October 5, 2009

TECHNICAL ASSIGNMENT ONE

PENN STATE AE SENIOR THESIS

EPRISCOPAL HIGH SCHOOL
CENTENNIAL GYMNASIUM
ADDITIONS & ALTERATIONS
ALEXANDRIA, VA

PENNSTATE
1855

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TECHNICAL ASSIGNMENT ONE

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EXECUTIVE SUMMARY

Technical Assignment One is intended to present the existing conditions and parameters that influenced the design and construction of the Episcopal High School Centennial Gymnasium Addition/Renovation. This project includes a 60,000 SF new gymnasium addition as well as 39,000 SF of renovation work to the existing gymnasium and wrestling facilities. The largest challenge associated with this project is that the proposed site is located in between two existing structures (both of which are included in the renovation work) on an active private high school campus. The surrounding facilities, including the structures to be renovated, must remain open and functional for the athletic department during different phases of construction.

Information regarding the complex phasing/turnover milestones of the new construction and renovation work is shown within the report and a summarized schedule is presented to depict the plan for completing the project by September 3, 2010. An in-depth look at the building systems assesses the design intent as well as the methods of construction that contribute to the overall project and the goal of achieving a LEED Certification for the facility. Project cost was evaluated using online estimating software providing insight into the particular aspects of the design that are above industry standards. Due to the uniqueness of the site, an existing conditions plan and local conditions summary analyzes the environmental/local factors that add to the complexity of the project, particularly the effects of the campus activities on the construction phase. Finally, a thorough analysis of the clients' intentions is summarized and the methods of how the project team will meet these needs are explained in the project delivery system and staffing plan sections.

After analyzing the information contained within this report, a major focus for upcoming thesis research will be directed towards the phasing and scheduling of the project. Meeting the set turnover dates and phased occupancies is a critical aspect of the success of the Centennial Gymnasium project and the means/methods of achieving these milestones will provide interesting research topics.

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PROJECT SCHEDULE SUMMARY

See APPENDIX A for the Project Summary Schedule

A design competition for the Episcopal High School Centennial Gymnasium addition was held in the summer of 2006, culminating in the selection of Cannon Design and a schematic design submission in March of 2007. Design development began in June of 2007 and construction documents started in January of 2008. Bid documents were delivered to the general contractor in October of 2008.

The project schedule is sequenced by the distinct areas to be constructed and/or renovated. A detailed 3-phase construction process, shown below in Figure 1, was developed to allow for demolition, renovation and new construction to take place simultaneously throughout the project schedule. The first phase, starting in mid-March 2009, was the site work demolition and excavation to prepare for the new gymnasium addition. The renovations to the existing Flippin' Field House was to follow in late April with demolition commencing in the Wrestling Cage in early May, then the adjacent Fitness Area in mid-June. During this time, the aggregate pier columns and foundation work at the new Centennial Gymnasium was set to begin in late June. Renovation to the existing Centennial Gymnasium is slated to begin in December of 2009 with substantial completion of the entire project on September 3, 2010.

The sequencing of work is scheduled to progress from East to West for the foundation through the structure, enclosure, MEP system and interior finishes for each of the building areas. Turnover is to be phased for each of the sections as shown below. See APPENDIX A for the project summary schedule.

TURNOVER ONE:	Flippin' Field House (July 22, 2009)
TURNOVER TWO:	Wrestling Cage (October 9, 2009)
TURNOVER THREE:	Fitness Area/Mechanical Room (February 9, 2010)
TURNOVER FOUR:	Existing Gymnasium/New Gymnasium (September 3, 2010)

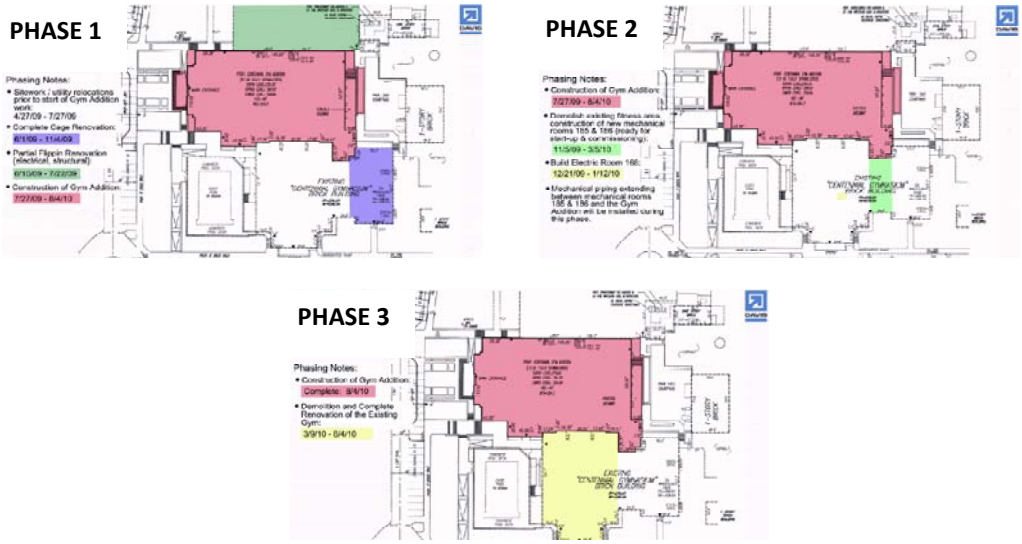


Figure 1: Phasing Diagrams (provided by DAVIS)

BUILDING SYSTEMS SUMMARY

BUILDING SYSTEMS CHECKLIST		
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	Excavation Support

Table 1: Building Systems Checklist

DEMOLITION

Approximately 39,000 SF of demolition is required prior to the renovation of the existing Centennial Gymnasium, Fitness Area and Wrestling Cage (shown in Figure 2). Types of materials found in this area of demolition include plumbing/electrical fixtures, furniture, interior wall assemblies, bleachers, locker facilities, basketball equipment and select structural elements to make way for the expanded mechanical room. The wood floor in the existing gymnasium is to be removed and the under slab prepped for new work. There is no asbestos in any of the demolition areas; however, lead paint covers several door frames and entry walls in the existing Centennial Gymnasium and will need to be removed prior to demolition.

Figure 2: Wrestling Cage Demolition, May 16

The 22 large bay windows on the North, East and West elevations of the existing Centennial Gymnasium are to be removed and prepped for installation of new window assemblies. In all, close to 50 fenestrations (includes doors, windows and louvers) are to be removed from the exterior elevations of the existing buildings and replaced with high performance assemblies.

Figure 3: New Addition Site, May 16

To make way for the new gymnasium addition, the 1.1 acre site between the existing Centennial Gym and Flippin' Field House (shown in Figure 3) had to be cleared of large trees, brick/concrete sidewalks, the North Stair tower of existing Centennial and a metal canopy. Also, this area houses several utility mains including storm, sanitary, electrical and water. All utilities have to be relocated and a 100' long, 5' deep steam tunnel demolished prior to excavation of the building pad. A new transformer and electrical duct bank is to be installed by Dominion Virginia Power prior to removal of underground electrical lines to ensure power is maintained at all adjacent existing buildings.

