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CASE HISTORY

TENAX tri-planar geocomposite replaces gravel leachate drainage layer at Marsden Park Landfill

PRODUCT	TENAX GNT geocomposite
LOCATION	Marsden Park Landfill, NSW, Australia
CONSULTANT	GeoSystems Ltd., Hong Kong, China
CONTRACTOR	Blacktown Waste Services
DESIGNER	Consulting Earth Sciences

INTRODUCTION

Following traditional practice, solid waste landfills are often constructed with gravel leachate drainage layers. This practice arose in parts of the world with plentiful supplies of clean river gravels, which is not always the case.

In the Sydney area of the State of New South Wales, Australia, gravel is in short supply, and is therefore quite expensive. During the design of a new landfill at Marsden Park, on the north-west side of Sydney, it was decided to investigate whether a geocomposite drainage layer could be used instead of gravel for the leachate drainage layer. After extensive laboratory testing, it was demonstrated that a geocomposite containing a tri-planar geonet would have equivalent or better performance under the site conditions than a gravel layer prescribed by regulatory guidance.

This geocomposite leachate drainage layer was approved by the New South Wales Environmental Protection Agency (NSW EPA) and was installed in the first phase of the new landfill in early 2004. This case history reviews the work carried out to determine that the TENAX GNT 2200 tri-planar geonet drain added to a 330 g/m2 nonwoven geotextile, was equivalent to a gravel drainage layer.

PROBLEM

LANDFILL DESIGN CONSIDERATION

The Marsden Park Landfill is being constructed in an old quarry excavation, used to supply crushed volcanic breccia for road construction, and the depth of backfilled waste is intended to be 50 metres.

The landfill will replace the nearby Penrith Landfill, which takes mainly office waste and some contaminated soil classified as Class 2 waste in NSW.

Weighbridge and void space measurements at the Penrith Landfill have shown that this waste is placed with a unit weight of 1.8 tonnes/m3.

From this, the EPA required the design pressure on the geocomposite drain to be taken as 1000 kPa. This design pressure gave rise to questions of whether the geonet drainage core could compress under this load, leading to inadequate flow capacity, and whether the geotextile filters would intrude into the core and block flow.

In addition, the EPA required consideration to be given to clogging of the drainage layer by the leachate.

The NSW EPA regulations require a drainage layer across the entire base of the landfill to comprise gravel, or a combination of gravel and geonet. They suggest that an acceptable design could comprise a gravel layer, with a thickness of 300 mm and a coefficient of permeability, k, greater than 1 x 10-3 m/sec.

SOLUTIONS

LABORATORY TESTING

Extensive laboratory testing was carried out to determine whether the TENAX GNT 2200 tri-planar geonet added to a 330 g/m2 nonwoven geotextile, would be equivalent to 300 mm of gravel with a k value greater than 1 x 10-3 m/s, and whether the drain would clog.

Flow rate (transmissivity) testing of the geocomposite drain was carried out with the intended cover soil on each side, to establish flow reduction due to intrusion of the geotextile under different hydraulic gradients and increments of applied load (up to 1000 kPa), in accordance with ASTM D4716. Cover soil/geotextile permeameter testing was carried out, to determine clogging potential, under a load of 1000 kPa and in accordance with ASTM D5567.

Compressive creep testing was carried out in accordance with ENV 1897:96. This test method applies a long term constant compressive load and measures the thickness reduction of the geonet over time.

REDUCTION FACTORS

Values of design reduction factors, as proposed by Prof. Robert Koerner (1999), were determined from the test results. These reduction factors were determined for intrusion, creep, and chemical and biological clogging of the geonet drainage core, and for soil clogging, intrusion, creep, and chemical and biological clogging of the geotextile filter.

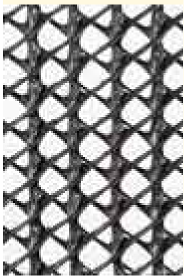
CONCLUSIONS

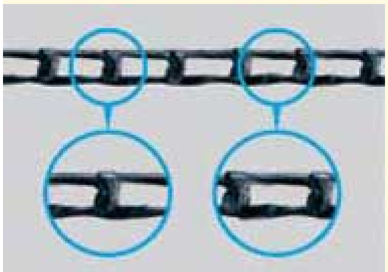
It was demonstrated that the TENAX GNT 2200 tri-planar geonet drain added to a 330 g/m2 nonwoven geotextile will have equivalent or better performance under the site conditions than a granular layer prescribed under regulatory guidance.

The geonet drainage flow capacity was found to have a factor of safety of 10, and the geotextile filter flow capacity was found to have a factor of safety greater than 7. The tri-planar geocomposite drain was approved by the NSW EPA as a substitute for a gravel leachate drainage layer, and was installed in early 2004.

TENAX GNT 2200 tri-planar geonet

TENAX GNT geonets are high profile mesh structures made by three sets of overlaid intersecting strands. The inner strands, thicker and heavier, provide high compressive resistance and transmissivity. The intersecting strands form overlaid sets of continuous deep channels which provide high flow capacity. These geonets are used in waste disposal and civil engineering projects, where a high hydraulic flow capacity is required.





TENAX GNT geonets are manufactured from extrusion of High Density Polyethylene (HDPE), black in color; they are inert to chemical and biological conditions normally occurring in soil. Moreover they are treated with special additives to resist UV degradation. TENAX GNT geonets are available in a wide range of thicknesses and widths, so as to satisfy any design and installation need.

DIMENSIONAL CHARACTERISTICS OF TENAX GNT 2200:	
Thickness at 20 kPa (ISO 9863):	9.50 mm
Thickness at 200 kPa (ISO9863):	9.20 mm
Mass per unit Area (ISO 9864):	2200 g/m2
Roll width:	2.05 m
Roll length:	20.0 m

TECHNICAL CHARACTERISTICS OF TENAX GNT 2200:	
Hydraulic Flow rate	
i=1 v=20 kPa (ASTM D4716) Short Term:	3.10 l/m/s
i=1 v=600 kPa (ASTM D4716) Short Term:	1.30 l/m/s
i=1 v=800 kPa (ASTM D4716) Short Term:	1.20 l/m/s
i=1 v=1000 kPa (ASTM D4716) Long Term (up to 204 hours):	1.51 l/m/s