

Mark Demianovich
Construction Management Option
Tech Assignment 2
Cost and Methods Analysis



Bellefonte Area High School
Bellefonte, PA

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Executive Summary

Technical Assignment 2: Cost and Methods Analysis will give a detailed breakdown for many different aspects of the Bellefonte Area High School building project. This detailed cost and methods analysis will help achieve a better understanding of project execution and project details. This will include a detailed project schedule that will be used at a later time for cost loading. The information ascertained will be utilized for data for later research topics. It will also include a site planning layout for a critical phase of construction. This report will also detail three different estimates; an assemblies estimate, a structural estimate, and a general conditions estimate.

The detailed schedule will show all major phases and activities for construction, grouped by function where possible. The site layout planning will detail the finishing and exterior façade of the project, pointing out any possible problems that might occur on site. An estimate of the fire alarm and fire suppressant system will also be performed. The structural systems and general conditions estimate will also be performed for all new construction on the project. All renovations on the project site alter the structural integrity very little, so the structural estimate will be performed on the new construction only. The estimates will be performed using actual data, design drawings, and estimating software.

Detailed Project Schedule

The Bellefonte Area High School construction project will take place from the Notice to proceed which was received on March 10, 2006 and will continue until construction completion on September 5, 2007.

Several other milestones include dry-in on May 8, 2007. Steel construction begins on April 12, 2006, but the entire structure does not use much steel in relation to the size of the project or site, so staging area and delivery should not be a problem.

The project is organized into sections of construction based on where and what is being constructed, trying to effectively trade stack repetitive tasks. The construction taking place moves trades from one area (new classroom construction) to another construction area on the site (new gym construction). A detailed representation can be seen on the attached schedule.

Site Layout Planning

Since all new construction will be taking place on an existing building site, very little excavation will be needed. The attached site plan will show trailer, crane, and dumpster locations, but will focus on site travel for erecting the façade and finishing on the building.

Pedestrian traffic flow will be non-existent as the school will be shut down during construction and is not used as a path from one location to another. The same goes for vehicular traffic, and a fence around the perimeter keeps out any random visitors or curious individuals. The site trailer will be located on an existing parking lot that will not be fully used since the school will be closed.

Dumpster locations will be placed around the site at various locations to eliminate long distances from construction to disposal. Since construction will be going on in many different locations at the same time, multiple locations will be utilized so that dumpsters will not need to be moved frequently. The site has is not very restricted so dumpsters used for specific materials to help with LEED ratings will be plausible.

Assemblies Estimate

The assemblies estimate will be performed to include the fire alarm system, initiating devices, notification appliances, and supervisory devices. This will include all labor and equipment used on site, as prescribed by the technical specifications. The fire alarm system installed will have to be from a list of pre-approved manufacturers unless a detailed alternative submittal is approved by the Engineer. Some of the possible selections for the fire system include SimplexGrinnell, Siemens, and Gamewell.

The fire system installed is a blanket system covering all area in the building, so connections, pipe size, and length were estimated for a standard classroom and then extrapolated for the entire building. Using ICE2000, the total sprinkler system estimate

using extrapolation was about \$430,000. Since the actual bid given out at the beginning of the project for the fire system was \$450,000, this is a fair estimate on the actual cost. For the detailed break down of the estimate, see attached estimate report.

Structural Estimate

A detailed structural estimate was created using R.S.Menas, as well as numbers, drawings, and project manuals provided by Reynolds Construction. The structural system is mainly composed of structural CMU, and was initially estimated by Reynolds Construction to be approximately \$1,200,000. Extrapolation was used with R.S. Means data to get a structural estimate of \$62439. The length and height of walls was calculated using the drawings to ascertain the wall heights and extrapolation based on the perimeter of certain rooms and how often those rooms occurred in the building. The detailed structural estimate can be seen on the attached estimate report.

