

Muralex® Reinforced Soil Walls Experience in Bulgaria 2002-2010

This case history describes the construction of a number of Muralex® clad reinforced soil structures within Bulgaria between the years 2002 to 2010. The report looks at the construction of the patented Muralex® system and illustrates the flexibility and ease of construction by highlighting a number of Muralex® structures built as part of major infrastructure projects.

The Muralex® system is a facing that can be attached to steep reinforced soil slopes or near vertical reinforced soil walls.

The front face of the system consists of a zinc coated steel face panel held at a defined distance in front of the wrap around faced reinforced soil block, thus creating a void space which can be filled with crushed rock. (See Figure 1 on the following page).

The Muralex® system is considered as a wall facing system only, supporting its own weight. It has the following distinct advantages:

- The separation of the reinforced soil block and the Muralex® facing ensures a well compacted high quality earthwork structure.
- The Muralex® system can be attached to the front of the reinforced soil wall after it has been constructed or even in the course of the construction process.



- Potential differential settlements between the Muralex® facing and the reinforced soil block will be minimised thereby not affecting the stability and servicability of either.
- The entire system is very ductile inclusive of the facing and consequently less sensitive to earthquake and differential settlements.
- The geosynthetic reinforcement is protected against damage by accident, vandalism or fire.
- In the case of damage the Muralex® facing can be easily replaced.

Case history

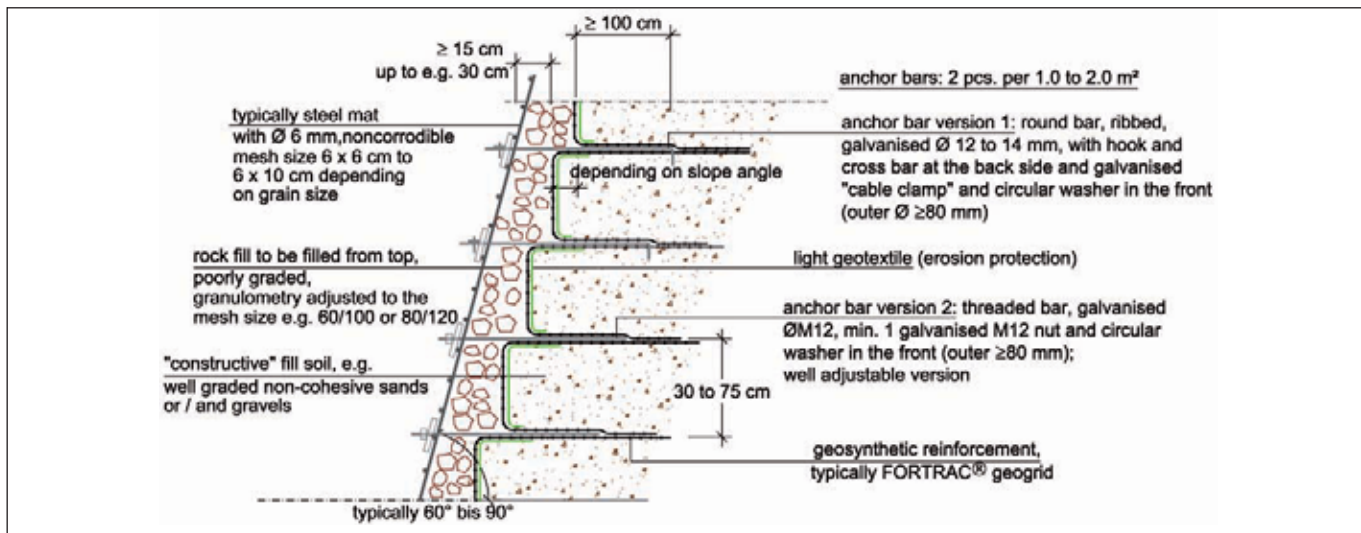


Figure 1: Typical Cross Section of the **Muralex®** stone facing system

Road I-8 (E85) Lot 4 Harmanli to Svilengrad 2002-2003:

This project was the first **Muralex®** stone clad structure to be built on a major highway route inside Bulgaria. The location of the structure is in the Rodopi mountains region of Bulgaria. The E85 highway is a major international highway running in roughly a north west to south east direction through Bulgaria to the border with Greece and Turkey.



