

IGS NEWS

NEWSLETTER OF THE INTERNATIONAL GEOTEXTILE SOCIETY

Dedicated to the scientific and engineering development of geotextiles, geomembranes and related products

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PRESIDENT'S REPORT

by

Professor R. Kerry Rowe

Introduction

There is a great deal of material to be included in this issue of IGS News – so the President's Report will be short. There are, however, five very important issues to draw your attention to: the 5th International Conference; the IGS elections; the name of our Society; international journals; and the Geosynthetics Bibliography.

5th International Conference

By the time you read this article, you should have received the next bulletin regarding the 5th International Conference on Geotextiles, Geomembranes and Related Products to be held in Singapore 5–9 September 1994. It is an exciting program and it is time for you to start making arrangements to attend. For other news related to the 5th International Conference see: page 9; page 10 – item 4 of the minutes of the Council meeting; and the call for footballers on page 14 in this issue of IGS News.

IGS Elections

This issue of IGS News contains a listing of the candidates for IGS President, Vice-President and the IGS Council who had declared their intention of being a candidate prior to this issue of IGS News going to press. Additional candidates for the IGS Council will be accepted up to 10 May 1994 (see page 3 for details). The election for IGS Council members will be conducted by postal ballot in the summer of 1994 and the results of this ballot will be announced at the Ordinary General Assembly to be held in Singapore on 6 September 1994. Candidates for the position of President and Vice-President will be accepted up to and at the Ordinary General Assembly in Singapore.

Please vote! Your Society needs your guidance in the selection of its leadership. When voting for IGS Council positions, please consider the need for geographic distribution of Council members, the various components of our discipline (consulting, manufacturing, installation and academia), and the experience of the candidates.

The "G" in IGS

Ever since the last IGS Ordinary General Assembly in The Hague, there has been considerable debate concerning the name of the IGS. As announced in the March 1993 issue of IGS News, after much discussion and much being written in IGS News, the IGS Council voted to ask the IGS members to choose, in a postal ballot, between the following two options:

- *Option A:* the current name, "IGS – The International Geotextile Society" with the subtitle "Dedicated to the scientific and engineering development of geotextiles, geomembranes, related products and associated technologies";
- *Option B:* a new name, "IGS – The International Geosynthetics Society" with the same subtitle "Dedicated to the scientific and engineering development of geotextiles, geomembranes, related products and associated technologies".

The IGS Council recommends *Option B* and encourages IGS members to vote for this option. The ballot will be enclosed with the ballot for IGS Council members in the summer of 1994.

International Journals

We are delighted to announce that after discussion with the IGS, that Elsevier has agreed to a substantial reduction in the cost of the journal Geotextiles and Geomembranes for IGS members, which can now be obtained at an 80% discount (see page 12 for details). Geotextiles and Geomembranes is an official journal of the International Geotextile Society and under the guidance of the past editor (Dr. T.S. Ingold) and chairman of the Editorial Board (Dr. J.P. Giroud) it has developed into a technical journal of which we can all feel proud. Geotextiles and Geomembranes has recently announced the appointment of a new editor, Dr. Nigel John, and we are confident that the quality that we have grown to expect from Geotextiles and Geomembranes will be maintained.

As a sign of the maturing of our discipline, the launching of a second international journal devoted to geosynthetics (Geosynthetics International) has recently been announced (see page 13 for details). The editor of the new journal is Dr. T.S. Ingold, and the chairman of the Editorial Board is Dr. J.P. Giroud. The presence of these "old hands" at the helm of this new journal bodes well for its success and we wish it well. The presence of two international journals devoted to our discipline is indeed the sign of our coming of age.

IGS Publications

The first volume of the Geosynthetics Bibliography

VOLUME 1 of the GEOSYNTHETICS BIBLIOGRAPHY (discount price available to IGS Members)

The Geosynthetics Bibliography is a book in two volumes, prepared by J.P. Giroud, with the cooperation of J.F. Beech and A. Khatami, of GeoSyntec Consultants, and published under the auspices of the IGS. Volume 1, hard cover, 781 pages, is now available and can be ordered from its publishers, the Industrial Fabrics Association International (IFAI).

For a detailed review of the Geosynthetics Bibliography, refer to IGS News Vol. 9 No. 3 November 1993. Volume 2 will be published in the next few months. The regu-

lar price for Volume 1 is \$99US. **The discount price for IGS members is \$79US** (postage not included). To order Volume 1 of the Geosynthetics Bibliography contact:

Cindy Noldy
Industrial Fabrics Association International (IFAI)
345 Cedar Str., Suite 800
St. Paul MN 55101-1088 USA

Tel: 1 (612) 222 2508
Fax: 1 (612) 222 8215

Proceedings of Seiken Symposium No.11 Recent Case Histories of Permanent Geosynthetic-Reinforced Soil Retaining Walls

In IGS News Vol. 8 No. 3 November 1992 we reported on an international symposium held in Japan and dedicated to international case histories of permanent geosynthetic-reinforced soil retaining walls. The papers presented at this gathering of internationally-recognized experts and collected discussions are now available in hard cover from Balkema (349 p.).

The book is edited by Dr. Fumio Tatsuoka and Dr. Dov

Leshchinsky. The cost of this high quality proceedings is \$80US and can be purchased from:

A.A. Balkema Publishers
Old Post Road
Brookfield, VT 05036 USA

Please be sure to mention ISBN number 90 5410 358 2.

Announcement IGS Ordinary General Assembly 6 September 1994, Singapore

The fourth General Assembly of the IGS will take place on Tuesday 6 September 1994 from 14:00 to 17:00 hrs in Singapore, during the 5th International Conference on Geotextiles, Geomembranes and Related Products.

During the assembly, important decisions will be made for the future of the IGS. These decisions will include: amendments to the By-laws; the date and location of the

following Ordinary General Assembly; and the election of the President and Vice-President of the IGS.

The names of the elected Council members will be announced at the meeting. All IGS members, individuals and corporate members, should attend or be represented. The agenda of the General Assembly, as well as instructions for proxy votes, etc., will appear in the next issue of IGS News, to be published in July 1994.

Last Call for Candidates for Officers or Council Members of the IGS (deadline extended to 10 May 1994)

The new IGS President and Vice-President will be elected at the Ordinary General Assembly of the IGS on 6 September 1994 in Singapore. Candidates for these positions may announce their intention up until the moment before these elections take place. However, these positions are very important for the future of the IGS and candidates are requested to announce their intention to stand for these positions to the Secretary of the IGS as soon as possible. By declaring now, proper announcements can be made to the IGS membership.

Further candidacies for IGS Council member can be submitted to the IGS Secretary prior to 10 May 1994. A postal ballot will be organized this coming summer to elect the eight new Council members.

If elected, candidates are expected to be able to travel and attend, at their own expense, the IGS Council meetings which are held once a year. Meetings of the IGS Council are generally held in conjunction with international conferences which many officers and Council members may be attending. The next two Council meetings following the Singapore meeting will likely be held in Europe and in North America.

At the time of writing, 10 persons have become candidates for the Council. The current IGS Council would like to encourage more members to consider standing for election. If the number of candidates does not exceed the number of available seats, the members will be declared elected by acclamation without a postal ballot.

IGS members who want to become a candidate for one of the Council member positions or who want to run for President or Vice-President are requested to write to the

IGS Secretary. Signed letters of application together with a biographical note (not exceeding 12 lines) should reach the Secretariat not later than 10 May 1994. In the letter to the IGS Secretary, candidates should clearly identify their country of residence and the position that they are running for. IGS members may run for more than one position but this should be clearly indicated in their letter.

The results of the postal ballot for Council members will be announced after the election of the President and the Vice-President at the Ordinary General Assembly in Singapore. If a person is elected as President or Vice-President and is also a candidate for Council member, his/her name will be removed from the list of successful candidates from the Postal Ballot to ensure that eight new Council members are elected.

After the next elections the IGS Council will consist of:

- eight new elected members
- members elected in 1992:
Toshinobu Akagi (Japan), Richard J. Bathurst (Canada), Barry R. Christopher (USA), Richard A. Jewell (Belgium), Colin J.F.P. Jones (United Kingdom), Chris Lawson (United Kingdom)
- members co-opted since 1992:
Masami Fukuoka (Japan)
Jean-Pierre Gourc (France)
- the newly elected IGS President
- the newly elected IGS Vice-President
- Past-President, R. Kerry Rowe (after September 1994)

Results of the Call for Candidates Issued in the November 1993 Issue of IGS News

The following candidates were received at the IGS Secretariat by 14 February 1994 in response to the call for candidates published in the November 1993 issue of IGS News (Vol. 9 No. 3):

- For President of the IGS:
Candidate: Colin J.F.P. Jones (United Kingdom)
- For Vice-President of the IGS:
Candidate: Richard J. Bathurst (Canada)
- For member of the Council of the IGS:
Candidates: Daniele Cazzuffi (Italy)
Jean-Pierre Gourc (France)
George Heerten (Germany)
Robert D. Holtz (USA)

D. Leshchinsky (USA)
J.N. Mandal (India)
Pietro Rimoldi (Italy)
Fumio Tatsuoka (Japan)
C.V.J. Varma (India)
Wim Voskamp (The Netherlands)

The Treasurer and the Secretary will be appointed by the new Council from the elected and co-opted Council members. The IGS Secretary, Wim Voskamp, is available for re-election. The IGS Treasurer, Peter E. Stevenson, has served the maximum number of consecutive elected terms as a Council member but would be available for co-option to Council to serve as Secretary or Treasurer if the Council decides to do so.

