



**FIBRE
NET**

composite engineering

CRM

SYSTEMS

RI-STRUTTURA

H-PLANET

STRUCTURAL REINFORCEMENT
OF MASONRY AND CONCRETE
STRUCTURES



MADE
IN
ITALY



RI-STRUTTURA, RI-STRUTTURA-FORCE, and H-PLANET are three CRM (Composite Reinforced Mortar) structural reinforcement systems using meshes, preformed corners and FRP (Fiber Reinforced Polymer) connectors, combined with structural mortars based on NHL lime or cementitious binders. These three systems differ in the fiber types employed in the manufacturing of the FRP components and their respective mechanical performance.

Specifically:

RI-STRUTTURA is a range composed of meshes, preformed corners, and connectors in GFRP (Glass Fiber Reinforced Polymer), made of long alkali-resistant glass fibers impregnated with a thermosetting epoxy-vinylester resin.

RI-STRUTTURA FORCE consists of five new preformed GFRP meshes, developed to deliver high mechanical performance.

H-PLANET is a high-performance line composed of meshes, preformed corners and connectors in CFRP (Carbon Fiber Reinforced Polymer), with bars manufactured from long carbon fibers impregnated with a thermosetting epoxy-vinylester resin.



MESHERS

impregnated, made in glass or carbon fiber

PREFORMED CORNERS AND STRESS DISTRIBUTION PATCHES

in glass or carbon fiber

CONNECTORS

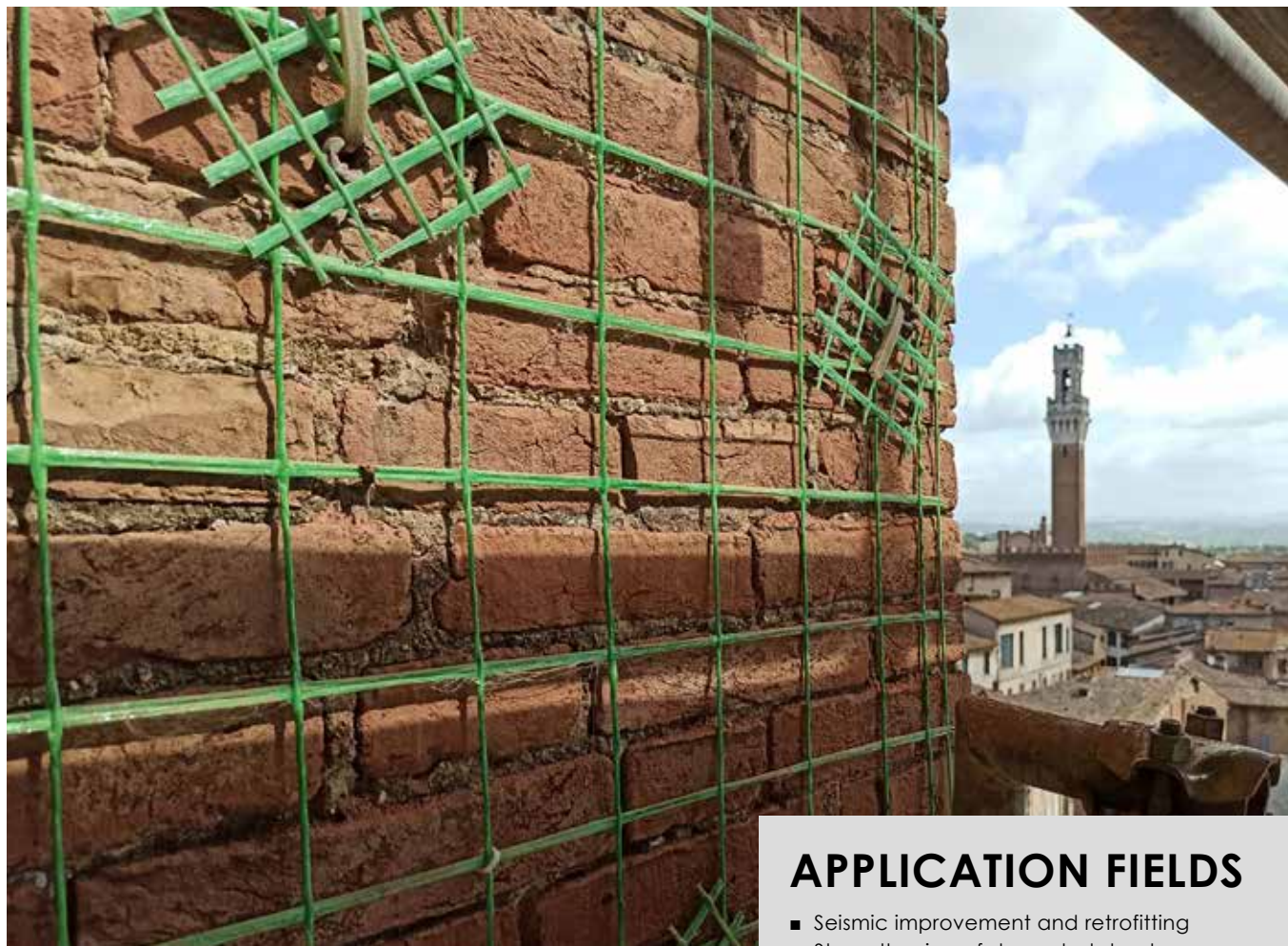
in glass fiber
and carbon

STRUCTURAL MORTARS

based on hydrated
lime and/or natural
hydraulic binders

CHEMICAL ANCHOR





APPLICATION FIELDS

- Seismic improvement and retrofitting
- Strengthening of degraded structures

CHARACTERISTICS AND ADVANTAGES

HIGH MECHANICAL STRENGTH

These systems enable a homogeneous and widespread enhancement of the mechanical performance of the reinforced element, with limited intervention thickness (approximately 3 cm).

