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## "THE SAGA OF THE WG4 - SUBSURFACE PLANNING" BY ANNICA NORDMARK

**Beginning**

It all began with the birth of the International Tunnelling Association in Oslo in April 1974, when the subject 'planning the use of the subsurface' was recognized as one of several important topics for ITA for the future. When, in 2002, Working Group No.4 closed its activities, it must be emphasized that this topic is by no means less important than before. However, with the merge with Working Group No. 13, these topics are now dealt with in Working Group No. 20 "Urban problems – Underground Solutions".

With a life-time as long as 27 years, the work of the members of Working Group No. 4 has been very important for the development of ITA. A very large number of valuable technical papers presenting solutions underground were submitted by its members throughout the years. Most of these were also published in the journals "Advances in Tunnelling Technology and Subsurface Use" later re-named "Tunnelling and Underground Space Technology" (TUST) as well as summaries in TRIBUNE, all widely spread in many nations. As for the international Working Group Reports for ITA, these have been recognized in the following.

**1974 -1975**

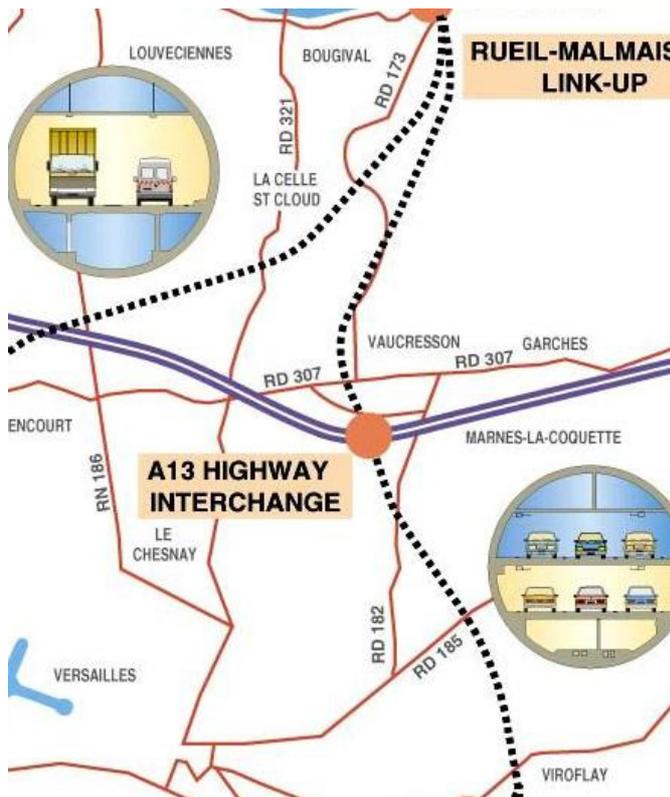
The overall objective of the group has been to prepare, discuss and publish papers that show the effective use of the subsurface and advance the art and science of underground design and construction. For specific topics, deemed of particular interest, international reports were also compiled (see further below).

In the Minutes from Munich 1975, we read that subsurface planning "is a large and complex subject, relevant to numerous specialities and for which no international organisation-work was made before". It was further recognized that existing local regulations paid no or very little attention to underground constructions and that the lack of information and exchange of information on an international level was very much lacking.

Consequently, the Working Group on Underground Planning "saw the light" in Munich and Birger Jansson (Sweden) was elected the Animateur.

The first nations to become active members in the group were: Australia, Belgium, Finland, France, Japan, Netherlands, Norway, Sweden, United Kingdom and USA and the first objective of the group would be to assemble data on studies already completed.

In the following, it has been the ambition to recall the main discussions and the development of the group as well as to acknowledge individual contributions (with the name of the individual or the member nation).

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**1976**

During ITA's meeting in London in 1976, a major lecture on Subsurface Planning was given by the Animateur, B. Jansson (Minutes 1976). The lecture, which was based on a report by the Swedish Council for Building research also served as a 'backbone' to the future work of the group.

**1977-1978**

In the meeting in 1977 in Stockholm, two tasks were deemed of particular interest namely, to work out a categorization and classification system for information on underground human occupancy and planning guidelines. These topics also became part of the ITA Open Session in Tokyo in 1978. During the meeting in Tokyo, the group confirmed the main subjects to be procedures and regulations, human habitation, evaluation methods, social goals and information transfer. Member contributions during the group meetings in Tokyo were:

- "Building Underground for People – 11 selected projects in the United States" (M. Barker, USA)
- "Work in the Fields of Public Transport, Roads and Urban Motorways" (van Hove, Netherlands)
- "Safety, Disaster Prevention and Earth-quake Proofing, Problems of Underground Area" (Suganara, Japan)

Working Groups**1979**

In Atlanta in 1979, a report on administration policy for underground use of public land was presented by Mr Kato, Japan. A new Animateur was elected in Michael Barker (USA) and a new subject for the group was given high priority: Energy savings in underground installations.

