

# PRODUCT DATA SHEET

## Sika® CarboDur® S

### PULTRUDED CARBON FIBRE PLATES FOR STRUCTURAL STRENGTHENING AS PART OF THE SIKAR® CARBODUR® SYSTEM

#### 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® S may only be used by experienced professionals.

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.

sion 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

#### APPROVALS / STANDARDS

- Slovakia: TSUS, Building Testing and research institutes,
- Slovakia: Technical Approval TO-09/0080, 2009: Systémy dodatočného zosilňovania konštrukcií Sika® CarboDur® a SikaWrap®.
- Poland: Technical Approval ITB AT-15-5604/2011: Zestaw wyrobów Sika® CarboDur® do wzmacniania i napraw konstrukcji betonowych
- 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
- France: CSTB - Avis Technique 3/16-875, Sika CarboDur, SikaWrap
- Fib, Technical Report, bulletin 14: Externally bonded FRP reinforcement for RC structures, July 2001.

- USA: ACI 440.2R-08, Guide for the Design and construction of Externally Bonded FRP Systems for strengthening concrete structures, July 2008.
- UK: Concrete Society Technical Report No. 55, Design guidance for strengthening concrete structures using fibre composite material, 2012.
- Switzerland: SIA 166:2004 Klebebewehrungen
- Italy: CNR-DT 200 R1/2013 - Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Existing Structures

## PRODUCT INFORMATION

|                             |   |              |                  |                           |
|-----------------------------|---|--------------|------------------|---------------------------|
| <b>Packaging</b>            | Cut to size as follows in non-returnable cardboard packaging. Supplied in rolls of 250 m in nonreturnable cardboard boxes.  |              |                  |                           |
| <b>Appearance / Colour</b>  | Carbon fibre reinforced polymer with an epoxy matrix, black.  |              |                  |                           |
| <b>Shelf Life</b>           | Unlimited, provided the storage conditions are met.   |              |                  |                           |
| <b>Storage Conditions</b>   | Store in original, unopened, sealed and undamaged packaging in dry conditions at temperatures of max. +50 °C. Protect from direct sunlight. Transportation: only in the original packaging, or otherwise adequately protected against any mechanical damage |              |                  |                           |
| <b>Density</b>              | 1.60 g/cm <sup>3</sup>  |              |                  |                           |
| <b>Dimensions</b>           | <b>Type Sika® CarboDur® S</b>   | <b>Width</b> | <b>Thickness</b> | <b>Cross section area</b> |
|                             | 512   | 50 mm        | 1.2 mm           | 60 mm <sup>2</sup>        |
|                             | 514   | 50 mm        | 1.4 mm           | 70 mm <sup>2</sup>        |
|                             | 614   | 60 mm        | 1.4 mm           | 84 mm <sup>2</sup>        |
|                             | 626   | 60 mm        | 2.6 mm           | 156 mm <sup>2</sup>       |
|                             | 812   | 80 mm        | 1.2 mm           | 96 mm <sup>2</sup>        |
|                             | 814   | 80 mm        | 1.4 mm           | 112 mm <sup>2</sup>       |
|                             | 914   | 90 mm        | 1.4 mm           | 126 mm <sup>2</sup>       |
|                             | 1012  | 100 mm       | 1.2 mm           | 120 mm <sup>2</sup>       |
|                             | 1014  | 100 mm       | 1.4 mm           | 140 mm <sup>2</sup>       |
|                             | 1214  | 120 mm       | 1.4 mm           | 168 mm <sup>2</sup>       |
|                             | 1512  | 150 mm       | 1.2 mm           | 180 mm <sup>2</sup>       |
|                             | 1514  | 150 mm       | 1.4 mm           | 210 mm <sup>2</sup>       |
|                             | Select dimensions according to local Sika product range   |              |                  |                           |
| <b>Fibre Volume Content</b> | > 68 %  |              |                  |                           |

