Project Overview

Background Summary

Highland Elementary School is a new 78,880 SF building housing 30 classrooms and standard elementary school facilities. It is located in Harmony Township, Ambridge, PA. The architectural design was created by a talented and experienced group of architects at Foreman Architects Engineers, Zelienople, PA. The facility was recognized in the *American School & University Architectural Portfolio 2003.* On the exterior, brick piers mimic smokestacks, reminiscent of steel mills and the American Bridge Company, namesake of the borough of Ambridge. Likewise, above the main entrance a suspension bridge-like structure is visible.

Rendering of front (north-east) facade

Ambridge Area School District (AASD) hired Foreman Program & Construction Managers (FPCM) for preconstruction and construction services. The Pennsylvania Department of Education's PlanCon process was followed and sixteen contracts were awarded (in addition to contracts for asbestos abatement and demolition of the former building on site.) Notices to Proceed were issued on 10 April 2003 and Substantial Completion was reached on 13 August 2004.

The Client

Ambridge is located north of Pittsburgh in Beaver County, Pennsylvania. Like many similar steel communities in the Pittsburgh area, Ambridge saw the departure of its main industry in the 1980s. The borough's namesake, the American Bridge Company, pulled out of town in 1983. Since then, the population in Beaver County has been declining steadily, falling 2.5% between 01 April 2000 and 01 July 2003. Crime rates are higher in Ambridge than the national average and the area can be described as economically depressed.

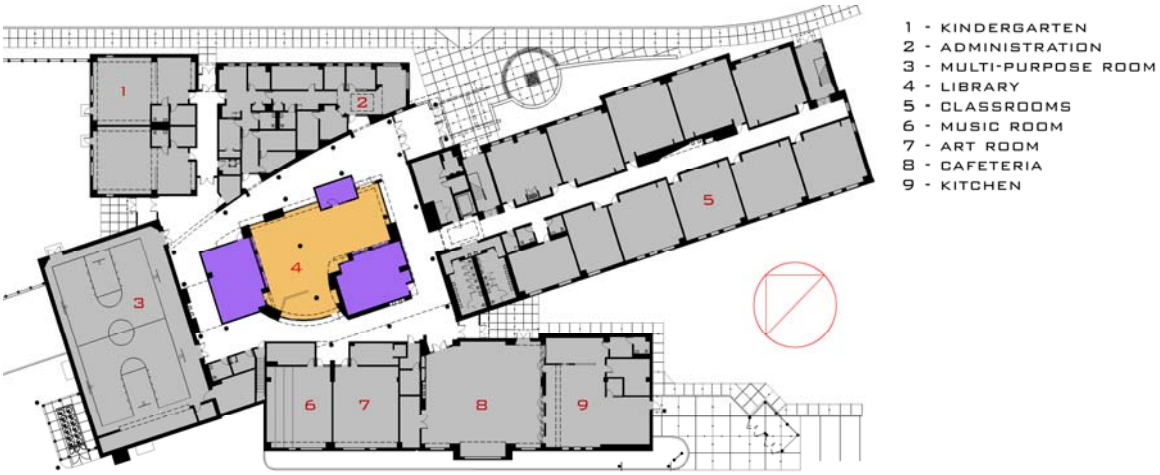
Ambridge Area School District adopted a program several years ago to consolidate from five to three elementary schools in the district. AASD also planned to replace their aging elementary buildings. This program was to result in a savings in their overall operations budget. The first phase of this program was completed in August 2002 with the opening of Economy Elementary School in Freedom, PA just a few miles north of the borough of Ambridge. Then, the former Highland Elementary was demolished in 2003 and a new building was completed in August 2004. In July 2004, the AASD school board approved plans to proceed with a new high school building.

Client Expectations

As a public school district, AASD was concerned about staying within both an inflexible budget and schedule. An amount for contingency was allowed in the budget to account for changes. Change order proposal costs were considered carefully over the course of the project as this contingency amount decreased. Delivering the project late was not a viable option as the first day of school had been established. No phasing plan was necessary.

