Forms. The reason for using so many different systems was they are all fast to erect and disassemble and the concrete subcontractor on this job was very familiar with all of these different types of systems.

The concrete for the parking levels was poured using the crane and bucket method. This was chosen over pumping because of the site restraints. The parking levels are almost the size of the entire site and because of the limited site access around the perimeter there was not enough room for both concrete trucks to both enter and leave the site and for the pumping equipment. For the tower levels, a pump and tremie method was used. A lane of travel was created for the concrete trucks to enter and leave the site on Nash Street and there was a designated spot for the installation of a pump and staging area for the pump truck. The hose line for the pump travels in the 4-pack elevators core to the desired level.

Mechanical System

The mechanical system is separate for the public lobby level and for each unit. In the lobby level, there will be three air-handling units. One unit will service the office space and has a total CFM of 4000, the second unit will service the pool area and had a total CFM of 13,800, and the third unit will service the rest of the lobby level and has a total CFM of 12,000. Each unit is connected to condenser water that is being chilled or heated on the roof. All of the units are located in the ceiling plenum and are hung from the second floor slab.

Each residential unit will have between one to three heat pumps depending on the size of the unit and they will be housed in each unit's mechanical closet. They are connected to the boilers and cooling towers on the roof and these stacks and lines will deliver the water to each unit that will enable the owner to control the temperature of their unit. To try and make this building energy efficient, a heat wheel is being used to help transfer energy from exhaust air to lessen the load on the heat pumps.

During the winter, the heat will be extracted from the heat wheel and pushed into the intake fresh air to raise the temperature of the air before going to the units. In the summer the exact opposite will occur with the cold air being pulled from the heat wheel and have that passed onto the intake air to cool it before it goes to the units. Once this air gets to the heat pump, outside air will be mixed from one of the outside air shafts that travel vertically through the building to each unit.

Electrical System

Power from Dominion Power is being supplied via 2 separate feeds to the building and is entering the building from underground. It is being stepped down via one of the buildings two main transformers located on parking level 3 in the electric vault. The first feed will be stepped down by one transformer to 480Y/277V 3-phase power and is fed into a 4000 amp box. There it is fed through the building to power the elevators and service anything that will require the higher voltage in public spaces. It is also sent through another transformer where it will stepped down again where it will be distributed to all public spaces for lighting and receptacles.

The other feed from street power will go into the second transformer where it will be transformed into 208Y/120V 3-phase power where it is fed into one of two 4000 amp boxes. These boxes feed all the private units by traveling through bus ducts. Electric rooms are located on every other floor and there the bus ducts will lead to the branch circuits. These electric rooms will serve both the units on that floor and the floor above.

A diesel emergency generator is located on the northeast of the site. It is specified to power life safety emergency systems in the building including fire suppression equipment, stairwell pressurization systems, fire alarms, emergency lighting, and one passenger elevator.

Masonry

There are two types of masonry that are found in this building. The first type, CMU blocks, are found in the parking levels and on the lobby level. These CMU blocks provide no structural support for the building itself. In the parking levels the blocks is used as the walls for all of the different rooms including private storage garages, bike garages, and electrical and fire rooms. On the lobby level, the CMU block is used to both frame out the some of the exterior walls on the building, but its primary use is to provide backing and support for the exterior stone that will be placed on it. The CMU block is installed on typical frame scaffolding that was moved around the site with the crews. The mortar mixing was done on the

parking 2 level in a back corner so it would not interfere with any other activities. The mortar was put in troughs where it was moved where it was needed by a forklift.

The second type of masonry is the stone that the lobby CMU block will be supporting. This stone is called Blue Pearl Granite and is coming from a specific quarry in Norway. This stone will not be able to be cut on site, so to ensure accurate dimensions, field measurements were made by a representative of the stone manufacturer. This stone will be delivered from Norway to China where it will be cut and then will be brought over the United States for delivery to the site. The method of placing this stone falls under the means and methods for the subcontractor and because the stone is being placed during cold weather months, it is still undecided how this will occur.

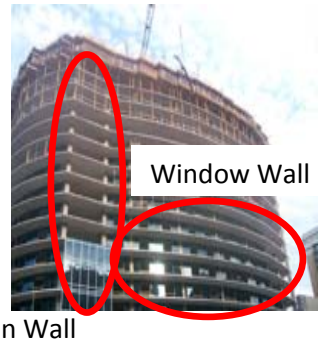
Fire Suppression System

The project incorporates two different active fire systems. For the parking levels, an air pressurized dry system is used. This is because a wet system would not survive in an environment where the temperature and conditions are not regulated. The tower level of the building is comprised of a wet system and is controlled by each floor. This system is tied into the fire control panel in the main lobby.

Passive systems include fire rated walls between the units and the corridors and the fire rated petitions that enclose any riser that is carrying exhaust from both the fans in the bathrooms and the range hoods in the kitchens.

Window Wall & Curtain Wall

The majority of the building's exterior skin is made up of a window wall and curtain wall system. Included in these systems will be the glass, the frames, the anchoring system, and the transitions. Each system was only given performance specifications by the architect and it was the responsibility of the subcontractor to design the rest of the system. The window walls are located at perimeter of the units where the balconies will be accessed by the tenants. The curtain wall goes on the building on the four corners and curves along the perimeter where there are no balconies. The balconies will have glass divider panels and glass inserts. All of the glass for these systems will be the same Versulux Blue 2000. The glass is being delivered from Buffalo in tractor-trailers every day. Each truck contains approximately 20-30 pieces of curtain wall or window wall.



The window wall was installed on each floor by workers who would offload the three sections from a cart. The pieces would be bolted together from connections in their frames. A special erection system was created to install their curtain wall because the tower crane was unable to assist in the installation. The curtain wall was lifted via the material hoist to a location two floors above where it was to be set. A special

device was used to lower the individual piece where it was bolted to the other pieces previously installed.

Support of Excavation

Soldier piles with sheeting and shoring was the method used for excavation. The piles were driven into the ground and then a wood lagging system was used to hold back the unexcavated material. Once the project got into the rock blasting phase, shotcrete was used in place of wood lagging. This is unique for the DC area as shotcrete is not seen often. Dewatering was necessary as excavation occurred well below the water table on the site. Well points were not drilled in an attempt to save money as a value engineering decision. The lowest points of the site, the elevator pits, were wrapped in waterproofing in attempt to stop water from coming in. Also, one of the three sump pumps will run during the duration of construction.

