



IMC

Students'

Challenge

Maximum Compressive Load
of Masonry Prisms

3rd Announcement
October 2013

1 Introduction

The “**IMC Students’ Challenge**” is an initiative of the Organizing Committee of the 9th International Masonry Conference, to be held in Guimarães, Portugal, during July 7-9, 2014. This competition is sponsored by EuLA - the European Lime Association.

The objective of this competition is **to predict the maximum compressive load** of two masonry prisms built with solid bricks, or hollow blocks, and mortar joints.

This document establishes the rules for the competition.

2 Objective

The prisms will be built in the Structural Lab of the University of Minho 240 days before the conference. They will be tested during the conference with an eccentric load.

The objective of this competition is to predict the maximum compressive load of the masonry prisms. The team with the closest prediction of the failure load with a sound report (maximum 10 pages + annexes) wins the competition.

A detailed description of the geometry of the prisms, of the bricks and blocks, of the mortar, and of the testing conditions, as well as all selected material properties are provided to the participants by the organizers.

3 Materials & specimens geometry

Two types of prisms will be built: a) hollow concrete block masonry and b) solid brick masonry, see Figure 1a. The tests will be carried out with an eccentric load under displacement control at constant velocity (quasi-static test). Annex A provides details of the setup configuration and of the masonry units adopted.

The mortar to be used has a volumetric ratio of 1:1:6 (cement – lime – sand), using materials according to European norms (CEM II/B-L 32,5N; CL 90-S; natural sand).

After construction, the mortar samples and the masonry prisms will be conserved in a climatic chamber: 7 days at 20°C and 95% relative air humidity and until the testing day at 20°C and at 60% of relative air humidity.

The geometry of the prisms is given in Figure 1. Note that the load has an eccentricity of 33 mm, and the mortar joints have 10 mm of thickness.

The eccentric compressive tests will be carried out 240 days after the specimens’ construction. Before testing the masonry prisms, several tests will be made in the masonry components according to Table 1. The results of the tests, carried out at 14 and 28 days after specimens’ construction, will be announced to the teams with a maximum of three days

after testing in the structural lab at the University of Minho (during November and December, 2013). For each test, a short report will be produced, including force-displacement diagrams.

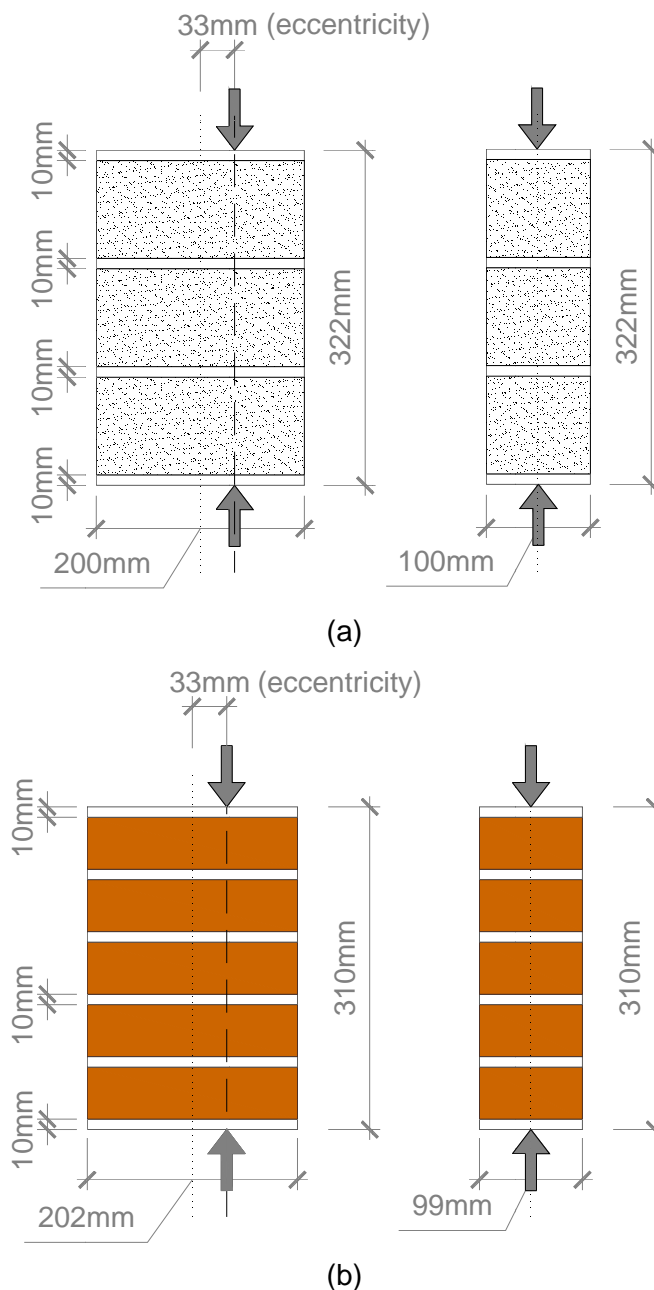


Figure 1 – Geometry of specimens with eccentric load application: a) concrete hollow prisms (front and lateral view); and b) brick prisms (front and lateral view)

