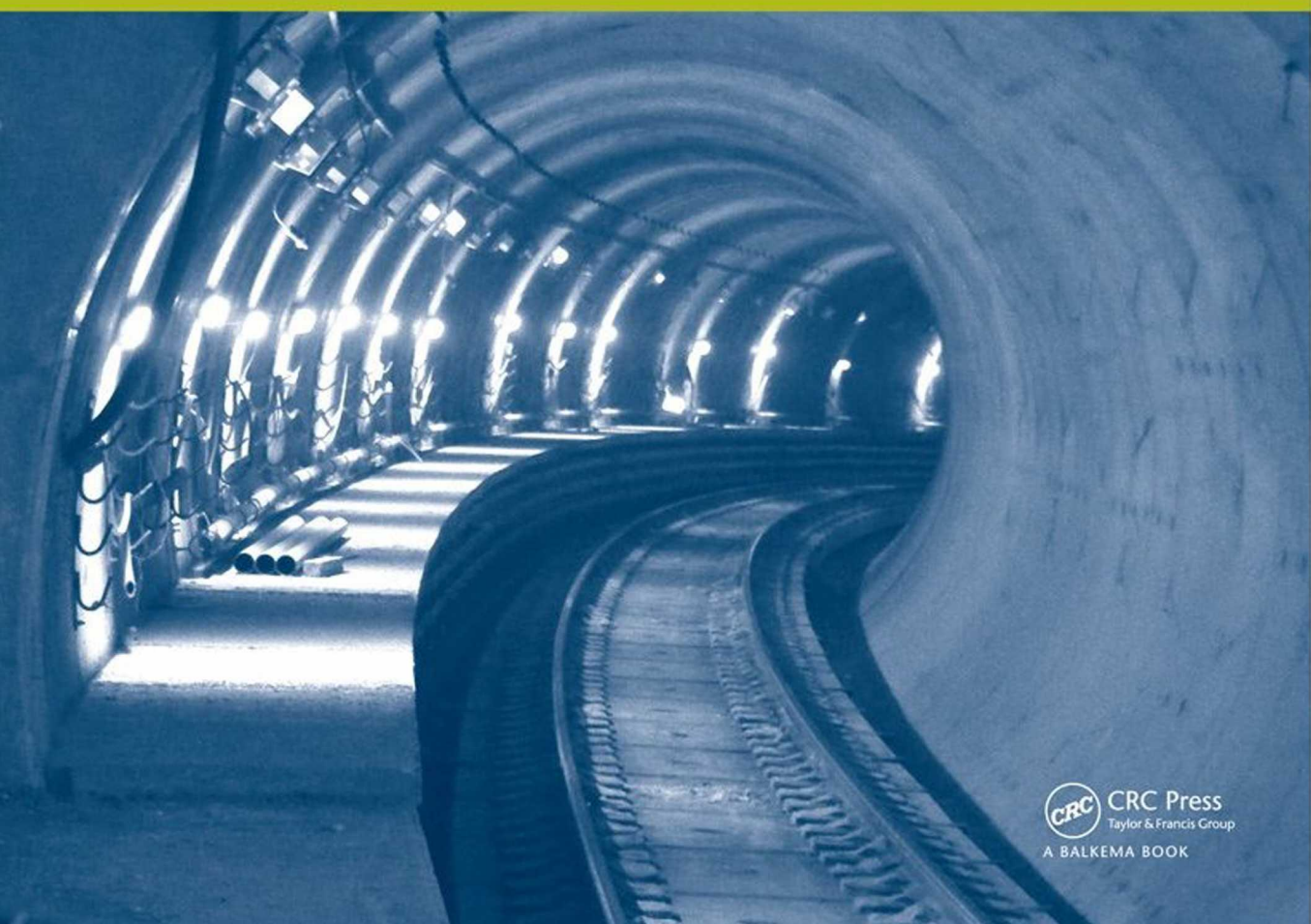


Giulia Viggiani, editor

# GEO TECHNICAL ASPECTS OF UNDERGROUND CONSTRUCTION IN SOFT GROUND



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A BALKEMA BOOK

PROCEEDINGS OF THE 7<sup>TH</sup> INTERNATIONAL SYMPOSIUM ON GEOTECHNICAL ASPECTS  
OF UNDERGROUND CONSTRUCTION IN SOFT GROUND, ROMA, ITALY, 17–19 MAY 2011

# Geotechnical Aspects of Underground Construction in Soft Ground

*Editor*

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*Università di Roma Tor Vergata, Roma, Italy*



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Picture 1. Construction of Line B of Roma Underground in the thirties. Coliseum Station.  
Adapted from:  
Perrone, V. (1955). *La Ferrovia Metropolitana di Roma*. Istituto Poligrafico dello Stato, Roma

Picture 2: View of one of the bored tunnels of Line C of Roma Underground.  
Courtesy of Metro C scpa

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## Preface

Technical Committee 204: "Underground Construction in Soft Ground" of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) was first established as TC28 in 1989 to provide a forum for interchange of ideas and discussion amongst representative from different countries with an active interest in tunnelling and deep excavations in the urban environment. In 1994, under the Chairmanship of Prof. Keiichi Fujita, TC28 organised its first symposium as a satellite event to the ISSMGE International Conference in New Delhi. Since then, the host society of TC28 was handed over from the Japanese Geotechnical Society to the British Geotechnical Society, under the Chairmanship of Prof. Robert Mair, and then to the French Geotechnical Society, under the Chairmanship of Prof. Richard Kastner.