STRUCTURAL STEEL

While the majority of the structural system is cast-in-place concrete, there are several structural steel elements in the Centennial Gymnasium project. The six large white columns at the West entrance to the new addition house two-story tall HSS8x8x.25" steel columns with W12x14 beams spanning 13'-0" from the columns to the bearing wall. At the expanded mechanical room area, four HSS6x6x.25" columns support W18x35 beams for the rooftop AHU's and cooling towers. Inside the Wrestling Cage area, a two story mat-lift hoist will be supported by 4'-0" HSS5x5x.25" beams connected to three HSS6x5x3/8" columns.

The largest structural steel element on the project is the 107' roof trusses spanning the two story gymnasium, shown below in Figure 4. Between each truss will be W8x18 braces spaced to allow for all MEP lines to pass through the structure above the bottom chord of the truss. The roof of the new Centennial Gymnasium will be ER3.5A 18 gage G90 galvanized metal decking supported by the trusses above the open gymnasium portion, and 1 ½" x 18 gage G90 galvanized metal decking supported by W14x22 beams over the remainder of the addition. On top of the metal decking will be 18" wide standing-seam metal panels with high performance two-coat fluoropolymer finish system to minimize the heat island effect and contribute to the LEED certification.

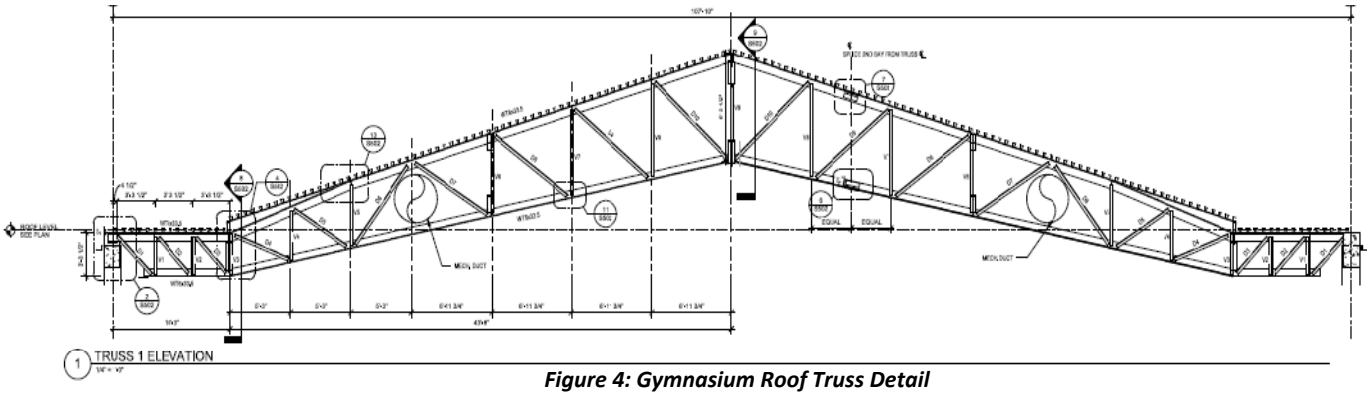


Figure 4: Gymnasium Roof Truss Detail

All of the structural elements will be erected by the same tower crane being used for the cast-in-place concrete placement. The crane model is Comansa #21LC290 with a rated capacity of 10,140 pounds. At a height of 100', the crane is located along column line 5 at the West end of the new addition and can reach the entire building structure with the 177.1' boom.

CAST-IN-PLACE CONCRETE

Reinforced cast-in-place concrete is to be used for pier caps, footings, grade-beams, foundation walls, SOG, columns, beams and one-way elevated slabs. ULMA Modular Gang System will be implemented for all vertical formwork elements and ULMA CC-4 Aluminum system is to be used for all horizontal formwork elements. A unique feature for the CIP concrete are 16 round, exposed columns that run along the South side of the new gym

Figure 5: Concrete Placement, Sept. 15

addition. Special Type 'A' formwork and placement strategies must be used to achieve the specified finish for these elements. As shown in Figure 5, the tower crane and bucket will be utilized to place concrete for all footings, foundation walls, columns and beams. The SOG and elevated slabs will be placed with a concrete truck and pump. All concrete materials will be recycled in a separate container as a part of the construction waste management program for LEED certification.

MECHANICAL SYSTEM

There are two mechanical rooms located on the lower level of the existing Centennial Gymnasium in the current fitness room area, and a third mechanical room located on the upper level of the new addition adjacent to the gymnasium. The overall system is an air-water AC system with the primary air supplied by air-handling-units and secondary air circulated by terminal/fan coil units. There are two AHU's and one cooling tower located on the roof above the lower level mechanical room, and five AHU's located inside the building. AHU 1 is a glycol run-around heat recovery system with 100% outside air. The rest of the AHU's operate with a VAV mixed air system. One 572 GPM centrifugal chiller is located in the lower level mechanical room and provides the chilled water for the AC system. Two 3000 MBH condensing boilers supply the hot water for the reheat/radiation system. Single line ductwork distributes the treated air to the individual spaces, while hydronic piping transports water to the terminal units.

The entire new addition and renovated area will be completely sprinklered with a wet-pipe system.

ELECTRICAL SYSTEM

An existing 480Y/277, 3-phase, 5-wire, 60 hertz feed will be supplied by Dominion Virginia Power Company. There is no back-up generator specified for the project, however battery back-ups are to be provided for the emergency fire alarm system.

MASONRY

The main building enclosure system for the exterior wall of the new Centennial Gymnasium is a modular "Delmarva" face brick backed by structural reinforced masonry bearing walls with 8" CMU's and air cavities. Structural steel lintels are to be utilized at interfaces with the existing structures to support the brick façade. Cast stone masonry sills are to be installed at all exterior windows with cast stone masonry clad units between the entry and upper level windows on the new gym addition. The general sequence for brick façade will be the East/South elevations followed by the North/West elevations. The scaffolding will be erected for the first phase and then repositioned for the second.

CURTAIN WALL

Connecting the new Centennial Gymnasium to the existing gymnasium is a two story glass atrium constructed of aluminum curtain wall framing with Solarban 70XL glazing. There is approximately 1500 SF of curtain wall designed by the Architect, Cannon Design. The stick-built system is to be erected by the installer with a 1/8 inch in 10 feet plumb tolerance and a 1/8 inch in 20 feet level tolerance.

PROJECT COST EVALUATION

The actual construction costs are based on the GMP tabulation provided by DAVIS Construction. The amounts are slightly altered and rounded for comparison purposes. All costs shown do not represent actual bid costs for the project.

PROJECT PARAMETERS

Square Footage of New Addition:	60,000 SF
Building Perimeter of New Addition:	700 LF
Square Footage of Renovations:	39,000 SF
Building Perimeter of Renovations:	650 LF
Total Square Footage:	99,000 SF
Total Building Perimeter:	1350 LF

CONSTRUCTION COST (New addition and renovation work)

Actual:	$17,535,400
Per SF:	$177.13

TOTAL PROJECT COST (New addition and renovation work)

Actual:	$22,457,000
Per SF:	$226.85

MAJOR BUILDING SYSTEMS COST ESTIMATE (New addition and renovation work)

MAJOR BUILDING SYSTEMS		
SYSTEM	**ACTUAL**	**PER SF**
Cast-In-Place Concrete	$2,192,000	$24.14
Masonry	$2,016,000	$20.36
Structural Steel	$657,200	$6.64
Glass and Glazing	$1,529,400	$15.45
Mechanical/Plumbing	$3,868,500	$39.08
Electrical	$2,011,400	$20.32

Table 2: Major Building Systems Cost Estimate

R.S. MEANS SQUARE FOOT ESTIMATE – Construction Cost

****See APPENDIX B for RSMeans CostWorks 2009 Square Foot Cost Estimate Reports***

New Gym Addition:

Actual:	$6,922,000
Per SF:	$115.37

Approximately $1 million in equipment/furnishings was added to the standard square foot estimate for the new gymnasium addition to account for the telescoping seating, basketball/wrestling equipment, high-end locker room finishes, etc. See the cost report for a detailed breakdown of the assumptions/additions.

