Underground Spaces Unveiled

'Beauty awakens the soul to act'

*After
Dante Alighieri
(Purgatorio, Canto XVIII)*

This book is dedicated to both our families

And to all those with a passion for cities
and their sustainable development
seeking harmony between humanity and nature
And who strive to participate in the creation
of the cities we need and want

Underground Spaces Unveiled

Planning and creating the cities of the future

Han Admiraal

BSc CivEng, MBA
Enprodes Management Consultancy BV

Antonia Cornaro

BSocSc, MA Urban Planning
Amberg Engineering AG

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Foreword by Dominique Perrault

Among many cultures, the underground world holds strong symbolic meaning. For some, it is where evil dwells; for others, it has long represented a natural shelter against elements. Although mindsets tend to change, the work of enthusiasts such as Han and Antonia represents a significant leap forwards in the progress of a global culture of 'groundscapes'.

This summer, I was delighted to meet Han again in Lyon, France, for a seminar. Han, Antonia and I have a strong interest in underground space, or groundscapes, and their potential value for future cities. We share the belief that building underground is not just a conceptual temporary architectural trend but holds long-term potential, especially for dense urban environments.

Cities now attract the majority of the world's population. In extremely dense cities, decision-makers are being challenged to find balance between sustainability and public space availability, between liveability and price control.

Han and Antonia have both developed incredible expertise in their own fields and in underground construction, eventually joining their efforts in developing underground space use as the chair and vice-chair of the International Tunnelling and Underground Space Association's Committee on Underground Space (ITACUS). Whereas Antonia focuses on how underground spaces

can play a role in urban planning and public space development, Han concentrates on combining engineering, organisational expertise, economics and social management.

They not only have had crucial roles in major underground projects around the world but also dedicate time to educating current and future engineers, architects, urban planners and decision-makers about every aspect of underground space use.

'Justification can only be obtained through dialogue.' Inclusive dialogue is key to Antonia and Han's approach to underground construction project management. Their book is the result of their vision and a step towards nurturing dialogue through educating current and future decision-makers. It features an ideal balance between technicality and accessibility, between a comprehensive approach to the matter and in-depth case studies that will help the reader translate its new knowledge into the real world.

An important feature of this book is that it plays an integral part in raising awareness

on groundscape. Although its focus is urban planning and urban design, it aims at giving a wide overview of the subject to the reader, regardless of their experience.

In having such a comprehensive approach to underground construction, Han and Antonia participate in a larger global culture that was reborn during the 20th century in our modern societies: the culture of appreciating the potential of the underground. This has started developing as a type of 'network' of knowledge,

of people, of technologies, of education and of urban experiments through the practical vanguard work of architects such as Edouard Utudjian and the visionary design of Archigram and Superstudio.

Today, what was only an echo is ready to emerge as the groundscape of our cities.

As various major cities now grasp the extent of the potential that their underground spaces hold, I'd like to invite you to seize the value of this book.

Dominique Perrault

DPA
DOMINIQUE PERRAULT ARCHITECTURE

Foreword by Dr Joan Clos

Underground Spaces Unveiled: Planning and Creating the Cities of the Future is an enriching analysis of underground space that comes at a crucial moment in the implementation process of the New Urban Agenda, the outcome document of Habitat III, adopted in Quito (Ecuador).

The quest for compact, energy-efficient, resilient and liveable cities has led to an increasing emphasis on planned urbanisation. The character and image of a city, too, are defined and framed by its streets and public spaces, whether boulevards or neighbourhood roads, squares or neighbourhood gardens or children's playgrounds. Urban centres that have limited public space on the surface or face severe weather conditions, such as Montreal and Helsinki, are starting to turn their attention to the underground, from subterranean parks to shopping malls and shopping arcades.

