



Rising to New Heights: Exploring Vertical Walls and the MacRes System for Sustainable Infrastructure

MACCAFERRI

Speaker

Mutondwa Mushaathoni – Civil Engineer

1. INTRODUCTION

2. MACRES SYSTEM

3. APPLICATIONS

4. DESIGN METHOD AND INSTALLATION PROCESS

5. CONCLUSION



Vertical walls are crucial in maximizing land use in densely populated urban areas.

New infrastructure is continuously built around the globe to keep up with the need of economic development and population growth.

An aerial photograph of a complex multi-level highway interchange. The interchange features several curved ramps and multiple lanes of traffic, with numerous cars visible. The infrastructure is integrated with a lush urban landscape, featuring dense green trees and some buildings. The vertical walls of the interchange are highlighted as a key design element.

Vertical walls also enhance urban landscapes by providing visually appealing structures that integrate seamlessly into the environment.

This is the reason why the demand for vertical structures has dramatically increased over the past few years.

An aerial photograph of a complex highway interchange. A multi-lane highway runs vertically through the center, passing under a bridge that spans a road. The bridge has a modern, curved design with a light-colored stone or concrete facade. To the left of the bridge, there is a large, circular interchange with multiple lanes. The surrounding area includes a mix of urban development, including parking lots, commercial buildings, and green spaces. The foreground shows a large, landscaped area with green trees and a dirt embankment. The overall scene depicts a modern infrastructure project integrated into an urban environment.

The MacRes System is one of our flagship products, designed to meet the demands of contemporary urban planning.