Renovation Work:

Actual:	$4,887,000
Per SF:	$124.03

The same assumptions/additions for the new addition were applied to the Centennial renovation estimate since the equipment and furnishings are similar to the new gym building. See the cost report for a detailed breakdown of the assumptions/additions.

Total Construction: (New Gym + Renovation Work)

Actual:	$11,809,000
Per SF:	$119.28

D4COST ESTIMATE – Construction Costs

****See APPENDIX C for D4COST V9.5 Estimate Reports***

New Gym Addition: (Case #RC961135 - Univ. of North Colorado Student Rec. Center)

Actual:	$8,050,000
Per SF:	$134.00

Renovation Work: (Case #EU080548 – Rowenhorst Student Center Renovation)

Actual:	$5,772,800
Per SF:	$148.00

Total Construction: (Case #RC961135 + #EU080548)

Actual:	$13,822,800
Per SF:	$139.62

COST COMPARISON

To compare the three estimates, the total project cost cannot be considered since D4Cost and RSMeans do not include amounts for sitework, contingencies, allowances, fees, etc. To provide an accurate assessment, the actual construction cost will be used in comparison with the D4Cost and RSMeans estimates.

The RSMeans CostWorks estimate is approximately $5.7 million below the actual construction cost, or $57.85/SF less. Since the project is a combination of new construction and renovation, two square foot estimates were run to account for the different facilities. RSMeans CostWorks does not have a

renovation option for the square foot estimator; therefore new construction was used for both estimates. Another major assumption made by RSMeans is that the gymnasium is a 1 story structure with spread footings. The actual building is 3 stories with aggregate pier footings. While the square foot software is a good tool to obtain a "ballpark" estimate, it was very difficult to include assumptions and additions for all of the high-end finishes, combination of new construction/renovation work and above-standard designs for the project.

In comparison to the square foot estimate, the D4Cost parametric estimate was slightly more accurate, only $3.7 million below the actual construction cost, or $38/SF less. The reason for the D4Cost estimate being more accurate than the RSMeans estimate can be attributed to the fact that D4Cost has renovation/addition projects in the database, which closely matches the actual project type for the Centennial Gymnasium. The difference in cost for the actual vs. D4Cost can be associated with the MEP systems and the interior finishes. The Centennial project has above-standard interior finishes, which would not be assumed in the parametric estimate. Also, since the project is pursuing a LEED certification, the MEP systems have a higher up-front cost, with an emphasis on a more sustainable, life-cycle cost benefit. This would not be reflected in the D4Cost analysis and contributes to the difference in cost.

EXISTING CONDITIONS SITE PLAN SUMMARY

See APPENDIX D for the Existing Conditions Site Plan

Figure 6: Google Map of EHS Campus and Surrounding Area

The site for the Centennial Gymnasium Addition is located between two existing structures. The Flippin' Field House, located north of the proposed site, is the indoor track facility for the EHS athletic department. Existing Centennial Gymnasium, located south of the proposed site, currently houses all of the athletic department offices, basketball, volleyball and wrestling facilities. The new addition is designed to connect the two existing buildings to increase and improve the athletic department facilities. The main issue with the new addition site is the amount of existing utilities that cross the area. Gas, water, electric, storm and sanitary lines run through the site connecting several other campus buildings. Several of these utility lines will need to be re-routed prior to excavation of the new addition building pad. While public vehicular and pedestrian traffic is not a concern since the site is located on a private campus, the site is currently a main walkway for students/faculty and will need to be addressed during construction. See APPENDIX D for the existing conditions site plan.

LOCAL CONDITIONS

Episcopal High School is located at 1200 N. Quaker Lane in Alexandria, VA. Spread out over a 130-acre campus, EHS is approximately 10-minutes from downtown Washington, DC. The DC Metro area is commonly known for using reinforced concrete for structural systems on low to mid-rise buildings. Due to the private access of the campus, the project site has minimal impact on public vehicular/pedestrian traffic. The main concern is the high volume of student/faculty pedestrian traffic within the campus grounds near the Centennial site. As shown in Figure 7, the new addition (shown in yellow) is being constructed between the existing Centennial Gymnasium (building 20) and the Flippin' Field House (building 22). Minimal construction parking is available north of the Flippin' Field House (shown in blue). An on-site parking program will be implemented to monitor the amount of parking available for each subcontractor.

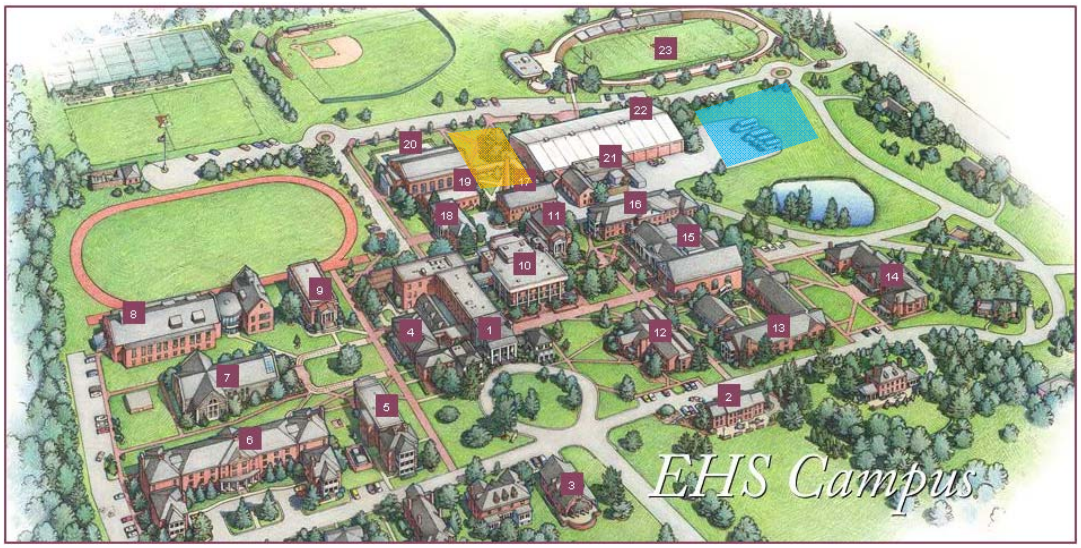


Figure 7: EHS Campus Map (www.episcopalhighschool.org)

The subsurface test borings for the site revealed 4-5 inches of topsoil followed by 3.5-6 feet of existing fill that is primarily moist clay. Below the topsoil and fill, the natural soils of site are comprised of a layer of coarse-grained sand/gravel and a layer of fine-grained silts/clays 10-18.5 feet below existing ground surface. Groundwater was recorded at depths varying between 8.6-14.4 feet below existing surface grades. The presence of the groundwater at these depths will require groundwater-control during installation of the deep foundations.

