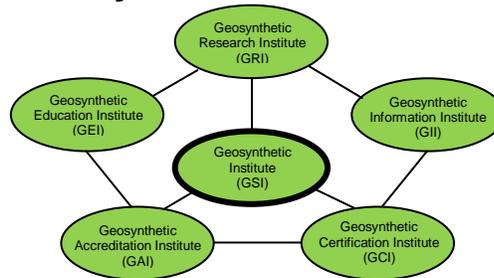


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 31, No.1

March, 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.

Activities of GSI's Directors and Officers

1. The Geotechnical Frontiers Conference in Orlando, Florida was simply awesome. Major GSI activities were as follows:
 - Bob and George were honored by GMA; see the article in this Newsletter/Report
 - The Annual Meeting was well attended and successful; see [www.geosynthetic-institute.org/member meeting](http://www.geosynthetic-institute.org/member_meeting) for the presented slides
 - The BoD Meeting, which was our 29th, was very interactive; contact George K. for info.
2. The keywords for all geosynthetic papers at the conference have been added to our website's Key Words section.
3. Our February 8, 2017 Webinar on Wave/Wrinkle Management of Geomembranes drew 51 sites (with 100's of viewers) and significant discussion; even blogs! It also spurred a new research project on the fate of creased geomembranes.
4. The complete textbook *Designing With Geosynthetics* on-line is available. See the Education section of this Newsletter/Report.
5. Accompanying the above item is a Certified Geosynthetic Designer program. There is some interest, but no "takers" as yet.
6. The nine person GSI Board of Directors is presently as follows:

Term Ends 2017

- Tony Eith - CEC Consultants , Inc. (Consultants and Testing Labs)
e-mail: teith@cecinc.com
- Nathan Ivy - AGRU America Inc. (Geomembranes and GCL's)
e-mail: nivy@agruamerica.com
- Moreno Scotto - Maccaferri (International - 2)
e-mail: moreno.scotto@gmail.com

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

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- Acknowledgement of GMA's Awards to Bob & George Koerner
- GSI's Member Organizations

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

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 (robert.koerner@coe.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.
Note: Several landfills have reported elevated temperatures and the U.S. EPA has a forthcoming workshop to assess the situation... more later.
2. **Flow Behavior of Innovative Leachate Collection and Removal Systems (LCRS's)** – Several new geocomposite drainage systems are being compared to traditional geonet composites. The project is in its second year and will be a multi-year effort.*
3. **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 over time. A 50-year time frame is envisioned! The long-term behavior will

eventually be compared to UV laboratory predicted data as noted previously.

4. **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 or strength and elongation are measured. The goal is lifetime prediction. 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 in April 2016 at Orlando and will again be 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.)
5. **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 decade long study are change in thickness and presence of crazing or cracking. Time will tell!
6. **Exposed Lifetime of Creased Geomembranes** - Stemming from a recent webinar 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. The project promises to take many years.
7. **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.
8. **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 4.

9. **Laboratory Exposed Geotextile Yarns** - A effort on behalf of a member organization (TenCate) is evaluating polypropylene yarns with and without long-term antioxidants. It will be interesting to observe differences in behavior insofar as long-term strength and elongation. As with all of our long-term exposure research, incubation is using UV-fluorescent devices per ASTM D7238.
10. **Laboratory Exposed GeoFoam** - A study examining the exposed lifetime of EPS and XPS geof foam has been concluded. Incubations were at 80, 65 and 55°C according to ASTM D7238 the UV-fluorescent exposed device. The criterion being used is thickness decreases over time since the phenomenon involved is a gradual powered of the samples. Results are available but not yet published.
11. **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.
12. **Retaining Wall Failure Evaluations*** - We presently have 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 301! *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. We have just recently presented the findings at two geotechnical conferences; one in Williamsburg and the other in Hershey. 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.
13. **pH Between Masonry Block Wall Units*** - George Koerner has been measuring the pH between three types of masonry blocks for over seven 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 are now down to eight and lower. George has a paper in this regard.
14. **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. The latest two failures in this regard are both in Pennsylvania and one resulted in a worker's death!
15. **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.
16. **Temperature Behavior Under Different Geosynthetic Layers** - Since exposed lifetime of geosynthetics is influenced by sunlight the lifetime of layers directly beneath the uppermost one (heat only, but no sunlight) is of interest. George Koerner has set up such a scenario on behalf of Watershed Inc., a GSI member.
17. **Mega Water Bags for Fresh Water Ocean Transportation** - Back in 1996 we gave the Terzaghi Lecture and suggested that massive geosynthetic bags filled with fresh water could easily be towed in the ocean thereby supplying drinking water where needed. To date it is occurring in Cypress and in several Caribbean Islands. A new GSI project is being considered. If readers have interest and ideas please advise while we are small in the experimental design phase.
18. **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
GM19 – Geomembrane Seams
GM21 – EPDM and EPDM-R Geomembranes
GM22 – Scrim Reinforced PE Barriers (New)
GM25 – LLDPE-R Geomembranes
GM28 – CSPE-R Geomembranes
GM30 – Coated Tape PE Barriers (New)
GT10 – Geotextile Tubes

