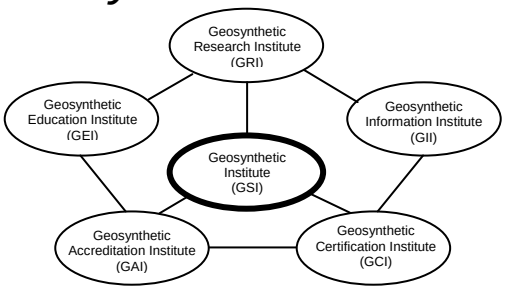
The GSI Newsletter/Report

Geosynthetic Institute



Vol. 19, No. 2 **June 2005**

This quarterly newsletter, now in its 19th year, presents the activities of GSI and its related institutes to all who are interested. It is available on the institute's home page at www.geosynthetic-institute.org. It also serves as a quarterly report to its member organizations. Details are available by contacting Robert M. Koerner or Marilyn Ashley at phone (610) 522-8440; fax (610) 522-8441 or e-mail at robert.koerner@coe.drexel.edu or mvashley@verizon.net.

Activities of the GSI Board of Directors & Institute Directors

1. A major effort over the past quarter has been expended in trying to sort out a number of GCL issues. To this end we have finalized White Paper #5 on GCL Separation Beneath Exposed Geomembranes. It is available on our Web Site.
2. Accompanying the above is a power point presentation which is available for members and for their respective use.
3. We have been requested to do a White Paper on "geomembrane lifetime prediction" and are doing so currently. It is our most frequently asked question and deserves to have a unified and consistent answer. It will be available on our Web Site.
4. The 5th Edition of Designing With Geosynthetics is out. The publisher is Pearson-Prentice Hall and it is available through them at www.prenhall.com, or through Amazon. com, or through GSI.
5. The GMA effort of answering e-mails from anyone, anywhere, at anytime is catching-on. To date we have answered 30-questions of a meaningful nature. To use it go to <GMAtechline@ifai.com> and ask away. Remember, however, that GSI member organization get far better service by coming straight to George, Grace, Marilyn or myself.
6. Geomembrane and Geonet (Geocomposite) use surveys, by application and geographic areas, are finished and have been sent to the participating companies. GSI is struggling a bit as to the continuing of these surveys, or to open it up to all geosynthetics. If you have ideas please forward them to us at GSI, or your BoD member.
7. Your board members are as follows.

NOTICE: This Newsletter/Report is mailed to the contact persons of the GSI member organizations (~ 100 total). Obviously, we wish you would share it with colleagues and friends. Please recognize, however, that it is always available on our Home Page at www.geosynthetic-institute.org in the open section under the heading "Newsletter/Report".

Term Ends 2005
Dick Stulgis - GeoTesting Express
Jim Olsta - CETCO
Dave Suits - NY State DOT
Term Ends 2006
Tony Eith - Waste Management Inc.
Boyd Ramsey (Chairman) -
GSE Lining Technology, Inc.
At Large; Sam Allen - TRI/Environmental, Inc.
Term Ends 2007
David Jaros - Corps of Engineers
Rex Bobsein - Chevron/Phillips Co.
Kent von Maubeuge - Naue Fasertechnik GmbH

IN THIS ISSUE

Overview of GRI Projects (Research)

Each issue of our Newsletter/Report provides a brief glimpse and update of current GRI research projects. Details and full briefings are available to member organizations at their request. Dr. Grace Hsuan, Associate Director of GRI can be contacted for additional information as can the other project managers listed in the write-ups. ***Projects marked with an asterisk have been written up as short "in-progress" papers.*** Grace can be reached at (610) 522-8440 or e-mail at <grace.hsuan@coe.drexel.edu>.

1. **Stress Cracking of Geomembranes*** - Dr. Grace Hsuan is project manager of our ongoing efforts to evaluate stress cracking of geomembrane resins, sheets and seams. In addition to her ongoing evaluations of HDPE geomembranes, Grace is now focusing on HDPE drainage and duct pipe. The goal for both geomembranes and geopipe is to include technically viable test methods and limiting values in generic specifications.
2. **Durability and Lifetime Prediction*** - This project is based on our previous 8-year long study on the lifetime prediction of HDPE geomembranes. George Koerner has set up 20 replicate columns each of which is subjected to a compressive stress equivalent to a 50-m high landfill. In each of the columns are the following:

   (a) 1.5 mm HDPE geomembrane with no antioxidants (Stage B and C degradation will be evaluated)
   (b) 140 g/m^2 needle punched nonwoven PP geotextile
   (c) 140 g/m^2 woven slit film PP geotextile
   (d) 90 kN/m woven multifilament PP geotextile
   (e) 175 kN/m woven multifilament PP geotextile

