

Waynesburg Central High School



Technical Assignment #1

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Construction Management
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Executive Summary

Waynesburg Central High School is located in Waynesburg, Pennsylvania. Central Greene School District is the owner of the project. Waynesburg Central High School is primarily a renovation project with two minor additions; the renovation work is about 154,000 square feet and the addition work approximately 24,000 square feet. The original school building was constructed in 1969, Central Greene School District desires to expand and gain more educational space while bringing all areas of the building to modern learning standards.

Sequencing is of particular interest to the district, because construction will last two years; all the while the school will be occupied. Waynesburg Central High School is broken up into twelve different phases. This poses concerns while creating a schedule and creates several critical activities to insure that students are able to occupy each phase of the building on time.

Waynesburg Central High School is a public project and therefore requires specific protocol to be followed. In the pre-construction phase of public school projects pricing must be submitted for state approval. Pennsylvania government also sets standards on the delivery method. A multiple prime with a construction management agency will be utilized on the high school. Public school projects in Pennsylvania also require a hard bid to take place with contractors submitting a lump sum bid, the lowest bidder is then awarded the contract.

One of the more unusual things on this construction project not often implemented on schools in western Pennsylvania is the use of precast concrete for the structural system. A series of precast concrete columns and beams comprise the primary structural system on the additions. Precast concrete buildings are not common practice requiring special attention be paid to the connections.

Renovation work on Waynesburg Central High School is only cosmetic and infrastructure related, no significant structural modifications are being made to the existing building. The project will provide Central Greene School District with a facility equipped with modern amenities such as wireless internet, new mechanical system, and completely remodeled lighting and electrical system. Construction on Waynesburg Central High School will provide the owner the desired space along with updating all systems from what was in the existing building.



Figure 1: Waynesburg Central High School logo

Project Schedule Summary

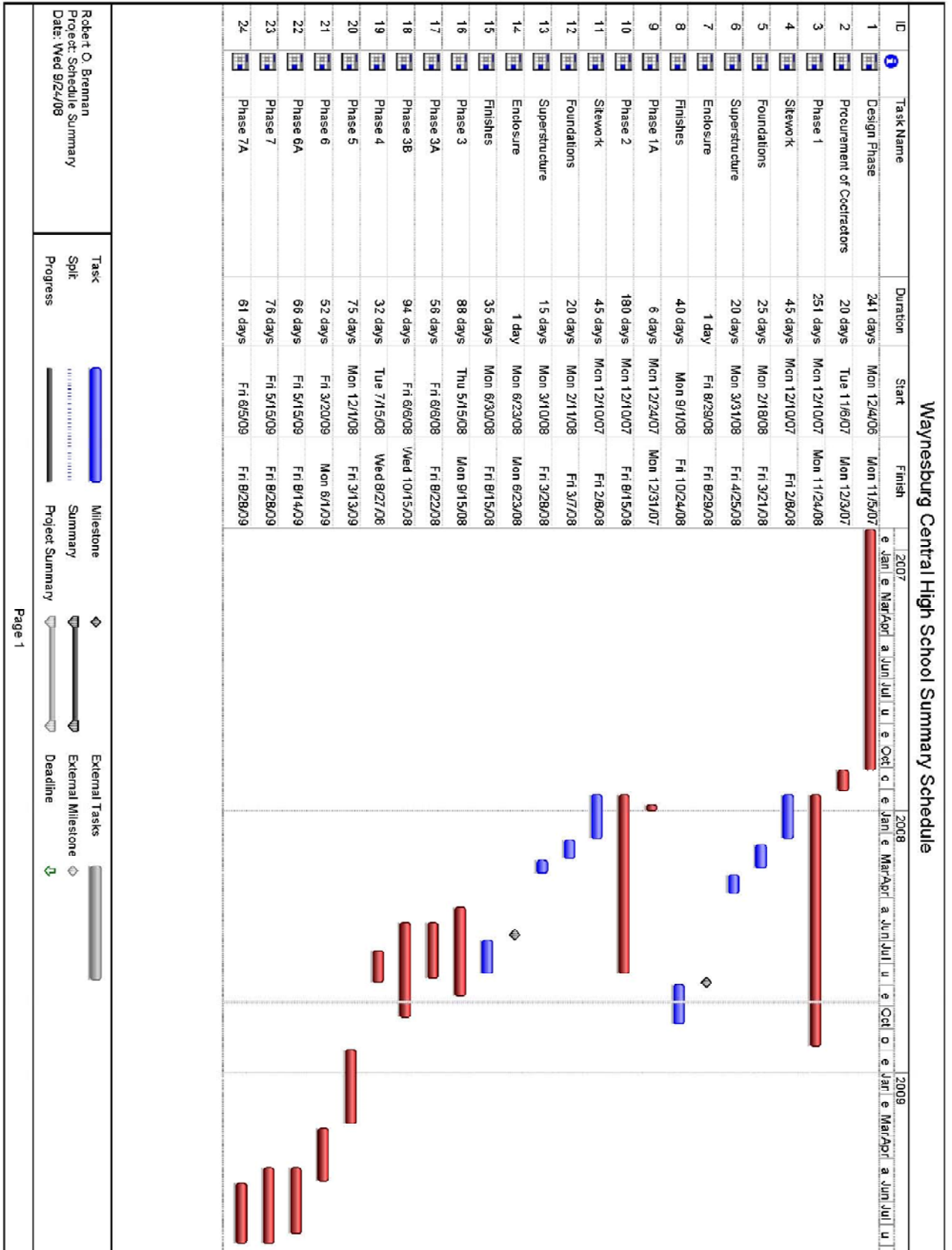
Waynesburg central High School is a facility in which the schedule is critical because the building will be occupied through the entirety of construction. The phasing sequence was carefully planned to ensure that no temporary facilities would need to be provided for students while school is in session. There are several phases where occupancy of the area will be taking place immediately following completion. Transitions into new phases are scheduled to occur over student breaks, thus alleviating much stress. The Waynesburg Central High School construction project is for the most part a renovation project. Less than a quarter of the area under construction is additions, the rest renovation work. The summary schedule on the page that follows shows time lines in which phases are scheduled to be completed.

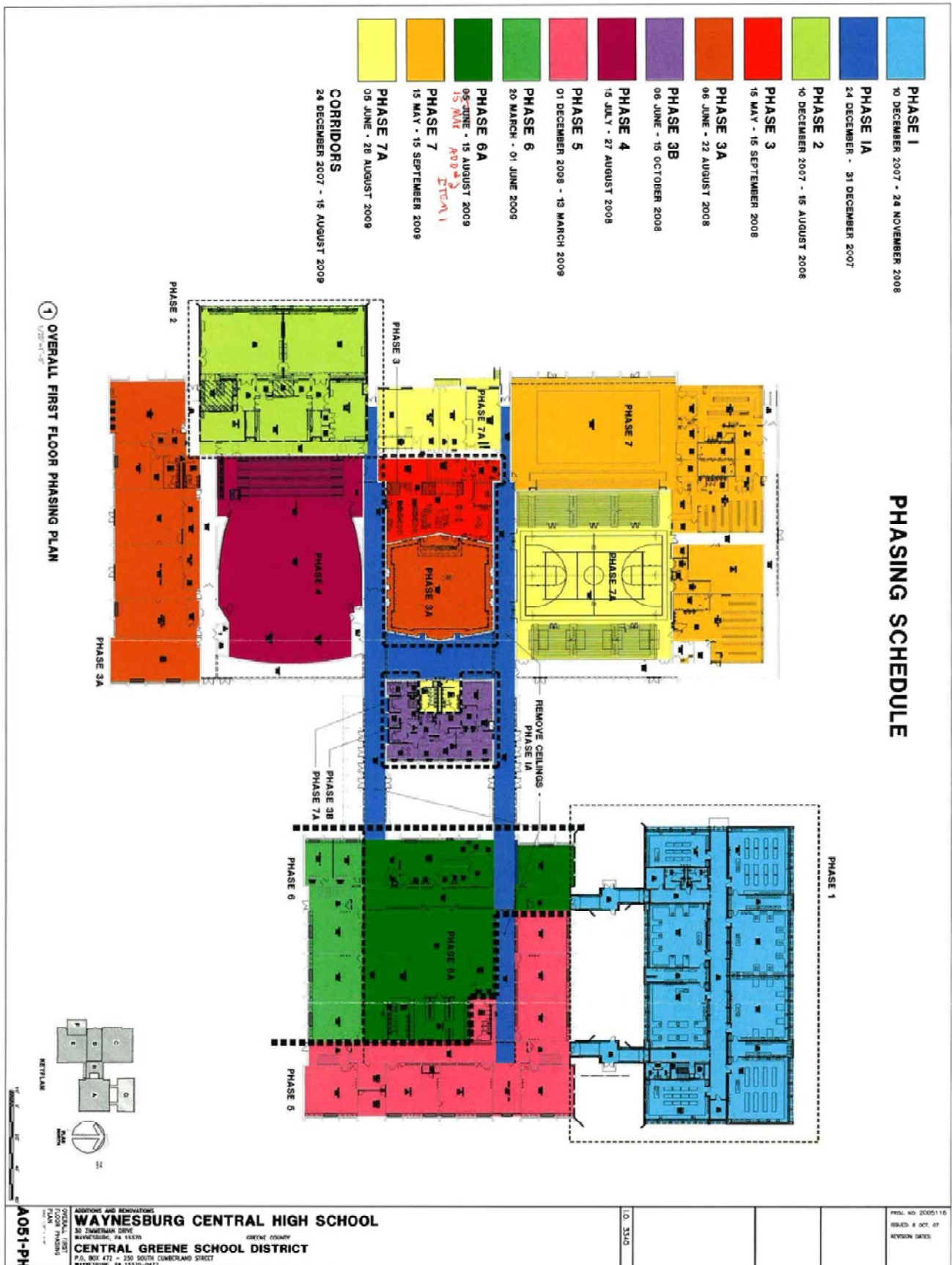
A supplemental phasing plan has been attached on page 6, to further help understand the schedule in which areas will be occupied and taken over for renovation throughout the course of the project. The phases are labeled on the plan and color coded. There are twelve phases on this project and as many as six under construction at any given time. With this many different areas of work, all of which have different turn over dates. It is important to first understand the phasing breakdown before the schedule.

