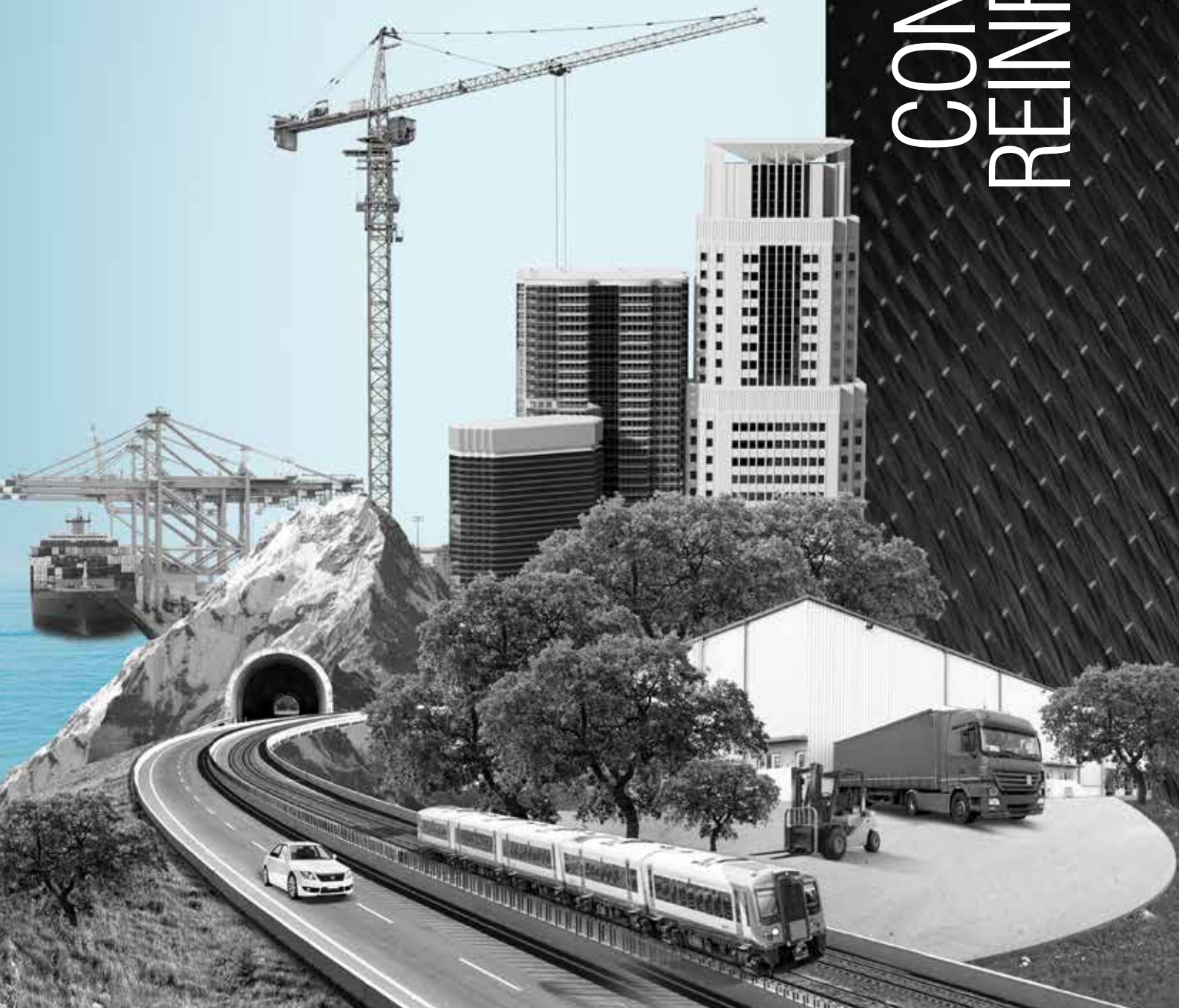


KRATOS

STRUCTURAL REINFORCEMENT

CONSTRUCTION REINFORCEMENT TECHNOLOGIES





“A Safe Future with Reinforced Structures”

About Kordsa

Kordsa, established in 1973 as a subsidiary of Sabancı Holding, is providing reinforcement products to leading tire manufacturers for more than 40 years as the industry leader. Kordsa has conveyed its experience in the field of reinforcement also to the construction and composite reinforcement markets over the years. Currently, Kordsa is strengthening 1 of every 2 automobile tires and 2 of every 3 aircraft tires produced in the world.

