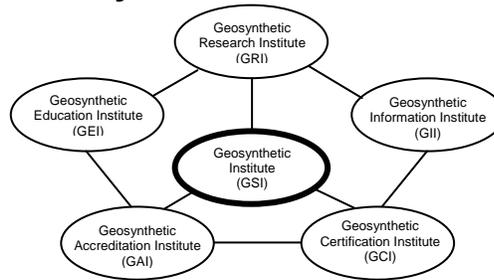


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 24, No. 1

March 2010

This quarterly newsletter, now in its 24th 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 GSI's Directors and 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. Our March 2, 2010 Webinar, hosted by ASCE, went off as planned and had 25 organizations participating. These are noon presentations where many people can be in attendance at each location, just how many is unknown. Considering that the topic was introductory, ASCE was satisfied and the next one is scheduled for November 22, 2010 and will be on a more "meaty" topic, e.g., veneer reinforcement on steep slopes.
2. In addition to regularly scheduled short courses at GSI, we have a MSE retaining wall Workshop set for April 1, 2010 at GSI. This members-only workshop will address the topic of wall failures which was daylighted in GRI Report #38. It is free, but please let us know if you are attending.
3. The New York Federation of Solid Waste will hold its annual conference at Sagamore, New York (a wonderful event) on May 17-19, 2010. This year it will have sessions on (i) solar panels on exposed geomembranes, and (ii) new horizons in geosynthetic materials, among many others.
4. GeoFrontiers II is set for Dallas, Texas March 13-16, 2011 and we will have our GRI-24 conference embedded within it. Our theme will be "Implementing Sustainability Using Geosynthetics". It's a "big-picture" topic and we are hoping for a nice set of GSI member papers and presentations. A call-for-titles has been sent to all GSI Members so please respond accordingly.
5. The Fall/Winter election cycle for BoD members resulted in Tony Eith, Boyd Ramsey and Sam

Allen being re-elected for a new three-year terms. Congratulations in this regard. Also Tony Eith was re-elected as BoD Chairman.

6. Your Board of Directors is as follows. Do contact any of them with regard to GSI matters.

Term Ends 2010

David Jaros - Corps of Engineers (Government Agencies)

e-mail: dave.l.jaros@usace.army.mil

Paul Oliveira - Firestone bp Inc. (Resin Producers)

e-mail: oliveirapaul@firestonebp.com

Kent von Maubeuge - NAUE GmbH & Co. KG
(International-1)

e-mail: kvmaubeuge@naue.com

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- GSI's Member Organizations

Term Ends 2011

Dick Stulgis - GeoTesting Express (Consultants and Testing Laboratories)

e-mail: rstulgis@geocomp.com

Gary Kolbasuk - Raven (Geomembranes and GCLs)

e-mail: gary.kolbasuk@ravenind.com

Wayne Hsieh - GSI-Taiwan (International-2)

e-mail: cwh@mail.npust.edu.tw

Term Ends 2012

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

e-mail: aeith@wm.com

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

e-mail: bramsey@gseworld.com

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

e-mail: Sallen@tri-env.com

Overview of GRI Projects (Research)

Each issue of our Newsletter/Report provides a brief glimpse and update of current GRI research projects. It will be noted that most projects are of a very long duration. (In this regard short projects are given to design firms or testing laboratories that are GSI Members). 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. In-Situ Temperature Monitoring of Liner and Cover Geomembranes in Dry and Wet Landfills*** - 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 extended into its 14th-year and has resulted in an extremely authoritative set of real-life data.
- 3. 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 up to 10 years. This activity has been extended to an adjacent landfill to see how reproducible the data is with a slightly different waste mass.

- 4. 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.
- 5. UV Exposure of Geomembranes*** - GSI is using UV-fluorescent devices to estimate the projected exposed lifetime of many different types of geomembranes. Presently being incubated are HDPE, LLDPE, fPP, PVC, EPDM, PE-R and LLDPE-R. Exposure times of 40,000 light hours are now realized at 70°C and a replicate set of samples are now being incubated at 60°C. These will take at least 60,000 light hours (≈ 8-years). The third sequence at 80°C was just started on 1/1/2010. Ongoing data is being reported to manufacturers and resin producers.
- 6. 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 various geogrids are now up to 25,000 light hours and data is being generated and sent to the respective manufacturers. As with the geomembranes, replicate samples will now be incubated at 60°C for eventual use in Arrhenius Modeling and lifetime prediction. The last set will be at 80°C.
- 7. UV Exposure of TRM Fibers** - We are also using UV-fluorescent exposure of several turf reinforcement mat fibers to assess their lifetime capabilities. They are presently being incubated at 70°C. Contact Bob Koerner if you have materials for inclusion into this effort.
- 8. 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 decreases per ASTM D7238 at 70°C.