Working Groups**1980**

The next meeting in 1980 in Brussels was devoted, as planned, to a number of national presentations by group members (unfortunately, these were not specified in the Minutes from 1980) with the intention to function as a basis for exchange of information among member nations. C.J. Pronk (Netherlands) was elected vice-Animateur.

Working Groups**1981**

In 1981 in Nice, the following papers were presented:

- "Planning and Use of the Subsurface in the United Kingdom" (D. Brook, U.K.)
- "Metro and Regional Subsurface Transit Systems of Paris, Marseille, Lyon and Lille" (J-P Godard, France)
- "Urban Subsurface Use in Japan" (H. Maeda, I. Kitamura, Japan)
- "Sports Halls and Swimming Pools in Rock in the Oslo Region" (van Rygh, Norway)
- "Examples of Subsurface Use: Draft of the Contents and the Structure of a Compilation" (F. Blennemann, Germany FRG)
- "Subsurface Storage of Foodstuffs" (B. Jansson, Sweden)
- "Five Earth-sheltered Buildings in the United States" (M. Barker, USA)

The group decided that forthcoming contributions should aim to include the following factors: social – economic – political – environmental – energy related – land-use – design – technology – administration and future decisions. Although this may have seemed a very ambitious programme, the intention of the group was always to contribute as much as possible to the evolution of ITA.

**1982**

Following the programme set up in the group, the 1982 meetings in Brighton enjoyed the following contributions:

- "Cost/benefit analysis of Underground Public Transport" in which new ways of weighing

subsurface solutions against other possibilities were surveyed (J-P Godard, France)

- "The use of the underground in complex urban systems outlining the situation at that time and future outlook in Japan with Osaka City as an example (A. Namiki, K. Shiotani, Japan)

- "Inventory of the future use of the subsurface in the Netherlands" (C.J. Pronk, NL)

- "The use of underground caverns for storage and disposal" – a worldwide state-of-the-art review to identify the factors leading to the choice of subsurface for such use in the United Kingdom (D. Brook, U.K.)

- "The use of the subsurface in smaller cities" - an evaluation of experiences in building underground transportation systems focussing on Munich as an example (F. Blenneman, Germany)

- "The Baghdad Metro" - a brief description of the plans for the first phase of the system (J.M. Alsaadi, Iraq)

- "Imaginative future uses of the subsurface throughout the world" (B. Jansson, Sweden).

**Working Groups**

**1983**

During the 1983 meeting in Warsaw, the group followed its previous decision to focus the presentations on the relation between energy and the use of the subsurface. This was done in the some of the following contributions:

- "Re-use of Exhausted Heat in the underground railway in Sapporo City" (Ishida, Japan)

- "Energy Saving Through District Heating" – the situation at that time in FRG Germany (W. Dietz, FRG)

- "A Review of Underground Technology Developed in Shanghai" (Wang, PR China)

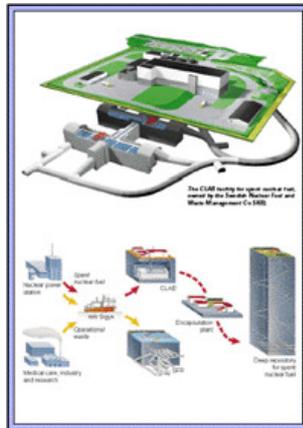
- "Energy Related Subsurface Use in the Netherlands" (C.J. Pronk, NL)

- "Use of the Subsurface for a Physical Laboratory (S. Pelizza, Italy)

- "Energy Savings by Subsurface Use" (B. Jansson, Sweden)

- "The Use of Underground Caverns for Storage and Disposal" (B. Brook, U.K.) – a continuation of his presentation in 1982.

- "The Peking Metro" (Q. Gao, PR China)



**1984**

Caracas was the next meeting point in 1984 where the following contributions continued to focus on energy related advantages by subsurface utilization:

- "Geothermal Energy for District Heating and the Generation of Electric Power in Reykjavik, Iceland"

- "The Potential Use of Geothermal Energy in Poland"

- "The subsurface Production and Storage of Energy in France"

- "The Use of the Underground to Store Food Particularly in Developing Countries" and

- "The Use of Earth Sheltering in Contemporary Architecture in the United States".

The group decided to add to its topics the successful utilization of urban underground developments in cities as well as on non-technical aspects of subsurface use, particularly in the legal and financial areas.



