

2nd CONTEST REGULATION

HIGH STRENGTH COLORED CONCRETE - COCAR 2015

1 OBJECTIVE

1.1 This contest intends to test the competitors' abilities on preparing 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 specimen and defines the ranking criteria. It also provides information about the offered prizes by IBRACON to the winner teams of this challenge.

2 PARTICIPATION

2.1 To participate in this Contest, the teams must be composed by technology or architecture and civil engineering or 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 agency from foreign countries.

2.2 Each team must be composed by students from a single educational institution and it is mandatory that at least one component of the team must be registered in the 57th Brazilian Concrete Congress 2015.

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

2.4 The team must elect one of its students as the team's leader. This student must be an IBRACON membership.

2.5 It is allowed the inscription of at the most two specimens per educational institution. In other words, if the institution is represented by only one team, they can participate at the most with two specimens.

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

2.7 Each team must be guided by a professor from the respective educational institution. This professor must be an IBRACON membership and ensure the team conformity with the rules established in this Regulation, signing the Technical Report (Annex 2) and the Responsibility Term (Annex 3) for the team participation in this

competition.

3 TEAMS APPLICATION

3.1 To perform the application, each team must submit the **Application Form (Annex 1)** properly filled until **July 30, 2015**.

3.2 The **Technical Report (Annex 2)** properly filled and the **Term of Responsibility (Annex 3)**, both signed by the team's professor mentor, must be submitted until **September 30, 2015**.

3.3 The documents above described must be submitted by e-mail to **cocar@ibracon.org.br** until the deadlines.

4 HANDLING THE SPECIMENS

4.1 The specimen must be handled at the Contests Arena in the Convention Center of Bonito/MS, where the 57th Brazilian Concrete Congress takes place.

4.2 **The handling shall be realized on October 27th, 2015, from 5pm to 8:30pm.**

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

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

4.5 It will not be accepted specimens handled by thirds or after the deadline.

4.6 It will not be allowed any changes in the specimen after it has been delivered.

4.7 The tests will take place at **2pm** on **October 28, 2015**.

5 MOUNTING THE SPECIMEN

5.1 Materials

5.1.1 Portland Cement and active mineral cementitious materials

For concrete mixture, any type of Portland cement, domestic or imported, currently



commercialized or normalized must be used and informed its datasheet.

It is allowed the use of active mineral cementitious materials since the main binding agent is Portland cement.

5.1.2 Aggregates

It must use fine and coarse aggregates of a stony nature or other origins (metals, industries, etc.), **except limestone aggregates**. 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 **50%** 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

It is not allowed the use of any kind of fibers.

The verification of the presence of any kind of fibers in the concrete (minerals, vegetables, metals, 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 equivalents products in Brazil. The characterization and the Technical Standard of this product shall be informed.

5.2 Executive Procedure

5.2.1 Specimen Characteristics

The specimens must be cubic, with 100 mm on each edge (not chamfered). 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

Os procedimentos laboratoriais devem seguir as prescrições das Normas Técnicas Brasileiras (ABNT), sempre que pertinentes.

5.2.5 Markings

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 on 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 salience 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.

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 TESTING

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: specimen's characterization

The specimen's mass must be determined in a balance with 1 g accuracy and the dimensions be registered by measuring the specimen edges 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 evaluated by its intensity, according to the color pallet illustrated in Figure 1.