WHO WE ARE

MACCAFERRI

Maccaferri at a glance



Sales in **100+** countries



Revenues ~ **600 M€**



3,000+ employees

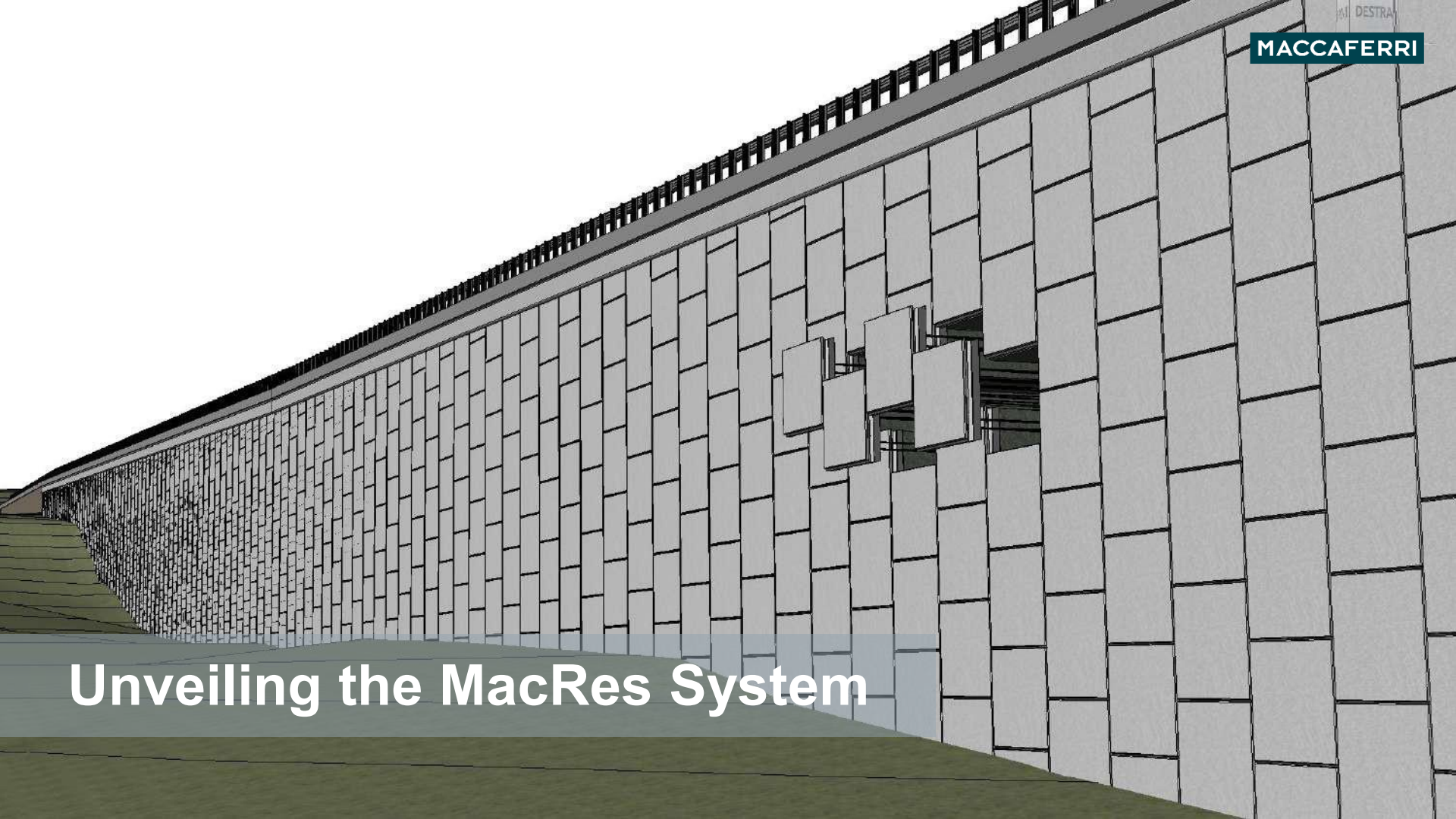


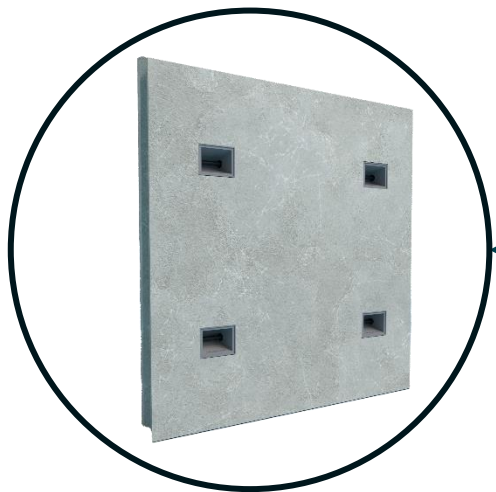
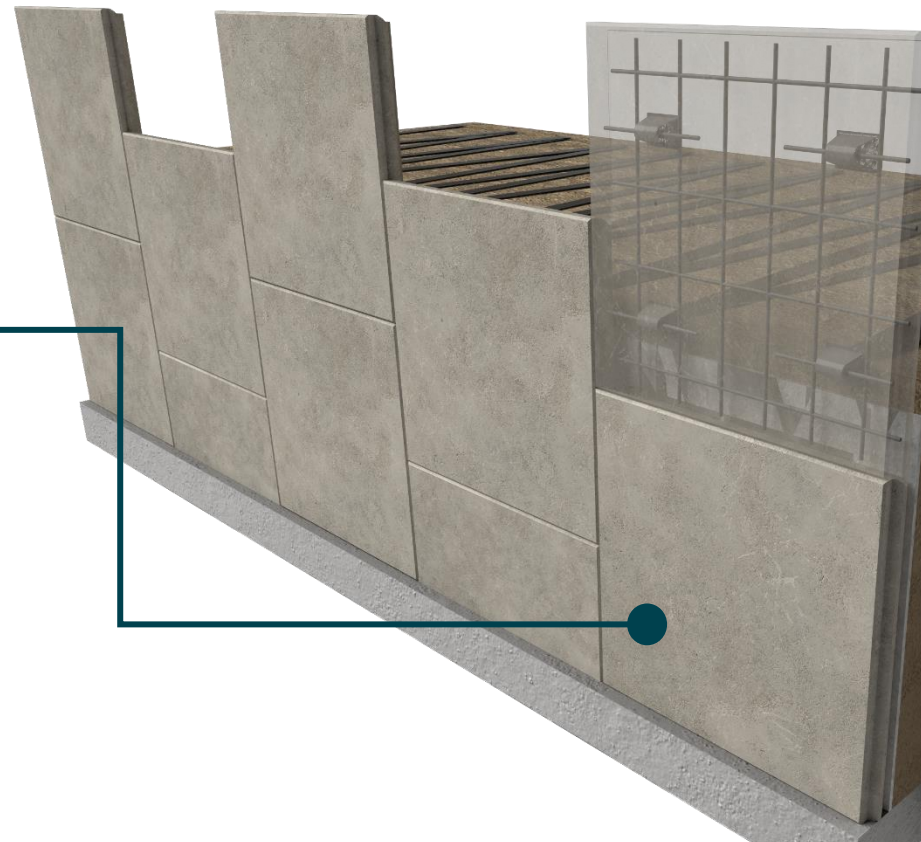
23 factories



70+ subsidiaries

Unveiling the MacRes System





Behind the wall - Panels



CONCRETE PANEL

Concrete type ***depends on project specifications***, but minimum requirements are:

- Class XF1 and XC4 (according to EN 206 or equivalent, resistant to rainwater and de-icing salts)
- Minimum compressive strength at 28 days, >35 Mpa
- Geometric tolerances and finishing shall meet EN13369
- Minimum panel thickness is 14cm



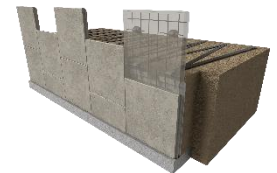
Behind the wall - Panels

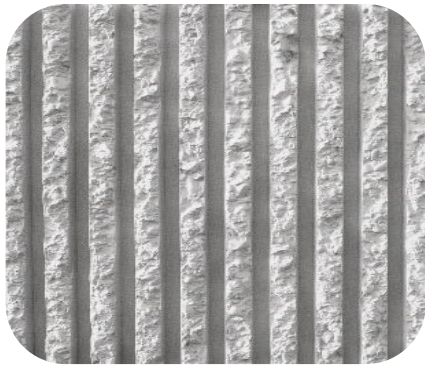
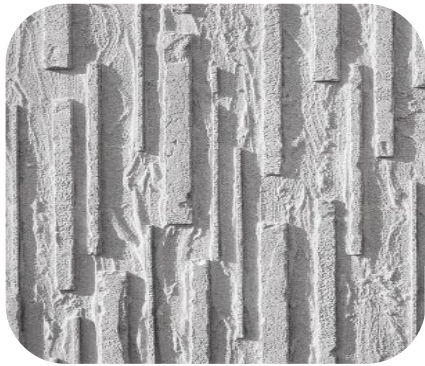


CONCRETE PANEL (VARIANTS)

Several panels' geometries are available to meet finished elevation requirements:

- M Base Panels**
- M Standard Panels**
- M Top Panels**
- M Corner Elements**





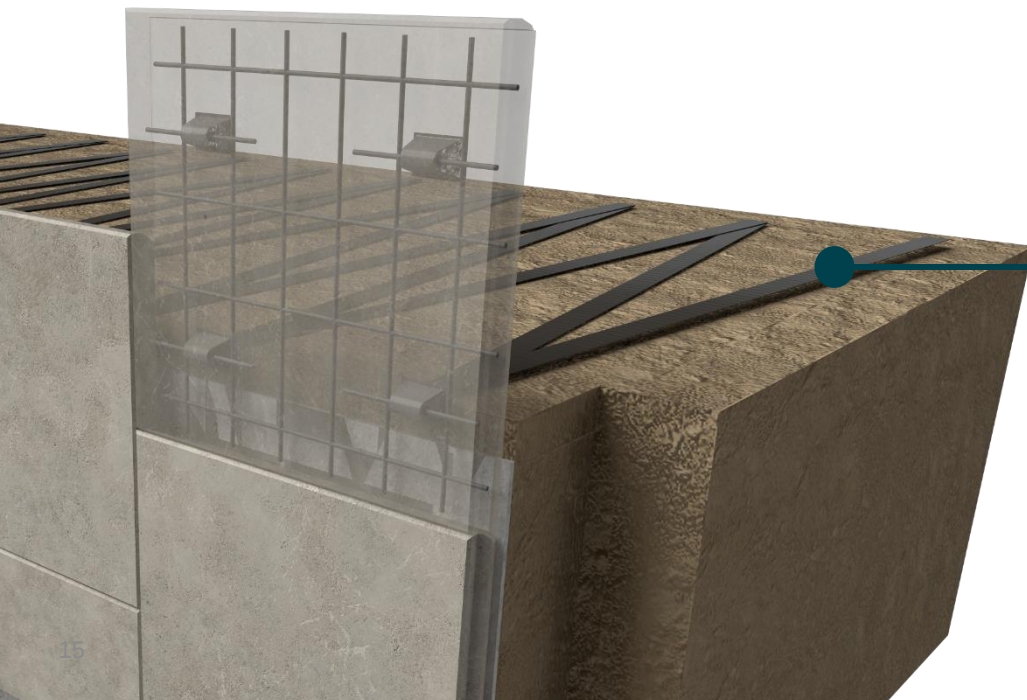
Behind the wall – Panels customization



MACRES SYSTEM

Behind the wall - Paraweb

MACCAFERRI



Geostrip reinforcement

Paraweb™ PET strips
with LLDPE coating

Rough surface which
develops excellent
friction

Resistant to corrosion

Several strip types
available to optimize
the design

Durability tested up to
120 years

Easy to be treated on
site and ease of
shipment

International
Certifications and
Worldwide Experience

Flexible and
adaptable installation



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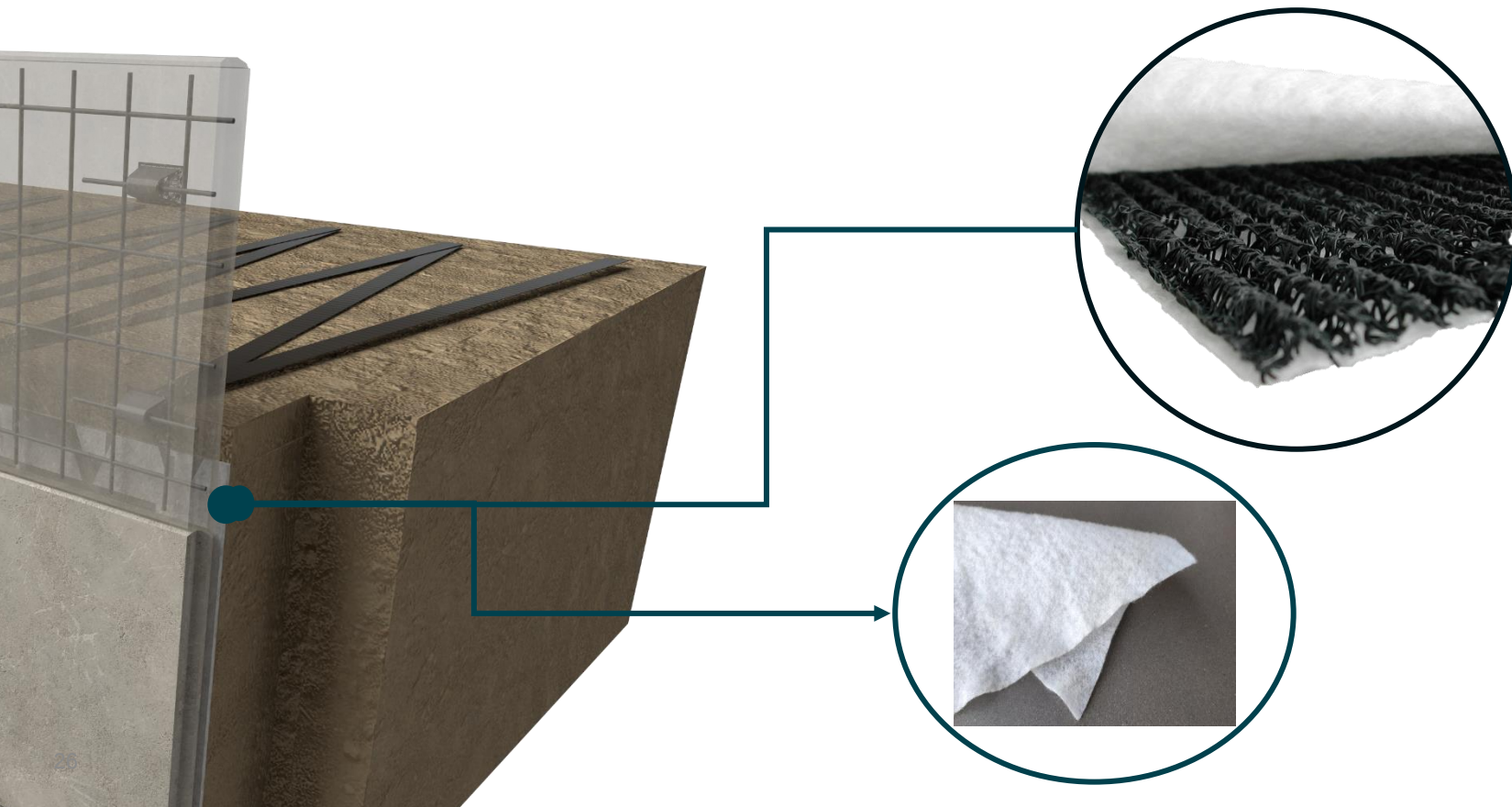
**Flexible and
adaptable installation**



