REFURBISHMENT STRUCTURAL STRENGTHENING WITH SIKA SYSTEMS

FOR CONTRACTORS

BUILDING TRUST

COMPETENCE YOU CAN TRUST

Sika provides you with a depth of knowledge from our 'state-of-the art' technical expertise and global practical experience to produce virtually tailor-made solutions for the repair, refurbishment and improvement by strengthening of your existing buildings and civil engineering structures. This includes fully compatible products and integrated systems to suit almost every project and site requirement. Sika customer advice and support is second to none, from concept, through design and detailing, to practical installation and successful completion on site. This is all based on more than 100 years of experience on large and small projects all over the world.

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EXTENDING FUNCTIONAL SERVICE LIFE

THE USE OF A BUILDING OR CIVIL ENGINEERING STRUCTURE may change throughout the course of its service life, as for example its whole function can change, loads can increase and/or higher building standards are required and the structure must be made compliant. Sika provides fully comprehensive solutions with complete systems for all kinds of structural strengthening and improvement. Whether increasing the bending, shear or impact resistance, tested and proven Sika systems are available for use on reinforced concrete, steel, wood and masonry load-bearing structures.

TYPICAL APPLICATION

COLUMN STRENGTHENING

BEAM STRENGTHENING

PRE-STRESSED STRENGTHENING

SEISMIC UPGRADING /EARTHQUAKE DAMAGE REPAIR

INCREASING IMPACT RESISTANCE

CRACK PREVENTION/REDUCTION

PROVEN PERFORMANCE AND DURABILITY

Sika Structural Strengthening Systems have been tested extensively internally and externally, under many different conditions to ensure their long-term performance in different environments for:

- Long-term fatigue
- Artificial ageing
- Exposure in alkaline environments
- Installation under dynamic load

Worldwide success with the completion of countless individual large and small projects over the last decades demonstrates the performance, reliability and durability of Sika Strengthening Systems. This is quality you can trust.

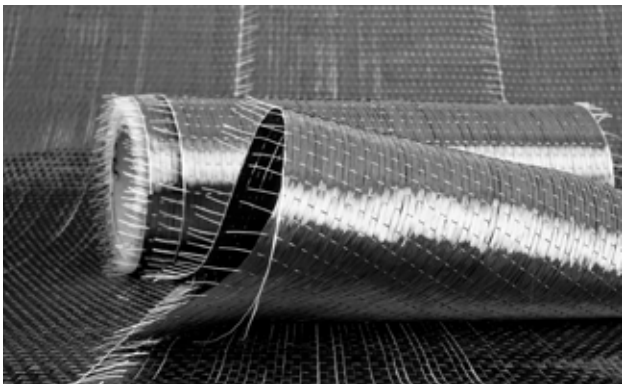
SIKA FOR EXCELLENCE IN STRUCTURAL STRENGTHENING

Sika brings sustained added value to building and civil engineering structure owners, their consultants and contactors. Sika provides technical assistance through every step of the project, from condition survey and developing the initial strengthening concept through to the successful completion and handover of your project.

SIKA – YOUR PARTNER ON SITE

- Global market leader in building and construction chemicals
- Highest technical expertise and practical experience in concrete refurbishment and structural strengthening
- Excellent reputation with leading contractors and authorities

SIKA VALUE ENGINEERING AND INNOVATIONS



- High performance integrated products and systems that can boost and improve the capacity, efficiency, durability and aesthetics of buildings and other structures – to the benefit of our customers and a more sustainable development
- Sika trained and experienced specialist contractor networks

UNIQUE SIKA SOLUTIONS FOR SPECIAL CONDITIONS

- Solutions for almost all different application requirements
- Controlled working, curing and hardening times for different climatic conditions
- Special end-anchorage solutions for use in lower strength concrete and other substrates

PROVEN SIKA SYSTEMS AND APPLICATION TECHNIQUES

- Over 40 years of experience with structural bonding and strengthening systems and techniques
- Products and systems with extensive internal and external testing and assessment
- Highest international standards of production and quality control

