CAREY L. STECKLER
HIGHLAND ELEMENTARY SCHOOL
ADVISOR: DR. RILEY

TECHNICAL ASSIGNMENT 1

04 OCTOBER 2004

CONTENTS

A. EXECUTIVE SUMMARY

Through research for this technical assignment, many things were learned about the Highland Elementary School project. Highland Elementary is a new 78,880 SF building housing 30 classrooms and standard elementary school facilities. It is located in Harmony Township, Ambridge, PA. Several feasibility studies were conducted before the conclusion was made that a new school building was in the best interest of the community.

The architectural design was created by an experienced group of architects at Foreman Architects Engineers and 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.

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 18 contracts were awarded (including asbestos abatement and demolition of the former building.) Notices to Proceed were issued on 10 April 2003 and Substantial Completion was reached on 13 August 2004.

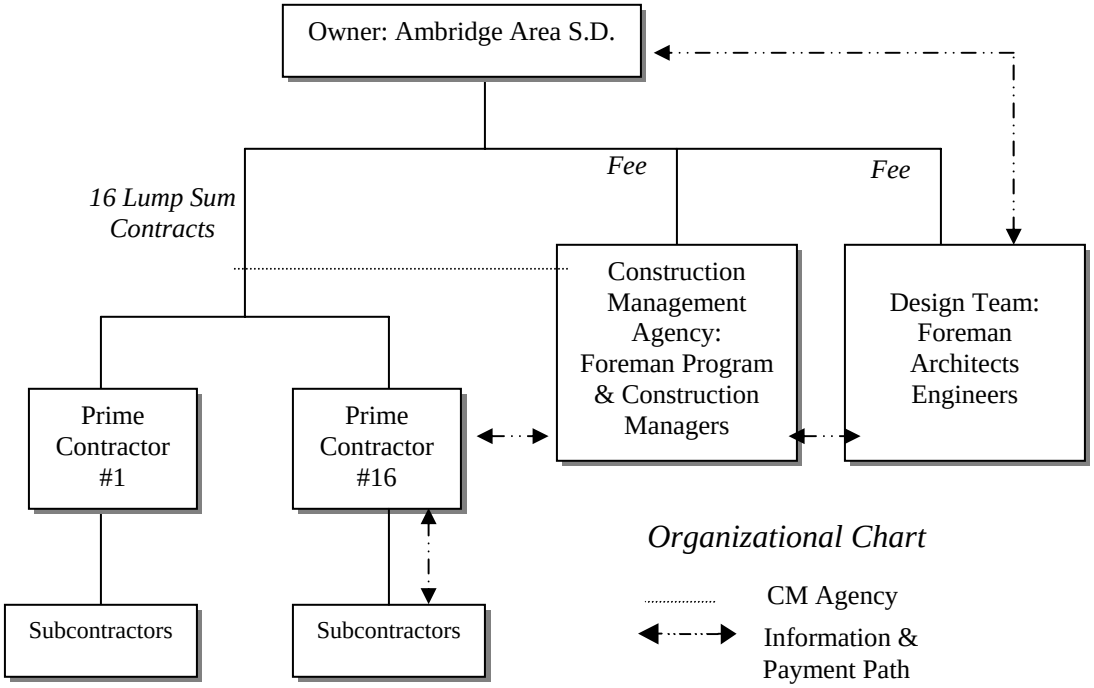
B. PROJECT DELIVERY SYSTEM

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 Foreman Program & Construction Managers (FPCM) as a construction management agency. Applications for payment, change orders and most correspondence to/from AASD from/to the contractors was conveyed through FPCM.



Design Team: Foreman Architects Engineers – Zelienople, PA
Main Contact: Kevin Renwick, Project Manager

CM Firm: Foreman Program & Construction Managers – Zelienople, PA
Main Contact: Aaron Bernett, Project Manager

C. PROJECT SCHEDULE SUMMARY - *See schedule next page.*

Schedule Notes - Key Elements

Foundation: Unit A—Excavation, reinforcement and construction of caissons
Excavation and construction of basement
Unit B—Excavation, reinforcement and construction of grade beams

Structural: Unit A—Structural steel, slab on grade, joists, roof deck
Unit B—CMU bearing walls, slab on grade, floor decks, joists roof deck

