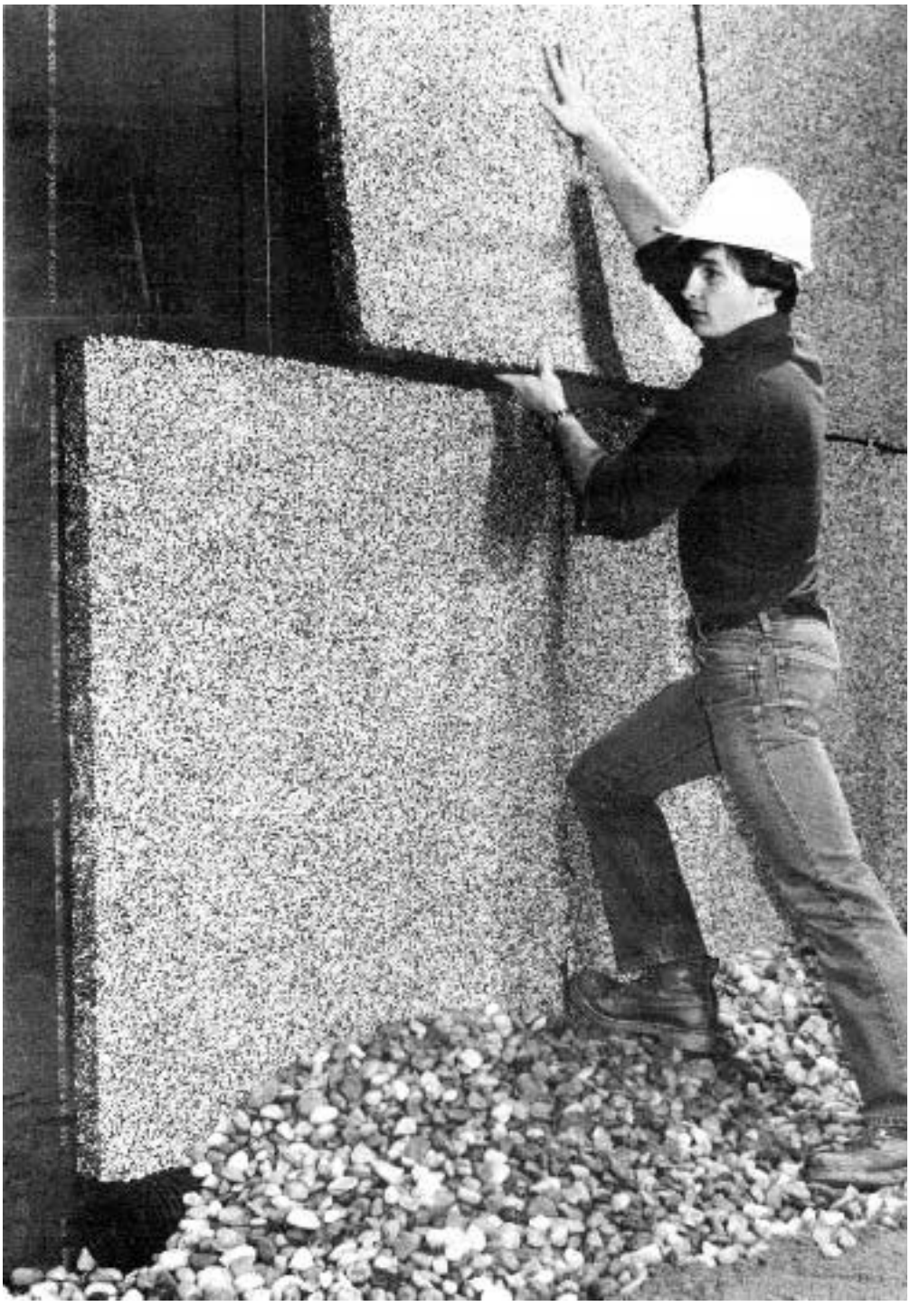
by Barry Dempsey

Geotextiles & Geocomposites

New "geo" products make it easy to stabilize slopes and waterproof basement walls



What do the following items have in common: a Roman road, a large area of filled land in Holland, and a residential foundation drain system? In case you didn't guess, the answer is geotextiles. The Romans used textiles woven from reeds to stabilize swampy soil beneath their roads. Following World War II, the Dutch used sailcloth and canvas to stabilize roadbed fill and to drain waterlogged soils. Modern "geo" products, made from synthetics rather than canvas or reeds, have been used for many years beneath interstate highways to increase the service life of paving.

