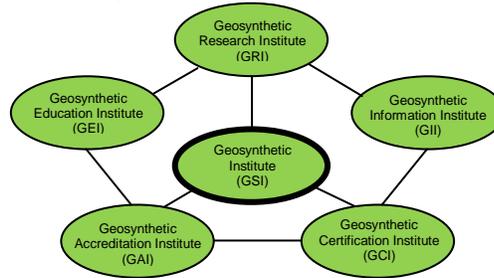


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 31, No. 4

December, 2017

This quarterly newsletter, now in its 31st 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 George R. Koerner or Marilyn Ashley at phone (610) 522-8440; fax (610) 522-8441 or e-mail at gsigeokoerner@gmail.com or mvashley@verizon.net.

*Happy Holidays and a Healthy
and Prosperous New Year*

Activities of GSI's Officers and Board of Advisors

1. By unanimous decision of the nine-person Board, they will now be referred to as the GSI Board of Advisors. This was done so as to relieve them from any fiscal and/or legal responsibility of actions by GSI or its officers now or into the future.
2. Results of the most recent voting for three positions on the Board of Advisors (BOA) resulted in Tony Eith being reelected to represent the Consultants and Testing Lab members and Moreno Scotto being reelected to represent one of the International members. Replacing Nathan Ivy will be Jimmy Youngblood of GSE representing the Geomembrane and GCL members.
3. A commemorative plaque thanking Nathan for his services to GSI was recently sent to him...sincere thanks go to Nathan Ivy.
4. Webinar's continue to play an important role in GSI's distance learning efforts. Totals for 2017 are as follows:
 - 19 for GSI
 - 7 for ASCE
 - 2 for ISSMGE
 - 5 for GSI Members

When added to two 3-day courses on QA/QC of Geosynthetics, this amounts to a major commitment for GSI in the area of Distance Learning.

5. Your nine person GSI Board of Advisors (BOA) is as follows:

Term Ends 2018

- John Workman - Waste Management Inc. (Owners and Operators)
e-mail: jworkman@wm.com
- Mark Wayne – Tensar Earth Technology (Geotextiles and Geogrids)
e-mail: mwayne@tensarcorp.com
- Sam Allen – TRI Environmental Inc. (At-Large)
e-mail: Sallen@tri-env.com

Term Ends 2019

- Kent von Maubeuge - NAUE GmbH & Co. KG (International-1)
e-mail: kvmaubeuge@naue.com
- A. K. Mukhopadhyay – BTRA & GSI-India (Agencies)
e-mail: btra@vsnl.com/btradirector@gmail.com
- Ashish Sukhadia – Chevron Phillips (Resin and Additives)
e-mail: sukhaam@cpchem.com

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Term Ends 2020

- Tony Eith - CEC Consultants, Inc.
(Consultants and Testing Labs)
e-mail: teith@cecinc.com
- Jimmy Youngblood - GSE Environmental
(Geomembranes and GCL's)
e-mail: jyoungblood@gseworld.com
- Moreno Scotto - Maccaferri
(International - 2)
e-mail: moreno.scotto@gmail.com

Overview of GRI Projects (Research)

The following projects are all funded by GSI membership dues unless specifically noted. Most are long-term projects for which we are well positioned to accomplish. *Those projects marked with an asterisk have written papers available; please ask and we will send them accordingly.* Contact George Koerner (gsigeokoerner@gmail.com), Grace Hsuan (g.hsuan@coe.drexel.edu) or Bob Koerner (rmk27@drexel.edu) for details and/or discussions.

- 1. 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 multiple thermocouples for long term measurements in both wet and dry municipal solid waste landfills in Pennsylvania. The project has been extended into its 19th-year and has resulted in an extremely authoritative set of real-life data which is being used by many researchers in their geomembrane lifetime predictions.
- 2. Field Exposed Lifetime of Geogrids Used at the Facing of Landfill Berms** - The facing of mechanically stabilized earth landfill berms (and other walls and slopes as well) is often using a wrap-around configuration leaving the geogrid exposed to the atmosphere. A project being conducted by George Koerner is presently investigating the behavior of two different geogrids and two erosion control materials over time. These four materials are also being exposed on the roof of the GSI carport. A 50-year time frame is envisioned! The long-term behavior will eventually be compared to UV laboratory predicted data as noted previously.
- 3. Laboratory Exposed Lifetime of Geomembranes*** - GSI is using three UV-fluorescent devices to estimate the projected exposed lifetime of six different types of geomembranes. They are HDPE, LLDPE, fPP, EPDM, PVC (N.A.) and PVC (Euro.). They are being incubated at 60, 70, and 80°C until half-life of strength and elongation are measured. The goal is lifetime prediction. Incubation times are now over 60,000 light hours (8.2 years) and are not yet complete. Some will take at least 90,000 light hours (\approx 12.3 years). GRI Report #44 is available on results to date and a webinar is also available. The information was made available to the public April 6, 2016 at Orlando and was again presented in Peru on March 30, 2017. It has now been republished in the International Geosynthetics Journal. A copy is available. (In this regard it should be noted that we have withheld the information before publication for well over a year which has been our custom.)
- 4. HDPE Geomembrane Lifetime as a Function of Thickness** - This often encountered question is being evaluated by exposure at 80°C in a QUV weathering device per ASTM D7238. Formulations are exactly the same and only the sample thicknesses vary. These thicknesses are 2.76, 2.44, 1.58, 1.08, 0.77 and 0.48 mm. Parameters being evaluated in this decades long study are change in thickness and presence of crazing or cracking. Time will tell!
- 5. Exposed Lifetime of Creased Geomembranes** - Stemming from a recent webinar on the effect of backfilled GM waves or wrinkles we have seven geomembranes which are purposely creased in double 180° bends being incubated at 80, 65, 55 and 25°C temperatures as of February 10, 2017. They are HDPE, LLDPE, LLDPE-R, fPP, fPP-R, EPDM and PVC. We are focused on if, and where, cracking might occur. The project promises to take many years but should be interesting.
- 6. Laboratory Exposed Lifetime of PVC (European) Geomembranes** - We have been evaluating five different European formulations for four years using three dedicated UV-fluorescent devices and the results are very impressive. The study is being conducted for CARPI Tech, a GSI member organization. The project also allows us to distinguish between PVC geomembranes manufactured in North America versus Europe. The differences are in the type of plasticizers used in the formulations as well as thicknesses.
- 7. Laboratory Exposed Lifetime of Geotextiles** - A similar UV study as with geomembranes, geogrids and TRM filaments has been conducted on various geotextiles. Woven monofilaments, woven slit films, nonwoven heat bonded and needle punched types are included. In the latter are four different weights of needle punched nonwovens. All data along with laboratory and field lifetime predictions are included in GRI Report #44 and the aforementioned International Geosynthetics Journal paper in Item #3.

