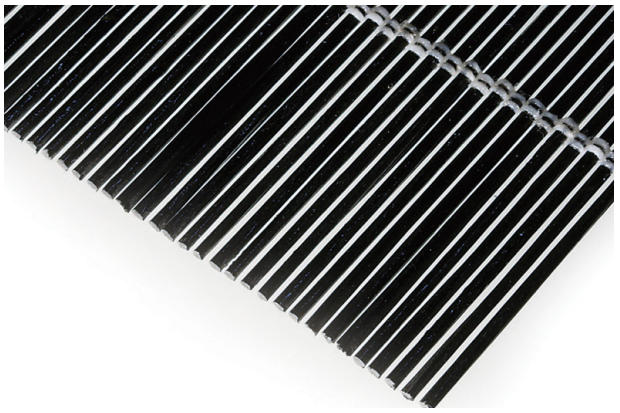
Milliken Infrastructure

RenewWrap™ Strand Sheet®

Pre-cured Unidirectional Carbon Fiber Reinforcement

BRIDGES + ROADWAYS | BUILDINGS + PARKING FACILITIES | OIL, GAS + INDUSTRIAL



RenewWrap™ Strand Sheets® are unidirectional reinforcement sheets consisting of an assembly of pre-cured carbon fiber micro bars. RenewWrap Strand Sheets are available in various stiffnesses and may be used to strengthen existing concrete or steel structures by external bonding. Strand Sheets combine the best features of traditional wet lay-up fabric and pre-cured plate FRP system. Carbon strand sheets are non-reactive. Wear appropriate PPE and use caution when handling since fine carbon dust may be occur when cutting.

General Features and Benefits

- Carbon fiber micro bars are pre-cured – No onsite impregnation
- Open construction of strand sheet facilitates bond to substrate allowing paste adhesive to encapsulate each micro bar
- Unlike solid carbon fiber plates, adhesive bond line can be visually inspected for consistency
- Unlike solid carbon fiber plates, can be spliced by overlapping
- Easy to slit to desired width
- High modulus versions ideally suited for strengthening steel structures
- Can be used to retrofit steel structures where welding is dangerous or not allowed
- Non-corrosive

Where to Use

APPLICATION	CF600/SM	CF600/IM	CF600/HM	CF900/HM
Concrete	X	X	X	X
Masonry	X			
Steel			X	X

Resin Selection for Strand Sheets

APPLICATION STEP	CONCRETE	STEEL
Prime Surface	None required	Primer FP-WE7
Smooth Surface Fills pits, voids, big holes	Filler Putty FE-Z	Filler Putty FE-Z
Bonding Adhesive (!st Coat)	Adhesive FB-E7S	Adhesive FB-E7S
Bonding Adhesive (2nd Coat)	Adhesive FB-E7S	Adhesive FB-E7S

Strand Sheet® products are based on technology developed by Nippon Steel & Sumkin Materials Company, Ltd. Strand Sheet® is a registered trademark of Nippon Steel & Sumkin Materials Co.

Storage & Shelf Life

- Store flat, in a cool, dry place at 40-95 °F (5-35 °C) away from flame or other hazards
- No shelf life if stored in unopened packaging
- Do not stack anything on top of Strand Sheets

Caution

RenewWrap carbon strand sheets are non-reactive. Wear appropriate PPE and use caution when handling since fine carbon dust may be occur when cutting. Use caution when cutting or working with carbon fiber around electrical equipment since carbon fibers are electrically conductive. SDS are available and should be consulted for additional information.

Limitations

- Design calculations shall be made and sealed by a licensed, independent engineer knowledgeable with the design of FRP strengthening systems. Design for concrete should follow the provisions of ACI 440.2R. Consult with Milliken Infrastructure Solutions for applications to steel members.
- Ambient temperature cure wet lay-up FRP strengthening systems are not suitable for applications requiring substantial strengthening and a structural fire rating.

