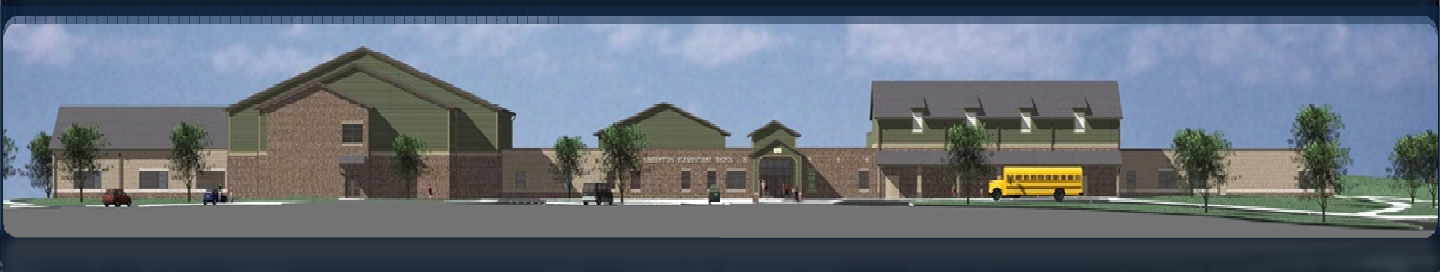


KIMBERTON ELEMENTARY SCHOOL
EAST PIKELAND TOWNSHIP, CHESTER COUNTY, PA



RALPH GARY KREIDER - 2009 AE SENIOR THESIS
APRIL 14TH, 2009 - CONSTRUCTION OPTION - MESSNER



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KIMBERTON ELEMENTARY SCHOOL

PROJECT BACKGROUND

Owner:	Phoenixville Area School District
Function:	1st – 5th grade elementary school
Area:	103,000 Square Feet on 2 stories
Construction Cost:	25.5 million dollars
Construction Period:	July 2008 – January 2009
Program:	Foreman Program and Construction Management
Architect:	Gilbert Architects

*never completed



PROJECT BACKGROUND

BUILDING SYSTEMS

Architecture:

1 Classroom – 650 Student Building

Two Main Wings: Classroom and Activity Wing

Structural Steel Building with Spread Footings

Water Source Heat Pump with Individual Heat Pumps in Room

Electrical System is Typical for an Elementary School

Different Types of Light Fixtures with Tandem Wiring



PROJECT BACKGROUND

SITE CONTAMINATES

0s and '60s dump for household municipal waste
so a dumping site for construction waste until 19

Required Site Closure Plan:

8,500 CY to be excavated – 3.85 acres – 61,000 SF

Removed until bedrock Approx. 4ft -10ft below grade

6,300 CY contaminated – remove for site

2,125 CY can be used for fill

Bring to grade and cover with liner and 2 ft of topsoil



PROJECT BACKGROUND

KIMBERTON SUPERFUND SITE

located Across Cold Stream Road

**previous owner from '47-'59 disposed of residues in lagoons on site which leached into groundwater
carcinogens detected in '81 when monitoring wells installed**

**began removing contaminates by air stripping in 1981
'92 public water system was built to avoid groundwater**

three Carcinogens of Concern

trichloroethylene, dichloroethylene, and vinyl chloride



PROJECT BACKGROUND

KIMBERTON SUPERFUND SITE

Installed additional monitoring wells
Hazardous levels found 180ft below grade
Only trace amount found on surface
Vapor mitigation system at precautionary measure
His expert states "The science clearly supports the
Conclusion that the Kimberton Elementary School c
ould be built at the proposed site without unacceptable risk
of vapor intrusion."



PROJECT BACKGROUND

KIMBERTON SUPERFUND SITE

On Thursday June 19th, 2008, the great
Philadelphia are woke up with...

Later that evening the Board voted 6-2

Reject all bids

Abandon the site

Parents celebrated "victory"



THESIS THEME

WHAT HAPPENS NOW?

What does the school district do now?