Finishes: Drywall, flooring, paint, casework

SCHEDULE HERE

D. BUILDING SYSTEMS SUMMARY

Y	N	Work Scope	If yes, address these questions / issues
X		Demolition Required?	• In initial building investigations by FAE, asbestos was found in several places such as floor tile adhesive and pipe insulation. • Asbestos contractor removed the identified materials before building demolition.
X		Structural Steel Frame	• Unit A is structural steel, erected in typical fashion, bolted and welded connections. • Crawler, lattice boom 50 ton crane. • Guy cables used for additional temporary bracing. • Five different crane locations were necessary—indicated on site plan.
X		Cast in Place Concrete	• Grade beams and foundation walls primarily utilized prefabricated panel forms. In locations where the panel use was not possible wood forming was used. • Concrete placed by chute from truck or pump.
X		Precast Concrete	• Exterior window sills and wall caps only. • Sills installed as part of masonry construction. Sit on top of flashing, which extends thru wall. • Wall caps set with mortar as part of masonry construction. • Placed by hand or lift.
X		Mechanical System	• 2,920 SF basement mechanical room, adjacent maintenance & controls rooms. • 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 • Distribution mostly by rectangular sheet metal ductwork (interior—steel, exterior—aluminum.) Spiral steel ductwork used in exposed areas. • Wet pipe sprinkler coverage of entire building. • Dampers in ductwork as required by code.
X		Electrical System	• 2000A main distribution panelboard. • 5 transformers in the bldg, 3 for emergency systems. • Most lighting 277/480, receptacles 120/208. • 3 phase, 4 wire. • Typical classroom lighting – 32W T8. • One diesel emergency generator – 125kW/156kVA.

X		Masonry	• Unit A: Steel Structure – masonry veneer—CMU w/ brick façade on exterior. • Unit B: CMU load-bearing walls, interior & exterior. • Walls bonded together with Z bars, toothed together every-other course. • Brick ties adhere bricks to CMU backup. • Steel scaffolding utilized w/ 2x10 planks, 4 levels high. • Brick work during January '04—enclosed scaffolding.
X		Curtain wall	• 5 locations—3 stairwells & 2 vestibules. • Materials: Aluminum frame, trim & break metal; steel reinforcement within frame; glazing. • Basic design & details by FAE in construction docs. • Contractor must submit shop drawings for approval. • Manufacturer to provide installer with instructions. • Frame shop-fabricated and stick-build in field; glazing installed by separate crew after frame assembly.
X		Support of Excavation	• Ditch/trench boxes suitable support for all excavation. • No dewatering necessary.

E. PROJECT COST EVALUATION

Bid Results (Including accepted alternates)			
Contract	**Prime Contract**	**Contract Value**	**% of Total**
401	GENERAL CONSTRUCTION	$ 4,955,200.00	46%
402	ROOFING CONSTRUCTION	$ 344,380.00	3%
403	ALUMINUM ENTRANCES AND 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%
	TOTAL BID COST	**$10,758,490.00**	**100%**

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**
+ Design, Construction Management, Demolition, Site Costs, etc.	+ 3,678,811
= Total Project Costs ($184.67 per SF)	**$14,566,970**

- **Mechanical** (HVAC + Plumbing): $2,014,438 = $25.54 per SF
  Does not include sanitary sewage disposal—considered a site cost.
- **Electrical:** $1,176,000 = $14.91 per SF
- **Structural System:** $3,087,530 = $39.14 per SF
  Per C&M Contracting Schedule of Values

Parametric Estimate

An 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.

F. SITE PLAN OF EXISTING CONDITIONS - *See site plan next page.*

SITE PLAN

G. LOCAL CONDITIONS

The design and construction of Highland E.S. was fairly typical of projects in southwestern Pennsylvania. Steel products and concrete are readily available and both are used for buildings in the area. The soil is suitable for basements and excavation is not usually difficult as the soil is often clay. On this site, borings showed fill material from the surface to around 9 to 15 feet, with residual material of siltstone or clay below.

Parking for construction was available on the site, but because of the limited area, overflow parking was allowed on the neighboring streets. Area officials and neighbors were very understanding through the project. AASD signed an Excess Maintenance Agreement in which they agreed to create an escrow account to hold money in the event the Harmony Township road repair was necessary as a result of construction traffic.

Tipping fee per dumpster averaged $400. During demolition, the demo contractor had to be careful to separate clean waste/debris from any hazardous material. These went to two different landfills. Steel was also separated out for recycling.

H. CLIENT INFORMATION

History

Ambridge is located north of Pittsburgh in Beaver County, Pennsylvania. Not unlike many similar steel communities in the Pittsburgh area, Ambridge saw the departure of its main industry in the 1980s as the borough's namesake, the American Bridge Company, pulled out of town in 1983. 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.

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.

Meeting Owner Satisfaction

Keys to meeting the satisfaction of the AASD school board have been to meet the expectations they have regarding budget, quality and time. To coordinate between contractors, design personnel, and AASD, the school board hired a construction agency, FPCM. FPCM was instrumental in representing the school board's interests in proceeding with a minimum number of change orders, achieving a high quality of construction, and delivering the project in time for the start of school in August 2004.