

O. Kusakabe, K. Fujita & Y. Miyazaki, editors

Geotechnical Aspects of Underground Construction in Soft Ground

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON GEOTECHNICAL ASPECTS
OF UNDERGROUND CONSTRUCTION IN SOFT GROUND – IS-TOKYO '99
TOKYO/JAPAN/19 – 21 JULY 1999

Geotechnical Aspects of Underground Construction in Soft Ground

Edited by

O. Kusakabe

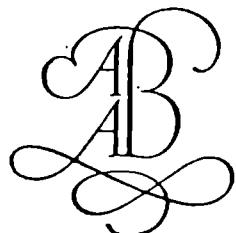
Department of Civil Engineering, Tokyo Institute of Technology, Japan

K. Fujita

Department of Civil Engineering, Science University of Tokyo, Chiba, Japan

Y. Miyazaki

Obayashi Corporation, Tokyo, Japan



A.A. BALKEMA / ROTTERDAM / BROOKFIELD / 2000

Cover photograph (top): Shinagawa Station Project – Excavation for the underpass, Shinagawa Shinkansen Station.

Cover photograph (bottom): Courtesy of Nishimatsu Construction: DLR Project, London. Photo by QA Photos Ltd, Folkestone, Kent, UK.

The texts of the various papers in this volume were set individually by typists under the supervision of each of the authors concerned.

Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by A.A. Balkema, Rotterdam, provided that the base fee of US\$ 1.50 per copy, plus US\$ 0.10 per page is paid directly to Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transactional Reporting Service is: 90 5809 106 6/00 US\$ 1.50 + US\$ 0.10.

Published by

A.A. Balkema, P.O.Box 1675, 3000 BR Rotterdam, Netherlands

Fax: +31.10.413.5947; E-mail: balkema@balkema.nl; Internet site: www.balkema.nl

A.A. Balkema Publishers, Old Post Road, Brookfield, VT 05036-9704, USA

Fax: 802.276.3837; E-mail: info@ashgate.com

ISBN 90 5809 106 6

© 2000 A.A. Balkema, Rotterdam

Printed in the Netherlands

Table of contents

Preface	XIII
Organisation	XV
<i>Special lecture</i>	
Seismic design of underground structures in soft ground: A review <i>K.Kawashima</i>	3
<i>Session reports</i>	
Bored tunnelling – NATM tunnelling <i>L.E.Sozio</i>	23
Bored tunnelling – TBM and shield tunnelling <i>H.Akagi</i>	33
Modelling and prediction <i>R.N.Taylor</i>	39
Braced excavation – Deformation and displacement of walls <i>P.W.Day</i>	43
Braced excavation – Excavation in general <i>T.S.Tan & J.N.Shirlaw</i>	53
1 <i>Bored tunnelling – NATM tunnelling</i>	
Experimental study of the stability of a tunnel face reinforced by bolts <i>R.Al Hallak, J.Garnier & E.Leca</i>	65
Geotechnical aspects regarding the construction of Bucharest Subway <i>V.Beldean, V.Ciugudean-Toma & S.Calinescu</i>	69
Ground and structure response to a hand driven decline in London clay <i>A.G.Bloodworth & S.R.Macklin</i>	75
Prediction of final displacement of tunnel section during excavation <i>H.S.Chung, N.Y.Kim & Y.C.Hwang</i>	81

Facing a major geological hazard for a highway tunnel in the French Alps <i>A.Guilloux</i>	87
Some deformation observations in underground openings <i>N.Gurung, Y.Iwao, K.Ishibashi & S.Hongo</i>	93
An example of a pile-tunnel interaction problem <i>K.G.Higgins, I.L.J.Chudleigh, H.D.St.John & D.M.Potts</i>	99
A design study for a road tunnel: The effects of construction detail <i>K.G.Higgins, R.Fernie, H.E.Edmonds & D.M.Potts</i>	105
Shallow compressed air tunnelling: Field measurements and a laboratory test <i>G.Kammerer & S.Semprich</i>	111
High-speed railway tunnelling in soft granular Frankfurt ground <i>R.Katzenbach, U.Arslan, G.Festag & A.Rückert</i>	117
Tunnels for public services built in wet sand by NATM <i>M.Müller, A.Harsányi & Z.Czap</i>	123
The residual stress of a thawed overconsolidated clayey soil <i>T.Nishimura & Y.Kondou</i>	129
Tunnels in soft ground for German high speed railway line Cologne-Frankfurt <i>H.Quick, J.Michael & U.Arslan</i>	135
Ground water and underground constructions in the City Urban Development <i>G.Rasula</i>	141
A compensation grouting trial in Singapore marine clay <i>J.N.Shirlaw, W.Dazhi, V.Ganeshan & C.S.Hoe</i>	149
Experiences from the construction of a twin tunnel in a marly formation <i>A.I.Sofianos, A.Kalkantzi & Ch.Giannaros</i>	155
Building collapse and ground subsidence in northern section of Calcutta Metro Construction <i>N.N.Som</i>	161
Squeezing rock response to NATM tunnelling: A case study <i>C.P.Tsatsanifos, P.M.Mantziras & D.Georgiou</i>	167
Monitoring ground deformation around a tunnel heading in London clay <i>J.P.van der Berg & C.R.I.Clayton</i>	173
Evaluation of environmental effects of subway in Nanjing city <i>Y.Wang</i>	179
2 Bored tunnelling – TBM, shield tunnelling	
CATSBY signal aided boring: Sydney experimentation <i>P.Aristaghes & V.Blanchet</i>	187
Monitoring the second Heinenoord Tunnel and the Botlek Rail Tunnel <i>K.J.Bakker, F.de Boer & J.B.M.Admiraal</i>	191

