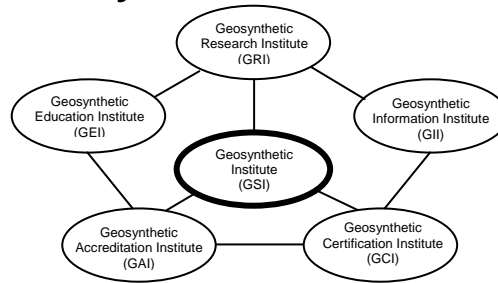


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 22, No. 2

June 2008

This quarterly newsletter, now in its 22nd 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 mvashtey@verizon.net.

Activities of the Institute Directors & GSI Board of Directors

NOTICE: Due to the increasing cost of printing, shipping and handling, this Newsletter/Report will be made available on our Home Page at www.geosynthetic-institute.org. It is in the open section under the heading "Newsletter/Report". Please share it with your friends and colleagues.

1. The GSI Bylaws have been modified insofar as affiliations of the Board of Directors is concerned. There are still nine persons involved, however, one of the two "At-Large" members will become a second "International" member. This change will take place in the Fall election cycle.
2. There continues to be the restriction that no one organization can have more than one member on the GSI Board of Directors.
3. The Session on "Engineered Berms at Landfills" set for the Global Waste Conference in Cooper River, Colorado for September 7-10, 2008 is now complete. It consists of seven speakers (all from GSI member organizations). It appears to be an excellent tutorial from the initial economics to long-term monitoring.
4. The GRI-22 Conference to be held in Salt Lake City between February 25-27, 2009 will have the theme:
"It's All in the Details"
5. It appears that our last conference in Cancun on geosynthetics in aquaculture and agriculture was meaningful since the IGS's 10th International Conference in Brazil will have it as one of their primary themes as well.
6. Our new GSI "Request-for-Proposals" follows. It is a fantastic opportunity for students (to be known as "GSI-Fellows") doing research on geosynthetics. The stipends (up to \$25,000) are to be taken from the GSI Endowment Fund. Don't hesitate to ship-it-around to your favorite university.

"It's All in the Details"

Of course, we mean geosynthetic details and it will cover all facets of geosynthetic activities, i.e., manufacturing, design, installation, and inspection. We have some submitted topics, but still need more, so please consider this opportunity and send a title and/or abstract to us as soon as possible.

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REQUEST-FOR-PROPOSALS

The Geosynthetic Institute (GSI) is delighted to announce a worldwide call for student requests-for-proposals (RFPs) focusing on innovative geosynthetics research and development projects. There will be multiple awards made, each for \$10,000 per year, and they are renewable, pending an annual written report, to a total amount of \$25,000 per student. It is important to note that students must have completed their candidacy examinations leading to a doctoral degree in engineering or science to be eligible. The proposals must be submitted in the following four page format (with no exceptions).

- Page 1 – Letter of recommendation from student's department head or advisor
- Page 2 – Title and detailed abstract
- Page 3 – Student's resume
- Page 4 – Documentation of completed candidacy examination

The RFPs for the 2008-2009 academic year must be submitted to both of the undersigned by e-mail by July 15, 2008 and awards will be announced on, or before, September 1, 2008. Review of the proposals is by the nine-person Board of Directors of GSI. For information on the institution, visit us at the following website:

www.geosynthetic-institute.org

Robert M. Koerner, Ph.D, P.E., NAE
Director – Geosynthetic Institute
e-mail robert.koerner@coe.drexel.edu

Jamie R. Koerner
Special Projects Coordinator
e-mail jrkoerner@verizon.net

7. Don't hesitate to contact us at GSI, or any of your board members who are as follows:

Term Ends 2008

Dick Stulgis - GeoTesting Express (Consultants and Testing Laboratories)

Gary Kolbasuk - Raven (Geomembranes and GCLs)

Mark Sieracke - Weaver Boos Consultants, Inc. (At-Large)

Term Ends 2009

Tony Eith (Chairman) - Waste Management Inc. (Owners and Operators)

Boyd Ramsey - GSE Lining Technology, Inc. (Geotextiles and Geogrids)

Sam Allen - TRI/Environmental, Inc. (At-Large)

Term Ends 2010

David Jaros - Corps of Engineers (Government Agencies)

Paul Oliveira - Firestone bp Inc. (Resin Producers)

Kent von Maubeuge - NAUE GmbH & Co. KG (International)

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 following write-ups. **Projects marked with an asterisk have been written up as either short "in-progress" papers or complete papers.** Grace can be reached by phone at (610) 522-8440 or e-mail at <grace.hsuan@coe.drexel.edu>.