8. **Cable Tied Geonet Evaluations** - A study has been focused on the plastic cable ties used to connect the overlapped ends and edges of geonets and geospacers. The draft of a new GRI Test Standard is available as well as the draft of a technical paper to be published at the IGS Conference in Seoul, Korea.
9. **Retaining Wall Failure Evaluations*** - We have past GRI Reports 38, 39, and 40 addressing mechanical stabilized earth (MSE) walls using geosynthetic reinforcement which document 82-failures. Our data base has now grown to 141, then 171, then 286 and now 312! *Readers, we have a very serious situation in this regard!* The failures are either excessive deformation or collapses. We have presented one-day courses on this topic along with inspector training and development insofar as a field inspectors certification program; see the certification section of this Newsletter/Report. A paper was published by the Journal of Geotextiles and Geomembranes in October, 2013 and the publisher (Elsevier) reports that 1400 requests have been made to date. It was voted as being the best paper of 2013 by the journal. This was the topic of a GSI course and lecture presented at GeoAmericas in April, 2016. An up-to-date GSI webinar is available.
10. **pH Between Masonry Block Wall Units*** - George Koerner has been measuring the pH between three types of masonry blocks for over eight years to monitor the values. Concern here is over PET geogrids which are known to be sensitive to very high alkalinity environments. Indeed, the values started high, but over time they are now down to eight and lower. George has a paper in this regard.
11. **Landfill Failure Analysis** - Since our originally reported paper on ten landfill failures in a 2000 publication, we have accumulated ten more. All 20-failures have been analyzed using the ReSSA Code and are now available to members and associate members as GRI Report #41. There are two recent failures in this regard, both in Pennsylvania, and one resulted in a worker's death!
12. **Slow Pressurization of HDPE Geomembranes in Axi-Symmetric Testing*** - The ASTM D5716 method of testing geomembranes in a 3-D axi-symmetric mode uses a pressure rate of 6.9 kPa/min (1.0 psi/min). While such a rate is appropriate for most geomembrane types, it is very fast for HDPE which is semi-crystalline and cannot readily stress relax so as to accommodate the applied pressure. To investigate slower rates we have initiated a project with rates as low as 6.9 kPa/month (1.0 psi/month)! The last test, just now begun, is at a rate of 6.9 kPa/six months (1.0 psi/six months) and it will take an estimated five years to conclude. A preliminary paper was presented at Geosynthetics '15 in Portland.
13. **PVD Strengthening of Soft Foundation Soils*** - A new project, conducted over the past summer, addresses the use of PVDs for drainage (as customary) plus tensile reinforcement (never recognized to date). The experimental device was developed and used to assess three different PVDs. This data was then used with the ReSSA soil stability code on an old foundation soil failure that did not have PVDs. The FS-values increased 4% and could go higher with closer spacing or stronger PVDs. A journal paper is available.
14. **Seams of Reinforced Geomembranes** - There are now five scrim reinforced geomembranes available and the properties are listed in our GRI Specifications. To compliment these sheet products a set of shear and peel tests are have been evaluated. A new specification designated GRI-GM19(b) has been developed... GRI-GM19(a) is presently solely for homogeneous geomembranes.
15. **Methods of Testing Multi-Component Geomembranes** - Co-Extruded geomembranes are becoming commonplace, e.g., white-black-conductive types. As such, testing (e.g., density, OIT, SCR, etc.) is problematic. George Koerner is investigating ways of separation and then individual component testing... more later.
16. **Generic Specifications** - A major continuing effort is ongoing with respect to the development and updating of GRI's generic geosynthetic specifications. The current status of these specifications is as follows. Incidentally, all 17 are currently being copyrighted.
- Completed and Available on our Website
 GM13 – HDPE Geomembranes
 GM17 – LLDPE Geomembranes
 GM18 – fPP and fPP-R Geomembranes
 GM19a – Geomembrane Seams-Homogeneous
 GM19b – Geomembrane Seams-Fabric Reinforced
 GM21 – EPDM and EPDM-R Geomembranes
 GM22 – Scrim Reinforced PE Barriers
 GM25 – LLDPE-R Geomembranes
 GM28 – CSPE-R Geomembranes
 GM30 – Coated Tape PE Barriers
 GCL3 – Geosynthetic Clay Liners
 GS15 – Geocells using HDPE Strips
 GT10 – Geotextile Tubes
 GT12 (a and b) – Geotextile Cushions
 GT13 (a and b) – Geotextile Separators
 GCL3 – Geosynthetic Clay Liners
 GC14 – Turf Reinforcement Mats
 GC16 – Prefabricated Vertical Drains
- Working; Available Upon Request
 GGXX – Bidirectional Geogrids (tabled)
 GGXX – Unidirectional Geogrids (tabled)
 GNXX – Geonet Drainage Composites (tabled)