Monitoring: Evaluation of stresses in the lining of the Second Heinenoord Tunnel <i>K.J.Bakker, W.L.Leendertse, P.S.Jovanovic & G.P.C.van Oosterhout</i>	197
Reducing settlement caused by shield tunnelling in alluvial soils <i>S.Benmebarek, R.Kastner & C.Ollier</i>	203
Factors influencing the ground loss due to tunnels driven by EPB shield <i>C.T.Chang, Y.W.Chen & J.J.Wang</i>	209
Settlement, rotation and distortion of Piccadilly Line tunnels at Heathrow <i>M.L.Cooper & D.N.Chapman</i>	213
Field investigations of long term ground loading on an old tunnel in London Clay <i>S.M.Gourvenec, M.D.Bolton, K.Soga, M.W.Gui, R.J.Mair, H.E.Edmonds, I.L.J.Chudleigh & A.P.Butler</i>	219
Compensation grouting to control tilt of Big Ben Clock Tower <i>D.I.Harris, R.J.Mair, J.B.Burland & J.R.Standing</i>	225
Investigation on successive settlement due to shield tunnelling <i>T.Hashimoto, K.Hayakawa, K.Mizuhara & T.Konda</i>	233
From spoil to soil: Reuse of soil from TBM's in the Netherlands <i>M.B.G.Ketelaars & L.E.B.Saathof</i>	239
Centrifuge investigation on deformations around tunnels in nailed clay <i>J.Kuwano, A.Takahashi, T.Honda & K.Miki</i>	245
A case study of ground control mechanisms of EPB shield tunnelling in soft clay <i>K.M.Lee, H.W.Ji, C.K.Shen, J.H.Liu & T.H.Bai</i>	251
The effects of compensation grouting on segmental tunnel linings <i>S.W.Lee, G.R.Dasari, R.J.Mair, M.D.Bolton, K.Soga, T.Sugiyama, Y.An, T.Hagiwara & M.Nomoto</i>	257
Pipe jacking through soft alluvial clay near London: A case history <i>M.A.Marshall & G.W.E.Milligan</i>	263
Ground movements caused by TBM tunnelling in the Athens Metro Project <i>I.Mihalis & M.Kavvadas</i>	269
Experiences in the subsidence problems in Madrid Subway Extension <i>C.S.Oteo, M.Arnaiz, J.Trabada, M.Melis & F.Mendaña</i>	275
Design of bored tunnel linings installed within partially excavated C&C boxes <i>F.Prinzl & A.R.A.Gomes</i>	281
The Westerschelde tunnel: New shield technologies in Europe <i>H.-J.Sager & M.Herrenknecht</i>	287
The effects of boring a new tunnel under an existing masonry tunnel <i>H.R.Samuel, R.J.Mair, Y.C.Lu, I.L.J.Chudleigh, P.Readings & T.I.Addenbrooke</i>	293
Construction principles for large-sized grid shield tunnelling in soft clay <i>Y.Shao, E.J.Macari, M.Xia & X.Ye</i>	299

