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.

Cover Picture: Prestressed concrete bridge Sika® «World record» in composite-plate length, Australia

Shear Strengthening with

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

Seismic Retrofitting with

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

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

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

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- SikaWrap® FRP fabrics

Seismic Retrofitting with

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Cover Picture: Prestressed concrete bridge Sika® «World record» in composite-plate length, Australia

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Shear Strengthening
Flexural Strengthening
Seismic Retrofitting
Timber and Steel Bridges
Prestressed Strengthening
Bridge Strengthening
Sika® CarboDur® Composite Systems

System Components

<table>
<thead>
<tr>
<th>CFRP Plates System Components</th>
<th>Sika® CarboDur®</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFRP plates</td>
<td>Elastic modulus</td>
<td>165 000 N/mm²</td>
<td>210 000 N/mm²</td>
<td>280 000 N/mm²</td>
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<tr>
<td>Tensile strength</td>
<td>2800 N/mm²</td>
<td>2800 N/mm²</td>
<td>2800 N/mm²</td>
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</tr>
</tbody>
</table>

Sika® Prestressing Systems

- Prestressing of Sika® CarboDur® plates over 200 kN (20 tons) with Sika® StressHead or LEOBA CarboDur® prestressing system

Sika® CarboHeater

Heat application (2 – 3 min) of Sika® CarboDur® plates

<table>
<thead>
<tr>
<th>Sika® CarboShear® L</th>
<th>Type L</th>
<th>L-shaped CFRP plates</th>
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</thead>
<tbody>
<tr>
<td>Epoxy adhesives and mortars</td>
<td>Application temperature</td>
<td>10 – 30 °C</td>
</tr>
<tr>
<td>Elastic modulus</td>
<td>12 000 N/mm²</td>
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<tr>
<td>Bond strength</td>
<td>&gt; 4 N/mm²</td>
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</tbody>
</table>

Sikadur®

- Plate adhesive
- Plate adhesive

Sika® Prestressing

Prestressing of Sika® CarboDur® plates over 200 kN (20 tons) with Sika® StressHead or LEOBA CarboDur® prestressing system

<table>
<thead>
<tr>
<th>Sika® CarboHeater</th>
<th>Type</th>
<th>Type M</th>
<th>Type H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic modulus</td>
<td>122 000 N/mm²</td>
<td>210 000 N/mm²</td>
<td>300 000 N/mm²</td>
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<tr>
<td>Tensile strength</td>
<td>2800 N/mm²</td>
<td>2800 N/mm²</td>
<td>1350 N/mm²</td>
</tr>
</tbody>
</table>

Test Reports

- Fatigue and Failure Test EMPA Test Report 1999
- Sika CarboDur Structural Strengthening EMPA Test Report 2001
- Bonding of CFRP strips under dynamic load EMPA Test Report 2001

Approvals

- General construction approval for steel plate strengthening with Sika® CarboDur® Plaques Typ S and Typ M 2001
- General construction approval for Sika® CarboDur® Plaques Typ S 2000
- General construction approval for Sika® CarboDur® Plaques Typ S 2000
- General construction approval for Sika® CarboDur® Plaques Typ S 2000

Also available from Sika

- CFRP Plates
- Prestressing
- CarboHeater
- CarboShear
- Fabrics
- Epoxy adhesives and mortars
- Sikadur®

For additional information see corresponding Product Data Sheets.

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Your local Sika Company

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