The Pennsylvania State University
5th Year thesis

Technical Assignment One

Construction Project Management

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Executive Summary

This Technical Assignment takes an in depth look at the existing conditions for the project 2175 K Street NW, Washington D.C. Numerous key aspects of construction management were explored; including the project schedule, the building systems, the project cost, the existing conditions and existing utilities, the local conditions, the client, the project delivery method, and the staffing plan.

Minshall Stewart Properties purchased the building and due to the availability of transfer development rights, decided the building could benefit from a renovation/expansion. More importantly, the dollars just seemed to make sense to embark on this project. The project entails taking an existing eight story structural concrete building with three levels of below grade parking and adds three new levels on top with a new penthouse constructed with structural steel. For the existing structure to be able to carry the newly imposed loads, several columns needed to be reinforced with steel jackets or carbon fiber. Additionally, the existing foundation needed to be expanded.

The project has its challenges, as do all projects. For this project, the schedule was quite challenging. This was caused by the building remaining occupied throughout construction. To make matters worse, the existing bank of three elevators cars had to receive a facelift and the shaft needed to be extended to service the three new stories that were to be constructed. The preconstruction on the project started on 2 February 2007 and construction activities started on 1 August 2008. The substantial completion dates are 20 November 2009 and 4 March 2010. The dual substantial completion is based upon the turnover of elevator #2 and elevator #3 respectively. The project is to enter the closeout phase on 14 December 2009 and is to wrap up by 11 March 2010.

The total project cost, as of 15 May 2007, was determined to be $14,122,431. This work out to be $419.18 per square foot based upon the proposed new construction area. This number is much higher than typical projects of the same nature because the façade of the existing building is to be updated at the same time as the façade is being installed on the new levels. If the total project cost is compared to the total area of the building, it comes down to $78.58. Similarly, the construction cost was determined to be $11,109,461 with a construction cost per square foot of $392.75 when compared to new area and $61.81 when compared to the total area.

This project, being as it is a renovation project, uses all the existing utilities with no new ones being added. The project delivery method for this project is construction manager with a general contractor. Davis construction is serving as the GC with Appian Realty Advisors overseeing construction.

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A. Project Schedule

The design phase was started in June of 2006 with the preconstruction starting on 2 February 2007. The site is an existing eight story office building located near the intersection between K Street and 22nd Street in the northwest part of Washington, DC. The owner, Minshall Stewart Properties decided to renovate this building while adding three levels to the existing eight for a total of eleven stories. Through Transfer Development Rights, the owner is applying for a variance to their existing certificate of occupancy thereby not required to apply for a new one for the additional three floors.

During the preconstruction phase of the project, in an effort to accelerate the project, the more complex or first systems to be installed were handled separately from the balance of the trades. The two long lead activities were determined to be curtainwall shop drawings and structural steel mill order and shop drawings. All the other trades were given a later notice to proceed by the owner. This can be seen on the summary schedule located in Appendix A. To properly describe the various notices to proceeds, a range was given which encompasses all NTP's for the project.

Work on the project started on 1 August 2008 with the mobilization and the construction of covered walkways and other safety measures. Next to follow was the minor excavation and expansion of a few footers under parking level three.

The new structure for the three additional floors was started on 9 December 2009, first with the structural steel and followed by the composite metal decking with lightweight concrete. On the schedule located in Appendix A, the concrete activity is shown starting before the steel. This is to represent the concrete used in the foundation expansion.

Next in the sequence was the façade and roof. Again, the summary schedule is misleading; showing the façade starting before the structural steel but this is because there was some façade work included in the project scope that dealt with the façade renovation of the existing building. Next is the penthouse which will be installed once the steel for the roof is installed including the concrete pad it will sit on. The rest of the roof on the eleventh floor is supported by roof deck.

On this project the proper phasing of the elevator rise-up and modernization was critical. Seeing as how this project involves an existing occupied building, two of the three elevators had to remain in service at all times. This is shown on the summary schedule with each elevator following the previous with a finish to start relationship. Another impact the elevators had on the schedule was because work on them could not be started until the new elevation machine room was dry.

Part way through the first elevator modernization, the general contractor will enter the first floor space to complete the necessary renovation on this level. Wrapping up construction is the core work on levels two through seven, followed by project completion which included demobilization and project closeout.

B. Building Systems Summary

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

Table B.1 Building Systems Summary

Demolition

The nature of this project is an occupied renovation. The demolition portion of this project consists of selective demolition on the two parking levels, the cellar level, the ground level, the cores of levels two through seven, level eight, and Roof and Penthouse level. Most of the materials involved with these areas consisted of drywall, light gauge metal framing, electrical conduit, lighting fixtures, and ceiling tile and track.

Going into a little more detail, the demolition work on parking level three consisted of removing the old generator and fuel oil tank, the concrete pad beneath the previously mentioned equipment, and the chain-link fence used to surround the generator and tank.

On the ground floor, the project scope contains the renovation of the space occupied by Starbucks Coffee. In addition, the building lobby is to receive a makeover. In general, the majority of the demolition is the removal of interior walls.

Moving onto another place of interest, on levels two thru seven, the demolition consists of the removal of the toilets and toilet partitions, the partition support steel, the vanities along with the supporting steel, the ceiling tiles and track, lighting fixtures, and the floor tile. The support steel for the vanities and the partitions will be reused in the new construction but the rest is to be scrapped.

On levels eight, the demolition is quite extensive leaving only the structural concrete, elevator shaft, and façade intact.

With regards to the roof and penthouse demolition, the work consisted of maintaining operation of the existing cooling tower and mechanical equipment until the new penthouse was completed.

The existing building was built in 1981 and because of this, there was no lead paint or asbestos abatement necessary.

Structural Steel Frame

This project involves the addition of three levels of structural steel with lightweight slab on deck construction. Levels ten and eleven structural slab is to be 3 ¼" lightweight concrete over 2" deep by 18 gage galvanized composite metal deck measuring a total of 5 ¼" reinforced with 6x6 –W2.0 x W2.0 welded wire fabric. The typical bay size is 23'-3" by 36'-8". To achieve these spans, composite beams were utilized. The crane used to erect the steel and pour the concrete slabs was placed where a future elevator and grand staircase was to be installed. This elevator was to only service levels eight thru eleven. Due to the constraints imposed by the limited space on site, the crane was placed atop four columns on the existing roof. Concrete piers were poured to create the foundation on which the crane was placed. Carbon fiber and/or steel jackets were used to allow the column to carry the new load imposed by the crane and the material lifted by it. The crane used was a 2 ton tower crane.

Cast in Place Concrete

There was limited cast in place concrete on this job. It was limited to the lightweight slab on deck, equipment pads, and the minor expansion of several of the exiting footers. The foundation of the existing building consists of 48" x 48" x 24" footers, where several underwent minor expansions as previously mentioned to support the new loads imposed by the additional structure above. The existing building consists of cast in place concrete where several columns received carbon fiber or steel jackets to help them carry the newly imposed load from the new construction. Where there was new cast in place concrete, edge angle was used to create the edge of slab and wood formwork for the equipment pads. The concrete used for the lightweight slab on composite metal deck was 3,000psi (110 PCF) and the concrete used in the above mentioned concrete piers was 4,000psi (145 PCF). Where the footings needed expanding, 3,000psi (145 PCF) concrete was used.

Mechanical System

The primary mechanical room for this project is located on the penthouse level. Located there is one 1,200 GPM 350 ton induced draft cooling tower which serves eleven self-contained packaged water cooled units throughout the building. Each of the self-contained units on levels nine, ten, and eleven contain a 14,000 CFM fan with an incoming air temperature ranging between 65° and 80°F and a returning air temperature of 53°F with respect to cooling. Each SCU is rated for 35 tons of cooling. On the other hand, with respect to heating, electrical resistant heating coils operated on 3-phase 208V power were used. The previously mentioned self-contained units service the tenant spaces whereas a closed loop system with VAV's was used in the building core.

