GEOTECHNICAL ENGINEERING / REINFORCED SOIL WALLS / PARTIAL HEIGHT CONCRETE PANELS (MACFORCE)

Product: MACFORCE & PARAWEB™

Problem

To provide a cost-effective and aesthetically pleasing design for the construction of walls required at the multi-level interchange linking the John Ross Parkway with the West Central Arterial road in Richards Bay. The site is in close proximity to a phosphate and phosphoric acid producing company, a reservoir and an aluminium smelter. Walls had to accommodate existing and future services. Culverts, not all of which were perpendicular to the walls, ran through the embankment; and an impact barrier was required on top of the wall. This barrier had to be designed in a way which would limit the transfer of loads onto the wall. Also, the client envisaged future widening of the on-ramp to the West Central Arterial road. Thus, design of one of the walls had to include founding to the same depth as the bridge abutment foundation to allow for future piling. It also had to take into account environmental and construction factors. These included the short and long-term effects of damage during construction, as well potential damage arising from the chemical properties of the soils affecting the long-term strength of the material.

Solution

A MacForce, Mechanically stabilised earth wall (MSEW) satisfying SANS 207 was chosen as the solution. The Macforce system comprises moulds, geosynthetic reinforcement and geotextile, toggles, loops, half rounds, PVC sleeves, locating pins and buffer pads.

The client had determined the extent and location of the retaining walls but detailed design had not commenced. The project comprised the design and construction of five walls with a maximum height of 12 m. Two of them formed a back-to-back MSEW wall on either side of one of the on-ramps. The front face of a MacForce wall is a precast concrete panel. The reinforcement consists of ParaWeb™ polyester strips.

The concrete panels were designed to withstand both lifting and placement in the vertical position, and the force generated on each of the reinforcements. This is not directly translated onto the panel, but for design purposes it is assumed to be so. A panel is then modelled in the design as a beam with point loading.

Limitation of the transfer of loads onto the wall by the impact barrier was achieved by making the coping separate from the barrier. Special "lips" were incorporated into the design of the culverts. These acted as wedges to improve the sliding resistance of the walls.

With over 1000 panels required and 8-10 working weeks for the casting of the panels, 26 moulds were sent to site. This number included the special moulds necessitated by the culverts. The tolerance of the moulds in the manufacture of the concrete panels are critical. Storage space in the pre-cast yard had to be carefully managed so as to meet the programme and sequence of panel construction. This was achieved by the appointment of a full time Maccaferri supervisor to guide the contractor through the initial panel casting and construction of the wall. The contractor utilised a ready-mix batch plant at the pre-casting yard.

Placing of the panels
Benefits

MacForce was utilised here on the first major roads project and in the largest combined total area of a MSEW wall in Africa, being in excess of 4 000 m².

MacForce provides a continuous homogeneous block where durability and reliability are required.

The system can be tailor-made for individual applications.