GT12 (a and b) – Geotextile Cushions
GT13 (a and b) – Geotextile Separators
GCL3 – Geosynthetic Clay Liners
GC14 – Turf Reinforcement Mats (New)

Working; Available Upon Request

GGXX – Bidirectional Geogrids (active)
GGXX – Unidirectional Geogrids (active)
GNXX – Geonet Drainage Composites (active)

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. Of note is that GM22 and GCL 3 have been upgraded for stiffness and hydraulic conductivity, respectively.

19. 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 11.
- 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 geosynthetics literature published in English. 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.

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 use of the Electrical Leak Location Survey (ELLS) method. See White Paper #34 on our Home Page for the state-of-the-practice in this regard. 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 GSI and ASCE 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, 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 remaining 2017 schedule of GSI Webinars is as follows:

Date	GSI No.	Title
April 12	W-11	Lateral & Vertical Expansions over Landfills
April 26	W-6	Geosynthetics in Heap Leach Mining
May 10	W-12	Landfill Covers: Past-Present-Emerging
May 24	W-13	Beneficial Uses of Abandoned and/or Closed Landfills
June 14	W-14	Lifetime Predictions of Exposed & Nonexposed Geosynthetics
June 28	W-21	A Brief Overview of Geosynthetics and Their Major Applications (New)
July 12	W-15	In-Situ Stability of Soil Slopes Using Nailed GS
August 9	W-16	Sand Drains-to-Wick Drains to Sand Columns
September 13	W-17	Geosynthetics in Erosion Control
October 11	W-1	MSE Wall Failure Data Base (301 cases)
October 25	W-2	MSE Wall Back Drainage Design
November 8	W-3	MSE Wall Remediation and Monitoring
December 13	W-4	MSE Wall Field Construction Inspection Practices

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 June 6-7-8, 2017)
2. Construction Inspection of Mechanically Stabilized Earth (MSE) Walls, Berms and Slopes (scheduled for July 25-26-27, 2017)

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 16-proposals which were reviewed and graded by the GSI-BoD and ourselves. Nine were accepted and are listed below. If a specific proposal is of interest please contact Jamie Koerner at jrkoerner@verizon.net. Requests for RFPs for the 2017-'18 A.Y. will go out shortly.

GSI Fellowships for 2016-'17 A.Y.

No.	Name	University	Advisor	Topic
1	Abbaspour, Aiyoub	George Mason University	Burak Tanyu	Clogging evaluation of drainage geotextiles using recycled concrete aggregate
2	Ekici, Anil	Middle East Technical Univ.	Nejan Huvaj	Interaction of marginal fills and geogrids for walls and slopes
3	Guo, Jun	University of Kansas	Jie Han	Soil column tests to evaluate wicking geotextile to remove water
4	Haselton, Henry	Montana State University	Steve Perkins	Biaxial response of geosynthetics
5	Kermani, Behnoud	Penn State University	Ming Xiao	Geotextile separation preventing particle movement into pavements due to cyclic loading
6	Maddah, Layal	Texas A&M	Jean-Louis Briaud	MSE Walls subjected to vehicle impact on roadside barrier systems
7	Morsy, Amr	University of Texas	Jorge Zornberg	Composite behavior of geosynthetic reinforced structures
8	Yilmaz, Mehmet	University of Wisconsin	James Tinjum and Craig Benson	Co-extruded EVOH geomembrane covers to avoid Landfill gas emissions
9	Zheng, Yewei	University of California SD	Patrick Fox	GRS abutments with bridge superstructure under seismic loading

