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Stabilisation of Fine Grained Soil Using Fly Ash and Lime to Use as Embankment Material

Priyadarshani R.M.S.[1], Udamulla K.M.L.A.[2*]

[1]Department of Civil Engineering, IESL College of Engineering, Colombo 07, Sri Lanka
[2]Department of Civil Engineering, Open University, Nawala, Sri Lanka
**lakshika0807@hotmail.com*

Abstract

The objective of this study was to evaluate the effectiveness of self-cementing fly ashes with lime for stabilisation of soft fine-grained soils to assess whether the same could be used in construction of type I material of embankments. The material used for the top 500 mm of embankment shall conform to the requirements of type I material. Soil samples were collected from Kudaoya area in Monaragala District. The fly ash is from Lakvijaya Power Plant while lime was Quick lime (CaO). Index tests, modified proctor compaction tests and California Bearing Ratio (CBR) tests were conducted on mixtures prepared with soft fine-grained soils, fly ash and lime. The soils selected had a limited range of plasticity, with plasticity indices ranging between 27 and 29. All the samples were classified as high plastic clays (CH) according to the Unified soil classification system. Tests were conducted on soils and soil fly ash / lime mixtures prepared at 100% soil, 95%soil: 2.5% fly ash: 2.5% lime, 90% soil: 5% fly ash: 5% lime. Addition of fly ash and lime resulted in decrease in the dry density and an increase in the optimum moisture contents. Based on Institute of Construction Training and Development (ICTAD) specification, maximum dry density (MDD) should exceed 1.6 g/cm^3 for type I material. All the mixtures were found to comply with the requirement for type I embankment material. Soaked CBR value of fly ash/lime mixture were found to increase with the increase in the fly ash lime content. Based on ICTAD RDA Specification 4 day soak CBR (at 95% compaction from modified MDD) value for type I material should exceed 7%. The CBR values of soil fly ash mixtures were 36% and 50% respectively while the virgin soil had 5% thus complying with the requirement. Liquid Limit (LL) and Plasticity Index (PI) values of fly ash lime mixture were found to increase with the increase in the fly ash lime content. Based on ICTAD RDA Specification LL and PI values for embankment I type soil should be less than 50% and 25% respectively. The LL values of virgin soil and soil fly ash mixtures were found to be 51.4%, 53.0%, 45.7% respectively. The PI values of virgin soil and soil/fly ash mixtures were found to be 29.27%, 28.09%, 12.96% respectively. Therefore the findings suggest the reuse of fly ash together with lime could be used to stabilise fine grained soils to achieve sustainable construction.

Keywords: Soil stabilisation, Fine grained soils, Embankment, Fly ash, Lime