IGS NEWS

NEWSLETTER OF THE INTERNATIONAL GEOSYNTHETICS SOCIETY

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

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The Sixth International Conference on Geosynthetics 25 - 29 March 1998

by Danette Fettig - Secretary-General, 6IGC

The 6th International Conference on Geosynthetics will be held in Atlanta, Georgia, USA, on 25 - 29 March 1998. The July 1997 IGS News described the general scope and concept of 6IGC. Details of the 6IGC are provided in this article. The 6IGC has a wide variety of events covering all aspects of the geosynthetics industry. Highlights of the conference are given below.

On Wednesday, 25 March 1998

- The traditional football (soccer) games continue... and in the Olympic City, no less! For this conference four teams will suit up for an activity that no one will want to miss. Bus service and refreshments will be provided to and from the conference hotel.
- The opening session will begin at 1330 followed by the Giroud Lecture given by Professor R. M. Koerner on the topic of "Design and Analysis of Veneer Cover Soils."
- At 1510, a series of three concurrent technical sessions will continue until 1800.
- The Welcome Reception will be from 1930 to 2100. Please come and meet new and old friends.

On Thursday, 26 March 1998

- At 0900, Professor R. K. Rowe will present a Keynote Lecture on the topic of "Geosynthetics and the Minimization of Containment Migration through Barrier Systems."
- Beginning at 1000, three concurrent technical sessions will continue through the afternoon.
- At 1600, the exhibits will open. Here, 150 exhibitors will present their products, techniques, and services.

On Friday, 27 March 1998

- At 0900, Professor F. Tatsuoka will present a Keynote Lecture on the topic of "Seismic Stability Against High Seismic Loads for Geosynthetic-reinforced Soil Retaining Walls."
- Nine parallel workshops on "hot topics" will be held from 1010 to 1155 and another nine from 1330 to 1515. These workshops will encourage interaction between speakers and audience. Come to your favorite topic sessions and participate.
- Exhibits will be open from 1200 to 1700 and be accompanied by a complimentary lunch. A concurrent poster session will be run. The authors will be available to answer questions.

On Saturday, 28 March 1998

- At 0900, Professor A. McGown will present a Keynote Lecture on the topic of "Taking Geosynthetic-reinforced Soil Structures to Their Limits."
- Three concurrent technical sessions will continue from 1010 to 1430.
- Exhibits will be open from 1000 to 1500 and be accompanied by a complimentary lunch.

IN THIS EDITION:

Visit the IGS Web site at *http://igs.rmc.ca*

6IGC at a Glance

by Danette Fettig

GENERAL INFORMATION

The Sixth International Conference on Geosynthetics will be held 25-29 March 1998 in Atlanta, Georgia, USA.

The conference will feature four keynote lectures (including the Giroud Lecture) and approximately 100 technical presentations on the state-of-the-practice and state-of-the-art with respect to geosynthetics.

Papers will be presented in three parallel sessions. There also will be a poster session and panel discussions.

A three-day exhibition of products and services will run in conjunction with the conference, which is expected to attract more than 2,000 attendees, including geotechnical, environmental and transportation engineers, project designers and specifiers, fabricators and installers, geosynthetics manufacturers and distributors, contractors , government officials, civil engineering professors and students.

PAPER THEMES

Original papers that describe novel and innovative developments, practical applications, new technologies and research will be presented at the conference.

Papers to be presented at the conference will be subdivided among three general application themes: transportation, environmental and geotechnical. Further subdivisions will be made subsequently.

The conference will highlight technical advances, novel applications, innovative developments, new technologies and state-of-the-practice papers that clearly demonstrate the benefits that can be derived from the appropriate use of geosynthetics.

- Three panel sessions from 1450 to 1630 will conclude the technical part of the conference. These sessions will be used to tie together the essence of the conference along with the most important technical details.
- A reception at 1700 followed by the Banquet and Closing Session from 1830 to 2200 will end the conference. This finale will be spectacular.

On Sunday, 29 March 1998

- A Farewell Brunch will be held at 1000 followed by Technical Tours of reinforced walls and slopes in the greater Atlanta area.
- Several golfing outings to some of Atlanta's many excellent golf courses will be conducted.

From Thursday through Saturday

A companion's program in the Atlanta area:

- Georgia's Stone Mountain (including Memorial Hall and "The Road to Tara" Museum).
- The Pulse of Atlanta's Past (including Tullie Smith House, the Atlanta History Museum and History Center).
- Atlanta's Famous Firsts (including The CNN Center, World of Coca-Cola Pavilion, and Underground Atlanta).

The technical program promises to be fruitful. The Technical Review Committee (see photograph) has completed its work. Approximately 250 abstracts have been reviewed and accepted. Many interesting papers are expected to be presented at the 6IGC.

Additional details are available in 6IGC Bulletin #3 (also see sidebar). This bulletin also includes important hotel and registration forms. Contact Miss Danette Fettig or Ms. Jeanne McGovern at 1 (612) 222-2508 at the Industrial Fabrics Association International for copies. See you in Atlanta!

Visit the 6IGC Web site on the internet at http://www.ifai.com/6icg.html

6IGC Technical Review Committee (left to right):Piero Sembenelli, Jeanne McGovern, Jochen Muller-Rocholz, Danette Fettig, R. Kerry Rowe, Barry Christopher, Hiroshi Miki.

IGS Meetings to be held at the 6IGC, March 1998

The following IGS meetings will be held in conjunction with the 6IGC (see previous article).

Monday, 23 March, IGS Officers Meeting, 0900 - 1700
Tuesday, 24 March, IGS Council Meeting, 0900 - 1700
Friday, 27 March. IGS General Assembly, 1530 - 1800
Friday, 27 March, IGS Council Meeting, 1800 - 1900
Friday, 27 March, IGS Corporate Members Reception, 1900 - 2100
Saturday, 28 March, IGS Chapter Presidents Luncheon, 1200 - 1300
Sunday, 29 March, IGS Officers meeting, 0700 - 0800
Sunday, 29 March, IGS Council meeting, 0800 - 1000

Call to the Ordinary General Assembly of the IGS to be held at the 6IGC

All IGS members are invited to attend the IGS Ordinary General Assembly (OGA) which will be held on Friday, 27 March 1998 in Atlanta, GA, USA, at the 6IGC (see related article on p1). The meeting will immediately follow the IGS Awards Ceremony which begins at 1530 hours. The Awards Ceremony is open to members and non-members of the IGS.

If the required quorum of 40% of the voting membership is not present or represented at the OGA, a new OGA will be held for which the quorum rules will be suspended. In this case the second OGA will be held on Friday, 27 March 1998 at 1615 hours.

