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Seismic Improvement of Historical Masonry Structures

Baris Sayin*

Department of Civil Engineering, Istanbul University, Turkey

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***Corresponding author:** Baris Sayin, Department of Civil Engineering, Istanbul University, Turkey, Tel: +902124400000-17937
Email: barsayin@istanbul.edu.tr

Editorial

The restoration of historical masonry structures, especially, consolidation of main structural members, is becoming a crucial important issue. Therefore, the structures need restoration to survive their life as a result of aging and increasing load demand. Many historical structures have been restored in order to resist these effects [1]. Masonry constructions are typically complex structures and there is lack of knowledge and information concerning the behavior of their structural systems, particularly in what regards their seismic response. These structures are more massive than today's structures and usually carry their actions primarily in compression.

According to results of the work developed within the ICOMOS 2001 recommendations, a thorough understanding of the structural behavior and material characteristics is essential for any project related to the architectural heritage. It is recommended that the work of analysis and evaluation should be done with the cooperation of specialists from different disciplines, such as earthquake specialists, architects, engineers and art historians. In addition, it is considered necessary for these specialists to have common knowledge on the subject of conserving and upgrading or strengthening the historical buildings [2].

In historical structures, restoration processes have become necessary because their life cycle of structural and non-structural members is completed due to natural result of material structure, environmental conditions and/or user errors. One of the most important intervention decisions in restoration stages carried out in historical buildings is known as retrofitted of the structure. The choice technique of retrofitting of the structural members is becoming a very important issue in the scope of restoration of historical masonry structures belonging to the cultural heritage. Additionally, it should be decided to optimally preserve such buildings' original forms and to make interventions to increase the building's service life; in this regard, it is important to preserve the structures' historical identity and constructional value. Therefore, retrofitting applications have become essential to prevent the damage level and to have adequate level of structural strength in order to resist dynamic effects such as earthquakes. In this editorial, it is aimed to underline the significance of conventional and modern techniques within the scope of laboratory tests and numerical approaches in recovering the historical structures.

A number of researches have been carried out to investigate the seismic resistant of historical masonry structures [3-25]. Asteris et al. [3] present a methodology for earthquake resistant design or assessment of masonry structural systems. Abruzzese et al. [4] evaluated the risk of collapse of the Huzhu Pagoda, one of the oldest masonry pagodas built in the XI century. In the study, mechanical properties of the masonry material have been obtained by experimental tests on small specimen and the mechanical behavior of the structure has been evaluated via numerical models. The static analysis of this ancient pagoda constitutes a prerequisite base for the evaluation of its structural behavior leading to a suitable maintenance program. Mahini [8] proposed a macro-modelling approach and the performance of a CFRP-retrofitted in historical building. The brick and adobe, prism samples of the building have been modelled by commercial code, which uses smeared-crack materials and eight-noded isoparametric, solid elements. Valluzzi et al. [9] investigated that the structural rehabilitation of monumental area. In the paper, after a general presentation of the main properties and of the most relevant deterioration phenomena of the principal parts of the monumental area, the methodology that is being used for the structural diagnosis, for the implementation of guidelines for the future interventions and for the maintenance of the restored conditions are presented.

Barbieri et al. [13] performed a structural analysis of a historic masonry building subject to significant static instabilities due to an overturning of the longitudinal facades related to ground settlements. Aktas and Truer [14] focused on seismic evaluation and strengthening of Nemrut monuments.

The simulations showed vulnerability of cut-stone blocks separating from one another under seismic action, and simple strengthening solutions were proposed. Mele et al. [18] analyzed a basilica-type church in order to assess its structural behavior and seismic vulnerability. For this purpose, an effective two-step procedure has been used, consisting of static and dynamic linear analyses of the structural complex, and in another studies, nonlinear push-over analysis of the single macro-elements. Bernardeschi et al. [21] described the numerical techniques implemented in the finite-element code NOSA for structural analysis of masonry constructions.

Masonry structures in many countries worldwide are characterized by inadequate resistance to earthquake effects. The using of appropriate techniques for retrofitting of historical masonry structures should be made a decision by the reference to additional structural system and members as well as repair and retrofitting on period after built of the mentioned structures, and this fact is evaluated in terms of the protection of the original identity as well as the cultural value of the structures. The opinion presents an overview on the retrofitting of historical masonry structures in terms of seismic resistant. Retrofitting techniques of historical masonry structures are mostly affected from the scientific and technological advances. Accuracy of retrofitting methods depends mainly upon analyses of the structures and classification techniques. The efficiency of the retrofitting for historical masonry structures is related to the suitability of the used methods or techniques with retrofitting principles.

