

**A STUDY ON IMPROVEMENT OF UNSUITABLE
SOILS FOR ROAD CONSTRUCTION USING LIME
AND FLY ASH**

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Degree of Master of Science

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University of Moratuwa

Sri Lanka

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Thesis submitted in partial fulfilment of the requirements for the degree Master of
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DECLARATION

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ABSTRACT

In Sri Lanka, residual soils are abundantly encountered in constructions where residual soils with poor engineering properties have been left unused in many situations. However, it is uneconomical and non-ecological to leave these soils unused. As a solution, stabilizing the soils with chemical techniques such as lime and fly ash stabilization to the required properties has become popular and sustainable.

In this study, an unsuitable residual soil was stabilized with 3%, 5% and 8% of lime, 6%, 12% and 18% of fly ash and with 3% lime increasing the fly ash percentage at 6%, 12% and 18% by dry soil mass to investigate the variation in soil properties to be used in road constructions. First, the basic soil properties were investigated. Then the variation in plasticity characteristics, maximum dry density (MDD), optimum moisture content (OMC), unconfined compressive strength (UCS) and California bearing ratio (CBR) was studied.

A decrease in plasticity index (PI) was observed with 3% lime, but with further addition no variation observed. For soil stabilized with fly ash and lime-fly ash admixture no such variation in PI observed. There was a decrease in MDD with the increase in lime and lime-fly ash admixture percentages, but there was a slightly increasing trend with fly ash. No significant variation in optimum moisture content observed with any of the additives. An increase in the UCS of the soil with the curing time and additive percentage was observed. A significant improvement in CBR was observed with lime and lime-fly ash admixtures, but not with fly ash alone. It can be concluded that with 6% lime or 3% lime with 18% fly ash, the required CBR value for the soil to be used as a capping layer material can be achieved.

Keywords: stabilization, lime, fly ash, soil

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LIST OF ABBREVIATIONS

Abbreviation	Description
CAH	Calcium aluminate hydrate
CBR	California bearing ratio
CSH	Calcium silicate hydrate
DDL	Difused doule layer
EDS	Energy dispersive spectrometry
ICL	Initial consumption of lime
LL	Liquid limit
MDD	Maximum dry density
OMC	Optimum moisture content
PI	Plasticity index
PL	Plastic limit
SEM	Scanning electron microscope
UCS	Unconfined compressive strength
XRD	X-ray diffraction