III. Project Cost Evaluation

Actual Cost

Actual Building Construction Cost (CC)

Construction Cost (CC)	$155,500,000
CC / SF	$210.14

Total Project Costs (TC)

Total Project Cost (TC)	$250,000,000
TC / SF	$337.84

Major Building Systems Cost (BSC)

Structural	$28,600,000
MEP	$33,200,000
Fire Protection	$2,300,000
Curtain Wall / Window Wall	$15,200,000
Major Building System Cost (BSC)	$79,300,000
BSC / SF	$105.73

R.S. Means Square Foot Estimate

R.S. Means 2008 was used to develop an estimate for both the residential tower of the building as well as the parking deck. Once the square foot estimates were calculated, a total building estimate was created. An 8-24 story apartment building was used at 500,000 SF. Perimeter adjustments were calculated in the estimates. Additions include elevators and fully furnished kitchens. For the parking garage, a perimeter adjustment was needed and the typical height of the parking garage was kept the same. Below are the calculated values. Details for these calculations can be found in **Appendix D**.

R.S. Means SF Total Building Estimate

	Square Feet	Cost / SF	Total Cost
Residential Tower	500,000	$169.79	$84,895,000
Parking Garage	240,000	$77.90	$18,696,000
			$103,591,000
R.S. Means Location Factor (Arlington, VA)			1.04
		Total Estimate	$107,734,640

Actual Building Construction Cost (CC) vs. R.S. Means 2008 SF Estimate

Estimate Type	Cost	Cost / SF
Building Construction Cost (CC)	$155,500,000	$210.14
R.S. Means Estimate	$107,734,640	$145.59
Difference in Estimates	**$47,765,360**	**$64.55**

To compare the R.S. Mean estimate to the actual estimate, the total estimate was divided by the total square footage of the tower and garage. The estimate above shows $145.59/SF. When this is compared to the building construction cost obtained from the general contractor of $210.14/SF, this method is off by $64.55/SF. The reason for the error in calculation can be because of the following reasons:

- The use of post-tension concrete instead of reinforced concrete
- The actual building has varying ceiling heights
- The building has very high end kitchen appliances, tile floors, and bathroom accessories
- No fire suppression or life safety devices is included in the R.S. Means estimate
- Elevators for the additions in R.S. Means do not include the use of 3 hydraulic elevators

D4 Cost Analysis

In the database for D4 Cost 2002 there are no buildings that match Turnberry Tower Arlington. To get an approximate cost, 5 buildings that were the same type and above $15 million were used. Below are the calculated values obtained by D4 Cost compared to the actual building construction cost. The details from the D4 Cost Analysis can be found in **Appendix C**.

Actual Building Construction Cost (CC) vs. D4 Cost 2002

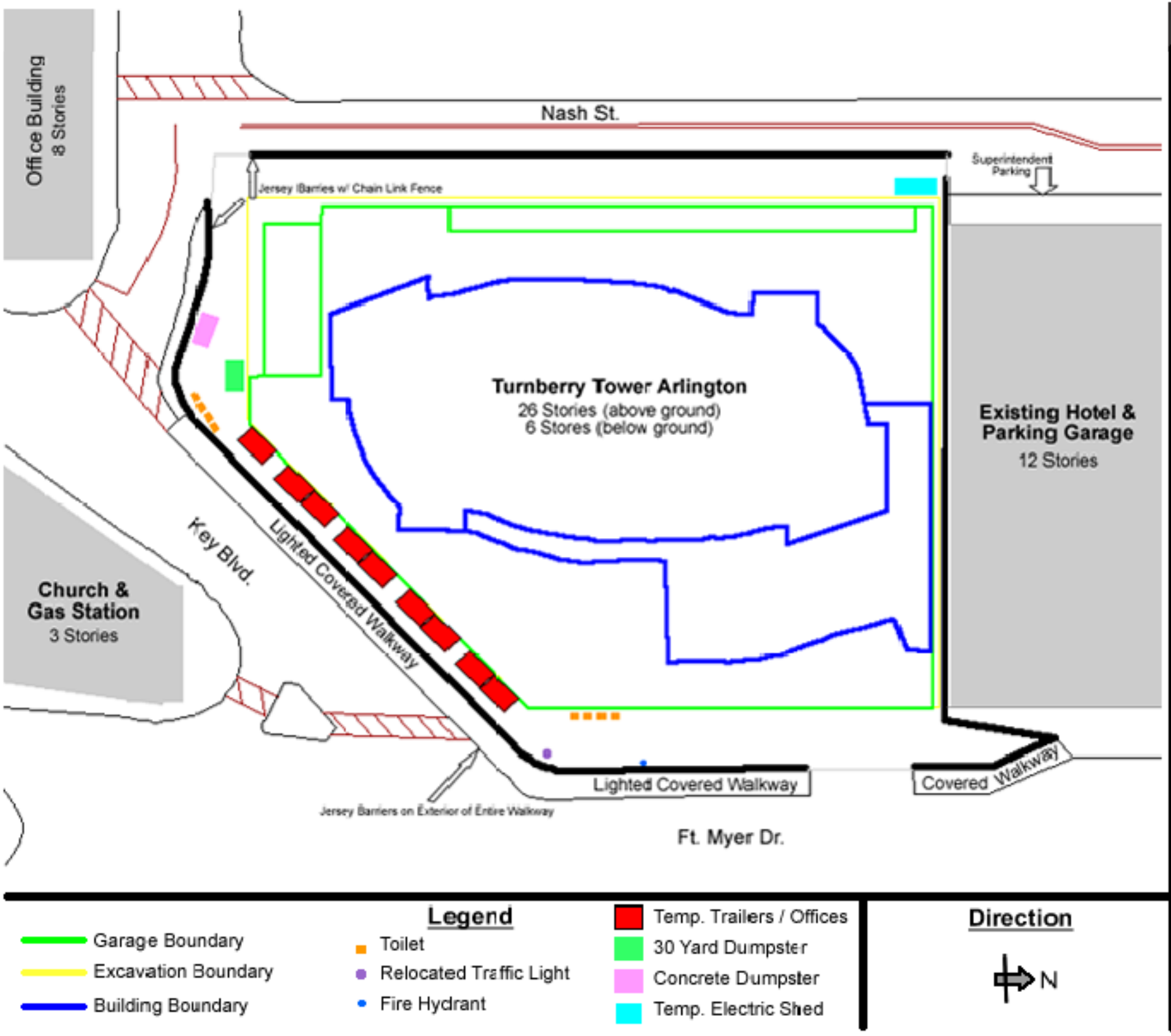
Estimate Type	Cost	Cost / SF
Building Construction Cost (CC)	$155,500,000	$210.14
D4 Cost 2002	$95,416,943	$128.94
Difference in Estimates	**$60,083,057**	**$81.19**

