Editorial

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Biographical notes: Oguz C. Celik's research focuses on the seismic evaluation, design, and retrofit of existing buildings and bridges, including historic timber and masonry structures. His work addresses the protection of such structures under extreme events, e.g., earthquakes, using seismic energy dissipation systems and advanced composite materials. He is a member of several national and international committees. He has been involved in many real-life seismic rehabilitation and retrofit projects in Turkey, Europe, and in Asia, including Ottoman Imperial mosques, Roman and Byzantine churches, cisterns, and aqueducts. He has published more than 80 publications in national and international journals, conference proceedings, and books.

Significant experimental and theoretical work has been done so far in the field of structural damage detection, evaluation, and rehabilitation of historic buildings. Major earthquakes over the last 20 years in Turkey, Indonesia, Italy, Chile, New Zealand, and Haiti have revealed the need to reinvestigate structural rehabilitation issues related to historic masonry buildings and other structures. Performance of architectural heritage buildings during the 2009 L'Aquila, Italy earthquake is of special importance, since many unreinforced masonry (URM) buildings (from the 14th century or later) within the city centre and its surroundings experienced heavy damage or some totally collapsed. Because of their unique cultural value, special emphasis should be placed on rehabilitation of damaged buildings following an earthquake. In seismically vulnerable areas, prior to a major potential earthquake, structural evaluation and retrofit of historic buildings are also important to preserve their architectural impact as well as structural technique used in their original construction.

To address these needs, six invited papers that focused on structural evaluation and rehabilitation issues of historical buildings, are included in this special issue of the *International Journal of Materials and Structural Integrity* (*IJMSI*). The guest editor believes that these scholarly papers will contribute to the state-of-the art and practice in rehabilitation of historical buildings. With its contents, it is also believed that this special issue will be one of the key references in future.

This special issue begins with the paper titled 'Fixed and base isolation retrofitting of historical masonry buildings' by Garevski. The author overviews the traditional methods and materials used in the construction of historical masonry buildings. Seismic damages to historic buildings during the well-known past earthquakes (including the 2009 L'Aquila, Italy earthquake) are summarised. To compare the seismic responses of a fixed-base versus an isolated case, a time-history analysis for a historic masonry church is conducted. Numerical results from this analytical work revealed that base isolation is

very applicable in retrofitting of historic buildings since it drastically reduces the seismic forces and enables protection of these structures by minimal interventions.

In 'Effective techniques for restoration of heritage masonry', Korany points out that the selected technique should be consistent with aesthetics, function, and the requirements of strength, ductility, and stiffness. Both traditional and recent techniques in restoring heritage masonry structures are investigated. Special requirements for restoration of heritage structures and the main non-destructive evaluation methods that could be used to assess their structural condition are given. Some of the most effective structural restoration techniques such as repointing, replacing, grouting, reinforced injection, centre coring, external reinforcement, post-tensioning, anchoring-tying, overlaying, bracing, underpinning, and base isolation are explained with some figures specific to that restoration technique under consideration.

The paper titled 'Restoration of historical buildings: conservation principles and structural assessment' by Roca, addresses general conservation criteria within the context of some international documents such as the Nara Document on Authenticity, ICOMOS/ISCARSAH Committee, ISO 13822 Standard, and the Venice Charter-International Charter for the conservation and restoration of monuments and Sites. Aims of structural restoration, phases, activities, modelling, and analysis issues are discussed. Various approaches to structural assessment are also mentioned. Specific case studies from many existing structures are introduced. It is noted that the complexity/uncertainty of the problem requires optimal solutions, while granting the reliability requirements, cause the minimum possible alteration to the original features of the structure.

An experimental study of 'In-situ testing of a low intervention NSM seismic strengthening technique for historic URM buildings' is presented by Dizhur, Derakhshan, Griffith and Ingham. A near-surface mounted (NSM) carbon fibre reinforced polymer (CFRP) seismic retrofit solution to enhance the out-of-plane behaviour of URM walls is investigated. The paper covers testing of five masonry walls loaded out-of-plane in four different buildings located in New Zealand. Testing confirmed that the CFRP retrofit technique is an excellent, minimally-invasive, and cost effective option for seismic strengthening of URM buildings. Details of the history of the buildings, and the methods used to undertake these field tests are reported, and experimental results are presented.

In the paper titled 'A simplified theoretical model for the evaluation of structural behaviour of masonry spandrels', Calderoni, Cordasco, Lenza and Pacella report on a simplified theoretical model (named 'the arched strut'), useful for the evaluation of the structural behaviour of masonry spandrels subjected to shear. Observed collapse mechanisms during the tests are verified using the results from numerical analyses. Theoretical expressions corresponding to the different observed failure mechanisms (toe-crushing and tension cracking) are formulated. Both experimental and theoretical findings from this study are compared with the Italian code requirements.

'Safety assessment of the Sanctuary of Vicoforte, Italy' is presented by Aoki, Yuasa, Hamasaki, Nakano, Takahashi, Tanigawa, Komiyama, Ina, Sabia and Demarie. A series of non-destructive tests are carried out for diagnostic inspection of the elliptical masonry dome of the Sanctuary of Vicoforte. Dynamic ambient vibration tests were performed and the relevant modes of vibration are identified using the stochastic subspace identification method. The two fundamental modes of vibration determined through a preliminary analysis are consistent with the corresponding modes identified by the stochastic subspace identification algorithm. It is concluded that the dome would

experience severe damage under a potential future earthquake since the first two natural frequencies fall into the maximum acceleration frequency range characteristics of the Italian seismicity.

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