Maccaferri is active in the research and development of innovative solutions and new products for retention works. In launching MacRes®, our aim was to add a vertical faced, durable reinforced soil system for demanding infrastructure applications.

**MacRes®**

The Maccaferri MacRes® system is a Mechanically Stabilized Earth (MSE) retaining wall system comprised of precast concrete facing panels and discrete high adherence polymeric soil reinforcing strips. The tensile forces in the soil are transferred to the reinforcing strips by means of friction.

The MacRes® has been used on many projects worldwide for various applications such as bridge wing walls and abutments, railways, highways, airports, quarries and other industrial areas.

**System Components**

The MacRes® system consists of 3 structural elements designed for easy installation and flexible use:

1. Precast concrete facing panels either square (5’w x 5’h), or rectangular in shape (10’w x 5’h)
2. High strength polyester soil reinforcing ParaWeb™ strips encased in a tough and durable Linear Low Density Polyethylene (LLDPE) coating available with nominal tensile strength ranging from 6,740 to 25,170 lb
3. Connection assembly composed of a High Density Polyethylene (HDPE) MacBox™ cavity insert box secured by a steel rebar cast into the precast facing panel

**Panel Features**

The precast concrete facing panels are designed based on a minimum concrete compressive strength at 28 days of 4,000 psi. MacRes® panels minimum thickness is 5½ inches. The front face of the concrete facing panels can be finished with a broad range of form liner textures to satisfy a wide range of aesthetic and architectural requirements.
Polymeric Reinforcing Strips

The ParaWeb™ reinforcements are planar strips manufactured from high tenacity, multifilament polyester yarns aligned and co-extruded with a LLDPE sheath to form polymeric strips.

The ParaWeb™ soil reinforcing strips are available in a wide range of tensile strengths in order to optimize the design and construction efficiency.

The ParaWeb™ mechanical and physical properties have been qualified by:

NTPEP (National Transportation Product Evaluation Program).

BBA (British Board of Agrément), a reputable British third-party certification body of construction products, based on laboratory tests.

The polyethylene coating allows the use of ParaWeb™ in highly alkaline environments (pH>11) commonly found in recycled concrete and lime-stabilized backfill materials.

Connecting System

The HDPE MacBox™ is integrated with the panel by an embedded steel rebar encased in a polymeric sleeve for corrosion protection. The sleeve avoids any intrusion during the casting phase and prevents damage to the polymeric soil reinforcing strips in contact with the rebar.

An alternate polymeric anchor rod (in lieu of a steel rebar) may also be considered with this system.

The geostrips are simply wrapped around the anchor bar. The connection strength has been determined through independent connection/pullout testing programs.
Advantages of System

The MacRes® MSE wall system outperforms traditional reinforced concrete structures because it offers:

- Resistance against corrosion and increased durability of all components, giving a project working life of up to 120 years even in chemically aggressive soils;
- Rapid system deployment and installation;
- Cost effective due to system simplicity and design efficiency;
- Does not require specialist mechanical equipment or experienced labor;
- Enables the use of lower quality backfill materials in reinforced zone;
- Attractive appearance and high level of customization possible;
- Flexibility to meet layout requirements;
- Deep experience on challenging and complex projects;
- High quality technical and construction support from planning through to construction;
- Use of MSEW software or the Maccaferri dedicated software for stability calculations and drawings.

Maccaferri Services

- Research and Development with Research Institutions and Universities
- Technical design support using dedicated software
- Architectural design support
- Installation assistance
- Widespread presence throughout the country
Faster construction: up to 2,100 sq. ft. per location per day. Approximately 5 times faster than the construction and soil placement of a traditional reinforced concrete gravity structure.

MacRes® System

5-step MacRes® System

1. Excavation and foundation preparation and leveling pad construction
2. Positioning the first row of panels on the lean concrete leveling pad
3. Laying and compaction backfill
4. Installation of soil reinforcing strips
5. Placement of subsequent panels
Notable case studies

During the 2015 Transportation Research Board (TRB) annual meeting, a paper on the project’s monitoring program, “Instrumented MSE Wall reinforced with Polyester Straps”, was voted Best Paper 2015 in the Soil Mechanics Section.