1. **Stress Cracking of Geomembranes and Geopipe*** - In addition to Grace Hsuan's ongoing evaluations of HDPE geomembranes, She is presently focusing on HDPE drainage and duct pipe mainly for the Florida DOT. The goal for both geomembranes and geopipe is to include technically viable test methods and limiting values for inclusion in generic specifications.
2. **Durability of Polypropylene Geotextile Fibers** - Incubation at temperatures of 75, 65 and 55°C in high oxygen pressure containers is ongoing using PP-woven geotextile fibers. 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.
3. **In-Situ Temperature Monitoring of Liner and Cover Geomembranes in Dry and Wet Landfills*** - Dr. George Koerner is measuring the in-situ temperature behavior of liner and cover geomembranes and has installed 60± thermocouples for long term measurements in both wet and dry municipal solid waste landfills in Pennsylvania. The project has been updated into its 14th-year for presentation at the Global Waste Conference in September, 2008.
4. **Bioreactor (aka, Wet) Landfill Behavior and Properties*** - One of the cells mentioned in Item 3 is at field capacity, hence it is a true anaerobic bioreactor. Dr. George Koerner is in charge of considerable monitoring at this cell 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 monthly 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 with a slightly different waste mass. It will also be presented at the Global Waste Conference in September.

5. **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 consist of both natural soils and geosynthetic drains. The project is now in its third year and is at a landfill in the Philadelphia area. It is our third paper for the Global Waste Conference in September.

6. **Hydrostatic Creep Puncture of Geomembranes*** - A series of tests using 600 g/m² protection geotextiles on 1.5 mm thick HDPE geomembranes is being evaluated; the time is currently 10-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. The purpose of these tests is to better define the creep reduction factor used in the design method. The setups are presently being dismantled and analyzed accordingly.

7. **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 will be for 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 is national 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.

8. **UV Exposure of Geomembranes*** - GSI is using UV-fluorescent devices to evaluate the projected outdoor lifetime of nine different types of geomembranes; HDPE, LLDPE, 4 fPPs, PVC, EPDM 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.

9. **UV Exposure of Geogrids** - We have recently begun the UV-fluorescent exposure of four different biaxial geogrids which are used at the exposed surfaces of welded wire mesh retaining walls. The geogrids are now up to 13,000 light hours and ongoing data is being generated and sent to the respective manufacturers.

10. **UV Exposure of TRM Fibers** - We have begun UV-fluorescent exposure of several turf reinforcement mat fibers to assess their lifetime capabilities. Contact Bob Koerner if you have materials for inclusion into this effort.

11. **Generic Specifications** - A major effort is ongoing with respect to the development and maintenance of generic geosynthetic specifications. The current status of these specifications is as follows:

Completed and Regularly Updated

GM13 – HDPE Geomembranes
GM17 – LLDPE Geomembranes
GM21 – EPDM Geomembranes
GM22 – Exposed Temporary Covers
GM19 – Geomembrane Seams
GT10 – Geotextile Tubes
GT12 – Geotextile Cushions
GT13 – Geotextile Separators
GCL3 – Geosynthetic Clay Liners

Working Within Focus Groups

GCXX – TRMs for Erosion Control
GTXX – High Strength Reinforcement Geotextiles

Delayed or Off in the Distance

GGXX – Bidirectional Geogrids
GGXX – Unidirectional Geogrids
GNXX – Geonet Drainage Composites
GCXX – Drainage Geocomposites

Tabled

GM18 – fPP & fPP-R Geomembranes

The complete 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.

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 GSI members and associate members 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 primary GSI Home Page 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
- CPReS
- CPHyS
- Laboratory Accreditation
- Answers to Your Questions
- Newsletter/Reports
- Geosynthetics Links
- GSI Annual Meeting
- GSI Focus Group Meeting
- GSI Short Courses
- Inspector Certification Exams

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, the following 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 25,000 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 website.

Progress within GEI (Education)

Free CD

We sent a broadcast e-mail to everyone on February 25, 2008 stating that many power point presentations were available and would be sent upon request. About 20 persons replied asking for all of them. Therefore,

we put all 63 presentations on a CD which was sent to all GSI contact persons. That said, we have many copies still available so do ask and we will mail it to you immediately. Topic areas are all types of geosynthetics, plus walls/slopes, landfills, specifications, and miscellaneous.

