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Report for 1981 and 1982
U.S. National Committee on Tunneling Technology

A Summary of the Work
Conducted During Calendar Years 1981 and 1982

Commission on Engineering and Technical Systems
National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C., 1983

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee and subcommittees were chosen for their special competences and with regard for appropriate balance.

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INTRODUCTION

The U.S. National Committee on Tunneling Technology (USNC/TT), a unit of the Commission on Engineering and Technical Systems, was formed within the National Research Council in 1972 by the presidents of the National Academy of Sciences and the National Academy of Engineering. It was formed in response to a request from the chairman of the Federal Council for Science and Technology for a "U.S. focal agency to be responsible for assessment of tunneling activities, and where appropriate, for stimulation of improvements in tunneling technology."

The committee's purposes, as stated in its constitution, are the following:

- To serve as the national organization for stimulating advancement in the state of the art of tunneling technology and in the effective use of the subsurface by promoting the coordination of activities pertaining thereto—assessment, research, development, education, training, and collection and dissemination of information.
- To effect appropriate participation in all activities of the International Tunnelling Association (ITA) through the National Academy of Sciences-National Academy of Engineering-National Research Council, which adheres to the ITA on behalf of the scientists, engineers, and technologists of the United States interested in tunneling technology.

The committee's functions include, but are not limited to, the following:

- Collection and dissemination of technical information related to tunneling, including current research, development, and innovative activities, as well as data on cost and performance of tunneling components and systems.
- Continuing assessment of the state of the art of the tunneling system to identify technical needs which might be met through research and development, to ascertain the overall level and structure of research and development, to review periodically the extent to which it is appropriate to the future demand for different types of tunneling, and to stimulate cross-fertilization of advanced technology developed for other purposes.
- Periodical statistical demand forecasting and collection of demand data.

- Study of contracting practices in relation to the present state of the art of tunneling, including consideration of how the risks are shared and how to encourage the use of improved techniques.
- Action necessary to improve the understanding on the part of planners, officials, and the general public of the benefits to be obtained from increased and planned use of the subsurface.
- Review of the adequacy of education and training of engineers in the field of tunneling.
- Participation in international activities concerned with the application, planning, and practice of tunneling.

This biennial report describes the work of the committee and its subcommittees in calendar years 1981 and 1982. The committee is grateful to the federal agencies that sponsor its activities.

ACTIVITIES OF THE COMMITTEE

Nomination and Appointment of Members and Officers, 1981

Six members completed their terms on the committee on June 30, and were succeeded by new members.

The following new members were appointed for terms ending in 1984:

David Barna (representative of the federal agencies)
Z.T. (Dick) Bieniawski (academic/research)
Lynn A. Brown (representative of the Association of Engineering Geologists)
Dennis J. Lachel (industry)
R.M. (Ray) Monti (government)
Glen R. Traylor (industry)

Mr. Norman A. Nadel completed his term as committee chairman on June 30 and became immediate past chairman and ex officio committee member. He was succeeded as chairman by Professor Edward J. Cording, who served in that capacity from July 1, 1981 to June 30, 1982. Dr. Don A. Linger was appointed vice chairman for the same period.

A roster of the committee and its subcommittees for the period July 1, 1981 to June 30, 1982 is included as Appendix A.

Nomination and Appointment of Members and Officers, 1982

Fourteen members completed their terms on the committee on June 30; twelve were succeeded by new members, and the terms of two were extended for one year.

The following new members were appointed for terms ending in 1984:

John W. Leonard (industry)
Malcolm J. McPherson (academic/research)
Ota Spacek (industry)

The following new members were appointed for terms ending in 1985:

Frank E. Dalton (government)
Bruno Dietl (representative of the Associated General Contractors of America)
James L. Drake (government)
Herbert H. Einstein (academic/research)
William H. Hansmire (industry)
William A. Hustrulid (academic/research)
George A. Mealy (industry)
Thomas J. O'Neil (representative of the American Institute of Mining, Metallurgical and Petroleum Engineers)
P.E. (Joe) Sperry (representative of the American Society of Civil Engineers)

The following members were reappointed for a period of one year, ending in 1983:

Fred H. Kulhawy (academic/research)
Raymond E. Levitt (academic/research)

Professor Edward J. Cording completed his term as committee chairman on June 30 and became immediate past chairman and ex officio committee member. He was succeeded by Dr. Don A. Linger, who will serve as chairman from July 1, 1982 to June 30, 1983. Mr. Dennis J. Lachel was appointed vice chairman for the same period.

The membership of the committee and its subcommittees for the period July 1, 1982 to June 30, 1983 is listed in Appendix A.

Annual Meetings, 1981 and 1982

Two regular topics of discussion at annual meetings are the programs of the subcommittees and the activities of the International Tunnelling Association (ITA). These programs and activities are summarized in subsequent sections of this report.

The Tenth Annual Meeting of the committee was held May 2-3, 1981, in San Francisco, California, in connection with the Rapid Excavation and Tunneling Conference (RETC). The committee meetings included plenary sessions and individual subcommittee meetings. The record of the meeting is included as Appendix B.

The Eleventh Annual Meeting was held May 12-14, 1982, in Park City, Utah. The first two days were devoted to individual meetings of the subcommittees and a general session attended by all members. A field trip, conducted on the third day, included visits to two projects of the Bureau of Reclamation. The first was a visit to the Stillwater Tunnel project, in which a tunnel boring machine became stuck. A committee member, Glen R. Traylor, whose construction firm has undertaken the removal of the TBM and completion of the project, guided the committee through the tunnel. The second project included the Hades and Rhodes tunnels, which were excavated with a TBM. The record of this annual meeting is included as Appendix C.

ACTIVITIES OF THE SUBCOMMITTEES

The substantive activities of the USNC/TT are carried out primarily by ad hoc subcommittees. From time to time a subcommittee conducts a separately funded study resulting in a published report, but generally the subcommittees conduct their work as part of the committee's continuing activities and are supported with core funding. Some of the subcommittees perform work that supports U.S. participation in the activities of the ITA while others undertake tasks primarily related to tunneling within the United States. The programs of the seven subcommittees active during 1981 and 1982 are summarized below. Rosters of the subcommittees are included in Appendix A; additional information on their activities appears in Appendices B and C.

Subcommittee on Contracting and Management Practices

The subcommittee continued work on three tasks initiated in 1980. These are (1) to review the implementation of recommendations discussed in three previously published reports—*Better Contracting for Underground Construction, Recommended Procedures for Settlement of Underground Construction Disputes,* and *Better Management of Major Underground Construction Projects;* (2) to facilitate participation in the ITA Working Group on Contractual Sharing of Risks; and (3) to study contractual arrangements among owners, engineers, and designers in order to effect innovation in design. For the first task, the subcommittee has completed the survey format and is refining the distribution list of owners, contractors, and engineers. With respect to the second task, the subcommittee has prepared position papers on ground support, site characterization, and mobilization payments, and is preparing comments on four papers submitted for review. With respect to the third task, the proposed format of the survey intended for design firms has been submitted to the USNC/TT for comments and approval.

Subcommittee on Demand Forecasting

In 1981 the subcommittee completed work on compiling data for a summary forecast of construction and published its report, *Demand Forecast of Underground Construction and Mining in the United States*. The report lists approximately 160 specific projects with estimated start-construction dates from 1980 to 2000. It also includes projections for the mineral industry and nonspecific estimates of construction for water supply, wastewater conveyance and treatment, storm and sanitary tunnels and storage systems, transportation, hydroelectric power (including pumped storage), nuclear waste disposal, oil mining, storage of petroleum reserves, and defense. Subcommittee activities for 1982 centered on the plans and schedule for updating the report, as recommended by the USNC/TT.

Subcommittee on Design Considerations

The subcommittee, established in 1980, reviewed the scope of its charter and determined that an appropriate area of concentration for its initial efforts was small diameter (6-20 ft) shallow depth (up to 200 ft) urban tunnels. The immediate goal is to produce a report that develops guidelines for such tunnels. The subcommittee has identified areas of interest for additional projects and plans to propose a more extensive program of activities for USNC/TT approval.

Subcommittee on Education and Training

The subcommittee's activities for 1981 centered on completion of two projects undertaken in 1979-1980: compilation of a set of slides and development of a list of films available for loan. Availability of the set of 212 slides illustrating tunnel construction methods (and accompanying descriptive text) was announced in the March issue of *Tunneling Technology Newsletter*. The annotated list of 64 films related to tunneling was published as a supplement to the December issue of the *Newsletter*. During 1982 the subcommittee concentrated its efforts on developing a "mini" slide set on rock bolting, planning to update and expand the annotated reading list published in 1977, and defining the focus of future activities.

Subcommittee on Geologic Site Investigations

The subcommittee, which is undertaking a special (i.e., separately funded) activity, held its first meeting in December 1981 to plan the conduct of the two-year study intended to result in the development of guidelines for better and more cost-effective site investigations. The subcommittee determined that the best procedure was to study completed projects—both successful and less than successful—and compare construction histories with site investigation data used in design and planning construction. During 1982, the subcommittee concentrated on identifying tunnel projects to be evaluated, preparing interview documents, obtaining technical documents from owners, and initiating interviews with owners and contractors. Data compilation and analysis are expected to be completed during 1983.

Subcommittee on Planning and Evaluation

The subcommittee held its first meeting in August 1981, during which the general charge to the subcommittee was modified and the specific charge for activities was developed. In 1982, the subcommittee devoted its efforts to planning for the case-study approach to be used in its evaluation of the use of the subsurface for urban mobility, common duct, and energy systems. The Pittsburgh light rail project was selected for the first case study, and several projects were identified as possible subjects for the future. It is planned that the final report of the first case study will be presented for USNC/TT consideration in 1983. In addition to this task, the subcommittee provided for liaison with the ITA Working Group on Subsurface Planning.

Subcommittee on Research Needs

The subcommittee has completed the case-history format intended to assist researchers with different goals in identifying projects of interest by facilitating access to the most significant elements of data on a large number of tunnels. Efforts have been initiated to determine the most effective methods of obtaining data and providing for a permanent collection process. The subcommittee continued formulating possible approaches to the planned effort to identify constructor-perceived research needs and examine their relationship to research activities. Also, the subcommittee contributed to projects conducted by the ITA Working Group on Research.

WORKSHOP ON TECHNOLOGY FOR THE DESIGN AND CONSTRUCTION OF DEEP UNDERGROUND DEFENSE FACILITIES

In response to a request from the Chief of the Strategic Structures Division, Defense Nuclear Agency, the U.S. National Committee on Tunneling Technology convened a workshop on the technology for design and construction of deep underground basing facilities for strategic missiles. In its request, dated October 9, 1981, the Defense Nuclear Agency (DNA) indicated its interest in "evaluating the constructibility, vulnerability, and survivability of deep underground defense systems," and called on the USNC/TT to help in assessing current and developing tunneling technology that would be important in designing and constructing deep basing facilities. Citing an "urgent need to respond quickly to changing defense needs," DNA asked that the workshop be held in early November and that a report on the proceedings be completed in April 1982.

The workshop was held on November 5 and 6, 1981, in Washington, D.C. In attendance were all available members of the USNC/TT and several of its subcommittees, as well as selected past members of the committee and others whose expertise was judged indispensible. The workshop participants are listed in Appendix D.

After a brief executive session dealing with procedural matters, the first day was devoted to public briefings by representatives of the U.S. Air Force, the Defense Nuclear Agency, and several contractors (Merritt CASES, Inc., the Boeing Company, and R&D Associates, Inc.) that have performed conceptual and design work on aspects of the deep basing problem. These briefings outlined the relevant issues of nuclear weapons effects, the strategic incentives for deep basing, the system requirements, and various deep basing concepts.

As part of its request, the Defense Nuclear Agency had asked for specific guidance in six areas: (1) costing, contracting, personnel, and management; (2) siting; (3) use of existing underground space; (4) egress; (5) mechanical mining; and (6) construction planning and validation. The USNC/TT accordingly had established a working group to deal with each of these topics. In the evening of the first day the six working groups met separately and developed preliminary draft reports for presentation on the following day.

The morning of the second day was occupied with the presentation of working group reports, again in open session. In the afternoon the assembled tunneling technologists met in executive session to discuss the

preliminary working group reports and agree on the general outlines of their revision as chapters in the committee's report.

The report, *Design and Construction of Deep Underground Basing Facilities for Strategic Missiles,* is presented in two volumes. *Volume 1, Evaluation of Technical Issues,* contains the committee's report, which avoided the strategic and political issues surrounding the MX missile siting decision. It concentrated instead on the as yet vaguely defined technical requirements of the deep basing option, discussing in general terms the technical and management issues raised by the proposal. Its aim was to help the Defense Nuclear Agency and the Air Force to refine their plans in preparation for a final decision on the MX missile's basing mode, expected in 1984. *Volume 2, Briefings on System Concepts and Requirements,* contains transcripts of the briefings arranged for by the sponsor to provide background information for the workshop participants. The report was completed in April 1982 and published in May.

REPRESENTATION OF THE UNITED STATES IN THE ACTIVITIES OF THE INTERNATIONAL TUNNELLING ASSOCIATION (ITA)

The USNC/TT functions to fulfill the responsibilities of the United States as a member-nation of the ITA, which is one of the basic purposes stated in its constitution. The committee works with the other 32 member nations of the ITA, thereby providing cross-fertilization of current, developing, and advanced technologies. Through the committee the U.S. maintains an active and leading role in the ITA, with one individual serving as ITA vice president and four others serving as members, animateurs, or vice animateurs of working groups. In addition, the committee provides input, when requested, for the activities of the other ITA working groups.

Meetings of the General Assembly, 1981 and 1982

The Seventh Annual Meeting of the ITA was held in Nice, France, May 10-14, 1981, in conjunction with the international symposium "Cost Cutting in Tunnelling," organized by the French Tunnelling Association (Association Francais des Travaux en Souterrain). Representatives of 27 national and 4 international organizations participated in the meeting. The United States was represented by a delegation of eight persons, headed by the committee chairman, Norman A. Nadel. At the General Assembly meeting, two motions of particular significance were considered; both were viewed favorably but neither received the required 80 percent majority vote required for adoption. The first amendment would have changed the Association's name to International Tunnelling and Subsurface Use Association. The second amendment proposed extending Association membership to individual and corporate supporting members. The General Assembly was advised that the Executive Council will seek United Nation recognition of ITA as a Nongovernmental International Organization. Four new nations were accepted for membership, bringing the total to 30 member nations. A special open session was also held in conjunction with the ITA meeting and the AFTES symposium; approximately 300 persons attended that session, "Economic Aspects of Subsurface Use." A report of the ITA meeting is included as Appendix E.

The Eighth Annual Meeting of the ITA was held in Brighton, England, June 6-9, 1982, in conjunction with "Tunnelling '82," sponsored by the

Institution of Mining and Metallurgy and the British Tunnelling Society. Representatives of 30 nations and one international organization participated in the meeting. The United States was represented by a delegation of six persons, headed by the committee chairman, Edward J. Cording. At the General Assembly meeting, a proposal to modify the ITA Statutes to admit individual and corporate affiliate members was unanimously accepted. Two new nations were accepted for membership, bringing the total to 32 member nations. In addition, Hungary was approved for membership subject to formal receipt and acceptance of their application together with the appropriate membership fee. The terms of two members of the Executive Council were extended: Dr. Einar Broch, an additional member of the Executive Council, was reelected for a period of two years, and Dr. Victor Roisin, secretary general, was reelected for a three-year term. The Nominating Committee, consisting of Dr. Gunter Girnau and the two former presidents of ITA, A. Muir Wood and Hans C. Fischer, was reappointed for elections scheduled for 1983. Mr. Magnus Bergman (Sweden) presented a progress report on the ITA's application for recognition by the United Nations as a Nongovernmental Organization (NGO). Also, an open session was held jointly with the Tunnelling '82 participants. Approximately 200 persons attended the special session, entitled "The Subsurface: Contributions to Energy Savings." A report of the ITA meeting is included as Appendix F.

Activities of the Working Groups, 1981 and 1982

The ITA conducts its technical activities primarily through working groups with memberships representing a cross section of the member nations. The areas of interest of the nine established working groups are as follows: standardization, research, contractual sharing of risk, subsurface planning, health and safety in work, maintenance and repair of underground structures, structural design models, catalog of tunnels, and seismic effects on underground structures. Reports of the results of working groups activities usually are published in the ITA journal, *Advances in Tunnelling Technology and Subsurface Use*.

