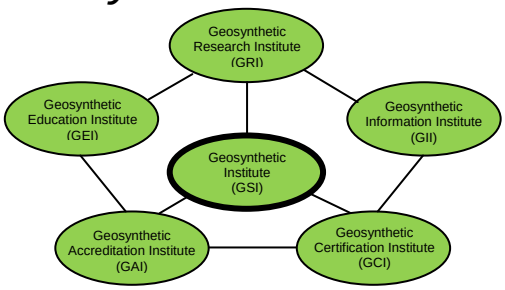
The GSI Newsletter/Report

Geosynthetic Institute



Vol. 28, No. 2 **June, 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.

Activities of GSI's Directors and Officers

1. We are now in a steady-state insofar as delivering various webinars. For ASCE, we have seven live topics given twice per year which are also recorded. For GSI we have twelve live topics and those are also recorded. The recorded (hence, "on-demand") ASCE topics are handled by ASCE whereas the GSI topics are being handled through Minerva, Inc. Note: If any of you would want a webinar beamed into your office(s) please advise.
2. Requests-for-Proposals for GSI Fellowships for the 2014-'15 academic year have been received; there are 12 of them. The GSI-BOD is reviewing and ranking them presently.
3. George Koerner will host a GSI Annual Meeting and GSI-BOD Meeting in Berlin in conjunction with the 10th IGS meeting on September 24, 2014. Time and room are being set and information will be sent shortly. The meetings and agenda will also be on our website.
4. Between the above mentioned IGS conference and the Geosynthetics '15 conference set for Portland on February 15-18, 2015 we seem to be in a technical paper writing mode. It is, however, a worthwhile and important activity.
5. The nine-person GSI Board of Directors is presently as follows:

Term Ends 2014

- Mark Sieracke - Weaver Boos (Consultants and Testing Labs)
  e-mail: msieracke@weaverboos.com
- Boyd Ramsey - GSE (Geomembranes and GCLs)
  email: bramsey@gseworld.com
- Wayne Hsieh - NPUST and GSI-Taiwan (International-2)
  e-mail: cwh@mail.npust.edu.tw

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

Overview of GRI Projects (Research)

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 60± 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 just now beginning 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 paper has been written for the IGS Berlin 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.) and EPDM. Exposure times of 70,000 light hours are now realized at 70°C and a replicate set of samples are being incubated at 60°C. Some will take at least 80,000 light hours (~ 11 years). The third sequence at 80°C was started on 1/1/2010. Ongoing data is being reported to manufacturers and resin producers. GRI Report #42 is available on the 70°C data using a correlation coefficient to estimate field lifetime of the various geomembranes. Furthermore, our GSI-8 Webinar gives preliminary data using the time-temperature superposition and Arrhenius modeling for improved field lifetime prediction.
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. (Note that the exposure and lifetime prediction of North American produced PVC GMs has been concluded).
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 are now up to 40,000 light hours and data is being generated and sent to the respective manufacturers; Tensar and TenCate. Replicate samples are now being incubated at 60°C for eventual use in Arrhenius Modeling and lifetime prediction. The last set at 80°C has just begun incubation.
9. **Laboratory Exposed Lifetime of TRM Fibers** - We are also using UV-fluorescent exposure of four different turf reinforcement mat fibers to assess their lifetime capabilities. They have been incubated at 60°C, 70°C and 80°C. A final report to the manufacturer has just been submitted.
10. **Laboratory Exposed Lifetime of Geotextiles** - We have completed a UV study on a heat-bonded nonwoven PP geotextile used for three dimensional cell structures which are exposed to the atmosphere. The results for the particular geotextile and its specific formulation at 20°C (68°F) average field temperature are 4.9 years for halflife of breaking strength and 4.1 years for halflife of breaking elongation. This study of other exposed geotextile lifetimes has been extended to include a lightweight needle-punched nonwoven. Its lifetime, as expected, is much shorter. The third geotextile is a woven slit

film and it is almost finished. A woven monofilament GT will conclude the series. Results will appear in about six months in a GSI Report.

