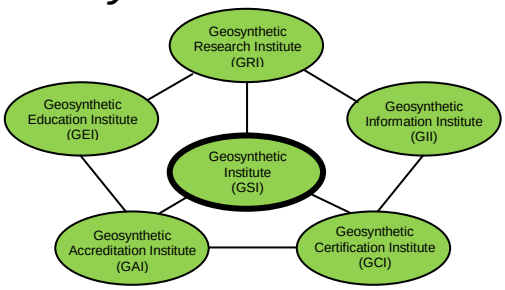
The GSI Newsletter/Report

Geosynthetic Institute



Vol. 31, No. 3 **September, 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 GSI Board of Directors reviewed 20 proposals for GSI Fellowships. Eleven were selected (at $5,000 each) and are descried in the education institute writeup of this Newsletter/ Report.
2. The GeoMEast Conference was held in Sharm El-Sheik, Egypt on July 16-19, 2017 during which Bob Koerner was granted an honorary lectureship. Bob addressed the audience of about 350 participants remotely including an introduction of Alberto Scuero of CARPI as the keynote speaker.
3. A very rapid research project on the potential of increasing soft soil shear strength using PVDs was initiated and concluded over the summer. It required a new testing device (by George Koerner), PVD testing (by Max Koerner) and analysis (by Bob Koerner) with the resulting paper being accepted by the Journal of Geosynthetics and Ground Engineering for November, 2017 publication.
4. The above is the 5th paper by Koerner[3], and Max has just started in Mechanical Engineering at GeoTech University!
5. Your 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

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

IN THIS ISSUE

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 for us 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.
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 halflife of strength and elongation are measured. The goal is lifetime prediction. Some will take at least 90,000 light hours (~ 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 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.
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 307! *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. **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.
14. **PVD Strengthening of Soft Foundation Soils*** - A new project, conducted over the summer, addresses the use of PVDs for drainage (as customary) plus tensile reinforcement (never recognized to date). The experimental device was manufactured and used to assess three different PVDs. This data was then used in 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 draft paper is available.
15. **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 presently being evaluated. Eventually a new specification designated GRI-GM19(b) will be developed… GRI-GM19(a) will then be solely for homogeneous geomembranes.
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.

    <u>Completed and Available on our Website</u>
    GM13 – HDPE Geomembranes
    GM17 – LLDPE Geomembranes
    GM18 – fPP and fPP-R Geomembranes
    GM19 – Geomembrane Seams (being modified)
    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)
    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 (New)

    <u>Working; Available Upon Request</u>
    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**
- **Prospectus**
- **Associate Membership (Agencies)**
- **Members by Focus Groups**
- **GSI Publications**
- **GRI Specs, Guides, White Papers**
- **Laboratory Accreditation**
- **Product Certification**
- **Newsletter/Reports**
- **Internet Courses**
- **GSI Members Links**
- **GSI Member Meetings**
- **Courses at GSI**
- **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**
- **GRI Reports**
- **GRI Technical Papers (Citations)**
- **Notes of GSI Meetings**
- **Links to the GSs World**
- **Keyword Search for Literature**
- **Example Problems**
- **Frequently Asked Questions (FAQs)**

The Keywords Section contains about 35,000 citations which is the majority of the geosynthetics 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.

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 remaining 2017 schedule of GSI Webinars is as follows:

Date	GSI No.	Title
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 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 ~ 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	Analyzation 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 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 252 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of September, 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
dwKim@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.Schoupe@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
btra@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 Chayaporenlert – 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. (24 tests)
Manuel Constantino Olivares Espinoza –
073-511814-511829
calidad@pgaperu.com

72[B] - Tensar Corp. GA (4 tests)
Lynn Cassidy-Potts (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 Amercica Inc. (9 tests)
Mark Lockliear - (843) 325-6119
mlocklear@AgruAmerica.com

75[B] - GeoMatrix S.A.S. (29 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 (15 tests)
Cesar Agusto 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 Technical Materials (10 tests)
André Parent (418) 387-4801
andre.parent@texel.ca

81[B] - GSE Germany (18 tests)
Evelyn Kroeger 49-40-767420
ekroeger@gseworld.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 (12 tests)
Manuel Constantino Olivares Espinoza –
073-511814-511829
calidad@pga.peru.com

86[B] - BOSTD China (29 tests)
Zheng Hong - 86-532-8780-6919
zhenghong@bostd.com

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88[B] - Geosynthetic Testing Services Pvt. Ltd. (16 tests)
Deepak Manjunath - 91-02717-250019
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89[B] - Megaplast India Pvt. Ltd. (13 tests)
Hermendra Behera - 91-937404-4620
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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
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92[B] - Techfab (India) Industries Ltd. - Khadoli (2 tests)
Jagdeesh B.S. - 91-22-229-76224
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[A]Third Party Independent [C]Institute
[B]Manufacturers QC [D]Government

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

GSI has a new Standard of Practice for sampling geosynthetics. We put the practice to use recently for this year's GAI-LAP samples which were obtained at GSE, TenCate and CETCO. We thank these companies for their hospitality and generosity. Sampling should be conducted on a flat, dry and smooth surface. This is best done at the manufacturing facility or a distribution center. As you see in the attached photographs. ⟶

The practice provides a means by which samples of geosynthetics should be obtained to preserve sample integrity during shipment and handling prior to conformance testing in an accredited laboratory. This practice gives instructions on taking samples from which test specimens are obtained. The GRI sampling practice does not provide a procedure for providing a statistically valid sample. That is covered in ASTM D4354 "Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing."

It was felt that there was need for this practice to reduce the coefficient of variation in test results for conformance testing. Specimens cut from samples will generate conformance test results which will be compared to a specification. If the sample is not representative of the product in question and in good order, the whole exercise has been compromised from the start.

For most geosynthetics, samples extending the width of the roll and at least three (3) feet in length are the norm. The samples shall be taken without joints or seams. It should also have no fold or wrinkles in it and should be placed inside or around a rigid core during shipment. Samples should be labeled, marked with the machine direction and then packaged in a robust protective cover wrap to prevent damage during shipping and handling.

The next GAI-LAP 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 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	5 (18%)
2017	61	1 (2%)	49	2 (4%)
TOTAL (to date)	**731**	**86 (12%)**	**668**	**75(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 (GDCP)" 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.

Commentary on Geosynthetic Specifications

One can only suspect that the first specification on a given manufactured material came along with or very shortly after the first manufactured product became available. It follows then that some 200 years later manufactured geosynthetic materials should do

likewise. In fact, so-called Standards Organizations* have evolved by publishing the following items:

> "Test Methods" - a definitive procedure that produces a test result.
> "Guides" - an organized collection of information or series of options that does not recommend a specific course of action.
> "Practices" - a set of instructions for performing one or more specific operations that does not produce a test result.
> "Specifications" - an explicit set of requirements to be satisfied by a material, product, system, or service.

In this communication, however, we focus completely on specifications, recognizing that they necessarily include test methods and occasionally guides and practices as well.
With the above as a very brief introduction to specifications, such as those used for geosynthetic products, they can follow significantly different approaches. To follow are three quite different types of specifications; e.g., proprietary, generic and performance and related discussion.

Regarding proprietary specifications, every manufacturer should have one for every product they manufacture. It is to be expected that the listed test methods and their numeric property values will be acceptable to their manufactured product(s). However, such a specification can go much further in that the specific selection of tests and corresponding values prescribed can deftly exclude competitors manufacturing of similar products. As such, proprietary specifications are excellent marketing and sales vehicles for a manufacturer's specific products but of limited value to a broader audience such as an owner, regulator, or design consultant.

On the other hand, generic specifications attempt to provide a collection of test methods along with minimum (or maximum) values which meet the objectives of a particular application and are acceptable to several manufacturers of competing products. That said, if the bar is set too low all such products will be acceptable, if it is set too high it could be excessively restrictive, such that few or no products are acceptable. Thus, it is a difficult task for the facilitator to strike a balance in crafting a valuable and useful specification. The selection of pertinent, but not superfluous, test methods and particularly the numeric values ascribed to the designated test methods are fraught with compromise and negotiation. Furthermore, the updating and ongoing care of such specifications is important so as to keep current with industry developments and product enhancements.

> For example, generic geomembrane specifications began under U.S. EPA stimulus in 1983 by the National Sanitation Foundation. They abruptly discontinued their activity in 1993 and GSI followed with its first generic specification on HDPE geomembranes in 1997. GSI currently has 18 generic specifications (9-GMs, 5-GTs, 1-GCL and 3-GCs)… see www.geosynthetic-institute.org/specs.htm.

While the general goal of generic specifications is to set a lower limit of product acceptability, they can often have the effect of not encouraging additional product enhancements by the associated manufacturers. In this regard, it can be said that generic specifications have a tendency to commoditize products for the specific application under consideration.

Performance specifications avoid the somewhat negative aspect of commoditization just mentioned. In this case, an owner, regulator or design consultant states a series of objectives for a particular application and allows an engineer or consultancy to design accordingly. An example of a performance specification is the U.S. EPA regulations for solid waste landfill Leachate Collection and Removal Systems (LCRS). It requires the following:

1. The maximum leachate head above the primary liner of a landfill must be equal or less than 300 mm
2. The time for leachate removal from the farthest distance of the cell to the outlet sump must be equal or less than 24 hours
3. The minimum grade of the landfill's liner system must be 2% or higher.

Such criteria leaves the design consultant complete freedom as to use any type of granular soils, any type of geocomposite drains, or even a combination of drainage soil and geosynthetics. [Conversely, the German UBA is completely prescriptive for this same application in requiring 450 mm thickness of rounded, non-limestone, gravel of size between16 and 32 mm diameter!]

This above commentary on different specification types was prompted by a topic of discussion at the GSI Annual Meeting in Orlando on March 13, 2017. Several attendees, particularly from Europe, encouraged the use of performance specifications over generic specifications. Clearly, with an available population of knowledgeable design engineers and consultancies this is justifiable and will result in many different acceptable solutions for a given application. On the other hand, for designers not familiar with the specific application, in whole or part, it can lead to chaos or even improper practice insofar as subsequent poor performance or failures. It should be mentioned that

*ASTM Intl. was formed in 1898, while ISO followed in 1947 and GRI entered in 1997.

there are tens of thousands civil engineering design consultancies in America. As long as a company has a professional engineer (PE) on staff, or otherwise available, they can make such a design and have it sealed for construction. Considering that there are very few geosynthetic design courses available within universities and *there has never (to our knowledge) been a single geosynthetic question on any Professional Engineering Examination* the use of performance specifications seems risky, if not outright dangerous, in light of the guidance and directions given in performance specifications.

It is our considered opinion that generic specifications play an important and positive role in all types of geosynthetic products. As such, they should be continued and possibly expanded. Of course, an important caveat is that such generic specifications are kept current with respect to evolving new products and a watchful eye on existing issues and non-performance via field evaluations.

Bob & George 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,* Intermas Group of Spain with Rubén Palacios and Thrace Group with Steven Lothspeich/Stella Karavasili. Thanks to all and welcome to GSI!!!**

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Chemours Technology
Clifford Early
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Silas Nichols/Daniel Alzamora
Golder Associates Inc.
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IN THE NEXT ISSUE

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- Progress within GEI (Education)
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- The GSI Affiliate Institutes
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