During the period of this report, two individuals affiliated with the USNC/TT have continued to fill key positions as animateurs (moderators) of the working groups: Michael B. Barker for Planning the Use of the Subsurface, and William W. Hakala for Seismic Effects on Underground Structures. In addition, Winfield O. Salter continued to serve as vice animateur of the Working Group on Contractual Sharing of Risk. At the Seventh Annual Meeting in 1981, William N. Lucke participated as a member of the Working Group on Standardization and Terence G. McCusker in the Working Group on Research. At the Eighth Annual Meeting in 1982, the Working Group on Research selected Mr. McCusker as vice animateur, and Joseph D. Guertin, Jr., acted as it co-reporter for North America.

During the 1981 meeting in Nice, each of the nine working groups held meetings and also participated in a round table discussion of subsurface use in the developing countries. Results of these working group

meetings and the round table discussion were presented to the General Assembly in its final session. Detailed accounts of these working group activities are contained in Appendix E.

During the 1982 meeting in Brighton, each of the nine working groups held meetings and presented the results of these meetings to the General Assembly. In addition, a tenth Working Group on Cost/Benefits of Underground Urban Public Transportation was established. The first meeting of this working group was chaired by Dr. Girnau, ITA President; subsequently, an animateur from the Federal Republic of Germany was selected to head the group. Detailed accounts of the working group activities are contained in Appendix F.

PUBLICATIONS

Tunneling Technology Newsletter

The committee published eight issues of the *Newsletter* in 1981 and 1982. Each featured one or more technical articles on an aspect of tunneling as well as notices of meetings and other items of interest. Most issues also listed recent reports on tunneling and underground construction and included calls for papers at forthcoming conferences. Each issue was distributed to approximately 1400 individuals and organizations. The technical articles published in 1981 and 1982 were:

- "Baltimore's Fort McHenry Tunnel"
- "Tunneling for the Milwaukee Water Pollution Abatement Program"
- "Prevention of Blowouts in Shield-Driven Tunnels"
- "Influence of Geologic Logs and Descriptions on Tunnel Design and Costs"
- "Underground Technology in the People's Republic of China"
- "Design Considerations for a Nuclear Waste Repository in Salt"
- "The Kerckhoff 2 Underground Hydroelectric Power Plant Project"
- "Seattle to Get Largest Diameter Soft-Ground Bored Tunnel in the USA"
- "Ground Deformations Induced by an Earth Pressure Balance Shield in Silts and Clays"

Also, a supplement was issued to the December 1981 *Newsletter,* entitled "Films on Tunneling."

Tunnel Construction Methods—A Slide Set

This set of 212 slides was compiled by the Subcommittee on Education and Training. The set, which includes a commentary describing each slide, illustrates soft ground tunnel excavation procedures and equipment, tunnel linings, shield tunneling, settlement over tunnels, braced-cut construction, rock tunnel excavation, tunnel boring machines, rock support, and submerged tube construction. Early tunneling methods are illustrated, as well as recent advances in tunneling technology. Slide sets were provided to all federal agency sponsors and are available for sale from the USNC/TT Secretariat at a price of $50 per set.

Demand Forecast of Underground Construction and Mining in the United States

This report, which was completed in 1981, presents a twenty-year forecast of underground works which may be constructed in the United States. Copies are available from the USNC/TT Secretariat (free of charge).

Design and Construction of Deep Underground Basing Facilities for Strategic Missiles—Evaluation of Technical Issues and *Briefings on System Concepts and Requirements*

This two-volume report details the briefings, discussions, and conclusions presented in a two-day workshop on the technology for design and construction of deep underground basing facilities, held November 5 and 6, 1981. Copies are available for sale from the National Academy Press (print on demand) and the National Technical Information Service.

Executive Presentation—Recommendations on Better Contracting for Underground Construction

This is a reprint of the 1976 publication, which was prepared to complement the full-length report published in 1974. A limited number of copies are available from the Secretariat for selective distribution.

Appendix A

MEMBERSHIP, 1981-1982
U.S. NATIONAL COMMITTEE ON TUNNELING TECHNOLOGY

JULY 1, 1981-JUNE 30, 1982

Officers

Chairman
Edward J. Cording
Department of Civil Engineering
University of Illinois
Urbana, Illinois

Vice Chairman
Don A. Linger
Strategic Structures Division
Defense Nuclear Agency
Washington, D.C.

Immediate Past Chairman
Norman A. Nadel
MacLean-Grove and Company, Inc.
Greenwich, Connecticut

Designated Representatives

Federal Agencies
David Barna
Mineral Resources Technology Division
U.S. Bureau of Mines
Washington, D.C.

Associated General Contractors of America
Chris F. Woods
Al Johnson Construction Company
Minneapolis, Minnesota

JULY 1, 1982-JUNE 30, 1983

Officers

Chairman
Don A. Linger
Strategic Structures Division
Defense Nuclear Agency
Washington, D.C.

Vice Chairman
Dennis J. Lachel
LACHEL HANSEN & Associates, Inc.
Golden, Colorado

Immediate Past Chairman
Edward J. Cording
Department of Civil Engineering
University of Illinois
Urbana, Illinois

Designated Representatives

Federal Agencies
David Barna
Mineral Resources Technology Division
U.S. Bureau of Mines
Washington, D.C.

Associated General Contractors of America
Bruno Dietl
Valley Engineers Inc.
Fresno, California

JULY 1, 1981-JUNE 30, 1982	JULY 1, 1982-JUNE 30, 1983
American Society of Civil Engineers Eugene B. Waggoner Consultant San Jose, California	*American Society of Civil Engineers* P.E. (Joe) Sperry Consultant Woodland Hills, California
American Institute of Mining, Metallurgical, and Petroleum Engineers *(to be appointed)*	*American Institute of Mining, Metallurgical, and Petroleum Engineers* Thomas J. O'Neil Amoco Minerals Company Englewood, Colorado
Geological Society of America Lloyd B. Underwood Consultant Omaha, Nebraska	*Geological Society of America* Lloyd B. Underwood Consultant Omaha, Nebraska
Association of Engineering Geologists Lynn A. Brown U.S. Bureau of Reclamation Denver, Colorado	*Association of Engineering Geologists* Lynn A. Brown U.S. Bureau of Reclamation Denver, Colorado
American Underground-Space Association J. Gavin Warnock Acres Consulting Services, Ltd. Toronto, Ontario, Canada	*American Underground-Space Association* J. Gavin Warnock Acres Consulting Services, Ltd. Toronto, Ontario, Canada
Industry	Industry
G. Stanley Bates Pacific Gas & Electric Company San Francisco, California	William H. Hansmire Parsons, Brinckerhoff, Quade & Douglas, Inc. New York, New York
J. Joseph Casey Dillingham Construction San Francisco, California	John W. Leonard Morrison-Knudsen Company Boise, Idaho
Edward Cross Compressed Air and Free Air Tunnel Workers Union New York, New York	George A. Mealey Freeport Mining Company New York, New York
Dennis J. Lachel LACHEL HANSEN & Associates, Inc. Golden, Colorado	Ota Spacek Dravo Engineers & Constructors Denver, Colorado
	Glen R. Traylor Traylor Bros., Inc. Calumet Park, Illinois

JULY 1, 1981-JUNE 20, 1982	JULY 1, 1982-JUNE 30, 1983
Winfield O. Salter Parsons, Brinckerhoff, Quade & Douglas, Inc. Atlanta, Georgia	
Government	
William D. Alexander Consultant (formerly Metropolitan Atlanta Rapid Transit Authority) Pawley's Island, South Carolina	William D. Alexander Consultant (formerly Metropolitan Atlanta Rapid Transit Authority) Pawley's Island, South Carolina
Gordon E. Bunker Division of Occupational Safety and Health, State of California San Francisco, California	Gordon E. Bunker Division of Occupational Safety and Health, State of California San Francisco, California
Gilbert L. Butler Office of Rail and Construction Technology Urban Mass Transportation Admin. Washington, D.C.	Frank E. Dalton Metropolitan Sanitary District of Greater Chicago Chicago Illinois
Donald J. Duck (formerly Bureau of Reclamation) Construction Management Office Harza Engineering Company Chicago, Illinois	James L. Drake Waterways Experiment Station U.S. Army Corps of Engineers Vicksburg, Mississippi
R.M. (Ray) Monti Port Authority of New York and New Jersey New York, New York	R.M. (Ray) Monti Port Authority of New York and New Jersey New York, New York
Academia and Research	**Academia and Research**
Bruce F. Baird College of Business University of Utah Salt Lake City, Utah	Z.T. (Dick) Bieniawski Mining & Mineral Resources Research Institute The Pennsylvania State University University Park, Pennsylvania
Z.T. (Dick) Bieniawski Mining & Mineral Resources Research Institute The Pennsylvania State University University Park, Pennsylvania	Herbert H. Einstein Department of Civil Engineering Massachusetts Institute of Technology Cambridge, Massachusetts
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JULY 1, 1981-JUNE 30, 1982	JULY 1, 1982-JUNE 30, 1983
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	Malcolm J. McPherson Department of Materials Science and Mineral Engineering University of California, Berkeley Berkeley, California
International Tunnelling Association	**International Tunnelling Association**
Vice President Jack K. Lemley Morrison-Knudsen Company Boise, Idaho	*Vice President* Jack K. Lemley Morrison-Knudsen Company Boise, Idaho
Animateur, Working Group on Seismic Effects on Underground Structures William W. Hakala Earthquake Hazards Mitigation Section National Science Foundation Washington, D.C.	*Animateur, Working Group on Seismic Effects on Underground Structures* William W. Hakala Earthquake Hazards Mitigation Section National Science Foundation Washington, D.C.
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	Vice Animateur, Working Group on Research Terence G. McCusker Consultant San Francisco, California

JULY 1, 1981-JUNE 30, 1982	JULY 1, 1982-JUNE 30, 1983
Liaison Representatives	**Liaison Representatives**
Building Research Advisory Board *(to be appointed)*	*Advisory Board on the Built Environment* Henry A. Borger, Jr. National Academy of Sciences Washington, D.C.
Transportation Research Board John W. Guinnee National Academy of Sciences Washington, D.C.	*Transportation Research Board* Lawrence G. Spaine National Academy of Sciences Washington, D.C.

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John E. Wagner, *Executive Secretary* (as of November 1, 1981)
U.S. National Committee on Tunneling Technology

Susan V. Heisler, *Assistant Executive Secretary*
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Virginia M. Lyman, *Administrative Assistant*
U.S. National Committee on Tunneling Technology

Janie B. Marshall, *Secretary* (as of August 30, 1982)
Study of Geologic Site Investigations for Tunnels

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*William C. Shepherd, Sr.
Consultant
Hilton Head Island, South Carolina

Harry Sutcliffe
Bechtel Civil Minerals, Inc.
San Francisco, California

Henry R. Tiedemann
Jacobs Associates
San Francisco, California

*deceased (1982)

SUBCOMMITTEE ON EDUCATION AND TRAINING

Fred H. Kulhawy, *Chairman*
School of Civil and Environmental Engineering
Cornell University
Itahca, New York

Z.T. (Dick) Bieniawski
Mining and Mineral Resources Research Institute
The Pennsylvania State University
University Park, Pennsylvania

Lynn A. Brown
U.S. Bureau of Reclamation
Denver, Colorado

Lynne Fitzpatrick
A.A. Mathews Division
CRS Group Engineers, Inc.
Rockville, Maryland

John Ramage
CH2M Hill
Reston, Virginia

SUBCOMMITTEE ON GEOLOGIC SITE INVESTIGATIONS

Eugene B. Waggoner, *Chairman*
Consultant
San Jose, California

Don U. Deere
Consultant
Gainesville, Florida

Richard Hamburger
Consultant
Germantown, Maryland

Howard J. Handewith
Consultant
Pittsburgh, Pennsylvania

W. Stanfield Johnson
Crowell and Moring
Washington, D.C.

Dennis J. Lachel
LACHEL HANSEN & Associates, Inc.
Golden, Colorado

Daniel F. Meyer
Morrison-Knudsen Company
Boise, Idaho

Walter E. Newcomb
Battelle Memorial Institute
Columbus, Ohio

Walter H. Paterson
Consulting Engineer
Toronto, Ontario, Canada

Donald C. Rose
Tudor Engineering Company
San Francisco, California

Reuben Samuels
Thomas Crimmins Contracting Company
New York, New York

Lloyd B. Underwood
Consultant
Omaha, Nebraska

Edward L. Waddell, Jr.
Washington Metropolitan Area Transit Authority
Washington, D.C.

Sheldon P. Wimpfen
Consulting Engineer
Luray, Virginia

Victor L. Wright
Consulting Engineering Geologist
Placerville, California

SUBCOMMITTEE ON PLANNING AND EVALUATION OF UNDERGROUND SPACE

Michael B. Barker, *Chairman*
Department of Practice & Design
American Institute of Architects
Washington, D.C.

William D. Alexander
Consultant
Pawley's Island, South Carolina

Sumner Myers
Institute of Public Administration
Washington, D.C.

J. Gavin Warnock
Acres Consulting Services, Ltd.
Toronto, Ontario, Canada

SUBCOMMITTEE ON RESEARCH NEEDS

Terence G. McCusker, *Chairman*
Consultant
San Francisco, California

Donald J. Duck
Harza Engineering Company
Chicago, Illinois

Joseph D. Guertin, Jr.
Goldberg-Zoino & Associates, Inc.
Newton Upper Falls, Massachusetts

Howard J. Handewith
Consultant
Pittsburgh, Pennsylvania

Thomas J. O'Neil
Amoco Minerals Company
Englewood, Colorado

Appendix B

NATIONAL RESEARCH COUNCIL

ASSEMBLY OF ENGINEERING

2101 Constitution Avenue Washington, D.C. 20418

TENTH ANNUAL MEETING
U.S. NATIONAL COMMITTEE ON TUNNELING TECHNOLOGY
MAY 2-3, 1981
San Francisco, California

Record of the Meeting

ATTENDEES

COMMITTEE AND SUBCOMMITTEE MEMBERS:

Norman A. Nadel, *Chairman*
Edward J. Cording, *Vice Chairman*
David G. Hammond, *Immediate Past Chairman*

Joginder S. Bhore
Z.T. (Dick) Bieniawski
Tor L. Brekke (May 2)
Gordon E. Bunker (May 3)
J. Joseph Casey (May 2)
G. Wayne Clough
Edward Cross
Don U. Deere
Drupad B. Desai, *Chairman*
Subcommittee on Design Considerations
Donald J. Duck
Eugene L. Foster, *Cochairman,*
Subcommittee on Demand Forecasting
Richard Hamburger (May 3)
Howard J. Handewith
Fred H. Kulhawy, *Chairman,*
Subcommittee on Education & Training
Dennis J. Lachel
Raymond E. Levitt
Don A. Linger, *Federal Agencies Representative*
Terence G. McCusker, *Chairman,*
Subcommittee on Research Needs
Walter H. Paterson
Winfield O. Salter, *Chairman,*
Subcommittee on Contracting and Management Practices
S. Alex Scott
Henry R. Tiedemann
Erland A. Tillman
Lloyd B. Underwood, *GSA Representative*
Eugene B. Waggoner, *ASCE Representative & Chairman, Subcommittee on Site Investigation*
J. Gavin Warnock, *AUA Representative*
Sheldon P. Wimpfen, *Cochairman,*
Subcommittee on Demand Forecasting
Victor L. Wright, *AEG Representative*
Chris F. Woods, *AGC Representative*

GUESTS (May 3):

Gary S. Brierly, *Vice Chairman, Underground Technology Research Council*
Peter S. Tarkoy

STAFF:

Robert L. Bangert, *Executive Secretary*
Susan V. Heisler, *Assistant Executive Secretary*
Virginia M. Lyman, *Administrative Assistant*

During the morning of May 2, the subcommittees met in individual sessions to review the status of their activities and discuss plans for continuing and new activities. The plenary session convened the afternoon of May 2 and morning of May 3, during which subcommittees' program recommendations were presented and other items of domestic and international business were considered by the committee.

PLENARY SESSION, MAY 2

The Chairman, Norman A. Nadel, opened the meeting at 1:15 p.m., welcoming the participants and initiating introductions.

Mr. Nadel stated that the first agenda item, "Old Business," was generally confined to the minutes of the 1980 meeting in Albuquerque and that corrections and additions would be deferred to the next day's agenda.

Potential Sources of Bias

Robert L. Bangert, Executive Secretary, informed the members that every committee within the NAS-NAE-NRC is required to review annually the status of members with regard to potential sources of bias. He then read the letter from Dr. Handler, President of the NAS, that is printed on the reverse of each bias form and explains relevant Academy policies and procedures. The members were asked to notify the Secretariat of any changes to the information in the form submitted at the time of their appointment to membership.