The proposed agenda for the General Assembly is:

1. Award presentation ceremony (open to nonmembers also)
2. Opening of the OGA (IGS members only) and welcome to the membership (President)
3. Quorum (Secretary)
4. Presentation of the procedure for the OGA and appointment of poll tellers (Secretary)
5. Approval of the minutes of the preceding OGA (Secretary) - VOTE
6. Address and report of the President of the IGS
7. Report of the Secretary of the IGS

8a. Report of the Treasurer of the IGS
8b. Report of the Finance Committee of the IGS
9a. Approval of the Financial Report (Treasurer) - VOTE
9b. Proposed subscription fee (Treasurer) -VOTE
10. Approval of the Society's activities (President) - VOTE
11. Election of President and Vice President (President)

11a. Presentation of Candidate(s) for President
11b. Election of President - VOTE
11c. Announcement of President Elect
11d. Presentation of Candidate(s) for Vice President
11e. Election of Vice President - VOTE
11f. Announcement of the Vice President Elect
11g. Announcement of the Council Members Elect

12. Appointment of the Financial (Audit) Committee
13. Selection of the date of the 8th International Conference (2006) (to be held after the 7th International Conference in Nice in 2002) (President) - VOTE
14. Selection of the date and location of the next OGA (Secretary) - VOTE
15. Other business (President)
16. Closing remarks (President)

submitted by P. E. Stevenson, Secretary, IGS

Policies and Procedures for Student IGS Members

Background: The International Geosynthetics Society encourages students interested in geosynthetic applications and related technologies. A student may join the IGS on his/her own or as part of a student Chapter.

Student Chapters are typically formed by a group of students under the tutelage of an IGS member. This "mentor" is usually an educator and assists the Chapter in organizing and administering the group. A principal task is the collection of dues (US$10) and the maintenance of a membership roster. Many student IGS Chapters are formed where a national Chapter exists. The national Chapter may provide additional benefits to those listed below.

Student benefits:

- Receipt of the IGS News,
- Discounts at IGS sponsored conferences/seminars,
- Listing in the IGS Directory and Web site in a special student section,
- Eligibility for awards, especially the Young IGS Member Award,
- Listing of theses related to geosynthetics in the IGS News and on the IGS Web site.

In those countries where a national Chapter exists, student dues are retained by the national Chapter and are intended for use in support of the student Chapter program. If a student group is formed without the assistance of a national Chapter, the US $10 dues are forwarded to the IGS Secretariat along with the roster of student Chapter membership. This list with periodic updates and corrections is the list that will be published in the IGS Directory.

Additional information is available from the the IGS Secretary at the address listed on p16.

submitted by P. E. Stevenson, Secretary, IGS

The Sixth International Landfill Symposium - Sardinia '97

by R. Kerry Rowe, Immediate Past President, IGS

The Sixth International Landfill Symposium (Sardinia '97) was held in Cagliari, Italy in October 1997 (see related article on p10). The Sardinia series of landfill symposia have established a reputation for providing a forum for discussing a wide range of landfill issues and as such attracts a diverse selection of papers and attendees. The Sixth Symposium, held on the tenth anniversary of the series of conferences, attracted more than 1000 delegates. Over 300 papers were presented. Topics addressed at the symposium and covered in the five volume (3100 page) proceedings included landfill processes and long term behavior, bottom liners, covers and caps, drainage and leachate collection systems, lining on slopes,

testing of liners, hydrologic modeling, landfill stability, landfill drainage systems, landfill gas emissions, waste characterization, fate of organics in landfills, leachate quantity and quality and leachate treatment. Of specific relevance to geosynthetic engineering, papers were presented dealing with geosynthetics in drainage systems, liners, and covers. Particular emphasis was placed on issues such as: clogging of leachate collection systems; diffusion of contaminants through geosynthetic clay liners (GCLs) and geomembranes; the role of geosynthetics with respect to slope stability; leakage through geomembrane liners and composite liners; and puncture protection and aging of geomembranes.

Several highly successful workshops related to geosynthetics were held. These included a workshop on "Lining on Slopes" chaired by Dr. Jean-Pierre Gourc, a workshop on "Landfill Top Cover Systems" chaired by Dr. R. Kerry Rowe, a workshop on "Testing of Liners" chaired by Mr. Daniele Cazzuffi, and a workshop on "Landfill Drainage Systems" chaired by Dr. R. Kerry Rowe. The discussions in two of these workshops are summarized below.

Workshop on Landfill Covers

The workshop on landfill covers involved an extensive discussion of the issue of design standards. Many attendees from many countries raised concerns about the movement towards "standard designs" which reduce design flexibility and are often overly expensive. There was a general consensus that standards for covers (and indeed all components of the landfill) should be performance based rather than prescriptive. It was noted that the design of a cover for a landfill should be based on consideration of the primary objectives (e.g. the need to enhance gas collection and/or the need to control leachate generation). Depending on the climate and the nature of the waste, the configuration of a cover that would meet the design objectives could vary considerably.

The potential problems that can be caused by clay liner components (both compacted clay and geosynthetic clay) of a landfill cover due to desiccation and root penetration were discussed in some detail. It was noted that once compacted clay cracks (e.g. due to desiccation), it will not self-heal and remains relatively permeable at the low stress levels encountered in a landfill cover. GCLs may do a better job at rehydrating and regain much of their hydraulic conductivity but even they may not fully recover the original low hydraulic conductivity. One participant showed data where, after drying in a field application, a particular GCL regained a hydraulic conductivity of the order of 10^{-9} m/s rather than the original value that had been of the order of 10^{-11} m/s. However, the greatest concern with respect to maintaining the long term hydraulic conductivity was shown to be root penetration into the clay liner since it was shown that this could potentially increase the bulk hydraulic conductivity to about 10^{-7} m/s without significant self-healing. Thus the importance of having either a GCL designed to limit root penetration (it being noted that some products may be more prone to root penetration than others), or an overlying layer that will minimize root penetration (e.g. a geomembrane in a cover with a composite geomembrane over clay liner) was highlighted.

Some of the challenges of constructing low permeability composite lined covers were examined. Chief among these were the problems of ensuring cover stability. Two primary concerns arose.

The first concern was the need to provide adequate drainage above the geomembrane to prevent pore pressure build-up. It was noted that drainage material should have a hydraulic conductivity of greater than 10^{-4} m/s. However, this alone is not enough. One must also ensure that there are negligible fines in the drainage layer since these tend to migrate to critical drainage points and cause clogging which in turn causes a pore pressure build-up and potential failure. This also implies the need to have a filter to minimize migration of fines into the drainage layer from adjacent layers.

The second concern was the need to design a gas collection/relief system that prevents build-up of gas pressure beneath the geomembrane. Examples of major failures due to gas build-up were presented to the workshop. It was indicated that, like the drainage layer, the gas collection/relief layer should have a hydraulic conductivity greater than 10^{-4} m/s since material having the commonly specified value of 10^{-5} m/s is not adequate once the layer becomes moist. Finally, it was noted that the system should be designed to avoid problems from changes in atmospheric pressure.

Workshop on Landfill Drainage Systems

Leachate drainage systems are a critical component of most landfills. One key observation made at this workshop is that landfill conditions may vary substantially from location to location and that prescriptive regulations relating to the design of drainage systems have severe limitations. However, there are a number of important design considerations that may be considered widely applicable and these include the need to: design the collection system to minimize particulate, biological and chemical clogging; to minimize the residency time for leachate in any collection system; to minimize temperature on the liner below the collection system; the need to be able to clean the leachate collection pipes; and the need to minimize damage to the system due to settlement (especially the need to avoid damage to inspection and cleanout systems due to waste settlements).

The choice of leachate collection stone was extensively discussed. Some German experience indicated that clogging was much worse when crushed limestone was used than when crushed granite was used. However, other experience had shown no negative effect due to the use of dolomitic limestone. Likewise, some experience had shown that systems have performed adequately with small diameter drainage stone while other experience had shown substantial clogging with small stone and that large stone was much better at minimizing clogging provided that there was also a suitable filter between the waste and the open stone. It appears that the dif-

ferences in apparent performance of different systems may, in part, be due to differences in leachate composition, other factors associated with the collection system design, and the level of investigation that had been conducted.

