

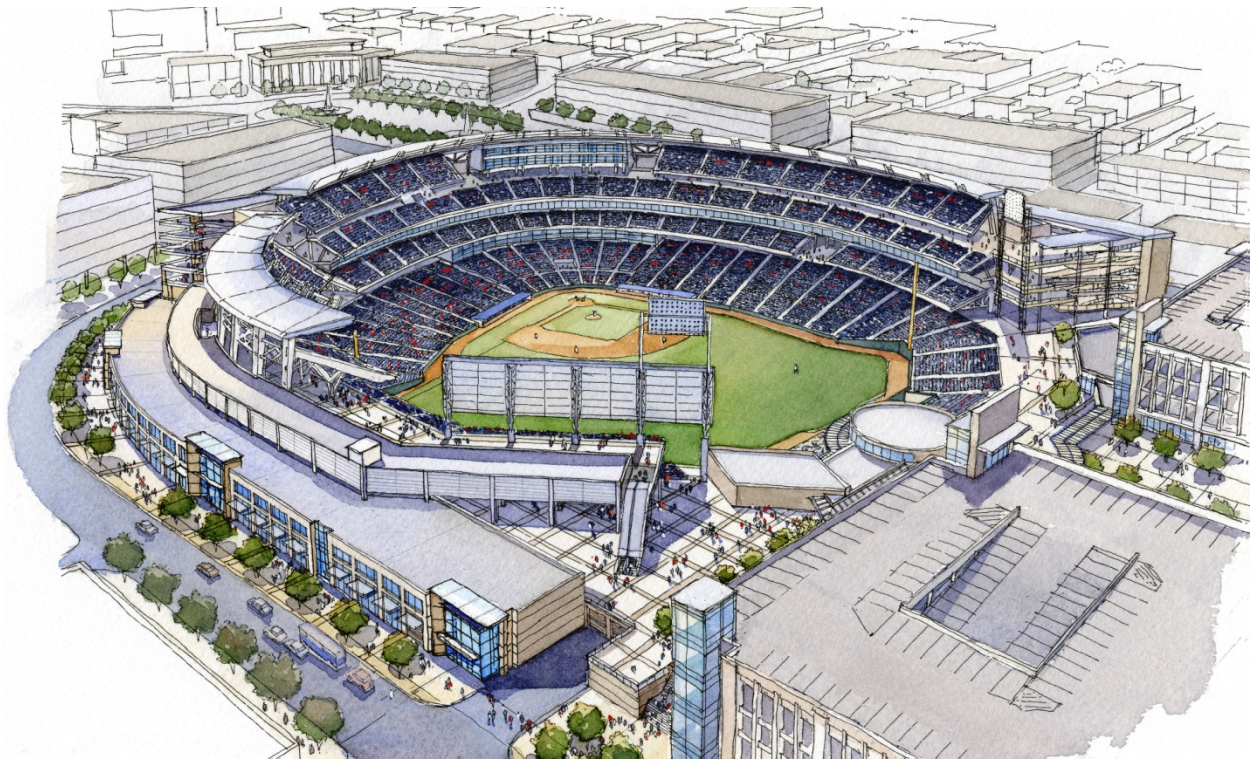
THE WASHINGTON NATIONALS BALLPARK  
WASHINGTON, DC



MATTHEW MOORE | CONSTRUCTION MANAGEMENT | MESSNER

# Technical Report 1

## Construction Project Management



**Technical Assignment 1: Construction Project Management**

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## **Executive Summary**

The Washington Nationals Ballpark is a fast-tracked design build baseball ballpark located in the SE of Washington, DC. The ballpark is set to be completed by opening day for Major League Baseballs Washington Nationals in April of 2008. Three major general contractors in the DC area formed “A Joint Venture” to become Clark / Hunt / Smoot, to oversee the ballparks erection. The ballpark is the creation of another joint venture in HOK Sport and Devroux and Purnell, the architects who came together to create the beautiful, and unique ballpark. The project has the largest construction cost ever to date for a Major League Baseball stadium with an overall project cost of \$611 million.

This technical assignment gives a major overview to the construction project management for The Washington Nationals Ballpark. Within this document, there is an overall project schedule which exhibits major construction milestones, a building system summary that highlights major systems that are being used in the construction. The document contains a project cost evaluation, which looks at historical construction data on past Major League Ballparks. It also features a site plan that displays existing site conditions and as well as information about the local conditions. There is also a history about the client, The DC Entertainment and Sports Commission, who is responsible for the construction of the ballpark. Lastly there is a breakdown of the project delivery system and the staffing involved in the project.



## Project Schedule Summary

The one page summary schedule that highlights the major phases of construction for the ballpark can be found in Appendix A.

Due to the hard deadline of opening day the schedule for the ballpark was developed to with very little margin for error in construction.

There is a fee of \$1,000,000 per day in liquated damages if the ballpark is not completed by opening day for The Washington Nationals.

