At GOLDER ASSOCIATES we strive to be the most respected global group specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.
Having your soil and synthetic materials tested by an independent laboratory is important to demonstrate that these construction materials meet your standards. This type of quality assurance can satisfy your design specifications and provide a measure of due diligence that is documented. In today’s complex environment, it is more important than ever to test materials in order to identify potential problems caused by manufacturing defects, construction installation or even natural disasters. As an owner or project manager, you are concerned not only with the long-term viability and profitability of your facility, but keeping current construction costs as low as possible. This means that materials testing must be quick, reliable and reasonably priced.

Golder has fully equipped geotechnical and geosynthetic laboratories that test materials quickly, accurately and cost-effectively. With our state-of-the-art equipment and advanced technologies, we can conduct more than 60 geotechnical and geosynthetic tests—all standardized by the American Society for Testing and Materials (ASTM). For some materials, ASTM standards have not yet been created. In those situations, we draw on our professional experience to develop testing techniques that provide you with a comfortable level of quality assurance. When your technical needs go beyond normal lab testing, we also draw upon the environmental and geotechnical experience of Golder professionals who are located throughout a worldwide network of offices.

# Geotechnical Testing

Golder’s geotechnical labs offer the most complete range of standardized geotechnical soils testing available in the industry. For example, our labs have more than 60 permeability cells in offices worldwide with the majority located in the United States. These cell types make use of a flow pump, expediting results faster than typical falling head results. From grain size distribution to permeability and strength testing, the geotechnical labs produce accurate results that are presented in a technical format, making interpretation easy. Golder works towards ensuring the quality of procedures, staff and results by membership in the ASTM D18 Committee on Soils and participation in the American Association of State Highway and Transportation Officials (AASHTO) standardization program.

AASHTO has accredited our Atlanta laboratory office and the U.S. Army Corps of Engineers recognize the Institute (GSI), to conduct more than 40 ASTM tests, as indicated in the list to the right. The U.S. Environmental Protection Agency and U.S. Army Corps of Engineers recognize the Geosynthetic Accreditation Institute as the official accrediting organization for geosynthetic testing.

As active members of the GSI and the ASTM D35 Subcommittee on geo-synthetics, our lab professionals have a developmental role in testing standards and procedures and stay abreast of the rapid changes that occur in the industry.

### Geosynthetic Tests

- **Apparent Opening Size** - ASTM D6382
- **Asperity Height** - ASTM D4166
- **Burst Strength, Mullen** - ASTM D3786
- **Carbon Black Content** - ASTM D1603
- **Carbon Black Dispersion** - ASTM D5996
- **Density/Specific Gravity** - ASTM D782
- **Destructive (pore/shear)** - ASTM D6392
- **Dimensional Stability** - ASTM D1204
- **Direct Shear** - ASTM D5321
- **Environmental Stress Crack** - ASTM D6243
- **Fluoride** - ASTM D5891
- **Free Swell** - ASTM D5890
- **Grab Strength** - ASTM E6352
- **Mass Per Unit Area** - ASTM D5621
- **Per尹ivity/Permeability** - ASTM D4491
- **Puncture** - ASTM D4833
- **Soil Burial** - ASTM D3083
- **Tear Resistance** - ASTM D3004
- **Tensile Properties** - ASTM D638
- **Volatility Loss** - ASTM D1203
- **Water Absorption** - ASTM D570
- **Water Extraction** - ASTM D1239
- **Wide Width Tensile** - ASTM D4595

### Geotechnical Tests

- **Atterberg Limits** - ASTM D4318
- **Calif. Bearing Ratio** - ASTM D1083
- **Carbonate Content** - ASTM D3042
- **Consolidation** - ASTM D2435
- **Direct Shear** - ASTM D3080
- **Moisture Content** - ASTM D2216
- **Organic Content** - ASTM D2097
- **pH Determination** - ASTM D1293
- **Permeability (granular)** - ASTM D2434
- **Permeability (flex member)** - ASTM D5084
- **Pinhole Dispersion** - ASTM D4447
- **Proctor** - ASTM D698
- **Resistance** - ASTM D57
- **Settlement of Cohesive Soils** - ASTM D4546
- **Soil Permeability Testing** - ASTM D3084
- **Sieve Analysis (wet)** - ASTM D422
- **Sieve Analysis (#200)** - ASTM D1140
- **Sieve w/Hydrometer** - ASTM D422
- **Triaxial** - ASTM D2850
- **Unconfined Compression** - ASTM D2166
- **Unit Weight & Moisture** - ASTM D2917
- **Visual-Manual Class.** - ASTM D2488