OVERVIEW OF SIKA STRUCTURAL STRENGTHENING SYSTEMS

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Sika CarboStress® System

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Sika CarboShear System

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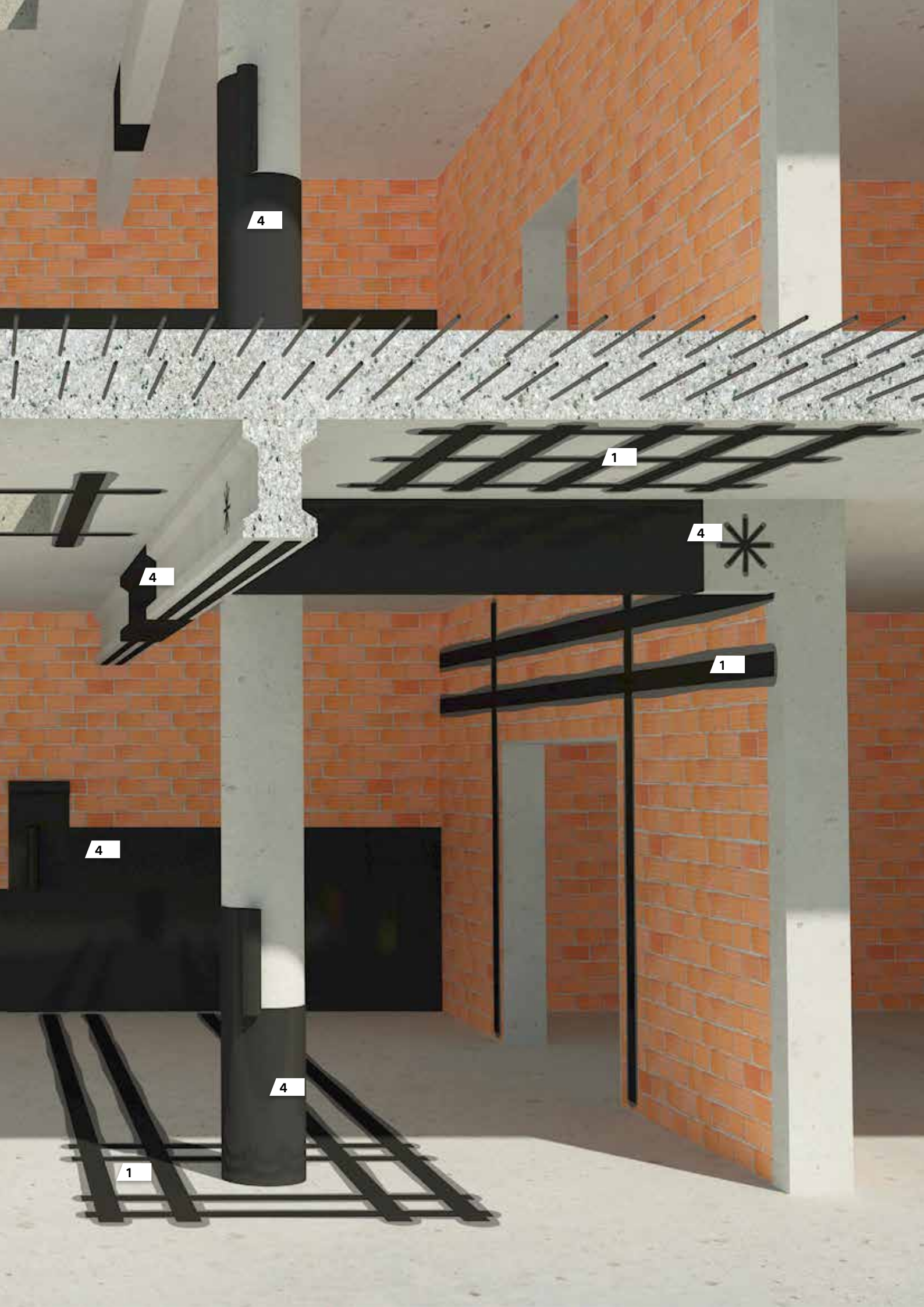
SikaWrap® Fabric Strengthening System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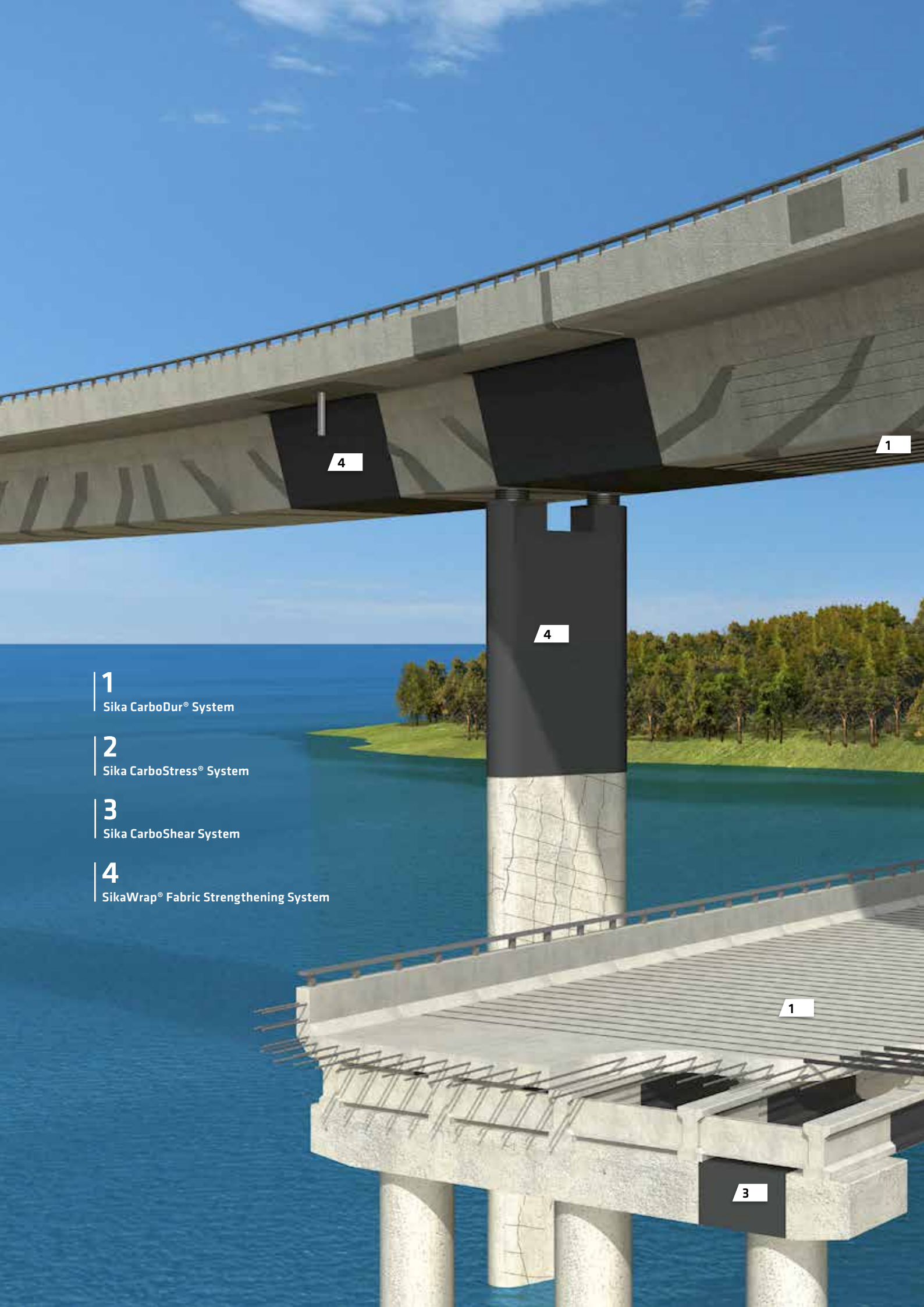