   Temperatures are being maintained at 85, 75, 65 and 55ºC and the samples are being removed on approximate 6-mo. intervals. Grace Hsuan and George Koerner are in charge of the project. White Paper #6 on this topic will be available shortly.
3. **Durability of Polypropylene Geotextile Fibers and HDPE Geogrid Ribs** - Incubation at temperatures of 75, 65 and 55°C in forced air ovens is ongoing using PP-woven geotextile fibers and HDPE geogrid ribs. This study periodically measures changes in density, dimensions, mass, morphology, strength, elongation, modulus, melt index, OIT and carbonyl content. Dr. Hsuan is in charge of the project.
4. **Durability of Polyester Geotextile Fibers and Polyester Geogrid Yarns** - PET geotextile fibers and coated geogrid yarns are being incubated at temperatures of 65°C, 55°C and 45°C while being immersed in deionized water. Additional parameter variations are crystallinity, molecular weight and CEG content. This study periodically measures changes in mass, diameter, morphology, strength, elongation, modulus, molecular weight, crystallinity and CEG content. Dr. Hsuan is in charge of the project.
5. **In-Situ Temperature Monitoring of Liner and Cover Geomembranes in Dry and Wet Landfills*** - Dr. George Koerner is evaluating the in-situ temperature behavior of geomembranes and has installed 60± thermocouples for long term measurements in both a wet and dry municipal solid waste landfill in Pennsylvania. Presently data for 10-years is available. This is clearly the longest in-situ measurement project in all of geosynthetics.
6. **Bioreactor (aka, Wet) Landfill Behavior and Properties*** - The above temperature monitoring has segued into a major effort under sponsorship of GSI and Waste Management, Inc. The wet cell under investigation is at field capacity, hence it is a true anaerobic bioreactor. Dr. George Koerner is in charge of considerable monitoring which includes the following:
   - waste moisture content
   - waste temperature
   - leachate chemical analysis
   - waste gas analysis
   - perched leachate within the waste

   Data is being collected on a quarterly basis. The timeline of the project calls for monitoring for 5 to 10 years. This activity will now extend to an adjacent landfill to see how reproducible the data is.
7. **Flow Behavior of Fully Degraded Waste*** - A field project under sponsorship of GSI and Waste Management investigates the drainage of highly degraded MSW placed directly on leachate collection systems. The leachate collection systems are both natural soils and geosynthetic drains. The project has commenced this summer at a landfill in the Philadelphia area.
8. **Hydrostatic Creep Puncture of Geomembranes*** - The effect of sustained long-term hydrostatic and geostatic pressures on the puncture strength of geomembranes is an ongoing project. A series of tests using 600 g/m^2 protection geotextiles on 1.5 mm thick HDPE geomembranes is being evaluated; the time is currently 8-years. The four-test setups use truncated cone simulations of coarse subgrade stones against the geotextile protecting the underlying geomembrane. The behavior of the

geomembranes under these tests is a combination of creep and stress relaxation. Results are used in a puncture design method that has been published previously. The purpose of these current tests is to better define the creep reduction factors used in the design method.

9. **Long-Term Benefits of Geotextile Separators*** - A full-scale field database of using geotextile separators on firm soil subgrades is being developed and maintained by Dr. George Koerner. Monitoring is proposed for up to 20-years. The target sites are paved highways, driveways, parking lots, etc., where control sections without geotextiles are also available for comparison purposes. This database will be national and perhaps even international in scope. Included are sites which meet the following criteria:
   - sites must have both geotextile and nongeotextile control sections
   - known type of geotextile(s)
   - known soil conditions
   - known traffic conditions
   - available hydrologic and environmental conditions
   - capability of quantifying the original condition of the pavement surface vs. the aged condition… this will be accomplished visually as well as by using falling weight deflectometers.

   There are currently 14-sites included in this program. If you have additional sites to add, please contact George at (610) 522-8440.
10. **UV Exposure of Geomembranes*** - GSI is using its new Xenon Arc device along with its two existing UV-fluorescent devices to evaluate the simulated outdoor lifetime of nine different types of geomembranes 2 HDPEs, LLDPE, 3 fPPs, 2 PVCs and PE-R. The effort is considered as part of GSI's Center for Polymers in Hydraulic Structures (CPHyS), but has relevancy in many other applications as well. White Paper #6 will update our efforts in this regard.
11. **High Pressure Incubation for Lifetime Prediction*** - Dr. Grace Hsuan has an ongoing National Science Foundation project on this topic. Five high pressure cells are involved: four are at 2.1, 3.5, 4.9 and 6.3 MPa and one is the control at atmospheric pressure. In the cells are HDPE geogrids, needle punched nonwoven PP geotextiles, and woven slit film PP geotextiles. They will be periodically retrieved and tested for OIT and tensile strength. Comparison will then be made to nonpressure incubation to assess the acceleration factor.
12. **Generic Specifications** - A major effort is ongoing with respect to the development of generic geosynthetic specifications. The current status of these specifications is as follows, with the GCL spec being the most recent.

