

Project Overview

Our team was tasked by The Committee on Concrete Canoe Competitions (C4), which is considering manufacturing and building concrete canoes for interested consumers and clients and showcasing the proposed design, prototype, and display at the World of Concrete Expo 2023. As such, C4 is soliciting pre-qualified ASCE student chapters, hereinafter referred to as "Teams," to submit their Project Proposals to design and construct a full-scale prototype of a concrete canoe. The Proposal should demonstrate why a team's design and materials should be selected as the premier concrete canoe for the showcase



Theme and Origin

Our theme: Phoenix Rising From the Ashes

The Phoenix is a mythical bird that burns up but resurrects and rises from the ashes of its predecessor. Like the Phoenix, the Trine concrete canoe team is returning to competition for the first time since Covid, and they are fired up to have the opportunity to do so.



Concrete Mix Design

Four main Mix Design Criteria:

Strength: This criteria ensured that our canoe would be strong enough to perform in the races.

Durability: This criteria ensured that our concrete, when placed in its casting mold, would be able to come out in one piece. This test was also used to see if our canoe would be able to make it 300 miles in a trailer.

Workability: This criteria tested how well the concrete formed and worked in our mold. We tested the concrete slump and a half-inch slump in our final concrete mix.

Floatation: This criteria ensured that our concrete would float before being casted in the canoe mold. The targeted specific weight was less than 62.4pcf after one day of curing.



Canoe Mold and Casting

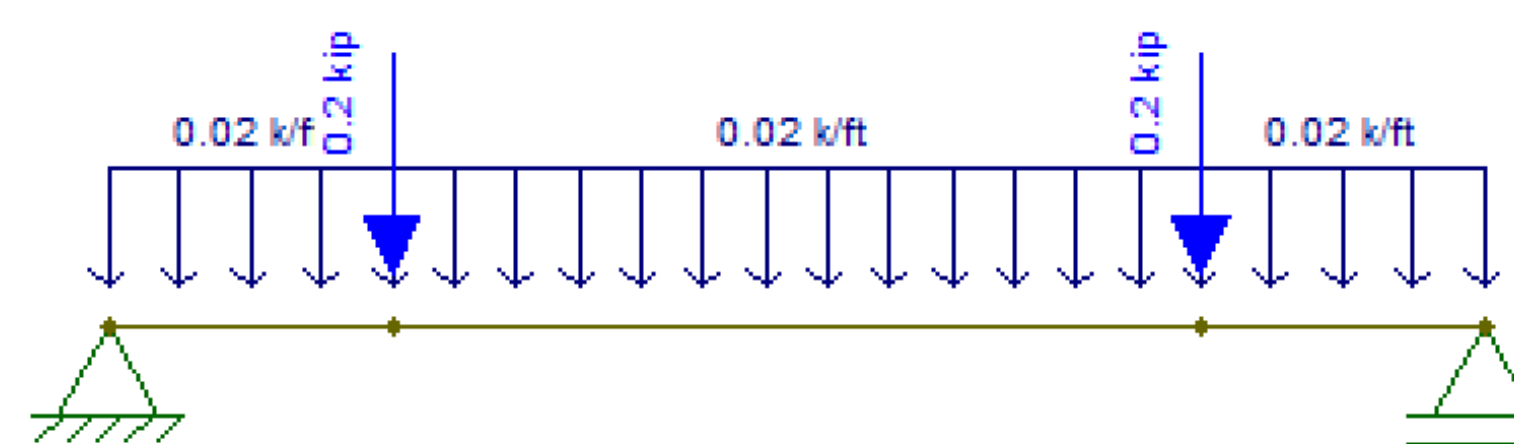
The team reused a canoe mold that was used by previous teams. The team refurbished and created a new mold that can be used for succeeding teams.

The mold is a wooden framed mold that is filled with foam board cut to the curvature of the desired canoe. The foam has a layer of plaster that is sanded to be smooth to allow for the concrete to have a similar smooth finish.

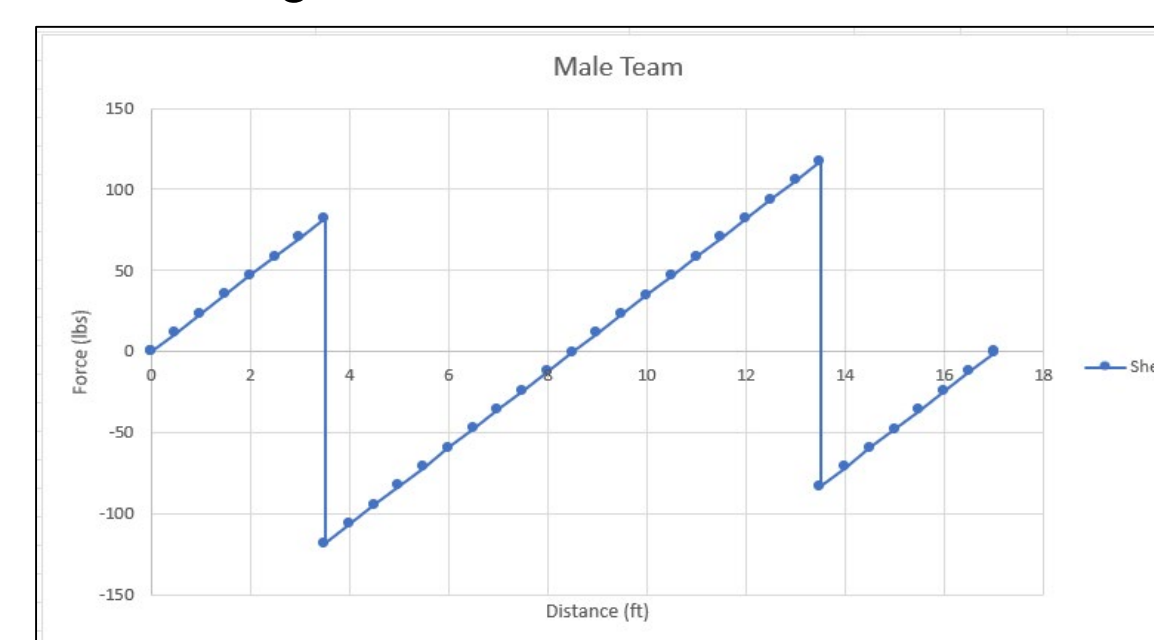
The mold was finished with a plastic lining, so the canoe has a smooth exterior finish.



