A set of new approaches to seismic hazard clarification, the experience of Kyrgyzstan

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The subject of the study is the improvement of methods for assessing seismic hazards associated with the magnitude of the maximum possible seismic impact and local conditions. In mountainous conditions, where the thickness of the soil layer is only a few tens of meters from the rock mass, it is necessary to study local conditions in more detail. By itself, the study of local conditions was carried out by engineering-geological methods, until recently its analysis was carried out mainly within the framework of engineering seismology. The task of this work is to study the magnitude of the maximum possible seismic impact, and to clarify the local response to such an impact.

The error in determining the maximum possible seismic impact due to the rare recurrence of strong earthquakes can reach 2-3 points, and a typical error due to underestimation of local ground conditions usually ranges from half a point (in exceptional cases up to 1.5 points).

From the engineering and construction point of view, the top 30-meter soil layer is considered an important factor for the design of buildings and infrastructures. The study of the propagation of seismic waves on the ground and in the building, allows us to describe the relationship of soil-building (soil-structure interaction) and the dynamic effects of the building (see direct and inverse problems), to create a theoretical basis for solving important problems of engineering seismology.

In seismological practice, a number of issues of a fundamental nature are not clear, in particular:

1) how are the periods of fluctuation of loose soil near the infrastructure arranged;

is it possible and how to determine the parameters (frequency characteristics, shear wave velocity at a 30-meter thickness, dimensions/thickness of the ground layer) using seismic noise, regardless of geological data, surface wave data and other hard-to-obtain information;

2) is there an almost reliable relationship of shear wave velocities (Vs30) for tectonically active mountainous areas by the properties of the geomorphology (terraces) of the terrain;

3) what is the geomechanical nature of the process of transition of seismic waves from the ground layer to the infrastructure;

4) how to correctly extrapolate observations of ground vibrations obtained at medium distances and magnitudes to large magnitudes and small distances, how to theoretically substantiate empirical laws of engineering seismology.

A set of new approaches has been proposed and implemented to refine seismic hazard estimates in terms of estimating the magnitude of maximum seismic impacts and taking into account ground conditions.

An area estimate of the values of maximum seismic impacts and PGV values was obtained based on field macroseismic data in the Pamir-Alai collision zone and for the upper Naryn river area.

The comparative efficiency is determined and an effective method for determining the site effect values based on the analysis of the microseism field is tested. A method of soil classification has been developed and tested using the frequency characteristics of the soil.