Christopher R. Stultz | Construction Management

Faculty Consultant | Dr. David Riley

Project | Crystal Plaza II

Location | Arlington VA

Date | 9/29/08

Technical Report I | Construction Project Management

Crystal Plaza II

Arlington VA

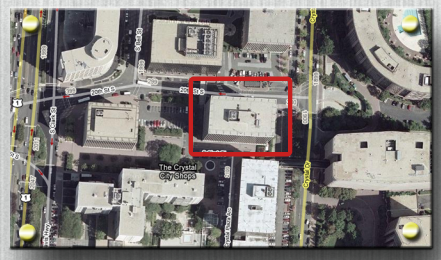
Design & Construction Team

Owner/Occupant: Charles E. Smith/Vornado

General Contractor: Balfour Beatty Construction

Architects: Dorsky Hodgson Parrish Yue
Hellmuth Obata Kassabaum
Hartman Desgign Group

Engineers: Tadjer Cohen Edelson (Structural)
GHT Limited (MEP)
VIKA, Inc. (Civil)
Greenscape (Leed)



Building Information

- Location: 220 20th Street Arlington VA
- Construction Dates: January 2008 - August 2009
- Building Size: 325,000 SF
- Building Stories/Height: 20 Stories, 218 FT
- Construction Cost: $67.3 Million
- Overall Cost: $82 Million
- Contract Type: Negotiated GMP with Pre-Construction Services
- Notable: First Building in Crystal City to Exceed 12 Stories, LEED NC-Silver Rating Version 2.2
- Architecture: Facade features a unitized curtain wall system & a cobination of roof coverings, such as pavers, topping slab, and modified bituminous membrane with ballst

Building Systems

Structural:

Levels 1-12

- two way, flat plate slab
- 10" thick, concrete shear wall
- CFRP around critical columns

Levels 13-20

- 6" post tensioned, 5000 psi, flat plate slab
- Existing Caisson foundation

MEP Systems:

- Four, 5200 CFM RTU's & varying water source heat pumps
- 400 nominal ton, cross flow cooling towers
- Four natural gas, condesing fire tube boilers
- 120/208 V lighitng system for units supplied by bus duct
- 450 kW, 277/408 V, 3 phase diesel generator
- Dual, wet & dry, fire suppresion systems

Construction:

Renovation of existing 12 story building

- Removed precast facade & replaced with curtain wall system
- Phased completion of rental office, floors 1-3, & floors 4-20

Christopher R. Stultz

Construction Management

http://engr.psu.edu/ae/thesis/portfolios/2009/crs5011

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Executive Summary

The goal of this technical report is to gain a basic, background understanding of the Crystal Plaza II project located in Arlington, VA. Research into project location, owner information and goals, project delivery and staffing, as well as schedule, cost, and building systems create an understanding of the current state of the project and its direction in the future.

Vornado/Charles E. Smith, the owner, approached Balfour Beatty Construction to provide preconstruction services for Crystal Plaza II, a 325,000 square foot, renovation/addition project located on 20th Street, in the heart of a changing Crystal City. The 12 story existing building was originally to be demolished and replaced with a new high rise apartment building, but after preconstruction and market research by the owner, it was determined to renovate the existing structure and add 9 stories to house the 266 residential units and supporting systems. The original building was completed in 1969 as a 12 story office building, and after its transformation into a 266 unit residential tower it will be in a prominent location in Arlington County featuring connections to the metro, proximity to Ronald Reagan National Airport, and direct access to the Crystal City shops. The current project uses the existing concrete structure through the twelfth floor with nine additional floors of post tensioned slabs. The individual apartments range from studios to penthouse suites located on the uppermost floors. A two story lobby with direct access from 20th Street, Crystal City Shops, and the plaza located behind the building greets its occupants with colorful terrazzo flooring and stone finish work. Also inside the lobby will be a small retail area and a club room on the second level. An underground garage will be available for the building's tenants. The exterior design is a glass façade, constructed using a unitized curtain wall system. The new look creates a dynamic difference between the new Crystal Plaza II residential tower and the surrounding office buildings. Also distinguishing it from other residential areas is the overall building height, which towers 7 stories above all the surrounding structures. Construction began on the current project in January 2008 and is scheduled to be complete in August 2009.

Crystal Plaza II is a challenging project that faces many obstacles, including a congested site, public safety, a relatively short schedule, and multiple occupancy phases. The project is also pursuing a LEED Silver rating. Proper management and allocation of resources are necessary for the success at Crystal Plaza II.

A. Project Schedule Summary

The project schedule for Crystal Plaza II used in this report is based upon a modified combination of the original project construction schedule from preconstruction and a current schedule. The modified schedule summary can be seen in Appendix A with brief descriptions of key schedule activities listed below.

The summary schedule begins with the design phase and key approvals to the building proposal. Of note is the approval of the Federal Aviation Administration that allows the building to rise above 12 stories. Approval was needed due to the proximity to the Ronald Reagan National Airport. Key procurement activities include the bid/proposal/procurement of glass and glazing, as this was a long lead time item and was released early to account for this issue. Also important is the notice to proceed with demolition as much of the façade and interior needed demolition prior to the start of construction on the site.

The structural system sequence is repetitious from floor 13 through 20. As can be seen, about a floor a week was constructed in a two pour per floor sequence to allow material staging and forming. Each pour was approximately 200 CY and required a day to place and finish the 5000 psi concrete. A "puddling" method was also used over critical columns that required 8000 psi concrete. Typically within 24 hours of finish, shores and formwork for the next floor were being placed to allow a quicker floor sequence and a decreased schedule, finishing in early July rather than late August. Columns were poured 1-3 days prior and were similarly broken into two pours. Re-shores were required three levels under the current floor, whether the concrete had reached maximum strength or not. Another key element for the structure is the reinforcement of the existing structure before key dates set forth by the structural engineer. The reinforcing is a long process that requires a substantial area and therefore is a critical member of the schedule. The structural reinforcement was a critical concern and began as early as possible, so as to keep the upper floor construction on schedule.

The enclosure sequence highlights the key activities to create a water tight structure, with the goal of being water tight, or dried in, by November 2008 to provide temporary heat for interior finish activities and persons on site.

The finish sequencing on the project is a complex part of the schedule with trades starting on different floors for different reasons, but primarily to avoid trade stacking with structural trades reinforcing and leveling the existing structure.

Occupancy is also a complex sequence because much of the building is phased occupancy. Turnover to the owner occurs in sets of three floors about every two weeks beginning in early June 2009 and finishing in early August 2009. This provides a unique challenge that requires proper scheduling for inspections and punch-list completions as these activities occur multiple times over the finish course of the project.

B. Building Systems Summary

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

B.1 Demolition Required

Demolition of the interior spaces was completed in the early stages of the project prior to much of the construction beginning onsite. This included asbestos abatement of the primary occupant spaces, however, the remaining plumbing components and some areas in the parking area needed abatement during construction. The precast exterior began removal in January 2008, as construction began, and finished in April 2008. Other demolition includes slab removal for stairs, elevators, and slab edges, exterior demolition of parking structure wall/plaza area, and complete removal of the northern section of the 2nd floor slab over the lobby.

Exterior façade to be removed

Demo of existing stair tower

B.2 Structural Steel Frame

While there is no structural steel frame used as a building support system, use of structural steel is implied around the new, larger elevator and stair openings.

Fire proofed structural steel around stair opening

B.3 Cast in Place Concrete

Floors 13-20 feature a cast in place, post tensioned slab. Concrete was placed on the reusable plywood formwork, supported by aluminum I-beams, using a 3 yard concrete bucket hoisted by the tower crane. Two different mixes were used on each floor and required coordination between the concrete sub contractor, the supplier, and the general contractor. The columns for floors 13-20 were placed in much the same manner, utilizing reusable gang forms and feature four sloping columns. Interior concrete work, such as shear wall, infill, and stairs, from floors G2-13 was placed using concrete buggies and various form types. Stairs and infills used built in place plywood and the shear wall used a gang form system.

Formwork and concrete typical floor

Column formwork

Shear wall formwork and bracing

B.4 Precast Concrete

The only precast element on the site was the stairs for floors 13-20. There were cast in Bethesda, MD and the installation followed the erection of the formwork until the building topped out in July 2008.

B.5 Mechanical System

The building uses a fairly complex system in which fresh air is provided to all spaces by four roof top, packaged units. Local settings are achieved in the individual units by using a water source heat pump sized specifically for that space. The water for the heat pump is pumped from the unit to the roof where it goes through a heat exchanger connected to one of the cooling towers. Hot water for the building is provided by four, condensing fire-tube, natural gas boilers. The roof level is where a majority of the equipment is located, with the exception of the heat pumps. There are three primary rooms on the roof devoted to mechanical equipment. The first is for the pool equipment, including a gas heater and pump/filter system. Two additional rooms are located on the west side with one housing the boilers, heat exchangers, and pumps, and the other housing the hot water storage system. The 400 nominal ton, cross flow type cooling towers are located adjacent to these two rooms.

B.6 Electrical System

Apartment units will receive 120/208 V, 125 A service via 19 meter centers located on each floor in the electrical closet. Meter centers are broken into two supplies, one from floors 2-10 and a second for floors 11-19. Meter centers are connected to a single, 3 phase, 5000 A switchboard by bus duct with a primary riser size of 2500 A and connection ducts of 600 A that is part of Dominion Virginia Power's grid. Estimated maximum load for this system is 1,514 KW. The 277/480 V system provides power to many of the buildings mechanical and fire suppression systems. Use of transformers also allows the voltage to be stepped down for use in common areas. The system is distributed through two switchboards with the first being the initial connection to service. The first switchboard provides power to lower level systems such as the lobby and 2nd floor lighting/receptacles (via 150KVa transformer), 1st floor mechanical units, emergency systems, and the second switchboard located on the roof level. Estimated maximum load for this system on the initial switchboard is 1,831 KW and 1,294 KW on the second switchboard. Stand-by power is available through a 450 KW, diesel generator located on the roof in the machine room. Lighting in the apartments varies between incandescent A19, wall and surface mounted luminaires, MR-16 track lighting, and recessed PAR fixtures. A majority of the public areas utilize various types of florescent luminaires.

