Examination of the damage of the high-rise building foundation during a large scale earthquake

Project Number: hp150063
Category: K Industrial Use
Period: 2015/4/1 - 2016/3/31

Objectives

Damage prediction of a high rise building in a bay area under large earthquakes is very important issue for a metropolitan like Tokyo. A Foundation of a high rise building on soft ground is predicted to be damaged by large soil deformation. However there are many uncertainties on the seismic behavior of a foundation. The aim of this study is to clarify the damage of a foundation of a high rise building using a numerical analysis of a detailed soil-building interaction model and to improve the safety of a building.

Outline of Results

Seismic response analysis of the 12 stories residential building supported on the piled raft foundation with grid-form deep mixing walls (DMWs) is conducted. At this building, the seismic monitoring data was recorded at the 2011 off the Pacific Coast of Tohoku Earthquake, and the data have been numerically reproduced using the detailed three dimensional finite element model successfully in the previous study. In this study, a large earthquake load that is notified by Japanese building design code as a level 2 earthquake is used as an input motion. The recurrence interval of the level 2 earthquake is assumed to be 500 years, and it is used for a performance design of a building. Under the level 2 earthquake, tension failure will occur within the grid-form DMWs. Then the constitutive model that is able to evaluate tension failure correctly is used for the DMWs. Consequently, it is found that the grid-form DMWs are very effective at reducing the sectional force of piles to an acceptable level even if the induced stress in the DMWs partially reaches its tensile strength during a large earthquake.