

IBRACON COCAR 2014

1 OBJECTIVE

1.1 This contest intends to test the competitors' abilities on to develop high strength colored concretes.

1.2 The proposed challenge consists of molding a cubic specimen with a 10 cm edge, using a colored concrete that has the capacity to reach high compressive strength, foreseen in this Regulation.

1.3 This Regulation sets the requirements to be attended in order to participate in this contest, provides the guidelines to prepare the specimens and defines the ranking criteria. It also provides information about the offered awards by IBRACON to the winner teams.

2 PARTICIPATION

2.1 In order to participate in this Contest, the teams must be composed by architecture, civil engineering or technology students from any state of Brazil or from other countries, since the students are enrolled in academic year in a program authorized by *Ministério da Educação* (MEC) or respective higher education organisms from foreign countries.

2.2 Each team must be composed by students from a single educational institution.

2.3 There is no restriction regarding the number of participants in each team.

2.4 It is allowed the inscription at the most of two specimens per educational institution.

2.5 It is not allowed the participation of any member in more than one team.

2.6 Each team must be guided by a professor from the respective educational institution. This professor must ensure the team conformity with the rules established in this Regulation and sign the Responsibility Term (Annex 3) for the team participation in this contest.

3 TEAMS APPLICATION

3.1 The application must be carried out by the e-mail cocar@ibracon.org.br, until September 20, 2014.

3.2 At the registration, each team must submit the following documents:

- a) Application Form properly filled in (Annex 1);

- b) Technical Report properly filled in (Annex 2);
- c) Responsibility Term signed by the team's supervisor professor (Annex 3);

4 HANDLING THE SPECIMENS

4.1 The specimens must be handled at the Convention Center in Natal/RN, where the 56th Brazilian Concrete Congress takes place.

4.2 **The handling shall be realized on October 7th, 2014, from 5pm to 8pm or on October 8th, 2014, until 10am.**

4.3 As soon as the Organizer Committee receives the specimen, it must verify if every specimen attends the dimensional (5.2.1), form (5.2.1), marking (5.2.4) and homogeneity and finishing (5.2.5) requirements. The realization of these procedures must be accompanied by a member of each team. The noncompliance with these requirements disqualifies the team.

4.4 If the specimen is accepted by meeting the 4.3 requirements, the team will receive identification from the Organizer Committee that confirms its participation in the Contest and the specimen will be retained by the Committee until the moment of the tests.

4.5 It will not be accepted specimens handled by thirds.

4.6 The date of the test will be reported when the team handles the specimens.

5 CAST THE SPECIMEN

5.1 Materials

5.1.1 Portland Cement and active cementitious mineral admixtures

For concrete proportioning, any type of Portland cement must be used and informed on its technical data sheet. In the case of teams from foreign countries, it is allowed the use of Portland cement produced in the team's country since it is properly identified in its technical data sheet.

It is allowed the use of admixtures, since the main binding agent is Portland cement.

5.1.2 Aggregates

Fine and coarse aggregates shall have stony nature or other origins (metals, industries, etc.). The aggregates can have a continuous grading curve, but the maximum dimension of the coarse aggregates is restricted to 25 mm (see ABNT NBR NM 248).

The quantity of coarse aggregates must not be less than 30% of the concrete mass. It is known that coarse aggregates are those which grading curves presents 95% of the aggregates retained on the 4.75mm sieve.

5.1.3 Fibers

The use of fibers is forbidden.

The verification of the presence of any kind of fibers in the concrete (minerals, plant, metallic, propylene, polyethylene or other) will disqualify the team.

5.1.4 Chemical Admixtures

It is allowed the use of admixtures according to ABNT NBR 11768.

In the case of teams from foreign countries, the use of chemical admixtures must be restricted to equivalent products in Brazil. The characterization and the Technical Standard of this product shall be informed.

5.2 Executive procedure

5.2.1 Specimens characteristics

The specimens must be cubic, with 100 mm on each edge. The tolerance is 2 mm for each dimension.

5.2.2 Compaction

The compaction process can be manual or mechanic and it must be informed on the Technical Report.

5.2.3 Curing

The curing process can be chosen by the teams. It is allowed moist-cure at ambient temperature, thermo-controlled cure and other procedures, since they are described on the Technical Report.

