



Washington-Lee High School

Matthew Hoerr | CM | Technical Report 1 | Messner

Technical Assignment 1 Construction Project Management





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Executive Summary

The new Washington-Lee High School is being built on the same site as the current High School is located. The school is surrounded by homes on three sides and is located at 1300 North Quincy Street in Arlington, Virginia. The new school is going to be approximately 362,000 square feet and is going to require the demolition of 225,000 square feet of the existing school. The new school is going for a LEED Silver rating and is very advanced compared to the current school that was originally built in 1924.

The new Washington-Lee High School is going to be a 4-story building that contains a courtyard in the center. The building is designed to hold the more than 1600 students that currently attend school there. The building itself contains sixteen science labs, three business labs, eight computer labs, and 3 music rooms. This building also contains a cafeteria that opens up towards the track. A large auditorium, gym, and natatorium are also going into the building.

The construction of the new school is going to be done in 3 phases. The first phase is the largest part and contains the 4-story section. The second phase includes some of the demolition of the existing school and contains the gym, auditorium, and natatorium. The third and final phase of construction includes the demolition of the rest of the existing school and the creation of 2 new soccer fields. The building is going to be a phased occupancy project with students entering phase 1 of the new school in January 2008. The entire construction is to be completed in December 2009.

This first technical report contains background information on the construction site and what is going into the building. It also contains a summary schedule using Microsoft Project and an estimate analysis using the actual estimate, a D4Cost estimate, and a square foot estimate using R.S. Means 2007 information. Other items that are included in this report are an existing site plan, a project delivery method analysis, and a staffing plan analysis. Information regarding local construction conditions and client information are also provided in this report.



A. Project Schedule Summary

A one-page summary schedule can be seen in Appendix A

Introduction

The new Washington-Lee High School is going to be completed in 3 phases. The first phase consists mainly of new classrooms, offices, and a cafeteria and is going to be completed in December of 2007. The students will move into this building in January and some of the old school will be demolished to make room for the phase 2 part of the building. Phase 2 consists of an auditorium, gym, and natatorium. Phase 3 follows and consists of the creation of 2 new soccer fields and demolishing the remaining parts of the old school.

Foundation

The foundation used on Washington-Lee High School was concrete. The soil onsite was good, so they used shallow spread footings where there are columns and continuous strip footings around the perimeter walls. They started in the areas closest to the stadium and moved away from it for the first phase of construction. The building was broken up into 5 sections with A and B comprising phase 1 and C, D, and E in phase 2. They basically followed the areas in order. The only areas of the building that needed extra foundation work were the Orchestra pit in phase 2 and the elevator shafts.

Structure

The structure of the building is a basic steel structure that uses beams typically spanning between 20 and 30 feet. The sequencing was done just like that of the foundation. Section A in phase 1 was completed first followed by section B in phase 1. Phase 2 has not yet begun but is going to be done in the same manner starting with Area C and working their way to Area E.

Finishes

The main element in the finishing work on this building is the MEP work. The building is going for a LEED Silver rating so the mechanical and electrical equipment are very large and are highly efficient. Coordinating this work was the most important thing when it came to finishing. All of the other items in finishing followed a typical order starting with framing the walls and ending with the new furniture in the building. The building is done in 2 phases so that the students can occupy phase 1 while phase 2 is being completed.

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

Demolition

Approximately 225,000 square feet of the existing Washington-Lee High School had to be demolished so that the new High School could be constructed. In phase I, only part of the existing building is going to be demolished. These areas include the auditorium as well as some classrooms and offices. In Phase II, the cafeteria along with several classrooms will be demolished. After phase II is complete the new school building is complete and the rest of the existing school will be demolished.

There will be some trouble with asbestos and lead paint. This is mainly because the original building was constructed in the 1920's. Hess Construction has a separate contractor already scheduled to take care of these items.

Structural Steel

The new Washington-Lee High School is designed to be a mainly steel structure. The typical floor spans of the steel beams are usually between 20 and 30 feet. These beams will carry a 2" deep composite metal deck and have 5 1/4 " light weight concrete on top.