### Soil Permeability Testing

- **ASTM D3084**

**Quality Assurance**

The geosynthetic laboratory tests for the mechanical and physical characteristics of geomembranes, geotextiles, geocomposites, geogrids, and geosynthetic clay liner materials.

- **Golder’s geosynthetic labs offer the most complete range of standardized geosynthetic soils testing available in the industry.**

- **For example, our labs have more than 60 permeability cells in offices worldwide with the majority located in the United States. These cell types make use of a flow pump, expediting results faster than typical falling head results.**

- **From grain size distribution to permeability and strength testing, the geotechnical labs produce accurate results that are presented in a technical format, making interpretation easy.**

- **Golder works towards ensuring the quality of procedures, staff and results by membership in the ASTM D18 Committee on Soils and participation in the American Association of State Highway and Transportation Officials (AASHTO) standardization program.**

- **AASHTO has accredited our Atlanta laboratory office and the U.S. Army Corps of Engineers recognize the Institute (GSI), to conduct more than 40 ASTM tests, as indicated in the list to the right.**

- **The U.S. Environmental Protection Agency and U.S. Army Corps of Engineers recognize the Geosynthetic Accreditation Institute as the official accrediting organization for geosynthetic testing.**

- **As active members of the GSI and the ASTM D35 Subcommittee on geo-synthetics, our lab professionals have a developmental role in testing standards and procedures and stay abreast of the rapid changes that occur in the industry.**

### Geotechnical Tests

- **Atterberg Limits** - ASTM D4318
- **Calif. Bearing Ratio** - ASTM D1083
- **Carbonate Content** - ASTM D3042
- **Consolidation** - ASTM D2435
- **Direct Shear** - ASTM D3080
- **Moisture Content** - ASTM D2216
- **Organic Content** - ASTM D2097
- **pH Determination** - ASTM D1293
- **Permeability (granular)** - ASTM D2434
- **Permeability (flex member)** - ASTM D5084
- **Pinhole Dispersion** - ASTM D4447
- **Proctor** - ASTM D698
- **Resistance** - ASTM D57
- **Settlement of Cohesive Soils** - ASTM D4546
- **Soil Permeability Testing** - ASTM D3084
- **Sieve Analysis (wet)** - ASTM D1140
- **Sieve w/Hydrometer** - ASTM D422
- **Triaxial** - ASTM D2850
- **Unconfined Compression** - ASTM D2166
- **Unit Weight & Moisture** - ASTM D2917
- **Visual-Manual Class.** - ASTM D2488

### Soil Permeability Testing

- **ASTM D3084**

- **Golder has fully equipped geotechnical and geosynthetic laboratories that test materials quickly, accurately, and cost-effectively.**

- **With our state-of-the-art equipment and advanced technologies, we can conduct more than 60 geotechnical and geosynthetic tests—all standardized by the American Society for Testing and Materials (ASTM).**

- **For some materials, ASTM standards have not yet been created. In those situations, we draw on our professional experience to develop testing techniques that provide you with a comfortable level of quality assurance.**

- **When your technical needs go beyond normal lab testing, we also draw upon the environmental and geotechnical experience of Golder professionals who are located throughout a worldwide network of offices.**

