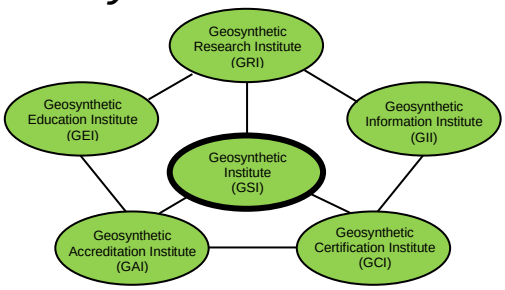
The GSI Newsletter/Report

Geosynthetic Institute



Vol. 33, No. 3 **September, 2019**

This quarterly newsletter, now in its 33rd 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 Officers and Board of Advisors (BOA)

1. GSI has awarded eighteen fellowships for graduate students doing geosynthetics research at their respective universities. Each was for $5000 to be used during the 2019-2020 academic year. See details in the GEI section of this Newsletter/Report.
2. GSI White Paper #42 focuses on post-closure care of closed solid waste landfills. It is based on a survey conducted by Jamie Koerner, and is available on our website… Results on Post-Closure Care have been embedded in our webinar entitled "Landfill Closures; Past, Present, Emerging".
3. Three new GRI Standards were published during this past summer; GS20 "Exposed Lifetime Prediction Methodology", GS21 "Tensile Testing of GeoStrips" and GM32 "Data Acquisition Welders"… all are available on our website.
4. A major effort in explaining geosynthetic testing procedures on You Tube has been provided and is presently available. Do look them up (there are 33 separate tests) and provide comments if so desired.
5. The GSI Board of Advisors for 2019-2021 is as follows:

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: info@btraindia.com/ director@btraindia.com
- Ashish Sukhadia – Chevron Phillips (Resin and Additives)
  e-mail: sukhaam@cpchem.com

*Nominations and elections begin in October, 2019.

Term Ends 2020

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

IN THIS ISSUE

Term Ends 2021

- John Workman - Waste Management Inc.
  (Owners and Operators)
  e-mail: jworkman@wm.com
- David Andrews – Propex
  (Geotextiles and Geogrids)
  e-mail: David.Andrews@propexglobal.com
- Sam Allen – TRI Environmental Inc.
  (At-Large)
  e-mail: Sallen@tri-env.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 (hsuanyg@drexel.edu) or Bob Koerner (rmk27@drexel.edu) for details and/or discussions.

1. **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) often uses 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 at a local landfill 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 our UV laboratory predicted database.
2. **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 and PVC (N.A. and European). They are being incubated at 60, 70, and 80°C until halflife of strength and elongation are measured. The goal is lifetime prediction. Incubation times are now over 60,000 light hours (8.2 years) and several are not yet complete. They will probably take as long as 90,000 light hours (~ 12.3 years). The information up to this point in time was made available to the public on April 6, 2016 at the GeoAmericas Conference in Orlando, Florida. It has been republished in the International Geosynthetics Journal. A copy is available. It is now also being offered as a 90 min. webinar.
3. **HDPE Geomembrane Lifetime as a Function of Thickness** - This often-encountered question is being evaluated at elevated temperature exposure at 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!
4. **Laboratory Exposed Lifetime of PVC (European) Geomembranes** - We have been evaluating five different European formulations for nine 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. The program will end this year but may be extended with new formulations.
5. **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 grown to 141, then 171, then 320 and now 346! *Readers, we have a very serious situation in this regard!* The failures are either excessive deformation or actual 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. An updated paper on 320 case histories has just been published in the Journal of Geotextiles and Geomembranes. Lastly, three ongoing GSI webinars are also available on this general topic.
6. **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 published a paper in this regard.
7. **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, begun in 2017, 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. Recently, yield was observed in the deformed geomembrane but air pressure is still sustained. A preliminary paper was presented at Geosynthetics '15 in Portland.