SUMMARIES OF THE CANDIDATES

For President of the IGS

Dr. Colin J.F.P. Jones (United Kingdom)

Colin Jones was educated in Norway and England and studied at the University of Durham (BSc), Newcastle (MSc) and Leeds (PhD). He undertook management training at the University of Birmingham and Henley Management College. He is a Fellow of the Institution of Civil Engineers. Colin Jones was appointed Professor of Geotechnical Engineering at the University of Newcastle upon Tyne in 1986. Prior to this he was in Government service working primarily on the design and maintenance of bridges and the development of new construction technologies, including reinforced soil and geotextiles. He is a member of the United Kingdom Bridge Committee and a Council Member of the International Geotextile Society. He is a past Chairman of the UK Chapter of IGS. Professor Jones has thirty years experience in civil, geotechnical and structural design, construction and research, including the development of National Design Studies and Codes of Practice. For a number of years he has been active in developing links between industry, universities and research establishments including joint ventures in the United Kingdom, North America, Scandinavia, Malaysia and Japan.

For membership of the IGS Council

Mr. Danielle Cazzuffi (Italy)

After a degree in Civil Engineering (Politecnico di Milano, 1979), Mr. Cazzuffi joined the Research Centre on Hydraulics and Structures (CRIS) of ENEL in 1981. He has been involved in research and design programs at ENEL related to the use of geotextiles, geomembranes and related products in geotechnical, hydraulic and environmental engineering applications. Mr. Cazzuffi is author or co-author of more than 60 technical papers and an active member on many different national and international technical committees, such as ISSMFE (TC9: Geotextiles and Geosynthetics), ICOLD (Italian Group on Materials for Fill Dams) and ASTM (D35: Geosynthetics). He is also Chairman of WG12 (Reinforced Vegetative Bank Protection) of PIANC (Permanent International Commission of Navigation Congresses) and of WG3 (Mechanical Tests on Geotextiles) of CEN (European Committee on Standardization) and ISO (International Standards Organization). Mr. Cazzuffi has been a Council Member of IGS since 1990 and Vice-President of the Italian Chapter since its formation in 1993. He was Chairman of IGS Education Committee (1990–1993) and is presently Chairman of the IGS Standards Committee. He is also Associate Editor of IGS News for Europe.

Dr. Jean-Pierre Gourc (France)

Dr. Gourc is Professor of Mechanics and Civil Engineering at Grenoble University, France. He is also Manager of the Research Group: "Geotechnics and Environment, Geotextiles, Geomembranes" at IRIGM since 1978. The team consists of six full-time researchers and 10 students. Dr. Gourc has published 80 papers on geosynthetics. He was the Keynote Speaker at the 4th International Symposium on Earth Reinforcement Practice, Kyu-

For Vice-President of the IGS

Dr. Richard J. Bathurst (Canada)

Richard Bathurst has been the Editor of IGS News since 1990 and has served on the IGS Council since 1992. When not working on the newsletter, he is a Professor of Civil Engineering and Director of Research Administration at the Royal Military College of Canada. Professor Bathurst has a PhD. (1985) from Queen's University in Kingston and was formerly a Geotechnical Engineer with Golder Associates for three years. He continues to be active in research and consulting. Dr. Bathurst is Chairman of the Organizing Committee of Geosynthetics'95 to be held in Nashville, Tennessee, USA and served as Chairman of the Technical Committee for Geosynthetics'93. He is also: a Vice-President of the North American Geosynthetics Society (NAGS); Vice-Chairman of the Geosynthetics Division of the Canadian Geotechnical Society; and Chairman of the Committee on Geotextiles of the Canadian General Standards Board. He also serves on a number of other North American and international committees related to geosynthetics and is on the editorial boards of three international journals.

shu'92, and gave the Mercer Lecture at the 13th International Conference of the ISSMFE, New Delhi, 1994. He will be a General Reporter at the 5th International Conference on Geotextiles, Geomembranes and Related Products in Singapore, 1994. Dr. Gourc is also: a member of the ISSMFE and the Chairman of TC 9; a member of the French Delegation of CEN and ISO; and Council Member of the French Committee of Geotextiles.

Dr. -Ing. Georg Heerten (Germany)

Born in 1949 he was educated in Civil Engineering at the Technical University of Hanover, Germany with a specialty in hydraulic engineering. Since 1975 he has been involved in geosynthetic research, development, production and applications. He is active in many international and national societies and standardization organizations (IGS, ISSMFE, PIANC, CEN, ISO, DIN) and has published more than 30 papers on geosynthetics. At present he is Managing Director of the German geosynthetics company, Naue Fasertechnik GmbH & Co. KG, which is a corporate member of the IGS as well as a member of the newly created German IGS Chapter.

Dr. Robert D. Holtz (USA)

Dr. Holtz is Professor of Civil Engineering at the University of Washington in Seattle. He previously was on the faculty at Purdue University for 15 years, and he has worked for the California Dept. of Water Resources, Swedish Geotechnical Institute, NRC – Canada, and as a consulting engineer in Chicago, France and Italy. He has degrees in Civil Engineering from the University of Minnesota and Northwestern University. He began using geotextiles in 1971 and has carried out research on geosynthetics since then. He is co-author or editor of nine books

and book chapters, including: the FHWA Geotextile Engineering Manual (1985); Geosynthetics for Soil Improvement (ASCE 1988); FHWA Geotextile Design and Construction Guidelines (1989); Prefabricated Vertical Drains: Design and Performance (1991); Grouting, Soil Improvement, and Geosynthetics (ASCE 1992); and more than 140 technical papers, discussions and reports. He is an active member of ASCE, TRB, ISSMFE, ASTM, and the North American Geosynthetics Society (NAGS) Chapter of IGS; he is Immediate Past-President of NAGS.

Dr. Dov Leshchinsky (USA)

Dr. Leshchinsky has a BSc. and MSc. in Civil and Geotechnical Engineering from Technion and a PhD. in Materials Engineering from the University of Illinois at Chicago. As a research engineer with the Association of American Railroads he conducted laboratory investigations on the behaviour of soil-geotextile-ballast systems during 1979-1980. He joined the University of Delaware in 1982 and is currently a Professor of Civil Engineering. In addition to teaching a variety of geotechnical courses, he also conducts analytical and experimental (laboratory and field) research on a wide range of geosynthetic applications. Dr. Leshchinsky is a member of ASCE, ASTM, ISSMFE, AREA and BGS. He serves on: the editorial board of the Journal of Geotechnical Engineering, ASCE; Embankment Dams and Slopes Committee, ASCE; Committee on Geosynthetics (A2K07), TRB; Committee D35, ASTM; and Committee 1 (Roadway and Ballast), AREA.

Dr. J.N. Mandal (India)

Dr. J.N. Mandal is presently on the faculty of the Civil Engineering Department, Indian Institute of Technology, Bombay, India. Dr. Mandal organized the First Indian Geotextiles Conference in 1988 and seminars on ground movement techniques in 1986 and 1993. He has published more than 130 research papers in international and national journals and conferences. He is the author of three books (in press). He has been instrumental in the formation of the International Geotextile Society Chapter of India. He is on the Editorial Board of the International Journal of Geotextiles and Geomembranes, U.K. and is on the Editorial Advisory Board of the International Journal of Construction and Building Material, U.K. He is also a member of the International Geotextile Society Education Committee. Dr. Mandal has extensive teaching, research and consultancy experience.

Mr. Pietro Rimoldi (Italy)

Age 34. Degree: Civil Engineering (Politecnico di Milano University, 1984). Initial working experience: Researcher in hydrology and hydraulics, Politecnico di Milano University, 1985. Present position: Director of the Geosynthetics Division, Tenax SpA. Main achievements: Development of new geosynthetics products; many field and laboratory test programs on geosynthetics; design of several important geosynthetics projects around the world; author of more than 40 international papers on geosynthetics; active member of international associations (ISSMFE, IECA, etc) and technical committees,

such as ISO (TC38-SC21: Geotextiles), CEN (TC189: Geotextiles and Related Products), ASTM (D35: Geosynthetics); Professional Engineer, Italy; Certified Professional Soil Erosion and Sediment Control Specialist, USA; Council Member of the Italian Chapter of IGS.

Dr. Fumio Tatsuoka (Japan)

Dr. Tatsuoka is Professor of Geotechnical Engineering at the University of Tokyo. For the past 15 years, he has been involved in many research projects related to geotextile-reinforced soil retaining walls, and has published many scientific papers on this subject. He has promoted and fostered the use of geosynthetics in reinforced wall structures in Japan. He was one of the keynote lecturers for the International Symposium on Earth Reinforcement Practice, IS Kyushu'92. In 1992, he organized the International Symposium on Permanent Geosynthetic Reinforced Soil Retaining Walls (the proceedings were published by Balkema in January 1994). He is Secretary of the Japanese Society of Soil Mechanics and Foundation Engineering and has contributed to the fruitful collaborations between IGS and ISSMFE.

