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Project | Crystal Plaza II

Location | Arlington VA

Date | 10/24/08

Technical Report II | Cost and Schedule Analysis

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Executive Summary

This technical assignment focuses on the key features of Crystal Plaza II that affect the execution of the project.

Expanding from Technical Report 1, the first section looks at a more detailed project schedule. This schedule breaks the activities into various categories based on trade and building component type, such as existing structure, new structure, skin/roof, and interiors. The schedule shows a beginning date of September 26, 2006 as the building permit is submitted, and ends with full occupancy and substantial completion on August 31, 2009. Of primary focus for schedule changes and research is the pour sequence, interior rough in and fit out, and occupancy phasing.

The next section, Site Layout Planning, in this report is also an expansion from Technical Report 1, with scale drawings of three critical phases during construction. The phases are demolition, superstructure and glazing construction, and finishing. The congested site posed potential problems with deliveries and onsite storage, but with help from the owner in the use of an underground parking level, many of these concerns were taken care of. By utilizing the outdoor space for material lay down and staging, and not for onsite offices, the general contractor was able to maximize the space for construction without eliminating the proper managerial support for that construction. Key areas from each plan include large equipment location and use, delivery/storage/lay down areas, and public safety measures, such as site fence.

The Detailed Structural Estimate provided an estimate of $2.6 million dollars, approximately $1.5 million dollars under the estimated amount provided for Technical Report 1. Detailed breakdowns for concrete, reinforcing, post tension tendons, and formwork allow for visualization of costs in the structural system. Using detailed take-offs and cost data from RS Means 2009, the estimate was assembled. Possible errors are mostly associated with assumptions such as tower crane usage, labor force size, exclusion of certain members and reinforcing, additional concrete pours on the project, as well as others discussed in the conclusion section of the estimate.

The General Conditions Estimate provided a value of approximately $3 million, or about 4% of the anticipated project cost provided by the general contractor. This value is acceptable, but does include some assumptions for key items, such as site offices. These assumptions are listed with reasoning, as well as with visual breakdowns of the estimate. The actual value from the general contractor is $3.05 million, and is very close to the estimate produced in this report. This estimate will be key in cost savings determinations resulting from schedule changes and possible construction techniques.

The Critical Industry Issues section provides a brief synopsis of the 2008 PACE Roundtable seminar as attended by the construction management students of Architectural Engineering. Key focus of the seminar was “Investing in People”, with breakout sessions surrounding three important topics from industry. The three topics were LEED, BIM, and Energy and Economy. Using the seminar to provide possible research topics for the spring thesis proposal and establishing contacts that can assist in the areas of research were great opportunities provided at this seminar.

A. Detailed Project Schedule

A.1 Overview

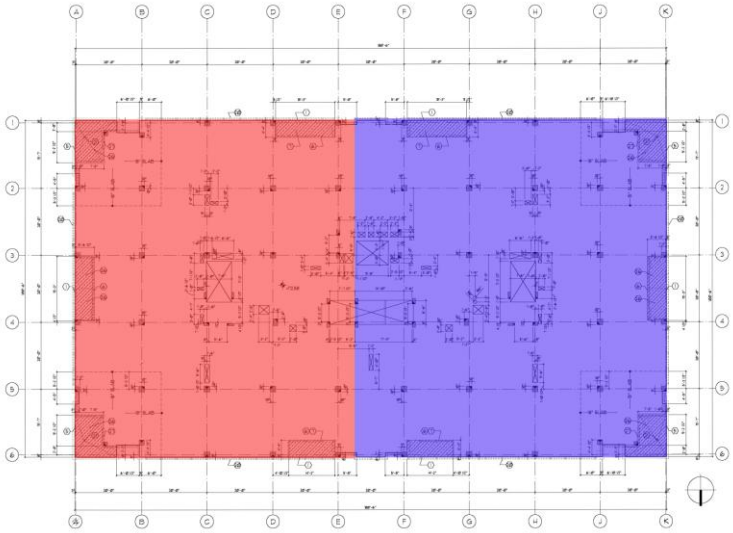
The full size, Detailed Project Schedule can be found in Appendix A.

This schedule is a representation of the construction activities at Crystal Plaza II. The dates, durations, and lead/lag times have been slightly modified to reflect the combination of provided schedules from preconstruction, current construction on site, and typical construction sequencing. This modified schedule is an expansion of the Project Schedule Summary in Technical Report 1. Key milestones are highlighted in the schedule and include:

- Review/Issue of Building Permit- March 15, 2007
- Federal Aviation Administration (FAA) Approval- May 18, 2007
- Demolition Substantial Completion- August 1, 2007
- Crane Erection/Removal- May 23-25, 2007 & January 4-8, 2008
- Material Hoist Erection/Removal- May 7, 2007 & January 7, 2009
- Individual Floor Sub Completion/Turnover/Occupancy- Varies
- Building Substantial Completion- August 31, 2009

A.2 Areas/Sequences of Interest

An area of key interest is the sequencing of pours for the 8 new floors and roof (9 total stories). Given the limitations of a 200 activity schedule, the phasing of the pours is difficult to visualize. Floors were broken into two pour sections to allow material staging and lay down on one side as work was being completed on the other. After the concrete was placed and work began on the second area, bracing, shoring, and formwork began erection over area one. The floor break/pour sequence is illustrated below. The formwork for the pour was left in place until the concrete reached 75% of its 28 day strength. Re-shores were also used three floors below the active pour for four total levels of shoring to provide support of the construction loads, and the post tension cables were stressed when the concrete strength reached 3000 psi.



Typical slab pour sequence with area/pour 1 in red and area/pour 2 in blue.

View of 13th floor west pour (area 2) from 14th floor east (area 1) framing, 2 days after 13th floor east pour (area 1).

Another complicated sequence, although easier to see in the schedule, is the completion and turnover of the floors to the owner. The project has multi-phased occupancy which allows the owner to open the leasing office and lower level public spaces first, and then, in sets of three floors, rental units as they become available. This will create a dynamic situation as final construction on the upper floors is occurring as residents are beginning to occupy the lower floors. A visual of turnover/occupancy can be seen below. Please note that the dates of turnover and occupancy are direct results from the detailed project schedule created for this report that can be found in Appendix A. Therefore, the dates of turnover and occupancy may differ from the actual dates on the original schedules.

Turnover/Occupancy Schedule

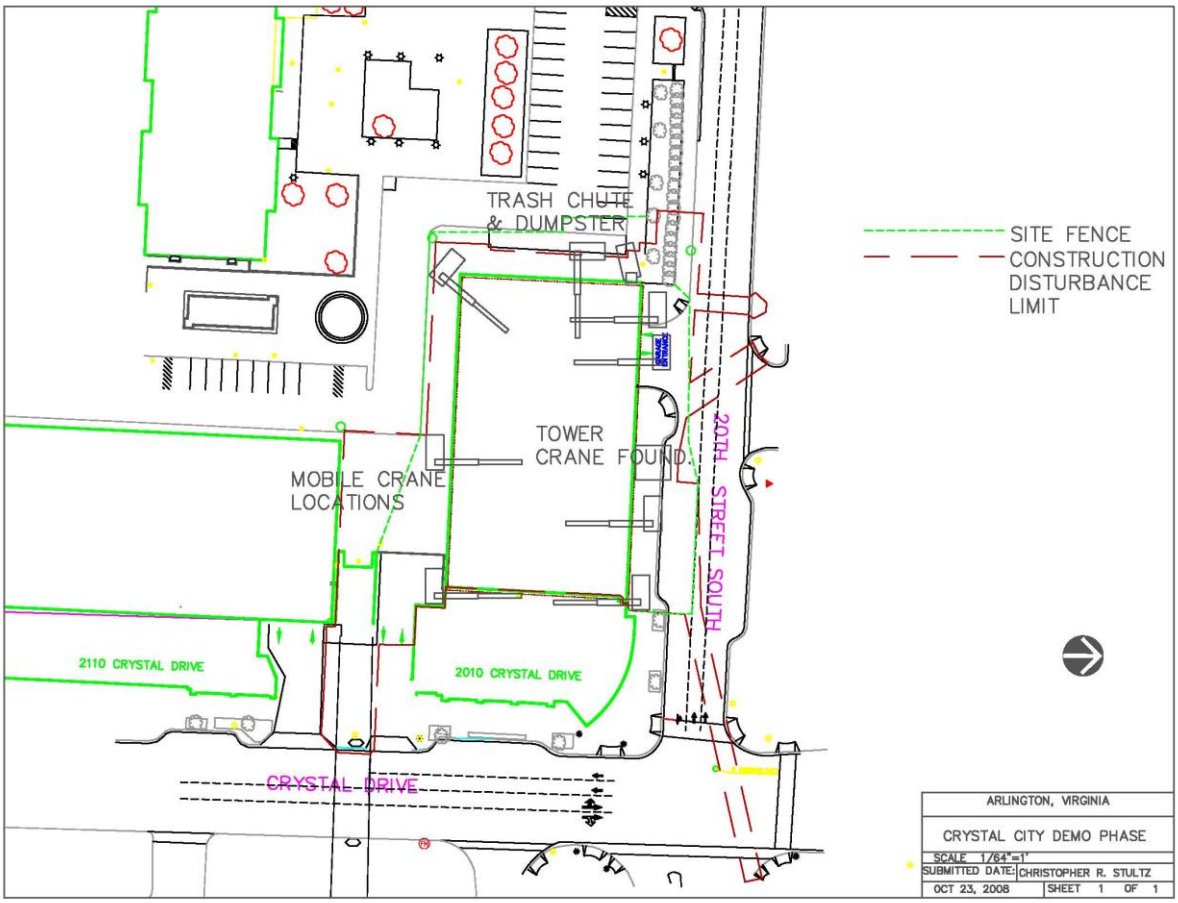
B. Site Layout Planning

B.1 Overview

The site layout at Crystal Plaza II changes little from its initial phase of demolition to its final phase of finishes. The site's limited space does not allow for the plan to change much between phases and use of available lay down areas between trades is common. The site's layout and nature as a renovation can provide advantages however, especially in the use of existing utilities and spaces for temporary facilities such as job site offices and material storage. The three major phases of the project, demolition, superstructure and glazing construction, and finishing are listed below with their respective site layouts.

B.2 Demolition Phase

The first phase at Crystal Plaza is different from the common phase associated with construction. There is no excavation on the project as it is a renovation and addition to an existing building, with all the addition in new floors constructed on the existing structure. The plan, seen below and in full size in Appendix A, has a few key elements to discuss.



