

Eastern promise

Professor In-Mo Lee, recently voted president of the International Tunnelling Association (ITA-AITES), talks to George Demetri about his hopes and aspirations

Outline your educational achievements and your career to date?

I received my BS degree with honours in civil engineering from Seoul National University, Korea, and both MS and PhD degrees in geotechnical engineering from Ohio State University, US. Having completed this formal education, I worked as a civil engineer officer in the Korean Airforce for four years.

I started my academic career at the Korea Advanced Institute of Science & Technology, where I stayed for two years as an assistant professor before joining the Department of Civil, Environmental and Architectural Engineering at Korea University, where I have been a professor since 1988.

Outside the university, from 2004-09, I served as director of the Underground Space Construction Technology Centre, funded by the Korean Ministry of Land, Transport and Maritime Affairs, and as president of the Korean Tunnelling Association from May 2006 to April 2008.

“Tunnelling engineers are the creators of the new and sustainable world we all seek”

I am currently a full member of the National Academy of Engineering of Korea, director of the Institute of Underground Space Technology at Korea University, and president of the International Tunnelling and Underground Space Association (ITA).

Name some notable tunnelling projects that you have worked on and the lessons you have learned from them

As a professor in the field of geotechnical engineering at one of the top universities in Korea, I have carried out numerous research projects, as well as consulting works, pertinent to the geomechanics of tunnelling and underground structures.

In particular, seepage force consideration in tunnelling; face stability; the prediction of ground conditions ahead of the tunnel face; blast-induced damage; non-destructive



testing in tunnelling; grouting technology; and geotechnical parameter estimation.

From the findings obtained from the research, I have published more than 300 papers in international and domestic journals, as well as in conference proceedings. I have also delivered numerous keynote, invited, special and theme lectures worldwide.

Many of my research projects have been derived from numerous tunnelling projects in Korea, including urban tunnelling for metro

lines, electric lines, telecommunications lines, and mountain tunnels for highways as well as railways. It is difficult for me to choose the most interesting and challenging projects among these. But, if I must, I would choose – on the basis of the steady public interest in the project, as well as the engineering challenges involved – the urban, underwater tunnels crossing the Hahn River in Seoul, which divides the city into northern and southern areas.

You were recently elected as ITA president. What motivated you to run for president and what are your top three objectives over the next three years?

Since the ITA was founded in 1974, most ITA activities have taken place in European member nations. Nowadays, however, with economic growth and land development, more tunnel projects are located in Asia and/or South America.

With this geographic shift in tunnelling activity, it is inevitable for the ITA to widen its horizon by recognising and inviting those countries that are not yet part of it, and I wanted to actively participate in that process. Thus I ran for ITA president. The top three objectives I have over the next three years are as follows:

- **Growth of ITA**

As mentioned previously, I would like to see more countries be part of ITA. To achieve this goal, I will promote the 58 current member nations, led by the ITA-CET committee on education and training, to engage in more proactive efforts to help nations that need to train young tunnelling engineers in order to advance their tunnelling technology.

- **Promoting greater public/government support for tunnelling engineers**

I believe that more successful underground works can be delivered when the public and government recognise that tunnelling engineers are the creators of the new and sustainable world we all seek. Thus I will work closely with the Committee on Underground Space (ITACUS) to convey this message to each member nation.

- **Increasing the presence of ITA among similar academic societies**

The main difference between the ITA and other professional bodies, such as the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), and the International Society for Rock Mechanics (ISRM), is that the ITA tries to develop technology that can be directly applied to industry. I will try my best so that the ITA can be more industry-oriented. For this purpose, a new committee – ITA TECH – will soon be established and will form a platform where industry issues are discussed, opinions formed and conclusions transferred to market practice.

How is the ITA working to ease the skills shortage in the short term?

The ITA has 13 working groups and three committees to examine all kinds of technical problems that need to be solved. The skills shortage caused by the recent boom in the industry will be resolved as more qualified engineers enter the industry over the long term. To facilitate this process in the short term we

will allocate more resources to ITA working groups to provide support for the resolution of technical problems.

How can we best promote tunnelling, both as a career and to the wider world?

As I have mentioned in my responses above, the most important step is to gain the support of the public and/or decision makers. The ITA is willing to help each member nation in this aspect.

The ITA Committee on Underground Space (ITACUS) was set up to address the issue of underground space usage worldwide and to raise awareness, both of the actual use and need to develop a vision that will facilitate the use of underground space in the future.

“There is still a great need to develop ways to control risk during construction”

In which areas of tunnelling practice, design or construction do you feel there needs to be more research?

In recent decades there have been significant advancements in tunnelling technology. However, not all of the risks associated with tunnelling have been resolved. Personally, I strongly feel that there is still a great need to develop ways to control risk during construction.

‘Guidelines for tunnelling risk management’ was prepared by ITA working group No.2 and published in 2004 in the *TUST (Tunnelling and Underground Space Technology) Journal* in order to indicate to all parties involved in the project the way to prepare and implement a comprehensive tunnel risk-management system.

However, this guideline requires subjective input that may vary from one person to another; further research on how this technique can be applied objectively to a broad spectrum of tunnelling projects worldwide will result in a more reliable tool to reduce the risks in tunnelling and underground construction projects.

Does Asia have the skills to implement its increasing tunnel-construction requirements or will it be reliant on Western expertise for the foreseeable future?

It depends on the countries involved. I believe countries such as Korea, Japan, Singapore and China, which have seen a boom in tunnelling projects over the past few decades, have acquired self-sufficiency in tunnelling technology. On the other hand, those in which the tunnelling business is in its incipient phase may need to rely on Western expertise for the next decade or so.

Are there any lessons that Korea can teach the global tunnelling fraternity?

In Korea there have been abundant underground construction projects using conventional tunnelling methods. Although mechanised tunnelling is a great technology, Korean engineers and contractors feel that the conventional method was more readily applicable, and economical, to many projects they have delivered. Hence it is safe to say that conventional and mechanised tunnelling methods will co-exist as a complement to each other.

Korea also has much up-to-date experience in tunnelling work through intermediate geo-materials (IGM). These are in between soils and rocks known to have widely varying mechanical properties, dependant on the parent rock types and weathering conditions. These are very common in Korea, and include residual granite soils and/or weathered granite rocks.

Moreover, Korea is one of the forerunners in using underground space for eco-friendly transport systems. On the Korean peninsula, two major projects are being planned:

- the ‘U-Smartway’ project, designed to ease traffic congestion in Seoul’s metropolitan area by building a 148.7km-long network of underground motorways at depths of 40-50m; and
 - the GTX (Great Train eXpress) project to connect Seoul metropolitan city with its satellite towns via a 145.5km-long, deep, underground express railway that will facilitate travelling speeds of around 200km/h.
- These two ambitious projects might be good examples of utilising underground space for sustainable development.

Where in tunnelling do you feel that most innovation is required – in technology or in the way projects are delivered?

As long tunnels are being designed and constructed more frequently, I feel that the development of better technology to protect tunnels from fire and other catastrophic events requires the most innovation. Another area might be the technology to construct undersea tunnels as, for example, when these connect two nearby islands/continents they can provide an economic means of transport compared to conventional methods by sea or air.

What, in your mind, has been the greatest innovation recently in the tunnelling sector?

I think mechanised tunnelling technology utilising large-diameter, tunnel-boring machines is the greatest innovation in the sector. In fact, its availability has caused great progress in tunnelling practice, making possible projects that were once deemed impossible.