Mr. C.V.J. Varma (India)

Mr. C.V.J. Varma is the Member Secretary of the Committee for International Geotextile Society (India) - CIGSI which functions as Chapter of IGS in India. He graduated in Engineering in 1954 and is presently working as Member Secretary in the Central Board of Irrigation and Power which is a unique organization devoted to technological advancements in fields of water resources and power engineering through sustained research. He has been mainly responsible for organising an active group to promote the use of geotextiles in civil engineering applications in India and was mainly responsible for organizing the first International Workshop on Geotextile in India in 1989 followed by the 2nd in January 1994, apart from number of events at National Level besides bringing out a number of publications which have been helped to create awareness among practising engineers. He is also associated with other International Organisation viz. ICOLD, IWRA, ISRM, ITA, IAHR etc. and is presently Vice President of ICOLD for Asia Region.

Mr. Wim Voskamp (The Netherlands)

After receiving a Civil Engineering Degree (MSc) at Delft University he joined an international construction company. Since 1980 he has worked for Akzo Industrial Systems and has played an active role in the development of soil reinforcement products and techniques. He has gained a lot of experience in the application of geosynthetics and has been actively involved in the promotion and design of structures with geosynthetics in Europe and South East Asia. He has published many papers and delivered lectures in conferences and seminars. At present he holds a management position with Akzo Industrial Systems. Wim Voskamp is Vice-President of the IGS Chapter in The Netherlands and of the Dutch Geotextile Organization. Since 1990 he has been Secretary of the IGS and is available for re-election as Secretary or, alternatively, as Treasurer for the next four years.

Quality Assurance of Barrier Systems for Landfills

by

R. Kerry Rowe and J.P. Giroud

The 4th International Landfill Symposium, held in Sardinia, Italy 11–15 October 1993, proved to be a great success. This symposium, held every two years, is one of the key entries in the diaries of those wishing to actively keep up with the state of the art in design, construction and operation of landfills. The IGS was involved in the promotion of this conference and was invited to organize a workshop on quality assurance relating to barrier systems. This workshop, which was co-chaired by the authors, involved short presentations by Dr. Jean-Pierre Giroud, Dr. Ian D. Peggs, Dr. André Rollin, Dr. Jean-Marie Rigo and Dr. Pietro Jarre. The subsequent discussion focused on a number of questions arising from the short presentations. The purpose of this article is to summarize some of the issues discussed and conclusions reached at the workshop since it was thought these would be of interest to the IGS membership. The discussions addressed some of the philosophical considerations relating to quality assurance as well as some of the specific details that need to be addressed.

Quality Assurance of Design

There was general agreement in the discussion on two basic principles: (1) the quality and performance of the completed project can be no better than the design permits; (2) barriers must be designed and constructed as part of a system. These two statements warrant some explanation. The growing trend of increased reliance on engineered systems within landfills, the increasing complexity of landfill design, and the fact that engineered components must last for a very substantial period of time (hundreds of years, in many cases) have combined to increase the need for quality in design. In order to provide protection of the environment, it is necessary to have some form of peer review of designs to ensure that quality is achieved in the first critical component of the process that is to give rise to a landfill. The means of achieving this peer review may depend on local conditions and past practice. In some countries, for example, there is already an established practice of review of important civil engineering designs by specialized organizations (such as *bureaux de contrôle* in France and Belgium) that have an established role of providing review of engineered design. In other countries where this tradition does not exist, it was the general feeling of the workshop that the design of a landfill should be subjected to a third-party review, for example by some other competent, independent, consulting company. This approach provides checks and balances in terms of the quality of the design, especially in cases where the owner of the landfill and/or regulatory authorities have a limited capacity to adequately review complex designs.

Construction Quality Assurance

The second important step in ensuring the quality of a completed landfill is the preparation of a quality assur-

ance plan in the relatively early phases of the project development. The quality assurance plan and the implementation of construction quality assurance are directed at ensuring that the construction is consistent with the designer's specifications and that the construction of the facility is adequately documented. In order to most effectively do this, it is essential that the quality assurance plan be developed in parallel with the design. The quality assurance plan should deal with all the components of the engineered barrier system including, as appropriate, clay liners, geomembranes and other geosynthetics, drainage layers, and earthworks. It is important that there be one integrated construction quality assurance team which has specialists to deal with complexities of the individual components but also has generalists to ensure that the quality of the system is maintained. For example, it serves little purpose to construct a high quality compacted clay liner if one then allows the clay liner to desiccate prior to placement of the overlying geomembrane or as a result of heating of an uncovered geomembrane. Similarly, while it is essential to ensure good seams for the geomembrane, much of the benefits derived from this will be lost if sufficient care is not taken in placing materials over the completed geomembrane in order to ensure that the geomembrane is not punctured. These issues require attention to both ensuring the quality of the components as they are constructed and minimizing the subsequent damage to those components of the system already constructed. It is also important that the quality assurance team provide feedback to the designer.

Wrinkles in Geomembranes

It is generally well known that it is difficult to install high density polyethylene geomembranes without large wrinkles because they have a relatively high coefficient of thermal expansion but more importantly because they are stiff as shown by Giroud and Morel (1992).

Differential Wrinkling

If two adjacent panels of HDPE geomembranes are not installed at the same time and the same temperature, there will be differential wrinkling between the two panels. This causes an annoying problem because, as seaming progresses, a wrinkle in one of the two panels is pushed in front of the seaming equipment and this wrinkle becomes larger and larger until it is no longer possible to properly seam. The large, open wrinkle, which prevents the equipment from moving is called a "fishmouth". The operator must then stop seaming and cut the geomembrane to eliminate the fishmouth. This can only weaken the geomembrane liner and, therefore, efforts should be made to minimize wrinkling.

Large Wrinkles

Large wrinkles often appear at the toe of side slopes lined with exposed membranes. This is the case of liquid

impoundments where the geomembrane is not covered and the case of landfills during construction and, for some landfills, during operations. This occurs because temperature cycles between day and night cause the geomembrane to expand and contract. On a flat area, the resulting wrinkles would appear and disappear. On the slopes, however, these wrinkles tend to move down the slope and, after some time, accumulate as one large wrinkle at the toe of the slope. These large wrinkles must be eliminated because:

- they constitute a dam that will hamper leachate flow;
- they constitute areas of stress concentration where the geomembrane liner can be damaged; and
- they make it difficult to install the subsequent components of the barrier system.

Minimizing Wrinkles

There are a number of possible means of minimizing wrinkles. Those mentioned at the workshop include:

- use geomembranes with a white coating to minimize the thermal energy absorbed by the geomembrane;
- place and seam geomembranes at night;
- cover geomembranes as quickly as possible;
- develop HDPE geomembranes with a lower stiffness (modulus); and
- apply some tension to the geomembrane (which may, however, have some detrimental effects on the long-term behaviour of the geomembrane).

Seaming of Geomembranes

Seaming is the most critical part of geomembrane installation. Two types of seams are commonly used: fusion seams and extrusion seams. Fusion seams are made using automatic equipment and do not require grinding of the geomembranes prior to seaming. It was mentioned at the workshop that extrusion seams have a failure rate more than twice that of fusion seams – however, extrusion seams are still needed and hence warrant close examination.

Extrusion Seams

Extrusion seams are usually constructed with hand-held seaming machines that produce extrusion fillet seams. One of the problems with this procedure is the fact that the seaming machine is operated by hand and not fully automated. This lack of automation may result in overheating of the geomembrane which can cause a modification of the geomembrane microstructure and may make the geomembrane more susceptible to brittle fracture mechanisms in the vicinity of the seam. More importantly, overheating can change the geometry of the geomembrane adjacent to the seam and this can cause significant stress concentrations when the geomembrane is subjected to loads. Therefore, it is essential that the temperature of

the extrudate at the nozzle of the seaming machine be well controlled and it is also necessary that the temperature of the geomembrane be controlled, especially during cold weather.

Since the quality of extrusion seams is highly operator dependent, it is essential that well trained operators be used for extrusion seaming. These operators must be aware of the importance of temperature control and the need to keep the extrusion bead as small as practical (e.g. see Struve 1990). The view, held by some, that the thicker the bead the better was not deemed correct by participants at the workshop. It was pointed out that operators must also be aware that seaming speed and pressure are also important factors influencing the quality of the seam.

Grinding

HDPE geomembranes contain some molecules with low molecular mass. After a relatively short period of time, those molecules migrate to the surface of the geomembrane forming a waxy layer that must be removed prior to extrusion seaming (e.g. see Struve 1990). Failure to remove this layer will result in a poor seam since it will prevent good bonding between the extrudate base and the geomembrane sheet. Typically, the waxy layer is removed by grinding, however the grinding can itself cause major problems and, as discussed by several participants in the workshop, this grinding is perhaps the most critical element of extrusion seaming.

