Geo-Institute

of the American Society of Civil Engineers

Presents

Competition Rules for the

2026 ASCE Virginias Student Symposium GeoWall Competition

Held at Old Dominion University

April 9 - 11, 2026

Captains meeting: Saturday, April 11th 8-9AM (Chartway Arena)

Competition: Saturday, April 11th 10AM-12PM (Chartway Arena)

Competition Info: https://studentsymposium.asce.org/virginias/

GeoWall Competition Rules

2026 ASCE Virginias Student Symposium

1. **Objective** -- The objective of the GeoWall competition is to design and build a model mechanically stabilized earth (MSE) retaining wall using paper reinforcement taped to a posterboard wall facing. The design objective is to use the least amount of reinforcement needed to support the retained soil plus vertical surcharge loads.
2. **Eligibility --** Only one team per school will be allowed to compete. A team consists of a maximum of four (4) undergraduate students. Each team shall designate a captain who shall be the point of contact for the team. All team members must be enrolled students at the date of the competition.
3. **Differences from the National GeoWall Competition --** For the Virginia's regional competition a poster will be displayed and judged in place of a paper. There will be no horizontal loading component to the surcharge.
4. **Submittal** – The Mechanically Stabilized Earth Wall Poster:

   The poster must include:

   a. Name of institution; names and status (graduate, undergraduate) of each team member; identification of team captain with email address; and name, title, and email address of faculty advisor.
   b. Material properties used in design including methods (lab tests, correlations, assumptions) used to obtain the properties.
   c. Description of the engineering design and construction procedures including assumptions and equations used.
   d. A complete description of the geometry and placement of all reinforcing elements. Estimated mass of the reinforcing paper in grams (not including facing material or tape).

   Formatting requirements:

   e. Poster board dimensions are the standard 36 in. by 48 in.

   Posters will be judged before the walls are built and tested by a panel of practicing engineers and professors. Judging will consider reasonableness of design equations, material properties, factors of safety, and assumptions. “Trial and error” designs will be heavily penalized. In addition, presentation and theme of the poster will be taken account. The judging rubric is presented in Appendix B.
5. **Sandbox –** The MSE wall will be constructed within an apparatus hereafter referred to as a sandbox. Each team shall bring their own sandbox to the competition. Painting and addition of school or sponsor logos and other decorations to the exterior of the sandbox is encouraged. The sandbox shall be made up of a bottom and three fixed vertical sides. The fourth side, also vertical, must be a removable facing panel that serves as the temporary form against which the MSE wall is constructed. Dimension of the box are shown in Figures 1 through 2. The sandbox will meet the following requirements

a. Have exteriors walls and base constructed of standard ¾-inch A-C grade plywood.
b. Have planar inside surfaces.
c. Removable facing panel will be flush with the front of the box and held in place with threaded inserts, screws or other easily removable fasteners.
d. Include a steel tie rod designed to keep the two fixed sides of the box parallel after removal of the facing panel.
e. All dimensions of the sandbox shall be as shown in Figures 1 and 2.

For convenience, sandboxes may be designed so they can be transported as flat pieces and reassembled at the competition site.

Sandboxes will be checked for compliance at the pre-competition captains' meeting. Teams will have until the beginning of competition to correct any compliance issues. Any team with a box out of compliance at the start of competition will be penalized.

6. **Backfill Sand-** The backfill material will be clean, dry sand provided by the host school at the competition site. The sand selected for use is locally supplied mortar sand that meets specifications of ASTM C144 – 11, Natural Sand. The backfill material must be used as-is: no water, additives, or chemical stabilizers may be placed in the backfill material.

   Competition organizers will make reasonable efforts to ensure the specified sand is provided. In the event the specified sand cannot be provided at the location and time of the competition, a substitute sand will be provided.

7. **Wall Materials –** Materials will be provided by competition organizers on site. See Appendix A for detailed specifications.
   a. **Facing** - Poster board. See Figure 3 for dimensions.
   b. **Reinforcement** – 60 lb Kraft Paper. Quantity of reinforcement will be measured by mass to the nearest 0.01g. There are no restrictions on the shape or geometry of reinforcing elements, but all reinforcement must be cut from a single sheet 24″ × 24″.
   c. **Reinforcement Attachment to Facing** – Heavy duty polypropylene packaging tape, 2″ wide.