The estimate above gives $128.94/SF from the D4 Cost Analysis. When this is compared to the number obtained from the general contractor for building construction cost of $210.14/SF, there is a difference of $81.19/SF. Some of the possible errors in this estimate are:

- Buildings in the database are not close to the complexity or cost of finishes in the actual building
- There is a much more complex conveying system than the compared buildings
- The use of post-tension concrete instead of reinforced concrete
- The building has very high end kitchen appliances, tile floors, and bathroom accessories
- A 6-story underground parking garage

IV. Site Plan of Existing Conditions

A site plan of existing conditions was created. On the first diagram the limits of the property, garage, and proposed building are drawn. All adjacent buildings are labeled as well as all local roads running around the site. The covered walkway that will be up through the duration of construction is shown along with the temporary office trailers and other temporary facilities. The second diagram shows all existing utilities and how they will be routed into the new building.



Turnberry Tower

Turnberry Tower Arlington
Site Plan

Revisions

Date	No.	Description

Seal

Drawn by: Larry Warner
Date: 9/29/2008

Sheet Number

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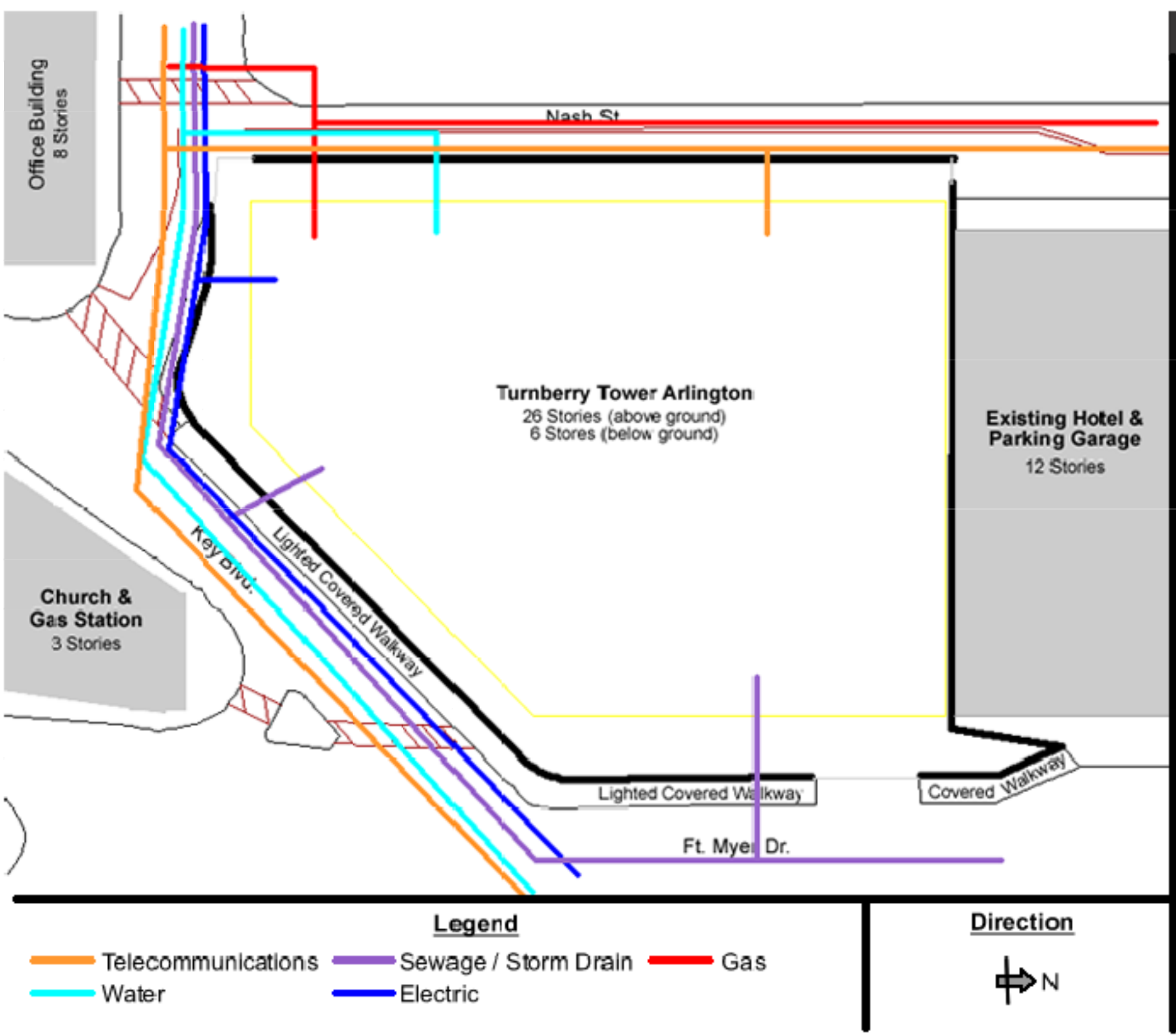

Turnberry Tower

Turnberry Tower Arlington
Site Utility Plan

Revisions

Date	No.	Description

Seal

Drawn by: Larry Warner

Date: 9/29/2008

Sheet Number

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V. Local Conditions

In the Washington D.C. Metropolitan area, post-tension concrete is most utilized due to the height restriction inside the District of Columbia. Although this height restriction is not enforced in Arlington, Virginia, the use of the post-tension concrete allows for larger bays between columns and a thinner floor slab which is a huge advantage in a condominium building. Combine these advantages to the efficiency the crews already have with using P-T concrete, it was deemed appropriate to use this system on this project.