In the Alexandria, VA area, a standard co-mingled dumpster cost $350 per offload. A separated material dumpster (i.e. concrete, metal, etc.) will cost $280 per offload and tends to be slightly smaller in size. DAVIS estimated that on this project the co-mingled dumpster will need to be emptied once a week, and the separated recycled content dumpsters twice a week.

CLIENT INFORMATION

Episcopal High School is a private preparatory academy that pursues high performance in academics and athletics. Several years ago, the Board of Trustees identified the Centennial Gymnasium addition and renovation as the top facility priority for the EHS campus due to the outdated conditions of the existing athletic facilities. This project will allow the School to better meet the needs of the athletic department that supports 43 interscholastic teams (www.episcopalhighschool.org).

EHS has several key expectations for the expansion project. Walking around the campus, ***tradition and quality*** are common themes throughout all the facilities. Carrying this into the new addition, EHS has selected high-end finishes for the Lobby and Trophy Hall of Fame area and extra attention has been given to detailed architecture/landscape design to uphold the rich traditions of the campus.

Given the nature of construction projects on school facilities, ***schedule*** is a major concern when discussing expectations. The project is slated to be completed over one full school year with multiple phases and occupancies to allow for continued use of the facilities throughout the construction process. All parties involved are committed to meeting the phasing needs of EHS and turning over a completed facility prior to the start of the 2010/2011 school year.

EHS is a private organization that is funded by "The Roll Call" foundation that supports all aspects of the School's operations. While ***cost*** is not the driving factor in the expectations for the Centennial Gymnasium addition, a detailed and concise budget is necessary to ensure that the project meets all of the needs for EHS and those who graciously donated to the foundation.

As is on all projects, EHS and all firms involved have committed to design, construct and maintain a ***safe*** facility. All necessary regulations and codes have been followed to ensure a sound design of the gymnasium. EHS and DAVIS Construction have worked together to implement a logical and safe site plan that separates construction activities from pedestrian/vehicular traffic. No aspect of quality, tradition, schedule or cost is more important than ensuring the safety of all individuals involved in the construction process.

As described in the Project Summary Schedule section, a detailed 3-phase sequencing process has been developed for the Centennial Gymnasium project to ensure that EHS has access to certain areas throughout the entire schedule. There are four distinct turnover dates that allow the athletic department to relocate equipment, personnel and athletes without losing functionality of the facility. It is key for DAVIS Construction to understand this complex phasing plan and closely manage the process to ensure that EHS is able to continue with day-to-day activities during the construction schedule.

PROJECT DELIVERY SYSTEM

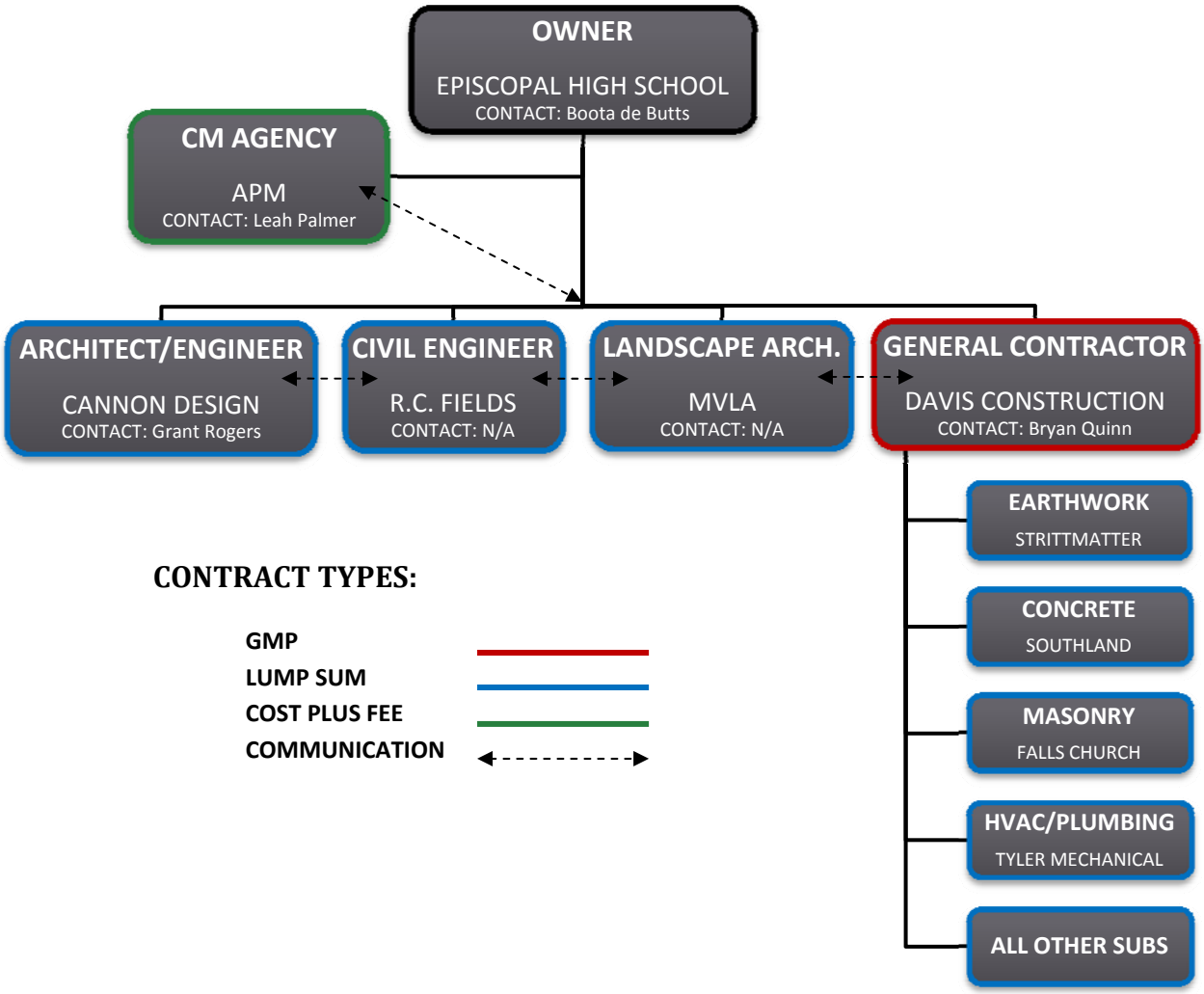


Figure 8: Project Organizational Chart

The project delivery system for the Centennial Gymnasium project is a ***DESIGN-BID-BUILD with a CM AGENCY***. DAVIS' contract for general contractor services is a negotiated guaranteed maximum price. Due to the incomplete design at the time of the bid, the GMP allowed for contingencies and allowances to encompass any additional costs related to design changes and additions. The presence of a CM Agency is appropriate since the EHS School Board does not have the time or expertise to manage a large scale project effectively. Contracting with APM allowed for advice during the preconstruction phase and sound management and supervision throughout construction. All of the subcontracts held by DAVIS are lump sum contracts awarded to the lowest, prequalified bidder.

DAVIS is not required to submit a bond to the owner for this project. Instead, EHS has requested that only certain subcontractors (selected by EHS) must submit a bond to DAVIS in lieu of a contractor bond. This system was developed to minimize the amount of bonds paid for by the owner. EHS is carrying the Builders Risk Insurance and DAVIS is carrying the General Liability Insurance for the project.

