

WORCESTER NORTH HIGH SCHOOL

TECHNICAL REPORT 1 :: **ADAM TRUMBOUR** :: CONSTRUCTION MANAGEMENT



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EXECUTIVE SUMMARY

The following Technical Report is intended to discuss preliminary stages of construction of the Worcester North High School. Focusing on Construction Management aspects of the project, studies include cost estimations, scheduling, contracting, organizational structure and existing conditions.

Worcester North High School (WNHS) currently exists approximately 2.5 miles east of the city center, at 150 Harrington Way. The new high school will be constructed adjacent to the existing building on land that is currently used as athletic fields, replacing an aging and over-populated facility. This 195,000 square foot building will serve over 1,200 students daily with numerous amenities including: two full size basketball courts, auditorium, soccer fields, cafeteria, lab space, classrooms, a library and support spaces. The design team is utilizing a modern flair on the classic brick school house with brick veneers and metal louvered panels. Bright color schemes, rectilinear forms and varying roof heights portray a move into the educational future.

While the project design is not seeking LEED certification, several features have been integrated to reduce environmental impact, including a solar PV array, weather-responsive HVAC and whole-building automation and monitoring.

The design team did not foresee a need for sophisticated 3D or 4D modeling since it is a public project in the educational sector. An in-house design team for the City of Worcester tackled the design of the high school. Typical design and delivery methods are employed under a Guaranteed Maximum Price contract with Gilbane Building Company.

Currently on-schedule, the WNHS project began in June 2008 and should last until September 2011. This period includes design, bidding and construction. Gilbane was hired in May of 2009 as Construction Manager for an estimated \$54 million. The final contract value is expected to be much less due to current market trends.

PROJECT SCHEDULE SUMMARY

The Worcester North High School project began in June of 2008 with the client seeking bids for a Guaranteed Maximum Price contractor. Gilbane Building Company was ultimately chosen as the construction manager and began working on the WNHS project in April of 2009. Currently, Gilbane is buying out subcontracts in order to submit their GMP to Worcester Public Schools for approval in November of this year. It is interesting to note that the schedule is of utmost importance, as construction is well under way despite the lack of a 100% GMP agreement. This project does not have any intended construction phasing.

At the moment, sitework, excavation, structural steel and cast-in-place concrete are active trades on-site. A portion of ledge needed to be removed from the site, involving a small amount of blasting. The project is currently in the midst of setting steel and pouring concrete slabs. Concrete foundations wrapped up at the end of the summer. The roofing trade has a long duration on the schedule due to the large area of EPDM roofing that must be installed.

Finishes are scheduled to begin at approximately 2/3 completion of roofing and exterior enclosure. This is possible due to a progression of trade flow from the southwest to the northwest corners of the facility. Coordination between trades is important to ensure that work is completed in designated areas per schedule requirements; successive trades must begin on their intended date and cannot do so until predeceasing work is fulfilled.

CHART 1: SUMMARY SCHEDULE



TASK filter: All Activities

Page 1 of 1

Actual Work Remaining Work Critical Remaining ...

Remaining Work Milestone

(c) Primavera Systems, Inc.

BUILDING SYSTEMS SUMMARY

STRUCTURAL

Demolition of the existing high school will take place post-completion of the new WNHS; the owners will address this in a separate bid in the future. Excavation for foundations and piers will not require shoring; sloped soil walls of at least 2:1 but should be determined by the excavation contractor.

WNHS is a typical CMU/brick on steel superstructure design. The steel system supports composite decking for cast-in-place slabs, with steel shapes ranging from W8 to W24 in size. An EPDM membrane over rigid foam insulation and steel roof deck forms the major roof system. As part of building section C, the gymnasium, a truss system is used to span the gym and support the roof.

Due to the soil characteristics and the presence of ledge on-site, the building is designed for support by columns sitting on concrete piers, ranging from 3'x3' to 10'x10' in size, at a maximum depth of 3'. Piers are linked by 2'x3' grade beams. A 5" slab-on-grade, fiber reinforced, forms the basement floor, while 18" reinforced concrete walls form the perimeter of the building where there is a basement. No precast concrete is used.

The brick veneer comprises the majority of the exterior surface. Two colors were chosen for the bricks; traditional red is used in a linear fashion, clearly designating each floor, while yellow brick is used on the ends of each wing to weight the structure visually into the earth. In addition to the brick veneer, enameled steel panels are used to clad the exterior between windows and in between each line of red brick. At the entrance of the building, an aluminum curtain wall is used to define the gym entrance as well as administration spaces.

MECHANICAL

HVAC systems for WNHS are split between individual classroom energy recovery units and rooftop air handlers that supply VAV boxes for non-classroom spaces. A 2-pipe heating/cooling changeover system supplies the classroom recovery units. Heating is generated via two gas-fired boilers, capable of outputs from 200,000 – 3,000,000 BTUs/Hr. These Aerco "Benchmark" series boilers feature ultra-low nitrous-oxide output as well as 15:1 turn down ratios, ultimately creating a more enviro-friendly product. Cooling capabilities are furnished via one Trane RTHD series helical rotary chiller, capable of outputting 175 – 450 tons. This equipment is located in the mechanical room at the southwest corner of the first floor, where utilities also arrive at the building.

The entire HVAC system is linked electronically; the system can be monitored and controlled through a network interface at a computer terminal. This aids system management by allocating multiple controls through a solitary interface. Coupled with these controls is an outdoor temperature monitor which limits system functionality in a 15° range. A so-called "dead zone" locks out heating and cooling modes when the outdoor temperature is mild.

ELECTRICAL

A 4,000 amp service feeds WNHS, split over a 3-phase 4-wye grid connection at 480/277 volts. Backup power is supplied via 400 kilowatt, diesel-fueled emergency generator. A fluorescent lighting system is network-interfaced for control and energy monitoring, as are the utility feeds. An allowance of \$300,000 was included in the original estimate for a roof-mounted solar PV array. The system is currently being designed and analyzed by the mechanical engineers.

PROJECT COST EVALUATION

Please refer to tables following this text for cost estimates.

A preliminary budget estimate was prepared by Gilbane Building Company when retained by Worcester Public Schools as a Guaranteed Maximum Price (GMP) construction manager. The total building cost of just over \$54 million contained a \$2 million contingency, \$1 million allowance for escalation, \$1.5 million contingency for the CM, as well as \$5.3 million in general conditions and \$1.175 million in fees. The budget was created in April of 2009 for a buyout period of October-November 2009. The bids that the CM has received are currently well below the budgeted value, indicating that the final GMP will be between \$45 and \$50 million. Bids have been low due to a decrease in the number of construction projects nationwide. Subcontractors are scouring for work and have submitted low-ball bids in hopes of winning the job.

