GENERAL CATALOGUE

RUREGOLD

INNOVATION & SAFETY FOR BUILDING

RUREGOLD

innovation and **safety** for Construction and infrastructure.

Ruregold is a leading brand in the **structural strengthening** sector, with extensive knowledge of the building refurbishment and infrastructure maintenance market, thanks to know-how acquired in over 20 years of experience.
At Ruregold, our focus is on developing new ways of strengthening concrete and masonry structures through the use of **high performance composite materials**, **in particular the FRCM range of products**, which are the first in the world to be awarded the **international validation certification**, demonstrating, through accredited references, their seismic qualities and **increased safety** when used for structural strengthening applications.
Ruregold's wealth of know-how, acquired during many years of involvement in high engineering content projects in the building refurbishment sector, enables us to offer an extensive range of technologies: in particular the new **CRM reinforced plaster** system with G-MESH 400, 490 and 1000 meshes; **MX-PVA Fibre Reinforced Mortar** for strengthening masonry in the absence of distributed reinforcement; **Safenet, Stucanet, Armanet solutions** for securing and repairing slabs; and HPFRC (High-Performance Fibre Reinforced) **Concretes**.
This means we are able to provide engineers intending to adopt Ruregold's innovative technological solutions with all the support they may need.

As of the 1st January 2024 **Laterlite** trades, both in Italy and worldwide, as **a single Company organised into 6 main product lines called: LaterLite Expanded Clay, LaterMix, CentroStorico, GrasCalce, RureGold and PreMix**. The various product lines, which are all leaders in their respective market segments, adopt a common innovation, growth and sustainable development policy, guarantees an increasingly complete and integrated range of products for the construction and infrastructure sectors.
In this way, **Laterlite** demonstrates its willingness to expand and strengthen its offer of technical solutions for the building industry, confirming its vocation as a **partner in sustainable construction and renovation projects**.

RUREGOLD

Laterlite
Your Building Solutions

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Our specific know-how and experience, acquired in the structural and seismic strengthening sectors, permits **Ruregold** to offer **integrated, hi-tech solutions** that, together with the support of the **Laterlite technical department**, represent the ideal response to all the most important structural strengthening and design issues.

Structural strengthening: our 4 technologies

FRCM with PBO/Carbon mesh and technical mortars.

FRP with carbon fabrics/laminates and organic matrix.

CRM reinforced plaster with impregnated fibreglass meshes and structural mortars.

HPFRC steel and synthetic fibre-reinforced concretes.

The **structural strengthening** solutions

Masonry structures

stone, tufa and brick

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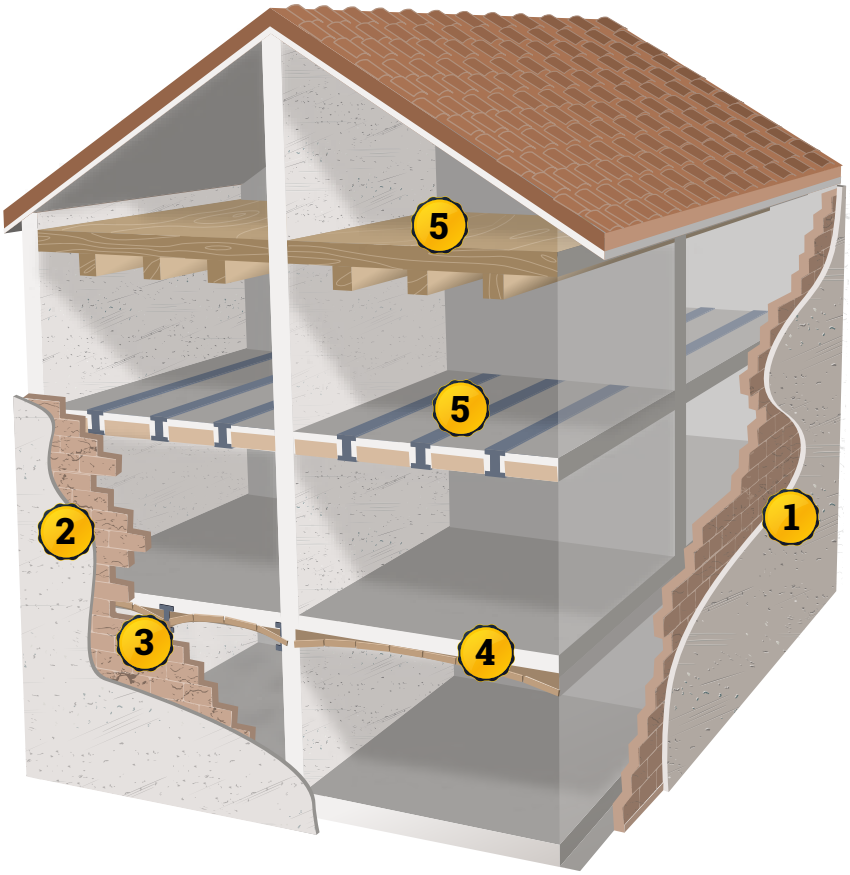

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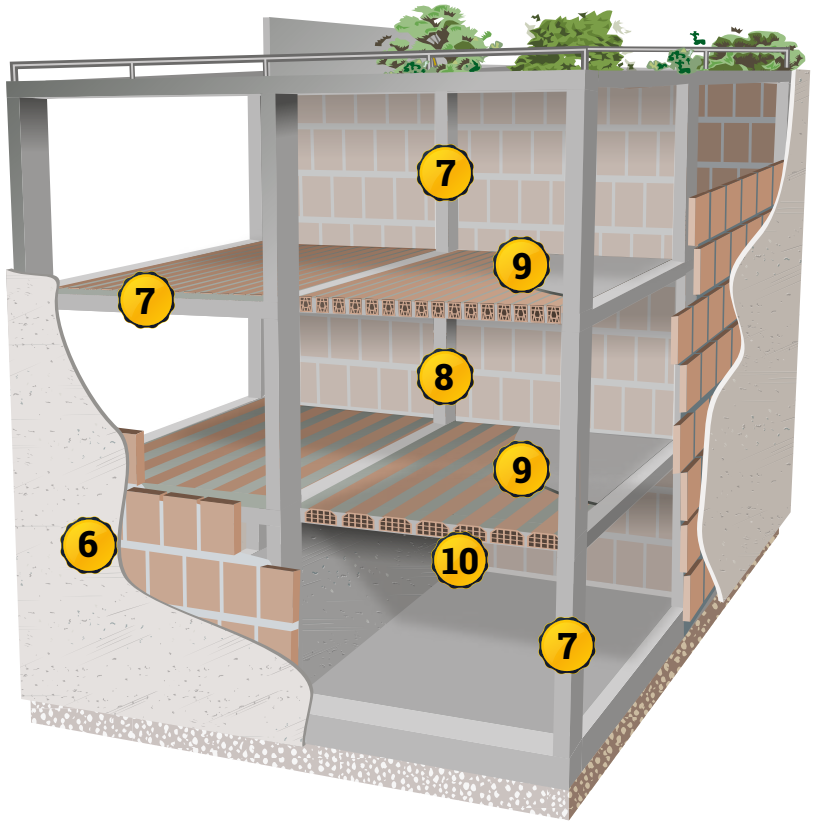


Structural strengthening

FRCM PBO-BASED SYSTEM
FRCM CARBON-BASED SYSTEM

Why do we use **structural strengthening**?

During the course of their service lives, buildings may be subject to structural deterioration, due to the effect of both static and dynamic actions. Such issues may render buildings unable to perform the functions they were originally designed for.

The principal causes of such deterioration are as follows:

- **material degradation** to the point where the existing structure is no longer able to bear the loads it was designed to support, due to the loss mechanical and performance characteristics;
- **variations to the intended use** inside the existing structure, such that the resulting load paths exert greater stress than those the structure was originally designed to bear;
- **the need to intervene in the event of insufficient construction details** regarding the structural elements of the building where the work is to be carried out, due to increased load conditions, caused by, for example, seismic activity, changes in the regulatory framework with respect to the previous design conditions.

Increases in **static type loads** give rise to critical conditions in individual structural elements that are directly affected by such factors (deflected beams, combined axial and flexural forces acting on columns), whereas **horizontal type loads**, such as **seismic activity**, also affect those parts of the building where joints between individual structural elements are present (beam-column joints, slab-wall), in the case of buildings requiring restoration and strengthening actions.
The aims of certain types of structural strengthening operations may be summarised as follows:

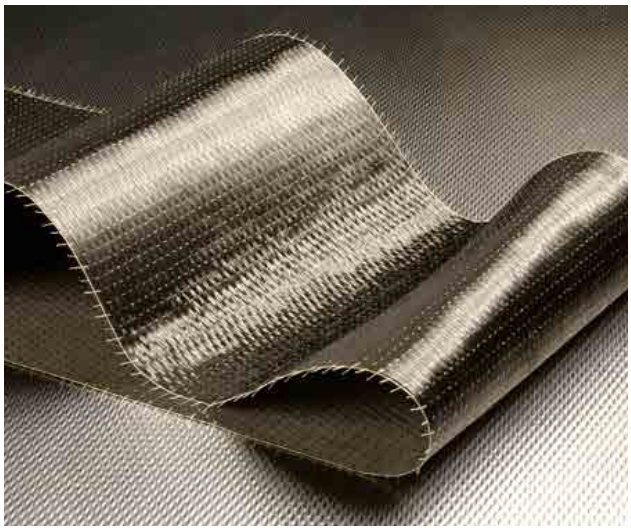
- Increasing the **resistance** of structural elements;
- Increasing the **ductility** of the structure at both local and global level.

One of the most important aspects when using certain structural strengthening systems lies in their capacity to deliver an **optimal weight to resistance ratio** in addition to the anisotropic properties of the reinforcement. Thanks to these properties, it is possible to orientate certain structural materials, such as composites, in the desired direction, intervening "surgically" (even locally, if necessary) based on the design principles inherited from traditional construction science and techniques.

Traditional Reinforcement

Traditional reinforcement applications typically entail **replacing or restoring the degraded materials used in the structures (blocks, mortars, concrete, reinforcements) with the aim of reconstructing the original section, restoring continuity**, and eventually increasing the sections to ensure greater load bearing capacity and safety.
In the case of applications designed to improve structural performance or counteract forces detrimental to the structural scheme, in the past wood and iron elements such as chains, rods, keys and hoops were inserted into the masonry. Recent times have also seen **applications to confine reinforced concrete columns**, as well as the **laying of heavy steel plates (lower side) of beams and slabs glued with epoxy resins** (beton plaqué technique).
These types of applications, which are difficult to perform and interfere significantly with the static state and aesthetics of buildings, also **tend not to maintain the desired level of reinforcement over time**.

FRP strengthening with epoxy resins

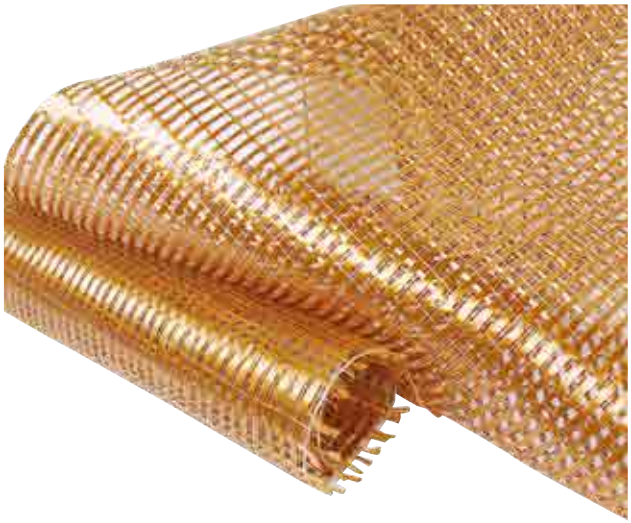


FRP strengthening systems are based on the **union of long fibres having high mechanical strength and a matrix, which acts as an adhesive** between the fibres and the substrate, so that stress is transferred from the structure to the fibres. **The fibres used for structural strengthening, such as carbon, have high Modulus of elasticity and high tensile strength.**

Thanks to the exceptional mechanical properties of the structural fibres, this technology makes it possible to carry out strengthening work using an extremely versatile solution, which combines practicality, limited space requirement, speed of execution, and cost-effectiveness with respect to traditional techniques.

Compared to traditional techniques, the lightness of FRP systems means they are well suited for use on particularly weak or damaged structures, respecting the architecture of the building and the functionality of the structural elements, while not significantly increasing the loads exerted on the structure.
Lastly, the ease of installation and their adaptability to the various shapes of structural elements mean this material is also widely used in the construction sector.

FRCM strengthening with inorganic matrix



FRCM *(Fabric Reinforced Cementitious Matrix)* structural strengthening systems are based on the union of **long, high-performance fibres and a stabilized inorganic matrix, which acts as an adhesive,** replacing the epoxy resins of traditional FRP systems.

The FRCM system overcomes the various limits regarding the safety, reliability, and durability of the mechanical performance of FRP systems, **since the stabilized matrix is more compatible with the substrate than epoxy resins.** The matrix also provides effective adhesion both for the structural fibres of the mesh and the materials that constitute the base screed, thus ensuring high reliability of the structural strengthening.

Inorganic matrix strengthening systems

The new solution in structural strengthening: composite FRCM materials

FRCM ***(Fabric Reinforced Cementitious Matrix)*** structural strengthening systems consist of the union a **high performance long fibre** and a stabilized inorganic matrix **used as an adhesive**, replacing the epoxy resins of traditional FRP systems.

Ruregold has introduced a global innovation in the field of structural strengthening by **patenting several FRCM strengthening systems**, each of which has been specifically developed to meet the needs of structural strengthening and seismic retrofitting applications on various existing structures, such as **reinforced concrete and masonry structures**.

Ruregold strengthening systems use two different types of fibres, carbon and PBO (Polyparaphenylene Benzobis Oxazole), both synthetic materials with **high mechanical performance properties able to absorb the stresses generated by overloads and exceptional events, such as earthquakes.** Compared to carbon fibres, PBO fibres have 20% greater tensile strength and 15% greater modulus of elasticity.

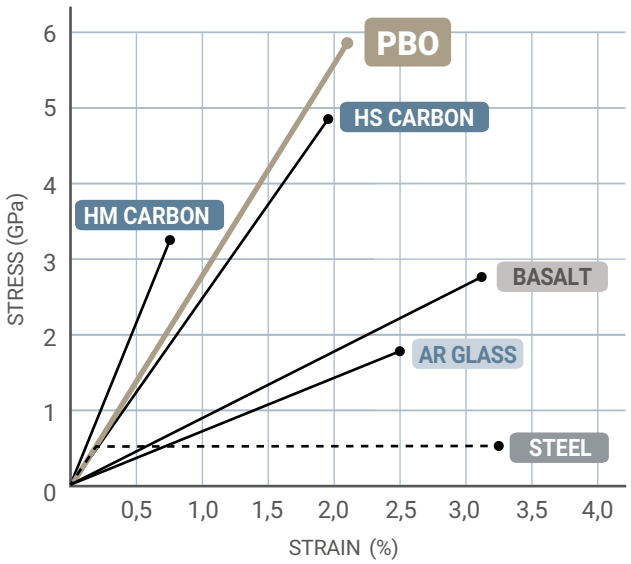
The special mortars are formulated to match each type of mesh reinforcement system, thus **ensuring effective bonding** for both the structural fibres of the mesh and to materials constituting the substrate, guarantees the high reliability of the structural strengthening.

Ruregold composite strengthening systems use **woven structural fibres with a specific geometry to guarantee greater versatility of use** or, in other words, an increased capacity to handle stresses, even in the most complex load situations, such as combined axial and flexural forces of columns, shear strength of beam-columns joints, bending and shear of beams, and actions inside and outside the plane.

LONG FIBRE WITH
HIGH MODULUS OF ELASTICITY

FRCM

INORGANIC MATRIX



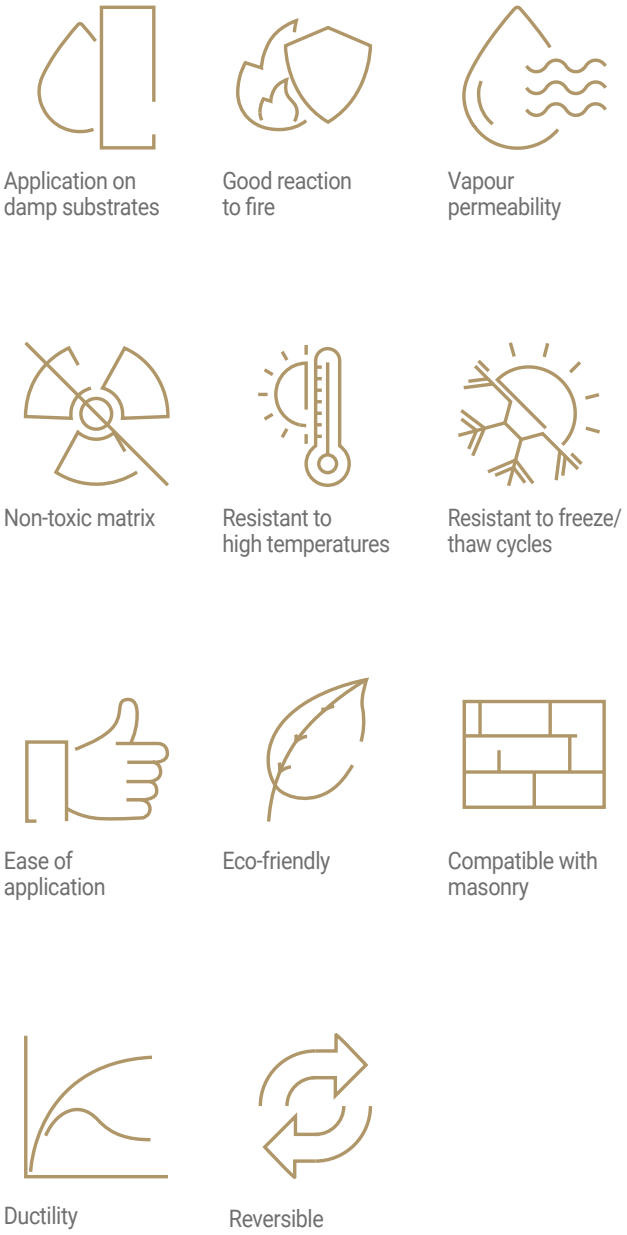
HM CARBON = HIGH MODULUS CARBON
HS CARBON = HIGH STRENGTH CARBON
AR = ALKALI RESISTANT

The advantages of the inorganic matrix

Using an inorganic matrix in externally bonded structural strengthening systems means **overcoming the limits related to safety, reliability, and durability attributable to the use of epoxy resins in traditional FRP systems.**

FRCM strengthening systems guarantee:

- **applicability on damp substrates**: the hydraulic binder is not affected by the presence of moisture;
- **good reaction to fire**: in direct contact with fire the reaction of the matrix is to that of the support, i.e., it is not combustible, emits very little smoke, and does not release incandescent particles;
- **good resistance to high temperatures:** the inorganic binders maintain their mechanical characteristics and adhesion to the substrate;
- **high resistance to freeze-thaw cycles;**
- **water vapour permeability:** the matrix prevents condensation phenomena that can entrap humidity and cause damage to wall decorations;
- **non-toxicity:** the matrix is not harmful for the health of operators or for the environment, so it can be applied without the use of special protections and can be disposed of without particular precautions;
- **ease of installation:** the premixed matrix is prepared by mixing with water and does not require the use of specialized personnel for installation;
- **high system reliability** guaranteed by the pseudo-ductile behaviour with respect to organic matrices;
- **durability even with high ambient humidity:** the capacity of the inorganic matrix to adhere to the support is not altered at high RH;
- **wide workability temperature range:** there are no significant variations in workability, setting and hardening times between 41 and 104 °F (+5 and +35°C);
- **reversibility:** thanks to the nature of the organic matrix adhesion mechanism, it is possible to remove the strengthening at a later date if necessary;
- **speed of application:** thanks to the "layer on layer" application method.

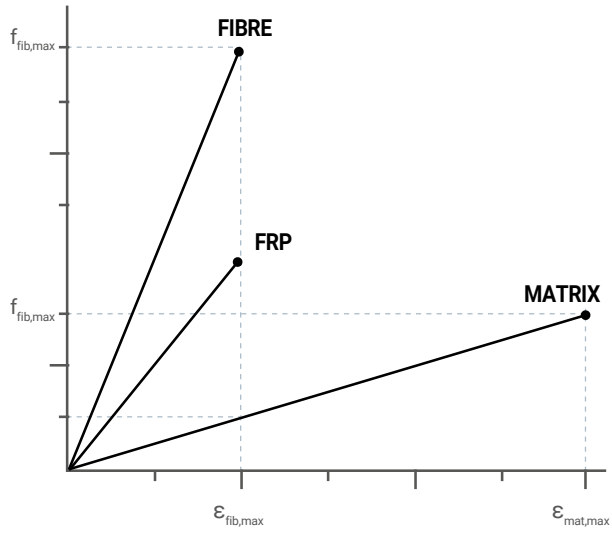


FRCM features

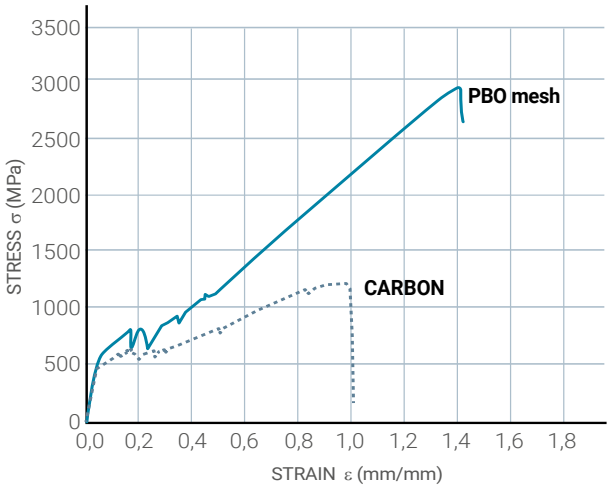
Ductile behaviour of FRCM systems

The uniaxial tensile stress-strain relationship of FRCM (Fibre Reinforced Cementitious Matrix) systems differs from that of FRP (Fibre Reinforced Polymers) systems with organic matrices.
In fact, in terms of behaviour, FRP systems occupy an intermediate position, between organic matrices - typically epoxy resins - and strengthening fibres, with linear elastic stress-strain relationship characteristics.

Thanks to their **innovative design** with respect to the more established FRP systems, the stress-strain relationship of **FRCM systems** is characterised by an initial phase, during which the principal role is played by the contribution of the inorganic matrix/mortar plays, this is followed by a cracking phase within the matrix itself and, lastly, the residual contribution of the dry mesh.



This behaviour is evidence of the **pseudo-ductility of FRCM systems with respect to FRP systems,** which translates to an advantage in terms of the local ductility of strengthening material when applied to the structural element on which the work is to be carried out. This local ductility also has positive effects when used to determine global system ductility, an approach applied to all the structural elements that need to dissipate energy and possess the capacity to deform when subjected to high load conditions, for example, seismic activity.



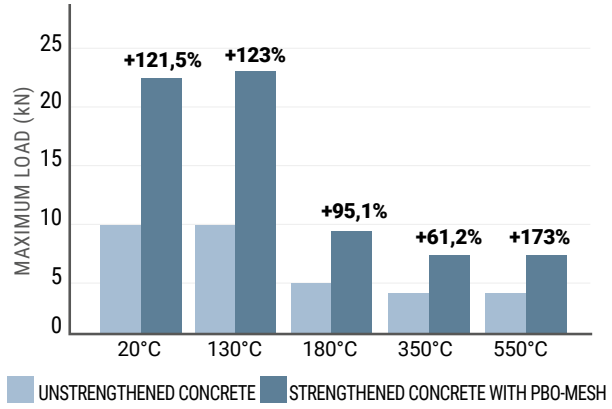
Resistance to high temperatures

In order to compare the deterioration of the mechanical performance of concrete elements (reinforced and unreinforced) in response to temperature increases, flexural strength was selected over compressive strength as the significant parameter, since it is more sensitive to deterioration cause by heat.
As can be seen in the graph on the right, as the temperature rises and, in particular, once it exceeds 130°, there is a noticeable deterioration in mechanical performance.

While they are also affected temperature increases, FRCM strengthening systems retain their efficacy in terms of the increase in flexural strength with respect to unstrengthened concrete at the same temperature.

With respect to ambient temperature, the strengthening system is able to counter the phenomenon of detachment between aggregates and cement paste, which is the cause of loss of strength of unstrengthened concrete.

FLEXURAL STRENGTH VARIATION ACCORDING TO TEMPERATURE



Glass transition temperature

As temperature rise, epoxy resins begin to transition from a solid to a visco-elastic state, resulting in deterioration of their adhesive properties and, hence, the mechanical performance of the FRP system.
To calculate the environmental temperature at which the strenghtening is efficacious, it is necessary refering to the ACI 440.2R-17.

Reaction to fire

When subjected to the reaction to fire test, in accordance with the applicable European standard, EN 13501-1, Ruregold's FRCM system **was certified as at least Class B-s1,d0.** This means that it does not cause toxic fumes and does not form incandescent drops that are potentially very hazardous for people during a fire.

All FRP systems, on the other hand, have been certified in class "E", because they use an organic adhesive that contributes to the generation and/or propagation of fire and therefore require appropriate protection.

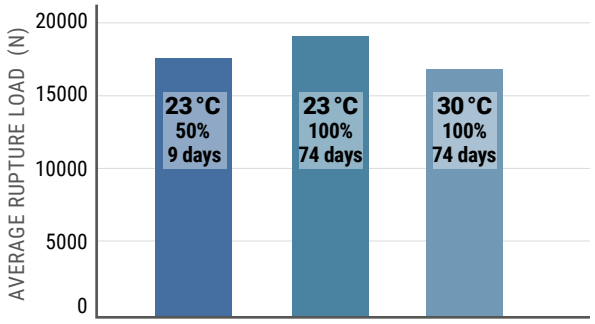
Durability and humidity

Ruregold's FRCM (Fabric Reinforced Cementitious Matrix) strengthening systems maintain the specified performance properties independently of the Relative Humidity (RH) and the environmental temperature, in contrast to FRP systems, which only guarantee such properties under standard thermo-hygrometric conditions (20°C and 50% RH.)

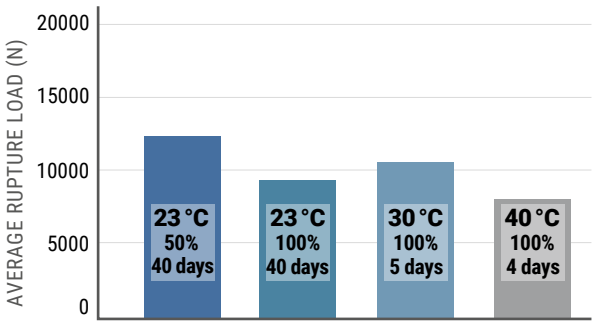
The results of a durability test carried out at the ITC-CNR Laboratory of S. Giuliano Milanese (IT) show how much environmental conditions influence the mechanical performances of FRP structural strengthening systems, as can be seen from the graphs on the right. Results similar to the ones obtained at the ITC-CNR Laboratory were also obtained at MIT in Boston (USA) and the University of Edinburgh (UK).

