

The 2022 International Concrete Dragon Boat Competition

(ICDBC-2022)

1. Background

Concrete is one of the most important modern materials. To reflect the cutting-edge progress of concrete research and technology, encourage students for innovation, cross-disciplinary and creative thinking, the 2022 International Concrete Dragon Boat Remote Competition (ICDBC-2022) will be organized on the June 5, 2022, in Jiaxing, Zhejiang, China. The competition promotes professionalism, technology, sportsmanship, entertainment, and synergy. The event is of great significance to combine cultural heritage inheritance with the study of modern science and technology, as well as cross-culture communication and collaboration. The competition is organized by Zhejiang University, Zhejiang University-University of Illinois Institute and cosponsored by American Concrete Institute (ACI) and other organizations.

This document provides the rules and regulations of the competition. The guiding principle is to encourage innovation and implementation of state-of-the-art new technologies.

2. Overview of Competition

2.0 General rules

The team should be formed primarily by undergraduate students. The team of players should independently design and build a concrete dragon boat model ship that meets the specified size and shape requirements and has the corresponding remote navigation capability. Each contestant team needs to submit a concrete dragon boat model ship and a report to the designated location before the competition.

The competition consists of three parts:

1. design (technical paper and presentation);
2. experimental validation (hull parameter measurement, material tests);
3. racing competition (straight-line racing, obstacle maneuver). Each part of the game has a corresponding score, and the final score of each team is weighted and summed as the final score, and the ranking of the game is determined.

2.1 Design Essential Elements

- 1) The influence of the geometric scale of the concrete dragon boat hull;
- 2) Buoyancy and gravity calculation of concrete dragon boat hull;
- 3) Aggregate selection, concrete proportioning design and reinforcement design;
- 4) Stability of the hull in fluid, anti-overturning design, sealing and waterproofing;
- 5) Hull strength, internal force analysis and reinforcement calculation;
- 6) Dragon boat CFD simulation analysis

2.2 Optimized Design

- 1) Optimized hull shape to reduce fluid resistance;
- 2) Engine layout and control system performance for improved stability and maneuverability;
- 3) Artistic presentation (dragon boat decoration);

2.2 Key date and venue

Date (2022)	Arrangement	Location
Before April 5	Promotion and registration	On-line
Before June 2	Design, manufacture, pre-racing	Own arrangement
June 2	Submit paper, video	concretedragon@zju.edu.cn
June 4, 2022	Check in	Zhejiang Univ. Int. Campus, Haining
June 5, 2022	Official competition	Zhejiang Univ. Int. Campus, Haining

3. Competition Contents

3.1 Entry requirements and registration method

- ① Due to the organizational capacity and time limit of the event, the event is an invitational tournament. The participation is free, but the teams are responsible for their own cost for all other need. In principle, participants are required to be students currently enrolled in the full-time undergraduate programs and participate in teams. Each team is normally formed with three to five students. Each university is in principle, limited to up to two teams to participate in ICDBC-2022. Participants must submit registration information online, at URL: www.concretedragon.org
- ② Each team can only submit one model and should name the boat preferably in Chinese characters.
- ③ Each student is only allowed to participate in one team, and each team should independently complete the project design and model construction.
- ④ The team must register on-line by the deadline. Each team shall participate according to the competition rules and send the boat model to the organizer. Failure of sending the boats and participating on line in time will be disqualified.

3.2 Competition Rules

3.2.0 Hull production

As shown in Figure-1, the concrete hull structure (decorative faucet tail is not included) shall have a length (the front end to the hull end) of 80cm to 100cm. The height and width are not regulated but are recommended as 9.0cm-20.0cm for the height and 5.0cm-30.0cm for the width. The shape of the hull is freely designed by the competitors, however, in principle, it is required to conform to the shape of the dragon boat in the traditional sense.

