



METHOD STATEMENT

Substrate Preparation for Sika® Rigid Bonding and Structural Strengthening Systems

03/01/2023 / VERSION 1.0 / SIKA® LIMITED / ROB DOHERTY

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1 SCOPE

This Method Statement describes the preparation of different substrates for the application of the Sika® Structural Bonding and Strengthening Systems. The application of the individual Systems is outside the scope of this Method Statement, and more details can be found in the documentation linked below:

- 850-41-02 SikaWrap® Manual Dry Application
- 850-41-03 SikaWrap® Manual Wet Application
- 850-41-04 SikaWrap® Saturator Application
- 850-41-05 Sika® CarboDur® System
- 850-41-06 Sika® CarboShear L System
- 850-41-07 Sika® CarboDur® NSM (Near Surface Mounted) Reinforcement
- 850-41-09 SikaWrap® FX Fibre Connector
- 850-42-01 Sikadur®-31+ Range

2 STRENGTHENING AND BONDING SYSTEMS

2.1 Sika® CarboDur®

The Sika® CarboDur® System is a high-performance Structural Strengthening System consisting of Sika® CarboDur® Plates and Sikadur®-30 adhesive. It is used for the post-construction reinforcement of buildings and civil engineering structures or elements.

The Sika® CarboDur® System is commonly applied on reinforced concrete, but can also be used on unreinforced concrete, steel or wood structures.

2.2 Sika® CarboDur® NSM (Near Surface Mounted)

The Sika® CarboDur® NSM System is a high-performance Structural Strengthening System consisting of Sika® CarboDur® Plates or Rods and Sikadur®-30, Sikadur®-330 or Sika® AnchorFix® 3030 adhesives. It is used for the post-construction reinforcement of buildings and civil engineering structures or elements.

The Sika® CarboDur® NSM System is commonly applied on reinforced concrete, but can also be used on unreinforced concrete, masonry or wood structures.

2.3 Sika® CarboShear

The Sika® CarboShear L System is a high-performance Structural Strengthening System, consisting of Sika® CarboShear L profiles and different Sikadur® adhesives. It is designed for the post-construction reinforcement of concrete structures in shear and to anchor Sika® CarboDur® Plates.

The Sika® CarboShear System is primarily applied on reinforced concrete. Use on unreinforced concrete could also be considered.

2.4 SikaWrap®

The SikaWrap® Composite System is a high-performance Strengthening System containing carbon fibre-based fabrics and strings and epoxy-based impregnation resins. The products are applied on site and formed into a fibre composite.

The SikaWrap® System is commonly applied on reinforced concrete, but can also be used on unreinforced concrete, masonry, steel or wood structures.

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2.5 Sikadur®-31+ Adhesive Range

The Sikadur®-31+ Range consists of a standard and a rapid variant of thixotropic structural epoxy adhesive for rigid bonding. The adhesives can be used to bond most common construction materials. Please refer to the latest Product Data Sheets for details.

3 SUBSTRATE REQUIREMENTS

3.1 PULL-OFF STRENGTH

Good bond strength between the bonding adhesive and the substrate is a key factor in performance of the Sika® Rigid Bonding and Structural Strengthening Systems.

Any substrate must be sound, clean, dry and free of all contaminants such as dirt, oil, grease, coatings and surface treatments, etc.

The pull-off strength is measured according to the European Standard **BS EN 1542**. The Table below shows the minimum strength for the different substrates and Systems:

| Substrate | Pull-Off Strength | System |
|------------------------|-------------------------------|---|
| Reinforced Concrete | Minimum 1.5 N/mm ² | Rigid Bonding, SikaWrap®, Sika® CarboDur® NSM |
| | Minimum 1.5 N/mm ² | Sika® CarboDur® Externally Bonded, Sika® CarboShear |
| | Average 2.0 N/mm ² | |
| Steel | Minimum 1.5 N/mm ² | Sika® CarboDur® Externally Bonded |
| Masonry, Natural Stone | Minimum 1.0 N/mm ² | SikaWrap®, Textile Reinforced Mortar |
| Polymers | Minimum 1.5 N/mm ² | SikaWrap®, Sika® CarboDur® |
| Timber | Not relevant | |

For concrete, masonry and natural stone, the failure must be in the substrate, not the interface or the adhesive.