Weather in the Washington D.C. area is quite extreme. Because of the location of swamp lands, the weather can change dramatically from day to day. In the winter months, very cold temperatures can be expected which can impact schedules with concrete pours and on this job with hanging exterior stone work. Parts of the exterior building and floors will have to be tented in and heated to allow for concrete and mortar to set.

The summer months for this project were also tough on the project and the workers. The summer of 2007 was especially hot with many days of 100% humidity. This is tough on workers to get the work done that is necessary to keep up with the schedule. Summer of 2008 proved not to be any easier. Along with many hot and humid days, there were many large thunderstorms that provided the area with much precipitation and knocked out power to the area for hours and even days. This weather also led to the area's public transportations system to be shut down and disabled for large amounts of time. Large construction the Metro's Orange Line led to an increase in traffic on all major roads and highways in the area. This traffic would lead to an increase in time for all deliveries and pickups from the site.

The site located at 1881 North Nash Street has some height restrictions because of the approach path of aircrafts landing at Reagan National Airport. The tower cranes are restricted to their height which makes it hard for critical picks for the heavy roof top machinery onto the building.

This site causes problems with traffic flow and patterns because of the adjacencies to a county "major roadway." Fort Myer Drive is designated as a main route as it allows the passage of cars through Arlington County from both Interstate-66 and Georgetown. This restricts the site deliveries because they can't occur during rush hour traffic in the morning and afternoon.

The soils in the area are a combination of sand and clay for about 30' down for excavation and then disintegrated rock for the next 30'. This is typical in the Rosslyn section of Arlington County.

VI. Client Information

Turnberry Limited are the primary owners of this project with Facchina Development as the secondary owners. The project was owned by Facchina initially and needed another party to come in, back the project and become the primary owner. Turnberry is known for picking sites that are "dramatic" and providing something that can't be duplicated. Some of their other sites include Paradise Island in the Bahamas and Las Vegas, Nevada. Further expansion includes on the water in Boston, Massachusetts.

This site was selected because of the views that will be offered. At the top, you will have unobstructed views to all of the District of Columbia and Georgetown and parts of the Anacostia River. The building has been outfitted since Turnberry has purchased the building to fit their décor. High ceilings in the lobby level with plenty of downlight and magnificent finishes will greet guests as they enter the building. Turnberry will also have installed two water features that will be noticed by anyone who passes by the building. These few features along with stone from Norway and the full height window walls will allow Turnberry Tower Arlington to become a symbol for the Rosslyn section of Arlington County.

Cost, quality, and schedule are the three most important factors in achieving a successful project. In the case of this project an interesting approach was taken. When Facchina sold the building to Turnberry and became the secondary owner, one stipulation was that Facchina's general contractor division would be used to build and manage the job. The hope was that by having the owner and general contractor work together and be one in the same that it would be possible to achieve cost, quality, and schedule which is not typical on most projects. When there was a delay from permitting problems, both sides worked together very well. The project fell behind three months and it did not sit well with any of the parties. Both sides worked together and were able to speed up the project to get back on the original schedule and they did this without increasing any cost or decreasing any quality.

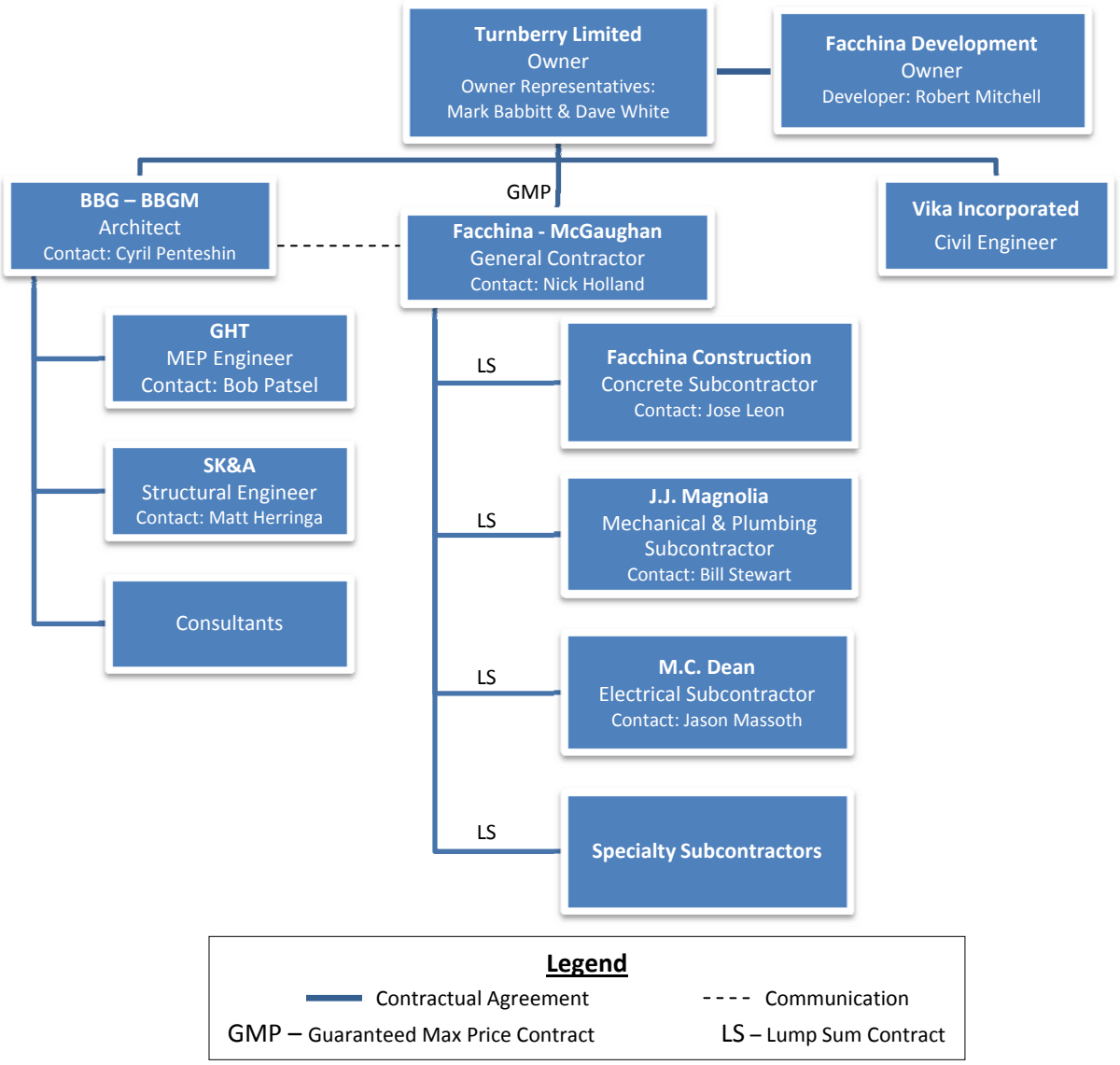
Throughout construction there was also constant communication between the owner and general contractor dealing with all changes. In an effort to keep costs down, quality high, and schedule on track, these parties would meet regularly to discuss any and all changes. This showed that when the general contractor has a vested interest in a project they will try to do what they can to keep cost, quality, and schedule in check.

