

EFFECT OF ORDINARY PORTLAND CEMENT AND WHITE CEMENT ON UNCONFINED COMPRESSIVE STRENGTH OF CLAY

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ABSTRACT

Clay is a poor soil for support any construction on it if it is soft or water saturated without consolidation, so construction of any structure on clay soil needs strong foundation which is costly, but for better structural stability the clay soil must stabilized with admixture to increase its strength to take larger loads. In this research, clay soil was stabilized with ordinary Portland cement and white cement. Ordinary Portland cement and white cement were collected and mixed with clay soil with different proportion like 3%, 6%, 9%, 12% and 15%. Then Unconfined Compressive Strength Tests was performed. The test result revealed that mixing of 15% cement produced the growth of shear strength on the clay soil for both ordinary Portland cement and white cement.

Keywords: *Clay soil, Ordinary portland cement, White cement, Soil stabilization, Unconfined compressive strength test.*

1. INTRODUCTION

Clay cannot be very easily defined in exact expressions. In general, the term "clay" denotes a natural, earthy, fine-grained material which when mixed with a limited amount of water develops plastic properties. Plasticity, as related to Soil Mechanics, is that property which allows a material to undergo rapid deformation without break, volume change, or elastic rebound. Clays exhibit plasticity when mixed with water in certain proportions. However, when dry, clay becomes steady and when fired in an oven, permanent physical and chemical changes occur. Clays are distinguished from other fine-grained soils by differences in size and mineralogy. Cement is one of the most important building materials, is a binding agent that sets and hardens to adhere to building units such as stones, bricks, tiles, etc. White cement is the same as that of grey Portland cement but the only difference is in the color and fineness. This color of this cement is determined by its raw materials and the process of manufacture. The objective of this research was to get the improvement of clay soil by adding both ordinary Portland cement and white cement and also to observe the difference between the improvements of the clay by the two different cements.

2. METHODOLOGY

Firstly, clay soil sample was collected as a Shelby tube undisturbed sample from Sreepur upazila, Gazipur, Bangladesh. Ordinary Portland cement and White cement was purchased from nearest shop of laboratory. After confirming it as a clay soil by grain size analysis test (sieve analysis and hydrometer), the soil sample were mixed with ordinary Portland cement and white cement in 3%, 6%, 9%, 12% & 15% ratio with presence of a little portion of water in five plastic molds sized by 4 inch height and 1.5 inch depth. Then it was kept in sun for drying for 5 days. After 5 days the plastic mold was removed and Unconfined Confined Compressive Strength Test was performed for the mother soil and all the cement mixed soil. Figure 1 illustrates the plastic mold and the prepared sample.



Figure 1: Clay soil mold with cement admixture

3. LABORATORY TEST RESULTS AND DISCUSSIONS

From the Unconfined Compressive Strength Test it was found that the unconfined compressive strength increased a little with the increase of % of ordinary cement & white cement. But it was found that in case of ordinary cement, 3% & 6% of cement mixing with the sample showed a poor value because of lack of bonding between cement & soil. But for 9%, 12%, 15% admixture content, the compressive strength of soil improved respectively is 3.1%, 7.7% and 13.7%. Similarly for white cement mixing the value of compressive stress for 9% & 12% mixing was poor than the mother soil, it was just cracked because of not proper bonding. But for 15% content, the compressive strength of soil improved 6.6%. So from these test results it can clearly noticeable that for 15% of mixture both

ordinary cement and white cement give the ultimate strength against compression load. The unconfined compressive strengths for different soil sample mixed with two types of soil are illustrated in figure 2 and figure 3.

