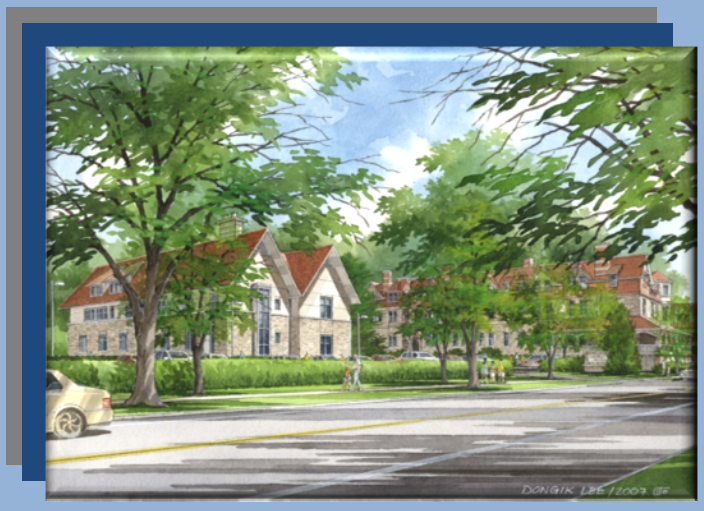
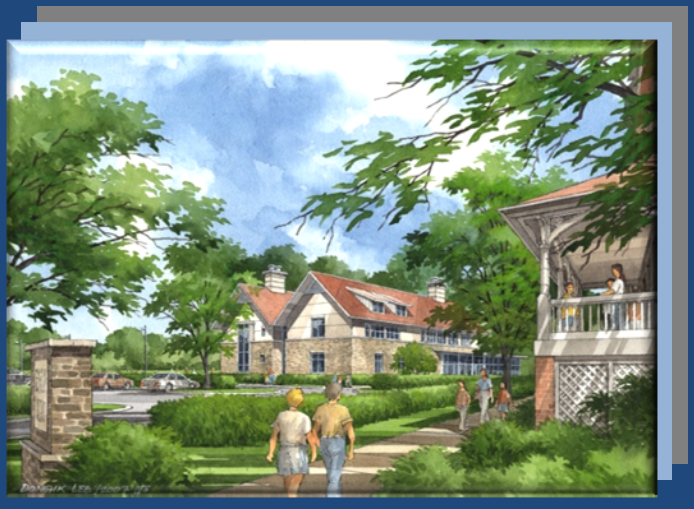


Science & Technology Center
Chestnut Hill Academy
Philadelphia, PA

Michael R. Pothering

Construction Management



Technical Assignment #1

Advisor Dr. Messner

Table of Contents

Executive Summary

The 26,870 S.F. project is located in Philadelphia, PA on the private campus of the Chestnut Hill Academy which is an all boy preparatory school. The building will house the Science & Technology Center on the campus of the academy. Students will have state-of-the-art laboratories and classrooms which will provide the valuable hands on learning environment needed with the science and technology topics.

This project will be seeking LEED Silver certification. It will be the first LEED building in the greater Chestnut Hill area. The certification will be gained by several sustainable features such as photovoltaic cells, solar panels, a wind turbine, grey water collection system and porous paving. Using innovative technology with the use of an interactive meter wall which will display information collected from the energy saving devices which teachers may use in their teachings.

Chestnut Hill Academy has hired Lilley Dadagian Architects to design and Tuner Construction to construct the $9.6 million dollar building. Construction is on a twenty-one month schedule beginning in March 2007 and substantial completion in November 2008.

Included in this assignment is information on a project schedule summary, building systems, project cost estimate comparisons, existing site conditions, local conditions, project delivery, and staff planning. These categories are intended to give the readers an overview of the projects general logistics, building cost estimates, and site conditions.

A. Project Schedule Summary

Foundation work is one of the most important precursors to keeping the construction on schedule. The foundation consists of strip and spread footings with a slab on grade. It is scheduled to begin 12/24/07 and last five weeks. A concern during this time of the year would be that the concrete cures properly due to the temperature. Wrapping the concrete would help insure proper curing and prevent an insufficient product.

Structural steel erection will commence soon after the foundation has adequately cured. This as well as the foundation is a critical path task. Steel erection will commence approximately a week and a half after the concrete foundation has finished. Once the steel in a section is finished the floor deck can be placed with shear studs and followed by the concrete slabs.

Once the deck and slabs are in place the enclosure can begin with the roof system. The structural stud framing will also begin to allow the stone veneer to start around the perimeter of the building. As the exterior begins to seal off the building the interior contractors such as may start to install their portions. After the testing and finishes come to a close the project team will check their punch list ensuring all items have been completed resulting in turn over to the owner.