The Gilbane estimate is closest to an estimate of \$55,296,139 obtained from D4 Cost Estimation software. This value is based on a high school of similar size, adjusted for construction in 2009 and the Worcester, MA market. This value may be closer to the high value of \$54 million indicated by Gilbane but will not be a likely value for the final contract amount, since bids have come in consistently low. D4 does not adjust for current market trends; location adjustments are based on long-term averages.

Vis-à-vis R.S. Means Costworks data, the final contract amount is likely to be closer to the online estimate of \$43,787,500.00. A probable cause for this closer figure is the application of the most current construction data (3rd Quarter 2009). It is important to note, however, that the R.S. Means online estimate should be increased by \$1-2 million to allow for the complex exterior skin, a solar PV system and many additions including furniture, kitchen equipment and auditorium specialties. The hand estimate of \$34,536,578 is lower probably due to an estimate that is less customized than its online counterpart, as well as adjustments that were made for building perimeter.

TABLE 1: BUDGET ESTIMATE CONSTRUCTION COSTS

	Building Systems Costs	
	Construction Cost (CC)	CC/Foot ²
CIP Foundations	\$1,291,048.00	\$6.62
CIP Flatwork	\$1,806,114.00	\$9.27
Masonry	\$4,098,889.00	\$21.03
Structural Steel	\$2,890,000.00	\$14.83
Roofing	\$1,155,313.00	\$5.93
Metal Windows/Storefronts	\$1,595,647.00	\$8.19
Doors/Frames/Hardware	\$620,103.00	\$3.18
Drywall	\$3,475,991.00	\$17.83
Specialties	\$2,627,126.00	\$13.48
Kitchen Equipment	\$1,110,000.00	\$5.69
Fire Protection	\$892,443.00	\$4.58
Plumbing	\$2,146,025.00	\$11.01
HVAC	\$6,386,024.00	\$32.76
Electrical	\$4,964,200.00	\$25.47
	Overall Costs	
Actual Building Cost	\$45,751,904.00	\$219.32
Total Building Cost	\$54,025,811.00	\$277.16

TABLE 2: R.S. MEANS SQUARE-FOOT ESTIMATE

Building Data

Total Building Area	194926.00	SF
Basement Area	13676.95	SF
Total Building Perimeter	1564.40	LF
# Stories	4	
Story Height	14'-8"	

Raw Cost/Square Foot

RS Means Est. Cost/SF	\$156.10
Perimeter Adjustment	(\$12.76)
Story Height Adjustment	\$0.58
Adjusted Cost/SF	\$143.93
Project Cost	\$28,055,179.38
Basement Adjustment	\$432,191.62
Total Adjusted Size Cost	\$28,487,371.00

Additions

	Cost	Unit	Qty	Subtotal
Bleachers	\$115.00	Seat	500	\$57,500.00
Clock System (50 Room)	\$39,100.00	Each	1	\$39,100.00
Elevator, #2500 cap.	\$66,300.00	Each	1	\$66,300.00
Flagpole	\$3,475.00	Each	1	\$3,475.00
Kitchen Equipment				
Broiler	\$4,025.00	Each	2	\$8,050.00
Cooler	\$4,925.00	Each	4	\$19,700.00
Dishwasher	\$4,950.00	Each	1	\$4,950.00
Food Warmer	\$735.00	Each	2	\$1,470.00
Freezer	\$3,725.00	Each	4	\$14,900.00
Lockers	\$120.00	Pair	600	\$72,000.00
Auditorium Seating	\$277.00	Each	486	\$134,622.00
Classroom Seating	\$100.00	Each	1200	\$120,000.00
Total Additions				\$542,067.00

Totals

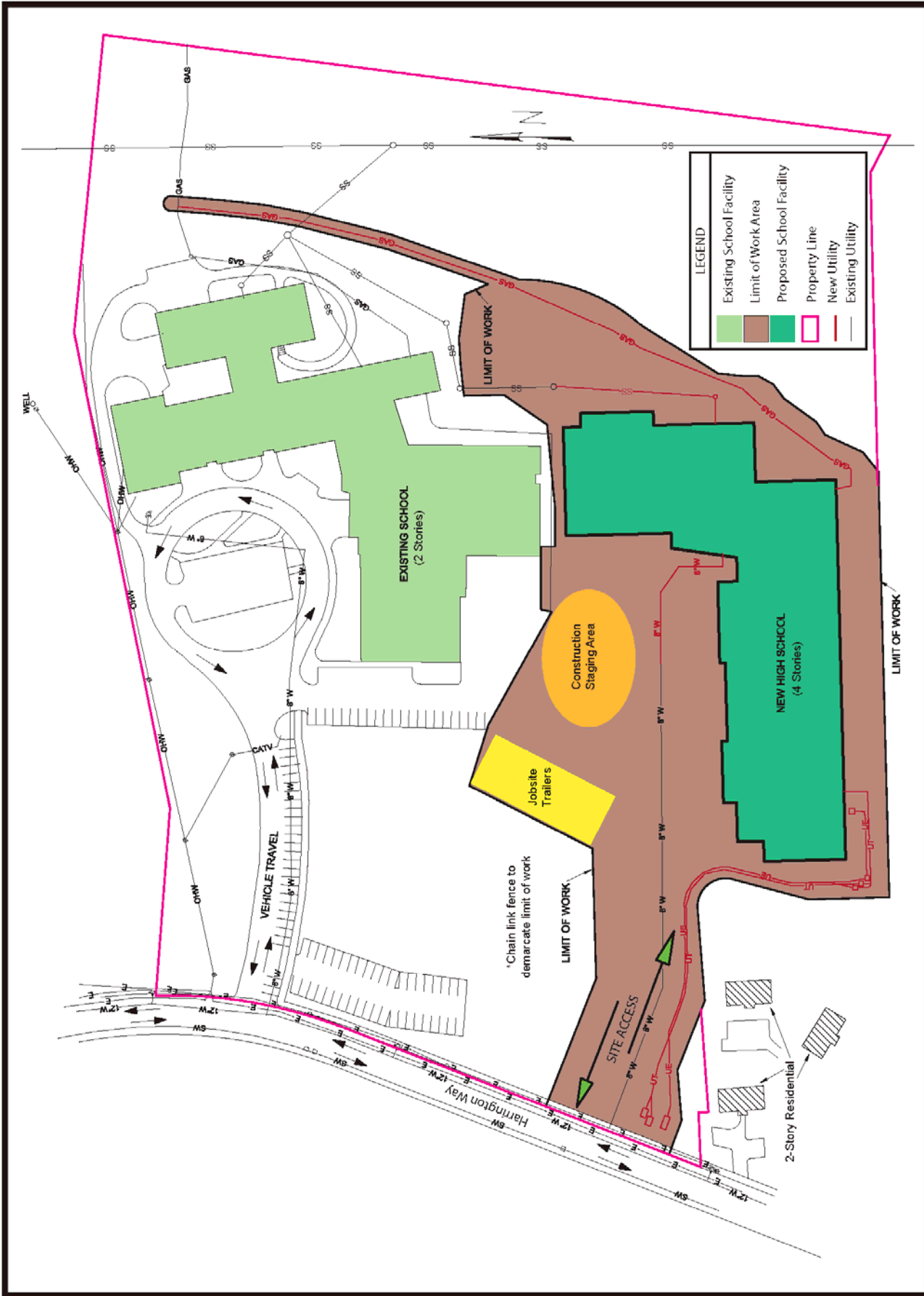
		Hand Estimate	Online Estimate
Building Cost TOTAL		\$29,029,438.00	\$35,030,000.00
Contractor's Overhead & Profit	25%	\$7,257,359.50	\$8,757,500.00
Location Factor (Worcester, MA)	106.2%		
Constructed Cost TOTAL		\$38,536,578.94	\$43,787,500.00