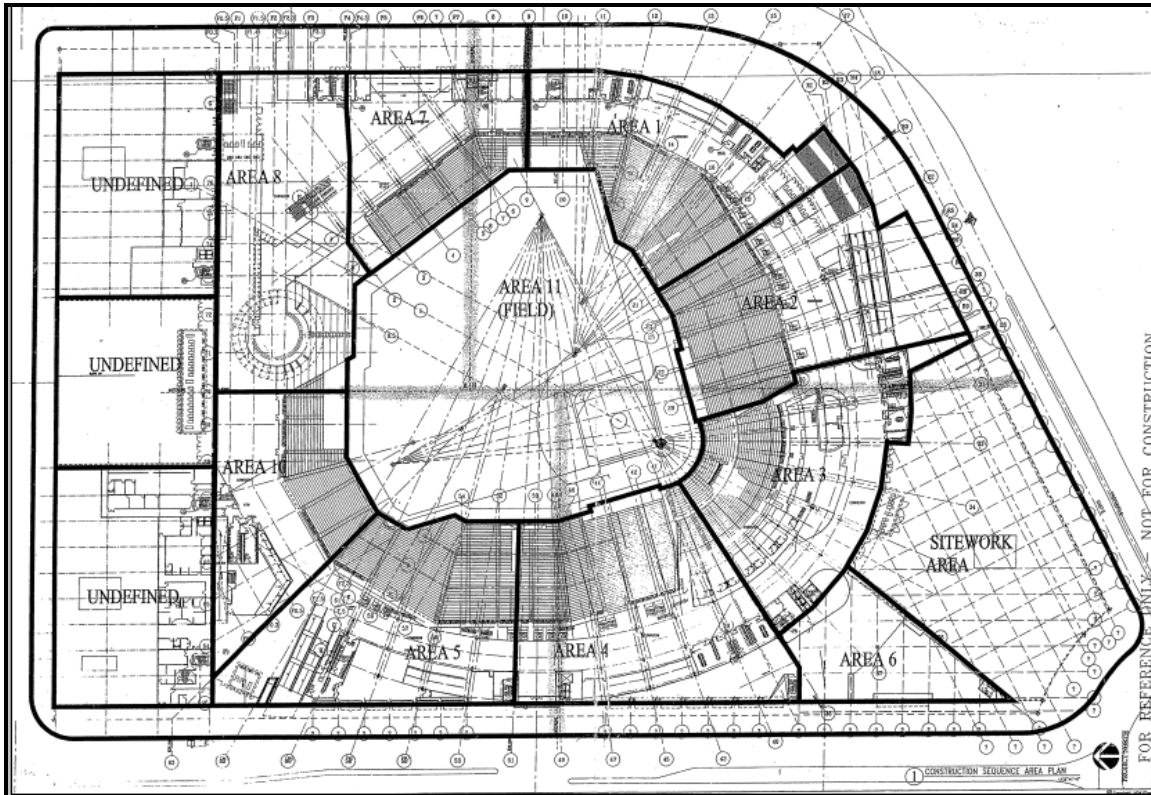
## Key Project Dates

Notice to Proceed	March 3, 2006
Foundations Started	May 22, 2006
Structural Steel Started	October 9, 2006
Topping Out	July 11, 2007
Substantial Completion	April 11, 2007
First Pitch	April 13, 2007

## Foundation Sequence

The ballpark consists of a deep foundation system. They are using 14” Steel H-piles which were driven down 45 feet to gain the allowable bearing capacity of 100 tons per pile. They were left 2’6” above the slab-on-grade so that the structure can tie into the foundation system. The foundation system was selected due to the site containing very hard clays and silty sands, which is typical since it is located right along the Anacostia River. The foundation was sequenced by breaking the ballpark into 10 different areas, which can be seen in the plan below. There were 3 different rigs which drilled an average of 12 piles per day. The first rig started in Area 1 and continued to Area 2. The second rig started in Area 4 and moved to Area 3 and then Area 5. The third rig was started in Area 7 and moved to Area 8 and then to Area 10. This was sequenced by making sure the main concourse area was completed first because that is where the majority of the ballparks structure is. The rigs worked their way around to meet in between Area 2 and Area 3, which is the center of the main concourse area.

Construction Area Breakdown:



**Structural Sequence**

The structural sequence is unique because half way through construction it was changed from a concrete structural system to a steel structural system, due to fact that steel was a long lead time item and concrete would allow them to fast-track the project and begin while the steel was being fabricated. The concrete framed areas, the 1<sup>st</sup> and 2<sup>nd</sup> level, are cast in place beams and girders. The 3<sup>rd</sup> level and above will be steel construction. The structural steel is sequenced the same way that the foundation was. They first starting erecting in Area 1 and continued to Area 2. They then started in Area 4 which was followed by Area 3 and then Area 5. They then erected the steel in Area 7, and then Area 8.



## Finishing Sequence

Most of the finishing work that needs to be completed are inside premium spaces in the ballpark, which includes rooms like the Players Locker Rooms, the Founders Bar and the many Suites. The finishing sequence is broken down by:

- Rough in Framing and Subroof
- Tie in Conduit/Pull Wire
- Hanging GWB
- Painting Walls
- Acoustic Ceiling Grid
- CWB Ceiling Framing and Ceilings
- Install Light Fixtures
- Millwork
- MEP Devices and Trim
- Flooring
- Doors/Architecture Trim

## Building Systems Summary

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

### Demolition

It was necessary for the demolition of buildings located on site before the construction could begin. The ballpark is located in the South East of Washington, DC, where they are trying to revitalize the area around the ballpark. The entire surrounding areas are all going to be demolished and rebuilt in hopes that it will renew the area. It is effectively named “The Ballpark District” which is going to be a mixed use community that features shops, restaurants, entertainment venues, offices, hotels, and apartments.

