ACI Egg Protection Device Competition

Fall 2025 - Baltimore, MD, USA

Responsible Committee(s)

239 - Ultra-high performance concrete

239-E – Educational outrage for UHPC

Objectives

Design and build the highest-impact-load resistant ultra-high performance concrete (UHPC) egg protection device (EPD). Learn about and report on the sustainability, durability, impact resistance, and other benefits of UHPC.

Prizes

Prizes will be awarded based on technical performance. Scoring is described in Part 6 of the Rules. First, Second, and Third place entries will each be awarded a certificate of recognizion, will be recognized in Concrete International magazine if space allows, and will be recognized on ACI's website. In addition, the First Place team will receive a \$750 award, the Second Place team will receive \$500, and the Third Place team will receive \$250. Awards and overall results will be announced during the Student Awards on Monday, October 27, 2025.

Aesthetics Evaluation

Teams may optionally participate in the aesthetics portion of the competition, where they will design and/or decorate their EPD according to the theme *Cultural History of Baltimore*. For details on the aesthetics evaluation, refer to *Addendum 1 - Aesthetics* on the ACI competition webpage.

Rules

- 1. Eligibility
 - 1.1. This competition is open to teams of 3-8 students currently enrolled in an undergraduate college or university program.
 - 1.2. Only one team per school is eligible for this competition.
 - 1.3. All team members must be from the same school.
 - 1.4. Individuals may not be part of more than one team.
 - 1.5. Each team must have a supervising faculty advisor to provide guidance and to help understand and ensure compliance with the rules of the competition.
 - 1.6. Each team must have one (1) primary contact person.
 - 1.7. One or more team member(s) must attend the competition and be present during the testing of the specimen. The judges will assign a check-in time in advance of the competition.
- 2. Specimen and Testing Configuration
 - 2.1. Teams will produce one EPD for impact testing and three cubes for compression testing.
 - 2.2. EPDs
 - 2.2.1. The basic structure of the EPD is shown in Figure 1.



Figure 1. EPD dimensions (dimensions in mm)

- 2.2.2. Shall not exceed 400 mm (15.75 in) in width, 250 mm (9.84 in) in height, and 200 mm (7.87 in) in depth.
- 2.2.3. Shall include an opening that allows clear passage of a rectangular template measuring 275 mm (10.83) in width and 175 mm (8.27 in) in height.
- 2.2.4. Shall include a flat spot on its top face where the impact load will be applied. The flat spot shall measure at least 100 mm (1.98 in) in all directions and shall not be raised above the surrounding area by more than 12 mm (0.47 in).
- 2.2.5. Shall include a footing on each side where the EPD will contact the base plate. Each footing shall not exceed 50 mm (1.97 in) in width and 200 mm (7.87 in) in depth. No other portion of the EPD may contact the base plate.
- 2.2.6. Shall not exceed 12.00 kg (26.46 lbs) in mass.
- 2.2.7. Shall be cast monolithically from a single batch of UHPC.
- 2.2.8. Shall be cured to a solid state (i.e., no fresh concrete).
- 2.2.9. May be decorated using approved materials and techniques.
- 2.2.10. Shall not be modified in any manner after they are submitted for competition.
- 2.3. Cubes
 - 2.3.1. Shall measure either 50x50x50 mm or 2x2x2 in.

