ABSTRACT

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Soil improvement by cement column method, which increase shear strength and reduce consolidation of soil, is very successful in soft clay. However, there are very limited informations of the application for stiff clay or clayey sand. This study presents the results of soil improvement by cement for soft clay, stiff clay, clayey sand, and sand from both field and laboratory works. In part I, the study presents the results of soil improvement by mixing with cement in laboratory and field for clay (CH, CL), clayey sand (SC), and sand (SW, SW-SP) from West Bank Raw Water Canal Project (Mae Klong – Tha Chin). Jet Grouting Method was selected for installation of cement column in the field. In part II, the study presents the results of soil improvement by cement in laboratory for stiff clay and clayey sand in Chiang Mai province.

In part I, it was found that the field undrained shear strength from unconfined compression test of the soil cement varied in a very wide range, the highest value is about 3 times of the lowest value. The strength from soil cement specimens prepared in laboratory is 2 to 4 times higher than the lowest strength in the field. The strength for clayey sand and sand is 2 times higher than clay. In part II, it was found that the laboratory undrained shear strength and modulus of elasticity (E_{50}) from unconfined compression test of stiff clay and clayey sand, which mixed with cement, increased when quantity of cement was increased or value of water by cement ratio was reduced. The strength at 28 days of improved stiff clay (shear strength before improving is 10 t/m^2) is 40 to 125 t/m^2 and modulus of elasticity is 14,000 to 41,000 t/m^2 when quantity of cement is 100 to 300 kilograms per cubic meter of soil and water by cement ratio is 1.0 to 1.7 by weight. The $E_{50}/c_{u,col}$ ratio of stiff clay is 200 to 500. For improved clayey sand, the strength at 28 days and modulus of elasticity is 60 to 180 t/m^2 and 26,000 to 60,000 t/m^2, respectively. The $E_{50}/c_{u,col}$ ratio of clayey sand is 200 to 600. The strength and modulus of elasticity for both soils are higher at 90 and 180 days than at 28 days.

The undrained shear strength of soil cement is reduced when plasticity index or percent finer in the unimproved soil is increased. From the informations about laboratory and field undrained shear strengths of the Canal Project, the field undrained shear strength of Chiang Mai stiff clay and Chiang Mai clayey sand might be estimated as 20 to 60 t/m^2 and 35 to 100 t/m^2 when quantity of cement is 100 to 300 kilograms per cubic meter of soil and water by cement ratio is 1.0 to 1.7 by weight.