Final Report

Construction Project Management

Dec 7th, 2010

Shane Flynn
Construction Management
Dr. Faust

700 6th Street
Washington, DC

700 6th Street

Washington, DC

General Building Data

Location: 700 6th Street, Washington, DC
Size: 318,000 Square Feet
Height: 12 Stories
Construction Dates: April 2nd 2007-November 2009
Cost: $46,450,000.00
Delivery Method: Design-Bid-Build

Design Team

Owner: Akridge Real Estate Services
Architect: HOK, Inc
General Contractor: Balfour Beatty Construction
Strucural Engineer: Cagley Associates
MEP Engineer: Girard Engineering
Civil Engineer: Bowman Consulting

Architectural

At the center of downtown Washington 700 Sixth Street is a classically-designed, modern office structure with all the attributes and amenities demanded by businesses today. 700 6th has over 300,000 square feet of office space with efficient floor layouts to maximize the user's needs. There is a 4 level parking garage directly below the building accommodating commuters that do not use the Metro. The main lobby has marble flooring, glass bridges, and metal walls. This is a LEED Platinum rated building with the largest Commercial Office Building Green Roof in DC.

MEP

HVAC – variable air volume system
Electric power – 2.5 watts per square foot for lighting; 6.0 watts per square foot for power receptacles
Voice/data – fiber optics and T1

Structural

Reinforced concrete base building construction
Floor load – 80 lbs. live load, 25 lbs. dead load – typical floors
Finished ceiling height of 8'6" on all office floors
Column spacing – 30'x30'

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1. Acknowledgements

Pennsylvania State University

Dr. Faust
Dr. Magent
Dr. M. Kevin Parfait
Dr. David Riley
Professor Moses Ling

Balfour Beatty Construction

Mr. Sean Flynn

Lorton Stone, LLC

Mr. Manuel Seara

700 6th Street

John E. Akridge
Matthew J. Klein

Fellow AE Students

Shane Boyer
Dan Hesington
Joe Hirsch
Zack Yarnall
Joe Podwats

All my Family & Friends for their continued support, Especially

Mom, Dad, Sean, & Brock

2. Executive Summary

Analysis 1: It's Never Too Late to Go Green

700 6th Street started construction May 2007 and substantial completion was achieved in April 2009. In fall of 2008, only months prior to substantial completion and LEED Silver certification a new goal was announced. The new goal would be to achieve LEED Platinum. This plan was cost effective and did not have schedule impacts. The first thing the team looked at was optimizing energy performance by upgrading core lighting, reducing garage lighting power density, adding garage lighting occupancy sensors and adding tenant day lighting controls. This was followed by increased requirements for, and verification of, construction waste management, recycled content, low emitting materials, reduction in water use and tenant sub-metering.

Analysis 2: Alternative Stone for Lobby

The stone used in the Lobby was very expensive and came from Italy. There is a lot of money tied up in this lobby. I changed the floor to granite which is a more durable material. This change saved money and did not change the look of the lobby.

Analysis 3: Glass Bridge Improvements (Structural Breadth)

In the main lobby there is a glass bridge and glass floors. The problem with having a glass floor is it is very delicate. A week after the glass floor was installed a screw driver was dropped on the glass causing it to spider crack all the way through the glass. At the moment a total of 5 panels have been broke and replaced. Each glass panel is approximately 8 feet x 4 feet. These panels are approximately $10,000 each to replace and install and are only produced by 2 manufacturers. The lead time for these panels is months and is not easy to replace. From my research I found that increasing the thickness of the glass will prevent the glass from breaking and also does not affect the structural system.

Analysis 4: Precast vs. Handset Stone (Architectural Breadth)

Handset stone is very expensive and time consuming. The first 4 floors of 700 6th street use handset stone, the rest of the building uses precast with limestone casted into place. Handset stone is much slower and more expensive than precast. After the analysis precast was found to be more cost effective.

3. Project Information and Background

I. Client Information

Akridge employs about 200 professionals in the D.C. metropolitan area. They were founded in 1974; Akridge is a full-service commercial real estate firm in the Washington, D.C. area. Their projects total over 12 million square feet of office, industrial/flex, residential, retail, and entertainment space at a value of over $2.0 billion. Akridge is uniquely positioned to meet today's real estate market challenges. They excel in every aspect of commercial real estate development, construction, leasing, and management.

Akridge is building this facility to offer a world class LEED Platinum rated office space to their clients. Akridge wants to set the standard for buildings in DC and help make more buildings Green; 700 6th Street has the largest commercial green roof in DC.

The funding for this project comes directly from Akridge. It is important to note that it is very important for the contractor to keep the project within budget and to update the owner regularly on the projects financial status.

The project needed to be done summer of 09 to allow clients finish their space and move in. But because of a large change order i.e. Green Roof the move in of clients was delayed. The owner decided to up the LEED rating of the building three quarters of the way through the project. This shows that quality is more important than the bottom line. The safety expectations for this project and every project that Akridge develops are the highest. A successful project not only involves completing the project to the highest standards but having no injuries and more importantly no fatalities.

II. Building Overview

At the center of downtown Washington in the vibrant Penn Quarter, 700 Sixth Street is a classically-designed, modern office structure with all the attributes and amenities demanded by businesses today. Featuring approximately 300,000 square feet of office space with efficient floors, LEED Platinum certification and just steps to the Gallery Place Metro, this project represents a one-of-a-kind opportunity.

III. Local Conditions

Washington, DC

The project is located in downtown DC on 6th street. The preferred method of construction in DC is moving towards building Green. Most structures in DC are masonry, cast-in-place concrete and light steel. There is not a lot of construction parking on this site, because of it being located in the heart of DC. There is a parking garage located next door to the building and 700 6th street will have its own 4 story below grade garage. Parking on the street is very limited and all parking is metered. Recycling of materials from the old building was very important on this project because the building is going for LEED Platinum. To remove waste that can't be recycled it will cost $690.00 for a 6 ton construction dumpster. The soil consists of sands and silts which is not a great soil to build on.

Picture 3.1-Site Map

700 6th Street is located right next to the Verizon Center and attached to the Gallery Place. This is a very difficult site to manage because of it being located in the city. This site is a nightmare for any project manager to manage. Next to the building there's a parking garage that has to be open for use at all times. This is a problem because the entrance to the garage is in the swing of the crane. Thousand pound precast pieces have to be erected while cars are driving underneath them. There is a high volume of

pedestrians on this site, there is pedestrian walkway to handle this, but there is always the risk of someone not using the walkway and hurting themselves. Traffic in DC is always a nightmare which makes it hard to bring materials in and get wastes out. This site has no room for material or equipment storage. All the materials need to be shipped in when they are needed. This aspect increases the coordination of the project. The site trailer is a neighboring building because there is no room on site.

IV. Site Development

The site of 700 6th Street is very congested. It is in the middle of downtown Washington, DC. The building footprint takes up almost all the space on the site. The only extra space is walkways between 700 6th Street and neighboring buildings. 700 6th Street is attached to the Gallery Place Building so special care needs to be taken not to damage or disturb the occupants of the neighboring building.

Since there was such limited space, Balfour Beatty set up the field office across the street in a neighboring building. The parking for the workers is located in a parking garage across from 700 6th Street.

Excavation Site Plan

There are 3 construction gates for the site. The gate closest to the restaurant building is the main gate for construction. This gate is where all the trucks are loaded with soil from the excavation. There are 2 excavators located in the pit. Once the excavation starts to get deep where trucks cannot get in the soil is piled on the perimeter of the pit. A third excavator with an extended boom is used to scoop that soil and load it in a truck. Please refer to the **Excavation Site Plan located in the Appendix** and the picture below for more information.

Picture 3.2-Extended Boom Excavator

Superstructure Site Plan

While the structure goes up, the site starts to become very congested. Concrete trucks needs to have constant access to the concrete bucket, but deliveries also have to come in. For that reason it is very beneficial that the site has three entrances. The concrete trucks back into the alleyway in-between 700 6th Street and the Restaurant. There are wash down areas next to the exits for the concrete trucks to get cleaned off before returning to the roadways. The pump truck is mobile and stations itself around the building. The tower crane is located opposite the main construction entrance. It has a swing radius of 164’. The tower crane can cover every inch of the building and can unload trucks at any construction entrance. There isn’t a lot of room for lay down areas so almost all of the deliveries have to be coordinated to come in when they are needed. There is one staging area located in-between the tower crane and the street. Please refer to the **Superstructure Site Plan located in the Appendix** and the picture below for more information.

Picture 3.3-Concrete Pump Truck

Interiors/Finishes Site Plan

This site gets a little less congested than the past site plans. The main reason for this is deliveries can now come in through the Gallery Place/700 6th Street loading dock. All the trucks will come in on H Street and leave on H Street. At this point the building is still surrounded by a site fence but is a lot less cluttered. Some of the smaller deliveries can come in through the alley way in-between 700 6th Street and the Verizon Center. **Please refer to the Interiors/Finishes Site Plan located in the Appendix** for more information.

V. Building Systems Summary

a) Cast in Place Concrete

- Cast –in-place concrete was used for building footings, foundation walls, grade beams, slabs-on-grade, suspended slabs, concrete toppings, and columns.
- All the above used normal weight concrete.
- All the formwork used typical wood framing. The formwork is removed, cleaned, and reused.
- A pump truck and crane bucket was used for all major pours.

Column Formwork

Picture 3.4-Column Formwork

Suspended Slab Formwork

Picture 3.5-Suspended Slab Formwork

b) Precast Concrete

- 2 types of precast on this job
    - Pre-cast with Alabama Limestone casted into pre-cast. Goes from 4th to 12th floor.
    - Precast that has similar color to match Alabama limestone
- The stone to precast anchoring needs a minimum of 2 anchors per casted section.
- The precast units are bolted to the building structural frame. Clips and hangers are used to attach the precast units to the structural frame.
- Precast was used on all elevations
- The crane that was used to erect the precast pieces was a mobile crane.
- Refer to the attached map below for crane locations when erecting precast.

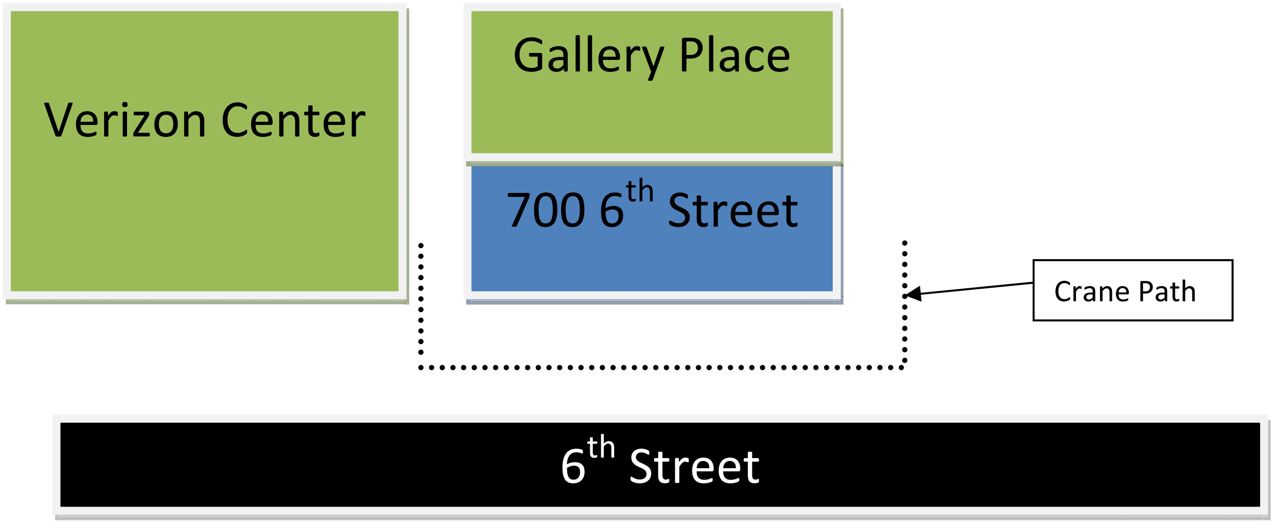


Diagram 3.6-Crane Path

Precast Pieces

Picture 3.7-Precast Pieces

Precast Being Hung

Picture 3.8-Precast Being Hung

c) Structural

The main superstructure of the building consists of cast-in-place concrete. Cast –in-place concrete was used for building footings, foundation walls, grade beams, slabs-on-grade, suspended slabs, concrete toppings, and columns. All the above features used normal weight concrete. The column spacing is 30' by 30' with a finished ceiling height of 8'-6". The typical slab thickness is 9" with a thickened slab thickness of 16.5" at columns. All columns are typically 24"x 24". All the formwork used typical wood framing. The formwork is removed, cleaned, and reused. A pump truck and crane bucket was used for all major pours.

d) Mechanical System

The main mechanical is located on the penthouse floor plan. The penthouse has floor plan has 3 cooling towers and an emergency generator. Also located on that floor are a Mechanical Engineers room and a mechanical room. Each individual floor has its own mechanical room located in the core of the building. There is a total of 25 Air Handling Units located throughout the building. Each air handling unit on average has the capacity of 9000 CFM and runs on 460 Volt 3 Phase motors. The 3 cooling towers have an average capacity of 1100 GPM's that run on 460 Volt 3 phase motors. The HVAC is a variable air volume system. The AHU's distribute through galvanized sheet metal duct and supplied to rooms through registers and grilles. The fire protection system consists of a wet pipe sprinkler system.

e) Electric System

700 6th Street has on average 6.0 watts per square foot for power receptacles. Each floor contains a 150 KVA, 480-208/120V/3 Phase dry-type transformer. The P-1 level contains multiple transformers ranging from 15 KVA to 75 KVA. Level P-1 contains 3 switchboards that are rated to withstand a fault current of 300,000 Amps. Emergency/standby power will be supplied by a 500 KW diesel engine generator.

f) Lighting

2.5 watts per square foot is the average power for lighting for 700 6th Street. There are 36 different types of lights used on this building. The different types of lighting fixtures are fluorescent, metal halide, and L.E.D. Most of these fixtures run off 277 volts and the rest run off of 120 volts. The lights are all mounted differently, there are; surface mounted, semi-recessed and recessed. Only the core, parking levels, and lobby are fitted with lighting fixtures. The rest of the building is left for the owner to fit out.

g) Masonry

- The exterior cladding is made of Indiana Limestone.
- The main lobby/elevator car floors are made of Italian marble and Limestone.
- All thresholds are made out of granite.
- All the exterior paving is made out of honed granite.
- All stone countertops are made out of honed marble
- CMU's were used for interior masonry walls

Main Lobby

Picture 3.9-Main Lobby

h) Curtain Wall

- The curtain wall is glazed aluminum
- The curtain wall is hung off the edge of a slab using metal brackets that are cast into the slab.
- The space between the slab and the curtain wall is filled with a fire caulking compound.

Curtain Wall

Picture 3.10-Curtain Wall

VI. Project Delivery System

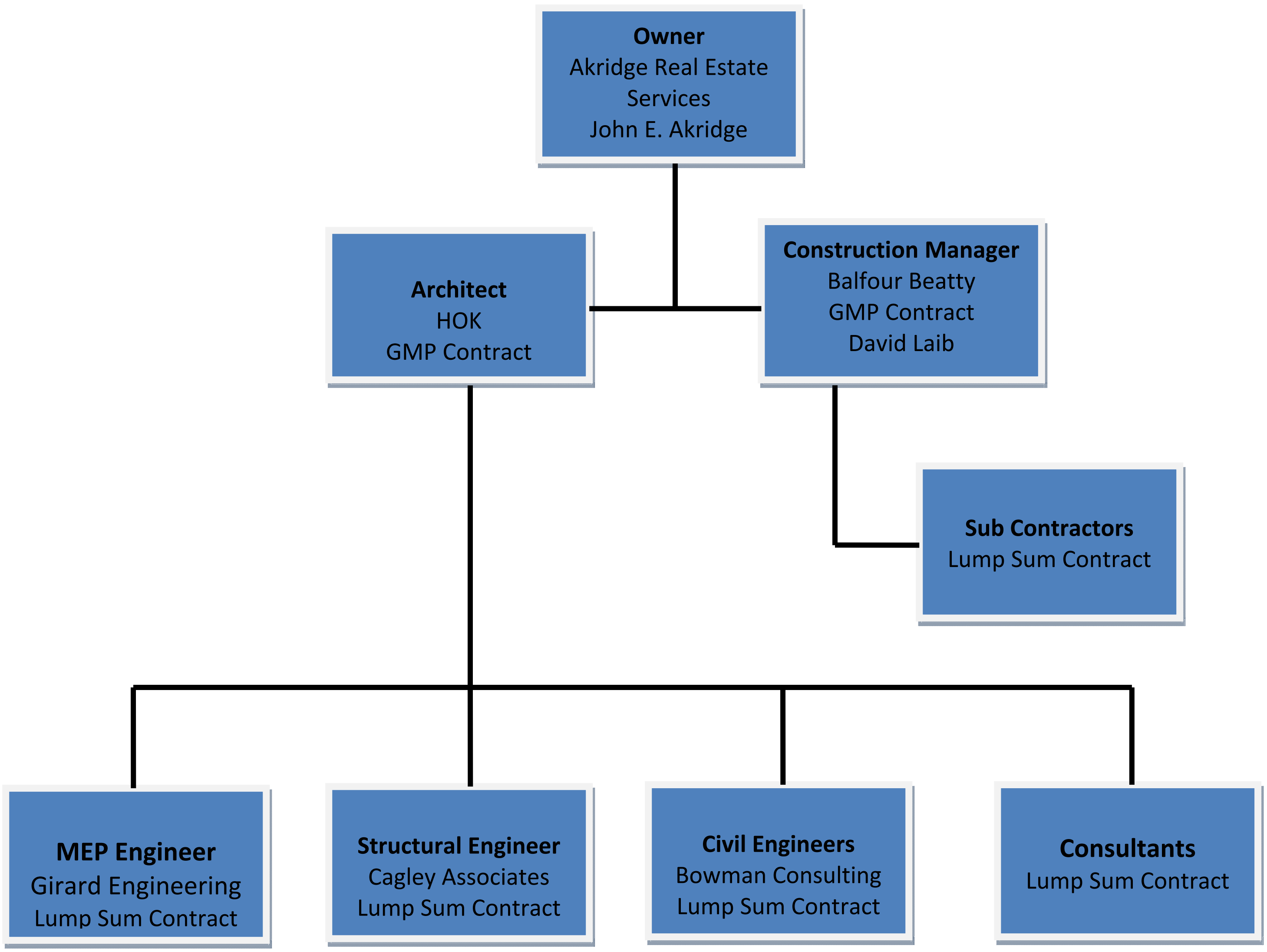


Diagram 3.11-Project Delivery System

Balfour Beatty was chosen by Akridge to provide construction services to build 700 6th Street. Balfour Beatty was chosen because they had the lowest competitive bid. The owner also has done work with Balfour Beatty in the past and liked the work they provided. Design-Bid-Build was the chosen delivery system for this project because the owner has used this delivery system before and feels comfortable with it. This traditional delivery system was chosen because time was not a huge factor. The contract between Balfour Beatty and the owner was a GMP of $46,500,000 and schedule duration of 2.2 years. The Architect and Construction Manager have GMP contracts with the owner. All the sub contractors have Lump Sum contracts with Balfour Beatty. The architect's consultants have lump sum contracts as well.