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 and documentation for specific standard ASTM, ISO or GRI 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 245 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of February, 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
jinelson@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 (17 tests)
Benjamin Bell -- (770) 869-1187
bbell@lumiteco.com
- 13^A - TRI Env. Inc. (Precision Labs) (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 (59 tests)
Gary Torosian -- (978) 635-0424
gtt@geotesting.com
- 22^B - CETCO Hoffman Estates (13 tests)
Barbara Gebka -- (847) 851-1500
barbara.gebka@cetco.com
- 24^B - CETCO Lovell (10 tests)
Roger Wilkerson -- (307) 548-6521
roger.wilkerson@cetco.com
- 25^B - Ten Cate, Pendergrass (13 tests)
Melissa Medlin -- (706) 693-2226
m.medlin@tencate.com
- 26^B - Agru America Inc. (27 tests)
Maria Coffey -- (843) 546-0600
MLocklear@AgruAmerica.com
- 29^E - FITI Testing and Research Institute (80 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 (30 tests)
Mauricio Ossa
mossa@gseworld.com
- 38^C - Sageos/CTT Group (122 tests)
Eric Blond -- (450) 771-4608
eblond@GCTTG.com
- 40^B - GSE Environmental (13 tests)
Mary Thompson -- (843) 382-4603
mthompson@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 - PGI and Fiber Web, Inc. (9 tests)
Mitchell Clendenin -- (615) 847-7155
Mitchell.Clendenin@avintiv.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 Geosinteticos (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)
Ximena Parra Pizarro -- 011 55-2883308
xparra@polytex.cl
- 55^B - Atarfil Geomembranes (21 tests)
Gabriel Martin Sevilla -- 34 958 439 200
gmartin@atarfil.com
- 56^B - Polytex Santiago (13 tests)
Marta Tenorio F. Jeff -- 011 56-2-677-1000
MTenorio@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 (9 Tests)
Janie Simpson -- (864) 439-5641
SimpsonJanie@firestonebp.com
- 60^B - Polytex Lima (14 tests)
Roberto Diaz Palacios -- 51 16169393
rdiaz@polytex.cl
- 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
btra@vsni.com
- 66^B - Rowad International Geosynthetics Co. Ltd (14 tests)
Mohammad Usman Ansari -- +966-3-812-1360
mu.ansari@tasnee.com