References

1. Binda L, Gatti G, Mangano G, Poggi C, Sacchi LG (1992) The collapse of the Civic Tower of Pavia: A survey of the materials and structure. Masonry International 20(6): 11-20.
2. ICOMOS (2001) Recommendations for the analysis, conservation and structural restoration of architectural heritage.
3. Asteris PG, Chronopoulos MP, Chrysostomou CZ, Varum H, Plevris, et al. (2014) Seismic vulnerability assessment of historical masonry structural systems. Engineering Structures 62-63(2014): 118-134.
4. Abruzzese D, Miccoli L, Yuan J (2009) Mechanical behavior of leaning masonry Huzhu Pagoda. Journal of Cultural Heritage 10(4): 480-486.
5. Chmielewski R, Kruszka L (2015) Application of selected modern technology systems to strengthen the damaged masonry dome of historical St. Anna's Church in Wilanów (Poland). Case Studies in Construction Materials 3: 92-101.
6. Ding L, Xianguo W, Zhang L, Skibniewski MJ (2015) How to protect historical buildings against tunnel-induced damage: A case study in China. Journal of Cultural Heritage 16(6): 904-911.
7. Moropoulou A, Bakolas A, Moundoulas P, Aggelakopoulou E, Anagnostopoulou S (2013) Optimization of compatible restoration mortars for the earthquake protection of Hagia Sophia. Journal of Cultural Heritage 14(Suppl 3): e147-e152.
8. Mahini SS (2015) Smeared crack material modelling for the nonlinear analysis of CFRP-strengthened historical brick vaults with adobe piers. Construction and Building Materials 74(2015): 201-218.
9. Valluzzi MR, Bondì A, Porto FD, Franchetti P, Modena C (2002) Structural investigations and analyses for the conservation of the 'Arsenale' of Venice. Journal of Cultural Heritage 3(1): 65-71.
10. Pinto APF, Rodrigues JD (2012) Consolidation of carbonate stones: Influence of treatment procedures on the strengthening action of consolidants. Journal of Cultural Heritage 13(2): 154-166.
11. Bednarz LJ, Jasienko J, Rutkowski M, Nowak TP (2014) Strengthening and long-term monitoring of the structure of an historical church presbytery. Engineering Structures 81(2014): 62-75.
12. Lignola GP, Nigro E, Cosenza E (2010) Seismic vulnerability of natural stone pinnacles on the Amalfi Coast in Italy. Journal of Cultural Heritage 11(1): 68-80.
13. Barbieri G, Biolzi L, Bocciarelli M, Fregonese L, Frigeri A (2013) Assessing the seismic vulnerability of a historical building. Engineering Structures 57(2013): 523-535.
14. Aktas YD, Turer A (2015) Seismic evaluation and strengthening of nemrut monuments. Journal of Cultural Heritage 16(3): 381-385.
15. Yildirim M (2012) Assessment of the decision-making process for re-use of a historical asset: The example of Diyarbakir Hasan Pasha Khan, Turkey. Journal of Cultural Heritage 13(2012): 379-388.
16. Osmancikli G, Uçak S, Turan FN, Türker T, Bayraktar A (2012) Investigation of restoration effects on the dynamic characteristics of the Hagia Sophia bell-tower by ambient vibration test. Construction and Building Materials 29(2012): 564-572.
17. Herráez J, Denia JL, Navarro P, Bosch L, Bosch I (2013) Design and calibration of a drill-guided system by laser for structural strengthening of historic bridge. Journal of Cultural Heritage 14(3): 248-253.
18. Mele E, Luca AD, Giordano A (2003) Modelling and analysis of a basilica under earthquake loading. Journal of Cultural Heritage 4(4): 355-367.
19. Faella G, Frunzio G, Guadagnuolo M, Donadio A, Ferri L (2012) The church of the nativity in Bethlehem: Non-destructive tests for the structural knowledge. Journal of Cultural Heritage 13(Suppl 4): e27-e41.
20. Cakir F, Uysal H (2015) Experimental modal analysis of brick masonry arches strengthened prepreg composites. Journal of Cultural Heritage 16(3): 284-292.
21. Bernardeschi K, Padovani C, Pasquinelli G (2004) Numerical modelling of the structural behaviour of Buti's bell tower. Journal of Cultural Heritage 5(4): 371-378.
22. Agostino SD, Lombardi G, Russo G, Viggiani C (2010) Structural engineering and geology applied to the static problems of the Etruscan Tomba dell'Orco Tarquinia, Central Italy. Journal of Cultural Heritage 11(1): 107-112.
23. Akcay C, Sayin B, Yildizlar B (2017). The conservation and repair of historical masonry ruins based on laboratory analyses. Construction and Building Materials, 132 (2017): 383-394.
24. Bozkurt TS, Sayin B, Akcay C, Yildizlar B, Karacay N (2016) Restoration of the historical masonry structures based on laboratory experiments. Journal of Building Engineering 7: 343-360.
25. Akcay C, Bozkurt TS, Sayin B, Yildizlar B (2016) Seismic retrofitting of the historical masonry structures using numerical approach. Construction and Building Materials 113(2016): 752-763.

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