The sub contractors where chosen through a competitive bid. All subs had to show qualifications to perform the work. There are a total of 42 subs given contracts to perform work. All sub contractors are required to be bonded and insured to work on this project.

The GMP contract for the Construction Manager is a good contract for the owner because the CM will be acting in the owner's interest. The lump sum bids held between the subs and the CM allow for easy payment requests as well as cost reimbursement for possible change orders. I think the delivery system is appropriate for this job because time is not a factor and this design system will give the architects more time to design the building. This is a LEED rated building and in order to get a LEED Platinum rating extra time will be needed in the design side.

VII. Balfour Beatty Construction Staffing

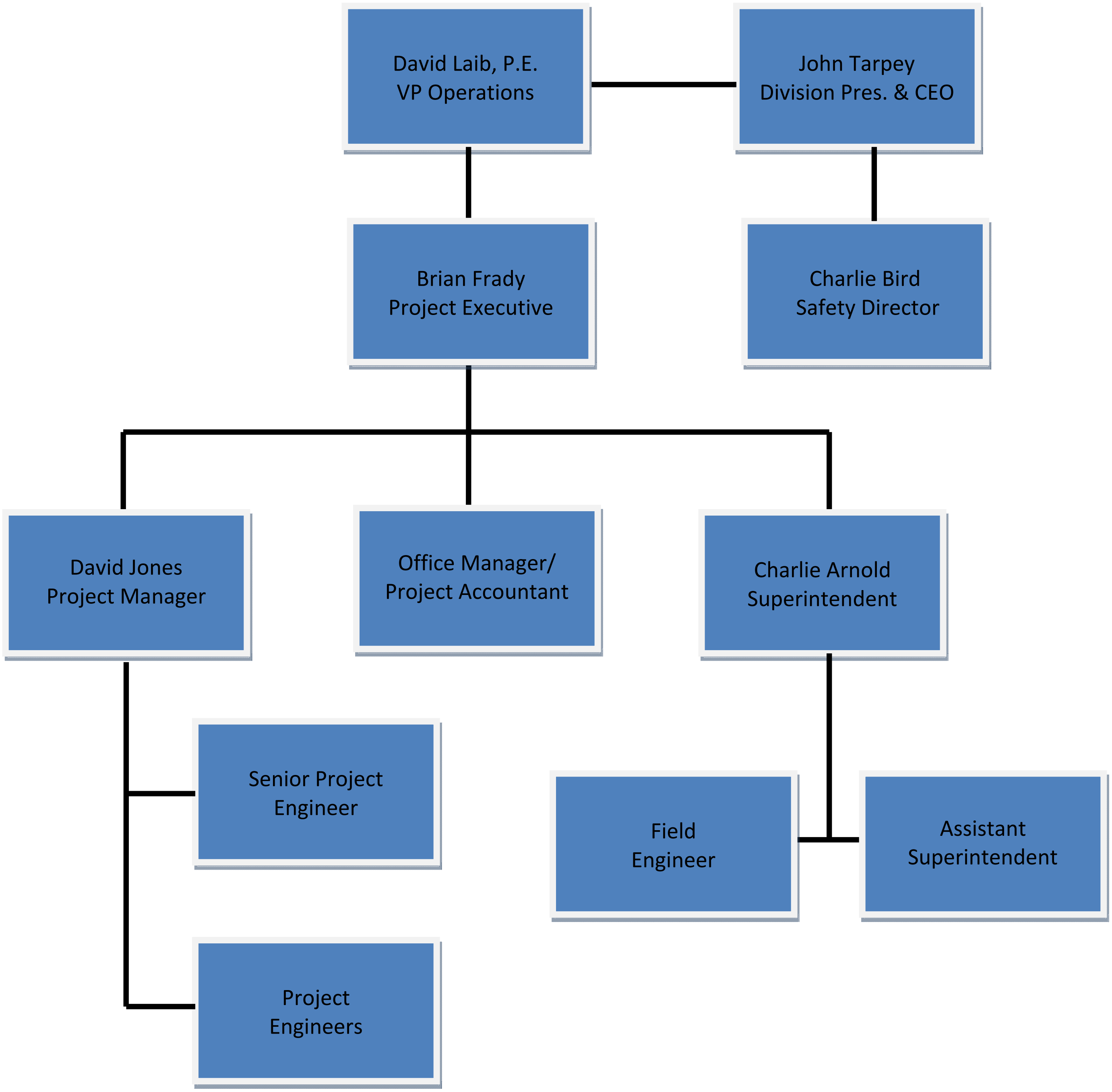


Diagram 3.12-Construction Staffing

The project executive is the head of the construction team; he works out of the office and reports to the site once a week. The project manager and superintendent both report to the project engineer and are in charge of onsite construction. They update the schedule and mediate between different subcontractors. Each building system for this project is assigned a senior project engineer and they are responsible for the coordination between subs. The project engineers all report to the project manager daily for progress reports. The superintendent is in charge of the field engineers and assistant superintendents. This project was fairly large and required a lot of construction managers. Towards the end of the project Balfour Beatty had companywide layoffs and a few project engineers were laid off. To help with the workload interns were assigned to the project to assist the project engineers and to do file management.

VIII. Project Cost Evaluation

a. Building Systems Cost

Building Systems Cost			
Trade	Description	Price Breakdown	Price/318,000 SF
Div.2 - Sitework Subcontractor			
	Excavation	NA	0
	Other Earthwork	$459,017.00	$1.44
	Pepco Vaults	$217,400.00	$0.68
	Site Pavers/Curb and Gutter	$207,543.00	$0.65
	Road Paving Repair	$33,960.00	$0.11
	Landscaping/Hardscaping	$16,075.00	$0.05
Div. 3-Concrete			
	Concrete	$9,540,000.00	$30.00
	Precast Concrete	$1,056,720.00	$4.92
Div. 4-Masonry			
	Masonry	$387,750.00	$1.22
	Stone	$1,519,800.00	$4.78
Div. 5-Metals			
	Miscellaneous/Ornamental Metals	$1,392,251.00	$4.38
	Glass Floor Assembly	$900,000.00	$2.83
Div. 6-Woods and Plastics			
	Carpentry	$23,500.00	$0.07
	Millwork	$131,266.00	$0.41
Div. 7-Thermal and Moisture Protection			

	Waterproofing and Roofing	$800,000.00	$2.52
	Caulking	$190,000.00	$0.60
	EIFS	$170,000.00	$0.53
	Fire-Proofing	$16,111.00	$0.05
Div. 8-Doors and Windows			
	Doors, Frames, and Hardware	$188,000.00	$0.59
	Access Doors	$609.00	$0.00
	Overhead Doors	NA	$0.00
	Glass and Glazing (Incl Spandrel Panels)	$7,250,000.00	$22.80
Div. 9-Finishes	Drywall	$1,650,000.00	$5.19
	Tile	$254,278.00	$0.80
	Carpet and Resilient Flooring	$150,000.00	$0.47
	Painting	$225,000.00	$0.71
Div. 10-Specialities			
	Toilet Partitions	$147,375.00	$0.46
	Louvers	$37,711.00	$0.12
	Signage	$30,438.00	$0.10
	Lockers	$11,700.00	$0.04
	Fire Extinguishers	$2,263.00	$0.01
	Postal Specialties	$5,347.00	$0.02
	Toilet Accessories	In Toilet Partitions	$0.00
	Other	$10,515.00	$0.03
Div. 11-Equipment			
	Building Maintenance Equipment	$17,505.00	$0.06
	Key Box	NA	$0.00
	Loading Dock Equipment	$39,340.00	$0.12
Div. 12-Furnishings			

	Entrance Mats		$1,037.00	$0.003
	Blinds/Shades		$49,935.00	$0.16
Div. 14-Conveying Systems				
	Elevators		$2,595,000.00	$8.16
Div. 15-Mechanical/Fire Protection				
	Sprinkler		$600,000.00	$1.89
	Mechanical		$6,554,600.00	$20.61
Div. 16-Electrical				
	Electrical		$3,659,000.00	$11.51
		Total Project Cost:	**$41,049,306**	
		Total Project Cost/SF:		**$129.09**
		Actual Building Construction Cost (Excludes Site Work):	**$40,115,311**	
		Actual Building Construction Cost/SF (Excludes Site Work):		**$126.15**

Table 3.13-Building Systems Cost

b. D4 Cost Estimate

Statement of Probable Cost

700 6th Street - Jan 2007 - District of Columbia

Prepared By:	Shane Flynn Shane Flynn 755 South Preston Rd Lakewood, PA 18439 Fax:	Prepared For:	, Fax:
Building Sq. Size:	318000	Site Sq. Size:	26136
Bid Date:	1/1/2007	Building use:	Office
No. of floors:	12	Foundation:	CON
No. of buildings:	1	Exterior Walls:	PAN
Project Height:	168	Interior Walls:	GYP
1st Floor Height:	10.5	Roof Type:	MEM
1st Floor Size:	26000	Floor Type:	CON
		Project Type:	NEW

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**4.38**	**5.82**	**1,849,305**
	Bonds/Fees	4.38	5.82	1,849,305
01	**General Requirements**	**3.30**	**4.39**	**1,396,105**
	General Conditions	3.30	4.39	1,396,105
03	**Concrete**	**20.23**	**26.88**	**8,547,000**
	Concrete	20.23	26.88	8,547,000
04	**Masonry**	**4.50**	**5.97**	**1,900,000**
	Masonry	0.95	1.26	400,000
	Stone	3.55	4.72	1,500,000
05	**Metals**	**7.10**	**9.43**	**3,000,000**
	Architectural Metal	7.10	9.43	3,000,000
06	**Wood & Plastics**	**1.52**	**2.01**	**640,203**
	Rough Carpentry	1.52	2.01	640,203
07	**Thermal & Moisture Protection**	**4.83**	**6.42**	**2,040,725**
	Fireproofing	1.01	1.34	424,857
	Membrane Roofing	2.96	3.94	1,251,873
	Waterproofing	0.86	1.14	363,995
08	**Doors & Windows**	**10.40**	**13.82**	**4,393,305**
	Doors	0.93	1.24	393,305
	Glass & Glazing	9.47	12.58	4,000,000
09	**Finishes**	**10.23**	**13.60**	**4,323,678**
	Acoustical Ceilings	0.10	0.13	41,214
	Drywall	9.70	12.89	4,097,750
	Paint	0.44	0.58	184,715
10	**Specialties**	**0.60**	**0.80**	**253,317**
	Postal	0.04	0.05	17,060
	Signage	0.22	0.29	91,899
	Toilet Accessories	0.34	0.45	144,358
12	**Furnishings**	**0.29**	**0.38**	**121,792**
	Blinds	0.29	0.38	121,792
14	**Conveying Systems**	**7.10**	**9.43**	**3,000,000**
	Elevators	7.10	9.43	3,000,000
15	**Mechanical**	**16.06**	**21.33**	**6,784,152**
	Fire Protection	1.86	2.47	784,152
	Mech/Plumbing	14.20	18.87	6,000,000
16	**Electrical**	**9.47**	**12.58**	**4,000,000**
	Electrical	9.47	12.58	4,000,000
Total Building Costs		**100.00**	**132.86**	**42,249,581**

Table 3.14-D4 Cost Estimate

c. Square Foot Estimate

SQUARE FOOTAGE ESTIMATE			
RS Means Source Year	2009	**Model #**	M.480
Pages	180-181, 453	**Exterior Wall Type**	Precast Concrete Panel with Exposed Aggregate
Area	318,000	**Frame**	R/ Conc. Frame

The Area falls between:	260000 SF	and	400000 SF	
			Base Cost per Square Foot is:	136.9

Cost Adjustment Type: (Story Height)	0.688	Per SF Adjustment:	-0.69
Cost Adjustment Type: (Perimeter)	13.76	Per SF Adjustment:	13.76
		Adjusted Base Cost Per Square Foot:	149.97

Base Building Cost:	149.97	x	318000	=	47690460
Basement Cost:	36.4	x	27430	=	998452

RS Means Additions:

Addition:	Elevators (4) 3000# Capacity	Amount:	1722000

Multiplier Type	Location	Value:	1
Multiplier Type	Time	Value:	-
		Total SF Estimate for Building:	$50,410,912.00

Table 3.15-Square Foot Estimate

d. Summary

Estimate Type	Cost	Cost/SF
Actual Building Construction Costs (CC)	40,115,311.00	126.15
Total Project Costs (TC)	41,049,306.00	129.09
D4 Cost Estimate	42,249,581.00	132.86
R.S. Means Square Foot Estimate	50,410,912.00	158.52

Table 3.16-Summary Chart

The highest value came from the R.S. Means Square Foot Estimate. I believe this was higher than the Actual building cost because the GC was only responsible for the construction of the building with finishes left for the owner to complete. R.S. Means accounts for a completely finished building. Another unnecessary increase in cost could of came from the of the additional basement square footage. I included 4 extra floors in the estimate. The 4 extra floors are for parking so the square foot estimate for parking would be a lot less than a normal basement square foot. The D4 estimate got me a lot closer to the Actual Building Cost. I believe this worked better because I got to compare my existing to building to a building with similar features. I was able to modify the building systems to mimic my own. The building I chose to compare with 700 6th Street is an Office Building that has 8 floors.

Case No.	Use	Project Name	Size	Floors	Bldg. Cost
OF050918	Office	Preston Pointe Office/Retail/Condo	105786	8	$8,242,378.00

Table 3.17-D4

IX. Project Schedule Summary

This project schedule breaks down the 700 6th Street building by phase of construction and activity. The major phases for the building are the substructure, superstructure, exterior skin, and MEP. The building is 12 stories so most of the schedule is broken down by floor. **The Milestone schedule can be found in the Appendix.**

There was a detailed schedule made for 700 6th Street constructed by the project manager. I could not get a copy of it, but heard it had over 2000 items in it. The attached detailed summary was derived from the summary schedule done in Technical Assignment 1. This project was scheduled to mobilize mid April of 2007. The site will have site fence put up before any demolition work starts.

The concrete foundation consists of spread footings at all columns, mat slab, and slab on grade at all other locations. The foundation is a driver to keep the schedule on time. Nothing can start till the foundation is done. Half of the concrete work was done during warm weather and the other was done during the colder months. Special care had to be taken to adjust the admixtures during the hot and cold months to ensure the concrete cures to its designed strength.

Picture 3.18-Excavation

Once the foundation is complete the concrete superstructure starts construction. The estimated amount of days to complete all the levels is 115 days. Once a few floors are completed precast concrete will start to be hung. A tower crane will handle the concrete superstructure and mobile cranes will hang the precast on the lower levels.

Picture 3.19-Concrete Superstructure

Balfour Beatty is only responsible for lobby, and central core finishes. The owner is responsible for finishing the rest of the building. Finishing the lobby is in the back end the construction schedule. The main reason for this is the finishes cannot start till that floor is sealed from the environment. That means that none of the finishing trades can start till the precast, windows, and EIFS are complete. Once the lobby is finished the trades will go from floor to floor, finishing only the core area. Once testing and finishes come to a close the project team will check their punch list items and turn over the building to the owner.

X. General Conditions Estimate

The general conditions estimate is broken down in the chart below. The highest cost from the general conditions estimate came from the project staffing costs. The project staffing costs is almost half of the general conditions costs. The general conditions each month is approximately $92,000. If time is saved on the schedule this money could also be saved. The total general conditions for this project are $2,760,887 which is approximately 6% of the total contract value.