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Cast in Place Concrete

The foundation is where most of the cast in place concrete took place on Washington-Lee High School. The foundation system of the school is very basic in that it uses shallow spread footings at each of the columns in the building and a continuous strip footing around the perimeter of the building. The slab on grade and the other floor slabs are reinforced with welded wire fabric. The way the concrete got to the upper floors was by a pump.

Mechanical System

In Phase I of the construction of Washington-Lee High School the mechanical systems are located in a ground floor mechanical room and in the mechanical penthouse. On Phase II of the construction the mechanical systems are located in a second floor mechanical room. In total there are three different areas of the building that the equipment will be placed. The two 500 ton chillers are located in the mechanical room on the first floor along with all of the boilers. All of the air handling units serving the phase I areas are located on the roof along with 2 cooling towers. The other air handling units used to serve the second phase of construction will be located in the second floor mechanical room. All of the air handling units in the building range in size from 9000 to 21500 CFM. Each temperature zone in the building contains a VAV box with reheat coils. The science labs in the building will have a 24/7 make-up and exhaust system so that it complies with LEED requirements. The building will have electric direct digital controls and each zone and classroom will have their own temperature sensor.

Electrical System

The electrical service on Washington-Lee High School is an 8000 amp 277/480 volt, 3-phase, 4 wire system. The panels are located throughout the building in electrical closets and in the mechanical rooms. There is also a 277/480 volt 150 KW diesel backup generator for the school.



Masonry and Curtain Wall

The façade of Washington-Lee High School consists mainly of red brick which is traditionally used in Arlington County. With the building aiming for LEED Silver, large windows and open spaces also take up a significant amount of space on the building façade. These windows are mainly on the south side of the structure and contain shading devices to prevent too much solar gain. Metal panels are also used at several parts of the building so it gives the structure a better sense of scale both up close and from a distance. A different color brick is used to create banding to make the building look aesthetically pleasing and to help the scale when up close to the building. There will also be a lighter colored brick used for the stairwells, entranceways, and the fourth floor to make these areas stand out. Most of the exterior walls are 1'7" thick with CMU being tied in to the face brick.

Support of Excavation

The only support used in the excavation was some temporary timber retaining walls. All of the excavation was sloped up to OSHA standards.



C. Project Cost Evaluation

Building Cost

Washington-Lee High School is scheduled to be about 362,000 square feet. The original bid for the school was 84 Million dollars. This gave a cost of \$232.04/SF for the building. The total project cost is estimated to be 95.2 Million dollars. This gives a total cost of the project of \$262.98/SF. A breakdown of the building systems costs is as follows:

Contractor Requested actual cost breakdown be kept confidential

D4Cost Estimate

The D4 estimate was done by taking the average of 5 other schools in the system that were somewhat similar. The main problem encountered was that none of the schools in the system had near the amount of square feet that Washington-Lee is supposed to have and aren't as technologically advanced. The D4 estimate turned out to be **\$54,706,720** and can be seen in Appendix B. A comparison of the different estimates can also be found on page 10.



Square Foot Estimate

This estimate turned out to be somewhat challenging and required some interpolation and assumptions. The main problem was that RS Means data only goes up to a 210000 SF building and Washington-Lee High School is 362000 SF. The building in RS Means is also for a 2-3 Story High School and Washington-Lee has some areas that go as high as 4 stories. It also did not help that the starting cost/SF was \$111.80 which is well below what the actual cost/SF ended up being. When interpolation was done to find the adjusted perimeter and story height cost both turned out to be negative which did not seem reasonable so it was assumed that the perimeter adjustment would be .5 and the story height adjustment would be .55. The square foot estimate went as follows:

