

Paper Number: 5102

Liquefaction-Fluidization induced land subsidence: Impact of the 2011 Tohoku earthquake on man-made strata around Tokyo bay area, Japan

Kagawa, A.¹, Furuno, K.¹, Kusuda, T.¹, Sakai, Y.¹, Yoshida, T.¹ and Kazaoka, O.¹

¹Research Institute of Environmental Geology Chiba (RIEGC), Inagekaigan, Mihama-ku, Chiba, Japan

The 2011 off the Pacific coast of Tohoku Earthquake caused heavy damage by Tsunami and geologic disaster on east Japan. Tokyo bay area is underlain by hydraulically emplaced dredged fill and man-made strata resting on thick uncompacted Holocene deposits. In this area, liquefaction-fluidization was visibly manifest by sand boils, ejection of muddy groundwater, land subsidence and floating underground tanks. In part, the banks on the edge of the reclaimed lands had broken by the outflowing boiled sand pressure.

Urayasu city, located along the northeast coast of the Tokyo bay, is composed of Holocene deltaic strata and man-made strata. The authors surveyed by levelling the elevation differences of a number of the benchmarks before (2010) and after (2011) the earthquake. The results show that about 4 cm of subsidence developed in the area with Holocene deposits, and more than 17 cm in the reclaimed land. Moreover, the authors investigated the differences between land subsidence of the ground level and the remains of the pre-earthquake surface in correspondence of the piled buildings. The value of subsidence is representative of the degree of liquefaction-fluidization [1].

At the latest hydraulically emplaced dredged fill area, land subsidence reached 95 cm. The historic aerial photographs show a correspondence between the dredged trench and the rates of subsidence. The differences between the thickness of the man-made strata and Holocene sediments played an important role on the subsidence amount and distribution.

References:

[1] Kagawa, A., Furuno, K., Kusuda, T., Satoh, K., Sakai, Y., Kamura, K., Kazaoka, O., Morisaki, M. and Nirei, H. (2000) Land Subsidence in artificial islands due to liquefaction caused by the Kobe Earthquake in 1995, Japan. Proceedings of the Sixth International Symposium on Land Subsidence, 45-51.