The Owner and local authorities expected an incredibly safe site, as it is located within a dense neighborhood. The entire site was enclosed with fencing. *See site plan.* AASD held an owner-controlled insurance plan for the project; consequently, a safety inspection was conducted approximately every two weeks. Reports resulting from these inspections were sent to Foreman Program & Construction Managers personnel, who were also instrumental in maintaining a safe project.

Quality was also of importance to AASD and Superintendent Kenneth Voss. The building has a long life expectancy and early maintenance/repairs were not desirable. This is demonstrated in the selection of quality mechanical and kitchen equipment. AASD also wanted quality to be apparent to occupants and visitors, as reflected in their choices of interior finishes, i.e. the expensive, bright-hued polychromatic paint specified for interior spaces. Testing and inspection were required by the specifications for many materials and systems, from concrete to thermostat controls.



First Floor Plan

Location & Site

Months of discussion took place regarding the need for a new building and the location of this potential building. Two sites were considered in Ambridge, a new site on School Street and the site of the former Highland Elementary on Highland Avenue, the former being chosen. The new building's main axis differs approximately 30-degrees from the old building with a main entrance parallel to and facing Highland Avenue. It is located in Harmony Township, northeast of the Borough of Ambridge on a triangular site immediately bordered by small streets and surrounded by residential neighborhood.

Historical Consideration

In 1903, the American Bridge Company began operations in the area along the Ohio River formerly known as Economy Township. In 1905, the borough of Ambridge was incorporated and as American Bridge continued to prosper through much of the twentieth century, Ambridge continued to grow. The company was responsible for the production of steel for structures from suspension bridges and sports arenas to the Empire State Building and the Sears Tower.

Not unlike many similar steel communities in the Pittsburgh area, Ambridge saw the departure of its main industry and its namesake when the company pulled out of the town in 1983. Since the 1970s, the Ambridge Historic District and Historical Architectural Review Board have been active in preserving and restoring a portion of the borough east of Highland Elementary. The historical value of the former Highland Elementary building was a consideration, however, the School Board and Architect were able to conclude that the best option for a new school was to replace the current building at the existing site.

Rendering of Library

Design

Many of those involved in the project, including individuals from Foreman Architects Engineers, the Ambridge Area School Board and Ambridge Superintendent Mr. Ken Voss, strived to create a building design that would celebrate the history of the neighborhood without imposing on the landscape. The design encompassed new technology and forward-thinking by placing the library/media center and computer labs in a single story "learning core" at the center as part of the Public Wing. The more traditional three-story Classroom Wing houses the majority of the classrooms spaces. The two units are also unique structurally as the Public Wing is a steel structure with masonry backup and the Classroom Wing is a concrete block structure with steel joist and deck. The facility is 78,880 SF with a 28,860 SF footprint.

The façade of Highland Elementary is primarily concrete masonry units with face brick supported by caissons and grade beams in Unit A and by reinforced concrete footings in Unit B. Visual interest was added with two colors of face brick and several different brick patterns as well as accents of ground face CMU. Aluminum windows were specified and are often complimented by insulated metal panels or mineral fiber cement siding.

Now completed, the building is a patchwork quilt of vibrant colors on the inside and surrounded with visual interest on the exterior as Foreman Architects Engineers had promised with extensive and impressive computer renderings. Brick "columns" visible on the front façade are reminiscent of the steel mill smoke stacks once prevalent along the Ohio River Valley skyline. The cables and suspended deck at the front entrance mimic a bridge, paying homage to the American Bridge Company for which the borough of Ambridge was named. The building successfully exhibits fresh, new technology and design without losing sight of the area's history.

