CENE 476 Proposal Presentation

Concrete Canoe Capstone Project

Team Members

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Introduction

- **Purpose**

Design and construct a successful concrete canoe in accordance with ASCE (American Society of Civil Engineers).

- **Stakeholders**

Mark Lamer, ASCE,
Pluto Jacks, TA

- **Location**

Salt Lake City, Utah
(Competition)

- **Background**

Mix design, hull design, structural analysis, modeling, and construction will be needed to create a concrete canoe prototype. The prototype will be judged and scored at the 2026 ISWS (Intermountain Southwest Symposium) Conference.

Figure 1- 2024 Concrete Canoe Team at Competition –ASCE [5]

Scope of Services

Task 1: Project Preparation

Task 1.1: Project Research

Task 1.2: Sponsorship/Donations

Task 1.3: Lab Safety & Clean-up

- Deliverables:
  - Waste Disposal & Clean-up Plan
  - Emergency Response Plan
  - Safety Data Sheets
  - PPE- hard hat, gloves, boots, safety glasses, vest

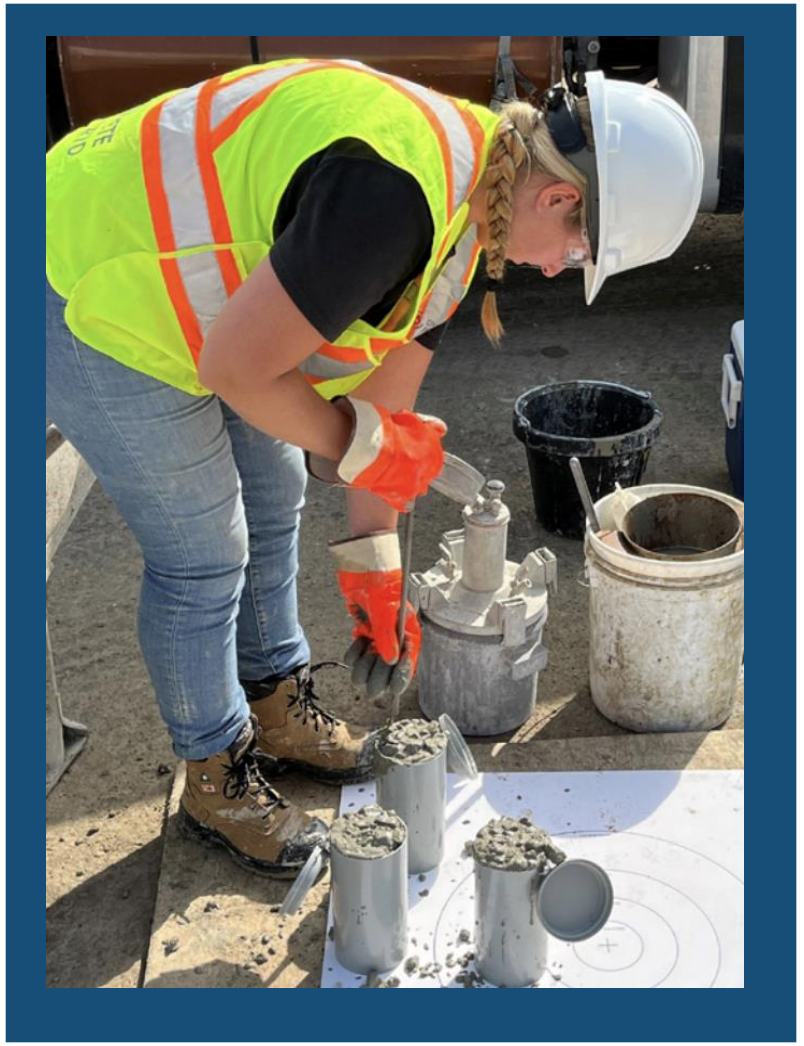

Figure 2- Required PPE for working with wet concrete [6]

Scope of Services

Task 2: Concrete Mix Design

Task 2.1: Material Research

- RFP Material Constraints [5]:
  - Max unit weight: < 80.0 lb/ft^3
  - c/cm ratio: < 40%
  - Aggregate volume: > 35%

