Reducing The Seepage By Grouting

Mohammed Faiz[1], Mohd. Umraiz[2], Mohd. Mohsin[3] ,Deepankar Saini[4],Punit Kumar[5],

Mohd. Saqib Qadeer[6]

[1] Mohammed Faiz, Bachelor in Technology, Civil Engineering, MIT Moradabad
[2] Mohd. Umraiz, Bachelor in Technology, Civil Engineering, MIT Moradabad
[3]Mohd. Mohsin, Bachelor in Technology, Civil Engineering, MIT Moradabad
[4]Deepankar Saini Bachelor in Technology, Civil Engineering, MIT Moradabad
[5]Punit Kumar Bachelor in Technology, Civil Engineering, MIT Moradabad

[6] Assistant Professor, Dept. of Civil Engineering, Moradabad Institute of Technology, Uttar Pradesh, India

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Abstract - *Grouting is regularly embraced to lessen the Permeability of shake or soil arrangements and this procedure is utilized broadly in the development of pressure driven structures, for example, dams, control houses, and burrows and in a wide assortment of exceptional cases. Different materials, for example, bond, sand, residue, dirt, bentonite, chemicals and so forth are utilized, contingent on the need and motivation behind grouting and the way of developments to be grouted. Despite the fact that the use of this grouting procedure to diminish the porousness of shake arrangements has been accounted for in writing, no genuine endeavors are accounted for about the compelling utilization of this strategy to lessen the penetrability of soil developments.*

Key Words: Seepage, Sandy soil, Grouting, Permeability.

1.INTRODUCTION

Grouting is characterized as the system of filling or infusing liquid with weight into the dirt, for the most part by means of boreholes.(1) The reason for infusing a grout is to abatement porousness of the dirt and to expand the shear quality of the establishment soil. Grouting materials utilized for filling the voids existing in the dirt to lessen penetrability of soil. The innovation of grouting now assumes a vital part in every one of the fields of establishment building, for example, leakage control in shake and soil under dams, propelling passages, cut off dividers and so forth in the assessment of wellbeing of any dam, issues associated with unreasonable draining and drainage. Drainage not just aims loss of profitable water put away in the store, additionally postures issues by its reality through channeling. Control of drainage through the dam establishment and limiting way out slope on the downstream, assume enter parts in the investigation and outline of dams. Whenever travel or utility passages are to be set underneath the water table and the dirts experienced have porousness more prominent than around 1 x 10-5 m/s, water inflow can be normal. Alongside this water inflow, soil can be disintegrated into the passage, bringing about channeling breakdown and unfriendly surface settlements. Healing and recovery measures for capturing abundance draining and drainage fundamentally include controlling the porousness of the dirt strata by methods for grouting.

1.1 Grouting Material For Seepage Reduction

In order to choose a grout type, several properties of grout should be concerned, such as rheology, setting time, toxicity, strength of grout and grouted soil, stability or permanence of the grout and grouted soil and the penetrability of the grouted soil(2). Moreover, spreading of the grout plays an important role in the development of grouting technology. In the actual filed, the grouting method requires an extensive consideration on the grout hole equipment, distance between boreholes, length of injection passes, number of grouting phases, grouting pressure and pumping rate (3) . Two classes of grouting materials are classified for seepage reduction: i) suspension-type grouts, ii) solutions-type grouts. The suspension-type grouts include clay and cement, while solutions- type grouts include a wide variety of chemicals such as acrylamide, NMethaloacrylamide, acrylate and colloidal silica (4).

1.2 Cement as the grout material

For grout injected specimens, decreasing the water to cement ratio of the grout and increasing the curing time significantly lowered the permeability and increased the strength, whereas increasing the distance from the injection point had little effect on the permeability but produced meaningful reductions in strength. These trends are consistent with the sand acting as a filter for the grout suspension. In order to determine the effect of cement in reducing the permeability of the sand medium, permeability tests were conducted on specimens prepared in the permeability mould (5).

2. EFFECTS OF GROUTING ON PERMEABILITY OF SANDY SOIL

Figure 1 shows the effect of cement content on permeability of sandy soil treated with cement, at different curing periods. As we expect, the permeability decreases with increase in the percentage of cement. The reduction in permeability is only marginal in case of specimens cured for 7 & 14 days, whereas the reduction is substantial as the curing period is increased to 28 days. Similarly increase in use of cement (beyond 10%) can influence the permeability at higher curing periods only.

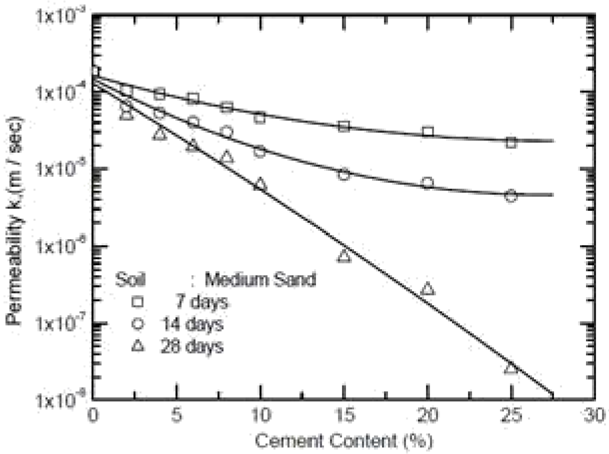

Figure-1: Effect of cement content on permeability of cement treated sand.