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Sika CarboDur® SYSTEM

More than 20 years' experience with installations all over the world

THE SIKA CARBODUR® SYSTEM is one of the most established and well-proven, carbon-fibre-reinforced polymer (CFRP) based structural strengthening solutions worldwide. It consists of Sika CarboDur® CFRP plates and rods, plus the structural epoxy resin based adhesives Sikadur®-30 and Sikadur®-30 LP. This simple and reliable, high performance system is easy to apply and provides outstanding long-term durability in service.

Proven Long Term Solutions	■ Extensive use and monitoring in numerous different applications for more than 20 years
Fast Installation = Minimal Down Time	■ No additional plate preparation work and one product for surface filling, priming and bonding
(In)-Visible Strengthening	■ External surface and near surface mounted applications (NSM) ■ Additional overcoating or mortar cover possible
Whole System = One Supplier	■ Including matrix resin of the plates, the bonding adhesive and the protective coatings where required

Sika CarboDur®

For externally bonded and near surface mounted (NSM) flexural strengthening of concrete, steel, timber, masonry and glass fiber structures.
Sika CarboDur® plates and rods are carbon fibre reinforced polymers produced by a pultrusion process to have precisely defined properties and performance; all in accordance with tight specifications and quality control procedures. The materials are widely used for the flexural strengthening of dynamic and statically loaded buildings and other structures including bridges, beams, ceilings and walls, for both negative and positive moments.

FLEXURAL STRENGTHENING:

Positive moments
- Park decks
- Buildings
- Bridges

Negative moments
- Bridge decks
- Flat roofs
- Curved substrates

See how Sika CarboDur® FRP plates strengthen a simple concrete beam to carry much higher loads:

NEAR SURFACE MOUNTED (NSM) APPLICATION

The embedding of Sika CarboDur® pultruded rods or plates into concrete, timber or masonry substrates has many advantages:
- Superior end anchorage
- No extra protection necessary as embedded
- No aesthetic impact
- Installation in weak or cracked substrates is possible
- Application is possible on flat and curved substrates
- Available as different profiles (rectangular or round) and dimensions to suit

HIGH STRENGTH END ANCHORAGE

When Sika CarboDur® plate ends are prepared with a 'scratch coat' of Sikadur adhesive and embedded into the same slab or a perpendicular slab or column, up to 100% of the plate strength can be anchored into the substrate. The plate ends are also secured and any damage or peel-off anchorage failure is avoided. This unique anchoring system for Sika CarboDur® CFRP plates has been tested extensively by independent external test institutes and is also the same system that is used for the anchorage of CarboShear profiles.

PROVEN DURABILITY

Sika Strengthening Systems have been tested for durability under many demanding conditions to ensure long-term performance in different applications and environments:

Long-term creep test: A concrete beam, strengthened with a steel plate applied with Sikadur® adhesive was loaded to 80% of the expected failure load back in 1971 and maintained ever since. The deflection has been stable for the past 40+ years with a very small amount of creep. This test is ongoing and conducted by an independent institute.

Artificial ageing: Samples of Sika CarboDur® and SikaWrap® were exposed to artificial ageing for 500 days. The test results before and after this exposure showed no changes or deterioration in the tensile, pull-off and lap shear strengths of the installed systems.

Exposure in an alkaline environment: Coated and uncoated Sika CarboDur® plates were fully immersed in a highly alkaline solution. The strength of the coated samples decreased 10 % after the first 90 days, and leveled out at a total strength loss of 14% after one year of exposure. While the results are hard to translate and interpret for real life environmental conditions, the positive result makes a strong argument for the durability of these Sika Strengthening Systems in alkaline environments.

Installation under oscillating dynamic load: Sika CarboDur® plates can be installed under oscillating dynamic load with no decrease in the strengthening capacity of the system (extensively tested by an independent external institute).