In the process of grinding, scratches are made on the geomembrane. If these scratches are parallel to the direction of the seam, they are stress concentrating features for stresses oriented perpendicular to the seam. They will cause a decrease in the geomembrane thickness next to the seam, which, combined with the extra thickness at the seam and other geometrical features of the seam, creates significant stress concentration. The magnitude of this stress concentration has been quantified by Giroud et al. (1993b). In order to minimize problems with extrusion seams that may result from grinding, the following suggestions are made:

- grind in a direction of at least 45° to the seam, although one participant indicated that, in his opinion, 45° was not enough and the grinding should be at about 90° to the direction of the seam;
- frequently change grinding disks;
- use a highly skilled and appropriately trained operator who has a good understanding of the importance of grinding to the quality of the seam and hence the project; and
- ensure that the operator has good working conditions and regular breaks.

It was also hoped that more sophisticated grinding equipment would be developed.

Seam Acceptance Criteria

Seam samples are taken in the field and they are shipped to an independent laboratory which typically performs two types of tests: shear tests and peel tests. The

results of those tests are evaluated using seam acceptance criteria. These criteria should be sufficiently high to ensure that the seam is likely to satisfy the needs of the designer – but not too high. Specifications of unrealistically high seam strength requirements will result in the rejection of many good seams. Seams, when they are replaced, are often replaced by two seams, because of the shape of the patch that is used. Since seams are weaker than the parent geomembrane, a liner with two good seams is weaker than a liner with one good seam. Furthermore, the seams used for repair are often made by extrusion and are therefore generally not as good as the original seams made by fusion (except, of course, in cases where the original seam was rejected for truly insufficient strength). So, excessive criteria that are intended to promote the use of a better liner may actually weaken the liner as indicated at the workshop and subsequently published by Giroud et al. (1993a).

The frequency of testing was raised as another area where an over enthusiastic construction quality assurance program can decrease quality since the greater the number of samples taken for destructive tests, the greater will be the number of patches made with hand-held extrusion machines. The frequency of sampling of geomembranes is best controlled by a systematic sampling based on smart seaming machine data that indicate locations where problems are most likely to occur (and hence most deserving of destructive testing) combined with an independent random sampling program.

The problems with destructive testing noted above indicate the need to develop better non-destructive seam testing techniques. Workshop participants also agreed that an impact test to establish the brittleness of the geomembrane at or next to a seam (such as the one developed by Rollin et al. 1991) would be useful since this is not adequately addressed by either of the present techniques.

Construction Damage

One area requiring considerable additional investigation is the effect of overlying materials upon the performance of a geomembrane. This is particularly important at side slopes, but even on the base of the landfill the effect of construction equipment moving on the material, which has been placed over the geomembrane, requires further investigation. Of particular concern are both obvious physical damage (e.g. holes in geomembrane) and induced stresses within the geomembrane which may affect its long-term performance. As discussed at the workshop, this problem must be addressed at the design stage since the risk of construction damage can be minimized by carefully considering how the system will be built when developing the design and the construction specifications. This applies both to the geomembrane and to the underlying clay liner.

Conclusion

The foregoing summarizes the main points discussed in the quality assurance workshop. In addition to these items, the following points were also raised but not extensively discussed:

- How can we best relate “index” seam acceptance criteria to performance?

- How can we make kinematic acceptance requirements for seams more realistic and representative of likely field situations?
- How can we best certify: (a) technicians involved in key components of the construction such as seaming; and (b) the construction quality assurance team?
- What quality assurance documentation should be collected and how should it be presented and preserved?
- Should we systematically conduct ponding tests on landfill sumps?

It was generally agreed at the workshop that the benefits of an appropriate construction quality assurance program can be very substantial. For example, one of the workshop participants indicated that he estimated that the number of defects can be reduced by a factor of about 30, but at what cost? The issue of cost was not fully discussed. However, there was general agreement that there are many other benefits of construction quality assurance in addition to a reduction in the number of defects as mentioned above. For example, good documentation of the program:

- provides a record of what was constructed for future generations;
- increases the confidence of regulators; and
- increases the confidence of the public regarding the safety of modern engineered waste disposal systems.

It was generally agreed that construction quality assurance plays an important part in developing landfill barrier systems which can be expected to provide long-term groundwater protection, however, construction quality assurance can never make the landfill better than the design permits and hence construction quality assurance should be preceded by a thorough “design quality assurance” review.

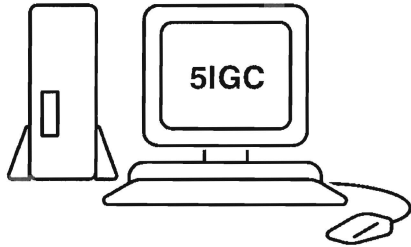
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5th International Conference on Geotextiles, Geomembranes and Related Products Singapore, 5–9 September 1994

COMPUTER DISPLAY



The Organizing Committee of the 5th International Conference on Geotextiles, and Related Products (5IGC) has set aside a special display area in the conference venue for computer enthusiasts to display novel developments in the use of personal computers for analysis and design of geotechnical structures that incorporate geotextiles, geomembranes and related products. The aim is to publicize the availability of specialist software and encourage its use within the industry.

Logistics permitting, it is intended that the Computer Display (CD) area, like the exhibition area, will be open to Conference delegates free of charge (see Bulletin 2, mailed in March 1994).

Invitation

The Organizing Committee would welcome interested individuals, companies and institutions to take part in the display which is the first of its kind at a conference of this nature. An application form (Form CD-1) is contained in Bulletin 2 and should be completed and sent to reach the Conference Secretariat by 30 April 1994. If you have not received Bulletin 2 by the above date please contact the Conference Secretariat at the address given below.

Cost of Participation

There will be a nominal charge to cover the cost of space and hire of computer equipment. However, academic institutions or individuals who demonstrate non-profit software or whose software is completely generic (i.e. non-commercial) may request a waiver of the nominal fee. Such a request will be considered after review of the software by the conference organizers.

Operation Details

The equipment that will be available for hire will be IBM-PC machines or compatibles running with 486-DX33 processors or better. The machines will be equipped with 100MB hard drives and 4MB RAM. The software should be available to run using instructions sup-

plied on the screen or on a nearby poster. Better still, an operator should be available to respond to questions.

Programs that generate excessive audio output are discouraged. Participants will be allocated a standard booth equipped with a table, a chair and a 230V AC power point. Operating system software provided with the computers will be MS DOS Version 6.0 and MS WINDOWS Version 3.1. Peripherals such as printers, modems etc. will not be provided with the standard package of hired equipment. If peripherals are required, the participants will be required to make separate arrangements with the Organizing Committee.

Selection

Substantial interest is anticipated but space is limited. Selection of software to be presented will be based upon the following criteria listed in decreasing order of priority:

- subject matter and applicability
- non-product-oriented software
- at least one operator of the software registered at the conference
- operator available on site.

In order for the Organizing Committee to make its selections, a diskette containing an executable program, a sample problem, a printout of results, and supporting documentation should be submitted together with the application form.

Liability

The Organizing Committee cannot bear responsibility for inadvertent exposure of the submitted information to a third party during the selection and/or evaluation process. All applications should therefore indemnify the Organizing Committee in all such cases and copyright-protect the material submitted.

Contact

Conference Secretariat Attn: R.S. Douglas
5th International Conference on Geotextiles,
Geomembranes and Related Products (5th IGC)
Thompson Road, P.O. Box 0177, Singapore 9157

Tel: (65) 353 5511

Fax: (65) 3532 424 Attn: R.S. Douglas

reported by G.P. Kanunaratne

HIGHLIGHTS OF THE IGS COUNCIL MEETING 18–19 OCTOBER 1993, MILAN, ITALY

by
Wim Voskamp, Secretary of the IGS

The Milan meeting of the IGS Council was the last meeting of the Council before the Ordinary General Assembly to be held in Singapore on 6 September 1994. Consequently, much of the business of the Council was focussed on the organization of the Ordinary General Assembly.