9. **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
GM18 – fPP Geomembranes
GM21 – EPDM Geomembranes
GM22 – Exposed Temporary Covers
GM25 – LLDPE-R Geomembranes
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 – Other 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. Copies of the above listed draft specification tables are available to members and associate members.

10. **Other GRI Standards** - There are several GRI Standards in various forms of preparation. One involved spray-on geomembranes and the other vapor barriers. Contact George Koerner for the status of these new efforts.

Activities within GII (Information)

Our GSI Home Page and is accessed as follows:

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

It has been completely revised and is being maintained 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
- Product Certification
- Newsletter/Reports
- Internet Courses
- Geosynthetics Links
- GSI Member Meetings
- Courses at GSI
- CQA Insp. Cert.

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 of the website that we (and others we are told) use the most in our various activities.

In addition to the information provided in our home page as just mentioned, Jamie Koerner (Special Projects Coordinator) is performing various surveys of pertinent topics in geosynthetics. To date she has focused on the following; all of which are available. Note that we are open to suggestions to other survey-related topics.

- State adoption of AASHTO M288 geotextile specification (GRI Report #31)
- State liner and cover regulations for solid waste disposal (GRI Report #32)
- International liner and cover regulations for solid waste disposal (GRI Report #34)
- Allowable leachate head in landfill sumps (White Paper #13)
- Allowable leakage rates for waste ponds (White Paper #15)
- Professional development hours (PDH's) required by the various states for continued licensure. (See later description in this Newsletter/Report).
- Status of state environmental regulators with respect to conformance testing and levels of CQA at landfills and surface impoundments.

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.

GRI Reports

To date, we have 39 GRI Reports available to members and associate members. These reports vary in length from 30 to 200 pages and beginning with Report #25 they are on the password protected section of our home page. Prior to that date only the abstract is available online. All of them, however, are available in hard copy. The most recent reports are as follows:

- #36 – Inadequate Performance of Geotextile Filters Under Different and Challenging Field Conditions
- #37 – Geosynthetic Supported Base Reinforcement Over Deep Foundations
- #38 – A Data Base and Analysis of Geosynthetic Reinforced Wall Failures
- #39 – Methods of Stabilizing Excessively Deformed MSE Walls (available 4/1/10)

Courses

We have scheduled the following sequence of courses:

- Tuesday, March 23, 2010
Quality Control/Quality Assurance of Geosynthetics
- Wednesday, March 31, 2010
Design, Analysis, and Failures (i.e., Lessons Learned) of Geosynthetically Reinforced Retaining Walls and Steep Soil Slopes
(with Professor Dov Leshchinsky of University of Delaware)

The above 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 (mvashley@verizon.net)

GSI Fellowships

We are pleased to announce the second class of GSI Fellows for the academic year 2009-2010. The basic criteria are as follows:

1. Student must have completed his/her doctoral candidacy examinations.
2. Student must be researching an innovative topic involving geosynthetics.
3. Student must express an interest and desire to teach and/or research in the geosynthetic field.

Four of the proposals contained excellent projects which have been awarded. These four plus four second year students (continuing their research projects) have been sent stipend checks accordingly.