Demolition Site Plan

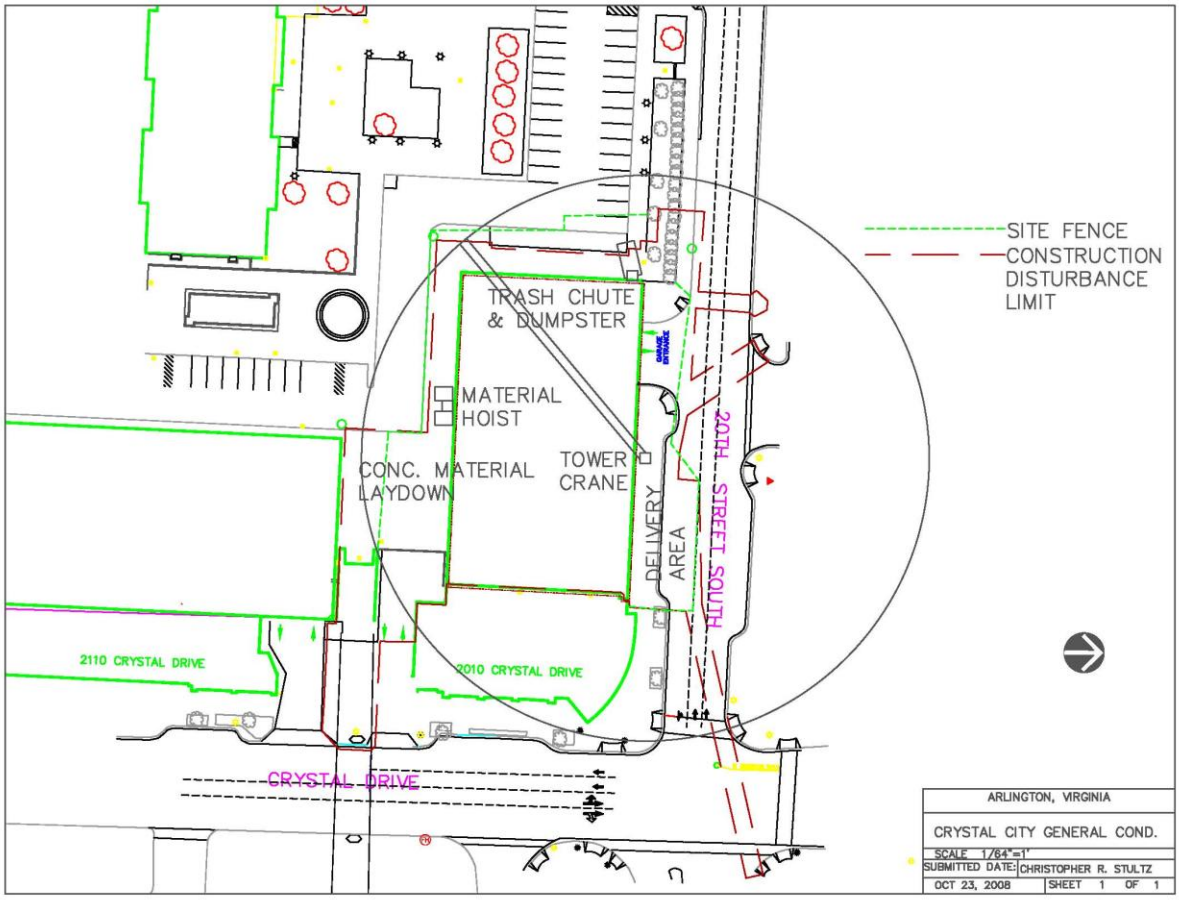
The first point to mention is the location of the site disturbance area and site fence. While not as crucial in this phase, the maximum area for lay down and storage becomes increasingly important as the project progresses. In this phase the precast façade is being removed, foundation work for the tower crane is under way, and demolition of building systems and interiors has begun. Of high concern is the precast façade elements located outside the mobile crane's reach on the east side of the building. These members will remain in place until the tower crane is erected and can remove them as its first objective. The mechanical equipment on the roof can also be removed by the mobile crane.

Exterior façade to be removed

This is also the phase when trades begin to mobilize and set up job trailers on site. The owner has agreed, as part of the contract, to allow the contractors to use the first level, G1, of parking for office setup and as a limited storage area. As so, the contractors constructed temporary offices rather than set up mobile office trailers. This is all contained under the building footprint.

B.3 Superstructure and Glazing Construction

The construction of the superstructure and glazing is the next phase of construction at Crystal Plaza II. This phase encompasses the construction of the nine additional floors and the erection of the curtain wall system. The floor construction uses the tower crane as its primary mode of transporting materials for construction, while the curtain wall has its own system of swing stages, lifts, and jib cranes that are contained within the building to place the unitized pieces in place. The plan can be seen below and in full size in Appendix A.



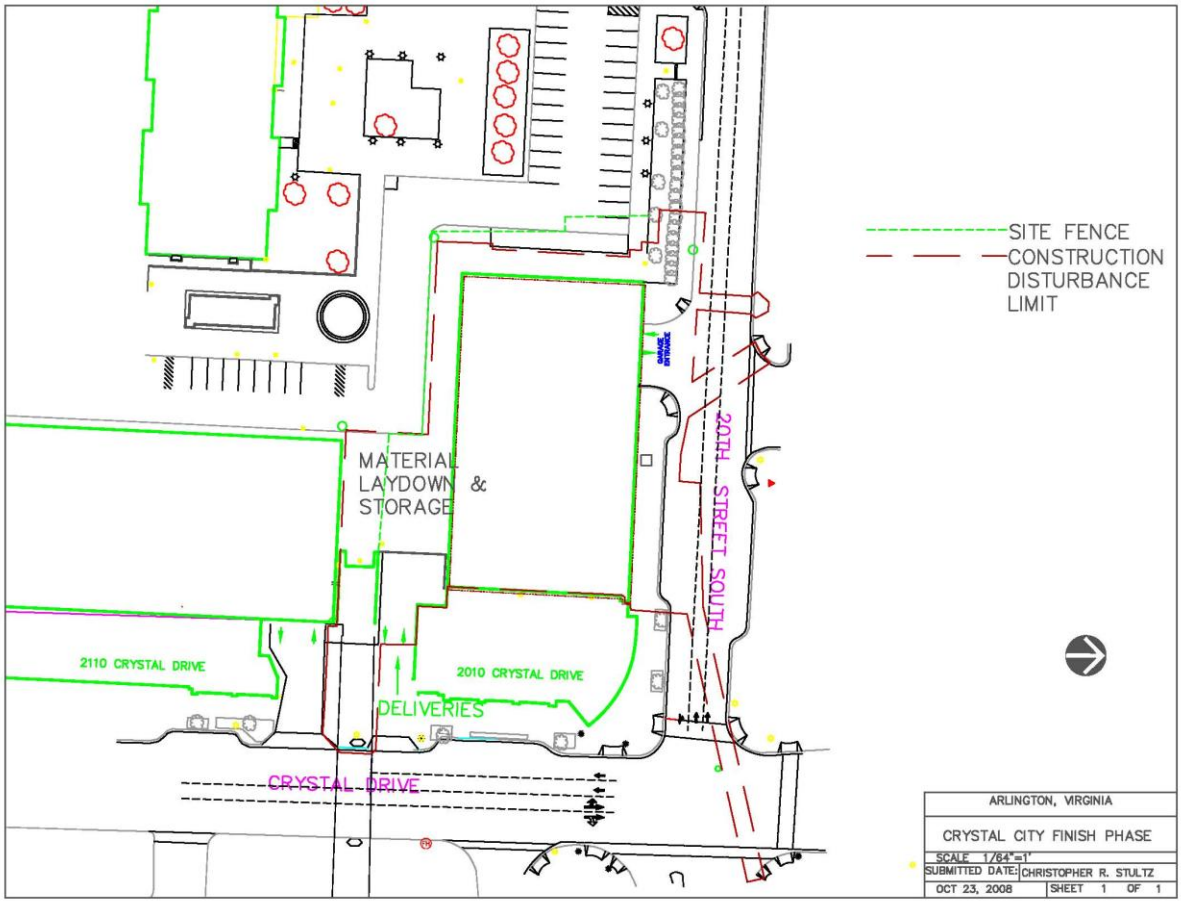
Superstructure and Glazing Phase

This is the phase were all available lay down and staging is taken advantage of. The site fence is moved to its maximum allowable location that still allows pedestrian flow around the site. A delivery area is set up for concrete at the north side of the project. Closure of one lane of South 20th Street is also apparent for this delivery area. This allows incoming concrete deliveries to be close to the tower crane in attempt to limit the cycling time between bucket pours. Also new to the site are material hoists on the south side. These are necessary as the existing vertical transportation system has been removed and a majority of the work and need for materials are on upper floors. Throughout these first two phases all material deliveries are to one of two areas, either the material lay down area on the south side or the delivery area on the north.

Superstructure and Glazing Phase beginning

B.4 Finish Phase

After the installation of the curtain wall system and roof top mechanical components the tower crane is removed from the site, thus beginning the finishing phase. Also to be removed is the material hoist as the single bay service elevator becomes operational. The finish phase continues the construction process to closeout with the temporary facilities still housed in the G1 level of the parking garage below the structure. Many of the small, 3rd tier subcontractors do not have offices and utilize the subcontractor's office of the contractor that oversees them. Parking during this phase becomes a greater issue as more finish trades begin work. Strict parking regulations must be enforced to provide space for storage and site offices. The finishing plan can be seen below and in full size in Appendix A.



Finishing Phase

As the project moves towards substantial completion, there are key differences on the site plan. The tower crane and material hoist have been removed and the previous concrete lay down area has been converted to a general material storage area. Site fencing on the north side of the project has been removed as the owner begins occupancy of the lower floors and the leasing office. Without the delivery area on the north side, all deliveries are now to the permanent loading dock located on the east side of the building. This dock is shared with neighboring buildings; therefore careful sequencing of deliveries requiring the dock is of vital importance. Use of the centralized trash system is also in effect as the trash chute has been removed. The site offices are still located beneath the structure, but are in limited space as residents begin to rent parking.

Final Rendering of Crystal Plaza II

B.5 Conclusions

In conclusion, with the congested site, opportunistic lay down and temporary facility areas, and concern for public safety, the general contractor did as best as possible to provide an accessible and organized construction site. By keeping layouts relative similar, the general contractor was able to avoid confusion with phase changes and to keep materials on site, in storage. For projects in urban environments, site logistics is often the largest problem with the construction of the building, and with distinct phases and phase layouts, Crystal Plaza II was able to overcome these issues.

C. Detailed Structural Systems Estimate

C.1 Estimate Summary

The Detailed Structural System Estimate was created through take-offs performed on the structural drawings and using RS Means 2009 as a cost source. Summarized take-off charts can be found in Appendix A. The result of the detailed estimate is approximately ***$2,580,000***, about $1.5 million off of that show in Technical Report 1 which was provided by the owner. The cost for the concrete package, both structural and non-structural, was about $4.1 million. Reasoning's for the difference can be found in section C.4 Estimate Conclusions. Results of the estimate are below, broken down into various forms to show cost structure.