The complete set of formalized specifications are available to everyone (members and nonmembers) on the open section of our Home Page. Please download and use them accordingly. There is a brief tutorial accompanying each specification. Also note that this is where the latest modification will always be available. They are updated/modified on an as-required basis.

17. **Other GRI Standards** - There are several GRI Standards in various forms of preparation. These include the following:
- A practice on field seaming inspection emphasizing the electrical leak location system (ELLS).
 - Three standards on GCL joining so as to prevent/monitor panel separation.
 - A standard on GN joining with plastic cable ties... see Item #8.
 - A guide as to recommended testing of drainage geocomposites.
 - A practice explaining the use of MARV for geotextiles
 - A transverse rib bending test for homogeneous geogrids

Progress within GII (Information)

Our GSI Home Page is accessed as follows:

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

It has been 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 | • Product Certification |
| • Prospectus | • Newsletter/Reports |
| • Associate Membership (Agencies) | • Internet Courses |
| • Members by Focus Groups | • GSI Members Links |
| • GSI Publications | • GSI Member Meetings |
| • GRI Specs, Guides, White Papers | • Courses at GSI |
| • Laboratory Accreditation | • Insp. Cert. Programs |

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 available. 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 35,000 citations which is the majority of the geosynthetic literature published in English. It is updated as each published paper is received. Citation retrieval is quite easy 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 daily activities.

Important Note: This keyword search is now available to everyone. It is on the open section of our website, however, there is a charge to non-GSI members, (www.geosynthetic-institute.org/keywordpay.html). The duplicate information is in the password protected section and is free for GSI members.

In addition to the information provided in our home page as just mentioned, Jamie Koerner (Special Projects Coordinator) performs various surveys on pertinent topics in geosynthetics. The latest is a survey on the regulatory aspects of heap leach mining. Also, if you have topics in need of the current status please advise accordingly.

Progress within GEI (Education)

GRI Reports

To date, we have 45 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. Our most recent report is:

- #45 - A Review of 3000 Geosynthetic Q&As on the GMA Techline Since Its Inception in 2004. In it are the 100 "most difficult" questions asked and answered since the Techline's inception in 2004.

GSI Webinars (90 minutes long)

11:30 AM – 1:00 PM (Eastern Time Zone)
Registration at

www.geosynthetic-institute.org/webinar.htm

1.5 Professional Development Hours
Nonmembers Cost - \$250; Members Cost - \$200

Commentary on Webinars: Never in Bob K's long career has he "reached out" to so many people than when giving these webinars. For the single cost of \$250 or \$200 a feed is delivered over Adobe Connect to the requested site. This can be anywhere, e.g., office, conference room, hotel room, auditorium or even sent to additional offices and sites. For example, NY-DEC had the feed going into their Albany auditorium and then into the 13-regions of New York State. Clearly, hundreds of participants were involved!

Dear readers; on-line distance learning, aka, webinars, is the way to communicate information to masses of people in an inexpensive and time efficient manner. Indeed, the future of learning is here! The just released 2018 schedule of GSI Webinars is as follows:

| Date | GSI No. | Title |
|--------------|---------|---|
| January 10 | W-5 | Geosynthetics in Hydraulic Applications |
| January 24 | W-18 | Pond Liner Design & Performance |
| February 14 | W-19 | Wave (or Wrinkle) Management [For Proper Deployment of Geomembranes] |
| February 28 | W-20 | Geosynthetic Drainage Materials: Applications, Design, Installation and Performance |
| March 14 | W-9 | Behavior and Analysis of Twenty Solid Waste Landfill Failures |
| March 28 | W-11 | Lateral and Vertical Expansions Over Old and Existing Landfills |
| April 11 | W-6 | Geosynthetic Applications Used in Heap Leach Mining |
| April 25 | W-12 | Landfill Covers: Past-Present-Emerging |
| May 9 | W-14 | Lifetime Predictions of Covered and Exposed Geosynthetics |
| May 23 | W-24 | Geotextile Filters; Concerns and Issues |
| June 13 | W-15 | In-Situ Stabilization of Soil Slopes Using Nailed (or Anchored) Geosynthetics |
| July 11 | W-21 | A Brief Overview of Geosynthetics and Their Major Applications |
| August 15 | W-16 | Sand Drains-to-Wick Drains-to-Sand-Columns (Including a Major Failure Case History) |
| September 12 | W-17 | Geosynthetics in Erosion Control |
| October 10 | W-1 | A Data Base and Analysis of 301 Failed MSE Walls With Geosynthetic Reinforcement |
| October 24 | W-25 | Disposal of Coal Combustion Residuals (CCRs) |
| November 14 | W-26 | Soil Consolidation using Wick Drains, aka PVDs |
| November 28 | W-27 | Applications and Design of Geotextile Tubes |
| December 12 | W-28 | Stability Design of Landfill Cover Soils |

