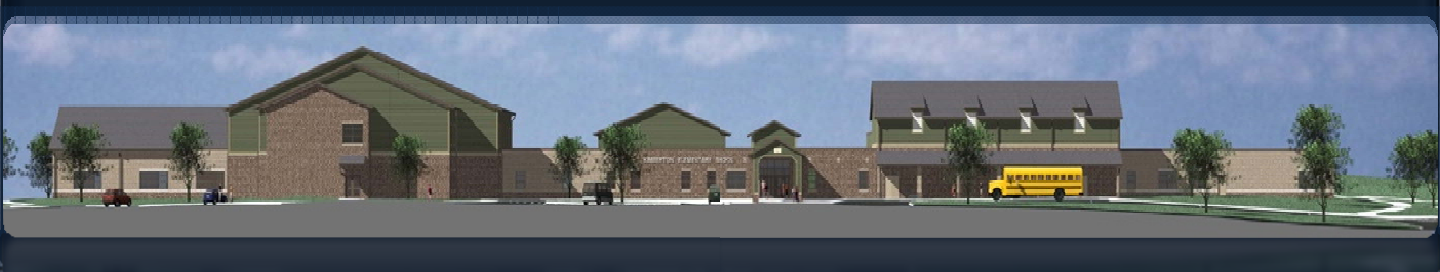


KIMBERTON ELEMENTARY SCHOOL  
EAST PIKELAND TOWNSHIP, CHESTER COUNTY, PA



RALPH GARY KREIDER - 2009 AE SENIOR THESIS  
APRIL 14<sup>TH</sup>, 2009 - CONSTRUCTION OPTION - MESSNER



KIMBERTON ELEMENTARY SCHOOL  
EAST PIKELAND TOWNSHIP, CHESTER COUNTY, PA



RALPH GARY KREIDER - 2009 AE SENIOR THESIS  
APRIL 14<sup>TH</sup>, 2009 - CONSTRUCTION OPTION - MESSNER



# KIMBERTON ELEMENTARY SCHOOL

## PROJECT BACKGROUND

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

\*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

50s and 60s used to dump household municipal waste  
site was also used as a dumping site for construction  
waste until 1990s

### 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 into 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**  
**This 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

Thursday June 19<sup>th</sup>, 2008 woke up with  
later that evening the Board voted 6-2

**Reject all bids**

**Abandon the site**





# 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**

**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 B  
Kimberton design on East Pikeland or  
Meadow Brook Golf Course**

**9 hole golf course**

**Discussed as an original possible site by school district**

**Neighbors the High School and Middle School**

**Additional Space To Expand Campus**

**50 Acres**

**2.5 Miles From Kimberton**

**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 of 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**

**Baseball 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 other schools in the area**

**Minimizing Excavation to site**

**Solar Considerations**

**vehicular 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**

**vehicular 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

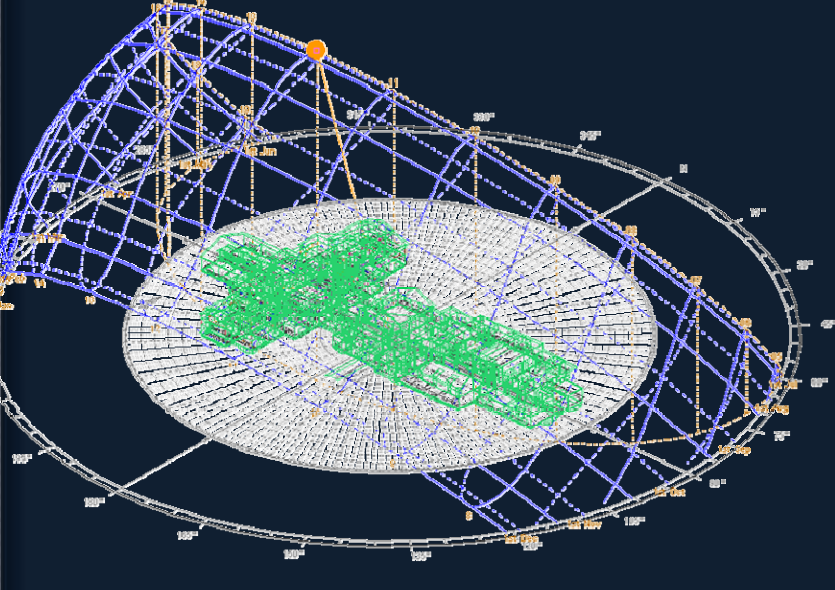
**286 Cubic Yards of Concrete in Addition**  
**Added approximately \$84,000 more in Cost**  
**Added 1.9 Days to the Schedule at 150 CY per Day**