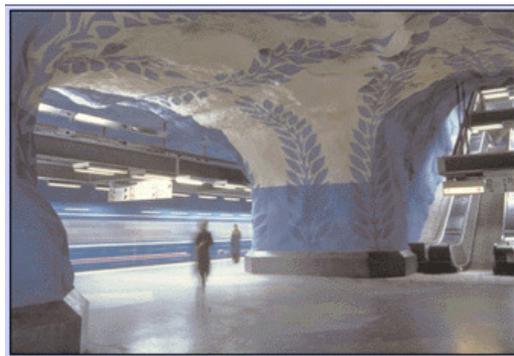
1985

The meeting in Prague in 1985 delivered several contributions mainly on the subject of successful utilization of the underground:

- "The Subsurface Museum of Modern Art in Brussels" (V. Roisin, Belgium)
- "Underground Parking Caverns with Civil Defense Shelters" (W. Dietz, FRG)
- "Underground Shopping Mall at Yokohama Station" (T. Tatsukami, Japan)
- "Subsurface Planning" (J. Gran, Czechoslovakia)
- "Use of Underground Space for Storage and Disposal" (Ch. Day, U.K.)
- "Tunnel Selected for the Oseberg Field Crude Oil Pipeline Shore Approach" (S. Froise, Norway)
- "The Underground Gothenburg" (B. Jansson, Sweden)
- "[The Underground Pedestrian System in Toronto](#)" (M. Barker, USA)

The Animator, Michael Barker, summarized the achievements of the group since its start.

"During these years over 30 papers were published to promote the use of the subsurface to serve human needs. The main topics covered were earth sheltering; urban and regional land-use planning; energy savings; urban systems and subsurface transportation systems". In fact, initial exploration of the benefits of the latter topic lead to the creation of ITAs Working Group on Costs and Benefits of Underground Public Transportation chaired by F. Blennemann (up till then member of WG 4).



1986

At the meeting in Florence in 1986, J. Gran presented a paper on the first underground sewage treatment plant in Czechoslovakia showing that this underground facility had comparative costs to a surface plant. P. Duffaut from France presented a paper on the legal problems of subsurface use, particularly the ownership and liability aspects. S. Pelizza presented a paper on some underground projects in Italy:

1. the Gran Sasso laboratory for subnuclear physics
2. seven underground hydroelectric power plants
3. the Abbadir Lariana underground highway interchange
4. the water collection chamber of the Monteponi mine.

S. Froise made a presentation about the Norwegian experience of storing hydrocarbons in unlined rock caverns and A. Palmström, Norway, presented new techniques for crossing fiords in deep tunnels at a 40% cost saving over surface bridges. B. Jansson, Sweden, presented a paper on the environmental influence on the demand for legal regulations on the use of subsurface.



**1987**

Following the discussions in Caracas (1984), the meeting in Melbourne in 1987 decided to concentrate its work on legislative aspects, which is a complex subject differing from country to country. The basic questions should be:

- forms of ownership
- ownership restrictions i.e. national, state, and local laws and regulations
- permitting requirements and
- ownership succession and responsibilities

The ambition of the group was to present to the General Assembly and publish results from such a survey among the member nations. The group also agreed that legal concerns studies should continue in future years developing the sub-topics of permitting processes, adjudication of conflicts and useful policies and approaches to common problems.

Two reports were presented in Melbourne:

- "The Latest Underground Concourse in Japan, the Kawasaki Station Underground Complex" (N. Masaki, Japan)
- "The latest in underground works in Norway (S. Froise, Norway)

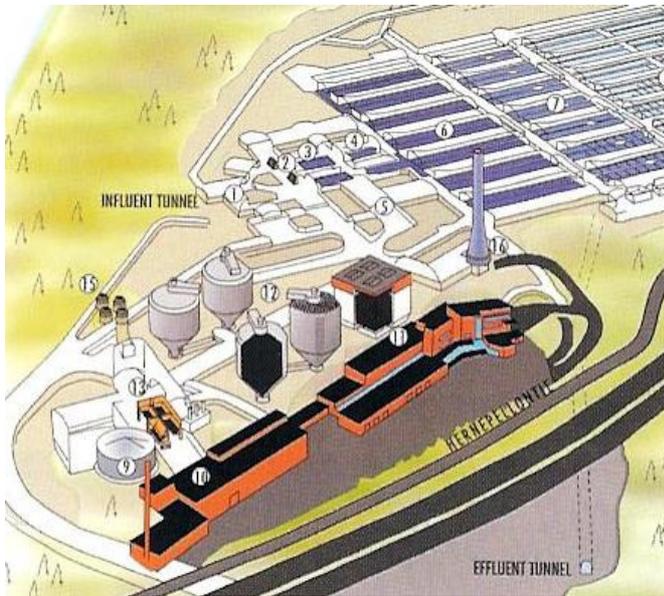
#### Working Groups

**1988**

The 1988 meetings in Madrid mainly discussed legal matters based on current replies to the Questionnaire. At this time the group realized that the survey was only a starting point to deal with this important and comprehensive subject. Plans for additional work would include (1) Policy statement on legal concerns and (2) Data base and bibliography.