Sikadur®-30 AND -30 LP EPOXY RESIN ADHESIVES

More than 50 years of practical experience on demanding projects with Sikadur® adhesives

THE UNIQUE COMBINATION of excellent adhesion to many different substrates as well as to the Sika CarboDur® CFRP plates, plus high stiffness and low creep makes Sikadur®-30 and -30 LP adhesives the ideal materials for secure application of the strengthening system.

All-in-one Product	■ Serves as the primer, levelling mortar, putty and adhesive ■ Fast and cost effective application
Extensively tested	■ Fully in accordance with the requirements of EN 1504-4 and FIP ■ Full system testing at independent Universities and institutes ■ Additional extensive in-house testing under extreme conditions

Sikadur®-30 LP also has two additional important advantages:

Extended pot-life and open time	■ Suitable for application at ambient temperatures up to 55 °C
Higher maximum service temperature	■ When cured at elevated temperatures

Sika CarboHeater

Rapid curing device: Allows up to 50 times faster curing of Sikadur®-30 and -30 LP
This innovative and patented device that is exclusive to Sika was specially designed for:

Rapid Installation	■ Minimal area disturbance ■ Minimal down time
Application in cold conditions	■ Precisely controlled adhesive curing
Installations with higher service temperatures	■ Maximum service temperature up to + 80 °C (only with Sikadur®-30 LP) ■ Ideal for structures in hot climates with direct sunlight ■ Ideal for hot environments in production and process facilities or power stations etc.

Sika CarboStress® SYSTEM

Post-tensioned strengthening

ACTIVE STRENGTHENING OF STRUCTURES as a replacement for damaged steel prestressing cables, seismic retrofitting, or for installation on cracked concrete surfaces.

The concept of post tensioning: a force is applied to create permanent stress in a structure, so it can withstand the working load more effectively, or with less total deflection. In conventional post tensioning, the load is applied through steel tendons within the concrete structure. With the Sika CarboStress® system, the advantages of the Sika CarboDur® CFRP plates and regular post tensioning are combined to form a unique external active strengthening solution.
The Sika CarboStress® system has an excellent track record with considerable experience from more than 400 major strengthening projects that have been successfully completed all around the world. This system has been used to increase the service load capacity, strengthen and reinforce many different structures including bridges, industrial facilities and high-rise buildings.

Fast and flexible Installation	■ Minimal breakout required ■ Tendon assembly on-site
Thin tendons	■ Cross-over installations are possible
Very lightweight tendons	■ Ideal for difficult access sites and structures
Standardized and tailor-made system solutions	■ Alternative anchoring solutions ■ Suitable for different tendon lengths and substrates

Sika CarboShear SYSTEM

L-shaped CFRP profiles for simple shear strengthening

A UNIQUE SIKA SOLUTION for external shear strengthening of T-beams. The shear capacity of reinforced concrete-beams can be significantly increased by externally applied Sika CFRP strengthening systems. The ideal solution is the unique Sika CarboShear L-shaped CFRP profiles, which are bonded onto the beam and anchored into the top slab, with the Sikadur®-30 and -30 LP structural epoxy resin based adhesives – Simple, but highly effective and efficient shear strengthening.

Sika CarboShear L-shaped profile

- Easy and fast installation
- Pre-prepared end section to provide excellent anchorage
- Low thickness, easy to overcoat
- Available in four dimensions
- The length of both legs can easily be adjusted
- No drilling through the top slab is required

Strengthened T-beam

- Sika CarboDur® plate system for flexural strengthening
- Sika CarboShear L-Profiles for shear strengthening
- Anchorage of Sika CarboShear profile legs in the top slab
- Overlapping with Sika CarboShear links for improved end anchorage of the Sika® CarboDur® plates

Since the end anchorage section of the Sika CarboShear L-Profile is pre-prepared on site, any leg length is possible. With the different Sika CarboShear L-Profile sizes available, structural beams of up to 140 cm in height and 140 cm width can be strengthened.

