

2027

American Society of Civil Engineers®
Concrete Canoe Competition™

REQUEST FOR PROPOSALS



September 8, 2026

Subject: Request for Proposals — 2026-2027 Concrete Canoe

To: ASCE Student Chapters and Concrete Canoe Teams



1801 Alexander Bell Drive Reston, VA 20191-4382
800.548.2723 | +1.703.295.6300 | asce.org

The Committee on Concrete Canoe Competitions (C4) is pleased to present the following Request for Proposals (RFP) for the 2026-2027 competition year.

We welcome all eligible ASCE chapters to prepare submissions for an opportunity to become the next concrete canoe champion next June at the 2027 ASCE Civil Engineering Student Championships at Kansas State University in Manhattan, Kansas.

2027 marks the 175th year that the American Society of Civil Engineers has been serving our profession, and it also marks the 40th year of the concrete canoe competition. What an incredible milestone for both!

Just imagine how much the concrete canoe competition has evolved and grown over the past four decades. As design technologies and concrete materials advanced through the years, so did the opportunities available to civil engineering students to improve the means and methods used to develop, build and demonstrate the performance of their concrete canoes. To commemorate this momentous occasion, C4 decided on three key words to distinguish the identity of this year's competition: ***Simplify, Collaborate, Celebrate.***

Simplify—C4 reviewed all the feedback from students, judges, and volunteers collected from last year, and a common theme identified throughout was the request to simplify the rules to increase focus on the fundamental aspects of the competition. So new this year:

- You must make your own canoe mold by hand – no CNC or outsourcing allowed
- The report has been simplified to focus on the technical narrative of your design
- A set of construction drawings will be required to show the judges all the steps and details needed to actually build your canoe
- The men's and women's slalom races have been replaced with a single coed slalom race

Collaborate – Similar to the teams of decades past, you will be blessed with the chance to spend quality time with your teammates building, sanding, tweaking and perfecting your canoe mold by hand – no pesky CNC technology to rob you of that magical and nostalgic experience. As always, in addition to your teammates and advisor there is a community of civil engineers in your area – alumni, past competitors, concrete enthusiasts – that would be able and willing to share their knowledge and experience to help your team excel. Don't be afraid to reach out!

Celebrate – Most people, most engineers, most civil engineers, most students...have never embarked on the unique journey to design, build and race a concrete canoe. It's an incredible accomplishment to build a canoe out of concrete, and you are hereby charged with the important and rewarding task of celebrating your efforts with the people in your communities. Whether you hold an "open house" with fellow students (not just engineers) and faculty at your school, pay a visit to an elementary or high school science class, or host a "day at the lake" and invite area schools and the public (as done in Middle Tennessee), sharing what you've achieved serves an invaluable purpose to increase awareness of the competition and the entire civil engineering profession.

As a reminder, be sure to read this year's RFP completely to understand what you are being asked to produce. Have fun, be safe, and work hard to make the quality of this year's competition commensurate of the distinct honor to go down in history as the 40th ASCE Concrete Canoe Competition!

Sincerely,

COMMITTEE ON CONCRETE CANOE COMPETITIONS

Joshua D. Gilman, PE, ENV SP, M.ASCE

Chair, Committee on Concrete Canoe Competitions

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INTRODUCTION

Since the early 1970s, ASCE student chapters have been building and racing concrete canoes. While designs and mixes have evolved, the tradition of teamwork, camaraderie, and spirited competition remains constant. All participants, including teams, associates, and volunteer judges, are expected to uphold and enhance this tradition.

Concrete Canoe Competition Objectives:

- Provide civil engineering students with hands-on experience and leadership skills in concrete mix design and project management.
- Highlight the versatility and durability of concrete as a construction material.
- Promote concrete technology and its applications to students, educators, and the industry.
- Raise awareness of ASCE's and national sponsors' commitment to civil engineering education.
- Showcase civil engineering as a vital and innovative profession to industry leaders and the public.
- Encourage lifelong ASCE membership among students, professionals, and faculty.

While the competition focuses on learning and gaining technical and social experience, students are on the brink of becoming practicing engineers, contributing to projects essential to society. Ethics, professionalism, civility, and respect are crucial to the competition's success, and ASCE expects all participants to adhere to these standards. ASCE is committed to maintaining the quality of this competition and improving future ones.

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AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)



The American Society of Civil Engineers (ASCE) is the oldest national engineering society in the United States. Founded in 1852 with 12 members, the Society was created to disseminate information among engineers building a young nation's roads, canals, bridges, and railroads.

Today, ASCE is a global organization with more than 160,000 members, including international members residing in 177 countries outside the United States. Individual professional engineers rather than companies or organizations hold membership. The members are organized geographically into ten regions, 106 sections, 160 branches, 130 Younger Member Groups, and 461 student chapters. Student Chapters sponsor meetings, educational outreach, symposia, student competitions, social events, and other activities to help future engineers better prepare for their careers. Numerous scholarships and awards are made available for deserving students of civil engineering, and a variety of Society-wide finals competition opportunities are held so students have a platform to compete with other students from around the world.

A Board of Direction governs the Society. The Board, which includes ASCE officers and representatives elected by the membership, establishes all policies for the organization. A staff of 250 implements the policies; most staff work at ASCE International Headquarters in Reston, Virginia.

For more information, visit <http://www.asce.org>.

R. JOHN CRAIG MEMORIAL AWARD

The concept of a society-wide competition has existed for many years. In the mid-1980s, Dr. R. John Craig, a professor at the New Jersey Institute of Technology and member of the ASCE Committee on Student Services (CSS), and other members of CSS began to formulate plans for more uniform regional competitions. They formalized a plan to study the feasibility of a national competition with finalists from each region.

In the spring of 1985, Dr. Craig first brought his grand vision of the National Concrete Canoe Competition™ to ASCE. He was instrumental in bringing delegates from all over the country to meet one auspicious day in New York City at the ASCE National Headquarters executive conference. During this meeting, the feasibility of conducting a national competition was discussed, preliminary rules were prepared, and a formal recommendation to proceed was drafted.

In the fall of 1985, the preliminary rules were presented to the CSS. During the next year, discussions regarding sponsorship were conducted with Master Builders, Inc. and ASCE Headquarters. After almost two years of CSS debate, while meeting at the fall 1987 ASCE National Convention, the Educational Activities Committee (EdAC) adopted the preliminary rules. It established a standing task committee to implement the rules and requirements.

In the winter of 1987, just as the first National Competition was in sight, Dr. Craig was diagnosed with a rare inoperable brain tumor. He passed away just two months before his dream came to fruition. In June of 1988, the first National Concrete Canoe Competition™ was held in East Lansing, Michigan, hosted by Michigan State University.

In the spring of 1989, CSS approved the formation of a permanent subcommittee to ensure the continuation of the National Concrete Canoe Competition™. Through the efforts and dedication of individuals like Dr. R. John Craig, the National Concrete Canoe Competition™ has become a perennial favorite event for tens of thousands of students.

In that spirit, ASCE has dedicated the Coed Sprint Race as a memorial to the teamwork and dedication of Dr. R. John Craig. It is our distinct honor to present the *R. John Craig Memorial Award* to the school that best exemplifies the spirit and cooperative ideals of the Competition by placing first in the Coed Sprint Race each year.

MIKE CARNIVALE, III, SPIRIT OF THE COMPETITION AWARD

The American Society of Civil Engineers (ASCE) presents the Mike Carnivale, III, Spirit of the Competition Award to the team that best exemplifies the values of camaraderie, teamwork, professionalism, and FUN! This award honors the legacy of Mike Carnivale, who was an integral part of the ASCE Concrete Canoe Competition for 20 years. As a passionate student competitor, dedicated volunteer, and former Chair of the Committee on National Concrete Canoe Competitions from 2004-2006, Mike made significant contributions to the competition.

Even after his tenure, he continued to support the event as a corresponding member, developing rules and guiding students until his untimely passing in 2022. In recognition of his enduring impact, ASCE is privileged to dedicate the Spirit of the Competition Award in his memory. This award serves as a tribute to Mike's passion, leadership, and unwavering commitment, and it is ASCE's distinct honor to present it to the school that best embodies these cherished values.

SPIRIT OF THE COMPETITION

The Committee on Concrete Canoe Competitions (C4) acknowledges and values the competitive spirit exhibited by teams participating in this event year after year. The drive to win stems from a deep understanding of the material, desire for innovative problem-solving, and crafting compelling messages. This intrinsic motivation is vital for advancing the industry in a world that continually demands creativity and uniqueness. However, it is essential that this competitive drive does not overshadow the commitment to learning, growth, and the development of well-rounded engineers and individuals. Therefore, C4 aims to define the Spirit of the Competition clearly by aligning it with the [ASCE Code of Ethics](#).

Section 3.c: Engineers represent their professional qualifications and experience truthfully.

Throughout the nearly year-long competition, it is expected and understood that emotions can run high. Nevertheless, engineers are responsible for always presenting themselves as level-headed, fact-based, and unbiased toward any particular outcome. The task is to provide the best solution given the constraints and to calmly inform clients, teammates, and the public of any restrictions faced, opinions disagreed with, and limits on resources, including withdrawing from situations deemed unethical or not beneficial to the public being served.

Section 3.d: Engineers reject practices of unfair competition

Fairness, coupled with safety, serves as the foundation of this competition. C4 establishes rules and processes that allow each team, regardless of size or history, a fair opportunity to showcase their product. When individuals or teams violate the intent of the rules, the entire competition's foundation becomes unstable, and the trust established between C4, volunteer judges, and competitors erodes. It is recognized that teams invest significant time, energy, and passion into this competition. For that, C4 expresses gratitude and respect. Teams must reciprocate by trusting that C4 and volunteer judges perform each task and make each decision as fairly as possible.

Section 3.d: Engineers uphold the honor, integrity, and dignity of the profession.

Elements of this competition are founded on the principle that volunteer judges and C4 take a team's word at face value. As in industry, once trust is broken, it can be nearly impossible to revive. Teams should strive to always present themselves honestly and be willing, as C4 and volunteer judges are, to change opinions when presented with new information.

Section 3.e: Engineers promote mentorship and knowledge-sharing equitably with current and future engineers.

The community fostered at these competitions is important and unique. Competitors are expected to not only network with those around them but also to promote a culture of knowledge sharing with peers, volunteer judges, and C4, so that collective knowledge can be used to leave the competition, and in time, the industry, better than it was found.

The volunteer judges and/or C4 may take disciplinary action, including warnings, point deductions, or disqualification of a team or entry for the team's behavior, the team's faculty advisors, or any persons associated with the team that violates the Spirit of the Competition. The volunteer judges and/or C4 have the final authority on this matter.

1.0 REQUEST FOR PROPOSALS

1.1 Problem Statement

C4, as part of the American Society of Civil Engineers (ASCE), is considering the purchase of a concrete canoe design. C4 prioritizes the canoe's innovative design, material selection, fabrication, aesthetics, and paddling performance (maneuverability and speed). To achieve this, C4 invites ASCE student chapters, referred to as "Teams", to respond to this Request for Proposals as described within. Interested teams shall:

1. **Develop and deliver a Letter of Intent and Qualification Form** detailing the team's goals, milestones, and health & safety program for the Project (see *Section 5.4* for required components).
2. **Develop and deliver a project submittal** including design narrative, construction drawings, and calculations & materials notebook package detailing the technical aspects of the team's proposal submission (see *Sections 5.5, 5.6, and 5.7* for required components).
3. **Construct a Project Prototype and Display** aimed at educating other engineering students, C4, the judges, and the public about the canoe's design, research, testing, materials, fabrication process, and durability (see *Sections 6.0 and 7.0* for required components).
4. **Deliver a Technical Presentation & Interview** that highlights the unique details and innovations of each Teams proposal. During the interview, judges will assess the Teams technical knowledge of their proposal and design (see *Section 8.0* for requirements).
5. **Participate in a Performance Demonstration** including 200- and 400-meter sprints with 180-degree turns and a 200-meter slalom course (600-meter endurance slalom at Society-wide) to demonstrate performance and prototype durability (see *Section 9.0* and *Exhibit 8* for additional information).

To ensure fairness, C4 has acquired judges to serve as a selection committee to identify the most qualified teams. Teams will first attend their student symposium for an initial evaluation. The top qualifying teams from each student symposium will be invited to the ASCE Civil Engineering Student Championships hosted by Kansas State University in Manhattan, Kansas in June 2027 for a final evaluation and award.

C4 encourages teams to collaborate with local ASCE professional Sections, Branches, and Younger Member Groups to enhance their project. ASCE and C4 will assist in making these connections and developing contacts.

1.2 Contextual Comments / C4 Commentary

Contextual comments will be presented throughout this RFP in the following format:

This is a sample of a contextual comment. It has a visually distinct style to help stand out against the RFP's requirements. These serve as commentary to help describe C4's intent behind certain sections. These comments are also used to place emphasis on certain statements. Don't skip reading these!

1.3 Request for Proposal (RFP) Documents

The following documents, as part of this RFP, will be provided to teams:

Table 1. Request for Proposal Documents

Document	Release Date
Request for Proposal (this document)	September 8, 2026
Mix Design & Material Compliance Template (MS Excel spreadsheet)	September 8, 2026
Detailed Cost Breakdown Template (MS Excel spreadsheet)	September 8, 2026
Materials Notebook Submittal Template (Cerberus Folder Structure)	September 8, 2026
Hull Thickness/Reinforcement & Percent Open Area Template (MS Excel spreadsheet)	September 8, 2026
Request for Information Summary	Early February 2027

If major clarifications are needed, RFP addendums may be released. Release announcements would be posted at the following locations:

1. [C4 Facebook page](#)
2. [ASCE Concrete Canoe website](#)

Revisions to the RFP's text issued via addendum will be presented using this text style and highlighting.

1.4 Request for Information (RFI)

Requests for Information (RFI) are opportunities for teams to request clarifications regarding stated rules or to request that material be allowed as an approved equal to a required standard. RFIs will be submitted via the RFI Submittal Form link below. Teams are encouraged to be mindful of which sections are for C4 use only and which are for global release. Official responses will be posted to the C4 Facebook page. An RFI Summary will be aggregated and released in early February 2027.

[RFI Submittal Form](#)

The cut-off date for submitting an RFI is Monday, January 25, 2027.

Note: *RFI responses from previous years do not carry over.*

In the spirit of the competition, C4 does not provide "approved equal" determinations for materials or provide clarifications privately. Any RFI submitted will be made public so that all teams have the same information, a process that mirrors the engineering profession's standard procedure. For any "approved equals" a team might seek to use, they must either prove its compliance independently or submit it for public knowledge.

– End of Section –

2.0 WEBINARS

2.1 Live Webinars

C4 will host live webinars during the academic year to engage and communicate with the teams and prepare them for success. Participation in these webinars is highly encouraged, but not mandatory. Registration information will be posted on the [C4 Facebook page](#).

Table 2. Live Webinar Schedule

Live Webinar	Planned Date
Competition Kick-off, Design Considerations, Construction Drawings, & Requests for Information (RFI)	September 24, 2026
Concrete Mix Design Calculations	October 8, 2026

Live webinars are not intended to be all-encompassing design solutions. They are designed to familiarize teams with overall processes and terminology (particularly with the concrete mix design calculations and structural analysis webinars). C4's intent is to provide teams with enough context about a given topic for the teams to conduct their own research and develop their own strategies.

2.2 Previously Recorded Webinars

C4 has hosted additional webinars in previous years, and the content is still relevant, even if it does not apply directly to the current year's RFP. See below for a list of previously hosted webinars, with associated links for viewing.

Note: These previously recorded webinars were created with a previous RFP in mind. Remember that the requirements can change from one year to the next. As always, be sure to refer to and comply with the requirements of the current year's RFP.

Table 3. Previously Recorded Webinars

Previously Recorded Webinar	Link
Proposal Format How-To	Concrete Canoe Proposal Writing Webinar (https://players.brightcove.net/75114961001/SFtvStcMPG_default/index.html?videoId=6315676301112)
How to Give a Presentation	Presentations 101 The Art of Persuasion (https://players.brightcove.net/75114961001/SFtvStcMPG_default/index.html?videoId=6321489682112)
Infographics	A Guide to Infographics: The Art of Simplicity (https://players.brightcove.net/75114961001/SFtvStcMPG_default/index.html?videoId=6342982537112)
Structural Analysis	2024 Structural Analysis Webinar (https://upload.asce.org/public/folder/40rretkyakcmom18tgl6zg/AAA Reference Documents and Webinars/2024 Concrete Canoe Structural Analysis Webinar.mp4)
Material Compliance	2025 Material Compliance (Materials Notebook Submittal) (https://upload.asce.org/public/folder/kin5_j1z70kn65puv1hhpw/AAA%20Reference%20Documents%20and%20Webinars)

– End of Section –

3.0 ELIGIBILITY

It is expected that teams foster an inclusive culture and treat everyone with dignity and respect.

3.1 Registered Participants

A team can have up to 10 registered participants, with no more than 5 identifying as she/her/hers and no more than 5 identifying as he/him/his. Registered participants who identify as they/them/their or do not align strictly with either set of pronouns can choose to compete in either the men's or women's races and must stick with that choice for the entire competition. All registered participants must meet the requirements listed in *Exhibit 3 - Student Chapter and Participant Eligibility*. **No one is allowed to challenge a participant's gender identity.**

Only registered participants can represent the team in presentations, races, or other activities. Substitutions of registered participants are allowed until on-site registration, except in special circumstances. Each team must designate two registered participants as captains.

Substitutions of registered participants after on-site registration are possible for extenuating circumstances outside of a team's control (for example, illness, injury, etc.) at the judges' discretion.

Note: C4 strongly encourages students not to paddle if they have an injury and strongly encourages judges to find fair solutions for all participating teams in these scenarios.

3.2 Levels of Competition & Student Chapter Eligibility

There are two levels of competition: the ASCE Student Symposia and the Society-wide Finals Competition. The Society-wide Finals Competition will take place during the ASCE Civil Engineering Student Championships in June 2027 at Kansas State University in Manhattan, Kansas.

Teams can be invited to the Society-wide Finals Competition by placing as the top qualifying team at their assigned ASCE Student Symposia Concrete Canoe Competitions or as the host school of the Society-wide Finals Competition.

All qualifying teams must represent an ASCE Student Chapter and meet the requirements outlined in *Exhibit 3 - Student Chapter and Participant Eligibility*.

After each student symposium, ASCE will verify competition scores and the eligibility of each participating student chapter. Teams will only be invited to the Society-wide Finals Competition once eligibility is confirmed.

3.3 Available Wild Cards to Society-Wide Finals

When possible, in addition to the top qualifying team from each Conference, ASCE may select Wild Card teams through a random draw to compete in the Concrete Canoe Society-wide Finals. The Wild Card process was established to provide broader access to the Championships, allowing teams who might not otherwise have the chance to participate, to gain experience and learn from established competitors, thereby improving their skills for the future. To be eligible as a Wild Card team, the team must:

- Rank in the top third (1/3) of all Annual Student Chapter Reports,
- Submit a Statement of Interest, signed by the Department Chair and ASCE Faculty Advisor, and
- Finish in the top half (1/2) of their respective Symposium Competition.

No Conference may have more than one Wild Card team selected in a given year, and a team cannot be chosen as a Wild Card in consecutive years.

– End of Section –

4.0 SUBMISSION REQUIREMENTS & DEADLINES

Teams shall meet all submission deadlines listed below. Submissions not received by the deadlines or partial/incomplete submissions will be considered non-responsive and subject to a deduction. Symposia host schools shall not change or amend any of the submission requirements. If a host school does, teams are directed to only follow the requirements listed below. Refer to *Exhibit 1 – Summary of Important Dates/Deadlines*.

4.1 Conference/Team Folders

ASCE uses a submission platform called Cerberus Web Client. All digital competition deliverables must be submitted on this platform. Submissions outside of this platform will be considered non-responsive and will not be considered.

The main folder (link provided below) contains a sub-folder for each Student Symposium, and within each Symposium Folder is a folder for each school. Please note that these folders will only allow files to be uploaded and viewed, no file deletions will be permitted. Refer to *Exhibit 2 – How to Navigate Folders and Upload Submissions* for directions.

<https://upload.asce.org/public/folder/t69evl4nne61vth1ypnwfa/2027%20Concrete%20Canoe%20Submission%20Folders>

Note: All submissions are stored in the competition submission platform alongside every other team's submissions and are not held confidential. Teams should submit accordingly.

4.2 Letter of Intent and Qualification Form

Letter of Intent and Qualification Form responses shall be uploaded to their respective folders **no later than 5:00PM EDT (Eastern) Monday, November 2, 2026**. See *Exhibit 11 – Pre-Competition Submittals* for required template and form.

For real-world projects, owners often require preliminary planning and certifications before development of a full proposal or execution of the work. Establishing project goals and major milestones early provides a basis for evaluating progress and understanding how the project develops over time. Similarly, confirming appropriate health and safety practices at project initiation reinforces that safety should be planned before technical work begins rather than addressed after the fact. This initial submittal is intended to provide teams with experience establishing these commitments before preparing their full Project Proposal.

4.3 Design Narrative, Construction Drawings, and Calculation Package & Materials Notebook

For Student Symposia Competitions, submittals listed in Table 4 must be uploaded to their respective folders by the stated deadline. **No hard copies are required for ASCE Student Symposia.**

For Society-wide Finals Competition, digital versions of the submittals listed in Table 4 must be uploaded to their respective folders according to the instructions in the Letter of Invitation by the stated deadline. **Six (6) bound hard copies of the Project Proposal Deliverables must be received by the stated deadline, at the following address:**

ASCE Student Programs
1801 Alexander Bell Drive
Reston, VA 20191
Attn: Concrete Canoe

4.4 Submission Summary

Table 4. Required Formats, Score Weighting, and Deadlines for Project Proposal Deliverables

Submittal Name	Weight	Required Format	Deadline		
1. Letter of Intent and Qualification Form (Section 5.4)	5 %	PDF (Fillable form template)	Pre-competition submittal Monday, November 2, 2026 by 5:00 PM EST		
			Student Symposium (Digital Submission)	Society-wide Finals (Digital Submission)	Society-wide Finals (Hard Copies)
2. Design Narrative (Section 5.5)	35 %	PDF (components and page limits per Table 7)	Thursday, February 11, 2027 by 5:00PM EST	Tuesday, May 11, 2027 by 5:00PM EDT	Received no later than Tuesday, May 11, 2027
3. Construction Drawings (Section 5.6)	30 %	PDF			
4. Calculation Package & Materials Notebook (Section 5.7)	30 %	Submit both: - Excel (.xlsx) – Completed Percent Open Area, Hull Thickness, and Mix Design Sheet, and MTDS Summary templates. - PDF – Compiled PDF prints of templates, bound with the Example Calculations.			

File names must adhere to the following formatting requirements. Society-wide finalists must re-upload all files for their Society-wide Finals digital submission as indicated below.

Student Symposia Competitions:

"School Name_Canoe Name_Document_Year"

(e.g., "South Central Louisiana State University_Mud Dawg_Construction Drawings_2027").

Society-wide Finals Competition:

"School Name_Canoe Name_Document_Year_Society-Wide"

(e.g., "South Central Louisiana State University_Mud Dawg_Construction Drawings_2027_Society-Wide").

Note: The school name must match across all submitted files. Failure to adhere to this format may result in a deduction in scoring.

Note: For both the Student Symposia Competitions and the Society-wide Finals Competition, the digital submission shall be considered the official and governing version of all required materials listed in Table 4. For deliverables where both Excel (.xlsx) and PDF files are required, the official and governing version shall be the Excel (.xlsx) file. In the event of any discrepancies between the digital and hard copy submittals (where applicable), the digital version will take precedence. Any omissions, formatting issues, or inconsistencies in the digital files may result in scoring deductions, as determined by the judging panel.

– End of Section –

5.0 PROJECT PROPOSAL DELIVERABLES

Each team shall provide their *Letter of Intent and Qualification Form*, *Design Narrative*, *Construction Drawings*, and *Calculation Package & Materials Notebook*, which details their approach to meeting the requirements of the RFP solicitation as it pertains to the various areas related to the design and construction of the concrete canoe.