Building Systems

Electrical & Lighting

- 2000A main distribution panelboard
- 5 transformers in the bldg, 3 for emergency systems
- Most lighting 277/480V, receptacles 120/208V
- 3 phase, 4 wire
- One diesel emergency generator – 125kW/156kVA
- Typical classroom lighting – 32W T8 on 277/480V

Mechanical

- Various systems for different spaces:
  - UVs servicing all B-wing classrooms
  - 17 spaces heated with radiant panels
  - One AHU for administrative suite
  - Two hot water boilers, 3665 MBH output each
  - One 191 ton chiller
  - Five roof-top AHUs & nine blower coil AHUs
  - State-of-the-art controls & computer monitoring
- 2,920 SF basement mechanical room, adjacent maintenance & controls rooms
- Distribution mostly by rectangular sheet metal ductwork (interior--steel, exterior--aluminum), spiral steel ductwork used in exposed areas

Structural

- Unit A is a structural steel system
  - Bolted and welded connections
  - Crawler, lattice boom 50 ton crane
- Unit B utilizes masonry bearing walls

Project Team

Architectural: Foreman Architects Engineers – Zelienople, PA
http://www.foremangroup.com
Project Manager: Mr. John Hummel
Project Architect: Mr. Kevin Renwick

Construction Management: Foreman Program & Construction Managers – Zelienople, PA
http://www.foremangroup.com
Project Executive: Mr. John Kamer
Project Manager: Mr. Aaron Bernett
Site Manger: Mr. Dan Doyle
General Contractor: C&M Contracting – Pittsburgh, PA
Project Manager: Mr. John Cozza
Asbestos Consultants: AGX, Inc. – Wexford, PA
http://www.agxinc.com
Project Manager: Rich McVicker
Project Designer: Dan Winkle

Prime Contracts

As a public school building in Pennsylvania, Ambridge Area School District (AASD) was required to use multiple prime contractors to build the new Highland Elementary School. The Pennsylvania Department of Education specifies that school building projects have least four separate contracts: (1) general; (2) plumbing; (3) heating, ventilating and air conditioning; and (4) electrical. The PA Dept. of Education also requires a fifth prime contract for asbestos abatement.

Sixteen prime contracts were chosen for this project, in addition to asbestos abatement and demolition contracts:

1. General Construction Contact: John Cozza	C&M Contracting Pittsburgh, PA
2. Roofing Construction Contact: Jack Funovitz	Pennsylvania Roofing Systems, Inc. Bakerstown, PA
3. Aluminum Entrances/Storefronts Contact: Del Smith	Delrey Windows, Inc. Valencia, PA
4. Aluminum Windows Contact: Del Smith	Delrey Windows, Inc Valencia, PA
5. Acoustical, Drywall & Plaster Contact: Ray Dohn	J.J. Morris & Sons Pittsburgh, PA
6. Ceramic & Quarry Tile Contact: Michael Fantin	Fantin Flooring Rankin, PA
7. Resilient Flooring & Carpeting Contact: Greg DeGol	DeGol Carpet Duncansville, PA
8. Painting Contact: Greg Manesiotis	L.G. Manesiotis & Co., Inc. Ingomar, PA

9. Visual Display Boards Contact: Betty Anderson	Polyvision, Inc. Clymer, PA
10. Food Service Equipment Contact: Doug Atwell	Commercial Appliance Contracts Grove City, PA
11. General Casework Contact: Betty Anderson	Polyvision, Inc. Clymer, PA
12. Library Casework Contact: Charles Leist	Reed Associates, Inc. Harleysville, PA
13. Plumbing Contact: Al Chlystek	Wheels Mechanical Contracting Pittsburgh, PA
14. Fire Protection Contact: Time Walsh	Preferred Fire Protection Pittsburgh, PA
15. HVAC Contact: Ed Weider	Weider Services Gibsonia, PA
16. Electrical Contact: Bob Monti	Allegheny City Electric Pittsburgh, PA

To manage these contracts and provide on-site management, AASD hired a construction management agency—Foreman Program & Construction Managers (FPCM), Zelienople, PA. Applications for payment, change orders and most correspondence to/from AASD from/to the contractors were conveyed through FPCM.

