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Партизански одреди 24,
П.Фах 560, 1001 Скопје
Македонија

MASE
MACEDONIAN ASSOCIATION OF STRUCTURAL ENGINEERS

Partizanski odredi 24,
P. Box 560, 1001 Skopje
Macedonia

mase@gf.ukim.edu.mk
http://mase.gf.ukim.edu.mk

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MECHANICAL BEHAVIOUR OF MASONRY REINFORCED WITH READY-MIX REPOINTING MORTAR

Bojan DAMCHEVSKI[1], Sergey CHURILOV[2], Elena DUMOVA-JOVANOSKA[3]

[1]BSc, ADING AD, Skopje, Republic of Macedonia, bojan@ading.com.mk
[2]Assoc. Prof. PhD, Faculty of Civil Engineering, University Ss. Cyril and Methodius, Skopje, Macedonia, curilov@gf.ukim.edu.mk
[3]Prof. PhD, Faculty of Civil Engineering, University Ss. Cyril and Methodius, Skopje, Macedonia, dumova@gf.ukim.edu.mk

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1. INTRODUCTION

Historically, masonry structures are one of the mostly used structural types in the world, dating back from prehistoric era till today. Today's building and design codes limit the use of masonry as structural material for load bearing structural elements in seismic regions. Such constraints are based on the fact that beside the compressive stresses, tensile and shear stresses need to be considered in the design. However, masonry inherently has very low or almost none tensile and shear strength, which very often leads to cracking and damage to the structures. Several traditional strengthening methods exist and are used in the country and the region. Usually, rehabilitation of the cracks by crack repair, crack injection, RC jackets and joint repointing. This research is motivated on the material behavior of masonry strengthened by joint repointing and application of advanced mortars. The aim of the results reported in the study is to determine the mechanical characteristics of strengthened masonry by joint repointing with polymer-modified, fiber-reinforced cement-based repair mortar (Reparatur mortar F4) produced by the company ADING AD Skopje. The research comprises determination of the physical and mechanical properties of the masonry constituents, strength properties of solid bricks, lime mortar and Reparatur mortar, as well as compressive and diagonal shear strength of masonry, existing (unreinforced) and strengthened.

2. EXPERIMENTAL TESTS

To achieve the assigned goals, an experimental program was launched, fig. 1, which includes laboratory tests for determination of:

- Phisical and mechanical properties of solid bricks, lime mortar and Reparatur mortar,
- Compressive strength and tensile bending strength of solid bricks,
- Compressive strength and tensile bending strength of mortars (lime and Reparatur),
- Masonry compressive strength (unreinforced-URM and strengthened-SM),
- Masonry diagonal shear strength (unreinforced-URM and strengthened-SM).

The tests performed were according to EN standards, such as EN 771-1:2006, EN 12190:2009, EN 1504-3:2006, EN 1052-1:1999 and ASTM E519-02.

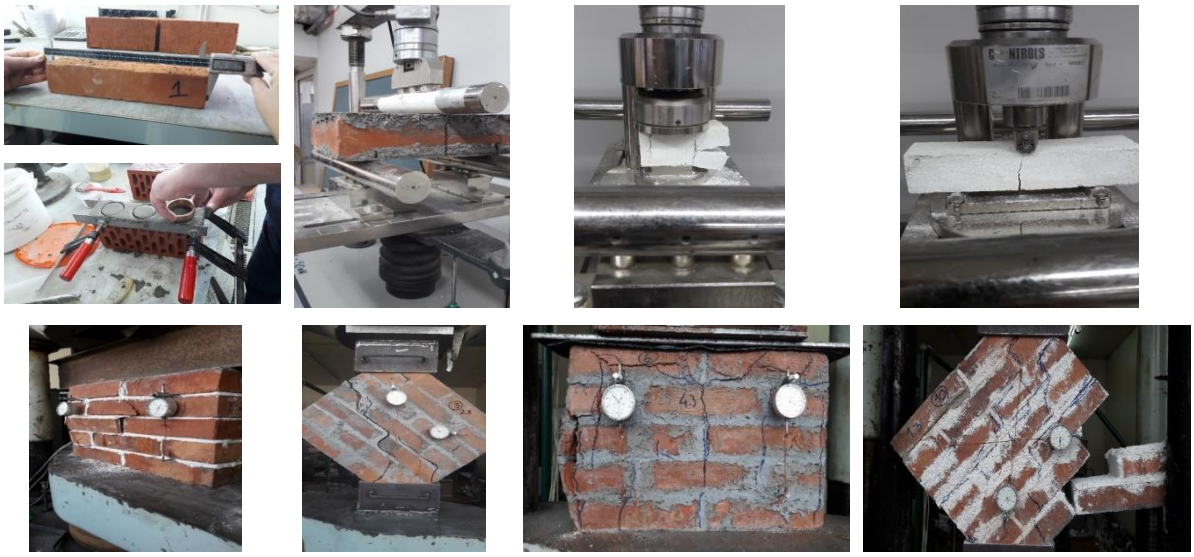

Fig. 1. Experimental tests on masonry and constituents

3. RESULTS

The following results for the masonry constituents were obtained from the experimental tests:

Property	Solid brick	Lime mortar	Reparatur mortar
Specific density γ (kg/m^3)	2002.00	1650.20	2045.00
Mean compressive strength f_b/f_m (MPa)	10.64	0.94	58.20
Mean tensile bending strength f_{bt}/f_{mt} (MPa)	3.04	0.73	4.25

The experimentally obtained masonry properties are summarized in the following table.

Property	URM Lime mortar	SM joint repointing	URM Reparatur mortar
Compressive strength f_k (MPa)	3.10	2.54	7.49
Modulus of elasticity E (MPa)	1756.75	862.57	3744.55
E/f_k	551.37	343.80	499.94
Diagonal shear strength τ (MPa)	0.19	0.45	/
Shear modulus G (MPa)	559.94	400.98	/

CONCLUSION

The joint repointing with high strength repair mortar has significant influence on the masonry resistance under shear loads. The shear strength of the strengthened masonry is for 137% higher than the one for the unreinforced masonry. On contrary, the compressive strength is lower in the joint repointed masonry with a percentage change of 18%. The modulus of elasticity is within the Eurocode 6 defined limits ($100f_k \leq E \leq 2000f_k$), although significantly lower than code recommended ($E = 1000f_k$). The ratio of shear modulus and modulus of elasticity is $G/E = 0.15$ for unreinforced and $G/E = 0.11$ for joint repointed masonry, which is lower than code recommended ($G/E = 0.4$).

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