I-95 / SR1 Interchange New Castle, Delaware–DelDOT

The SR 1/I-95 interchange is a full cloverleaf interchange that connects Interstate 95 to SR 1 and SR 7 in New Castle County, Delaware. The main purpose of this project was to relieve congestion at a highly trafficked interchange. The Delaware Department of Transportation (DelDOT) approved this project for construction in 2011.

The scope of the project included 16 MSE walls and 12 bridge abutments which were built using rectangular concrete panel units (10’h x 5’w x 5.5”d) and soil backfill reinforced by polymeric ParaWeb™ strips.

The maximum wall height achieved was 40 ft. and the total wall surface built is 172,000 sq. ft.

AASHTO does not address polymeric reinforcing strips and DelDOT required that at least one section of the wall include monitoring instrumentation.

A 26.9 ft high section was fully instrumented enabling it to be monitored and performance data collected.

Analysis of the performance data revealed:

• Confirmation that the design input was correct;
• Long-term loads in the straps and in the connection were at least 4 times smaller than predicted,
• The displacement at mid-height was negligible and the length of the reinforcing straps is adequate.
Notable case studies
Contact your local Maccaferri Technical Office for more detailed project information and experience.

Santa Rosa Tunnel, Perù
The MSE wall built in Perù for the Santa Rosa Tunnel is 62 ft. high, has a surface area of 129,000 sq. ft. and was constructed in 2010. Maccaferri collaborated with the project engineers for this Lima Municipality project.

Kwagga Coal Mine, South Africa
Maccaferri Africa constructed 82 ft. high wall 30,139 sq. ft. surface in the Mpumalanga region of South Africa. The bench between the two tiered wall sections is less than 3 ft. The designer for the mining company and Maccaferri Africa technical department collaborated during the design phase. This MSE wall is the highest ever built in South Africa.

Reading Viaduct, UK
The constructions consist of a series of back-to-back MacRes® walls to create an elevated railway. The walls were designed to accommodate derailment loads. 27,000 sq. ft. of MacRes® walls of up to 17 ft. in height were built on a load transfer platform, reinforced with Paralink™.

Arluno Overpass, Italy
The lack of space and the need of a railway overpass for a cycle track had to be overcome in this Italian project. 37,000 sq. ft. of the MacRes® system with geosynthetic reinforcements provided a safe and effective solution for this problem.
Officine Maccaferri Group Profile

Founded in 1879, Officine Maccaferri soon became a technical reference in the design and development of solutions for erosion control and retaining structures.

Since then, through technological innovation, geographical expansion and focused diversification, Maccaferri now offers solutions at a global level for a wide range of civil and environmental engineering applications.

Consultancy and Partnership

Maccaferri’s motto is ‘Engineering a Better Solution’; We do not merely supply products, but work in partnership with our clients, offering technical expertise to deliver versatile, cost effective and environmentally sound solutions. We aim to build mutually beneficial relationships with clients through the quality of our service and solutions.

Organizational Structure

Officine Maccaferri is at the heart of the Maccaferri Industrial Group. Its continued growth is based upon long-held values of innovation, integrity, excellent service and respect for the environment.

Maccaferri’s vision is to become a leading international provider of advanced solutions to the civil engineering and construction market. Implementing a strategy of vertical integration, Maccaferri researches, manufactures, designs, supplies and constructs solutions within its target markets.

The capability of the business continues to expand due to a strategic plan to open new markets and grow existing ones; Maccaferri now offers advanced engineered solutions from beach nourishment to reinforced soil structures and from rockfall mitigation to tunneling systems.

With nearly 3000 employees, over 30 manuring facilities and local operation in 100 countries around the world, Maccaferri can truly claim to have a global presence with local focus.

Maccaferri: Engineering a Better Solution