**See Appendix A: Cost Sources for a detailed copy of the estimate compiled via meanscostworks.com and to view sources for hand estimate.*

TABLE 3: D4 COST ESTIMATION

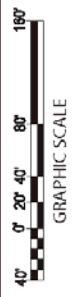
Building Costs				
Code	Division Name	%	Sq. Cost	Projected
01	General Requirements	13.78	34.56	\$6,739,396.00
03	Concrete	4.42	11.0	\$92,163,398.00
04	Masonry	9.32	23.3	\$84,559,154.00
05	Metals	9.68	24.2	\$84,733,656.00
06	Wood,Plastics,andComposites	1.85	4.63	\$902,455.00
07	ThermalandMoistureProtection	4.33	10.8	\$52,115,725.00
08	Openings	7.90	19.81	\$3,862,395.00
09	Finishes	6.48	16.25	\$3,169,609.00
10	Specialties	1.78	4.46	\$869,065.00
11	Equipment	1.96	4.92	\$959,072.00
12	Furnishings	3.30	8.27	\$1,612,549.00
14	ConveyingSystems	0.31	0.78	\$152,073.00
21	FireSuppression	1.26	3.15	\$613,976.00
22	Plumbing	5.75	14.42	\$2,811,747.00
23	HVAC	16.37	41.05	\$8,005,333.00
26	Electrical	7.96	19.95	\$3,890,923.00
27	Communications	2.77	6.95	\$1,354,834.00
28	ElectronicSafetyandSecurity	0.78	1.96	\$382,487.00
	Total Building Costs	100.00	250.76	\$48,897,848.00
Non-Building Costs				
02	Existing Conditions	23.49	0.55	\$1,502,672.00
31	Earthwork	19.57	0.46	\$1,252,324.00
32	Exterior Improvements	42.95	1.00	\$2,748,319.00
33	Utilities	13.99	0.33	\$894,976.00
	Total Non-Building Costs	100.00	233.15	\$6,398,291.00
	Total Project Costs			\$55,296,139.00

SITE PLAN OF EXISTING CONDITIONS



LEGEND

	Existing School Facility
	Limit of Work Area
	Proposed School Facility
	Property Line
	New Utility
	Existing Utility



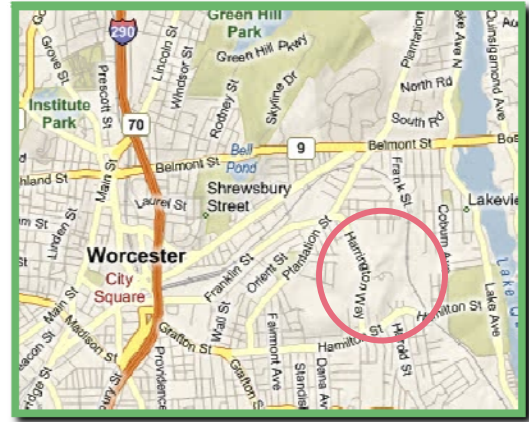
Site Plan: Existing Conditions

LOCAL CONDITIONS

WORCESTER CONSTRUCTION

Worcester, Massachusetts is a city of just under 175,000 in central Massachusetts. Typical construction techniques in the city include steel, reinforced concrete and timber frame structures. A temperate climate and negligible seismic concerns allow for a variety of construction methods to be employed here. Brick is a predominant feature in the city, as a majority of its structures date from the latter half of the nineteenth century when the industrial revolution settled in on the area.

A significant decline has occurred in the amount of construction in the U.S., including Massachusetts. In order to win bids, subcontractors (and subsequent GCs) have decreased their bid prices 6% - 11% since last year.¹ This trend is dangerous for subcontractors and construction managers. Subcontractors may be operating at a loss simply to generate cash flow. Low bids from subs mean CM firms must cut their fees as well, operating on an even slimmer profit margin. It is important for CM estimators to include contingencies in their estimates for claims and change orders. While the downward trend in bid prices may negatively affect subs and CMs, it can mean a new building at a lower cost for the owner.



Map courtesy maps.google.com

SITE SPACES AND PARKING

Construction of the new facility is on fields adjacent to the current structure; ample space is available on the North side of the site for shakeout, staging and temporary facilities. Additionally, an 80+ foot wide passage has been allocated for site access, allowing for sufficient two-way access in and out of the site. Construction parking will be on-site, most likely along the site access road and next to job trailers. The shape of the access road grants sufficient space for pull-in parking spots.

WASTE AND TIPPING FEES

Waste will be handled by a local waste management contractor. Construction waste recycling is not required in the City of Worcester. The client is not attempting to attain LEED certification either, so recycling is of little importance during the construction phase (on the contrary, recycling may be on the docket for the demolition phase). Tipping fees, collected via cold calls to various local companies are as follows:

Average Dumpster Fee: \$575
Average Tipping Fee: \$75

¹ Source: Edward R. Zarenski, Estimating Executive, Gilbane Building Company

SOILS/SUBSURFACE CONDITIONS

The site has primarily sandy loam soils, with a section of ledge that must be excavated below the foundation. The Geotech reports do not cite any water on-site. The water table is also well below the excavated depth for the foundations and basement.