- Constituents:
  - Lightweight aggregate, SCM's, and Admixtures

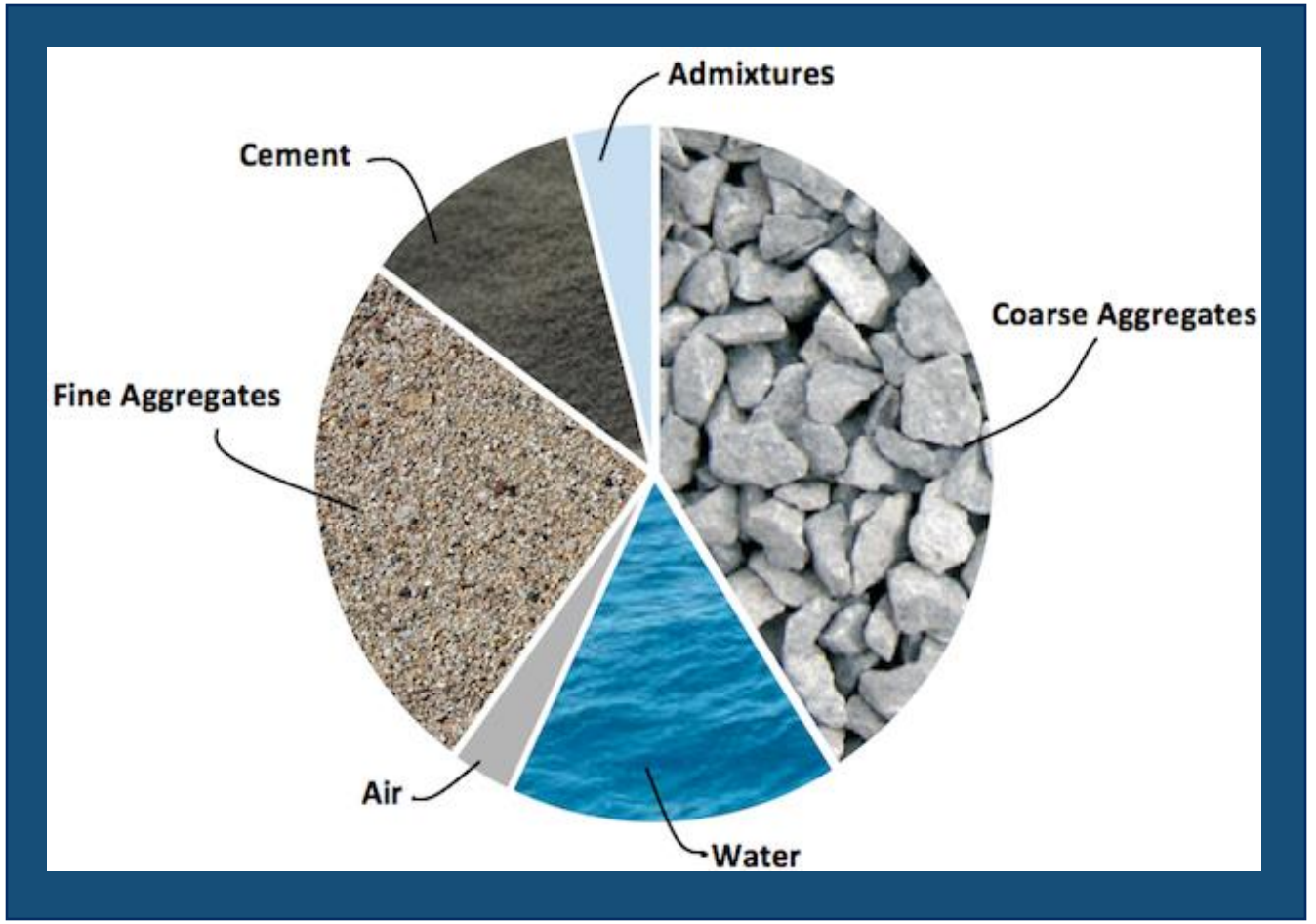

Figure 3- Required Materials for Concrete Mix [7]