B. Building System Summary

Yes	No	Work Scope	Description
X		Demolition Required	• Existing Asphalt paving • Existing Concrete curbs and paving • Existing Basketball court • Existing Underground utilities such as 2" irrigation and 1" waterline • Existing Trees • Existing Light poles and underground wiring • Existing underground 12" steel storm culvert pipe
X		Structural Steel Frame	• Steel braced frame • Metal studs • Steel decking with shear studs
X		Cast in Place Concrete	• 5" Slab on grade with WWF • Footings, piers, foundation walls • Composite floor slabs with decking and shear studs • Placement done by direct dump and concrete pump
	X	Precast Concrete	None
X		Mechanical System	• AHU's located in half story attic above 2nd floor • Two AHUs , forced air with packaged enthalpy wheels • Wet-pipe sprinkler system • Solar Hot water heater • See Figure 1
X		Electrical System	• 480V/3 Phase/ 4 wire • 400A/3Phase main feeder breaker • 12 Electrical Panels throughout
X		Masonry	• 4-6" Stone exterior veneer, non-load bearing • Lobby floor will have Bluestone flooring • See Figure 2
X		Curtain Wall	• Lobby will have an anodized aluminum curtain wall, glazed tempered glass • See Figure 3
	X	Support of Excavation	None

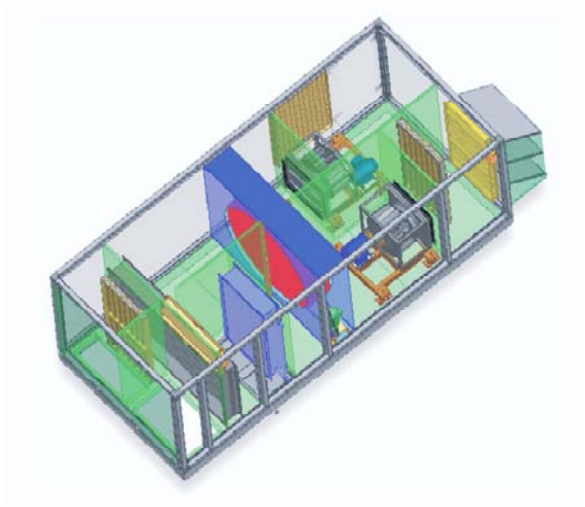


Figure 1- 3D rendered section by Annexair

Figure 2 -Elevation of Stone & Stucco veneer by Lilley Dadagian Architects

Figure 3- Elevation showing Curtian Wall by Lilley Dadagian Architects

C. Project Cost Evaluation

Project Cost information for the Science & Technology Center.

Project Construction Costs	Amount
Construction Cost	$ 8,383,700.00
Cost Per Square Foot	$ 312.01

Total Project Costs	Amount
Project Cost	$ 9,623,041.00
Cost Per Square Foot	$ 358.13

Building System Cost	Total	SF
Concrete	$ 424,600.00	$ 15.80
Steel	$ 744,600.00	$ 27.71
Drywall	$ 713,000.00	$ 26.54
HVAC and Plumbing	$ 1,543,700.00	$ 57.45
Electrical	$ 866,800.00	$ 32.26
Fire Protection	$ 109,300.00	$ 4.07
Roofing	$ 550,700.00	$ 20.49
Masonry	$ 634,900.00	$ 23.63
Glass, Glazing, Curtain wall	$ 450,800.00	$ 16.78

D4 Cost 2002 Estimate

**See Appendix B for D4Cost breakdown*

While using D4Cost software to perform an estimate I used the smart averaging wizard to derive a cost estimate from four buildings of similar size, shape, cost, and function. Using smart averaging allowed the software to take similar components of the four buildings and take the average of only the buildings that have the component rather than dividing by a building that had nothing.

Project Name	Year of Construction	Size (SF)	Floors	Building Cost
N.E. Mississippi C.C. Math/Science	1991	44,200	3	$3,514,676.00
University Sciences Building	2005	39,775	2	$6,735,900.00
Classroom & Laboratory Building	2000	30,515	2	$2,577,197.00
Science Lecture/Lab Building	1998	25,563	2	$2,746,522.00

The buildings I chose are all related in a similar way to CHA's Science and Technology Center. All four buildings are academic buildings in the science/laboratory areas.

It was difficult to find buildings that had a similar building cost. The reason for this would be that it has very unique and scientifically advanced features such as the robotics lab, the state-of-the-art monitoring system, and all of the LEED/sustainable aspects that were taken in account for this building. Another reason the cost difference would be the dates of construction, such as the N.E. Mississippi C.C. Math/Science Building was constructed in 1991 and the cost of building as escalated significantly. D4Cost accounts for all of these time, location and size factors in its estimating program.

D4Cost 2002 generated a total building cost of $9,270,515. This is fairly close to the price of the actual building only differing by $352,526. This difference could easily be due to the elaborate laboratory systems, and sustainable practices taken by the CHA's Science & Technology Center.

R.S. Means Evaluation

**See end of report for cut sheets of R.S. Means References*

R.S. Means provides building models of similar function to derive an estimate. This estimate was taken from was a College, Classroom building model M.120 Decorative Concrete Block with Steel Frame from the 2008 R.S. Means Square Foot Estimate reference book.