- 2.3.2. Shall be cast from the UHPC matrix only, comprising the same ingredients and proportions as the UHPC mixture but without fibers.
- 2.3.3. Shall not be ground, resized, or otherwise modified after demolding.
- 2.4. All specimens
 - 2.4.1. Shall be cured at atmospheric pressure at temperatures lower than the boiling point of water.
 - 2.4.2. Shall be cast no more than 56 days prior to the competition date.
 - 2.4.3. Shall be indelibly marked with a five-digit identification code matching the code in the team registration.
- 3. Material
 - 3.1. Teams may use either proprietary UHPC products consisting of one or more components mixed as specified by the manufacturer OR non-proprietary UHPC materials produced using individually sourced components mixed at proportions determined by the team.
 - 3.1.1. Non-proprietary UHPC mixtures shall only include:
 - 3.1.1.1. Binders consisting of any combination of portland or blended cements meeting ASTM C150, C595, or C1157, and supplementary cementitious materials meeting ASTM C618, C989, C1240, 1697, or C1866.
 - 3.1.1.2. Chemical admixtures meeting ASTM C494.
 - 3.1.1.3. Natural or manufactured aggregates, not including metallic aggregates.
 - 3.1.1.4. Fibers (see 3.3).
 - 3.2. Decorative materials shall be limited to materials that are explicitly intended for use in concrete as stated in the material technical datasheet.
 - 3.3. EPDs may be fiber reinforced.
 - 3.3.1. Fibers shall conform to the specifications of ASTM C1116 Section 4.
 - 3.3.2. Fibers shall be added to the fresh concrete during the mixing stage. Fibers shall not be manually placed during casting. Directional casting to provide preferential fiber orientation is permitted.
 - 3.3.3. Fibers shall not exceed 50 mm in length or 2 mm in any other dimension.
 - 3.3.4. EPDs shall not include any additional reinforcement, embedments, inclusions, or coverings.
- 4. Report
 - 4.1. Each team shall prepare a written report, not to exceed 8 pages, with the following structure:
 - 4.1.1. Cover page identifying the team name, names of team members, name of advisor, name of school, and the five-digit identification code provided in the team registration.
 - 4.1.2. Photographs and descriptions of the mold and mold fabrication procedures, batching and mixing procedures, and specimen(s) and specimen fabrication procedures.

- 4.1.3. Detailed descriptions of the materials and mixture proportions:
 - 4.1.3.1. For proprietary UHPC:
 - 4.1.3.1.1. Report the trade name, supplier and/or manufacturer, and other relevant details of the product used.
 - 4.1.3.1.2. Describe the components used in the mixture and the process by which it was designed (e.g., specified by the manufacturer).
 - 4.1.3.1.3. Describe the process by which the properties of constituent materials were determined (e.g, provided by supplier, measured per ASTM C128, etc...).
 - 4.1.3.1.4. Include a completed mixture proportion worksheet as an appendix .
 - 4.1.3.2. For non-proprietary UHPC:
 - 4.1.3.2.1. Describe the materials used in the mixture and the process by which it was designed.
 - 4.1.3.2.2. Describe the gradation of aggregates. Include a gradation curve as an appendix (see 4.f).
 - 4.1.3.2.3. Describe the process by which the properties of constituent materials were determined (e.g, provided by supplier, measured per ASTM C128, etc...).
 - 4.1.3.2.4. Include a completed mixture proportion worksheet as an appendix.
- 4.1.4. Detailed descriptions of casting and curing procedures, including date of casting and predicted compressive strength of cubes, in MPa
- 4.1.5. Appendices (not to be included in the page limit):
 - 4.1.5.1. Completed mixture proportion worksheets.
 - 4.1.5.2. Technical data sheets and/or mill certificates for all manufactured products used (data sheets are not required for mixing water or natural aggregates).
 - 4.1.5.2.1. An acceptable substitution for technical data sheet(s) is a signed and dated letter from a technical representative of the manufacturer stating the material meets the requirements of these rules. The judges reserve the right to contact the technical representative listed or another representative of the manufacturer to inquire about the specific suitability of the material application. Teams found to be fabricating or otherwise misleading the judges will be disqualified.
 - 4.1.5.3. Aggregate gradations, unless included in technical data sheets.
- 4.2. Items 4.1.1 4.1.5 shall be combined into a single searchable PDF and submitted via the online portal by the date listed in Section 8.
- 4.3. Failure to provide sufficient evidence of compliance with any part of the Rules may result in disqualification.
- 5. Qualification and Testing Procedures
 - 5.1. Qualification

- 5.1.1. The EPD and cubes will be weighed, measured, and checked for compliance with the Rules.
- 5.1.2. The Judges reserve the right to conduct additional inspections as needed. If, at any time during or after the competition, an entry is found not to comply with the Rules, the team will be disqualified.

5.2. Report Grading

5.2.1. Reports will be graded from 0 to 100% following the rubric in Table 1. Details about report requirements are included in Part 4 of the Rules. Teams will be ranked in order of decreasing score (higher is better). Teams with identical scores will earn the same rank.