Reports of the Subcommittees

Subcommittee on Contracting and Management Practices

Winfield O. Salter, Chairman, reported that the subcommittee was continuing to pursue the following tasks: (A) review implementation of the recommendations of USNC/TT reports on contracting practices, settlement of disputes, and management of major projects; (B) facilitate participation in ITA Working Group on Contractual Sharing of Risks; and (C) study owner/engineer/designer contractual arrangements that may prevent or inhibit innovation in design.

For Task A, the subcommittee is still developing a questionnaire and updating the mailing list of owners and selected contractors and engineers. The purpose is to determine what steps toward implementation have been taken and how effective they have been. The current plan is to have the questionnaire ready for review in advance of the fall/winter meeting of the Executive Committee. Mr. Salter noted that representation on the RETC program ("Increasing Productivity Through Better Contractual Arrangements and Management") will help publicize the reports.

For Task B, the subcommittee is reviewing draft position papers as they are received from the ITA Working Group, as well as preparing position papers for its consideration. The paper on ground characterization will be discussed by the Working Group at the ITA annual meeting in Nice.

For Task C, the subcommittee is developing a questionnaire to elicit owners' and engineers' opinions as to what contractor contractual relations have an adverse effect on innovation in design. Recommendations will be considered following review and analysis of responses. It is planned to have the questionnaire ready for review before the Executive Committee meeting.

In the ensuing discussion, Edward J. Cording, USNC/TT Vice Chairman, asked Mr. Salter to elaborate on the plans for Task C. He replied that a position statement accompanied by a questionnaire (as easy to respond to as possible) would be sent engineers who engage in design and to owners who engage engineers for that purpose. The owners list is fairly well established from Task A, but the engineers list is not yet well defined. The purpose of the questionnaire is to identify what is the perception of the problem (if any), what is the magnitude of the problem, and what parts of the problem are significant. Then the subcommittee would recommend what can be done—by education or by recognition, for example—to offset the situation. Mr. Salter stated that the subcommittee might conclude that the problem is not of sufficient magnitude for the USNC/TT to pursue any further, although there is an apparent perception of a definite problem.

Subcommittee on Demand Forecasting

Eugene L. Foster, Cochairman (with Sheldon P. Wimpfen) stated that the draft being handed out to all the assembled members represented the subcommittee's final version of the report on demand forecasting. He then presented the results of the subcommittee meeting in the form of recommendations, as follows:

- Publication of the report, after appropriate editing and review, and announcement of its availability in the *Tunneling Technology Newsletter*.

- Continuation of the subcommittee to pursue the following activities: gather and evaluate comments received on the report after its publication, suggest direction for future efforts of the USNC/TT, provide coordination with other groups working on the subject of demand, and assess the effects on demand of changing needs in energy and defense programs.

A question by J. Gavin Warnock concerning the existence of a mechanism for updating the report elicited several expressions of opinion. Some members favored continuous updating, stating that the momentum could be maintained and procedures expanded with minimal difficulty and that short range forecasts are the most accurate but longer range forecasts lose accuracy with time. Other members preferred updating on a periodic basis, citing the time requirements for collecting sufficient data for meaningful forecasts, the need to sharpen techniques, and the desirability of promoting the idea of forecasting and assessing audience response. Discussion closed with a recommendation by Don U. Deere that the report be updated in three years. Dennis J. Lachel seconded that recommendation and suggested that the subcommittee undertake the task of determining methods to accomplish the task.

Subcommittee on Design Considerations

Drupad B. Desai, Chairman, indicated the necessity of controlling the cost of in-place construction in order for demand forecasts to be useful for transit tunnels. He reported that the subcommittee is concentrating at this time on shallow (less than 200 ft deep) urban tunnels and is addressing issues with respect to type of tunnel and construction methods. Also under consideration will be constructibility of tunnels, innovation, and sharing of risk philosophy (coordinated with the Subcommittee on Contracting and Management Practices). The subcommittee intends to highlight issues that lead to defensive engineering, which is not to be confused with conservative design. Defensive design is not only unnecessary and very costly, but also frequently results in the use of wrong methods.

The subcommittee is planning to prepare an executive-summary type of document that will present guidelines. The summary format has been selected to aid "readability" and make the document more attractive to decision makers. Consideration will also be given to developing a slide set and commentary (in coordination with the Subcommittee on Education and Training).

Subcommittee on Education and Training

Fred H. Kulhawy, Chairman, stated that the 212-slide set with commentary is now available for sale at cost ($50 per set), and that action will soon be forthcoming on the questionnaire for the student intern program. He then reported the status of the following activities: film list, annotated reading list, follow-up to Vail short course, speakers list, and specialty slide sets.

The list of films on tunneling available for loan has been drafted and is being reviewed by the subcommittee. The members plan to contact exhibitors at the RETC for suggestions of additional films. The list, which includes a brief description and ordering information for each film, is planned for publication as a supplement to the December issue of the *Tunneling Technology Newsletter*.

The subcommittee is beginning its effort to update the "Selected, Annotated Reading List on Tunneling," published in 1977. The USNC/TT and subcommittee members were asked to assist by reviewing the list and forwarding briefly annotated citations of important references to Professor Kulhawy. It was noted that Z.T. (Dick) Bieniawski is starting to expand the mining section of the list.

The 1976 Vail (Colorado) short course, held for faculty members interested in teaching tunneling, was considered to be very successful. It is now time to aks whether another short course should be arranged. Accordingly, the subcommittee plans to survey the Vail participants to determine the usefulness of the course, information transfer into the classroom, and increase in instructional capability.

The list of speakers is a new subcommittee endeavor. It is planned to identify individuals—one or two from each of five or six different regions—who would be available at specific times of the year to speak on selected topics. The purpose is to provide speakers to address schools and professional groups interested in tunneling and related fields such as civil and mining engineering. The speakers would be selected to represent not only the USNC/TT but also the industry and their own organizations. It is intended that groups needing speakers would contact the individuals directly; travel costs would be paid but not an honorarium. The subcommittee will revise the list each year at the annual meeting and will provide the selected speakers with sufficient time to prepare presentations on specific topics. It is proposed to publicize the list in the *Newsletter* and other publications.

Development of a specialty (mini) slide set is proposed as a test of audience response to the idea. The mini set will be limited to 30-35 slides, probably a combination of line-drawing and photographic slides. The subject selected is rock bolting—types of bolts and their components, installation procedures, applications, and failures and effects. The set will be completed in time to be presented for review and comment at the 1982 annual meeting.

Subcommittee on Research Needs

Terence G. McCusker, Chairman, reported progress on the case-history study, as follows: the format has been defined and the questions have been formalized. The format minimizes space for questions and maximizes space for comments. Actual data gathering will not begin until the usefulness of the case-history format has been tested on a computer (in conjunction with the site investigation study). Following successful results from the test, the format will be published with a request for information. Howard J. Handewith noted that he has used the format to develop 25 case histories from a list of 105 tunnels constructed with TBM's during the past 20 years.

Mr. McCusker indicated that the project referred to by Mr. Handewith was conducted in response to an effort by the ITA Working Group on Research to develop a report on TBMs in hard rock. A bibliography of about 800 references has been prepared for that report by one of Professor Kulhawy's graduate students. It was suggested jointly by Mr. McCusker and Professor Kulhawy that the USNC/TT consider publication of the bibliography separately from its use in the ITA report. Professor Kulhawy noted that the bibliography contains numerous references to rock mechanics and that the USNC/TT should consider joint publication with the USNC/RM. The suggestion to publish was approved, with or without joint sponsorship by the USNC/RM.

PLENARY SESSION, MAY 3

The Chairman, Norman A. Nadel, convened the session at 9:00 a.m., with a continuation of the agenda item, "Reports of the Subcommittees."

Subcommittee on Site Investigation

Eugene B. Waggoner, Chairman, reported that the delays encountered in beginning the study were the result of extended contract negotations with the Transportation Systems Center (TSC), which is serving as lead agency for the nine agencies funding the study. Commitments on much of the funding have been received, the subcommittee members have been appointed, and tasks to be accomplished at the first meeting have been identified. As soon as the contract is signed, the meeting to begin the study will be scheduled. It is planned to coordinate aspects of the study with the Subcommittee on Research Needs and with committees of the Underground Technology Research Council.

Plans for 7th Annual Meeting of the ITA

Mr. Nadel reported that the annual meeting of the International Tunnelling Association is scheduled to be held in Nice, France, during May 10-14, in conjunction with the conference "Cost Cutting in Tunnelling." Representation for the United States will be provided through the USNC/TT's delegation, as follows: N.A. Nadel, Voting Delegate; E.J. Cording, Nonvoting Delegate; J.K. Lemley, ITA Vice President; M.B. Barker, Animateur, Working Group on Subsurface Planning; W.W. Hakala, Animateur, Working Group on Seismic Effects on Underground Structures; W.O. Salter, Vice Animateur, Working Group on Contractual Sharing of Risks; T.G. McCusker, Member, Working Group on Research; and W. N. Lucke, Member, Working Group on Standardization.

Mr. Nadel presented two motions that are to be proposed by the ITA Executive Council at the annual meeting. These concerned modification of the name of the Association and the status of supporting members. The USNC/TT approved both proposed motions without objection.

Working Group on Seismic Effects on Underground Structures

Mr. Bangert (for William W. Hakala, Animateur) reported that a paper produced at the National Science Foundation would be presented by Dr. Hakala as a basis for Working Group discussion in Nice.

Working Group on Subsurface Planning

Mr. Bangert (for Michael B. Barker, Animateur) reported that various member countries had prepared papers for presentation to the Working Group in Nice. It is possible that the papers will be included in the proceedings of the meeting.

Working Group on Contractual Sharing of Risks

Winfield O. Salter, Vice Animateur, reported that position papers were in progress on the following subjects: mobilization payments, award of contract, ground support, and site characterization. The draft of site characterization will be discussed in Nice, and new subjects for study will be adopted.

Working Group on Research

Terence G. McCusker, the member representing the U.S., reported the status of several projects. He indicated that the report on shield tunneling is expected to be published by the time of the meeting in Nice, that the draft of the report on TBM tunneling in hard rock will be discussed in Nice and the final report will be presented at the 1982 meeting in Brighton, and that the new subject selected for study is water problems in tunneling. For the new project, the co-reporter for North and South America will be Joseph D. Guertin, Jr.

Underground Space Conference and Exposition

J. Gavin Warnock, AUA representative, noted that the conference will be held June 8-10 in Kansas City and that the name had been changed to emphasize the difference between the conference and the RETC. The conference will consist of four main sessions: public policy questions, earth-sheltered residential and commercial buildings, urban planning for underground space use, and deep underground space use.

Coordination with Other Groups

Mr. Nadel noted that the USNC/TT will host a breakfast meeting on Tuesday, May 5, to which representatives of the following groups have been invited: AUA, ASCE, RETC, UTRC, TRB, and USNC/RM. The purpose of the meeting is to continue to develop the coordination of activities, projects, and meetings that was initiated during a similar meeting held at the 1979 RETC in Atlanta.

Plans for the Coming Year

Mr. Nadel announced the officers and new members for terms beginning July 1, as follows:

Don A. Linger, Vice Chairman (to succeed as Chairman, July 1, 1982)
R.M. (Ray) Monti, member from government
Dennis J. Lachel, member from industry
Glen R. Traylor, member from industry
Z.T. (Dick) Bieniawski, member from academia
David Barna, federal agencies representative
Lynn A. Brown, AEG representative

Mr. Nadel stated that he had been pleased to have the opportunity to serve as Chairman and that the energetic and dedicated support of the committee and subcommittee members and Secretariat staff had made his term of office a rewarding experience. He then turned the meeting over to the incoming Chairman, Edward J. Cording.

Professor Cording thanked Mr. Nadel, indicating that moving into the position of Chairman would be relatively easy because Mr. Nadel would be available to provide continuity and counsel as Immediate Past Chairman. He indicated that he was looking forward to working with the new members and to the successful continuation of committee and subcommittee activities.

Plans for the 1982 Annual Meeting

In response to Professor Cording's request for proposed locations (offering field trip possibilities) for the 1982 meeting, the members suggested the following: Las Vegas, in conjunction with the ASCE spring convention; Buffalo or Rochester, New York; Salt Lake City area; Montana (Troy project); and the Spokane (Washington) area. Professor Cording stated that these and other suggestions would be considered by the Executive Committee at its fall/winter meeting.

The meeting was then adjourned.

NATIONAL RESEARCH COUNCIL
COMMISSION ON ENGINEERING AND TECHNICAL SYSTEMS
2101 Constitution Avenue Washington, D.C. 20418

U.S. NATIONAL COMMITTEE
ON TUNNELING TECHNOLOGY

OFFICE LOCATION:
JOSEPH HENRY BUILDING
21ST STREET AND
PENNSYLVANIA AVENUE, N.W.
(202) 334-3136

ELEVENTH ANNUAL MEETING
U.S. NATIONAL COMMITTEE ON TUNNELING TECHNOLOGY

May 13-15, 1982
Park City, Utah

Record of the Meeting

ATTENDEES

COMMITTEE AND SUBCOMMITTEE MEMBERS:

Edward J. Cording, *Chairman*
Don A. Linger, *Vice Chairman*

Michael B. Barker, *Chairman, Subcommittee on Planning and Evaluation of Subsurface Use*
David Barna, *Representative for Federal Agencies*
Z.T. Bieniawski
Lynn A. Brown, *AEG Representative*
Gilbert L. Butler, *Chairman, Subcommittee on Demand Forecasting*
Edward Cross
Drupad B. Desai, *Chairman, Subcommittee on Design Considerations*
Bruno Dietl, *AGC Representative*
Lynne Fitzpatrick
Sam D. Guy (May 13)
William W. Hakala
Fred H. Kulhawy, *Chairman, Subcommittee on Education & Training*
Dennis J. Lachel
Jack K. Lemley (May 14), *ITA Vice President*
John W. Leonard (May 13)
Raymond E. Levitt
Terence G. McCusker, *Chairman, Subcommittee on Research Needs*
Sumner Myers
Boyd C. Paulson (May 13)
John Ramage
Edward J. Ruff
Winfield O. Salter, *Chairman, Subcommittee on Contracting and Management Practices*
Ota Spacek
Harry Sutcliffe
Henry R. Tiedemann

GUESTS:

William Pease, *Consultant, Subcommittee on Site Investigation*
S. Magnus Bergman (May 14), *Representative of International Tunnelling Association*

STAFF:

John E. Wagner, *Executive Secretary*
Susan V. Heisler, *Assistant Executive Secretary*
Virginia M. Lyman, *Administrative Assistant*

During the afternoon of May 13, the subcommittees met in individual sessions to review the status of their activities and discuss plans for new and continuing activities. On May 14th, the group met as a whole in a general session to conduct committee business. The subcommittee chairmen gave their reports, including program recommendations for approval. May 15th was devoted to a scheduled field trip to the Stillwater, Hades, and Rhodes tunnels for those whose schedules permitted.

MAY 14

The chairman, Edward J. Cording, opened the meeting at 8:00 a.m., welcomed the participants, and requested an introduction from each one.

Potential Sources of Bias

John E. Wagner, Executive Secretary, informed the members that each ongoing committee within the NAS-NAE-NRC is required to review annually the status of members with regard to potential sources of bias. He then read the letter from Dr. Press, President of the NAS, that is printed on the reverse of each bias form and explains relevant Academy policies and procedures. Bias, as well as conflict of interest, was identified and discussed by the group.

Subcommittee Reports

Subcommittee on Education and Training

Fred H. Kulhawy, chairman, stated that the subcommittee will begin the project of updating the 1977 reading list, with a greater focus on the state of the art, mining, and newer journals. The list will also provide more complete information on where the reports can be obtained. He then reported the status of ongoing activities as indicated below:

Speakers List: There appears to be a similar activity being sponsored by the UTRC and the subcommittee agreed that any further action should be coordinated with that group. Also, it would be desirable to determine how much interest is generated from the UTRC activity before continuing the subcommittee's effort.

Vail Short Course: A follow-up letter will be sent to all participants to determine the effectiveness to faculty of this short course.

"Mini" Slide Set: This set, which is about half completed, will contain approximately 30 slides. The focus is on rock bolting, and attendees were asked to submit good slides on bolt installation or examples of extremely good or bad installation practices.

Films on Tunneling: This project—a list of more than 60 films available for loan, with a brief description of each—was completed and printed as a supplement in the December 1981 issue of the *Tunneling Technology Newsletter*.

