

ABSTRACT

The doctoral dissertation concerns the assessment of surface seismic hazard as an effect of the impact of potential induced seismic events, forecast for current and perspective hard coal mining in the central and northern part of the Upper Silesian Coal Basin (USCB), up to 2050. The main scientific goal of the dissertation was therefore to determine the seismic intensity and surface vibration parameters for high-energy seismic events forecast for 2050 in the area of research. To achieve this goal, in the first stage a forecast of the magnitude of potential seismic phenomena induced in the areas of planned and perspective mining, using statistical Gumbel distributions was developed. This forecast showed that during future operation in the next 30 years, the occurrence of a mining tremors with energy $E \geq 9 \cdot 10^8$ J is a certain event (probability $p = 1$), while the occurrence of a shock with $E \geq 2 \cdot 10^{10}$ J is expected with a probability of $p = 0,15$. Isoline maps of the thickness of the Quaternary layers were developed and based on this data, isoline maps of the ground vibration amplification coefficient for the characteristic wavelength of strong seismic events induced or activated by mining exploitation in the research area were determined. Parameters of predicted ground motion were calculated and maps of vibration isolines of peak velocity amplitudes, PGV_{Hmax} and peak horizontal accelerations, PGA_{H10} in the area of the Bytom trough and main saddle were developed. The highest amplitudes of PGV_{Hmax} determined from regression curves, reach values from 0,06 to 0,11 m/s, while the highest amplitudes of PGA_{H10} reach values from 1,2 to 3,2 m/s^2 . Based on the predicted ground vibration parameters until 2050 in the Bytom trough and main saddle, maps of seismic intensity distribution were elaborated, according to the scale developed for seismicity induced by mining exploitation, GSIS-2017. From this map it can be concluded that in small areas, located in the epicenter of the predicted mining tremors, the vibrations may reach the V-VI intensity level according to the GSIS-2017 scale, and thus may be harmful to buildings, including even structural elements of existing buildings. In the aspect of designing new buildings in the areas of planned and perspective coal mining, design acceleration maps were developed according to Eurocode 8. In the certain areas of the Bytom trough and the main saddle, the projected maximum design acceleration reach values from 0,4 to 1,4 m/s^2 and mean the need to take dynamic forces into account when new buildings are designed.

Knowledge gained should have practical application and be used and helpful both for mining entrepreneurs in conducting current or planned coal extraction, for mining supervision authorities, for Archives of Survey and Geological Documentation, for approving mining plant operation plans, for decision-making bodies in the scope of granting concessions, as well as for local governments when making decisions regarding urban development of the areas, under which the extraction of new or reused hard coal deposits in USCB will be carried out.