Waynesburg Central High School is a publicly funded project which means funding must be approved by several parties before construction can commence. Being a publicly funded project causes for a longer design phase; since there are more parties imputing information and reviewing the designs before sending for approval and construction. The procurement of contractors is a straight forward process that is further elaborated on in the project delivery section. Since it was a public project the bid date was set and when the bids came in the lowest contractor was selected to perform the work.

Phase 1 of Waynesburg Central High School is the main addition to the building. This new addition will house the science department immediately following completion. Soon thereafter phase 5 the old science rooms will be taken and renovated into general purpose classrooms. This sequence will follow the general progression set forth with phase 6 following phase 5 and subsequently phase 6a following phase 6.

The schedule summary on the following page only breaks out the new addition phases into subsequent sections. New addition phases are the only phases in which any site work, foundation, or structural work will being done. The phases are colored in red and the subsections of the additions are shown in blue, with building enclosure shown as a milestone.





Building Systems Summary

Yes	No	Work Scope	If yes, address these questions / issues
x		Demolition Required	Extensive demolition work is necessary on this project. A variety of different materials shall be removed from the site. Asbestos was present in several areas and a specialty contractor (PSI, Inc.) was removing prior to other systems. Since the project scope contained a total renovation PSI, Inc. conducted a thorough analysis of all questionable materials in the building before any demolition occurred. Metal lockers were removed and taken to a salvage yard where the owner received compensation and did not have to pay tipping fees.
	x	Structural Steel Frame	Two column lines flanking the interior corridor in building G contain structural steel. These column lines contain less than eight columns per, and building G is a single story structure.
	x	Cast in Place Concrete	No extensive cast in place concrete is scheduled. A few slabs on grades shall be poured but no formwork is required because exterior walls are already in place and act as formwork.
x		Precast Concrete	<ul style="list-style-type: none"> • Precast concrete cast by Concrete Fabricators, in Wheeling, West Virginia • Concrete columns are connected to the foundation using leveling plates and anchor bolts • 45 ton mobile crane used to set all precast concrete
x		Mechanical System	<ul style="list-style-type: none"> • New mechanical room located in basement of building G • 215 ton air cooled chiller located outside mechanical room • 15 prepackaged air handling units • 73, 4 pipe unit ventilators replacing existing system • Fire protection system is a pre action sprinkler system
x		Electrical System	<ul style="list-style-type: none"> • 277/480V, 3 phase, 4 wire main service to building • 3000A, 3 phase main breaker • 208Y/120V service to receptacles and some luminaires • 150KW/180KVA, 120/208V-3 phase, 4 wire diesel emergency generator • 40 different luminaires used in the building
x		Masonry	<ul style="list-style-type: none"> • A combination of load bearing and non load bearing CMU walls are utilized. • The building has a brick veneer struck with a grapevine joint. • Traditional scaffolding used on this project which had a maximum height of two stories. • Masonry walls are connected to the precast concrete through a series of angle iron braces.
	x	Curtain wall	No curtain wall system implemented in construction.
	x	Support of Excavation	No unusual conditions existed in the excavation process. Rock was encountered before the desired footer depth allowing for a redesign and shallower footing system to be implemented.

Project Cost Evaluation

Cost is often a driving factor for any building, when a publicly funded project is proposed a question of what it is going to cost the public carries heavy weight. Public board meetings are held to discuss the project budget which is then sent out for public approval. Waynesburg Central High School, being a public project, followed the same pattern for funding. The project cost evaluation will analyze the cost of the project and compare it with two different estimating techniques. Actual building cost is the best way to directly compare buildings, because local area cost are minimized, by excluding land costs, site size and preparation, along with the permitting costs that vary based on geographic location. The following table displays roughly the actual cost to construct Waynesburg Central High School per the plans and specifications on bid day.

Actual Building Construction Cost	
Total Cost excluding land	\$ 17,191,000.00
Cost of Site work	\$ 952,000.00
Actual Building Construction Cost	\$ 16,239,000.00

Actual Building Construction Cost per Sq. ft.	\$ 91.23
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Table 1: Actual Building Construction Cost

Waynesburg Central High School is being constructed on a school campus setting where the land is already owned by the district. With previous ownership of the land this cost is not factored in for the total building construction cost. Some additional costs are incurred over the course of construction which are subsequently accounted for in table 2. Table 2 displays the total building construction cost along with the fees for additional services not directly related to the construction, as well as the additional costs like permits and financing.

Total Building Construction Cost	
Total cost excluding land	\$ 17,191,000.00
Architect and Engineer Fees	\$ 1,450,000.00
Construction Manager Fees	\$ 2,100,000.00
Additional related costs	\$ 750,000.00
Actual Building Construction Cost	\$ 21,491,000.00

Table 2: Total Building Construction Cost

Various systems are intricately intertwined in order to construct a building. These systems create a large majority of the construction cost and should be analyzed to assure the systems are not out of line with the common construction practices. Table 3 shows some of the building systems that were installed and the cost associated with them. The construction management fee and the architect and engineering fees have also been included since this is the area of particular interest for this report. Since this is a multiple prime contract which is further elaborated upon in the project delivery system all systems were installed by a separate prime contractor.

Building System Costs	
Mechanical system	\$ 3,840,000.00
Structural system	\$ 810,000.00
Electrical system	\$ 2,310,000.00
Communication system	\$ 399,000.00
Plumbing system	\$ 1,342,000.00
Roofing system	\$ 1,108,000.00
Interior Finish systems	\$ 508,000.00
Construction Manager	\$ 2,100,000.00
Architect and Engineer	\$ 1,450,000.00

Table 3: Building Construction Cost

D 4 is a cost estimating software package that can be utilized early to gain a conceptual cost of a construction project. Estimates are attained by selecting similar projects from a preset database of previously built projects. Projects in the D4 database vary from single family residences to large office complexes. Information on the project is displayed which informs of the systems that were implemented in the building to attain closer matches to the desired project. System costs as well as whole building costs are available. Since construction varies drastically in different regions across the United States, area is one of the more important things to take into account. After selecting several projects they are then averaged to attain costs based on the square footage of construction, the square footage of the desired project is then input and numbers for systems and a total cost are attained.

For Waynesburg Central High School eight similar projects were chosen from the D4 database, from which an analysis was derived. Buildings were chosen from the D4 database based on preset criteria. Type of building was the most important aspect when selecting a building, since D4 has such a large database there were many high schools to choose from. Location was the next criteria element used to eliminate possible buildings. Since Waynesburg Central High School is in south west Pennsylvania buildings that would have been built to similar standards and methods needed to be selected. Buildings were selected from Ohio, Pennsylvania, and Maryland. Buildings were further scrutinized by analyzing the systems used in construction. When the process was finished there were a total of eight buildings left, from which the estimate on the subsequent pages was developed.