Dr. Kulhawy then expressed two concerns of the subcommittee with respect to its future focus. First, activities to date have been aimed at practitioners in

the field and now the subcommittee desires to gear its program to assisting planners, managers, and supervisors in being more effective. Second, a lack of instructors is seriously affecting the quality and availability of tunneling and underground construction courses in universities, which in turn results in a lack of appropriate courses offered to engineering students. In subcommittee discussion of these concerns, it was suggested that perhaps the training and education aspects should be separated.

A general discussion ensued on these two issues, with several opinions and ideas expressed. Working seminars could be an effective means of reaching the management/supervisory level; if held on a regional basis with local industry personnel assisting in teaching, the seminar could involve all levels of the industry. The faculty-level Vail Short Course was considered a success, but a follow-up was not conducted to determine how effectively it accomplished its purpose. Perhaps the faculty participants could have benefited from further assistance in the way of teaching aids, programs, etc., for courses. It became apparent during discussion that there was some rationale for splitting training and education as the purposes and goals were divergent and the approaches were different, e.g., students also need educating in regard to the general process and business environment in which engineering takes place. However, the final consensus of the group was that the Subcommittee on Education and Training should remain intact for the present. The scope of the subcommittee should be addressed by the Executive Committee to consider a long-range strategy and, at the request of Dr. Kulhawy, to give direction for subcommittee priorities in order not to fragment its activites too much. The thrust of the subcommittee has been more to education than training; if training were to be increasingly emphasized, then either a new subcommittee should be formed or the current subcommittee membership expanded.

Subcommittee on Contracting and Management Practices

Winfield O. Salter, chairman, reported on the status of the three tasks: (A) assessing the level of implementation of the USNC/TT reports on contracting practices, settlement of disputes, and management of major projects; (B) facilitating participation in the ITA Working Group on Contractual Sharing of Risks; and (C) studying contractual relationship with respect to inhibition of design innovation.

For Task A, the subcommittee has settled on a survey which will go to a very broad group in the industry and will cover all three USNC/TT reports. The mailing list is being refined and the survey format is nearly complete. The format will be subjected to a "test case" effort by some of the committee, amended as appropriate, and then mailed. A statistical analysis of the survey results will be prepared and provided to those who respond. It is expected that the results of Task A will form the basis of any further activities recommended by the subcommittee.

During discussion of this task, it was noted that DOT had recently contracted to determine how the three USNC/TT reports plus other DOT publications have been implemented, using Baltimore as a specific example. Results of that effort should be available some time in the late spring of 1983. The subcommittee was given approval to proceed with Task A as planned, but should coordinate activities with the committee secretariat to ensure necessary staff participation.

Task B discussion was deferred until the ITA section of the agenda.

For Task C, the survey format has been developed and is ready for approval to distribute. In the discussion that followed, concern was expressed about the overlap in the surveys being generated for these tasks, from the standpoint of the resulting work load on recipients, subcommittee members, and staff. It was pointed out that Tasks A and C are different, with the Task C survey going only to owner agencies and design consultants. Considering the various factors, it was recommended that Task C be held until the results of Task A are in hand.

Subcommittee on Design Considerations

Drupad B. Desai, chairman, reported that the subcommittee's immediate goal is to produce a short report which develops guidelines dealing with small diameter (6-20 ft) shallow depth (up to 200 ft) tunnels. In conjunction with this effort, the subcommittee members plan to coordinate collection of information with other groups working in the same area. Then the subcommittee would like to undertake a more extensive project to develop guidelines to assist in selection of qualified designers and develop a methodology to follow in arriving at decisions in design and construction projects. Additional items of interest include identifying roles and responsibility and length of involvement of the designer, achieving tolerances required for projects, and basic concepts. Mr. Desai noted that the subcommittee also might act as an "overview" group for critiquing R&D design programs of federal agencies and providing guidance and recommendations. The subcommittee plans to complete development of the proposed program and then present it to the committee for approval.

Subcommittee on Planning and Evaluation of Subsurface Use

Michael B. Barker, chairman, read the general and specific charges for activities (Attachment 1) and reported that the subcommittee felt that it had a two- to three-year task ahead. The method of operation would be case studies, involving a trip to the selected site by the subcommittee members and two to three other persons chosen especially for that study. The subcommittee will examine: urban design aspects (how it works physically); social, economic, and political implications; how the project was put together and managed; and technology utilized for design and construction. After the site visit, the case study will be written by the study participants, with each responsible for five to seven pages of judgemental evaluation of his assigned area. The final report of each case study will be submitted to the USNC/TT when completed.

The overall plan is to conduct one study this next year (Pittsburgh light rail), two the following year, and one more after that. Other projects under consideration include FEMA and civil defense shelters for multiple uses, recycling of tunnels and underground works, Toronto and Montreal use of space, Les Halles project in Paris, BART impact on Market Street, Penn Center in Philadelphia, Houston pedestrian walkways underground, and the skyramp in Minneapolis.

Subcommittee on Research Needs

Terence G. McCusker, chairman, distributed a case-history format that had been prepared with the immediate aim of obtaining a data base to serve as a source of information for researchers. The ultimate goal is to provide for a continuing, permanent process. Plans to coordinate this project with the site investigation study have not materialized; therefore he suggested that the committee's funding agencies be requested to require completion of the format sheet in their contracts for all federally funded projects. The format could also be printed in the *Newsletter* with a request for reader responses. With respect to the effort to determine research needs perceived by industry, a new approach was discussed and decided upon; that is, in order to categorize tunneling problems, to prepare a checklist in a form suitable for an interview. This checklist would be circulated, with a cover letter, to about 50 people in construction and mining and then followed up with a telephone interview. It is hoped that, in 1983, the effort would be completed and the results analyzed to see the relationship between contractor-perceived needs and research activities. In discussion of the case-history format, it was noted that OMB approval would be necessary to incorporate completion of the format as a requirement in contracts for federal funding.

Subcommittee on Demand Forecasting

Gilbert L. Butler, chairman, reported that the basis for subcommittee discussion was the 1981 annual meeting recommendation that their report, *Demand Forecast of Underground Construction and Mining in the United States* (1981), be updated every three years. The subcommittee recommended that its task for the short term be limited to updating the inventory of specific projects (Chapter 2), which could be printed in the *Newsletter;* the entire report would be updated in six years. The subcommittee also recommended that it be placed on inactive status until next year when the update of specific projects would begin (to be published in 1984). It was suggested that the secretariat put the data for Chapter 2 in a maintainable format and check the inventory format against others for compatibility. It was also recommended that additional sources of input (e.g., ITA) be investigated.

Subcommittee on Site Investigation

William Pease, consultant to the subcommittee, reported for the chairman, Eugene B. Waggoner, who was unable to attend. The first meeting of the subcommittee was held in Washington, D.C., in December 1981. At that time the interview document was formulated, identification of tunnel projects was initiated,

and a draft outline for the report was developed. He also noted that the geotechnical engineering firm had been selected to do some of the work and the second consultant, Charles W. Daugherty, had also been selected. The draft interview form was distributed, and the attendees were asked to fill out one for any tunnel project on which they had information or experience. The committee was informed that a letter had been prepared which would be sent to owners, explaining the subcommittee's mission and requesting that documents be sent to provide information for the study.

International Tunnelling Association

1982 ITA Annual Meeting

Dr. Cording announced that the 8th annual ITA meeting would be held in Brighton, England, in conjunction with the Tunnelling '82 symposium, June 7-9, 1982. The delegation will include Edward J. Cording (voting delegate), Don A. Linger (nonvoting delegate), Joseph D. Guertin, William W. Hakala, Terence G. McCusker, Winfield O. Salter, and John E. Wagner.

Dr. Cording requested USNC/TT approval for support of the renomination of Einar Broch, Norway, as member-at-large of the ITA Executive Council. Approval was granted.

Vice President's Report

Jack K. Lemley, ITA Vice President, stated his view that the ITA was now a well-established international organization and is beginning to make a contribution. It has made arrangements with a publishing company to print meeting and working group reports. There are now thirty member countries, with several more countries expressing interest in joining. He also reported the following:

- The 1982 annual meeting is still being planned for Warsaw, but is contingent upon the political situation. The prospective location for the meeting in 1984 is Caracas, Venezuela.

- The ITA and the Swedish national group are working with the Natural Resources Committee of the United Nations organization on the problem of meeting the needs of third world countries. These countries have a need for engineering expertise and projects but do not have the financial capability for development.

- It is expected that a new class of membership will be approved at the 1982 annual meeting in Brighton. It would permit individuals and companies to become affiliated with ITA, but without voting rights.

ITA Elections

Dr. Cording informed the committee that the position of ITA President would be open for election in 1983. It is the feeling of many within the ITA that it is time for the U.S. to undertake the presidency and that Jack Lemley has served well and would be a good candidate. Dr. Cording noted that he had discussed this with the Swedish and Norwegian delegations, which indicated their support of Mr. Lemley's candidacy.

Dr. Cording proposed the nomination of Mr. Lemley for ITA president; Michael Barker proposed that the nomination be by acclamation. David Barna seconded this, and the nomination was so approved.

United Nations Membership Application

Mr. Magnus Bergman, USNC/TT guest, provided information on the background of the application and current status. He acknowledged interest in developing "a market for ITA" and that he is serving as a one-man committee to develop relations between ITA and the UN. The UN became interested in the utilization of underground space at Rockstore '80, which was sponsored by the Swedish government. However, because involvement relating to interests of the UN should have an international basis, the ITA seemed the proper organization to deal with the concerns of the UN Committee on Natural Resources, as expressed in a UN Resolution: "... utilization of subsurface space with particular reference to the potential benefits to the developing countries..." with respect to energy, water, and minerals. Thus, they have identified underground space as a "natural resource." The ITA has recommended that it carry out any program the UN committee adopts in this area. Mr. Bergman distributed the draft report that is being submitted to the UN Division for Natural Resources and Energy. The "Conclusions and Recommendations" section of that report is included as Attachment 2.

Working Group on Subsurface Planning

Michael B. Barker, Animateur, reported that eight to ten papers are expected for the working group meeting in Brighton. He will be unable to attend and the vice animateur will chair the meeting. Mr. Barker sees a close tie-in between the activities of this group and his USNC/TT subcommittee, as well as a good interface with the new ITA Working Group on Cost/Benefits of Underground Urban Public Transportation.

Working Group on Contractual Sharing of Risk

Winfield O. Salter, Vice Animateur, reported that the working group has produced discrete recommendations on six subjects; the recommendations are basically "a statement of philosophy." Papers in the process of being prepared deal with award of contracts, performance bonds, measurement problems, insurance, and role of the engineer. There are three papers drafted by the U.S. which are being presented for approval to publish: ground support, site characterization, and mobilization payments. The interface between the USNC/TT and the ITA working group is effected by the distribution of any working group material to the subcommittee for review; then Mr. Salter responds on behalf of the U.S.

Working Group on Seismic Effects

William W. Hakala, Animateur, noted that the purpose of the working group is to examine the conditions under which seismic effects may be crucial to the design of underground construction. The group's objective is to provide guidance to designers of underground structures which may be subject to seismic effects

at some time during the life of the structure. Plans to accomplish this include the following means: develop a bibliography, compile case histories of damage or lack of it, write a state of the art paper, develop an outline for an aseismic design manual, list research needs, and then disseminate the information to ITA member nations. At the last ITA meeting in Nice, it was decided to emphasize instrumentation in structures. At the Brighton meeting the working group expects to comment on a report by John Blume and review drafts of an outline for the aseismic design manual.

Working Group on Research

Terence G. McCusker, the member representing the U.S., stated that the report on TBM tunneling in hard rock is now in preparation. At the Brighton meeting this year, case histories on water problems in tunneling will be considered; Mr. Joseph D. Guertin will be presenting a paper for the U.S. The working group also plans to discuss the direction of its effort for the next year.

USNC/TT Field Trip

Mr. Glen R. Traylor was requested to give a brief description of what was to be seen on the field trip the next day. Traylor Bros., Inc., is the construction contractor for the Stillwater Tunnel, and the committee is grateful to Mr. Traylor for his cooperation and efforts in arranging the field trip to the Hades, Rhodes, and Stillwater tunnels.

Deep Basing Report

Prepublication copies of *Volume 1, Evaluation of Technical Issues,* of *Design and Construction of Deep Underground Basing Facilities for Strategic Missiles* were distributed. It was announced that the two-volume report would be off the press and available during the next two weeks. Dr. Cording explained the review process that had been conducted for the report in accordance with NAS policies.

New Projects

Proposal for Advisory Board to DNA

Dr. Wagner reported that Dr. Don A. Linger, Defense Nuclear Agency, had suggested the possibility of forming an oversight committee to review and assess the geotechnical and construction feasibility aspects of the Air Force weapons system plan that would incorporate underground base development and egress—construction, planning, and management. Dr. Wagner then turned the meeting over to Dr. Linger, who first briefed the group on the observations of the Air Force with respect to the deep basing report. He indicated his ideas of how the oversight committee might function from an "arts and sciences" or "technical audit" point of view. A general discussion ensued with respect to potential for conflict of interest, the time that might be required for the activity, and

operational aspects of such a committee. It was agreed that should the Air Force or DNA formally request the activity, the USNC/TT would be responsive with one such meeting but that further requests would be subject to approval by the committee. It was noted that Dr. Linger, as upcoming chairman of the committee, would not preside at any such meetings.

Plans for the Coming Year

Dr. Cording thanked the committee and subcommittee members for their interest and considerable efforts, and then turned the meeting over to Dr. Linger, the incoming chairman. Dr. Linger complemented Dr. Cording on the very successfull accomplishments of the committee under his leadership and indicated plans to rely on his guidance. Dr. Linger noted his intent to continue supporting and promoting the group's momentum and his wish to develop synergism between the subcommittees. In these and other important tasks, he anticipated being ably assisted by Dennis J. Lachel, the incoming vice chairman.

It was proposed and agreed that the 1983 annual meeting would be held in conjunction with the RETC in Chicago in June 1983.

The meeting was adjourned at 4:10 p.m.

THE SUBCOMMITTEE ON PLANNING AND EVALUATION

USNCTT

GENERAL CHARGE: Under the guidance of the parent Committee (USNCTT), the Subcommittee will analyze the social, economic and environmental implications of major uses of the subsurface. The ultimate purpose of the analysis will be to inform decision-makers who influence the use of subsurface of the benefits to be gained by the effective use of the subsurface. While the Subcommittee will be able to provide some advice to decision-makers directly, it must stimulate indepth analysis and research to achieve its purpose. The advantages and disadvantages of specific uses of the subsurface and the related heavy construction technology will be evaluated. Researchable projects will be defined so that public and private funding sources can be attracted to studying the benefits of a better planned and more complete use of the subsurface.

SPECIFIC CHARGE: The specific charge to the Subcommittee for its first two years of operation will be to study the use of the subsurface for urban mobility, common duct, and energy systems. The Subcommittee will use the case study technique to assemble information and draw conclusions.

Attachment 2

DRAFT

Preliminary Report

THE UTILIZATION OF SUBSURFACE SPACE AND ITS POTENTIAL IN DEVELOPING COUNTRIES

Prepared for the United Nations Division
for Natural Resources and Energy.

May 5, 1982

ITASCA
Consulting Group, Inc.

to encourage large underground projects without outside financial support. Second, the usual methods of justifying expenditures for public works are hampered where the subsurface is concerned, for lack of locally applicable technical and resource information and convincing cost/benefit analyses.

When considering projects in developing nations, international lending agencies and other international financing institutions need detailed cost studies to determine what kind of loan will be required to ensure completion. When these data are not available, the tendency will be to discourage such projects. In this regard, projects which develop subsurface space are at a definite disadvantage, especially if they are somewhat innovative in nature. Conservative solutions to space problems and time-tested methods of construction will be considered lower in risk, and the lack of hard local experience in a given area of construction will make it difficult to convince lenders otherwise.

The need for comprehensive cost/benefit models, then, becomes increasingly apparent, especially when reductions in costs can be projected from the incorporation of locally familiar construction techniques and locally available materials. If the costs and long-range benefits of utilizing subsurface space can be shown to be favorable, then lenders will be more apt to join planners in encouraging the development of this resource.

4. Conclusions and Recommendations

The discussion on the preceding pages has presented the basic concepts in utilizing subsurface space as a natural resource, outlined the principal uses of this resource from the viewpoint of careful development and conservation, and pointed out the importance of planning in achieving these goals. It is possible to draw several general conclusions from this discussion.

4.1. Conclusions

1. The assumption that the surface of the earth must accommodate all vital human activities and support systems places an unnecessary constraint on development. Subsurface space is a valuable natural resource which can be utilized to great advantage in both developed and developing countries. Particularly in densely populated urban areas, the subsurface can provide an answer to the problem of growth without presenting the usual spectacle of congestion and overcrowding. Many traditional and innovative uses of subsurface

space exist, but optimal use in a particular area will be determined by investigation and planning.