Category	Weight (%)
Formatting	10
Cover page	5
Photographs - mold and fabrication	10
Photographs - batching and mixing	10
Photographs - specimens and fabrication	10
Materials and mixture proportions	15
Casting and curing procedures	15
Appendices - mixture proportion worksheets	15
Appendices - Technical data sheets and aggregate gradations (as required)	10

Table 1. Report rubric

5.3. Cube Test

- 5.3.1. Two cubes will be tested in compression at a loading rate of 1.7 MPa/s (250 psi/s).
- 5.3.2. Cubes will be loaded on their molded faces.
- 5.3.3. The team score will be the sum of:
 - 5.3.3.1. The percent difference between the average compressive strength and the predicted compressive strength; and
 - 5.3.3.2. The percent difference between the two measured compressive strengths.
- 5.3.4. Teams will be ranked in order of increasing score (lower is better).
- 5.4. Impact Test

- 5.4.1. EPDs will be loaded by dropping a 5-kg weight from progressively increasing heights (between 0.5 and 4 m) until the EPD fails. The exact loading sequence will be released after the registration deadline.
- 5.4.2. EPDs will be considered to have failed if:
 - 5.4.2.1. The egg cracks due to structural damage or concrete spalling.
 - 5.4.2.2. The EPD becomes unstable and can no longer support its own weight.
 - 5.4.2.3. If the egg falls due to vibration and is damaged, testing will continue using a new egg.
- 5.4.3. Teams will be ranked according to the highest impact load survived during testing. In the event of a tie, teams will be further ranked according to the lightest EPD.
- 6. Scoring
 - 6.1. The final score will be the weighted average of the team's ranking in the impact test (60%), cube test (20%), and report (20%).
 - 6.2. Teams will be ranked according to the lowest score.
 - 6.3. In the event of a tie, teams will be further ranked according to the lightest EPD.
 - 6.4. An example of scoring is shown in Table 3.

Category	Weight	Team A	Team B	Team C	Team D
Impact test (rank)	60%	1	2	4	3
Cube test (rank)	20%	2	1	3	4
Report (rank)	20%	3	1	4	2
EPD mass (g)	Tiebreaker only	2340	1975	1760	2020
Final score		1.6	1.6	3.8	3.0
Final ranking		2	1	4	3

Table 3. Scoring example

7. Judging

- 7.1. Judges will be appointed by the sponsoring committee(s).
- 7.2. The judges retain the right to interpret, modify, or eliminate any section(s) of these rules as special circumstances arise.
- 7.3. The judges have final determination regarding what is acceptable for continued participation in the competition.
- 7.4. Teams may be disqualified if they:
 - 7.4.1. Do not follow the Rules.

- 7.4.2. Miss the deadlines for registration or submission.
- 7.4.3. Check in either too early or too late on the day of the competition.
- 7.4.4. Exhibit unsafe, disruptive, offensive, or unprofessional behavior.
- 7.4.5. Submit EPDs or test specimens that do not conform to these Rules.
- 7.5. At the judges' discretion, disqualified teams may be allowed to continue participating in the competition, but they will not be eligible for prizes.
- 7.6. Egregious violations of the Rules may result in removal of a Team from the competition and/or loss of eligibility for future competitions.
- 8. Registration and Submission
 - 8.1. Advance registration is required.
 - 8.2. Registration and submission deadlines are summarized in Table 4.
 - 8.3. On-site check-in times will be assigned at least one week before the competition. Checkin times may be as early as 7:30 AM on the day of the competition.
 - 8.4. Failure to register or submit the EPD Report by the relevant deadlines, regardless of the reason, will result in disqualification.
 - 8.5. Failure to check in and submit physical specimens at the designated on-site check-in time, regardless of the reason, may result in point penalties or disqualification, at the sole discretion of the judges.

Task	Description	Deadline
Team registration	Complete and submit team registration form on ACI competition website	Friday, September 3, 2025 at 11:59 PM ET
Report submission	Submit report and supporting materials as a single PDF on ACI competition website	Friday, October 3, 2025 at 11:59 PM ET
Check-in & specimen submission	Check in with judges and submit EPD and beam	Sunday, October 26, 2025 at designated on-site check-in time

Table 4. Summary of deadlines

9. Contact Information

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