Third International Interactive Symposium on UHPC

https://www.regcytes.extension.iastate.edu/uhpc/

Student Competition

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Timeline:

Announcement and start of competition	**December 6th, 2022**
Phase I:	
• Submission of Written Report and Video	**By February 28, 2023**
• Judging Complete & Notice to Finalists	**By March 7, 2023**
Phase II:	
• Arrival of specimens for final testing	**By April 29th, 2023**
Phase III:	
• Winners Attendance at Conference	**June 4 - 7, 2023**

Competition Synopsis:

As part of the Third International Interactive Symposium on Ultra-High-Performance Concrete (UHPC), a student competition will be held to grow interest in the area of UHPC amongst engineering and architecture students. The competition will be open to students across the world and will require finalists to attend the symposium during which the winners will be announced.

The basic premise of the competition will be developments of innovative mix designs of UHPC in different categories that will be mainly evaluated for their compressive strength per the guidelines below.

Definition of UHPC:

For this competition, UHPC is defined as a binder composite with non-continuous fiber reinforcement. The maximum particle size and maximum fiber length are limited to 25 mm and 50 mm, respectively. The maximum fiber volume fraction is limited to 5%, and a minimum spread of 170 mm as per ASTM C1437 is required.

Categories for the competition:

Each competing team can participate in **one or both** of the following categories:

Classic: ***Normal weight UHPC*** with a maximum specific gravity at testing of 2.7
regular curing conditions* – minimum compressive strength of 120 MPa (17.4 ksi)

Extra light: ***Light weight UHPC*** with a maximum specific gravity at testing of 1.5
regular curing conditions* – minimum compressive strength of 80 MPa (11.6 ksi)

* Special treatment is not allowed, such as steam curing, heat treatment or pressure curing. The testing institution will reserve the liberty to test the material for reaction products which form under special treatment. The competing team will be disqualified if special treatment has been used to cure the cylinders.

Invitation to the final competition:

The competition consists of a written report based on work done at the competing team's educational organization. The written report will be judged on content depending on the categories mentioned above. Up to **20 finalists (teams)** in each category will be invited to submit their specimens for testing to the Advanced Cementitious Materials and Composites (ACMC) laboratory at the University of Connecticut. The shipping details will be shared with the finalists at notice.

Student teams can consist of up to 4 students per team; all members of the team must be enrolled in an undergraduate or graduate program. Each student team must have a supervising faculty advisor. A student representative from the team must be present at the UHPC symposium to receive the award. More than one team per institution is welcome in the competition. The same mixture design cannot be used among several teams from one institution.

Student Deliverables:

As part of the competition, the student teams must first submit a written report that will be reviewed and judged. Not more than **20 teams in each category** will be invited to ship their specimens.

The selected winners of the competition from each category will receive their award during the UHPC Symposium in Wilmington, Delaware, USA on June 6, 2023.

Phase I: Written Report:

The written report (max. 2 pages) must include the following:
(a template is available as download):

1. The category in the competition that the team would consider for competing as classified above.
2. Table and explanation of the mixture design used (in kg/m^3), including cost in US dollars of each constituent and total cost of the mix per m^3. Teams may modify a proprietary mixture or develop their own mix. The specimens are only allowed to be fiber reinforced. No other means of reinforcement will be allowed.
3. Summary of your results, which includes:
    a. Preliminary compressive load at failure results in the average of three 3 in. x 6 in. (75 mm x 150 mm) cylinders as described in Appendix A (in MPa).
    b. Age of UHPC at testing (preferably at age of 28 days).
    c. The specific gravity of produced UHPC.
    d. Curing and specimen preparation
    e. Flow test results per ASTM C1437 - Standard Test Method for Flow of Hydraulic Mortar – including a picture.
4. Supplemental information, which include photos of the flow testing, the UHPC cylinder before and after testing, and a 10 second video showing the flow test, failure and peak load of the cylinder during compressive testing.

Teams are responsible for the materials used to cast the UHPC cylinders. No materials will be provided. The details in the report are required to make sure the tested specimens are submitted in the right specified category.

Due date: **February 28th 2023**

Phase II: Submission for testing specimens

Teams invited to ship their specimens for testing in Phase II will compete for the winners and must follow the guidelines below.

1. Shipping of **two** 3 in. x 6 in. (75 mm x 150 mm) cylinders for final compressive strength testing in the lab specified when noticed for finalists. The cylinders need to be clearly labeled with the name of the institution, and casting date. It is preferred to receive the specimens with load surfaces already ground. However, in case of insufficient grinding quality, the testing institution will ground the specimens as specified in Appendix A.

2. The specimens should arrive at the test institution no later than April 29, 2023. Ideally the age of the cylinders should be less than 28 days at arrival.
   (The shipping address will be shared when the finalists are notified.)

3. Clearly identify the educational organization, team, category, and casting date on the side of the cylinders.

4. Providing a summary power point slide about the team and concrete mixture
   (template will be made available to finalists)

Samples will be competed and judged according to the **ratio of highest compressive strength / specific gravity** among each specified category. Only one of the two provided specimens will be arbitrarily chosen and tested for its compressive strength at the rate specified in the modifications in ASTM C1856 for UHPC testing. A video will be recorded for each test by the testing laboratory and the video record can be provided if required by the competing team. The testing laboratory will record the dimensions of the specimen, its weight, and the compressive load at failure. The collected data will be provided to judges for a final decision of the winners in each category.

Phase III: Prizes for winners

A student representative from the team must be present at the competition to receive the award.

1. $500 – first place team (in each category) + certificate.
2. $250 – second place team (in each category) + certificate.
3. $100 – third place team (in each category) + certificate.
4. Participation certificates for other competitors.

Contact information:
If you have any questions, feel free to reach out to:
Kay Wille – University of Connecticut at **kay.wille@uconn.edu.**

Appendix A – UHPC Compression Testing Procedure for Reporting Purposes

Compressive Strength

1. Determine the compressive strength of cylindrical specimens made from UHPC in accordance with Test Method ASTM C39/C39M with the rate of loading specified in the modifications in ASTM C1856 for UHPC testing, with the exceptions described in this section.

2. Only 3 in. (75 mm) diameter x 6 in. (150 mm) long cylindrical specimens shall be used for compressive strength testing of UHPC.

3. Prior to testing, all cylinders shall be end ground such that neither end of test specimens shall depart from perpendicularity to the axis by more than 0.5° (approximately equivalent to 1 mm in 100 mm). The ends of compression test specimens (cylinders) that are not plane within 0.050 mm shall be ground to meet that tolerance.

   For Phase I and Phase II: the teams are encouraged to do their best in cylinder end grinding *Prior to testing the cylinder strength for the finalists of phase II the testing institution will check the quality of the cylinder ends and if necessary will grind them to fulfill the requirements stated above.*

4. The diameter used for calculating the cross-sectional area of the cylindrical test specimen shall be determined to the nearest 0.1 mm by averaging two diameters measured at right angles to each other at about mid-height of the specimen.