Class 1 - Continued Funding for 2nd Year

Number	Student	Advisor	University	Topic
1-08	Michael McGuire	George Filz	Virginia Tech	Geosynthetic reinforced pile supported embankments
2-08	Connie Wong	Grace Hsuan	Drexel Univ.	Durability specification development for HDPE transmission and drainage pipes
3-08	Axel Ruiken	Martin Ziegler	RWTH Aachen	Geogrid behavior used in walls and slopes
4-08	Eleni Kapogianni	Michael Sakellairou	U. of Athens	Geosynthetic reinforcement of soil slopes under seismic conditions

Class 1 - New Funding this Year

Number	Student	Advisor	University	Topic
1-09	Anil Bhandari	Jie Han	U. of Kansas	Geogrids in pavements under dynamic loading
2-09	Brent Robinson	Mo Gabr	N. C. State	GT/GG behavior in lime stabilized subgrade soils
3-09	Ioanna Tzavara	Yiannis Tsompanakis	U. of Crete	Seismic design for geogrid reinforced walls
4-09	Majid Khabbazian	Victor Kaliakin	U. of Delaware	Geosynthetic Reinforced stone columns and embankment stabilization

Activities within (Accreditation)

The Geosynthetic Accreditation Institute's (GAI) current mission is focused on a Laboratory Accreditation Program (LAP) for 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 as an ISO 17011 enterprise. In short, this means that the GSI lab does not conduct outside commercial testing.

It should also be made clear 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. Presently, there are 194 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of March, 2010, 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
Sallen@tri-env.com
- 3^A - Golder Associates (45 tests)
Jonathan Ellingson -- (770) 492-8280
Jellingson@golder.com
- 4^C - Geosynthetic Institute (116 tests)
George Koerner -- (610) 522-8440
gkoerner@dca.net
- 8^B - Propex, Ringgold (19 tests)
Todd Nichols -- (800) 258-3121
todd.nichols@propexinc.com
- 9^B - Lumite (10 tests)
Rebecca Page -- (770) 869-1700
rpape@lumite.com
- 11^A - AECOM Inc. (13 tests)
Bill Quinn -- (847) 279-2500
bill.quinn@aecom.com
- 13^A - Precision Laboratories, CA (95 tests)
Ron Belanger -- (714) 520-9631
rbelanger@precisionlabs.net
- 14^A - Geotechnics (61 tests)
J. P. Kline -- (412) 823-7600
JPKline@geotechnics.net
- 19^A - HTS Consultants Inc. (42 tests)
Larry McMichael -- (713) 692-8373
LMcMichael@htshouston.com
- 20^A - GeoTesting Express, MA (46 tests)
Gary Torosian -- (978) 635-0424
gtorosian@geotest.com

- 22^B - CETCO Hoffman Estates (13 tests)
Jim Olsta -- (847) 392-5800
jim.olsta@cetco.com
- 23^B - CETCO Cartersville (10 tests)
Chris Cunningham -- (706) 337-5316
chris.cunningham@cetco.com
- 24^B - CETCO Lovell (10 tests)
Roger Wilkerson -- (307) 548-6521
roger.wilkerson@cetco.com
- 25^B - Ten Cate, Pendergrass (11 tests)
Beth Wilbanks -- (706) 693-2226
beth_wilbanks@rtcusa.net
- 26^B - Agru America Inc. (17 tests)
Grant Palmer -- (843) 546-0600
gpalmer@agruamerica.com
- 29^e - FITI Testing and Research Institute (70 tests)
Hong-Kwan Kim -- 82-2-3299-8071
HKKim@fiti.com.re.kr
- 31^D - NYS Dept. of Transportation (9 tests)
John Remmers -- (518) 457-4104
Jremmers@dot.state.ny.us
- 32^A - Vector Engineering (6 tests)
Ken Criley -- (530) 272-2448
criley@vectoreng.com
- 34^B - GSE Richey Road (28 tests)
Jane Allen -- (281) 230-6726
Jallen@gseworld.com
- 37^B - GSE Chile (21 tests)
Mauricio Ossa -- 56-2 6010153
Mossa@gseworld.com
- 38^C - Sageos/CTT Group (91 tests)
Eric Blond -- (450) 771-4608
eblond@groupectgroup.com
- 40^B - GSE Lining Technology Inc. (17 tests)
Vicki Parrott -- (843) 382-4603
Vparrott@gseworld.com
- 41^A - SGI Testing Service, LLC (19 tests)
Zehong Yuan -- (770) 931-8222
ZYuan@interactionspecialists.com
- 42^C - NPUST (GSI-Taiwan) (59 tests)
Chiwan Wayne Hsieh -- 011-886-8-7740468
CWH@mail.npust.edu.tw
- 43^A - Ardaman & Associates (18 tests)
George DeStafano -- (407) 855-3860
gdestafano@ardaman.com
- 44^B - BBA Fiber Web, Inc. (9 tests)
Ken McLain -- (615) 847-7575
k.mclain@fiberweb.com
- 45^B - Ten Cate Malaysia SDN Bhd. (23 tests)
C. P. Ng -- (603) 519 28568
cpng@tencate.com
- 46^B - Bentofix Technologies (13 tests)
Colin Murphy -- (705) 725-1938
cmurphy@gseworld.com
- 47^A - Precision Laboratories, TX (13 tests)
Mike Bishop -- (866) 522-0843
mbishop@precisionlabs.net
- 48^B - Tenax Corporation (9 tests)
Andrew Barker -- (410) 522-7000
ABarker@tenax.com
- 49^B - Engepol Geossinteticos (19 tests)
Carolina Polomino -- (55) 11-4166 3001
Carolina@nortene.com.br
- 50^B - ADS, Inc. Hamilton (7 tests)
Terry McElfresh -- (513) 896-2065
mcelfresh@ads-pipe.com
- 51^B - Solmax International Inc. (20 tests)
Simon Gilbert St. Pierre -- (450) 929-1234
simonGSP@solmax.com
- 53^B - Polytex Inquique (13 tests)
Cristian Valdebenito -- 011 56 57 42 90 00
cvaldebenito@polytex.cl
- 54^B - ADS, Inc. Finley (9 tests)
David Gonso -- (419) 424-8377
davegonso@ads-pipe.com

