



# Ruregold C-MESH

**Proven, Innovative Composite Strengthening System  
for the Reinforcement of Masonry Structures**  
with carbon fibres and without epoxy resins



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An innovative composite system is designed specifically for masonry structures, including historic preservation. It can be applied on damp substrates and at high Relative Humidity (RH). It is breathable, thus not entrapping moisture. Lightweight, it is fast and easy to install.

C-MESH increases the shear and flexural strength of masonry elements and their ductility. It strengthens vaults and arches eliminating the formation of connection lines. It does not require protection from fire making it an ideal solution for the renovation/refurbishment of commercial buildings.

**Proven, Innovative,  
Composite Strengthening System  
for the Reinforcement  
of Masonry Structures.**

**Certified Performance,  
Easy to Use,  
Effective Long-term.**

# Ruregold C-MESH

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## Designed for Masonry

C-MESH composite strengthening system is specifically designed for masonry structures. It comes from the **combination of a carbon mesh with high-performance fibers and a specifically designed pozzolan-based matrix** that works as an adhesive and does not require the use of a primer.

Due to the outstanding performance properties of the carbon fibers and the capacity of the adhesive to transfer stress/strain from the substrate to the fibers, **this composite system is able to reduce the deformation of masonry structural elements, increase flexural and shear strength, and improve their ductility.** In case of arches and vaults, C-MESH eliminates the formation of connection lines. The formulation of the pozzolan-based adhesive makes C-MESH system ideal for historic masonry preservation.



## A Solution for Loss of Efficiency and Structural Upgrade

Composite strengthening systems are the result of the US, European and Japanese research into use of non-metallic reinforcements for concrete structures.

Research and development work conducted by innovation-focused companies, such as Mitsubishi and Ruregold, have resulted in the development of a strengthening technology that is both easy to use and effective.

## Limitation of Epoxy Resins

Conventional Fiber Reinforced Polymer (FRP) systems use an epoxy resin to externally bond continuous strengthening fibers, such as carbon, aramid or glass, to the structure. However, epoxy resins have well-known limitations due to their chemical nature, which affect both their application and durability.

- **Epoxy resins cannot be applied to damp substrates.**
- **Epoxy resins are not fire-resistant.** Once epoxy resins harden, they typically melt at temperatures between 230°F (110°C) and 300°F (150°C) when the fibers detach from the structure and the strengthening reinforcement stops working. Fire protection comes with a high cost.
- **Epoxy resins are not resistant to high temperatures.** When they reach the T<sub>g</sub> (glass - transition temperature) epoxy resins change from a glassy to a visco-elastic state thus ceasing to secure the designed bond. T<sub>g</sub> of epoxy resins used in commercially available FRP systems typically ranges from 140 to 180 °F (60 to 82°C). In a dry environment ACI 440.2R recommends that FRP service temperature not exceed T<sub>g</sub> - 27 °F (T<sub>g</sub> - 15°C). At a temperature of 113 °F (45°C) it is therefore possible that an FRP system no longer provides the designed reinforcement.
- **Epoxy resins are not UV resistant.** They must be protected from direct sunlight, which can cause chemical-physical alterations in the epoxy matrix.



C-MESH composite strengthening system is **extremely versatile**. It can be applied over a number of substrates, such as CMU, clay brick, hollow clay tiles, tuff and natural stone. It can be installed with one or multiple plies of carbon mesh depending on design needs. It can be easily customized for application over curved surfaces, such as arches and vaults.

C-MESH system is **lightweight**, with a thin thickness and light **gray color**. It does not add appreciable weight to the structural elements to be reinforced. At 1/3 in. (8 mm) thickness, when one ply of carbon mesh is applied, it does not alter the geometry of the structure, its spans and clearances. Light gray, it **blends easily with the original structure**.

C-MESH is an ideal solution to recover and/or upgrade the load-carrying capacity of deteriorated masonry structures.

These structures can deteriorate over time for a variety of reasons, such as poor original design, degradation of original materials, settlements, corrosion of reinforcing elements, moisture infiltration, and environmental conditions

C-MESH can be successful used to improve the capacity of masonry structures that undergo refurbishment or change in use and may carry new loads such as, for example, in the conversion of masonry warehouses into industrial-style lofts.



effective • resistant • versatile • compatible • safe • certified

# Ruregold

## C-MESH: a Unique Solution for Masonry Reinforcement

C-MESH uniquely combines the performance properties of carbon fibers with a pozzolan-based hydraulic binder that provides adhesion to the substrate and full compatibility with masonry substrate for the transfer of stress and strain.



