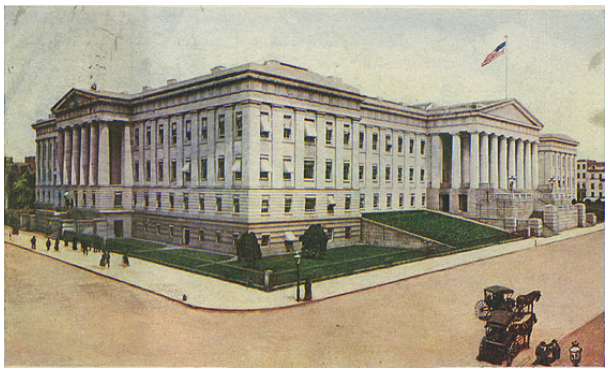


Robert M. Leicht
Construction Management Option
Advisor: Dr. John Messner
Bldg: Smithsonian Institution
Patent Office building
Washington, DC
11/12/04
Technical Assignment 3

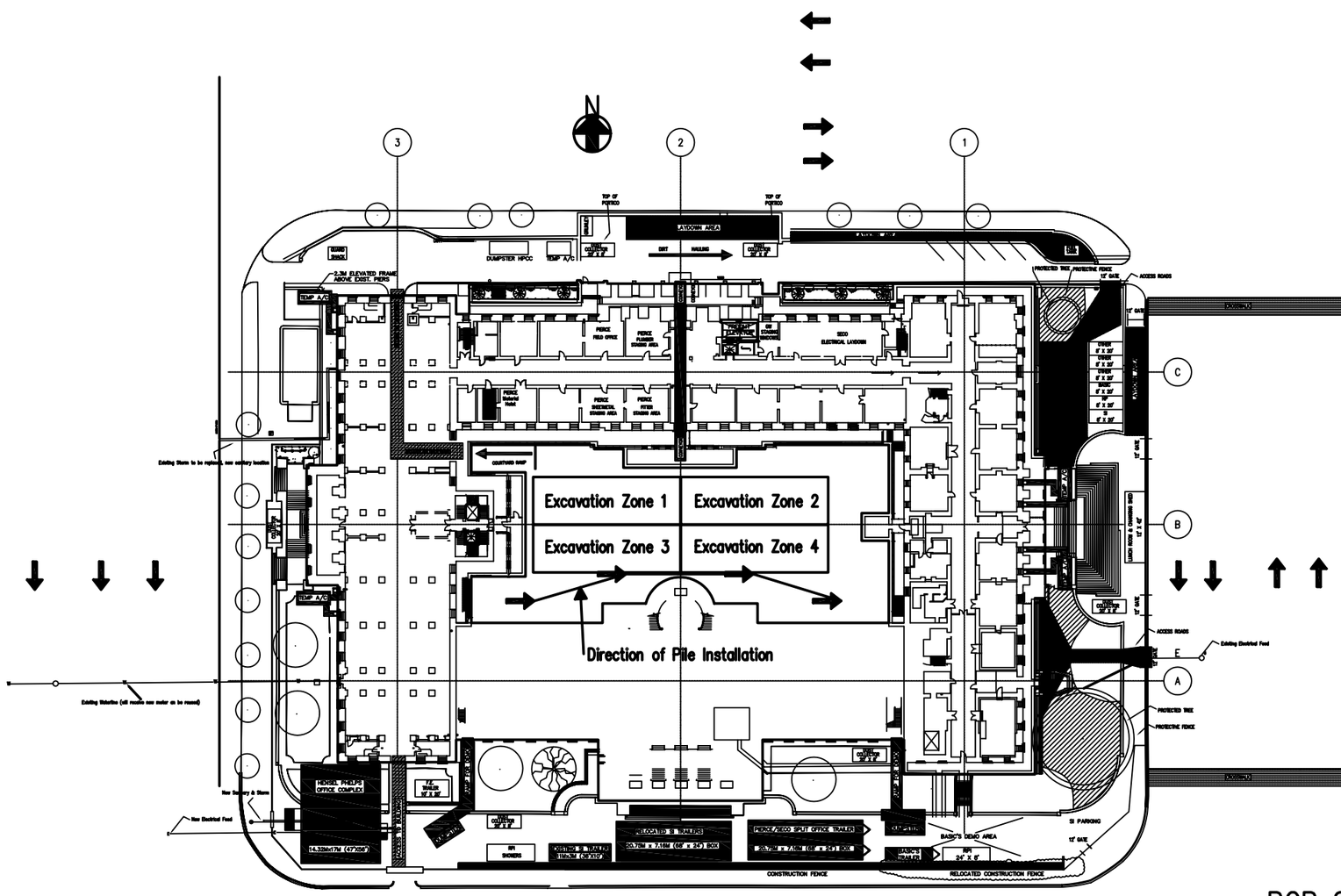
Executive Summary:

The submission of Technical Assignment includes the Site Layout Planning with the three main phases: Excavation, Erection, and Interior work. There are minimal changes between the phases because the building is a renovation project. The temporary Utilities are fairly simple because the contractor can use the existing power, water, etc, while the construction going on. The Contractor does need to coordinate the switchover from existing to the new utilities in order to maintain operations. The detailed systems estimate shows a large variation from the previous two estimates, mainly due to the unstated assumptions in the square foot and assemblies estimates that the building project is new construction. Since the project is a renovation the detailed estimate takes into account the placement methods needed and therefore bears a higher cost of installation. The general Conditions estimate worked out to be approximately 3% of the overall construction budget. The research and analysis methods go into detail about the goals and objectives of the research and there is preliminary version of the survey to be used for the research.

Submission Contents:	**Page(s)**

Office
6 Story

New Construction Project



Misc. Offices
5 Story

MCI Center

5 Stories Tall

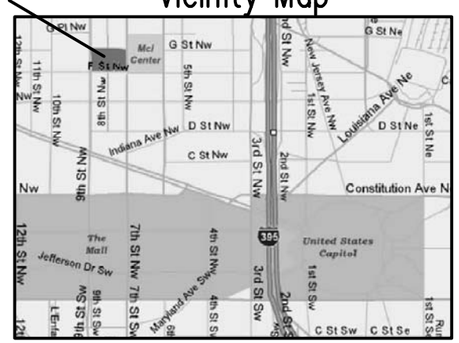
Spy Museum

Hotel – 6 story

0' 20' 40' 60' 80' 100'
10' 30' 50' 70' 90'

POB Site

Vicinity Map



Robert M. Leicht
5th Year AE – CM Option
Adviser – Dr. John Messner

Smithsonian Institution
Patent Office Building
801 F Street, NW
Washington, DC 20004

Excavation Site Plan

11/3/04

Office
6 Story

New Construction Project

Road Barricades

Road Barricades

500 Ton
Crane w/
Extension

Steel Delivery
Trailer Parking

Area of
Steel
Erection

Misc. Offices
5 Story

MCI Center

5 Stories Tall

F STREET

Spy Museum

Hotel – 6 story

0' 20' 40' 60' 80' 100'
10' 30' 50' 70' 90'

POB Site

Vicinity Map

Robert M. Leicht
5th Year AE – CM Option
Adviser – Dr. John Messner

Smithsonian Institution
Patent Office Building
801 F Street, NW
Washington, DC 20004

