



MacArmour®

QUICK-TO-INSTALL & TOP PERFORMANCE
ROCKFALL DRAPERY SYSTEM

December 2, 2021

MACCAFERRI

WEBINAR AGENDA

MACCAFERRI



5' *Introduction*

10' *Lorem*

20' *Lorem*

Live Q&A Session

Speakers

A. Gagliardi – Head of Rockfall Business Unit

L. Gobbin – Corporate Technical Specialist



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Climate change
is responsible for
rising temperatures
and extreme
rainfall events,
leading to
increased
hydrogeological
instability and
hazardous
rockfalls

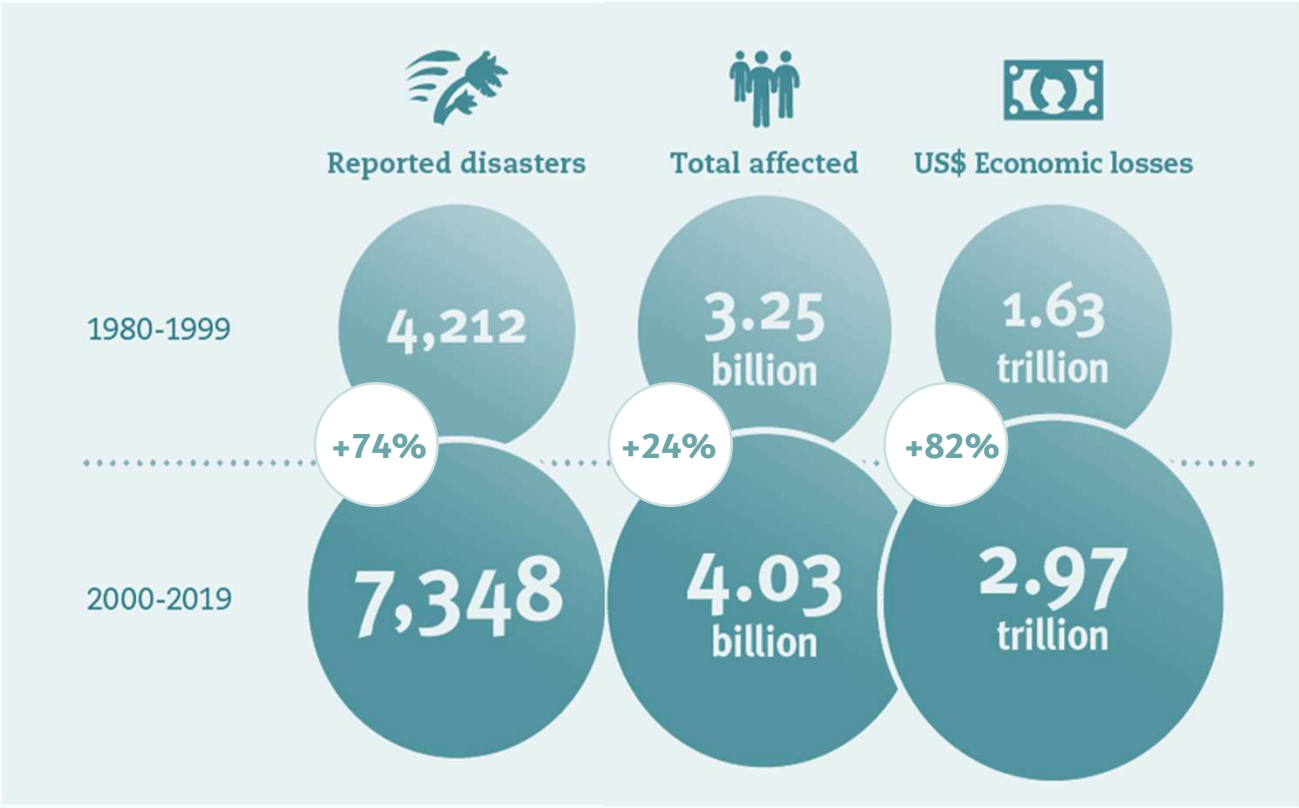
“ People and **assets** around the world are being exposed to a growing mixture of hazards and risks, in places and to an extent previously unrecorded. ”

2019, Global Assessment Report on Disaster Risk Reduction (GAR)



DISASTER RISK IS TAKING ON NEW SHAPES AND SIZES

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2020, United Nations Office for Disaster Risk Reduction, The human cost of disasters: an overview of the last 20 years (2000-2019)



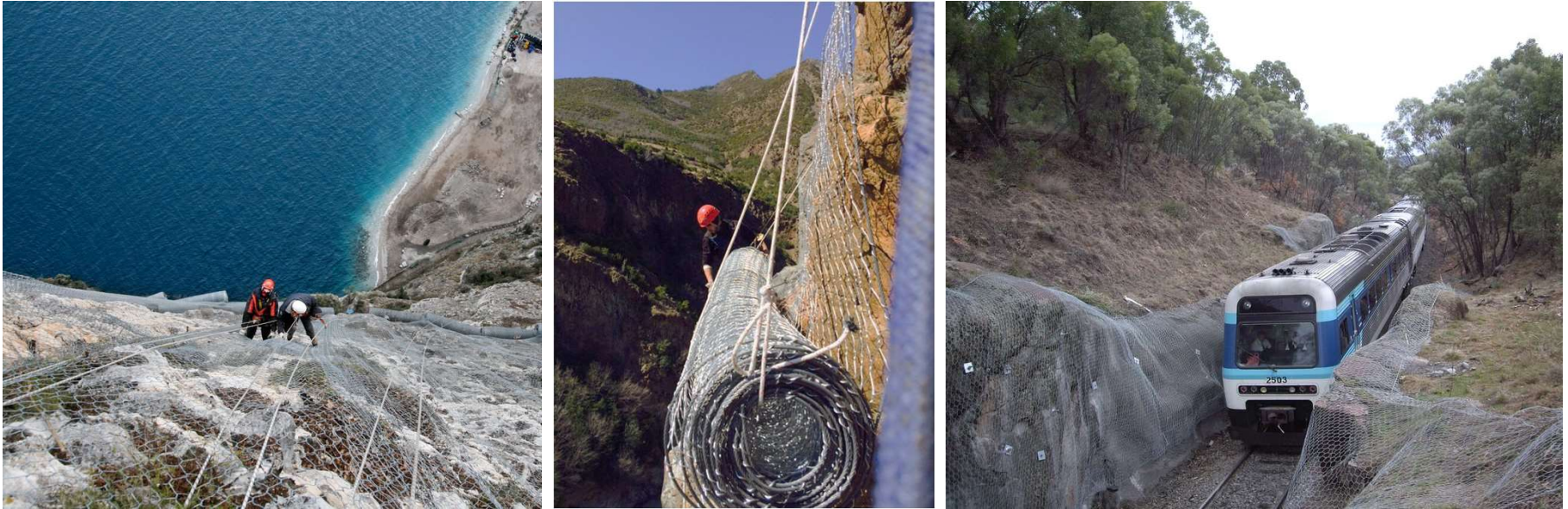


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In order to face the increasing exposure to risks, we need **more robust and safer solutions.**

OUR COMMITMENT TO A CONTINUOUS IMPROVEMENT

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We have developed a 140 years' experience in geohazards mitigation systems. Every day we work to apply the most appropriate solution to the specific hazard.



