

**2012 Great Lakes Conference
Official Rules- Geotechnical
Saturday, April 21, 2012
Bradley University**



2012 Geotechnical Competition

Objective

The objective of this competition is to design a system that allows water to travel down through a soil matrix, underneath a polyshield sheet pile, and up to the surface of the soil mixture without the sheet pile failing. The scoring shall be based on time of construction and seepage, usage of optional additives, and quality of design submittal. The design of your choosing shall be submitted by March 1st, 2012.

Eligibility

Only one team from each school will be allowed to participate in the Geotechnical Competition. Each team may have a maximum of four students, including a designated team captain. The team captain shall be the point of contact for the team.

Procedure

The procedure of the Geotechnical Competition shall be as follows:

- Teams shall send design submittals by March 1st, 2012. See Submittal Section below for details.
- Teams shall bring prebuilt boxes and necessary construction materials to event.
- **Construction Stage**
 - The polyshield board shall be placed per design submittal and sealed to the plexiglass walls of the box to prevent leakage. Note: The material to seal the wall (pottery clay) will be provided by the judges on the day of the competition.
 - Soil placement in the pre-built box shall be as per the design submitted by the school. Deviations are not permitted.
 - Optional additives (see optional additives section) may be used to augment the soil.
 - A layer of tissue paper shall be placed on the surface of the water seepage receiving side.
 - The construction stage shall be timed by a judge.
- **Testing Stage**
 - Once the sheet pile and soil material are in place, seepage test will be conducted.
 - A funnel shall be used to perform a uniform pour on the designed structure. The pour shall be monitored by a judge.
 - The seepage effectiveness shall be timed starting from the instant the water hits the soil matrix to the moment the tissue paper indicates presence of water.

Materials Provided by Host

- **Pottery Clay**

Each team is required to provide a prebuilt box. The polyshield sheet pile shall be sealed, using only the pottery clay, against the plexiglass sides to prevent leakage when water is added to the box. Each team will be provided the same amount of pottery clay at the time of the competition.

- **Soil Material**

Three different types of soil material shall be provided. The soil materials are:

- Sand- Menards Handy Sand or equivalent will be provided.
- Local Top soil shall be provided.
- Peat Moss (from Menards) shall be provided.

Each team shall use a minimum of 0.5 ft³ of each soil material listed above (provided by the host) for their soil design. Soil placement shall be decided by each team. No chemicals or water may be placed into any of the materials. Only supplied additives (see Optional Additives Section) may be placed into the soil materials.

- **Sheet Pile**

Rigid foam insulating sheathing (From Menards or other home improvement stores) shall be used: Dimensions – 0.5 inch thickness, 12 inches (1 foot) in length in order to cross the width of the box. However, the height shall be a minimum of 12 inches.

- **Optional Additives**

Optional additives will be provided for teams to use in their soil mixture. Usage of the optional additive(s) will result in a point deduction of the team's overall score (values are shown below). A maximum of 5 additives will be allowed, with a maximum of 1-quart per additive, in 1-cup increments. The following items may be used as additives to the soil mixture:

- Synthetic BB's - Point Deduction: 1 point per cup
- All Purpose Flour- Point Deduction: 0.5 point per cup
- Ice Melt- Point Deduction: 1 point per cup
- Mulch- Point Deduction: 1 point per cup
- Sugar- Point Deduction: 0.5 point per cup

- **Water**

The host shall supply 4 gallons of water.

Materials Provided by Teams

- **Box**

The teams will build boxes and bring them to the event. The box will be constructed out of two materials: Acrylic plexiglass and plywood. The dimensions of the box are shown in Figures 1, 2 and 3 (see below). All dimensions are inside dimensions. A ¼ inch tolerance shall be accepted, any larger dimension will result in disqualification. Grade BC plywood with smooth side facing inwards and a ¼ inch plexiglass is also recommended. Boxes should be painted with a waterproof latex paint or epoxy based paint, and all seams or cracks between walls or floors must be sealed with a smooth layer of silicone caulk to prevent water leakage. The name or logo of the team's institution should be displayed on the constructed box.