Courses

We are now abandoning our in-house, one-day, courses (which have been given for the past 30-years) and delivering two of them in six segments over three consecutive days, one each morning and then afternoon. They are the following:

1. Quality Assurance/Quality Control of Geosynthetic in Waste Containment Facilities (scheduled for October 3-4-5, 2017)
2. Construction Inspection of Mechanically Stabilized Earth (MSE) Walls, Berms and Slopes (scheduled to be announced)

The third and newest of these courses is an On-Line "Designing With Geosynthetics (DwG)" course. Please

go to <http://www.geosynthetic-institute.org/courses.htm> and scroll down to Course #3. Here you will see the requisite details. The course itself is completely coordinated with the 6th Edition of the DwG textbook. It consists of 1540 slides with \approx 18 hours of voice over; about one minute for each slide. See the special writeup in this Newsletter/Report.

Contact Jamie Koerner at jrkoerner@verizon.net if you want information and details.

GSI Fellowships

A major change over previous years has been quite successful again this year. We now offer fellowships for masters and doctoral students. The stipend is \$5000 for a single year, rather than three multiple years. This change resulted in 20-proposals which were reviewed and graded by the GSI-BoD and ourselves. Eleven were accepted. The accepted proposals for the 2017-'18 A.Y. are as follows. If a specific proposal is of interest please contact Jamie Koerner at jrkoerner@verizon.net.

| No. | Name | University | Advisor | Topic |
|-------|-------------------------|------------------------------------|---------------|---|
| 1-17 | Cengiz, Cihan | TC Bogazici U Turkey | Erol Guler | Seismic behavior of soft clay foundations under embankments using geosynthetic encased columns |
| 2-17 | Dutta, Susom | U of Massachusetts - Lowell USA | Pradeep Kurup | Novel geotextiles for energy harvesting |
| 3-17 | Kermani, Behnud | Penn State USA | Ming Xiao | Numerical investigation on the effectiveness and durability of geotextiles against migration of subgrade soil to overlying granular layer in pavement systems |
| 4-17 | Lieske, Wolfgang | Ruhr-Universitat Bochum Germany | Tom Schanz | Polymer-modified bentonite for the application in geosynthetic Clay Liners (GCL) |
| 5-17 | Lin, Chuang | Missouri U of Science and Tech USA | Xiong Zhang | Analysis of wicking fabrics used to remove capillary water in road embankments |
| 6-17 | Morsy, Mohamed | Queen's University Canada | Kerry Rowe | Selection of a realistic and representative stress crack resistance for use in design |
| 7-17 | Robey, Nicole | U of Florida USA | Tim Townsend | Landfill EGS wind uplift research: complementary field and wind tunnel assessments |
| 8-17 | Vahidi, Siavash | Drexel University USA | Grace Hsuan | Evaluation of wrinkle induced strains in geomembranes using a finite element method (FEM) |
| 9-17 | Valente, Rodrigo Borela | Georgia Inst. of Technology USA | David Frost | Numerical modeling of aggregate-geogrid composite behavior for multiaxial geogrids in pavement applications |
| 10-17 | Wang, Dongfang | U of Massachusetts Amherst USA | Guoping Zhang | Enhancement of geosynthetics with ultra-hydrophobic and long-lasting organogeopolymers |
| 11-17 | Williams, Thomas | U of Virginia USA | Craig Benson | Protecting geosynthetic in liner systems from atmospheric exposure by utilizing a surcharge layer |

Activities within GAI (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. *It should be emphasized that our 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 training and documentation for specific standard ASTM or ISO test methods. 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 252 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of December, 2017, the following laboratories are accredited by the GAI-LAP for the number of test methods listed in parenthesis. Contact personnel, telephone numbers and e-mails are also listed.

- 1^A - TRI/Environmental Inc. (155 tests)
Jarrett Nelson -- (512) 263-2101
jnelson@tri-env.com
- 3^A - Golder Associates (43 tests)
Henry Mock -- (770) 492-8280
Henry_Mock@golder.com
- 4^C - Geosynthetic Institute (109 tests)
George Koerner -- (610) 522-8440
gkoerner@dca.net
- 8^B - Propex Operating Co., Ringgold (11 tests)
Todd Nichols -- 438-553-3757
todd.nichols@propexglobal.com
- 9^B - Lumite (16 tests)
Rebecca Kurek -- (770) 869-1187
rkurek@lumiteco.com
- 13^A - Precision Geosynthetic Labs (TRI Env.) (86 tests)
Cora Queja -- (714) 520-9631
cqueja@tri-env.com
- 14^A - Geotechnics (51 tests)
J. P. Kline -- (412) 823-7600
JPKline@geotechnics.net
- 20^A - GeoTesting Express, MA (60 tests)
Gary Torosian -- (978) 635-0424
gtt@geotesting.com
- 22^B - CETCO Hoffman Estates (11 tests)
Barbara Gebka -- (847) 851-1500
barbara.gebka@cetco.com
- 24^B - CETCO Lovell (10 tests)
Stuart Yates -- (307) 548-6521
stuart.yates@colloid.com