STAFFING PLAN

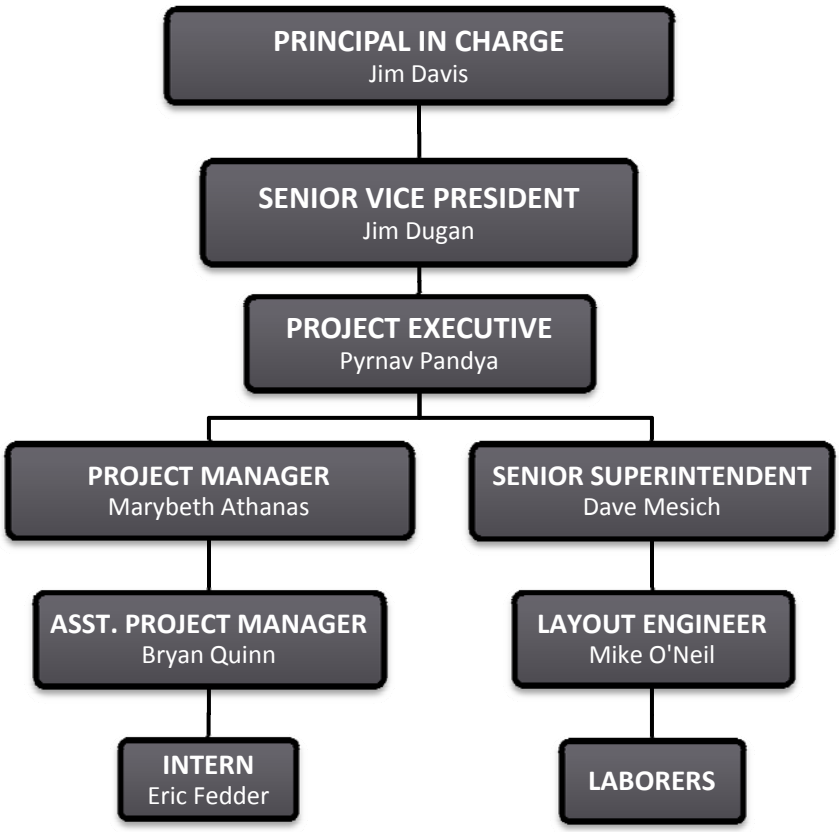


Figure 9: GC Staffing Plan

DAVIS Construction staffs their projects based on project size. The standard staffing plan for DAVIS, which includes a project manager, superintendent, assistant project manager and a layout engineer, is shown above in Figure 9. This particular project only had one management team given the size and complexity. At DAVIS, a project executive oversees 3-4 project teams, and the vice president will manage an entire group, which may include 8-10 project teams. Each project team may manage an entire project, as is the case for Centennial Gymnasium, or a group of divisions within a larger project.

On this project, the management staff (VP, PX, PM, APM and intern) is located at the office headquarters. The field staff (superintendent, layout engineer and laborers) is stationed at the jobsite in a field trailer. Typically, the management staff visits the site 2-3 times a week for progress meetings, safety inspections and conflict resolution.

Aside from the project specific staff shown above, DAVIS has a safety department that assigns safety managers to monitor a group of projects on a weekly basis. There is not a safety manager assigned solely to the Centennial Gymnasium project, therefore a majority of the daily safety related issues are handled by the superintendent.