It was agreed that sand was generally not suitable for use in primary leachate drainage systems and that coarser granular material was required. In the design of blanket drains, the presence of a filter between the waste and the main drainage blanket was considered to be highly desirable. Experience was that a suitably selected geotextile filter/separator worked well and that even though the geotextiles clogged, they still retained sufficient permeability to allow the passage of leachate into the drainage system without excessive perched leachate mounding.

Some investigators reported that clogging was found to be greatest in areas where there were fluctuating leachate levels and at the transition from unsaturated to saturated drainage material. While this could be minimized by keeping the collection system saturated, concern was raised that keeping the system saturated may have negative effects due to an induced increased temperature at the liner, increased leachate retention time and reduced gas collection from the leachate collection system. Although not a unanimous view, most participants were of the opinion that it is better to operate the leachate collection system in an unsaturated state by gravity drainage. When continuous gravity drainage is not possible, the system should be kept drained by regular pumping that would prevent significant fluctuation in leachate levels. There was a consensus that the use of the collection system for leachate storage between pumping events was likely to accelerate clogging of the collection systems.

Since clogging tends to be most severe where the leachate flows are greatest, there was a general consensus that it is desirable to (a) take special care in the design of sumps and (b) to locate the collection pipes so that the collection of leachate is distributed along the pipes as much as possible. Pipes should be regularly cleaned. On the issue of pipe cleaning, experiences were described where pipes were cleaned with water jetting at pressures of 40 MPa over pipe lengths of up to 300 m. It was indicated that for some landfills, the leachate is sufficiently strong that it is necessary to clean the collection pipes (followed by a borehole camera inspection) up to four times per year.

The use of geonets in drainage systems was discussed. Positive and negative experiences were presented. It would appear that although geonets have considerable potential to clog, they can also perform quite adequately in situations where the leachate is not too strong and/or there is a steep slope and/or the applied pressures (due to the weight of the waste) are not too great.

The size of holes (perforations) in leachate collection pipes is seen to be important; larger holes minimize the potential for clogging and ease of cleaning. However, concern was raised about the effects of this and the stresses due to larger diameter stones that must accompany larger holes or pipe stresses. [This is an issue currently under investigation by Dr. Rowe in the large test cell at the University of Western Ontario.]

It was generally agreed that, provided the primary liner is either a compacted clay or composite (e.g. geomembrane over GCL) liner, there is reduced potential for clogging of secondary leachate collection/leak detection systems. However, particular care is required if a geocomposite drain is used for secondary collection to avoid intrusion of the overlying liner material or migration of bentonite (if a "dry" GCL is placed) into the drain during construction. However, as with most other potential problems, these effects could be mitigated by appropriate design.

Concern was raised with regard to possible negative effects on the performance of leachate collection pipes due to high temperatures (60-80°C). These high temperatures appear to be related either to leachate mounding or to the operation of the leachate collection system as part of the gas collection system (which in the case of some German landfills were reported to have resulted in gas temperatures as high as 80°C even though the leachate temperature was only 30-35°C). This implies the need to design and operate the landfill in such a way as to minimize the temperature increase at the base of the landfill.

The final topic for discussion was the impact of both subsoil and waste settlement on the performance of the collection system. The main concern was with respect to downdrag forces on monitoring and cleanout of systems. The problems related involved downdrag of monitoring wells and penetrations through the liner (emphasizing the need to design to prevent this) and the failure of cleanout/inspection chambers in landfills where there is a very substantial thickness of waste (e.g. valley landfills).

Concluding Comments

The conference format that involved formal parallel paper presentation sessions and complementary workshops where there was considerable interaction and discussion amongst a smaller group (20-50 people) worked very well and was much appreciated by the attendees. It is a format that will be emulated at the Sixth International Conference on Geosynthetics to be held in Atlanta in March 1998 (see related article on p1). The conference proceedings contain a large number of papers that should be regarded as "essential reading" for those involved in research, design, construction, or operation of landfills. In addition to the technical issues, a number of papers also addressed regulatory and legal issues that may also be regarded as essential reading.

As in the past, the social aspects of the conference were very well organized and very enjoyable. On the tenth anniversary of these conferences, the organizers are to be congratulated on another outstanding performance.

Geosynthetics in India

Geosynthetics in India are important. India is important in the world of geosynthetics. I shall restate these two points in several ways in my next few remarks with the intent that the reader recognize the key arguments that support these themes. My arguments follow.

India has organized a Chapter of the IGS. In fact, India was the fifth nation or group in the world to organize a Chapter of the IGS. Today there are fourteen Chapters based on national or regional organizations with several additional groups under formation. Recently the society has grown at a rate of two Chapters per year. India is one of the founding members in the Chapter system. The successes of the Indian Chapter have pointed out the way to other groups with geosynthetics interests.

A word about the IGS is in order. The International Geosynthetics Society (IGS) was founded in Paris, on 10 November 1983, by geotechnical engineers and textiles specialists. The Society brings individual and corporate members together from all parts of the world, who are involved in the design, manufacture, sale, use or testing of geotextiles, geomembranes, related products and associated technologies. The IGS is dedicated to the scientific and engineering development of geotextiles, geomembranes, related products and associated technologies. The fundamental core of the IGS is the resident membership in each region or country that is represented by the Chapters. Chapters provide the vehicle for the IGS to achieve its goals of teaching, educating and disseminating knowledge in order to promote advancement of the discipline and expand the industry.

The Indian Chapter has been very successful. In terms of output, that is, the dissemination of information, India's sole rival is NAGS, the North American Geosynthetics Society. The North American Geosynthetics Society enjoys great success with their biennial conferences which can be traced back to the International Conference in Las Vegas in 1982.

NAGS has done an excellent job in promoting our discipline. But so has India. India has organized meetings, developed seminars, published proceedings and now India has organized a regional International Conference "Geosynthetics Asia '97". While the organization of this conference is a crowning achievement for the Indian Chapter, the officers of the IGS are sure that Geosynthetics Asia '97 will prove to be the launch pad for a very important series of regional conferences in Asia.

The conference Geosynthetics Asia '97 is the second argument that illustrates the importance of India to geosynthetics. To organize and conduct an inaugural Asia regional conference is a magnificent achievement. This meeting, conducted under the auspices of the IGS and coordinated with the quadrennial International Conference as well as the regional conferences in Europe and North America, will surely contribute to the achievement of the goals of the IGS. The objectives of the IGS are:

- to collect and disseminate knowledge on all matters relevant to geotextiles, geomembranes and related products, e.g. by promoting seminars and conferences,
- to promote the advancement of the state of the art of geosynthetics and of their applications, e.g. by encouraging, through its members, the harmonization of test methods, equipment and criteria, and
- to improve communication and understanding regarding such products, e.g. between designers, manufacturers and users and especially between the textile and civil engineering communities.

This series of well planned and coordinated Asian conferences will foster the growth of knowledge about geosynthetics in Asia and will result in growth within the industry.

