



BRIDGE STRENGTHENING FRP COMPOSITE SYSTEMS

BUILDING TRUST



SYSTEM SOLUTIONS FOR REINFORCED AND PRESTRESSED CONCRETE, TIMBER, STEEL AND MASONRY ARCH BRIDGES

REASONS FOR STRENGTHENING

- Corrosion of the reinforcement
- Corrosion of prestressing cables
- Increased traffic loads
- Inadequate design
- Modified standards/codes
- Excessive cracking of concrete
- Seismic retrofitting

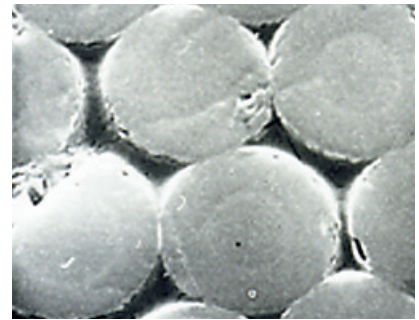
MATERIALS USED

FRP Fabrics

Uni and/or bidirectional fabrics with carbon, glass and aramid fibres. Mostly used for seismic retrofitting and shear strengthening.

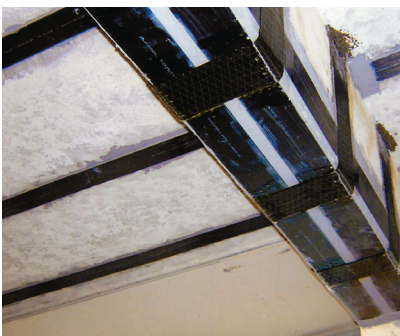
CFRP Plates

Carbon fibre plates produced by pultrusion process with precise material properties. Mostly used for flexural and shear strengthening of dynamic loaded structures such as bridges, etc.



CFRP plate magnification 1:2000

SHEAR STRENGTHENING



FLEXURAL STRENGTHENING

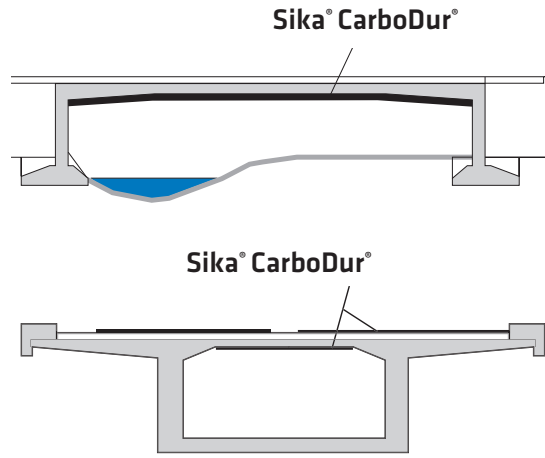


BRIDGE DECKS



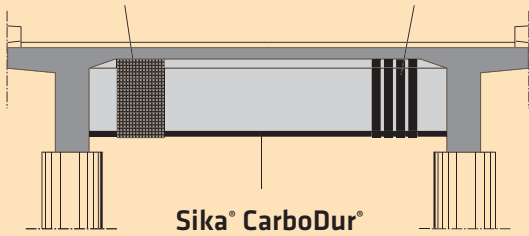
FLEXURAL STRENGTHENING WITH:

- Sika® CarboDur® CFRP plates
- Sika® CarboHeater, heating device for rapid application
- Sika® CarboDur® prestressed CFRP plates
- SikaWrap® FRP fabrics



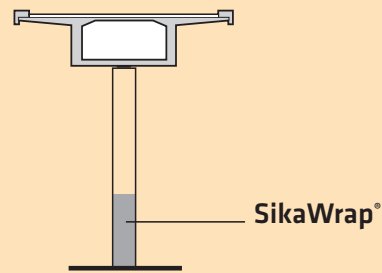
SHEAR STRENGTHENING WITH:

- Sika® CarboShear® L CFRP plates
- SikaWrap® FRP fabrics



SEISMIC RETROFITTING WITH:

- SikaWrap® FRP fabrics



All Sika composite materials are bonded with Sikadur® high strength epoxy adhesives

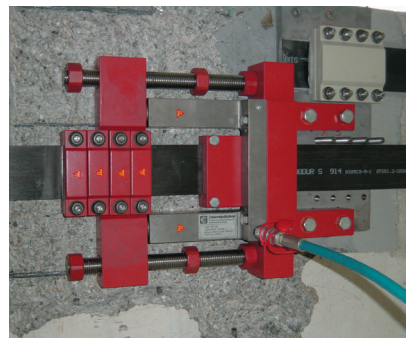
SEISMIC RETROFITTING



TIMBER & STEEL BRIDGES



PRESTRESSED STRENGTHENING



BRIDGE STRENGTHENING

FRP COMPOSITE SYSTEMS

CFRP PLATES - SYSTEM COMPONENTS

Sika® CarboDur® CFRP plates		Type S	Type M	
	Elastic modulus:	165,000 N/mm ²	210,000 N/mm ²	
	Tensile strength:	2,800 N/mm ²	2,900 N/mm ²	
Sika® Prestressing Systems	Prestressing of Sika® CarboDur® plates with Sika® CarboStress prestressing system.			
Sika® CarboHeater Heating device	Fast application (2 – 3 hrs) of Sika® CarboDur® plates			
Sika® CarboShear® L-shaped CFRP plates	L Min. tensile load:	126 kN/40 mm width		
	Elastic modulus:	150,000 N/mm ²		
Sikadur® Epoxy adhesives and mortars	Sikadur® Product:	Sikadur®-30	Sikadur®-30 LP	Sikadur®-41 CFN
	Application temperature:	8 – 35 °C	25 – 55 °C	10 – 30 °C
	Elastic modulus:	11,200 N/mm ²	10,000 N/mm ²	9,000 N/mm ²
	Bond strength:	> 4 N/mm ² (concrete failure)	> 4 N/mm ² (concrete failure)	> 4 N/mm ² (concrete failure)
	Use:	Plate adhesive	Plate adhesive	Repair mortar

FRP FABRICS - SYSTEM COMPONENTS

SikaWrap® FRP Fabrics	Several types of SikaWrap® FRP fabrics are available to meet the requirement of specifier and contractor. Uni-directional woven and non-woven fabrics made of glass, aramid and different types of carbon fibres are available. Bi-directional types can be offered with carbon and glass fibres. The range of areal weight is between 200 and 600 g/m ² for carbon, 400 to 1,000 g/m ² for glass and 300 to 600 g/m ² for aramid fibre fabrics. Further possibilities and fibre combinations are available on request.
Sikadur® Epoxy impregnating resins	All SikaWrap® fabrics can be impregnated with the system tested Sikadur® impregnating resins that are all suited for the most common substrate types.

TEST REPORTS

Fatigue and Failure Test Test beams B1 and B2	EMPA Test Report No. 402017E/2	1999
Sika CarboDur Structural Strengthening System, Fatigue and Failure Test, Test beam B3	EMPA Test Report No. 415 053E/3	2001
Sika CarboDur Structural Strengthening System, Bonding of CFRP strips under dynamic load	EMPA Test Report No. 170 569e-1	1999
Bonding of CarboDur CFRP plates under dynamic load	EMPA Test Report No. 418 931E	2001

APPROVALS

General construction approval for steel plate strengthening with Sikadur-30 and Icosit 277	German Institute of Construction No. 7-36.1-30, Germany	07.04.95
General construction approval for Sika CarboDur, Plates Typ S	German Institute of Construction No. 7-36.12-29, Germany	11.11.97
Report/Technical Investigation for CarboDur, Plates Typ S and SikaWrap-230C fabric	SOCOTEC No. HX0823, France	07.08.00
Evaluation Report for SikaWrap FRP Systems	ICBO No. ER-5558, California, U.S.	01.04.00



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composite system
information

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