- 25^B - Ten Cate, Pendergrass (13 tests)
Darrell Scoggins -- (706) 693-2226
d.scoggins@tencate.com
- 26^B - Agru America Inc. (27 tests)
Maria Coffey -- (843) 325-6119
mcoffey@AgruAmerica.com
- 29^E - FITI Testing and Research Institute (84 tests)
Dong Whan Kim -- 82-2-3299-8071
dwhKim@fitiglobal.com
- 31^D - NYS Dept. of Transportation (9 tests)
Tom Burnett -- (518) 457-4704
tburnett@dot.ny.gov
- 32^A - Geo-Logic Inc. (6 tests)
Ken Criley -- (530) 272-2448
kcriley@geo-logic.com
- 34^B - GSE Environmental Richey Road (29 tests)
Debra Gortemiller
Dgortemiller@gseworld.com
- 38^C - Sageos/CTT Group (123 tests)
Eric Blond -- (450) 771-4608
eblond@GCTTG.com
- 40^B - GSE Environmental (14 tests)
Mauricio Osso -- (843) 382-4603
Mosso@gseworld.com
- 41^A - SGI Testing Service, LLC (18 tests)
Zehong Yuan -- (770) 931-8222
ZYuan@interactionspecialists.com
- 42^C - NPUST (GSI-Taiwan) (71 tests)
Chiwan Wayne Hsieh -- 011-886-8-7740468
CWH@mail.npust.edu.tw
- 43^A - Ardaman & Associates (22 tests)
George DeStafano -- (407) 855-3860
gdestafano@ardaman.com
- 44^B - Fiberweb, a Berry Global Inc. Co. (9 tests)
Mitchell Clendenin -- (615) 847-7193
mitchellclendenin@berryglobal.com
- 45^B - Ten Cate Geosynthetics Malaysia SDN Bhd. (24 tests)
Boon Kean Tan -- (603) 519 28576
b.k.tan@tencate.com
- 46^B - TAG Environmental Inc. (13 tests)
Colin Murphy -- (705) 725-1938
colin_murphy@tagenv.com
- 49^B - Engepol Geossinteticos (15 tests)
Patricia Ferreira -- (55) 51 3303-3901
patricia@engepol.com
- 50^B - ADS, Inc. Hamilton (7 tests)
Terry McElfresh -- (513) 896-2065
terry.mcelfresh@ads-pipe.com
- 51^B - Solmax International Inc. (22 tests)
Simon Gilbert St. Pierre -- (450) 929-1234
simonGSP@solmax.com
- 53^B - Polytex Autofagasta (19 tests)
Maria Teresa Ortiz Lopez -- 011 55-2883308
mortiz@polytex.cl
- 55^B - Atarfil Geomembranes (21 tests)
Gabriel Martin Sevilla -- 34 958 439 200
gmartin@atarfil.com
- 56^B - Polytex Santiago (13 tests)
Maria Teresa Ortiz Lopez -- 011 56-2-677-1000
mortiz@polytex.cl
- 57^B - Ten Cate Cornelia (22 tests)
Melissa Medlin -- (706) 778-9794
m.medlin@tencate.com
- 58^B - Propex Operating Co. Hazelhurst (16 tests)
Victoria Shoupe -- (912) 375-5406
Victoria.Shoupe@propexglobal.com
- 59^B - Firestone (8 Tests)
Janie Simpson -- (864) 439-5641
SimpsonJanie@firestonebp.com
- 60^B - TDM Geosintéticos S.A. (14 tests)
Roberto Diaz -- 051-1-6300330
rdiaz@tdmgeosinteticos.com.pe
- 61^B - Raven Industries (18 tests)
Clint Boerhave -- (605) 335-0288
Clint.Boerhave@ravenind.com

