

STRENGTHENING (POST-STRESS) OF MASONRY BUILDINGS

METHOD OF VERTICALIZATION OF LOAD

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Summary

This paper is about the use of pre-stressed cables for the strengthening of masonry structures. This technique can be used, for example, for the renewal and recovery of historic buildings. It is partially reversible, introduces minimal changes in the characteristics of the structural system and in the visible form of the building. Therefore, it is a practical and economical solution comparing with the traditional strengthening methods. Up to this date, the research on this field has mainly focused on the behaviour of components and only a few results about the effectiveness of post-tensioning in the process of strengthening of structures has been published. This paper resumes the results of an extensive parametric research, done in order to study the effectiveness of the mentioned technique, and a number of numerical simulations. This technique was applied on an antique building, “*Iglesia da Santa Maria da Sar*”, a church in masonry construction of the 12th century. This case study enabled the gathering of data, the verification and interpretation of the test results and finally the analyzing of the effectiveness of the technique. One of the results of this positive test is the development of a mechanical model combined with a program based on the Finite Element Method for studying numerically the behavior of the horizontal joint between the bricks of masonry. The possibility of numerical analyses has considerable advantages since it permits a more realistic simulation of the phenomenology involved in the actual behavior of the masonry with joints filled or not with mortar. Another feature of the developed model relates to the treatment of the seismic action, configured to perform in the program a step-by-step integration of seismic excitations. Furthermore, this paper presents a methodology of actions enabling to recover this type of buildings. The application of the appropriate structural reinforcement does not change the original form of the building. The tested strengthening solutions consist of inserting reinforcing pre-stressed steel elements within the masonry. The pre-stressed elements cause compressive forces in the masonry wall that consequently lead to the so-called "verticalization" of load in the wall, thus reducing the strength of the horizontal load that destabilizes the masonry wall. The methodology treats the effectiveness of the pre-stressing or post tensioning which depends on the location of the cables, the material and the geometry of the structure.

Keywords: pre-stressed cable, masonry, reinforced masonry, arch failure, buttress, flying buttress.