Erection Site Plan

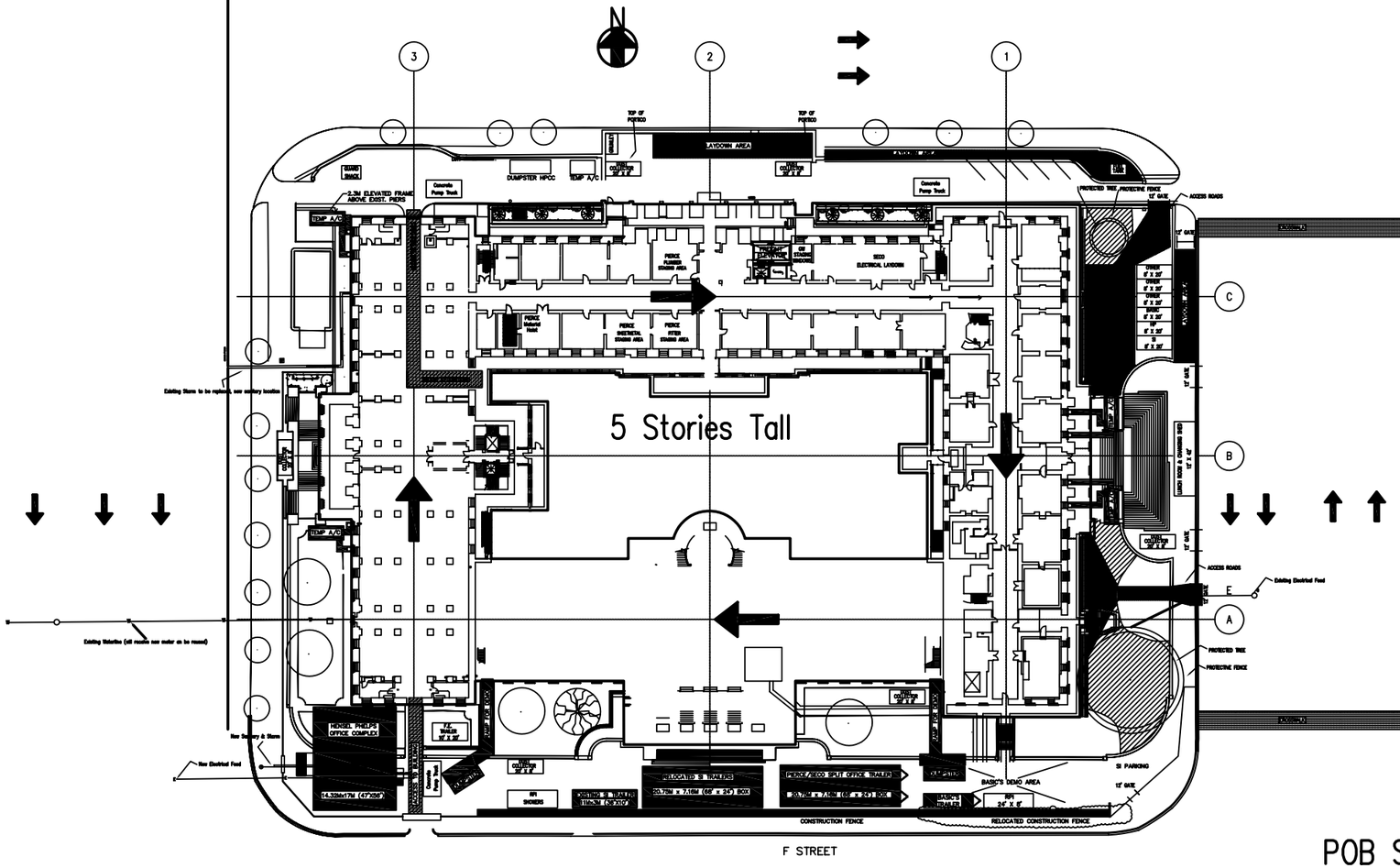
11/3/04

*Direction of Workflow for Interiors follows large arrows and begins at the SW Corner

Office
6 Story

New Construction Project

Misc. Offices
5 Story



MCI Center

Spy Museum

Hotel – 6 story

0' 20' 40' 60' 80' 100'
10' 30' 50' 70' 90'

POB Site

Vicinity Map

Robert M. Leicht
5th Year AE – CM Option
Adviser – Dr. John Messner

Smithsonian Institution
Patent Office Building
801 F Street, NW
Washington, DC 20004

Interiors Site Plan

11/3/04

Temporary Utilities

The use of the utilities required to run the renovation are somewhat unique because the building is a renovation project. The specification section covering the use of the existing building states that when the existing utilities are not available for use, when they are being worked on and changed over, then the contractor should base their use from the specification section 1500.

Use of the Existing Building

The existing building must be maintained in a weather tight condition. The use of existing utilities is allowed until such time as they need to be removed to install new utility lines or replace the existing lines. (Coordination of the change over is obviously the responsibility of the contractor.) Permits must be obtained from Smithsonian Institution in order to perform welding and cutting, because the building is historic the owner wants to be aware of all work involving a potential fire. Tools and equipment causing vibration must also request permission from SI before doing work due to the potential damage the vibration can cause to the Historic Building. The chart below shows the limitations on the equipment to be used in the building.

Frequency	Maximum Peak Particle Velocity
1-10 Hz	6mm/sec
10-40 Hz	6-13 mm/sec
40 Hz and above	13 mm/sec

Temporary Utilities

1. Sewers and drainage
2. Water service, metering, and distribution
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities
4. Heating and cooling facilities
5. Ventilation
6. Electric power service
7. Lighting
8. Telephone service

Since the building is very old, there are issues relating to the different expansion and contraction of materials due to changes in weather. In order to limit the change in materials due to the temperature, the building is maintained at a relatively constant temperature using two (2) 40 ton temporary chillers and two heaters while it is under construction. The project has not had to add separate services for electricity, sanitary or storm drainage. All of those requirements are running from the buildings existing utility supplies and the systems have been coordinated so there is a direct switch-over from the old to the new system in all cases.