- 62^B - Solmax International Asia (14 tests)
Pei Ching Teoh – (450) 929-1234
pcteoh@solmax.com
- 63^A - TRI Environmental, Inc.; DDRF (4 tests)
Jay Sprague -- (864) 346-3107
Jesprague@tri-env.com
- 64^B - Agru America (NV) (14 tests)
Ryan Steele -- (775) 835-8282
RSteele@AgruAmerica.com
- 65^C - Bombay Textile Research Assoc. (BTRA) (23 tests)
Riyaz Shaikh
(0) 022-25003551
bttra@vsnl.com
- 66^B - Rowad International Geosynthetics Co. Ltd (13 tests)
Asad Ullah Khan -- +966-3-812-1360
asad@rowadplastic.com
- 68^B - Glen Raven Technical Fabrics LLC (4 tests)
Andrea Saurage -- (336) 229-5576
asaurage@glenraven.com
- 69^B - GSE Environmental (13 tests)
Siriporn Chayaporenlerit – 6638-636638
Siriporn@gseworld.com
- 70^A - RSA Geo Lab LLC (47 tests)
Rasheed Ahmed – (908) 964-0786
geolab13@yahoo.com
- 71^B - Plásticos Agrícolas y Geomembranas S.A.C. (24 tests)
Manuel Constantino Olivares Espinoza –
073-511814-511829
calidad@pqaperu.com
- 72^B - Tensar Corp. GA (4 tests)
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- 73^B - Gai Loi JSE (10 tests)
Paul Wong 84-650-362-5825
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- 74^B - Agru America Inc. (9 tests)
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mlocklear@AgruAmerica.com
- 75^B - GeoMatrix S.A.S. (29 tests)
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jdiaz@geomatrix.com.co
- 76^B - Tehmco (Chile) (15 tests)
Patricia Rojas Perez (562) 580-2852
projas@tehmco.cl
- 78^B - PQA Mexico (15 tests)
Cesar Augusto Arcila (669) 954-8202
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- 79^A - TRI Geosynthetic Testing and Services (32 tests)
Ping Wang 86-512-6283-1396
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- 80^B - Texel Technical Materials (10 tests)
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- 88^B - Geosynthetic Testing Services Pvt. Ltd. (16 tests)
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- 89^B - Megaplast India Pvt. Ltd. (13 tests)
Hermendra Behera - 91-937404-4620
geo.sqc@megaplast.in
- 90^B - Techfab (India) Industries Ltd. - Daman (10 tests)
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Anant Kandi - anant@techfabindia.com
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- 94^B - Al Hoty Stanger Laboratory (2 tests)
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- 95^B - Mexichem Colombia (Pavco) (8 tests)
Juan David Lopez Torres - 57-1-782-5100 (ext. 1534)
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- 96^B - Tensar China (5 tests)
Zhu Zhaolian - 86 (0)-27-8447-3277
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^AThird Party Independent ^CInstitute
^BManufacturers QC ^DGovernment

If anyone desires more information on the GAI-LAP, its test methods, the associated laboratories, etc., a directory is published in December of each year. It is available on GSI's home page at <http://www.geosynthetic-institute.org> (Accreditation).

The next GAI-LAP semi-annual meeting will be held in January, 2019 in conjunction with ASTM D-35 in New Orleans, Louisiana. It is a pleasure working with you. We appreciate your participation and congratulate you on your success! If you have questions, please contact me accordingly.

George R. Koerner (gsigeokoerner@gmail.com)

Activities within GCI (Certification)

GSI presently has three separate inspector certification programs. One (begun in 2006) is focused on QA/QC of field inspection of waste containment geosynthetics and compacted clay liners. The second (begun in 2011) is focused on MSE Wall, Berm and Slope field inspection. The third on Geosynthetic Designer Certification was begun on September 1, 2016. See our website at www.geosynthetic-institute.org under "certification" for a description and information on all three of them. They are similar in that a perspective candidate must...

- Be recommended by a professional engineer who knows, and can attest to, at least six months of acceptable experience performing professional services within the specific application area.

- Submit a completed application and be approved by the Geosynthetic Certification Institute to take the exam.
- Must successfully pass a written examination (70% of the questions is the passing grade) proctored by GCI or a GCI designated organization and graded by the Geosynthetic Certification Institute to become a certified inspector or engineer.
- Must pay a one-time fee which covers a five-year period upon completion of the above items. The fee is \$500 for five-years of certification.

Program #1 - Inspection of Liner Systems for Waste Containment Facilities

This program now in its eighth year has been recommended, and in some cases required, by solid waste owners, state regulators, and design consultants for proper QA/QC in field installation of both geosynthetic materials and compacted clay liners. The statistics to date are as follows. The examination has been greatly revised attesting to the changes occurring over the past 10-years.

Inspector Certification Test Results for Waste Containment Inspectors 2006 – 2017

| Year | Geosynthetic Materials | | Compacted Clay Liners | |
|------------------------|---------------------------|----------------------------|---------------------------|----------------------------|
| | 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%) |
| 2007 | 82 | 11 (13%) | 73 | 12 (16%) |
| 2008 | 95 | 25 (26%) | 89 | 20 (22%) |
| 2009 | 36 | 7 (19%) | 36 | 2 (5%) |
| 2010 | 59 | 12 (20%) | 54 | 7 (13%) |
| 2011 | 54 | 6 (11%) | 53 | 3 (6%) |
| 2012 | 34 | 5 (15%) | 28 | 3 (11%) |
| 2013 | 32 | 4 (12%) | 30 | 1 (3%) |
| 2014 | 45 | 1 (3%) | 42 | 3 (7%) |
| 2015 | 56 | 6 (11%) | 51 | 6 (12%) |
| 2016 | 36 | 3 (10%) | 35 | 4 (14%) |
| 2017 | 78 | 5 (6%) | 66 | 3 (5%) |
| TOTAL (to date) | 748 | 90 (12%) | 685 | 76 (11%) |

The 5-year renewal periods for those having taken the exam before 2010 is ongoing and about 60% have renewed accordingly. This is felt to be encouraging from our perspective.

Program #2 - Inspection of MSE Walls, Berms and Slopes

While a field inspector cannot require proper design or direct a contractor how to build a wall, flaws can be identified for possible design modification or mitigation action. Furthermore, and at minimum, construction

practices can be observed and corrected if inadequate or improper.

The official launch of this inspection program was on December 1, 2011 with a course and the examination afterward. More recently a somewhat revised course on November 29, 2012 was presented. Presently, the corresponding course for this certification program has been transferred into a series of six presentations over a consecutive three-day period. Contact Jamie Koerner at jrkoerner@verizon.net for details and arrangements.

The status of the program is shown in the following table.