SF Area = 26,870
LF Perimeter= 443

Interpolated Cost/SF = $173.34

Perimeter Adjustment
Interpolated Perimeter Adjustment = $ 5.25 per 100 LF
= (443LF /100LF) * $5.25
=$23.26 additional

Story Height Adjustment
Interpolated Story Height Adjustment = **$1.53/foot** difference below actual
Actual Story Hgt. 13' assumed Hgt. was 12'
=$1.53 additional

Location modification factor for Philadelphia, PA = 1.15

Adjusted Unit Cost = $1.53 +$ 23.26 + $173.34 = $233.79/SF

Estimated Project Cost = $233.79/SF *26,870 S.F. = $6,281,937.30

The estimated cost from R.S. Means of **$6,281,937.30** is must lower than the actual cost of $9,623,041.00. After looking through the materials of the Model from the R.S. Means reference book, it is apparent that there are significant differences between the R.S. Means and the actual building. Several of the main components of the actual building that would add to the project's cost is that the exterior wall is comprised of a stone and stucco veneer backed with sheeting and metal studs, the R.S. Means model used decorative concrete block. The roof system is also significantly different. The actual is sloped wood rafters with asphalt shingles, the model uses a built-up tar and gravel roof with no slope. Among the several other building system differences, the actual building will be seeking a LEED rating of Silver/Gold which adds much more cost effected circumstances.

D. Site Plan of Existing Conditions

***see Site Plan in Appendix**

The site is located on the campus of Chestnut Hill Academy, there is ample room for storage, maneuvering of materials, and crane work. There is one side of the site which is somewhat restricted due to an existing structure which is only 75' away from the exterior wall. This area is the Southeast side of the Science& Technology Center. This area must be restricted access so the pedestrians are not in the construction area.

Due to the soil consistency on the site being made of decomposed rock and rock below elevation 332.5 heavy equipment will need to be used for removal. There are also existing and abandoned underground utilities that the excavation team will need to marked.

Satellite Aerial View by Google Maps

Rendered Site Plan by Lilley Dadagian Architects

E. Local Conditions

The site is located in Philadelphia, Pennsylvania on the private campus of the Chestnut Hill Academy. There are few preferred construction methods in this area of Philadelphia. The site is between two roads with a neighboring building to south end of the site approximately 80' away.

Parking:
Parking for the site workers is located on the side streets adjacent to the site. The deliveries are all timed ensuring minor congestion onsite.

Soil:
Soil conditions for the foundation will be mainly situated on dense to very dense decomposed rock. This soil will make it suitable for the foundation to only consist of shallow based columns and wall footings. This soil provides a bearing capacity of 4,000 PSI. The areas below elevation 332.5 will encounter rock and will need to use heavier equipment for removal. There were no ground water issues on this site at the depth of excavation so no precautions are necessary.

Recycling Fees:
Recycling of solid waste costs $52/ton in the Philadelphia region.
Recyclables only are FREE.
Separated refuse & recyclables are FREE.

Cost of Construction Trash Dumpster Removal:
20 Cu. Yd at 4 ton capacity costs $490.00
30 Cu. Yd at 5 ton capacity costs $590.00
40 Cu. Yd at 6 ton capacity costs $690.00