MACRES SYSTEM

MACCAFERRI

Behind the wall – MacDrain and MacTex



Behind the wall

MACTEX

Nonwoven geotextile should meet
local requirements for:

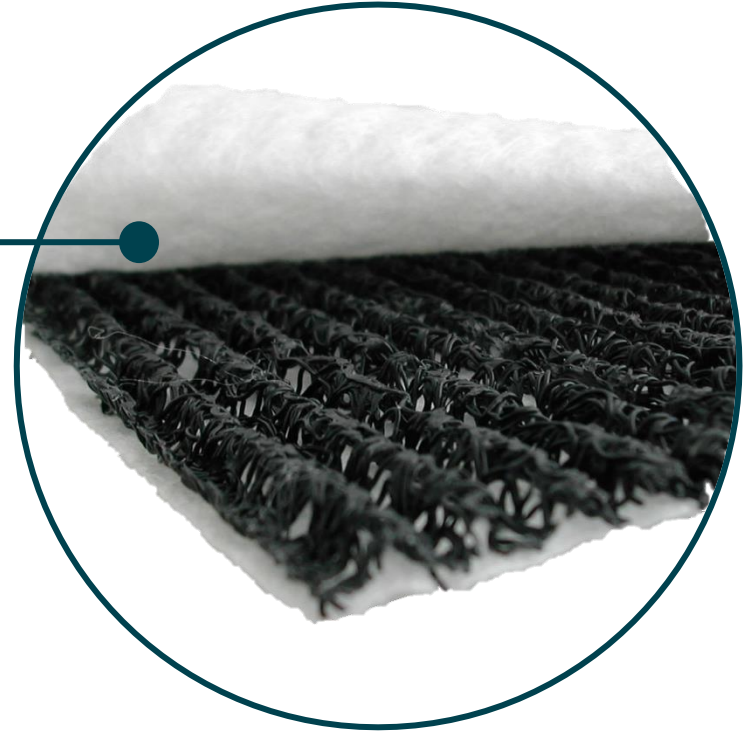
- M** Filtration
- M** Migration of fines