8. **PVD Strengthening of Soft Foundation Soils*** - A recent project, conducted over last summer, addresses the use of PVDs for drainage (as customary) plus their tensile reinforcement (never recognized to date). An experimental device was developed and used to assess three different PVDs. This data was then used with the ReSSA soil stability code on a major foundation soil failure that did not have PVDs. The FS-values increased 4% and could go higher with closer spacing or stronger PVDs. A journal paper is available.
9. **Geotextile Intrusion into Geonet and Geospacer Drainage Cores* -** A series of in-plane flow tests on geonet drainage composites has resulted in the flow rate results for the geonet by itself, the geocomposite with different weights of needle-punched nonwoven geotextiles, and composites with a heat-bonded nonwoven geotextile. The decrease in flow rates of the composites are large when testing boundaries use rubber surfaces. Since this simulates in-situ soil conditions it is significant. A paper has been accepted by the Geotechnical Testing Journal of ASTM. It also includes a generic specification and is available.
10. **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 have been evaluated. A new specification designated GRI-GM19(b) has been developed… Note that GRI-GM19(a) is solely for homogeneous geomembranes. Lastly, a review of the GRI-GM30 specification is underway and it will be modified to reflect new manufacturing of scrim reinforced coated polyethylene geomembranes (≥ 0.75 mm, or 30 mils)/barriers (< 75 mm, or 30 mils).
11. **Generic Standards** - A major continuing effort is ongoing with respect to the development and updating of GRI's generic geosynthetic standards. As customary, "standards" consist of specifications, guides, practices and test methods. The current status of these standards is as follows.

11a. GRI Specifications - Currently we have 21 generic specifications on most of the products generally used. The notable exception is geogrids, which is, and has been for years, very contentious with no obvious accommodations. Incidentally, all are currently copyrighted.

11b. GRI Guides - Currently we have 12 guides on detailed aspects of geosynthetics, their installation and project performance. Topics vary widely; from statistical sampling-to-constructing test pads. Topics of interest for our development should be communicated to George or Bob Koerner.

11c. GRI Practices - Currently we have 8 practices on wide ranging topics generally used in design methods. They are very detailed and sometimes are based on our concept of what we perceive to be "best practice".

11d. GRI Test Methods - Currently we have 29 test methods available on the following geosynthetic types:

Geotextile Related - 2
Geogrid Related - 2
Geomembrane Related - 6
GCL Related - 2
Geocomposite Related - 11
Geosynthetic (multipurpose) Related - 6

Additionally, 31 of our test methods have been co-opted by ASTM and we have depreciated our version. Incidentally, our test methods are for members only and are in the password protected portion of our website. We are delighted to report that ASTM has given the David Suits Award to GSI for our cooperation in sharing these GRI standards. We will continue to distribute our test methods in this manner, but specifications, guides and practices are available free as mentioned previously.

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:

Newsletter	**Research**
Prospectus	**Certification**
Specifications	**Information**
White Papers	**Education**
Bookstore	**Accreditation**
Keyword Search (new)	**Personnel Contacts**
Members Only	**Upcoming Webinars**

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 obtain 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 then available.

- **GRI Test Methods**
- **GRI Reports**
- **GRI Technical Papers (419 Citations)**
- **Notes of GSI Meetings**
- **Links to the GSs World**
- **Keyword Search for Generic Papers**
- **Example Problems**
- **Frequently Asked Questions (FAQs)**

The Keywords Section contains about 35,000 citations which is the vast (~ 90%) 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.

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

In addition to the information provided in our home page as just mentioned, Jamie Koerner (Special Projects Manager) performs various surveys on pertinent topics in geosynthetics. The latest surveys by Jamie Koerner were on the status of geosynthetic use by U.S. State Departments of Transportation (White Paper #39), State Pavement Design Methods (White Paper #40) and Post-Closure Care of Landfills (White Paper #42). Also, if you have topics in need of the current status via a survey please advise accordingly.

Progress within GEI (Education)

GRI Reports

To date, we have 46 GRI Reports available to members and associate members. These reports vary in length from 30 to 200 pages. They are on the password protected section of our home page at www.geosynthetic-institute.org/member/reports.html. Most of them are also available in hard copy. Our most recent report is:

- #46 - Utilizing PVDs to Provide Shear Strength to Saturated Fine-Grained Foundation Soils

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;
GSI and GMA Member Cost - $200

Commentary on Webinars: For the single cost of $250 (non-members) or $200 (members), Adobe Connect streams the webinar to all requested sites. Webinars can be transmitted anywhere and to anyone. Recently, NY-DEC streamed our webinar to their auditorium and 13 regional offices. Clearly hundreds of participants were involved! We also gave a presentation to GIGSA in South Africa with over 60 participants. Clearly, this is the most efficient way to communicate information to masses of people. Following is a list of topics given on behalf of GSI and ASCE. Contact us for details in each case.

GSI Webinars

GSI 1 – "A Data Base and Analysis of 320 Failed MSE Walls With Geosynthetic Reinforcement"
GSI 2 – "MSE Wall Back Drainage Design"
GSI 3 – "MSE Wall Remediation and Monitoring"
GSI 4 – "MSE Wall Inspection"
GSI 5 – "Geosynthetics in Hydraulic Applications"
GSI 6 – "Geosynthetic Applications Used in Heap Leach Mining"
GSI 7 – "Geosynthetics in Agriculture and Aquaculture"
GSI 8 – "Geosynthetics Applications in the Private Sector"
GSI 9 – "Behavior and Analysis of Twenty Solid Waste (Landfill) Failures"
GSI 10 – "Wet (Bioreactor) Landfills for Rapid Degradation of MSW Organics"
GSI 11 – "Lateral and Vertical Expansions Over Old and Existing Landfills"
GSI 12 – "Landfill Covers: Past, Present, Emerging"
GSI 13 – "Beneficial Uses of Abandoned and/or Closed Landfills"
GSI 14 – "Lifetime Predictions of Covered and Exposed Geosynthetics"
GSI 15 – "In-Situ Stabilization of Soil Slopes Using Nailed (or Anchored) Geosynthetics"
GSI 16 – "Sand Drains-to-Wick Drains-to-Sand Columns (Including a Major Failure Case History)"
GSI 17 – "Geosynthetics in Erosion Control"
GSI 18 – Pond Liner Design and Performance
GSI 19 – "Wave (or Wrinkle) Management [For Proper Deployment of Geomembranes]"
GSI 20 – "Geosynthetic Drainage Materials: Applications, Design, Installation and Performance"
GSI 21 – "A Brief Overview of Geosynthetics and Their Major Applications"
GSI 22 – "Geosynthetic Reinforced MSE Walls; Overview, Failures and Items for Improvement"
GSI-23 – "Geosynthetic Filters: Concerns and Issues
GSI-24 – "Disposal of Coal Combustion Residuals"
GSI-25 – "Soil Consolidation by Wick Drains, aka PVDs"
GSI-26 – "Applications and Design of Geotextile Tubes"
GSI-27 – "Stability Design of Landfill Cover Soils"

ASCE Webinars

ASCE 1 – "A Brief Overview of Geosynthetics and Their Major Applications"
ASCE 2 – "Geosynthetic Reinforced Mechanically Stabilized Earth (MSE) Walls"
ASCE 3 – "Analysis and Design of Veneer Cover Soils"
ASCE 4 – "Use of Geosynthetics for Waterproofing Critical Hydraulic Structures"
ASCE 5 – "Design of Geomembranes for Surface Impoundments (Ponds, Reservoirs, etc.)"
ASCE 6 – "Geosynthetic Applications Accompanying Shale Gas Drilling Operations"
ASCE 7 – "Geosynthetic Opportunities Associated With Coal Mining Spoils and Coal Combustion Residuals"
ASCE 8 – "Geosynthetic Applications in Unpaved and Paved Roads"
ASCE 9 – "Geotextile Tubes for Erosion Control, Dewatering and Decontamination"
ASCE 10 – "Lessons Learned Using Geotextiles as Filters"
ASCE 11 – "Geosynthetic Basal Reinforcement Over Deep Foundations Including Geosynthetic Encased Stone/Sand Columns"
ASCE 12 – "Consolidation of Saturated Fine-Grained Soils from Vertical Flow-to-Sand Drains-to-Wick Drains, aka PVD's (With a Major Failure Case History)"
ASCE 13 – "Selected Topics Regarding Geosynthetic Clay Liners"
ASCE 14 – "In-Situ Stabilization of Soil Slopes Using Nailed (or Anchored) Geosynthetics"
ASCE 15 – "Long Term Durability of Geosynthetics"
ASCE 16 – "Erosion Control and Revegetation Materials; Design, Installation and Performance"
ASCE 17 – "Installation, Design and Performance of Prefabricated Vertical Drains, aka, Wick Drains"
ASCE 18 – "Design Beyond Factor of Safety: The Probability of Failure"
ASCE 19 – "A Data Base and Recommendations on 320 Failed MSE Walls with Geosynthetic Reinforcement"
ASCE 20 – "MSE Wall Remediation and Monitoring"
ASCE 21 – "Mechanically Stabilized Earth (MSE) Wall Construction Inspection"
ASCE 22 – "Geonet and Geospacers Drainage Materials and Their Geocomposites"
ASCE 23 – "Landfill Final Covers: Current Status, Potential Uses and Post Closure Care"

Courses

We have now abandoned our in-house, one-day, courses (which have been given for the past 30-years) and are presently 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 (December 3- 4-5, 2019)
2. Construction Inspection of Mechanically Stabilized Earth (MSE) Walls, Berms and Slopes (currently not scheduled)

The third and newest of GSI 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 synchronized 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.

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

GSI Fellowships

GSI, with the guidance of the its Board of Advisors, has made their fellowship award selections for the 2019-'20 academic year. The program recognizes and supports outstanding students from around the world studying geosynthetics. The GSI fellowship program for this academic year continues to include candidates pursuing a master's degree, as well as a doctoral degree. The amount awarded to each fellowship recipient is $5000. The eighteen recipients for the 2019-'20 GSI Fellowship awards are as follows. We thank the entire geosynthetic community for advertising the program and their encouragement as well.

GSI Fellowships 2019-2020

No.-Yr.	Student	University	Advisor	Topic
1-19	Mr. Daniel Adeleke	U. of Cape Town South Africa	Denis Kalumba	Investigation into the effects of asperities on GM–geotextile shear characteristics
2-19	Mr. Conor McCafferty	Drexel U.	Grace Hsuan	Using geo-composites to increase filtration of a stacked GT tube system in various configurations
3-19	Ms. Jackeline Gastelo	George Mason U.	Burak Tanyu	Hydraulic conductivity of GCL overlap areas
4-19	Mr. Hao Liu	U. of Kansas	Jie Han	Internal reinforcement of abutment backfill to mitigate bumps at end of integral bridges
5-19	Mr. Sung Ryoo	U. of Maryland	Ahmet Aydilek	Hydraulic and erosion control performance of conical filter system with DOT backfill materials
6-19	Mr. Javad Galinmoghadam	Missouri U. of Science & tech.	Xiong Zhang	Use of wicking GT to mitigate frost action in cold regions – a numerical study
7-19	Mr. Jin-Cheng Yeh	NPUST Taiwan	Wayne Hsieh	Low impact development of plastic underground storage tanks seismic evaluation procedure
8-19	Mr. Yuan Feng	U. of Nebraska	Jongwan Eun	Effect of gas collection system with LLDPE or EVOH GM covers on landfill gas emission
9-19	Mr. Amin Rafiei	N. Carolina State U.	Mo Gabr	Evaluation of residual pore water pressure and deformation of seabed beneath GT sand containers due to nonlinear waves: a coupled hydro mechanical finite element analysis
10-19	Mr. Ridvan Doger	U. of Oklahoma	Kianoosh Hatami	Influence of facing on structural performance and economics of GRS bridge abutments
11-19	Mr. Sudheer Prabhu	Penn State U.	Tong Qiu	Laboratory investigation on the benefits of GS in flexible pavement retrofit
12-19	Ms. Janelle Skaden	U. of Rhode Island	Christopher Baxter	Long term monitoring of a GSC-reinforced dunes in Montauk, NY
13-19	Mr. Wolfgang Lieske	RUB University Germany	Habil Wichtmann	A systematic approach to apply theoretical models for composition of anionic modified GCLs with focus on formulation and long term stability
14-19	Mr. Jan Derksen	RWTH Aachen Germany	Martin Ziegler	Investigations on indirect GG activation in transparent soil on a micro scale
15-19	Mr. Kazi Moimul Islam	U. of South Carolina	Juan Caicedo	Evaluations of GS reinforcement over flexible pavements using finite element modeling
16-19	Ms. Nuzhath Fatema	Syracuse U.	Shobha Bhatia	Addition of synthetic fibers in minimizing the flow behavior of dewatered fly ash slurries
17-19	Ms. Shihui Liu	Tennessee State U.	Lin Li	Investigation of nonwoven GTs for molds used in preparation of MICP-treated geomaterials
18-19	Ms. Fengjuan Tao	Tongji U. China	Zhen Zhang	Subgrade settlement of GS reinforced column (GRCS) embankments subjected to surface wheel 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 training and documentation for specific standard ASTM or ISO test methods. In addition, GAI-LAP verifies that an effective quality system exists at accredited laboratories by way of proficiency testing.

There have been significant additions to the number of GAI-LAP tests. Presently, there are 257 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of September, 2019, 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 (108 tests)
George Koerner -- (610) 522-8440
gsigeokoerner@gmail.com

8[B] - Propex Operating Co., Ringgold (17 tests)
Todd Nichols -- 438-553-3757
todd.nichols@propexglobal.com

9[B] - Lumite (17 tests)
Rebecca Kurek -- (770) 869-1187
rkurek@lumiteco.com

13[A] - Precision Geosynthetic Labs (TRI Env.) (87 tests)
Cora Queja -- (714) 520-9631
cqueja@tri-env.com

14[A] - Geotechnics (50 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)
Minerals Technologies Inc.
Barbara Gebka – (847) 851-1904
Barbara.gebka@mineralstech.com

24[B] - CETCO Lovell (10 tests)
Minerals Technologies Inc.
Stuart Yates -- (307) 548-6521
stuart.yates@mineralstech.com

25[B] - Ten Cate, Pendergrass (13 tests)
Darrell Scoggins -- (706) 693-2226
d.scoggins@tencategeo.com

26[B] - Agru America Inc. (27 tests)
Maria Coffey -- (843) 546-0600
mcoffey@AgruAmerica.com

29[e] - FITI Testing and Research Institute (80 tests)
Dong Whan Kim -- 82-2-3299-8071
dwKim@fitiglobal.com

31[D] - NYS Dept. of Transportation (9 tests)
Tom Burnett -- (518) 485-5707
tburnett@dot.ny.gov

34[B] - SOLMAX - Houston, TX USA (29 tests)
Lana Hickman
Lhickman@solmax.com

38[C] - CTT Group SAGEOS (123 tests)
Jacek Mlynarek -- (450) 771-4608
jmlynarek@gcttg.com

40[B] - SOLMAX - Kingstree, SC USA (14 tests)
Thomas Harrelson -- (843) 382-4603
tharrelson@solmax.com

41[A] - SGI Testing Service, LLC (18 tests)
Zehong Yuan -- (770) 931-8222
ZYuan@sgilab.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 DeStefano -- (407) 855-3860
gdestafano@ardaman.com

44[B] - Fiberweb, a Berry Global Inc. Co. (9 tests)
Devin Clem -- (615) 847-7299
devinclem@berryglobal.com

45[B] - Ten Cate Geosynthetics Malaysia SDN Bhd. (24 tests)
Boon Kean Tan -- (603) 519 28576
BK.tan@tencase.com

46[B] - TAG Environmental Inc. (13 tests)
Ryan Ackerman -- (705) 725-1938
ryan_ackerman@tagenv.com

49[B] - Engepol Geossinteticos (15 tests)
Patricia Ferreira -- (55) 51 3303-3901
patricia@engepol.com

50[B] - ADS, Inc. Hamilton (7 tests)
Justin Elder -- (513) 896-2065
justin.elder@ads-pipe.com

51[B] - SOLMAX - Canada (22 tests)
Claude Cormier -- (450) 929-1234
ccormier@solmax.com

53[B] - Polytex Autofagasta (19 tests)
Mario Contreras Cardenas -- 011 55-288-3308
mcontreras@polytex.cl

55[B] - Atarfil Geomembranes (21 tests)
Gabriel Martin Sevilla -- 34 958 439 200
gmartin@atarfil.com

56[B] - Polytex Santiago (13 tests)
Luedy Utria Caicedo -- 011 56-2-677-1000
Lutria@polytex.cl

57[B] - Ten Cate Cornelia (22 tests)
Melissa Medlin -- (706) 778-9794
m.medlin@tencategeo.com

58[B] - Propex Furnishing Solutions - Hazelhurst (10 tests)
Victoria Shoupe -- (912) 375-6180
Victoria.Schoupe@propexglobal.com

59[B] - Firestone (9 Tests)
Janie Simpson -- (864) 439-5641
SimpsonJanie@firestonebp.com

60[B] - TDM Geosintéticos S.A. (17 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 - Selangor - Malaysia (14 tests)
Pei Ching Teoh -- (450) 929-1234
pcteoh@solmax.com

63[A] - TRI-SC Labs (11 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) (21 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] - Shawmut Corporation (4 tests)
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69[B] - SOLMAX - Rayong - Thailand (13 tests)
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70[A] - RSA Geo Lab LLC (48 tests)
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71[B] - Plasticos Agricolas y Geomembranas S.A.C. (24 tests)
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72[B] - Tensar Corp. GA (5 tests)
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lcassidy@tensarcorp.com

73[B] - Gai Loi JSE (10 tests)
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74[B] - Agru America Inc. (9 tests)
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75[B] - GeoMatrix S.A.S. (37 tests)
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76[B] - Tehmco (Chile) (15 tests)
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78[B] - PQA Mexico (15 tests)
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79[A] - TRI Geosynthetic Testing and Services (32 tests)
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80[B] - Texel Technical Materials (11 tests)
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81[B] - SOLMAX - Rechlin - Germany (18 tests)
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83[B] - SOLMAX - 6th of October City - Egypt (13 tests)
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90[B] - Techfab (India) Industries Ltd. - Daman (10 tests)
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92[B] - Techfab (India) Industries Ltd. - Khadoli (2 tests)
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93[B] - Garware Technical FIbres (18 tests)
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95[B] - Mexichem Colombia (Pavco) (8 tests)
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96[B] - Tensar China (6 tests)
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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/gai/intro.pdf.

The next GAI-LAP annual meeting will be held on February 5th, 2020 in conjunction with ASTM D-35 in Atlanta, GA. 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 began 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 superior or 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. It is renewable if so desired.

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

This program, now in its thirteenth 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 gradually revised attesting to the changes occurring over the past years. For example, geospacers are now included with geonets and drainage composites. This program, by far, is the most successful of the three GSI certification programs.

Inspector Certification Test Results
2006 – 2019

Year	Geosynthetic Materials		Compacted Clay Liners		Commentary
	No. of people taking exam	No. of people failing exam	No. of people taking exam	No. of people failing exam	No. of people failing both exams
2006	141	5 (3%)	128	12 (9%)	2
2007	82	11 (13%)	73	12 (16%)	7
2008	95	25 (26%)	89	20 (22%)	13
2009	36	7 (19%)	36	2 (5%)	2
2010	59	12 (20%)	54	7 (13%)	5
2011	54	6 (11%)	53	3 (6%)	1
2012	34	5 (15%)	28	3 (11%)	3
2013	32	4 (12%)	30	1 (3%)	1
2014	45	1 (3%)	42	3 (7%)	0
2015	56	6 (11%)	51	6 (12%)	1
2016	36	3 (10%)	35	5 (18%)	0
2017	78	5 (6%)	66	3 (4%)	1
2018	53	5 (10%)	51	1 (3%)	0
2019	86	17 (21%)	87	11(14%)	9
TOTAL (to date)	**887**	**112 (13%)**	**823**	**89 (11%)**	**45 (5%)**

There are currently 386 practicing certified inspectors, 309 inspectors (2015-2019) and 77 inspectors (2006-2014) who have renewed to keep their certifications current, i.e., we are not getting many renewals. Renewals represent 20%. Incidentally, the next on-line course is December 3-4-5, 2019.

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. 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. The live on-line course has not been scheduled, however, recordings are available. Contact Jamie Koerner at jrkoerner@verizon.net for details and arrangements.

The status of the program is shown in the following table. Here it can be seen that this particular GSI certification has not been successful even though we have 340 similar MSE wall failures (recall Item #5 in the research section on page 2).

Inspector Certification Test Results for
MSE Walls and Berms Inspectors
(2011-2018)

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
2017-19	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".

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 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 a 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.

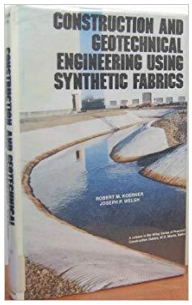
GSI-India under the new direction of Dr. A. K. Mukhopadhyay (who succeeds Dr. A. N. Desai) was formed in 2015. The hosting organization is the Bombay Textile Research Association (BTRA) which is world known for its excellence in textile R & D and is currently branching out into all forms of geosynthetics. 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.

A Forty-Year Anniversary for the First Hard-Bound Book on Geosynthetics

In the late 1970's I was in the habit of regularly inviting speakers to make presentations to my geotechnical engineering classes at Drexel University. Two of them were very memorable; Bill Ragen of Mirafi and Bill Witherow of Carlisle. Their respective topics were "filter fabrics" and "pond liners" and in truth I didn't associate them with one another within the modern context of geosynthetics that we do today. Shortly after their presentations and following several small consulting projects, two other events occurred which were meaningful. One was the 1977 conference in Paris, France, entitled "International Conference on the Use of Fabrics in Geotechnics," and the other was a chance meeting between an editor of the John Wiley Book Company (by name of Dan Morris) and a good friend, Joe Welsh of the ground modification firm of Hayward

Baker Co. Dan, who had read the proceedings of the Paris conference, suggested to Joe that he write a book on construction fabrics and Joe, being too busy, suggested that he and I do it together. It was interesting to me from the perspective that this was a new field and that it would result in a *hard-bound book*. This was important to me in that throughout my formal education all school books that we used were hard-bound. This continued throughout my university years at Drexel, Columbia, Delaware and Duke. There simply were no (respectful!) soft-bound books used at that time. When soft-bound books and paper-backed conference proceedings began to appear, my thoughts (and perhaps others) was that they were not quite "finalized". Many were published by university print departments and updated regularly. As an example, all soils laboratory books fell into this category until Lambe's hard-bound book eventually settled the issue. In general, a hard-bound book was felt to be archival and belonged permanently on one's bookshelf.

At any rate, my initial thought regarding the possibility of a new hard-bound book was that the information base was certainly sparse, but upon further reflection (remember the "publish or perish" concept was deeply entrenched in all of academia, including Drexel University) I started gathering all available publications and manufacturers literature and formed a table of contents. While the focus was indeed "fabrics", certain impermeable fabrics (aka, pond liners and inflatable tents) were also considered. As such, the book was written between 1978 and 1979 and published as a 267-page hard-bound book in 1980 by J. Wiley and Sons, Inc., under the title "Construction and Geotechnical Engineering Using Synthetic Fabrics". The individual chapters were as follows:



1. Overview and Background of Synthetic Fibers
2. Construction Fabrics
3. Fabric Use in Separation of Materials
4. Fabric Use in Reinforcement
5. Fabric Use in Drainage
6. Fabric Use in Erosion Prevention
7. Fabric Use as Forms
8. Impermeable Fabrics
9. Guidelines and Current Research and Development Activities
10. Several Appendices and a "units" conversion table.

There were a few numerical examples, but it was far from a complete textbook in that there were no homework problems and the references were obviously lean at this early stage of the technology.

We (myself and Joe Welsh) were delighted with the book's initial reception in that its sales were good and more importantly, my phone "never stopped ringing". Clearly, my subsequent decision to go completely into this newly emerging field was very obvious and with an interest level well beyond all other research activities that I had at the time, e.g., deep foundations, particulate behavior, acoustic emissions, ground-penetrating radar, etc. The one cloud that arose, however, was a review by Dr. Alan Haliburton of Oklahoma State University who reviewed the book with the ending comment that it was "too much salad and not enough meat and potatoes". For those of you who remember Alan, you can somewhat understand the context of his comment. What it did for me, however, was to propel me onward to a "meat and potatoes" book which emerged six-years later as the first edition of "Designing With Geosynthetics" published in 1986. Subsequent editions have been in 1990, 1994, 1998, 2005 and 2012.

Sometime after the publication of this first book in 1980, I learned from England's Peter Rankilor that our "Construction Fabrics" book was very close to not having been the first hard-bound geosynthetics book. It seems that he had submitted his own manuscript to the Wiley Book Company in London about the same time as we submitted ours to the Wiley Book Company in New York. Of course, neither London nor New York knew of the overlap of the two respective book topics and, more importantly, Wiley in London lost all of Rankilor's artwork, photographs, and drawings forcing him to do everything all over again. (Remember these were the days before computers and an all-electronic publication system.) The delay caused him at least a year which resulted in his book appearing a year later than ours in 1981. Somewhat more disconcerting was to learn from Georg Heerten of NAUE that he had studied under Prof. Zitscher at Hanover University who had written a book in 1971 titled "Kunststoffe für den Wasserbau" (Plastic Materials in Hydraulic Engineering). Had I known about it, our original book would have been much more detailed and authoritative.

At any rate, the Koerner/Welsh hard-bound book of 1980 certainly put me on the map and (fortunately) I never looked back. All subsequent research at Drexel University, along with courses, students, projects, etc., was focused on geosynthetics and it has not stopped to this day, but now within the context of the Geosynthetic Institute. Geosynthetics is a marvelous field of endeavor and a technology which has had, and will continue to have, an awesome growth and benefit to society. I am delighted to have been a part of this growth and hope to continue for as long as possible.

Bob 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 are (i) SKAPS Industries with Nilay Patel**

and Anurag Shah, (ii) Chesapeake Containment Systems (CCS) with Steven Mayes, (iii) Duke Energy with Evan Andrews and Ken Karably and (iv) Layfield Group with Deepaksh Gulatias and Mark Simpson as the main contact persons. Thanks to all and welcome to GSI!!!

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Golder Associates Inc.
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Tensar International Corporation
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Kevin Pavlik/Richard DePasquale
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IN THE NEXT ISSUE

- Activities of the GSI Directors and Board
- Overview of GRI (Research) Projects
- Activities within GII (Information)
- Progress within GEI (Education)
- Activities within GAI (Accreditation)
- Activities within GCI (Certification)
- The GSI Affiliate Institutes
- The GSI Centers-of-Excellence
- Changing the 1 in 500 ft. Paradigm on Geomembranes Field Sampling
- GSI's Member Organizations