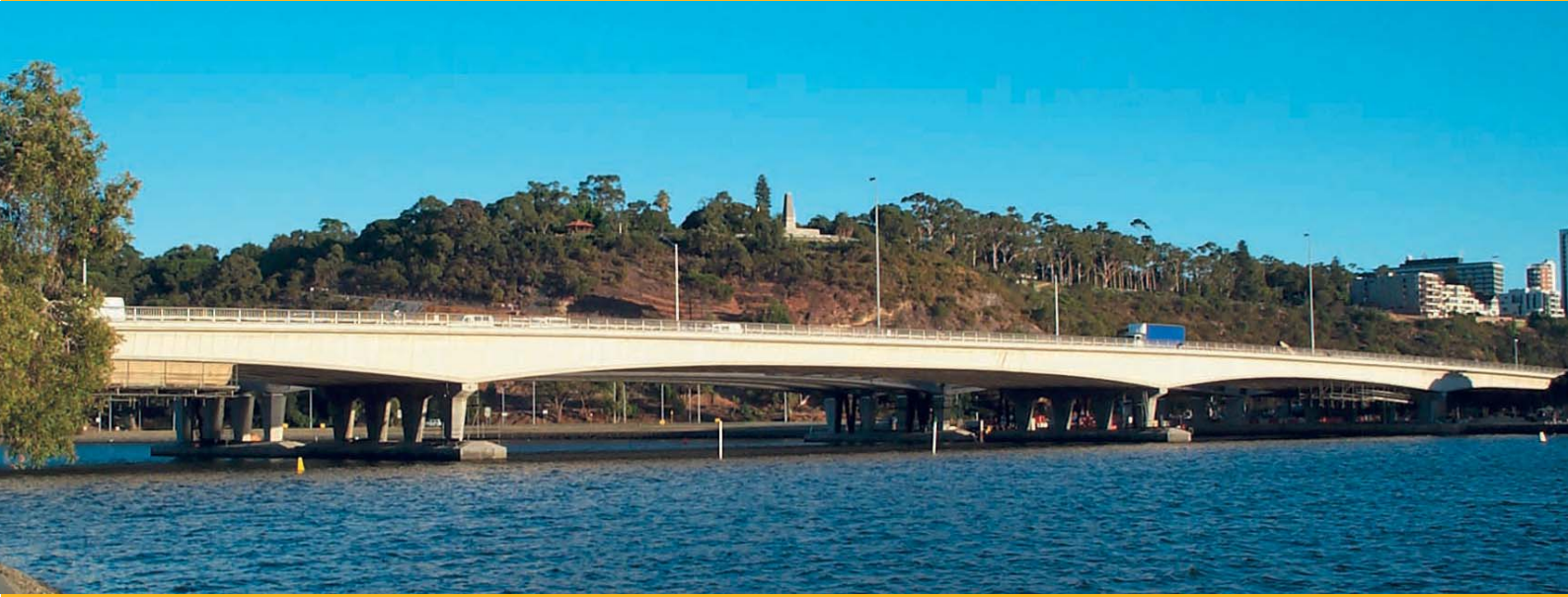


# Bridge Strengthening

**Sika® CarboDur® Composite Systems**



- ▲ **Flexural Strengthening**
- ▲ **Shear Strengthening**
- ▲ **Seismic Retrofitting**



# Bridge Strengthening with Sika® Carbo Dur® Composite Systems



## System Solutions for Reinforced and Prestressed Concrete, Timber 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

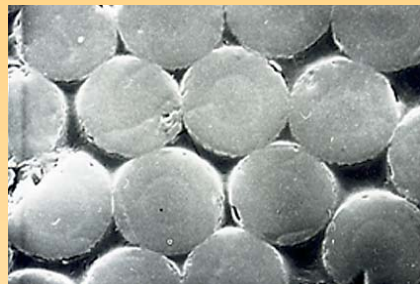
### Materials used

#### 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.

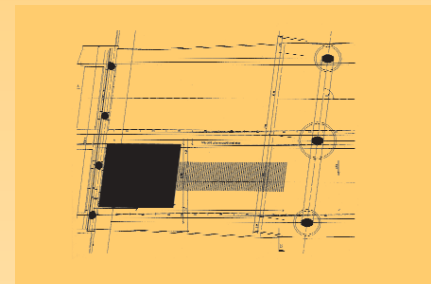


CFRP Plate Magnification 1:2000



Heavy Truck Crossing the Bridge

Slovenija



Bridge Deck: Design of Plates

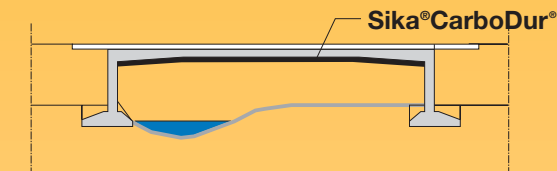


Applied CarboDur CFRP Plates

### Sika® System Solutions for:

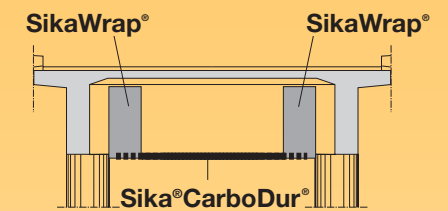
#### Flexural Strengthening with

- ▲ Sika® CarboDur® CFRP plates
- ▲ Sika® CarboDur® prestressed CFRP plates
- ▲ SikaWrap® FRP fabrics