The experimentation has demonstrated that, in the case of FRP systems, the presence of moisture on the surface of the structure modifies the type of break from "cohesive", i.e. within the support, to "adhesive", i.e. At the interface between the support and the strengthening. It has also been observed that prolonged exposure to moisture causes progressive deterioration of mechanical shear resistance and flexural strength, which tends to accelerate as the temperature increases in the interval between 73-104°F (23-40°C).

FLEXURAL STRENGTH OF FRCM AS A FUNCTION OF TEMPERATURE, RH, AND DAYS OF EXPOSURE



FLEXURAL STRENGTH OF FRP AS A FUNCTION OF TEMPERATURE, RH, AND DAYS OF EXPOSURE



Regulatory framework regarding the use of strengthening systems

The use of **composite materials** for strengthening existing structures represents an **innovative technique**. For this reason, such materials are subject to **qualification, certification and specific design regulations** for each type of product.

FRCM – qualification and certification

It is necessary to distinguish between the **Guidelines** adopted in the **European Union** for qualifying **FRCM systems**, and those used in the **USA**.
Within the **European Union**, when qualifying an FRCM system, with the purpose of obtaining the "**European Technical Assessment**" (**ETA**) and, hence, **CE marking**, manufacturers are required to adhere to the **(European Assessment Document) EAD 340275-00-0104 "Externally-bonded composite systems with inorganic matrix for strengthening of concrete and masonry structures" guidelines**.
CE marking was obtained with corresponding **EAD 340275-00-0104** according to **ETA no. 23/0770**.

The equivalent reference document in the **USA** is **AC 434 "Acceptance criteria for masonry and concrete strengthening using fabric-reinforced cementitious matrix (FRCM) and steel reinforced grout (SRG) composite systems"**, issued by the ICC Evaluation Service (ICC-ES), which permits manufacturers to obtain the **Evaluation Service Report (ESR)**.
Ruregold has been awarded the Evaluation Service Report (**ESR No.3265**) for several of its PBO and Carbon Fibre FRCM systems by ICC - ES (**International Code Council - Evaluation Report**) in accordance with the USA AC 434 (Acceptance criteria for masonry and concrete strengthening using fabric - reinforced cementitious matrix FRCM composite systems) Guidelines for the qualification of inorganic matrix fibre-reinforced FRCM composites.
In addition to material **qualification testing**, the standard **AC 434** also stipulates **tests for determining structural performance** and, in particular, tests on structural elements strengthened using FRCM materials:
- combined axial and flexural force and shear tests on R.C. beams;
- tests on R.C. columns;
- combined axial and flexural force tests on load-bearing walls (piers);
- shear tests on load-bearing walls (piers).

Ruregold FRCM systems have also completed the **qualification process within the context of the Italian regulatory framework**, with reference to the **Identification, qualification and acceptance of fibre-reinforced inorganic matrix composites guidelines** drawn up by the **CSLP (Italian Ministry of Public Works) in December 2018 and issued in January 2019**, obtaining the **C.V.T. (Technical Evaluation Certificate)** for the related structural strengthening systems (**No. 285 - 28/06/2023**).
FRCM - design

The is no **international European reference standard** regulating the design of strengthening solutions using FRCM systems.
A useful reference, which is recognised at **European level**, is the **Italian document DT 215/2018 "Guide for the Design and Construction of Externally Bonded Fibre-Reinforced Inorganic Matrix Systems for Strengthening Existing Structures"**, drawn up by the Italian National Research Council; the document is **also available in English and Spanish**.
In the **USA**, the following internationally recognised reference standards apply **ACI 549.4R "Guide to Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix and Steel-Reinforced Grout Systems for Repair and Strengthening of Concrete Structures" and ACI 549.6R "Guide to Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix (FRCM) and Steel-Reinforced Grout (SRG) Systems for Repair and Strengthening of Masonry Structures"**. There are a **number of similarities** between the design approaches adopted in the USA and Italy, notably with regard to the calculation of solutions for masonry structures, although the two philosophies differ with regard to specifics.

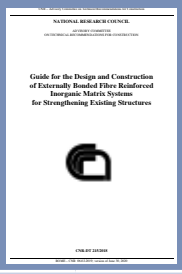
FRP

In the case of FRP systems, the reference adopted in the USA for the qualification process is **AC 125 "Acceptance criteria for concrete and reinforced and unreinforced masonry strengthening using externally bonded fibre-reinforced polymer (FRP) composite systems"**, whereas there are currently no specific EAD regarding wraps and pultruded laminates within the European Union.
In the case of **Italy**, the **Guidelines for identification, qualification and acceptance testing on polymer matrix fibre-reinforced composites**, issued by the CSLP in July 2015, and the subsequent updates issued in May 2019, are adopted.

When **designing** FRP systems for strengthening existing structures, the **regulatory reference document adopted the USA**, which may also be useful at international level, is **ACI 440.2R "Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures"**, issued by the American Concrete Institute. At **European level**, the new **Eurocode 2 EN 992-1:2023** also includes **an annex** dedicated to **designing FRP solutions: (Annex J) "Strengthening of existing concrete structures with CFRP"**.

In **Italy**, the **Design Guidelines issued by the CLSP in July 2009** are adopted, together with CNR (National Research Council) Instructions **DT200R1/2013**.

Regulatory framework of FRCM structural strengthening systems

	EU	USA	ITALY
Design guidelines	CNR-DT 215/2018 	549.4R/6R-20 	CNR-DT 215/2018 
Qualification guidelines	EAD 340275-00-0104 	A.C. 434/2019 	March 2022 GUIDELINES 
Product certifications	ETA 23/0770 	E.S.R. N°3265 	CVT 285.28/06/2023 

Design guidelines
CNR-DT 215/2018: Instructions for the design, construction, and control of structural strengthening works using fibre-reinforced inorganic matrix composites.
ACI 549.4R-20: Guide to Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix and Steel-Reinforced Grout Systems for Repair and Strengthening of Concrete Structures.
ACI 549.6R-20: Guide to design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix (FRCM) and Steel-Reinforced Grout (SRG) Systems for Repair and Strengthening Masonry Structures
CNR-DT 215/2018: Instructions for the design, construction, and control of structural strengthening works using fibre-reinforced inorganic matrix composites.

Qualification guidelines
EAD 340275-00-0104: Externally-bonded composite systems with inorganic matrix for strengthening of concrete and masonry structures.
A.C. 434/2019: Acceptance criteria for masonry and concrete strengthening using fabric-reinforced cementitious matrix (FRCM) and steel reinforced grout (SRG) composite systems.
March 2022 GUIDELINES: Guideline for the identification, qualification and acceptance checking of fibre-reinforced inorganic matrix composites (FRCM) used for the structural strengthening of existing buildings. Enacted into Italian Law by the Decree published in January 2019.

Product certifications
ETA 23/0770: European Technical Assessment of 03/04/2024
E.S.R. N°3265: ICC-ES Evaluation Report.
C.V.T. (T.E.C.): Technical Evaluation Certificate No. 214, issued on 20/06/2022.

FRCM: **proven seismic efficacy**

Properties of Ruregold's FRCM strengthening systems

The purpose of implementing **structural strengthening systems in a seismic zone** is to retrofit existing structures so they are able to withstand the intensity of the expected seismic activity. **Composite materials are particularly suitable** for this purpose since they are **resistant, lightweight and easy to apply**, which is particularly important **in critical areas of the structure that may be difficult to reach.**

The strategy of seismic retrofit interventions is aimed at **eliminating the brittle failure mechanism** of individual load-bearing structural elements and the collapse mechanisms associated with the slabs, as well as **improving the overall strain capacity of the structure.**

In reinforced concrete structures this requirement is usually met by **increasing the ductility of the plastic hinges** and obtaining **box behaviour in load-bearing masonry elements**, so as to render them more resistant to horizontal actions, eliminate the orthogonal thrusts on the load-bearing walls (piers) and connect the perpendicular load-bearing elements to each other.

The strain capacity of the single strengthened element and the adhesion of the element to the structure are of fundamental importance for the effectiveness and reliability of seismic retrofits. Ruregold's FRCM systems guarantee these characteristics even in extreme conditions, when cracks are forming in the support.

Perfect behaviour of vaults *strengthened with Ruregold*

PROVEN SEISMIC RESISTANCE

A very challenging test

The earthquake that struck L'Aquila in central Italy, on April 6, 2009, also damaged the **Church of S. Maria dei Centurelli in Caporciano** (AQ), about 30 km from the epicentre. The shock recorded at the site was 6.1 on the Richter scale.

The church, which dates back to the 16th century, **had been restored and strengthened in 2002** *following extensive damage caused by a* **previous earthquake that struck the Umbria and Marche regions in 1997**. Although the 1997 seismic activity was lower than in 2009, the damage was such that some vaults were at risk of collapse.

What amplified *the effect of* **the 1997 earthquake** *on the structure were the* **concrete edge beams and the concrete trusses** constructed during restoration work that took place in the 1970's, and which, due to their rigidity, exerted a hammering effect on the more deformable walls.

Effective seismic protection

Improvement of the **strain capacity** of the vaults

In order to provide effective **seismic protection to the structure**, the 2002 restoration and reinforcement work entailed the strengthening the vertical walls with **injections of pozzolanic hydraulic grouting**, and the spans and vaults with **the Ruregold carbon fibre composite system and inorganic matrix**, with the aim of providing **effective seismic protection to the surface of the vaults**, while maintaining the normal breathability of the masonry. The overall strengthening of the structure was so successful that designers were able to **remove the concrete elements** introduced during the previous restoration work.

The violent shocks of the 2009 earthquake, which seriously damaged many buildings in the area, **did not compromise the structure of the church**, which, as can be seen from the images suffered only the partial expulsion of a few stone segments in the weakest part of the façade and the breakage of an internal chain. **The masonry vaults strengthened with the Ruregold system**, on the other hand, demonstrated **perfect resistance to the seismic activity**.

Strengthening system for concrete structures

Application phases

CONFINEMENT OF THE **COLUMN**

- Smooth edges to form a rounded surface that ensures optimum adhesion of the strengthening element and prepare the support, repairing any damaged areas by applying **PASSIVATOR** and **MX-R4 Repair** mortar.
- **MX-PBO Concrete**: after having saturated the substrate, apply the first layer of mortar. Thickness: approx 3/5 mm.
- **PBO-MESH**: apply the PBO fibre mesh.
  - press one the PBO-mesh gently into the layer of the mortar to ensure perfect adhesion;
  - the mesh should be applied to optimise the grammage of the PBO wrapped around the column;
  - overlay the mesh for at least 30 cm;
- **MX-PBO Concrete**: apply the second layer of mortar. Thickness: approx 3/5 mm. For indoor columns, use a suitable skim coat.

Download the Technical Handbook and the construction details for AutoCAD

DWG

Shear strengthening and confinement of a column.

STRENGTHENING THE **BEAM-COLUMN**

Saturating the support.

Strengthening to absorb the action exerted by an infill wall.

- After preparing the support, apply the first layer of the strengthening system, consisting of **MX-PBO Concrete** *cementitious mortar* and **PBO-MESH** to absorb the action exerted by the infill wall.
- Cover the **PBO-MESH** with **MX-PBO Concrete** cementitious mortar.

FLEXURAL AND **SHEAR** STRENGTHENING OF THE **BEAM**

- After cleaning and preparation the substrate thoroughly, apply the first layer of **MX-PBO Concrete** mortar and **PBO-MESH**, following the direction of the beam flexural strengthening rebars.
- Cover the mesh using **MX-PBO Concrete** mortar.
- Shear reinforcement with **PBO-MESH** between two layers of **MX-PBO Concrete** mortar in the direction perpendicular to the reinforcing rebars of the beam.
- Cover the mesh using **MX-PBO Concrete** mortar.

Flexural strengthening.

Shear strengthening.

Increasing the shear resistance of the beam-column joint.

Finishing.

- Frontal covering of the beam-column joint with **PBO-MESH** and **MX-PBO Concrete** cementitious mortar to increase the shear resistance of the beam-column joint panel.
- Confining the joints in the beam-column joint with **PBO-MESH** and **MX-PBO Concrete** cementitious mortar to increase ductility at the extremities of the beams and columns. Applying a skim coat and finishing with a paint, if necessary.

STRENGTHENING **CONCRETE BEAM AND BLOCK FLOOR JOISTS**

After confirming that the joist is capable of supporting the project loads and, if the state of deterioration is evident, it is necessary to intervene in order to restore the condition of the degraded concrete (volumetric reconstruction of the missing concrete) using **PASSIVATOR** and **MX-R4 Repair** products.

In this way it is possible to integrate the existing reinforcements, without adding excessive additional weight, by using the unidirectional **FRCM** system, consisting of **PBO-MESH** together with **MX-PBO Concrete** cementitious mortar.

Concrete repair.

PBO-MESH 105 Mesh

Applying the FRCM strengthening system.

Applying the STUCANET ceiling anti-shatter system.

WALL OVERTURN PROTECTION

- If it is necessary to regularise any localised areas of the support and/or mortar joints, apply **MX-RW High Performance**, **MX-15 Plaster**, **MX-CP Lime** mortars.
- Strengthen by applying a layer of **PBO-MESH** between two coats of **MX-PBO Masonry** mortar, at a thickness of approx. 3/5 mm per coat.
- Connect the system to the supporting structure using the **PBO-JOINT** anchor and **MX-PBO-JOINT** mortar.

Applying the FRCM system.

Strengthening system for masonry structures

Application phases

Strips in grid layout extrados (upper side) strengthening.

STRENGTHENING THE **VAULTS**

Before proceeding with structural strengthening, remove any loose materials/layers and any other residues. Carefully clean and dampen the substrate.

- If necessary, apply a rough coat of **MX-RW High Performance** or **MX-CP Lime** mortar as a primer.
- Install the strengthening system over the vaults, applying **PBO-MESH** between two coats of **MX-PBO Masonry** cementitious mortar at a thickness of 3/5 mm each, and connecting to the load-bearing structural elements using **PBO-JOINT** if necessary.

Strengthening of masonry corners and floor edge beams.

STRENGTHENING OF **MASONRY CORNERS AND FLOOR EDGE BEAMS**

In the case of structures with masonry load-bearing elements, in order to prevent local collapse phenomena, the structure may be strengthened by wrapping the masonry elements with **PBO-MESH** between two coats of **MX-PBO Masonry** cementitious mortar on the masonry corners and on the floor edge beams, up to the height established for the roof.

Before applying the Ruregold strengthening system, in order to ensure perfect adhesion to the masonry, remove any pre-existing skim coats and plasters, and clean and wash the masonry substrate.

Strips in grid layout strengthening.

STRENGTHENING OF **LOAD-BEARING WALLS (PIERS) AND SPANDRELS**

It is possible to strengthen load-bearing walls (piers) and spandrels in structures with masonry supporting elements by applying **PBO – MESH** to the masonry surface, between two coats of **MX - PBO Masonry** mortar. Such systems may be extended to cover the entire surface of the masonry element, or applied in bands sufficiently wide to guarantee in and out-of-plane strengthening against shear and combined axial and flexural forces. Before applying the strengthening, it is necessary to prepare the substrate adequately to ensure the product adheres correctly and guarantee the reliability of the structural strengthening solution.

Application of Ruregold Strengthening Systems with inorganic matrix

Application phases

Preparing the base screed

The substrate must be structurally sound, clean, free of dust, loose parts and without any pollutants, such as paints, release agents, etc. In the presence of macroscopic surface defects or irregularities, use a repair mortar suitable for the nature of the base screed in order to fill irregularities and render the surface smooth again.
Round any edges to a radius of curvature of 2 cm.

Preparing the inorganic cementitious matrix

Prepare as per a normal premix mortar, by adding water and mixing continuously with a cement mixer or, in the case of limited quantities, use a bucket and a whisk drill, mixing for at least 4-5 minutes.

Application of the Ruregold system.

Saturate the substrate and, after ensuring there is no surface water present, apply the first coat of the matrix (approx. 3/5 mm) using a smooth metal float. Embed the mesh into the mortar, applying pressure with the float until the matrix begins to emerge through the openings in the mesh. Apply the second coat of inorganic matrix (between 3 and 5 mm) so as to cover the mesh completely. Overlay by approx. 30 cm at the junction points.

Applying a second layer of the system, if necessary

If the design requires more than one layer of the reinforcing system, apply the second layer of the mesh and the final layer of inorganic matrix, always applying successive layers while the preceding layer is still fresh.

Applying a fibre anchor, if necessary

In some configurations it may also be necessary to insert PBO fibre achors, to bind the system to the structure. Once a hole has been made in the supporting structure, fill it with the appropriate mortar and insert the joint. The free end of the joint should be opened, spread out in a fan shape on the surface of the mortar covering the strengthening mesh, and then covered with the appropriate Ruregold mortar.

Structural strengthening

FRCM PBO-BASED SYSTEM

PBO fibre composite materials and inorganic matrix for structural strengthening. PBO (Polyparaphenylene Benzobis Oxazole) fibre with market-leading mechanical properties in the FRCM structural strengthening solutions sector.

PBO-MESH 105

FRCM strengthening system for concrete consisting of uniaxial PBO mesh weighing 105 g/m² (3.1 oz/yd²) and MX-PBO Concrete inorganic matrix.

Thanks to the high grammage of the PBO mesh and the high performance inorganic matrix, it is suitable for the most demanding applications on structures in concrete and reduced sections, such as slab joists.

- Good reaction to fire
- Damp supports
- Vapour permeability
- Ease of application
- Non-toxic matrix
- Resistant to freeze/thaw cycles

SYSTEM PROPERTIES

- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing resistance to combined axial and flexural forces in reinforced concrete columns.
- Increasing shear resistance in reinforced concrete beams, columns, beam-column joints and walls.
- Increasing the resistance of the terminal parts of reinforced concrete beams and columns.
- Increasing the ductility of one-dimensional elements such as reinforced concrete beams and columns.
- The system is also resistant to high temperatures and freeze-thaw cycles.
- The inorganic matrix guarantees excellent adhesion to the concrete support.
- The inorganic matrix is easy to apply and produces reliable results, in the same way as a traditional bagged premixed cementitious mortar.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

FRCM SYSTEM FOR CONCRETE

CE EAD340275-00-0104

SYSTEM ELEMENTS

Mesh

PBO-MESH 105

Unidirectional PBO fibre mesh weighing 105 g/m². Thermoplastic glass fibre transversal to the direction of the PBO fibres.
Available in:
- H 10 cm, 30 m reel
- H 25 cm, 15 m reel.

Inorganic matrix

MX-PBO Concrete

Cementitious fibre-reinforced inorganic matrix for use with PBO-MESH 105 mesh on concrete structures.
Ideal for optimising the transfer of stresses from the structural element to the strengthening mesh.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Retrofitting and upgrading the static and seismic behaviour of infrastructure in reinforced concrete.
- Flexural structural strengthening of reinforced concrete beams and joists.
- Combined axial and flexural strengthening of reinforced concrete columns.
- Shear strengthening of reinforced concrete beams, columns, beam-column joints and walls.
- Confinement of reinforced concrete columns.
- Improving the ductility of reinforced concrete elements.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

PBO FIBRE	
Toughness	5.8 GPa (841.2 ksi)
Strain at rupture	2.5%
Modulus of elasticity of PBO fibre	270 GPa (3.91x10^4 ksi)

PBO-MESH 105 MESH	
Weight of the PBO fibres	105 g/m^2 (3.1 oz/yd^2)
Modulus of elasticity of PBO mesh	228 GPa (33068.6 ksi)
Equivalent thickness of the mesh in warp	0.067 mm (0.0026 in)
Equivalent thickness of the mesh in weft	0.00 mm
Products	H 10 cm (3,9 in), 30 m (98.4 ft) reel H 25 cm (9,8 in), 15 m (49.2 ft) reel
Storage	Indoors, in a cool, dry place

MX-PBO Concrete INORGANIC MATRIX	
Density	Approx. 1900 kg/m^3 (118.6 lb/ft^3)
Compressive strength after 28 days (EN 12190)	≥ 40 MPa (5801.5 psi)
Coverage	approx. 12.4 kg/m^2 (2.5 lb/ft^3) per strengthening layer (4+4 mm) approx. 18.5 kg/m^2 (3.8 lb/ft^3) per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 1504-3
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

PBO-MESH 70/18

FRCM strengthening system for concrete consisting of biaxial PBO fibre mesh weighing 70+18 g/m² (2.06+0.53 oz/yd²) and MX-PBO Concrete inorganic matrix.

Thanks to the conformation of the PBO mesh and the high performance inorganic matrix, the system is suitable for applications such as wrapping reinforced concrete columns and strengthening beam-column joints.

- Good reaction to fire
- Damp supports
- Vapour permeability
- Ease of application
- Non-toxic matrix
- Resistant to freeze/thaw cycles

SYSTEM PROPERTIES

- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing resistance to combined axial and flexural forces in reinforced concrete columns.
- Increasing shear resistance in reinforced concrete beams, columns, beam-column joints and walls.
- Increasing the resistance of the terminal parts of reinforced concrete beams and columns.
- Increasing the ductility of one-dimensional elements such as reinforced concrete beams and columns.
- The system is also resistant to high temperatures and freeze-thaw cycles.
- The inorganic matrix guarantees excellent adhesion to the concrete support.
- The inorganic matrix is easy to apply and produces reliable results, in the same way as a traditional bagged premixed cementitious mortar.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

FRCM SYSTEM FOR CONCRETE

EAD340275-00-0104

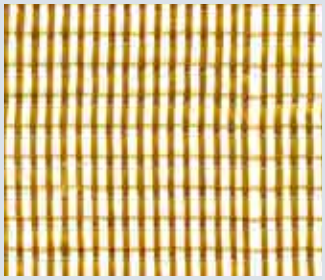
ESR-3265

SYSTEM ELEMENTS

Mesh

PBO-MESH 70/18

Unbalanced bi-directional PBO fibre mesh weighing 70 g/m² in the warp direction and 18 g/m² in the direction of the weft.
Available in:
• H 100 cm, 15 m reel.



Inorganic matrix

MX-PBO Concrete

Cementitious fibre-reinforced inorganic matrix for use with PBO-MESH 70/18 mesh on concrete structures.
Ideal for optimising the transfer of stresses from the structural element to the strengthening mesh.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Retrofitting and upgrading the static and seismic behaviour of infrastructure in reinforced concrete.
- Flexural strengthening of reinforced concrete beams.
- Combined axial and flexural strengthening of reinforced concrete columns.
- Shear strengthening of reinforced concrete beams, columns, beam-column joints and walls.
- Confinement of reinforced concrete columns.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

PBO FIBRE	
Toughness	5.8 GPa (841.2 ksi)
Strain at rupture	2.5%
Modulus of elasticity of PBO fibre	270 GPa (3.91x10^4 ksi)

PBO-MESH 70/18 MESH	
Weight of the PBO fibres	70 g/m^2 (2.06 oz/yd^2) in warp and 18 g/m^2 (0.53 oz/yd^2) in weft
Modulus of elasticity of PBO mesh	241 GPa (34954.1 ksi)
Equivalent thickness of the mesh in warp	0.045 mm (1.77x10^{-3} in)
Equivalent thickness of the mesh in weft	0.012 mm (4.72x10^{-4} in)
Products	H 100 cm (39.4 in), 15 m (49.20 ft) reel
Storage	Indoors, in a cool, dry place

MX-PBO Concrete INORGANIC MATRIX	
Density	Approx. 1900 kg/m^3 (118.6 lb/ft^3)
Compressive strength after 28 days (EN 12190)	≥ 40 MPa (5801.5 psi)
Coverage	approx. 12.4 kg/m^2 (2.5 lb/ft^3) per strengthening layer (4+4 mm) approx. 18.5 kg/m^2 (3.8 lb/ft^3) per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 1504-3
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

PBO-MESH 88

FRCM strengthening system for concrete consisting of uniaxial PBO mesh weighing 88 g/m² (2.59 oz/yd²) and MX-PBO Concrete inorganic matrix.

Thanks to the good grammage of the PBO mesh and the high performance inorganic matrix, it is suitable for important applications on concrete elements, such as wrapping or shear and flexural strengthening.

- Good reaction to fire
- Damp supports
- Vapour permeability
- Ease of application
- Non-toxic matrix
- Resistant to freeze/thaw cycles

SYSTEM PROPERTIES

- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing resistance to combined axial and flexural forces in reinforced concrete columns.
- Increasing shear resistance in reinforced concrete beams, columns, beam-column joints and walls.
- Increasing the resistance of the terminal parts of reinforced concrete beams and columns.
- Increasing the ductility of one-dimensional elements such as reinforced concrete beams and columns.
- The system is also resistant to high temperatures and freeze-thaw cycles.
- The inorganic matrix guarantees excellent adhesion to the concrete support.
- The inorganic matrix is easy to apply and produces reliable results, in the same way as a traditional bagged premixed cementitious mortar.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

FRCM SYSTEM FOR CONCRETE

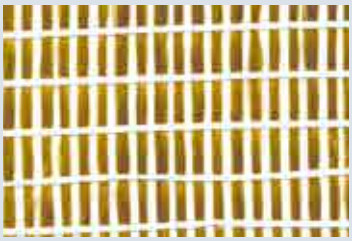
CE EAD340275-00-0104

SYSTEM ELEMENTS

Mesh

PBO-MESH 88

Unidirectional PBO fibre mesh weighing 88 g/m². Thermoplastic glass fibre transversal to the direction of the PBO fibres.
Available in:
- H 25 cm, 15 m reel.



Inorganic matrix

MX-PBO Concrete

Cementitious fibre-reinforced inorganic matrix for use with PBO-MESH 88 mesh on concrete structures.
Ideal for optimising the transfer of stresses from the structural element to the strengthening mesh.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Retrofitting and upgrading the static and seismic behaviour of infrastructure in reinforced concrete.
- Flexural strengthening of reinforced concrete beams.
- Combined axial and flexural strengthening of reinforced concrete columns.
- Shear strengthening of reinforced concrete beams, columns, beam-column joints and walls.
- Confinement of reinforced concrete columns.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

PBO FIBRE	
Toughness	5.8 GPa (841.2 ksi)
Strain at rupture	2.5%
Modulus of elasticity of PBO fibre	270 GPa (3.91x10^4 ksi)

PBO-MESH 88 MESH	
Weight of the PBO fibres	88 g/m^2 (2.59 oz/yd^2)
Modulus of elasticity of PBO mesh	196 GPa (2.84 x10^4 ksi)
Equivalent thickness of the mesh in warp	0.056 mm (0.0022 in)
Equivalent thickness of the mesh in weft	0.00 mm
Modulus of elasticity in compression after 28 days (EN 1504-3)	≥ 15 GPa (2175.6 ksi)
Products	H 25 cm (9.84 in), 15 m (49.21 ft) reel
Storage	Indoors, in a cool, dry place

MX-PBO Concrete INORGANIC MATRIX	
Density	Approx. 1900 kg/m^3 (118.6 lb/ft^3)
Compressive strength after 28 days (EN 12190)	≥ 40 MPa (5801.5 psi)
Coverage	approx. 12.4 kg/m^2 (2.5 lb/ft^3) per strengthening layer (4+4 mm) approx. 18.5 kg/m^2 (3.8 lb/ft^3) per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 1504-3
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

PBO-MESH 44

FRCM strengthening system for masonry consisting of uniaxial PBO mesh weighing 44 g/m² (1.3 oz/yd²) and MX-PBO Masonry inorganic matrix.