Completed

GM13 – HDPE Geomembranes
GM17 – LLDPE Geomembranes
GM18 – fPP Geomembranes (Temporarily Suspended as of May 3, 2004)
GM21 – EPDM Geomembranes
GM19 – Geomembrane Seams
GT10 – Geotextile Tubes
GT12 – Geotextile Cushions
GT13 – Geotextile Separators
GCL3 – Geosynthetic Clay Liners (New)

Working Within Focus Groups

GCXX – TRMs for Erosion Control
GNXX – Geonet Drainage Composites
GMXX – Exposed Temporary Covers

Delayed or Off in the Distance

GGXX – Biaxial Geogrids
GGXX – Uniaxial Geogrids
GCXX – Drainage Geocomposites

The completed specifications are available to everyone (members and nonmembers) on the open section of our Home Page. Please download and use them accordingly. Also note that this is where the latest modification will always be available.

These specifications are available on a separate power point CD which shows photos of the test devices and can be used as a presentation to your clients and customers, as well as being an in-house training vehicle… don't hesitate to ask for a copy.

13. **Technical Guidance Documents on QC/QA of Waste Containment Facilities** - Drs. David Daniel and Bob Koerner have completed the Second Edition of this EPA project by greatly updating the original 1993 report. Its publication is uncertain, but if you want a preliminary copy on CD (~ 390 pages) contact us accordingly.
14. **Various Power Point Presentations** - To date we have distributed about 500 copies of a Introduction to Geosynthetic CD and about 300 copies of a Selected Geosynthetics Lectures CD (SRWs, LF Expansions, and Dam Waterproofing). Each screen has a short voice-over and each can be presented in about 50-minutes. They are ideal for classroom use or for "brown-bag" seminars, and the like. Ask if you want copies; no charge. We will now do our third CD, this one with an additional three lectures. Our target date is mid-July.

Activities within GII (Information)

We are currently supporting 2-Home Pages. The first is the GRI Home Page which is accessed as follows:

<<http://www.drexel.edu/gri>>

This home page is very introductory as far as geosynthetics knowledgeable people are concerned, and is meant to be promotional (for prospective students and potential institute members). It is probably only of nominal interest to most readers of this Newsletter/Report.

The second home page is the GSI Home Page (which is "terrific") and is accessed as follows:

<<http://www.geosynthetic-institute.org>>

It has been reconfigured through the fine efforts of Marilyn Ashley. Everyone (members and nonmembers) can access the open part, which has the following menu:

- **Introduction to GSI**
- **Prospectus**
- **Associate Membership (Agencies)**
- **Members by Focus Groups**
- **GSI Publications**
- **GRI Specs, Guides, White Papers**
- **Laboratory Accreditation**
- **CPReS & CPHyS**
- **Laboratory Accreditation**
- **Product Certification**
- **Newsletter/Reports**
- **Internet Courses**
- **Winter 2005 Courses**
- **Geosynthetics Links**
- **GSI Member Meetings**
- **Next GRI Conference**

To go further one needs a members-only password. Your contact person (see the last section of this Newsletter/Report if you do not know who it is) must get a password from Marilyn Ashley. Marilyn can be reached by e-mail at mvashley@verizon.net. When you get into this section, a treasure-trove of information is presented. This includes:

- **GRI Test Methods**
- **GRI Reports (Summaries)**
- **GRI Technical Papers (Citations)**
- **Notes of GSI Meetings**
- **Links to the GSs World**
- **Keyword Search for Literature**
- **Example Problems**
- **Frequently Asked Questions (FAQs)**

The keywords section contains about 7500 citations of all of the geosynthetics literature published in English. It's quite easy to use provided that you have a specific topic, or area, in mind. This is the section that we (and others we are told) use the most in our entire site.

Progress within GEI (Education)

The following four (each 1-day long) courses will be offered at GSI in August, 2005. They are good and they are also inexpensive!

Course #1 - August 4, 2005

Geosynthetics in Transportation/Geotechnical Applications

Goal: This one-day course is focused on the design, testing and construction of geosynthetics used in transportation and infrastructure facilities such as paved highways, unpaved roads, railroads, walls, steep slopes, embankments, filters, drains, and erosion control. The geosynthetics utilized are the following:

- geotextiles,
- geogrids,
- geonets,
- geomembranes,
- GCLs, and
- geocomposites.

Course #2 - August 5, 2005

Geosynthetics in Reinforced Walls and Slopes incl. Computer Design

Goal: This one-day course is focused on the proper design and construction of reinforced retaining walls and steep soil slopes using geogrids or geotextiles. Included are the following:

- overview of concepts, aesthetics, costs, designs and performance,
- actual testing for tension, shear and transmissivity of geosynthetics,
- computer design using MSEWall® and ReSlope® - with Dr. Dov Leschinsky of the University of Delaware, and
- design of wall and slope drainage systems

Course #3 - August 11, 2005

Geosynthetics in Waste Containment Applications

Goal: This one-day course is focused on the proper design, testing, and construction of geosynthetics used in liner and cover systems for landfills, surface impoundments and waste piles. Included are the following geosynthetics:

- geomembranes,
- geotextiles,
- geonets,
- geogrids,
- geosynthetic clay liners,
- geocomposites, and
- geopipe.