The next argument recognizing India's impact on the geosynthetic industry is the recent formation of the Asian Activities Committee (AAC). The committee is to coordinate geosynthetic activities in the region and to develop regional conferences. The Asian Activities Committee is modeled after the European Activities Committee (EAC). The EAC was formed to coordinate efforts of several European Chapters, to minimize conflict between programs. The AAC has the same mission. AAC membership is automatically extended to Chapters in the Asian region. New Chapters formed in the region will also be extended membership. The AAC is encouraged to pay heed to the concerns of groups representing IGS membership in countries that have not formed a Chapter. For example, in Europe this means the Scandinavian countries of Denmark, Norway and Sweden can nominate a delegation to the EAC to express their views. Perhaps an Asian parallel would be a delegation representing points of view held by Australia and New Zealand.

India was the motivating force to form the Asian Activities Committee and will certainly continue to be a motivating force in the operation of the committee being formed during Geosynthetics Asia '97. The initiative for AAC was the product of the leadership of the Indian Chapter. Many people have contributed to the success of the Indian Chapter. Perhaps each IGS officer and council member could prepare a list of special contributors.

Two special contributors to the IGS as well as the Indian Chapter of the IGS stand out amidst the many important contributors. These two people have been my faithful correspondents for ten years while I held office as the Treasurer of the IGS and now as Secretary of the International Geosynthetics Society. These gentlemen are Mr. A.R.G. Rao and Mr. C.V.J. Varma. Mr. Varma is a duly elected member of the IGS Council and is an important contributor to that body.

The final testimonial to the significance of India in the world of geosynthetics is the candidacy of a second member

of the Chapter for the Council of the IGS. Mr. Som Sarkar is one of 12 candidates for 8 positions on the Council in the postal ballot election now being conducted.

There are other evidences of India's importance to the geosynthetic community. For example, the typical inventory of product types and technologies in the geosynthetic industry include woven geotextiles of polypropylene and polyester, knits of similar materials, nonwovens from needled and heat bonded processes, geogrids from extrusion and textile processes, geosynthetic clay liners, and drainage composites. India has the technology to produce a wide variety of these products. India's national technical inventory includes weaving, knitting, needlepunched non-woven manufacture and, with the inclusion of products from natural fibers, presents a technical spectrum that would be impressive for a region, let alone a country.

In conclusion, India is a major player in all aspects of geosynthetics. The conferences, manufacturing facilities, technical acumen and experts all testify to it. India sets a model for other Chapters.

submitted by P. E. Stevenson
Secretary, IGS

Indian Chapter Report

News Bulletin of the Committee

The committee brings out a news bulletin every six months. The latest issue was published in January 1997. The July 1997 issue is in print at the time of this report.

Formation of Asian Activities Committee of the IGS

It is proposed that an Asian Activities Committee of the IGS be formed along lines similar to the one constituted for the European Region. A request in this regard has since been made to the IGS.

The main task of this proposed committee will be to endeavor to achieve the aims of IGS and to promote and develop the use of geosynthetics in the region by organizing Asian Regional Conferences periodically (biennially). The first Asian Regional Conference is being organized for 26-29 Nov 1997 in Bangalore, India.

The proposed composition of the committee is:

- Chairman: Chairman of the Chapter hosting the regional conference,
- Members: One representative of each of the chapters in the Asian Region,
- One representative of IGS,
- Member Secretary: Member Secretary of CIGSI, New Delhi, India.

Forthcoming Meetings

1. Asian Activities Committee Meeting of IGS, 24 Nov 1997,
2. General Body Meeting of ASEG, 26 Nov 1997,
3. General Body Meeting of CIGSI, 27 Nov 1997.

Forthcoming Publications

The committee plans three special publications for the Geosynthetics Asia '97 conference:

1. Bibliography - The Indian Contribution to Geosynthetics,
2. Directory of Geotextiles in India (Vol. II),
4. Geosynthetics in Environmental Engineering.

submitted by Mr. A.R.G. Rao
Director-cum-Treasurer
Indian Chapter of the IGS

Short News Items

Geo'99 Call for Abstracts

The Industrial Fabrics Association International and the North American Geosynthetics Society make the following call for abstracts for the Geosynthetics '99 conference. Abstracts are due 12 December 1997. First draft papers are due 7 August 1998.

Contact: Ms. Martha Barnes at the Industrial Fabrics Association International, 1801 County Road BW, Roseville, MN 55113-4061, USA, Tel.: 1 (800) 225-4324.

Publications of the Indian IGS Chapter Available

- Proceedings of 2nd International Workshop on Geotextiles - US$100,
- An Introduction to Geotextiles and Related Products in Civil Engineering Applications - US$50,
- Directory of Geotextiles in India - US$30,
- Proceedings of Short Course on Ground Improvement with Geosynthetics - US$40,
- Proceedings of Workshop "Engineering with Geosynthetics" - US$40,
- Geosynthetics in Dam Engineering - US$60.

To order, please contact:
Mr. M. L. Gupta, Member Secretary
Central Board of Irrigation and Power, New Delhi, India
Tel.: 91-11-6875017 or 6870117 Fax: 91-11-6116347
http://www.cbip.org email: info@cbip.org

Feodorov Receives Degree

The President of Romanian IGS Chapter, Mr. Valentin Feodorov, received his Ph.D. degree from the Technical University of Civil Engineering in Bucharest on 4 Nov 1997.

reported by Ramiro Sofronie
member, Romanian Chapter

The First PLPS Geogrid Soil Railway Bridge Pier Now in Service

by F. Tatsuoka, T. Uchimura and M. Tateyama

The first prototype preloaded and prestressed (PLPS) geogrid-reinforced soil (GRS) bridge pier was constructed to support two 16.5 m railway bridge girders in the summer of 1996 in Fukuoka City, the Kyushu Island (Figure 1), Japan. The subsoil of the pier, which was a soft clay deposit, was improved by mixing in cement before construction of the pier. A GRS bridge abutment was also constructed to support one of the girders at the other end. The configuration of the abutment was similar to the PLPS GRS pier. The decision to construct these reinforced soil structures, instead of conventional reinforced concrete structures supported by a pile foundation, was based on its better cost/performance ratio. The backfill, which was a highly compacted well graded crushed sandstone gravel, was reinforced with geogrid sheets placed at an average vertical spacing of 15 cm with the help of gravel-filled bags placed on the shoulder of each gravel layer.

Immediately after the construction, a vertical preload of 2400 kN, or a vertical average pressure of 200 kPa, was applied to the pier through the top reaction block by means of four hydraulic jacks attached to the top ends of four tie rods. A compression of about 8 mm was observed. Then, at a total vertical load of 970 kN, the top ends of the four tie rods were locked to the top reaction reinforced concrete block to place the pier in compression. Subsequently, the full height rigid reinforced concrete facings were constructed on the four sides of the pier. Details are shown in Figure 2.

By these procedures, the backfill, under a high pressure, became a nearly elastic material when reloaded, having a very high stiffness, and no creep deformation (n.b.: even creep recovery was observed). The compression of the pier by a vertical load of 211 kN due to the placing of the girders was very small (only 0.08 mm), and the relaxation in the tie rod tension during the following year (approximately) was negligible. In comparison, the abutment was compressed about 0.5 mm immediately by the girder weight of 105 kN and exhibited a creep settlement of about 1.5 mm in the same time. The working principle of the PLPS reinforced soil and more details of the behavior of the pier and abutment up to this stage have been reported by Tatsuoka et al. (1997a, b).