**School needs to be built to replace East Pikeland
cannot use Kimberton site**

Cost about 3.8 million dollars so far

**Includes land purchase, design and consultants' fees,
environmental remediation of site.**

My thesis is based around the school districts quest

“What to do?”



RELOCATING OF BUILDING

LOCATE NEW SITE

Options Now Include renovating East Pikeland or Bimberton design on East Pikeland or Meadow Brook Golf Course

**Discussed as an original possible site by school district
Neighbors the High School and Middle School
Additional 50 acres to expand campus**

- **Eliminates the nine-hole recreation area**
- **Site is expensive**
- **2.5 Miles From Kimberlin**
- **Redrawing district lines**



RELOCATING OF BUILDING

NEW SITE CONSIDERATIONS

Site Survey

Different Topography

Need for New Site Plan

Grading of Site

Site Layout

Permitting

Local Permits

Penn Dot Permits

Soil and Erosion Permits



RELOCATING OF BUILDING

NEEDS OF A NEW SITE PLAN

Parking – 150 spaces + 50 Overflow spaces

Bus Drop Off Stalls – 11 Stalls

Hard Surface Multipurpose Recreation – 39000 Sq Ft

Soft Play Ground Surface – 2717 Sq Ft + 3750 Sq Ft

Softball/ Kickball Field – 30,000 Sq Ft

Tennis Field – 22000 Sq Ft

Soccer Field (185' x 300')

Retention Area (at least 15% of impermeable surface)



RELOCATING OF BUILDING

LOCATION OF THE BUILDING

Based on Middle School and High School Location

Minimizing Excavation to Site

Solar Considerations

Vehicle Access

Multiple Locations Considered



RELOCATING OF BUILDING (BREADTH)

VIEWS OF NEW SITE PLAN

Exceeds site requirements

Building separated from rest of schools to prevent interaction

Building orientation allows for daylighting

Additional varsity soccer and baseball field

Fields can be used all schools

Retention basins double as outdoor classroom and practice field



RELOCATING OF BUILDING (BREADTH)

VIEWS OF NEW SITE PLAN

Classroom wing separated from Pothouse Road by trees and landscape

Site entrance does not interfere with Pothouse Road

Four-Way Intersection with Trofters Drive

Vehicle Traffic is separated from Students and Athletes
Separate bus and car loops



RELOCATING OF BUILDING

SOIL CONDITIONS

500 psf soil bearing capacity for Kimberton Site

500 psf soil bearing capacity for Meadow Brook site

3000 psf based on local geotechnical engineer

2500 psf used for extra precaution

A geotechnical report will have to be produced before building



FOUNDATIONS (BREADTH)

ASSUMPTIONS

500 psf soil bearing capacity for Kimberton Site
500 psf soil bearing capacity for Meadow brooks s
3000 psf based on local geotechnical engineer
2500 psf used for extra precaution
A geotechnical report will have to be produced before building
Ratio of Area of foundation to soil bearing capacity
for foundations
reinforcing changes are insignificant



FOUNDATIONS (BREADTH)

