AYDIN UNCONTROLLED DISPOSAL SITE
AYDIN, TURKEY

SLOPE REINFORCEMENT IN LANDFILLS
Product: Paragrid 100/05 & 50/05, Paralink 700, 500 & 400, Terram 1B, Macline GCL NL10, Terram 1000 & 4500, 2mm Macline SHE

Problem
As part of the design of the new controlled disposal site in the Municipality of Aydin (in southern Turkey, near the ancient ruins of Ephesus) it was necessary to design - in addition to the bottom barrier system of the disposal site itself - two structures which acted as containment dams for the first and second cells. The gorge had to be divided into two independent cells; the first cell was constructed at the same time as the formation of the containment structures whilst the second cell will be waterproofed as soon as the first one has been completed and made safe. The cells are very deep so it has been necessary to build a series of access roads within the disposal site and for connection to the town of Aydin.

Solution
The solution developed by the designers has been based on the techniques and construction practices which have been in use for some time in Europe with regard to the barrier system package and considerable use has been made of geogrids for the formation of the containment structures for the two cells and for the embankments forming the site roads. The adoption of various strengths of geogrids has enabled use of the soil present on site and the grading of slopes to inconceivable angles for a loose material, thereby achieving considerable reductions, both in terms of costs and material volumes. The bottom barrier system uses a 2 mm HDPE membrane (Macline SHE) resting on a layer of low permeability clay covered by a geotextile protection layer (Terram 4500), used in combination with a bed of sand and a mineral drainage layer in which a mesh of drainage pipes has been incorporated. The clay layer has been replaced on the steep slopes by a bentonite geocomposite laminate (Macline GCL NL10), whilst a geogrid-geotextile non-woven geocomposite (Terram 1B) has been used to protect the membrane.

Client:
MUNICIPALITY OF AYDIN
Main contractor:
CENGI CONSTRUCTION S.p.A (Ankara)
Designer:
SERDAR Engineering (Ankara)
Products used:
Paragrid 100/5 110,000m², Paragrid 50/05 5,000 m², Paralink 700 5,000m², Paralink 500 5,000 m², Paralink 400 32,000m², Macline GCL N10 44,000m², Terram 1B 30,000m², Terram 1000 26,000 m², Terram 4500 10,500m², 2mm Macline SHE 45,000m²
Date of construction:
November 2006 — April 2007
The stability of the structures (both internally and globally) has been checked using specific software called MACSTARS (Maccaferri Stability Analysis Reinforced Slopes). This enables the use of different types of reinforcement elements (synthetic and metal), with different mechanical strengths and with any geometrical configuration, thereby simulating the various types of external loads applied to the structure (point loads and distributed forces, seismic forces, etc.). The diagram alongside shows the output for the external stability checks carried out for a section of the embankments, in which the slip circles are highlighted with different colours depending on the safety factor. This diagram enables a fast visualisation of the critical slip surfaces and becomes a powerful and effective tool for design and control.
Spring 2007 — Installation of bottom barrier system

Post construction, North bound off-slip

Puncture-resistant drainage geocomposite Terram B1
Granular drainage material
Non-woven geotextile Terram 4500 with sand
1m clay layer
2mm HDPE geomembrane Macline SHE
Bentonite geocomposite laminate Macline GCL NL 10