

# Sika CarboDur® S

Pultruded carbon fibre plates for structural strengthening as part of a Sika CarboDur® system

## 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.

Sika CarboDur® plates can also be bonded into slots as near surface mounted reinforcement using Sikadur®-30 or Sikadur®-330 epoxy resin based adhesives for normal application temperatures, additionally Sikadur®-33 or Sika AnchorFix®-3+ epoxy resin based adhesives supplied in cartridges can be used.

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

Construction



- 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

Norway: NBI Teknisk Godkjenning, NBI Technical Approval, No. 2178, 2001, (Norwegian).

Slovenia: ZAG, Technical Approval No. S418/99-620-2, za uporabo nacina ojacitev armirano betonskih in prednapetih elementov konstrukcij z dolepljenjem lamel iz karbonskih vlaken "Sika CarboDur<sup>®</sup>" v Republiki Slonemiji (Slovenian).

Slovakia: TSUS, Building Testing and research institutes, Technical approval No. 5502A/02/0633/0/004, 2003: Systém dodatocného zosilnovania zelezobetonovych a drevenych konstrukcij Sika CarboDur<sup>®</sup> (Slovak).

Poland: Instytut badawczy drog i mostow, technical approval No. AT/2003-04-0336, System materialow Sika CarboDur<sup>®</sup> do wzmacniania konstrukcji obiektow 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, 2000 (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

## Product Data

### 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 100m in nonreturnable cardboard boxes.

### Types

Type	Width	Thickness	Cross sectional area
Sika CarboDur <sup>®</sup> S1.030	10 mm	3.0 mm	30 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S1.525	15 mm	2.5 mm	37.5 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S2.025	20 mm	2.5 mm	50 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S512	50 mm	1.2 mm	60 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S614	60 mm	1.4 mm	84 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S812	80 mm	1.2 mm	96 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S914	90 mm	1.4 mm	126 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S1012	100 mm	1.2 mm	120 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S1212	120 mm	1.2 mm	144 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S1214	120 mm	1.4 mm	168 mm <sup>2</sup>
Sika CarboDur <sup>®</sup> S1512	150 mm	1.2 mm	180 mm <sup>2</sup>

**Not all profiles are available in stock please check with your local Sika office prior for quoting and specification**

## 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

165'000 N/mm<sup>2</sup>

Minimum Value

> 160'000 N/mm<sup>2</sup>

5% Fractile-Value

162'000 N/mm<sup>2</sup>

95% Fractile-Value

180'000 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>

Minimum Value

> 2'800 N/mm<sup>2</sup>

5% Fractile-Value

3'000 N/mm<sup>2</sup>

95% Fractile-Value

3'600 N/mm<sup>2</sup>

### Strain at break

Value in longitudinal direction of fibres

(according to EN 2561)

Minimum value

> 1.70%

## 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.

Structural strengthening Carbon plates – CarboDur S.

For detailed information on Sikadur<sup>®</sup>-30, together with the application details, please refer to the Sikadur<sup>®</sup>-30 Product Data Sheet and the “Method Statement Sika CarboDur<sup>®</sup> Externally Bonded Reinforcement” or the “Method Statement Sika CarboDur<sup>®</sup> Near Surface Mounted Reinforcement”.

### Application Details

#### Consumption

Width of CarboDur <sup>®</sup> plate	Typical Consumption of Sikadur <sup>®</sup> 30
50 mm	0.25 – 0.35 kg/m
60 mm	0.30 – 0.40 kg/m
80 mm	0.40 – 0.55 kg/m
90 mm	0.50 – 0.70 kg/m
100 mm	0.55 – 0.80 kg/m
120 mm	0.65 – 1.00 kg/m
150 mm	0.85 – 1.25 kg/m

#### Substrate Quality

*Sika CarboDur<sup>®</sup> 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.

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

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

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

*Sika CarboDur<sup>®</sup> externally bonded to other substrates:*

For application of Sika CarboDur<sup>®</sup> plates to all other substrates (brick, stone, steel, wood, fibre reinforced polymer etc.) please refer to the “Method Statement for Sika CarboDur<sup>®</sup> Externally Bonded Reinforcement”.

*Sika CarboDur<sup>®</sup> plates applied in slots as near surface mounted reinforcement:*

Please refer to the “Method Statement for Sika CarboDur<sup>®</sup> Near Surface Mounted Reinforcement”.

#### Substrate Preparation

Concrete must be cleaned and prepared to achieve a laitance and contaminant free, open textured surface.

*For externally bonded application*

Please also refer to the “Method Statement Sika CarboDur<sup>®</sup> Externally Bonded Reinforcement”.

*For near surface mounted application:*

Please also refer to the “Method Statement Sika CarboDur<sup>®</sup> Near Surface Mounted Reinforcement”.

### Application Conditions / Limitations

#### Application Conditions / Limitations

*For externally bonded application*

Please refer to the relevant Sika epoxy adhesive Product Data Sheet:

- Sikadur<sup>®</sup>-30

*For near surface mounted application*

Please refer to the relevant Sika epoxy adhesive Product Data Sheet:

- Sikadur<sup>®</sup>-30
- Sikadur<sup>®</sup>-330
- Sikadur<sup>®</sup>-33
- Sika AnchorFix<sup>®</sup>-3+

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## Application Instructions

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### Application Method / Tools

*For externally bonded application*

Please refer to the relevant Product Data Sheet

- Sikadur<sup>®</sup>-30

Please refer to the "Method Statement Sika CarboDur<sup>®</sup> Externally Bonded Reinforcement".

*For near surface mounted application*

Please refer to the relevant Product Data Sheet

- Sikadur<sup>®</sup>-30
- Sikadur<sup>®</sup>-330
- Sikadur<sup>®</sup>-33
- Sika AnchorFix<sup>®</sup>-3+

Please refer the "Method Statement Sika CarboDur<sup>®</sup> Near Surface Mounted Reinforcement".

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### Notes on Application / Limitations

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<sup>®</sup> strengthening systems with Sika CarboDur<sup>®</sup> 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.

Maximum permissible continuous service temperature is approx. +50°C.

Please also refer to the relevant Method Statements for further limitations and guidelines:

- "Method Statement Sika CarboDur<sup>®</sup> Externally Bonded Reinforcement"
- "Method Statement Sika CarboDur<sup>®</sup> Near Surface Mounted Reinforcement"

Detailed advice can always be obtained from Sika Services AG and your local Sika Technical Services Department

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### Fire Protection

Where required for local regulations, Sika CarboDur<sup>®</sup> plates can also be over coated with additional fire protection materials.

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## Health and Safety Information

For information and advice on the safe handling, storage and disposal of chemical products, users shall refer to the most recent Material Safety Data Sheet containing physical, ecological, toxicological and other safety-related data.

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## 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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Sika Australia Pty Limited  
ABN 12 001 342 329

aus.sika.com  
1300 22 33 48