MACARMOUR: A NEW SOLUTION FOR NEW CHALLENGES

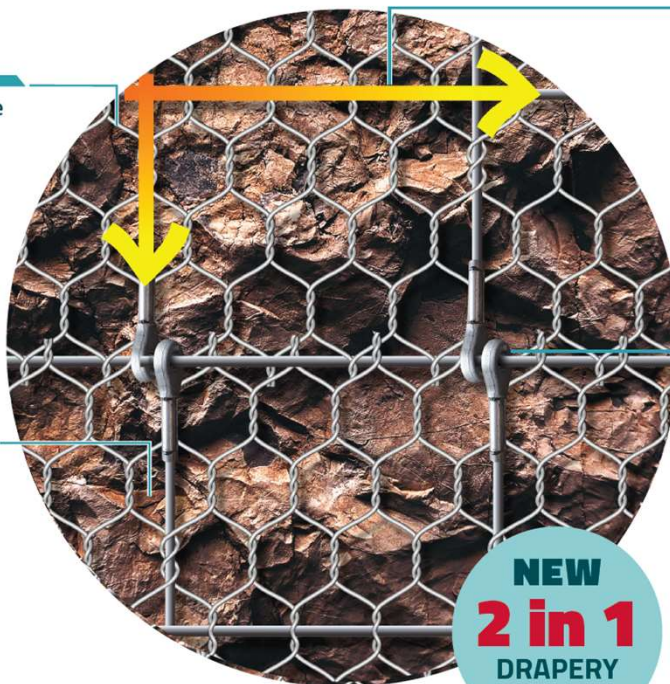
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Higher performance

Conceived with longitudinal and transversal ropes to minimise the deformation.

Long lasting protection

Engineered to withstand the most severe application conditions.



Perfect Homogeneity

Created to ensure the maximum resistance in both longitudinal and transversal directions..

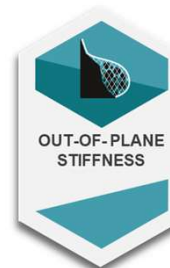
New easy-to-install connections

Designed to minimize the time of installation and the relative associated costs.

NEW
2 in 1
DRAPERY
SYSTEM



MacArmour®



OUT-OF-PLANE
STIFFNESS



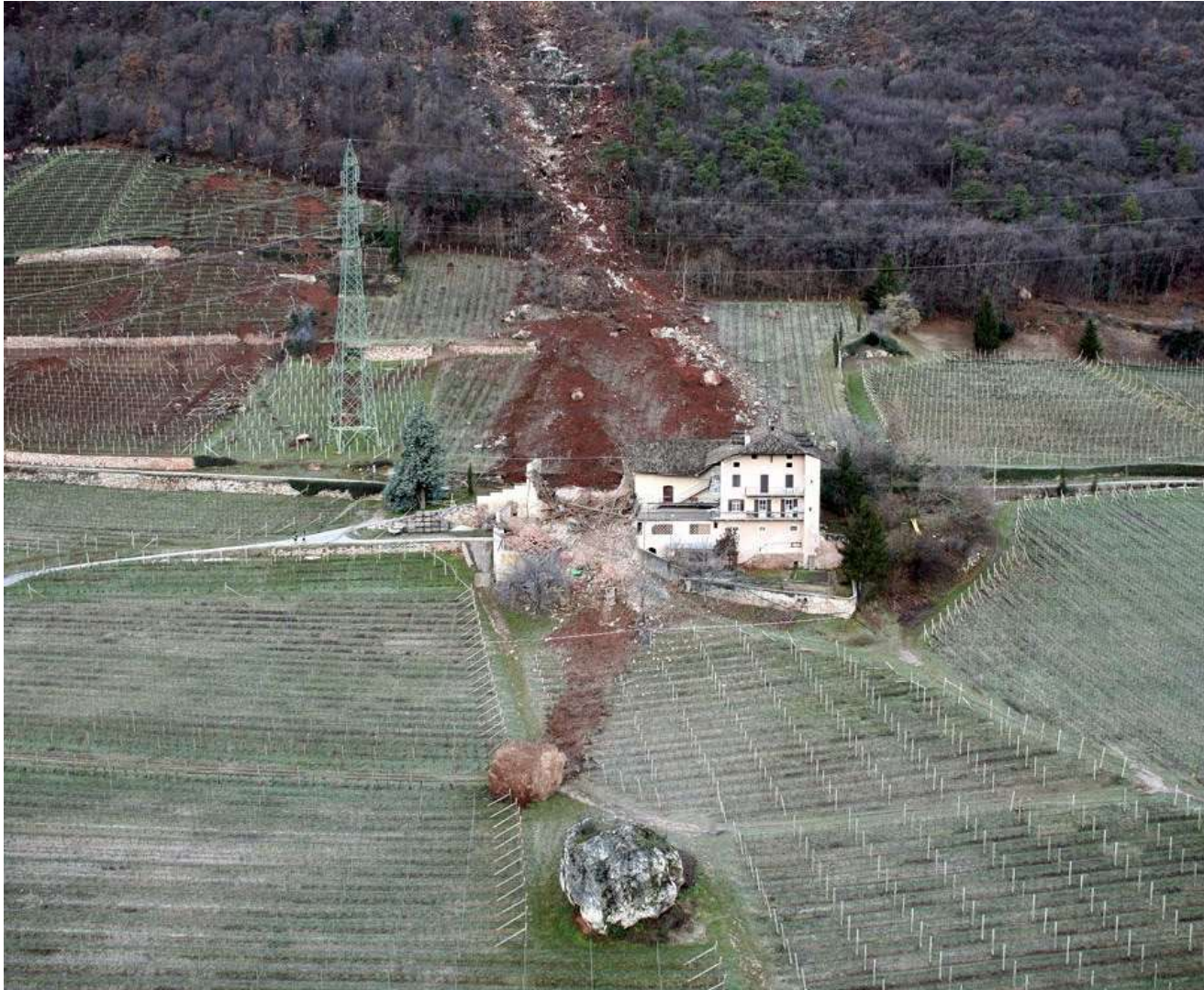
DURABILITY



INSTALLATION
TIME



VIDEO MACARMOUR



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The alarming rate of occurrence and severity of natural disasters is nowadays recognized as one of the main global issues affecting **human life quality and environmental safety.**

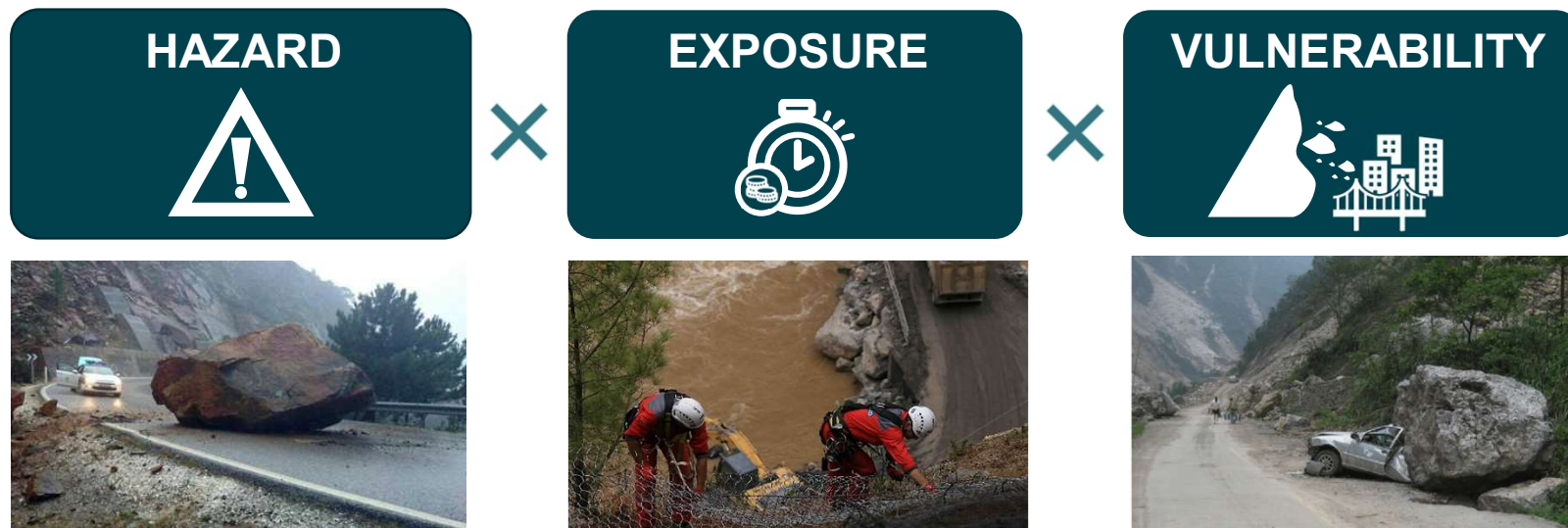
WHY RISK AND UNCERTAINTY ANALYSIS IN THE ROCKFALL SECTOR?

