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Secretariat: BSI

Determination of long-term flow of geosynthetic drains

WD/CD/DIS/FDIS stage

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Contents

Foreword

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This document was prepared by Technical Committee~~*[or Project Committee]* ISO/TC *[or ISO/PC]*###, *[name of committee]*, Subcommittee SC ##, *[name of subcommittee]*.~~ ISO/TC 221, *Geosynthetics*.

~~This second/third/... edition cancels and replaces the first/second/... edition (ISO #####:####), which has been technically revised.~~

~~The main changes compared to the previous edition are as follows:~~

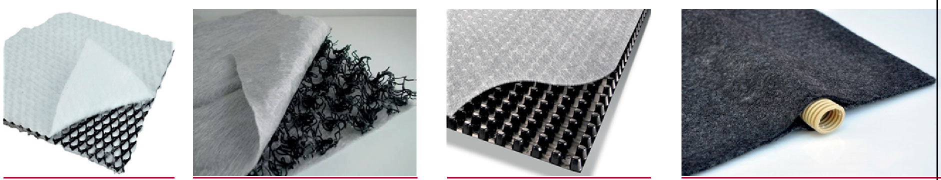
~~— xxx xxxxxxx xxx xxxx~~

~~A list of all parts in the ISO ##### series can be found on the ISO website.~~

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The most commonly used drainage geosynthetics are the geocomposites which are produced by laminating one or two geotextiles, with a filter function, onto a drainage core. Examples are included in Figure 1.



a) Geonet core b) Geomat core c) Cuspated core d) Perforated tube core

Figure 1 — Examples of drainage cores

The components generally have the following characteristics under operating conditions:

— filtering component:

  — adequate permeability to gases and liquids in the direction perpendicular to the filter plane;

  — retention capacity of the soil particles;

— drainage core:

  — adequate permeability to gases and liquids in the direction planar to the drainage structure;

  — adequate compressive strength and creep resistance for the loads to be applied.

The geocomposites are often defined by the drainage cores: geomats (GMA), geonets (GNT), geospacers (GSP), multi-linear drains.

Determination of long-term flow of geosynthetic drains

1 Scope

This document specifies methods of deriving reduction factors for geosynthetic drainage materials to account for intrusion of filter geotextiles, compression creep, and chemical and biological degradation. It is intended to provide a link between the test data and the codes for design with geosynthetic drains.

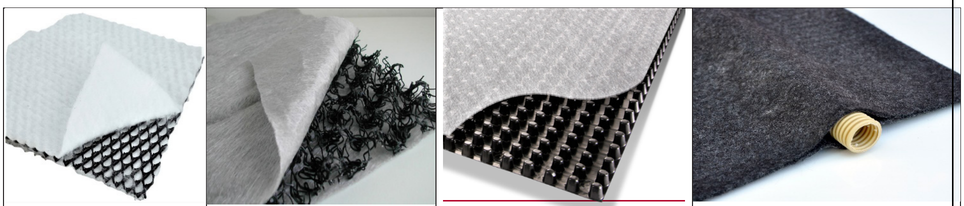
~~1.1 Introduction~~

The geosynthetics covered include those whose primary purpose is planar drainage, such as geonets, cuspated cores only, or cuspated cores combined with laminated filter geotextiles, and drainage liners, where the drainage core is made from polypropylene and high-density polyethylene. The majority of geosynthetic drains are geocomposites with geotextiles laminated to a drainage core and it is important, where possible, to consider the drainage behaviour of the geocomposite as a whole rather than the behaviour of the component parts in isolation.

This document does not cover the strength of overlaps or joints between geosynthetic drains nor whether these might be more or less durable than the basic material. It does not apply to geomembranes, for example, in landfills. It does not cover the effects of dynamic loading nor any change in mechanical properties due to soil temperatures below 0 °C, or the effects of frozen soil. This document does not cover uncertainty in the design of the drainage structures, nor the human or economic consequences of failure. Design guidance for geosynthetic drains is found in ISO/TR 18228-~~4e~~-4.

~~1.2 Materials~~

~~The most commonly used drainage geosynthetics are the geocomposites which are produced by laminating one or two geotextiles, with a filter function, onto a drainage core. Examples are included in Figure 1.~~



~~Geonet Core~~	~~Geomat Core~~	~~Cuspated Core~~	~~Perforated Tube Core~~

~~**Figure 1 — Examples of Drainage Cores**~~

~~The components generally have the following characteristics under operating conditions:~~

- filtering component:
  - adequate permeability to gases and liquids in the direction perpendicular to the filter plane;
  - retention capacity of the soil particles;
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  - adequate permeability to gases and liquids in the direction planar to the drainage structure;
  - adequate compressive strength and creep resistance for the loads to be applied.