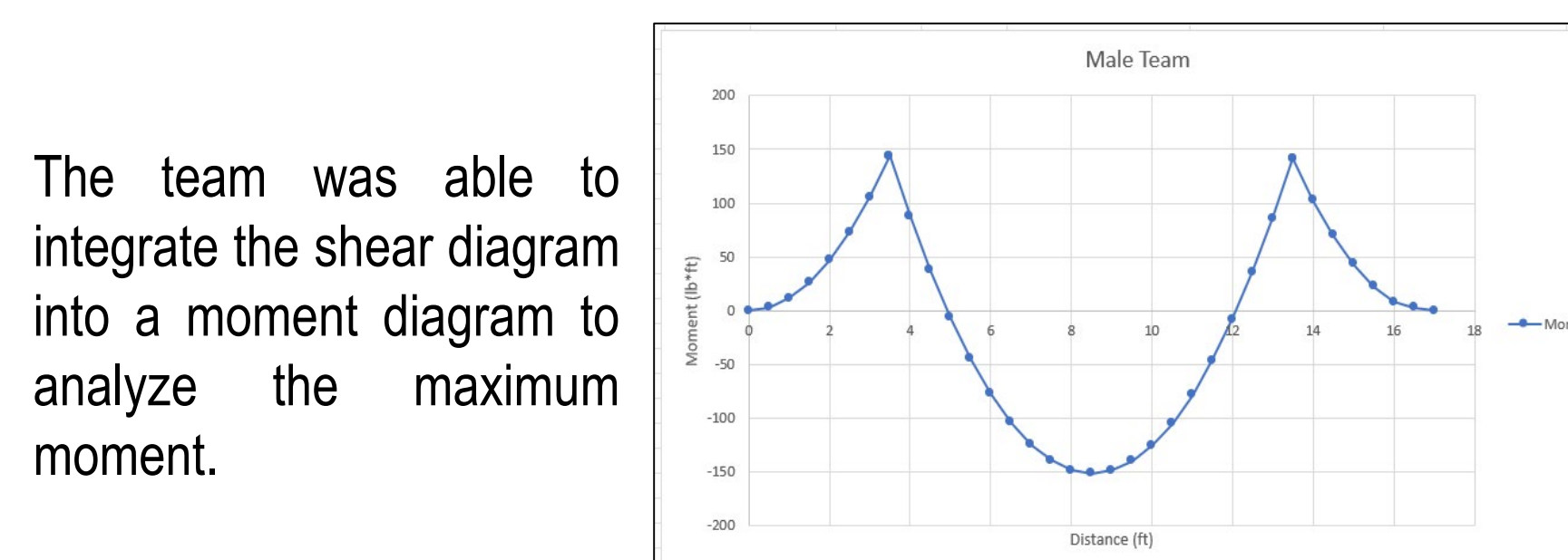
Canoe Structural Analysis



ASCE required a structural analysis of a load case with the canoe and two male rowers. For this, the team assumed that the male rowers would be 200lb point loads and the self-weight of the canoe would be around 400 lbs.



From the assumptions, the team was able to calculate the needed buoyant force.



The team was able to integrate the shear diagram into a moment diagram to analyze the maximum moment.

Canoe Aesthetics

The group wanted to encompass the theme of the canoe into the final product. The team created a mock-up design for the final product using a miniature model. The design was to create a final product that represented a blue phoenix. Our group chose a blue phoenix as it is the hottest of all the flames. This represents the goal the team had to burn the competition at the regional ASCE symposium held at Western Kentucky University.



Indiana Kentucky Symposium Results

Four main categories received awards at the Symposium:

Technical Proposal Award: Trine placed second and received zero deductions on the proposal.

Overall Project Prototype Award: Trine placed Third and received zero deductions on the final prototype.

Technical Presentation Award: Trine placed second and received zero deductions on the presentation.

Overall Placement Award: Trine placed second, competing against 9 other universities.

Final Summary—Sorted by Rank

Sorted Rank	School Name	Points
1	Western Kentucky University	91.0
2	Trine University	76.2
3	University of Notre Dame	72.3
4	University of Illinois at Urbana-Champaign	60.5
5	Rose-Hulman Institute of Technology	57.6
6	University of Kentucky	37.4
7	Purdue University at West Lafayette	32.0
8	University of Southern Indiana	26.5
9	Valparaiso University	23.0

Special Thanks

We want to thank all the volunteers who helped in the creation of our prototype and those who helped our team compete in the competition.