Now a number of geotextiles and related products are finding use in residential construction. Among other things, this family of products could solve one of builders' major headaches — complaints from customers with damp and leaky basements. In fact, the products can serve so many uses that one article can't do them all justice. These are the most common applications:

- as a substitute for traditional gravel backfill
- as waterproofing or damp proofing layer
- as insulation combined with dampproofing
- for sub-surface patio and driveway drainage
- for erosion control

Geotextiles

Geotextiles are fabrics designed to filter out small soil particles called "fines." Geotextiles can serve several functions: separation of one backfill material from another, reinforcement of slopes, filtration, or drainage. They are also used with materials that provide a moisture barrier.

In residential construction, geotextiles can be used to filter out silt fines suspended in groundwater or rainwater run-off. As the water percolates down toward the drain tile, it carries the silt fines with it. But once it enters the drain tile, the water flow slows down,

Polystyrene beads mixed with an asphalt binder give this drainage board its insulating value. The board is supplied over a waterproof membrane.

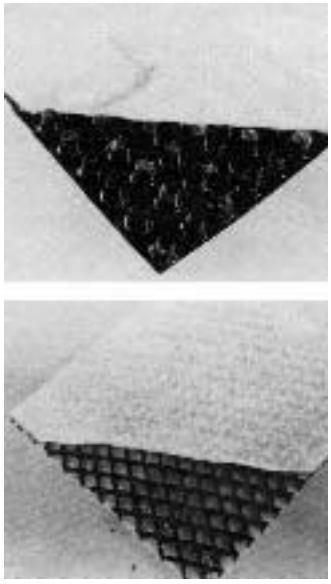


Figure 1. *Drainage geocomposites are composed of a plastic core and a geotextile covering to filter out silt particles. The two shown are Miradrain (top), which uses an egg-crate core, and J-Drain (bottom), with a lattice-shaped core.*

and the silt fines settle out. Eventually the drain tiles fill up with silt and do not function effectively.

Two kinds of geotextiles are manufactured as filters — woven and nonwoven. The nonwoven fabrics are less expensive and work best for drainage. In these the threads (made of polyester or polypropylene) are scrambled or randomly oriented and often heat-fused to produce a permeable sheet. They are adequate for most residential work. Woven fabrics are generally stronger but are too expensive for residential use.

Geocomposites

Several very different materials are marketed as geocomposites. Basically, a geocomposite is a man-made material configured to enhance drainage. These generally consist of a synthetic core covered on one or both sides with a geotextile fabric (see Figure 1).

The core material should offer high strength and good durability. Three materials are generally used: polyethylene, polystyrene, and nylon. Avoid nylon-based geocomposites, however, since they lose strength when soaked with water. They won't hold up in long-term use against basement walls, but may perform adequately for erosion control.

To evaluate the many drainage products now on the market for house construction, you need to understand that these products must do four things- and do them well. First, they must filter out the silt fines. Second, they must conduct water to a drainage channel. Third, they must not degrade with inground use. And fourth, they must be strong. We will try to give you some guidance about which products work best for different applications.

Foundation Drainage

Every contractor needs to be concerned about the bottom line. But let's face it. The usual way of coating the foundation with water-based asphalt emulsion, may be adding a layer of polyethylene, and backfilling, doesn't always work. Many contractors leave out the gravel they know should go in just above the drain tile. Many don't put asphalt building paper above the gravel to keep silt fines out of the tile (this solution isn't very effective anyway). And then the backhoe operator may not be particularly sensitive to the polyethylene wrap, if you use one-ripping it to shreds with big clods of soil or rock.

On down the line, the homeowner begins to see water seeping through the basement walls. If the foundation is unreinforced block — common in our part, of the country — it may begin to crack. If the water and earth pressures are too great, the wall can fail. In other cases, a high water table starts causing seepage right from the start.

There are better ways to build. Even if building cheaply is the number one priority, consider using a geocomposite drainage system in the following situations:

- When the basement will be inhabited
- When the walls will be unreinforced 8-inch block
- When the site has a known high groundwater level
- When the site has expansive soils
- When frost heave could be a problem.