The construction of Pinglin tunnel through adverse geology <i>C.P.Shen, H.C.Tsai, Y.S.Hsieh & B.Chu</i>	305
Injection/grouting near pile foundations: Full scale test Amsterdam <i>A.E.C.van der Stoel & A.F.van Tol</i>	313
Compensation grouting at the Docklands Light Railway Lewisham Extension project <i>T.Sugiyama, T.Nomoto, M.Nomoto, Y.An, T.Hagiwara, R.J.Mair, M.D.Bolton & K.Soga</i>	319
Study on ground behavior by 4-centered slurry shield driving method <i>H.Yamada, M.Sugimoto, M.Nishio & K.Kayukawa</i>	325
Construction simulation for the interaction between shield segments and ground <i>H.Zhu, W.Ding, T.Hashimoto, J.Nagaya & T.Tamura</i>	331
3 Modelling and prediction	
Influence of infiltration and groundwater flow on tunnel face stability <i>W.Broere & A.F.van Tol</i>	339
Centrifuge modelling of a spile-reinforced tunnel heading <i>M.Calvello & R.N.Taylor</i>	345
Three dimensional simulation of slurry shield tunnelling <i>D.Dias, R.Kastner & M.Maghazi</i>	351
Segmental tunnel lining behaviour in axial direction <i>W.H.N.C.van Empel, R.G.A.de Waal & C.van der Veen</i>	357
Neural networks as a means for predicting convergence in tunnels <i>K.B.Fifer</i>	363
Designing shallow tunnel linings upon the action of moving surface loads <i>N.N.Fotieva, N.S.Bulychev & A.S.Sammal</i>	369
Evaluating plasticity solutions for the response of clay around tunnels <i>R.J.Grant & R.N.Taylor</i>	373
The role of the soil k_0 value in numerical analysis of shallow tunnels <i>P.F.M.Guedes de Melo & C.Santos Pereira</i>	379
A field case of rock-bolt deformations in pullout tests <i>N.Gurung, Y.Iwao, K.Ishibashi, S.Hongo & M.R.Madhav</i>	385
Displacement of saturated sand during slurry shield driving <i>K.Hosokawa & H.Akagi</i>	391
Earth pressure exerted on tunnels due to the subsidence of sandy ground <i>K.Komiya, E.Shimizu, T.Watanabe & N.Kodama</i>	397
Effects of excavation sequence on the 3-D settlement of shallow tunnels <i>T.Nakai, M.M.Farias, H.Matsubara & S.Kusunoki</i>	403
Prediction and performance: A review of numerical analyses for tunnels <i>A.Negro & P.I.B.de Queiroz</i>	409

Numerical solution model for instability of underground cavity <i>S.A.Sadrnejad</i>	419
Development of compensation grouting modelling and control system <i>K.Soga, M.D.Bolton, S.K.A.Au, K.Komiya, J.P.Hamelin, A.Van Cotthem, G.Buchet & J.P.Michel</i>	425
Development of a ground reaction curve for shield tunnelling <i>A.Sramoon & M.Sugimoto</i>	431
Study on shield behaviour by 3-D shield simulator <i>M.Sugimoto, N.Yoshiho & A.Sramoon</i>	437
Stress paths around a 3-D numerically simulated NATM tunnel in stiff clay <i>D.K.W.Tang, K.M.Lee & C.W.W.Ng</i>	443
Evaluation of active earth pressure on the facing of the shield entrance in a shaft <i>A.Wakai, K.Ugai & K.Anan</i>	451
Tunnel face reinforced by longitudinal bolts: Analytical model and in situ data <i>H.Wong, V.Trompille, D.Subrin & A.Guilloux</i>	457
Behavior of tunnel face pre-reinforced with sub-horizontal pipes <i>C.S.Yoo & H.K.Shin</i>	463
Discussion: Comment on conventional access inaccuracies and advanced general earth pressure model <i>P.Koudelka</i>	469
Discussion: Can settlements over tunnels be accurately predicted using advanced numerical methods? <i>J.N.Shirlaw</i>	471
4 Braced excavation – Deformation and displacement of walls	
Simulation failure mechanism of anchored sheet pile walls in a small centrifuge <i>H.G.B.Allersma & Y.Toyosawa</i>	475
Behavior of large-scale cylindrical earth retaining wall <i>K.Ariizumi, T.Kumagai & A.Kashiwagi</i>	481
Movement of stabilized coal-ash soil wall during excavation <i>K.Azuma, S.Noguchi, K.Kurisaki, H.Hyodo & M.Nagaoka</i>	487
Successful excavation to 15 m depth in clay downtown Oslo, Norway <i>A.Bye, A.S.Simonsen & N.Bergersen</i>	493
Informational construction approach for deep excavation <i>S.Y.Chi, J.C.Chern & C.C.Wang</i>	499
Behavior and control of cable duct in proximity to ground excavation work <i>H.Hanakura, N.Sakata & H.Yoshikuni</i>	505
The use of numerical methods for the design of base propped retaining walls <i>K.G.Higgins, R.Fernie, D.M.Potts & C.Houston</i>	511