PLAN 2: LEDGE LOCATIONS AND ELEVATIONS

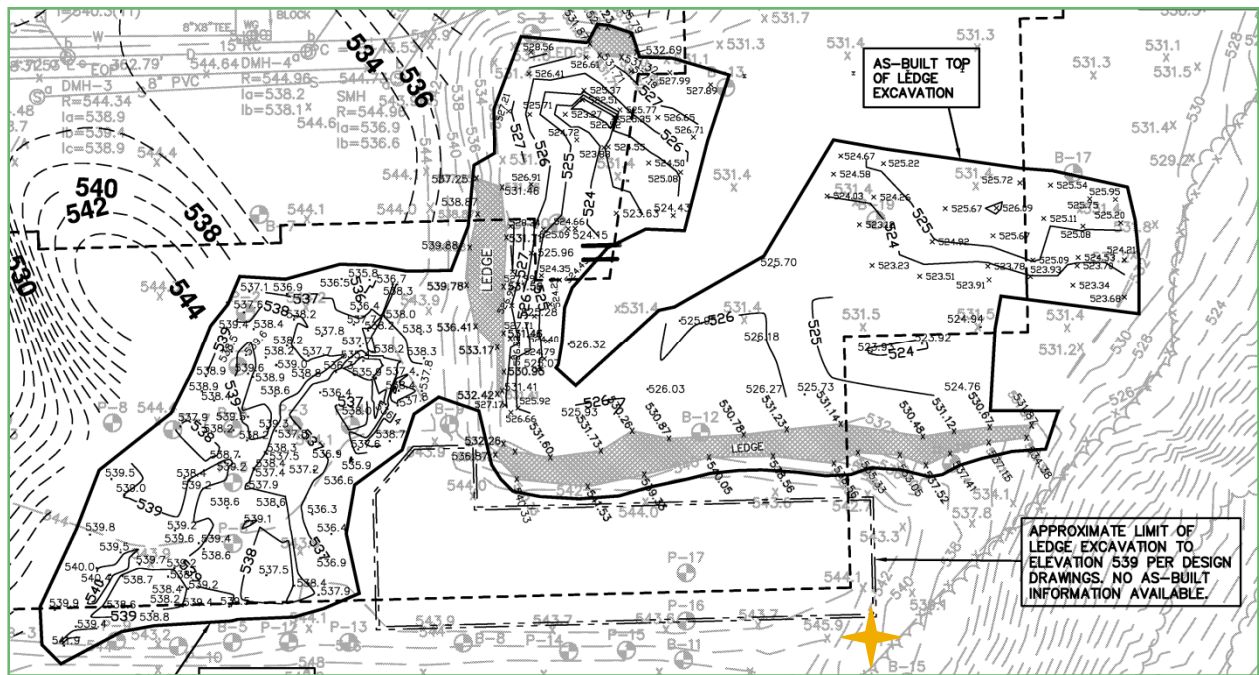
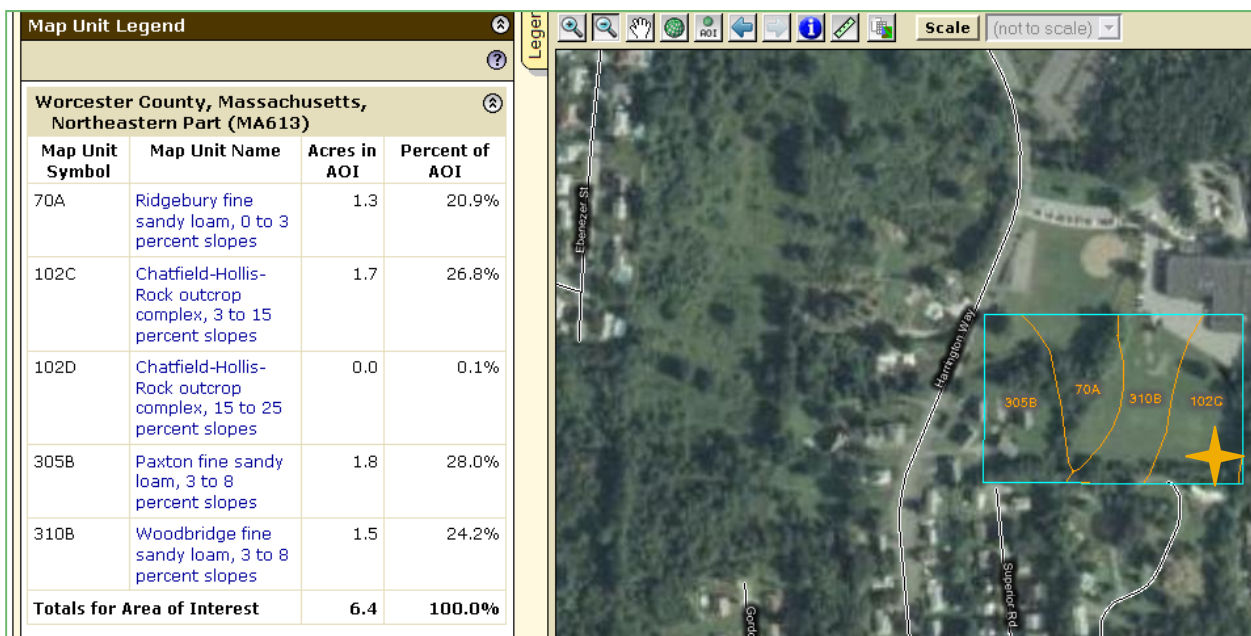


IMAGE: USDA SOIL SURVEY



Courtesy websoilsurvey.nrcs.usda.gov

CLIENT INFORMATION

"The Worcester Public Schools provides learners with a quality education in a safe and healthy environment. We believe that all students can achieve at high levels as they prepare to become productive citizens in our changing technological world. We are committed to supporting students, parents, educators, and citizens in their pursuit of learning." –Worcester Public Schools Mission Statement

Worcester Public Schools is the governing body of seven Worcester High Schools, including Worcester North. The existing North High School facility dates back to the 1960s; both outdated and under-sized, the City of Worcester agreed to construct a replacement. Integral to their mission, building a new school will furnish a safe and healthy environment in which to learn and teach.

Of utmost importance to Worcester Public Schools (WPS) is the safety of their students. While safety is critical on all projects, extra precautions must be taken throughout the duration to ensure no student is disturbed or harmed by the construction process. Key features include 8 foot high chain link fences surrounding the perimeter of the work realm, gated at all times and locked at night, as well as video cameras to monitor the site. It is crucial that the CM team has a specific safety plan and hazard protocol for this project in order to satisfy the client's needs.

