

## PROJECT OVERVIEW

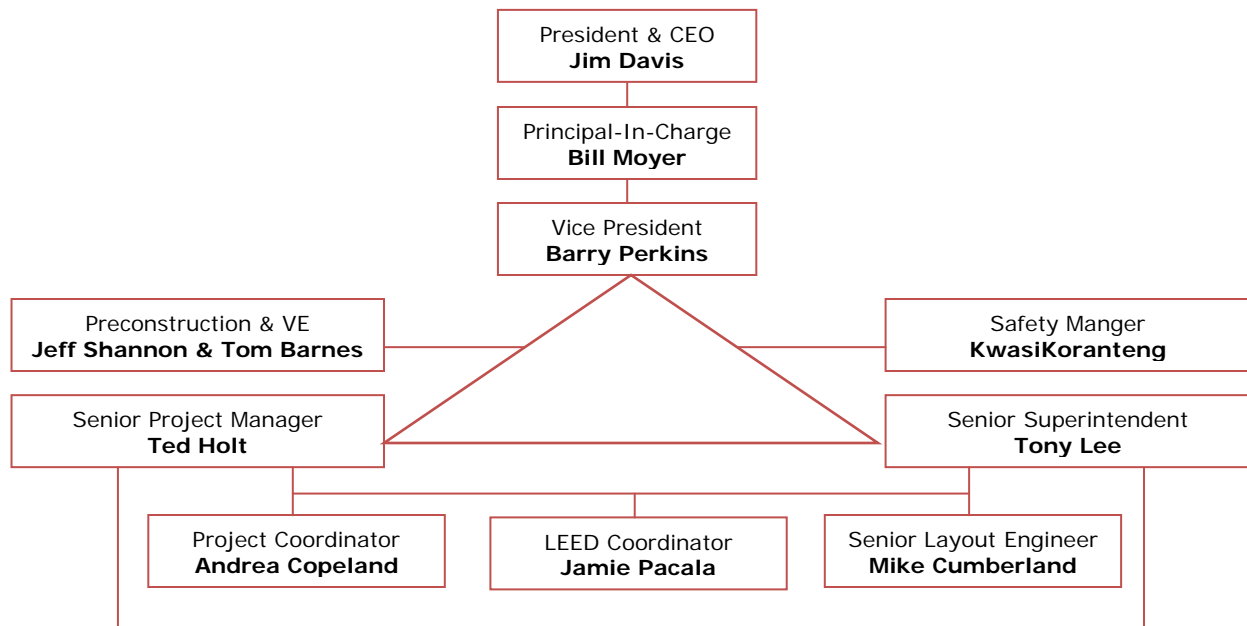
Constitution Center is a renovation of an existing building, located a few blocks south of the National Mall, originally constructed in 1976. It was formerly occupied by the Department of Transportation (DOT). It is located between 6<sup>th</sup> and 7<sup>th</sup> Street and D and E Street in SW DC. The building takes up an entire city block, with 3 levels of parking below grade, which is approximately 15 acres in size. Additionally, there are 10 levels above grade with a penthouse for MEP equipment. There is an open, landscaped courtyard (approximately 1 acre in size) at the center of the site with a decorative fountain. The building is not yet leased, but is designed as offices for a potential government tenant, with Level IV security rating. Constitution Center is striving to attain LEED Gold Certification.



Figure 1: Map of the Central DC showing the location of Constitution Center.



The structure of the general contractor, DAVIS, on Constitution Center is a typical hierarchy. Please see Figure 2 for a visual description of the hierarchy at Constitution Center. Jim Davis, the President and CEO oversees all DAVIS projects. Bill Moyer, Principal-In-Charge, manages multiple projects at DAVIS. The Vice President, Barry Perkins, is responsible for several projects; however he spends most of his time overseeing Constitution Center. Both Ted Holt, Senior Project Manager, and Tony Lee, Senior Superintendent, work onsite of Constitution Center daily and provide guidance to the progress of the project. Under their leadership, the project is divided into five main areas: Site, Demolition, & Plaza Coordination; Structure, Blast & Masonry; Façade & Division 7; MEP & Elevators; and Interiors & Finishes. Each of these areas has a Project Manager, Project Superintendent, Assistant Project Manager, and a summer intern to insure the project is being built it the correct specifications.



