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National Mitigation Strategy against Earthquakes in Central Asia

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Throughout history, earthquakes have caused extensive damages in urban areas with important infrastructures and high population density. Especially, earthquakes have extensively damaged many regions of Central Asia (e.g., Tashkent in 1966, and Almaty in 1911). Hence, the estimation of the seismic hazard of the urban areas in Central Asia is very important due to the high level of seismicity in Central Asia and the rapid construction of new buildings. The high earthquake-induced damages in the cities often result from the local geological conditions and engineering properties of the soils that can produce significant site effects. Such seismic effects combined with the high vulnerability of buildings can result in extreme disasters during earthquakes. Therefore, geotechnical engineers/seismologists should decide to divide the city into specific microzones depending on their site effects and soil properties. However, conventional approaches in Central Asia have been proposed, based on (1) general engineering geological information; (2) the building code based on the estimates of the ground motions in terms of MSK-64 scale developed in 1978; and (3) the quantitative assessment only mapping and overlaying the data.

By characterizing the soft layers of their nature, thickness, and structure, and assessing the numerical model developed for the high-seismicity area of Central Asia, we can better assess specific site effects in each region of Central Asia. In addition, to predict the essential consequences of earthquakes, physically-based ground motion simulations should be developed by numerical simulations considering all possible processes of seismic wave propagation. Compared to empirical ground-motion predictions, numerical simulations of earthquake scenarios will provide much more flexible and better-suited solutions for most applications – especially those involving complex city environments. The ground-motion prediction equations or stochastic ground-motion estimates integrate characteristics of the earthquake source, path, attenuation, and site effects via approximate or statistical approaches. This method will provide rapid solutions that may be valid for a well-known context and would also be applied in Central Asia, for comparison with the numerical simulations. Finally, the quantitative approach for microzoning map incorporated with numerical simulation/site response analysis, for infrastructures (e.g., buildings, bridges, and dams) will be significantly useful in the future.