BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LVIII (LXII), Fasc. 1, 2012
Secția
CONSTRUCȚII. ARHITECTURĂ

USING OF NORMALIZED EXPERIMENTAL CURVES IN MASONRY STRENGTHS ESTIMATION

BY

ANDA TANASĂ[*]

“Gheorghe Asachi” Technical University of Iaşi
Faculty of Civil Engineering and Building Services

Received: October 20, 2011
Accepted for publication: January 30, 2012

Abstract. The paper introduces a model used to determine the resistance of mortar in masonry by connecting the penetration force of a mortar sample taken from the joint of a masonry work embedded in a plaster disk, and the standard mortar resistance. Determinations have been performed on different mortar samples with known characteristics and the penetration force of the mortar sample; they facilitate the evaluation of mortar resistance, mortar which will be taken from the existent masonry work.

Key words: masonry; mortar; fracture; disc-test; sample.

1. Introduction

Masonry constructions have been used for more than 5000 years and they continue to be the main system in the production of structural elements with small volume constructions, closing and compartmentalization constructions, associated with other structural systems.

The durability of brick masonry can be very high if we take into account its component materials, but also evidences from all over the world. Unfortunately, time has had an unfavourable effect on certain structural or presentation characteristics. The special sensitivity of this structural type to

[*] *e-mail*: tanasa_anda@yahoo.com

deformation leads to crazes, crevices, dislocations, local or general creeping when exposed to earthquakes, settlement or vibrations.

Modern rehabilitation systems in masonry work consist in adding additional elements in order to reduce the damage effects and to ensure the stability and the resistance required by the structure.

Regardless of the rehabilitation system, calculations are required to determine the resistance and residual stability capacity after the consolidation as well. Resistance calculations made by engineers require data on mechanical characteristics of mortars and masonry blocks.

The evaluation of the mechanical characteristics of masonry mortars is difficult, if not impossible, if we take into account the thickness of joint mortar, the heterogeneity due to different revetment conditions, etc.

A method has been developed in order to determine the mortar type and its mechanical characteristics indirectly by connecting the penetration force of a piston from a sample and the mortar resistance to compression.

The principle of the method consists in

a) Taking a *mortar sample* from the masonry joint.

b) Including the *mortar sample* in a plaster plate.

c) Testing the mortar at hindered compression.

d) According to the correspondence of the result and reference diagrams, the brand value is established.

2. Experimental Results

In the first stage of the research, the testing device has been conceived and tested. For determinations, the following component types of the testing device have been analysed:

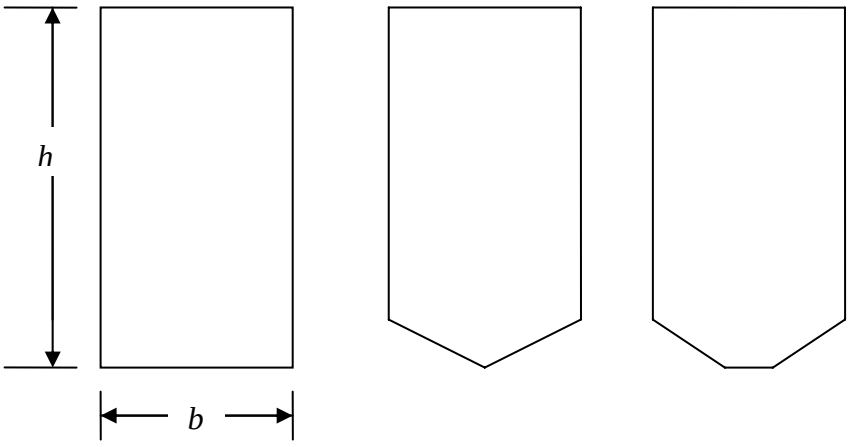

Fig.1 – The shape of the test pistons.

a) The plate ring which will embed the plaster sample, in two variants: 10 cm diameter, 15 cm respectively, and 1, 5 cm high.

b) The penetration piston.

Three types of pistons have been manufactured (Fig. 1) piston-disc, crown-head piston and bevel cant piston with two sections: 1 cm^2 and 0.5 cm^2. The other end of the sample has been fitted with a thread which would allow the anchorage in a disk so that during the test the piston is perpendicular to the surface of the testing sample (Fig. 2).