Second to student safety is project schedule. The public school system operates on a strict calendar; any fluctuation in the building turnover date is of major importance to the school board. Currently, this project is slated to end for student occupation immediately at the beginning of the academic year. The CM team has integrated sufficient float time into the project schedule in order to eliminate such a delay.

It is important to consider cost requirements as well. As this is a public job, costs are tightly monitored by the project management team. Furthermore, a GMP contract requires that any credits be turned over to the owner. Change orders are non-billable. The CM team must be cognizant of project status and cost during all stages of construction to avoid cost liabilities in later stages of the process.

In order to accommodate the construction of a new high school, Worcester Public Schools will maintain the current North High School for the duration of construction. Students will move into the new facility after turnover in September of 2011. This allows for construction to occur without a phasing plan; however the demolition of the old building is often considered Phase II of the Worcester North High School project. Phase II is not covered under the GMP contract and will be bid separately in the future.

To complete this project successfully, the CM team should to adhere to the following:

- Complete project within specified time frame
- Fulfill construction contract at or under budget
- Arrive at completion without any significant effect on students

If the team can integrate the preceding three priorities into their goals for the project, Worcester Public Schools will be undoubtedly satisfied with the outcome of the project.

PROJECT DELIVERY SYSTEM

Worcester Public Schools utilized in-house design professionals for the design of the new North High School. Incepted in 1993, the Architecture Department of the Worcester Department of Public Works and Parks handles design projects under the purview of the City of Worcester. The School Board does not have frequent construction projects therefore a Project Management firm was hired, Maguire Group, Inc., to orchestrate the project from the start. This relationship is most likely a lump sum contract between parties. Maguire Group dealt with the Architect, MEP Engineer, Site Engineer, Structural Engineer and Food Service Consultant (presumably lump sum contracts) in order to establish a set of construction documents.

Maguire group accepted bids for a Guaranteed Maximum Price by various contractors. In GMP, Gilbane will be reimbursed for actual costs incurred, as well as their established fee. Cost overruns must be paid for by the CM and cost underruns must be returned to the owner.

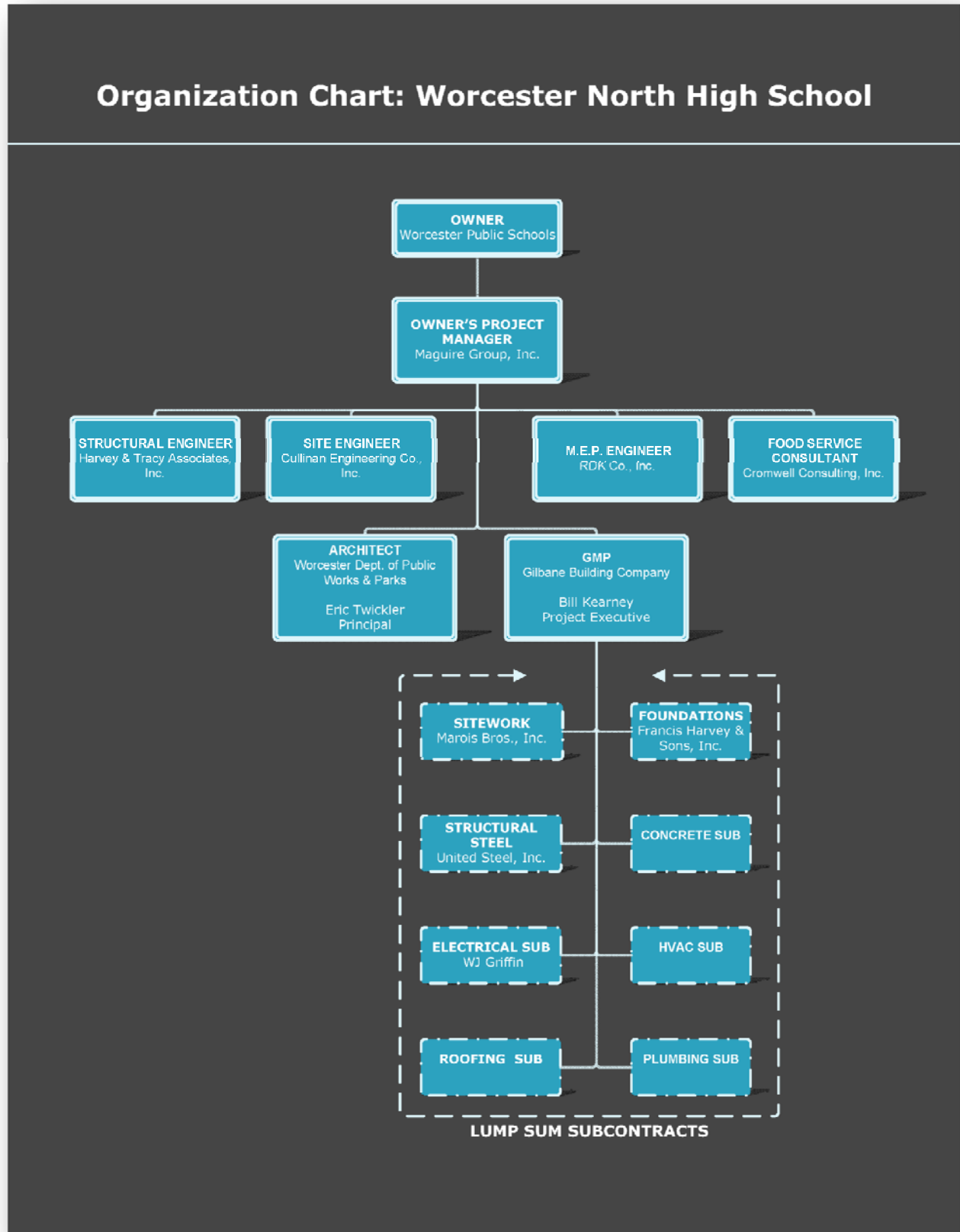
Being that this is a public job, the CM can only accept bids at prevailing wage rates. These rates were provided in an addendum to the specifications. This requirement is typical of public jobs where the local government operates with the prerogative of maintaining the local economy. Of similar intentions, the CM must diversify their accepted bids with a minimum of 10% minority-owned businesses and 5% woman-owned businesses. This is known as a MBE/WBE requirement. The job is also 100% union, increasing the cost of labor.

A GMP contract between the Construction Manager and the Owner is appropriate because it forces the CM to lock their bid in early; the owner is then able to select their low bidder. After awarded, the CM bids out the project to subcontractors. When the subcontractor bills the CM, any cost overruns must be paid by the CM and any credits must be returned to the owner. The owner recoups these funds (including any balance left in contingency) and they go back to public use, thus being an overall benefit to the community who is ultimately paying for the project.

