



**GEF Incorporated**  
*Innovative Solutions in Fiberglass*

# BRIDGE COMPONENTS

## FIBER REINFORCED POLYMER COMPOSITES



**EXTREN DWB® (Double Web Beam)**

**GRIDFORM™ Stay-In-Place Bridge Deck System**

**SAFPLANK® / SAFPLANK HD® Planking System**

**STRONGDEK® Decking System**

**COMPOSOLITE® / COMPOSOLITE HD™**  
**Structural Building Panels**

**EXTREN® Structural Shapes & Plate**

**DURADEK® / DURAGRID® Pultruded Grating**

**SAFSTRIP® / SAFSTRIP® Carbon**  
**Strengthening Strip**





# INTRODUCTION

Strongwell is the world's leading pultruder of fiber reinforced polymer (FRP) structural shapes and operates three ISO 9001 Quality Certified Manufacturing Plants. The company's FRP composite products have been used since 1956 to solve problems for customers in a wide variety of markets, some of which are shown below. Strongwell's in-house staff includes registered professional engineers and experts covering nearly every engineering discipline. The company also has complete fabrication facilities and the largest production capacity in the industry to ensure that customer needs are satisfied quickly and completely. The company manufactures FRP structural shapes, grating, handrail, ladders, planks and numerous other building products.



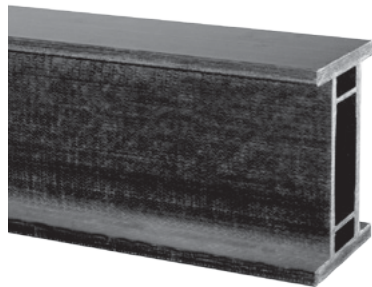


# FRP BRIDGE GIRDERS

**EXTREN DWB®** is a pultruded composite double web beam made from fiberglass continuous strand mat and stitched mat, fiberglass rovings and/or carbon tows, a synthetic surfacing veil and a premium vinyl ester thermoset resin system.

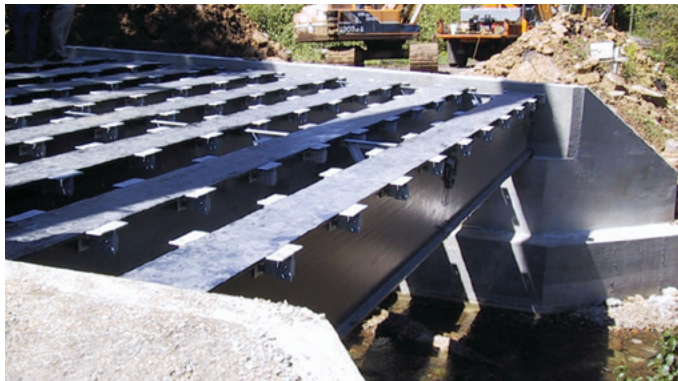
The primary features of **EXTREN DWB®** that are beneficial to bridge construction are:

- High strength-to-weight ratio
- Corrosion resistance
- Extremely stable — reduces the number of lateral bracing diaphragms
- Dimensional stability
- Low conductivity — thermally and electrically



**EXTREN DWB®** is available in 8" x 6" and 36" x 18" sizes in either all-glass or hybrid glass/carbon fiber configurations when increased stiffness is required. Stitched fabrics are located in the webs and internal stiffeners for improved torsional resistance and shear. The synthetic surfacing veil aids in weathering and corrosion resistance.

The larger 36" x 18" **EXTREN DWB®** has a modulus of elasticity of 6.0 msi versus a modulus of elasticity of 2.6 msi for traditional FRP structural shapes. The double web shape provides excellent stability with torsional rotation less than 0.5% in three point laboratory loading.



**Above:** The 36" x 18" **EXTREN DWB®** was installed in a Federal Highway Administration (FHWA) sponsored demonstration bridge project as part of the Innovative Bridge Research and Construction Program (IBRC) in September 2001. University professors from Virginia Tech performed a series of tests on the 36" x 18" **EXTREN DWB®** including stiffness testing of each beam. Eight beams were selected for the 38' span AASHTO HS-20 bridge located on Route 601 in Sugar Grove, Virginia.

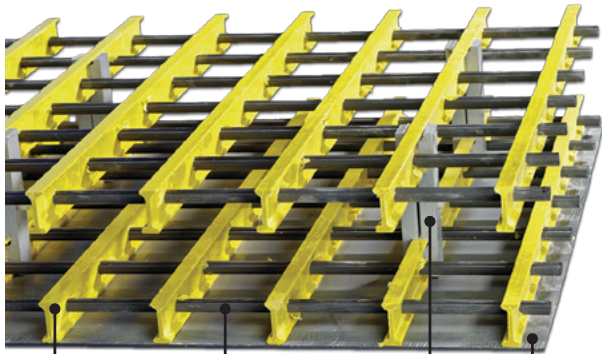
**Above:** Tom's Creek Bridge, Blacksburg, Virginia, reopened to traffic June 23, 1997 as one of the first composite short-span vehicular bridges in the U.S. After replacing the corroded steel beams supporting the bridge with 8" x 6" composite beams, the 17-1/2 ft. x 22 ft.-wide bridge was upgraded from 10-ton capacity to 20-ton capacity. More than 1,000 cars per day cross the bridge.