Displacement control design method of excavation <i>X.Y.Hou, G.B.Liu & Y.X.Huang</i>	517
Soil-structure interaction of deep excavations in urban environment <i>R.Katzenbach, U.Arslan & Chr.Moormann</i>	523
Behavior of a braced structure for excavation under asymmetrical lateral load <i>S.Kazama</i>	531
The Rotterdam sheet pile wall field test: Test setup <i>D.A.Kort, A.F.van Tol & A.Jonker</i>	537
A case of a braced excavation in Bangkok clay <i>K.Matsumoto, K.Horio, Y.Kikuchi & K.Yaegashi</i>	543
A case of deep braced excavation for subway in Tokyo <i>T.Okada, T.Hoshino, S.Sakuma & S.Kohda</i>	549
Behavior of an earth retaining wall during deep excavation in Shanghai <i>K.Onishi & T.Sugawara</i>	555
A customised earth retaining system for deep excavation works <i>K.B.Poh, J.M.Lim, S.K.Tang & T.W.Tan</i>	561
Design and construction of deep circular cofferdam in collapsed ground <i>A.J.Powderham</i>	567
Behavior and soil resistance of shaped cantilever diaphragm walls <i>H.Sei & Y.Miyazaki</i>	573
Particular demands on deformations of building pit side <i>T.Siemer, S.Herzberg & H.Fricke</i>	581
3-D finite element modelling of slurry trenching <i>T.-S.Tan, K.-Y.Yong & B.Hou</i>	587
Behavior of cantilever earth retaining with buttress type stabilisation <i>M.Tsuzuki, J.Nakajima, S.Takayama & T.Kanekura</i>	593
Case studies of buttress-wall type ground improvement in struttied excavations <i>N.Uchiyama, Y.Katsura & M.Kamon</i>	599

5 Braced excavation – Excavation in general

Three dimensional analysis of building settlement caused by shaft construction <i>A.G.Bloodworth & G.T.Houlsby</i>	607
Stability of excavations in soft clay with floating self supported DMM wall <i>A.El Nahas, J.Takemura & M.Kouda</i>	613
Construction of the CTA cofferdam at Heathrow Airport, London <i>J.D.Findlay</i>	619
Settlement of sewer pipes in soft clay installed in a trench <i>G.Franzén, T.Spetz & G.Sälfors</i>	625

Earth retaining structures under seismic motion of Kobe earthquake <i>M.Furukawa, T.Tamano, Y.Toyosawa, S.Tanaka, J.Matuura & K.Sekiya</i>	631
Soil behavior due to freezing and frozen column during excavation of soft ground <i>T.Hongo, Y.Iwasaki & T.Ohrai</i>	635
Ground settlement around a braced excavation work <i>T.Horiuchi & M.Shimizu</i>	641
Earth pressures acting on a deep shaft and the movements of adjacent ground in sand <i>S.Imamura, T.Nomoto, T.Fujii, T.Hagiwara & O.Kusakabe</i>	647
Ground bottom heave due to large and deep excavation <i>T.Inoue, M.Nishi, Y.Kanaoka, M.Iwagaki, M.Uekuri, K.Ishikawa, K.Yaegashi, A.Uchida & H.Kikuchi</i>	653
Experimental study of heaving in a cofferdam on soft ground <i>T.Kawasaki & Y.Shioi</i>	659
Effect of anchor installation on settlement of nearby structures in soft soils <i>H.G.Kempfert & B.Gebreselassie</i>	665
Design of pretensioned soil nailing systems in excavations <i>H.T.Kim, I.K.Kang, S.W.Park & S.K.Lee</i>	671
Measures to prevent heaving during the excavation of soft ground <i>N.Kubota, H.Sako, M.Morota & K.Kojima</i>	677
Behavior of grout column reinforced clay under lateral compression <i>H.J.Liao & S.F.Su</i>	681
Considering time-space-effect's excavation design software <i>G.B.Liu, Y.X.Huang & X.Y.Hou</i>	687
Deformation behaviour and heaving analysis of deep excavation <i>K.Ohnishi, M.Katagiri, K.Saitoh & K.Azuma</i>	693
Investigation of groundwater status for deep underground construction <i>S.Ono, M.Kamon & T.Tamano</i>	699
Surface settlements due to walled excavation on 200 projects in Tokyo <i>S.Saji, J.Murata & T.Sugimoto</i>	705
In situ measurements and FE-analysis of a deep excavation <i>H.F.Schweiger, M.G.Freiseder & H.Breymann</i>	711
Seepage failure experiments on sand behind sheet piles <i>T.Tanaka, A.Verruijt & K.Hayashi</i>	717
Full scale test on environmental impact of diaphragm wall trench excavation in Amsterdam <i>J.C.W.M.de Wit, J.C.S.Roelandts & M.de Kant</i>	723
FEM analysis of excavation with soils improved in its passive zone <i>K.H.Xie, D.J.Zhang & X.Wang</i>	731