COST IMPLICATIONS

286 Cubic Yards of Concrete in Addition

Added approximately \$84,000 in Cost

Added 2 Days to the Schedule at 150 CY per Day

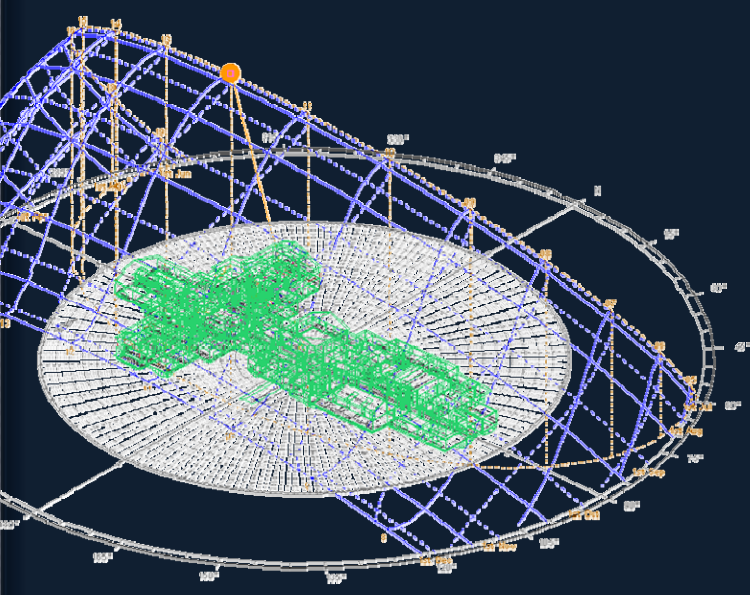
	Takeoff Quantity	Cost per Unit	Total
Final Strip Footing	314.26 CY	\$221.54 /CY	\$70,000
Strip Footing	460.45 CY	\$221.54 /CY	\$102,000
Difference	143.20 CY	\$0 /CY	\$3,000

	Takeoff Quantity	Cost per Unit	Total
Final Spread Footing	223.99 CY	\$363.40 /CY	\$81,000
Spread Footing	366.78 CY	\$363.40 /CY	\$133,000
Difference	142.78 CY	\$0 /CY	\$5,000



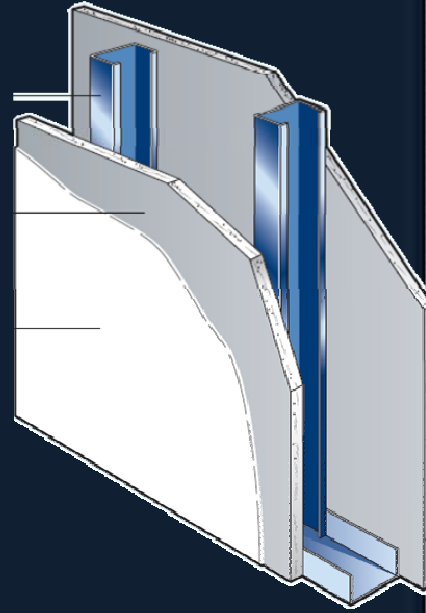
ADDING SUSTAINABILITY AND VE

Daylighting Study



Important Sustainable
Feature for Schools

Alternative Partitions



Constant Debate
School Construction



ADDING SUSTAINABILITY AND VE

DAYLIGHTING (BREADTH)

not considered by architect

GI 32 used to find out current daylighting

current classroom design does not offer much daylight

otect was then used

xported directly from Revit

asily displays solar angles

uilding shadows are all on the north



ADDING SUSTAINABILITY AND VE

DAYLIGHTING (BREADTH)

performed daylighting analysis of entire building
little daylighting inside building
gymnasium has some daylighting
media center has decent daylighting
classroom wing has very poor daylighting
overall Building not very well day it
will need to redesigned to add better daylighting
Light shelves, windows, shape/layout of building



ADDING SUSTAINABILITY AND VE

ALTERNATE PARTITION TYPE

MU is very costly and labor intensive

MU is more durable over time

drywall is less expensive and quicker to install

less durable over life cycle

Use High-Abuse Fiberock Panel by USG

Reduced Life-Cycle Cost

95% Recycled Material

Reinforced throughout entire panel

Improved constructability



ADDING SUSTAINABILITY AND VE

ALTERNATE PARTITION TYPE

9.56 per square foot of CMU Block Wall

\$2.45 per square foot for materials

\$7.90 per square foot for labor

4.30 per square foot of Fiberock on metal stud wall

\$1.21 per square foot for materials

\$3.40 per square foot for labor

Fiberock cost varied between \$.50 and \$.87 per sq ft (\$.80 used)

