

Assessment of Masonry Strength in a Heritage Building

M. Holicky, M. Hrabanek, J. Kolisko & M. Sykora

Klokner Institute, Czech Technical University in Prague, Czech Republic

Abstract

Heritage buildings in the Czech Republic are made of different types of masonry. Decisions concerning upgrades of these buildings should be preferably based on the reliability assessment, taking into account actual material properties. Due to inherent variability of historical masonry, information on its actual mechanical properties has to be obtained from tests. Estimation of masonry strength from measurements may then be one of key issues in the assessment of historical structures. In the submitted study, the standard technique provided in the Eurocode EN 1996-1-1 is applied in assessment of a masonry structure built in the 19th century. Characteristic and design values of the masonry strength derived using principles of the Eurocode are compared with corresponding fractiles of a developed probabilistic model. It appears that the characteristic value based on the probabilistic model is lower than that obtained by the standard technique. To the contrary, the partial factor for masonry recommended in EN 1996-1-1 seems to be rather conservative.

Keywords: masonry, characteristic strength, statistical methods

References

- [1] EN 1996-1-1, *Eurocode 6 - Design of masonry structures - Part 1-1: General rules for reinforced and unreinforced masonry structures*, CEN: Brussels, 2005.
- [2] Lourenco, P.B., Computations on historic masonry structures. *Progress in Structural Engineering and Materials*, **4(3)**, pp. 301-319, 2002.
- [3] Stewart, M.G. & Lawrence, S.J., Model Error, Structural Reliability and Partial Safety Factors for Structural Masonry in Compression. *Masonry International*, **20(3)**, pp. 107-116, 2007.
- [4] Grubbs, F., Procedures for Detecting Outlying Observations in Samples. *Technometrics*, **11(1)**, pp. 1-21, 1969.
- [5] Ang, A.H.S. & Tang, W.H., *Probabilistic Concepts in Engineering Emphasis on Applications to Civil and Environmental Engineering*, John Wiley & Sons: USA, 2007.
- [6] Stewart, M.G. & Lawrence, S., Structural Reliability of Masonry Walls in Flexure. *Masonry International*, **15(2)**, pp. 48-52, 2002.
- [7] Holicky, M., Middleton, J. & Vorlicek, M., Statistical Analysis of Partial Safety Factors for Structural Masonry. *Computer Methods in Structural Masonry 4: Proc. of the Fourth Int. Symp. on Computer Methods in Structural Masonry*, eds. G.N. Pande, J. Middleton & B. Kralj, Taylor & Francis: London, pp. 325-338, 1998.
- [8] ICOMOS, *Recommendations for the analysis, conservation and structural restoration of architectural heritage*, International council on monuments and sites: Paris, pp. 37, 2003.
- [9] Holicky, M., Pume, D. & Vorlicek, M., Masonry Strength Determination from Tests. *Computer Methods in Structural Masonry 3 - Proc. of the Third Int. Symp. on Computer Methods in Structural Masonry*, eds. G.N. Pande & J. Middleton, Books & Journals International: Swansea, pp. 107-116, 1997.
- [10] EN 1990, *EN 1990:2002 Eurocode - Basis of structural design*, CEN: Brussels, pp. 87, 2002.