8. **Construction Tools -** The following construction tools may be used and must be provided by the competing team (quantities of these items shall not be restricted):
   a. Pencils, pens, and markers
   b. Rulers and straight edges
   c. Levels
   d. Cardboard or poster board templates.
   e. Manually operated cutting instruments (e.g., scissors, utility knifes, razor blades, hole punch)
   f. Cutting boards or mats
   g. Design notes, calculations and drawings
   h. Compaction tools consisting of any hand operated devices with no moving parts.
   i. Screwdrivers (battery operated drills or screwdrivers may be used, but only to remove fasteners when removing the facing panel)

j. Temporary templates for use in any stage of competition. May be made of any material, must not have any moving parts, must be removed at the end of any stage in which they are used.

Scoops, buckets and shovels will be provided by the competition organizers. It may be necessary for teams to haul sand a distance up to 20 feet.

9. **Execution –** Construction and testing of the wall will be done in the following stages:
   a. **Reinforcement Fabrication Stage –** Each team will be provided with a single sheet of 60 lb kraft paper approximately 24″ × 24″. The team must fabricate all their reinforcing elements from this sheet using authorized construction tools. Fifteen (15) minutes will be allotted for this stage. Teams will be penalized for time exceeding the time limit. After all reinforcing elements are fabricated, excess material will be disposed of and the judges will weigh the reinforcing elements to the nearest 0.01 grams.
   b. **Wall Assembly Stage** – After each team's reinforcing elements have been fabricated and weighed, the team will be provided with a single sheet of poster-board (22″ × 28″) and a roll of packaging tape. The team must assemble their wall using these materials and authorized construction tools. Dimensions for the wall facing are shown in Figure 3.
      Tape may be used only to attach reinforcement to wall facing. Tape must be used in individual pieces no larger than 2″ × 2″. The adhesive side of each piece of tape must be in contact with both the wall facing and a reinforcing element. Tape pieces may not overlap one another. All tape pieces must be placed on the wall facing in the vertical plane of the wall facing (not on the wings or bottom of the facing). Tape may not be used for any other purpose, including but not limited to: sealing corners of facing material, joining two or more reinforcing elements, anchoring facing material or reinforcement to the box.
      The wall should be trial-fitted to the sandbox during this stage. Any portion of the wall which rises more than ¼″ above the top of the sandbox must be trimmed off. The assembly stage is complete when the facing material is properly folded and trimmed, and all the reinforcing elements are attached to the facing. No sand is added to the box in this stage. Fifteen (15) minutes will be allotted for this stage. Teams will be penalized for time exceeding the time limit. Judges will check to ensure the wall is properly assembled.
   c. **Construction Stage** – After the wall is assembled and checked by the judges, the judges will instruct the team to start construction. During this stage the team installs their wall in the sandbox, fills the box with sand to within one (1) inch of the top of the box, and places the empty 5 gallon vertical surcharge bucket on top of the sand. The facing material must be in direct contact with the inside of the sandbox at all times during this stage. The tie rod may be removed from the box at the start of this stage, but it must be in place before any sand is placed in the box. Temporary templates may be used during this stage so long as they are removed before the end of the stage.

The construction stage is complete when the wall is in place, the sand backfill is level and within one (1) inch of the top of the box, any temporary templates have been removed, and the empty vertical surcharge loading bucket is in place. Twenty (20) minutes will be allotted for this stage. At the end of the phase, judges will check fill and pile placement to ensure they meet requirements.

d. **Loading Stage** – This stage occurs in three steps: 1) removal of front panel and 2) placement of vertical surcharge. During each step the wall will be checked for the following three criteria: 1) excessive deformation (any portion of the wall extending outside of the sandbox), 2) excessive soil leakage (more than 30 cm^3 of sand passing out of the sandbox), and 3) catastrophic failure. The team will be penalized for excessive soil loss and excessive deformation. Catastrophic failure will disqualify the team.
   i. When directed by judge, the team shall remove the front panel of the sandbox. After the panel is removed, the judge will wait one (1) minute and then check the three criteria.
   ii. If the wall does not fail catastrophically, the team will then place 50 lbs of sand in the vertical surcharge bucket. The team will have one (1) minute to place the load. After the load is placed, the judge will wait one (1) minute and then check the three criteria.