Table 1 – Testing schedule for all materials and specimens (European norms used)

Materials or specimens	Type of Test	Important dates			
		08-11-2013 (0 days)	22-11-2013 (14 days)	06-12-2013 (28 days)	07-07-2014 (240 days)
Mortar	Density		3 specimens	3 specimens	-
	Compressive strength	Specimens construction	3 specimens	3 specimens	-
	Flexural strength		3 specimens	3 specimens	-
Masonry units	Density		3 specimens per masonry unit type	-	-
	Compressive strength	Specimens preparation	3 specimens per masonry unit type	-	-
	Flexural strength		3 specimens per masonry unit type	-	-
Masonry prisms	Eccentric compression test	Specimens construction	-	-	3 specimens for each type of masonry units

4 Deliverables

Each team should send a report with the predicted response, describing the adopted hypotheses, methods used, calculations and estimated maximum values. The principles and the theoretical background supporting the response predictions, the innovative character of the analysis, the creativity and the theoretical soundness will also be evaluated. Students are encouraged to use a formal and scientific style in their reports.

The winning team will give a short presentation about their work, focusing on the most important aspects of their theoretical analysis and models.

Prior to the conference, each team must submit the following three documents in pdf format:

- The registration form
- The report (pdf format) according to the table of contents presented in Annex B
- An A1 sized poster (59.4 x 84.1cm, 23.39 x 33.11 inches)

The registration form must be sent until the **31st of January, 2014**. The report and the poster must be sent to the conference organization before the **15th of June, 2014**.

During the conference, at least one team member must present the printed poster on a special Poster Session dedicated to the “**IMC Students’ Challenge**”.

5 Teams

Each team must consist of no more than three students currently enrolled in a MSc or PhD program. All members of a given team must belong to the same institution. A student may not be a member of more than one team.

Each team must have an advisor from the teaching staff of their institution, who will confirm that the students' team complies with the rules of the competition. The institution advisor can only supervise one team.

At least one team member designated to represent each team must be present at the IMC Students' Challenge, which will take place during the 9th International Masonry Conference, to be held in Guimarães, Portugal, July 7-9, 2014. During the IMC Students' Challenge, the team members can take part in the lab tests.

6 Time Schedule

The schedule for the competition, including the testing procedure, is the following:

- Reception of the registration forms: **31st of January, 2014;**
- Reception of the report and poster from the participating teams: **15th of June, 2014;**
- Specimens testing at the University of Minho Structural Laboratory: **7th of July, 2014**
- Poster presentation (A1 size) during the conference sessions **7-9 July, 2014;**
- Winners' announcement: **8th of July, 2014.**

7 Evaluation Criteria

The evaluation will consider two main aspects:

- Criterion A is related to the objective quantification of the estimated maximum load obtained by the two specimens, given by a maximum of 20 points as the average of the two predictions: $20 \times [1 - \text{abs}(1 - \text{Estimated Force} / \text{Experimental Force})]$, rounded up to an integer; and
- Criterion B is related to the evaluation of the report by the Scientific Committee of the competition, given by a maximum of 20 points, rounded up to an integer.

The final grade is given by the following formula:

$$\text{Final Grade} = 2 \times \text{Grade of Criterion A} + 1 \times \text{Grade of Criterion B}$$

In case of equal scores, the grade in Criterion B ranks the teams.



8 Prizes and awards

The results of the competition, winners and a brief summary of the proposals submitted will be published on the IMS web page and in the newsletter of the Institute for Sustainability and Innovation in Structural Engineering (ISISE). This publication will give visibility and emphasize the most creative and innovative aspects of the teams' work.

The winning teams will be awarded with the following prizes:

- 1st Prize: € 750 (seven hundred and fifty euro);
- 2nd Prize: € 500 (five hundred euro);
- 3rd Prize: € 250 (two hundred and fifty euro).

The winning team must give a 5 minute presentation emphasizing the most important aspects of their work. This presentation will be given in the prize ceremony of the IMC Students' Challenge during the 9th International Masonry Conference (8th of July 2014).

Honour mention certificates may be granted to participating teams that, although not winning, are selected for having submitted outstanding proposals considering the main evaluation parameters referred to earlier.

