AN INVESTIGATION OF SOME FACTORS INFLUENCING THE USE OF COLLIERY DISCARDS AS A FILL MATERIAL FOR REINFORCED EARTH CONSTRUCTION

BY

Duleep A.Fernando BSc(Middx),MSc(Dunelm),Phd(Glasgow),FGS

A thesis submitted for the degree of Doctor of Science(DSc)

Department of Civil Engineering,
The University of Glasgow

1992

THE AUTHOR DEDICATES THIS THESIS TO

HIS PARENTS

IRENE AND STANLEY

ACKNOWLEDGEMENTS

This thesis would not have been possible without the tremendous encouragement and support received by the author from numerous individuals and the author is indebted to the following:

Professor D.R.Green,Head of Planning Unit,Glasgow University,Professor H.B.Sutherland,Glasgow University,Professor D.Muir Wood,Cormack Professor of Civil Engineering,Glasgow University and Professor P.B.Attewell of Durham University.

The late Dr R.K.Taylor who was instrumental in generating the author's interest in this subject and for encouraging the author to pursue higher studies.

All the technicians of the Department of Civil Engineering, in particular to:

Messers Burnett, Gray, Montgomery, Hawthorn, Thompson, Yuell and MacCaskie.

INDEX

PAGE NO

LIST OF PLATES

SUMMARY

This thesis is concerned with an investigation of some factors influencing the use of coarse colliery discards as a fill material for reinforced earth construction.The work carried out in this study is primarily a laboratory study,investigating the properties of the fill materials, reinforcements and the soil-reinforcement interaction coefficients.

Tests were carried out on Cardowan colliery discards to establish the geotechnical properties and to establish whether the discards satisfied the criteria set out by BE3/78(revised) and the DTp specification for Highway works(1986).

Instruments ranging from free field strain coils were used to measure strains in the soils.All methods utilised are reported.But,the success of the methods considered varied due to the nature of the fill materials.

A thorough investigation was carried out to establish the shear strength envelope.Two shear strength envelopes were established,they are as follows:

i)Particle sizes pertaining to the whole grading curve;

ii)Specific particle size ranges;

These tests indicate that the envelope can be segregated into two sections,one for the low stress region and another for the high stress region.

The results of the former indicate that the shear strength is stress dependent and can be accurately fitted by curvilinear regression analyses.

The interaction tests carried out in this study and the data reviewed from the other sources when represented non-dimensionally indicates that the RMS strips and the Tensar SR2 grids yield the highest alpha values and hence the coefficients of friction.The results of shales tested with RMS strips yield the highest coefficients of interaction.Envelopes have been formulated,subsequent to the collation of data for all the materials considered in this study.The results indicates that the alpha values as presented in BE3/78(revised) are conservative,in the case of the RMS strips.

The pull-out tests carried out in this study indicates that the RMS strips are the most efficient of all the conventional strips.

The grid tests yielded the highest pull-out forces and they were most efficient of all the reinforcements tested.

The field pull-out test data as reported by Wei indicated that the friction coefficients were lower with respect to the laboratory data.This can be attributed to the differences in compaction.

Comparison of the coefficients of friction indicates that the skin friction tests as measured in the shearbox are lower with repect to the pull-out test data.

An equation was formulated using the results of the established Mohr envelopes with respect to particle size,skin friction tests and the spacing of the ribs in a RMS strip.The predicted values are accurate to within 10% of the measured values.