Scope of Services

Task 2.2: Material Testing

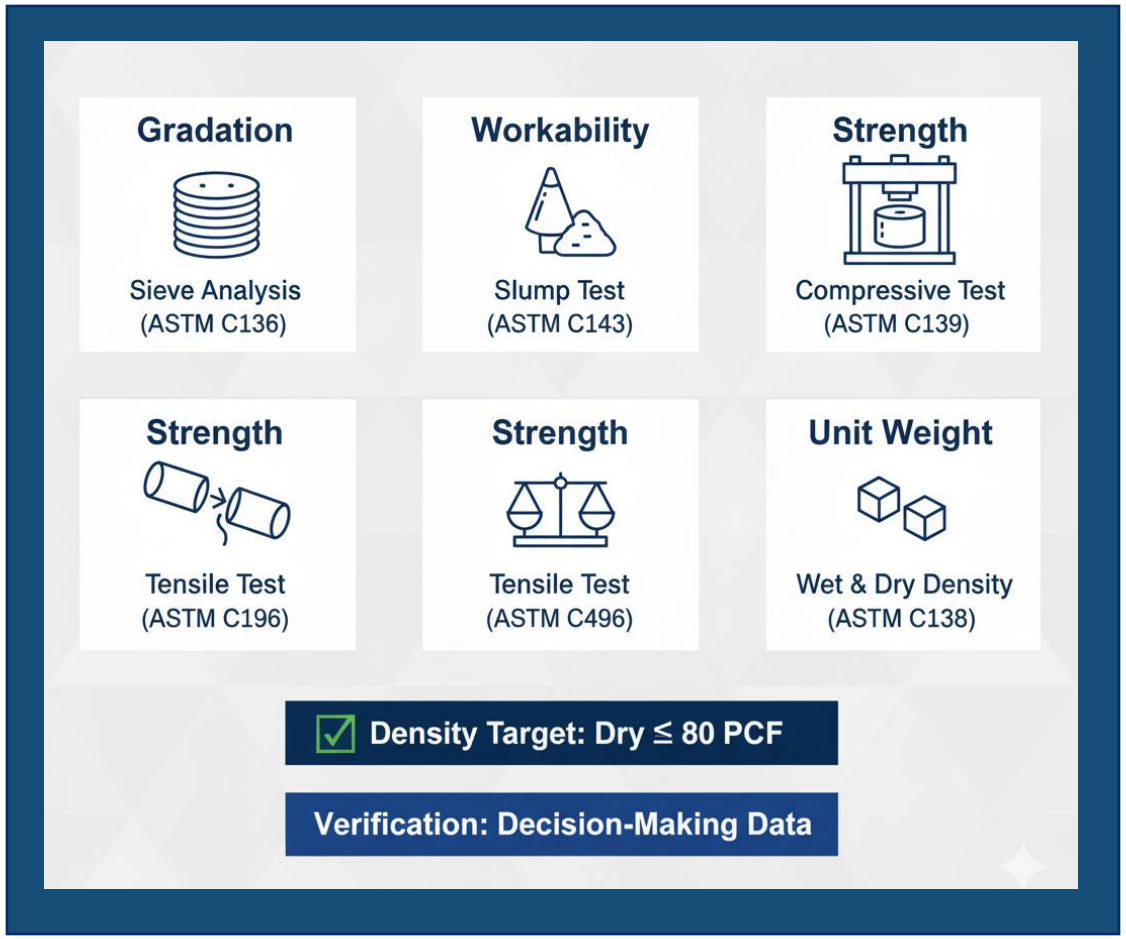

Figure 4- Material Testing to be Completed [1]

<u>3 Mix Designs</u>

- Compressive Strength
  - 18 Cylinders Made
  - 1 7-day, 2 14-day, 2 28-day, and 1 Hold for each mix
- Slump
  - 1 Slump test for each mix
  - Done on batch day for cylinders
- Gradation
  - Particle distribution curve for the aggregates of each mix
- Unit Weight
  - 1 test for each mix
- Tensile Strength
  - 18 Cylinders Made 1 7-day, 2 14-day, 2 28-day, and 1 Hold for each mix

Scope of Services

Task 2.3: Mix Design/Decision Matrix

Figure 5- Example Concrete Cylinder Strength Testing [7]

Figure 6- Project Final Mix Selection Process [1]

Scope of Services

Task 3: Hull Design/Decision Matrix

Task 3.1: Design Criteria and Decision Matrix

- Stability, Maneuverability, Straight-Line Speed
- Cross-section width, length, rocker curve
- Minimum 6-inches of freeboard [5]

