Global Synthetics

LEADERS IN GEOSYNTHETICS

WMRR – Landfill and Transfer Stations

Considerations for Drainage Composites – 8th June 2021

Topics

Range of materials / Drainage Cores / Geotextile Filters / Separators

Various standards / Creep Factors / Clogging Guidelines

Specification Examples

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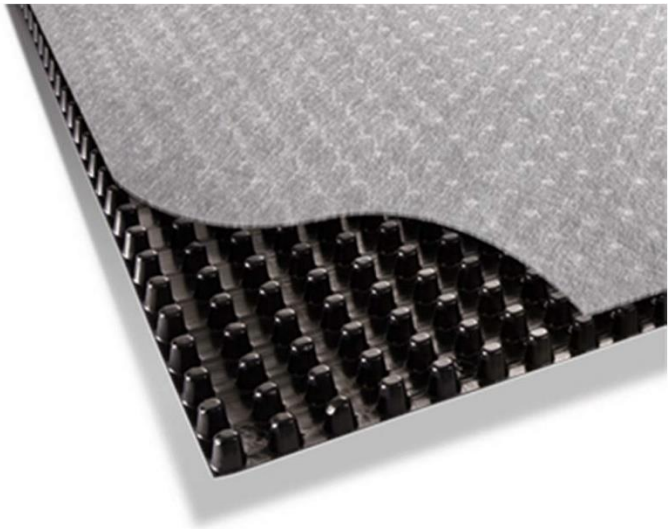
What are drainage composites

Drainage Composites

Drainage composites consist of a plastic drainage core and a filter/separator on one or both sides making the composite.
There key function is transport.



4 key examples are

- Geonet
- Cuspate
- Extruded monofilament
- Tubular Pipes

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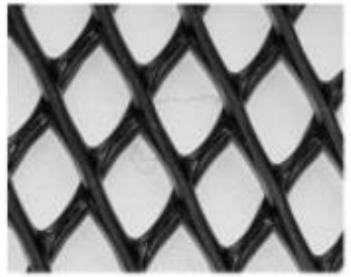
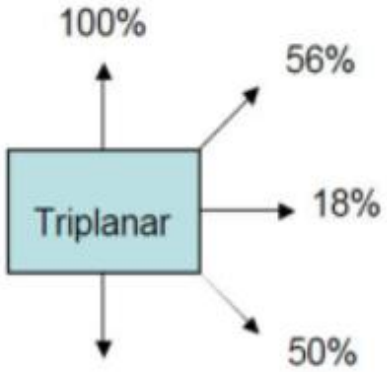
Variations of the composites

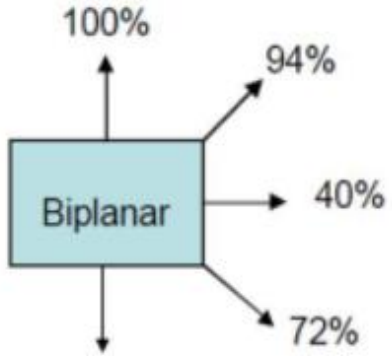
Geonet Cores

Geonets come in 3 general shapes.
Bi-planar
Tri-planar
Box Form



Geonets have the ability for directional flow and high compressive strength ranging from 450-2250kPa.





However need to consider geotextile intrusion

Cuspate or Sheet Drain

Generally made from HDPE
Is made through extrusion process to a range of thickness
These studs range from 4mm-25mm
Also comes single or double sided.

Can have high multi directional transmissivity values, but lower compressive strength ~ <750kPa

Monofilament mats

Can be made from a range of polymers.

Have very high flow rates. Wider rolls for ease of installation.

However flow has a rapid decrease over >20kPa loading

Tubular Drain

Pipes are made from PP

Come in range of sizes
Can be spaced depending on the transmissivity requirements.
Connection details for controlled flow

Very high compressive strength
> 2000kPa (once confined)

However flow in 1 direction

Different Filters

Filters can be woven or nonwoven geotextiles made from PP or PET polymers

They are either bonded by Thermal or Adhesive

However Thermal alter mechanical values

Adhesive alter Hydraulic values

Other considerations for the filter/separator are:

- Protection requirements
- Elongation
- UV resistance
- Chemical Attack
- Virgin vs recycled
- Clogging
- Permeability

Delamination with structure

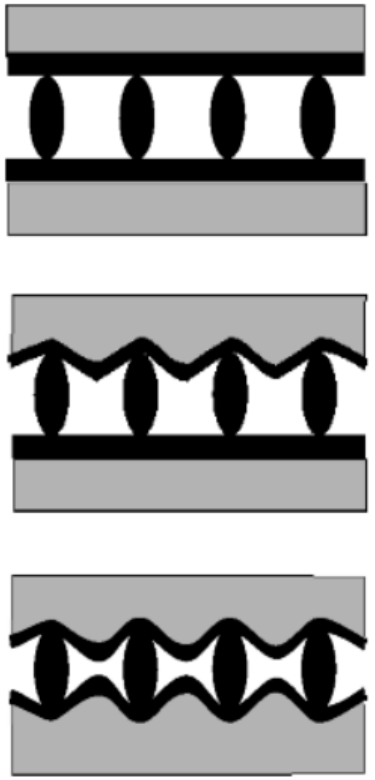
Composite Consideration

Boundary Conditions affecting transmissivity

Once selected installation needs consideration.