C.2 Estimate Assumptions

Many assumptions were used to complete the Detailed Structural Estimate and are as follows:

- Estimate is for new construction only and does not include any renovation work
- All slabs are rectangular, slab cut outs are ignored
- Elevator beams and curb/beams on the roof are ignored
- Floors are typical for all PT slabs unless otherwise noted
- Precast and cast in place stairs are not included
- All concrete is strength as listed, differing strengths in pours is not accounted for
- Tower crane is part of general conditions as it is used for other trades
- Total SFCA used for formwork, extra cost is for removal and re-installation
- No frictional losses for PT tendons over 120', therefore no additional tendons
- Slab thickening at various points, such as 14th floor, is not included
- No shoring or re-shoring is included
- PT tendons linear weight is calculated using similar rebar linear weight (#4)
- PT tendons priced as un-grouted single strand for a 100' slab with 25 kips force
- Equipment/labor costs are bare, do not include overhead or mark up
- Standard fee as used by RS Means
- Reinforcing members around openings, structural steel, is not included
- $5.25 per CY added for winter conditions in pours from November-February
- All price data from RS Means 2009, no time factor needed

C.3 Estimate Results

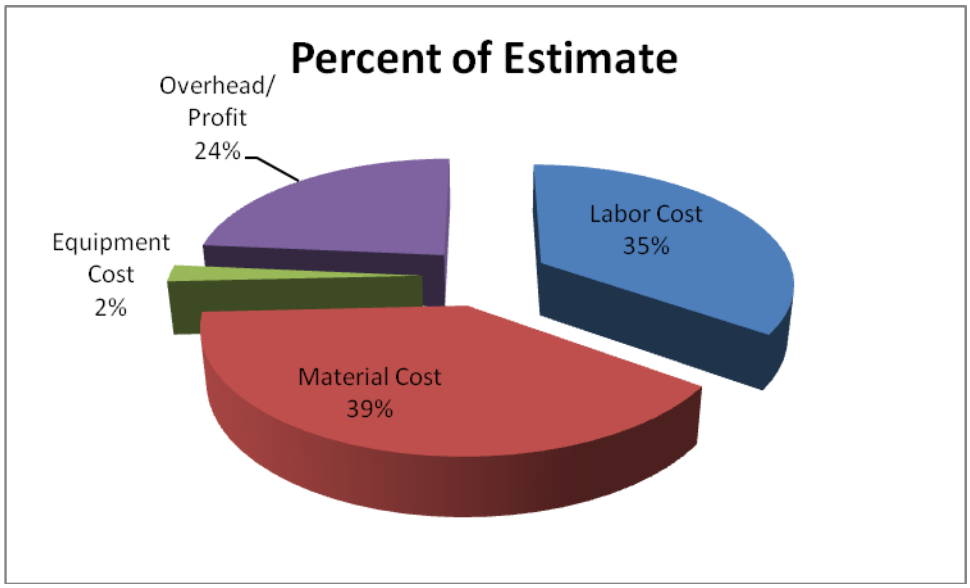
System		Cost
Structural Column Total		$412,059.34
Structural Framing Total		$34,572.16
Slab Total		$2,096,401.34
Shear Wall Total		$219,550.62
Total		$2,762,583.46
Arlington Location Factor	93.4	$2,580,252.95
Original Estimate		$4,100,000.00
Difference		$1,519,747.05

Concrete By Use/Type (Including Labor, Profit, Overhead)					
System	**Total CY**	**$/CY**	**Placement/Finish $**	**Winter $**	**Total Cost**
Structural Column					
4000 psi	550.61	$116.00	$45,454.38	$1,053.61	$110,378.50
Structural Framing					
5000 psi	72.98	$122.00	$5,729.10	$383.16	$15,016.09
Slabs					
5000 psi	2891.75	$122.00	$191,761.20	$4,523.61	$549,078.49
Shear Wall					
6000 psi	476.17	$139.00	$34,316.25	$0.00	$100,504.55
*Not adjusted for location				**Total**	$774,977.63

Formwork (Including Labor, Profit, Overhead)	
System	**Cost**
Structural Columns	$274,809.76
Structural Framing	$7,743.75
Slabs	$1,188,210.10
Shear Wall	$13,499.82
Total	$1,484,263.44
*Not adjusted for location	

Reinforcing (Including Labor, Profit, Overhead)		
System	**Rebar Cost**	**PT Tendons**
Structural Columns	$26,871.08	$0.00
Structural Framing	$9,672.04	$2,140.27
Slabs	$104,748.56	$254,364.19
Shear Wall	$105,546.24	$0.00
Subtotal	$246,837.93	$256,504.46
Total	$503,342.39	
*Not adjusted for location		

Cost Breakdown									
System	Overall Cost	Labor Cost	% of Total	Material Cost	% of Total	Equipment Cost	% of Total	Overhead/Profit	% of Total
Structural Columns	$412,059.34	$145,714.74	35.4%	$162,409.67	39.4%	$12,157.00	3.0%	$91,777.93	22.3%
Structural Framing	$34,572.16	$11,393.81	33.0%	$16,685.95	48.3%	$1,358.90	3.9%	$5,133.49	14.8%
Slabs	$2,096,401.34	$782,844.45	37.3%	$820,863.44	39.2%	$42,462.46	2.0%	$520,141.50	24.8%
Shear Wall	$219,550.62	$46,033.03	21.0%	$116,625.62	53.1%	$7,152.15	3.3%	$49,739.83	22.7%
Total	$2,762,583.46	$985,986.03	35.7%	$1,116,584.67	40.4%	$63,130.52	2.3%	$666,792.75	24.1%



*Please not costs on this page are not adjusted for location.

C.4 Estimate Conclusions

The estimate of $2.6 million has many reasons as to its value below the given value of $4.1 million. While only the structural concrete was accounted for on the new floors, additional concrete was installed below floor 12. This includes slab infills, stairs, and a raised slab in the lobby. This work requires more reinforcing, splicing, backfill, custom formwork, and labor to complete, causing an increase in price. Another possible area is the use of epoxy coated rebar in areas where the underside of the slab is exposed and rebar in the beam/curbs that were not included in the estimate. Also, the job utilized many Saturday deliveries to accelerate the schedule that was not accounted for in this estimate, as well as more laborers than the crews listed in RS Means. Another logical price difference can be accounted for in the rise of steel prices. Prices for reinforcing may have escalated and caused the actual cost to be higher. Final observations include the omission of the tower crane. It may have been included with the concrete price as it was only on site for a month after topping out, and was primarily used by the concrete subcontractor.

The cost per square foot of the Detailed Structural Estimate is $7.94/SF and the percentage of total contract value is 3.8%. However, the cost per square foot is deceiving given only 9 new slabs were poured on the project. This is also about $5 short of the value per square foot from Technical Report 1.

D. General Conditions Estimate

D.1 Overview

The general conditions estimate for Crystal Plaza II is a compilation of general personnel and equipment used on site. The availability of a general conditions estimate will become critical to calculate cost savings/losses if the schedule is accelerated or delayed. The entire estimate is located in this section with visual breakdowns of the general conditions and the general conditions versus the overall project cost.

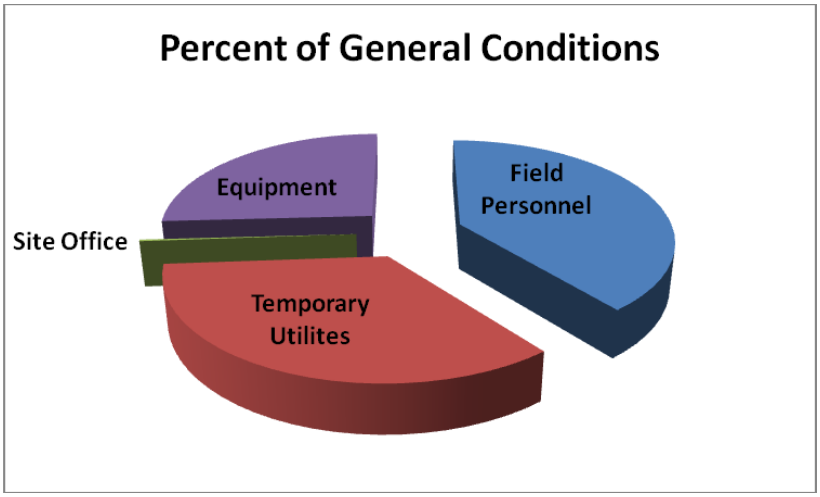
D.2 Estimate Assumptions

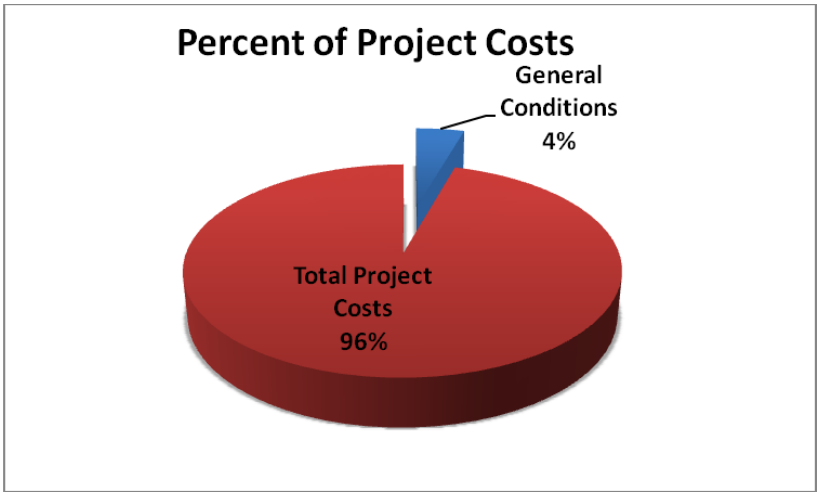
The following assumptions were considered during the general conditions estimate:

- The Administrative Manager is equal to a minimum Field Engineer
- Scheduled time is approximately 20 months
- To compute time in various units, a multiplier of 4.33 weeks per month, and 7 days per week was used
- Only personnel on site are included, upper management from the home office is considered part of the home office overhead and not part of this estimate
- Site offices are not listed as these are one time construction costs and require no renting
- All lifts and equipment other than the man/material hoist and tower crane will be provided by the respective subcontractor

D.3 Estimate Results

Field Personnel				
Description	**Quantity**	**Unit**	**Price/Unit**	**Amount**
Administrative Manager	87	weeks	$835.00	$72,645.00
Layout Engineer	65	weeks	$1,085.00	$70,796.25
Field Engineer	87	weeks	$1,250.00	$108,750.00
Field Engineer	87	weeks	$1,250.00	$108,750.00
Field Engineer	12	weeks	$1,250.00	$15,000.00
Project Manager	87	weeks	$1,775.00	$154,425.00
Project Manager	87	weeks	$2,025.00	$176,175.00
Assistant Superintendent	87	weeks	$1,650.00	$143,550.00
Superintendent	87	weeks	$1,875.00	$163,125.00
General Purpose Laborer	87	weeks	$1,150.00	$100,050.00
General Purpose Laborer	87	weeks	$1,150.00	$100,050.00
			Total	$1,213,316.25
Temporary Utilities				
Description	**Quantity**	**Unit**	**Price/Unit**	**Amount**
Lighting	3250	CSF	$121.00	$393,250.00
Heating	3250	CSF	$16.10	$680,225.00
			Total	$1,073,475.00
Site Office				
Description	**Quantity**	**Unit**	**Price/Unit**	**Amount**
Office Equipment	20	MO	$165.00	$3,300.00
Office Supplies	20	MO	$105.00	$2,100.00
Office Lights & HVAC	20	MO	$121.00	$2,420.00
			Total	$7,820.00
Equipment				
Description	**Quantity**	**Unit**	**Price/Unit**	**Amount**
Tower Crane	8	MO	$14,700.00	$117,600.00
Tower Crane Crew	243	days	$1,550.00	$376,650.00
80 Ton Truck Crane Crew	61	days	$1,214.00	$74,054.00
80 Ton Truck Crane	2	MO	$8,750.00	$17,500.00
Man/Material Hoist	19	MO	$11,300.00	$214,700.00
			Total	$800,504.00
			Grand Total	$3,095,115.25





D.4 Estimate Conclusion

In conclusion, the general conditions fall within the acceptable range of typical projects accounting for approximately 4% of total project costs with a value of just over $3 million. The project specific amount for general conditions as provided by the general contractor is approximately $3 million, a very close amount when compared with the estimate completed. Results of research in topics that affect the general conditions' cost may have an overall impact on the cost of the project, however, because the general conditions only encompass a small percentage of project costs, the savings may be minimal or cause the general conditions to become a larger percent of total project costs.