Construction Tools Provided by Host

The following tools shall be provided by the host:

- Scoops and shovels
- Buckets
- Soil materials
- Funnels
- Tissue paper

Note that it may be necessary for teams to haul soil materials a distance not to exceed 200 feet.

Construction Tools Provided by Team

The following tools shall be provided by each team. These will not be provided by the host. Quantities are not restricted.

- Pencils, pens, markers
- Rulers, straightedges
- Material templates
- Kitchen supplies
- Cutting instruments (e.g., scissors, razor blades)
- Design notes, calculations, and drawings

Specifications

The design must meet certain criteria. The soil mixture height does not have to be uniform across the box; however, it must have a minimum height of 12 inches. The box must be designed to allow for the 4 gallons of water that shall be used for the testing of the seepage effectiveness. If water overflows box, the team shall be disqualified. If the sheet pile fails, the team shall be disqualified.

Submittal

- The paper shall be a maximum of 3 pages long (not including references or title page). Single spacing, one inch margins, and 12 point font are required.
- The paper will provide information regarding the engineered design and construction process. This shall include the soil structure, amount of soil materials to be used.
- The paper will describe methods which shall include lab tests, assumptions, and figures used to obtain the soil and material engineering properties. Also, a computer generated figure (using AutoCAD, Google SketchUp, etc.) of the design will be required. The design may not be altered after date of submission.
- The paper will list design equations and material properties assumed. Also state dimensions of the sheet pile wall, the soil mixture dimensions on both sides of the sheet pile wall, and other design dimensions.
- The paper shall also include a section describing a real world application of the Competition.
- Judging will consider reasonableness of design equations, quality of design, soil properties, and assumptions. "Trial and Error" designs will be disqualified.
- The paper will be submitted electronically in both PDF and MS Word format to Katlyn Melton, kmelton@mail.bradley.edu, by March 1st, 2012, for review of design and materials by an anonymous source. Sender will receive confirmation of receipt by e-mail. Cover page must include name of institution, names, e-mail address, and task of each team member. Any late submittals before April 1st, 2012 will have a 30% deduction in scoring, and any late submittals after April 1st, 2012 will be disqualified from the Geotechnical Competition.

Scoring

The scoring shall be based on the following criteria:

1. Design Submittal: There shall be 34 possible points. The design submittals will be ranked in order. First place shall receive 34 points, second place shall receive 32 points, third place shall receive 30 points, etc.
2. Construction Time: There shall be 30 possible points. A maximum of 30 minutes shall be allowed to build the seepage structure. Points shall be calculated by the following equation:

$$(\text{Allowed time}) - (\text{actual time}) = \text{Score}$$

For example, if a team completes construction of the structure in 10.4 minutes, they shall receive 19.6 points. Equation:

$$(30\text{minutes}) - (10.4 \text{ minutes}) = 19.6 \text{ points}$$

3. Seepage Time: The seepage time shall be 30 possible points, and shall be calculated the same as the construction time. 30 minutes shall be allowed, and the following equation that shall be used:

$$(\text{Allowed time}) - (\text{Seepage time}) = \text{Score}$$

For example, if the water reaches the tissue paper in 22.8 minutes, the team shall receive 7.2 points. Equation:

$$(30 \text{ minutes}) - (22.8 \text{ minutes}) = 7.2 \text{ points.}$$

4. Teamwork: There shall be 6 maximum possible points for teamwork and cooperation. Judges will assess how team members work together and also how the team interacts with other teams in the competition. The presiding judge(s) will penalize unsportsmanlike conduct.

