

Effect of reclaimed asphalt pavement stabilization on the microstructure and strength of black cotton soil

Mustapha Mohammed Alhaji, author

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Abstrak

Black Cotton Soil (BCS) collected from Guyuk, Adamawa State- North-eastern Nigeria, was treated with 0 to 100% Reclaimed Asphalt Pavement (RAP) in 10% steps to evaluate the microstructure and strength of the compacted mixtures. The index property results show that the BCS and RAP are classified under clay of high plasticity (CH) and poorly graded sand (SP) respectively, according to the Unified Soil Classification System (USCS). An extraction test gave a RAP bitumen content of 5.99%, which is within the value of 5–6% recommended in the literature. An x-ray diffraction test carried out on both the BCS and RAP showed that the BCS predominantly consisted of quartz, microcline, albite and kaolinite, which is similar to the results obtained in the literature, while the RAP, however, consisted of quartz, albite, orthoclase, phyllogopite and actinolite, which is slightly different to what is reported in the literature, probably due to the source of the bitumen. The results of compaction, at a modified energy level, conducted on the mixtures, show that the Maximum Dry Density (MDD) increased from 1.890 to 2.034 mg/m³ at 30% RAP content, after which the value fell to 1.925 mg/m³ at 100% RAP content. The Optimum Moisture Content (OMC) however, decreased from 13.7% at 0% RAP, to 8.8% at between 40-60% RAP content, after which the value increased marginally to 9.5% at 90% RAP. Similar to the MDD, the California Bearing Ratio (CBR) increased from 11% at 0% RAP to a maximum of 35% at 30% RAP content, after which the value fell to 5% at 100% RAP content. 30% RAP is therefore the optimal mixture giving the highest strength and can be used as a sub-base material for roads with light traffic use, according to the Nigerian General Specification for Road and Bridge Works. Hence the 3.07% bitumen obtained for this mixture can be adopted as the fixation point for BCS-RAP mixtures. Durability was found to be far lower than the resistance to loss in strength of 80% suggested in the literature.