Inspector Certification Test Results for MSE Walls and Berms Inspectors (2011-2017)

| Year | Course Location | MSE Wall And Berms | |
|--------------|--------------------|-------------------------------|--------------------------------|
| | | No. of People Taking the Exam | No. of People Failing the Exam |
| 2011 | GSI Course | 7 | 0 |
| 2012 | GSI Course | 6 | 0 |
| 2013 | GSI Course | 2 | 0 |
| 2014 | GSI Course | 3 | 0 |
| 2015 | GSI Course | 4 | 0 |
| 2016 | GSI On-Line Course | 2 | 2 |
| 2017 | GSI On-Line Course | 0 | 0 |
| TOTAL | | 24 | 0 |

Program #3 - Geosynthetic Designer Certification

The “Geosynthetic Designer Certification Program (GDGP)” is also now available. Please go to <http://www.geosynthetic-institute.org/gdcpintro.pdf> for the requisite details. Included are introduction (rationale behind the program was given in a recent GSI Column called “We’re Losing the Battle”), disclaimer, requirements, application, reference material, sample questions, proctor manual and proctor application. In the *requirements* section you will see that the applicant must;

- be a graduate of an accredited engineering program,
- have six-months geosynthetic designer experience,
- complete the application form,
- pay the \$500 fee for 5-years certification, and
- take a 45-question examination with ≥ 70% passing.

The *examination* itself is subdivided into 15-sections, each consisting of five questions. A candidate must answer any 3 questions in each section, making a total of 45 questions to be answered. Most of the questions are numeric, as is geosynthetic design practice in general. Unlike our other certification examination questions, however, this examination is of an open-

book, open-notes format and does require a calculator so as to “crunch the numbers”.

The on-line courses for preparation of three of these certification programs is available in a series of six-90 minute webinars. Contact Jamie Koerner at jrkoerner@verizon.net for details and arrangements.

Lastly, please spread-the-word within your organization and to others as well. We sincerely hope that one, or all three, of the above programs will be beneficial in upgrading the technical base of geosynthetic design and installation so as to properly utilize all of our geosynthetic materials in all of their many applications. All three programs are on-going and if you have questions and/or comments please contact us accordingly.

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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 three countries (Korea, Taiwan and India), 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). It is presently in the transition of being held entirely within INHA University.

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. His active participation at conferences worldwide is very admirable. He has provided research and development in many geosynthetic subjects including geotextiles, geomembranes, geocells, additives for GCLs, recycled plastics for improved formulations, etc.

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 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 three very successful internal conferences to date and has also held a much broader one, namely, GSI-Asia in Taichung, Taiwan.

GSI-India under the new direction of Dr. A. K. Mukhopadhyay (who succeeds Dr. A. N. Desai) was formed in 2015. The hosting organization is the Bombay Textile Research Association (BTRA) which is world known for its excellence in textile R & D and is currently branching out into all forms of geosynthetics. We are delighted in this regard and, as a side-note, Dr. Mukhopadhyay has replaced Dr. Desai on GSI's Board of Directors to fill out his term.

Items of Interest

Please note that this section will no longer be carried in these quarterly GSI Newsletter/Reports. This is due primarily to limit the length of the reports which have grown considerably over time.

Ten Years of GSI Student Fellowships

There are 29 different types of 501(C) nonprofit organizations in the United States and probably many more worldwide. The most common are 501(C)(3) organizations which vary between religious, charitable, scientific, literary or education purposes. Of the approximately 4-million in the U.S.A. alone, GSI is one of them. These organizations are approved by the Internal Revenue Service (IRS) to be tax-exempt which has several interesting features. One of these is that we can invest whatever profit is made annually into a sustaining endowment fund, which is fortunately non-taxed. Thus, the funds can accumulate over time, which they have. One condition, however, is that some of the funds must be distributed annually for the express purpose that the organization is established. In our case, it is for educational purposes, which include student fellowships researching geosynthetic topics. After years of accumulating funds, the principal became sufficient to begin a GSI Fellowship program in 2008. It is presently 10-years since its inception and this GSI Column describes our progress to date.

Working with the GSI Board of Directors (BoD) we initially focused on doctoral candidates doing research in geosynthetics with up to a three-year grant at \$10k, \$5k, \$5k per year. Requests-for-proposals were sent to many magazines, newsletters, websites, etc. and when received were ranked by the BoD for funding. Five were accepted the first year. In the second year four new and four continuation grants were made. As seen in the attached table, this pattern existed for 7-years, i.e., from 2008 to 2014.

As time progressed, however, it was recognized that there were relatively few doctoral candidates doing geosynthetics research. Additionally, American students were the primary recipients. Thus a change in the program was implemented for the 2015-'16 academic year. From that time to the present, all worldwide masters and doctoral graduate students working on a geosynthetics topic would be eligible for a single year funding at \$5,000. With these changes, the number of proposals increased significantly and hence the number of fellowships granted increased as well; see attached table. This situation has continued to date.

