



The Pennsylvania State Recreation Hall Wrestling and Student Fitness Center

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Final Presentation



The Pennsylvania State Recreation Hall Wrestling and Student Fitness Center

Outline

- I. Project Overview
- II. Structural Analysis – The Removal of the Reinforced Fill System
- III. Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass
- IV. Construction Management Analysis – The Use of ProPress Fittings
- V. Research Analysis – Reducing LEED Costs
- VI. Recommendations



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Project Overview

Background

Owner: The Pennsylvania State University

Architect: L. Robert Kimball and Associates



Construction Management: Gilbane Building Company



Area:

Addition: 19,794ft²

Renovation: 28,587ft²

Cost: \$13.3 Million

Start Date: April, 2005

Final Completion: September, 2006

LEED Project: Silver Rating



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Project Overview Systems

Structural:

Micro Piles

C.I.P. Grade Beams

C.I.P. Foundation Walls

Structural Steel

C.I.P. Slab on Grade



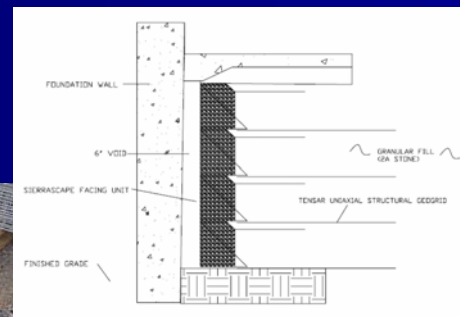
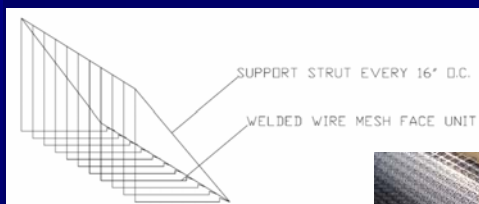


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Structural Analysis – The Removal of the Reinforced Fill System

Background

- Reinforcement fill system is SierraScape by Tensar Earth Technologies
- Covers approximate 178 ft of perimeter of building
- Welded wire face unit has diagonal bracing
- Uni-Axial GeoGrid connects face unit to compact fill
- Placed in 18" lifts



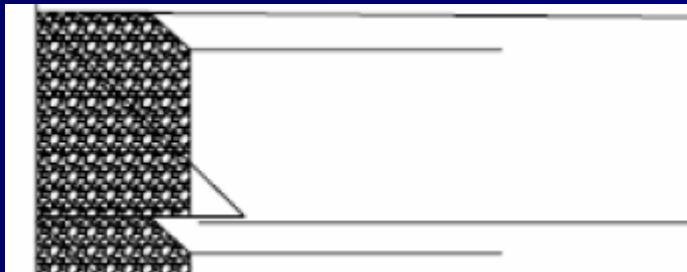


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Structural Analysis – The Removal of the Reinforced Fill System

Disadvantages

- Costly - \$25/Unit (includes labor and material)
- Time consuming :
 - Construction of each unit
 - Cutting of material for MEP rough in
 - Placement of decking at void for slab on grade





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Structural Analysis – The Removal of the Reinforced Fill System

Proposal

- Remove the reinforced fill system and replace with traditional compact fill to produce a cost savings to the owner and reduce the project schedule



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Structural Analysis – The Removal of the Reinforced Fill System

Procedure

- Calculate cost savings between 2 systems
 - Does not include cost for labor and material of stone placement
- Determine if existing foundation wall can withstand lateral forces checked at typical locations
- Calculate Schedule Reduction



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Structural Analysis – The Removal of the Reinforced Fill System

Findings

- Cost savings of: \$26,700
- Existing foundation wall is able to resist lateral forces when slab on grade is connected
 - Requires shoring prior to slab placement
 - F.S. for sliding = 1.8 (For large portion of wall)
 - F.S. for sliding = 1.5 (For small portion of wall)
- Duration difference: 5 days
 - No schedule reduction due to order of activities
- Constructability issues
 - Easier for under slab M.E.P. rough in
 - Less prep work required for slab on grade placement



