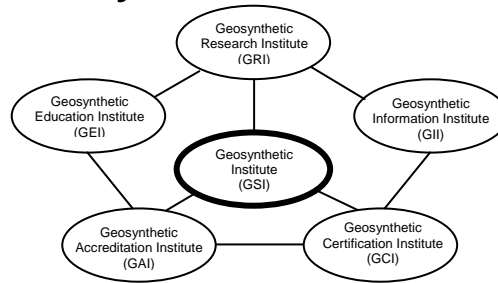


# The GSI Newsletter/Report

## Geosynthetic Institute



Vol. 22, No. 4

December 2008

This quarterly newsletter, now in its 22<sup>nd</sup> 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](http://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](mailto:robert.koerner@coe.drexel.edu) or [mvashley@verizon.net](mailto:mvashley@verizon.net).

*Happy Holidays and a Healthy  
and Prosperous New Year*

## Activities of the Institute Directors & GSI Board of Directors

1. Since publication of our last Newsletter/Report we have generated two GRI Reports (geotextile filter problems and geotextiles used as basal reinforcement), and two GRI White Papers (survey of maximum head in landfill sumps and creep of geotextiles used for geomembrane protection). All four are major items that required a concentrated effort by the GSI team. Our website has them available to members.
2. Our GRI-22 Conference set for Salt Lake City on February 27, 2009 will have about 24-papers on the general theme of "It's All in the Details". It will be held in conjunction with Geosynthetics '09.
3. We are presently in the process of election of three members of the BoD; consultants/testing labs, geomembranes/GCLs, and a new international member. By a recent change in By-Laws we will now have a second international member and one less at-large member keeping the total of a nine-person BoD.
4. 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)

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](http://www.geosynthetic-institute.org). It is in the open section under the heading "Newsletter/Report". Please share it with your friends and colleagues.

### 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)

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## 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 14<sup>th</sup>-year and has been presented at the Global Waste Conference in September, 2008.
4. **Bioreactor (aka, Wet) Landfill Behavior and Properties\*** - One of the landfill 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 was also 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. We gave our third paper on the topic at the Global Waste Conference in September.
6. **Hydrostatic Creep Puncture of Geomembranes\*** - This ten-year creep puncture project has just been dismantled and an analysis of the findings has been concluded. A short version is available as GSI White Paper #14 on our website and a complete paper has been submitted to the Journal of Geotextiles and Geomembranes for review and possible publication. Contact us if you are interested in the draft paper.
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 exposed lifetime of many different types of geomembranes. Presently being incubated are HDPE, LLDPE, 5 fPPs, PVC, EPDM and PE-R. Exposure times of 40,000 light hours are being approached.

9. **UV Exposure of Geogrids** - The UV-fluorescent exposure of four different biaxial geogrids which are used at the exposed surfaces of welded wire mesh retaining walls is ongoing. The geogrids are now up to 18,000 light hours and data is being generated and sent to the respective manufacturers.
10. **UV Exposure of TRM Fibers** - We are also using 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. **UV Exposure of Repair Tape** - We have found that a particular type of polyethylene repair tape has been successfully used to repair an exposed geomembrane at a Delaware landfill. After five-years it appears very durable. Original samples are being evaluated in one of our fluorescent tube weatherometers per ASTM D7238 at 70°C.
12. **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 (ASTM & ISO)  
 GT13 – Geotextile Separators (ASTM & ISO)  
 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

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             | • Laboratory Accreditation      |
| • Prospectus                      | • Answers to Your Questions     |
| • Associate Membership (Agencies) | • Newsletter/Reports            |
| • GSI Publications                | • Geosynthetics Links           |
| • GRI Specs, Guides, White Papers | • GSI Annual Meeting            |
| • GSI Fellowships and Projects    | • GSI Focus Group Meeting       |
| • Contact Us                      | • 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](mailto:mvashley@verizon.net). When you get into this section, the following information is presented. This includes:

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| • GRI Test Methods                 | • Links to the GSs World            |
| • GRI Reports                      | • Keyword Search for Literature     |
| • GRI Technical Papers (Citations) | • Example Problems                  |
| • Notes of GSI Meetings            | • 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 of the website that we (and others we are told) use the most in our various activities.

## 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. We also have a new report on landfill berms (Report #35) available on CD.