Thanks to the good grammage of the PBO mesh and the high performance inorganic matrix, it is suitable for important applications on masonry elements, such as wrapping or shear and flexural strengthening.

- Bio
- Damp supports
- Vapour permeability
- Ease of application
- Non-toxic matrix
- Good reaction to fire

SYSTEM PROPERTIES

- Increased strength capacity of structural elements that are subject to shear and combined axial and flexural forces, for in-plane and out-of-plane actions.
- Increased ductility of masonry buildings.
- High system ductility and energy dissipation capacity.
- The system is also resistant to high temperatures and freeze-thaw cycles.
- The inorganic matrix guarantees excellent adhesion to the support and chemical and physical compatibility with masonry.
- The inorganic matrix is easy to apply and produces reliable results, in the same way as a traditional bagged premixed cementitious mortar.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

FRCM SYSTEM FOR MASONRY

CE EAD340275-00-0104

SYSTEM ELEMENTS

Mesh

PBO-MESH 44

Unidirectional PBO fibre mesh weighing 44 g/m². Thermoplastic glass fibre transversal to the direction of the PBO fibres.
Available in:
- H 25 cm, 50 m reel.

Inorganic matrix

MX-PBO Masonry

Cementitious fibre-reinforced inorganic matrix for use with PBO-MESH 44 mesh on masonry structures.

SUPPLEMENTARY ELEMENTS

Anchor

PBO-JOINT

PBO fibre anchor.
Available in:
- Ø 3 mm, dispenser 10 m
- Ø 6 mm, dispenser 10 m.

Inorganic matrix

MX-JOINT

Inorganic matrix for impregnation and application of the PBO-JOINT fibre anchor.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of masonry buildings.
- Structural strengthening of load-bearing walls (piers) and perimeter strips (spandrels) in masonry buildings.
- Structural strengthening of masonry corners and floor edge beams.
- Structural strengthening of edge beams in masonry walls.
- Structural strengthening of masonry arches, vaults, and domes.
- Structural strengthening of masonry infrastructure.
- Overturn protection for external infill walls in r.c. frame buildings.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

PBO FIBRE	
Toughness	5.8 GPa (841.2 ksi)
Strain at rupture	2.5%
Modulus of elasticity of PBO fibre	270 GPa (3.91x10^4 ksi)

PBO-MESH 44 MESH	
Weight of the PBO fibres	44 g/m^2 (1.3 oz/yd^2)
Modulus of elasticity of PBO mesh	280 GPa (4.06x10^4 ksi)
Equivalent thickness of the mesh in warp	0.028 mm (0.0011 in)
Equivalent thickness of the mesh in weft	0.000 mm
Products	H 25 cm (9.84 in), 50 m (19.68 ft) reel
Storage	Indoors, in a cool, dry place

MX-PBO Masonry INORGANIC MATRIX	
Density	Approx. 1750 kg/m^3 (109.2 lb/ft^3)
Compressive strength after 28 days (EN 12190)	≥ 20 MPa (2900.7 psi)
Coverage	approx. 11.4 kg/m^2 (2.33 lb/ft^3) per strengthening layer (4+4 mm) approx. 17.1kg/m^2 (3.5 lb/ft^3) per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 1504-3
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

See page 35 for the technical specifications of the products PBO-JOINT and MX-JOINT inorganic matrix.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

PBO-MESH 22/22

FRCM strengthening system for masonry consisting of biaxial PBO mesh weighing 22+22 g/m² (0.65+0.65 oz/yd²) and MX-PBO Masonry inorganic matrix.

Thanks to the good grammage of the PBO mesh and the high performance inorganic matrix, it is suitable for applications on masonry elements, especially wrapping vaults and load-bearing walls (piers).

- Bio
- Damp supports
- Vapour permeability
- Ease of application
- Non-toxic matrix
- Good reaction to fire

SYSTEM PROPERTIES

- Increased strength capacity of structural elements that are subject to shear and combined axial and flexural forces, for in-plane and out-of-plane actions.
- Increased ductility of masonry buildings.
- High system ductility and energy dissipation capacity.
- The system is also resistant to high temperatures and freeze-thaw cycles.
- The inorganic matrix guarantees excellent adhesion to the support and chemical and physical compatibility with masonry.
- The inorganic matrix is easy to apply and produces reliable results, in the same way as a traditional bagged premixed cementitious mortar.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

FRCM SYSTEM FOR MASONRY

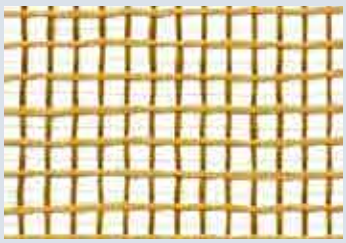
CE EAD340275-00-0104

SYSTEM ELEMENTS

Mesh

PBO-MESH 22/22

Balanced bi-directional PBO fibre mesh weighing 44 g/m2, uniformly distributed in weft and warp.
Available in:
- H 100 cm, 15 m reel.



Inorganic matrix

MX-PBO Masonry

Cementitious fibre-reinforced inorganic matrix for use with PBO-MESH 22/22 mesh on masonry structures.

SUPPLEMENTARY ELEMENTS

Anchor

PBO-JOINT

PBO fibre anchor.
Available in:
- Ø 3 mm, dispenser 10 m
- Ø 6 mm, dispenser 10 m.

Inorganic matrix

MX-JOINT

Inorganic matrix for impregnation and application of the PBO-JOINT fibre anchor.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of masonry buildings.
- Structural strengthening of load-bearing walls (piers) and perimeter strips (spandrels) in masonry buildings.
- Structural strengthening of masonry corners and floor edge beams.
- Structural strengthening of edge beams in masonry walls.
- Structural strengthening of masonry arches, vaults, and domes.
- Structural strengthening of masonry infrastructure.
- Increased ductility of masonry buildings.
- Overturn protection for external infill walls in r.c. frame buildings.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

PBO FIBRE	
Toughness	5.8 GPa (841.2 ksi)
Strain at rupture	2.5%
Modulus of elasticity of PBO fibre	270 GPa ($3.91x10^4$ ksi)

PBO-MESH 22/22 MESH	
Weight of the PBO fibres	22 g/m² (0.65 oz/yd²) in warp and 22 g/m² (0.65 oz/yd²) in weft
Modulus of elasticity of PBO mesh	282 GPa (40900.6 ksi)
Equivalent thickness of the mesh in warp	0.014 mm ($5.51x10^{-4}$ in)
Equivalent thickness of the mesh in weft	0.014 mm ($5.51x10^{-4}$ in)
Products	H 100 cm (39.4 in), 15 m (49.20 ft) reel
Storage	Indoors, in a cool, dry place

MX-PBO Masonry INORGANIC MATRIX	
Density	Approx. 1750 kg/m³ (109.2 lb/ft³)
Compressive strength after 28 days (EN 12190)	≥ 20 MPa (2900.7 psi)
Coverage	approx. 11.4 kg/m² (2.33 lb/ft³) per strengthening layer (4+4 mm) approx. 17.1kg/m² (3.5 lb/ft³) per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 1504-3
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

See page 35 for the technical specifications of the products PBO-JOINT and MX-JOINT inorganic matrix.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

PBO-JOINT

PBO fibre anchor for FRCM systems.

Together with the MX-JOINT inorganic matrix, the PBO-JOINT connection system interconnects existing masonry and reinforced concrete structures by means of FRCM PBO structural strengthening systems.
The fibre anchor is prepared on site and consists of a bundle of continuous parallel fibres or strands bound within a tubular elastic net made of polyester, polyamide and latex fibres. The net can be extended both longitudinally and transversely, and may also be removed. The bundled fibres become rigid when impregnated with the appropriate MX-JOINT inorganic matrix and inserted into a specially made hole in the masonry and/or reinforced concrete structural element.

- Bio
- Damp supports
- Vapour permeability
- Ease of application
- Non-toxic matrix

SYSTEM PROPERTIES

- Increases the capacity of the PBO-FRCM strengthening system to adhere to the existing support.
- Increases the capacity of the FRCM PBO-based system to adhere to the existing masonry substrate when it is applied to one wall face only.
- Application of the PBO fibre anchor increases adhesion capacity to the masonry substrate in multi-leaf and/or rubble-core masonry.
- Increased adhesion capacity of the FRCM PBO-based system to the concrete support when shear strengthening is applied to reinforced concrete beams.
- Increased adhesion capacity of the FRCM PBO-based system to the concrete support when strengthening is applied to reinforced concrete walls.
- Continuous force transfer to the structure is created by the PBO-FRCM strengthening system when it is applied to strengthening against combined axial and flexural forces in reinforced concrete columns.
- Creation of constraints when the PBO fibre anchor is inserted into masonry and reinforced concrete structures.
- The system can also be applied to damp supports without any need for special protection.
- The bundled fibres are manageable and easy to apply.

FRCM SYSTEM CONNECTIONS

CE EAD340275-00-0104

SYSTEM ELEMENTS

Anchor

PBO-JOINT

PBO fibre anchor
Available in:
- Ø 3 mm, dispenser 10 m
- Ø 6 mm, dispenser 10 m.

Inorganic matrix

MX-JOINT

Inorganic matrix for impregnation and application of the PBO-JOINT fibre anchor.

APPLICATIONS WHEN USED WITH THE FRCM SYSTEM

- Retrofitting and upgrading the static and seismic behaviour of masonry and reinforced concrete buildings.
- Structural strengthening of load-bearing walls (piers) and spandrels in masonry buildings, when the FRCM system is applied to one wall face only.
- Structural strengthening of load-bearing walls (piers) and spandrels in masonry buildings, when the FRCM system is applied to multiple-leaf and/or rubble-core masonry.
- Structural strengthening of masonry corners and floor edge beams.
- Structural strengthening of edge beams in masonry walls.
- Structural strengthening of masonry arches, vaults, and domes.
- Structural strengthening of masonry infrastructure.
- Shear strengthening of reinforced concrete beams.
- Combined axial and flexural strengthening of reinforced concrete columns.
- Structural strengthening of infrastructure in reinforced concrete.
- Internal partition and external infill wall anti-overturn systems.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

PBO FIBRE	
Toughness	5.8 GPa (841.2 ksi)
Strain at rupture	2.5%
Modulus of elasticity of PBO fibre	270 GPa (3.91x10^4 ksi)

PBO-JOINT ANCHOR		
Nominal diameter of the fibre anchor	3 mm (0.12 in) (CVT 214)	6 mm (0.24 in)
Tensile strength	2413 MPa (3.5x10^5 psi)	1860 MPa (2.7x10^5 psi)
Ultimate strain	2.14 %	1.95 %
Modulus of elasticity	198 GPa (2.87x10^4 ksi)	238 GPa (3.45x10^4 ksi)
Products	Ø 3 mm (0.12 in), 10 m (32.81 ft) dispenser Ø 6 mm (0.24 in), 10 m (32.81 ft) dispenser	
Storage	Indoors, in a cool, dry place	

MX-JOINT INORGANIC MATRIX	
Density	Approx. 2000 kg/m^3 (124.87 lb/ft3)
Compressive strength after 28 days (EN 12190)	≥ 25 MPa (3625.9 psi)
Coverage	approx. 10 kg (22.05 lb) per 10 m (32.81 ft) of anchor (1 kg/m)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 998-2
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

Accessories

Application Gun

Professional manual application gun for inserting the **MX-JOINT** matrix into the holes, consisting of a nylon tube and equipped with a nozzle, complete with rigid extension and flexible fitting for accessing hard-to-reach positions.

Scissors

Special PBO-Mesh Scissors.

Structural strengthening

FRCM SYSTEM IN CARBON

Carbon fibre composite materials and inorganic matrix for structural strengthening. After PBO (Polyparaphenylene Benzobis Oxazole) fibre, carbon fibre has the market-leading mechanical properties in the FRCM structural strengthening sector.

C-MESH 182

FRCM system for concrete consisting of uniaxial carbon mesh weighing 182 g/m² (5.37 oz/yd²) and MX-C 50 Concrete inorganic matrix.

Thanks to the high grammage of the carbon mesh and the high performance inorganic matrix, it is suitable for applications on concrete elements, such as wrapping or shear and flexural strengthening.

- Good reaction to fire
- Damp supports
- Vapour permeability
- Ease of application
- Non-toxic matrix
- Resistant to freeze/thaw cycles

SYSTEM PROPERTIES

- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing resistance to combined axial and flexural forces in reinforced concrete columns.
- Increasing shear resistance in reinforced concrete beams, columns, beam-column joints and walls.
- Increasing the resistance of the terminal parts of reinforced concrete beams and columns.
- Increasing the ductility of one-dimensional elements such as reinforced concrete beams and columns.
- The system is also resistant to high temperatures and freeze-thaw cycles.
- Inorganic matrix guarantees excellent adhesion to the concrete support.
- The inorganic matrix is easy to apply and produces reliable results, in the same way as a traditional bagged premixed cementitious mortar.
- The system can also be applied on damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

FRCM SYSTEM FOR CONCRETE

SYSTEM ELEMENTS

Mesh

C-MESH 182

Unidirectional carbon fibre mesh weighing 182 g/m², with thermoplastic glass fibres transversal to the direction of the carbon fibres.
Available in:
• H 25 cm, 15 m reel.

Inorganic matrix

MX-C 50 Concrete

Cementitious fibre-reinforced inorganic matrix for use with C-MESH 182 mesh on concrete structures.
Ideal for optimising the transfer of stresses from the structural element to the strengthening mesh.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Retrofitting and upgrading the static and seismic behaviour of infrastructure in reinforced concrete.
- Flexural strengthening of reinforced concrete beam and floor block beams and joists.
- Combined structural strengthening against axial and flexural forces in reinforced concrete columns.
- Shear structural strengthening of reinforced concrete beams, columns, beam-column joints and walls.
- Confinement of reinforced concrete columns.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

CARBON FIBRE	
Toughness	4.9 GPa (710.7 ksi)
Strain at rupture	1.9%
Modulus of elasticity of Carbon fibre	250 GPa (3.62x10^4 ksi)

C-MESH 182 MESH	
Weight of the carbon fibres	182 g/m^2 (5.37 oz/yd^2)
Modulus of elasticity of the Carbon mesh	109 GPa (15809.1 ksi)
Equivalent thickness of the mesh in warp	0.10 mm (0.0039 in)
Equivalent thickness of the mesh in weft	0.00 mm
Products	H 25 cm (9.84 in), 15 m (49.21 ft) reel
Storage	Indoors, in a cool, dry place

MX-C 50 Concrete INORGANIC MATRIX	
Density	Approx. 1900 kg/m^3 (118.6 lb/ft^3)
Compressive strength after 28 days (EN 12190)	≥ 20 MPa (2900.7 psi)
Coverage	approx. 12.0 kg/m^2 (2.46 lb/ft^3) per strengthening layer (4+4 mm) approx. 18.5 kg/m^2 (3.80 lb/ft^3) per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 1504-3
Storage conditions and shelf-life (EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

C-MESH 84/84

FRCM system for masonry consisting of biaxial carbon mesh weighing 84+84 g/m² and MX-C 25 Masonry inorganic matrix.

Thanks to the high grammage of the carbon mesh and the high performance inorganic matrix, it is suitable for applications on masonry elements, such as wrapping or shear and flexural strengthening.

- Good reaction to fire
- Damp supports
- Vapour permeability
- Ease of application
- Resistant to freeze/thaw cycles
- Non-toxic matrix

SYSTEM PROPERTIES

- Increased strength capacity of structural elements that are subject to shear and combined axial and flexural forces, for in-plane and out-of-plane actions.
- Increased ductility of masonry buildings.
- High system reliability in relation to post-cracking behaviour in detachment conditions.
- High system ductility and energy dissipation capacity.
- The system is also resistant to high temperatures and freeze-thaw cycles.
- The inorganic matrix guarantees excellent adhesion to the support and chemical and physical compatibility with masonry.
- The inorganic matrix is easy to apply and produces reliable results, in the same way as a traditional bagged premixed cementitious mortar.
- The system can also be applied on damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

FRCM SYSTEM FOR MASONRY

ICC ES ESR-3265

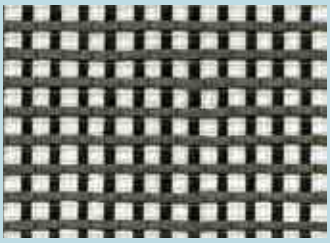
SYSTEM ELEMENTS

Mesh

C-MESH 84/84

Bi-directional Carbon fibre mesh weighing 168 g/m², uniformly distributed in weft and warp.

Available in:
- H 100 cm, 15 m reel.



Inorganic matrix

MX-C 25 Masonry

Cementitious fibre-reinforced inorganic matrix for use with C-MESH 84/84 mesh on masonry structures.
Ideal for optimising the transfer of stresses from the structural element to the strengthening mesh.

SUPPLEMENTARY ELEMENTS

Anchor

C-JOINT

Carbon fibre anchor.
Available in:
- Ø 6 mm, dispenser 10 m
- Ø 10 mm, dispenser 10 m.

Inorganic matrix

MX-JOINT

Inorganic matrix for impregnating and anchoring the C-JOINT fibre anchor.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of masonry buildings.
- Structural strengthening of load-bearing walls (piers) and perimeter strips (spandrels) in masonry buildings.
- Structural strengthening of masonry corners and floor edge beams.
- Structural strengthening of edge beams in masonry walls.
- Structural strengthening of masonry arches, vaults, and domes.
- Structural strengthening of masonry infrastructures.
- Internal partition and external infill wall overturn protection.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

CARBON FIBRE	
Toughness	4.9 GPa (710.7 ksi)
Strain at rupture	1.9%
Modulus of elasticity of Carbon fibre	250 GPa (3.62x10^4 ksi)

C-MESH 84/84 MESH	
Weight of the carbon fibres	84 g/m^2 (2.5 oz/yd^2) in warp and 84 g/m^2 (2.5 oz/yd^2) in weft
Modulus of elasticity of the Carbon mesh	239 GPa (34664.0 ksi)
Equivalent thickness of the mesh in warp	0.046 mm (0.0018 in)
Equivalent thickness of the mesh in weft	0.046 mm (0.0018 in)
Products	H 100 cm (39.4 in), 15 m (49.20 ft) reel
Storage	Indoors, in a cool, dry place

MX-C 25 Masonry INORGANIC MATRIX	
Density	Approx. 1750 kg/m^3 (109.2 lb/ft^3)
Compressive strength after 28 days (EN 12190)	≥ 20 MPa (2900.7 psi)
Coverage	approx. 10.4 kg/m^2 (2.13 lb/ft^3) per strengthening layer (4+4 mm) approx. 15.6 kg/m^2 (3.19 lb/ft^3) per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 1504-3
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

See page 42 for the technical specifications of the products C-JOINT and MX-JOINT inorganic matrix.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

C-JOINT

Carbon fibre anchor for FRCM systems.

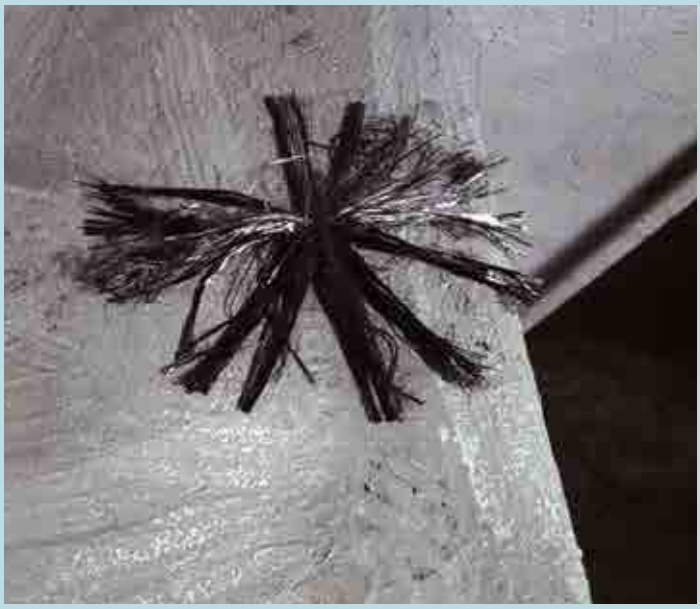
Together with MX-JOINT, the C-JOINT connection system interconnects existing masonry and reinforced concrete structures by means of FRCM carbon fibre structural strengthening systems. The fibre anchor is prepared on site and consists of a bundle of continuous parallel fibres or strands bound within a tubular elastic net made of polyester, polyamide and latex fibres. The net can be extended both longitudinally and transversely, and may also be removed. The bundled fibres become rigid when impregnated with the appropriate MX-JOINT inorganic matrix and inserted into a specially made hole in the structural element.

- Bio
- Damp supports
- Vapour permeability
- Ease of application
- Non-toxic matrix
- Good reaction to fire

SYSTEM PROPERTIES

- Increases the capacity of the carbon FRCM strengthening system to adhere to the existing support.
- Increases the capacity of the carbon FRCM system to adhere to the existing masonry substrate when it is applied to one wall face only.
- Application of the carbon fibre anchor increases adhesion capacity to the masonry substrate in multi-leaf and/or rubble-core masonry.
- Increased adhesion capacity of the carbon FRCM system to the concrete support when shear strengthening is applied to reinforced concrete beams.
- Increased adhesion capacity of the carbon FRCM system to the concrete support when strengthening is applied to reinforced concrete walls.
- Continuous force transfer to the structure is created by the carbon FRCM strengthening system when it is applied to strengthening against combined axial and flexural forces in reinforced concrete columns.
- Creation of constraints when the carbon fibre anchor is inserted into masonry and reinforced concrete structures.
- The system can also be applied on damp supports without any need for special protection.
- The bundled fibres are manageable and easy to apply.

FRCM SYSTEM CONNECTIONS



SYSTEM ELEMENTS

Anchor

C-JOINT
Carbon fibre anchor.
Available in:
- Ø 6 mm, dispenser 10 m
- Ø 10 mm, dispenser 10 m.

Inorganic matrix

MX-JOINT
Inorganic matrix for impregnating and anchoring the C-JOINT fibre anchor.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of masonry and reinforced concrete buildings.
- Structural strengthening of load-bearing walls (piers) and spandrels in masonry buildings, when the FRCM system is applied to one wall face only.
- Structural strengthening of load-bearing walls (piers) and spandrels in masonry buildings, when the FRCM system is applied to multiple-leaf and/or rubble-core masonry.
- Structural strengthening of masonry corners and floor edge beams.
- Structural strengthening of eaves edge beams in masonry walls.
- Structural strengthening of masonry arches, vaults, and domes.
- Structural strengthening of masonry infrastructure.
- Shear strengthening of reinforced concrete beams.
- Combined axial and flexural forces strengthening of reinforced concrete columns.
- Structural strengthening of infrastructure in reinforced concrete.
- Internal partition and external infill wall anti-overturn systems.

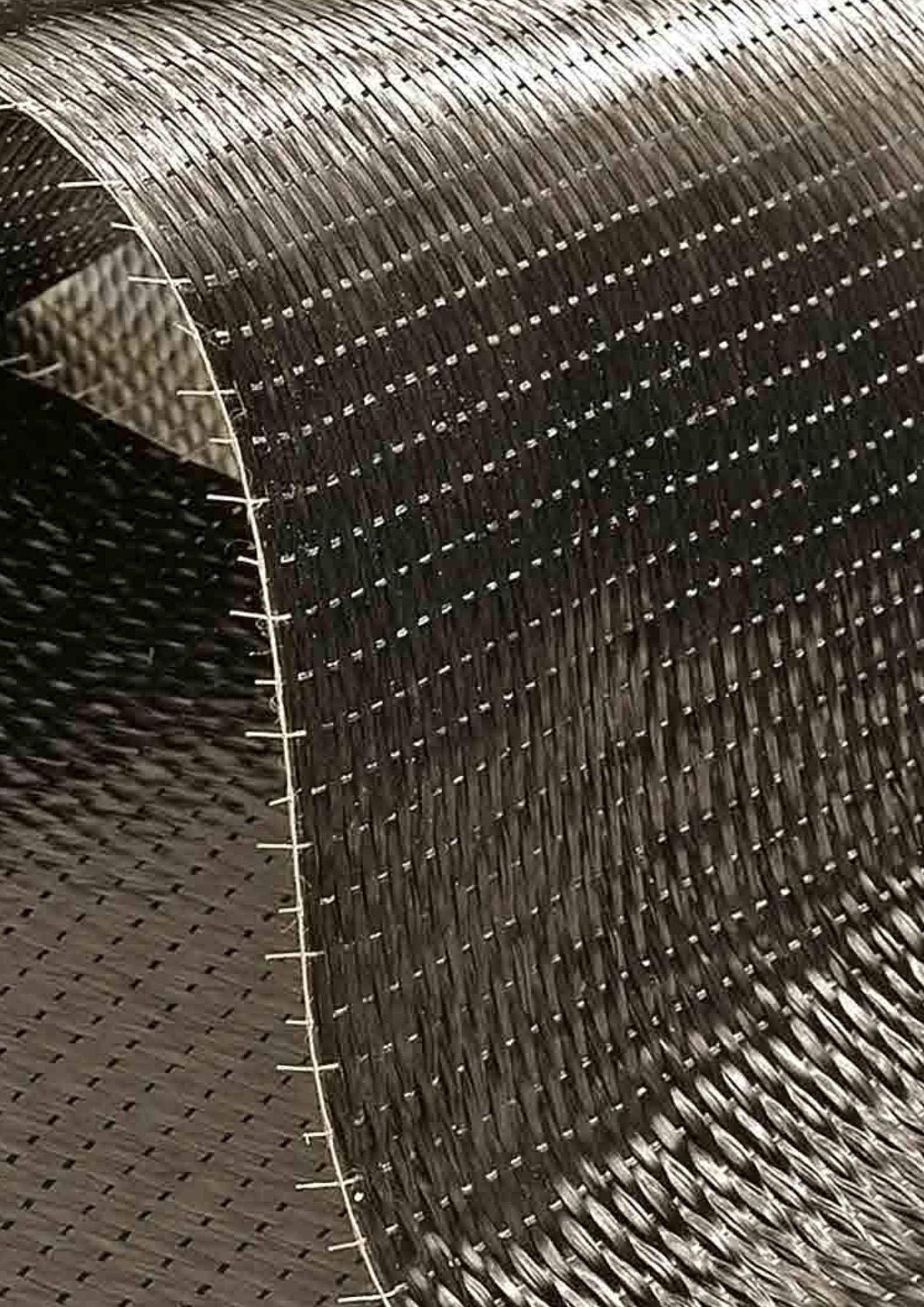
TECHNICAL SPECIFICATIONS OF THE COMPONENTS

CARBON FIBRE		
Toughness	4.9 GPa (710.7 ksi)	
Strain at rupture	1.9%	
Modulus of elasticity of Carbon fibre	250 GPa (3.62x10^4 ksi)	

C-JOINT ANCHOR		
Nominal diameter of the fibre anchor	6 mm (0.24 in)	10 mm (0.39 in)
Tensile strength	1225 MPa (1.78x10^5 psi)	1221 MPa (1.77x10^5 psi)
Ultimate strain	0.68 %	0.49 %
Modulus of elasticity (average value)	234 GPa (33938.8 ksi)	232 GPa (33648.7 ksi)
Products	Ø 6 mm (0.24 in), 10 m (32.81 ft) dispenser Ø 10 mm (0.39 in), 10 m (32.81 ft) dispenser	
Storage	Indoors, in a cool, dry place	

MX-JOINT INORGANIC MATRIX	
Density	Approx. 2000 kg/m^3 (124.87 lb/ft3)
Compressive strength after 28 days (EN 12190)	≥ 25 MPa (3625.9 psi)
Coverage	approx. 10 kg (22.05 lb) per 10 m (32.81 ft) of anchor (1 kg/m)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product
CE marking	EN 998-2
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.



