

Can Concrete Float?

by Brandy Woldstad

It may be hard to imagine, but yes it can. Each spring teams of college students in the United States and Canada race canoes that they designed and built out of concrete. The canoes not only float, but they also hold up to four people. The races test how fast the canoes go, how well they steer and how durable they are.

At the beginning of the school year, the concrete canoe teams divide the tasks needed to meet the requirements of the contest. One of the tasks is figuring out the best design of the canoe hull. This is done using a computer program that assists with the calculations to determine the final design of the canoe.

Another task is to figure out how to make the concrete float, yet still be strong. Concrete is made up of three main elements: cement, water, and aggregates. Usually, in concrete, an aggregate is a mixture of coarse gravel and sand. Since rocks tend to add weight which could potentially sink the canoe, the team tries to find lighter aggregates such as ash, foam, lightweight beads, or other light materials. Once an aggregate is created it is then mixed with the cement. The cement, when mixed with water, acts like glue to hold everything together. The end result is concrete that, if it were tossed into a pool of water will float.

The overall design of the canoe determines if the canoe will float with or without people, how easy it will move on the water, and how easy it is to paddle. Calculations are done before the canoe is built to determine if the proposed canoe design will float. Once a design is agreed upon, the concrete is poured into molds to the shape of the canoe. Each canoe takes about 5-10 cubic feet of concrete. The final canoe has walls one-half to one inch thick, weighs 170-250 pounds, and is about 19 feet long. It looks like a regular canoe. It steers like a regular canoe and can go as fast as one. One main difference from a regular canoe is the concrete canoe is brittle. If it is struck by something or hits the shore too hard, it will get a hole in it instead of a crack like other materials.

Each team selects who paddles the canoe in different ways. Some of the teams select experienced paddlers or people who have been training for the event all year. Other teams let anyone who helped build the canoe paddle it. Paddling the canoe is a reward for all the hours spent building it. Teams practice paddling their canoe before race day to make sure it floats and to see how well it moves in the water. Minor adjustments are made as needed.

On race day, all the concrete canoes must pass a safety test called the swamp test. The canoe will be taken into knee deep water. Then the team submerges it. If the submerged canoe floats to the top of the water it passes the test. If it doesn't pass, the canoe is taken out and foam blocks may be added to the inside of the canoe to help it float to the top. The canoe is then tested again. The swamp test ensures that if something happens to the canoe in deeper water the canoe won't sink to the bottom. Instead, it will float enough that it can be retrieved and brought back to shore.

There are five races that the canoes run. Each race has a different number of paddlers. One will have two men, another will have two women, another will have three men, another will have three women, and the last one will have two men and two women. The winners of the concrete canoe race receive a score that is added to their final competition score. The teams are also scored on their design paper, a presentation given to a panel of judges, and the final product (how it looks and how durable it is).

After the competition is over the teams decide what to do with the canoe. Some canoes are put on display at the team's college. Other canoes have been auctioned off to raise money for charity, recycled to build a new canoe the next year, or thrown away. One time, a team from Michigan Tech used their concrete canoe as a toboggan.

Building a concrete canoe gives engineering students (and anyone else who is interested) a chance to gain hands-on experience with different ways concrete can be used. It also challenges what we expect concrete to be used for.

Bibliography

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