E. Critical Industry Issues

The Partnership for Achieving Construction Excellence (PACE) 2008 Round Table conference was structured as a primary meeting of 27 industry members and the construction management students from the Architectural Engineering Department at Penn State. The morning focus was on the implementation of an industry-student mentorship program and the issues surrounding its creation. Focus was placed on both the thoughts of the students and the industry members with concerns on facilitation and evaluation of results. The afternoon sessions featured three current topics in industry, all with focuses on the conference's theme of "Investing in People". The three topics were the Evolution of LEED, BIM Strategies, and Energy and the Economy.

Evolution of LEED was a discussion on the changing LEED system and why the change was necessary. It also addressed the effect on future projects pursuing LEED certifications and how the building industry can influence changes in the system, as well as become better green builders. While Crystal Plaza II is building seeking Silver rating under the LEED 2.2 system, the changes could affect future projects by the developer. Comparing the strategies used on Crystal Plaza II to achieve Silver to the current system may be a way to provide the developer with information about the new system and their future investments, therefore discussion and notes from this session may be very important. New areas in LEED 2009 or Version 3, such as ongoing commissioning, regional points, and system level metering can be applied to the project to see how the results of a current green building can be affected by the new system.

BIM Strategies provided a discussion on the methods to staff and utilize BIM on current projects that have proven to be successful. Also discussed were possible advancements and where to take BIM next. A number of case studies were shared and discussed. While it may be too late to utilize BIM on Crystal Plaza II to assist in the construction, it may prove beneficial in analysis of thesis research on the project. Changes to material, their life cycle, and construction schedule can all be manipulated and seen in a model of Crystal Plaza. This model may not be the most high-tech, but can still provide valuable information, such as estimating take-off. Review and comparisons to case studies may provide direction to an effective model.

The final discussion option, Energy and the Economy, focused on how the increase in energy costs are effecting construction and how different sectors of the market will take advantage or sustain through the current economic crisis. The discussion began with focus on how rising energy costs will affect the prices of materials, what owners/developers are currently doing, and how project types are shifting from new construction to renovation and energy savings projects. The discussion then proceeded to how the industry is adapting to the economic situation and what we as new graduates can expect when we graduate. I was most surprised at all the industry members' positive outlook on the situation, completely convinced that we should have nothing to worry about upon graduation. The primary thought was this was a great time to provide training and preparation for when the market turns around and has a large initial boom. I was also surprised that a majority of the companies represented where having little effect from

the recent economic downturn, but expected it to hit in the future with the private market. They still felt that they had enough backlog to continue business with little problem. Information about rising material and energy prices can be applied to thesis research at Crystal Plaza II, given its goal of LEED Silver, energy efficiency, and high end finish materials. Tying back to the LEED discussion and advancing it to compare Crystal Plaza II to a typical high end, multi-family residential building can show the benefits of designing for energy efficiency. Reviewing the choice of finish materials or value engineering the finishes may provide a way for the owner to save on the high end finishes while still providing the high quality they desire.

During the break times between presentations and discussions, the interaction with industry members was amazing. I found myself trying to talk to a different member at every chance. While I didn't want certain conversations to end, I felt the need to get information from many of the members. Contacts from Forrester Construction, Davis Construction, and Clark Contractors all had varying and valuable opinions about construction process at Crystal Plaza II. Other contacts from Southland Industries and Truland Systems can provide valuable information concerning specialty systems and process associated with them.

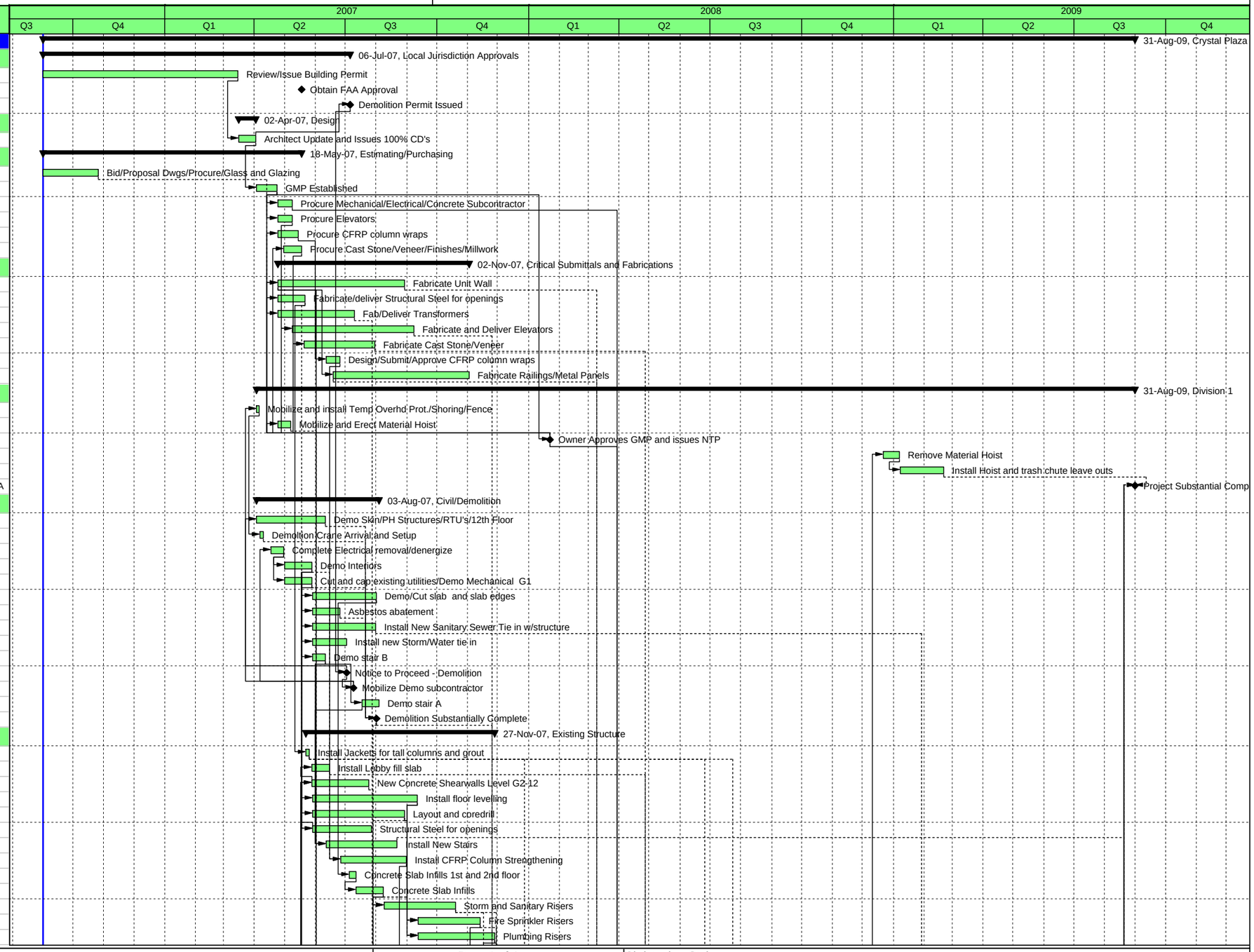
My final surprise was how industry members viewed of thoughts and views of industry during the student panel discussion. I would think the "pace" we sustain as students is just as demanding as that of the work environment, and while my opinion may be biased, I still feel that being able to leave the job and come back to it tomorrow without doing homework or studying is a change that many students will find refreshing. It's not the days that get to us as students; it's the long hours in studio and the library till 1 or 2 am, and waking up for an 8am exam. Work may demand more in a shorter time, but at least work can be left at work, even for a short time.

Appendix A-User Created Documents

Crystal Plaza 2

Classic WBS Layout

Activity Name	Original Duration	Start	Finish
Crystal Plaza 2	776	01-Sep-06 A	31-Aug-09
Local Jurisdiction Approvals	215	01-Sep-06 A	06-Jul-07
Review/Issue Building Permit	140	01-Sep-06	15-Mar-07
Obtain FAA Approval	0	18-May-07 A	
Demolition Permit Issued	0	06-Jul-07 A	
Design	12	16-Mar-07	02-Apr-07
Architect Update and Issues 100% CD's	12	16-Mar-07	02-Apr-07
Estimating/Purchasing	181	01-Sep-06	18-May-07
Bid/Proposal Dwgs/Procure/Glass and Gl	40	01-Sep-06	26-Oct-06
GMP Established	15	03-Apr-07	23-Apr-07
Procure Mechanical/Electrical/Concrete S	11	24-Apr-07	08-May-07
Procure Elevators	11	24-Apr-07	08-May-07
Procure CFRP column wraps	15	24-Apr-07	14-May-07
Procure Cast Stone/Veneer/Finishes/Mill\	15	30-Apr-07	18-May-07
Critical Submittals and Fabric	139	24-Apr-07	02-Nov-07
Fabricate Unit Wall	90	24-Apr-07	29-Aug-07
Fabricate/deliver Structural Steel for oper	20	24-Apr-07	21-May-07
Fab/Deliver Transformers	55	24-Apr-07	10-Jul-07
Fabricate and Deliver Elevators	85	09-May-07	07-Sep-07
Fabricate Cast Stone/Veneer	50	21-May-07	30-Jul-07
Design/Submit/Approve CFRP column wr	10	12-Jun-07	25-Jun-07
Fabricate Railings/Metal Panels	95	19-Jun-07	02-Nov-07
Division 1	629	03-Apr-07 A	31-Aug-09
Mobilize and install Temp Overhd Prot./S	3	03-Apr-07	05-Apr-07
Mobilize and Erect Material Hoist	10	24-Apr-07	07-May-07
Owner Approves GMP and issues NTP	0	22-Jan-08 A	
Remove Material Hoist	10	22-Dec-08	07-Jan-09
Install Hoist and trash chute leave outs	30	08-Jan-09	20-Feb-09
Project Substantial Completion	0		31-Aug-09 A
Civil/Demolition	89	03-Apr-07 A	03-Aug-07
Demo Skin/PH Structures/RTU's/12th Flo	50	03-Apr-07	11-Jun-07
Demoltion Crane Arrival and Setup	2	06-Apr-07	09-Apr-07
Complete Electrical removal/denergize	10	17-Apr-07	30-Apr-07
Demo Interiors	20	01-May-07	28-May-07
Cut and cap existing utilities/Demo Mecha	20	01-May-07	28-May-07
Demo/Cut slab and slab edges	46	29-May-07	01-Aug-07
Asbestos abatement	20	29-May-07	25-Jun-07
Install New Sanitary Sewer Tie in w/struct	45	29-May-07	31-Jul-07
Install new Storm/Water tie in	25	29-May-07	02-Jul-07
Demo stair B	10	29-May-07	11-Jun-07
Notice to Proceed - Demolition	0	02-Jul-07 A	
Mobilize Demo subcontractor	0	09-Jul-07 A	
Demo stair A	13	18-Jul-07	03-Aug-07
Demolition Substantially Complete	0		01-Aug-07
Existing Structure	136	22-May-07	27-Nov-07
Install Jackets for tall columns and grout	4	22-May-07	25-May-07
Install Lobby fill slab	15	28-May-07	15-Jun-07
New Concrete Shearwalls Level G2-12	41	28-May-07	24-Jul-07
Install floor levelling	73	29-May-07	11-Sep-07
Layout and coredrill	65	29-May-07	29-Aug-07
Structural Steel for openings	43	29-May-07	27-Jul-07
Install New Stairs	50	12-Jun-07	21-Aug-07
Install CFRP Column Strengthening	47	26-Jun-07	31-Aug-07
Concrete Slab Infills 1st and 2nd floor	5	05-Jul-07	11-Jul-07
Concrete Slab Infills	20	12-Jul-07	08-Aug-07
Storm and Sanitary Risers	49	09-Aug-07	19-Oct-07
Fire Sprinkler Risers	44	12-Sep-07	13-Nov-07
Plumbing Risers	52	12-Sep-07	27-Nov-07