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 grew to 141, then 171, and now (thanks to Rick Valentine) 236. *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 500 requests have been made to date.
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 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 questionable for HDPE which is semi-crystalline and cannot readily stress relax. To investigate slower rates we have initiated a new 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 one of our member organizations.
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 one of our member organizations.
17. **GCL's vs. CCL's in Landfill Covers -** A new effort in trying to convince regulatory agencies to stop using compacted clay liners (CCL's) in landfill coves is being mounted. They simply don't work over degrading (hence settling) solid waste materials. Of course, the alternative of geosynthetic clay liners (GCL's) is an excellent choice. Incidentally, South African regulations are already in place in this regard…
18. **Difficult Q & A's from the Techline** - As many of you know we service GMA's Techline on a daily basis. In so doing we categorize the questions on a five-point scale and have collected the most difficult ones of the 2500 Q & A's to date. These most difficult ones have formed GRI Report #43. We think it is most important in moving our technology forward and gives great insight as to potential future R & D for all of us.
19. **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, Available and Regularly Updated</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 Within Focus Group</u>
GTXX – Turf Reinforcement Mats (tabled)
GMXX – Coated Slit Film Geotextiles

<u>Delayed or Off in the Distance</u>
GGXX – Bidirectional Geogrids
GGXX – Unidirectional Geogrids
GNXX – Geonet Drainage Composites
GCXX – Other Drainage Geocomposites
GSXX – High Strength Reinforcement Geotextiles

The complete set of 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. There is a brief tutorial accompanying each specification. They will be updated shortly. Copies of the above listed draft specification tables are also available to GSI members and associate members.

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

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) is performing various surveys of pertinent topics in geosynthetics.

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.

#26 - Need for Justification of Quality Management Systems for Successful GS Performance
#27 - The Intimate Contact Issues of Field Placed Geomembranes With Respect to Wave (or Wrinkle) Management
#28 - Cold Temperature and Freeze-Thaw Cycling of Geomembranes and Their Seams

Jamie's most recent survey is a retrospective review of the 136 faculty which participated in the Educate-the-Educators week-long courses at Auburn University from 1994-1998. Do ask for a copy if interested.

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)

Courses

We have scheduled the following two courses here at GSI. They are as follows.

#1 December 11, 2014
QA/QC of Geosynthetics in Waste Containment Systems
(Optional Exam Follows)

#2 December 12, 2014
Construction Inspection of MSE Walls, Berms and Slopes
(Optional Exam Follows)

Each course carries with it 8 PDH's. All are held at GSI so demonstrations by George can illustrate and enliven the respective lectures. GSI is approximately 4.5 miles from Philadelphia International Airport.

Course Registration and Fee:
$350/person for each one-day course (up to one month prior to course)
$400/person thereafter
$250/person – GSI Members
Contact: Marilyn Ashley (mvashley@verizon.net)

Webinars

(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

W1 – June 11, 2014 "MSE Wall Failures Data Base"
W2 – July 9, 2014 "MSE Wall Back Drainage Design"
W3 – August 13, 2014 "MSE Wall Remediation"
W4 – September 10, 2014 "MSE Wall Inspection"
W5 – October 8, 2014 "GSs in Hydraulic Applications"
W6 – November 12, 2014 "GSs in Heap Leach Mining"
W7 – December 10, 2014 "GSs in Agriculture"
W8 – 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"

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 – October 3, 2014 "Geotextile Tubes"
ASCE 2 – November 13, 2014 "Geosynthetic in Basal Reinforcement"
ASCE 3 – December 9, 2014 "Geosynthetic Pond Liners"
ASCE 4 – January 16, 2015 "Geotextile Filter Failures"
ASCE 5 – February 25, 2015 "Geosynthetics in Roads"
ASCE 6 – 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 are being 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 2012-'13 Academic Year

Class 4 (a) – 2nd Year Funding at $5,000 per student

No.	Name	University	Advisor	Topic
3-11	Felix Jacobs	RWTU-Aachen, Germany	Martin Ziegler	Geogrid Reinforced Soil in Biaxial Compression Tests
4-11	Mahmound Khachan	Syracuse University	Shobha Bhatia	Dewatering Performance of Geotextile Tubes