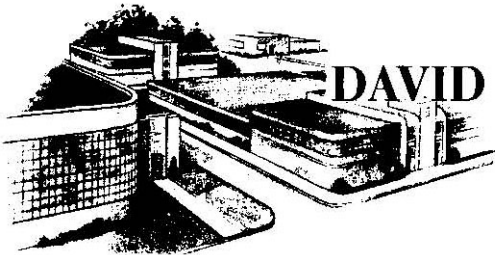
Site, Demolition & Plaza Coordination		Structure, Blast, & Masonry		Façade & Div. 7		MEP & Elevators		Interiors & Finishes	
Project Manager, LEED	Project Superintendent	Project Manager, LEED	Project Superintendent	Project Manager, LEED	Project Superintendent	Project Manager	Project Superintendent	Project Manager, LEED	Project Superintendent
<b>Brad Cordek</b>	<b>Tim Swanson</b>	<b>TJ Sterba</b>	<b>Dan Gowin</b>	<b>Meghan Ulrich</b>	<b>Doug Bolden</b>	<b>Bill Bundens</b>	<b>Drew Broglie</b>	<b>Greg Ghent</b>	<b>Tim Swanson</b>
Assistant Project Manager		Assistant Project Manager		Assistant Project Manager		Assistant Project Manager		Assistant Project Manager	
<b>Jamie Pacalla</b>		<b>Frank Lefler</b>		<b>Jesse May</b>		<b>Ihsan Gin, Nestor Santos, Omega Tadesse</b>		<b>Jamie Pacalla</b>	
Intern		Intern		Intern		Intern		Intern	
<b>Natalie Bryner</b>		<b>Natalie Bryner</b>		<b>Desmon Hayden</b>		<b>Natalie Bryner</b>		<b>-</b>	

Figure 2: Hierarchy of the general contractor, James G. Davis Construction Corporation

*Client Information*

David Nassif Associates are the owners of Constitution Center. They originally built the building back in the 1970's, and have operated and leased the building since then. The company thrives on owning a smaller number of larger buildings, like Constitution Center. This will be the largest privately owned office building in Washington, DC and owning it is one of the goals of the ownership. The building, like many others built in the 1970s, are ready for renovations. Additionally, they saw this moderation as an excellent opportunity to bring a newly updated and renovated LEED building to the DC area.

David Nassif Associates want the best in cost, quality, schedule, and safety for Constitution Center. They expect the highest quality work possible, within the schedule of the project. Additionally, they have extremely high safety expectations, as they have the onsite nursing staff for drug testing and any injuries. One of their strategies with the cost is to "bend but not break."<sup>1</sup> They are willing, unlike most owners, to pay more for items that actually warrant extra money. It is believed that this strategy will help them get a better quality product in the end. David Nassif Associates have provided numerous free things for the subcontractors. Some examples include the parking that is available in the garage and trips with the subcontractors to look at the curtain wall, stone, trees, and chilled beams. As one can tell, they have spent a lot of money on travel to ensure they have the best product.



**DAVID NASSIF ASSOCIATES**

*Pioneers in Property Development*

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The main sequencing issue that is of interest to the owners is that the building is completed in the correct sequences, so that the appropriate quadrant is released at the projected time. With this, there are no occupancy requirements, other than turning the quadrants over on time. In order for Constitution Center to be completed to the owner's satisfaction, they would like to make sure that the punch lists are done for the majority of the items installed to ensure that they are getting the highest quality they are expecting.

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<sup>1</sup> (Cordek)

## Project Delivery System

Constitution Center is being delivered as a design-bid-build project. This means that the owner holds the contracts for both design and construction. The reason the owner chose this type of contract was because the project is so large that they wanted to manage the contracts for the different phases and be involved throughout the entire renovation. Please see the organizational chart, Figure 3, for the other key contracts. There is a guaranteed maximum price (GMP) contract between David Nassif Associates and DAVIS, which states that the owner is not obligated to compensate DAVIS for any amount beyond the contract price. DAVIS holds all of the subcontracts, which are all lump sum contracts, except for the Abatement Subcontractor, Aceco, Inc., which is a unit rate. The reason DAVIS chose to do a unit rate contract with Aceco is because they had to add and deduct rates for different abatement quantities. David Nassif Associates holds lump sum contracts with everyone that is involved in the design phase. These two types of contractors are very common in most construction projects and they are very appropriate for this large job.

DAVIS selected the subcontractors, which are listed to the right, by weighing the cost proposals against the performance strategies. The primary subcontractor had a meeting with the ownership to discuss their planning strategies, prior to decisions being made. DAVIS was selected in a similar manner; they provided their estimate, along with the planning strategies.

The project requires a Contractor Controlled Insurance Program (CCIP), which provides coverage for all enrolled subcontractors. A typical CCIP provides coverage in the following three areas: Workers' Compensation / Employer's Liability, Commercial General Liability, and Excess Liability.

### Major Subcontractors:

- Government Agency (Power) – Pepco
- Government Agency (Gas) – Washington Gas
- Government Agency (Metro) – Washington Metropolitan Area Transit Authority
- Survey & Layout – William H. Gordon Associates
- Demolition – Aceco, LLC, The Berg Corporation
- Site Concrete – GT Contracting Corporation
- Site Signage – All State Striping & Sealing Co.
- Landscaping – Ruppert Nurseries
- Cast In Place Concrete – Brothers Concrete Construction, Inc.
- Concrete Restoration – Concrete Restoration Services
- Masonry – Genco Masonry Inc, Worcester Eisenbrant
- Stone – Rugo Stone
- Metals – Extreme Steel
- Miscellaneous Metals – Superior Iron Works
- Ornamental Metal – Louis Hoffmann
- Waterproofing – Eastern Waterproofing & Restoration
- Sprayed On Fireproofing – Diamond Engineering
- Manufactured Roof & Wall Panels – A.C. Dellovade
- Roofing – Gordon Contractors
- Doors, Frames & Hardware – C.H. Edwards
- Glass & Glazing – Enclos Corporation
- Drywall & Acoustical Ceiling – C.J. Coakley
- Painting & Wallcovering – Brien Miller Painting Company
- Elevators – Mid-American Elevator
- Plumbing & HVAC – Pierce Associates
- HVAC Controls – Facility Dynamics Engineering
- Electrical – J.E. Richards

