# NAU ASCE CONCRETE CANOE 2026

PLUTO JACKS — Design A | Northern Arizona University

## NAU CHAPTER PROFILE

Northern Arizona University ASCE Student Chapter, Flagstaff AZ. Active in regional and national competitions. Committed to sustainable infrastructure and hands-on engineering education.

## INNOVATIVE FEATURES

- Lightweight concrete with Poraver expanded glass aggregate
- Computational hull optimization exploring 3 candidate designs
- AI-assisted structural analysis and verification
- $CO_2$-cured mix design for improved sustainability
- PVA fiber mesh reinforcement (42% POA)

## PROTOTYPE SPECIFICATIONS

### DIMENSIONS

| | |
|---|---|
| Length | 192" (16.0 ft) |
| Beam | 32" (2.67 ft) |
| Depth | 17" (1.42 ft) |
| Wall Thickness | 0.5" |

### WEIGHT

| | |
|---|---|
| **Total Weight** | **174.3 lbs** |
| Concrete Shell | 163.1 lbs |
| Reinforcement (PVA) | 8.2 lbs |
| Finish / Sealant | 3.0 lbs |

### STRUCTURAL

| | |
|---|---|
| Flexural Strength | 1,500 psi |
| Compressive Strength | 2,000 psi |

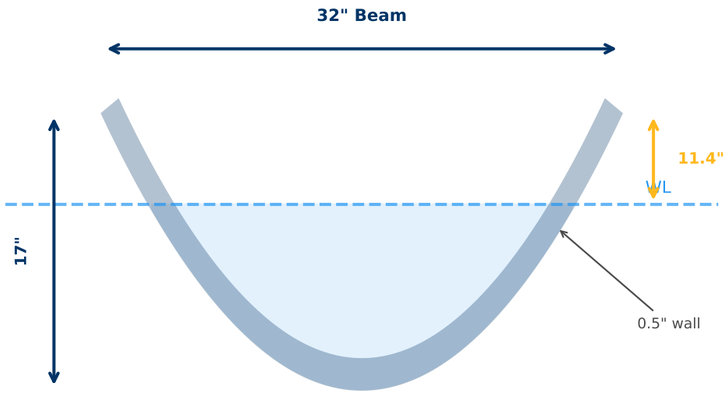
## MIX DESIGN SPECIFICATIONS

| | |
|---|---|
| Wet Density | ~80 PCF |
| Oven-Dried Density | 60 PCF |
| Slump | 4 - 6 in. |
| Air Content | 8 - 12% |
| Compressive Strength | 2,000 psi |
| Flexural Strength | 1,500 psi |

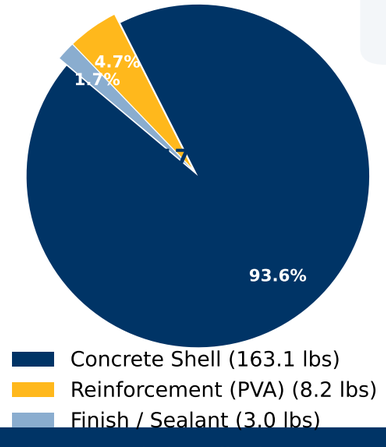
## ASCE COMPLIANCE

| Requirement | Actual | Required | Status |
|---|---|---|---|
| Freeboard | **11.4"** | ≥ 6.0" | ✓ **PASS** |
| Metacentric Height | **8.68"** | ≥ 6.0" | ✓ **PASS** |
| Safety Factor | **2.30** | ≥ 2.0 | ✓ **PASS** |
| Canoe Weight | **174.3 lb** | ≤ 237 lb | ✓ **PASS** |
| Cement Ratio | **0.35** | ≤ 0.40 | ✓ **PASS** |
| Reinforcement POA | | ≥ 40% | ✓ **PASS** |

## Hull Cross-Section (Midship)




## Weight Breakdown




✓ **174.3lbs** — Total Weight

✓ **2.30** SF — Safety Factor

✓ **11.4"** — Freeboard

✓ **8.68"** — GM Height