Tri-planer Geonets and Draintube have flow in certain directions.

Geotextile should also have excess material on the edges for overlapping and bonding



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Various standards

There are 3 main standards/guides

GRI-GC08
Super Seeded by GRI-GC15

ISO/DTR 18228-4 – with the committee

ASTM D7931-18

Both GRI standards are similar to ASTM

ISO has a new creep consideration

ASTM INTERNATIONAL

ISO

ASTM D7931-18 & D4439-17

ASTM D4439
acknowledged Tubular
Drainage composites

Standard Terminology for Geosynthetics[1]

multi-linear drainage geocomposite, *n*—a manufactured product composed of a series of parallel single drainage conduits regularly spaced across its width sandwiched between two or more geosynthetics.

ASTM D7931 updated
This included in the additional permitters on Flow after Creep Reduction factors.

Other areas include:
Polymer Degradation
Shear Strength
Geoelectric Conductivity
Leak detection

Creep Factors Compared

$$FS = \frac{\theta_{allow}}{\theta_{reqʼd}} \qquad \theta_{allow} = \frac{\theta_{100}}{RF_{CR} \cdot RF_{CC} \cdot RF_{BC} \cdot RF_{GI} \cdot RF_{L}}$$

$RF_{CR} \cdot RF_{CC} \cdot RF_{BC}$: GRI GC8 (2001)

RF_{GI}: ASTM D7931 (2018)

RF_{L}: ISO 18228-4 (2020)

FGI - Blond

Creep Reduction Factors

Term	Description	Indicative range
RF_{in}	Reduction Factor for intrusion of the filter geotextiles into the draining core	1,0 – 2,0
$RF_{cr\text{-}Q}$	Reduction Factor for flow rate due to compressive creep of the core	1,0 – 6,0
RF_{cc}	Reduction Factor for pore/volume reduction due to chemical clogging	1,0 – 1,5
RF_{bc}	Reduction Factor for pore/volume reduction due to biological clogging (not including applications in landfills)	1,0 – 1,3
RF_L	Reduction Factor for overall uncertainties on laboratory data and field conditions	1,0 – 1,5

FGI - Blond

Clogging Reduction Factors

Application	Chemical Clogging (RF_{CC})	Biological Clogging (RF_{BC})
Sport fields	1.0 to 1.2	1.1 to 1.3
Capillary breaks	1.0 to 1.2	1.1 to 1.3
Roof and plaza decks	1.0 to 1.2	1.1 to 1.3
Retaining walls, seeping rock and soil slopes	1.1 to 1.5	1.0 to 1.2
Drainage blankets	1.0 to 1.2	1.0 to 1.2
Landfill caps	1.0 to 1.2	1.2 to 3.5
Landfill leak detection	1.1 to 1.5	1.1 to 1.3
Landfill leachate collection	1.5 to 2.0	1.1 to 1.3

Source GRI-GC8

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Specification Examples

Specification Example

Geocomposite	Ply adhesion	ASTM D7005
	Transmissivity	ASTM D4716
Geotextile (Before Lamination)	Mass per unit area	AS 3706
	Grab Tensile Strength	AS 3706.2b
	Grab Elongation	AS 3706.2b
	Trapezoidal Tear	AS 3706.3
	CBR Burst Strength	AS 3706.4
	Permittivity	AS 3706.9
	Pore Size	ASTM D6767
	UV Stability	ASTM D4355
Geonet Core (Before Lamination)	Carbon Black content	ASTM D4218
	Compressive Strength	ASTM D1621
	Thickness @ 200kPa	ASTM D5199
	Peak Tensile Strength	ASTM D7179

Standards

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Challenge of composites

Here is the catch.

As mentioned earlier composites are either bonded through thermal or adhesive

This means that your CQA testing can only test the overall composite, i.e. Transmissivity and Ply Adhesion

MQA CQA Difference

Geocomposite

Ply adhesion	ASTM D7005
Transmissivity	ASTM D4716

CQA Only

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What are the options

Reduction factors within the specification

Independent MQA inspections

Shear Box Testing

Perhaps standardization of specification within landfill

Summary

Think about the compressive strength required.
Transmissivity required
Potential Directional Control
Discharging options

Bonding process of the composites
Ingress of the filter into the core
Clogging of the filter
UV resistance of the filter
Permeability
Different Polymers and Chemical resistance

FINALLY

Should Manufactures demonstration Reduction Factors

$$\theta_{allow} = \frac{\theta_{100}}{RF_{CR} \cdot RF_{CC} \cdot RF_{BC} \cdot RF_{GI} \cdot RF_{L}}$$