## Project Team

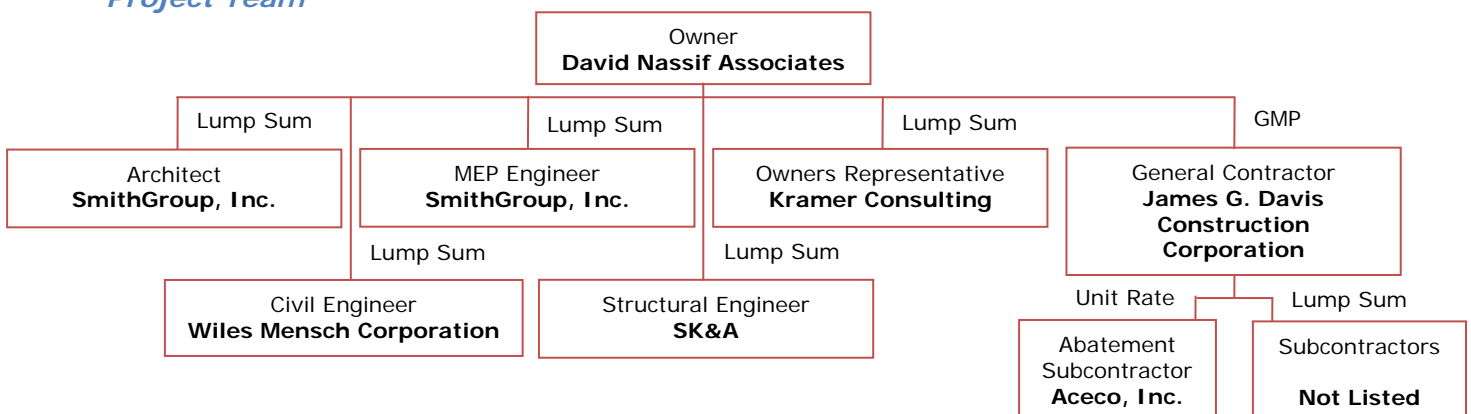


Figure 3: Hierarchy of the design-bid-build delivery system, including the major project team members.

## Site Plan and Existing Conditions

The site plan of existing conditions can be found on page 13. It includes the footprint of Constitution Center, along with the buildings that surround it. Additionally, it depicts the patterns for both traffic and pedestrians. Fire hydrants and metro grate locations are included on the plan. As one can tell, the north sidewalk is for the L'Enfant Plaza metro entrance, which is open Monday through Friday. Even though the metro entrance is within the site, overhead protection is not necessary, since the north face of the curtain wall was previously installed before the reopening in July 2008. Parking for the workers of Constitution Center can be found on the three levels below the building in the parking garage. There is one access road into the site, which can be found at the south of the building. This road is used to get into the parking garage and where deliveries occur. There is storage found around the site, in the areas between the side-walks and the driving lanes that are temporarily shut down. Additional storage areas are in the parking garage areas. Since the site is so large, the utility locations can be found on a separate drawing, which is Figure 4. This drawing depicts where the existing water, gas, and communication locations were found. The offices of Constitution Center can be found on the south side of the second and third floors. DAVIS' office is located on the second floor; SmithGroup, David Nassif Associates, and Kramer Consulting are all on the third floor; and subcontractors can be found on both floors.