General Conditions Breakdown		
Description	**$**	**$/Month**
Scheduling	In-Project Management	$0
Supervision	$362,664	$12,089
Executive Management	$150,696	$5,023
Project Management	$687,949	$22,932
Project Secretary/Field Office Manager	$120,540	$4,018
MEP Coordinator	$174,000	$5,800
EEO Representative	In-Project Management	$0
Field Engineer	$183,820	$6,127
Surveying Instrumentation and Equipment	$25,020	$834
Contractor's Office	$50,700	$1,690
Final Cleaning	$60,470	$2,016
Job Office Expense	$34,650	$1,155
Office Equipment	$27,746	$925
Progress Photos	$3,530	$118
Contractor's Telephone	$39,950	$1,332
Drawings and Specs	$9,500	$317
Company Vehicle Expense	$77,175	$2,573
Travel Expense	$9,600	$320
Safety Inspector	$8,820	$294
Safety Carpenter	$99,029	$3,301
Safety Railings	$9,500	$317
Field Clean Up/Laborers	$146,390	$4,880
Water Pumping	$1,000	$33
Dumpsters	$64,400	$2,147
Misc. Tools and Equip.	$13,500	$450
Security	$14,300	$477
Power Consumption	$126,000	$4,200
Temporary Toilets	$11,440	$381
Temporary Water	$2,700	$90
Cost Engineering/Project Accounting	In-Project Management	$0
Purchasing	No Charge	$0
Elevator Operator	$21,651	$722
Liability Insurance	$136,671	$4,556
DIC Insurance	$23,986	$800
Other (Protection, temp heat, safety materials)	$63,490	$2,116
TOTAL	**$2,760,887**	**$92,030**

Table 3.20-General Conditions Breakdown

4. It's Never Too Late to Go Green

I. Background

700 6th Street started construction May 2007 and substantial completion was achieved in April 2009. In fall of 2008, only months prior to substantial completion and LEED Silver certification a new goal was announced. The new goal would be to achieve LEED Platinum. **Refer to Diagram below to view time line of events.**

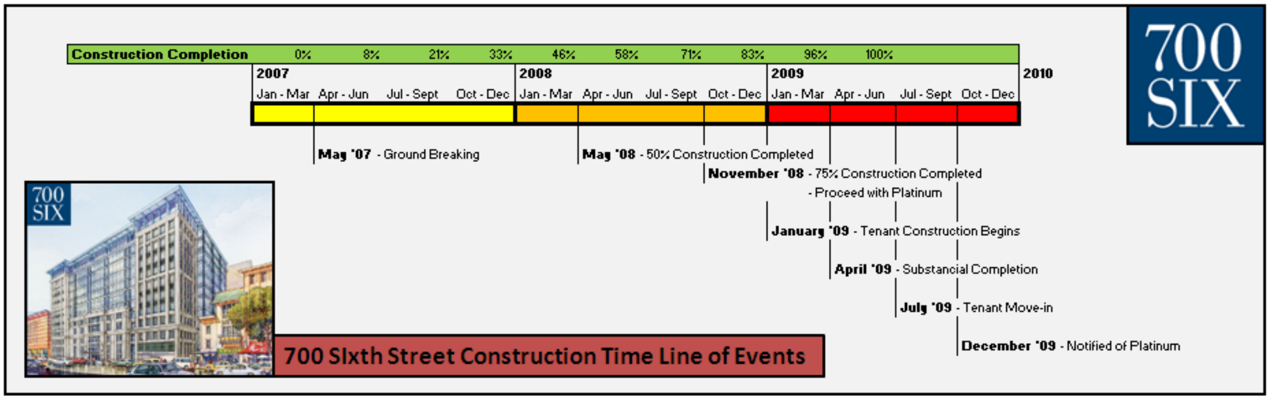


Diagram 4.1-Time Line of Events

The construction team and owner were not sure how to do it but with a holistic approach it could be done. These solutions had to be efficient and cost effective especially with the economic recession taking place. This plan was cost effective and did not have schedule impacts. The first thing the team looked at was optimizing energy performance by upgrading core lighting, reducing garage lighting power density, adding garage lighting occupancy sensors and adding tenant day lighting controls. This was followed by increased requirements for, and verification of, construction waste management, recycled content, low emitting materials, reduction in water use and tenant sub-metering.

Energy design performance was the most important aspect to the success in achieving LEED Platinum. The baseline projections for the building were 16.3% savings, which is an annual cost savings of $2.02/SF. With the additional energy designs implemented a reduction of $.52/SF could be obtained. The cumulative savings is now 21.3%, the construction team was able to increase the energy savings by 5.1%. This savings reduces the utility costs per year by $151,770.

The original LEED Scorecard for LEED Silver was 33 points, the maximum for LEED Silver. In September, 7 2007 the construction team realized that they were going to get LEED Silver with relative ease and already had enough points to get LEED Gold. **Refer to the Attached LEED Scorecard in the appendix.** This prompted the discussion of actually going for LEED Platinum so late in the game. The discussions did not get serious until fall of 2008 when the construction team said to the owner they could get LEED Platinum. In December 10th 2009 the final LEED Scorecard was made showing that the construction team was able to get LEED Platinum. **Refer to the Attached LEED Scorecard in the appendix.**

II. Energy and Atmosphere

The construction team said that this was the most important part in achieving LEED Platinum. There were five different strategies implemented; upgrade core lighting, reduce garage lighting power density, add garage lighting occupancy sensors and add tenant day lighting control. The original baseline projection for this building is 16.3% savings, which gives two points for LEED. Credits 1.1 and 1.2 were achieved before the push for LEED Platinum began. **Refer to the Diagram below**. With the 5 strategies implemented a total of 4 points were achieved, LEED credits 1.1-1.4.

2	1	11	Energy & Atmosphere		Possible Points 14
Y	?	N			
Y			Prereq 1	Fundamental Commissioning of the Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
			Credit 1.1	Optimize Energy Performance: 10.5% New / 3.5% Existing	1
		1	Credit 1.2	Optimize Energy Performance: 14% New / 7% Existing	1
		1	Credit 1.3	Optimize Energy Performance: 17.5% New / 14% Existing	1
		1	Credit 1.4	Optimize Energy Performance: 21% New / 17.5% Existing	1
		1	Credit 1.5	Optimize Energy Performance: 24.5% New / 17.5% Existing	1
		1	Credit 1.6	Optimize Energy Performance: 28% New / 21% Existing	1

Diagram 4.2-LEED Scorecard

1. Upgrade Core Lighting

The upgrade consisted of changing restroom lighting to LEDs. This resulted in $4,218/yr utility cost savings ($.01/SF). A .6% energy cost savings relative to the baseline, which increases the cumulative savings to 16.9%. At this point only LEED credits 1.1 and 1.2 are available.

2. Reduce Garage Lighting Power Density

This upgrade involved lowering FC levels with the owner's consent and redesigning fixture layout to be more efficient. This resulted in $13,523/yr utility cost savings ($.05/SF). A 1.9% energy cost savings relative to the baseline, which increases the cumulative savings to 18.8%. At this point LEED credits 1.1, 1.2, and 1.3 are available. **Refer to the Attached Diagram Below**.

2	1	11	Energy & Atmosphere		Possible Points 14
Y	?	N			
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	
Y			Prereq 2	**Minimum Energy Performance**	
Y			Prereq 3	**Fundamental Refrigerant Management**	
☆			Credit 1.1	**Optimize Energy Performance: 10.5% New / 3.5% Existing**	1
☆		1	Credit 1.2	**Optimize Energy Performance: 14% New / 7% Existing**	1
☆		1	Credit 1.3	**Optimize Energy Performance: 17.5% New / 14% Existing**	1
		1	Credit 1.4	**Optimize Energy Performance: 21% New / 17.5% Existing**	1
		1	Credit 1.5	**Optimize Energy Performance: 24.5% New / 17.5% Existing**	1
		1	Credit 1.6	**Optimize Energy Performance: 28% New / 21% Existing**	1

Diagram 4.3-LEED Scorecard

3. Add Garage Lighting Occupancy Sensors

These upgrade involved luminaries that stayed illuminated for 15 minutes after being tripped. This resulted in $4,434/yr utility cost savings ($.02/SF). A .6% energy cost savings relative to the baseline, which increases the cumulative savings to 19.4%. At this point only LEED credits 1.1, 1.2, and 1.3 are available.

4. Add Tenant Day Lighting Controls

In perimeter zones of the building the lights will have the capability to be dimmable by the occupant leasing the area. This resulted in $13,738/yr utility cost savings ($.05/SF). A 1.9% energy cost savings relative to the baseline, which increases the cumulative savings to 21.3%. At this point LEED credits 1.1, 1.2, 1.3, and 1.4 are now available.

Refer to the Attached Diagram Below

2	1	11	Energy & Atmosphere		Possible Points 14
Y	?	N			
Y			Prereq 1	Fundamental Commissioning of the Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
★			Credit 1.1	Optimize Energy Performance: 10.5% New / 3.5% Existing	1
★		1	Credit 1.2	Optimize Energy Performance: 14% New / 7% Existing	1
★		1	Credit 1.3	Optimize Energy Performance: 17.5% New / 14% Existing	1
★		1	Credit 1.4	Optimize Energy Performance: 21% New / 17.5% Existing	1
		1	Credit 1.5	Optimize Energy Performance: 24.5% New / 17.5% Existing	1
		1	Credit 1.6	Optimize Energy Performance: 28% New / 21% Existing	1

Diagram 4.4-LEED Scorecard

By changing some of the lighting systems 2 additional LEED points were awarded and the electric bill is also quite a bit less. The cumulative savings after these measures have been implemented are $151,770/yr which is a $.52/SF annual utility costs savings.

5. Tenant Sub-Metering

Tenant Sub-Metering was installed to obtain another LEED credit. Tenant Sub-Metering allows for the owner to monitor each tenant individually. If energy is monitored on a per tenant basis, the tenant is more inclined to implement energy efficient measures, such as motion sensor lights, certain day lighting techniques (automatic blinds), auto shut off for computers, ect. Balfour Beatty is not responsible for construction of the interior office space finish work; the only interior finish work Balfour Beatty did was the core, which consisted of bathrooms and elevators. This monitoring pushes tenants to build their office spaces with energy efficient controls. **Refer to the Attached Diagram below.**

2	1	11	Energy & Atmosphere		Possible Points 14
Y	?	N			
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	
Y			Prereq 2	**Minimum Energy Performance**	
Y			Prereq 3	**Fundamental Refrigerant Management**	
			Credit 1.1	**Optimize Energy Performance: 10.5% New / 3.5% Existing**	1
		1	Credit 1.2	**Optimize Energy Performance: 14% New / 7% Existing**	1
		1	Credit 1.3	**Optimize Energy Performance: 17.5% New / 14% Existing**	1
		1	Credit 1.4	**Optimize Energy Performance: 21% New / 17.5% Existing**	1
		1	Credit 1.5	**Optimize Energy Performance: 24.5% New / 17.5% Existing**	1
		1	Credit 1.6	**Optimize Energy Performance: 28% New / 21% Existing**	1
		1	Credit 1.7	**Optimize Energy Performance: 31.5% New / 24.5% Existing**	1
		1	Credit 1.8	**Optimize Energy Performance: 35% New / 28% Existing**	1
		1	Credit 2	**On-Site Renewable Energy**	1
		1	Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
		1	Credit 5.1	**Measurement & Verification: Base Building**	1
		1	Credit 5.2	**Measurement & Verification: Tenant Sub-metering**	1
	1		Credit 6	**Green Power**	1

Diagram 4.5-LEED Scorecard

6. Measurement and Verification Base Building

700 6th Street has infrastructure within the base building design to facilitate metering building electricity and tenant electrical end-uses.

7. Enhanced Refrigerant Management

No refrigerants were used on 700 6th Street.

III. Material and Recourses

1. Recycled Content 20%

700 6th Street was originally only supposed to use 10% recycled content but the owner realized 20% was within reach. Achieving this credit was no small order considering the construction team only got 20.5% recycled content for the project. Fortunately, the Project's elaborate façade allowed for a healthy contribution toward the credit; however each material from toilet partitions, CMU rubber control joints, down to steel angle used at the concierge desk was evaluated for contribution toward this credit. In addition, actual concrete poured-in place quantities were used to bolster the amount of fly ash that could contribute toward this credit- a time consuming series of tabulations and calculations. Due diligence paid-off and the project barely was able to achieve this credit.

Some of the recycled content was made of steel and aluminum. It is extremely energy intensive to produce and roil virgin steel; it's also cost effective for steel producers to not use virgin material and to use scrap steel (in other words, even before LEED, there is significant recycled content in division 5 material). The curtainwaller and/or ornamentals subcontractor used recycled aluminum. This was a challenge to the construction team because architectural grade aluminum is usually a virgin material, so it was continually important for the construction team to continually inform the subcontractors in the fabrication phase to specify recycled content.

2. Construction Waste Management

In order to get this LEED credit 75% of construction waste had to be diverted from disposal in a landfill. 700 6th Street ended up diverting 80% of construction waste. Balfour Beatty averages 95%. During construction a negative was turned into a positive in regards to unforeseen sight conditions. While excavating, existing foundation elements were found the previous demo'd structure and had to be removed in order to proceed with work. This did have a schedule impact, but they were able to recycle the material (concrete and rebar) and use the tonnage towards the LEED credit.

The concrete subcontractor was responsible for refuse hauling during the concrete phases. The project management team members had to regulate where the refuse was going in order to achieve this credit. The concrete subcontractor was able to contribute towards the credit by minimizing their amount of plywood for formwork sent to landfill once stripped, which further aided the project in achieving an 80% diversion rate. Selecting a refuse hauler for the non-concrete phases of the job that was proficient in recycling was more costly but proved extremely beneficial in achieving this credit.

3. Regional Materials 20%

20% of all the materials were within a 500 mile radius of 700 6th Street. The limestone used on the façade came from Indiana which is within the 500 miles. All of the precast and concrete was within the radius. All the furniture in the building is within the radius as well.

IV. Indoor Environmental Quality

1. Low –Emitting Materials

This credits purpose is to reduce the quantity of indoor air contaminants that are odorous. The elevator cab carried the most cost in getting this credit. The elevator subcontractor had already started constructing the cab with the planned material and had to stop half way through construction. This stop had schedule implications and cost ones as well. The elevators were going to be used to move materials, but because of this delay finishes on floors were delayed. Other materials needed to be changed as well such as locker room benches, telephone room backer boards, walnut window sills, rest room purse shelves, ect. All the original materials contained urea-formaldehyde resins. Now the materials do not contain urea-formaldehyde resins and the new wood finishes do not exceed the VOC content limits established by SCAQMD.

V. Innovation & Design Process

1. 40% Water Use Reduction

In the pursuit of this credit an unforeseen side affect lay within the faucets, which had already begun fabrication. In order to achieve this credit, the amount of gpms delivered to each restroom faucet was decreased. In decreasing the amount of gpms delivered to each faucet, the motion-sensored facet's batteries would not recharge adequately. Fortunately, the mechanical subcontractor was able to work with the faucet supplier and retro-fit the faucets so that they may function as intended. There are also waterless urinals used and waster efficient toilets in the bathrooms.

VI. Recommendation and Summary

After doing this analysis I realized that it is never too late to go green, even 75% of the way through the project. This change did have cost implications and minimal schedule implications, but overtime those costs will be accounted for in the energy savings of the building. The building would have never gotten LEED Platinum without a holistic approach. The owner, the subs, and the construction team all needed to be on the same page to complete this daunting task. All those parties did come together and completed the task with minimal schedule implications and was cost effective. I would recommend that any project that is close to achieving another level of LEED to go for it. 700 6th Street did it with 75% of the construction completed. This means that almost any project can achieve the same as long as all parties involved in the project are working together for the same goal.

5. Alternative Stone for Lobby

I. Reasoning for Redesign

700 6th Street has a beautiful lobby with a marble floor and limestone walls. The elevators also have matching marble floors.

Picture-5.1 Main Lobby

This marble floor leads me into a value engineering analysis. Marble is a very porous stone and needs to be polished regularly and resealed every 9 months in a high traffic area. This lobby is a high traffic area and will require to be resealed every 9 months or less depending on the traffic. Marble is susceptible to staining if a watery or oily liquid is left on the surface. The sealer gives you 24 hours, versus 30 minutes, to wipe up spills before they lodge to deep for you to wipe them away. This is why it is so important to reseal and clean the marble floor regularly. Another issue is dulling, once dulling occurs it cannot be reversed. The only way to fix dulling is to sand down the area and repolish/reseal the marble. If a marble tile gets stained there are chemicals to help take out the stain but you may never be able to completely remove the stain. If the stain is beyond what your eye can take and cannot be completely removed that piece of marble will have to be removed. Another problem with marble is it is not a local material. The marble for this material was shipped in from Italy. The replacement of this material could be troublesome because of the long lead time.

This lobby is beautiful but I propose to use an alternative material that is cheaper, aesthetically similar, and is more durable. This material is granite. Granite is not as porous and is also a harder material. Granite does not need to be sealed as much, in some cases granite can be put down without a sealer. This is done only for aesthetic purposes only. Granite allows for less resealing compared to marble. Another pro of granite is it is readily available in the United States. Using granite could have made it easier to get LEED Platinum. As you can see granite seems like the obvious choice over marble.

II. Goal

The goal of this redesign is to provide a cheaper and more durable stone floor that still is aesthetically pleasing. Granite has many different colors and an alternative can be found to match the marble.

III. Steps

- Calculate the total square feet of the marble
- Find price per square foot of marble to install and furnish
- Find alternative for marble (granite)
- Find granite alternative that looks the same
- Get price per square foot for granite to install and furnish
- Cost comparison

IV. Tools

- Calculator
- Architectural Scale
- Engineering Paper

V. Aesthetic Comparison

The marble used for 700 6th Street is Perlino Bianco and New St. Laurent.

Picture 5.2-Perlino Bianco Marble Slab

Picture 5.3-New St. Laurent Marble Slab

The proposed granite to be used is Imperial White and Absolute Black

Picture 5.4-Imperial White Granite

Picture 5.5-Absolute Black Granite

From the pictures the granite does not look exactly the same but is very similar. The granite will give the same feel that the marble does. The finish will be the same; both are polished with a sealer. This granite is going to be coming out of Barre Vermont which is just within the 500 mile radius for LEED.