1. An update of the IGS Guidelines for a General Assembly was prepared and all activities of the assembly were finalized. The waiting time at the assembly will be considerably reduced because the election of the eight new Council members will be carried out by postal ballot before the assembly. Only the results will be announced at the meeting. The procedures for registration of members are also shortened. The agenda and the time schedule for the preparations were approved.
2. The financial books of the IGS are reviewed every year by a Certified Public Accountant. His report was discussed and the budget for 1994 was approved. A separate account was established as an emergency account with \$75,000US. This money will not be part of the normal budget and financial business of the IGS, but is an investment to allow the Society to continue to function under conditions of financial emergency. The IGS books will be audited by the CPA in 1994. The IGS auditors, acting on behalf of the membership, can supervise or use the results of this CPA audit.
3. The IGS has grown to such a size that administrative tasks of the Society have become a large undertaking. To ensure continuity of IGS administrative tasks the officers recommended a change to the administrative organization of the IGS. It is anticipated that there will be a need to form an administration office of the IGS and that this office should be managed by one of the officers. The Council shall determine the conditions of the service of the administrative support. All activities of the officers will remain unpaid and carried out as individual support to the IGS. A By-laws change will be prepared to allow for such a change in the administration. The new Council will make the final decisions on this matter.
4. The preparations for the 5th International Conference on Geotextiles, Geomembranes and Related Products are well underway. The conference and the exhibition will be held at the same place. At the time of this newsletter, 35% of the available space is booked. 537 abstracts of papers have been received, 210 were accepted for oral presentation, 112 were accepted for poster presentation. It is expected that 700–800 delegates will attend.
5. A formal proposal for the organization of the 6th International Conference in 1998 was received from the North American Chapter of the IGS (NAGS). All the conditions of the IGS rules for International Conferences were fulfilled by this proposal and the Council officially approved the proposal. The 6th International Conference will be held in Washington, D.C., in mid-March 1998.
6. The formation of an European Activities Committee was approved. The Committee is chaired by Prof. Colin Jones, U.K. The main task of the committee is to coordinate activities such as the organization of the first European Conference on Geosynthetics.
7. The formation of new chapters in Korea, France, Italy, Germany and Latin America was approved.
8. The members of the IGS Awards Committee were appointed. The Award rules have been changed from past years (see IGS News Vol. 9 No. 3 1993). It is now possible to nominate someone for an award by fax or letter to the Secretary. The Secretary will then contact the nominated person to investigate their willingness to present their work for an Award. Alternatively members can take the initiative themselves and present their work to the Awards Committee. A complete set of the IGS Awards Rules can be obtained from the Secretary of the IGS.
9. A booklet on Guidelines for the use of Mathematical and Graphical Symbols has been finalized by the Technical Committee. Copies can be obtained from members of the committee or by contacting the Secretary or the Treasurer of the IGS. A Codes of Practice Bibliography is in preparation.
10. Volume 1 of the Geosynthetics Bibliography is now available through IFAI. Volume 2 is in its final comments phase. The Council complimented and thanked J.P. Giroud for the enormous amount of work he has dedicated to the preparation of this document.
11. A. Arman, J.M. Rigo and F. Goussé have resigned as members of the Council due to increasing job-related commitments. J.P. Gourc has been co-opted as Council member to ensure balanced geographical representation in the Council.
12. D. Cazzuffi has taken over the chairmanship of the Standards Committee and this committee continues to have as its primary task the completion of the Inventory of Test Methods for Geomembranes.
13. J-P. Gourc has become chairman of the Education Committee.
14. The Conference Committee was temporarily disbanded since the European Activities Committee has taken over part of their work. The other coordinating activities of the Conference Committee have been taken over by the officers of the IGS.



IGS Council Members and IGS Officers meet in Milan, Italy (November 1993)
 back row: Mr. C. Lawson, Dr. R.A. Jewell, Dr. B.R. Christopher; Mr. W. Voskamp (Secretary)
 middle row: Dr. R.J. Bathurst, Prof. Dr.-Ing. Rudolf Floss (Vice-President), Dr. J.P. Giroud (Past-President)
 Dr. R.K. Rowe (President), Mr. P. Stevenson (Treasurer), Dr. C.J.F.P. Jones
 front row: Dr. J-P. Gourc, Mr. D. Cazzuffi, Prof. S.D. Ramaswamy, Prof. M. Fukuoka, Dr. T. Akagi

The French Committee of Geotextiles and Geomembranes by Daniele Cazzuffi, Associate Editor of IGS News (Europe)

The French Committee of Geotextiles and Geomembranes is a non-profit association composed of organizations, companies and associations interested in geotextiles and/or geomembranes. The members include: public authorities, educational and research institutes, public works contracting firms, engineering and design offices, geotextile and/or geomembrane manufacturers, and distributors. The mandate of the committee is to promote the use of geotextiles and geomembranes by exchanging information and studying matters of general interest to the geosynthetics community in France. Recently, the new officers of the French Committee of Geotextiles and Geomembranes were elected and the names and telephone numbers of the officers are given here.

- | | |
|------------------------|---|
| President | Ph. Delmas
Tel: (1) 34 23 53 95 Fax: (1) 34 23 53 48 |
| Vice-Presidents | Marc Schaeffner
Tel: (1) 40 43 52 45 Fax: (1) 40 43 54 98
Daniel Fayoux
Tel: (1) 46 91 57 50 Fax: (1) 47 73 64 39
(1) 49 01 09 98 |
| Treasurer | Gaëtan Potie
Tel: (1) 40 78 35 88 Fax: (1) 45 88 56 87 |
| Secretary | P.M. Spillemaecker
Tel: (1) 47 16 41 19 Fax: (1) 47 14 03 79 |

Geotechnical Fabrics Report's (GFR) Specifier's Guide (now available on diskette)

The Specifier's Guide is an important annual publication of the trade magazine Geotechnical Fabrics Report. This document provides a comprehensive catalogue of geosynthetic products available in North America including technical data.

This valuable resource is available on diskettes for PC machines operating under DOS or WINDOWS. The diskettes include a menu-driven program that allows for quick access to product information. The program allows the user to print information on one product or a group of products.

The cost of the diskettes is \$29.95US. To order a set of diskettes contact:

Mary Snavelly
 Publication Sales Manager
 Industrial Fabrics Association International (IFAI)
 345 Cedar Str., Suite 800
 St. Paul MN 55101-1088 USA

Tel: 1 (612) 222 2508
 Fax: 1 (612) 222 8215

Announcing Two Important Changes:

New Editor-in-Chief
New improved discount rate for IGS members

reported by
Dr. James Milne, Elsevier Science Ltd

We are delighted to announce the appointment of a new Editor-in-Chief of the journal *Geotextiles and Geomembranes*. Dr. Nigel John (University of London) has replaced Dr. Terry S. Ingold who, together with Dr. Jean-Pierre Giroud, Chairman of the Editorial Board, resigned last year. Authors are encouraged to send their manuscripts for editorial consideration to Dr. John at the address shown below:

Dr. Nigel W.M. John
Department of Civil Engineering
Queen Mary & Westfield College
University of London
Mile End Road London, E1 4NS
U.K.

We congratulate Dr. John on his appointment and wish him every success with the journal.

New Discount Rate for IGS Members

The publishers of *Geotextiles and Geomembranes* have substantially increased the discount offered to IGS members wishing to subscribe to this important publication. With immediate effect, individual members of the IGS are entitled to an 80% discount on the full price. Corporate members are eligible for a 50% discount. The IGS member rate for individuals for 1994 is now:

£66UK or \$102US for 12 issues (inclusive of international mailing and insurance).

We hope that IGS members will support this offer. Regrettably, owing to the administrative costs involved, the publishers are unable to offer a partial refund to members who have already subscribed for 1994 at the previous rate.

The Journal

For 1994 the journal has increased its frequency from eight issues a year to monthly. This will provide subscribers with a more frequent service and authors will benefit from greatly improved publication times.

The full subscription price for 1994 is £330 or \$510US, Members of the IGS may subscribe at an 80% discount, i.e. £66 or \$102US. Corporate members of the IGS may subscribe at a 50% discount, i.e. £165 or \$255US.

Reduced subscriptions are available directly from the publisher and may be paid for by cheque or credit card. Please write to:

Subscriptions Department
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The Boulevard
Langford Lane
Kidlington
Oxford OX5 1GB
U.K.

Fax: 44 (0) 865 843911

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IGS membership: Individual/Corporate

Signature: _____ Date: _____

Note: EEC customers must add their VAT equivalent to the subscription price.

IGS Members are reminded that to take advantage of this discount they must inform Elsevier that they are a member of IGS.

The Editor, Nigel John, the IGS Editorial Board Representative and the IGS President, R. Kerry Rowe, hope that IGS members will use *Geotextiles and Geomembranes* as an outlet for their technical papers and thus contribute toward the continuing success of this high quality publication which now has subscribers in over 40 countries worldwide. Papers should contain work not published in full elsewhere and should be sent to the editor for consideration.

Instructions to authors are available from Dr. Nigel John.

Matters concerning this or other Elsevier publications should be directed to Dr. James Milne at Elsevier Science Ltd.. Dr. Milne's address at Oxford is shown above and his direct fax number is +44 (0) 865 843920.

Geosynthetics International

A new technical journal

by

Dr. J.P. Giroud and Dr. T.S. Ingold

The Industrial Fabrics Association International (IFAI) has recently announced the launch of *Geosynthetics International* with Dr. T.S. Ingold as Editor and Dr. J.P. Giroud as Chairman of the Editorial Board. The journal will publish original technical papers and technical notes on geosynthetics and their applications. The first issue is due for publication in April 1994.

Why a new journal?

The Publisher, the Editor and the Chairman believe that there is a need for an international journal on geosynthetics at a price affordable to individuals, companies and university libraries. A journal with an affordable subscription price can be expected to have a broad circulation. This is consistent with the first goal of the IGS, which is to disseminate information.