Class 5 (a) – 1st Year Funding at $10,000 per student

No.	Name	University	Advisor	Topic
1-12	Chuangi Wang	University of Memphis	David Arellano	Properties of Recycled Expanded Polystyrene
2-12	Xunchang Fei	University of Michigan	Dimitrois Zekkos	Biodegradation of Geotextiles
3-12	Jitendra K. Thakur	University of Kansas	Jie Han	Recycled Asphalt Used in Geocells

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 June, 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. (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 Inquique (19 tests)
Christian Valdebenito -- 011 56 57 42 90 00
cvaldebenito@polytex.cl
davegonso@ads-pipe.com

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

56[B] - Polytex Santiago (13 tests)
Christian Valdebenito -- 56-2-627-2054
cvaldebenito@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)
Tim Smith -- (229) 686-5511
Tim.Smith@propexglobal.com
SimpsonJanie@firestone.com

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

61[B] - Raven Industries (17 tests)
Justin Norberg -- (605) 335-0288
Justin.Norberg@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)
Heather Smalley – (720) 406-4806
heather.smalley@microbac.com

68[B] - Glen Raven Technical Fabrics LLC (4 tests)
Richard Greeson -- (336) 229-5576
rgreeson@glenraven.com

69[B] - GSE Environmental (12 tests)
Siriporn Chayaporenlert – 6638-636638
Siripornc@gseworld.com

70[A] - RSA Geo Lab LLC (48 tests)
Raza Ahmed – (908) 964-0786
geolab13@yahoo.com

71[B] - Plasticos Agricolas y Geomembranas S.A.C. (15 tests)
Jhoana Carolina Diaz Martinez – 073-511814-511829
calidad@pga.peru.com

72[B] - Tensar Corp. GA (5 tests)
Mignon Kittler (770) 968-3255
mkittler@tensarcorp.com

73[B] - Gai Loi JSE (9 tests)
Paul Wong 84-650-362-5825
paul905677@gmail.com

74[B] - Agru Amercica Inc.
Mark Locklear (843) 221-4412
ml@agruamerica.com

75[B] - GeoMatrix S.A.S.
Javier Diaz Cipagauta (571) 424-9999
jdiaz@geomatrix.com.co

76[B] - Tehmco (Chile)
Patricia Rojas Perez (562) 589-2800
projas@tehmco.cl

78[B] - PQA Mexico
Cesar Agusto Arcila (669) 954-8202
calidadmexico@pga.com.co

[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

The annual GAI-LAP meeting was held in Toronto Ontario Canada in conjunction with ASTM D35 on June 26 , 2014. Twelve people attended representing 18% of the 55 active GAI-LAP labs. Attendance was off at this meeting and all the ASTM meetings that I attended in Toronto. It appears most labs are very busy this time of year and could not afford the time to break away from their day to day duties in the middle of the construction season. I want to thank all that were in attendance for their time and effort. Most of whom are pictured in the figure below:

Front row: Jan Wildman – Ardaman & Associates, Jim Olsta – CETCO, J. P. Kline – Geotechnics, Mark Wayne-Tensar, Gary Kolbasuk-Raven Industries. Back row: Sam Allen – TRI Environmental, Chris Athanassopaulos – CETCO, George Koerner- Geosynthetic Institute (GSI), Richard Gene Bledsoe-Propex, Eric Blond – Sageos/CTT Group. Not Pictured: Joel Sprague – TRI Environmental and John Paulson-Milliken.

The results of the meeting were as follows.

1. A brief introduction and background of the GAI-LAP program was discussed.

   (a) Program started in 1995
   (b) Accredit only geosynthetic labs
   (c) ISO 17025 is our model
   (d) On-site audits (Years 1, 5, 10 etc...)
   (e) Proficiency tests every year
   (f) Our Goal is Cv < 10 for each test

The newest members are as follows, further details can be found in the latest GAI-LAP directory.

- Gai Loi Geotextile
  Contact: Paul Wong
- Agru America Andrews GT Plant
  Contact: Brittany Garner
- Geomatrix
  Contact: Javier Diaz Cipagauta
- TEHMCO S.A.
  Contact: Patricia Rojas Perez
- PQA México
  Contact: Cesar Augusto Arcila

2. The Demographics of the current GAI-LAP organizations are summarized as follows:

   19 independent labs
   31 manufacturer QC labs
   5 centers (ISO 17011, research or government)
   55 total active
   Also:
   33 are GSI members
   21 international labs

   This demographics show an ever increasing interest in the program, particularly from international laboratories.

