EVALUATION OF CRUMB-RUBBER IN THE STABILISATION OF SOFT SOIL

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ABSTRACT

The presence of soft soil poses challenges to foundation, thus necessitating the need for ground improvement techniques like weak soil replacement, compaction, and soil stabilization. This study evaluated the effect of crumb-rubber (CR) on selected soft soil. The CR specimen was prepared into sizes of 0.6 mm (CR1), 1.18 mm (CR2), 2.36 mm (CR3) and 4.75 mm (CR4). The soil sample was treated with each of the sizes of CR specimen at percentage replacement of 0, 2.5, 5, 7.5 and 10 %. Each of the Soil-CR mixture was identified as SCRM1, SCRM2, SCRM3, and SCRM4 based on the aforementioned CR sizes, respectively, and has four sample mixtures based on aforementioned percentage replacements, with a total number of sixteen samples in all. The geotechnical and chemical properties of the soil, CR, and SCRMs were examined by performing tests such as Natural Moisture Content (NMC), Specific Gravity (Gs), Atterberg Limits, Compaction, Unconfined Compressive Strength (UCS), California Bearing Ratio (CBR), X-ray Fluorescence (XRF), X-ray Diffractometry (XRD) and Scanning Electron Microscopy (SEM). The results showed that the soil has high water holding capacity of 23.5 %, light weighted (Gs = 1.62), low plasticity (PI = 2.72) and thus classified as Low Plastic Organic Silty Soil (OL). It has a UCS value of 50 kN/m^2 and CBR value of 10 %. The major oxides and crystal compounds present in the soil were ferric oxides (Fe_2O_3) and quartz (SiO_2), respectively with a spongy surface. The CR was found to be light weighted Gs (between 1.01 and 1.06), and the major oxides, functional group, and amorphous compounds present were zinc oxides (ZnO), aromatic (C-H), and polystyrene, respectively. Similarly, the SCRMs showed increase in Gs (which ranges from 1.99 to 2.30), the highest value of PI, UCS and CBR were obtained at 5% optimum CR replacement as 15.58% for SCRM4 (4.75 mm), 393.36 kN/m^2 for SCRM2 (1.18 mm) and

16.61% for SCRM4 (4.75 mm) respectively. The XRF result on optimized samples (SCRM2 and SCRM4 at 5%) indicated the presence of SO_3, decrease in Fe_2O_3, ZrO_2, TiO_2 while there was increase in ZnO, SiO_2, CaO, and Al_2O_3 in the samples. The FTIR result showed that hydroxyl (O-H) group was maintained for both samples, while XRD result showed the presence of polypropylene in SCRM2 and methyl-styrene in SCRM4. The SEM images showed that the SCRM4 appeared more smooth and cohesively bonded while SCRM2 appeared as intermediate compared to the virgin soil. This study revealed that there is improvement in the engineering properties of soft soil with crumb-rubber as stabilizer.