The four distinct deliverables are considered the team's Project Proposal.

Reference documents can be found at the link below:

https://upload.asce.org/public/folder/kin5_j1z70kn65puv1hhpw/AAA%20Reference%20Documents%20and%20Webinars

One of the greatest challenges in the engineering profession today is the art of stating a complex idea, solution, or decision simply. From city council meetings to public hearings, engineers are increasingly asked to address the society they work for in terms they can understand.

The setup of this RFP aims to aid each team in learning the importance of simple visuals and concise writing to help others understand complex technical material. The sections below are separated so that each portion of the report serves a different subset of people engineers can expect to interact with.

Table 5. General Requirements

Component	Requirement
Page Size	8-1/2 in x 11 in (unless otherwise specified below)
Margins	½ in on all sides (except for MTDS and construction drawings)
Font	Times New Roman, Arial, Calibri, or Aptos, 12 pt., normal width, single-spaced; See Section 5.6 for Construction Drawings text requirements
Headings/Subheadings	Any legible font and size equal to or larger than body text
Headers/Footers	Within margins, any legible font and size equal to or larger than body text
Dividers	Optional for sections and appendices
Units	Report all dimensions in English units
Language	All deliverables (including MTDS) shall be submitted in English

5.1 Pictures, Figures, Graphics, and Infographics

Pictures, renderings, illustrations, graphs, figures, etc. are permitted and encouraged.

- No use of copyrighted or trademarked materials is permitted without written approval from the copyright or trademark owner.
- Items from publications must be properly referenced.
- Items developed and owned by the 2026-2027 team do not need to be referenced. Items developed and owned by a previous year's team (for example, photographs depicting a construction method) can be used if they represent what is being proposed for this submission and are properly cited in the proposal as previous teams' work.
- Hyperlinks and QR codes are not permitted.

5.2 Plagiarism

Plagiarism of any kind, intentional or unintentional, will not be tolerated and is grounds for disqualification.

Per Merriam-Webster, plagiarism is:

"To [use] and pass off (the ideas or words of another) as one's own; to use (another's production) without crediting the source."

Submitted proposals may be screened for plagiarism at the discretion of the judging panel and/or the C4. If plagiarism is suspected, C4 shall make the final determination regarding disqualification, not the judging panel.

If it is determined that the team has plagiarized, the team will be disqualified from competition.

Additional guidelines related to plagiarism:

- All language included in the proposal, presentation, display, and any other incidental deliverables shall reflect work completed within the current academic year, unless otherwise referenced and properly cited as work completed in a prior year. This includes but is not limited to text, pictures, renderings, illustrations, graphs, figures, etc. Failure to properly cite work completed in a prior year will be considered plagiarism.
- The use of generative artificial intelligence (AI) and natural language processing models (NLP), such as OpenAI's ChatGPT, is neither encouraged nor discouraged by C4. However, if such tools are used, all instances (including any images created by an AI program) must be clearly cited as work completed by the respective AI/NLP. Failure to cite these sources will also be considered plagiarism.

Framing the rules and regulations of this competition as a Request for Proposals is intended to provide teams with familiarity and experience with how the competitive bid process works in industry and for teams to articulate in plain language how the deliverables were created within the current academic year. It should be noted that while the framework is that of a competitive bid process, this is still an academic competition. As such, teams are expected to adhere to the principles of academic integrity.

By participating in the 2027 ASCE Concrete Canoe Competition, teams agree to adhere to the ethical publishing standards in ASCE Journals. As ASCE is a Committee on Publication Ethics (COPE) member, all project proposals submitted to the C4 must follow the guidelines recommended by COPE and the requirements outlined above. ASCE reserves the right to publish any project proposal submitted during the competition exclusively and will not review or publish any proposal that violates the ASCE or COPE ethical guidelines.

Proper AI/NLP Citation Method

Citation of the AI and NLP shall be presented in the format provided below.

Format: Author. (Date). *Name of tool* (Version of tool). URL

Example Bibliography: OpenAI. (2026). ChatGPT (Mar 14 version). <https://chat.openai.com/chat>

Example In-Text Citation: (OpenAI, 2026)

Verification of Plagiarism

C4 will use an online plagiarism detection program that compares submitted documents against a comprehensive database of internet sources and academic work from all institutions. This program identifies similarities such as relocated sections of text, slight modifications to existing phrasing, or reuse of larger content blocks. Any verification of plagiarized content through this tool is grounds for disqualification as stated above.

5.3 Content Recycling

While text recycling may be permissible in some professional and industry contexts, it will not be allowed for this competition. It is expected that teams draft their own proposal each year that accurately attributes work done by the team and work done by others, including previous teams.

Content recycling is defined as:

Reusing an organization's content from a prior deliverable without proper citation.

As such, participants must ensure that any reused content from past work is appropriately cited. C4 has provided documentation under separate cover offering guidance on how teams can avoid text-recycling and, if used, how to cite it properly.

Recycled content that lacks citation will result in no-proposal points being awarded.

Verification of Content-Recycling

C4 will use an online program designed to compare documents from the same team against one another to verify any potential cases of content recycling. This program analyzes the similarities and differences between the text that is inclusive of relocating a block of text within the document, minor revisions to a previously used sentence or paragraph, and wholesale recycling of text. Any verification of content recycling via this program will result in no proposal points awarded.

The prohibition on content recycling applies to more than written narrative. Teams should also consider figures, photographs, CAD linework, calculations, tables, and other visual or technical content developed by prior teams. This is particularly important for the expanded Construction Drawings this year, where previously developed geometry, details, or drawing content may be tempting to reuse. C4 expects each team to clearly distinguish work developed during the current academic year from work created by previous teams and to provide appropriate attribution whenever prior work is incorporated. The intent is not to discourage teams from learning from previous efforts, but to ensure that submitted deliverables accurately represent the work performed by the current team.

When in doubt, cite it out.

5.4 Letter of Intent and Qualification Form

Teams shall submit a formal letter acknowledging the team's intent to participate in the competition using the template provided in *Exhibit 11. Pre-Competition Submittals*. The letter shall be accompanied by the completed fillable form located in *Exhibit 11*, that captures key team details, eligibility, and basic qualifications.

Responses may be presented as narrative paragraphs, as bulleted or numbered lists, or as a combination of the two. All words in a response count toward the stated limit regardless of format. References and citations placed within a section's available space do not count toward that section's word limit.

Form responses shall include the following topic areas:

1. Project Goals (300 words max)

Present the team's goals for both the canoe prototype and overall Team development. Goals and/or performance targets for the canoe prototype at a minimum should cover hull design, concrete materials and mix design, construction, and proposed innovations.

Proposed innovations should be thought in the context of 'trying something that the team has not tried before' and as a comparison of the team's previous processes, designs, testing, new materials, and methods to the current team. Innovation is not necessarily trying something that no team has ever tried before. Some areas of the Design Narrative ask the team to discuss objectives or goals. The discussion about goals here should be at a higher level, with more granular specifics discussed in the appropriate Design Narrative sections.

2. Proposed Project Milestones (15 milestones max)

Provide proposed milestones on the fillable form table provided outlining the team's timeline from issuance of the Request for Proposal solicitation to the competition. Consider milestones for key project decision points, research and development, testing, material selection, construction, and design narrative development. Include any paddling milestones if appropriate.

Provide an estimate of person-hours the team believes will be associated with each milestone in the fillable form table. The team should generally track their time throughout the project both for this task and – the team will need to present actualized dates and person-hours in the Design Narrative.

Teams are responsible for identifying the major milestones that best reflect how their project will be planned and executed. A detailed project schedule is not required this year; instead, teams should identify the key activities they expect to use when evaluating project progress and execution. These may include critical path activities, major design or construction decisions, or other milestones the team considers significant to the successful delivery of its prototype and proposal.

3. Health and Safety Program (300 words max)

Having certified in the Letter of Intent that all applicable university health and safety requirements are followed, provide at least three specific examples of health or safety hazards anticipated during the project. For each example, identify the hazard, explain how exposure or injury could occur, and describe the specific practice, control, or PPE used to mitigate the risk. Reference Safety Data Sheet information where applicable. Examples may include hazards associated with concrete or constituent materials, batching and construction activities, material testing equipment, tools and equipment, lifting and handling, or canoe-related activities.

The intent of this section is not for teams to repeat general laboratory rules or provide a list of standard PPE. C4 is interested in whether teams understand the specific hazards associated with the materials, processes, equipment, and activities used throughout the project and why particular safety measures are necessary. The examples provided should demonstrate hazard recognition and the connection between a potential exposure or injury and the controls used to reduce that risk.

5.5 Design Narrative

The sections outlined below in Table 6 are expected to be in the order presented and contain all requested information described in the following subsections. The team can use less than the specified page limit in each section, but the specified page limits should not be exceeded.

Table 6. Required Components & Page Restrictions for Design Narrative

Component	Page Limits and Size Requirement(s)
Front Cover	1 page
Cover Letter	1 page
Table of Contents	1 page
Infographic	1 page (11 in x 17 in)
Organizational Chart	1 page (either 8-1/2 in x 11 in OR 11 in x 17 in)
Project Execution	2 pages
Hull Design and Analysis	5 pages
Development and Testing	
Detailed Cost Breakdown	1 page (PDF Printed from provided template)
Appendix A – Bibliography	No page limit
Appendix B – Letter of Intent and Qualification Form	PDF Printed from provided template
Appendix C – Supporting Documentation (if used)	No page limit
Back Cover (Optional)	1 page (if provided)

5.5.1 Front Cover

A front cover is required for both:

- Student Symposium competitions, where no hard copies are requested, teams should include a digitized PDF of their cover as a single page.
- Society-wide finals competition, where hard copies are required, the front cover of hard copies shall be single-sided. The backside of the front cover shall be left blank.

5.5.2 Cover Letter

In an official response to the C4 Request for Proposal solicitation, the following statements will be included and will not be considered for plagiarism or content recycling (excluding signatures). By signing the Cover Letter, the team agrees that:

- The hull design, concrete mixture design, reinforcement scheme, and construction of the prototype canoe have been performed in full compliance with the specifications outlined in the Request for Proposal.
- Material Technical Data Sheets (MTDS) and Safety Data Sheets (SDS) have been reviewed by the team for completeness and compliance.
- The team acknowledges receipt of the Request for Information (RFI) Summary and that their submissions comply with the responses provided.
- The anticipated registered participants are qualified student members and Society Student Members of ASCE and meet all eligibility requirements (including names and ASCE Society Member ID Numbers).
- All text generation AI/NLP algorithm uses are properly cited within the respective document.
- All University Health and Safety Policies have been followed.

The letter shall be signed by at least one (1) team captain and the ASCE Student Chapter Faculty Advisor, certifying that the information presented in the Letter of Intent and Qualification Form, Design Narrative, Construction Drawings, and Calculation Package & Materials Notebook is valid. The team captain and faculty advisor's phone number and e-mail address shall be provided.

5.5.3 Table of Contents

List the sections and appendices of the *Design Narrative*, including appropriate page numbers. A list of tables and figures may be provided but is not required.

5.5.4 Infographic

C4 requests an infographic that will serve as a general overview for this project and will be included on the project display (Section 7.2.1) and used as the presentation visual aid in lieu of slides (Section 8.4).

To aid in each team's infographic, C4 offers the following definition: Infographics are graphic visual representations of information, data, or knowledge intended to present information quickly and clearly.

Rather than block text (paragraphs), this one-page maximum is expected to rely heavily on illustrations, lists/tables, icons, and other graphical content.

The infographic must include the following, along with any additional relevant information the team deems appropriate:

1. School's Student Chapter Profile:

- Brief history, activities, awards, and other relevant details your team feels should be highlighted for your chapter.

2. Canoe Program Total Hours and Cost:

- Provide total number of person-hours for the project
- Provide the total cost of materials to fabricate (1) one canoe from the team's Detailed Cost Breakdown. Include Total Cost, Mold Materials Cost, and Canoe Materials Cost.

3. Team's Innovative Features:

- Unique features of the design, approach to the problem statement, material testing, structural analysis, construction and finishing techniques, etc.

- Highlighting innovative items specific to your team

4. Prototype Specifications:

- Dimensions: Length, Width, Depth, Thickness, Weight.
- Composite flexural strength (specify the age of testing).
- All reinforcement used (specify primary or secondary, type, and name).
 - Percent Open Area
 - Reinforcement Ratio
- Any flotation used (type/name and density, if applicable).

5. Concrete Mixture Specifications:

- Density: Wet (plastic) and oven-dried unit weights (for each mix).
- Concrete slump/spread and air content (for each mix).
- Compressive and tensile strength (specify the age of testing for each mix).

All properties shall be reported in English units to the accuracies outlined in the industry standards (e.g., ASTM C39, C138, C109, and C496, as examples) and as outlined in the table below.

Note: These shall be used as the official properties used for any compliance checks. For the Student Symposia, if there are canoe or concrete properties not fully available at the time of submission, provide context for the information that is being presented. For example, “Estimated Weight.” Or using an asterisk to provide a footnote, etc.

Table 7. Material Properties & Reported Accuracy

Property	Reported Accuracy (to the nearest...)
Strength	10 psi
Density (hardened concrete)	1 lb/ft ³
Density (fresh concrete)	0.1 lb/ft ³
Slump, Spread	¼ in
Weight	1 lb
Air Content	0.1%

5.5.5 Team Organizational Chart

Provide team member names, including descriptions of the roles, tasks, or areas in which they contributed at any time during the project. Include the year (Fr., So., Jr., Sr., Grad or 1st year, 2nd year, 3rd year, 4th year, etc. as applicable) for all members. Indicate team captains. As appropriate, list advisors, sub-consultants, and other pertinent individuals.

5.5.6 Project Execution

1. Goals

Summarize the original project goals, discussing if the team met, exceeded, fell short, or revised the original goals/performance targets set in the Letter of Intent and Qualification Form.

2. Innovations

Provide a discussion that highlights your team's overall achievements that makes your project stand out from the rest.

Describe any notable innovations or unique approaches developed by the team during the course of the project and how those innovations helped achieve the team's project goals or make the end product "better". These may include, but are not limited to:

- New materials or mix designs
- New or improved approach to material evaluation or structural analysis/verification
- New or original structural, construction, or finishing techniques
- Project management tools or communication strategies
- Iterative processes that significantly improved performance or quality

"Better" is relative. Innovations should be framed as a comparison of the team's previous processes, designs, testing, new materials, and methods to the current team. C4 wants to see you discuss how your efforts this year are moving the needle for your team. C4 is not looking for comparisons to other teams in this section.

3. Project Management

The following categories should be included as part of the discussion on project management.

- Milestones – Provide a table to update the team's milestones (*listed from the Letter of Intent and Qualification Form submission*) to include actualized milestone dates. Discuss and provide rationale for any deviations from the original milestones.
- QA/QC – Discuss the team's overall QA/QC program as it relates to concrete materials and construction activities. Describe the differences in how the team is incorporating quality assurance vs. quality control.
- Sustainability - Using one or more of the three pillars of sustainability — social, economic, and environmental — discuss the team's proposed approach to sustainability. Prioritize discussion of unique sustainability elements over standard sustainability practices. Provide specific examples of proposed practices or decisions that relate to the selected pillar(s) and describe their direct or indirect impacts.
- Health & Safety – Highlight if there were any changes or additional health and safety considerations due to other materials, equipment, or unknowns at the time of the Qualifications Package submission.

The Health & Safety section here is to provide the opportunity for new information to be shared by the team if there is any. If there are no changes from the Qualifications package, provide a quick acknowledgement of no changes/new considerations from the information provided in the Qualifications Package. There is no need to re-state any of the information already provided in the Qualifications Package.

5.5.7 Hull Design and Analysis

The Hull Design and Analysis subsection should include the following:

1. Present the team's holistic design process and approach, along with related performance objectives.
2. Discuss the final design selections – including hull geometry, overall shape, structural elements, and other notable features or innovations. These design decisions should be supported by relevant data where applicable.
3. Justify how the design meets performance goals such as stability, maneuverability, turning, and straight-line speed, as well as any other relevant criteria or constraints. Consider how the defined race routes impact hull design priorities, including any trade-offs made between turning ability, speed, stability, and maneuverability.
4. Describe the impact that refinements/alterations to the hull design have on the overall final product. Consider the following for discussion: how do changes to the hull design affect structural analysis, development and testing, and/or construction.

If comparisons are made to previous years, be sure to quantify the comparison to ensure proper understanding from the judges.

5. Present the team's structural analysis and detail the methods chosen for determining the following:
- All load cases and highlight the governing load case(s)
 - Free-body diagram for the governing load case(s)
 - Minimum Required Strength: Maximum compressive (σ_c), tensile (σ_t), and punching shear stresses multiplied by any applicable Factors of Safety (FS) or Load Factors (LF). Provide justification and discussion for any applied FS or LF.
 - Critical section moment of inertia (I_x) and location of neutral axis.
 - Analysis methods used to calculate the hull's freeboard under four-person loading (see Section 6.2 for additional information)
 - If FEA or other 3D analysis is used, a discussion comparing the 2D analysis and FEA/3D analysis results and their differences is required.
6. Example Calculations for the design and analysis shall be included in the Calculation Package. The calculations shall be prepared in digital format – no handwritten calculations shall be submitted in the package. The use of computational programs such as, but not limited to, MathCAD®, Matlab® and Microsoft Excel™ to perform repetitive, routine calculations is allowed. The example calculations shall include at a minimum the following:
- Hull Freeboard calculations
 - Structural calculations for the 2D analysis, which provide backup for the maximum moment and shear for the governing load case(s) with and without FS, LF, etc.
 - Moment of Inertia calculation
 - Maximum stress calculations
 - Hull punching shear (Per ACI)

Note: Failure to include all requested components of the Hull Design and Analysis sub-section as well as the requested example calculations in Appendix C will result in a deduction.

5.5.8 Development and Testing

Present the team's approach to planning, developing, researching, and testing of concrete materials, the mix design, and reinforcement selection to meet the requirements of this RFP. Additionally, present the development, research and testing of other materials to be used in canoe fabrication (i.e. mold materials, stains, sealers, pre/post tensioning elements, etc.) and how your team decided to use these specific materials. Refer to standard test methods where appropriate. Sustainable products should be highlighted in any materials being used. At a minimum, teams should provide the following:

1. Relating to Mix Design Selection:

- Identify and present the team's overall process in developing trial mixes and the reasons for altering each trial mix (i.e. structural properties, workability, weight, etc.)
- Quantitative test results of mixtures tested and selected.
- Concrete and mix constituents considered, tested, and selected.
- Physical properties and composition of the proposed aggregate sources, including specific gravity, absorption, and particle size.
- Admixtures considered, tested, and their effects on concrete properties/behavior.

2. Relating to Reinforcement Selection:

- Primary (and secondary if applicable) reinforcement considered, tested, and used, and layering scheme chosen and determined by composite testing results. Provide detailed reasoning behind the reinforcement selections made and layering scheme chosen, including composite test results.
- Discuss any pre/post tensioning or other reinforcing elements used and discuss the reasoning for implementing them.

C4 would like to see elaboration behind the process of how you came to conclusions on the materials selected for the creation of your final product. Additionally, the new or innovative ideas, materials and methods implemented can be team specific year to year and comparison discussion should be made as such.

Remember the wise words of Fred R. Barnard “a picture [or graphic] is worth a thousand words”.

3. Composite Performance and Durability

- Discuss the composite concrete (reinforcement and concrete mix) in terms of stress (shear and bending) and compare it to the structural analysis performed for the anticipated forces and required design stresses.
- Provide the Demand-to-Capacity Ratio(s): Relate the minimum required strength to the concrete mix design's actual strength (as determined via testing), expressed as a percentage. Discuss how any reserve capacity (capacity above and beyond the minimum required strength) in the mix design is justified.
- Using the structural analysis and composite mix design results, identify where structural distress is most likely to occur, the anticipated failure mechanism(s), and how the governing load case(s), calculated stresses, demand-to-capacity ratios, reinforcement layout, hull geometry, and tested composite properties support those conclusions.

4. Mold Development

- Discuss the mold material selection process, including materials considered with rationale for what was ultimately chosen as the mold formwork
- Discuss fabrication techniques and processes to maintain geometric accuracy
- Highlight sustainable aspects of the chosen mold materials or fabrication process

5.5.9 Detailed Cost Breakdown

Following the completion of the full-scale prototype, each team shall provide a Detailed Cost Breakdown using actual person-hours and the team's actual/market material costs following Exhibit 7 and the provided Excel template.

All values shall use the labor rates, material assumptions, and formatting conventions provided in *Exhibit 7 – Detailed Cost Breakdown*.

For the Student Symposia, use actual hours and costs up to the point of publishing along with projected hours and costs for any future activities prior to the Student Symposia. Denote projected and future items with clear notation, such as an asterisk/footnote or other notation.

Outsourcing:

If any part of the material research & testing, canoe fabrication, or final display is outsourced, clearly note this in the Detailed Cost Breakdown as outsourced labor.

C4 and the selection panel (judges) place value on work completed by the teams themselves. While outsourcing is only prohibited for mold construction (Section 6.2.1), teams should be advised that outsourcing significant portions of the project may affect judges' scoring.

5.5.10 Appendix A – Bibliography

ASTM and other industry standards, technical software, and any previously published material, including previous design papers for prior RFP submittals and sources referenced when performing calculations, must be properly cited, as applicable. Any professionally acceptable reference style can be used if the reader can use the citation to find original information sources.

5.5.11 Appendix B – Letter of Intent and Qualification Form

Appendix B should include the initial Letter of Intent and Qualification Form submitted in November for reference. No other documentation should be provided in this appendix.

5.5.12 Appendix C – Supporting Documentation

Appendix C should only be included if the team uses *Exhibit 9 – Durability and Repairs* (if applicable) and other documentation as directed by C4. It cannot be used by the team to include any additional information not specifically requested by C4.

5.5.13 Back Cover

A back cover is not required for either PDF or hard copies of the Design Narrative. However, should a team choose to include one:

- For Student Symposium competitions, where no hard copies are requested, teams should include the digitized PDF of their back cover as a single page, with no need to include a blank page.
- For the Society-wide Finals competition, where hard copies are required, the back cover of hard copies shall be single-sided. The front side of the back cover shall be left blank.

5.6 Construction Drawings

Present isometric, elevation, plan, and typical composite cross-section views of the canoe and mold with all applicable dimensions in each view, bill of materials, and other details which would be needed to construct the canoe. Additional sections and details may be added to present construction techniques. Provide any relevant specifications as deemed essential by the team.

The Construction Drawings shall include sufficient detail such that the team's mold and canoe can be constructed from the drawings by the judges or C4.

The Construction Drawings shall consist of a maximum of (5) five, 11" x 17" pages and be numbered from **S-01 to S-05**. Drawings shall use uppercase text for call-outs, dimensioning, and labeling. For Notes and Specifications, the normal combination of upper and lowercase text may be used. All non-title block text shall be Arial with a minimum size of 3/32." Title block text can be any size and font type. No margin requirements are specified.

S-01. Notes and Specifications

Provide overall notes and specifications for the Construction Drawings. At a minimum, include:

- Concrete Batching
 - Batch sizing, pre-batching (if applicable), and order of operations
- Concrete and Reinforcement Placement
 - Sequence and techniques to minimize cold joints, segregation, or air entrapment
 - Detail the placement process, including how reinforcement was positioned within the mold and secured to maintain location during concrete placement
 - Integration of reinforcement with the concrete mix, including layering schemes and the sequence of placement to ensure bond development and prevent shifting or segregation

- If applicable, prestress or post-tensioning procedures, including tendon layout, anchorage locations, timing of tensioning, and method used to apply force.
- Concrete Curing
 - Curing method (e.g., wet/dry cure), materials and application, and time requirements
- Canoe Demolding
 - Process, sequence, and/or techniques for demolding the canoe
- Concrete Finishing
 - Surface treatments, grinding, sanding, or polishing
 - Application of graphics or visual enhancements
 - Use of pigments, stains, or sealers

S-02. Mold Fabrication

Present plan, elevation, and cross-section views. Include measurements, detail callouts, and constructability techniques for the mold fabrication. The drawing should show a state where the mold is prepared for concrete placement and include any required pre-concrete placement procedures (e.g. form oil, attaching depth gauge, etc).