- 55^B - Atarfil Geomembranes (20 tests)
Iganacio Garcia Arroyo -- 34 958 439 278
larroyo@atarfil.com
- 56^B - Polytex Santiago (11 tests)
Jamie Morales -- 56-2-627-2054
Jmorales@polytex.cl
- 57^B - Ten Cate Cornelia (15 tests)
Melissa Medlin -- (706) 778-9794
mmedlin@tencase.com
- 58^B - Propex Nashville (9 tests)
Tim Smith -- (229) 686-5511
TimSmith@propeinc.com
- 59^B - Firestone (9 Tests)
Janie Simpson -- (864) 439-5641
SimpsonJanie@firestonebp.com
- 60^B - Polytex Lima (11 tests)
Elias Jurufe -- 51 16169393
Ejarufe@polytex.cl
- 61^B - Raven Industries (17 tests)
Justin Norberg -- (605) 335-0288
Justin.Norberg@ravenind.com
- 62^B - Solmax International Asia (14 tests)
Marie Andre Fortin -- (450) 929-1234
MarieAF@solmax.com
- 63^A - TRI Environmental, Inc.; DDRF (4 tests)
Joel Sprague -- (864) 242-2220
JSprague@tri-env.com
- 64^B - Agru America (NV) (14 tests)
Chris Adams -- (775) 835-8282
- 75^C - Bombay Textile Rsearch Assoc. (BTRA) (24 tests)
Riyaz Shaikh
(0) 022-25003551
btra@vsnl.com

^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:

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E-mail: gkoerner@dca.net

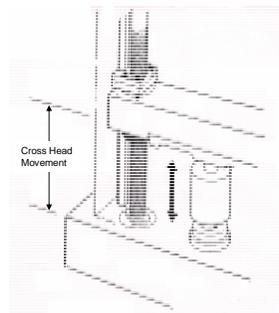
GSI-LAP has noticed several inconsistencies with strain/elongation measurements over the past quarter. They have arisen in association with ASTM D4595 geotextile WWT testing. Conflicts generally involve the testing of PET geotextiles. In most cases such textiles rupture prior to 20% strain. One certainly starts to question the results when break strains are greater than 20%. Cause for such errors include:

- grip slippage
- poor extensometer accuracy
- synchronization of data acquisition process control for load and deflection

Over the years we have seen several methods to measure strain during ASTM D4595 testing. The four most prevalent methods are listed below;

1. Cross head measurement via odeometer
2. Contact extensometer
3. Non contact extensometer
4. Foil strain gauge

Each of these are depicted in Figures 1-4, respectively. Each method has its advantages and disadvantages in addition to its applicability to a specific grip type.