### Support of Excavation

A free draining sheeting systems, which consists of H Beams, wood lagging and bracing, was used for excavation support. All excavations were within code from the Occupational Safety and Health Administration (OSHA) and in accordance with the District of Columbia and Federal regulations for supporting the excavation.

### Structural Steel Framing

The structural steel is unique because it is only located in the structures above the Club Level as well as in the scoreboard in the right field. All of the rolled shapes excluding angles and channels shall conform to ASTM A992 or A572, Grade 50 steel. The connection materials are conformed to ASTM A36 steel. The metal decking is composed of 3” 18 gage type VL.



### **Cast in Place Concrete**

Cast in place concrete is used for the foundation and SOG. The SOG is 6" thick with reinforced WWF which is on top of a drainage layer made of washed gravel and crushed stone. There are also foundation walls on the services level that are cast in place concrete, which are to be 18" thick min. The retaining walls on the service level are 24" min to support the backfill pressure. They are all vertically formed by formwork and are required to have a design strength of 5000 psi after 28 days.

### **Precast Concrete**

Precast concrete is mainly used for the seating bowl of the stadium. They are precast, pre-stressed with 6" thick risers and 4" thick treads that are formed offsite. The precast seating will have an average thickness of 5.5" and are reinforced to 1.5 psf.

### **Masonry and Curtain Wall**

The ballpark consists of pre-cast concrete with masonry back-up curtain wall and storefront glazing systems, as well as metal panels with masonry back-up. There are single wythe running bond CMU with rebar that are filled cell for support. The roofing systems are made up of a combination of many types including a parapeted built-up roof with scupper and leader drainage, and some sheet metal decking with scupper and leader drainage.

### **Mechanical System**

The mechanical system is designed for a peak cooling load of 2000 tons. It has (2) 800 ton water cooled chillers for the on peak loads and (1) 400 ton water cooled chiller for the off peak loads. The cooling loads were designed with an outside temperature of 95° F dB and 76° F Wb, and with an inside temperature of 72° F +/- 3° F. Humidity will not be added to any of the enclosed spaces and it will be kept under 60% at all times. The premium spaces will have variable air volume air handling units with VAV Boxes for control. For the heating loads there will be (2) 12500 AMBH output, natural gas fired, forced draft hot water boilers.





## Electrical System

The electrical system has (3) 13.2 kV circuit feeders that are provided from the Potomac Electric Power Company (PEPCO) that will supply the ballpark. The main switchgear feeds the step-down transformers that support a 4160 volt network bus switchgear that are distributed throughout the ballpark. There are unit substations have dry type transformers rated for 28500/3330 kVA, 4, 160 volt, 3-phase delta primary and a 480/277 volt wye secondary. The transformers feed a 400 amp switch board rated for 277/480 volt, 3 phase, 4-wire. There is also an emergency power system that has generators that will provide 1000 kW and 1250kW in the case of a power failure. The generators will provide back up for the building egress lighting, seating bowl emergency lighting, fire alarm systems, security systems, fire department communication, emergency sound system and fire pump systems.



## **Project Cost Evaluation**

### **Overall Project Costs**

The overall project cost for the ballpark is \$611 million.

The cost per square foot (611 million / 1.2 million square feet) is \$509.16 per square foot.

### **D4Cost**

See Appendix B for the detail D4Cost schematic estimate.

D4Cost was used to try to create a schematic estimate of the ballpark. D4Cost uses actual cost data from existing building projects to help develop a schematic estimate of a new construction project. Unfortunately there is only 1 related project which the ballpark can be compared to, the Southwestern Bell Bricktown Ballpark, a minor league (AAA) stadium with an overall project cost of \$21,835,787. With the location modifier of Washington, DC and an updated time modifier, D4Cost came up with an overall construction cost of \$177,191,520. It is well below the ballpark's overall project cost.

### **R.S. Means**

There is no way to estimate a baseball stadium by a square foot estimate in R.S. Means. Historical data on ballpark construction costs were compared instead.

### **Historical Data Comparison**

Typically ballpark estimates are based off of cost per seat, therefore project cost and seating capacity was collected from the 10 the most recent major league ballparks that have been constructed.



Cost Comparisons of Recent Ballpark Construction:

Team	Ballpark Name	Year	Project Cost (millions)	Capacity	Cost / Seat
Washington Nationals	Washington National Ballpark	2008	\$611	41222	\$14,822.18
St. Louis Cardinals	Busch Stadium	2006	\$346	43975	\$7,868.11
Philadelphia Phillies	Citizens Bank Park	2004	\$346	43647	\$7,927.23
San Diego Padres	PETCO Park	2004	\$411	42445	\$9,683.12
Cincinnati Reds	Great American Ballpark	2003	\$297	42059	\$7,061.51
Milwaukee Brewers	Miller Park	2001	\$322	42200	\$7,630.33
Pittsburgh Pirates	PNC Park	2001	\$230	38496	\$5,974.65
Detroit Tigers	Comerica Park	2000	\$300	41070	\$7,304.60
Houston Astros	Minute Maid Park	2000	\$266	40950	\$6,495.73
San Francisco Giants	AT&T Park	2000	\$306	41503	\$7,372.96
Seattle Mariners	Safeco Field	1999	\$517	47116	\$10,972.92

