Construction

Sika CarboDur® S

Pultruded Carbon Fibre Plates for Structural Strengthening As Part of a **Sika CarboDur® S**ystem

System Description

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

Sika CarboDur® S 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.

Sika CarboDur® plates can also be bonded into slots as near surface mounted

(NSM) reinforcement, please refer to separate product data sheet **Sika CarboDur® S NSM.**

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

Product Data

Form	Preformed plate profiles
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 or 250 m in nonreturnable cardboard boxes.

Types

Type	Width	Thickness	Cross sectional area
Sika® CarboDur® S512	50 mm	1.2 mm	60 mm^2
Sika® CarboDur® S514	50 mm	1.4 mm	70 mm^2
Sika® CarboDur® S613	60 mm	1.3 mm	78 mm^2
Sika® CarboDur® S614	60 mm	1.4 mm	84 mm^2
Sika® CarboDur® S626	60 mm	2.6 mm	156 mm^2
Sika® CarboDur® S812	80 mm	1.2 mm	96 mm^2
Sika® CarboDur® S814	80 mm	1.4 mm	112 mm^2
Sika® CarboDur® S912	90 mm	1.2 mm	108 mm^2
Sika® CarboDur® S914	90 mm	1.4 mm	126 mm^2
Sika® CarboDur® S1012	100 mm	1.2 mm	120 mm^2
Sika® CarboDur® S1014	100 mm	1.4 mm	140 mm^2

Sika® CarboDur® S1214	120 mm	1.4 mm	168 mm^2
Sika® CarboDur® S1512	150 mm	1.2 mm	180 mm^2
Sika® CarboDur® S1514	150 mm	1.4 mm	210 mm^2

Storage

Storage Conditions / Shelf Life	Unlimited, provided there is no exposure to direct sunlight (UV light). Store in dry conditions and at temperatures at max. 50°C Transportation: only in the original packaging, or otherwise adequately protected against any mechanical damage

Technical Data

Density (at 23°C)	1.60 gm/cm^3		
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^2	
	5% Fractile-Value	165'000 N/mm^2	
Tensile Strength	Values in longitudinal direction of fibres		(according to EN 2561)
	Mean Value	3'100 N/mm^2	
	5% Fractile-Value	2'900 N/mm^2	
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®-30 or Sikadur®-30 LP.

Structural strengthening Carbon plates - CarboDur® S.

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"

Application Details

Consumption

Width of CarboDur® 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%.

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^2
- Minimum: 1.5 N/mm^2

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:
- Sika 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 *Sika* 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"

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"

Application Conditions / Limitations

Application Conditions / Limitations	Please refer to the relevant Sika® epoxy adhesive Product Data Sheet: - Sikadur®-30 - Sikadur®-30 LP

Application Instructions

Application Method / Tools	Please refer to the relevant Product Data Sheet - Sikadur®-30 - Sikadur®-30 LP CarboDur® plates can be cut with a diamond saw or a hacksaw. Please refer the “Method Statement Sika CarboDur® Externally Bonded Reinforcement”
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® 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. 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. Please also refer to the “Method Statement Sika CarboDur® Externally Bonded Reinforcement” Detailed advice can always be obtained from Sika® Technical Services Department
Fire Protection	Where required for local regulations, Sika CarboDur® plates can also be overcoated with additional fire protection materials.

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Value Base	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 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.
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.
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.

All products are manufactured under a management system certified to conform to the requirements of the quality, environmental and occupational health & safety standards ISO 9001, ISO 14001 and OHSAS 18001

Sika UAE L.L.C
P.O. Box 126212
Dubai,
United Arab Emirates
Phone: +971 4 4398200
info@ae.sika.com
http://gcc.sika.com

Sika Gulf B.S.C (c)
P.O. Box 15776
Adliya,
Kingdom of Bahrain
Phone: +973 17738 188
sika.gulf@bh.sika.com
http://gcc.sika.com

Sika Saudi Arabia Co. Ltd
P.O. Box 58647,
Riyadh 11583,
Kingdom of Saudi Arabia
Phone: +9661 2176532
info@sa.sika .com
http://gcc.sika.com