   There are 240 possible tests for accreditation (178 ASTM, 1 FTM, 8 GRI, 53 ISO). The number of accredited tests per lab varies as follows;

   4 min., 27 ave. 160 max.

   There has been a rapid rise of new test methods, with a near tripling of methods covered in a nineteen year period since the inception of the program. New tests being added appear to be outside the ASTM D35 arena with a huge surge in the number of textile related tests last year.

3. Proficiency testing is still the hallmark of the GAI-LAP.Of the 2614 proficiency test results submitted this year, only 19 first submittals were outliers representing 1% of the total. All outliers were resolved. Results of the proficiency tests were shared at the meeting. Electronic and hardcopy of the 2014-15 proficiency test results are available upon request.

   The GAI-LAP proficiency test program would not function without samples to test. The GAI-LAP would like to thank the following organizations for their generous contribution of geosynthetics for the 2014-15 proficiency samples:

   - **GM**: GSE, AGRU, JPS, Solmax & Firestone
   - **GT**: ACF
   - **GG**: Naue
   - **GP**: ADS & Driscopipe
   - **GCL**: Cetco
   - **EC-TRM**: ACF

4. The GAI-LAP Customer Survey was again sent out to all program participants and the findings were reviewed at the meeting.

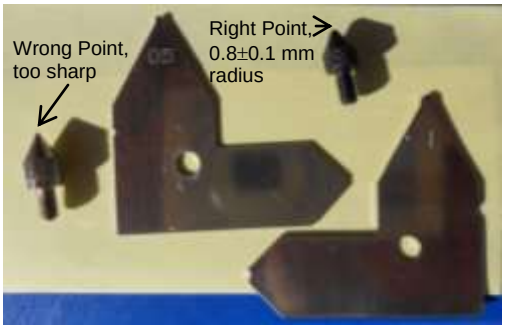
   13% return; the following are results (5 best to 1 poorest)
   (a) Information exchange = 4.1
   (b) Conflict resolution = 4.3
   (c) Proficiency Testing = 4.7
   (d) Directory and Internet = 3.4

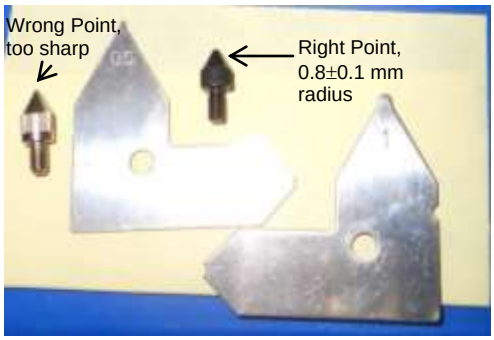
   Overall = 4.1
   Overall results to date: 2013 (4.1), 2012 (4.1), 2011 (4.1), 2010 (4.3), 2009 (4.4), 2008 (4.4), 2007 (3.9), 2006 (4.0), 2005 (4.0), 2004 (4.1), 2003 (4.1), 2002 (4.2)

   We feel that the program has had a very good year in 2014 thanks to a great effort by its membership!

5. The corrective action and Lab observation for the year were as follows:

   (a) 5ASTM D4833, Index Puncture(clamping-slipping issues and fixity of probe to load cell)
   (b) ASTM D5397, NCTL stress crack, (notching and notch verification keys to success)
   (c) ASTM D6637, GG Tensile (grips, padding and measurement of strain were issues)
   (d) SIM Tensile (Type I dog bone 1 vs. 2 in. Extensometer was hotly debated and tested)
   (e) ASTM D6693, D.B. Tensile (rough die cut causing low strain measurement of LLDPE)
   (f) ASTM D7005, Ply adhesion (should a lab count un-bonded specimens from the roll width sample? YES!)
   (g) 3x's ASTM D5994, Core thickness (search technique still and issue and the shape of the points must be rounded 0.8 mm per the standard. Please note, GSI has been using incorrect points for years. The Two figures below illustrate the error.)





(h) GeoNet Testing of entire Specification to check how long such information takes to generate.

