Geophysical Research Abstracts,
Vol. 11, EGU2009-8478, 2009
EGU General Assembly 2009

Protective system for civil buildings and industrial structures subjected to the seismic risk

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Romania is a European country with significant seismicity. The most active seismic zone is represented by the Vrancea area, located within the arch of the Carpathians Mountains. Vrancea seismicity is characterized by intermediate depth earthquakes which occur in a narrow epicentral and hypocentral region. During the last 70 years, Romania experienced four strong Vrancea earthquakes: 10 November 1940 (Mw =7.7, 160 km depth), 4 March 1977 (Mw =7.5, 100 km depth), 30 August 1986 (Mw =7.2, 140 km depth), 30 May 30 1990 (Mw =6.9, 80 km depth). The 1977 event was characterized by catastrophic consequences: 1500 casualties and collapsing of 35 high-risk buildings, mostly occurring in Bucharest.

The purpose of this paper is to present a protective system designed to be installed in the civil buildings and industrial structures placed in the high seismic regions, and therefore to contribute to the mitigation of the strong earthquake effects on human society. This system proposes an efficient antiseismic protection, respectively shutting down the installations and equipments mounted in the building's infrastructure, which can become extremely dangerous in case of a major earthquake by appearing the possibility of explosions, deflagration, fires, toxic and polluting fluids leakage. The damages are strongly amplified by the fact that, simultaneously, water and electric energy lines distributions are damaged too, making impossible an efficient firemen intervention, for localizing the fire sources. Moreover, the installations of the individual heating stations which operate with open flame increase the risk of explosions inside the buildings during an earthquake.

The protective system consists of a seismic switch used for activating through weak-electric-currents of the building's safety systems in case of strong earthquake, especially designed for building's elevators, as well as for moving parts of installations, which require positioning in safety place areas. The originality of this device is based of a network of minimum three seismic sensors (accelerometers), which, through a coincidence circuit, endorses the presence of a seismic shock, excluding the accidental triggers caused by local noises and mechanical shocks from neighboring area. When is activated, the system allows to automatically place in safe position the most dangerous installations located in buildings, such as elevators, heating systems using natural gas or high pressure liquid, water pipes, thermal stations, electrical power line etc.

Presently, in Romania, such protective systems installed in the buildings and structures subjected to seismic risk are not available. The only possibility of protection against the potential disastrous effects of earthquakes (wounded, lost of human lives, important material losses, explosions, fires, damages of the water and electricity lines) is to adopt clear solutions for preventing and reducing as much as it is possible the dimensions of material damages and casualties.