9 Support and Grants

50% reduction on student registration fees will be available to the first twenty team members that register to the conference. Additionally, the first eight teams that submit the registration form will have a grant of € 500 (five hundred euro) per team for traveling and accommodation (this applies only for the first team of a given institution).

Guimarães, October 2013

The 9thIMC Challenge Organizing Committee

Luís F. Ramos, University of Minho

Ad Vermeltoort, Eindhoven University of Technology

Paulo B. Lourenço, University of Minho

9th International Masonry Conference

July 7, 8, 9 2014
Guimarães, Portugal



IMC Students' Challenge

Registration Form



European
Lime
Association

(Please use caps letters)

Team Name: _____

Supervising Institution Advisor Name: _____
(Corresponding student and the one to attend the IMC)

Institution: _____

Address: _____

Country: _____

E-mail: _____

Telephone: _____ Telefax: _____

1st Student Name: _____
(Corresponding student and the one to attend the IMC)

PhD Student MSc Student Telephone: _____

E-mail: _____

2nd Student Name: _____

PhD Student MSc Student Telephone: _____

E-mail: _____

3rd Student Name: _____

PhD Student MSc Student Telephone: _____

E-mail: _____

Annex A – Lab test setup

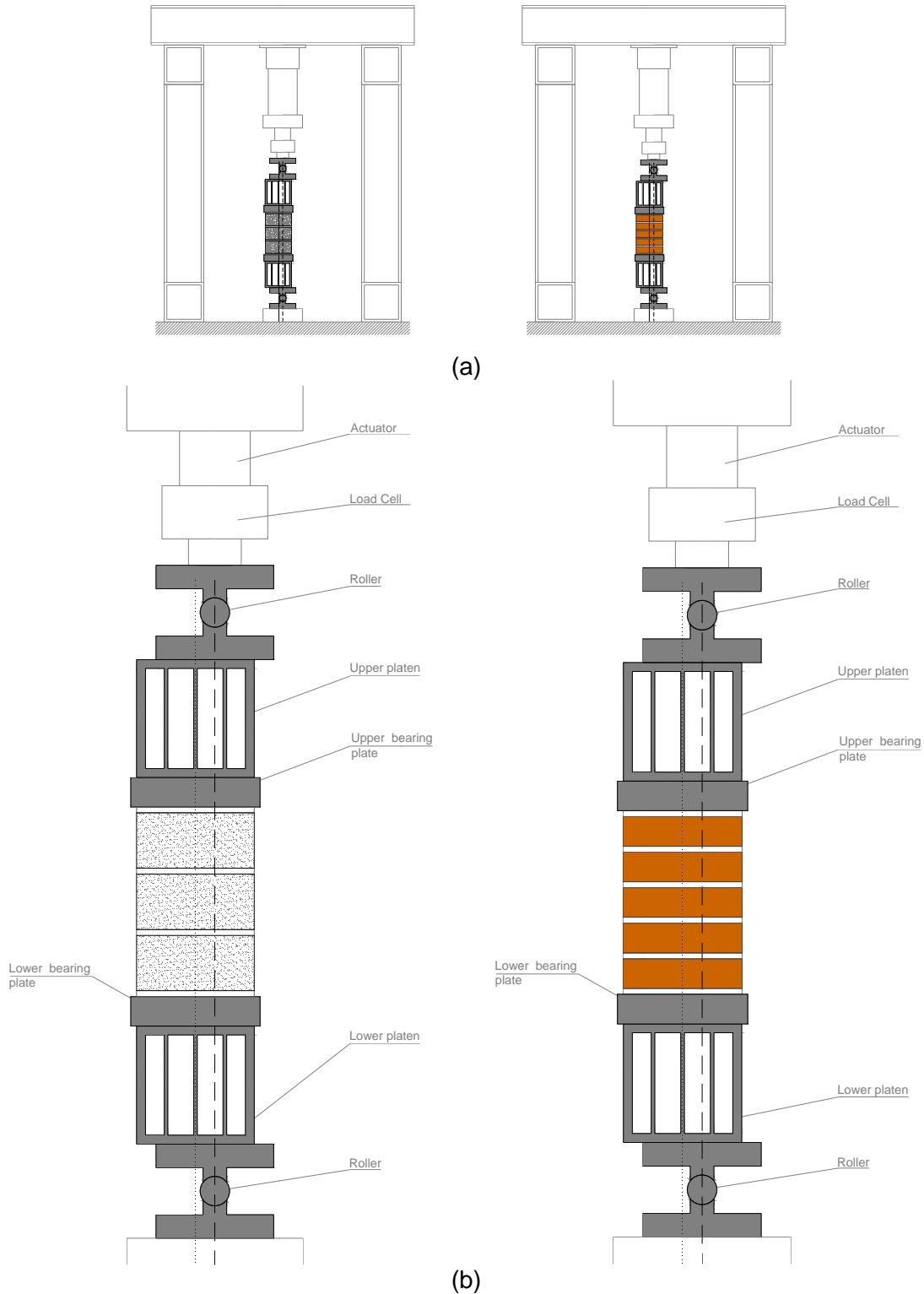


Figure A1 – Test setup for the two different prisms: a) general view; and b) detailed view