LIGHTWEIGHT AND RAPID INSTALLATION

The system components, being lightweight and manageable, allow for straightforward and rapid application, reducing construction time and costs.

ENVIRONMENTAL SUSTAINABILITY

The systems are eco-compatible and exhibit low environmental impact, EPD certified.

DURABILITY AND COMPATIBILITY

The high corrosion resistance of the employed materials guarantees the long-term effectiveness of the reinforcement. The possibility of employing various types of mortars, including those based on natural hydraulic lime, ensures breathability and chemical-physical compatibility with historic substrates.

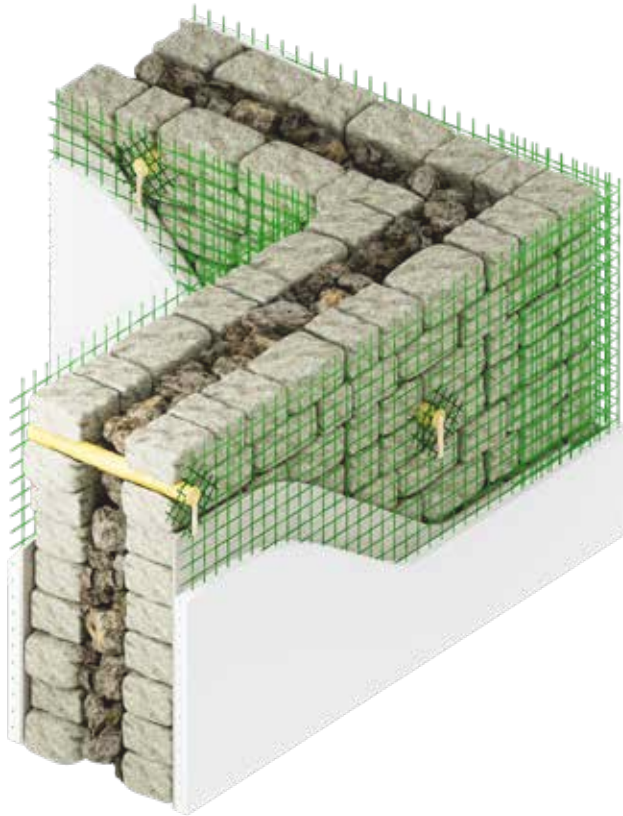
REVERSIBILITY

The ability to remove the systems without permanently altering the original masonry, enables application on historic buildings or structures subject to preservation constraints.

MASONRY

The CRM intervention enhances the load-bearing capacity and ductility of vertical masonry structural elements (piers and spandrels), with respect to both shear forces and in-plane and out-of-plane bending, while inducing only a modest increase in stiffness. The reinforcement intervention can also be carried out on only one face of the masonry.

The absence of corrosion in the reinforcement elements ensures high durability and effectiveness of the system over time and allows the application of thin structural mortar layers, thereby limiting the increase in mass. The system is reversible and appropriate for interventions on historic masonry.



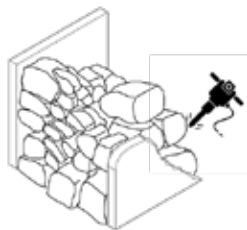
A. SUBSTRATE PREPARATION:

- removal of existing plaster and restoration of deteriorated areas;
- thorough cleaning of masonry surfaces by washing;
- application scratch coat, if of the required;
- drilling of holes for the installation of connectors.

