

2022 American Society of Civil Engineers®  
Concrete Canoe Competition™

# REQUEST FOR PROPOSALS



**Date:** September 7, 2021

**To:** ASCE Student Chapters and Concrete Canoe Teams

**Subject:** Request for Proposal – 2021-2022 Concrete Canoe

Dear ASCE Student Chapters and Concrete Canoe Teams:

The Concrete Canoe Competition Committee (C4) is excited to release the Request for Proposals (RFP) for 2021-2022. We plan to return to in-person competitions this year but also recognize that unforeseen changes could result in variance in the delivery of in-person events. As we all navigate the competition this year, we can each contribute towards safely engaging and participating through proven measures that reduce the spread of COVID. In connection with planning, preparation, or participation in the competition, we encourage you all to follow CDC guidelines at all times in addition to those provided by your university and local authorities to decrease the spread and provide a higher probability of in-person events in 2022. It is up to each one of us to do our part. It may not always be the easiest or the most comfortable to do those things that prevent the spread, but we can make this happen when we all work together. Together, we are more!

Our transition in 2019 from a “rules” format to an RFP format was intended to provide closer resemblance of real-world practices. We have seen many teams present stronger materials by aligning with this real-world concept. We encourage you all to present your materials so that you are trying to “win the bid” and not just meet the requirements set forth in the RFP. How will you convince the judges that your materials and product is the winner? How do your materials and products best meet the metrics established in the RFP?

Good luck this year. We are counting on you all! We look forward to seeing the new ideas, innovation, and designs you all come up with. We wish all the student chapters the best as you move forward in starting an exciting year! See you in Ruston, LA!

Sincerely,

## COMMITTEE ON CONCRETE CANOE COMPETITIONS



Andrew Brunton, PE, Aff.M.ASCE  
Chair, Committee on Concrete Canoe Competitions (2022)

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## INTRODUCTION

Since the early 1970s, ASCE student chapters have been constructing and racing concrete canoes. During that time, canoe mixes and designs have varied, but the long-established tradition of teamwork, camaraderie, and spirited competition has been constant. Teams, their associates, judges, and all other participants are expected to maintain and build upon this tradition.

The objectives of the Society-wide Competition are as follows:

- Providing civil engineering students an opportunity to gain hands-on, practical experience and leadership skills by working with concrete mix designs and project management.
- Building awareness of the versatility and durability of concrete as a construction material among civil engineering students, educators, and practitioners, as well as the general public.
- Creating awareness of concrete technology and application among civil engineering students, educators, and practitioners, as well as the general concrete industry.
- Generating and increasing awareness of ASCE's and national sponsors' commitment to civil engineering education among civil engineering students, educators, and practitioners, as well as the general public.
- Increasing awareness of civil engineering as a dynamic and innovative profession essential to society among industry leaders, opinion makers, and the general public.
- Increasing awareness of the value and benefits of ASCE membership among civil engineering students, professionals, and faculty in order to foster lifelong membership and participation in the Society.

While the intent of the competition is to learn and build experience both technically and socially, students are a short step from being practicing engineers involved in projects that are critical to society's welfare.

Ethics, professionalism, civility, and respect are the cornerstone of every successful competition, and ASCE expects professional conduct from all participants. To preserve the quality of this competition and to improve the quality of future competitions, ASCE enforces high standards.

The Concrete Canoe Competition rules are © 2022 ASCE. Permission is granted to copy, distribute, or otherwise use the rules for any noncommercial purpose as long as proper credit is given to ASCE as the source of these rules.

## 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 who were building the roads, canals, bridges and railroads of a young nation.

Today, ASCE is a global organization with more than 150,000 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, 93 sections, 160 branches, 130 Younger Member Groups and 400 student chapters. Student Chapters sponsor meetings, educational outreach, symposia, student competitions, social events and other activities to help future engineers become better prepared 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 policy for the organization. A staff of 250 implements the policies; the vast majority of staff work at ASCE International Headquarters located in Reston, Virginia.

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

## R. JOHN CRAIG MEMORIAL AWARD

The concept of a society wide competition has been around 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 and 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 executive conference of the ASCE National Headquarters. During this meeting the feasibility of conducting a national competition was discussed, preliminary rules prepared, and a formal recommendation to proceed was drafted.

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

## 1.0 REQUEST FOR PROPOSAL

### 1.1 Problem Statement

The Committee on Concrete Canoe Competitions (C4, a subcommittee of the American Society of Civil Engineers (ASCE), is considering manufacturing/building concrete canoes for interested consumers/clients and showcase the proposed design, prototype, and display at the *World of Concrete Expo 2023*. As such, C4 is soliciting pre-qualified ASCE student chapters, herein after referred to as “Teams,” to submit their *Project Proposal* and *Enhanced Focus Area Report* as a response to this Request for Proposal and to design and construct a full-scale prototype of a concrete canoe.

The Proposal response should demonstrate why a team’s design and the materials chosen should be selected as the premier concrete canoe for manufacturing.

Ultimately, the selected team will be awarded a contract to provide the standard design to use for manufacturing. (**Note:** *manufacturing of canoes is a hypothetical situation for the purpose of identifying an end goal for this Request for Proposals and the competition.*)

Teams are to construct a prototype canoe and display that educates the selection panel and World of Concrete Expo attendees about the canoe’s design, materials chosen, and durability to withstand the rigors of a series of race demonstrations consisting of 200- and/or 400-meter sprints with 180-degree hairpin turns, and a 200-meter slalom course, including the transportation to and from various venues. Teams will need to research, design, procure & test materials, and construct a full-scale prototype in full compliance with this RFP, taking into consideration the specifications, constraints, and other requirements.

Furthermore, teams shall provide their *Project Proposal*, *Enhanced Focus Area Report*, and *MTDS Addendum* to be evaluated by a panel of judges, and will follow up by meeting regionally to showcase their prototype, provide a technical presentation, and have a live race demonstration.

ASCE will then invite qualifying teams to a Society-wide Final Competition held at Louisiana Tech University in June 2022 to present their project, where a panel of national judges will evaluate and award the winning team.

Furthermore, engaging with local ASCE professional chapters is highly encouraged to promote impactful contributions to the development of project deliverables. ASCE and the C4 are committed to assisting teams in facilitating these engagements and developing the necessary contacts.

### 1.2 Request for Qualifications (RFQ) Pre-Qualification Form & Letter of Intent

In many instances for real world projects, prior to working on and submitting a proposal, the Owner of a project will solicit interested companies to provide a response to a Request for Qualifications (RFQ). This is to help determine what companies are interested in the project, outlines their experience/qualifications, and show they meet the requirements outlined for the project.

The Pre-Qualification Form (see *Exhibit 4*) is required to be completed and signed off by each team, including signatures from the team’s project manager and the ASCE Student Chapter Faculty Advisor. A brief Letter of Intent shall act as a cover letter for the Pre-Qualification form. See **Section 4.2.1** for submittal requirements.

### 1.3 RFP Documents

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

Request for Proposal – Release September 7, 2021

RFI Summary – Release Early February 2022

If there are any major clarifications needed, RFP addendums may be released. Release announcements would take place on the C4 Facebook page, as well as the ASCE Concrete Canoe website at <https://www.asce.org/communities/student-members/conferences/rules>

### 1.4 Request for Information (RFI)

*Requests for Information* (RFI) are to be directed via e-mail to [concretecanoe@asce.org](mailto:concretecanoe@asce.org). Official responses will be posted to the C4 Facebook page (<https://www.facebook.com/ASCENCCC>). **The cut-off date for submitting an RFI is Friday, January 21, 2022.**

– End of Section –



## 2.0 WEBINARS

The C4 will host a live/recorded webinar over the course of the academic year to engage and communicate with the teams and provide them with the support they need to be successful. Participation in these webinars are not mandatory but highly encouraged. Information regarding registration will be posted to the ASCE Concrete Canoe Competition Facebook Page.

### 2.1 Competition Kick-Off

The C4 will host a *Kick-Off Webinar* in the weeks following the release of the rules (estimated to be at the end of September/early October), which will include a synopsis of the information provided in this RFP followed by a question-and-answer period. Interested teams should check the C4 Facebook page (<https://www.facebook.com/ASCENCCC>) for upcoming details.

### 2.2 Concrete Mixture Design Calculations

The C4 hosted a webinar last year regarding how to perform concrete mixture design calculations, included tips and tricks, and was followed by a question-and-answer period. The information presented in this webinar is still valid and useful for this year's competition. Any follow up questions can be sent as an RFI. A recording of this is available at: [Concrete Mix Design Calculations Webinar](https://bcove.video/3BOcEZj)  
<https://bcove.video/3BOcEZj>

### 2.3 Miscellaneous

The C4 may host additional webinars depending on their necessity and would be announced on the C4 Facebook page.

– End of Section –

### 3.0 ELIGIBILITY

A team may register up to a maximum of ten (10) participants. The requirements set herein strive for gender diversity by making the team composed of no more than five (5) participants that identify with pronouns she/her/hers and no more than five (5) participants that identify with pronouns he/him/his. When a team includes participants that identify as they/them/their or participants that do not distinctly identify with she/her/hers or he/him/his, the difference in the number of participants that identify with pronouns she/her/hers and he/him/his should aim to achieve a difference that is NOT greater than one. The following table illustrates a few examples of possible team compositions, but this does not disclude teams that only contain participants that identify with she/her/hers or he/him/his as long as the number of participants in each of the binary genders does not exceed five (5). Teams of ten (10) may be composed entirely of participants that identify with pronouns they/them/their.

Number of Participants that Identify with each Pronoun (Example)			
she/her/hers	they/them/their she/her/hers he/him/his	he/him/his	Total Participants
1	2	1	4
2	2	1	5
1	2	1	5
2	2	2	6
2	3	2	7
3	3	2	8
2	3	3	8
3	3	3	9
3	4	3	10

Participants who identify with a gender may register in accordance with their gender identification, with no requirements for submitting requests, obtaining approvals, or notifying anyone. Participants will be expected to apply this policy in good faith and in accordance with the Spirit of the Competition; this does not give every person the option to choose any gender identification, but to promote inclusion and access regardless of where a participant lies on the gender spectrum.

For other components of the competition that specify gender requirements (i.e., men's sprint, women's sprint, co-ed sprint, co-ed slalom, or other components), participants that do not identify with she/her/hers or he/him/his can fill either spot at their choosing while keeping in mind the Spirit of the Competition and competing fairly. They do not need to notify anyone of this choice but once they fill either spot, they must fill that spot for the entire Symposium or Society-wide Competition. No other team, judge, host, etc., shall dispute or appeal the choice that a participant makes.

Registered participants are eligible to present at the Technical Presentation, participate in races and/or any other activities. Substitutions are allowed up to the time of on-site registration. No substitutions shall be permitted afterwards. Each team shall designate two (2) registered participants as team captains.

Teams may be invited to the Society-wide Final Competition by placing as the top qualified team at one of the twenty-one (21) ASCE Student Symposia Concrete Canoe Competitions (Conference Competitions), or as the host school of the Society-wide Final Competition.

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

– End of Section –

## 4.0 SUBMISSION REQUIREMENTS AND DEADLINES

### 4.1 Conference/Team Folders

ASCE is using a submission platform called *Cerberus Web Client*. All competition deliverables must be submitted in this platform. Submissions outside of this platform will be considered non-responsive and will not be considered. The main folder contains a sub-folder for each Student Conference, and within each Conference Folder is a folder for each school in that conference. This is a Read/Write link (no delete). Refer to *Exhibit 2 – How to Navigate Folders and Upload Submissions for directions*.

Click the hyperlink to access: [Project Proposal Submissions](https://upload.asce.org/public/folder/yM0_DPNGLE_Afec7o56lrA/2022%20Concrete%20Canoe%20Submissions)  
([https://upload.asce.org/public/folder/yM0\\_DPNGLE\\_Afec7o56lrA/2022%20Concrete%20Canoe%20Submissions](https://upload.asce.org/public/folder/yM0_DPNGLE_Afec7o56lrA/2022%20Concrete%20Canoe%20Submissions))

### 4.2 Required Submissions and Schedule

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 deduction. Symposium 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*.

#### 4.2.1 Letter of Intent & Pre-Qualification Forms

Teams shall submit a *Letter of Intent* along with their *Pre-Qualification Forms* which acknowledges receipt of the Request for Proposal solicitation and shall provide a synopsis of their understating of the project. The letter must be **signed** by at least one (1) team captain and ASCE Student Chapter Faculty Advisor. The phone number and email address for both the team captain and faculty advisor shall be provided.

The *Pre-Qualification Forms* (see *Exhibit 4*) are required to be completed and signed off by each team including initialing off on each line item and providing signatures from the team's team captain and the ASCE Student Chapter Faculty Advisor.

Adobe PDF versions of the *Letter of Intent* and *Pre-Qualification Forms* are to be uploaded to the team's respective folder **no later than 5:00 pm EDT [Eastern] Friday, November 5, 2021. Late submissions and documents missing any of the required signatures, initials, and email addresses will be considered non-responsive and subject to deduction.**

#### 4.2.2 Preliminary Project Delivery Schedule

All teams are to upload their schedule to their respective folder, no later than **5:00 pm EDT [Eastern] Friday, November 5, 2021.** This Preliminary Project Delivery Schedule shall cover the period from the issuance of this RFP up team's respective ASCE Student Symposia Concrete Canoe Competition, and shall include items such as but not limited to, design and construction-related activities, important milestones, and deadline submission.

### 4.2.3 Project Proposal, MTDS Addendum, and Enhanced Focus Area

The following formats and number of documents are required:

#### Digital Format (PDF Version)

- For the Student Symposia Competitions, digital versions of *Project Proposal*, *MTDS Addendum*, and the *Enhanced Focus Area* documents are to be uploaded to their respective folder **no later than 5:00 pm EDT [Eastern] Friday, February 18, 2022.**
- For the Society-wide Final Competition, digital versions of *Project Proposal*, *MTDS Addendum*, and the *Enhanced Focus Area* documents are to be uploaded to their respective folder according to the instructions in their *Letter of Invitation* **no later than 5:00 pm EDT [Eastern], Tuesday, May 10, 2022.**
- File names shall be in the form of “School Name – Canoe Name – Document – Year” (examples: *South Central Louisiana State University – Mud Dawg – Project Proposal – 2022*)

#### Hard Copies

- For the ASCE Student Symposium, five (5) Bound Hard Copies of the *Project Proposal* and the *Enhanced Focus Area Report* to the address provided by the host school received **no later than Friday, February 18, 2022.**
- For the Society-wide finals competition, Six (6) Bound Hard Copies of the *Project Proposal* and the *Enhanced Focus Area Report* received **no later than 5:00 pm EDT, Tuesday, May 10, 2022** at the following address:

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

– End of Section –

## 5.0 PROJECT PROPOSAL and MTDS ADDENDUM

Each team shall provide their *Project Proposal* which details their approach to meeting the requirements of the Request for Proposal solicitation as it pertains to the various areas related to the design and construction of the concrete canoe such as concrete and composite development and testing, project management, innovations, and sustainable aspects of the design. In addition, teams will also submit an addendum containing their Material Technical Data Sheets (MTDS) as a supplement (herein referred to as *MTDS Addendum*) to this *Project Proposal*. Information for the submission format is provided in the following subsections.

### 5.1 General Requirements

- All body pages - 8 ½ in. by 11 in. pages
- Organization Chart – 8 ½ in. by 11 in. or 11 in. x 17 in.
- Construction Drawing & Specifications and Project Schedule – 11 in. x 17 in. pages
- All pages – ½ in. margins on all sides (*MTDS are not subject to this requirement*)
- Body text shall be in Times New Roman, Arial, or Calibri font, 12 pt. normal width character spacing, at least single spaced.
- Section headings and subheadings may be of any legible font type or size
- Hard copies shall be single sided
- Headers and footers are permitted and may be of any legible font type or size and can be within the margins.
- Section and Appendix dividers are permitted, but are not required
- All dimensions throughout are to be reported in English units

### 5.2 Pictures, Figures, Graphics, and Infographics

Pictures, renderings, illustration, graphs, figures, etc. are permitted

- Team should avoid the use of copyrighted or trademarked materials, unless they are granted permission to use them
- Items from publications must be properly referenced
- Items developed and owned by the team do not need to be referenced (for example, photographs depicting a construction method can be used regardless of the year it was taken, as long as it is representative of what is being proposed for this submission.)