**Compare Estimates**

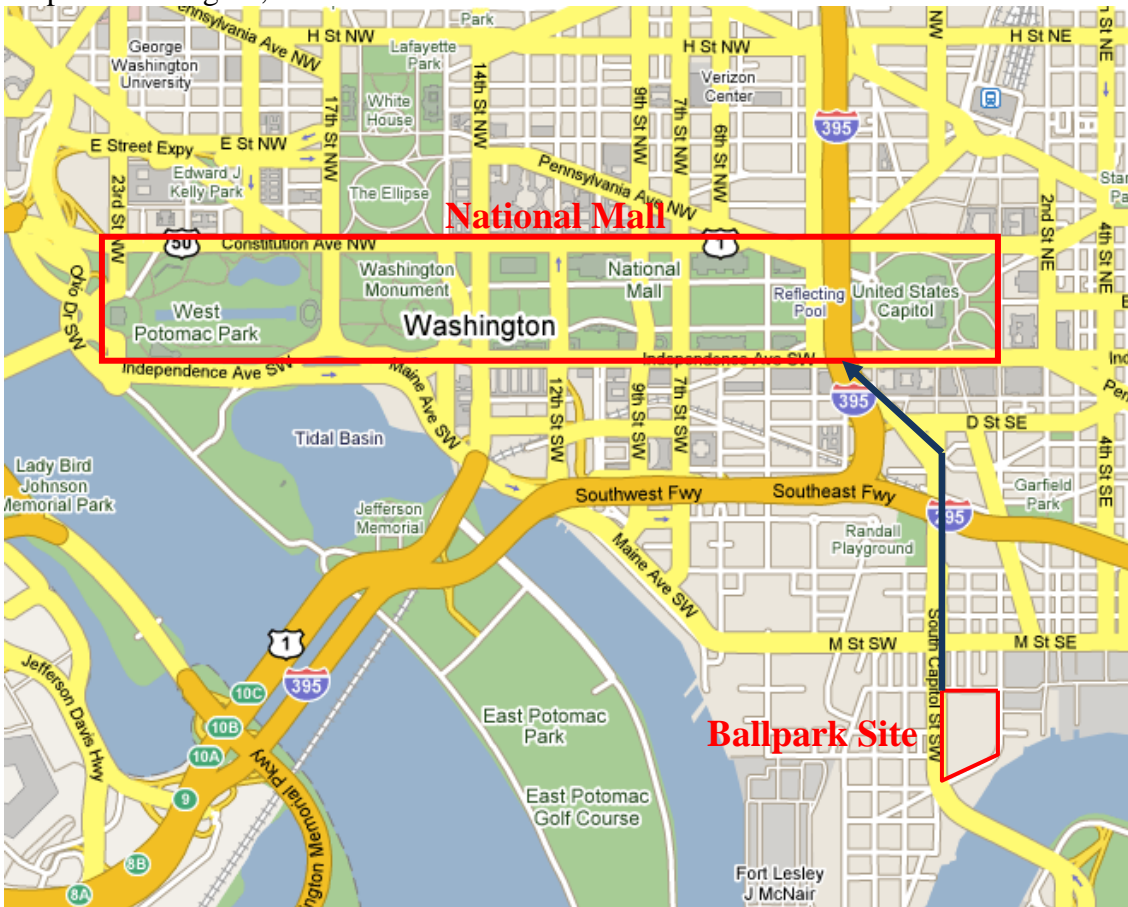
The Washington National Ballpark has the largest project cost in the history of construction of Major League Baseball stadiums. This can be contributed to the excessive amount of luxury boxes, 78 in total, as well as the fast-tracked schedule. The ballpark is trying to become the first LEED rated stadium. There are also major cost impacts from the extreme fast paced schedule that they needed to create to make sure the ballpark opened on time. It is also extremely expensive in trying to achieve the LEED rating. The D4Cost estimate can not even compare to the overall budget of the project because it is based off of historical data from a Minor League ballpark which will not have any of the same amenities that a Major League ballpark has.

### Site Plan of Existing Conditions

The one page site plan developed for the ballpark can be found in Appendix C.

The site is located in the middle of the revitalization of the “New Ballpark District.” The ballpark is facing north and is on a direct line with The United States Capitol. The ballpark will have 2 parking garages and metro stop at the Navy Yard green line that is one block from the ballpark. Below is a map of Washington, DC showing the close proximity of the ballpark to the National Mall.

Map of Washington, DC:





## **Local Conditions**

### **Waste Removal**

The overall goal of the waste removal program is that by the end of the project there will be a minimum of 75% salvage and recycling ratio vs. the total wasted generated by the work. There will be separate containers for recyclable materials and every worker is required to be trained on proper waste management.