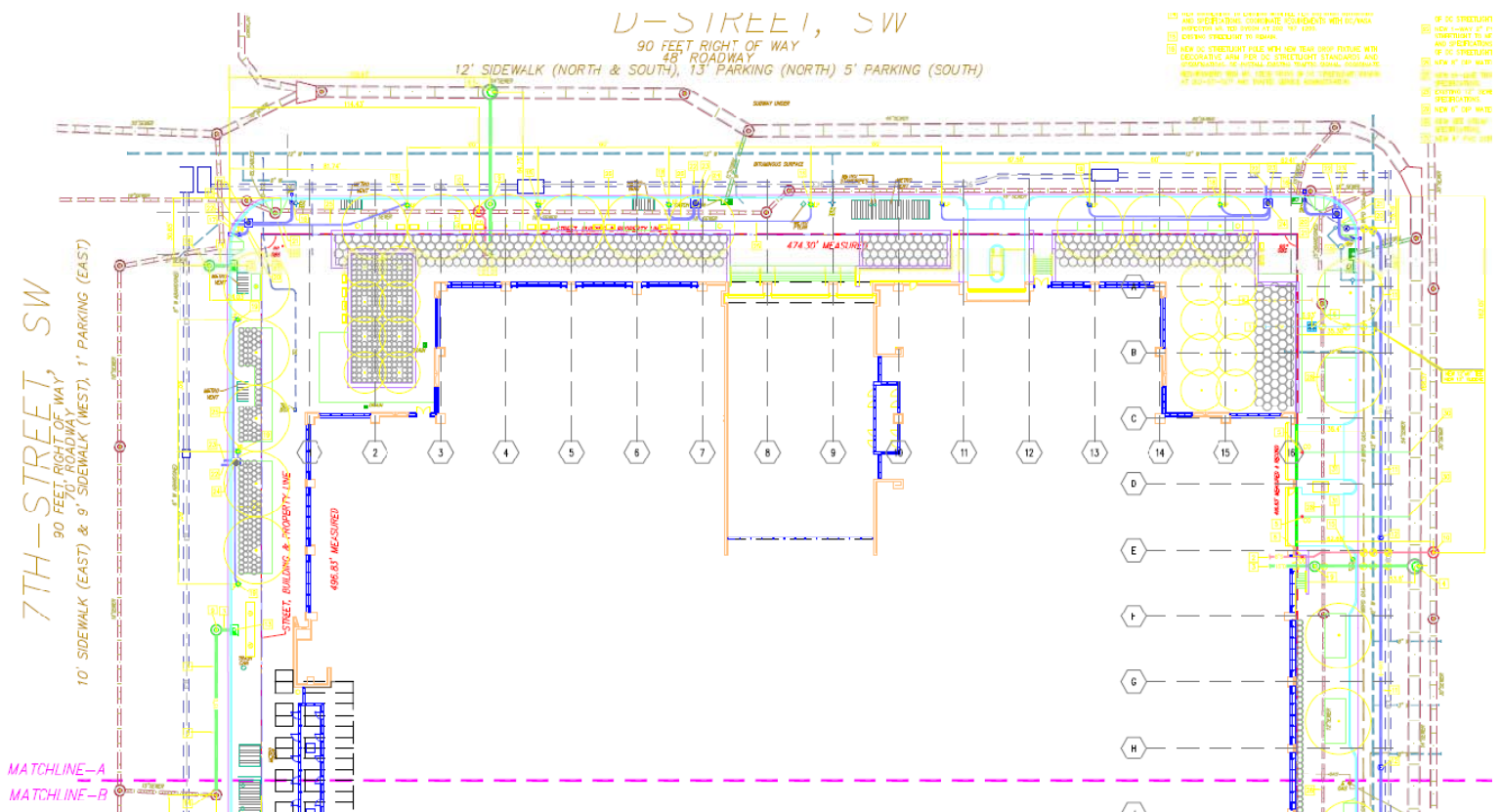
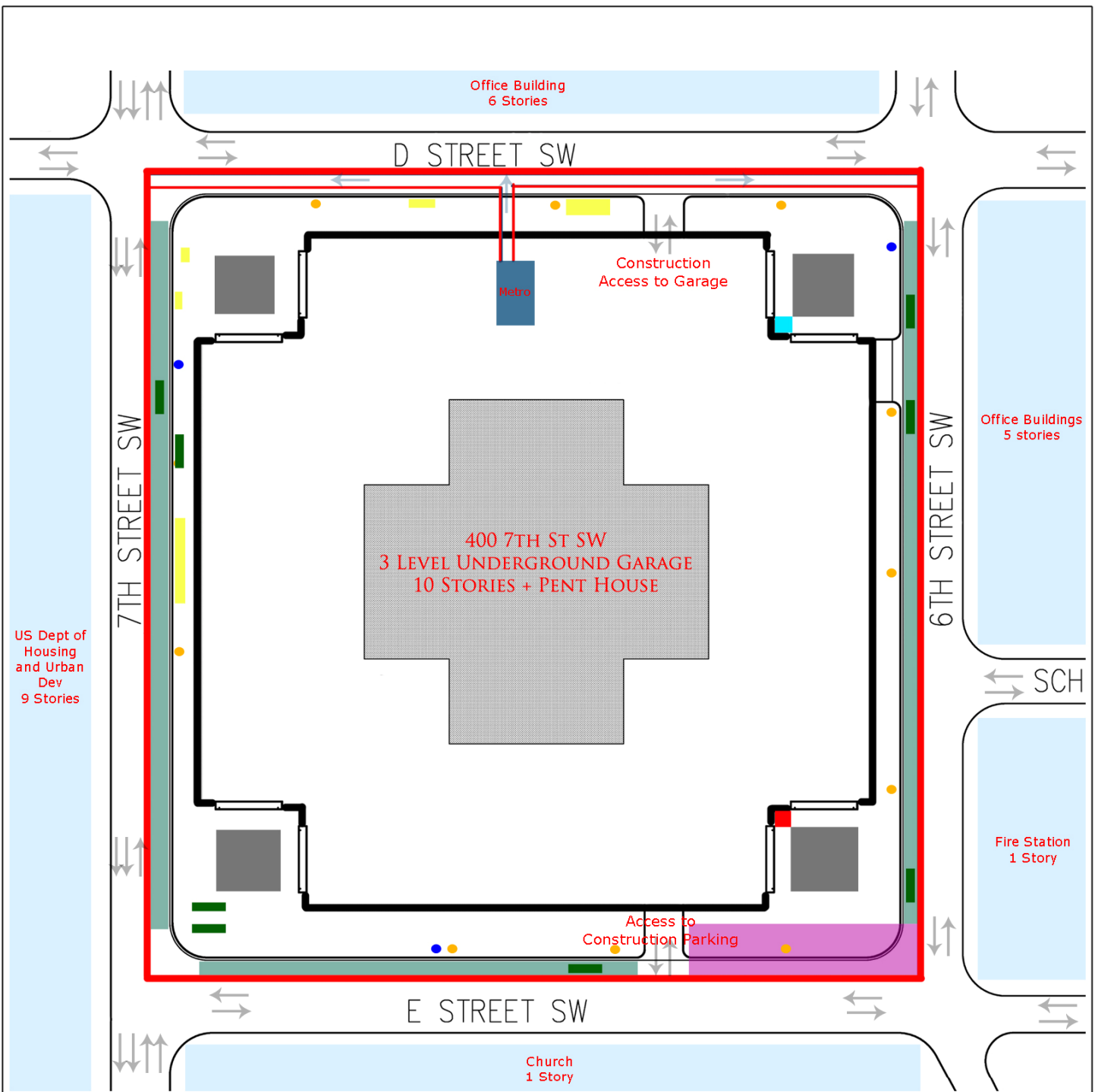


