Austin, TX - USA | Anaheim, CA - USA | Anderson, SC - USA
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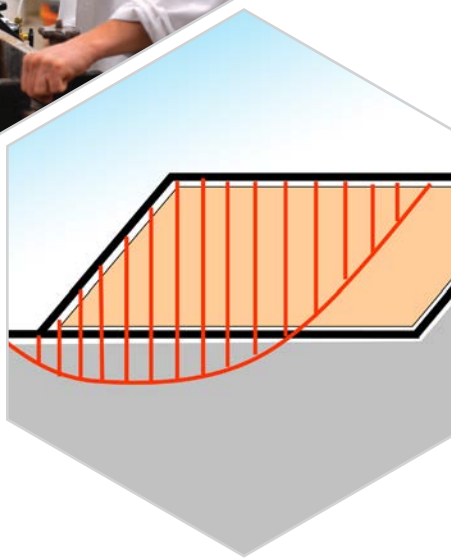
TRI ENVIRONMENTAL, INC.

EDUCATION: TWO-DAY SHORT COURSE

SLOPE STABILITY OF CONTAINMENT SYSTEMS

Understanding Issues Related to Design and Interface Friction Testing

WORTH 8 PDHs



Tuesday, May 23 – Wednesday, May 24, 2017

LOCATION: TRI Environmental, Inc.

9063 Bee Cave Road | Austin, Texas 78733 USA

Email: Friction@TRI-ENV.com | Phone: +1 512 263 2101

Instructors

Dr. Jeffrey A. Kuhn, Ph.D., P.E. | *TRI Environmental*
Dr. Ranjiv Gupta, Ph.D., P.E. | *Geosyntec Consultants*

Attend and learn about ....

- Why slope failures occur
- How to determine and use shear strength
- The history of interface friction testing
- Understanding ASTM D 5321 and D 6243 – interface friction tests
- The “ins” and “outs” of interface friction testing
- How to identify and avoid meaningless test data
- How to specify a relevant interface friction test
- How to review and employ results of friction tests
- Lessons learned from slope failures

www.GeosyntheticsTesting.com

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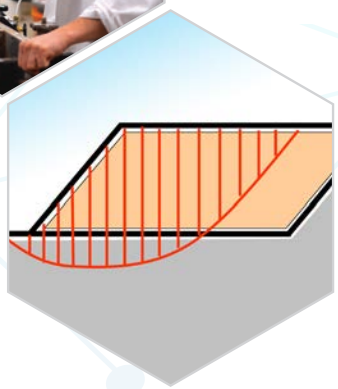
This course, worth 8 PDHs, is specifically targeted to those persons who have a need to understand and specify interface friction and direct shear tests—and who use these results in subsequent design, construction, and monitoring performance of containment structures. Participants include:

- Design, Consulting and Certifying Engineers
- Construction and Quality Assurance Managers
- Manufacturers
- Installers and Contractors
- Third-Party Inspectors
- Regulators

REGISTER ONLINE TODAY!



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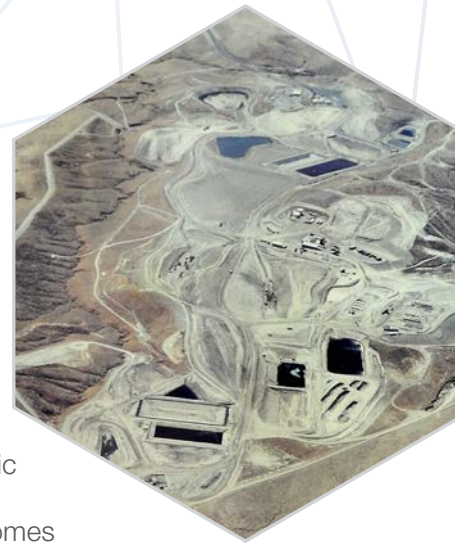
WHY THIS COURSE?



Modern waste containment structures (municipal and hazardous waste landfills, coal ash surface impoundments, heap leach pads) are constructed using multiple layers of geosynthetic materials such as geomembranes, geotextiles, geonets, geocomposites, and geosynthetic clay liners (GCL). The design of a containment structure not only requires an understanding of the properties of each individual geosynthetic material but also the ability to comprehend the interaction mechanism (friction) between various geosynthetic layer interfaces. This understanding of interface friction between various geosynthetic layers becomes even more challenging as the interface governing slope stability of the containment structure may change depending on if the project is in a construction phase, a waste filling phase, or being closed with a final cover system.

The standard test method for the evaluation of friction between one geosynthetic and another or between soil and a geosynthetic is ASTM D5321 (large-scale direct shear test for geosynthetics) and ASTM D6243 (determining internal and interface shear strength of GCLs). While these tests are simple in concept, the generated test results are significantly affected by the test parameters and the procedures used for testing the materials. As a result, understanding the specifications for interface friction testing and how to interpret and use generated test results becomes a crucial part of an engineering project.

The presenters, one from the geosynthetic testing industry and one from geoenvironmental consulting industry, will address a broad range of issues related to laboratory testing and design of containment structures. This course will be presented in two parts, each of which complements the other, to provide maximum benefit to the attendees. The first part will focus on slope stability of containment structures including an overview of sources of interface strength, the difference between peak and large displacement strength for design, the relation between normal stress and failure envelopes, and slope stability calculations.

