



សិក្ខាសាលា ស្តីអំពី

បច្ចេកវិទ្យានៃការធ្វើទុយណែល និងសំណង់ក្រោមដី

Tunnelling and Underground Space Technology

14 December 2011

Venue:

**Himawari Hotel
Phnom Penh, Cambodia**

Organized by:

Norton University (NU), Cambodia

Supported by:

***ITACET Foundation for Education and Training on Tunnelling and
Underground Space Use***



SYNOPSIS

Why Go Underground? by Mr. Olivier Vion – Session 1

For hundreds of thousands of years, our natural domain has been a principally two-dimensional space: the surface of the ground.

In this field, as in the others, nature provides many challenges and we must doggedly gather our experiences, draw lessons from failures, improve techniques and use all our resources of inventiveness before succeeding.

Underground works have always been difficult but this did not prevent their use at a very early stage of human development, as proved by the discovery of underground excavations that are among the first records of human activity.

However, the most rapid increase in the use of underground works only appeared in the 19th and particularly the 20th centuries, thanks to the impetus of economic development.

During these periods, there was a dramatic increase in underground space use, in mining, in the field of transportation with the development of roads, waterways, and railways, and in the field of hydroelectric facilities.

Nowadays and specifically in urban areas, climate change and massive urbanization are the main purposes to go underground.

ITA is trying to contribute together with UN bodies such as UN Habitat and UN ISDR to find solutions to these major topics by using underground space in a better way.

Principles for choice of a Tunnelling Method by Dr. Harald WAGNER – Session 1

Choosing a tunnelling method is more than just ordering a machine or producing drawings to visualize a structure which later should become a tunnel. The tunnel designer is at the same time a manager of the tunnel construction itself, as his choice of design is a management tool in construction. While keeping this in mind, this lecture on the choice of tunnel design and management by design intends to summarize the state of the art for both conventional and mechanized tunnelling. A detailed brief description will be given in regard to design stages, contractual applications, and construction organization.



Conventional Tunnelling Methods by Professor In-Mo Lee – Session 2

Fundamental concept of conventional tunnelling is addressed first. Arching effect will be taught. Concept of convex arch and inverted arch will be addressed. Some case studies will be introduced. More specifically, failures due to change from convex arch to inverted arch are introduced. Then, definition of conventional tunnelling is addressed by taking the convex arch concept into account. Secondly, analysis scheme will be briefly taught as follows: elastic analysis, elasto-plastic analysis, and numerical approach. Based on those methods mentioned above, the so-called “Convergence confinement method, CCM” will be addressed. Then, stability assessment in soft ground will be addressed based on the assumption of inverted arch. The tunnel stability methodology will be addressed which is also based on the concept of inverted arch.

Mechanized Tunnelling Methods by Mr. Felix AMBERG – Session 2

Mechanized Tunnelling has become more and more important in the past years. The paper will present the principals of mechanized tunneling, explain the different types of machines which are used for the different ground conditions as well as briefly describe the used lining types and their characteristics. Some representative case studies will show how mechanized tunneling has been successfully applied for challenging underground infrastructure projects.

Principles for Design by Dr. Harald WAGNER – Session 3

Tunnel Design activities could be carried out by the clients engineering team, by the consultants design offices, or by the construction contractors design team, where the consultant is representing the client being usually responsible for design in all phases of a conventional tunnel project. Sometimes different design companies are appointing designers at different stages of the project.

Ground Recognition by Mr. Felix AMBERG – Session 3

Ground recognition is of paramount importance for the design and construction of any underground infrastructure. Many of the cost and time overruns in the realization of such infrastructures go back to insufficiently carried out ground investigations. However there is a proven state of the art for such work which forms also an essential part of the risk management. The paper will describe the aims, the extend and methods of ground recognition work in the different phases of the planning and construction of underground infrastructures and also show in some case studies how they were applied for specific projects.



Ground Improvement by Mr. Piergiorgio GRASSO - Session 4

Nowadays, tunnelling has been a rapidly evolving technology; focusing mainly on long and deep tunnels in mountain areas and complex subway systems in urban regions. Faced up with the difficult ground conditions which are unavoidable contexts of almost all tunnelling projects, the conventional and the mechanized tunnelling need for application of different types of ground improvement mainly for the purposes of crossing “geo” problems which are not suitable for conventional and TBM tunnelling; controlling settlement in urban area and to protect delicate surface buildings and infrastructures; guarantying stability of the excavation face; maintaining the natural water table in loose ground to reduce the settlement due to water table fluctuation and etc. Following introduction for general features and the different types of ground improvement techniques, the geo-problems requiring ground improvement and their practical solutions are in turn presented for both conventional and TBM applications. Some real tunnelling case histories associated with suitable ground improvement are also provided.