Construction Sequence

To use these materials, the construction sequence has to be altered very little. Put on a damp-proofing material. You can use either a spray-on elastomeric membrane or a cementitious coating. (See product listing, end of this article) Don't use the typical asphalt emulsion because the material is water-soluble, and it is not compatible with many of the geocomposites.

Next, install the drainage geocomposite. Most of these materials come in wide rolls (4-foot wide is common). Lap the product over the drain tile, which should be placed at the outside base of the footing and not in the footing/foundation-wall joint (see Figure 2). Some materials are installed vertically and some horizontally. Follow the manufacturer's recommendations for joining.

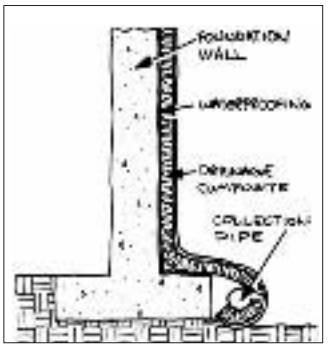


Figure 2. *Geocomposites can be used to carry water down the drain tile and eliminate hydrostatic buildup against the wall.*

If it's easier, you can install the geocomposite just on the basement wall, not lapping it over the footing. In that case make sure you use a gravel backfill, and lay a geotextile filter fabric over the gravel. With this method, the geocomposite on the wall will channel water down the footing, and the gravel will permit the water to flow into the drain tile.

The use of geocomposite means you can reduce the amount of gravel (or eliminate it with some products). It means you may be able to leave out the rebar from block walls. It means you can reduce the water pressure against the walls. And most of all, it means you can eliminate water flow into the basement.

If geoproducts seem too expensive for your market, offer their use as an option to your customers. Let them choose it as a quality add-on.

Which Products to Use

Some of these products are easier to use than others. There are single-sided and double-sided geocomposites, products with loose fabric, and some with attached fabric. Some products have a solid backing, and in some the backing is perforated. Manufacturers make many advertising claims about the products, but you will have to determine for yourself which is easiest to work with and which will hold up in your application.

When you are evaluating geocomposites, you can make a crude estimate of their strength and water-carrying capacity. Geocomposites must have the "core capacity" needed to rapidly carry water away from the foundation wall. Try compressing the base material with your fingers. If it flattens under hand pressure, you can imagine what it will do when backfill pressures push against it. In the same way, some of the products with loose fabrics may have their flow capacity reduced if the fabric is pushed into the flow channels by backfill.

The products that are most promising for foundation use are the single-sided geocomposites, with solid backing, and with fabric attached to the core projections. The solid backing means you can skip a damp-proofing or waterproofing layer. The material can be glued right to the wall with any construction mastic. If you start at the bottom of the wall and install the material horizontally, the layers can be overlapped (see Figure 3).

Some geocomposites, which look like inverted egg crates, snap together like LEGOs. Seams can be sealed with a hot-melt adhesive. Products such as Miradrain 6000 and Monsanto's Hydraway WD 300 are examples of geocomposites that have the strength and workability appropriate for residential basement foundations. Some of these products have strengths adequate for deep foundations as well.

A number of other configurations are also available. These use cuspated (bumpy on both sides) core material. They may be more difficult for the contractor to handle in the field because there is no flat side to attach to the foundation wall.

Many of these products are also perforated so that water can penetrate through the material. This means that a damp-proofing or waterproofing layer is

