

Improvement in Strength and Durability of Soil Using Blast Furnace Slag and Lime

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Abstract- Sometimes when the soil is not ideal for construction purpose and creates lot of problem to civil engineer during the execution. To make the problematic soil suitable for engineering projects is known as ground improvement. In this present study effort has been made to stabilize the clayey soil using blast furnace slag and lime. Soil sample was collected from Lohatbaddi (Distt- Ludhiana, Punjab). This soil is classified as (CI) as per Indian standard classification system. Main aim of this study is to investigate the effect of lime and blast furnace slag in various proportions on unconfined compressive strength of clayey soil

Indexed Terms- Blast furnace slag, Lime, Optimum moisture content, Unconfined Compressive Strength, Durability.

I. INTRODUCTION

First the optimum amount of lime content was determined by conducting unconfined compressive strength tests using 2%, 4%, 6% and 8% lime content after seven days curing. From these tests 4% lime content was found to be optimum because of maximum relative percentage increase of UCS obtained between 2% - 4% lime.

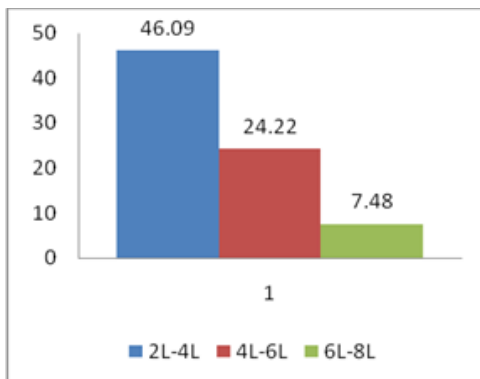


Fig.1. Percentage relative increase in U.C.S with increase in percentage of lime

Then using this optimum value of lime content i.e. 4%, various percentage of blast furnace slag 10%, 20%, 30%, 40% and 50% of BFS were mixed with soil. The samples were prepared on wet side of optimum, at optimum moisture content and dry side of optimum. From these results optimum mix was obtained with 4% lime, 30% slag and 66% soil and U.C.S on dry side was found to be maximum. The curing period adopted was 7, 14, 28 and 56 days. The U.C.S value was increased by 8.69 times the virgin soil at optimum moisture content.