The second part will provide an explanation of ASTM D5321, including detailed discussion of test parameters. Procedural implications of specimen anchorage, normal stress application, machine friction and calibration, rate of shear, and reporting mechanisms will be discussed. In addition, limitations of the ASTM D5321 test will be explored, with explanation of alternative tests including torsional shear, tilt table, and double interface shear. Special emphasis will be placed on specifying a meaningful shear test that will best serve the user's project requirements. The forensic analysis of several slope failure case studies will be presented to help relate the material presented during the course with real-world applications.

COURSE SCHEDULE

DAY 1 — TUESDAY, 23 MAY 2017

HOURS	DESCRIPTION
8:30 – 9:00 am	Registration and Coffee
9:00 – 9:15 am	Welcome
9:15 – 10:15 am	Introduction and Overview
10:15 – 10:30 am	Break
10:30 – 11:30 am	Case Histories I What happened, what was lerrned, how industry was impacted
11:30 am – 12:30 pm	Lunch (Provided, On Site)
12:30 – 1:15 pm	Slope Stability I How to approach a slope stability problem, what's needed for evaluation, what can be done, what can't be done
1:15 – 1:30 pm	Break
1:30 – 3:00 pm	Slope Stability II Factor of Safety, Limit Equilibrium, Finite Element, Staged Construction, Gas Pressure, Pseudo-static, Seismic, 3-D Effects, Remedial Measures
3:00 – 3:15 pm	Break
3:15 – 6:00 pm	Test Demonstration and Laboratory Tour
6:00 pm	Dinner at County Line

DAY 2 — WEDNESDAY, 24 MAY 2017

HOURS	DESCRIPTION
8:30 – 9:00 am	Breakfast and Coffee
9:00 – 10:15 am	Interface Shear Strength Testing I Historical background, Equipment, Normal Stress, Clamping, Step and Ramp Loading, Conditioning and Consolidation, Traditional Shear Rates, Shear Rate Determination
10:15 – 10:30 am	Break
10:30 – 11:30 am	Interface Shear Strength Testing II Step and Ramp Loading, Pre-Hydration/Conditioning, Single and Multi-layer Interface, How to Review Test Results, Historical Databases, Review of Demonstration Data
11:30 am – 12:30 pm	Lunch (Provided, On Site)
12:30 – 1:15 pm	Case Histories II A real world application: Illustrative example of a slope stability problem showing how a shear testing program was established (specified), how the results were interpreted, and how the results were used in stability analysis
1:15 – 1:30 pm	Break
1:30 – 2:30 pm	New Developments
2:30 – 3:00 pm	Final Remarks
3:00 pm	Closing

WHERE TO STAY

Sonesta Bee Cave Austin. 12525 Bee Cave Parkway, Bee Cave, TX 78738. Phone: +1 512 483 5900. Call for a Reduced Rate. Code: TXRES. 20 miles from airport, 5.2 miles from short course. NO shuttle service.

Holiday Inn Express Hotel & Suites, Austin-Sunset Valley. 4892 US Highway 290 West, Austin, TX 78733. +1 800 315 2621. 10 miles from airport, 9.9 miles from short course. NO shuttle service.

ABOUT TRI

TRI/Environmental, Inc. has been active in materials testing, inspection, and research and development for 20+ years. TRI is an independent, third-party laboratory and consulting firm unaffiliated with any manufacturing, engineering/consulting, or construction management firm. TRI's geosynthetics testing laboratories provide a variety of services.

www.GeosyntheticsTesting.com

REGISTER ONLINE

Registrations must be received by 5:00 pm CST, Friday, 12 May 2017.

There will be a $100/person late fee thereafter. $50.00 cancellation fee for refunds requested before May 12, 2017 - no refund will be provided thereafter.

Course fee includes course notes and handouts, lunch and refreshments during breaks, and dinner on Day 1. Course notes are not sold separately.

ABOUT YOUR INSTRUCTORS

DR. JEFFREY KUHN, PH.D., P.E.

Jeffrey A. Kuhn serves as TRI Environmental's division director for the interaction and geotechnical laboratory. He holds a bachelor's degree in civil engineering from The University of Maryland (2003) and a doctorate from The University of Texas at Austin (2010). While at the University of Texas, Jeff principally worked on alternative/evapotranspirative cover design and evaluation for the EPA, performed research with expansive clays for TxDOT, and participated in the design and implementation of a centrifuge permeameter to study flow through unsaturated soils. Following his degree, Dr. Kuhn consulted for two years, during which time he worked on the design and installation of the Circuit of the Americas F1 Race Track over expansive clays with tight differential movement criteria. Dr. Kuhn has led TRI's geotechnical laboratory since 2012 and overseen the interaction and geotechnical laboratory division since early 2016.

DR. RANJIV GUPTA, PH.D., P.E.

Ranjiv Gupta is a Project Engineer with Geosyntec Consultants in Phoenix, Arizona. Dr. Gupta has 12 years of academic and professional experience in geotechnical and geosynthetics engineering. His research work at The University of Texas at Austin included developing soil-geosynthetic interface models for geosynthetic-reinforced pavements over expansive clays. Since joining Geosyntec (2010), Dr. Gupta has been involved with the design and permitting of waste containments structures, including solid and hazardous waste landfills, coal combustion residual surface impoundments, and mine tailings facilities throughout the United States. Dr. Gupta is the member of ASCE's Geo-Institute Technical Committees on Sustainability and Geoenvironmental Engineering. He currently serves as a Vice President and Treasurer on the Board of the International Geosynthetics Society's North America chapter.

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