S-03. Canoe Design

Present plan, elevation, cross-section, and isometric views. Include measurements, use detail callouts, and include constructability techniques for key elements of the canoe design. Details to consider may include reinforcing tendons-bars-ribs, lettering location, rocker design, bulkhead design, reinforcement attachment, aesthetic elements, etc.

S-04. Details

Provide drawing details referenced on the Mold Fabrication, Canoe Design, or 'Floater Page' that adequately aid in constructing and finishing of the mold and canoe.

S-05. 'Floater Page' (Optional)

This is an optional drawing sheet that may include additional section views, details, or design elements to aid in the prestressing/post-tensioning of reinforcement tendons, construction process, curing, and/or finishing process. This sheet can have any title and be inserted anywhere in the drawing set after the Notes and Specifications sheet. This sheet can be used to help show information that cannot fit on one of the previous sheets.

Construction drawings are a key component of the evaluation as C4 solicits teams to provide a design that can be given to a manufacturer to build a concrete canoe. The Construction Drawings shall be the primary source of information for the manufacturer that provides the key features and pertinent information to fabricate the canoe. Construction drawings used to construct a bridge, building, or dam would be pertinent real-life examples.

5.7 Calculation Package & Materials Notebook

Each team shall submit a consolidated Calculation Package in PDF format that summarizes the engineering calculations and supporting compliance documentation used to substantiate the design of the canoe prototype. The PDF shall include the required example calculations described below and printed or exported pages of all applicable Microsoft Excel worksheets used for design, compliance, and mixture calculations.

The Calculation Package is intended to provide judges and C4 with a concise, reviewable record of the calculations supporting the team's design presented in the Design Narrative. Where Microsoft Excel, MathCAD®, Matlab®, or other permitted digital tools are used, the relevant inputs, assumptions, equations, and results shall be included within the PDF Calculation Package in a legible format sufficient to understand and review the calculations.

In addition to inclusion within the PDF Calculation Package, all native calculation files, including required Microsoft Excel workbooks identified below, shall be uploaded in their prescribed formats. The submitted native

files will be used by C4 and the judges for calculation and compliance verification and shall be considered the official governing documents where discrepancies exist between the native files and printed or exported pages included in the PDF Calculation Package.

The Calculation Package shall include:

- Example Design Calculations
- Hull Thickness/Reinforcement and Percent Open Area Calculations (Excel Template)
- Mix Design Sheets (Excel Template)
- Materials Notebook (Excel Template and Folder Submission)

5.7.1 Example Design Calculations

This section may be in either portrait and/or landscape orientation and is limited to four (4), 8-1/2" by 11" pages. The calculations shall be performed in digital format – no handwritten calculations shall be submitted. The use of programs such as, but not limited to, MathCAD®, Matlab® and Microsoft Excel™ to perform repetitive, routine calculations is allowed. Provide detailed, step-by-step required example calculations (showing all relevant equations, variables and inputs including proper units) for the following scenarios:

- Hull freeboard calculations under four-person loading;
- Structural calculations for the 2D analysis which provide backup for the maximum moment, shear of the 3 person co-ed endurance slalom load case with and without FS, LF, etc.;
- Moment of Inertia calculation;
- Maximum stresses calculations; and
- Hull punching shear (Per ACI)

At a minimum, the following shall be provided in the calculation:

- list of all assumptions (cite references as applicable);
- free body diagram with all relevant point and distributed loads and their respective values and cross-sectional properties including applicable dimensions; and
- The cross-sectional properties of the representative section are to be approximated by hand calculations (i.e., the use of exact values from programs such as AutoCAD are not permitted).

5.7.2 Hull Thickness/Reinforcement and Percent Open Area Calculations

Present the measurements and calculations of the reinforcement thickness and hull thickness for the various canoe elements (i.e., walls, ribs, gunwales, thwarts, and bulkheads) and percent open area (POA) as applicable, using the provided Excel™ template.

5.7.3 Mix Design Sheets

Each team shall provide **one** Microsoft Excel™ file with a worksheet (tab) for **each** mix design utilizing the template located at the link provided in Section 5.0. Mixtures that differ in only color will be considered as one mixture, and one worksheet shall be provided. In this case, it should be clearly noted on the table or worksheet name that the color of the mix varies.

No rows, columns, or text in cells with no background color shall be deleted or altered from this provided format. Failure to adhere to this will result in penalties. The team is only to input values in the **blue cells** and only equations in the **orange cells** as noted in the legend within the template.

Proficiency in Excel™ and other Microsoft™ tools is crucial for engineers, who use these skills daily for tasks like cost estimates and schedules required by various agencies and developers. To foster this skill and streamline the judging process, C4 provides an Excel™ file template; however, output formulas are not included and must be developed by the team. Teams must apply their knowledge of Excel™ functions and formatting to correctly input equations and calculations, simulating the real-world process of project submission and reducing discrepancies.

5.7.4 Materials Notebook

The Materials Notebook is used to provide detailed information about the materials used in the canoe prototype. It is separate from the Design Narrative and must include all materials' specifications for compliance verification by judges and C4.

A PDF copy of the Completed Mix Design & Materials Compliance Table shall be included in the Calculation Package.

Please note that the Materials Notebook will be submitted using a newer format introduced in 2026, aimed at reducing the level of effort for teams to compile, and reducing the amount of time it takes for judges/C4 to conduct compliance reviews. This newer format is detailed below.

5.7.4.1 Components

- Completed Mix Design & Materials Compliance Table (**one** Microsoft Excel™ file per team)
- Technical data sheets for each material

5.7.4.2 Submission Requirements

1. The Materials Notebook shall be submitted using the folder structure in the template format provided. Teams shall complete the Mix Design & Materials Compliance Table Excel™ file for each material used. The folder structure template format can be found with the Reference Documents linked at the start of Section 5.0.

Note: Web links and QR codes shall not be used and will not be accepted.

2. PDFs of technical data sheets for each material shall be saved to its corresponding folder. For example, a MTDS for *Type I Portland cement* should be saved in the folder named “01_Cementitious Materials”.

Note: Sheets should offer technical details, not promotional/brochure-type content.

3. Submitted MTDS for all materials shall be clearly named in a manner that identifies the manufacturer and product. For example, “*Lehigh - Type I Portland Cement - MTDS.pdf*”.

Note: Safety Data Sheets (SDS) are not a substitute for Material Technical Data Sheets (MTDS).

4. Submitted MTDS shall provide current information and verify compliance of materials against RFP requirements with specific standards (e.g., ASTM).
 - a. If no technical data sheet is available from the manufacturer, provide a certification letter on company letterhead.
 - b. Teams are required to clearly highlight the relevant specification or standard (e.g., ASTM number, VOC content) directly on the PDF for each material to demonstrate compliance.
5. Provide PDFs of basic technical information for materials without specific RFP requirements. For example, printouts from store websites or packaging showing material properties are acceptable. (e.g., blocks of foam for bulkhead use showing type and density of the foam; reinforcement tendons showing size, working/breaking strength, stranding; etc.)

For questions about datasheets or products, submit an RFI to C4 or refer to *Exhibit 4 – Materials Notebook* for additional information.

If a team fails to provide clear compliance documentation, such as missing data sheets, incomplete MTDS tables, absent PDF highlighting, or if a material is determined to be non-compliant or not previously approved by C4, a deduction will be applied as noted in the Final Product Prototype score.

Real world projects typically include specifications for materials that may be used, and often require the Contractor to submit mix designs, material product data sheets, and more to the Owner and/or Engineer or Record to review for compliance with the project specifications and drawings.

– End of Section –

6.0 CANOE HULL DESIGN PROTOTYPE

Teams shall analyze and design a canoe hull to establish the minimum required concrete properties. After development and testing, the team will construct a full-scale canoe prototype of their proposed design ahead of their Student Symposium.

6.1 Dimensional Constraints

6.1.1 Hull Thickness

Society-Wide Only: the maximum hull thickness (as measured by calipers) is restricted to ½” with a 1/8” tolerance. The location and measurement of the maximum hull thickness shall be at the discretion of the judging panel and/or C4.

Note: this restriction does not include ribs, gunwales, etc.

6.2 Design Constraints

6.2.1 Mold Construction

Teams are required to construct their own canoe molds. Outsourcing mold construction is prohibited.

The use of computer numerically controlled (CNC) equipment/processes for the construction of molds is prohibited. This includes but is not limited to: CNC mills, CNC routers, laser cutters, water jets, 3D printers, etc. This restriction does not prohibit teams from using CNC to construct jigs or templates that aid in the actual construction of their molds.

Molds from previous years cannot be used, unless teams can provide proof that the previous team constructed their mold themselves, without the aid of CNC processes.

In honor of the 40th anniversary of the National Concrete Canoe Competition (you know, ancient times that predate the World Wide Web), C4 has placed this additional restriction on teams that limits the use of modern milling technology for the mold construction process. Requiring teams to construct their own molds without the aid of outside parties is also intended to help teach students the importance of simplicity in design/detailing. This requirement will provide students with a unique perspective on whether something is easily constructable or prohibitively difficult. This is a valuable skill that translates directly into the civil engineering profession – what you design ultimately needs to be buildable.

6.2.2 Freeboard

The canoe must maintain a minimum freeboard under four-person loading such that the entire school name and canoe name remain fully visible above the waterline when the canoe is fully loaded with all four coed race paddlers. This visibility requirement corresponds to the lettering specification as described below in Section 6.7.

Compliance will be verified during co-ed race staging. Teams are required to prove compliance in the Calculation Package by showing calculated freeboard under full coed loading conditions (as described in Section 5.7.1).

Should the judging panel or C4 observe that any portion of the school or canoe name is submerged during compliance verification, a 30-second penalty will be applied to that team’s Coed Sprint race time.

Note: Policing of this requirement by any persons other than the judging panel or C4 is in direct conflict with the spirit of the competition and will not be tolerated. This requirement is intended for teams to engineer the solution to a specific constraint, not for teams to weaponize the constraint against one another during races.

6.2.3 3D Elements

The use of decorative three-dimensional (3D) elements installed on any portion of the canoe above the gunwale line illustrated in Figure 1 is strictly prohibited.

6.3 Canoe Material Components

The Final Product Prototype shall be constructed with components that are categorized under and comply with **Concrete, Reinforcement, or Flotation** requirements presented herein. All flotation and reinforcement must be encased in concrete.

Exclusions: lettering, sealers, stains, damage repairs (tape), and flotation needed to pass flotation test.

6.4 Gunwale

The gunwale will be finished to prevent injury to the paddlers (i.e., no exposed reinforcement or sharp edges.) Foam pipe insulation may be used as gunwale protection and may be secured with tape.

6.5 Concrete Materials, Mixtures, and Reinforcement

Concrete mixtures shall comply with the specification in *Exhibit 5 – Technical Specifications for Concrete and Reinforcement*.

6.6 Flotation

In the event a canoe becomes submerged, canoes should be designed and constructed to pass the flotation test by the buoyant design of the canoe. Flotation material shall be limited to within 3 feet of the bow and stern sections and encased in concrete. The 3 feet restriction is measured from the outermost tip of the bow and stern to the innermost concrete plane of the bulkhead as visible at the competition site.

6.6.1 Flotation Test

The canoe must pass a flotation test where it should float generally horizontal near the water's surface within 2 minutes after being filled with water.

The flotation test focuses on the canoe's ability to stay buoyant, not the exact depth it floats at. The goal is to ensure the canoe does not sink and can be easily retrieved if submerged, ensuring safety before the race.

Teams are responsible for handling and submerging the canoe by any means (e.g., filling it with water, tilting it, or pushing it down). Gunwale caps/protection are not allowed during the test but can be added afterward. If the canoe does not pass the test on the first try, it will receive a deduction on the Final Product Prototype score.

6.6.2 Additional Flotation

If a canoe does not pass the flotation test, teams shall be required to add additional flotation materials until the canoe does pass the test to the satisfaction of the judges and/or C4. Any added flotation shall be below the gunwale line. Gunwale caps/protection shall not be permitted to serve as flotation material. If flotation is added at the Student Symposium Competition, it shall be removed for the Society-wide Competition. At the Society-wide Competition, the canoe will be evaluated in the flotation test as if it was the first time undergoing the flotation test.

If a team fails the flotation test at a Student Symposium Competition, they will be re-assessed at the Society-wide competition if they qualify. This is a re-testing of the canoe as it was designed and intended to be delivered at the Student Symposium Competition and does not allow teams to "repair" their canoe to pass the flotation test before the Society-wide Competition.

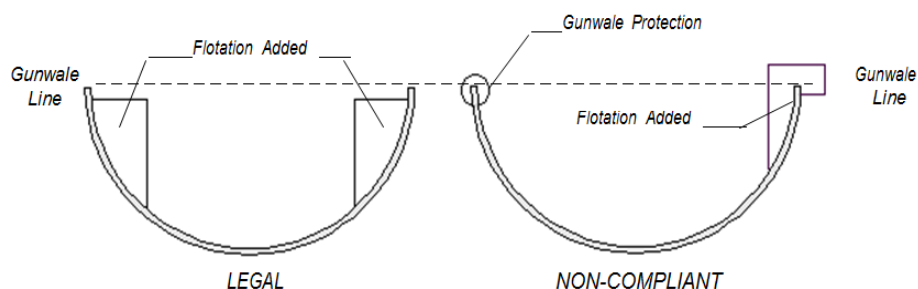


Figure 1. Gunwale Example

6.7 Finishing & Aesthetics

6.7.1 Canoe & School Name

The school and canoe names must be clearly displayed on both sides of the canoe, above the waterline, installed or applied with the top of lettering at one (1) inch below the gunwale line with individual letters measuring five (5) inches tall $\pm \frac{1}{4}$ inch. Recognized abbreviations from the school's official website are acceptable, but the name must be at least five characters long.

Names must follow the graphics specifications in Section 6.7.2, except for adhesive lettering. Adhesive lettering is allowed, but only for the school and canoe names.

6.7.2 Graphics

Graphics created with coloring agents or pigments integrally mixed within the concrete mix design can be of any size and used as desired, provided they meet ASTM C979.

Commercially available transparent, semi-transparent, or translucent stains formulated for concrete are permitted to be applied to both the inside and outside of the canoe, with the restrictions described below in Figure 2. Stains must have a VOC content ≤ 350 g/L and be penetrating, non-film forming. VOC compliance shall be based on adherence to the manufacturer's specifications for dilution and application as shown in the Materials Notebook.

Stains, which come in the form of powdered dyes that are to be reconstituted with water or other liquids are allowed, following the manufacturer's instructions for proportioning and mixing.

Acid stains may include thickeners formulated for acid stains if the combination does not exceed VOC limit specified above.

Glitter, particulate material, and other additives are not permitted. Unless directed by the manufacturer, stains cannot be diluted with water, acetone, or other mediums. The application of any given stain shall be limited to two (2) coats maximum.

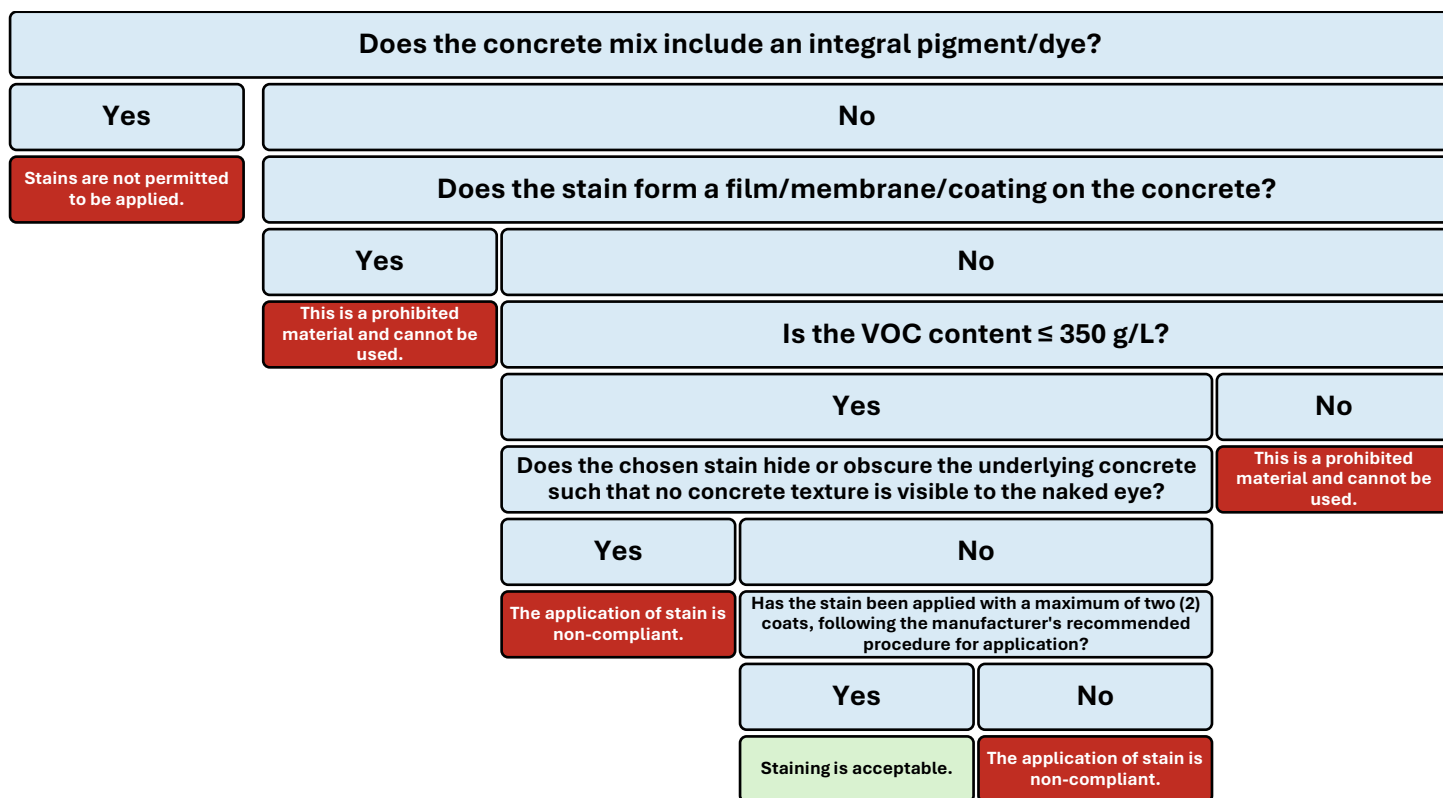


Figure 2. Flowchart describing how and when stains may be applied.

C4 and the selection panel (judges) value visible concrete. Teams' lightweight concrete mixes should be the highlight of the final product, not hidden or obscured by layers of stain.

6.7.3 Concrete Sealers

Only clear, non-pigmented concrete sealers may be applied to the canoe. The sealer may be either:

1. silane- or siloxane-based penetrating sealer with a VOC of less than or equal to 350 g/L,
- OR**
2. liquid membrane-forming compound for curing and sealing compliant with ASTM C1315 requirements (there are no VOC requirements with this option)

Post-manufacturer additives such as glitter or other particulate material are not permitted. The application of sealer to any portion of the canoe shall be limited to a maximum of two (2) coats, following the manufacturer's recommended procedure for application and thickness.

For the purpose of this competition, there are two main types of sealers, which C4 presents above. It's imperative that the team understand what they are using to ensure compliance. While there are many resources, the link below provides a neatly organized table to aid in selecting appropriate sealers. <https://www.concretenetwork.com/products-sealer/comparison.html>

6.8 Durability and Repairs

Canoes should be durable enough to survive the rigors of the Student Symposium Competition, the Society-wide Finals Competition, and transportation to and from the various events. Following the completion of the slalom races and the preliminary sprint races, all canoes shall be removed from the water, assembled in a commonplace or a location specified by the head judge, and inspected by the judges and/or C4 members for durability (judges score) and use of tape as a repair (deduction). *Exhibit 9 – Durability & Repairs*, discusses in detail the criteria for assessing durability.

6.9 Official Weigh-In and Hull Thickness Check

At the Society-wide Finals, canoes are subject to an official weigh-in and hull thickness measurement with the measured weight and thickness compared to the weight reported in their Design Narrative infographic.

– End of Section –

7.0 PROTOTYPE DISPLAY AND EDUCATIONAL WORKSHOP

Teams will have the opportunity to showcase their canoe on display, alongside a Project Display highlighting the processes, materials, and a cross-section of the canoe representing its construction (canoe and mold). This prototype display enables teams to present their results to the judges and share their insights with other teams, fostering a collaborative environment aligned with ASCE values. Non-compliance with the following requirements may result in penalties.

Table 8. Restrictions on Prototype Display

Component	Requirement
Project Display Dimensions	The display must fit within a 4-foot wide by 8-foot long by 7-foot high space.
Display Design	Displays must be designed for judging from the front only (not a walk-around).
Self-Supporting	Displays must be self-supporting. Nothing can be taped, mounted, or attached to surrounding trees, walls, doors, floors, etc.
No Electronic Devices	Displays cannot include electronic devices such as laptops, lighting, sound or video equipment, radios, loudspeakers, or any noise-creating devices.
No Sponsor-Related Items	Sponsor lists, logos, or related items are not allowed in the display. Manufacturer branding appearing on off-the-shelf paddles and life jackets as purchased is acceptable and need not be removed or covered.
No Scents	Using scents from humidifiers or open-flamed candles is prohibited.

7.1 Elevator Pitch

During the judges' evaluation of the Final Product Prototype, teams will have the opportunity to deliver a brief, live pitch highlighting the element they are most proud of or their favorite aspect of the canoe. This could be a construction technique, material innovation, aesthetic feature, or any other standout element the team wishes to showcase. This pitch is intended to educate judges on the process or technical reasoning behind the team's approach. Props are encouraged, provided they comply with the requirements outlined in Table 8.

Judges may ask brief follow-up questions after the presentation to clarify techniques or understand the team's decision-making process.

In practice, engineers are often called upon to explain complex work clearly and quickly to clients, executives, or the public. Whether delivering a big-picture summary or diving deep into a single technical topic, this exercise prepares teams to think critically about what matters most and how best to communicate it. Creativity in format and delivery is encouraged, as long as the presentation remains focused and informative.

Remember though, judges will generally have less than 10 minutes total to evaluate the entire Final Product Display, including the canoe, cross-section, materials, and other required components. While the pitch itself is not timed, teams should be mindful that the time they use to present reduces the time available for judges to assess other parts of the display.

7.2 Requirements

Alongside the canoe prototype, the Project Display is where a team will showcase their approach to the design, research, testing, and construction. At a minimum, teams must include the following:

7.2.1 Required Information and Samples

Teams must present information and data that clearly highlight their project's strengths. The portions of the project that should be included in the display, at a minimum shall include:

1. Hull design and structural analysis elements

- Show/explain hull design shape and dimension choices
- Purpose for elements of hull shape (chine, gunwale, keel, etc)
- Purpose for structural elements (ribs, gunwale, prestress, post-tensioning, etc)

- Show how the hull design was conceptualized, refined, and finalized (performance and structurally)

2. **Research, testing methods and results**

Include information related to the team's reinforcing and concrete materials research along with mix design testing regime to highlight how the team went from a baseline mix to the final mix selection(s) and final materials and reinforcement chosen

3. **Mold and canoe construction techniques and details**

- Show/explain how the mold and canoe were built, including materials and methods used
- Highlight innovations in techniques and materials
- If used, consider including concrete shaping tools, depth checkers, items to create inlay, outlay, 3D elements, structural elements, etc

To present the above elements, teams should use the following guidelines.