(a) - Photograph of sensor (b) - Schematic diagram illustrating cross head movement

Fig. 1 – Examples of cross head monitoring assuming insignificant grip slippage for ASTM D4595 testing (modified from Instron literature)

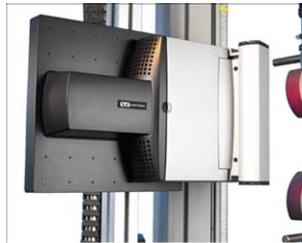


(a) - Photograph of clip-on extensometer (b) - Photograph of cable "roller style" extensometer

Fig. 2 – Examples of contact extensometer elongation monitoring for ASTM D4595 testing (compliments Epsolon Corp.)



(a) - Photograph of video extensometer



(b) - Photograph of infra-red extensometer

Fig. 3 – Examples of noncontact extensometer elongation monitoring for ASTM D4595 testing (compliments Instron Corp.)

Inspector Certification Test Results 2006 – 2009

Year	Geosynthetic Materials		Compacted Clay Liners		Commentary
	No. of people taking exam	No. of people failing exam	No. of people taking exam	No. of people failing exam	
2006	141	5 (3%)	128	12 (9%)	2 (1.5%)
2007	82	11 (13%)	73	12 (16%)	7 (8.5%)
2008	95	25 (25%)	89	20 (23%)	13 (14%)
2009	26	6 (23%)	24	2 (8%)	2 (8%)
TOTAL (to date)	344	47 (14%)	314	46 (15%)	24 (7%)

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).

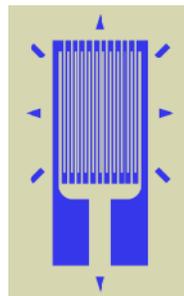
FITI is a 30-year old testing organization located in Seoul focusing on interlaboratory proficiency; environmental protection; safety and flammability; hazardous substances; in-house quality control; consumer protection; complaint analysis; quality marking; procurement; household and industrial applications; 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



(a) - Photograph of foil strain gauges. Note one is attached to geotextile.



(b) - Schematic diagram of foil strain gauge used for monitoring

Fig. 4 – Examples of foil strain gauges used for monitoring elongation of ASTM D4595 specimens (compliments Micro Measurements Corp.)

However, we recommend that even with the most sophisticated equipment that the technician, quality manager and engineer ask the question; “Does the result make sense?”. It would go a long way in eliminating conflict resolution and retesting.

George Koerner

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. The table 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 the exam is reasonably difficult and at an appropriate level for today's CQA personnel.

Professor in the Department of Civil Engineering and Dean of the R & D Office. 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 59 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.

Items of Interest

1. Faculty Position at RWTH University in Aachen, Germany

This advertisement for a full professor in structural engineering was interesting in that the criteria are extremely "forward thinking". For example,

- (a) German not necessary to begin, but will be expected as teaching language within the first five years.
- (b) The RWTH Aachen aims to increase the number of women in areas in which they are underrepresented, thus women are strongly encouraged to apply.
- (c) The RWTH Aachen aims to integrate persons with disabilities, thus persons with disabilities are strongly encouraged to apply.

2. Geotextile Boom in China

Mr. Zhu Minu, Chairman of the China Nonwovens & Industrial Textiles Association (CNITA), anticipates that heavy investment by the state government in railways and road construction will involve major development and utilization of geotextiles to solve application problems; nonwoven geosynthetics, geonets, geomats, geocells and drainage boards, among others. Applications in filtration, anti-seepage, water drainage, separation and soil reinforcement are all key growth areas for use of geosynthetics in China's infrastructure.

(ref. *Specialty Fabrics Review, IFAI, 01.10*)

3. Oil in Bakken Formation

North Dakota and Montana have an estimated 3.0 to 4.3 billion barrels of undiscovered, technically recoverable oil in an area known as the Bakken Formation. A U. S. Geological Survey assessment, released April 10, shows a 25-fold increase in the amount of oil that can be recovered compared to the agency's 2005 estimate of 151 million barrels of oil.

New geological models applied to the Bakken Formation, advances in drilling and production technologies and recent oil discoveries have resulted in these substantially larger technically recoverable oil volumes. About 105 million barrels

of oil were produced from the Bakken Formation by the end of 2007.

(ref.