(i) Significant figures as they relate to specifications and test results generated by a GAI-LAP lab. Conformance testing is described in bullet form below:

- For starters, the owner and their representative (an engineer) make a specification and put it out.
- Candidate materials are sampled according to a protocol.
- Conformance testing occurs at an accredited third party lab to a prescribed (ASTM, ISO etc.) standard test method.
- A result is generated per the test method's procedure requiring a specific reporting protocol.
- The owner or their representative makes a decision on whether the material passes or fails the specification.

In short, a lab's hands are tied by the test method in regard to what numbers are produced. A lab can only produce a minimum average test result to the accuracy of the test. As a general rule of thumb Table 1 below present typical accuracy for common geosynthetic lab equipment.

Table 1. Accuracy of Typical Geosynthetic Laboratory Equipment

Equipment	Standard Use for Verification	Accuracy
CRE Machine for load/force	ASTM E4, Practices for Force Verification of Testing Machines	+/- 1%
CRE Machine extensometer	ASTM E83, Practice for Verification and Classification of Extensometers	+/- 0.5%
Pressure Gauge	ASTM D5720, Practice for Static Calibration of Electronic Transducer Based Pressure Measurement Systems for Geotechnical Purposes	+ 1%
Thermocouple	ASTM E77, Test Method for Inspection and Verification of Thermometers	+/- 0.5 deg C
Timer/ Stopwatch	MIL 45662A	+/- 0.25%
Volume	E694, Specification for Volumetric Ware	+/- 0.5%
Gas Flow	NIST 18010C	Class dependent
Water Flow	NIST 18020C	Class dependent
Balance	ASTM D4753, Specification for Evaluating, Selecting, and Specifying Balances and Scales for Use in Testing Soil, Rock and Related Construction Materials	0.5%
Mass	ASTM E617, Specification for Laboratory Weights and Precision Mass Standards	Class 1, 2, 3, or 4 dependent
Micrometer/ Caliper/LVDT	ASTM D6027, Practice for Calibrating Linear Variable Differential Transducers for Geotechnical Purposes	+/- 1%
Gage Block Set	NIST Traceable	+/- 0.001 in.

Therefore, the issue with significant figures is with the owner not the test lab. I think it is a valid one and we certainly need to educate owners and their representatives about this issue. This issue is a critically important and is further complicated by which system of units is considered the reference.

For the 2014-15 accreditation year nineteen19 Total GAI-LAP audits were conducted.

- TRI conducted 12 (Thank You: Sam, Richard, Joel and Jarret)
- and GSI conducted 7
- As of 6/25/14 only 25 of the 55 have closed all audit finding and issues with the proficiency testing. This represents a meager 45% of the total labs in the program. There were many hard feeling on June 30th However, we are sticking to the rules of the program and hopefully applying them uniformly.

The next big undertaking at the GSI to be conducted in conjunction with the GAI-LAP is a white paper on what constitutes a defect versus a blemish. We often get the question to rate the severity of a Fold, Streak, Smear, Acne, Blister, Bubble, Blotch, Goober, Kling-on

etc. within or on a geomembrane. Questions such as: How many are too many? Is this staticically significant? And will such imperfection affect quality and or long term durability of the geomembrane? GSI Line with imperfection in geomembrane sheet has always centered knowing if it is: "Severe enough to make sheet fall below specification, it is a defect and needs to be rectified. To this end the institute would like to make recommended for remediation, downgrade, rejection of affect geomembrane. In addition we would like there to be a tracking system in place to determine the final disposition of material in question.

6. The open discussion portion of the meeting was highlighted by the following housekeeping items:

   (a) The next GAI-LAP annual meeting will be held
   (b) in June 18, 2015 in conjunction with ASTM D-35 in Anaheim California. We also discussed the possibility of having a virtual annual meeting.
   (c) GAI solicited manufacturers for geosynthetic materials for 2015 proficiency testing.
   (d) It was also noted that each lab can add up to seven tests per year.

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A GAI-LAP customer survey form appears below. Even if you are not a GAI-LAP laboratory please take a few minutes to fill out the survey and return by FAX to (610) 522-8441 or e-mail (gkoerner@dca.net).