Suggested materials: concrete made with cement-based binder, foam templates, water reducing agents, lightweight sands, steel wire or steel bars, FRP, multi-channel remote control equipment, motors, batteries, tapes, screwdrivers, utility knives, hot melt adhesives, etc. The

participants are allowed to add materials or adjust the ratio of materials when preparing the concrete. The volume ratio of concrete material in the hull shall not be less than 50% and should be clearly stated in the technical paper.

Concrete dragon boat hull structure must be made of concrete except the skeleton. Cement based materials should be at least 50%. If the boat hull is made of plastic products, acrylic board, wood and other prohibited materials, the team will be disqualified from the competition.

The hull of the model boat should be decorated by the player to preferably achieve the image of the dragon boat. Several examples are shown in Figure-2, for reference only.

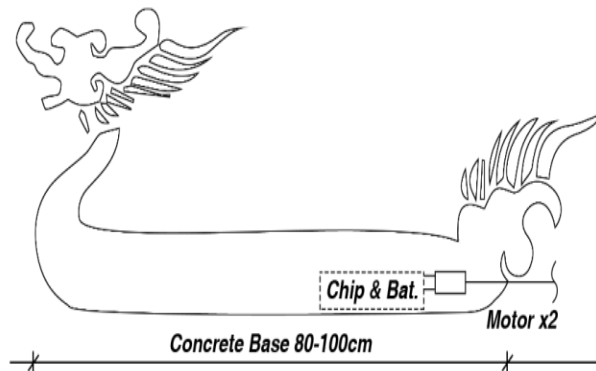


Figure-1 Model dragon boat hull size



Figure-2 Example of a dragon boat model

The power engine system is recommended to use the remotely controlled double electric motors (the example motor model is RK-380PH-4733) and double propellers. Each remote control and receiving device correspond to a specific radio frequency number. Before the competition, the team shall be sure to provide the organizer the specific operating frequency and shall be confirmed by the organizer. Unconfirmed remote controls may not be able to enter the competition due to possible interference with the event. The ratios of motor power and boat weight, as well as speed will be counted as indexes for final score.

3.2.1 Technical Report

A) **Technical Paper:** Submitted in PDF format, no more than 10 pages in 12-point font. The template of the technical report can be downloaded from the official website of concrete dragon boat. The content and specific requirements can be detailed in the template description. **Website:** www.concretedragon.org/download/

B) **PPT video recording:** no longer than 3:30 minutes with screen ratio of 16:9. It should include team introduction, origin of dragon boat name, technical description, etc.

C) **Team photo:** One electronic photo of the participating team members and the concrete dragon boat.

D) **Exhibition report:** uniform size 60*80cm, submitted in PDF file format (print by the organizing committee).

E) **File naming format:** all files shall be named as "university + dragon boat name", for example: XX University-XXX.

3.2.2 Time Schedule

(1) May 30, 2022

electronic version of the exhibition newspaper send the electronic version to the organizer's email address: concretedragon@zju.edu.cn. The subject of the email and the attachments should be named as "XXX University + Name of Dragon Boat".

(2) June 2, 2022

Before 23:59 on June 2, the participating teams should pack the electronic draft of the technical paper, PPT video recording and group photo together with the compressed file, and send the electronic version to the organizer's email address: concretedragon@zju.edu.cn. The subject of the email and the attachments should be named as "XXX University + Name of Dragon Boat".

(3) June 4, 2022

June 4 before 16:00, teams arrived International Campus of Zhejiang University for registration, familiar with the racing track, testing the dragon boat, dragon boat used measuring dragon boat size is in accordance with the requirements and at the same time of dragon boat gravity data, submit concrete test, the lottery group and get the number for the second day of the game.

(4) June 5, 2022

The opening ceremony will be held at 9:00 am on June 5. After that, the competitors will have the PK competition in the designated area according to the order and group of the draw. Commissioning of the vessel and charging/replacing of batteries will be carried out at noon.

Starting at 13:30 p.m., the steeplechase race will take place at the designated venue according to the order of draw.

After the completion of all competitions, the judges will calculate the total score of all teams on the spot, and award the Grand Prize, First Prize, Second Prize, Third Prize and Individual Awards such as Creative Design Award.