Temporary Utilities continued

Support Facilities

1. Temporary roads and paving
2. Wash racks
3. Dewatering facilities and drains
4. Project identification and temporary signs
5. Waste disposal facilities
6. Field offices
7. Storage and fabrication sheds
8. Lifts and hoists
9. Temporary elevator usage
10. Temporary stairs
11. Construction aids and miscellaneous services and facilities

Security and Protection Facilities

1. Environmental protection
2. Stormwater, sediment, and erosion controls control
3. Tree, plant, and animal protection
4. Pest control
5. Site enclosure fence
6. Security enclosure and lockup
7. Barricades, warning signs, and lights
8. Covered walkways
9. Temporary enclosures
10. Temporary partitions
11. Noise control
12. Weather protection
13. Fire protection
14. Existing storm water drains

Environmental Requirements: Concrete Placement

- Cold Weather concreting:
  - ◊ Frozen ground: Do not place concrete on frozen ground.
  - ◊ Do not place concrete when temperature is below 40 degrees F, except with prior approval of Smithsonian Institution
  - ◊ Place concrete in cold weather in accordance with ACI 306.
- Hot Weather concreting:
  - ◊ Do not place concrete when atmospheric conditions endanger quality of concrete.
  - ◊ Place concrete in hot weather in accordance with ACI 305.
  - ◊ Cover reinforcing steel with water soaked burlap if necessary to maintain steel temperature not exceeding ambient air temperature immediately before embedment in concrete.
  - ◊ Use water reducing retarding admixture when concrete temperatures exceed 80 degrees F or other adverse placing conditions, as approved by COTR.
- At time of placement, provide concrete temperature not lower than 50 degrees F, or higher than 90 degrees F. Maintain surfaces receiving concrete at approximately same temperature as concrete being placed.