In addition to these discussions, the following reports were presented during the meeting:

- "Water and Sewage in Caverns and Tunnels" - reviewing the subsurface water and sewer works in Sweden (B. Jansson, Sweden)
- "The Amsterdam Metro Planning" - exploring the design and construction challenges in the difficult geological and urban conditions of Amsterdam (H.P. van Lohuizen)



1989

In 1989 in Toronto, the group welcomed the cooperation of R. Sterling, University of Minnesota, for taking part in the work to prepare a Draft report on legislative matters. A Final report could be foreseen in 1990. The papers presented by the members in Toronto were:

- "Concepts and Projects for New Underground Space Utilization in Italy (S. Pelizza, Italy). The paper discussed (1) a subsurface wine cellar and laboratory (2) liquified natural gas storages underground (3) a seaside Trieste underground auditorium (4) the use of existing cavities in the Naples area for parking and arboritum
- "Gas storage projects in Denmark" (T. Blomqvist, Sweden)
- "Theoretical work on planning classification for urban places and their subsurface potential" (X. Hou, PR China)
- "An analysis of the Toronto underground pedestrian systems – 12 km long" (D. Dennis, Canada)

Working Groups

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1990

1990 brought us to Chengdu in China. The major agenda item this year was the final report on "The Legal and Administrative Issues in Underground Space Use: a Preliminary Survey of ITA Member Nations" the editor of which had been R. Sterling with financial support by the Executive Council of ITA. The group unanimously approved of the report as later did the General Assembly. (Please refer to TUST, Vol. 6/2, 1991) Participating nations: Australia, Belgium, China, Czechoslovakia, Denmark, Finland, France, Germany, Hungary, Italy, Japan, Mexico, Norway, South Africa, Sweden, Switzerland, U.K., USA and Venezuela.

Working Groups

1991

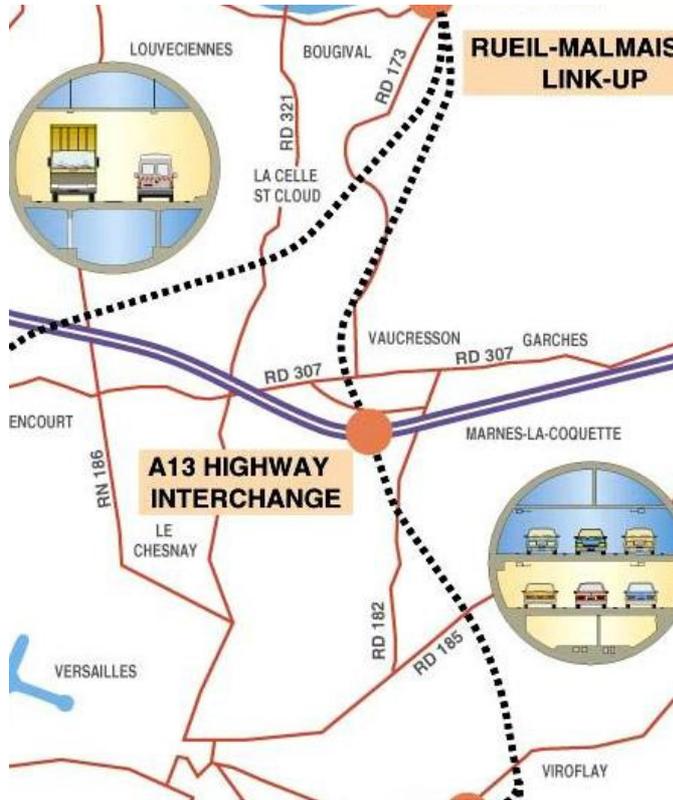
The venue for the 1991 meeting of ITA was London, U.K. With a rizing interest for the work of the group, we now had participation from 17 member nations, in three meetings. A special guest to the group this year was A. McCullough, Manager of Planning of the Transmanche Link, who informed about the many difficult permitting issues for this project.

A revised Policy Statement of the group was presented and accepted by the General Assembly (Minutes, London, April 1991).

A new project was discussed dealing with fire and life safety in underground facilities - after construction. Design, operations and regulatory concerns should be in focus.