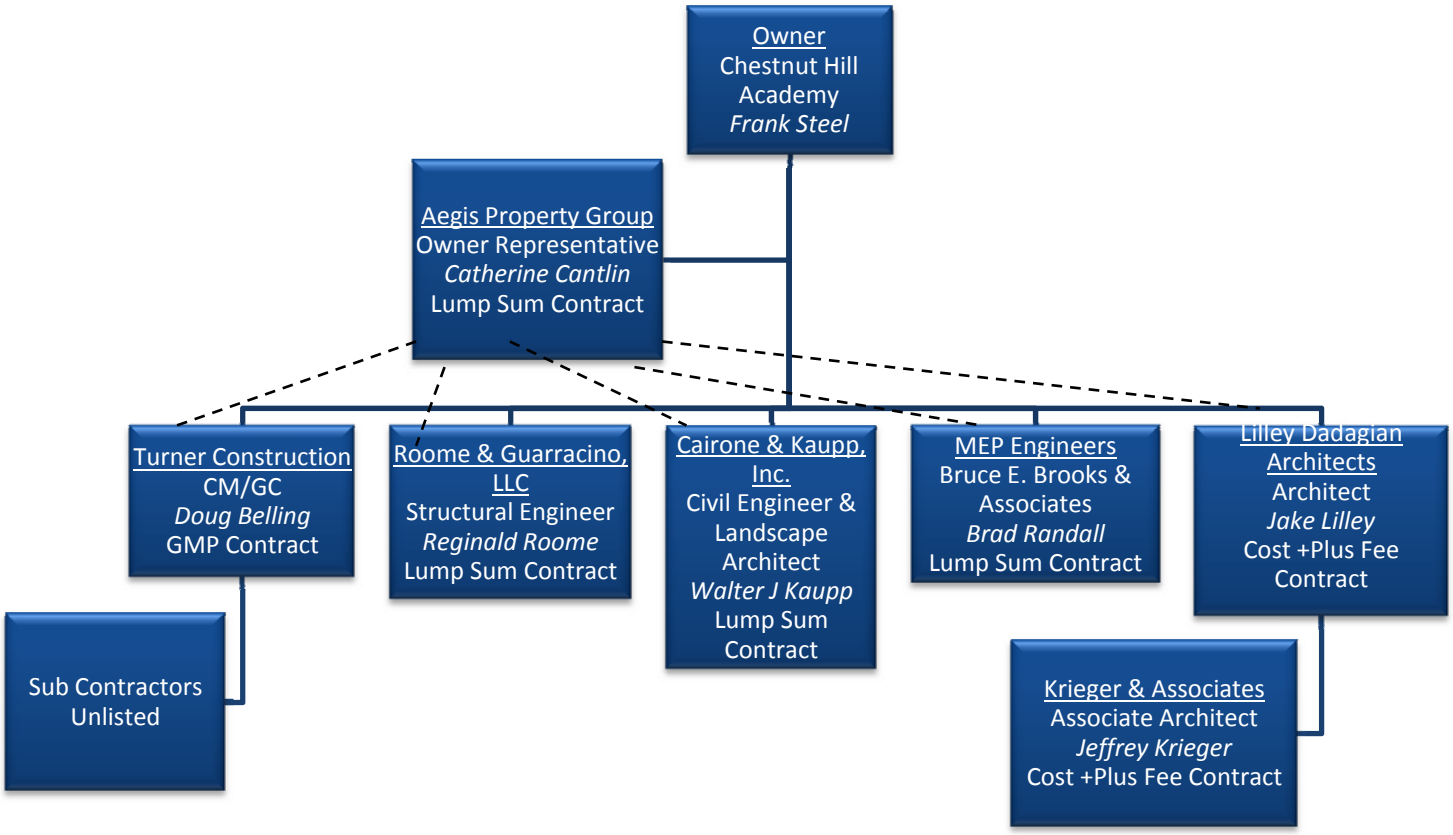
F. Client Information

Chestnut Hill Academy is the owner of the New Science and Technology Building. The school is an all boy predatory school grades K through 12, dedicated to providing its students with the environment to grow, learn and mature into well educated driven individuals.

The building is being built to serve as a hands-on learning environment for students and visitors. The building includes photovoltaic cells, solar panels, a wind turbine, and state of the art monitoring panels that shows the buildings energy use and other systems displays. It will have classrooms and laboratories for biology, chemistry, physics, mechanical engineering robotics lab all are designed to be visible to passing by students stimulating their curiosity in the sciences.

G. Project Delivery System

.



The Science & Technology Center was designed by Lilley Dadagian and is being constructed by Turner. Both firms have had experience with school projects that had green design technologies involving classroom and laboratory buildings. There were no sub bonds required by owner. The owner hired a representative to act as a middle man between the GC, engineers, and architects. Having only one person reporting to them with updates and issues keeps the project running smoothly.

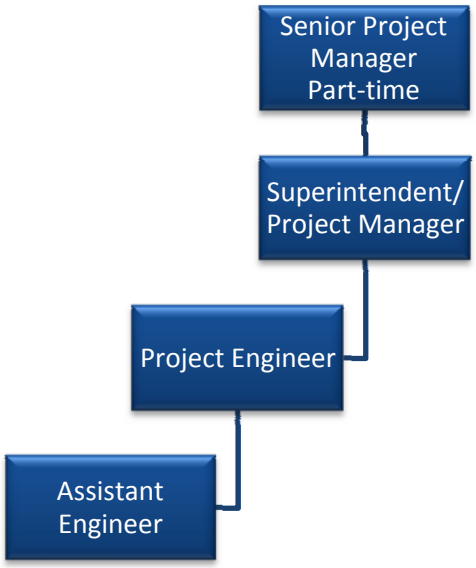
All contracts held between Tuner and their subcontractors are lump sum. This allows for easy payment requests as well as cost reimbursement for possible change orders.

H. Staffing Plan

Tuner Construction's staffing plan is as follows. The Senior Project Manager was only part time, the need for a Senior PM committed 100% of the time is not necessary for a project of this scope, Senior PM can act as a liaison between owner and contractor.

The PM/Superintendent will act as the operations lead and take charge of the team to mediate problems. He will also answer the RFI's that arise.

