Construction

Bridge Strengthening

Sika® CarboDur® Composite Systems

System Solutions for reinforced and prestressed Concrete, Timber, Steel and Masonry Arch Bridges

Reasons for Strengthening

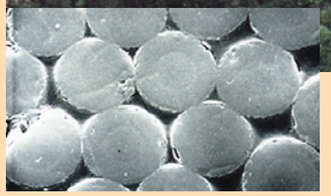
- **Corrosion of the reinforcement**
- **Corrosion of prestressing cables**
- **Increased traffic loads**
- **Inadequate design**
- **Modified standards/codes**
- **Excessive cracking of concrete**
- **Seismic retrofitting**

Materials used

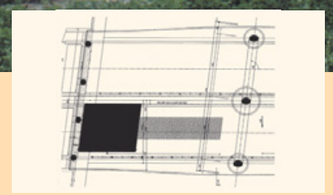
FRP Fabrics
Uni- and/or bidirectional fabrics with carbon, glass and aramid fibers. Mostly used for seismic retrofitting and shear strengthening.

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.

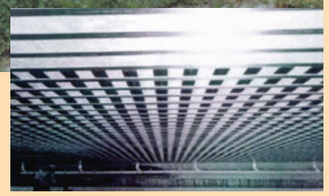
Heavy truck crossing the bridge, Slovenija



CFRP plate magnification 1:2000



Bridge deck: Design of plates

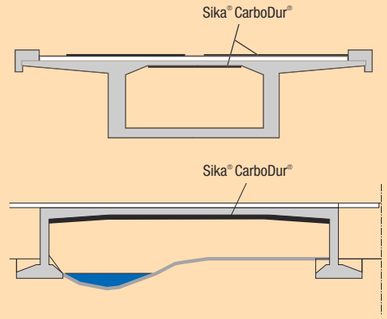


Applied CarboDur CFRP plates

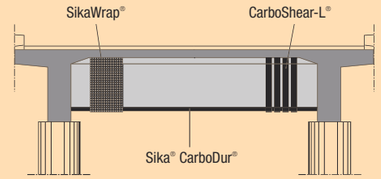
Cover Pictures: Prestressed concrete bridge Sika® «World record» in composite-plate length, Australia
Steel-concrete bridge Sika® «Tailor made» Composite-plate, United Kingdom

Sika® Systems

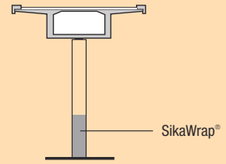
Flexural Strengthening with
- **Sika® CarboDur®** CFRP plates
  Sika® CarboHeater, heating device for rapid application
- **Sika® CarboDur®** prestressed CFRP plates
- **SikaWrap®** FRP fabrics



Shear Strengthening with
- **Sika® CarboShear® L** CFRP plates
- **SikaWrap®** FRP fabrics

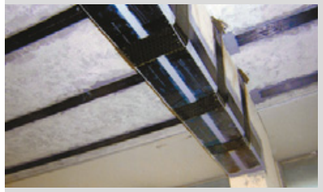


Seismic Retrofitting with
- **SikaWrap®** FRP fabrics



All Sika® Composite materials are bonded with Sikadur® High strength epoxy adhesives

Shear Strenghening



Flexural Strengthening

Seismic Retrofitting

Timber and Steel Bridges

Prestressed Strengthening

Bridge Strengthening
Sika® CarboDur® Composite Systems

System Components

CFRP Plates System Components

Sika® CarboDur®		**Type S**	**Type M**	**Type H**
CFRP plates	Elastic modulus	165 000 N/mm²	210 000 N/mm²	300 000 N/mm²
	Tensile strength	2800 N/mm²	2800 N/mm²	1350 N/mm²
Sika® Prestressing Systems	Prestressing of **Sika® CarboDur®** plates over 200 kN (20 tons) with **Sika® StressHead** or **Sika® LEOBA CarboDur®** prestressing system			
Sika® CarboHeater Heating device	Fast application (2 – 3 hrs) of **Sika® CarboDur®** plates			
Sika® CarboShear® L L-shaped CFRP plates	Min. tensile load	126 kN/40 mm width		
	Elastic modulus	120 000 N/mm²		
Sikadur®		**Sikadur®-30**	**Sikadur®-30 LP**	**Sikadur®-41**
Epoxy adhesives and mortars	Application temperature	10 – 35 °C	25 – 55 °C	10 – 35 °C
	Elastic modulus	12 800 N/mm²	10 000 N/mm²	9000 N/mm²
	Bond strength	> 4 N/mm² (concrete failure)	> 4 N/mm² (concrete failure)	> 4 N/mm² (concrete failure)
	Use	Plate adhesive	Plate adhesive	Repair mortar

Fabrics System Components

SikaWrap® FRP Fabrics	Several types of **SikaWrap®** FRP fabrics are available to meet the requirement of specifier and contractor. Unidirectional woven and non-woven fabrics made of glass, aramid and different types of carbon fibers are available. Bi-directional types can be offered with carbon and glass fibers. The range of areal weight is between 200 and 600 g/m² for carbon, 400 to 1000 g/m² for glass and 300 to 600 g/m² for aramid fiber fabrics. Further possibilities and fiber 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. are all suited for the most common substrate types.

For additional information see corresponding Product Data Sheets.

Test Reports

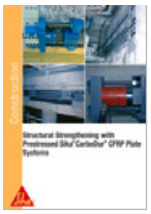
Fatigue and Failure Test Test beams B1 and B2	EMPA Test Report No. 402017E/2	1999
Sika CarboDur Structural Strengthening System, Fatigue and Failure Test, Test beam B3	EMPA Test Report No. 415053E/3	2001
Sika CarboDur Structural Strengthening System, Bonding of CFRP strips under dynamic load	EMPA Test Report No. 170569e-1	1999
Bonding of CarboDur CFRP plates under dynamic load	EMPA Test Report No. 418931E	2001

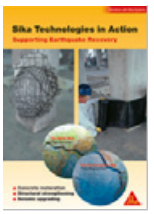
Approvals

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

Also available from Sika





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Your local Sika Company

Our most current General Sales Conditions shall apply. Please consult the Product Data Sheet prior to any use and processing.

Responsible Care

Certified Quality System ISO 9001/EN 29001 since 1986

Certified Management System ISO 14001 since 1997

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