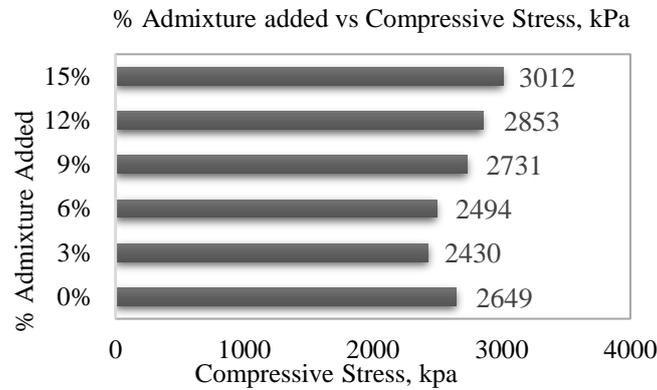


Figure 2: Unconfined Compressive Strength of soil mixed with Ordinary Portland Cement

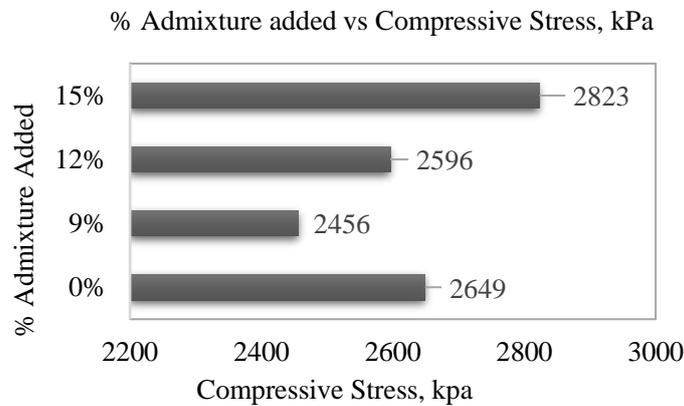


Figure 3: Unconfined Compressive Strength of soil mixed with White cement

The unconfined compressive strength gains for different samples for both ordinary cement and white cement is shown comparatively in figure 4. Figure 5 illustrates the percentage of improvement of the clay soil sample for the both type of cement.

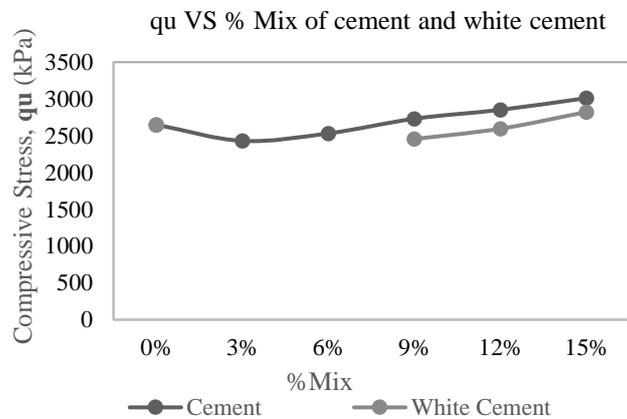


Figure 4: Unconfined Compressive Stress gained by different percentages of Ordinary Portland Cement and White Cement admixture

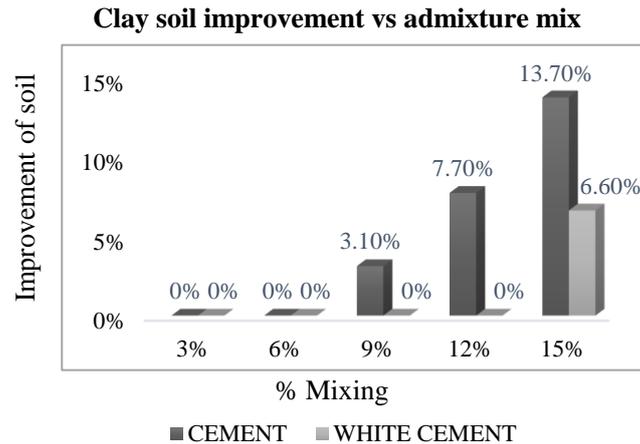


Figure 5: Ordinary Portland cement and White cement improvement by percentage

4. CONCLUSIONS AND RECOMMENDATIONS

The geotechnical properties of clay soils depend on particle size, texture, mineral composition. In particular these factors determine the structure of the soil with the void ratio and the water content increases when void ratio is increased. A Geotechnical engineer has to think and calculate a lot for foundation design and consideration if there is clay soil under the building foundation. The research report mainly focused on the shear strength effects of clay soil mixed with ordinary cement and white cement. Though the improvement was not considerably high but it was found that improvement pattern was most likely same for both type of cement. So that it is recommended that more analysis should be done for stabilizing clay soil by adding different types of cement and determining different index and engineering properties of the cement mixed soil.

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