D4 Cost Estimate Spreadsheet

Statement of Probable Cost

Project Information

Prepared By		Prepared For	
	Phone:		Phone:
	Fax:		Fax:
Projected Size	178000	Projected Location	PA - Other
Building Height	0	Projected Date	Aug 2008
Building Use	Educational	Foundation	CON
Number of Buildings	0	Exterior Wall	CMU
Site Size	3294225	Interior Wall	CMU
1st Floor Size	0	Roof Type	
1st Floor Height	0	Floor Type	CON
Number of Floors	2	Project Type	ADD/REN

Building Costs

Division #	Label	Projected %	Projected Sq. Cost	Projected
00	Bidding Requirements	0.28	0.94	167,441
	Bidding Requirements	0.28	0.94	167,441
	Untitled	0.00	0.00	0
01	General Requirements	3.32	11.11	1,977,294
	General Requirements	3.32	11.11	1,977,294
02	Site Work	4.13	13.80	2,456,792
	Site Work	4.13	13.80	2,456,792
03	Concrete	2.79	9.32	1,658,982
	Concrete	2.79	9.32	1,658,982
04	Masonry	5.89	19.68	3,503,333
	Masonry	5.89	19.68	3,503,333
05	Metals	4.90	16.38	2,915,245
	Metals	4.90	16.38	2,915,245
06	Wood & Plastics	0.93	3.10	552,254
	Wood & Plastics	0.93	3.10	552,254
07	Thermal & Moisture Protection	2.16	7.23	1,286,681
	Thermal & Moisture Protection	2.16	7.23	1,286,681
08	Doors & Windows	2.52	8.42	1,498,139
	Doors & Windows	2.52	8.42	1,498,139
09	Finishes	3.98	13.32	2,370,522
	Finishes	3.98	13.32	2,370,522
10	Specialties	0.89	2.98	530,050
	Specialties	0.89	2.98	530,050
11	Equipment	1.69	5.66	1,006,800
	Equipment	1.69	5.66	1,006,800
12	Furnishings	1.95	6.51	1,158,812
	Furnishings	1.95	6.51	1,158,812
13	Special Construction	0.16	0.55	97,523

	Special Construction	0.16	0.55	97,523
14	Conveying Systems	0.16	0.52	93,115
	Conveying Systems	0.16	0.52	93,115
15	Mechanical	7.79	26.03	4,633,864
	Mechanical	7.79	26.03	4,633,864
16	Electrical	4.31	14.40	2,562,546
	Electrical	4.31	14.40	2,562,546
21	Fire Suppression	1.37	4.59	817,283
	Fire Suppression	1.37	4.59	817,283
22	Plumbing	4.41	14.75	2,624,763
	Plumbing	4.41	14.75	2,624,763
23	HVAC	12.77	42.70	7,601,411
	HVAC	12.77	42.70	7,601,411
26	Electrical	9.13	30.53	5,434,597
	Electrical	9.13	30.53	5,434,597
27	Communications	2.28	7.62	1,356,285
	Communications	2.28	7.62	1,356,285
28	Electronic Safety and Security	0.77	2.57	456,598
	Electronic Safety and Security	0.77	2.57	456,598
31	Earthwork	4.77	15.96	2,840,904
	Earthwork	4.77	15.96	2,840,904
32	Exterior Improvements	11.02	36.83	6,555,828
	Exterior Improvements	11.02	36.83	6,555,828
33	Utilities	5.63	18.82	3,350,727
	Utilities	5.63	18.82	3,350,727
	Total Building Costs	100	334.31	59,507,788

Non-Building Costs

Division #	Label	Projected %	Projected Sq. Cost	Projected
	Total Non-Building Costs	100	0.00	0
Total Project Costs		--	--	59,507,788

Building Division Notes

Division	Note
Bidding Requirements	Averaged subdivision. Used in 3 of 8
General Requirements	Averaged subdivision. Used in 8 of 8
Site Work	Averaged subdivision. Used in 7 of 8
Concrete	Averaged subdivision. Used in 8 of 8
Masonry	Averaged subdivision. Used in 8 of 8
Metals	Averaged subdivision. Used in 6 of 8
Wood & Plastics	Averaged subdivision. Used in 8 of 8
Thermal & Moisture Protection	Averaged subdivision. Used in 8 of 8

Doors & Windows	Averaged subdivision. Used in 8 of 8
Finishes	Averaged subdivision. Used in 8 of 8
Specialties	Averaged subdivision. Used in 8 of 8
Equipment	Averaged subdivision. Used in 8 of 8
Furnishings	Averaged subdivision. Used in 7 of 8
Special Construction	Averaged subdivision. Used in 4 of 8
Conveying Systems	Averaged subdivision. Used in 6 of 8
Mechanical	Averaged subdivision. Used in 7 of 8
Electrical	Averaged subdivision. Used in 7 of 8
Fire Suppression	Averaged subdivision. Used in 1 of 8
Plumbing	Averaged subdivision. Used in 1 of 8
HVAC	Averaged subdivision. Used in 1 of 8
Electrical	Averaged subdivision. Used in 1 of 8
Communications	Averaged subdivision. Used in 1 of 8
Electronic Safety and Security	Averaged subdivision. Used in 1 of 8
Earthwork	Averaged subdivision. Used in 1 of 8
Exterior Improvements	Averaged subdivision. Used in 1 of 8
Utilities	Averaged subdivision. Used in 1 of 8

RS Means is the second method used to determine an estimate for Waynesburg Central High School. A square foot approach was used in Means to attain an overall building cost as well as a cost per square foot. RS Means is a computed average of similar buildings across the United States, where the information is then presented in table form and can be seen in appendix A. A high school building type was selected and the number retrieved for the square footage and perimeter closest to the actual. This cost is then adjusted to compensate for differences in perimeter and height, neither of which applied to Waynesburg. Since Waynesburg is primarily a renovation project the perimeter adjustment does not apply directly since the majority of the perimeter is not being constructed. Similarly the story height was on average that of the RS Means, subsequently requiring no adjustments. There are additional costs that need to be added into the estimate to gain greater accuracy. Where after the final cost is then adjusted for a location factor. Waynesburg Central High School is in south west Pennsylvania with no close locations contained in the RS Means location adjustment table, located in appendix A, so the Pennsylvania other was selected which is a factor of .97. Table 4 shows the elements that were added and the items that incurred additional cost into the estimate.

Waynesburg Central High School RS Means Estimate			
	sq. ft./# of units	Cost per	Total Cost
Base Estimate			
Face Brick with Concrete Backup	178,000	\$ 145.50	\$ 25,899,000.00
Additional Costs			
Clock System	1	\$ 37,400.00	\$ 37,400.00
Broiler	1	\$ 3,400.00	\$ 3,400.00

Cooler, 6' long, Reach-in	2	\$ 4,475.00	\$ 8,950.00
Dishwasher, 10-12 racks per hour	1	\$ 4,375.00	\$ 4,375.00
Freezer, 44 C.F, reach-in	2	\$ 8,150.00	\$ 16,300.00
Lockers, steel, single tier, 60"-70"	654	\$ 200.00	\$ 130,800.00
Total Cost:			\$ 26,100,225.00
Location Adjustment:			0.97
Total Adjusted Cost:			\$ 25,317,218.25
Cost per sq. ft.			\$ 142.23

Table 4: RS Means estimate spread sheet

Comparison:

Further analysis between the actual cost of construction and the estimated cost of construction reveals considerable variance. With the actual construction cost being \$ 21,491,000.00, and the estimated cost of construction from D4 coming in at a number almost three times greater than the actual, at \$ 59,507,788.00, a large error occurred. One factor causing a significant difference between the numbers is that the Waynesburg Central High School project is mostly renovation work. D4 cost estimating software does not have an option present to factor in renovation work which is significantly cheaper on this project because there are no structural alterations to the existing building. Renovation work does not account for the entire difference between the two costs; some of the difference could have been incurred from the buildings chosen from the database. Though the major systems had several buildings with similar systems as shown on page 11 and 12 under the section titled building division notes, several of the systems were only averaged with one project containing a similar system. The difference between the D4 estimate and the actual cost is too large for a building of this size.

RS Means proved to be a slightly more accurate estimate for the actual cost of construction, with a price of \$ 25,317,218.25. Some of the same things can account for the difference in price; renovation work is also not able factored into construction in RS Means. Since RS Means derived a relatively similar number to the actual this was then analyzed and compared for square foot pricing. RS Means derived a cost per square foot of \$ 142.23 compared to an actual square foot cost of \$ 91.32. A difference of \$ 50.91 per square foot is a significant difference yet much closer to the final number than D4. Both estimating tools are very crude ways to estimate a project and primarily designed to gain a better understanding of the rough cost of a building not to provide detailed numbers that can be used for a bid. This is a reason to see small amounts of deviation between the estimates and the actual construction costs.