B.7 Masonry

Masonry walls are limited on the site as well. Their primary use is on the lower floors, G2-1. On G2 an 8", fire rated CMU partitions enclose Elevator 1 and the new pump room. Their use continues on the 1st floor as separators from the existing garage and loading area, as well as the demising walls for existing retail spaces.

B.8 Curtain Wall

The curtain wall is a very repetitive system used as a façade for the entire building which feature an operable window panel for the apartments. The curtain wall is an aluminum frame, low-e glass system that attaches to the slab via concrete imbeds. For the existing slab, a plate was attached to the slab to provide a connection point. The design of the system was the responsibility of a separate architect, and testing/quality control is performed by an independent consultant hired by the owner and curtain wall sub contractor. To keep the project on schedule given the initial delay, the curtain wall was released for manufacture before construction began. This allowed the sub contractor to stockpile the unitized pieces for quick transportation to the site and to prepare a better site layout/work progress. The specialized pieces, such as corners, terrace walls, and come backs will be constructed after the given section of unitized pieces is in place. This provides a large risk to the project as it strives towards water tightness, especially with the limited capacity and location of the supplier/sub contractor. Curtain wall pieces are prefabricated and shipped from the factory in Buffalo, NY.

Curtain wall units stored onsite

B.9 Support of Excavation

The project is a renovation of an existing building, and therefore has little excavation. The excavation of the landscaping was done primarily by the demolition sub contractor as it involved removing existing landscaping and hardscape.

C. Project Cost Evaluation

C.1 Cost Information

The following is the cost of construction at Crystal Plaza II, excluding land costs, site work, permitting, and associated project soft costs.

Construction Cost: $67.3 Million
Construction Cost/SF: $207.08/SF

The following is the total cost of the project, excluding land costs, previous site work, demolition, and abatement, as well as owner provided items.

Total Cost: $82 Million
Total Cost/SF: $252.31/SF

The following is a breakdown of specific building systems in the Crystal Plaza II project. Each category is representative of a specification division and other items from varying divisions have been included as noted.

Mechanical System Cost: $13 Million
Mechanical System Cost/SF: $40/SF

Electrical System Cost: $7.5 Million
Electrical System Cost/SF: $23.08/SF

Structural System Cost (Concrete only): $4.1 Million
Structural System Cost/SF: $12.62/SF

Curtain Wall System (As part of Doors/Windows): $11.2 Million
Curtain Wall System Cost/SF: $34.46/SF

C.2 D4 Cost 2002 Parametric Estimate

The D4 Parametric Estimate results can be found in Appendix A

As part of the parametric estimation process, six buildings from the D4 database were selected based on various criteria. The use of six buildings was due to the fact that no building with similar use was of the magnitude in height or cost range. To get a more diverse result, the buildings listed below were selected for the reasons stated.

Project Name	Size (SF)	Floors	Cost	Use	Reasoning
Dulles Office Building	92,444	4	$5,652,100	Office	Similar location, structure
Willow Oak II	407,042	7	$16,757,728	Office	Similar location, structure
111 Jones St Apt Complex	127,325	9	$11,323,434	Residential	Similar use, structure
201 Turk St Apt Complex	215,260	9	$18,026,908	Residential	Similar use, structure
Federal Detention Center	320,000	13	$60,556,000	Civil/Government	Similar square footage, cost
Westchase Corporate Center	308,500	6	$10,492,634	Office	Similar square footage, structure

The first two projects were selected for their locations in a similar area as Crystal Plaza II and because they exhibit a similar type of structure. As for the next two, their use as high rise, residential projects share similarities with Crystal Plaza II and therefore should produce similar cost per square foot data and a good background of information for divisional requirements in the Statement of Probable Cost. The final two selections are based on similar square footages, assuming costs are related to economies of scale.

Using the integrated averaging program within D4, the selected buildings were compared with a target date of January 2008, the unofficial start of construction for the project. The result was an estimate of ***$45,236,011***, well below the listed $67,300,000 for the project. The difference may be the result of many inputs, such as lack of similar projects, varying local conditions for the project, carrying an above average contingency, or project changes that resulted from issues during preconstruction. Another logical suggestion is the building components. The buildings selected may not have the similar components, such as the intricate glass curtain wall façade on Crystal Plaza II.

C.3 RS Means 2008 Cost Estimate

The RS Means estimation calculations are based on RS Means Square Foot data for a Commercial/Industrial/Institutional Apartment, 8-24 stories in height with a ribbed, precast concrete panel supported by a reinforced concrete frame. This exterior wall system is assumed to be the closest to the curtain wall system of Crystal Plaza II in construction methods when compared to the other options of face brick and stucco. Values for cost per square foot, linear foot adjustment, and story height adjustment

were calculated using interpolation of the given values in the chart. Additives to the estimate are shown below to help achieve higher accuracy and have the higher value in the common range to account for the quality level anticipated in apartment furnishings. The referenced pages can be found in Appendix B.

Crystal Plaza II Data
20 story apartment with 11' average story height
Building Area: 325,000 SF
LF of Perimeter: 560 ft
Number of Units: 254

Cost/SF:	$162.61/SF
Linear ft of Building:	546 (560-546 < 100, no adjustment needed)
Story Height:	10'6 (11'-10'6 < 1', no adjustment needed)
Location Factor:	0.92 (Arlington VA)
Adjusted Cost/SF:	$149.60/SF
Estimated Project Cost:	**$48,620,000**

Additives	
Cooking Range, 30" Free Standing, 1 oven:	$2,175 EA
Dishwasher, 4 cycle:	$1,300 EA
Refrigerator, 20 c.f.:	$1,175 EA
Washer, 4 cycle:	$1,050 EA
Dryer, 16 lb. capacity:	$ 860 EA
Total cost/unit:	$6,560
Total cost ($6,560*266):	$1,744,960
Elevators:	
3,000#, 21 stops (3):	$1,095,375
3,000#, 22 stops (1):	$373,000
Total Elevator Cost:	$1,468,375
Total Additives Cost:	**$3,134,615**
Total RS Means Estimate:	**$51,833,335**

This estimate, similarly to the D4 parametric estimate, is significantly lower than the project cost of $67,300,000. The difference in price may be the result of the expensive curtain wall system that was not an available option for this building type in RS Means. Also, the project is a partial renovation, which may increase the cost per square foot given the unknown nature of the project as it pertains to demolition and required modifications to the structure for the upper floor additions.

D. Site Plan of Existing Conditions

The Site Plan and General Conditions Plan can be seen in Appendix A.

Crystal Plaza II is located in a very congested area, and therefore requires intense planning and organization for safety and workflow. As for site conditions, many of the primary utilities feed from Crystal Drive to an underground area that supplies the building. The sanitary sewer exits from the 20th street side and connects to the main under Jefferson Davis Highway. Connections to the utilities were fairly easy given the existing connections to the previous building. General Condition's layout was the key in the layout of the site. Given the congestion of the site, it was decided to place as much parking, material storage, and site trailers in one, partial level of underground parking. This area had direct access to 20th Street and provided a secure, covered storage area that would otherwise be unobtainable. Material lay down areas also existed on the south side of the building near the material hoist, however this area was primary used by the concrete subcontractor for assembly of column rebar and material storage. Deliveries to the site were received on the northern side, closest to the tower crane. This allowed deliveries to be monitored by the general contractor, whose office was located at the bottom of the garage ramp, and for ease of unloading with the tower crane or forklifts as the sidewalk area was closed around the delivery area. The southernmost lane of 20th Street was closed to allow for multiple deliveries to arrive at the site, and as a temporary lay down area. As for safety and pedestrian traffic, an overhead walkway was constructed to allow pedestrian traffic to utilize the Crystal City Shops entrance near the parking garage entrance, although this needed to be closed on certain occasions to allow for material staging on upper floors.

E. Local Conditions

Arlington County's Crystal City Public Forum began research into a revised concept plan for Crystal City that was presented on January 30, 2008, after much of the design for Crystal Plaza II was complete. As part of the presentation, an economic analysis summary was presented with an outcome goal of providing "a greatly enhanced urban place without losing existing assets and amenities."[1] Their findings indicated adequate office demand to support growth, but that residential demand exceeded the Vision Plan looking forward to 2050. The new proposed master plan has 6 points:

- Strong public realm
- Balance mix of uses
- Legible urban design/architecture
- Enhanced transportation connectivity (multi-modal)
- Transition to adjacent neighborhoods
- Economically, environmentally, and socially sustainable[1]

As for construction in this area, concrete structures are the dominate choice. Given the advantages to building with concrete in a height limited zone, and its use as an architectural component, it becomes the logical choice for owners and developers to achieve maximum profitability while trying to achieve a design or architectural aesthetic. Labor also plays a vital role in this construction type as the large availability of a labor force to perform the necessary tasks within concrete make it the prime choice for building. By avoiding a structural steel frame, the necessary lay down area has been reduced and is less congested on a limited area site, with only a small area required for concrete deliveries.