- 68^B - Glen Raven Technical Fabrics LLC (4 tests)
Richard Greeson -- (336) 229-5576
rgreeson@glenraven.com
- 69^B - GSE Environmental (13 tests)
Siriporn Chayaporenlernt – 6638-636638
Siripornc@gseworld.com
- 70^A - RSA Geo Lab LLC (47 tests)
Rasheed Ahmed – (908) 964-0786
geolab13@yahoo.com
- 71^B - Plasticos Agricolas y Geomembranas S.A.C. (21 tests)
Manuel Constantino Olivares Espinoza –
073-511814-511829
calidad@pqaperu.com
- 72^B - Tensar Corp. GA (4 tests)
Lynn Cassidy (770) 968-3255
lcassidy@tensarcorp.com
- 73^B - Gai Loi JSE (10 tests)
Paul Wong 84-650-362-5825
paul905677@gmail.com
- 74^B - Agru America Inc. (9 tests)
Mark Locklear - (843) 325-6119
mlocklear@AgruAmerica.com
- 75^B - GeoMatrix S.A.S. (24 tests)
Javier Diaz Cipagauta (571) 424-9999
jdiaz@geomatrix.com.co
- 76^B - Tehmco (Chile) (15 tests)
Patricia Rojas Perez (562) 580-2852
projas@tehmco.cl
- 78^B - PQA Mexico (14 tests)
Cesar Augusto Arcila (669) 954-8202
directorcalidad@payg.mx
- 79^A - TRI Geosynthetic Testing and Services (32 tests)
Ping Wang 86-512-6283-1396
Pwang@tri-env.com
- 80^B - Texel (Canada) (8 tests)
André Parent (418) 387-4801
andre.parent@texel.ca
- 81^B - GSE Germany (18 tests)
Evelyn Kroeger 49-40-767420
ekroeger@gseworld.com
- 82^B - CARNO ATC (1 test)
Mary Lynn Smith (770)-427-9456
marylynn.smith@cardno.com
- 83^B - GSE Egypt (13 tests)
Ahmed Abdel Tawab - 202-2-828-8888
atawab@gseworld.com
- 84^B - Interwrap India (14 tests)
Ashutosh Dixit - 1-778-945-2888
adixit@interwrap.com
- 85^B - PAG Tacna (11 tests)
Manuel Constantino Olivares Espinoza –
073-511814-511829
calidad@pqa.peru.com
- 86^B - BOSTD China (29 tests)
Zheng Hong - 86-532-8780-6919
zhenghong@bostd.com
- 87^B - Willacoochee Industrial (18 tests)
Jason Booth - 912-534-5757
jason@winfabusa.com
- 88^B - Geosynthetic Testing Services Pvt. Ltd. (16 tests)
Deepak Manjunath - 91-02717-250019
dmanjunath@gts-pl.com
- 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)
Jagdish Chandra Joshi - 91-22-2287-6224
nonwoven.qualitylab@techfabindia.com
Anant Kandi - anant@techfabindia.com
- 91^B - Techfab (India) Industries Ltd. - Rakholi (3 tests)
Rajendra Chavan - 91-982-593-9922
geogrid.qualitylab@techfabindia.com

- 92^B - Techfab (India) Industries Ltd. - Khadoli (2 tests)
Jagdeesh B.S. - 91-22-229-76224
geotxt.works@techfabindia.com

^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).

George R. Koerner

The semi-annual GAI-LAP meeting was held in Norfolk, VA in conjunction with ASTM D35 on February 2nd, 2017. Sixteen people attended this meeting which was held at 7:00 AM in the morning before Task Groups began. We should point out that a virtual repeat meeting was held via a webinar on March 2nd, 2017. Seventeen additional labs were on-line for this event. This representing 46% of the 71 active GAI-LAP labs. We are grateful that ASTM allowed us the venue. I also want to thank all that were in attendance for their time and effort.



Front row: Nigel Wrigley (NewGrid), Gary Torosian (Geotesting Express GeoComp), Cora Queja (TRI), Rebeca Kurek (Lumite), Nathan Ivy (AGRU), Joel Sprague (TRI), Back Row: Jason Booth (Winfab, Willacoochee Ind. Fabrics), James Goddard (ASTM), Melissa Medlin (TenCate), Gary Kolbasuk (Raven Industries) Tim Bauters (Golder Associates), Eric Blond (Sageos), Sam Allen (TRI), Richard Lacey (TRI), Not Pictured: Mike Bernardi (Strata Systems), George Koerner (GSI)

The discussion at the meeting was as follows. A brief introduction and background of the GAI-LAP program was discussed. Please note that we are in our 22nd year of operations. The program started in 1995. We accredit only geosynthetic labs and model the program after ISO 17025. On-site audits are conducted every five years and proficiency tests every year with a goal of the coefficient of variation less than five for each test conducted.

The demographics of the current GAI-LAP labs are summarized as follows: 20 independent labs, 46 manufacturer QC labs and 5 centers (research or government) for 71 total. Thirty-eight of these labs are GSI members and 19 are international labs from 17 different countries. It appears that this program is getting traction internationally. There are 244 possible tests for accreditation (182 ASTM, 1 FTM, 8 GRI, 53

ISO). The number of accredited tests per lab varies greatly, e.g., 4 min., 27 ave. 128 max.