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When facing a geohazard problem, we deal with risk.
Loss and damage are a function of hazard, exposure and vulnerability.



RISK



Source: Protezione civile, Italy



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**STOP
THE
ROCK**

NEW
2 in 1
**DRAPERY
SYSTEM**



MacArmour®

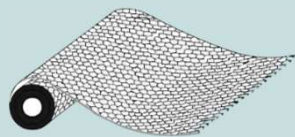
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MacArmour®



THE SAFEST AND MOST EFFECTIVE
DRAPERY SYSTEM

NEW
2 in 1
DRAPERY
SYSTEM



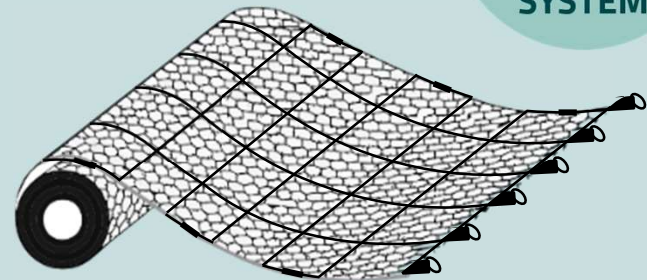
Double Twist Wire Mesh

+



Rope panel

=



MACARMOUR® MEETS EVERY NEEDS

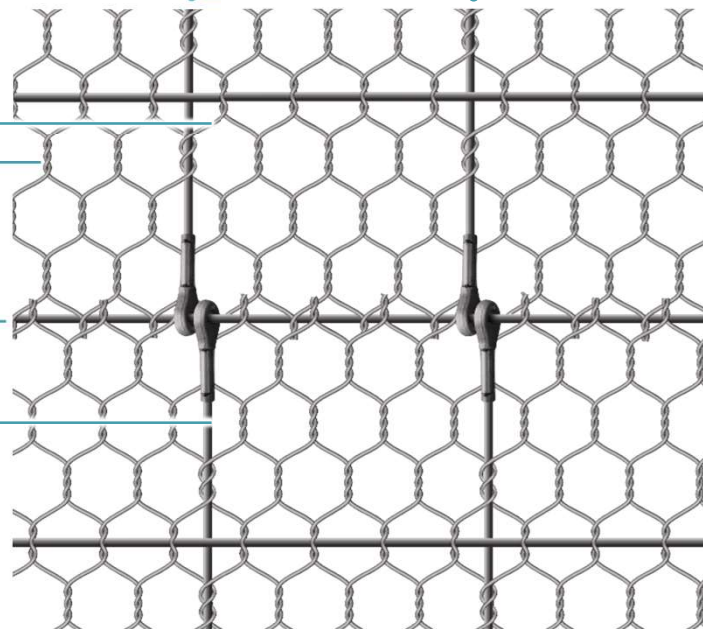
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MacArmour features can be customized to suit all the market needs.

Coating
Galfan - PoliMac

Wire diameter
2.7 mm

Rope diameter
6 mm - 8 mm



**Longitudinal
rope spacing**
30 - 60 cm

**Transversal
rope spacing**
30 - 60 cm



MACARMOUR® A CUSTOMIZED SOLUTION

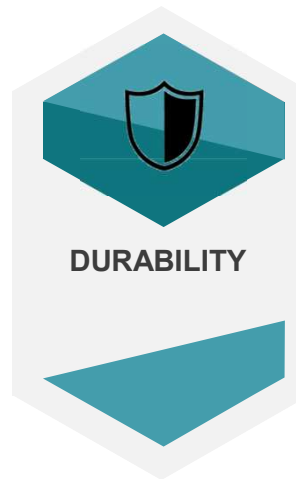
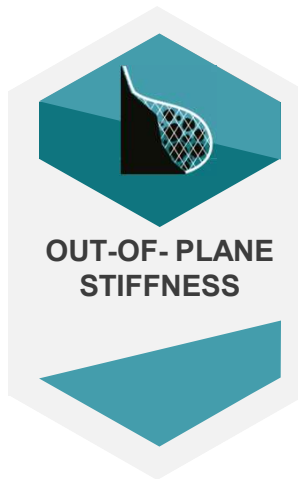
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	 Longitudinal rope spacing	 Transversal rope spacing	 Rope diameter	 Wire diameter	 Coating
Mac Armour 30x30/2.7/6/P	34 cm	31 cm	6 / 8 mm	2,7 / 3,7 mm	PoliMac®
Mac Armour 30x60/2.7/6/P	34 cm	62 cm	6 / 8 mm	2,7 / 3,7 mm	PoliMac®
Mac Armour 60x60/2.7/6/P	68 cm	62 cm	6 / 8 mm	2,7 / 3,7 mm	PoliMac®
Mac Armour 30x30/2.7/8/G	34 cm	31 cm	8 mm	2,7 mm	GalMac®
Mac Armour 30x60/2.7/8/G	34 cm	62 cm	8 mm	2,7 mm	GalMac®
Mac Armour 60x60/2.7/8/G	68 cm	62 cm	8 mm	2,7 mm	GalMac®

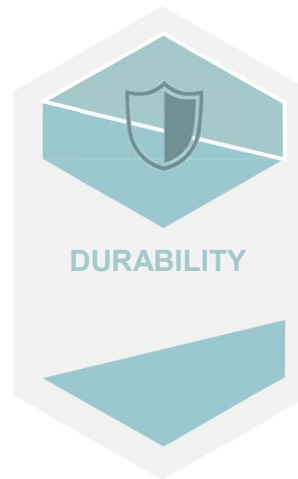
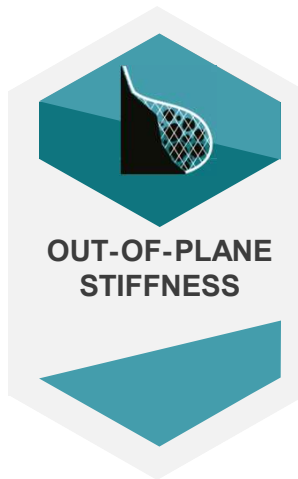
Technical characteristics of the engineering materials must respond to the needs of a changing world.
With a wide MacArmour® portfolio we can respond to all the market needs



MacArmour[®] strengths:



MacArmour[®] strengths:



SERVICEABILITY

MacArmour® is a unique product that has an outstanding tensile strength in the longitudinal and transversal direction and an excellent out-of-plane stiffness (punch resistance).



MacArmour® has been developed to maximise the **serviceability** of the protected **infrastructures**.

High performance along the **longitudinal and transversal directions** are a key factor to enhance the serviceability.