INSTALLATION OF Sika CarboShear L-Profiles

Sika CarboShear L-Profiles are mostly used as an alternative to a fully CFRP fabric wrapped beam configuration for shear strengthening. They are installed on rectangular T-beams and anchored in the top slab, without the need to cut all the way through the slab. The overlap under the beam connects the profiles to form a U-shaped strengthening system, similar to a traditional reinforcing stirrup. This configuration provides a highly effective shear strengthening solution.

Scratch coat with Sikadur®-30 adhesive

- Pre-prepared on site and fully cured before installation
- Effective anchoring of the full CFRP profile strength

Anchoring holes

- Cut into the top slab where required and to avoid main reinforcement by core drilling or special saws

Grafton Bridge, Auckland, New Zealand

SikaWrap® FABRIC STRENGTHENING SYSTEM

For structural column confinement, strengthening of weaker concrete, masonry, natural stone and timber structures

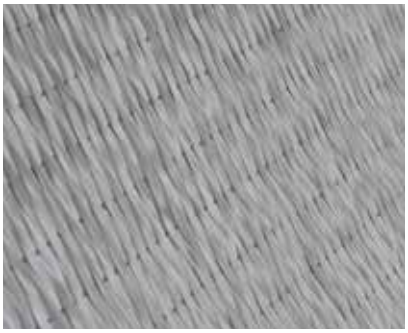
THE SikaWrap® FABRIC STRENGTHENING SYSTEM is comprised of unidirectional, carbon or glass fibre fabrics and Sikadur® structural epoxy resin based, impregnating resins. These unique combinations provide a wide range of strengthening and upgrading solutions to meet the many varied demands of different projects and applications.

SikaWrap® Fabric Strengthening Systems deliver proven outstanding performance for:

Strengthening irregularly shaped structures and substrates

Note: Using a single layer of heavyweight fabric can sometimes be stronger and more cost effective than several layers of the standard lightweight fabrics

Carbon Fibre Fabric: SikaWrap® C
Active Strengthening: for constant or high loadings



Glass Fibre Fabric: SikaWrap® G
Passive Strengthening: for temporary loading and seismic event protection

SikaWrap® fabrics also including:
Aramid Fibre Fabrics, Special Bidirectional and Quadraxial Fabrics

TYPICAL STRUCTURAL APPLICATIONS

CONFINEMENT

- For structural members in compression
- To enhance load carrying capacity or ductility
- Multi-layer applications are possible

SHEAR STRENGTHENING

- Non-rectangular cross sections are possible
- End anchorages with SikaWrap® FX

SEISMIC STRENGTHENING

- Mostly using SikaWrap® glass fibre fabrics
- For passive strengthening solutions
- As an alternative to textile reinforced mortars (TRM)

WEAK SUBSTRATE STRENGTHENING

- For strengthening masonry, natural stone walls and other structures
- Flexural strengthening of weak concrete elements or structures

DRY AND WET APPLICATION

Dry application: For installation of lightweight fabrics up to 450 g/m²

- The Sikadur® impregnation resin is spread directly onto the prepared substrate, also filling small irregularities in the surface
- The dry fabric is placed on the resin and pressed on by hand
- The resin is worked into the fibre with a roller, always in the direction of the fibres
- When the fabric is fully impregnated, the excess resin can either be removed with a plastic scraper or additional resin can be applied for the installation of an additional layer

Wet application: installation of pre-impregnated fabrics heavier than 450 g/m²

- The Sikadur® impregnation resin is poured on a plastic sheet and the dry fabric placed on top of it
- The resin is worked into the sheet with a plastic roller until the fibres are completely impregnated
- The substrate is covered with a thin layer of the Sikadur® resin as a primer
- The 'wet' fabric is applied on the primed substrate and pressed on firmly with a plastic roller, thereby removing any entrapped air

SikaWrap® fibre reinforced polymer structural strengthening and seismic retrofitting system:

SikaWrap® video

SikaWrap® FX FIBRE CONNECTORS

Versatile end anchorage and NSM strengthening solutions

SikaWrap® FX Fibre Connectors are prepared dry bundles of Carbon or glass fibres which can be used in different configurations.