FRP strengthening systems

FRP structural strengthening systems with carbon fabrics or pultruded laminates and bars and epoxy matrix.

C-WRAP 300/600 HS

FRP systems for concrete consisting of a uniaxial carbon fabric tape and epoxy resin.

C-WRAP 300/600 HS are FRP strengthening systems, impregnated in situ, consisting of unidirectional, high resistance carbon fibre tapes and epoxy resins.

SYSTEM PROPERTIES

- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing resistance to combined axial and flexural forces in reinforced concrete columns.
- Increasing shear resistance in reinforced concrete beams, columns, beam-column joints and walls.
- Increasing the resistance of the terminal parts of reinforced concrete beams and columns.
- Increasing the ductility of one-dimensional elements such as reinforced concrete beams and columns.
- The tape is manageable and easy to apply.

FRP SYSTEM FOR CONCRETE

SYSTEM ELEMENTS

Tapes

WRAP 300 HS
Unidirectional carbon fabric tape, available in:
• H 20 cm, 50 m reel

WRAP 600 HS
Unidirectional carbon fabric tape, available in:
• H 20 cm, 50 m reel.

Primer

C-PRIMER
Specific bi-component epoxy primer for use with C-QUADRIWRAP HS.

Resin

C-RESIN
High adhesive capacity epoxy resin for the application of C-QUADRIWRAP HS.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Retrofitting and upgrading the static and seismic behaviour of infrastructure in reinforced concrete.
- Flexural strengthening of reinforced concrete beams.
- Strengthening for combined axial and flexural forces of reinforced concrete columns.
- Shear strengthening of reinforced concrete beams, columns, beam-column joints and walls.
- Confinement of reinforced concrete columns.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

CARBON FIBRE	
Modulus of elasticity	≥ 230 GPa
Toughness	≥ 4900 MPa
Fibre density	1.8 g/cm^3

SYSTEM	C-WRAP 300 HS	C-WRAP 600 HS
Classification	210 C	210 C
Tensile Modulus of elasticity in the direction of the fibres	≥ 210 GPa	≥ 210 GPa
Traction resistance in the direction of the fibres	≥ 2700 GPa	≥ 2700 GPa
System application temperature	+10/+35 °C	+10/+35 °C

UNIDIRECTIONAL FABRICS	WRAP 300 HS	WRAP 600 HS
Grammage	300 g/m^2	600 g/m^2
Total equivalent thickness of the system, t_{eq}	0.167 mm	0.333 mm
Products	H 20 cm 50 m reel	H 20 cm 50 m reel

C-PRIMER PRIMER	
Coverage	Approx. 0.25 kg/m^2
Packaging	5.2 kg bins (comp. A+B)

C-RESIN RESIN	
Coverage	approx. 1-1.2 kg/m^2 (for WRAP 300 HS) approx. 1.5-1.7 kg/m^2 (for WRAP 600 HS)
Packaging	4.20 kg bins (comp. A+B)

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

C-QUADRIWRAP HS

FRP system for concrete consisting of quadriaxial carbon fabric tape and epoxy resin.

C-QUADRIWRAP HS is an FRP strengthening system, consisting of quadriaxial, high-resistance carbon fibre fabric and epoxy resins.

SYSTEM PROPERTIES

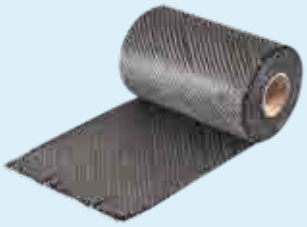
- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing resistance to combined axial and flexural forces in reinforced concrete columns.
- Increasing shear resistance in reinforced concrete beams, columns, beam-column joints and walls.
- Increasing the resistance of the terminal parts of reinforced concrete beams and columns.
- Increasing the ductility of one-dimensional elements such as reinforced concrete beams and columns.
- Increasing the ductility of beam-column joints.
- The tape is manageable and easy to apply.

FRP SYSTEM FOR CONCRETE

SYSTEM ELEMENTS

Tape

QUADRIWRAP 380 HS
Quadriaxial carbon fabric.
Available in
• H 42 cm, 50 m reel.



Primer

C-PRIMER
Specific bi-component epoxy primer for use with C-QUADRIWRAP HS.

Resin

C-RESIN
High adhesive capacity epoxy resin for the application of C-QUADRIWRAP HS.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Retrofitting and upgrading the static and seismic behaviour of infrastructure in reinforced concrete.
- Flexural strengthening of reinforced concrete beams.
- Strengthening against combined axial and flexural forces of reinforced concrete columns.
- Shear strengthening of reinforced concrete beams, columns, beam-column joints and walls.
- Confinement of reinforced concrete columns.
- Strengthening the beam-column joints panel.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

CARBON FIBRE	
Modulus of elasticity	≥ 230 GPa
Toughness	≥ 4900 MPa
Fibre density	1.8 g/cm^3

C-QUADRIWRAP HS SYSTEM	
Classification	210 C
Tensile Modulus of elasticity in the direction of the fibres	≥ 210 GPa
Traction resistance in the direction of the fibres	≥ 2700 GPa
System application temperature	+10/+35 °C

QUADRIWRAP 380 HS QUADRIAXIAL FABRIC	
Grammage	380 g/m^2
Total equivalent thickness of the system, t_{eq}	0.21 mm
Products	H 42 cm 50 m reel

C-PRIMER PRIMER	
Coverage	Approx. 0.25 kg/m^2
Packaging	5.2 kg bins (comp. A+B)

C-RESIN RESIN	
Coverage	approx. 1.3-1.5 kg/m^2
Packaging	4.20 kg bins (comp. A+B)

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

C-WRAP 300 HM

FRP system for concrete consisting of a uniaxial carbon fabric tape and epoxy resin.

C-WRAP 300 HM is an FRP strengthening system, impregnated in situ, consisting of unidirectional, high-modulus carbon fibre tapes and epoxy resins.

SYSTEM PROPERTIES

- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing resistance to combined axial and flexural forces in reinforced concrete columns.
- Increasing shear resistance in reinforced concrete beams, columns, beam-column joints and walls.
- Increasing the resistance of the terminal parts of reinforced concrete beams and columns.
- Increasing the ductility of one-dimensional elements such as reinforced concrete beams and columns.
- The tape is manageable and easy to apply.

FRP SYSTEM FOR CONCRETE

SYSTEM ELEMENTS

Tapes

WRAP 300 HM
Unidirectional carbon fabric tape, available in:
• H 20 cm, 50 m reel

Primer

C-PRIMER
Specific bi-component epoxy primer for use with of C-WRAP 300 HM.

Resin

C-RESIN R
Special, high adhesive capacity epoxy resin for the application of C-WRAP 300 HM.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Retrofitting and upgrading the static and seismic behaviour of infrastructure in reinforced concrete.
- Flexural strengthening of reinforced concrete beams.
- Strengthening against combined axial and flexural forces of reinforced concrete columns.
- Shear strengthening of reinforced concrete beams, columns, beam-column joints and walls.
- Confinement of reinforced concrete columns.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

CARBON FIBRE	
Modulus of elasticity	≥ 350 GPa
Toughness	≥ 4000 MPa
Fibre density	1.8 g/cm^3

C-WRAP 300 HM SYSTEM	
Classification	≥ 350/2800 C
Tensile Modulus of elasticity in the direction of the fibres	≥ 350 GPa
Traction resistance in the direction of the fibres	≥ 2800 GPa
System application temperature	+10/+35 °C

UNIDIRECTIONAL FABRIC	WRAP 300 HM
Grammage	300 g/m^2
Total equivalent thickness of the system, t_{eq}	0.167 mm
Products	H 20 cm 50 m reel

C-PRIMER PRIMER	
Coverage	Approx. 0.25 kg/m^2
Packaging	5.2 kg bins (comp. A+B)

C-RESIN R RESIN	
Coverage	approx. 1.0 kg/m^2 (first layer) and 0.5 kg/m^2 for subsequent layers
Packaging	5 kg bins (comp. A+B)

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

C-LAM HS/HM

FRP system for concrete consisting of enhanced adhesion pultruded carbon laminate with epoxy resin.

C-LAM is a strengthening system consisting of pultruded carbon fibre laminates and available in the **HS high strength** and in the **HM high moduls** version for flexural strengthening on any type of support.

The strengthening work should be carried out on site and, after preparing the support correctly, involves impregnating the laminates with the specific epoxy resin.

SYSTEM PROPERTIES

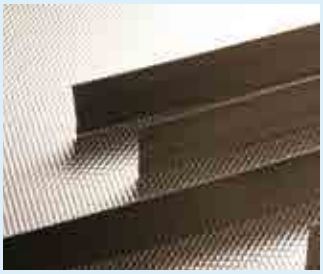
- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing the bending strength capacity of the concrete beam and block floor slab joists (slabs made of concrete joists and infill blocks or bricks).

FRP SYSTEM FOR CONCRETE

SYSTEM ELEMENTS

Laminate

LAM HS
Pultruded carbon laminates.
Available in:
- H 50 mm, 50 m reel
- H=100 mm, 50 m* reel.



LAM HM
Pultruded carbon laminates.
Available in:
- H 50 mm, 50 m reel.
- H 100 mm, 50 m reel.

Resin

C-RESIN LAM
High adhesive epoxy resin for the application of LAM HS and LAM HM laminates.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Retrofitting and upgrading the static and seismic behaviour of infrastructure in reinforced concrete.
- Flexural strengthening of reinforced concrete beams.
- Flexural strengthening of concrete beam and block floor joists.
- Flexural strengthening of timber structures.
- Flexural strengthening of steel structures.
- Structural strengthening of concrete walls.
- Increasing the bending capacity of concrete beam and block floor slabs.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

SYSTEM	C-LAM HS	C-LAM HM
Classification	C 150/2300	C 200/1800
Tensile Modulus of elasticity in the direction of the fibres	≥ 150 GPa	≥ 200 GPa
Traction resistance in the direction of the fibres	≥ 2300 MPa	≥ 1800 MPa
System application temperature	+10/+35 °C	+10/+35 °C

LAMINATE	LAM HS	LAM HM
Laminate thickness	1.4 mm	1.4 mm
Modulus of Elasticity E_f	≥ 165 GPa	≥ 203 GPa
Tensile strength	≥ 2633 GPa	≥ 3135 GPa
Ultimate strain	1.5 %	1.5 %
Products	• H 50 mm 50 m reel • H 100 mm* 50 m reel	• H 50 mm* 50 m reel • H 100 mm* 50 m reel

C-RESIN LAM RESIN	
Coverage	approx. 200-250 g/m (for C-LAM HS/HM h 50 mm) and approx. 400-500 g/m (for C-LAM HS/HM h 100 mm)
Packaging	4.95 kg bins (comp. A+B)

* Contact the Ruregold sales office for delivery times.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

C-JOINT

Carbon fibre anchor for FRP system

The C-JOINT connection system interconnects existing reinforced concrete structures by means of FRP systems. The fibre anchor is prepared on site and consists of a bundle of continuous parallel fibres or strands bound within a tubular elastic net made of polyester, polyamide and latex fibres. The net can be extended both longitudinally and transversely and may also be removed. The bundled fibres become rigid when impregnated with the appropriate C-RESIN JOINT organic matrix and inserted into a specially made hole in the structural element.

SYSTEM PROPERTIES

- Increases the capacity of the FRP strengthening system to adhere to the existing support.
- Increases the capacity of the FRP strengthening system to adhere to the concrete support when applying shear strengthening to reinforced concrete beams.
- Increases the capacity of the FRP strengthening system to adhere to the concrete support when applying strengthening to reinforced concrete walls.
- Continuous force transfer to the structure is created by the FRP strengthening system when used to strengthen reinforced concrete columns against combined axial and flexural forces.
- Creation of constraints when the carbon fibre anchor is inserted into reinforced concrete structures.
- The bundled fibres are manageable and easy to apply.

FRP SYSTEM FOR CONCRETE

SYSTEM ELEMENTS

Anchor

C-JOINT
Carbon fibre anchor
Available in:
- Ø 6 mm, dispenser 10 m
- Ø 10 mm, dispenser 10 m.

Resin

C-RESIN JOINT
Special, high adhesive capacity epoxy resin for the application of C-JOINT anchor.

Chemical anchor

ADHESIVE SEISMIC ANCHOR 400
Two-component styrene-free vinylester chemical anchor for structural fasteners.

APPLICATIONS

- Retrofitting and upgrading the static and seismic behaviour of buildings in reinforced concrete.
- Shear strengthening of reinforced concrete beams.
- Combined axial and flexural forces strengthening of reinforced concrete columns.
- Structural strengthening of infrastructure in reinforced concrete.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

CARBON FIBRE		
Toughness	4.9 GPa	
Strain at rupture	1.9%	
Modulus of elasticity of Carbon fibre	250 GPa	

C-JOINT ANCHOR		
Nominal diameter of the fibre anchor	6 mm	10 mm
Tensile strength	1225 MPa	1221 MPa
Ultimate strain	0.68 %	0.49 %
Modulus of elasticity	234 GPa	232 GPa
Products	Ø 6 mm, 10 m dispenser Ø 10 mm, 10 m dispenser	
Storage	In a cool, dry place	

C-RESIN JOINT	
Packaging	5.2 kg or 6.0 kg bins (comp. A+B)
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

ADHESIVE SEISMIC ANCHOR	
Packaging	400 ml cartridges in packs of 12
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, in a cool, dry, unventilated place, not exposed to sunlight. Not more than 16 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

C-BAR/G-BAR

Enhanced adhesion pultruded rods for FRP structural strengthening systems.

C-BAR and G-BAR are connection systems designed to respond to various structural requirements and consist of enhanced adhesion pultruded glass and carbon fibre rods, obtained by sand-blasting.

The C-Bar and G-Bar systems are particularly suited to strengthening and repairing reinforced concrete and masonry structures.

SYSTEM PROPERTIES

- Excellent adhesion to concrete thanks to their surface characteristics.
- Suitable for connection systems on existing masonry.
- Suitable as anchoring bars in existing concrete.

PULTRUDED RODS

SYSTEM ELEMENTS

Bar

C-BAR
Enhanced adhesion pultruded carbon rod, available in
• Ø 10 mm (3 m bar).

G-BAR
Enhanced adhesion pultruded glass fibre GRFP rod, available in
• Ø 12 mm (3 m bar).

Resin

C-RESIN JOINT
Special, high adhesive capacity epoxy resin for the application of C-BAR and G-BAR rods.

Inorganic matrix

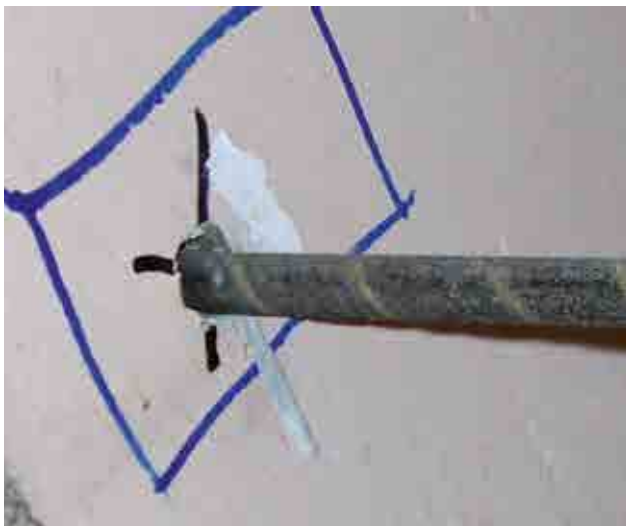
MX-JOINT
Inorganic matrix for the application of C-BAR and G-BAR as connectors in CRM reinforced plasters systems

Chemical anchor

ADHESIVE SEISMIC ANCHOR 400
Two-component styrene-free vinylester chemical anchor for structural fasteners.

APPLICATIONS

- Enhanced adhesion bar inside reinforced concrete sections
- Traction resistant bar inside masonry structures.
- Bar for improving anchoring between walls.



TECHNICAL SPECIFICATIONS OF THE COMPONENTS

PULTRUDED RODS	C-BAR 10 in Carbon	G-BAR 12 in Glass
Nominal diameter	10.0 mm	12.0 mm
Rupture load	192 kN	96 kN
Tensile breaking strength	2450 MPa	850 MPa
Tensile Modulus of elasticity	130 GPa	46 GPa
Products	• Ø 10.0 mm (3 m bar)	• Ø 12.0 mm (3 m bar)

C-RESIN JOINT ORGANIC MATRIX	
Packaging	5.2 kg bins (comp. A+B)
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

MX-JOINT INORGANIC MATRIX	
Density	Approx. 2000 kg/m^3
Compressive strength after 28 days (EN 12190)	≥ 25 MPa
Coverage	Approx. 1.5 kg/m
Packaging	Disposable wooden pallets laden with 60 x 25 kg bags equivalent to 1500 kg of loose product
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

ADHESIVE SEISMIC ANCHOR	
Packaging	400 ml cartridges in packs of 12
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, in a cool, dry, unventilated place, not exposed to sunlight. Not more than 16 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

CRM System - Reinforced plasters

Fibreglass mesh reinforced plasters and specific mortars for repairing and strengthening masonry structures.

Structural strengthening of masonry
CRM system - Reinforced plasters

Strengthening masonry, using the **reinforced plaster** technique, represents one of the possible solutions for increasing the load-bearing and earthquake resistant capacity of existing walls.

This solution is particularly effective in the case of severely damaged or discontinuous masonry, if the necessary transverse connection elements are installed and anchored securely to the reinforcement on both sides of the masonry.
Ruregold reinforced plaster is realised using the **CRM masonry strengthening system**, consisting of the following elements:

- **G-MESH 400, G-MESH 490** and **G-MESH 1000**; preformed GFRP alkali-resistant impregnated glass fibre meshes;
- Connection system consisting of **HELICAL ANCHOR** helical, stainless steel bars or, alternatively, **G-MESH ANCHOR** preformed, A.R. glass fibre elements;
- **G-MESH GUSSETS** for distributing the stress concentrations across the connection systems;
- Structural plaster mortars: high pozzolanicity hydraulic binder-based (**MX-RW High Performance)**, cement based (**MX-15 Plaster**) and lime-based (**MX-CP Lime**), obtained using premix technology.

It is also possible to increase the load-bearing capacity of walls, thereby enhancing their seismic performance, by eliminating discontinuities: closing niches, alcoves, flues and cavities and repairing existing damage and/or interruptions in the walls themselves.
Other actions that may be used to complement the use of reinforced plaster are discussed in the dedicated section on **repairing the support** (topic specific to masonry).

The reinforced plaster application procedure is as follows:

1. removing the existing plaster;
2. removing discontinuous or detached parts of the masonry;
3. repairing any damage that may be present;
4. first "roughcast" preparation layer to render the substrate if necessary;
5. sub-horizontal passing through perforations;
6. positioning the **G-MESH 400/490/1000** on either face of the masonry;
7. applying the **HELICAL CONNECTORS** or the **G-MESH Connectors** (4-5/m^2);
8. securing the strengthening meshes to the connection system;
9. installing the **G-MESH GUSSET** to redistribute the concentrated stresses;
10. forming the structural plaster **MX-RW High Performance, MX-CP Lime or MX-15 Plaster** structural plaster on the walls, having prepared them as required beforehand (and/or saturated/dampened).

Download the Technical Handbook and the construction details for AutoCAD

DWG

Designing **reinforced plaster**

CRM: Qualification

Within the European Union, with regard to the **qualification of CRM systems** for strengthening existing structures using the reinforced plasters the following guidelines were introduced in November 2018: **(European Assessment Document) EAD 340392-00-0104 "CRM (Composite Reinforced Mortar) systems for strengthening concrete and masonry structures".**

CE marking has been obtained with corresponding product DoP according to ETA no. 22/0078, for further information visit the Ruregold.com website

It should be noted that, in the case of CRM systems, the **various components are qualified individually**, but **there is no overall qualification procedure for the system as a whole**. This means that, while the meshes, pre-formed connectors and angle plates must be CE marked in accordance with the above-mentioned guidelines (EAD 340392-00-0104), **any mortars used must be CE marked in accordance with the Standards EN 998-1 "Specification for mortar for masonry - Part 1: Rendering and plastering mortars" and EN 998-2 "Specification for mortar for masonry - Part 2: Mortars for masonry"**.

CRM: Design

Unlike when designing structural strengthening systems with FRP (Fibre Reinforced Polymers) and FRCM (Fibre Reinforced Cementitious Matrix) composite materials, when using the **reinforced plaster technique for the static and seismic improvement of masonry structures**, **there are no specific internationally validated Design Guidelines and/or standards.**

The effects of this type of strengthening procedure may be estimated through the use of assessment methods that take into account the thickness of the walls and the reinforced plaster, and the respective mechanical parameters

In Italy, Circular No. 7 to the NTC2018 (Technical Construction Regulations), issued on 21/1/2019, defines the multiplication factors to be applied to the mechanical characteristics of the masonry element on which the strengthening work is carried out, as summarised in **Table C8.5** (**see below**).

TYPE OF MASONRY	CURRENT STATE			STRENGTHENING WORK			
	GOOD MORTAR	COURSES OR MORTAR JOINTS	TRANSVERSE CONNECTION	INJECTION OF BINDER MIXES*	REINFORCED PLASTER **	REINFORCED REPOINTING WITH CONNECTION BETWEEN WALLS**	MAXIMUM OVERALL COEFFICIENT
Rubble masonry (cobbles, erratic and irregular stones)	1.5	1.3	1.5	2	2.5	1.6	3.5
Rough-hewn block masonry, with variable thickness	1.4	1.2	1.5	1.7	2.0	1.5	3.0
Split-face masonry with regular bond	1.3	1.1	1.3	1.5	1.5	1.4	2.4
Irregular soft stone masonry (tufa, limestone, etc.)	1.5	1.2	1.3	1.4	1.7	1.1	2.0
Regular-hewn soft stone masonry (tufa, limestone, etc.)	1.6	-	1.2	1.2	1.5	1.2	1.8
Dressed stone block masonry	1.2	-	1.2	1.2	1.2	-	1.4
Solid brick masonry with lime mortar	***	-	1.3****	1.2	1.5	1.2	1.8
Semi-hollow brick masonry with cementitious mortar (e.g. 12x12x25 cm brick, perforation ≤40%)	1.2	-	-	-	1.3	-	1.3

* The corrective coefficients corresponding to injections of binder mixes must proportionate to the beneficial effect on the masonry, which may be evaluated during the execution phase (injectability) and retrospectively (experimental assessments using sonic measurement techniques or similar methods).

** These values should be reduced accordingly in the case of very thick walls (e.g. > 70 cm).

*** In the case of brick masonry, "good mortar" is defined as mortar having a mean compression strength f_m in excess of 2 MPa. In this case, a corrective coefficient of $f_m^{0.35}$ (f_m in Mpa) may be implemented.

**** In the case of brick masonry, transversal connected masonry is defined as that realised in accordance with the applicable regulations.

CRM system - Reinforced plasters
Experimental testing - University of Pavia (IT)

The Material and Structural Testing Laboratory of the Department of Civil Engineering and Architecture (DICAr) at the **University of Pavia (IT)** conducted an **exhaustive series of experimental tests** on samples of natural stone masonry that had been strengthened using the CRM technique and employing **various combinations of mortars, meshes and connectors from the Ruregold range**.

The scope of the research activities was to evaluate the **benefits of the various CRM strengthening systems applied to non-strengthened masonry**, in terms of resistance and failure modes.

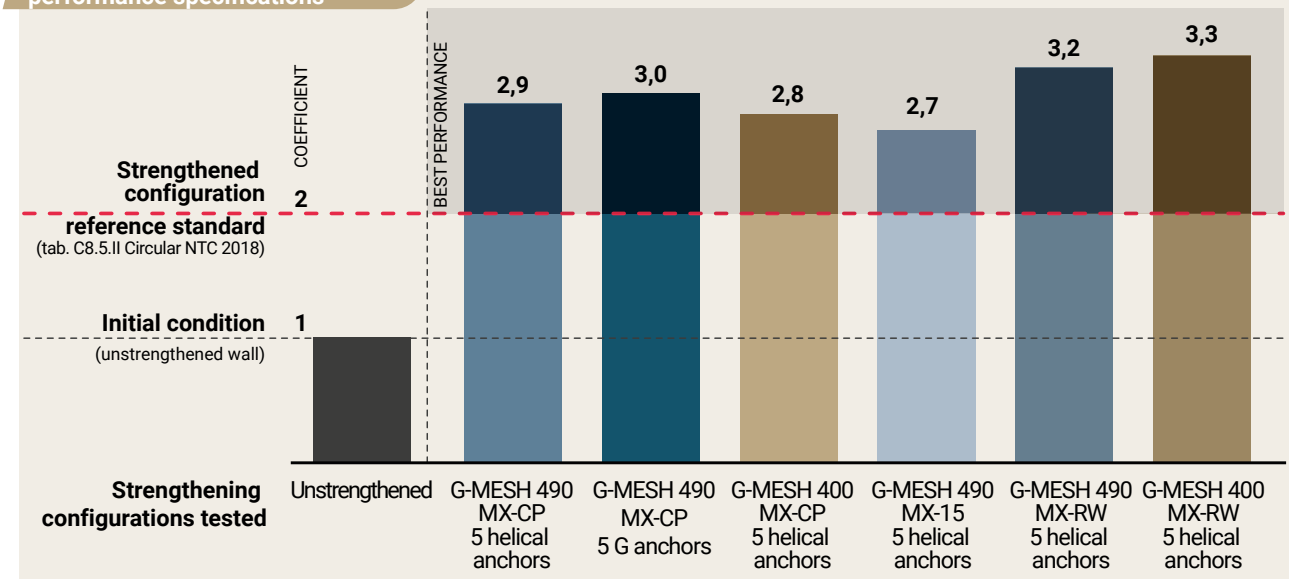
A series of **diagonal compression tests** were conducted, applying the compressive force along one diagonal of the square load-bearing wall (pier) and not along the other.

The **maximum applied force P_{max}** was recorded for each individual test.

The maximum load values ($P_{AVg.\ MAX}$) obtained using Ruregold CRM systems was approximately 3 times more that obtained when testing unstrengthened samples.