Fiberock is \$5.26 is less than CMU Block Wall

Fiberock is 45% of the cost of CMU Block Wall



ADDING SUSTAINABILITY AND VE

ALTERNATE PARTITION TYPE

Total Cost for Block is \$840,000

Total Cost for Fiberock is \$377,000

\$462,000 difference

ce	Area	Material cost/SF	Material	Labor Cost /SF	Labor	Cost / SF	Tot
	87,799	\$2.45	\$215,379	\$7.90	\$693,504	\$9.56	\$
CK	87,799	\$1.21	\$106,422	\$3.40	\$298,654	\$4.30	\$
e	0.00	\$1.24	\$108,956	\$4.50	\$394,850	\$5.27	\$
ge		49.1%	49.4%	43.1%	43.01	44.9%	

Differences in Price between Two Systems averaged with each Takeoff Method



ADDING SUSTAINABILITY AND VE

ALTERNATE PARTITION TYPE

500 Man-hours less for Fiberock than CMU Block

10 day less for a work crew of 10 people

Difficult to know the true affect on schedule because

project was not completed

	Square Feet	Hours / SF	Total Man-hours	D
	87,799	0.046	4039	
ock	87,799	0.108	9482	
ence	0.00	0.06	5,444	

ty Comparison of CMU and Drywall



ESTIMATING USING BIM

own conclusions.

rchitecture 2009



Autodesk

odesk.com

innovaya

Combining your vision with ours,
we innovate, with great passion...

www.innovaya.com



ESTIMATING USING BIM

TRADITIONAL ESTIMATING

knoken off with ruler and scale

l walls were assumed to be 14 feet tall

rices From RS Means

rea of 88,500 sq ft and 3.5 hours for takeoff

	Area	Material cost/SF	Material	Labor Cost /SF	Labor	Cost / SF	Tot
	88,474	\$2.45	\$217,035	\$7.90	\$698,838	\$9.56	\$
K	88,474	\$1.21	\$107,241	\$3.40	\$300,951	\$4.30	\$
e	0	\$1.24	\$109,794	\$4.50	\$397,887	\$5.27	\$
e		49.4%	49.4%	43.1%	43.1%	44.91%	

Summary between CMU Block and Drywall for Traditional Takeoff



ESTIMATING USING BIM

REVIT QUANTITY SCHEDULE

Created a schedule in Revit

Sorted by Wall type 3A – Interior CMU Wall

Exported to excel

7,000 sq ft – 15 minutes to perform takeoff

Area	Material cost/SF	Material	Labor Cost /SF	Labor	Cost / SF	Total
87,123	\$2.45	\$213,722	\$7.90	\$688,170	\$9.56	\$899,892
87,123	\$1.21	\$105,604	\$3.40	\$296,357	\$4.30	\$401,961
0	\$1.24	\$108,118	\$4.50	\$391,813	\$5.27	\$500,931
	49.4%	49.4%	43.1%	43.1%	44.9%	

Comparison Summary between CMU Block and Drywall for Revit Takeoff



ESTIMATING USING BIM

INNOVAYA

ya Composer for Revit

Unhandled exception has occurred in a component in your application. If you click Continue, the application will ignore this error and attempt to continue.

Retrieving the COM class factory for component with CLSID {FAA74A42-4366-405E-A47F-9D2186CAB475} failed due to the following error: 80040154.

[Details](#)

[Continue](#)

ave Since Repaired the Plug-in to work with Revit



ESTIMATING USING BIM

AUTODESK QUANTITY TAKEOFF

Publish Revit to 2D and 3D dwf

Breaks up by object types. i.e. walls, structural, floor

Open in Autodesk QTO take off wall type 3A

Easily see what is being takeoff

7,000 sq ft, 10+ hours learning, 30 minutes of takeoff

Category	Area	Material cost/SF	Material	Labor Cost /SF	Labor	Cost / SF	Total
CMU	87,123	\$2.45	\$213,722	\$7.90	\$688,170	\$9.56	\$899,892
Drywall	87,123	\$1.21	\$105,604	\$3.40	\$296,357	\$4.30	\$401,961
Subtotal	0	\$1.24	\$108,118	\$4.50	\$391,813	\$5.27	\$500,000
Percentage		49.4%	49.4%	43.1%	43.1%	44.9%	