### 5.3 Project Proposal

The Project Proposal shall adhere to the following format as described below. Sections and/or subsections may be retitled if it clearly identifies said section/subsection (e.g., “Quality Control and Quality Assurance” could be renamed “QA/QC Program”, “Introduction to QA/QC”, etc.).

#### 5.3.1 Front Cover

For the hard copies, the front cover shall be single-sided. The back side of the front cover shall be left blank.

### 5.3.2 Cover Letter

Serves as a response to the Request for Proposal solicitation and shall provide a synopsis of understanding of the project. Must include, at a minimum, statements certifying that:

- The proposed hull design, concrete mixture design, reinforcement scheme, and construction of the prototype canoe has been performed in full compliance with the specifications outlined in the *Request for Proposal*.
- That Material Technical Data Sheets (MTDS) and Safety Data Sheets (SDS) have been reviewed by the team.
- The team acknowledges receipt of the *Request for Information* (RFI) Summary and that their submissions comply with responses provided.
- The anticipated registered participants are qualified student members and Society Student Members of ASCE and meet all eligibility requirements (include the names, and ASCE Society Member ID Numbers).

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 *Project Proposal* and *MTDS Addendum* is valid. The phone number and e-mail address for both the team captain and the faculty advisor shall be provided. (*Page Limit – 2 max.*)

### 5.3.3 Table of Contents

List the various sections and appendices of the *Project Proposal*. The pages should be numbered as appropriate. List of tables and figures may be provided but are not required.

### 5.3.4 Executive Summary

Highlight why the team is best suited to be awarded this contract to provide the standardized design for manufacturing/building canoes for consumers. Touch on innovative features of the hull design, structural analysis, mixture design, construction, project management, and sustainability, as applicable. Provide a summary of the canoe prototype dimensions (at a minimum: length, width, depth, thickness, and weight) and concrete properties (at a minimum: density, including both the wet (plastic) and oven-dried unit weights, compressive strength, tensile strength, concrete composite flexural strength, concrete slump/spread, and concrete air content). Strength tests should also indicate age of testing (i.e.: 7-day, 28-day, etc.).

Concrete and canoe properties shall be reported in English units to the accuracies outlined in the industry standards (e.g., ASTM C39, C138, C109 and C496, etc.) and as outlined in the table below. These shall be used as the official properties used for any compliance checks.

PROPERTY	REPORTED ACCURACY (to the nearest..)
Strength	10 psi
Density (hardened concrete)	1 lb/ft <sup>3</sup>
Density (fresh concrete)	0.1 lb/ft <sup>3</sup>
Slump, Spread	¼ inch
Weight	1 lb
Air Content	0.1 %

Additional information deemed appropriate by the team may be incorporated as well and is at the discretion of the team (*Page Limit – 2 max.*)

### 5.3.5 Project Delivery Team

#### a. ASCE Student Chapter Profile

Provide a profile of your school's student chapter, brief history, highlighting its' activities, awards, etc. as applicable (*Page Limit – 1*)

#### b. Key Team Members

List key team members, including a descriptions/details of their roles and responsibilities (*Page Limit – 2*)

#### c. Organizational Chart

Provide team member names, role(s), tasks, or areas in which they made contributions at any time during the project. Include the year (Fr., So., Jr., Sr., Grad) for all members. Indicate team captains. List advisors, subconsultants etc. as appropriate, (*Page Limit – 1 – either 8 ½ x 11 or 11 x 17*)

### 5.3.6 Technical Approach to the Overall Project

*Sections a. through e. is restricted to a total page limit of ten (10) max. The topics below should be covered in a manner that best demonstrates to the panel of judges how overall approach to the project and design best meets the intent of the Request for Proposal.*

#### a. Design, Analysis, and Construction

Demonstrate a thorough understanding of the proposal requirements and sequence of tasks as it relates to development of a concrete canoe in terms of its hull design, structural capacity, material selection and testing protocol, and constructability.

Present the overall approach and any goals set for the hull design in relation to the RFP scored elements. Provide a description and reasoning of the selected hull geometry and general design. Discuss any structural element choices, including all applicable dimensions and any specific relevant features of the design.

Discuss the approach to structural analysis and determination of the material design requirements, including quantitative results from the analysis, loading cases, support conditions, assumptions, and analysis tools used. Describe material property values/design specifications for the concrete, reinforcement, and composite. For simplicity, structural analysis is to be limited to 2-D analysis only, based on concepts of mechanics of materials, strength of materials, and reinforced concrete design. Please note that the Enhanced Focus Area Report may discuss more advanced analytical structural methods, however, they should not be included or referred to in this Project Proposal.

Present the general approach for how the team planned to develop research and test, along with any goals set, to meet the requirements of the RFP. Provide a description of the concrete and reinforcement materials considered and selected. Include quantitative test results of mixtures tested and selected. Refer to standard test methods where possible. Provide the physical properties and composition of the proposed aggregate sources, including specific gravity, absorption, and particle size. Discuss the admixtures tested and their effects on concrete behavior. Discuss any primary reinforcement considered, tested, and used and the reasons for this selection, including the layering scheme chosen. Discuss new or innovative ideas, materials, and methods that were implemented in the development of the concrete composite and the impacts on budget, schedule, and safety.

Describe the construction process including form material selection, form construction, methodology of mixing and placement of concrete and reinforcement, layering scheme, curing, form removal, concrete finishing, and aesthetics. Include discussion of new or innovative ideas implemented in the construction of the mold and/or canoe and their impacts on budget, schedule, and safety.

#### **b. Scope, Schedule, and Fee**

Present the team's project management scheme and planning process as it relates to budget, schedule, scope, and risk management. Discuss the financial and resource allocation associated with material procurement and construction. List anticipated major milestone activities and how these were determined and will be achieved. Present critical path activities and describe how this critical path was determined. Identify hurdles that pose the most risk to critical path activities and how these hurdles affected the planning process.

#### **c. Quality Control and Quality Assurance**

Discuss the quality control and quality assurance (QA/QC) practices as they apply to concrete mixing and concrete placement during construction of the canoe prototype. In addition, discuss the QA/QC plan/program as it relates to non-construction related aspects of the project. Items to consider include material procurement and compliance review, document review, training, and work product review.

#### **d. Sustainability**

Highlight aspects of the materials being used, incorporated into the construction process, and other facets of the overall project as they relate to the three pillars of sustainability: social, economic, and environmental impacts.

#### **e. Health & Safety**



Discuss the team's safety program and implementation as it applies to the overall project, including at a minimum, material testing and construction. Discuss health and safety measures taken into consideration for COVID-19.

### 5.3.7 Construction Drawings & Specifications

Present isometric, elevation, plan, and typical composite cross-section views of the canoe and mold with applicable dimensions and other details as needed to construct. Additional details, cross sections, etc. may be added to clearly present construction techniques. Provide any relevant specifications as deemed essential by the team. *(Page Limit – 2 max. 11 x 17)*

### 5.3.8 Project Schedule

Provide a complete project schedule from issuance of Request of Proposal solicitation to the Society-wide Competition at the Louisiana Tech University. *(Page Limit – 1, 11 x 17)*

### 5.3.9 Appendices

#### a. Appendix A – Bibliography

ASTM and/or other industry standards, technical software, and any previously published material (e.g. past design reports, papers, conference proceedings, manufacturer's literature, patent, theses, etc.) as well as sources referenced when performing calculations must be properly cited, as applicable. Any professionally acceptable reference style can be used, as long as, the reader is able to use the citation to find the sources of original information. *(Page Limit – none)*

#### b. Appendix B – Mixture Proportions and Primary Mixture Calculation

Provide a *Concrete Mixture Data Table* (see *Exhibit 5: Technical Specification for Concrete and Reinforcement*) for each mixture used. Mixtures which differ in color only shall be considered as one mixture and one table shall be presented (note on the table that color varies).

For the primary mixture, provide a detailed, step-by-step calculation of the yielded mixture proportions, including the determination of volumes of the concrete constituents, gravimetric air content, w/c and w/cm ratios, and wet unit weight, and aggregate proportioning requirements. This table (in Word format) is available for download at <https://www.asce.org/communities/student-members/conferences/rules> *(Page Limit – none)*

#### c. Appendix C – Structural & Freeboard Calculations

Provide detailed, step-by-step example calculations (showing all relevant equations, variables and inputs including proper units) for the determination of bending moments along the length of the hull for the various loading conditions:

- Female Tandem
- Male Tandem
- Four-Person Co-ed
- Simply-Supported (extreme ends)
  - Canoe right side up
  - Canoe upside down

Paddlers are to be considered as point loads. The magnitude of the paddler loads and their race positions are at the team's discretion. All loads are to be unfactored. 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, resulting shear (V) and bending moment (M) diagrams.

Provide a summary table indicating load case, magnitude and location of maximum positive and negative bending moment for each scenario.

### **Freeboard Calculation**

Provide estimated freeboard and draught values (in inches) for the shallowest section of the canoe, which is defined as the section with the minimum distance (i.e. canoe height) between a horizontal line at the bottom of the canoe and the gunwale.

- As a function of load, varying from the unloaded condition (i.e., self-weight of the canoe) to a maximum load of 1000 lbs + self-weight of the canoe
- Indicate the freeboard for the team's design male tandem, female tandem, and four-person co-ed (unfactored).
- For this calculation, teams may use outputs from naval architectural software, such as, but not limited to, displaced volumes, in preparing these estimates.

*(Page Limit – 8 max.)*

### **d. Appendix D – Hull Thickness/Reinforcement and Percent Open Area Calculations**

Present the measurements and calculations of the reinforcement and hull thickness for the various canoe elements (i.e., walls, ribs, gunwales, thwarts, and bulkheads) and percent open area (POA) as applicable. *(Page Limit – 2 max.)*

### **e. Appendix E – Detailed Fee Estimate**

Provide one-page itemized fee summary sheet for the following:

- Projected total hours (including a breakdown of person-hours) dedicated to project management, hull design, structural analysis, mixture design development, mold construction and canoe construction, and the preparation of this *Project Proposal*, *Enhanced Focus Area Report*, presentation, and display. Exclude any time associated with paddling practice.
- Costs of concrete, reinforcement and finishing materials based on the amounts needed to for manufacturing a single canoe
- Lump sum fee for mold construction.
- Estimated shipping cost of the canoe (lump sum) from point of origin to Ruston, LA. State the type of shipping method that is used.

Hourly rates, material costs, and appropriate multipliers, are provided in *Exhibit 8 – Detailed Cost Assessment*. *(Page Limit – 2 max.)*

## f. Appendix F – Supporting Documentation

Provide the completed Pre-Qualification Forms, documents outlined in *Exhibit 10 – Durability and Repairs (if applicable)*, as well as any additional documents required by the C4. (Page Limit – none)

### 5.3.10 Back Cover

The back cover shall be single-sided. The front side of the back cover shall be left blank.

## 5.4 Material Technical Data Sheet (MTDS) Addendum

The intent of the *MTDS Addendum* is to provide a document that includes all of the materials used as part of the canoe itself that show compliance to ASTM standards or other material requirements outlined in the Request for Proposal. The judges and C4 will use this document to verify all materials are included from a team's Project Proposal and verify compliance of materials.

Provide MTDS pages for each of the materials used in the canoe itself along with a Summary Table that summarizes all the materials used in the canoe prototype, that at a minimum, includes the complete brand name (include company name), type of material (ie: Water Reducer, Reinforcing Mesh) and applicable industry standard. Include web links (such as URLs) to individual pages of MTDS. Safety Data Sheets (SDS) are not equivalent documentation for MTDS and shall not be provided.

The MTDS must provide current information clearly verifying that the materials used in the canoe comply with all the specifications (ex: a cement MTDS should show compliance with the applicable ASTM outlined herein). If there are multiple different products on a MTDS, circle, highlight, or identify which product is being used. In the event the information is not provided (such as proprietary reasons), a letter from the company (on letterhead) certifying that the materials used follow the specifications shall suffice and shall be submitted to C4 for its review and approval, prior to its inclusion in the *MTDS Addendum*. Contact information of the individual providing the letter shall be included.

Some reinforcement materials from local stores may not have an official MTDS available; however, a printout (from the store website or from the packaging) showing basic strength properties of the material may be included instead.

If you are in doubt of a product or MTDS, contact C4 for review.

See *Exhibit 7: MTDS Summary Table Example* for an example of the table. Note, the format can differ, as long as the minimum required information is included.

– End of Section –

## 6.0 ENHANCED FOCUS AREA

### 6.1 Intent

The intent of this section is to provide the specifications for the Enhanced Focus Areas portion of the project. In general, the Enhanced Focus Area can be on any aspect of the project to provide added value to the proposal and justify the benefits of the results to help the proposal reviewers (judges) to select the best proposal and therefore product. There will be no limits on tools or advanced analysis techniques for work conducted in the Enhanced Focus Area, however, all content presented should be targeted for an audience of engineers who may not have a specialization in the particular subdomain area. Some examples of potential Enhanced Focus Areas that teams can pursue are listed below, however, this list is by no means all-inclusive and teams are encouraged to select areas they deem most valuable.

#### Examples:

- Finite Element Analysis of proposed canoe to improve the design of structural elements
- Development of full-scale plans and specifications for fabrication of the proposed canoe
- Creation of Building Information Model of proposed canoe and the fabrication process
- Fluid dynamics analysis to optimize hull design
- Computational design optimization of concrete mixture proportions
- Development of team website for knowledge collection and transfer to future teams
- Risk analysis of proposed canoe adherence to requirements
- Artistic design and rendering of canoe aesthetics

### 6.2 Text, Margins, Page Size and Layouts

Refer to Section 5.1 for requirements, except Section and Appendix dividers are not permitted.

### 6.3 Pictures, Figures, Graphics, Infographics

Refer to Section 5.2 for requirements.

### 6.4 Enhanced Focus Area Outline

The *Enhanced Focus Area Report* shall be limited to no more than 5 pages, excluding front and back covers, Table of Contents, and References. Emphasis should be placed on concisely conveying the information and effective use of graphics. As a rough guideline, 750-1000 total words in the document would be reasonable, though evaluation of the report is left to the discretion of the judges.

#### 6.4.1 Front Cover

The front cover shall be single-sided. The back side of the front cover shall be left blank.

#### 6.4.2 Table of Contents

List the various sections of the *Enhanced Focus Area Report*. The pages should be numbered as appropriate. Provide List of Tables and List of Figures. (*Page Limit – 2 max.*)

### 6.4.3 Enhanced Focus Area Selection Process

Provide details of the process for identifying Enhanced Focus Areas. Discuss the method utilized for down selecting potential focus areas to the one chosen.

### 6.4.4 Enhanced Focus Area Value Added

Provide details on the value added by working on the selected focus area. If possible, provide quantifiable backup data for the value created, e.g. decreased proposed canoe costs, compressed time schedule, reduction of risk, reduced canoe weight, etc. Discuss any impacts of the Enhanced Focus Area to differentiate the teams proposed canoe from other team's proposals.

### 6.4.5 Enhanced Focus Area

Provide a description of the problem statement. Discuss background research conducted to support the technical approach. Describe the collaborative team approach utilized for conducting work on the focus area. Detail the technical approach pursued to address the problem statement. State all assumptions made during the course of analysis, if applicable. Describe any methods or tools utilized to aid in the technical approach. Detail all impacts of the focus area's impact on the proposed canoe. Summarize final results of focus area and whether the approach met the problem statement requirements. Describe methods for transferring the knowledge acquired conducting work on the focus area to future teams.

### 6.4.6 References

ASTM and/or other industry standards, technical software, and any previously published material, as well as, sources referenced when performing calculations must be properly cited, as applicable. Any professionally acceptable reference style can be used as long as the reader is able to use the citation to find the sources of original information. (*Page Limit – none*)

### 6.4.7 Back Cover

The back cover shall be single-sided. The front side of the back cover shall be left blank.

– End of Section –

## 7.0 CANOE HULL DESIGN PROTOTYPE

Teams shall propose a canoe hull and conduct a structural analysis on their proposed designs to establish the concrete properties needed. After research and testing, the team will construct a full-scale canoe prototype of their proposed design ahead of their Conference Symposium.