Detailed Structural Estimate of Courtyard

Line Number	Description	Crew	Daily Output	Labor Hours	Quantity	Unit	Ext. Material	Ext. Labor	Ext. Equipment	Ext. Total	Ext. Total Incl O&P	Zip Code Prefix	Type	Release
033102405010*	Structural concrete, in place, slab on grade, 6" thick, includes textured finish only	C14G	2,600.00	0.022	7,050.00	S.F.	$11,773.50	$3,243.00	$70.50	$15,087.00	$17,905.87	20004	Union	2003
031104201500*	C.I.P. concrete forms, elevated slab, flat plate, plywood, 15' to 20' high, includes shoring, erecting, stripping and cleaning	C2	495.00	0.097	3,800.00	S.F.	$3,306.00	$8,284.00		$11,590.00	$16,567.92	20004	Union	2003
031104203000*	C.I.P. concrete forms, elevated slab, floor, hung from steel beams, 1 use, includes shoring, erecting, stripping and cleaning	C2	485.00	0.099	3,250.00	S.F.	$4,257.50	$7,247.50		$11,505.00	$15,989.35	20004	Union	2003
031104453000*	C.I.P. concrete forms, slab on grade, edge, wood, to 6" high, 4 use, includes erecting, stripping and cleaning	C1	600.00	0.053	500.00	L.F.	$170.00	$585.00		$755.00	$1,094.92	20004	Union	2003
031104552700*	C.I.P. concrete forms, wall, job built, plywood, exterior, over 16' high, 1 use, includes erecting, stripping and cleaning	C2	235.00	0.204	7,880.00	SFCA	$12,450.40	$36,169.20		$48,619.60	$70,517.25	20004	Union	2003
032202000100*	Welded wire fabric, sheets, 6 x 6 - W1.4 x W1.4 (10 x 10) 21 lb. per C.S.F., A185	2 Rodm	35.00	0.457	14.10	C.S.F.	$102.93	$193.88		$296.81	$430.01	20004	Union	2003
033102400820*	Structural concrete, in place, column, square, avg reinforcing, 16" x 16", includes forms(4 uses), reinforcing steel, and finishing	C14A	12.55	15.911	23.00	C.Y.	$8,050.00	$8,740.00	$1,403.00	$18,193.00	$24,146.32	20004	Union	2003
033102400920*	Structural concrete, in place, column, square, avg reinforcing, 24" x 24", includes forms(4 uses), reinforcing steel, and finishing	C14A	17.70	11.293	5.00	C.Y.	$1,465.00	$1,355.00	$215.00	$3,035.00	$3,975.35	20004	Union	2003
033102401950*	Structural concrete, in place, elevated slab, flat slab, 125 psf superimposed load, 30' span, includes forms(4 uses), reinforcing steel, and finishing	C14B	51.00	4.079	340.00	C.Y.	$56,100.00	$33,150.00	$5,083.00	$94,333.00	$119,015.30	20004	Union	2003
033102403200*	Structural concrete, in place, elevated slab, floor fill, 6" slab, includes finishing	C8	2,575.00	0.022	7,050.00	S.F.	$12,126.00	$3,172.50	$2,044.50	$17,343.00	$20,444.65	20004	Union	2003
033102405010*	Structural concrete, in place, slab on grade, 6" thick, includes textured finish only	C14G	2,600.00	0.022	7,050.00	S.F.	$11,773.50	$3,243.00	$70.50	$15,087.00	$17,905.87	20004	Union	2003
033102405020*	Structural concrete, in place, slab on grade, 8" thick, includes textured finish only	C14G	2,325.00	0.024	7,050.00	S.F.	$15,369.00	$3,595.50	$70.50	$19,035.00	$22,419.85	20004	Union	2003
033107000650*	Structural concrete, placing, column, square or round, with crane and bucket, 18" thick, excludes material	C7	55.00	1.309	25.00	C.Y.		$583.00	$400.40	$983.40	$1,341.76	20004	Union	2003
033107000850*	Structural concrete, placing, column, square or round, with crane and bucket, 24" thick, excludes material	C7	70.00	1.029	40.00	C.Y.		$798.00	$543.40	$1,341.40	$1,824.27	20004	Union	2003
033107001550*	Structural concrete, placing, elevated slab, with crane and bucket, 6" to 10" thick, excludes material	C7	110.00	0.655	185.00	C.Y.		$2,252.50	$1,547.00	$3,799.50	$5,100.72	20004	Union	2003
033107004700*	Structural concrete, placing, slab on grade, with crane and bucket, over 6" thick, excludes material	C7	145.00	0.497	185.00	C.Y.		$1,708.50	$1,173.00	$2,881.50	$3,909.43	20004	Union	2003
033107005400*	Structural concrete, placing, walls, with crane and bucket, 15" thick, excludes material	C7	95.00	0.758	306.00	C.Y.		$4,650.00	$3,165.00	$7,815.00	$10,498.35	20004	Union	2003
033503250160*	Control joint, concrete floor slab, sawcut in green concrete, 2" depth	C27	1,600.00	0.010	400.00	L.F.		$92.00	$24.00	$116.00	$156.03	20004	Union	2003
033503500600*	Concrete finishing, walls, float finish, 1/16" thick	1 Cefi	300.00	0.027	5,000.00	S.F.	$50.00	$3,050.00		$3,100.00	$4,599.50	20004	Union	2003
051202607200*	Column, structural, 2-tier, W12x87, A36 steel, incl shop primer, splice plates, bolts	E2	985.00	0.057	180.00	L.F.	$8,820.00	$358.20	$264.60	$9,442.80	$10,619.91	20004	Union	2003
051202607250*	Column, structural, 2-tier, W12x120, A36 steel, incl shop primer, splice plates, bolts	E2	960.00	0.058	324.00	L.F.	$21,870.00	$660.96	$489.24	$23,020.20	$25,757.79	20004	Union	2003
051206401500*	Structural steel member, 100-ton project, 1 to 2 story building, W12x26, A36 steel, shop fabricated, incl shop primer, bolted connections	E2	880.00	0.064	24.00	L.F.	$352.80	$53.52	$39.60	$445.92	$515.99	20004	Union	2003
051206401900*	Structural steel member, 100-ton project, 1 to 2 story building, W14x26, A36 steel, shop fabricated, incl shop primer, bolted connections	E2	990.00	0.057	40.00	L.F.	$588.00	$78.80	$58.40	$725.20	$840.04	20004	Union	2003
051206402700*	Structural steel member, 100-ton project, 1 to 2 story building, W16x26, A36 steel, shop fabricated, incl shop primer, bolted connections	E2	1,000.00	0.056	40.00	L.F.	$588.00	$78.00	$58.00	$724.00	$840.00	20004	Union	2003
051206403300*	Structural steel member, 100-ton project, 1 to 2 story building, W18x35, A36 steel, shop fabricated, incl shop primer, bolted connections	E5	960.00	0.083	54.00	L.F.	$1,063.80	$159.30	$85.86	$1,308.96	$1,538.94	20004	Union	2003
051206404300*	Structural steel member, 100-ton project, 1 to 2 story building, W21x50, A36 steel, shop fabricated, incl shop primer, bolted connections	E5	1,075.00	0.075	65.00	L.F.	$1,820.00	$173.55	$92.95	$2,086.50	$2,405.01	20004	Union	2003
051206405100*	Structural steel member, 100-ton project, 1 to 2 story building, W24x62, A36 steel, shop fabricated, incl shop primer, bolted connections	E5	1,100.00	0.072	252.00	L.F.	$8,820.00	$645.12	$345.24	$9,810.36	$11,213.95	20004	Union	2003
051206406100*	Structural steel member, 100-ton project, 1 to 2 story building, W30x99, A36 steel, shop fabricated, incl shop primer, bolted connections	E5	1,200.00	0.067	48.00	L.F.	$2,688.00	$113.28	$60.96	$2,862.24	$3,215.98	20004	Union	2003
051206406500*	Structural steel member, 100-ton project, 1 to 2 story building, W30x116, A36 steel, shop fabricated, incl shop primer, bolted connections	E5	1,150.00	0.069	60.00	L.F.	$3,930.00	$147.00	$79.20	$4,156.20	$4,650.02	20004	Union	2003
051206407900*	Structural steel member, 100-ton project, 1 to 2 story building, W36x230, A36 steel, shop fabricated, incl shop primer, bolted connections	E5	1,125.00	0.071	576.00	L.F.	$74,880.00	$1,457.28	$783.36	$77,120.64	$85,248.03	20004	Union	2003
							$262,414.43	**$126,037.59**	**$18,167.21**	**$406,619.23**	**$504,688.38**			