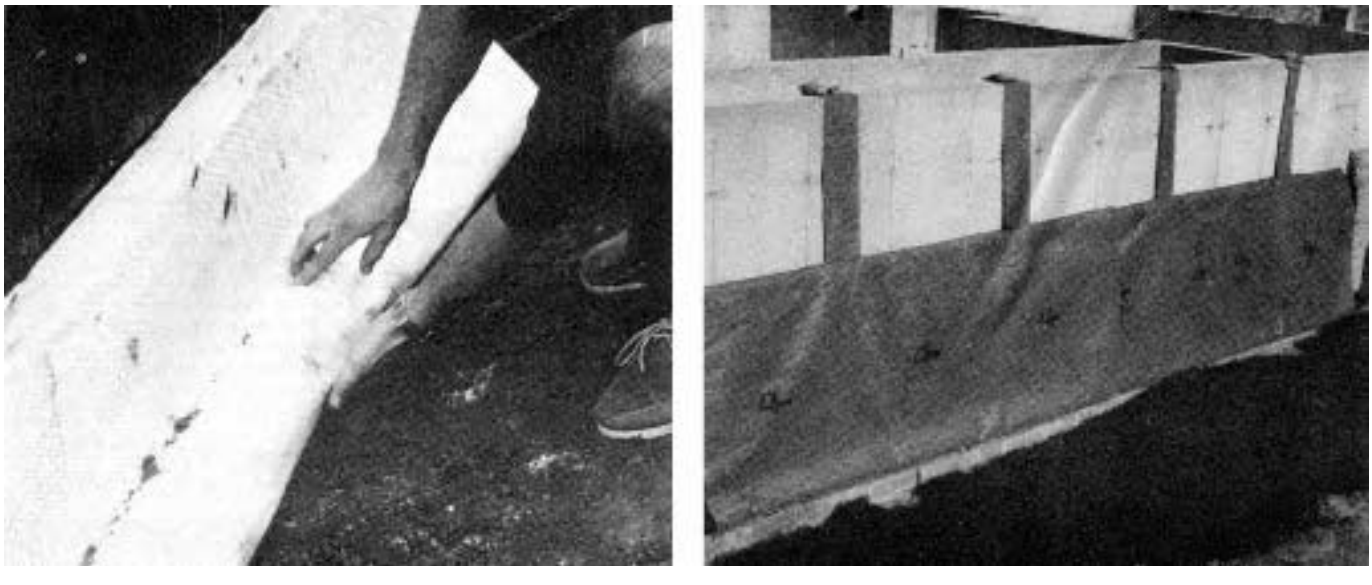


Figure 3. *Some drainage composites, such as J-Drain (left), are stuck to the wall with mastic, and can warp right around the drain tile. A similar from Eljen (right) uses strips of drainage material to conduct water down the wall.*

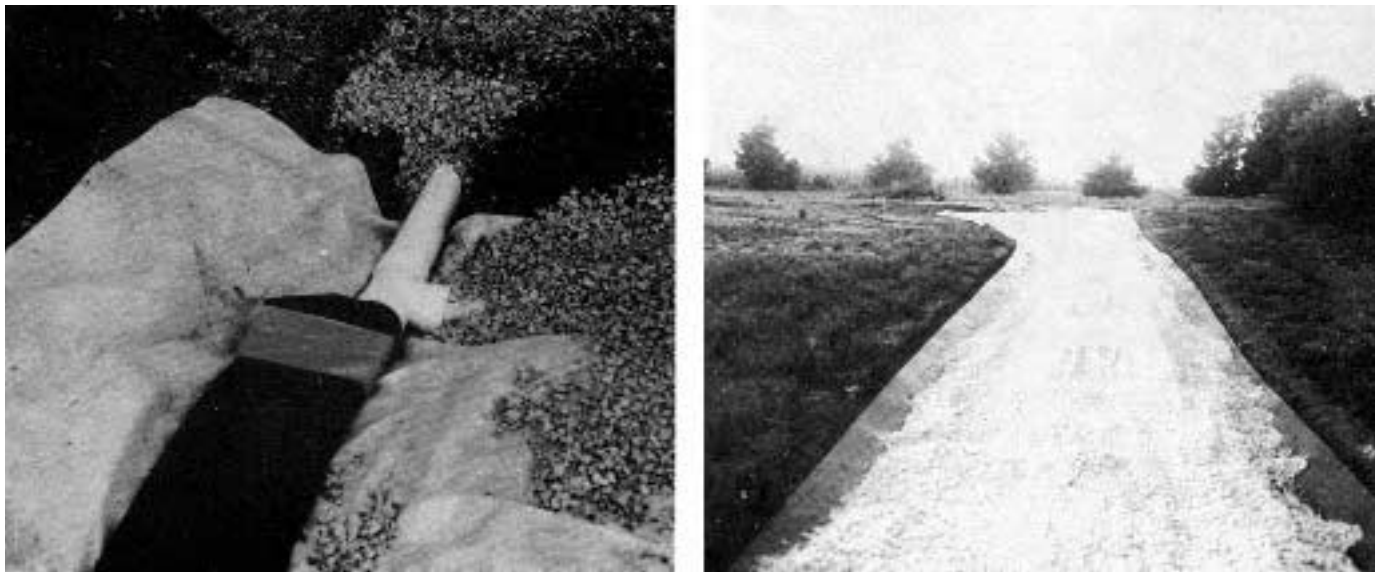


Figure 4. *Geocomposites can drain under roads to prevent frost heave. This product, called Findrain (left), has special end caps that conduct the water into a 4-inch pipe, and then to a drainage ditch or storm drain. The road (right) with buried drains down each side of it, is ready for paving.*

extremely important because the material, by itself, is not a water barrier.