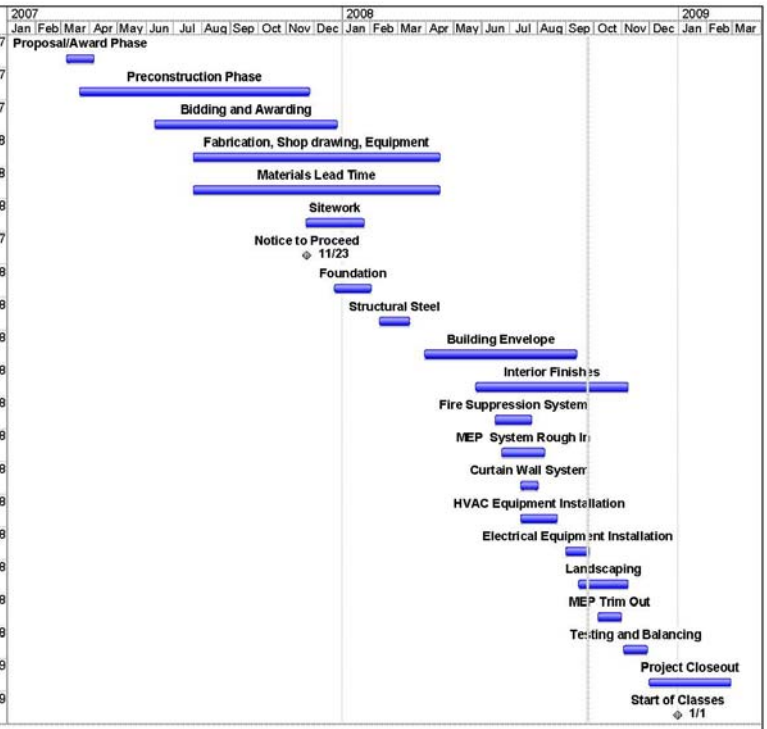
The project team worked very closely together on this project. Since the project was a smaller scale project in size there was not much need for extended assistants and site managers.



Appendix A

Schedule

ID	Task Name	Duration	Start	Finish
1	Proposal/Award Phase	22 days	Wed 3/7/07	Thu 4/5/07
2	Preconstruction Phase	179 days	Wed 3/21/07	Mon 11/26/07
3	Bidding and Awarding	143 days	Mon 6/11/07	Wed 12/26/07
5	Fabrication, Shop drawing, Equipment	193 days	Mon 7/23/07	Wed 4/16/08
6	Materials Lead Time	193 days	Mon 7/23/07	Wed 4/16/08
8	Sitework	45.5 days	Fri 11/23/07	Fri 1/25/08
7	Notice to Proceed	0 days	Fri 11/23/07	Fri 11/23/07
9	Foundation	30 days	Mon 12/24/07	Fri 2/1/08
17	Structural Steel	25 days	Mon 2/11/08	Fri 3/14/08
18	Building Envelope	120 days	Mon 3/31/08	Fri 9/12/08
19	Interior Finishes	120 days	Mon 5/26/08	Fri 11/7/08
12	Fire Suppression System	30 days	Mon 6/16/08	Fri 7/25/08
14	MEP System Rough In	35 days	Mon 6/23/08	Fri 8/8/08
4	Curtain Wall System	15 days	Mon 7/14/08	Fri 8/1/08
10	HVAC Equipment Installation	30 days	Mon 7/14/08	Fri 8/22/08
13	Electrical Equipment Installation	20 days	Mon 9/1/08	Fri 9/26/08
11	Landscaping	40 days	Mon 9/15/08	Fri 11/7/08
15	MEP Trim Out	20 days	Mon 10/6/08	Fri 10/31/08
16	Testing and Balancing	20 days	Mon 11/3/08	Fri 11/28/08
21	Project Closeout	65 days	Mon 12/1/08	Fri 2/27/09
20	Start of Classes	0 days	Thu 1/1/09	Thu 1/1/09



Project: Schedule
Date: Wed 9/24/08

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

Page 1

Appendix B

D4Cost Software Estimate

Estimate of Probable Cost

Project Information

Prepared By	Michael Pothering , Phone: Fax:	Prepared For	Technical Assignment 1 , Phone: Fax:
Projected Size	26870	Projected Location	PA - Philadelphia
Building Height	42	Projected Date	Mar 2007
Building Use	Educational	Foundation	CON
Number of Buildings	1	Exterior Wall	STO
Site Size	1229130	Interior Wall	DRY
1st Floor Size	0	Roof Type	ASP
1st Floor Height	13	Floor Type	VCT
Number of Floors	2	Project Type	NEW

Building Costs

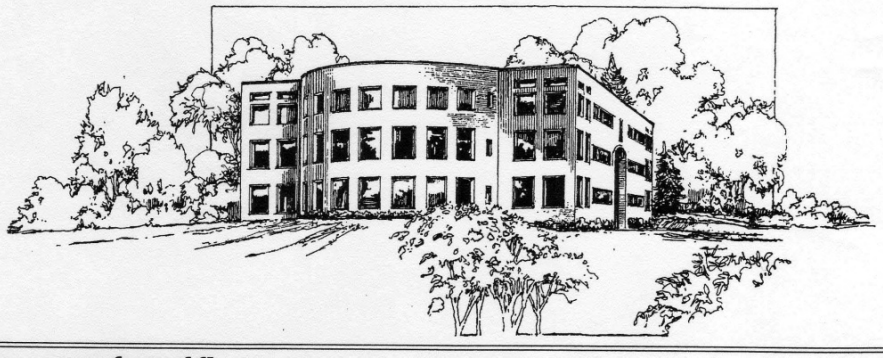
Division #	Label	Projected %	Projected Sq. Cost	Projected
00	Bidding Requirements	0.75	2.59	69,560
	Bidding Requirements	0.75	2.59	69,560
01	General Requirements	5.77	19.91	534,855
	General Requirements	5.77	19.91	534,855
02	Site Work	7.87	27.15	729,507
	Site Work	7.87	27.15	729,507
03	Concrete	3.28	11.30	303,610
	Concrete	3.28	11.30	303,610
04	Masonry	3.49	12.04	323,595
	Masonry	3.49	12.04	323,595
05	Metals	7.03	24.27	652,146
	Metals	7.03	24.27	652,146
06	Wood & Plastics	0.94	3.24	87,141
	Wood & Plastics	0.94	3.24	87,141
07	Thermal & Moisture Protection	2.11	7.29	195,838
	Thermal & Moisture Protection	2.11	7.29	195,838
08	Doors & Windows	1.53	5.28	141,820
	Doors & Windows	1.53	5.28	141,820
09	Finishes	4.10	14.16	380,548

