

# Development of technologies that contribute to the regeneration and strengthening of cities through the rationalization of structural regulations related to buildings and the ground

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INOUE Namihiko, Building Quality Researcher, Building Department

NAKAZAWA Atsushi, Head, SAKASHITA Masanobu (Ph.D. in Engineering), Chief researcher, Standards and Accreditation System Division

KIKITSU Hitomitsu (Ph.D. in Environmental Science), Head, KASHIWA Hisatoshi (Ph.D. in Engineering), Chief researcher, Structural Standards Division

TSUCHIYA Naoko (Ph.D. in Engineering), Chief researcher, Material and Component Standards Division

ISHIHARA Tadashi (Ph.D. in Engineering), Head, Evaluation System Division

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## 1. Introduction

About half of all non-residential buildings in Japan are more than 30 years old, and the number of cases where reconstruction is being considered is increasing. Amidst this growing momentum for urban renewal, it is necessary to develop rational structural regulations for buildings that address issues related to existing piles in order to promote the renewal of buildings while responding to diverse needs and to rapidly strengthen cities. The objective of this study is to develop a safe and rational use of sites that have existing piles. In FY 2020, in order to contribute to the development of a design method for pile foundations on the grounds of a site where existing piles have been removed, loading tests and response analyses were conducted to understand the effects of pile removal. Details of the development of technology related to the retaining wall of existing residential sites conducted in this study are reported separately.

## 2. Outline of technological development

### (1) Loading test to evaluate the effect of removing existing piles from the ground

On the grounds of a site with existing piles, the existing piles were removed and backfilled, followed by the installation of new piles, and vertical and horizontal loading tests were conducted (photo). The experimental data will be used to demonstrate how changes in the ground characteristics of the site caused by the removal of piles would affect newly installed piles at the site, thereby moving on to the development of a rational earthquake resistant design method for pile foundations and superstructures that includes the handling of existing piles.

### (2) Analysis to evaluate the effect of the removal of existing piles and installation of new piles on the

### superstructure of buildings

In order to understand the effects of pile removal and new installation, the study used numerical analyses to investigate the effect of ground loosening and other conditions caused by the removal of existing piles and new installation on the stress and seismic response performance of the superstructure of a newly constructed building (Figure).



Photo: Vertical load test (rapid loading method)

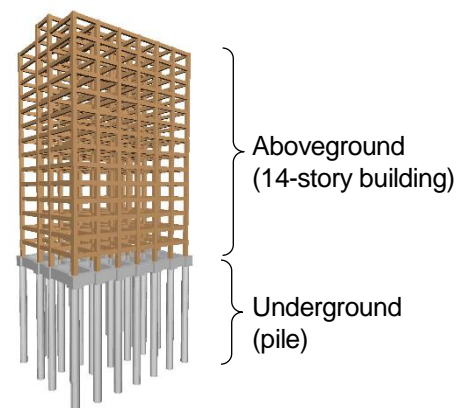


Figure: Subject of study (a 14-story model integrated with piles)

## 3. Future plans

Technological development will be conducted while

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continuing the collaboration with the relevant departments of the Ministry of Land, Infrastructure, Transport and Tourism, the Building Research Institute, academic experts, and related organizations, such as industry associations related to building foundations and geotechnical engineering.