### **Site Conditions - Geotechnical Report**

The proposed ballpark structure will have concrete framing which will then support a steel frame. The design loads are from approximately 200 kips to 3600 kips. There were 19 test borings taken in 2 different phases. In phase 1, 6 test borings were initially taken and then in Phase 2, 13 test borings were taken. The site is underlain with loose/soft fill consisting of silt, fat clay and silty sand, with asphalt, concrete and brick fragments down to 25 feet below the surface. The next level of soils consist of alluvium and terrace deposits containing inter-bedded deposits of medium stiff to hard fat clay, very soft to hard lean clay and sandy silt, and dense to very dense clayey sand to poorly graded gravel down to 72 feet. They are then followed by stiff to hard sandy lean clay to fat clay and dense to very dense poorly graded sand with clay to clayey sand down to 100 feet. The allowable bearing capacity of 3000 psf is to be located on natural soils and on the sand filters they can carry a capacity up to 2000 psf. The recommendation for the foundations is that it is to be a deep foundation system with the use of 14 inch steel H-piles. The backfill is to consist of SM, SP, SW, GM, GC, GP or GW soils per ASTM D-2487 with a liquid limit of 45 and plasticity index of 15. The fill that is placed behind a retaining wall should be compacted to 95% of the max dry density as per ASTM D-698.



## Client Information

The owner of the ballpark is the DC Sports and Entertainment Commission. They are independent agency of the District of Columbia government. The DCSEC is active in the planning and revitalization of the Anacostia water front. They are building the new ballpark to help redevelop the area as well as to provide a new home for the Washington Nationals, A Major League Baseball team. They will be responsible for the management and operation of the new home to the Washington Nationals.

The DCSEC wanted to provide a spectacular venue for the Washington Nationals that will combine the best parts of other MLB ballparks and well as provide its own unique style. As owners of the RFK stadium, where the Nationals currently play, the DCSEC wanted to make sure that they created a new ballpark that was above and beyond the old stadium, which can be seen below in the stadium comparisons. They wanted the design of the playing field to have an asymmetrical outfield to create exciting plays. They also wanted the make sure it had great views from any seat in the house. Another design concern was the amount of seats and suites that the ballpark will have. It will have 41,222 outside seats and 76 suites, which include 8 founder’s suites, 1 team owner double suite, 1 DCSEC double suite, 8 party double suites, and 58 regular suites.

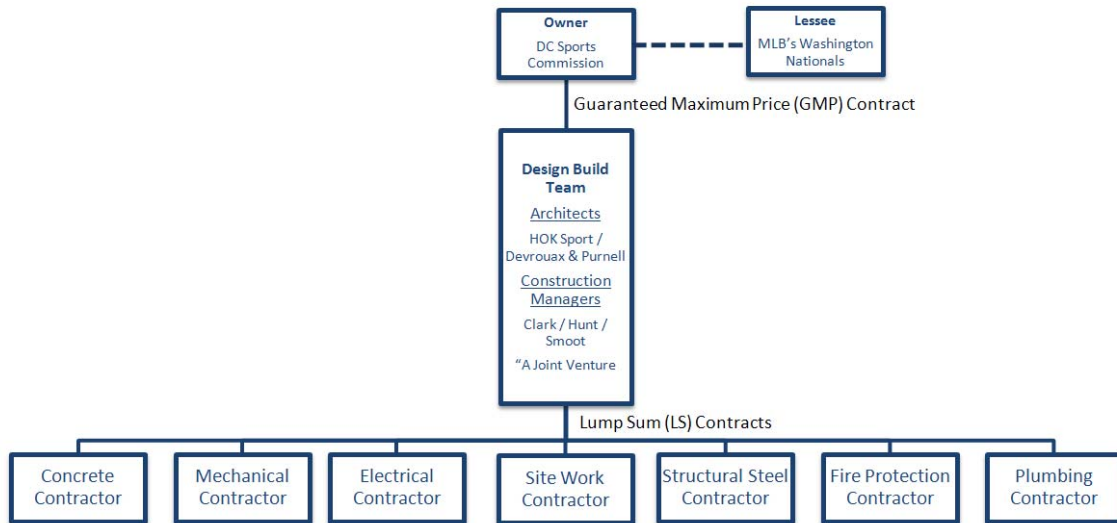
The owner’s major concern with the project is that will it be ready for the start of the 2008 baseball season, with the first pitch expected to be thrown on Sunday, April 13, 2008.

Comparison of the New Ballpark vs. RFK Stadium (The Nationals Old Home):

Nationals Park		vs.	RFK Stadium		
41,222		Total Capacity			46,000
Left Field 336 ft		Field Dimensions			Left Field 335 ft
Left Center 377 ft		Left Center 380 ft			Left Center 380 ft
Center Field 403 ft		Center Field 410 ft			Center Field 410 ft
Right Center 370 ft		Right Center 380 ft			Right Center 380 ft
Right Field 335 ft		Right Field 335 ft			Right Field 335 ft
Main Level 40 ft		Average Concourse Width			Main Level 19 ft
Club Level 26 ft		Mezzanine Level 20 ft			Mezzanine Level 20 ft
Upper Level 30 ft		Upper Level 15 ft			Upper Level 15 ft
181		Concessions – point of sale			102
4 Clubs 64,200 sf		Restaurants (square footage)			Diamond Club 8,900 sf
4,532 sf		Nationals Park			1,376 sf
Escalators 8		Cupholders			0
Elevators 7		Legroom between rows			26"
33		Disabled Seats			448
Escalators 8		Vertical Transportation			Escalators 0
Elevators 7		Elevators 1			Elevators 1
33		Permanent Ticket Windows			10
3 stores		Team Stores			1 store
4,532 sf		Scoreboard Dimensions			1,376 sf

