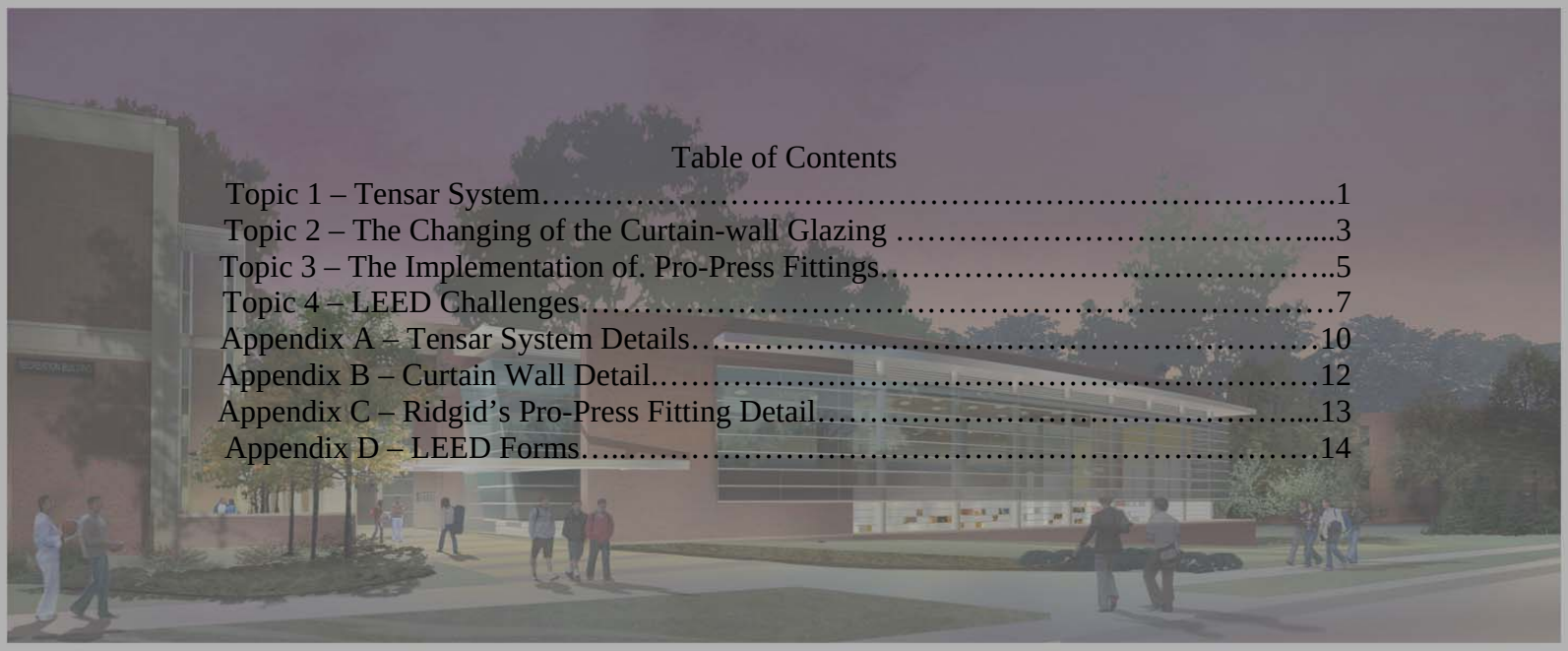

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The Pennsylvania State Recreation Hall

Focus 1 – Tensar System

Background

The Pennsylvania State University Recreation Hall building is consists of 19,794ft^2 addition area and 28,587ft^2 of renovation area. The addition area will hold a student fitness center, with one ground floor level and one mezzanine level, which encompasses half of the addition footprint. The addition rests on a system of mini-piles, pile caps, grade beams and foundation walls. Along with these foundation members is a reinforced fill system, which is placed on the interior of the foundation walls, a detail of this system can be found in Appendix A. The system removes the lateral load from the foundation walls. The slab on grade rests on certain grade beams, foundation walls and also the reinforced fill system.