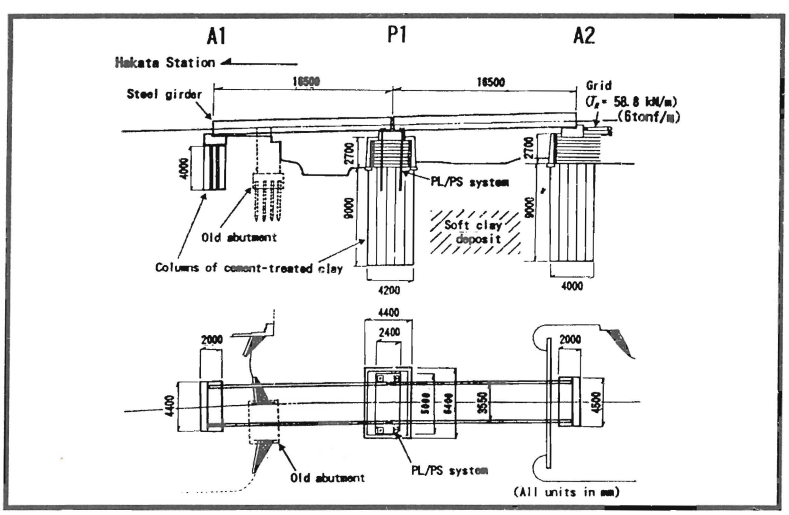

Figure 1. Two simple beam bridge girders for a single railway track, supported with a PLPS GRS pier and a GRS bridge abutment, Fukuoka City, Kyushu.

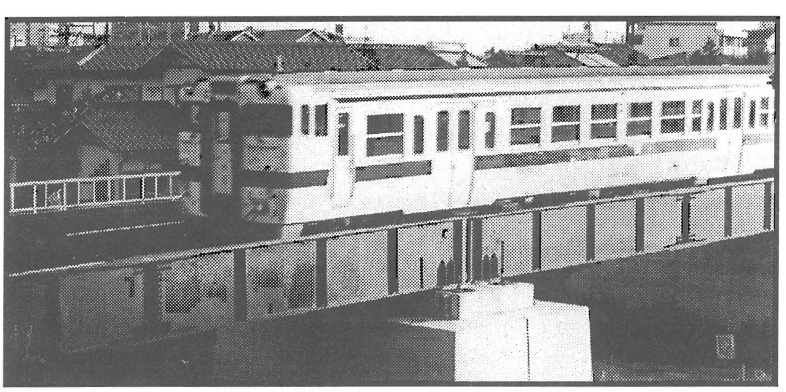

Figure 3. The first train passing over the bridge.

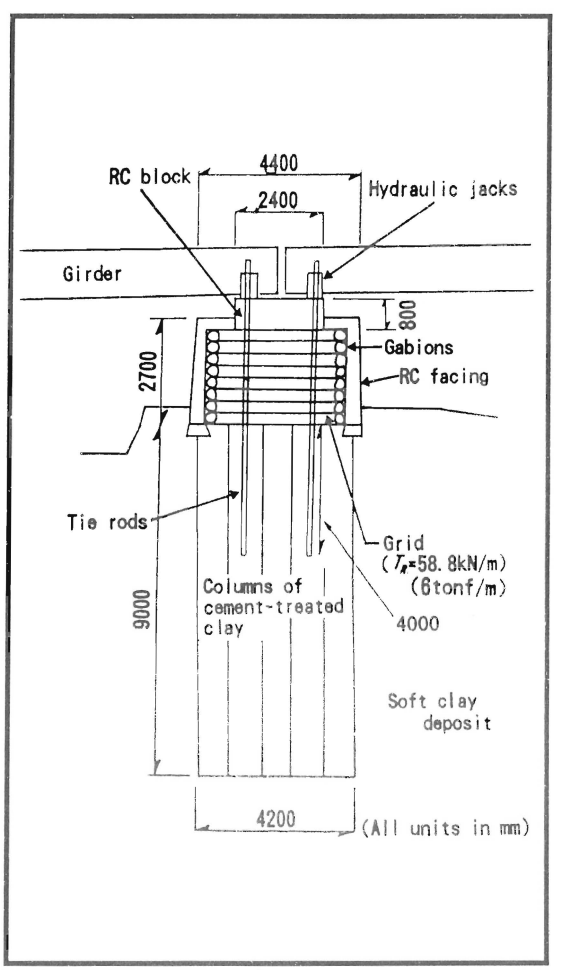

Figure 2. Details of the PLPS GRS pier.

On 19 July 1997, a 65-tonne diesel locomotive passed 6 times over the bridge. The residual compression of the pier was 0.02 mm, while the residual compression of the abutment was 0.52 mm. The bridge was opened to service for passenger trains on 3 August 1997 (Figure 3). The weight of each coach without passengers was 30 to 40 tonnes. On average, 125 trains, each consisting of two to four coaches, pass over the bridge every day The time histories of movements and tie rod tensions were recorded during the passing of the first train in service. The maximum compression of the pier was only about 0.02 mm without exhibiting any noticeable residual compression. In contrast, the abutment exhibited much larger maximum and residual settlements. Maintenance work will be required to alleviate the large residual compression of the abutment. On the other hand, no noticeable compression of the pier and reduction in the tie rod tension has been observed.

The performance of the PLPS GRS bridge pier has been very satisfactory. It is expected that this case history can contribute to the improvement of this new construction method and can lead to further applications in other construction projects.

References:

Tatsuoka, F., Tateyama, M, Uchimura, T. and Koseki, J. (1997a) Geosynthetic-Reinforced Soil Retaining Walls as Important Permanent Structures, Mercer Lecture 1996-1997, *Geosynthetics International*, v4, no.2, p81-136

Tatsuoka, F., Uchimura, T. and Tateyama, M. (1997b) Preloaded and Prestressed Reinforced Soil, *Soils and Foundations*, v37, no.3, p79-94

submitted by F. Tatsuoka and T. Uchimura
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and M. Tateyama
Railway Technical Research Institute, Japan

Geofoam Activities: Projects in South America and a New WWW URL

What is believed to be the first geofoam project in all of South America was completed in August 1997. The site of this project was near Valdivia in southern Chile, an area geologically renowned as the epicentral region for what some now believe was the largest earthquake in recorded history, in 1960. This area is also underlain by extensive deposits of weak, compressible soils which have resulted in conditions such as the one shown in Figure 1 - the abutment of the existing Cayumapu River bridge on Route T-205, the primary road between Valdivia and its airport. The traditional soil bridge approach/abutment fill has caused not only extensive settlement of the fill but a rotational shear failure of the underlying natural soils that has resulted in lateral deformation and buckling of the piles supporting the abutment. As a consequence, the abutment itself has rotated significantly as shown in the Figure (note that the bridge is still in service without any vehicle restrictions).

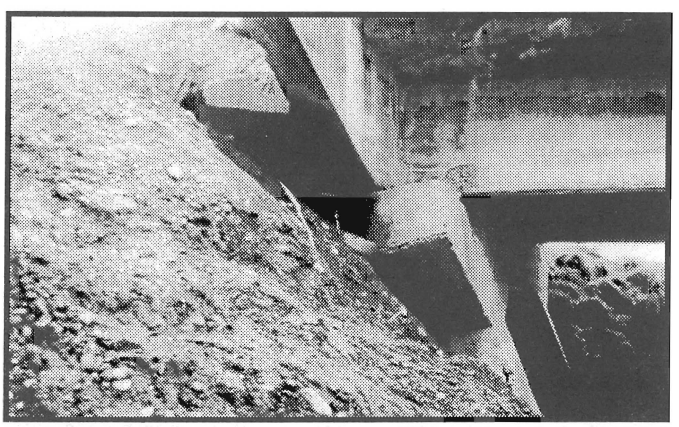

Figure 1. Bridge pier damaged by earthquake.

