

# Effects of groundwater level on characteristics of ground motion during earthquake

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Recently, besides groundwater pollution and drinking-water scarcity, severe problem of the rising groundwater table is emerging in urban areas of Japan. Shallow water table can be susceptible to amplify the ground shaking, to liquefy the subsurface layer during earthquake and to collapse the excavation walls at underground construction sites.

Osaka province where has gotten as a pivotal position of various industries in southwest Japan since beginning of the nineteenth century. The stretch of bay area suffered tremendous damages of land subsidence resulted from pumping-up a great volume of the groundwater. The government imposed legal controls on the industry-water pumping consequent upon the land subsidence as a matter of course. The measure could make the land subsidence terminate successfully and completely. The groundwater table in Osaka, however, has continuously raised so far since the legal control and has ultimately reached to near ground surface.

Some differences were observed between distribution patterns of seismic intensity for the Showa Nankai earthquake (1946,  $M=8.0$ ) and the Ansei Nankai earthquake (1854,  $M=8.4$ ). Although Osaka area showed the normal zoning of seismic intensity for the Showa Nankai earthquake, the seismic intensity anomaly is found in Osaka for the Ansei Nankai earthquake. This fact can be interpreted as the result from the difference of the groundwater levels. The distribution pattern of seismic intensity in Osaka were also examined for the other several tens main events from 1930 to present. As the results, a period showing normal distribution of seismic intensity corresponds to the period, year of 1940 to 1960 which Osaka area was under the state of extremely lower groundwater level.

It is necessary to hold the groundwater table to most reasonable level, to prevent the earthquake damages due to liquefaction.