More specifically, the **values obtained** (ratio of the load obtained in the strengthened configuration to that obtained in the unstrengthened configuration) were between **2.7 and 3.3**.

Ruregold CRM performance specifications



The tests demonstrated that the improvements introduced by the strengthening system should be evaluated by adopting a **global approach**, taking into account both **increased resistance** and **behaviour at rupture**:

- **the increased performance achieved by the system is also affected by the resistance of the mortar**: in the case of samples strengthened with MX-CP and MX-15 (15 MPa), the ratios were between 2.7 and 3.0, whereas those treated with MX-RW (49.5 MPa) achieved ratios of up to 3.3 (see page 24-25 for further information on selecting the right mortar);
- **Variations in the grammage of the glass fibre mesh do not affect the improvement coefficient significantly**: nevertheless, the superior tensile strength of G-MESH 490 (490 g/m^2) with respect to G-MESH 400 (400 g/m^2) may improve overall stress distribution, thereby improving structural behaviour;
- **the number of connectors per square meter affects the behaviour at rupture significantly**: in fact, installing sufficient numbers of connectors (4-5/m^2) helps to ensure correct confinement of the masonry (in the case of samples where a single, central anchor was used, phenomena of separation of the side wall leafs were observed).

Structural repairs without reinforcement
Fibre-reinforced mortar

By using **MX-PVA Fibre-reinforced mortar**, with its excellent mechanical performance and ductile performance specifications, it **doesn't need to use the sort of extensive reinforcement** that typifies traditional reinforced plaster solutions and/or innovative CRM systems.

When determining the improvement coefficients to be adopted when using **MX-PVA Fibre-reinforced** mortar, it is important to take into account the mechanical characteristics that were identified during an **extensive series of experimental tests conducted by the University of Perugia (IT)**; it is also recommended the use of transversal connection systems, such as **HELICAL ANCHOR**, or **C-BAR** or **G-BAR** pultruded FRP rods (together with **MX-JOINT** mortar for insertion into the perforation or with the use of adhesive seismic anchor 400).

In order to assess the significant technical contribution of **MX-PVA Fibre-reinforced** mortar, a series of diagonal compression tests were conducted on unstrengthened masonry samples, compared with similar samples strengthened with 2.5-3 cm of **MX-PVA Fibre-reinforced** mortar, without any form of transversal connections.

On the basis of the resulting mean resistance values, it may be seen that the **shear strength of masonry strengthened using MX-PVA Fibre-reinforced mortar is increased by a factor of approximately 1.85 with respect to unstrengthened masonry**.
The crisis modes, which are also used to assess the validity of the intervention, are triggered as follows:

- diagonal rupture along the mortar joints in unstrengthened load-bearing walls (piers);
- **homogeneous diagonal rupture on both the strengthening and the support in strengthened panels.**

The performance of this FRC system, on different types of masonry, was evaluated at the University of Florence (IT), with results exceeding the use of traditional systems consisting of shotcrete with the use of steel mesh.

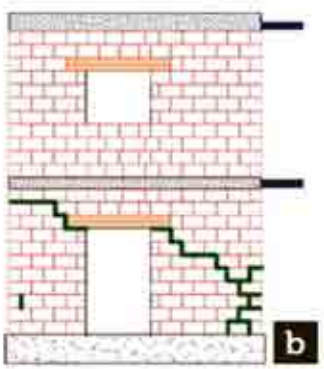
The use of **MX-PVA Fibre-reinforced mortar** was also evaluated by conducting a series of vibration table tests at the **ENEA** (Italian National Agency for New Technologies, Energy and Sustainable Economic Development) Structural Dynamics and Control Laboratory in Casaccia (Rome IT). The laboratory is equipped with 4x4 metre vibration table with six degrees of freedom and a maximum load capacity of 10 tonnes.

The system is capable of simulating accelerations of up to 3g, which means that it can be used to apply seismic stresses in real scale.

The above tests were included in a broader research project entitles Safe House: innovative seismic techniques in construction, with the aim of promoting a synergistic relationship between research, industry, building firms and technicians within the ambit of the construction sector.

In order to assess the efficacy of the technique implemented through the use of the **MX-PVA Fibre-reinforced** structural repair system without extensive reinforcement, a series of experimental tests were conducted using a vibration table, comparing two simulations based on a prototype building constructed using ordinary masonry according to traditional building techniques.

The structure, which featured a regular plan and elevation configuration, had a 3.00 x 3.50 metre base and an inter-storey height of 2.20 metres.
The first test produced crack pattern shown below.



For the second test, a coat of approximately 3 cm of mortar was applied to the inner and outer surfaces affected by the above-mentioned cracking, on the ground floor only.
During the second test, the presence of the structural repairs without extensive reinforcement on the ground floor shifted the weak-storey effect to the floor above while also preventing any further widening of the pre-existing cracks.

G-MESH 400/490/1000

Preformed GFRP alkali-resistant impregnated glass fibre meshes for structural strengthening of existing masonry.

G-MESH 400, G-MESH 490 and G-MESH 1000 are alkali resistant, preformed composite GFRP *(Glass Fibre Reinforced Polymer)* meshes for structural strengthening of existing brick, tufa and irregular stone masonry. G-MESH 400, G-MESH 490 and G-MESH 1000 are part of the CRM (*Composite Reinforced Mortar*) system, together with the plaster mortars, the CONNECTORS, the G-MESH GUSSET for redistributing the stress concentrations and the G-MESH ANGLE element.

- Good reaction to fire
- Damp supports
- Vapour permeability
- Ease of application
- Bio
- Resistant to freeze/thaw cycles

SYSTEM PROPERTIES

- Alkali resistant GFRP glass fibre reinforcement.
- High tensile Modulus of elasticity and excellent mechanical resistance performance.
- Highly compatible with masonry.
- Also ideal for historic and monumental buildings.
- Reversible.
- Easy to install
- Practical.

REINFORCED PLASTERS CRM TEM FOR MASONRY

CE EAD340392-00-0104

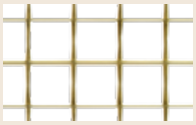
ETA 22/0078

SYSTEM ELEMENTS

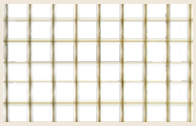
Mesh

G-MESH 400
400 g/m² grammage.
80x120 mm mesh.
H 2 m, L 20 m reels, equivalent to 40 m².

G-MESH 490
490 g/m² grammage.
80x80 mm mesh.
H 2 m, L 20 m reels, equivalent to 40 m².



G-MESH 1000
1050 g/m² grammage.
40x40 mm mesh.
H 2 m, L 20 m reels, equivalent to 40 m².



Mortar

MX-RW High Performance
Compressive strength ≥ 45 MPa.

MX-CP Lime
NHL 3.5 lime base.
Compressive strength ≥ 15 MPa.

MX-15 Plaster
Compressive strength ≥ 15 MPa.

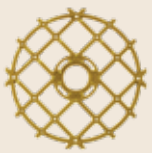
Accessories

HELICAL ANCHOR
Stainless steel bar for connection systems. Available in the following lengths:
200, 400, 600, 1000 mm.
For use with the **HELICAL GUIDE**.

G-MESH ANCHOR
Preformed GFRP alkali-resistant impregnated glass fibre connection element. Available in the following lengths:
200, 400, 600 mm x 100 mm width.
For use with chemical anchors (e.g. Adhesive Seismic Anchor 400) or MX-JOINT.

G-MESH ANGLE
490 g/m² grammage, 80 x 80 mm mesh.
Dimension: H 2 m, L 30 cm per side.
Necessary for forming internal and external angles.

G-MESH GUSSET
35 x 35 mm mesh. Dimension:
ext. diam. 170 mm
int. diam. 30 mm.
For use with the **CONNECTORS**.



ADHESIVE SEISMIC ANCHOR 400
Two-component styrene-free vinylester chemical anchor for structural fasteners.

APPLICATIONS

- For strengthening existing solid brick, tufa, and irregular stone masonry.
- Static and seismic retrofitting and upgrading existing load-bearing masonry buildings.
- For preparing CRM system consisting of G-MESH 400/490/1000 alkali-resistant glass fibre meshes and mortars for structural plaster.
- Mesh for structural plasters in compliance with the European Guidelines EAD 340392-00-0104 "CRM (Composite Reinforced Mortar) systems for strengthening concrete and masonry structures", issued in November 2018.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

MESH	G-MESH 400	G-MESH 490	G-MESH 1000
Constituent properties of the GFRP mesh	Epoxy resin-impregnated glass fibre		
Tensile strength of the mesh (characteristic values)	67 kN/m in warp, 59 kN/m in weft	72 kN/m in warp, 89 kN/m in weft	109 kN/m in warp, 155 kN/m in weft
Modulus of elasticity of the mesh (average values)	38.20 GPa in warp 61.28 GPa in weft	37.24 GPa in warp 56.20 GPa in weft	44.69 GPa in warp 59.15 GPa in weft
Mesh dimensions	80 x 120 mm	80 x 80 mm	40 x 40 mm
Application temperature	In a cool, dry place		
Products	80 x 120 mm, 40 m^2 reel (L 20 m e H 2 m)	80 x 80 mm, 40 m^2 reel (L 20 m e H 2 m)	40 x 80 mm, 40 m^2 reel (L 20 m e H 2 m)

MORTAR FOR PLASTER	MX-RW HIGH PERFORMANCE	MX-CP LIME	MX-15 PLASTER
Compressive strength at 28 days	≥ 45 MPa	≥ 15 MPa	≥ 15 MPa
Coverage	approx. 17 kg/m^2 per cm of thickness	approx. 16.5 kg/m^2 per cm of thickness (MI production) approx. 15.0 kg/m^2 per cm of thickness (SR production)	approx. 16.5 kg/m^2 per cm of thickness (MI production) approx. 15.0 kg/m^2 per cm of thickness (SR production)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg
Further information	page 68 product data sheet	page 70 product data sheet	page 66 product data sheet

ACCESSORIES	HELICAL ANCHOR	G-MESH ANCHOR L100	G-MESH ANGLE	G-MESH GUSSET
Products	L200 mm L400 mm* L600 mm* L1000 mm pack containing 25 pcs HELICAL GUIDE pack of one.	L200 mm L400 mm L600 mm pack containing 100 pcs	H 2 m, L 30 cm per side, pack containing 10 pcs	Ext. diam. 170 mm Int. diam. 30 mm pack containing 200 pcs

* please conact the technical support to know shipping times

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

MX-15 PLASTER

M15 cement-based structural fibre-reinforced mortar for structural strengthening of existing masonry.

M15 structural fibre-reinforced mortar together with the traditional reinforced plaster technique and/or CRM system, for deep pointing mortar joints using the cut and plug brick replacement. Compressive strength grading M15 (15 Mpa), according to the product standard EN 998-2, and CS IV, according to the product standard EN 998-1. Density approx. 1850 kg/m^3, CE marked in accordance with EN 998-1/2.

Good reaction to fire

Damp supports

Ease of application

Compatible with masonry

PROPERTIES

- Good mechanical strength to compression.
- Excellent adhesion to masonry.
- Easy and quick to apply and finish.
- Pumpable with traditional plastering machines (e.g. PFT G4).

MORTAR FOR MASONRY

CE EN 998-1/2

Mortar

MX-15 Plaster
Compressive strength ≥ 15 MPa.

Ideal with the following meshes:

G-MESH 400 - G-MESH 490 and G-MESH 1000
B-MESH 200
STUCANET SN MESH

APPLICATIONS

- For preparing reinforced plasters - CRM system consisting of Ruregold G-MESH 400, G-MESH 490 and G-MESH 1000 alkali-resistant glass fibre meshes.
- For strengthening existing solid brick, tufa, and irregular stone masonry.
- Mortar for structural plasters, in compliance with the European Guidelines EAD 340392-00-0104 "CRM (Composite Reinforced Mortar) systems for strengthening concrete and masonry structures", issued in November 2018.
- As a scratch coat to prepare masonry (brick, tufa, stones) for the application of structural strengthening using composite materials.
- Reconstructing masonry using the cut and plug brick replacement technique.
- Strengthening existing masonry through repointing (reinforced and non-reinforced).

TECHNICAL SPECIFICATIONS

MORTAR MX-15 plaster	
Mixing water	approx. 4 - 4.5 litres (MI production) approx. 5.5 - 6 litres (SR production)
Grain size of aggregates	0-3 mm
Volumetric mass of fresh mortar	approx. 1850 kg/m^3
Compressive strength after 28 days	≥ 15 MPa
Reaction to fire (EN 13501-1)	Euroclass A1
Consistency of the mix	Thixotropic
Application time at 20°C	45 minutes
Application temperature	From +5°C up to +35°C
Minimum application thickness per coat	15 mm
Maximum application thickness per coat	30 mm
Coverage	For structural plaster: approx. 16.5 kg/m^2 per cm of thickness (MI production) approx. 15.0 kg/m^2 per cm of thickness (SR production)
	For bedding mortar: variable depending on masonry type.
Packaging	Disposable wooden pallet laden with 60 x 25 kg bags - total weight 1500 kg
CE Marking	EN 998-1/2
Storage conditions (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place.
Shelf life (Italian Ministerial Decree 10/05/2004)	Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

MX-RW HIGH PERFORMANCE

M45 high performance fibre-reinforced structural mortar for strengthening existing masonry.

MX-RW High Performance is a low-salt-content premix product based on highly pozzolanic hydraulic binder with selected aggregates, admixtures and polypropylene fibres. Its special composition has been designed to exclude the risk of chemical reactions with any salts (sulphates, carbonates, nitrates, chlorides, etc.) that may be present in older masonry. Adding water produces a thixotropic mortar that is highly adhesive to masonry, tufa and stonework, it is durable and suitable for repairs and structural plasters, without shrinkage.
Ready to use: just add water for thixotropic paste, without bleeding and segregation phenomena, that can be applied by trowel or spray. Where high aesthetic quality of surfaces is required, we recommended using a suitable skim coat.

Resistant to freeze/thaw cycles

Damp supports

Ease of application

Compatible with masonry

PROPERTIES

- Excellent mechanical performance.
- Polypropylene fibre admixture.
- Excellent adhesion to masonry.
- High pozzolanicity and low salt content.
- Easy to apply.
- Pumpable with traditional plastering machines (e.g. PFT G4).

MORTAR FOR MASONRY

CE EN 998-1/2

Mortar

MX-RW High Performance
Compressive strength ≥ 45 MPa.

Ideal with the following meshes:

G-MESH 400 - G-MESH 490 and G-MESH 1000
B-MESH 200
STUCANET SN MESH

APPLICATIONS

- For preparing reinforced plasters - CRM system consisting of Ruregold G-MESH 400, G-MESH 490 and G-MESH 1000 alkali-resistant glass fibre meshes.
- For strengthening existing solid brick, tufa, and irregular stone masonry.
- Mortar for structural plasters, in compliance with the European Guidelines EAD 340392-00-0104 "CRM (Composite Reinforced Mortar) systems for strengthening concrete and masonry structures", issued in November 2018.
- As a scratch coat to prepare masonry (brick, tufa, stones) for the application of structural strengthening using composite materials.
- Reconstructing masonry using the cut and plug brick replacement technique.
- Strengthening existing masonry through repointing (reinforced and non-reinforced).

TECHNICAL SPECIFICATIONS

MX-RW High Performance MORTAR	
Mixing water	approx. 4.7 - 5.0 litres
Grain size of aggregates	0-3 mm
Volumetric mass of fresh mortar	approx. 2050 kg/m^3
Compressive strength after 28 days	≥ 45 MPa
Reaction to fire (EN 13501-1)	Euroclass A1
Consistency of the mix	Thixotropic
Application time at 20°C	60 minutes
Application temperature	From +5°C up to +35°C
Minimum application thickness per coat	10 mm
Maximum application thickness per coat	30 mm
Coverage	For structural plaster: approx. 17 kg/m^2 per cm of thickness
	For bedding mortar: variable depending on masonry type.
Packaging	Disposable wooden pallet laden with 60 x 25 kg bags - total weight 1500 kg
CE marking	EN 998-1/2
Storage conditions (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place.
Shelf life (Italian Ministerial Decree 10/05/2004)	Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

MX-CP LIME

MORTAR FOR MASONRY

CE EN 998-1/2

M15 NHL 3.5 natural hydraulic lime-based structural mortar for structural repair of masonry.

MX-CP Lime is a natural NHL 3.5 hydraulic lime-based premix for repairing masonry, breathable and compatible with every time of masonry substrate. Adding water produces a mortar that is highly adhesive to masonry, tufa and stonework, it is durable and suitable for repairs and structural plasters. Ready to use bags of premix product: simply add water and mix to obtain a paste that may be applied either by hand or with a traditional plastering machine (e.g. PFT G4).
The porosity of the finished product permits sufficient permeability to water vapour. The mortar is highly resistant to aggressive agents.

Bio

Damp supports

Ease of application

Compatible with masonry

PROPERTIES

- Excellent compatibility with historic masonry walls.
- Eco-compatible hydraulic binder.
- Excellent adhesion to masonry.
- Excellent breathability.
- Easy and quick to apply and finish.
- Pumpable with traditional plastering machines (e.g. PFT G4).

Mortar

MX-CP Lime

NHL 3.5 Lime base.
Compressive strength ≥ 15 MPa.

Ideal with the following meshes:

G-MESH 400 - G-MESH 490 and G-MESH 1000
B-MESH 200
STUCANET SN MESH

APPLICATIONS

- For preparing reinforced plasters - CRM system consisting of Ruregold G-MESH 400, G-MESH 490 and G-MESH 1000 alkali-resistant glass fibre meshes.
- For strengthening existing solid brick, tufa, and irregular stone masonry.
- Mortar for structural plasters, in compliance with the European Guidelines EAD 340392-00-0104 "CRM (Composite Reinforced Mortar) systems for strengthening concrete and masonry structures", issued in November 2018.
- As a scratch coat to prepare masonry (brick, tufa, stones) for the application of structural strengthening using composite materials.
- Reconstructing masonry using the cut and plug brick replacement technique.
- Strengthening existing masonry through repointing (reinforced and non-reinforced).

TECHNICAL SPECIFICATIONS

MX-CP Lime MORTAR	
Mixing water	approx. 4 - 4.5 litres (MI production) approx. 5.5 - 6 litres (SR production)
Grain size of aggregates	0-3 mm
Volumetric mass of fresh mortar	approx. 1850 kg/m^3
Compressive strength after 28 days	≥ 15 MPa
Reaction to fire (EN 13501-1)	Euroclass A1
Consistency of the mix	Thixotropic
Application time at 20°C	45 minutes
Application temperature	From +5°C up to +35°C
Minimum application thickness per coat	15 mm
Maximum application thickness per coat	30 mm
Coverage	For structural plaster: approx. 16.5 kg/m^2 per cm of thickness (MI production) approx. 15.0 kg/m^2 per cm of thickness (SR production)
	For bedding mortar: variable depending on masonry type.
Packaging	Disposable wooden pallet laden with 60 x 25 kg bags - total weight 1500 kg
Storage conditions (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place.
Shelf life (Italian Ministerial Decree 10/05/2004)	Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

MX-PVA FIBRE REINFORCED

M45 polyvinyl-alcohol fibre-reinforced, high performance structural mortar for structural strengthening of existing masonry.

MX-PVA Fibre Reinforced is a low-salt-content premix based on highly pozzolanic hydraulic binder with selected aggregates, admixtures and high-modulus polyvinyl alcohol fibres. Its special composition has been designed to exclude the risk of chemical reactions with any salts (sulphates, carbonates, nitrates, chlorides, etc.) that may be present in older masonry. Adding water produces a thixotropic mortar that is highly adhesive, non-shrink, durable, and suitable for improving the ductility and toughness of masonry structures.
Ready to use: just add water for thixotropic paste, without bleeding and segregation phenomena, that can be applied by trowel or spray.
Where high aesthetic quality of surfaces is required, we recommended using a suitable skim coat.

Resistant to freeze/thaw cycles

Damp supports

Strain-hardening behaviour

Compatible with masonry

PROPERTIES

- Excellent capacity to absorb energy after cracking.
- Outstanding ductility and toughness.
- Increased tensile and bending strength, even after cracking.
- Excellent resistance to impacts and general wear and tear.
- No corrosion of the PVA fibres.
- Excellent adhesion to masonry.
- Excellent breathability.
- Highly resistant to attack by chemical agents (chlorides, sulphates, acid rain, carbon dioxide, etc.)
- Easy and quick to apply.

MORTAR FOR MASONRY

CE EN 998-1/2

Mortar

MX-PVA Fibre Reinforced
Compression resistance ≥ 45 MPa.

Accessories

HELICAL ANCHOR
Stainless steel bar for connection systems. Available in the following lengths:
200, 400, 600, 1000 mm.
For use with the **HELICAL GUIDE**.

G-MESH ANCHOR
Preformed GFRP alkali-resistant impregnated glass fibre connection element. Available in the following lengths:
200, 400, 600 mm x 100 mm width.
For use with chemical anchors (e.g. Adhesive Seismic Anchor 400) or MX-JOINT.

G-MESH GUSSET
35 x 35 mm mesh. Dimension:
ext. diam. 170 mm
int. diam. 30 mm.
For use with the **CONNECTORS**.

ADHESIVE SEISMIC ANCHOR 400
Two-component styrene-free vinylester chemical anchor for structural fasteners.

APPLICATIONS

- Repairing structures that are subject to shock loads and dynamic loads.
- Fibre-reinforced plasters (without mesh reinforcement) for repairing and reinstating the walls.
- Strengthening existing masonry through fibre-reinforced repointing.
- Repair work on structures that are exposed to severe chemical or environmental conditions.
- Repairing damaged masonry elements.
- As a scratch coat to prepare masonry (brick, tufa, stones) for the application of structural strengthening using composite materials.

TECHNICAL SPECIFICATIONS

MX-PVA Fibre-Reinforced MORTAR	
Mixing water per 25 kg bag	approx. 4.7 - 5 litres
Density	Approx. 2000 kg/m^3
Fresh mortar workability time (20°C)	approx. 30 - 45 min.
Reaction to fire (EN 13501-1)	Euroclass A1
Compressive strength after 28 days (EN 1015-11)	≥ 45 MPa
Rendering for structural plaster	approx. 17 kg/m^2 per cm of thickness
Maximum thickness per layer	10 - 40 mm
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
CE marking	EN 998-/2 - EN 1504-3 (R3)
Storage conditions and shelf-life (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

Substrate repair and preparation

Repairing the existing support in concrete and masonry and preparing it for the application of FRCM, FRP and Reinforced Plaster structural strengthening systems.

Introduction

When carrying out structural maintenance work, a good understanding of the element or structure where the work is to be carried out, so as to project actions designed to increase the level of safety isaessential.

In order to ensure correct interpretation of the performance specifications required of any given structural work, it is necessary to intervene on the **state and preparation of the support. The latter factors will affect the performance of the structural strengthening solutions** whether carried out using FRP or FRCM system, which **rely on adhesion to the substrate** (substrate detachment effect, sliding deformation limits), or reinforced plasters/CRM system.

Preparing the support for **FRP and FRCM systems**

When applying FRP and FRCM structural strengthening systems, the starting hypotheses are linked to the need for the system to **adhere perfectly to the support it is applied to** (r.c. or masonry element).

Depending on their respective resistance and preparation method, **masonry and concrete substrates** may lead to the efficacy of the work being overestimated.

For example, it is important to be aware that applying shrinking compensated mortars to substrates with low surface roughness may cause the concrete cover to become detached, nullifying the positive effects of the operation.

Due to the tendency of the metallic reinforcements to deteriorate, when **preparation work on the concrete substrate must be carried out in depth and cover all the areas affected by negative electrical potentials**: in other words, the work should not be limited to areas where there are evident signs of rust.

It is equally important to ensure that **connecting studs** are dimensioned correctly; if these elements are excessively rigid, they may concentrate high levels of tangential tension to the interface, resulting in peaks capable of causing localised de-lamination.

For the reasons set out above, the design guidelines for these systems focus on the existing substrate, the potential performance of the structural strengthening systems (FRP and FRCM) and the degree to which they are dependent on the nature of the substrate.

Repairing the **existing concrete**

The process of repairing the existing concrete involves **removing all the deteriorated and carbonated portions of the concrete, including the areas surrounding the iron parts to be treated**. The deteriorated concrete must be removed manually or mechanically, **so as to obtain a mechanically resistant surface that is sufficiently rough (roughness ≥ 5 mm)**. It is important to ensure the iron is free from loose pieces, grease, oil and rust. It is also recommended sandblasting the metal reinforcement to expose clean metal or, if this is not possible, brushing the surface of the metal thoroughly to achieve the same effect.

Any additional and/or replaced reinforcements must also be treated in the same way.
Once these preliminary operations are complete, **use a paintbrush to apply two coats of Ruregold PASSIVATOR anti-corrosive cementitious mortar** so as to cover the entire surface of the iron with an even layer.

Apply the product, as much as possible on the reinforcement completely colering the rebars.
The aim of applying the passivator to the iron is to raise the pH above the minimum level necessary to prevent it from corroding. It is also essential to ensure the passivator adheres correctly to the rebars, which means it must have a sufficient adhesion value on concrete.
After applying the anti-corrosive grout to the reinforcement rods so as to protect them, the next step is the volumetric reconstruction of the concrete cover.

The reinforced concrete cover may be repaired through volumetric reconstruction with Ruregold MX-R4 Repair mortar, applying the product manually with a trowel, or by using a plastering machine, so as to achieve a thickness of 20/25 mm per layer, applying each coat while the preceding one is still fresh. **MX-R4 Repair** polypropylene fibre-reinforced, cement-based controlled-shrinkage mortar with selected aggregates and super plasticizer admixtures.
MX-R4 Repair mortar meets the requirements of UNI EN 1504-9 (“Products and systems for the protection and repair of concrete structures: definitions, requirements, quality control and compliance assessment. General principles for use of the products and systems) and is **CE-marked** in accordance with the harmonised standard EN 1504-3 (Structural and non-structural repairs).

It is important to note that, after carrying out repairs using **MX-R4 Repair** type mortars, which require the substrate to be wet, **it is possible carry out structural strengthening work immediately using FRCM systems** (PBO and carbon fibres with inorganic matrix); whereas, in the case of **FRP systems** (with organic matrix), it is necessary **to wait until the substrate is completely dry** before applying the carbon fibres.

Repairing **existing masonry**

In existing buildings **the masonry is the result of an assemblage of different materials**, where the construction technique, the application methods, the mechanical characteristics of the constituent materials and their state of conservation **determine the mechanical behaviour of the construction as a whole**.

Naturally, it is beyond the scope of this section to cover every aspect of repair procedures for structural elements of masonry constructions. **In fact, the scope of the following paragraphs is to provide a series of tools and techniques** that may be used to improve the mechanical characteristics and properties of the masonry element, depending on the specific cases.
In particular, **by focusing on the actual condition of the masonry pier, it is possible to intervene through factors designed to increase the performance of the existing masonry structure**, regarding, respectively:

- high performance mortars;
- the presence of courses or edging;
- the systematic use of transversal connection elements.

By focusing on **strengthening procedures**, **the criteria and types of operations** it is possible to list a series of applications capable of improving the mechanical characteristics of the existing masonry structure by:

- injecting binder mixes;
- Applying reinforced plaster;
- Reinforced repointing with connection between walls.