Manufacturers of these products recommend spray-on elastomeric waterproofing. Some manufacturers also recommend a 1-inch layer of EPS board between the drainage board and the waterproofing layer. This keeps the geocomposite from puncturing the waterproofing layer when backfill is installed. And it adds a layer of insulation.

The single-sided, solid-backed geocomposites could also be used with EPS board. It would probably be easier to place the EPS outside the drainage material. To keep the insulation relatively dry and protect its R-value, however, the EPS board could be fastened to the wall first, and the drainage material attached to it.

Cost. A quality geocomposite does not have to cost a fortune. Prices range from $.50 to $1.10 per square foot. The price varies according to the strength of the core material, the flow capacity of the core, and the fabric covering used.

Paving, Driveways, and Patios

Geocomposites and geotextiles improve the ways paving behaves. For expansive soils, filled sites, paved patios, loose-laid masonry block paving, or sites with frequent freeze/thaw cycling, it may make sense to use these products.

The products are used in two ways. First, a geotextile can be used to separate the subgrade soil from the gravel or sand fill. The geotextile helps stabilize the material above it, prevents subgrade intrusions, and prevents plant growth, a plus where it is used beneath block pavers.

Secondly, a geocomposite with a geotextile filter can be used beneath paving. The geocomposite provides drainage channels, just as it does on walls. Water is collected in pipe collectors at the sides of paved areas. Many geocomposites make termination units that collect the material into a 4-inch round pipe. The collection pipe can be emptied into a drainage ditch or storm drain (see Figure 4).

Typical products that are especially useful in paving or in retrofits where drainage tile have clogged are AdvanEdge, Hydraway, and Stripdrain 100. These are thin, elliptical or rectangular geocomposite drainage materials that are extremely strong.

Retrofit Applications. Products used to drain paving can be installed with a narrow trencher around the perimeter of an existing foundation. These geocomposites have a geotextile sleeve to prevent clogging (see Figure 5). Because paving drainage systems come with special fittings to step down to a 4-inch pipe, they can be conveniently used to retrofit existing foundations. The pipe can be directed into the yard or into a sump pit. The cost of the material is about $1.25/lineal foot.

Erosion Control

Builders are now putting homes on sloped sites that used to be considered unbuildable. Protecting these sloped grades from erosion is important, especially where soils are unstable.

One important factor in erosion control is root growth. Some geoproducts provide an open-weave structure that holds topsoil in place until plants begin to grow. The open-weave material is laid on the slope, top soil is installed on it, and seeds are planted in the topsoil. The fiber matrix keeps the soil and seeds from washing down the hill (see Figure 6).

With some geoproducts, you can also eliminate retaining walls. Normally, a sloping site must be graded gradually or contained behind a retaining wall. But building a good retaining wall is expensive. A geogrid

Waterproofing Plus Insulation

If you want to both waterproof and insulate a basement at the same time, these three products can help.

The first — Owens Cornings' Warm-N Dri — uses rigid fiberglass panels installed vertically on basement walls. They are stuck to a modified-asphalt waterproofing layer called Tuff-N Dri, which is sprayed on. Owens Corning warrants residential basements using this system, but requires contractors using it to be trained and licensed by the company.

Another insulation/drainage system is Geotech Drainage Board. This product looks like polystyrene beads mixed with asphalt. The board, which protects the waterproofing layer form damage, comes in a number of widths — 1 1/2-inch board is normally used for basement walls. With this board, gravel backfill can be eliminated, although it is still a good idea to use gravel, covered with geotextile, above the drain tile.

For waterproofing, the company recommends a rubberized sheet membrane, such as PolyGuard. If only dampproofing is required, a spray-on asphalt parging can be used. The board is attached with adhesive and installed 6 to 12 inches below grade. A filer fabric is an integral part of the system.

