

The Effect of CKD and RAP on the Mechanical Properties of Subgrade Soils

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Abstract

The construction of pavement layers on subgrade soil with good characteristics decreases the thickness of these layers, which in turn lowers the cost of building and maintaining roadways. However, it is impossible to avoid constructing pavements on unsuitable subgrade due to a number of limitations. Using conventional additives like lime and cement to improve subgrade properties results in additional costs. As a result, utilizing by-products (cement kiln dust and reclaimed asphalt pavement) in this field has benefits for the environment, economy, and technology. Large amounts of cement kiln dust (CKD), a by-product material, are produced in Portland cement factories. On the other hand, large amounts of reclaimed asphalt pavement (RAP) are accumulated as a result of the rehabilitation of old roads. This paper discusses using CKD and RAP to improve the characteristics of poor subgrade layers by conducting a series of Unconfined Compressive Strength (UCS) and California Bearing Ratio (CBR) tests on samples of natural soil and soil stabilized with different percentages of CKD and RAP with different curing times to investigate their impacts on soil properties. The curing was carried out by wrapping the stabilized samples with several layers of nylon and then placing them in plastic bags at room temperature. The compaction results illustrated that the addition of CKD increases OMC and decreases MDD, in contrast to RAP, which decreases OMC and increases MDD. The addition of CKD and RAP led to a significant and unexpected increase in the CBR values. The results show that the soaked and unsoaked CBR values improve from 3.4% and 12.1% for natural soil to 220.1% and 211%, respectively, after adding 20% CKD and curing the samples for 28 days. Also, the addition of 25% RAP to soil-20% CKD blend increased the soaked and unsoaked CBR values to 251% and 215%, respectively. All the additions resulted in a significant reduction in swelling.