1. PRODUCT NAME

GeoTech Geoinclusion[®] (US Patent # 5,102,260)

2. MANUFACTURER

GeoTech Systems Corporation 326 McGhee Road Winchester, Virginia 22603 Phone: (703) 759-0300 Fax: (703) 757-0119 Web Page: http://members.aol.com/ geosyscorp

3. PRODUCT DESCRIPTION

Basic Use: The GeoTech Geoinclusion is a unique, patented geosynthetic product that can simultaneously provide the functions of compressible inclusion, thermal insulation and drainage. The GeoTech Geoinclusion is innovative in its ability to deform under load in a controlled, predictable fashion.



The Geoinclusion is used in compressible inclusion applications where a strong yet lightweight material is required to reduce stresses and provide fluid drainage on structural elements such as:

- Retaining walls,
- Foundation walls above the permanent groundwater table,
- Bridge abutments,
- Bermed structures

Earth pressure is reduced because it compresses with relatively little resistance under:

- the gravity stress of the retained soil,
- the expansion of swelling soils, rock, or freezing soils,
- the inertial loading of large scale events such as earthquakes or blasts.

Hydrostatic pressure and gases, such as radon or methane, are relieved when the Geoinclusion is part of a hydrostatic pressure relief or gas venting system. Water is eliminated and gases vented through the drainage composite portion of the Geoinclusion.

Quality of below grade space is improved through the Geoinclusion's thermal insulating characteristics resulting in:

- lower heating costs,
- reduced dehumidification costs because the dew point is moved to outside the below grade space.

The Geoinclusion provides superior earth vibration damping from seismic activity and road and rail traffic. Sound vibration damping is both from or into below grade space.

Exposed retaining walls perform better:

- Thermal insulation can prevent freezing of the retained soil. Stresses associated with expansion during freezing are absorbed by the Geoinclusion.
- With a polymeric reinforcement located in the retained soil, thermal insulation can reduce creep of the reinforcement which results when the soil is heated by solar radiation on the face of the wall.
- Long term structural and thermal performance is assured by a patented insect treatment incorporated into the TerraFlex during the manufacturing process.

Composition and Materials: The Geo-Tech Geoinclusion consists of a rectangular panel of GeoTech TerraFlex synthetic compressible inclusion laminated to a GeoTech Drainage Panel which combines a drainage medium and a geotextile.

The GeoTech <u>TerraFlex</u> has a nominal density of 14.4 kg/m³ (0.9 lb./ft.^3). The TerraFlex synthetic compressible inclusion is manufactured under a patented process which incorporates a natural mineral formulated to resist termite infestation.



Size and Shape: Standard panel dimensions are 1219 mm (4 feet) wide by 1219 mm (4 feet) long with the thickness dependent on specific project requirements. Other panel shapes and dimensions can be produced on a special order basis.

Environmentally Safe: The Geoinclusion contains no CFC's, HCFC's, HFC's, or formaldehyde. It is chemically and biologically inert, non-nutritive and highly stable. It will not decompose, decay, or produce undesirable gases or leachates. It is a permanent filler between earth materials and the structure.

Limitations and Cautions: The Geoinclusion stands up well to normal weather conditions encountered during installation. Long-term (6 months or greater) exposure to UV radiation will cause discoloration of the TerraLite and TerraFlex component. Material should be covered as soon as practical. The Geoinclusion in unaffected by freeze-thaw cycling, moisture, or road salts. Protect the Geoinclusion from exposure to hydrocarbons, highly solvent extended mastics and coal tar pitch. The Geoinclusion contains a flame retardant additive; however, it should be considered combustible and should not be exposed to open flame or any source of ignition.

4. TECHNICAL DATA

The GeoInclusion is made up of two components: a TerraFlex component which is the bulk of the compressible inclusion, and a Drainage Panel component which serves as the medium for the Hydrostatic Pressure relief system. The thickness of these two components can be what ever the user specifies, following the guidance for each of the two parts which follows.



Part I: TerraFlex Component

To select the required thickness of the TerraFlex compressible inclusion, the design professional should develop project specific design curves relating deformation of the ground surface and stress at the ground surface from the expanding ground. In general, the largest stress occurs under confined (zero deformation) conditions and the largest deformation occurs under free-swell (zero stress) conditions. The designer must select a magnitude of surface stress and corresponding deformation that is intermediate to these limiting conditions and for which the structure will be designed.

Note: In the absence of data relating surface stress and deformation, the designer can use deformations estimated using free-swell tests and arbitrarily select a stress level for which the structure will be designed.

The thickness of TerraFlex required should be such that the material will not experience sustained stresses resulting in more than 20% strain as this is the elastic strain limit. Transient loading (as might occurr during seismic events) beyond this limit are allowable.

Figure 1 shows the stress-strain relationship of TerraFlex Synthetic Compressible Inclusion in unconfined axial compression at room temperature. To determine the thickness of TerraFlex required for project specific conditions Figure 1 is used to estimate the strain level in the Synthetic Compressible Inclusion. Once determined, the following steps are to be used:

Step 1. Find the stress magnitude for which the structure will be designed on the vertical axis. If this corresponds to less than a strain level of 20% for TerraFlex, use step 3, otherwise use step 2.

Step 2. Based upon the maximum displacement determined from analysis of the structure or prevailing soil conditions, select a thickness of TerraFlex such that under this degree of compression, it will be experiencing less than 20% strain.

Step 3. If it is necessary to limit the stress on the structure to less than that with TerraFlex at the elastic strain limit (20%), determine the thickness needed by determining the maximum strain from the rapid loading curve, and divide the estimated displacement by that value instead of 20%.