Parking onsite is achieved via existing underground garage areas that serve the surrounding retail and office area. Use of one level was permitted and regulated by the general contractor. By regulating parking and properly scheduling trades, the use of onsite parking helped alleviate tensions about getting workers to the project. However, given the location, site deliveries must be well scheduled to avoid traffic and site congestion. Use of a well designed delivery schedule is imperative to a successful project.

Soil conditions for the project are not of high concern given the project is a renovation of an existing structure. However, special care needs to be taken to ensure the caisson foundations can support the new structure.

The tipping fees for the site are expected to be higher than average in the area because the material removed from site is sorted and a report is produced as part of the LEED requirements.

[1] "Crystal City Planning Process." Crystal City Planning Process. page 3

F. Client Information

Vornado/Charles E Smith Commercial Realty, founded 1946, is the owner/developer of Crystal Plaza II, along with the majority of properties in Crystal City. Vornado/Charles E. Smith is the largest owner of properties in the Washington, D.C. region and the 4th largest real estate investment trust in the United States. In D.C. alone, they own and manage 15.9 million square feet of property, with over 50 years of experience in the property management market. Even with these accomplishments, Vornado/Charles E. Smith is actively seeking new opportunities for property acquisitions and development in the entire Washington, D.C. area.

Key elements in Vornado/Charles E. Smith's strategy that apply to the redevelopment of Crystal Plaza II, and more generally to Crystal City are:

- Sustain and expand our dominant position in the Washington, DC region--through acquisition and development in the best submarkets
- Maximize the value of our real estate portfolio through strategic re-investments in our properties
- Sustain our superior occupancy track record via strong leasing and management efforts which focus on attracting and retaining the highest quality tenants[2]

Crystal City itself was the product of Charles E. Smith's pioneering efforts in the 1960's to create an established, mixed use development by integrating office, retail, and residential in a balanced proportion according to market demands. By enforcing their own strategy through re-investment in the original buildings of Crystal City, Vornado/Charles E. Smith is creating a dominate position in the strong, residential market of D.C. suburbs, maximizing the value of their property through renovations, and sustaining high occupancy rates by creating new areas for markets in demand.

The owner is looking to produce a very high end, prestigious atmosphere and is aiming at the top of the northern Virginia market. By placing emphasis on the finishes and location of the building, Vornado/Charles E. Smith can justify the higher rental cost. Given the project, the owner is expecting an 18-20 month turnaround for occupancy because there was no excavation, foundation work, and structure work on the first 12 stories. Another expectation is to open a temporary leasing office approximately 90 days prior to the turnover of the first floors to allow pre-sales of the apartments. This tactic is common for the owner so that upon the issuing of the certificate of occupancy, tenants may begin to use the space, eliminating time and profit loss from non-rented units. This is important because of the large upfront cost of construction before any return on investment is made. As for general expectations, Vornado/Charles E. Smith is looking for high quality of work and craftsmanship, as well as creation and cohesion of a construction team to make good decisions in the later parts of construction and close out.

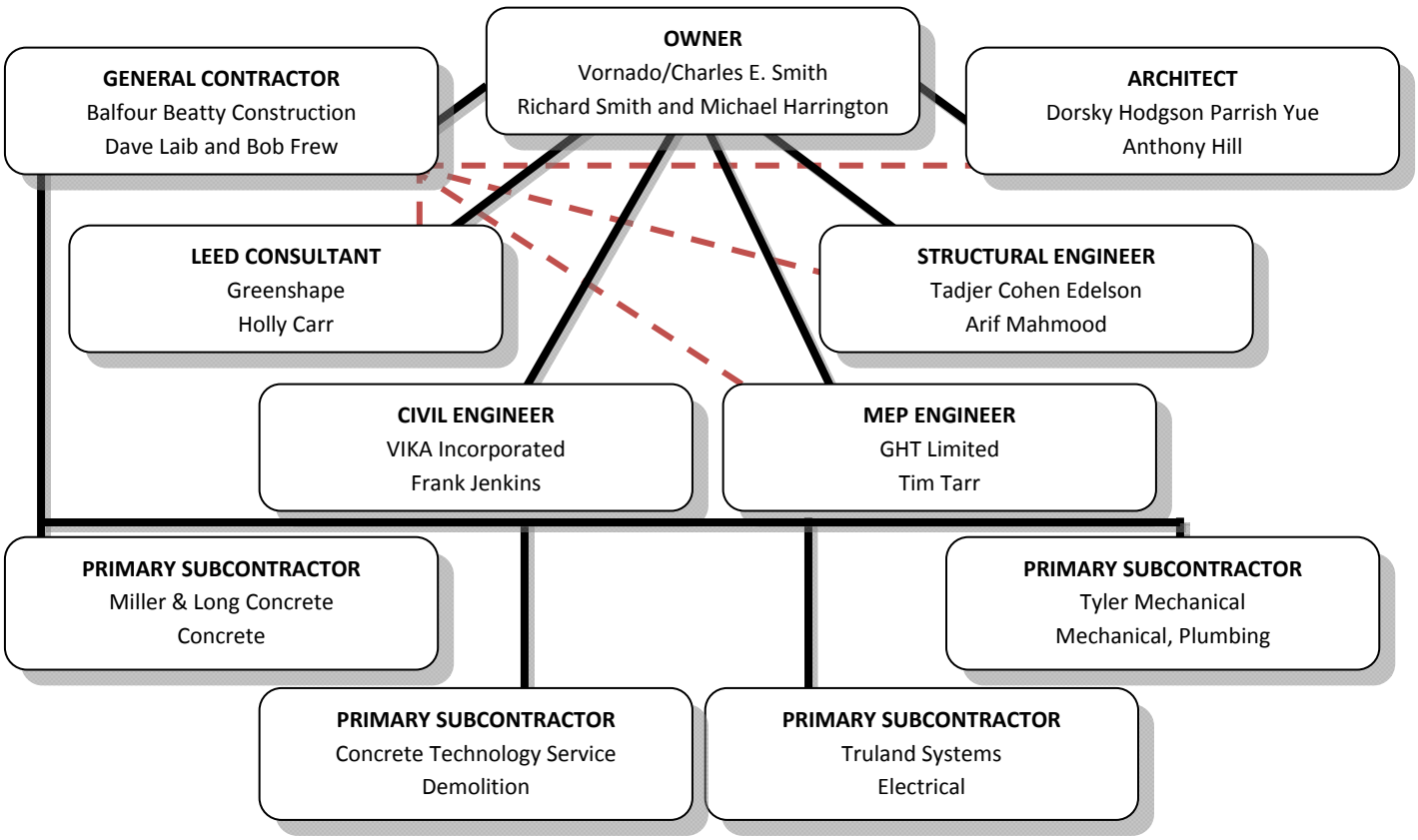
[2] "Strategy." Vornado/Charles E. Smith Strategy.

G. Project Delivery System

For Crystal Plaza II, Balfour Beatty acts as a general contractor that was brought onto the project team during final design phases to provide preconstruction services to the owner. The preconstruction services for the project lasted approximately 2 years as issues with the project were resolved and changes made to the original plan of demolition and building new. The final outcome was a guaranteed maximum price contract between Balfour Beatty Construction and Vornado/Charles E. Smith. This type of contract utilized allowances based on estimations for parts of the project that were still incomplete when the contract was signed. This type of contract is subject to change orders, however, Balfour Beatty has included contingency to cover some of the unknown costs.

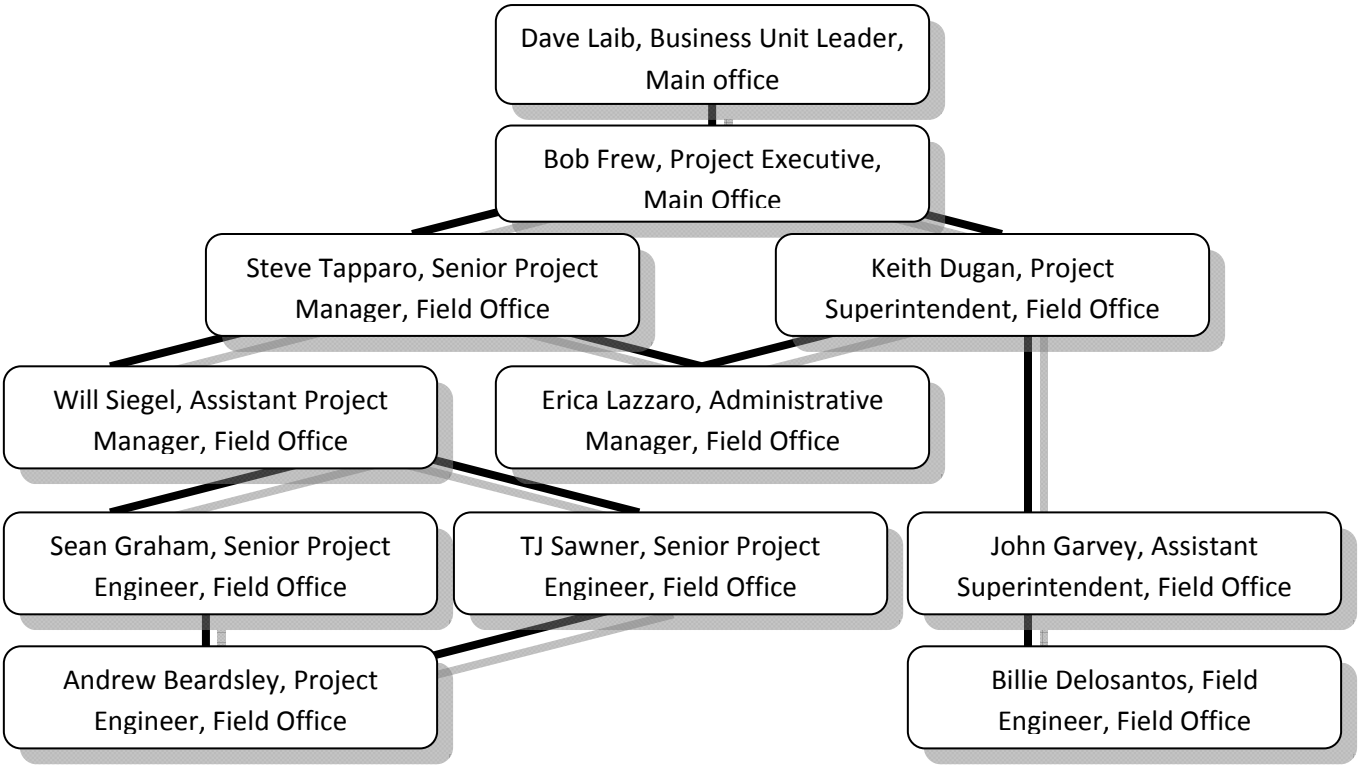
The contracts between the owner and the remaining project team members is assumed to be similar in fashion to that with Balfour Beatty Construction, given the past history of working with the selected team members and the use of a preconstruction period with those members. Lines of key communication are show in red, dashed lines between parties that hold no contract. As for Balfour Beatty Construction's subcontractors, the primary selection method was lump sum bid. These subcontractors were also responsible for their own bonds and insurance, as no CCIP or OCIP was provided on the project.