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Structural Analysis – The Removal of the Reinforced Fill System **Findings**





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Structural Analysis – The Removal of the Reinforced Fill System

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Structural Analysis – The Removal of the Reinforced Fill System Findings

A1030	F/R/P Concrete Foundations	50	19-Apr-05	28-Jun-05		F/R/P Concrete Foundations
A1040	Underslab Utilities	30	08-Jun-05	20-Jul-05		Underslab Utilities
A1050	F/R/P Slab On Grade	7	21-Jul-05	29-Jul-05		F/R/P Slab On Grade



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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Background

- Large portion of façade is composed of aluminum curtain wall
- Double pane glazing used
 - Two layers of $\frac{1}{4}$ " glass with $\frac{1}{2}$ " air space
- Two patterns of glass on curtain wall:
 - Spandrel Glass
 - Ceramic Frit Glass
- Glass manufactured by Viracon





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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Proposal

- Replace the double pane glass with triple pane glass, in order to reduce long term energy costs



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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Procedure

- Determine the difference in initial cost for each system
- Determine energy loss for each system per month
- Determine energy loss costs for each system per month
- Determine payback period
- Calculate additional loading caused by triple pane glass to verify structural system can carry load



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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Findings

-Initial costs:

-Double Pane Glass: \$53,013.00

-Triple Pane Glass: \$89,217.00

-Difference: \$36,204.00

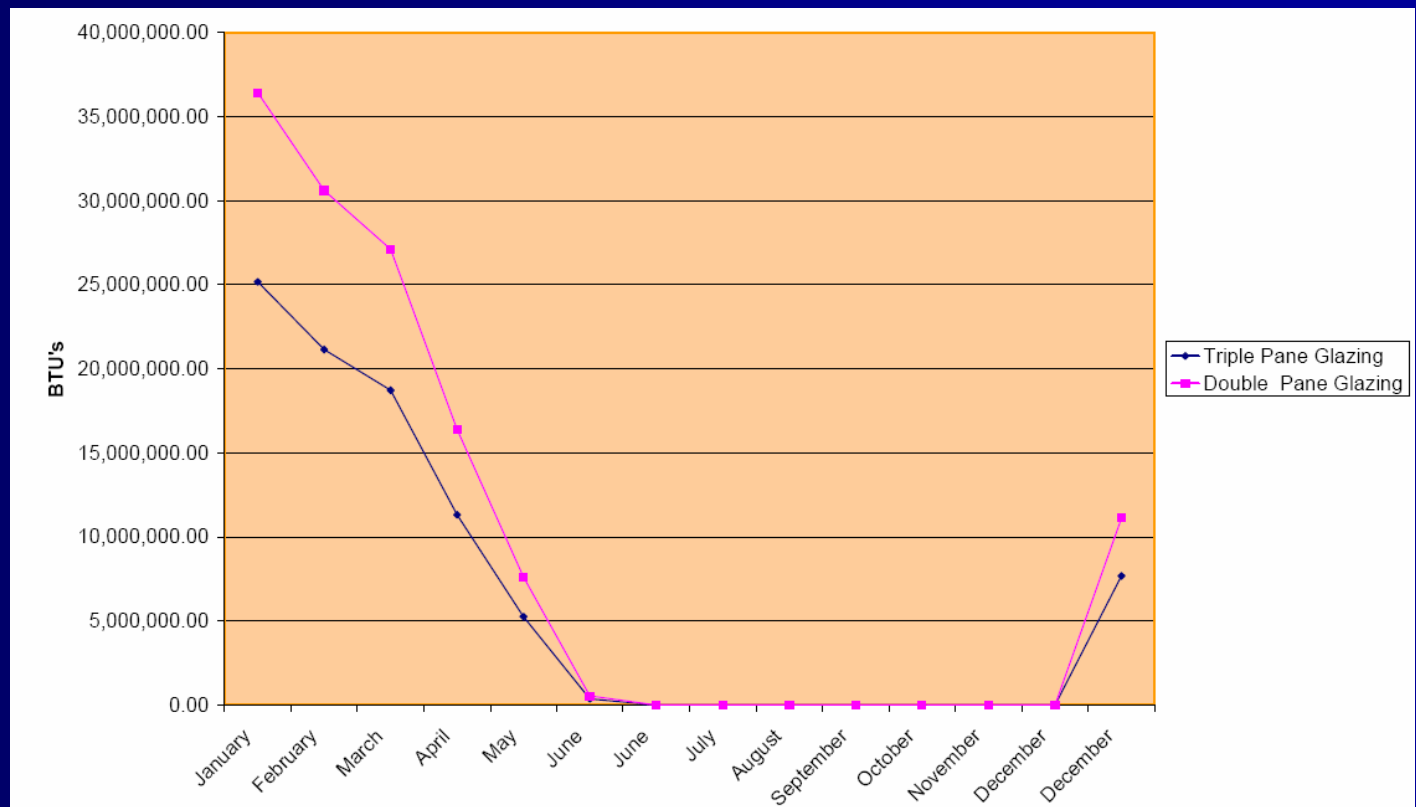


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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Findings

-Heating load energy loss for each system per month:



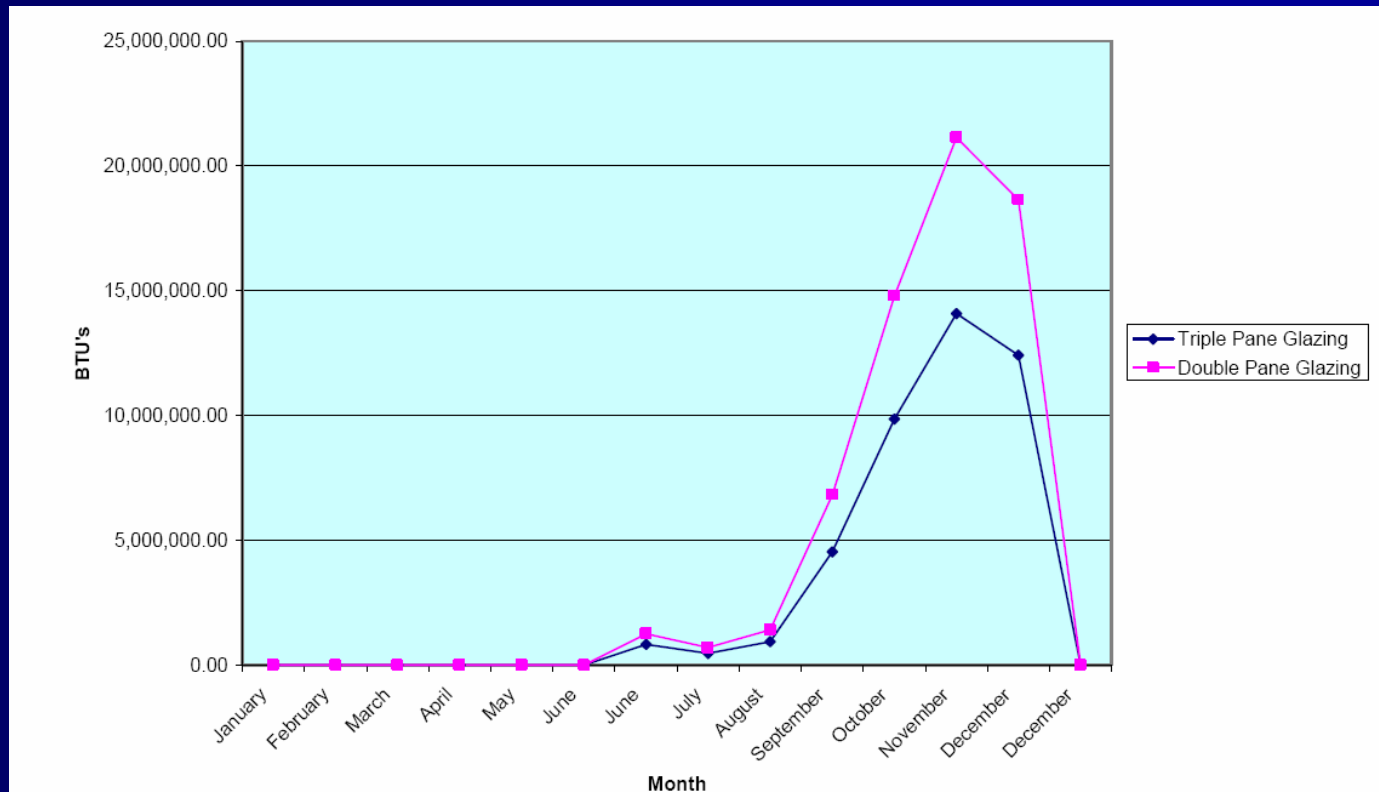


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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Findings