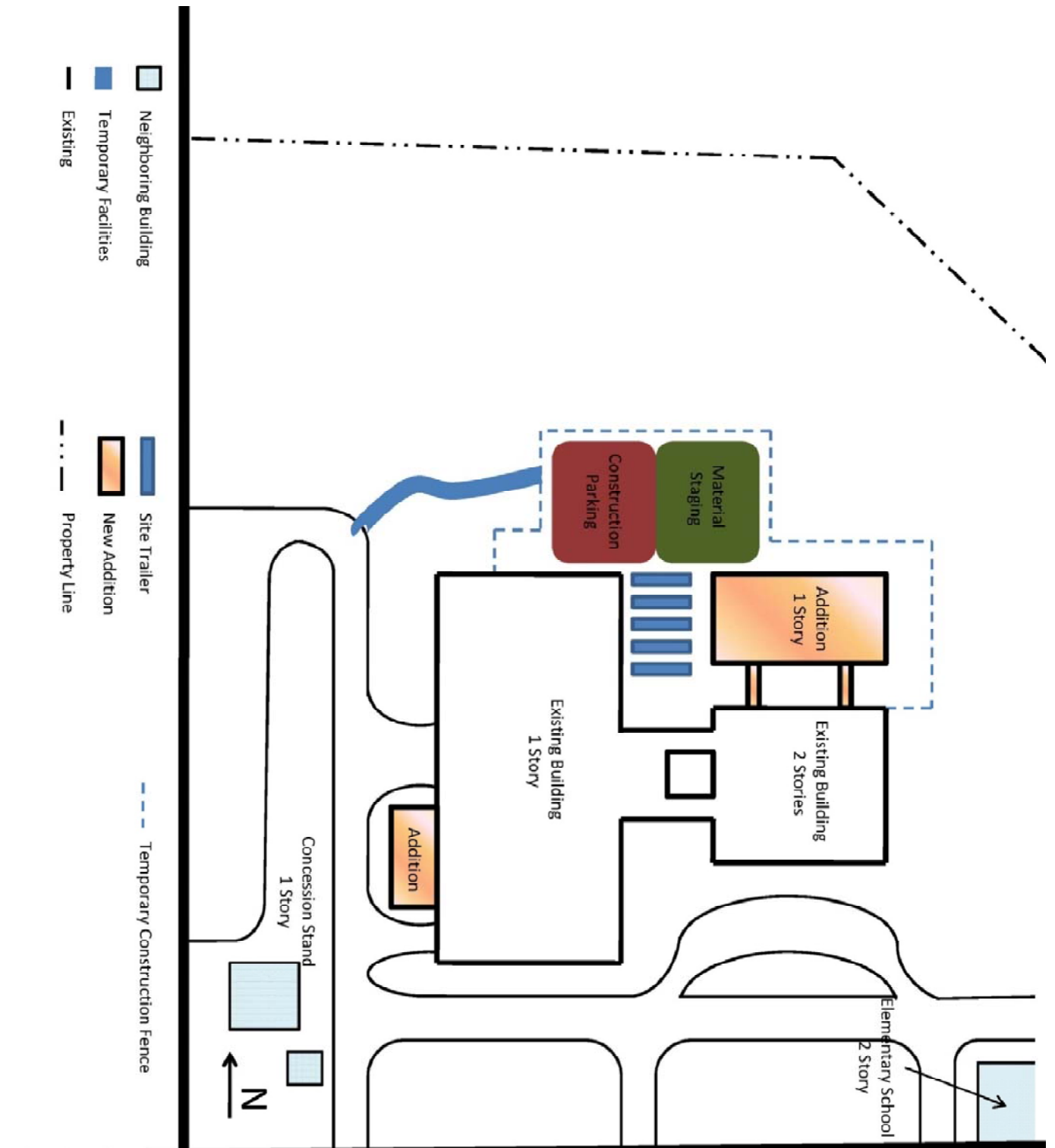
Site Plan of Existing Conditions

Waynesburg Central High School construction is being done on Central Greene School Districts central campus which also houses the elementary school, a vocational school, as well as several sports fields. Site plans were constructed for different areas of construction. Different plans were used to alleviate congestion and allow for additional information to be added at a later time, to further expound on the schematics.

The first plan labeled site plan shows the basic layout of the site with the existing buildings and existing roadways. Buildings are labeled with the number of stories. The layout of the designated construction areas are blocked out and labeled to show the general vicinity in which the activities will occur.

Site utilities plan is the second site plan in the section. This site plan shows the underground utilities that are present on the site. Future site utilities are included on the site utilities plan and depicted the same as the existing utilities. All existing utilities shown on the site plan are not to be moved throughout the duration of construction.

Site navigation plan is the third plan included in the site plan section. Included in the site navigation plan is the flow of materials and people through the construction site. Pedestrian or student traffic was negligibly affected as a result of construction and with the exception of a few phases the traffic pattern is unchanged. Navigation of students inside the building was minimally affected with some exits being closed off and sections of corridors partially walled off, rerouting occupants through other corridors. Construction traffic is also depicted with arrows representing the main path of entrance and exit from the site.