A third product is Conproco, an extruded polystyrene board coated with a cement-based polymer. The company sells directly to contractors and provides design advice for contractors who want to build true living spaces below grade. These insulation/drainage products cost $1.25 per square foot or less. In areas where building codes require foundation insulation, you may find it easier to install a combined system than to install the products separately. –B.D.

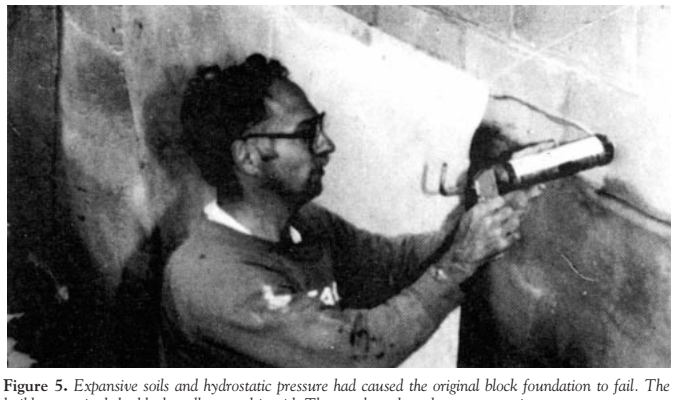


Figure 5. *Expansive soils and hydrostatic pressure had caused the original block foundation to fail. The builders repaired the block wall, parged it with Thoroseal, and used a geocomposite to route water to an exterior sump. The result: no leaks in five years.*

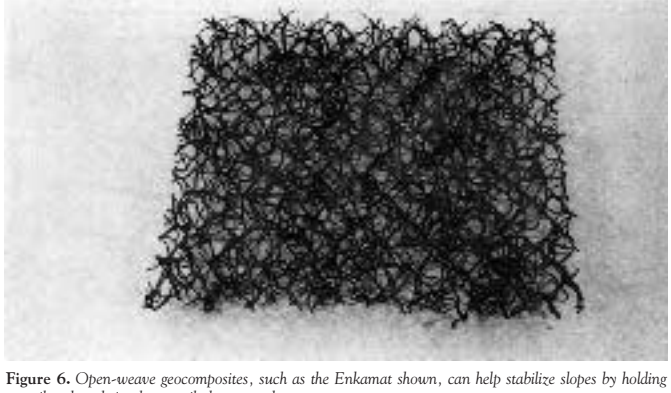


Figure 6. *Open-weave geocomposites, such as the Enkamat shown, can help stabilize slopes by holding topsoil and seeds in place until plants put down roots.*

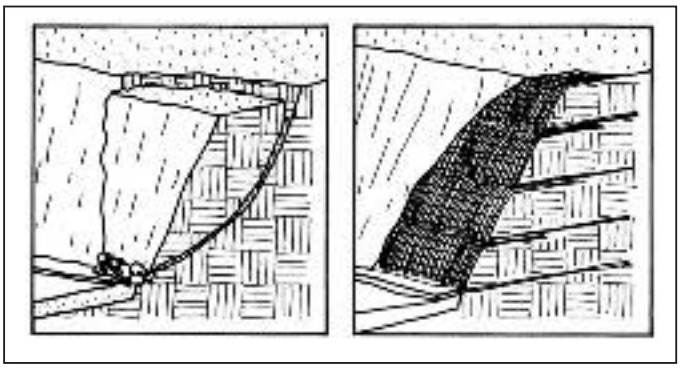


Figure 7. *Heavy-duty composite materials called geogrids can economically stabilize steep slopes. They are typically installed in horizontal sections, like a layer cake.*

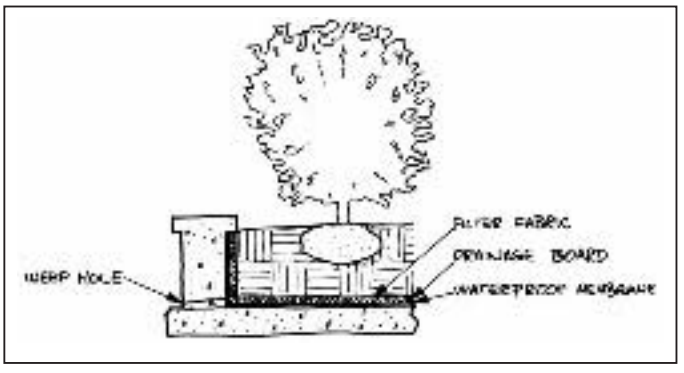


Figure 8. *Geocomposites can be used inside planters and may be combined with EPS board to reduce the amount of soil, and weight, of the planter.*

system can be used instead (see Figure 7). Geogrids are installed in horizontal layers, like the layers of a cake. These systems must be designed by an engineer.