Fig.2 – Types of testing pistons.

2.1. Testing Machine of 100 daN Capacity

Tests have been made in order to choose the piston type and the size of the plaster disk for best results with little dispersal. The test was performed on disks made from the same plaster type. The test machine determined the penetration force on six samples.

Fig. 3 – Fracture of plaster disks.

Preliminary tests have shown an insignificant difference between the beveled edge piston test and the crown-head piston test and, as a result, subsequent tests have been performed on two plaster disks (10 cm, 20 cm, respectively) and with piston-discs and crown-head pistons (0.5 cm^2, 1 cm^2, respectively).

The obtained results are presented in Tables 1,…,8.

Table 1

Test Results for the Crown-Head Piston, with a Section of 0.5 cm^2 and Plaster Disk with 10 cm Diameter

Piston types	Force, *P*, [N]	Sample fracture
Crown-head piston 10 cm diameter/ section 0.5 cm^2	1,370	intact sample
	1,450	fractured sample
Crown-head piston 10 cm diameter/ section 0.5 cm^2	1,350	intact sample
	1,500	fractured sample
Crown-head piston 10 cm diameter/ section 0.5 cm^2	1,390	intact sample
	1,500	fractured sample
Crown-head piston 10 cm diameter/ section 0.5 cm^2	1,350	intact sample
	1,490	fractured sample
Crown-head piston 10 cm diameter/ section 0.5 cm^2	1,430	intact sample
	4,450	fractured sample
Crown-head piston 10 cm diameter/ section 0.5 cm^2	1,360	intact sample
	1,430	fractured sample

Table 2

Test Results for the Piston-Disc, with a Section of 0.5 cm^2 and Plaster Disk with 10 cm Diameter

Piston types	Force, *P*, [N]	Sample fracture
Piston-disc 10 cm diameter/ section 0.5 cm^2	1,510	fractured sample
Piston-disc 10 cm diameter/ section 0.5 cm^2	1,750	fractured sample
Piston-disc 10 cm diameter/ section 0.5 cm^2	1,480	fractured sample
Piston-disc 10 cm diameter/ section 0.5 cm^2	1,550	fractured sample
Piston-disc 10 cm diameter/ section 0.5 cm^2	1,470	fractured sample
Piston-disc 10 cm diameter/ section 0.5 cm^2	1,470	fractured sample

Table 3

Test Results for the Crown-Head Piston, with a Section of 1 cm^2 and Plaster Disk with 10 cm Diameter

Piston types	Force, *P*, [N]	Sample fracture
Crown-head piston 10 cm diameter/ section 1 cm^2	1,550	fractured sample
Crown-head piston 10 cm diameter/ section 1 cm^2	1,490	fractured sample
Crown-head piston 10 cm diameter/ section 1 cm^2	1,730	fractured sample
Crown-head piston 10 cm diameter/ section 1 cm^2	1,570	fractured sample
Crown-head piston 10 cm diameter/ section 1 cm^2	1,610	fractured sample
Crown-head piston 10 cm diameter/ section 1 cm^2	1,580	fractured sample

Table 4

Test Results for the Piston-Disc, with a Section of 1 cm^2 and Plaster Disk with 10 cm Diameter

Piston types	Force, *P*, [N]	Sample fracture
Piston-disc 10 cm diameter/ section 1 cm^2	1,550	fractured sample
Piston-disc 10 cm diameter/ section 1 cm^2	1,580	fractured sample
Piston-disc 10 cm diameter/ section 1 cm^2	1,610	fractured sample
Piston-disc 10 cm diameter/ section 1 cm^2	1,620	fractured sample
Piston-disc 10 cm diameter/ section 1 cm^2	1,620	fractured sample
Piston-disc 10 cm diameter/ section 1 cm^2	1,570	fractured sample

Table 5

Test Results for the Piston-Disc, with a Section of 0.5 cm^2 and Plaster Disk with 15 cm Diameter