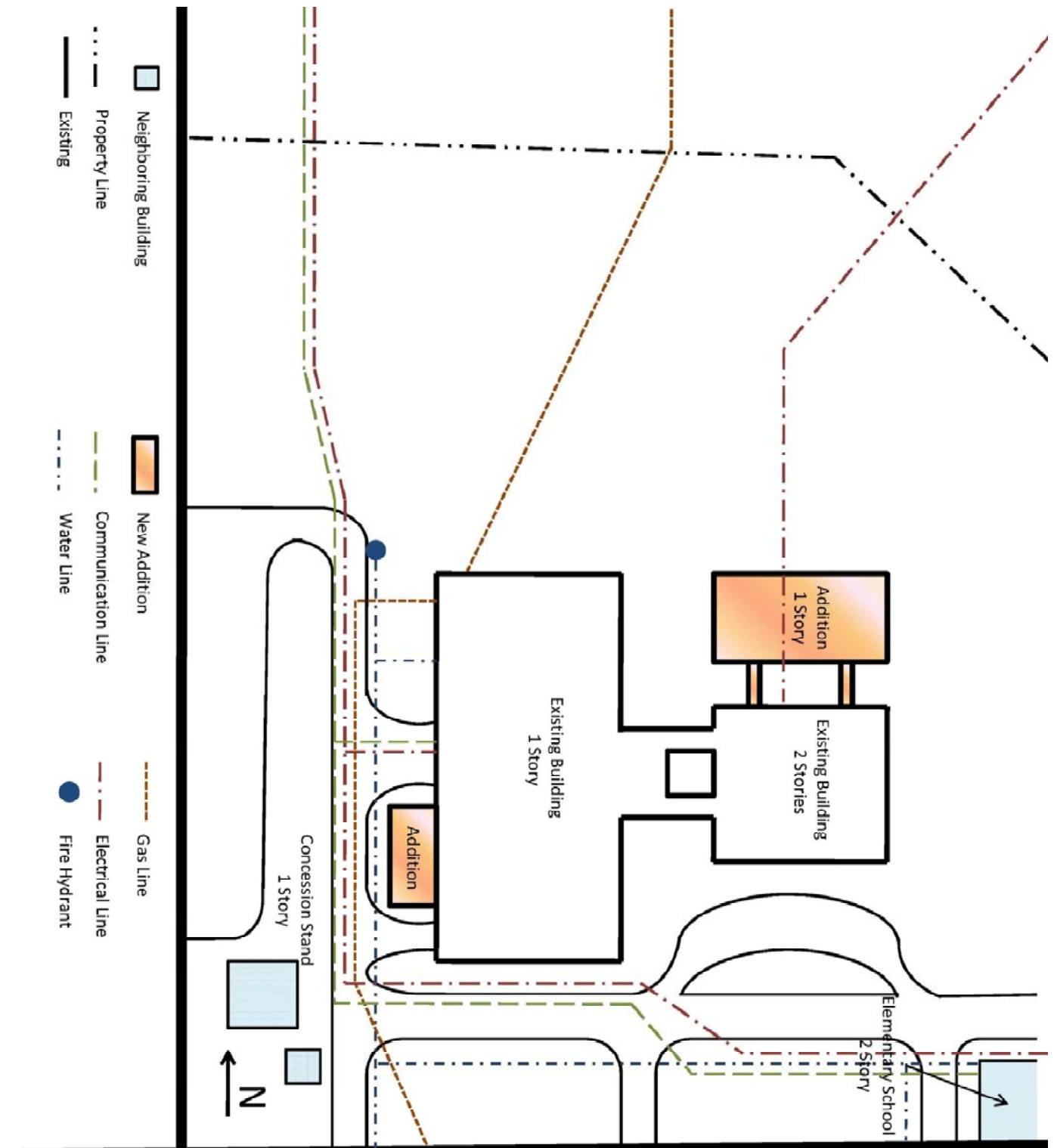


09/23/2008

Site Plan

Waynesburg Central High School

Robert O. Brennan Construction Management

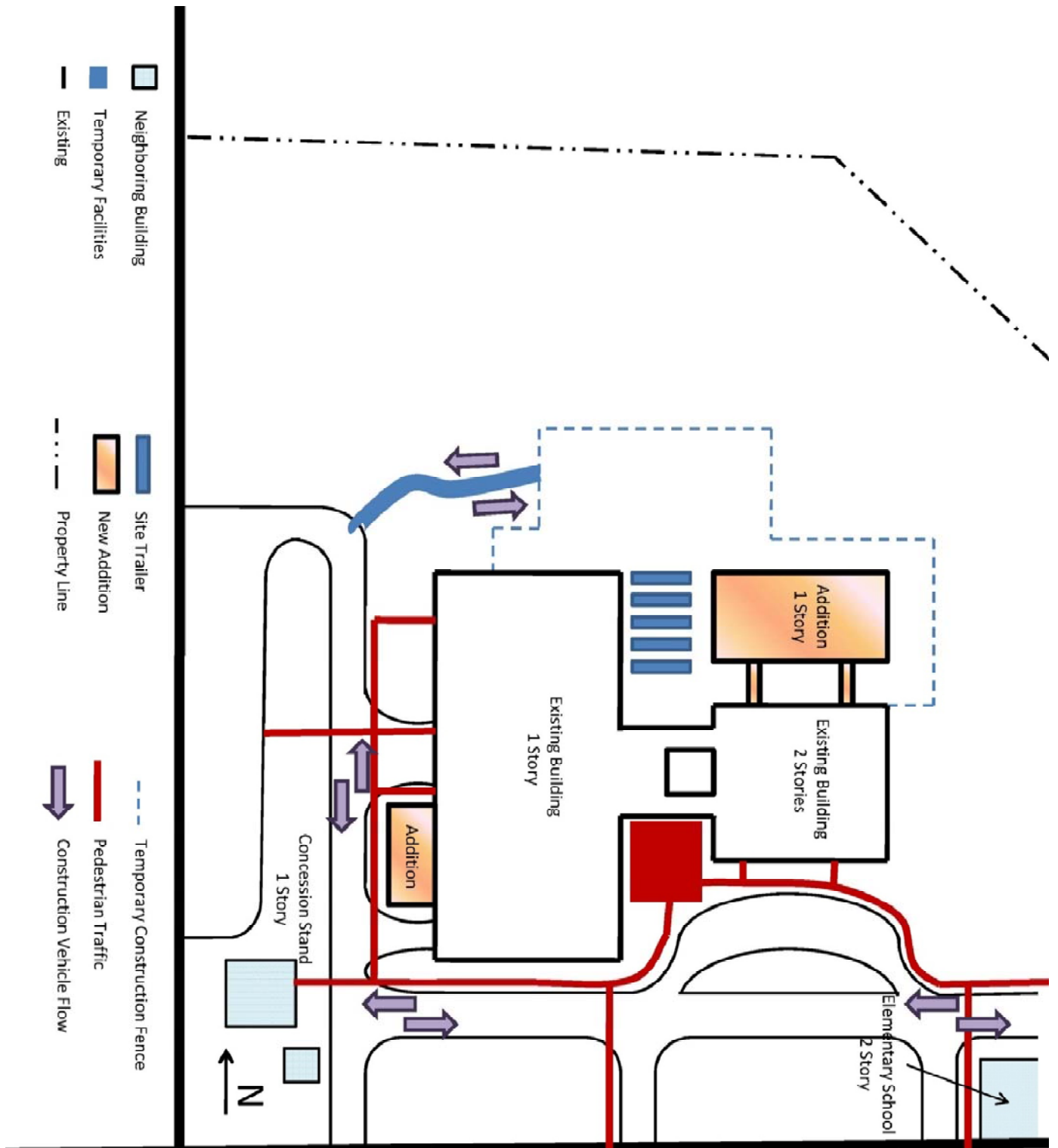


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Site Utilities Plan

Waynesburg Central High School

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Site Navigation Plan

Waynesburg Central High School

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Local Conditions

Waynesburg Central High School is located in Waynesburg Pennsylvania. Waynesburg Pennsylvania is located 50 miles south of Pittsburgh just off of I-79. Waynesburg is also only 20 miles north of Morgantown West Virginia. Waynesburg’s location makes construction convenient because of the easy access to a major interstate.

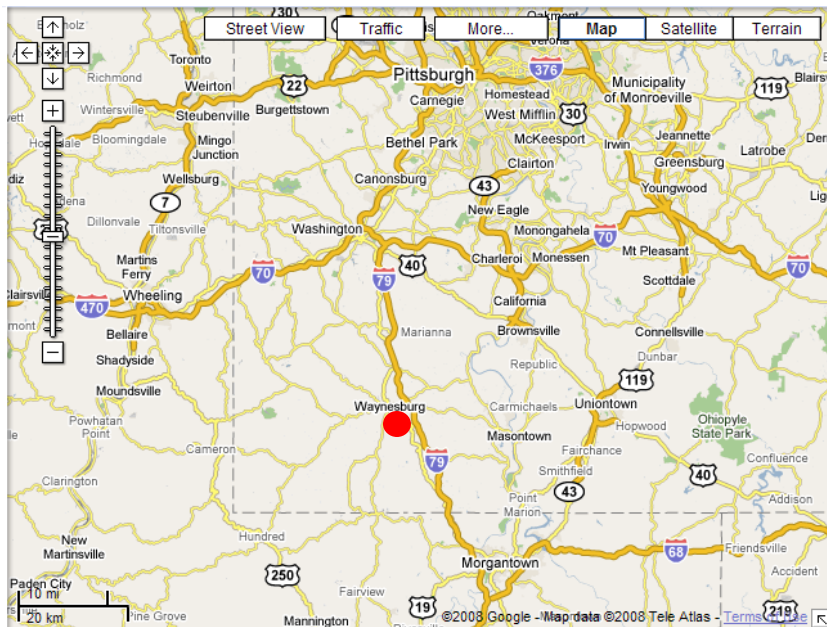


Figure 2: Waynesburg Central High School depicted in red

Contractor parking is often an issue on construction projects, but at Waynesburg the site is large enough to provide adequate space for contractors to park. Over the course of construction, designated parking areas will be changed. Contractors will be permitted to park in student parking lot located west of the school building when school is not in session. When school is in session contractors are only permitted to park in the last row of that lot and in the parking area designated on the site plan.

Tipping Fees in Pennsylvania and Neighboring States

State	Remaining Capacity (tons)	2007 Average Tipping Fee*	Per-Ton State Imposed Fees
Pennsylvania	278,704,216	\$61.00	\$6.25/ton to state + \$1.00/ton to host municipality
Delaware	59,800,000	\$61.00	No fees; facilities are state-owned
Maryland	7,947,736	\$68.00	No fees
New Jersey	38,000,000	\$73.00	\$1.00/ton to host municipality + \$0.25/ton post closure fee
New York	90,000,000	\$95.00	No fees
Ohio	370,793,903	\$33.00	Multiple fees vary from \$1.00 to \$9.00/ton
Virginia	235,094,159	\$47.00	Fee assessed on waste received above approved permit level
West Virginia	107,568,455	\$34.00	\$8.25/ton + \$0.50/ton to host municipality

*Source: Solid Waste Digest, Year 17, Report No. 1. 2007 Chartwell Gate Price Progress Report.

Figure 3: Tipping fees chart for north eastern United States

Specifications do not require recycling of materials during the demolition of this project. Central Greene School District decided to contact a local salvage yard for the removal of lockers. This was suggested by the general contractor to save tipping costs; the salvage yard provided dumpsters and removed them at no charge to the owner and also paid the owner for the materials. An average price for tipping on other dumpsters in Pennsylvania is given in figure 3.

Site Conditions and unforeseen conditions are the single largest reason for changes and delays to a construction project. Soil conditions are a critical part of foreseeing possible problems and potential delays. At Waynesburg Central High School an independent consultant was hired to perform soil tests on the property. These soil tests were compiled prior to the completion of design and issued to all contractors bidding on the project. Civil & Environmental Consultants, Inc. performed the soil analysis.

Civil & Environmental Consultants, Inc. performed a series of 19 core bores were done in various locations surrounding the building. Figure 4 shows the locations in which the bores were taken. Appendix B contains two sample core bores, B4 and B7. Core bores on site vary in depth from 3.3 feet to a depth of 21.8 feet. The depth of core bore is dependent on the depth of excavation in the area. The south side of building G is the deepest excavation occurring on the site thus the core bores are the deepest. Core bores show the different types of materials encountered and the composition of the soils.

The general soil composition on the site is a sandy clay material consistent on the surface layer, protruding downward an average depth of 4 to 6 feet. Many core bores encountered some form of sandstone following the sandy clay classified as medium hard to hard. This layer of sandstone required hammering to take place during the excavation process and was necessary to be foreseen therefore not delay the scheduled construction. Water levels on the site varied from 2 to 8 feet in depth when encountered, several core bores never encountered water. Water levels were not an issue and did not require any special techniques to handle the water.