Full cooperation with the IGS

Geosynthetics International intends to fully cooperate with the IGS. It is the first technical journal that has adopted the mathematical and graphical symbols recommended by the IGS, and it offers a significant discount to IGS members as discussed below. *Geosynthetics International* will apply to become an official journal of the IGS after the publication of the first issue which, we are confident, will show that *Geosynthetics International* meets all the required criteria.

An affordable cost

The subscription fee of *Geosynthetics International* is \$99US for IGS individual and corporate members and \$225US for others. **If you are a member of the IGS, remember to identify yourself when ordering your subscription.**

As a result of its high technical quality and affordable price, it is believed that *Geosynthetics International* will be widely circulated. Furthermore, the journal is advertised at all seminars and conferences organized by the IFAI.

Quality first

The Editor and the Chairman believe that the readers are far more interested in quality than quantity. Therefore, *Geosynthetics International* will have only four issues in 1994 and six in the following years. By focusing their energy on a limited number of issues, the Editor and the Chairman believe they will be in a position to ensure the publication of papers of the highest possible quality. To help them in their task, a first rate Editorial Board composed of international experts has been appointed.

Authors and readers

The first issues of *Geosynthetics International* will contain papers by well known authors – Bathurst, Gourc, Mitchell, Hoare, Bonaparte, Tatsuoka, Scott, Cazzuffi, Beech, Peggs, Palmeira, Giroud – and many others who have already submitted high-quality papers.

Geosynthetics International welcomes authors from all countries on all subjects pertaining to geosynthetics.

To help the authors and speed up the review process, strict but easy-to-use guidelines for paper preparation are available. These guidelines may be obtained from the Editor, the Chairman, or the Publisher. Authors who publish papers in *Geosynthetics International* will disseminate information to many readers, thereby fulfilling the first goal of the IGS.

To submit a manuscript for possible publication contact:

Dr. T.S. Ingold, Editor
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United Kingdom

Tel: 44 727 842433; Fax: 44 727 845266

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St. Paul MN 55101-1088 USA

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Corporate Profiles

The IGS Council has decided that in each issue of the IGS News up to three Corporate Members will be allocated space to allow them to introduce their company or association and present their achievements. The criteria for selec-

tion of corporate profiles were described in IGS News, Vol. 4, No.2, p. 7. Alternatively, you can get details by writing to the Editor. There is no charge for having a corporate profile published; it is a benefit of corporate membership.

Taiyo Kogyo Corporation by Takayuki Masuo 2-33-16, Ikejiri, Setagaya-ku, Tokyo 154, Japan

Taiyo Kogyo Corporation was established in 1947. In Japanese the word "Taiyo" means the sun, a symbol of dynamic energy and growth. The word "Kogyo" means industries. Begun as a tent maker and sewing company, Taiyo Kogyo grew rapidly to become a world leader in membrane technology. Taiyo Kogyo is an appropriate name for this energetic company and its dynamic growth. It has now grown into a large, diversified corporation that operates internationally and has developed technological innovations through a number of industries and businesses.

The Civil Engineering Division of Taiyo Kogyo has developed geosynthetics for a number of civil engineering applications.

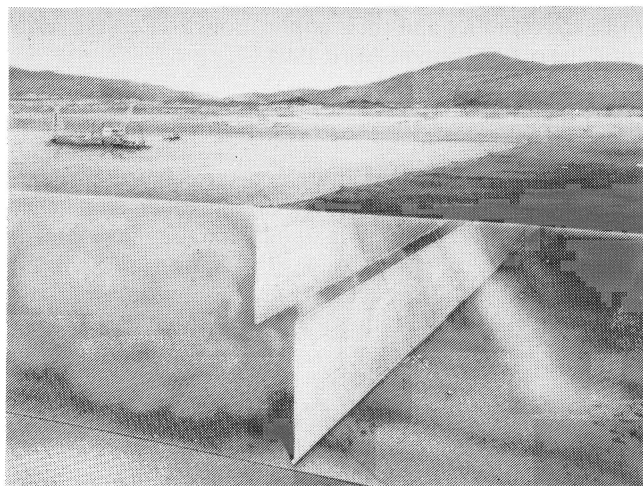
SILT PROTECTOR – Pollution control fence

Harbour construction work can lead to sea pollution. Taiyo Kogyo's system for prevention of ocean pollution, was developed from its own membrane structure technology. The SILT PROTECTOR system has been proven in the Japanese domestic market and is valued for its low cost and effectiveness.

TACOM VSL MAT – Fabric Formwork Concrete Mats

The TACOM VSL Mat process consists of injecting concrete (or mortar) into a formwork of two specially developed woven synthetic fabrics. The result is a highly rigid, durable mat. These fabric formwork concrete mats have been used for berm protection and sea revetments. They have proven to be more effective than conventional slope protection systems that use wire baskets filled with stones, or blocks. They are also an effective construction method at sites with limited space.

Taiyo Kogyo hopes, through its technological achievements and the combined talents of employees, to contribute to the use of geosynthetics in civil engineering works to minimize environmental damage.



SILT PROTECTOR – Sea pollution control fence



TACOM VSL MAT – Fabric Formwork Concrete Mats for berm slope protection of a oil retention pond in Iraq

Taiyo Kogyo Corporation has been a corporate member of the IGS since 1992.

Call for footballers! IGS SOCCER MATCHES at 5ICG

Following a tradition established at the 3rd and 4th International Conference on Geotextiles, Geomembranes and Related Products, soccer teams representing geographical regions will be formed from interested conference attendees. The soccer matches will "kick off" the conference and serve to enjoy the comradery that is an important part of our Society. Of course, there are a few

old scores to settle following the defeat of the "Rest of the World" by the "Latin" at the last two conferences (see IGS News Vol. 7 No. 1 March 1991). Interested parties are requested to contact the Secretary General of the 5ICG at the address given on page 9 of this newsletter.

reported by R.S. Douglas

Association of Producers and Users of Geotextiles

by Pavel Malcik

Vaclavská 6, 658 41 Brno, Czech Republic

The first meeting of delegates from all Czech and Slovak geotextile producers and representatives of civil engineering companies that use geotextiles in their projects took place in February 1992. The delegates recognized the need to create the Association of Producers and Users of Geotextiles (APUG) with its aim to promote the use of geotextiles in civil engineering works.

The Textile Testing Institute in Brno was chosen as the site for the APUG recognizing the accreditation granted the institute by EN 45001/45012 and its convenient geographical location in the middle of the region. The collection and dissemination of information related to geotextiles is the main function of the APUG. This information is necessary to ensure that designers select the best geotextile for each project. The APUG is also adapting Czech and Slovak standards to ISO and regional EN standards. This last activity has led to our becoming a corporate member of the IGS. We hope that our membership will provide access to information about the state of the art with respect to geotextiles and foster contacts with other IGS corporate and individual members.

The first action of the APUG was the publication of a catalogue of geotextile products offered by our producers. The catalogue contains 55 products made by 12 producers from the Czech Republic (CR) and Slovakia (SR). The volume of these products in recent years represents about 10–12 million square metres per year. Needle-punched geotextiles represent approximately 50% of this volume. The products included in the catalogue are made in widths from 1.5 to 9 metres and mass per unit area from 150 to 2000 g/m². Geotextile properties, information about handling and storage, and potential benefits of the products are given in the catalogue. The catalogue of geotextiles was sold out immediately. For this reason the APUG is preparing a second edition that will include geomembranes. The APUG members consider the education of engineers in the use of geotextiles to be essential since there is currently a scarcity of designers familiar with geotextiles in the Czech and Slovak Republics. A book about geotextiles that is intended for technical universities is also being prepared for publication. The first volume will contain general information about geotextiles while the other volumes will focus on applications, e.g. road construction and hydraulic engineering. The photographs on this page are taken from this book.

The tradition of geotextile use in the Czech Republic and Slovakia goes back to 1967 when a mud pit containing uranium ores was built that used more than 10,000 square metres of geotextile. Geotextiles have been used in many other projects since 1967. Among the most important projects are:

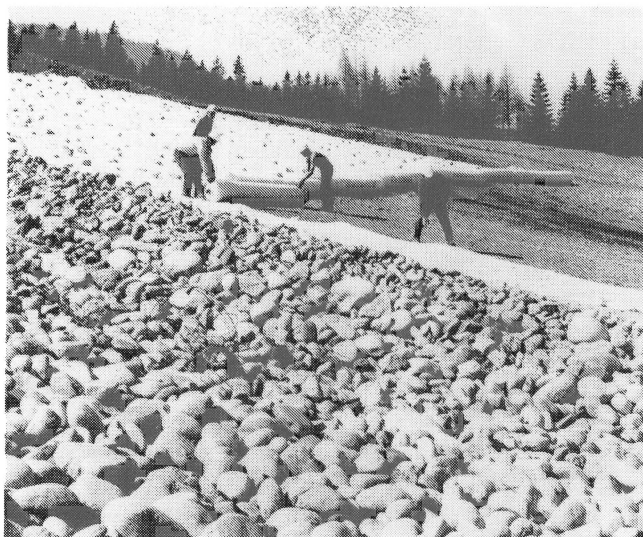
- the drainage channels of the Nové Mlýny dam. (CR)
- the Brno-Bratislava Highway. (CR + SR)
- the shore stabilization of the lower basin of the pumped storage hydro-electric power plant at Cierny Váh. (SR)

- the restoration of the Svratka river banks near Brno using geotextile bags. (CR)
- the separation layer in reconstruction of the superstructure in Prague “Na Poríčí”. (CR)
- the adjustment of the percolation channel banks of the Gabčíkova dam along the Danube River. (SR)
- the scour protection of Hostivický stream in Prague by concrete filled geotextile mattresses. (CR)

Recently, there has been a decline in the use of geotextiles in both countries due to reduced investments in civil engineering projects.