10. **Design Changes –** Teams may change their design between the time the design poster is presented and the wall is tested. The official mass of the reinforcing material used for scoring will be computed as the greater of a) the average of the mass reported in the design poster and the mass actually used or b) the mass actually used.

11. **Scoring** – After completion of the loading stage, the score for each team will be computed using the following formula:

$$Score = R + 16(13 - M) - 5(N_{\min}) - 25(N_{maj}) - 2(T) - 20(D) \quad (1)$$

Where

R = poster score out of 50 points
M = official mass of the reinforcement material in grams
N_{min} = number of minor rules violations
N_{maj} = number of major rules violations
T = total number of minutes over time limit for all phases rounded up to nearest minute
D = deflection rating
3 if wall fails deflection criterion during initial loading without surcharge
1 if wall fails deflection criterion during vertical surcharge loading
0 if wall passes deflection criterion for all loading phases

a. **Minor Penalties**
   i. Box dimension out of spec

ii. Any other rule violation that in the opinion of the judges that has the potential to provide the team with a measureable but minor advantage

b. **Major Penalties**
   i. Soil leakage greater than 30 cm^3 (volume of standard 1 oz plastic medicine cup)
   ii. Improper use of adhesive tape
   iii. Any other rule violation that in the opinion of the judges has the potential to provide the team with a significant advantage, but does not warrant disqualification

c. **Disqualification –** Teams may be disqualified for the following:
   i. Catastrophic wall failure
   ii. Unsafe practices
   iii. Design or construction techniques which violate the spirit of the competition and provide an large and unfair advantage

Scores will be recorded to the nearest tenth of a point. In the event of a tie the following criteria will be used, in order, to break the tie: 1) lowest reinforcement mass, 2) higher poster score, 3) lowest deflection rating, 4) judges' consensus of best decorated box.

The judges will follow the rules as published using reasonable judgment and interpretation. The head judge will be the arbiter of any disputes. Decisions of the head judge are final.

Scoring Example: Assume a team constructs a wall with following characteristics

- Poster Score: 38/50, $R = 38$
- Design poster specifies 7.44 g. Reinforcement used, 6.42g.

$$M = \frac{7.44 + 6.42}{2} = 6.93$$

- Minor deductions for tape overlapping on wall face and pile misalignment, $N_{min} = 2$
- One major deduction for leakage of more than 30 cm^3 of sand out of box, $N_{maj} = 1$
- Execution times were
  - Reinforcement fabrication: 15:18 (18 sec over allotted time)
  - Wall assembly: 16:05 (1:05 over allotted time)
  - Construction: 18:27 (under allotted time)
  - Total time over: 1:23, $T = 2$
    Note: Only times over limit during each stage are counted. Teams get no benefit for times under the limit of any individual stage.
- Wall passed deflection test in first loading phase but failed during second loading phase, $D = 1$

Using equation 1, the final score would be

$$\begin{aligned} Score &= 38 + 16(13 - 6.93) - 5(2) - 25(1) - 2(2) - 20(1) \\ &= 76.12 \end{aligned}$$

See Appendix C for scoring checklists.