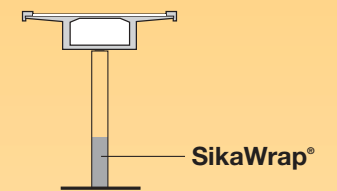
#### Shear Strengthening with

- ▲ 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

### Flexural Strengthening



Greece

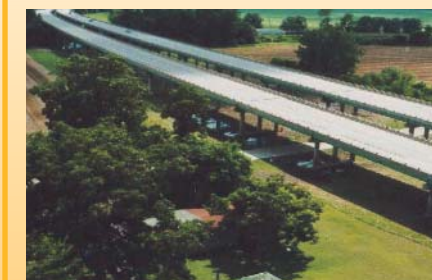


Indonesia



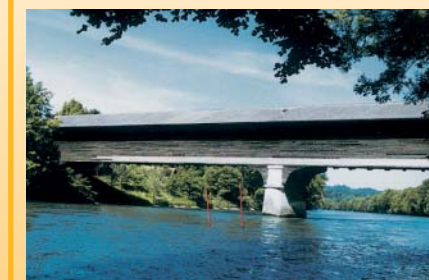
China

### Seismic Retrofitting



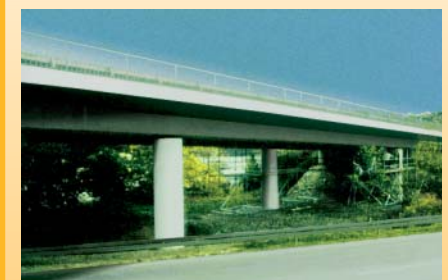
United States

### Timber Bridge



Switzerland

### Prestressed Strengthening



Germany

Cover Pictures: Prestressed Concrete Bridge Sika® «World record» in Composite-Plate length, Australia  
Steel-Concrete Bridge Sika® «Tailor made» Composite Plate, United Kingdom

# Bridge Strengthening

## Sika® CarboDur® Composite Systems

### System Components

Sika® CarboDur® Plates			
	Sika® CarboDur S	Sika® CarboDur M	Sika® CarboDur H
E-modulus	165'000 N/mm <sup>2</sup>	210'000 N/mm <sup>2</sup>	300'000 N/mm <sup>2</sup>
Tensile strength	2800 N/mm <sup>2</sup>	2400 N/mm <sup>2</sup>	1300 N/mm <sup>2</sup>

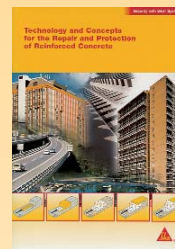
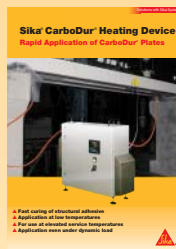
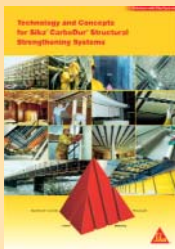
Sika® CarboShear L®	
Min. Tensile load	126KN/40mm
E-modulus mean value	120'000 N/mm <sup>2</sup>

Sikadur® Epoxy Adhesives and Mortars		
	Sikadur® -30	Sikadur® -41
E-modulus	12'800 N/mm <sup>2</sup>	9'000 N/mm <sup>2</sup>
Bond strength on concrete	> 4 N/mm <sup>2</sup> (concrete failure)	> 4 N/mm <sup>2</sup> (concrete failure)

### Test Reports

Fatigue and Failure Test Test beams B1 and B2	EMPA Test Report No. 402'017E/2	1999
Sika CarboDur Structural Strengthening System, Fatigue and Failure 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

### Also available from Sika



The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users should always refer to the most recent issue of the Technical Data Sheet for the product concerned, copies of which will be supplied on request.



Internet: <http://www.sika.com>

SikaWrap® Fabrics				
	Dry Application		Wet Application	
	SikaWrap® Hex-230C	SikaWrap® Hex-420G	SikaWrap® Hex-103C	SikaWrap® Hex100G
Areal weight	230 g/m <sup>2</sup>	430 g/m <sup>2</sup>	610 g/m <sup>2</sup>	920g/m <sup>2</sup>
Tensile strength of fibres	3'500 N/mm <sup>2</sup>	2'250 N/mm <sup>2</sup>	3'500 N/mm <sup>2</sup>	2'250 N/mm <sup>2</sup>
Tensile modulus of fibres	230'000 N/mm <sup>2</sup>	70'000 N/mm <sup>2</sup>	230'000 N/mm <sup>2</sup>	70'000N/mm <sup>2</sup>

Sikadur® Epoxy Adhesives		
	Dry Application Sikadur® -330	Wet Application Sikadur® Hex-300/-306
Flexural modulus	3'800 N/mm <sup>2</sup>	3'120 N/mm <sup>2</sup>
Bond strength on concrete	> 4 N/mm <sup>2</sup> (concrete failure)	> 4 N/mm <sup>2</sup> (concrete failure)
Viscosity	Pasty	Low viscous

### 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

### Your Local Sika® Company