### Courses

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

- March 9, 2009  
*Geosynthetic Design in Waste Containment Systems*
- 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:

\$275/person for each one-day course (up to one month prior to course)  
\$325/person thereafter  
\$175/person – GSI Members

Contact: Marilyn Ashley ([mvasshley@verizon.net](mailto:mvasshley@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. In addition, the program uses the GSI lab as the reference test lab and operates it as an ISO 17011 enterprise. In short, this means that the GSI lab does not conduct outside conformance testing for a fee.

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. In addition, 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. There are currently 180 GAI-LAP methods available for accreditation. Please consult our home page for a current listing.

As of December, 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<sup>A</sup> - TRI/Environmental Inc. (118 tests)  
Sam Allen -- (512) 263-2101
- 3<sup>A</sup> - Golder Associates (44 tests)  
Henry Mock -- (770) 492-8280
- 4<sup>C</sup> - Geosynthetic Institute (116 tests)  
George Koerner -- (610) 522-8440
- 6<sup>A</sup> - GeoSystems Consultants (27)  
Craig Calabria -- (215) 654-9600
- 8<sup>B</sup> - Propex, Ringgold (19 tests)  
Todd Nichols -- (800) 258-3121
- 9<sup>B</sup> - Propex, Alto (10 tests)  
Melvin Wallace -- (770) 532-9756
- 11<sup>A</sup> - STS Consultants Ltd. (13 tests)  
Bill Quinn -- (847) 279-2500
- 13<sup>A</sup> - Precision Laboratories, CA (95 tests)  
Ron Belanger -- (714) 520-9631
- 14<sup>A</sup> - Geotechnics (61 tests)  
J. P. Kline -- (412) 823-7600
- 19<sup>A</sup> - HTS Inc. (42 tests)  
Larry McMichael -- (713) 692-8373
- 20<sup>A</sup> - GeoTesting Express, MA (46 tests)  
Gary Torosian -- (978) 635-0424
- 22<sup>B</sup> - CETCO Arlington Heights (13 tests)  
Jim Olsta -- (847) 392-5800
- 23<sup>B</sup> - CETCO Cartersville (10 tests)  
Sid Weiser -- (706) 337-5316
- 24<sup>B</sup> - CETCO Lovell (10 tests)  
Roger Wilkerson -- (307) 548-6521
- 25<sup>B</sup> - Ten Cate, Pendergrass (11 tests)  
Beth Wilbanks -- (706) 693-2226
- 26<sup>B</sup> - Agru America Inc. (17 tests)  
Grant Palmer -- (843) 546-0600
- 29<sup>C</sup> - FITI Testing & Research Institute (70 tests)  
Moon-Hyun Jeong -- (011-82-2-960-8034)
- 31<sup>D</sup> - NYS Dept. of Transportation (9 tests)  
John Remmers -- (518) 457-4704
- 32<sup>A</sup> - Vector Engineering (6 tests)  
Ken Criley -- (530) 272-2448
- 34<sup>B</sup> - GSE Richey Road (28 tests)  
Jane Allen -- (281) 230-6726
- 37<sup>B</sup> - GSE Chile (21 tests)  
Mauricio Ossa -- 56-2 6010153
- 38<sup>C</sup> - Sageos/CTT Group (82 tests)  
Eric Blond -- (450) 771-4608
- 40<sup>B</sup> - GSE Lining Technology Inc. (17 tests)  
Vicky Parrott -- (843) 382-4603
- 41<sup>A</sup> - SGI Testing Service, LLC (19 tests)  
Zehong Yuan -- (770) 931-8222
- 42<sup>C</sup> - NPUST (GSI-Taiwan) (49 tests)  
Chiwan Wayne Hsieh -- 011-886-8-7740468
- 43<sup>A</sup> - Ardaman & Associates (18 tests)  
George DeStafano -- (407) 855-3860
- 44<sup>B</sup> - BBA Fiber Web, Inc. (9 tests)  
Ken McLain -- (615) 847-7575
- 45<sup>B</sup> - Ten Cate Malaysia SDN Bhd. (23 tests)  
C. P. Ng -- (603) 519 28568
- 46<sup>B</sup> - Bentofix Technologies (13 tests)  
Colin Murphy -- (705) 725-1938
- 47<sup>A</sup> - Precision Laboratories, TX (13 tests)  
Mike Bishop -- (866) 522-0843
- 48<sup>B</sup> - Tenax Corporation (9 tests)  
Andrew Barker -- (410) 522-7000