Picture 5.6-Bare Vermont Quarry

VI. Cost Estimation

Material	MNF./Supplier	Color	Cost to Furnish and Install per Square Foot	Square Feet	Cost
Marble	Rugo & Carosi	Perlino Bianco	$70	1564	$109,480
Marble	Stone Source	New St. Laurent	$70	1918	$134,260
Granite	Barre, VT Quarry	Imperial White	$50	1564	$78,200
Granite	Barre, VT Quarry	Absolute Black	$50	1918	$95,900
Marble Total Cost	$243,740				
Granite Total Cost	$174,100				
Total $ Saved	**$70,000 approx.**				

Table 5.7-Cost Comparison

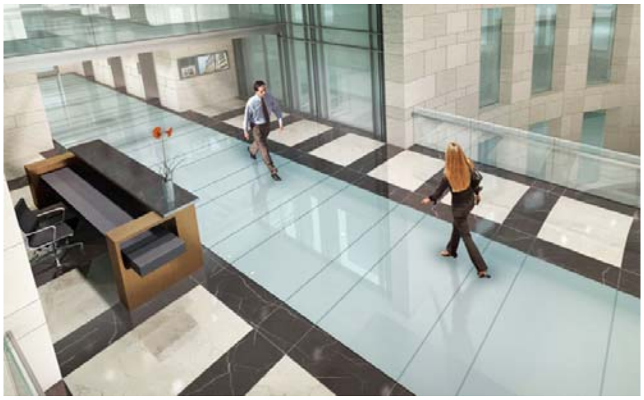
The marble cost $70 per square foot to install and furnish. The granite price came out be $50 dollars per square foot to install and furnish. The marble is more expensive because it's an Italian marble which is one of the most expensive marbles. Shipping the marble from Italy increased the price as well. The granite and marble price is higher than normal. The radial cuts on the stone increases the price dramatically. Most of the cost is in the material and not the installation. Any time each piece has to be jet cut to a tolerance of 1/32 plus or minus the price increases. The granite is cheaper because it's coming from Vermont and is cheaper in general compared to marble. The total savings if granite was used is approximately $70,000. This does not include the savings of sealing the floor less. So over the lifetime of the granite floor the savings will be more than $70,000. **Please refer to hand calculations for takeoff of marble square feet located in the appendix.**

VII. Recommendation/Conclusion

I would recommend after this analysis to use granite instead of marble. The granite is more durable, cheaper, and looks aesthetically similar. The granite does not need to be sealed as much either which can lead to thousands of dollars of savings over the lifetime of the floor. If the marble get damaged there will be a long lead time to get another piece because it is from Italy. The granite is from Vermont which is also within the 500 mile radius for LEED. I think the obvious decision is to use granite. Another alternative is Bluestone which could lead to a possible savings of $124,000 compared to marble. The bluestone can be supplied by a local company called FlynnStone.

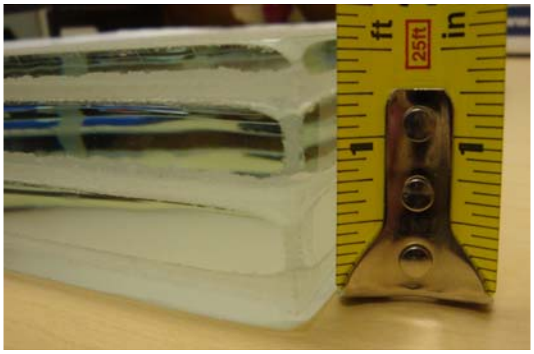
6. **Analysis 3:** Glass Bridge Improvements (Structural Analysis)

I. Background/Problem

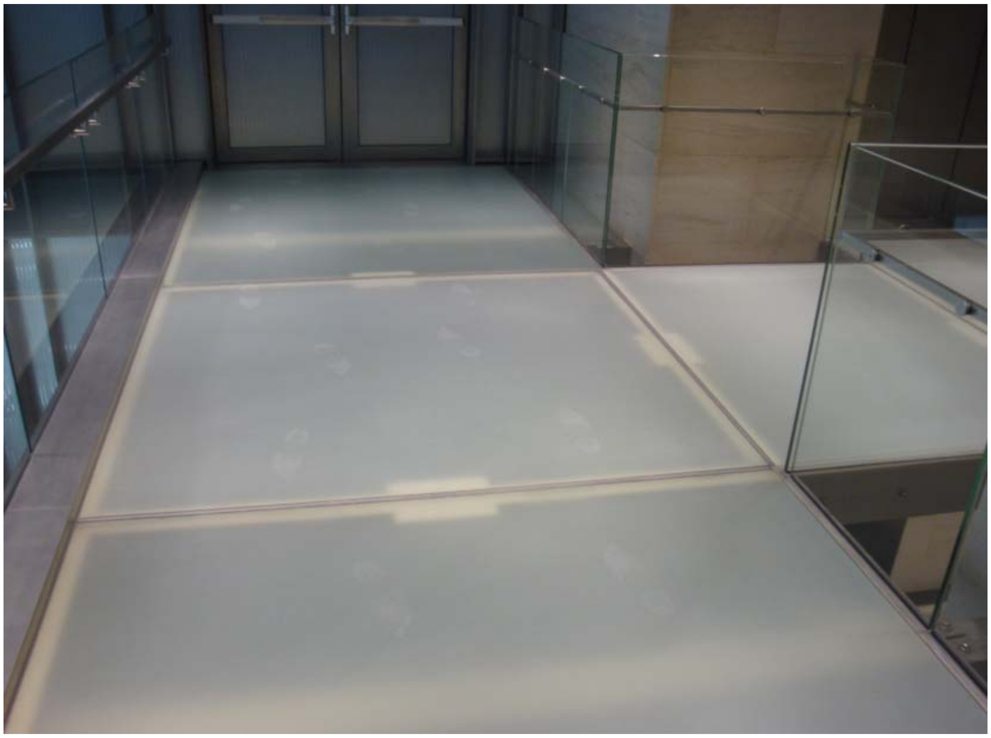


Picture 6.1-Glass Bridge

In the main lobby there is a glass bridge and glass floors. The glass bridge is in the upper right hand corner of the following picture and the glass floor is in the bottom right of the picture. The problem with having a glass floor is it is very delicate. A week after the glass floor was installed a screw driver was dropped on the glass causing it to spider crack all the way through the glass. The screw driver was dropped from a distance of 4 feet, which should show you how delicate the glass is. At the moment a total of 5 panels have been broke and replaced. Each glass panel is approximately 8 feet x 4 feet. These panels are approximately $10,000 each to replace and install and are only produced by 2 manufacturers. The lead time for these panels is months and is not easy to replace. At the moment the owner is getting complaints about the glass panels being broke. Tenants are worried that the glass is not safe, because they have spider cracked completely across the top of the glass. The panels are actually still structurally safe because they are layered. The layers thickness from top to bottom is, ¼”, ½”, ½”, and ¼”. Refer to the picture for a section of the glass.



Picture 6.2-Glass Section



Picture 6.3-Glass Bridge

Picture 6.4-Glass Walkway

II. Potential Solutions

I talked to the glass manufacturer and installer Jack King, President of Soheil Mosun Glass located in Toronto and asked him a few questions. The first question I asked Jack was, is there a protective coating that can be put on the glass? He said there is no protective coating that can be put on the glass that won't take away from the look of the glass. The next question I asked was is there another material that could have been used? Jack also said that there is not another material that has the look or strength requirements. My last question to Jack was what can be done to stop the panels from breaking? He said that there isn't a whole lot that can be done; glass is very fragile and can break if a sharp object lands on it. Glass is weakest at the corners and it is just the nature of the material. Jack did tell me one thing that could have been done; he said that the top layer of the glass could be thickened to ¾" (add another ½" of glass). He said this would definitely help and would double the impact strength of the glass and would also increase the load that the glass could hold. This solution leads to a new problem.

III. New Dead Load

With the addition of another ½" of glass this increases the dead load of the glass substantially. The original dead load of the glass is 40.4 pounds per square foot. With the addition of a ½" the new dead load is 54 pounds per square foot. This is an additional 13.6 pounds per square foot. This new additional dead load is not currently accounted for in the existing structural system. This leads me to the structural breadth of this analysis. Will the existing supports for the glass bridge have enough structural strength to compensate for an additional 13.6 pounds per square foot?

IV. Existing Structural System w/ New Loading

The existing structural system is made up of W10x12 beams. The glass sits on the beams and then the load from the beams is transferred to a load bearing masonry wall. The horizontal W10x12 beams transfer their loads to the vertical beam on the left hand side of the figure. The long W10x12 beam then transfers those loads to a load bearing masonry wall. I checked to see if the existing system can support the extra dead load. **Refer to structural calculations in the appendix.** After checking each beam with the new dead load I came to the conclusion that the existing system can hold the new dead load. The extra 13.6 pounds per square foot did not add enough to up the beam size.

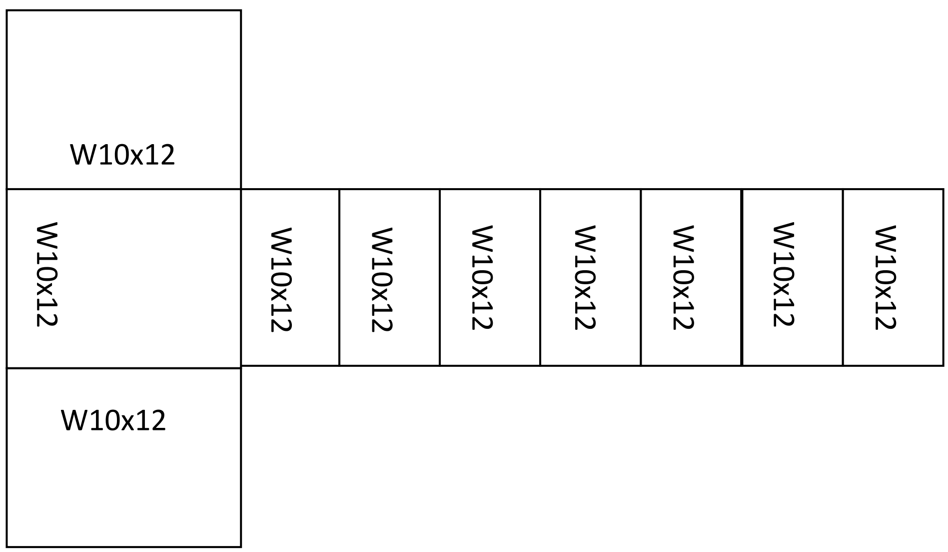


Figure 6.5-Existing System

V. Cost Implications

The cost implications of this new system with a thicker glass are minimal because the structural system does not need to be redesigned with larger members. The only cost increase will be in the glass. Each panel of glass cost $3,000 (this does not include installation). The glass manufacturer told me the thicker glass would add 10% to the cost of the glass. So each new panel would cost $3,300.

It is clearly cheaper to use the thicker glass when it is only an extra $300. It cost $10,000 to replace a broken panel compared to an extra $9,000 to thicken the glass system. Already 5 panels have broken which is costing the owner $50,000.

VI. Schedule Implications

The schedule will not change with this new system. The only thing changing is the thickness of the glass. This will not affect the installation time for the glass.

VII. Conclusion/Recommendation

I would recommend to the owner to increase the thickness of the glass. The structural system does not need to be redesigned to accommodate the new glass. The new system will only cost an extra $9,000 which is less than replacing one glass panel. This thickened glass will break less than the existing glass, but there isn't a guarantee that the thicker glass will never break. Glass can break if a heavy enough object lands in the right spot (especially the corners). The owner might want to consider a new material, possibly a granite/marble floor to match the lobby below.

7. **Analysis 4:** Precast vs. Handset Stone (Architectural Breadth)

I. Background

700 6th Street has a complicated skin; it is made up of precast with limestone casted into place, handset limestone, EIFS, and curtain wall. In this analysis I am going to focus on the precast with limestone casted into place and the handset limestone. This analysis will be broken down into two parts; the first analysis will be to replace handset limestone with precast with limestone cast into place and the second analysis will be to replace all limestone with just precast (no limestone). This will lead into an architectural breadth showing that there is not a noticeable difference between precast and limestone.

The handset limestone is located on floors 1-3 and the precast with limestone cast into place is on floors 4-12. The limestone is on the south, east, and north elevations. The west elevation has precast without limestone. The west elevation does not have any limestone because it's in an area where it cannot be seen by the public. Refer to diagram for the orientation of the building.

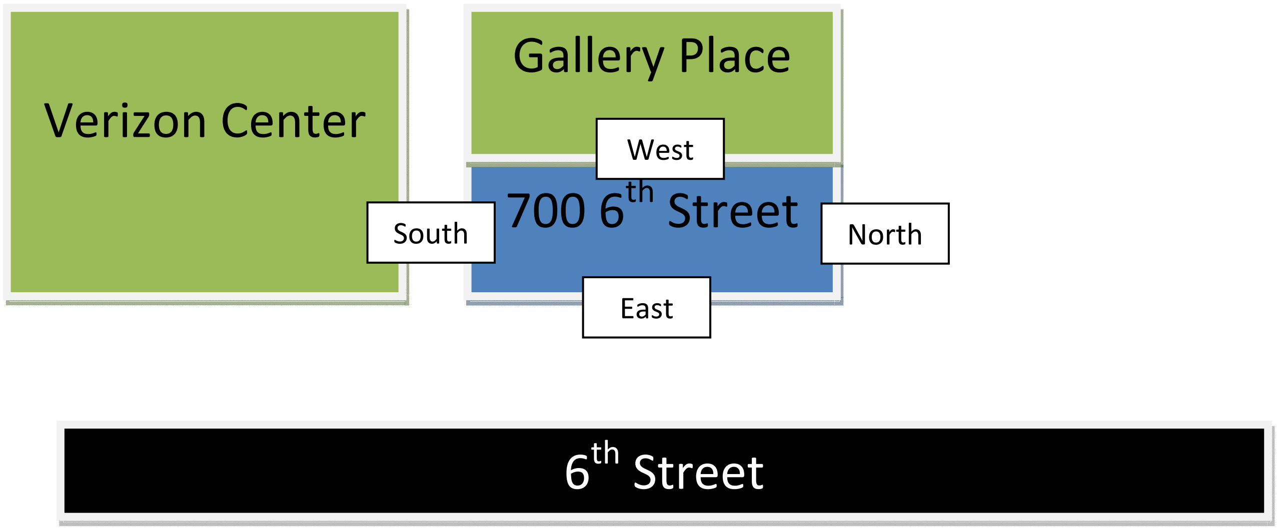
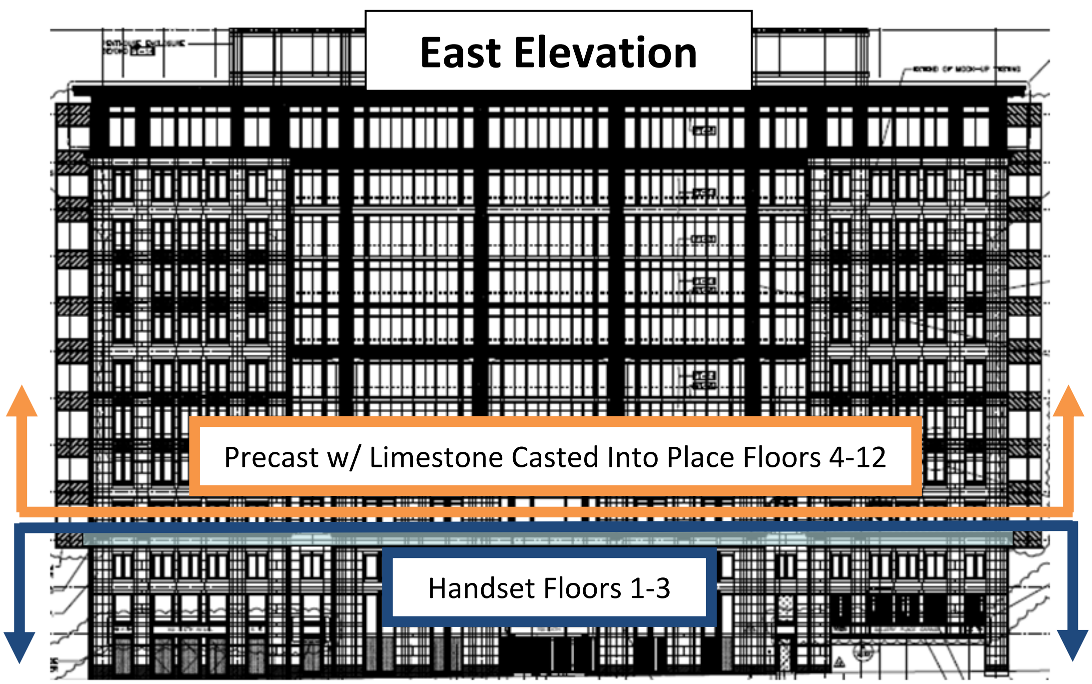


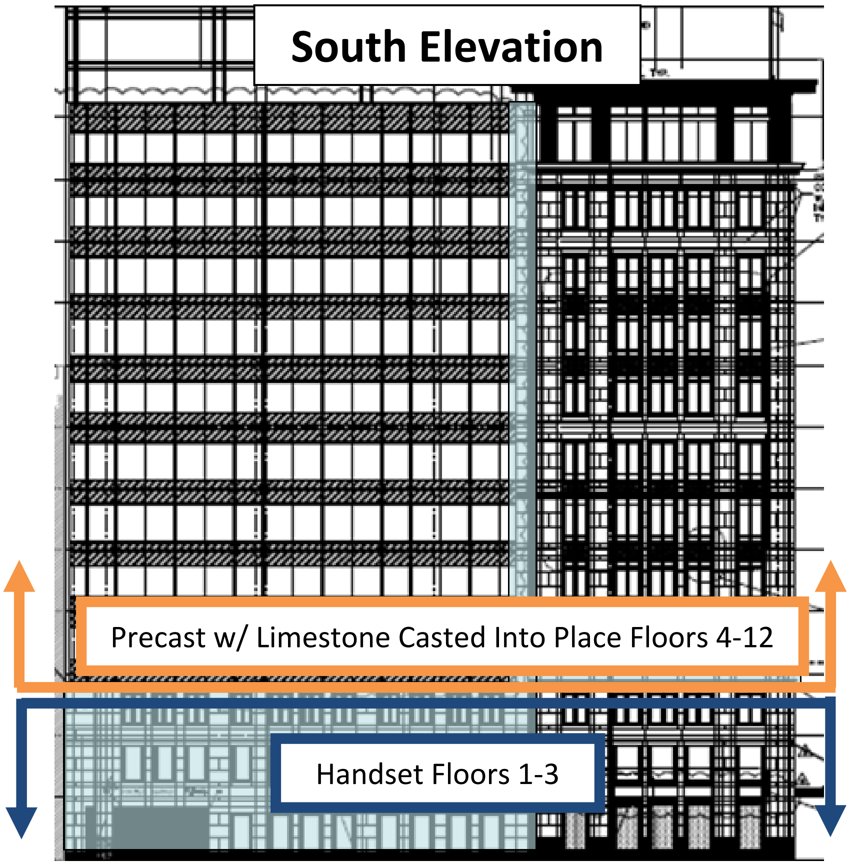
Diagram 7.1-Map

There is approximately 4,000 square feet of handset limestone and 7,340 square feet of precast with limestone casted in place on the East Elevation.



