



**METHOD STATEMENT N. 4  
RECOVERY OF REINFORCED CONCRETE BY COMPOSITE MATERIALS**

Composite Material is a system consisting of a reinforcing element, usually Carbon Fiber, made integral to the structure to be strengthened with Epoxy Resin. It is identified by the initials **CFRP (Carbon Fiber Reinforced Polymer)**.

**Company presentation**

Our company began to operate in the sensitive field of Composite Materials in 1996 with the property brand **CARBONFORCE®**, and since then has designed, executed and tested numerous interventions, including the structural restoration in the year 2000 of the UNIS Towers in Sarajevo (BiH), at that time, the most important work worldwide with the utilization of 49.600 l.m. of Carbon Fiber Sheets.

In this long period time SINIT Engineers have carried out an intense research activities in collaboration with several prestigious Italian and foreign Universities, and numerous in-situ testing of the executed works.



**Types of carbon fibers**

The most utilized Carbon fibers are those denominated HR (High Resistance), which allow good results with the best cost / benefit ratio.

SINIT offers as well the new generation very high modulus fibers denominated HM (Ultra High Modulus).

The main features of HR fibers are:

- Modulus of elasticity 230000 MPa
- Tensile strength 4900 Mpa

The main characteristics of the HM fibers are:

- Modulus of elasticity 390000 Mpa
- Tensile strength 4460 Mpa

The modulus of elasticity is the decisive parameter in the design of all kinds of reinforcements. The accurate design proposed by SINIT, based on the wealth of experience, can always find the solutions which offer the best performance at the minimum cost.

## Types of carbon fiber reinforcements

The fibers type described above will allow to achieve the two most commonly used reinforcement systems:

- Dried Carbon Fiber Sheets with weight up to  $600 \text{ g/m}^2$  shaped and glued, in situ, to the structure to be strengthened with E/2 Liquid Epoxy Resin, are suitable for all types of reinforcement.
- Carbon Fiber Lamellas glued in situ, to the structure to be strengthened with P.A.103 Epoxy Paste, suitable only for bending reinforcement.

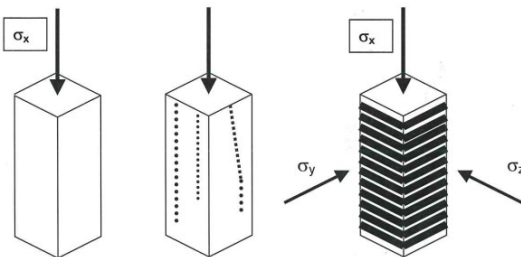
## Design

Significant guidelines have been drafted in 2002 by 'American Concrete Institute (ACI). In Europe are also used guidelines of the Federation International du Beton - FIB Bulletin 14 "Externally bonded FRP Reinforcement for RC structures" issued in 2001.

SINIT offers the design according to the latest guidelines DT200, developed in 2013 by the CNR (National Research Council), and only in these guidelines can be found also how to design the reinforcement of masonry buildings (Cultural Heritage). The CNR is Italy most important research Institute. SINIT can offer the complete design or is ready to collaborate with local design organizations.

## The main interventions with CFRP

- Compression reinforcement of columns by wrapping with Carbon Fiber Sheets/Epoxy Resin: this intervention is to be considered as the most important and allows the recovery of columns, damaged or designed in line with old specifications that have proven inadequate.



- Bending and shear reinforcement of beams, bending reinforcement of slabs, reinforcement of column-beam connections of frame structures.



Main fields of this type of reinforcements are: road and rail bridges and viaducts, wharfs and reinforced concrete structures in general.