- 49<sup>B</sup> - Engepol Geossinteticos (20 tests)  
George Nastas -- (55) 11-4166 3001
- 50<sup>B</sup> - ADS, Inc. Hamilton (7 tests)  
Terry McElfresh -- (513) 896-2065
- 51<sup>B</sup> - Solmax International Inc. (17 tests)  
Guy Elie -- (450) 929-1234
- 53<sup>B</sup> - Polytex Inquique (13 tests)  
Cristian Valdebenito -- 011 56 57 42 90 00
- 54<sup>B</sup> - ADS, Inc. Finley (9 tests)  
David Gonso -- (419) 424-8377
- 55<sup>B</sup> - Atarfil Geomembranes (20 tests)  
Isabel Merida Fernandez -- 34 958 439 278
- 56<sup>B</sup> - Polytex Santiago (11 Tests)  
Jamie Morales -- 56-2-627-2054
- 57<sup>B</sup> - Ten Cate Cornelia (15 Tests)  
Melissa Medlin -- (706) 778-9794
- 58<sup>B</sup> - Propex Nashville (9 Tests)  
Tim Smith -- (229) 686-5511
- 59<sup>B</sup> - Firestone (9 Tests)  
Janie Simpson -- (864) 439-5641
- 60<sup>B</sup> - Polytex Lima (11 Tests)  
Elias Jarufe -- 51-16169393

<sup>A</sup>Third Party Independent    <sup>C</sup>Institute  
<sup>B</sup>Manufacturers QC            <sup>D</sup>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:

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](mailto:gkoerner@dca.net)

A new edition of ISO 9001, the world's most widely used quality management system standard has been approved by the ISO membership on November 28, 2008. The revision does not introduce additional requirements compared to the last edition in 2000 and does not change the intent of the standard. It still provides the requirements for a quality management system (QMS), which is a framework for an organization to control its processes in order to achieve objectives including customer satisfaction, regulatory compliance and continual improvement. ISO 9001:2008 is the fourth edition of the standard which was first published in 1987. It represents a fine-tuning, rather than a thorough overhaul of the standard. It introduces clarifications to the requirements existing standard, based on user experience over the last eight years, and changes that are intended to improve further compatibility with the ISO 14001:2004 standard for environmental management systems. This note is particularly important to the 25 GAI-LAP laboratories that are geosynthetic manufactures. Update from ISO 9001:2000 to ISO 9001:2008 will encourage them

to consider sustainability in there operations. In short, the ISO quality standards have gone green.

## Activities within GCI (Certification)

Due in part to the active interest by many GSI members and associate members we present a tabular summary of the Inspectors Certification Program as of November, 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".

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%)
	<b>TOTAL</b>	<b>141</b>	<b>5 (3%)</b>	<b>128</b>	<b>12 (9%)</b>
2007	GSI Course	46	9 (19%)	38	6 (16%)
	Other Course	18	2 (11%)	18	3 (16%)
	No Course	18	0	17	3 (17%)
	<b>TOTAL</b>	<b>82</b>	<b>11 (13%)</b>	<b>73</b>	<b>12 (16%)</b>
2008 (to date)	GSI Course	23	6 (26%)	20	4 (25%)
	Other Course	44	11 (25%)	43	11 (25%)
	No Course	23	6 (26%)	22	5 (23%)
	<b>TOTAL</b>	<b>90</b>	<b>23 (25%)</b>	<b>85</b>	<b>20 (23%)</b>
2006- 2008 (to date)	GSI Course	103	15 (14%)	85	15 (17%)
	Other Course	121	16 (13%)	118	18 (15%)
	No Course	89	8 (9%)	83	11 (13%)
	<b>2006/08 TOTAL</b>	<b>313</b>	<b>39 (12%)</b>	<b>286</b>	<b>44 (15%)</b>

## 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 twelve people (two 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.

## GSI Fellowships

As mentioned our last Newsletter/Report we have awarded five GSI Fellowships in the amount of \$10,000 for research in geosynthetics.

