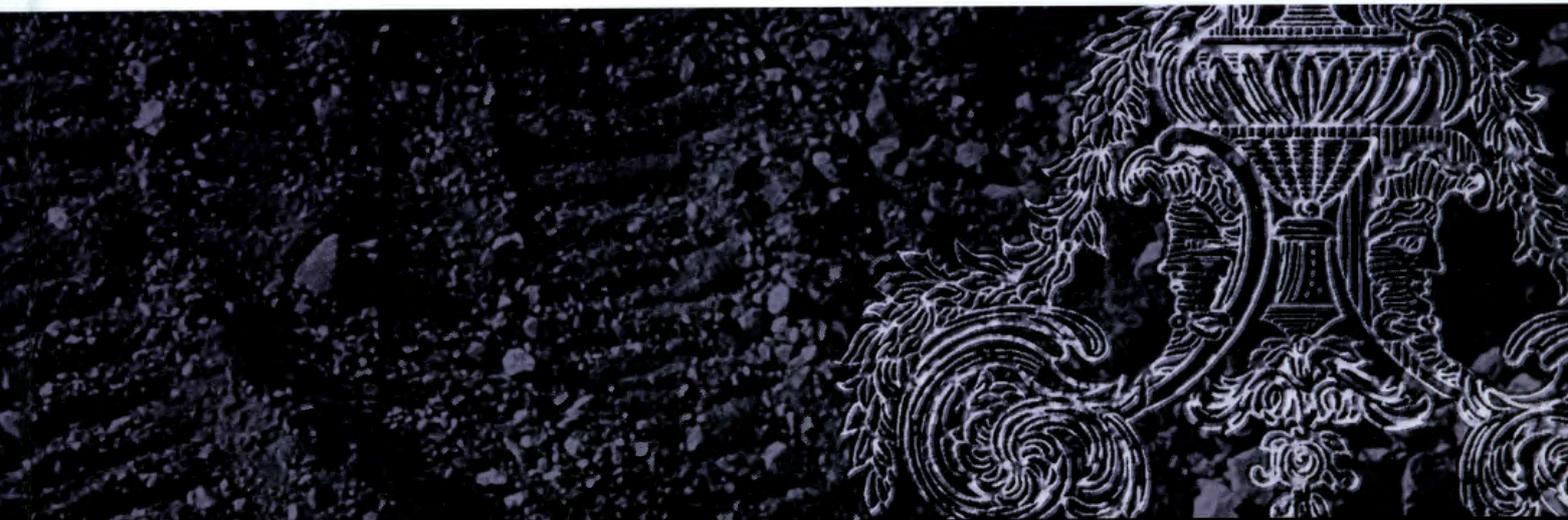


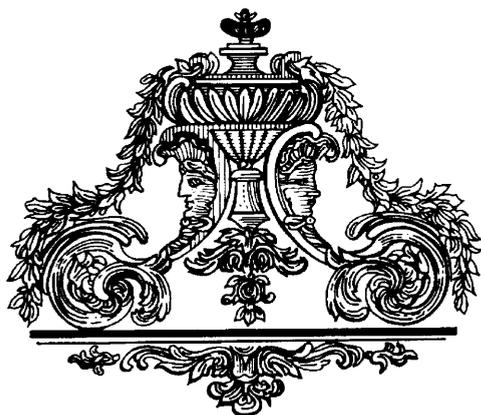
Ground and soil improvement

Edited by C. A. Raison



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THE INSTITUTION OF CIVIL ENGINEERS

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Preface

C. A. RAISON

The first *Géotechnique* Symposium in Print was published in March 1975. Since then the Symposium in Print has become a regular feature with topics chosen by the *Géotechnique* Advisory Panel to reflect current issues and research interests covering a wide range of subjects, (see **Table 1**).