Piston types	Force, *P*, [N]	Sample fracture
Piston-disc 15 cm diameter / section 0,5 cm^2	1,570	fractured sample
Piston-disc 15 cm diameter / section 0,5 cm^2	1,530	fractured sample
Piston-disc 15 cm diameter / section 0,5 cm^2	1,560	fractured sample
Piston-disc 15 cm diameter / section 0,5 cm^2	1,550	fractured sample
Piston-disc 15 cm diameter / section 0,5 cm^2	1,580	fractured sample
Piston-disc 15 cm diameter / section 0,5 cm^2	1,570	fractured sample

Table 6

Test Results for the Crown-Head Piston, with a Section of 0.5 cm^2 and Plaster Disk with 15 cm Diameter

Piston types	Force, *P*, [N]	Sample fracture
Crown-head piston 15 cm diameter / section 0.5 cm^2	1,410	fractured sample
Crown-head piston 15 cm diameter / section 0.5 cm^2	1,450	fractured sample
Crown-head piston 15 cm diameter / section 0.5 cm^2	1,440	fractured sample
Crown-head piston 15 cm diameter / section 0.5 cm^2	1,430	fractured sample
Crown-head piston 15 cm diameter / section 0.5 cm^2	1,420	fractured sample
Crown-head piston 15 cm diameter / section 0.5 cm^2	1,450	fractured sample

Table 7

Test Results for the Crown-Head Piston, with a Section of 1 cm^2 and Plaster Disk with 15 cm Diameter

Piston types	Force, *P*, [N]	Sample fracture
Crown-head piston 15 cm diameter / section 1 cm^2	1,590	fractured sample
Crown-head piston 15 cm diameter / section 1 cm^2	1,490	fractured sample
Crown-head piston 15 cm diameter / section 1 cm^2	1,530	fractured sample
Crown-head piston 15 cm diameter / section 1 cm^2	1,570	fractured sample
Crown-head piston 15 cm diameter / section 1 cm^2	1,530	fractured sample
Crown-head piston 15 cm diameter / section 1 cm^2	1,550	fractured sample

Table 8
Test Results for the Piston-Disc, with a Section of 1 cm^2 and Plaster Disk with 15 cm Diameter

Piston types	Force, *P*, [N]	Sample fracture
Piston-disc 15 cm diameter / section 1 cm^2	1,380	fractured sample
Piston-disc 15 cm diameter / section 1 cm^2	1,360	fractured sample
Piston-disc 15 cm diameter / section 1 cm^2	1,450	fractured sample
Piston-disc 15 cm diameter / section 1 cm^2	1,540	fractured sample
Piston-disc 15 cm diameter / section 1 cm^2	1,500	fractured sample
Piston-disc 15 cm diameter / section 1 cm^2	1,430	fractured sample

3. Conclusions

The most favourable dispersion was obtained for the small crown-head diameter disc (0.5 cm^2) and for the plaster disc with a 20 cm diameter. Consequently, for determinations, the crown-head piston has been chosen (with the section 0.5 cm^2 and the plaster disc with a 20 cm diameter).

REFERENCES

Groll L., *Physical-Chemical Basis for the Study of Construction Materials* (in Romanian). Rotaprint, Polyt. Inst., Jassy, 1990.
Groll L., Tanasă A., *A New Proceeding for Testing of Masonry Mortars Strength*. Sci. Session „Constructions and Installations", Braşov, vol. **I**, 2008.
Hîrhui I., Groll L., *Construction Materials*. Edit. Vesper, Iaşi, 1996.
Nistor C., *Consolidation and Maintenance in Constructions* (in Romanian). Edit. Tehn., Bucureşti, 1991.
* * * P100/2006 Norm.

FOLOSIREA CURBELOR EXPERIMENTALE ÎN STABILIREA MĂRCII MORTARELOR

(Rezumat)

Se prezintă un model de determinare a rezistenței mortarelor din zidării prin legătura între forța de penetrație a unui eşantion de mortar recoltat din rostul unei zidării, înglobat într-un disc de ipsos, şi rezistența mortarelor standard.

S-au făcut determinări pe diferite probe de mortar cu caracteristici cunoscute şi forța de penetrație a probei de mortar, ce permit evaluarea rezistenței mortarelor care vor fi recoltate din zidăriile existente.