	Finishes	4.10	14.16	380,548
10	Specialties	0.52	1.78	47,857
	Specialties	0.52	1.78	47,857
11	Equipment	4.00	13.80	370,841
	Equipment	4.00	13.80	370,841
12	Furnishings	3.71	12.78	343,523
	Furnishings	3.71	12.78	343,523
13	Special Construction	0.93	3.22	86,483
	Special Construction	0.93	3.22	86,483
14	Conveying Systems	0.43	1.50	40,254
	Conveying Systems	0.43	1.50	40,254
15	Mechanical	9.29	32.04	860,867
	Mechanical	9.29	32.04	860,867
16	Electrical	4.97	17.13	460,308
	Electrical	4.97	17.13	460,308
21	Fire Suppression	0.79	2.73	73,314
	Fire Suppression	0.79	2.73	73,314
22	Plumbing	2.48	8.57	230,236
	Plumbing	2.48	8.57	230,236
23	HVAC	17.88	61.69	1,657,616
	HVAC	17.88	61.69	1,657,616
26	Electrical	9.93	34.25	920,216
	Electrical	9.93	34.25	920,216
27	Communications	0.83	2.85	76,641
	Communications	0.83	2.85	76,641
28	Electronic Safety and Security	0.44	1.52	40,972
	Electronic Safety and Security	0.44	1.52	40,972
31	Earthwork	0.80	2.75	73,834
	Earthwork	0.80	2.75	73,834
32	Exterior Improvements	1.21	4.16	111,894
	Exterior Improvements	1.21	4.16	111,894
33	Utilities	4.93	17.01	457,040
	Utilities	4.93	17.01	457,040
	Total Building Costs	100	345.01	$9,270,515

Appendix C

RS Means References

COMMERCIAL/INDUSTRIAL/INSTITUTIONAL | **M.120** | **College, Classroom, 2-3 Story**



Costs per square foot of floor area

Exterior Wall	S.F. Area	15000	20000	28000	38000	50000	65000	85000	100000	150000
	L.F. Perimeter	350	400	480	550	630	660	750	825	1035
Face Brick with Concrete Block Back-up	Steel Frame	199.20	187.60	177.55	170.00	164.75	159.65	156.30	154.85	151.65
	Bearing Walls	198.70	185.95	175.00	166.55	160.70	154.80	151.05	149.35	145.70
Decorative Concrete Block	Steel Frame	191.70	181.15	172.05	165.35	160.75	156.35	153.55	152.20	149.45
	Bearing Walls	191.20	179.55	169.50	161.85	156.65	151.50	148.20	146.70	143.50
Stucco on Concrete Block	Steel Frame	188.50	178.10	169.05	162.45	157.95	153.70	150.85	149.55	146.85
	Bearing Walls	190.35	178.85	168.90	161.35	156.25	151.20	147.90	146.40	143.30
Perimeter Adj., Add or Deduct	Per 100 L.F.	8.30	6.25	4.45	3.20	2.55	1.90	1.50	1.25	0.85
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	2.05	1.70	1.50	1.20	1.10	0.90	0.85	0.75	0.65
For Basement, add $30.85 per square foot of basement area										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $105.05 to $246.90 per S.F.

Common additives

Description	Unit	$ Cost
Carrels Hardwood	Each	655 - 1200
Clock System		
20 Room	Each	15,400
50 Room	Each	37,400
Elevators, Hydraulic passenger, 2 stops		
1500# capacity	Each	55,100
2500# capacity	Each	57,800
3500# capacity	Each	62,100
Additional stop, add	Each	9000
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	278
Nickel cadmium	Each	800
Flagpoles, Complete		
Aluminum, 20' high	Each	1425
40' High	Each	3200
70' High	Each	9975
Fiberglass, 23' High		1725
39'-5" High	Each	3250
59' High	Each	8200

Description	Unit	$ Cost
Lockers, Steel, single tier, 60" or 72"	Opening	165 - 298
2 tier, 60" or 72" total	Opening	104 - 137
5 tier, box lockers	Opening	58 - 79
Locker bench, lam. maple top only	L.F.	20.50
Pedestals, steel pipe	Each	62
Seating		
Auditorium chair, all veneer	Each	218
Veneer back, padded seat	Each	264
Upholstered, spring seat	Each	264
Classroom, movable chair & desk	Set	65 - 120
Lecture hall, pedestal type	Each	208 - 620
Smoke Detectors		
Ceiling type	Each	174
Duct type	Each	445
Sound System		
Amplifier, 250 watts	Each	2225
Speaker, ceiling or wall	Each	181
Trumpet	Each	345
TV Antenna, Master system, 12 outlet 0	Outlet	299
30 outlet	Outlet	192
100 outlet	Outlet	179