Task 3.2: Structural Analysis

Task 3.3: 3D Finite Element Analysis

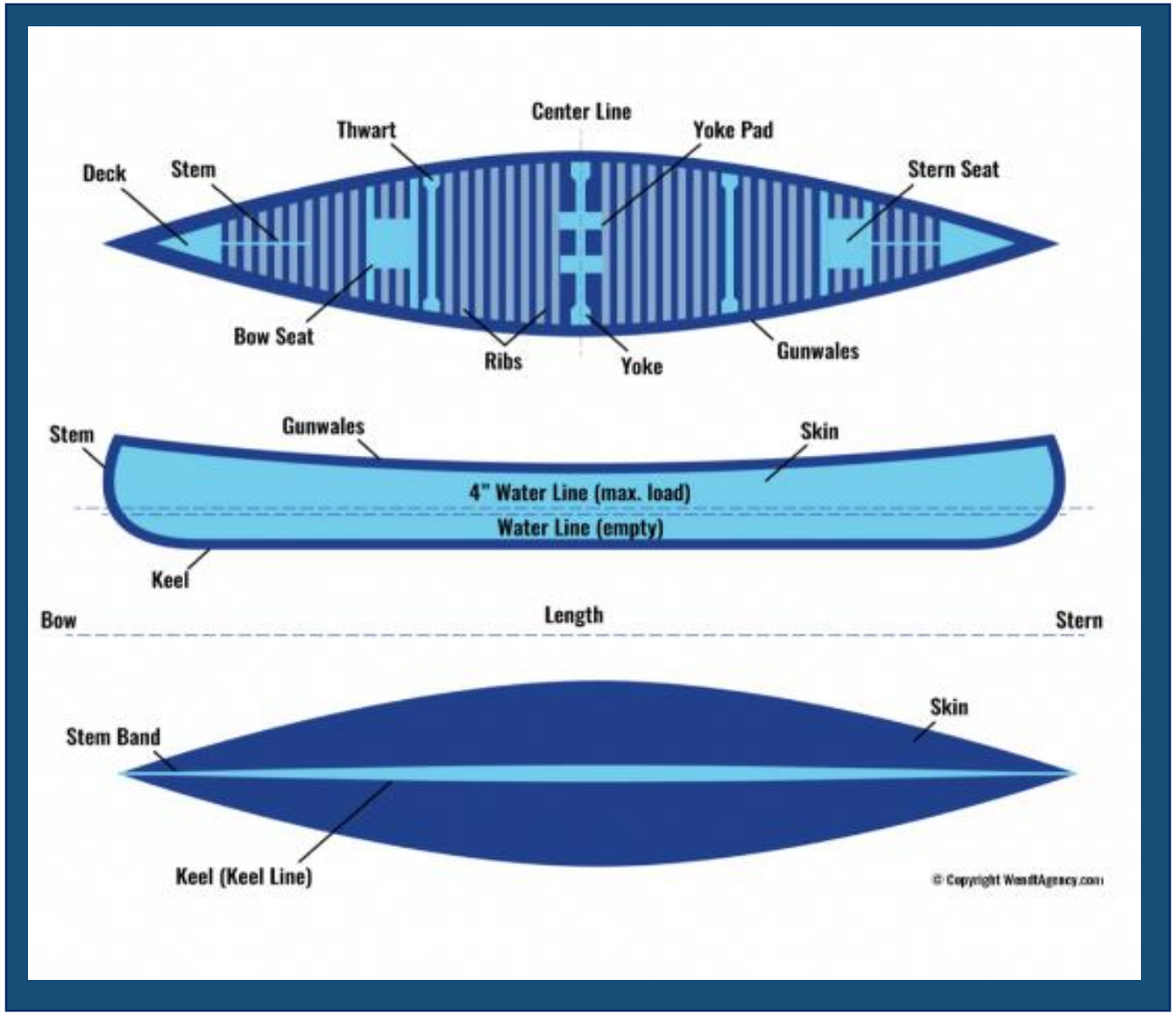

Figure 7- Hull Design Terminology [8]

Scope of Services

Task 4: Construction/Fabrication

Task 4.1: Mold

Figure 8- Example Male Concrete Canoe Mold [5]

Task 4.2: Stand

- Stands should raise canoe 4 feet off ground [5]
- Wood construction

Task 4.3: Canoe

Task 4.3.1 Concrete Batching

- material measured by volume following mix design specifications
- mixed using a concrete mixer

Task 4.3.2 Concrete Placement

- placed over the mold using a concrete sprayer
- wire mesh reinforcement applied in layers.