Finally, the award ceremony and closing ceremony were carried out.

4. Competition Rules

4.1 Hull index inspection

Before the start of the race, measure the size and weight of each dragon boat (the quality of the whole dragon boat, along with the power plant, signal receiving device, and the bow and stern decoration, etc.), test the structure of the main part of the dragon boat, confirm whether the concrete dragon boat meets the requirements of production.

4.2 Strength test

Each team is required to make 4 concrete testers (length: 10.0cm, width: 2.0cm, thickness: 1.0cm) for loading and impact test. The test pieces shall be able to reflect the hull structure, including the use of reinforcement, fiber reinforced materials and cement and concrete matrix of the same specification and proportion. In the static load test, the test pieces will be damaged. If illegal substances are found in the test pieces, and the hull structure cannot be proved, the result of the strength test will be cancelled.

During the test, the staff randomly selected two specimens for static load test and one specimen for impact test. Please mark on the test strip the name of the participating school and the dragon boat and the front and back of the test.

a) Loading test

In the static load test, the universal testing machine will test and load the specimen strip for failure. The staff will randomly select two test pieces and measure the maximum strength of the concrete test pieces through the universal testing machine loading. The average value of the maximum strength of the two test pieces will be taken as the result, and the average value of the static load test bearing capacity of each participating group will be given the corresponding score according to the ranking. The total score is 10.

b) Impact test

Drop hammer impact test is 100g weight falling impact from the initial drop of 20.0cm; If successful, the second impact test will be carried out, and the drop will be increased by 20.0cm. Additional tests were added successively until the drop reached 100.0cm and no additional tests were added. After each impact, the total residual deformation does not exceed 2% of the span, that is, no fracture, no crack is the success of the impact loading. The total score is 10 points, with 2 points for each increase of 20.0cm. 100.0cm is the full score.

4.3 Straight Line racing PK race

Straight line racing PK competition by the competitors draw groups, each time by two dragon boats at the same time for straight line racing, the first to reach the end of the team to win, the winning team will enter the next round of PK competition, the second round of opponents will be in the same area in another group of winning team for the second round of PK competition, until the straight line racing PK competition.

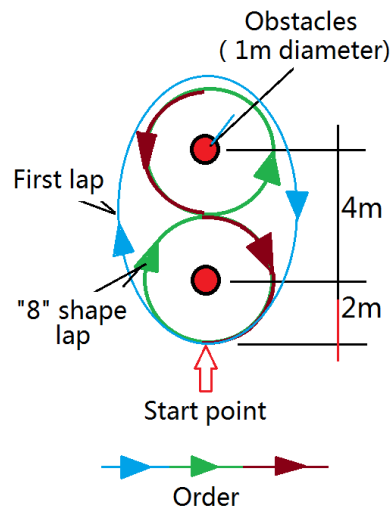
During the race, the two dragon boat operators stand in front of the starting point and place the dragon boat in the designated area. After the signal gun is fired by the referee, the dragon boat is controlled by the remote control to speed forward in a straight line until it passes the finish line. The staff records the time spent by each dragon boat to complete the straight line to the finish line at the finish line. A total of 15 points will be scored according to the rank of the straight-line race, Champion: 15, runner-up: 12.5, Final 4:10, Final 8:7.5, Final 16:5, Finisher: 2.5, Unfinished Player: 0. The champion prize, runner-up prize and third-place prize will be set separately.



