

# PERMEABILITY OF SAND-LIME-CEMENT MIXTURES

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**Abstract**— The permeability of mixture of sand and lime was recorded and tested. The constant head method was employed in this study. Different cement contents including 1%, 2%, and 3% in combination with lime with the same percentages were mixed with sand and tested. The permeability test results showed that addition of cement and lime reduced the permeability of the sand.

**Keywords**— Permeability Test, Sand, Lime, Cement

## I. INTRODUCTION

Permeability is an important characteristic of the soil that shows the rate of flow in the soil [1-13]. The permeability value is high at the coarse-grained soil like sand and is very low at fine-grained soils like clay [14-28]. A high value of permeability can be a representative of a high flow in the soil and therefore a lower strength value for the soil in the long run [29-45]. Addition of cementitious agents such as lime and cement can be effective in reduction of the permeability however its amount is not clear [45-53]. This study investigates effect of addition of cement and lime on permeability characteristics of sand.

## II. MATERIALS

The materials which were used in this study were:

### a) Sand:

The employed sand had  $C_u = 8.5$ . The  $C_c$  of sand was 1.05. The  $G_s$  was 2.65.

### b) Lime

Apparent density was calculated as  $0.5 \text{ gr/cm}^3$ . The ignition loss was 19.8%.

### c) Cement

Portland cement was selected in this study.

## III. PERMEABILITY TEST

The tests were conducted in constant head device. The permeability of mixture were recorded with varying in lime percentage.

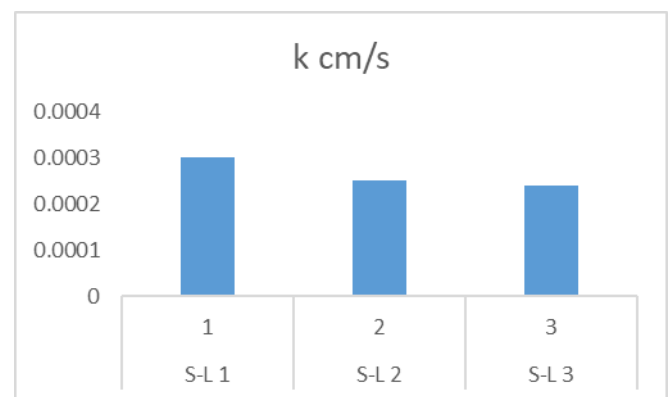
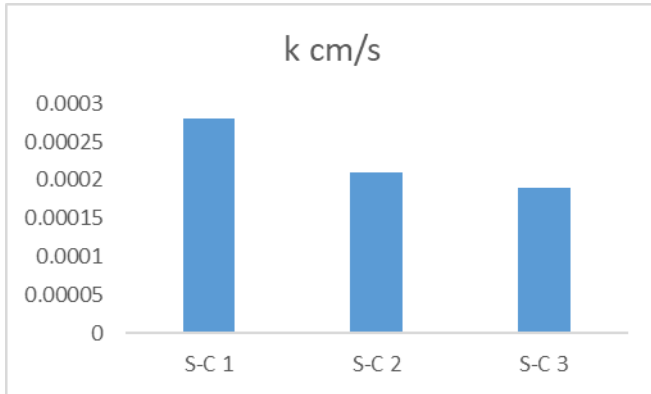
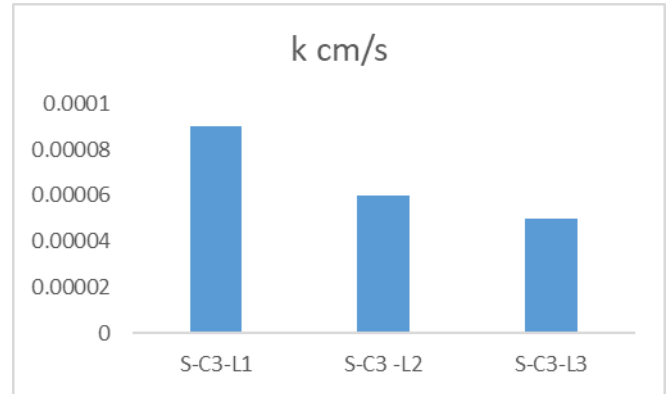


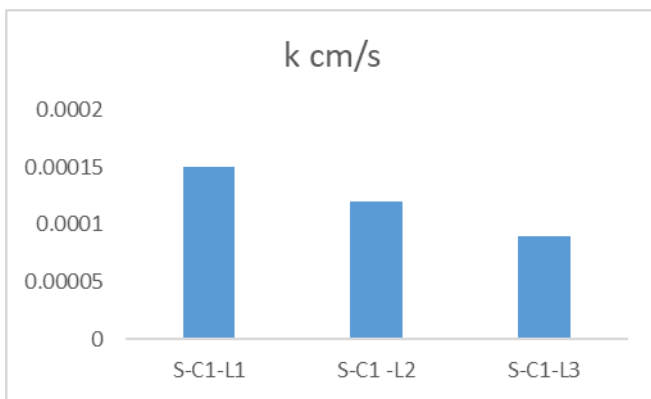
Fig. 1. Permeability of lime-sand mixtures



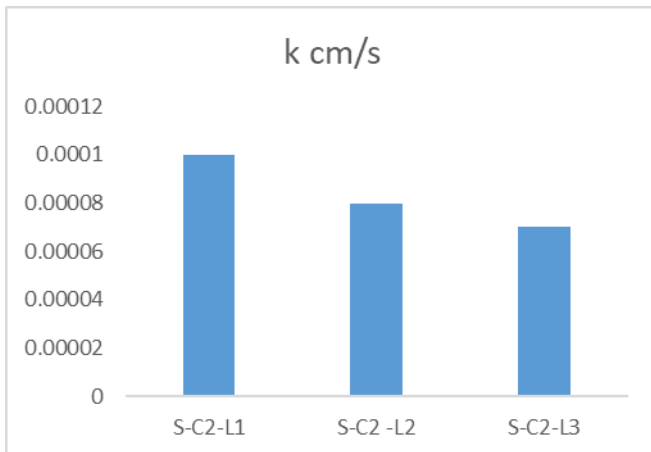
**Fig. 2.** Permeability of cement-sand mixtures



**Fig. 4.** Permeability of cement-lime sand mixtures with 3% cement.



**Fig. 3.** Permeability of cement-lime sand mixtures with 1% cement.



**Fig. 4.** Permeability of cement-lime sand mixtures with 2% cement.

#### IV. CONCLUSION

A series of permeability tests were conducted on mixtures of cement, lime and sand. Also, permeability tests were conducted individually on cement and lime. The results showed that addition of cement/lime reduced permeability of sand. Also, both cement and lime together decreased the permeability of sand.

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