The fire-suppression system combined sprinkler/standpipe system. In areas affected by freezing conditions, a dry system was used. Such a location included a portion of the loading dock. In all other areas, a wet system with heat sensitive sprinkler heads was used.

Electrical System

The main service feeders for the building enter from the Pepco transformer vaults on K Street at the cellar level. Due to the nature of the project, the Pepco vaults were not touched and therefore the size and type of transformers held within is unknown. The electrical service for the new construction enters at 2,000A and is distributed on a 208Y/120V system. To handle the new electrical load, a new switchgear along with two 2,000A distribution panels were added. The emergency power is supplied by a 250 KW 208Y/120V diesel generator.

Masonry

The masonry used on this project was only a veneer. Red clay brick was used on the North façade facing the neighboring apartment buildings from level nine thru the roof. Incorporated into the brick façade is one punch window on each floor with three punch windows in total. To assist in the placement of the brick, scaffolding was erected on the eight floor roof and extended up to the eleventh floor roof. Where the roof on the ninth floor was not present, swing stages were utilized in the placement of the brick. The brick dead loads at each level and is then carried by a piece of angle iron attached to the structure. To prevent lateral movement in and out of the plane of the wall, brick ties were used every couple of brick courses.

Curtain Wall System

There are several types of systems that make up the building façade. As mentioned above, masonry was used on the north façade while a curtain wall system was used on the south and west façade and ribbon windows were used on the east façade. The curtain wall system used on the south and west facades is a unitized system comprised of aluminum framing and exterior glazed glass panels. Each unit is one story in height and four feet in width. On the southwest corner of the building, due to its prominent location, a separate type of curtain wall system was used. This stick built system is three units wide and spans the total height of the building starting on level two and extending up to the roof. Accent Metal Services was responsible for the design and Harmon was responsible for the installation.

Support of Excavation

There was very limited excavation on this project because it was an existing building before the project started and the building was to remain in use throughout construction. The only excavation needed was to expand a number of the footings below parking level two. This excavation did not require any support because the footers are on bedrock and the expansion only adjusted the width in the x-y plane. The height of the footer was not adjusted therefore underpinning was not required either.

LEED Requirements

When the owner first approached the design team with the desire to put this project into the works, they had no intention of pursuing any LEED certification. Approximately one year into the construction phase of the project, the owner came to one of the owners meetings and started tossing around the idea of going for a LEED certification. Due to the public desire to rent “green”

space, the owner decided to move ahead with LEED in mind. Due to the nature of the project and the point at which they expressed an interest, LEED in the traditional terms was not an option. The architect mentioned the possibility of achieving LEED EB (LEED for Existing Buildings). The owner, based upon a suggestion from the architect, decided to contract a third party consultant to conduct a LEED feasibility study and they would go from there.

Even though LEED was never an end goal, the design team did incorporate a few LEED strategies into their design. First, the solar shades on the façade of the building could provide passive solar shading and thereby reduce the thermal gain and consequently reduce the mechanical load on the building during the summer months. The other distinct green feature was the green roof that covers the roof on the ninth floor. Because the green roof is not the primary roof system, the area it covers is rather small, only approximately 12% of the total roof surface.

C. Project Cost Evaluation

The various costs associated with this project are skewed because the new construction only consists of adding three stories to the existing building while the work being done on the façade and other aspects of the project encompass the entire building. Below in Table C.1 is a summary of the various costs associated with this project. Four key prices to note in the upper table is the total construction cost, total construction cost per square foot, total building cost (also known as total project cost), and total building cost per square foot. These values are $11,109,461, $329.75 (when compared to new square footage) or $61.81 (when compared to gross square footage), $14,122,431, $419.18 (new square footage) or $78.58 (gross square footage) respectively.

Also found in the below table is a summary of the cost associated with a few of the major building systems and the breakdown of the costs per square foot. A more detailed spreadsheet can be found in Appendix C.1 of this document.

Summary	Cost	Cost per NSF*	Cost per TSF*	Subtotal	Cost per GSF*
Garage	$ 139,430	$ 4.14	$ 4.40	$ 139,430	$ 0.78
Office	$ 10,970,031	$ 325.61	$ 74.08	$ 10,970,031	$ 61.04
Total Construction Cost	$ 11,109,461	$ 329.75	$ 78.49	$ 11,109,461	$ 61.81
Total Building Cost	$ 14,122,431	$ 419.18	$ 78.58	$ 14,122,431	$ 78.58

Building System Summary	Cost	Cost per NSF*	Cost per TSF*	Subtotal	Cost per GSF*
Mechanical	$ 1,523,053	$ 45.21	$ 10.29	$ 1,523,053	$ 8.47
Electrical	$ 1,152,090	$ 34.20	$ 7.78	$ 1,152,090	$ 6.41
Plumbing	$ 319,343	$ 9.48	$ 2.16	$ 319,343	$ 1.78
Concrete	$ 562,747	$ 16.70	$ 3.80	$ 562,747	$ 3.13
Structural Steel	$ 1,030,420	$ 30.58	$ 6.96	$ 1,030,420	$ 5.73
Elevator	$ 905,000	$ 26.86	$ 6.11	$ 905,000	$ 5.04
Glass & Glazing	$ 3,455,498	$ 102.56	$ 23.34	$ 3,455,498	$ 19.23

Notes:
Cost per new square footage (NSF) is a ratio of the cost with respect to new construction area
Cost per total square footage (TSF) is a ratio of the cost with respect to total area (new and existing)
Cost per gross square footage (GSF) is a ratio of the cost with respect to total building area (new/existing office and garage)

Table C.1 Project Cost Summary

D4Cost was used to estimate the construction cost on this project. It does this by referencing historical data on past projects. A project of similar type, size, and number of stories was used to generate an estimated construction cost of $5,037,356 with a cost per square foot of $149.52. To see a detailed breakdown on the results of the D4Cost analysis, see the table in Appendix C.2. There are several reasons why these numbers differ from the actual project numbers. First, D4Cost did not have any data on a past project that consisted of an office building undergoing similar construction activities. Additionally, with respect to Glass & Glazing, the software assumes the façade scope of work only deals with the new construction whereas the project scope includes new and existing façade. This same situation also applies to various other systems; including a new lobby, new storefront, new mechanical, new electric etc. With respect to the mechanical, electrical, plumbing, and fire protection, the new systems service the entire building therefore are more expensive than if they only serviced the three new floors. Additionally, some of these systems required some updating to the existing system.

RS Means Costworks was also used to produce a square foot estimate for this project. RS Means Costworks does not have the option that matches the project type of 2175 K Street. To get a reasonable number, an estimate for an eleven story office building was computed as well as a seven story office building. This was done because the difference between these two estimates matches the project type more closely. This approach will not produce an accurate estimate but it's at least point of reference. The resulting total construction cost was determined to be $5,744,500 which computes to $124.99 per square foot. These numbers fall short when compared to the same values

discussed above. The same reasoning for the difference in prices from the D4Cost analysis applies to this scenario as well.

D. Site Plan of Existing Conditions

The site of this project is located on the north side of K Street at 22nd Street and Washington Circle. The building neighbors consist of a residential building to the north, a commercial building to the east, K Street to the south, and 22nd Street to the West. There is a small alleyway between this building and the commercial building to the east. This alleyway had to remain open throughout the project because it provides access from K Street to several neighboring building's loading docks.