Kordsa provides high quality end-to-end solutions with its advanced technical competence. Through its mission to “Reinforce Life”, Kordsa is continuously making investment in its customers, shareholders, and employees. Kordsa’s title of “The Reinforcer” which it has deserved by its technology and market leadership, strong global footprint, and its experience of many years in reinforcement technologies has been accepted across the world.

Kordsa has united its ‘Reinforcer’ title with its industrial fiber technology and has launched Kratos brand, the first product of the Construction Reinforcement Business Unit, and is continuing to develop innovative products with its R&D studies. Kratos Fiber is a successful and innovative synthetic fiber reinforcement for construction industry with its long-term durability and low carbon emission advantage for successful and sustainable construction projects along with providing speed, labor, energy, and cost savings in concrete reinforcement applications.

Kratos Structural Reinforcement is a carbon fiber reinforced polymer (CFRP) based structural reinforcement system Kordsa has offered and is newly joined the product family after Kratos Fiber. It is an innovative reinforcement system used in both for increasing the service life of existing structures and for design and construction of more durable new structures. Kratos Structural Reinforcement system is consisted of high-strength carbon fabric, pultruded carbon plate with its resin impregnated beforehand and resin.

Our activities in the markets where our global footprint is located continue at full speed.





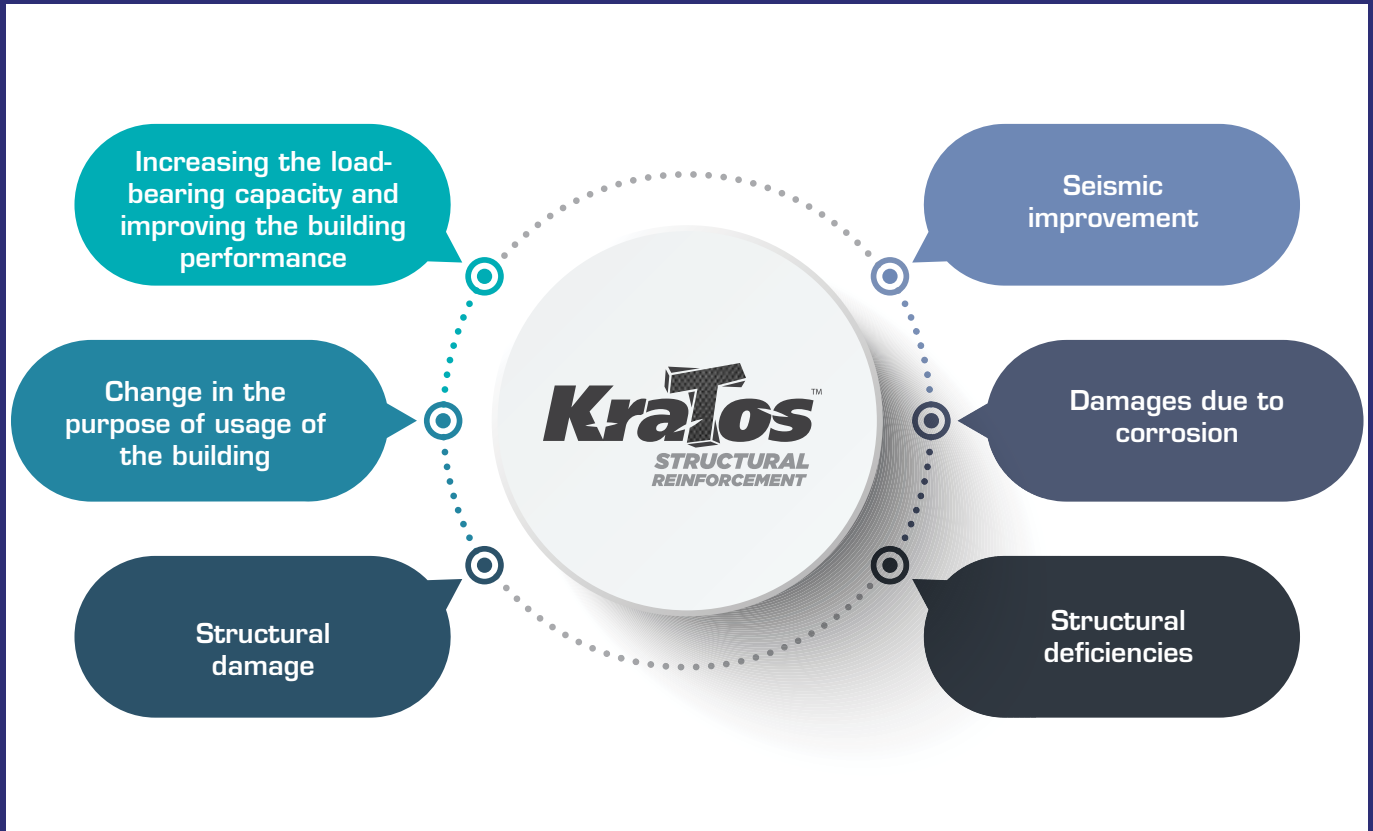
What is Structural Reinforcement, Why is It Needed?