Problem Statement

The replacement of the existing reinforced fill system with a traditional compacted fill system will cause the foundation wall to encounter a larger lateral load. Therefore, a foundation wall/grade beam system must be designed to resist the lateral load, which the current reinforced fill system is carrying, of the un-reinforced compacted backfill system on the interior of the building footprint. The system must resist sliding and overturning caused by the load enforced by the compacted backfill.

Proposed Solution

A thicker foundation wall will be designed composed of a larger quantity of reinforcement. The grade beam at this area will also be increased in size, increasing the toe and heel of the structure, to prevent the wall from overturning and the grade beam from sliding. A calculation must be completed to verify the pile caps and piles are able to hold the additional dead load caused by the increase in size to the foundation wall and grade beam.

Theoretical Benefits

I hypothesize the replacement of the reinforced fill system with the traditional backfill system will reduce the cost of the building. I also feel the traditional compacted

backfill system will be a much quicker installation than the Tensar system. This will decrease the overall schedule of the project, as this activity is on the critical path. This acceleration of the backfill procedure will allow the concrete foundations to begin and be completed at an earlier date, which in turn will accelerate the erection of the building.

Solution Method

- Redesign the foundation wall to withstand the new earth lateral load, using the Coulumb and Rankine methods.
- Redesign the grade beam to support the increased dead load from the new foundation wall and to prevent sliding and overturning, using the Coulumb and Rankine methods.
- Calculate the new dead loads placed on the mini-piles and pile caps to ensure the system can support the heavier load.
- Using R.S. Means calculate the cost, including labor and material, and time required for the original foundation wall and grade beam system.
- Using R.S. Means calculate the cost, including labor and material , and time required for the redesigned foundation wall and grade beam system.
- Using R.S. Means calculate the cost, including labor and material, and time required to place the proposed compacted backfill system.
- Obtain the actual cost and time required for the reinforced fill system from the site work subcontractor. (This information is not found in R.S. Means)
- Calculate the total costs and schedules for each system.
- Compare the costs and schedules to determine the most efficient system.

Focus 2 – The Changing of the Curtain-wall Glazing

Background

A major portion of the Recreation Hall façade is composed of an aluminum curtain wall. This curtain wall system spans approximately 90% of the main face of the building, along Atherton Street, as well as approximately 50% of the façade on the building West face. On the Atherton Street facing side of the building, the curtain wall is divided into two main sections. The first section of the curtain wall spans the length of the curtain wall and ends at a height of 9'9". This section of the curtain wall is composed of double pane patterned frit glass. This section of glass rises straight in the vertical plane, and begins 3' from the face of the building in the horizontal plane. The second section of curtain wall begins at 9'9" and extends to the bottom of the parapet roofing system, 26'. This section of the curtain wall is hung from the columns along the perimeter of the building. This section of the curtain wall is angled, on the vertical plane, from the extent of the parapet roof to the face of the brick on the perimeter of the building, for a better understanding please see Appendix B for a detail of the wall. The upper section of the curtain wall is composed of double pane spandrel glass.

Problem Statement

Although the specified glass for the curtain wall system has a high thermal resistance value and is very durable, a higher glass quality can be achieved. This change would not affect the structural integrity of the building, but would affect the electrical and mechanical attributes of the building. The changing of the glass to a more insulated and more thermal resistant material will improve the building conditions and reduce the mechanical and electrical requirements.

Proposed Solution

In order to increase the thermal resistance value of the aluminum curtain wall, the specified double pane glass will be replaced with triple pane glass of the same type and pattern. The proposed glass will consist of one extra pane of glass, as well as an extra

layer of insulation. The glass will reflect the appearance of the specified glass as to not change the sought after architectural appearance.

Theoretical Benefits

Through the changing of the glass types, the long time maintenance costs will decrease. The decrease in cost will be caused by the lower utility cost for the mechanical systems. Due to the increase in the thermal resistance, caused by the change from double pane glass to triple pane glass, the thermal transmittance will decrease. Therefore, the building will be able to hold heat, as well as cool air, for a longer period of time. This will ease the requirements on the Air Handling Units, therefore decreasing the energy costs. Through the implementation of the thicker glass, LEED credits may also be achieved, as the energy required for the building will be lowered. A disadvantage that may be encountered through this alteration is the lighting requirements. Due to the thicker glass, the outside day light entering the building through the curtain wall may be lowered, therefore causing the lighting load to be larger. This may increase the energy required for the lighting system. Through my research, I hope to find that the proposed change is a value engineering idea and will save the owner money in long term costs.