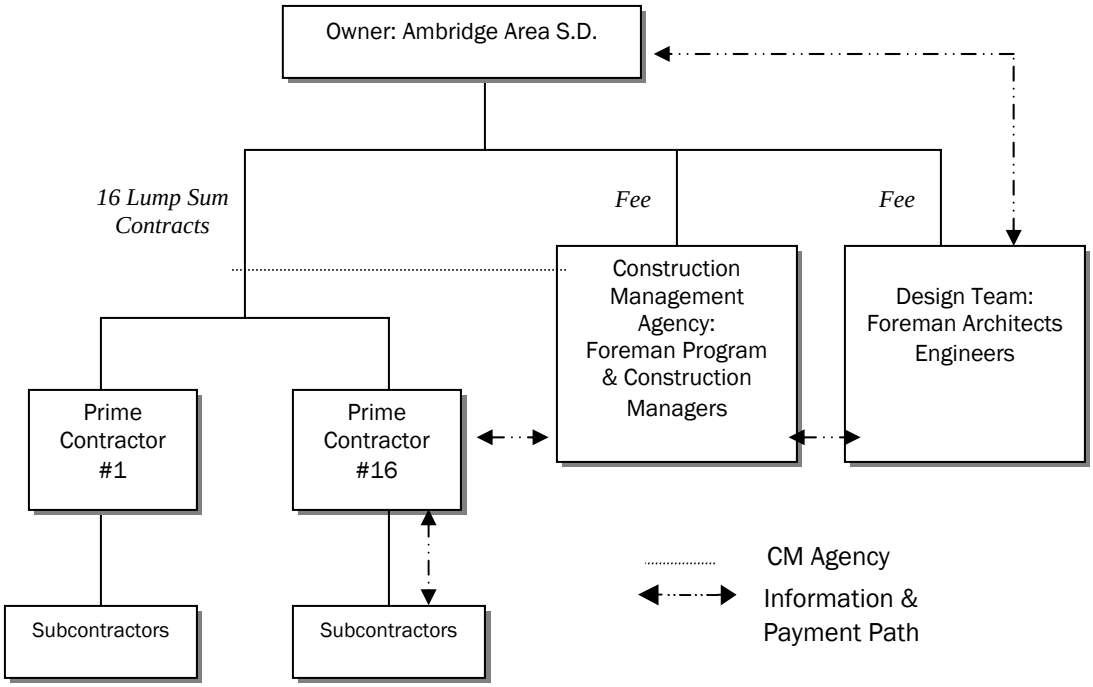
Owner Contracts

Construction Manager and Architect

The Ambridge Area School District held a contract for a set fee with the Construction Management firm, Foreman Program & Construction Managers. This contract included Preconstruction Services, such as value engineering studies and the completion of the Department of Education's PlanCon process, and Construction Services including project and site management. AASD also held a set fee contract with the Architect, Foreman Architects Engineers.

Prime Contractors

The contract for each Prime Contractor is based on AIA Document A201/CMa: General Conditions of the Contract for Construction, where the Construction Manager is not a Constructor. Some additions and deletions were made to this template document and noted as Supplementary Conditions. As a Pennsylvania public school project, it was required that Prime Contractors be selected by competitive hard bid. Low bidders were selected accordingly. An Owner Controlled Insurance Program (OCIP) was utilized covering builder's risk, workers' compensation, and commercial general liability. Contractors were responsible for commercial general (for off-site operations), automobile, aircraft, and asbestos/lead abatement liability.

