

MACRES SYSTEM

REINFORCED SOIL STRUCTURE WITH VERTICAL CONCRETE FACING PANELS

The **MacRes System** comprises of a reinforced embankment with high adherence linear reinforcements, placed in the ground in successive layers and connected to a flexible precast concrete face.

To adapt to the unique demands of each project, the **MacRes System** offers the possibility of using high adherence polymeric reinforcement with varied resistance to optimise efficiency. Its characteristics allow the construction of very high structures able to sustain very high loads.

Components include: precast concrete facing panels, high adherence polymeric reinforcement, tie strips for connecting the reinforcement to the front face, bolts, plating, locating pins and sleeves, lifting pins and material for the backfill.

Standards and Reference Guide

- **CNR UNI 10006/1963** "Construction and maintenance of roads. Techniques used on the soils" in order to reinforce the embankment;
- **TESTO UNICO** "Technical Guideline for construction", 30 March 2005;
- **AFNOR NF-P 94/220** "Ouvrages en sols rapportés renforcés par armatures ou nappes peu extensibles et souples";
- **SANS 207:2006** "Design and construction of reinforced soils and fills";
- **EN 10025-2/2004** "Hot Steel laminated products for structural use" for steel reinforcement;
- **UNI 3740/6** "Steel bolts and nuts. Technical regulations. Protective coatings for fastening bolts.
- **UNI EN ISO 1461/99** "Hot dip galvanising of ferrous products and steel items – Trial specifications and methods".

Technical characteristics of constituent components

Front face

- **Concrete components**
Concrete with compressive strength $> 35 \text{ N/mm}^2$ at 28 days;
- **Reinforcement for reinforced concrete panels (where necessary)**
High yield steel type Fe B 44 K with the following characteristics:
Resistance at break $\geq 540 \text{ N/mm}^2$;
Elastic limit $\geq 430 \text{ N/mm}^2$;
- **Locating steel pins** and injection mould rigid PVC sleeves;
- **Lifting pins**
In DEHA forged steel having a lifting capacity equal to 10 kN;
- **Bearing pads** in EPDM rubber;
- **Horizontal and vertical joints**;
- Strips of AG300 non woven geotextile supplied in 40 cm wide rolls and 265g/m^2 in weight.