Miscellaneous

Photo of participants	739
Author index	741

Preface

The International Society for Soil Mechanics and Geotechnical Engineering formed the Technical Committee 28 on Underground Construction in Soft Ground (TC 28) at the Rio de Janeiro conference in 1988 and appointed the Japanese Geotechnical Society (JGS) as host society and Professor K. Fujita as the chairperson. Under his leadership, the International Symposium on Underground Construction in Soft Ground was held at the time of the New Delhi conference in 1994 as the major activity of the Technical Committee 28. The proceedings of the International Symposium contain 23 national reports on braced excavation and shield tunnelling practice prepared by the TC 28 members as well as 52 technical papers, focusing on case histories.

Following the successful New Delhi International Symposium, the Second International Symposium on Geotechnical Aspects of Underground Construction in Soft Ground was planned and held in London in 1996, when the host society was handed over from the Japanese Geotechnical Society to the British Geotechnical Society. Professor R.J.Mair was then appointed as chairperson and Professor R.N.Taylor as secretary of TC 28. This London Symposium established the symposium format; distributing preprint volumes in advance, preparing general reports, and focusing on discussions as well as construction site visits. The proceedings of Geotechnical Aspects of Underground Construction in Soft Ground contain 5 general reports and 116 technical papers.

The third symposium was planned at the time of the 50th anniversary of the Japanese Geotechnical Society in Tokyo in July 19-21, 1999, as one of IS (International Symposium) series which the Japanese Geotechnical Society has been organising. Since the symposium followed the same symposium themes and format as those of the London Symposium, the Technical Committee decided to call the symposium the Second International Symposium on Geotechnical Aspects of Underground Construction in Soft Ground (IS-Tokyo'99). 193 participants from 27 countries attended the symposium. The preprint volumes containing 109 papers and 5 general reports were prepared. The special issue of 'Soils and Foundations' on the symposium theme was also published and the papers were presented for discussions during the symposium.

Seven sessions were organised in the symposium as follows:

Session 1: Bored tunnel – NATM tunnelling etc., chaired by O.Sjostrom;

Session 2: Bored tunnel – TBM, shield tunnelling, chaired by Dr M. D. Bolton;

Session 3: Modelling and prediction, chaired by Professor O. Kusakabe;

Session 4: Braced excavation – Deformation and displacement of walls, chaired by A.Guilloux;

Session 5: Braced excavation – Excavation in general, chaired by Dr C.T.Chang;

Sessions 6 & 7: Soils and foundations, chaired by K.J.Bakker & Dr Y.Tsukamoto.

The final proceedings contain one special lecture on 'Seismic design of underground structures in soft ground: A review' by Professor K. Kawashima of Tokyo Institute of Technology, five general reports and more than 100 technical papers after careful peer-review by the TC members and some Japanese experts in the field. The organising committee is grateful to the following Japanese experts who helped to review the manuscripts: Y.Abe, T.Asakura, T.Hashimoto, Y.Ishii, Dr M. Kanatani, Professor M. Sugimoto, Professor J.Takemura, Y.Toyosawa and Professor A. Yashima.

The organising committee is specially grateful to the financial support by the Ministry of Education, Culture and Science. The symposium would not have been possible without help from the following persons; K.Ariizumi, H.Hasegawa, K.Iida, M.Inoue, T.Inoue, T.Inoue, T.Kesen, Y.Kondo, S.Machida, M.Nagao, I.Sandanbata, Y.Takahara, A.Takahashi, S.Torii, H.Watanabe, H.Yamamura, K.Yoshida and T.Yoshikawa.

O.Kusakabe
Chairman of Organising Committee
Tokyo, Japan
October, 1999

Organisation

The Symposium was organised by the International Society for Soil Mechanics and Geotechnical Engineering, Technical Committee TC 28 on Underground Construction in Soft Ground.