II. COMPARISON GRAPHS OF U.C.S V/S PERCENTAGE OF SLAG

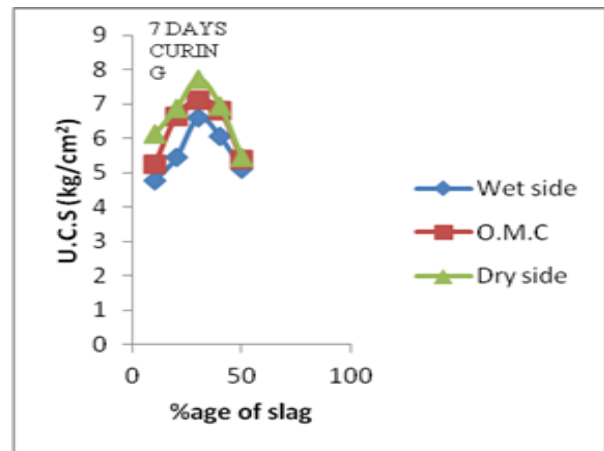


Fig. 2. U.C.S V/s Percentage of slag after 7 Days curing

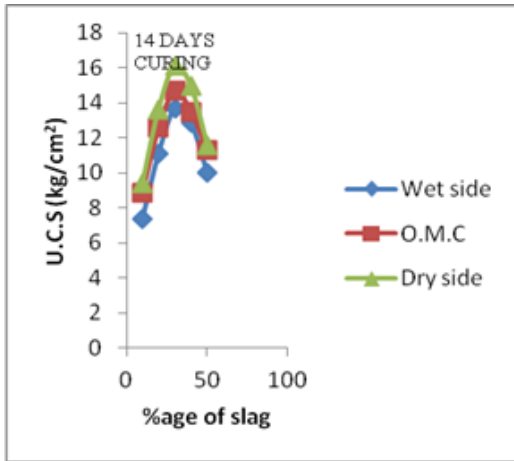


Fig. 2. U.C.S V/s Percentage of slag after 7 Days curing

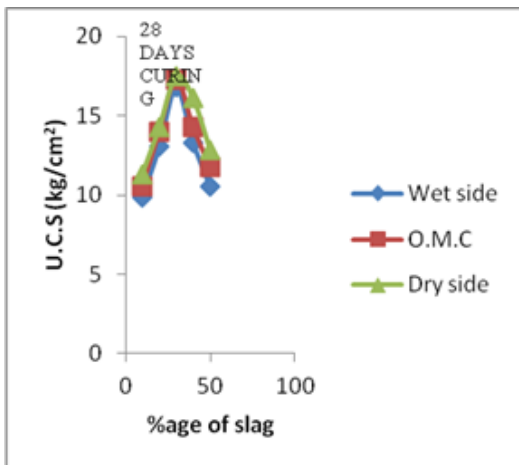


Fig. 4. U.C.S V/s Percentage of slag after 28 Days curing

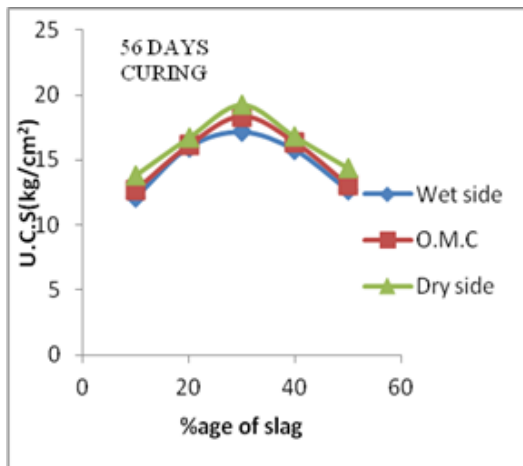


Fig. 5. U.C.S V/s Percentage of slag after 56 Days curing

III. SCANNING ELECTRON MICROSCOPE (SEM) TEST

This test was conducted on stabilized mix (4% lime, 30% slag and 66% soil) from sophisticated analytical instruments laboratories Patiala by using Scanning Electron Microscope (SEM) machine. To conduct this test the samples of optimum mix i.e (L:BFS: S= 4:30:66) was taken. Three samples having curing period of 7, 14 and 56 days were taken for testing. In this test a gold coating was done on the samples for making them conducting. After the coating they were inserted into SEM machine. Then the results were obtained from computer that was attached to the machine.

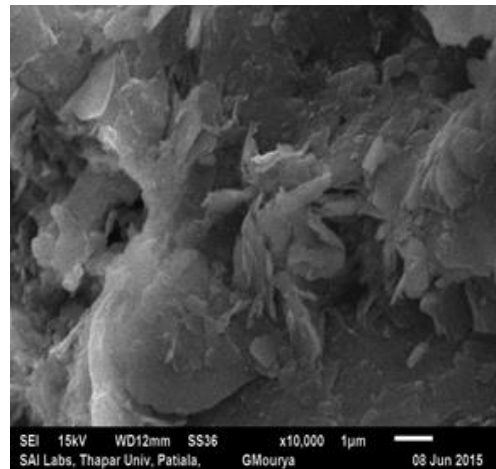


Fig. 6. SEM photograph after 7 days curing.

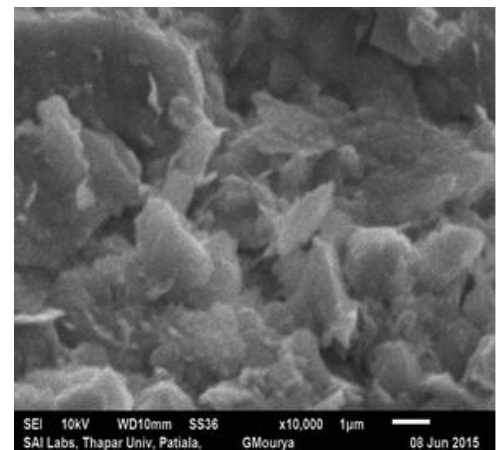


Fig. 7. SEM photograph after 14 days curing

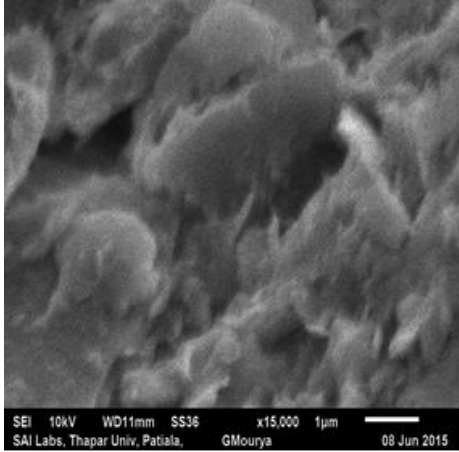


Fig. 8. SEM photograph after 56 days curing

As the curing period increases the soil structure have transformed from particles based to integrated composition. As the curing time increases flocculation and aggregation of particles occur. Aggregation produces the thicker and larger particles.

IV. DURABILITY TEST

Durability test was performed on the samples after 28 days of curing and the mix (Lime: Blast Furnace Slag: Soil = 4:30:66) retain maximum strength after 12 wetting and drying cycles. In durability test the mix L: BFS: S = 4: 30: 66 retained highest strength.

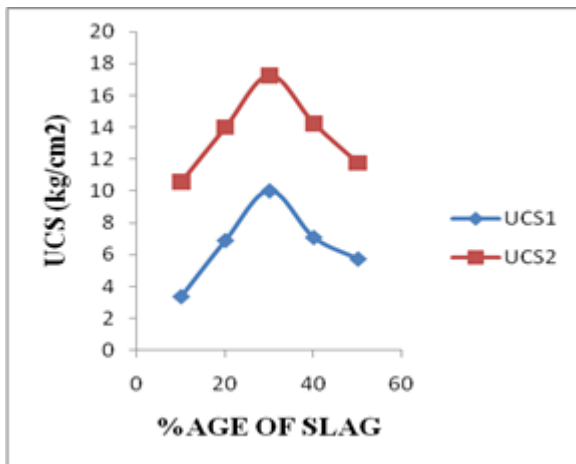


Fig. 9. Durability result after 28 Days curing and then subjected to 12 wet dry cycles.

UCS₁- Unconfined compressive strength of samples after curing period of 28 Days and then subjected to 12 wetting drying cycles.

UCS₂- Unconfined compressive strength of samples after curing period of 28 Days.

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