It is also possible to consider **augmenting the load-bearing capacity of the walls** by implementing the following techniques:

- cut and plug brick replacement;
- repointing the mortar joints.

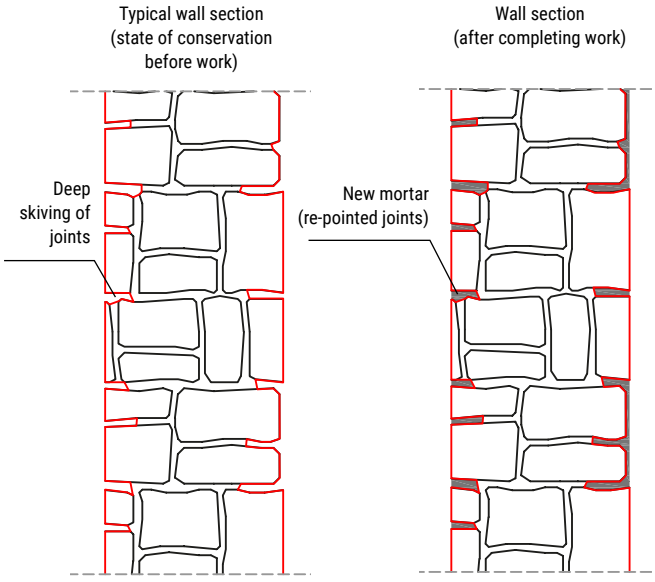
In the case of procedures based on **injecting binder mixes**, using special Ruregold **MX-INJECT NHL** grouts, it is also necessary to conduct a **feasibility study** to determine the capacity of the masonry to absorb and disperse the injected mortar; particular attention must be given to the pressure at which the mix is injected, so as to avoid causing localised instability. The operation should be conducted starting from the base and working upward.

Localised demolition, cut and plug brick replacement, and subsequent reconstruction should be conducted exercising the utmost caution, avoiding violent impacts and vibration during the demolition phase and implementing any safety measures that may be necessary.

The procedure is as follows:

1. remove the damaged part of the masonry;
2. **clean** the wall face using a low-pressure water jet;
3. reconstruct the masonry segments that were removed previously, replacing them with solid bricks, laying the latter using **mortar having similar physical-mechanical characteristics as the pre-existing type** such as Ruregold **MX-PVA Fibre-reinforced**, **MX-RW High Performance, MX-CP Lime** and **MX-15 Plaster** mortars.

In the case of **erosion of the mortar joint**, resulting in loss of function, is recommended **repointing the joints**; the repair and strengthening procedure is purely superficial (**MX-PVA**, **MX-RW, MX-CP** and **MX-15**).



MX-INJECT NHL

MASONRY REPAIRS

CE EN 998-2

Pozzolanic hydraulic binder for injection grouting, for masonry strengthening.

MX-INJECT NHL is a pozzolanic hydraulic binder with low salt content which, when mixed with water, forms injection grouts that are compatible with pre-existing masonry construction materials.
The special chemical composition of MX-INJECT NHL has been designed to exclude the risk of chemical reaction with any salts (sulphates, carbonates, chlorides, etc.) that may be present in older masonry.
MX-INJECT NHL mortar is used for structural strengthening of masonry.

PROPERTIES

- Consistency (plastic, fluid, super-fluid) gives good workability that varies depending on the dosages of the binder and water.
- Chemically and physically compatible with pre-existing masonry.
- Adequate mechanical properties.
- Good resistance to freeze-thaw cycles.
- Good resistance to attack by soluble salts.

Mortar

MX-INJECT NHL
Compressive strength ≥ 15 MPa.
Modulus of Elasticity ≥10 GPa.

TECHNICAL SPECIFICATIONS

MX-INJECT NHL GROUT	
Density	Approx. 2000 kg/m^3
Compressive strength after 28 days (EN 1015-11)	≥ 15 MPa
Modulus of elasticity after 28 days (EN 13412)	≥ 10 GPa
Coverage	approx. 50 holes/bag (hole Φ 3 cm and length 30 cm) Loose 1.54 kg/m^3
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
CE marking	EN 998-2
Storage conditions and shelf-life (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

PASSIVATOR

REPAIRING CONCRETE REBARS

CE EN 1504-7

Single-component powdered passivating grout for corrosion protection of steel, based on cementitious binders, synthetic resins, microsilica and corrosion-inhibiting admixtures.

APPLICATIONS

- Anti-corrosion protection for the rebars in reinforced concrete.
- Suitable for: re-alkalising and passivating rebars for concrete repair.
- Ideal for use before applying the respective thixotropic MX-R4 Repair mortar.

Mortar

PASSIVATOR

Anti-corrosion grout for concrete rebars.

TECHNICAL SPECIFICATIONS

PASSIVATOR MORTAR	
Appearance	Yellow powder
Application thickness	1 mm per coat
Mixing water for each 5 kg bucket	1.5 litres
Workability time | pot-life (temp. 20±2°C, r.h. 65±5%)	max 1 h.
Time between applying coats	r.c. 2 hours
Permitted application temperature	from + 5°C to + 35°C

HARDENED PRODUCT	
Density	1700 Kg/m^3
Anti-corrosion protection	Check passed
Coverage	approx.1.6 kg/m² per 1 mm thickness
Packaging	5 kg bin
CE marking	EN 1504-7:2006
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

MX-R4 REPAIR

Fibre-reinforced, thixotropic concrete repair mortar with compensated shrinkage.

MX-R4 Repair is a premix based on cement, selected aggregates, super plasticizer admixtures and polypropylene fibres, with shrinkage control agents in both the plastic phase and the hardened phase. Adding water produces a thixotropic mortar that is highly adhesive to concrete, brick and steel, it is durable and suitable for structural repairs and coatings, without shrinkage.
Ready to use: just add water for a thixotropic paste that can be applied by trowel or spray.
For surface finishes that guarantee high aesthetic quality, use a suitable skim coat.

Resistant to freeze/thaw cycles

Damp supports

Ease of application

PROPERTIES

- High mechanical resistance to compression and bending.
- Easy and quick to apply and finish.
- Modulus of elasticity and coefficient of thermal expansion similar to those of concrete.
- Resistance to sulphates (no degradation).
- Resistance to attack by chemical agents such as chlorides (de-icing salts, sea water, etc.), sulphates, acid rain, carbon dioxide.
- High impermeability to water and aggressive aqueous solutions.
- Resistance to freeze-thaw cycles even in the presence of de-icing salts.
- Absence of shrinkage cracking.
- Absence of bleeding.

CE EN 1504-3

Mortar

MX-R4 Repair

Compressive strength > 50 MPa.
Modulus of elasticity > 20 GPa.

APPLICATIONS

- Repairing damaged concrete elements.
- Regularising the concrete prior to applying the structural strengthening with composite materials.
- Reconstructing reinforced concrete beams, columns and slab joists.
- Repairing deteriorated concrete cover.
- Partial or total repair of prefabricated elements.

TECHNICAL SPECIFICATIONS

MX-R4 Repair mortar	
Mixing water per 25 kg bag	4.5 - 5 litres
Density	Approx. 2050 kg/m^3
Compressive strength after 28 days (EN 12190)	≥ 50 MPa
Flexural strength after 28 days (EN 196-1)	≥ 7 MPa
Modulus of elasticity after 28 days (EN 13412)	≥ 20 GPa
Chloride content	≥ 0.05 %
Adhesion bonding	≥ 2 MPa
Adhesion to concrete after 28 days (EN 1542)	≥ 2 MPa (the support yields)
Reaction to fire (EN 13501-1)	Euroclass A1
Resistance to sulphates (ASTM C88)	No degradation after 15 cycles
Coverage	approx. 17 kg/m^2 per 1 cm of thickness
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
CE marking	EN 1504-3 - Class R4
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

MX-R4 SUPER FLOW

High-performance fibre-reinforced pourable premixed mortar for concrete restoration (Class R4)

MX-R4 Super Flow is a premixed and fiber-reinforced product with PVA structural fibers.
After the addition of water, it results in a pourable mortar that can be pumped with piston or worm-screw plastering machines.
Ready to use: just add water to obtain a flowable mixture.

Castable

Ease of application

Fiber-reinforced with PVA structural fibers

Shrinkage compensation

PROPERTIES

- High mechanical resistance to compression and bending. Easy and quick to apply and finish.
- Modulus of elasticity and coefficient of thermal expansion similar to those of concrete.
- Resistance to attack by chemical agents such as chlorides (de-icing salts, sea water, etc.), carbon dioxide.
- High fluidity for operating on elements with complex geometry.
- No vibration required.

CE EN 1504-3 CE EN 1504-6

Mortar

MX-R4 SUPER FLOW

Compressive strength > 70 MPa.
Modulus of elasticity > 30 GPa.

APPLICATIONS

- Repairing and reconstruction of reinforced concrete columns and beams.
- Low-thickness jacketing of concrete columns and beams.
- Filling of rigid joints between concrete elements.
- Anchoring of new steel reinforcement.

TECHNICAL SPECIFICATIONS

MX-R4 Super Flow Mortar	
Mixing water per 25 kg bag	Approx. 3,5 litres
Density	Approx. 2300 kg/m^3
Compressive strength after 28 days (EN 12190)	≥ 50 MPa
Flexural strength after 28 days (EN 196-1)	≥ 70 MPa
Modulus of elasticity after 28 days (EN 13412)	≥ 10 GPa
Chloride content	≥ 0.05 %
Adhesion bonding	≥ 3 MPa
Pull out strength of steel rebar – displacement at load of 75 kN (EN 1881)	Displacement ≤ 0.6 mm
Reaction to fire (EN 13501-1)	Euroclass A1
Coverage	approx. 20 kg/m2 per 1 cm of thickness
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
CE marking	EN 1504-3 - Class R4 EN 1504-6
Storage conditions and shelf-life (E.D. 2003/53/EC)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

HPFRC Fibre reinforced concretes

Steel fibre-reinforced concrete for structural strengthening of columns, beams, beam-column joints and top strengthening concrete layers for slabs and decks.

Technical specifications

Fibre-reinforced concretes (FRC) are now widely used in numerous structural applications, **where they have taken supplanted (either partially or completely) traditional reinforcement solutions**.

This means that the designer can plan the work to be carried out in the knowledge that they are using a material having structural characteristics that differ with respect to normal concrete.

FRC concretes are composite materials consisting of a cementitious matrix (concrete or mortar) with the addition of short steel or synthetic fibres. Depending on the type of structural element where the work is to be carried out, these may be augmented by the use of ordinary or pre-compression reinforcements.
The addition of dispersed fibres to a cementitious type matrix modifies its mechanical properties.
The purpose of the fibres is to contrast the progressive widening of cracks by conferring significant residual tensile strength on the concrete post-cracking (toughness of FRC concrete).

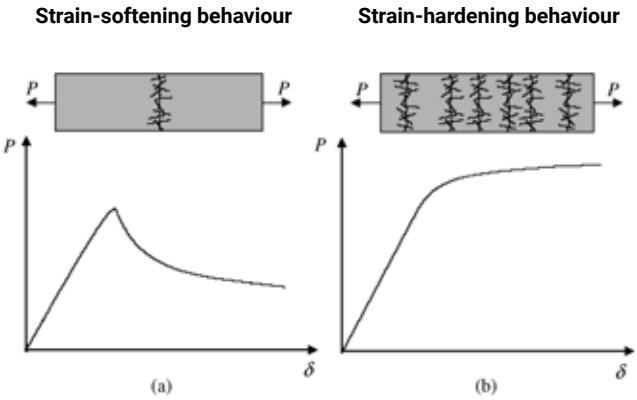
The **residual tensile strength**, and hence the specific energy required to rupture the conglomerate via, or reach levels sufficient to widen the predetermined cracks, depends on several factors, as follows:

- the aspect ratio of the fibre;
- the percentage of fibre by volume with respect to the total volume of the composite;
- the physical-mechanical characteristics of the fibres;
- the physical-mechanical characteristics of the cementitious matrix.

Thus **the fibres** are able to exert their influence by **conferring on the composite a post-cracking resistance** that is absent in non-fibre reinforced matrices, thanks to **the development of widespread cracking within the matrix**.

Stress-strain curve

Depending on the type and quantity of fibres and the properties of the matrix, the **stress-strain bond of an FRC may present a descending (or softening) branch**, which is, nevertheless, characterised by increased residual resistance and toughness with respect to non-fibre reinforced concrete, or a **strain-hardening branch, thanks to the appearance of multi-cracking**.



Reference and classification framework

Reference standards

The **reference standards** adopted for identification, qualification and **acceptance control certification** of FRC (Fibre Reinforced Concrete) at international level are as follows:

- **in the USA**, the Standard **ACI 544.4R "Guide to Design with Fibre-Reinforced Concrete"**
- the new **FIB Model Code 2010**, published in 2012;
- **the annex to Eurocode 2 on fibre-reinforced concrete. (annex L "Steel fibre reinforced concrete structures")**

In **Italy**, the following standards are adopted:

- CNR - DT 204/2006 "Instructions for Designing, Executing and Testing Structures in Fibre-reinforced Concrete".
- **"Guidelines for designing, implementing, checking and testing structural elements in steel and polymer fibre-reinforced concrete", issued by the Italian Ministry of Public Works in May 2022.**

In Italy, in accordance with the **CSLP Qualification Guidelines**, FRC composite materials must have completed the prescribed qualification process in its entirety and have the corresponding **Technical Evaluation Certificate (C.V.T.)**.

Classification of FRCs

FRCs are classified as follows:

- **standard performance**, for compressive strength up to **C45/55**;
- **high performance**, with compressive strength up to **C70/85**;
- **high strength**, with compressive strength greater than **C70/85** and up to**C90/105**;
- in the case of compressive strength ratings of greater than **C90/105**, the **UHPC** performance specifications are not covered by the current regulatory framework.

Concretes belonging to resistance classes listed above and characterised by a structural fibre content of greater than 0.3% by volume may be classified as follows:

- **FRC** (*Fibre Reinforced Concrete*);
- **HPFRC** (*High Performance Fibre Reinforced Concrete*);
- **UHPFRC** (*Ultra High - Performance Fibre Reinforced Concrete*).

This classification includes Ruregold's Micro Gold Steel concrete, which is classified as HPFRC: high performance and fibre-reinforced.

Characteristics of the composite and its components

The cementitious matrix of an FRC is characterised a concrete or mortar and should be designed paying particular attention to the **fine fraction of the aggregate, so as to guarantee good coupling with the fibres** and workability of the mix.

The **physical and mechanical characteristics of the matrix** must conform to the specific reference standard covering non-fibre reinforced concrete.

The fibres are characterised by the type of material, geometrical parameters such as length, the equivalent diameter, the aspect ratio and the shape. **Steel and polymer fibres must be CE-marked** according to EN 14889-1 and EN 14889-2, respectively.

Applications

Ruregold **Micro Gold Steel** high performance HPFRC fibre-reinforced concrete is used for a wide range of structural strengthening applications:

- Strengthening against shear and combined axial and flexural forces in reinforced concrete columns.
- Structural strengthening of beam-column joints panel;
- Strengthening against shear and combined axial and flexural forces in beams;
- Strengthening of existing collaborating top concrete slabs that are subject to traction.

Reinforced concrete columns

As has been noted, existing columns in reinforced concrete may be subject to **structural weaknesses** against the following stresses:

- insufficient capacity to resist combined axial and flexural forces;
- insufficient capacity to resist shear forces.

Therefore, the **requisites that must be satisfied by concrete columns** are as follows:

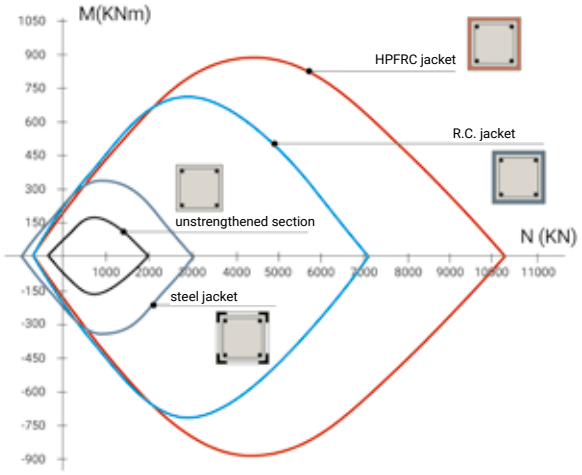
- appropriate rigidity of the element;
- sufficient resistance of the section;
- necessary ductility of the resisting element.

Thanks to the use of high performance, fibre-reinforced concretes, it is possible to **reduce the thickness of the material used to jacket the existing column**, thereby **quantity of reinforcement required** while **significantly increasing the performance specifications** of the strengthened element.

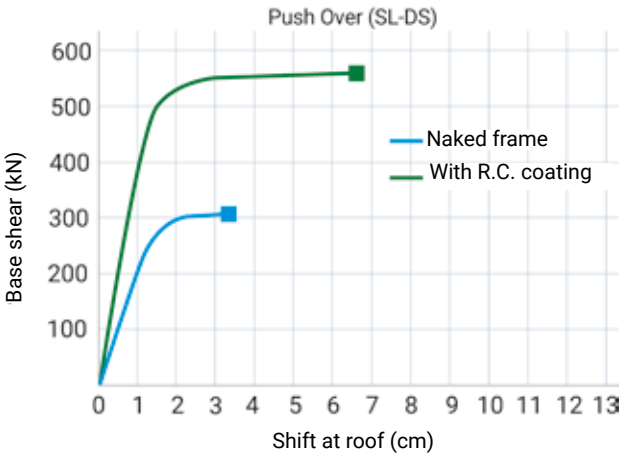
The following **example compares the increased resistance to normal actions** (column subject to combined axial and flexural forces) obtained with the following technologies:

- Initial, unstrengthened section;
- jacketing with steel plates;
- jacketing with traditional concrete (for example Gras Calce Compat Concrete);
- Jacketing with Ruregold HPFRC concrete.

It should be born in mind that, in the case of **reinforced concrete frame structure**, in which the initial section is

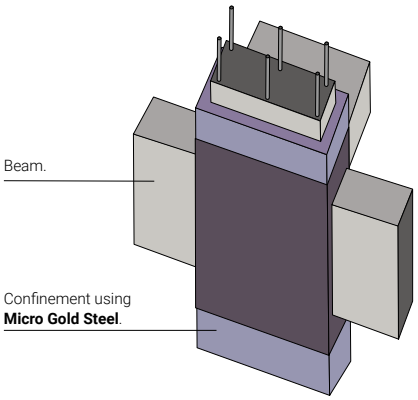


jacketed with high performance, fibre-reinforced concrete, the intervention is defined in terms of **increased ductility and resistance** of the element and the structure as a whole, but also the **rigidity** of the same.
By way of example, the following graph illustrates the PUSH-OVER curve of a frame structure reinforced using this technique, in which the increased resistance ductility can be plainly seen (also as a result of the rigidity of the strengthened structure).



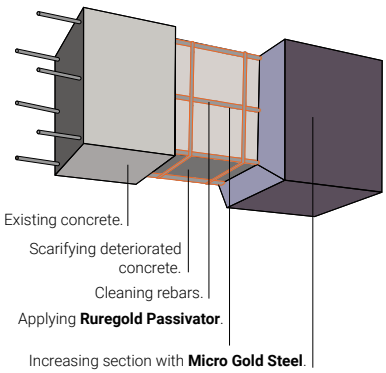
Beam-column joints panel

Reinforcing beam-column joints panels represents an interesting application for **increasing the capacity of the dissipation zones of reinforced concrete frames**.
This type of application is particularly useful when applied to the **non-confined portion of the joints panel**, by applying a jet of Ruregold micro-concrete.



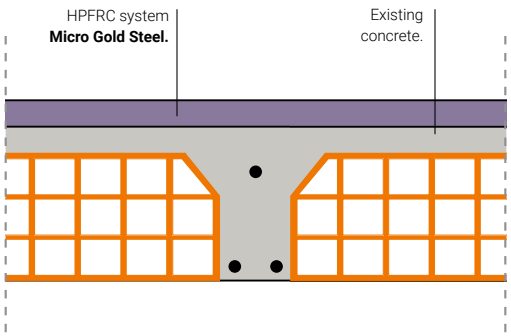
Strengthening against shear and combined axial and flexural forces in beams

On occasions it may be necessary to strengthen existing beams in reinforced concrete against flexural and shear forces, if increasing the section of the columns and beam-column joints panels **with FRCM and FRP structural strengthening systems is not sufficient**.
In such cases **it is necessary to increase the initial section using Ruregold micro-concrete**, capable of replacing and/or upgrading the original flexural and shear reinforcement where the section was insufficient.



Strengthening the extrados (upper side) of existing collaborating top concrete slabs

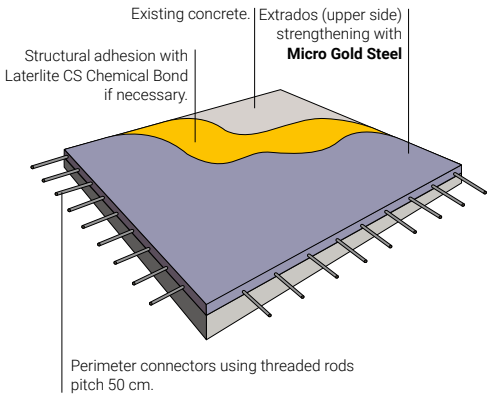
The use of Ruregold high performance micro-concretes, with their **high residual tensile strength on the extrados (upper side)** of collaborating top concrete slabs is important in the case of **floor decks with long, continuous spans resting on multiple supports**.
In such cases, the presence of a material that renders it possible to **work at reduced thicknesses (as little as 2 cm)** and the capacity to confer **residual tensile strength to the extrados (upper side) tension zone** contributes significantly towards ensuring the load-bearing structure satisfies the required performance specifications.



Another potential use on the extrados (upper side) of existing collaborating top concrete slabs is characterised by its capacity to **absorb high loads concentrated in low thicknesses**.

Download the Technical Handbook and the construction details for AutoCAD

DWG



Mechanical specifications

The role of distributed micro-cracking

Once matrix cracking has been achieved, the fibres are able to exert their influence, **conferring a post-cracking resistance on the composite**, which is absent in the non-fibre reinforced matrix.

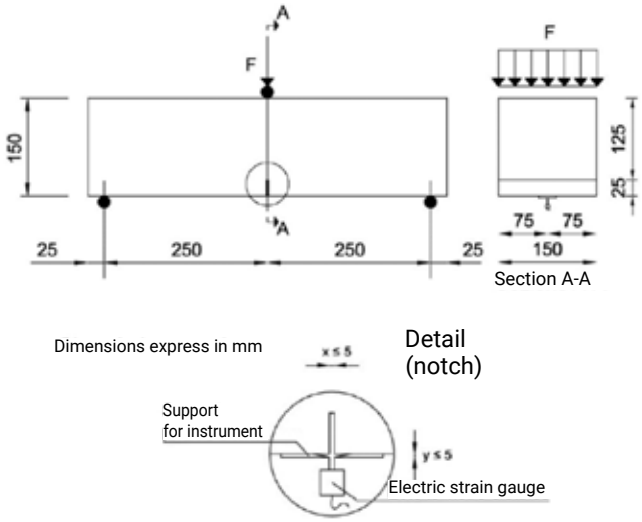
Provided ultimate limit state matrix cracking is achieved, strengthening existing structures using fibre-reinforced micro-concretes makes it possible to **dissipate energy** via the distributed micro-cracks that are formed within the composite.

Determining residual tensile strength and performance classes

The **performance specifications requested of FRC concrete** and hence high performance micro-concrete, are as follows:

- compressive strength;
- consistency;
- exposure;
- limit of proportionality;
- toughness.

In particular, the parameters **compressive strength, consistency and exposure** depend on the characteristics of the matrix and its rheology; for example, the Modulus of elasticity and Poisson's ratio have been determined for the non-fibre reinforced matrix.
The **limit of proportionality and toughness class** are determined by carrying out a bending test on a sample with a centrally positioned crack, a section of 150 x 150 mm (b x h) and length 500-700 mm, supporting the sample at its extremities and subjecting it to a centrally positioned load - as per EN 14651.



The test involves measuring the applied load while monitoring the opening of the crack mouth (**CMOD** - *Crack Mouth Opening Displacement*).

The following parameters are determined, with reference to the individual test:

- **Limit of proportionality** and **residual strength** at crack mouth opening values of 0.5 mm and 2.5 mm.
  By convention, this parameter is defined as follows:

$$f^{f}_{ct,L} = \frac{3F_L L}{2bh^2_{sp}}$$

  where F_L represents the maximum force applied and L the distance between the supports.
- **the toughness class** as the ratio between the residual tensile bending strength in the presence of a crack mouth opening of 2.5 mm and 0.5 mm.

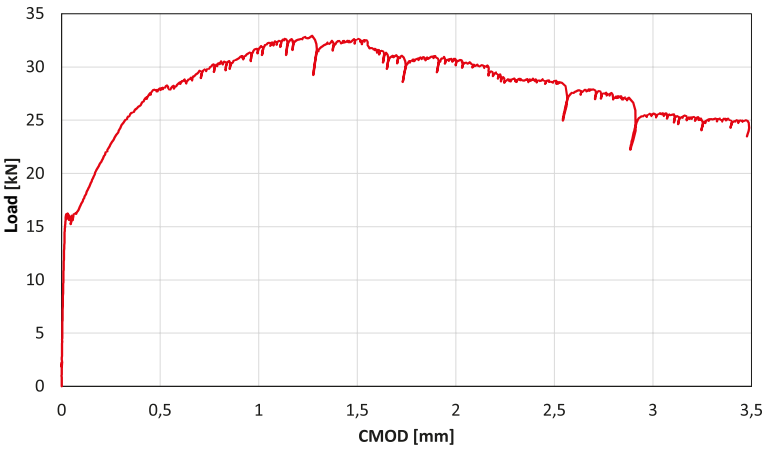
Fibre-reinforced concrete is suitable for **use in structural elements** provided the following relationships are respected:

$$f_{R,1k} / f^{f}_{ct,Lk} > 0,4$$
$$f_{R,3k} / f_{R,1k} > 0,5$$

In order to **classify post-cracking behaviour** it is necessary to define the residual tensile strength in the presence of a crack mouth opening of 0.5 mm (f_{R1}), in the test defined in EN 14651, and the ratio between residual tensile strength at 2.5 mm and 0.5, mm respectively (f_{R3}/f_{R1}). These values are used to define the various toughness classes of the fibre-reinforced concrete.
The following residual **tensile strength curves** were obtained for **Micro Gold Steel** during the ministerial qualification process.

It should also be noted that Ruregold **Micro Gold Steel passed a series of additional test** regarding adhesion following freeze/thaw treatment with de-icing salts, which represents a particularly important parameter in the ambit of infrastructure.

MicroGold Steel CMOD characterisation



CMOD	MICRO GOLD STEEL - f_{Rj}*
0.5 mm	9.39 MPa
1.5 mm	10.83 MPa
2.5 mm	9.68 MPa
3.5 mm	8.41 MPa

* the average residual tensile strength values obtained when conducting the tests defined in EN 14651 were recorded

MICRO GOLD STEEL

High-ductility, high-fluidity fibre-reinforced cementitious mortar (HPFRC) for structural strengthening of concrete elements.