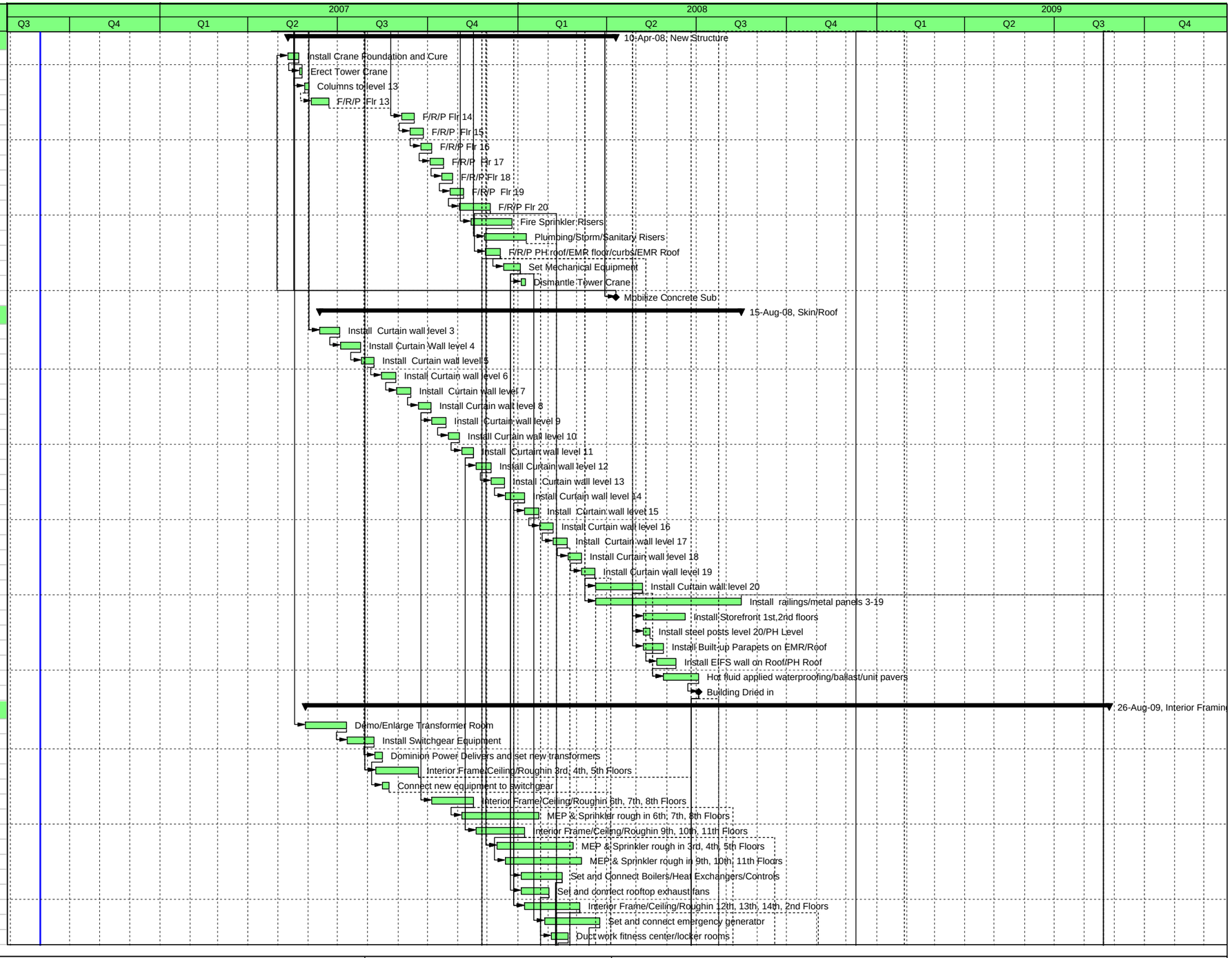
Actual Work | Critical Remaining Work | Summary

Remaining Work | Milestone

Christopher Stultz

Crystal Plaza II

Activity Name	Original Duration	Start	Finish
New Structure	239	11-May-07 A	10-Apr-08
Install Crane Foundation and Cure	8	11-May-07	22-May-07
Erect Tower Crane	3	23-May-07	25-May-07
Columns to level 13	5	28-May-07	01-Jun-07
F/R/P Flr 13	15	04-Jun-07*	22-Jun-07
F/R/P Flr 14	10	04-Sep-07	17-Sep-07
F/R/P Flr 15	10	13-Sep-07	26-Sep-07
F/R/P Flr 16	10	24-Sep-07	05-Oct-07
F/R/P Flr 17	10	03-Oct-07	17-Oct-07
F/R/P Flr 18	10	15-Oct-07	26-Oct-07
F/R/P Flr 19	10	24-Oct-07	06-Nov-07
F/R/P Flr 20	20	02-Nov-07	03-Dec-07
Fire Sprinkler Risers	27	14-Nov-07	26-Dec-07
Plumbing/Storm/Sanitary Risers	27	28-Nov-07	09-Jan-08
F/R/P PH roof/EMR floor/curbs/EMR Roof	12	29-Nov-07	14-Dec-07
Set Mechanical Equipment	10	17-Dec-07	03-Jan-08
Dismantle Tower Crane	3	04-Jan-08	08-Jan-08
Mobilize Concrete Sub	0	10-Apr-08 A	
Skin/Roof	308	13-Jun-07	15-Aug-08
Install Curtain wall level 3	15	13-Jun-07	03-Jul-07
Install Curtain Wall level 4	15	04-Jul-07	24-Jul-07
Install Curtain wall level 5	10	25-Jul-07	07-Aug-07
Install Curtain wall level 6	10	15-Aug-07	29-Aug-07
Install Curtain wall level 7	10	30-Aug-07	13-Sep-07
Install Curtain wall level 8	10	21-Sep-07	04-Oct-07
Install Curtain wall level 9	10	05-Oct-07	19-Oct-07
Install Curtain wall level 10	10	22-Oct-07	02-Nov-07
Install Curtain wall level 11	10	05-Nov-07	16-Nov-07
Install Curtain wall level 12	10	19-Nov-07	04-Dec-07
Install Curtain wall level 13	10	05-Dec-07	18-Dec-07
Install Curtain wall level 14	10	19-Dec-07	07-Jan-08
Install Curtain wall level 15	10	08-Jan-08	22-Jan-08
Install Curtain wall level 16	10	23-Jan-08	05-Feb-08
Install Curtain wall level 17	10	06-Feb-08	20-Feb-08
Install Curtain wall level 18	10	21-Feb-08	05-Mar-08
Install Curtain wall level 19	10	06-Mar-08	19-Mar-08
Install Curtain wall level 20	35	20-Mar-08	07-May-08
Install railings/metal panels 3-19	105	20-Mar-08	15-Aug-08
Install Storefront 1st,2nd floors	30	08-May-08	19-Jun-08
Install steel posts level 20/PH Level	5	08-May-08	14-May-08
Install Built-up Parapets on EMR/Roof	14	08-May-08	28-May-08
Install EIFS wall on Roof/PH Roof	13	22-May-08	10-Jun-08
Hot fluid applied waterproofing/ballast/uni	27	28-May-08	03-Jul-08
Building Dried in	0		03-Jul-08
Interior Framing/Roughin/Fini	587	29-May-07	26-Aug-09
Demo/Enlarge Transformer Room	30	29-May-07	10-Jul-07
Install Switchgear Equipment	20	11-Jul-07	07-Aug-07
Dominion Power Delivers and set new tra	6	08-Aug-07	15-Aug-07
Interior Frame/Ceiling/Roughin 3rd, 4th, 5	30	09-Aug-07	21-Sep-07
Connect new equipment to switchgear	5	16-Aug-07	22-Aug-07
Interior Frame/Ceiling/Roughin 6th, 7th, 8	30	05-Oct-07	16-Nov-07
MEP & Sprinkler rough in 6th, 7th, 8th Flc	50	05-Nov-07	22-Jan-08
Interior Frame/Ceiling/Roughin 9th, 10th,	30	19-Nov-07	07-Jan-08
MEP & Sprinkler rough in 3rd, 4th, 5th Flc	50	11-Dec-07	26-Feb-08
MEP & Sprinkler rough in 9th, 10th, 11th	50	19-Dec-07	05-Mar-08
Set and Connect Boilers/Heat Exchanger	30	04-Jan-08	15-Feb-08
Set and connect rooftop exhaust fans	20	04-Jan-08	01-Feb-08
Interior Frame/Ceiling/Roughin 12th, 13th	39	08-Jan-08	04-Mar-08
Set and connect emergency generator	40	28-Jan-08	24-Mar-08
Duct work fitness center/locker rooms	13	04-Feb-08	21-Feb-08