The students are all doctoral candidates doing research in geosynthetics. From a worldwide solicitation of proposals the following five were selected. Their full proposals are on our website at [www.geosynthetic-institute.org](http://www.geosynthetic-institute.org); click on "GSI Fellowships and Projects".

University	Advisor	Student	Topic
Virginia Tech Univ.	George Filz	Michael McGuire	Geosynthetically reinforced pile supported embankments
Drexel Univ.	Grace Hsuan	Connie Wong	Durability specification development for corrugated HDPE pipe
RWTH Aachen	Martin Ziegler	Axel Ruiken	Geogrid behavior when used in wall and slope applications
Univ. of Athens	Michael Sakellari	Elena Kapogianni	Geosynthetic reinforced soil slope stability under seismic conditions

Univ. of Kansas	Jie Han	Xiaoming Yang	Geocell behavior when used to reinforce aggregate bases
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Their reports are due on or before June 30, 2009 and, pending appropriate progress, they can reapply for a second and even a third year. We will begin a new solicitation on July 15, 2009. In the steady state after the third year we expect to be supporting 12 to 15 students per year. Funding for this program comes from the GSI endowment.

## Items of Interest

### 1. Recycling rates in the USA.

(from *Civil Engineering*, Sept. 2008)

#### Recycling Rates of Major Waste Components

Auto Batteries	99.0%
Steel Cans	62.9%
Yard Trimmings	62.0%
Paper and Paperboard	51.6%
Aluminum Beer and Soft Drink Cans	45.1
Tires	34.9%
Plastic Soft Drink Bottles	30.9%
HDPE Milk and Water Bottles	31.0%
Glass Containers	25.3%

ref: U. S. EPA, 2006

### 2. Geosynthetic Consumption in Europe (2005)

Nonwoven Fabrics:	> 180 million m <sup>2</sup>
Woven Fabrics:	> 75 million m <sup>2</sup>
Geogrids:	> 35 million m <sup>2</sup>
Geodrain/Composites:	> 15 million m <sup>2</sup>
Geomembranes:	> 45 million m <sup>2</sup>
Geosynthetic Clay Liners:	> 20 million m <sup>2</sup>
Total annual volume:	> 370 million m <sup>2</sup> (370 km <sup>2</sup> )
approx.	~ 200,00 t

36<sup>th</sup> International Conference "Foundation Engineering", BRNO 2008, G. Heerten data

### 3. Tree-root clogging of filters and drains

#### Trees that are prone to clogging drainage systems

Shallow Rooted Trees	Intermediately Routed Trees	Deep Rooted Trees
All Poplars All Willows Black Maple Manitoba Maple Red Maple Silver Maple Tamarack White Cedar Speckled Alder	American Elm Black Ash Green Ash White Ash Pin Oak Swamp White Oak Sycamore Mulberry	Bur Oak Black Walnut Hackberry Bitternut Hickory Shellbark Hickory

Trees that rarely clog drainage systems

Shallow Rooted Trees	Intermediately Routed Trees	Deep Routed Trees
American Beech Black Cherry White Birch Norway Maple Staghorn Sumac Hemlock White Pine White Spruce Colorado Spruce	Apple Pear Peach Plum American Chestnut Sugar maple	Red Oak White Oak Butternut Shagbark Hickory Tulip

ref. Grand River Conservation Authority ([www.grandriver.ca](http://www.grandriver.ca))

**4. Regarding longitudinal cracks in asphalt pavements**



ref. *The Economist*, June 28, 2008

Comment: The reason that this photo is shown is to justify that the cross machine direction strength of biaxial geogrids used in pavement reinforcement is always slightly greater than the machine direction strength. We get this question frequently.

**5. Editor John Trotti’s (MSW Management Magazine) “Farewell 2008... and Good Riddance**

“By the time this issue MSW Management Magazine hits your desk, the election will be over, and whether your favorites fared well or not, the relief from the stress of a birthing that rivaled at least in duration that of an elephant has to be enormous to us all. Now we can get back to the day-to-day issues with which we can deal, leaving our elected representatives to face the rest.