Other Uses

Many of these products can be used elsewhere in construction sites. On the soil side of a masonry retaining wall, for example, a geocomposite can be used to reduce water pressure and divert water to weep holes or drain tile.

The materials can also be used in trench drains or interceptor drains where high-quality backfill is not available. The geocomposites can also be used inside planters and may be combined with EPS board to reduce the amount of soil (and weight) of the planter (see Figure 8).

Finding Materials

The biggest problem the residential contractor will have with geo materials is finding them. In major metropolitan areas, waterproofing suppliers or regional distributors are likely sources of supply. Call the companies listed in this article to obtain product brochures and the names of regional distributors.

If there is enough demand, one day a contractor may be able to buy geoproducts along with plywood and 2x4s. There are so many uses for geocomposites and geotextiles in residential construction that it's only a matter of time. ■

Dr. Barry Dempsey is a civil engineering professor at the University of Illinois. As a consultant to the industry, he has been active in the testing and development of geotextiles and geocomposites.

FOR PRODUCT INFORMATION:

Waterproofing Materials

Electronic Sealers

A-H Seamless Membrane
Anti Hydro Co., Inc.
265 Badger Ave.
Newark, NJ 07108
201/242-8000
Wall is cleaned, then sprayed or rolled. On uneven surfaces use two or three coats.

Hydrocite Liquid Membrane
Sonneborne-ChemRex
415 E. 16th St.
Chicago Heights, IL 60411
312/757-3300
Spray-on, trowel-on, roll-on, or pourable self-leveling elastomeric coating.

Tremco TP-60
Tremco Manufacturing
3735 Green Road
Beachwood, OH 44122
800/321-7906, 216/292-5000
Spray-on elastomeric coating.

Cementitious Coatings
Thoroseal &
Thoroseal Foundation Coating
Thoro System Products
7800 Northwest 38th Street
Miami, FL 33166
800/445-6182 west coast
800/443-5090 midwest area
800-277-8410 east coast
800/322-7825 southern area
Trowel or brush application.

Ultra-Shield
GMX Corporation
3802 E. 91st St.
Cleveland, OH 44105
800/642-7502, 216/641-7502
Applied by certified applicators. Warranty depending on region and distributor.

Sheet Goods
Dri-Shield
W.R. Grace & Co.
62 Whittemore Ave.
Cambridge, MA 02140
800/242-4476, 617/876-1400
Rubberized asphalt with cross-laminated polyethylene film, release paper. Recommended drainage board to protect it.

Poly-Guard
Poly-Guard Products, Inc.
Box 755
Ennis, TX 75120
800/541-4994
Sheet goods. Comes in rolls of 4x50 feet, with 200 square feet to a roll. Sticky on one side with a release paper. Hangs like wallpaper.
Primer and seam sealer also available.

Butyl
Carlisle Syntec
Box 7000
Carlyle, PA 17013
800/233-0551
Cured butyl rubber membrane available in sizes up to 45x125 feet.

Foundation Drainage Only (no insulating value)

Hydro-duct
W.R. Grace & Co.
62 Whittemore Ave.
Cambridge, MA 02140
800/242-4476
Single-sided drainage board, geotextile attached.

J-Drain
JDR Enterprises, Inc.
725 Branch Drive
Alpharaetta, GA 30201
800/843-7569
Used on foundation walls. Must be placed over waterproofing. Comes in rolls 4x75 feet.

Wrap-N-Drain
JDR Enterprises, Inc.
725 Branch Drive
Alpharaetta, GA 30201
800/843-7569
Replaces aggregate backfill but not drain tile. Comes in rolls 16 inches x 50 feet. Placed at bottom of wall above drain tile. Keeps silt fines out of tile. High density polyethylene.

Eljen PDS
Eljen Corp.
15 Westwood Rd.
Storrs, CT 06268
203/429-9486
Channeled polystyrene core, sewn fabric sleeve. Panels available in any height specified lengths 5 or 10 feet.

