An Innovative method of Concrete Canoe

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Abstract:* Concrete, it's in our sidewalks, the foundations of our homes, in buildings, bridges, roads and dams around the world. While concrete has become the most widely used building material in the world, it remains a mystery to many. All that makes concrete float is its density, made lower than that of water. A simple Archimedes principle is used for its design. The concrete canoe should be able to float on water with its self weight alone (i.e. before loading it). After the canoe have to be bear the 2/3 of the weight have to be bear in the total area of the boat while concrete boat in floating of water. The boat should constitute of cement and sand as primary constituents and other materials of bamboo stick, wire mesh and hydrogen pyraxiode. The canoes must contain 75% cement. Concrete is made by mixing an aggregate material, usually sand or gravel, with cement and water, which causes the cement to bind the mass. Most teams choose a light concrete mix made of things such as tiny balloons, microscopic glass beads or hollow ceramic. The trick: to create a concrete mix less dense-lighter-than water.

***Index Terms* – Cement, Bamboo, Hydrogen peroxide, concrete canoe, compressive strength.**

I. INTRODUCTION

Concrete is a common construction material used in pavement, architectural structures, foundations, roads, parking structures, and brick/block walls. It consists of cement mixed with water and an aggregate (a space filler). Concrete used for sidewalks, for example, use larger, heavier aggregates like rocks, gravel, or sand, but for concrete canoes, the teams use very light materials: glass bubbles, fly-ash, or silica fume. Concrete hardens after mixing and placement because the water reacts with the cement -- a chemical process known as hydration -- and this bonds all the components together to create a stone-like material.

Canoe design is considered more an art than a science. Design evolution has grown from experience unlike naval research, which guides ship development. This difference in design strategy does not Neglect the fact that designs are governed by their use. Ship theory literature, past experience, and interviews with a commercial canoe designer led the research effort. The primary goal of the construction process was to ensure consistent concrete thickness and shape while efficiently utilizing resources. To effectively control concrete thickness and cracking while curing the canoe team elected to construct a new female mold from Styrofoam. The choice of this foam was based on its low price, its ease of hotwiring, and its safety compared to other materials.

Concrete canoes can float thanks to Archimedes' Principle. Archimedes was an ancient Greek mathematician who figured out that a body immersed in a fluid is pushed up by a force equal to the weight of the displaced fluid. This is called buoyancy; an object will float if its buoyancy is greater than its weight, and will sink if its weight is greater than its buoyancy. The shape and position of the body affects the strength of the force pushing up on the body. So a concrete canoe placed on end in water will sink because the weight of concrete is greater than that of the displaced water. However, in its normal position, the weight of the canoe depends on its total volume, since it includes all the air inside it. So the average weight is less than that of the water displaced, and the canoe floats.

II. PRINCIPLE

Ignoring hydrodynamic effects, all ships or boats float because the weight of the water they displace is equal to the weight of the boat (Archimedes principle) However, many boats are made of materials that are denser than water, meaning that the boat will sink if filled with water. Although it is not required by the rules of the competition, some competitive concrete canoes have concrete mix designs that are less dense than water. They must pass a test in which the canoe is filled with water and pushed below the surface; the canoe must then resurface in order to qualify for racing. This is possible because, unlike normal concrete which uses sand and small rocks, concrete canoes are created with porous aggregates such as Microcline and microspheres However, because many teams still design their concrete mixes to be denser than water, in the United States, teams are allowed to insert concrete-covered, non-structural foam pieces in their canoes to make the canoes float after being submerged.

III. MATERIALS USED FOR CONCRETE CANOE

a) Bamboo sticks and steel mesh of gauge 0.4 to 0.6mm and spacing of 5mm are necessary
b) Birla white cement and Ordinary Portland Cement of 53grade
c) Fine aggregate
d) Hydrozen peroxide is used for bublle fomation in the concrete and it is an air entired concrete
e) Binding wire of 0.5mm gauge for the purpose of jointing the edge of the bamboo sticks and to maintain the stiff joint at the edges
f) Super plasticizers (0.1%) to increase the workability criteria of a concrete

IV. METHODOLOGY

4.1 **Preparation of bamboo sticks canoe:**

To preparation of canoe using of bamboo stick to arrange proper shape of the boat should be prepared after that the edges and joints should be joined by the using of binding wire 0.5mm gauge should be used to the joints.