This setup of project team players seems to work well for the owner, especially given the preconstruction period planning and management. The use of lump sum contracts for Balfour Beatty Construction is typical in the industry and a clear way to track cost and schedule. Again, the use of this contract type may also produce unwanted change orders that will need to be assessed and paid for either from contingency or the owner, depending on the situation.



H. Staffing Plan

The staffing plan at Crystal Plaza is fairly straight forward. Beginning at the top is the Business Unit Leader, very similar to a Senior Project Executive, that visits the site about every 2 weeks for review, and on an intermittent basis for key meetings. His primary focus is on the client's requests and current state of construction (on schedule, behind schedule, ect.). He is responsible for multiple jobs, primarily those that are multi-unit residential in the Washington, D.C. area. The next individual is the Project Executive, responsible for 3-4 jobs at any given time, usually in different phases. The Project Executive is onsite more often, but does most of their work from the main office. Primary focus is keeping the job running on schedule by ensuring the processing and returns of submittals and RFI's. The superintendent side of operations, in the field, is headed by the Project Superintendent, who is responsible for all the day to day construction activities and overall site safety. The Project Superintendent is assisted by the Assistant Superintendent, similar responsibilities, and a Field Engineer, responsible for layout. On the engineering side of the project is the Senior Project Manager who is responsible for the finances on the project, submittals, RFI's, and a majority of the administrative requirements of the project. This branch of the staff is organized more like a flat organization, rather than hierarchical, with each member taking on responsibility of sub contractors and RFI's. The Administrative Manager is responsible for processing pay applications, financial planning, and general office management. The Assistant Project Manager is responsible for project schedule and current project finances, and works constantly with the Administrative Manager to monitor the finances. The final places are occupied by Project and Senior Project Engineers who are responsible for sub contractors, processing submittals, RFI's, posting RFI solutions, site documentation, as well as minor parts of project financing and schedule updating.



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"Crystal City Planning Process." Crystal City Planning Process. 30 Jan. 2008. Crystal City Public Forum. 20 Sept. 2008 <http://www.arlingtonis.biz/cc_taskforce/downloads/communityforumpreview.pdf>.

"Strategy." Vornado/Charles E. Smith Strategy. 2004. 20 Sept. 2008 <http://smithcommercialrealty.com/about_us.idx/strategy.pg>.

Appendix A-User Created Documents

Crystal Plaza II

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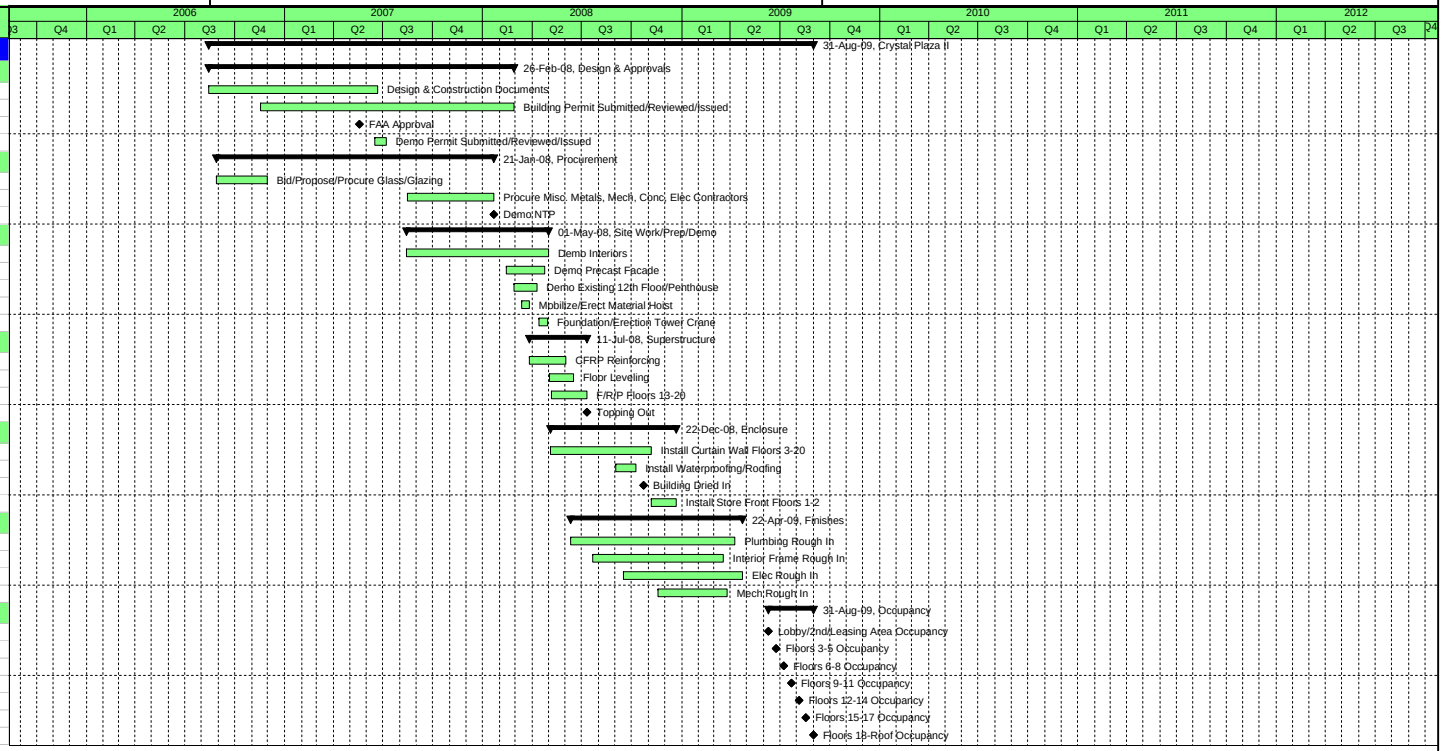
Activity ID	Activity Name	Original Duration	Start	Finish
Crystal Plaza II		791	14-Aug-06	31-Aug-09
Design & Approvals		397	14-Aug-06	26-Feb-08
A1000	Design & Construction D...	218	14-Aug-06	20-Jun-07
A1010	Building Permit Submitte...	329	17-Nov-06	26-Feb-08
A1020	FAA Approval	0	18-May-07	
A1030	Demo Permit Submitted/...	16	15-Jun-07	06-Jul-07
Procurement		361	28-Aug-06	21-Jan-08
A1040	Bid/Propose/Procure Gl...	66	28-Aug-06	30-Nov-06
A1060	Procure Misc. Metals, M...	114	15-Aug-07	21-Jan-08
A1050	Demo NTP	0	21-Jan-08	
Site Work/Prep/Demo		189	13-Aug-07	01-May-08
A1070	Demo Interiors	189	13-Aug-07	01-May-08
A1080	Demo Precast Facade	51	13-Feb-08	23-Apr-08
A1090	Demo Existing 12th Floo...	30	28-Feb-08	09-Apr-08
A1100	Mobilize/Erect Material ...	10	13-Mar-08	26-Mar-08
A1110	Foundation/Erection To...	11	14-Apr-08	28-Apr-08
Superstructure		77	27-Mar-08	11-Jul-08
A1120	CFRP Reinforcing	48	27-Mar-08	02-Jun-08
A1130	Floor Leveling	32	02-May-08	16-Jun-08
A1140	F/R/P Floors 13-20	49	06-May-08	11-Jul-08
A1150	Topping Out	0		11-Jul-08
Enclosure		166	05-May-08	22-Dec-08
A1160	Install Curtain Wall Floor...	133	05-May-08	05-Nov-08
A1180	Install Waterproofing/Ro...	27	02-Sep-08	08-Oct-08
A1190	Building Dried In	0		23-Oct-08
A1170	Install Store Front Floors...	33	06-Nov-08	22-Dec-08
Finishes		227	10-Jun-08	22-Apr-09
A1230	Plumbing Rough In	217	10-Jun-08	08-Apr-09
A1210	Interior Frame Rough In	173	21-Jul-08	18-Mar-09
A1220	Elec Rough In	158	15-Sep-08	22-Apr-09
A1200	Mech Rough In	92	18-Nov-08	25-Mar-09
Occupancy		59	09-Jun-09	31-Aug-09
A1240	Lobby/2nd/Leasing Area...	0		09-Jun-09
A1250	Floors 3-5 Occupancy	0		23-Jun-09
A1260	Floors 6-8 Occupancy	0		07-Jul-09
A1270	Floors 9-11 Occupancy	0		21-Jul-09
A1280	Floors 12-14 Occupancy	0		04-Aug-09
A1290	Floors 15-17 Occupancy	0		18-Aug-09
A1300	Floors 18-Roof Occupancy	0		31-Aug-09