B. APPLICATION OF THE REINFORCEMENT SYSTEM:

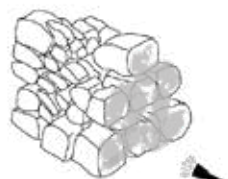
- installation of the mesh and preformed angular elements;
- application of the connection system after injection of the holes with chemical anchor (refer to the technical datasheet of the adopted connection system for specific installation instructions);
- application of the mortar layer with a minimum thickness of 30 mm, ensuring the mesh is positioned at the mid-thickness of the plaster.

INSTALLATION PROCEDURE



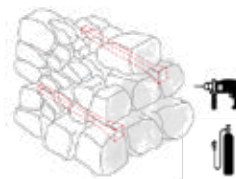
1

REMOVAL
OF THE EXISTING PLASTER



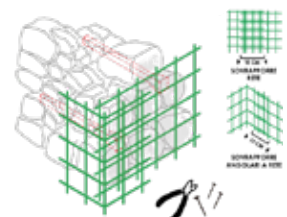
2

APPLICATION OF A
SCRATCH COAT



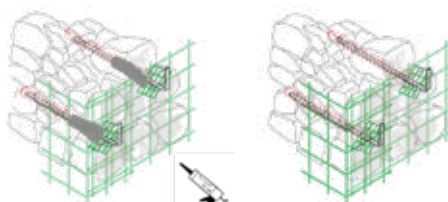
3

EXECUTION OF PASSING THROUGH
HOLES WITH A DIAMETER OF 12 MM



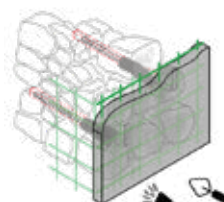
4

INSTALLATION OF THE MESH
AND PREFORMED CORNERS



5

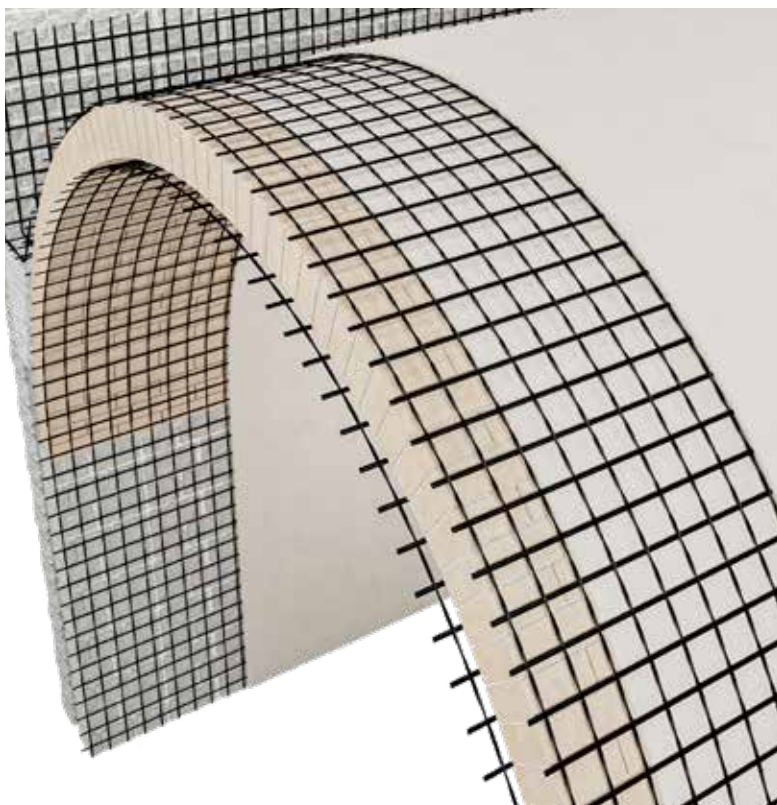
POSITIONING OF THE PATCHES, INSERTION
AND CHEMICAL ANCHORING OF THE CONNECTORS



6

APPLICATION
OF THE PLASTER

VAULTS



The reinforcement intervention using a Composite Reinforced Mortar (CRM) system on masonry arches and vaults involves the application of a thin layer of low elastic modulus mortar, preferably lime-based, reinforced with a preformed FRP mesh.

The objective is to compensate for the lack of tensile strength in the masonry assembly by counteracting the formation of hinges. Furthermore, the thickness added by the reinforcing mortar results in an increased cross-section allowing for greater variation in the load path and enhancing the overall stability of the arch or vault. The CRM system enables a uniform and widespread increase in the vault's capacity to resist gravitational loads and improves its response under seismic actions.