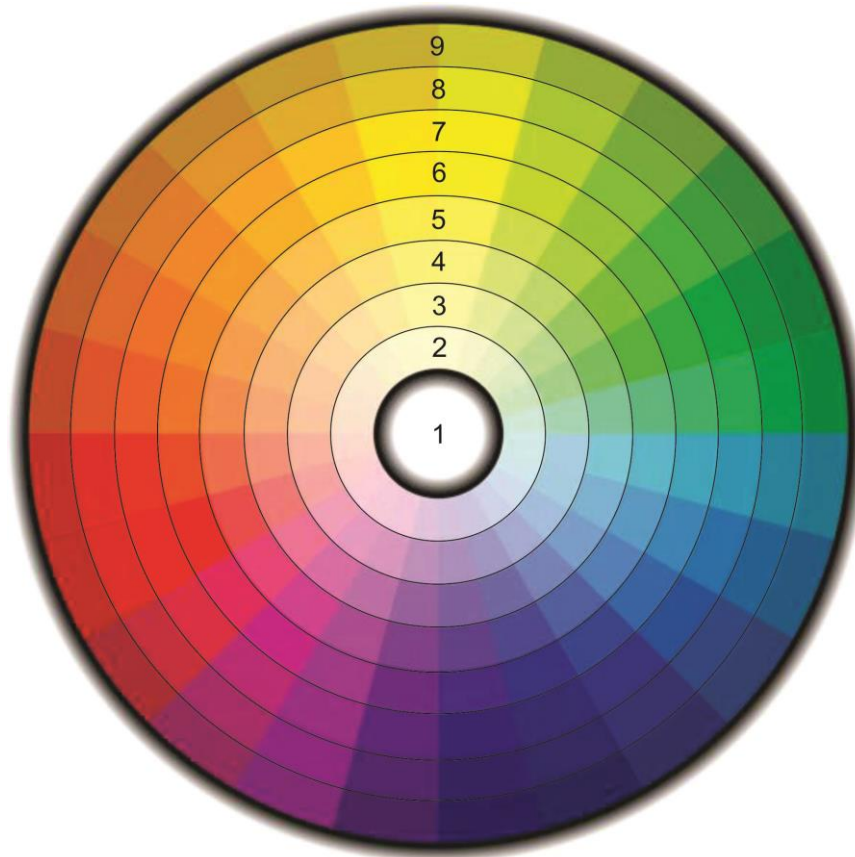


Figure 1 – Color pallet to define the color coefficient

The criterion 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 of colors of the pallet illustrated in Figure 1.

Table 1 – Color coefficients of the specimens

Color gradient of concrete specimen	Color coefficient (C)
1	0,00
2, 3 and any other color out of the pallet	0,70
4 e 9	0,80
5 e 8	0,90
6 e 7	1,00

The evaluation of the specimens is visual and will be made by consensus among the Organizer Commission members and the team leader with the assistance of the color pallet at the moment the specimen is handled.

6.3 Step 2: determination of compressive strength

After its characterization (Step 1), the specimens must be submitted by axial compressive strength in a fixed plate press, 200 t capacity, 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: inspection of the internal homogeneity of the specimen

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.

6.5 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 in 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.

7 RANKING OF THE TEAMS

7.1 Ascending sort by results

The ranking of the teams will be based on the final score for the tested specimens, in a descending order.

It will be considered the winner the team which the specimen obtains the highest final



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score. The second and third places will be from the teams with specimens rated on 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. The specimen 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 for the final score, the winner team will be the one which the specimen has the lowest density. During the realization of the event, the mass of each specimen will be known only by the team that prepared it and the Organizer Committee.

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 57th Brazilian Concrete Congress 2015.

The Organizer Committee is responsible for receiving and verifying the specimens, determining the color coefficient, realizing the resistance tests and evaluating the compliance of this Regulation.

The divulgation of results will be made by IBRACON's Direction on the awards event of the 57th Brazilian Concrete Congress.

More information can be reported to the Organizer Commission by the e-mail [**cocar@ibracon.org.br**](mailto:cocar@ibracon.org.br).

9 PRIZES

The team winning first place will be awarded a cash prize (the value of which will be released from 30/04 on the contest website). The three teams with highest scores will receive, during the awards ceremony of the 57th Brazilian Concrete Congress, the plates allusive to the reached result in this contest.

**ANNEX 1
APPLICATION FORM**
**2nd COCAR CONTEST
BONITO/MS - 2015**

Educational Institution				
Team members	Name	E-mail	Registration number	IBRACON's membership number
Professor mentor			--	
Team's Captain				

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

**ANNEX 2
TECHNICAL REPORT
2nd COCAR CONTEST
BONITO/MS - 2015**

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						
Cementitious Material 1						
Cementitious Material 2						
Admixture 1						
Admixture 2						

Annex the Technical Report of the used cement

Concrete composition		Concrete properties			
Material	Quantity kg/m ³	Determination	Used method (Technical Standard)	Value	Unit
Cement		Slump			Mm
Water		Compressive strenght			MPa
Air-entrained					

Information about the specimen's execution process		
Molding date		(day/month/year)
Temperature and curing process		°C
Detail the concrete preparation, checking the weight of materials, etc. and include photos of every steps.		

Team's professor mentor signature

**ANNEX 3
RESPONSABILITY TERM**

**2nd COCAR CONTEST
BONITO/MS - 2015**

**TO
INSTITUTO BRASILEIRO DO CONCRETO
A/C: 2nd COCAR ORGANIZER COMMITTEE**

RESPONSABILITY 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 2nd IBRACON Competition – COCAR 2015 Organizer Committee this Responsibility Term in 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 educational 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.

..... 2015.
(Full name and signature of mentor professor)
(Registration number on respective education institution)