Subcontractors are selected via standard bid process. They must have commercial general liability insurance as well as vehicle, pollution, worker's compensation and excess umbrella coverage insurance. In addition, subs must be bonded for performance, labor and material to Gilbane Building Company.

The selected contracting method makes sense given the project constraints. A GMP contract is often the most cost-effective contracting method for the owner. Additionally, the use of in-house design teams saved on costs and made cooperation undoubtedly easier for the users of the building, the owners and the designers. Furthermore, outsourcing a project management team ensures that Worcester Public School board can attend to pertinent educational matters and leave the construction process to their contracted managers.

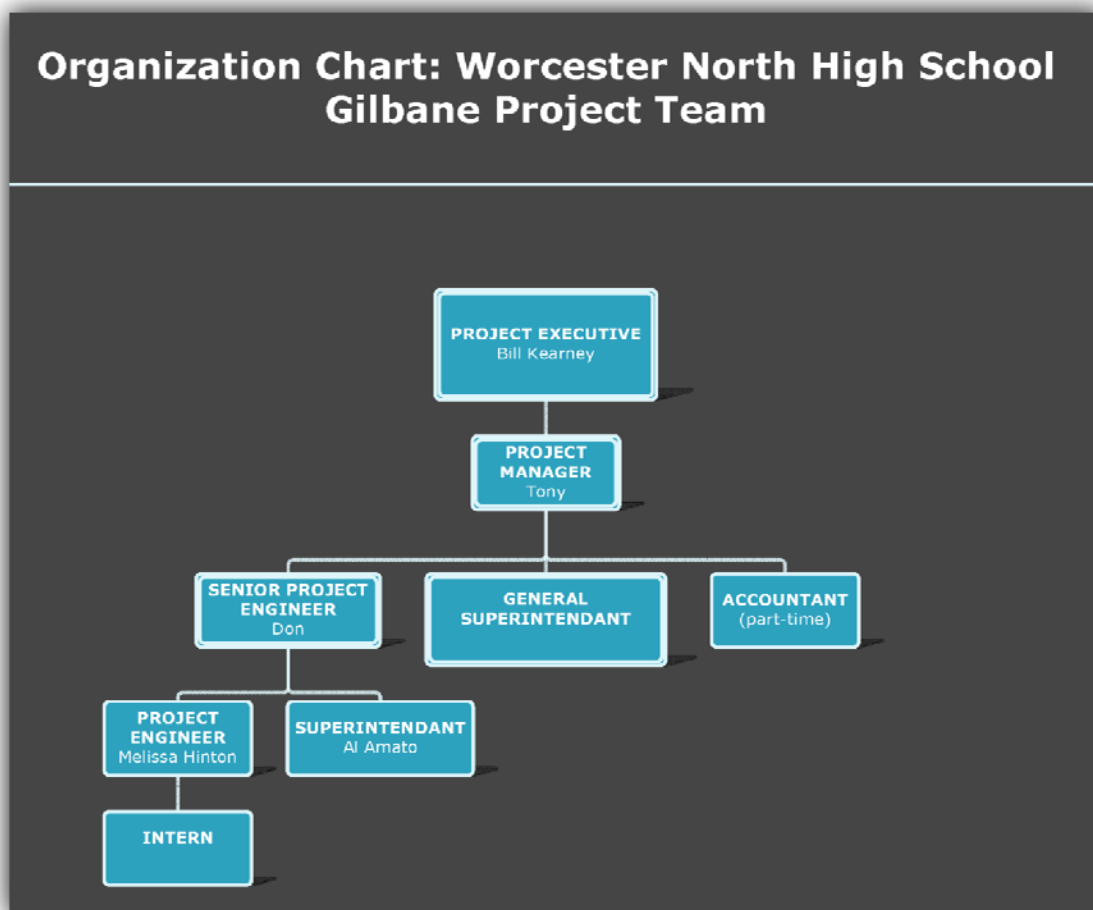
CHART 2: WNHS PROJECT TEAM



STAFFING PLAN

Gilbane Building Company plans to staff eight people on the WNHS job, one of them exclusively part-time. The Project Executive, Bill Kearney, handles major issues with the job, as well as contracts and project launch and closeout. He will not be located on-site, rather Bill works out of the Boston office. His involvement could be considered part-time. The Project Manager, and those below him, work on-site for the duration of the project. The accountant is part-time and is spread between several jobs. The Intern is present for one semester but will be replaced once his/her internship is complete. The General Superintendant is the most experienced with the type of job; he will help oversee operations of the entire site and coordinate with all subs. The regular Superintendant coordinates with the foremen of each trade and ensures trades are building to specification. The Project Engineer works with the Superintendant to follow the established schedule and complete submittals, RFIs and other engineering issues.

