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.

Flexural Strengthening

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

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

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Bridge Strengthening

Sika® CarboDur® Composite Systems

System Components

Sika® CarboDur Plates

<table>
<thead>
<tr>
<th>Material</th>
<th>E-modulus (N/mm²)</th>
<th>Tensile strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sika CarboDur S</td>
<td>165.000</td>
<td>210.000</td>
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<tr>
<td>Sika CarboDur M</td>
<td>210.000</td>
<td>260.000</td>
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<tr>
<td>Sika CarboDur H</td>
<td>300.000</td>
<td>350.000</td>
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Sika® CarboShear L

<table>
<thead>
<tr>
<th>Condition</th>
<th>E-modulus (N/mm²)</th>
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<tbody>
<tr>
<td>Mean value</td>
<td>120.000</td>
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<tr>
<td>Min. Tensile load</td>
<td>120.000</td>
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</table>

Sikadur® Epoxy Adhesives and Mortars

<table>
<thead>
<tr>
<th>Material</th>
<th>E-modulus (N/mm²)</th>
<th>Bond strength (N/mm²)</th>
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</thead>
<tbody>
<tr>
<td>Sikadur® -30</td>
<td>12.800</td>
<td>&gt; 4</td>
</tr>
<tr>
<td>Sikadur® -41</td>
<td>9.000</td>
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Test Reports

- Fatigue and failure tests: EMPA Test Report 1999
- Fatigue and failure tests: EMPA Test Report 2001
- Fatigue and failure tests: EMPA Test Report 1999
- Fatigue and failure tests: EMPA Test Report 2001
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- Fatigue and failure tests: EMPA Test Report 2001

SikaWrap® Fabrics

<table>
<thead>
<tr>
<th>Condition</th>
<th>E-modulus (N/mm²)</th>
<th>Bond strength (N/mm²)</th>
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<td>Min. Tensile load</td>
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<tr>
<td>E-modulus</td>
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<td>&gt; 4</td>
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<tr>
<td>E-modulus</td>
<td>300.000</td>
<td>&gt; 4</td>
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</table>

Sikadur® Epoxy Adhesives

<table>
<thead>
<tr>
<th>Condition</th>
<th>E-modulus (N/mm²)</th>
<th>Bond strength (N/mm²)</th>
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</thead>
<tbody>
<tr>
<td>Min. Tensile load</td>
<td>3.900</td>
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<tr>
<td>Mean value</td>
<td>3.120</td>
<td>&gt; 4</td>
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</table>

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
  No. 418031, France
  07.08.95
- Evaluation Report for SikaWrap FRP Systems
  No. 1035, No. FR-315, California, U.S.
  01.04.00
- Evaluation Report for SikaWrap FRP Systems
  No. 1035, No. FR-315, California, U.S.
  01.04.00

Also available from Sika

- Rapid Application of CarboDur® Plates
- Fast curing of structural adhesive
- Application at low temperatures
- For use at elevated service temperatures
- Application even under dynamic load

Solutions with Sika Systems

- Shear Strengthening
  - High strength composite systems
  - Corrosion resistant
  - Easy application
  - No maintenance cost

- Structural Strengthening
  - Tested and approved systems
  - Easy application
  - No maintenance cost

- Seismic upgrading
  - Concrete restoration
  - Structural strengthening
  - Seismic upgrading

Solutions with Sika Systems

- Support for Earthquake Recovery
  - Concrete restoration
  - Structural strengthening
  - Seismic upgrading

Your Local Sika Company

Internet: http://www.sika.com

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