Interpolation to find SF cost of building

$$\frac{(362000-190000)}{(210000-190000)} = \frac{(A-112.15)}{(111.8-112.15)}$$

$$A = \$109.14/\text{SF}$$

Interpolation to find LF perimeter value

$$\frac{(362000-190000)}{(210000-190000)} = \frac{(B-1566)}{(1700-1566)}$$

$$B = 2700 \text{ LF}$$

Story Height Adjustment

$$4 * .55 = \$2.20$$

Perimeter Adjustment

$$-700/100 * .5 = -\$3.50$$

Total Building Square Foot Cost

$$109.14 + 2.20 - 3.50 = \$107.84/\text{SF}$$

$$\$107.84 * 362000 * 0.93 = \$36,305,414.50 \Rightarrow \mathbf{\$36,305,400}$$



Comparison of Estimates

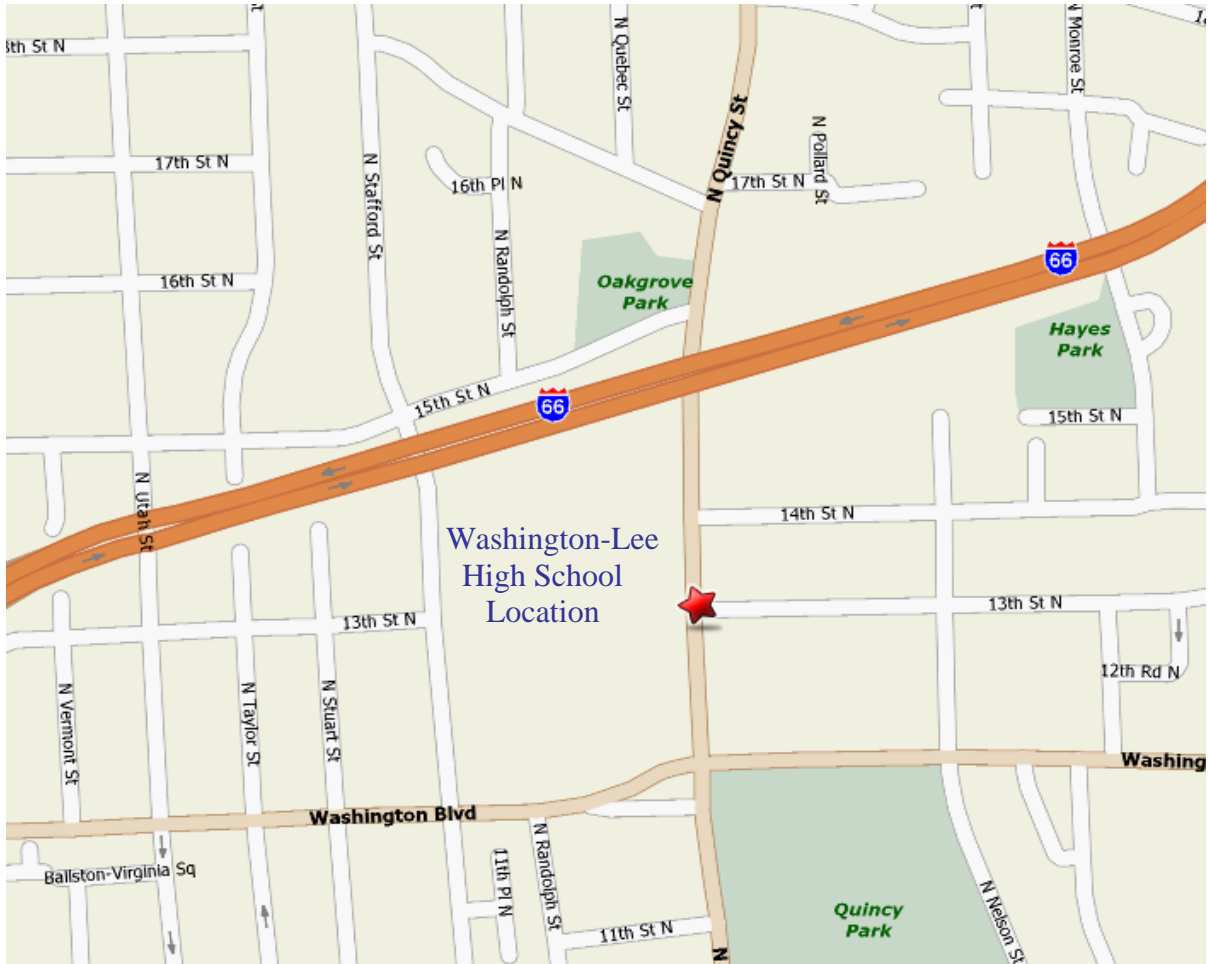
The estimated costs of Washington-Lee High School are significantly lower than the actual cost. The reason the D4Cost estimate is so far off is most likely because of the amount of demolition that has to take place in actuality and also because there were no school buildings that were even close to the amount of square footage that the new Washington-Lee School is going to be. The RS Means estimate also did not include demolition in it however it was almost 2.5 times smaller than the actual bid. This is most likely because the new school is going to be more technologically advanced and is also going for a LEED Silver rating. Other items that could have contributed in this error was the fact that the new school is 4-stories high in some parts and the RS means data is for 2-3 story high schools.