5.2.4 Laboratorial Procedures

The laboratorial procedures must follow the Brazilian Technical Standard (ABNT) requirements, when relevant.

5.2.5 Marking

It is not allowed to identify the specimen with a logo or with the institution name, in order to do not influence in its aesthetic.

5.2.6 Homogeneity and finishing

The specimens will be test under axial load in an orthogonal direction to the compaction, without any finishing to the surfaces that will be in contact with the press machine. Therefore, the lateral surfaces must be flat and without saliences or any kind of defect that may stain the concrete surface.

Painting or sanding cannot be used to improve its aesthetics or to rectify the faces in contact with the press machine.

It will not be accepted specimens with similar color to concrete.

The specimen must be homogeneous, with the same composition throughout its mass. It will not be accepted specimens with cores of different materials (this condition will be verified after the compressive strength test).

6 TEST

6.1 Steps

The test consists of three steps, and each of them will be scored independently, according to the specimen's performance.

The Organizer Committee will be responsible for the tests realization, and the presence of a member of each team to accompany its development is obligatory.

The test steps are informed bellow and described in detail from 6.2 to 6.4:

- Step 1: specimen's characterization;
- Step 2: determination of compressive strength;
- Step 3: inspection of the internal homogeneity of the specimen.

6.2 Step 1: Dimensions, density, color

The specimen's dimensions must be determined and registered with 0.1 mm accuracy. The specimen that does not attend the dimensions, considering the tolerances provided in 5.2.1, will be disqualified.

The specimen's color must be jointly and comparatively evaluated, and it will be attributed a color coefficient to each specimen. Therefore, all specimens must be placed over a flat and white surface, forward to a white background, placed on a way to unite them by color similarity, forming a gradient to each tonality (red, blue, yellow and other tonalities). The criteria to attribution of the color coefficient is qualitative and must attend what is established in Table 1, depending on the position of the specimen within the set formed by all specimens of competitors in the same tonality.

Table 1 – Color coefficients of the specimens

Color gradient of specimen's concrete	Color coefficient (C)
Concrete a: More vivid or more intense coloring	1,00
Concrete b: Less intense coloring than Concrete a	0,90
Concrete c: Less intense coloring than Concrete b	0,80
Concrete d: Less intense coloring than others	0,70

The specimens must be placed in a way to permit the observation to everyone.

The evaluation of the specimens is visual and will be made by consensus among the organizer commission members with the assistance of the Pantone Colors Table (Annex 4), considering there is no distinction between the chosen tonalities, but the color intensity of each specimen will be evaluated.

NOTE It may occur that a certain tonality does not reach the maximum tonality coefficient reached by others.

6.3 Step 2: Compressive strength

After its characterization (Step 1), the specimens must be submitted by axial compressive strength under a $(0,45 \pm 0,15)$ MPa/s loading velocity. The maximum breaking load (F) obtained with three decimal places, in kiloNewtons (kN), shall be registered.

This value will be considered on the final score calculation to each team.

The compressive strength of each specimen shall be calculated by the following equation:

$$f_c = \frac{F}{d_1 \cdot d_2}$$

where:

f_c is the compressive strength of the specimen, in megaPascals (MPa);

F is the maximum load registered on the compressive strength test, in kiloNewtons (kN);

d_i are the edges' dimensions measured on the ruptured faces of the specimen, in millimeters (mm).

6.4 Step 3: Analysis of the specimens internal homogeneity

The specimens submitted by compressive load must be visually analyzed to prove its homogeneity, the existence or not of internal cores or non-permitted materials on this Regulation will be checked. The finding of heterogeneity of the specimen disqualifies the team.

6.4 Step 4: Final Score

The Final Score (PF) of each specimen must be calculated by the following equation:

$$PF = f_c \cdot C$$

Where:

f_c is the compressive strength of the specimen, in megaPascals (MPa), determined on Step 2 (6.3)

C is the color coefficient, obtained at Step 1 (6.2, Table 1)

The final score value will be presented with four decimal places accuracy.

The rating of the teams will be realized considering the final score in descending order.

NOTE Therefore, the specimens with higher score will receive the best ratings.

