UF ACI – Concrete Canoe Competition Project

David Orense
University of Florida
About the Concrete Canoe Competition

• The ASCE (American Society of Civil Engineers) National Concrete Canoe Competition (NCCC) provides students with a practical application of the engineering principles they learn in the classroom, along with important team and project management skills they will need in their careers. The event challenges the students' knowledge, creativity and stamina, while showcasing the versatility and durability of concrete as a building material.

Excerpt from article on Concrete Canoe on Wikipedia
https://en.wikipedia.org/wiki/Concrete_canoe
The 2019 UF Concrete Canoe Team

Each year, a team of undergraduate student design leads and volunteers work at the University of Florida to design and construct a concrete canoe for the ASCE regional and national competitions.
Research and Development

• Development of rule-compliant mortar designs
  • ASTM C330 Aggregate Requirement
  • Specified documentation of ingredients

• Design parameters
  • Workable for hand placement
  • Lightweight for buoyancy
  • Structural at 7 days

• Over 40 trial batches conducted over a 6-month testing program
The Design Process

- **Preliminary Research**
  - Academic knowledge and faculty
  - Industry contacts

- **Focus on aggregate optimization**
  - Reduce concrete unit weight
  - Improve strengths to reduce required cement content

- **MathCAD integration for QC on mix designs**
Pour Day

- Concrete production / placement
- High student volunteer involvement (30+)
- Management and teamwork skills
- Mortar – carbon fiber composite
<table>
<thead>
<tr>
<th>Property</th>
<th>Core</th>
<th>External</th>
<th>Aesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Unit Weight (pcf)</td>
<td>56.3</td>
<td>56.2</td>
<td>58.0</td>
</tr>
<tr>
<td>Oven-Dry (OD) Unit Weight (pcf)</td>
<td>45</td>
<td>43</td>
<td>51</td>
</tr>
<tr>
<td>7-day Compressive Strength (psi)</td>
<td>2400</td>
<td>2050</td>
<td>1500</td>
</tr>
<tr>
<td>7-day Tensile Strength (psi)</td>
<td>143</td>
<td>92</td>
<td>102</td>
</tr>
<tr>
<td>7-day Composite Flexural Strength (psi)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Content (%)</td>
<td>4.1</td>
<td>4.1</td>
<td>1.9</td>
</tr>
</tbody>
</table>
Table 1: *Free Floatin’ Specifications*

<table>
<thead>
<tr>
<th>Specification</th>
<th>Free Floatin’ Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td><em>Free Floatin’</em></td>
</tr>
<tr>
<td>Weight</td>
<td>160 lbs.</td>
</tr>
<tr>
<td>Primary Colors</td>
<td>Maroon, Gray, Black, White</td>
</tr>
<tr>
<td>Primary Reinforcement</td>
<td>Kevlar® woven carbon fiber</td>
</tr>
<tr>
<td>Secondary Reinforcement</td>
<td>Polypropylene Micro-Fibers</td>
</tr>
<tr>
<td>Maximum Length</td>
<td>21.8 ft.</td>
</tr>
<tr>
<td>Maximum Width</td>
<td>2.10 ft.</td>
</tr>
<tr>
<td>Average Thickness</td>
<td>½ in.</td>
</tr>
<tr>
<td>Maximum Depth</td>
<td>1.15 ft.</td>
</tr>
</tbody>
</table>
25 schools competed in Concrete Canoe. Each school was judged in 4 categories:

- Design Paper
- Presentation
- Final Product Display
- Race

UF won 1st in all 4 categories and moved forward towards Nationals in Melbourne, FL in June 2019!
National Concrete Canoe Competition

Concrete Canoe National Competition
Melbourne, FL June 6\textsuperscript{th}-8\textsuperscript{th}, 2019
• 20+ schools worldwide

Awards:
• Oral presentation 1\textsuperscript{st}
• Design Paper 1\textsuperscript{st}
• Final Product 2\textsuperscript{nd}

UFCC 1st Place Overall Champions!
Lessons Learned

• Take pride in technicality
• Prioritize your team and its members
• Think outside the box
• Success is more than a trophy
Starting ACI at University of Florida

We were last active in 2013.

How can we move forward as a new student chapter?
Thank You!