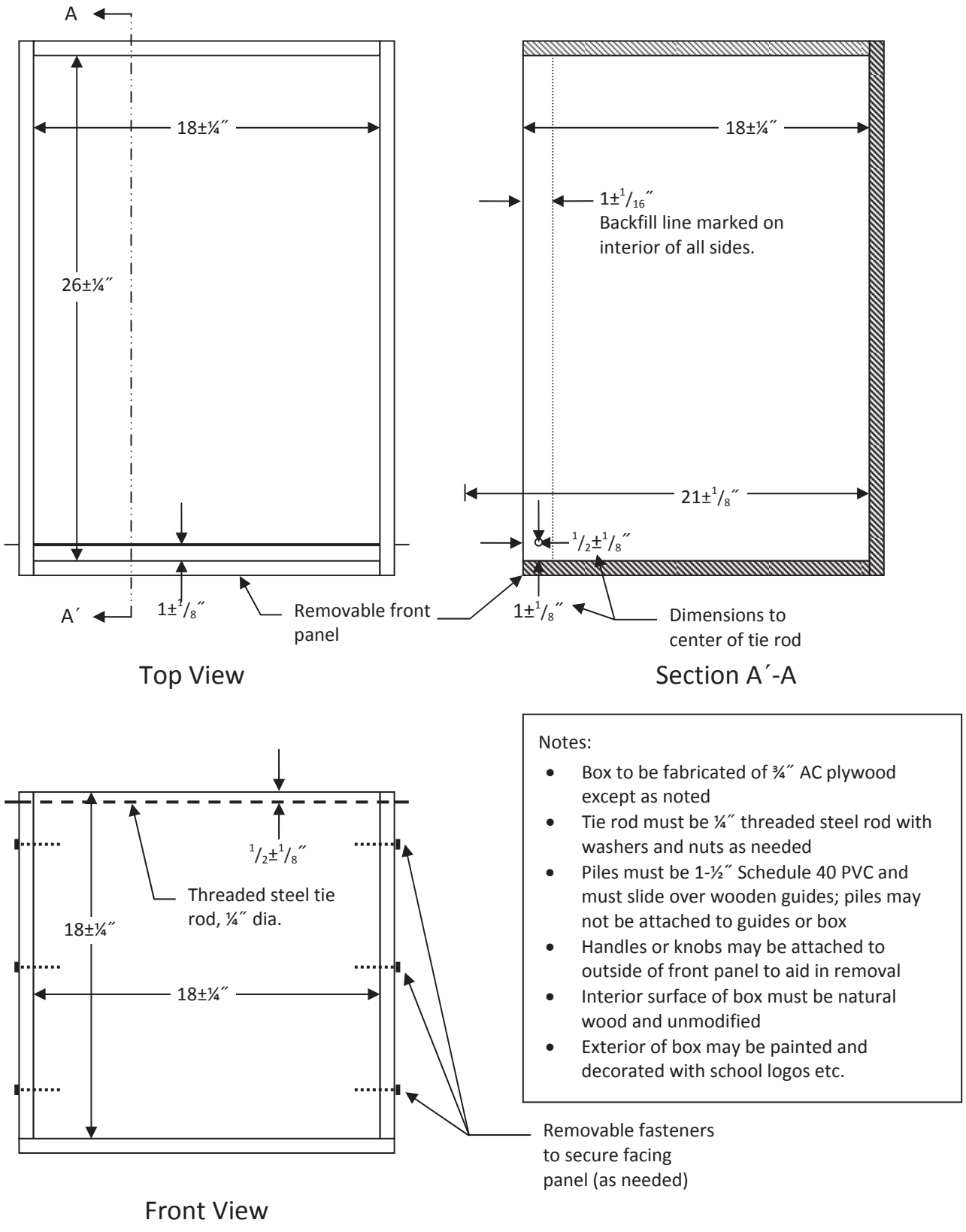
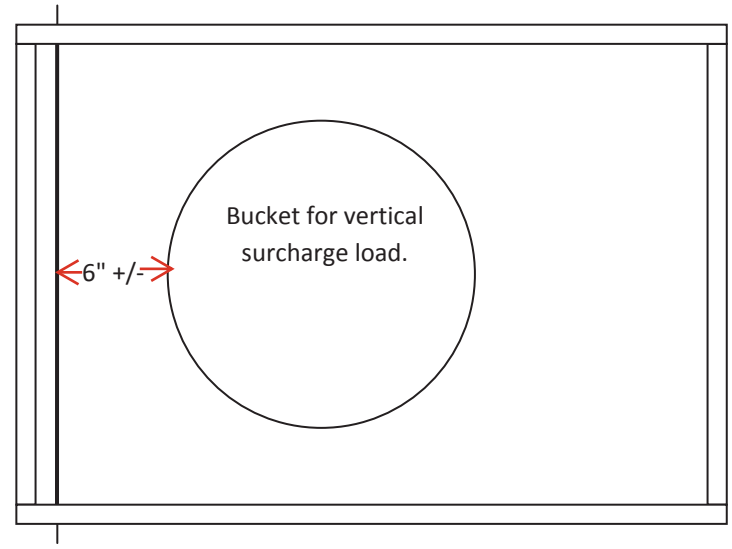