TECHNICAL COMMITTEE 28

R.J.Mair, *Chairman*
R.N.Taylor, *Secretary*

CORE-MEMBERS

K.Fujita	A.Negro
A.Guilloux	J.N.Shirlaw
O.Kusakabe	W.Steiner

MEMBERS

H.Akagi	T.D.O'Rourke
K.Bakker	C.Oteo
F.de Boer	T.Paul
G.Canetta	V.P.Petrukin
C.T.Chang	J.Robert
Hyung-Sik Chung	V.M.Sharma
M.Erdemgil	O.Sjostrom
S.D.Eskesen	M.M.Soares
Xueuan Hou	A.Sharif Softani
P.J.Huergo	N.Som
K.Karlsrud	A.Sousa
R.Kastner	C.P.Tsatsanifos
J.Mecsi	W.Wittke

COOPERATED MEMBER

Y.Leblais

ORGANISING COMMITTEE

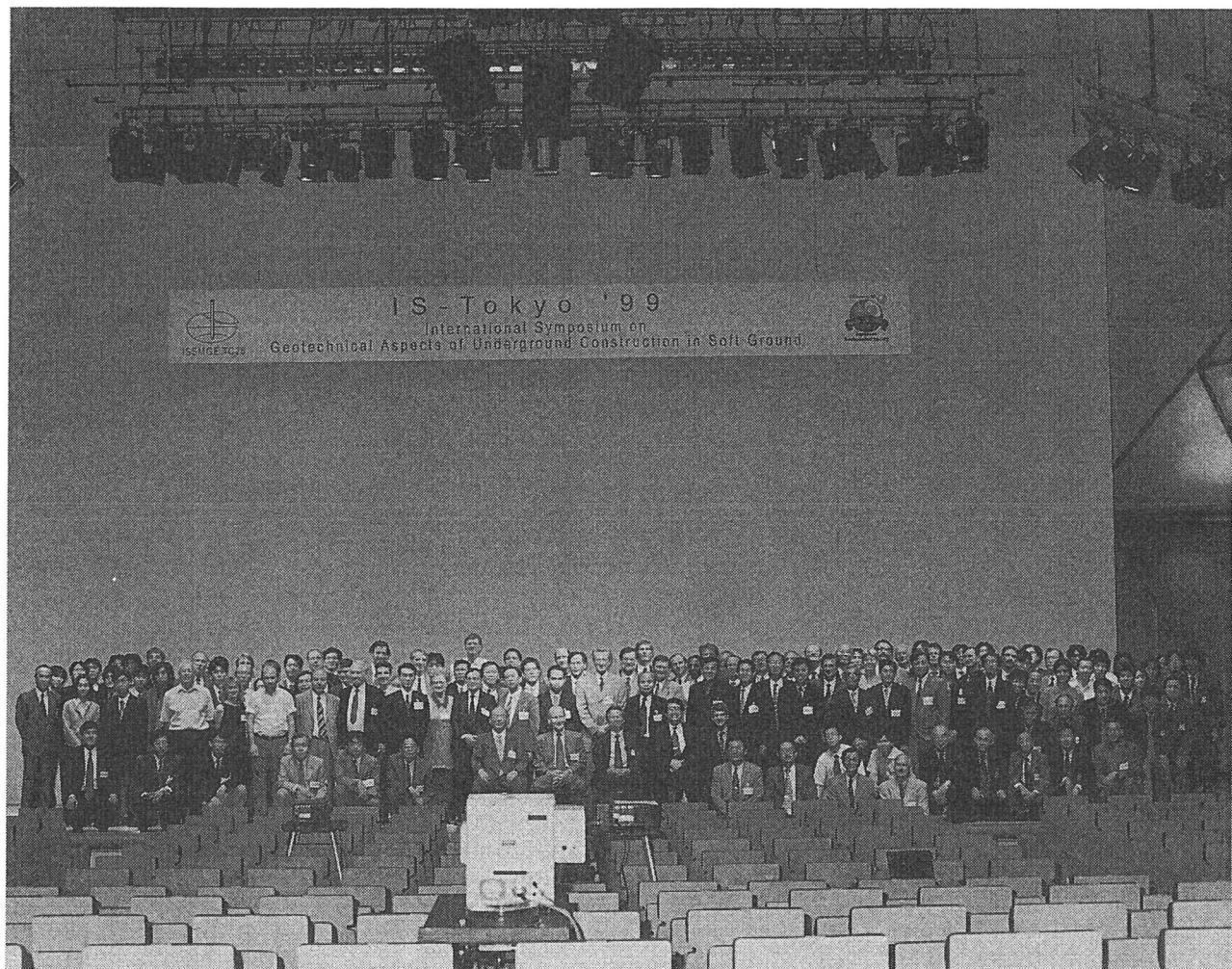
O.Kusakabe, *Chairman*

K.Fujita, *Secretary*

MEMBERS

H.Akagi	Y.Miyazaki
T.Hagiwara	T.Nomoto
S.Imamura	T.Sugimoto
K.Komiya	Y.Tsukamoto

Photo of participants



Author index

- Addenbrooke, T.I. 293
Admiraal, J.B.M. 191
Akagi, H. 33, 391
Al Hallak, R. 65
Allersma, H.G.B. 475
Anan, K. 451
Ano, Y. 257, 319
Aristaghes, P. 187
Ariizumi, K. 481
Arnáiz, M. 275
Arslan, U. 117, 135, 523
Au, S.K.A. 425
Azuma, K. 487, 693