Actual Cost	D4Cost	Square Foot
\$84,000,000	\$54,706,720	\$36,305,400



D. Site Plan of Existing Conditions

The new Washington-Lee High School has not been given an official address, however the current school is located at 1300 North Quincy Street in Arlington, Virginia. The site plan is located in Appendix C.





E. Local Conditions

The new Washington-Lee High School is located in an urban environment and is in a very tight area, so there are not a lot of areas to park. The current softball field is being used as a staging area and for contractor parking. At some times during the day cars are triple parked within this area. After taking 29 boring samples it was found that the site contained fat clay, lean clay, silt, silty sand, clayey sand, poorly graded sand, and clayey gravel. About half of the soils located on the site can be used for structural fill.

The location of the new building was already fairly level however they had to be careful of organic materials and other buried items because of the old school. They also had to be careful of localized soft zones of soil. It was found that the new school would not adversely affect the water table at all. The building is going for a LEED Silver rating so recycling is very important and is readily available.



F. Client Information

The owner of Washington-Lee High School is Arlington County Public Schools. They are very experienced in building new schools and doing renovations. Washington-Lee was chosen to get a new school because the original school was built in 1924 and it was time for an upgrade. They wanted to update their technology and also give more room to the more than 1600 students that currently attend school there.

Safety is important on every jobsite and that includes this school. The owner does not want anyone to get injured while onsite and also wants to protect pedestrians as well as students and faculty. School is in session during most of construction so it is very important to keep school children out of the construction areas and also to control the amount of noise due to the new construction.

The owner wants to have a good quality building that is going to last a long time. This is demonstrated by the fact that the building is going for a LEED Silver Rating. This shows that the owner is looking towards the future of building and is hoping to save money in the long run by having very efficient equipment in the building.

The schedule is of utmost importance to the owner. The new Washington-Lee High School is a phased occupancy building and is going to be completed in three phases. The first phase is the largest of them all and should be completed by the end of December 2007 so that students can use this facility starting in January of 2008 and phase 2 of construction can begin. It is very important that phase 1 is completed on time so that the students can start immediately after Christmas Break. It is important that the new High School be completed on time, at a high quality, and with minimal safety incidents.