Reinforced soil block using sandbag formers



The finished **Muralex®** facing using stone fill

The structure is as a maximum of 6.6 m high and extends over a 60 m length in a slightly curved alignment.

The wall was required to enable the widening of the existing road by 3 m as it crossed a river valley. The face of the wall was at 80°.

Case history

The reinforced soil block was formed with a wrap around face which, due to the curved face, used sand bags to form the front alignment. This structure was designed for zone VIII seismicity and the geogrid reinforcement was **Fortrac® T** geogrids. Locally available, non-cohesive backfill material was used to form the reinforced soil block.

Road III-868 Devin–Mihalkovo 2007-2010

Investor: National Electrical Company

Road Designer: Burda Company

Specialist Consultant: Geo Kraft

Contractor: Alpine Mayreder, Austria

This project involved the relocation of an existing road to higher ground due to the construction of a hydroelectric power plant and associated dam. The new road was required because the lake which was to be created behind the new dam would cover the existing road location.

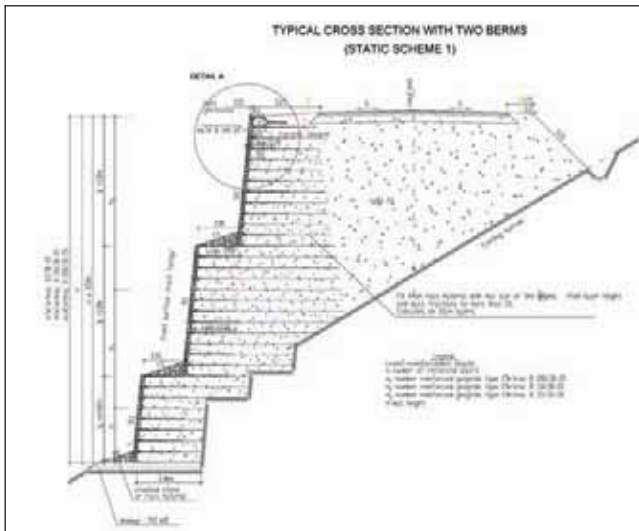
A number of reinforced soil structures were required to support sections of the road as it passed through the very difficult terrain of the Rodopi Mountains. These structures were all constructed using the **Muralex®** System.

The structures were designed by specialist geotechnical consultant Geo Kraft with assistance from HUESKER GmbH. The walls had to include seismic loadings in accordance with Zone VIII acceleration force profile.

There were 28 separate structures required with a total length of 2 km and a maximum height of 24 m. The stone facing was typically inclined at 10v in 1h. A number of different typical sectional geometries and fill volumes were designed ranging from a smooth faced option to those incorporating a single or double intermediate berm.



Case history



This flexibility of design made it easier for the contractor to rationalize the site disposal and associated haulage of rock fill material along the route of the new road.

The reinforced soil structures were all constructed with **Fortrac® T** geogrids using site excavated fill materials making them a very cost effective solution when compare to the cost of having to remove and dispose of site won fill materials at off site locations.



The analyses for all the Muralex walls was performed by HUESKER Synthetic GmbH using the GGU Stability software (by Civilserve) specially adapted to allow the easy analysis of reinforced soil structures incorporating Huesker's range of reinforcement products.

The software is Limit State based and allows the use of a range of international design codes (BS8006, DIN, EC7, US Code and others), allowing the application of partial factors in the design process.

Internationally recognised analysis methods such as Bishop, Krey and Janbu can be selected to investigate both circular and polygonal slip surfaces both internally and externally. Two part wedge analyses can also be used to check internal and block sliding.