And, as part of the group's objectives, the following presentations were made:

- by S. Pelizza, Italy, about the reuse of mined space and caverns in Italy and the difficulty of attaining architectural finishes in excavated caverns
- by D. Brook, U.K., about tourism in U.K. mines and caves
- by H-P van Lohuizen, Netherlands, about a proposed underground space centre at Delft University called the Nova Terra Foundation
- by J. Gran, Czechoslovakia - a report on fire safety in metros
- by P. Duffaut, France, about proposed tunnels in the Paris region that would complete critical links in the transportation system
- by S. Froise, Norway, about the 1994 Olympic Ice Skating Stadium excavated in rock with a clear span of 60 m and an interesting tunnelled spiral parking garage
- by K. Saari, Finland, a report on the proposed underground infrastructure systems for Helsinki



**1992**

In 1992, we met in Acapulco where the participants discussed the proposed Fire and Life Safety Study, considered to be the largest project for the ITA to that date. The time schedule aimed at a published report in 1994. S. Pelizza was elected vice-Animateur.

A Geological Data Base for planning subsurface works was also discussed and it was assigned to H-P van Lohuizen, the Netherlands and J. Gran, Czechoslovakia Republic to prepare a needs analysis that would be submitted to private sector vendors of computer hardware and software.

We also received the following contributions during our meetings:

- "Resuse of mined space" (S. Pelizza, Italy)
- "Urban flood control" (H. Takasaki, Japan)
- "Safety systems in the underground shopping centre at Kawasaki Station" (Y. Yuasa, Japan)
- "Quality of underground experience" (Campo, Italy)

**Working Groups**

**1993**

The 1993 meeting in Amsterdam continued the work on planning the Fire and Life Safety Study. Nine research institutes had volunteered to support this work: STUVA, Germany; USC, USA; SINTEF, Norway; BeFo, Sweden; JTA, Japan; SGI, Italy; Metrostav, Czech Republic; CETU and AFTES, France. The oversight of the project remained with the working group in co-operation with the Executive Council.. A new vice-Animateur was elected in A. Nordmark, Sweden

Papers delivered in Amsterdam:

- "A graphic/computer geological database for planning subsurface facilities" (P. Maurenbrecher, Netherlands)
- "Tokyo Trans-Bay Highway Tunnel - design, fire and life safety measures" (H. Takasaki, Y. Ota, Japan)
- "Olympic Stadium in Gjovik - fire and life safety measures" (O. Meland, Norway)
- "Underground Municipal Water Supply - using limestone mining for water storage" (S. Pelizza, Italy)
- "Underground Industrial Park - 37 million square feet of used underground space in Missouri" (D.Woodard, USA). This included information about a USD 5 billion claim for a large fire in this space.
- "Innovative Subsurface Uses in Sweden" (A. Nordmark, Sweden)



1994

The meeting in Cairo in 1994 started with the election of A. Nordmark as new Animateur after the resignation of M. Barker. She recalled the policy statement for the group which was approved in London in 1991 ' that the subsurface is a resource for future development in the same way as surface land'.

The meeting agreed that national, regional and local policies should be prepared to provide guidelines, criteria and classifications for assessing appropriate uses of underground space identifying geologic conditions, defining priority uses and resolving potential utilization conflicts etc. It was hence decided that a major task of the group for the next-coming years should be to pay special attention to subsurface mapping in urban areas for planning purposes and to legislative matters, i.e. existing laws and regulations to be consulted for underground facilities. Another topic deemed of interest was the re-use of abandoned mines.

For the Fire and Life Safety Study, Japan had prepared technical tables on 'Present Status of Fire and Life Safety Principles in Underground Structures'. A report from STUVA (Germany) which was part of a EUREKA project was presented. Member countries were urged to contribute to this work by submitting similar case studies from their respective countries.

#### Working Groups

1995

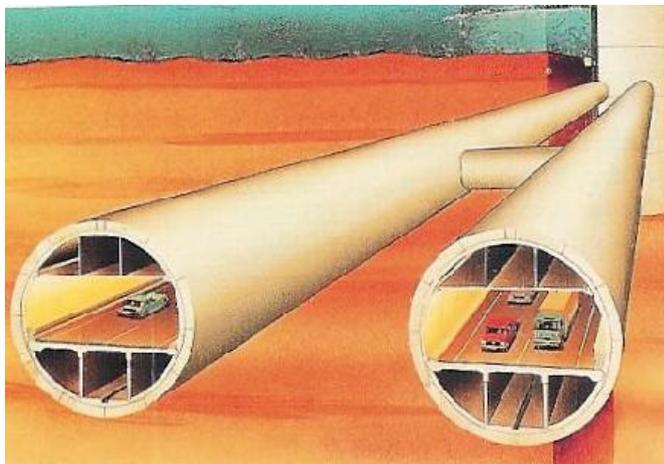
In 1995 in Stuttgart our meetings were attended by 27 people from 14 nations. Regarding the topic Subsurface Planning and Mapping, the discussions confirmed that legislation is often primarily developed for building above ground and that underground space use therefore often becomes complicated because of a lack of routine among those responsible for the legal procedures. The group proposed to the Executive Council to compile a report about national procedures and experiences and to identify problems in current legislation, with the objective to encourage subsurface solutions, i.e. legal processes for building permits and development plans and subsurface mapping and geo-information systems. The ambition was to produce a final report by 1998.