The first Symposium was published on the subject of Ground Treatment by Deep Compaction. The topic of soil improvement was addressed again in March 1981 when the third *Géotechnique* Symposium in Print was published on Vertical Drains. Both issues contained a significant number of papers dealing with case histories and trials, reflecting the empirical nature of the design process and the lack of a rigorous theoretical framework.

Methods for improving ground and soil have undergone significant developments since the first Symposium particularly in terms of application and usage, and many innovative techniques have been introduced. However, it is of significance that in many areas the design process still lacks a theoretical framework. It is also clear that ground and soil improvement has received little input from the research community in the last two decades despite the immense practical importance of the subject.

Against this background, the *Géotechnique* Advisory Panel decided to call for a Symposium in Print focussed again on Ground and Soil Improvement. The theme for the Symposium was to be restricted to the mechanical improvement of ground using Vibro Compaction, Vibro Replacement, Dynamic Compaction, Soil Mixing, Compaction Grouting, Surcharging, Deep Drainage and other improvement techniques used to consolidate or reinforce the soil. One of the aims of the Symposium was to collect together data and experience in the hope of stimulating more interest from the research community.

Since 1975, substantial research efforts have been made in understanding fundamental soil behaviour, in developing powerful numerical analysis methods and improving testing and modelling techniques, particularly in the centrifuge. These developments are beginning to be applied to ground and soil improvement techniques and this Symposium includes at least two examples. However, the influence and importance of the construction methods, many of them proprietary, and the linkage with final performance still needs to be addressed. Because of these difficulties, much development is still based on observations and site specific trials.

The *Géotechnique* Advisory Panel set up an organising sub-committee comprising three members of the panel and

three external members. The sub-committee was responsible for reviewing and assessing papers with the full support of the Advisory Panel, the Institution of Civil Engineers Secretariat and external referees.

The response to the Symposium was substantial with over sixty five papers offered by authors throughout the world reflecting the interest and importance of this topic to many engineers. Unfortunately due to time restraints and the very tight deadline imposed by the Advisory Panel, many of these papers did not achieve fruition. The Panel was also acutely aware of the difficulties many of the authors had in meeting the high standards required by *Géotechnique* particularly in regard to completeness and extent of supporting data. Despite these difficulties, a total of fourteen papers were selected covering a range of topics from vacuum preloading, consolidation by vertical drains, dynamic compaction to vibro replacement. As reflects the practical nature of the subject matter, many of these papers are case histories. A significant proportion of the papers are from international contributors.

The eleventh *Géotechnique* Symposium in Print was published in December 2000, and was followed by a discussion meeting held at the Institution of Civil Engineers in London on 6th February 2001. This full day meeting was attended by about 140 delegates and followed the format of brief presentations of each paper by the authors followed by periods to allow questions and discussion from the audience. The meeting was divided into four sessions roughly following themes as follows:

Consolidation	Vacuum consolidation Vertical drains Preloading
Compaction	Explosive compaction Dynamic compaction Compaction grouting
Stone columns	Group effects Instrumented trial Drainage and reinforcement
Jet grouting	Single fluid grouting

In addition to the published papers, two key note presentations were made by Dr Andrew Charles of the Building Research Establishment and by Dr Alan Bell of Keller

Table 1. *Géotechnique* Symposia in Print

1st	March 1975	Ground treatment by deep compaction
2nd	March 1976	Piles in weak rock
3rd	March 1981	Vertical drains
4th	June 1983	The influence of vegetation on the swelling and shrinking of clays
5th	December 1984	Performance of propped and cantilevered rigid walls
6th	March 1987	The engineering application of direct and simple shear testing
7th	March 1992	The geotechnical aspects of contaminated land
8th	June 1992	Bothkennar soft clay test site: characterization and lessons learned
9th	December 1994	The observational method in geotechnical engineering
10th	August 1997	Pre-failure deformation behaviour of geomaterials
11th	December 2000	Ground and soil improvement

Ground Engineering. Dr Charles introduced session 1 with a paper dealing with the interaction between engineering based on science and theory and that based on experience and empiricism as related to ground improvement. Dr Bell introduced session 3 with a paper dealing with the importance of construction technique in successful deep vibratory ground improvement. Both papers are included in this volume.