2. Much information on the use of subsurface space is presently available. Engineers, planners, and government decision-makers should be made aware of the potential which the subsurface holds for development, and the public should be informed of the advantages of various underground solutions to the problems of urban growth.

3. An even greater range of uses for subsurface space remains to be identified. The sharing of techniques in subsurface development on an international level would initiate a program of technology exchange that would benefit both developed and developing countries, and further research could be planned in areas where it is required. Special attention should be paid to adapting technological solutions from developed countries to the special conditions in developing countries.

4. Subsurface development should be incorporated in long-range planning wherever surface congestion is a problem in urban development. The costs of subsurface projects should be weighed against the long-term benefits of these projects.

5. Communication among the countries developing subsurface space should be coordinated in the early stages of planning so that experience can be exchanged. An international ''clearing-house'' is needed to stimulate activities and exchange of information on the utilization of subsurface space.

4.2. Recommendations

The following recommendations for the development and coordination of subsurface space use are meant to focus the discussion of this resource around several issues and provide the initiative for drawing up a list of concrete proposals in the future.

1. Consideration of the subsurface should be formally required as part of the projects undertaken by international planning and financing agencies.

2. The United Nations Committee on Natural Resources should commission an international body with the task of overseeing the collection and dissemination of information on the economic and technological aspects of subsurface development. This body should coordinate the

utilization of subsurface space through the international exchange of information and should report its findings to the international agencies.

3. The international body should undertake the following projects with a view towards encouraging the wise use of subsurface space:

   - collect information and draw up reports on subsurface space use;
   - serve as an international clearing-house for subsurface space development;
   - produce a resource guide to subsurface space and case-studies on the most widely applied techniques of subsurface development;
   - identify the most promising areas of underground research and development, especially in the adaptation of technology to the conditions of developing nations;
   - construct cost/benefit models for analysis of subsurface projects which can aid planners and decision-makers during feasibility studies.

4. The international body should address directly the matter of planning subsurface space use and should construct models for planning the development of this resource.

4.3. Proposal for implementation

Recognizing that the development of an international vehicle for coordinating the utilization of subsurface space should not require special funding or the establishment of a new organization, existing agencies and organizations should cooperate to sponsor the work.

The most practical proposal for this purpose is the formation of a working relationship between the United Nations COMMITTEE ON NATURAL RESOURCES and the INTERNATIONAL TUNNELLING ASSOCIATION.

The International Tunnelling Association (ITA--in French, A.I.T.E.S., Association Internationale des Travaux en Souterrain) is an organization established in 1974, with the objective of sharing experience in the use of subsurface space and furthering its development, particularly in the field

of technology. The Association is composed of representatives from national bodies in each member nation. These bodies are central organizations dealing with the coordination and development of subsurface space. Membership is open to all countries and now stands at 34. The Association meets at least once a year and produces reports and documentation of progress in the use of subsurface space, with committee reports in special areas such as technology, planning, and the contractual sharing of risk. The ITA is currently under consideration for Non-Governmental Organization status with the United Nations.

One difficulty which the ITA has experienced in carrying out its program is gaining the attention of planners, policymakers, and administrators in its member nations. The ITA has been searching for means to form stronger ties with these groups and individuals to ensure the timely, planned development of subsurface space. The United Nations Committee on Natural Resources could help by providing the necessary link between the advocates of subsurface space and national developers.

Because the Committee on Natural Resources meets every second year, it offers a reasonable opportunity for establishing and maintaining contact with policymakers in the field of resource development. Subsurface space will be dealt with as a separate topic at the 1983 meeting. Since the Committee will prepare the agenda and the documentation for future meetings, a commitment to the discussion of subsurface space would ensure its proper consideration among other topics.

This working arrangement holds definite advantages for both groups. Through its Secretariat, the United Nations Division for Natural Resources and Energy, the Committee on Natural Resources could assign the work of compiling reports to the International Tunnelling Association before each meeting, and could make recommendations for research and development programs afterwards. In this way, the Committee would have a firm hand in carrying out its commitment to the utilization of subsurface space, especially in developing countries where there is little money for research projects for adapting technology to local resources. The Division for Natural Resources and Energy could then coordinate these reports with the work of other United Nations organizations, such as the Food and Agricultural Organization.

In turn, the International Tunnelling Association would be able to partially fill the gap that now exists between its member representatives and the planners, policymakers, and administrators in its member nations. Its work could be directed towards the real needs of its member nations. Since any nation would be welcomed as a member, the Association would be able to expand its work to cover a wider range of necessary projects.

This interaction would be of mutual benefit to both organizations, for the exchange of experience and the adaptation of technological solutions to specific problems would become a reality.

4.4. Summary of conclusions and recommendations

Conclusions

1. Subsurface space is a valuable resource which can be utilized to the advantage of both developed and developing countries.

2. Engineers, planners, government decision-makers, and the public should be made aware of the potential which the subsurface holds for future development.

3. A subsurface technological exchange at the international level, with special emphasis on the needs of developing countries, should be established.

4. Subsurface development should be incorporated into long-range planning on the national and regional levels.

5. An international clearing-house for information on the use of subsurface space is needed.

Recommendations

1. The use of subsurface space should be formally considered in the projects of international planning and financing agencies.

2. An international body should be designated to oversee the dissemination of information on subsurface space use.

3. This body should gather information on subsurface use; serve as an international clearing-house for subsurface development; produce case studies and research reports on underground projects; make recommendations for innovative technology programs; and draw up cost/benefit models for feasibility studies.

4. This body should also address directly the matter of planning the utilization of subsurface space.

Proposal for Implementation

The United Nations Committee on Natural Resources should recommend that the International Tunnelling Association carry out this program and report regularly to the Committee at its scheduled meetings.

Appendix D

PARTICIPANTS
WORKSHOP ON TECHNOLOGY FOR THE DESIGN AND CONSTRUCTION OF DEEP UNDERGROUND DEFENSE FACILITIES

MODERATOR

Edward J. Cording, *Chairman, USNC/TT*
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Urbana, Illinois

WORKING GROUP ON SITING

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Arthur G. Strassburger
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Henry R. Tiedemann
Jacobs Associates
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WORKING GROUP ON THE USE OF EXISTING UNDERGROUND SPACE

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Luray, Virginia

David Barna
Mineral Resources Technology Div.
U.S. Bureau of Mines
Washington, D.C.

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Earthquake Hazards Mitigation Section
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Ithaca, New York

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University Park, Pennsylvania

Eugene L. Foster
Underground Technology Develop-
ment Corporation
Alexandria, Virginia

Thomas J. O'Neil
Amoco Minerals Company
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Richard J. Robbins
The Robbins Company
Kent, Washington

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Thomas Crimmins Contracting Company
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*William C. Shepherd, Sr. (deceased)
Consultant
Hilton Head Island, South Carolina

*deceased (1982)

WORKING GROUP ON MANAGEMENT, CONTRACTING, COSTING, AND PERSONNEL

Winfield O. Salter, *Chairman*
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Division of Occupational Safety and Health
State of California
San Francisco, California

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Local Union 147
Compressed Air and Free Air Tunnel Workers Union
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Edward L. Waddell, Jr.
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Chris F. Woods
Al Johnson Construction Company
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Susan V. Heisler, *Assistant Executive Secretary,* USNC/TT
Virginia M. Lyman, *Administrative Assistant,* USNC/TT
Duncan M. Brown, *Commission Editor and Staff Officer*

SEVENTH ANNUAL MEETING OF THE INTERNATIONAL TUNNELLING ASSOCIATION

Nice France May 10 - 14, 1981

ATTENDANCE

U.S. Delegation (NRC-USNC/TT)	Norman A. Nadel, Voting Delegate
	Edward J. Cording, Nonvoting Delegate
	Michael B. Barker, Animateur, Working Group on Subsurface Planning
	William W. Hakala, Animateur, Working Group on Seismic Effects on Underground Structures
	William N. Lucke, Member, Working Group on Standardization
	Terence G. McCusker, Member, Working Group on Research
	Winfield O. Salter, Vice Animateur, Working Group on Contractual Sharing of Risk
ITA Officer from U.S.	Jack K. Lemley, Vice President, ITA and Member of ITA Executive Council
Number of Countries Represented	27 (21 of 30 member countries and 6 non-member countries)
International Organizations Represented	Permanent International Association of Road Congresses (PIARC)
	International Association of Engineering Geology (IAEG)
	International Commission of Irrigation and Drainage (ICID)
	International Society of Soil Mechanics and Foundation Engineering (ISSMFE)

ADMINISTRATIVE

New Member Countries	New member countries are Brazil, Iraq, Republic of South Korea, and Venezuela
Motions Considered	Two motions were considered by the General Assembly: first, to amend the Association's name to International Tunnelling and Subsurface Use Association; second, to extend Association membership to individual and corporate supporting members. Although both motions were favorably received, neither received the required 80 percent majority vote for adoption. Both will be considered again at a later date.

Future Meeting	8th Annual Meeting in Brighton, England, June 6-9, 1982 in conjunction with *Tunnelling 1982*, a technical meeting organized by the Institution of Mining and Metallurgy of the United Kingdom.
Detailed Report	A detailed summary of the meeting, including the main discussions of the General Assembly, detailed reports of the activities of the working groups, and reports of round table discussion of subsurface use in developing countries and the open session on the economic aspects of underground works will be published at a later date in Volume 2, number 1 of the ITA Journal.
Application to the United Nations	The Executive Council is in the process of discussing with the United Nations the application by the ITA for recognition by the UN as a nongovernmental international organization. It is thought that such recognition may enhance the standing and prestige of the ITA.
Financial Report	The ITA financial report for 1980 was presented and approved by the General Assembly. A copy is appended to this report.

TECHNICAL ACTIVITIES

The working activities were carried out through a round table discussion of subsurface use in developing countries, an open session on the economic aspects of underground works, and through meetings of nine working groups. A short summary of these activities follows:

Round Table Discussion, Subsurface Use in Developing Countries	Representatives of Algeria, Belgium, France, the Federal Republic of Germany, Iceland, India, Japan, The Netherlands, South Africa, Sweden, the United Kingdom, and the United States held a fruitful exchange of information on needs and present possibilities that will help define the ITA role in this field.
Open Session, Economic Aspects of Subsurface Use	Approximately 300 persons participated in this discussion. The criteria for cost benefit analyses and methods of assessing nonmonetary benefits were discussed. Recent studies described included: subsurface storage in hard rock (Norway), construction of underground railways (Germany), and underground commercial centers (Japan).
Working Group on Standardization	The working group's four-language glossary of tunneling terms was published in Volume 1, Number 2 of the ITA Journal. A second glossary on the traditional excavation process is under preparation. The working group has also prepared a synthesis on standardization of tunnel profiles.

Working Group on Research	The working group's report on shield tunneling will be published in Volume 1, Number 3 of the ITA Journal. The working group is investigating the use of tunnel boring machines and will present a report on this subject at the 1982 annual meeting. The working group is also looking at the problems caused by water during construction.
Working Group on Contractual Sharing of Risk	The group adopted recommendations on ground support and mobilization payments, and prepared recommendations on performance bonds and award of contracts. It continued to work on insurance, measurement of work, ground characterization, and the role of the engineer in construction.
Working Group on Catalogue of Works in Progress	The group reviewed the lists of works prepared by 16 countries. The group recommended a change of title to Catalogue of Tunnels.
Working Group on Maintenance and Repair of Underground Structures	The group intends to publish a general report with case history studies. At this meeting it examined reports from France, Japan, and the U.K.
Working Group on Health and Safety in Work	The group adopted its new name (as shown on the left). Several international safety signs have been designed. Work on recommendations continues.

INTERNATIONAL SYMPOSIUM

Cost Cutting in Tunnelling

The symposium, organized by the French Tunnelling Association (AFTES) had as its major themes:

- o Starting and running an underground project
- o Legal obligations, contracts: legislative and prescribed policies in tunnelling scope
- o Specific standards and technical specifications
- o Technical realization and research in execution of cost-saving methods.

In addition, papers on case studies were presented and a special session for showing technical films was held. The symposium was followed by six technical visits to underground construction projects.

CONCLUSIONS

As reported last year, U.S. participation in ITA activities continues to be worthwhile. While the U.S. has made and continues to make contributions to the Association's activities, a real benefit is realized by the opportunity to keep abreast of tunneling activities in other countries. The information gained will help the U.S. to adopt new technology developed elsewhere.

For these reasons, U.S. participation in ITA activities and support of the ITA should continue at approximately the present level.

OAITES
ITA

BILAN CUMULE AU 31.12.80
CUMULATED BALANCE ON DEC. 31st, 1980

RECETTES/RETURNS		
. Cotisations années antérieures Previous years subscriptions	8.197,00	
. Cotisations année en cours Current year subscriptions	74.720,60	
	82.917,60	82.917,60
Ventes des publications/Sales of the publications		5.736,38
Divers (recettes exceptionnelles) Miscellaneous (exceptional returns)		8.055,76
TOTAL RECETTES/TOTAL RETURNS		96.709,74
DEPENSES/EXPENDITURES		
Fonctionnement secrétariat/Secretariat operations		58.973,76
Frais d'édition des publications Publication costs		23.614,08
Frais divers/Miscellaneous expenditures		778,42
TOTAL DEPENSES/TOTAL EXPENDITURES		83.366,26
BILAN CUMULE/CUMULATED BALANCE		
Résultat 1980/Result 1980		13.343,48
Résultat au 31.12.79 Result on Dec. 31st,1979		23.659,14
Résultat cumulé au 31.12.80 Cumulated result on Dec. 31st, 80		37.002,62

AITES
ITA

BUDGET 1980 - COMPARAISON AVEC LES PREVISIONS
SITUATION AU 31.12.80

BUDGET 1980 - COMPARISON WITH THE ESTIMATES
BALANCE ON 12.31.80

LIBELLES/ TITLES		Prévu Estimated	Effectif Real
RECETTES / RETURNS			
- Cotisations 1980/Subscriptions 1980		87.500,00	74.720,60
- Vente des publications/ Sales of publications		2.500,00	5.736,38
- Divers (Don Morgan Grampian pour aide de l'AITES à l'établissement du Tunnelling Directory 80) Miscellaneous (Morgan Grampian donation for the ITA assistance to the writing of the Tunnelling Directory 80)		5.000,00	4.747,11
TOTAL/ TOTAL		95.000,00	85.204,09
DEPENSES/ EXPENDITURES			
- Fonctionnement du secretariat Secretariat operations		50.000,00	47.113,17
- Edition des publications Publication costs		40.000,00	23.614,08
- Fonctionnement du bureau et des G.T. (déplacements) Operations of the E.C. and the W.G (travels)		25.000,00	11.859,59
- Divers / Miscellaneous		-	778,42
TOTAL/ TOTAL		115.000,00	83.366,26
RESULTAT PROPRE A L'ANNEE 1980 RESULTS SPECIFIC TO 1980		- 20.000,00	+ 1.837,83
RECETTES AFFERENTES AUX ANNEES ANTERIEURES : RETURNS CONCERNING PREVIOUS YEARS :			
Cotisations/Subscriptions	8.197,00		
Dettes diverses / Various debts	3.308,65		
	11.505,65		+ 11.505,65
RESULTAT FINAL 1980/ FINAL RESULT 80			13.343,48

AITES
ITA

EXERCICE 1981 - PREVISION DE BUDGET
1981 FINANCIAL YEAR - ESTIMATED BUDGET

RECETTES/REVENUES	
a) 27 cotisations à 4000 F 27 subscriptions at 4000 F	108.000,00
b) Vente des publications sale of publications	2.000,00
	110.000,00
DEPENSES/EXPENDITURES	
a) Organisation des réunions organization of meetings	
b) Publications/Publications	
c) Secrétariat/Secretariat	
- honoraires comptable/book-keeping honoraries	3.000,00
- salaires, poste, photocopie, telex salaries, mail, xeroxing, telex	50.000,00
- déplacements/travels	32.000,00
- téléphone/phone	5.000,00
	90.000,00

Ce projet de budget tient compte d'un relèvement du montant de la cotisation d'environ 14 %, ce qui correspond à une augmentation annuelle d'environ 7 %

This draft budget considers an increase in subscription amount of about 14 %, which corresponds to an annual increase of about 7 %.