Courses

We have scheduled the following sequence of courses for the winter season:

- December 8, 2008 and March 9, 2009
Geosynthetic Design in Waste Containment Systems
- June 18, 2008, December 9, 2008, and March 10, 2008
Quality Control/Quality Assurance of Geosynthetics

The above courses will be held at:

Geosynthetic Institute
475 Kedron Avenue
Folsom, PA 19033

(approx. 4.5 miles from Phila. International Airport)

Course Registration and Fee:

\$250/person for each one-day course (up to one month prior to course)

\$300/person thereafter

\$150/person – GSI Members

Contact: Marilyn Ashley (mvashley@verizon.net)

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.

As of March, 2008, 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. (118 tests)
Sam Allen -- (512) 263-2101
- 3^A - Golder Associates (43 tests)
Henry Mock -- (770) 496-8280
- 4^C - Geosynthetic Institute (114 tests)
George Koerner -- (610) 522-8440
- 6^A - GeoSystems Consultants (27)
Craig Calabria -- (215) 654-9600
- 8^B - Propex, Ringgold (19 tests)
Todd Nichols -- (800) 258-3121
- 9^B - Propex, Alto (10 tests)
Melvin Wallace -- (770) 532-9756
- 11^A - STS Consultants Ltd. (13 tests)
Bill Quinn -- (847) 279-2500
- 13^A - Precision Laboratories, CA (95 tests)
Ron Belanger -- (714) 520-9631
- 14^A - Geotechnics (61 tests)
J. P. Kline -- (412) 823-7600
- 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 (12 tests)
Jim Olsta -- (847) 392-5800
- 23^B - CETCO Cartersville (10 tests)
Sid Weiser -- (706) 337-5316
- 24^B - CETCO Lovell (10 tests)
Roger Wilkerson -- (307) 548-6521
- 25^B - Ten Cate, Pendergrass (11 tests)
Beth Wilbanks -- (706) 693-2226
- 26^B - Agru America Inc. (14 tests)
Grant Palmer -- (843) 546-0600
- 29^C - FITI Testing & Research Institute (70 tests)
Moon-Hyun Jeong -- (011-82-2-960-8034)
- 31^D - NYS Dept. of Transportation (9 tests)
James Curtis -- (518) 457-4735
- 32^A - Vector Engineering (6 tests)
Ken Criley -- (530) 272-2448
- 34^B - GSE Richey Road (28 tests)
Jane Allen -- (281) 230-6726
- 37^B - GSE Chile (16 tests)
Mauricio Ossa -- 56-2 6010153
- 38^C - Sageos/CTT Group (82 tests)
Eric Blond -- (450) 771-4608
- 40^B - GSE Lining Technology Inc. (14 tests)
Victoria Singletary -- (843) 382-4603
- 41^A - SGI Testing Service, LLC (18 tests)
Zehong Yuan -- (770) 931-8222
- 42^C - NPUST (GSI-Taiwan) (39 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 - Ten Cate Malaysia SDN Bhd. (23 tests)
C. P. Ng -- (603) 519 28568
- 46^B - Bentofix Technologies (13 tests)
Colin Murphy -- (705) 725-1938
- 47^A - Precision Laboratories, TX (13 tests)
Mike Bishop -- (866) 522-0843
- 48^B - Tenax Corporation (9 tests)
Andrew Barker -- (410) 522-7000
- 49^B - Engepol Geossinteticos (20 tests)
George Nastas -- (55) 11-4166 3001
- 50^B - ADS, Inc. Hamilton (7 tests)
Terry McElfresh -- (513) 896-2065
- 51^B - Solmax International Inc. (14 tests)
Guy Elie -- (450) 929-1234
- 53^B - Polytex Inquique (13 tests)
Cristian Valdebenito -- 011 56 57 42 90 00
- 54^B - ADS, Inc. Finley (9 tests)
David Gonso -- (419) 424-8377
- 55^B - Atarfil Geomembranes (21 tests)
Isabel Merida Fernandez -- 34 958 439 278

- 56^B - Polytex Santiago (11 Tests)
Jamie Morales -- 56-2-627-2054
- 57^B - Ten Cate Cornelia (15 Tests)
Melissa Medlin -- (706) 778-9794
- 58^B - Propex Nashville (9 Tests)
Tim Smith -- (229) 686-5511
- 59^B - Firestone (9 Tests)
Janie Simpson -- (864) 439-5641

^AThird Party Independent ^CInstitute
^BManufacturers QC ^DGovernment

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:

George R. Koerner, Ph.D., P.E., CQA
Geosynthetic Institute
475 Kedron Avenue
Folsom, PA 19033-1208
Telephone: (610) 522-8440
Fax: (610) 522-8441
E-mail: gkoerner@dca.net

The GAI-LAP annual meeting to be held on June 26, 2008 in Denver, CO in conjunction with ASTM.