General Conditions Estimate










A general conditions estimate was created using CostWorks and information from project specifications. The general conditions estimate for the Bellefonte Area High School Project is approximately \$2,800,000. This varies little from the estimate supplied

by Reynolds Construction for their general conditions cost. This number could change based on schedule improvements or delays, making time and efficient building methods very important. The estimate was based on a 72 week project using a senior project manager and a MEP engineer some of the time and a project manager, assistant project manager, project engineer, and superintendent for the entire duration of the project. A NON-OCIP liability insurance rated at 0.8 percent of the total project cost was used as well. The detailed general conditions estimate can be seen on the attached estimate.

ID	Task Name	Duration	Start	Finish	2007																							
					Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct			
1	Notice to Proceed	0 days	Fri 3/10/06	Fri 3/10/06	◆ 3/10																							
2	Drawing Submittals	9 days?	Mon 4/10/06	Thu 4/20/06	[Task bar]																							
3	Reviews and Approvals	22 days?	Wed 4/12/06	Thu 5/11/06	[Task bar]																							
4	Delivery and fabrication of mate	69 days?	Wed 5/3/06	Mon 8/7/06	[Task bar]																							
5	Site work	107 days?	Fri 3/10/06	Mon 8/7/06	[Task bar]																							
6	Classroom demolition	10 days?	Fri 3/31/06	Thu 4/13/06	[Task bar]																							
7	Classroom footing	15 days?	Fri 4/14/06	Thu 5/4/06	[Task bar]																							
8	Classroom masonry foundation	10 days?	Fri 4/28/06	Thu 5/11/06	[Task bar]																							
9	Underslab MEP	15 days?	Fri 5/5/06	Thu 5/25/06	[Task bar]																							
10	Masonry 1st level	31 days?	Fri 5/12/06	Fri 6/23/06	[Task bar]																							
11	MEP rough-in walls	62 days?	Fri 5/12/06	Mon 8/7/06	[Task bar]																							
12	Stone for SOG	6 days?	Fri 5/26/06	Fri 6/2/06	[Task bar]																							
13	Structural Steel	3 days?	Mon 6/19/06	Wed 6/21/06	[Task bar]																							
14	Pre-cast Plank	21 days?	Mon 6/26/06	Mon 7/24/06	[Task bar]																							
15	SOG	10 days?	Tue 7/18/06	Mon 7/31/06	[Task bar]																							
16	Masonry 2nd level	31 days?	Tue 7/25/06	Tue 9/5/06	[Task bar]																							
17	MEP rough-in overhead	51 days?	Tue 8/15/06	Tue 10/24/06	[Task bar]																							
18	Roofing/joist-deck	25 days?	Wed 9/6/06	Tue 10/10/06	[Task bar]																							
19	Painting	48 days?	Wed 9/27/06	Fri 12/1/06	[Task bar]																							
20	HVAC equipment	10 days?	Wed 10/11/06	Tue 10/24/06	[Task bar]																							
21	Windows and entrances	25 days?	Wed 10/11/06	Tue 11/14/06	[Task bar]																							
22	MEP trim	65 days?	Wed 10/11/06	Tue 1/9/07	[Task bar]																							
23	Ceiling-grid, tiles, inspection	50 days?	Wed 11/1/06	Tue 1/9/07	[Task bar]																							
24	Flooring	27 days?	Mon 12/18/06	Tue 1/23/07	[Task bar]																							
25	Hardware & Accessories	15 days?	Wed 1/10/07	Tue 1/30/07	[Task bar]																							
26	Gym Demolition and Site prep	10 days?	Thu 6/1/06	Wed 6/14/06	[Task bar]																							
27	Gym foundations	21 days?	Thu 6/15/06	Thu 7/13/06	[Task bar]																							
28	Underslab MEP	21 days?	Thu 6/29/06	Thu 7/27/06	[Task bar]																							
29	Load Bearing CMU	35 days?	Fri 7/7/06	Thu 8/24/06	[Task bar]																							
30	MEP rough-in walls	40 days?	Fri 7/7/06	Thu 8/31/06	[Task bar]																							
31	Stone for SOG	5 days?	Fri 7/28/06	Thu 8/3/06	[Task bar]																							
32	Precast Plank	5 days?	Fri 8/4/06	Thu 8/10/06	[Task bar]																							