### Geosynthetic Tests

- **Apparent Opening Size** - ASTM D6382
- **Asperity Height** - ASTM D4166
- **Burst Strength, Mullen** - ASTM D3786
- **Carbon Black Content** - ASTM D1603
- **Carbon Black Dispersion** - ASTM D5996
- **Density/Specific Gravity** - ASTM D782
- **Destructive (pore/shear)** - ASTM D6392
- **Dimensional Stability** - ASTM D1204
- **Direct Shear** - ASTM D5321
- **Environmental Stress Crack** - ASTM D6243
- **Fluoride** - ASTM D5891
- **Free Swell** - ASTM D5890
- **Grab Strength** - ASTM E6352
- **Mass Per Unit Area** - ASTM D5621
- **Per尹ivity/Permeability** - ASTM D4491
- **Puncture** - ASTM D4833
- **Soil Burial** - ASTM D3083
- **Tear Resistance** - ASTM D3004
- **Tensile Properties** - ASTM D638
- **Volatility Loss** - ASTM D1203
- **Water Absorption** - ASTM D570
- **Water Extraction** - ASTM D1239
- **Wide Width Tensile** - ASTM D4595
Having your soil and synthetic materials tested by an independent laboratory is important to demonstrate that these construction materials meet your standards. This type of quality assurance can satisfy your design specifications and provide a measure of due diligence that is documented. In today’s complex environment, it is more important than ever to test materials in order to identify potential problems caused by manufacturing defects, construction installation or even natural disasters. As an owner or project manager, you are concerned not only with the long-term viability and profitability of your facility, but keeping current construction costs as low as possible. This means that materials testing must be quick, reliable and reasonably priced.

**QUALITY ASSURANCE**

Golder has fully equipped geotechnical and geosynthetic laboratories that test materials quickly, accurately, and cost-effectively. With our state-of-the-art equipment and advanced technologies, we can conduct more than 60 geotechnical and geosynthetic tests—all standardized by the American Society for Testing and Materials (ASTM). For some materials, ASTM standards have not yet been created. In those situations, we draw on our professional experience to develop testing techniques that provide you with a comfortable level of quality assurance. When your technical needs go beyond normal laboratory testing, we draw upon the environmental and geotechnical experience of Golder professionals who are located throughout a worldwide network of offices.

### GEOTECHNICAL TESTING

Golder’s geotechnical labs offer the most complete range of standardized geotechnical soils testing available in the industry. For example, our labs have more than 60 permeability cells in offices worldwide with the majority located in the United States. These perm cells make use of a flow pump, expediting results faster than typical falling head tests. From grain size distribution to permeability and strength testing, the geotechnical labs produce accurate results that are presented in a technical—but simple—format, making interpretation easy. Golder works towards ensuring the quality of procedures, staff and results by membership in the ASTM D38 Committee on Soils and participation in the American Association of State Highway and Transportation Officials (AASHTO) standardization program. AASHTO has accredited our Atlanta laboratory office and the US Army Corps of Engineers has also accredited our Atlanta office lab. A list of the ASTM tests we conduct is listed to the right.

<table>
<thead>
<tr>
<th>Test Method</th>
<th>ASTM Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atterberg Limits</td>
<td>D4318</td>
</tr>
<tr>
<td>Calif Bearing Ratio</td>
<td>D1083</td>
</tr>
<tr>
<td>Carbonate Content</td>
<td>D3042</td>
</tr>
<tr>
<td>Consolidation</td>
<td>D2435</td>
</tr>
<tr>
<td>Direct Shear</td>
<td>D3080</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>D2216</td>
</tr>
<tr>
<td>Organic Content</td>
<td>D2094</td>
</tr>
<tr>
<td>pH Determination</td>
<td>D1293</td>
</tr>
<tr>
<td>Permeability (granular)</td>
<td>D2434</td>
</tr>
<tr>
<td>Permeability (flex member)</td>
<td>D5084</td>
</tr>
<tr>
<td>Proctor</td>
<td>D698</td>
</tr>
<tr>
<td>Resilicty</td>
<td>D567</td>
</tr>
<tr>
<td>Settlement of Cohesive Soils</td>
<td>D4546</td>
</tr>
<tr>
<td>Sieve Analysis (wt)</td>
<td>C136</td>
</tr>
<tr>
<td>Sieve Analysis (#200)</td>
<td>D1140</td>
</tr>
<tr>
<td>Sieve w/Hydmometer</td>
<td>D422</td>
</tr>
<tr>
<td>Triaxial</td>
<td>D2850</td>
</tr>
<tr>
<td>Unconfined Compression</td>
<td>D2166</td>
</tr>
<tr>
<td>Unit Weight &amp; Moisture</td>
<td>D2037</td>
</tr>
<tr>
<td>Visual-Manual Class.</td>
<td>D2488</td>
</tr>
</tbody>
</table>

