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CASE HISTORY

A 35 m high reinforced slope in Taichung City, Taiwan

PRODUCT	TENAX TT 601 SAMP mono-oriented geogrids
LOCATION	Chung-Hsin Village Taichung City
OWNER	A private investment group
PROJECT	Plato Engineering, Nelson Chou
CONTRACTOR	Johnson Contraction Co., Ltd

Reinforced slope two months after construction

PROBLEM

In the central part of Taiwan, a housing real estate scheme required to extend its construction on top of a mountainous area. The property owner planned to maximize the usable land space to fit in luxury villas and townhouses. In order to create more space for new housing, the engineers had to consider building a 35 m high wall, about 60° steep, with 250,000 m³ of excavated backfill soils on a V-shaped valley.
The fill soil was excavated from a nearby hill.
Considered design inputs were the environmental impact, the aesthetics, the maximization of usable space and the full utilization of available on-site weathered shale for backfill soil.

SOLUTION

Several design and construction options were considered and a cost effective decision resulted in the construction of a 35 m high geogrid reinforced slope. The 35 m high wall consists of a stepped slope with 5 m high partial slopes at 2:1 (V:H) and 2.5 m wide berms. The main design considerations included seismic factors, existing backfill, adequate sub-surface and backfill drainage, vegetation of slope face and increase of development space.

TENAX TT 601 SAMP HDPE mono-oriented geogrids were selected for the reinforcement of the weathered shale fill. The site is in a sub-tropical rain forest area, where torrential rainstorms are frequent; therefore the contractor had to complete the installation within a three months time scale. The installation system was constructed from timber formwork fixed in place with wire ropes to achieve the required slope angle and to support the face during compaction.

The geogrids were fixed in place using U-shaped steel staples in the reinforced soil block and also on face supported by the formwork. Vegetation of the face was achieved by utilizing a pre-seeded straw mat placed inside the face wrapping length of the geogrid. To avoid desiccation due to summer draught at the steep face, a irrigation system was designed, consisting of flexible plastic pipes (ø 1/2") and water sprinklers, uniformly distributed on the wall face.
The seepage of the torrential rain water on the face of the slope was considered critical for the local stability of the face: hence the seepage flow was collected by horizontal strips of geocomposite edge drains, 5.0 m long and 200 mm wide, placed at a horizontal interval of 1.5 m and a vertical spacing of 1.5 m.

CONCLUSIONS

The successful completion of the 35 m high geogrid reinforced soil wall achieved the following objectives:

- low cost, fast construction and easiness to shape the slopes;
- fast and excellent vegetation of the face;
- excellent stability: after five years of monitoring, only minimal base and face movements were recorded;
- positive drainage: low pore pressure was noted in the reinforced block while the culvert discharges a continuous high flow. Hence this project shows that good geosynthetics engineering can provide a solution even to extremely difficult geotechnical problems.