USE OF LIGHTWEIGHT FILL MATERIALS IN CONSTRUCTION OF ROAD EMBANKMENTS ON SOFT PEATY CLAY

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DECLARATION

The work included in this thesis in part or whole has not been submitted for any other academic qualification at any institution.

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ACKNOLEDGEMENT

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Abstract

Number of proposed highways in Sri Lanka are to be constructed over sites underlain by soft peaty clay, due to scarcity of land. In order to ensure that the in-service settlements of these roads are small enough and the road could function satisfactorily, number of special ground improvements techniques are to be adopted. An alternate approach that could be considered is the use of a lightweight fill material in the construction. Extremely lightweight fill material such as expanded and extruded polystyrene blocks were used in a number of developed countries in the construction of road embankments over soft ground and in landslide repair. However, these materials are to be imported to the country and would be very expensive. As such, from a local point of view, a process involving the use of such materials would not be economically competitive. In order to find an economically feasible solution, the lightweight fill materials should be developed with the locally available inexpensive raw materials.

As such, lightweight fill materials were developed locally by mixing with different proportions of tyre chips with lateritic soil, sawdust with lateritic soil and paddy husk with lateritic soil. Tyre chips were obtained by shredding discarded motorcar tyres. Sawdust was obtained from wood mill waste and paddy husk was obtained from rice mill waste. The developed fill material should of sufficiently low density and workable. Different mix proportions were tried out to get several suitable mixes. The developed material should be sufficiently incompressible and should possess adequate shear strength. Further detailed tests were conducted on selected mixes to establish their engineering characteristics in relation to strength and stiffness.

The effectiveness of the use of lightweight fill material in the embankment construction was studied in detail by the finite element package CRISP. The set criterion was that the in-service settlement of the road should be less than 50mm.This was achieved through the preloading process. In this study a comparison was done for two different approaches; one constructed with lateritic soil and the other incorporating the developed lightweight fills in the preloading process. The placement of the fill layers, the settlement of the peaty clay, the effect of the removal of the preload and the application of the pavement and

traffic load was studied with a fully coupled Modified Cam clay constitutive model. Parametric analyses were also done varying the thickness of the embankment and the peaty clay. The process was found to be helpful in reducing the construction period and consumed fill volume. The advantages were more prominent with the increase of embankment height and soft layer thickness.