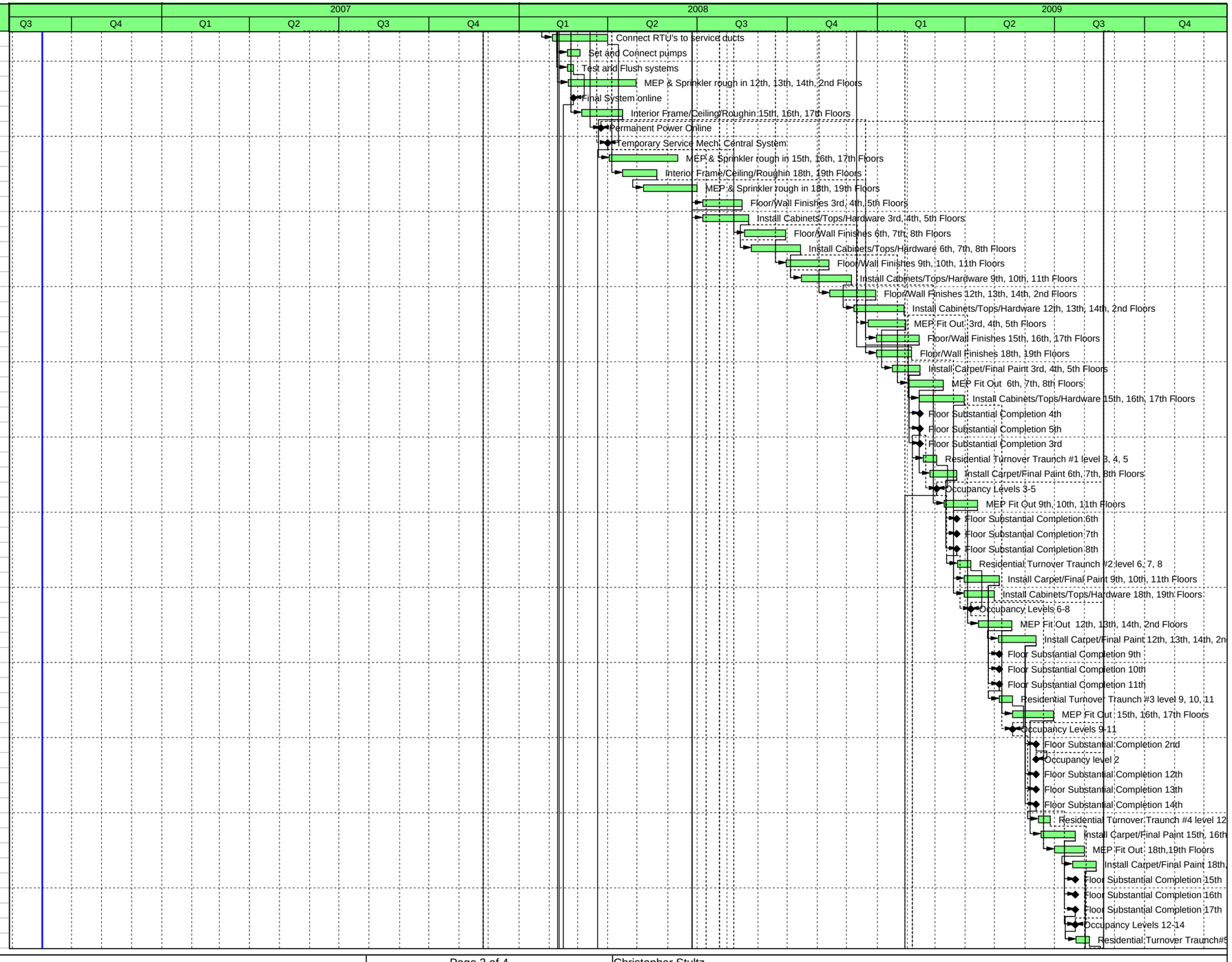


Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

Christopher Stultz

Crystal Plaza II

Activity Name	Original Duration	Start	Finish
Connect RTU's to service ducts	40	04-Feb-08	31-Mar-08
Set and Connect pumps	10	19-Feb-08	03-Mar-08
Test and Flush systems	5	19-Feb-08	25-Feb-08
MEP & Sprinkler rough in 12th, 13th, 14th	50	20-Feb-08	29-Apr-08
Final System online	0		25-Feb-08
Interior Frame/Ceiling/Roughin 15th, 16th	30	05-Mar-08	15-Apr-08
Permanent Power Online	0		24-Mar-08
Temporary Service Mech. Central System	0		31-Mar-08
MEP & Sprinkler rough in 15th, 16th, 17th	50	02-Apr-08	11-Jun-08
Interior Frame/Ceiling/Roughin 18th, 19th	25	16-Apr-08	20-May-08
MEP & Sprinkler rough in 18th, 19th Floors	38	07-May-08	30-Jun-08
Floor/Wall Finishes 3rd, 4th, 5th Floors	30	07-Jul-08	15-Aug-08
Install Cabinets/Tops/Hardware 3rd, 4th,	35	07-Jul-08	22-Aug-08
Floor/Wall Finishes 6th, 7th, 8th Floors	30	18-Aug-08	29-Sep-08
Install Cabinets/Tops/Hardware 6th, 7th, 8	35	25-Aug-08	14-Oct-08
Floor/Wall Finishes 9th, 10th, 11th Floors	30	30-Sep-08	12-Nov-08
Install Cabinets/Tops/Hardware 9th, 10th	35	15-Oct-08	05-Dec-08
Floor/Wall Finishes 12th, 13th, 14th, 2nd	30	13-Nov-08	30-Dec-08
Install Cabinets/Tops/Hardware 12th, 13th	34	08-Dec-08	28-Jan-09
MEP Fit Out 3rd, 4th, 5th Floors	25	23-Dec-08*	30-Jan-09
Floor/Wall Finishes 15th, 16th, 17th Floors	30	31-Dec-08	12-Feb-09
Floor/Wall Finishes 18th, 19th Floors	25	31-Dec-08	05-Feb-09
Install Carpet/Final Paint 3rd, 4th, 5th Flo	20	16-Jan-09	13-Feb-09
MEP Fit Out 6th, 7th, 8th Floors	25	02-Feb-09	09-Mar-09
Install Cabinets/Tops/Hardware 15th, 16th	31	13-Feb-09	30-Mar-09
Floor Substantial Completion 4th	0		13-Feb-09
Floor Substantial Completion 5th	0		13-Feb-09
Floor Substantial Completion 3rd	0		13-Feb-09
Residential Turnover Traunch #1 level 3,	10	17-Feb-09	02-Mar-09
Install Carpet/Final Paint 6th, 7th, 8th Flo	20	24-Feb-09	23-Mar-09
Occupancy Levels 3-5	0		02-Mar-09
MEP Fit Out 9th, 10th, 11th Floors	25	10-Mar-09	13-Apr-09
Floor Substantial Completion 6th	0		23-Mar-09
Floor Substantial Completion 7th	0		23-Mar-09
Floor Substantial Completion 8th	0		23-Mar-09
Residential Turnover Traunch #2 level 6,	10	24-Mar-09	06-Apr-09
Install Carpet/Final Paint 9th, 10th, 11th F	26	31-Mar-09	05-May-09
Install Cabinets/Tops/Hardware 18th, 19th	23	31-Mar-09	30-Apr-09
Occupancy Levels 6-8	0		06-Apr-09
MEP Fit Out 12th, 13th, 14th, 2nd Floors	25	14-Apr-09	18-May-09
Install Carpet/Final Paint 12th, 13th, 14th	29	05-May-09	12-Jun-09
Floor Substantial Completion 9th	0		05-May-09
Floor Substantial Completion 10th	0		05-May-09
Floor Substantial Completion 11th	0		05-May-09
Residential Turnover Traunch #3 level 9,	10	06-May-09	19-May-09
MEP Fit Out 15th, 16th, 17th Floors	31	19-May-09	30-Jun-09
Occupancy Levels 9-11	0		19-May-09
Floor Substantial Completion 2nd	0		12-Jun-09
Occupancy level 2	0		12-Jun-09
Floor Substantial Completion 12th	0		12-Jun-09
Floor Substantial Completion 13th	0		12-Jun-09
Floor Substantial Completion 14th	0		12-Jun-09
Residential Turnover Traunch #4 level 12	10	15-Jun-09	26-Jun-09
Install Carpet/Final Paint 15th, 16th, 17th	26	17-Jun-09	22-Jul-09
MEP Fit Out 18th,19th Floors	23	01-Jul-09	31-Jul-09
Install Carpet/Final Paint 18th, 19th Floors	18	20-Jul-09	12-Aug-09
Floor Substantial Completion 15th	0		22-Jul-09
Floor Substantial Completion 16th	0		22-Jul-09
Floor Substantial Completion 17th	0		22-Jul-09
Occupancy Levels 12-14	0		22-Jul-09
Residential Turnover Traunch#5 level 15,	10	23-Jul-09	05-Aug-09