A detailed description of the pull-off test can be found in **BS EN 1542**.

Different standards or requirements may apply in your country or region, please substitute, and update if necessary.

3.2 MOISTURE CONTENT

Prior to application, confirm substrate moisture content, relative humidity and dew point (See also Section 4).

A clean but wet substrate can compromise the adhesion of the different Bonding and Strengthening Systems to the substrate, and a small water film on the interface will prohibit the bonding of the epoxy adhesive.

The maximum moisture contents for different substrates and applications are listed in the Table below. For values outside of these limitations, please consult with your local Sika® Technical Services.

| Substrate | System | Moisture Content |
|------------------------|---------------------------|--|
| Reinforced Concrete | Strengthening Systems | < 4% (percentage by weight) |
| | Bonding Systems | Matt damp, no standing water |
| Steel | Sika® CarboDur® | Dry, free of rust |
| Masonry, Natural Stone | Bonding Systems, SikaWrap | < 4% (percentage by weight) |
| Polymers | All | Dry |
| Timber | Sika® CarboDur® NSM | Average moisture content during intended use |
| | SikaWrap® | |

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3.3 EVENNESS OF THE SUBSTRATE, ROUNDING OF EDGES

Evenness:

The Sika® CarboDur® Plates are most effective if the fibres are as straight as possible. The unevenness tolerance is **up to 10 mm over 2 m length, and up to 4 mm over 0.3 m length** (please check your local guidelines or standards, they may have different or more strict requirements).

Rounding of Corners:

Sika® CarboShear System: Round all corners to a radius of 40mm. If this is not feasible, it is also possible to build up the substrate with Sikadur®-30, Sikadur®-41 or Sikadur®-31+. For details, please refer to the Method Statement for Sika® CarboShear application.

SikaWrap® System: If installed on beams or rectangular columns, round all corners to a minimum radius of 20 mm, or according to your local guideline.

4 AMBIENT CONDITIONS

The ambient temperature must be in the range mentioned in the Product Data Sheet of the respective resin, and a minimum of 3°C above the dew point. The dew point is the point at which a surface becomes wet due to condensation, dependent on the ambient temperature and the relative humidity.

The dew point can be determined, with the Sika® Dew Point Calculator, pictured on the right, or with a dew point Table.

The substrate temperature must be in the range mentioned in the Product Data Sheet. There may be no frozen water on the substrate before application.

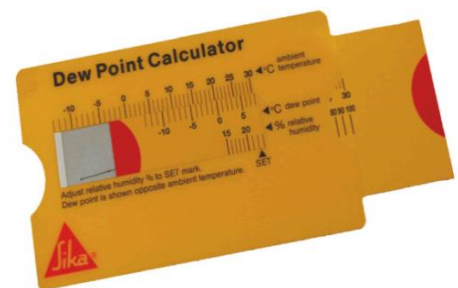
The Systems cannot be applied if it is raining actively on the substrate in question.

Avoid leaving the System components in the direct sun, as this may shorten the pot-life of the resins due to heating, and the UV radiation may damage the CFRP products over time.

5 SUBSTRATE PREPARATION

The standard preparation and quality checks for different substrate is outlined in the sections below.

The recommendations are based on Sika® experience as well as different standards and guidelines. The specific reference documents are mentioned in each sub-section.



5.1 CONCRETE AND REINFORCED CONCRETE

Concrete must be clean and free of standing water, oils, coatings and any other residue. Any substrate defects such as cracks, blow holes and voids must be repaired using suitable materials such as Sika® MonoTop® or Sikadur® repair mortars.