For example, assume a maximum allowable stress from swelling is determined to be 50 kPa (1044 psf) and a deformation of 25 mm (1.0 inch) is expected at this stress level.

The corresponding strain for rapid-loading is estimated to be 17%. The calculation yields a required TerraFlex thickness of 147 mm (5.79 inches). For design simplicity a TerraFlex thickness of 150 mm (6 inches) would be specified. Using this simple approach, different combinations of stress transmitted to the structure and TerraFlex synthetic compressible inclusion thickness can be evaluated to find the most cost effective design.

Note: The Drainage Panel component has rapid loading characteristics identical to those of the TerraFlex, but tends to undergo plastic deformation, even at low strains.

Part II: The Drainage Panel Component

Density/Weight: 2.0 pcf nominal. **Coefficient of Permeability:** 2.0 cm/sec (ASTM D-4716, 4" thick @15psf loading)

Thermal conductivity: K=.285 (dry) @ 75° (ASTM C518) *Thermal resistance:* R= 3.5 (dry)

 $@ 75^{\circ}$ (per inch of thickness- uncompressed).

Compression Strength: GeoTech Drainage Panels have been extensively tested for both rapid loading conditions as well as sustained loading, in accordance with ASTM D1621. These results are compiled for strains up to 50% in **Chart 1**, found on the last page.

Stability: GeoTech products are permanently resistant to moisture, including total immersion, and are unaffected by normal acidic or alkylinic soil conditions.

To Select the Proper Thickness

When designing a hydrostatic pressure relief system with GeoTech's Insulated Drainage Panels, it is important to consider two unique aspects of this product:

• The Transmissivity (or permeability) is determined by the thickness of the sheet.

• When buried, the material will compress, which will affect the Transmissivity.

Figure 2 on the following page illustrates the relationship between the soil permeability, and the change in water table height caused by a hydrostatic pres-

sure relief system (modeled as an "infinite slot"), and the expected flow.

The lateral pressure against a wall will be a function of the soil type and will be proportional to the depth of the foundation. In some cases, it is prudent to specify thicker sheets of Drainage Panel to account for the compression they experience as a result of the higher lateral forces present at the bottom of the wall.

Chart 1, found on the last page provides the relationship between soil pressure, Drainage Panel Strain, and Transmissivity for a 1.5", 4", and 6" thick sheet of the material under sustained loads. These graphs have been corrected for creep and the values may be considered the long-term, steady state values.

<u>Illustration of Utilizing Design</u> <u>Graph</u>

(The following discussion refers to **Chart 1** on the following page)

A. The lateral force at the bottom of a basement wall is predicted to be approximately 700 psf, shown as point "A" on the chart. This corresponds to the "at rest" pressure conditions of a cohesionless soil with a density of 140 pcf at a depth of 10 feet.

B. This pressure will result in compres-



 $\frac{c_{o}}{d}$ $\frac{c_{o}}{d}$

sion of the Drainage panel of approximately 21%, shown as point "B" on the chart. To determine the transmissivity for a given thickness of the Drainage panel material, refer to the three dashed lines, which correspond to thicknesses of 1.5", 4", and 6". In this case, a 4" piece will have a transmissivity of 6 gpm/ft (point "C"). The actual thickness required would be dependent upon the transmissivity required based on results of the soil analysis following the method described in **Figure 2**.

5. INSTALLATION

(Refer to Figure 3 on Following Page)

For most applications, the Geoinclusion is installed in accordance with the following guidelines. Additional guidelines for specific applications should be developed by the design engineering.

1. Surfaces should be clean, dry and sound; free of excessive dust, dirt, loose paint, oil and grease or any foreign matter that would interfere with adhesion.

2. When applying over waterproofing or dampproofing materials, check to determine compatibility of the DB-784 adhesive. Be sure concrete and waterproofing materials are well cured and dry.

3. Apply DB-784 adhesive using trowel or putty knife to the TerraFlex side of the Geoinclusion. Place three walnut sized daubs of adhesive spaced every 12" apart across the top of the rear of the Geoinclusion board, beginning 6" from the edges.

4. Press panels firmly against wall surfaces, making sure vertical joints are staggered and all joints are butted tightly.

5. Panels are furnished with a 2" minimum fabric lap on two adjacent edges. Install panels so that all joints are completely covered by geotextile fabric, making sure that fabric side faces the earth. Begin first row with fabric lap at the bottom. The adjacent side lap will then be in the left vertical position. Additional spot-gluing of fabric joints may be necessary during backfill operations to insure complete masking of joints.

GT-GI.pdf



6. AVAILABILITY AND COST

Cost is directly related to the thickness of the material. Please contact GeoTech Systems Corporation or the licensee to determine current material cost. The GeoTech Geoinclusion is available throughout the United States, Canada and Puerto Rico.

7. MAINTENANCE

Under normal conditions of use, the GeoTech Geoinclusion requires no maintenance for the life of the system.

8. TECHNICAL SERVICES

Complete technical services are available from GeoTech Systems Corporation and its licensed manufacturers or distributors. Services include assistance during the design and specification stages. Sales representatives can also work with the contractor through the initial stages of application to assure proper installation.

Notice: The information contained herein is, to the best of GeoTech's knowledge, accurate and reliable as of April, 1999. Freedom from patents of GeoTech or others is not to be inferred. For any information that may have been developed subsequent to April, 1999, consult the nearest GeoTech sales office. For further information and pricing, please contact GeoTech Systems Corporation or your local GeoTech Geoinclusion licensee:

Insulated Building Systems, Inc. 326 McGhee Road Winchester, VA 22603 Phone: (540) 662-0882 FAX: (540) 662-9104