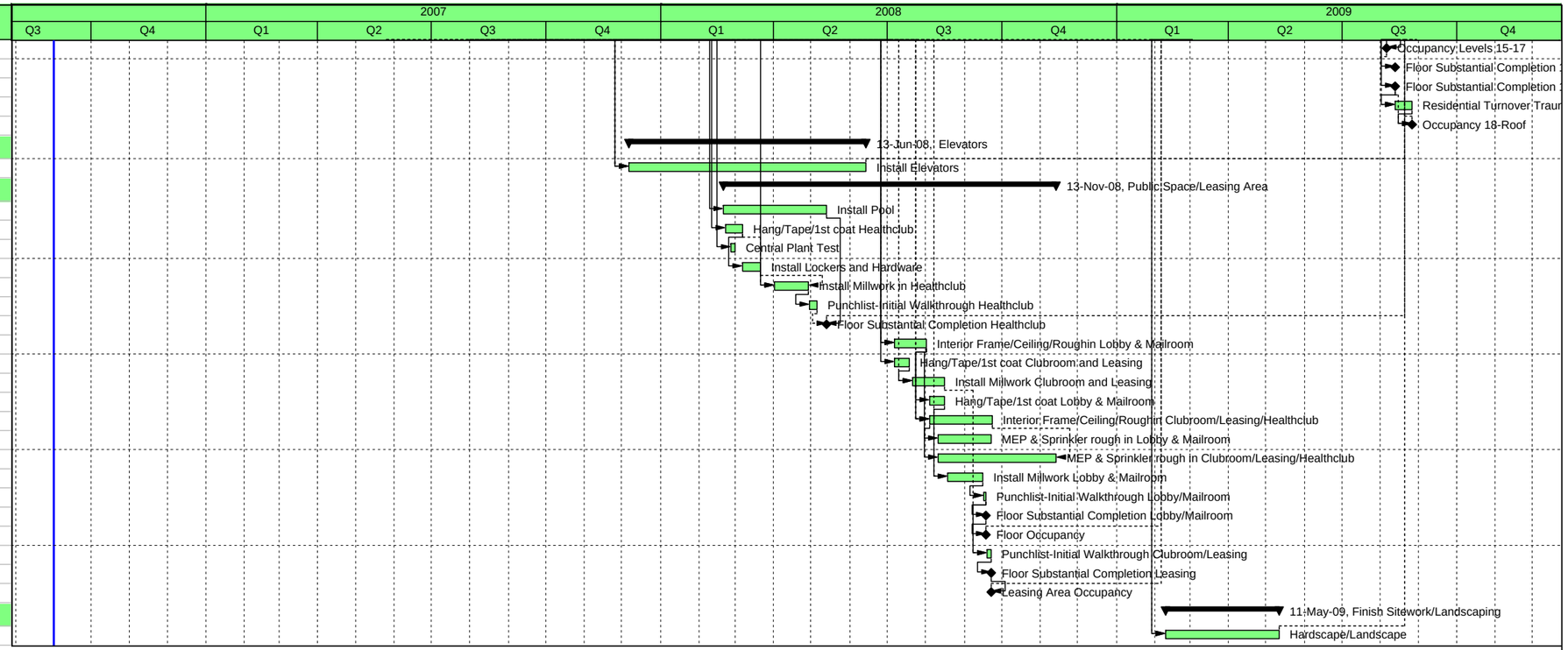


Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary

Christopher Stultz

Crystal Plaza II

Activity Name	Original Duration	Start	Finish
Occupancy Levels 15-17	0		05-Aug-09
Floor Substantial Completion 18th	0		12-Aug-09
Floor Substantial Completion 19th	0		12-Aug-09
Residential Turnover Traunch #6 level 18	10	13-Aug-09	26-Aug-09
Occupancy 18-Roof	0		26-Aug-09
Elevators	137	06-Dec-07	13-Jun-08
Install Elevators	130	06-Dec-07	13-Jun-08
Public Space/Leasing Area	192	20-Feb-08	13-Nov-08
Install Pool	60	20-Feb-08	13-May-08
Hang/Tape/1st coat Healthclub	10	22-Feb-08	06-Mar-08
Central Plant Test	4	26-Feb-08	29-Feb-08
Install Lockers and Hardware	11	07-Mar-08	21-Mar-08
Install Millwork in Healthclub	20	01-Apr-08	28-Apr-08
Punchlist-Initial Walkthrough Healthclub	5	29-Apr-08	05-May-08
Floor Substantial Completion Healthclub	0		13-May-08
Interior Frame/Ceiling/Roughin Lobby & M	20	07-Jul-08	01-Aug-08
Hang/Tape/1st coat Clubroom and Leasing	10	07-Jul-08	18-Jul-08
Install Millwork Clubroom and Leasing	20	21-Jul-08	15-Aug-08
Hang/Tape/1st coat Lobby & Mailroom	10	04-Aug-08	15-Aug-08
Interior Frame/Ceiling/Roughin Clubroom	36	04-Aug-08	23-Sep-08
MEP & Sprinkler rough in Lobby & Mailro	30	11-Aug-08	22-Sep-08
MEP & Sprinkler rough in Clubroom/Leas	66	11-Aug-08	13-Nov-08
Install Millwork Lobby & Mailroom	20	18-Aug-08	15-Sep-08
Punchlist-Initial Walkthrough Lobby/Mailr	3	16-Sep-08	18-Sep-08
Floor Substantial Completion Lobby/Mailr	0		18-Sep-08
Floor Occupancy	0		18-Sep-08
Punchlist-Initial Walkthrough Clubroom/L	2	19-Sep-08	22-Sep-08
Floor Substantial Completion Leasing	0		22-Sep-08
Leasing Area Occupancy	0		22-Sep-08
Finish Sitework/Landscaping	66	09-Feb-09	11-May-09
Hardscape/Landscape	65	09-Feb-09*	11-May-09



Actual Work
Remaining Work
Critical Remaining Work
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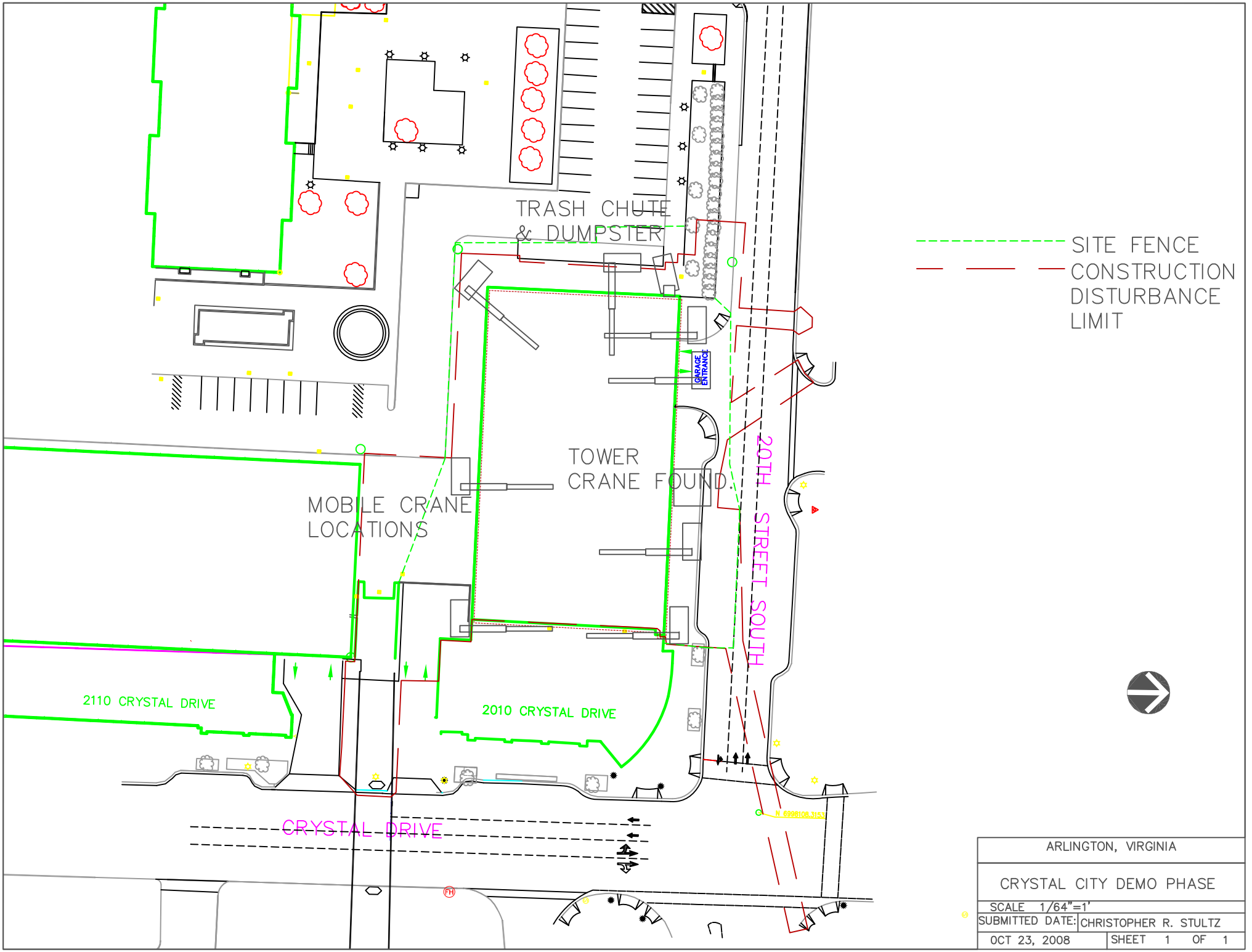
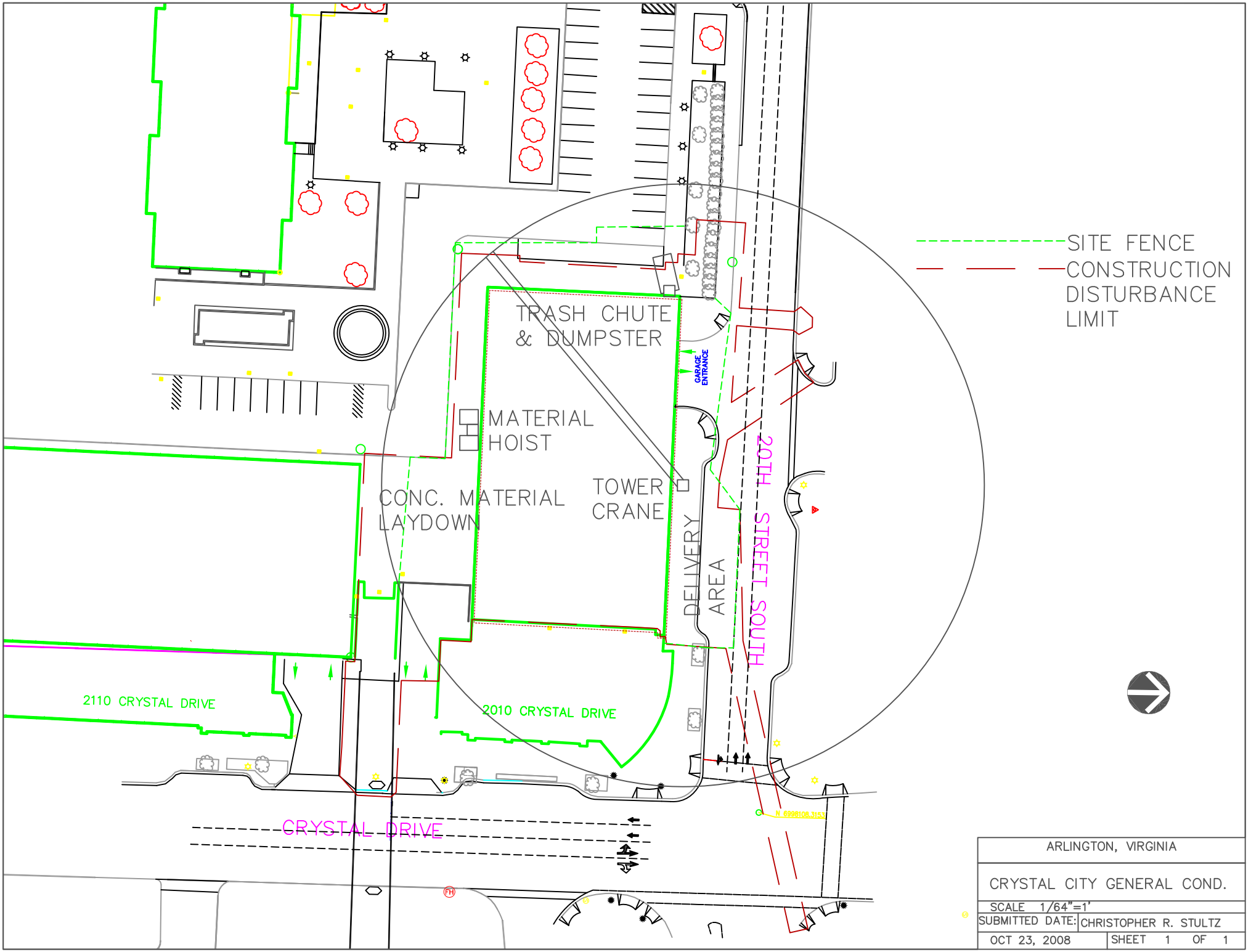
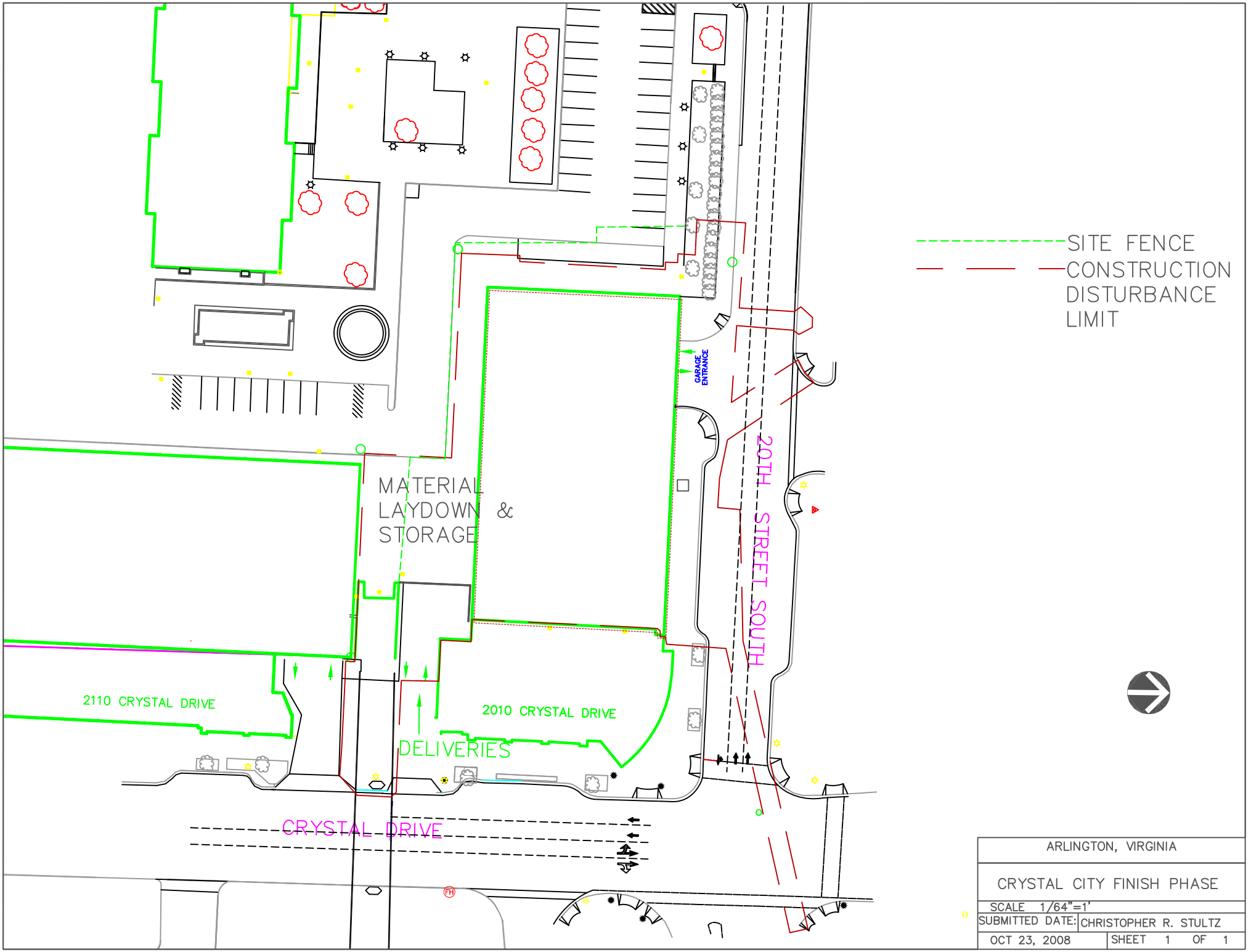
Christopher Stultz