Using of Birla white cement (The density should be low compared to the other cement) and fine aggregate as a mix ratio of 1:2.5, and water as 50%, H_2SO_4 50% and super plasticizer of 0.1% is used for the preparation of cement paste it should be applied to the mould of a bamboo for suitable thickness and prepare as a good finishing to the concrete boat. After that with the same mortar to cast the cubes of a size of 7.04cmX7.04cmX7.04cm. casting the cubes and curing to find out the compressive strength cement mortar.

4.2 **Preparation of steel mesh canoe:**

To preparation of canoe using of steel mesh of gauge 0.4 to 0.6mm and spacing of 5mm to arrange proper shape of the boat should be prepared after that the edges and joints should be joined by the using of binding wire 0.5mm gauge should be used to the joints.

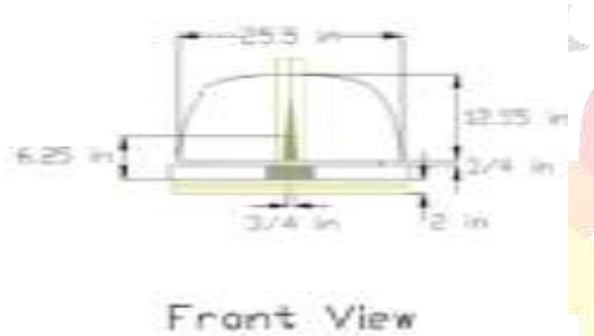
Using of Ordinary Portland Cement and fine aggregate as a mix ratio of 1:2.5, and water as 50%, H_2SO_4 50% and super plasticizer of 0.1% is used for the preparation of cement paste it should be applied to the mould of a steel mesh for suitable thickness and prepare as a good finishing to the concrete boat. After that with the same mortar to cast the cubes of a size of 7.04cmX7.04cmX7.04cm. Casting the cubes and curing to find out the compressive strength cement mortar.

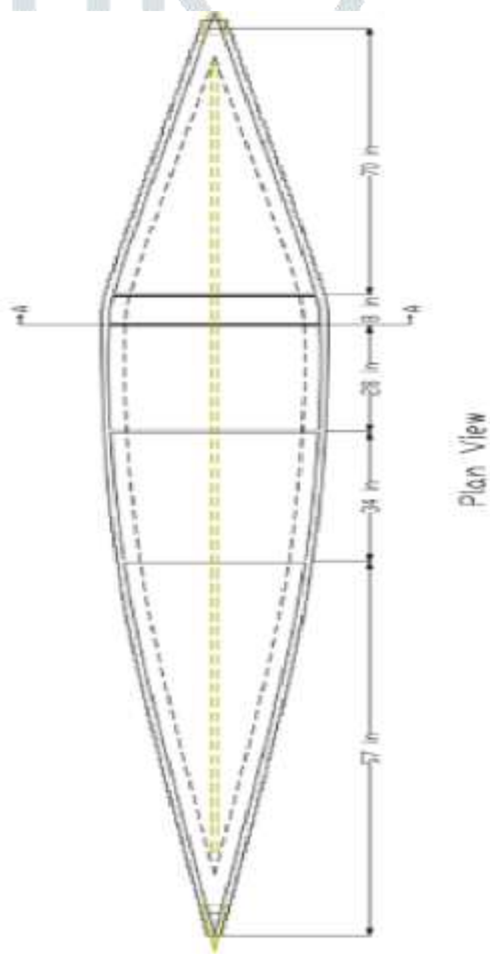
4.3 Mix design:

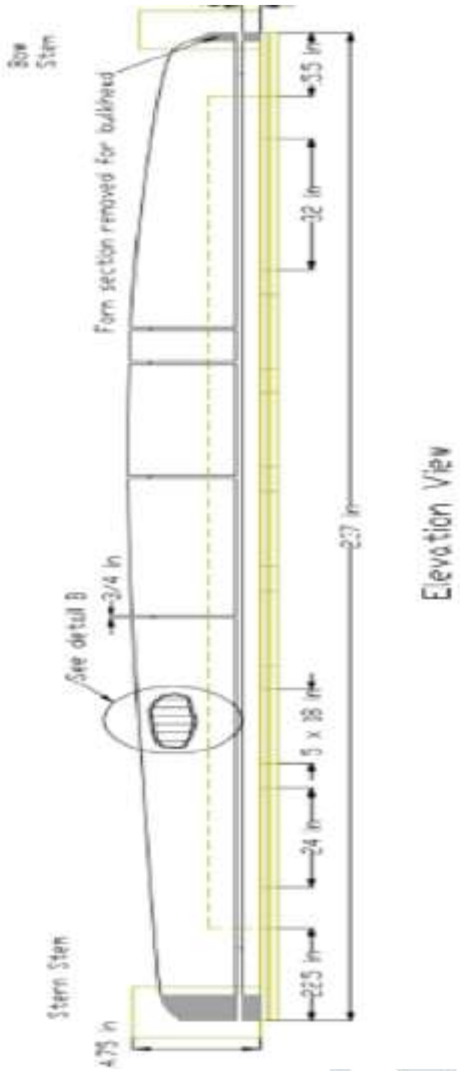
Cement and fine aggregate ratio =1:2.5
Water cement ratio = 0.40%
Amount of cement =2.0kg
Total amount of water = 0.8lit
Using 50% of water and 50% H_2SO_4
Compressive strength of 28days =53mpa
Amount of fine aggregate =5.0kg

4.4 Details of concrete canoe:

The details of the designed and prepared concrete canoe are shown in the following figures.







Physical characteristics of a boat such as length, beam width, rocker heights, and chine radii directly affect its behavior. This study investigated the impact of these characteristics by varying them one at a time. Several shapes were produced in an iterative process and then compared to identify the impact of the hull characteristics on the canoe performance with respect to the four objectives listed above. Shape performance was compared based on two important parameters in boat design engineering: the Displacement-Length (D/L) ratio and the Beam-Draft (B/T) ratio. The D/L ratio is an indicator of the wave generation of the hull passing through water.

"*Dt*" is the displacement of the boat in water in long tons and *LWL* is the load waterline length in feet. The B/T ratio is the maximum width at the waterline divided by the draft. This value provides information about the drag constituents of the wave making resistance and the wetted surface friction. For BOREALIS' design, the B/T ratio was used as an indicator to minimize resistance.

4.5 structural analysis:

The analysis is determined the required concrete and composite properties of the canoe, and designed a longitudinal prestressing system to reduce tensile stresses in the concrete. The spreadsheet analysis yielded tendon geometry and jacking forces that minimized longitudinal tensile stresses in the canoe. The structural analysis spreadsheet to determine the force demands in the canoe. The spreadsheet calculated section properties such as cross sectional area, moment of inertia, and center of gravity at one-foot intervals. Paddler loads and canoe weight determined the demands placed on the canoe in five different loading cases: simply supported, inverted simply supported, prestressing only, two paddler race, and four paddler race. The spreadsheet also solved for the pitching angle and water

line for each paddler load case by equilibrating the resultant net moment caused by the difference in center of action of the applied loads and the buoyant force.

The boundary conditions included vertical spring supports at paddler locations and lateral restraints at the bow and stern for model stability. The analysis set the allowable stress limits to 15 percent of the modulus of rupture and 75 percent of the compressive strength. In addition, a load factor of 1.25 was added to account for the dynamic load magnification.

The analysis considered prestressing losses of 25 percent due to creep, shrinkage, elastic shortening, and steel relaxation in accordance with AASHTO Bridge Design (2011) provisions. Even though this method is not specific to lightweight applications, the analysis team used engineering judgment and previous experience to determine that using the AASHTO specifications yielded a conservative estimation of the losses.

V. CONCLUSION:

Uses of simple material preparation of concrete canoe it should be floating of water and as well as bear the 2/3 of the weight have to be bear in the total area. This type of boats used for the conveyance of any type of materials it should be economical.

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