The APUG actively supports the use of geotextiles in projects that have environmental sensitivity. The APUG members are committed to carrying out research on test methods and emerging geotextile applications, and to the dissemination of information from other sources.

The APUG has been a corporate member of the IGS since 1993.



Replacement of a sand filter by a geotextile at the site of a reservoir for a power plant



Geotextile filtration layer panels being sewn at the site of a mud retention pond

Report of the Japan Chapter of the International Geotextile Society (JCIGS), January 1994

by
Professor T. Akagi, Associate Editor (Asia)

On 28 January 1994, the JCIGS General Assembly was held in Tokyo. The following items were reported and approved by the membership:

Membership as of 30 June 1993:

Honourary member	1
Individual members	169
Student members	45
Corporate members	20

Publications in 1993:

- JCIGS Membership Directory, January.
- JCIGS Newsletters: March, July and December.
- "Report on Quantities of Geosynthetics used in Japan in 1991 Based on a Questionnaire Survey," July.
- The JCIGS Geotextile Seminar, Tokyo, November.
- Proceedings of the Eighth Geotextile Symposium, Tokyo, December.

Programs sponsored by JCIGS in 1993:

- JCIGS General Assembly, Tokyo, 29 January.
- A survey based on questionnaires sent to manufacturers and distributors was conducted to estimate quantities of geosynthetics used in Japan in 1991. A report of the results was published in Japanese in the July 1993 issue of the JCIGS Newsletter. Briefly, a total of roughly 80 million square metres of geosynthetics was used in Japan during the year 1991. This volume consisted of geowovens (27), geo-nonwovens (34), geonets (2.5), geogrids (3.5), prefabricated drains (1.0), geomembranes (9.7), geocomposites (1.4) and others (1.2), where the numbers in parentheses indicate the quantities in millions of square metres.
- Geotextile Seminar: Reports were presented by several speakers on the recent international developments in various geosynthetics fields, Tokyo, 10 November: 50 participants.
- Geotextile Seminar for Student Members: A lecture was given by Professor M. Fukuoka to students at Tokyo Science University on 18 November: 30 participants.
- The Eighth Geotextile Symposium, Tokyo, 1 December: 14 papers were presented and a special report was given on the "Survey on the Quantities of Geosynthetics used in Japan in 1991" by Professor T. Akagi: 110 participants.

Activities of JCIGS Committees:

The dates of committee meetings held are as follows:

- Steering Committee: 22 January, 10 August, 1 October and 1 December.
- Programs Committee: 12 November.
- Editorial Committee for JCIGS Newsletters:

29 January, 14 May, 15 June, 1 September, 6 October, 15 November, and 13 December.

- Geomembrane Technical Committee: 17 November and 21 December.
- Audit Committee: 26 January.

Contacts with IGS:

- IGS Council Meeting in Milan: Attended by Professors M. Fukuoka and T. Akagi, 19-20 October.
- IGS News: The Annual Report of JCIGS published in the March 1993 issue of IGS News.
- List of JCIGS Members: Transmitted to IGS on 13 September.

Election of JCIGS officers for 1994

Chairman: Masami FUKUOKA
Advisors: Shigeru TANAKA and
Toyotoshi YAMANOUCHI

Secretary General: Komei IWASAKI

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Programs proposed for 1994

- Publication of the JCIGS Membership Directory in January, JCIGS Newsletters to be issued in March, July and November. Seminar textbooks and Proceedings of the Ninth Geotextile Symposium to be held in December.
- Sponsorship of the Geotextile Seminar.
- Sponsorship of Geotextile Seminars for student members.
- Co-sponsorship of Symposium on Standardization of Geotextile Testing Methods with JSSMFE, June.
- Promotion of the Fifth International Conference in Singapore, 5-9 September and sponsorship of a group tour for the JCIGS members attending the conference.
- Sponsorship of the Ninth Geotextile Symposium to be held on 1 December.
- Committee activities by Steering Committee, Planning Committee, Programs Committee, Editorial

Committee for JCIGS Newsletters and Technical Committee.

- h) Participation in the IGS Council: JCIGS will continue to be in close contact with the IGS and send the Japanese Council members to the IGS Council meetings to be held in Singapore in September.
- i) Promotion of IGS membership drive with a goal to increase membership by 10% by the end of 1994.

Treasurer's Report

In the year 1993 the Chapter revenue was 6,829,648 yen, while expenditures were 6,878,693 yen resulting in a deficit of 49,045 yen. Without the considerable support provided by the Japanese Society of Soil Mechanics and Foundation Engineering (JSSMFE), the deficit would have been far greater. JCIGS has no office of its own nor full-time employees.

Report of Committee for International Geotextile Society (India)-CIGSI Indian Chapter of IGS by C.V.J. Varma

Short Courses on Recent Developments in the Design of Embankments on Soft Soils

Two short courses on "Recent Developments in the Design of Embankments on Soft Soils" were organized by the Committee for International Geotextile Society (India) – CIGSI and the Central Board of Irrigation and Power (CBIP) on 30 November – 2 December 1993 in New Delhi and on 31 January 1994 in Calcutta.

The faculty for the courses were drawn from the Indian Institute of Technology, Delhi and comprised Dr. R. Kaniraj, Dr. G.V. Rao and Dr. A. Varadarajan. Lectures and tutorials were given on the following topics: Overview, Soil Mechanics, Geosynthetic Reinforcement, Stability of Unreinforced Embankments on Soft Soils, Deformation of Embankments on Soft Soils, Stability of Reinforced Embankments on Soft Soils, Computer Software Demonstration, etc.. Dr. R. Kaniraj acted as the course co-ordinator.

2nd International Workshop on Geotextiles

The 2nd International Workshop on Geotextiles was organized by the Committee for International Geotextile Society (India) – CIGSI and the Central Board of Irrigation and Power (CBIP) on 11–12 January 1994 in the Conference Hall, CBIP Secretariat, Malcha Marg, Chanakyapuri, New Delhi–110021. Dr. N.C. Nigam, Director, Indian Institute of Technology, Delhi, inaugurated the workshop and Dr. R.K. Katti, President of CIGSI, presided over the function. Mr. C.V.J. Varma, Member and Secretary of CIGSI, welcomed the participants. Dr. G.V. Rao, Professor of Civil Engineering, IIT, Delhi, gave an overview of the workshop and Mr. A.R.G. Rao, Director of CBIP, proposed the vote of thanks. During the inaugural session the following two publications were released:

1. Directory of Geotextiles in India (Dr. R.K. Katti).
2. An Introduction to Geotextiles and Related Products in Civil Engineering Applications (Dr. N.C. Nigam).

A total of 92 participants, including eight from foreign countries, participated in the workshop. During the workshop, 21 papers covering the following topics were dis-

cussed: Materials and Testing; Reinforcement; Roads and Railways; Natural Materials; and Erosion Control.

On the second day, a panel discussion on the "Role of Geotextiles and Related Products in Developing Countries with Special Reference to Indigenous Fibres/Fabrics Available" was held. Mr. K.M. Rabbani of IJO, Bangladesh, chaired the panel discussion. The other speakers were: Prof. V.K. Kothari, IIT, Delhi; Mr. S.S. Sethi, BIS, New Delhi; Mr. C.R.R. Varma, Aspinwall Co. (Travancore) Ltd., Cochin; and Mr. Som S. Sarkar, Som S. Sarkar Associates, New Delhi. The major recommendations that emerged out of the discussions were:

1. Geojute and Geocoir are best suitable for use in civil engineering for filtration, drainage and erosion control.
2. Geojute and Geocoir if used in the region where they are available will be much cheaper than materials imported from other regions.

Second General Body Meeting of CIGSI

The Second General Body Meeting of the Committee for International Geotextile Society (India) – CIGSI was held on 11 January 1994 under the chairmanship of Dr. R.K. Katti, President, CIGSI, at the Imperial Hotel, New Delhi.

Publications brought out by CIGSI during 1993

1. Proceedings of the National Workshop on "Role of Geosynthetics in Water Resources Projects".
2. Monograph on Analysis of Stone Columns with and without Geosynthetics Encasing.
3. Recent Developments in the Design of Embankments on Soft Soils.
4. Directory of Geotextiles in India – Volume 1.
5. An Introduction of Geotextiles and Related Products in Civil Engineering Applications.
6. Proceedings of the 2nd International Workshop on Geotextiles.
7. Two issues of News Bulletin (January and July 1993).