G. Project Delivery System

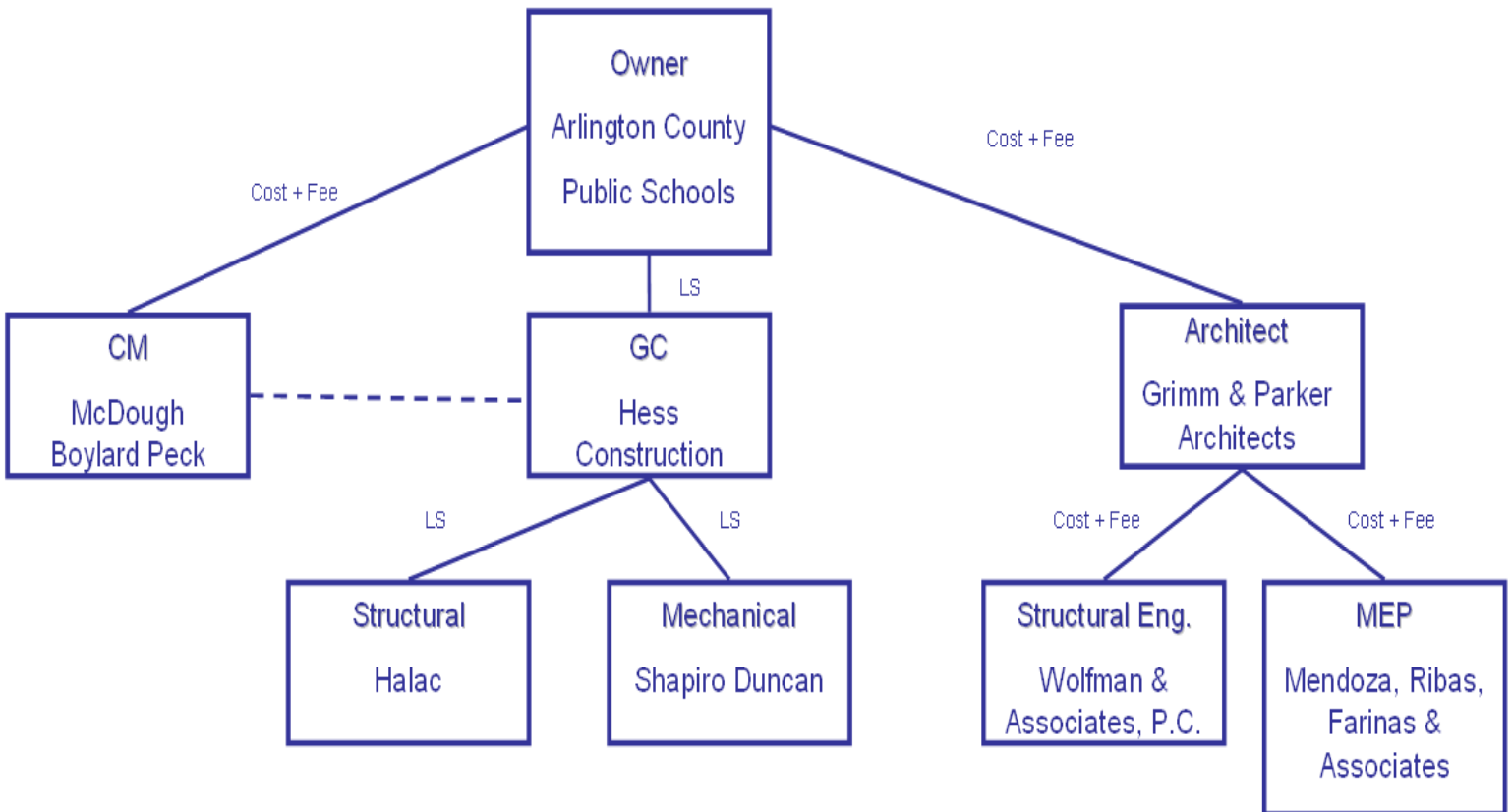
The project delivery method used on Washington-Lee High School was Design-Bid-Build. This method was chosen so that costs could be kept down and the project did not need to be fast tracked. They also wanted the building to be technologically advanced and LEED rated so the design took some time to accomplish. A CM-Advisor was also chosen to assist the owner in decisions and to make sure everything was going smoothly during construction.

Hess Construction Company was chosen as the contractor from a select list of prequalified bidders. They had the lowest bid. The bonds required on this project were a performance bond and a payment bond that both had to equal 100% of the bid. Certain subcontractors also had to have these bonds. Most of the contract types are lump sum on the contractor side and cost plus fee on the design side. The organizational chart can be seen on the next page.