The concrete surface must be prepared to have an open textured structure without laitance layer. The roughness shall correspond to the profiles CSP-2, CSP-3 or CSP-4, as defined by the International Concrete Repair Institute (**ICRI Guideline No. 310.2R-2013**) and illustrated overleaf. The concrete can be prepared by grinding or sandblasting.

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CSP-1:
Acid Etched*



CSP-2:
Grinding



CSP-3:
Light Shot Blast



CSP-4:
Light Scarification



CSP-5:
Medium Shot Blast



CSP-6:
Medium Scarification



CSP-7:
Heavy Abrasive Blast



CSP-8:
Scabbled



CSP-9:
Heavy Scarification

After grinding or sandblasting, the surface must be cleaned of all loose particles and dust. Brush the dust out well with a dry brush and use a vacuum cleaner. The use of compressed air is not recommended, as it will push the loose particles into the concrete instead of removing them.

For the Sika® CarboDur® NSM application, slits or grooves need to be cut into the substrate. Cut the slits to the specified depth and width with a diamond saw and remove all loose particles and dust as well as any standing water.

5.2 STEEL AND OTHER METALS

Steel and metal substrates must have a rough, completely rust and coating free surface. If the substrate is not standard steel, it is recommended to make at least 3 pull-off tests as described in Section 3.1 to check the adhesion.

The substrate preparation is best achieved by sandblasting (quality Sa 2.5, according to **ISO 8501-1**) and then cleaning off the residue dust and other particles. Application of the adhesive or Structural Strengthening System should be as soon as possible after surface preparation, to avoid any corrosion formation. If this is not possible, the steel should be coated with a temporary corrosion protection, or a corrosion protection layer that will not compromise the performance of the overall System.

5.3 MASONRY AND NATURAL STONE

Remove all dirt, coatings and loose material from the substrate. If the masonry or stone is weak, consider strengthening options other than Carbon Fibre-Based Systems, for example a Textile Reinforced Mortar System. If the substrate is uneven, level it with either a cementitious or an epoxy-based mortar. Do not apply Epoxy Based Systems on the whole area unless they are specifically approved for it, as they will seal the substrate and water vapor diffusion will no longer be possible.

For natural stone: perform at least three pull-off tests as described in Section 3.1 to check the adhesion.

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5.4 TIMBER

For SikaWrap®: Grind the area where the Strengthening System will be installed so it is flat with no grooves or edges. Remove all coatings, round all corners to a minimum radius of 20 mm, and remove all dust and loose material. Fill in any large splits or cracks before application of the SikaWrap® System.

For Sika® CarboDur® NSM: cut slits to the specified dimensions. Remove all dust and loose material.

In applications on timber, always consider the moisture content of the wood. If a Strengthening System is applied when the wood is wet, it may buckle and delaminate when the wood dries.

5.5 POLYMER MATERIALS

Do not use the epoxy resins on Polyethylene or Teflon substrates.

For any other polymer substrate, remove all coatings, dirt, oil and grease from the substrate surface. Perform at least three pull-off tests as described in Section 3.1 to check the adhesion. If necessary, roughen the polymer surface for better mechanical interlocking.

6 LIMITATIONS

- Beware of condensation! The substrate must be at least +3°C above dew point.
- Do not apply the Bonding or Strengthening Systems on top of old coatings or surface finishes.
- Remove all coatings, oil, grease and dirt, as well as any loose material and dust from the substrate.
- Do not apply epoxy-based systems on wet concrete. Remove any standing water and water in the pores before application.

7 HEALTH AND SAFETY

Silica dust produced by the grinding or blast cleaning of concrete can be hazardous. Protect yourself and others by using a vacuum grinder or vacuum blast cleaning equipment with dust extraction and abrasive recycling attachments respectively. Always wear a dust mask / respirator when grinding concrete. Do not inhale the concrete dust. Always wear a dust mask / respirator when sandblasting / grinding steel. Wear appropriate eye protection during all substrate preparation works.

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8 LEGAL NOTE

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 products 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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