A new bridge is under construction adjacent to the existing one. The Chilean federal government road engineers elected to use EPS (expanded polystyrene) block geofoam for the first time as a lightweight fill material behind the abutment, primarily to both reduce settlement of the fill behind the abutment and reduce the potential for a rotational failure. A significantly reduced lateral "earth" pressure on the abutment itself is also a benefit. The high strength-to-density ratio of EPS-block geofoam was the reason for its choice on this project. The very low density of EPS-block geofoam (20 kg/m^3 on this project) is demonstrated in Figure 2 which shows two workers handling the unusually long (6 meters) blocks that are manufactured locally in Chile. Even with a density that is only 1% of that of soil, many projects worldwide since 1972 have demonstrated that EPS-block geofoam can satisfactorily support motor vehicles, trains, and airplanes.

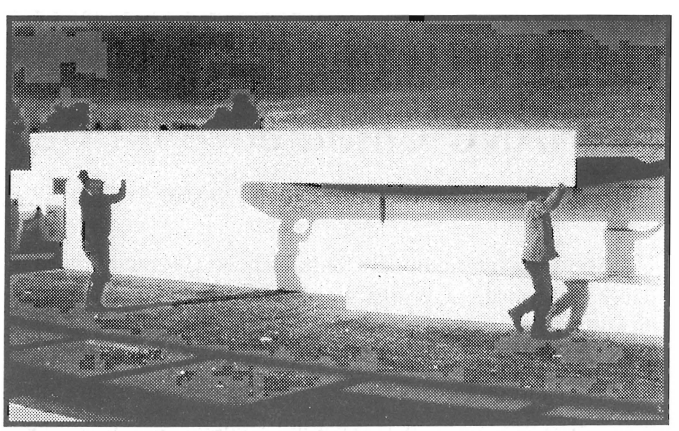

Figure 2. Workers carrying large block of geofoam.

Use of geosynthetics is widespread in Chile. This project was no exception. The complementary, often synergistic rela-

tionship that geofoam has with other, more-traditional geosynthetics was demonstrated on this project as well. Because the approach fill for the new bridge was to be constructed in water after the new bridge was in place (the abutments for the new bridge were constructed within temporary cofferdams), a geotextile-wrapped "mattress" of geogrid-reinforced sawdust (a locally available lightweight fill material) was placed to provide access to the previously constructed abutment.

With the successful completion of this first geofoam project, other projects using EPS-block geofoam for both new and rehabilitated roads are already under design in Chile. This country's roads have been particularly distressed this past year by the abnormally heavy winter rains accompanying the latest El Niño weather pattern.

On a related matter, 1 September 1997 marked the move of The GEOFOAM WWW Site to a new server: http://www.geofoam.org

submitted by John S. Horvath
IGS Member

Liner Testing Workshop Held at Sardinia '97

A workshop on "Testing of Liners" was held at the recent Sixth International Landfill Symposium (Sardinia '97) in Cagliari, Italy in October 1997 (see related article on p3). The topics discussed ranged from the determination of the hydraulic conductivity of compacted clay liners to the aging of geomembranes. The importance of measuring diffusion coefficients for both GCLs and geomembranes and the use of these in impact calculations was discussed. It was noted that there is significant potential for some organic contaminants to migrate through geomembranes. Hence, the underlying compacted clay or, eventually, GCL has an important role to play in limiting the migration of these contaminants. Likewise, the "clay" liner is very important for limiting the advective movement of contaminant through holes in the geomembrane and the subsequent transport through the underlying liner. Designers must carefully consider the mineralogy of the clay and assess the clay leachate compatibility. Estimates of long term leakage should be based on considerations of long term hydraulic conductivity of the clay in contact with leachate.

The challenges associated with assessing the puncture resistance of geomembranes and the effectiveness of protection layers (incorporating geotextiles) was discussed in some detail and it was concluded that much more work needs to be done. Several participants indicated that geomembranes with many holes are being installed. These are being detected by modern techniques and most can be repaired before the liner goes into operation. However this highlights the need for better design of protection layers. It was noted that the holes that may be formed during construction are only one aspect of the problem, and one that can be relatively easily fixed. Another aspect is the stresses induced in the liner during (and following) placement of waste and the potential these may have for affecting the long-term performance of the geomembrane. The potential problems can be minimized by using an appropriate protection layer over the geomembrane.

The final topic was the potential for interaction and aging of geomembranes in contact with leachate. More needs to be done on this issue. In particular, aging studies on HDPE geomembranes should also include tests in a stressed condition to examine the effects of aging on stress crack resistance. The importance of more specific studies for the development of "synthetic" leachates for laboratory aging investigations, according to the different field situations, was also discussed.

Finally, the need for long-term monitoring of geomembranes in field installations was emphasized. There will be several papers on this topic at the Sixth International Conference on Geosynthetics to be held in Atlanta, 25-29 March 1998 (see related article on p1). At the end of the workshop, all the participants stressed the need of stimulating more research on site testing on both natural and artificial liners.

submitted by Daniele Cazzuffi, IGS Council Member
and R. Kerry Rowe, Immediate Past President, IGS

PIANC Conference on Geotextiles and Geomembranes in River and Maritime Works

The First International Conference on Geomembranes in River and Maritime Works was held in Reims, France, on 7 October 1997.

The conference, organized by PIANC (Permanent International Association of Navigation Congresses), was a success, attracting delegates from ten countries, primarily European.

The objective of the conference was to provide an overview of the current uses and applications of geosynthetics in maritime and river works. There were several distinguished speakers from France, Belgium, Italy, Germany, The Netherlands, the UK, and the USA.

Copies of the proceedings are available from the PIANC General Secretariat, Graaf de Ferraris, 11eme etage, Box 3, Bld. Emile Jacqmain 156, B-1000 Brussels, Belgium (Fax: +32 2 553 71 55).

submitted by C.J.F.P. Jones
President, IGS

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 selection of corporate profiles were described in IGS News, v4, no. 2, p7. 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.

E&S Engineering Co., Ltd.
Seoul, Korea

by Young Youn Kim, Executive Director

E&S Engineering Co., Ltd. specializes in geotechnical and structural engineering. E&S focuses on reinforced earth retaining walls and has developed its own design facilities. The company has supplied up to 800,000m^2 of wall face in local markets since 1986 (US$6.5 million in annual revenue). E&S has imported the Geoweb system from the Presto Products Company in the USA since 1994 as a sole distributor and supplier of this product to the local market with its own design and consulting services.

Presently, E&S designs its own reinforcements that satisfy the local geological conditions including the predominant soil properties in Korea. The new reinforced earth retaining system, the so-called Korean traditional type, which consists of unique facing blocks and ES Grid, has been developed by our own research team including Dr. Eun-Soo Lee, President of the Korean Institute of Construction & Structural Safety, Prof. Hongtaek Kim at Hongik University, Prof. Eunchul Shin at the University of Inchon, and Prof. Hanyong Jeon at Chonnam National University. E&S Engineering is proud of its reputation earned from past projects. E&S has expanded its scope of expertise to include:

- Site investigation and instrumentation,
- Laboratory testing,
- Design and planning,
- Development planning,
- New reinforcement techniques: ES Grid, Friction tie, Plate anchor, Triangle anchor,
- Construction and Consulting,
- Slope protection, erosion control, earth retention, soil improvement,
- Sole distributor of Geoweb Cellular Confinement System.