### GEOSTYNTHETIC TESTING

The geosynthetic laboratory tests for the mechanical and physical characteristics of seawed and unseamed geomembrane, geotextile, geomat, geocomposites, geogrid, and geosynthetic clay liner materials. As an example of our capability, we can test 100 geomembrane seam destructive samples in a normal business day.

Our geosynthetic lab is accredited by the Geosynthetic Accreditation Institute, a division of Geosynthetic Institute (GSI), to conduct more than 40 ASTM tests, as indicated in the list to the right. The U.S. Environmental Protection Agency and U.S. Army Corps of Engineers recognize the Geosynthetic Accreditation Institute as the official accrediting organization for geosynthetic testing.

As active members of the GSI and the ASTM D35 Subcommittee on geo-synthetics, our lab professionals have a developmental role in testing standards and procedures and stay abreast of the rapid changes that occur in the industry.

<table>
<thead>
<tr>
<th>Test Method</th>
<th>ASTM Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apparent Opening Size</td>
<td>D4751</td>
</tr>
<tr>
<td>Abrasion Height</td>
<td>GRI GH12</td>
</tr>
<tr>
<td>Burst Strength, Muller</td>
<td>D3786</td>
</tr>
<tr>
<td>Carbon Black Content</td>
<td>D1603</td>
</tr>
<tr>
<td>Carbon Black Dispersion</td>
<td>D5696</td>
</tr>
<tr>
<td>Density/Specific Gravity</td>
<td>D782</td>
</tr>
<tr>
<td>Destructive (peel/shear)</td>
<td>D6392</td>
</tr>
<tr>
<td>Dimensional Stability</td>
<td>D1204</td>
</tr>
<tr>
<td>Direct Shear</td>
<td>D5321</td>
</tr>
<tr>
<td>Environmental Stress Crack</td>
<td>D6243</td>
</tr>
<tr>
<td>Fluid Loss</td>
<td>D5893</td>
</tr>
<tr>
<td>Free Swell</td>
<td>D5890</td>
</tr>
<tr>
<td>Grab Strength</td>
<td>D5632</td>
</tr>
<tr>
<td>Mass Per Unit Area</td>
<td>D5261</td>
</tr>
<tr>
<td>Permittivity/Permeability</td>
<td>D1603</td>
</tr>
<tr>
<td>Permeability (flex member)</td>
<td>D5084</td>
</tr>
<tr>
<td>Permeability (granular)</td>
<td>D2434</td>
</tr>
<tr>
<td>Pinhole Dispersion</td>
<td>D4467</td>
</tr>
<tr>
<td>Proctor</td>
<td>D698</td>
</tr>
<tr>
<td>Resistivity</td>
<td>D567</td>
</tr>
<tr>
<td>Soil Burial</td>
<td>D3083</td>
</tr>
<tr>
<td>Soil Burial</td>
<td>D3083</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
</tbody>
</table>

**Soil Permeability Testing**

<table>
<thead>
<tr>
<th>Test Method</th>
<th>ASTM Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Permeability</td>
<td>D5084</td>
</tr>
</tbody>
</table>
Having your materials tested by an independent laboratory is important to demonstrate that these construction materials meet your standards. This type of quality assurance can satisfy your design specifications and provide a measure of due diligence that is documented. In today’s complex environment, it is more important than ever to test materials in order to identify potential problems caused by manufacturing defects, construction installation or even natural disasters.

As an owner or project manager, you are concerned not only with the long-term viability and profitability of your facility, but keeping current cost as low as possible. This means that materials testing must be quick, reliable and reasonably priced.