However, the potential of underground spaces is typically overlooked or neglected in planning processes. Most cities have limited understanding of the potential of underground space, and there is little clarity on the importance of a planning approach to this space. Traditionally, cities have made use of underground space for transport (particularly rapid rail transport), services and parking. In some cases, such as Hong Kong, Singapore and, lately,

London, areas of public space, with commerce and entertainment, as well as pedestrian connectivity, have been developed successfully. However, such spaces often follow the layout of surface public space, as the circumstances and even the legal status below private plots remain unclear, and underground spatial planning or design strategies – where they exist – may not provide adequate guidance in this regard. Indeed, the effective use of underground space poses specific challenges, including geology and underground ecology, as well as legal barriers and governance constraints in its planning and management. Without a vision, a strategy and appropriate legal and fiscal instruments to address these challenges, its use would remain ad hoc and chaotic.

A growing interest in underground space is clearly driven by the need and opportunities for the location of services and waste management, as well as energy-related infrastructure for production and distribution. In addition, locating other functions underground (such as

transportation, cinemas and shopping facilities, as well as museums and cultural spaces – as in the case of Athens) will create more space above ground for recreation and other social activities. Building underground can improve our urban environment by relieving the pressure on the surface, developing better public transport networks, reducing noise, and leaving more green areas intact above ground.

The use of underground space can help cities remain compact, be energy efficient or find the space needed to include new functions in the existing city landscape. Underground spaces can play a critical role in cities, connecting spaces,

people and goods, and thereby facilitating commerce, social interaction and mobility, creating new urban tissue, which can also contribute to the liveability and character of cities.

Planning the underground space coupled with the development of legal frameworks will require planners and decision-makers to work together with new knowledge and understanding of the specific constraints and opportunities of this important space. This book occupies an important niche and significantly advances the discussion in this area.

Joan Clos

*Under-Secretary-General, United Nations
Executive Director, UN-Habitat*

Preface

Humanity is facing enormous challenges as it moves into the Anthropocene – the era where human intervention is influencing the Earth’s natural systems. We are part of a transition that requires us to seek a new balance between nature and humanity and between ourselves. It is about harmony among human beings and between humanity and nature. This transition requires us to look for new paradigms that question the past and show new ways forward. Some look to outer space for the future of humanity. We believe that in the interim before we can leave this planet in search of other worlds, we should look at what underground space has to offer.

Our fascination with underground space lies in the stark contrasts it delivers, from the raw, dark utilitarian uses of 19th-century Paris sewer systems designed by Haussmann to the modern architecture of Perrault, manipulating the soil and welding surface and underground together in poetic forms of stunning beauty that enhance the urban fabric and create loveable public spaces. It is the task of the urban planner to unveil these invisible spaces. By unveiling and making these spaces visible, they will contribute to our cities of the future. Cities that are sustainable, resilient, inclusive and, above all, liveable for their citizens. Becoming aware, understanding and appreciating the role of the subsurface is vital, as it plays a critical role in the existence and development of smart

cities. Participatory, integrated and sustainable planning and management are the means to achieve this.

With this book, we hope to contribute to a greater understanding of underground space. It comes forth from a journey of discovery that turned from fascination to real passion. According to the philosopher John Rawls, we all form our opinions and decisions while remaining behind a veil of ignorance that refuses us other views. We truly hope that this book helps in unveiling the underground space for you and to shift the veil of ignorance that covers its existence.

Han Admiraal and Antonia Cornaro

Acknowledgements

The authors would like to extend their gratitude to Joan Clos and Dominique Perrault for writing the forewords to this book. We are extremely fortunate to have found supporters in them to convey our message. Each in their unique way has shaped the urban landscape and left a legacy for years to come.