## Project Delivery System

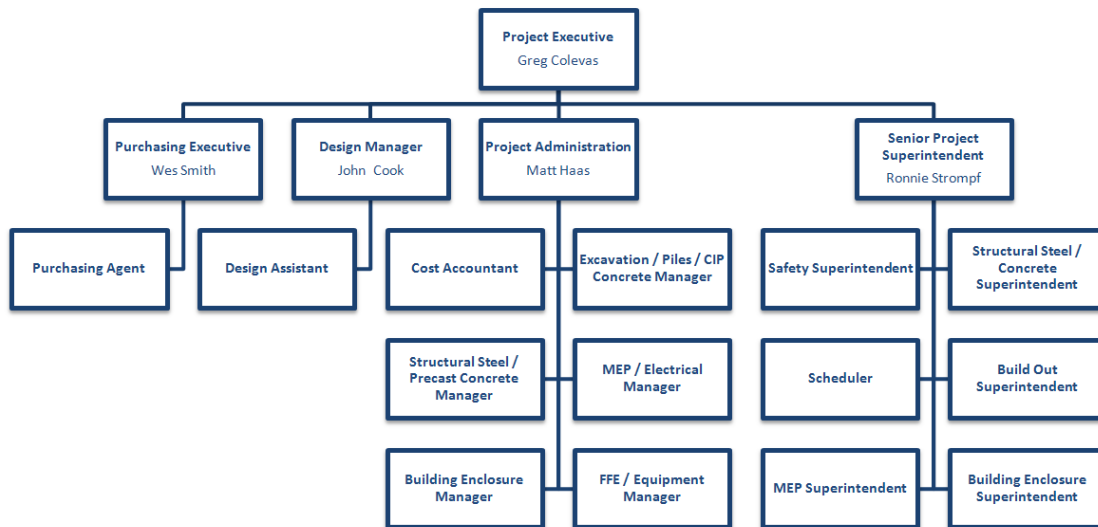
The ballpark is an extremely unique project that has many different companies coming together to form a joint venture to make the ballpark come to life. The project is a combination of multiple companies coming together to deliver the fast-tracked design-build project. The design team of HOK Sport, and Devroux and Purnell, formed a joint venture to act as the architects of the project. When they were 50% complete with the design process, the Guaranteed Maximum Price (GMP) contract was accepted by the District of Columbia. After the GMP contract was accepted, major local general contractors, Clark, Hunt, and Smoot formed a joint venture to work together as one construction company and perform the work as the construction managers on the ballpark. They assumed the design team contract with the owner creating a large design build firm. The major benefits of the design-build construction method are that it allows for great coordination between the designers and the contractors. Coordination is a major concern for making sure that project is completed on time for the 2008 baseball season. Clark, Hunt, and Smoot, are in charge of holding the contracts between the GC and the subcontractors.



## Staffing Plan

The staffing is unique to this project since it is multiple companies, Clark, Hunt, and Smoot that are coming together to form “A Joint Venture.”

The Project Executive is responsible for overseeing the entire project and making sure that the ballpark is being constructed to the owner’s specifications. The Project Administrator is responsible for overseeing the work of the individual trade Project Managers. The individual trade Project Managers are responsible for managing the subcontractors that were hired to perform work on the ballpark. For example the Structural Steel / Precast Concrete Manager is responsible for all of the subcontractors that are performing the steel and concrete work. They are responsible for the coordination of the shop drawings and well as making sure that the subcontractors are able to perform the work that they have contractually agreed to complete. The Senior Project Superintendent is responsible for all of the work that is being performed on site. He is responsible for managing all of the individual Superintendents and he is also responsible for making sure that the project is being constructed properly. The individual Superintendents are responsible for the onsite work, within their trade, that is being constructed on a daily basis.