Detailed Estimate Takeoff Notes for Concrete

Below is shown the Concrete Takeoff for the courtyard. Concrete is used in several capacities. Obviously the slab on grade is concrete, the elevated slab is also concrete, though only half is structural two way while the other half is supported on steel beams. The walls are structural concrete, 18" thick, and half of the columns in the Courtyard are also concrete.

Item	Dimension	Quantity
CIP Columns	14' Tall, 15" square	35
Steel Columns	18' Tall, 48 plf	24
Steel Columns	18' Tall, 58 plf	5
One Way Slab	30' x 6'	1
	200' x 7'	1
	20' x 40'	1
	53' x 16	1
Total		3250 SF
Two Way Slab	80' x 43'	1
	53' x 3'	1
	33' x 6'	1
Total		3800 SF
Slab on Grade		7050 SF
W shape Beams & Girders	3250 SF	1
CIP Walls	18' x 53'	2
	18' x 16'	1
	14' x 75'	2
	14' x 53'	1
Total		5000 SF

Concrete Columns (#)	Dimension 1 (in)	Dimension 2(in)	Height (ft)	CY
24	16	16	14	22.12
4	14	24	14	4.84
1	30	30	14	3.24
7	30	30	18	29.17
Total				65
Concrete Slabs	**SF area**	**Depth (ft)**	**CY**	
SOG East Half	3800	0.42	58.64	
SOG West Half	3250	0.67	80.25	
Elev Slab East Half	3800	0.83	117.28	
Elev Slab West Half	3250	0.67	80.25	
Total			370	
Concrete Walls	**SF area**	**Depth (ft)**	**CY**	
	5000	1.5	306	
Total Amount of Concrete			**741**	**CY**

Detailed Estimate Takeoff Notes for Steel

Below is the takeoff of the Courtyard's steel structural system. Steel is used for the columns and beams in the Auditorium area of the courtyard which makes up a little less than half of the courtyard area.

Steel Member	Quantity	Length (ft)	Total Length (ft)	Weight (lb)	Weight (Tons)
Columns					
W 12 x 87	10	18	180	15660	8
W 12 x 120	18	18	324	38880	20
Beams					
W 12 x 26	3	8	24	624	1
W 14 x 26	5	8	40	1040	1
W 16 x 26	4	10	40	1040	1
W 18 x 35	3	18	54	1890	1
W 21 x 50	5	13	65	3250	2
W 24 x 62	14	18	252	15624	8
W 30 x 116	2	30	60	6960	4
W 30 x 99	4	12	48	4752	3
W 38 x 120	9	64	576	69120	35
				Total Weight	84

There is a large change in the cost of the structural system from the previous estimates. In reviewing the differences I feel the reason for the increase in this estimate is the disparity of using the two separate structural systems has come out. There is an inherent efficiency in using a single system for an entire structure. By using two different systems for the east and west halves of the courtyard structure, there is an increased cost and increased time to construct. Also, the fact that the courtyard is in the interior of a building being renovated was more evident because the placement methods for the steel and the concrete now were taken into account. In the square foot and assemblies estimates there was an inherent assumption in the cost data that the building was new. These two major items account for the majority of the cost differences from the two preliminary estimates to the current detailed estimate.

