

Activities of ITA WG14 Mechanized Tunnelling

Koichi Ono¹

¹ ITA First Vice President and Tutor of the WG14, Professor Emeritus of Kyoto University, President of Maizuru National College of Technology, Japan

Forward

Demand for better human life is being accelerated by various demands for improved traffic particularly in urban area followed by rapid increase and concentration of world population. This demand is encouraging an extend development of subsurface area by tunnel and underground space use in the world. Subway construction is still under way in many cities and many more is under planning. Shifting already existing structures at the ground into the underground such as Boston Central Archery and Stuttgart 21 project is an aggressive challenge. These projects to retrofit the ground surface for a better use by utilizing the underground use are expected to advance more aggressively in many areas. Big projects in the future such as strait crossing in Gibraltar, Bering, Tatar and Japan-Korea are not far beyond a reach. Mechanized tunneling technology will play a big role to perform such projects. Further development of mechanized tunneling technology is sincerely expected.

1. ITA

International Tunnelling Association(ITA) was founded in 1974 as Non-Profit Organization. ITA consists of 53 Member Nations, 9 other nations represented by affiliate members, 123 Corporate affiliate members and 147 Individual affiliate members at the end of 2005.

The aims of ITA are to encourage the use of the subsurface for the benefit of social, environment and sustainable development especially by increasing the awareness of public and of the decision-makers and to promote advances in planning, design, construction, maintenance and safety of tunnels and underground space by managing and minimizing risk and assuring safety and security in all tunnelling activities.

About 300,000 euros of ITA office expenses a year is covered by the annual member fees from the member nations, affiliate members, supporters and prime sponsors. Each prime sponsor pays 15,000 euros a year for 5 years and gets a lot of benefits having their logo in the front page of ITA Website which is directly connected to their home pages. ITA has now 6 prime sponsors. They are LOVAT, Herrenknecht, Sika, Hochtief, Bilfinger Berger and Shield Tunneling Association of Japan(STAJ).

However, most of the ITA activities are conducted by voluntary bases of the members. The values are estimated as 15 millions euros a year.

ITA WG

Activities of ITA working groups are very important and very valuable. Up dated and important topics relevant to the development of tunnel and underground space are discussed in each working group by the various specialists. All the ITA members are welcome to participate to any of the working groups. Table 1 shows the active working groups at present.

Table 1 ITA Working Group

WG 2 - RESEARCH
WG 3 - CONTRACTUAL PRACTICES
WG 5 - HEALTH AND SAFETY IN WORKS
WG 6 - MAINTENANCE AND REPAIR
WG 11 - IMMersed AND FLOATING TUNNELS
WG 12 - SHOTCRETE USE
WG 14 - MECHANIZED TUNNELLING
WG 15 - UNDERGROUND AND ENVIRONMENT
WG 16 - QUALITY
WG 17 - LONG TUNNELS AT GREAT DEPTH
WG 18 - TRAINING
WG 19 - CONVENTIONAL TUNNELLING
WG 20 - URBAN PROBLEMS, UNDERGROUND SOLUTIONS

WG in the past

WG 1 – STANDARDIZATION
WG 4 - SUBSURFACE PLANNING
WG 7 - GENERAL APPROACHES TO DESIGN
WG 8 - CATALOG OF TUNNELS
WG 9 - SEISMIC EFFECTS
WG 10 - COSTS-BENEFITS OF UNDERGROUND URBAN PUBLIC TRANSPORTATION
WG 13 - DIRECT AND INDIRECT ADVANTAGES OF UNDERGROUND STRUCTURES

ITA Executive Council

Most of the important decisions are discussed and decided at the ITA General Assembly which is held every year by the participation of the Member Nation Representatives.

Most of the preparatory works for the ITA General Assembly are discussed in the ITA Executive Council Meeting which is held 4 times a year at various places in the world.

The Executive Council Members are also in charge of various ITA activities such as proposal and action of ITA strategy, editing ITA publication, tutor for ITA Working group, lecturing at various seminars, symposium, conferences and training course sponsored by ITA. Present Executive Council consists of 16 members. All the activities done by the Executive Council Members are also on the voluntary bases.

Information from ITA

Various information regarding tunnel and underground can be obtained through ita@news and ITA Website. Most of them are free of charge including the articles such as TRIBUNE and TUST (Tunnelling and Underground Space Technology).

Send your @mail address to secretariat@ita-aites.org to receive ita@news regularly.

ITA Website can be reached by <http://www.ita-aites.org>.

News from the Association, News from Sister Associations, Activities of the Working Groups, News from the Member Nations News from the ITA World Tunnel Congresses, Forthcoming events, Publications and News from the Executive Council Members are distributed. According to the recent visitor statistics, ITA Website was hit about 4 million times and visited 180,000 times a year.