This new publication has the aim of bringing together in one volume the fourteen papers originally published in *Géotechnique* in December 2000, the two keynote papers

together with a full record of the informal discussion and questions. The publication also includes written discussion received and published by *Géotechnique* subsequent to the meeting. It is hoped that publication of this volume provides a valuable record of the current state of the art in ground and soil improvement, covers a typical cross section of problems faced by many practising engineers and lastly, gives advice and guidance on how these problems can be dealt with in a practical manner.

Chris Raison

Contents

v Preface

Session 1

Papers

- 3 **Keynote:** Ground improvement: the interaction of engineering science and experience-based technology
A. Charles
- 9 Vacuum preloading consolidation of Yaoqiang Airport runway
M. Tang and J. Q. Shang
- 21 Soil improvement by the vacuum preloading method for an oil storage station
J. Chu, S. W. Yan and H. Yang
- 29 Consolidation of a very soft clay with vertical drains
M. S. S. Almeida, P. E. L. Santa Maria, I. S. M. Martins, A. P. Spotti and L. B. M. Coelho

Informal discussion

- 41 Chairman: Dr Angus Skinner

Written discussion

- 44 Vacuum preloading consolidation of Yaoqiang Airport runway; Soil improvement by the vacuum preloading method for an oil storage station; Consolidation of a very soft clay with vertical drains
A. E. Skinner
-

Session 2

Papers

- 53 Precompression design for secondary settlement reduction
E. E. Alonso, A. Gens and A. Lloret
- 65 Explosive compaction: design, implementation and effectiveness
W. B. Gohl, M. G. Jefferies, J. A. Howie and D. Diggles
- 75 Laboratory investigation of efficiency of conical-based pounders for dynamic compaction
T.-W. Feng, K.-H. Chen, Y.-T. Su and Y.-C. Shi
- 83 A study of low-energy dynamic compaction: field trials and centrifuge modelling
C. M. Merrifield and M. C. Davies

Informal discussion

- 91 Chairman: Mr Barry Slocombe

Written discussion

- 94 Precompression design for secondary settlement reduction
D. Nash and T.-W. Feng
- 99 Explosive compaction: design, implementation and effectiveness
W. H. Craig

Session 3

Papers

- 103 **Keynote:** The development and importance of construction technique in deep vibratory ground improvement
A. Bell
- 113 The effect of the development of undrained pore pressure on the efficiency of compaction grouting
N. Kovacevic, D. M. Potts and P. R. Vaughan
- 119 Group effects in stone column foundations: model tests
D. Muir Wood, W. Hu and D. F. T. Nash
- 129 An instrumental trial of vibro ground treatment supporting strip foundations in a variable fill
K. S. Watts, D. Johnson, L. A. Wood and A. Saadi

Informal discussion

- 139 Chairman: Dr Ken Been

Written discussion

- 142 The effect of the development of undrained pore pressure on the efficiency of compaction grouting
M. G. Jefferies and D. A. Shuttle
- 144 Group effects in stone column foundations: model tests
D. A. Greenwood

Session 4

Papers

- 147 Drainage and reinforcement of soft clay tank foundations by sand columns
Z. A. Al-Khafaji and W. H. Craig
- 153 The densification of granular soils using vibro methods
B. C. Slocombe, A. L. Bell and J. I. Baez
- 165 Vibro-replacement for industrial plant on reclaimed land, Bahrain
D. G. Renton-Rose, G. C. Bunce and D. W. Finlay
- 177 Analysis of single-fluid jet grouting
P. Croce and A. Flora

Informal discussion

- 187 Chairman: Mr Ken Watts

Written discussion

- 190 Vibro-replacement for industrial plant on reclaimed land, Bahrain
D A Baker
- 191 Analysis of single-fluid jet grouting
D. A. Greenwood and A. L. Bell

