



ASSOCIAZIONE DEGLI INGEGNERI
DELLA PROVINCIA DI UDINE



ORDINE DEGLI INGEGNERI
PROVINCIA DI UDINE

L'Associazione degli Ingegneri della Provincia di Udine in collaborazione con l'Ordine degli Ingegneri della Provincia di Udine e con il CISM di Udine ha organizzato per **martedì 6 dicembre 2016, ore 16.00 – 18.00** un convegno sul tema:

IL CONTRIBUTO DELL'ISTITUTO ZAG DI LUBIANA PER LA MESSA A PUNTO DEL METODO POR PER LA VERIFICA SISMICA DEGLI EDIFICI IN MURATURA DOPO IL SISMA DEL FRIULI 1976

che avrà come relatore il **prof.dr. Miha Tomaževi**, già Direttore dello ZAG – Zavod za Gradbenivstvo Slovenije (Slovenian National Building and Civil Engineering Institute).

Il metodo POR per la verifica sismica degli edifici in muratura fu elaborato in seno all'Istituto ZAG di Lubiana dopo le esperienze dei terremoti di Skopje nel 1963, Banja Luka nel 1969, e Kozjansko nel 1973. Il prof.dr. Miha Tomaževi fu colui che messe a punto tale metodo e venne chiamato a far parte del gruppo interdisciplinare centrale (comunemente indicato come Gruppo A) a cui erano stati attribuiti compiti di programmazione e coordinamento generali dell'attività di ricostruzione dopo gli eventi sismici che colpirono il Friuli nel 1976. Nel corso del suo intervento il prof. Tomaževi illustrerà le specificità del Metodo POR e ricorderà il contributo dato all'interno dell'attività del Gruppo A in occasione del terremoto del Friuli.

Il prof. Tomaževi, terrà la propria conferenza alternando la lingua italiana alla lingua inglese a seconda dei temi illustrati. In ogni caso la documentazione proiettata sarà tutta espressa in lingua inglese.

Sede del convegno: **Aula Conferenze del CISM – Palazzo del Torso, in piazza Garibaldi 18, a Udine**

Posti disponibili: **50**

La partecipazione al convegno, per l'intera durata dell'evento, consentirà il conseguimento di n. **2 crediti formativi (CFP)**

Le iscrizioni dovranno essere effettuate accedendo con le proprie credenziali al portale "Formazione" al link:

<http://www.isiformazione.it/ita/risultatiricerca.asp?Interface=ING-UD&TipoOrdine=Ingegneri&Luogo=Udine>

inderogabilmente **entro venerdì 2 dicembre 2016**.

Eventuali informazioni possono essere richieste alla segreteria dell'Associazione Ingegneri di Udine ai seguenti numeri tel.: 0432 295142 – 338 4251810.

THE IDEA OF METHOD “POR” AND EXPERIMENTAL RESEARCH TO SUPPORT THE SEISMIC RESISTANCE VERIFICATION OF MASONRY BUILDINGS: SLOVENIAN CONTRIBUTION

Based on the analysis of earthquake damage to masonry buildings, observed after the earthquakes of Skopje in 1963, Banja Luka in 1969, and Kozjansko in 1973, as well as experimental simulation, a simple method for seismic resistance verification of masonry buildings has been developed at the Institute for Testing and Research in Materials and Structures (ZRMK) in 1975/76. The idea of the method, one of the first practical push-over methods, worldwide, was to calculate the available resistance of a masonry structure by step-wise increasing the story drift (story displacements), i.e. pushing the structure, and summing up the resistances of structural walls at that drift-step by following their idealized resistance curves. Since the method was based on the observed story mechanism of the entire structure and shear (or flexural) failure mode of structural walls, it was named method “POR” by the first three letters of Slovenian words “PORušna metoda” (failure mechanism method).

In a way, Friuli earthquakes of 1976 represented a breaking point in the development of earthquake engineering in Europe, especially in the field of masonry structures. The results of European experimental and theoretical research in seismic behavior of masonry buildings, both new and historical, carried out in the past decades, represent the basis of the masonry part of European standard for earthquake resistant design of buildings, Eurocode 8. In this regard, the contribution of ZAG, Slovenian National Building and Civil Engineering Institute, will be summarized. Since shear failure mode prevails in the behavior of masonry buildings when subjected to strong earthquakes, adequate modeling the shear failure mode is of relevant importance. On the basis of the results of shaking table tests and taking into consideration damage limitation and displacement capacity of typical masonry buildings, the ranges of possible values of force reduction factor have been assessed. Different types of units and a series of masonry walls have been tested to propose a measure for sufficient robustness of hollow clay masonry units, a critical property of hollow masonry units regarding the displa-

cement and energy dissipation capacity of masonry walls. The experiments have shown, that sufficient robustness of units and adequate bond between mortar and reinforcement is needed in order to fully activate the assumed capacity of reinforcing steel. Laboratory and in-situ tests provided information regarding the effectiveness of traditional and contemporary methods for the repair and strengthening. As regards the seismic resistance verification of existing buildings, experiments and observations have shown that the simultaneous use of confidence and partial material safety factors to reduce the experimentally obtained values of mechanical properties of masonry, is too conservative.

Miha Tomažević (Slovenian National Building and Civil Engineering Institute ZAG) holds a Bachelor of Engineering and Ph. D. degrees from the University of Ljubljana (1966 and 1985 respectively) and Masters Degree (1977) from the Institute of Earthquake Engineering and Engineering Seismology in Skopje, Macedonia. He served as the Head of Department of Structures and Section of Earthquake Engineering for many years, and the Director of the Institute from 1996 to 2005.

Prof. Tomažević's research on earthquake resistant masonry construction, a significant part of which is devoted to retrofit and rehabilitation of cultural heritage buildings, has led him to the publication of more than 400 technical papers and seven books. His book entitled Earthquake-resistant design of masonry buildings has been published by Imperial College Press in 1999 and translated into Greek in 2006. He taught courses on earthquake-resistant design of masonry structures at universities in Italy (Trento, Padua, Brescia and Trieste as well as Politecnico di Milano), Chile (Universidad de Chile in Santiago), Germany (University of Dresden), and India (Indian Institute of Technology, Roorkee). He delivered more than 90 seminars and invited lectures at many universities and institutes in Europe and USA, China and Japan, Chile, Mexico, and India. On the basis of his experience obtained in earthquake disaster mitigation activities at home, he served as a consultant to the governments of Italy and Mexico, as well as for UNIDO and the World Bank. He is a member of Slovenian Academy of Sciences and Arts and Slovenian Academy of Engineers, and also of several national and international professional organisations and technical committees. He is recipient of several national and international awards.