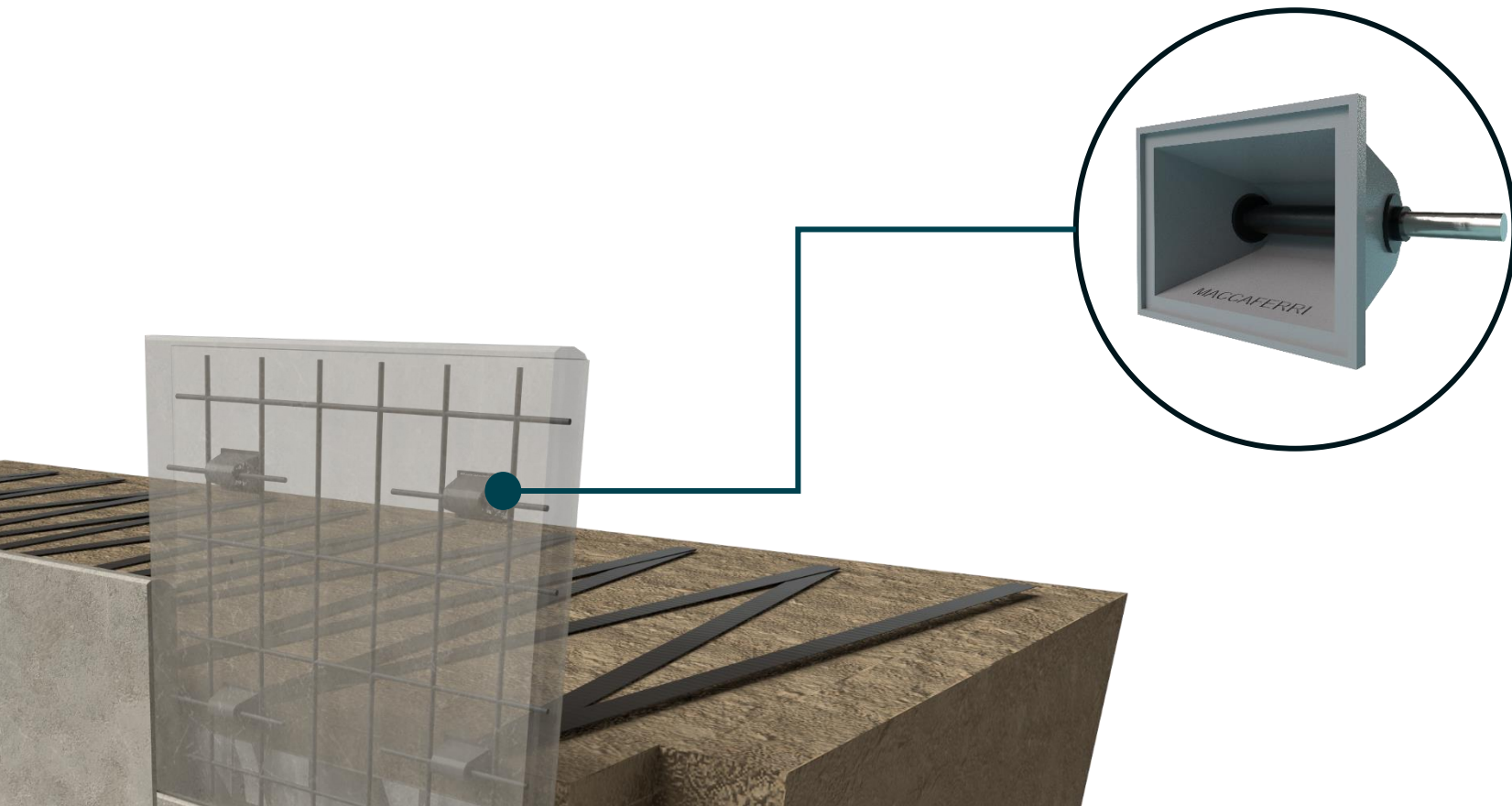


Behind the wall

MACDRAIN

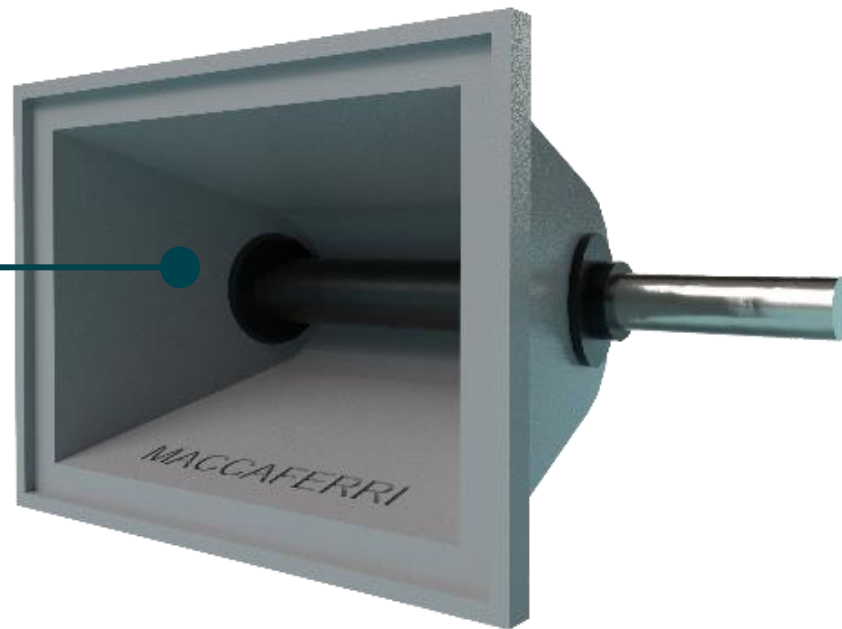
MacDrain is drainage geocomposite comprised of a flexible core and 1 or 2 non-woven geotextile filters.





MACBOX ←

MacBox: a HDPE cavity insert box.



Behind the wall - MacLoop

MACLOOP

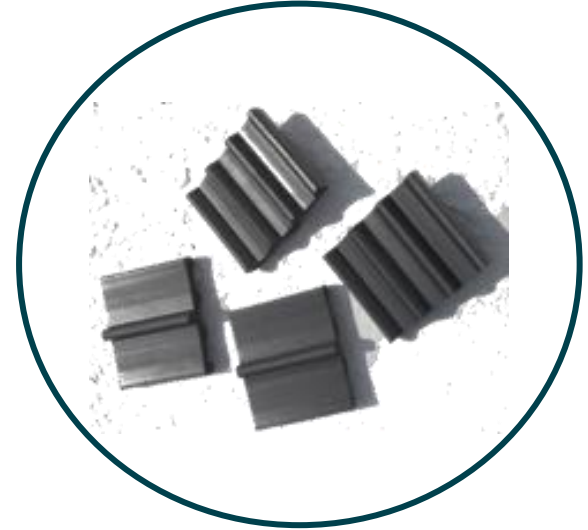
MacLoop: loop made of paraweb strips, protected by a polymeric saddle for ease of installation.