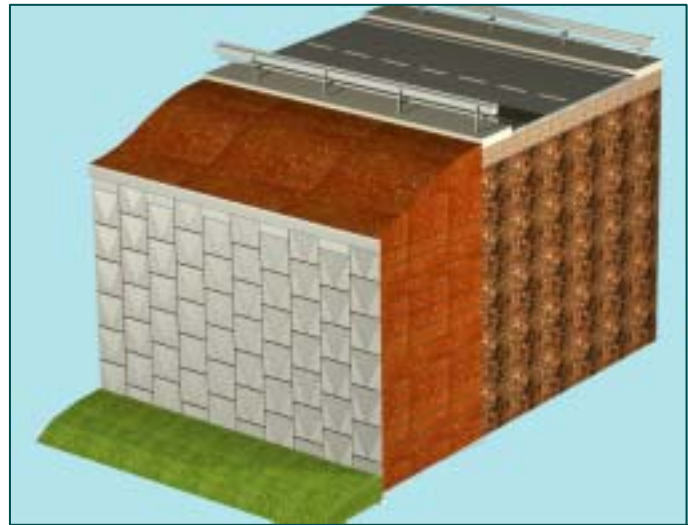


Figure 1 - Retaining wall with MacRes System

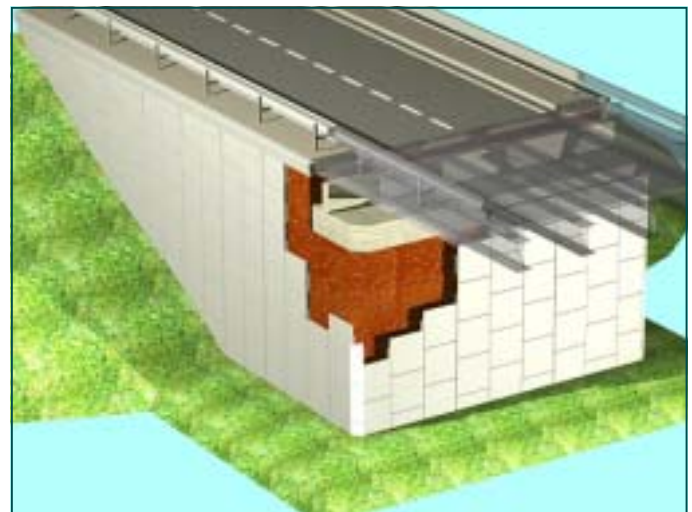


Figure 2 - Bridge Embankment with MacRes System

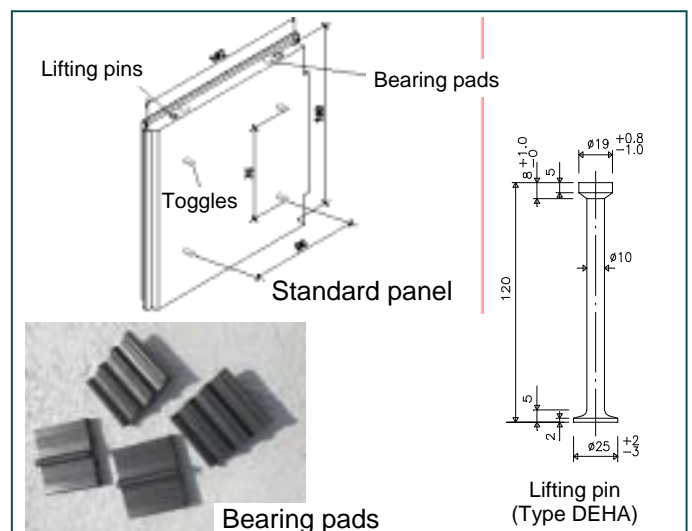


Figure 3 - Front face constitutive elements

Reinforcement System

- **High Adherence Polymeric Reinforcements**

Comprised of polyester sheaths protected by a polyethylene coating with increased interlock. The sheaths are concentrated in separate bundles and coated in polyethylene through a "vacuum" process.

- **Attachments for High Adherence Polymeric Reinforcement**

Made from steel that conforms to the European standard EN 10025, type S355JO (equivalent to ASTM, type 50 and comparable to Italian Fe 52) having the following characteristics:

- Resistance at break $\geq 510 \text{ N/mm}^2$;
- Elastic limit $\geq 355 \text{ N/mm}^2$;
- Elongation $\geq 22\%$;
- Hot dip galvanising: zinc coating conforming to standard UNI 3740/6.

- **Material constituting the reinforced embankment**

Soil from groups A1-a, A1-b, A3, A2-4, A2-5 according to the classification CNR UNI 10006/1963 are to be used as material for backfilling of the reinforced structure.

The backfill may be lightened by interposing layers of a mixed granular soil or sand, as indicated in the construction plans.

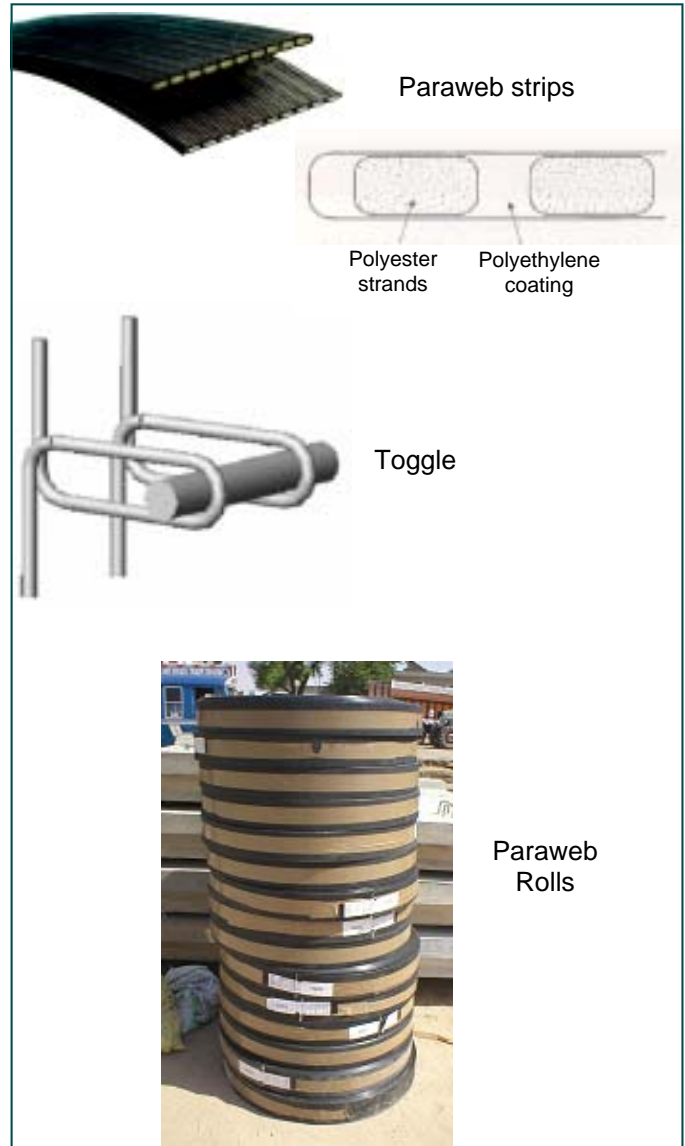


Figure 4 - Paraweb reinforcement system



Figure 5 - Typical MacRes panels