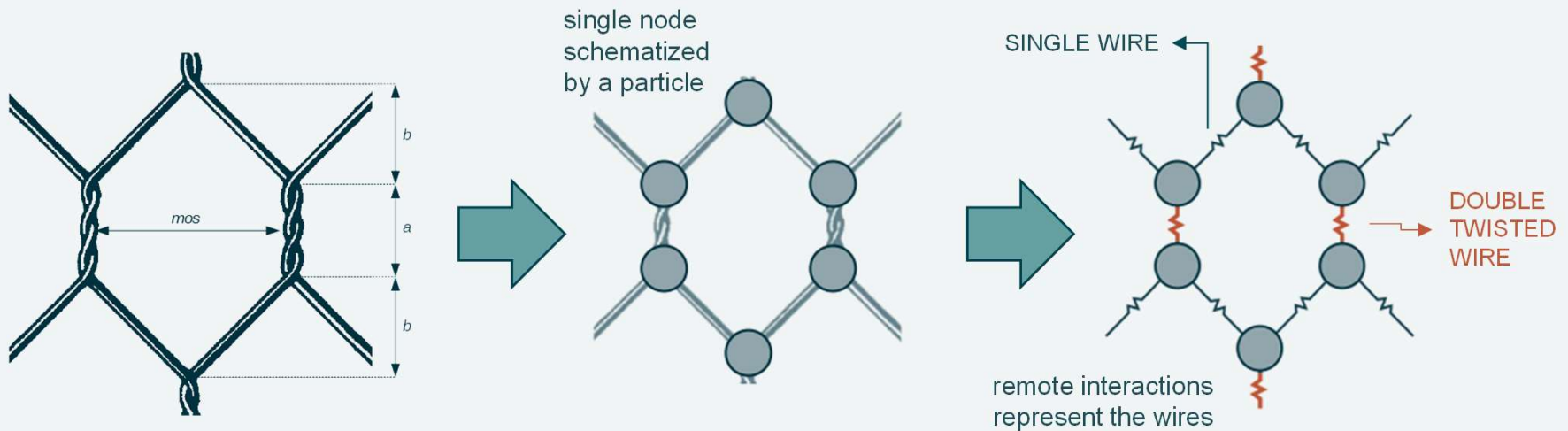
The higher the **stiffness** of the product, the lower the risk of hampering running infrastructure after a rockfall event.



FROM THE WIRE MESH TO THE NUMERICAL MODEL

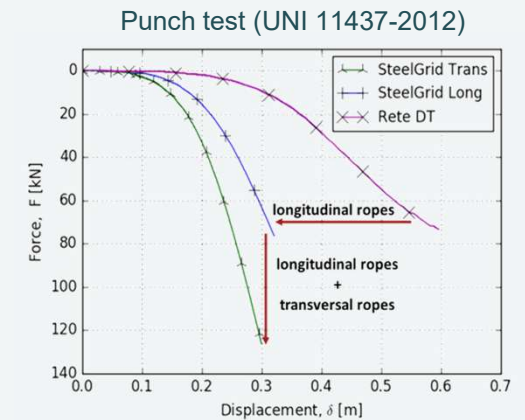
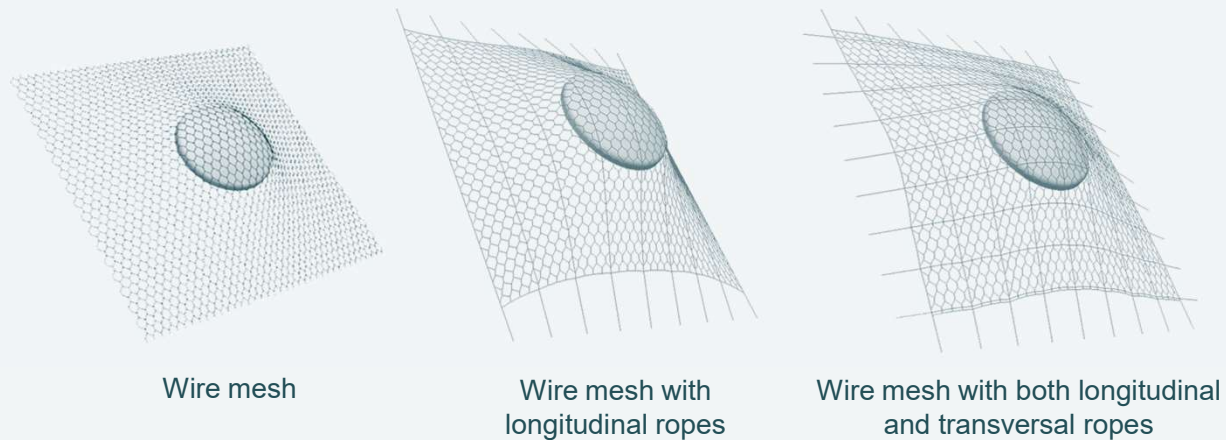
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Numerical and analytical models were used to confirm the need of resistance in a transversal direction, in addition to the one along the slope line.



THE NEED OF HIGHER PERFORMANCE

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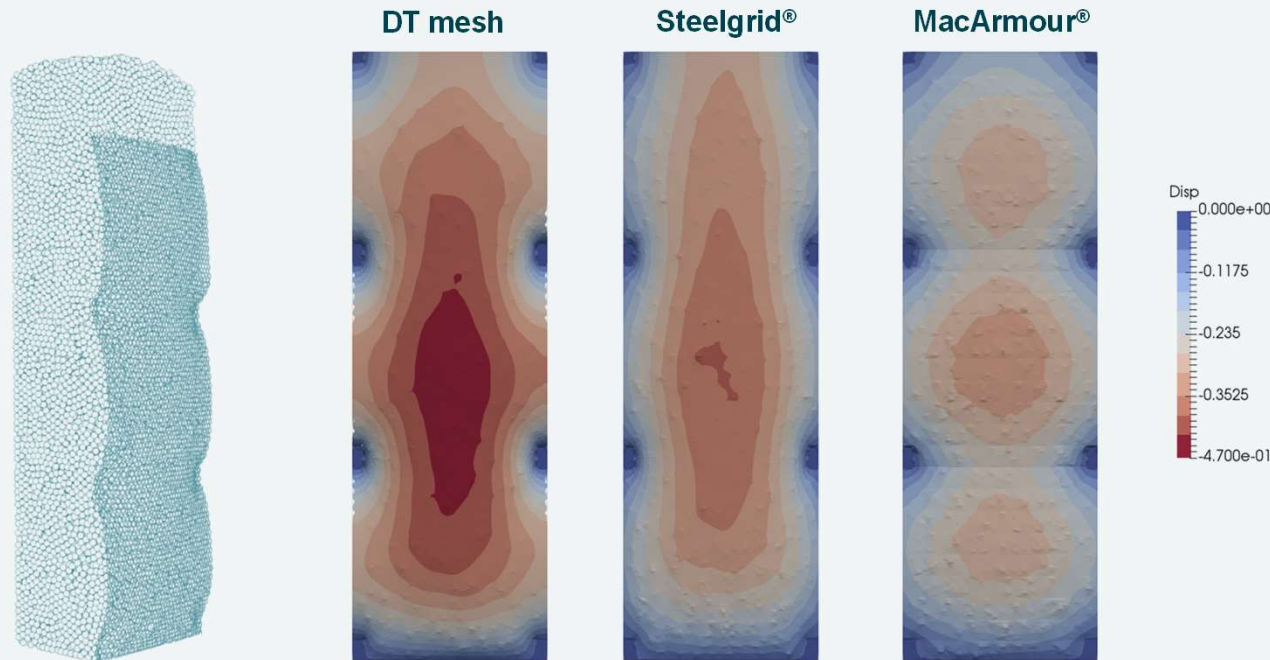


With an accurate model of the punch test, it was possible to properly study the influence of the ropes' insertion into the mesh.