When asked what safety expectations were required, the only answer from the owner was "100% at all times."

In order to complete this project so the owner is satisfied, all of the units must have the kitchens and bathrooms finished and have the rest of the unit roughed out with junction boxes for lights and power to the receptacles. The corridors on the typical floors must be finished as well. The lobby level will need to be completely finished including the pool, spa, gym, and mezzanine level. The parking garage will need to have all private garage doors installed. All the systems in the building must be commissioned, online and ready to work properly for turnover.

VII. Project Delivery System

Turnberry Tower Arlington Organizational Chart



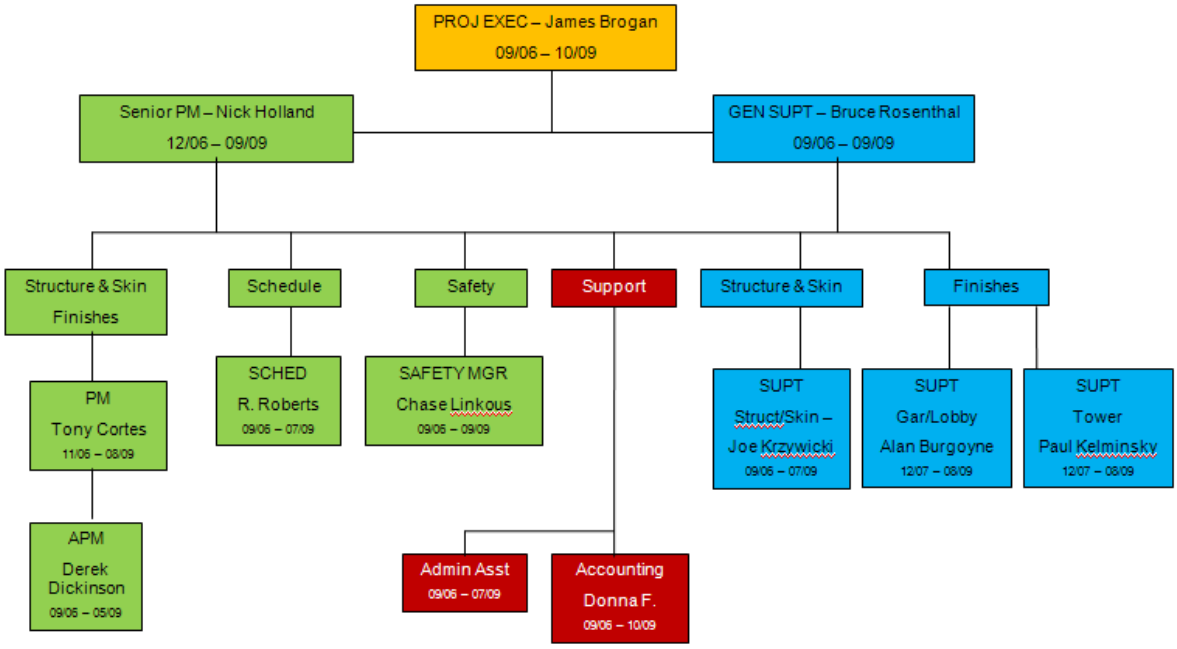
This project is being delivered in a design-bid-build approach. This was chosen because Turnberry wanted to the building to fit their exact needs so it could be a building they would be proud to own.

Between the owner and the general contractor there is GMP contract. In parts of the budget where items were not yet purchased or it was not decided what was exactly needed, an allowance was put in. A lump sum contract is used between the general contractor and subcontractors. The subcontractors were picked by the use of a hard bid. In some cases it was required for the subcontractor to bond 1.5% of their bid in the form of a payment and performance bond. The project uses a CCIP Insurance program so all subcontractors were required to participate in this program.

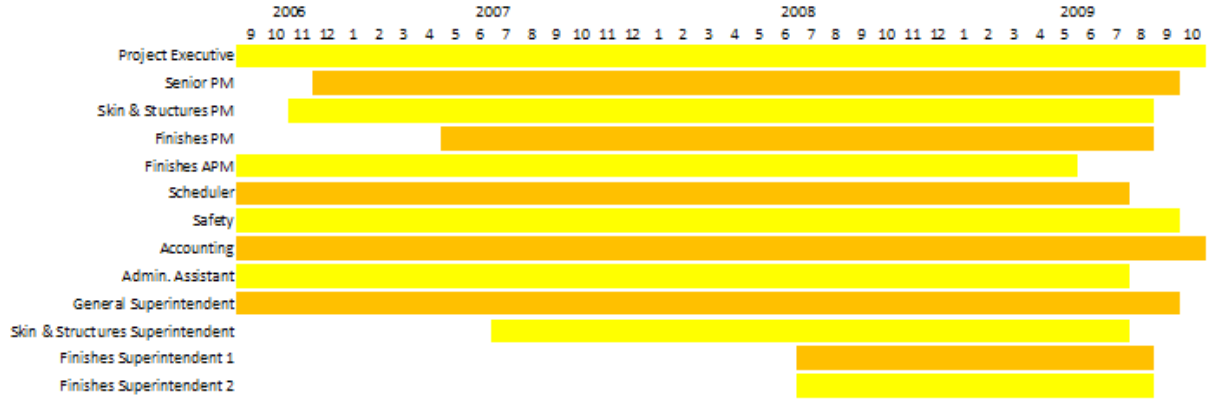
VIII. Staffing Plan

Below is the organization chart and the staffing plan for the Turnberry Tower Arlington project being used by the general contractor. The organization chart is set so there is one project executive that deals primarily with the owner while everyone else has who they should report to. Because of the flexibility of this project and the open communication between the owner and general contractor, everyone on the job is able to communication with everyone on the owner's side and vice versa. The staffing chart was set up before the job and describes what the job will need in regards to the onsite personal.