- Use images, photos, graphs, sketches, tables, flow charts, decision trees, matrices, and/or physical items, etc.
- Items used to adhere to requirements outlined below are not eligible for inclusion in showcasing the design process.
- All methods of presenting the required elements will be labeled.
- All examples should be of the team's specific process or results – generic content is not acceptable.
- The cross-section does not count towards fulfilling the above elements.

All elements should aid in educating other teams, judges, and the general public of the team's design approach, construction methods, research, and testing during throughout the competition.

While the product display table can be themed with the rest of the final product display pieces, its purpose is to inform. Think of this space as an additional canvas to tell the story of your design that may not have made it into your proposal or your presentation. Remember that you have this display to convince the judging panel that you have the most thought-out, thoroughly designed, and appropriately functioning canoe for their use.

As part of the display, the following items must be included:

- **Samples of aggregates, cementitious materials, and fibers** in transparent, labeled containers. The samples should be large enough to clearly showcase the materials.
- **Individual sample(s) of each aggregate** and **composite sample(s) of aggregates** blended in the same proportions as used in the concrete mixtures. Composite blends should only include aggregate.
- **Concrete cylinders** from each mixture (3 or 4 inches in diameter), split into two halves.
- **Raw reinforcement samples**, including mesh, grids, strips, tendons, and bars, representative of the materials used in the canoe.
- **Composite Flexural testing sample** – include (1) tested (broken) composite flexural testing sample
- **Individual sample(s) of each cementitious material** and any fibers used in the concrete mixtures.
- **One hard copy** each of the Design Narrative, Construction Drawings, and Calculations Package & Materials Notebook.
- **Infographic** from the Design Narrative, displayed for viewers.
- **Detailed Cost Breakdown and Person-Hours** from the Design Narrative, displayed for viewers
- **Required photos:** A minimum of 12 photos displayed for viewers covering development and testing of materials, mold construction, aesthetics and finishing. Include labels/brief caption for each photo.

Additionally, the following items shall be readily available for compliance checking:

- **Seats/Mats** for measurement verification.
- **Life jackets and paddles.**
- **[Society-wide Finals only] Concrete cylinders** (unbroken, 3 or 4 inches in diameter) for each concrete mixture used, prepared according to ASTM C39. These cylinders should be oven-dried and represent the in-place density, color, consistency, and composition of the concrete used in the canoe.

7.2.2 Canoe Cross-Section

A full-scale model cross-section of the canoe, representing both raw and finished stages, must be displayed alongside the canoe. The cross-section should illustrate the concrete and reinforcement layering, concrete elements (ex: inlay/outlay, 3D elements, structural elements, etc), finishing (levels of sanding, staining, and sealing), reinforcement techniques, and must include the mold. All elements must be labeled. The cross-section, including any stand, should fit within a 4-foot wide by 4-foot long by 7-foot high space, separate from the main product display. The cross-section shall be displayed off the ground.

Full-scale means that every element depicted (wall and rib thicknesses, reinforcement layers, gunwale and bulkhead geometry) matches the corresponding dimensions of the prototype at a 1:1 scale. The RFP does not prescribe which station along the hull the cross-section represents, and elements may be arranged as needed to show the full sequence of raw and finished stages, provided every element remains at true scale.

The entire cross-section display is intended to fit inside the dimensions listed above. Consider those dimensions to be an invisible box that the team cannot exceed. It will be within the judge's purview to either not judge anything outside of the box or dock overall product display points as they deem fit should the team not contain the product display within limits.

7.2.3 Canoe Stands

The canoe should be displayed on stands that hold the canoe approximately 4 feet off the ground from the top of the gunwale. The underside of the canoe must be visible for inspection. The ends of the canoe do not need to be at the same height, but the 4-foot height is approximate to ensure judges can inspect all areas of the canoe.

The height requirement intends to allow judging to occur from a generally upright standing position. The judges shouldn't be required to climb a step stool or kneel to get a full view of the entire canoe. The listed four foot height is an approximate value to aid the students in planning their display to accomplish this intent. It will be up to the judges if this intent is achieved.

Note: *If judges cannot see the inside or outside of the canoe without the use of a stand/ladder, they are not required to include those elements in their scoring.*

– End of Section –

8.0 PRESENTATION & TECHNICAL INTERVIEW

Each team will deliver a **2-minute presentation** covering the topic areas contained within the team's infographic followed by an **8-11-minute technical interview session with a panel of judges**. The judges will evaluate the teams based on the content presented during this timeframe.

Presentations and technical interviews are intended to be open to the public, with preference for seating/viewing given to the school actively presenting.

8.1 Presentation

Only one registered team member is permitted to speak during the initial presentation. The presenter shall be joined on stage with all registered team members who will be participating in the technical interview.

The presentation must be live and delivered in English. Pre-recorded speech will not be permitted.

8.2 Technical Interview

Following the presentation, teams will differentiate themselves by answering questions from the judging panel, demonstrating their knowledge of the project in the following topic areas: project management, hull design, structural analysis, mix development & testing, and construction.

Any registered team member signed in at registration may participate in the technical interview, including the initial presenter. A minimum of two registered team members must participate in the technical interview.

8.3 Audience & Focus

Presentations should be catered to a technical audience. For the purposes of this presentation, the judging panel should be considered representatives of a concrete canoe manufacturing company.

Teams shall present their canoe prototype with the goal of convincing the judging panel that their prototype is worth purchasing by succinctly emphasizing the key aspects of the canoe's technical design, innovative elements, and overall value proposition as described within the team's infographic.

Recall this is a hypothetical scenario to provide an end goal for the RFP and the competition. The presentation and technical interview intends to go beyond simply informing the audience of what you did and how you did it. Ultimately, the presentation and technical interview is your opportunity to pique the interest of the judges and persuade the judging panel to select your prototype.

8.4 Visual Aids

The only visual aid permitted for the presentation and technical interview is the team's infographic. Online platforms, such as Canva, are not permitted to be used in the development of the team's infographic.

Handouts, props, or other additional visual display materials of any kind will not be permitted.

Restrictions on the use of visual aids are intended to simplify project deliverables for students while increasing the connective tissue between competition elements. While this restriction is limiting in terms of the available space, C4's intent is to help students determine what information is most critical to illustrating your prototype's strengths in the areas of technical design, innovation, and overall value.

8.5 Presentation Order

Presentation order will be randomly selected and provided to teams by the host school. Presentation order shall be considered final at the beginning of on-site registration.

8.6 Equipment

The host school will provide access to electrical outlets, and visual display equipment (e.g. projector screen or television display). Teams must bring any additional equipment they need.

– End of Section –

9.0 CANOE PROTOTYPE PERFORMANCE DEMONSTRATION

Each team will have the chance to showcase their canoe's racing capabilities, handling performance, seaworthiness, and durability through a series of races. These races will assess straight-line speed and turning abilities under various loading conditions. The events include:

Student Symposia Competitions:

- Co-ed 200-meter slalom (1 person identifying as she/her/hers and 1 person identifying as he/him/his)
- Women's 200-meter Sprint (2 persons identifying as she/her/hers)
- Men's 200-meter Sprint (2 persons identifying as he/him/his)
- Co-ed 200-meter Sprint (2 persons identifying as he/him/his and 2 persons identifying as she/her/hers)

Society-wide Finals Competition:

- Co-ed 600-meter Endurance Slalom (3 persons with at least 1 person identifying as she/her/hers and at least 1 person identifying as he/him/his)
- Women's 200-meter Sprint (2 persons identifying as she/her/hers)
- Men's 200-meter Sprint (2 persons identifying as he/him/his)
- Co-ed 200-meter Sprint Preliminary Heats (2 persons identifying as he/him/his and 2 persons identifying as she/her/hers)
- Co-ed 400-meter Sprint Finals (2 persons identifying as he/him/his and 2 persons identifying as she/her/hers)

The quantity of races held and overall length of each race will be dependent upon site-specific restrictions beyond C4's control. While every effort should be made to complete all the races as described, variations/alterations may need to occur. Any variations in the race format should be clearly communicated to team captains with as much notice as possible.

9.1 Demonstration Course

9.1.1 General Requirements

The canoe's bow must remain at the front throughout each race, regardless of turns or finish buoys. The racecourse lanes will be marked with different colored buoys. The alignment, distance, spacing, and turns of the Slalom and Sprint courses must adhere to *Exhibit 8 – Race Regulations and Safety*, though adjustments may be made based on site-specific conditions.

9.1.2 Student Symposia and Society-wide Finals Competition

For all Student Symposia competitions, all sprint races shall be 200 meters. For the Society-wide Finals competition, the co-ed sprint finals will be increased to 400 meters. For the Society-wide competition, the 200-meter slalom course will be replaced with a 600-meter endurance slalom course.

9.1.3 Slalom Course (200- and 600-meter)

Student Symposia Competitions: The Slalom course consists of seven buoys staggered 5 meters apart transversely, with longitudinal spacing of 10 meters and 20 meters between the third and fourth buoys. The course involves slalom turns over the first 100 meters, followed by a 180° turn, and 100 meters straight back.

Society-wide Finals Competition: The slalom section (first 100-meters) will be similar to the Student Symposia Competitions, with site-specific adjustments, followed by a 500-meter endurance leg.

9.1.4 Sprint Course (200- and 400-meter)

The sprint course is a straight 200 meters with 100 meters out, a 180° turn, and 100 meters back. For the Society-wide Finals Competition, the Co-ed sprint finals will be 400 meters, consisting of two laps of the 200-meter sprint course.

9.1.5 Lane Requirements

Lanes shall be no narrower than 15 meters. See **Figures 3, 4, and 5** for additional information.

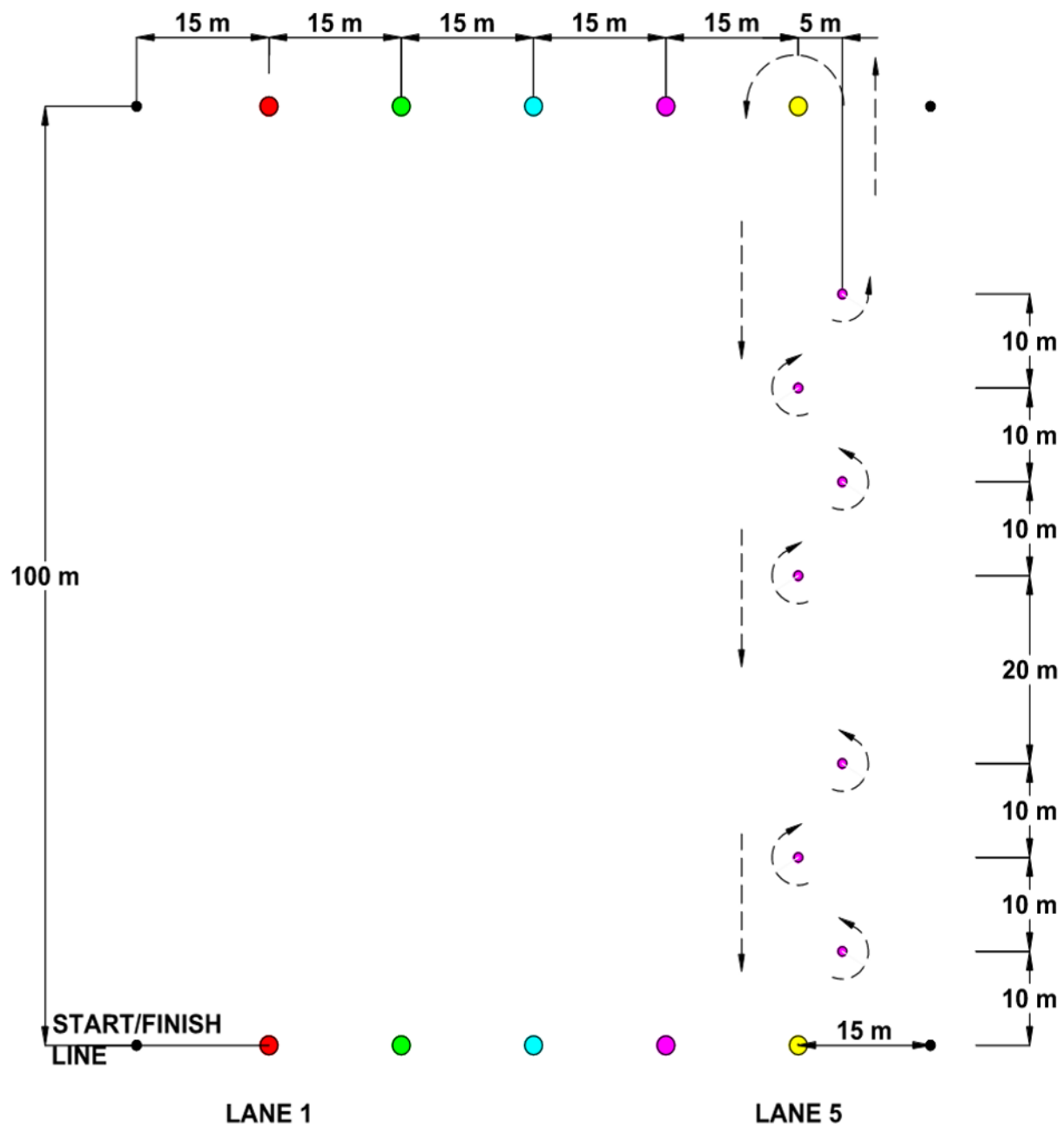


Figure 3. Example Racecourse Layout – Student Symposia Competition

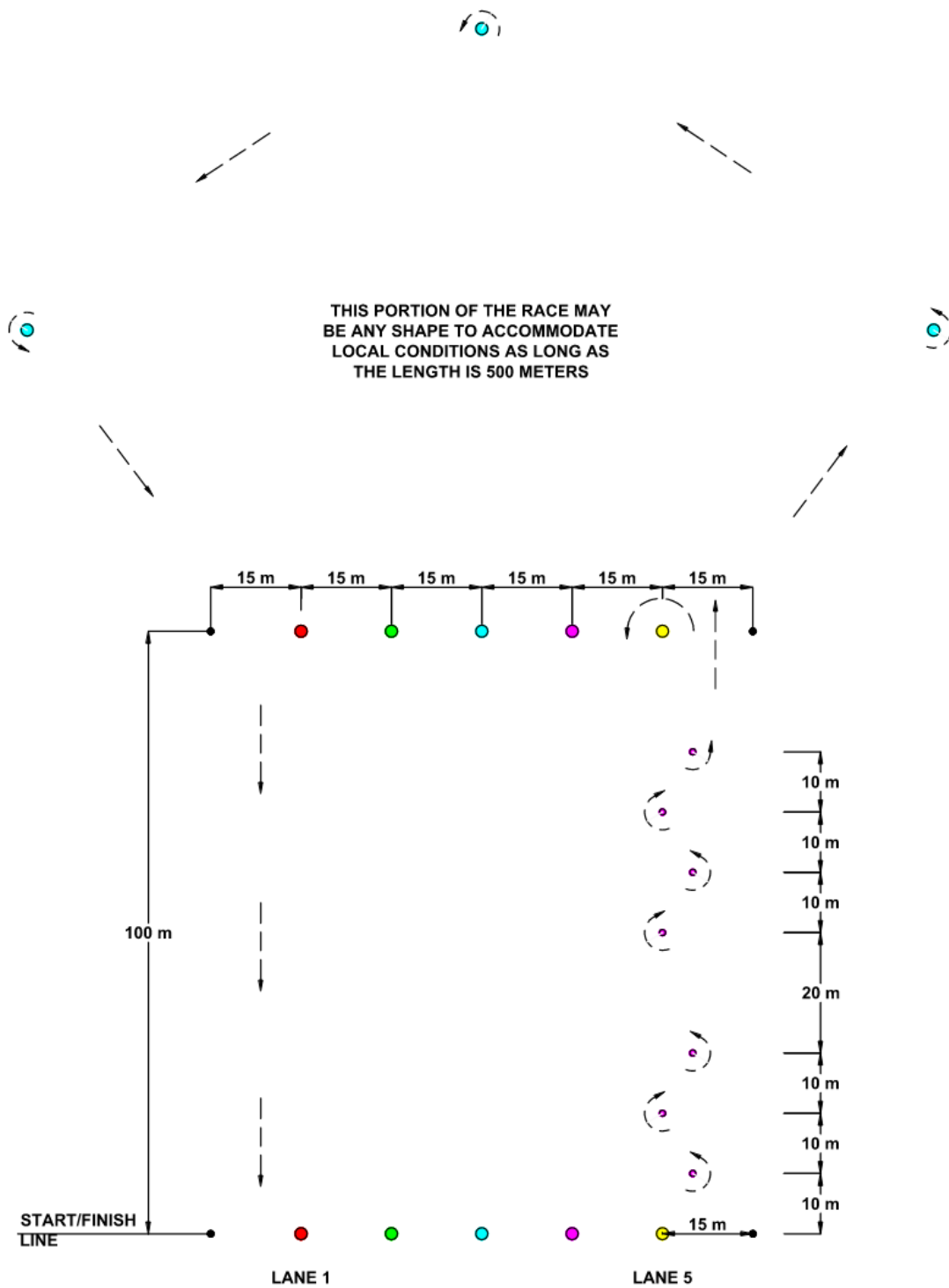


Figure 4. Example Endurance Slalom Racecourse Layout – Society Wide Finals Competition

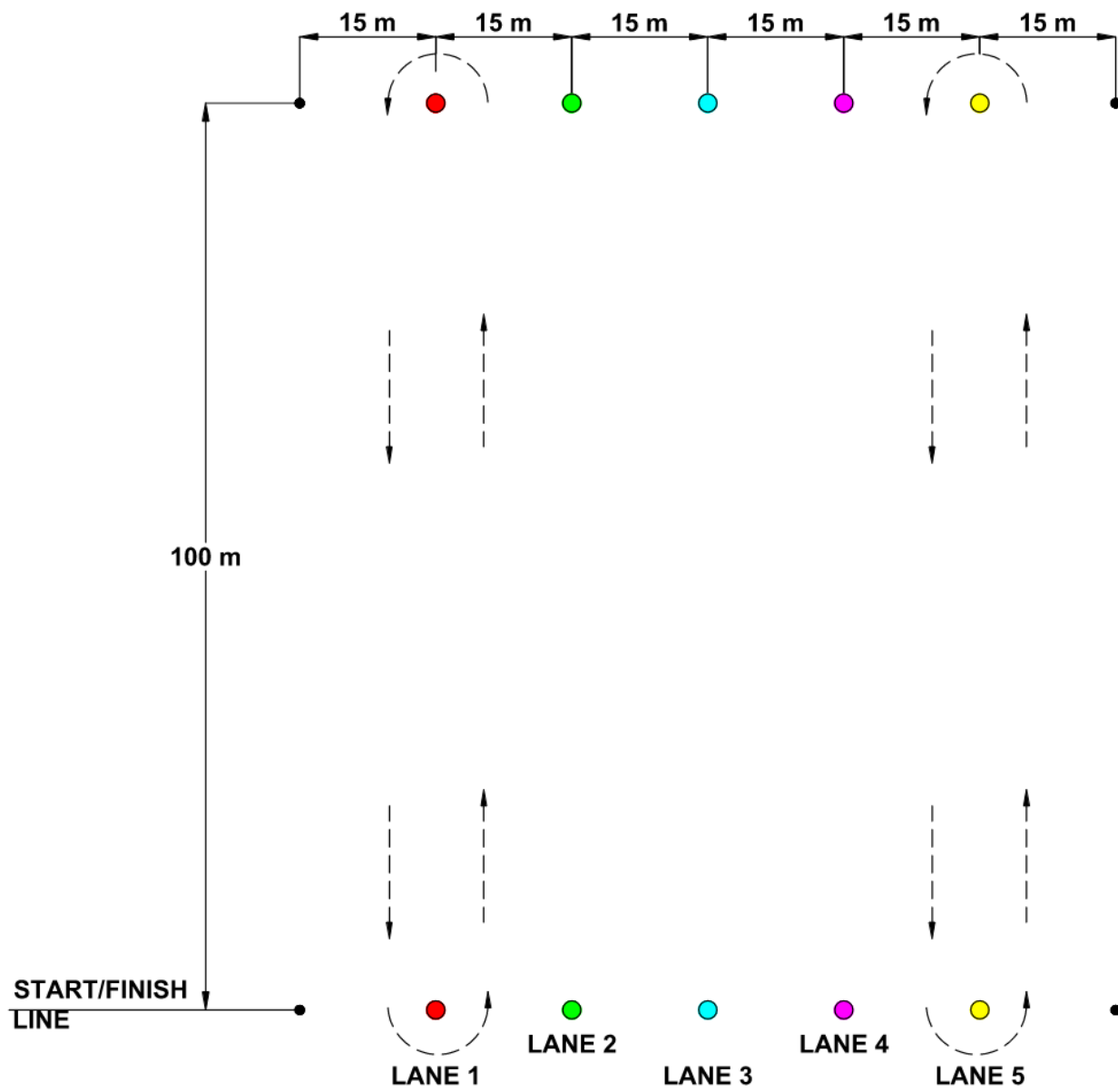


Figure 5. Example Sprint Racecourse Layout

– End of Section –

10.0 EVALUATION

The evaluation of the teams will be divided into four (4) categories, as described below in Table 9:

Table 9. Point Breakdown by Category

Category	Maximum Points
Project Proposal Deliverables	30
Presentation and Technical Interview	25
Final Product Prototype	25
Race Demonstrations	20 (across four events)
Total Possible	100

If none of the race events take place, the overall competition score will be based solely on the technical components (Project Proposal, Technical Presentation, and Final Product Prototype), with a maximum score of 80 points.

10.1 Evaluation Panel

Each event will be evaluated by a panel of 3 to 5 judges. C4 aims to have the same judges assess all portions of the competition. If different judges evaluate each portion, C4 will consider the competition invalid and will not extend an invitation to the Society-wide Finals Competition to teams from that student symposium. In exceptional cases, C4 may request details about the evaluation panel to assess the competition's validity and may still consider inviting the team to the Society-wide Finals Competition.

10.2 Scoring Method

The scoring method used across competition events that are judged by the Evaluation Panel is described in Figure 6. The scoring method used for race demonstration events is described in Figure 7.

10.2.1 Proposal, Final Product, and Technical Interview Scoring

Judged events begin with each judge independently assigning raw scores using the applicable Evaluation Form. Deduction units are calculated separately for each judge based on 1 percent of the range between the highest and lowest pre-deduction raw scores. Deduction units are subtracted from each team's raw score to establish adjusted scores, which are then ranked for each judge. Average rankings are calculated for each team, with lower rankings representing better performance. Average rankings are ordered, converted to a score ratio, and used to proportionally determine points awarded for the event, with first place receiving the maximum points and last place receiving zero points.

Teams earn race points from two components – where the canoe places and how close its finishing time is to the fastest team. These two components are weighted such that teams who finish ahead of others are rewarded for their performance.



Figure 6. Scoring Method Outline for Judged Competition Events

1.0 Average Times are Recorded

- Using stopwatches, two volunteer timers record finish times for each school for each race event. These times are input into the electronic scoresheet and averaged

$$\bullet \text{Time}_{\text{average}} = \Sigma(T_1 + T_2) \div 2$$
$$\bullet T_i = \text{Finish Time Recorded by Timer } i$$

2.0 Assess Penalties

- Race penalties are assessed (if applicable). Time penalties are assessed against a team's average finish times for a given race event to determine the team's **Adjusted Finish Time**.

3.0 Calculate Adjusted Finish Times

- **Adjusted Finish Times (AFT) = Time_{average} + Assessed Penalties (seconds)**
- **AFT** are ordered from fastest to slowest to determine finish placement for a given race event (first, second, third, etc.). This determines a team's eligibility for final race events.
- When finals are held, grand finalists place first through fifth, petite finalists 6th through tenth, and all others (11th or lower). A team that makes a final cannot place below its bracket.