AITES
ITA

EXERCICE 1982 - PREVISION DE BUDGET
1982 FINANCIAL YEAR - ESTIMATED BUDGET

1.1.1981

RECETTES/REVENUES	
a) 30 cotisations à 4000 F 30 subscriptions at 4000 F	120.000,00
membres bienfaiteurs p.m supporting members f.m	
	120.000,00
DEPENSES/EXPENDITURES	
a) Organisation des réunions Organization of meetings	-
b) Publications/Publications	-
c) Secrétariat/Secretariat	
- honoraires comptable/Book-keeping honoraries	3.500,00
- salaires, poste, photocopie, telex salaries, mail, xeroxing, telex	56.000,00
- déplacements/travels	35.000,00
- téléphone/phone	5.500,00
	100.000,00

AITES
ITA

BILAN DE L'ASSOCIATION ET PROJET DE BUDGET

FINANCIAL STATUS & PREVISION

Libellés/*Wordings*	1974	1975	1976	1977	1978	1979	1980	Prévisions Forecasting 1981	1982
Recettes/*Revenues*									
- cotisations/*subscriptions*	34976.52	51996.47	57019.22	67210.83	63000.00	76553	82917.60	108.000	120.000
- vente des publications/ *sale of publications*	-	-	-	5380.00	4300.00	3274.32	5736.38	2.000	
- divers/*miscellaneous*	-	19398.67	21388.17	-	-	-	8055.76		
Total/*Total*	34976.52	71395.14	70407.39	72590.83	67300.00	79827.32	96709.74	110.000	120.000
Dépenses/*Expenditures*									
- fonctionnement du Secrétariat *operation of Secretariat*	8904.85	31618.54	25564.82	31308.54	35054.78	45350.63	58973.76	90.000	100.000
- édition des publications/ *publishing of publications*	-	22212.00	19200.00	16500.00	7609.50	21364.96	23614.08		
- fonctionnement du Bureau et des GT *operation of ExC and WG*	-	6130.33	12447.50	1314.35	16144.71	41074.82	-		
- divers/*miscellaneous*	-	18744.15	17038.33	-	-	2375.25	778.42		
Total/*Total*	8904.85	78705.02	74250.65	49122.89	58808.99	110 965.66	83366.26	90.000	100.000
Bilan (perte ou bénéfice) *Balance (profit or loss)*	+26071.67	-7309.88	+4156.74	+23467.94	+8411.01	-31138.34	+13343.48	+20.000	+20.000
Bilan cumulé/ *Cumulative Balance*	+26071.67	+18761.79	+22918.53	+46306.47	+54797.48	+23659.14	+37002.62		

YEAR 1980

CASE SITUATION ON DEC. 31st, 80

TITLES			AMOUNTS
RETURNS			
Cash at the BNP Bank on 12.31.79			29.848,90
Subscriptions of previous years paid in 1980			8.197,00
Subscriptions for the current year			74.720,60
Sales of publications			5.736,38
EXCEPTIONAL RETURNS			
DAUB Debt for 1979	1.097,72		
IVA Debt for 1979	2.210,93		
Morgan Grampian donation (for the ITA assistance to the writing of the Tunnelling Directory 80)	4.747,11		
	8.055,76		8.055,76
	TOTAL RETURNS		126.558,64
EXPENDITURES			
CETU service charge - 4th term 1979			6.189,76
Secretariat operations : CETU 1980	44.263,67		
Travels	11.859,59		
Phone	850,50		
Book holding	2.000,00		
	58.973,76		58.973,76
Publication costs			23.614,08
Miscellaneous expenditures			778,42
	TOTAL EXPENDITURES		89.556,02
REMARKS :			
Cash appearing on BNP slip of 12.31.80	58.271,74		
Planned expenditures (CETU service charge - 2nd semester)	- 21.269,12		
	37.002,62	real cash balance on 12.31.80	37.002,62

Appendix F

EIGHTH ANNUAL MEETING
OF THE
INTERNATIONAL TUNNELING ASSOCIATION

Brighton, England June 6-9, 1982

ATTENDANCE

U.S. Delegation (NRC-USNC/TT)	Edward J. Cording, Voting Delegate
	Joseph D. Guertin, Jr., Co-reporter for North America, Working Group on Research
	William W. Hakala, Animateur, Working Group on Seismic Effects on Underground Structures
	Terence G. McCusker, Member, Working Group on Research
	Winfield O. Salter, Vice Animateur, Working Group on Contractual Sharing of Risk
	John E. Wagner, Executive Secretary USNC/TT and Nonvoting Delegate
Number of Countries Represented	30 (25 of 32 member countries and 5 non-member countries)

ADMINISTRATIVE

New Member Countries	New countries accepted for membership: Czechoslovakia and Mexico
Motions Considered	The General Assembly favorably considered a proposal from the Hungarian representative to accept Hungary as a new member country upon receipt of formal and acceptable application for membership and payment of appropriate membership fees.
	The General Assembly unanimously authorized member countries to have affiliate members. Each nation must develop its own procedures for accepting affiliate members (see Attachment 1).
Election of Officers	Dr. Einar Broch (Norway) was reelected as an Additional Member of the Executive Council for a period of 3 years (see Attachment 2). Dr. Victor Roisin (Belgium) was reappointed Secretary General for a period of 3 years.

Nominating Committee	The nominating committee consisting of A. Muir Wood, H.C. Fischer, and G. Girnau was reappointed.
Future Meetings	The 9th Annual Meeting will be held in Warsaw, Poland, May 15-18, 1983, in conjunction with an international symposium "Underground Works-Man-Environment" organized by the Polish Federation of Engineering Associations (NOT) (see Attachment 3). The General Assembly approved continuation of planning for the 1983 meeting in Warsaw after assurances by the Polish delegate that all ITA delegates would be able to obtain visas for entry into Poland. ITA was informed that all delegates, even from countries not maintaining diplomatic relations with Poland, would be authorized entry. Processing of visa applications may require as much as 3 months, however. Venezuela was approved to organize the 1984 ITA meeting. The theme will be "Tunnelling for Hydroelectric Power Schemes." Informal invitations have been extended from Austria, Czechoslovakia and Spain for the 1985 ITA meeting and from Italy in 1986 and Iraq in 1987.
Detailed Report	A detailed summary of the 8th Annual Meeting, including the main discussions of the General Assembly, detailed reports of the activities of the working groups, and reports on the open session on "The Subsurface Contributions to Energy Savings," will be published at a later date in Volume 3, Number 1 of the ITA journal, *Advances in Tunnelling Technology and Subsurface Use*.
Application to the United Nations	Magnus Bergman reported to the General Assembly on the progress made in processing the ITA application for recognition as a Non-Governmental Organization (NGO).
Financial Report	The ITA financial report for 1981 and the 1983 budget were presented by the Secretary General (see Attachment 4).

TECHNICAL ACTIVITIES

The technical activities of the ITA consisted of working group meetings and a joint ITA-Tunnelling '82 session.

Open Session, the Subsurface: Contributions to Energy Savings	Approximately 200 persons attended this session in which 5 papers were presented related to energy savings through the use of subsurface facilities (see Attachment 5). Dr. Sten Bjurstrom presented a substitute keynote paper due to the absence of Dr. Stauffer, who could not attend because of illness; however, his paper will be published as a part of the report on the open session. During the next year the Working Group on Subsurface Planning will devote its efforts to energy savings aspects of planning.

Working Group Reports:

Standardization	R. Fechtig (Switzerland). Representatives of 6 countries participated. A second draft of the Glossary of Terms for Excavation has been completed in German. It will be translated into Japanese and English and be published. Possible translation into Italian and Spanish is under consideration. A proposal is being prepared to standardize circular tunnels in a range of diameters for the fabrication of segmented tunnel liners for soft ground tunneling. Further work will address standardization of electrical and other support facilities. The new animateur will be M. Hurpin (France).
Research	P. Kieft (Netherlands). Twenty-three persons for 14 countries participated. Two subjects were considered: tunnel boring machines and water problems. The General Reporter on tunnel boring machines will circulate letters to coordinate working group positions on techniques, raise borers and characterization. Eight papers presenting case histories of water problems were proposed in response to guidance received in Nice. The papers addressed groundwater, waterproofing, and water inflow during construction. A report for 1983 will be prepared. J.F. Bougard (France) was nominated to be Animateur, replacing Mr. Kieft. T.G. McCusker (USA) was nominated to be Vice Animateur.
Contractual Sharing of Risk	W.O. Salter (USA). Seven member countries attended, represented by 10 participants. Work on the development of two of the six propositions currently under study reached the final stage and were submitted to the General Assembly for ratification and publication. The two subjects were *IX—Ground Characterization* and *X—Tendering and Award of Contracts*. The delegate from Iraq took exception to one of the recommendations put forth in the latter proposition and the matter was subsequently resolved by the Animateur. Progress was made on the propositions dealing with "Measruement Problems," "Performance Bonds," and "Insurance," with new assignments made to South Africa, Belgium and USA, respectively, toward final drafts for circulation to

all member nations. The background papers on "Performance Bonds" (Belgium) and "Insurance" (France) were recommended and approved for publication as separate documents. The UK recognized it was committeed to a first draft of the proposition on "Role of the Engineer." The working group discussed the level of success in implementation of the ITA's past recommendations toward more equitable sharing of risk, with the conclusion that much progress has been made. The future activity of the group was also discussed, beyond completion of committeed study subjects. Views of all group members will be invited concerning new areas of need for attention or, alternatively, disbanding the group.

Subsurface Planning

K. Pronk (Netherlands). Sixteen people from 8 of the 11 member countries and several nonmember nations participated. Presentations concerned: cost benefit analysis of underground public transport (France), use of the underground in complex urban systems (Japan), inventory for the future use of the subsurface in the Netherlands (Netherlands), the use of underground caverns for storage and disposal (UK), the use of the subsurface in smaller cities (Germany), the Baghdad metro (Iraq) and imaginative future uses of the subsurface throughout the world (Sweden). The working group felt that its activity resulted in the birth of the new working group on the benefits and costs of urban rail passengers transport systems.

The working group decided that next year's presentation will, as far as possible, be concentrated on the subject "The use that can be made of the subsurface with respect to energy."

E. Cording briefly described the plans for the new USNC/TT Subcommittee on Planning, under the chairmanship of M. Barker.

Health and Safety in Work

R. Krige (South Africa). Seven of the 11 member countries participated. Sweden has dropped out and Italy joined the working group. The draft document "Guidelines for Good Tunnelling Practice" was discussed extensively and alterations made where necessary. The up-dated document consisting of 6 sections will be circulated before September for final comments by members who attended the meeting of the working group. It is anticipated that the final document will then be presented to the ITA Secretariat early in 1983 for publication. The working group has decided that further guidelines on the use of compressed air and electrical installations will be developed as part of the future program. Further discussions on dust problems also will form part of the program.

Maintenance and Repair of Underground Structures	M. O'Reilly (UK). Only 3 countries were represented—Japan, Venezuela, and Great Britain. Since the meeting at Nice, a start had been made on preparing a bibliography on the Maintenance and Repair of Tunnels and contributions have been received from 10 countries, with one more expected. A comprehensive report on the renovation of sewers was presented by Great Britain, and Japan presented a status report and case history studies on the repair and maintenance of underground structures in Japan. For the coming year emphasis will be on completing the bibliography and on case history studies.
Structural Design Models	H. Duddeck (Germany). Eleven representatives of 8 countries participated. A synopsis of the working group paper "Views on Structural Design Models for Tunneling" was published in Vol. 2, No. 3, of *Advances in Tunnelling*. The basic objectives of the present working group have been met. The working group decided to resume its work by changing its objectives and name. It is proposed to continue the "general approaches to the design of tunnels" (new name of the working group). General guidelines for the interdependent procedures of *in-situ* probing, laboratory tests, design, model analysis, and monitoring will be the next areas. Some recommendations may be included for the appropriate integration of the different engineers working on a tunnel project and for the interpretation of single results in view of the entire project. Besides this, the working group will gather information on design rules that are based on construction practice, rather than only the result of calculation.
Seismic Effects on Underground Structures	W.W. Hakala (USA). Six of 14 members participated. The animateur noted that progress in all six areas has been substantial. The bibliography has rapidly expanded, a number of case studies have been reported, the state of the art report has been published and distributed, research needs have been identified, and dialogues have been developed between member nations. An outline for an aseismic design manual has been prepared. It is anticipated the final publication will be submitted to ITA in 1984.
Catalogue of Tunnels	M. Fukuchi (Japan). Nine representatives of six countries participated. They reviewed, revised, and approved a format for inventories. Only 3 nations are planning to submit new catalogues. However, the work of the previous working group on Catalogue of Works in Progress was reviewed and the only significant changes expected pertain to Germany. Approaches for publishing the Catalogue of Works in Progress were discussed. It is too lengthy for *Advances in Tunnelling*, which will publish only the introductory information. One complete copy of the report will be sent to each member

country. Others who want the detailed report may request it from the Japanese Tunnelling Society. The animateur expects to develop statistical analyses of the catalogue data for the purpose of suggesting future perspectives.

Cost/Benefits of Underground Urban Public Transportation

A tenth working group was established (see Attachment 6) and held a meeting chaired by G. Girnau, ITA President. The animateurs for the first year will be Blenneman (FRG) and Godard (France). Member nations will nominate their representatives and begin to collect facts and figures about different categories of benefits: public and individual transports, safety, reduced environmental impact, economic implications for transport undertakings, and impact on urban development. U.S. delegates to ITA attended the formational meeting and agreed to propose a U.S. representative for membership on the working group.

OTHER BUSINESS

- Spain will host an international colloquium, November 9-12, 1982, in Madrid on "The Feasibility of a Permanent Link Between Gibraltar and North Africa."
- USSR announced the International Association for Hydraulic Research will meet in September 1983 in the USSR.
- All member nations were reminded to review their addresses for the ITA brochure.
- ITA Executive Council feels it will be better not to devote an entire issue of *Advances in Tunnelling* to internal ITA business, because it is not of general interest. The next issue will contain the open session papers, in addition to news from ITA and noteworthy news or literature from member nations.
- Norway announced a June 20-23, 1984, International Symposium on Low Cost Road Tunnels.

EC STATEMENT ON "AFFILIATES"

Attachment 1

(Supporting Members)

1) Different kinds of organization in member nations

- The Statutes say in para. 4.2. : "Adhering National Organization (= member) shall be at liberty to establish their organization freely in accordance with their requirements, having regard to the circumstances in the country itself and its national legislation".

- Accordingly, the national member organizations comprise those which may be described as :
  . an 'open' society with unrestricted individual and corporate membership
  . or/a society limited to members with certain qualifications
  . or/a committee/subcommittee with a limited number of individual members selected from different professional areas (administration, science, industry etc...) and -in some cases- with a limited time of office

- This implies in practice :
  . in member nations with an 'open' society all interested individuals and corporations can participate in the ITA via their national organization ; ITA information is freely available
  . in member countries with a 'closed' society, many but not all potentially interested individuals and corporations can participate in ITA
  . in member nations with a 'Committee' only a few individuals can participate directly in the ITA ; ITA information is mainly limited to committee members
  . in nom-member nations, ITA information depends on specific direct contact by the Secretariat

- Conclusion : Any rules providing for "Affiliates" must consider these differerences.

2) Criteria for application and admission of "Affiliates"

- The procedure for admission of 'Affiliates' from each country which is a member nation shall be agreed with the country concerned. In general, the procedure is foreseen as :
  . for 'open' societies, membership of the national organization is condition of admission as 'Affiliates' to ITA (multi-national companies would be considered as belonging to the country where their headquarters are situated)
  . for 'closed' societies, membership of the national organization of those eligible shall be a condition of admission of such 'Affiliates' to ITA. The question of eligibility in each instance shall be agreed between the Secretariat and the national member organization
  . for member nations represented by Committee, the member nation will indicate whether or not condition of admission of 'Affiliates' shall be subject to the approval of the member nation or whether it shall be accepted directly by the ITA Secretariat.

- For non-member countries, application for admission as 'Affiliate shall be made direct to the ITA Secretariat. When such a country is subsequently accepted to membership of the ITA, 'Affiliates' shall immediately become subject to the procedure described above for the appropriate form of member organization

- The General Assembly finally decides on the admission of 'Affiliates' at their annual meetings.

3) Privileges of 'Affiliates'

- All 'Affiliates' have the right to :
  . attend the General Assemblies, conferences, symposia, workshops etc... of ITA
  . participate in the Working Groups, subject to support by their national organization (where such exists)

- They have access to all ITA publications at a reduced membership-rate

- Corporate 'Affiliates' appear as "Supporter" on the magazine of the association

- 'Affiliates' are not allowed to use a title of membership on notepaper or in other ways advertise association with ITA (to avoid confusion over the policy control by member nations)

- 'Affiliates' have no voting rights in the General Assembly.