A working group report was delivered by Japan, chosen coordinator of the Fire and Life Safety Study. Members were asked to make more effort in order increase the participation in this study.

The Netherlands informed that an Underground Space Centre had now been established at the University of Delft with close communication with the International Federation of Housing and Planning. The latter which had set up a special working group on subsurface planning.

Participating members contributed with reports concerning (1) laws and building permits in underground planning (2) computer aided tunnel design methods and the Eureka project on fire and life safety (3) the planned Messina strait crossing (4) the East-West Express Link in Paris (5) a planned tunnel connection between Helsinki and Tallin and (6) a video about the Trans-Tokyo Bay Highway was also shown.

A new vice-Animateur was elected in D. Peila, Italy



1996

The meetings in Washington in 1996 were attended by 24 people from 12 nations. The Animateur reported that the group now had 24 member nations officially represented in the group. An interim meeting had been gathered by the Animateur in September 95 during the

"Underground Space and Urban Planning" conference in Paris. In November she had also received the Tutor of the group, Prof Pelizza, in Sweden to visit an abandoned mine now used for commercial/industrial purposes.

The Final Draft of the Fire and Life Safety study (started in 1992) covering road tunnels, rail and metro tunnels, pedestrian tunnels and underground facilities for human occupancy was reported by Japan to be in the final stage with the participation of eight countries: Australia, Canada, China PRC, Germany, Italy, Japan, Sweden and the USA. An appendix had also been added to the study by the Animateur covering addresses to a number of national and international organizations involved in fire and life safety aspects of underground works. The report would be sent to the Executive Council for approval before the next meeting. Special thanks were directed to Japan for their work to compile and evaluate the contributions from the participating members.

Ten nations were reported to participate in the ongoing report about Planning and Mapping of Subsurface Space. To a limited extent this report would encompass also environmental issues with an impact on building permit procedures.

The following presentations were made by participating members:

"Evaluation of the Opportunities for the Use of Underground Space in the Netherlands"

"Planning and Mapping of Underground Space in Japan"

"Underground Planning and Mapping in Sweden"

"Mined Industrial Space in Minneapolis; Planning and Development Studies"

"Kiba Railway Depots in Japan"

"Centre for Underground Construction in the Netherlands"

"The re-use of an Abandoned Mine in Central Sweden".

Proposals for future discussion were also made concerning incidents in tunnels and education in underground construction.

#### Working Groups

##### **1997**

Seventeen of the now 26 member nations in the group participated in Vienna in 1997.

The deadline for submitting contributions to the Planning and Mapping of Underground Space report was extended till the end of the year. A First Draft is expected for Brazil 1998.

Japan suggested to the group an inventory about underground facilities for water supply and storage. Italy expressed an interest to include also water conveyance tunnels (with regard to flood control and prevention of landslides). Japan and Spain both proposed a study concerning Access Ways to Underground Facilities.

Both proposals were accepted by the group. Japan and Italy were assigned to coordinate the first report and Japan and Spain were asked to cooperate in the latter work. The time schedules for these reports and plans of action would be established at the next meeting.

The Animateur also informed that during the past year she and J-P Godard, Animateur of WG 13, "Direct and Indirect Advantages of Underground Space" had together prepared a paper for TRIBUNE No.2 on "Tunnelling: A Factor in the Development of Infrastructure".

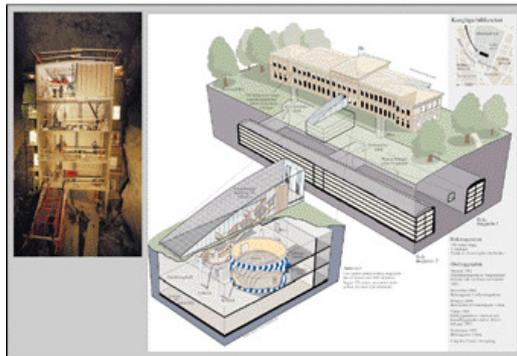
Three members reported the completion of their national books/works, which could be ordered from the respective national group:

"The Fourth Way of Rock Construction" (Finland)