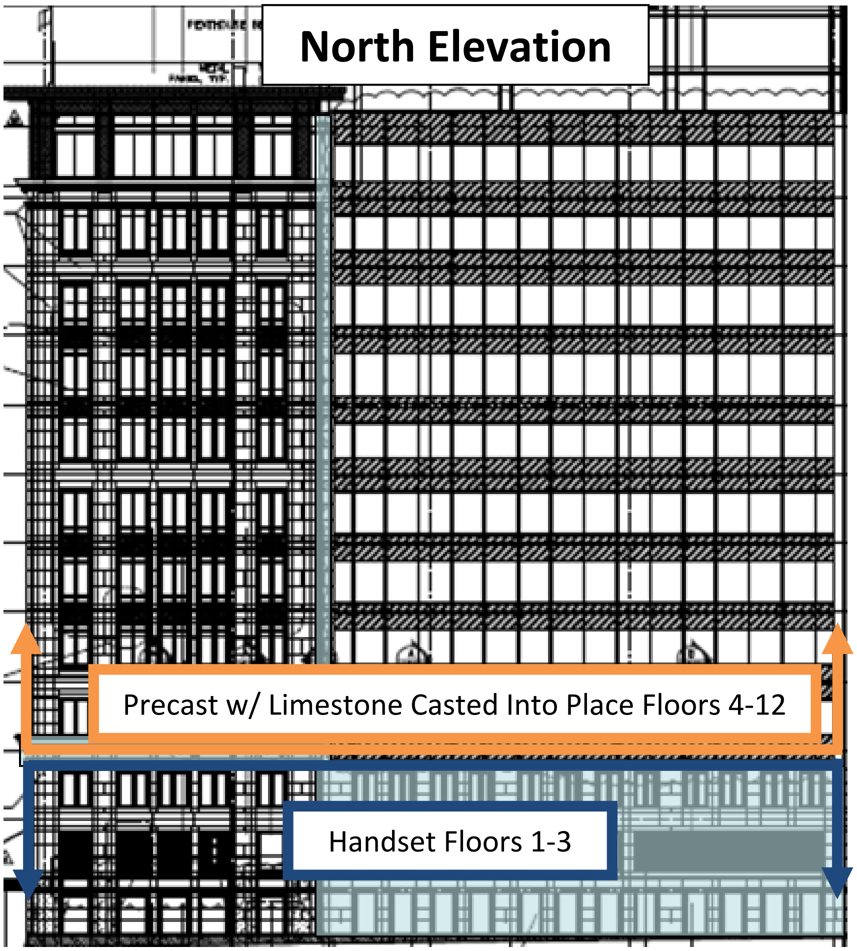
Picture 7.2-East Elevation

There is approximately 2,625 square feet of handset limestone and 2,418 square feet of precast with limestone casted in place on the South Elevation.



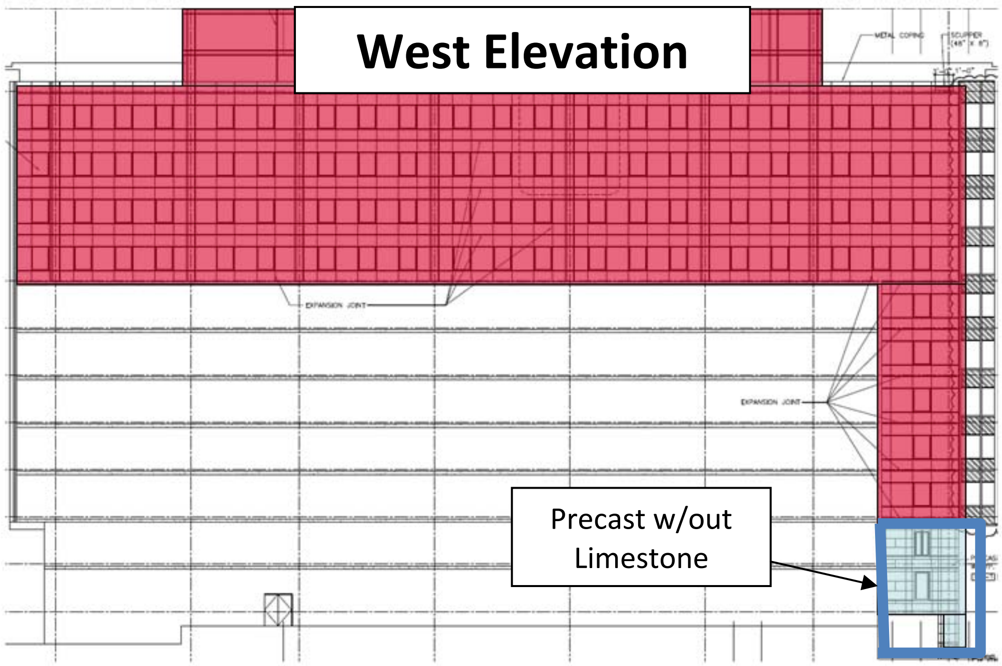
Picture 7.3-South Elevation

There is approximately 2,625 square feet of handset limestone and 2,418 square feet of precast with limestone casted in place on the North Elevation.



Picture 7.4-North Elevation

There is approximately 256 square feet of precast without limestone on the West Elevation, the rest is EIFS.



Picture 7.5-West Elevation

This gives a total of **9,250** square feet of handset and **12,432** square feet of precast with limestone cast into place. **Refer to hand calculations for takeoff of façade.**

II. Handset Stone vs. Precast

Handset stone has some advantages but more disadvantages. An advantage of handset stone is the aesthetics and quality of work. Handset stone is supposed to look better than precast. I talked to the precaster and stone mason on the project and got mixed reviews. Both said their work was better than the others. If precast is done right it is almost impossible to tell the difference between the two. But on this project handset stone was chosen on floors 1-3 because the owner believed that handset would look better. The owner chose precast on floors 4-12 to decrease the cost and schedule. As far as advantages go for handset quality of work is it and that is a matter of opinion in most cases. Disadvantages of handset are it is very expensive, labor intensive, and takes more time than precast. Cost is an issue because of the amount of hours the masons have to spend hanging the limestone. In order to seal the building flashing and caulking is required, precast does not need flashing. Precast is a lot faster than handset which will allow for the building to be watertight earlier. Finishing the lobby was delayed on this job because it was not water tight when it should have been. The lobby is a critical path item and was held up because of delays on the handset end. If precast was used the lobby would have been completed on time. Another disadvantage of handset is it takes up a lot of room on the job site. All the stone was brought in at once taking up a lot of the staging area. This site is already pretty congested as it is. Precast is brought in on trucks when needed and craned into position off of the trucks. One disadvantage of precast is some of the pieces were very big and that made it hard to attach to the building.

III. Schedule Analysis

Precast with Limestone Casted into Place

The existing system consist of precast and handset stone. The handset is at floors 1-3 and the precast is at floors 4-12. For floors 4-12 it took 60 days to hang the precast. This is approximately 6.7 days per floor. The handset stone also took 60 days to do, which is 20 days per floor**. Please refer to Milestone Schedule located in the appendix**. The precast is 3 times faster than handset stone. If the bottom 3 floors used precast it would only add 20 days to the precast schedule, increasing precast to 80 days of construction rather than 105 days of construction. Precast is on the critical path so 25 days would have been saved on the construction schedule. Please refer to diagram below for durations. As for the construction sequence the precast erection will start on the 1st floor of the south face and work up to the 12th floor. The crane will then move to the east face and erect floors 1-12 and then the crane will move to the north face and erect floors 1-12. **Attached in the appendix is a detailed precast schedule for floors 1-12.**

Existing vs. Proposed Construction Durations					
Existing					
		Duration	**Floors**	**Days/Floor**	
	Precast Floors 4-12	60 Days	9	6.6	
	Handset Floors 1-3	60 Days	3	20	
		Total Days of Construction			105
Proposed					
	Precast Floors 1-12	80 Days	12	6.6	
		Total Days of Construction			80
		Total Days of Construction Saved			**25**

Table 7.6-Exisitng vs. Proposed

Precast Without Limestone

As far as the schedule goes for precast without limestone for floors 1-12 it will be the same as precast with limestone. The connections will not be the same and the pieces will be the same sizes. With this alternative 25 days will be saved.

IV. Cost Analysis

Cost of Existing System (Handset Floors 1-3 and Precast w/ Limestone Floors 4-12)

The precast for the existing system cost $1,056,720. There is a total of 12,432 square feet of precast which gives a cost per square foot of $85. This is to install and furnish (which includes labor, materials, crane cost, ect.). The cost of the handset stone $971,250. There is a total of 9,250 square feet of handset stone which gives a cost per square foot of $105, which is to install and furnish. The total cost for the existing system is **$2,027,970**. The square foot estimate for the precast came from the building systems cost estimate from Tech one. I divided the precast total by the square feet of precast. For the handset stone I had to contact the mason that installed and furnished the stone and got the $105 per square foot estimate.

Cost of Existing System			
	Square Feet	Cost Per SF	Total Cost
Precast w/ Limestone	12,432	$85	$1,056,720
Handset Limestone	9,250	$105	$971,250
		Total Cost of System	**$2,027,970**

Table 7.7-Cost of Existing

Cost of Precast with Limestone Casted into Place Floors 1-12

The cost of the precast with limestone is $1,842,970. This price is for floors 1-12. I got this price by adding together the square feet of precast (12,432) and square feet of handset stone (9,250) which gives a total of 21,682 SF. I took that total and multiplied it by the cost per square foot to erect precast ($85) which gave me that total cost.

Cost of Precast w/ Limestone Floors 1-12			
	Square Feet	Cost Per SF	Total Cost
Precast w/Limestone	21,682	$85	$1,842,970
		Total Cost of System	**$1,842,970**

Table 7.8-Cost of Precast w/ Limestone

Cost of Precast With Out Limestone

The cost of precast without Limestone is $1,311,761. I got this price from **R.S. Means which is located in the appendix**. R.S. Means gave me a $60.50 per square foot estimate which includes materials labor and equipment.

Cost of Precast w/out Limestone Floors 1-12			
	Square Feet	Cost Per SF	Total Cost
Precast w/out Limestone	21,682	$60.50	$1,311,761
		Total Cost of System	**$1,311,761**

Table 7.9-Cost of Precast w/out Limestone

System Cost Comparison

The cheapest system is the precast w/out limestone. This is the cheapest system because of the elimination of all limestone. Any time limestone is added to anything the price will go up dramatically. With this system a total of $716,209 is saved. The precast w/limestone on floors 1-12 saved $185,000. This isn't as much as just precast but is still significant. Both of these proposed systems save 25 days on the constructions schedule which saves on general conditions. The general conditions each month cost $92,030. This will give an additional savings of approximately $77,000.

System Cost Comparison				
	System	Square Feet	Cost Per SF	Total Cost
Existing				
	Precast w/ Limestone	12,432	$85	$1,056,720
	Handset Limestone	9,250	$105	$971,250
Precast w/Limestone				
	Precast w/Limestone	21,682	$85	$1,842,970
Precast w/out Limestone				
	Precast w/out Limestone	21,682	$60.50	$1,311,761

Savings w/Proposed Systems	
Precast w/ Limestone	$185,000 saved compared to Existing
Precast w/out Limestone	$716,209 saved compared to Existing
Precast w/out Limestone	$531,209 saved compared to Precast w/Limestone

Savings w/Proposed Systems Including General Conditions	
Precast w/ Limestone	$262,000 saved compared to Existing
Precast w/out Limestone	$793,209 saved compared to Existing
Precast w/out Limestone	$608,209 saved compared to Precast w/Limestone

Table 7.10-System Cost Comparison

V. Architectural Analysis

For the Architectural analysis I am going to show that Precast and limestone look almost identical. Architectural precast can be made to look like almost any façade material including Limestone. On the west face of the building there is a location where there is architectural precast made to look like limestone. The precast is located here because it's in an area with low traffic.

Picture 7.11-Precast

Picture 7.12-Handset Limestone

Picture 7.13-Precast (left) and Limestone (right) Side by Side

From these pictures it's obvious that the precast can and does look like limestone.

VI. Recommendation/Summary

My recommendation after doing this analysis is to use the precast without limestone. The schedule and cost savings are significant compared to the original system. Almost $800,000 is saved by eliminating all the limestone and handset limestone. This is a savings of 37% compared to the existing. 25 days on the schedule is saved by eliminating the handset stone, this will allow for the building to be water tight earlier. The original schedule had precast first then handset after. Now the precast can start on the ground level and work up. This will allow the lobby work to commence earlier. The lobby is a critical item in the schedule with all the expensive and complex systems (Glass Bridge, marble floor, and limestone walls). The precast is a good alternative architecturally as well. The precast looks just like the limestone from the above pictures. I would recommend the precast without limestone.

8. Summary and Conclusions

Analysis 1: It's Never too Late to Go Green

After doing this analysis I realized that it is never too late to go green, even 75% of the way through the project. This change did have cost implications and minimal schedule implications, but overtime those costs will be accounted for in the energy savings of the building. The building would have never gotten LEED Platinum without a holistic approach. The owner, the subs, and the construction team all needed to be on the same page to complete this daunting task. All those parties did come together and completed the task with minimal schedule implications and was cost effective. I would recommend that any project that is close to achieving another level of LEED to go for it. 700 6^{th} Street did it with 75% of the construction completed. This means that almost any project can achieve the same as long as all parties involved in the project are working together for the same goal.

Analysis 2: Alternative Stone for Lobby

I would recommend after this analysis to use granite instead of marble. The granite is more durable, cheaper, and looks aesthetically similar. The granite does not need to be sealed as much either which can lead to thousands of dollars of savings over the lifetime of the floor. If the marble get damaged there will be a long lead time to get another piece because it is from Italy. The granite is from Vermont which is also within the 500 mile radius for LEED. I think the obvious decision is to use granite.

Analysis 3: Glass Bridge Improvements (Structural Breadth)

I would recommend to the owner to increase the thickness of the glass. The structural system does not need to be redesigned to accommodate the new glass. The new system will only cost an extra $9,000 which is less than replacing one glass panel. This thickened glass will break less than the existing glass, but there isn't a guarantee that the thicker glass will never break. The thicker glass can break if a heavy enough object lands in the right spot (especially the corners). The owner might want to consider a new material, possibly a granite/marble floor to match the lobby below.

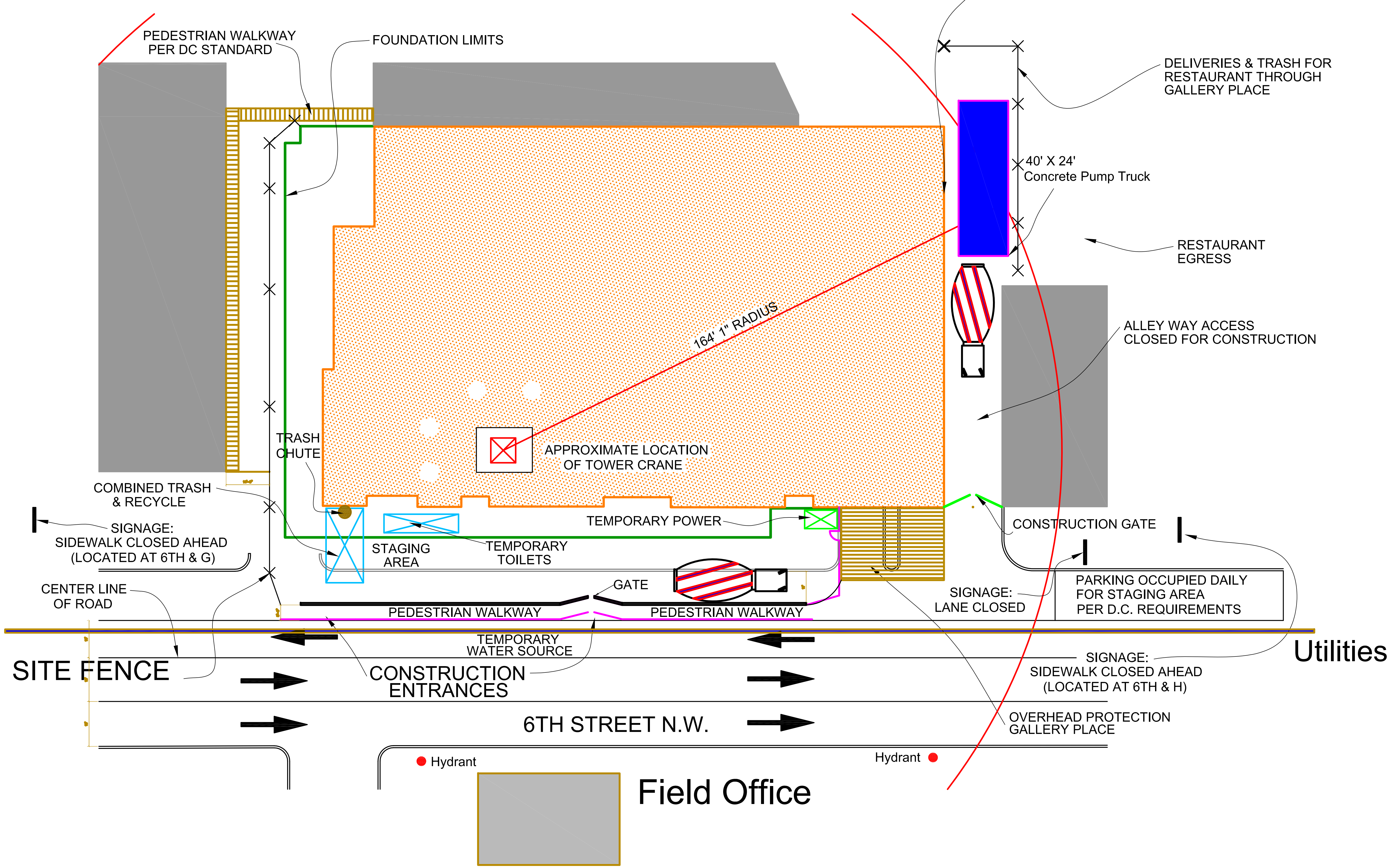
Analysis 4: Precast vs. Handset Stone (Architectural Breadth)

My recommendation after doing this analysis is to use the precast without limestone. The schedule and cost savings are significant compared to the original system. Almost $800,000 is saved by eliminating all the limestone and handset limestone. This is a savings of 37% compared to the existing. 25 days on the schedule is saved by eliminating the handset stone, this will allow for the building to be water tight earlier. The original schedule had precast first then handset after. Now the precast can start on the ground level and work up. This will allow the lobby work to commence earlier. The lobby is a critical item in the schedule with all the expensive and complex systems (Glass Bridge, marble floor, and limestone walls). The precast is a good alternative architecturally as well. The precast looks just like the limestone from the above pictures. I would recommend the precast without limestone.