Activities within GCI (Certification)

Due in part to the active interest by many GSI members and associate members we give the outcomes of the Inspectors Certification Program as of March, 2008. The table following gives the pass/fail statistics by year as well as insight as to the impact of taking a course before the written examination. In looking at the data it appears as though we are not "teaching-the-exam" and, if anything, there is an inverse correlation; no comment in this regard...

Year	Course Situation	Geosynthetic Materials		Compacted Clay Liners	
		No. of people taking the exam	No. of people failing the exam	No. of people taking the exam	No. of people failing the exam
2006	GSI Course	34	0	27	5 (18%)
	Other Course	59	3 (5%)	57	4 (7%)
	No Course	48	2 (4%)	44	3 (7%)
	TOTAL	141	5 (3%)	128	12 (9%)
2007	GSI Course	46	9 (19%)	38	6 (16%)
	Other Course	18	2 (11%)	18	3 (16%)
	No Course	18	0	17	3 (17%)
	TOTAL	82	11 (13%)	73	12 (16%)
2008 (to date)	GSI Course	14	3 (21%)	13	3 (23%)
	Other Course	0	0	0	0
	No Course	17	3 (18%)	16	1 (6%)
	TOTAL	31	6 (19%)	29	4 (14%)
2006-2008 (to date)	GSI Course	94	12 (13%)	78	14 (18%)
	Other Course	77	5 (6%)	75	7 (9%)
	No Course	83	5 (6%)	77	7 (9%)
	TOTAL	254	22 (9%)	230	28 (12%)

The GSI Affiliated 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 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.

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. 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 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.

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. GSI Taiwan has hosted two very successful conferences to date and has plans for another, followed by a broader conference for Southeast Asia.

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>.
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>>.
3. In both CPReS and CPHyS, Bob Koerner acts in an advisory manner and as a peer reviewer. In both centers existing GSI Members and Associate Members are fully entitled to the information that is developed and their interaction is encouraged.
4. There is a distinct possibility for additional centers of this type. In particular we are looking to team with a university specializing in CAFO's, i.e., large-scale agricultural operations and possibly aquaculture and mining operations as well. Please contact Bob Koerner with suggestions and ideas.

Items of Interest

1. **AGC Voices Concern Over U.S. Budget Cuts**
President Bush has released a \$3.1 trillion budget for fiscal year 2009, which shrinks domestic spending and reduces the amount of money aimed at infrastructure investment at a time when it is needed most, according to the Associated General Contractors of America (AGC).
According to comments issued in a press release from the AGC, the administration's budget proposes a 2.9-percent cut in infrastructure funding below last year's level.
"At a time when we're looking for ways to stimulate the economy, cutting infrastructure spending is short-sighted," says Stephen E. Sandherr, CEO of

the AGC. "This budget does not help to promote job growth and protection in a declining economy. The budget proposes to cut \$1.8 billion from the highway program, \$200 million from the transit program and \$750 million from the airport improvement program.

More information is available at www.agc.org.

2. Levees Reinforced with Geosynthetics Perform Exceptionally Well

Geosynthetic-reinforced levees challenged by Hurricane Katrina performed exceptionally well, the U.S. Army Corps of Engineers has reported. The St. Charles and Jefferson levees are reinforced with geotextiles. The Corps cite the use of geosynthetics as a factor that allowed the levees to perform well considering these most severe conditions.

"Both the St. Charles and Jefferson levees were loaded (filled by the storm) during Katrina and performed exceptionally. They were stable and the geosynthetic was inherent to their strength," said John Bivona, Deputy Chief, Engineering Division, New Orleans District, U. S. Army Corps of Engineers.

"No reason to say that the [geosynthetics] won't continue to be used in our designs and continue to benefit us in the future," Bivona concluded.

For information on the innovative use of geosynthetics contact the Geosynthetics Material Association managing director Andrew Aho, at (651) 225-6907, amaho@ifai.com.