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
01110.100	Engineering fees	50,000.00	LS				4,560.000				4,560.000	228,000,000.00
01310.100	Project manager	468.00	WEEK	1,589.6500							1,589.650	743,956.20
01310.110	Superintendent	156.00	WEEK	1,241.1500							1,241.150	193,619.40
01310.120	Assistant superintendent	750.00	WEEK	898.5500							898.550	673,912.50
01310.130	Job engineer	900.00	WEEK	841.2500							841.250	757,125.00
01310.140	Clerk	156.00	WEEK	384.0000							384.000	59,904.00
01310.160	Secretary	156.00	WEEK	729.1500							729.150	113,747.40
01310.170	General purpose laborer	312.00	WEEK	888.8500							888.850	277,321.20
01310.180	General pupose carpenter	312.00	WEEK	936.7500							936.750	292,266.00
01310.190	Living expenses	2,880.00	WEEK	412.8500							412.850	1,189,008.00
01310.200	Permit	1.00	LS							50,000.000	50,000.000	50,000.00
01310.210	Purchase drawings	50.00	LS							100.000	100.000	5,000.00
01310.220	Travel expenses	50,000.00	LS							50,000.000	50,000.000	2,500,000,000.00
01320.100	Progess photographs	36.00	MO				119.000				119.000	4,284.00
01320.110	CPM schedule	1.00	LS				4,852.000			30,000.000	34,852.000	34,852.00
01450.100	Laboratory testing	1.00	LS							200,000.000	200,000.000	200,000.00
01510.100	Temporary wiring	36.00	MO				258.000				258.000	9,288.00
01510.110	Job telephone	720.00	MO				89.350				89.350	64,332.00
01510.120	Electric light bill	36.00	MO				283.000				283.000	10,188.00
01510.130	Water bill	36.00	MO				89.000				89.000	3,204.00
01510.140	Temporary heat	18.00	MO				1,107.850				1,107.850	19,941.30
01510.150	Temporary fire protection	36.00	MO				206.000				206.000	7,416.00
01520.100	Office trailer	126.00	MO				374.000				374.000	47,124.00
01520.120	Portable chemical toilet	540.00	MO				87.250				87.250	47,115.00
01520.130	Water, ice and cups	432.00	MO				138.000				138.000	59,616.00
01520.140	First aid supplies	72.00	MO				50.000				50.000	3,600.00
01520.150	Safety supplies	36.00	MO				150.000				150.000	5,400.00
01520.160	Office supplies	36.00	MO				275.750				275.750	9,927.00
01540.100	Crane rental	0.50	MO			191.000					191.000	95.50
01540.180	Small tools	36.00	MO			167.750					167.750	6,039.00
01540.190	Air compressor	36.00	MO			261.000					261.000	9,396.00
01540.210	Equipment repair	1.00	LS							50,000.000	50,000.000	50,000.00
01540.220	Gasoline and lubricating oil	100,000.00	GALS			1.850					1.850	185,000.00
01540.230	Generators	12.00	MO			1,216.000					1,216.000	14,592.00
01540.240	Pickup truck rental	180.00	MO			521.000					521.000	93,780.00
01540.250	Truck rental	12.00	MO			874.000					874.000	10,488.00
01540.260	Pumps	36.00	MO			115.000					115.000	4,140.00
01540.270	Conveyors	96.00	MO			350.000					350.000	33,600.00
01540.280	Power buggies	120.00	DAY			68.750					68.750	8,250.00
01540.290	Forklift	720.00	MO			631.000					631.000	454,320.00
01540.310	Scaffolding	1.00	LS							100,000.000	100,000.000	100,000.00
01540.320	Jobsite communications	36.00	MO		87.500						87.500	3,150.00
01560.100	Watchman	156.00	WEEK	518.2500							518.250	80,847.00
01560.130	Protect trees	2.00	EACH	24.5000	16.100						40.600	81.20
01560.150	Sidewalk barricades	50.00	LNFT	30.0000	10.000						40.000	2,000.00
01560.160	Temporary partitions	1,000.00	SQFT	0.5500	0.150						0.700	700.00
01560.170	Temporary storage	1.00	LS							100,000.000	100,000.000	100,000.00
01560.180	Weather protection	2.00	LS							20,000.000	20,000.000	40,000.00
01580.100	Job sign	2.00	EACH	275.0000	114.000						389.000	778.00
01650.100	Freight demurrage	1.00	LS				1,038.650			20,000.000	21,038.650	21,038.65
01720.100	Layout supplies	156.00	WEEK		81.000						81.000	12,636.00
01730.100	Cut and patch	1.00	LS							100,000.000	100,000.000	100,000.00
01740.100	Job clean up	382,000.00	SQFT	0.3800							0.380	145,160.00
01740.110	Clean glass	50,000.00	SQFT	0.5100							0.510	25,500.00
01740.120	Trash chutes	4.00	FLRS				214.000				214.000	856.00
01740.130	Rubbish removal	100,000.00	CUYD	15.1100	1.265						16.375	1,637,500.00
01830.100	Turn on HVAC early	6.00	MO									
Total Estimate												**$2,736,022,094**

General Conditions Estimate continued

The general conditions estimate was put together using MC^2. Areas where the specific costs and amounts were not known (permits, temporary storage, etc) a lump sum estimate was filled in using an educated guess of the amount needed for the project and a rough idea of the cost.