102

Important: See the Reference Section for Location Factors

Model costs calculated for a 2 story building with 12′ story height and 50,000 square feet of floor area

College, Classroom, 2-3 Story

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings		S.F. Ground	1.18	.59	3.7%
1020	Special Foundations	N/A		–	–	–	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	4.63	2.32	
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing		S.F. Ground	.25	.13	
2020	Basement Walls	4′ Foundation wall		L.F. Wall	65	1.35	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Open web steel joists, slab form, concrete		S.F. Floor	15.16	7.58	10.2%
1020	Roof Construction	Metal deck on open web steel joists, columns		S.F. Roof	8.74	4.37	
	B20 Exterior Enclosure						
2010	Exterior Walls	Decorative concrete block	*65% of wall*	S.F. Wall	14.09	2.77	5.9%
2020	Exterior Windows	Window wall	*35% of wall*	Each	34.20	3.62	
2030	Exterior Doors	Double glass and aluminum with transom		Each	4575	.55	
	B30 Roofing						
3010	Roof Coverings	Built-up tar and gravel with flashing; perlite/EPS composite insulation		S.F. Roof	4.94	2.47	2.1%
3020	Roof Openings	N/A		–	–	–	
C. INTERIORS							
1010	Partitions	Concrete block	*20 S.F. Floor/L.F. Partition*	S.F. Partition	13.08	6.54	26.0%
1020	Interior Doors	Single leaf hollow metal	*200 S.F. Floor/Door*	Each	842	4.22	
1030	Fittings	Chalkboards, counters, cabinets		S.F. Floor	4.24	4.24	
2010	Stair Construction	Concrete filled metal pan		Flight	14,500	2.90	
3010	Wall Finishes	95% paint, 5% ceramic tile		S.F. Surface	3.45	3.45	
3020	Floor Finishes	70% vinyl composition tile, 25% carpet, 5% ceramic tile		S.F. Floor	4.37	4.37	
3030	Ceiling Finishes	Mineral fiber tile on concealed zee bars		S.F. Ceiling	4.74	4.74	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Two hydraulic passenger elevators		Each	68,500	2.74	2.3%
1020	Escalators & Moving Walks	N/A		–	–	–	
	D20 Plumbing						
2010	Plumbing Fixtures	Toilet and service fixtures, supply and drainage	*1 Fixture/455 S.F. Floor*	Each	5697	12.52	12.6%
2020	Domestic Water Distribution	Oil fired hot water heater		S.F. Floor	1.52	1.52	
2040	Rain Water Drainage	Roof drains		S.F. Roof	1.36	.68	
	D30 HVAC						
3010	Energy Supply	N/A		–	–	–	16.1 %
3020	Heat Generating Systems	Included in D3050		–	–	–	
3030	Cooling Generating Systems	N/A		–	–	–	
3050	Terminal & Package Units	Multizone unit, gas heating, electric cooling		S.F. Floor	18.80	18.80	
3090	Other HVAC Sys. & Equipment	N/A		–	–	–	
	D40 Fire Protection						
4010	Sprinklers	Sprinklers, light hazard		S.F. Floor	1.99	1.99	1.7%
4020	Standpipes	N/A		–	–	–	
	D50 Electrical						
5010	Electrical Service/Distribution	2000 ampere service, panel board and feeders		S.F. Floor	4.39	4.39	19.4%
5020	Lighting & Branch Wiring	Fluorescent fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	11.10	11.10	
5030	Communications & Security	Alarm systems, internet wiring, communications systems and emergency lighting		S.F. Floor	6.53	6.53	
5090	Other Electrical Systems	Emergency generator, 100KW		S.F. Floor	.65	.65	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		–	–	–	0.0 %
1020	Institutional Equipment	N/A		–	–	–	
1030	Vehicular Equipment	N/A		–	–	–	
1090	Other Equipment	N/A		–	–	–	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		–	–	–	0.0 %
1040	Special Facilities	N/A		–	–	–	
G. BUILDING SITEWORK		**N/A**					
					Sub-Total	117.13	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				*25%*	29.27	
	ARCHITECT FEES				*7%*	10.25	
					Total Building Cost	**156.65**	