Facchina-McGaughan Organization Chart



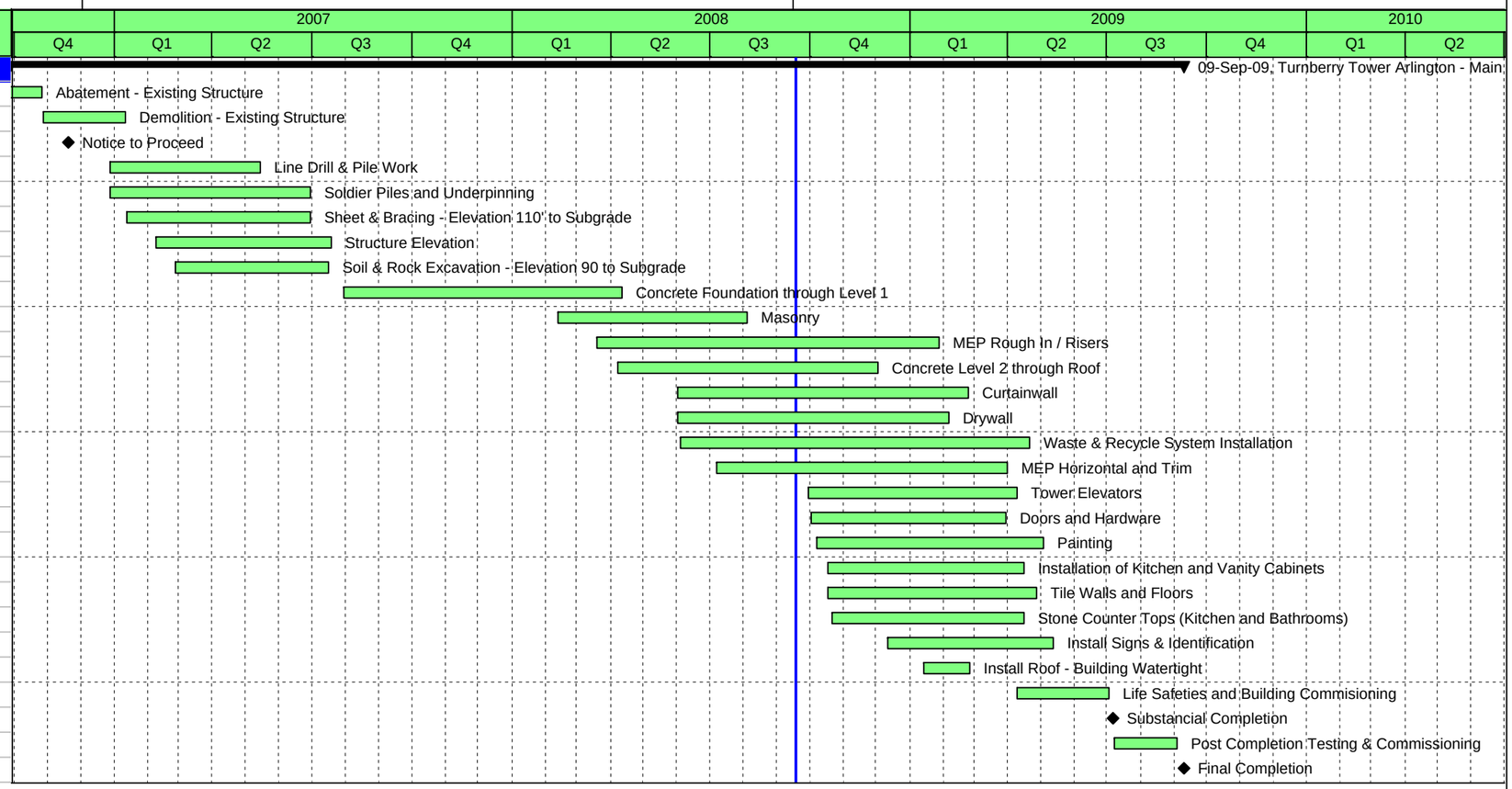
Facchina-McGaughan Staffing Chart



Appendix A – Schedule Summary

Turnberry Tower Arlington - Main Activities | Classic WBS Layout | 24-Sep-08 17:14

Activity Name	Original Duration	Start	Finish
Turnberry Tower Arlington - Main Activities	767	27-Sep-06	09-Sep-09
Abatement - Existing Structure	22	27-Sep-06	26-Oct-06
Demolition - Existing Structure	50	27-Oct-06	10-Jan-07
Notice to Proceed	0	20-Nov-06	
Line Drill & Pile Work	97	28-Dec-06	14-May-07
Soldier Piles and Underpinning	131	28-Dec-06	29-Jun-07
Sheet & Bracing - Elevation 110' to Subgrade	121	12-Jan-07	29-Jun-07
Structure Elevation	116	08-Feb-07	19-Jul-07
Soil & Rock Excavation - Elevation 90 to Sul	101	26-Feb-07	16-Jul-07
Concrete Foundation through Level 1	184	31-Jul-07	11-Apr-08
Masonry	124	13-Feb-08	04-Aug-08
MEP Rough In / Risers	225	19-Mar-08	27-Jan-09
Concrete Level 2 through Roof	172	07-Apr-08	02-Dec-08
Curtainwall	191	02-Jun-08	23-Feb-09
Drywall	179	02-Jun-08	05-Feb-09
Waste & Recycle System Installation	230	04-Jun-08	21-Apr-09
MEP Horizontal and Trim	192	07-Jul-08	31-Mar-09
Tower Elevators	138	30-Sep-08	09-Apr-09
Doors and Hardware	128	02-Oct-08	30-Mar-09
Painting	150	07-Oct-08	04-May-09
Installation of Kitchen and Vanity Cabinets	129	17-Oct-08	15-Apr-09
Tile Walls and Floors	137	17-Oct-08	27-Apr-09
Stone Counter Tops (Kitchen and Bathrooms)	127	21-Oct-08	15-Apr-09
Install Signs & Identification	109	11-Dec-08	12-May-09
Install Roof - Building Watertight	30	14-Jan-09	24-Feb-09
Life Safeties and Building Commisioning	60	10-Apr-09	02-Jul-09
Substancial Completion	0		07-Jul-09
Post Completion Testing & Commissioning	42	08-Jul-09	03-Sep-09
Final Completion	0		09-Sep-09