2022 ICDBC -- straight line racing PK competition

4.4 Obstacle race

The steeplechase is held in the central lake of Zhejiang University International Campus. The steeplechase consists of two laps, and the teams are drawn in turn. The operator stands in front of the starting point. After the referee's signal gun is fired, he controls the dragon boat to drive around the obstacles through the remote control. The boats need to complete two "O" and "S" circles along the route until he returns to the starting point. The staff records the time taken by each group to complete the obstacle race. If the competition cannot be completed within 3 minutes, there will be no score in this round of obstacle race. Each team has two chances to challenge, and pick the best one as final score. The total score of obstacle competition is 15 points, of which 15 points are ranked and given corresponding points by the referee group according to the length of obstacle competition. According to the result of finishing obstacle course, the shortest T_{min} is 15 points, the interval of $(T_{min}, T]$ is 14.5 points, the interval of $(T, T+1t]$ is 14 points, and the interval of $(T+1t, T+2T]$ is 13 points, and so on, each increase of $1T$ is decreased by 1 point, until the interval of $(T+9t, T+10t]$ is 5 points. The interval of $(T+10t, T+20t)$ is 4 points, 3 points for completing the race over $T+20t$, and 0 points for not completing the race. Where, T and T are determined according to the actual situation of the competition.



The Third International Concrete dragon boat race -- the schematic diagram of obstacle race track

4.5 Attention:

- It's a foul for the referee to start sailing before firing the signal gun. The result of the race will be cancelled for two fouls.
- If the contestants cannot participate in the competition on time due to their own reasons, they will be deemed as abandoning the competition.
- The size of the competition area is about 60 meters \times 8 meters, and each channel is about 4 meters wide. There are two channels in total. The boat channel is delimited by circular buoys floating on the water, and each track is separated by buoys.
- Each group of dragon boats is not allowed to enter other racetracks, otherwise the race score may be cancelled.
- If the model breaks down or loses control in the competition, resulting in the suspension or sinking of the ship, the staff will salvage the model and exit.

- f) In case of any situation beyond the rules, the technical committee shall be consulted to make a fair assessment.

4.6 Other projects

- a) Appearance design: judged by the judging team, according to the beauty, artistry and structural rationality of the Dragon Boat works, the total score is 10.
- b) Exhibition of works: judged by the judging team, the total score is 15 points according to the exhibition board and PPT defense video of each team.
- c) Technical papers: judged by the referee team, according to the technical papers submitted by each team, the total score is 25.

5. Scoring

Project	Detail	Total score: 100
Design	Aesthetic, artistic and reasonable in structure	10
Exhibition of works	including technical background, dragon boat design, calculation, material ratio and design, etc.	15
Technical papers	include appearance and geometric performance, structural performance and calculation, introduction of concrete batching, design scheme of electronic control system, design aesthetics, CFD simulation analysis of ship model, hull data, etc. (see the template description of technical papers for details).	25
The strength test	loading test and drop weight test.	20
Obstacle race	The race is 15 points, and the ability to pass obstacles is 5 points	15
PK competition	According to the straight-line PK competition position, and separate awards are set up.	15

6. Award

The Organizing Committee of the competition selects well-known experts from all over the world to form an evaluation committee to comprehensively evaluate the entries according to the design theme, design concept, design effect and competition results.

The awards are as follows:

- Special Prize (1 team), certificate of Honor and bonus of RMB 5000 YUAN;
- First prize (3 teams), certificate of honor and bonus of RMB 2000 YUAN each;
- Second prize (6 teams), certificate of honor and bonus of RMB 500 YUAN each;
- Third prize (10 teams), certificate of honor and bonus of RMB 200 YUAN each;
- Innovation award (several), certificate of honor;
- Best design award (several), certificate of honor
- Best report award (several), certificate of honor
- Best paper award (several), certificate of honor
- Best technology award (several), certificate of honor
- Cultural Inheritance award (several), and certificate of honor

Spiritual civilization award (several), and certificate of honor

Straight line racing PK champion award (1 team), trophy, certificate of honor and bonus of RMB 2000 YUAN;

Straight line racing PK second award (1 team), trophy, certificate of honor and bonus of RMB 1000 YUAN;

Straight line racing PK third award (1 team), trophy, certificate of honor and bonus of RMB 500 YUAN.

7. Others

Website: www.concretedragon.org

Email: concretedragon@intl.zju.edu.cn

Tel: 86 0571-87572532

Address: 718, Haizhou East Road, 1C, engineering building, Zhejiang University (International Campus), Haining City, Zhejiang Province

Concrete Dragon Boat Organizing Committee Secretariat