As required by DC code, both sidewalks along K Street and 22nd Street must be protected from falling debris at all times. To provide for staging/storage area, along both streets, one lane was requisitioned. One challenging aspect to security and safety was the drive-up entrance to the residential building to the north. Special attention to safety was needed when working on the north or northwest corner of the building to prevent or catch falling debris. To do this, a netting system with outriggers was used.

Another challenge dealing with overhead protection was encountered when ensuring safe passage entering and exiting Starbucks Coffee on the ground floor. On the plus side, the overhead protection needed in this location provided a working platform to use in conjunction with the installation of the southwest corner curtain wall system.

The man/material hoist was strategically placed in a location that was complimented by an area most suited for deliveries. This location was on the west side of the elevation bordered by 22nd Street.

Due to the nature of this project, the use of temporary utilities was limited to temporary electric which was feed by the existing building electric until the new switchgear and supporting equipment were in place.

For more information, please reference Appendix D. Located in Appendix D.1 is a set of maps to help locate the project site in Washington, DC. Additionally, in Appendix D.2 and D.3 are graphical representations of what was stated above as well as much more information.

E. Local Conditions

In the Washington, D.C. area, the preferred structure has been post-tensioned concrete with unbonded tendons. This has been the preferred structure for several reason all dealing with the height restrictions in D.C. One of the benefits associated with concrete is lower floor-to-floor height which allows a building to remain under the height restriction while having a greater number of

stories. In addition, concrete is better suited for congested sites because there is less space required for supporting activities. For example there is less space needed by the concrete truck in comparison to the larger amount of space needed for steel shakeout. Another benefit to concrete with respect to the D.C. area is the labor cost. In the D.C. area, the labor costs are less because the frequency of which concrete construction is used.

Generally, the soil conditions in D.C. are less than spectacular. This is because the area used to be a swamp before it was developed into what it is today. Because the soil tends to be very poor, deep construction is rare and most projects only go at most four stories below grade. On the 2175 K Street site, the subsurface conditions are primarily silty fines that extend down to a depth of 35 feet. A thin layer of weathered bedrock was encountered from a depth of 34 feet to approximately 36 feet and was followed by bedrock at a depth of 46 feet. The depth of the bedrock varied from the two test borings by approximately 20 feet. Additionally, found in the geotechnical report, the ground water was determined to be approximately 27 feet below grade.

Parking in the D.C. metro area is very limited for construction workers and commuters alike. The primary source of parking was the parking structure under the existing building, much of which was needed for tenant use. To aid in the parking situation, one of the D.C. metro rails is only five blocks from the site. For the most part, the owner was able to provide limited parking for use by the construction workers but this came with a daily parking fee.

Recycling on the project was not incorporated. This is because when starting the project, the owner had no intentions of perusing a LEED certification. On the other hand, for the tenant fit-out portion of the building, the owner is pursuing a LEED certification and therefore recycling is strictly enforced. The tenant fit-out is being performed outside Davis' contract with the owner by another general contractor.

Because recycling was not required, the project used comingled dumpsters and emptied them approximately once per week, depending upon the type of construction taking place during that particular time frame. These dumpster typically cost around $350 per pickup.

F. Client Information

The owner of the project is Minshall Stewart Properties. From their offices in Washington, DC, Columbus, OH and Jackson, WY they use a market-based approach to purchase real estate assets in the localities they know best. They identify assets that can be positioned to earn extraordinary returns for both them and their partner companies. Taking a step back, Minshall Stewart Properties, as they are known today, was started in 1989. Before that year they were know by the name Minshall Development Company. Since then, they have strived to make opportunistic and long term investments in high quality commercial and multi-family real estate. To do this they call upon a variety of acquisition strategies including all equity, leveraged, and tax advantaged structures. They

claim to target assets that fit the requirements of their institutional capital providers. Based upon research on their website, they have experience in the following types of assets:

- Vacant and underperforming assets
- Debt secured by real estate assets
- Partnership and leasehold interests
- Controlling interests in corporation that own real estate assets
- Credit leased properties

Their real estate professionals have a long and successful history of working together. The team's experience encompasses all aspects of real estate investment and management. This includes acquisition, financing, disposition, leasing, and construction management of a broad range of real estate product types in geographic regions across the country.

The owner decided to renovate and add three levels because after purchasing the building, they decided the dollars just made sense to commit to the project. This was primarily due to the transfer development rights which allowed Minshall Stewart Properties to add levels to the building as mentioned above. They also decided this would be a good time to renovate the existing eight levels as to impose the least amount of incontinence on the tenants or at least not at two different times.

With respect to this project, the schedule was very important. More specifically, the phasing of the elevator rise-up and modernization was crucial. This is due to the requirement by the owner to maintain an operational building throughout construction. This task proved difficult to achieve because one of the two elevators that were to remain in service while the one was down for construction kept having problems. One of the most common problems was it would get stuck on the B1 level and never respond to the call buttons on the other floors.

Additionally, sequencing the project in a way to minimize tenant disturbance was important. With respect to the tenant's outlook on the construction process, Davis was to intermittently work where the tenants could see the working being done as to show them the benefits that were resulting from the construction process should they start to get annoyed with the disturbances associated with construction.

Finally, with regards to sequencing, the owner expected Davis to complete the project in a timely manner as to allow for the tenant construction to begin and subsequently allow the new and returning tenants to move in.

Safety was of utmost importance to the owner, both the safety of their tenants and of the construction working performing the work.

G. *Project Delivery System*

The project delivery system selected by the owner to use for this project is a construction manager with general contractor (CM with GC). The owner selected this delivery method as to not carry any of the risk themselves and have the general contractor carry this burden. To assist in the checks and balances, the owner decided to incorporate a construction manager into the organizational structure of the project. In the below figure, figure G.1, a detailed breakdown of the project team organizations chart is depicted. Davis construction does not generally prefer this delivery method. Davis construction typically prefers general contractor at risk (also known as CM @ Risk) in which they act as the construction manager and general contractor. One reason for this preference is Davis tends to do a great deal of negotiated work which is easier if they hold the only contract with respect to the construction activities.