Project: Overall Project Schedulefinal. Date: Fri 2/9/07	Task		Milestone		External Tasks	
	Split		Summary		External Milestone	
	Progress		Project Summary		Deadline	

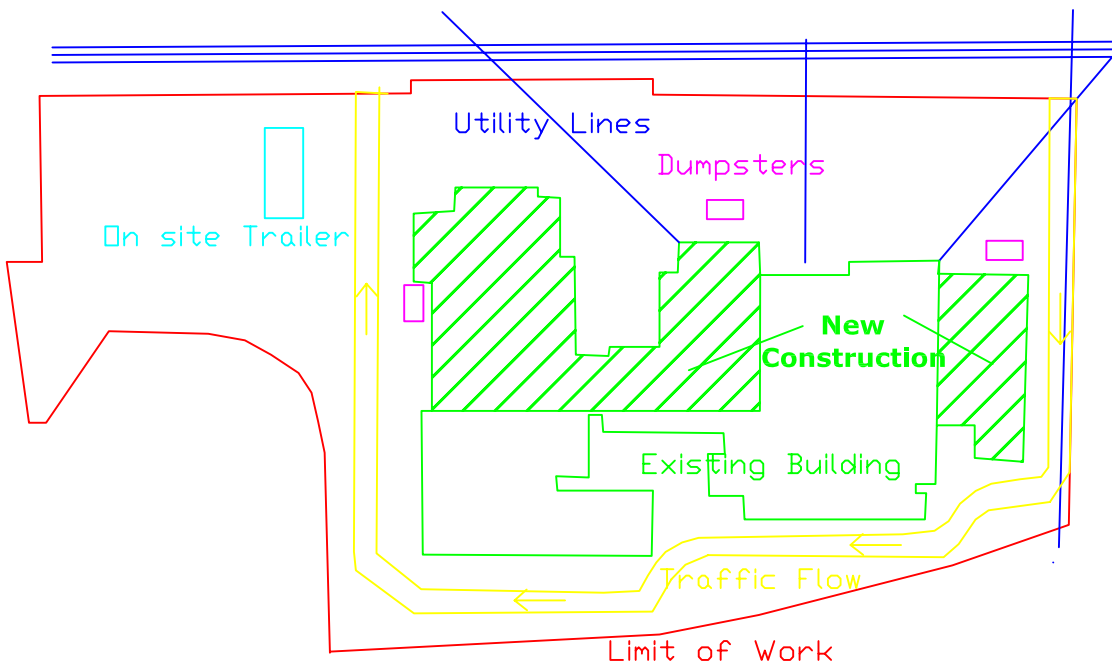
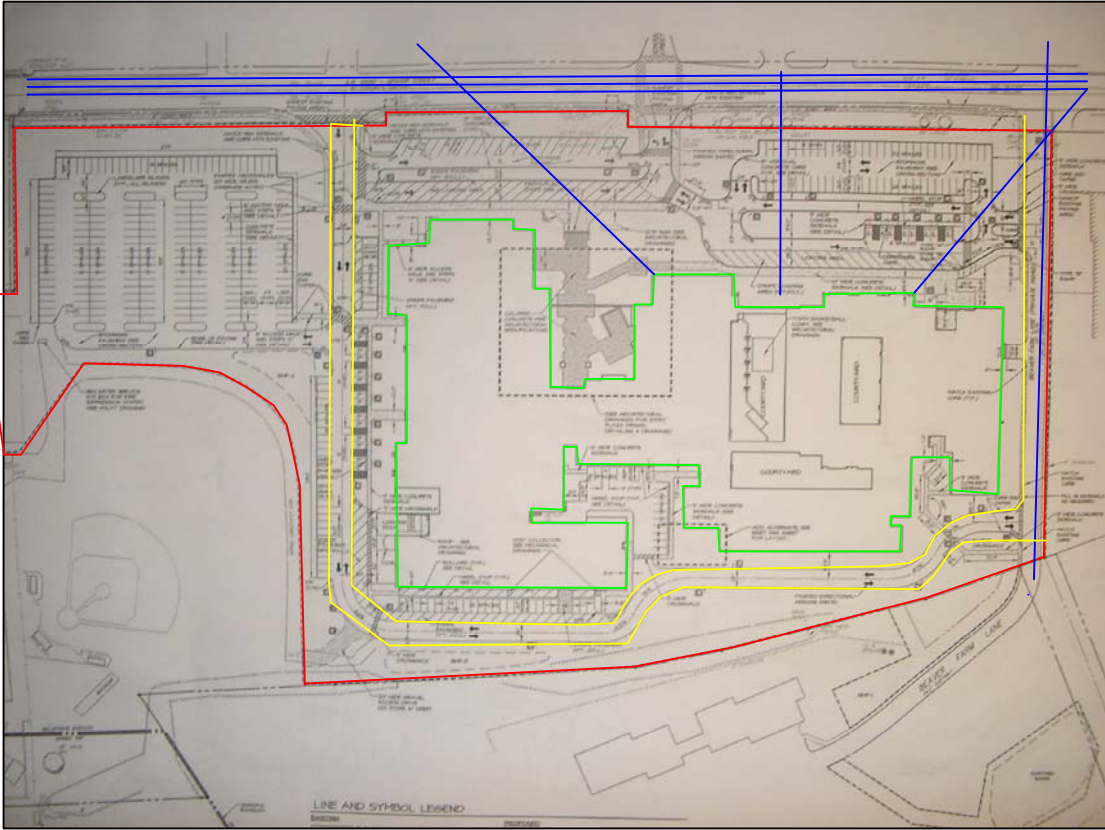
ID	Task Name	Duration	Start	Finish	2007																	
					Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
33	Trusses, joists, deck	16 days?	Fri 8/25/06	Fri 9/15/06																		
34	CMU parapet	10 days?	Mon 9/18/06	Fri 9/29/06																		
35	SOG	15 days?	Mon 9/18/06	Fri 10/6/06																		
36	Roofing	20 days?	Mon 10/2/06	Fri 10/27/06																		
37	Brick Veneer	20 days?	Mon 10/2/06	Fri 10/27/06																		
38	MEP rough-in overhead	30 days?	Mon 10/9/06	Fri 11/17/06																		
39	Paint	44 days?	Mon 10/30/06	Thu 12/28/06																		
40	Glass and Glazing	23 days?	Mon 11/6/06	Wed 12/6/06																		
41	Wood Floor	21 days?	Thu 11/30/06	Thu 12/28/06																		
42	Ceiling Grid	22 days?	Thu 12/7/06	Fri 1/5/07																		
43	MEP trim	17 days?	Thu 12/14/06	Fri 1/5/07																		
44	Bleachers and equipment	16 days?	Fri 12/29/06	Fri 1/19/07																		
45	Ceiling Tile	10 days?	Mon 1/8/07	Fri 1/19/07																		