What a year this has been. Without trying to catalog events, a few stand out in bold relief...the run-up of fuel and material prices (including those for a number of recyclables) and the collapse of the housing market and the underlying credit debacle...the causes and presumed bailout of which beggar the imagination. You, I, and the auto industry might not be happy with the way things have gone in the recent past, but now as the smoke from the credit meltdown, bailout, and

election hyperbole begins to thin, it’s time to take stock of what the future might hold.”

Comment: Let’s all think positive and work to make things better in 2009, and beyond.

**Issues in Wide Width Tensile Testing**

Recently we have been asked by several GSI and GAI-LAP members to show some supportive documents that strip, yarn or rib tensile tests for high-strength geosynthetics (geotextiles mainly) are acceptable equivalents to ISO 10319 or ASTM D4595 wide width test results. The request usually is as follows: “Would you be able to provide us some sort of written clarification or documentation to assure our customers on the matter of strip, yarn (or rib) test results being equivalent to wide width tensile test results?”

Our response generally is as follows: “We would like to help you with your customer’s request for supportive documents showing that strip, yarn or rib tensile tests are equivalent to wide width tests for woven high-strength geotextiles and geogrids as well. Unfortunately, we cannot find any such reference. In addition, our experience shows us that the strip, yarn, or rib tests results are invariably stronger than the wide width results. This phenomenon has to do with several factors affecting the results including, but not limited, to test speed, fabrication stresses, and the weakest yarns or ribs dominating performance in wide width testing.”

For high strength geotextiles the arrangement as well as the properties and the structure of the fibers within the yarns and the yarns within the fabric generate a complex strength and elongation mechanism in textiles. (In this regard, geogrids are not as complex). In 1969 Pierce, et al. developed a theoretical model of the mechanical behavior of fabrics based on weave geometry. This work showed that it was possible to simulate different stresses, to determine the fabric response, and to compare the behavior of the various structures. This simulation requires the use of a realistic meshing of the basic cell and an accurate characterization of the physical parameters of the material that composes the basic cell. The models were good but in general they under-predicted the textile strength of the fabric due to a conservative assignment of reduction factors such as crimp, twist, abrasion, friction, etc.

In reflecting on this research, things have changed in the geosynthetic testing arena; particularly with regard to WWT testing. The following iterations are of note:

1. Wedge type grips like those shown in Figure 1 as per ASTM D4595, and a CRE machine containing an internal odeometer or LVDT (see Figure 2) used for measuring cross head movement for deformation from which strain is calculated.
2. Capstan type grip like those shown in Figure 3 and a contact extensometer for measuring deformation as shown in Figure 4.
3. Demgen type grips like those shown in Figure 5 and a non-contact extensometer for measuring deformation as shown in Figure 6.



Figure 1. Wedge type grips per ASTM D4595.



Figure 2. Odeometer or LVDT in the CRE machine for measuring crosshead movement.



Figure 3. Capstan grips.



Figure 4. Contact extensometer.

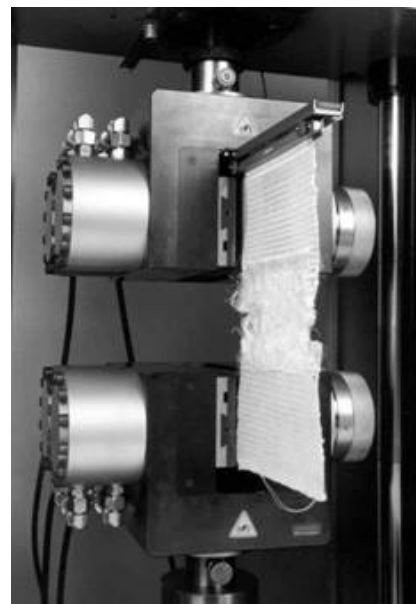


Figure 5. Demgen grips.



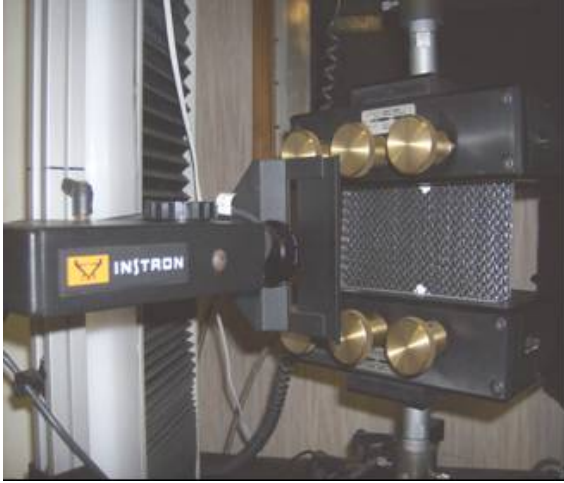


Figure 6. Photograph of non-contact extensometer.