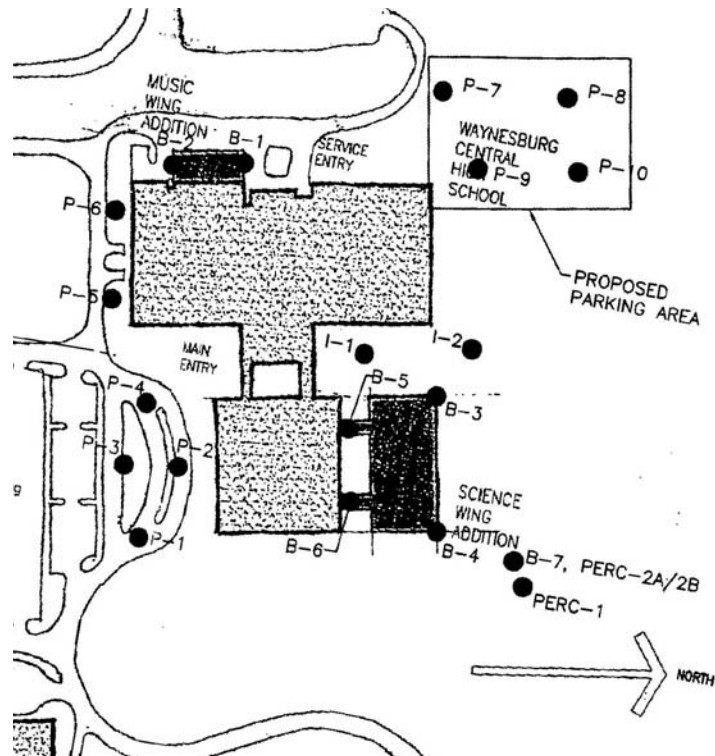


Figure 4: Core boring plan from specifications

Client Information

Waynesburg Central High School is owned by Central Greene School District (CGSD). Central Greene School District has a graduating class of about 190 students. CGSD has four buildings in the district Perry Elementary, Waynesburg Central Elementary, Margaret Bell Miller Middle School, and Waynesburg Central High School. CGSD has a central campus where three buildings are located one of which is Waynesburg Central High School. The other two buildings are Waynesburg Central Elementary School, and Greene County Vocational-Technical School.

Central Greene School District is renovating and adding on to Waynesburg Central High School to update the learning environment and create additional space. Waynesburg Central High School was originally built in 1969 and has not had a significant renovation since. The entire building will undergo a complete renovation of all systems except the structural. When the project is complete the building will have a modern learning atmosphere equipped with wireless internet throughout the building, along with modern mechanical and electrical systems.

Central Greene School District is interested in the entire sequencing of the project. The construction sequence is of particular interest to CGSD because the building will remain occupied through the entirety of construction. This creates potential safety issues for CGSD since areas of the building will be under construction while students attend classes. Sequencing is also important to ensure that students are able to occupy classrooms when scheduled.

Central Greene School District is concerned with construction related issues like cost, quality and safety as well. This is evident in the type of insurance plan required for all contractors on site; CGSD implemented an owner controlled insurance program (OCIP). A representative of OCIP is onsite on a weekly basis and gives feedback on potential safety hazards and possible violations. Since Waynesburg Central High School is a publicly funded project the budget was a point of concern through the design phase. Cost of construction and following the bid documents is a priority because all change orders must be taken to the school board for approval, which only meets once a month. This creates not only cost increases but also has the potential to create delays in construction.



Figure 5: Central Greene School District's mascot

Project Delivery System

Waynesburg Central High School is a public project in south west Pennsylvania, which requires that public school projects follow a certain delivery structure. The delivery structure used on this project is a multiple prime contract. Figure 5 shows the delivery method for Waynesburg Central High School, in which the owner is shown on the left side with all the contractors having a contract with the owner on the right. Contract types are color coded.

Waynesburg Central High School Organizational Chart

Figure 5: Organizational chart

Waynesburg Central High School is a design-bid-build construction method. Construction documents were complete before being put out for bid by contractors. Since it was chosen to be delivered in a design-bid-build construction method the construction manager was brought on during design phase. Foreman, the construction manager, then advised the owner on the best way to divide packages when placing them out for bid. The manner in which packages for contractors is broken has to be determined prior to final construction documents being complete; because the specifications of the project are dependent on the project package definitions. Waynesburg Central High School was then placed out for a competitive bid, in which the low bidder receives the contract and becomes the prime contractor for the given package.

Multiple prime contractors is a common approach for many public projects, not only public school buildings. A multiple prime contract delivery method is when the owner, in this case Central Greene School District, holds all the contracts as depicted in figure 5. Prime contractors are then only legally obligated to the owner and no other organization. In the case of Waynesburg Central High School the construction manager (Foreman Program and Construction Manager) takes the role of a construction advisor to the owner. Foreman is responsible to ensure that contractors perform work to the required specifications and notify the owner of negligence or failure to comply. Foreman does not hold any contract with the prime contractors.

Each Prime contractor is responsible to the owner for a given section of the specifications. The concept behind a multiple prime approach is driven by conceptual savings to the owner, because there are fewer markups by each prime contractor since they have less sub contractors. This is the reason why Waynesburg Central High School has 13 prime contractors, with a construction management agency, and then an architect.

Staffing Plan

Foreman Program and Construction Managers is the construction manager on Waynesburg Central High School. Foreman’s staffing organizational chart is in figure 6 showing the general structure and the lines of communication. Solid lines depict a direct hierarchy were the dashed lines represent a cooperative working relationship.

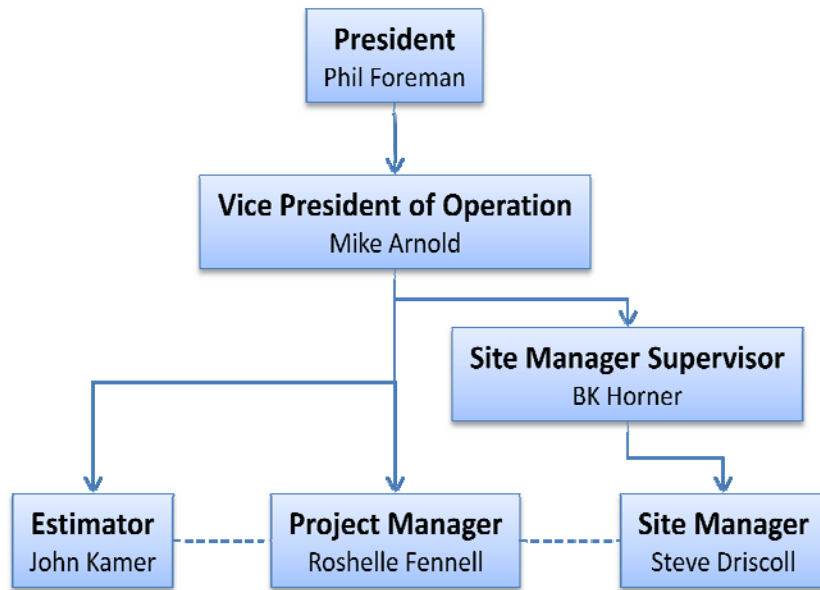


Figure 6: Foreman organizational chart for Waynesburg Central High School

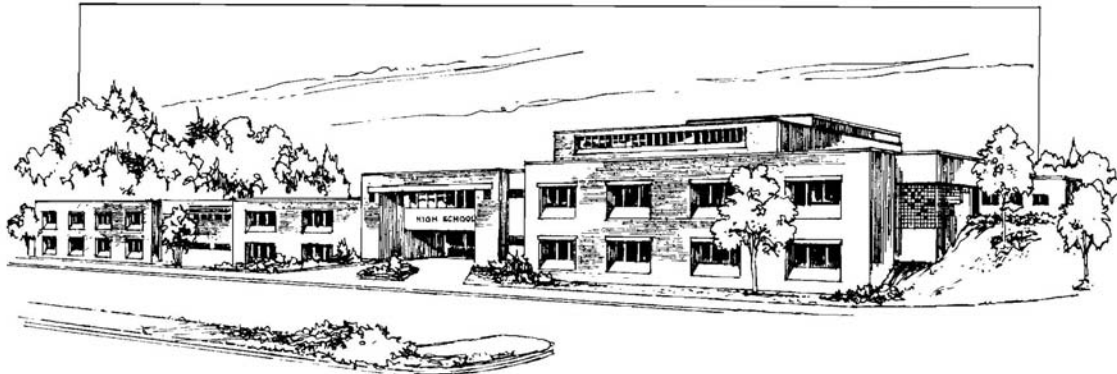
Foreman Program and Construction Managers organizational chart does not give the full scope of the staffing on Waynesburg Central High School. Figure 7 shows in more detail the personnel involved throughout different phases of the construction process. Some of the individuals listed in the organizational chart are not represented in the staffing chart because of the infrequency of work dedicated to this project. Site Manager Supervisor only makes infrequent stops to the site while the site manager is present in order to insure consistency between construction projects. Likewise the president is only involved on an infrequent basis and therefore a bar representation of the time would be miss representative. The bars represent time spent working on the project on a consistent basis.