Figure 4: Site Utility Locations



# CONSTITUTION CENTER

400 7TH STREET SE, WASHINGTON, DC 20024

**Legend:**

- Jersey Barriers and Fences, indicating Construction Boundaries
- ← Traffic Flow
- ← Pedestrian Flow
- Tower Cranes (Four)
- Metro Grates
- Metro Entrance
- Delivery Area
- Material Storage
- Material Hoist
- Person Hoist
- Dumpsters
- Light Poles
- Fire Hydrants



**NATALIE BRYNER**

TECHNICAL ASSIGNMENT ONE  
SEPTEMBER 29, 2008

SITE PLAN  
EXISTING CONDITIONS

The preferred method of construction in Washington, DC is the use of concrete. The reason for this method is because there is a height restriction in Washington, DC. "In 1899, Congress passed the Heights of Buildings Act ... but it was amended in 1910 to the width of the adjacent street plus 20 feet."<sup>2</sup> Therefore, when Constitution Center was built in 1976, they used a two-way waffle slab for the floors and concrete columns to create 30' by 30' bays to maximize the floor to floor height, staying within the height restriction.



Figure 5: Sample of the parking arrangements for August 2008 at Constitution Center. The colored blocks indicate parking spaces per subcontractor.



At Constitution Center, there are currently 350 parking spaces available to the workers. The spaces are in the three level controlled access parking garage, which will have 1,500 spaces when construction is complete. DAVIS has given each particular subcontractor a limit to the amount of people that receive parking passes and have a guard on duty throughout the day checking the passes. The spaces alternate between the levels, depending on where work is taking place at the time. Figure 5 shows how the parking spaces are divided on parking level one. If the workers were not provided with parking arrangements, Constitution Center has direct access to four of the five L'Enfant Plaza metro entrances, the Virginia Rail Station, and 14 bus lines. Overall, parking has not been a problem for the workers of Constitution Center.

Since Constitution Center is striving for LEED Gold Certification, the site has a total of eight dumpsters; five belong to DAVIS, two trash, one metal, one block, and one wood while the other three are the responsibility of the subcontractors, ACECO, Brothers, and CRS. The wood and trash dumpsters are emptied every day, while the metal and blocks are removed every three to four days. Additionally, ACECO pulls theirs three times a day and Brothers and CRS empties them every four to six days. The initial cost of the dumpsters was about \$500 and they have a tipping fee of about \$130. Overall, dumpsters play a very large part in the site receiving LEED Certification; therefore DAVIS has an assistant project manager responsible for tracking the percentage of material that is being recycled.





Constitution Center is a renovation of the existing David Nassif Building, therefore soil and subsurface water conditions did not play a large role in the construction. However, since there is a three level parking garage under the building, which is not the same footprint as the building, proper shoring was necessary with the mobile cranes used for the installation of the curtain wall.