46	Flooring	10 days?	Mon 1/29/07	Fri 2/9/07																		
47	Doors and Hardware	10 days?	Mon 2/12/07	Fri 2/23/07																		
48	Media Center demolition	15 days?	Wed 2/7/07	Tue 2/27/07																		
49	Footing, Foundation Walls	16 days?	Wed 2/28/07	Tue 3/20/07																		
50	Underground MEP	10 days?	Wed 3/14/07	Tue 3/27/07																		
51	Erect Steel	10 days?	Wed 3/21/07	Tue 4/3/07																		
52	Stone for SOG	5 days?	Tue 3/27/07	Mon 4/2/07																		
53	Steel Decking	10 days?	Wed 4/4/07	Tue 4/17/07																		
54	SOG, SOD	10 days?	Wed 4/18/07	Tue 5/1/07																		
55	Membrane Roofing	15 days?	Wed 4/18/07	Tue 5/8/07																		
56	MEP rough-in	36 days?	Wed 5/2/07	Wed 6/20/07																		
57	HVAC equipment installed	21 days?	Wed 5/9/07	Wed 6/6/07																		
58	Masonry Veneer	26 days?	Wed 5/9/07	Wed 6/13/07																		
59	Interior Drywall	21 days?	Wed 5/23/07	Wed 6/20/07																		
60	Windows	23 days?	Thu 5/31/07	Mon 7/2/07																		
61	Terrazzo	21 days?	Thu 6/7/07	Thu 7/5/07																		
62	MEP Trim	41 days?	Thu 6/7/07	Thu 8/2/07																		
63	Roofing	21 days?	Thu 6/14/07	Thu 7/12/07																		
64	Painting	26 days?	Thu 6/14/07	Thu 7/19/07																		