The general conditions estimate shows the major portion to be going into staffing for the job. Since each of the superintendents and the project manager receive cars, those costs were built into the estimate as well. There was no need to put money in for a site fence, one was already present. There needed to be money for trailers, but because the site is very tight there is minimal room for trailers and not as many as would be typical of a project this size with more space. Since there is limited space there needs to be money for staff parking offsite (travel expenses). The project also requires regular progress photos.

Overall the estimate makes the cost of the general conditions around 3% of the job cost. The percentage seems low for a typical project, however the size of the project throws off the relationship normal to a construction project. Also, the program used to do the estimate uses salaries and some other costs that appear low based on the contractor performing the work. The size of the project staff also creates different levels to the staff that can not easily be delineated in the estimating software.

Research and Analysis Methods

Problem Statement: There are no LEED registered art museums and a general lack of interest in green building from museums and similar facilities. Green building is a theme that should be universal in construction and arts' centers would be a large stepping stone in convincing people green building is not just a small niche in the market. Since most buildings are not toured on a regular basis by large numbers of people, it is rare for the advantages of green building to be showcased to the public. Integrating green design and construction into a building aimed to showcase and teach the public is an ideal setting for demonstrating the value green techniques can bring to a building.

Goals: Showing LEED certification is not only viable but advantageous for museums and arts centers would go a long way to show green building is practical in almost all facility types. To properly show LEED as being viable it is necessary to pinpoint the challenges for these building types and show how they can be overcome or alternative systems which will fulfill the requirements and be better for the environment.

Objectives:

1. Literature Review
    - ◊ Read 12 relevant and current articles on issues with greenbuilding
    - ◊ Review of LEED Point system and narrow down the areas of the system that are most challenging for museums and arts' centers.
    - ◊ Talk/email with the design manager from Smithsonian Institution at the Patent Office Building and see what concerns they have with LEED and why more environmentally friendly systems and techniques were not used.
    - ◊ Talk w/ Penn State Office of Physical Plant Project Manager to gain some insight the differences between a museum facility and a regular classroom facility and the challenges with applying LEED to an arts' center.

2. Study
    - ◊ Analysis of points areas for museums to focus
    - ◊ Develop Reasoning behind museums as next logical step for LEED
    - ◊ Study similar facilities and arts' centers which are close to meeting LEED requirements
    - ◊ Review market data for LEED from USGBC website and analyze for points aimed at by different building types

3. Outcome - review data and show if museums should go green
    - ◊ Show challenges specific to museums/arts' centers
    - ◊ Demonstrate via similar building types and answers to interview questions that Art Museums have equal opportunity and reasons to go green/LEED

4. Future Research - find shortcomings of research and new areas and ideas created by outcomes
    - ◊ Show two areas of research shortcomings with potential for further research
    - ◊ Show three new areas opened up by the research for further study

Opening Statement: LEED is a growing portion of the building market. Thus far there are no LEED registered art museums and a general lack of interest in green building from museums and similar facilities. Arts' centers would be a large stepping stone in convincing people that green building is not just a small niche in the market. Since most buildings are not toured on a regular basis by large numbers of people, it is rare for the advantages of green building to be showcased to the public.

Unstructured Interview: Smithsonian Institution

1. What is Smithsonian's take on the LEED point systems and does Smithsonian plan on using it on any projects in the near future?

2. What special concerns does a museum have which will make building a LEED certified facility especially challenging?

3. What reasons are most appealing to SI for having a LEED certified building?

4. What issues might affect an art museum from attaining points in the following areas:
    - Sites? (access - loading/unloading of exhibit items)
    - Water? (chemicals used in restoration, green roof)
    - Energy? (requirements for maintaining painting quality, daylighting)
    - Materials? (low VOC's, recycled materials, regional materials)

Structured Interview: Office of Physical Plant at Penn State

1. What are the key reasons Penn State has started building LEED certified buildings?

2. What special concerns does a museum have which might make building a LEED certified facility challenging?

3. Penn State has decided to build LEED certified buildings, are there any building types where the possibility of LEED is discounted, and why?

4. What issues might affect an art museum from attaining points in the following areas:
    - Sites? (access - loading/unloading of exhibit items)
    - Water? (chemicals used in restoration, green roof)
    - Energy? (requirements for maintaining painting quality, daylighting)
    - Materials? (low VOC's, recycled materials, regional materials)