7 SCORE AND RATINGS CRITERIA

7.1 Rating ascending by results

The rating will continue until all the specimens have been rated.

The team with the highest final score will be considered winner. The second and third places will be from the teams with specimens rated in this sequence.

Teams who registered more than a specimen will be rated by the specimen with the best performance. In this case, the specimen with the lowest score of each team will be disregarded.

The noncompliance of this Regulation disqualifies the team, even after the ending of the Congress and the specimens of the five best rated teams may be collected for verification as to its compliance.

Disqualified teams will have its procedures evaluated by the Judging Commission and may be prevented from participate for one or two editions of this contest.

7.2 Tiebreaker

In the event of a tie between teams with the same resistances and same color coefficient, it will be considered the winner the team whose specimen has the lowest mass.

8 ORGANIZER COMMITTEE

The Organizer Committee is formed by IBRACON members that represent the region of the event and the National Coordination. The members of the Organizer Committee will be revealed during the 56th Brazilian Concrete Congress 2014.

The Organizer Committee is responsible for receiving and verifying the specimens, determining the color coefficient, realizing the compressive strength test and evaluating the compliance with this Regulation.

The divulgation of results will be made by IBRACON's Board of Directors on the awards event of the 56th Brazilian Concrete Congress.

More information can be reported to the Organizer Commission by the e-mail cocar@ibracon.org.br.

The team that win first place will be awarded a prize of R\$ 3.000,00 (three thousand Reais). The three teams with highest scores will receive, during the awards event of the 56th Brazilian Concrete Congress, the plaques relatives to the reached result on this contest.

9 PRIZES

The team that win first place will be awarded a prize of R\$ 3.000,00 (three thousand Reais). The three teams with higher scores will receive, during the awards event of the 56th Brazilian Concrete Congress, the plaques relatives to the reached result on this contest.

**ANNEX 1
APPLICATION FORM**
**1st COCAR COMPETITION
NATAL/RN - 2014**

Educational Institution				
Team members	Name	E-mail	Registration n.	Ibracon's membership n.
Professor mentor			--	
Team's Captain				

At the time of registration, attach the logo of the educational institution and the team photo to this Application Form.

**ANNEX 2
TECHNICAL REPORT
1st COCAR COMPETITION
NATAL/RN - 2014**

Educational Institution:

Material proprieties of concrete components

Material	Identification/ type/brand	Precedence/ producer	Density kg/m ³	Maximum dimension of the aggregate mm	Fineness modulus of the aggregate	Observations
Cement						
Water						
Aggregate 1						
Aggregate 2						
Aggregate 3						
Cimentitious Admixture 1						
Cimentitious Admixture 2						
Admixture1						
Admixture 2						

Attach the Technical Report of the used cement

Composition of concrete

Material	Quantity kg/m ³
Cement	
Water	
Air-entrained	
Aggregate 1	
Aggregate 2	
Aggregate 3	
Cimentitious Admixture 1	
Cimentitious Admixture 2	
Admixture 1	
Admixture 2	

Concrete properties

Determination	Used method (Technical Standard)	Value	Unit
Slump			mm
Compressive Strength			MPa

Information about the specimen's execution process

Molding date		(day/month/year)
Temperature and curing process		°C
Summarize how the concrete was prepared and how the compaction process was realized.		

**ANNEX 3
RESPONSIBILITY TERM**

**1st COCAR COMPETITION
NATAL/RN - 2014**

**TO
INSTITUTO BRASILEIRO DO CONCRETO
A/C: 1st COCAR ORGANIZER COMMITTEE**

RESPONSIBILITY TERM

I, (Name of the mentor professor), RG, (CI, CREA or CAU)....., Mentor Professor of the team, from(Name of education institution)....., send to the 1st IBRACON Competition – COCAR 2014 Organizer Committee this Responsibility Term which I declare that the specimens registered in this competition are in conformity with the respective Regulation.

I certificate that all the registered students are architecture, engineering or technology students of this education institution.

I also declare to be aware that any noncompliance with the Regulation will disqualify the team, that will have its procedures evaluated by the Judging Commission and may be prevented from participate for one or two editions of this competition.

....., 2014.

(Full name and signature of the mentor professor)

(Registration number on respective education institution)

ANNEX 4 PANTONE TABLE OF COLORS