### 7.1 Dimensional Constraints

#### 7.1.1 Length

The maximum longitudinal hull dimension is restricted to 22 feet.

#### 7.1.2 Other Dimensions

Are not regulated and their values are at the sole discretion of the team.

### 7.2 Canoe Material Components

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

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

#### 7.2.1 Gunwale

The gunwale shall be finished to prevent injury to the paddlers (i.e., no exposed reinforcement or sharp edges.) Foam pipe insulation foam may be used as gunwale protection and may be taped to secure it.

### 7.3 Concrete Materials, Mixtures, and Reinforcement

Concrete mixtures shall be developed using concrete materials and reinforcement that complies to the specification in *Exhibit 5 – Technical Specifications for Concrete and Reinforcement*. Teams should consider setting up a research and testing regime that allows for testing of individual materials, concrete mixtures, and composite elements.

### 7.4 Flotation

In the event a canoe becomes submerged, canoes should be designed and constructed to be able 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.

#### 7.4.1 Flotation Test

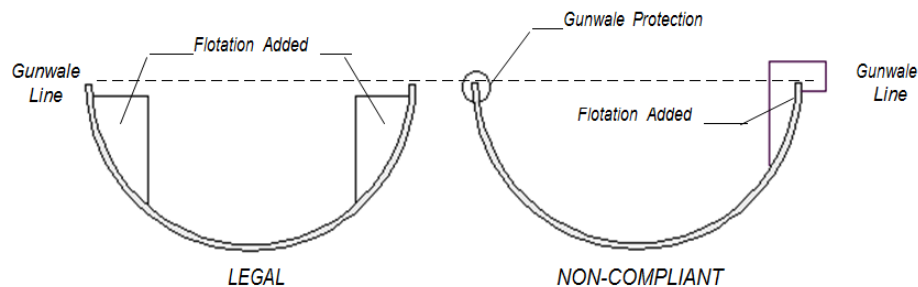
The canoe shall pass a flotation test whereby the canoe floats generally horizontal, with the canoe floating near the surface of the water, within two (2) minutes of being filled with water. The canoe's buoyancy rather than the exact depth at which it floats will be the subject of the test. *The canoe does not necessarily need to break the water surface – the intent of this test is to ensure the canoe does not sink and is easily retrievable should the canoe be submerged during the competition and*

ensure the safety of team members prior to the race. Teams shall submerge their canoe by whatever means necessary (such as, filling the canoe with buckets of water, tilting the canoe so that water fills in, pushing it downward, etc.) and are solely responsible for handling the canoe to meet the requirements of the test. Gunwale caps are not permitted on the canoe during the flotation test. Once the canoe has been certified as passing, gunwale caps may then be added.

Canoes that do not pass the flotation test on the first attempt will automatically be assessed a deduction on the Final Product Prototype.

### 7.4.2 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 shall not be permitted to serve as flotation material. Flotation added at the Conference Symposium Competition shall remain in place for canoes that qualify for the Society-wide Competition. At the Society-wide Competition, the canoe with its added flotation shall be considered “as built, as delivered” and shall be judged accordingly.



At the time of judging, any gunwale caps and coverings shall be removed. Aesthetics judging may take place before or after the canoe has been certified as passing the flotation test. If judging takes place after the flotation test, teams that required additional flotation to pass the test may temporarily remove the added flotation to be judged. After judging has been concluded, the teams shall place the flotation back in its original position.

## 7.5 Finishing & Aesthetics

### 7.5.1 Canoe & School Name

The name of the school and canoe shall be prominently displayed on the exterior of the canoe, above the waterline, on both sides, with individual letters. The school and canoe name shall consist of letters between 4 and 6 inches high. Recognized abbreviations for the official school name, based on the school’s official website, are permitted. The use of adhesive lettering is limited to the lettering used for the school and canoe names. The minimum name length is 5 characters.

### 7.5.2 Graphics

Graphics created using concrete coloring agents and pigments within the concrete mix design (i.e., integrally colored concrete) are not limited in dimension or frequency. Any coloring agents or pigments used shall be in accordance with ASTM C979. The use of stains and/or paints of any kind is prohibited.

### 7.5.3 Concrete Sealers

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

- a. silane- or siloxane-based penetrating sealer with a VOC of less than or equal to 350 g/L, or
- b. liquid membrane-forming compound for curing and sealing that is 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.

## 7.6 Durability and Repairs

Canoes should be tough enough to survive the rigors of the Symposium Competition, the Society-wide 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 common place, and inspected by the judges and/or C4 members for durability. *Exhibit 10 – Durability and Repairs*, discusses in detail, the criteria for how durability shall be assessed.

## 7.7 Official Weigh-In

At the Society-wide event, canoes are subject to an official weigh-in with the measured weight compared to the weight reported in their *Project Proposal*.

– End of Section –



## 8.0 PROTOTYPE DISPLAY REQUIREMENTS

### 8.1 General

Teams will have the opportunity to showcase their canoe on display, along with having a Project Display to highlight the processes and materials from the project and have a cross-section of the canoe representing its construction (canoe and mold).

### 8.2 Restrictions

*Project Display* – the display, as a whole, shall fall within a 4 ft (W) by 8 ft (L) by 7 ft (H) space.

- a. Displays must be designed so that they can be judged from the front (not a walk-around).
- b. Displays must be designed to be self-supporting. Nothing shall be taped, mounted, or attached in any form or manner to any surrounding trees, walls, doors, or floors, etc.
- c. Displays shall not include electronic devices (such as, but not limited to, laptops, lighting, sound or video equipment, radios, loudspeakers, or any other noise-creating devices).
- d. No sponsor-related items (such as sponsor lists, logos, etc.) shall be part of the display.

### 8.3 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 will need to include what is outlined in 8.3.3. Teams should also include what they deem appropriate to fully convey the strengths of their Proposal.

#### 8.3.1 Canoe Cross-Section

A full-scale model cross-section *representative* of both the raw and finished canoe shall be presented alongside the canoe. The cross-section shall demonstrate the concrete casting, finishing, and reinforcement techniques used, including showing the mold. The cross-section, including any stand, shall fall within a 4 ft (W) by 4 ft (L) by 7 ft (H) space, separate from the Product Display.

#### 8.3.2 Canoe Stands

The canoe is to be displayed on stands which hold the canoe approximately 4 feet off the ground.

#### 8.3.3 Required Information and Samples

The following shall be provided as part of the display. Samples of aggregates, mineral fillers, and fibers shall be provided in transparent containers and labeled accordingly.

- Individual sample(s) of concrete aggregate, 500 mL (min.)
- Individual sample(s) of mineral fillers, 500 mL (min.)
- Composite sample(s) of concrete aggregate + mineral filler, 500 mL (min.)
  - Composite blends should be of the same proportion of each concrete mixture.

- Concrete cylinder(s) of each mixture, 3 in. or 4 in. diameter, split in two halves
  - If several colors of a given concrete mixture is used, provide only one (1) sample of that mixture (i.e., samples of each color are not required).
- Raw reinforcement samples
  - *Mesh and Grids* – A 12 in. x 12 in. (min.) square sample of each reinforcement material
  - *Strips, Tendons and Bars* – If the reinforcement is “as-received” as a rolled strip (less than 12 in. wide), a 12 in. long sample strip shall suffice. If bars, tendons or strands are utilized, a sample of 12 in. (min.) length shall be provided.
- For any fibers used in the concrete mixtures, individual sample(s) of 50 mL (min.)
- One (1) hard-copy of *Project Proposal*
- One (1) hard-copy of *Enhanced Focus Area Report*
- One (1) hard-copy of *MTDS Addendum*

In addition, the following items are to be readily available for compliance checking:

- Seats/Mats for measurement check
- Life Jackets & Paddles
- **[Society-wide Only]** Concrete cylinders (unbroken) 3 in. or 4 in. diameter cylinder, oven-dried, of each concrete mixture used for unit weight verification.
  - These should be prepared per ASTM C39. The sample(s) shall be a quality control (QC) test cylinder taken at the time of canoe construction and be representative of the in-place density, color, consistency and make-up of the concrete(s) used.

– End of Section –

## 9.0 TECHNICAL PRESENTATION

### 9.1 Time Limit

Each team will be afforded the opportunity to present a 5-minute long presentation, followed by an additional 7-minute period for questions by a panel of judges. The panel will evaluate the presentation based on what has been presented within that timeframe.

### 9.2 Presentation Focus

The presentation should focus on the primary aspects of the design, construction, and technical capabilities. Briefly summarize the major aspects of the project, with the intent of demonstrating why your team, design, and prototype should be selected by the panel of judges for the design of canoe manufacturing/building. *(recall this is a hypothetical scenario to provide an end goal for the RFP and the competition)*

### 9.3 Language

All presentations are to be presented in English.

### 9.4 Presentation Order

Shall be randomly selected and shall be provided to the teams no later than the time of on-site registration. The presentations, including the question-and-answer period, shall be open to the public for viewing.

### 9.5 Equipment

The host school shall provide electrical outlet access, a projection screen, and a projector unit for use during the presentations. A room diagram shall be provided by the host school a minimum of two weeks prior to the event. The individual school making a presentation shall furnish any additional equipment necessary.

### 9.6 Presenters

Presenters may be any of the registered team members who officially sign-in at registration. Presenters are considered those with speaking parts and individuals operating the computer or projectors. A minimum of two (2) presenters must have speaking parts.

Teams shall make a live presentation. The use of video shall be permitted. Teams shall not pre-record any speaking parts. No handouts or other materials shall be given to the panel as part of the presentation. Any registered participant on a team may be on stage to participate in the question-and-answer period.

### 9.7 Question and Answer Session

Following the 5-minute presentation, teams will need to set themselves apart by displaying their knowledge to the panel by answering questions related to their *Presentation, Project Proposal, and Enhanced Focus Area*.

– End of Section –

## 10.0 CANOE PROTOTYPE PERFORMANCE DEMONSTRATION

Each team will be afforded the opportunity to demonstrate the racing capabilities, handling performance, seaworthiness, and durability of their full-scale prototype. This will be accomplished by a series of races focused on assessing both straight-line speed and turning capabilities under various loading conditions. A total of five (5) types of races are to be held (weather conditions permitting): women's slalom (2 women), men's slalom (2 men), women's sprint (2 women), men's sprint (2 men), and co-ed sprint (2 men and 2 women).

### 10.1 Demonstration Course

#### 10.1.1 General Requirements

The bow of the canoe shall remain the bow of the canoe throughout each race in consideration of a successful negotiation of a turn or finish buoy.

Different colored buoys shall mark the racecourse lanes. The Slalom and Sprint courses must meet the alignment, distance, spacing, and turns as noted in *Exhibit 9 – Race Regulations and Safety*; however, these are subject to site-specific conditions and limitations.

#### 10.1.2 Symposia and Society-wide Competition

For all Symposia competitions all sprint races shall be 200 meters. For the Society-wide competition, the co-ed sprint race will be increased to 400 meters.

### 10.2 Slalom Course (200-meter)

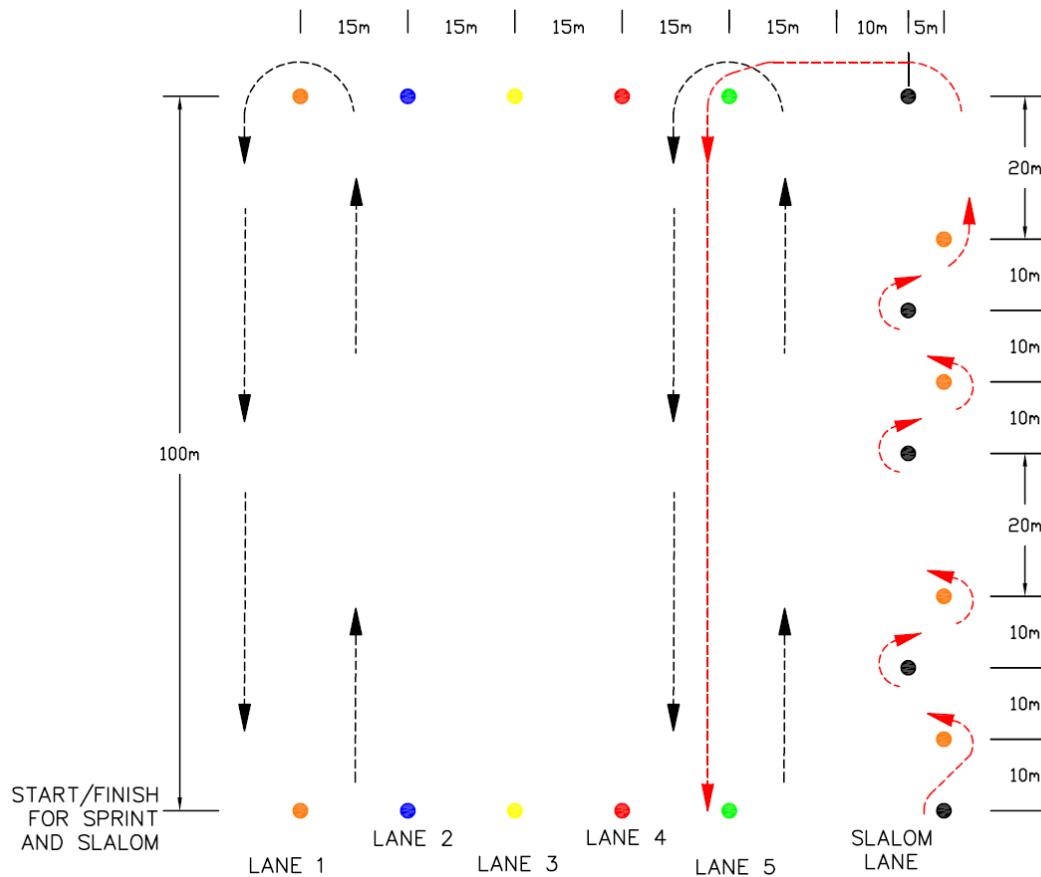
The slalom course shall consist of the following, subject to site conditions:

- a. The men's and women's slalom course will be nominally a 200-meter race consisting of a slalom course through the first 100 meters out (*actually a little longer with the slalom turns*), a 180° turn, and 100 meters straight back.
- b. At Symposia Competitions, the course shall begin with a slalom course consisting of seven (7) buoys. Each slalom buoy shall be staggered 5 meters transversely from each other. Buoys shall be longitudinally spaced at 10 meters with 20 meters between the third and fourth buoy.

### 10.3 Sprint Course (200- and 400-meter)

A sprint course shall consist of the following subject to site conditions:

- a. The men's and women's sprint course will be a 200-meter race consisting of a straight course 100 meters out, a 180° turn, and 100 meters back.
- b. For Symposia competitions, the co-ed race will also be a 200-meter race.
- c. For the Society-wide competition, the co-ed race will be a 400-meter race and shall consist of two (2) laps of the sprint course.
- d. Lanes shall be no narrower than 15 meters.

**Example Race Course Layout**

*Note that the slalom race return path is around the buoy for lane 5. This is to provide adequate space to prevent interference between a team heading away from the starting line and a team returning to the finish line. This reduces the time it takes to run the slalom race at both regionals and nationals by allowing the next team to start before the previous team finishes the race. The host school can also choose other layouts for the return path that allow the next team to start before the previous team finishes so long as there is adequate space to prevent interference between a team heading away from the starting line and a team returning to the finish line.*

– End of Section –

## 11.0 EVALUATION

### 11.1 General

The evaluation of the teams will be divided into four (4) categories:

Categories	Maximum Points
Project Proposal	25
Enhanced Focus Area	5
Technical Presentation	20
Final Product Prototype	25
Race Demonstration (5 events)	25
Total Possible	100

In a situation where none of the race events can take place, the overall competition score shall be based solely on the results of the technical portion of the competition (Project Proposal, Enhanced Focus Area, Technical Presentation, and Prototype) with the maximum possible score being 75 points.

### 11.2 Evaluation Panel

Each event shall be evaluated by a panel of judges. The minimum number for any given event is three (3) and the maximum is five (5). It is the intent of C4 that the same judges will evaluate each portion of the competition.