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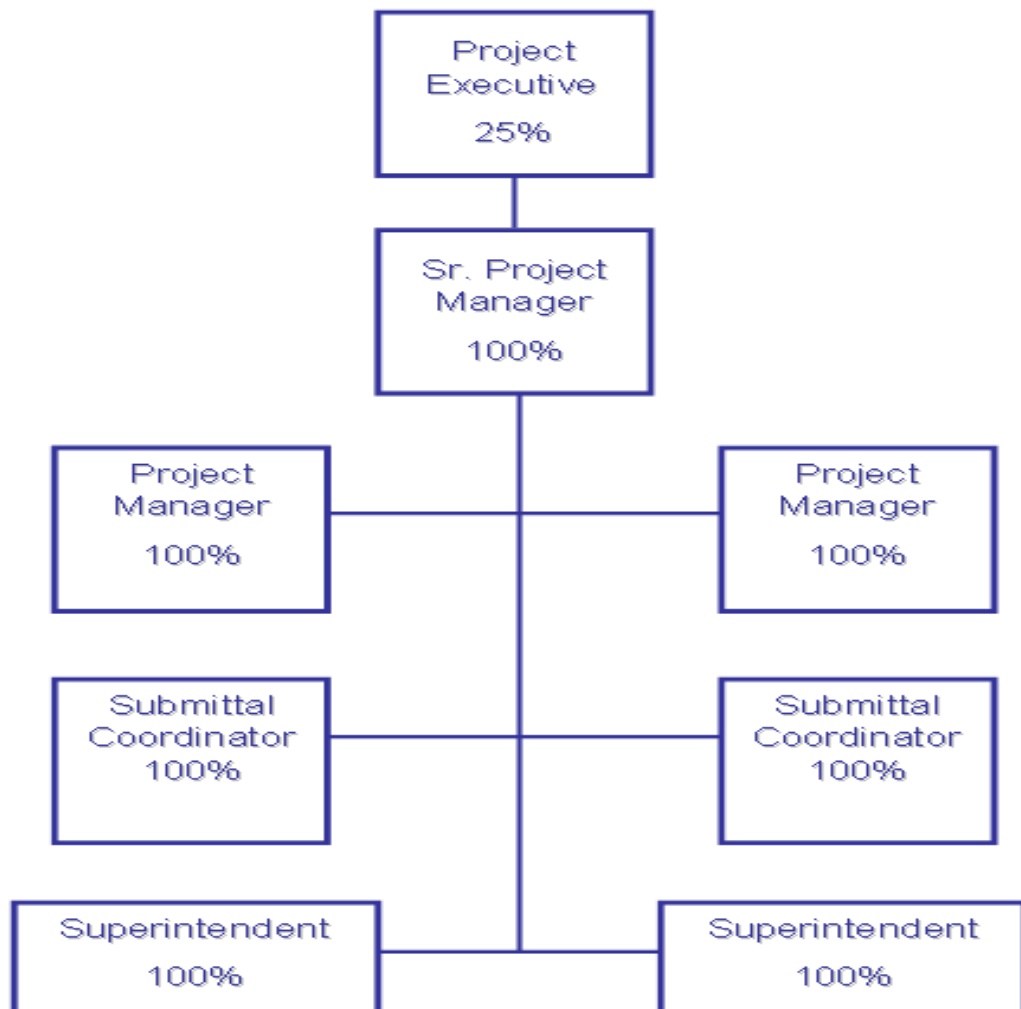
H. Staffing Plan

Washington-Lee High School is currently Hess Construction Company's largest project so they have allocated more staff to this project than they normally do. At the top is a project executive that is allocated to be on the project 25% of the time. Under him is a Sr. Project manager for the entire site. There are also 2 regular Project Managers that are going to be onsite all of the time and so the work can be evenly distributed. There are also going to be 2 Submittal Coordinators onsite at all times. Two Superintendents were chosen to keep track of the subcontractors since the project was 97% subcontracted out. A staffing layout can be found on the next page.