9. Appendix

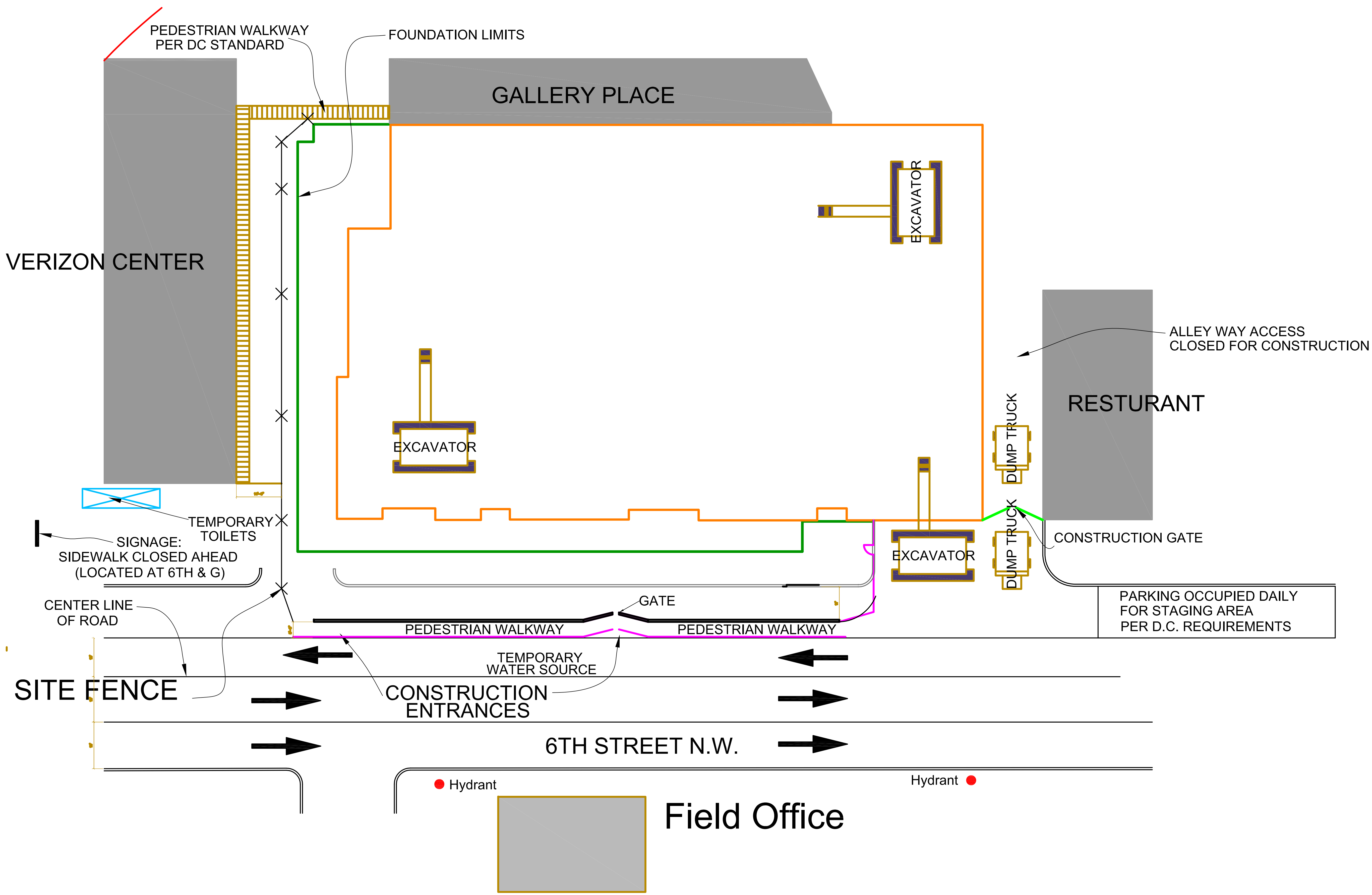
Appendix A: Project Site Plan

Site Plan


BUILDING FACADE LIMITS
PEDESTRIAN WALKWAY PER DC STANDARD
FOUNDATION LIMITS
DELIVERIES & TRASH FOR RESTAURANT THROUGH GALLERY PLACE
40' X 24' Concrete Pump Truck
RESTAURANT EGRESS
164' 1" RADIUS
ALLEY WAY ACCESS CLOSED FOR CONSTRUCTION
TRASH CHUTE
APPROXIMATE LOCATION OF TOWER CRANE
COMBINED TRASH & RECYCLE
SIGNAGE: SIDEWALK CLOSED AHEAD (LOCATED AT 6TH & G)
TEMPORARY POWER
CONSTRUCTION GATE
STAGING AREA
TEMPORARY TOILETS
CENTER LINE OF ROAD
GATE
PARKING OCCUPIED DAILY FOR STAGING AREA PER D.C. REQUIREMENTS
SIGNAGE: LANE CLOSED
PEDESTRIAN WALKWAY
PEDESTRIAN WALKWAY
TEMPORARY WATER SOURCE
Utilities
SIGNAGE: SIDEWALK CLOSED AHEAD (LOCATED AT 6TH & H)
SITE FENCE
CONSTRUCTION ENTRANCES
6TH STREET N.W.
OVERHEAD PROTECTION GALLERY PLACE
Hydrant
Hydrant
Field Office