4) Subscriptions by 'Affiliates'

Subscription rates of 'Affiliates' will be expressed as a percentage of annual subscription of member nations as determined by Section III of the By-laws. A corporate 'Affiliate' shall pay 50 % of the subscription of a member nation ; an individual 'Affiliate' shall pay 10 % of the subscription of a member nation.

The intention will be to ensure that the additional income to the ITA shall more than compensate the additional costs of servicing 'Affiliates'. The additional income may help to finance additional activities of the ITA or to reduce overall rates of subscription. The Association is not a profit seeking body (Statute 2.3).

Enclosure 1

Topic 8 and 17 of the General Assembly

Modification of Statutes and By-Laws - Affiliates

1. Foreword :

With the President's letter of Nov. 26, 1981 we informed member nations on the proposals of the EC concerning "Affiliates" asking for a reply. We received some answers :

- none against such a motion
- most appreciating the "rules" concerning criteria for application and admission, privileges ans subscriptions for "Affiliates"
- some with proposals for minor changes.

Taking this into account and summarizing the obvious opinion of the majority of the member countries, the EC proposes to the General Assembly the following changes of statutes and By-laws.

2. Change of Statutes

New § 3.2. (Participation in the Association)

Corporations and individuals can participate in the activities of the Association by becoming an "Affiliate". The criteria for application and admission of affiliates, their rights and subscription rules are set out in the By-Laws.

The General Assembly finally decides on the admission of "Affiliates".

Addition to § 9.1. (Subscription and Contributions)

.... the several Adhering National Organisations and the"Affiliates" will pay, to the order of the Secretary General

3. Change of By-Laws

Add to the unchanged previous text :

IV - AFFILIATES

4.1. Criteria for application and admission

a) The procedure for admission of "Affiliates" from each country which is a member nation shall be agreed with the country concerned. In general, the procedure is foreseen as :

(1) for "open" societies, membership of the national organization is condition of admission as "Affiliates" to ITA registration is made through the national member organization (multinational companies would be considered as belonging to the country where their headquarters are situated)

(2) for "closed" societies, membership of the national organization of those eligible shall be a condition of admission of such "Affiliates" to ITA. The question of eligibility in each instance shall be agreed between the Secretariat and the national member organization

(3) for member nations represented by Committee, the member nation will indicate whether or not condition of admission of "Affiliates" shall be subject to the approval of the member nation or whether it shall be accepted directly by the ITA Secretariat.

b) For non-member countries, application for admission as "Affiliates" shall be made direct to the ITA Secretariat. When such a country is subsequently accepted to membership of the ITA, "Affiliates" shall immediately become subject to the procedure described above for the appropriate form of member organization.

4.2. Privileges

a) All "Affiliates" have the right to :

(1) attend the General Assemblies, conferences, symposia, workshops etc... of ITA
(2) participate in the Working Groups, subject to support by their national organization (where such exists)

b) "Affiliates" have access to all ITA publications at a reduced membership-rate

c) Corporate "Affiliates" appear as "Supporter" on the magazine of the association

d) "Affiliates" are not allowed to use a title of membership on notepaper or in other ways advertise association with ITA (to avoid confusion over the policy control by member nations)

e) "Affiliates" have no voting rights in the General Assembly.

4.3. Subscriptions by "Affiliates"

Subscription rates of "Affiliates" will be expressed as a percentage of annual subscription of member nations as determined by Section III of the By-Laws. A corporate "Affiliate" shall pay 50 % of the subscription of a member nation ; an individual "Affiliate" shall pay 10 % of the subscription of a member nation.

The intention will be to ensure that the additional income to the ITA shall more than compensate the additional costs of servicing "Affiliates". The additional income may help to finance additional activities of the ITA or to reduce overall rates of subscription. The Association is not a profit seeking body (Statute 2.3).

In member countries, where an "open" society exists, subscriptions of "Affiliates" have to be transmitted via the national member organization

Enclosure 5

Topic 15 of the General Assembly

Appointment of an additional member to the Executive Council

The Nomination Committee has informed member nations concerning the situation in the circular letter of November 26, 1981.
At the General Assembly 1982 in Brighton the period of office for Einar Broch (Norway) expires. Re-appointment is possible.

The Executive Council received proposals from Belgium, Finland, France, Germany, Netherlands, Norway and Sweden, asking for re-appointment of Einar Broch.

An other proposal came from Spain, nominating Dr. Ingeniera D. Eduardo Tegido Nogues ; his curriculum vitae is enclosed.

After detailed discussion of the situation the Executive Council came the following conclusion :
Considering the inevitable changes in the Council in 1983 (see letter of November 26, 1981) and laying high emphasis on the continuity of ITA's development in the future the Executive Council proposes to the General Assembly to re-appoint Einar Broch for another period of three years.

Association Internationale des Travaux en Souterrain
International Tunnelling Association

To
Member Nations

5747.AITES

Bron, le 26-11-81

Re : Nominations

Dear Sirs,

As you know, the Nomination Committee consists of the Honorary President, the Past President and the Acting President and the Nomination Committee has the tast to prepare nominations for vacant positions on the Executive Council.

At the forthcoming General Assembly in Brighton in June 1982 there will be one vacant seat, and at the following General Assembly in Warszaw in May 1983 there will be six vacant seats including President and Vice Presidents. The situation is illustrated in the enclosed diagram of the Executive Council members during the years. (Encl. 1)

The rules concerning procedures and possible candidates are found in our Statutes and our By-Laws. An extract of the relevant paragraphs is enclosed. (Encl. 2)

What is expected from members of the Executive Council is of course, primarily personal attendance to most of the Executive Council meetings but also willingness and capacity to take on special tasks, such as keeping in touch with one or two of our working groups, activity in contacting potential new member nations, representing ITA at meetings of other international organizations, etc...

The present tradition is to have two or three Executive Council meetings between the Annual Meetings. There is a tendency and a wish to arrange one of these Executive Council meetings in connection with a visit to a member country inside or outside Europe and take part in some local activity.

As you know, we are working with a very limited budget, and thus it is only in exceptional cases that contributions to travel expenses can be provided. This implies that Executive Council members or their National Organizations are normally expected to finance the attendance to the Executive Council meetings.

Secrétariat : 109, Av. Salvador Allende — 69500 BRON - FRANCE — Tél. : (78) 26-04-55 — Télex : CETELYON 370008

In 1982, the present period for Einar Broch expires. While there are rules that President and Vice Presidents can not be re-elected, there is no corresponding rule concerning Additional Members. Thus it is possible to appoint him for another period, and it is also possible to replace him by some other person.

It is the task of the Executive Council to propose to the General Assembly the appointment of Additional Members. The Executive Council intends to discuss this question at a meeting 30-31 January 1982. Thus any proposals arriving before this meeting can be considered.

Our general task as Nomination Committee is to have the best possible development of ITA and its activities in mind. This will include consideration of the qualifications of the individual candidates, as well as their expected capacity to devote time and effort to our work.

Furthermore, it is desirable to ensure a reasonable geographical distribution around the world, and perhaps also consider variation of geotechnical and economic conditions in the nations of the candidates. It may be also be desirable to include persons with non-technical background and interests such as finance, law, insurance, social consequences, etc...

Thus, for the appointment at the General Assembly 1982, we need suggestions and curriculum vitae for any new candidate at the latest in the middle of January 1982, and correspondingly one year later for elections and appointments 1983.

Yours sincerely,

Günter Girnau
President

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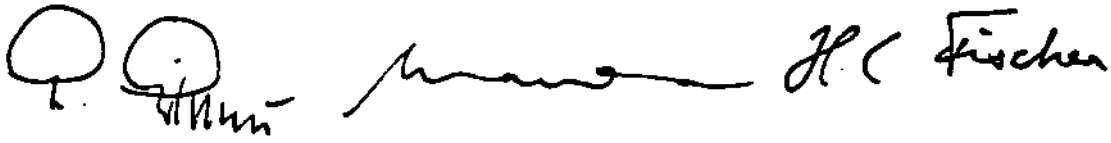
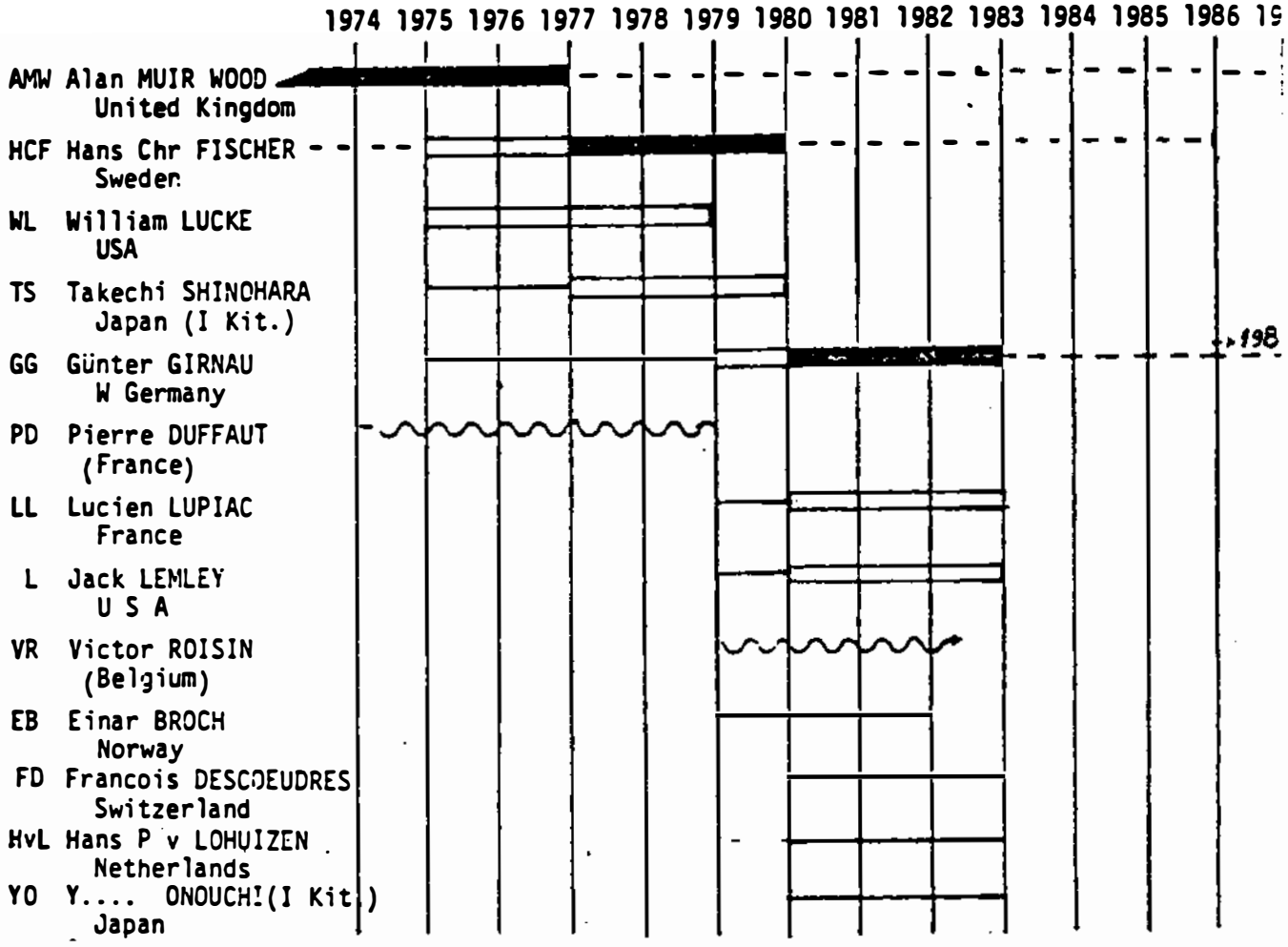
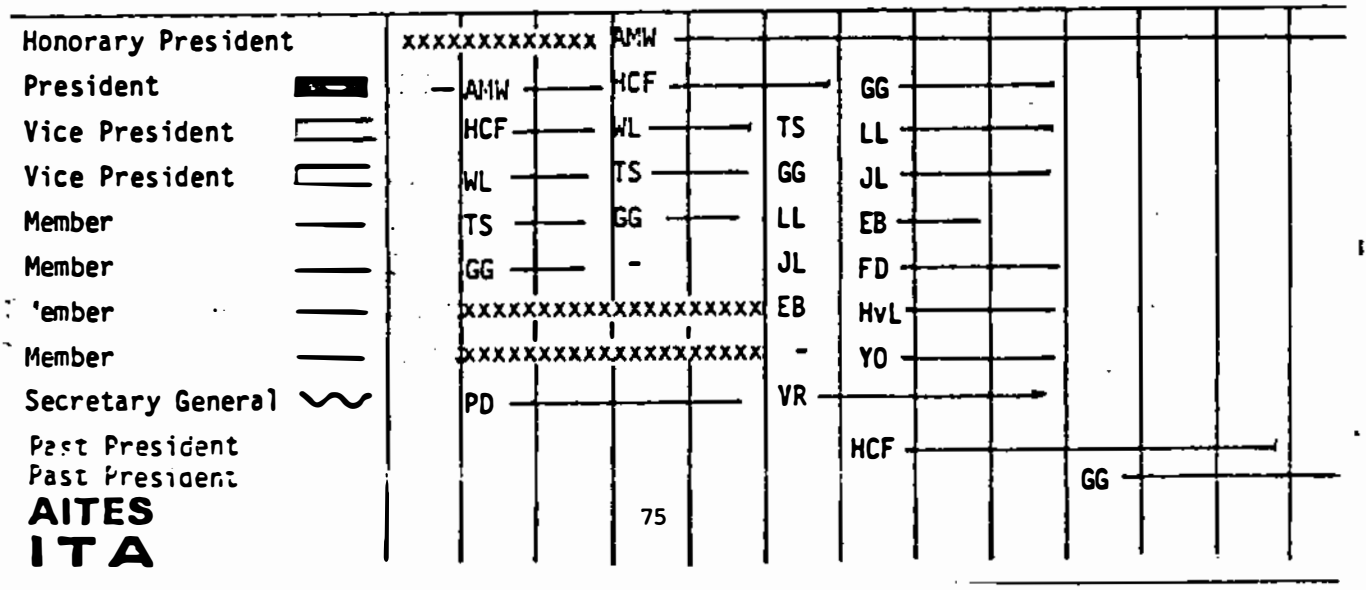


Association Internationale des Travaux en Souterrain
International Tunnelling Association

hcf Aug 1979
Oct 1981

EXECUTIVE COUNCIL MEMBERS





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Association Internationale des Travaux en Souterrain
International Tunnelling Association

EXTRAIT DES STATUTS ET REGLEMENT INTERIEUR
EXTRACT FROM STATUTES AND BY-LAWS

STATUTS / *STATUTES*

§ 6.4 c)	Au terme de son mandat, un Président ne peut pas se présenter à l'élection suivante, et son successeur immédiat doit être de nationalité différente.	*A President on completion of his term of office shall not be eligible for re-election, nor shall his immediate successor belong to the same nation.*
6.5 c)	Au terme de son mandat, un vice-président n'est pas ré-éligible comme vice-président.	*A vice-president on completion of his term of office shall not be eligible for re-election as a vice-president.*
d)	Un vice-président est éligible à la fonction de Président, soit pendant son mandat, soit au terme de son mandat.	*A vice-president is eligible for nomination as President either during, or on completion of his term of office.*

REGLEMENT INTERIEUR / *BY-LAWS*

1.2 b) 1.3 b)	... Tout candidat à ce poste (de Président ou de vice-président) devra avoir été délégué d'une nation membre...	*... Every candidate for the office of President or vice-president must previously have been delegate of a member nation...*
1.5	Les membres de droit comprennent les anciens Présidents, pendant six ans après la fin de leur mandat.	*"Ex officio" members include past Presidents for a period of six years after the end of their offices.*
	Le Bureau Exécutif proposera à l'Assemblée Générale, dans l'ordre du jour, la nomination des membres supplémentaires (quatre au plus) en indiquant ... la durée des fonctions proposées.	*The Executive Council may propose to the General Assembly, in the agenda, the appointment of additional member (maximum of four) indicating ... the duration of the proposed function.*
2.2 a)	... Les nations membres devront ... jamais moins de trois mois avant (l'Assemblée Générale) indiquer au Secrétariat ... toute présentation de candidat à une nomination au Bureau Exécutif.	*... The member countries shall ... no less than three months before (the General Assembly) inform the Secretariat of ... any proposal of candidate to an appointment of the Executive Council.*

AITES
ITA

Attachment 3

INVITATION

Intensive activity of man, especially in the field of technology, brought along the importance of the problem of preservation and conservation of natural environment. Underground works constitute an important factor in shaping this environment as they can exert a negative influence on it, but they can contribute to it's conservation as well.