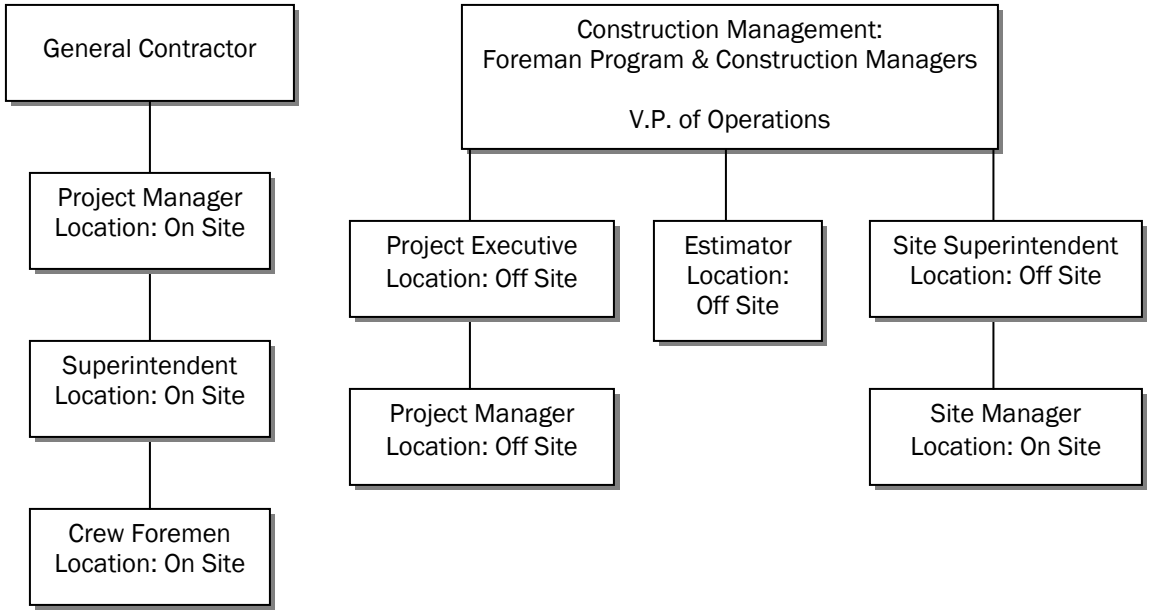


Organizational Chart

Communication

Typically, each of the Prime Contractor's personnel included an onsite crew foreman and a project manager who visited the site biweekly for the Job Conference meetings. Communication was common amongst onsite foremen and between the foremen and FPCM's site manager. Each foreman would also be in communication with his project manager, usually based in the contractor's main office with the exception of the general contractor's project manager who maintained an onsite office.

Project managers from different contractors would be likely to communicate amongst themselves as well as with the FPCM project manager. The Construction Management also had distinct lines of communication. The site and project managers were in daily contact regarding the project issues. The project manager and executive as well as site manager and superintendent also kept in contact.



Staffing Plan

Construction Coordination

Contractual Obligations

The contract of each prime contractor explains, "The Contractor shall be solely responsible for…coordinating all portions of the Work under this Contract, subject to overall coordination of the Construction Manager…" (Article 3.3.1) 3.10.2 goes on to clarify, "The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractors Work to avoid conflict, delay in or interference with the Work of other Contractors or the construction or operations of the Owner's own forces." 3.10.2.1 adds "The Contractor is financially responsible to the other prime contractors for undue delay caused by him to other prime contractors on the Project."

With regards to the Construction Management, the contract states, "The Construction Manager will provide for coordination of the activities of other Contractors and of the Owner's own forces with the Work of the Contractor, who shall cooperate with them." (Article 4.6.3) It also explains that the Construction Manager is responsible for compiling the Project Construction Schedule with the input of the Contractors' Preliminary Construction Schedules. (Article 3.10.2.1) This corresponds with Article 4.6.4 "Each Prime Contractor shall schedule and coordinate their activities with that of the other prime contractors in accord with the latest approved Project Construction Schedule."

Coordination Drawings

Specifications Section 01311: Project Coordination and Meetings
Original coordination drawings are to be furnished by the HVAC Contractor within 60 days after Execution of the Agreement or Notice to Proceed, whichever occurs first. Then, each Prime Contractor in turn has 14 days to add their particular trade items as they are agreed upon in coordination meetings.

Sequencing of drawing additions:

1. HVAC Contractor (prepares original coordination documents)
2. General Contractor
3. Plumbing Contractor
4. Fire Protection Contractor
5. Electrical Contractor
6. Food Service Equipment Contractor
7. Acoustical, Drywall, and Plaster Contractor

Once the last contractor has reviewed and approved the drawings, the HVAC Contractor must prepare and distribute a final reproducible systems coordination drawing, illustrating the work by each Prime Contractor.