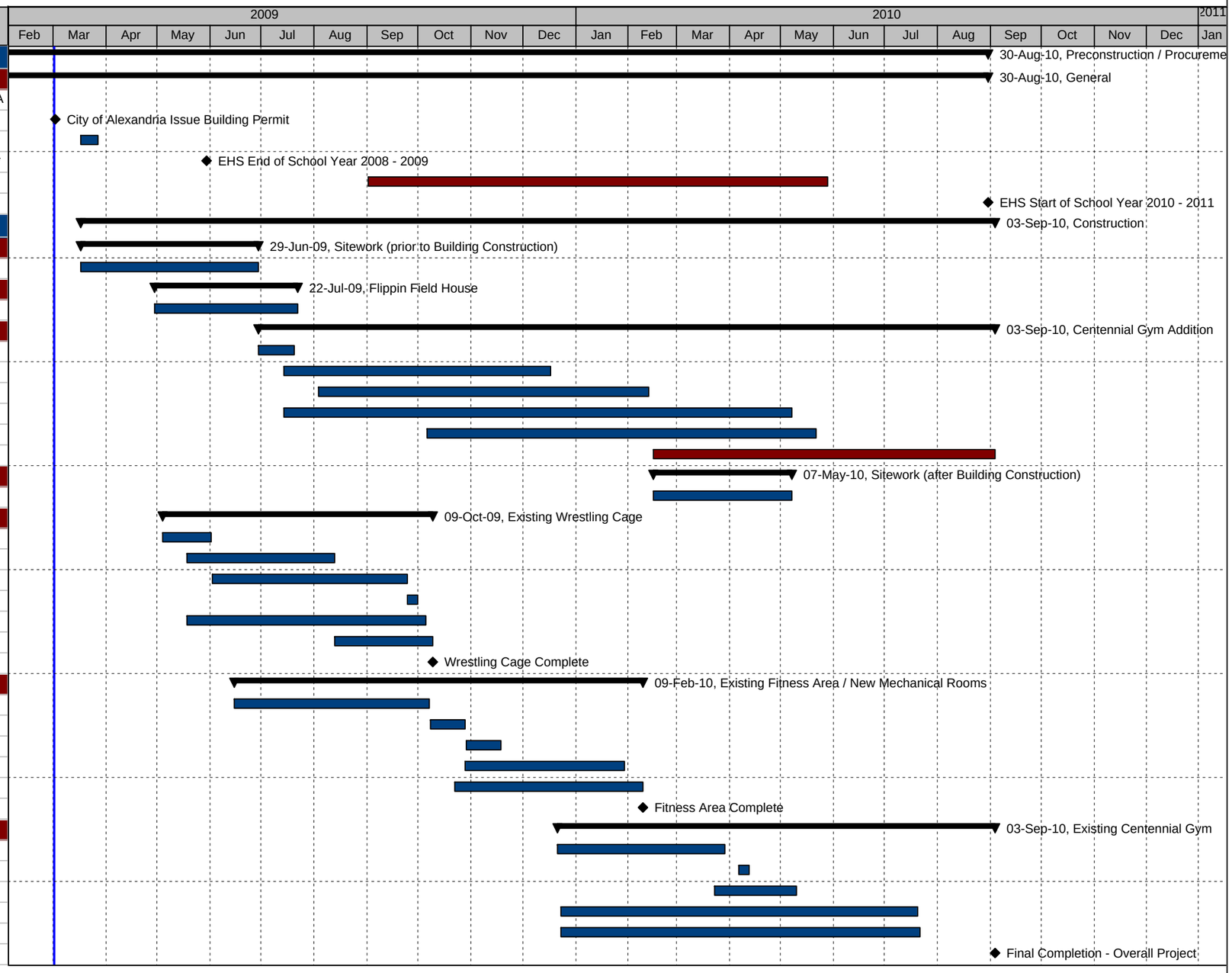
APPENDIX A – Project Summary Schedule

PENNSTATE

ERIC FEDDER
CONSTRUCTION MANAGEMENT

SUMMARY PROJECT SCHEDULE - TECH ONE
OCTOBER 5, 2009

Activity Name	Original Duration	Start	Finish
Preconstruction / Procurement	475	27-Oct-08 A	30-Aug-10
General	475	27-Oct-08 A	30-Aug-10
Receive Bid Documents from Design Team	1	27-Oct-08 A	29-Oct-08 A
City of Alexandria Issue Building Permit	0		02-Mar-09
Issue Notice to Proceed to Subs	9	17-Mar-09*	27-Mar-09
EHS End of School Year 2008 - 2009	0		29-May-09*
EHS School Year 2009 - 2010	189	01-Sep-09*	28-May-10
EHS Start of School Year 2010 - 2011	0	30-Aug-10*	
Construction	384	17-Mar-09	03-Sep-10
Sitework (prior to Building Construction)	75	17-Mar-09	29-Jun-09
Site Demolition/Excavate Building Pad	74	17-Mar-09*	29-Jun-09
Flippin Field House	61	29-Apr-09	22-Jul-09
Flippin Field House Renovation	59	29-Apr-09*	22-Jul-09
Centennial Gym Addition	310	29-Jun-09	03-Sep-10
Geopiers / Stone Columns	15	29-Jun-09*	20-Jul-09
Pour Concrete/Install Roof Steel	110	14-Jul-09*	17-Dec-09
Exterior Enclosure - Dried-In	135	03-Aug-09*	12-Feb-10
MEP Installation	209	14-Jul-09*	07-May-10
Interior Finishes	160	06-Oct-09*	21-May-10
Commissiong & Close-out	143	15-Feb-10*	03-Sep-10
Sitework (after Building Construction)	60	15-Feb-10	07-May-10
Complete Sitework, Hardscaping & Landscaping	60	15-Feb-10*	07-May-10
Existing Wrestling Cage	115	04-May-09	09-Oct-09
Cage Demo	20	04-May-09*	01-Jun-09
Cage Structure Repairs	61	18-May-09*	12-Aug-09
Renovate/Install Facade	81	02-Jun-09*	24-Sep-09
Owner Move Fitness Equip to Cage	5	24-Sep-09*	30-Sep-09
MEP Installation	98	18-May-09*	05-Oct-09
Interior Finishes	41	13-Aug-09*	09-Oct-09
Wrestling Cage Complete	0		09-Oct-09
Existing Fitness Area / New Mechanical Rooms	172	15-Jun-09	09-Feb-10
Demo Fitness Area	81	15-Jun-09*	07-Oct-09
Structure at New Mechanical Room	15	08-Oct-09*	28-Oct-09
Roof - Fitness Area	15	29-Oct-09*	18-Nov-09
Interior Finishes	64	28-Oct-09*	29-Jan-10
MEP Installation	75	22-Oct-09*	09-Feb-10
Fitness Area Complete	0		09-Feb-10
Existing Centennial Gym	185	21-Dec-09	03-Sep-10
Demo Portions of Exisiting Gym	69	21-Dec-09*	29-Mar-10
Repair Structure	5	06-Apr-10*	12-Apr-10
Renovate Facade	35	23-Mar-10*	10-May-10
Interior Finishes	146	23-Dec-09*	20-Jul-10
MEP Installation	147	23-Dec-09*	21-Jul-10
Final Completion - Overall Project	0		03-Sep-10*



Remaining Work ◆ Milestone
Critical Remaining Work Summary

EPISCOPAL HIGH SCHOOL
CENTENNIAL GYMNASIUM PROJECT
ALEXANDRIA, VA

APPENDIX B – RSMeans CostWorks 2009 Reports

NEW ADDITION ESTIMATE:

	Square Foot Cost Estimate Report
Estimate Name:	**New Gym**
Building Type:	**Gymnasium with Face Brick with Concrete Block Back-up / Rigid Steel Frame**
Location:	**ALEXANDRIA, VA**
Story Count:	**1**
Story Height (L.F.):	**37.5**
Floor Area (S.F.):	**60000**
Labor Type:	**Open Shop**
Basement Included:	**No**
Data Release:	**Year 2009**
Cost Per Square Foot:	**$115.37**
Building Cost:	**$6,922,000**

		% of Total	Cost Per S.F.	Cost
A Substructure		**5.20%**	**$6.05**	**$363,000**
A1010	Standard Foundations		$0.92	$55,500
A1030	Slab on Grade		$3.98	$239,000
A2010	Basement Excavation		$0.12	$7,500
A2020	Basement Walls		$1.02	$61,000
B Shell		**40.50%**	**$46.72**	**$2,803,500**
B1020	Roof Construction		$23.48	$1,409,000
B2010	Exterior Walls		$15.44	$926,500
B2020	Exterior Windows		$2.84	$170,500
B2030	Exterior Doors		$0.49	$29,500
B3010	Roof Coverings		$4.47	$268,000
C Interiors		**16.10%**	**$18.54**	**$1,112,500**
C1010	Partitions		$1.32	$79,000
C1020	Interior Doors		$1.65	$99,000
C1030	Fittings		$0.14	$8,500
C3010	Wall Finishes		$2.48	$148,500
C3020	Floor Finishes		$12.18	$730,500
C3030	Ceiling Finishes		$0.78	$47,000
D Services		**23.80%**	**$27.42**	**$1,645,500**
D2010	Plumbing Fixtures		$4.95	$297,000
D2020	Domestic Water Distribution		$1.63	$98,000
D3050	Terminal & Package Units		$8.81	$528,500
D4010	Sprinklers		$2.28	$137,000
D5010	Electrical Service/Distribution		$0.31	$18,500
D5020	Lighting and Branch Wiring		$7.61	$456,500
D5030	Communications and Security		$1.65	$99,000
D5090	Other Electrical Systems		$0.18	$11,000
E Equipment & Furnishings		**14.40%**	**$16.62**	**$997,500**
E1090	Other Equipment		$16.62	$997,500
	200 - Locker, bench, pedestals, steel pipe			
	1000 - Locker, bench, laminated maple, top only			
	450 - Lockers, steel, baked enamel, single tier, maximum			
	12 - Basketball backstops, school equipment, wall mounted, swing-up, 6' extended, maximum			

	4 - School equipment, scoreboards, basketball, one side, maximum 4800 - School equipment, wrestling mats, heavy duty, 1" thick 4000 - Wall pads, school equipment, 1-1/2" thick 8000 - Gym divider curtain, school equipment, mesh top, vinyl bottom, manual 1200 - School equipment, bleachers, for integral power operation, add, max 1200 - Bleachers, telescoping, school equipment, manual, to 15 tier, maximum Architectural equipment, school equipment bleachers-telescoping, manual operation, 15 tier, economy (per seat) Architectural equipment, school equipment, weight lifting gym, universal, deluxe Architectural equipment, sauna, prefabricated, including heater and controls, 7' high, 6' x 4'		
F Special Construction		0.00%	$0.00	$0
G Building Sitework		0.00%	$0.00	$0
Total Building Cost			$115.37	$6,922,000

RENOVATION ESTIMATE:

	Square Foot Cost Estimate Report
Estimate Name:	**Centennial Renovation**
Building Type:	**Gymnasium with Face Brick with Concrete Block Back-up / Rigid Steel Frame**
Location:	**ALEXANDRIA, VA**
Story Count:	**1**
Story Height (L.F.):	**37.5**
Floor Area (S.F.):	**39000**
Labor Type:	**Union**
Basement Included:	**No**
Data Release:	**Year 2009**
Cost Per Square Foot:	**$124.03**
Building Cost:	**$4,837,000**