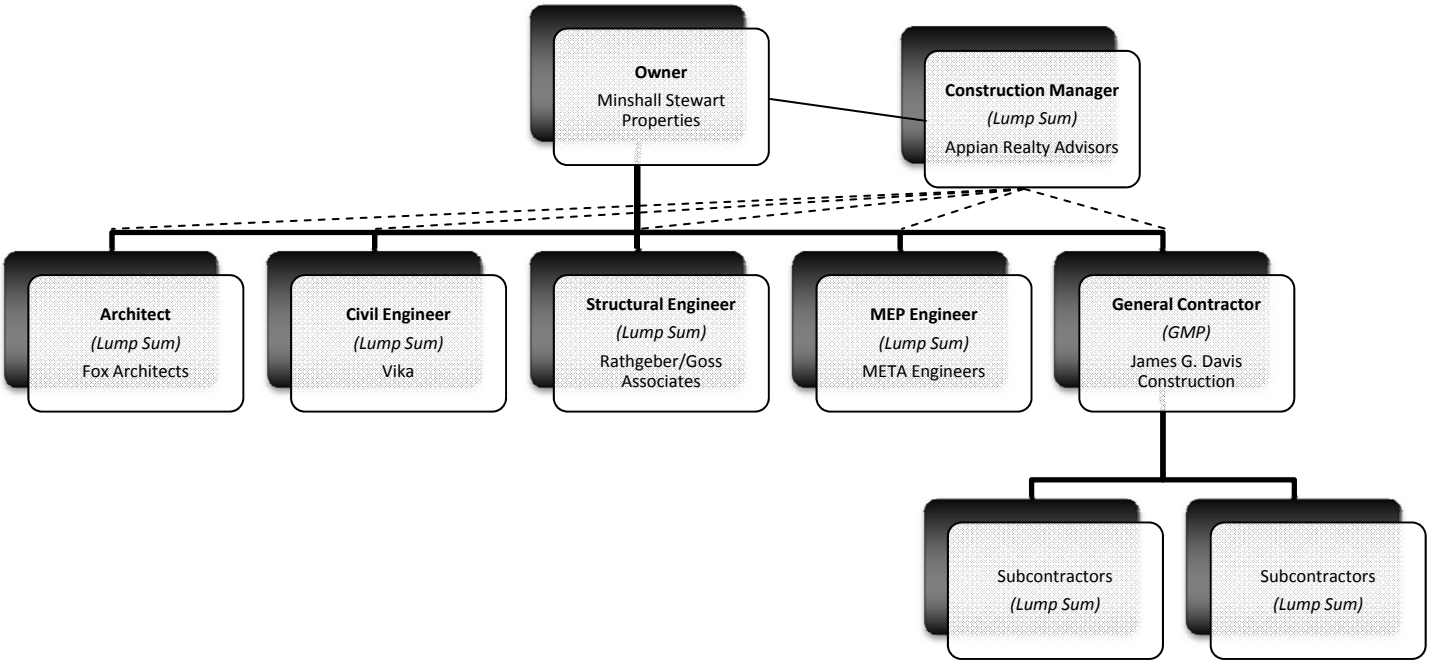


Figure G.1 Project Organizational Chart

Minshall Stewart Properties holds contracts with the architect, the civil engineer, the structural engineer, the MEP engineer, and the general contractor. They also hold a contract with the construction manager who will provide construction guidance and advice. As shown in the above organizational chart, the owner holds a lump sum contract with all parties except they hold a GMP contract with Davis. They decided to use a GMP contract with Davis to add a layer of detail. The terms of the contract state that Davis must provide back-up for work in place along with the payment applications. This would not be required with a lump sum contract where in that case, the owner only sees a line item with respect to payment. The GMP contract has a higher level of inherent detail.

The lump sum contract held with the construction manager is based upon an agreed percent of the project construction cost. This contractual agreement leaves a little to be desired. If the construction manager is to proved construction assistance or advice and their profit is based upon project cost, they are less likely to point out cost saving opportunities because this would lower the project cost and therefore decrease their profit. Language in the contract should be incorporated to help prevent this scenario.

On this project and typically on most Davis projects, Davis bonds the project at approximately 1.5% of the contract value. In addition, Davis requires insurance from all subcontractors with contracts of $250,000 or more.

The major subcontractors are as follows:

Glass & Glazing: Harmon, Inc.
Electrical: Chesapeake Electrical Systems
Mechanical: Welch & Rushe, Inc.
Structural Steel: Southern Iron Works, Inc.
Elevators: ThyssenKrupp Elevator Corporation
Demolition: Aceco, LLC
Drywall: Davis Construction Corporation
Concrete: Brothers Concrete Construction, Inc.
Masonry: Genco Masonry, Inc.

H. Staffing Plan

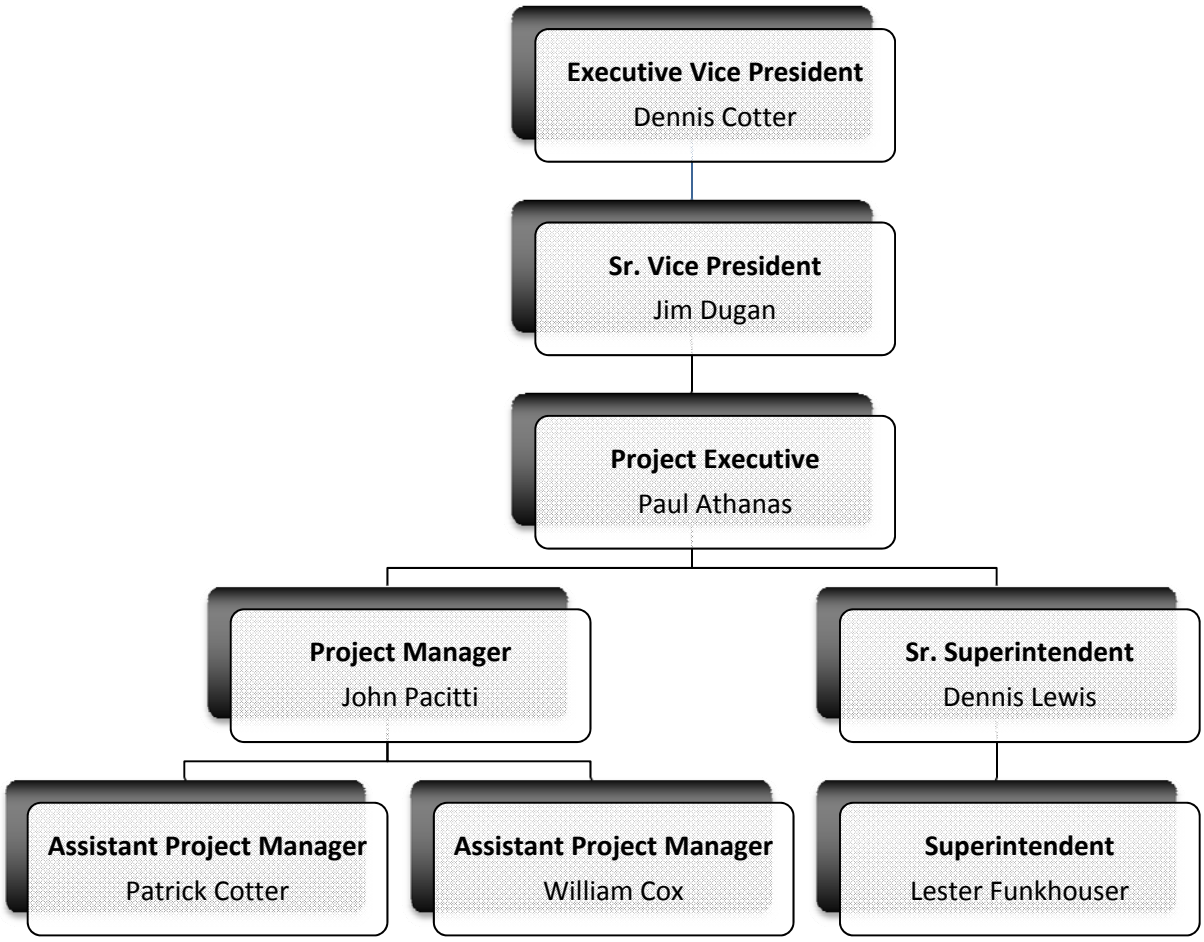
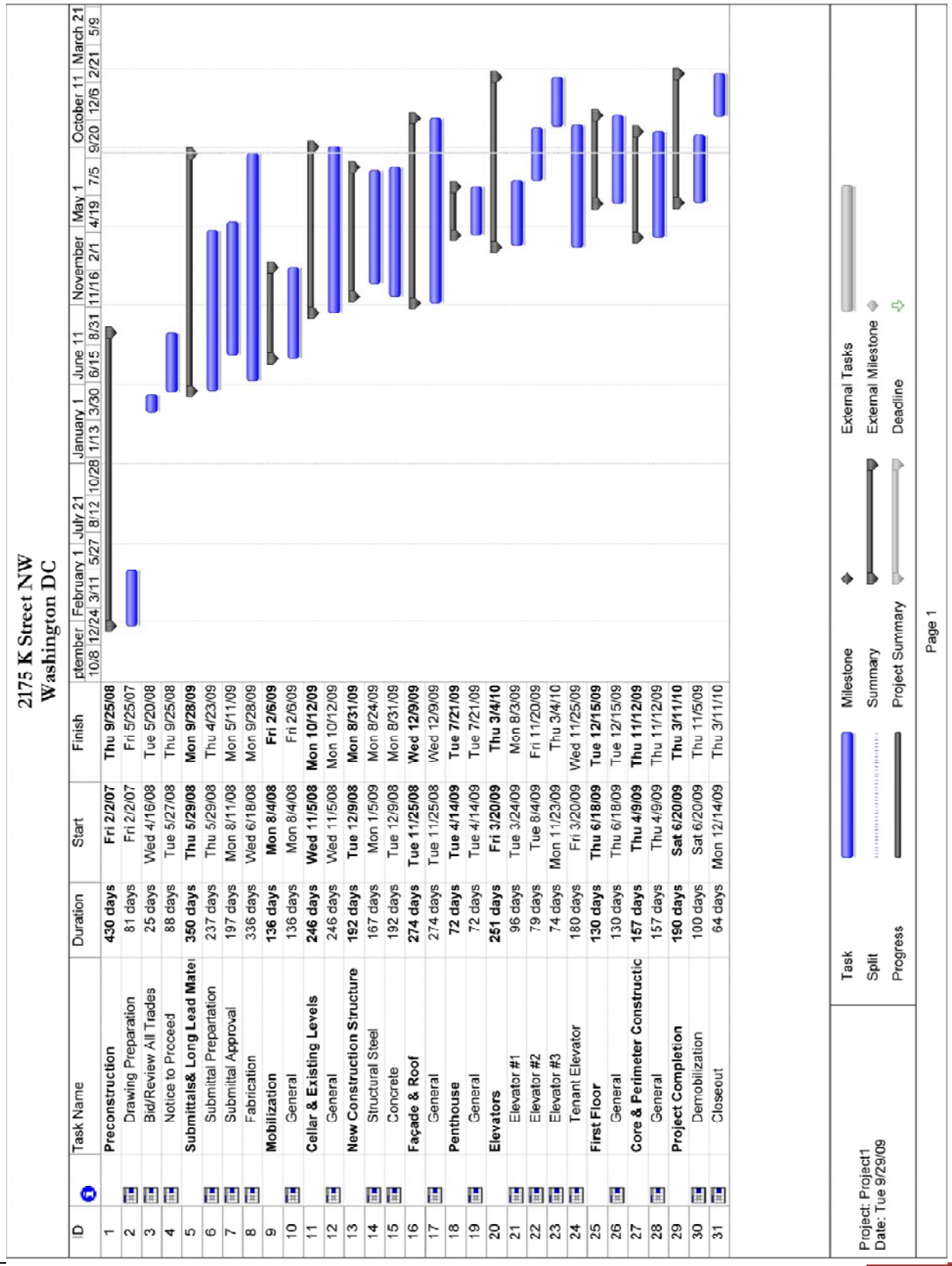


