

PROCEEDINGS OF THE TENTH REGIONAL CONFERENCE FOR AFRICA ON SOIL
MECHANICS & FOUNDATION ENGINEERING AND THE THIRD INTERNATIONAL
CONFERENCE ON TROPICAL & RESIDUAL SOILS / MASERU / 23-27 SEPTEMBER 1991

Geotechnics in the African Environment

Technical editors

G. E. BLIGHT, A. B. FOURIE, I. LUKER,
D. J. MOUTON & R. J. SCHEURENBERG

VOLUME ONE



A. A. BALKEMA / ROTTERDAM / BROOKFIELD / 1991



Table of contents

Preface	v
Organising Committee	vi
Third International Conference on Tropical and Residual Soils	
Lateritic soils: Chemical & geotechnical properties <i>J.B. Queiroz de Carvalho</i>	3
The role of iron hydroxide in the engineering behaviour of tropical soils <i>A. Sridharan, Sudhakar M. Rao, K. P. Ramanath & H. B. Nagaraj</i>	7
The design, construction and behaviour of permanently cased piles at Sua Pan, Botswana <i>A. J. Hammond, B. G. Bulley & G. P. Byrne</i>	15
The origin and engineering properties of the Cainozoic pan sediments at Sua Pan, Botswana <i>B. G. Bulley & A. J. Hammond</i>	23
Piles in deep residual clays <i>J. P. Pellissier</i>	31
Characteristics of a deeply weathered residual norite <i>B. E. Hall, P. A. Legg & T. C. Partridge</i>	41
Retention forces for cuts in slopes of limiting equilibrium <i>L. D. Wesley & Lee Wai Hin</i>	49
Slope failures associated with the floods of September 1987 and February 1988 in Natal and Kwa-Zulu, Republic of South Africa <i>A. van Schalkwyk & Marion A. Thomas</i>	57
Deterioration and rehabilitation of earth roads in Madagascar <i>José Carlos de O. S. Horta & Carlo R. Traverso</i>	65
Railway embankment failures due to dispersive soils <i>F. Bucher, M. W. Giger, H. S. Mawona & A. K. Zuber</i>	75
Derivation of interim performance-related specifications for coarsely graded plastic calccrete basecourse gravels <i>F. Netterberg & M. I. Pinard</i>	81

The extraordinary phenomenon of chemical heaving and its effect on buildings and roads <i>A.A.B.Williams</i>	91
A case history of structural distress on heaving clay: Colinda Primary School <i>H.A.C.Meintjes</i>	99

Tenth African Regional Conference on Soil Mechanics and Foundation Engineering

1. *Engineering geology, waste disposal and the environment*

The engineering geology of the Wolwedans Dam <i>G.N.Davis</i>	109
Grouting of dolomite under foundations for a large bridge <i>B.P.Wrench & W.F.Heinz</i>	117
An engineering geological rock mass characterization system for tunnelling purposes <i>G.V.Price & A.van Schalkwyk</i>	123
A geohydrological study of the Vaal River north bank for the design of water conservation and seepage control measures <i>J.R.C.Yates & J.A.Wates</i>	141
The need for proper domestic waste disposal management in developing countries <i>O.Ogunsanwo</i>	147
Soil erosion patterns of Mollisols in the Katse Watershed <i>D.Nkalai</i>	149

2. *Roads*

The applicability of pavement evaluation and rehabilitation design methods in Botswana <i>C.J.van der Merwe & M.I.Pinard</i>	157
Use of the Dynamic Cone Penetrometer (DCP) in the design of road structures <i>M.de Beer</i>	167
Mechanistic pavement design using a Pencil Pressuremeter (PSPP) <i>P.J.Sanders</i>	177
Factors influencing the compactability and bearing capacity of untreated roadbuilding materials <i>C.J.Semmelink</i>	185
The long-term durability of lime-treated soils <i>P.Paige-Green</i>	193
Aggregate durability: Recommended tests and specification limits for road basecourse <i>L.R.Sampson</i>	197

Effects of undermining a gravel road near Secunda by longwalling <i>F.Netterberg & J.N.van der Merwe</i>	205
 3. Foundations	
Settlement and allowable pressure on sand <i>G.N.Rosenthal & R.van der Vlugt</i>	215
Full scale pile testing under controlled conditions <i>F.Scheele, E.J.Sellers & S.J.Cowburn</i>	223
Load transfer functions and pile performance modelling <i>J.P.Everett</i>	229
Design and performance: Piled raft foundation beneath the new 26 storey Palace Hotel in Durban <i>Clive Wilson & Zank Zietkiewicz</i>	235
New options for foundations on heaving clay <i>A.A.B.Williams & J.P.Pellissier</i>	243
Development of raft foundations for small structures on heaving clay <i>J.P.Pellissier & A.A.B.Williams</i>	249
 4. Laboratory and field testing	
A comparison of the three swell test procedures <i>H.D.Schreiner & J.B.Burland</i>	259
Lateral swelling pressure developed in an active clay <i>A.B.Fourie</i>	267
Microprocessor control of the drained triaxial test <i>C.T.Saunders & T.Zwe</i>	275
Piezocone testing to predict soft soil settlement <i>G.A.Jones & E.Rust</i>	283
A simple field suction measurement probe <i>M.S.Crilly, H.D.Schreiner & C.S.Gourley</i>	291
 5. Dams	
Breaching of an earth dam in the Western Cape by piping <i>Clive Wilson & Louis Melis</i>	301
The use of dynamic replacement and slurry cut-off key for dam construction on soft organic alluvium <i>F.Wagener, T.Hughes & E.Friedlaender</i>	313
Countering potential piping at an earth dam on dispersive soils <i>C.F.Watermeyer, B.E.Hall & G.R.Botha</i>	321

6. The Lesotho Highlands scheme: Geotechnical engineering aspects	
Geotechnical investigation for Katse dam, Lesotho <i>I.J.A.Brackley, S.Wallace, R.M.Galliers & M. Lephoma</i>	331
Lesotho highlands scheme – Compactability problems of crushed stone <i>G.C.Van Niekerk & A.Weyers</i>	343
Expected engineering geology of the Transfer Tunnel <i>R.M.Galliers, I.J.A.Brackley, M.Lephoma & A.B.Simpson</i>	351
Reinforced Earth™ in the Lesotho Highlands water scheme <i>G.M.Bentel & A.C.S.Smith</i>	359
7. Problem soils	
A case study of the effects of unsuitable foundations for residential dwellings constructed on collapsing sands and the remedial measures required <i>A.Tanner & H.J.Craig</i>	367
Prewetting expansive clay to minimize heave of structures <i>G.A.Jones & A.N.Els</i>	375
The influence of the mineralogy on the durability of Drakensberg basalts <i>J.L.van Rooy</i>	383
The impact rolling of a large housing site Boksburg <i>F.W.Solesbury & D.G.Walker</i>	393
The investigation, design and monitoring of concrete raft foundations on expansive soils: A case study of preliminary performance <i>J.H.Strydom & J.P.Pellissier</i>	401
8. General	
The creation of job opportunities in geotechnical construction <i>H.Weber & J.E.S.Boswell</i>	411