Course #4 - August 12, 2005

Quality Control/Quality Assurance of Geosynthetics

Goal: This one-day course is focused on the quality control and quality assurance of geosynthetics as placed in permanent and/or critical applications. Specifications and testing are emphasized. It focuses on both the manufactured geosynthetics and on the installation processes. Applications are mainly in the waste containment area, i.e., landfills and surface impoundments, but applicability to walls, slopes, dams, canals, etc., will also be discussed. Included are the following geosynthetics:

- geomembranes,
- geosynthetic clay liners,
- geosynthetic drainage systems (geonets and geocomposites),
- vertical cutoff walls,
- ancillary materials & appurtenances.

All of these courses come with a complete set of notes, are fast-paced, extremely current, come with a great lunch, and are cheap! ($100 for GSI members; $200 for nonmembers). In addition, continuing education credits are given for each course!

Activities within GAI (Accreditation)

The Geosynthetic Accreditation Institute's (GAI) current mission is focused on a Laboratory Accreditation Program (LAP) for all geosynthetic test methods. George Koerner is in charge of the program. The GAI-LAP was developed for accrediting geosynthetic testing laboratories on a test-by-test basis. GAI-LAP suggests that laboratories use ISO 17025 as their quality system model.

It should be made clear, however, that GAI-LAP does not profess to offer ISO certification, nor does it "certify" laboratory results. GAI-LAP provides accreditation to laboratories showing compliance with equipment and documentation for specific standard test methods, usually ASTM or ISO standards. GAI-LAP verifies that an effective quality system exists at accredited laboratories by way of proficiency testing.

There have been significant additions to the number of GAI-LAP tests. These additions are twofold; ISO methods, and plastic pipe related methods. There are currently 157 GAI-LAP methods available for accreditation. Please consult our home page for a current listing.

As of June 2005, the following laboratories are accredited by the GAI-LAP for the number of test methods listed in parenthesis. Contact personnel and telephone numbers are also listed.

1[A] - TRI/Environmental Inc. (110 tests)
Sam Allen -- (512) 263-2101

3[A] - Golder Associates (43 tests)
Henry Mock -- (770) 496-8280

4[C] - Geosynthetic Institute (121 tests)
George Koerner -- (610) 522-8440

5[A] - NTH Consultants, Ltd. (52 tests)
Debra Klinger -- (610) 524-2300

6[A] - GeoSystems Consultants (27)
Craig Calabria -- (215) 654-9600

7[B] - Synthetic Industries Inc., Chickamauga (10 tests)
Steve Thaxton -- (800) 258-3121

8[B] - Synthetic Industries Inc., Ringgold (19 tests)
Toni Ruppert -- (800) 258-3121

9[B] - Synthetic Industries, Inc., Alto (10 tests)
Melvin Wallace -- (770) 532-9756

11[A] - STS Consultants Ltd. (13 tests)
Bill Quinn -- (847) 279-2500

13[A] - Precision Laboratories (88 tests)
Ron Belanger -- (714) 520-9631

14[A] - Geotechnics (61 tests)
Rick Lacey -- (412) 823-7600

18[A] - EMCON/OWT (55 tests)
Rasheed Ahmed -- (845) 492-3170

19[A] - HTS Inc. (42 tests)
Larry McMichael -- (713) 692-8373

20[A] - GeoTesting Express, MA (58 tests)
Gary Torosian -- (978) 635-0424

22[B] - CETCO Arlington Heights (13 tests)
Jim Olsta -- (847) 392-5800

23[B] - CETCO Fairmount (10 tests)
Derek Reece -- (706) 337-5316

24[B] - CETCO Lovell (10 tests)
Roger Wilkerson -- (307) 548-6521

25[B] - TC Nicolon (10 tests)
Melissa Medlin -- (706) 693-2226

26[B] - Agru America Inc. (17 tests)
Grant Palmer -- (843) 546-0600

27[B] - Amoco Fabrics and Fibers Co. (14 tests)
Barbara Barr-Howell -- (770) 944-4718

29[C] - FITI Testing & Research Institute (70 tests)
Moon-Hyun Jeong -- (011-82-2-960-8034)