Bai, T.H. 251
Bakker, K.J. 191, 197
Beldean, V. 69
Benmebarek, S. 203
Bergersen, N. 493
Blanchet, V. 187
Bloodworth, A.G. 75, 607
Bolton, M.D. 219, 257, 319, 425
Breymann, H. 711
Broere, W. 339
Buchet, G. 425
Bulychev, N.S. 369
Burland, J.B. 225
Butler, A.P. 219
Bye, A. 493

Calinescu, S. 69
Calvello, M. 345
Chang, C.T. 209
Chapman, D.N. 213
Chen, Y.W. 209
Chern, J.C. 499
Chi, S.Y. 499
Chu, B. 305
Chudleigh, I.L.J. 99, 219, 293
Chung, H.S. 81

Ciugudean-Toma, V. 69
Clayton, C.R.I. 173
Cooper, M.L. 213
Czap, Z. 123

Dasari, G.R. 257
Day, P.W. 43
Dazhi, W. 149
de Boer, F. 191
de Kant, M. 723
de Queiroz, P.I.B. 409
de Waal, R.G.A. 357
de Wit, J.C.W.M. 723
Dias, D. 351
Ding, W. 331

Edmonds, H.E. 105, 219
El Nahas, A. 613

Farias, M.M. 403
Fernie, R. 105, 511
Festag, G. 117
Fifer, K.B. 363
Findlay, J.D. 619
Fotieva, N.N. 369
Franzén, G. 625
Freiseder, M.G. 711
Fricke, H. 581
Fujii, T. 647
Furukawa, M. 631

Ganeshan, V. 149
Garnier, J. 65
Gebreselassie, B. 665
Georgiou, D. 167
Giannaros, Ch. 155
Gomes, A.R.A. 281
Gourvenec, S.M. 219
Grant, R.J. 373
Guedes de Melo, P.F.M. 379

Gui, M.W. 219
Guilloux, A. 87, 457
Gurung, N. 93, 385

Hagiwara, T. 257, 319, 647
Hamelin, J.P. 425
Hanakura, H. 505
Harris, D.I. 225
Harsányi, A. 123
Hashimoto, T. 233, 331
Hayakawa, K. 233
Hayashi, K. 717
Herrenknecht, M. 287
Herzberg, S. 581
Higgins, K.G. 99, 105, 511
Hoe, C.S. 149
Honda, T. 245
Hongo, S. 93, 385
Hongo, T. 635
Horio, K. 543
Horiuchi, T. 641
Hoshino, T. 549
Hosokawa, K. 391
Hou, B. 587
Hou, X.Y. 517, 687
Houlsby, G.T. 607
Houston, C. 511
Hsieh, Y.S. 305
Huang, Y.X. 517, 687
Hwang, Y.C. 81
Hyodo, H. 487

Imamura, S. 647
Inoue, T. 653
Ishibashi, K. 93, 385
Ishikawa, K. 653
Iwagaki, M. 653
Iwao, Y. 93, 385
Iwasaki, Y. 635