Score Sheet

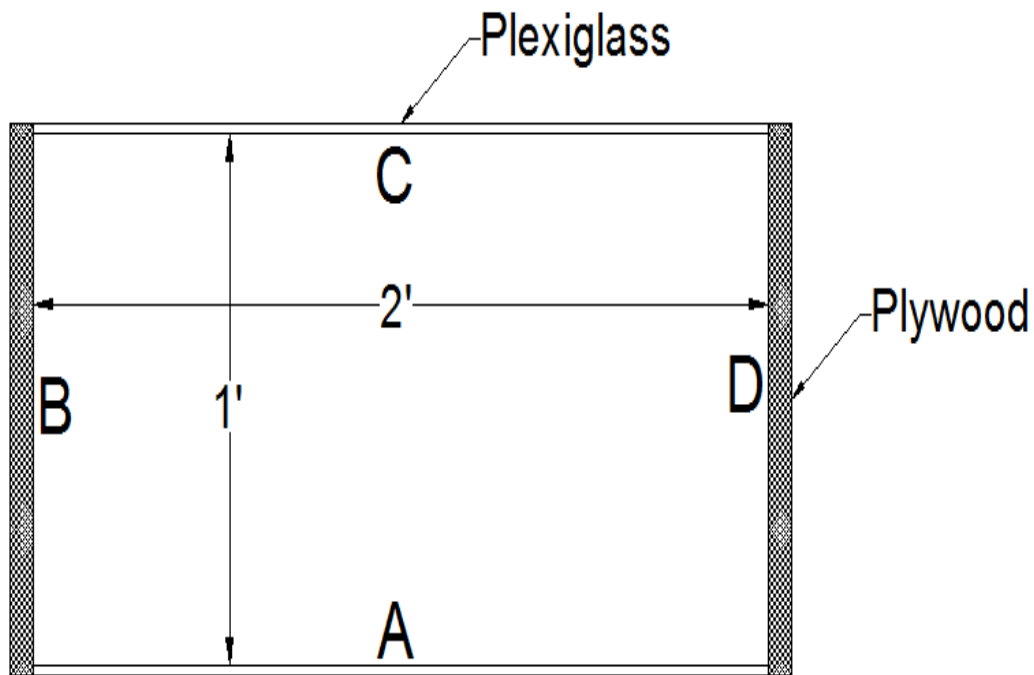
GEOTECHNICAL COMPETITION - SCORE SHEET				
INSTITUTION NAME:				
TEAM CAPTAIN:				
SUBMITTAL:	See Submittal Section			
CONSTRUCTION TIME:	30 minus		=	
SEEPAGE TIME:	30 minus		=	
TEAMWORK:	6			
TOTAL SCORE:				

SUBMITTAL RANKING SYSTEM

PLACE	POINTS
1	34
2	32
3	30
4	28
5	26
6	24
7	22
8	20
9	18
10	16
11	14
12	12
13	10
14	8
15	6
16	4
17	2

Figures

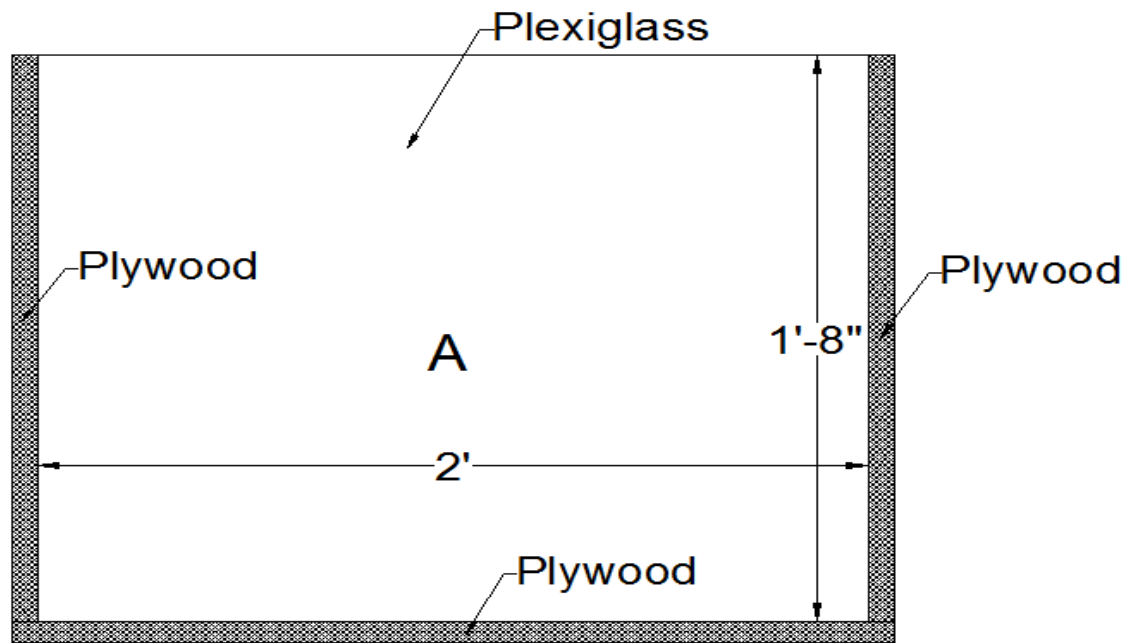
The following figure shows the Top View of the box. This shows side B and D as plywood, and side A and C as Acrylic Plexiglass. The distance between A and C is 12 inches. The distance between B and D is 24 inches. The bottom of the box is constructed from the same plywood as the sides. The plexiglass is recommended to be $\frac{1}{4}$ inch thick and the Plywood is recommended to be Grade BC plywood with smooth side inwards. Boxes should be painted with a waterproof latex paint or epoxy based paint, and all seams or cracks between walls or floors must be sealed with a smooth layer of silicone caulk to prevent leaking of water. The name or logo of the team's institution should be displayed on the constructed box.