THE NEED OF HIGHER PERFORMANCE

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The three meshes were compared in terms of displacement. **MacArmour®**, with both longitudinal and transversal ropes, turned out to be the stiffest material with the smallest deformation.



EXCELLENT OUT-OF-PLANE STIFFNESS

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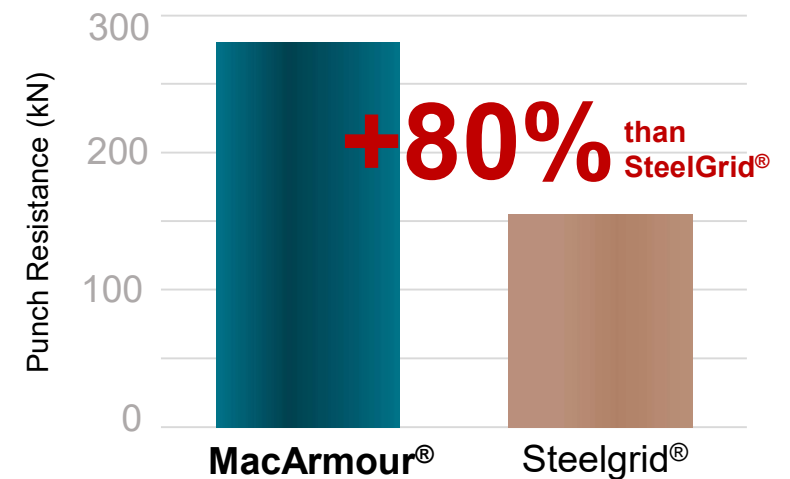
MacArmour® has been punch tested to measure its out-of-plane stiffness.



MacArmour® Tests at IAUV, University of Venice (Italy)

PUNCH TEST

UNI 11437 "Opere di difesa dalla caduta massi - Prove su reti per rivestimento di versanti "

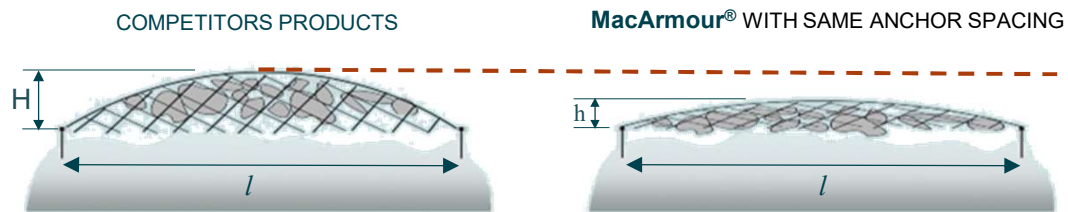


MacArmour® is 80% stiffer than SteelGrid® that is currently considered the stiffest product on the market.



WHY DOES MACARMOUR ENHANCE SERVICEABILITY?

MacArmour® significantly reduces the deformation under load compared to competitors' products. As a result, **SERVICEABILITY** becomes a priority in the design process.

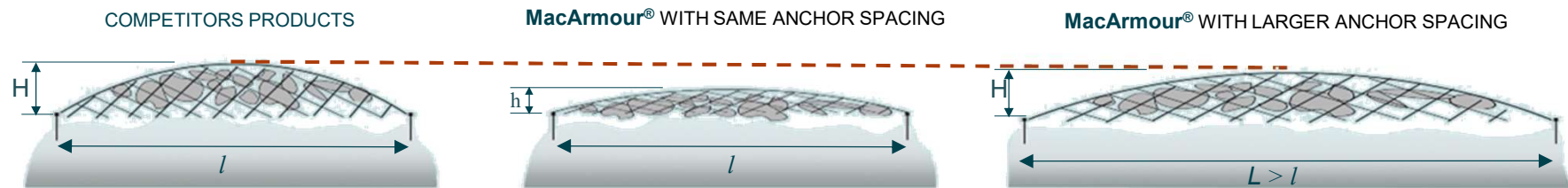


Using the same anchor spacing, the rockfall protection has a lower risk of hampering roads and railways. Generally speaking, **MacArmour®** is the best solution when there is no room for great deformation.



WHY IS MACARMOUR A COST-EFFECTIVE SOLUTION?

Keeping the same level of stiffness, **MacArmour®** allows an increase in anchors spacing.



When there is no need for a smaller deformation, **MacArmour®** is a real **COST-EFFECTIVE** solution.

MACARMOUR® APPLICATIONS

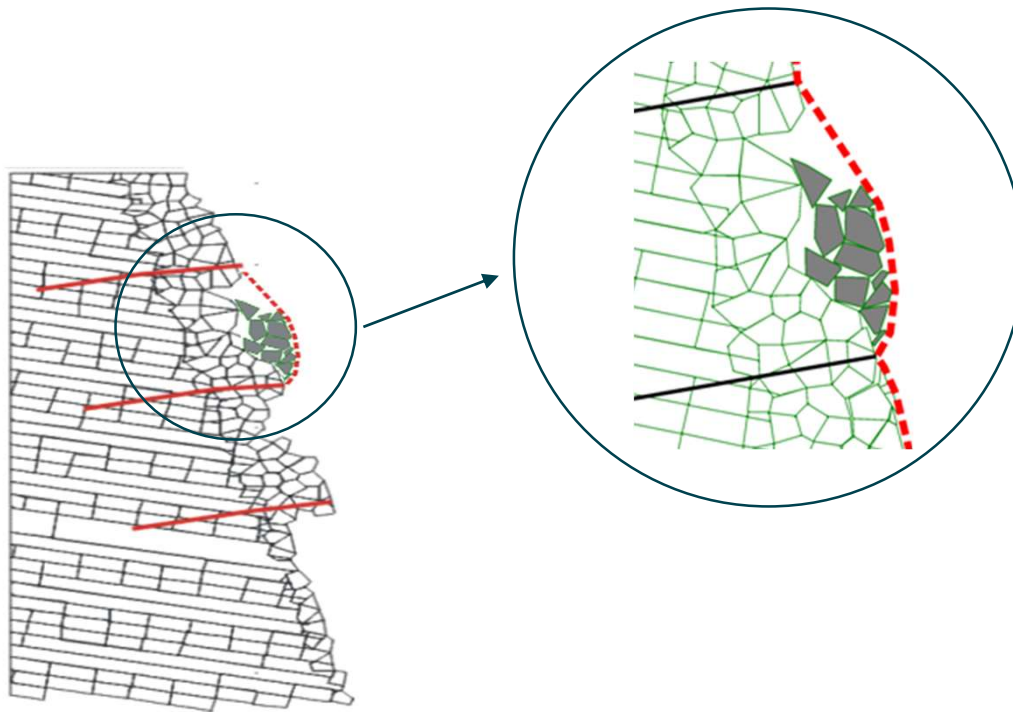
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MacArmour® is especially suited to be deployed in difficult conditions such as narrow corridors or steep slope. If used in combination with nails, MacArmour® can be used as remedial solution to stabilize unstable rock/soils.