Foreman Staffing Chart for Waynesburg Central High School									
Title	Personnel	Design Phase			Contractors Bidding	Construction Phase			Project Close out
Vice President	Mike Arnold								
Estimator	John Kamer								
Project Manager	Roshelle Fennell								
Site Manager	Steve Driscoll								

Figure 7: Foreman staffing plan for Waynesburg Central High School

Appendix A

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	151.55	148.05	145.90	144.60	143.70	143.20	142.60	142.20	141.85
	R/Conc. Frame	156.00	151.85	149.35	147.85	146.70	146.15	145.50	145.05	144.60
Decorative Concrete Block	Steel Frame	146.60	142.70	140.40	139.00	137.95	137.35	136.75	136.30	135.90
	R/Conc. Frame	148.30	144.40	142.10	140.70	139.60	139.05	138.45	138.00	137.60
Limestone with Concrete Block Back-up	Steel Frame	171.05	166.20	163.10	161.25	159.85	159.25	158.45	157.85	157.35
	R/Conc. Frame	177.80	172.90	169.90	168.00	166.65	166.05	165.20	164.65	164.10
Perimeter Adj., Add or Deduct	Per 100 L.F.	3.60	2.60	2.05	1.65	1.40	1.15	1.10	0.95	0.85
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	1.80	1.75	1.70	1.65	1.65	1.65	1.65	1.65	1.60
<i>For Basement, add \$29.05 per square foot of basement area</i>										

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 \$84.35 to \$198.65 per S.F.

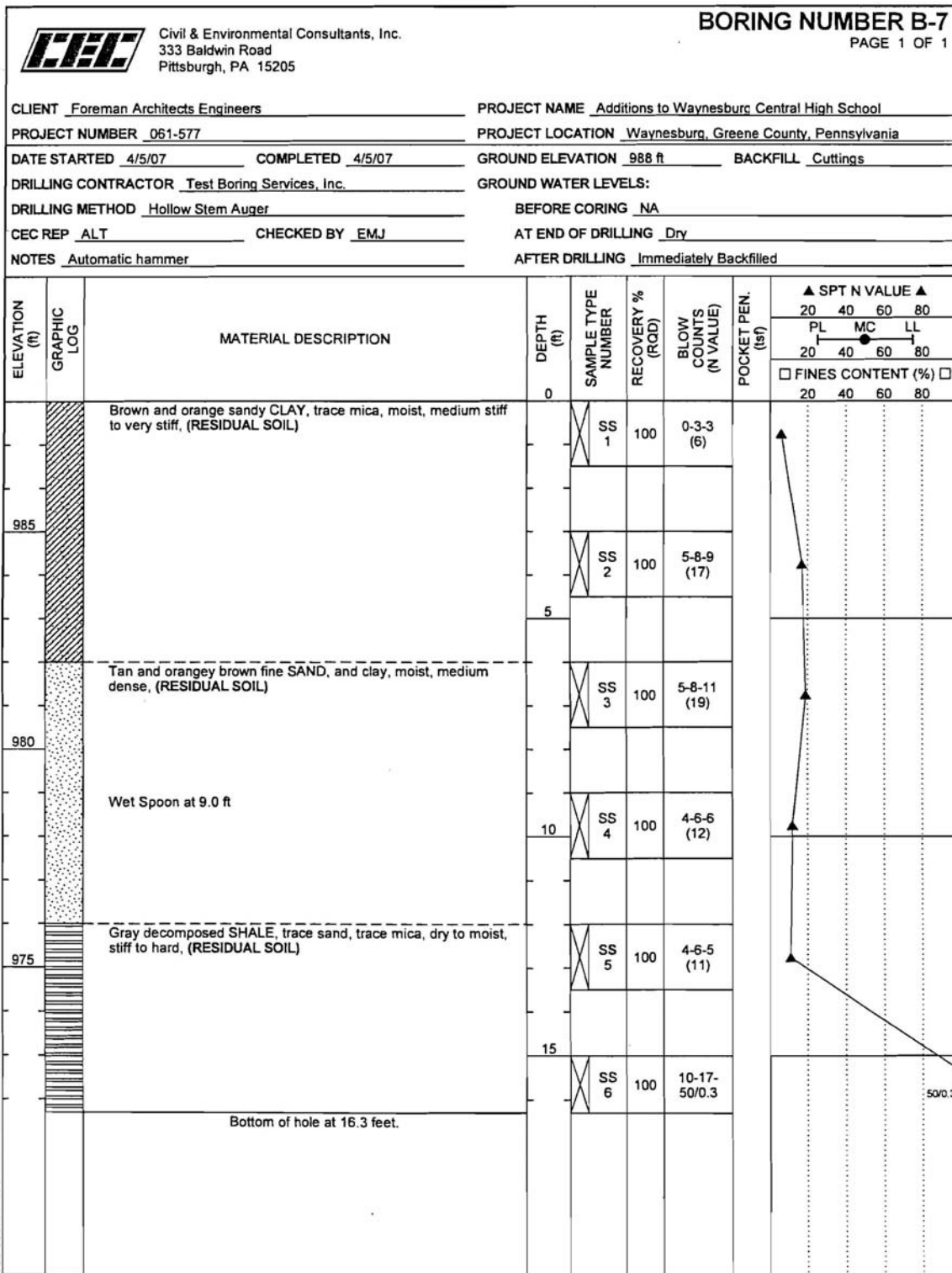
Common additives

Description	Unit	\$ Cost	Description	Unit	\$ Cost
Bleachers, Telescoping, manual			Kitchen Equipment		
To 15 tier	Seat	111 - 154	Broiler	Each	3400
16-20 tier	Seat	227 - 279	Cooler, 6 ft. long, reach-in	Each	4475
21-30 tier	Seat	242 - 292	Dishwasher, 10-12 racks per hr.	Each	4375
For power operation, add	Seat	44 - 69.50	Food warmer, counter, 1.2 KW	Each	630
Carrels Hardwood	Each	655 - 1200	Freezer, 44 C.F., reach-in	Each	8150
Clock System			Lockers, Steel, single tier, 60" or 72"	Opening	165 - 298
20 room	Each	15,400	2 tier, 60" or 72" total	Opening	104 - 137
50 room	Each	37,400	5 tier, box lockers	Opening	58 - 79
Elevators, Hydraulic passenger, 2 stops			Locker bench, lam. maple top only	L.F.	20.50
1500# capacity	Each	55,100	Pedestals, steel pipe	Each	62
2500# capacity	Each	57,800	Seating		
Emergency Lighting, 25 watt, battery operated			Auditorium chair, all veneer	Each	218
Lead battery	Each	278	Veneer back, padded seat	Each	264
Nickel cadmium	Each	800	Upholstered, spring seat	Each	264
Flagpoles, Complete			Classroom, movable chair & desk	Set	65 - 120
Aluminum, 20' high	Each	1425	Lecture hall, pedestal type	Each	208 - 620
40' high	Each	3200	Sound System		
Fiberglass, 23' high	Each	1725	Amplifier, 250 watts	Each	2225
39'-5" high	Each	3250	Speaker, ceiling or wall	Each	181
			Trumpet	Each	345