4.0 Calculate Score Ratio

- A team's **Score Ratio** is calculated, which is a multiplier used to determine how many points a team has earned for a given race event
- **Score Ratios** are calculated differently for races than they are for judged competition events. For races, adjusted finish times are ratioed against the best performing and worst performing teams to determine a relative point spread.
- An additional multiplier is then applied based on finish placement, which rewards finishing ahead of other teams, regardless of how close their AFT is

5.0 Award Points

- **Points Awarded = Max Points × Score Ratio**
- **Max Points** = Maximum points for the race event
- **DNF:** A team that does not finish earns 0 points, and its time is excluded so it does not affect other teams' scores.
- **Final Events:** When finals are held, a petite finalist scores at least 0.1 points below the last grand finalist, and a non-finalist scores at least 0.25 points below the last petite finalist.

10.3 Evaluation Scoring

10.3.1 Scoring Examples

Table 10 below demonstrates how this system works with 30-teams in a judged event worth 30 points.

Table 10. Evaluation Point Breakdown for a Judged Competition Event Worth 30 Points

Number of Schools	School	Average Judge Ranking	Final Ranking Placement	Ranking Difference from best Score	Score Ratio	Points Lost	Points Awarded
1	Aqua Avengers	1.95	1	0.00	0.00	0.00	30.00
2	Bow Before Us	2.68	2	0.73	0.03	0.79	29.21
3	Buoy Scouts	3.47	3	1.52	0.06	1.65	28.35
4	Canoephoria	4.01	4	2.06	0.07	2.24	27.76
5	Channel Surfers	4.80	5	2.85	0.10	3.09	26.91
6	Drift Hustlers	5.26	6	3.28	0.12	3.56	26.44
7	Hull Yeah!	6.13	7	4.18	0.15	4.54	25.46
8	Lake It or Leave It	7.88	8	5.93	0.21	6.44	23.56
9	Liquid Legends	8.79	9	6.84	0.25	7.43	22.57
10	Oar Else	9.19	10	7.24	0.26	7.86	22.14
11	Oarade Crew	9.75	11	7.80	0.28	8.47	21.53
12	Paddle Patrol	10.34	12	8.39	0.30	9.11	20.89
13	Paddle Powered	11.71	13	9.76	0.35	10.60	19.40
14	Paddle Punishers	12.50	14	10.55	0.38	11.45	18.55
15	Rapid Rascals	13.77	15	11.82	0.43	12.83	17.17
16	River Rebels	14.62	16	12.67	0.46	13.76	16.24
17	Row Hard or Float Home	15.35	17	13.40	0.48	14.55	15.45
18	Rudder Madness	16.84	18	14.89	0.54	16.17	13.83
19	Splash Tactics	17.48	19	15.53	0.56	16.86	13.14
20	Stream Dream	18.26	20	16.31	0.59	17.71	12.29
21	Stroke of Luck	19.07	21	17.12	0.62	18.59	11.41
22	Team Glide Tide	20.05	22	18.10	0.66	19.65	10.35
23	The Eddy Outlaws	21.42	23	19.47	0.70	21.14	8.86
24	The Float Pack	22.16	24	20.21	0.73	21.94	8.06
25	The Rowgues	23.63	25	21.68	0.78	23.54	6.46
26	The Stern Chasers	24.94	26	22.99	0.83	24.96	5.04
27	The Wet Bandits	26.80	27	24.85	0.90	26.98	3.02
28	Tip No More	27.11	28	25.16	0.91	27.32	2.68
29	Wake Warriors	28.39	29	26.44	0.96	28.71	1.29
30	Wavemakers	29.58	30	27.63	1.00	30.00	0.00

In this example, *Aqua Avengers* achieved the best average rank (1.95) and earned the full 30 points. *Wavemakers* had the worst average rank (29.58), resulting in zero points for this category. All other teams received points scaled proportionally between these two extremes.

The ranking-based scoring process ensures that every team's effort is recognized and that results are determined by relative performance rather than raw scores alone. Instead of awarding points only to the top ten teams—and leaving many teams with zero points for the entire competition—this method scales points proportionally across all competitors.

This means that a team placing 15th, for example, still earns points that contribute meaningfully to their overall score, reflecting the real value provided to the client and the competition. Even if a team does not finish near the top, their work is acknowledged in the final standings, which rewards consistent efforts and placement by the team.

In addition, this system minimizes the impact of differences in scoring style between judges. Because final points are determined by rankings relative to other teams within each judge's scores, no judge's personal scoring style can disproportionately influence the results.

By combining proportional scoring with judge-style neutrality, the ranking-based method produces a more balanced, equitable, and representative outcome—ensuring that all teams receive credit for the value they contribute.

10.3.2 Summary of Deductions / Disqualification

Deductions may also be referenced in other sections of this document and/or the scoring sheets. Judges should contact C4 regarding situations that may not be covered to determine the appropriate course of action.

10.3.3 Deductions

The Deduction Scorecards determine a deduction unit that is entered into the electronic scoresheet to adjust the final scores for each judge for each school. Each deduction unit is calculated as 1% of the difference between the highest team's pre-deduction score and the lowest team's pre-deduction score for that specific portion of the competition. This calculation is done separately for each judge.

10.3.4 Disqualification

Teams may be disqualified (DQ) from the competition for the following:

- Failure to meet student eligibility requirements
- Violations under the Spirit of the Competition or under the Ethics and the Competition
- Sportsmanship and interference requirements
- Failure to follow safety rules
- Plagiarism

10.4 Deduction Resolution

During the competition, judges and/or C4 will notify team captains of any deductions assessed. Team captains may then either address these deductions by resubmitting, if eligible, or appeal them if they believe the deductions were improperly applied, as outlined in sections Exhibit 10. **Both actions require a written response to the judges for review, and only designated team captains are authorized to revise, resubmit, or appeal deductions.**

If a team chooses to appeal or resubmit, the team captains must submit a completed Deduction Scorecard (with signature), Final Product Prototype Revise and Resubmit Form, Appeals Form, and any supporting documentation by the specified deadline to the Head Judge or C4 member. The judges will review the appeal, make a final decision, and inform the team captains. Once the decision is communicated, no further appeals will be permitted.

Figures 8 and 9 below outline the procedures for handling the revise and resubmit and appeals process, including the responsibilities of team captains, judges, and C4. Judges' decisions after review are final, with no further appeals allowed. Judges may consult with C4 for guidance and to ensure proper deduction procedures are followed. **C4 will not accept any resubmissions or appeals beyond the Student Symposium Competition, nor will it overturn the deductions decided by Student Symposium judges.**

10.4.1 Revise and Resubmit

Deductions that are marked "Revise and Resubmit" on the deduction score card are eligible to be reevaluated by the judges using the Final Product Prototype Revise and Resubmit Form through the Team Captain. All supporting documentation must be included with the form at the time of resubmission, clearly indicating the revisions made. **The Revise and Resubmit Process is further outlined below in Figure 8.**

The "Revise and Resubmit" process is designed to simulate the submittal procedures commonly used in industry, offering teams an educational opportunity to correct errors or provide missing materials. However, please note that a "nuisance" deduction will be applied if deductions are rescinded upon resubmittal, to account for the additional time and effort required for reevaluation.

10.4.2 Appeals

Any deduction may be appealed if a team believes it was applied inappropriately by submitting an Appeal Form through the Team Captain. All supporting documentation must be included, clearly indicating the perceived error or explaining any extenuating circumstances.

Any appeals related to eligibility for advancement to Society-wide Finals competition must be initiated by a student chapter leader or team captain in disagreement with a ruling related to their own team within seven days of notification of ineligibility and received through student@asce.org with subject line: ASCE 2027 Competition Eligibility Appeal. This email will initiate a request for an appeals form. The form will be used to explain the appeal.

Appeals regarding any other part of the competition should be presented to the head judge during competition or emailed to concretecanoe@asce.org prior to the start of the awards ceremony.

The Appeals Process is further outlined below in Figure 9.

The appeal process is designed to address errors in applying deductions or to account for genuine extenuating circumstances. However, the "Revise and Resubmit" process is intended to minimize the need for appeals, as appeals are rare in industry. Please note that appeals based on personal dissatisfaction, misinterpretation of the rules, or claims that contradict objective evidence will not be considered valid grounds for an appeal.

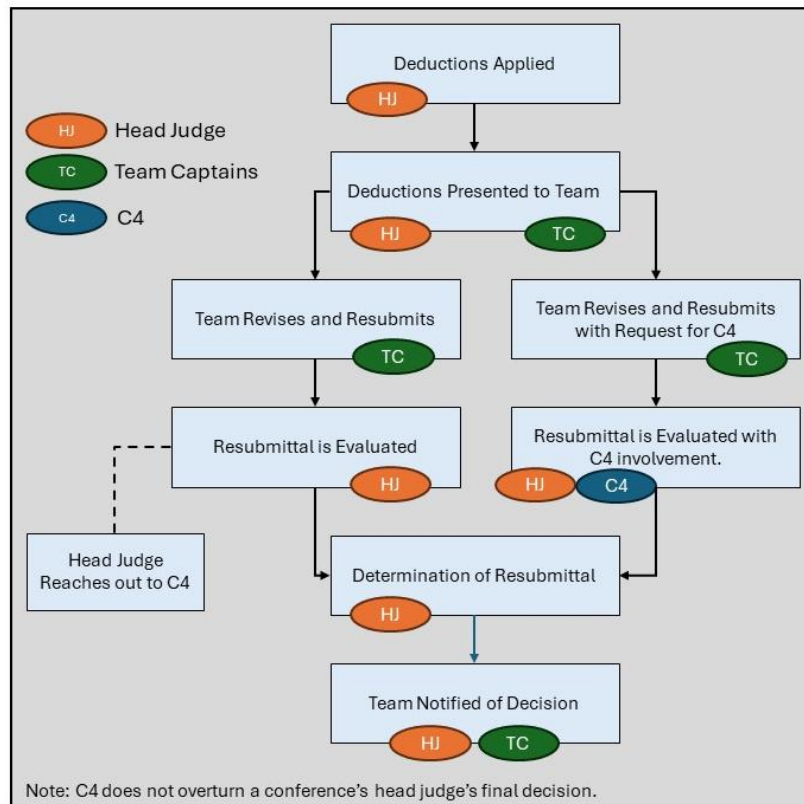


Figure 8. Revise and Resubmit Process and Assignments

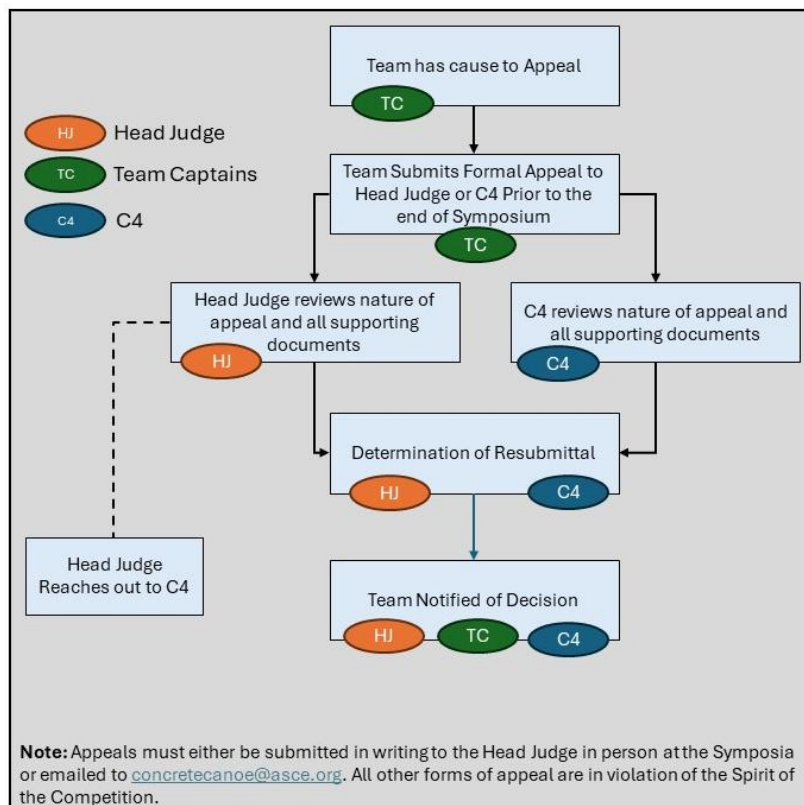


Figure 9. Appeals Process and Assignments

10.4.3 Tiebreaker (Final Overall Standings)

Ties in the final standings for the competition overall shall be broken. In such cases, a tie-breaking score, TBS, shall be calculated according to the following formula:

$$\text{TBS} = \frac{30}{100} \left(\frac{\sum \text{DPP}}{\text{NOJ}} \right) + \frac{25}{100} \left(\frac{\sum \text{OPP}}{\text{NOJ}} \right) + \frac{25}{100} \left(\frac{\sum \text{FPP}}{\text{NOJ}} \right) + \text{RP}$$

Where:

- **DPP** = Project Proposal event points for a given judge
- **OPP** = Technical Presentation event points for a given judge
- **FPP** = Final Product Prototype event points for a given judge
- **NOJ** = number of judges
- **RP** = unmodified race points – the summation of a team’s earned competition points for each individual race

The calculation of the TBS shall not change the standings for team placement in any given technical scoring part. Of the teams tied for the overall winner or second place, the team with the highest TBS shall be awarded the place in contention.

If a tie still exists for first and/or second place after the tie-breaking scores have been determined, then the judges shall determine the overall winner for the competition position. The judges may base their decision on whatever criteria they deem appropriate.

The judges’ criteria and decision shall be final and may not be appealed.

– End of Section –

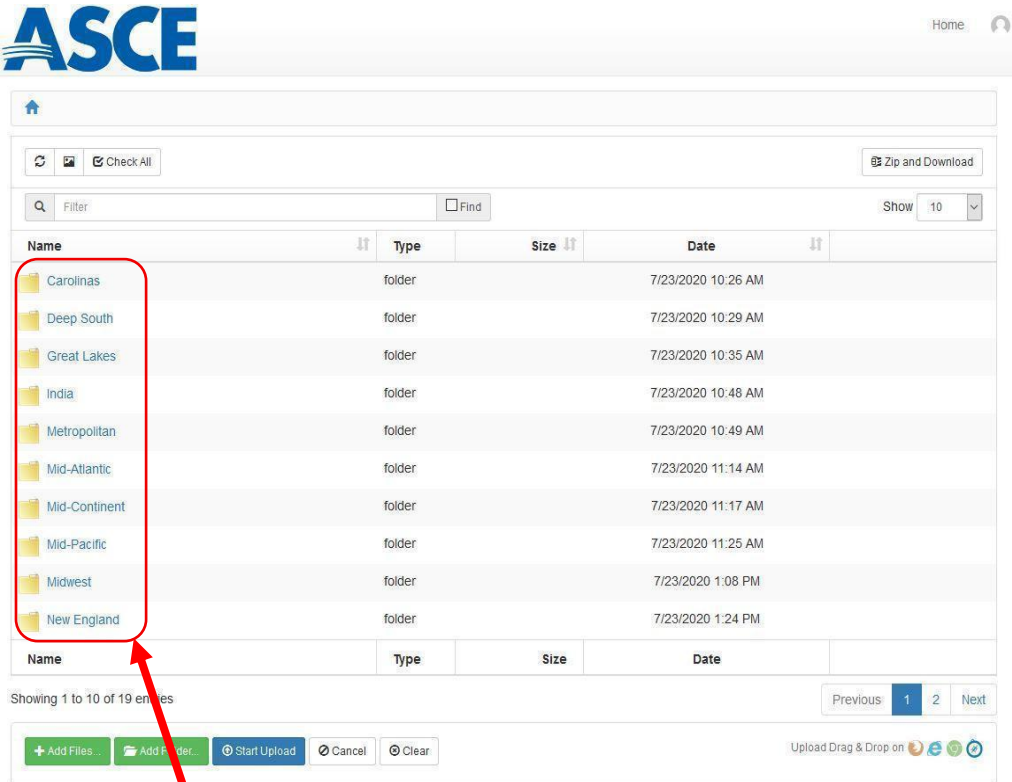
EXHIBIT 1. SUMMARY OF IMPORTANT DATES/DEADLINES

Table 11. Summary of Dates & Deadlines

Item	Date
Issuance of 2027 Request for Proposal Solicitation	September 8, 2026
Webinar: Welcome Kick-Off; RFI Overview & Deliverables	September 24, 2026
Webinar: Concrete Mix Design Calculations	October 8, 2026
Deadline for Submission of Letter of Intent and Qualifications Form	November 2, 2026
Last Day to Submit RFIs to the C4	January 25, 2027
ASCE Student Chapter Annual Reports/Dues Deadline	February 1, 2027
Issuance of RFI Summary	On or about February 1, 2027
Project Proposal Deliverables: Design Narrative, Construction Drawings, Calculation Package & Materials Notebook Deadline (Student Symposia Competitions)	February 11, 2027
ASCE Student Symposia Competitions	March to Late April 2027
Project Proposal Deliverables: Design Narrative, Construction Drawings, Calculation Package & Materials Notebook Deadline (Society-wide Finals)	May 11, 2027
2027 ASCE Society-wide Finals, hosted by Kansas State University, Manhattan, Kansas	June 17-19, 2027

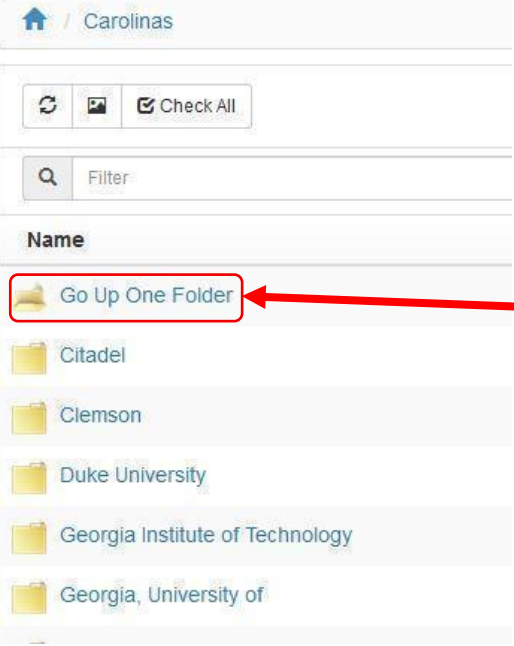
EXHIBIT 2. HOW TO NAVIGATE FOLDERS AND UPLOAD SUBMISSIONS

When you first arrive at the upload site, you will see folders labeled for each Student Conference:



The screenshot shows the ASCE upload site interface. At the top is the ASCE logo and a 'Home' link. Below the logo is a navigation bar with a home icon, a refresh icon, a 'Check All' button, and a 'Zip and Download' button. A search bar with a 'Filter' label and a 'Find' button is present. A table lists folders for various Student Conferences, with columns for Name, Type, Size, and Date. The folders listed are Carolinas, Deep South, Great Lakes, India, Metropolitan, Mid-Atlantic, Mid-Continent, Mid-Pacific, Midwest, and New England. A red box highlights this list of folders. Below the table, it says 'Showing 1 to 10 of 19 entries'. At the bottom, there are buttons for '+ Add Files...', '+ Add Folder...', 'Start Upload', 'Cancel', and 'Clear'. A pagination control shows 'Previous', '1', '2', and 'Next'. A red arrow points from a text box to the 'Previous' button.

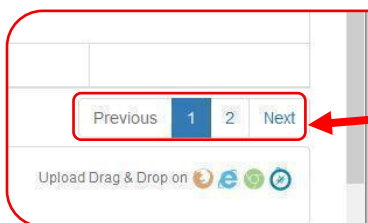
Locate your Student Conference and click the folder to open it. If you don't see the name of your Student Conference, click the page navigation to move to the second page.



The screenshot shows the ASCE upload site interface with the 'Carolinas' folder selected. The breadcrumb path is 'Home / Carolinas'. Below the navigation bar, there is a search bar with a 'Filter' label. A table lists the contents of the folder, with a column for Name. The first item is 'Go Up One Folder', which is highlighted with a red box. Below it are other folders: Citadel, Clemson, Duke University, Georgia Institute of Technology, and Georgia, University of. A red arrow points from a text box to the 'Go Up One Folder' button.

When you click the folder for your Student Conference, you will see a list of the Student Chapters assigned to that Conference.

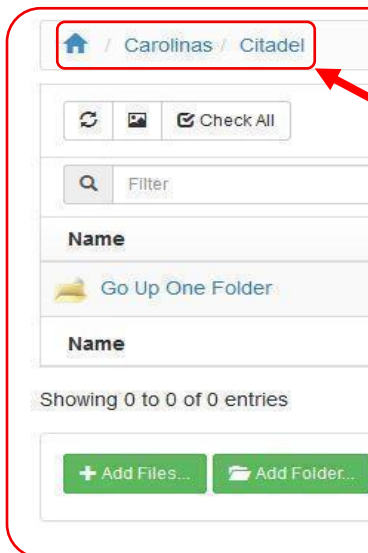
If you accidentally open the wrong folder, you can “back up” by clicking **Go Up One Folder** and navigate correctly.



Previous 1 2 Next

Upload Drag & Drop on

Locate your Student Chapter and click the folder to open it. If you don't see the name of your Student Chapter, click the page navigation to move to the second or third page.



/ Carolinas / Citadel

Check All

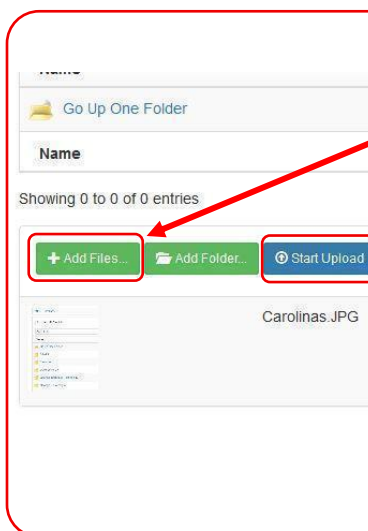
Filter

Name	Type	Size
Go Up One Folder	up	
Name	Type	Size

Showing 0 to 0 of 0 entries

+ Add Files... Add Folder... Start Upload Cancel Clear

When you have opened the folder for your Student Conference and Student Chapter, double-check that you are in the correct location before you begin uploading your files (In this case, **The Citadel** – within the **Carolinas** Student Conference).



Go Up One Folder

Name

Showing 0 to 0 of 0 entries

+ Add Files... Add Folder... Start Upload Cancel Clear

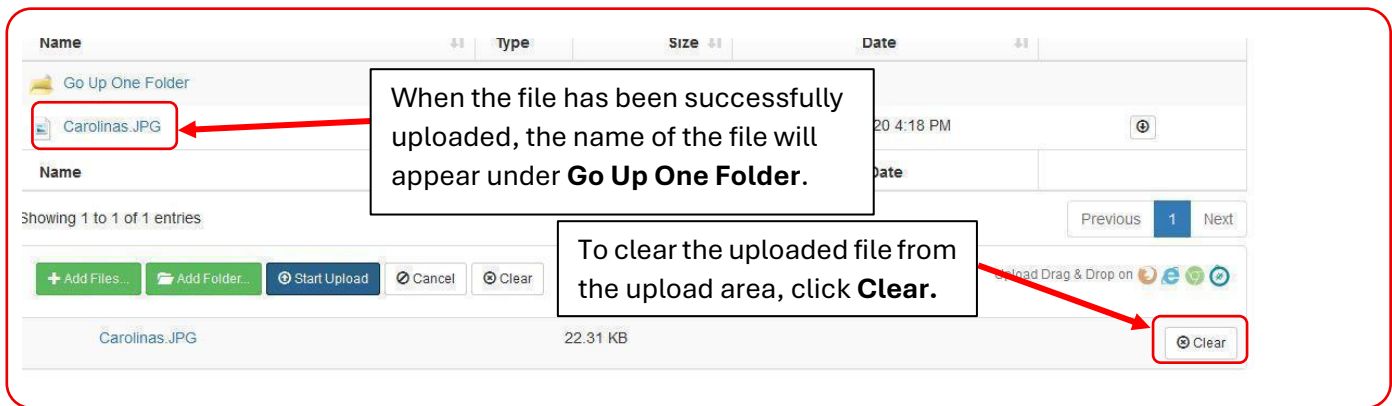
Upload Drag & Drop on

Carolinas.JPG 22.31 KB

Start Cancel

When you have confirmed that you have navigated correctly to the proper folder, you can either click the **+Add Files** button and then browse to find the files to upload or drag and drop files to the area directly below the **+Add Files** button.