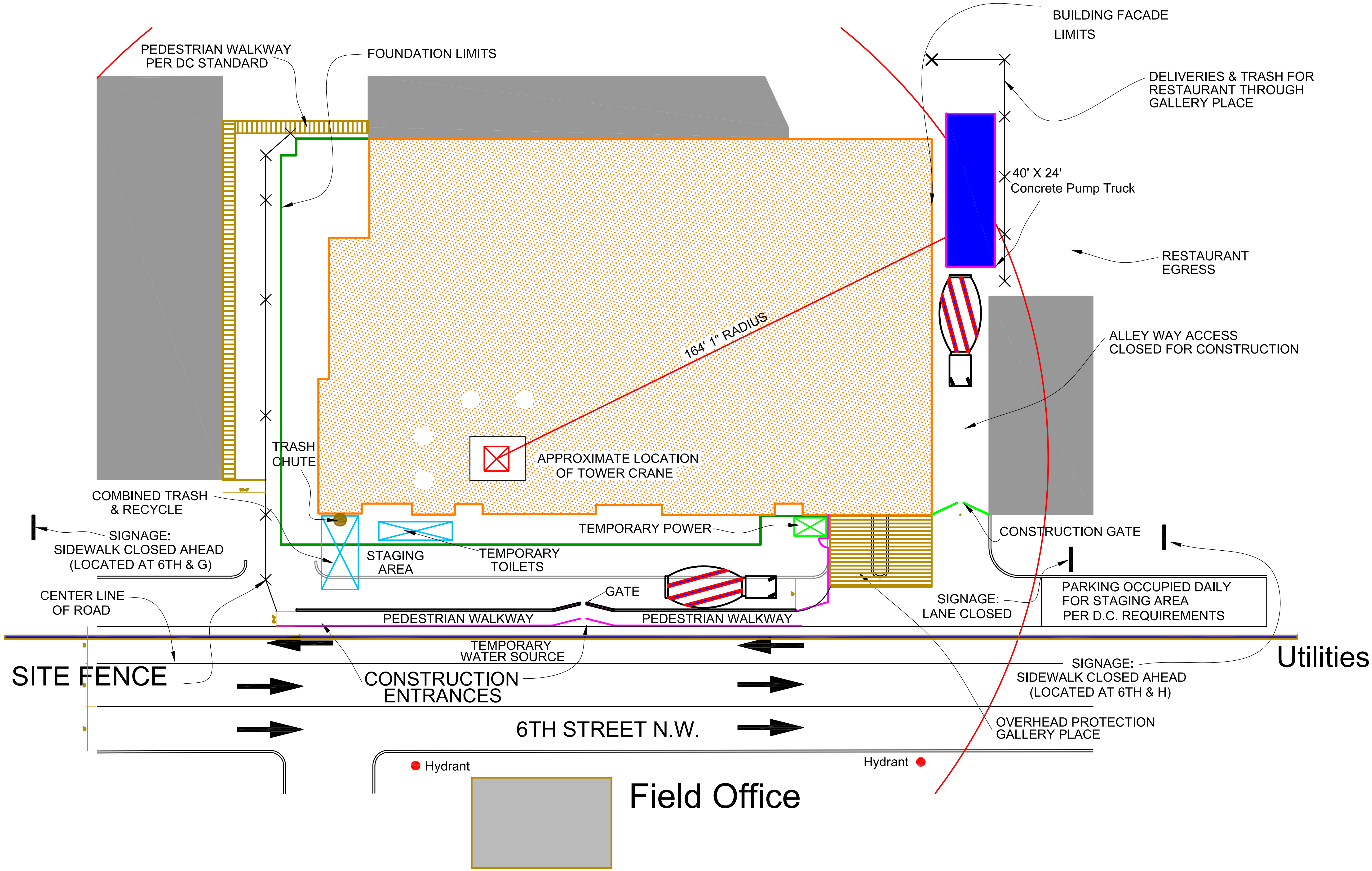
Appendix B: Excavation Site Plan

Site Plan For Excavation Phase



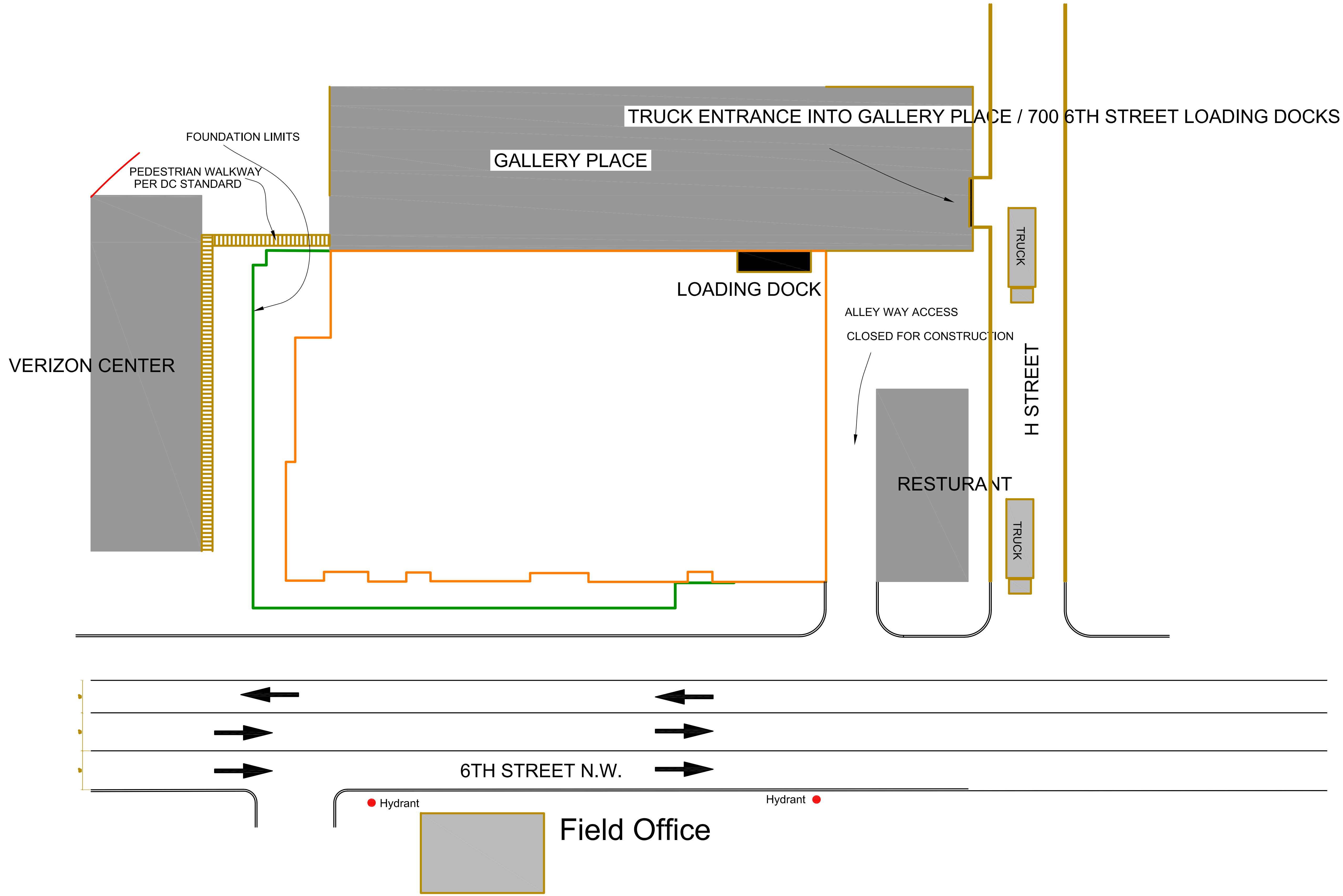
Appendix C: Superstructure Site Plan

Site Plan For Superstructure Phase



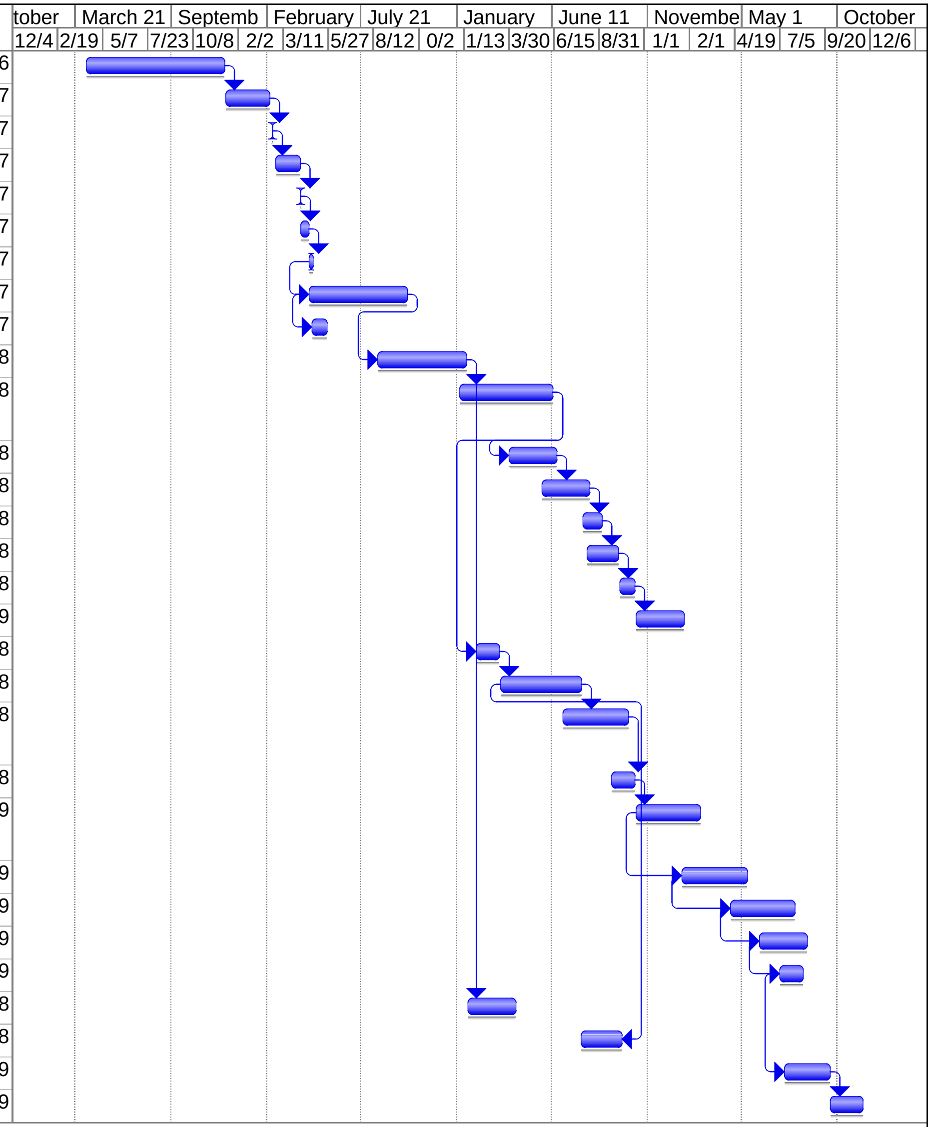
Appendix D: Interiors/Finishes Plan

Site Plan For Finish Phase



Appendix E: Milestone Project Schedule

ID		Task Name	Duration	Start	Finish
1		DESIGN DOCUMENTS	170 days	Mon 4/10/06	Fri 12/1/06
2		BID	55 days	Mon 12/4/06	Fri 2/16/07
3		AWARD	1 day	Wed 2/21/07	Wed 2/21/07
4		PROCUREMENT	30 days	Tue 2/27/07	Mon 4/9/07
5		NOTICE TO PROCEED	1 day	Tue 4/10/07	Tue 4/10/07
6		NTP/MOBILIZATION	10 days	Wed 4/11/07	Tue 4/24/07
7		SITE DEMOLITION	5 days	Wed 4/25/07	Tue 5/1/07
8		EXCAVATION/S&S	120 days	Wed 4/25/07	Tue 10/9/07
9		INSTALL DEWATERING	20 days	Mon 4/30/07	Fri 5/25/07
10		CONCRETE FOUNDATIONS TO GRADE	110 days	Mon 8/20/07	Fri 1/18/08
11		CONCRETE SUPERSTRUCRURE LEVELS 1 TO PENTHOUSE	115 days	Mon 1/7/08	Fri 6/13/08
12		PRECAST LEVELS 1-12	60 days	Mon 3/31/08	Fri 6/20/08
13		EXTERIOR CMU/HANDSET STONE	60 days	Mon 5/26/08	Fri 8/15/08
14		EXTERIOR STUDS	25 days	Mon 8/4/08	Fri 9/5/08
15		PUNCH WINDOWS	40 days	Mon 8/11/08	Fri 10/3/08
16		EIFS	20 days	Mon 10/6/08	Fri 10/31/08
17		ROOFING	60 days	Mon 11/3/08	Fri 1/23/09
18		INTERIOR CMU	30 days	Mon 2/4/08	Fri 3/14/08
19		MEP ROUGH IN	100 days	Mon 3/17/08	Fri 8/1/08
20		CORE CONSTRUCTION AND ROUGH INS LEVELS 1-12	80 days	Tue 7/1/08	Mon 10/20/08
21		SWITCH GEAR ROOM FIT OUT	30 days	Mon 9/22/08	Fri 10/31/08
22		ROOF TOP EQUIPMENT AND PENTHOUSE MEP	80 days	Mon 11/3/08	Fri 2/20/09
23		MECHANICAL ROOMS	80 days	Tue 1/20/09	Mon 5/11/09
24		LOBBY FINISHES	80 days	Mon 4/13/09	Fri 7/31/09
25		CORE/BATHROOM FINISHES	60 days	Mon 6/1/09	Fri 8/21/09
26		PARKING GARAGE FINISHES	30 days	Mon 7/6/09	Fri 8/14/09
27		ELECTRICAL VAULTS AND SITE UTILITIES	60 days	Mon 1/21/08	Fri 4/11/08
28		MEP TRIM OUT	50 days	Fri 8/1/08	Thu 10/9/08
29		TESTING AND BALANCING	56 days	Tue 7/14/09	Tue 9/29/09
30		PROJECT CLOSEOUT	40 days	Wed 9/30/09	Tue 11/24/09



Project: Milestone
Date: Tue 4/6/10

Task		Milestone	◆	External Tasks	
Split		Summary		External Milestone	◆
Progress		Project Summary		Deadline	⇩

Appendix F: Sept. 7 LEED Scorecard

LEED® Credit Scorecard

LEED-CS Green Building Rating System, version 2.0 (June 2006)

700 6th Street DC

Akridge Real Estate

September 7, 2007

Y	?	N	Total Project Score		Possible Points 63
34	6	20	Certified 23-27 points Silver 28-33 points Gold 34-44 points Platinum 45-61 points		

Y	?	N		Sustainable Sites	Possible Points 15
13	1	1			
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
1			Credit 2	Development Density & Community Connectivity	1
1			Credit 3	Brownfield Redevelopment	1
1			Credit 4.1	Alternative Transportation: Public Transportation Access	1
1			Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1
1			Credit 4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	1
1			Credit 4.4	Alternative Transportation: Parking Capacity	1
1			Credit 5.1	Site Development: Protect or Restore Habitat	1
1			Credit 5.2	Site Development: Maximize Open Space	1
1			Credit 6.1	Stormwater Design: Quantity Control	1
	1		Credit 6.2	Stormwater Design: Quality Control	1
1			Credit 7.1	Heat Island Effect: Non-Roof	1
1			Credit 7.2	Heat Island Effect: Roof	1
		1	Credit 8	Light Pollution Reduction	1
1			Credit 9	Tenant Design & Construction Guidelines	1

Y	?	N		Water Efficiency	Possible Points 5
4		1			
1			Credit 1.1	Water Efficient Landscaping: Reduce by 50%	1
1			Credit 1.2	Water Efficient Landscaping: No Potable Use or No Irrigation	1
		1	Credit 2	Innovative Wastewater Technologies	1
1			Credit 3.1	Water Use Reduction: 20% Reduction	1
1			Credit 3.2	Water Use Reduction: 30% Reduction	1

Y	?	N		Energy & Atmosphere	Possible Points 14
2	1	11			
Y			Prereq 1	Fundamental Commissioning of the Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
1			Credit 1.1	Optimize Energy Performance: 10.5% New / 3.5% Existing	1
		1	Credit 1.2	Optimize Energy Performance: 14% New / 7% Existing	1
		1	Credit 1.3	Optimize Energy Performance: 17.5% New / 14% Existing	1
		1	Credit 1.4	Optimize Energy Performance: 21% New / 17.5% Existing	1
		1	Credit 1.5	Optimize Energy Performance: 24.5% New / 17.5% Existing	1
		1	Credit 1.6	Optimize Energy Performance: 28% New / 21% Existing	1
		1	Credit 1.7	Optimize Energy Performance: 31.5% New / 24.5% Existing	1
		1	Credit 1.8	Optimize Energy Performance: 35% New / 28% Existing	1
		1	Credit 2	On-Site Renewable Energy	1
		1	Credit 3	Enhanced Commissioning	1
1			Credit 4	Enhanced Refrigerant Management	1
		1	Credit 5.1	Measurement & Verification: Base Building	1
		1	Credit 5.2	Measurement & Verification: Tenant Sub-metering	1
	1		Credit 6	Green Power	1

Y	?	N		Materials & Resources	Possible Points 11
4	3	4			
Y			Prereq 1	Storage & Collection of Recyclables	
		1	Credit 1.1	Building Reuse: Maintain 25% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	Building Reuse: Maintain 50% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	Building Reuse: Maintain 75% of Existing Walls, Floors & Roof	1
1			Credit 2.1	Construction Waste Management: Divert 50% from Disposal	1
	1		Credit 2.2	Construction Waste Management: Divert 75% from Disposal	1
		1	Credit 3	Materials Reuse	1
1			Credit 4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	1
	1		Credit 4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	1
1			Credit 5.1	Regional Materials: 10% Extracted, Processed & Manufactured Regional	1
	1		Credit 5.2	Regional Materials: 20% Extracted, Processed & Manufactured Regional	1
1			Credit 6	Certified Wood	1

Y	?	N		Indoor Environmental Quality	Possible Points 11
7		3			
Y			Prereq 1	Minimum IAQ Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
1			Credit 2	Increased Ventilation	1
1			Credit 3	Construction IAQ Management Plan: During Construction	1
1			Credit 4.1	Low-Emitting Materials: Adhesives & Sealants	1 for 2
1			Credit 4.2	Low-Emitting Materials: Paints and Coatings	2 for 3
1			Credit 4.3	Low-Emitting Materials: Carpet Systems	3 for 4
	1		Credit 4.4	Low-Emitting Materials: Composite Wood & Agrifiber Products	
1			Credit 5	Indoor Chemical & Pollutant Source Control	1
		1	Credit 6	Controllability of Systems: Thermal Comfort	1
1			Credit 7	Thermal Comfort: Design	1
		1	Credit 8.1	Daylight & Views: Daylight 75% of Spaces	1
		1	Credit 8.2	Daylight & Views: Views for 90% of Spaces	1

Y	?	N		Innovation & Design Process		Possible Points 7
4	1					
1			Credit 1.1	Innovation in Design:	Green Housekeeping/O&M	1
	1		Credit 1.2	Innovation in Design:	40% Water Use Reduction	1
1			Credit 1.3	Innovation in Design:	Exemplary Performance - Alternative Transpor	1
1			Credit 1.4	Innovation in Design:	100% Undercover parking	1
			Credit 1.5	Innovation in Design:	70% Green Power	1
			Credit 1.6	Innovation in Design:		1
1			Credit 2	LEED™ Accredited Professional		1

Appendix G: Final LEED Scorecard

LEED® Credit Scorecard

LEED-CS Green Building Rating System, version 2.0 (June 2006)

700 6th Street DC

Akridge Real Estate

12/10/09 Final

Sustainable Design Consulting

LEED — Leadership in Energy & Environmental Design

● : ADD FROM LEED SILVER TO LEED PLATINUM

Y	?	N		Possible Points
46		15	**Total Project Score**	61

Certified 23-27 points Silver 28-33 points Gold 34-44 points Platinum 45-61 points

Sustainable Sites

Y	?	N	Sustainable Sites		Possible Points 15
14		1			
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
1			Credit 2	Development Density & Community Connectivity	1
1			Credit 3	Brownfield Redevelopment	1
1			Credit 4.1	Alternative Transportation: Public Transportation Access	1
1			Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1
1			Credit 4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	1
1			Credit 4.4	Alternative Transportation: Parking Capacity	1
1			Credit 5.1	Site Development: Protect or Restore Habitat	1
1			Credit 5.2	Site Development: Maximize Open Space	1
1			Credit 6.1	Stormwater Design: Quantity Control	1
1	●		Credit 6.2	Stormwater Design: Quality Control	1
1			Credit 7.1	Heat Island Effect: Non-Roof	1
1			Credit 7.2	Heat Island Effect: Roof	1
		1	Credit 8	Light Pollution Reduction	1
1			Credit 9	Tenant Design & Construction Guidelines	1

Water Efficiency

Y	?	N	Water Efficiency		Possible Points 5
4		1			
1			Credit 1.1	Water Efficient Landscaping: Reduce by 50%	1
1			Credit 1.2	Water Efficient Landscaping: No Potable Use or No Irrigation	1
		1	Credit 2	Innovative Wastewater Technologies	1
1			Credit 3.1	Water Use Reduction: 20% Reduction	1
1			Credit 3.2	Water Use Reduction: 30% Reduction	1

Energy & Atmosphere

Y	?	N	Energy & Atmosphere		Possible Points 14
8		6			
Y			Prereq 1	Fundamental Commissioning of the Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
1			Credit 1.1	Optimize Energy Performance: 10.5% New / 3.5% Existing	1
1	●		Credit 1.2	Optimize Energy Performance: 14% New / 7% Existing	1
1	●		Credit 1.3	Optimize Energy Performance: 17.5% New / 14% Existing	1
1	●		Credit 1.4	Optimize Energy Performance: 21% New / 17.5% Existing	1
		1	Credit 1.5	Optimize Energy Performance: 24.5% New / 17.5% Existing	1
		1	Credit 1.6	Optimize Energy Performance: 28% New / 21% Existing	1
		1	Credit 1.7	Optimize Energy Performance: 31.5% New / 24.5% Existing	1
		1	Credit 1.8	Optimize Energy Performance: 35% New / 28% Existing	1
		1	Credit 2	On-Site Renewable Energy	1
		1	Credit 3	Enhanced Commissioning	1
1	●		Credit 4	Enhanced Refrigerant Management	1
1	●		Credit 5.1	Measurement & Verification: Base Building	1
1	●		Credit 5.2	Measurement & Verification: Tenant Sub-metering	1
1			Credit 6	Green Power	1

Materials & Resources

Y	?	N	Materials & Resources		Possible Points 11
7		4			
Y			Prereq 1	Storage & Collection of Recyclables	
		1	Credit 1.1	Building Reuse: Maintain 25% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	Building Reuse: Maintain 50% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	Building Reuse: Maintain 75% of Existing Walls, Floors & Roof	1
1			Credit 2.1	Construction Waste Management: Divert 50% from Disposal	1
1	●		Credit 2.2	Construction Waste Management: Divert 75% from Disposal	1
		1	Credit 3	Materials Reuse	1
1			Credit 4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	1
1	●		Credit 4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	1
1			Credit 5.1	Regional Materials: 10% Extracted, Processed & Manufactured Regional	1
1	●		Credit 5.2	Regional Materials: 20% Extracted, Processed & Manufactured Regional	1
1			Credit 6	Certified Wood	1

Indoor Environmental Quality

Y	?	N	Indoor Environmental Quality		Possible Points 11
8		3			
Y			Prereq 1	Minimum IAQ Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
1			Credit 2	Increased Ventilation	1
1			Credit 3	Construction IAQ Management Plan: During Construction	1
1			Credit 4.1	Low-Emitting Materials: Adhesives & Sealants	1 for 2
1			Credit 4.2	Low-Emitting Materials: Paints and Coatings	2 for 3
1			Credit 4.3	Low-Emitting Materials: Carpet Systems	3 for 4
1	●		Credit 4.4	Low-Emitting Materials: Composite Wood & Agrifiber Products	
1			Credit 5	Indoor Chemical & Pollutant Source Control	1
		1	Credit 6	Controllability of Systems: Thermal Comfort	1
1			Credit 7	Thermal Comfort: Design	1
		1	Credit 8.1	Daylight & Views: Daylight 75% of Spaces	1
		1	Credit 8.2	Daylight & Views: Views for 90% of Spaces	1

Innovation & Design Process

Y	?	N	Innovation & Design Process			Possible Points 5
5						
1			Credit 1.1	Innovation in Design:	Green Housekeeping/O&M	1
1	●		Credit 1.2	Innovation in Design:	40% Water Use Reduction	1
1			Credit 1.3	Innovation in Design:	Exemplary Performance - Alternative Transpor	1
1			Credit 1.4	Innovation in Design:	100% Undercover parking or 70% GP	1
1			Credit 2	LEED™ Accredited Professional		1

Design Phase Credit

Construction Phase Credit

Sustainable Design Consulting, LLC

Appendix H: Square Foot Take-off Marble

Alternative Stone For Lobby

Lobby

Floor

	Mater.	MNF./Supplier	Color
ST-1	Marble	Rugo & Carosi	Perlino Bianco
ST-2	Marble	Stone Source	New St. Laurent

Walls

	Mater.	MNF./Supplier	Color
ST-4	Limestone	Rocamat	Valanges

Sheet #
A-2.23 A
A-2.24A

Lower Lobby whole area 2200 sf
↓
St-2 Area 1200 sf   St-1 Area 1000 sf

Vertical
(2)·2'·13' = 52
(2)·2'·20' = 80
(2)·2'·23' = 92
(2)·2'·26' = 104
(2)·2'·27' = 108
(2)·2'·30' = 120
= 556 sf

horizontal
2'·16 =
2'·110 =
2'·45 =
2'·65 =
2'·50 =
652 sf

22
3.5·4
4.1.1 = 21
.7·1.1
3.5·.7

Upper Lobby / Elevators

St-1 Area
(20)·4.17·5' = 417
(7)·21 = = 147
= 564

St-2 Area
(22)·2'·5' = 220
(2) 44'·1' = 88
(2) 75'·1.6' = 240
10'·1.6' = 16
7·22 = 154
= 718

Upper & Lower Lobby

ST-1	ST-2
1564 sf	1918 sf

= to

Lobby Limestone SF

ST-4

(1) 120 · 35' = 4200
(2) 115 · 35' = 4025 = 8,225 SF

Granite Flooring will be used instead

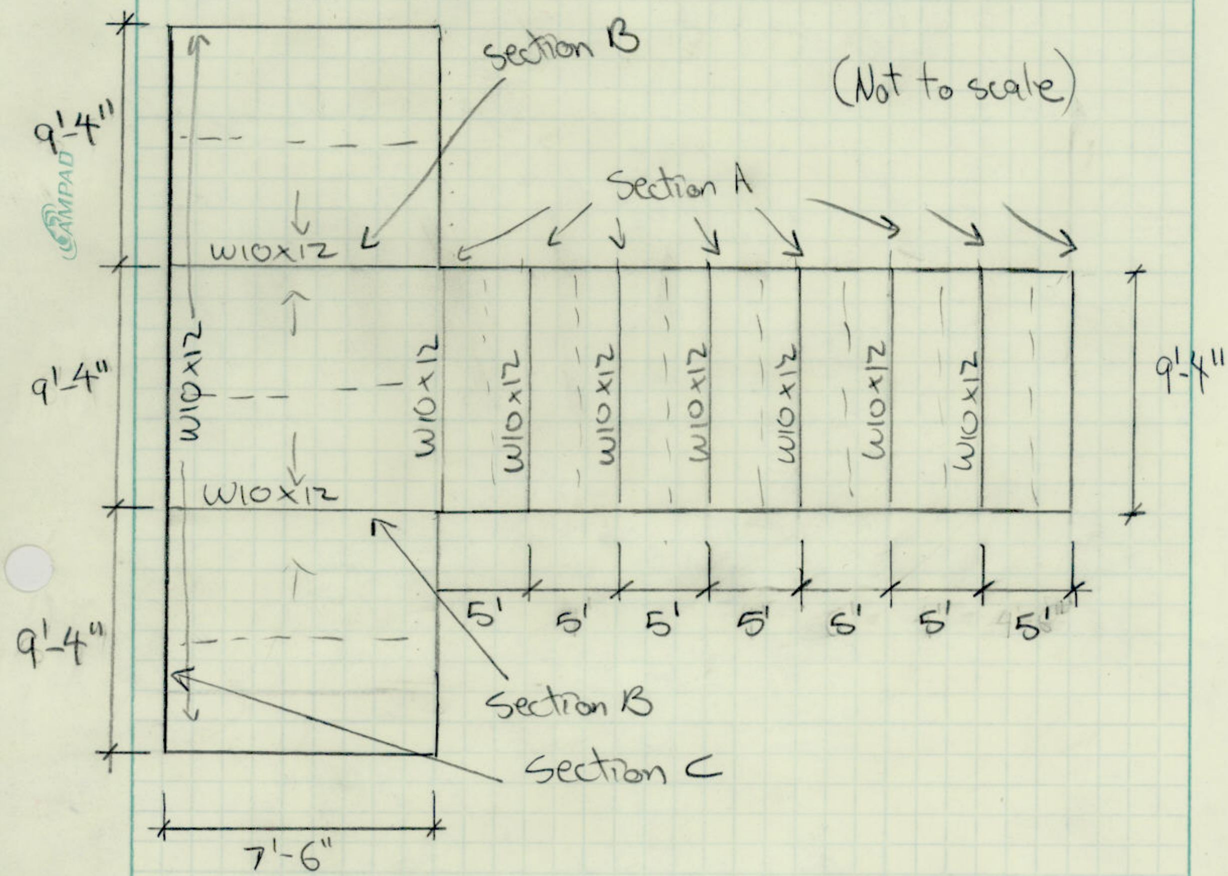
Do bluestone analysis

Appendix I: Structural Calculations

Glass Bridge Analysis

Dead Load = 54 psf
Live Load = 100 psf

Existing



Section A Beam Calcs.

