

KIMBERTON ELEMENTARY SCHOOL

EAST PIKELAND TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA

THESIS BREADTHS All the Knowledge of AE



CONSULTANT: DR. JOHN MESSNER

FRIDAY DECEMBER 12TH, 2008





KIMBERTON ELEMENTARY SCHOOL

EAST PIKELAND TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA



ARCHITECTURE:

- •650 students Elementary
- Two main wings: Classroom and Activities
- 30 750 SF classrooms
- •2 computer labs
- •3000 SF media center
- 650 seat auditorium/cafeteria
- •6000 SF gymnasium with full basketball and volleyball courts

BUILDING ENVELOPE:

 Masonry Veneer Exterior •Split face block on first floor •Green cementitious siding used on second floor

top of the classrooms, media center, gymnasium, and entry •White single-ply membrane flat roof on remainder of building

•Size: 104,000 sq ft - Two Stories

- •Construction: July 2008 Jan 2010
- Construction Cost: \$25.5 Million
- ·Delivery Method: Design-Bid-Build with Multiple Prime and CM Agency

STRUCTURAL:

- Structural Steel Building
- •1.5" 20 GA composite deck with
- 2.5" of NW concrete
- Classroom live load is 40 PSF
- •Asphalt shingled gabled roof on •Most columns are HSS8x8x1/2
 - Spread footing support columns
 - •First floor is 4" cast-in-place concrete slab with 6x6 W2.9xW2.9WWF

MECHANICAL:

- •Water source heat pump
- Individual heat pumps for each classroom housed in the second floor mechanical room
- •6 water source heat recovery units manufactured by Des Champs housed on the roof
- •Originally designed as geothermal heat pump

PROJECT TEAM:

96

- •OWNER: Phoenixville Area School District
- CONSTRUCTION MANGER: Foreman Program and Construction Managers
- ARCHITECT: Gilbert Architects
- •STRUCTURAL: Baker, Ingram, & Associates
- •M.E.P.: Snyder Hoffman & Associates

ELECTRICAL:

- •Disturbed through building at 480/277V Supply Voltage is 33KV
- •5 Local Transformers step down to 208/120V
- Lighting uses 277V
- 125 KW Backup Generator
- •40 panel boards located throughout school

LIGHTING:

- 59 lighting types
- •Classrooms use 3 32W T8 lamps
- Switching allows for 3 light levels
- The media center contains pendent and drop lights
- •Gymnasium lighting is produced by high bay fluorescents
- Cafeteria/auditorium has dimmable metal halide lights







HTTP://www.engr.psu.edu/ae/thesis/portfolios/2009/rgk5000/

Executive Summary

Thesis Proposal

Executive Summary:

To replace the aging East Pikeland elementary school, the Phoenixville Area School District decided to build a 650 student elementary school on a fallow site next to the Kimberton Fair Grounds. Because of delays due to site containments, the proposed completion date was pushed back to January 2010. The cost of construction including all fees was \$27.7 million (\$270 dollars per square foot) plus \$2 million for the site.

The site of Kimberton is complicated by the site closure plan. This project was cancelled due to contaminated groundwater underneath the proposed site. The site contained VOCs such as trichloroethylene, dichloroethylene, and vinyl chloride in aquifers 180 feet below the surface. The school board decided in June of 2008 to suspend the project and abandon the site at Kimberton. It is this cancellation that has played a critical role for a number of the analyses to be preformed during my senior thesis.

Schedule Acceleration during Site Closure Plan

The site closure plan is one of the biggest risks to the schedule due to possible unforeseen conditions. For this analysis I will detail the schedule of the site closure plan and look for alternate methods of site closure. Presumably other methods will impose less risk to the schedule. I will document the differences using 4D scheduling. If the schedule can not be reduced using an alternate method, then I will look for way to reduce the project schedule in general possibly using short interval production scheduling.

Evaluation of Alternate Site

An elementary school still needs to be built for the school district. An alternate site needs to be selected for the school. To relocate this building I will consider a number of factors including, building aesthetics, location on site, mechanical system to be used, soil and foundation system and other construction related factors. These analyses will include structural mechanical and architectural breadths.

Alternate Building Exterior Envelop

Due to delay in construction the masonry construction of the building will take place during the winter months. I will consider using precast concrete to replace the exterior masonry. This study considers which precast panels to use, cost of switching the system, and the possible schedule savings. Tying into my graduate education, I will use BIM to assist in the different analyses.

Integrated Project Delivery

Currently the construction industry is being transformed by the Integrated Project Delivery method. PA law requires multiple prime contracts as the project delivery method for schools. This method leads to extra changes. I will research if there is anyway to bring the contractors in early to have a method similar to integrated project delivery. This research will most likely result in an entirely new delivery method for projects.

Overall my thesis will incorporate the knowledge I have gained in my entire architectural engineering education at Penn State. It will focus in the areas of Critical Issue Research, Value Engineering Analysis, Constructability Review, and Schedule Reduction /Acceleration Proposal. My thesis will also consist of investigations based on my graduate level studies.

onstruction Option: Messner

Breadth Studies

Architectural Breadth

The evaluation of an alternate site is very architecturally intensive. First I will need to locate the building aesthetically on the site as well as the best location for environmental gain. I will need to architecturally review the building to make sure that it will fit the site in the first place. Modification may be necessary. I will also evaluate the floor plan to see if the functionality is still maintained. Additionally the site will also have to be completely redeveloped to make sure that it incorporates all the uses of the original site plan.

My study into an alternate exterior enclosure will have to consider the aesthetics of the proposed precast concrete systems. This will need to be considered at both locations and it will be very important to maintain the architect's original image of the elementary school.

Mechanical Breadth

When relocating the building it may be feasible to return to the originally proposed system of geothermal heat which was changed due to site contamination. This will involve reviewing the design and making the necessary changes to use geothermal heat. I would also evaluate the life cycle cost of the system. I would also need to locate the geothermal wells on the site and make sure they are up to the requirements of the system.

In addition to the relocation of the building, the analysis of an alternate building enclosure system would have to consider thermal heat gain and loss based on the system's heat transfer rates. If the R-value is significantly higher, it may be possible to reduce the size of the HVAC system.

Structural Breadth

When evaluating the alternate site, the structural stability of the foundation will need to be confirmed because of different site soil bearing capacity. I will need to check these soil conditions and make sure the soil bearing capacity is at least as high as the original site. If it is not as high I will have to redesign a few of the footers and possibly use those changes to scale the other footers to the proper size. Depending on the soil type this could be a simple analysis or a very complex analysis.

Overall, my thesis investigations will require a very well rounded breadth of architectural knowledge and is not just limited to my understanding of building construction.