The selected (or dragged and dropped) files will appear in the upload area. To upload the file into the folder, click **Start Upload**.



Need help?

If you uploaded a file to the wrong folder, or want to replace an uploaded file with a corrected version, send an email to concretecanoe@asce.org and ask that the incorrect file be deleted. Include both the location (folder path) and **exact name** of the file you want deleted. (Files cannot be moved – you will have to upload the file again to the correct folder after it has been deleted). If you cannot locate a folder for your school, please contact us at the same address for assistance.

EXHIBIT 3. STUDENT CHAPTER AND PARTICIPANT ELIGIBILITY

The purpose for student competitions is to provide student members career-enrichment opportunities to gain hands-on, practical experience and leadership skills. Competitions are an important and special opportunity to showcase the engineering and professional skills of student teams. As such, mutual respect is required for all stakeholders, including competitors, judges, hosts, and guests. Invitations to the Student Symposia and the ASCE Civil Engineering Student Championships/Society-wide finals competition are a privilege, not a right. Failure to act professionally can result in sanctions, disqualifications, and loss of invitations. Please note that the requirements for eligibility for Society-wide finals competition are more stringent than the requirements for participation at the student symposia competitions.

REGISTERED PARTICIPANTS

Registered participants (for both Symposia and Society-wide Competitions) shall meet all the following requirements:

1. Be an undergraduate student during the 2026/27 academic year (August 2026 to June 2027). Students do not need to be enrolled during the entire year (e.g., students graduating in December, or students not in school during the fall term but in school for the spring term.) Students that graduate during the academic year and have begun graduate studies during the same academic year are eligible to compete;
2. Be members of an ASCE Student Chapter in good standing;
3. Be Society Student Members of ASCE. ASCE student membership numbers shall be required upon registration
4. Have contributed to the design and construction of the concrete canoe during the current academic year.

STUDENT CHAPTER ELIGIBILITY FOR STUDENT SYMPOSIUM COMPETITIONS

The following qualifications are required of all ASCE Student Chapters to compete at the Student Symposium Competitions:

An ASCE Student Chapter must:

1. Be in good standing with ASCE:
 - a. Have paid their annual dues, as received by ASCE, **no later than the start of their Student Symposium.**
 - b. Have submitted their student chapter full Annual Report or EZ Annual Reporting Form **no later than February 1, 11:59 p.m. EST.**

STUDENT CHAPTER ELIGIBILITY FOR SOCIETY-WIDE COMPETITIONS

The following qualifications are required of all ASCE Student Chapters in order to advance to the ASCE Society-wide Finals Competition:

An ASCE Student Chapter must:

1. Be in good standing with ASCE:
 - a. Have paid their annual dues, as received by ASCE, **no later than February 1, 2027 11:59 p.m. EST**
 - b. Have submitted their student chapter's **full Annual Report, no later than February 1, 2027 11:59 p.m. EST** and have received a minimum score of 25 points out of a possible 100. **Student Chapters that submit an EZ annual reporting form do not qualify** to advance on to competition finals; and

2. Attend and participate in their assigned Student Symposium as shown through their school's:
 - a. On-time attendance and active participation by a student member of the ASCE Student Chapter at the Student Symposium Business Meeting.
 - b. Participation in the Student Symposium Paper Competition, including submission and presentation by a student member of the ASCE Student Chapter. Note that any papers/presentations created for any other competition do not count as an entry into the Student Symposium Paper Competition.

Note: *Invitations to Student Symposia and ASCE Civil Engineering Student Championships/Society-wide Finals Competition are a privilege, not a right. Failure to act professionally can result in letters of reprimand, mandatory behavior management plans, and loss of invitations to further competition for individual institutions and/or entire conferences.*

Questions regarding eligibility should be directed to student@asce.org.

QUALIFIERS

The Society-wide competition host school has the choice of competing in the current year or deferring their entry until the following year. The Society-wide host school must compete at their respective Student Symposium competition the same year they intend to compete in the Society-wide finals.

Student Symposia competitions are required to meet certain standards. To earn an invitation to the Society-wide ASCE Concrete Canoe Competition, a student team shall qualify through participation in its assigned Student Symposium competition. There must be at least three (3) eligible ASCE Student Chapters that are official members of the Conference participating in the concrete canoe competition to constitute a qualified Student Symposium competition. In addition, the Student Symposium competition must be hosted by a school that is an official member of the Conference. Only one (1) team from any given school can compete in a Student Symposium competition.

Official Guest Teams

ASCE Student Chapters hosting symposia may invite Official Guest teams, which are teams from Region 10 that have an official ASCE Student Chapter not yet assigned to any Student Conference. Official Guest teams are eligible to place and receive awards at the student symposium competition and be invited to the Society-wide finals competition (if they meet the other requirements, including eligibility requirements). Official Guest teams may compete in only one student symposium per year. ASCE Student Programs shall be notified by the ASCE Student Symposium host of an Official Guest team prior to the start of the student symposium via email to student@asce.org.

Exhibition Teams

A university group that is in the establishment phase of becoming an ASCE Student Chapter may request to compete at their potential future ASCE Student Symposium as an exhibition team. If the student symposium host grants permission, the exhibition team may compete.

An ASCE Student Chapter team wanting to enter a competition that is NOT being hosted at their assigned student symposium may request to compete at another ASCE Student Symposium as an exhibition team. If the student symposium host grants permission, the exhibition team may compete.

An ASCE Student Chapter team wanting to enter a competition that is being hosted at their assigned student

symposium but has circumstances that prevent participation at their assigned student symposium may contact ASCE Student Programs (student@asce.org) with a description of the circumstances to explore options.

The exhibition team will be scored but shall not be ranked or win awards at the student symposium competition. The exhibition team will not be eligible to advance to Society-wide finals competition based on competition placement.

Conference assignments are listed in the ASCE Official Registrar at <https://www.asce.org/about-asce/official-register>, and symposium host chapters are listed at <https://www.asce.org/communities/student-members/conferences>.

ETHICS AND THE COMPETITION

According to the ASCE Code of Ethics, Canon 5, “Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.”

In the context of this contest, “unfair competition” may include conduct such as the following:

- Failure to provide proper credit for past teams, plagiarism, or any other false statements concerning the source of material used in the contest;
- Taking other people’s designs, artwork, or other creative content without permission (for an overview of Intellectual Property Laws, including Trademark and Copyright, visit <http://fairuse.stanford.edu/overview/introduction/intellectual-property-laws/>); and
- Any false or malicious statements about other teams, members, or others involved in the contest.

EXHIBIT 4. MATERIALS NOTEBOOK EXAMPLE

MATERIALS COMPLIANCE TABLE EXAMPLE

Below is a screenshot of the combined Mixture Design and Materials Compliance Table Template. Teams should enter data for the mix design on the lefthand portion of the table.

HYDRAULIC CEMENT					HYDRAULIC CEMENT			
Component	Specific Gravity	Volume (ft ³)	Amount (lbs)		MTDS Provided?	Material Compliant?	Requirement Satisfied? (for official's use only)	Officials Comments Only
Enter Cement 1				Total C=				
Enter Cement 1								
Enter Cement 1								
SCM/POZZOLAN					SCM/POZZOLAN			
SCM/POZZOLAN				Total SCM =				
SCM/POZZOLAN				c/cm =				
SCM/POZZOLAN				Hydraulic Lim w/cm =				
SCM/POZZOLAN				cwt =				
SCM/POZZOLAN								

Material compliance checks are on the righthand side of the template. Teams should select “Yes”, “No”, or “N/A” in the drop-down lists for “MTDS Provided?” and “Material Compliant?” columns for each material used.

Note: Additional entries can be added to the template by copying a given row and inserting the copied cells.

Note: Teams should verify that they have included the required MTDS in the provided folder structure to be uploaded as part of the Materials Notebook submission before selecting “Yes” from the drop-down lists.

HYDRAULIC CEMENT			
MTDS Provided?	Material Compliant?	Requirement Satisfied? (for official's use only)	Officials Comments Only
Yes			
No			
N/A			
SCM/POZZOLAN			

The completed entry for material compliance will look as follows:

HYDRAULIC CEMENT			
MTDS Provided?	Material Compliant?	Requirement Satisfied? (for official's use only)	Officials Comments Only
Yes	Yes		
SCM/POZZOLAN			

Be mindful of the next two columns marked for official use only. Do not make entries into these columns.

In addition to materials used in the mix design itself, additional rows for primary reinforcing, sealers, stains, flotation, and other materials have been added to the template below the mix design calculations to capture the material name and material compliance status of all other materials used in the construction of the canoe. These fields are to be filled out in the same manner as the fields above. Please see the screenshot below for reference.

PRIMARY REINFORCING (Meshes & Grids, Strands, Tendons, & Bars, Bearing Plates & Fasteners)		PRIMARY REINFORCING (Meshes & Grids, Strands, Tendons, & Bars, Bearing Plates & Fasteners)			
REQUIREMENTS PER EXHIBIT 5 Meshes & Grids: 1. Must satisfy percent open area (POA) requirements. 2. Pre-impregnated (pre-preg) materials containing resins that heat for polymerization are prohibited. 3. Solid mats or plates used for reinforcement are not allowed. Strands, Tendons, & Bars: 1. Materials less than 1/2" wide used to make a reinforcing grid OR used in pre- or post-tensioning. 2. When used individually, must meet thickness requirements but are not subject to percent open area requirements. 3. Grids consisting of strands, tendons, and bars are subject to thickness requirements and percent open area requirements. Bearing Plates & Fasteners: 1. Used for pre- or post-tensioning. 2. Not subject to percent open area requirements. 3. Must be located within 2 feet from the bow and stern sections. 4. Thickness of any bearing plate itself is limited to 1/4 inch.					
Component	NOTE: PRIMARY REINFORCING IS PROVIDED FOR MATERIAL COMPLIANCE CHECKS ONLY. PRIMARY REINFORCING IS NOT TO BE INCLUDED IN MIX DESIGN CALCULATIONS.	MTDS Provided?	Material Compliant?	Requirement Satisfied? <i>(for official's use only)</i>	Officials Comments Only
Enter Material Name from Manufacturer					
Enter Primary Reinforcing					
Enter Primary Reinforcing					
SEALERS		SEALERS			
REQUIREMENTS PER EXHIBIT 5 & SECTION 6 Curing Compounds: 1. Must be liquid membrane-forming compound (ASTM C309 and/or ASTM C1315) or a C4-approved equivalent. 2. Any curing compound applied is limited to a maximum of two coats following the manufacturer's procedure for application and thickness. Concrete Sealers: 1. Must be silane- or siloxane-based penetrating sealer with a VOC of less than or equal to 350 g/L. 2. Any sealer applied is limited to a maximum of two coats following the manufacturer's procedure for application and thickness.					
Component	NOTE: CURING COMPOUNDS ARE PROVIDED FOR MATERIAL COMPLIANCE CHECKS ONLY. CURING COMPOUNDS ARE NOT TO BE INCLUDED IN MIX DESIGN CALCULATIONS.	MTDS Provided?	Material Compliant?	Requirement Satisfied? <i>(for official's use only)</i>	Officials Comments Only
Enter Curing Compound					
Enter Curing Compound					
Enter Curing Compound					
CONCRETE SEALERS		CONCRETE SEALERS			
Component	NOTE: SEALERS ARE PROVIDED FOR MATERIAL COMPLIANCE CHECKS ONLY. SEALERS ARE NOT TO BE INCLUDED IN MIX DESIGN CALCULATIONS.	MTDS Provided?	Material Compliant?	Requirement Satisfied? <i>(for official's use only)</i>	Officials Comments Only
Enter Concrete Sealer					
Enter Concrete Sealer					
Enter Concrete Sealer					
CONCRETE STAINS		CONCRETE STAINS			
REQUIREMENTS PER EXHIBIT 5 & SECTION 6 1. Transparent, semi-transparent, or translucent stains for concrete with VOC of less than or equal to 350 g/L. 2. The stain must be penetrating and non-film-forming. 3. Acid stains may include thickeners if the combination does not exceed the 350 g/L VOC limit. 4. Glitter and other additives are prohibited. 5. Stains cannot be diluted with water, acetone, or other mediums. 6. Powdered dyes mixed with water or other liquids are allowed, following the manufacturer's instructions, and applied with a limit of two (2) coats maximum. 7. See Section 6.7.2 for additional information regarding restrictions on use of concrete stains.					
Component	NOTE: CONCRETE STAINS ARE PROVIDED FOR MATERIAL COMPLIANCE CHECKS ONLY. CONCRETE STAINS ARE NOT TO BE INCLUDED IN MIX DESIGN CALCULATIONS.	MTDS Provided?	Material Compliant?	Requirement Satisfied? <i>(for official's use only)</i>	Officials Comments Only
Enter Concrete Stain					
Enter Concrete Stain					
Enter Concrete Stain					
FLOTATION		FLOTATION			
Component	NOTE: FLOTATION IS PROVIDED FOR MATERIAL COMPLIANCE CHECKS ONLY. FLOTATION IS NOT TO BE INCLUDED IN MIX DESIGN CALCULATIONS.	MTDS Provided?	Material Compliant?	Requirement Satisfied? <i>(for official's use only)</i>	Officials Comments Only
Enter Flotation					
Enter Flotation					
Enter Flotation					
OTHER		OTHER			
1. Requirements depend upon material type and use case. 2. Insert comments in text field next to component name below.					
Component	Comments from Team on Use Case	MTDS Provided?	Material Compliant?	Requirement Satisfied? <i>(for official's use only)</i>	Officials Comments Only
Enter Other Component Name					
Enter Other Component Name					
Enter Other Component Name					

MTDS COMPLIANCE REVIEW EXAMPLE

The following demonstrates a simple compliance review using MTDS (Material Technical Data Sheet) documents. According to the RFP, the fibers must meet the criteria specified in *Exhibit 5 - Technical Specifications for Concrete and Reinforcement*. Though this is a simple example, it can be used for all of the team's submittals to aid the judges and C4 in verifying compliance. Should a team encounter a product data sheet that does not provide the appropriate standard, they should follow the process in section 5.7.2.



PRODUCT DATA SHEET

Sika® Fibermesh®-150

MICRO-SYNTHETIC MONOFILAMENT FIBER

PRODUCT DESCRIPTION

Sika® Fibermesh®-150, micro-reinforcement system for concrete—100 percent virgin homopolymer polypropylene multifilament (monofilament) fibers with e3® patented technology containing no reprocessed olefin materials. Specifically engineered and manufactured in an ISO 9001 certified manufacturing facility. Sika® Fibermesh®-150 is designed to control plastic shrinkage and settlement cracking in concrete. Sika® Fibermesh®-150 was previously SikaFiber PPM.

USES

Sika® Fibermesh®-150 act mechanically by supporting the aggregate within the concrete with multidimensional fiber network and developing a uniform bleed system. The fiber does not affect the curing process chemically and does not absorb water. The Sika® Fibermesh®-150 can be used in all types of concrete applications to control plastic shrinkage and settlement cracking. Typical applications include:

- Slabs on ground
- Residential applications: side-walks, driveways, decks, curbs
- Precast elements,
- Overlays / toppings
- Stucco
- Shotcrete
- Roads / Pavements
- Bridge Decks

CHARACTERISTICS / ADVANTAGES

- Reduces plastic shrinkage cracking
- Reduces plastic settlement cracking
- Improves impact, shatter and abrasion resistance
- Enhances durability
- Promotes uniform bleed and reduces bleed water
- Inhibits and controls the formation of intrinsic cracking in concrete
- Increases cohesion and reduces segregation
- Reinforces against abrasion
- Reduces freeze/thaw damage

APPROVALS / STANDARDS

- Sika® Fibermesh®-150 is UL/Ulc certified and approved for usage in floor-ceiling D700, D800, D900, G229, G243, G256 & G514 series designs.
- Complies with European Standard EN 14889-2:2006 Fibres for Concrete Part 2: Class Ia and carries the CE marking
- Complies with ASTM C1116, C1116M, Type III fiber reinforced concrete and therefore ASTM D7508

Product Data Sheet
Sika® Fibermesh®-150
November 2019, Version 01.01
021408021010000056

Contextual Comment: On this product data sheet, the required standard is clearly defined by the manufacturer. Highlighting the required specification, as shown, helps the reviewer, the team's client, to easily verify compliance.

EXHIBIT 5. TECHNICAL SPECIFICATIONS FOR CONCRETE AND REINFORCEMENT

Each concrete mixture developed shall comply with this section's requirements. The use of pre-packaged or pre-mixed concrete, mortar, or grout is not permitted. Bondo®, epoxy or similar materials are not permitted as materials in the concrete mix, reinforcement installation, placements or connection and shall not be in any way present in or on the canoe before, during, or after casting.

Teams shall develop a reinforcement scheme using materials that meet percent open area (POA) requirements with the total thickness of the reinforcing layers is equal to or less than 50% of the total thickness of the reinforced composite, and the reinforcing materials do not have post-manufacturer applied coatings that enhance the properties of the reinforcement.

General Requirements	
Composite Thickness	The ratio of the total measured thicknesses of the primary reinforcement to the total thickness of the canoe wall or structural element at any point in the canoe shall not exceed 50%. All canoe elements, including but not limited to, the hull, ribs, gunwales, thwarts, bulkheads, etc., and the connections of structural elements to the canoe wall are subject to this rule.
Number of Concrete Mixtures	Limited to a total of two (2) concrete mixture designs, while any given mixture(s) can be produced in a multitude of colors.
Primary Reinforcement	All primary reinforcement shall be covered in concrete. All materials not part of a concrete mixture or a flotation material shall be classified as reinforcing material and shall comply with the specifications outlined below.
Maximum Unit Weight	All concrete mixture designs shall have an oven-dried unit weight less than 80.0 PCF.

MATERIALS

Cementitious Materials, Alternative Supplementary Cementitious Materials (ASCM), and Pozzolans

Any commercially available inorganic cementitious binder—whether hydraulic, non-hydraulic, or a combination of both—is permitted. These materials must comply with the relevant ASTM standards as indicated in the submitted MTDS documentation.

Material Specifications:

- The maximum amount of hydraulic cement (c) in any concrete mixture must not exceed 50% (by mass) of the total cementitious materials (cm) content (i.e., the c/cm ratio must be less than 0.50 for any concrete mixture).
- Neither hydrated lime nor quicklime may be used
- Between 30% and 50% of the total cementitious materials must be comprised of ASTM C595 cement.
- Other cementitious materials that meet the following ASTM standards may be used provided that the maximum hydraulic cement limit and ASTM C595 cement requirements are met:

Cementitious Materials	ASTM
<i>Hydraulic Cement (c)</i>	C150, C595, C1157, or C845
<i>Coal Ash</i>	C618 (Class C or F)
<i>Metakaolin, Calcined Clay, Ground Pumice, Pumicite, or Volcanic Ash Natural Pozzolan</i>	C618 (Class N)
<i>Slag Cement</i>	C989 (Grade 80 minimum)
<i>Silica Fume</i>	C1240
<i>Ground-Glass Pozzolan</i>	C1866
<i>Blended supplementary cementitious material</i>	C1697

Alternative Cementitious Materials and Pozzolans: Alternative cementitious materials and pozzolans evaluated under ASTM C1709 provisions are also allowed.

Aggregates: Any natural, manufactured, or recycled aggregate is permitted, provided the proportioning meets the following requirements:

- The total aggregate volume must constitute at least 35% of the total volume of any concrete mixture, regardless of the source.

Aggregate Gradation Requirements: While no specific limits are imposed on gradation, it must be reported.

- Teams must conduct a sieve analysis and provide a particle size distribution table for each individual aggregate as received, as well as for the composite aggregate used in each mix, following ASTM C136.
- If aggregates are sieved and recombined into a specific distribution, this must be clearly stated in the report, along with the original gradation as received and the final composite aggregate from all sources.
- The particle size distribution and table must be tested and created by the team (not provided by the aggregate supplier) and included in the team's aggregate product information in their Materials Notebook.

Fibers: Fibers shall meet the requirements of ASTM C1116 and be considered as secondary reinforcement and dispersed within the concrete matrix. Other fibers may be considered if approved by the C4 prior to use.

Admixtures: Admixtures must comply with the following ASTM standards, as specified in the submitted MTDS documentation:

Admixtures	ASTM
<i>Water-Reducing & Set-Control</i>	C494
<i>Air-Entraining</i>	C260
<i>Coloring Admixture/Agents & Concrete Pigments</i>	C979
<i>Specialty Admixtures</i>	C494 (Type S)
<i>Latex Emulsions</i>	C1438

Latex Emulsions: Latex emulsions can be used in either re-dispersible powder form or as a liquid formulated for use with hydraulic cements. They must be accounted for in mass and volume calculations during mixture proportioning to ensure proper concrete yield. While latex emulsions can be added to concrete mixtures, they cannot be used as bonding adhesives. Other bonding adhesives (ASTM C1059) are prohibited. When used, latex emulsions are limited to a solid powder or dehydrated liquid equivalent of no more than 100 lb/yd³ of concrete. Approved latex emulsions include the following products:

- SikaLatex® R
- Sakrete Concrete Bonder & Fortifier
- Euclid SBR LATEX
- ACRY-LOKTM

Prohibited Materials: Epoxy resins, curing agents, asphalt emulsions, or similar materials are not considered specialty admixtures and are strictly prohibited.

Solids Content: The solids content of dyes and powder admixtures must be included in the determination of total solids content. Contributions from other admixtures can be disregarded.

Curing Compounds – concrete may be cured using a liquid membrane-forming compound (ASTM C309 and/or ASTM C1315) or a C4-approved equivalent. Any curing compound applied is limited to a maximum of two coats following the manufacturer’s procedure for application and thickness.

Concrete Sealers – See section 6.7.3 for Concrete Sealers

Integrally Colored Concrete and Stains – See section 6.7.2 for concrete coloring agents, pigments, and use of concrete stains

Mesh and Grids: All materials used as primary reinforcement must have sufficient open space to allow for mechanical bonding with the concrete composite, as measured by their percent open area (POA). Solid mats or plates used for reinforcement are not allowed. Pre-impregnated (pre-preg) materials containing resins that require heat for polymerization are also prohibited. Solid mats and plates are defined as materials needing additional bonding agents or post-manufacturing perforations to prevent delamination due to insufficient open space for mechanical bonding.

The minimum percent open area (POA) of any layer of reinforcing material is 40%. The determination of the POA is obtained by the following equation:

$$POA = \frac{\Sigma Area_{open}}{Area_{total}} \times 100\%$$

where:

- **Area_{open}** is the total open area (i.e., the area of the apertures)
- **Area_{total}** is the total area of the reinforcement specimen

Modification and Fabrication: Teams may modify a mesh by removing strands as needed to achieve the required POA. Teams are also permitted to fabricate meshes or grids by placing (weaving, tying) materials in their “as-received” condition. Once fabricated, materials cannot be treated (e.g., by applying coatings or heat).

As-Received Condition: “As-received” refers to commercially available, off-the-shelf products directly accessible to consumers without modification by a third party. For example, fiberglass can be used in its original form, but having a third party modify it into a grid and then considering it “as-received” is not allowed.

Strands, Tendons, and Bars – are materials less than ½ inch wide used to make a reinforcement grid or used in pre- or post-tensioning. When used individually, they must meet thickness requirements but are not subject to percent open area. Grids consisting of strands, tendons, and bars are subject to thickness and percent open area requirements.

Bearing Plates and Fasteners – used for pre- or post-tensioning of tendons are permitted and are not subject to the thickness or percent open area requirements. The location of the bearing plates is limited to within 2 feet from the bow and stern sections. The thickness of any bearing plate itself is limited to ¼ inch.