Solution Method

- Acquire the U-Values and R-Values for both types of glass from the manufacturer.
- Calculate the cost to install the triple pane glass.
- Acquire the cost to install the double pane glass from the subcontractor.
- Calculate the amount of energy required for each year with each system.
- Calculate the cost for the utilities with each system.
- Determine the time required for the cost savings to outweigh the increase in the initial cost to use triple pane glass.

Focus 3 – The Implementation of Pro-Press Fittings

Background

The Recreation Hall Project consists of an addition phase as well as a renovation phase. The renovation process includes the demolition and replacement of many systems, including electrical, mechanical, plumbing, structural and architectural. The challenge when performing this type of work is completing the work without affecting the tenants and keeping the building in operation. Although the demolition and replacement of the systems may only be required in certain areas of the building, the work may affect other areas of the building.

Problem Statement

Although a plumbing line may only need replaced in one area, that pipe may affect many sections of the building. Therefore, when performing this work, time is extremely important. In order to accommodate the owner as much as possible, work that affects various sections of the building that are in operation is often performed during night shift. The implementation of swing shift can prove to be very costly. The traditional process of connecting sections of domestic water piping, using solder, is very time consuming, and also very costly. A system that can expedite the plumbing renovation phase must be developed and implemented.

Proposed Solution

In order to accelerate the renovation of the plumbing systems, specifically the domestic water line, the use of Ridgid's Pro-Press fittings could be implemented. This method of connecting the domestic water lines could be used in both the renovation phase as well as the addition phase. Although the benefits would not be as great for the addition phase as it would be for the renovation phase, the use of the Pro-Press system would be advantageous for the whole project.

Theoretical Benefits

The employing of the Pro-Press system will prove extremely beneficial in many aspects of the renovation phase. This system improves the constructability of the plumbing system, as it is much easier for the plumbers to install the domestic water pipe. The improvement in constructability directly affects the schedule. The use of this system will accelerate the schedule, as the man hours required to complete the work will decrease. The constructability and schedule reduction both help in decreasing the cost for the plumbing renovation work. Although the cost for the material used in the Pro-Press system is more expensive than the materials required for the traditional soldering method, the decrease in man hours will save a large amount of money in labor expenses. Above all other advantages, the most beneficial of this system is owner satisfaction. The less time the building is affected for this activity, the happier the owner is.

Solution Method

- Determine the number of fittings required for the domestic water piping system by using the contract drawings.
- Obtain an estimate for the cost to install one Pro-Press fitting, including labor and material, from the plumbing subcontractor.
- Calculate the cost to install the domestic water plumbing system by using the Pro-Press fitting system.
- Obtain the cost to install the domestic water plumbing system using the traditional soldering method from the plumbing subcontractor.
- Compare the costs of the two systems and determine which system is more beneficial for the owner.

Focus 4 – LEED Challenges

Background

The Penn State Recreation Hall project is striving for a LEED rating of silver. In order to achieve this rating the project must achieve 32 credits. These credits are achieved both through design, as well as during construction. The credits to be achieved through the design of the building consists of a high-albedo Energy Star roof, a high performance building envelope, a lighting system that consumes less than 1Watt/SF, along with many other design features. The credits to be accomplished through the construction phase of the project consists of the use of recycled, locally extracted and manufactured materials, the control of soil erosion and the recycling of waste from the demolition of areas of the existing building as well excess construction materials. In order to fulfill these requirements, the construction management firm and subcontractors are forced to complete a large amount of paperwork to document these processes. This documentation includes LEED submittal forms that are completed for each material to be used on the project, for an example please see Appendix D. These forms list the percentage of post industrial, post consumer and combined recycled content of the submitted material. The forms also document the location in miles of the manufacturing location, as well as the location in miles from the job site that the materials used for the product were extracted. The LEED submittal form also documents the VOC content of the product. In order to track the recycled material the subcontractors are required to submit the forms from the waste management companies to document the amount of waste that is recycled. The soil erosion on the jobsite is documented through the completion of Erosion and Sedimentation Forms, that record problems with soil erosion precautions and the actions taken to improve the conditions.