Crystal Plaza II



ARLINGTON, VIRGINIA	
CRYSTAL CITY DEMO PHASE	
SCALE 1/64"=1'	
SUBMITTED DATE:	CHRISTOPHER R. STULTZ
OCT 23, 2008	SHEET 1 OF 1


SITE FENCE
CONSTRUCTION DISTURBANCE LIMIT
TRASH CHUTE & DUMPSTER
GARAGE ENTRANCE
MATERIAL HOIST
CONC. MATERIAL LAYDOWN
TOWER CRANE
DELIVERY AREA
20TH STREET SOUTH
2110 CRYSTAL DRIVE
2010 CRYSTAL DRIVE
CRYSTAL DRIVE
N 6998108.3153
ARLINGTON, VIRGINIA
CRYSTAL CITY GENERAL COND.
SCALE 1/64"=1'
SUBMITTED DATE:
CHRISTOPHER R. STULTZ
OCT 23, 2008
SHEET 1 OF 1



ARLINGTON, VIRGINIA

CRYSTAL CITY FINISH PHASE

SCALE 1/64"=1'

SUBMITTED DATE: OCT 23, 2008

CHRISTOPHER R. STULTZ

SHEET 1 OF 1

4000 psi concrete	$116.00	/CY		550.61	CY	$63,870.50
material only						
material/cy	$106.00	=		$58,364.42		
		profit/overhead		$5,506.08		
Placing						
Columns square or round 18" thick (12&14) with crane/bucket						
crew c-7	$92.50	/CY		269.74	CY	$24,951.36
labor/CY	$45.00	=		$12,138.50		
equipment/CY	$22.00	=		$5,934.38		
		profit/overhead		$6,878.48		
Columns square of round 24" thick (20) with crane/bucket						
crew c-7	$73.00	/CY		280.86	CY	$20,503.02
labor/CY	$35.00	=		$12,736.37		
equipment/CY	$17.10	=		$6,222.63		
		profit/overhead		$1,544.03		
for winter concrete	5.25	/CY		200.69		$1,053.61
			sum			$110,378.50

Forms in Place, Columns						
Steel Framed plywood						
16 x 16 (columns with a 14" or 16" dimension, largest)	$7.60	/SFCA		1241.33	SFCA	$9,434.13
labor/SFCA	$3.03	=		$3,761.24		
material/SFCA	$2.63	=		$3,264.71		
		profit/overhead		$2,408.19		
20 x 20 (columns with an 18" or 20" dimension, largest)	$7.05	/SFCA		33866.57	SFCA	$238,759.30
labor/SFCA	$2.88	=		$97,535.71		
material/SFCA	$2.35	=		$79,303.65		
		profit/overhead		$61,919.93		
24 x 24 (for all columns with a 24" dimension, largest)	$6.10	/SFCA		4363.33	SFCA	$26,616.33
labor/SFCA	$2.75	=		$11,999.17		
material/SFCA	$1.67	=		$6,726.20		
		profit/overhead		$7,890.96		
					sum	$274,809.76

Reinforcing in Place						
Columns #3-#7	$3,250.00	/ton		1.79	ton	$5,809.30
crew 4 rodm						
labor/ton	$950.00	=		$1,698.10		
material/ton	$1,550.00	=		$2,770.59		
		profit/overhead		$1,340.61		
Columns #8-#18	$2,725.00	/ton		7.73		$21,061.78
crew 4 rodm						
labor/ton	$620.00	=		$4,792.04		
material/ton	$1,550.00	=		$11,980.10		
		profit/overhead		$4,289.65	sum	$26,871.08

5000 psi concrete		122	/CY	72.98	CY	$8,903.83
material only						
	material/cy	$106.00	=	$7,736.12		
			profit/overhead/	$1,167.72		
Placing						
Large Beams						
Crane and Bucket						
crew c-7	78.5 /CY			72.98	CY	$5,729.10
	labor/CY	$38.00	=	$2,773.32		
	equipment/CY	$18.40	=	$1,342.87		
			profit	$1,612.91		
for winter concrete		$5.25	/CY	72.98		$383.16
				sum		$15,016.09

Forms in Place, Beams & Girders						
Interior Beam, plywood, 12", 1 use						
12 x's only		$14.40	/SFCA	212.92		$3,066.00
	labor/SFCA	$6.20	=	$1,320.08		
	material/SFCA	$4.40	=	$936.83		
			profit/overhead	$809.08		
Forms in Place, Beams & Girders						
Interior Beam, plywood, 24", 1 use						
		$12.15	/SFCA	385.00		$4,677.75
	labor/SFCA	$6.20	=	$2,387.00		
	material/SFCA	$4.40	=	$1,694.00		
			profit/overhead	$596.75		
					sum	$7,743.75

Reinforcing in Place						
Beams & Girders #8-#18		$2,575.00	/Ton	3.76		$9,672.04
crew 4 rodm						
	labor/ton	$950.00	=	$3,568.33		
	material/ton	$1,550.00	=	$5,822.01		
			profit/overhead	$281.71		
					sum	$9,672.04

Reinforcing in Place, Elevated Slabs, PT Cables						
#4-#7		$2.67	/LB	801.60		$2,140.27
crew C-4						
	labor/lb	$1.20	=	$961.92		
	equipment/lb	$0.02	=	$16.03		
	material/lb	$0.62	=	$496.99		
			profit/overhead	$665.33		
					sum	$2,140.27

Elevated Slab including finish no framing/reinforcing						
crew c-8						
regular concrete	6" slab	3.68	/SF	=		$554,270.56

5000 psi concrete	122	/CY		2891.75	CY	$352,793.68
material only						
for winter concre	$5.25	/CY		861.64	CY	$4,523.61
	material/c	$111.00	=		$320,984.41	
			profit/overhead/		$31,809.27	
Placing						
Elevated Slab 6-10"						
Crane and Bucket						
crew c-7	$46.00	/CY		2891.75	CY	$133,020.57
	labor/CY	$22.50	=		$65,064.41	
	equipment	$10.90	=		$31,520.09	
			profit		$36,436.07	
Finishing						
Power screed, bull float, machine float & trowel ride on						
crew c-10e	0.39	/SF		150617.00	SF	$58,740.63
	labor/SF	$0.22	=		$33,135.74	
	equipment	$0.06	=		$9,037.02	
			profit		$16,567.87	
					sum	$549,078.49

Forms in Place, Elevated Slabs						
Flat plate, plywood, up to 15', 2 use						
typical floors (13-19)		$8.30	/SF	127897.00	SF	$1,061,545.10
	labor/SFCA	$3.59	=		$459,150.23	
	material/SI	$2.49	=		$318,463.53	
			profit/overhead		$283,931.34	
flat plate, plywood, 15'-20', 4 use						
floor 20		$7.70	/SF	16450.00	SF	$126,665.00
	labor/SFCA	$3.77	=		$62,016.50	
	material/SI	$1.67	=		$27,471.50	
			profit/overhead		$37,177.00	
flat plat, plywood, up to 15', 1 use						
PH and 21		$11.15	/SF	6270.00	SF	$69,910.50
	labor/SFCA	$3.97	=		$24,891.90	
	material/SI	$4.53	=		$28,403.10	
			profit/overhead		$16,615.50	
					sum	$1,188,210.10

Reinforcing in Place, Elevated Slabs						
#4-#7		$2,600.00	/Ton	32.43	Tons	$84,324.12
crew 4 Rodm						
	labor/ton	$490.00	=		$15,891.85	
	material/tc	$1,650.00	=		$53,513.38	
			profit/overhead		$14,918.88	
#4-#7		$2,600.00	/Ton	7.86	Tons	$20,424.45
crew 4 Rodm	For PH Roof					
	labor/ton	$490.00	=		$3,849.22	
	material/tc	$1,650.00	=		$12,961.67	
			profit/overhead		$3,613.56	
					sum	$104,748.56

Reinforcing in Place, Elevated Slabs, PT Cables						
#4-#7		$2.67	/LB	95267.49	LB	$254,364.19
crew C-4						
	labor/lb	$1.20	=		$114,320.99	
	equipment	$0.02	=		$1,905.35	
	material/lb	$0.62	=		$59,065.84	
			profit/overhead		$79,072.02	
					sum	$254,364.19

6000 psi concrete		139 /CY		476.17 CY		$66,188.30
material only						
	material/cy	$106.00	=	$50,474.53		
			profit/overhead/ov	$15,713.77		
Placing						
Walls, 12", With Crane/Bucket						
crew c-7		56.5 /CY		476.17 CY		$26,903.88
	labor/CY	$27.50	=	$13,094.81		
	equipment/CY	$13.30	=	$6,333.13		
			profit	$7,475.94		
Wheeled Conc, 50' haul		15.8 /CY		469.14 CY		$7,412.38
	labor/CY	$8.95	=	$4,261.76		
	equipment/CY	$1.72	=	$819.02		
			profit	$2,331.59		
				sum		$100,504.55

Forms in Place, Walls						
Plywood, 8'-16', 4 use		$8.20 /SFCA		1646.32 SFCA		$13,499.82
	labor/SFCA	$4.73	=	$7,787.09		
	material/SFCA	$0.78	=	$1,284.13		
			profit/overhead	$4,428.60		
					sum	$13,499.82

Reinforcing in Place, Walls						
#3-#7		$2,400.00 /Ton		43.98 Ton		$105,546.24
crew 4 Rodm						
	labor/ton	$475.00	=	$20,889.36		
	material/ton	$1,475.00	=	$64,866.96		
			profit/overhead	$19,789.92		
					sum	$105,546.24