1. GAI-LAP information exchange (5-excellent to 1-poor)
5 4 3 2 1
Comment, _____
2. Conflict Resolution Service (5-excellent to 1-poor)
5 4 3 2 1
Comment, _____
3. Proficiency Test Program (5-excellent to 1-poor)
5 4 3 2 1
Comment, _____
4. GAI-LAP Directory and Internet (5-excellent to 1-poor)
5 4 3 2 1
Comment, _____
5. GAI-LAP overall (5-excellent to 1-poor)
5 4 3 2 1
Comment, _____

We would like to get a return of over 70% of then participating labs and 20 outside opinions to validate it. We thrive on constructive criticism and appreciate your comments.

It is a pleasure working with you and thanks for participating in the GAI-LAP program. If you have questions, please contact accordingly.

George 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 – 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	34	1 (3%)	31	2 (7%)	1
TOTAL (to date)	**567**	**76 (13%)**	**522**	**62(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.

Note that a GSI course on this topic will be offered on June 19, 2014 with the exam following directly.

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.

This one-day course and subsequent examination were developed by GSI and reviewed by a steering committee consisting of the following individuals:

- Kent von Maubeuge – NAUE Group
- Mohammed Karim – Virginia DEQ
- Bob Sabanas – NTH Consultants
- John Conturo and Maria Tanase – AECOM, Inc.
- John Lostumbo – TenCate Geosynthetics
- Mike Yako – GEI Consultants
- Steve Poirier – Geosyntec Consultants
- Willie Liew – Tensar International
- Doug Clark – CEC Consultants
- Dick Stulgis – Geocomp, Inc.
- Frank Adams, Paul Whitty, Rafael Ospina – Golder Associates
- Daniel Alzamora - FHWA
- Sam Allen – TRI Environmental Inc.
- Greg Cekander – Waste Management Inc.
- Greg Fedak – CETCO Contracting Services

Our thanks go to them in this regard.

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.

Note that a GSI course on this topic will be offered on December 12, 2014 with the exam following directly.

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.

*Both of these affiliated institutes are currently under re-organization. Details will be forthcoming.

GSI-India under the direction of Dr. A. N. Desai is presently being 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.

Items of Interest

1. **Genesis of 30-Year Landfill Post Closure Care Period**
   Richard Moss of the U.K.'s Environment Agency states that 30-years is equivalent to a generation as referred to in the Brundtland Commission's definition of sustainability. Financial provisions via the EU Landfill Directive requires all operational and new sites to provide for 30 years from the closure of the landfill.

2. **Switch in USA to Mass Transportation**
   "Americans are boarding public buses, trains, and subways in greater number than any time since the suburbs began booming." The study further states that, "Nearly 10.7 billion trips were made in 2013-the highest total since 1956." AMPTA tells us that "People are making a fundamental shift to having options aside from a car in how they get around." Michael Melaniphy, association President says, "This is a long term trend. This isn't just a blip." It seems that expanding bus and train networks help spur this growth.
   (ref. S. Litke, Foundation Drilling, April, 2014)

3. **Water Resources Bill in USA**
   The Water Resources Development Act of 2013 commonly known as the WRDA bill has passed both the House (May 20, 2014 on a vote of 412-4) and the Senate (May 22, on a vote of 91-7) and is expected to be signed into law by President Obama. The conference bill, negotiated by both the House and Senate contains language in the section on innovative materials that requires the evaluation of geosynthetic materials in project that are funded by the bill. This is a substantial accomplishment and will benefit and expand the usage of geosynthetic materials.
   (ref. B. Ramsey, per GMA 5/27/2014)

Commentary on Drainage Geocomposites

The original drainage geocomposites (ca. 1970's) were formed by injecting a high density polyethylene formulation into a grooved counterrotating die resulting in two sets of integrally joined parallel ribs. Upon expansion and cooling, a biplanar geonet with diamond-shaped apertures resulted. With two geotextiles bonded to the surface the first drainage geocomposite resulted. The geonet cores eventually came in varying thicknesses which resulted in different planar flow rates or transmissivities. We will use the term flow rate rather than transmissivity, but it should be recognized that the two terms are related using Darcy's formula as follows:

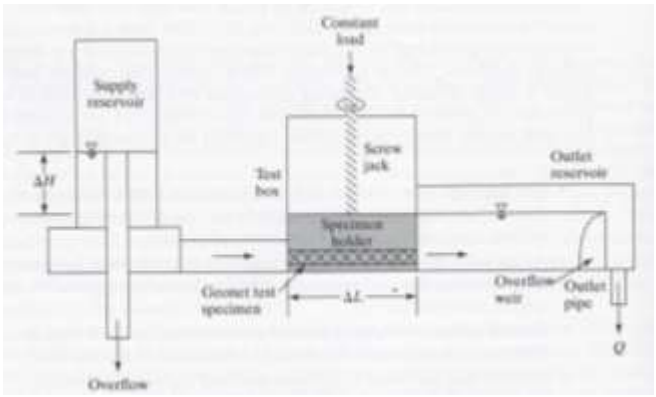
$$q = kiA$$
$$q = ki\,(W \times t)$$
$$q/W = i\,(k \times t)$$
$$q/W = i\,\theta$$

where

- q/W = flow rate (m^3/m-s, or more generally m^2/s)
- k = coefficient of permeability (m/s)
- i = hydraulic gradient = $\Delta H/\Delta L$
- ΔH = total head lost (m)
- ΔL = length of specimen (m)
- A = cross section of specimen (m^2)
- W = width of specimen (m)
- t = thickness of specimen (m)
- θ = transmissivity (m^2/s)

It should also be noted that the units of q/W and θ are identical (m^2/s) but only at $i = 1.0$ are the numeric values the same. The laboratory testing device and cross section (per ASTM D4716 or ISO 12958) is shown below and at least 17 laboratories are accredited by the GAI-LAP to perform the test, see

(a) A flow rate testing device



(b) Schematic diagram of flow rate testing device

GSI's hydraulic testing device for measuring in-plane flow of a drainage geocomposites.

http://www.geosynthetic-institute.org/gai/methlist/d4716.html.

The following uses of drainage geocomposites have been documented in the literature:

- For water drainage behind retaining walls
- For water drainage of seeping rock slopes
- For water drainage of seeping soil slopes
- For water drainage behind geomembranes in dams and canals
- For water drainage beneath all types of athletic facilities
- For water drainage of frost-susceptible soils
- For water drainage beneath building foundations
- For water drainage of plaza decks and earth sheltered structures
- For water drainage beneath highways and airfields
- For leachate collection in landfills and waste piles
- For leachate collection in heap leach pads
- To detect leaks between double liners in landfills and surface impoundments
- As underdrain systems beneath landfills
- As surface water drains in landfills caps and closures
- As gas venting systems in landfill caps and closures
- To detect leaks between two geomembranes in vertical containment walls
- As drainage blankets beneath surcharge fills

As expected, several manufacturers began to produce biplanar geonet drainage geocomposites and the market became quite competitive. At the request of these manufacturers, GSI drafted a generic specification (it still exists as a draft) and then finalized a guide for design (GRI-GC8) insofar as reduction factors are concerned.

At that point in time, about 1990, we naively thought that the above standards were adequate but then the innovative nature of several manufacturers came into being. In rapid succession the very nature of the drainage core changed drastically. For example the following drainage cores were successively produced;

- triplanar polyethylene geonets,
- three-dimensional nylon meshes,
- three-dimensional polypropylene meshes,
- dimpled one or two sided polystyrene sheets,
- cuspated one or two sided polystyrene sheets,
- cuspated and porous one or two sided polypropylene sheets,
- nubbed one or two sided polystyrene sheets,
- channeled (or tubular) polyethylene sheets,
- undulating W-shaped polyethylene sheets,
- small perforated pipes within geotextile encapsulation and
- wick drains encapsulated by one or two sided geotextiles.

There is no end in sight! While product innovation is exciting and stimulating there is the vexing issue of proper product selection, at a competitive price, from the perspective of the specifier, purchaser and owner. It might be noted that each design situation is different although a common targeted value of flow rate is the equivalent of 300 mm thickness of sand having a permeability value of 0.1 cm/s since this is often the competitive situation to which drainage geocomposite flow rates must be equivalent, or greater.