	Takeoff Quantity	Cost per Unit	Total Cost
Final Strip Footing	314.26 CY	221.54 \$/CY	\$70,000
Strip Footing	460.45 CY	221.54 \$/CY	\$102,000
Concrete	143.20 CY	0 \$/CY	\$31,000
	Takeoff Quantity	Cost per Unit	Total Cost
Final Spread Footing	223.99 CY	363.40 \$/CY	\$81,000
Spread Footing	366.78 CY	363.40 \$/CY	\$133,000
Concrete	142.78 CY	0 \$/CY	\$51,000

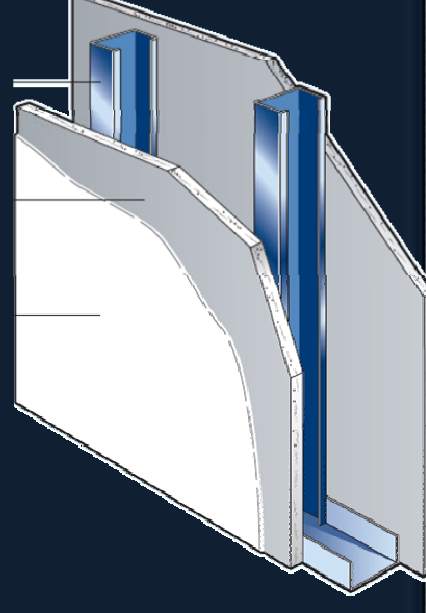


# ADDING SUSTAINABILITY AND VE

## Daylighting Study



## Alternative Partition



# ADDING SUSTAINABILITY AND VE

## DAYLIGHTING (BREADTH)

not considered by architect

CGI used to find out current daylighting

current classroom design does not offer much daylight

software was then used

exported directly from Revit

software easily displays solar angles

building shadows are all on the north



# ADDING SUSTAINABILITY AND VE

## DAYLIGHTING (BREADTH)

Daylighting analysis of entire building was performed

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 lit

Will need to be redesigned to add better daylighting

Light shelves, windows, shape of building



# ADDING SUSTAINABILITY AND VE

## DAYLIGHTING (BREADTH)

Building must be changed for daylighting be viable  
response Daylight by LedaLite may be possible if b  
reconfigured

ready installed in line of lighting fixtures

can be added to other lighting fixtures

no commissioning required

letter for construction



# 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 \$5.27 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**

Price	Area	Material cost/SF	Material	Labor Cost /SF	Labor	Cost / SF	Total
Block	87,798.64	\$2.45	\$215,378.84	\$7.90	\$693,503.89	\$9.56	\$838,882.73
FIBEROCK	87,798.64	\$1.21	\$106,422.49	\$3.40	\$298,654.10	\$4.30	\$377,000.00
Difference	0.00	\$1.24	\$108,956.36	\$4.50	\$394,849.80	\$5.27	\$462,000.00
Percentage		49.41%	49.41%	43.06%	43.06%	44.91%	

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	Days
	87,798.64	0.046	4038.737	50
Block	87,798.64	0.108	9482.253	11
Difference	0.00	0.06	5,443.52	

Cost Comparison of CMU and Drywall



# ESTIMATING USING BIM

own conclusions.



odesk.com

## innovaya

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

[www.innovaya.com](http://www.innovaya.com)