Location Factors							
STATE/ZIP	CITY	Residential	Commercial	STATE/ZIP	CITY	Residential	Commercial
NORTH DAKOTA (CONT'D)				PENNSYLVANIA (CONT'D)			
586	Dickinson	.77	.84	190-191	Philadelphia	1.18	1.15
587	Minot	.82	.87	193	Westchester	1.11	1.07
588	Williston	.77	.84	194	Normstown	1.10	1.10
				195-196	Reading	.97	.99
OHIO				PUERTO RICO			
430-432	Columbus	.94	.94	009	San Juan	.75	.79
433	Marion	.90	.90	RHODE ISLAND			
434-436	Toledo	1.01	.99	028	Newport	1.07	1.04
437-438	Zanesville	.90	.90	029	Providence	1.07	1.04
439	Stuebenville	.95	.95	SOUTH CAROLINA			
440	Lorain	.99	.96	290-292	Columbia	.85	.79
441	Cleveland	1.01	1.00	293	Spartanburg	.85	.78
442-443	Akron	.98	.97	294	Charleston	.88	.83
444-445	Youngstown	.96	.95	295	Florence	.80	.78
446-447	Canton	.94	.93	296	Greenville	.84	.78
448-449	Mansfield	.94	.93	297	Rock Hill	.83	.77
450	Hamilton	.93	.92	298	Aiken	.99	.86
451-452	Cincinnati	.93	.93	299	Beaufort	.83	.76
453-454	Dayton	.93	.93	SOUTH DAKOTA			
455	Springfield	.94	.93	570-571	Sioux Falls	.78	.82
456	Chillicothe	.97	.95	572	Watertown	.74	.78
457	Athens	.89	.89	573	Mitchell	.76	.78
458	Lima	.91	.94	574	Aberdeen	.78	.81
OKLAHOMA				575	Pierre	.75	.80
730-731	Oklahoma City	.79	.82	576	Mobridge	.74	.78
734	Ardmore	.78	.81	577	Rapid City	.76	.79
735	Lawton	.81	.82	TENNESSEE			
736	Clinton	.77	.81	370-372	Nashville	.83	.86
737	Enid	.77	.81	373-374	Chattanooga	.76	.80
738	Woodward	.76	.80	375,380-381	Memphis	.82	.86
739	Guymon	.67	.69	376	Johnson City	.71	.80
740-741	Tulsa	.78	.80	377-379	Knoxville	.73	.78
743	Miami	.82	.82	382	Mckenzie	.72	.79
744	Muskogee	.72	.73	383	Jackson	.70	.77
745	Mcalester	.74	.76	384	Columbia	.72	.79
746	Ponca City	.77	.80	385	Cookeville	.71	.80
747	Durant	.77	.80	TEXAS			
748	Shawnee	.75	.79	750	Mckinney	.74	.79
749	Poteau	.78	.81	751	Waxahackie	.75	.80
OREGON				752-753	Dallas	.82	.85
970-972	Portland	1.02	1.03	754	Greenville	.68	.73
973	Salem	1.00	1.02	755	Texarkana	.72	.78
974	Eugene	1.01	1.01	756	Longview	.67	.73
975	Medford	1.00	1.02	757	Tyler	.73	.80
976	Klamath Falls	1.01	1.02	758	Palestine	.66	.71
977	Bend	1.02	1.02	759	Lufkin	.70	.73
978	Pendleton	1.00	.99	760-761	Fort Worth	.81	.81
979	Vale	.99	.94	762	Denton	.76	.77
PENNSYLVANIA				763	Wichita Falls	.79	.80
150-152	Pittsburgh	.97	.99	764	Eastland	.72	.72
153	Washington	.93	.97	765	Temple	.74	.76
154	Uniontown	.89	.95	766-767	Waco	.77	.80
155	Bedford	.88	.93	768	Brownwood	.68	.72
156	Greensburg	.93	.96	769	San Angelo	.71	.75
157	Indiana	.90	.95	770-772	Houston	.84	.88
158	Dubois	.89	.95	773	Huntsville	.68	.73
159	Johnstown	.89	.95	774	Wharton	.70	.76
160	Butler	.92	.95	775	Galveston	.83	.86
161	New Castle	.91	.94	776-777	Beaumont	.81	.83
162	Kittanning	.93	.96	778	Bryan	.73	.82
163	Oil City	.90	.93	779	Victoria	.73	.77
164-165	Erie	.94	.94	780	Laredo	.73	.77
166	Altoona	.87	.93	781-782	San Antonio	.80	.83
167	Bradford	.90	.94	783-784	Corpus Christi	.77	.78
168	State College	.90	.94	785	Mc Allen	.75	.76
169	Wellsboro	.89	.94	786-787	Austin	.79	.80
170-171	Harrisburg	.94	.96	788	Del Rio	.66	.69
172	Chambersburg	.89	.93	789	Giddings	.69	.71
173-174	York	.91	.94	790-791	Amarillo	.77	.81
175-176	Lancaster	.91	.92	792	Childress	.75	.77
177	Williamsport	.84	.87	793-794	Lubbock	.75	.79
178	Sunbury	.91	.94	795-796	Ablene	.74	.78
179	Pottsville	.90	.94	797	Midland	.75	.77
180	Lehigh Valley	1.01	1.03	798-799,885	El Paso	.74	.77
181	Allentown	1.04	1.02	UTAH			
182	Hazleton	.90	.95	840-841	Salt Lake City	.81	.88
183	Stroudsburg	.91	.97	842,844	Ogden	.79	.85
184-185	Scranton	.96	.98	843	Logan	.79	.86
186-187	Wilkes Barre	.92	.95				
188	Montrose	.90	.95				
189	Doylestown	1.05	1.05				

Appendix B

Samples of Core Borings



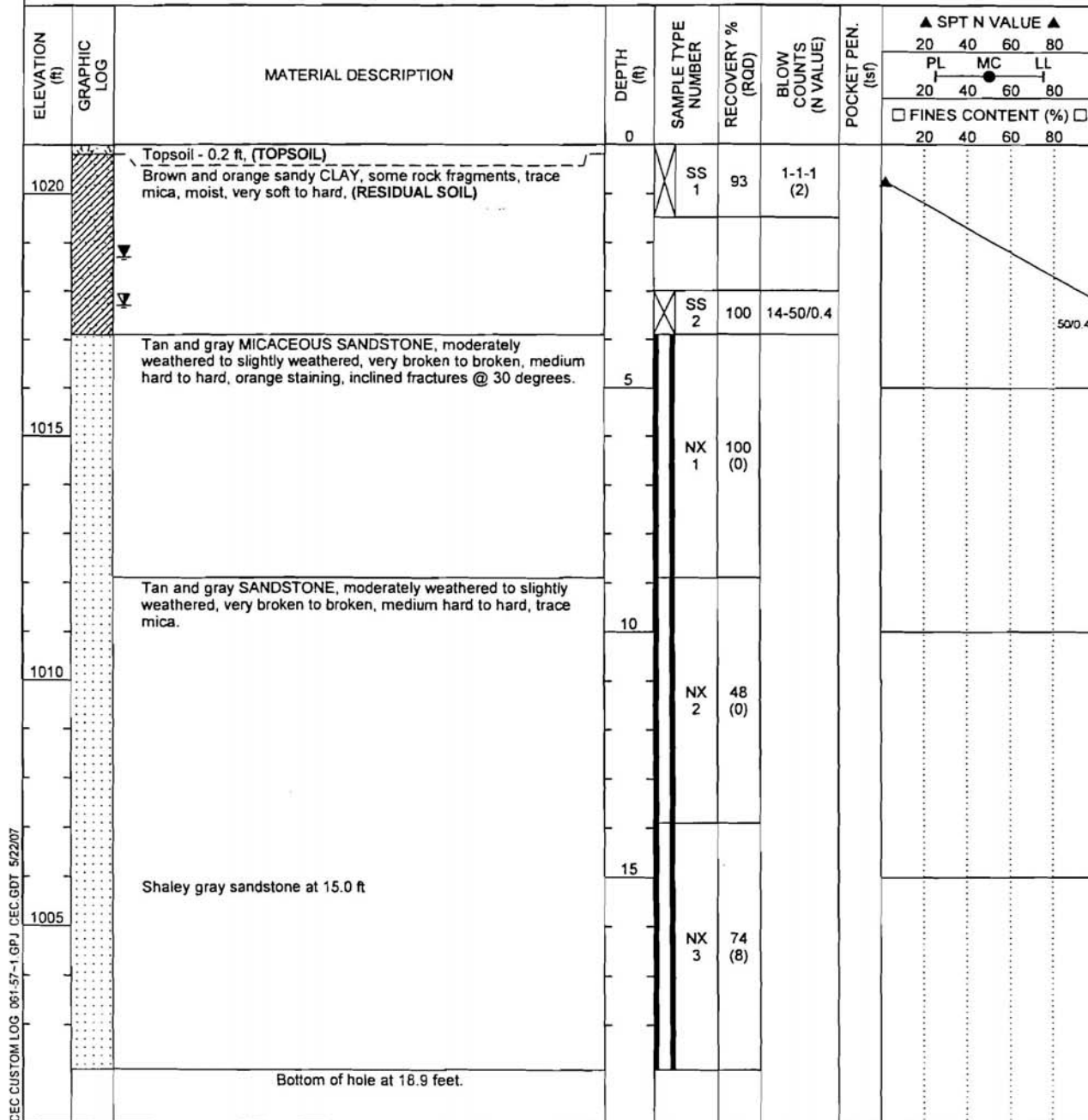


Civil & Environmental Consultants, Inc.
333 Baldwin Road
Pittsburgh, PA 15205

BORING NUMBER B-4

PAGE 1 OF 1

CLIENT <u>Foreman Architects Engineers</u>	PROJECT NAME <u>Additions to Waynesburg Central High School</u>
PROJECT NUMBER <u>061-577</u>	PROJECT LOCATION <u>Waynesburg, Greene County, Pennsylvania</u>
DATE STARTED <u>4/3/07</u> COMPLETED <u>4/3/07</u>	GROUND ELEVATION <u>1021 ft</u> BACKFILL <u>Cuttings</u>
DRILLING CONTRACTOR <u>Test Boring Services, Inc.</u>	GROUND WATER LEVELS:
DRILLING METHOD <u>Hollow Stem Auger & NQ Core</u>	BEFORE CORING <u>Dry</u>
CEC REP <u>EMJ</u> CHECKED BY <u>JFB</u>	▼ AT END OF DRILLING <u>2.3 ft / Elev 1018.7 ft</u>
NOTES <u>Automatic hammer</u>	▼ 24hrs AFTER DRILLING <u>3.3 ft / Elev 1017.7 ft</u>



CEC CUSTOM LOG 061-57-1.GPJ CEC.GDT 5/22/07