

## Prediction of long-period ground motions and damage prediction map of long-period structures from great subduction earthquakes

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Mega-cities such as Tokyo, Yokohama, Nagoya, and Osaka representative of cities in Japan are located on deep sedimentary basins and near subduction zones with high earthquake potential. There are many long period and low damping structures (such as super high-rise buildings and large oil storage tanks). Therefore, those cities have high possibility hit by strong long-period ground motions once great subduction earthquakes happen.

It is very important for the earthquake disaster mitigation to predict long period strong ground motions of the future great earthquakes that are capable of exciting long-period strong ground motions over a wide area. In this study, we estimated long-period ground motions in Osaka and Nagoya from the future great Tonankai-Nankai earthquake with M 8 class using 3D finite difference method. We also estimated long-period ground motions in Tokyo and Yokohama from the large nearby earthquakes with M 7 class with high probability of occurrence.

Then, we tried to assess the damage potentials of structures against long-period ground motions. First, we confirmed that seismic responses of an equivalent single degree of freedom structure model due to long period ground motions are comparable to those of detailed frame structure model with respect to responses in the fundamental mode. We evaluate maximum deformation angles and energy equivalent velocities of structures as damage indices for simplified structure models with an equivalent single degree of freedom against predicted long-period ground motions. We construct damage potential maps for long-period structures with predominant periods of three to six seconds in Osaka and Nagoya. The damage limits are expected to be about 1/100 radian for the maximum deformation angles and 110 - 220 kines for the energy equivalent velocity. We find there are some areas beyond such damage limits in Osaka and Nagoya. These results provide very useful information for the earthquake disaster mitigation of long period structures such as super high-rise buildings and large oil storage tanks.