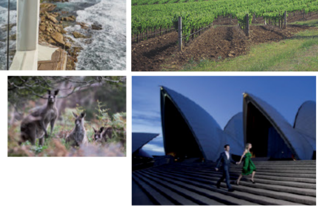
SYDNEY
7iYGEC 2022

A GEOTECHNICAL DISCOVERY DOWN UNDER

7th International Young Geotechnical Engineers Conference
29 April – 1 May 2022 | Sydney, Australia



Proceedings of 7th International Young Geotechnical Engineers Conference
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Hosted by the Australian Geomechanics Society and the International Society for Soil Mechanics and Geotechnical Engineering

AUSTRALIAN GEOMECHANICS SOCIETY

SIMSG ISSMGE

Proceedings of the 7th International Young Geotechnical Engineers Conference

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Preface

This volume presents the proceedings of the 7th International Young Geotechnical Engineers Conference (7iYGEC) held in Sydney, Australia, from 29 April to 1 May 2022. This event was organised by the Australian Geomechanics Society (AGS) under the auspices of the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE).

Key objectives of the 7iYGEC are to bring young geotechnical practitioners together to participate in their own dedicated conference ahead of the 20th International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE 2022), in a relaxed, friendly and supportive environment to share their research, ideas and experience, build international networks and discuss the challenges facing young geotechnical engineers in a rapidly changing world.

Traditionally, the iYGEC conference series has addressed the aforementioned objectives by running in-person conferences. The intention was to run this conference in the same format; however, the global pandemic has necessitated that a hybrid conference model be implemented. The organising committee thanks the conference delegates for their participation in the technical paper peer review process, the submission of their technical papers and pre-recorded presentations ahead of the conference, as well as their participation during the conference in panel discussion sessions.

The topics covered by the papers included in this volume encompass a wide range of categories, from fundamentals, to applications, to impact on society. Within this volume, there are 109 papers that are organised by ISSMGE Region; Africa (7 papers), Asia (37), Australasia (7), Europe (43), North America (8) and South America (7). Delegates from 50 ISSMGE member societies are represented at this conference.

Acknowledgements

We would like to thank the ISSMGE and the AGS for their financial support of the 7iYGEC.

We are grateful to the member societies of the ISSMGE who helped to review the manuscripts and the 7iYGEC delegates who participated in a peer review process, which improved the overall technical standard and presentation of the published papers.

We appreciate the support of our keynote speakers, Prof. Harry Poulos and Dr. Fleur Loveridge. Additionally, we are grateful to the senior members of the geotechnical community who have helped with this conference as chairs and facilitators of the panel discussion sessions.

We thank the conference delegates for their participation in this conference, whether they could attend online or in-person. We also thank the sponsors of this conference for their support and trust that they have benefited by engaging with future leaders of the geotechnical industry.

The organising committee would like also to acknowledge the contribution of the staff at ICMS Australasia Pty Ltd for their help and support, in particular Ms. Ainslie Bishop (formerly of ICMS) and Ms. Lieke Scherbeijn who have worked closely with the organising committee to deliver the 7iYGEC. The assistance of Mr. Robin Lehane in preparing this volume of the proceedings is also greatly appreciated. Finally, we would like to thank Prof. Harry Poulos for writing the introduction to this volume.

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Brendan Scott
Daniel King
Somaye Sadeghian
Jonathan Sutton
Lauren Foote
Lucy Wu

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Introduction

I am delighted to contribute this Introduction to the Proceedings of the 7th International Young Geotechnical Engineers Conference. This is the most recent of a series that commenced in 2000, and was aimed at assisting the career paths of young professionals under the age of 35. The first event took place in Southampton in the UK, and featured contributions from such geotechnical luminaries as Ralph Peck, Evert Hoek, Peter Fookes and Victor de Mello. This conference series has featured technical contributions from the younger cohort of our profession world-wide, many of whom have become, or are destined to become, the leaders of our profession in the years ahead.

I have been given license to offer what I consider to be some relevant comments in this Introduction, and so I will outline my own career development, and then focus on some aspects that have been important in this development, and on some lessons that I have learned. I will also reflect on how the geotechnical profession has developed over the past 50 years or more, and some of the possible directions that it may follow in the future.

I began my professional career undertaking a PhD, under the supervision of E.H. Davis, on the subject of three-dimensional settlement analysis of foundations. After completing my research, I spent a year working largely as a structural engineer within a Sydney consulting company, and then secured an academic position at the University of Sydney. I continued to undertake research on foundation settlements, extending the work that I had done on shallow foundations to deep foundations. This broad subject has occupied my attention for over 50 years and still continues to provide stimulating challenges today. After 24 years as a full-time academic, I changed direction and joined the consulting firm of Coffey Partners International, while retaining a part-time appointment at the University of Sydney. I held these dual roles for 12 years until my retirement from the University in 2001. I am still associated with the University of Sydney as an Emeritus Professor and am also a Senior Consultant with the company, now re-branded as Tetra Tech Coffey.