Coordination: In Practice

Weekly coordination meetings or "foremen's meetings" were held at the FPCM site office trailer and facilitated by the FPCM Site Manager. A foreman or superintendent representing each onsite contractor, as well as any contractor who has work ongoing or upcoming within the next three to four weeks was required to attend. The meetings were used to discuss a two-week look-ahead schedule and any issues necessary to the group.

A set of coordination drawings was described above. These drawings in combination with the weekly coordination meetings created a coordinated MEP construction plan and minimized conflicts in the field. As a result, few minor MEP conflicts arose. Conflicts encountered between structural and MEP work were minor as well, although this could be where the greatest coordination challenges occurred. The most significant involved a conflict between the size of a load bearing CMU shaft and the duct. This issue was resolved quickly and work continued without considerable delay.

Cost Information

Bid Results (Including accepted alternates)			
Contract Number	Prime Contract	Contract Value	% of Total
401	GENERAL CONSTRUCTION	$ 4,955,200.00	46%
402	ROOFING CONSTRUCTION	$ 344,380.00	3%
403	ALUMINUM ENTRANCES & STOREFRONTS CONSTRUCTION	$ 183,700.00	2%
404	ALUMINUM WINDOWS CONSTRUCTION	$ 134,960.00	1%
405	ACOUSTICAL, DRYWALL & PLASTER CONSTRUCTION	$ 571,950.00	5%
406	CERAMIC TILE & QUARRY TILE CONSTRUCTION	$ 265,694.00	2%
407	RESILIENT FLOORING & CARPETING	$ 208,000.00	2%
408	PAINTING CONSTRUCTION	$ 94,685.00	1%
409	VISUAL DISPLAY BOARDS CONSTRUCTION	$ 74,640.00	1%
410	FOOD SERVICE EQUIPMENT CONSTRUCTION	$ 231,644.00	2%
411	GENERAL CASEWORK CONSTRUCTION	$ 264,649.00	2%
412	LIBRARY CASEWORK CONSTRUCTION	$ 66,750.00	1%
413	PLUMBING CONSTRUCTION	$ 572,500.00	5%
414	FIRE PROTECTION CONSTRUCTION	$ 110,100.00	1%
415	HVAC CONSTRUCTION	$ 1,503,638.00	14%
416	ELECTRICAL CONSTRUCTION	$ 1,176,000.00	11%
	TOTALS	$ 10,758,490.00	100%

Project Cost Evaluation

Construction Bid Cost	**$10,758,490**
- Sanitary Sewage (site cost w/in contract #413)	- 61,700
	$10,696,790
+ OCIP Cost	+ 191,369
= Construction Cost ($138.03 per SF)	**$10,888,159**
+ Architect's Fee (6% of Construction Cost)	+ 655,415
+ Moveable Fixtures & Equipment & Fee	+ 483,000
+ Architectural Printing	+ 24,950
+ Test Borings	+ 80,000
+ Site Surveys	+ 10,925
+ Site Costs	+ 70,547
+ Construction Manager Fee & Costs	+ 439,759
+ Demolition of Existing	+ 247,231
+ HVAC Balancing & Testing	+ 25,000
+ Local plan review, L&I, water tap-in	+ 89,627
+ Contingency	+ 376,000
+ Financing Costs	+ 1,166,357
+ Executed Change Orders	+ 136,980
= Total Project Costs ($186.40 per SF)	**$14,703,950**

Estimates

One estimate was created for Highland Elementary using D4Cost 2002 estimating software and the smart average feature. Four projects of new buildings similar to Highland were averaged to result in an estimate of **$8,413,873**.

Dillard Drive E.S.	83,580 SF	1 Floor	$6,463,515
Rancho Santa Fe E.S.	81,600 SF	1 Floor	$5,778,000
Rising Star E.S.	80,000 SF	1 Floor	$4,788,976
Reid Park E.S.	83,500 SF	1 Floor	$4,578,635

Square Foot Estimate

R.S. Means 2003 data was utilized to create a square foot estimate. Because of the building's three stories, a 2-3 story Jr. High School building was chosen as the model. An adjustment was made to account for 57% of the structure being CMU bearing and 43% steel. Adjustments were also made to reflect perimeter and story height differences, and a lump sum additions were also made. This resulted in a total estimated cost of **$8,959,057** or $114 per SF.