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

Larry Warner

Turnberry Tower Arlington Key Activity and Milestones

Appendix B – SIPS

Facchina-McG

Turnberry Tower 1881 N. Nash St

9/5/2008

2008

FLOOR	2/25/08	3/3/08	3/10/08	3/17/08	3/24/08	3/31/08	4/7/08	4/14/08	4/21/08	4/28/08	5/5/08	5/12/08	5/19/08	5/26/08	6/2/08	6/9/08	6/16/08	6/23/08	6/30/08	7/7/08	7/14/08	7/21/08	7/28/08
Weeks	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
26																							
25																							
24																							
23																							SV
22																						SV	FL
21																					SV	FL	FL
20																				SV	FL	FL	WL/H1
19																			SV	FL	FL	WL/H1	H1
18																		SV	FL	FL	WL/H1	H1	H1
17																	SV	FL	FL	WL/H1	H1	H1	WD
16																SV	FL	FL	WL/H1	H1	H1	WD	WD
15															SV	FL	FL	WL/H1	H1	H1	WD	WD	WD
14														SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD
12													SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2
11												SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2
10											SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP
9										SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3
8									SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1
7								SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2
6							SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD
5						SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT
4					SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT
3				SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT
2			SV	FL/WL	FL/WL	WL/H1	H1	H1	WD	WD/HR	WD/HR	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1
Structural Build-out	T5	T6	T7	T8	T9	T10	T11	T12	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	MR	EF

FLOOR	8/4/08	8/11/08	8/18/08	8/25/08	9/1/08	9/8/08	9/15/08	9/22/08	9/29/08	10/6/08	10/13/08	10/20/08	10/27/08	11/3/08	11/10/08	11/17/08	11/24/08	12/1/08	12/8/08	12/15/08	12/22/08
Weeks	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
26			SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	
25		SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	
24	SV	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	
23	FL	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	
22	FL	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	
21	WL/H1	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	
20	H1	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	
19	H1	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	
18	WD	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	P	P	D2	V1	V2/EH	
17	WD	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	
16	WD	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	
15	WD	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	
14	S1/H2	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB	
12	S1/H2	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB		
11	FP	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB			
10	H3	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB				
9	E1	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB					
8	E2	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB						
7	I/GD	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB							
6	DT	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB								
5	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB									
4	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB										
3	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB											
2	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB									TE			
Structural Build-out	ER																				

2009

FLOOR	12/29/08	1/5/09	1/12/09	1/19/09	1/26/09	2/2/09	2/9/09	2/16/09	2/23/09	3/2/09	3/9/09	3/16/09	3/23/09	3/30/09	4/6/09	4/13/09	4/20/09	4/27/09	5/4/09	5/11/09	5/18/09	5/25/09
Weeks	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69
26	DT	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB										
25	DT	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB											
24	D1	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB												
23	H4/P	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB													
22	P	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB														
21	D2	V1	V2/EH	ET	T1	CL/PL	PS/TB															
20	V1	V2/EH	ET	T1	CL/PL	PS/TB																
19	V2/EH	ET	T1	CL/PL	PS/TB																	
18	ET	T1	CL/PL	PS/TB																		
17	T1	CL/PL	PS/TB																			
16	CL/PL	PS/TB																				
15	PS/TB																					
14																						
12																						
11																						
10																						
9																						
8																						
7																						
6																						
5																						
4																						
3																						
2						FE												TCO1				
Structural Build-out																						

T8

SW (week 15)

SD (week 15)

- SV = SURVEYOR FOR PRIMARY CONTROL
- FL = FLOOR LAYOUT, INSTALL TOP TRACK
- WL = WINDOW LAYOUT
- H1 = DUCT WORKS ROUGH-INS, HVAC/ PLUMBING ROUGH-INS
- WD = INSTALL WINDOW WALLS, CURTAIN WALL
- HR = INSTALL BALCONY RAILING/ DIVIDERS
- S1 = FRAME, BLOCKING, DOOR FRAME CORR.
- H2: H3 = SET TUBS
- FP = SPRINKLER ROUGH-IN UNITS/CORRIDOR
- H3 = PLUMBING WALL ROUGH-INS, SET SHOWER DIVERTERS
- E2 = ELECTRICAL WALL RI, CONTROL WIRING TO FCU STAT
- E2 = ELECTRICAL WALL RI, CONTROL WIRING TO HP STAT
- I = INSPECTIONS, WALL INSULATION, INSULATE PLMB DW RISERS
- DT = DRYWALL & TAPE; 3RD WEEK WINDOW TRIMS
- D1 = PRIME PAINT WALLS/ UNIT CEILINGS/ DOORS
- H4: T1 = SET AND HOOK UP HP'S, WATER HEATERS
- P = INSTALL TILE FLOORS & WALLS
- D2 = INSTALL VANITIES & KITCHEN CABINET FRAMES
- V1 = INSTALL STONE VANITY TOPS/ KITCHEN STONE TOPS, SHOWER ENCLOSURES & MIRRORS
- V2 = INSTALL PLUMBING FIXTURES
- EH = ELECTRICAL TRIM-OUT, WIRE HP'S, WIRE WATER HEATERS AND FIXTURES, GRSD'S, ATC TRIMS
- ET = INSTALL APPLIANCES, CABINETS FACES/DOORS/DRAWERS
- T1 = INSTALL DOORS, HARDWARE & TOILET ACCESSORIES
- PL = CONTRACTOR PUNCH
- PS =SIGNS, FIRE EXTINGUISHERS at CORRIDORS
- TB = TEST & BALANCE