Task 4.3.3 Concrete Finishing

- polished, painted, and sealed.
- blemishes due to reinforcement will be patched.

Figure 9- Finished Concrete Canoes Lined up at Competition [5]

Scope of Services

Task 5: Competition

Task 5.1: Competition Preparation

- Rowing practices
- Mentee acquisition

Task 5.2: Transportation

- NAU trailer
- Extra cushion and a firm case for safety

Task 5.3: Presentation/Display

- 5-minute technical presentation
- Prototype display
- Relevant samples and info on the prototype.

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Task 5.4: Buoyancy/Swamp Test

- Passing this test is required for the race without penalty.
- Canoe is completely submerged in the water and must float back near the water surface within two minutes

Task 5.5: Race

Figure 10- Concrete Canoe Race- ASCE [5]

Scope of Services

Task 6: Project Impacts

- Economy/Society
- Environment
- Public Health

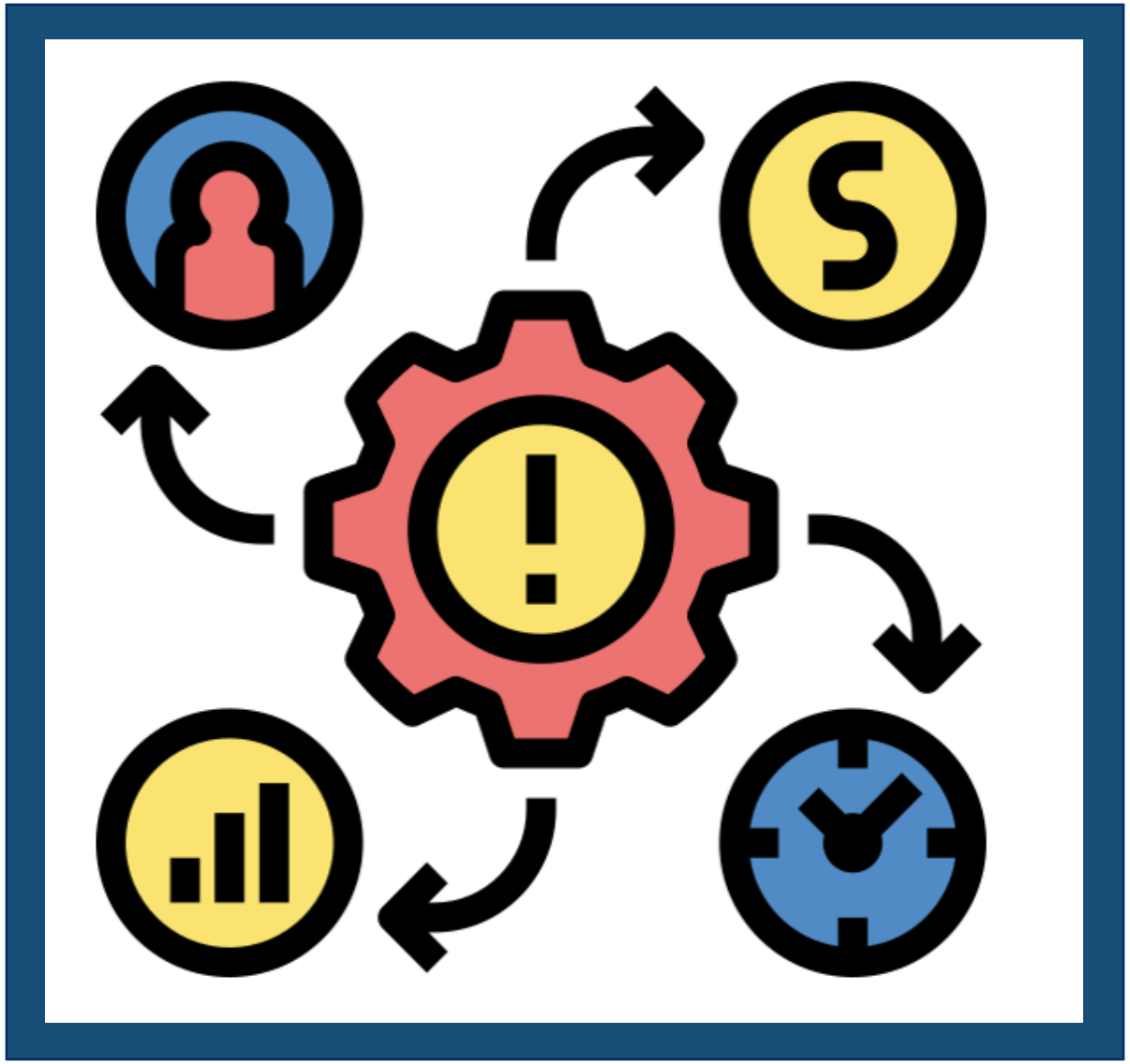

Figure 11- Project Impacts Diagram [2]

Scope of Services

Task 7: Project Deliverables

Task 7.1: 30% Deliverables - Task 1: Project Preparation and Task 2: Concrete Mix Design

Task 7.2: 60% Deliverables - Task 3: Hull Design/Decision Matrix as well as previous tasks

Task 7.3: 90% Deliverables - Task 4: Construction/Fabrication and Task 5: Competition as well as previous tasks

Task 7.4: Final Deliverables - Task 6: Project Impacts as well as previous tasks

Task 7.5: ASCE ISWS Deliverables

- **Task 7.5.1: Proposal and Qualifications Package**
- **Task 7.5.2: Technical Execution Package**

Exclusions