MICRO GOLD STEEL is a metal fibre-reinforced premix product designed to improve seismic resistance and strengthen reinforced concrete structures, even without the use of additional metallic elements. Adding water produces a pourable mortar that is highly adhesive to any type of substrate and guarantees excellent ductility and durability. Unlike traditional fibre-reinforced structural mortars, its post-cracking behaviour is characterised by increased residual tensile strength. This mechanical behaviour, characterised by an extremely high capacity to absorb energy, means MICRO GOLD STEEL is ideal for enhancing the seismic performance of a range of reinforced concrete structures, at thicknesses varying between 20 and 50 mm.

Resistant to freeze/thaw cycles

Good reaction to fire

Strain-hardening behaviour

Ease of application

PROPERTIES

- The presence of metal fibres in the cementitious matrix enhances its mechanical characteristics.
- Extremely ductile and enhanced toughness with respect to traditional fibre-reinforced mortars.
- During the post-cracking phase, the three dimensional contribution of the fibres increases its energy absorption capacity.
- High mechanical resistance to compression and bending.
- Capable of supporting loads even after initial cracking.
- Easy and quick to apply and finish.
- Resistance to freeze-thaw cycles.
- Mechanical performance specifications certified by qualification testing.

CE EN 1504-3/6

Fibre Reinforced concrete

MICRO GOLD STEEL
Compression resistance class C80/95
Modulus of elasticity ≥ 42 GPa
Available in units of approx. 103.5 kg consisting of:
Part A 4 x 25 kg bags of dry premix
Part B 1 x 3.5 kg box of steel fibres.

APPLICATIONS

- Low-thickness jacketing (20-50 mm), also without reinforcement, on reinforced concrete structures: beams, joints, foundations and walls.
- Low-thickness collaborating top concrete slabs (20-50 mm) on concrete and steel slabs, timber floors and on concrete beam and block floors (slabs made of concrete joists and infill blocks or bricks).
- Restoring reinforced concrete beams and columns.
- Refurbishing decks on bridge structures.
- Refurbishing of tunnel covers.
- Repairing special paving (airport runways, etc...)

TECHNICAL SPECIFICATIONS

MICRO GOLD STEEL FIBRE REINFORCED CONCRETE	
Grain size of aggregates	0-3 mm (0-0.118 in)
Mixing water for 4 bags of dry premix (100 kg) + 1 box of fibres (3.5 kg)	12-14 litres
Consistency (EN 12350)	SF3
Consistency of the mix	Super plastic (Self-compacting)
Density	Approx. 2300 kg/m^3 (143.6 lb/ft^3)
Compressive strength (EN 12390)	C80/95
Compressive strength after 28 days (EN 1504-3)	Class R4 (≥ 110 MPa) (≥ 15954.1psi)
Tenacity (EN 14651)	7d
Tensile strength after 28 days - typical	≥ 3.39 MPa (≥ 491.7 psi)
Modulus of elasticity in compression after 28 days (L.G.FRC)	≥ 42.42 GPa (≥ 6152.5 ksi)
Adhesion bond (EN 1542)	≥ 2 MPa (≥ 290.7 psi)
Resistance to accelerated carbonatisation	Check passed
Coverage	approx. 20.0 kg/m^2 (4.1 lb/ft^3) per cm (0.39 1n) of thickness
Packaging	Disposable wooden pallets laden with 60 x 25 Kg (55 lb) bags, equivalent to 1500 kg (3300 lb) of loose product + 15 x 3.5 kg (3.5 lb) boxes, equivalent to 49 kg (part B)
CE marking	EN 1504-3/6
Storage conditions and shelf-life (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

Wall overturn protection

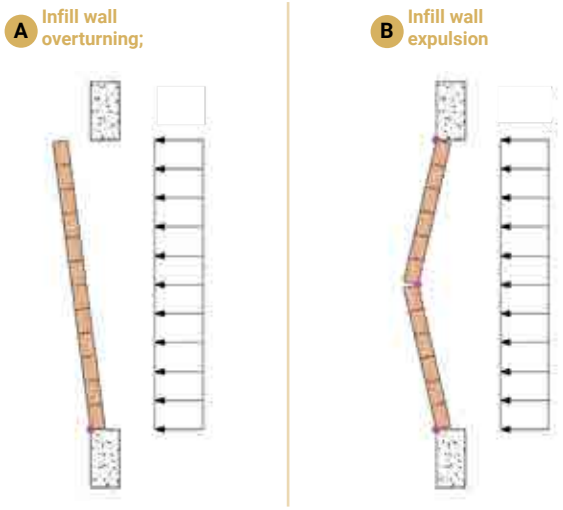
Systems for securing internal and external infill walls.

Overturn protection systems
for internal and external infill walls.

During an earthquake, seismic activity affects the building in all directions, also subjecting non-structural elements to stress (initially the external infill walls and subsequently the internal ones), causing them to overturn or be expelled from the building envelope, putting people's lives at risk.
Thus, while it does not affect the structural response, the design of infill walls represents a significant factor with regard to safety and/or well-being of persons.
Depending on the degree of solidarity with the structure, when subjected to seismic activity infill walls may manifest the following collapse mechanisms:

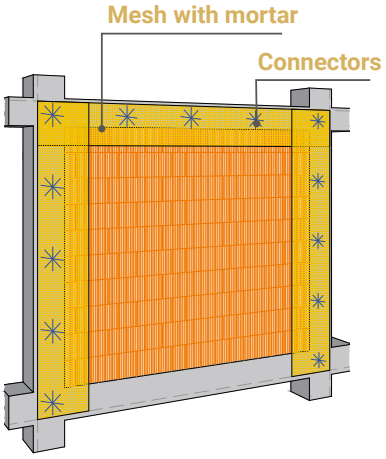
A infill wall overturning;

B infill wall expulsion.



A Infill wall overturning;

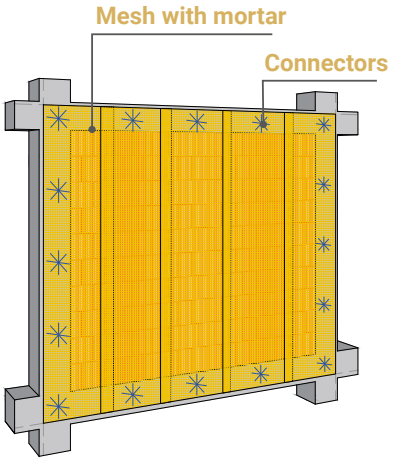
This mechanism involves the rigid rotation of the infill wall around the horizontal hinge at the base, which forms due to the actions of out-of-plane stresses. For this mechanism to occur, the wall must be free to move at the top and not be sufficiently restrained to the walls perpendicular to it (or the perpendicular walls must be weakened).
To avoid the risk of overturning, internal and external infill walls are secured to the structural frame using Ruregold meshes and connectors.



Frame layout external infill wall

B Infill wall expulsion

When the infill wall is integral with the surrounding frame, a three-hinge arc-type collapse mechanism may occur due to concentration of the flexural capacity in the centreline section. This mechanism may occur when the infill wall is constrained between two slabs so that the presence of a connection device at the top prevents the wall from tipping outwards, resulting, instead, in a bulge between the two affected planes (which degenerates into three-hinge arc kinematics).
The external infill wall is secured by applying Ruregold meshes and connectors arranged in a diffuse or grid configuration, as necessary.



Diffused layout

RUREGOLD SOLUTIONS

Ruregold offers a range of solutions, depending on the specific construction and design requirements:

- 10/10 g/m^2 bidirectional PBO mesh (**PBO-MESH 10/10**) with **MX-PBO Masonry** mortar, and **PBO-JOINT** connectors (and corresponding **MX-JOINT** mortar).
- 42/42 g/m^2 bidirectional carbon mesh (**C-MESH 42/42**), with **MX-C 25 Masonry** mortar, and **C-JOINT** connectors. (and corresponding **MX-JOINT** mortar).
- Basalt fibre mesh (**B-MESH 200**), with **MX-RW High Performance /MX-CP Lime /MX-15 Plaster /MX-C 25 Masonry /MX-PBO Masonry** mortar and **B-JOINT** connectors (and corresponding **MX-JOINT** mortar).
- Electrowelded, highly galvanised steel mesh (**STUCANET SN MESH**) with **MX-RW High Performance/MX-CP Lime/ MX-15 Plaster** mortar.

VERIFICATION OF INFILL WALLS IN ACCORDANCE WITH ITALIAN MINISTERIAL DECREE 2018

As has already been noted, the 2018 Technical Construction Regulations pay particular attention to the design of non-structural elements, since such elements may still collapse and compromise the overall safety of structures.

The checks on the non-structural elements required by Italian Ministerial Decree 2018 are illustrated in the following Table 7.3.III, depending on the class of use of the building (CU I, CU II, CU III, as defined in § 2.4.2) and the limit state taken into account. It can be seen that, for non-structural elements (indicated as "NS"), stability checks (indicated as "STA"), are necessary only for classes of use from 2 to 4 (meaning that only structures with the occasional presence of people and agricultural buildings are excluded) and only as far as regards the Life Safety Limit State (LSLS).

Limits states of primary structural elements (ST), non-structural elements (NS) and plant (IM).

LIMITS STATES		CU I	CU II			CU III and IV		
		ST	ST	NS	IM	ST	NS	IM(*)
SLS	SLO					RIG		FUN
	SLD	RIG	RES			RES		
ULS	VLS	RES	RES	STA	STA	RES	STA	STA
	SLC		DUT(**)			DUT(**)		

The Damage control (at the Damage Limit State (DLS), or, if requested, at the Operating Limit State) on non-structural elements, as clarified at § C7.3.6.2 of the 2019 Explanatory Circular to the Italian Ministerial Decree of 2018, is not the subject of a specific verification, as it is already guaranteed by compliance with the checks on the containment stiffness of the relative plane displacements, as per § 7.3.6.1 for structural elements.

If it is necessary to carry out stability checks, § 7.3.6.2 of Italian Ministerial Decree 2018 requires that the non-structural element is not "expelled" under the equivalent seismic action (identified as Fa).

PBO-MESH 10/10

Infill wall overturn protection consisting of 10 + 10 g/m² biaxial PBO mesh and MX-PBO Masonry inorganic matrix.

Thanks to the low grammage of the PBO mesh and the specific inorganic matrix for masonry structures, it is ideal for internal partition and external infill wall overturn protection.

- Bio
- Damp supports
- Vapour permeability
- Safety system
- Non-toxic matrix
- Good reaction to fire

SYSTEM PROPERTIES

- Reduced risk of triggering local overturn mechanisms in internal partitions.
- Reduced risk of triggering local overturn and collapse mechanisms in external infill walls.
- Reduction of local collapse mechanisms in non-structural elements.
- No increase of the participating masses and modification to the stiffness of the structure.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

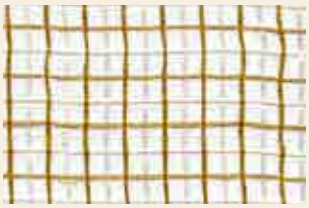
WALL OVERTURN PROTECTION

SYSTEM ELEMENTS

Mesh

PBO-MESH 10/10

Bi-directional PBO fibre mesh, weighing 20 g/m², uniformly distributed in weft and warp.
Available in:
- H 100 cm, 15 m reel.



Inorganic matrix

MX-PBO Masonry

Cementitious fibre-reinforced inorganic matrix for use with PBO-MESH 10/10 mesh on masonry structures.

Anchor

PBO-JOINT

PBO fibre anchor.
Available in:
- Ø 3 mm, dispenser 10 m
- Ø 6 mm, dispenser 10 m.

Inorganic matrix

MX-JOINT

Inorganic matrix for impregnation and application of the PBO-JOINT fibre anchor.

APPLICATIONS

- Overturn protection for internal partitions.
- Overturn protection for external infill walls.
- Connecting non-structural elements with the reinforced concrete structure of beams and columns.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

PBO FIBRE	
Toughness	5.8 GPa
Strain at rupture	2.5%
Modulus of elasticity of PBO fibre	270 GPa

PBO-MESH 10/10	
Weight of the PBO fibres	10 g/m^2 in warp and 10 g/m^2 in weft
Equivalent thickness of the mesh in warp	0.0064 mm
Equivalent thickness of the mesh in weft	0.0064 mm
Products	H 100 cm, 15 m reel
Storage	Indoors, in a cool, dry place

MX-PBO Masonry inorganic matrix	
Density	Approx. 1750 kg/m^3
Compressive strength after 28 days (EN 12190)	≥ 20 MPa
Coverage	approx. 11.4 kg/m^2 per strengthening layer (4+4 mm) approx. 17.1 kg/m^2 per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
CE marking	UNI EN 998-2
Storage conditions and shelf-life (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

See page 35 for the technical specifications of the products PBO-JOINT and MX-JOINT inorganic matrix.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

C-MESH 42/42

Wall overturn protection consisting of 42+42 g/m² biaxial carbon mesh and MX-C 25 Masonry inorganic matrix.

Thanks to the low grammage of the carbon mesh and the specific inorganic matrix for masonry structures, it is ideal for internal partition and external infill wall overturn protection.

- Bio
- Damp supports
- Vapour permeability
- Ease of application
- Reversible
- Good reaction to fire

SYSTEM PROPERTIES

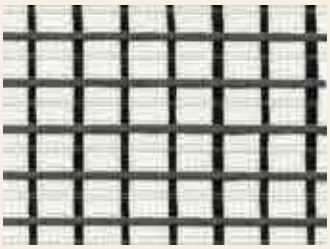
- Reduced risk of triggering local overturn mechanisms in internal partitions.
- Reduced risk of triggering local overturn and collapse mechanisms in external infill walls.
- Reduction of local collapse mechanisms in non-structural elements.
- No increase of the participating masses and modification to the stiffness of the structure.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

WALL OVERTURN PROTECTION

SYSTEM ELEMENTS

Mesh

C-MESH 42/42
Bi-directional carbon fibre mesh weighing 84 g/m², uniformly distributed in weft and warp.
Available in:
• H 100 cm, 15 m reel.



Inorganic matrix

MX-C 25 Masonry
Cementitious fibre-reinforced inorganic matrix for use with C-MESH 42/42 mesh on masonry structures.
Ideal for optimising the transfer of stresses from the structural element to the strengthening mesh.

Anchor

C-JOINT
Carbon fibre anchor.
Available in:
• Ø 6 mm, dispenser 10 m
• Ø 10 mm, dispenser 10 m.

Inorganic matrix

MX-JOINT
Inorganic matrix for impregnating and anchoring the C-JOINT fibre anchor.

APPLICATIONS

- Overturn protection for internal partitions.
- Overturn protection for external infill walls.
- Connecting non-structural elements with the reinforced concrete structure of beams and columns.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

CARBON FIBRE	
Toughness	4.9 GPa
Strain at rupture	1.9%
Modulus of elasticity of Carbon fibre	250 GPa

C-MESH 42/42	
Weight of the carbon fibres	42 g/m^2 in warp and 42 g/m^2 in weft
Equivalent thickness of the mesh in warp	0.023 mm
Equivalent thickness of the mesh in weft	0.023 mm
Products	H 100 cm, 15 m reel
Storage	In a cool, dry place

MX-C 25 MASONRY inorganic matrix	
Density	Approx. 1750 kg/m^3
Compressive strength after 28 days (EN 12190)	≥ 20 MPa
Coverage	approx. 11.3 kg/m^2 per strengthening layer (4+4 mm) approx. 17 kg/m^2 per double strengthening layer (4+4+4 mm)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
CE marking	UNI EN 998-2
Storage conditions and shelf-life (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

See page 43 for the technical specifications of the products C-JOINT and MX-JOINT inorganic matrix.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

A-MESH 45/45

FRCM overturn protection consisting of 45 + 45 g/m² biaxial aramid mesh and MX-NHL Masonry inorganic matrix.

Due to the natural hydraulic lime content, the system presents enhanced masonry compatibility.
Thanks to grammage of the Aramid mesh and the specific inorganic matrix, it is ideal for internal partition and external infill wall anti-overturn protection.

- Bio
- Damp supports
- Vapour permeability
- Safety system
- Non-toxic matrix
- Good reaction to fire

SYSTEM PROPERTIES

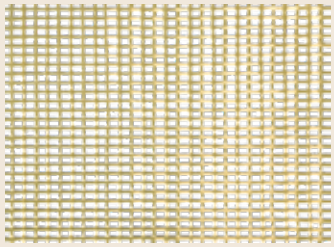
- Basalt fibre reinforcement.
- Reduced risk of triggering local overturn mechanisms in internal partitions.
- Reduced risk of triggering local overturn and collapse mechanisms in external infill walls.
- Reduction of local collapse mechanisms in non-structural elements.
- No increase of the participating masses and modification to the stiffness of the structure.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is manageable and easy to apply.

WALL OVERTURN PROTECTION

SYSTEM ELEMENTS

Mesh

A-MESH 45/45
Bi-directional Aramid fibre mesh, weighing 90 g/m², uniformly distributed in weft and warp.
Available in:
• H 100 cm, 30 m reel



Inorganic matrix

MX-NHL Masonry
Inorganic fiber-reinforced lime-based matrix for overturning protection systems in low thickness for use with A-MESH 45/45 on masonry structures.

Anchor

A-JOINT
Aramide fibre anchor.
Available in:
• Ø 6 mm, dispenser 10 m

Inorganic matrix

MX-JOINT
Inorganic matrix for impregnating and anchoring the C-JOINT fibre anchor.

APPLICATIONS

- Overturn protection for internal partitions and external infill walls.
- Connecting non-structural elements with the rein¬forced concrete structure of beams and columns.
- Crack stitching in masonry .

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

ARAMID FIBRE	
Toughness	2.9 GPa
Strain at rupture	3.7%
Modulus of elasticity of Carbon fibre	67 GPa

A-MESH 45/45	
Weight of the carbon fibres	45 g/m^2 in warp and 45 g/m^2 in weft
Equivalent thickness of the mesh in warp	0.0031 mm^2/mm
Equivalent thickness of the mesh in weft	0.0031 mm^2/mm
Products	H 100 cm, 30 m reel
Storage	Indoors, in a cool, dry place

MX-NHL Masonry inorganic matrix	
Density	Approx. 1800 kg/m^3
Compressive strength after 28 days (EN 12190)	≥ 20 MPa
Coverage	approx. 11.8 kg/m^2 per strengthening layer (4+4 mm)
Packaging	approx. 17.7 kg/m^2 per double strengthening layer (4+4+4 mm)
CE marking	Disposable wooden pallets laden with 60 x 25 kg bags, equivalent to 1500 kg of loose product
Storage conditions and shelf-life (Italian Ministerial Decree 10/05/2004)	UNI EN 998-2

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

STUCANET SN MESH

Electrowelded, highly galvanised steel mesh for internal partition and external infill wall anti-overturn systems.

STUCANET SN MESH is suitable for internal partition and external infill walls overturn protection, connected to the support and used together with MX-RW High Performance, MX-CP Lime, MX-15 Plaster high-thickness mortars for structural plaster.

- Good reaction to fire
- Damp supports
- Vapour permeability
- Ease of application
- Bio
- Resistant to freeze/thaw cycles

SYSTEM PROPERTIES

- Steel reinforcement.
- Ease of installation.
- Practical.

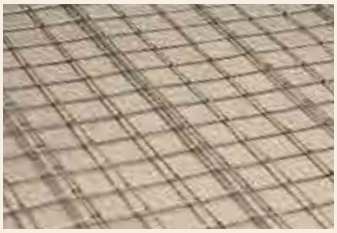
WALL OVERTURN PROTECTION

SYSTEM ELEMENTS

Mesh

STUCANET SN MESH

Galvanised steel mesh in 2.40 x 0.70 m (1.68 m^2) panels.



Mortar

MX-RW High Performance

Compressive strength ≥ 45 MPa.

MX-CP Lime

NHL 3.5 Lime base. Compressive strength ≥ 15 MPa.

MX-15 Plaster

Compressive strength ≥ 15 MPa.

APPLICATIONS

- Wall overturn protection for non-structural elements.
- Making internal partitions and walls safe.
- Making external frame infill walls in reinforced concrete safe.
- Ceiling shatter protection.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

STUCANET	SN MESH
Longitudinal and transversal strands	1.5 mm
Strengthening strands	1.5 + 2.0 mm
Mesh dimensions	38 x 50 mm
Lateral mesh dimensions	38 x 27 mm
Tensile strength	> 350 N/mm^2
Zinc coating	60 g/m^2
Coverage	Allow for overlap of at least 10 cm
Products	2.40 x 0.70 m (1.68 m^2) panels in bundles of 15 panels - 25 bundles per pallet

Mortar for plaster	MX-RW High Performance	MX-CP Lime	MX-15 Plaster
Compressive strength at 28 days.	≥ 45 MPa	≥ 15 MPa	≥ 15 MPa
Coverage	approx. 17 kg/m^2 per cm of thickness	approx. 16.5 kg/m^2 per cm of thickness (MI production) approx. 15.0 kg/m^2 per cm of thickness (SR production)	approx. 16.5 kg/m^2 per cm of thickness (MI production) approx. 15.0 kg/m^2 per cm of thickness (SR production)
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg
Further information	page 68 product data sheet	page 70 product data sheet	page 66 product data sheet

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

B-MESH 200

Resin coated basalt fibre mesh for internal partition and external infill wall overturn protection systems.

B-MESH 200 is a 220 g/m² grammage, basalt fibre mesh, suitable for internal partition and external infill walls overturn protection, used together with the B-JOINT anchor and MX-RW High Performance, MX-CP Lime, MX-15 Plaster high-thickness mortars for structural plaster and MX-C 25 Masonry or MX-PBO Masonry low-thickness mortar.

- Good reaction to fire
- Damp supports
- Vapour permeability
- Ease of application
- Bio
- Resistant to freeze/thaw cycles

SYSTEM PROPERTIES

- Basalt fibre reinforcement.
- Ease of installation.
- Practical.

CRM WALL OVERTURN PROTECTION

SYSTEM ELEMENTS

Mesh

B-MESH 200

Grammage 220 g/m².
25x25 mm mesh
H 1 cm, 50 m reel.

Mortar

MX-RW High Performance
Compressive strength ≥ 45 MPa.

MX-CP Lime
NHL 3.5 Lime base.
Compressive strength ≥ 15 MPa.

MX-15 Plaster
Compressive strength ≥ 15 MPa.

MX-C 25 Masonry
Compressive strength ≥ 20 MPa.

MX-PBO Masonry
Compressive strength ≥ 20 MPa.

MX-NHL Masonry
Inorganic fiber-reinforced lime-based

Anchor

B-JOINT

Basalt fibre anchor,
available in:
• Ø 10 mm, dispenser 10 m.

Inorganic matrix

MX-JOINT

Inorganic matrix for impregnating and anchoring the B-JOINT fibre anchor.

Inorganic matrix

MX-NHL Masonry

APPLICATIONS

- Wall overturn protection for non-structural elements.
- Making internal partitions and walls safe.
- Making external frame infill walls in reinforced concrete safe.
- Ceiling shatter protection.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

MESH	B-MESH 200
Density of the fibre	2.67 g/cm^3
Tensile breaking strength of the mesh	≥ 50 kN/m
Mesh dimensions	25 x 25 mm
Weight of the mesh	200 g/m^2
Products	H 1 cm, 50 m reel

MORTAR FOR PLASTER	MX-RW High Performance	MX-CP Lime	MX-15 Plaster	MX-C 25 Masonry	MX-PBO Masonry
Compressive strength at 28 days.	≥ 45 MPa	≥ 15 MPa	≥ 15 MPa	≥ 20 MPa	≥ 20 MPa
Coverage	17 kg/m^2 per 1 cm th.	16.5 kg/m^2 per 1 cm th. (MI Production) 15.0 kg/m^2 per 1 cm th. (SR Production)	16.5 kg/m^2 per 1 cm th. (MI Production) 15.0 kg/m^2 per 1 cm th. (SR Production)	1.3 kg/m^2 per 1 mm th.	1.3 kg/m^2 per 1 mm th.
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
For more information see page	68 product data sheet	70 product data sheet	66 product data sheet	41 product data sheet	31 product data sheet

B-JOINT ANCHOR	
Nominal diameter of the fibre anchor	10 mm
Tensile strength (characteristic)	700 MPa
Ultimate strain	0.95 %
Modulus of elasticity	84 GPa
Packaging	Ø 10 mm, dispenser 10 m

MX-JOINT INORGANIC MATRIX	
Density	Approx. 2000 kg/m^3
Compressive strength after 28 days	≥ 25.0 MPa
Coverage	approx. 10 kg per 10 m of anchor
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
Further information	see page 43 product data sheet

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

Ceiling shatter protection systems

Passive or active protection systems against detachment of ceiling fragments from floor slabs.

The **phenomenon** of **shatter and falling of ceiling fragments**

"Shatter and falling of ceiling components" is defined as the condition **where the lower panels of the lightening blocks inserted in the mixed concrete beam and block floor (slabs made of concrete joists and infill blocks or bricks) become detached and then fall**. These blocks may be used exclusively for lightening or they may also play a structural role.
Irrespective of whether they are used simply for lightening purposes or form an integral part of the building structure, these lightening blocks may constitute a hazard for persons or property in the event they are damaged or collapse, even partially.

The **possible causes of shatter and falling of ceiling fragments**, on cast-in-place slabs include:

- **poor workmanship**, in particular, the presence of steels bars positioned on the bottom of the joist in contact with the brickwork, resulting in an irregular and discontinuous concrete cover;
- **elevated grain size of the aggregates present in the concrete** with respect to the geometry of the joist, together with a failure to vibrate the concrete correctly (or at all) when casting;
- **misalignment of the vertical piers of the blocks**, resulting in a concentration of stresses in the joints, which, unable to transmit them to the horizontal piers, damaging the lower panels and causing them to collapse;
- **design errors,** such as excessive differences between slab spans, which may cause entire portions of the shorter slabs to collapse ("arch" effect). Or beam spans similar to those of the slabs which may trigger "plate" mechanisms that are difficult to evaluate 'a priori'.
- **phenomena attributable to external actions or events** occurring during the service life of the construction, such as water leaks, the presence of suspended loads, etc.

The phenomenon of shatter and falling of ceiling fragments expands and evolves over time as the consequence of several different factors and requires **timely intervention** to **render affected structures safe.**

Hazardousness of shatter and falling of ceiling fragments, caused by the **failure of the lower panels of the hollow-core infill blocks** with **separation and collapse of the slab** (including extensive surfaces and significant falling loads).

Shatter and falling of ceiling fragments caused by water leaks, resulting in **expansion of the brickwork,** and accelerated **ageing of the intrados (lower side)** of the slab, coupled with **corrosive oxidisation of the joist concrete rebars**.