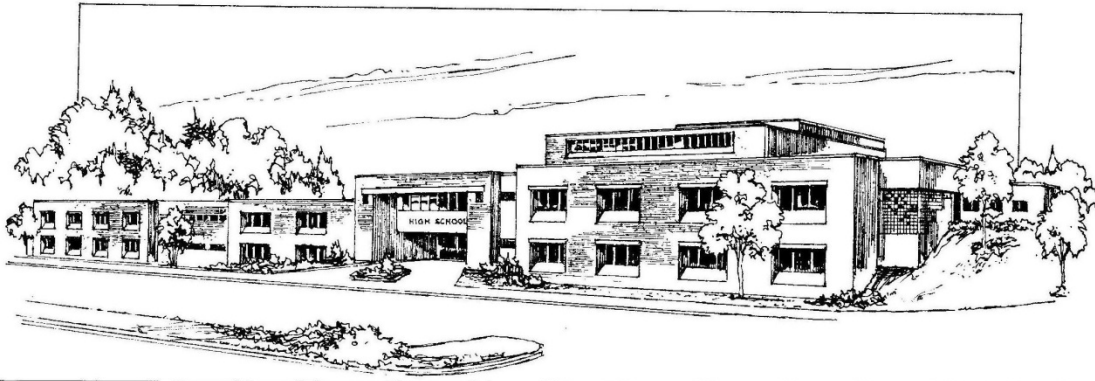
CHART 3: GILBANE PROJECT TEAM



APPENDIX A: COST SOURCES

ESTIMATE 1: MEANSCOSTWORKS REFERENCE BOOK 2009

COMMERCIAL/INDUSTRIAL/INSTITUTIONAL **M.570** School, High, 2-3 Story



Costs per square foot of floor area

Exterior Wall	S.F. Area	50000	70000	90000	110000	130000	150000	170000	190000	210000
	L.F. Perimeter	850	1140	1420	1700	1980	2280	2560	2840	3120
Face Brick with Concrete Block Back-up	Steel Frame	166.05	162.30	160.10	158.65	157.65	157.15	156.55	156.10	155.75
	R/Conc. Frame	167.85	163.40	160.85	159.15	157.95	157.35	156.70	156.10	155.70
Decorative Concrete Block	Steel Frame	161.20	157.00	154.60	153.00	151.90	151.35	150.70	150.25	149.85
	R/Conc. Frame	160.00	155.80	153.45	151.80	150.75	150.15	149.55	149.00	148.65
Limestone with Concrete Block Back-up	Steel Frame	185.30	180.15	177.05	175.00	173.55	172.95	172.15	171.45	170.90
	R/Conc. Frame	189.65	184.45	181.35	179.30	177.85	177.25	176.45	175.75	175.25
Perimeter Adj., Add or Deduct	Per 100 L.F.	3.90	2.80	2.15	1.70	1.45	1.25	1.15	1.00	0.90
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	1.95	1.95	1.80	1.70	1.75	1.75	1.75	1.75	1.65

For Basement, add \$31.60 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 \$91.70 to \$215.95 per S.F.

Common additives

Description	Unit	\$ Cost	Description	Unit	\$ Cost
Bleachers, Telescoping, manual			Kitchen Equipment		
To 15 tier	Seat	115 - 160	Broiler	Each	4025
16-20 tier	Seat	235 - 288	Cooler, 6 ft. long, reach-in	Each	4925
21-30 tier	Seat	249 - 300	Dishwasher, 10-12 racks per hr.	Each	4950
For power operation, add	Seat	45.50 - 71.50	Food warmer, counter, 1.2 KW	Each	735
Carrels Hardwood	Each	660 - 990	Freezer, 44 C.F., reach-in	Each	3725
Clock System			Lockers, Steel, single tier, 60" or 72"	Opening	191 - 310
20 room	Each	16,000	2 tier, 60" or 72" total	Opening	107 - 141
50 room	Each	39,100	5 tier, box lockers	Opening	65 - 83.50
Elevators, Hydraulic passenger, 2 stops			Locker bench, lam. maple top only	L.F.	21
1500# capacity	Each	62,800	Pedestals, steel pipe	Each	63.50
2500# capacity	Each	66,300	Seating		
Emergency Lighting, 25 watt, battery operated			Auditorium chair, all veneer	Each	238
Lead battery	Each	282	Veneer back, padded seat	Each	288
Nickel cadmium	Each	805	Upholstered, spring seat	Each	277
Flagpoles, Complete			Classroom, movable chair & desk	Set	65 - 120
Aluminum, 20' high	Each	1650	Lecture hall, pedestal type	Each	227 - 680
40' high	Each	3475	Sound System		
Fiberglass, 23' high	Each	1775	Amplifier, 250 watts	Each	2350
39'-5" high	Each	3325	Speaker, ceiling or wall	Each	191
			Trumpet	Each	365

ESTIMATE 2: MEANSCOSTWORKS ONLINE

Building Type:	School, High, 2-3 Story with Face Brick with Concrete Block Back-up / Steel Frame
Location:	WORCESTER, MA
Stories Count (L.F.):	3.00
Stories Height	15.00
Floor Area (S.F.):	195,000.00
Labor Type	Union
Basement Included:	Yes
Data Release:	Year 2009 Quarter 3
Cost Per Square Foot	\$224.55
Total Building Cost	\$43,787,500



Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.

		% of Total	Cost Per SF	Cost
A Substructure		11.4%	20.41	\$3,980,000
A1010	Standard Foundations		12.65	\$2,466,500
	Strip footing, concrete, reinforced, load 11.1 KLF, soil bearing capacity 6 KSF, 12" deep x 24" wide			
	Spread footings, 3000 PSI concrete, load 200K, soil bearing capacity 6 KSF, 6'-0" square x 20" deep			
A1030	Slab on Grade		1.81	\$352,000
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	Basement Excavation		1.43	\$278,000
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	Basement Walls		4.53	\$883,500
	Foundation wall, CIP, 12' wall height, pumped, .444 CY/LF, 21.59 PLF, 12" thick			
B Shell		44.3%	79.55	\$15,513,000
B1010	Floor Construction		34.22	\$6,673,000
	Cast-in-place concrete column, 12" square, tied, 200K load, 12' story height, 142 lbs/LF, 4000PSI			
	Steel column, W8, 100 KIPS, 16' unsupported height, 31 PLF			
	Steel column, W10, 150 KIPS, 16' unsupported height, 45 PLF			
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 P:			
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and column, 25'x25' bay, 29" deep, 100 PSF sup			
	Fireproofing, gypsum board, fire rated, 2 layers, 1" thick, 8" steel column, 3 hour rating, 14 PLF			
B1020	Roof Construction		2.86	\$558,500
	Floor, steel joists, beams, 1.5" 22 ga metal deck, on columns, 25'x25' bay, 20" deep, 40 PSF superimposed load, 60			
B2010	Exterior Walls		22.52	\$4,391,000
	Brick wall, composite double wythe, standard face/CMU back-up, 8" thick, perlite core fill			
B2020	Exterior Windows		15.02	\$2,928,000
	Aluminum flush tube frame, thermo-break frame, 2.25" x 4.5", 5'x6' opening, 2 intermediate horizontals			
	Glazing panel, insulating, 1/2" thick, 2 lites 1/8" float glass, tinted			
B2030	Exterior Doors		0.50	\$97,500
	Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening			
	Door, steel 18 gauge, hollow metal, 1 door with frame, no label, 3'-0" x 7'-0" opening			