The only exclusions for this project are the full annual ASCE Student Chapter Report and Dues Payment Report, which are required for a team to participate in the ISWS competition. These will be completed by the ASCE student chapter secretary and treasurer and are not the responsibility of the Concrete Canoe Team.

Scope of Services

Task 8: Project Management

Task 8.1: Schedule Management

- Gantt Chart

Task 8.2: Resource Management

- Fund Acquisition
- Material Acquisition
- Budget

Task 8.3: Meetings

- Team (5)
- Grading Instructor (optional)
- Technical Advisor (2)
- Client (1)
- Meeting Minute Binder

Figure 12- Standard Gantt Chart [2]


Task Name
Aug
Sep
Qtr 4, 2025
Oct
Nov
Dec
Qtr 1, 2026
Jan
Feb
Mar
Qtr 2, 2026
Apr
May
Jun
Task 1: Project Preperation
Task 1.1: Project Research
Task 1.2: Sponsorhip/Donations
Task 1.3: Lab Safety & Clean-up
Task 2: Concrete Mix Design
Task 2.1: Material Research
Task 2.2: Material Testing
Task 2.3: Mix Design/Decision Matrix
Task 3: Hull Design/Hull Decision Matrix
Task 3.1: Design Criteria and Decision Matrix
Task 3.2: Structural Analysis
Task 3.3: 3D Finite Element Analysis
Task 4: Construction/Fabrication
Task 4.1: Mold
Task 4.2: Stand
Task 4.3: Canoe
Task 4.3.1: Concrete Batching
Task 4.3.2: Concrete Placement
Task 4.3.3: Concrete Finishing
Task 5: Competition
Task 5.1: Competition Preparation
Task 5.2: Transportation
Task 5.3: Presentation/Display
Task 5.4: Buoyancy/Swamp Test
Task 5.5: Race
Task 6: Project Impacts
Task 7: Project Deliverables
Task 7.1: 30% Deliverables
Task 7.2: 60% Deliverables
Task 7.3: 90% Deliverables
Task 7.4: Final Deliverables
Task 7.5: ASCE ISWS Deliverables
Task 7.5.1: Proposal and Qualifications Package
Task 7.5.2: Technical Execution Package
Task 8: Project Management
Start Date: September 15, 2025
End Date: May 6, 2026
Total Duration: 170 Days