Figure H.1 Project Management and Supervision Staff Organizational Chart

James G. Davis Construction is structured in a way where each group focuses on a type of construction or a market and overseeing several groups is an executive vice president. In the case of group Dugan, Dennis Cotter is the executive vice president. Continuing down the hierarchy, overseeing each group is a vice president. The group outlined above is within group Dugan with Jim Dugan in charge. Each group can have several project executives within it. There are typically two or three project executives under each vice president. In this group the project executive position is filled by Paul Athanas. Typically, each project has one project manager. In the case of larger jobs the role of project manager might involve several people with varying responsibilities. On this project the project manager is John Pacitti. Under the project manager is two assistant project managers Patrick Cotter and William Cox. Like many of the roles within the group the number of assistant project managers varies, sometimes the number changes at different points within the duration of the job. On the field supervision side of the group there is the senior superintendent Dennis Lewis who is responsible for the workings of the project outside the office. Under the senior

superintendent, we have a superintendent. This is not the typical field support tree. On this job, since Davis is a general contractor and is self-performing the drywall on the job, we have a full time superintendent managing this portion of the work. Lester Funkhouser has a separate team that reports to him but he still reports to Dennis at the end of the day. Not shown on the above organizational chart, due to space, there was an assistant superintendent whose primary role was to manage the workers performing the drywall.

Appendix A – Project Schedule



ID	Task Name	Duration	Start	Finish
1	**Preconstruction**	**430 days**	**Fri 2/2/07**	**Thu 9/25/08**
2	Drawing Preparation	81 days	Fri 2/2/07	Fri 5/25/07
3	Bid/Review All Trades	25 days	Wed 4/16/08	Tue 5/20/08
4	Notice to Proceed	88 days	Tue 5/27/08	Thu 9/25/08
5	**Submittals& Long Lead Mate**	**350 days**	**Thu 5/29/08**	**Mon 9/28/09**
6	Submittal Prepartation	237 days	Thu 5/29/08	Thu 4/23/09
7	Submittal Approval	197 days	Mon 8/11/08	Mon 5/11/09
8	Fabrication	336 days	Wed 6/18/08	Mon 9/28/09
9	**Mobilization**	**136 days**	**Mon 8/4/08**	**Fri 2/6/09**
10	General	136 days	Mon 8/4/08	Fri 2/6/09
11	**Cellar & Existing Levels**	**246 days**	**Wed 11/5/08**	**Mon 10/12/09**
12	General	246 days	Wed 11/5/08	Mon 10/12/09
13	**New Construction Structure**	**192 days**	**Tue 12/9/08**	**Mon 8/31/09**
14	Structural Steel	167 days	Mon 1/5/09	Mon 8/24/09
15	Concrete	192 days	Tue 12/9/08	Mon 8/31/09
16	**Façade & Roof**	**274 days**	**Tue 11/25/08**	**Wed 12/9/09**
17	General	274 days	Tue 11/25/08	Wed 12/9/09
18	**Penthouse**	**72 days**	**Tue 4/14/09**	**Tue 7/21/09**
19	General	72 days	Tue 4/14/09	Tue 7/21/09
20	**Elevators**	**251 days**	**Fri 3/20/09**	**Thu 3/4/10**
21	Elevator #1	96 days	Tue 3/24/09	Mon 8/3/09
22	Elevator #2	79 days	Tue 8/4/09	Fri 11/20/09
23	Elevator #3	74 days	Mon 11/23/09	Thu 3/4/10
24	Tenant Elevator	180 days	Fri 3/20/09	Wed 11/25/09
25	**First Floor**	**130 days**	**Thu 6/18/09**	**Tue 12/15/09**
26	General	130 days	Thu 6/18/09	Tue 12/15/09
27	**Core & Perimeter Constructic**	**157 days**	**Thu 4/9/09**	**Thu 11/12/09**
28	General	157 days	Thu 4/9/09	Thu 11/12/09
29	**Project Completion**	**190 days**	**Sat 6/20/09**	**Thu 3/11/10**
30	Demobilization	100 days	Sat 6/20/09	Thu 11/5/09
31	Closeout	64 days	Mon 12/14/09	Thu 3/11/10