- Ji, H.W. 251
 John, H.D.St. 99
 Jonker, A. 537
 Jovanovic, P.S. 197
- Kalkantzi, A. 155
 Kammerer, G. 111
 Kamon, M. 599, 699
 Kanaoka, Y. 653
 Kanekura, T. 593
 Kang, I.K. 671
 Kashiwagi, A. 481
 Kastner, R. 203, 351
 Katagiri, M. 693
 Katsura, Y. 599
 Katzenbach, R. 117, 523
 Kavvadas, M. 269
 Kawasaki, T. 659
 Kawashima, K. 3
 Kayukawa, K. 325
 Kazama, S. 531
 Kempfert, H.G. 665
 Ketelaars, M.B.G. 239
 Kikuchi, H. 653
 Kikuchi, Y. 543
 Kim, H.T. 671
 Kim, N.Y. 81
 Kodama, N. 397
 Kohda, S. 549
 Kojima, K. 677
 Komiya, K. 397, 425
 Konda, T. 233
 Kondou, Y. 129
 Kort, D.A. 537
 Kouda, M. 613
 Koudelka, P. 469
 Kubota, N. 677
 Kumagai, T. 481
 Kurisaki, K. 487
 Kusakabe, O. 647
 Kusunoki, S. 403
 Kuwano, J. 245
- Leca, E. 65
 Lee, K.M. 251, 443
 Lee, S.K. 671
 Lee, S.W. 257
 Leendertse, W.L. 197
 Liao, H.J. 681
 Lim, J.M. 561
 Liu, G.B. 517, 687
 Liu, J.H. 251
 Lu, Y.C. 293
 Macari, E.J. 299
- Macklin, S.R. 75
 Madhav, M.R. 385
 Maghazi, M. 351
 Mair, R.J. 219, 225, 257, 293, 319
 Mantziaras, P.M. 167
 Marshall, M.A. 263
 Matsubara, H. 403
 Matsumoto, K. 543
 Matuura, J. 631
 Melis, M. 275
 Mendaña, F. 275
 Michael, J. 135
 Michel, J.P. 425
 Mihalis, I. 269
 Miki, K. 245
 Miliigan, G.W.E. 263
 Miyazaki, Y. 573
 Mizuhara, K. 233
 Moormann, Chr. 523
 Morota, M. 677
 Müller, M. 123
 Murata, J. 705
- Nagaoka, M. 487
 Nagaya, J. 331
 Nakai, T. 403
 Nakajima, J. 593
 Negro, A. 409
 Ng, C.W.W. 443
 Nishi, M. 653
 Nishimura, T. 129
 Nishio, M. 325
 Noguchi, S. 487
 Nomoto, M. 257, 319
 Nomoto, T. 319, 647
- Ohnishi, K. 693
 Ohrai, T. 635
 Okada, T. 549
 Ollier, C. 203
 Onishi, K. 555
 Ono, S. 699
 Oteo, C.S. 275
- Park, S.W. 671
 Poh, K.B. 561
 Potts, D.M. 99, 105, 511
 Powderham, A.J. 567
 Prinzl, F. 281
- Quick, H. 135
- Rasula, G. 141
 Readings, P. 293
 Roelands, J.C.S. 723
- Rückert, A. 117
 Saathof, L.E.B. 239
 Sadnejad, S.A. 419
 Sager, H.-J. 287
 Saitoh, K. 693
 Saji, S. 705
 Sakata, N. 505
 Sako, H. 677
 Sakuma, S. 549
 Sällfors, G. 625
 Sammal, A.S. 369
 Samuel, H.R. 293
 Santos Pereira, C. 379
 Schweiger, H.F. 711
 Sei, H. 573
 Sekiya, K. 631
 Semprich, S. 111
 Shao, Y. 299
 Shen, C.K. 251
 Shen, C.P. 305
 Shimizu, E. 397
 Shimizu, M. 641
 Shin, H.K. 463
 Shioi, Y. 659
 Shirlaw, J.N. 53, 149, 471
 Siemer, T. 581
 Simonsen, A.S. 493
 Sofianos, A.I. 155
 Soga, K. 219, 257, 319, 425
 Som, N.N. 161
 Sozio, L.E. 23
 Spetz, T. 625
 Sramoon, A. 431, 437
 Standing, J.R. 225
 Su, S.F. 681
 Subrin, D. 457
 Sugawara, T. 555
 Sugimoto, M. 325, 431, 437
 Sugimoto, T. 705
 Sugiyama, T. 257, 319
- Takahashi, A. 245
 Takayama, S. 593
 Takemura, J. 613
 Tamano, T. 631, 699
 Tamura, T. 331
 Tan, T.S. 53
 Tan, T.-S. 587
 Tan, T.W. 561
 Tanaka, S. 631
 Tanaka, T. 717
 Tang, D.K.W. 443
 Tang, S.K. 561
 Taylor, R.N. 39, 345, 373

- Toyosawa, Y. 475, 631
Trabada, J. 275
Trompille, V. 457
Tsai, H.C. 305
Tsatsanifos, C.P. 167
Tsuzuki, M. 593
Uchida, A. 653
Uchiyama, N. 599
Uekuri, M. 653
Ugai, K. 451
Van Cothem, A. 425
van der Berg, J.P. 173
van der Stoel, A.E.C. 313
van der Veen, C. 357
van Empel, W.H.N.C. 357
van Oosterhout, G.P.C. 197
van Tol, A.F. 313, 339, 537
Verruijt, A. 717
Wakai, A. 451
Wang, C.C. 499
Wang, J.J. 209
Wang, X. 731
Wang, Y. 179
Watanabe, T. 397
Wong, H. 457
Xia, M. 299
Xie, K.H. 731
Yaegashi, K. 543, 653
Yamada, H. 325
Ye, X. 299
Yong Shao 299
Yong, K.-Y. 587
Yoo, C.S. 463
Yoshiho, N. 437
Yoshikuni, H. 505
Zhang, D.J. 731
Zhu, H. 331

4