A Case History - Phoenix Park Resort

The Phoenix Park Resort is a new development located in Kangwon-do, a noted popular resort region on the eastern side of the Korean peninsula. The total area of this project is approximately 16,500,000 m^2. The project was constructed by the Samsung Construction Co. The geological setting is very rugged and steep. Preserving the natural landscape would be almost impossible. In particular, the access road could not be constructed without overexcavation and construction of a heavy retaining wall which would give an unsightly appearance to this resort. E&S Engineering recommended a Geoweb retaining wall which could be blended with the surrounding scenery as the best solution.

The Geoweb System is an expandable, polyethylene honeycomb-like cellular structure used to confine and improve the performance of infill materials in the earth retention system. It provides a very steep or near vertical surface which minimizes erosion and remains structurally stable under its own weight and externally imposed loads. The basic Geoweb System can be adapted to a wide range of design requirements and site conditions. The system's extreme versatility results from its inherent flexibility, unique load deformation behavior, and suitability with a wide range of infill materials and foundation soils. Eventually this retaining wall, which is 200m long, with heights varying from 6 to 14m, was successfully completed. After vegetation started on the face of this wall in 5 months, all parties were satisfied and pleased with this attractive and reliable retaining wall system.

For more information please contact:

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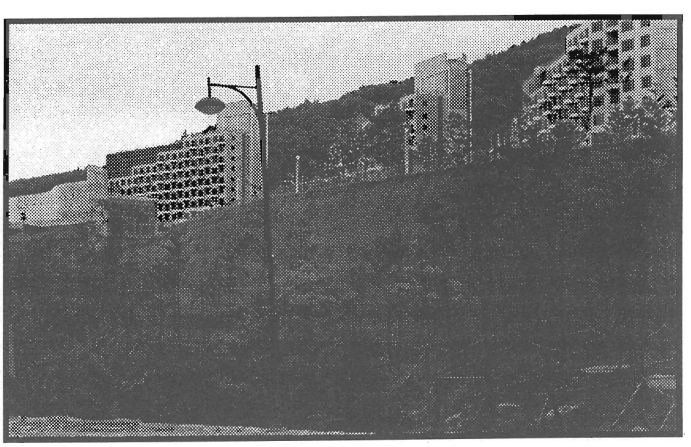
email: EANDS@chollian.dacom.co.kr

E&S Engineering Co., Ltd. has been a Corporate Member of the IGS since 1997.



Phoenix Park Resort in Pyungchang, Kangwon-do, Korea.

Geofelt G.m.b.H.

Linz, Austria

by Günter Göhring, President

Background to the incorporation of Geofelt

During the last decade or so there has been a tremendous increase in the number of generic types of geosynthetic products with even more still emerging. Nowadays almost any geotechnical problem can be solved with the use of the proper geosynthetic. However, this multitude of material types can make it very difficult for some designers, specifiers and contractors to find the right products, at a fair price, backed by professional technical and commercial support.

In some instances the large and long established commodity producers, with limited product ranges, either have not addressed this problem or responded to its challenge. This has opened up the opportunity for the emergence of a number of small companies offering multi-product sourcing.

Geofelt was founded in March 1994 to provide the international civil engineering community in Europe, the Middle East, and Southeast Asia, with geosynthetics, technical advice and practical commercial expertise.

Corporate philosophy and principles

Geofelt's philosophy is to 'think in systems', paraphrased as 'geo-logical competence'. By this, Geofelt means working with customers from inception through the selection of the correct package of products and their 'just in time' delivery. Geofelt's product portfolio includes the following materials: classical geotextiles - both nonwoven and woven; high strength geotextiles; geogrids; drainage composites; vertical drains; erosion control products; biodegradable geotextiles; paving grade fabrics; sandmat composites; geosynthetic clay liners; geomembranes; concrete protective liners; pipes; fittings and accessories.

These are produced for us, to our specifications, by leading manufacturers who hold product quality in the highest regard. Therefore, almost without exception, our production partners operate under ISO 9000 series manufacturing quality assurance procedures. Geofelt does random and independent material quality verification testing. This is called 'our quality concept' and it means that Geofelt customers can have the utmost confidence in the entire range of geosynthetics.

Corporate structure

Geofelt is not a large company in terms of the number of staff members, nor does it intend to become one. This is because Geofelt would lose the personal aspect of the business and perhaps efficiency.

Geofelt's headquarters are in Linz, Austria. This is where the commercial team is located, lead by Gerald Wurzinger, Vice President, Marketing and Sales. The German office is in Wuppertal, in central Austria, and it is directed by Klaus Freiter who has more than 20 years of practical experience in designing with geosynthetics, as well as in their distribution and installation. In Southeast Asia, Geofelt has a joint venture company in Singapore, together with a resident company.

These three offices are supported by a carefully selected and well-trained team of specialist distribution partners. These independent firms are at multiple locations in most European countries, the Middle East, and Southeast Asia.

The future

Geofelt is now three years old. Geofelt intends to continue to provide our customers with the total geosynthetic solution, every time, on time and in synergy with their needs.

For more information, contact:

Geofelt G.m.b.H.
Landstrasse 80, A-4020 Linz, Austria.
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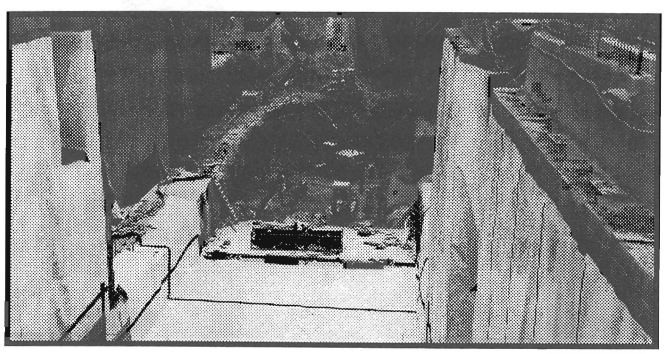
Geofelt has been a Corporate Member of IGS since 1997.



The Athens Metro. Geofelt has supplied the geosynthetic components for the entire lining system.

Installing a large area of Geofelt Bentonite Liner (GBL).

Geosynthetics International
an Official Journal of the IGS

Geosynthetics International has established itself as a premier peer-reviewed journal on geosynthetics. The journal publishes technical papers, technical notes, discussions, and book reviews on all topics relating to geosynthetic materials (including natural fiber products), research, behavior, performance analysis, testing, design, construction methods, case histories and field experience.

The Editor of *Geosynthetics International* (Dr. T.S. Ingold), Co-Editor (Prof. R.J. Bathurst), and Chairman of the Editorial Board (Dr. J.P. Giroud) have more than 30 years of combined experience with the publication of technical journals. They are assisted by a first-rate Editorial Board composed of international experts that are appointed to four year terms and who represent a broad range of geosynthetics expertise. Rapid publication of papers provides subscribers with current papers covering geosynthetics research, design, construction methods and important case studies. Only papers peer-reviewed by experts are published. The journal has published over 750 pages of technical papers, technical notes, and discussions in each volume of the last two years. Special issues devoted to specific, state-of-the-art topics have included "Design of Geomembrane Applications" and "Liquid Migration Control Using Geosynthetic Liner Systems". A special issue titled "Geosynthetics in Earthquake Engineering" will be published at the beginning of 1998.