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Appendix A

One Page Summary Schedule

ID	Task Name	Duration	Start	Finish	1st Half		2nd Half		1st Half		2nd Half		1st Half		2nd Half		1st Half		2nd Half		1st Half					
					tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr		
1	Design Phase	267 days?	Mon 1/3/05	Tue 1/10/06																						
2	Prequalification Packages	1 day?	Wed 1/11/06	Wed 1/11/06																						
3	Bids Due	1 day?	Wed 3/8/06	Wed 3/8/06																						
4	Notice to Proceed	1 day?	Mon 4/3/06	Mon 4/3/06																						
5	Demo for Phase 1	20 days	Tue 4/4/06	Mon 5/1/06																						
6	Foundation Phase 1	27 days	Thu 7/13/06	Fri 8/18/06																						
7	Steel Phase 1	103 days?	Mon 8/21/06	Wed 1/10/07																						
8	Masonry	178 days?	Wed 9/20/06	Fri 5/25/07																						
9	MEP	218 days?	Wed 1/17/07	Fri 11/16/07																						
10	Interiors	210 days?	Mon 2/12/07	Fri 11/30/07																						
11	Building Phase 1 Completed	1 day?	Fri 12/14/07	Fri 12/14/07																						
12	Startup of Phase 2	1 day?	Mon 1/7/08	Mon 1/7/08																						
13	Demolition for Phase 2	180 days?	Tue 1/8/08	Mon 9/15/08																						
14	Foundation Phase 2	15 days?	Tue 9/16/08	Mon 10/6/08																						
15	Steel Phase 2	75 days?	Tue 10/7/08	Mon 1/19/09																						
16	Masonry	70 days?	Tue 1/20/09	Mon 4/27/09																						
17	MEP	80 days?	Mon 2/2/09	Fri 5/22/09																						
18	Interiors	92 days?	Mon 2/23/09	Tue 6/30/09																						
19	Building Phase 2 Completed	1 day?	Tue 7/7/09	Tue 7/7/09																						
20	Phase 3 Startup	1 day?	Wed 7/22/09	Wed 7/22/09																						
21	Demo of remaining building	103 days?	Thu 7/23/09	Mon 12/14/09																						
22	Sitework and Soccer Fields	117 days?	Thu 7/23/09	Fri 1/1/10																						
23	Project Completion	1 day?	Mon 1/4/10	Mon 1/4/10																						

Project: Schedule Date: Wed 10/3/07	Task		Rolled Up Task		External Tasks	
	Progress		Rolled Up Milestone		Project Summary	
	Milestone		Rolled Up Progress		Group By Summary	
	Summary		Split		Deadline	



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Appendix B

D4Cost 2002 Estimate

Estimate of Probable Cost of Washington-Lee High School

Washington-Lee High School - Mar 2006 - VA - Arlington

Prepared By: **Matthew Hoerr**

Prepared For: **Dr. Messner
Penn State University**

Building Sq. Size: **362000**
 Bid Date: **3/8/2007**
 No. of floors: **4**
 No. of buildings: **1**
 Project Height:
 1st Floor Height:
 1st Floor Size:

Site Sq. Size: **380873**
 Building use: **Educational**
 Foundation: **CON**
 Exterior Walls: **MAS**
 Interior Walls: **DRY**
 Roof Type: **MEM**
 Floor Type: **VCT**
 Project Type: **NEW**

Division	Percent	Sq. Cost	Amount
00 Bidding Requirements	0.85	1.29	467,584
01 General Requirements	5.38	8.13	2,942,944
02 Site Work	5.60	8.46	3,060,861
03 Concrete	11.61	17.55	6,351,946
04 Masonry	9.69	14.65	5,303,456
05 Metals	5.30	8.01	2,897,906
06 Wood & Plastics	1.49	2.25	814,491
07 Thermal & Moisture Protection	2.57	3.88	1,403,638
08 Doors & Windows	4.11	6.20	2,245,833
09 Finishes	7.23	10.92	3,953,155
10 Specialties	1.11	1.67	605,079
11 Equipment	6.92	10.46	3,787,067
12 Furnishings	2.01	3.04	1,101,592
13 Special Construction	0.30	0.46	164,767
14 Conveying Systems	1.01	1.53	554,525
15 Mechanical	24.09	36.40	13,177,561
16 Electrical	10.74	16.23	5,874,314
Total Building Costs	100.00	151.12	54,706,720
Total Non-Building Costs	100.00	0.00	0
Total Project Costs	--	--	54,706,720