Staffing Plan

Position	Abbr.	Key Qualifications	Primary Responsibilities
Senior Engineer	SENG	At least 15 years of experience as a Structural Engineer, Licensed Professional Engineer (PE)	Technical oversight, final authority on analysis & design.
Project Manager	PM	At least 5 years of experience in Research and Development (R&D) and Construction Schedules, Licensed Professional Engineer (PE)	Project planning, schedule, client POC, risk and resource managment.
Engineer in Training	EIT	Entry-level Entry-level experience with technical tasks and modeling software such as RISA, FE and SolidWorks.	Assist modeling, design, general tasks and drawings.
Lab Technician	TECH	Experience in required standardized material testing according to ASTM standards and material procurement	Organize inventory, prepare batches, ASTM concrete testing.
Quality Manager	QM	Experience in Quality Control/Quality Assurance (QC/QA) and reviewing technical submissions for RFP compliance	Implement QC/QA during construction, ensure guideline compliance.

Estimated Hours

Task Name	SENG (Hrs)	PM (Hrs)	EIT (Hrs)	TECH (Hrs)	QM (Hrs)	Subtotal (person-hours)
Task 1: Project Preperation						
Task 1.1: Project Research	2	10	5	9	3	
Task 1.2: Sponsorhip/Donations	1	3	3	0	1	
Task 1.3: Lab Safety & Clean-up	2	2	2	1	6	50
Task 2: Concrete Mix Design						
Task 2.1: Material Research	5	6	10	20	10	
Task 2.2: Material Testing	5	8	10	20	15	
Task 2.3: Mix Design/Decision Matrix	5	6	20	20	15	175
Task 3: Hull Design/Structural Analysis						
Task 3.1: Design Criteria and Decision Matrix	3	4	13	3	5	
Task 3.2: Structural Analysis	7	3	12	1	5	
Task 3.3: 3D Finite Element Analysis	5	3	10	1	5	80
Task 4: Construction/Fabrication						
Task 4.1: Mold	2	5	12	10	5	
Task 4.2: Stand	0	4	10	5	5	
Task 4.3: Canoe						
Task 4.3.1: Concrete Batching	3	4	6	10	10	
Task 4.3.2: Concrete Placement	3	4	6	10	10	
Task 4.3.4: Concrete Finishing	2	3	6	10	10	155

Task Name	SENG (Hrs)	PM (Hrs)	EIT (Hrs)	TECH (Hrs)	QM (Hrs)	Subtotal (person-hours)
Task 5: Competition						
Task 5.1: Competition Preparation	2	2	3	3	3	
Task 5.2: Transportation	0	5	8	0	0	
Task 5.3: Presentation/Display	0	1	1	0	3	
Task 5.4: Buoyancy/Swamp Test	0	1	1	1	4	
Task 5.5: Race	0	1	2	1	0	42
Task 6: Project Impacts	3	10	10	0	10	33
Task 7: Project Deliverables						
Task 7.1: 30% Deliverables	1	8	8	2	2	
Task 7.2: 60% Deliverables	2	8	8	2	2	
Task 7.3: 90% Deliverables	3	8	9	5	2	
Task 7.4: Final Deliverables	4	9	9	4	2	
Task 7.5: ASCE ISWS Deliverables						
Task 7.5.1: Proposal and Qualifications Package	2	1	3	1	1	
Task 7.5.2: Technical Execution Package	3	1	3	1	1	115
Task 8: Project Management						
Task 8.1: Schedule Management	1	2	3	0	4	
Task 8.2: Resource Management	1	15	4	1	3	
Task 8.3: Meetings	3	3	3	3	3	49
Total Hours	118	282	338	189	219	1177

Cost of Engineering Services

1.0 Personnel	Rate, $/Unit	Quantity	Unit	Subtotal
SENG	$120	112	HR	$13,440
PM	$80	140	HR	$11,200
EIT	$40	200	HR	$8,000
TECH	$50	144	HR	$7,200
QM	$40	145	HR	$5,800
Total Personnel				$45,640
2.0 Travel				
Mileage	$0.7/mile	1000	MILE	$700
Van Rental	$62/day	4	DAY	$248
Overnight	120$/night	8	Room-Night	$960
3.0 Supplies				
Equipment	2,000$	1	LS	$2,000
Lab Rental	100$/day	56	DAY	$5,600
Materials	5,000$	1	LS	$5,000
4.0 Total				$60,148

References

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Questions?