SUB BASE IMPROVEMENTS BY STABILIZATION TECHNIQUES USING WASTE MATERIALS

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Degree of Master of Engineering in Highway and Traffic Engineering

Department of Civil Engineering

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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree Master in Engineering

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Declaration

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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T.Sathiyaparathan Date

The above candidate has carried out research for the Masters Dissertation under my supervision.

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Dr.H.R.Pasindu Date

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Abstract

Improvements of rural roads are active socio-economic passageways to a high quality of life for most of the Srilankan people living in rural areas. The fund allocated for low volume road project is limited, thus it is important to use existing resources for economic advantages. Also, adverse environmental impact can be reduced. Roads are designed for low-volume traffic and are constructed of local soils containing high percentages of fines and high indices of plasticity. These type of soils may not have certain properties pertinent for the sub base in the construction of flexible pavement in rural roads. Thus, it is necessary to modify or stabilize this kind of soil to make it suitable for construction. The soil modification process can be effectively used to meet the challenges of sustainability of the environment, to minimize the adverse effect of industrial wastes such as plastic, glass, paddy husks, etc. Wastes are multiplying day by day leading to diverse environmental concerns. On the account, the disposal of those wastes without causing any environment hazards is a real challenge. Therefore, using plastic waste, glass waste & paddy husk ash stabilizing agents is an economical utilization since there are demand and shortage of well graded soil for sub-base. This research involves a comprehensive study on the feasible use of the waste products for soil stabilization for the sub-base material in the North Central Province I-Road Project in Sri Lanka.

A series of field and laboratory tests were carried out for collected sub-base materials to identify the deficiency of sub base material properties. CIDA specification for the roads was referred and confirmed to the specification for the road projects in Sri Lanka. The specification says that Liquid Limit should be less than 40 (LL<40) and Plasticity Index should be lesser than 15 (PI<15). Three different borrow pits Sub-base materials from Polonnaruwa area were stabilized with different percentage of paddy husk ash, plastic waste and glass waste with weight-based mix proportions. But the experimental study of two sub base borrow pits samples such as Mahadamana source and Sooriyaweva source demonstrated that with a 8% and 10% of optimum paddy husk ash. At the same time, the two composite samples from Mahadamana source and Sooriyaweva source were reduced the Liquid Limit by 20%, 26% and reduced the Plastic Index by 26%, 36 % accordingly. Similarly, California Bearing Ratio of the Mahadamana and Sooriyaweva composite samples were improved by 10% and 14.7% respectively. Finally, it was concluded that the stabilized composite soil can be used for the construction of flexible pavement in rural areas with low volume traffic.

Keywords: Sub-base, Stabilization, Liquid Limit, Plastic Index, Wastes, Paddy Husk Ash

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List of Abbreviations

Abbreviation	Description
AASHTO	American Association for Highways and Transportation Officials
ABC	Aggregate Base Course
ASTM	American Society for Testing and Materials
BS	British Standards
CIDA	Construction Institute Development Authority
CL	Center Line
EL	Edge Line
I-Road	Integrated Road
LL	Liquid Limit
MDD	Maximum Dry Density
NAASRA	National Association of Australian State Road Authority
NS	Natural Soil
OMC	Optimum Moisture Content
PHA	Paddy Husk Ash
PI	Plastic Index
PL	Plastic Limit
RDA	Road Development Authority
SL	Shrinkage Limit

TRL	Transport Road Laboratory
UCS	Unconfined Compressive Strength
USC	Unified Soil Classification System

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