In order to try to "sort-out" this large array of products we are currently drafting a GRI Guide as to the critical properties necessary for a drainage geocomposite to be contrasted to a site-specific situation. The properties felt to be necessary under all situations are as follows:

1. Flow rate under load at a given hydraulic gradient: All product types mentioned can be configured in flow rate devices with the possible exception of the last two bulleted

products. Here accommodation is needed and is becoming available.

2. Sustained compressive strength (at approximately 1.5 times design load) of the drainage core over time: It is felt that this can best be accomplished using the stepped isothermal method (SIM) per ASTM D6992. There are literature references for guidance in this regard.
3. Other tests, such as geotextile properties and their bonding to the core are readily accomplished or can be modified accordingly.

The point in this communication is that the plethora of drainage geocomposites (while exciting from a product development perspective) is disconcerting for the specifier, purchaser and owner in their selection process. We hope that the forthcoming GRI Guide will help establish the optimal drainage geocomposite(s) for site-specific situations. Comments in this regard are always welcome.

Bob & George Koerner

Upcoming GSI Events

GSI Webinars
(2nd Wednesday of Every Month – see following website)
Contact: www.geosynthetic-institute.org/webinar.htm

ASCE Webinars
(see following website)
Contact: www.asce.org/webinars

GSI Courses in Folsom, PA

#1 December 11, 2014
QA/QC of Geosynthetics in Waste Containment Systems
(Optional Exam Follows)

#2 December 12, 2014
Construction Inspection of MSE Walls, Berms and Slopes
(Optional Exam Follows)
Contact: mvashley@verizon.net

- July 21-23 2014
  ASCE Shale Conference
  Pittsburgh, PA
  Contact: www.asce.org/conferences
- June 25-27, 2014
  ASTM Committee D35 on Geosynthetics
  Toronto, Canada
  Contact: www.astm.org
- September 8-11, 2014
  Geosynthetics in Mining Solutions
  Vancouver, Canada
  Contact: www.geosyntheticssolutions.com
- September 21-25, 2014
  10th Intl. Geosynthetics Conf.
  Berlin, Germany
  Contact: www.geosyntheticssociety.org
- May 15-18, 2015
  Geosynthetics '15
  Portland, OR
  Contact: www.geosyntheticsconference.com

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 and the Department of Water Affairs of South Africa with Kelvin Legge as contact persons. Thanks to all and welcome to GSI.**

GSE Environmental
Boyd Ramsey [BoD]/Aigen Zhao
U.S. Environmental Protection Agency
David A. Carson
E. I. DuPont de Nemours & Co., Inc.
John L. Guglielmetti/David W. Timmons
Federal Highway Administration
Silas Nichols/Daniel Alzamora
Golder Associates Inc.
Mark E. Case/Tim Bauters
Tensar International Corporation
Mark H. Wayne [BoD]/Joseph Cavanaugh
Bonar Inc. (Colbond)
Richard Goodrum
Geosyntec Consultants
Steve Poirier
LyondellBasell Industries
Fabio Ceccarani/Rob Olivero
TenCate Geosynthetics
John Henderson/Chris Lawson
CETCO
Chris Athanassopoulos/James T. Olsta
Huesker, Inc.
Sven Schröer/Dimiter Alexiew
NAUE GmbH & Co. KG
Kent von Maubeuge [BoD]
Propex
Andy Burran/Judith Mulcay
Polymer Group Inc.
Brian H. Whitaker
NTH Consultants, Ltd.
Rick Burns
TRI/Environmental Inc.
Sam R. Allen [BoD]/Joel Sprague
U. S. Army Corps of Engineers
David L. Jaros
Chevron Phillips Co.
Yingying Lu

URS Corp.
John Volk/Ron Hager
Solmax Géosynthétiques
Robert Denis/Guy Elie/Daniel Tan Su Ming
Envirosource Technologies, Inc.
Douglas E. Roberts
CARPI, Inc.
Alberto M. Scuero/John A. Wilkes
Civil & Environmental Consultants, Inc.
Tony Eith/Daniel Tolmer
Agru America, Inc.
Paul W. Barker/Markus Haager/Nathan Ivy
Firestone Specialty Products
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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
- In-Situ Repair of Geomembrane Bubbles, Hippos and Whales
- GSI's Member Organizations