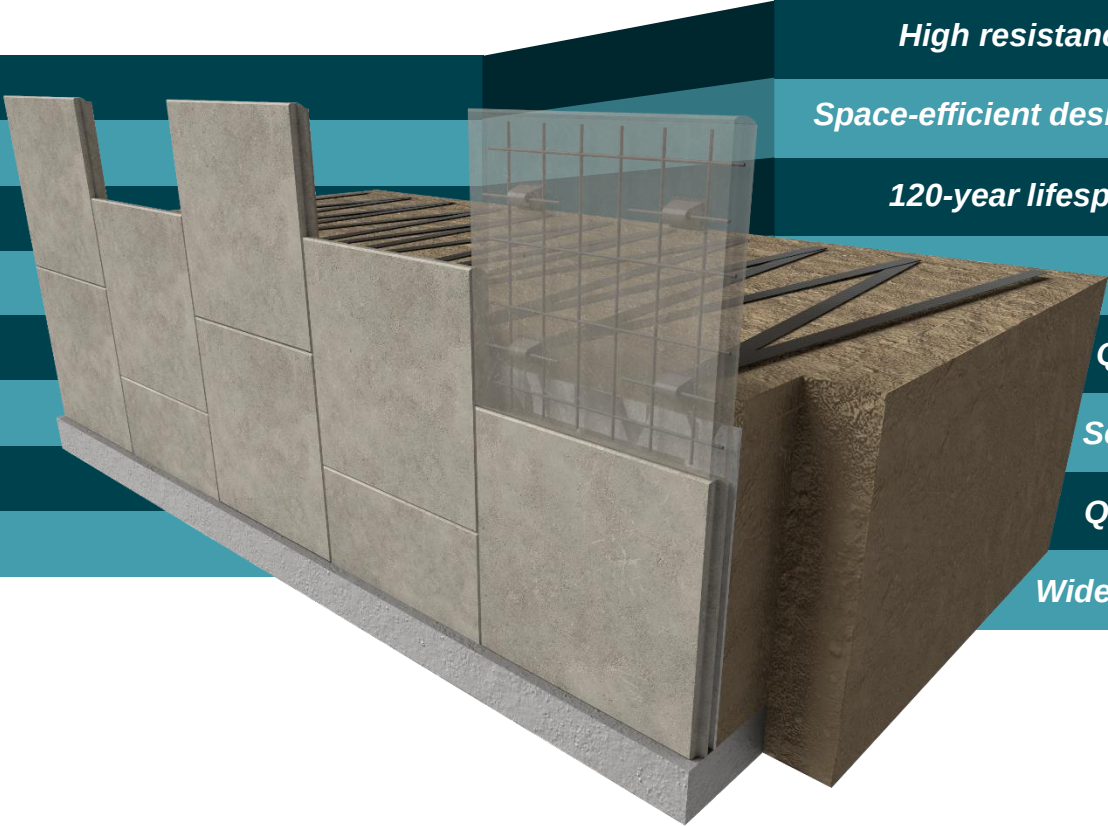


Behind the wall – EPDM Pads

EPDM PADS

Bearing pads are pre-formed EPDM rubber pads utilized to avoid concrete-to-concrete contact and to accommodate panels settlement.





High resistance against seismic events

Space-efficient design

120-year lifespan engineering

High alkaline environment durability

Quick and easy installation capability

Service disruption minimization

Quality of life enhancement

Wide range of customization options available

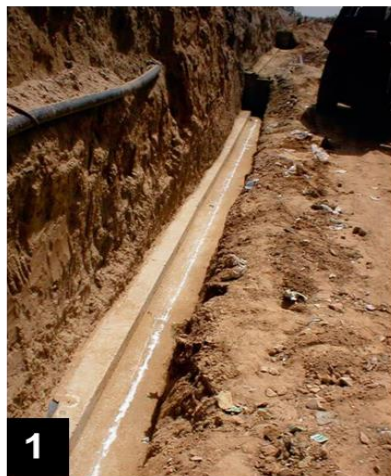
Installation





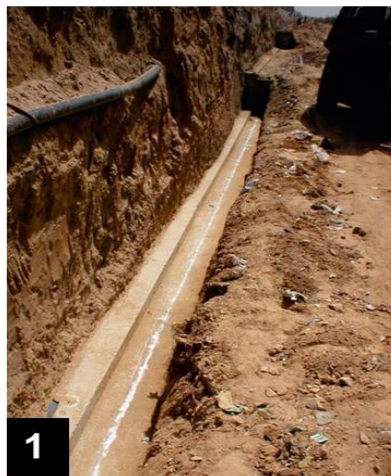
Installation Procedure:

1. Excavation and foundation preparation



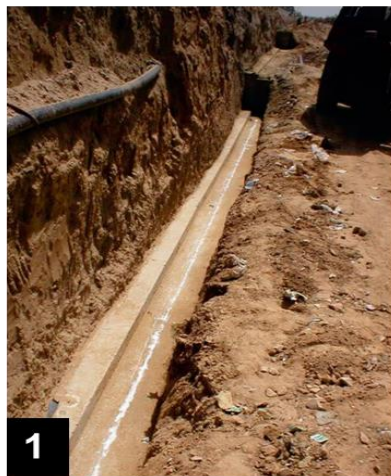
Installation Procedure:

1. Excavation and foundation preparation
2. Positioning the first row of panels



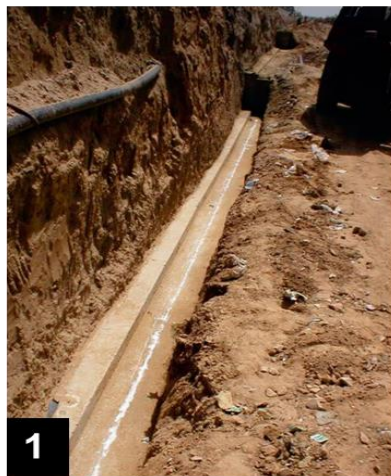
Installation Procedure:

1. Excavation and foundation preparation
2. Positioning the first row of panels
3. Laying and compaction backfill



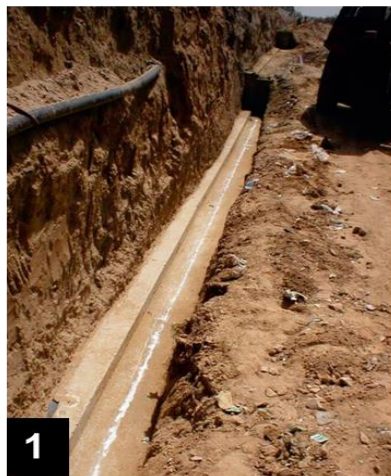
Installation Procedure:

1. Excavation and foundation preparation
2. Positioning the first row of panels
3. Laying and compaction backfill
4. Installation of soil reinforcing strips



Installation Procedure:

1. Excavation and foundation preparation
2. Positioning the first row of panels
3. Laying and compaction backfill
4. Installation of soil reinforcing strips
5. Repeat process



Installation Procedure:

1. Excavation and foundation preparation
2. Positioning the first row of panels
3. Laying and compaction backfill
4. Installation of soil reinforcing strips
5. Repeat process
6. Install subsequent rows of panels

Applications



TRANSPORTATION APPLICATION

St Pierre Bypass,
Mauritius



MINING APPLICATION

Klipspruite Mine,
South Africa

RAILWAY APPLICATION

East Africa



ROAD OVER RAIL

Standard Gauge Rail,
Tanzania



TRUE BRIDGE ABUTMENT

Ford Silverton,
South Africa





ROAD OVER RAIL

Phoenix ROR
Mauritius



Other Typical Applications



Soil reinforcement interaction is extremely important, as it is the mechanism through which forces are transferred between the geosynthetic reinforcement and the surrounding soil.

Design



DESIGN: WHAT DO WE NEED TO KNOW?

