

## Sika CarboDur® S

### Pultruded Carbon Fibre Plates for Structural Strengthening as Part of a Sika CarboDur® System

#### Product Description

Sika CarboDur® Plates are pultruded carbon fibre reinforced polymer (CFRP) laminates, designed for strengthening concrete, timber, masonry, steel and fibre reinforced polymer structures.

Sika CarboDur® Plates are bonded onto the structure as externally bonded reinforcement using Sikadur®-30 epoxy resin based adhesive for normal, or Sikadur®-30 LP epoxy resin based adhesive for elevated temperatures during application and / or service.

Please refer to the relevant Product Data Sheet for more detailed information about each of these adhesives.

#### Uses

Sika CarboDur® Systems are used to improve, increase or repair the performance and resistance of structures for:

*Increased Load Carrying Capacity:*

- Increasing the load capacity of floor slabs, beams and bridge sections
- For the installation of heavier machinery
- To stabilise vibrating structures
- For changes in building use

*Damage to structural elements due to:*

- Deterioration of the original construction materials
- Steel reinforcement corrosion
- Accidents (Vehicle impact, earthquakes, fire)

*Improvement of serviceability and durability:*

- Reduced deflection and crack width
- Stress reduction in the steel reinforcement
- Improved fatigue resistance

*Change of the structural system:*

- Removal of walls and / or columns
- Removal of floor and wall sections to create access / openings
- Resistance to possible events:
- Increased resistance to earthquakes, impact or explosion etc.

*To repair design or construction defects such as:*

- Insufficient / inadequate reinforcement
- Insufficient / inadequate structural depth



## Characteristics / Advantages

- Non corroding
- Very high strength
- Excellent durability and fatigue resistance
- Unlimited lengths, no joints required
- Low system thickness, simple execution of plate intersections or crossings
- Easy transportation (rolls)
- Lightweight, very easy to install, especially overhead (without temporary support)
- Minimum preparation of plate, applicable in several layers
- Smooth edges without exposed fibres as result of production by pultrusion
- Extensive Testing and Approvals available from many countries worldwide

## Tests

### Approval / Standards

France: CSTB - Avis Technique 3/10-669, SIKA CARBODUR SIKA WRAP

Slovakia: TSUS, Building Testing and research institutes, Technical Approval TO-09/0080, 2009: Systémy dodatočného zosilňovania konštrukcií Sika® CarboDur® a SikaWrap® (Slovak).

Poland: Technical Approval ITB AT-15-5604/2011: Zestaw wyrobów Sika CarboDur do wzmacniania i napraw konstrukcji betonowych (Polish)

Poland: Technical Approval IBDiM Nr AT/2008-03-0336/1 „Płaskowniki. pręty, kształtki i maty kompozytowe do wzmacniania betonu o nazwie handlowej: Zestaw materiałów Sika CarboDur® do wzmacniania konstrukcji obiektów mostowych (Polish)

Fib, Technical Report, bulletin 14: Externally bonded FRP reinforcement for RC structures, July 2001 (International).

USA: ACI 440.2R-08, Guide for the Design and construction of Externally Bonded FRP Systems for strengthening concrete structures, July 2008, (USA).

UK: Concrete Society Technical Report No. 55, Design guidance for strengthening concrete structures using fibre composite material, 2012 (UK).

Switzerland: SIA 166:2004 Klebebewehrungen

Italy: CNR-DT 200/2004 - Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Existing Structures

## Form

### Appearance / Colour

Carbon fibre reinforced polymer with an epoxy matrix, black.

### Packaging

Cut to size as follows in non-returnable cardboard packaging. Supplied in rolls of 100 m in nonreturnable cardboard boxes.

### Types

Type	Width	Thickness	Cross sectional area
Sika CarboDur® S512	50 mm	1.2 mm	60 mm <sup>2</sup>
Sika CarboDur® S514	50 mm	1.4 mm	70 mm <sup>2</sup>
Sika CarboDur® S812	80 mm	1.2 mm	96 mm <sup>2</sup>
Sika CarboDur® S814	80 mm	1.4 mm	112 mm <sup>2</sup>
Sika CarboDur® S912	90 mm	1.2 mm	108 mm <sup>2</sup>
Sika CarboDur® S914	90 mm	1.4 mm	126 mm <sup>2</sup>
Sika CarboDur® S1012	100 mm	1.2 mm	120 mm <sup>2</sup>
Sika CarboDur® S1014	100 mm	1.4 mm	140 mm <sup>2</sup>
Sika CarboDur® S1214	120 mm	1.4 mm	168 mm <sup>2</sup>
Sika CarboDur® S1512	150 mm	1.2 mm	180 mm <sup>2</sup>

Select dimensions according to your local Sika product range and plate supplier

## Storage

### Storage Conditions/ Shelf Life

Unlimited, provided there is no exposure to direct sunlight (UV light), in dry conditions and at temperatures of max. 50°C

Transportation: only in the original packaging, or otherwise adequately protected against any mechanical damage

## Technical Data

### Density

1.60 g/cm<sup>3</sup>

### Glass Transition Temperature

> 100°C

(according to EN 61006)

### Fibre Volume Content

> 68%

## Mechanical / Physical Properties

### E-Modulus

Values in the longitudinal direction of the fibres (according to EN 2561)

Mean Value 170,000 N/mm<sup>2</sup>

5% Fractile-Value 165,000 N/mm<sup>2</sup>

### Tensile Strength

Values in longitudinal direction of fibres (according to EN 2561)

Mean Value 3,100 N/mm<sup>2</sup>

5% Fractile-Value 2,900 N/mm<sup>2</sup>

### Strain at break

Value in longitudinal direction of fibres (according to EN 2561)

Minimum value > 1.80%

## System Information

### System Structure

The system build-up and configuration as described must be fully complied with and may not be changed.