Project: Overall Project Schedulefinal. Date: Fri 2/9/07	Task		Milestone		External Tasks	
	Split		Summary		External Milestone	
	Progress		Project Summary		Deadline	

ID	Task Name	Duration	Start	Finish	2007																	
					Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
65	Acoustical ceiling	31 days?	Thu 6/21/07	Thu 8/2/07																		
66	Painting	26 days?	Thu 6/14/07	Thu 7/19/07																		
67	Doors and hardware	15 days?	Wed 7/11/07	Tue 7/31/07																		
68	Flooring/Carpet	18 days?	Wed 7/25/07	Fri 8/17/07																		
69	Punch List	11 days?	Wed 8/22/07	Wed 9/5/07																		
70	Complete Construction	0 days	Wed 9/5/07	Wed 9/5/07																		



Project: Overall Project Schedulefinal. Date: Fri 2/9/07	Task		Milestone		External Tasks	
	Split		Summary		External Milestone	
	Progress		Project Summary		Deadline	



Estimate Detail - Standard Construction Project

Detail - Without Taxes and Insurance

Estimator :
Project Size : sqft

ItemCode	Description	Quantity	UM	Lab.Unit	Mat.Unit	Eqp.Unit	Sub.Unit	Eqp.Rent.Unit	Temp.Mat.Unit	Other Unit	Tot.UnitCost	TotalCost
02518.005	FIRE HYDRANT		****									
02518.014	DEPTH OF BURY 7'0"	50.00	EACH	200.4000	932.992						1,133.392	56,669.60
02518.024	W/PUMPER CONN		****									
02518.025	DEPTH OF BURY 2'6"	2.00	EACH	158.6500	910.298						1,068.948	2,137.90
13910.552	PIPE VOLUME	3,812.06	GALS									
13910.030	EXCAVATE W/BCKHOE	4,783.95	CUYD	4.3275	1.792						6.120	29,275.39
13910.035	BACKFILL BACKHOE	4,419.52	CUYD	1.1540	0.896						2.050	9,060.01
13920.010	FIRE PUMP		****									
13920.029	DIESEL W/CNTRL & JOCKEY		****									
13920.031	100HP	2.00	EACH	2,304.6000	30,080.000						32,384.600	64,769.20
13930.010	SCH 10 S STEEL PIPE		****									
13930.072	GROOVED FITTINGS		****									
13930.097	90 ELL 3"	400.00	EACH	48.0960	26.637						74.733	29,893.12
13930.170	COUPLING 3"	1,038.10	EACH	23.4802	21.414						44.895	46,604.87
13930.171	COUPLING 4"	4.76	EACH	27.2878	31.206						58.494	278.54
13930.780	SCH 80 STEEL PIPE		****									
13930.781	BLK T & C		****									
13930.789	PIPE 3"	5,000.00	LNFT	10.0200	9.280						19.300	96,500.00
13930.790	PIPE 4"	100.00	LNFT	11.0220	13.760						24.782	2,478.20
13930.796	CAST IRON SCRW FTGS 250LB		****									
13930.821	90 ELL 3"	400.00	EACH	88.8440	49.062						137.906	55,162.56
13931.131	GLAND W/T-BOLTS 3"	800.00	EACH	8.3166	16.960						25.277	20,221.28
13931.385	BOLT & GASKET SET		****									
13931.393	FLANGE PACK 3"	400.00	EACH	8.3166	7.462						15.779	6,311.60
13931.850	PIPE HANGERS STEEL		****									
13931.851	W/3' ROD & BEAM CLAMP		****									
13931.859	ADJ SPLT RING 3"	500.00	EACH	30.7280	7.091						37.819	18,909.60
Total Estimate												438,271.86