If each portion of the competition is not judged by the same judges, the C4 will not consider the competition a valid competition and will not extend an offer to compete at the Society-wide Final Competition. In extenuating circumstances, the C4 will request a description to determine the validity of the competition and may invite the team to the Society-wide Final Competition. At least three of the judges shall be the same for each of the competition parts.

### 11.3 Evaluation Scoring

Evaluation points will be allotted per placement according to the following table:

Place	Maximum Points						
	Technical Categories				Race Categories		
	Project Proposal	Enhanced Focus Area	Technical Presentation	Final Prod. Prototype	Slalom	Tandem Sprints	4-person Sprints
First	25.0	5.0	20.0	25.0	5.0	4.5	6.0
Second	22.5	4.5	18.0	22.5	4.5	4.0	5.4
Third	20.0	4.0	16.0	20.0	4.0	3.6	4.8
Fourth	17.5	3.5	14.0	17.5	3.5	3.1	4.2
Fifth	15.0	3.0	12.0	15.0	3.0	2.6	3.6
Sixth	12.5	2.5	10.0	12.5	2.5	2.2	3.0
Seventh	10.0	2.0	8.0	10.0	2.0	1.8	2.4
Eighth	7.5	1.5	6.0	7.5	1.5	1.4	1.8
Ninth	5.0	1.0	4.0	5.0	1.0	0.9	1.2
Tenth	2.5	0.5	2.0	2.5	0.5	0.4	0.6

Competition Points for Project Proposal, Enhanced Focus Area, Technical Presentation and Prototype are awarded per *Exhibit 11 – Evaluation Forms*.

Placement in each category is determined by the ranking of the overall scores, and in the case of races, the overall time. In the event of a tie, the average of the raw scores will determine the actual placing. If the tie remains after averaging the raw scores, then the tie will remain.

The *Project Proposal*, *Enhanced Focus Area*, *Technical Presentation*, and *Prototype* will be ranked for each judge independently from 1st to  $n$ th place (with  $n$  being equal to the number of teams competing) for each category. The aggregate of the independent rankings of each judge will be averaged to determine the overall rank for the entry and scores will be assigned based on the scoring table for places 1 through 10. Raw scores will be used in the event of a tiebreaker for the categories.

## 11.4 Summary of Deductions / Disqualification

### 11.4.1 General

These deductions may also be referenced in other sections of this document and/or the scoring sheets. **It is highly suggested that the judges contact C4 regarding situations that may not be covered to determine the appropriate course of action.**

### 11.4.2 Deductions

The Deduction Scorecards determine a deduction unit that is the input into the electronic scoresheet and is used to adjust the final scores for each judge for each school. Each deduction unit is one (1) percent of the difference between the pre-deduction highest and lowest score by judge for that particular portion of the competition and is calculated for each judge.

### 11.4.3 Disqualification

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

- a. Failure to meet student eligibility requirements
- b. Violations under the *Spirit of the Competition* [at the discretion of C4 and/or Judges] or under the *Ethics and the Competition*
- c. Failure to follow academic year, repair/reconstruction, and material requirements
- d. Sportsmanship and interference requirements
- e. Failure to follow safety rules

## 11.5 Appeal of Deductions

During the competitions, the judges and/or C4 shall inform the team captains about the deductions that have been assessed. The team captains will then be afforded the opportunity to appeal the deductions through a written response that will then be reviewed by the judges. **Designated team captains are the only individuals that may appeal the deductions.** The decisions of the judges following their review are

final and the judges will accept no further appeals beyond those decisions. The judges may contact C4 to ensure that the proper deductions are made and for any additional guidance.

**C4 will not consider any appeals beyond the Symposium Competition, nor will it overturn any of the Symposia judges' decisions regarding the deductions assessed against a given team.**

The following sections detail the process of teams being informed of the deductions, the team captain's appeal (if they choose to do so), and the rendering of the final decision of the judges following their review of the appeal.

If the team chooses to appeal deductions, the team captains will have until the date/time specified to submit to the Head Judge or C4 member a completed *Deduction Scorecard* (with signature), *Appeals Form*, and any supporting documentation. The judges shall review the appeal, render their final decision, and inform the team captains of the decision. Upon being informed of the judges' decision, no further appeal may be filed

### 11.6 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:

$$TBS = \frac{25}{100} \left( \frac{\sum DPP}{NOJ} \right) + \frac{20}{100} \left( \frac{\sum OPP}{NOJ} \right) + \frac{5}{100} \left( \frac{\sum EFA}{NOJ} \right) + \frac{25}{100} \left( \frac{\sum FPP}{NOJ} \right) + RP$$

Where: *DPP* = Project Proposal event points for a given judge  
*OPP* = Technical Presentation event points for a given judge  
*EFA* = 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 calculation of the *TBS* shall not change the standings for team placement in any given technical scoring part. Of the teams tied for overall winner or overall 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 choose to 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

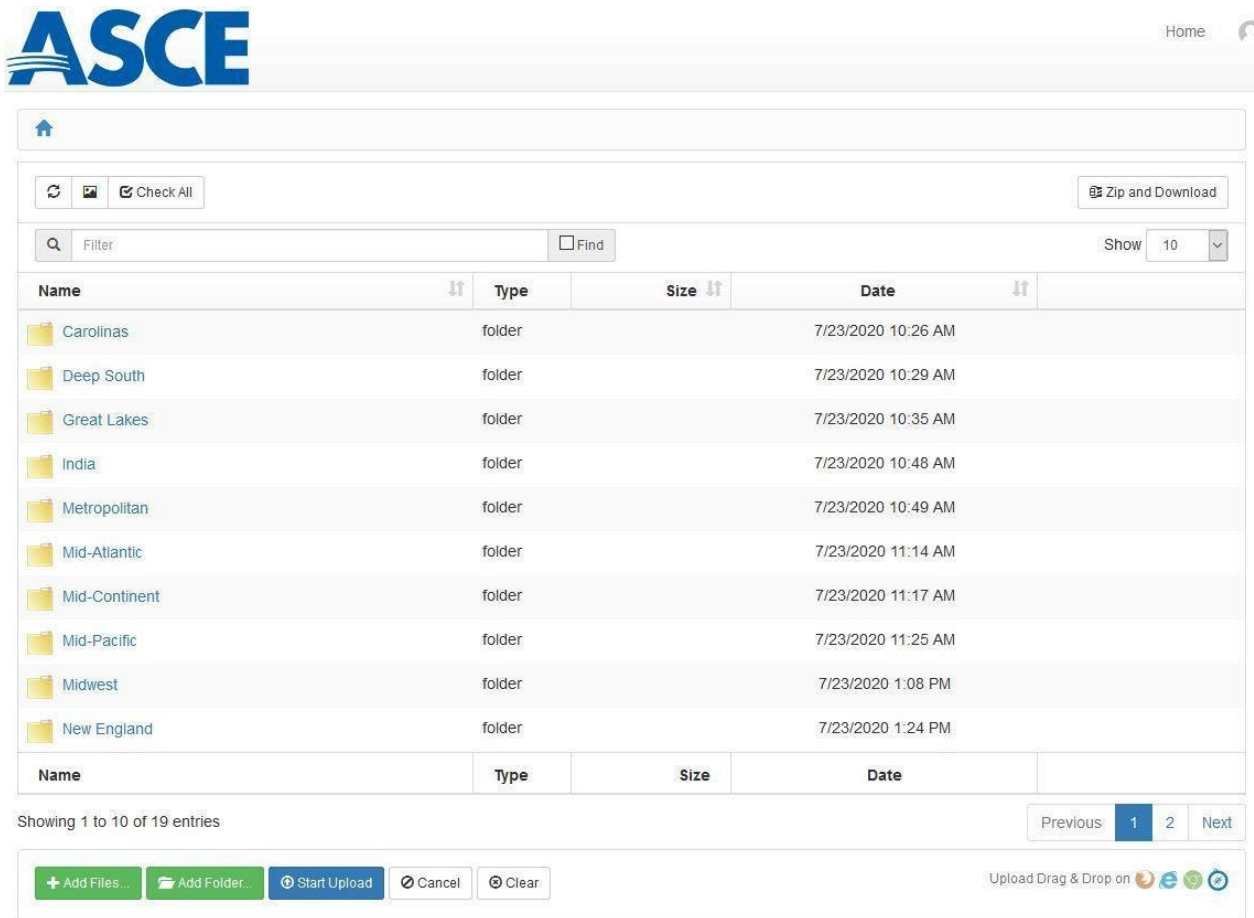
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ITEM	DATE
Issuance of 2022 Request for Proposal Solicitation	September 7, 2021
Deadline for Submission of <i>Preliminary Project Delivery Schedule, Letter of Intent, and RFQ Pre-Qualification Form</i>	November 5, 2021
Last Day to Submit RFI's to the C4	January 21, 2022
ASCE Student Chapter Annual Reports/Dues Deadline	February 1, 2022
Issuance of RFI Summary	On or about February 1, 2022
<i>Project Proposal, Enhanced Focus Area Report, and MTDS Addendum</i> Deadline (Symposia Competitions)	February 18, 2022
ASCE Student Symposia Competitions	March to Late April 2022
<i>Project Proposal, Enhanced Focus Area Report, and MTDS Addendum</i> Deadline (Society-wide finals)	May 10, 2022
2022 ASCE Concrete Canoe Competition, hosted by Louisiana Tech University, Ruston, LA	June 3-5, 2022

# 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:



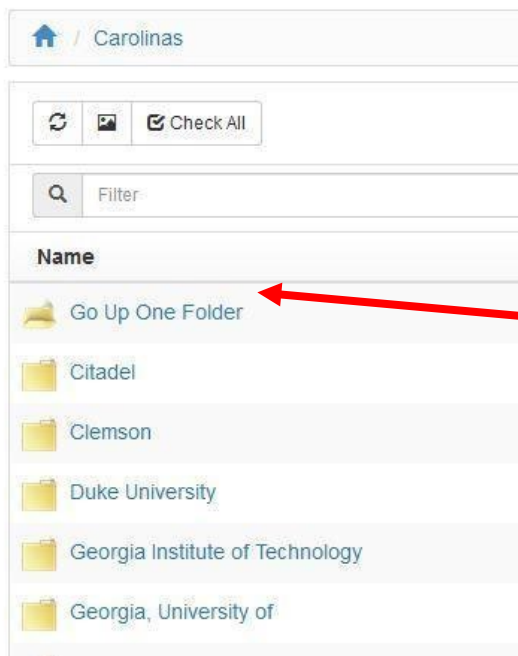
The screenshot shows the ASCE upload site interface. At the top is the ASCE logo and a 'Home' link. Below the logo is a navigation bar with a home icon, a 'Check All' button, and a 'Zip and Download' button. A search bar with a 'Find' button and a 'Show 10' dropdown menu is also present. The main content area displays a table of folders for various student conferences. The table has 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. Below the table, it says 'Showing 1 to 10 of 19 entries' and provides 'Previous', '1', '2', and 'Next' page navigation buttons. At the bottom, there are buttons for '+ Add Files...', '+ Add Folder...', 'Start Upload', 'Cancel', and 'Clear', along with a 'Upload Drag & Drop on' section with icons for different upload methods.

Name	Type	Size	Date
Carolinas	folder		7/23/2020 10:26 AM
Deep South	folder		7/23/2020 10:29 AM
Great Lakes	folder		7/23/2020 10:35 AM
India	folder		7/23/2020 10:48 AM
Metropolitan	folder		7/23/2020 10:49 AM
Mid-Atlantic	folder		7/23/2020 11:14 AM
Mid-Continent	folder		7/23/2020 11:17 AM
Mid-Pacific	folder		7/23/2020 11:25 AM
Midwest	folder		7/23/2020 1:08 PM
New England	folder		7/23/2020 1:24 PM

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:

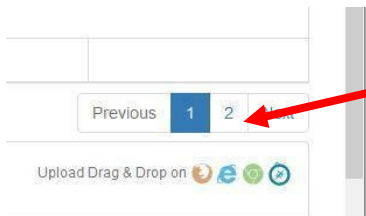


When you click the folder for your Student Conference, you will see a list of the Student Chapters assigned to that Conference:

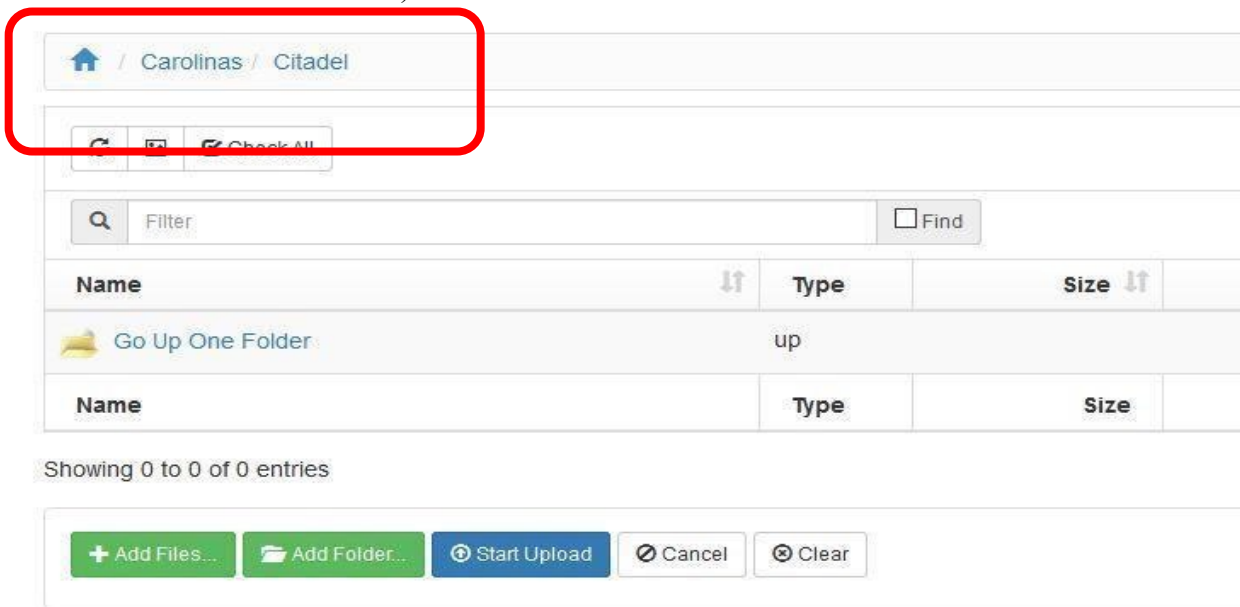


If you accidentally open the wrong folder, you can “back up” by clicking the **Go Up One Folder** folder and navigate correctly.