MACCAFERRI

Ground

Aesthetic

Groundwater

Durability and
maintenance

Construction
requirements

Row

Environmental
concerns

Boundary Conditions

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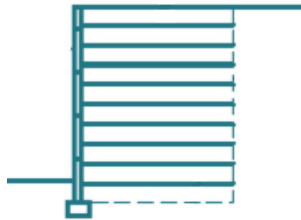
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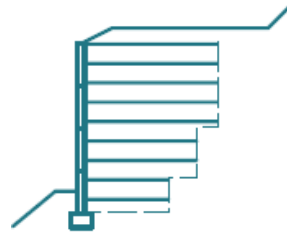




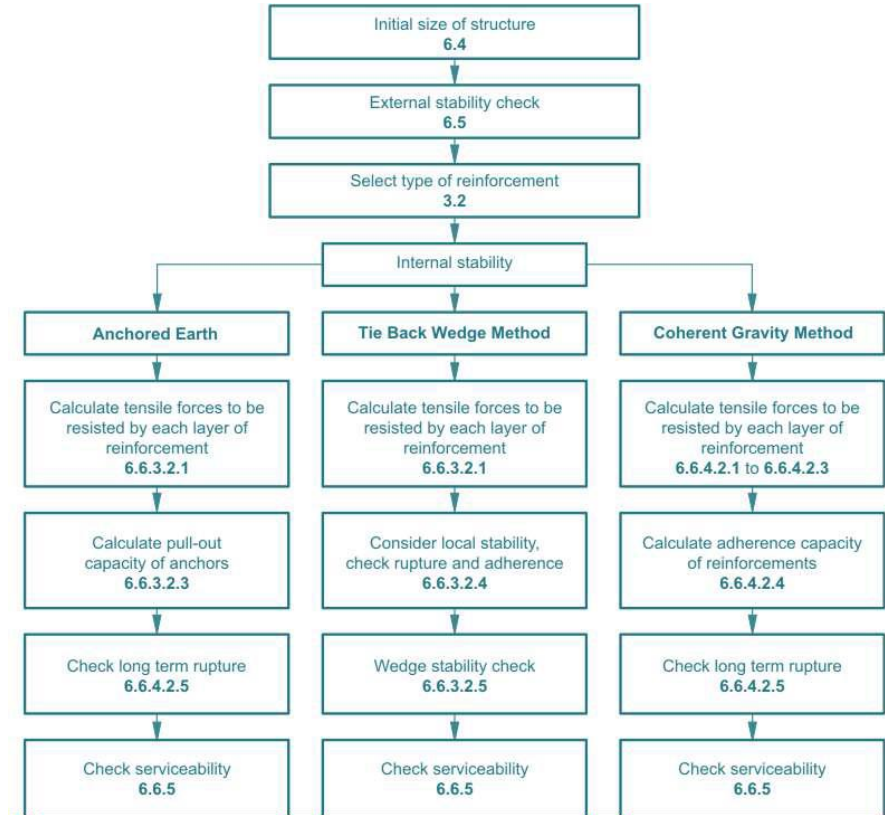
Back-to-back



Simple



Trapezoidal



The design load is sustained by the long-term design strength LTDS ($T_{al} = T_d$) of the reinforcement, which is calculated considering the appropriate RFs for creep, installation damage and durability:

$$T_{al} = T_{ult} / (RF_{cr} \times RF_{id} \times RF_d)$$

MACCAFERRI

Results of Analysis - LRFD Procedure

Soils Loads Summary
 P_u Ksf
 Q_u Ksf

CDR NOTE

Bearing Capacity Direct sliding Eccentricity

Strength **Connection** **Pulout**

Bearing capacity: CDR 312 (Based on length of bottom layer)
Foundation interface: CDR-direct sliding 1.292 e/L = 0.2273

Geogrid

LAYER #	Elevation		Length	Type	Connection Strength			Results of Analysis			Eccentricity, e/L
	[ft]	[m]			CDR (pulout criterion)	CDR (break criterion)	CDR (geogrid strength)	Geogrid Strength, CDR	Pulout resistance, CDR	Direct sliding, CDR	
2	3.69	11.00	2	N/A	1.63	1.49	1.49	1.653	1.805	0.1420	
3	6.15	11.00	2	N/A	1.98	1.81	1.809	1.428	2.228	0.0968	
4	8.61	11.00	1	N/A	2.52	2.30	2.304	1.664	2.723	0.0589	
5	11.07	11.00	1	N/A	3.47	3.17	3.173	1.349	3.562	0.0206	
6	13.53	11.00	1	N/A	5.22	4.78	4.783	1.025	4.906	0.0086	

Modfy Reinforcement

PROGRAM MANAGER
 Select DESIGN or ANALYSIS

DESIGN MODE
 Specify target values

ANALYSIS MODE
 Performance: Acceptable
 reference values

Geometry
 Simple
 Complex

Reinforcement
 Geogrid
 Geotextile
 Metal Mat
 Metal Strip

Facies
 Wind Around
 Full Height Precast
 Segmental Panels
 Modular Blocks

MODIFY INPUT DATA

Version
 Asian Pacific

Run MS3D - Display Results

Input a Global or Local Coordinate
 Compound / Global / Local

Save as Text
 Save as Btmap

Cal Point Input
 Create File

Mod value per layer:
 Full or Rf
 Global efficiency

Seismic results
Static results

Export to ReSSA

RETURN

Quality with nature

At Maccaferri, our primary commitment is to address environmental, economic, and social aspects with a holistic approach.



The MacRes® system aligns with the Company's vision and has earned certifications from accredited international laboratories, including BBA and NTPEP.