The international symposium under motto: "Underground Works – Man – Environment", organized under the sponsorship of AITES-ITA, is expected to provide full analysis, in abstracts as well as during discussions, of reciprocal interactions of three mentioned on the motto components taking into consideration design and utilization of underground works.

In the course of the symposium, following accepted tradition, 9th annually held General Assembly AITES-ITA together with debates in working groups of the Association will take place.

On behalf of the Subcommittee for Underground Works of the Polish Committee for Geotechnics and the Polish Federation of Engineering Associations "NOT" I invite very warmly all interested in problems covered by the symposium to its session in Warsaw, held in May 1983.

I hope, that your stay in Poland will serve further consolidation of international tunneling family, strengthening of old friendships and making new ones and hope it to be nice and fruitful.

Prof. Zdzisław GERGOWICZ

President of the Subcommittee
for Underground Works
of the Polish Committee for Geotechnics
of the Polish Federation of Engineering
Associations "NOT"

THEMES

The subject-matter of the symposium contains four groups of topics:

A. Underground works as a factor of environmental protection
- *application of methods of underground works in rescuing historical buildings, old cities, etc.,*
- *role of mass underground transport in environmental protection*
- *underground storage of mass materials and wastes*
- *service tunnels in city agglomerations*
- *underground industrial works and public services*

B. Precautions taken during execution and exploitation of underground works for the purpose of environmental protection
- *influence of execution and exploitation of underground works on surface structures (noise, vibration, air pollution ...)*
- *influence of execution and exploitation of underground works on the level and flow of ground waters*

C. Underground works on areas of mining and in seismic zones
- *problems of design, execution and exploitation of tunnels*
- *safety conditions of underground works*

D. Improvement of underground works' conditions
- *struggle against noise, vibration and dust in underground works*
- *improvement of work conditions (ventilation, air-conditioning, lighting ...)*
- *ergonomics in underground works*
- *clothes and protective personal equipment*

Each of four groups of topics constitutes a subject for a separate plenary session of the symposium.
Each session can be accompanied by a discussion.

LANGUAGES

Official languages of the symposium are: English, French and Polish.
Translation into these languages will be provided by the organizers.

PUBLICATIONS

The first volume of the symposium proceedings containing complete texts of the papers will be handed to the participants during registration in Warsaw.
The second volume containing texts of various voices in discussions will be sent under required address till the end of February, 1984.
We shall appreciate your papers and would like to ask the authors to fill in the enclosed announcement form and to send a summary of the paper (0,5 of the sheet A4 – 15 verses) in English or French till 15th August,1982 with the indication of a subject-matter group (A,B,C,D).
We shall inform you about the acceptance of papers till 30th September,1982 and give some technicalities concerning their preparation.
Deadline for sending papers to the Secretariat of the Symposium – 15th December, 1982.
The volume of one paper should not exceed 10 pages of typescript together with drawings.
The papers will be copied by reprint.

SYMPOSIUM PROGRAMME

This follows a frame programme. It can be a subject to some changes.

Sunday 15.05.1983	before midday	– session of AITES-ITA Presidium
	in the afternoon	– session of AITES-ITA Presidium
		– AITES-ITA General Assembly
Monday 16.05.1983	before midday	– symposium
	in the afternoon	– AITES-ITA working groups
		– filmes and lectures
	in the evening	– Welcome Reception
Tuesday 17.05.1983	before midday	– symposium
	in the afternoon	– working groups
		– sightseeing of Warsaw
Wednesday 18.05.1983	before midday	– symposium
	in the afternoon	– films and lectures
		– AITES-ITA Special Session
		– AITES-ITA General Assembly
	in the evening	– Closing Banquet
Thursday 19.05.1983	before midday	– symposium

Friday, 20.05.1983
Saturday, 21.05.1983 excursions
Sunday, 22.05.1983

AITES-ITA GENERAL ASSEMBLY

At the time of symposium sessions there will be held the General Assembly sessions and AITES-ITA working groups sessions and the parcticipants of the symposium are invited to join them on behalf of AITES-ITA *(participation at the General Assembly and working groups should be previously announced in the registration form).*
AITES-ITA reserves itself the right to limit the participations at the General Assembly sessions.
The official languages of the General Assembly sessions are English and French (with simultaneous translation into the second language).

AITES-ITA SPECIAL SESSION

The AITES-ITA will organize on 15th May, 1983 a special session devoted to problems connected with the general subject-matter of the symposium.
The official languages are English and French.
Details will be given in the Announcement No.3.

FILMS AND LECTURES

Between 16th and 18th May, 1983 films and lectures accompanied by films on general problems of underground works will be provided.
The following projection equipment will be available: 8 mm,8 mm super and 16 mm with optical and magnetic sound record as well as slide and writing projectors.
The organizers will not assure translation of films and lectures.
The Scientific Committee reserves itself the right to select films and lectures while fixing the programme *(to announce a film or a lecture please fill a proper point in the registration form).*

EXHIBITION

The symposium will be accompanied by a technical and trading exhibition.
Inviting you to the participation we would like to inform you that exhibition rooms are not adapted for presentation of heavy exhibits.
The exhibition will include:
1.models of machines and various equipment used in underground works,
2.control equipment and test stands,
3.clothes and protective equipment used in underground works,
4.books,catalogues and other technical and scientific publications.
Exhibition of heavy equipment used in underground works is possible outside exhibition rooms.
Form of exhibits are free: natural exhibits, models, photographs, posters or films and slides.
The pay per 1 m.sq. of an exhibition stand is 80 $ U.S.A. (the pay includes: plastic arrangements, setting-up, rack lending, lighting).
The organizers suggest to use the rack SYMA (the width of a largescale illustration – 120 cm) in the following dimensions: 240x360 cm,240x480 cm,etc.
Please announce your participation at the exhibition in the enclosed form.
Further details concerning the exhibition will be passed in the Announcement No.3, and on request may be sent by the Centre for Progress in Technology "NOT".

PROGRAMME FOR ACCOMPANYING PERSONS

A special programme is being prepared for accompanying persons including sightseeing tour of Warsaw:
- the Łazienki park and the palace - XVIII c., the residence of the last Polish king Stanisław August Poniatowski,
- the palace and the park in Wilanów - XVII c.,the residence of the king Jan III Sobieski,the conqueror of the Turks ,
- the National Museum,
- the Old City in Warsaw.

The pay –100 $ U.S.A. – includes participation in the above mentioned programme and Welcome Reception.

PROGRAMME OF SIGHTSEEING

- At additional pay and after the previous announcement the participants of the symposium may take part in excursions forseen for accompanying persons.
- The Polish Travel Office "ORBIS" - Congress Bureau suggests a visit to Żelazowa Wola - the birthplace of Fryderyk Chopin (concert included) and a performance in the Opera.
- By the end of the symposium there will be a closing banquet payed additionaly by the participants of the symposium and accompanying persons.
- After closing the symposium the organizers propose tourist and technical visits (2-, 3- days) on the following routes:

I.Warszawa - Bełchatów (brown coal mine) - Częstochowa (centre of religious worship) - Katowice (mining and metallurgical region) - Porąbka-Żar (hydro-power station) - Wadowice (birthplace of the Pope John Paul II) - Warszawa

II.Warszawa - Kraków (old capital city of Poland - the monument of "0" class) - Wieliczka (historical salt mine) - Sandomierz (historical city at the Vistula Slope) - the cave "Paradise" (RAJ) - Warszawa

III.Warszawa - Toruń and Frombork (cities connected with Mikołaj Kopernik) - Gdańsk - Warszawa

IV.Warszawa - Białowieża (forest and the reserve of aurochs) - Warszawa

Cost of the above mentioned excursions will be available in the Announcement No.3.

TRANSPORTATION

The participants of the symposium will receive tickets (without pay) for local means of communication in Warsaw.

HOTEL RESERVATION

The Polish Travel Office "ORBIS" - Congress Bureau has been appointed for reservation your accomodation.
ORBIS suggests accomodation in following hotels:

	Single room		A place in a twin room
	with 2 meals daily	with breakfast	
VICTORIA Intercontinental	*132.00 $*	*102.00 $*	*88.00 $ / 58.00 $*
FORUM (4 stars)	*96.00 $*	*74.00 $*	*64.00 $ / 42.00 $*
EUROPEJSKI (4 stars)	*75.00 $*	*57.00 $*	*60.00 $ / 42.00 $*
VERA/SOLEC/NOVOTEL (4 stars)	*50.00 $*	*55.00 $*	*73.00 $ / 32.00 $*
GRAND (4 stars)	*63.00 $*	*45.00 $*	*50.00 $ / 32.00 $*

The prices are valid in the time of the issue of the Announcement.
They may be subject to some changes.
The form for hotel reservation will be included in the Announcement No.3.

PAYMENTS

The registration fee is 400 $ U.S.A.
It includes:
- receipt of two volumes of congress materials
- tickets for local means of communication
- participation at the Welcome Reception
- sightseeing of Warsaw
- drinks served during symposium breaks

The fees for services not included here will be given in the Announcement No.3.

FORM OF PAYMENT

The registration fee as well as all pays for accompanying persons should be passed before 31st March, 1983.
For all the registrations received after 1st April, 1983, the registration fee is 450 $ and the pay for accompanying persons – 110 $ U.S.A.
For cancellations received before 30th April, 1983, all fees minus 20% will be refunded and after 1st May, 1983 no refunds will be made.

The number of account on which all payments are to be made, will be given in the Announcement No.3.

ADDRESS FOR CORRESPONDENCE

For all correspondence or miscellaneous inquires, please contact:

OŚRODEK POSTĘPU TECHNICZNEGO NOT
(The Centre for Progress in Technology "NOT")
Sekretariat Symposium
"Budownictwo podziemne – Człowiek – Środowisko"
Pałac Kultury i Nauki *Strefa "G"*
00-901 Warszawa
Tel. 249040 *Telex 814469 opt pl*

B U D G E T 1 9 8 1 Attachment 4

COMPARAISON AVEC LES PREVISIONS
COMPARISON WITH THE ESTIMATES

SITUATION A FIN D'EXERCICE / BALANCE AT THE END OF FINANCIAL YEAR

(31.12.81)

LIBELLES / Titles	PREVU Estimated	SITUATION A FIN D'EXERCICE BALANCE AT THE E
RECETTES/REVENUES		
a) 27 cotisations à 4000 F 27 subscriptions at 4000 F	108 000,00	106 429,44
b) Vente des publications Sales of publications	2 000,00	2 072,33
	110 000,00	108 501,77
DEPENSES/EXPENDITURES		
a) Organisation des réunions/Organization of meetings	-	-
b) Publications / Publications	-	-
c) Secretariat/Secretariat		
- Tenue des comptes/Book-holding	3 000,00	3 000,00
- Salaires, poste, photocopie, telex Salaries, mail, xeroxing, teles	50 000,00	69 594,18
- Deplacements/Travels	32 000,00	9 333,20
- Téléphone/Phone	5 000,00	961,00
- Frais divers/Various debts	-	-
	90 000,00	83 138,38
RESULTAT PROPRE A L'EXERCICE 1981 RESULTS SPECIFIC TO FINANCIAL YEAR 1981	+ 20 000,00	+25 363,39
RECETTES AFFERENTES AUX ANNEES ANTERIEURES : RETURNS CONCERNING PREVIOUS YEARS		
- cotisations 1980 /subscriptions 1980	-	+10 500,00
- Résultat final pour 1981/ Final result for 1981	+ 20 000,00	35 863,39
- Résultat au 31.12.80 / Result at 31.12.80		+37 002,62
- Résultat cumulé au 31.12.81/ Cumulated result on Dec.31st,81		+72 866,01

EXERCICE 1982 - 1983 - PREVISION DE BUDGET

1982 - 1983 FINANCIAL YEAR - ESTIMATED BUDGET

	1982	1983
RECETTES / REVENUES		
30 Cotisations à 4000 F 30 subscriptions at 4000 F	120.000,oo	120.000,oo
membres bienfaiteurs p.m supporting members f.m	-	-
	120.000,oo	120.000,oo
DEPENSES / EXPENDITURES		
a) Organisation des réunions Organization of meetings	-	-
b) Publications/Publications	-	-
c) Secrétariat/Secretariat		
- honoraires comptable/Book-keeping honoraries	3.500,oo	3.500,oo
- salaires, poste, photocopie, telex salaries, mail, xeroxing, telex	66.000,oo	76.000,oo
- déplacements/travels	35.000,oo	35.000,oo
- téléphone/phone	5.500,oo	5.500,oo
	110.000,oo	120.000,oo

Enclosure 4 **Attachment 5**

JOINT OPEN SESSION ITA - BTS

"THE SUBSURFACE - CONTRIBUTIONS TO ENERGY SAVINGS"

Chairmen : Presidents of BTS and ITA

This session is chaired jointly by the ITA-President and the BTS-Chairman. ITA-President is Professor, Dr.Ing. Günter GIRNAU and BTS-Chairman Mr. Oliver M BEVAN.

LECTURERS

1) Dr. T. Stauffer, Sr., Professor, University of Missouri (USA) :
"The conservation of space and energy through use of the subsurface by planned excavation and conversion of mined areas"

2) M. Dørum, Chief engineer, Fortifikasjon A/S (Norway)
"Energy savings in subsurface cold stores, oil stores and sportshalls".

3) Mr. I.W. Hannah, Civil Engineer, Central Electricity Generating Board (London - United Kingdom)
"Dinorwic and energy storage"

4) F. Descoeudres, Professor, Swiss Federal Inst. of Technology, (Lausanne, Switzerland)
"Energy savings by insertion of tunnels in a highway network"

5) D. Sutton, Ingénieur Général, RATP (Paris - France)
"Underground urban transit systems and energy savings"

6) Dr. Tony M. RIDLEY, Managing Director - Railways London Transport Executive (London - United Kingdom)
"The energy implications of the design of moss transit railways"

Enclosure 2 Attachment 6

Topic 9 and 18 of the General Assembly

Proposal für a new ITA Working Group
"Cost-Benefits of Underground Urban Public Transportation"

1. Situation:

Urban public transportation needs considerable improvement all over the world. This is the only way to solve the traffic problems of bigger cities, to save energy and to protect the urban environment. The most effective - but also the most expensive - solution is the construction and operation of underground railways (heavy and/or light railway systems). This solution is only applicable if considerable public (federal, state, municipal) funds can be made available for a long period. This is a decision of politicians. As basis for a positive approach the benefits of the underground urban traffic installations have to be demonstrated - in the future in a much more detailed manner than in the past.

2. Categories of benefits

The benefits of investments in local public passenger transport are generally determined too narrowly, because they are in most cases confined to the effects on traffic conditions only. But it is an error, to assess the value of rapid transit systems merely in terms of passenger loads. The full impact of the effects of such construction programmes must be considered if we want an objective and complete assessment of the benefits. The following categories should be observed (always comparing data before and after investment):

a) Public transport improvements
   - reduced travel times
   - reduced delays
   - increased passenger loads

b) Individual transport improvements
   - changes in modal split
   - reduced car movements in the urban area
   - lower rates of increase of private cars

...

c) Improved safety (lower accident rates)
- for passengers in trains
- for pedestrians
- for road traffic

d) Reduced environmental impact
- air pollution from exhaust fumes
- noise and vibration levels from individual and public traffic
- visual intrusion

e) Economic implications for transport undertakings
- development of fare income
- development of operating costs (post-construction-costs)

f) Impact on urban development
- renewal of the city
- more intensive (and better) surface land use
- preservation of historical buildings
- stimulation of private investments along the lines
- developments of land values

g) Overall economic aspects
- securing of jobs in construction industry
- securing of jobs in vehicle and supply industry

3. Tasks of the Working Group

The tasks of the Working Group should be:

- to collect data from all over the world concerning methods of determining benefit-categories listed under 2 above (and perhaps others not listed)
- to try (as far as possible) to express the benefits in monetary figures
- to study and compare qualitative factors including the "do-nothing" option.
- to compare average costs with average (monetarized) benefits
- perhaps: to develop and/or recommend standardized and simplified methods for a comprehensive cost-benefit-analysis in urban underground transportation.

4. Acknowledgement:

These tasks are very much different from those of the ITA-Working-Group "Subsurface Planning", so that both can work in parallel without interference. The setting up of the new Working Group is coordinated with the animateur of the WG "Subsurface Planning".