Closure

- 193 **Mr Chris Raison and Mr David Johnson**

Closure

CHRIS RAISON, CHAIRMAN

There is very little I want to say now. I think the evidence, certainly to me, is that there has been an immense interest in this subject. During the organising of the symposium we had a huge response from potential authors who wished to contribute. Unfortunately because of time constraints and other difficulties those potential authors were not able to submit papers. But it does indicate the huge range of interest. This interest is not just from the UK, it is international. I hope that you all feel that the end product, the symposium that was published in December last year, was worth publishing. It certainly reflects and gives a good international feel. It certainly reflects the wide ranging interest in the various systems that are available for ground improvement.

I would like to thank the delegates who have attended the meeting. Again we have had over 160 people who have attended. That is very rewarding for the efforts of the organising committee. Really at this stage I would like to say thank you to my fellow committee members. There is Ken Watts, Barry Slocombe, Dr Ken Been, Dr Angus Skinner and I should not forget David Johnson. David has been out of the country for a little while and has flown back specifically for this meeting. Rather than let him get away without doing anything for the meeting I have asked him to give a vote of thanks to the authors. David if I could put upon you.

DAVID JOHNSON

As Chris has said I have got off quite lightly. My excuse is that I have been overseas. I agree that today's symposium has been a great success and in that regard there are various people that should be thanked. Chris has already thanked the members of the committee but we should particularly thank the keynote speakers Andrew Charles and Alan Bell.

I would like to briefly touch on a couple of items than Andrew Charles highlighted which I think are important. He highlighted the fact that there is a general lack of papers produced on this subject, technical papers. Really there should be more. Chris Raison has just mentioned that there was a very large number of papers that were submitted for this symposium and that it was impossible for them all to be accepted. I think that the authors that have been unsuccessful in getting papers published for this symposium really should be encouraged to publish them elsewhere. My personal view is that there should be, and I am wearing my contractors hat here, I think there should be more specialist contractors, academics, universities and organizations such as Building Research Establishment, that there really should be more collaborative projects to encourage more theoretical analysis of ground improvement in general.

We should of course thank various people who have presented today including contributors from the floor. Chris has already given thanks to members of the committee. We should not forget of course the staff from the Institution of Civil Engineers, Mary Henderson and her helpers who have been in the background organising the administration. Last but not least we should thank the microphone experts Rafael Monroe, Joshua Weng, Laura Pumfrey and Dominique Brightman, MSc students from Imperial College. We should express our appreciation in the usual way.

CHRIS RAISON

Just before I close the symposium we ought to also thank the panel members of the *Géotechnique* Advisory Panel who have put a lot of hard work themselves into looking at papers that were submitted and perhaps more importantly the referees that we used to review the papers in the first place. With that I will close the symposium and thank you all for attending.

The eleventh *Géotechnique* Symposium in Print was first published in December 2000 and was followed by a discussion meeting in February 2001, held at the Institution of Civil Engineers in London. The meeting allowed brief presentations of each paper to be made by the authors and was followed by lively and informative discussion covering the full subject matter.

This new publication brings together in one volume the fourteen papers originally published in *Géotechnique*, along with a full record of the informal discussion that took place during the meeting, and presents in a convenient manner all the formal written discussion received and published in *Géotechnique* subsequent to the meeting. The volume also includes keynote papers by two well-renowned practitioners, Dr Andrew Charles from the Building Research Establishment and Dr Alan Bell of Keller Ground Engineering.

The publication reflects the interest and importance of ground and soil improvement through papers covering a range of topics, including vacuum preloading, consolidation by vertical drains, dynamic compaction and vibro replacement. The papers and discussion cover a typical cross-section of many of the problems faced by practising engineers and provides advice and guidance on how these problems can be dealt with in a practical manner. This volume will be of interest both to practitioners and to those involved in research and development.

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