

Stabilization and consolidation of historical multi-layer masonry

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ABSTRACT

Historic masonry structures with a greater thickness (masonry thickness > 0.9 m) can often be made as so-called multi-layer masonry with outer layers lined with the application of some of the masonry bonding methods and with the inner layer of the so-called cast core formed by fragments of stones of different sizes that are bonded with more mortar. Due to the nature of the inner layer containing a large amount of binder (e.g. 40-60% of the generally more flexible binder) than the outer masonry layers (e.g., 15-30% binder), different deformation properties, load carrying capacity and mechanism of failure of the outer and outer inner layers can be expected. Proper "bonding" of the outer layers with the inner layer by means of stones or bricks - so-called bond-stones or inbond bricks - extending from the outer to the inner layer increases the cohesion and the integrity of the multi-layered masonry. Natural irregularity of the inner surface of the outer layers made of unworked stones also improves the bonding of the individual layers and increases the resistance of the multi-layer masonry structure to "delamination", which generally precedes complete masonry failure.

Analysis of the stress of a multi-layer masonry with different physical-mechanical properties of the inner and outer layers with good or poor cohesion demonstrates the importance of ensuring perfect shear strength of the joint between the layers. The extreme case of failure of this cohesion can be a significant reduction in the load-bearing capacity of the multi-layer masonry or total loss of stability and structural failure.

One of the means of ensuring the cohesion of the individual layers is grouting of the joints with mixtures of suitable properties. As a part of the NAKI II research project, load tests of multi-layer masonry segments were performed. These tests pointed to the difficulty of solving this problem. The results of experimental tests of multi-layer masonry structures "reinforced" by grouting and corresponding numerical analysis will be presented in the article.



Fig. 1 Test specimens of multi-layer masonry segments before and after experimental loading.