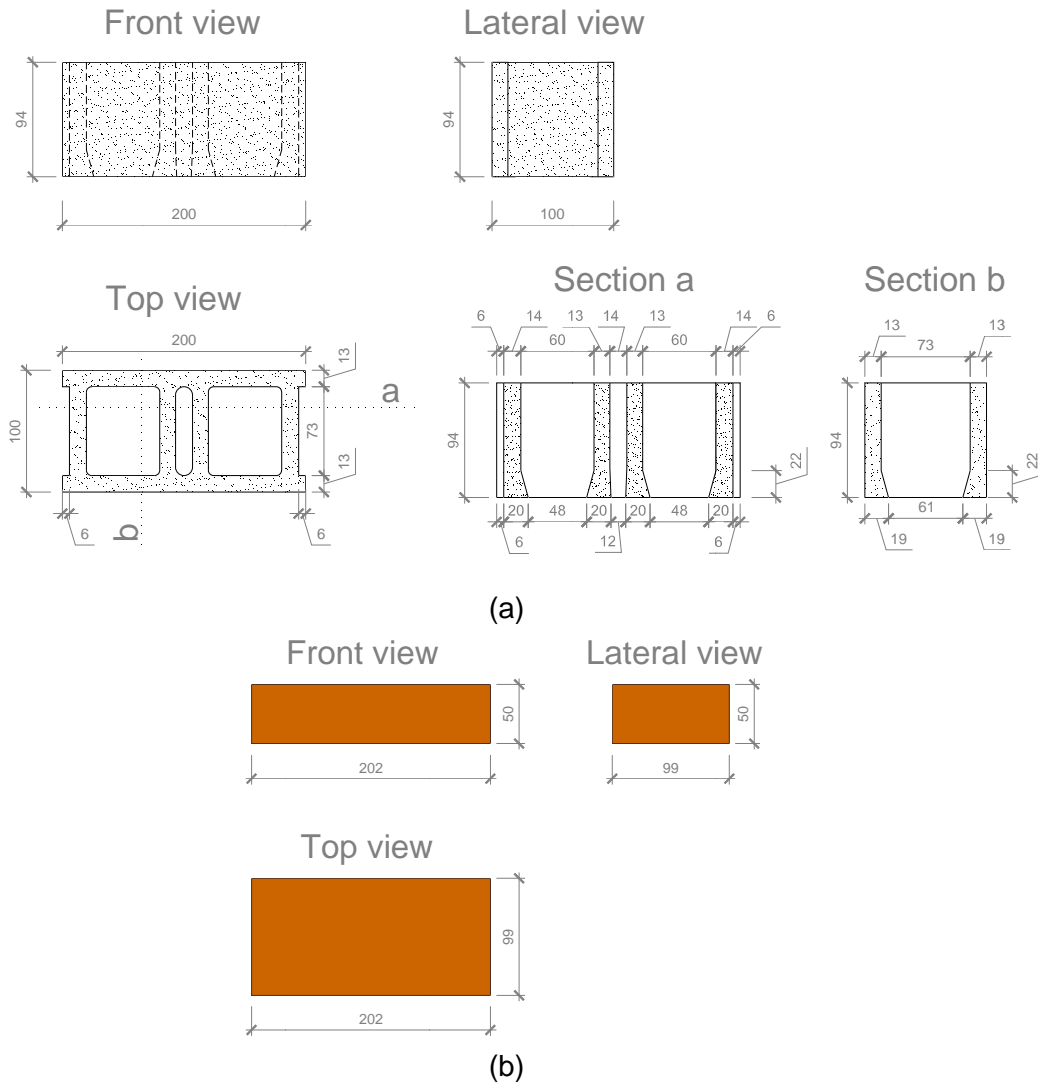


Figure A2 – Geometry of the masonry units (dimensions in mm): a) concrete hollow blocks; and b) ceramic bricks



Annex B – Report Table of Contents

The report must have maximum 10 pages + annexes.

The Cover Page should have the name of the team, the name of the participants, and the name of the participants' institution.

The report must be arranged using the following sections:

1. **Introduction**
2. **Methodology**
3. **Results**
4. **Discussion**
5. **Conclusions (with estimates for the capacities of the two masonry prisms)**