<http://www.usgs.gov/newsroom/article.asp?ID=1911>

4. Vision for CE's in 2025

In June a diverse group of civil engineering and other leaders gathered in Lansdowne, Virginia, to participate in the Summit on the Future of Civil Engineering. Their purpose was to articulate a global vision for the future of civil engineering, addressing all levels of facets of the civil engineering community. Their report, prepared by the ASCE Steering Committee to Plan a Summit on the Future of the Civil Engineering Profession in 2025, was published in June.

(ref. *Civil Engineering, August*)

Recap of ASTM/GRI-23 Workshop on "Geosynthetic Materials Durability"

A workshop on field and laboratory experiences of geosynthetic materials durability was held in conjunction with ASTM's Committee D35 meeting in San Antonio, Texas on January 29, 2010. This one-day event was organized by Sam Allen of TRI Environmental, Inc. and George Koerner of the Geosynthetic Institute. There were nineteen presentations and to say that the topics, presentations and audience participation were all excellent is a decided understatement. Rave reviews and numerous compliments were expressed at the workshop's conclusion and the days' afterward. A glimpse of the material presented by each speaker follows.

The morning session focused on geomembrane durability. Bob Koerner of GRI presented a review of laboratory exposed geomembrane durability via five-years of incubation in ultraviolet fluorescent weathering devices. HDPE, LLDPE, fPP, and EPDM were included in the evaluations and, properly formulated, all should function for at least thirty years in a hot climate. Rick Thomas of TRI followed describing how an investigator assesses the remaining service life of exposed geomembranes that have already been in service. The issue, of course, is how much longer life is available. Rick gave several interesting illustrations of his technique. Ian Peggs of I-Corp followed with his approach toward predicting end-of-life for exposed HDPE geomembranes. For HDPE he looks at surface oxidation, embrittlement, and initiation of stress cracking. These three opening presentations dovetailed one another in a very instructive manner.

George Koerner of GSI then presented two case histories of exposed HDPE geomembranes (sixteen and twenty years) with comparison of various property

values as-manufactured versus their present condition. Oxidative induction time was seen to be the key parameter to monitor in this regard. Mark Wolschon of EPI International Inc. illustrated how a PVC geomembrane retained its functionality after thirty-years of exposed service. Bob Koerner of GSI then illustrated the basic failure modes of fPP geomembranes as being cracking, powdering, and flaking. This latter mode has never been reported before. Craig Benson of the University of Wisconsin gave his results of the behavior of various exhumed geosynthetics in landfill covers after service lifetimes of five-to-nine years at nine different landfills. Most significant in this regard was the reported loss of interface strength of thermally bonded geotextile-to-geonet drainage composites.

In a change-of-pace presentation, Chris Athanassopoulos of CETCO (for Archie Filshill) described how polymer additives inserted into the structure of bentonite enhances physical and mechanical properties of geosynthetics using data from HDPE testing. Indeed, nanotechnology has come to geosynthetics! Jimmy Youngblood of GSE illustrated the nine year and twenty year performance of two HDPE lined surface impoundments. As illustrated by physical and mechanical testing there was no apparent degradation. John Cowland of GeoSystems Ltd. gave a presentation which compared steel tank containment of hazardous liquids against a floating geomembrane cover system. The latter is significantly more economical. Five years performance data of such an application was also presented. This particular presentation engendered much participant discussion with respect to geomembrane additives, and whether or not the specific anti-oxidant formulations should be made public (at least to the owner/designer/purchaser). It was a lively discussion to say the least.

The afternoon session focused on durability of geosynthetics other than geomembranes. Willie Lieu of Tensar began by presenting data on exposed PP geogrids in laboratory incubation for 80°C, 70°C and (anticipated) 60°C with a resulting halflife of 114-years. Ben Doerge of the USDS-NRCS federal agency presented geotextile information after exhuming samples which had been in place for twenty years. There were no changes in any of the mechanical properties. This type of “no change” is a powerful inducement for agencies to use geosynthetics for long-term applications. Robert Lozano of Linear Composites Inc. presented data on three MSE walls which had been in-place for 20 to 30 years. The PET reinforcement geogrids showed no signs of hydrolytic degradation. J. P. Kline of Geotechnics, Inc. presented results of a overlap test to evaluate possible leakage between adjacent GCL panels. The resulting permeability through the seam overlap indicates a maximum permeability of 5×10^{-9} cm/s which meets the GRI-GCL3 specification. Eric Blond of SAGEOS

and Pascal Saunier of Afitex-Textel presented their laboratory evaluations of a new drainage geocomposite insofar as mechanical and hydraulic properties are concerned. Joel Sprague of TRI Environmental, Inc. illustrated a potential in-situ test method to evaluate the tensile strength (aka, possible degradation) of rolled erosion control products.