There has been a rapid rise of new test methods. New tests added appear to be outside the ASTM D35 arena. The international arm of testing is very strong. We particularly see this in Europe, South America and Asia. Proficiency testing is still the hallmark of GAI-LAP. Of the 3617 proficiency test results submitted this year, only 64 first submittals were outliers representing 1.8% of the total. All outliers were resolved. Results of the proficiency tests were shared at the meeting and also distributed electronic via e-mail and CD. *Congratulations to the GAI-LAP members on a job well done.* Several other certification and accreditation programs around the world are now requiring proficiency test data per ISO 17025. All GAI-LAP labs easily comply with this requirement.

The GAI-LAP proficiency test program would not function without samples to test. In this regard we would like to thank the following organizations for their generous contribution of geosynthetics to this cause.

- TenCate Inc. and Propex for geotextiles
- GSE Lining Technology and AGRU America for geomembranes
- NAUE for geogrids and for GCLs
- ADS Inc. for plastic pipe
- Maccaferri for geonets and geocomposites

The GAI-LAP Customer Survey was again sent out to all program participants and the findings were reviewed at the meeting via a 27% return. The following are the results (5 best to 1 poorest); (a) Information exchange = 4.1; (b) Conflict resolution = 4.4; (c) Proficiency testing = 4.6; (d) Directory and internet = 3.7; Overall = 4.2. Overall results to date: 2016 (4.2), 2015 (4.3), 2014 (4.2), 2013 (4.2), 2012 (4.1), 2011 (4.1) 2010 (4.3), 2009 (4.4), 2008 (4.4), 2007 (3.9), 2006 (4.0), 2005 (4.0), 2004 (4.1), 2003 (4.1), 2002 (4.2) We feel that the program has had a very good year and look forward to expanding our outreach going forward.

As usual at these annual meetings we had a lively discussion regarding the conflict resolution cases addressed by the GAI-LAP this year. They are summarized below;

1. ASTM D638 GM Tensile, "nick in cutting die"
2. ASTM D5994 Core thickness, "search technique challenged"
3. ASTM D5199 Thickness, "GN thickness after lamination into GC (GT-GN-GT)"
4. ASTM D5199 Thickness, "Beta gamma, x-ray, ultrasonic and backscatter"
5. ASTM D5321 DS, "GC internal shear (GT to GN) gripping tricks"

6. ASTM D4595 WWT GT, "poor agreement between wedge-roller and Demgan grips"
7. ASTM D5981 Fluid Loss, "way in which slurry is prepared"

The next GAI-LAP annual meeting will be held in June 2017 in conjunction with ASTM D-35. GAI solicited manufacturers for geosynthetic materials for 2017 proficiency testing. In addition, it was noted that each lab can add up to seven tests per year. 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 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.
- 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.

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 (11%)
2017	27	1 (4%)	18	1 (5%)
TOTAL (to date)	697	86 (12%)	637	74 (12%)

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
(2011-2016)

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 Course	2	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 ready to go and if you have questions and/or comments please contact us accordingly.

Bob Koerner robert.koerner@coe.drexel.edu
Marilyn Ashley mvashley@verizon.net
Jamie Koerner jrkoerner@verizon.net

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. (See associated writeup on the "Global Geosynthetics Summit" in the December, 2014 Newsletter/Report).

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.

Acknowledgement of GMA's Awards to Bob and George Koerner

On March 14, 2017 at the Geotechnical Frontiers Conference in Orlando I was graciously presented the Robert M. Koerner Award and Lecture Series. The award was established by the GMA Executive Council and furthermore George Koerner was the first recipient of this biennial award. The two plaques given to us are shown below.



George presented a splendid lecture as part of the morning plenary session. However, the time taken for other events was rather long and as a result there was insufficient time for me to acknowledge GMA as well as many other organizations and people. Following are my prepared (but nondelivered) remarks in this regard.

“Thank You All for This Superb Honor!!!”

