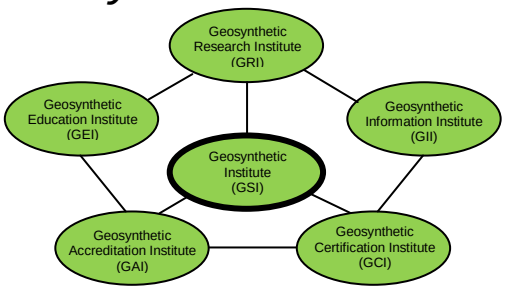
The GSI Newsletter/Report

Geosynthetic Institute



Vol. 29, No. 4 **December, 2015**

This quarterly newsletter, now in its 29th 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 gkoerner@dca.net or mvashley@verizon.net.

Happy Holidays and a Healthy and Prosperous New Year

Activities of GSI's Directors and Officers

1. GSI Board of Directors voting is now in progress for the owner/operator, geotextile/geogrid, and at-large members.
2. The multichaptered Geotextile Book (27 chapters) is at the publication stage and should be available in January, 2016. The publisher is Woodhead a Division of Elsevier Publications headquartered in The Netherlands.
3. Webinars continue to be strong with one having 32 sites and another taken in Taiwan. The latter had Prof. Hsieh and his students listening at midnight!
4. The GeoAmericas Conference in Miami, Florida in April, 2016 looks to be a major event for GSI and includes 1 course, 1 keynote, 4 papers, annual meeting and BoD meeting. Details will be provided as we get closer!
5. "GSI-India and BTRA-ASTM International jointly organized a programme on 'Testing, Standards and Applications of Geosynthetics' on 2nd December 2015. The next day there was a meeting of ASTM D-35 on Geosynthetics at BTRA, wherein issues concerning ASTM standards of testing geosynthetics was discussed. Many issues were expressed by Indian stakeholders. During this two day event, stalls from manufacturers to exhibit their products were put up outdoors. Contact Dr. A. N. Desai at btra@vsnl.com for details of the seminar and see the more detailed writeup in the information section of this Newsletter/Report.
6. The nine person GSI Board of Directors is presently as follows:

Term Ends 2015

- 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 2016

- A. N. Desai – BTRA & GSI-India (Agencies)
  e-mail: btra@vsnl.com
- Edgard Chow – Kuraray (Resin Producers)
  e-mail: edgard.chow@kuraray.com
- Kent von Maubeuge - NAUE GmbH & Co. KG (International-1)
  e-mail: kvmaubeuge@naue.com

IN THIS ISSUE

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

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 (gkoerner@dca.net), 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 17th-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. **Flow Behavior of Innovative Leachate Collection and Removal Systems (LCRS's)** – Several new geocomposite drainage systems are being compared to traditional geonet composites. The project is in its second year and will be a multi-year effort. It is likely that a Standard Guide will be developed on this topic.
3. **Flow Behavior of Fully Degraded Waste*** - This is a field project on investigating the drainage of highly degraded MSW placed directly on leachate collection systems. The leachate collection materials consist of both natural soils and geosynthetic drains. The experimental setup has been dismantled and a second paper was presented by George Koerner in Berlin at the 10th IGS Conference. A very recent draft White Paper was sent to members and was "shot down" immediately. That said, we do indeed listen to our membership!
4. **GT Flow Behavior of CCR Materials -** This new laboratory project examines the behavior of four geotextile filters to fly ash, bottom ash, coal desulphurization material and a well graded sand for control. George Koerner is handling the project.
5. **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 two different geogrid's behavior over time. A 50-year time frame is envisioned! The long-term behavior will eventually be compared to UV laboratory exposed data as noted in Item #9 below.
6. **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.). Some of the products have exposure times of 70,000 light hours at 70°C and a replicate set of samples are being incubated at 60°C. Some will take at least 90,000 light hours (~ 12.3 years). The third sequence at 80°C was started on 1/1/2010. They, of course, degrade much faster and are complete. GRI Report #44 is available on results to date and a webinar is available. The information will be made available to the public in April 2016 and will be the topic of our Keynote Lecture. (In this regard it should be noted that we have withheld the information for well over a year which has been our custom.)
7. **HDPE Geomembrane Lifetime as a Function of Thickness** - This often encountered question is being evaluated by exposure at 80°C in a QUV weathering device per ASTM D7238. Formulations are exactly the same and only the sample thicknesses vary. These thicknesses are 2.76, 2.44, 1.58, 1.08, 0.77 and 0.48 mm. Parameters being evaluated in this decade long study are change in thickness and presence of crazing or cracking. Time will tell!
8. **Laboratory Exposed Lifetime of PVC (European) Geomembranes** - Of late, we have been attempting to distinguish between PVC geomembranes manufactured in North America versus Europe. Of course, the differences are in the type of plasticizers used in the formulations as well as thickness. In this regard 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.
9. **Laboratory Exposed Lifetime of Geogrids** - The UV-fluorescent exposure of two different polypropylene biaxial geogrids which are used at the exposed faces of welded wire mesh MSE structures is ongoing. The various geogrids

were incubated at 80, 70 and 60°C until halflife was achieved for strength and elongation. Laboratory lifetime predictions at 20°C as well as field predictions for Phoenix, Arizona are provided in GRI Report #44.

10. **Laboratory Exposed Lifetime of TRM Filaments** - We are also using UV-fluorescent exposure of four different turf reinforcement mat filaments to assess their lifetime capabilities. They have been incubated at 60°C, 70°C and 80°C. A final report to the manufacturer (Propex) has been submitted.
11. **Laboratory Exposed Lifetime of Geotextiles** - A similar UV study as with geomembranes (Items 6, 7 and 8), geogrids (Item 9) and TRM filaments (Item 10) 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 and laboratory and field lifetime predictions are included in GRI Report #44.
12. **Laboratory Exposed Geotextile Yarns** - A new effort on behalf of a member organization (TenCate) is evaluating polypropylene yarns with and without long-term antioxidants. It will be interesting to observe differences in behavior insofar as long-term strength and elongation. As with all of our long-term exposure research, incubation is using UV-fluorescent devices per ASTM D7238.
13. **Retaining Wall Failure Evaluations* -** We presently have GRI Reports 38, 39, and 40 addressing mechanical stabilized earth (MSE) walls using geosynthetic reinforcement which document 82-failures. Our data base has now grown to 141, then 171, and now 273! *Readers, we have a very serious situation in this regard!* The failures are either excessive deformation or collapses. We have presented one-day courses on this topic along with inspector training and development insofar as a field inspectors certification program; see the certification section of this Newsletter/Report. We have just recently presented the findings at two geotechnical conferences; one in Williamsburg and the other in Hershey. A paper was published by the Journal of Geotextiles and Geomembranes in October, 2013 and the publisher (Elsevier) reports that 900 requests have been made to date. It was voted as being the best paper of 2013 by the journal. This will be the topic of a GSI course presented at GeoAmericas in April, 2006.
14. **pH Between Masonry Block Wall Units*** - George Koerner has been measuring the pH between three types of masonry blocks for over six years to monitor the values. Concern here is over PET geogrids which are known to be sensitive to very high alkalinity environments. Indeed, the values started high, but over time are now down to eight and lower. George has a paper in this regard.
15. **Landfill Failure Analysis** - Since our originally reported paper on ten landfill failures in a 2000 publication, we have accumulated ten more. All 20-failures have been analyzed using the ReSSA Code and are now available to members and associate members as GRI Report #41. The latest failure in this regard is in Easton, Pennsylvania. It is presently in litigation.
16. **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 reasonable for most geomembrane types, it is very fast for HDPE which is semi-crystalline and cannot readily stress relax. 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 about five years to conclude. A preliminary paper was presented at Geosynthetics '15 in Portland.
17. **Shrinkage of GCLs Under Wet/Dry Cycling** - George Koerner has been evaluating shrinkage of various GCLs in boxes on the overhead roof of GSI. The study is on behalf of CETCO and will be presented at GeoAmericas in April, 2016.
18. **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.
19. **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:

<u>Completed and Available on our Website</u>
GM13 – HDPE Geomembranes
GM17 – LLDPE Geomembranes
GM18 – fPP and fPP-R Geomembranes
GM21 – EPDM and EPDM-R Geomembranes
GM22 – Exposed Temporary Covers
GM25 – LLDPE-R Geomembranes
GM19 – Geomembrane Seams
GM28 – CSPE-R Geomembranes
GT10 – Geotextile Tubes
GT12 – Geotextile Cushions
GT13 – Geotextile Separators
GCL3 – Geosynthetic Clay Liners
GC14 – Turf Reinforcement Mats
GS15 – Geocells

Working; Available Upon Request
GTXX – Coated Tape Barriers (active)
GGXX – Bidirectional Geogrids (active)
GGXX – Unidirectional Geogrids (active)
GNXX – Geonet Drainage Composites (active)

Delayed; Available Upon Request
GCXX – Other Drainage Geocomposites
GSXX – Polymeric Marine Mattresses (tabled)
GSXX – High Strength Reinforcement Geotextiles

The complete set of formalized specifications are available to everyone (members and nonmembers) on the open section of our Home Page. Please download and use them accordingly. There is a brief tutorial accompanying each specification. Also note that this is where the latest modification will always be available. Of note is that GRI-GM13 for HDPE geomembranes has been upgraded for both stress crack resistance and asperity height.

20. **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 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's quite easy to use provided that you have a specific topic, or area, in mind. This is the section of the website that we (and others we are told) use the most in our 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. If you have topics in need of the current status please advise accordingly.

Regarding Item #5 in the Activities Section, it is important to note that ASTM International Committee D35 on Geosynthetics had its geosynthetics seminar in Mumbia, India on December 2nd, 2015 at the Bombay Textile Research Association (BTRA) headquarters. A one day programme on "Testing, Standard and Application of geosynthetics" was organized at BTRA under the aegis of GSI India and BTRA-ASTM International.

The seminar was well attended which is no surprise because India is one of the world's fastest growing economies. It is also home to many infrastructure projects and has a huge textile industry. Like all emerging markets, there are standardization needs. This sentiment has been promoted by multiple organizations, including the Federation of Indian Chambers of Commerce and Industry (FICCI) and the International Geosynthetic Society (IGS).

Speakers and delegates from various geosynthetic backgrounds attended the seminar. The program began with welcome speech and introduction by Dr. A. N. Desai, Director of BTRA India. Dr. Desai also gave information about the infrastructure and facilities available at BTRA for a complete solution of geosynthetic and related materials testing, i.e., geosynthetic polymer testing, soil testing and asphalt testing. The following topics relating to geosynthetics were presented and discussed in the programme.

- 'Introduction of ASTM International' by Mr. Len Morrissey, ASTM International.

- 'Geosynthetic barriers and ASTM Standards' by Mr. Bob Mackey, S2Li, presented by Mr. Sam Allen.
- 'Geosynthetic reinforcement and ASTM standards' by Mr. Michael Bernardi, Strata.
- 'Use of geogrids and geocells for stability of cover systems on steep slopes of MSW landfills' by Prof. Manoj Datta, IIT Delhi, India.
- 'Application of geocells in Indian roads: a laboratory and field perspective' by Prof. Sireesh Saride, IIT Hyderabad.
- 'Geosynthetic drains/filters and ASTM standards' by Mr. Sam Allen, TRI/GTSPL.
- 'ASTM standards for erosion control products and sediment retention devices' by Mr. Joel Sprague, TRI.

BTRA was an excellent host for this ASTM seminar. The association has a long history of research and interaction with polymeric materials engineering. The conference was informative and involved considerable networking. Attendees were particularly impressed with the discussion after the presentations and the free flow of ideas about major projects going forward.

Dr. A. N. Desai delivering Welcome Address during the Inaugural function on 2nd Dec. 2015


Group photos of delegates attending the seminar

Progress within GEI (Education)

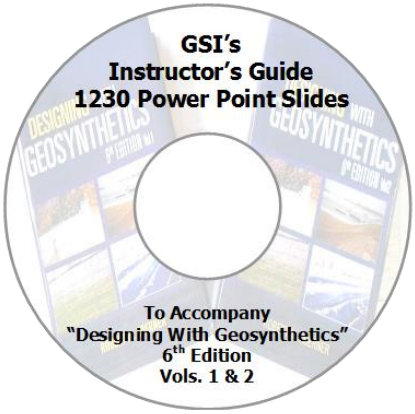
Free CD

We sent a broadcast e-mail to everyone stating that many power point presentations were available and would be sent upon request. Many persons replied asking for all of them. Therefore, we put all 63 presentations on a CD which was sent to all GSI contact persons. That said, we have copies still available so do ask and we will mail it to you immediately. Topic areas are all types of geosynthetics, plus walls/slopes, landfills, specifications, and miscellaneous.

6th Edition of Designing With Geosynthetics

The 6th Edition of Designing With Geosynthetics continues to sell well in all three of its formats; hardback, softback and e-book… the latter is really cheap; i.e., $3.50 for each volume! The two volume set can be purchased through GSI, Xlibris, Amazon and Barnes and Noble. A special link is available on the cover page of our website. All proceeds go to GSI.

Additionally, we have developed a power point presentation for the entire 914-page book. This is what it looks like and it does indeed contain 1230 nonencrypted ppt slides. Call or e-mail if you want a copy. It is free to all, but we need your postal address.



GRI Reports

To date, we have 44 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:

- #44 - Exposed Lifetime Predictions of 19-Different Geosynthetics in the Laboratory and in Phoenix, Arizona

Courses

Due to lack of attendance for day-long courses at GSI we have not scheduled further in-house dates. That said, our two certification courses are available on-line via a series of six, ninety-minute, interconnected webinars. Contact Jamie Koerner at jrkoerner@verizon.net if you want information and details.

GSI Webinars (90 minutes long)

(Second Wednesday of Every Month)
11:30 AM – 1:00 PM (Eastern Time Zone)
Registration at
www.geosynthetic-institute.org/webinar.htm
1.5 Professional Development Hours
Nonmembers Cost - $250; Members Cost - $200

Commentary on Webinars: Never in Bob K's long career has he "reached out" to so many people than when giving these GSI and ASCE webinars. For the single cost of $250 or $200 a feed is delivered over Adobe Connect to the requested site. This can be anywhere, e.g., office, conference room, auditorium or even sent to additional offices and sites. For example, NY-DEC had the feed going into their Albany auditorium and then into the 13-regions of New York State. Clearly, hundreds of participants were involved. For one ASCE webinar there were 62-sites! We are now abandoning our in-house, one-day, courses (which have been given for the past 30-years) and delivering them in six segments over three days each morning and afternoon. *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!*

GSI Fellowships

A major change over previous years has been quite successful this year. We now offer fellowships for masters and doctoral students, and the stipend is $5000 for a single year, rather than three multiple years. This change resulted in 22-proposals which were reviewed and graded by the GSI-BoD and ourselves. Twelve were accepted and are listed below. If a specific proposal is of interest please contact Jamie Koerner at jrkoerner@verizon.net.

	Name	School	Advisor	Topic
1	Beauragar, Melissa	University of Colorado	Jonathan Wu	Protocol for Selecting Wall Facing for GS Reinforced Structures
2	Bester, Karl James	University of Cape Town	Kelvin Legge	Test Methods for GT Filters used in Waterway Engineering
3	Bredacs, Marton	Montan University	Gerald Pinter	Aging Mechanisms and LT Assessment of PE Tunnel Liner
4	Gutierrez, Angel	Arizona State University	Edward Kavazanjian	Evaluation of GM Seam Strain Concentration Factors
5	Huang, Muji	NPUST	Wayne Hsieh	RECP Soil Protection Properties due to Variables in Channel Flow
6	Huang, Grace	Virginia Tech	George Filz	GS Contribution to Stability of Column- Supported Embankments
7	Javadi, Sadra	University of Louisville	Qian Zhao	Advection and Sorption of Organic Containment in GCL with Organobentonite
8	Jiang, Yan	University of Kansas	Jie Han	Evaluating Performance of Hybrid GRE Walls
9	Kiffle, Zeru	Syracuse University	Shobha Bhatia	Finite Element Model of GT Tubes Stacking in Dewatering Projects
10	Sievering, Roland	RWTH Aachen University	Martin Ziegler	Interaction Modeling in Finite Element Simulation of GG Reinforced Soil
11	Xu, Lei	Columbia University	Hoe Ling	Centrifuge modeling of wire mesh facing GS reinforced Soil Retaining Wall
12	Zadeh, Shahin Ghazi	Colorado State	Chris Bareither	Evaluation of Long Term Internal Shear of GCLs in Mining Applications

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 the GSI lab does not conduct outside commercial testing.*

It should also be made clear that GAI-LAP does not profess to offer ISO certification, nor does it "certify" laboratory results. GAI-LAP provides accreditation to laboratories showing compliance with equipment and documentation for specific standard ASTM, ISO or GRI test methods. In addition, GAI-LAP verifies that an effective quality system exists at accredited laboratories by way of proficiency testing.

There have been significant additions to the number of GAI-LAP tests. Presently, there are 245 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of December, 2015, 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. (135 tests)
Jarrett Nalson -- (512) 263-2101
Sallen@tri-env.com

3^A - Golder Associates (45 tests)
Henry Mock -- (770) 492-8280
dalexander@golder.com

4^C - Geosynthetic Institute (116 tests)
George Koerner -- (610) 522-8440

gkoerner@dca.net

8[B] - Propex Operating Co., Ringgold (18 tests)
Todd Nichols -- (800) 258-3121
todd.nichols@propexglobal.com

9[B] - Lumite (16 tests)
Rebecca Kurek -- (770) 869-1700
rpage@lumiteco.com

13[A] - TRI Env. Inc. (Precision Labs) (97 tests)
Cora Queja -- (714) 520-9631
cqueja@tri-env.com

14[A] - Geotechnics (49 tests)
J. P. Kline -- (412) 823-7600
JPkline@geotechnics.net

20[A] - GeoTesting Express, MA (47 tests)
Gary Torosian -- (978) 635-0424
gtt@geotesting.com

22[B] - CETCO Hoffman Estates (13 tests)
Barbara Gebka – (847) 851-1500
mailto:b.gebka@cetco.com

24[B] - CETCO Lovell (10 tests)
Roger Wilkerson -- (307) 548-6521
roger.wilkerson@cetco.com

25[B] - Ten Cate, Pendergrass (12 tests)
Beth Wilbanks -- (706) 693-2226
b.wilbanks@tencate.com

26[B] - Agru America Inc. (20 tests)
Maria Coffey -- (843) 546-0600
mc@agruamerica.com

29[e] - FITI Testing and Research Institute (68 tests)
Hong-Kwan Kim -- 82-2-3299-8071
hoganKim@fiti.re.kr

31[D] - NYS Dept. of Transportation (9 tests)
Tom Burnett -- (518) 457-4704
tburnett@dot.state.ny.us

32[A] - Geo-Logic Inc. (6 tests)
Ken Criley -- (530) 272-2448
criley@geologic.com

34[B] - GSE Environmental Richey Road (36 tests)
Mauricio Ossa -- (281) 230-6890
Mossa@gseworld.com

37[B] - GSE Environmental Chile (19 tests)
Mario Contreras -- 56-2 6010153
Mcontreras@gseworld.com

38[C] - Sageos/CTT Group (103 tests)
Eric Blond -- (450) 771-4608
eblond@GCTTG.com

40[B] - GSE Environmental (14 tests)
Bruce Pressley -- (843) 382-4603
bpressley@gseworld.com

41[A] - SGI Testing Service, LLC (19 tests)
Zehong Yuan -- (770) 931-8222
ZYuan@interactionspecialists.com

42[C] - NPUST (GSI-Taiwan) (71 tests)
Chiwan Wayne Hsieh -- 011-886-8-7740468
CWH@mail.npust.edu.tw

43[A] - Ardaman & Associates (22 tests)
George DeStafano -- (407) 855-3860
gdestafano@ardaman.com

44[B] - PGI and Fiber Web, Inc. (9 tests)
L. Mitchell Glendewin -- (615) 847-7155
Mitchell.Glendewin@avintiv.com

45[B] - Ten Cate Geosynthetics Malaysia SDN Bhd. (23 tests)
B. K. 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 (14 tests)
Carolina Polomino -- (55) 51 3303-3916
carolina@engepol.com

50[B] - ADS, Inc. Hamilton (7 tests)
Terry McElfresh -- (513) 896-2065
terry.mcelfresh@ads-pipe.com

51[B] - Solmax International Inc. (22 tests)
Simon Gilbert St. Pierre -- (450) 929-1234
simonGSP@solmax.com

53[B] - Polytex Autofagasta (19 tests)
Ximena Parra Pizarro -- 011 56 57 42 90 00
XPanna@polytex.cl

55[B] - Atarfil Geomembranes (19 tests)
Gabriel Martin Sevilla -- 34 958 439 200
gmartin@atarfil.com

56[B] - Polytex Santiago (13 tests)
Marta Tenorio F. Jeff -- 011 56-2-627-2054
MTenorio@polytex.cl

57[B] - Ten Cate Cornelia (13 tests)
Melissa Medlin -- (706) 778-9794
m.medlin@tencate.com

58[B] - Propex Operating Co.Hazelhurst (16 tests)
Ron (Jeff) Bercher -- (229) 686-5511
Ronald.Bercher@propexglobal.com

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

60[B] - Polytex Lima (12 tests)
Elias Jurufe -- 51 16169393
Ejarufe@polytex.cl

61[B] - Raven Industries (17 tests)
Clint Boerhave -- (605) 335-0288
Clint.Boerhave@ravenind.com

62[B] - Solmax International Asia (14 tests)
Teoh Pei Ching – (450) 929-1234
pcteoh@solmax.com

63[A] - TRI Environmental, Inc.; DDRF (5 tests)
Joel Sprague -- (864) 242-2220
JSprague@tri-env.com

64[B] - Agru America (NV) (14 tests)
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65[C] - Bombay Textile Rsearch Assoc. (BTRA) (24 tests)
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66[B] - Rowad International Geosynthetics Co. Ltd (14 tests)
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68[B] - Glen Raven Technical Fabrics LLC (4 tests)
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69[B] - GSE Environmental (12 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. (15 tests)
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72[B] - Tensar Corp. GA (5 tests)
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73[B] - Gai Loi JSE (9 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 (Accreditation).

George R. Koerner

Activities within GCI (Certification)

GSI presently has two 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 other (begun in 2011) is focused on MSE Wall, Berm and Slope field inspection. See our website at www.geosynthetic-institute.org under "certification" for a description and information on both of them. They are both 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 CQA activities with either geosynthetic liner or cover systems or MSE walls, berms, or slopes using geosynthetic reinforcement.
- Submit a completed application and be approved by the Geosynthetic Certification Institute to take the exam.
- Must successfully pass a written examination (70% of the questions is the passing grade) proctored by GCI or a GCI designated organization and graded by the Geosynthetic Certification Institute to become a certified inspector.
- Must pay a one-time fee which covers a five-year period upon completion of the above items. The fee is $500 for five-years of certification.

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

This program now in its eighth year has been recommended, and in some cases required, by solid waste owners, state regulators, and design consultants for proper QCA in field installation of both geosynthetic materials and compacted clay liners. The statistics to date are as follows.

Inspector Certification Test Results
2006 – 2015

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%)
TOTAL (to date)	**634**	**82 (13%)**	**584**	**69 (12%)**

The 5-year renewal period 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 instruct 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. Next year, the corresponding course for this certification program will now be transferred into a series of six-90 minute on-line webinars. 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
MSE Walls and Berms
(2011-2015)

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
TOTAL		**22**	**0**

The on-line courses for preparation of both 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.

The GSI Affiliated Institutes

It has long been realized that the information generated within the GSI group should have a timely outlet to all countries, and in all languages. To this end, GSI has created affiliated institutes in two countries (Korea and Taiwan), and potentially others in the future. These affiliated institutes are full members of GSI and are empowered to translate and use all available information so as to create similar institutes and activities in their respective countries.

GSI-Korea was formed on February 9, 1998 as a collaborative effort between FITI Testing and Research Institute (a quasi-government organization) and INHA University (through its Geosynthetics Research Laboratory). 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 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 direction of Dr. A. N. Desai has just been formed. 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. Desai has just been elected to GSI's Board of Directors. (See associated writeup on the "Global Geosynthetics Summit" in the December, 2014 Newsletter/ Report).

Items of Interest

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

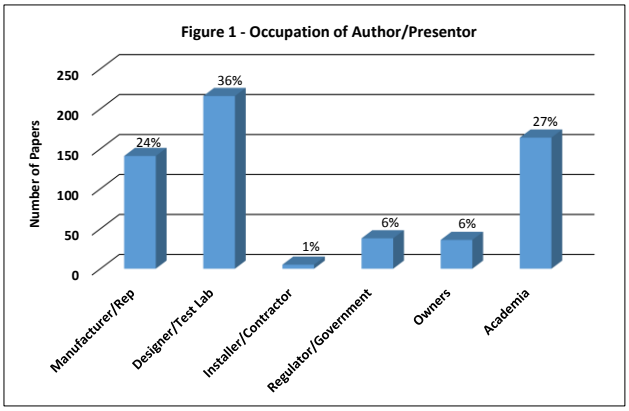
Retrospective of Twenty-Five GRI Conferences

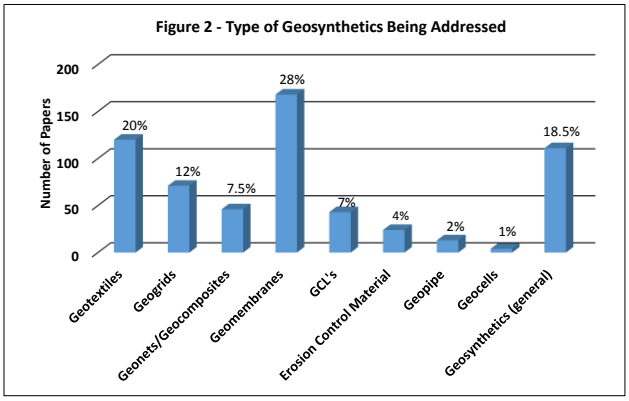
The Geosynthetic Research Institute was founded in 1986 at Drexel University in Philadelphia, Pennsylvania, USA with the purpose of conducting research and development on all types, functions and applications of geosynthetics used in the constructed environment and its infrastructure. With R & D at the core of the activity it was natural that archival publications would be the preferred outlet for information dissemination. This goal led directly to the initiation of conferences with accompanying proceedings. To date, there have been twenty-five such conferences consisting of 600 individual papers which have attracted 5015 participants. This communication is a retrospective on these conferences. All have hard copy and electronic versions of individual papers and each individual conference has a bound proceedings volume. The conference chronology is as follows:

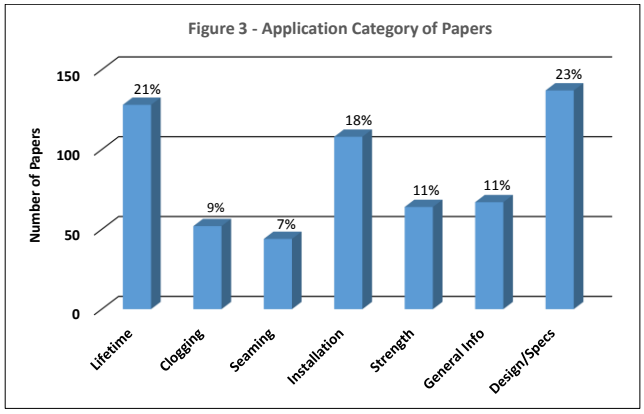
Table 1. Geosynthetic Themes of the GRI Conferences

Conf. No.	Year	Theme	No. of Papers	Atten-dance
GRI-1	1987	Soft Soil Stabilization	15	60
GRI-2	1988	Durability and Aging	21	112
GRI-3	1989	Seaming of Geosynthetics	27	170
GRI-4	1990	Landfill Closures	23	190
GRI-5	1991	Filtration and Drainage	20	172
GRI-6	1992	Quality Control/Quality Assurance	26	282
GRI-7	1993	Geosynthetic Liner Systems	21	282
GRI-8	1994	Resins, Formulations and Manufacturing	26	223
GRI-9	1995	Geosynthetics in Infrastructure	21	195
GRI-10	1996	Field Performance of Geosynthetics	19	243
GRI-11	1997	Field Installation of Geosynthetics	24	295
GRI-12	1998	Lessons Learned from Problems	24	225
GRI-13	1999	Geosynthetics in the Future	36	250
GRI-14	2000	Hot Topics in Geosynthetics - I	33	244
GRI-15	2001	Hot Topics in Geosynthetics - II	20	180
GRI-16	2002	Hot Topics in Geosynthetics - III	24	147
GRI-17	2003	Hot Topics in Geosynthetics - IV (w-NAGS)	22	203
GRI-18	2005	Research and Development In-Progress (w-IGS)	69	242
GRI-19	2005	Hot Topics in Geosynthetics - V	17	190
GRI-20	2007	Terrorism and Natural Disasters (w-ASCE)	19	175
GRI-21	2008	Agriculture and Aquaculture (w-IGS)	15	250
GRI-22	2009	"It's All in the Details" (w-IFAI)	17	175
GRI-23	2010	Durability: Field and Laboratory (w-ASCE)	19	155
GRI-24	2011	Optimizing Sustainability (w-IGS)	20	170
GRI-25	2013	25-Year Retrospective (w-IFAI)	22	185
		TOTALS =	**600**	= 5015

While these themes are indeed discrete from one another, there have been common patterns established over the years. They are shown in the following bar charts describing the occupation of the author, the type of geosynthetic being addressed, and the application category being focused upon. See Figures 1, 2 and 3.







From Figure 1 it is readily seen that manufacturers/ representatives, designers/test labs, and academia (faculty and institutes) have given the large majority of the papers (87%). Of course, regulators and owners are critically important to us all and it's nice to see their representation at 6% each. Unfortunately, installer/contractors were largely absent as far as prepared papers were concerned but many were present at the individual events. After all, this group makes all of us either "sink-or-swim"!

From Figure 2 it is seen that geomembranes and geotextiles are the "big-two" (48%) with all others being reasonably represented. The "general category" was for papers representing all geosynthetics but not in a specified manner.

From Figure 3 it is seen that lifetime/durability issues along with design/specification topics represented 44% of the total. Interestingly, while few installers prepared papers their "product" was critically important and represented 18% of the papers. Clogging, seams, strength and general information were all represented each with about 10% of the total.

At the risk of slighting any one author/presenter during these past twenty-five conferences we would like to single out an individual who was always memorable in the six papers he wrote and delivered. He is Bob Denis, Vice President of Solmax International. Bob's titles were as follows:

GRI-11 - Field Implications of Requiring Flat Geomembranes
GRI-13 - Darwinian View of Geosynthetic Field Quality Control
GRI-14 - We Offer Quality, Price and Service; But You Can Only Choose Any 2 Out of 3…
GRI-15 - We're Ready!
GRI-17 - The Twilight Zone
GRI-21 - The Need of Ongoing Research for the Health and Welfare of the Geosynthetic Industry

For those who have heard Bob present, it is always a joy insofar as being entertaining, insightful, challenging, and instructive. We have collected his six papers and if you want a CD please advise accordingly. That said, *we would be remiss if we didn't congratulate all paper preparers and presenters involved over the years*. You are each individually important to us at the institute and are indeed leaders of the geosynthetics industry. Thank you ever so much for sharing your intellectual knowledge and companionship over the past 25-years!

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 are Altakomol Alhadith Cont. Co. of Saudi Arabia with Carlos Lasserre; 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 and Borouge Pte. Ltd. of Singapore with Julia Putih as contact members. Thanks to all and welcome to GSI!!!**

GSE Environmental
Boyd Ramsey]/Aigen Zhao
U.S. Environmental Protection Agency
David A. Carson
Chemours Technology
John L. Guglielmetti
Federal Highway Administration
Silas Nichols/Daniel Alzamora
Golder Associates Inc.
Mark E. Case/Tim Bauters/Paul Sgriccia
Tensar International Corporation
Mark H. Wayne [BoD]/Joseph Cavanaugh
Bonar Inc. (formerly Colbond)
Richard Goodrum
Geosyntec Consultants
Steve Poirier
LyondellBasell Industries
Fabio Ceccarani/Rob Olivero
TenCate Geosynthetics
John Henderson/Chris Lawson
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NAUE GmbH & Co. KG
Kent von Maubeuge [BoD]
AVINTIV (formerly Polymer Group Inc.)
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TRI/Environmental Inc.
Sam R. Allen [BoD]/Joel Sprague
U. S. Army Corps of Engineers
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Chevron Phillips Co.
Yingying Lu/Jennifer Beem
AECOM (formerly URS Corp.)
John Volk/Ron Hager/John Bove
Solmax Géosynthétiques
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Civil & Environmental Consultants, Inc.
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Nathan Ivy [BoD]/Markus Haager
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William Johnson/Anthony Salvatori
INHA (GSI-Korea)
H.-Y. Jeon
Waste Management Inc.
Greg Cekander/John Workman [BoD]
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Geo-Logic Associates
Monte Christie
Weaver Consultants Group, Inc.
Mark Sieracke
Aquatan (Pty) Ltd.
Piet Meyer
Jones Edmunds, Inc.
George Reinhart/Tobin McKnight
Afitex-Texel
Pascal Saunier
EVAL Americas (Kuraray)
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Ardaman & Assoc.
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Scott Morris/Craig Phelps
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Carlos Lasserre
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Archie Filshill
Sotrafa S. A.
Jose Miguel Munoz Gomez
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Garth James
Interwrap, Inc.
Clive Mills/Mortin Vido
Borouge Pte. Ltd.
Julia Putih

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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
- Items of Interest
- Whales & Hippos in Surface Impoundment
- GSI's Member Organizations