<sup>2</sup> (Grunwald)

## Building Systems Summary

Table 1: Summary of the key aspects of the design and construction of Constitution Center

Yes	No	Work Scope	Information
x		Demolition Required?	<p>The demolition subcontractor, Aceco, was responsible for the removal of asbestos, lead based paint, Polychlorinated biphenyls (PCB) &amp; mercury, hazardous chemicals, and biological elements. Some of the asbestos was the cementitious surfacing materials, the duct connectors and gaskets, the elevator door packing, exhaust mufflers, etc. Examples of the lead based paint were in the mechanical motor units, the ceramic wall tile, the metal wall flashing, etc. PCB and mercury were in the light ballasts, the fluorescent light tubs, and the mercury contained bulbs and thermostats. Petroleum liquids and glycol coolant are the hazardous chemicals. Finally, the biological elements were the avian and rodent excreta, mold impacted abatement, and surfaces that needed to be disinfected.</p> <p>The building demolition included removing everything from the building, expect for the floor slabs and columns. The picture below shows how much demolition occurred.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>August 29, 2007</p> </div> <div style="text-align: center;">  <p>July 30, 2008</p> </div> </div>
	X	Structural Steel Frame	N/A
x		Cast in Place Concrete	<p>The cast in place concrete included new concrete blast reinforcement, which was installed with items such as blast walls, blast hardening, etc. There were also newly installed topping slabs and raised slabs at some areas that required elevation changes. Formwork was standard stick built on-site by the concrete subcontractor, Brothers Concrete. Concrete placement methods included by tower cranes, boom truck, and buggies.</p>



x		Precast Concrete	<p>Decorative precast concrete was installed at the four corners of the building with welded steel connections. Coordination issues with the building roof overhang occurred therefore the steel was erected from a mobile crane, as opposed to the tower cranes.</p> 
x		Mechanical System	 <p>The mechanical rooms are located on the Pent House level. The building mechanical system consists of AHU's, Chillers and Boilers. Ductwork feeds the chilled beam systems that will be installed in the office spaces.</p> <p>The sprinkler system varies from dry to wet, depending on the location of the pipe runs.</p>
x		Electrical System	<p>The power distribution system of 13.8 kVA is feed from four primary switchgears connected to Pepco feeders. It is then distributed to 10 secondary 4000A transformers within the garage and penthouse levels. Two 1000-kilowatt generators are roof mounted to provide power back up to the critical building systems during a power outage.</p>
x		Masonry	<p>Constitution Center does not have veneer brick, however it does have CMU partition walls and blast walls. The connections are typical for masonry work in all areas of the building. They are utilizing the typical scaffold, which makes the work area fairly straightforward, especially since it is not in hard to access areas.</p>
x		Curtain Wall	 <p>The curtain wall system is composed of composite glass and aluminum panels. These structures are prefabricated offsite and erected a panel at a time. The overhang was an issue; so mobile cranes have been used to set these pieces. The design of the curtain wall, although outlined by the architect, fell mostly into the subcontractor's engineer's responsibility.</p>
	x	Support of Excavation	N/A

## Project Schedule Summary

One of the main concerns of the ownership of Constitution Center is that the project be completed on time; therefore the schedule plays a major part in the construction. Figure 6, summarizes the schedule to make it easy to tell what phases are taking place during a specific month.

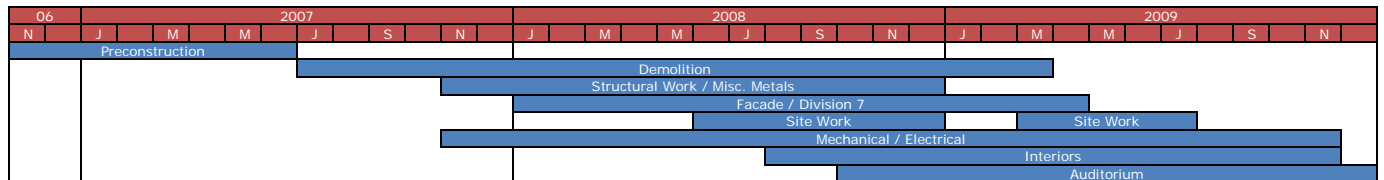


Figure 6: Simple schedule that is used to show when each general phases is being constructed.

Figure 7 shows a project schedule summary, which includes pre-construction, demolition, and actual construction milestones. Each of these phases is then broken into the key elements that must occur in order for that phase of construction to be completed. The finishes take approximately 206 days to complete, therefore this is a main phase in the construction progress. The first key element for the finish sequence of the garage is the construction of the elevator shaft walls. After this is completed, the erection of the CMU blast walls occur, followed by the hardening of the concrete walls. The next element is the rough-in of the MEP, along with the hardening of the columns. To finish the parking garages, the raised slabs must be constructed, the lights installed, and the finishes applied. For the typical floors, there are five main elements that much occur before the finish sequence. First, the steel columns and beams must be installed. Then the expansion joints need to be removed. Next the slabs need to be in-filled and the MEP rough-in has to take place. Finally the shaft walls need to be constructed then the finishes are applied.

Preconstruction started in November of 2006. This phase includes both mobilization and critical procurement of 7 elements. After the preconstruction, demolition started in July 2007 and may last until March 2009. Finally construction started in September 2007 and the building will be turned over in 4 quadrants. The sequence is the northeast on May 1, 2009, the northwest on July 1, 2009, the southwest on September 1, 2009 and the southeast on November 1, 2009. Finally the project close-out will last until December 2009, which includes commissioning.