Why the difference?

Structural system: Bid cost $3,087,530; D4 $2,173,680; Means $2,647,861

Highland E.S. is unique in that it has two different structures attached to each other, the 3-story B-wing with masonry-bearing and the 1-story A-wing with steel. The coordination of these systems and complex geometry of the building could explain the low estimates.

Mech/plumbing system: Bid cost $2,076,138; D4 $1,444,882; Means $2,006,202

From the data provided about the D4 model buildings, the differences in mechanical systems between the model buildings and Highland E.S. were not apparent. One differing characteristic is that the model buildings were located in Kansas, North Carolina, and Arizona, areas with quite different climates than southwestern Pennsylvania.

Electrical system: Bid cost $1,176,000; D4 $875,300; Means $943,353

Each classroom in Highland E.S. has several data outlets, two television outlets and a public address call box and speakers. In addition, there are two computer labs and a library with data outlets, as well as a security system with motion sensors and CCTV surveillance. It appears that neither the R.S. Means nor the D4 estimates account for an electrical system of this scale.

General Conditions Estimate

An estimate for general conditions was created using R.S. Means estimating guides and actual project data. The result is a total estimate of $376,448 including approximate variable costs of $8025 per month. Also, information from the Specifications was compiled to detail the General Contractor's temporary facilities obligations. As not all of these specified items were actually utilized on the project or required by the Construction Manager/Architect, an estimate was not created for these items.

General Contractor			
Project Management	$6500 /mo	16 mos	104,000
Supervision	$6000 /mo	16 mos	96,000
Bonds	LS		48,000
Road Bond	LS		200
Site Survey	LS		2,500
Layout/Engineering	LS		3,750
Schedule	LS		5,000
Submittals	LS		7,200
Mobilize Trailers	LS		5,014
Field Offices	LS		6,000
Temporary Fence	$6 /LF	200 LF	1,200
Phone Service	$600 /mo	16 mos	9,600
Sanitary	$150 /mo	16 mos	2,400
Mobilize Excavator	LS		9,211
Silt Fence	LS		6,350
Parking, Entrance, Laydown	$1.25 /SF	42000 SF	52,500
Utilities			
Temp Electricity	$105 /mo	15 mos	1,575
Temp Heating/Ventilation	$10 /CSF	764 CSF	7,640
Temp Lighting & Outlets	$9.50 /CSF	764 CSF	7,258
Temp Water	$70 /mo	15 mos	1,050
Monthly Costs: $8025 /mo			**Total Cost: $376,448**