Cost Summary between CMU Block and Drywall for Autodesk QTO



ESTIMATING USING BIM

COMPARING DIFFERENT METHODS

Manual Takeoff took the longest time at 3.5 hours

15 minutes for Revit Quantity Schedules

30 minutes for Autodesk QTO takeoff

Manual takeoff takes 14 times as long as Revit Schedules

Manual takeoff takes 7 times as long as Autodesk QTO

Use Revit Schedules for quick takeoffs (1 step process)

Use Autodesk QTO for entire building (2 step process)



ESTIMATING USING BIM

COMPARING DIFFERENT METHODS

only useful if accurate takeoff and comparable to actual
difference of 1,350 sq ft between methods
difference \$13,500 for Block and \$6,000 for Fiberon
automated takeoff 98.5% of manual takeoff
5% difference between the methods
could be good to use as verification on current estimates
BIM takeoff will be trusted as alternative to manual takeoff

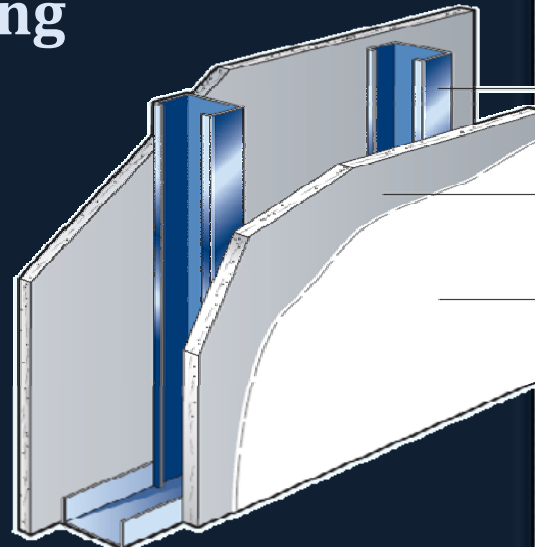
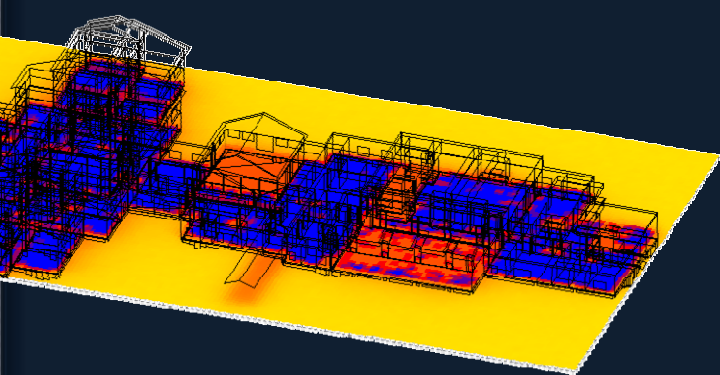


CONCLUSIONS

SUSTAINABILITY AND VALUE ENGINEERING

Currently very little lighting building will need configured for lighting to be feasible

- Recommend Fiberock Resistant Panels over block wall for cost and saving



FINAL THOUGHTS

PROJECT UPDATE

**Superintendent has since Retired
Business Manager has been Fired
New Superintendent Resigned
The School Board is Currently investing purchase of Site
The District has filed claims against Superintendent
Considering Claims Against Business Manager, Property
and People responsible for the contaminants**

**Not going to build the Elementary School
Moving Forward with Middle School Project
Dismissed Construction Manager for Association with Kin
seeking lost funds as per their contract**



FINAL THOUGHTS

LESSONS LEARNED

There No Such Thing as a Sure Thing!

Public Opinion Matters when Dealing with School Districts (Public Tax Money and Children)

Take Small Bites - Don't Try to Eat the Whole Thing

The Construction Business is More About Dealing with Different Personalities than Knowing the Technical Details

Don't Take Yourself Too Seriously



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QUESTIONS

THANK YOU!