		% of Total	Cost Per SF	Cost
	Door, steel 24 gauge, overhead, sectional, manual operation, 8'-0" x 8'-0" opening			
B3010	Roof Coverings		4.40	\$857,500
	Roofing, single ply membrane, EPDM, 60 mils, fully adhered			
	Formed roofing, zinc-copper alloy, standing seam, 2-1/2" min slope, .020" thick, 0.87 PSF			
	Insulation, rigid, roof deck, polyisocyanurate, 2#/CF, 2" thick, R14.29			
	Insulation, rigid, roof deck, polyisocyanurate, tapered for drainage			
	Base flashing, aluminum, .016" thick, fabric 2 sides, .025" aluminum reglet, .032" counter flashing			
	Roof edges, aluminum, duranodic, .050" thick, 6" face			
B3020	Roof Openings		0.04	\$7,500
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs			
C Interiors		17.0%	30.57	\$5,962,000
C1010	Partitions		7.87	\$1,535,500
	Concrete block (CMU) partition, light weight, hollow, 6" thick, no finish			
	1/2" fire rated gypsum board, taped & finished, painted on metal furring			
C1020	Interior Doors		1.35	\$263,500
	Door, single leaf, kd steel frame, hollow metal, commercial quality, flush, 3'-0" x 7'-0" x 1-3/8"			
C1030	Fittings		1.51	\$295,000
	Toilet partitions, cubicles, ceiling hung, stainless steel			
	Chalkboards, liquid chalk type, aluminum frame & chalktrough			
C2010	Stair Construction		0.76	\$148,500
	Stairs, steel, cement filled metal pan & picket rail, 16 risers, with landing			
C3010	Wall Finishes		3.81	\$743,000
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	Painting, masonry or concrete, latex, brushwork, addition for block filler			
	Wall coatings, acrylic glazed coatings, maximum			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	Floor Finishes		7.52	\$1,466,000
	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, minimum			
	Terrazzo, maximum			
	Vinyl, composition tile, maximum			
C3030	Ceiling Finishes		7.75	\$1,510,500
	Acoustic ceilings, 3/4" mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid, suspended support			
D Services		24.9%	44.69	\$8,715,000
D1010	Elevators and Lifts		0.95	\$184,500
	1 - Hydraulic, passenger elevator, 2500 lb, 2 floors, 100 FPM			
	Hydraulic passenger elevator, 2500 lb., 2 floor, 125 FPM			
D2010	Plumbing Fixtures		4.82	\$939,000
	Water closet, vitreous china, bowl only with flush valve, floor mount			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, PE on CI, 20" x 18"			
	Kitchen sink w/trim, countertop, stainless steel, 44" x 22" triple bowl			
	Service sink w/trim, PE on CI, comer floor, wall hung w/rim guard, 24" x 20"			
	Shower, stall, baked enamel, terrazzo receptor, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	Domestic Water Distribution		0.96	\$188,000
	Gas fired water heater, commercial, 100< F rise, 600 MBH input, 576 GPH			
D2040	Rain Water Drainage		0.67	\$130,500
	Roof drain, CI, soil, single hub, 4" diam, 10' high			
	Roof drain, CI, soil, single hub, 4" diam, for each additional foot add			

		% of Total	Cost Per SF	Cost
	Roof drain, CI, soil, single hub, 5" diam, 10' high			
	Roof drain, CI, soil, single hub, 5" diam, for each additional foot add			
D3010	Energy Supply		4.72	\$919,500
	Commercial building heating system, fin tube radiation, forced hot water, 100,000 SF, 1mil CF, total 3 floors			
D3030	Cooling Generating Systems		15.77	\$3,075,000
	Packaged chiller, water cooled, with fan coil unit, schools and colleges, 60,000 SF, 230.00 ton			
D4010	Sprinklers		2.24	\$436,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 50,000 SF			
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 50,000 SF			
D5010	Electrical Service/Distribution		0.85	\$166,000
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 2000 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 2000 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 2000 A			
D5020	Lighting and Branch Wiring		9.69	\$1,890,500
	Receptacles incl plate, box, conduit, wire, 8 per 1000 SF, .9 W per SF, with transformer			
	Wall switches, 2.0 per 1000 SF			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	Motor installation, three phase, 460 V, 15 HP motor size			
	Motor feeder systems, three phase, feed to 200 V 5 HP, 230 V 7.5 HP, 460 V 15 HP, 575 V 20 HP			
	Fluorescent fixtures recess mounted in ceiling, 2 watt per SF, 40 FC, 10 fixtures @40 watt per 1000 SF			
D5030	Communications and Security		3.56	\$694,500
	Communication and alarm systems, includes outlets, boxes, conduit and wire, sound systems, 100 outlets			
	Communication and alarm systems, fire detection, non-addressable, 50 detectors, includes outlets, boxes, conduit and wire			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, master clock systems, 50 rooms			
	Communication and alarm systems, includes outlets, boxes, conduit and wire, master TV antenna systems, 100 outlets			
	Internet wiring, 2 data/voice outlets per 1000 S.F.			
D5090	Other Electrical Systems		0.47	\$91,000
	Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 250 kW			
E Equipment & Furnishings		2.4%	4.35	\$849,000
E1020	Institutional Equipment		1.55	\$302,000
	Architectural equipment, laboratory equipment, counter tops, acid proof, economy			
	Architectural equipment, laboratory equipment, counter tops, stainless steel			
	Architectural equipment, laboratory equipment, cabinets, wall, open			
	Architectural equipment, laboratory equipment, cabinets, base, drawer units			
E1090	Other Equipment		2.81	\$547,000
	1200 - School furniture, classroom, movable chair & desk type, minimum			
	486 - Auditorium chair, fully upholstered, spring seat			
	600 - Lockers, steel, baked enamel, double tier, 60" or 72", minimum			
	1 - Freezers, commercial kitchen equipment, reach-in, 44 C.F.			
	1 - Food warmer, commercial kitchen equipment, counter, 1.2KW			
	1 - Dishwasher, commercial kitchen equipment, 10 to 12 racks per hour			
	1 - Cooler, commercial kitchen equipment, reach-in, beverage, 6' long			
	1 - Broiler, commercial kitchen equipment, without oven, standard			
	1 - Flagpoles, aluminum, tapered, ground set, 40' high, excludes base or foundation			
	1 - Clock equipments, master time clock system, clocks & bells, 50 rooms, excl. wires & conduits			
	500 - School equipment, bleachers, telescoping, manual, to 15 tier, minimum			
	Architectural equipment, school equipment basketball backstops, suspended type, electrically operated			
	Architectural equipment, school equipment bleachers-telescoping, manual operation, 15 tier, economy (per seat)			
	Architectural equipment, school equipment, weight lifting gym, universal, economy			

		% of Total	Cost Per SF	Cost
	Architectural equipment, school equipment, scoreboards, basketball, 1 side, economy			
F Special Construction		0.0%	0.00	\$0
G Building Sitework		0.0%	0.06	\$11,000
G2040	Site Development		0.06	\$11,000
	Specialties, flagpole, on grade, aluminum, tapered, 59' high			
Sub Total		100%	\$179.64	\$35,030,000
Contractor's Overhead & Profit		25.0%	\$44.91	\$8,757,500
Architectural Fees		0.0%	\$0.00	\$0
User Fees		0.0%	\$0.00	\$0
Total Building Cost			\$224.55	\$43,787,500