## **Appendix A**

### **Project Summary Schedule**

**THE WASHINGTON NATIONALS BALLPARK**  
 WASHINGTON, DC



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ID	Task Name	Start	Finish	Duration	2005				2006				2007				2008											
					A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	
1	<b>Design Development Phase</b>	Mon 9/5/05	Fri 5/25/07	450 days																								
2	Schematic Design Documents	Mon 9/5/05	Fri 5/25/07	450 days																								
3	Procurement of Subcontractor	Mon 1/9/06	Mon 9/25/06	186 days																								
4	Design Assist/Submittals	Mon 3/20/06	Mon 4/23/07	286 days																								
5	<b>Construction Phase</b>	Wed 3/22/06	Fri 4/11/08	538 days																								
6	Notice To Proceed	Wed 3/22/06	Wed 3/22/06	1 day																								
7	Demolition	Mon 4/17/06	Mon 6/19/06	46 days																								
8	Mobilization on Site	Mon 5/1/06	Mon 5/29/06	21 days																								
9	Excavation	Mon 5/1/06	Mon 9/4/06	91 days																								
10	Foundations	Mon 5/22/06	Mon 12/4/06	141 days																								
11	CIP Concrete	Mon 6/12/06	Mon 5/21/07	246 days																								
12	Structural Precast	Mon 9/25/06	Mon 4/16/07	146 days																								
13	Structural Steel	Mon 10/9/06	Wed 7/11/07	198 days																								
14	Topping Out	Wed 7/11/07	Wed 7/11/07	1 day																								
15	Plumbing	Mon 2/5/07	Mon 2/18/08	271 days																								
16	Electrical	Mon 3/12/07	Mon 2/18/08	246 days																								
17	HVAC	Mon 3/19/07	Mon 2/18/08	241 days																								
18	Building Envelope	Mon 4/9/07	Mon 1/14/08	201 days																								
19	Telecommunications	Mon 5/14/07	Fri 4/11/08	240 days																								
20	Roofing	Thu 5/31/07	Fri 1/4/08	157 days																								
21	Fire Protection	Mon 6/11/07	Mon 3/17/08	201 days																								
22	General Trades - Interiors	Mon 7/2/07	Mon 3/17/08	186 days																								
23	Stadium Seating	Mon 8/6/07	Mon 12/17/07	96 days																								
24	Food Service	Mon 9/3/07	Mon 3/17/08	141 days																								
25	Millwork	Mon 9/3/07	Mon 3/17/08	141 days																								
26	Playing Field	Mon 10/1/07	Mon 3/17/08	121 days																								
27	Scoreboards and Stadium Lighting	Mon 10/22/07	Mon 2/4/08	76 days																								
28	Punch List - Close Out	Mon 3/17/08	Fri 4/11/08	20 days																								
29	Substantial Completion	Fri 4/11/08	Fri 4/11/08	1 day																								
30	Opening Day - First Pitch	Sun 4/13/08	Sun 4/13/08	1 day																								

Design Phase : 9/9/2005 to 5/25/2007  
 Construction Phase: 3/22/2006 to 4/11/2008

THE WASHINGTON NATIONALS BALLPARK  
WASHINGTON, DC



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## **Appendix B**

### **D4 Cost Estimating Comparison Print Out**

# Estimate of Probable Cost

Washington National Ballpark - Jun 2006 - District of Columbia

Prepared By: **Matthew T. Moore**  
**Penn State University**  
**2277 Spruce Ave**  
**State College, PA 16801**  
**(814)883-5709 Fax:N/A**  
**1200000**

Building Sq. Size: **1200000**  
 Bid Date:  
 No. of floors: **7**  
 No. of buildings: **1**  
 Project Height: **130**  
 1st Floor Height: **12**  
 1st Floor Size:

Prepared For: **Architectural Engineering Dept.**  
**Penn State University**  
**104 Engineering Unit A**  
**University Park, PA 16802**  
**(814) 865-6394 Fax:(814) 863-4789**  
**1130000**

Site Sq. Size: **1130000**  
 Building use: **Recreational**  
 Foundation: **PIL**  
 Exterior Walls: **CMU**  
 Interior Walls: **GYP**  
 Roof Type: **MET**  
 Floor Type: **CON**  
 Project Type: **NEW**

Division		Percent	Sq. Cost	Amount 611000000
<b>02</b>	<b>Site Work</b>	<b>10.64</b>	<b>15.71</b>	<b>18,852,808</b>
	Site Work	10.64	15.71	18,852,808
	Untitled	0.00	0.00	0
<b>03</b>	<b>Concrete</b>	<b>24.27</b>	<b>35.84</b>	<b>43,007,680</b>
	Concrete	24.27	35.84	43,007,680
<b>04</b>	<b>Masonry</b>	<b>9.08</b>	<b>13.41</b>	<b>16,092,869</b>
	Masonry	9.08	13.41	16,092,869
<b>05</b>	<b>Metals</b>	<b>14.98</b>	<b>22.12</b>	<b>26,547,105</b>
	Metals	14.98	22.12	26,547,105
<b>06</b>	<b>Wood &amp; Plastics</b>	<b>0.23</b>	<b>0.34</b>	<b>402,933</b>
	Wood & Plastics	0.23	0.34	402,933
<b>07</b>	<b>Thermal &amp; Moisture Protection</b>	<b>3.72</b>	<b>5.49</b>	<b>6,588,775</b>
	Thermal & Moisture Protection	3.72	5.49	6,588,775
<b>08</b>	<b>Doors &amp; Windows</b>	<b>2.45</b>	<b>3.62</b>	<b>4,338,952</b>
	Doors & Windows	2.45	3.62	4,338,952
<b>09</b>	<b>Finishes</b>	<b>6.91</b>	<b>10.20</b>	<b>12,243,279</b>
	Finishes	6.91	10.20	12,243,279
<b>10</b>	<b>Specialties</b>	<b>1.70</b>	<b>2.51</b>	<b>3,013,262</b>
	Specialties	1.70	2.51	3,013,262
<b>11</b>	<b>Equipment</b>	<b>1.77</b>	<b>2.62</b>	<b>3,142,184</b>
	Equipment	1.77	2.62	3,142,184
<b>12</b>	<b>Furnishings</b>	<b>3.98</b>	<b>5.88</b>	<b>7,056,398</b>
	Furnishings	3.98	5.88	7,056,398
<b>14</b>	<b>Conveying Systems</b>	<b>0.83</b>	<b>1.23</b>	<b>1,479,080</b>
	Conveying Systems	0.83	1.23	1,479,080
<b>15</b>	<b>Mechanical</b>	<b>8.36</b>	<b>12.35</b>	<b>14,817,101</b>
	Mechanical	8.36	12.35	14,817,101
<b>16</b>	<b>Electrical</b>	<b>11.07</b>	<b>16.34</b>	<b>19,609,093</b>
	Electrical	11.07	16.34	19,609,093
<b>Total Building Costs</b>		<b>100.00</b>	<b>147.66</b>	<b>177,191,520</b>
<b>Total Non-Building Costs</b>		<b>100.00</b>	<b>0.00</b>	<b>0</b>
<b>Total Project Costs</b>		<b>--</b>	<b>--</b>	<b>177,191,520</b>

