Tyagunov, S., Stempniewski, L., Grünthal, G., Wahlström, R., Zschau, J. (2006): Building stock vulnerability modelling for earthquake damage and loss assessment
First European Conference on Earthquake Engineering and Seismology (1st ECEES) (Geneva 2006), 135 p.

Table of Contents

of building typology used in current urbanization, i.e.: Level I, using traditional, so-called “macroseismic" or "statistic", methods based on a large damage data sets compiled in past earthquakes affecting Italy, Greece, Romania and former Yugoslavia, and Level II, using modern, so-called “mechanical (analytical)” methods, based on behavioral analyses, so-called "displacement analyses" for assessment of destructive "performance" and whose main development was proposed in the ATC 40 (1996) and the HAZUS (1999) project. The WP04 developments are principally carried out by IZIIS (Skopje), UNIGE (Genoa), AUTh (Thessaloniki), and UTCB (Bucharest) for a fundamentally European buildings' context, based on the typologies defined under the RISK-UE WP01. The presentation intends to discuss the achievements of RISK-UE, in particular Level I and II vulnerability functions developed for European building environment that can readily be implemented for real time apriori and all level (local, regional, global) damage/loss assessments.

VULNERABILITY OF THE BUILDING STOCK ACCORDING THE EMS-98 - APPLICATION TO SOFIA – ID 409

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Methodology for evaluation of vulnerability of buildings in a given region in terms of assignment of the vulnerability classes according the new EMS 98 scale is presented. The methodology is applied for vulnerability analysis on surveyed buildings in Sofia – Triaditca region. The main results of this case study are the graphs where are shown the distribution of buildings in different vulnerability classes; the relationships between different damage grades and intensity for some of the vulnerability classes. All results are presented in GIS format. The vulnerability curves are shown for types of buildings included in data bank of buildings, typical to Bulgaria. The results in this paper are received with financial support of European Commision in the frame of Project RISK-UE “An advanced approach to earthquake risk scenarios with applications to different European towns”.

BUILDING STOCK VULNERABILITY MODELLING FOR EARTHQUAKE DAMAGE AND LOSS ASSESSMENT – ID 2054

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Seismic vulnerability is one of the key factors determining the level of risk in earthquake prone regions. The vulnerability may affect different aspects of community safety (structural, functional, social, economic, etc.), though, primarily, the seismic vulnerability is considered in the structural sense, which implies the ability of buildings and structures to withstand seismic loads. Often the structural vulnerability of existing built environment might be responsible for the bulk of human and economic losses resulting from earthquakes. The paper presents a methodology of analysis and modelling of seismic vulnerability of the building stock of communities for damage and losses assessments on a regional scale. In the frame of the large-scale approach the main attention is paid to the seismic performance of the whole building stock of communities rather than to the seismic response of single buildings. Therefore, the principal core of the methodology is modelling of the vulnerability composition of the existing building stock of communities, which is implemented in terms of the vulnerability classification of the European Macroseismic Scale (EMS-98). Description and application of the methodology is given with specific reference to the residential building stock of earthquake prone communities of Germany. The vulnerability composition models are constructed on the basis of information derived from field observations and available databases. Validation and calibration of the models are performed with the use of observed data from a few past damaging earthquakes in Germany and the nearby area. The results of the validation prove that the developed models are adequate to predict the performance of the building stock under seismic influence and therefore they are applicable both for risk assessment studies and near-real time damage and loss estimates in the region.

REAL-TIME ASSESSMENT OF EARTHQUAKE INDUCED DAMAGE: LESSONS LEARNED IN ICELAND – ID 1346

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This paper describes lessons learned in Iceland on near real-time assessment of earthquake induced damage. The scenario is the South-Iceland Lowland in June 2000, which has been hit by a devastating South-Iceland Earthquake leaving thousands of damaged buildings in its wake. The assessment of the damage had to be carried out swiftly, without any delays, to prevent people from staying in unsafe buildings as the area was being shaken by further on-going earthquakes activity. Furthermore, to provide the authorities with real-time information required for efficient planning of urgently needed relieve operation. The damage assessment and the subsequent numerical analysis was organised by the local Office of Building Inspector. The methodology adopted can be described as a ‘real-time’ on-line loss-estimation applying geographic information technology and the Internet. Information on damage was collected in the field by qualified engineers. This information was then transferred to a database already containing building related information like architectural and engineering drawings. This data was readily linked to the official real-estate database to get information related to each building, including insurance, value, number of inhabitants, their age etc. Furthermore, the databank was also linked to the Icelandic Strong-Motion Network, which provided real-time information on recorded ground motion. The data on damage, along with above mentioned information, could then be visualised, inspected and analysed using a password-protected Website. This Website provided the local authorities with a valuable analysis tool they could use to follow directly, from one hour to the next, the development in the field. Furthermore, they got a rapid estimate on extend and nature of the damage which proved helpful both in their short- and long-term planning of mitigating actions and relief operations. Finally, new development of this damage assessment system, introduced since the described real-time operation was carried out, is outlined.

AUTOMATED DAMAGE DETECTION OF BUILDINGS FROM HIGH-RESOLUTION SATELLITE IMAGES – ID 714

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In the recent years, satellite remote sensing has become one of the most important and efficient tools to identify affected areas due to natural disasters, notably earthquakes, tsunamis, hurricanes, and floods. Among various remote sensing technologies, high-resolution optical satellites, e.g. QuickBird (QB) and Ikonos, have demonstrated their capability to capture damage distribution in urban areas due to disasters. Using actual high-resolution images with spatial resolution of 0.6-1.0 m, visual damage inspections have been conducted by several research groups for recent disasters. But it is time consuming to cover large areas and the results of visual inspection are dependent on interpreters. Hence in this study, automated damage detection methods are developed and their accuracy is examined, compared with the results of visual interpretation. As an example, QuickBird images obtained both before and after the 21 May 2003 Boumerdes, Algeria, Earthquake are employed. Both pixel based classification and object-oriented classification methods are used to identify severely damaged or collapsed buildings, which are characterized by debris around them. Based on pixel based classification using edge information,