31[D] - NYS Dept. of Transportation (9 tests)
Dave Suits -- (518) 457-4704

32[A] - Vector Engineering (6 tests)
Ken Criley -- (530) 272-2448

33[D] - Arizona DOT (5 tests)
Oscar Mousaui -- (602) 712-8200

34[B] - GSE Richey Road (16 tests)
Jane Allen -- (281) 230-6726

35[B] - GSE Hardy St. (12 tests)
Jimmy Youngblood -- (281) 230-6726

37[B] - SL Limitada (16 tests)
Mauricio Ossa -- 56-2 6010153

38[C] - Sageos/CTT Group (54 tests)
Eric Blond -- (450) 771-4608

40[B] - GSE Lining Technology Inc. (14 tests)
Charles Miller -- (843) 382-4603

41[A] - SGI Testing Service, LLC (18 tests)
Robert Swan, Jr. -- (770) 931-8222

42[C] - NPUST (GSI-Taiwan) (33 tests)
Chiwan Wayne Hsieh -- 011-886-8-7740468

43[A] - Ardaman & Associates (18 tests)
George DeStafano -- (407) 855-3860

44[B] - BBA Fiber Web, Inc. (9 tests)
Ken McLain -- (615) 847-7575

45[B] - Polyfelt Geosynthetics SDN Bhd. (23 tests)
C. P. Ng -- (603) 519 28568

46[B] - Bentofix Technologies (13 tests)
Pat Thiffault -- (705) 725-1938

47[A] - Precision Laboratories (13 tests)
Ron Belanger -- (866) 522-0843

48[B] - Tenax Corporation (9 tests)
Tim Bauters -- (410) 522-7000
49[B] - Engepol Geosinteticos (20 Tests)
George Nastas -- (55) 11-4166 3001

[A]Third Party Independent [C]Institute
[B]Manufacturers QC [D]Government

If you are interested in this program and would like a copy of the GAI-LAP directory, please advise accordingly. A directory is published annually in December, and is also kept current on GRI's Home page at http://www.geosynthetic-institute.org. For additional information on the GAI-LAP program contact:

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E-mail: gkoerner@dca.net

Activities within GCI (Certification)

We have an ongoing product certification program for all geosynthetics which have a generic specification. The program has as its target, conformance to a specific GRI specification such as GRI-GM13 for HDPE geomembranes. This specification has been in use for approximately 4 years with generally good reviews and considerable exposure. The specification is seen referenced in many project plans, specifications and quality assurance documents around the world.

The GCI certification program using this specification is based on ISO 9000 audits conducted on a 6-month cycle wherein the manufacturer's quality control plan and statistical data base are evaluated, along with sampling of the product. Upon testing by an accredited laboratory, the results are assessed and certification is granted, postponed or rejected. Certification carries with it the right to identify products as "GRI- Certified"; in this case “GRI-GM13 Certified”. We are delighted to report that SL Limitada of Chile continues to be approved and can mark its HDPE geomembrane.

GRI-GM13 Certified

Our sincere congratulations go to the following people who are the principals involved:

Enrique Saavedra - General Manager
Mauricio Ossa - Technical Manager
Michael Mathieson - N.A. Representative
(WASEW Technologies Inc.)

The GSI Affiliate Institutes

It has long been realized that the information generated within the GSI group should have a timely outlet to all countries, and in all languages. To this end, GSI has created affiliated institutes in two countries (Korea and Taiwan), and potentially many others in the future. These affiliated institutes are full members of GSI and are empowered to translate and use all available information so as to create similar institutes and activities in their respective countries. We introduce these institutes to you in this Newsletter/Report and will present ongoing details of their respective activities.

GSI-Korea was formed on February 9, 1998 as a collaborative effort between FITI Testing and Research Institute (a quasi-government organization) and INHA University (through its Geosynthetics Research Laboratory).

FITI is a 30-year old testing organization located in Seoul focusing on interlaboratory proficiency; environmental protection; safety and flammability; hazardous substances; in-house quality control; consumer protection; complaint analysis; quality marking; procurement; household and industrial applications; and materials approval. It employs 120 people (8 with doctoral degrees) and 42 engineers. The geosynthetics testing group within FITI has 12 people (2 with doctoral degrees) and 10 engineers. The geosynthetic laboratory is GAI-LAP accredited for 70 geosynthetic test methods. Dr. Jeonghyo Kim is the general manager within FITI’s geosynthetics activities.

INHA University is located in Incheon (50 km west of Seoul) and the geosynthetics laboratory is led by Professor Han-Yong Jeon. Dr. Jeon has 10-students working on geosynthetic-related projects and is extremely active both nationally and internationally. The ongoing efforts of both FITI and INHA will be described in future Newsletter/Reports.

GSI-Taiwan was formed on August 18, 2000 and is wholly contained within the National Pingtung University of Science and Technology in Nei Pu, Pingtung (southern Taiwan). It completely parallels GSI in that it has specific units for research, education, information, accreditation and certification. The Director is Dr. Chiwan Wayne Hsieh who is a Professor in the Department of Civil Engineering and Director of the Computer Center. GSI-Taiwan has an Taiwanese consortium of geogrid/geotextile manufacturers who work toward producing quality products according to the draft GRI geogrid specifications and the associated test methods. As such, GSI-Taiwan is a GAI-LAP accredited laboratory for 32 geosynthetic test methods. Dr. Hsieh has 10-

students working on geosynthetic-related projects and is extremely active nationally and internationally. The ongoing efforts of GSI-Taiwan will be described in future Newsletter/Reports.