3. Top Ten Jobs for the Undergraduate Class of 2008

No.	Description	Mean Salary	No. of Positions
1	Financial Analyst	\$ 66,590	75,000
2	Computer Analyst	69,760	146,000
3	Computer Engineers	85,370	99,000
4	Accountants	54,630	226,000
5	Civil Engineers	68,600	46,000
6	Marketing Managers	98,720	24,000
7	Financial Managers	90,970	64,000
8	Chemical Engineers	78,860	2,400
9	Electrical Engineers	75,930	9,600
10	Mechanical Engineers	69,850	9,400

(ref. <msn.careerbuilder.com>)

4. Turnpike for Sale?

A consortium led by Abertis and including Citigroup won the bidding to take over the 75-year lease on Pennsylvania's turnpike, the state's main toll road. At \$12.8 billion, the deal is one of the biggest privatization initiatives in America's infrastructure sector. Abertis operates toll roads in Spain and France and has other assets in transportation.

(ref. *The Economist*, May 24, 2008)

Historical Perspectives on GRI's Polyolefin Specifications

From the very beginning of the GSI/GRI consortium in 1986 it was recognized that specific focus groups were the way to initiate individual programs and documents. After a draft document is eventually established within a group, the entire membership is then brought into the activity for modification and eventual agreement. This approach has worked well over the years. At a September 16, 1993 meeting in Philadelphia the issue of crafting GRI specifications was seriously discussed among the resin producers and geomembrane manufacturers combined group. The status of available generic geomembrane specifications at that time was as follows:

- The only available generic geomembrane specifications were from the National Sanitation Foundation (NSF).
- The values were very minimal, particularly those related to geomembrane durability.
- Many withdrawn and non-available geomembranes were included.
- Many new geomembrane types were available but not included.
- Regulators were apprehensive over the continued use of these specifications.
- Consultants and specifiers would support a credible alternative effort.

At a December 23, 1993 meeting in San Diego, a high density polyethylene (HDPE) specification was targeted beginning with the development of the required durability methods and criteria. This was followed by two years of research primarily on stress cracking and oxidative induction time (OIT) testing after oven aging and ultraviolet exposure. The work was supported by the U. S. EPA and by membership fees and was primarily done by Grace Hsuan at GRI's laboratory at Drexel University.

At a December 13, 1995 meeting in Philadelphia work began in earnest on template specification development for high density polyethylene (HDPE), to be followed a few years later by very flexible polyethylene (VFPE), and then still later by flexible polypropylene (fPP) geomembranes. This decision brought in all of the resin producers and geomembrane manufacturers so as to craft the necessary physical, mechanical and durability property values for the new specifications. Those involved at the time were the following:

Resin Producers

- Phillips – Rex Bobsein
- Novacor – Nolan Edmonds
- Solvay – Phil Dunaway
- Mobil – Frank Nagy
- Quantum – Adel Haddad
- Chevron – Pam Maeger

Geomembrane Manufacturers

- GSE – Fred Struve/Bill Walling
- NSC – Gary Kolbasuk/George Zagorski
- Poly Flex – Jim Nobert/George Yazdani
- Serrrot – Bob Otto
- S. D. Ent. – Dave Eakin

Following this meeting, intense HDPE testing was performed by all of the above organizations in assessing their materials stress cracking performance via the new ASTM D5397 notched constant tensile load (NCTL) test developed and pushed through ASTM by Grace Hsuan. (The test method subsequently won a Heritage Award by ASTM). Additionally, the standard and high pressure oxidative induction time (OIT) initial values and subsequently after oven aging and ultraviolet fluorescent exposure were major durability items worked on by all. Note that both stress cracking and OIT performance are largely resin and additive related, thus the large group of resin producers was extremely active, and to a slightly lesser extent the geomembrane manufacturers as well. Simultaneous with the durability criteria development was the physical and mechanical property development. Here the geomembrane manufacturers played the major role as did George Koerner in evaluating and homogenizing the data into a single set of acceptable values.

After three meetings and countless telephone calls between the parties involved the HDPE specification tables were completed. Text was then added and agreed upon by the two focus groups. Then the complete draft specification was sent to the general membership for comments, of which there were many. The focus groups then assessed these comments and agreed upon the final specification. It was launched on June 17, 1997 under the title:

GRI-GM13; Standard Specification for “Test Methods, Test Properties, Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes”

Subsequently, this specification has had eight minor revisions and the most recent version is available free on the GSI Website at <geosynthetic-institute.org>.