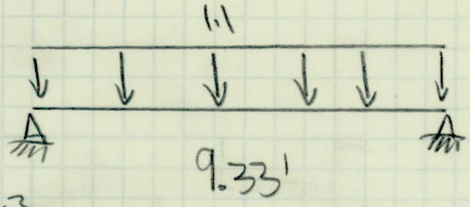
$$L = L_o\left(.25 + \frac{15}{\sqrt{K_{LL}(A_T)}}\right)$$

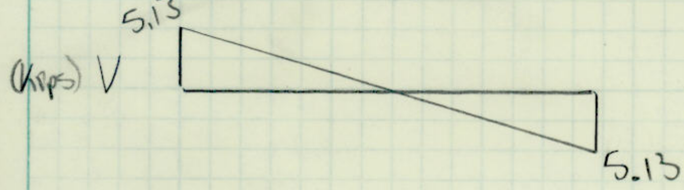
$$= 100\left(.25 + \frac{15}{\sqrt{2(5)(9.33)}}\right) = 96.4 \text{ psf}$$

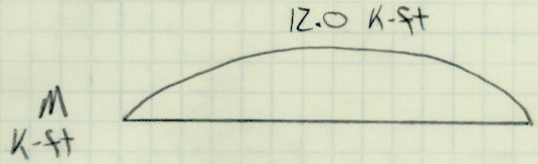
$$W_u = 1.2D + 1.6L$$

$$= 1.2(54) + 1.6(96.4) = 219.04 \text{ psf}$$

$$w_u = 219.04 \cdot 5' = 1.1 \text{ K/ft}$$







From steel manual p 3-19

W10x12

$\Phi M_{px} = 46.9 > 12$

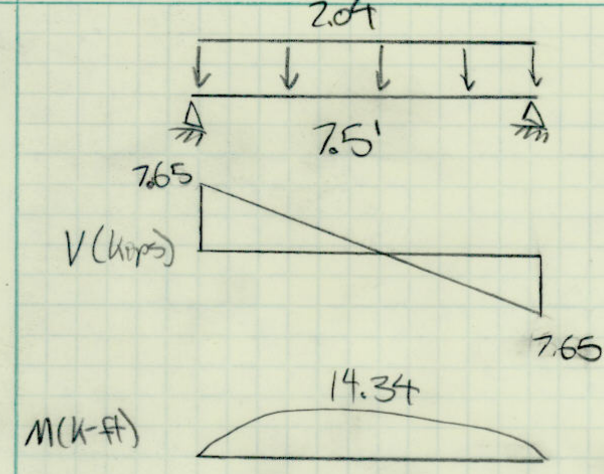
✱ W10x12 can still handle new dead load ✱

<u>Section B Beam Calcs.</u>

Same Live Load = 96.4 psf
Same Dead Load = 54 psf

$W_u = 1.2D + 1.6L$
$= 1.2(54) + 1.6(96.4) = 219.04$

$W_u = 219.04 \cdot 9.33' = 2.04\ K/ft$



From Steel Manual p 3-19

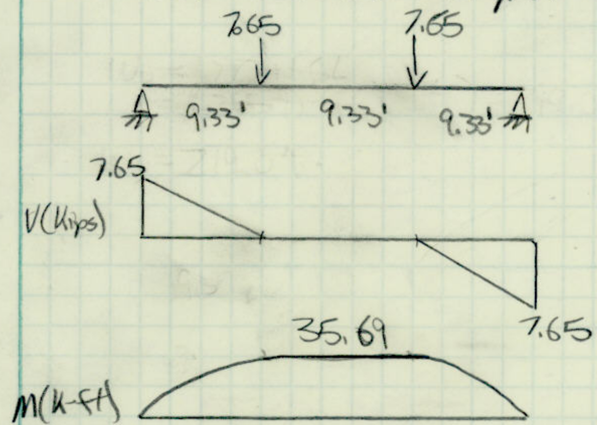
W10×12

$\phi M_{px} = 46.9 > 14.34$

* W10×12 can still handle new dead load *

Section C Beam Calcs.

Same Live Load = 96.4 psf
Same Dead Load = 55 psf



From Steel Manual p 3-19
W10×12
$\phi M_{px} = 46.9 > 35.69$
* W10×12 can still be used *

Appendix J: Façade Take-off Calcs.

RS Means price comparison

Precast vs. Limestone

Precast Concrete 1,564,980

East

(60% is precast (limestone)

Handset Limestone

4000 sf

Precast

(8)·84'·6' = 4032
(6) 18'·5' = 540
(2)·18'·4' = 144
(4)·6'·4' = 96
(12)·6'·5' = 360
(8)·2'·8' = 128
(8)·28'·2' = 448
(1)·100·5' = 500
(6)·17'·8' = 816
(2)·10'·4' = 80
(4)·4'·7' = 112
(4)·7'·3' = 84

= 7340 sf

South

Hardset

(1)·48'·4' = 192
(1)·48'·5' = 240
(1)·76'·4' = 304
(1)·84'·5' = 420
(1)·76·2' = 152
(24)·5'·6' = 720
(1)·55'·3' = 165
(36) 2'·6 = 432

= 2625 sf

Precast

(4)·84'·5' = 1680
(3)·4·18' = 216
(1)·3·18' = 54
(2)·5'·3' = 30
(6)·5'·5' = 150
(4)·8'·2' = 64
(4)·28'·2' = 224

= 2418 sf

North

Hardset

2625 sf

Precast

2418 sf

West

Precast

256 sf

Total Hardset

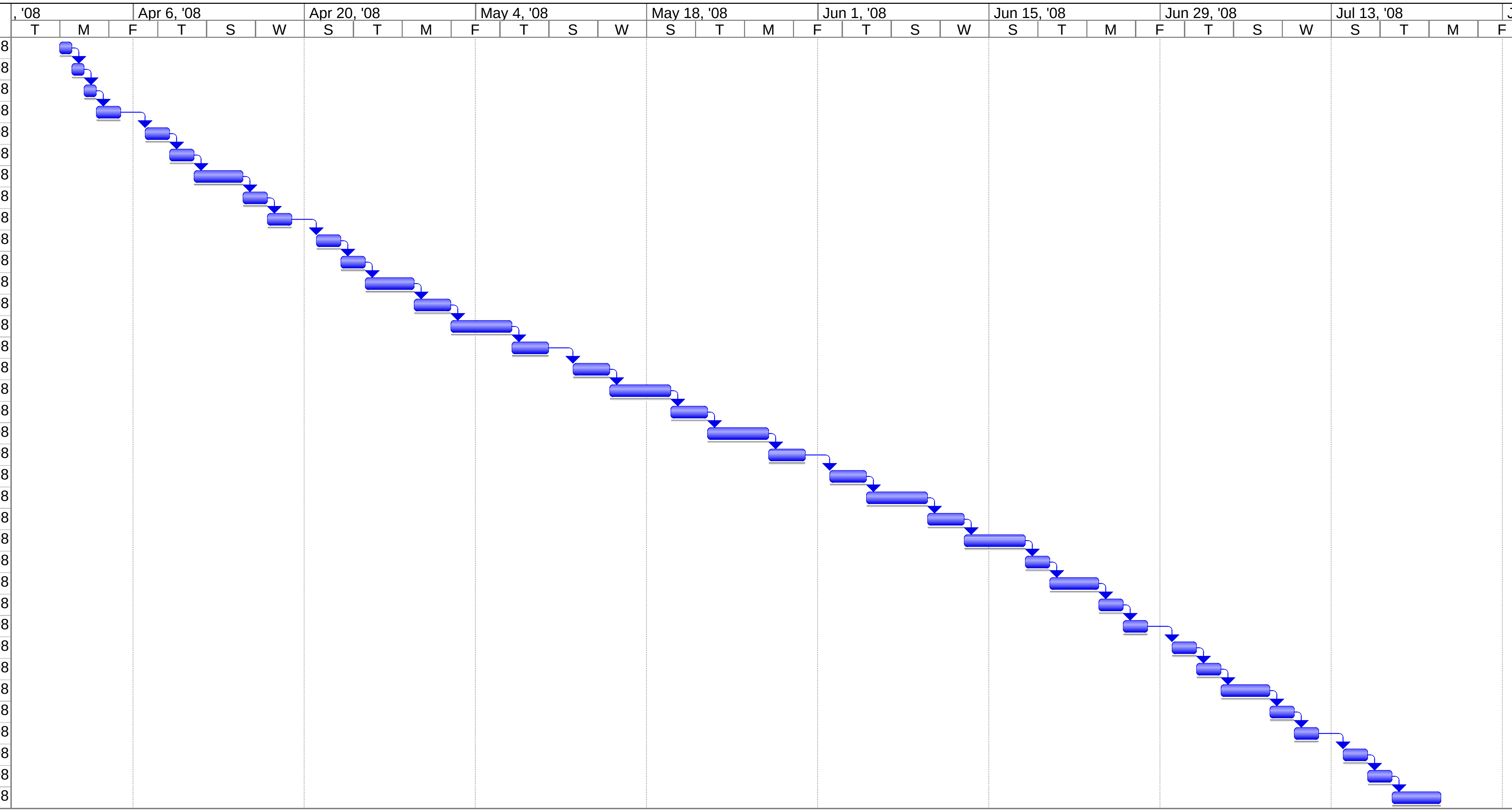
9,250 sf

Total Precast

12,432 sf

Appendix K: Detailed Precast Schedule for Floors 1-12

ID		Task Name	Duration	Start	Finish
1		Precast 1st Floor South	1 day	Mon 3/31/08	Mon 3/31/08
2		Precast 2nd Floor South	1 day	Tue 4/1/08	Tue 4/1/08
3		Precast 3rd Floor South	1 day	Wed 4/2/08	Wed 4/2/08
4		Precast 4th Floor South	2 days	Thu 4/3/08	Fri 4/4/08
5		Precast 5th Floor South	2 days	Mon 4/7/08	Tue 4/8/08
6		Precast 6th Floor South	2 days	Wed 4/9/08	Thu 4/10/08
7		Precast 7th Floor South	2 days	Fri 4/11/08	Mon 4/14/08
8		Precast 8th Floor South	2 days	Tue 4/15/08	Wed 4/16/08
9		Precast 9th Floor South	2 days	Thu 4/17/08	Fri 4/18/08
10		Precast 10th Floor South	2 days	Mon 4/21/08	Tue 4/22/08
11		Precast 11th Floor South	2 days	Wed 4/23/08	Thu 4/24/08
12		Precast 12th Floor South	2 days	Fri 4/25/08	Mon 4/28/08
13		Precast 1st Floor East	3 days	Tue 4/29/08	Thu 5/1/08
14		Precast 2nd Floor East	3 days	Fri 5/2/08	Tue 5/6/08
15		Precast 3rd Floor East	3 days	Wed 5/7/08	Fri 5/9/08
16		Precast 4th Floor East	3 days	Mon 5/12/08	Wed 5/14/08
17		Precast 5th Floor East	3 days	Thu 5/15/08	Mon 5/19/08
18		Precast 6th Floor East	3 days	Tue 5/20/08	Thu 5/22/08
19		Precast 7th Floor East	3 days	Fri 5/23/08	Tue 5/27/08
20		Precast 8th Floor East	3 days	Wed 5/28/08	Fri 5/30/08
21		Precast 9th Floor East	3 days	Mon 6/2/08	Wed 6/4/08
22		Precast 10th Floor East	3 days	Thu 6/5/08	Mon 6/9/08
23		Precast 11th Floor East	3 days	Tue 6/10/08	Thu 6/12/08
24		Precast 12th Floor East	3 days	Fri 6/13/08	Tue 6/17/08
25		Precast 1st Floor North	2 days	Wed 6/18/08	Thu 6/19/08
26		Precast 2nd Floor North	2 days	Fri 6/20/08	Mon 6/23/08
27		Precast 3rd Floor North	2 days	Tue 6/24/08	Wed 6/25/08
28		Precast 4th Floor North	2 days	Thu 6/26/08	Fri 6/27/08
29		Precast 5th Floor North	2 days	Mon 6/30/08	Tue 7/1/08
30		Precast 6th Floor North	2 days	Wed 7/2/08	Thu 7/3/08
31		Precast 7th Floor North	2 days	Fri 7/4/08	Mon 7/7/08
32		Precast 8th Floor North	2 days	Tue 7/8/08	Wed 7/9/08
33		Precast 9th Floor North	2 days	Thu 7/10/08	Fri 7/11/08
34		Precast 10th Floor North	2 days	Mon 7/14/08	Tue 7/15/08
35		Precast 11th Floor North	2 days	Wed 7/16/08	Thu 7/17/08
36		Precast 12th Floor North	2 days	Fri 7/18/08	Mon 7/21/08



Project: Precast Schedule Floors 1-12
Date: Tue 4/6/10

Task		Progress		Summary		External Tasks		Deadline	
Split		Milestone		Project Summary		External Milestone			

Appendix L: R.S. Means Table (Precast)

03 41 Precast Structural Concrete

03 41 33 – Precast Structural Pretensioned Concrete

03 41 33.60 Tees		Crew	Daily Output	Labor-Hours	Unit	2010 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
2350	20" x 8' wide, 40' span	C-11	18	4	Ea.	1,975	184	111	2,270	2,625
2400	24" x 8' wide, 50' span		16	4.500		2,650	207	125	2,982	3,400
2450	32" x 10' wide, 60' span	↓	14	5.143	↓	4,625	236	143	5,004	5,675

03 41 36 – Precast Structural Post-Tensioned Concrete

03 41 36.50 Post-Tensioned Jobs		Crew	Daily Output	Labor-Hours	Unit	Material	Labor	Equipment	Total	Total Incl O&P
0010	**POST-TENSIONED JOBS**									
0100	Post-tensioned in place, small job	C-17B	8.50	9.647	C.Y.	1,175	415	47	1,637	2,025
0200	Large job	"	10	8.200	"	885	355	40	1,280	1,600

03 45 Precast Architectural Concrete

03 45 13 – Faced Architectural Precast Concrete

03 45 13.50 Precast Wall Panels		Crew	Daily Output	Labor-Hours	Unit	Material	Labor	Equipment	Total	Total Incl O&P
0010	**PRECAST WALL PANELS**									
0050	Uninsulated 4" thick, smooth gray									
0150	Low rise, 4' x 8' x 4" thick	C-11	320	.225	S.F.	20.50	10.35	6.25	37.10	48
0210	8' x 8', 4" thick		576	.125		20	5.75	3.48	29.23	36
0250	8' x 16' x 4" thick		1024	.070		19.95	3.23	1.96	25.14	30
0600	High rise, 4' x 8' x 4" thick		288	.250		20.50	11.45	6.95	38.90	50.50
0650	8' x 8' x 4" thick		512	.141		20	6.45	3.91	30.36	38
0700	8' x 16' x 4" thick		768	.094		19.95	4.30	2.61	26.86	32.50
0750	20' x 10', 6" thick, smooth gray	↓	1400	.051		31	2.36	1.43	34.79	40
0800	Insulated panel, 2" polystyrene, add					1.04			1.04	1.14
0850	2" urethane, add					.84			.84	.92
1200	Finishes, white, add					2.73			2.73	3.01
1250	Exposed aggregate, add					1.69			1.69	1.86
1300	Granite faced, domestic, add				↓	28.50			28.50	31.50
2200	Fiberglass reinforced cement with urethane core									
2210	R20, 8' x 8', minimum	E-2	750	.075	S.F.	21	3.41	2.14	26.55	31.50
2220	Maximum	"	600	.093	"	31.50	4.26	2.68	38.44	45

03 47 Site-Cast Concrete

03 47 13 – Tilt-Up Concrete

03 47 13.50 Tilt-Up Wall Panels		Crew	Daily Output	Labor-Hours	Unit	Material	Labor	Equipment	Total	Total Incl O&P
0010	**TILT-UP WALL PANELS**									
0015	Wall panel construction, walls only, 5-1/2" thick	C-14	1600	.090	S.F.	6.80	3.66	.97	11.43	14.50
0100	7-1/2" thick		1550	.093		7.95	3.78	1	12.73	16.05
0500	Walls and columns, 5-1/2" thick walls, 12" x 12" columns		1565	.092		10.25	3.75	.99	14.99	18.50
0550	7-1/2" thick wall, 12" x 12" columns		1370	.105	↓	11.80	4.28	1.13	17.21	21
0800	Columns only, site precast, minimum		200	.720	L.F.	16.65	29.50	7.75	53.90	75
0850	Maximum	↓	105	1.371	"	19.30	56	14.70	90	129

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