103

Location Factors

STATE/ZIP	CITY	Residential	Commercial
NORTH DAKOTA (CONT'D)			
586	Dickinson	.77	.84
587	Minot	.82	.87
588	Williston	.77	.84
OHIO			
430-432	Columbus	.94	.94
433	Marion	.90	.90
434-436	Toledo	1.01	.99
437-438	Zanesville	.90	.90
439	Steubenville	.95	.95
440	Lorain	.99	.96
441	Cleveland	1.01	1.00
442-443	Akron	.98	.97
444-445	Youngstown	.96	.95
446-447	Canton	.94	.93
448-449	Mansfield	.94	.93
450	Hamilton	.93	.92
451-452	Cincinnati	.93	.93
453-454	Dayton	.93	.93
455	Springfield	.94	.93
456	Chillicothe	.97	.95
457	Athens	.89	.89
458	Lima	.91	.94
OKLAHOMA			
730-731	Oklahoma City	.79	.82
734	Ardmore	.78	.81
735	Lawton	.81	.82
736	Clinton	.77	.81
737	Enid	.77	.81
738	Woodward	.76	.80
739	Guymon	.67	.69
740-741	Tulsa	.78	.80
743	Miami	.82	.82
744	Muskogee	.72	.73
745	Mcalester	.74	.76
746	Ponca City	.77	.80
747	Durant	.77	.80
748	Shawnee	.75	.79
749	Poteau	.78	.81
OREGON			
970-972	Portland	1.02	1.03
973	Salem	1.00	1.02
974	Eugene	1.01	1.01
975	Medford	1.00	1.02
976	Klamath Falls	1.01	1.02
977	Bend	1.02	1.02
978	Pendleton	1.00	.99
979	Vale	.99	.94
PENNSYLVANIA			
150-152	Pittsburgh	.97	.99
153	Washington	.93	.97
154	Uniontown	.89	.95
155	Bedford	.88	.93
156	Greensburg	.93	.96
157	Indiana	.90	.95
158	Dubois	.89	.95
159	Johnstown	.89	.95
160	Butler	.92	.95
161	New Castle	.91	.94
162	Kittanning	.93	.96
163	Oil City	.90	.93
164-165	Erie	.94	.94
166	Altoona	.87	.93
167	Bradford	.90	.94
168	State College	.90	.94
169	Wellsboro	.89	.94
170-171	Harrisburg	.94	.96
172	Chambersburg	.89	.93
173-174	York	.91	.94
175-176	Lancaster	.91	.92
177	Williamsport	.84	.87
178	Sunbury	.91	.94
179	Pottsville	.90	.94
180	Lehigh Valley	1.01	1.03
181	Allentown	1.04	1.02
182	Hazleton	.90	.95
183	Stroudsburg	.91	.97
184-185	Scranton	.96	.98
186-187	Wilkes-Barre	.92	.95
188	Montrose	.90	.95
189	Doylestown	1.05	1.05

STATE/ZIP	CITY	Residential	Commercial
PENNSYLVANIA (CONT'D)			
190-191	Philadelphia	1.18	1.15
193	Westchester	1.11	1.07
194	Norristown	1.10	1.10
195-196	Reading	.97	.99
PUERTO RICO			
009	San Juan	.75	.79
RHODE ISLAND			
028	Newport	1.07	1.04
029	Providence	1.07	1.04
SOUTH CAROLINA			
290-292	Columbia	.85	.79
293	Spartanburg	.85	.78
294	Charleston	.88	.83
295	Florence	.80	.78
296	Greenville	.84	.78
297	Rock Hill	.83	.77
298	Aiken	.99	.86
299	Beaufort	.83	.76
SOUTH DAKOTA			
570-571	Sioux Falls	.78	.82
572	Watertown	.74	.78
573	Mitchell	.76	.78
574	Aberdeen	.78	.81
575	Pierre	.75	.80
576	Mobridge	.74	.78
577	Rapid City	.76	.79
TENNESSEE			
370-372	Nashville	.83	.86
373-374	Chattanooga	.76	.80
375,380-381	Memphis	.82	.86
376	Johnson City	.71	.80
377-379	Knoxville	.73	.78
382	Mckenzie	.72	.79
383	Jackson	.70	.77
384	Columbia	.72	.79
385	Cookeville	.71	.80
TEXAS			
750	Mckinney	.74	.79
751	Waxahackie	.75	.80
752-753	Dallas	.82	.85
754	Greenville	.68	.73
755	Texarkana	.72	.78
756	Longview	.67	.73
757	Tyler	.73	.80
758	Palestine	.66	.71
759	Lufkin	.70	.73
760-761	Fort Worth	.81	.81
762	Denton	.76	.77
763	Wichita Falls	.79	.80
764	Eastland	.72	.72
765	Temple	.74	.76
766-767	Waco	.77	.80
768	Brownwood	.68	.72
769	San Angelo	.71	.75
770-772	Houston	.84	.88
773	Huntsville	.68	.73
774	Wharton	.70	.76
775	Galveston	.83	.86
776-777	Beaumont	.81	.83
778	Bryan	.73	.82
779	Victoria	.73	.77
780	Laredo	.73	.77
781-782	San Antonio	.80	.83
783-784	Corpus Christi	.77	.78
785	Mc Allen	.75	.76
786-787	Austin	.79	.80
788	Del Rio	.66	.69
789	Giddings	.69	.71
790-791	Amarillo	.77	.81
792	Childress	.75	.77
793-794	Lubbock	.75	.79
795-796	Abilene	.74	.78
797	Midland	.75	.77
798-799,885	El Paso	.74	.77
UTAH			
840-841	Salt Lake City	.81	.88
842,844	Ogden	.79	.85
843	Logan	.79	.86

456

Appendix D

Site Plan