The Engineering Properties of Dredged Marine Soil Solidified with Activated Steel Slag

Chee-Ming Chan (Faculty of Civil and Environmental Engineering & Universiti Tun Hussein Onn Malaysia (UTHM), Malaysia)

Dredging is the operation of removing material from one part of the water environment and relocating it to another, with the general purpose of offshore construction, maintenance of waterways and reclamation. The large amount of dislodged materials known as dredged soils, are generally considered a waste and dumped into open sea, causing environmental concerns. On the other hand, steel slag is an industrial waste resulting from the process of steelmaking, destined for disposal in landfills too. As such, this study is about the mixing of a dredged marine soil with activated steel slag, with the aim of determining the effectiveness of the slag in solidifying the soil. The dredged soil was collected from Melaka waters, categorized as a high plasticity silt (MH), with natural moisture content 130.7 %, specific gravity 2.53, liquid limit 66 % and plastic limit 51.6 %. The steel slag was first ground to particles smaller than 2 mm for mixing with the soil. It was activated with a range of different molarity NaOH, with only the optimum molarity resulting in maximum improvement of the soil being used throughout the study. 3 predetermined ratios of clay: activated steel slag were examined, i.e. 3:7, 5:5 and 7:3, and the soil-slag specimens were left to cure up to a month. The specimens were subjected to the unconfined compressive strength (UCS), vane shear and bender element tests at the respective ages. It was found that greater strength and stiffness improvement were produced by higher steel slag content and longer curing periods. The steel slag addition also helped reduce moisture in the originally wet soil. Overall it can be concluded that activated steel slag from Malaysian steel-making industry can be potentially used to solidify the otherwise waste dredged marine soils for reuse as a sound geomaterial.