Geosynthetics International is dedicated to the mission of the IGS which is to promote the scientific and engineering development of geotextiles, geomembranes, related products, and associated technologies. *Geosynthetics International* offers a reduced subscription rate to individual IGS members. Individual IGS Members can subscribe for US$129 per 6 issues. *Geosynthetics International* is offered to university and college libraries at US$138 per 6 issues. The standard rate of US$225 applies to all others.

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Geotextiles and Geomembranes
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Elsevier Science Ltd. is pleased to announce the appointment of Professor R. Kerry Rowe as the new Editor of *Geotextiles and Geomembranes*. Prof. Rowe is Immediate Past President of the IGS. He begins editorship with Volume 16. This appointment maintains the high regard held for the journal by the scientific community. Submit contributions to:

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Chanakyapuri, New Delhi, INDIA 110021
Tel.: 91 11 3015984/3016567 Fax: 91 11 3016347
email: cbip@cbipdel.uunet.in

Filtration '97
International Conference & Exposition
Chicago, IL, USA, 1 - 3 December 1997
Rosemont Convention Center
Contact: INDA, 1001 Winstead Drive, Suite 460, Cary, NC 27513, USA
Tel.: 1 (919) 677-0060 ext. 126 Fax: 1 (919) 677-0211

Creep and Assessment of Geosynthetics
for Soil Reinforcement
Leatherhead, Surrey KT22 7SA, UK, 5 Dec 1997
Contact: Emma Mahoney, Conference Assistant
Tel.: +44 (0) 1372 367125 Fax: +44 (0) 1372 377927
email: conferences@era.co.uk

The 11th Annual GSI/GRI Conference
Springfield, PA, USA, 9 - 10 Dec 1997
Contact: Geosynthetic Institute/Geosynthetic Research Institute, 130 Wood Road, Springfield, PA 19064, USA
Tel.: 1 (215) 895-2343 or 1 (610) 543-5262
Fax: 1 (215) 895-1437 or 1 (610) 543-5262
email: marilyn.ashley@coe.drexel.edu

GEO-BENTO '98
Paris, France, 2-3 Feb 1998
Contact: Mireille FERRY-ALIX/BRGM Formation
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FRANCE
Tel.: 33 238 64 32 40 Fax: 33 238 64 47 00
email: m.ferryalix@brgm.fr

Sixth International Conference on Geosynthetics
Atlanta, Georgia, USA, 25-29 Mar 1998
Contact: Danette Fettig, IFAI, 1801 County Road BW
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Tel.: 1 (612) 222-2508 Fax: 1 (612) 222-8215
email: DFettig@northernnet.com

World Road Association (PIARC)
Granada, Spain, 11-13 Nov 1998
Contact: Asociacion Tecnica de Carreteras
C/ Monte Esquinza, 24, 28010 Madrid, Spain
Tel.: 34 (1) 308 23 18 Fax: 34 (1) 308 23 19
http://www.piarc.inrets.fr

Geosynthetics '99
Boston, MA, USA, 28-30 Apr 1998
Contact: Danette Fettig, IFAI, 1801 County Road BW
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Du Pont De Nemours Int. (Luxembourg) S.A. - Luxembourg (1984)
E & S Engineering Co., Ltd. - Korea (1997)
Engtex AB - Sweden (1995)
Fibertex A/S - Denmark (1984)
Fiti Testing and Research Institute - Korea (1997)
Fritz Landolt Ag - Switzerland (1985)
Geofabrics Ltd. - UK (1995)
Geofelt GmbH - Austria (1996)
Geotechnics Holland B.V. - Netherlands (1991)
Geotextiles (M) Sdn Berhad - Malaysia (1991)
Geotop Corporation - Japan (1994)
Golden-Pow Co., Ltd. - Korea (1996)
GSE Lining Technology, Inc. - USA (1988)
Hong Kong Geosynthetics - Hong Kong (1996)
Hong Leong Plastics Pte Ltd. - Singapore (1994)
Huesker Synthetic GmbH & Co. - Germany (1987)
Industrial Fabrics Association International (IFAI) - USA (1985)
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)
Mecaroute S.A. - France (1996)
Mitsubishi Kagaku Sanshi Corporation - Japan (1992)
Mitsui Petrochemical Industrial Products Ltd. - Japan (1992)
National Seal Company - USA (1992)
Naue Fasertechnik GmbH & Co. KG - Germany (1987)
Netlon Ltd. - UK (1989)
Nippon Zeon Co., Ltd. - Japan (1992)
Nittoc Construction Co., Ltd. - Japan (1994)
Obayashi Corporation - Japan (1988)
Officine Maccaferri S.P.A. - Italy (1997)
Okasan Kogyo Co., Ltd. - Japan (1984)
Pavco S.A. - Colombia (1991)
Poly-Flex, Inc. - USA (1996)
Polyfelt GmbH - Austria (1984)
Presto Products - USA (1996)
Rhodia-ster Fipack S.A. - Brazil (1994)
Sewon Geosynthetics Co. - Korea (1997)
Shimizu Corporation - Japan (1990)
Solmax International, Inc. - Canada (1997)
Sotrap S.A. - France (1996)
Steel Dragon Enterprise Co., Ltd. - Taiwan (1996)
SVUG - Czech Republic (1993)
Synthetic Industries Inc. - USA (1991)
Taiyo Kogyo Co., Ltd. (Ocean) - Japan (1996)
Taiyo Kogyo Corporation (Sun) - Japan (1991)
Tanaka Co., Ltd. - Japan (1993)
Tele Textiles AS - Norway (1995)
Ten Cate Nicolon B.V. - Netherlands (1984)
Tenax SpA - Italy (1991)
Terram Ltd. - UK (1988)
Thai Nam Plastic Public Co., Ltd. - Thailand (1994)
The Reinforced Earth Co. - USA (1989)
The Tensar Corporation - USA (1989)
The Zenitaka Corporation - Japan (1992)
Tokyu Construction Co., Ltd.- Japan (1984)

***note**: date is earliest year of continuous membership*

The International Geosynthetics Society

OBJECTIVES OF THE IGS

The International Geosynthetics Society was formed with the following objectives:

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

WHY BECOME A MEMBER OF THE IGS?

First, to contribute to the development of our profession.
By becoming a member of the International Geosynthetics Society you can:

- help support the aims of the IGS, especially the development of geotextiles, geomembranes, related products and associated technologies.
- contribute to the advancement of the art and science of geotextiles, geomembranes and related products, and associated technologies.
- participate in 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, email 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 IGS endorsed journals.
- A central system for ordering selected publications.
- Possibility of earning an IGS award.

IGS MEMBERSHIP APPLICATION

Membership of the International Geosynthetics Society (IGS) 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 individuals and US$1000 for corporate members. Individuals of 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.

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- **Eligibility** (i.e. connection with geotextiles, geomembranes, related products and associated technologies)

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PAYMENT

Membership fee schedule: ❑Individual US$45 ❑Corporate US$1000 ❑Benefactors contribution (at least US$200)

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