Problem Statement

The subcontractors working on the Recreation Hall project are very new to the LEED process. This causes problems when fulfilling the previously mentioned LEED requirements, as the subcontractors have not filled out this paperwork before. This causes the numerous types of documentation, specifically the LEED submittal forms, to be filled out numerous times before being completed correctly. This also causes many

problems when locating materials that meet the specified requirements to achieve the LEED credits.

Proposed Solution

With the intention of easing the LEED process for the involved subcontractors, I propose to reduce the amount of paperwork. The USGBC has made an effort to accomplish this through the implementation of a web based submittal process. Along with the web based LEED submittal process I feel the tracking of recycled waste should be completed electronically. The proposed system would automatically record the tonnage of material being recycled when it is removed from the jobsite. In conjunction with this electronic tracking, I feel an electronic listing, available to all subcontractors, of manufacturers for certain material that meet LEED requirements should be developed. An example of this challenge, was the locating of fire treated plywood that met LEED recycle requirements. The process took over a month to locate, at which the subcontractor discovered there is only one manufacturer of the specified material in the United States, which is in Wisconsin.

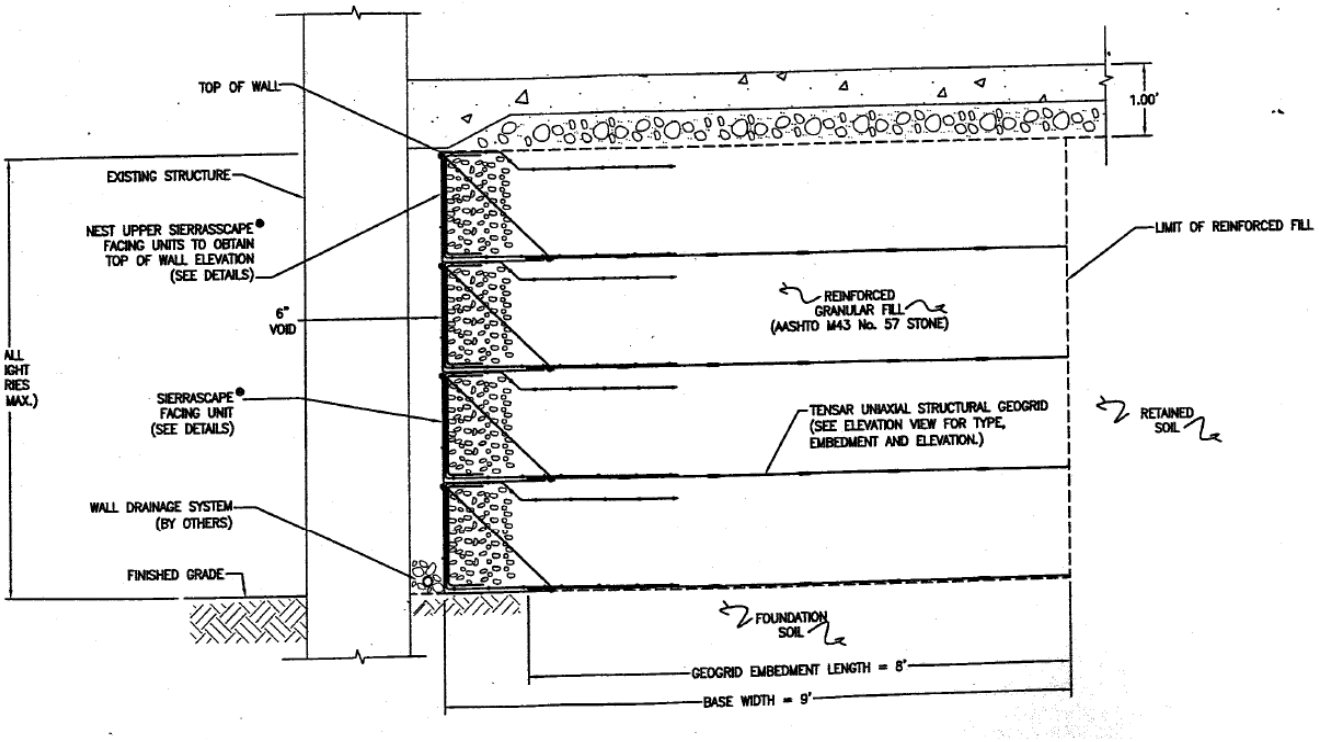
Theoretical Benefits

These improvements to the LEED process would be most beneficial to the subcontractors involved in the project. The electronic tracking and recording of the recycling of waste would allow the superintendents/foremen to focus on the onsite activities without having to worry about documenting the removal of recycled materials. The electronic listing of approved materials for LEED projects would allow subcontractors to locate the appropriate materials in a quicker manner, as well as prevent delays in the project due to the lack of materials.

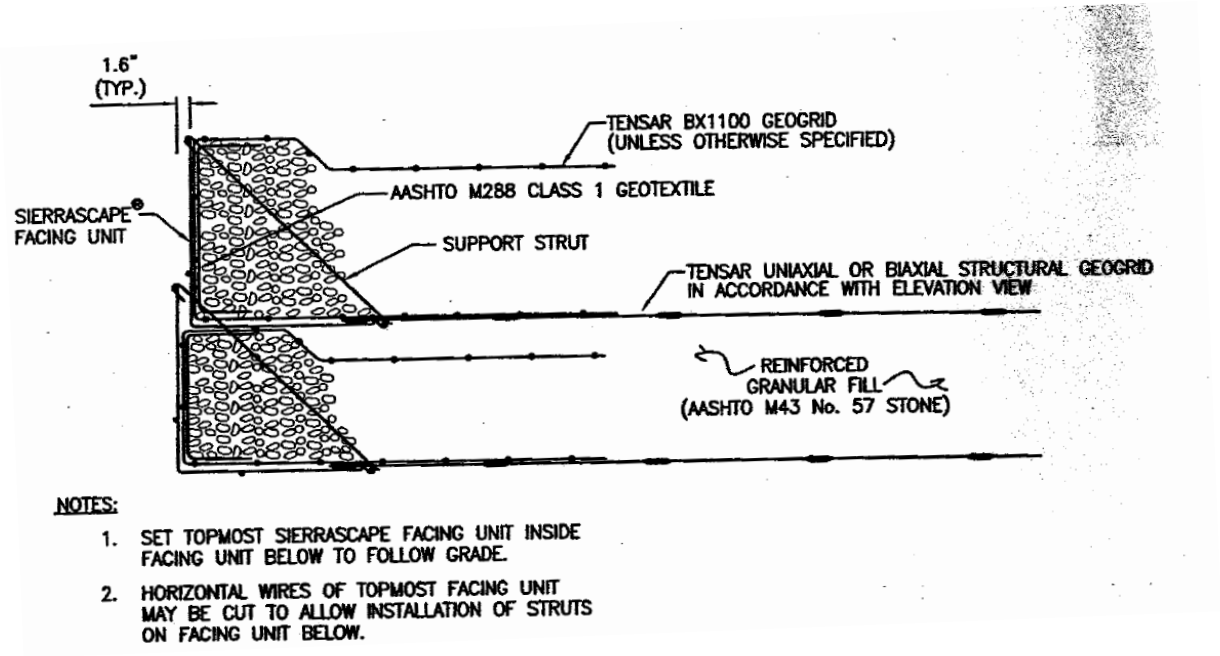
Solution Method

- Distribute survey, found in Appendix D, to all subcontractor superintendents on the Recreation Hall Project.
- Collect completed surveys from the subcontractors.
- Attend Gilbane's "Lessons Learned" meeting with the subcontractors to discuss problems faced during the LEED process and improvements that should be made.
- Review information received from distributed surveys and "Lessons Learned" meeting to identify possible improvements to the LEED process.