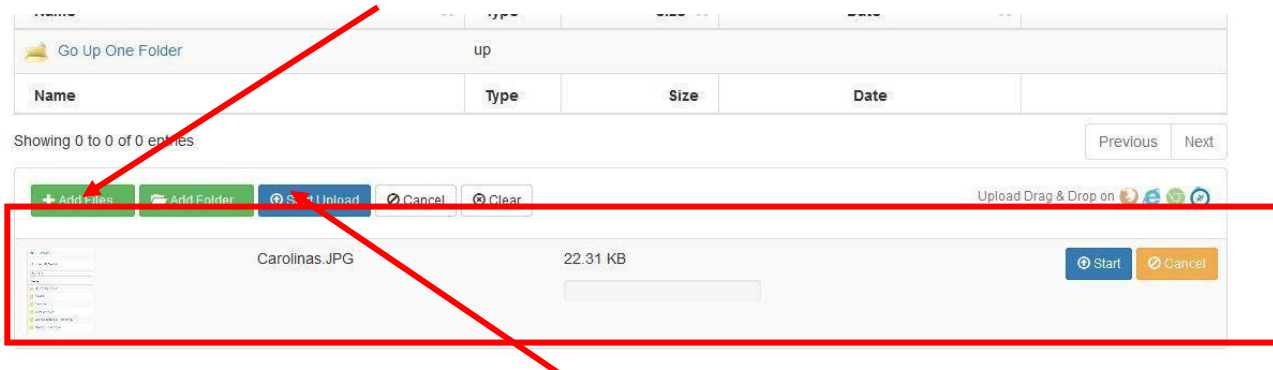
Locate the folder for your Student Chapter and click to open it. If you don’t see the name of your Student Chapter, click the page navigation to move to the second or third page:



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 **Carolinass** Student Conference):

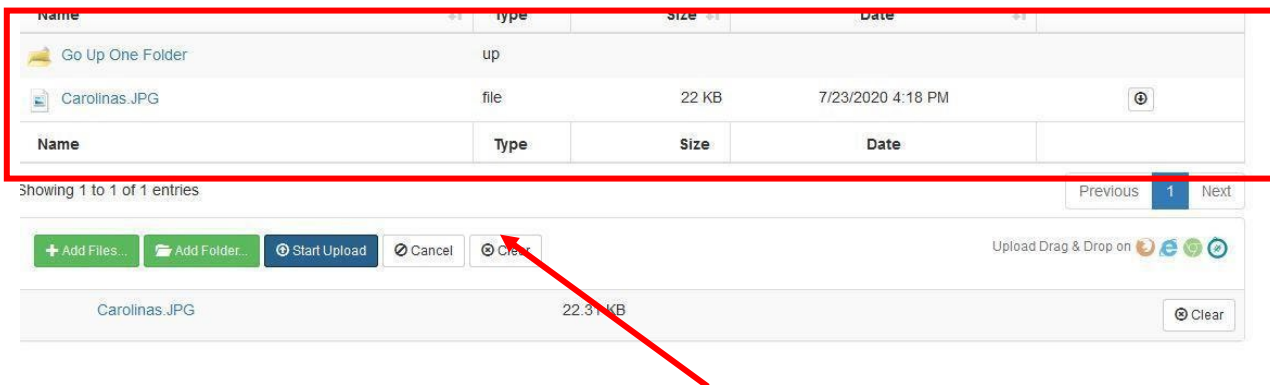


When you have confirmed that you have navigated correctly to the proper folder, you can either click the **+Add Files** button and then browse to find the files to upload or drag and drop files to the area directly below the **+Add Files** button.



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

When the file has been successfully uploaded, the name of the file will appear under the **Go Up One Folder** folder



To clear the uploaded file from the upload area, click **Clear**.

### 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](mailto: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).

# EXHIBIT 3

## Student Chapter and Participant Eligibility

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### REGISTERED PARTICIPANTS

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

- a. Be an undergraduate student majoring in engineering or related to engineering during the 2021/22 academic year (August 2021 to June 2022). 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;
- b. Be members of an ASCE Student Organization in good standing;
- c. Be Society Student Members of ASCE. ASCE student membership numbers shall be required upon registration; and
- d. Have contributed to the design and construction of the concrete canoe during the current academic year.

### STUDENT CHAPTER ELIGIBILITY FOR SOCIETY-WIDE COMPETITIONS

To facilitate broader participation by ASCE Student Chapters in Student Conference activities, ASCE Headquarters stresses the importance of the ASCE Student Symposium as an event that is much more than a qualifying round for Society-wide finals. As such, all ASCE Student Chapters must meet the following eligibility requirements to participate in the Society-wide finals:

#### **An ASCE Student Chapter must:**

1. Be in good standing with ASCE:
  - a. Have paid their annual dues, as received by ASCE, prior to the start of the Student Symposium to participate and receive awards at the Symposium (***however, to advance to Society-wide finals competition, dues must be paid by February 1***); and
  - b. Have submitted their student chapter full Annual Report **no later than February 1, 11:59 p.m.** EST, and have received a minimum score of 40 points out of a possible 100. Student Chapters that submit an EZ annual reporting form do not qualify; and
  - c. Act appropriately. As representatives of ASCE and the civil engineering profession, all competition and symposium participants are expected to and must act professionally and courteously. The use of alcohol, marijuana, or other controlled substance is strictly prohibited.

***Note:*** *Invitations to Symposium and Society-wide Competitions are a privilege, not a right. Failure to act appropriately can result in letters of reprimand, mandatory behavior management plans, and loss of invitations to further competition for individual institutions and/or entire conferences.*

2. Attend and participate in their assigned Student Symposium as shown through their school's:
  - a. Good faith participation in the annual Student Conference Business Meeting as a component of the Student Symposium. At least one (1) student representative shall be present at the start of the Business Meeting;
  - b. Good faith participation in the Student Symposium Paper Competition, including submission and presentation by at least one (1) 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.

Questions regarding eligibility should be directed to [student@asce.org](mailto: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 Conference competition the same year they intend to compete in the Society-wide finals.

Conference level regional competitions are required to meet certain standards. To earn an invitation to the Society-wide finals ASCE Concrete Canoe Competition, a student team shall qualify through participation in its assigned region 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 region competition. In addition, the region 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 region competition.

ASCE student chapters hosting Symposia may invite Official Guest teams, which are teams from colleges or universities that have an official ASCE student chapter that is not assigned to any Student Conference. Official Guest teams are eligible (if they meet the other requirements) to be invited to the Society-wide competition. Official Guest teams may compete in only one Student Symposium per year. ASCE Student Services shall be notified by the Student Symposium Host School of an Official Guest team prior to the start of the Student Symposium. Notification can be by e-mail to [student@asce.org](mailto:student@asce.org). 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:

- 1) Failure to provide proper credit for past teams, plagiarism, or any other false statements concerning the source of material used in the contest;
- 2) 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
- 3) Any false or malicious statements about other teams, members, or others involved in the contest.

## **SPIRIT OF THE COMPETITION**

The judges and/or C4 may take disciplinary action, including warnings, point deductions, or disqualification of a team or entry for inappropriate use of materials, language, alcohol, uncooperativeness, or general unprofessional behavior or unethical behavior of team members or persons associated with a team. The judges and/or C4 have the final authority to determine what constitutes a violation of the “Spirit of the Competition” and may take appropriate action towards point deduction or disqualification.

# EXHIBIT 4

## Pre-Qualification Forms

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Teams shall submit their **Letter of Intent** along with their **Pre-Qualification Forms** which acknowledges receipt of the Request for Proposal solicitation and shall provide a synopsis of their understating of the project.

The letter must be signed by at least one (1) team captain and ASCE Student Chapter Faculty Advisor. The phone number and email address for both the team captain and faculty advisor shall be provided.

The **Pre-Qualification Forms** are required to be completed and signed off by each team including initialing off on each line item and providing signatures from the team's team captain and the ASCE Student Chapter Faculty Advisor.

Adobe PDF versions of **Letter of Intent** and **Pre-Qualification Forms** are to be uploaded to the team's respective folder **no later than 5:00 pm [Eastern] Friday, November 5, 2021.**

**Late submissions and documents missing any of the required signatures, initials, and email addresses will be considered non-responsive and subject to deduction.**

Click the following hyperlink to access: [Project Proposal Submissions](#)

<https://upload.asce.org/public/folder/a7sjRfG1rUeV2uR7rWEIZQ/2022%20Concrete%20Canoe%20Submissions>

## Pre-Qualification Form (Page 1 of X)

\_\_\_\_\_  
(school name)

We acknowledge that we have read the 2022 ASCE Society-wide Concrete Canoe Competition Request for Proposal and understand the following (initialed by team project manager and ASCE Faculty Advisor):

The requirements of all teams to qualify as a participant in the ASCE Student Symposium and Society-wide Competitions as outlined in Section 3.0 and Exhibit 3. \_\_\_\_\_

The eligibility requirements of registered participants (Section 3.0 and Exhibit 3) \_\_\_\_\_

The deadline for the submission of *Letter of Intent*, *Preliminary Project Delivery Schedule* and *Pre-Qualification Form* (uploaded to ASCE server) is November 5, 2021; 5:00 p.m. Eastern \_\_\_\_\_

The last day to submit *ASCE Student Chapter Annual Reports* to be eligible for qualifying (so that they may be graded) is February 1, 2022 \_\_\_\_\_

The last day to submit *Request for Information* (RFI) to the C4 is January 22, 2022 \_\_\_\_\_

Teams are responsible for all information provided in this *Request for Proposal*, any subsequent RFP addendums, and general questions and answers posted to the ASCE Concrete Canoe Facebook Page, from the date of the release of the information. \_\_\_\_\_

The submission date of *Project Proposal*, *Enhanced Focus Area Report*, and *MTDS Addendum* for the Student Symposium Competition (hard copies to Host School and uploading of electronic copies to ASCE server) is Friday, February 18, 2022. \_\_\_\_\_

The submission date of *Project Proposal*, *Enhanced Focus Area Report*, and *MTDS Addendum* for Society-wide Final Competition (hard copies to ASCE and uploading of uploading of electronic copies to ASCE server) is May 10, 2022; 5:00 p.m. Eastern. \_\_\_\_\_

\_\_\_\_\_  
Team Captain

\_\_\_\_\_  
(date)

\_\_\_\_\_  
ASCE Student Chapter Faculty Advisor

\_\_\_\_\_  
(date)

\_\_\_\_\_  
(signature)

\_\_\_\_\_  
(signature)



## Pre-Qualification Form (Page 2 of X)

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*(school name)*

***As of the date of issuance of this Request for Proposal, what is the status of your school / university's 2021-22 classroom instruction (in-person, remote, hybrid)? What is anticipated after Thanksgiving and winter holiday break? If in-person or hybrid, do you have access to laboratory space or other facilities outside of classes?***

***In 250 words or less, provide a high-level overview of the team's Health & Safety (H&S) Program. If there is currently not one in place, what does the team envision their H&S program will entail? Include a discussion on the impact of COVID-19 on the team's ability to perform work and what plans would be implemented assuming work could be performed.***

***In 150 words or less, provide a high-level overview of the team's current QA/QC Program. If there is currently not one in place, what does the team envision their QA/QC program will entail?***

***Has the team reviewed the Department and/or University safety policies regarding material research, material lab testing, construction, or other applicable areas for the project?***

***The anticipated canoe name and overall theme is – (please provide a brief description of the theme. The intent is to allow ASCE to follow up to determine if there may be copyright or trademark issues to contend with, as well as to provide insight.***

***Has this theme been discussed with the team's Faculty Advisor about potential Trademark or Copyright issues?***

***The core project team is made up of \_\_\_\_ number of people.***

# EXHIBIT 5

## Technical Specifications for Concrete and Reinforcement

### GENERAL

Each concrete mixture developed shall comply with all the requirements of this section. The use of pre-packaged or pre-mixed concrete, mortar, or grout is not permitted. Bondo®, epoxy or similar materials are not permitted during any stages of the construction of the canoe (i.e., as the component of the mixture itself, as an aid during the placement of concrete, as a modifier of the reinforcement, or as a means of attaching the flotation material).

Teams should 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.

### 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 three (3) 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.

### MATERIALS

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

Any type of commercially available, inorganic cementitious binder, either hydraulic, non-hydraulic, or a combination of these is permitted. These materials shall meet the following ASTM standards and stated as such in the submitted MTDS documentation.

<b>Cementitious Materials</b>	<b>ASTM</b>
<i>Hydraulic Cement</i>	C150, C595, or C1157
<i>Fly Ash</i>	C618 (Class C or F)
<i>Metakaolin</i>	C618 (Class N)
<i>Slag Cement</i>	C989 (Grade 100 minimum)
<i>Silica Fume</i>	C1240
<i>Hydrated Lime</i>	C207 (Type S or N) or C821

Alternative cementitious materials and pozzolans evaluated using provisions of ASTM C1709 are also permitted. If non-commercial products are being considered, approval by C4 shall be obtained prior to their use.

### Aggregates

Any natural, manufactured, or recycled aggregate is permitted, and its proportioning shall meet both of the following requirements:

- Regardless of source, the total aggregate volume shall be 30% (min.) of the total volume of any concrete mixture.
- A minimum of 50% of the total aggregate volume shall be composed of:
  - (a) commercially-available lightweight aggregate (meeting the requirements of ASTM C330),
  - (b) recycled concrete aggregate (RCA), or
  - (c) a combination of these.

### Mineral Filler

The portion of any aggregate source that passes the No. 200 (75 µm) sieve shall be classified as **mineral filler** and is not to be considered in the volume of the aggregate calculation as defined above.

### 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

These materials shall meet the following ASTM standards and stated as such in the submitted MTDS documentation.

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

The use of bonding adhesives (ASTM C1059), waste latex paints, and latex emulsions (ASTM C1438) is prohibited.

Epoxy resins, their curing agents, asphalt emulsions, or similar materials shall not be considered specialty admixtures and are strictly prohibited. Teams wishing to incorporate a material as a specialty admixture that does not fall under ASTM C494 Type S, is not commercially available, or specifically made for use in concrete and have questions or concerns of whether it is an acceptable material shall contact C4 for a determination of its applicability.

The solids content of dyes and admixtures in powder form are to be accounted for in the determination of solids content. Disregard the contribution of solids from other admixtures.

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

**Mesh and Grids** – All materials serving as primary reinforcement shall have sufficient open space to allow for the mechanical bonding of the concrete composite as measured by its *percent open area* (POA). Solid mats or plates for reinforcing are not permitted. Pre-impregnated (pre-preg) materials which contain resins and require heat to complete

polymerization, are not permitted. Solid mats and plates are described as materials that require additional bonding agents or post-manufacturer perforations to keep the reinforcement from delaminating (i.e., there is a lack of open space between the reinforcement sufficient 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:

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

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

Teams are permitted to modify a given mesh by removing strands as needed to achieve the required POA. Teams may fabricate meshes or grids by placing (weaving, tying) material in the “as-received” condition. Once fabricated, teams are not permitted to treat the material (e.g., apply coatings or heat). The “as-received” condition is defined as a commercially available “off the shelf” product directly available to a consumer which has not been modified by a third-party (for example, fiberglass can be used as is, but to have a third-party make a grid out of it, then “delivering” it to the team 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.

**MIXTURE: NAME/DESCRIPTION OF MIX**

CEMENTITIOUS MATERIALS							
Component	Specific Gravity	Volume	Amount of CM				
Cement, $c$		$ft^3$	$lb/yd^3$	Total cm (includes $c$ ) _____ $lb/yd^3$ $c/cm$ ratio, by mass _____			
Cementitious Material 1, $cm_1$		$ft^3$	$lb/yd^3$				
Cementitious Material 2, $cm_2$		$ft^3$	$lb/yd^3$				
Cementitious Material 3, $cm_3$		$ft^3$	$lb/yd^3$				
FIBERS							
Component	Specific Gravity	Volume	Amount of Fibers				
Fiber 1, $f_1$		$ft^3$	$lb/yd^3$	Total Amount of Fibers _____ $lb/yd^3$			
Fiber 2, $f_2$		$ft^3$	$lb/yd^3$				
AGGREGATES (EXCLUDING MINERAL FILLERS PASSING NO. 200 SIEVE)							
Aggregates	ASTM C330 or RCA <sup>1</sup>	Abs (%)	SG <sub>OD</sub>	SG <sub>SSD</sub>	Base Quantity, $W$		Volume, $V_{agg, SSD}$
					$W_{OD}$	$W_{SSD}$	
Aggregate 1, $agg_1$	Yes / No	%			$lb/yd^3$	$lb/yd^3$	$ft^3$
Aggregate 2, $agg_2$	Yes / No	%			$lb/yd^3$	$lb/yd^3$	$ft^3$
Aggregate 3, $agg_3$	Yes / No	%			$lb/yd^3$	$lb/yd^3$	$ft^3$
LIQUID ADMIXTURES							
Admixture	lb/ US gal	Dosage (fl. oz / cwt)	% Solids	Amount of Water in Admixture			
Liquid Dye, $ld$			%	$lb/yd^3$	Total Water from Liquid Admixtures, $\sum W_{adm}$ _____ $lb/yd^3$		
Admixture 1, $adm_{x1}$			%	$lb/yd^3$			
Admixture 2, $adm_{x2}$			%	$lb/yd^3$			
SOLIDS (DYES, POWDERED ADMIXTURES, AND MINERAL FILLERS)							
Component	Specific Gravity	Volume ( $ft^3$ )	Amount ( $lb/yd^3$ )				
Solid Component of Liquid Dye, $S_{ld}$		$ft^3$	$lb/yd^3$	Total Solids. $S_{total}$ _____ $lb/yd^3$			
Powdered Admixture, $S_{p admix}$		$ft^3$	$lb/yd^3$				
Mineral Filler (Passing No. 200 sieve), $mf$		$ft^3$	$lb/yd^3$				
WATER							
	Amount				Volume		
Water, $w$ , $[=\sum (w_{free} + w_{adm} + w_{batch})]$	w/c ratio, by mass _____ w/cm ratio, by mass _____				$lb/yd^3$	$ft^3$	
Total Free Water from All Aggregates, $\sum w_{free}$					$lb/yd^3$		
Total Water from All Admixtures, $\sum w_{adm}$					$lb/yd^3$		
Batch Water, $w_{batch}$					$lb/yd^3$		
DENSITIES, AIR CONTENT, RATIOS, AND SLUMP							
Values for 1 cy of concrete	cm	Fibers	Aggregate (SSD)	Solids, $S_{total}$	Water, $w$	Total	
Mass, $M$	lb	lb	lb	lb	lb	$\sum M$ : lb	
Absolute Volume, $V$	$ft^3$	$ft^3$	$ft^3$	$ft^3$	$ft^3$	$\sum V$ : $ft^3$	
Theoretical Density, $T$ , $(=\sum M / \sum V)$	$lb/ft^3$		Air Content, Air, $[= (T - D)/T \times 100\%]$			%	
Measured Density, $D$	$lb/ft^3$		Air Content, Air, $[= (27 - \sum V)/27 \times 100\%]$			%	
Total Aggregate Ratio <sup>2</sup> $(=V_{agg, SSD} / 27)$	%		Slump, Slump flow, Spread (as applicable)			in.	
C330+RCA Ratio <sup>3</sup> $(=V_{C330+RCA} / V_{agg, SSD})$	%						

