

## **Engineering Brief # 42**

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Subject: INFORMATION: Engineering Brief No. 42, Geocomposite  
Pavement Edge Drains

FROM: Manager, Engineering and Specifications Division, AAS-200  
TO: All Regions

Attn: Managers, Airports Division

Engineering Brief No. 42 discusses the use of geocomposite edge drains as an alternative to the conventional system of perforated pipe aggregate and geotextile material.

The purpose of engineering briefs is to keep Airports field offices informed of construction materials and methods which are being tried, but which are not necessarily known to the Regions and ADO's. The information contained in this brief is not to be construed as general approval by the Office of Airport Safety and Standards. Any use of geocomposite edge drains will require prior approval by this office.

Any comments you have concerning this brief will be appreciated.

ORIGINAL SIGNED BY  
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ENGINEERING BRIEF NO. 42

GEOCOMPOSITE PAVEMENT EDGE DRAINS

General

Free water that enters and collects in undrained base courses and is subject to traffic is a major cause of premature pavement failure. Joint separation, frost damage, and "D" cracking normally do not occur in the absence of free water. In addition, a saturated base course causes a reduction in the load-carrying capacity of the pavement. Pavement design should include the use of edge drains to facilitate the removal of water. The conventional approach is to place perforated pipe, surrounded by select aggregate and geotextile material. While such a system is effective, its high installation costs may preclude its use in all but the most severe conditions.

Prefabricated geocomposite drainage systems which combine a polymer core and a geotextile fabric wrap provides an effective, economical alternative to conventional systems. It offers efficient soil filtration, drainage, and durability in one prefabricated, easy-to-install package.

The primary factor in selecting a geocomposite is its ability to

function as a drain. As with conventional drain, geocomposites have specific flow areas and hydraulic characteristics and provide varying amounts of discharge as functions of shape, hydraulic radius, and frictional resistance. All of these elements interact and have an influence on the discharge capacity of the system. Consequently, flow data must be based on tests that resemble field conditions under the which the product is to perform.

This engineering brief discusses the principle design features of geocomposite drains and some laboratory tests required to evaluate field performance.

### Design Features

**Core Geometry.** The size and placement of the cusps or pins affects the flow efficiency. Systems with almost identical cross-sectional areas can produce different flow rates at the same gradient. This can be attributed to the effective flow area of the core and the complexity of the flow paths developed by the core shape.

A pipe edge drain which is essentially an elongated corrugated cylinder is also available. Pillars are located through the core in order to maintain the shape of the corrugated sides.

**Core Strength.** The ability of a geocomposite to perform under load is essential, as its behavior in a compressed state determines the flow rate. Since the confining stress of the surrounding material has an influence on the on the flow capacity of the system, the flow rate must be evaluated at the stresses anticipated in the field.

**Fabric.** The fabric must resist binding and clogging from fine soil particles migrating with the flowing water. The overall efficiency of a geocomposite is a function of the long-term filtration and flow properties of the fabric exterior. Under full flow conditions, the outer edges of the flow contacts the fabric producing friction that reduces the rate of flow. This is similar to surface roughness affecting the flow through pipes.

The fabric must also:

1. Be permeable enough to convey the water coming from the soil without building up excess pore water stress.
2. Retain the upstream soil and prevent soil piping so that the core does not transmit soil particles or become blocked.
3. Have sufficient strength so as not to fail between the ribs of the core material.
4. Interact with the core to maintain the flow capability of the geocomposite.

### Laboratory Testing

**Load Simulation.** Environmental boundary conditions must be considered in addition to the normal load on the geocomposite during testing. A simulated soil environment will account for the pliable nature of the soil that reshapes the fabric into the

core's flow area. The amount of deformation depends on the type of fabric, core geometry, soil type, and compaction of the surrounding soil.

Hydraulic Gradient. Volume flow rates conducted at a test gradient of 1.0 cannot be extrapolated to lower gradients. Since many drains are required to function at gradients less than .10 (10%) only tests that were conducted in these ranges provide meaningful information.

Load Duration. The core and fabric of a geocomposite drain tend to deform with time under sustained loading. This is referred to as creep and can cause a reduction in flow capacity.

Flow Rate. The geocomposite drain is tested for flow rate in accordance with ASTM D 4716 at a specified lateral pressure, in a soil environment, for a specified number of hours at a specified hydraulic gradient.

Fabric. Tests on the geotextile material to determine properties such grab tensile strength, elongation, puncture, etc. are also performed.

Property Requirements. The following table lists properties of the core and fabric normally specified when specifying geocomposite drains.

CORE

Property	Value	Test Method
Composition	Polyethylene	ASTM D 1248
Fungus resistance	No growth	ASTM G 21
Moisture absorption	.05% (max)	ASTM D 570

FILTER FABRIC

Property	Value (min.)	Test Method
Tensile strength	90 lbs	ASTM D 4632
Elongation	50%	ASTM D 4632
Burst strength	150 psi	ASTM D 3786
Puncture	45 lbs	ASTM D 3787
Trapezoidal tear	40 lbs	ASTM D 4533
Coeff. of permeability#	.20 cm/sec	ASTM D 4491

Apparent opening size                      70                      ASTM D 4751  
(Equivalent U.S.Sieve)

# coefficient of permeability = permittivity \* thickness

#### GEOCOMPOSITE

Property	Value	Test Method
Compressive strength (20% max. deformation)	55 psi (min)	ASTM D 1621
Flow capacity @ 10 psi i=.10 @ 100 hours \1	15 gal/min/ft	ASTM D 4716

\1 Flow test shall be performed with a representative sample of finished product and in a soil environment. If a core separates the flow channel into two or more parts, only the flow rate of the channel facing the pavement shall be considered.

#### Installation

In order for a geocomposite drainage system to function as designed it must be installed properly in a vertical position against the pavement edge. The nodes of the inner core must be placed toward the pavement. The flat side of the core should always be placed away from the pavement and base course.

The edge drain is placed in a trench adjacent to the pavement as shown on the plans. Trench depths, widths, and slopes are shown on the plans and excavated material is used for backfilling. The drain must be temporarily supported against the pavement edge while the backfill is placed. Backfill material should not be allowed between the drain and the pavement edge.

While most installations are accomplished using conventional trenching equipment, wheel-type trenchers can be used for excavation. The edge drain is furnished in coils which are unrolled along the open trench and then placed in a vertical position against the pavement edge. In an attempt to obtain high productivity, equipment has been modified to allow trenching, placing of the edge drain, backfilling, and compacting in one continuous operation. This method is most cost-effective on highway jobs where the total length installed is in the tens of thousands of feet. Coil lengths vary from 100 to 500 feet, depending on the project size, equipment used, and the manufacturer.

Fittings for outletting water from the edge drains should conform to the manufacturer's recommendations. The fittings must be capable of maintaining the integrity of the system under long-term loads and provide efficient and unrestricted flow. While outlet spacing is site specific, normal spacing should not exceed

800 feet.

Couplings used to join rolls of material should meet the specifications of the manufacturer. They must provide a positive connection that will prevent pull-apart during installation procedures. All connections between the drain and fittings/couplings should be soil tight as recommended by the manufacturer.

Geocomposite drainage systems were first installed on highways in 1982 and on airports in 1985. Since then thousands of miles have been installed on highways and at over 50 airports and appear to be operating as designed. However, the long term durability of these systems is still under evaluation. The average cost of a 12

inch wide edge drain installed is \$3-4 per linear foot.

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