Appendix C.1 – Project Cost Summary

Construction Activity	Cost	Cost per NSF*	Cost per TSF*	Subtotal	Cost per GSF*
GARAGE					
Concrete Work	$ 56,600	$ 1.68	$ 1.79		
Masonry & Stone	$ 12,365	$ 0.37	$ 0.39		
Metals	$ 16,090	$ 0.48	$ 0.51		
Rough Carpentry	$ 2,301	$ 0.07	$ 0.07		
Thermal/Moisture Protection	$ 8,856	$ 0.26	$ 0.28		
Doors, Frames & Hardware	$ 1,570	$ 0.05	$ 0.05		
Glass & Glazing	$ 26,340	$ 0.78	$ 0.83		
Finishes	$ 10,349	$ 0.31	$ 0.33		
Specialties	$ 2,400	$ 0.07	$ 0.08		
Mechanical/Plumbing	$ -	$ -	$ -		
Fire Protection	$ 2,560	$ 0.08	$ 0.08		
Electrical	$ -	$ -	$ -	$ 139,430	$ 4.40
OFFICE					
Concrete	$ 506,147	$ 15.02	$ 3.42		
Precast	$ -	$ -	$ -		
Masonry	$ 322,390	$ 9.57	$ 2.18		
Stone	$ 140,770	$ 4.18	$ 0.95		
Structural Steel	$ 1,030,420	$ 30.58	$ 6.96		
Metals	$ 225,267	$ 6.69	$ 1.52		
Rough Carpentry	$ 41,900	$ 1.24	$ 0.28		
Millwork	$ 107,315	$ 3.19	$ 0.72		
Thermal/Moisture Protection	$ 160,321	$ 4.76	$ 1.08		
Canopies	$ 13,200	$ 0.39	$ 0.09		
Fireproofing	$ 85,823	$ 2.55	$ 0.58		
Doors, Frames & Hardware	$ 54,010	$ 1.60	$ 0.36		
Glass & Glazing	$ 3,429,158	$ 101.78	$ 23.16		
Drywall	$ 259,921	$ 7.71	$ 1.76		
Finishes	$ 35,830	$ 1.06	$ 0.24		
Painting	$ 179,375	$ 5.32	$ 1.21		
Specialties	$ 97,612	$ 2.90	$ 0.66		
Tower Crane	$ 298,450	$ 8.86	$ 2.02		
Elevators	$ 905,000	$ 26.86	$ 6.11		
Mechanical	$ 1,523,053	$ 45.21	$ 10.29		
Plumbing	$ 319,343	$ 9.48	$ 2.16		
Fire Protection	$ 82,638	$ 2.45	$ 0.56		
Electrical	$ 1,152,090	$ 34.20	$ 7.78	$ 10,970,031	$ 74.08
Garage	$ 139,430	$ 4.14	$ 4.40	$ 139,430	$ 0.78
Office	$ 10,970,031	$ 325.61	$ 74.08	$ 10,970,031	$ 61.04
TOTAL CONSTRUCTION COST	**$ 11,109,461**	**$ 329.75**	**$ 78.49**	**$ 11,109,461**	**$ 61.81**
SITEWORK					
Demolition	$ 249,662	$ 7.41	$ 1.69		
General Excavation	$ 12,528	$ 0.37	$ 0.08		
Dewatering	$ -	$ -	$ -		
Site Utilities	$ 5,000	$ 0.15	$ 0.03		
Site Concrete and Paving	$ 43,400	$ 1.29	$ 0.29		
Site Development	$ 324,564	$ 9.63	$ 2.19		
Landscaping	$ 1,300	$ 0.04	$ 0.01	$ 636,454	$ 3.54
General Conditions	$ 1,338,081	$ 39.72	$ 9.04		
Design/Construction Contingency	$ 300,000	$ 8.90	$ 2.03		
Selective O.T. (Allowance)	$ 100,000	$ 2.97	$ 0.68		
General Liability	$ 57,172	$ 1.70	$ 0.39		
Builders Risk Insurance	$ 38,092	$ 1.13	$ 0.26		
General Contractors Fee	$ 543,170	$ 16.12	$ 3.67		

Performance & Payment Bond	Excluded	$ -	$ -		
Escalation	By Owner	$ -	$ -	$ 2,376,516	$ 13.22
TOTAL BUILDING COSTS	**$ 14,122,431**	**$ 419.18**	**$ 78.58**	**$ 14,122,431**	**$ 78.58**

Notes:

Cost per new square footage (NSF) is a ratio of the cost with respect to new construction area

Cost per total square footage (TSF) is a ratio of the cost with respect to total area (new and existing)

Cost per gross square footage (GSF) is a ratio of the cost with respect to total building area (new/existing office and garage)

Appendix C.2 – D4Cost Summary

Div #	Division	Base Cost	%	Cost per SF	Projected
00	Bidding Requirements	$ 7,600	0.27%	$ 0.41	$ 13,742
01	General Requirements	$ 472,685	16.97%	$ 25.37	$ 854,687
03	Concrete	$ 168,007	6.03%	$ 9.02	$ 303,783
04	Masonry	$ 258,078	9.26%	$ 13.85	$ 466,646
05	Metals	$ 196,765	7.06%	$ 10.56	$ 355,782
06	Wood & Platics	$ 216,160	7.76%	$ 11.60	$ 390,851
07	Thermal & Moisture Protection	$ 116,718	4.19%	$ 6.26	$ 211,043
08	Doors & Windows	$ 114,069	5.17%	$ 7.73	$ 260,499
09	Finishes	$ 461,908	16.58%	$ 24.79	$ 835,201
10	Speialties	$ 10,984	0.39%	$ 0.59	$ 19,861
11	Equipment	$ 6,565	0.24%	$ 0.35	$ 11,870
12	Furnishings	$ 352	0.01%	$ 0.02	$ 673
14	Conveying Systems	$ 39,864	1.43%	$ 2.14	$ 72,081
15	Mechanical	$ 461,509	16.57%	$ 24.77	$ 834,480
16	Electrical	$ 224,625	8.06%	$ 12.06	$ 406,157
	TOTAL	**$ 2,755,889**	**100%**	**$ 149.52**	**$ 5,037,356**

Table C.2 D4Cost Analysis Summary

Appendix C.3 – RS Means Square Foot Cost Summary

Square Foot Cost Estimate Report

Estimate Name:	**2175 K 11 Stories**
Building Type:	**Office,11-20 Story with Double Glazed Heat Absorbing Tinted Plate Glass Panels / Steel Frame**
Location:	**WASHINGTON, DC**
Story Count:	**11**
Story Height (L.F.):	**13**
Floor Area (S.F.):	**33691**
Labor Type:	**Union**
Basement Included:	**No**
Data Release:	**Year 2009**
Cost Per Square Foot:	**$180.25**
Building Cost:	**$5,744,500**

Costs are derived from a building model with basic components.

Scope differences and market conditions can cause costs to vary significantly.