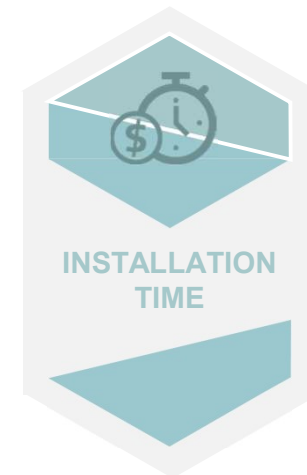
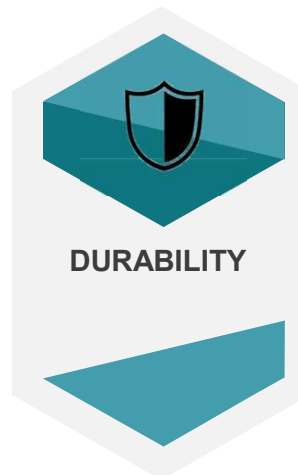
MacArmour®
can be also used
in Hybrid Barrier
Systems





Because of the small deformations allowed, MacArmour® is able to keep the rock or the soil between the nails, avoiding the risk of nail stripping

MacArmour[®] strengths:

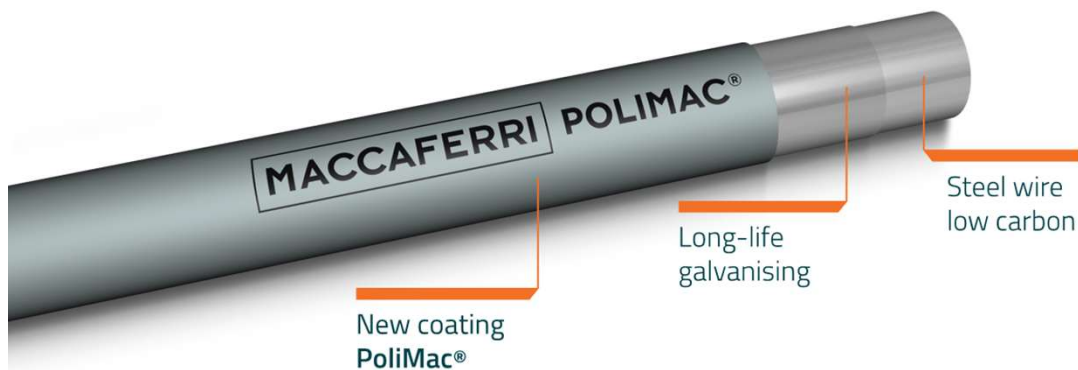


MACARMOUR® STRENGTHS

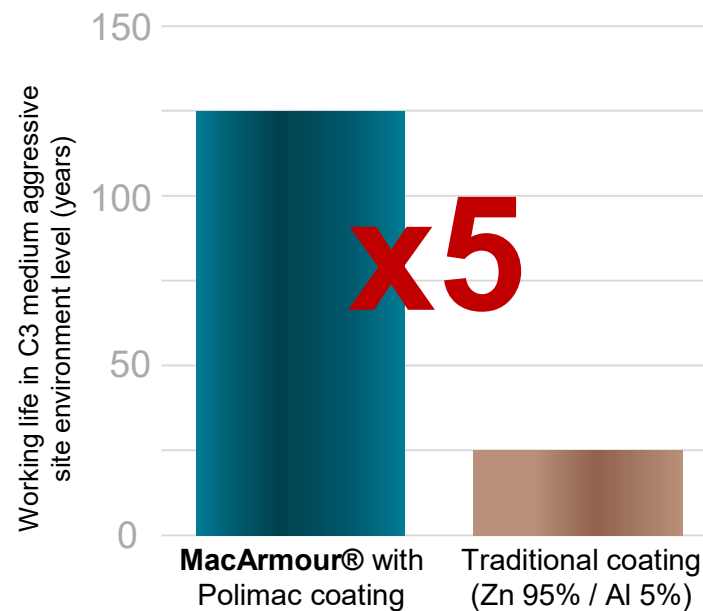
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DURABILITY

PoliMac® coated **MacArmour®** is the unique revolutionary drapery system engineered to face the most aggressive environmental conditions.



Metallic wire shall not be used in very aggressive environment, including coastal areas and polluted zones (EN10223).



MacArmour® with **PoliMac®** coating has a working life **5 times** longer than traditional metallic coating medium aggressive environments.

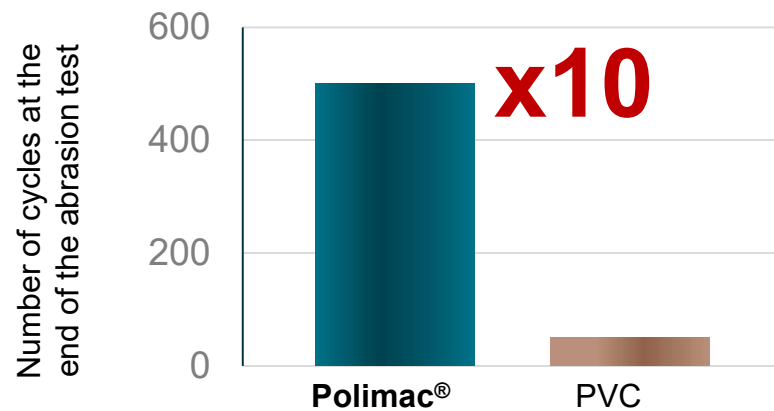


DURABILITY: ABRASION AND HARDNESS RESISTANCE

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MacArmour® coated with **PoliMac®** is harder and more resistant than other systems with traditional polymeric coatings thus preventing damages during product unrolling operations.

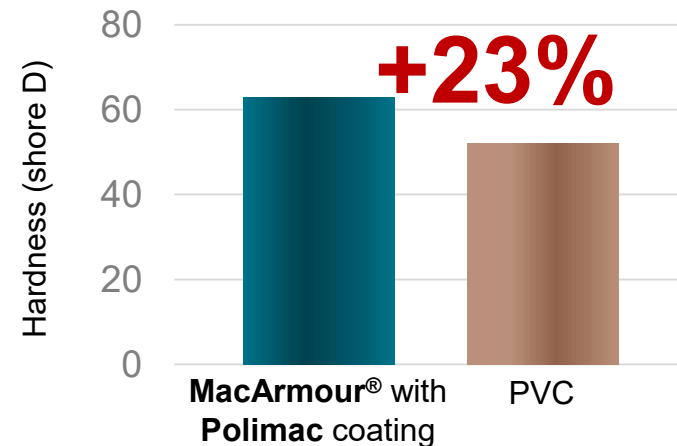
ABRASION TEST ASTM A975-21



Wire Mesh coated with **PoliMac®** offers 10x better abrasion resistance than traditional polymeric coating.

HARDNESS TEST

ASTM D 2240 "Standard Test Method for Rubber Property - Durometer Hardness"



MacArmour® coated with **PoliMac®** is 23% harder than traditional polymeric coating.



DURABILITY: LOW TEMPERATURE BRITTLENESS

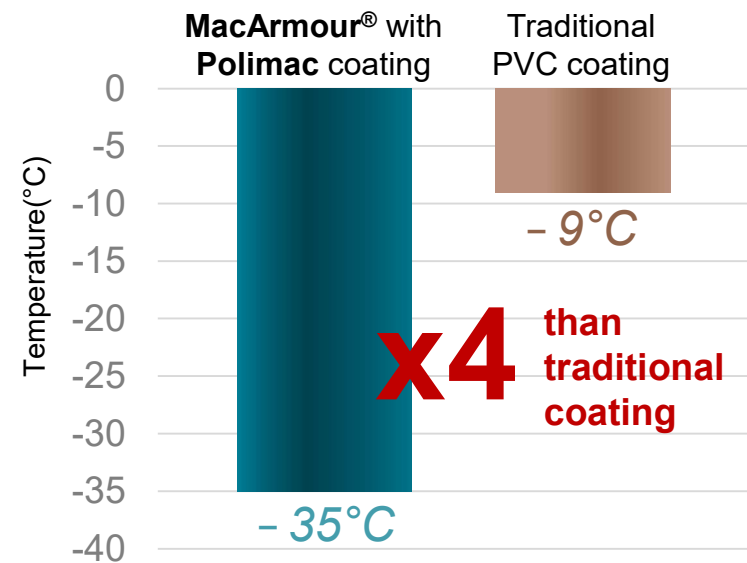
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MacArmour® coated with **PoliMac®** offers an outstanding resistance to low temperature, enhancing the durability and effectiveness of the rockfall protection in very cold climates.



