Problem

During construction of the municipal landfill at San Donnino in San Donato in Vinci (1994) a landslide occurred which affected the road around the landfill and one of its bank sides (photo 3). The landslide was 42 metres wide and 12 metres high. The foundation soil consisted of alternating layers of impermeable, plastic blue clay and sand with various quantities of silt. The reason for the collapse was the excessive angle of the slope and the infiltration of water through the sandy layers which caused saturation of the over-consolidated layer of foundation clay.

Solution

In order to complete the construction of the landfill and stop the landslide it was decided to employ reinforced soil using Paragrid geogrids (types 50/15 and 100/15, with tensile strengths of 50 kN/m and 100 kN/m respectively). Reinforcing the slope would improve its structural stability and enabling it to stand securely at the required slope face angle. In order to obtain low permeability values for the embankment, the clay soils available locally were used for its construction (ref. photo 1). A detailed design was carried out to determine the length of the anchors necessary (which was particularly important bearing in mind the “marginal” characteristics of the soil, which would normally be rejected for reinforced soil applications). The slope was divided into two berms with variable heights, with the reinforcements installed as shown in the diagram.
The lengths of the reinforcements varied from 6.50 to 13.50 m, and they were placed at intervals of between 40 cm and 90 cm.

The construction was carried out in 20 days using a 20 t excavator, a 15 t bulldozer, a 12 t static sheepfoot roller and two trucks (photos 3-5).

The clay, which was compacted in 20/30 cm layers, was mixed with sodium bentonite (3%) in order to reach the specified permeability values (1x106 m/sec) within the upper metre of the embankment.

A drainage system was installed behind the structure to collect the infiltration water.

Geotextile material was placed on the front face of the geogrid to prevent erosion of the face before installation of the geomembrane.

**Paragrid 50/15S geogrid**

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**Silty-sand**

**Clay**

**Granular drainage layer**

**Drainage pipe**

**Non-woven filtering geotextile material**