-Cooling load energy loss for each system per month:



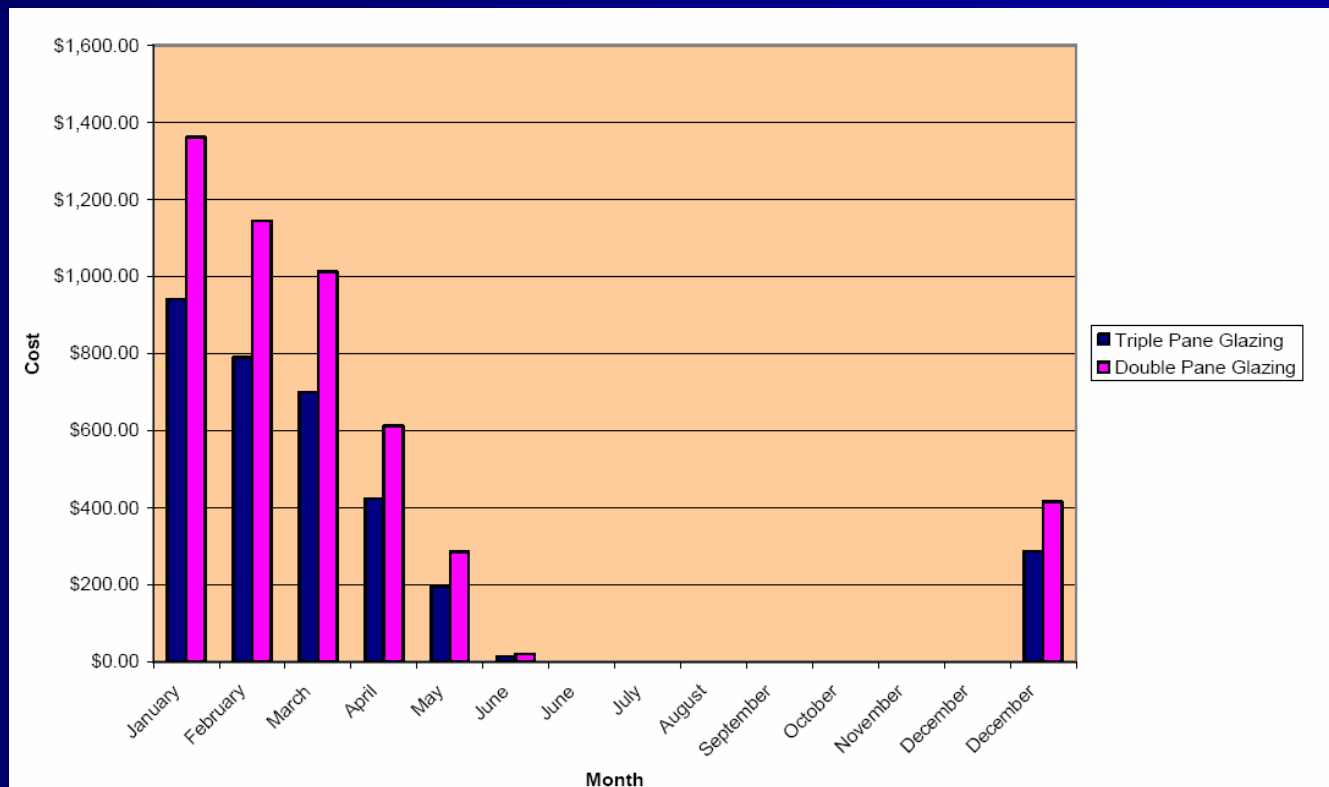


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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Findings

