

Geotechnical Design Rules

Participants

- Each school may have only one team compete.
- Teams may be composed of up to four members, one of which must be a freshman for the 2016-17 academic school year.
- Each team member must be a registered participant of the 2017 Great Lakes Student Conference.

Event Description

The goal of the 2017 GLSC geotechnical competition is to build a cost effective paper retaining wall out of the materials provided that can support the self-weight of the soil and an applied load of 100 pounds. Teams will design and construct the paper retaining wall in the wooden box provided. When completed, one side of the plywood box will be removed leaving the paper retaining wall to support the weight of the soil and the applied load. As in all real life civil engineering applications, cost is the primary factor and scoring will be based on the quantity of materials purchased.

Guidelines

Box Specifications

- The testing box will be made out of $\frac{1}{2}$ " plywood
- Bottom dimension 12" x 12"
- Side 1 & 3 dimension 12" x 16- $\frac{1}{2}$ " (see figure 1)
- Side 2 & 4 dimension 13" x 16- $\frac{1}{2}$ " (see figure 1)
- One 2"x2"x12" brace flush with the top corner between sides 1 & 3 alongside 2 (see figure 1)
- All testing boxes used at the 2017 GLSC will be provided by Milwaukee School of Engineering with a tolerance of $\pm \frac{1}{4}$ "



Figure 1: The test box with and without the front temporary wall. Inner dimensions are 12"x12"x16"

Material Specifications:

- Menards play sand: model #1891108
- Comet 8.5x11 printer paper
- Scott® Roll Towels: 12"x1000' lengths
- Georgia-Pacific 2-ply toilet paper (perforated) with width of 3.5"
- No additional additives, liquids, or materials shall be used except what is provided as specified in the official rules
- Materials can only be used inside the dimensions of the box

Fill Line:

- The testing box must be filled to between the minimum fill line at 14" and 16" as measured from the bottom of the box

Failure:

- Spill failure occurs when sand spills from the paper retaining wall after the temporary wall has been removed. Spills will be penalized as follows:
 - i) No penalty for $\frac{1}{4}$ cup or less

- ii) A \$100 penalty shall be assessed for a $\frac{1}{4}$ - $\frac{1}{2}$ cup spill after the temporary wall has been removed.
- iii) A \$250 penalty shall be assessed for a $\frac{1}{2}$ - 1 cup spill after the temporary wall has been removed.
- iv) Complete failure occurs when more than 1 cup (14.44 in³) has spilled out of the retaining wall.
- Vertical displacement failure occurs when the height of the sand drops by more than one vertical inch after the temporary wall is removed.
 - i) Before removing the temporary wall, the height of the sand will be marked by a judge.
 - ii) If upon removing the temporary wall, the soil settles more than 1" below the initial mark in **any** location after being leveled out, then complete vertical failure has occurred.

Loading:

- After the wall is completed and the testing box is filled, the temporary wall will be removed.
- If either complete spill or vertical failure do not occur, then a load of 100 pounds will be applied as a block of steel measuring 8" x 8" x 5.5" tall, to the center of the top surface of the backfill for 15 seconds.
- At the end of 15 seconds, if complete spill or vertical failure has not occurred, the retaining wall will be scored as follows:

Scoring and Judging

A dollar value has been assigned to each of the approved materials listed below. All of the materials that are to be used during the competition should be secured from Milwaukee School of Engineering during the event check in. Additional material can be purchased throughout the competition at a 10% cost surcharge.

Material	Cost Per Inch of Material	Notes
Printer Paper	\$15	Measured along the 8.5" side
Paper Towels	\$13	
Toilet Paper	\$1	

- The final cost will be determined as the length of material times the cost of each initial material, plus length of material times cost times 1.10 of additional materials, plus any penalties that have been assessed.
- Material will be provided in the total length requested. Scissors will be provided if teams wish to make more changes to the material dimensions.
- All materials purchased are final and will not be refunded.
- Time is not a scoring consideration, however all participants must complete the construction of their retaining wall within one hour. Teams who do not complete their retaining wall in the allotted time are subject to disqualification or additional penalties.
- Materials are subject to site conditions and may change without notice.