The Geosynthetic Institute Centers-of-Excellence

1. The Center for Polymeric Reinforced Structures (CPReS) was formed on Dec. 27, 2002 for the purpose of proper use of geosynthetics in walls, slopes, and foundation reinforcement. It involves Dov Leshchinsky of Delaware, Grace Hsuan of Drexel and George Koerner of GSI as Co-Directors. The mission statement and goals are available on the GSI Home Page at <geosynthetic-institute.org>. Ongoing projects are the following:

   (a) Dov Leshchinsky is modifying and incorporating two important aspects of reinforced walls into his widely-used computer program "MSEWall". They are; design to accommodate short reinforcement lengths when full space is unavailable, and the incorporation of drainage geocomposites in accommodating low permeability backfill soils. The first topic was presented at GRI-17 and a paper is available. The second topic will be presented at GRI-19 in December, 2005.
   (b) Grace Hsuan is utilizing the Stepped Isothermal Method (SIM) for assessing the long-term behavior of various geosynthetic reinforcements including geofoam. Graduate student Sang-Sik Yeo, is performing the requisite research.
   (c) George Koerner has supervised the construction of a segmental retaining wall at GSI which has 3-different masonry block types. He is measuring the pH-values directly between block surfaces and will do so for many years into the future… the following photograph is of the "GSI Wall". Data is currently available. [As a comment, this wall has geogrid reinforcement between every block layer and is backfilled completely with AASHTO #57 stone. It will not collapse or even deform]!

2. The Center for Polymers in Hydraulic Structures (CPHyS) was formed on June 20, 2003 for the purpose of proper use of geosynthetics in dams, canals, reservoirs, tunnels, pipes and related hydraulic systems. Jorge Zornberg of the University of Texas at Austin, Grace Hsuan of Drexel, and George Koerner of GSI are Co-Directors. The mission statement and goals are available on the GSI Home Page at <<geosynthetic-institute.org>>. Initial projects are being decided upon, but two are certain.

   (a) Grace Hsuan is focusing on exposed geomembrane durability and lifetime. (See Item 10 previously). This issue is critically important to gain confidence regarding polymer lifetime in the minds of owners, regulators, designers and specifiers in the focused application areas.
   (b) Jorge Zornberg's activity, via a GSI funded graduate student, Christine Weber, will focus on drainage behind exposed geomembranes on dams.
   (c) George Koerner's activities are within GSI and focus on the Xenon Arc and UV fluorescent devices.
3. In both CPReS and CPHyS, Bob Koerner will act in an advisory manner and as quality assurance! In both centers existing GSI Members and Associate Members are fully entitled to the information that is developed and their interaction is encouraged. No additional funding is anticipated. We will keep the membership advised as to progress in this regard. We sincerely hope that the membership is supportive of these initiatives and your comments/suggestions are always solicited.
4. There is a distinct possibility for additional centers of this type. Please contact Bob Koerner with suggestions and ideas.

Items of Interest

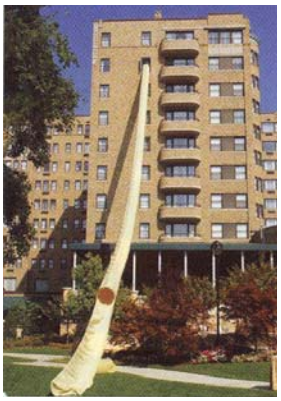
1. David E. Daniel Named President of UT Dallas

David E. Daniel, Ph.D., Gutgsell Professor of Civil Engineering and Dean, College of Engineering, University of Illinois at Urbana-Champaign, was named President of the University of Texas at Dallas on February 10, 2005 by the UT System Board of Regents. In his acceptance comment, Daniel said "Unbeknownst to some, North Texas has a higher-education jewel that is evolving into one of the nation's best universities. I'm talking about the University of Texas at Dallas, which I am convinced, has the potential to become one of the great universities of the world. Far-fetched? Highly improbable? Not to me. On Thursday, I enthusiastically accepted an offer to become UTD's next president."

GSI/GRI and all of its employees extend to Dave Daniel our very best wishes for success in his new position!

2. Textile "Life-Saving" Building Chutes

The Baker Life Chute is a self-contained unit that can be stored inside or on top of a structure and can be moved by hand to the safest exit locations, including windows, balconies, or roofs. It is triggered by the fire alarm and unfolds automatically from the structure; escape is accomplished by sliding down the chute, slowing as appropriate by outward pressure of feet and with hands held above the head.



The advanced modular evacuation system is triggered by a fire alarm; the chute unfolds automatically from the structure. The user enters the chute through automatic doors and slides down, landing on a cushioned landing pad. Acceleration during descent is controlled through a series of "steps," which occur every five floors.

Ed. Note: We just couldn't resist showing you these photos.