# ESTIMATING USING BIM

## TRADITIONAL ESTIMATING

Measured off with ruler and scale

Wall walls were assumed to be 14 feet tall

Prices From RS Means

Area of 88,473.90 sq ft and 3.5 hours for takeoff

	Area	Material cost/SF	Material	Labor Cost /SF	Labor	Cost / SF	Total
	88,473.90	\$2.45	\$217,035.32	\$7.90	\$698,837.63	\$9.56	\$915,872.95
CMU	88,473.90	\$1.21	\$107,240.98	\$3.40	\$300,951.05	\$4.30	\$408,192.03
Drywall	0	\$1.24	\$109,794.34	\$4.50	\$397,886.59	\$5.27	\$507,680.93
		49.41%	49.41%	43.06%	43.06%	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	Tot
	87,123.38	\$2.45	\$213,722.36	\$7.90	\$688,170.15	\$9.56	\$8
K	87,123.38	\$1.21	\$105,603.99	\$3.40	\$296,357.15	\$4.30	\$3
e	0	\$1.24	\$108,118.37	\$4.50	\$391,813.01	\$5.27	\$4
e		49.41%	49.41%	43.06%	43.06%	44.91%	

Difference 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



# ESTIMATING USING BIM

## AUTODESK QUANTITY TAKEOFF

publish Revit to 2D and 3D dwf

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

open in Autodesk QTO take of wall type 3A

easily see what is being takeoff

7,000 sq ft, 10+ hours learning, .5 hours on takeoff

	Area	Material cost/SF	Material	Labor Cost /SF	Labor	Cost / SF	Total
	87,123.38	\$2.45	\$213,722.36	\$7.90	\$688,170.15	\$9.56	\$
L	87,123.38	\$1.21	\$105,603.99	\$3.40	\$296,357.15	\$4.30	\$
e	0	\$1.24	\$108,118.37	\$4.50	\$391,813.01	\$5.27	\$
e		49.41%	49.41%	43.06%	43.06%	44.91%	

Price 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**

**half-hour 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

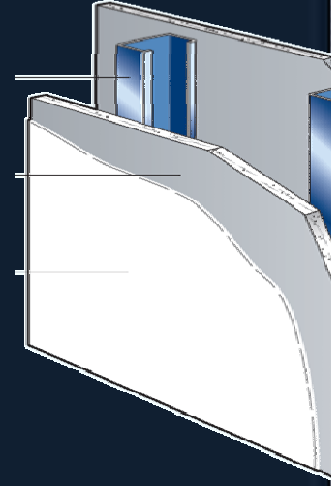
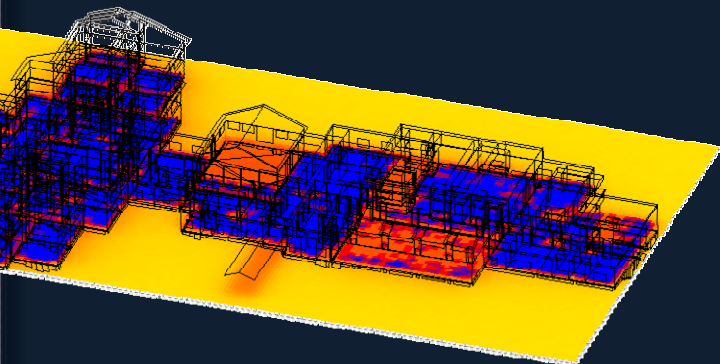


# CONCLUSIONS

## 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  
by Superintendent Resigned  
School Board is Currently investing purchase of Site  
District has filed claims against Superintendent  
Considering Claims Against Business Manager, Property Owner  
people responsible for the contaminants

going to build the Elementary School  
moving Forward with Middle School Project  
Hired Foreman Construction and Program Managers  
Foreman is filing claim for lost profits for middle and elementary  
school



# 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**



# ACKNOWLEDGEMENTS

**Program and Construction Manager**

Mr. Jeff Angstadt, Mr. Mike Arnold, Mr. Keith Smith, Mr. Algie LaBrasca

**Phoenixville Area School District**

Mr. Ronald Miller

**Architects**

Mr. Brian Good

**Engineering**

Mr. Glenn Harris, Ms. Monica Sweeny, Ms. Ann Logue

**er, Ingram, & Associates**

Mr. David Rosso

**er Hoffman Associates**

Mr. Robert Malehorn, Mr. Jeff Manhick



QUESTIONS

THANK YOU!