C-MESH strengthening system fully meets structural engineer's expectations in terms of long-term performance properties and durability. Due to the mechanical characteristics of pozzolan-based MX-C 25 Masonry adhesive and its vapor permeability, C-MESH strengthening system is particularly suitable for historic masonry preservation.



## The benefits of using C-MESH 84/84

- Reliable, long-lasting performance properties, certified by ICC-ES (see last page)
- Easy to apply. Lightweight material is ideal for overhead applications
- Easy to clean. Tools are cleaned with water only
- No risk of soil contamination at the job site since it does not use epoxy resin.
- Can be applied after rain over damp substrates.
- Permeable to vapor, does not entrap moisture.
- Compatible with masonry substrates in the response to stress-strain.
- Does not require fire protection since it does not alter the response to fire of masonry elements.
- Not affected by high environmental/substrate temperatures.
- Does not require to be painted for UV protection.
- Nonhazardous shipping.
- Tested by independent University Labs, on both specimens and large scale elements.
- Proven, with hundreds of worldwide references.



## Tests and Certifications

C-MESH 84/84 strengthening system has been **tested extensively by the University of Miami as part of the ICC-ES AC434 test certification protocol**. The test program encompassed **extensive testing on large scale elements**, made of bricks and CMUs, for shear and flexural strength. The program also included testing composite specimens for tensile and lap strength, aging and durability.

Results all exceeded AC434 design requirements for strengthening levels. C-MESH 84/84 increased resistance to in-plane shearing stress from 55% (1 layer of carbon mesh) up to 251% (4 layers of carbon mesh).

Since 2001, when it was launched on the Italian market, several million sq.ft of C-MESH have been applied worldwide for the strengthening of different types of buildings and structures, including historic preservation. Among the references C-MESH 84/84 was used for the strengthening of world-famous Doge's Palace in San Mark Square in Venice, under the supervision of the Italian Building Preservation Authority.



1. Masonry substrate
2. First layer of MX-C 25 Masonry
3. C-MESH 84/84
4. Second layer of MX-C 25 Masonry
5. Plaster or finishing glaze, if desired

Typical application sequence

• clean • patented

# C-MESH

With Carbon Fibres  
and without  
epoxy resins

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## A patented system

**C-MESH system** consists of a carbon mesh (C-MESH 84/84) and a special cement-based adhesive, MX-C 25 Masonry for masonry structures that works as an adhesive.

All certifications and test results pertinent to the system relate exclusively to the use of the two components, C-MESH 84/84 mesh and MX-C 25 Masonry adhesive, as specified in the Technical Data Guide.

On-site performance characteristics of C-MESH 84/84 strengthening system depend on the scrupulous compliance with instructions for installation reported in the Technical Data Guide. Any use of the system differently from what specified in the Technical Data Guide is not allowed.



According to European fire reaction standard **EN 13501-1**, C-MESH structural strengthening system has been classified as follows:

### Classification fire reaction:

**A<sub>2</sub>** = no contribution to fire  
**s<sub>1</sub>** = low smoke emission  
**d<sub>0</sub>** = no flaming droplets/particles

## Ruregold C-MESH 84/84 according to the Guidelines AC434 issued by ICC - ES

C-MESH 84/84 is a composite strengthening system for structural reinforcement based on carbon fibers embedded in a specially formulated pozzolan-based adhesive. It meets the criteria of AC 434: "Acceptance Criteria For Masonry and Concrete Strengthening Using Fabric -reinforced Cementitious Matrix (FRCM) Composite Systems".

Tests required for the certification of the system were performed at the accredited Laboratory of the University of Miami and relative certification was issued by US ICC-ES.

ICC-ES is an international association dedicated to "developing model codes and standards used in the design, build and compliance process to construct safe, sustainable, affordable and resilient structures".

Performance properties of Ruregold's C-MESH 84/84 composite strengthening system, as reported in the ICC-ES certifications, can be specified for any strengthening reinforcement project for masonry structures.



Certification of product given by: International Code Council Evaluation Service USA.



Guidelines for the project and placement of cement-based reinforcement systems (FRCM) for the repair and reinforcement of concrete and masonry structures.



## With Carbon Fibres and without epoxy resins

### Laterlite Group

Thanks to the recent acquisition of the company, Ruregold is now the fourth company in the Laterlite Group, which combines the Leca brand with the company LecaSistemi and 40% of the associated company Gras Calce. The Laterlite Group in this way demonstrates its willingness to expand and strengthen its offer of technical solutions for the building industry, confirming its vocation as a 360-degree partner in sustainable construction and renovation projects.



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