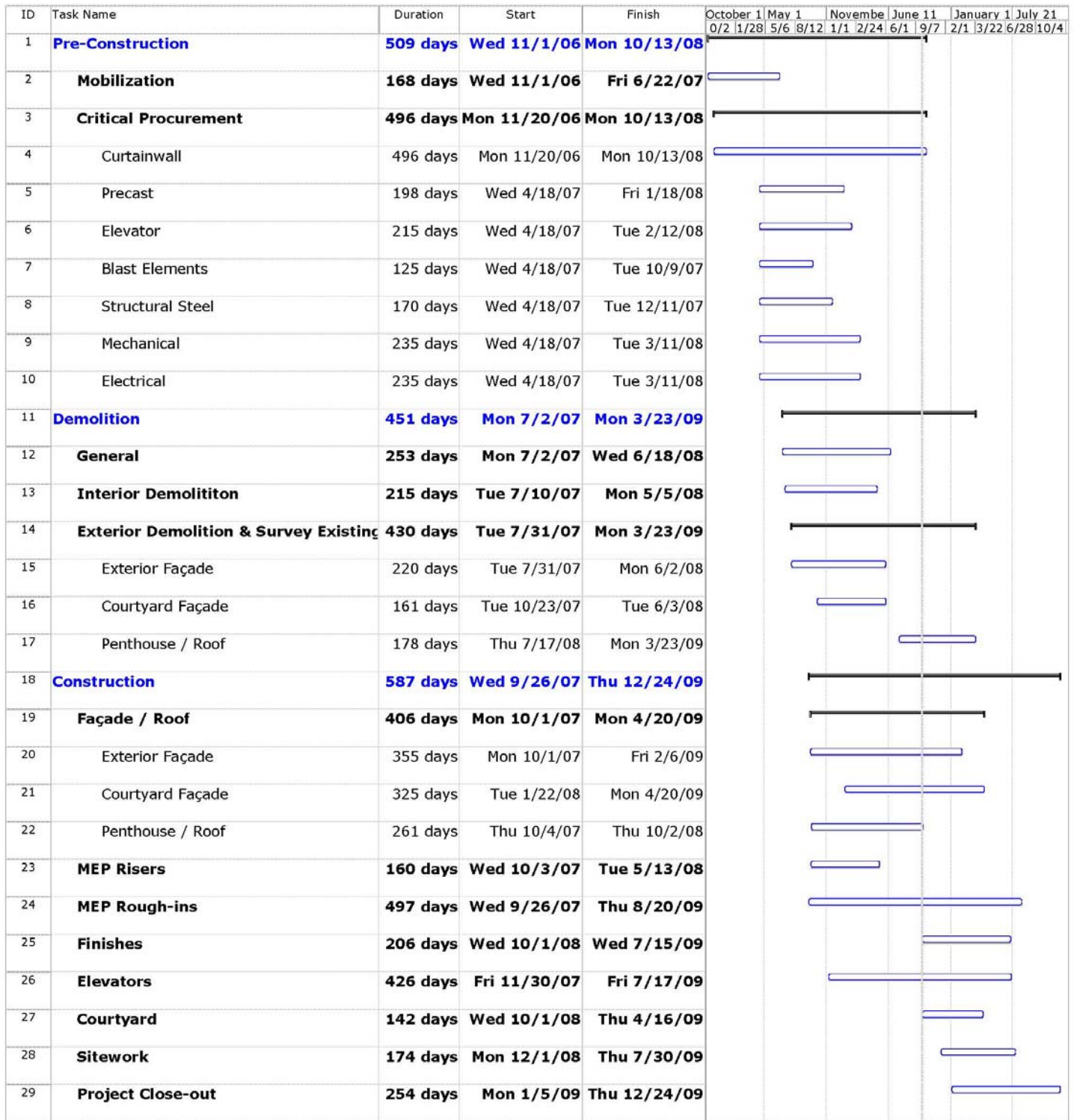


Figure 7: Project Summary Schedule produced in Microsoft Project

## Project Cost Evaluation

The project cost of Constitution Center was evaluated several different ways. First, Table 2 shows the building construction cost, as one can see it is \$211,191,150 or \$140.70/SF. Next the total project cost is outlined in Table 3, showing that the cost is \$244,700,033 or \$163.13/SF. Table 4 shows the major building systems costs and the cost per square foot for each of the systems. After evaluation, it is determined that the mechanical system is the most expensive, being around \$52 million.

