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Prediction of Strength parameters of Stabilized Sand Soil with Nonoclay Using Artificial Neural Network

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Abstract

Nowadays, soil stabilization and improving its strength properties has captured researchers' attention. To achieve the objective, a variety of methods and materials are applied. One of the novel methods of soil stabilization is to combine it with nanoclay. This research seeks to predict the soil strength parameters of stabilized sand with nanoclay, using artificial neural networks. The experiments on samples mixed with different percentages of nanoclay and different processing length indicate that in a few of samples, increase in nonoclay in the soil leads to increase in the soil shear strength and in angle of friction. By the help of experimental results and a series of input (the geotechnical properties of soil samples), output (cohesion and friction angle of soil samples) and using MATLAB software several models were investigated. After training several neural networks and evaluating, and comparing the values of determination coefficients of MSE, T and R2 in each of the networks, we can conclude the neural networks that calculate parameters of cohesion coefficients and friction angles separately have better behavior and accuracy than neural networks that predicts these parameters simultaneously.

Key words: Montmorillonite clay, soil shear strength, artificial neural networks, friction angle, cohesion coefficients.

1. Introduction

Soil stabilization in layers of backfill and road bed is one of the major topics in geotechnical engineering. To achieve this goal, various methods and materials such as lime and cement are applied. Due to difficulties in preparation, implementation, and operation, as well as environmental damage, various methods are being investigated. One of the newest ways to improve the strength properties of soil is the use of nanoparticles. Researchers have long been concerned with improving the mechanical properties of soil. Nanosoil is in fact the milled product of natural soil where a large share of eroded particles amount to 1 to 100 nanometers in size. Due to their tiny size, the materials have high specific surface area, thus respond very actively. Because of the high specific surface area and surface charge, even if very little use of these substances in the soil environment, the materials substantially impact on physical-chemical behavior of soil even if they are used rarely. Many researchers have studied the impact of nanomaterials on the geotechnical properties of soil [1-11].