"Manual de Tuneles y Obras Subterranas" (Spain)

"Underground Construction - Sweden in Focus" (Sweden)

Additional contributions during our meetings were (1) London Underground (Metro) Extensions", (2) "Tunnel Heritage in Spain; the Monte Furado Tunnel and the Mine of Daroca" and (3) "Use of Preliminary Investigations in Tunnelling Projects in Italy"



##### **1998**

The first topic on the agenda for the meetings in Sao Paulo in 1998 was to confirm that an extended summary had been added to the report "Fire and Life Safety for Underground Facilities: Present Status of Fire and Life Safety Principles Related to Underground Facilities" and that it was now ready for publication (please refer to TUST Vol.13/3, 1998).

Participating nations were: Australia, Canada, China, Germany, Italy, Japan, Sweden and the USA.

Progress had also been made to the report on Subsurface Planning and Mapping, now with nine member nations participating. The purpose of which had earlier been decided by the group to be to :

- give an overview of the development of underground space utilization
- explain the present legislation and the common issues on mapping
- analyse the legal problems encountered
- analyse the need for better maps and geo-information systems
- and finally also propose recommendations

A draft questionnaire for the study of Access Ways to Underground Facilities was discussed. Japan and Spain were assigned to finalize this for distribution to all member nations. The objective is to produce a document with practical recommendations if possible by including also selected examples with technical analyses.

Decided upon in Vienna was also a survey on Water Installations Underground. The group discussed the format of a questionnaire. An interim report was scheduled for the Oslo meeting.

Two contributions were orally presented during the meetings: (1) from the Asian Institute of Technology about utility duct systems and subway mass transportation systems in Bangkok and (2) about a new Master Course organized in Torino, Italy, sponsored by the EEC and specially devoted to prepare specialists for underground planning and design.

### Working Groups

#### **1999**

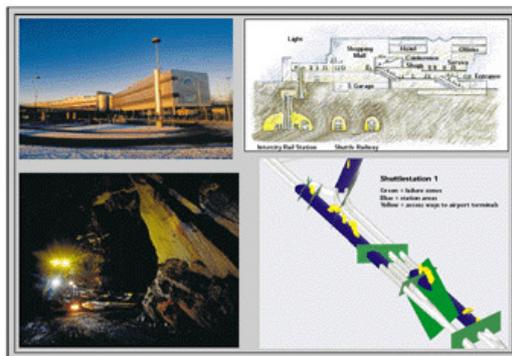
In Oslo in 1999, three major topics were on the agenda.

The Subsurface Planning and Mapping Report. The group acknowledged with thanks to the Executive Council the receipt of FF 30,000 in support of the preparation of an international synopsis of the work. Additional costs for the implementation of this work were carried by Sweden (coordinator).

The survey of Water Installations Underground. Japan had compiled an interim report based on contributions from six nations. More contributions had been announced and a First Draft is expected at the next annual meeting. The second part of the report specifically concerning tunnels for the prevention of flooding and landslide stabilization was being prepared by Italy.

Access Ways to Underground Facilities. Questionnaires on the topics of underground stations, shopping malls, parking areas and road tunnels had been prepared in cooperation between Japan and Spain. It was emphasized in the discussions that members should give priority to recent installations and experiences.

In addition, the meeting included the following presentations: (1) Underground storage and treatment of water and sewage in Trondheim, Norway, (2) Underground Systems for transportation of goods (non-bulk) in the Netherlands, (3) The new Tomei Expressway in Japan, (4) The underground Takayama Festival Art Museum, inaugurated 1998 (Japan), (5) Underground structures at the 3rd traffic circle in Moscow, Russia and (6) Tunnelling in Slovakia.



#### **2000**

Durban 2000. The group welcomed Jean-Paul Godard as its new Tutor. A new vice-Animateur was also elected in Eivind Grov, Norway.

The Animateur confirmed that the international synopsis of the report Planning and Mapping of Underground Space had been finished, approved by the Executive Council and was to be published in TUST Vol.15/3 (July-Sept 2002). Participating nations: Australia, Czech Republic, Finland, Italy, Japan, Netherlands, Norway, Sweden and Turkey.

Water Installations Underground report. Part 1 - water-supply and storage - had been compiled by Japan in a second Draft. A new deadline for additional contributions was set till end October 2000, also for the part covering landslide stabilization, in order to receive more contributions on these subjects. For the same reason it was decided to put the questionnaires on ITA's website. The group recommended that the two parts should be self-standing

documents, but preferably published at the same time, most likely, in 2002.

Access Ways to Underground Facilities. The deadline for submission of contributions was put forward with a First Draft scheduled for Milan 2001.