End anchorage of SikaWrap® fabrics
In shear strengthening with fabrics, preventing delamination of the fabric at the edges is the most critical problem. As fabric anchors, the SikaWrap® FX Fibre Connectors are installed into the substrate before and under the SikaWrap® fabric to optimize force transfer. The dry fibre bundles are partially impregnated, then inserted into drilled holes and spread out into slits cut into the surface.

Advantages:
- Improved connection of the SikaWrap® fabric with the substrate
- Anchorage and force transfer into beams or top slabs
- No cutting through top slabs is necessary
- Installation uses standard site anchoring equipment

Near Surface Mounted (NSM) Reinforcement
As a near surface mounted (NSM) strengthening system, the SikaWrap® FX Fibre Connectors provide new possibilities for the strengthening of irregular and dome-shaped surfaces. The SikaWrap® FX Fibre Connectors are impregnated with Sikadur®-300 or Sikadur®-52, and then installed into slits cut in the surface and also pre-filled with the resin.

Advantages:
- Strengthening of any substrate surface geometry
- Continuous tows, with no splicing necessary
- Ideal combination with end-anchorage solutions

Shear Strengthening
The SikaWrap® FX Fibre Connectors can also be used for the shear strengthening of beams – by replacing SikaWrap® fabric strips in complex and / or difficult access locations.

Advantages:
- Minimal breakout is required and only small holes need to be drilled
- Strengthening of any beam shape is possible
- Less substrate preparation is necessary

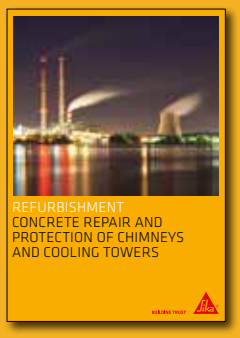
Sikadur®-330 AND Sikadur®-300

Sikadur® adhesives – proven quality and performance since 1960

MULTI-PURPOSE STRUCTURAL EPOXY RESIN based materials that reduce the working steps necessary for fast, easy and secure installation of SikaWrap® Fabric strengthening systems.

All-in-one product	■ Primer, putty and impregnation resin ■ Fast, easy and secure application of SikaWrap® Fabrics ■ Extremely cost effective
Sikadur®-330	■ A 4in1 product: primer, void filler, impregnation resin and adhesive ■ Non-drip, paste like consistency ■ Multiple-layers and overhead application is possible ■ Fabrics are impregnation directly on the substrate surface ■ Protective coating or mortar overcoating is possible ■ Ideal for 'Dry' application of lightweight fabrics
Sikadur®-300	■ Very long open time ■ Impregnation by hand or saturator machine ■ Protective coating or mortar overcoating is possible ■ Ideal for 'Wet' application of heavy fabrics
Saturator machine	■ Option for more efficient fabric impregnation ■ Larger surface areas and heavy fabrics are possible ■ Less resin wastage ■ Fast and cost effective system installation ■ Especially suited for larger projects

ALSO AVAILABLE FROM SIKA



FOR MORE REFURBISHMENT SOLUTION INFORMATION:

WHO WE ARE

Sika AG, Switzerland, is a globally active specialty chemicals company. Sika supplies the building and construction industry as well as manufacturing industries (automotive, bus, truck, rail, solar and wind power plants, façades). Sika is a leader in processing materials used in sealing, bonding, damping, reinforcing and protecting loadbearing structures. Sika's product lines feature highquality concrete admixtures, specialty mortars, sealants and adhesives, damping and reinforcing materials, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

Our most current General Sales Conditions shall apply.
Please consult the Data Sheet prior to any use and processing.

Certified Quality System ISO 9001/EN 29001 since 1986
Certified Management System ISO 14001 since 1997
U.S. GREEN BUILDING COUNCIL MEMBER
Responsible Care

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