PROFILE OF SPEAKERS

Prof. Dr. In-Mo Lee



Dr. In-Mo Lee received his B.S. degree (with honors) in Civil Engineering from Seoul National University, M.S. and Ph.D. degrees in Geotechnical Engineering from Ohio State University. He has been a professor of Civil, Environmental, and Architectural Engineering at Korea University since 1988. Dr. Lee's main research area is tunnelling and underground structure-related Geomechanics. He has published more than 300 papers in international and domestic journals as well as in conference proceedings. He has also delivered numerous keynote, invited, special, and theme lectures worldwide. Dr. Lee is currently the director of Institute of Underground Space Technology at Korea University. He served as the president of Korean Tunnelling and Underground Space Association from May, 2006 to April, 2008 and is currently the president of International Tunnelling and Underground Space Association (ITA).

Mr. Olivier Vion



Olivier Vion is the Executive Director of the International Tunnelling and Underground Space Association since January 2009. He was before in charge of the communication of the Association (NGO in charge of development of use of underground space and share of knowledge in tunnelling techniques). Previously he has been in charge by Lafarge Group of special cements for underground works (Channel Tunnel, HSL Tunnels), then Deputy sales manager by DTP Terrassement (Bouygues Subsidiary). In 1994, he started his own company of consultancy in marketing in underground works sector worldwide. He is a chartered civil engineer, specialized as structural engineer and former auditor of College for High study in Sustainable Development.

Dr. Harald WAGNER



Civil Engineer, M.Sc., Ph.D. (Dr.Techn.Science, Suma cum Laude), Licensed Masterbuilder, Government, Counsellor, appointed by President of Austrian Republic, Chartered Expert at Court, Consultant to the World Bank. An international well-recognized Consultant for Underground Infrastructures with more than 40 years of Professional Experience in Tunnel Design, Construction and Consultancy. Consultant to the World Bank for more than 15 years. A former Assistant Professor at Technical University Graz in Austria on Soil Mechanics & Foundation Engineering for Architects, a Vice President of ITA (International Tunnelling and Underground Space Association). An Expert Member of ITA's Executive Council, who has worked throughout his career as a designer and consultant in more 35 countries around the world.



Mr. Felix AMBERG



Mr. Felix AMBERG graduated from the ‘Swiss Federal Institute of Technology’ in civil engineering in 1981. After some years working as site manager for different tunnel construction sites he joined the Amberg Group (established 1965) of which he became President in 1995. The Amberg Group consists of Amberg Engineering Ltd, a consultancy specialized in underground infrastructures, Amberg Technologies Ltd, a manufacturer of monitoring and measurement devices for underground structures and Hagerbach Test Gallery Ltd, an underground research, testing and training facility. F Amberg is treasurer of ITA and tutor of ITA Working Group 12 on Sprayed Concrete, was former Chairman of ITA COSUF and Vice Animateur of WG 12 ‘Mechanized Tunnelling’. He also was President of the ‘Swiss Tunnelling Society’.

Mr. Piergiorgio GRASSO



Mr. Piergiorgio GRASSO graduated from the “Politecnico di Torino” of Italy in civil engineering, He began his engineering career in 1975; and he is the founder, President and Principal Engineer of Geodata since 1984, which is a consultancy specialised in the design and management of underground works, both in urban environments and in mountain areas. He was part of the ITA Executive Council member and he was the ITA past Vice President. He also served the ITA Working Group 17 on “**Long and Deep Tunnels**” as its animateur and tutor. Mr. Grasso is currently the vice-president of ITACET Foundation and is one of ITA expert.



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Tunnelling and Underground Space Technology
Himawari Hotel, Phnom Penh, CAMBODIA
14 December, 2011

Morning session

7:30- 8:30 a.m.	Registration	
8:30-8:40 a.m.	Master of Ceremony	Dr. Lim Suktay/ Dr. Domingo S Aranal
8:40-8:55 a.m.	Speech by the President of ITA	Prof. Dr. In-Mo Lee
8:55-9:10 a.m.	Welcome speech and opening ceremony by Rector of NU	Prof. Chan Sok Khieng
9:10-9:40 a.m.	Why Go Underground?	Mr. Olivier VION

9:40-10:05 a.m. Photo session and coffee break

Lecture session

Moderator: Mr. Piergiorgio GRASSO

10:05-10:50 ~ ~ ~	Principles for choice of a Tunnelling Method	Dr. Harald WAGNER
10:50-11:35 ~ ~ ~	Conventional Tunnelling Methods	Prof. Dr. In-Mo LEE
11:35-12:20 ~ ~ ~	Mechanized Tunnelling Methods	Mr. Felix AMBERG

12:20-1:50 p.m. Lunch and Networking, Himawari Hotel

Afternoon session

Moderator: Prof. Dr. In-Mo LEE

1:50-2:35 p.m.	Principles for Design	Dr. Harald WAGNER
2:35-3:20 p.m.	Ground Recognition	Mr. Felix AMBERG

3:20-3:45 p.m. Coffee break

3:45-4:30 p.m.	Ground Improvement	Mr. Piergiorgio GRASSO
4:30-4:45 p.m.	Q & A Session / Discussion	
4:45-5:10 p.m.	Award of Acknowledgement letters and official closing of ceremony	Prof. Chan Sok Khieng