\*see notes 1 &amp; 2 on next page\*

1. Indicate if aggregate is ASTM C330 compliant (C330) or recycled concrete aggregate (RCA).

2. Ratio of total aggregate volume (in percent) compared to the total volume of concrete (min. allowable is 30%)

Ratio of combined volume of C330 and RCA ( $V_{C330+RCA}$  (in percent)) compared to the total aggregate volume of aggregate in SSD condition ( $V_{agg,SSD}$ ); (min. allowable is 50%)

## TERMS AND FORMULAS

<b><i>Abs</i></b>	= absorption of an aggregate, whether taken as a whole, the coarse, or the fine aggregate, %.
<b><i>adm<sub>x</sub></i></b>	= admixtures
<b><i>air</i></b>	= gravimetric air content, per ASTM C138, %
<b><i>agg</i></b>	= aggregate
<b><i>c</i></b>	= cement
<b><i>cm</i></b>	= cementitious materials (including cement)
<b><i>c/cm</i></b>	= ratio of cement to cementitious materials, by mass, <i>dimensionless</i>
<b><i>cwt</i></b>	= hundred weight of cementitious material (example 750 lb/yd <sup>3</sup> of cm is 7.5 cwt)
<b><i>f</i></b>	= fibers
<b><i>ld</i></b>	= liquid dyes
<b><i>M</i></b>	= mass, <i>lb</i> .
<b><i>MC<sub>total</sub></i></b>	= total moisture content referenced to the oven-dried condition of the aggregate, %.
<b><i>MC<sub>free</sub></i></b>	= free moisture content, referenced to the saturated, surface-dry condition (SSD), of the aggregate, %.
<b><i>mf</i></b>	= mineral fillers (i.e., aggregate-like materials passing the No. 200 sieve (75 μm))
<b><i>D</i></b>	= measured density (wet, plastic) of concrete test cylinders, per ASTM C138, <i>lb/ft<sup>3</sup></i> .
<b><i>T</i></b>	= theoretical density of concrete (zero air voids), per ASTM C138, <i>lb/ft<sup>3</sup></i> .
<b><i>S<sub>ld</sub></i></b>	= solids in liquid dyes
<b><i>S<sub>p adm<sub>x</sub></sub></i></b>	= solids of powdered admixtures
<b><i>S<sub>total</sub></i></b>	= total solids of liquid dyes, powdered admixtures, and mineral fillers, <i>lb/yd<sup>3</sup></i> .
<b><i>SG<sub>SSD</sub></i></b>	= specific gravity, in the saturated, surface-dry condition, of aggregate, <i>dimensionless</i> .
<b><i>SG<sub>OD</sub></i></b>	= specific gravity, in the oven-dried condition, of aggregate, <i>dimensionless</i> .
<b><i>V</i></b>	= volume, <i>ft<sup>3</sup></i> .
<b><i>V<sub>agg,SSD</sub></i></b>	= volume, in the saturated, surface-dry condition, of aggregate, <i>ft<sup>3</sup></i> .
<b><i>W<sub>SSD</sub></i></b>	= mass, in the saturated, surface-dry condition, of aggregate per unit volume of concrete, <i>lb/yd<sup>3</sup></i> .
<b><i>W<sub>OD</sub></i></b>	= mass, in the oven-dried condition, of aggregate per unit volume of concrete, <i>lb/yd<sup>3</sup></i> .
<b><i>W<sub>stk</sub></i></b>	= mass, in the stock moisture condition, of the aggregate per unit volume of concrete, <i>lb/yd<sup>3</sup></i> .
<b><i>w<sub>adm<sub>x</sub></sub></i></b>	= the mass of water in the admixtures, per unit volume of concrete, <i>lb/yd<sup>3</sup></i> .
<b><i>w<sub>batch</sub></i></b>	= the mass of water to be batched per unit volume of concrete when the aggregates are in a stock moisture condition, <i>lb/yd<sup>3</sup></i> .
<b><i>w<sub>free</sub></i></b>	= free water carried into the batch by a wet per unit volume of concrete, <i>lb/yd<sup>3</sup></i> .
<b><i>w/c</i></b>	= water to cement ratio, by mass, <i>dimensionless</i> .
<b><i>w/cm</i></b>	= water to cementitious material ratio, by mass, <i>dimensionless</i> .

## TERMS AND FORMULAS

*Each one of these formulas should be applied to each aggregate source:*

$$Abs = \frac{W_{ssd} - W_{od}}{W_{od}} \times 100\%$$

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

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

$$W_{SSD} = \left(1 + \frac{Abs}{100\%}\right) * W_{OD}$$

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

Note that  $w_{free}$  can be a negative number indicating a dry and absorptive aggregate.

$$W_{stk} = W_{SSD} + w_{free}$$

Then, for the mixture as a whole:  $w_{batch} = w - (w_{free} + \sum w_{adm})$

*The following formula should be applied to all admixtures in liquid form:*

$$w_{adm} = dosage \text{ (fl oz/cwt)} * \text{cwt of cm} * \text{water content (\%)} * 1 \text{ gal/128 fl oz} * \text{lb/gal of admixture}$$

*The following formula should be applied to liquid dyes only:*

$$S = dosage \text{ (fl oz/cwt)} * \text{cwt of cm} * \text{solid content (\%)} * 1 \text{ gal/128 fl oz} * \text{lb/gal of admixture}$$

# EXHIBIT 6

## General Guidelines for Concrete Mixture Data Table

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### General Comments:

- This exhibit provides general guidelines and helpful hints so that teams understand what is required in the table and how it should be properly filled out.
- Under the categories of “Cementitious Materials,” “Aggregates,” “Fibers,” and “Admixtures”, provide the name of the constituents that are being used. **Commercial (trade) names should be used if it is clear what the product is.**
- Absorption and moisture content values (in percent) for the aggregates shall be provided (to the nearest 0.1%)
- Under the “Specific Gravity” column, provide the specific gravity (dimensionless) of the cementitious materials, aggregates, fibers, and water used in the concrete mix. **For aggregates, you will provide the Oven Dried (OD) and Saturated, Surface Dry (SSD) values.** Two or three decimal places are sufficient.
- The weight of the liquid admixtures shall be provided in lb/gal.

### Notes:

1. The values provided in these tables are shown for MATHEMATICAL EXAMPLE purposes only.
2. Teams should not consider the mixture proportions shown to result in concrete with the needed fresh (slump, air content) and hardened (strength) characteristics required for the competition.
3. Values such as specific gravity are based on generalized numbers and should not be used for your design calculations (i.e., do not reference this document as the one you based your values on).

The following is a step-by-step example for reporting FINAL yielded concrete mixture proportions and checks to make sure that it is theoretically and mathematically correct. **This means that the reported unit weight is measured, and the values provided consider relative yield,  $R_y$ .**

### Proposed Mixture Proportions

Type I/II 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 <sub>dry</sub> = 1.55 (ASTM C330 compliant)
Pumice, aggregate	600 lbs (dry), Abs = 17%, SG <sub>dry</sub> = 1.59 (ASTM C330 compliant)
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 <sup>3</sup>
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/ft<sup>3</sup>), as shown by:

$$\text{Absolute Volume} = \text{mass} / (\text{SG} \times 62.4)$$

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

$$\begin{aligned} \text{Volume}_{\text{cement}} &= \text{Mass}_{\text{cement}} / (\text{SG}_{\text{cement}} \times 62.4) \\ &= 400 / (3.15 \times 62.4) = 2.04 \text{ ft}^3 \end{aligned}$$

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<sub>OD</sub>) and saturated, surface dry (SG<sub>SSD</sub>). **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 (SG<sub>SSD</sub> = 1.55; A = 13%), the SG<sub>OD</sub> 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<sub>OD</sub> 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<sub>SSD</sub>.

## 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?

$$\begin{aligned} \text{Water} &= \text{w/cm} \times \text{cm} \\ \text{Water} &= 0.50 \times 900 \text{ lb} = 450 \text{ lb} \end{aligned}$$

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):

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

## 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 <sub>OD</sub> (lb)	Abs (%)	W <sub>SSD</sub> (lb)	MC <sub>total</sub> (%)	MC <sub>free</sub> (%)	W <sub>free</sub> (lb)
Expanded Shale	600	13	678	8	-5	-30
Pumice	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:

$$\text{Water in admixture} = \text{dosage} \times \text{cwt of cm} \times \text{water content} \times (1 \text{ gal}/128 \text{ fl oz}) \times (\text{lbs}/\text{gal of admixture})$$

### From liquid dye

$$[20 \text{ fl oz}/\text{cwt} \times 8.30 \text{ cwt}] \times [(100\% - 50\% \text{ solids})/100] \times (1 \text{ gal}/128 \text{ fl oz}) \times (10 \text{ lb}/\text{gal}) = \underline{6.48 \text{ lb}}$$

### From HRWR

$$[6 \text{ fl oz}/\text{cwt} \times 8.30 \text{ cwt}] \times [(100\% - 47\% \text{ solids})/100] \times (1 \text{ gal}/128 \text{ fl oz}) \times (8.5 \text{ lb}/\text{gal}) = \underline{1.75 \text{ lb}}$$

Total water from all the admixtures is then 8.93 lb.

## 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:

$$\begin{aligned} w_{batch} &= w - (w_{free} + \sum w_{admx}) \\ &= 450 \text{ lbs} - (-57.5 + 10.34) = 497.16 \text{ lb} \end{aligned}$$

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

$$\begin{aligned} Volume_{water} &= Mass_{water} / (62.4) \\ &= 450 / 62.4 = 7.21 \text{ ft}^3 \end{aligned}$$

## 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 (which are prohibited) 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

$$Solids \text{ in admixture} = dosage \times cwt \text{ of cm} \times solid \text{ content} \times (1 \text{ gal}/128 \text{ fl oz}) \times (lb/gal \text{ of admixture})$$

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 x 12 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<sup>3</sup>.
- Solids volume is 0.0375 ft<sup>3</sup>. Note: 1 gal = 0.13368 ft<sup>3</sup>.
- The unit weight of solids is then 6 lb / 0.0375 ft<sup>3</sup> = 160 lb/ft<sup>3</sup> and therefore its SG is determined to be 2.56.

From liquid dye

$$[20 \text{ fl oz/ cwt} \times 9 \text{ cwt}] \times [(50\% \text{ solids})/100] \times (1 \text{ gal}/128 \text{ fl oz}) \times (12 \text{ lb/gal}) = 8.44 \text{ lb}$$

From HRWR

$$[6 \text{ fl oz/ cwt} \times 9 \text{ cwt}] \times [(47\% \text{ solids})/100] \times (1 \text{ gal}/128 \text{ fl oz}) \times (8.5 \text{ lb/gal}) = 1.90 \text{ lb}$$

**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:

$$M = Amount_{cm} + Amount_{fibers} + Amount_{aggregate} + Amount_{water} + Amount_{solids}$$

$$M = 900.00 + 8.0 + 1321.50 + 450 + 8.44 = \underline{2687.84 \text{ lb}}$$

**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. **This value has to be less than 27 ft<sup>3</sup> (1 vd<sup>3</sup>):**

$$V = Volume_{cm} + Volume_{fibers} + Volume_{aggregate} + Volume_{water} + Volume_{solids}$$

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

**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):

$$T = M / V$$

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

**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/ft<sup>3</sup>

**Air Content** – The air content is computed by comparing the theoretical density (no air) to the measured density (D):

$$Air \text{ content} = (T - D) / T \times 100$$

$$Air \text{ content} = (112.27 - 99.55) / 112.27 \times 100 = 11.3\%$$

***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 someplace).***

$$Air \text{ content} = (27 - V) / 27 \times 100$$

$$Air \text{ content} = (27 - 23.941) / 27 \times 100 = 11.3\% \text{ (check)}$$

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

## Cement-Cementitious Materials Ratio

The c/cm ratio is a calculated value:  $400 \text{ lb c} / 900 \text{ lb cm} = \underline{0.444}$

## Water-Cementitious Materials Ratio

The w/cm ratio is a calculated value:  $450 \text{ lb} / 900 \text{ lb cm} = \underline{0.50}$

**Slump** – measured value (in inches).

## AGGREGATE PROPORTIONING

**Aggregate - Concrete Ratio (Volumetric)** – Per **EXHIBIT 5 – Technical Specifications for Concrete and Reinforcement**, “Regardless of source, the total aggregate volume shall be 30% (min.) of the total volume of any concrete mixture.”

$$\text{Aggregate Ratio (\%)} = V_{\text{aggregate}} / 27 \times 100\%$$

$$(11.75 / 27) \times 100\% = \underline{43.5\% > 30\% \text{ (OK!)}}$$

**C330+ RCA to Total Aggregate Ratio (Volumetric)** – Per **EXHIBIT 5 – Technical Specifications for Concrete and Reinforcement**, “A minimum of 50% of the total aggregate volume shall be composed of: commercially-available lightweight aggregate (meeting the requirements of ASTM C330), recycled concrete aggregate (RCA), or a combination of these.”

$$V_{C330 + RCA} / V_{\text{aggregate}} \times 100\% \geq 50\%$$

Both the expanded shale and pumice were deemed ASTM C330 compliant as part of this exercise and are the only two aggregate sources used, therefore,

$$(11.75 / 11.75) \times 100\% = \underline{100\% > 50\% \text{ (OK!)}}$$

# EXHIBIT 7

## MTDS Summary Table Example

Note, the format can differ from the below example, as long as the minimum required information is included.

Product Name	Type	Applicable Standard	URL/Link to Datasheet
<b>CEMENTITIOUS MATERIALS and POZZOLANS</b>			
Cemex Type I Cement	Type I	ASTM C150	No link available. See attached mill test report
<b>AGGREGATES</b>			
Utelite Structural Fines	Expanded Shale	C330	<a href="https://www.utelite.com/resources/material-reports-documents/">https://www.utelite.com/resources/material-reports-documents/</a>
<b>FIBERS</b>			
NYCON-PVA RECS100	PVA Fiber	C1116	<a href="https://cdn.shopify.com/s/files/1/0088/0764/5299/files/NyconPVARECS100Sheet042015.pdf">https://cdn.shopify.com/s/files/1/0088/0764/5299/files/NyconPVARECS100Sheet042015.pdf</a>
<b>ADMIXTURES</b>			
Euclid – Pastol 5000	Water Reducer	C494 Type A & F	<a href="https://www.euclidchemical.com/files/PrductFiles/tds/plastol_5000.pdf">https://www.euclidchemical.com/files/PrductFiles/tds/plastol_5000.pdf</a>
<b>REINFORCING MATERIALS</b>			
1/16" 7x7 Galvanized Aircraft Cable	Steel Tendon	n/a	<a href="https://www.fastenal.com/content/product_specifications/WR.7X7.SS.EQR.00.pdf">https://www.fastenal.com/content/product_specifications/WR.7X7.SS.EQR.00.pdf</a>
<b>CURING &amp; SEALING COMPOUNDS</b>			
BASF MasterKure CC 1315WB	Curing and Sealing Compound	ASTM C1315	<a href="https://www.buildsite.com/pdf/master_builders_solutions/MasterKure-CC-1315WB-Formerly-Kure-1315-Product-Data-1522742.pdf">https://www.buildsite.com/pdf/master_builders_solutions/MasterKure-CC-1315WB-Formerly-Kure-1315-Product-Data-1522742.pdf</a>
<b>OTHER/MISCELLANEOUS</b>			

# EXHIBIT 8

## Detailed Cost Assessment

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### LABOR COSTS

Total billable Direct Labor (DL) shall be calculated using the Raw Labor Rates (RLR). Labor Hours spent on the project (HRS), and the multipliers for Direct Employee Costs (DEC), Indirect Employee Costs (IEC), and Profit (P).