(ref. ASTM Standardization News, March, 2005)

3. New HDPE Pipe Specification Focuses on Storm Sewer Applications

A new ASTM standard developed by Committee F17 on Plastic Piping Systems will be an important step in advancing the use of high density polyethylene pipe in municipal storm sewer applications. The standard, F2306, Specification for 12 to 60 in. (300 to 1500 mm) Annular Corrugated Profile Wall Polyethylene (PE) Pipe and fittings for Gravity Flow Strom Sewer and Subsurface Drainage Applications, is under the jurisdiction of Subcommittee F17.62 on Sewer.
(ref. ASTM Standardized News, May, 2005)

4. Huge Pipe Deal: ADS buying Hancor

Advanced Drainage Systems Inc. is acquiring competitor Hancor Inc., of Findlay, Ohio, in a transaction that creates the largest plastic pipe company in North America. ADS officials said that the companies, both makers of large diameter high density drainage pipe, face formidable competition from other materials, including concrete, steel, PVC, and solid-wall polyethylene. Combined, the companies will have nearly 40 plants and sales of more than $700 million, according to sales numbers estimated by *Plastic News*. According to industry sources, the total market for corrugated high density polyethylene pipe roughly is 1.25 billion pounds. Hancor and Hilliard-based ADS combined will represent about 70 percent of that market.

With such girth, the question of regulation concerns naturally arises. Still, many industry sources said that passing the regulatory requirements won't be a problem, since ADS and Hancor ultimately are competing in an industry that exceeds $4 billion in total. The exact timing of the closing is a bit uncertain. Until the transaction closes, ADS and Hancor will remain separate companies.
(by Ann DeRosa, Plastics News Staff)

5. EPA Makes Research Center Permanent

The U. S. Environmental Protection Agency (EPA) has decided to give permanent status to the National Homeland Security Research Cetner (NHSRC), set up in Cincinnati in early 2003. It is also restructuring the center so that it will have three branches; threat assessments; decontamination; and the development of programs to manage security crises and protect water infrastructure. These changes will help the EPA design, implement, and oversee research at the center and will, it is hoped, improve communication between the EPA and other federal agencies and aid in establishing links with the private sector, universities, and researchers.
(ref. Civil Engineering, February 2005)

Commentary on Separation-in-Plane (SIP) in Geomembrane Testing

Background

While presenting a QA/QC course at GeoFrontiers in Austin, Texas with Mark Sieracke of STS and Sam Allen of TRI, we were taken to task by a very savvy audience on Separation-in-Plane (SIP). This uncommon phenomenon of MDPE or HDPE geomembranes manifests itself when the geomembrane delaminates internally after experiencing tensile loading at high strain rates. The phenomenon is also referred to as in-plane sheet fracture. Since this issue has been the result of two conflict resolutions associated with ASTM D6392 (one of which was experienced during an IAGI weld certification test), we feel that the topic deserves some open discussion.

Observations

1. SIP is unusual. It is estimated by Smith (2001) that it occurs in less that 1% of sheet produced.

Nobert (2001) estimates 0.1% of HDPE production exhibits SIP.
2. SIP is usually discovered during peel destructive seam testing per ASTM D 4437 or ASTM D 6392.
3. SIP has also been observed during tensile testing per ASTM D 638 or ASTM D 6693. Fracture planes can be observed upon examining the ends of ruptured specimens. The ruptured ends may separate into two distinct layers. In extreme cases, ruptured specimens may be split apart by hand peeling deformed portions apart.
4. SIP is seen with MDPE and HDPE. It is essentially non-existent in LLPDE.
5. SIP is seen in 1.5mm (60 mil) and thicker geomembranes. SIP has not been observed in 1.0 mm (40 mil) and thinner geomembranes.
6. SIP appears to be dependent on strain rate. It occurs more frequently at faster strain rates.
7. SIP is more readily observed when the geomembrane is strained in the cross machine direction rather than the machine direction.

SIP is most often seen when geomembrane is produced using the blown film manufacturing process, Struve (2003).

Possible Causes (also see Table 1)

1. "SIP failure of HDPE is very uncommon" and often attributable to problems with carbon black mixing and dispersion, Peggs and Allen (2000).
2. SIP may be a result of an incompatibility with the resin and masterbatch, Struve (2003). A masterbatch is a combination of ingredients compounded with a polymer (carrier resin) and pelletized. A known quantity of this "masterbatch" (also known to some as "concentrate") is added to the polymer being molded so as to attain a specific amount of ingredient (carbon black, antioxidant, processing aid, etc.) in the geomembrane. There are several reasons for using a materbatch. These are as follows: (a) weighing and mixing pellets is a lot cleaner and more accurate than weighing and mixing powders, (b) there is automatic equipment to weigh and mix pellets (difficult for powders), and (c) masterbatch can be vacuum transported where powdered ingredients can not be vacuum transported.
3. Improper mixing of the "let-down" (combination of the resin and masterbatch). There are several possible scenarios for inadequate mixing. Most of them are process and equipment related. In all cases there is a design made by the process engineer to assure that a given polymer formulation can run within the limits of a specific piece of manufacturing equipment. Most extruder-die combinations have several specific rate and temperature windows to make a repertoire of geomembranes, Nobert and Yazdani (2001).
4. Possible contamination of dirt dust from within the plants reused or recycled resin, Smith (2001).
5. Cooling as it relates to die-extruder design and its threshold for thicker geomembranes, (Struve 2003).
6. HDPE geomembranes manufactured by the blown film method have higher degree of crystallinity in the core than outer surfaces. This skin-core effect may develop internal shear planes which could result in SIP, (Norbert and Yazdani 2001).