We are also grateful for the continuing support we receive from the International Tunnelling and Underground Space Association (ITA). We thank its current president Tarcisio Celestino, and its past-presidents, in particular Søren Eskesen, Martin Knights and Harvey Parker, who understood the importance of unveiling underground space to a broader audience. We also want to express our gratitude to Olivier Vion, the ITA executive director, for his support for our work and the work of the ITA Committee on Underground Space (ITACUS). Without our fellow steering board members, the members of the advisory board and, indeed, the committee members, we would not have found the inspiration to write this book. The support we receive from the International Society of City and Regional Planners (ISOCARP) has been an immense help to us in ensuring that we focus on the subject of urban planning as instrumental to creating the cities of the future. Their receptiveness of our message has been incredible. We thank Ric Stephens, ISOCARP's current president, and past vice-presidents

Shipra Narang Suri, Manfred Schenk and Piotr Lorens, who have always supported and inspired us.

Writing a book takes time, and we would like to thank our families for standing by us as we wrote. Their support was without a doubt what kept us on course.

Our employers, Amberg Engineering of Switzerland and Enprodes of the Netherlands, have given us and are continuing to give us ample opportunities to explore underground space and put into practice what we preach.

A special word of thanks goes to Prof. Dr. em. Ray Sterling. Together with John Carmody, he was most assuredly one of the pioneers who picked up the topic in the 1970s and attempted to revive underground urbanism. Ray inspired us in many ways and was always a staunch supporter, both as a member of the ITACUS Steering Board and as a past-president of the Associated Research Centers for Urban Underground Space (ACUUS).

Last but not least, our sincere gratitude and appreciation go to the Institution of Civil

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Engineers and ICE Publishing. They had the foresight to ask us to chair a conference that led to our former editor Amber Thomas asking us to write this book. Also, a special word of thanks to our current editor Inês Pinheiro, who was professional and refreshing to deal with in our monthly online book progress meetings and supported us throughout the writing process.

With this book, we aim to provide the context

and impetus to make underground space part of urban planning and urban development. As such, we feel it's about unveiling opportunities to a broad audience – an audience that will help to create the cities of the future. Cities that this world so desperately needs.

Start to 'think deep' and unveil all those underground spaces that will further shape and enhance the cities we need.

About the authors

Han Admiraal

Han, a civil engineer (University of Applied Science, Rotterdam), is co-chair of the International Tunnelling and Underground Space Association's Committee on Underground Space (ITACUS) and a member of the Urban Planning Advisory Group of the United Nations Office for Disaster Risk Reduction (UNISDR), advising the special representative. As president of the Dutch-Flemish Pipeline Industry Guild, he promotes underground freight transport as a sustainable and economically efficient mode.

Over the course of his career, Han has worked for the National Department of Public Works and Water Management, acting, among other positions, as the project manager for the first machine-excavated (TBM-driven) tunnel in soft soil in the Netherlands. Later, as the executive director of the Netherlands Centre for Underground Construction (COB) he implemented visionary concepts on underground construction, and was part-time professor of underground space at Zeeland University of Applied Science. Since 2008 he has been the owner and managing director of Enprodes Management Consultancy in Delft, consulting in the fields of underground space and road tunnel safety.

He is passionate about urban planning and interdisciplinary dialogue between various stakeholders and professional disciplines dealing with urban and underground development. Having published numerous articles on this topic, this is his first book.

Antonia Cornaro

Antonia studied at New York University, where she earned her MA in Urban Planning in 1996.

She has over 20 years' experience of working as an urban and transport planner from the public and private sector in New York City, London, Vienna and Zurich, having worked for DCP in New York, Parsons Brinckerhoff (PB now WSP) in London, the Austrian Institute of Regional Planning (ÖIR) in Vienna, and the Zurich-based multi-disciplinary engineering consulting firm EBP.

In her current work as the business development manager for Amberg Engineering – an internationally active Swiss firm specialising in underground infrastructure design and management – she focuses on urban underground space with the aim of increasing the mobility, liveability and resilience of urban areas (from 2010 to date). This focus is also central to her work as co-chair of ITACUS.

Antonia is passionate about cities and global and sustainable development, and has presented and published extensively on this subject, often jointly with Han Admiraal. This is her first book.