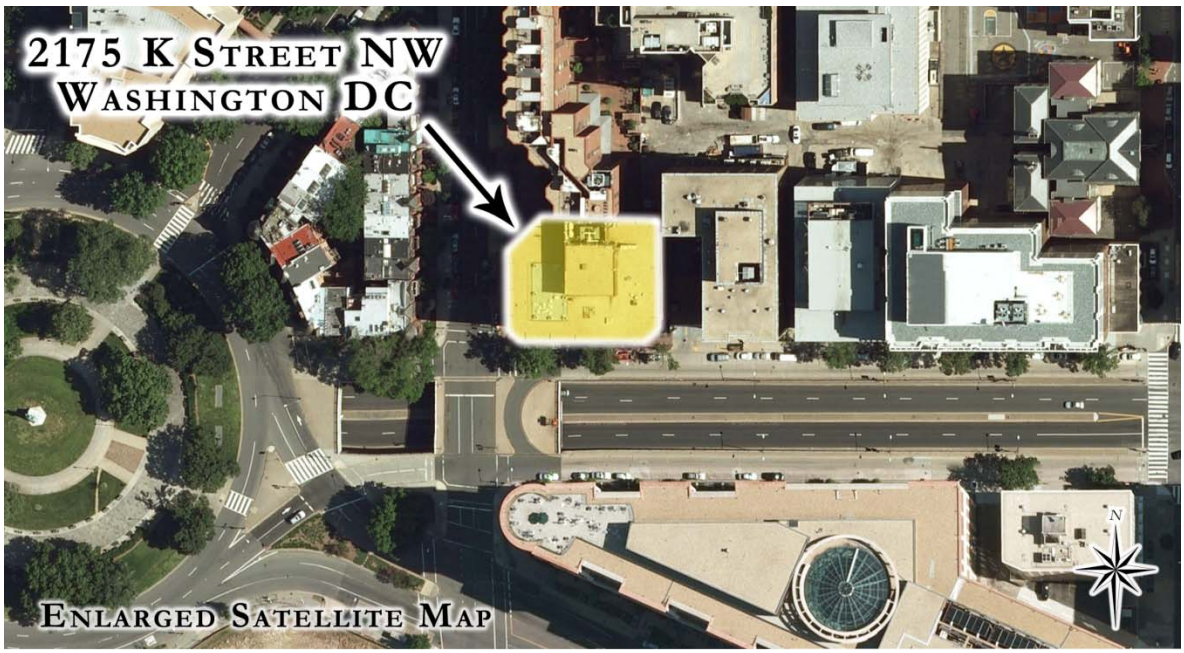
		% of Total	Cost Per S.F.	Cost
A Substructure		**5.60%**	**$9.54**	**$321,500**
A1010	**Standard Foundations**		**$0.65**	**$22,000**
	size, 900 K column			
	29"column size, 2155 K column			
A1020	**Special Foundations**		**$4.11**	**$138,500**
	Steel H piles, 50' long, 800K load, end bearing, 12 pile cluster			
	Steel H piles, 50' long, 1600K load, end bearing, 10 pile cluster			
	Grade beam, 30' span, 52" deep, 14" wide, 12 KLF load			
A1030	**Slab on Grade**		**$2.34**	**$79,000**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**$0.10**	**$3,500**
	on site storage			
A2020	**Basement Walls**		**$2.33**	**$78,500**
	12" thick			
B Shell		**44.29%**	**$75.51**	**$2,544,000**
B1010	**Floor Construction**		**$32.28**	**$1,087,500**
	Steel column, W5, 50 K, 10' unsupported length, 16 PLF			
	Steel column, W10, 200 KIPS, 16' unsupported height, 49 PLF			
	Steel column, W12, 300 KIPS, 16' unsupported height, 72 PLF			
	Steel column, W12, 400 KIPS, 16' unsupported height, 87 PLF			
	Steel column, TS14x10, 500 KIPS, 10' unsupported height, 76.07 PLF			
	Steel column, W14, 700 KIPS, 16' unsupported height, 145 PLF			
	Steel column, W14, 800 KIPS, 16' unsupported height, 159 PLF			
	Steel column, W14, 1000 KIPS, 16' unsupported height, 193 PLF			
	25'x25' bay, 20.5" total depth, 75 PSF superimposed load, 136 PSF			
	6.3 PLF			
	rating, 7.9 PLF			
	rating,10.8 PLF			
B1020	**Roof Construction**		**$4.79**	**$161,500**
	bay, 20" deep, 40 PSF superimposed load, 60 PSF total load			
B2020	**Exterior Windows**		**$35.42**	**$1,193,500**
	Glazing panel, plate glass, 1/2" thick, tempered			
B2030	**Exterior Doors**		**$0.59**	**$20,000**

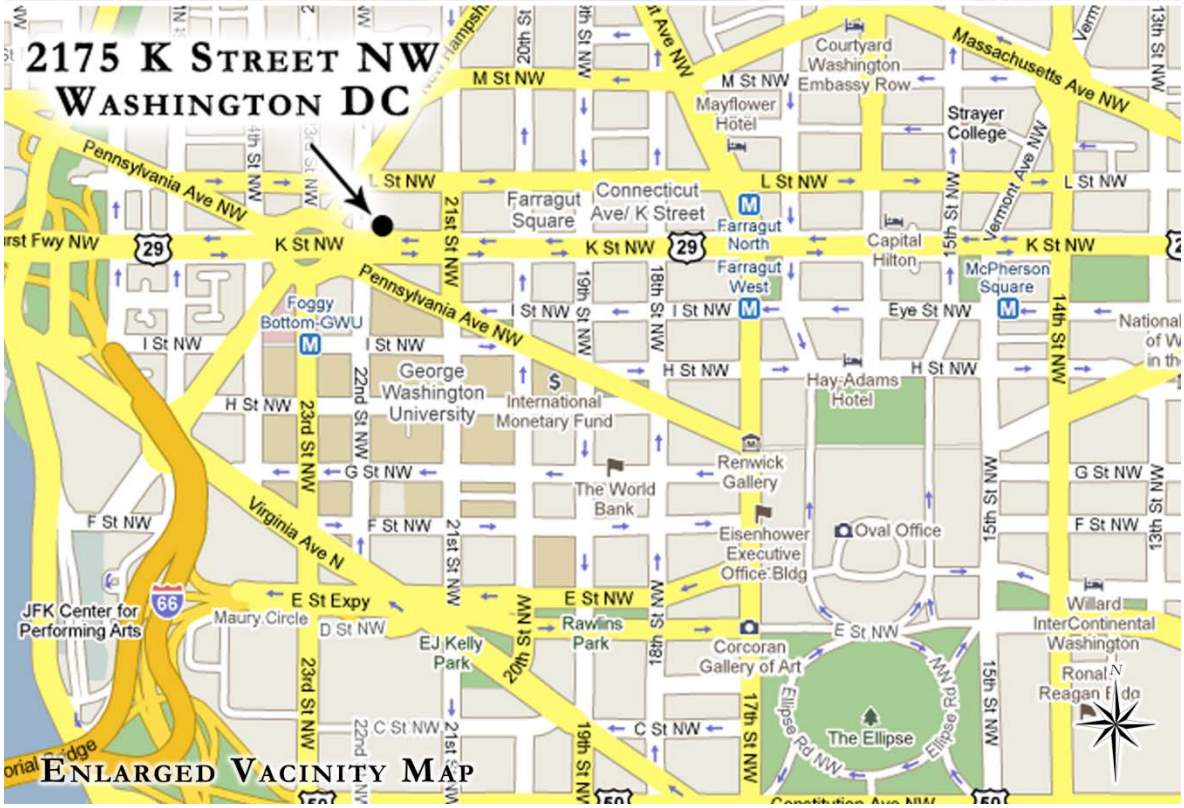
	hardware, 6'-0" x 7'-0" opening			
	hardware, 6'-0" x 10'-0" opening			
B3010	**Roof Coverings**		$2.42	$81,500
	adhesive			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			
	Flashing, aluminum, no backing sides, .019"			
C Interiors		**23.16%**	**$22.12**	**$1,330,500**
C1010	**Partitions**		$2.91	$138,500
	gyp board, 1 side			
	gypsum board base, 3-5/8" @ 24", same opposite face, no insulation			
	furring			
C1020	**Interior Doors**		$2.27	$76,500
	flush, 3'-0" x 7'-0" x 1-3/8"			
C1030	**Fittings**		$0.43	$14,500
	Toilet partitions, cubicles, ceiling hung, plastic laminate			
C2010	**Stair Construction**		$4.76	$704,500
	landing			
C3010	**Wall Finishes**		$0.68	$23,000
	work, primer & 2 coats			
	Vinyl wall covering, fabric back, medium weight			
C3020	**Floor Finishes**		$4.98	$168,000
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 35 oz			
	Vinyl, composition tile, maximum			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		$6.09	$205,500
	& channel grid, suspended support			
D Services		**26.96%**	**$73.08**	**$1,548,500**
D1010	**Elevators and Lifts**		$6.09	$249,000
	group, 350 FPM			
D2010	**Plumbing Fixtures**		$6.09	$98,000
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, vanity top, PE on CI, 20" x 18"			
	24" x 20"			
	Water cooler, electric, wall hung, 8.2 GPH			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		$6.09	$8,500
	GPH			
D2040	**Rain Water Drainage**		$6.09	$4,500
	Roof drain, CI, soil,single hub, 4" diam, 10' high			
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add			
D3020	**Heat Generating Systems**		$6.09	$67,500
	Plate heat exchanger, 1800 GPM			
	Utility fan set system, belt drive, 7500 CFM			
	Boiler, cast iron, gas & oil, hot water, 6000 MBH			
	GPM			
D3030	**Cooling Generating Systems**		$6.09	$444,000
	190.00 ton			
D4010	**Sprinklers**		$6.09	$72,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF			

