ASLAN™ 500

CARBON FIBER REINFORCED POLYMER (CFRP TAPES)

FOR STRUCTURAL STRENGTHENING

COMPOSITE REINFORCING FOR LONG LASTING CONCRETE STRUCTURES

- DRAMATICALLY **INCREASE FLEXURAL** & **SHEAR CAPACITY**
- EXTEND THE **LIFE OF THE STRUCTURE**
- RECTANGULAR BAR USED IN **THE NEAR SURFACE MOUNT TECHNIQUE**
- ALTERNATIVE TO **FIELD WET LAY UP**

Aslan FRP®

EXAMPLES USING **ASLAN™ SOLUTIONS**

ASLAN™ 500
CFRP TAPES

BENEFITS & **MECHANICAL** PROPERTIES

BENEFITS

› **Improved bond** with the substrate compared with externally bonded FRP systems ~ greater utilization of the FRP

› Aslan™ 500 Tape arrives with **guaranteed physical – mechanical properties**

› **Surface Preparation** issues are minimized

› After installation, **NSM tape is protected from mechanical damage and offers better fire performance** than externally bonded FRP's

› Strengthening results are **superior to externally bonded systems**

› **Installation of Aslan™ 500 Tape is fast** and can be done in more diverse weather conditions

Aslan™ 500 Carbon FRP "Tape" is used to structurally strengthen existing concrete, wood, stone or masonry members in flexure and shear. It is called a "tape" to help distinguish it from pre-cured laminate plates and field layup FRP materials. The Aslan™ 500 CFRP tape is a precured rectangular bar with a surface texture on each wide face which helps improve bond with the structural adhesives. Structures that are deficient due to either a structural flaw, deterioration or because of a change in use can often be brought to a useful capacity using Aslan™ 500. With extremely high strength and stiffness, along with the fact that they will not rust or corrode and are very light weight, FRP's such as the Aslan™ 500 tape are added to the concrete cover of an existing structure using a technique called "Near Surface Mount" or NSM strengthening. The method is analogous to adding "bandage" rebar to the structure. Since 1993, we have been at the forefront of worldwide academic and industry efforts to define consensus FRP standards and methods. Hundreds of structures have extended service lives due to Aslan™ 500 CFRP Tape.

MASONRY STRENGTHENING

› Rectangular bar format fits well in mortar joint
› Wide face of tape is half the thickness of narrowest point of CMU masonry unit.
› When structural tuck-pointing is performed, resulting FRP strengthening does not affect visual appearance of masonry (epoxy joint can be faced with mortar).

NEAR SURFACE MOUNT (NSM) STRUCTURAL STRENGTHENING

> Bridge decks & railings: cantilevers, negative moment regions, parapets
> Parking garages
> Floor slabs
> Column to slab connections
> Columns
> Crack stitching & adjoining members

Characteristic	Aslan™ 500 CFRP Tape	Aslan™ 200 CFRP Bar
Cross Sectional Area	#2 (6 mm) and #3 (10 mm) Equivalent Areas	#2 (6 mm), #3 (10 mm) and #4 (13 mm) Equivalent Areas
Minimum Groove Dimensions	3 X narrow dimension 1.5 X wide dimension	1.5 X bar diameter b_d
Bendable Along Axis	No	Yes

MECHANICAL PROPERTIES

Nominal Diameter			Nominal Area		f^*_{fu} Garanteed Tensile Strength		Ultimate Tensile Load		E_f Tensile Modulus of Elasticity		Ultimate Strain
Size	**mm**	**Dimension**	**mm^2**	**in^2**	**MPa**	**ksi**	**kN**	**kips**	**GPa**	**psi 10^6**	**%**
2	6	0.079" X 0.63"	32	0.049	2241	325	71	15.92	124	18	1.81%
3	10	0.177" X 0.63"	71	0.110	2172	315	154	34.65	124	18	1.75%

We reserve the right to make improvements in the product and/or process which may result in benefits or changes to some physical-mechanical characteristics. The data contained herein is considered representative of current production and is believed to be reliable and to represent the best available characterization of the product as of July 2011. Tensile tests per ASTM 7205. Available in up to 40ft lengths.