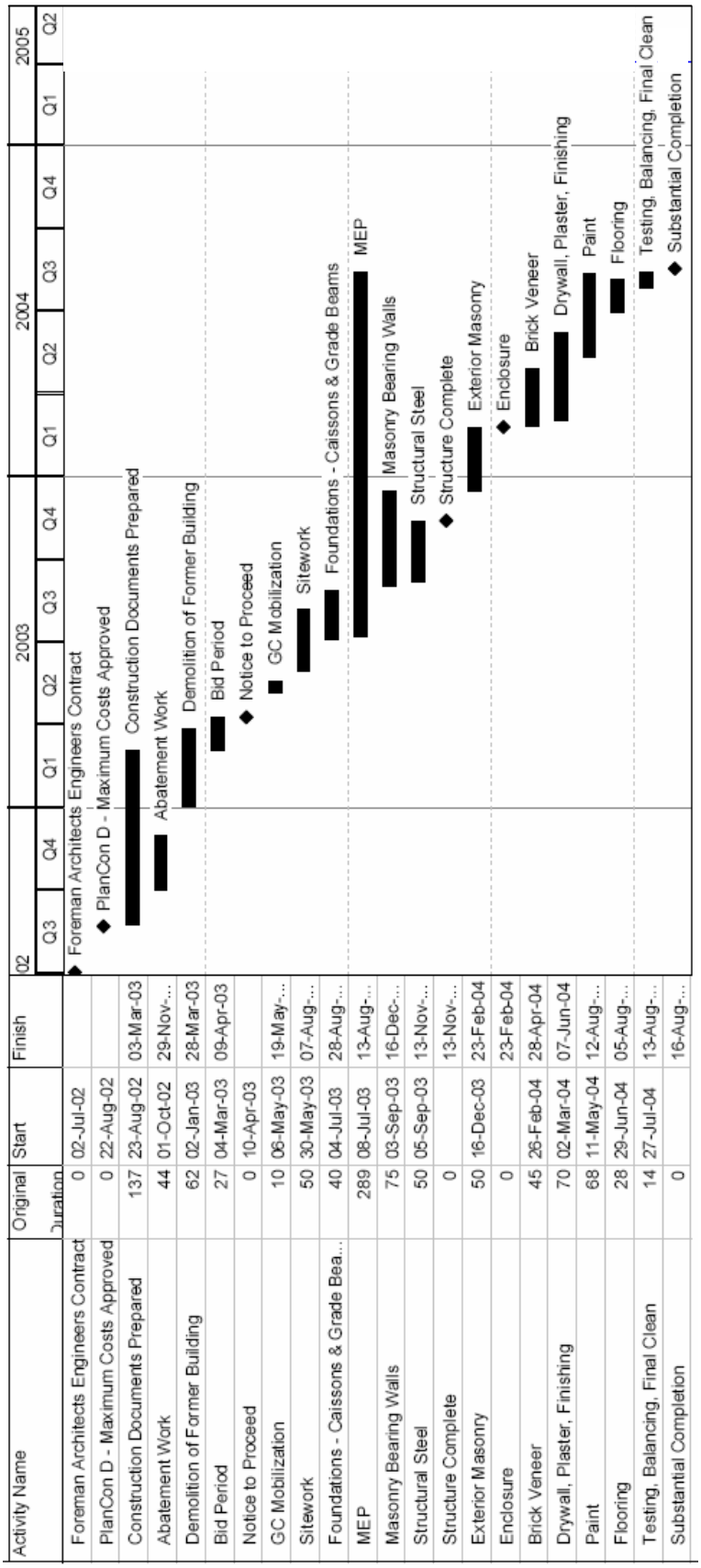
Schedule

Construction Dates: May 2003 through August 2004

Groundbreaking – May 2003
Concrete foundations – June through August 2003
Concrete masonry structure – September through December 2003
Structural steel frame erection – September & October 2003
Plumbing/HVAC/Elec. system backbone – December 2003 through March 2004
Veneer brick & windows/curtain wall – January through March 2004
Interior finishes – March through August 2004

Project Schedule Summary

See next page.



Activity Name	Original Duration	Start	Finish
Foreman Architects Engineers Contract	0	02-Jul-02	
PlanCon D - Maximum Costs Approved	0	22-Aug-02	
Construction Documents Prepared	137	23-Aug-02	03-Mar-03
Abatement Work	44	01-Oct-02	29-Nov-...
Demolition of Former Building	62	02-Jan-03	28-Mar-03
Bid Period	27	04-Mar-03	09-Apr-03
Notice to Proceed	0	10-Apr-03	
GC Mobilization	10	06-May-03	19-May-...
Sitework	50	30-May-03	07-Aug-...
Foundations - Caissons & Grade Bea...	40	04-Jul-03	28-Aug-...
MEP	289	08-Jul-03	13-Aug-...
Masonry Bearing Walls	75	03-Sep-03	16-Dec-...
Structural Steel	50	05-Sep-03	13-Nov-...
Structure Complete	0		13-Nov-...
Exterior Masonry	50	16-Dec-03	23-Feb-04
Enclosure	0		23-Feb-04
Brick Veneer	45	26-Feb-04	28-Apr-04
Drywall, Plaster, Finishing	70	02-Mar-04	07-Jun-04
Paint	68	11-May-04	12-Aug-...
Flooring	28	29-Jun-04	05-Aug-...
Testing, Balancing, Final Clean	14	27-Jul-04	13-Aug-...
Substantial Completion	0		16-Aug-...