Estimate Detail - Standard Construction Project

Detail - Without Taxes and Insurance

Estimator :
Project Size : sqft

ItemCode	Description	Quantity	UM	Lab.Unit	Mat.Unit	Eqp.Unit	Sub.Unit	Eqp.Rent.Unit	Temp.Mat.Unit	Other Unit	Tot.UnitCost	TotalCost
04210.011	MORTAR	400.00	CUYD		50.000						50.000	20,000.00
04210.503	ADD FOR FLEMISH BOND	180,000.00	SQFT	0.2609							0.261	46,962.00
04210.585	ADD FOR WEATHER JOINT	180,000.00	SQFT	0.2383							0.238	42,894.00
04219.101	EXTERIOR TUBULAR SCAFFOLDING	180,000.00	SQFT	0.4698		0.100					0.570	102,564.00
04219.990	* MASONRY WALL AREA *	180,000.00	SQFT									
04220.102	FILL VOIDS W/ CONCRETE	2,270.00	CUYD	20.5520	55.000						75.552	171,503.04
04220.502	8X8X16 CONC BLOCK	202,500.00	PCS	1.9929	0.630						2.623	531,137.25
04224.122	MASONRY REBAR	2,816.10	CWT	20.5520	26.750						47.302	133,207.16
04224.130	UNIT WALL TIES	104,408.35	PCS	1.0608	0.198						1.259	131,471.00
07140.011	WATERPROOFING ON MASONRY	180,000.00	SQFT	0.4983	0.358						0.857	154,206.00
Total Estimate												1,333,944.45

GENERAL CONDITIONS ESTIMATE					
Small Tools & Equipment	LS	1	50000	\$	50,000.00
Misc. Supplies	MO	18	150	\$	2,700.00
Computer equipment	MO	18	250	\$	4,500.00
Office Equipment/Fax/Copier	LS	1	10000	\$	10,000.00
Service & Supplies	MO	18	150	\$	2,700.00
Network Equipment	LS	1	1000	\$	1,000.00
Network Service	MO	18	150	\$	2,700.00
Drawings & Specifications	MO	18	200	\$	3,600.00
Postage & Shipping	MO	18	150	\$	2,700.00
Sanitary Facilities	MO	18	100	\$	1,800.00
Drinking Water	MO	18	100	\$	1,800.00
Radios (two-way)	MO	18	100	\$	1,800.00
Progress Photos	MO	18	1500	\$	27,000.00
Field Office	MO	18	20000	\$	360,000.00
Storage Trailers	MO	18	82	\$	1,476.00
Telephone Service and Equipment	LS	1	5000	\$	5,000.00
Telephone Charges	MO	18	250	\$	4,500.00
Temporary Electric	LS	1	250000	\$	250,000.00
Miscellaneous Travel	MO	18	5000	\$	90,000.00
Layout/Survey(Bldg.)	LS	1	100000	\$	100,000.00
Temporary Fencing	LF	1	5	\$	5.00
Gates EA 2	EA	2	400	\$	800.00
Project Signs	EA	4	50	\$	200.00
Site Maintenance	MO	18	2000	\$	36,000.00
Start-Up / Commissioning	LS	35000000	0.75%	\$	262,500.00
Misc Trucking/Equipment	LS	1	15000	\$	15,000.00
Dumpsters	MO	18	8000	\$	144,000.00
Trash chutes	MO	18	600	\$	10,800.00
Daily Clean-Up	MO	18	2000	\$	36,000.00
Final Clean-up	SF	121000	1.72	\$	208,120.00
Cold Weather Protection	MO	6	20000	\$	120,000.00
Temp Heat in Building	MO	6	15000	\$	90,000.00
Senior Project Manager	WK	18	2700	\$	48,600.00
Project Manager	WK	72	2375	\$	171,000.00
Assistant Project Manager	WK	72	2100	\$	151,200.00
Project Engineer	WK	72	1675	\$	120,600.00
MEP Engineer	WK	36	1675	\$	60,300.00
Superintendent	WK	72	2175	\$	156,600.00
Liability Insurance (NON OCIP)	LS	35000000	0.80%	\$	280,000.00
GENERAL CONDITIONS TOTAL:					\$2,835,001.00