Top View

Figure 1: Top view of box

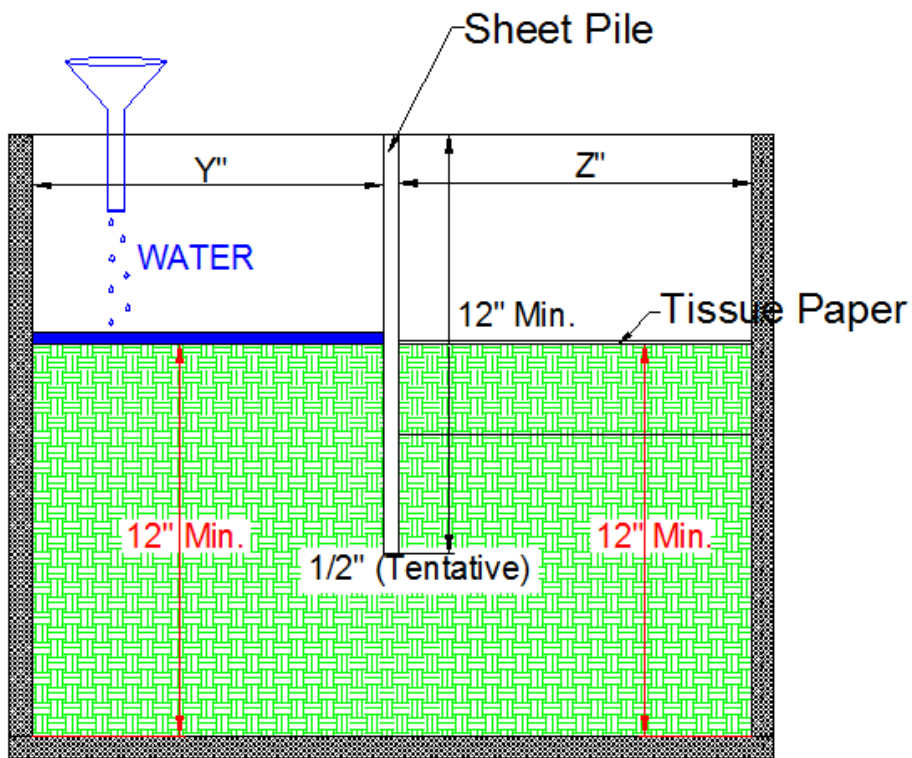
Side A shows the Plywood as both side panels and the bottom of the box, and the front panel as Plexiglass. The dimensions of the plexiglass are (24" by 20"). This is not including the plywood thickness. Only the inside dimensions are shown.



Side A

Figure 2: Side view of box

The following figure shows side A of the box. This figure also includes the Poly shield sheet pile along with the tentative and minimum dimensions. The placement of the poly shield sheet pile is the choice of each team. Just remember if the 4 gallons of water does not fit in the area shown a disqualification will be decided. The tissue paper is also shown below. This will be used to simplify the visual inspection of the seepage process.



Side A

Figure 3: Cross Section of box

Questions

All questions may be e-mailed to Katlyn Melton at kmelton@mail.bradley.edu. Good luck and happy designing!