SEISMIC HAZARD ASSESSMENT AND SITE-DEPENDENT RESPONSE SPECTRA PARAMETERS OF THE CURRENT SEISMIC DESIGN CODE IN ALBANIA

LL DUNI¹ and N KUKA¹

A probabilistically based hazard map of Albania expressed in terms of PGA for 475 years of return period following the spatially smoothed seismicity approach proposed by Frankel (1995) and developed by Slovenian researchers (Lapajne et al. 1997), is presented. Taking advantage of this development, an effort has been made to analyze the parameters of site-dependent acceleration response spectra parameters of the current seismic design code KTP-N.2-89 in Albania.

Keywords: design code; response spectra; seismic hazard; zoneless approach

Introduction

The continuous improvement of procedures for defining the seismic hazard at regional (national) and local level is essential for the optimum design of earthquake-resistant structures. Reference motion and detailed characterization of soil conditions are milestones for the definition of seismic action in design codes. Following the new probabilistically based seismic hazard map of the country recently carried out at the Seismological Institute, and due to the fact that the seismic hazard procedures adopted for the definition of the so-called “seismic coefficients” of the actual seismic design code are not based on the PSHA (Cornel approach), it is necessary to review the site-dependent spectral response parameters adopted in the current Albanian seismic code KTP-N.2-89, established mostly, taken into account the relations recommended by the MSK-64 macroseismic scale (Koçiku 2003). Furthermore, the new seismic hazard map can serve as basis for the definition of a new seismic design code of the country following the EC8 approach.

Seismic hazard analysis is the evaluation of potentially damaging related-phenomena to which a region or a facility may be subjected during its useful lifetime. The simple evaluation of the probable seismic hazard is the mapping of earthquakes epicenters that have occurred historically in a certain area. Another step would be the map of maximum observed intensities. Up to now, the seismic hazard in Albania has been assessed mostly in terms of macroseismic intensity (Substarova et al. 1980). Several attempts have been made to express the seismic hazard in terms of ground acceleration, velocity and displacement following both deterministic and probabilistic approaches Muço et al. (2001, 2002), Peçi et al. (2002).

The current practice in Albania for assigning the earthquake load in regard to the design of structures is to utilize the seismic zonation map (Fig. 1) published

¹Institute of Seismology, Academy of Sciences, Tirana, Albania, duni@sizmo.albnet.net, kuka@sizmo.albnet.net
by the Seismological Institute in 1980 (Sulstarova et al. 1980) and various maps compiled during the microzonation studies recently carried out for seven largest urban areas of the country. The map presented in Fig. 1 is based on the intensities of strong historical earthquakes, the earthquakes of XX-th century, as well as on seismotectonic synthesis. According to that, all the territory of Albania is divided into three main zones with basic intensity of shaking VIII, VII and VI degrees of MSK-64 scale, for average soil condition. In some parts, due to poor soil conditions, the seismic intensity may attain up to IX degree of intensity. As average soil condition, thick, stiff quaternary sediments with deep ground water level are considered.

**Seismic hazard assessment**

Of the various methods of seismic hazard analysis in use today, the most widespread is the probabilistic seismic hazard analysis (PSHA), proposed by Cornell in 1968 (Cornell 1968). A PSHA requires a model consisting of three main elements:

— The definition of potential seismic sources.

— A statistical description of seismicity in these zones. This is most often expressed in terms of a Guttenberg-Richter (G-R) magnitude recurrence relationship. It is generally assumed that the seismicity of each source follows a Poissonian occurrence process.

— An attenuation function relevant to the hazard parameters considered. It is necessary to know the rate at which ground motion decays with distance from the epicenter or hypocenter or fault rupture as a function of magnitude.

The PSHA output is defined as the probability that a ground motion parameter (PGA, spectral values, intensity, etc.) will be exceeded within a given time period. The result can be expressed either as a hazard curve giving the annual probability of any level of ground shaking being exceeded at the site of interest, or in the form of hazard maps represent spatial variability of the selected ground motion parameter for a given return period.

Two potential difficulties one faces in the process of probabilistic seismic hazard analysis:

— the incompleteness of seismic catalogues,

— requirement of specifying seismic source zones.

The latest requires many times the expertise of a number of independent groups of specialists for the creation of different, more or less subjective source zone models. On the other hand, the assumption of spatial uniformity within an area source sometimes conflicts with the observed spatial distribution of epicenters. This is the reason why a zoneless approach is often used Frankel (1995), Woo (1996), Crespo and Marti (2002), Martin et al. (2002).