Building Construction Cost (CC)	
Construction Cost	\$211,191,150
Cost per Square Foot	\$140.79

Table 2: Building Construction Cost Breakdown

Total Project Cost (TC)	
Construction Cost	\$244,700,033
Cost per Square Foot	\$163.13

Table 3: Total Project Cost Breakdown

Table 4: Building Systems Costs

Division	Title	Cost	Cost/SF
<b>Division 02</b>	<b>Existing Conditions</b>	<b>\$17,717,242</b>	<b>\$11.81</b>
	Selective Demolition	\$12,310,000	\$8.21
	HAZMAT Abatement	\$1,514,316	\$1.01
	Surveying	\$49,900	\$0.03
	Site Utilities: water, san, storm	\$643,040	\$0.43
	Asphalt Paving	\$218,000	\$0.15
	Restriping/Pavement Marking	\$22,900	\$0.02
	Concrete Site Work	\$544,000	\$0.36
	Site Furnishings	\$200,000	\$0.13
	Exterior Plants w/ Irrigation	\$1,253,000	\$0.84
	Retractable Bollards	\$422,141	\$0.28
	Parking Equipment	\$100,000	\$0.07
	Site Development	\$439,945	\$0.29
<b>Division 03</b>	<b>Concrete</b>	<b>\$23,142,494</b>	<b>\$15.43</b>
	Cast-in-Place Concrete	\$9,408,124	\$6.27
	Structural Precast Concrete	\$48,392	\$0.03
	Architectural Precast Concrete	\$1,975,834	\$1.32
	Cementitious Underlayment	\$3,538,710	\$2.36
	Fiber Reinforced Polymer	\$3,768,402	\$2.51
	Concrete Repair & Traffic Coat	\$4,403,032	\$2.94
<b>Division 04</b>	<b>Masonry</b>	<b>\$5,043,908</b>	<b>\$3.36</b>
	Tuckpointing	\$990	\$0.00
	Masonry	\$1,393,173	\$0.93
	Masonry Coating (Polyurea)	\$183,910	\$0.12
	Stone	\$3,465,835	\$2.31

<b>Division 05</b>	<b>Metals</b>	<b>\$14,521,856</b>	<b>\$9.68</b>
	Structural Steel	\$2,445,660	\$1.63
	Miscellaneous	\$6,481,564	\$4.32
	Curtain wall Anchors	\$2,729,113	\$1.82
	Steel Jackets	\$2,361,538	\$1.57
	Ornamental Metals	\$286,806	\$0.19
	Expansion Joints	\$217,175	\$0.14
<b>Divison 06</b>	<b>Wood, Plastics, and Composites</b>	<b>\$1,590,627</b>	<b>\$1.06</b>
	Carpentry	\$745,609	\$0.50
	Millwork	\$845,018	\$0.56
<b>Division 07</b>	<b>Thermal and Moisture Protection</b>	<b>\$6,757,989</b>	<b>\$4.51</b>
	Hot Fluid Applied Waterproofing	\$770,800	\$0.51
	Cementitious Waterproofing	\$70,000	\$0.05
	Crystalline Waterproofing	\$11,977	\$0.01
	Traffic Coatings	\$180,149	\$0.12
	Metal Wall Panels & Louvers	\$2,783,500	\$1.86
	Roofing, Hot Fl. & Membrane	\$2,234,937	\$1.49
	Applied Fireproofing	\$499,455	\$0.33
	Joint Sealants	\$207,171	\$0.14
<b>Division 08</b>	<b>Openings</b>	<b>\$47,918,829</b>	<b>\$31.95</b>
	Doors, Frames, Hardware	\$630,787	\$0.42
	Coiling Doors	\$80,767	\$0.05
	Exterior Curtain wall	\$46,697,203	\$31.13
	Interior Glass & Glazing	\$510,072	\$0.34
<b>Division 09</b>	<b>Finishes</b>	<b>\$6,350,845</b>	<b>\$4.23</b>
	Drywall	\$4,412,130	\$2.94
	Ceramic Tile	\$528,320	\$0.35
	Carpet and Resilient	\$136,469	\$0.09
	Painting	\$1,273,926	\$0.85
<b>Division 10</b>	<b>Specialties</b>	<b>\$551,329</b>	<b>\$0.37</b>
	Toilet Compartments	\$156,930	\$0.10
	Louvers & Vents	\$93,701	\$0.06
	Exterior & Interior Signage	\$156,023	\$0.10
	Fire Protection Specialties	\$31,675	\$0.02
	Toilet Accessories	\$113,000	\$0.08
<b>Division 11</b>	<b>Equipment</b>	<b>\$212,682</b>	<b>\$0.14</b>
	Window Washing Systems	\$212,682	\$0.14
<b>Division 12</b>	<b>Furnishings</b>	<b>\$519,489</b>	<b>\$0.35</b>
	Foot Grilles	\$160,107	\$0.11
	Horiz. Louver Blinds	\$359,382	\$0.24
<b>Division 13</b>	<b>Special Construction</b>	<b>\$446,862</b>	<b>\$0.30</b>
	Waterfeatures / Fountains	\$446,862	\$0.30
<b>Division 14</b>	<b>Conveying Equipment</b>	<b>\$8,862,503</b>	<b>\$5.91</b>
	Elevators	\$8,862,503	\$5.91
<b>Division 15</b>	<b>Mechanical</b>	<b>\$52,523,331</b>	<b>\$35.02</b>
	HVAC / Plumbing	\$49,517,031	\$33.01
	Sprinkler	\$3,006,300	\$2.00
<b>Division 16</b>	<b>Electrical</b>	<b>\$24,725,667</b>	<b>\$16.48</b>
	Electrical	\$24,725,667	\$16.48