The purpose of usage of a structure may vary in terms of current conditions due to its load-bearing capacity, function, and its required qualifications during its service life. The structure should be adapted to meet these new needs.

Reinforcement technologies using carbon fiber reinforced polymer (CFRP) are developed for eliminating bending, shearing strength or structural deficiencies on seismic base and for improving building performance in existing structures.

Accordingly, CFRP, reinforcing the existing structural elements of reinforced concrete building systems, is used to improve the structural properties relevant to strength and deformation and to increase load-bearing capacity of the building.

Why Do We Need to Reinforce Structures?



Advantages of Kratos Structural Reinforcement System

Kratos Structural Reinforcement product group may be used in all reinforcement works regardless of the surface shape. It minimizes volume losses in reinforced buildings. The light-weight property of the products also provides convenience and fast applicability in terms of workmanship. The density of composite products formed with high-strength carbon fiber is low; therefore, the additional load they bring to the applied surface remains so low which can be neglected.

Another advantage of carbon fabric applications among reinforcement applications is replacing steel or reinforced concrete jacketing applications if there is technical competence. Loss of space can be minimized by this way.

Structural reinforcement products are of capital importance also in terms of sustainability. Reinforcing structures which are suitable in terms of engineering, creates both cost and time advantage compared to demolishing and rebuilding them while offering a more environmentally-friendly solution.

Technical Service for Reinforcement Projects

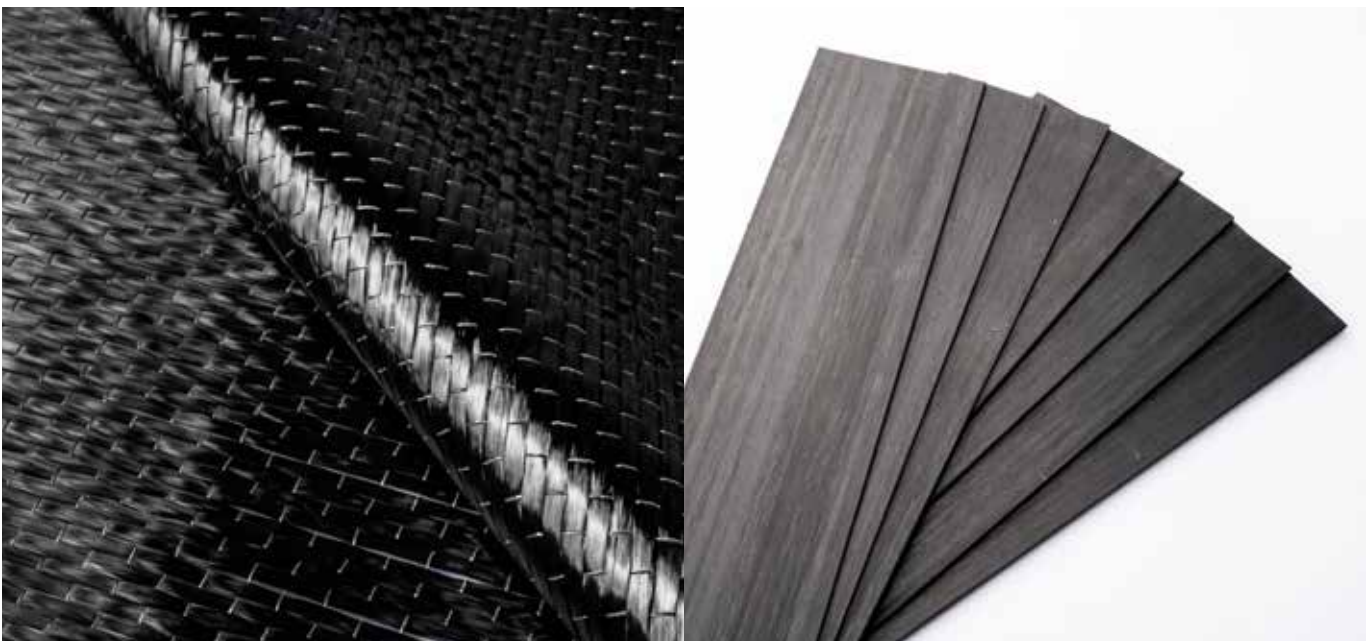
Kordsa offers technical support during the structural design in projects by taking ACI 440.2R-17 and ACI 318-14, TR55 and EUROCODE 2 and various local codes as the basis within the scope of Kratos Structural Reinforcement products.