Remaining Work Summary

Milestone

Christopher R. Stultz - Construction Management

Statement of Probable Cost

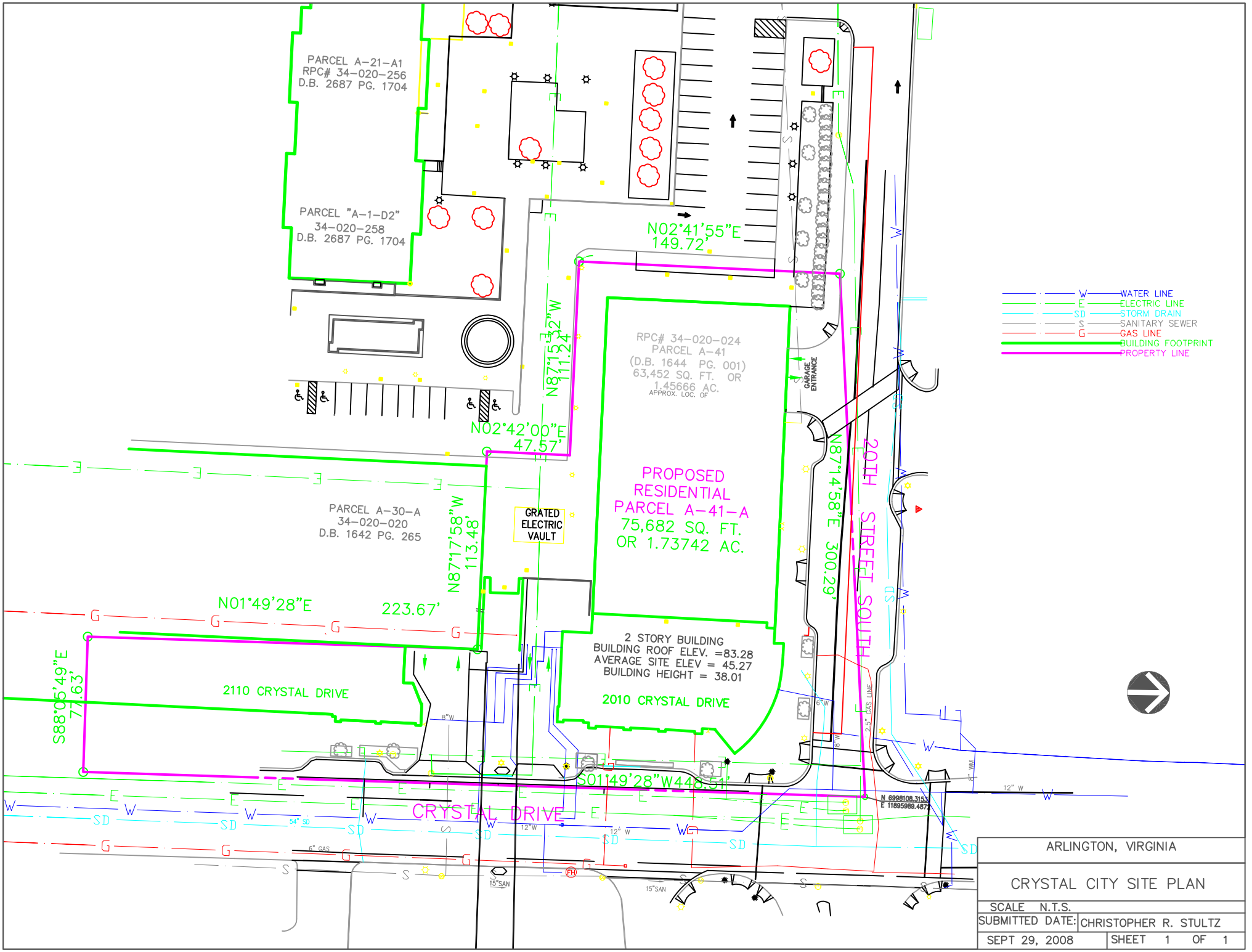
Project Information

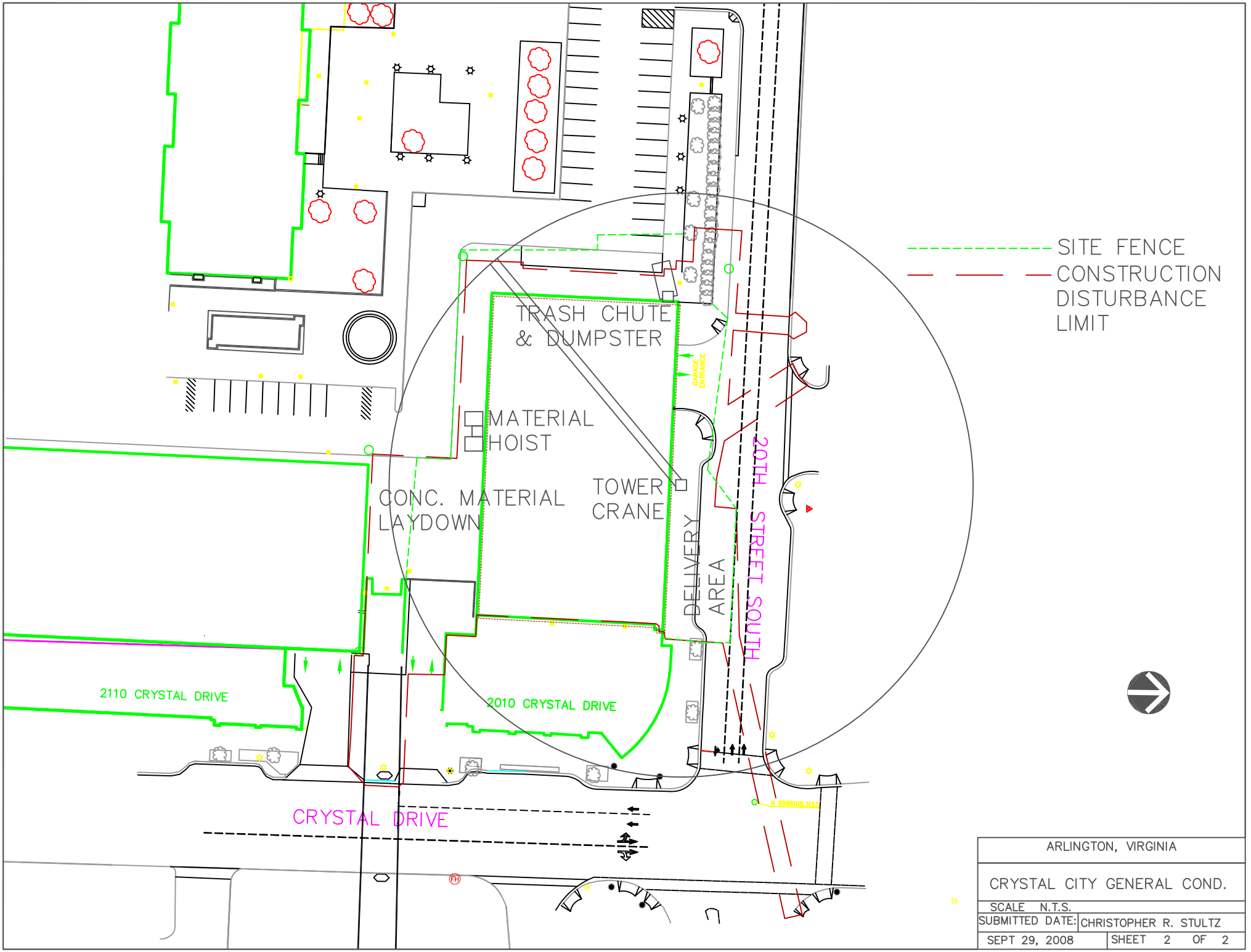
Prepared By	Christopher R. Stultz , Phone: Fax:	Prepared For	Technical Report 1 , Phone: Fax:
Projected Size	325000	Projected Location	VA - Arlington
Building Height	218	Projected Date	Jan 2008
Building Use	Residential	Foundation	CAS
Number of Buildings	1	Exterior Wall	CUR
Site Size	63427	Interior Wall	
1st Floor Size	18000	Roof Type	
1st Floor Height	10	Floor Type	CON
Number of Floors	20	Project Type	

Building Costs

Division #	Label	Projected %	Projected Sq. Cost	Projected
00	Bidding Requirements	3.49	4.85	1,577,652
	Bidding Requirements	3.49	4.85	1,577,652
01	General Requirements	1.83	2.54	826,030
	General Requirements	1.83	2.54	826,030
02	Site Work	9.57	13.32	4,330,512
	Site Work	9.57	13.32	4,330,512
03	Concrete	24.99	34.79	11,306,548
	Concrete	24.99	34.79	11,306,548
04	Masonry	5.22	7.26	2,360,124
	Masonry	5.22	7.26	2,360,124
05	Metals	4.62	6.43	2,089,106
	Metals	4.62	6.43	2,089,106
06	Wood & Plastics	0.71	0.99	323,131
	Wood & Plastics	0.71	0.99	323,131
07	Thermal & Moisture Protection	2.63	3.65	1,187,835
	Thermal & Moisture Protection	2.63	3.65	1,187,835
08	Doors & Windows	7.28	10.13	3,292,822
	Doors & Windows	7.28	10.13	3,292,822
09	Finishes	5.65	7.87	2,557,081