## TECHNICAL INFORMATION

|  |   |   |              |  |
|--|---|---|--------------|--|
| <b>Laminate Tensile Strength</b>                 | Mean value  | 3 100 N/mm <sup>2</sup>   | (EN 2561)    |  |
|  | 5 % fractile-value  | 2 900 N/mm <sup>2</sup>   |              |  |
|  | Mean value  | 3 100 N/mm <sup>2</sup>   | (ASTM 3039)  |  |
|  | 5 % fractile-value  | 2 900 N/mm <sup>2</sup>   |              |  |
|  | Mean value  | 3 200 N/mm <sup>2</sup>   | (EN ISO 527) |  |
|  | 5 % fractile-value  | 2 800 N/mm <sup>2</sup>   |              |  |
|  | Values in the longitudinal direction of the fibres<br>Select relevant standards |   |              |  |
| <b>Laminate Modulus of Elasticity in Tension</b> | Mean value  | 170 000 N/mm <sup>2</sup>   | (EN 2561)    |  |
|  | 5 % Fractile-value  | 165 000 N/mm <sup>2</sup>   |              |  |
|  | Mean value  | 165 000 N/mm <sup>2</sup>   | (ASTM 3039)  |  |
|  | Mean value  | 155 000 N/mm <sup>2</sup>   | (EN ISO 527) |  |
|  |   | Values in the longitudinal direction of the fibres<br>Select relevant standards |              |  |

|  |  |         |            |
|--|--|---------|------------|
| <b>Laminate Elongation at Break in Tension</b> | Mean value<br>Values in the longitudinal direction of the fibres | 1.80 %  | (EN 2561)  |
| <b>Glass Transition Temperature</b>            |  | >100 °C | (EN 61006) |

## SYSTEM INFORMATION

|                         |   |
|-------------------------|---|
| <b>System Structure</b> | The system build-up and configuration as described must be fully complied with and may not be changed.<br>Resin adhesive - Sikadur®-30 or Sikadur®-30 LP.<br>Structural strengthening Carbon plates – Sika® CarboDur® S.<br>For detailed information on Sikadur®-30 and Sikadur®-30 LP, together with the application details, please refer to the Sikadur®-30 or Sikadur®-30 LP Product Data Sheet and the “Method Statement Sika® CarboDur® Externally Bonded Reinforcement” Ref: 850 41 05 |
|-------------------------|---|

## APPLICATION INFORMATION

| Consumption | Width of Sika® CarboDur® S plate | Typical consumption of Sikadur®-30* |
|-------------|----------------------------------|-------------------------------------|
|             | 50 mm                            | 0.20 – 0.28 kg/m                    |
|             | 60 mm                            | 0.24 – 0.32 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 %.

## APPLICATION INSTRUCTIONS

### SUBSTRATE QUALITY

#### Sika® CarboDur® plates externally bonded to the concrete surface

Recommended minimum concrete pull-off strength after surface preparation:

- Mean: 2.0 N/mm<sup>2</sup>
- Minimum: 1.5 N/mm<sup>2</sup>

The effective concrete pull-off strength after surface preparation has to be verified.

If concrete pull-off strength is below the stated minimum requirements, alternative Sika solutions are available:

- CarboDur® applied in slots as near surface mounted (NSM) reinforcement
- SikaWrap® fabrics: Please refer to the Product Data Sheet for the SikaWrap® fabrics

Concrete must generally be older than 28 days (dependent on curing conditions and the type of concrete etc.)

#### Sika® CarboDur® externally bonded to other substrates

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. Contact Sika technical service for detailed advice.

### SUBSTRATE PREPARATION

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.

### APPLICATION METHOD / TOOLS

Please refer to the relevant Product Data Sheet:

- Sikadur®-30
- Sikadur®-30 LP

### LIMITATIONS

Please refer to the relevant Product Data Sheet of Sikadur® epoxy adhesive:

- Sikadur®-30
- Sikadur®-30 LP

**A suitably qualified Structural Engineer must be responsible for the design of the strengthening works. Additionally as this application is structural, great care must also be taken in selecting suitably experienced and trained specialist contractors.**

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 over coating materials, in situations where systems will be fully or partially exposed.

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 also refer to the relevant Method Statements for further limitations and guidelines: - "Method Statement Sika CarboDur® Externally Bonded Reinforcement" Ref: 850 41 05 Contact Sika technical service for detailed advice.

## BASIS OF PRODUCT DATA

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.

## LOCAL RESTRICTIONS

Please note that as a result of specific local regulations the declared data for this product may vary from country to country. Please consult the local Product Data Sheet for the exact product data.

## ECOLOGY

### REGULATION (EC) NO 1907/2006 - REACH

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)

## LEGAL NOTES

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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