Resin Adhesive - Sikadur<sup>®</sup>-30 or Sikadur<sup>®</sup>-30 LP.

Structural strengthening Carbon plates – CarboDur S.

For detailed information on Sikadur<sup>®</sup>-30 and Sikadur<sup>®</sup>-30 LP, together with the application details, please refer to the Sikadur<sup>®</sup>-30 or Sikadur<sup>®</sup>-30 LP Product Data Sheet and the "Method Statement Sika CarboDur<sup>®</sup> Externally Bonded Reinforcement" Ref: 850 41 05

## Application Details

### Consumption

Width of CarboDur <sup>®</sup> Plate	Typical Consumption of Sikadur <sup>®</sup> -30
50 mm	0.20 – 0.28 kg/m*
80 mm	0.32 – 0.44 kg/m*
90 mm	0.40 – 0.56 kg/m*
100 mm	0.44 – 0.64 kg/m*
120 mm	0.45 – 0.80 kg/m*
150 mm	0.68 – 1.00 kg/m*

\*Note: Consumption is for standard application only. Rough or uneven substrate surfaces, plate crossings, loss and wastage can lead to a higher adhesive consumption of up to 20%.

<b>Substrate Quality</b>	<p><i>Sika CarboDur® Plates externally bonded to the concrete surface:</i> Recommended minimum concrete pull-off strength after surface preparation</p> <ul style="list-style-type: none"> <li>■ Mean: 2.0 N/mm<sup>2</sup></li> <li>■ Minimum: 1.5 N/mm<sup>2</sup></li> </ul> <p>The effective concrete pull-off strength after surface preparation has to be verified.</p> <p>When the concrete pull-off strength is below the stated minimum requirements, alternative Sika solutions are available:</p> <ul style="list-style-type: none"> <li>■ CarboDur® applied in slots as near surface mounted (NSM) reinforcement</li> <li>■ SikaWrap® fabrics: Please refer to the Product Data Sheet for the SikaWrap® fabrics</li> </ul> <p>Concrete must generally be older than 28 days (dependent on curing conditions and the type of concrete etc.)</p> <p><i>Sika CarboDur® externally bonded to other substrates:</i> For application of CarboDur® plates to all other substrates (brick, stone, steel, wood, fibre reinforced polymer etc.) please refer to the “Method Statement for Sika CarboDur® Externally Bonded Reinforcement” Ref: 850 41 05</p>
<b>Substrate Preparation</b>	<p>Concrete must be cleaned and prepared to achieve a laitance and contaminant free, open textured surface. Please also refer to the “Method Statement Sika CarboDur® Externally Bonded Reinforcement” Ref: 850 41 05</p>
<b>Application Conditions / Limitations</b>	<p>Please refer to the relevant Sika® epoxy adhesive Product Data Sheet:</p> <ul style="list-style-type: none"> <li>■ Sikadur®-30</li> <li>■ Sikadur®-30 LP</li> </ul>
<b>Application Instructions</b>	<p><b>Application Method / Tools</b></p> <p>Please refer to the relevant Product Data Sheet</p> <ul style="list-style-type: none"> <li>■ Sikadur®-30</li> <li>■ Sikadur®-30 LP</li> </ul> <p>CarboDur® plates can be cut with a diamond saw or a hacksaw</p> <p>Please refer to the “Method Statement Sika CarboDur® Externally Bonded Reinforcement” Ref: 850 41 05</p>
<b>Notes on Application / Limitations</b>	<p>A suitably qualified Structural Engineer must be responsible for the design of the strengthening works.</p> <p><b>Additionally as this application is structural, great care must also be taken in selecting suitably experienced and trained specialist contractors.</b></p> <p>Sika CarboDur® strengthening systems with Sika CarboDur® Plates must be protected from permanent exposure to direct sunlight, moisture and/or water. Please refer to the relevant Method Statement and Product Data Sheets for the selection of suitable overcoating materials, in situations where systems will be fully or partially exposed.</p> <p>Maximum permissible continuous service temperature is approx. +50°C. Note: When using the Sika CarboHeater for curing Sikadur®-30 LP to be used at elevated temperatures, the maximum continuous service temperature can be increased to max. +80°C. Please refer to the Sika CarboHeater Product Data Sheet for further information.</p> <p>Please also refer to the “Method Statement Sika CarboDur® Externally Bonded Reinforcement” Ref: 850 41 05 Detailed advice can always be obtained from Sika Services AG and your local Sika Technical Services Department</p>
<b>Fire Protection</b>	<p>Where required for local regulations, Sika CarboDur® Plates can also be over coated with additional fire protection materials.</p>

<b>Value Base</b>	All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.
<b>Local Restrictions</b>	Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application fields.
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<b>Health and Safety Information</b>	This product is an article as defined in article 3 of regulation (EC) No 1907/2006 (REACH). It contains no substances which are intended to be released from the article under normal or reasonably foreseeable conditions of use. A safety data sheet following article 31 of the same regulation is not needed to bring the product to the market, to transport or to use it. For safe use follow the instructions given in this product data sheet. Based on our current knowledge, this product does not contain SVHC (substances of very high concern) as listed in Annex XIV of the REACH regulation or on the candidate list published by the European Chemicals Agency in concentrations above 0.1 % (w/w).

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 accordance with Sika's recommendations. 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 user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

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