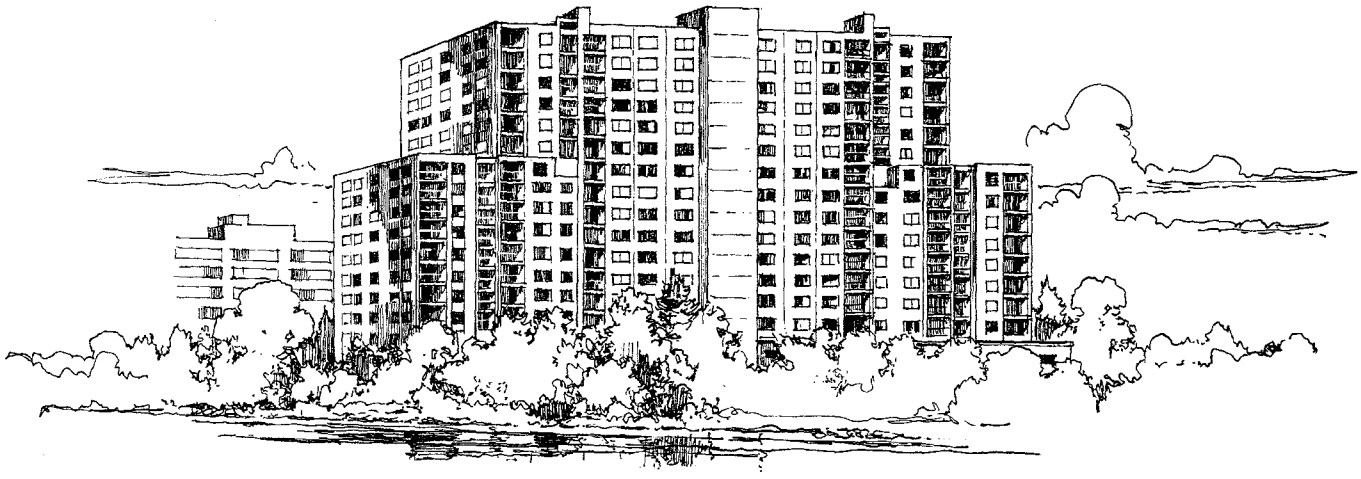
	Finishes	5.65	7.87	2,557,081
10	Specialties	2.52	3.51	1,141,874
	Specialties	2.52	3.51	1,141,874
11	Equipment	0.14	0.20	64,173
	Equipment	0.14	0.20	64,173
12	Furnishings	0.09	0.13	41,525
	Furnishings	0.09	0.13	41,525
13	Special Construction	0.01	0.01	4,334
	Special Construction	0.01	0.01	4,334
14	Conveying Systems	2.54	3.54	1,150,519
	Conveying Systems	2.54	3.54	1,150,519
15	Mechanical	17.66	24.58	7,987,980
	Mechanical	17.66	24.58	7,987,980
16	Electrical	11.04	15.37	4,994,763
	Electrical	11.04	15.37	4,994,763
	Total Building Costs	100	139.19	45,236,011


PARCEL A-21-A1
RPC# 34-020-256
D.B. 2687 PG. 1704
PARCEL "A-1-D2"
34-020-258
D.B. 2687 PG. 1704
N02°41'55"E
149.72'
N87°15'32"W
111.24'
N02°42'00"E
47.57'
RPC# 34-020-024
PARCEL A-41
(D.B. 1644 PG. 001)
63,452 SQ. FT. OR
1.45666 AC.
APPROX. LOC. OF
GARAGE ENTRANCE
PROPOSED
RESIDENTIAL
PARCEL A-41-A
75,682 SQ. FT.
OR 1.73742 AC.
20TH STREET SOUTH
N87°14'58"E 300.29'
PARCEL A-30-A
34-020-020
D.B. 1642 PG. 265
GRATED
ELECTRIC
VAULT
N87°17'58"W
113.48'
N01°49'28"E
223.67'
S88°05'49"E
77.63'
2 STORY BUILDING
BUILDING ROOF ELEV. =83.28
AVERAGE SITE ELEV = 45.27
BUILDING HEIGHT = 38.01
2010 CRYSTAL DRIVE
2110 CRYSTAL DRIVE
S01°49'28"W448.51'
CRYSTAL DRIVE
W WATER LINE
E ELECTRIC LINE
SD STORM DRAIN
S SANITARY SEWER
G GAS LINE
BUILDING FOOTPRINT
PROPERTY LINE
ARLINGTON, VIRGINIA
CRYSTAL CITY SITE PLAN
SCALE N.T.S.
SUBMITTED DATE:
SEPT 29, 2008
CHRISTOPHER R. STULTZ
SHEET 1 OF 1



ARLINGTON, VIRGINIA	
CRYSTAL CITY GENERAL COND.	
SCALE N.T.S.	
SUBMITTED DATE: SEPT 29, 2008	CHRISTOPHER R. STULTZ
	SHEET 2 OF 2

Appendix B-Referenced Documents



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	195.90	192.05	187.75	185.70	182.25	178.50	170.95	164.70	160.20
	R/Conc. Frame	188.65	184.90	180.80	178.80	175.60	172.05	164.95	159.10	154.85
Face Brick with Concrete Block Back-up	Steel Frame	176.20	172.70	169.00	167.15	164.20	161.05	154.70	149.55	145.70
	R/Conc. Frame	183.95	180.45	176.75	174.90	171.95	168.80	162.45	157.25	153.45
Stucco on Concrete Block	Steel Frame	165.80	162.85	160.00	158.40	156.10	153.75	149.20	145.40	142.70
	R/Conc. Frame	173.55	170.60	167.75	166.15	163.85	161.50	156.95	153.15	150.45
Perimeter Adj., Add or Deduct	Per 100 L.F.	9.80	8.35	7.20	6.40	5.50	4.65	3.40	2.35	1.50
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	3.15	2.95	2.70	2.60	2.40	2.25	1.60	1.25	0.90
***For Basement**, add $31.15 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 $77.70 to $182.35 per S.F.

Common additives

Description	Unit	$ Cost
Appliances		
Cooking range, 30" free standing		
1 oven	Each	375 - 2175
2 oven	Each	1750 - 2025
30" built-in		
1 oven	Each	620 - 2100
2 oven	Each	1700 - 2300
Counter top cook tops, 4 burner	Each	330 - 860
Microwave oven	Each	230 - 740
Combination range, refrig. & sink, 30" wide	Each	1550 - 4050
72" wide	Each	4450
Combination range, refrigerator, sink, microwave oven & icemaker	Each	5175
Compactor, residential, 4-1 compaction	Each	615 - 775
Dishwasher, built-in, 2 cycles	Each	570 - 890
4 cycles	Each	600 - 1300
Garbage disposer, sink type	Each	179 - 325
Hood for range, 2 speed, vented, 30" wide	Each	259 - 1325
42" wide	Each	480 - 2225
Refrigerator, no frost 10-12 C.F.	Each	610 - 840
18-20 C.F.	Each	765 - 1175

Description	Unit	$ Cost
Closed Circuit Surveillance, One station		
Camera and monitor	Each	1750
For additional camera stations, add	Each	940
Elevators, Electric passenger, 10 stops		
3000# capacity	Each	278,500
4000# capacity	Each	281,000
5000# capacity	Each	286,000
Additional stop, add	Each	7875
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	278
Nickel cadmium	Each	800
Laundry Equipment		
Dryer, gas, 16 lb. capacity	Each	860
30 lb. capacity	Each	3525
Washer, 4 cycle	Each	1050
Commercial	Each	1400
Smoke Detectors		
Ceiling type	Each	174
Duct type	Each	445