Miradrain 6000
Mirafi, Inc.
Box 240967
Charlotte, NC 28224
800/438-1855
Prefabricated drain, polystyrene, single sided, with fabric attached. Dimensions 4x8 feet, 25 feet or 50 feet.

Amerdrain
American Wick Drain Corp.
316 Warehouse Drive
Matthews, NC 28105
704/821-7681
Nippled core with geotextile on one side. Polystyrene core. Polypropylene mate. Dimensions 4x104 feet.

HITEK
Burcan Industries, Ltd.
111 Industrial Drive, Unit 19
Whitby, Ontario
Canada L1N 5Z9
416/668-3131
Some studded two sides. Some studded on side. High density polyethylene. Dimensions of up to 42 inches wide by various lengths. Comes with or without fiber

Stripdrain 75
Contech Construction Products
1001 Grove Street
Box 800
Middletown, OH 45044
513/425-2165
Cuspated polyethylene core, laminated or overwrapped with a nonwoven geotextile. The product is 22 or 44 inches x 180 feet.

Tiger Drain
Exxon Chemical
2100 River Edge Parkway
Suite 1025
Atlanta, GA 30328
404/955-2300
Perforated cuspated core made of high density polyethylene. Geotextile fabric 4 x 100 feet.

Tex-Net
Fluid Systems, Inc.
32 Triangle Dr.
Suite 3201
Cincinnati, OH 45246
800/346-9107
Geonet of polyethylene. Geotextile on one or both sides, approximately 8x300 feet.

Hydraway Drain
Monsanto
2381 Centerline Industrial Dr.
St. Louis, MO 63146
800/325-4330
Nippled core filter fabric attached. Polystyrene core, polypropylene fabric. Rolls of 12 or 18 inches x 400 feet, or 36 inches x 200 feet.

PDS 20
ProDrain Systems
P.O. Box 668
Highland, MI 48031
313/887-6657
Double, cuspated core, high density polyethylene, nonwoven fabric attached. Variable roll length, and widths up to 4 feet.

PDS 30
ProDrain Systems
P.O. Box 668
Highland, MI 48031
313/887-6657
Single cuspated core, same material and sizes as PDS 20.

Foundation Insulation Plus Drainage

Geotech Drainage Board
Geotech Systems Corp.
100 Powers Court
Sterling, VA 22170
703/450-2366
Drainage board used below grade to protect basements. Must be used with waterproofing layer. Thickness from 1 to 24 inches available. Comes in 4x4 foot boards. Porous EPS panels with binder, expanded polystyrene. Waterproof adhesive.

Conproco
10 Ferry Street
Concord, NH 03301
603/225-7292
Extruded polystyrene. Coated with cement-based, polymer-modified; fiber-reinforced cement coating. Distribution to contractors. Design guidance available.

Warm-N-Dri
Owens-Corning
Fiberglass Tower - T23
Toledo, OH 43659
419/248-7550
Fiberglass panels used with patented polymer-modified asphalt waterproofing, TUFF-N-DRI. Contractors must be trained and certified by manufacturer.

Paving Drainage

AdvanEdge
Advanced Drainage Systems
3300 Riverside Drive
Columbus, OH 43221
614/457-3051, 413/589-0515
Heavy-duty elliptical plastic panel drain, covered with geotextile fabric.

Stripdrain 100
Contech Construction Products
1001 Grove Street, Box 800
Middletown, OH 45044
800/338-1122, 513/425-2165
Cuspated high density polyethylene core overwrapped with a nonwoven geotextile. One inch thick, roll dimensions range from 12 to 36 inches wide x 400 feet.

Erosion Control

Armeter
Akzo Industrial Systems Co.
Box 7249
Asheville, NC 28802
704/258-5050
Honeycombed geomatrix. Unfolds like an accordion. Made of nonwoven polyester fabric. Panels cover approximately 180 square yards.

Enkamat
Akzo Industrial Systems Co.
Box 7249
Asheville, NC 28802
704/258-5050
Three-dimensional nylon matting. Enhances root growth on slopes; channel lining.

Excelsior Fiber Erosion Control Blanket
Contech Construction Products
Triangle Inquiry Center
8401 Claude Thomas Road
Franklin, OH 45005
800/338-1122
800/752-8899 in Ohio
Wood fibers interwoven with polyethylene netting for various temporary erosion control applications. Product is 4x100 feet or 4x180 feet.