-Heating load energy loss cost for each system per month:



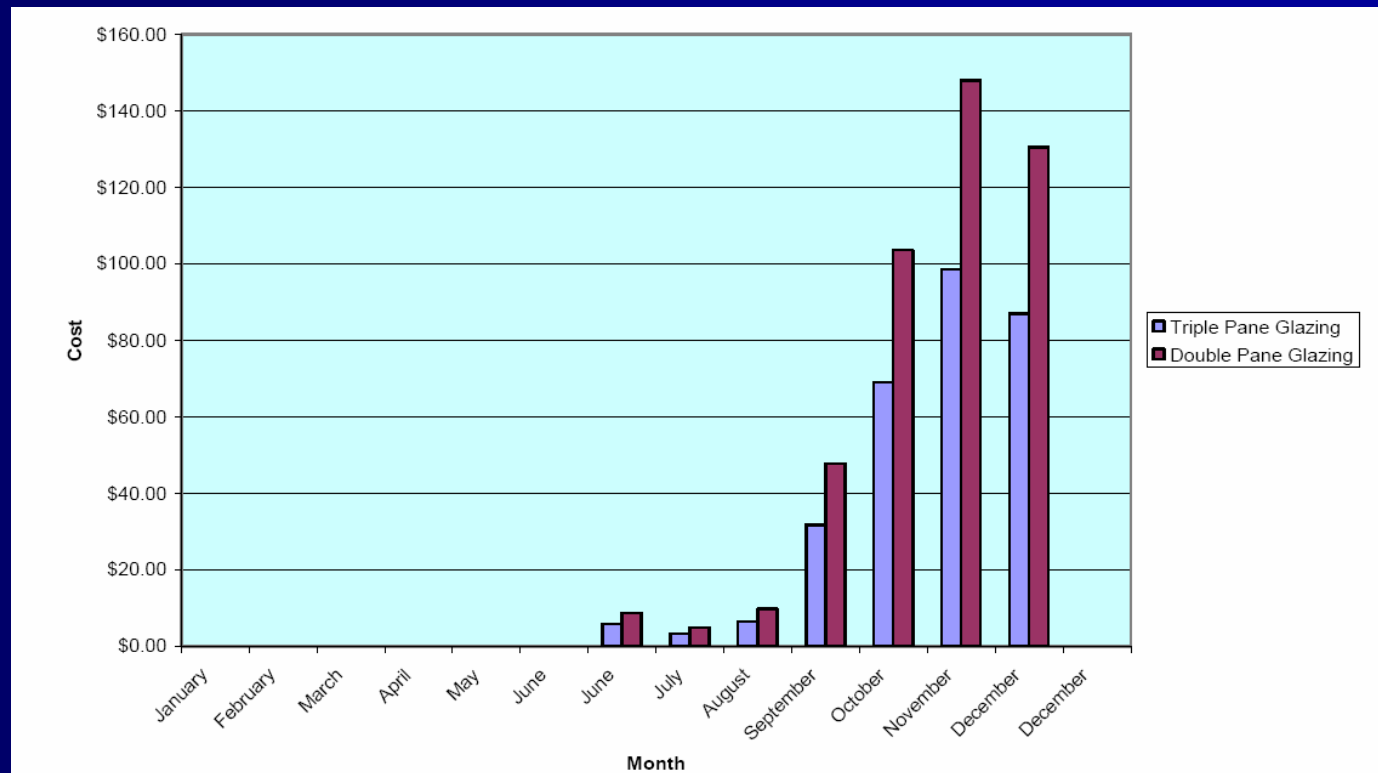


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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Findings

-Energy loss cost for each system per month





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Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass

Findings

- Payback period:
 - Current prices: 22 years
 - 5% increase: 21 years
 - 10% increase: 20 years



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Construction Management Analysis – ProPress Fittings