Important: See the Reference Section for Location Factor

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

Apartment, 8-24 Story

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	CIP concrete pile caps		S.F. Ground	8.55	.57	
1020	Special Foundations	Steel H-piles, concrete grade beams		S.F. Ground	176	11.74	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	4.63	.31	9.2%
2010	Basement Excavation	Site preparation for slab, piles and grade beam		S.F. Ground	.25	.02	
2020	Basement Walls	4' Foundation wall		L.F. Wall	65	.24	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Open web steel joists, slab form, concrete, interior steel columns		S.F. Floor	20.11	18.77	13.7%
1020	Roof Construction	Open web steel joists with rib metal deck, interior steel columns		S.F. Roof	6	.40	
	B20 Exterior Enclosure						
2010	Exterior Walls	Ribbed precast concrete panel	*87% of wall*	S.F. Wall	37.25	15.56	
2020	Exterior Windows	Aluminum horizontal sliding	*13% of wall*	Each	468	1.94	14.1%
2030	Exterior Doors	Aluminum and glass		Each	2624	2.23	
	B30 Roofing						
3010	Roof Coverings	Built-up tar and gravel with flashing; perlite/EPS composite insulation		S.F. Roof	5.10	.34	0.2%
3020	Roof Openings	N/A		—	—	—	
C. INTERIORS							
1010	Partitions	Gypsum board on concrete block and metal studs	*10 S.F. of Floor/L.F. Partition*	S.F. Partition	12.27	12.27	
1020	Interior Doors	15% solid core wood, 85% hollow core wood	*80 S.F. Floor/Door*	Each	584	7.30	
1030	Fittings	Kitchen cabinets		S.F. Floor	2.82	2.82	
2010	Stair Construction	Concrete filled metal pan		Flight	9700	2.88	26.0%
3010	Wall Finishes	70% paint, 25% vinyl wall covering, 5% ceramic tile		S.F. Surface	1.37	2.73	
3020	Floor Finishes	60% carpet, 30% vinyl composition tile, 10% ceramic tile		S.F. Floor	4.92	4.92	
3030	Ceiling Finishes	Painted gypsum board on resilient channels		S.F. Ceiling	3.49	3.49	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Four geared passenger elevators		Each	305,588	8.43	6.0%
1020	Escalators & Moving Walks	N/A		—	—	—	
	D20 Plumbing						
2010	Plumbing Fixtures	Kitchen, bathroom and service fixtures, supply and drainage	*1 Fixture/210 S.F. Floor*	Each	2371	11.29	
2020	Domestic Water Distribution	Gas fired water heater		S.F. Floor	3.58	3.58	10.7%
2040	Rain Water Drainage	Roof drains		S.F Roof	2.25	.15	
	D30 HVAC						
3010	Energy Supply	Oil fired hot water, baseboard radiation		S.F.Floor	5.90	5.90	
3020	Heat Generating Systems	N/A		—	—	—	
3030	Cooling Generating Systems	Chilled water, air cooled condenser system		S.F. Floor	7.56	7.56	9.6%
3050	Terminal & Package Units	N/A		—	—	—	
3090	Other HVAC Sys. & Equipment	N/A		—	—	—	
	D40 Fire Protection						
4010	Sprinklers	Wet pipe sprinkler system		S.F. Floor	2.11	2.11	2.3%
4020	Standpipes	Standpipe		S.F. Floor	1.09	1.09	
	D50 Electrical						
5010	Electrical Service/Distribution	4000 ampere service, panel board and feeders		S.F. Floor	2	2	
5020	Lighting & Branch Wiring	Incandescent fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	6.80	6.80	8.2%
5030	Communications & Security	Alarm systems, internet wiring, emergency lighting, antenna, intercom and security television		S.F. Floor	2.51	2.51	
5090	Other Electrical Systems	Emergency generator, 80KW		S.F. Floor	.18	.18	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		—	—	—	
1020	Institutional Equipment	N/A		—	—	—	0.0 %
1030	Vehicular Equipment	N/A		—	—	—	
1090	Other Equipment	N/A		—	—	—	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		—	—	—	0.0 %
1040	Special Facilities	N/A		—	—	—	
G. BUILDING SITEWORK	**N/A**						
					Sub-Total	140.13	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				*25%*	35.06	
	ARCHITECT FEES				*6%*	10.51	
					Total Building Cost	**185.70**	

Location Factors

STATE/ZIP	CITY	Residential	Commercial
UTAH (CONT'd)			
845	Price	.71	.78
846-847	Provo	.81	.87
VERMONT			
050	White River Jct.	.76	.80
051	Bellows Falls	.79	.83
052	Bennington	.81	.84
053	Brattleboro	.81	.86
054	Burlington	.82	.86
056	Montpelier	.83	.85
057	Rutland	.82	.86
058	St. Johnsbury	.79	.81
059	Guildhall	.78	.80
VIRGINIA			
220-221	Fairfax	1.02	.92
222	Arlington	1.04	.92
223	Alexandria	1.07	.94
224-225	Fredericksburg	.94	.88
226	Winchester	.92	.86
227	Culpeper	1.00	.88
228	Harrisonburg	.90	.86
229	Charlottesville	.91	.86
230-232	Richmond	.99	.88
233-235	Norfolk	1.00	.87
236	Newport News	1.00	.87
237	Portsmouth	.92	.86
238	Petersburg	.98	.88
239	Farmville	.90	.82
240-241	Roanoke	.98	.86
242	Bristol	.85	.81
243	Pulaski	.84	.80
244	Staunton	.92	.84
245	Lynchburg	.97	.87
246	Grundy	.84	.80
WASHINGTON			
980-981,987	Seattle	1.02	1.04
982	Everett	1.05	1.02
983-984	Tacoma	1.01	1.03
985	Olympia	1.00	1.02
986	Vancouver	.99	1.02
988	Wenatchee	.94	.96
989	Yakima	.97	.98
990-992	Spokane	1.00	.96
993	Richland	.98	.97
994	Clarkston	.98	.96
WEST VIRGINIA			
247-248	Bluefield	.88	.89
249	Lewisburg	.89	.92
250-253	Charleston	.95	.95
254	Martinsburg	.86	.89
255-257	Huntington	.96	.96
258-259	Beckley	.90	.93
260	Wheeling	.93	.96
261	Parkersburg	.91	.95
262	Buckhannon	.92	.95
263-264	Clarksburg	.91	.95
265	Morgantown	.92	.95
266	Gassaway	.92	.95
267	Romney	.88	.92
268	Petersburg	.90	.93
WISCONSIN			
530,532	Milwaukee	1.08	1.03
531	Kenosha	1.05	1.01
534	Racine	1.04	1.01
535	Beloit	1.00	.99
537	Madison	1.00	.99
538	Lancaster	.98	.95
539	Portage	.98	.96
540	New Richmond	1.00	.96
541-543	Green Bay	1.01	.97
544	Wausau	.95	.94
545	Rhinelander	.96	.96
546	La Crosse	.95	.95
547	Eau Claire	.99	.97
548	Superior	.99	.97
549	Oshkosh	.96	.95
WYOMING			
820	Cheyenne	.83	.86
821	Yellowstone Nat. Pk.	.75	.81
822	Wheatland	.75	.82
WYOMING (CONT'd)			
823	Rawlins	.75	.83
824	Worland	.74	.81
825	Riverton	.74	.81
826	Casper	.77	.83
827	Newcastle	.74	.81
828	Sheridan	.80	.84
829-831	Rock Springs	.79	.83
CANADIAN FACTORS (reflect Canadian currency)			
ALBERTA			
	Calgary	1.13	1.12
	Edmonton	1.13	1.12
	Fort McMurray	1.16	1.14
	Lethbridge	1.13	1.10
	Lloydminster	1.08	1.06
	Medicine Hat	1.08	1.06
	Red Deer	1.08	1.06
BRITISH COLUMBIA			
	Kamloops	1.06	1.07
	Prince George	1.06	1.08
	Vancouver	1.07	1.09
	Victoria	1.01	1.03
MANITOBA			
	Brandon	1.03	1.00
	Portage la Prairie	1.03	1.00
	Winnipeg	1.03	1.02
NEW BRUNSWICK			
	Bathurst	.96	.95
	Dalhousie	.95	.95
	Fredericton	1.03	.98
	Moncton	.96	.96
	Newcastle	.96	.95
	St. John	1.03	.99
NEWFOUNDLAND			
	Corner Brook	.97	.98
	St Johns	.99	.99
NORTHWEST TERRITORIES			
	Yellowknife	1.08	1.07
NOVA SCOTIA			
	Bridgewater	.98	1.00
	Dartmouth	.99	1.00
	Halifax	1.01	1.03
	New Glasgow	.98	.99
	Sydney	.97	.98
	Truro	.98	.99
	Yarmouth	.98	.99
ONTARIO			
	Barrie	1.14	1.09
	Brantford	1.16	1.11
	Cornwall	1.16	1.09
	Hamilton	1.18	1.14
	Kingston	1.16	1.10
	Kitchener	1.11	1.07
	London	1.15	1.11
	North Bay	1.12	1.08
	Oshawa	1.15	1.10
	Ottawa	1.17	1.10
	Owen Sound	1.13	1.09
	Peterborough	1.13	1.09
	Sarnia	1.16	1.11
	Sault Ste Marie	1.09	1.06
	St. Catharines	1.11	1.06
	Sudbury	1.09	1.06
	Thunder Bay	1.14	1.06
	Timmins	1.12	1.08
	Toronto	1.19	1.14
	Windsor	1.13	1.06
PRINCE EDWARD ISLAND			
	Charlottetown	.93	.95
	Summerside	.93	.95
QUEBEC			
	Cap-de-la-Madeleine	1.15	1.05
	Charlesbourg	1.15	1.05
	Chicoutimi	1.18	1.07
	Gatineau	1.14	1.04