GSI Fellowships (2008-2018)

| GSI Class | Academic Year | New Fellowships | USD Amount | Continuing Fellowships | USD Amount | Total Fellowships | Total USD Amount |
|---------------|---------------|-----------------|----------------|------------------------|------------|-------------------|------------------|
| 1 | 2008-09 | 5 | 50,000 | n/a | n/a | 5 | 50,000 |
| 2 | 2009-10 | 4 | 40,000 | 4 | 20,000 | 8 | 60,000 |
| 3 | 2010-11 | 4 | 40,000 | 3 | 15,000 | 7 | 55,000 |
| 4 | 2011-12 | 4 | 40,000 | 4 | 20,000 | 8 | 60,000 |
| 5 | 2012-13 | 3 | 30,000 | 2 | 10,000 | 5 | 40,000 |
| 6 | 2013-14 | 2 | 20,000 | 2 | 10,000 | 4 | 30,000 |
| 7 | 2014-15 | 3 | 30,000 | 1 | 5,000 | 4 | 35,000 |
| 8 | 2015-16 | 12 | 60,000 | n/a | n/a | 12 | 60,000 |
| 9 | 2016-17 | 9 | 45,000 | n/a | n/a | 9 | 45,000 |
| 10 | 2017-18 | 11 | 55,000 | n/a | n/a | 11 | 55,000 |
| Totals | | 57 | 410,000 | 16 | 80 | 73 | 490,000 |

Student names, university and geosynthetics topic are reported annually in our quarterly Newsletter/Report. All of them are on-line at www.geosynthetic-institute.org/new.htm. Regarding some statistics gathered during the past ten-years, the following applies:

- Of the 73 student recipients their locations are as follows
 USA = 52 (71%) Australia = 2 (3%)
 Europe = 14 (19%) Latin America = 1 (1.5%)
 Asia = 3 (4%) Canada = 1 (1.5%)
- Regarding the main geosynthetic material of focus in the various research programs:
 geotextiles = 23 (31%) geocomposites = 5 (7%)
 geogrids = 22 (30%) GCLs = 3 (4%)
 geomembranes = 10 (14%) others = 10 (14%)
- The application areas had some overlap but the main focus was as follows. Note that walls and slopes were placed in the geotechnical area, waste containment materials in the geoenvironmental area and highways/pavements in the transportation area.
 geotechnical = 22 (30%)
 geoenvironment = 18 (25%)
 transportation = 16 (22%)
 other industry = 17 (23%)
- The general approach taken by the students emphasized either theory or laboratory testing but some

field work (or data analysis) was also conducted as follows:

laboratory testing = 32 (44%)
 theory = 25 (34%)
 field = 12 (16.5%)
 other = 4 (5.5%)

Students are generally polite enough to acknowledge their grants and many list "GSI Fellowship" funding in whole or part in the technical papers they write for journals or conferences. As a result of this overall activity, the GSI Fellowship status will continue for the time being in order to see what eventual impact will accrue. That said, we hope that the funding of the students and their respective topics is of value to the industry and leads many of the student recipients into geosynthetics careers.

Jamie R. Koerner

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. **Our newest members INOVA Geosynthetics/AERO Aggregates with Archie Filshill; Sotrafa Agrualura y Geosinteticos of Spain with Jose Miguel Munoz Gomez; Kaytech Fabrics Co. of South Africa with Garth James; Interwrap Inc. with Clive Mills/Martin Vido, Borouge Pte. Ltd. of Singapore with Mohamed Ali Jaber/Peter Malmros/Rick Cui, and Thrace Group with Steven Lothspeich/Stella Karavasili. Thanks to all and welcome to GSI!!!**

- GSE Environmental**
Steve Eckhart/Jimmy Youngblood [BoA]
U.S. Environmental Protection Agency
David A. Carson
- Chemours Technology**
Clifford Early
- Federal Highway Administration**
Silas Nichols/Daniel Alzamora
- Golder Associates Inc.**
Frank Adams/Paul Whitty
- Tensor International Corporation**
Mark H. Wayne [BoA]/Joseph Cavanaugh/Doug Brown
- Low and Bonar PLC (formerly Colbond)**
Richard Goodrum
- Geosyntec Consultants**
Ranjiv Gupta
- TenCate Geosynthetics**
John Henderson/Chris Lawson
- CETCO**
Davie Chiet/Michael Donovan/Rob Valorio
- Huesker, Inc.**
Sven Schröder/Andreas Elsing/Lilma Schimmel
- NAUE GmbH & Co. KG**
Kent von Maubeuge [BoA]
- Propex Operating Company LLC**
Drew Loizeaux
- Berry Global Inc.**
Brian H. Whitaker
- TRI/Environmental Inc.**
Sam R. Allen [BoA]/Joel Sprague
- U. S. Army Corps of Engineers**
David L. Jaros

Chevron Phillips Chemical Co.
Ashish Sukhadia [BoA]/Randy Moynihan/Jennifer Hicks

AECOM (formerly URS Corp.)
John Volk/John Bove

Solmax Géosynthétiques
Jacques Cote/Simon Gilbert St-Pierre

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

Civil & Environmental Consultants, Inc.
Tony Eith [BoA]

Agru America, Inc.
Nathan Ivy [BoD]/Markus Haager

INHA (GSI-Korea)
H.-Y. Jeon

Waste Management Inc.
Greg Cekander/John Workman [BoA]

NPUST (GSI-Taiwan)
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Advanced Earth Sciences, Inc.
Kris Khilnani/Suji Somasundaram

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EPI, The Liner Co.
Daniel S. Rohe/Ryan Whalen

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Archie Filshill

Sotrafa S. A.
Jose Miguel Munoz Gomez

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Garth James

Interwrap, Inc.
Clive Mills/Martin Vido

Thrace Group
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