The formula for Direct Labor (DL) is as follows:

$$DL = [\Sigma(RLR * HRS)] * (DEC + IEC) * (1 + P)$$

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.
- **Indirect Employee Costs (IEC)** are all project expenses and costs incurred other than direct employee costs such as general administrative costs for office or lab space rent, vehicle use, general liability insurance, advertising to solicit participation, telephone and utilities, testing equipment rental, etc. Normally, the multiplier to determine the IEC is calculated as the sum of the actual general overhead and administrative expenses divided by the total billable direct labor. However, to simplify the calculation for the indirect employee costs, a multiplier of 1.30 shall be used.
- A **Profit Multiplier (P)** of eighteen percent (18%) 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 Materials Costs (MC), Direct Expenses (DE) and Markup (M).

The formula for Expenses (E) is as follows:

$$E = (\Sigma MC + \Sigma DE) * (1 + M)$$

- **Materials Costs (MC)** shall be determined using the materials rates described on the following page.
- **Direct Expenses (DE)** shall include, but are not limited to, costs of outside consultants and other direct expenses related to either the research and development or construction phases of the project. This does not include costs such as transportation of canoe, race equipment, or other costs associated with racing the canoe.
- A **Markup (M)** of ten percent (10%) shall be applied to both material costs and direct expenses.

**LABOR AND MATERIAL RATES****Raw Labor Rates (RLR)**

Principal Design Engineer	\$50/hour
Design Manager	
\$45/hour Project Construction Manager	
\$40/hour Construction Superintendent	
\$40/hour Project Design Engineer (P.E.)	
\$35/hour Quality Manager	
\$35/hour Graduate Field Engineer (EIT)	
\$25/hour Technician/Drafter	
\$20/hour Laborer/Technician	\$25/hour
Clerk/Office Admin	\$15/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 Costs**

Outside Consultants	\$200/hour
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An outside consultant shall be defined as anyone contributing to the project that is not a student as previously defined.

**Material Costs**

The material costs to produce a single canoe - concrete, reinforcement, flotation, and finishing materials – are to be provided. Unit rates for materials shall be based on current market price. Cite the source of the values provided.



# EXHIBIT 9

## Race Regulations and Safety

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### GENERAL

The race demonstration of the canoe prototypes will consist of five (5) types of races: women's slalom (2 women), men's slalom (2 men), women's sprint (2 women), men's sprint (2 men), and co-ed sprint (2 men and 2 women).

### RACE RULES

The following general rules apply to the paddlers:

- a. Good faith efforts are made to start and finish all races. Should issues arise that may compromise the structural integrity of the canoe or the safety of the paddlers, teams must exercise good judgment in determining the safest course of action.
- b. Teams shall use the same registered individuals in both the preliminary and final heats of any race.
- c. In the event of an injury that prevents a paddler from further competition after the preliminary race has been completed, the injured person or a substitute shall be in the canoe in subsequent races. The substitute passenger shall be one of the original five (5) of the same gender registered on the team and shall not be allowed to paddle.
- d. If a team cannot field the proper number of paddlers of the required gender, registered substitute passengers of opposite gender shall be used, but substitutes shall not be allowed to paddle.

Teams competing in the slalom races shall compete against the clock in a timed single event. All other races shall include timed preliminaries and finals. The top five canoes advance to the grand final and the next five canoes advance to the petite final based on qualifying times in the preliminaries. Points shall be awarded based on the finish times in the finals. If finals cannot be conducted or the host school determines before the race competition starts that separate finals heats will not be run; the preliminary times shall be used as the final times.

For all sprint races, if a team qualifies for a final event but cannot start the event, that team does not receive points and the team's slot is conceded to the team with the next best preliminary sprint time. For final sprint races, if a team starts a race in a canoe deemed race-worthy by the judges, but is unable to complete the race, they are awarded the points corresponding to completing the race in last place in that final event.

In a situation where all the race events cannot be conducted (for example, the slalom races were completed but the sprint races could not be completed), the race scores for all of the completed races shall be accounted for in the overall competition score. By no means should the race scores be adjusted to account for races not held/completed.

### SYMPOSIUM EVENTS

Depending on the number of entrants at the Symposia competitions, host schools shall decide on having grand and/or petite finals for the various sprint races. The host school shall inform all teams prior to the competition of the race setup.

**Lane Position and Heat Assignments** - Lane position and heat assignments shall be randomly selected before the competition begins and shall be provided by on-site registration. The conference and society-wide host schools shall

provide a diagram or map to the participants outlining the layout of the course prior to the races. Sprint course turn direction (left/right) shall be determined prior to races.

**Interference** - In situations where there is lane interference and/or when canoes collide, paddlers must immediately STOP, hold paddles above their heads and discontinue racing. If interference occurs, the team captain shall appeal directly to the head judge. Once presented with the appeal, the judges shall:

- a. Allow any team(s) directly affected by interference the option to rerun the heat in a timed event. Times from the rerunning of the heat shall be used as the official time for the heat. Heats shall be rerun after a minimum of ten (10) minutes to allow paddlers to prepare themselves.
- b. Disqualify a team that has willfully interfered with another team. (If the interference is not deliberate, then the team should not be disqualified).
- c. Disqualify a team that willfully fails to adhere to course boundaries resulting in interference with another canoe. (If the interference is not deliberate, then the team should not be disqualified).

**If paddlers fail to immediately stop, raise paddles and continue to race, they cannot claim interference and will not be granted an opportunity to rerun their race.**

## **EQUIPMENT**

**Paddles** - shall be single-bladed and may be straight bladed or bent. Spare paddles are permitted in the canoe during the race demonstration.

**Seats and Mats** - dimensions of seats and mats are regulated to prevent them from serving as a structural component. Seats cannot exceed a 20" x 20" x 20" maximum. Mats cannot exceed a 20" x 30" x ½" thick maximum. Seats and mats can be used together, at the same time, by one paddler. Alternatively, knee pads are permitted.

**Fixed Paddler Restraints** - Straps, seatbelts, Velcro®, suction cups or any other item that attaches the paddler to the canoe or that interferes with the paddler safely exiting the canoe in the event of capsizing, are not permitted. The judges and/or C4 will prohibit the use of any paddler restraints if safety is deemed an issue.

**Slip Resistant Materials** - Use of non-skid tape or other slip resistant material is not permitted.

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

## **RACE POINTS & PENALTIES**

A buoy is successfully negotiated when the entire canoe passes on the proper side of the buoy. A canoe may touch a buoy, but the top of the buoy must stay above the waterline on the proper side of the canoe until the canoe has entirely passed. A canoe's time shall not be considered final until all buoys have been properly negotiated. All slalom buoys must be attempted. The following corresponding penalties shall be assessed as defined below:

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

For a team to successfully finish a given race, the bow of the canoe must cross the finish line with the same number of paddlers (in the canoe or touching the canoe) with which the race began.

## **DID NOT FINISH (DNF)**

If a canoe cannot complete a given race but is found to be seaworthy enough to continue to compete (a typical example is when a canoe becomes submerged during a race), then the team will be given a "Did Not Finish" (DNF) for that race (zero points for a given race). If other circumstances arise where a DNF may be applicable, judges shall contact C4 to determine whether a DNF should be applied.

## **APPEALS**

Requests for rule interpretations and/or appeals during Competition shall be presented to the Symposium Head Judge by the designated team captain(s). Such request or appeals must be lodged before the start of the next heat or in the case of the slalom races, before the next three (3) canoes finish the race. Appeals shall be made by a team captain. The decisions made by the judges and/or C4 concerning all aspects of the race and judging shall be final. Symposium head judges may contact C4 to clarify rule interpretations and to discuss appeals.

## **SAFETY**

Below are safety protocols which shall be followed for the canoe prototype race demonstration, followed by safety guidelines to consider for both the participants and host schools.

**Powered Rescue Boat** - At least one and preferably two powered rescue boats shall be on the water during all the races. If a powered rescue boat is not available, the races shall not take place.

If sustained winds at the race site are greater than 25 miles per hour or if wave heights are greater than 1 foot, the races shall not take place.

If the water temperature is less than or equal to 35°F and/or the combined air and water temperatures are less than or equal to 85°F, the races shall not take place. If the combined air and water temperatures are between 85°F and 120°F, the races may take place at the discretion of the safety director. However, there must be a warming area at the race site which holds a constant temperature of greater than 75°F, and two powered rescue boats shall be on the water during all the races.

If lightning is encountered within 15 miles of the race site, the races **shall not** take place until there is at least 30 minutes of elapsed time since the last recorded strike within the 15 mile distance.

Any entry deemed unsafe or hazardous by the judges shall not be permitted in the water unless corrective measures are taken. If corrective measures are not or cannot be made the entry shall be disqualified from further competition. If repairs must be made to an entry prior to any race, the judges may allow the entry to reschedule for a later heat, but prior to the next event.

### **Safety Director**

A safety director shall be in a strategic position to observe the activities, especially those near the starting and docking area. The safety director is responsible for stopping all activities involving violations of any of the safety rules.

In addition, the safety director is responsible for briefing paddlers on all known hazards prior to any paddling or racing, and as conditions warrant throughout the race competition.

### **Paddler Safety**

All paddlers shall be competent swimmers. All Paddlers shall wear a US Coast Guard-approved inherently buoyant (no inflatables) Type I, II or III Personal Flotation Device (life jacket) always while in a canoe during competition and/or practice. Wet suit buoyancy pads shall not be used as a substitute for the Coast Guard approved Personal Flotation Device.

### **Safety Guidelines**

***Participant safety is always the first priority.*** When scheduling and planning the races, consider all safety hazards, depending on location and circumstances, plan accordingly to mitigate them and decide what conditions would cause races to be cancelled. Each competition host has the authority to require safety equipment or procedures beyond the general requirements established for the Society-wide Competition. The recommendations below identify many common hazards, but not all eventualities are covered. It is strongly recommended that each hosting site perform a comprehensive evaluation of specific hazards and develop their own safety plan.

***Cold water*** can cause impaired judgment, loss of coordination and hypothermia within minutes. Paddlers, already excited about the races, may make unreasonably poor decisions when cold and becoming hypothermic. Being immersed in water as warm as 60°F can initiate Cold Water Shock. The American Canoe Association (reference below) recommends wetsuits for water temperatures less than 60°F and/or if the combined air and water temperatures are less than 120°F. Consider requiring wetsuits (full-body, sleeveless, or shortie depending on severity) and more safety boats to get paddlers out of the water quickly.

***Wind and waves, currents, obstruction, and other rough water*** can more easily swamp and break canoes. Carefully evaluate the proposed race site during a variety of weather conditions to have a good sense for how the water behaves. Depending on seasonal weather conditions, water may be higher or lower. For the canoes, consider requiring integrated grab handles, provisions for tied-in air bags (common flotation for whitewater canoes), and more stringent flotation requirements. Just like cold water, more safety boats may be required.

***Hazardous wildlife*** in and out of the water can cause anything from skin irritations and allergic reactions to more serious lacerations. Be sure to alert participants and monitor activities carefully.

***Lightning and storms*** are also very dangerous. Monitor the weather and remove everyone from the water when lightning and/or strong storms threaten.

## Additional Safety References

Following are a couple references to documents from the American Canoe Association ([www.americancanoe.org](http://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://cdn.ymaws.com/www.americancanoe.org/resource/resmgr/sei-educational\\_resources/best\\_practices.pdf](https://cdn.ymaws.com/www.americancanoe.org/resource/resmgr/sei-educational_resources/best_practices.pdf)

American Canoe Association. Cold Water Survival [PDF document]:  
[https://sfbaywatertrail.org/wp-content/uploads/2017/04/cold\\_water\\_survival.pdf](https://sfbaywatertrail.org/wp-content/uploads/2017/04/cold_water_survival.pdf)

# EXHIBIT 10

## Durability & Repairs

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### General

The durability of the Canoe Prototype with regards to how the Canoe holds up to the competition events, transportation, and general handling will be evaluated following the completion of the slalom races and the preliminary sprint races. All canoes shall be removed from the water to be evaluated by the judges for durability. Team captains shall be present with their canoes at the time of inspection and shall have with them any *Damage/Accident Report* (included in this Addendum) including written permission from the Judges/CNCCC for any tape already applied to the canoe. Any tape applied to the canoe, without written permission, is subject to a 25-point deduction. Tape used to secure gunwale protective caps/coverings and tape used to secure additional flotation material in order to pass the flotation test does not apply in this instance. The team captain shall be informed verbally if a point deduction is being assessed. The decision of the judges and/or CNCCC members is final and is not subject to appeal.

### Judging Criteria

Each judge will evaluate and score the canoe from 0 to 5 for Durability in this category on the updated Final Product Prototype Score Card provided with this Addendum. Things to consider regarding durability include, but not limited to – the frequency and severity of any microcracks, the frequency and severity of any structural cracks, areas where repairs with tape were needed, seaworthiness, damage/cracking to aesthetic elements, etc.

Damage sustained from race collisions shall not be considered when evaluating a canoe's durability.

### REPAIRS

#### Repairs Made During Competition

After on-site registration at the competitions, repairs shall only be made with tape. Any type of tape is allowed. Canoes shall be assessed an automatic deduction if the tape is used for repairs.

If the damage to the canoe occurs due to a collision, deductions for the use of tape shall not be assessed against a team. In the event of damage resulting from a collision, the team must first file a *Damage/Accident Report* (included in this Addendum) with the judges or CNCCC and must receive written approval before any tape can be applied. This applies to all instances that tape will be added (that is, permission to use tape to repair damage in one location does not give the team the freedom to put tape elsewhere; permission is needed for each instance).

#### Repairs Made Between Competitions

If the qualifying Canoe Prototype is damaged during the Conference Competition or between the Conference and National Competitions, the team may patch, repair, and refinish it following the submission and subsequent approval of a *Repair Procedures Report*. If the damage is deemed beyond repair, the team shall submit a *Reconstruction Request* to rebuild the canoe.

The *Repair Procedures Report* or *Reconstruction Request* must be formally requested from the CNCCC via e-mail at [cnccc@asce.org](mailto:cnccc@asce.org), completed and signed by the team captain(s) and ASCE Student Chapter Faculty Advisor, and received by the CNCCC within seven (7) business days of the date that an incident damaging the canoe occurred.

Refinishing (such as, but not limited to, additional sanding, repairing minor dents and cracks, and the reapplication of sealers) constitutes a repair and is subject to this section. The reapplication of letters is not considered to be a repair. Any proposed repairs shall be made using materials originally used during construction of the Canoe Prototype. If reconstruction or repair is granted, the canoe shall be of the same hull design, materials and concrete mixture proportions of the original canoe.

The *Repair Procedure Report* or *Reconstruction Request* must contain sufficient information regarding the cause and extent of damage and the proposed repairs (including, the methodology, repair materials, and area of damage) to enable the CNCCC to decide regarding the approval of repairs or granting permission to rebuild a canoe. The CNCCC will review the documentation and, if necessary, provide comments regarding compliance of the proposed repairs/reconstruction, suitability of the repairs, requests for additional information/details, etc. Schools are not to repair or reconstruct their canoe until written approval is granted by the CNCCC.