EXHIBIT 6. GENERAL GUIDELINES FOR CONCRETE MIX DESIGN

This exhibit offers guidelines and tips to help teams understand how to complete the concrete mix design table accurately.

- Under the categories “Cementitious Materials,” “Aggregates,” “Fibers,” and “Admixtures,” specify the names of the constituents used. Use commercial (trade) names if they clearly identify the product.
- Provide absorption and moisture content values for aggregates, to the nearest 0.1%.
- In the “Specific Gravity” column, list the specific gravity (dimensionless) for the cementitious materials, Aggregates, fibers, and water. For aggregates, include both Oven Dried (OD) and Saturated, Surface Dry (SSD) values. Two or three decimal places are sufficient.
- Report the weight of liquid admixtures in lb/gal.
- The values in these tables are provided for mathematical example purposes only.
- Do not use the mixture proportions shown as a basis for achieving the required fresh (e.g., slump, air content) and hardened (e.g., strength) concrete characteristics for the competition.
- Specific gravity values are generalized and should not be referenced for your design calculations. This document is not intended as a reference for your mix design values.

Example Reporting: The following is a step-by-step example for reporting final concrete mixture proportions and verifying their theoretical and mathematical correctness.

Ensure that the reported unit weight is measured and that the values consider the relative yield (Ry).

Proposed Mixture Proportions

Type IL Cement	400 lb, SG = 3.15
Fly Ash (Class C)	250 lb, SG = 2.93
Blast Furnace Slag	250 lb, SG = 2.85
Fibers, Nylon	5 lb, SG = 0.92
Fibers, PVA	3 lb, SG = 1.40
w/cm ratio	0.50
Expanded Shale, aggregate	600 lbs (dry), Abs = 13%, SG _{dry} = 1.55
Pumice, aggregate	550 lbs (dry), Abs = 17%, SG _{dry} = 1.59
Admixtures:	6 fl oz/cwt HRWR Admixture (47% solids by weight, 8.5 lb/gal) 20 fl oz/cwt Liquid Dye (50% solids by weight, 10.0 lb/gal)
Design Unit Weight (wet)	99.55 lb/ft ³
Design Air Content	11.3%

ABSOLUTE VOLUME METHOD

The absolute volume of a given material is computed by dividing the mass of the material by its absolute density, which is the specific gravity (SG) times the density of water (62.4 lb/ft³), as shown by:

$$\text{Absolute Volume} = \frac{\text{mass}}{\text{SG} \times 62.4}$$

Example: How much volume does 400 lbs of portland cement occupy given that SG = 3.15?

$$\text{Volume}_{\text{cement}} = \frac{\text{mass}_{\text{cement}}}{\text{SG}_{\text{cement}} \times 62.4}$$

$$\text{Volume}_{\text{cement}} = \frac{400 \text{ lbs}}{3.15 \times 62.4 \text{ lb/ft}^3} = 2.04 \text{ ft}^3$$

In a batch of concrete, the sum of the absolute volumes of cementitious materials, aggregate, fibers, water, solids from admixtures and air, gives the volume of concrete produced per batch. The above equation can be used to determine the volumes of the various constituents and populate the table.

Please note that there are several specific gravities reported for aggregate, depending on the condition that they are in, such as dry (SG_{OD}) and saturated, surface dry (SG_{SSD}). **The values are different** as one is obviously in the dry state and the other considers the water that is required to bring the aggregate to the SSD condition, and it can be shown that it is a function of absorption. For example, it can be shown that for the shale ($\text{SG}_{\text{OG}} = 1.55$; $A = 13\%$), the SG_{SSD} is 1.75.

The volume that the aggregate occupies between the conditions, however, can be shown to be the same. That is, the volume of aggregate in the OD condition determined by taking the amount of aggregate in the OD condition divided by SG_{OD} is equal to the volume of aggregate in the SSD condition as determined by taking the amount of aggregate in the SSD condition divided by SG_{SSD} .

WATER

Based on the final w/cm ratio, the amount of water is simply computed using the total amount of cementitious material in the mixture

$$\text{Water} = \text{w/cm} \times \text{cm}$$

Example: How much water is needed for 900 lbs of cm using a w/cm of 0.50?

$$\text{Water} = \text{w/cm} \times \text{cm}$$

$$\text{Water} = 0.50 \times 900 \text{ lbs} = 450 \text{ lbs}$$

The water that is computed from the w/cm ratio is the water that is needed to hydrate the cementitious materials (cm). It is not used to condition the aggregate to the SSD condition.

The water (w) comes from three sources – water from the aggregate (if there is “free” water then the value of this is positive; if the aggregate is drier than the SSD condition, then the value is negative), water from the admixtures, and additional batch water, and is expressed as (or a rearrangement of this equation):

$$w_{\text{batch}} = w - (w_{\text{free}} + \sum w_{\text{admx}})$$

Compute Free Water from Aggregates

With the values previously obtained for the aggregates, the total moisture content, free moisture content and the amount of moisture available, can be computed for each aggregate using the following three equations:

$$MC_{total} = \frac{W_{stk} - W_{OD}}{W_{OD}} \times 100\%$$

$$MC_{free} = MC_{total} - A$$

$$W_{free} = W_{OD} \times \left(\frac{MC_{free}}{100\%} \right)$$

Aggregate	W _{OD} (lb)	Abs (%)	W _{SSD} (lb)	MC _{total} (%)	MC _{free} (%)	W _{free} (lb)
Aggregate #1	600	13	678	8	-5	-30
Aggregate #2	550	17	643.50	12	-5	-27.5

Combined, the aggregates have -57.50 lb of free water

What does this mean? In this case it means that the aggregates are drier than the SSD condition. So, if you added the amount of water computed above (450 lbs to get your 0.5 w/cm ratio), the aggregate would want to soak up 57.5 lbs of it to get to the SSD condition. So, in the end, your w/cm ratio is no longer 0.5. However, we must deal with water from other sources as well. See below.

Compute Water from Admixtures

The water in the various admixtures can be found from the following equation:

$$\text{Water in Admixture} = \text{Dosage} \times \text{cwt of cm} \times \text{water content} \times \left(\frac{1 \text{ gal}}{128 \text{ fl oz}} \right) \times \frac{\text{lbs}}{\text{gal of admixture}}$$

From liquid dye

$$W_{\text{adm}(liquid \text{ dye})} = \frac{20 \text{ fl oz}}{\text{cwt}} \times 8.30 \text{ cwt} \times \left[\frac{(100\% - 50\% \text{ solids})}{100} \right] \times \left(\frac{1 \text{ gal}}{128 \text{ fl oz}} \right) \times \frac{10 \text{ lbs}}{\text{gal}} = 6.48 \text{ lbs}$$

From HRWR

$$W_{\text{adm}(HRWR)} = \frac{6 \text{ fl oz}}{\text{cwt}} \times 8.30 \text{ cwt} \times \left[\frac{(100\% - 47\% \text{ solids})}{100} \right] \times \left(\frac{1 \text{ gal}}{128 \text{ fl oz}} \right) \times \frac{8.5 \text{ lbs}}{\text{gal}} = 1.75 \text{ lbs}$$

$$\Sigma W_{\text{adm}} = 6.48 \text{ lbs} + 1.75 \text{ lbs} = 8.93 \text{ lbs}$$

Compute Batch Water

We have computed water from two of the three sources – the aggregate and the admixtures. Based on this example, we ended up having no “free” water from the aggregate (if fact, you were in a deficit).

Since we know the amount of water needed to hydrate the cm (450 lb) based on the w/cm ratio chosen, the batch water can be computed by:

$$W_{\text{batch}} = W - (W_{\text{free}} + \Sigma W_{\text{adm}})$$

$$w_{\text{batch}} = 450 \text{ lbs} - (-57.5 \text{ lbs} + 8.93 \text{ lbs}) = 498.57 \text{ lbs}$$

The volume of water, to hydrate cm only, ($SG_{\text{water}} = 1$) is then

$$\text{Volume}_{\text{water}} = \frac{\text{mass}_{\text{water}}}{SG_{\text{water}} \times 62.4}$$

$$\text{Volume}_{\text{water}} = \frac{450 \text{ lbs}}{1 \times 62.4} = 7.21 \text{ ft}^3$$

SOLIDS (from liquid admixtures)

Typically, the proportional volume of the solids included in the liquid admixture is so small in relation to the size of the batch that it can be neglected. The exclusion to this includes latex admixtures and dyes (both liquid and in powder form) which can have substantial volumes.

- **For the competition, only dye solids (in the liquid medium) are to be accounted for.**
- **Disregard the contribution of solids from other admixtures.**
- If you have a powdered admixture (i.e., it is not in a liquid medium), then use the absolute volume method as previously shown.

The solids content can be computed in a fashion like the water content from admixtures

$$\text{Solids in Admixture} = \text{Dosage} \times \text{cwt of cm} \times \text{solid content} \times \left(\frac{1 \text{ gal}}{128 \text{ fl oz}} \right) \times \frac{\text{lbs}}{\text{gal of admixture}}$$

Based on the weight of the admixture (in lb/gal) and the percentages of water and solids within it, one can determine the SG of the solid particles (SG of water is taken as 1.0) as follows:

- If the liquid dye is 50% water by weight, the weight of water is 6 lb ($0.50 \times 12 \text{ lb}$)
- The weight of the solids is 6 lb (in a gal of admixture).
- The volume of water is then ($6 / 62.4$) to obtain 0.0962 ft^3 .
- Solids volume is 0.0375 ft^3 . Note: $1 \text{ gal} = 0.13368 \text{ ft}^3$.
- The unit weight of solids is then $6 \text{ lb} / 0.0375 \text{ ft}^3 = 160 \text{ lb/ft}^3$ and therefore its SG is determined to be 2.56.

From liquid dye

$$\text{Solids}_{\text{adm}(\text{liquid dye})} = \frac{20 \text{ fl oz}}{\text{cwt}} \times 9 \text{ cwt} \times \left[\frac{50\% \text{ solids}}{100} \right] \times \left(\frac{1 \text{ gal}}{128 \text{ fl oz}} \right) \times \frac{12 \text{ lbs}}{\text{gal}} = 8.44 \text{ lbs}$$

From HRWR

$$\text{Solids}_{\text{adm}(\text{HRWR})} = \frac{6 \text{ fl oz}}{\text{cwt}} \times 9 \text{ cwt} \times \left[\frac{47\% \text{ solids}}{100} \right] \times \left(\frac{1 \text{ gal}}{128 \text{ fl oz}} \right) \times \frac{8.5 \text{ lbs}}{\text{gal}} = 1.90 \text{ lbs}$$

DENSITIES, AIR CONTENT, SLUMP and RATIOS

Now that all the amounts have been determined, the respective volumes can be computed so that theoretical densities and air content can be found.

Mass of Concrete (M) – The mass of concrete is the sum of all masses of the constituents in the mixture – cm, fiber, aggregate, water and admixture solids:

$$M = \text{Amount}_{\text{cm}} + \text{Amount}_{\text{fibers}} + \text{Amount}_{\text{aggregate}} + \text{Amount}_{\text{water}} + \text{Amount}_{\text{solids}}$$

$$M = 900 \text{ lbs} + 8 \text{ lbs} + 1321.50 \text{ lbs} + 450 \text{ lbs} + 8.44 \text{ lbs} = 2687.84 \text{ lbs}$$

Absolute Volume of Concrete (V) – The absolute volume of concrete is the sum of all the constituents in the mixture. This is based on zero air content.

Note: This value has to be less than 27 ft³ (1 yd³).

$$V = \text{Volume}_{\text{cm}} + \text{Volume}_{\text{fibers}} + \text{Volume}_{\text{aggregate}} + \text{Volume}_{\text{water}} + \text{Volume}_{\text{solids}}$$

$$V = 4.81 \text{ ft}^3 + 0.12 \text{ ft}^3 + 11.75 \text{ ft}^3 + 7.21 \text{ ft}^3 + 0.05 \text{ ft}^3 = 23.941 \text{ ft}^3$$

Theoretical Density (T) – is the density of concrete with no air in it and is the mass of concrete (M) divided by the absolute volume of concrete (V):

$$T = \frac{M}{V}$$

$$T = \frac{2687.84 \text{ lbs}}{23.91 \text{ ft}^3} = 112.27 \text{ lb/ft}^3$$

Measured, or Anticipated, Density (D) – the density of concrete obtained from cylinders, cubes, etc. in the plastic (wet) state (i.e., immediately after casting). 99.55 lb/ft³

Slump – measured value (in inches).

Air Content – The air content is computed by comparing the theoretical density (no air) to the measured density (D) or using the absolute volume methods:

Air content from theoretical density:

$$\text{Air Content} = \frac{T - D}{T} \times 100\%$$

$$\text{Air Content} = \frac{112.27 \text{ lb/ft}^3 - 99.5 \text{ lb/ft}^3}{112.27 \text{ lb/ft}^3} \times 100\% = 11.3\%$$

Air content from absolute volume method:

$$\text{Air Content} = \frac{27 \text{ ft}^3 - V}{27 \text{ ft}^3} \times 100\%$$

$$\text{Air Content} = \frac{27 \text{ ft}^3 - 23.941 \text{ ft}^3}{27 \text{ ft}^3} \times 100\% = 11.3\% \text{ (Check)}$$

The value of the air content should be checked using the absolute volume method (you should come up with the same answer. If you do not, then there is an error somewhere).

Note: If the measured density is higher than the theoretical density, the result would be a negative air content. This is not possible.

Water-Cementitious Materials Ratio

The w/cm ratio is a calculated value:

$$\frac{450 \text{ lb}}{900 \text{ lb cm}} = 0.50$$

Cement-Cementitious Materials Ratio Compliance Check – Per *Exhibit 5 – Technical Specifications for Concrete and Reinforcement*, “The maximum amount of hydraulic cement (c) in any concrete mixture must not exceed 50% (by mass) of the total cementitious materials (cm) content (i.e., the c/cm ratio must be less than 0.50 for any concrete mixture).”

The c/cm ratio is a calculated value:

$$\frac{400 \text{ lb c}}{900 \text{ lb cm}} \times 100 = 44.4\%$$

$$44.4\% < 50\% \therefore \text{OK}$$

ASTM C595 Cement Compliance Check – Per *Exhibit 5 – Technical Specifications for Concrete and Reinforcement*, “Between 30 and 50% of the total cementitious materials must be comprised of ASTM C595 cement.”

ASTM C595 cement/cm ratio is a calculated value:

$$\frac{400 \text{ lb ASTM C595 (Type 1L)}}{900 \text{ lb cm}} \times 100 = 44.4\%$$

$$30\% < 44.4\% < 50\% \therefore \text{OK}$$

AGGREGATE PROPORTIONING

Aggregate - Concrete Ratio (Volumetric) Compliance Check– Per *Exhibit 5 – Technical Specifications for Concrete and Reinforcement*, “The total aggregate volume must constitute at least 35% of the total volume of any concrete mixture.”

$$\text{Aggregate Ratio (\%)} = \frac{V_{\text{aggregate}}}{27 \text{ ft}^3} \times 100\%$$

$$\text{Aggregate Ratio (\%)} = \frac{11.75 \text{ ft}^3}{27 \text{ ft}^3} \times 100\% = 43.5\% > 35\% \therefore \text{OK}$$

EXHIBIT 7. DETAILED COST BREAKDOWN

In addition to the breakdown below, teams will have access to an example Excel file to serve as a template, located at the link provided in Section 5.0. It is expected that teams only use this template as a reference. Teams should use and update the template to match current market costs, their specific labor hours, and materials.

For the sections below, teams shall include hours, as applicable, for each of the project sections listed below:

- Project Management
- Hull Design and Analysis
- Development and Testing
- Mold Construction
- Canoe Construction
- Proposal Preparation
- Interview Preparation
- Display Preparation

LABOR COSTS

Total billable Direct Labor (DL) shall be calculated using the Raw Labor Rates (RLR). See next page for Raw Labor Rates to be used. Labor Hours spent on the project (HRS), and the multipliers for Direct Employee Costs (DEC), and Profit (P). Direct Labor (DL) does not include work done by Outside Consultants.

$$DL = [\sum (RLR \times HRS)] \times (DEC) \times (1+P)$$

Each team shall develop a Table of Billable Direct Labor Rates for the classifications of personnel used in the project.

Direct Employee Costs (DEC) are those costs associated with employee taxes, benefits, insurance, and vacation. A multiplier of 1.50 shall be used to calculate the Direct Employee Costs.

A **Profit Multiplier (P)** of fifteen percent (15%) shall be applied to labor.

EXPENSES

Expenses (E) shall include both materials costs and other project direct expenses not specifically covered. Total expenses shall be calculated using the Direct Costs (DC), Direct Expenses (DE) and Markup (M).

$$E = (\sum DC + \sum DE) \times (1+M)$$

Direct Costs (DC) shall include cost of materials, equipment, and any other costs related to the fabrication of the canoe. Costs should be using actual or market (if donated) prices.

Direct Expenses (DE) shall include, but are not limited to, costs of Outside Consultants Labor (OCL) and other direct expenses related to the fabrication of the canoe.

Outside Consultant Labor (OCL) shall be calculated similar for the DL cost, using Outside Consultant Rate (OCR), from the next page, Labor Hours spent on the project (HRS).

$$OCL = [\sum (OCR \times HRS)]$$

A **Markup (M)** of ten percent (10%) shall be applied to both direct costs and direct expenses.

LABOR RATES

Raw Labor Rates (RLR)

Role	Rate
Team Captain	\$50/hour
Design/Research/Mix Design/Construction/Other Component Lead	\$40/hour
Team Member	\$30/hour
CAD Drafting	\$25/hour
Report Preparation	\$20/hour

In the situation where one person acts to serve in multiple functions, raw labor rates shall be applied according to the task being performed.

Outside Labor Expenses

Role	Rate
Outside Consultants	\$200/hour

An outside consultant shall be defined as anyone contributing to the project that is not a student, ASCE Faculty Advisor, or ASCE Student Chapter Practitioner Advisor. In industry, your ASCE Advisors would be considered a Mentor or Coach. Utilizing their experience and expertise will not count as an expense to your project. Note - outside consultants cannot be utilized in the fabrication of the canoe.

EXHIBIT 8. RACE REGULATIONS AND SAFETY

GENERAL

The race demonstration of canoe prototypes will consist of the following races:

1. (Student Symposia Only) Co-Ed Slalom (1 person identifying as she/her/hers and 1 person identifying as he/him/his)
2. (Society-wide Finals Only) Co-Ed Endurance Slalom (3 persons with at least 1 person identifying as she/her/hers and 1 person identifying as he/him/his)
3. Women's Sprint (2 persons identifying as she/her/hers)
4. Men's Sprint (2 persons identifying as he/him/his)
5. Co-ed Sprint (2 persons identifying as she/her/hers and 2 persons identifying as he/him/his)

RACE RULES

Race Commitment: Teams must make good faith efforts to start and finish all races. Should issues arise that compromise the canoe's structural integrity or paddlers' safety, teams should use sound judgment to determine the safest course of action.

Consistent Participation: The same registered individuals must participate in both the preliminary and final heats of any race.

Injury and Substitution: If a paddler is injured after the preliminary race, a substitute must replace them. The substitute must be one of the original 5 registered team members of the same gender and cannot paddle. If the required number of paddlers of the required gender cannot be provided, substitutes of another gender may be used but cannot paddle.

Safety Gear: Closed-toed water shoes are highly encouraged as a safety precaution. Waders cannot be worn during races as they pose a drowning risk. Properly fitted personal floatation devices are required to be worn at all times when in a canoe. It is recommended that paddlers dress appropriately for the water temperature.

Race Formats:

- **Slalom & Endurance Races:** Timed single event against the clock.
- **All Other Races:** Include timed preliminaries and finals. The top five canoes advance to the grand final, and the next five advance to the petite final based on preliminary times. Points are awarded based on final race times. If finals cannot be conducted or the host school decides before the competition starts that separate finals heats will not be run, preliminary times will be used as final times.

Sprint Races:

- If a team qualifies for a final but cannot start, the team does not receive points, and their slot is given to the team with the next best preliminary sprint time.
- If a team starts a final sprint race in a canoe deemed race-worthy by the judges but does not complete the race, they receive points for finishing last in that final event.

Incomplete Events: If all race events cannot be completed (e.g., slalom races completed but sprint races not), only the scores from completed races will be counted in the overall competition score. Scores will not be adjusted to account for any races that were not held or completed.

STUDENT SYMPOSIUM EVENTS

Race Setup: Depending on the number of entrants, host schools may decide to have grand and/or petite finals for the various sprint races. Depending on the competition size, finals races may consist of both grand and petite finals or only grand finals. The host school shall inform all teams of the race setup prior to the competition.

Lane Position and Heat Assignments: Lane positions and heat assignments will be randomly selected before the competition begins and provided at on-site registration. A diagram or map of the course layout will be provided to participants. Sprint course turn direction (left/right) will be determined before the races.

Interference: If lane interference occur, paddlers must immediately STOP, hold paddles above their heads, and discontinue racing. The team captain should communicate the interference claim to the head judge.

- Affected teams may be allowed to rerun the heat after a minimum of 10 minutes, and times from the rerun will be used as the official time for the heat.
- Teams that willfully interfere with another team, create unsafe conditions, or fail to adhere to course boundaries resulting in interference may be disqualified.
- Teams that do not stop, do not raise paddles, and/or continue to race immediately cannot claim interference and will not be granted a rerun opportunity.
- Collisions should be avoided to ensure the safety of all participants. If a collision is imminent paddlers should first navigate to avoid the collision, stop, and then raise paddles. Intentional collisions may result in disqualification.

EQUIPMENT

Paddles: Single-bladed paddles are required and may be straight-bladed or bent. Spare paddles are permitted in the canoe during the race demonstration.

Seats and Mats: Seats must not exceed 20" x 20" x 20". Mats must not exceed 20" x 30" x ½" thick. Seats and mats can be used together by one paddler, or knee pads may be used.

Fixed Paddler Restraints: Straps, seatbelts, Velcro®, suction cups, or any items that attach the paddler to the canoe or interfere with safe egress are not permitted. The judges or C4 may prohibit any restraints deemed unsafe.

Slip-Resistant Materials: Non-skid tape or other slip-resistant materials are not permitted.

Spray Skirts: Post-construction devices that prevent water from entering the canoe, such as spray skirts, are not permitted.

RACE POINTS & PENALTIES

Buoy Negotiation: To successfully complete a race, the bow of the canoe must cross the finish line with the same number of paddlers (in or touching the canoe) as when the race started. Teams may swim their canoe to the finish line and receive a time only if they have navigated the final turn of the race.

Did Not Finish (DNF): If a canoe cannot complete a race but is seaworthy enough to continue, the team receives a DNF (zero points). If other circumstances arise, judges will contact C4 to determine if a DNF is applicable.

A team's ability to re-race following a DNF will be determined by competition judges and evaluated on a case-by-case basis.

Description of Infraction	Penalty
Canoe crosses the finish line in wrong lane	30 seconds
Sprint: Turn buoy(s) not properly negotiated	DNF
Slalom: Missed buoy	30 seconds per buoy
Slalom: Bypass buoys to save time	DNF

SAFETY

Safety is the highest priority. Behaviors that cause and/or increase the risk of personal injury will not be tolerated. Judges and student symposium hosts, including the Safety Officers, are empowered to stop or prohibit an activity which is deemed to be hazardous, or to postpone an activity until the hazard is rectified. All participants are responsible for complying with all campus/venue protocols and procedures, including those deemed necessary for public health purposes.

Powered Rescue Boats: At least one, preferably two, powered rescue boats must be on the water during all races. If unavailable, races will not occur. The powered rescue boat must cover the entire perimeter of the paddling area before races begin. Powered rescue boat personnel shall have direct and functional communication channels with the safety officer and head judge (regional symposia) or the Chair of C4 (Society-wide Finals).

Weather and Water Conditions: Races will not occur if sustained winds exceed 25 mph, wave heights exceed 1 foot, or water temperature is less than or equal to 35°F and/or combined air and water temperatures less than or equal to 85°F. If temperatures are between 85°F and 120°F, races may proceed at the discretion of the safety officer, provided there is a warming area within 200 feet of the canoe/boat loading zone with a temperature greater than 75°F and two powered rescue boats are present.