These technical advances have in effect made ISO 10319 or ASTM D4595 wide width results nearly equivalent to the strip, yarn or rib tensile tests for high-strength materials. The past conversation among laboratory personnel conducting WWT testing has always been that mistakes in specimen preparation, handing, mounting, and testing always lead to lower results. That said, we have now come to the point where, with very expensive equipment, to replicate the various index test results.

Dr. C. Wayne Hsieh, Department of Civil Engineering, National Pingtung University of Science and Technology, Neipu, Pingtung, Taiwan, recently wrote a nice journal article entitled, "Tensile Test Method Effects on the Tensile Strength of Flexible PET Geogrids." He showed that results for strip, yarn or rib tensile tests were +/- 5% of WWT testing for most high strength geosynthetics.

Where we go from here will be interesting. GSI in an effort of inclusion has tried to strike a cord of practicality and good cost/benefit for testing. The entire geosynthetic community wants public and private entities to be able to check mechanical properties in a repeatable manner. It will be interesting to see if we go more toward use of strip, yarn or rib tensile tests for "design purposes" or continue to rely on wide width tensile testing only.

*George Koerner*

## Upcoming Events

- January 11-15, 2009  
Transportation Research Board Meeting  
Washington, DC  
Contact: [TRBMeeting@NAS.edu](mailto:TRBMeeting@NAS.edu)

- January 28-30, 2009  
ASTM D35 on Geosynthetics  
Atlanta, Georgia  
Contact: [csierke@astm.org](mailto:csierke@astm.org)
- February 25-27, 2009  
Geosynthetics '09  
Salt Lake City, Utah  
Contact: [bbwistrill@ifai.com](mailto:bbwistrill@ifai.com)
- March 9, 2009  
GSI Short Course  
GS Design in Waste Containment Systems  
GSI in Folsom (Philadelphia), PA  
Contact: [mvashley@verizon.net](mailto:mvashley@verizon.net)
- March 10, 2009  
GSI Short Course  
QA/QC of Geosynthetics  
GSI in Folsom (Philadelphia), PA  
Contact: [mvashley@verizon.net](mailto:mvashley@verizon.net)
- June 17-19, 2009  
ASTM Committee D35  
Vancouver BC, Canada  
Contact: [csierk@astm.org](mailto: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 and Trevor Arthurs as the contact member, and Geosyntec Consultants with Steve Poirier as the contact member. Welcome and welcome back, respectively.

**GSE Lining Technology, Inc.**

*Boyd Ramsey [BoD]*

**Earth Tech Consultants, Inc.**

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*Aigen Zhao/Piergiorgio Recalcati*

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*John Henderson/Chris Lawson*

**CETCO**

*James T. Olsta*

**Huesker, Inc.**  
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**Propex**  
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**STS Consultants**  
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**Fiberweb, Inc.**  
*Steve Bowlds/William Walmsley*  
**NTH Consultants, Ltd.**  
*James J. Parsons/Robert Sabanas*  
**TRI/Environmental Inc.**  
*Sam R. Allen [BoD]*  
**U. S. Army Corps of Engineers**  
*David L. Jaros [BoD]*  
**Chevron Phillips Co.**  
*Rex L. Bobsein*  
**URS Corp.**  
*John C. Volk*  
**Solmax Géosynthétiques**  
*Robert Denis*  
**Envirosource Technologies, Inc.**  
*Douglas E. Roberts*  
**CARPI, Inc.**  
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*Paul Emond*

***In The Next Issue***

- Activities of the GSI Directors and Board
- Overview of GRI (Research) Projects
- Activities within GII (Information)
- Progress within GEI (Education)
- Activities within GAI (Accreditation)
- Activities within GCI (Certification)
- The GSI Affiliate Institutes
- The GSI Centers-of-Excellence
- Items of Interest
- GMA Techline's First 1000 Q & A's
- GSI's Member Organization