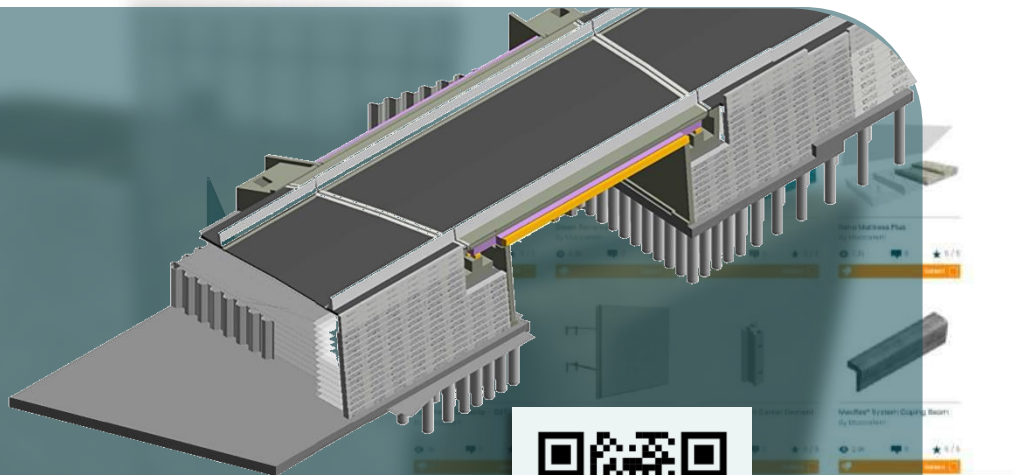


MacRes® system is approved for global use in various applications, from railways to highways, and lime-stabilized backfill to mining crusher walls.



Maccaferri prioritizes environmental sustainability by obtaining the EPD® certification for Paraweb™ products and offering project-specific MacRes® LCA analysis..

Maccaferri values cooperation and actively collaborates with stakeholders, integrating BIM software to assist designers, construction firms, and clients in developing 3D visual plans while ensuring alignment with their product BBA Certificates through the "BIM Object Assurance" service.



Scan here
and discover our BIM library
or visit maccaferri.com



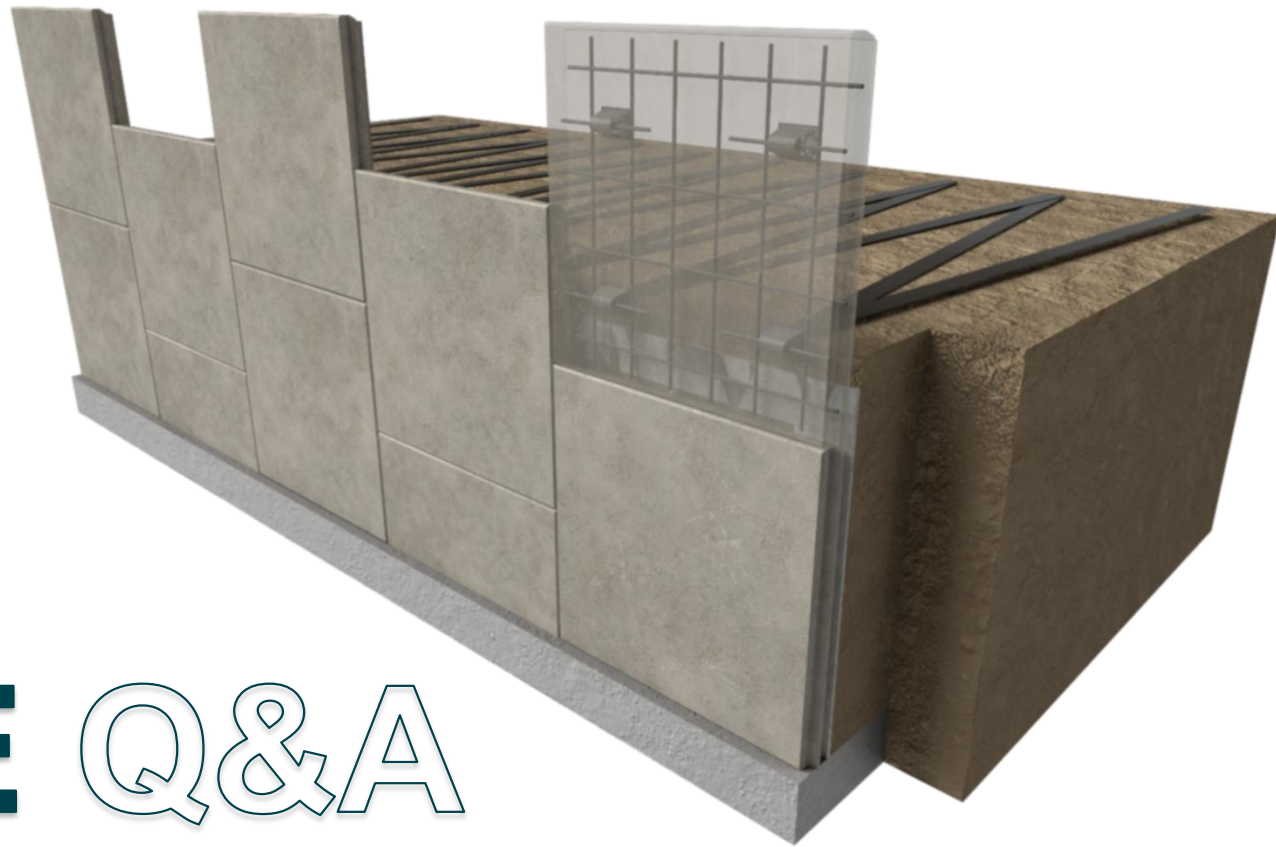
360° Support for your project

Do you need technical assistance?

Our engineers are always here to support you in designing and selecting the most suitable solutions for every type of project.

Type “**technical assistance**” in the chatbox or visit our website at www.maccaferri.com.





LIVE Q&A