Background

- The majority of the domestic water system services the renovation area
- The majority of this work takes place in occupied spaces
- Work area in ceilings are very tight due to:
 - Existing duct
 - Existing plumbing lines
 - Existing electrical lines
 - Existing structural system (structural steel beams)
- The domestic water system was bid to be all solder fittings, but only pipe sizes 2 -1/2" and larger were soldered
- The remainder of fittings were ProPress fittings; fittings manufactured by Viega and crimping tool manufactured by Ridgid





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Construction Management Analysis – ProPress Fittings

Proposal

- Replace all solder fittings with ProPress fittings for the domestic water system



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**Construction Management Analysis – ProPress Fittings
Procedure**

- Determine costs for three options:
 - All solder fittings
 - Solder fittings 2-1/2" and larger, ProPress all other fittings
 - ProPress all fittings
- Determine time durations for each option



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Construction Management Analysis – ProPress Fittings

Findings

-Costs for three options:

-All solder fittings: \$15,183.92

-Solder fittings $>$ or $= 2\text{-}1/2"$, ProPress all other fittings: \$13,313.36

-ProPress all fittings: \$12,865.66

-Time durations for three options:

-All solder fittings: 37 days

-Solder fittings $>$ or $= 2\text{-}1/2"$, ProPress all other fittings: 27.5 days

-ProPress all fittings: 18.5 days



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Construction Management Analysis – ProPress Fittings

Additional Benefits

-Quality

- Reduces risk of leaks
- Reduces need for skilled tradesmen

-Safety

- No risk of fire
- Work around finished material

-Convenience

- Reduces time in occupied spaces
- Reduces inconvenience for owner



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Research Study – Reducing LEED Costs

Background

- 12 main points were determined for reducing LEED Project costs:
 - Site Planning
 - Energy
 - Water
 - Materials
 - Recycling and Waste Management
 - Commissioning
 - Early Adoption of Environmental Considerations
 - Early Selection of Team Members w/ Sustainable Experience
 - Alignment of Team Members Goals and Project Goals

- These key points were compared to the practices used at Recreation Hall

- These 12 points were taken from a case study by John Mogge Jr. and a case study by Anthony R. Lapinski, Michael J. Horman, and David R. Riley



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Research Study – Reducing LEED Costs

Recycling

-Four types of waste were recycled on the Recreation Hall Project:

- Block for clean fill
- Wood
- Metals
- Cardboard



-Challenges:

- Placement of waste in appropriate dumpsters
- Locating companies that will remove the waste
- Conveying the importance of documenting the amount of material recycled to the subcontractors



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Research Study – Reducing LEED Costs

Location of Materials

- Materials used on the Recreation Hall Project were required to:
 - Contain materials that were abstracted within a 500 mile radius of State College, PA
 - Be composed of the specified amount of recycled content
 - Have $<$ or $=$ to the amount of V.O.C. content specified
- Challenges:
 - Locating materials that met the specifications



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Recommendations

- Structural Analysis – The Removal of the Reinforced Fill System
 - Use compact fill system
 - Use temporary shoring to resist overturning until slab on grade is placed
- Mechanical Analysis – Triple Pane Glass vs. Double Pane Glass
 - Use double pane glass
 - Payback period is too long
- Construction Management Analysis – ProPress Fittings
 - Use ProPress fittings for all sizes of pipe
 - Does not produce a large cost savings, but is beneficial in other areas
- Research Study – Reducing LEED Costs
 - Locate recycle programs prior to construction
 - Locate specified materials very early in construction process
 - Involve construction manager in design process
 - Explain job specific LEED goals to subcontractors



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Questions?



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Research Study – Reducing LEED Costs

Early Adoption of Team Members with Sustainable Experience

-Gilbane Building Co. chose a project manager with previous experience with LEED projects.

-Challenges:

-Finding Subcontractors with LEED experience



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Research Study – Reducing LEED Costs

Alignment of Team Member Goals and Project Goals

-Meetings with the Architect, Owner and Construction Management firm were held early in the process to allow for alignment of goals

-Challenges:

-Meetings were not held early enough to allow Construction Manager to assist in design process