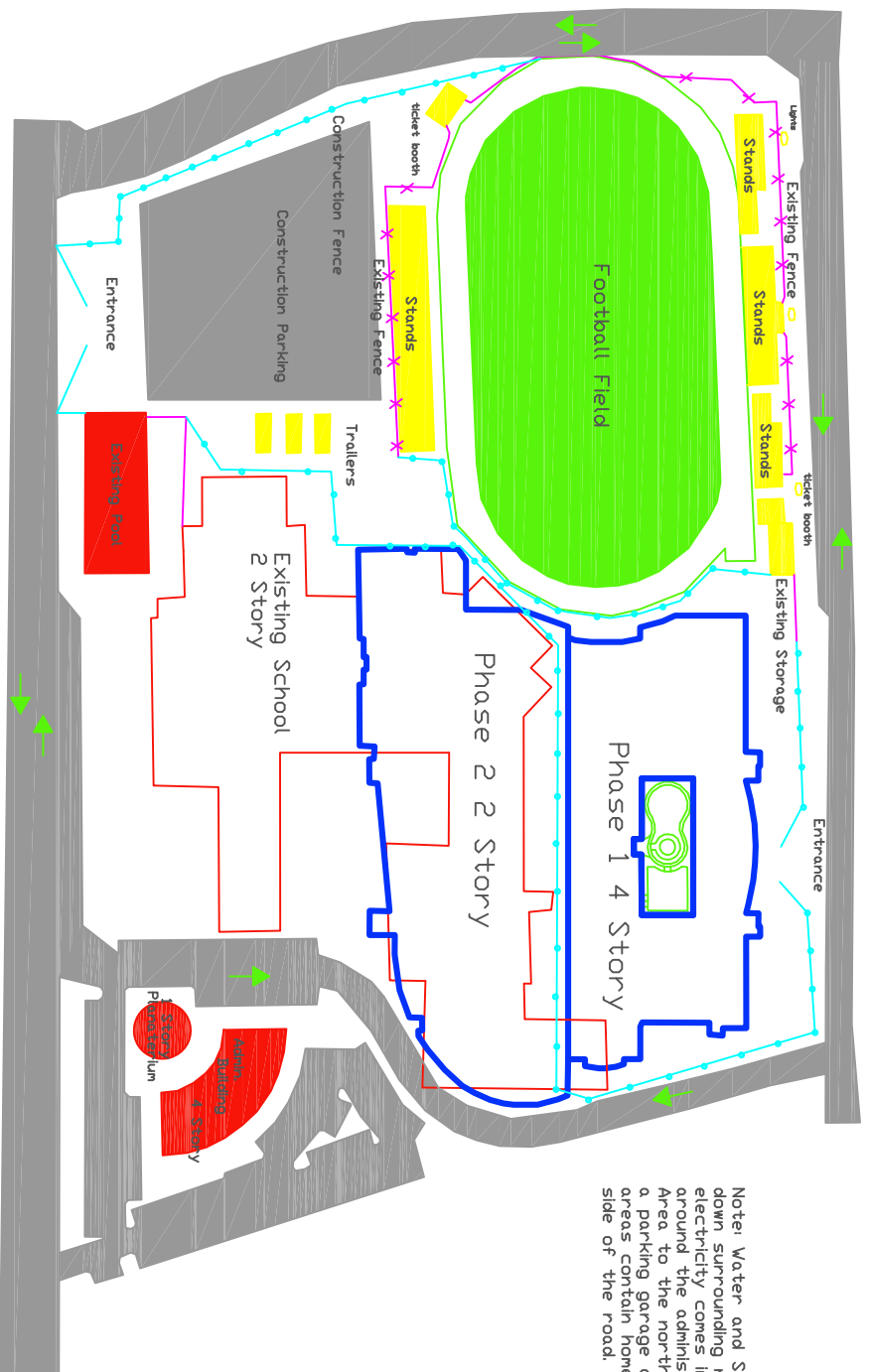


Appendix C

Site Plan of Existing Conditions

Technical Report #1

Note: Water and Sewer run down surrounding roads and electricity comes in from around the administration building. Area to the north of the road has a parking garage and all other areas contain homes on the other side of the road.



Matthew Hoerr

CM

Dr. Messner

Oct. 5, 2007

Existing Site Conditions Plan for Washington-Lee High School

Drawing

C 1,01