H.-Y. Jeon of INHA University used accelerated immersion testing with different liquids at different pH-values to evaluate possible degradation of geotextiles. Guidance on the conditions and criteria for acceptable long-term performance were also presented. Kent von Maubeuge of NAUE gave two sets of exposed durability data on black-vs.-white geotextiles. In the laboratory weathering device, the black geotextile outperformed the white geotextile, while in the field the exact opposite was observed. The discussion as to why and how this occurred was fascinating. Dhani Narejo of Caro Engineering LLC gave historical insight into two geocell walls; one nonvegetated the other vegetated. No noticeable degradation to the HDPE material was noticeable in either wall after 25-years of service.

Sam Allen was the excellent moderator of the workshop and George Koerner closed the event by summarizing each paper in an accurate and succinct manner. A booklet of the nineteen abstracts is available from GSI. That said, if specifics of any presentation is desired the presenter should be contacted directly. Also to be mentioned is that many of the abstracts are co-authored. To those co-authors appreciation is also extended. Lastly, Sam and George thanked the audience for their active and lively questions which followed each of the nineteen presentations.

Bob Koerner

Upcoming Events

- March 23, 2010
GSI Course on QA/QC
Folsom, PA
Contact: mvashley@verizon.net
- April 1, 2010
Workshop on MSE Wall Failures
(GSI Members Only)
Folsom, PA
Contact: mvashley@verizon.net
- April 30, 2010 and June 17, 2010
CETCO 25th Anniversary Seminars
Chicago and Atlanta, respectively
Contact: tim.rafter@cetco.com
- May 17-19, 2010
N.Y. Federation Waste Conference
Sagamore, New York
Contact: www.nyfederation.org

- June 3, 2010 and July 22, 1020
GSE Geosynthetic Seminars
Houston and Walnut Creek, respectively
Contact: bramsey@gseworld.com
- September 15-16, 2010
GCL Conference Wurzburg, Germany
Contact : hzanzinger@skz.de
- November 16-18, 2010
GSI-Asia
Taiwan
Contact: cwh@mail.npust.edu.tw
- November 22, 2010
ASCE Webinar on Veneer Reinforcement of Slopes
Contact: mvashley@verizon.net
- March 1-16, 2011
GeoFrontiers II
Dallas, TX
Contact: tvindemann@ifai.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. Recent member organizations are; Afitex-Texel with Pascal Saunier as contact person; EVAL Americas (Kararay) with Robert Armstrong as contact person and In-Plastics with Mark Williams as contact person. The newest associate member is Savannah River Remediation LLC with Dr. Amit Shyan as contact person. Thanks to all and welcome to GSI.

GSE Lining Technology, Inc.

Boyd Ramsey [BoD]

AECOM

Kevin McKeon/Ken Bergschultz/John Trast

U.S. Environmental Protection Agency

David A. Carson

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Federal Highway Administration

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U. S. Army Corps of Engineers

David L. Jaros [BoD]

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Rex L. Bobsein

URS Corp.

John C. Volk

Solmax Géosynthétiques

Robert Denis

Envirosource Technologies, Inc.

Douglas E. Roberts

CARPI, Inc.

Alberto M. Scuero/John A. Wilkes

Civil & Environmental Consultants, Inc.

Chris O'Connor/Daniel P. Duffy

Agru America, Inc.

Paul W. Barker/Peter Riegl

Firestone Specialty Products

Mark Munley/Paul E. Oliveira [BoD]

FITI (GSI-Korea)

Jeonhyo Kim/H.-Y. Jeon

Waste Management Inc.

Anthony W. Eith [BOD]/Greg Cekander

NPUST (GSI-Taiwan)

Chiwan Wayne Hsieh [BoD]

GeoTesting Express

W. Allen Marr/Richard P. Stulgis [BoD]

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