Long Term Performance

Consensus on this issue has not been reached. At this point we see problems with rejecting material that otherwise meets the GRI-GM13 specification. For example, when the test specimen reaches the required strength and subsequently shows SIP to occur, it should not be considered a failure. It should be noted that GRI-GM19 does not reject seams that exhibit SIP assuming that strength and elongation/incursion criteria are met before SIP occurs.

Recommendations

1. Recent SIP occurrences have raised concerns in our industry. GSI's policy is to accept such material but the report must state that the phenomenon was observed and to what degree.
2. Continue to monitor the situation on both a field and laboratory performance basis. Note that there are unlimited variables in such a design experiment. Therefore, identifying an acceptable level of SIP is our target for future research.

Table 1 - Literature Comments on Separation-In-Plane (SIP)

Reference	Date	Observed Occurrences	Cause(s)	Conclusion
Smith in Mining Record	July/Aug. 2001	HDPE ≥ 1.5 mm (not LLDPE)	1. rapid cooling 2. high plant temp 3. improper mixing 4. all of above	1. materials defect 2. long-term concerns 3. no consensus
Nobert in Poly-Flex Newsletter	Aug. 2001	1. HDPE ≥ 1.5 mm (not LLDPE) 2. mainly blown film 3. fast testing rates 4. mainly XMD 5. HDPE and MDPE (not LLDPE or VLDPE)	1. rapid cooling (skin-core effect)	1. artifact of rapid testing 2. not a material defect 3. not a seam defect
Allen in Smith memo	Aug. 2001	1. HDPE and fPP	1. poor C. B. dispersion 2. improper mixing	n/c
Struve in GFR	March 2003	1. all GM types 2. thicker GMs 3. blown film mainly	1. certain master batches 2. contaminants 3. temp. gradients 4. cooling conditions 5. rapid testing rates	1. low density carrier resin in master batch 2. resins with excessive low density "tails"

References

1. Nobert, J. and M. Smith, 2000, "Discussion of Sheet Fracture in Tensile and Peel Tests,", Polyfelt Document, Grand Prairie, TX, pp. 1-7.
2. Nobert, J. and G. Yazdani, 2001, "Separation in the Plane of the Sheet: Is it a Seam Failure,?" Polyflex Document, Grand Prairie, TX, pp. 1-2.

3. Peggs, I. and S. Allen, 2001, "Geomembrane Seam Peel Separation: How and Why?," Geotechnical Fabrics Report, Vol. 19, No. 3, Roseville, MN, pp. 16-18.
4. Smith, M. E. , 2001, "SIP in Geomembrane Liners: An Acceptable Condition?," The Latin America Mining Record, Vol. 8, No. 4, pp. 1-5.
5. Struve, F, 2003, "Separation in Plane (SIP)," Geotechnical Fabrics Report, Vol. 21, No. 2, Roseville, MN, pp. 24-25.

George Koerner

Upcoming Events

- June 16-17, 2005 - ASTM D-35 Meeting in Reno, NV
  Contact: <csierk@astm.org>
- One Day Courses at GSI
  August 4, 2005 - GSs in Transportation
  August 5, 2005 - Walls and Slopes
  August 11, 2005 - GSs in Waste Containment
  August 12, 2005 - QA/QC in Waste Containment
  Contact: <mvashley@verizon.net>
- November 30 - December 2, 2005 - CEDEX Symposium on Construction with Impermeable Barriers
  Seville, Spain
  Contact: <fgarcia@cedex.es>
- December 14-16, 2005 - NAGS '05/GRI-19 Combined Conference in Las Vegas, NV
  Contact: <janeharris@nagsigs.com>

GSI's Member Organizations

We sincerely thank all of our sponsoring organizations. Without them, GSI simply could neither happen nor exist. The current GSI member organizations and their contact members are listed below. The newest member organizations are CTI and Assoc., Inc., with Drs. Te-Yang Soong and P. D. Deo as our contact members, Advanced Earth Sciences Inc. with Mr. Kris Khilnani as our contact member, and the Florida Department of Transportation with Mr. Rod Powers as the contact member… thanks to all and welcome!

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- Progress within GEI (Education)
- Activities within GAI (Accreditation)
- Activities within GCI (Certification)
- The GSI Affiliate Institutes
- The GSI Center-of-Excellence
- Items of Interest
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