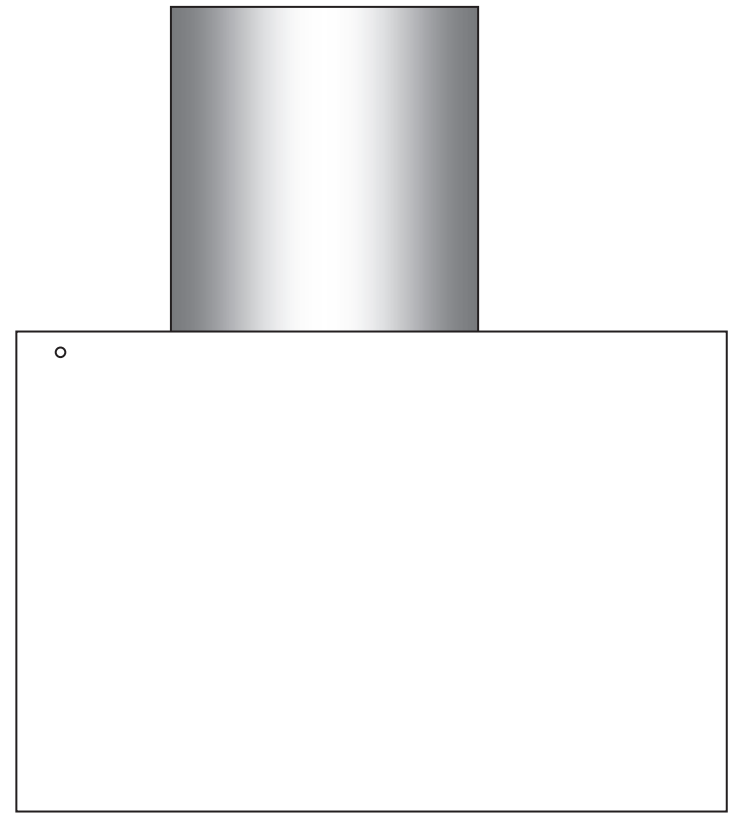