Kordsa shows its customers how to perform correct implementation of Kratos Structural Reinforcement system during application. Besides, Kordsa offers pull-off test in compliance with ASTM D7522 standard on site after Kratos Structural Reinforcement system application. Along with this test, Kordsa prepares a test report and shares with its customers the result of whether the application is suitable or not.



Kratos Structural Reinforcement Products

Kratos Structural Reinforcement product group consists of 4 products. The first of these is Kratos C-Fabric, a carbon fabric woven in one direction with carbon fiber that has high tensile strength at Kordsa Izmit Facilities. The second product is Kratos Prime Resin used to provide rigidity where Kratos C-Fabric is applied and to form a composite material together. The third product of the product group is Kratos C-Plate with high elastic modulus obtained as a result of lamination of carbon fibers extending in one direction with polymer-based epoxy resin. The last product of the product group is Kratos Adhesive which provides bonding of Kratos C-Plate on the surface to be applied.



Kratos C-Fabric and Kratos Prime Resin

Kratos C-Fabric is a single-layer cord created by attaching carbon threads extending only in 0° direction with sewing thread. Kratos C-Fabric is woven with carbon fibers, one of the strongest materials known in the world. Despite its strength, the fibers, which have the softness of yarn, are easily formed into the desired shape, and become rigid when used with Kratos Prime Resin, special epoxy resin, which is another member of Kratos Structural Reinforcement product group. Kratos Prime Resin is a two-component epoxy-based lamination resin specially produced for Kratos C-Fabric. When Kratos C-Fabric is applied with Kratos Prime Resin to load-bearing structural elements such as reinforced concrete columns-beams, it increases load-bearing capacity factor of these elements.



Application Areas of Kratos C-Fabric and Kratos Prime Resin

Kratos C-Fabric and Kratos Prime Resin are often used specifically for strengthen reinforced concrete structural elements. Reinforced concrete columns and walls are wrapped with Kratos C-Fabric and their shear and compressive strengths and ductility are increased. By wrapping reinforced concrete beams as well as columns and shear walls, these elements are strengthened against bending and shearing and their load-bearing capacity is increased.

Application Details of Kratos C-Fabric and Kratos Prime Resin

The application begins with the surface preparation of the element to be reinforced. Application surface should be free from any kind of dust, dirt, loose particles, cement slurry residues, oil, and grease, and should be dry. The concrete substrate must be clean, durable, and of sufficient strength. Plaster and paint on the application surface, if any, and weak concrete pieces must be removed and repaired with high-strength repair mortar and restored. The application surface must be cleaned by using various methods such as applying compressed air, etc. to provide the highest adhesion strength. Corners of elements such as columns and beams must be beveled and rounded at least 30mm, sharp surfaces shall cause breaking of carbon fibers of Kratos C-Fabric, and this shall result in failure of expected carrying capacity increase. Temperature of the application surface and the ambient must be minimum +5°C and maximum +30 °C during the application for lamination of Kratos Prime Resin.

Following the surface preparation, the application is started. Primarily, Kratos C-Fabric is made ready by cutting with a razor blade knife according to the geometrical properties of the surface to be applied. The prepared Kratos Prime Resin mixture is applied to the concrete with a roller. Afterwards, Kratos C-Fabric is stretched on the surface in the direction of the fibers, and Kratos Prime Resin is firmly adhered to the carbon by hand. There must be no air between the fabric and the surface. For Kratos Prime Resin to be absorbed into the fabric, air gaps must be removed by pressing in the direction of the fibers with a roller. Thus, Kratos C-Fabric is fully adhered to the surface. During bonding, Kratos Prime Resin at the bottom is provided to come out with a slightly rough plastic roller. This process is done in such a way that Kratos Prime Resin is placed on the entire surface homogeneously, and if Kratos Prime Resin is insufficient, Kratos Prime Resin is applied again, and the carbon fibers are saturated with epoxy.