DESIGN TENSILE & **MODULUS** PROPERTIES

Tensile and Modulus Properties are measured per ASTM D7205-06, Standard Test Method for Tensile Properties of Fiber Reinforced Polymer Matrix Composite Bars. The ultimate tensile load is measured and the tensile modulus is measured at approximately 10% to 50% of the ultimate load. The slope of the stress-strain curve is determined as the tensile modulus. Ultimate Strain is extrapolated from the ultimate load divided by the nominal area and modulus. The area used in calculating the tensile strength is the nominal cross sectional area. The "Guaranteed Tensile Strength", f^*_{fu} is as defined by ACI 440.1R as the mean tensile strength of a given production lot, minus three times the standard deviation or $f^*_{fu} = fu_{,ave} - 3\sigma$. The "Design or Guaranteed Modulus of Elasticity is as defined by ACI 440.1R as the mean modulus of a production lot or $E_f = E_{f,ave}$.

GLASS TRANSITION TEMPERATURE OF RESIN (T_g)

Known as the "glass transition temperature" or the temperature at which the resin changes from a "glassy state" and begins to soften. $T_g = 230°F$ (110°C)

DENSITY

Nominal Diameter		Unit Weight / length	
Size	**mm**	**kg/m**	**lbs/ft**
2	6	0.052	0.035
3	10	0.112	0.075

MATERIAL CERTS

Material test certs are available for any production lot of Aslan™ 500 Tape.

NEAR SURFACE MOUNT OR NSM ADHESIVE BOND

For NSM strengthening, bond of the strengthening "system" is a function of the properties of the high strengthen structural adhesive AND the characteristics of the Aslan™ 500 Tape. To replicate the typical mode of failure for flexural strengthening, we perform tests using different structural adhesives in an inverted hinged "tee beam". This loading replicates a bond mode component along the axis of the beam in combination with a pull-off mode. The result is a design parameter, τb or ldb describing the development length for a given adhesive used in conjunction with the Aslan™ 500 Tape. The Aslan™ NSM "system" utilizes several readily available commercial high strength structural adhesives typically purchased locally. Details of the various adhesives are described elsewhere.

DESIGN GUIDANCE **NEAR SURFACE** MOUNT

DESIGN GUIDES

› **ACI 440.2R "Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures"** Provides authoritative, consensus guidelines that include.

› **ACI 440.7R "Guide for the Design and Construction of Externally Bonded Fiber-Reinforced Polymer Systems for Strengthening Unreinforced Masonry Structures"** An ACI "Emerging Technology Series" document provides state of the art guidance for masonry strengthening with FRP bars.

HANDLING & **PLACEMENT**

Do Not Shear FRP Tape. When field cutting of FRP Tape is necessary, use a fine blade saw, grinder, carborundum or diamond blade. Carbon Tape is semi-conductive and NOT appropriate for nonmagnetic applications or in direct contact with dissimilar materials. For specific handling, use and installation instructions for Near Surface Mount strengthening, see the following.

NEAR SURFACE MOUNT OR NSM **STRENGTHENING**

NSM strengthening is a superior method in situations that allow the ability to cut shallow groves into the concrete cover. The method eliminates many of the surface preparation issues, critical to successful implementation and efficacy, associated with field lay-up externally bonded FRP systems. Since the bar is bonded to the member on three sides, development length is much shorter and it is possible to utilize the full strength of the bar. The Aslan™ 500 NSM Tape is furnished to the job site pre-cured with verifiable design properties. Unlike field layup FRP systems, there is no need for highly skilled and trained FRP installation experts. Design is dictated by ACI 440.2R.