Four interesting presentations were made during the meeting: (1) Underground Galleries in France, (2) Introduction of new law of underground space use in Japan, (3) Shunting Area in Rock Caverns - rail cargo terminal in Norway and (4) Study on the use of underground space for multi modal transport nodes in the U.K.

On the recommendation of the Executive Council, the group also discussed active cooperation with the International Society for Trenchless Technology as well as a joint venture between WG 4, WG 13 and WG 15 - discussions to be followed up at the next annual meeting.

### Working Groups

#### **2001**

In Milan 2001, the group met two times.

The Report of the Water Installations Underground (Part 1/Japan) had been summarized and delivered to the Executive Council for its approval. The original document comprised 300 pages of raw data and 43 installations with the participation of nine countries. The group expressed its wish to have this work published in TUST.

Japan also presented a First Draft for the work concerning Access Ways to Underground Facilities. So far ten nations had submitted 27 case descriptions. A developed version was scheduled for the next meeting.

Since the discussions in Durban a Plan of Action had been worked out between the Animateurs for a cooperation between WG 4 (A. Nordmark), WG 13 (J. Reilly) and WG 15 (R. Craig). The objective being to cover the wider concept of subsurface utilization including reasons for going underground such as direct and indirect benefits, planning, geo-mapping and environmental and socio-economic issues. This proposal had been approved by the Executive Council.

The objective of the proposed cooperation (2000) with ISTT is to study the risk factors during different phases and a number of identified sublevels in the implementation of an underground project from state of objective till operation. A report about this meeting in Milan was presented at the General Assembly by our group member G. Arends, the Netherlands.

The Animateur, A. Nordmark, was elected as member of the Executive Council

Following discussions between the Executive Council and the Animateurs for WG 4 and WG 13, our Tutor, J-P Godard informed the group that the E.C. would propose the merge of the two groups for the creation of a new group "Urban Problems - Underground Solutions". In anticipation that this group is formally established in Sydney, the two Animateurs will continue current activities and prepare for the change.

### Working Groups

#### **2002**

In Sydney, 2002, the group met a last time to finalize its business.

The report about Water Installations Underground (Part 1) had been approved by the Executive Council and was to be published in TUST Vol.17/2, Apr 2002. Participating nations: Australia, France, Japan, Lesotho, Netherlands, Norway, Sweden, U.K. and USA.

As regards Part 2 - landslide stabilization, the group regretted that due to a combination of D. Peila (editor of this part) becoming the Animateur of WG 18 and the closing of Working Group No.4, it would not be possible to finalize this work.

A second draft of the report Access Ways to Underground Facilities was presented by Japan. Norway and the Netherlands were assigned to review this work before presenting a final report to the Executive Council in Amsterdam in 2003. For this purpose, the former Animateur, A.Nordmark, will "remain on duty" and support Japan in the final production.

In other words - it all came to an end in Sydney in March 2002 - the closing of Working Group No.4 Subsurface Planning "at an age of 27". The Animateur thanked all members present and absent and past for their long and devoted work during the life-time of this group.

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#### **Epilogue and Acknowledgements**

The working group on Subsurface Planning has during the years of its existence served as a platform for the member nations of ITA to exchange information about various applications suitable for subsurface utilization and on the planning and legal issues of that use, so as to stimulate creative ideas and find out which factors are essential in the decision whether to go underground - or not.

The interest in the topics of our group speaks for itself in the fact that at the time of ending its activities, the group had official members from 25 nations and correspondent members from another 5 nations as follows:

A Henderson, Australia, B Strobl, Austria, V Roisin, W de Lathauwer, Belgium, Zh Wang, PR China, V Vales, Czech Rep., M el Oquaizy, Egypt, U Anttikoski, Finland, P Duffaut, J-P Godard, France, Dietz, Germany, T Keszthelyi, Hungary, Sh Tbs Rao, India, H Takasaki, Y Yuasa, Japan, Du-Wha Lee, Korea, H Y Leong, Malaysia, V H Mondragon, Mexico, G Arends, Netherlands, E Grov, Norway, V Zhukov, Russia, V Chomová, Slovak Rep., U. Bajzelj, Slovenia, J A Junca Ubierna, Spain, A Nordmark, Sweden, N Akcelik, Turkey, M Knights, United Kingdom, S Nelson, United States.

Correspondents: S da Fontoura, Brazil, B Ripley, Canada, D Peila, Italy, C Dinis da Gama, Portugal, T N Cockcroft, South Africa.

Looking back on the hard and sincere work performed by Working Group No.4 members, I am confident that it has supported the development of underground construction in our nations.

It is a privilege to have been its Animateur for the last 9 years.

Annica Nordmark

Animateur of WG 4 1993-20001/2

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