LOW TEMPERATURE BRITTLENESS

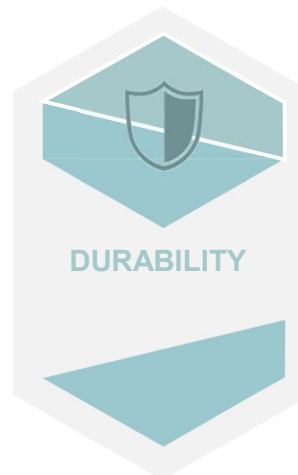
ASTM D 746 "Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact"



PoliMac® protection maintains its properties right down to -35°C.



MacArmour[®] strengths:



REDUCTION OF THE INSTALLATION TIME

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INSTALLATION TIME

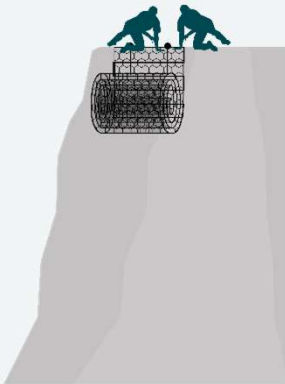
MacArmour® reduces the **installation time** and the **risks** associated with on-site activities.

UP TO **50%** FASTER
THAN ANY OTHER EXISTING SYSTEM

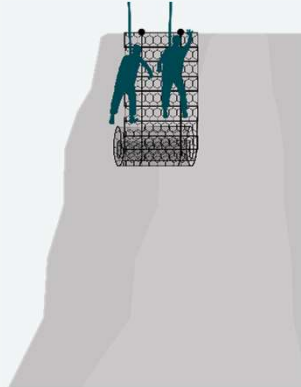


Ensure **rockfall protection** in maximum 4 easy steps:

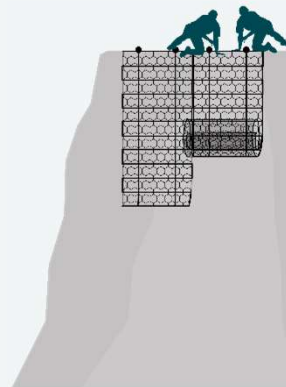
1 Fix of the first roll



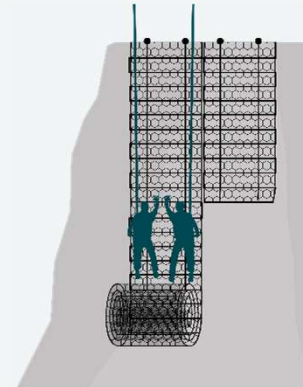
2 Unroll the MacArmour® system down the cliff face



3 Unroll subsequent MacArmour® rolls



4 Install MacArmour® rolls with ease thanks to new connections

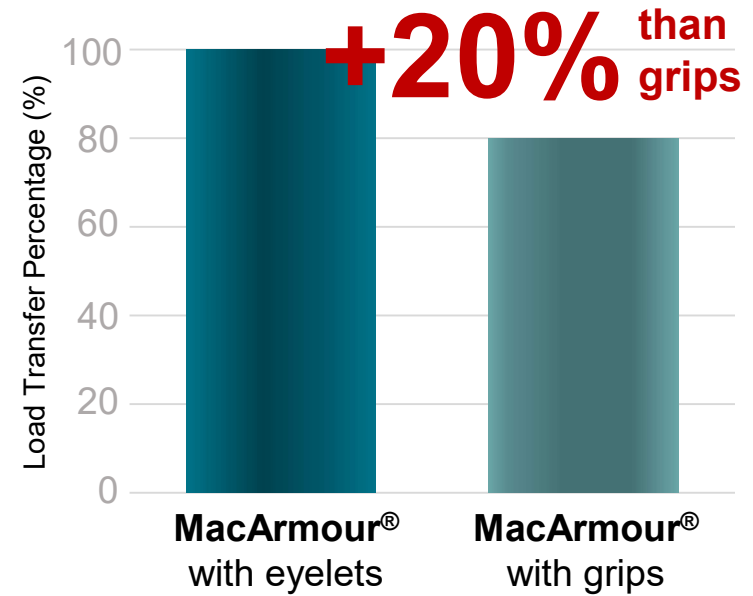
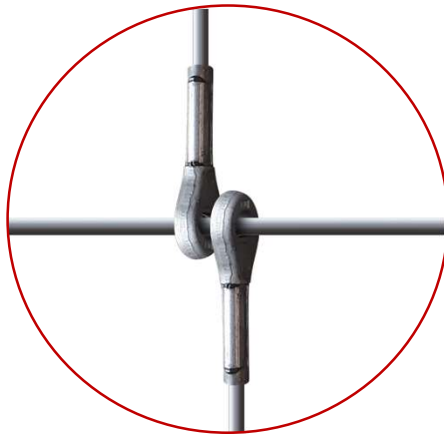
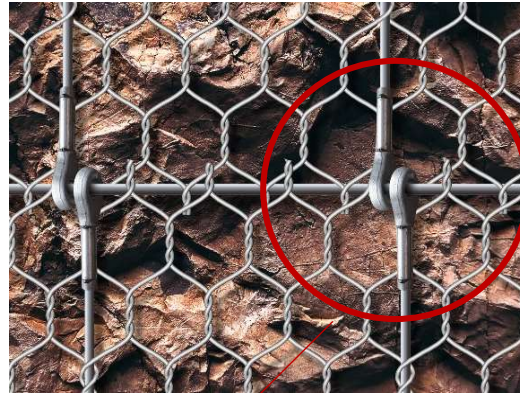


A FAST AND SAFE CONNECTION SYSTEM

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What's new?

MacArmour® features a new connection system between rolls which enables to speed up the installation.



Both solutions guarantee at least a load transfer of **80%** to the ropes (MBL), such that to have a correct load transfer between rolls.



A STORY OF EFFECTIVENESS

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MacArmour® is tested and certified according to international standards, offering the highest performance among market equivalent solutions.



MacArmour® is a 2-in-1 product designed to enable a faster installation than equivalent products on the market, reducing up to 50% the time of installation.



MacArmour® coated with PoliMac® has been specifically conceived to withstand extreme conditions (e.g. abrasion, impacts, low temperatures) in order to reduce the need of maintenance.



The **Total Cost of Ownership** (TCO) is an increasingly common design approach that considers the total cost of designing, constructing, operating, maintaining a project throughout its life.



THE KEY BENEFITS

MACCAFERRI



Project Owners will benefit from a safer and more durable solution than other products on the market. They can choose what to prioritize between a safer approach allowing small deformations and a cost-effective solution increasing the anchors spacing. This will result in a reduction of the total cost of ownership of the project.



Designers can optimize the design of the project by choosing between different options of **MacArmour®**: increasing the spacing between anchors, choosing for the most durable coating or modifying the structural safety factors with the help of our proprietary software.



Contractors have the advantage to install a 2-in-1 product that minimizes the installation time and consequently decreases the time spent by workers up the rock face, hence reducing jobsite risks.