NSM INSTALLATION INSTRUCTIONS

› **Step #1** Grooves are cut after marking the layout as per the Engineer of Records' specifications. Generally the final groove dimension is 1.5 times the bar diameter in depth and width. Dado cuts are also effective if possible. Note: Proper equipment such as diamond crack chasing blades, guide rails and sufficiently sized power tools make cutting of the grooves easier. Rather than cut the groove in a single pass, sometimes its more effective to cut parallel grooves and remove the concrete between the saw cuts.

› **Step #2** Chisel any remaining concrete between cut paths. A benefit of the Aslan™ 500 Tape is that often only a single saw cut is needed.

› **Step #3** Clean the groove and eliminate any residual dust with compressed air or vacuum. Note: It is not necessary to roughen the interior of the groove with additional abrasion, or brushing.

› **Step #4** For a clean appearance, mask the concrete adjacent to the groove. Note: A time saving tip is to mask over the groove and then trim the masking to each edge.

› **Step #5** Fill the groove approximately half way with adhesive. Note: Consider bulk dispensing of adhesive when making your choice of adhesive for the project.

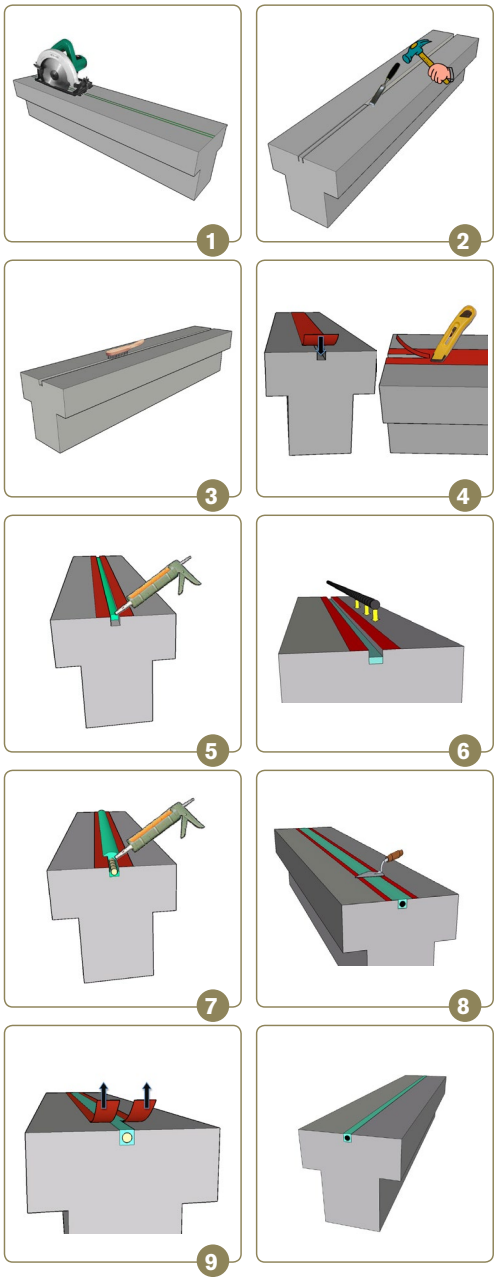
› **Step #6** Clean the textured surface of the Aslan™ 500 Tape with acetone until the cloth use is clean.

› **Step #7** Press the Aslan™ 500 tape into the groove partially filled with adhesive. The objective is to ensure adhesive is well consolidated around the bar without air pockets. Note: Some contractors have developed their own system based on epoxy crack injection methods using a low viscosity epoxy crack injection resin.

› **Step #8** Completely fill the groove with adhesive ensuring the bar is fully covered.

› **Step #9** Level off the excess adhesive with a trowel or putty knife.

› **Step #10** Remove masking. Note: pull the masking off before adhesive is fully cured.



ASLAN™ 500 NSM "SYSTEM" ~ SUGGESTED ADHESIVES

The following high strength structural adhesives have been used successfully.

› Hilti RE 500
› Pilgrim Magmaflow CF
› BASF Concresive 1420 & Concresive LPL
› DeNeef Enforce CFL Gel
› Unitex Pro-poxy 400

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