If the CNCCC does not permit the team to repair/reconstruct the canoe, the team shall be given an opportunity to decide whether it can safely, and in “good faith”, compete at the National Competition with a non-repaired canoe. If this requirement is not possible, the Student Organization shall forfeit to the designated alternate Student Organization concrete canoe team within their Conference.

If the CNCCC determines poor design or construction resulted in the damage to the canoe, the *Reconstruction Request* will be denied, and the next Conference qualifying team will be invited to the National Competition. If permitted to be re-built, the Canoe Prototype shall be of the same hull design, materials, and concrete mix design of the original canoe. If this is not possible, the team shall forfeit to the designated alternate concrete canoe team within their Conference.

The Repair/Reconstruction request, CNCCC disposition, and any supporting documentation shall be included as the last Appendix in the *Project Proposal*.

**Schools granted permission to repair their canoes shall be assessed a 25-point deduction at the National Competition. Schools granted permission to reconstruct shall be assessed a 50-point deduction at the National Competition.** The CNCCC reserves the right to waive the automatic deductions that may be assessed 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**

**Damage is due to 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*

<b>CNCCC Disposition</b>		
<b>Date:</b>		
<b>Request to Repair Canoe:</b>	<input type="checkbox"/> <b>Granted</b>	<input type="checkbox"/> <b>Declined</b>
<b>Reason for Disposition:</b>		

*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. The maximum final product points will be reduced to 75 out of 100 units. This penalty may be waived at the discretion of the CNCCC 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*

<b>CNCCC Disposition</b>		
<b>Date:</b>		
<b>Request to Reconstruct Canoe:</b>	<input type="checkbox"/> <b>Granted</b>	<input type="checkbox"/> <b>Declined</b>
<b>Reason for Disposition:</b>		

*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. The maximum final product points will be reduced to 50 out of 100 units. This penalty may be waived at the discretion of the CNCCC on a case by case basis.*

# EXHIBIT 11

## Evaluation Forms

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### GENERAL

The scoresheets will be filled out by the judges 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) one deduction scoresheet to be given to each team. See *Exhibit 10* for Damage/Accident, Repair, and Reconstruction Request Forms

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

### **INSTRUCTIONS - DEDUCTION SCORE CARDS**

1. The Symposium/Society-wide Final Judges shall come to a consensus on the determination of any infractions made by the team regarding the competition event.
2. Judges shall circle the unit value of the deduction in the "Deduction" column. The units of the deductions for the infractions are standardized (i.e., cannot be higher or lower than what is prescribed).
3. The Head Judge shall tally the deductions and initial his/her name next to it. At the Final Competition, a C4 member may tally the deductions in lieu of the Head Judge; however, the judges will make the determination of the infractions.
4. The total amount of deductions can exceed 100 units.
5. The Head Judge (or C4 member) shall provide all team captains with these forms to inform them of the deductions being assessed against them. Teams with no deductions will also be provided with these forms to assure anonymity.
6. The team captains shall indicate if they agree with the infractions and deductions or if they wish to appeal any of the infractions by signing the form. Teams that wish to appeal the infractions shall be given a reasonable amount of time to review the rules, obtain their supportive documentation, and provide the judges with their response. Teams are cautioned to be able to substantiate their appeals.
7. The Head Judge (or C4 member) shall indicate the day and time (deadline) that the team captains must submit the completed and signed form to the judges or C4 member.
8. Following the receipt of the form, the judges shall re-evaluate any infractions that the teams may appeal given the supportive documentation and render their final decision on the form. The Head Judge shall input the official total deduction, sign off on the form, and inform the team captains of the judges' decision. Once this is done, no further appeals regarding this matter will be entertained.
9. All appeals shall be handled prior to the Awards Ceremony. The final tally shall be inputted on the paper copy of the score sheet and in the electronic score sheet which is then officially ratified by the Head Judge. At the Final Competition, the Head Judge and the C4 will ratify the scores.

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 are given the option to request that the judges contact the C4 for rule interpretation (see *Request for Clarifications and Appeals*).

Project Proposal		25% of Overall Score	
School Name: _____ Canoe Name: _____		Possible Points	Score (whole numbers)
<b>Cover Letter, Table of Contents, Executive Summary, Intro to Project Team</b> Completeness, Clarity, Quality of Writing, Overall Layout & Format		10	
<b>Technical Approach</b> – Completeness and applicability to the response of the RFP as it related to the requested information for the following areas: Hull Design (10 points) Structural Analysis (15 points) Approach to Research & Testing Concrete Materials and Final Mix Selection, Reinforcement and Final Composite Material Selection (25 points) Construction Process (10 points)		60	
<b>Scope, Schedule, and Fee</b> Scope & Project Management (5 points) Schedule (Critical path, milestones, etc.) (5 points) Fee Summary Sheet (Appendix E) (5 points)		15	
<b>Health &amp; Safety</b> Overall and Material Testing & Construction, COVID-19 Impact		10	
<b>Quality Control &amp; Quality Assurance</b> Construction Related (5 points) Non-Construction Related (5 points)		10	
<b>Sustainability</b> – Completeness and applicability to the response of the RFP		5	
<b>Construction Drawings &amp; Specifications (11x17)</b> - Clarity & Ease of Understanding		10	
<b>Project Schedule (11x17)</b> - Completeness & Ease of Understanding		5	
<b>Concrete Mixture Materials and Proportions</b> Compliance of Materials to Proposal Specifications (Appendix B) and completeness of Mixture Design Table (10 points) Correct Math (all mixtures) & Thoroughness of Sample Mix Calculation (10 points)		20	
<b>Structural Calculations (Appendix C)</b> Thoroughness & Clarity of Calculation and Correct Math		15	
<b>Hull Thickness/Reinforcement and Percent Open Area (Appendix D)</b> Thoroughness & Clarity of Calculation and Correct Math		5	
<b>Innovation</b> - Incorporation of new, innovative ideas and concepts in the development of the prototype design, material testing, concrete mixture, construction, etc.		15	
<b>Overall</b> Conciseness and Clarity (5 points) Presentation of Information (5 points) Overall Layout and Format (5 points) Quality of Writing (5 points)		20	
<b>Subtotal</b>		<b>200</b>	
<b>Academic Judging – Project Proposal Total</b>			

Technical Presentation		20% of Overall Score	
School Name: _____ Canoe Name: _____		Possible Points	Score (whole numbers)
<b>Presenters</b> Preparation Level (10 points) Confidence/Voice Projection (6 points) Overall Demeanor (4 points)		20	
<b>Presentation</b> Quality of Audio/Visuals (10 points) Content (20 points) Professionalism (10 points)		40	
<b>Judges' Questions</b> Preparation/Expertise in Answers (20 points) Confidence Level (10 points) Conciseness of Answers (10 points)		40	
Comments:			
<b>Subtotal</b>		<b>100</b>	
<b>Deductions:</b> Failure to observe time limit: A penalty shall be assessed when the official time exceeds 5 minutes 5 seconds (5:05). 15 units Sponsorship or commercialism violation: 15 units Less than two (2) speakers: 15 units Failure to adhere to live presentation format: No Presentation Points			
<b>Academic Judging - Technical Presentation Total</b>			

Enhanced Focus Area		5% of Overall Score	
School Name: _____ Canoe Name: _____		Possible Points	Score (whole numbers)
<b>Selection Process for Enhanced Focus Area</b> Explanation of Selection Method and Process (5 points) Justification of Expected Value Added (5 points)		10	
<b>Summary of Enhanced Focus Area</b> Evaluation of Technical Results Value Added (5 points) Proposed Product Differentiation (5 points)		10	
<b>Enhanced Focus Area</b> Problem Statement (10 points) Technical Solution / Work Conducted (30 points) Results (10 points) Knowledge Transfer / Team Collaboration (10 points)		60	
<b>Presentation</b> Conciseness and Clarity (5 points) Effective Use of Visual Aids and Graphics (5 points) Overall Layout and Format (5 points) Quality of Writing (5 points)		20	
<b>Subtotal</b>		<b>100</b>	
<b>Academic Judging – Enhanced Focus Areas Total</b>			

# FINAL PRODUCT PROTOTYPE SCORE CARD

Evaluation Sheet from Judge: \_\_\_\_\_

Enter a numeric value (whole numbers) in category and tally the total score.

	Name of School	Canoe Workmanship (0 to 30 Points,)	Exterior and Interior Finish (0 to 25 Points)	Cross- Section Workmanship (0 to 20 Points)	Product Display (0 to 25 Points) <i>Required Items &amp; Overall</i>	Durability (0 to 5 Points) <i>*To be completed after Prelim Races*</i>	Total (100 pts. max)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

## FINAL PRODUCT PROTOTYPE

Below are a list of descriptions, guidelines, and things to consider while judging the Final Product Prototype. Note that these are not to be thought of as 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 build quality of a canoe. Most items in this category are related to construction of the canoe itself. Some things to consider include, but are not limited to:

- are there noticeable cold joints in the concrete;
- the “lumpiness” of the concrete;
- the consistency of the wall thickness;
- the consistency of concrete color(s);
- the consistency of concrete materials (i.e. are there clumps of fibers visible, are there other areas the concrete was clearly not mixed well, etc.);
- is there is any cracking or micro-cracking;
- is any reinforcement mesh visible;
- if there is any concrete chipped off (either due to poor construction or mishandling of the finished canoe);
- are there any other general quality control issues

**Exterior and Interior Finish** – The intent of the Exterior and Interior Finish is to mostly evaluate the post-construction processes and general aesthetics. Some things to consider include, but are not limited to:

- the smoothness of the finish;
- if there are noticeable voids/ “bug holes” in the concrete;
- the intricacy of graphics;
- how ‘clean’ the edges of the graphics are;
- the execution of various techniques used for creating the aesthetics (i.e. colored concrete, sand blasting, 3-D elements, etc.);
- evaluation 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. Some things to consider include, but are not limited to:

- is the cross-section full scale and is the mold shown
- is the cross-section representative of the construction process actually used;
- are all the layers of concrete shown and demonstrate the concrete casting process;
- are all the materials used shown (i.e. reinforcement, mold, graphics application, sealer, etc);
- are all the processes clearly labeled;
- if applicable, are there any components highlighting new or innovative processes;
- is the entire process from start to finish easy to follow

**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. Some things to consider include, but are not limited to:

- how the product display is organized and is it easy to find various components;
- are all the required sample items present and of proper size;
- are the items labeled and easy to read;
- if applicable, are there any components highlighting new or innovative processes;
- if there are more than the required items on the product display, do they help to provide insight to various tests or research performed during the project;
- are the product display, cross-section, and canoe stands effectively integrating the canoe theme
- is sustainability highlighted as relevant

**Durability** – See section 7.6 Durability and Repairs and Exhibit 10.



# PROJECT PROPOSAL DEDUCTION SCORE CARD

School: \_\_\_\_\_

Infraction	Deduction
	(Circle those that apply)
A. Use of plagiarized material	No Project Proposal Points
B. Project Proposal over specified number of pages ( _____ page(s))	x 10 units/page _____ Units
C. <i>Project Proposal</i> , or <i>MTDS Addendum</i> received after deadline ( _____ days) x 10 units/day	_____ Units
D. Failure to submit a <i>Preliminary Project Schedule</i> , <i>Pre-Qualification Form</i> , and/or <i>Letter of Intent</i> by deadline	10 Units

**Total Deductions (Project Proposal)** \_\_\_\_\_ Units

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

\_\_\_\_\_

Teams shall have until (day/time) \_\_\_\_\_ to either agree with the infractions listed above or to appeal the decision and provide supportive documentation.

## FOR TEAM CAPTAINS ONLY

- ☐ We agree with the infractions and deductions applied to the Project Proposal
- ☐ We wish to appeal the following infractions (*circle those that apply*):

A B C D

\_\_\_\_\_  
Team Captain

\_\_\_\_\_  
Team Captain

## FOR COMPETITION OFFICIAL USE ONLY

Upon review of the Appeal Form (and any supportive documentation) provided by the team captain:

- ☐ The deductions originally determined by the judges shall stand.
- ☐ The deductions for the following infractions shall be rescinded (*circle those that apply*):

A B C D

The total deduction for the Project Proposal is \_\_\_\_\_ Points.

\_\_\_\_\_  
Head Judge

# ENHANCED FOCUS AREA DEDUCTION SCORE CARD

School: \_\_\_\_\_

Infraction	Deduction (Circle those that apply)
A. Use of plagiarized material	No Project Proposal Points
B. <i>Enhanced Focus Area</i> over specified number of pages ( ____ page(s)) x 10 units/page	_____ Units
C. <i>Enhanced Focus Area</i> received after deadline ( ____ day(s)) x 10 units/day	_____ Units
<b>Total Deductions (Enhanced Focus Area)</b>	_____ Units

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

\_\_\_\_\_

Teams shall have until (day/time) \_\_\_\_\_ to either agree with the infractions listed above or to appeal the decision and provide supportive documentation.

## FOR TEAM CAPTAINS ONLY

- ☐ We agree with the infractions and deductions applied to the Project Proposal
- ☐ We wish to appeal the following infractions (*circle those that apply*):

A B C

\_\_\_\_\_  
Team Captain

\_\_\_\_\_  
Team Captain

## FOR COMPETITION OFFICIAL USE ONLY

Upon review of the Appeal Form (and any supportive documentation) provided by the team captain:

- ☐ The deductions originally determined by the judges shall stand.
- ☐ The deductions for the following infractions shall be rescinded (*circle those that apply*):

A B C

The total deduction for the Enhanced Focus Area is \_\_\_\_\_ Units.

\_\_\_\_\_ Head Judge

# FINAL PRODUCT PROTOTYPE DEDUCTION SCORE CARD

School: \_\_\_\_\_

Infraction	Deduction (Circle those that apply)	
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. Reinforcement thickness exceeds 50% of canoe thickness	No Final Product Points	
C. Use of Bondo®, epoxy, or similar materials for construction or repairs	No Final Product Points	
D. Use of more than 3 concrete mixtures	No Final Product Points	
E. Use of prohibited materials	No Final Product Points	
F. Flotation not within 3 ft of bow and/or stern or flotation not encased in concrete (prior to flotation test at ASCE Student Symposium)		10 Units
G. Non-compliant or non-approved concrete, admixtures, or finishing materials		15 Units
H. Canoe does not meet dimensional constraints		15 Units
I. Reinforcement does not meet Percent Open Area requirements		15 Units
<b>Society-wide Only</b>		
J. Reported concrete oven dry unit weight compared to measured unit weight	0-5 Units	____ Units
K. Reported weight of canoe not within $\pm 10$ lbs. of the measured weight		15 Units
L. School granted permission to repair /reconstruct canoe		25 / 50 Units
<b>Flotation Test:</b> PASS / FAIL		50 Units

**Total Deductions (Final Product Prototype)** \_\_\_\_\_ Units

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

\_\_\_\_\_

Teams shall have until (day/time) \_\_\_\_\_ to either agree with the infractions listed above or to appeal the decision and provide supportive documentation.

- ☐ We agree with the infractions and deductions applied to the Project Proposal
- ☐ We wish to appeal the following infractions (*circle those that apply*):

A B C D E F G H I J K L

\_\_\_\_\_  
Team Captain

\_\_\_\_\_  
Team Captain

Upon review of the Appeal Form (and any supportive documentation) provided by the team captain:

- ☐ The deductions originally determined by the judges shall stand.
- ☐ The deductions for the following infractions shall be rescinded (*circle those that apply*):

A B C D E F G H I J K L The total deduction for the Final Product Prototype is \_\_\_\_\_ Points.

\_\_\_\_\_  
Head Judge

# REQUEST FOR CLARIFICATIONS AND APPEALS

**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):**

**Nature of Inquiry:**

- ( ) Project Proposal
- ( ) Enhanced Focus Area Report
- ( ) Technical Presentation
- ( ) Final Product Prototype
- ( ) Race Demonstration
- ( ) Other: \_\_\_\_\_

**Briefly Describe Nature of Inquiry or Appeal: (Continue on reverse side if more space is needed).**

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

**Rules & Regulations Section(s) Referenced:**

**Team Captain's Signature:** \_\_\_\_\_

**Team Captain's Signature:** \_\_\_\_\_