Figure 1: Sandbox Dimensions (not to scale)



Top View



Side View

Figure 2: Load Placement (not to scale)

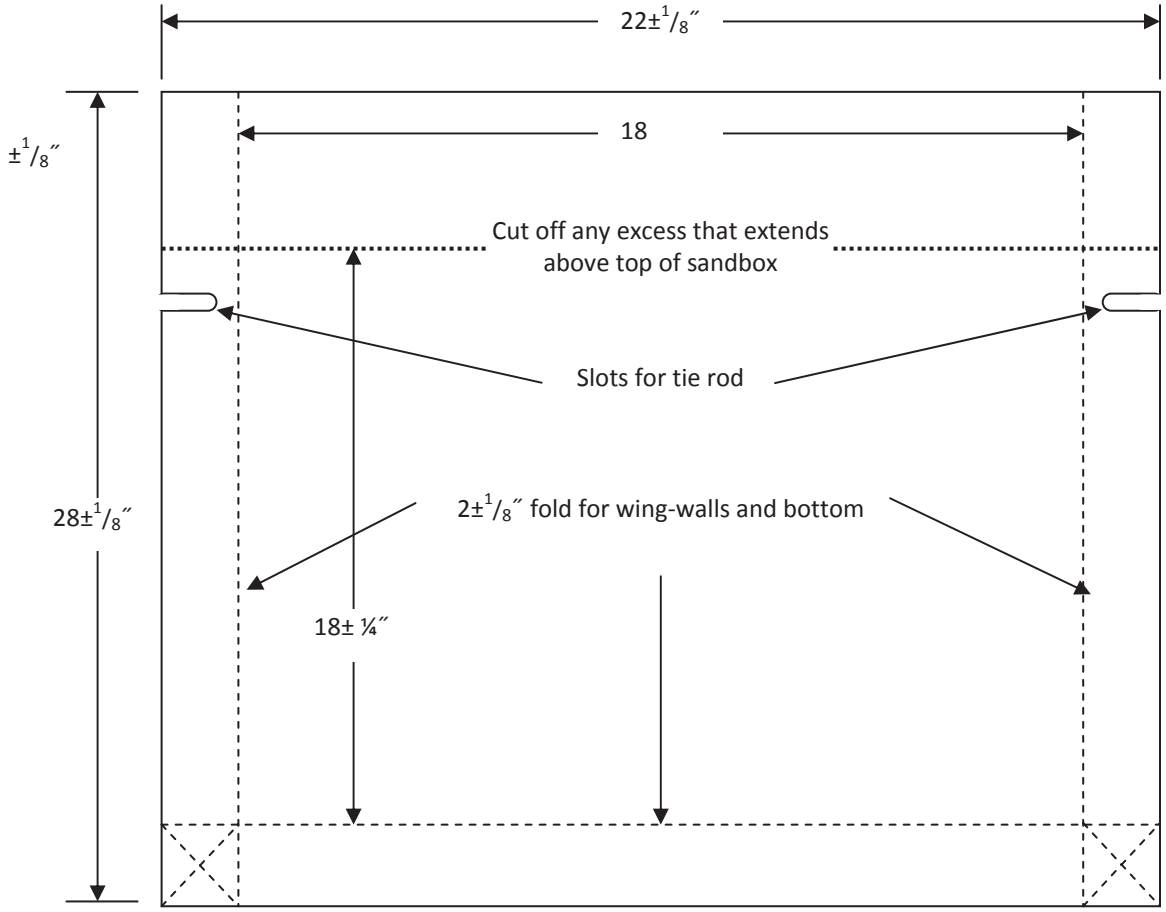


Figure 3: Dimensions of the posterboard wall facing (not to scale)

Appendices

Appendix A: Material Specifications

- **Sand**:
  - Clean sand ASTM C144 Natural Sand
- **Sandbox Material**:
  - Walls and Base: ¾″ A-C plywood
  - Pile guide: any wood material ¼″ thick or less
  - Tie Rod: ¼″ threaded steel rod with washers and nuts as needed
  - Fasteners: any suitable wood fasteners
- **Facing Material**:
  - Poster Board, 22" x 28", White
  - Grammage: 194 g/m^2, 0.125 g/in^2

- **Reinforcing Material**:
  - 60 lb Kraft Paper
  - Grammage: 97.7 g/m^2, 0.063 g/in^2

- **Adhesive Material**:
  - Heavy duty, clear, 2″ wide, polypropylene package tape
  - Scotch® 142-B Super Strength Mailing Tape, clear

Appendix B: Design Poster Judging Rubric

Geo-Institute of the ASCE: GeoWall Design Poster – Scoring Form			
Reviewer Guidelines: 1) Place weight on the team ability of engineering reasoning not technical knowledge 2) Place weight on team communication skills on procedures, findings and observations 3) Score in 0.5-point increments 4) Team to be awarded higher score if verifying design parameters beyond assumptions and references			
Team School:			
Criterion	**Max**	**Actual**	**Notes**
1) Formatting, Mechanics and Grammar:			
a. Poster size, margins & font are acceptable	2		
b. Layout, or structure, of poster is logical	2		
c. Grammar and punctuation are correct	2		
d. Figures & tables are clear, properly numbered, captioned and referenced in the text	2		
e. References are reasonably formatted and complete	2		
2) Experimental Methods, Analyses and Design:			
a. Methods to obtain soil properties	3		Experimental methods are reasonable and clearly described
b. Methods to determine reinforcement properties	3		Experimental methods are reasonable and clearly described
c. Methods to determine soil-reinforcement interaction	3		Experimental methods are reasonable and clearly described
d. Engineering properties are reasonable	3		Soil unit weight, friction angle, interface friction angle, reinforcement strength are compared to typical values
e. Earth-pressure calculations provided (backfill only)	3		Calculations are correct and presented in a logical, readily followed format
f. Vertical surcharge loads included in the design	3		Considers both lateral loads on wall and effect on reinforcement pullout
g. Method used to compute pressure applied from laterally loaded piles addressed in poster	3		Considers distribution of lateral load on wall
f. Determination of reinforcement length	3		Method and assumptions are reasonable
g. Determination of reinforcement spacing	3		Method and assumptions are reasonable
j. Evaluation of connection strength	3		Method and assumptions are reasonable
3) Engineering Reasoning and Communication			
The poster is clear, precise, and well-reasoned. Engineering terms and distinctions are used effectively and in keeping with established professional usage. Presenters demonstrate a clear understanding of the MSE wall design problem. Little or no irrelevant information is presented, key assumptions are identified, and key concepts are clear. The competing school has shown, through their poster & presentation, excellent engineering reasoning and problem-solving skills.	10		Scores may range from 0 to 10. It is the opinion of the reviewer as to how the overall poster and presentation measures up to the criteria listed under item 3 "engineering reasoning and communication".
Total	50		