		% of Total	Cost Per S.F.	Cost
A Substructure		5.40%	$6.65	$259,500
A1010	Standard Foundations		$1.03	$40,000
A1030	Slab on Grade		$4.29	$167,500
A2010	Basement Excavation		$0.14	$5,500
A2020	Basement Walls		$1.19	$46,500
B Shell		39.90%	$49.44	$1,928,000
B1020	Roof Construction		$24.12	$940,500
B2010	Exterior Walls		$17.17	$669,500
B2020	Exterior Windows		$3.01	$117,500
B2030	Exterior Doors		$0.50	$19,500
B3010	Roof Coverings		$4.64	$181,000
C Interiors		16.10%	$19.94	$777,500

C1010	Partitions		$1.45	$56,500
C1020	Interior Doors		$1.69	$66,000
C1030	Fittings		$0.22	$8,500
C3010	Wall Finishes		$2.77	$108,000
C3020	Floor Finishes		$12.96	$505,500
C3030	Ceiling Finishes		$0.85	$33,000
D Services		25.00%	$30.95	$1,207,000
D2010	Plumbing Fixtures		$5.29	$206,500
D2020	Domestic Water Distribution		$2.53	$98,500
D3050	Terminal & Package Units		$9.76	$380,500
D4010	Sprinklers		$2.58	$100,500
D5010	Electrical Service/Distribution		$0.50	$19,500
D5020	Lighting and Branch Wiring		$8.32	$324,500
D5030	Communications and Security		$1.78	$69,500
D5090	Other Electrical Systems		$0.19	$7,500
E Equipment & Furnishings		13.80%	$17.05	$665,000
E1090	Other Equipment		$17.05	$665,000
	100 - Locker, bench, pedestals, steel pipe			
	500 - Locker, bench, laminated maple, top only			
	200 - Lockers, steel, baked enamel, single tier, maximum			
	6 - Basketball backstops, school equipment, wall mounted, swing-up, 6' extended, maximum			
	2 - School equipment, scoreboards, basketball, one side, maximum			
	4000 - Wall pads, school equipment, 1-1/2" thick			
	8000 - Gym divider curtain, school equipment, mesh top, vinyl bottom, manual			
	1200 - Bleachers, telescoping, school equipment, manual, to 15 tier, maximum			
	Architectural equipment, school equipment bleachers-telescoping, manual operation, 15 tier, economy (per seat)			
	Architectural equipment, school equipment, weight lifting gym, universal, deluxe			
	Architectural equipment, sauna, prefabricated, including heater and controls, 7' high, 6' x 4'			
F Special Construction		0.00%	$0.00	$0
G Building Sitework		0.00%	$0.00	$0
Total Building Cost			$124.03	$4,837,000

APPENDIX C – D4COST V9.5 Estimate Reports

CASE STUDY FOR NEW ADDITION:

EHS Centennial New Addition	
Case Number	1
Project Name	EHS Centennial New Addition
Project Cost (Base)	4479047
Site Size	0
Building Use	Recreational
Bid Date	12/1/2008
Num Floors	2
Historic	False
Base Month	Mar
Base Year	1996
Base Location	CO - Denver
Projected Month	Mar
Projected Year	2009
Projected Location	VA - Alexandria
Building Size	60000
Auto Calc	True
Num Buildings	1
Project Height	40
1st Floor Height	20
1st Floor Size	30000
Foundation	CON
Exterior Wall	MAS
Interior Wall	CMU
Roof Type	MET
Floor Type	WOD
Case Study Firm	Sink Combs Dethlefs
Case Study Street	1900 Grant St., #1250
Case Study City	Denver
Case Study State	CO
Case Study Zip	80203
Case Study Phone	303-830-1200

Code	Division Name	%	Sq. Cost	Projected
00	Bidding Requirements	13.66	18.32	1,099,461
	Addenda	1.62	2.18	130746.83
	General Conditions	10.86	14.57	874360.67
	Supplementary Conditions	1.17	1.57	94353.38
03	Concrete	7.79	10.45	626,858
	Accessories	0.02	0.03	1748.23
	Cast-In-Place	1.14	1.53	91834.15
	Curing	0.14	0.18	11081.13
	Formwork	2.12	2.85	170868.59
	Mass	1.82	2.44	146226.18
	Reinforcement	1.44	1.93	115550.55

	Restoration & Cleaning	1.11	1.49	89549.45
04	Masonry	10.78	14.47	868,054
	Masonry & Grout	10.78	14.47	868053.82
05	Metals	14.11	18.93	1,135,951
	Expansion Control	0.06	0.08	4906.38
	Fabrications	0.78	1.05	62984.93
	Materials	0.25	0.34	20188.93
	Sheet Metal Fabrications	0.09	0.13	7548.27
	Structural Framing	12.92	17.34	1040322.88
06	Wood & Plastics	1.85	2.48	149,077
	Architectural Woodwork	0.66	0.88	53036.04
	Finish Carpentry	0.34	0.46	27431.22
	Rough Carpentry	0.85	1.14	68609.74
07	Thermal & Moisture Protection	3.56	4.78	286,884
	Flashing & Sheet Metal	0.37	0.50	29703.79
	Insulation	0.08	0.11	6739.53
	Joint Sealers	0.28	0.38	22698.73
	Manufactured Roofing & Siding	0.28	0.37	22224.27
	Membrane Roofing	2.47	3.31	198535.69
	Waterproofing	0.09	0.12	6982.15
08	Doors & Windows	3.62	4.85	291,041
	Glazing	2.28	3.06	183615.73
	Hardware	0.48	0.64	38298.04
	Metal Doors & Frames	0.29	0.39	23244.63
	Special Doors	0.05	0.07	4043.72
	Special Windows	0.49	0.66	39614.94
	Wood & Plastic Doors	0.03	0.04	2224.04
09	Finishes	13.69	18.37	1,102,035
	Acoustical Treatment	0.14	0.19	11520.55
	Carpet	1.07	1.44	86476.22
	Gypsum Board	4.05	5.43	326025.99
	Painting	2.48	3.33	199899.77
	Resilient Flooring	0.43	0.57	34244.89
	Tile	1.21	1.62	97321.47
	Wood Flooring	4.31	5.78	346546.50
10	Specialties	1.29	1.73	103,623
	Identifying Devices	0.07	0.09	5391.62
	Lockers	0.04	0.05	3228.23
	Pedestrian Control Devices	0.75	1.01	60655.75
	Storage Shelving	0.06	0.08	4717.67
	Toilet & Bath Accessories	0.22	0.30	18037.67
	Visual Display Board	0.14	0.19	11591.99
11	Equipment	1.74	2.33	139,799
	Athletic, Rec. & Therapeutic	1.50	2.02	120928.69
	Commer. Ldry. & Dry Cleaning	0.15	0.20	12131.15
	Security & Vault	0.08	0.11	6739.53
12	Furnishings	0.03	0.05	2,730
	Rugs & Mats	0.03	0.05	2729.51
14	Conveying Systems	0.67	0.90	53,916

