

University of South Alabama  
Civil Engineering Department

# **Rules and Regulations**

## **For**

# **The Model Concrete Canoe**



Presented by the Student Chapter of the American Society of Civil  
Engineers at the University of South Alabama  
for the USA-ASCE High School Competition

Rules Updated December 2021

# Concrete Canoe

## Requirements

Each team will construct one concrete canoe alongside one concrete cylinder, with the same mix design, to be tested for floatation, structural stability, and strength of the concrete cylinder. Teams should also provide a mix design sheet and testing data.

## Specifications

- The canoe shall have a length of at least 24 inches and shall not be more than 36 inches
- The canoe shall have a maximum beam width of 12 inches
- The canoe shall have an outside height of 4 to 6 inches
- The canoe shall have an inside depth of 3 to 5 inches
- Other elements of the canoe to include, but not limited to thwarts, ribs, and rockers, shall not be measured and their dimensions and locations are at the discretion of the team.

## Concrete Design

The concrete mix of the model canoe shall consist of any of the following materials:

- Fly Ash, cement, fibers, aggregates, admixtures
- Admixtures such as Water-Reducing (Normal, Mid-Range, and High-Range), Set-Controlling Admixtures, Air-Entraining Admixtures, Coloring Admixtures/Agents and Concrete Pigments, and Polymer Modifiers are permitted.
- Specialty Admixtures, such as but not limited to, shrinkage reducers, integral capillary water proofers, and viscosity-modifying admixtures are permitted
- Epoxy resins (such as acrylic, phenolic, and polystyrene resins), their curing agents, asphalt emulsions, or similar materials shall not be considered as specialty admixtures and are prohibited

## Mix Design Sheet

Mix Design Sheets must be submitted before **02/21/2022**. Failure to do so may result in 10 points being deducted from the final score of this competition.

- Materials used: including all admixtures, pigments, and reinforcements
- Specific gravity of each material used
- Water to cementitious materials ratio
- Aggregate proportionality
- Total water used
- Air content
- Theoretical, design, and actual density

### Reinforcement

- Any materials may be used for reinforcement as long as it is encased within the concrete

### Floatation

- Hollow cavities or air bladders are not permitted
- Floatation material that is incorporated into the canoe must be encased in concrete
- Floatation can be placed at any location inside the canoe as long as it is below the gunwale line
- Floatation pieces must be at least 6 inches from each other

### Concrete Cylinder

- Each team will submit one 4 inch diameter, 8 inch tall concrete cylinder with the same mix design as the canoe to be tested in the compression machine
- This competition will be scored based on the highest strength compared to the other competitors

### Testing

#### 1. Structural Stability:

- To determine the structural stability, weights will be applied to the canoe while in water until it sinks or cracks.
- The team that supports the most weight will receive the maximum number of points

#### 2. Floatation:

- The canoe shall pass a floatation test whereby the canoe floats horizontally such that the most exterior point of each canoe end breaks the water surface simultaneously within five minutes of being completely filled with water.
- Canoes should be able to pass the floatation test either by the inherently buoyant design of the canoe or through the incorporation of floatation material in the design
- Teams that pass the floatation test will receive the maximum number of points while teams that do not pass will receive zero points

\*Transportation of the Concrete Canoe to the University of South Alabama, on the morning of, or days leading up to, the judging, is up to the team.

Scoring

Category	Requirements	Points
Flotation	Passing the flotation test (40 points) Failure of the flotation test (0 points)	
Structural Stability	First Place (40 points) Second Place (35 points) Third Place (30 points) Nth Place (40-5(N-1) points)	
Mix Design Cylinder	First Place (20 points) Second Place (18 points) Third Place (16 points) Nth Place (20-2(N-1) points) *Bonus 10 points for any cylinder reaching 6000 psf	