	10,000 SF			
	Standard High Rise Accessory Package 16 story			
D4020	**Standpipes**		$6.09	$10,500
	floor			
	additional floors			
	Fire pump, electric, with controller, 5" pump, 100 HP, 1000 GPM			
	Fire pump, electric, for jockey pump system, add			
D5010	**Electrical Service/Distribution**		$6.09	$0
	3 phase, 4 wire, 120/208 V, 2000 A			
	A			
	A			
	2000 A			
	2000 A			
D5020	**Lighting and Branch Wiring**		$6.09	$376,500
	SF, with transformer			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	460 V 15 HP, 575 V 20 HP			
	Motor connections, three phase, 200/230/460/575 V, up to 5 HP			
	Motor connections, three phase, 200/230/460/575 V, up to 100 HP			
	10 fixtures @32watt per 1000 SF			
D5030	**Communications and Security**		$6.09	$199,500
	Telephone wiring for offices & laboratories, 8 jacks/MSF			
	detectors, includes outlets, boxes, conduit and wire			
	Fire alarm command center, addressable with voice			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		$6.09	$18,000
	diesel engine with fuel tank, 200 kW			
	kVA/12.75 kW			
E Equipment & Furnishings		0.00%	$0.00	$0
E1090	**Other Equipment**		$0.00	$0
F Special Construction		0.00%	$0.00	$0
G Building Sitework		0.00%	$0.00	$0
SubTotal		100%	$124.99	$5,744,500
Contractor Fees (General Conditions,Overhead,Profit)		0.00%	$0.00	$0
Architectural Fees		0.00%	$0.00	$0
User Fees		0.00%	$0.00	$0
Total Building Cost			$124.99	$5,744,500

Table C.3 RS Means Square Foot Estimate

Appendix D.1 – Vicinity Maps





Appendix D.2 – Site Utilities Plan

(See Next Page)

Sheet Notes:

1. All existing utilities are to remain
2. Project contains no new utilities
3. Construction activities are to use existing service
4. Telecommunication was not shown on utilities plan
5. No temporary lighting

Drawing Key

- Property Line
- Building Perimeter
- Domestic Water
- Electric Lines
- Gas Lines
- Sanitary Sewer
- Storm Drain
- Accent Light
- Domestic Water Shutoff Valve
- Electric Line Manhole
- Gas Line Manhole
- Sanitary Sewer Manhole
- Storm Drain Manhole
- Fire Hydrant

Site Existing Conditions Plan

Scale: NTS

ae PennState

Drawing By:
Timothy Conroy

Date:
1 October 2009

Project:
2175 K Street, NW
Washington, DC 20037

Drawn By: Timothy Conroy
Date: 1 October 2009

Drawing Title:
Site Utilities Plan

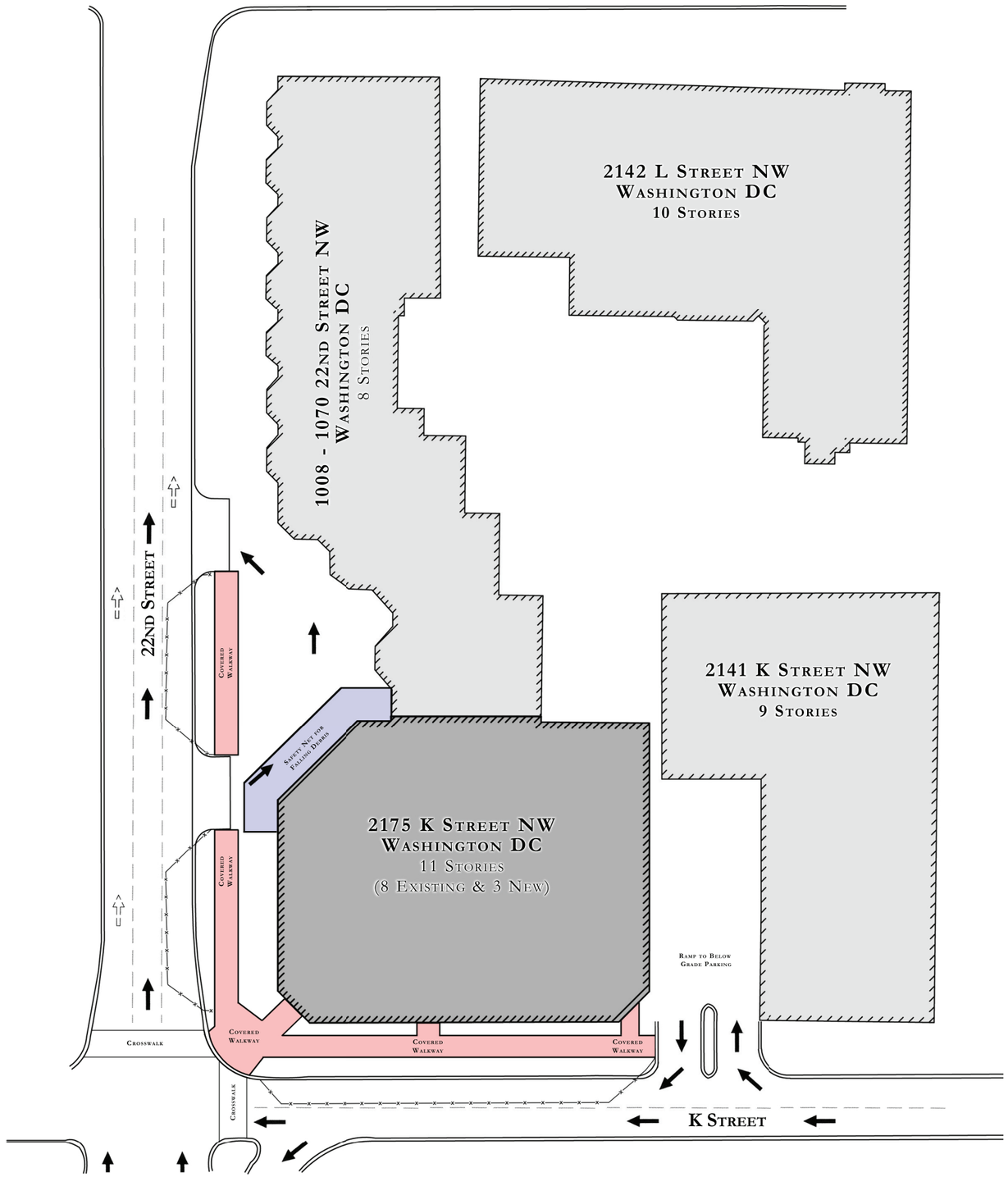
C-01

Appendix D.3 – Safety and Traffic Plan

(See Next Page)

Drawing Key

- Site Fence
- Normal Traffic
- Restricted Traffic (4:00 PM - 9:00 AM)



Safety and Traffic Control Plan

Scale: NTS

Drawing By:
Timothy Conroy

Date:
1 October 2009

Project:
2175 K Street, NW
Washington, DC 20037

Drawn By: Timothy Conroy
Date: 1 October 2009

Drawing Title:
Safety and Traffic Plan

C-02