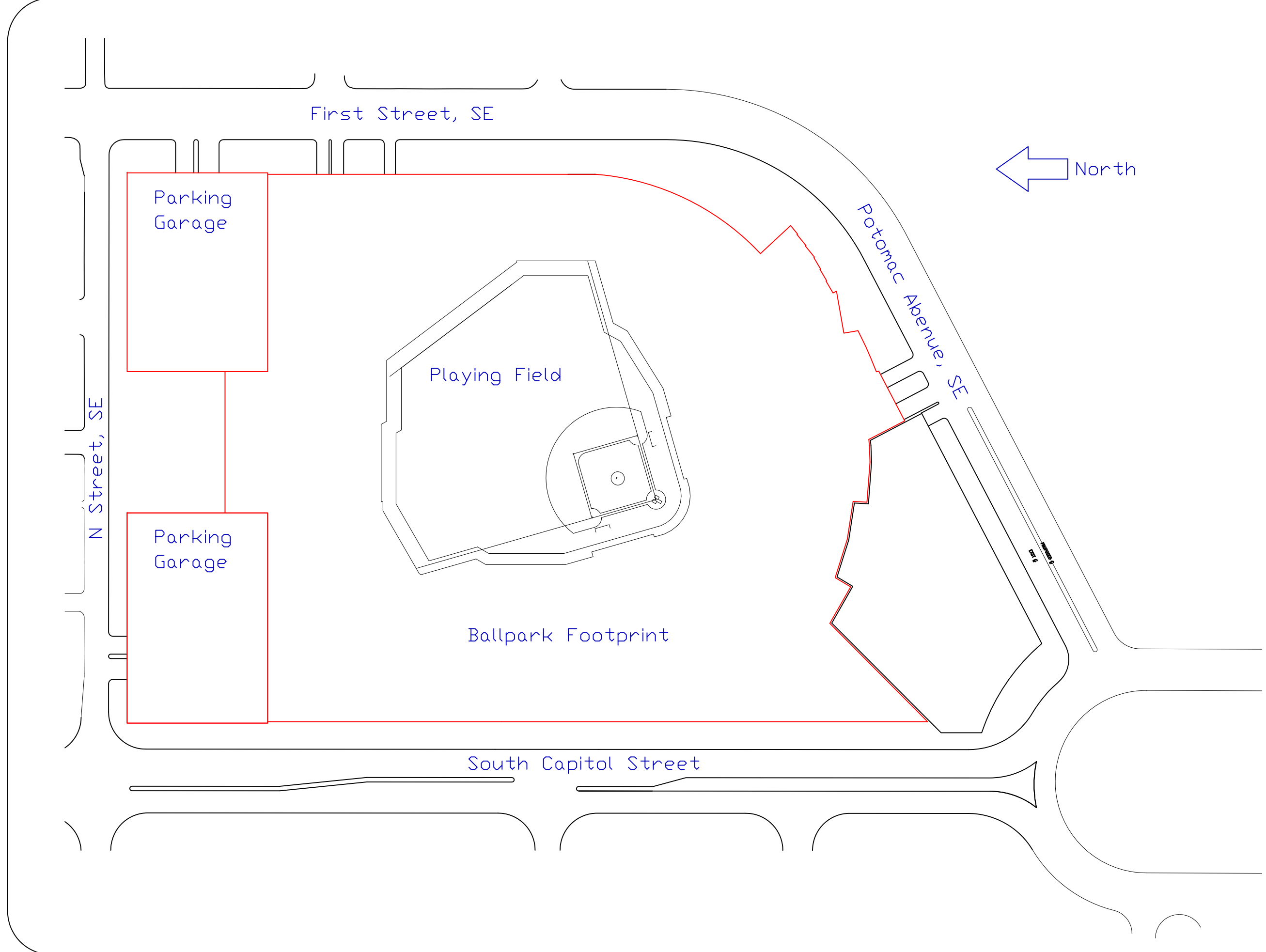
THE WASHINGTON NATIONALS BALLPARK  
WASHINGTON, DC



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## **Appendix C**

### **Site Plan**



General Notes

**THE WASHINGTON NATIONALS BALLPARK**  
WASHINGTON, DC

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No.	Revision/Issue	Date

Firm Name and Address

Project Name and Address

The Washington National Ballpark

Project	Nationals Ballpark	Sheet	C-1
Date	10/5/2007	Scale	
Scale	NTS		