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DECISSIVE FACTORS IN THE EVALUATION OF SUPPORT ELLEMENTS IN HAZARD, SEISMIC RISK AND VULNERABILITY ANALYSES

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Abstract
Destructive phenomena in Romania are priority issues for specialists and state administration responsible for protection of human lives and reduction of losses caused by natural disasters. The role of specialists is to develop strategies in order to prevent and reduce the effects due to natural hazards.
Romania is one of the countries possessing the most unfavorable seismic, geological and geotechnical for about 30% of the territory and having specific behavior under mechanical and fluid stresses, a variety of relief forms with structural, geological and hydrological particularities, soils affected by the subsidence process caused by the existence in the depth of artificial cavities due to human activities, subsoil exploitation or natural created subsoil.
The displaying way of the instability phenomena is conditioned by a number of influence factors namely, natural factors (seismic, landslides, heavy rain, explosions, etc.), had a leading role in relation to man-made factors. Areas affected by natural risk factors, known so far in Romania, are broadcasted by national mass-media structures, without making a complete and complex analysis of all current and potential high-risk areas.
Romania is located in a high seismic potential area. Vrancea area, located on the contact line of tectonics plate, is the epicenter of most medium and large amplitude seismic motions. Thus, the ongoing process of harmonization of the Romanian prescription with the European seismic design ones, requires to take into account the local ground conditions on seismic motion, their quantification being necessary accordingly with the specific geological, geotechnical and seismic of our country.
In accordance with the local soil conditions, starting from the simple observation that during the same earthquake the soil respond differently from one site to another and therefore the same building, during the same earthquake, will have a different response from one location to another.

Keywords: hazard, risk, vulnerability, seismicity, instability

1. INTRODUCTION

The foremost and continuous problems the factors of responsibility and implicitly the experts in the area are confronting with actually consist in the thorough cognition of the destructive phenomena on the territory of Romania in order to establish strategies for the prevention and the reduction of the effects of the natural hazards.
Romania is a country with highly unfavorable seismic, geological and geotechnical conditions. About 30% of our territory consists of soils with specific behavior under mechanical and hydrological loads, highly variable geological structures and hydrology, areas affected by subsidence phenomena due to deep cavities, either natural or created by man-made activities, such as subsoil utilization.
The ways instability phenomena manifest themselves are controlled by a series of factors, including natural factors (seismic motions, landslides, deluges, explosions, and so on) which together play an overwhelming role as compared to man-made factors. The areas affected by natural risk factors of Romania are intensely presented in the press, without a comprehensive analysis of all areas involving a high potential or existing risk.
Romania is a country with high seismic risk. Vrancea area, situated on the contact line between tectonic plates, is the epicenter of the majority of medium and high amplitude seismic motions. In this respect, the current process of harmonization of Romanian seismic codes with European standards compels us to consider the local soil conditions with regard to the seismic hazard by quantifying them considering the geological, geotechnical and seismic conditions of our country.
In accordance with local soil conditions, starting from the simple observation that during the same earthquake ground respond differently from one location to another and therefore the

same building during the same earthquake will have a different response from one location to another.
In 2003 Romania has signed at Kiev, the protocol regarding strategic environmental assessment which represents an operational instrument of insuring durable development, thus the project outcomes represents a contribution to achieve these goals.
The Yokohama Strategy, adopted in 1994, reflects the principles of administration for preventing hazards, assurance of readiness towards them and attenuation of their effects. The International Conference regarding the negative effects of the natural hazards (January 2005, Kobe) approved 5 guidelines to fight against them, which served as basis for the elaboration of the action framework 2005-2015: decreasing of hazard risks – national and local priority, highlighting, evaluation, risk monitoring, rationally use of knowledge and training system, increasing of the level of knowledge against hazards in the most effective and efficient response. During 2006-2007, ONU organized international campaigns so called "Disaster education begins in school" for informing and educating youngsters in relation to natural hazard factors effects, and to achieve a positive reaction in crisis situation.

2. SEISMIC RISK ANALYSIS

The seismic action is considered as a basic in risk analysis, hazard and vulnerability and is defined from the point of view of:

- source, the conventional representation of the area where it originated;
- location as a conventional representation of the place where the source affects a component of the building;
- magnitude;
- ground motion intensity as a measure of the severity of action in a certain place.

2.1. Seismic risk – definitions and applied methodology for evaluation

Seismic risk uses the results of a seismic hazard analysis, and includes both consequence and probability. The risk concerns in quantifying the effects of natural disasters, both in the form of value, but especially by the loss of life. Seismic risk has been defined as the potential economic, social and environmental consequences of hazardous events that may occur in a specified period of time. It is often determined using a seismic modeling computer programs which uses the seismic hazard inputs and combines them with the known susceptibilities of structures and facilities, such as buildings, bridges, electrical power switching stations, etc. While the results can be used as a general measure of seismic risk for types of buildings, the actual seismic risk for any individual building may vary considerably and will depend upon its exact configuration and condition [2].
Thus defined, the risk is waiting occurrence of damage or loss expressed in probabilistic terms compared with the final build that system performance depends on the time of service. Regarding the different characteristics of risk, we can define:

- specific risk depends on the expression of risk factors (representing various components of social life that may be affected by a disaster: people, goods, economic or cultural, different human activities: productive, cultural, administrative and so on, systems that ensure the responsiveness in special situations of crisis caused by a disaster), some of which are subject to permanent and stable, others only intermittently and in varying degrees of exposure;
- primary risk or damage;
- risk or risk of loss resulting;

The necessary and decisive factors to be taken into account for seismic risk assessment are defined as follows:

- selection of active faults in the region and type of movement. In addition are necessary geological criteria for fault movements in the Holocene;
- mapping of geological structure of that site and its surroundings, with an intensified focus on the superficial layer of rock and a study of the latest tectonic movements. Such maps show the rock type, structure and

surface faults include evaluations of the likely length, continuity and type movements of such faults;
- geophysical exploration are used to define and find the location of the most recent fault rupture. Geophysical evidence is found sometimes included in the resistance and gravity measurements along the profile normal fault;
- check the underground water level in the vicinity to determine if those barriers are present, which may be associated with fault and affects soil behind shake movements;
- a detailed documentary history of earthquakes in the area and around it. Catalogs of seismic events over time are necessary for the preparation of possible earthquakes lists. The list must provide the location, magnitude and maximum modified Mercalli intensity for each earthquake;
- the available recording review about seismic motions, damages and other information related to the intensity near the affected area;
- estimated maximum Mercalli intensity around the area through reports with forecasts;
- geological and seismological evidence gathered in one section can be used to predict an earthquake that will shake the most powerful of the earth in that area and where possible, to specify where the fault rupture may occur. These data are useful to express the magnitude of possible earthquake damage in the standard curve;
- data regarding geological foundation of this material, a geological report on the superficial layer of the area. Adding the areas of subsidence, settlement and slope stability should be studied;
- study of fundamental properties to extend the type of building search;
- measurements of soil physical properties determined in situ or in the laboratory tests;
- measurements of the seismic wave's velocity by using geophysical methods.

3. SEISMIC HAZARD

Although greatly confused with seismic risk, seismic hazard is the study of expected earthquake ground motions at any point on the earth.

The specialists in geography were concerned at first in the definition of risk and hazard, for use on the one hand to explain natural phenomena observed and registered in the planet, and on the other hand, the short or medium term forecast the appearance of these events and their dissemination as possible elements for advertising on climate.

There were data for more definitions of "hazard", namely:

- is a contest of circumstances (favorites or bad) whose cause remains unknown, an unforeseen accident, unexpected (game of hazard), word with French origin "hasard" (definition of DEX 1975, p. 393);
- in the Grand Larousse, Vol. V, states that the word is of Arabic origin, "az – zahr" (game of dice, symbolizing the episode) and is defined as an interface generally accidental and unexpected series between two or more causal relations of which are mutual, every time rigorously determined, but their relative independence, is not responsible then ignorance and our inability (quoted by Zavoianu and Dragomirescu 1994);
- the hazard is defined in Wikipedia "The Free Encyclopedia" as follows: "A hazard is a situation that poses a level of threat to life, health, property, or environment. Most hazards are dormant or potential, with only a theoretical risk of harm; however, once a hazard becomes active, it can create an emergency situation".

All these definitions lead us to conclusions, namely that: hazard is a random phenomenon, large scale, unpredictable, an indeterminacy in time and space, a step or a threshold in the evolution of the system that download and cause huge energy disorder, imbalance scale natural evolution of the environment, on its way to a new equilibrium.

Further, seismic disaster, was defined on a seismic hazard zone, representing a measure of recurring seismic events, with some features specific to a given time (in additions to the

Romanian Seismic design code: P 100-1/2006 "Seismic design code. Part l. Design provisions for buildings") [3].

The calculations for seismic hazard can be quite complex. First, the regional geology and seismology is examined for patterns (using seismometers and earthquake location). Each zone is given properties associated with source potential: how many earthquakes per year, the maximum size of earthquakes (maximum magnitude), etc. Finally, the calculations require formulae that give the required hazard indicators for a given earthquake size and distance. For example, some districts prefer to use peak acceleration, others use peak velocity, and more sophisticated uses require response spectral ordinates. The results may in the form of a ground response spectrum for use in seismic analysis. The standard seismic hazard calculations become adjusted upwards if you are postulating characteristic earthquakes. More elaborate variations on the theme also look at the soil conditions. Areas with high ground motion due to soil conditions are also often subject to soil failure due to liquefaction or landslides [4].

4. VULNERABILITY

Vulnerability as a concept is the susceptibility of a system built of objects; objectives located in a certain area, to suffer damage or loss following a seismic event individually and can be expressed in probabilistic or statistical terms. In relation to hazards and disasters, "the concept of vulnerability expresses the multidimensionality of disasters by focusing attention on the totality of relationships in a given social situation which constitute a condition that, in combination with environmental forces, produces a disaster" (Bankoff et al. 2004: 11).

Vulnerability refers to a seismic event and expresses individual parameters as function of magnitude (M).

In terms of methodology, it may be helpful to define components: primary vulnerability, which refers to the distribution of degree of damage to objects, the objectives of the site with a sure seismic vulnerability that is related to secondary distribution losses (for a component of losses defined - people, goods) and is conditioned by the degree of damage to the system built.

The product of the two components will give us the vulnerability results also represent concerns of seismology experts and manufacturers whose results are made available to those dealing with disaster management (in particular seismic disasters) [1].

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