**GOLDER PERFORMS THE FOLLOWING LABORATORY TESTS:**

- C29  Bulk Density (Unit Weight) and Voids in Aggregate
- C39  Compression of Concrete Cylinders
- C40  Organic Impurities in Fine Aggregates for Concrete
- C88  Soundness of Aggregates by Use of Sodium Sulfate or Magnesium
- C117 Materials finer than 75 um (No. 200) Sieve in Mineral Aggregates by Washing
- C127 Specific Gravity and Absorption of Coarse Aggregate
- C128 Specific Gravity and Absorption of Fine Aggregate
- C131 Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C136 Sieve Analysis of Fine and Coarse Aggregates
- C142 Clay Lumps and Friable Particles in Aggregates
- C535 Resistance to Degradation of Large-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- D2434 Permeability of Granular Soils
- D3042 Insoluble Residue in Carbonate Aggregates
- D3080/D5321 Large Scale Direct Shear
- D4791 Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
- Sand Equivalent
- Alkali-Aggregate Reactivity

Please visit us at: www.golder.com
Global Issues:

At GOLDER ASSOCIATES we strive to be the most respected global group specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Solutions that Stand:

Golder helps ensure the quality of procedures, staff and results through memberships in the ASTM D18 Committee on Soil and Rock and participation in the American Association of State Highway and Transportation Officials (AASHTO) standardization program. AASHTO and the US Army Corps of Engineers have also accredited our Atlanta office lab.

Golder U.S. Office Locations

Please visit us at: www.golder.com

CONTACT INFORMATION:
Golder Associates Inc.
3730 Chamblee Tucker Road, Atlanta, GA 30341
Tel (770) 496.1893 Fax (770) 934.9473
Henry Mock (Henry_Mock@golder.com)
Jim Renner (Jim_Renner@golder.com)
Jon Ellingson (Jon_Ellingson@golder.com)

Please visit us at: www.golder.com
At GOLDER ASSOCIATES we strive to be the most respected global group specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Local Solutions

Albuquerque, NM  
505.821.3043

Amherst, MA  
413.253.9772

Anchorage, AK  
907.344.6001

Atlanta, GA  
770.496.1893

Bellingham, WA  
425.658.4045

Boca Raton, FL  
561.994.9910

Bristol, PA  
610.941.8173

Buffalo, NY  
716.215.0850

Chicago, IL  
630.717.2838

Coeur d’Alene, ID  
208.676.9933

Columbus, OH  
614.506.4400

Denver, CO  
303.980.0140

Duluth, MN  
218.724.0088

Fort Collins, CO  
970.484.3875

Gainesville, FL  
352.336.5600

Greensboro, NC  
336.852.4693

Hartford, CT  
860.653.7042

Houston, TX  
281.821.6868

Irving, TX  
714.926.4400

Jacksonville, FL  
904.363.3430

Kamloops, BC  
250.865.1090

Lansing, MI  
517.482.2282

Manchester, NH  
603.668.0080

Minneapolis, MN  
612.607.9737

Mt. Laurel, NJ  
856.793.2005

Newark, NJ  
973.645.1922

Oak Ridge, TN  
865.483.9201

Phoenix, AZ  
480.966.0153

Portland, ME  
207.373.1520

Portland, OR  
503.607.8820

Raleigh, NC  
919.313.4813

Redwood, WA  
425.883.0777

Reno, NV  
775.828.9604

Richmond, VA  
804.358.7900

Sacramento, CA  
916.786.2424

San Francisco, CA  
415.386.3828

St. Louis, MO  
314.522.9000

Silver City, NM  
505.388.0118

Spokane, WA  
509.327.2084

Tallahassee, FL  
850.339.9947

Tampa, FL  
813.287.1717

Tucson, AZ  
520.888.8118

Wichita, KS  
316.685.3019

Winston, NC  
336.885.3972

Worldwide

Africa  
27.11.254.4800

Asia  
852.2562.3658

Australia and New Zealand  
61.3.7271.5400

Canada  
1.403.299.5600

Europe  
44.1628.586.213

South America  
55.21.3095.9900

www.golder.com/services

Global Issues

At GOLDER ASSOCIATES we strive to be the most respected global group specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.