Diagnosis and procedures for repairing slabs

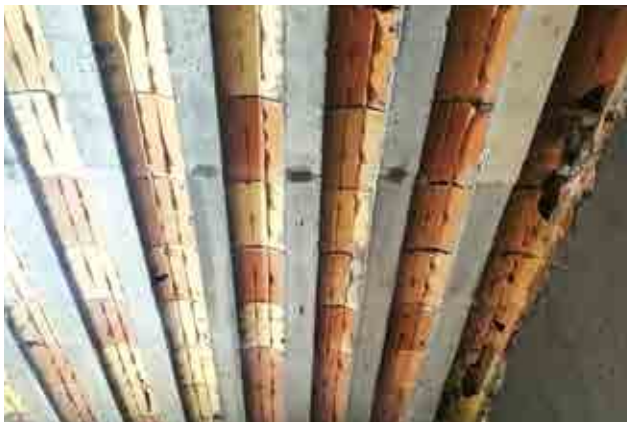
Before carrying out any repairs, it is necessary to **perform a complete analysis on the affected slab**, preferably with reference to the original design data. If possible, identify any gaps or imminent collapses by tapping, thermal imaging or Sonreb testing.
It is also necessary to assess the **degree of deterioration of the joists** (and, in particular, the reinforcements) and the presence of the collaborating top concrete slab above the lightening blocks.

If the condition of the joists is not acceptable restore the condition of the rebars by brushing them, treat them with **PASSIVATOR** and restore the concrete cover using **MX-R4 Repair** UNI EN 1504-3 certified concrete repair mortar.

If it is necessary to strengthen the reinforcement it is possible to intervene (without increasing the weight) by FRCM composite material structural strengthening, consisting of **PBO-MESH 105** series PBO meshes, together with **MX-PBO Concrete** cementitious adhesive matrix.

When using a ceiling shatter protection, it is fundamentally important to assess the condition of the joists in order to determine whether the concrete is capable of retaining the mechanical anchors. If not, it will be necessary to insert the anchors into the collaborating top concrete slab above the brickwork in a sort of hanging arrangement, using a **Concrete through-anchor KIT (TP-CLS)** so as not to disturb the joists (especially in the case of reduced sections).

The first stage of the procedure involves **removing the discontinuous parts of the joist** in concrete and **cleaning and passivating the concrete rebars**.



The second phase involves the **geometric reconstruction of the joist** using **MX-R4 Repair** structural repair mortar.

In the case of defective reinforcement, the joist should be structurally strengthened using FRCM technology, applying **PBO-MESH 105** and **MX-PBO Concrete** inorganic matrix.

Ruregold solutions

Thanks to over 10 years' of experience in the field, Ruregold, has developed and certified three complete systems, offering a solution for every on-site need. Each system consists of meshes, fastening systems and plaster mortars, all characterized by ease of application and secure performance.

Passive and active protection systems

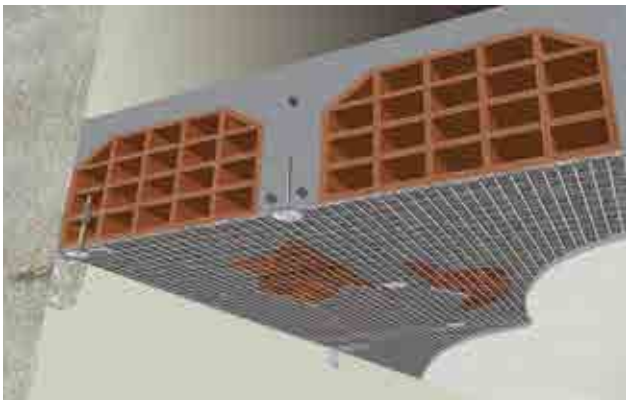
Protection systems are classified as active or passive, depending on the function they are required to perform:

- "**Passive" protection systems**: these are safety systems designed to the brickwork from falling and compromising the safety of people once it has become detached. Unlike "active" protections, these systems "contain" the element, rather than prevent it from becoming detached. **STUCANET** is Ruregold's "passive" ceiling shatter protection.
- "**Active" protection systems**: these are safety systems designed to prevent the lower panels of the lightening blocks from becoming detached, and subsequently falling. The Ruregold "active" ceiling shatter protection solutions are: **SAFENET** and **ARMANET**.

STUCANET system installed

SAFENET

This system offers the highest performance, as well as being quick and simple to install.



STUCANET

It is specifically designed for use on badly shattered or fallen slabs because it can be applied without preparing the support.

ARMANET

The traditional system with galvanised mesh that may also be dry-laid.

Certifications

All Ruregold protection systems have been subjected to experimental trials designed to assess their behaviour under ceiling shatter and falling loads.
Thanks to the support of qualified laboratories, it was possible to certify the performance of the three systems, with and without plaster:

- **SAFENET**: certified at the Milan Polytechnic at overloads of **500 kg/m²** (plastered system) and **250 kg/m²** (unplastered system), with various anchor point distribution patterns and the possibility of hanging loads (such as lights and functional elements).

- **STUCANET:** certified at the SidLab laboratory for behaviour under ceiling shatter and falling loads of up to **300 kg/m²** with various anchor point distribution patterns and the possibility of hanging loads (such as lights and functional elements) and up to **50 kg** single hanging point.

- **ARMANET**: certified at the SidLab laboratory for behaviour under ceiling shatter and falling loads of up to **130 kg/m²**, with various anchor point distribution patterns and the possibility of hanging loads (such as lights and functional elements).

Installed SAFENET system

SAFENET system load tests.

STUCANET system load tests.

SAFENET

A high performance ceiling shatter protection that is quick and simple to install.

SAFENET is the ceiling shatter system for securing concrete beam and block floor slabs, consisting of the SAFENET mesh in epoxy-coated AR fibre glass and SAFEPLASTER reduced shrinkage fibre-reinforced mortar. When secured mechanically to the structure, the system guarantees ceiling shatter protection certified for loads of up to **500 kg/m²** in plaster configuration.

Ease of application

Versatile

Active protection

Resistant

Certified for loads up to 500 kg/m².

PROPERTIES

- Certified for loads of up to 250 kg/m² in "dry" configuration and 500 kg/m² in "plaster" configuration.
- Suitable for use on all types of substrate (concrete beam and block floor, SAP, Varese, etc.)
- Easy and quick application and finishing.
- Lightweight.
- Ideal for use as an emergency safety system.
- Manageable.

APPLICATIONS

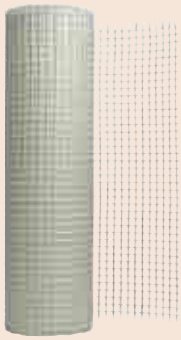
- Shatter protection for existing concrete beam and block floor slabs.
- Shatter protection of slabs with 'SAP' type prefabricated hollow-core infill blocks.
- Shatter protection of slabs with 'Varese' type prefabricated joists.
- The system may be left exposed, or rendered using SAFEPLASTER.

CEILING SHATTER PROTECTION SYSTEM

SYSTEM ELEMENTS

Mesh

SAFENET
AR fibre glass ceiling shatter protection mesh.
Grammage: 245 g/m²
Mesh: 25×25 mm.
Packaging: 1 m x 50 m reels



Mortar

SAFEPLASTER
Premixed, fibre-reinforced, reduced shrinkage plaster mortar for installing the SAFENET system.

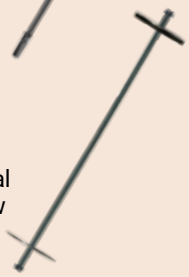
Accessories

V-CLS | Concrete Screw
Steel screw, supplied with dedicated steel washer and SBR coupled, for structurally fastening SAFENET mesh in concrete joists.
Pcs. /m² = 4 approx.

T-CLS | Concrete anchor
Steel expansion anchor, supplied with dedicated steel washer and SBR coupled, for non-structural fastening of SAFENET mesh in concrete joists.
Pcs. /m² = 4 approx.

TP-CLS | Concrete bolt wedge anchor
Steel expansion anchor, supplied with threaded rod, steel washer and SBR coupled, self-locking nut for structurally fastening SAFENET mesh in the concrete top slab.
Pcs. /m² = 4 approx.

BP | Concrete headed bolt
Threaded bar, coupled steel and SBR washers, self-locking nuts for structural fixing of the SAFENET mesh in the new upper concrete slab to be built.
Pcs. /m² = 4 approx.



PA | Angular plate
"L" shaped angular plate for perimeter securing SAFENET mesh, applied using nylon anchors.
Pcs. /m = 1 approx.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

SAFENET MESH	
Constituent material	Coated AR fibre glass mesh
Mesh dimensions	25 x 25 mm
Grammage of coated mesh	245 g/m²
Weft mesh tensile strength (average value)	≥ 50kN/m
Equivalent warp thickness	0.038 mm²/mm
Equivalent weft thickness	0.036 mm²/mm
Mesh colour	White
Type of coating	Epoxy
Application temperature	From +5°C up to +35°C
Packaging	50 m² rolls (length 50 m, height 1 m)
Storage conditions (Italian Ministerial Decree 10 May 2004)	Store in a dry, covered environment in its original packaging.

SAFEPLASTER MORTAR	
Classification EN 998-1:2016	GP - Guaranteed performance mortar for general indoor and outdoor rendering
Volumetric mass of fresh mortar	approx. 1850 kg/m³
Strength after 28 days	CS II
Mixing water per 25 kg bag	4.5 - 5.0 litres
Workability interval at 20°C	45 min
Application temperature	From +5°C up to +35°C
Application thicknesses	10 mm per coat (maximum thickness 30 mm)
Coverage	approx.15.5 kg/m² per cm thickness
Reaction to fire (EN 13501-1)	Euroclass A1
Packaging	Disposable wooden pallet laden with 60 x 25 kg bags - total weight 1500 kg
CE marking	EN 998-1
Storage conditions (Italian Ministerial Decree 10 May 2004)	The product must be kept in a dry place, in its original packaging.
Shelf life (Italian Ministerial Decree 10 May 2004)	Not more than 12 months from packing date.

ACCESSORIES				
FASTENING	V-CLS | Concrete Screw	T-CLS | Concrete anchor	TP-CLS | Concrete through-anchor	PA | Angular plate
Length/ø	100 mm/7.5 mm	70 mm/8 mm	25 mm/8 mm	100 mm/8 mm
Washer ø	50 mm	50 mm	50 mm	50 mm
Max. flexible th.	40 mm	30 mm	240 mm	30 mm
Hole	6 mm	8 mm	8 mm	8 mm
Packaging	Box containing 100 pcs.	Box containing 100 pcs.	Box containing 100 pcs.	Box containing 50 pcs.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

STUCANET

Shatter protection for badly shattered slabs.

STUCANET is the passive ceiling shatter protection consisting of a Stucanet panels in electrowelded, galvanised metallic mesh, interwoven with a cardboard backing sheet that ensures adhesion of the Plasterwall mortar in the plastic phase, whilst the holes ensure grip to the metal mesh during the setting phase. When secured mechanically to the structure, the system guarantees ceiling shatter protection certified for loads of up to **300 kg/m²**.

- Passive protection
- Ease of application
- Compatible with the masonry
- Good reaction to fire
- Certified for loads up to 300 kg/m².
- Versatile

PROPERTIES

- Load, suspension and resistance to fire certified (REI 240 on 20+4 concrete beam and block floor slab).
- Lightweight, strong and easy to mould.
- Rapid fastening on any type of support.
- Durable in the galvanised version.
- Low soluble salt content.
- High permeability to water vapour.
- Compatible with all pre-existing building materials in the original masonry.
- Resistance to freeze-thaw cycles.
- We recommend applying a reinforced skim coat over the Plasterwall mortar.

APPLICATIONS

- Load, suspension and resistance to fire certified (REI 240 on 20+4 concrete beam and block floor slab) passive ceiling shatter protection.
- Shatter protection for concrete beam and block floor slabs that are already partially or completely shattered.
- Wall overturn protection solutions for non-structural elements.

CEILING SHATTER PROTECTION SYSTEM

SYSTEM ELEMENTS

Mesh

STUCANET
Steel mesh with interwoven cardboard sheet in 2.40 x 0.70 m (1.68 m²) panels, 38 x 50 mm mesh. Available in the following versions:
-STUCANET S Plaster Support normal double row
-STUCANET 80 Strengthened normal*.

Mortar

PLASTERWALL
Fibre-reinforced, lightweight premixed plaster mortar for coating the STUCANET ceiling shatter protection.

Accessories

V-CLS | Concrete Screw
Steel screw, supplied with dedicated steel washer and SBR coupled, for structurally fastening STUCANET mesh in concrete joists.
Pcs. /m² = 8 approx.

T-CLS | Concrete anchor
Steel expansion anchor, supplied with dedicated steel washer and SBR coupled, for non-structural fastening of STUCANET mesh in concrete joists.
Pcs. /m² = 8 approx.

TP-CLS | Concrete bolt wedge anchor
Steel expansion anchor, supplied with threaded rod, steel washer and SBR coupled, self-locking nut for non-structurally fastening STUCANET mesh in the concrete top slab.
Pcs. /m² = 8 approx.

BP | Concrete headed bolt
Threaded bar, coupled steel and SBR washers, self-locking nuts for structural fixing of the SAFENET mesh in the new upper concrete slab to be built.
Pcs. /m² = 4 approx.

TN | Nylon anchor
Nylon expansion anchor, supplied with dedicated steel washer and SBR coupled, for non-structural fastening of STUCANET in concrete joists.
Pcs. /m² = 2 approx.

PA | Angular plate
"L" shaped angular plate for perimeter securing of STUCANET mesh, applied using nylon anchors.
Pcs. /m = 2 approx.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

MESH	STUCANET S	STUCANET 80*
Type	Stucanet normal double strand for fastenings up to 45 cm	Stucanet normal strengthened for fastenings up to 60/80 cm
Longitudinal and transversal strands	1.50 mm	1.50 mm
Strengthening strands (Ø/section)	2.00 mm	6.00 x 2.00 mm
Mesh dimensions (mm)	38 x 50	38 X 50
Lateral mesh dimensions (mm)	38 x 27	38 x 27
Tensile strength of the steel	> 350 MPa	
Galvanisation	Diameter 1.50 and 2.00 mm: min 60 g/m^2 Plate 6x2 mm: min 50 g/m^2	
Storage	In a cool, dry place	
Packaging	2.40x0.70 m panels, equivalent to 1.68 m^2, in bundles of 15 panels	2.40x0.70 m panels, equivalent to 1.68 m^2, in bundles of 15 panels*

PLASTERWALL MORTAR	
Mixing water for 100 kg of dry premix	18 - 20 litres
Density	approx. 1650 kg/m^3
Compressive strength after 28 days (EN 12190)	≥ 5 MPa
Reaction to fire (EN 13501-1)	Euroclass A1
Permeability to water vapour (EN 1015-19)	μ=5/ 20 (tabulated value)
Thermal conductivity (EN 1745)	λ=0.72 W/mK
Maximum application thickness (two coats)	≈ 20 mm
Coverage	approx. 12 kg/m^2 per cm of thickness
Packaging	Disposable wooden pallets laden with 60 x 25 Kg bags, equivalent to 1500 kg of loose product
CE marking	EN 998-1
Storage conditions and shelf-life (Italian Ministerial Decree 10/05/2004)	In original packaging, indoors, in a cool, dry, unventilated place. Not more than 12 months from packing date.

ACCESSORIES					
FASTENING	V-CLS | Concrete Screw	T-CLS | Concrete anchor	TP-CLS | Concrete through-anchor	TN | Nylon anchor	PA | Angular plate
Length/ø	100 mm/7.5 mm	70 mm/8 mm	25 mm/8 mm	100 mm/8 mm	100 mm/8 mm
Washer ø	50 mm	50 mm	50 mm	50 mm	50 mm
Max. flexible th.	40 mm	30 mm	240 mm	30 mm	30 mm
Hole	6 mm	8 mm	8 mm	8 mm	8 mm
Packaging	Box containing 100 pcs.	Box containing 100 pcs.	Box containing 100 pcs.	Box containing 100 pcs.	Box containing 50 pcs.

* Contact the Ruregold sales office for delivery times.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

ARMANET

Ceiling shatter protection with galvanised mesh and dry application for existing slabs.

ARMANET is the ceiling shatter protection for securing concrete beam and block floor slabs, consisting of ARMANET electrowelded, galvanised mesh - also available in stainless steel upon request - SAFEPLASTER reduced shrinkage fibre-reinforced mortar. When secured mechanically to the structure, the system guarantees ceiling shatter protection certified for loads of up to **130 kg/m²**.

Ease of application

Versatile

Active protection

Certified for loads of up to 130 kg/m²

PROPERTIES

- High yield resistance steel mesh.
- Ideal for use as an emergency safety system.
- Lightweight.
- Manageable.
- Ease of installation.
- Certified system.

APPLICATIONS APPLICATIONS

- Protection systems against shatter and falling of ceiling fragments on existing slabs.
- Left exposed when used as an emergency system.
- Ideal for uncovered application.
- Suitable for plastering.
- Suitable for cladding with plasterboard panels.

CEILING SHATTER PROTECTION SYSTEM

SYSTEM ELEMENTS

Mesh

ARMANET
Electrowelded, galvanised steel wire mesh.
Available in reels:
H 1 m, L 50 m reels,
19.0x19.0 mesh ø 0.65 mm.

Mortar

SAFEPLASTER
Premixed, fibre-reinforced, reduced shrinkage plaster mortar for installing the ARMANET system.

Accessories

V-CLS | Concrete Screw
Steel screw, supplied with dedicated steel washer and SBR coupled, for structurally fastening STUCANET mesh in concrete joists.
Pcs. /m² = 8 approx.

T-CLS | Concrete anchor
Steel expansion anchor, supplied with dedicated steel washer and SBR coupled, for non-structural fastening of STUCANET mesh in concrete joists.
Pcs. /m² = 8 approx.

TP-CLS | Concrete bolt wedge anchor
Steel expansion anchor, supplied with threaded rod, steel washer and SBR coupled, self-locking nut for non-structurally fastening STUCANET mesh in the concrete top slab.
Pcs. /m² = 8 approx.

BP | Concrete headed bolt
Threaded bar, coupled steel and SBR washers, self-locking nuts for structural fixing of the SAFENET mesh in the new upper concrete slab to be built.
Pcs. /m² = 4 approx.

TN | Nylon anchor
Nylon expansion anchor, supplied with dedicated steel washer and SBR coupled, for non-structural fastening of STUCANET in concrete joists.
Pcs. /m² = 2 approx.

PA | Angular plate
"L" shaped angular plate for perimeter securing of STUCANET mesh, applied using nylon anchors.
Pcs. /m = 2 approx.

TECHNICAL SPECIFICATIONS OF THE COMPONENTS

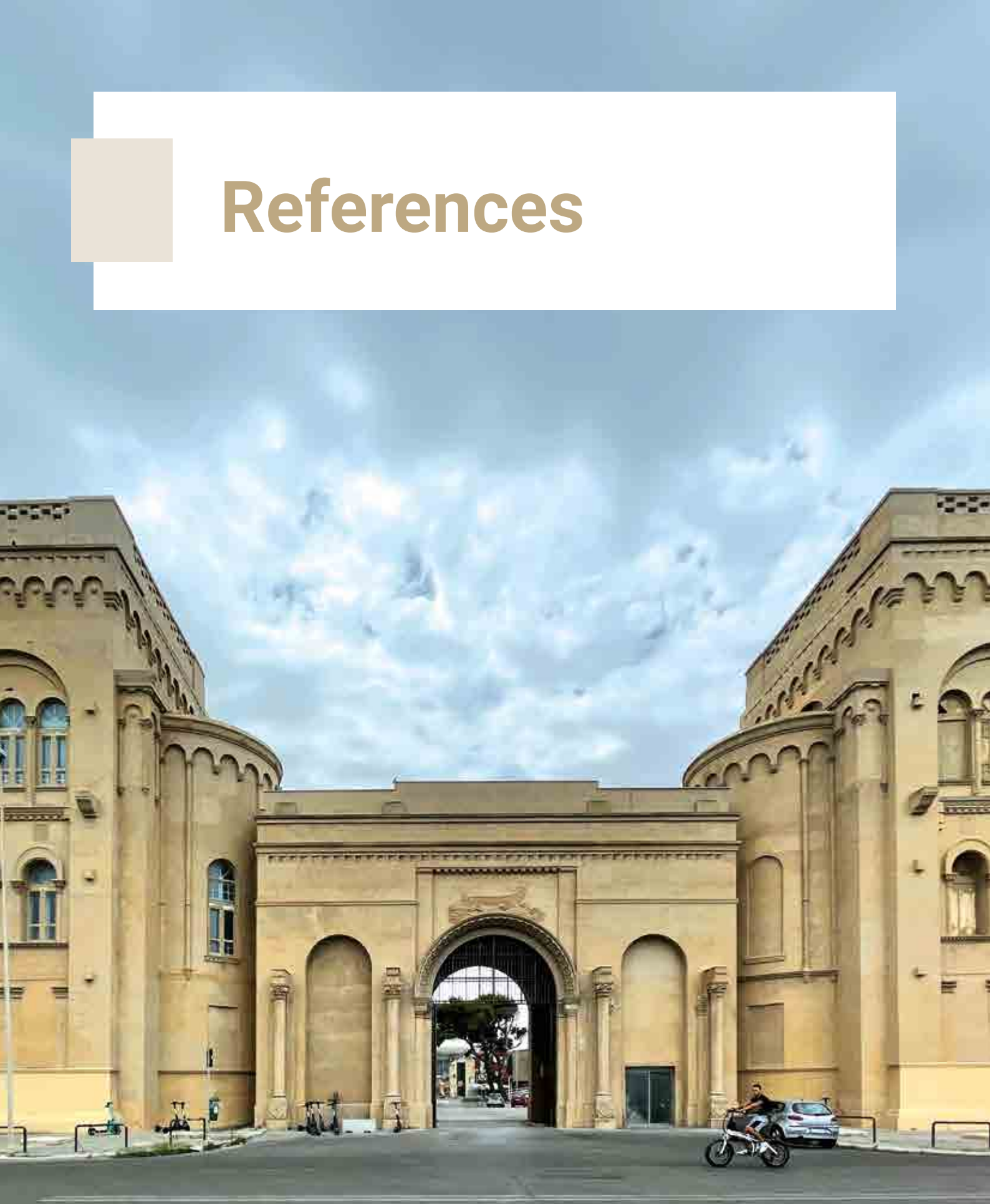
ARMANET MESH	
Constituent material	Galvanised steel mesh
Mesh dimensions	19 x 19 mm
Wire diameter	0.65 mm
Modulus of elasticity	210GPa
Tensile strength of steel wire	> 300 MPa
Application temperature	From +5°C up to +35°C
Packaging	50 m² rolls (length 50 m, height 1 m)
Storage conditions (Italian Ministerial Decree 10 May 2004)	Store in a dry, covered environment in its original packaging.

SAFEPLASTER MORTAR	
Classification EN 998-1:2016	GP - Guaranteed performance mortar for general indoor and outdoor rendering
Volumetric mass of fresh mortar	approx. 1850 kg/m³
Strength after 28 days	CS II
Mixing water per 25 kg bag	4.5 - 5.0 litres
Workability interval at 20°C	45 min
Application temperature	From +5°C up to +35°C
Application thicknesses	10 mm per coat (maximum thickness 30 mm)
Coverage	approx.15.5 kg/m² per cm thickness
Reaction to fire (EN 13501-1)	Euroclass A1
Packaging	Disposable wooden pallet laden with 60 x 25 kg bags - total weight 1500 kg
Storage conditions (Italian Ministerial Decree 10 May 2004)	The product must be kept in a dry place, in its original packaging.
CE marking	EN 998-1
Shelf life (Italian Ministerial Decree 10 May 2004)	Not more than 12 months from packing date.

ACCESSORIES					
FASTENING	V-CLS | Concrete Screw	T-CLS | Concrete anchor	TP-CLS | Concrete through-anchor	TN | Nylon anchor	PA | Angular plate
Length/ø	100 mm/7.5 mm	70 mm/8 mm	25 mm/8 mm	100 mm/8 mm	100 mm/8 mm
Washer ø	50 mm	50 mm	50 mm	50 mm	50 mm
Max. flexible th.	40 mm	30 mm	240 mm	30 mm	30 mm
Hole	6 mm	8 mm	8 mm	8 mm	8 mm
Packaging	Box containing 100 pcs.	Box containing 100 pcs.	Box containing 100 pcs.	Box containing 100 pcs.	Box containing 50 pcs.

Download the technical and safety data sheets from Ruregold.it for additional technical information and application methods.

References



Repair and Retrofitting of the historic Fiera del Levante (BA) to meet the respective standards

- Strengthening of the extrados (upper side) of the ceiling slab and increasing the section of the beams with MICRO GOLD STEEL
- Ceiling shatter protection with STUCANET system
- Strengthening masonry with CRM G-MESH 400 system and MX-CP Lime structural mortar

Strengthening at Thurgood Marshall Federal Courthouse, New York

- Structural strengthening of lift shafts with C-MESH 84/84 carbon mesh and MX-C 25 masonry inorganic matrix - C-JOINT connection system with MX-JOINT INORGANIC MATRIX

Redevelopment of the Hospital in Chiari (BS)

- Strengthening of masonry structures with CRM G-MESH 400 system and MX-CP Lime mortar

Structural repairs on a Primary School in Scalea (CS)
- Strengthening of supporting masonry structures using MX-RW High Performance, PBO-MESH 22/22 mesh with MX-PBO Masonry inorganic matrix and PBO-JOINT 6 mm diameter with MX-JOINT inorganic matrix
- Strengthening of concrete structures with PBO-MESH 105 and PBO-MESH 70/18 mesh and MX-PBO Concrete inorganic matrix.

Redevelopment of the old Officine Reggiane Factory Sheds - Reggio Emilia
- Securing the structure with PBO-MESH 10/10 mesh system and MX-PBO Masonry inorganic matrix.

Strengthening and improved seismic proofing of the main crossing, Old Hospital in Parma
- Strengthening of the cross vaults with PBO-MESH 22/22 mesh and MX-PBO Masonry inorganic matrix.

Securing and strengthening the Cavour Canal Bridge - Formigliana (VC)
- FRCM structural strengthening system with PBO-MESH 22/22 and PBO-MESH 44 mesh, and MX-PBO Masonry inorganic matrix.

Static strengthening of the bell-tower roof turrets after the earthquake of 2012, Oratory of the Santissima Annunziata in Colorno (PR)

- Wrapping of the columns and roof turrets strengthened with the FRCM system: PBO-MESH 22/22 mesh with MX-PBO Masonry inorganic matrix, PBO-JOINT connection system with MX-JOINT inorganic matrix.

The Church of Santa Maria della Provvidenza (Zafferana Etnea)

- Strengthening the intrados (lower side) of the arches and the perimeter masonry of the lantern tower with FRCM system in bi-directional PBO-MESH 22/22 mesh and MX-PBO Masonry inorganic matrix, and PBO-JOINT connection system, diameter. 6 mm with MX-JOINT inorganic matrix.
- External wrapping to counter the thrust exerted by the cover of the lantern tower with FRCM system in mono-directional PBO-MESH 44 mesh and MX-PBO Masonry inorganic matrix.

110% Sisma Bonus (Government funded seismic refit incentive) on Condominium in Milan

- Floor edge beam wrapping on 17 floors with FRCM structural strengthening system using PBO-MESH 105 mono-directional mesh and MX-PBO Concrete inorganic matrix, and PBO-JOINT 6 mm connection system with MX-JOINT matrix.

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