Appendix C: Judges' Scoring Checklist for GeoWall Competition

C1: Captains' meeting—Box check

Team School:		Deductions	
Item	**Instruction**	**Minor**	**Major**
Plywood	☐ ¾″ A-C grade ☐ Inside surfaces planar		
Box dimensions	☐ Within tolerance ☐ Sand fill height marked		
Facing panel	☐ Flush to box front ☐ Removable fasteners		
Tie rod	☐ ¼″ dia ☐ Located within tolerances		
Tools	☐ Only authorized tools used		
Other minor, explain:			
Other major, explain:			
Disqualification, explain:			
	Total deductions		

Notes:

C2: Reinforcement fabrication

Item	Instruction	Time	
		Total	**> 15:00 (Min:sec)**
Time	Give start command. Time ends when all elements cut to size and shape		
		Mass (g)	
		Design	**Actual**
Mass	Weigh reinforcement to nearest 0.01 g		
Compute official Mass, *M*, as max of a)average of design & actual or b) actual		*M* =	
		Deductions	
Deductions		**Minor**	**Major**
Tools	Only authorized tools used		
Other, explain			
	Total deductions		

Notes:

C3: Wall Assembly

Team School:			
Item	**Instruction**	**Time**	
		Total	**> 15:00 (Min:sec)**
Time	Give start command. Time ends when wall is assembled and trial fit to box (NO SAND PLACED DURING THIS PHASE)		
		Deductions	
		Minor	**Major**
Tape piece	☐ Each ≤ (2″ × 2″) ☐ On vertical front plane only ☐ Not overlapping ☐ Touch both wall and reinforcement		
Slots for tie rod	☐ Cut so rod does not support wall		
Dimension	☐ Trimmed to top of wall		
Design Compliance	☐ Spot check to ensure reinforcement is as designed. Explain any deductions		
Tools	☐ Only authorized tools used		
	Total deductions		

Notes:

C4: Construction

Item	**Instruction**	**Time**	
		Total	**> 20:00 (Min:sec)**
Time	Give start command. Time ends when soil filled to line and empty bucket & load frame are in place		
		Deductions	
		Minor	**Major**
Backfill	☐ Level ☐ Filled within 1″ of top		
Tools	☐ Only authorized tools used		
Tools	☐ Only authorized tools used		
	Total deductions		

Notes:

C5: Loading

Team School:			
Item	**Instruction**		
Stage 1: Backfill only	• Place clean posterboard on floor in front of box • At judge's direction students remove front panel of box. Electric drills/screwdriver may be used to remove fasteners. • Once panel is completely removed start 1 min wait period • At end of 1 min make following checks		
	☐ Swipe front wall face with straight edge to check for wall deflection outside of box front	☐ Pass	☐ Fail *D* = 3
	☐ Less than 30 cm^3 sand leaked from box onto floor	☐ Pass	☐ Fail Major Ded
	☐ Catastrophic failure	☐ Pass	☐ Fail DQ
Stage 2: Vertical Surcharge	• Bucket preweighed with 50 lbs of sand should be ready. • At judge's direction students add 50 lbs of sand to surcharge bucket. Students have one minute to complete loading. • Once load is placed start 1 min wait period • At end of 1 min make following checks		
	☐ Loading complete within 1 minute	☐ Yes	☐ No Minor Ded
	☐ Swipe front wall face with straight edge to check for wall deflection outside of box front	☐ Pass	☐ Fail *D* = 2
	☐ Less than 30 cm^3 sand leaked from box onto floor	☐ Pass	☐ Fail Major Ded
	☐ Catastrophic failure	☐ Pass	☐ Fail DQ

C6: Scoring

$$Score = R + 16(13 - M) - 5(N_{\min}) - 25(N_{maj}) - 2(T) - 20(D)$$

Team School:			
Item	**Score**	**Weight**	**Extended**
Poster score out of 50, *R*		1	
Reinforcement mass in grams, *M*, enter score as (13 – *M*)		16	
Total # of minor deductions, N_{min}		-5	
Total # of major deductions, N_{maj}		-25	
Total time over limit rounded up to nearest whole minute, *T*		-2	
Deflection rating, *D* 3 = Deflection exceeded at Stage 1 1 = Deflection exceeded at Stage 3 0 = Deflection never exceeded		-20	
		Final Score	

Notes: