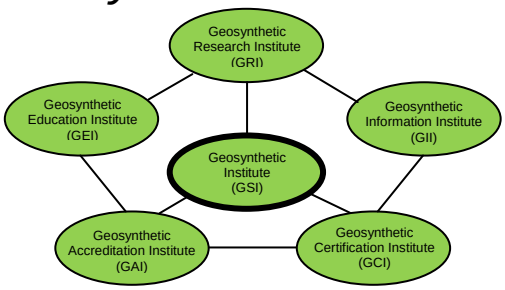
The GSI Newsletter/Report

Geosynthetic Institute



Vol. 28, No. 4 **December, 2014**

This quarterly newsletter, now in its 28th 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.

Winter has come to GSI, May you all enjoy the holidays and know our gratitude for your support

Activities of GSI's Directors and Officers

1. Voting for three Board of Directors for the 2015-2017 cycle has now been completed. In this regard:
   - Nathan Ivy of AGRU has replaced Boyd Ramsey of GSE to represent the Geomembrane and GCL Voting Group
   - Tony Eith of CEC has replaced Mark Sieracke of Weaver Boos to represent the Consultants and Testing Lab Voting Group
   - Moreno Scotto of Maccaferri has replaced Wayne Hsieh of NPUST/GSI-Taiwan to represent the 2nd International Member Voting Group

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2. Congratulations are offered to Nathan, Tony and Moreno in being elected.
3. Also, sincere thanks are offered to Boyd, Mark, and Wayne for having served in this capacity. They will all be sent plaques attesting to their serving in this regard.
4. The next BoD Meeting will be held in conjunction with Geosynthetics '15 to be held in Portland, Oregon on February 15-18, 2015. (day, time and room are being arranged)
5. 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

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

6. Every year, eighth grade students at Welsh Valley Middle School spend a morning with parents and community members representing a wide range of professions and industries to learn about the working world and gain insight into potential career paths on Career Day. Students prepare for the event by answering a questionnaire which helps identify their interests and particular skills. They are then matched with possible career categories.

   On Career Day, students are matched with five adults from a list of the visiting parent professionals, who present for 10 minutes on their specific career. This year's diverse cast of presenters featured 34 different professionals including yours truly, "The Engineer." As you can see by the following picture I was having a great time and was impressed with the questions and the enthusiasm of the kids. Geosynthetics were a huge hit for the third year in a row and the kids were shocked at the number of applications these polymers serve in ground related construction.

Geosynthetics at Welsh Valley Career Day "GO **DRAGONS"**

7. The 10th International Conference on Geosynthetics (organized quadrennially) was held September 21 to 25 September, 2014 at the Estrel Hotel & Convention Center in Berlin Germany. The conference convened in conjunction with the German Geotechnical Society and was a huge success. It attached 1200 attendees and was the best networking conference that we have attended in years with an international who's who of geosynthetics. GSI was involved with four papers presented at the conference, (all of which were well received and appear in a beautifully prepared conference proceedings.) The conference organizers were generous to allow the institute space for both the Annual and BOD meetings. Both of which were active and well attended. A few pictures of participants can be seen below.

Nathalie-Touz-Foltz, Eric Blond, George and Russell Jones

Jamie, George and Kevin Legge

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. George has presented an updated paper in Berlin at the 10th IGS Conference.
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.
4. **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 #8 below.
5. **Laboratory Exposed Lifetime of Geomembranes*** - GSI is using three UV-fluorescent devices to estimate the projected exposed lifetime of many different types of geomembranes. Presently being incubated are HDPE, LLDPE, fPP, PVC (N.A.), PVC (Euro.) and EPDM. 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. Ongoing data is being reported to manufacturers and resin producers. GRI Report #44 is available on results to date. Our GSI-8 Webinar gives preliminary data using the elevated temperature incubation and extrapolation modeling for lifetime prediction in the lab and in the field.
6. **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, presence of crazing and/or presence of cracking. Time will tell!
7. **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 difference is in the type of plasticizers and other additives used in the formulations. 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.
8. **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.

9. **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 just been submitted.
10. **Laboratory Exposed Lifetime of Geotextiles** - A similar UV study as with geomembranes (Items 5 and 7), geogrids (Item 8) and TRM filaments (Item 9) 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.
11. **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 244! *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 700 requests have been made to date. It was voted as being the best paper of 2013 by the journal.
12. **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 Koerner has a paper in this regard.
13. **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 under investigation presently.
14. **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 paper will be presented at Geosynthetics '15 in Portland.
15. **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 may be extended for other manufacturers.
16. **Temperature Behavior Under Different Geosynthetic Layers -** Since exposed lifetime of geosynthetics is influenced by sunlight the lifetime of layers directly beneath the uppermost one (heat only, but no sunlight) is of interest. George Koerner has set up such a scenario on behalf of Watershed Inc., a GSI member.
17. **Generic Specifications** - A major continuing effort is ongoing with respect to the development and maintenance 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
GS15 – Geocells

<u>Working; Available Upon Request</u>
GTXX – Turf Reinforcement Mats (tabled)
GSXX – Polymeric Marine Mattresses

<u>Delayed; Available Upon Request</u>
GGXX – Bidirectional Geogrids
GGXX – Unidirectional Geogrids
GNXX – Geonet Drainage Composites
GCXX – Other Drainage Geocomposites
GSXX – High Strength Reinforcement Geotextiles

The complete set of completed specifications are available to everyone (members and nonmembers) on the open section of our Home Page. Please download and use them accordingly. 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 stress crack resistance and asperity height. There is a brief tutorial accompanying each specification.

18. **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. Proceedings of the 10th IGS conference in Berlin are presently being added. 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) is performing various surveys of pertinent topics in geosynthetics. Two are in progress currently: State DOT use of AOS testing and data as well as turf reinforcement design and testing.

Most of these have been turned into GRI White Papers (for the concept please read the writeup on pg. 11-12 in this Newsletter/Report); the following being the most recent.

#30 - In-Situ Repairs of Geomembrane Bubbles, Whales and Hippos
#31 - On the Need for a Better Test Method Than Wet or Dry Sieving to Obtain the Characteristic Opening Size for Geotextile Filter Design Purposes

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.

Our most recent activity in this regard is to develop 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 43 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. The most recent reports are as follows:

- #39 – Methods of Stabilizing Excessively Deformed MSE Walls
- #40 – On the Prevention of Failures of Geosynthetic Reinforced MSE Walls and Recommendations Going Forward
- #41 – Analysis and Critique of Twenty Large Solid Waste Landfill Failures
- #42 – Lifetime Prediction of Laboratory UV Exposed Geomembranes Based on a Correlation Factor (due January 2, 2012)
- #43 – An Analysis of the Most Difficult Q & A's of the First 2500 Submittals to the GMA Techline (just published)

Announcement of our most recent report!

- #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 dates. That said, all of our courses are available on-line via a series of six, ninety-minute, webinars. Contact Bob Koerner at robert.koerner@coe.drexel.edu if you want information and details.

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; Cost $250

W14 – December 10, 2014 "In-Situ Stabilization of Soil Slopes Using Geosynthetics"
W13 – January 14, 2015 "Lifetime Prediction of Exposed and Nonexposed Geosynthetics"
W9 – February 11, 2015 "Landfill Failures"
W10 – March 11, 2015 "Landfill Bioreactors"
W11 – April 8, 2015 "Lateral and Vertical Expansions"
W12 – May 13, 2015 "Beneficial Uses of Closed Landfills"
W1 – June 10, 2015 "MSE Wall Failures Data Base"
W2 – July 8, 2015 "MSE Wall Back Drainage Design"
W3 – August 12, 2015 "MSE Wall Remediation"
W4 – September 9, 2015 "MSE Wall Inspection"

Note: These webinars are recorded and are available "on-demand" anytime and anyplace

More Webinars

11:30 AM – 1:00 PM (Eastern Time Zone)
Registration at www.asce.org/webinars
1.5 Professional Development Hours; Cost $400

ASCE 1 – November 13, 2014 "Geosynthetics in Basal Reinforcement"
ASCE 2 – December 9, 2014 "Geosynthetic Pond Liners"
ASCE 3 – January 16, 2015 "Geotextile Filter Failures"
ASCE 4 – February 25, 2015 "Geosynthetics in Roads"
ASCE 5 – March 16, 2015 "Geosynthetics in MSE Walls and Slopes

GSI Fellowships

As in the past, GSI has been awarding graduate fellowships for students performing geosynthetics research. There were twelve new proposals this academic year. These proposals were reviewed by the GSI Board of Directors along with Bob and George Koerner.

The presently established criteria are as follows:

- Students must be working on a geosynthetics topic which furthers the technology in a proactive manner.
- Students must have completed their candidacy requirements leading to a doctoral degree. (Comment, we hope that some of them will "go academic" and teach and/or do research on geosynthetics in their immediate future)
- Students must be recommended by their advisor or department head.

The fellowships can be renewed for a total of three-years depending upon acceptable annual reports. Three renewals are being reviewed presently. Funding for each student is $10,000 the first year and $5000 for the second and third years.

The following table identifies the successful recipients, their university, advisor and topic for our year of activity. We congratulate the students and wish them success in their endeavors. If any readers wish to add congratulations or to find greater detail as to specific projects and students please contact us accordingly.

GSI Fellowship Status for 2014-'15 Academic Year

Class 7(a) – 1st Year Funding at $10,000 per student

No.	Name	University	Advisor	Topic
1-14	Asli Yalcin Dayioglu	University of Maryland	Ahmet Aydilek	Clogging Behavior of Recycled Concrete Aggregate in Geotextile Systems
2-14	Michelle (Mingyan) Deng	Missouri Univ. of Science and Technology	Ronaldo Luna	Reliability Based Optimization Design of Geosynthetics Reinforced Embankment Slopes
3-14	Yonggui Xie	Oregon State University	Ben Leshchinsky	MSE Wall Abutments: an Analytical Solution for Evaluating Service State Deformations with Geosynthetic Reinforcement

Class 5 (c) – 3rd Year Funding at $5,000 per student

No.	Name	University	Advisor	Topic
3-11	Felix Jacobs	RWTH Aachen University	Martin Ziegler	Laboratory and Numerical investigation of Geogrid Reinforced Soil in Biaxial Compression Tests

Note that proposals for the new class for the A.Y. 2014-'15 are due on June 10, 2014. Please note Item #2 on "Activities of GSI's Directors and Officers" in this Newsletter/Report.

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. In short, this means 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 240 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of December, 2014, 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
jim.olsta@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)
Grant Palmer -- (843) 546-0600
gp@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)
Rich Schaefer -- (281) 230-6890
r.schaefer@gseworld.com

37[B] - GSE Environmental Chile (19 tests)
Mauricio Ossa -- 56-2 6010153
Mossa@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) (61 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)
Kim Thomas -- (615) 847-7155
Kim.Thomas@fiberweb.com

45[B] - Ten Cate Geosynthetics Malaysia SDN Bhd. (23 tests)
Gan Wee Hunn -- (603) 519 28576
wh.gan@tencate.com

46[B] - TAG Environmental Inc. (13 tests)
Colin Murphy -- (705) 725-1938
colin_murphy@tagenv.com

47[B] - GSE Syntec (10 tests)
Andrew Barker – (410) 327-1070
abarker@synteccorp.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)
Chris Adams -- (775) 835-8282
ca@agruamerica.com

65[C] - Bombay Textile Rsearch Assoc. (BTRA) (24 tests)
Riyaz Shaikh
(0) 022-25003551
btra@vsnl.com

66[B] - Rowad International Geosynthetics Co. Ltd (14 tests)
Asad Ullah Khan -- +966-3-812-1360
asad@rowadplastic.com

67[A] - MicroBac Hauser Division (10 tests)
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[A]Third Party Independent [C]Institute
[B]Manufacturers QC [D]Government

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

George R. Koerner

Porometry day at GSI

On December 2, 2014 we facilitated a Capillary Flow Porometer Workshop at GSI. Porometry is a characterization technique of porous media based on the displacement of a wetting liquid from the sample pores by applying a gas at increasing pressure across the plane of the sample. It is used to measure pore size distribution of geotextiles. The standard test method is covered in ASTM Committee D35 under the designation of ASTM D6767; "Test Method for Pore Size Characteristics of Geotextiles by Capillary Flow Test".

For this test method an inert gas is used to displace a liquid which has saturated the pores. The gas pressure and flow rates through the wet and dry samples are measured. The pressure required to empty the pores corresponds to the pressure necessary to evacuate the liquid from the most constricted part of the pores. This

measured pressure required to remove liquid from the pores so as to cause gas flow can be used to obtain the various pore diameters. They are calculated via the Young-Laplace formula.

Richard Lacey of TRI operating the Capillary Flow Porometer

The selection of the wetting liquid is important as it determines the measureable pore size range for a given pressure. Some common wetting liquids used in capillary flow porometry include water, alcohols, and oil. The use of water and/or alcohol is a disadvantage in that they can evaporate before the actual porometry test begins. In addition, water has a relatively high surface tension which results in the application of high pressures. In general, one wants a liquid that does not react with samples, i.e. it should not cause shrinking or swelling. In principle, there is no universal wetting liquid. However, it is important to always use the same wetting liquid when comparing results.

Attendees at the Porometer Day Workshop held at GSI, Sam Allen (TRI), Gene Bledsoe (Propex), Jason Booth (Willacoochee), Eric Booth (Willacoochee), J.P. Kline (Geotechnics), Melissa Medlin (TenCate), David Gallagher (Belton), Richard Lacey (TRI), Aigen Zhao (GSE), Anurag Shaw (Skaps)

TRI's Capillary Flow Porometer worked well and showed several features not commercially available on other porometers in the industry. More sensitive pressure gauges and flow meters have been installed directly above and below test specimens. This allows the TRI device to test over the entire range of geotextiles having AOS values from #200 to #10 and Permittivity range from 0.01 to 5 second^{-1}. The group even correlated ASTM round robin data for ASTM D4751 (AOS) and D4491 (Permittivity) specimens that were tested the previous week at GSI.

In short, we learned much at the workshop and it was great to see everyone here at GSI. We hope this technology gains traction and moves us forward in the area of geotextile filter design.

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 – 2014

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	44	1 (3%)	41	3 (7%)	1
TOTAL (to date)	**577**	**76 (13%)**	**532**	**63 (12%)**	**35**

The 5-year renewal period for those having taken the exam in 2009 is ongoing and about 60% have renewed accordingly. This is felt to be encouraging from our perspective.

The corresponding course for this certification program is available in a series of six-90 minute webinars. Contact Bob Koerner at robert.koerner@coe.drexel.edu for details and arrangements.

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

The official launch of the 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. There are now eighteen persons certified by GCI for the inspection of MSE Walls, Berms and Slopes.
While a field inspector cannot require proper design or instruct a contractor how to build the 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. Please contact George Koerner at gkoerner@dca.net or Jamie Koerner at jrkoerner@verizon.net for questions or additional information.

The corresponding course for this certification program is available in a series of six-90 minute webinars. Contact Bob Koerner at robert.koerner@coe.drexel.edu 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.

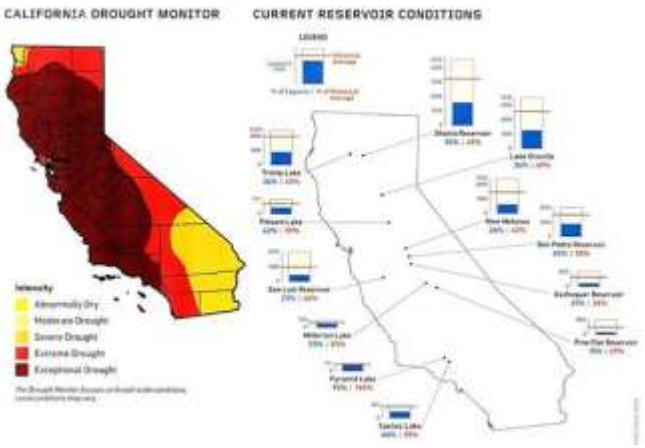
INHA University is located in Incheon and the geosynthetics laboratory is led by Professor Han-Yong Jeon. Dr. Jeon has 10-students working on geosynthetic-related projects and is extremely active both nationally and internationally. His active participation at conferences worldwide is very admirable. 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 this Newsletter/ Report).

Items of Interest

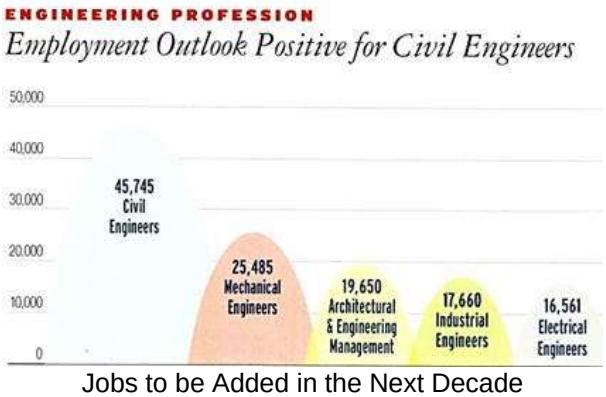
1. **California Drought and Reservoir Status**
   (ref. Landscape Architecture Magazine, Sept. 2014)
   -- The following data and information speaks for itself!



2. **Americans are the Hardest Working Folks on the Planet, Is That a Good Thing?**
   This commentary by Scot Litke is essential reading and a copy is available if interested!

3. **Employment Outlook Positive for Civil Engineers**
   (ref. Civil Engineering, Sept. 2014)

   -- See the following which looks good!



Jobs to be Added in the Next Decade

Commentary on AOS Testing of Geotextile Filters

On September 18, 2014 we wrote GRI White Paper #31 with the title of the following:

"On the Need for a Better Test Method Than Dry or Wet Sieving to Obtain the Characteristic Opening Size for Geotextile Filter Design Purposes"

This was prompted by the latest GAI-LAP proficiency test results which are given in the following table.

Geotextile	Mean Value (mm)	Standard Deviation (mm)	Coef. of Variation (%)
1. Woven silt film tape	0.289	0.039	14
2. Woven monofilament	0.317	0.025	8
3. Nonwoven needlepunched	0.257	0.027	10
4. Nonwoven heat bonded	0.129	0.09	69

Note: Past GAI-LAP proficiency test results have given different trends in C_v-values but invariably they are large in the context of their use and applicability in filter design.

Clearly seen is that the woven monofilament fabric has the lowest C_v-value but even its variation has significant implications when used in design. For example, if a designer uses plus or minus two standard deviations around the mean value, the resulting opening size varies within a rather large range; i.e.,

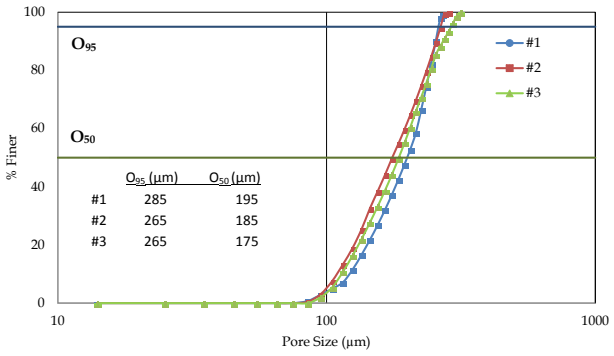
$$0.317 \pm 0.050 = 0.267 \text{ to } 0.367 \text{ mm}$$

Also note that the other geotextiles evaluated in Table 5 have even higher values as the coefficient of variation data indicates, e.g., at 69% the results from the above type of calculation are well beyond utilization.

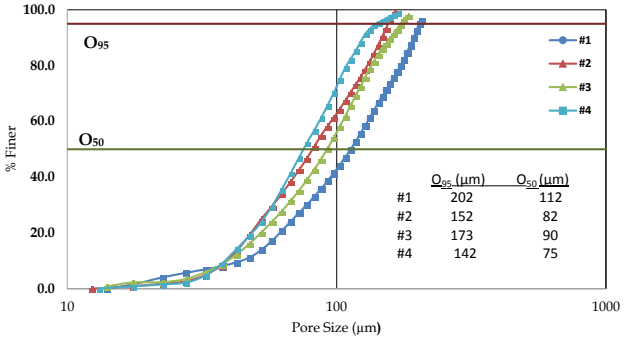
These values are even so large that their complimentary use in any one of thirteen design methods for O_{95}, O_{90}, O_{85}, O_{15}, etc. (see the referenced White Paper) make the design process essentially futile.
The above status regarding dry sieving is incrementally improved using wet sieving. Data from Dierickz and Myles (1996) indicates the relative situation insofar as a comparison of O_{90}-values. For example, wet sieving indicates quite large scatter in evaluating woven slit film and lightweight nonwoven geotextiles. This scatter is increased using hydrodynamic sieving with even woven monofilament geotextiles showing large variations. Again, the implications of using even wet sieving methods leaves a design required value with a relatively large spread of values.

Of the large number of alternative tests to sieving methods, it appears to the authors that some type of capillary flow method warrants serious consideration. There are two currently under discussion within the industry and within ASTM. ASTM D6767 describes one type (see the attached repeatability data) and the other is intended to be embodied in ASTM D4491. Please read the writeup on the Porometry Day Workshop at GSI in the Accreditation section of this Newsletter/Report. These methods provide (i) for

complete pore size characterization (thus can be used in any design method), (ii) allow for permittivity results using the same device, (ii) are based on sound theoretical principles, (iv) papers are available in the technical literature, and (v) they have been (or appear to be) standardized as well.



(a) repeatability results for a woven geotextile
(Mass/Unit Area = 410 g/m^2, thickness = 1.10 mm)



(b) repeatability results for a nonwoven geotextile
(Mass/Unit Area = 195 g/m^2, thickness = 1.40 mm)

Typical capillary flow test results for geotextiles
(ref. Kiffle, et al. 2014)

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 ThermaGreen with Tim Walter/Blu Alexander/Ken vander Velden, Maccaferri with Massimo Ciarla and Pietro Rimoldi, and Jones and Wagener (Pty) Ltd. with Anton Bain, Ardaman & Assoc. with Nadim Fuleihan/Thomas S. Ingra/Jan Wildman, Tecnologia de Materiales (TDM) with José Ferreyros, American Wick Drain with Scott Morris and Craig Phelps, the Department of Water Affairs of South Africa with Kelvin Legge and the Pennsylvania Dept. of Transportation with Kerry Petrasic as the contact person. Thanks to all and welcome to GSI.**

GSE Environmental
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E. I. DuPont de Nemours & Co., Inc.
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Federal Highway Administration
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Golder Associates Inc.
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Tensar International Corporation
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Bonar Inc. (Colbond)
Richard Goodrum
Geosyntec Consultants
Steve Poirier
LyondellBasell Industries
Fabio Ceccarani/Rob Olivero
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IN THE NEXT ISSUE

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- 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
- Perceived Status of Erosion Control Products
- GSI's Member Organizations