Case study on the use of multi-linear drainage geocomposite for primary leachate collection
Introduction

- Product description
- Project description
- Elements of design
- Geocomposite installation
- Conclusion
Multi-linear drainage geocomposites

Drainage geocomposite with drainage conduits regularly spaced between two geotextiles instead of a geonet core

Drainage conduits:
- Perforated PP mini-pipes,
- Strip drains
- Etc.
Multi-linear drainage geocomposites

Draintube technology consists of Perforated polypropylene mini-pipes between two geotextiles layers

Distance between mini-pipes
1/4 m, 1/2 m, 1 m or 2 m
(10°, 20°, 40° or 80°)

Perforated mini-pipes
diameter 20 mm or 25 mm

Nonwoven geotextiles

For water

For gas
Geocomposite Standardization

**ASTM D4439 Terminology**: Multi-linear drainage geocomposite.

**ASTM D7931 Standard Guide for specifying Drainage Geocomposites**: « Multi-linear drainage geocomposites may not be sensitive to creep when confined into a soil matrix because of their core structures.

**GRI GC15 standard test method** for Determining the Flow Rate per Unit Width of Drainage Geocomposites with Discrete High Flow Components
Project description

Mesa County Colorado Landfill, CO

History
Opened in 1981
Acquired by Mesa County in 1994
Operated by Mesa County since 1996

2018 New cell construction
Designed by SMA Engineers
215,000 sf cell + leachate pond
Total capacity of 282,000 cubic yard of waste
Mesa County Colorado Landfill, CO

Cross section of the cell (from bottom to top):
• 12 in of compacted clay
• 60 mil HDPE geomembrane
• DRAINTUBE 606 ST1 D20
• 12 in of native soil
Elements of design

Drainage geocomposite

DRAINTUBE 606 ST1 D20 selected instead of a 250 mil double sided (6 Oz/sq yd geotextiles) geonet geocomposite

- Same geotextile properties
- Same index transmissivity

What about Long Term Drainage Capacity?
Elements of design

GSI White Paper #4 (Koerner)
Reduction Factors (RFs) Used in Geosynthetic Design

\[ Q_{allow} = \frac{Q_{ult}}{RF_{IN} \cdot RF_{CR} \cdot RF_{CC} \cdot RF_{BC}} \]

\( q_{allow} \) = allowable (or design) flow rate or transmissivity,

\( q_{ult} \) = ultimate (or as-manufactured) flow rate or transmissivity,

\( RF_{IN} \) = reduction factor for intrusion of geotextiles or geomembranes into the core of drainage product,

\( RF_{CR} \) = reduction factor for creep of the drainage core or covering geosynthetics,

\( RF_{CC} \) = reduction factor for chemical clogging of drainage core, and

\( RF_{BC} \) = reduction factor for biological clogging of drainage core.
Elements of design

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Elements of design

Reduction factor for creep and geotextile intrusion
Function of the shape of the drainage core

For geonet drainage core

Reduction of the drainage capacity under load

Transmissivity vs. normal load for a double sided triplanar geonet geocomposite (soil / geocomposite / steel plate)
Elements of design

**Reduction factor for creep and geotextile intrusion**
Function of the shape of the drainage core

For geonet drainage core

Reduction of the drainage capacity over time

Creep Curves for a 250 mil geonet
Elements of design

Reduction factor for creep and geotextile intrusion
Function of the shape of the drainage core

For tubular drainage conduits

Arching effect when confined in soil
Elements of design

Reduction factor for creep and geotextile intrusion
Function of the shape of the drainage core

For tubular drainage conduits

No change in transmissivity with load
Elements of design

Reduction factor for creep and geotextile intrusion
Function of the shape of the drainage core

For tubular drainage conduits

No change in transmissivity over time

Published related reference

Assessment of the Resistance of Drain Tubes planar drainage geocomposites to high compressive loads
Eric Blond (SAGEOS) and Pascal Saunier (AFITEX-Texel), ICG 2010
Elements of design

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Elements of design

Reduction Factors for Biological and Chemical clogging

3 year test (2013-2016) with Koerner at Fairless Hills Landfill (PA)
Elements of design

Reduction Factors for Biological and Chemical clogging
Elements of design

Reduction Factors for Biological and Chemical clogging

Tubular geocomposite: **NWNP w TUBE**

Single sided biaxial geonet: **NWNP w GN**
“it is important to note that the needle punched nonwoven geotextile performed the best when placed over the tubular drainage composite. It is well designed with respect to the concrete sand’s gradation to avoid piping and is open enough to resist long term clogging. This is demonstrated by its ability to remain free flowing with leachate as a permeant for over three years of testing.”

Published related reference

Biological Clogging Resistance of Tubular Drainage Geocomposites in Leachate Collection Layers
E. Blond (SAGEOS), S. Fourmont and P. Saunier (AFITEX-Texel), Geosynthetics 2013

Evaluating Tubular drainage geocomposites for use in Lined Leachate Collection Systems,
E. Steinhauser (Sanborn, Head & Ass.) and S. Fourmont (Afitex-Texel), Geo-Environmental Engineering 2015

Determining the Long-Term Transmissivity of Selected Drainage Geocomposites to Landfill Leachate, G. Koerner (Geosynthetic Institute) and S. Fourmont (Afitex-Texel), Geo-Frontiers 2017
Elements of design

Long term drainage capacity (using GRI GC8, GSI White paper #4, ASTM D7931)

\[ Q_{allow} = \frac{Q_{ult}}{RF_{in} . RF_{cr} . RF_{cc} . RF_{bc}} \]

Index transmissivity
\[ \theta = 5 \times 10^{-4} \text{ m}^2/\text{s} \]

Graph showing index transmissivity with legend:
- Draintube 606 ST1 D20
- double sided 250 mil geonet
Elements of design

**Long term drainage capacity** (using GRI GC8, GSI White paper #4, ASTM D7931)

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- **Index Transmissivity**
  - Draintube 606 ST1 D20
  - double sided 250 mil geonet

- **After RFgi**
Elements of design

Long term drainage capacity (using GRI GC8, GSI White paper #4, ASTM D7931)

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**Index transmissivity**

\[ \theta = 5 \times 10^{-4} \text{ m}^2/\text{s} \]

**Graph:**
- **Index Transmissivity**
  - **After RFgi**
  - **After RFcr**
- **Bar Colors:**
  - Blue: Draintube 606 ST1 D20
  - Orange: double sided 250 mil geonet
Elements of design

Long term drainage capacity (using GRI GC8, GSI White paper #4, ASTM D7931)

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Elements of design

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Index transmissivity
\[ \theta = 5 \times 10^{-4} \text{ m}^2/\text{s} \]

Draintube 606 ST1 D20
\[ \theta = 1.92 \times 10^{-4} \text{ m}^2/\text{s} \]

Double sided 250 mil geonet
\[ \theta = 4.81 \times 10^{-5} \text{ m}^2/\text{s} \]

4 times higher long-term drainage capacity
Installation
Installation
Specific points on installation
Specific points on installation
Installation
Conclusion

Multi-linear drainage geocomposite

- Available on the market for 30 years
- GRI and ASTM standards
- Solid technical background
- Stable long term drainage capacity

“The Mesa County Solid Waste Management team has been very impressed with both the DrainTube product and their representatives. Working with Afitex-Texel truly has been a pleasure.”

Jennifer Richardson - Solid Waste Operations Manager
Mesa County Landfill
Stephan Fourmont
Business Development Manager – East
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Thank you for your attention