

2005 ASCE Carolina's Conference Geotechnical Competition

University of South Carolina - April 2005

The **intent** of this competition is to foster teamwork and sportsmanship in geotechnical engineering design. The competition rewards innovative engineering in minimizing the amount of constructing materials used, while maintaining practicality in assembly and construction times.

1. The **objective** of the geotechnical competition is to design and build a miniature reinforced-soil (also call Mechanically Stabilized Earth, or MSE) retaining wall inside a plywood form, using sand with paper affixed to a posterboard wall facing as reinforcement.
2. Design **goals** are to:
 - Satisfy prescribed MSE wall construction standards in a timely fashion, and
 - Sustain a specified surcharge load; while
 - Minimizing overdesign in terms of amount of paper reinforcement.
3. One **team** per campus will be allowed to participate. Teams may include up to four members.
4. The wall will be built inside an apparatus referred to as a **sandbox**. Each team will be provided with a sandbox at the competition. The sandbox has a bottom and three fixed, vertical sides. The fourth side, also vertical, is a removable panel that serves as the temporary form against which the reinforced wall is constructed. The box is made from standard $\frac{3}{4}$ inch "A-C" type plywood, with the "A"-side to the inside. The inside dimensions of the box are 18 inches wide, 18 inches high, and 26 inches long, with tolerances of +/- .one quarter inch. The inside surfaces are planar. The removable panel is flush with the front of the box. The removable panel is held in place with threaded inserts and wing bolts. When the panel is removed, the two fixed parallel sides of the box are held in place by a threaded tie rod located one inch below the top of the box and one inch back from the inside face of the removable panel. A conceptual sandbox is illustrated in Figure 1.

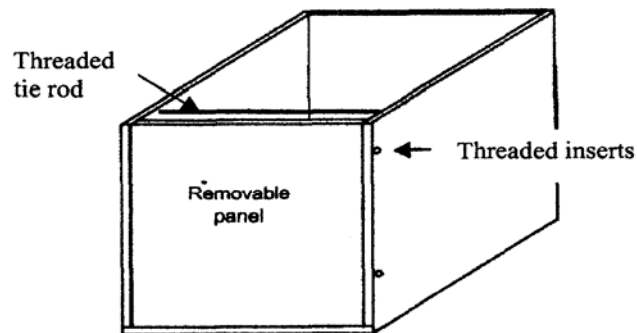


Figure 1. Schematic of plywood sandbox: front view.

5. The **backfill** material will be dry sand. The same material will be used as ballast to apply the design load. The University of South Carolina will provide the sand during the competition. Samples of the sand will be sent to each chapter no later than two months before the competition.
6. **Reinforcing materials** are specified in Table 1. The materials will be provided during the competition. Samples of the facing and soil reinforcing materials, each with areas of at least 16 square inches, will be sent to each chapter no later than two months before the competition begins.

Table 1. Reinforcing Materials

MSE Wall Component	Material
Facing	Posterboard, standard grade, 17 x 22 inches; one sheet
Soil reinforcement	Kraft paper, standard grade, 30-inch wide roll; length to be specified
Reinforcement – facing attachment	Packaging tape or carton-sealing tape, standard grade, 1.88 or 1.89 inches wide

7. Each team will provide its own **construction tools**. Permitted tools are pencils, pens, markers, rulers, straight edges, cardboard or posterboard templates, scissors, and razor knives. Quantities of the materials will not be restricted. **Scoops, buckets, and shovels will be provided at the competition.** The only other items that are permitted for use are design notes, calculations, and drawings. It will be necessary to use the bucket(s) to haul sand a distance not to exceed 200 feet.
8. **Construction** will proceed in two stages. Each stage must be completed in 30 minutes or less. No marking, layout, or assembly of the reinforcing materials is permitted prior to the start of construction.
 - A. **Assembly** stage – Reinforcement and facing are marked, cut, configured, and placed in the box as appropriate, preparatory to placement of sand. No sand can be placed or otherwise handled during this stage. The facing panel provided is larger than the height and width of the MSE wall so that small “wings” can be folded back to protect against spillage of sand around the edges. All tape used must be laid flat against the posterboard wall facing, with the sticky side facing the posterboard. Tape may only be used to attach kraft paper to the MSE wall. The inside surface of the box may not be textured or altered in any way.
 - B. **Execution** stage – The box must be filled with sand to within 2 inches of the top. The loading bucket is then placed on top of the sand, 5 inches back from the wall facing and centered between the side walls. The loading bucket is a construction-standard 5-gallon plastic bucket. Construction is not considered to be complete until the loading bucket is in place.

9. **Loading** of the constructed wall will proceed as follows: When directed by the judge, the team will be directed to remove the front panel of their sandbox. After a stabilization period of 1 minute, team members will apply a 50-pound surcharge load by pouring sand into the loading bucket. The 50 pounds of sand will have been measured and verified by a judge prior to this stage. Loading must be completed within ten minutes after the end of the stabilization period.
10. **Failure** of the wall will be declared if any part of the wall system, including paper, tape and retained sand, reaches the front plane of the sandbox. If failure occurs before loading is complete, the judge will record the weight of sand in the loading bucket at time of failure.
11. The team that **scores** the most points will be declared the winner. **Awards** will be handed out for the three highest scoring teams. Points will be awarded as follows:
 - One point (up to a maximum of 50 points) for every pound of surcharge the wall holds without failing.
 - $(100-X)$ points for total area of paper requested by the team where X is the area measured in square inches.
 - The amount of tape used will also be included in the scoring, but the method in which it will be included *has not yet been determined*.
 - $(30-Y)$ points for the time taken during the assembly stage where Y is the time measured in minutes.
 - $(30-Z)$ points for the time taken during the execution stage where Z is the time measured in minutes.

Awards will be distributed during the banquet on Saturday evening.

12. The following are grounds for **disqualification**:
 - a. Failure to adhere to the prescribed construction standards for the retaining wall or for the sandbox.
 - b. Failure to complete construction within the one-hour limit.
 - c. All judges agree that a team had deliberately tried to violate the spirit of the competition.

It should be noted that this is a working draft of the rules. Minor changes may come!

If you have any comments or questions, please contact Jared Bramblett at bramblej@engr.sc.edu.