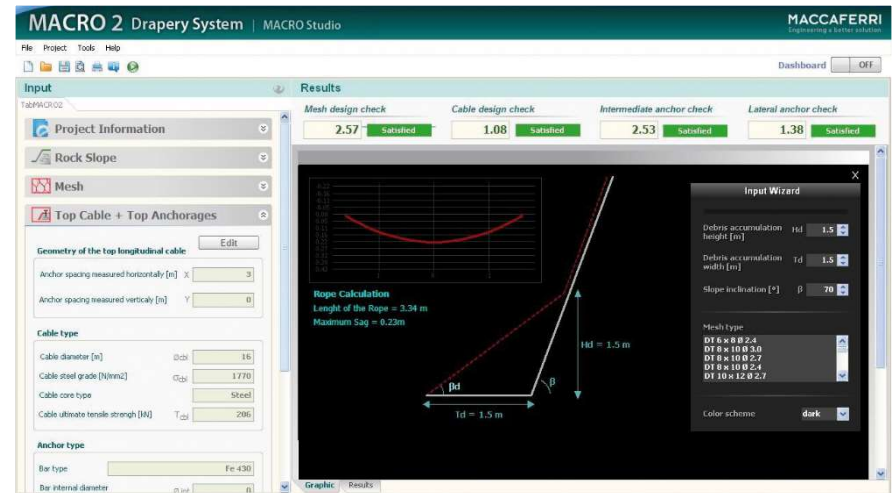
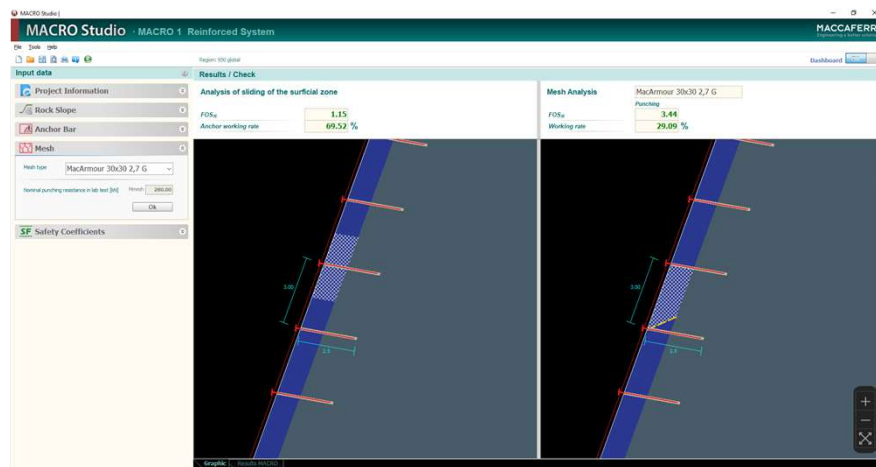


DESIGNING THE MESH SYSTEMS

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Maccaferri solutions are designed using state-of-the-art modelling software and techniques.

MACRO 1 | SECURED DRAPERY DESIGN



SIMPLE DRAPERY DESIGN | MACRO 2

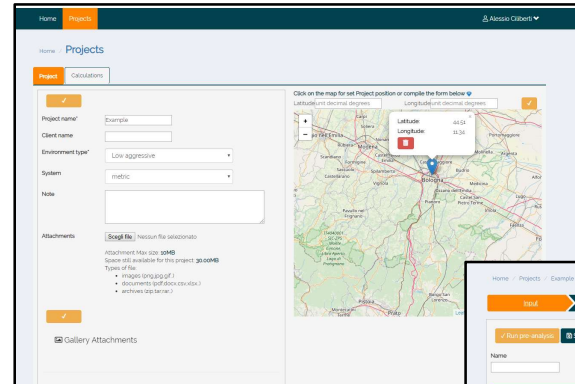
MACRO Studio includes a wide combination of performance data from full-scale testing and makes the design of your drapery system easier.



DESIGNING THE MESH SYSTEMS

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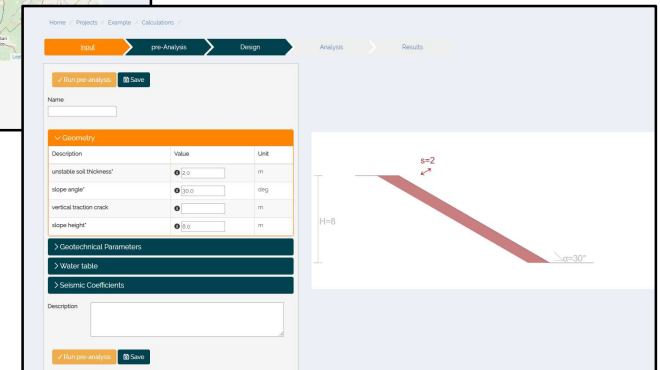
Conceived together with Politecnico di Milano, **MAC S-DESIGN** is the new revolutionary software for Soil Nail Facing design.



edesign.maccaferri.com



Mac S-Design
MAKE YOUR SLOPE SAFER



MAC S-DESIGN present a simple design approach for secured drapery system, combining the field experience of geologists and engineers on one hand, and the results of full-scale drapery field tests on the other hand.



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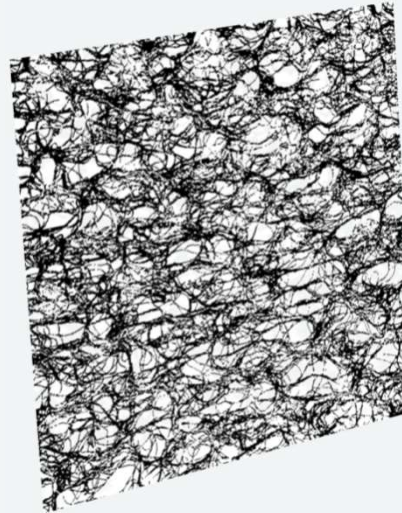


ONE STEP FURTHER FOR EROSION CONTROL

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MacArmour®

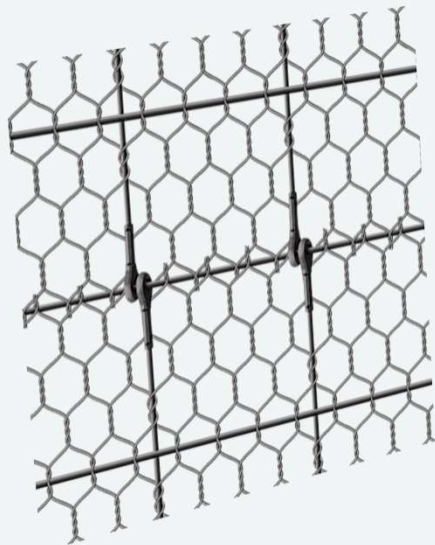


MacMat®

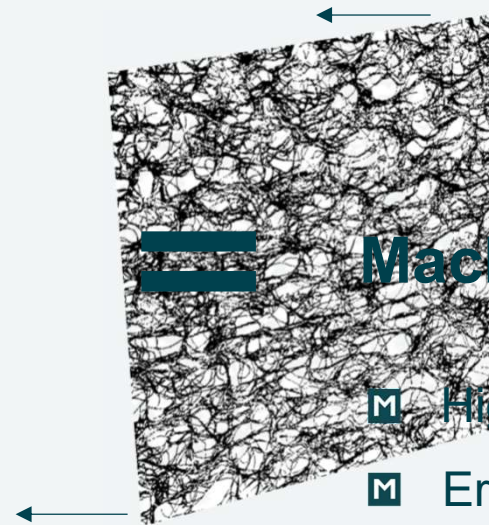


ONE STEP FURTHER FOR EROSION CONTROL

MACCAFERRI



MacArmour®



MacMat®



MacMat Armour™

-  High resistance facing
-  Erosion control



LIVE Q&A

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MacArmour[®]

THE SAFEST AND MOST EFFECTIVE DRAPERY SYSTEM