The technique can be applied to the intrados, the extrados, or on both sides. In any case, the system must be effectively connected to the perimeter masonry.

SLABS



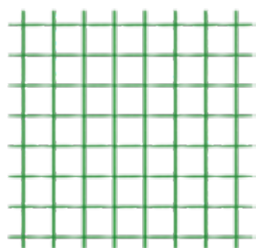
The reinforcement procedure for existing floors involves the construction of a thin composite slab in structural mortar, reinforced with preformed composite material meshes connected to the slab and vertical structural elements.

The objective is to enhance the slab's capacity to distribute horizontal and vertical loads, reduce deformations, and improve the overall structural behavior of the building under seismic actions.

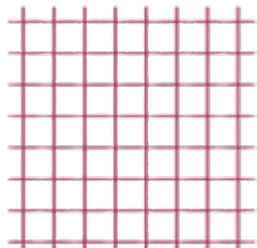
The application of glass fiber or carbon fiber meshes, combined with controlled-performance mortars, enables uniform distribution of in-plane stresses within the slab and effective stiffening of the floor system, with minimal increases in thickness and self-weight.

The reinforcement can be applied either on the intrados or extrados, incorporating the connection of the mesh to the slab via connectors and anchoring to the perimeter masonry with composite or steel bars.

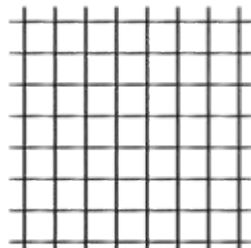
MESHES — PREFORMED



Fiber meshes
Glass fiber

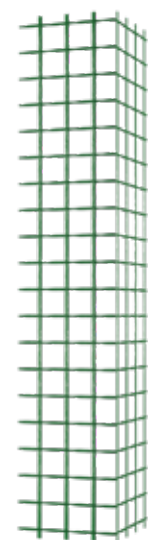


Fiber meshes
High-performance glass fiber

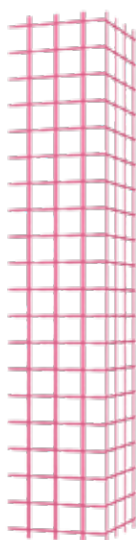


Fiber meshes
Carbon fiber

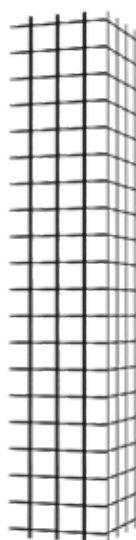
CORNERS AND PATCHES — PREFORMED



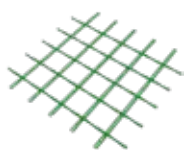
Glass fiber
preformed
corners



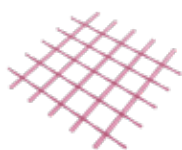
High-performance
glass fiber
preformed corners



Carbon fiber
preformed
corners



Glass fiber
patches



High-
performance
glass fiber
patches



Carbon fiber
patches

STRUCTURAL MORTARS



Structural mortar based
on hydraulic lime NHL,
compressive strength up
to 15 MPa



Structural mortar based
on hydrated lime and
hydraulic binders,
compressive strength
15/25 MPa

CHEMICAL ANCHOR



Chemical anchor
Epoxy, vinyl ester,
or polyester

CONNECTIONS



Bowed bars
carbon fiber



Bowed bars
in Glass Fiber



Bows in carbon
and glass fiber



Helical bars
in stainless steel



L-shaped
connector



REFERENCE STANDARDS

IDENTIFICATION AND QUALIFICATION

- EAD 340392-00-0104 - CRM (Composite Reinforced Mortar) system for strengthening concrete and masonry structures
- Guidelines for the identification, qualification, and acceptance control of preformed mesh systems in fiber reinforced polymer composite materials for use in the structural consolidation of existing buildings employing the CRM (Composite Reinforced Mortar) reinforced plaster technique. May 2019

DESIGN

- Ministerial Decree 17 January 2018 – Norme Tecniche per le Costruzioni (Technical Standards for Construction)
- CIRCULAR 21 January 2019, No. 7 C.S.LL.PP. Instructions for the application of the 'Update of the Technical Standards for Construction' pursuant to Ministerial Decree 17 January 2018
- UNI EN 1990:2006 - Eurocode 0 - General Principles of Structural Design



kerakoll

CRM

SYSTEMS

RI-STRUTTURA

H-PLANET

STRUCTURAL REINFORCEMENT OF MASONRY AND CONCRETE STRUCTURES



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