Over the years TC28 has always kept its commitment towards collecting information concerning the geotechnical aspects of the design, construction and analysis of deep excavations, tunnels, and large underground structures in the urban environment, with particular emphasis on the development, effects and control of ground movements, their interaction with existing structures, mitigation measures and risk management. The success of the New Delhi symposium led to the strong feeling that organising regular events would be both well received and productive so that five more International Symposia on "Geotechnical Aspects of Underground Construction in Soft Ground" have been organised by TC28 since 1994. These were held every three years in London (1996), Tokyo (1999), Toulouse (2002), Amsterdam (2005), and Shanghai (2008). This volume of Proceedings is the outcome of the seventh symposium of the series, which was held in Roma in May 2011. During the Symposium the Chairmanship of TC204 was handed over from Prof. Kastner to Prof. Adam Bezuijen from the Netherlands.

The themes for the Roma Symposium were in line with the terms of reference of Technical Committee TC204 and included tunnelling in soft ground, deep excavations, monitoring, numerical analysis, and mitigating measures. The call for papers drew an overwhelming response and over 200 abstracts were received, resulting in 116 technical papers accepted for publication in the proceedings and the attendance of nearly 180 delegates from 30 Countries.

As customary, the first two days of the symposium consisted of technical discussion sessions, covering:

1. Construction, design, and measured performance of bored tunnels
2. Physical and numerical modelling of deep excavations and bored tunnels
3. Construction, design, and measured performance of deep excavations
4. Design methods and predictive tools for deep excavations and bored tunnels
5. Ground movements, interaction with existing structures and mitigation measures

During each of these sessions, a general report was presented together with a small number of selected individual papers. Oral presentations were followed by open debate and discussion.

At the beginning and at the end of each of the first two days four invited special lectures were delivered by dr. Mario Aguillar Tellez (Mexico), Prof. Charles W.W. Ng (Hong Kong), Prof. Frits van Tol (the Netherlands) and Prof. Sebastiano Rampello. Their lectures were devoted to the geotechnical aspects of construction of the new Mexico City deep sewerage system (as a special contribution of TC214 "Soft Soils"), the long-term settlement mechanisms of tunnels in Shanghai, the lessons learned from the deep excavations for North-South Line in Amsterdam, and the evaluation of the effects of tunnel excavation on historical buildings, drawing from experience gathered during construction of a subway line C in Roma.

In addition to standard technical sessions, two special sessions also took place during the first two days of the Symposium, one devoted to an illustration of current activities of TC204 Working Groups, and another one to an overview of Roma and Napoli underground extension projects.

On the third day of the Symposium technical visits were organised to the work sites of Line C of Roma Underground, under construction at the time of the Symposium; for those delegates willing to stay, extra

technical visits to the construction sites of Linea 1 and Linea 6 of Napoli Underground were organised on the fourth day.

This volume contains 128 papers, including the written versions of the reports on the activities of TC204 working groups, of the general reports and of the invited lectures. All the papers that were submitted were peer-reviewed on a voluntary basis by members of TC204.

The success of the symposium must be attributed to the authors of the papers, the speakers at the symposium, the delegates who travelled to Roma to present their work orally or in the poster sessions and to take part in the discussion, and to friends and colleagues who accepted to act as chairmen of the technical sessions for their task of keeping everybody (more or less) to time. All the same, the Symposium would not have been possible without the efficiency and hard work of ing. Claudio Soccodato and Ms. Susanna Antonielli, and the tremendous support of the then Chairman and Secretary of TC204, Prof. Richard Kastner and dr. Jamie Standing.

Finally, thanks are due to the companies, both from Italy and from abroad, that were willing to give financial support to the organisation of the Symposium and that chose to use the Symposium as a showcase for their products and services; a list of the main sponsors and of the exhibitors is included in this volume of proceedings.

Stefano Aversa  
*Chairman AGI*  
*Chairman Local Organising Committee*

Giulia Viggiani  
*Editor*

## Organisation

The Symposium of Technical Committee 204 on “Geotechnical Aspects of Underground Construction in Soft Ground” was organised by the Italian Geotechnical Society (AGI) under the Auspices of the International Society for Soil Mechanics and Geotechnical Engineering and of the Italian Ministry for Public Works.



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