Appendix A

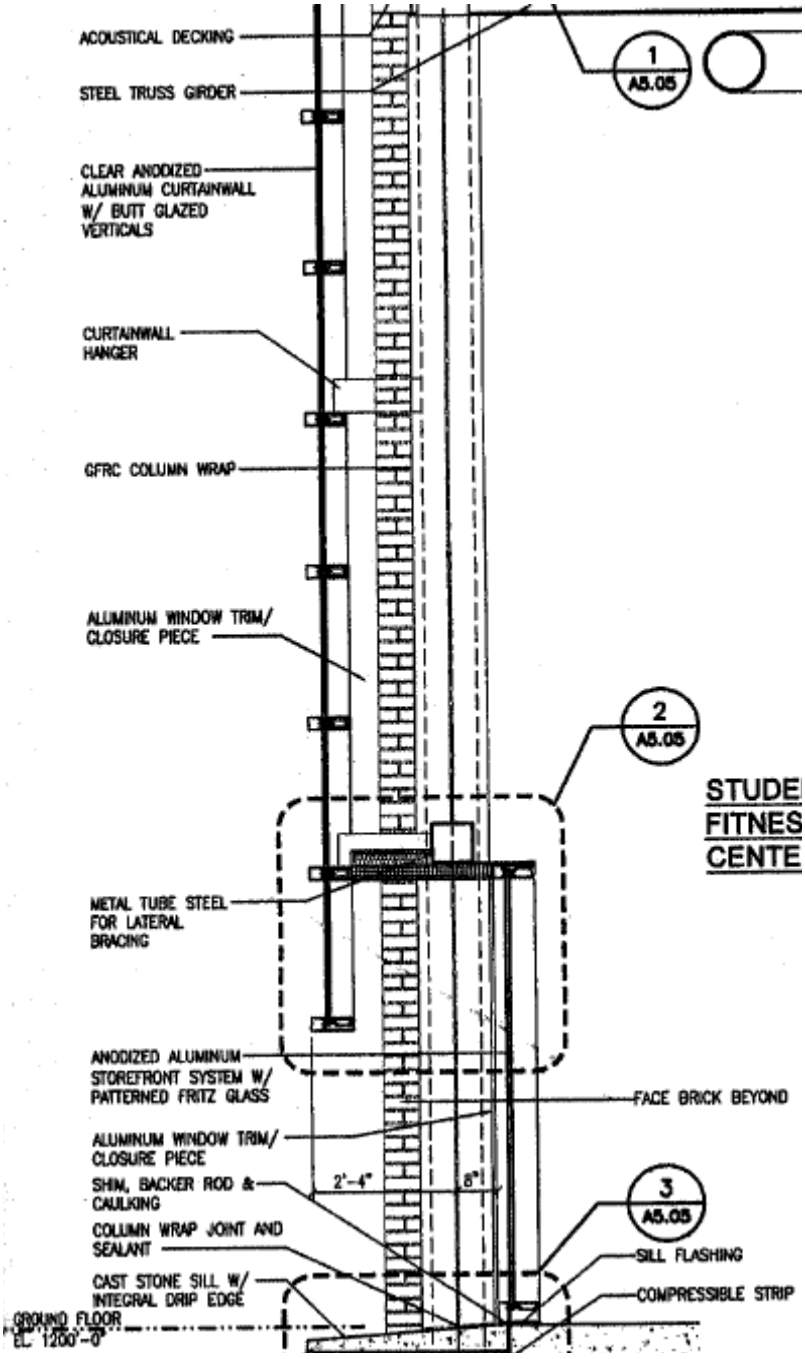


Detail A.1 – Tensar System with Foundation Wall and S.O.G.