Be aware that cold shock can occur when water temperatures are less than 60°F. Teams should dress appropriately for the water temperature.

Lightning: If lightning is detected within 15 miles or in proximity to the body of water the races are occurring in, races will be suspended until 30 minutes have elapsed since the last recorded strike. All people are to immediately get out of the water and away from the shore during this time.

Unsafe Entries: Any canoe deemed unsafe by the judges will not be allowed to race unless corrective measures are taken. If repairs are needed, the judges may allow rescheduling for a later heat, but before the next event.

Safety Officer: A safety officer will oversee activities, especially near the starting and docking areas, and is responsible for stopping activities involving safety rule violations. They will also brief paddlers on hazards before and during the competition. The designated Concrete Canoe Competition Safety Officer shall have direct and functional communication with the powered rescue boat personnel and the head judge (regional symposia) or the Chair of C4 (Society-wide Finals).

Paddler Safety: All paddlers must be competent swimmers and wear a US Coast Guard-approved Type I, II, III or Level 70 and higher Personal Flotation Device (life jacket) at all times when in the canoe, whether during competition or practice. Wetsuit buoyancy pads are not substitutes for US Coast Guard-approved life jackets. Life jackets must have a US Coast Guard tag and be in good condition.

ADDITIONAL SAFETY REFERENCES

Following are a couple references to documents from the American Canoe Association (www.americancanoe.org) for further reading and planning race day safety.

American Canoe Association. Best Practices for Paddlers and Paddlesport Programs [PDF document] URL:
https://americancanoe.org/wp-content/uploads/documents/sei-educational_resources/best_practices.pdf

American Canoe Association. Cold Water Survival [PDF document]:
https://www.usps.org/eddept/files/cold_water_survival_aca.pdf

EXHIBIT 9. DURABILITY AND REPAIRS

The Canoe Prototype's durability will be assessed based on its performance during competition events, transportation, and general handling. This evaluation will occur after the slalom and preliminary sprint races. Canoes will be removed from the water for durability inspection by the judges. Team captains must be present and provide any Damage/Accident Report and written permission from the Judges/C4 for any tape already applied. Unauthorized tape will incur a 25-unit deduction. Tape used for securing gunwale protective caps/coverings or additional flotation material for flotation tests is exempt. Team captains will be notified verbally of any deductions. Judges' and C4 members' decisions are final and not subject to appeal.

Judging Criteria: Judges will score each canoe from 0 to 20 for durability on the Final Product Prototype Score Card. Considerations include the frequency and severity of microcracks, structural cracks, tape repairs, seaworthiness, and damage to aesthetic elements. Damage from race collisions will not affect the durability score.

REPAIRS

During Competition: Repairs during the competition can only be made with tape. Any type of tape is allowed, but using tape for repairs will result in an automatic deduction. Tape used for securing gunwale protective caps/coverings or additional flotation material does not incur a deduction. If damage occurs due to a collision, tape repair deductions do not apply. Teams must file a Damage/Accident Report with the judges or C4 and receive written approval before applying tape. Each instance of tape application requires separate permission.

Between Competitions: If the Canoe Prototype is damaged between the Student Symposium and Society-wide Finals, teams may patch, repair, or refinish it after submitting and receiving approval for a Repair Procedures Report. For extensive damage, a Reconstruction Request must be submitted. The Repair/Reconstruction request, C4 decision, and supporting documentation must be included in Appendix C in the Project Proposal.

To request a Repair Procedures Report or Reconstruction Request, email concretecanoe@asce.org. The report or request must be completed and signed by the team captain(s) and ASCE Student Chapter Faculty Advisor, and received by the C4 within 7 business days of the damage.

The report or request must include details on the cause and extent of damage, proposed repairs (methodology, materials, and damage area), enabling the C4 to decide on approval. Repairs must use the original construction materials and methods, and reconstruction must match the original design, materials, and concrete mixture. Repairs or reconstruction cannot begin until written approval is received from the C4.

Refinishing, including sanding, minor repairs, and sealers, is considered a repair. Reapplication of letters is not considered a repair.

If damage is due to poor design or construction, the Reconstruction Request will be denied. If repairs or reconstruction are not allowed, the team must decide whether to compete with an unrepaired canoe in "good faith" or forfeit to the alternate concrete canoe team within their Student Symposium.

Teams granted permission to repair will receive a 25-unit deduction at the ASCE Student Civil Engineering Championships, and those permitted to reconstruct will receive a 50-unit deduction. The C4 reserves the right to waive these deductions on a case-by-case basis.

DAMAGE / ACCIDENT REPORT

School Name:

Canoe Name:

Date of Accident:

Location of Accident:

Type of Accident:

() Collision with other canoe

() Paddler fell out of canoe

() Collision with inanimate object

() Other: _____

Briefly Describe Circumstances of Accident:

Describe in Detail the Extent of Damage:

Team Captain's Signature: _____

Team Captain's Signature: _____

FOR COMPETITION OFFICIAL USE ONLY – HEAD JUDGE TO RETAIN THIS PORTION FOR DOCUMENTATION

School Name:

Damage due to an accident outside the control of the paddlers? (Circle one) YES NO

Comments:

() Deduct 25 units from Final Product

() Do Not Deduct 25 units from Final Product

Head Judge _____

REPAIR PROCEDURE REPORT

School Name:

Prototype Name:

Team Captain(s):

Date of Request:

Description of Cause:

Description of Repair:

Materials used in Repair:

Description of Supporting Documentation:

Provide a list of Supporting Documentation attached to this report

C4 Disposition		
Date:		
Request to Repair Canoe:	☐ Granted	☐ Declined
Reason for Disposition:		

Filing this report does not guarantee the school will be granted permission to conduct repairs to their canoe. The ability to do so is a function of the reason for the request and the supporting documentation. Under no circumstances should a school consider a verbal disposition permission to repair their canoe. If the school is permitted to conduct repairs, that school will receive a 25-unit penalty for doing so, reducing the maximum final product points to 75 out of 100 units. This penalty may be waived at the discretion of the C4 on a case-by-case basis.

RECONSTRUCTION REQUEST

School Name:

Prototype Name:

Team Captain(s):

Date of Request:

Reason for Request:

Description of Supporting Documentation:

Provide a list of Supporting Documentation attached to this report

C4 Disposition	
Date:	
Request to Reconstruct Canoe:	☐ Granted ☐ Declined
Reason for Disposition: 	

Filing this report does not guarantee the school listed above will be granted a Reconstruction Request. The ability to do so is a function of the reason for the request and the supporting documentation. Under no circumstances should a school consider a verbal disposition permission to rebuild their canoe.

If the school is permitted to reconstruct, that school will receive a 50-unit penalty for doing so, reducing the maximum final product points to 50 out of 100 units. This penalty may be waived at the discretion of the C4 on a case-by-case basis.

EXHIBIT 10. EVALUATION FORMS

The judges will fill out the scoresheets individually. The individual judges' scoresheets shall not be requested or given out during the competition. The judges will come to a consensus on the deductions applicable to each team and complete 1 deduction score sheet to be given to each team. See *Exhibit 9 - Durability & Repairs* for Damage/Accident, Repair, and Reconstruction Request Forms.

The following in this attachment includes the evaluation forms to be used by the judges.

INSTRUCTIONS - DEDUCTION SCORECARDS

1. The Student Symposium/Society-wide Finals Judges will reach a consensus to determine any infractions committed by a team during the competition event.
2. Judges will record the unit value of each deduction in the "Deduction" column. The units for these deductions are standardized and cannot deviate from the prescribed values.
3. The Head Judge will tally the deductions and initial the tally. During the Society-wide Finals Competition, a C4 member may tally the deductions in place of the Head Judge; however, the determination of infractions will remain with the judges.
4. The total deductions may exceed 200 units.
5. The Head Judge (or C4 member) will provide all team captains with forms detailing the deductions assessed against their teams. Teams with no deductions will also receive these forms to maintain transparency.
6. Team captains must sign the form to indicate whether they agree with the infractions and deductions or wish to revise, resubmit, or appeal any of them.
 - a) Teams that wish to revise, resubmit, or appeal will be given a reasonable period to review the rules, gather supporting documentation, and submit their responses. Teams should be prepared to substantiate their revisions or appeals.
7. The Head Judge (or C4 member) will specify the deadline for submitting the completed and signed form.
8. Upon receiving the form, the judges will re-evaluate any revised or appealed infractions based on the supporting documentation and make a final decision. The Head Judge will record the final total deduction, sign the form, and inform the team captains of the decision. Once communicated, no further revisions or appeals will be accepted.
9. All revisions and appeals must be completed before the Awards Ceremony. The final deduction tally will be recorded on both the paper and electronic score sheets, and will be ratified by the Head Judge. The Head Judge and the C4 will finalize and ratify the scores at the Final Competition.

Members of the C4 will be on-call and are available to provide guidance, clarification, and interpretation of the rules and regulations for the judges. During the competitions, teams can request that the judges contact C4 for rule interpretation via the appropriate Revise and Resubmit or Appeal form.

Project Proposal Deliverables		30% of Overall Score	
School Name: Canoe Name:		Possible Points	Score (whole numbers)
Letter of Intent and Qualification Form (Section 5.4) 10 points			
Project Goals (4 Points), Project Milestones (3 points), Health and Safety Program (3 Points)		10	
Design Narrative (Section 5.5) 70 points			
Infographic (Section 5.5.4): All required information presented, clarity of graphics, illustrations, pictures, etc. Presentation enhances understanding and experience		8	
Organizational Chart (Section 5.5.5): Team structure and roles identified		2	
Project Execution (Section 5.5.6): Goals, Innovations, and Project Management		10	
Hull Design and Analysis (Section 5.5.8 & Section 5.5.16): Hull Design (10 points), Structural Analysis (10 points), Refinement and Iterations to Design (5 Points)		25	
Development and Testing (Section 5.5.9): Mix Design (10 points), Reinforcement Selection (5 points), Other Materials Discussion (if applicable) and Composite Concrete Conclusions (5 points), Mold Development (5 points)		25	
Construction Drawings (Section 5.6, Exhibit 5, Exhibit 6) 60 points <i>Note, if 'Floater Page' is used, points should be considered part of the sub-category that best fits the sheet's content</i>			
Notes and Specifications: Concrete Batching (5 points), Concrete and Reinforcement Placement (5 points), Concrete Curing (5 points), Canoe Demolding, and Concrete Finishing (5 points)		20	
Mold Fabrication: Includes Geometry and Dimensions (5 points), Materials and Assembly (5 points), and Constructability & Clarity (5 points).		15	
Canoe Design: Includes Hull Geometry and Dimensions (5 points), Composite and Reinforcement Configuration (5 points), and Constructability & Coordination (5 points).		15	
Details: Informative Detail Selection (3 points), Drawing References & Callouts (4 points), and Enlarged/Supplemental Views (3 points).		10	
Calculation Package & Materials Notebook (Section 5.7, Exhibits 4,5, and 6) 60 points			
Example Structural Calculations: Hull Freeboard (3 points), 2D Analysis, (5 points), Moment of Inertia and Max Stress (5 points), Hull Punching Shear (3 points), and Calculation Documentation, including Assumptions, References, Free-Body Diagrams, Equations, and Variables (4 points).		20	
Hull Thickness/Reinforcement and Percent Open Area Calculations: Correct Equation Inputs; Clarity and ease of understanding compliance review		5	
Mix Design (Section 5.6, Exhibit 5, Exhibit 6): General Compliance of Mixture to Proposal Specifications and completeness of Mixture Design Excel File (10 points), Correct Equation Inputs (all mixtures) (5 points), and Overall concrete mix design properties discussed throughout the project (10 points)		25	
Materials Notebook: Clarity and ease of understanding compliance review		10	
Subtotal		200	
Academic Judging – Project Proposal Total			

Presentation and Technical Interview		25% of Overall Score	
School Name: Canoe Name:		Possible Points	Score (whole numbers)
Presenter Preparation and Delivery (5 points) Confidence and Professional Demeanor (5 points)		10	
Visual Aid and Presentation Effective Use of Infographic (10 points) Clarity and Persuasion of Technical Message (10 points)		20	
Technical Interview Accuracy and Technical Understanding (20 points) Basis and Defensibility of Responses (20 points) Relevance and Conciseness of Answers (15 points) Confidence Level (10 points) Team Participation (5 points)		70	
Comments:			
Subtotal		100	
Deductions: A. Failure to observe time limit: A penalty shall be assessed when the official time exceeds 2 minutes 5 seconds (2:05). 15 units B. Sponsorship or commercialism violation: 15 units C. More than one (1) speaker during the presentation or less than two (2) speakers during the interview: 15 units D. Failure to adhere to live presentation format: No Presentation Points			Circle All that Apply A B C D
Academic Judging – Presentation and Technical Interview Total			

Final Product Prototype					25% of Overall Score	
	SCHOOL NAME	Canoe Workmanship (40 pts max)	Cross-Section Workmanship (15 pts max)	Product Display (25 pts max)	Durability (20 pts max)	Total (100 pts max)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
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22						
23						
24						
25						

FINAL PRODUCT PROTOTYPE

Below is a list of descriptions, guidelines, and things to consider while judging the Final Product Prototype. Note that these are not to be considered an “all-inclusive list.” Ultimately, it is up to each individual judge to provide a score for each category and provide consistent scoring from school to school.

Canoe Workmanship – The intent of Canoe Workmanship is to evaluate the overall build quality of a canoe. Most items in this category relate to the construction of the canoe itself. Factors to consider include, but are not limited to, the following:

- presence of noticeable cold joints in the concrete;
- degree of “lumpiness” of the concrete;
- consistency of the wall thickness;
- consistency of concrete color(s);
- consistency of concrete materials (i.e. visible fiber clumps, areas of poorly mixed concrete, etc.);
- consistency and “smoothness” of the finish;
- presence of cracking or micro-cracking;
- presence of visible reinforcement mesh;
- whether any concrete has chipped off (due to poor construction or mishandling of the finished canoe);
- presence of other general quality control issues;
- whether there are noticeable voids/ “bug holes” in the concrete;
- intricacy of graphics;
- cleanliness and sharpness of graphics edges;
- execution of various aesthetic techniques (e.g. colored concrete, sandblasting, 3-D elements, etc.);
- execution of the overall theme and how it fits with the aesthetics/graphics

Cross-Section Workmanship – The intent of the Cross-Section Workmanship is to evaluate how well the cross-section represents all the processes and materials used to fabricate the canoe. Factors to consider include, but are not limited to, the following:

- presence of a full-scale cross-section and canoe mold;
- accuracy of the construction process shown by the cross-section;
- inclusion of all layers of concrete and the accuracy of the representation of the concrete casting process;
- inclusion of all materials used (e.g. reinforcement, mold, graphics application, sealer, etc.);
- clarity and completeness of the processes labeling;
- if applicable, the highlighting of new or innovative processes;
- clarity and ease of understanding of the entire construction process from start to finish

Product Display – The intent of the Product Display is to evaluate how creatively and effectively the display showcases the overall “big picture” of the entire canoe/cross-section/table display setup while incorporating all the required display items. Factors to consider include, but are not limited to, the following:

- organization of the product display and ease of locating various components;
- presence of all required sample items and representativeness of their size
- clarity, readability, and effectiveness of item labeling;
- if applicable, inclusion and presentation of new or innovative processes;
- value that additional display items have in providing insight into various tests or research performed during the project;
- integration of the canoe theme across the product display, cross-section, and canoe stands;
- incorporation of sustainability considerations, as relevant

Durability – The intent of the Durability category is to evaluate the canoe’s ability to withstand the stresses and the rigors of the races. This category emphasizes both structural integrity and the team’s attention to long-term performance. Factors to consider include, but are not limited to, the following:

- Visible Damage: Have repairs been made before competition events, and if so, are they well-integrated or clearly patched?
- Structural Integrity: Does the canoe survive water entry, paddling, and racing without significant failure or loss of materials?

- Structural Integrity: Are any reinforcement systems (fibers, mesh, etc.) exposed after use?
- Resistance to Impact and Handling: Is the edge durability (gunwales, caps, etc.) consistent, or do these areas show excessive chipping or fragility?
- Quality of Repairs: Do the repairs, if applicable, demonstrate a planned and thoughtful approach rather than reactive patching or all-encompassing taping?
- Overall Performance: Did the canoe maintain its intended functionality throughout the duration of races?
- Overall Performance: Was any damage catastrophic (e.g., structural failure), moderate (e.g., cosmetic cracking), or minor (superficial blemishes)?
- Longevity Considerations: Would the canoe reasonably survive extended use beyond competition?

Overall, durability judging should reflect not only whether the canoe “survived the races,” but also how well it maintained structural performance, visual quality, and integrity throughout construction, transport, display, and competition.

Project Proposal Deliverables

Infraction		Deduction
A	Use of plagiarized material	Disqualification
B	Use of content recycling	No Proposal Points
C	Project Proposal over specified number of pages (_____page(s)) × 10 units/page	_____ Units
D	Design Narrative/Construction Drawings/Calculation Package & Materials Notebook received late (≤ 7 calendar days)	30 Units
E	Design Narrative/Construction Drawings/Calculation Package & Materials Notebook received late (> 7 calendar days)	No Proposal Points
F	Failure to submit <i>Letter of Intent and Qualification Form</i> by deadline	10 Units
G	Failure to include all required sections and elements as specified in the RFP, in order; Failure to adhere to formatting requirements as specified in Table 5 of the RFP	10 Units
TOTAL DEDUCTIONS		_____ Units

[illegible]

☐ We agree with the deductions applied to the Project Proposal

☐ We are submitting an appeal (see attached form)

Team Captain

Upon review of the revised submission and any supporting documentation provided by the team captain:

- ☐ The deductions originally determined by the judges shall stand.
- ☐ The appeal was accepted

Head Judge _____

DEDUCTION SCORE CARD

FINAL PRODUCT PROTOTYPE

School: _____

Infraction				Deduction
A	Canoe not built within current academic year; cannot race due to design or safety issues, or cannot complete preliminary sprint and endurance events			No Final Product Points
B	Use of Bondo®, epoxy, or similar materials for construction or repairs			No Final Product Points
C	Use of prohibited materials (including mold CNC)			No Final Product Points
D	Use of more than 2 concrete mixtures			No Final Product Points
E	Flotation not within 3 ft of bow and/or stern or flotation not encased in concrete			10 Units
F	Product display does not include all required display components (7.2.1)			5 Units
G	School granted permission to repair canoe with tape			25 Units
H	Flotation Test	PASS	FAIL	50 Units
Society-Wide Finals Only				
I	Reported concrete oven dry unit weight compared to measured unit weight > 5 lb/ft³			5 Units
J	Measured weight of canoe not within the max of ±10 lbs or ±5% of the reported weight or measured canoe thickness exceeds the maximum ½” + 1/8” tolerance			15 Units
K	School granted permission to repair / reconstruct canoe			REPAIR = 25 Units RECONSTRUCT = 50 Units
Revise & Resubmit Allowed				
L	Reinforcement thickness exceeds 50% of canoe thickness			No Final Product Points
M	Non-compliant or non-approved concrete mix, materials, admixtures, or finishing materials (_____infraction(s)) × 5 units/infraction			_____ Units
N	Reinforcement does not meet Percent Open Area requirements			15 Units
O	Nuisance Deduction: If Infraction M or N or O is rescinded by resubmittal			5 Units
TOTAL FINAL PRODUCT PROTOTYPE DEDUCTIONS				_____ Units

Please provide information on the infraction(s) being applied:

Teams shall have until (day/time) _____ to either agree with the deductions listed above or to revise and submit or appeal with supportive documentation.

FOR TEAM CAPTAINS ONLY

- ☐ We agree with the deductions applied to the Project Proposal
- ☐ We are submitting an appeal (see attached form)
- ☐ We wish to revise and resubmit the following deduction (*circle those that apply*): L M N

Team Captain

Team Captain

FOR COMPETITION OFFICIAL USE ONLY

Upon review of the appeal/revised submission and any supporting documentation provided by the team captain:

- ☐ The deductions originally determined by the judges shall stand
- ☐ The appeal was accepted
- ☐ The following deductions shall be rescinded (*circle those that apply*): L M N

The total deduction for the Final Product Prototype is _____ Points.

Head Judge _____

FINAL PRODUCT PROTOTYPE

School Name:

☐ We wish to revise and resubmit the following deduction (*circle those that apply*): L M N

[illegible]

Rules & Regulations Section(s) Referenced: _____

Team Captain's Signature: _____

Team Captain's Signature: _____

APPEAL FORM

Instructions: Completed forms must be submitted by a Team Captain to the Head Judge. Requests will not be considered once the competition has concluded. All decisions of the judges are final.

School Name:

Team Captain(s):

Area of Appeal:

Briefly Describe the Appeal: (Continue on reverse side if more space is needed).

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

☐ **[Symposium Only]** We formally request that the C4 member on-call be contacted in order to obtain an official interpretation regarding this matter.

Rules & Regulations Section(s) Referenced: _____

Team Captain's Signature: _____

Team Captain's Signature: _____

EXHIBIT 11. PRE-COMPETITION SUBMITTALS

Letter of Intent (Page 1 of 1)

Dear C4,

On behalf of the _____ ASCE Student Chapter, we are pleased to submit this Letter of Intent confirming our intent to participate in the 2026–2027 ASCE Concrete Canoe Competition. Our team is enthusiastic about the opportunity to contribute to this long-standing tradition of innovation, collaboration, and engineering excellence.

We have carefully reviewed the 2027 Request for Proposals and understand the requirements regarding the Letter of Intent and Qualification Form, Design Narrative, Construction Drawings, and Calculation Package & Materials Notebook, and associated deliverables. Our chapter is fully committed to meeting all competition requirements, deadlines, and ethical guidelines established by C4 and ASCE.

The _____ Concrete Canoe Team will approach this project with professionalism, creativity, and dedication, guided by the principles of stewardship, safety, sustainability, and respect that are emphasized in the RFP. We are confident that our team's technical knowledge, collaborative spirit, and passion for engineering will be reflected in both our proposal and our prototype canoe.

We acknowledge that we have read the 2027 ASCE Society-wide Concrete Canoe Competition Request for Proposal and understand the following (initialed by 1 team captain and ASCE Faculty Advisor):

Statements of Agreement	Captain Initials	Advisor Initials
Teams must meet eligibility requirements outlined in Section 3.0 and Exhibit 3 to participate in the ASCE Student Symposium and Society-wide Competitions.		
Letter of Intent and Qualification Form must be uploaded to the ASCE server by November 2, 2026, 5:00 p.m. ET.		
ASCE Student Chapter Annual Reports and dues are due by February 1, 2027 for Society-Wide eligibility.		
The last day to submit a <i>Request for Information</i> (RFI) to the C4 is January 25, 2027.		
If using a theme, teams must consult their Faculty Advisor regarding potential trademark or copyright concerns.		
Teams are responsible for all information in this RFP, including addendums and Q&A posted on the ASCE Concrete Canoe Facebook Page.		
Teams must adhere to all deadlines, including submissions for the Project Proposal Deliverable components – Design Narrative, Construction Drawings, Calculation Package & Materials Notebook for both the Student Symposium and Society-Wide Finals.		

Thank you for your consideration and for your continued commitment to advancing civil engineering education through this competition.

Sincerely,

Team Captain (print)

Faculty Advisor (print)

Team Captain (signature)

Faculty Advisor (signature)

Email: _____

Email: _____

Qualification Form (Page 1 of 2)

(school name)

See Section 5.4 for required information for each topic area.

1. Project Goals (300 words max)

2. Proposed Project Milestones (15 milestones max)

Milestone	Planned Start Date	Planned End Date	Estimated Person-Hours

Qualification Form (Page 2 of 2)

(school name)

3. Health and Safety Program (300 words max)

The core project team is made up of ____ number of people. The “core project team” is not restricted to the maximum 10 registered members. Please include a count of all team members who are planned to work on the project.