Abstract of the dissertation

Title: Engineering Properties of Stabilized Marine Clay Using Basic Oxygen Furnace Steel Slag: Strength Development and Expansion Behaviour

（製鋼スラグを用いて改良した海成粘土の工学的性質：強度発現および膨張特性）

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The recycling of slag is a strategic issue in countries with huge iron and steel manufacturing industries. Japan itself annually produced 30 million tons of slag, 8.3% of the total worldwide production 360 million tons (globalslag.com). Over 39 million tons of steel slag was produced in 2010 and ~5% of it was landfilled in disposal facilities (Horii et al., 2013). The significant number of unused steel slag that ends up in disposal site is not only uneconomical but also not environmentally friendly, thus an alternative and sustainable method to increase the recycling rate is necessary.

This study was achieved as a fundamental study of engineering properties of stabilized marine clay with basic oxygen furnace (BOF) slag to enhance and broaden the use of BOF slag in civil works. Four main studies were performed: (i)Strength development and microstructural characteristic of dredged marine clay (DMC) with BOF slag, (ii)Particle size effect of BOF slag in the stabilization of DMC, (iii)Expansion characteristic of BOF slag mixed with DMC, (iv)Time-delay effect on the strength development of stabilized DMC with BOF slag.

In investigating the compressive strength and expansion rate of the stabilized DMC with BOF slag, a laboratory vane shear and an unconfined compression test, and an accelerated expansion test were performed. Scanning electron microscope and energy dispersive spectroscopy were adapted to observe the microstructure of stabilized DMC with BOF slag.

Overall, the study results indicate that BOF slag is satisfactory to stabilize DMCs. Strength of the stabilized DMC with BOF slag (SMSS) develops significantly with time; classified into three stages, inactive, high accelerated, and moderate accelerated zone. The different grain size distribution of BOF slag affects the strength development of BOF slag which highly relates to the specific surface of BOF slag. The expansion can also be effectively diminished with the addition of DMC. These findings are supported by the microstructure of the material. SMSS has a self-recovery feature that allows it to mobilize its strength after a disturbance occurs.