CALL for STUDENT PAPERS and STUDENT PAPER AWARDS Geosynthetics'95, Nashville, Tennessee, USA 21–23 February 1995

As part of Geosynthetics'95 there will be a session devoted to student presentations. Full-time graduate students enrolled in North American universities are invited to submit original papers to the Organizing Committee of Geosynthetics'95. The papers must have a strong geosynthetics theme but are otherwise unrestricted in scope. Papers are due 31 August 1994. An author from each of the top six papers will be given an expenses-paid trip to attend Geosynthetics'95 for presentation and final judging at the Student Papers Session. The best paper will be selected based on quality of the paper and the author's presentation at the session. All six authors will receive commemorative plaques, and the author of the overall best paper will receive a \$500US prize. All six papers will be published in the proceedings of Geosynthetics'95. Each paper will be reviewed by a panel of industry, academic and government

agency professionals who will critique them for originality, content and presentation.

The competition is co-sponsored by the Industrial Fabrics Association International (IFAI) and the North American Geosynthetics Society (NAGS). For more information contact:

Dr. David J. Elton
Geosynthetics'95 Student Papers Session Leader
c/o IFAI
345 Cedar Str., Suite 800
St. Paul MN 55101–1088 USA

Tel: 1 (612) 222 2508 Fax: 1 (612) 222 8215

reported by David J. Elton

Calendar of Events

Eighth International Conference of the International Association for Computer Methods and Advances in Geomechanics

Morgantown, West Virginia, USA, 22–24 May 1994

Contact: Professor H.J. Siriwardane
College of Engineering
637 Engineering Building
West Virginia University
Morgantown, West Virginia 26506–6101

Tel: (304) 293–3192 ext. 620 Fax: (304) 293–5042

International Conference Centrifuge 94

Singapore, 31 August – 2 September 1994

Contact: Dr. C.F. Leung
Dept. of Civil Engineering
National University of Singapore
10 Kent Ridge Crescent
Singapore 0511

Tel: (65) 7722281 Fax: (65) 7791635
E-mail: cvelc@nusvm.bitnet

5th International Conference on Geotextiles, Geomembranes and Related Products

Singapore, 5–9 September 1994

Contact: Conference Secretariat, 5th IGC
Thompson Road, P.O. Box 0177
Singapore 9157

Tel: (65) 353–5511 Fax: (65) 353–2424

Geosynthetics'95

Nashville, Tennessee, USA
21–23 February 1995

Contact: Secretary General NAGS
345 Cedar Str., Suite 800
St. Paul, MN 55101 USA

Tel: (612) 222–2508 Fax: (612) 222–8215

Note: Highlighted items are organized under the auspices of the IGS or with the support of the IGS.

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The IGS News is published three times per year. Material for publication should be submitted to the Editor or one of the Associate Editors by 16 February, 16 June, 16 October for the March, July and November issues respectively. Short articles and/or good quality photos (with a caption) are always **very welcome**.

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The IGS Council

Elected in 1990: D. Cazzuffi (Italy); S.D. Ramaswamy (Singapore). *Elected in 1992:* T. Akagi (Japan); R.J. Bathurst (Canada); B.R. Christopher (USA); R.A. Jewell (Belgium); C.J.F.P. Jones (UK); C. Lawson (UK). *Co-opted in 1991:* D. Price (Austria); D. Fayoux (Belgium). *Co-opted in 1992:* M. Fukuoka (Japan). *Co-opted in 1993:* J-P. Gourc (France). The IGS Council also includes the five IGS Officers elected for the period 1990–94.

List of Corporate Members of the IGS

Akzo Industrial Systems B.V. – Netherlands (1986)
Amoco Fabrics and Fibres Co. – USA (1987)
APUG – Czech Rep. (1993)
Asahi Chemical Industry Co. Ltd. – Japan (1984)
Associate Suisse Des Professionnels De
Géotextiles-Suisse (Aspg/Svg) – Switzerland (1984)
Belton Industries Inc. – USA (1989)
Bidim Geosynthetics – France (1984)
C.I. Kasel Co., Ltd. – Japan (1992)
Daito Kogyo Co., Ltd. – Japan (1992)
Don & Low Ltd. – UK (1984)
Du Pont De Nemours Int. S.A. – Switzerland (1984)
Exxon Chemical Geopolymers Ltd. – UK (1988)
Fibertex Aps – Denmark (1984)
Fritz Landolt Ag – Switzerland (1985)
Geotextiles (M) Sdn Berhad – Malaysia (1991)
Geotechnics Holland BV – Netherlands (1991)
Geosintex SRL – Italy (1993)
Gundle Lining Systems, Inc. – USA (1988)
Hoechst Celanese Corporation – USA (1984)
Huesker Synthetic GmbH & Co. – Germany (1987)
Industrial Fabrics Association International (IFAI)
– USA (1985)
James Clem Corporation – USA (1992)
Japan Spunbond – Japan (1984)
Kajima Corporation – Japan (1985)
Kumagai Gumi Co. Ltd. – Japan (1987)
Kuraray Co. Ltd. – Japan (1989)
Maeda Corporation – Japan (1988)

Maeda Kosen Co., Ltd. – Japan (1992)
Mitsubishi Yuka Industrial Products Co., Ltd.
– Japan (1992)
Mitsui Petrochemical Industrial Products Ltd.
– Japan (1992)
Naue Fasertechnik GmbH & Co. KG
– Germany (1987)
National Seal Company – USA (1992)
Netlon – UK (1989)
Nicolon B.V. – The Netherlands (1984)
Ohbayashi Corporation – Japan (1988)
Okasan Kogyo Co. Ltd. – Japan (1984)
Pavco S.A. – Colombia (1991)
Politex SPA – Italy (1993)
Polyfelt GmbH – Austria (1984)
Shimizu Co. – Japan (1990)
Synthetic Industries Inc. – USA (1991)
Taisei Corporation – Japan (1992)
Taiyo Kogyo Corporation – Japan (1992)
Tanaka Co. Ltd. – Japan (1993)
Tenax S.P.A. – Italy (1991)
The Tensar Corporation – USA (1989)
The Reinforced Earth Co. – USA (1989)
The Zenitaka Corporation – Japan (1992)
Tokyu Construction Co. – Japan (1984)
Uco N.V. – Belgium (1985)
Zeon Kasei Co., Ltd. – Japan (1992)

Dates indicate earliest year of continuous membership.

OBJECTIVES OF IGS (*)



The International Geotextile Society was formed with the following objectives:

- (1) to collect, evaluate and disseminate knowledge on all matters relevant to geotextiles, geomembranes, and related products;
- (2) to improve communication and understanding regarding geotextiles, geomembranes and related products, as well as their applications;
- (3) to promote advancement of the state of the art of geotextiles, geomembranes and related products, as well as their applications;
- (4) to encourage through its members the harmonization of test methods, equipment and criteria for geotextiles, geomembranes and related products.

WHY BECOME A MEMBER OF THE IGS?

First, to contribute to the development of our profession.

Becoming a member of the International Geotextile Society:

- Helps support the aims of the IGS, especially the development of geotextiles, geomembranes, and related products.
- Contributes to the advancement of the art and science of geotextiles, geomembranes, and related products, as well as their applications.
- Provides a forum for designers, manufacturers, and users, where new ideas can be exchanged and contacts improved.

Second, to enjoy the benefits.

The following benefits are available now to all IGS members:

- A directory of members, the IGS DIRECTORY, published every year, with addresses, telephone, telex and fax numbers.
- Newsletter, IGS NEWS, published three times a year.
- Reduced purchase price on all documents published by the IGS.
- Reduced registration fee and preferential treatment at all conferences organized under the auspices of the IGS.
- Reduced subscription fee for the journal "Geotextiles and Geomembranes".
- A central system for ordering selected publications.
- Possibility of being granted an IGS award.

MEMBERSHIP APPLICATION

Membership of the Society is open to Individuals or Corporations "...engaged in, or associated with, the research, development, teaching, design, manufacture or use of geotextiles, geomembranes and related products or systems and their applications, or otherwise interested in such matters". The annual fee for membership is (US) \$45 for Individual Members and (US) \$1000 for Corporate Members. Individuals or Corporations who voluntarily contribute a minimum of (US) \$200 annually to the Society, in excess of their membership dues, will be mentioned in the IGS Directory in a separate list as benefactors.

Send this completed form to:

Mr. P.E. Stevenson, Treasurer
226 Sitton Road
Easley, SC 29642
U.S.A.

Telephone: 1 (803) 855-0504
Fax: 1 (803) 859-1698

Eligibility (i.e. connection with geotextiles, geomembranes, or related products):

In this area, write your address as you wish it to appear in the next IGS Directory (your professional address is recommended but your personal address is acceptable provided the telephone, telex and fax numbers are also your personal numbers). *If the address below is your personal address please check this box:*

Title (circle one): Mr. Ms. Dr. Prof. Other _____

First Name _____ LAST NAME _____

Company, Division, Function (if applicable) _____

Address (Street or Postal Box) _____

City _____ Province/State _____

Postal Code _____ Country _____

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* A copy of the By-laws is available upon request.

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