Characterizing Geotechnical Properties of Drinking Water Sludge Blended with Graded Crushed Clay Brick for Road Subgrade: Effects of Gradation and Mixing Proportion of Crushed Clay Brick on CBR and Water Permeability

*Muhammad Rashid Iqbal[1], Akihiro Matsuno[1], Ken Kawamoto[1]

1. Graduate School of Science and Engineering, Saitama University

Effective uses of construction and demolition waste, sludge, and industrial by-products for engineering purposes are highly demanded in developing countries. Currently, these materials are used for other construction works such as ground levelling and backfilling without any quality control of materials and/or directly dumped at the landfill site. In this research, an attempt was made to use drinking water sludge (DWS) by blending with crushed clay bricks (CCB) to propose their utilization for constructing road subgrade. DWS with less than 2-mm was blended with CCB with three different particles range; (a) finer fraction having particle size 2-10mm, (b) Coarser fraction 10-30mm, and (c) graded fraction 2-30mm. The mixing proportion has been controlled from 0 to 100% on the dry mass basis. Geotechnical properties such as California bearing ratio (CBR) and water permeability were investigated in the laboratory. Experimental results showed that addition of a finer fraction of CCB from 0 to 100% with DWS improved CBR values from 45% to 88% which was almost double than the DWS itself and captured a well linear relationship. Up to 60% addition of a coarser and graded fraction of CCB increased CBR value from 45% to 110% which was 2.44 times higher than the DWS itself. However, at 80% addition of CCB, graded fraction enhanced the CBR value more as compared to coarser fraction which was due to the well packing and reduction of the voids. On the other hand, at 100% blend of CCB coarser fraction showed quite higher values which could be due to the breakage of the bigger particles and filling the voids effectively. The water permeabilities of all these blended samples showed a very well relationship with Hazen model as compared to Kozeny-Carman model. It can be concluded that graded and coarser fraction 60% blend had an equal or superiority effect than the 100% of the finer fraction blends. All the tested sample fulfilled the improved subgrade requirement to utilize for the road subgrade.

Keywords: Drinking water sludge, Crushed Clay bricks, California Bearing Ratio (CBR), Water Permeability