ITA Open Session is held every year during the ITA World Tunnel Congress (WTC) and a special topic is discussed. Table 2 is the topics discussed up to the year of 2005.

ITA members have the rights to participate in the general assemblies, conferences, working groups, symposia, workshops etc and to use the reference “ITA Member”.

ITA also provides various technical services such as Glossary, Training, Public Private Partnership, Risk Management, Risk Financing, Security, ITA Master Course, Training for Young Professionals, Training Material from the Working Groups and Regional Workshops

Table 2 ITA Open Session

1977 : Safety in service
1978 : To go underground : Right or wrong?
1979 : Member Nation addresses during RETC
1980 : Safe practices in tunnelling
1981 : Use of subsurface in developing countries
1982 : The subsurface : contributions to energy savings
1983 : Urban Contracting and the environment
1984 : Seismic effects on underground works
1985 : Underground Works in Urban Areas
1986 : Approaching the XXI st century. Expectations and perspectives
1987 : Subsurface developments in the urban community
1988 : Minitunnels
1989 : Future of mechanised tunnelling
1990 : Management of underground works
1991 : Utility tunnels
1992 : Towards new worlds in tunnelling
1993 : At or below ground level
1994 : Straits of Gibraltar
1995 : Mechanisation of excavation - New technologies and financial aspects
1996 : Tunnelling and underground space : their contributions to sustainable urban development
1997 : Choice of tunnelling methods
1998 : Contribution of small sized tunnels to the development of metropolises
1999 : Past, present and future of tunnelling
2000 : Mining and tunnelling : shaft construction
2001 : Project financing
2002 : Fire & Life safety
2003 : Immersed Tunnels
2004 : Underground Space for Sustainable Urban Development
2005 : Underground Space Use – Analysis of the Past and Lessons for the Future

2. Activities of WG 14 Mechanized Tunnelling

WG14 - Mechanized Tunnelling is very important working group particularly for practical construction of tunnel and underground space.

Current active members in WG14 are from 17 member nations. K. Fukumoto from Obayashi Corporation and F. Amberg from AMBERG Engineering are taking a role of the preset Animatuer and Vice Animatuer.

20 WG members from 13 member nations, namely Australia, China, Canada, France, Germany, Indonesia, Japan, Korea, Netherlands, Norway, Sweden, Singapore, and Switzerland participated to WG14 during WTC 2004 in Singapore and 17 members. During the WTC 2005 in Istanbul, 17 members participated from 9 member nations, namely Canada, Germany, Italy, Japan, Netherlands, Norway, Spain, Switzerland, and U.S.A.

Past publications

WG 14 published the followings in the past:

“Recommendations and Guidelines for Tunnel Boring Machines (TBMs)”

(Book was published in 2000)

“The Future of Mechanized Tunneling”

(Tunnelling and Underground Space Technology, Vol. 6, Nr. 2, pp.167-189, in 1991)

“Glossary of terms for Tunneling”

(Advances in Tunnelling Technology and Subsurface Use, Vol. 1,Nr. 2, pp.139 in 1981)

Current works

WG14 has been working on “Classifications and definition of TBM with recommended key words”and it is posted in ITA website.

“TBM Glossary” in the English-French-German-Japanese-Chinese-Italian version is posted on the ITA website. It will be extended to Spanish and Korean in the near future.

The glossary is expected to use effectively for better understanding of tunnel technology.

“Reference book” of Recommendations and Guidelines for Mechanized Tunneling in ITA member nations will be prepared.

Following Recommendations and Guidelines for Mechanized Tunneling are given:

Australia : Code of Practice - tunnels under construction (Draft)

France : Specification and Guidelines for the use of specialist products for Mechanized Tunneling in Soft Ground and Hard Rock

Germany : Recommendations for selecting and evaluating tunnel boring machines
Recommendations for Design and Operation of Shield Machines

Japan : Japanese Standard for Shield Tunneling

The title, table of contents and the place to order of these references will be posted on the ITA Website.

WG14 Next Tasks

During the WG14 meeting in Singapore in 2004 and Istanbul in 2005, the WG members discussed on future targets of WG14 and agreed to make a list of “Remarkable mechanized tunneling projects” and to establish “Mission of WG-14”

List of Remarkable Mechanized Tunnel Projects

Since performances and lessons learned from past remarkable projects give very useful information to the relevant future projects, WG14 decided to collect such information from the owners, contractors, consultants and machine manufacturers in all over the world. For this task, three subgroups and the leader are formed.

Ulrich Maidl from Germany is in charge of Europe, Brian Felcher from USA in charge of North and South America and Katsuji Fukumoto from Japan in charge of Asia.

The list of the collection is expected to complete and to complete by December 2005.