If a second coat of Kratos C-Fabric is to be applied to the surface, Kratos Prime Resin should be applied over Kratos C-Fabric with a roller and the fibrous polymer should be laminated between two layers of adhesive.

In multi-layer fibrous polymer applications, Kratos Prime Resin should be applied with a roller between each layer and the fibrous polymer fabric should be pressed with a roller and laminated in the adhesive. If plaster will be applied on the surface, angular sand should be sprinkled before Kratos Prime Resin on the last layer dries, and roughness should be formed on the surface that will facilitate the adhesion of the plaster. Sprinkled sand provides adherence between the carbon fiber and the plaster to be made. After the application is completed, the surface covered with Kratos C-Fabric must be protected from all kinds of impacts, fire, and sunlight.

Kordsa offers Kratos C-Fabric product with two different areal weight option; these are 300 g/m² and 600 g/m².

Type	Kratos C-Fabric 300	Kratos C-Fabric 600
Width (mm)	500	500
Tensile Strength (MPa)	4800	4800
Elastic Modulus (GPa)	235	235
Elongation at Break (%)	2	2
Areal Weight (g/m ²)	300	600

Kratos C-Plate and Kratos Adhesive

Kratos C-Plate is a plate product with a high modulus of elasticity obtained by laminating carbon fibers extending in one direction with polymer-based epoxy resin. The plate is formed by combining carbon fibers, one of the strongest materials known as fabric. Kratos C-Plate product must be used with Kratos Adhesive product which has been specially developed for bonding to the surfaces to be applied.



Application Areas of Kratos C-Plate and Kratos Adhesive

Kratos C-Plate and Kratos Adhesive are specifically used for increasing the load-bearing capacity of reinforced concrete beams and floors by strengthening them against bending. Especially in floors, Kratos C-Plate and Kratos Adhesive products play an important role in reinforcing slabs by eliminating the weaknesses caused by the later formed slab gaps.

Application Details of Kratos C-Plate and Kratos Adhesive

The application begins with the surface preparation of the element to be reinforced. Application surface should be free from any kind of dust, dirt, loose particles, cement slurry residues, oil and grease, and should be dry as in before the application of Kratos C-Plate and Kratos Adhesive. The concrete substrate must be clean, durable, and of sufficient strength. Plaster and paint on the application surface, if any, must be removed, weak concrete pieces must be repaired with high-strength repair mortar and restored. The application surface must be cleaned by using various methods such as applying compressed air, etc. to provide the highest adhesion strength. Temperature of the application surface and the ambient must be minimum +5°C and maximum +30 °C to ensure the best bonding of Kratos Adhesive.

Following the surface preparation, Kratos C-Plate is made ready by cutting according to the dimensions shown in the project and to the geometrical properties of the surface to be applied. The prepared Kratos Adhesive mixture is applied with a spatula to both the surface of application with a thickness of 1-1.5 mm and on the surface of the Kratos C-Plate product to be bonded in the same thickness. Afterwards, Kratos C-Plate product should be fixed in a way that it does not swell by stretching in the direction of the fibers. The plate must be pressed with a roller so that no air remains between the plate and the surface.

After the application is completed, Kratos C-Plate surfaces must be protected from all kinds of impacts, fire and sunlight, if it will be applied to a place that will be exposed to sunlight, the surface must be covered with repair mortars within 7 days.

Kordsa offers Kratos C-Plate product with two different geometric options.

Tip	100 mm x 1.2 mm	100 mm x 1.4 mm
Width (mm)	100	100
Cross Section Thickness (mm)	1,2	1,4
Tensile Strength (MPa)	2000	2000
Elastic Modulus (GPa)	165	165
Elongation at Break (%)	1,3	1,3

Application Areas

Kratos Structural Reinforcement Products are used in the following fields of application in reinforcing structural elements against bending and/or shearing.

- Hospitals and Healthcare Buildings
- Education Buildings
- Housing
- Public Buildings
- Industrial Buildings
- Bridges and Viaducts
- Silos and Chimneys
- Natural Gas and Petroleum Pipelines
- Water Structures





For Further Information:

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