Historical Cost Indexes

Year	National 30 City Average	Utah Salt Lake City	Vermont Bur-lington	Vermont Rutland	Virginia Alex-andria	Virginia Newport News	Virginia Norfolk	Virginia Rich-mond	Virginia Roanoke	Washington Seattle	Washington Spokane	Washington Tacoma	West Virginia Charles-ton	West Virginia Hunt-ington	Wisconsin Green Bay	Wisconsin Kenos
Jan 2008	173.0E	151.1E	149.7E	148.4E	161.7E	151.6E	151.2E	152.3E	147.8E	179.0E	163.2E	175.7E	163.9E	165.3E	165.9E	172.
2007	165.0	144.6	144.4	143.2	155.0	146.2	146.1	147.3	142.9	171.4	156.7	168.7	158.7	160.1	159.4	164.
2006	156.2	137.7	131.7	130.7	146.2	133.7	134.6	134.8	129.7	162.9	150.1	160.7	149.4	151.4	152.7	157.
2005	146.7	129.4	124.6	123.8	136.5	123.5	124.4	125.4	112.2	153.9	141.9	151.5	140.8	141.0	144.4	148.
2004	132.8	117.8	113.0	112.3	121.5	108.9	110.2	110.9	99.7	138.0	127.6	134.5	124.8	125.6	128.9	132.
2003	129.7	116.0	110.7	110.1	119.5	104.8	106.2	108.6	97.0	134.9	125.9	133.0	123.3	123.6	127.4	130.
2002	126.7	113.7	109.0	108.4	115.1	102.9	104.1	106.6	95.2	132.7	123.9	131.4	121.2	120.9	123.0	127.
2001	122.2	109.1	105.7	105.2	110.8	99.8	100.3	102.9	92.1	127.9	120.3	125.7	114.6	117.5	119.1	123.
2000	118.9	106.5	98.9	98.3	108.1	96.5	97.6	100.2	90.7	124.6	118.3	122.9	111.5	114.4	114.6	119.
1999	116.6	104.5	98.2	97.7	106.1	95.6	96.5	98.8	89.8	123.3	116.7	121.6	110.6	113.4	112.1	116.
1998	113.6	99.5	97.8	97.3	104.1	93.7	93.9	97.0	88.3	119.4	114.3	118.3	106.7	109.0	109.5	112.
1997	111.5	97.2	96.6	96.3	101.2	91.6	91.7	92.9	86.9	118.1	111.7	117.2	105.3	107.7	105.6	109.
1996	108.9	94.9	95.1	94.8	99.7	90.2	90.4	91.6	85.5	115.2	109.2	114.3	103.1	104.8	103.8	106.
1995	105.6	93.1	91.1	90.8	96.3	86.0	86.4	87.8	82.8	113.7	107.4	112.8	95.8	97.2	97.6	97.
1994	103.0	90.2	89.5	89.3	93.9	84.6	84.8	86.3	81.4	109.9	104.0	108.3	94.3	95.3	96.3	95.
1993	100.0	87.9	87.6	87.6	91.6	82.9	83.0	84.3	79.5	107.3	103.9	106.7	92.6	93.5	94.0	94.
1992	97.9	86.0	86.1	86.1	90.1	81.0	81.6	82.0	78.3	105.1	101.4	103.7	91.4	92.3	92.0	92.
1991	95.7	84.9	84.2	84.2	88.2	77.6	77.9	79.8	77.3	102.2	100.0	102.2	89.7	88.6	88.6	89.
1990	93.2	84.3	83.0	82.9	86.1	76.3	76.7	77.6	76.1	100.1	98.5	100.5	86.1	86.8	86.7	87.
1989	91.0	82.8	81.4	81.3	83.4	74.9	75.2	76.0	74.2	96.1	96.8	98.4	84.5	84.8	84.3	85.
1988	88.5	81.3	79.7	79.7	81.0	73.4	73.7	74.1	72.3	94.2	95.0	96.6	82.8	83.1	82.0	83.
1987	85.7	79.8	79.0	79.0	77.9	71.0	71.7	72.7	70.2	91.9	92.4	92.9	81.1	81.3	80.2	81.
1985	81.8	75.9	74.8	74.9	75.1	68.7	68.8	69.5	67.2	88.3	89.0	91.2	77.7	77.7	76.7	77.
1980	60.7	57.0	55.3	58.3	57.3	52.5	52.4	54.3	51.3	67.9	66.3	66.7	57.7	58.3	58.6	58.
1975	43.7	40.1	41.8	43.9	41.7	37.2	36.9	37.1	37.1	44.9	44.4	44.5	41.0	40.0	40.9	45.
1970	27.8	26.1	25.4	26.8	26.2	23.9	21.5	22.0	23.7	28.8	29.3	29.6	26.1	25.8	26.4	28.
1965	21.5	20.0	19.8	20.6	20.2	18.4	17.1	17.2	18.3	22.4	22.5	22.8	20.1	19.9	20.3	22.
1960	19.5	18.4	18.0	18.8	18.4	16.7	15.4	15.6	16.6	20.4	20.8	20.8	18.3	18.1	18.4	18.
1955	16.3	15.4	15.1	15.7	15.4	14.0	12.9	13.1	13.9	17.1	17.4	17.4	15.4	15.2	15.5	15.
1950	13.5	12.7	12.4	13.0	12.7	11.6	10.7	10.8	11.5	14.1	14.4	14.4	12.7	12.5	12.8	12.
1945	8.6	8.1	7.9	8.3	8.1	7.4	6.8	6.9	7.3	9.0	9.2	9.2	8.1	8.0	8.1	8.
▼ 1940	6.6	6.3	6.1	6.4	6.2	5.7	5.3	5.3	5.7	7.0	7.1	7.1	6.2	6.2	6.3	6.

Year	National 30 City Average	Wisconsin Mad-ison	Wisconsin Mil-waukee	Wisconsin Racine	Wyoming Chey-enne	Canada Calgary	Canada Edmon-ton	Canada Ham-ilton	Canada London	Canada Montreal	Canada Ottawa	Canada Quebec	Canada Tor-onto	Canada Van-couver	Canada Win-nipeg
Jan 2008	173.0E	168.3E	176.6E	172.7E	146.3E	190.5E	191.4E	194.3E	189.1E	187.4E	188.3E	187.8E	195.2E	187.3E	175.6E
2007	165.0	160.7	168.9	164.7	141.3	183.1	184.4	186.8	182.4	181.7	182.4	182.0	187.7	180.6	170.1
2006	156.2	152.8	158.8	157.2	128.0	163.6	164.8	169.0	164.9	158.6	163.7	159.0	170.6	169.3	155.9
2005	146.7	145.2	148.4	147.9	118.9	154.4	155.7	160.0	156.2	149.2	155.1	150.1	162.6	159.4	146.9
2004	132.8	129.7	134.2	132.7	104.7	138.8	139.4	142.6	140.4	134.5	141.0	135.7	146.0	141.7	129.7
2003	129.7	128.4	131.1	131.5	102.6	133.6	134.2	139.1	137.0	130.2	137.4	131.4	142.3	137.0	124.4
2002	126.7	124.5	128.2	126.5	101.7	122.5	122.2	136.3	134.1	127.2	134.9	128.4	139.8	134.6	121.4
2001	122.2	120.6	123.9	123.3	99.0	117.5	117.4	131.5	129.1	124.4	130.2	125.5	134.7	130.2	117.2
2000	118.9	116.6	120.5	118.7	98.1	115.9	115.8	130.0	127.5	122.8	128.8	124.1	133.1	128.4	115.6
1999	116.6	115.9	117.4	115.5	96.9	115.3	115.2	128.1	125.6	120.8	126.8	121.9	131.2	127.1	115.2
1998	113.6	110.8	113.4	112.7	95.4	112.5	112.4	126.3	123.9	119.0	124.7	119.6	128.5	123.8	113.7
1997	111.5	106.1	110.1	109.3	93.2	110.7	110.6	124.4	121.9	114.6	122.8	115.4	125.7	121.9	111.4
1996	108.9	104.4	107.1	106.5	91.1	109.1	109.0	122.6	120.2	112.9	121.0	113.6	123.9	119.0	109.7
1995	105.6	96.5	103.9	97.8	87.6	107.4	107.4	119.9	117.5	110.8	118.2	111.5	121.6	116.2	107.6
1994	103.0	94.5	100.6	96.1	85.4	106.7	106.6	116.5	114.2	109.5	115.0	110.2	117.8	115.1	105.5
1993	100.0	91.3	96.7	93.8	82.9	104.7	104.5	113.7	111.9	106.9	112.0	107.0	114.9	109.2	102.8
1992	97.9	89.2	93.9	91.7	81.7	103.4	103.2	112.4	110.7	104.2	110.8	103.6	113.7	108.0	101.6
1991	95.7	86.2	91.6	89.3	80.3	102.1	102.0	108.2	106.7	101.8	106.9	100.4	109.0	106.8	98.6
1990	93.2	84.3	88.9	87.3	79.1	98.0	97.1	103.8	101.4	99.0	102.7	96.8	104.6	103.2	95.1
1989	91.0	81.8	86.4	85.0	77.8	95.6	94.7	98.2	96.5	94.9	98.5	92.5	98.5	97.6	92.9
1988	88.5	79.9	84.1	82.4	76.3	93.9	93.0	95.4	93.2	90.6	94.0	88.3	94.8	95.9	90.0
1987	85.7	78.1	81.1	81.1	76.7	90.2	89.3	89.7	90.1	87.2	89.6	85.0	90.4	94.2	87.1
1985	81.8	74.3	77.4	77.0	72.3	90.2	89.1	85.8	84.9	82.4	83.9	79.9	86.5	89.8	83.4
1980	60.7	56.8	58.8	58.1	56.9	64.9	63.3	63.7	61.9	59.2	60.9	59.3	60.9	65.0	61.7
1975	43.7	40.7	43.3	40.7	40.6	42.2	41.6	42.9	41.6	39.7	41.5	39.0	42.2	42.4	39.2
1970	27.8	26.5	29.4	26.5	26.0	28.9	28.6	28.5	27.8	25.6	27.6	26.0	25.6	26.0	23.1
1965	21.5	20.6	21.8	20.4	20.0	22.3	22.0	22.0	21.4	18.7	21.2	20.1	19.4	20.5	17.5
1960	19.5	18.1	19.0	18.6	18.2	20.2	20.0	20.0	19.5	17.0	19.3	18.2	17.6	18.6	15.8
1955	16.3	15.2	15.9	15.6	15.2	17.0	16.8	16.7	16.3	14.3	16.2	15.3	14.8	15.5	13.3
1950	13.5	12.5	13.2	12.9	12.6	14.0	13.9	13.8	13.5	11.8	13.4	12.6	12.2	12.8	10.9
1945	8.6	8.0	8.4	8.2	8.0	9.0	8.8	8.8	8.6	7.5	8.5	8.0	7.8	8.2	7.0
▼ 1940	6.6	6.2	6.5	6.3	6.2	6.9	6.8	6.8	6.6	5.8	6.6	6.2	6.0	6.3	5.4