It's a pleasure being here at this combined Geotechnical and Geosynthetics Conference. I say that particularly since the two technologies are so

overlapping with one another; in this regard both have the following common features:

- consultants → plans and specifications
- test labs → evaluation of materials
- peer review → owners and permittees
- implementation → contractors and installers
- construction QC/QA → inspection and approval

That said, there is one profound difference; that is they both have very different sources of the materials involved, e.g.,

for soil, rock, water → The Almighty + geology
for geosynthetics → manufacturers

The Almighty didn't do very well from the aspect of manufacturing QC/QA, e.g., the many soil and rock variations, anisotropy, nonhomogeneity, either too much or too little water, etc., etc. Furthermore, He has no 800-number! On the other hand, geosynthetic manufacturers are expected to do considerably better... yet the process is quite complicated, tedious, time consuming and expensive. For example, a manufacturer must accomplish all of the following...

- decide on the particular product(s)
- build a factory
- arrange for suppliers
- establish a work force
- make (flawless) product
- market the product(s)
- sell them for a competitive price
- inventory and ship them on demand

In this regard, I submit to you that the manufacturers are the true "gamblers" of the entire geosynthetics technology with major up-front decisions some of which are...

- application area
- material type
- credit rating
- bank loans
- personal investment
- insurance
- attorneys
- stock holders
- and consistency, consistency and consistency

Thus, in a holistic sense, the manufacturers have and continue to make and stimulate the entire geosynthetics industry, and others (like myself and GSI) reap the benefits... As such, this award is deeply appreciated

- So I say, -

and with heart-felt thanks, I humbly accept this lectureship in my name. It is indeed the outstanding technical honor that an individual can achieve.

In particular, thanks to the Geosynthetics Materials Association (GMA), its officers, board and membership for initiating and creating the award. Also to their parent organization, the Industrial Fabrics Association International (IFAI), who has been with the geosynthetics industry from the very beginning with conferences, publications, surveys, government and industry guidance, etc.

Thanks to all of you and my best wishes going forward for continued success and growth."

Robert M. 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, Bourge Pte. Ltd. of Singapore with Mohamed Ali Jaber/Peter Malmros/Rick Cui, Intermas Group of Spain with Rubén Palacios and Thrace Group with Steven Lothspeich/Stella Karavasili. Thanks to all and welcome to GSI!!!**

GSE Environmental

Steve Eckhart/Jimmy Youngblood

U.S. Environmental Protection Agency

David A. Carson

Chemours Technology

Clifford Early

Federal Highway Administration

Silas Nichols/Daniel Alzamora

Golder Associates Inc.

Mark E. Case/Tim Bauters/Paul Sgriccia

Tensar International Corporation

Mark H. Wayne [BoD]/Joseph Cavanaugh/Doug Brown

Low and Bonar PLC (formerly Colbond)

Richard Goodrum

Geosyntec Consultants

Ranjiv Gupta

TenCate Geosynthetics

John Henderson/Chris Lawson

CETCO

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NAUE GmbH & Co. KG

Kent von Maubeuge [BoD]

Propex Operating Company LLC

Drew Loizeaux

AVINTIV (formerly Polymer Group Inc.)

Brian H. Whitaker

TRI/Environmental Inc.

Sam R. Allen [BoD]/Joel Sprague

U. S. Army Corps of Engineers

David L. Jaros

Chevron Phillips Chemical Co.

Randy Moynihan/Jennifer Hicks/Ashish Sukhadia [BoD]

AECOM (formerly URS Corp.)

John Volk/Ron Hager/John Bove

Solmax Géosynthétiques

Jacques Cote/Simon Gilbert St-Pierre/Daniel Tan Su Ming

CARPI, Inc.

Alberto M. Scuero/John A. Wilkes

Civil & Environmental Consultants, Inc.

Tony Eith [BoD]

Agri America, Inc.

Nathan Ivy [BoD]/Markus Haager

Firestone Specialty Products

Allen Sopko/ Carol Klinker

INHA (GSI-Korea)

H.-Y. Jeon

Waste Management Inc.

Greg Cekander/John Workman [BoD]

NPUST (GSI-Taiwan)

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GeoComp/GeoTesting Express

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Marlyn Waltner/AI Florez

BRTI (GSI-India)

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Kerry Petrasic

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- Items of Interest
- "MSE Wall Failures vis-à-vis the Lack of Filtration Design
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