MILESTONE LEGEND

- TCO = 1st TCO
- SW = Milestone to have shaft ready for first lift rails
- TE = Temp Elevator Ready for Use
- FE = All Elevators Ready for Use
- SD = Seal Deck @ T14

Appendix C – Cost Analysis Data

R.S. Means Data

Tower

Exterior Wall	S.F Area	400,000	500,000	600,000
	L.F. Perimeter	570	600	630
Ribbed Precast Concrete Panel	R/ Concrete Frame	$159.10	$156.98	$154.85
	Perimeter Adjustment	$2.35	$1.93	$1.50
	Story Height Adjustment	$1.25	$1.08	$0.90

Additions	Cost Per Unit	Total Cost
Appliances	$8,625	$2,233,875
Elevators	N/A	$2,228,000
Elevator Additional Stops	N/A	$1,323,000
Total Additions		$5,784,875
Cost per Square Foot		$11.57

Square Foot Estimate	$156.98
Perimeter Adjustment	$1.24
Additions	$11.57
Total per SF	$169.79

Parking Levels

Exterior Wall	S.F Area	40,000
	L.F. Perimeter	600
Ribbed Precast Concrete Panel	R/ Concrete Frame	$73.00
	Perimeter Adjustment	$2.45
	Story Height Adjustment	$1.45

Square Foot Estimate	$73.00
Perimeter Adjustment	$4.90
Total per SF	$77.90

Total

	Square Feet	Cost per SF	Total Cost
Residential Tower	500,000	$169.79	$84,895,000
Parking Garage	240,000	$77.90	$18,696,000
			$103,591,000
R.S. Means Location Factor (Arlington, VA)			1.04
		Total Estimate	$107,734,640

D4 COST 2002

Sunday, September 21, 2008

Statement of Probable Cost

Page 1

Turnberry Tower Arlington - Sep 2009 - VA - Arlington

Prepared By:	**Larry Warner**	Prepared For:	
,	**Fax:**	,	**Fax:**
Building Sq. Size:	**500000**	Site Sq. Size:	**853426**
Bid Date:		Building use:	**Residential**
No. of floors:	**31**	Foundation:	**CON**
No. of buildings:	**1**	Exterior Walls:	**CUR**
Project Height:	**210**	Interior Walls:	**GYP**
1st Floor Height:	**10**	Roof Type:	**EPD**
1st Floor Size:	**20000**	Floor Type:	**CON**
		Project Type:	**NEW**

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**2.33**	**4.45**	**2,223,882**
	Bidding Requirements	2.33	4.45	2,223,882
01	**General Requirements**	**7.50**	**14.31**	**7,155,875**
	General Requirements	7.50	14.31	7,155,875
02	**Site Work**	**4.36**	**8.32**	**4,162,246**
	Site Work	4.36	8.32	4,162,246
03	**Concrete**	**6.67**	**12.73**	**6,365,136**
	Concrete	6.67	12.73	6,365,136
04	**Masonry**	**4.09**	**7.81**	**3,904,365**
	Masonry	4.09	7.81	3,904,365
05	**Metals**	**0.93**	**1.77**	**882,877**
	Metals	0.93	1.77	882,877
06	**Wood & Plastics**	**6.34**	**12.10**	**6,049,079**
	Wood & Plastics	6.34	12.10	6,049,079
07	**Thermal & Moisture Protection**	**4.19**	**8.00**	**3,999,200**
	Thermal & Moisture Protection	4.19	8.00	3,999,200
08	**Doors & Windows**	**3.34**	**6.37**	**3,183,470**
	Doors & Windows	3.34	6.37	3,183,470
09	**Finishes**	**9.77**	**18.65**	**9,324,642**
	Finishes	9.77	18.65	9,324,642
10	**Specialties**	**0.61**	**1.17**	**585,671**
	Specialties	0.61	1.17	585,671
11	**Equipment**	**1.30**	**2.48**	**1,240,021**
	Equipment	1.30	2.48	1,240,021
12	**Furnishings**	**0.77**	**1.46**	**731,467**
	Furnishings	0.77	1.46	731,467
13	**Special Construction**	**0.29**	**0.55**	**273,867**
	Special Construction	0.29	0.55	273,867
14	**Conveying Systems**	**1.47**	**2.81**	**1,403,343**
	Conveying Systems	1.47	2.81	1,403,343
15	**Mechanical**	**13.26**	**25.31**	**12,654,937**
	Mechanical	13.26	25.31	12,654,937
16	**Electrical**	**8.39**	**16.01**	**8,002,735**
	Electrical	8.39	16.01	8,002,735
21	**Fire Suppression**	**1.25**	**2.38**	**1,191,954**
	Fire Suppression	1.25	2.38	1,191,954

22	**Plumbing**	**4.42**	**8.44**	**4,218,617**
	Plumbing	4.42	8.44	4,218,617
23	**HVAC**	**7.64**	**14.57**	**7,287,076**
	HVAC	7.64	14.57	7,287,076
26	**Electrical**	**6.58**	**12.56**	**6,281,739**
	Electrical	6.58	12.56	6,281,739
27	**Communications**	**0.48**	**0.92**	**457,780**
	Communications	0.48	0.92	457,780
28	**Electronic Safety and Security**	**0.12**	**0.24**	**118,191**
	Electronic Safety and Security	0.12	0.24	118,191
31	**Earthwork**	**1.87**	**3.57**	**1,787,112**
	Earthwork	1.87	3.57	1,787,112
32	**Exterior Improvements**	**1.40**	**2.68**	**1,337,766**
	Exterior Improvements	1.40	2.68	1,337,766
33	**Utilities**	**0.62**	**1.19**	**593,894**
	Utilities	0.62	1.19	593,894
Total Building Costs		**100.00**	**190.83**	**95,416,943**
Total Non-Building Costs		**100.00**	**0.00**	**0**
Total Project Costs		**--**	**--**	**95,416,943**