The geocomposites are often defined by the drainage cores: geomats (GMA), geonets (GNT), geospacers (GSP), multi-linear drains

272 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10318-1, *Geosynthetics — Part 1: Terms and definitions*

283 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10318 and the following-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

Field Code Changed

— IEC Electropedia: available at https://www.electropedia.org/

3.1

geotextile (GTX)
planar, permeable, polymeric (synthetic or natural) textile material, which may be nonwoven, knitted or woven, used in contact with soil and/or other materials in geotechnical and civil engineering applications

3.2
nonwoven geotextile (GTX N)
geotextile made of directionally or randomly orientated fibres, filaments or other elements, mechanically and/or thermally and/or chemically bonded

3.3
knitted geotextile (GTX K)
geotextile produced by interlooping one or more yarns, filaments or other elements

3.4

woven geotextile (GTX W)
Woven geotextile (GTX W): geotextile produced by interlacing, usually at right angles, two or more sets of yarns, filaments, tapes or other elements

3.5
geotextile related product (GTD)
planar, permeable, polymeric (synthetic or natural) material used in contact with soil and or other materials in geotechnical and civil engineering applications, which does not comply with the definition of a geotextile

3.6
geomat (GMA)
a three-dimensional permeable structure made of polymeric monofilaments, and/or other elements (synthetic or natural), mechanically and/or thermally and/or chemically and/or otherwise bonded

3.7
geonet (GNT)
geosynthetic consisting of parallel sets of ribs overlying and integrally connected with similar sets at various angles

3.8
geospacer (GSP)
a three-dimensional polymeric structure designed to create an air space in soil and/or other materials in geotechnical and civil engineering applications. A typical geospacer is a geocuspate typically formed from an extruded geomembrane and formed into a cuspated sheet.

3.9
geocomposite (GCO)
manufactured, assembled material using at least one geosynthetic product among the components.

Additional definitions include:

3.10
Multilinear geocomposite drains
manufactured product composed of a series of parallel single drainage conduits regularly spaced across its width sandwiched between two or more geosynthetics. Typical linear drains include perforated pipes or strips of other drain cores.

614 Test equipment and procedures for determination of short-term in- plane water flow

61.14.1 Measurement of maximum hydraulic transmissivity and flow rate

The primary function of geosynthetic drains is to convey or transmit fluid within the flow direction(s) of a drainage layer. The discharge capacity can be given in terms of:

- — Specific flow rate =, which is the discharge per unit width in the geosynthetic drain, under a specified hydraulic gradient:

$Q = q / B$, as per Formula (1)):

$$Q = q / B \quad (1)$$

Some users of flow tests desire to index the discharge rate per unit width to the applied hydraulic energy or hydraulic gradient at which flow is measured. In this case:

— Hydraulic transmissivity =, which is the discharge per unit width of the geocomposite and per unit of hydraulic gradient. –, as per Formula (2):

$$\theta = (q / B) / i$$

$$\theta = (q / B) / i \quad (2)$$

The concepts of transmissivity and flow capacity were developed specifically to avoid consideration of the thickness as it is often difficult to specifically define the thickness of a geosynthetic drain in application.

Transmissivity is equal to flow rate only at a gradient of 1. Note also that the numerical value of transmissivity can be very different than the numerical value of the specific flow rate at small hydraulic gradients (e.g. at i = 0.,1 transmissivity is 10 times the specific flow rate).

The discharge capacity test for a geosynthetic drain is performed in accordance with ISO 12958-1, ISO 12958-2 or ASTM D4716.

61.24.2 Test equipment

61.2.14.2.1 Unidirectional flow

The apparatus for these test methods are relatively simplistic in their design and ability to measure a discharge capacity or flow rate per unit width or transmissivity (Figure 2). By maintaining a constant head during the test, at a given normal stress, boundary conditions, and seating time, the flow rate (Q) of the geosynthetic drain can be determined using Formula (3):

$$Q_{\sigma,i,t,b} = \frac{q}{B} \cdot R_T \quad (3)$$

Where

$$Q_{\sigma,i,t,b} = \frac{q}{B} \cdot R_T \quad (3)$$

Where

$Q_{\sigma,gi,t,b}$ is the numerical value of the in-plane water flow capacity per unit width at a defined stress "σ",σ, gradient "i",, seating time under load prior to flow measurement "t" and boundary conditions "b", in liters per metre second, [l/(m·s)]

Qq is the numerical value of the discharge capacity for a geosynthetic drain of width B measured in the test (l/s);

B is the numerical value of width of flow (m)