The reduction in permeability with respect to the cement content and curing period is more clear in Fig. 2. It is shown that the permeability got reduced by 1/7400 in the case of 25% cement and cured for 28 days. When cement alone was added to the medium sand, the cement hydrates and occupied the voids of sand , decreasing the interconnectivity of soil voids by blocking the potential flow paths.

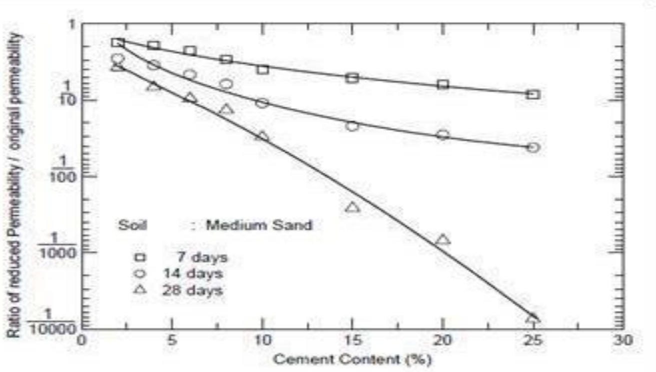

Figure -2: Reduction in permeability with cement content

Fig.3 shows the effect of curing period on permeability of cement treated sand having different cement contents 4, 10 and 25 %. It is shown that the permeability decreases with elapsed time, it becomes almost constant beyond 15 days of curing period for lower cement contents (i.e. 4 % and 10 %), but at higher contents (e.g. 25 %), the permeability goes on reducing drastically even after 15 days. Hence it can presumed that reduction in permeability is directly related to the hydration of cement.

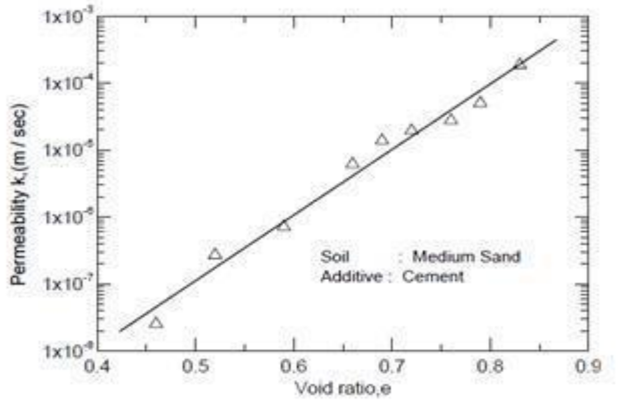

Figure-3: Effect of curing time on permeability of cement treated sand.

The reduction in the permeability with reduction in the size of particles of the mixture (sand + cement) is quite clear from Fig.4 which is a plot between the effective size D10 of the sand - cement mixture and the corresponding permeability. Similarly, the addition of cement will cause a reduction in the void ratio and the permeability.

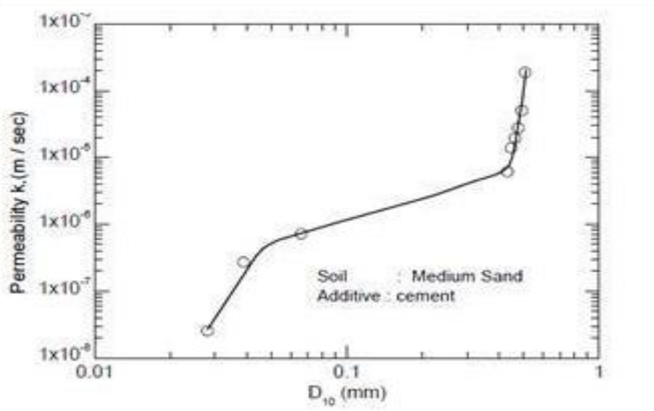

Figure-4: Effect of effective size of particles on the permeability of cement treated sand

The plot between the void ratios 'e' and the coefficient of permeability 'k' (Fig. 5) illustrates the reduction in permeability accompanied by the reduction in void ratio.

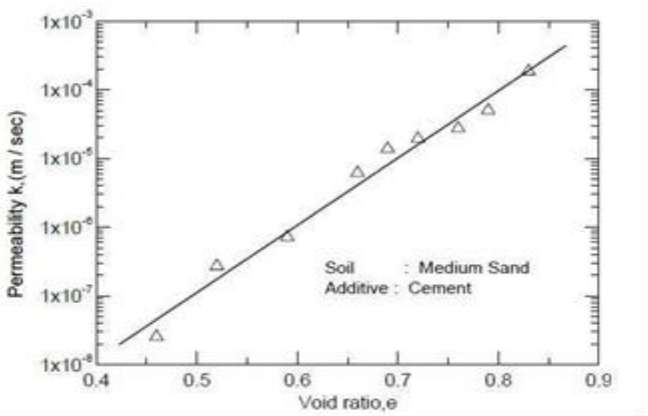

Figure-5: Plot between void ratio and permeability of sandy soil treated with cement

3. CONCLUSIONS

1. The shear strength of the loose sandy soil steadily increases with increase in cement content and also with curing period, for all sand fractions.

2. The rate of increase in shear strength is very high at higher percentages of cement than at lower percentages in the case of all the sand fractions.

3. Even though specimens of medium sand give higher shear strength than coarse sand specimens at lower cement contents; the coarse sand specimens register higher strength as the cement content increases.

4. The influence of the increased initial water content of the grout is to decrease the shear strength of the grouted sand and the effect is more pronounced at higher cement contents.

5. Shear strength of the grouted sand increases with increase in normal pressure. The stress–strain response exhibits a linear relationship prior to the peak, for all cement contents and the value of shear strength steadily increases with increase in cement content.

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