Packaging/Availability

- Available in 19.7 inch wide x 9.8 feet long sheets (500 mm x 3000 mm)
- Yield = 16.1 ft^2/sheet (1.5 m^2/sheet)
- Contact Milliken Infrastructure Solutions for availability of various products prior to design/specification.

infrastructure.milliken.com
855-655-6750

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Mechanical and Physical Properties

TYPICAL PROPERTY		CF600/SM	CF600/IM	CF600/HM	CF900/HM
Areal Weight	oz/yd^2 (gsm)	17.7 (300)	17.7 (300)	17.7 (300)	26.6 (900)
Nominal Thickness[1]	inch (mm)	0.013 (0.333)	0.013 (0.333)	0.0113 (0.286)	0.0167 (0.429)
Tensile Strength[2]	ksi (MPa)	493 (3,400)	421 (2,900)	276 (1,900)	276 (1,900)
Tensile Modulus of Elasticity[2]	Msi (GPa)	35.5 (245)	56.5 (390)	92.8 (640)	92.8 (640)
Elongation at Break[4]	%	1.39	0.74	0.30	0.30
Tensile Strength/Unit Width	k/in/ply (kN/mm/ply)	6.46 (1.10)	5.46 (0.95)	3.10 (0.54)	4.65 (0.81)
Tensile Stiffness/Unit Width[3]	k/in/ply (kN/mm/ply)	466 (81.5)	735 (128.7)	1,045 (183.0)	1,567 (274.5)

NOTES:

1. The reported thickness is based on the net fiber area in accordance with ACI 440.2R. Based on experience the typical thickness of a single strand sheet + adhesive, is approximately 0.06-0.12 in. (1.5 - 3.0 mm) depending on how the substrate surface and the quantity of resin used in the field. Actual thicknesses measured in the field may vary slightly. As with any FRP strengthening system, the strength/unit width and modulus/unit width should be used for design and for field QC purposes.
2. Tested in accordance with JIS A1191/JSCE-E541.
3. Modulus of elasticity and unit stiffness are reported as average values in accordance with ACI 440.2R and shall be used for design. They shall not be used for accepting/rejecting results of field QC test results.
4. Elongation at break is extrapolated from the measured ultimate tensile strength and the calculated modulus of elasticity.

General Application Notes (Concrete and Masonry)

The RenewWrap™ Strand Sheet strengthening system shall be installed by trained and qualified contractors experienced with doing concrete and masonry repairs, surface preparation, and the application of coatings. Consult the Milliken Installation Manual for detailed instructions.

1. Make necessary repairs to the existing concrete or masonry elements to be strengthened as directed by Engineer of Record.
2. Prepare surfaces to a minimum surface profile of CSP-3 (Ref. ICRI 310.2) by grinding, grit blasting, or other means. Clean prepared surface of all dust and insure it is dry prior to applying RenewWrap Strand Sheets.
3. Use Adhesive (FB-E7S) to fill any small bug holes or voids and to smooth surface.
4. Apply Adhesive (FB-E7S) to surface and gently press Strand Sheet into adhesive. Smooth the surface.
5. Apply a second coat of Adhesive (FB-E7S) and smooth.
6. Paint or coat the surface for additional protection/aesthetics.

General Application Notes (Steel)

The RenewWrap™ Strand Sheet strengthening system shall be installed by trained and qualified contractors experienced with the surface preparation and the application of coatings to steel structures. Consult the Milliken Installation Manual for detailed instructions.

1. Remove existing rust and paint from steel by grit blasting or other means and wipe clean using a solvent.
2. Immediately apply Primer (FP-WE7) to the prepared surface of the steel.
3. Use Paste (FE-Z) to fill any pits, smooth the surface, or create uniform fillets where RenewWrap CF fabrics are used with the RenewWrap Strand Sheets.
4. Apply Adhesive (FB-E7S) to surface and gently press the Strand sheet into the adhesive.
5. Apply a second coat of Adhesive (FB-E7S) and smooth.
6. Paint or coat the surface for additional protection/aesthetics.

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