Mission of WG 14

WG 14 decided to establish a fruitful future target of Mechanized Tunnelling in the range of 10 to 20 years. It will include construction of underground structures beneficial to human life and development of technology required for rational construction.

In order to achieve Mission of WG 14, ITA WG Vision 2020 has been proposed.

ITA WG 14 Vision 2020 (compiled by F. Amberg)

1. INTRODUCTION

At the ITA Congress 2005 in Istanbul it was agreed that a special group within the WG 14 would work on the vision and mission of this WG for the next couple of years. Members of this team are:

Europe:	Felix Amberg (Switzerland) Martin Herrenknecht (Germany)
North and South America:	Rick Lovat (Canada)
Asia:	Katsuji Fukumoto (Japan)

The following paper describes briefly these aspects, proposes next steps to do, the corresponding responsibilities and the actual situation after the 1st revision carried out by K. Fukumoto und F. Amberg at the AFTES Congress in Chambéry.

2. VISION FOR THE WG 14

According to the continuously increasing importance of mechanized tunneling within the domain of the construction of underground structures the vision for the WG 14 should be:

To become and to be recognized as the leading Working Group dealing with mechanized tunneling thus reflecting the importance of mechanized tunneling.

To be the leading WG means:

- to be an active WG
- attract WG members who are among the leading experts in mechanized tunneling and who are willing to contribute to the work of WG 14
- define the mission of the WG in a way that reflects this vision
- to work on issues defined in the mission on a top class level and to deliver corresponding results
- through these activities gain acknowledgment and reputation inside and outside ITA

3. SLOGAN FOR WG 14

Amberg, Fukumoto and Lovat propose the following slogan for WG 14:

Mechanized tunnelling opens new ways to the future

This slogan was approved.

4. MISSION FOR THE WG 14

The mission of the WG 14 should reflect its vision. It may consist of various activities:

4.1. Current Capabilities

Demonstrate the capabilities and wide range of application of mechanized tunnelling through major key projects

- Status 2005 in mechanized tunnelling
 - on leaflets (max 2 pages/projects)
 - key projects with addresses of clients, consultants, contractors, suppliers
 - constitution of subgroup 1 with the following duties:

This should increase the awareness of current technologies/projects

K. Fukumoto has developed a format which was revised and approved. The format will be handed out to WG members to be filled out.

Form (on paper, CD ITA website etc) and use of these leaflets are to be defined

4.2. Level to be achieved

The WG should define the level which should be achieved when deliver papers, information etc for the WG 14 in order to ensure a good to high quality level of the work of the WG 14.

- lay out of definition of the technical level which must be achieved

This task has been postponed to a later stage.

4.3. Client's Needs

In the end only clients do order tunnels. It is crucial to know more about the tunnel concepts clients may ask for in the future

- what concepts do clients ask for?

Collection of information on project criteria, which might be:

- multifunctional tunnels (rail and road traffic combined)
- city under the city (tunnels of various sizes)
- integration of stations into the tunnels (metros)
- tunnel diversions and convergences integrated in mechanized excavation
- single shell lining, fire resistant, safe during operation
- economical and safe construction without surprises in costs and schedules
- risk management and insurances

Define the activities of the WG and the results (and their forms)

This task has been postponed to a later stage.

4.4. Contractor's Needs

Contractors do construct the tunnels. They certainly also have needs which should be reflected in the activities of the WG 14

- what concepts do contractor ask for?

Collection of information on technical criteria

- high safety during construction (fire, accidents etc) = no casualties
- machines with little manpower underground
- automation of tunnelling process
- probing ahead during ground excavation
- monitoring and controlled boring process (settlement control, automatic guidance system etc)
- logistics and handling of materials (conveyor belts, segments), finished tunnel 400 – 500 m behind 'TBM'
- extend the extruded length/range for pipe jacking
- benefits of mechanized tunnelling against conventional (other) methods (promotion)
- training course, promotion activities for young engineers and workers

Define the activities of the WG and the results (and their forms)

This task has been postponed to a later stage.

5. FURTHER ACTIVITIES

To the above mentioned activities the following points should be discussed:

- The produced leaflets should be spread in various forms, which are to be defined.
- A 'training/education' kit should be put together about modern mechanized tunnelling, which is targeted to interested clients and decision makers in order to give them confidence into mechanized tunnelling. The kit should contain: Seminar programs which can be ordered at the ITA, PPP on the work of WG 14, leaflets on the state of the art etc). Content is to be defined.

6. NEXT STEPS

The next steps to do are proposed as follows:

What	Where	When	Who	Status
Discuss this paper and finalization	Chambéry	October 2005	F Amberg	Finalized
Approval of Animateur of WG 14		November 2005	F. Amberg K Fukumoto	Finalized
Start with activities as described in draft paper of November 2005		November 2005	F Amberg K Fukumoto	