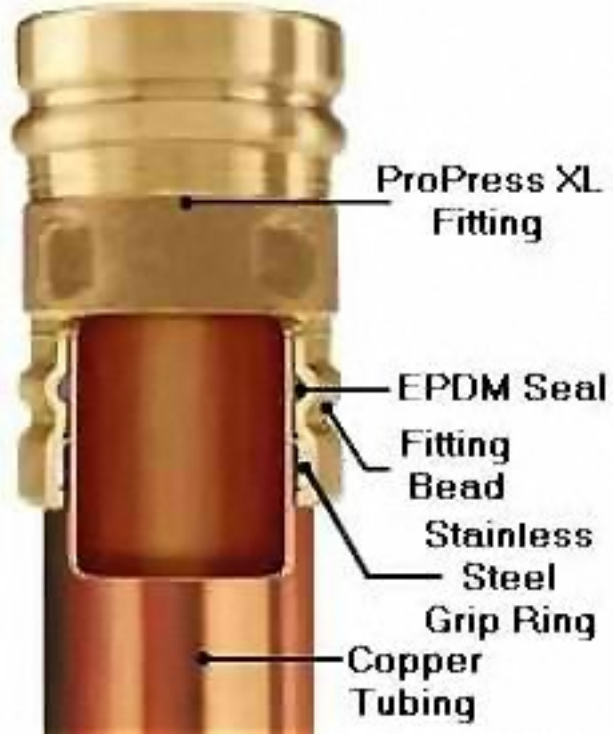
Detail A.2 – Tensar System

Appendix B



Detail B.1 – Exterior Wall Along Atherton Street

Appendix C



Picture C.1 - Ridgid's Pro-Press Fitting Detail

Appendix D

LEED SUBMITTAL FORM
Penn State Rec Hall Wrestling & Fitness Center

Kimball
L. Robert Kimball & Associates
Phone: 717-221-0770

Submitting Subcontractor: _____ Date: _____

Material / Product description: _____

Material Spec Section: _____ Material cost (exclude labor & delivery): _____

Location of manufacturing plant -- City, State: _____

Distance (in air miles) from location of manufacturing plant (or assembly) to job site*: _____
For sample distance calculatr, see www.indo.com/distance/index.html

List distance (in air miles) to job site from location of extraction for all materials contained in product*:

Material	*Distance in miles*

Percentage, by weight, of recycled Content in material*:
Post Consumer: _____ % Post-Industrial: _____ % Combined: _____ %

Percentage, by weight, of Rapidly Renewable Content in material*: _____ %
Qualifying materials are made from plants harvested within a 10-year cycle or shorter.

Percentage, by weight, of Certified Wood Content in material*: _____ %
Qualifying wood is Forest Stewardship Council (FSC) Certified only.

For Roofing Products, list material, Slope as > or < 2 in 12, Solar Reflectance Values, and Emissivity*:

Material:	*> or < 2 in 12*	*Initial Reflectance*	*3-yr aged reflect.*	*Emissivity*

For interior field-applied Adhesives & Sealants used, list products and VOC Content*:

Product:	*Location of use/Application*	*VOC Content*
		_____ g/L
		_____ g/L
		_____ g/L

For interior field-applied Paints & Coatings used, list products and VOC Content*:

Product:	*Location of use/Application*	*VOC Content*
		_____ g/L
		_____ g/L
		___ g/L

For Carpet, product meets requirements of CRI's Green Label IAQ Test Program* (Yes/No): _____

For Composite Wood Materials, product contains no added urea-formaldehyde resins* (Yes/No): _____
Materials include plywood, OSB, Particleboard, solid core wood doors, agriboard, etc.

Attach manufacturer's information, highlighted to verify requirements of Spec Section 01352

Form D.1 – LEED Submittal Form for Recreation Hall

Penn State Recreation Hall Project
LEED Challenges Survey
Company_____
Position_____

1.) How many LEED projects have you been involved with?
    a.) This is my first
    b.) Less than five
    c.) More than five

2.) Did you find it easier or harder to comply with the LEED requirements on this job when compared to other LEED projects you have been involved with?

3.) What made this job easier or harder than other LEED projects you have been involved with?

4.) What would you change about the LEED submittal process?

5.) What would you change about the tracking of the amount of construction waste to to be recycled?

6.) Were there any materials you used that did not meet the desired specification due to the unavailability of the material? If so what was the material?

7.) Have you received any education on LEED buildings or the process to achieve a a Green Building?

8.) Would you consider attending a class on LEED buildings and the process involved with Green Buildings?

9.) Was your estimate increased due to the extra work needed for LEED process?

Form D.2 – LEED Challenges Survey