Lagging by a few years but under a similar development methodology, the LLDPE specification was adopted on April 3, 2000 under the title:

GRI-GM17; Standard Specification for “Test Methods, Test Properties, Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes”

Subsequently this specification has had five minor revisions and the most recent version is available free on the GSI website at <geosynthetic-institute.org>

Continuing with all of the available polyolefin resin types, the fPP specification was adopted on February 18, 2002 under the title:

GRI-GM18; Standard Specification for “Test Methods, Test Properties, and Testing Frequencies for Flexible Polypropylene (fPP and fPP-R) Nonreinforced and Reinforced Geomembranes”

Subsequently, this specification was temporary suspended on May 3, 2004 and then withdrawn on January 22, 2007 due to concerns about OIT being able to predict long-term durability. Apparently, the antioxidant depletion nicely characterized by oxidative induction times in HDPE and LLDPE geomembranes is more complicated (and less reliable) for fPP geomembrane formulations.

The last in this sequence of GRI polyolefin specifications that the combined groups addressed was field seam properties. The previously developed specifications are silent on the topic of seams, thus the necessity of a separate specification. This specification addresses HDPE, LLDPE, and fPP geomembrane seams in all sheet thicknesses and types, e.g., smooth, textured, and scrim reinforced. The seam specification was adopted on February 18, 2002 under the following title:

GRI-GM19; Standard Specification for “Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes”

This set of four specifications, and in particular GRI-GM13 for HDPE geomembranes, has revolutionized all aspects of the respective polyolefin geomembrane materials technologies. The required tests, their properties, and minimum testing frequency impacts resin producers, additive suppliers, manufacturers, designers, specifiers, installers, inspectors, regulators and owners alike. The impact of the specifications was never felt stronger than within weeks after suspending GRI-GM18 we heard first from European producers and designers, followed shortly by organizations in Australia, Israel, and South Africa. The entire set of specifications is presently worldwide in acceptance, utilization, and compliance.

Obviously we at GSI/GRI are proud of the role we played in the above described polyolefin specification development, however, we recognize that many people and their respective companies were involved.

To all of them, we extend our heartfelt appreciation. In this regard, we promise that we will be good stewards of these specifications updating them when needed and continuing to offer them free to everyone. This applies as well to our other specification development with other geomembranes as well as the geotextile, geogrid, geonet, and geocomposites specifications. In citing any of them please include along with the relevant GRI number "latest modification". It is this latest version which will be regularly updated on our website at <geosynthetic-institute.org/specs.htm>.

Robert M. Koerner

Upcoming Events

- June 18, 2008
GSI Short Course on:
QA/QC of Geosynthetics
GSI in Folsom (Philadelphia), PA
Contact: mvashley@verizon.net
- June 25-27, 2008
ASTM D35 on Geosynthetics
Denver, Colorado
Contact: <csierke@astm.com>
- September 7-10, 2008
Global Waste Mgmt. Symposium
Cooper Mountain, CO
Contact: <www.wastesymposium.com>
- September 7-10, 2008
EuroGeo 4
Edinburgh, Scotland
Contact: <eurogeo4@eurogeo4.org>
- September 15-18, 2008
Aquaculture Europe '08
Krakow, Poland
Contact: www.krakow.pl/en/7
- December 8, 2008 and March 9, 2009
GSI Short Course
GS Design in Waste Containment Systems
GSI in Folsom (Philadelphia), PA
Contact: mvashley@verizon.net
- December 9, 2008 and March 10, 2009
GSI Short Course
QA/QC of Geosynthetics
GSI in Folsom (Philadelphia), PA
Contact: mvashley@verizon.net
- January 28-30, 2009
ASTM D35 on Geosynthetics
Atlanta, Georgia
Contact: csierke@astm.org
- February 25-27, 2009
Geosynthetics '09
Salt Lake City, Utah
Contact: bbwistricill@ifai.com
- June 17-19, 2009
ASTM Committee D35
Vancouver BC, Canada
Contact: csierk@astm.org

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 Intertape Polymer Group with Dohn Berger as the contact member, and Geosyntec Consultants with Steve Poirier as the contact member. Welcome and welcome back, respectively.

GSE Lining Technology, Inc.

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Tensar International Corporation

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LyondellBasell Industries

Michael J. Balow/Fabio Ceccarani

TC Nicolon USA

John Henderson/Chris Lawson

CETCO

James T. Olsta

Huesker, Inc.

Steven Lothspeich/Dimiter Alexiew

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Georg Heerten/Kent von Maubeuge [BoD]

Propex

Scott Manning

STS Consultants

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Fiberweb, Inc.

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CARPI, Inc.
Alberto M. Scuero/John A. Wilkes

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Morne Breytenbach/Piet Meyer

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- Progress within GEI (Education)
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- The GSI Centers-of-Excellence
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