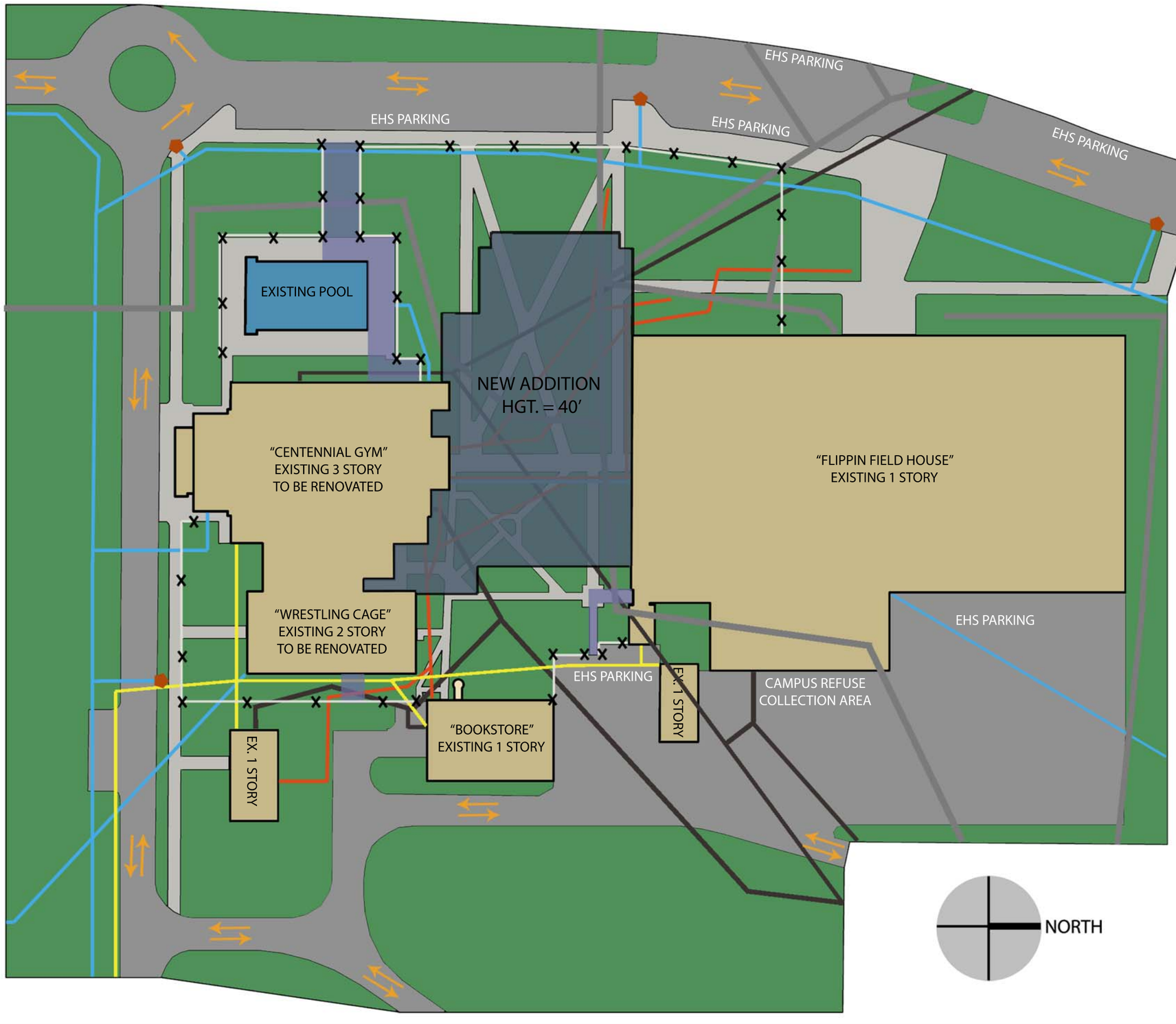
	Elevators	0.67	0.90	53916.22
15	Mechanical	18.00	24.15	1,448,998
	Basic Materials & Methods	16.74	22.47	1347905.48
	Fire Protection	1.26	1.68	101092.91
16	Electrical	9.21	12.36	741,348
	Basic Materials & Methods	9.21	12.36	741348.01
	Total Building Costs	**100.00**	**134.16**	**8,049,776**

CASE STUDY FOR RENOVATION WORK:

Centennial Renovation	
Case Number	2
Project Name	Centennial Renovation
Project Cost	4574960
Site Size	117612
Building Use	Educational
Bid Date	7/1/2006
Num Floors	1
Read Only	False
Historic	False
Base Month	Jul
Base Year	2006
Base Location	IA - Other
Projected Month	Mar
Projected Year	2009
Projected Location	VA - Alexandria
Building Size	39000
Auto Calc	True
Num Buildings	1
Project Height	27
1st Floor Height	27
1st Floor Size	39285
Foundation	CON
Exterior Wall	CMU
Interior Wall	CMU
Roof Type	MEM
Floor Type	CON
Project Type	REN
Case Study Firm	Cannon Moss Brygger & Associates
Case Study Street	401 Douglas Street #500
Case Study City	Sioux City
Case Study State	IA
Case Study Zip	51101

Code	Division Name	%	Sq. Cost	Projected
01	General Requirements	4.07	6.02	234,761
	Allowance Interior Signage	0.04	0.06	2505.37
	Temporary Utilities	0.65	0.96	37580.58
	Change Orders	3.37	4.99	194674.90
03	Concrete	6.29	9.32	363,306
	Cast-In-Place	6.29	9.32	363306.46
04	Masonry	1.95	2.89	112,742
	Unit	1.95	2.89	112741.73
05	Metals	6.78	10.04	391,476
	Structural Steel	6.78	10.04	391475.61
06	Wood, Plastics, and Composites	9.16	13.55	528,633
	Rough Carpentry	2.43	3.60	140300.82
	Finish Carpentry	6.73	9.96	388332.62
07	Thermal and Moisture Protection	11.95	17.69	689,768
	Sealants	0.45	0.67	26005.76
	Roofing & Metal Panels	11.50	17.02	663761.92
08	Openings	5.90	8.74	340,731
	Steel & Wood Doors	2.32	3.44	134037.39
	Overhead Doors	0.35	0.51	20042.97
	Aluminum Entrances	3.23	4.79	186650.20
09	Finishes	14.40	21.31	831,223
	Metal Framing & Gypsum	8.63	12.78	498451.23
	Ceramic Tile	1.45	2.15	83929.95
	Acoustical Ceilings	1.56	2.31	90193.38
	Vinyl & Carpet	1.62	2.40	93509.24
	Painting & Wallcovering	1.13	1.67	65139.67
10	Specialties	1.43	2.12	82,677
	Specialties	1.43	2.12	82677.27
21	Fire Suppression	1.63	2.41	93,951
	Fire Sprinkler	1.63	2.41	93951.44
22	Plumbing	8.31	12.30	479,785
	Plumbing	8.31	12.30	479784.95
23	HVAC	11.41	16.88	658,462
	HVAC	11.41	16.88	658461.80
26	Electrical	16.72	24.75	965,352
	Electrical	16.72	24.75	965352.31
	Total Building Costs	**100.00**	**148.02**	**5,772,868**

APPENDIX D – Existing Conditions Site Plan



LEGEND:

EXISTING UTILITIES:

- WATER
- GAS
- STORM
- SANITARY
- ELECTRIC

SYMBOLS:

- FIRE HYDRANT
- VEHICULAR TRAFFIC
- CONSTRUCTION FENCE
- COVERED EGRESS

EPISCOPAL HIGH SCHOOL CENTENNIAL GYMNASIUM

EXISTING CONDITIONS SITE PLAN

OCTOBER 5, 2009

ERIC FEDDER - CM