Among the aspects that I have found to be beneficial in my career development, and which I could commend to younger engineers, are the following:

1. Having a dedicated mentor to guide me through the early stages of my career was a crucial factor. The late Professor E.H. (Ted) Davis taught me to think critically, to understand the fundamentals of a problem, and to write as clearly and as simply as possible.
2. As an engineer, relating research to practice is a logical process. While there is scope for “blue-sky” research, it is generally much easier to find sponsorship for, and acceptance of, research if it is oriented towards a specific practical outcome.
3. My dual career as an academic and practitioner was probably the most fruitful period of my professional life. Real-life problems identified during consulting projects became research topics for my post-graduate students, and the results of their work were subsequently incorporated into practice.
4. As an academic, having consulting experience was invaluable in being able to develop more interesting lectures that included real projects as examples of the application of theory. I can heartily recommend the benefits of doing some consulting work to academics who wish to both broaden their knowledge of real-world geotechnics and who wish to enhance their teaching.
5. I benefitted enormously from periods of sabbatical leave during (and even after) my academic career. I had the privilege of spending two periods of sabbatical leave at MIT under the guidance of Professor T. William Lambe. It was there that I gained a better appreciation of how theory can be applied to practice, and the virtues of making real (“Class A”) predictions and subsequently comparing then with the outcomes. I also spent two months in 1977 working with McClelland Engineers in Houston, and it was there that I became much more familiar with offshore geotechnics and issues such as the cyclic loading of piles. Again, this was to influence my research over the ensuing 12 years or so.
6. As a consultant, I soon learned that time is a much more critical factor than it had been in academia. Time had to be accounted for, and the commercial success of an organization depends on projects being undertaken on time and within budget. For example, whereas one might wish to spend extra time on exploring finer points identified during a project, if the budget did not allow for this, then it should not be done, at least within company hours.
7. As a consultant, it is most important that, when carrying out geotechnical analyses, a check be done on the results of the analysis. In particular, many contemporary computer programs are very powerful but the user does not always understand how they work, and what some of the implicit assumptions may be. As a consequence, the results may turn out to be at best inaccurate, and at worst, misleading or wrong. Checks can be made in one or more of the following ways:
    a. Via previous experience with similar problems in similar ground conditions;
    b. Via review by another experienced professional within the same organization;
    c. Via third-party peer review;
    d. Via undertaking simplified analyses which incorporate the correct engineering principles of the problems, even though they may require a simplification of the ground conditions. This is an approach that I strongly advocate as an adjunct to any of the above procedures.

8. I have benefitted greatly from being able to attend conferences during my entire career. Not only do they provide a means of presenting one's work, whether research or project-related, but perhaps even more importantly, they provide a means of networking with fellow professionals, not necessarily only in the geotechnical field, and thus developing both professional and personal friendships that can endure for a lifetime. There are so many conferences these days that it is difficult to decide on which are most relevant, but preference can perhaps be given to those that will result in publications in proceedings or journals that are likely to be widely read, and those which tend to address issues that are likely to be of research or project-related benefit.

Since I began to carry out research for my PhD in 1961, I have seen remarkable developments in the field of geotechnical engineering. In the early 1960s, the main topics of interest can be gauged from the General Reports in the Proceedings of the 5th International Conference on Soil Mechanics and Foundation Engineering, held in Paris in 1961. These topics were as follows:

1. Soil properties and their measurements.
2. Foundations of structures, other than piles.
3. Foundations of structures, piles.
4. Roads.
5. Forces on structures.
6. Earth dams, slopes and open excavations.
7. Other problems, including soil stabilization and foundations in seismic areas.

Since that time, various broad areas have been developed that have extended the scope of the above topics, including:

1. Ground improvement techniques.
2. Soil reinforcement.
3. Geotechnical earthquake engineering.
4. Geo-environmental engineering.
5. Offshore geotechnics.
6. The application of probabilistic approached to design.
7. The application of high-level numerical techniques, including finite element and finite difference methods.

The International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) has established 38 Technical Committees that address specific issues within 3 broad categories:

1. Fundamentals.
2. Applications.
3. Impact on Society.

Most of the traditional topics are addressed within the first two categories, although the Applications category has expanded to include such topics as reinforced fill structures, scour and erosion, transportation, land reclamation, safety and serviceability, and system performance.

Perhaps the most significant extension in our profession has been the focus on the impact of our subject on Society. The specific topics addressed are historic sites, forensic geotechnics, floods, risk, megacities, geo-education, sustainability, energy geotechnics and machine learning. It is clear from this list that soil mechanics and foundation engineering has expanded well beyond its rather limited traditional base and is rapidly becoming much more multi-disciplinary. Moreover, there is an increasing trend towards the incorporation of other facets of science, including chemistry (whose importance became very prominent with the development of geo-environmental engineering), microbiology, as exemplified by the increasing number of methods of bio-geo treatment of soils and wastes, and artificial intelligence techniques that have the potential to be an invaluable adjunct to human-based geotechnical design. Such techniques can incorporate precedent and prior experience to facilitate checking and calibration of designs.

There has been a perception among some that research in geotechnical engineering is passé, and that all our problems have been addressed adequately. I would challenge this view! I believe that the years ahead will provide remarkable opportunities for younger engineers to become more proficient in what we might term "scientific geotechnics", an area that is much broader than that in which I developed my professional career. If I were starting my career today, I would relish the challenge of blending traditional soil mechanics and geotechnical engineering with science, not only the well-established areas such as geology, mathematics, statistics and computing, but in emerging areas such as microbiology, remote sensing and monitoring, and "green" energy production. I hope that attendees at this conference will feel the same enthusiasm as I do, and be able to forge interesting and dedicated careers that will benefit Society as well as themselves.

H.G. POULOS

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