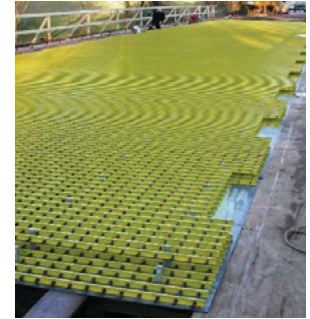
# STAY-IN-PLACE FRP CONCRETE FORMS

## GRIDFORM™

GRIDFORM™ is a stay-in-place concrete bridge deck system that is designed to replace steel rebar in reinforced concrete bridge decks. GRIDFORM™ consists of two layers of pultruded FRP I-bar grating separated by FRP connectors with nylon bolts. The grating features standard I-bars on 4" centers and cross rods on 4" spacings. A 1/8" pultruded FRP plate is bonded to the bottom grating layer to create a stay-in-place concrete form.



- 1.5" I-bars (4" on-center perpendicular to traffic)
- Three-part 0.6" x 0.5" cross rods (4" on-center parallel to traffic)
- Vertical connectors
- 1/8" thick adhesively bonded plate



This field application in Greene County, Missouri, shows the GRIDFORM™ installation from start to completion. As you can see, FRP panel setting, anchoring and concrete forming is easily done with a small work crew. The 144-foot bridge deck and concrete railing system was completed in just five days.



## SAFPLANK® & SAFPLANK HD®

When used flange side up, SAFPLANK® is a high strength system of fiberglass planks designed to interlock to construct a stay-in-place form. Panels are 2" deep by 12" or 24" wide. SAFPLANK HD® (6" deep by 36" wide) is a larger and stronger version of SAFPLANK®, used in applications where additional strength or longer spans are required. Like SAFPLANK®, SAFPLANK HD® is corrosion and rot resistant. If required, either or both sides of the planks can be gritted.



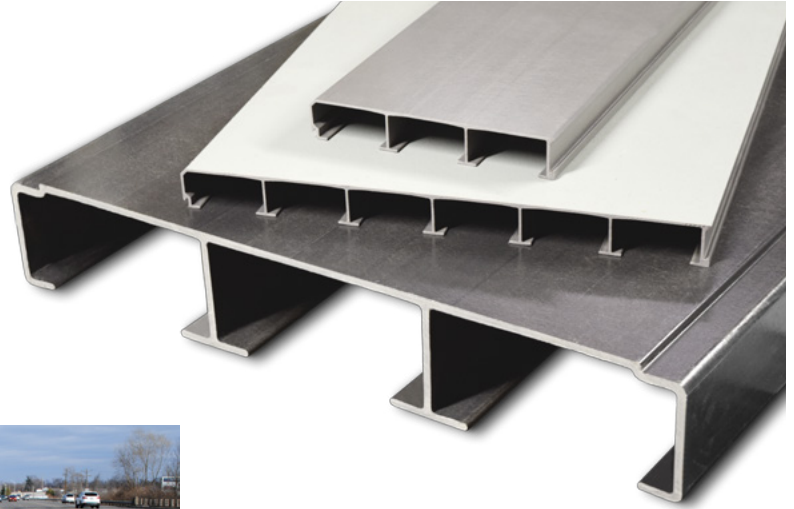
**Above:** A bridge on US Highway 12 over Coffee Creek in Black River Falls, Wisconsin required 2,400 sq.ft. of FRP deck form. Strongwell supplied 12" x 42" sections of SAFPLANK® with grit applied between the flanges. SAFPLANK® panels rested flange side up on a 3-1/2" x 1-1/2" ledge along both sides of the 54W pre-stressed girders, creating a clear span of 36". This installation eliminated the need to form between the girders and remove the forms after concrete was placed.



# FRP PEDESTRIAN BRIDGES, WALKWAYS, BIKEWAYS, ETC.

## **SAFPLANK® & SAFPLANK HD®**

SAFPLANK® is a high strength system of fiberglass planks designed to interlock to form a continuous solid surface. Panels are 2" deep by 12" or 24" wide. SAFPLANK HD® (6" deep by 36" wide) is a larger and stronger version of SAFPLANK®, used in applications where additional strength or longer spans are required. Both SAFPLANK® and SAFPLANK HD® are highly corrosion and rot resistant. Either product may be ordered with a grit surface or with a smooth surface for non-pedestrian applications.



**BEFORE**

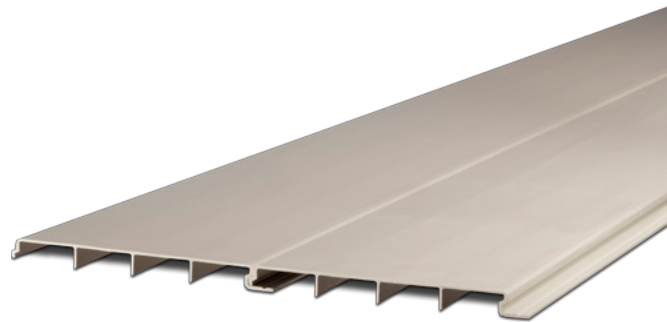


**AFTER**

**Above:** A walkway on Refugee Road over Beaver Creek in Franklin County, Ohio, uses SAFPLANK® along with EXTREN® structural supports.



**Above:** A bridge that connects the Frog Hollow Nature Trail with adjoining trails and recreation areas in Jefferson City, Missouri is refurbished using STRONGDEK™ to replace structurally-deficient steel bridge decking.



## **STRONGDEK™**

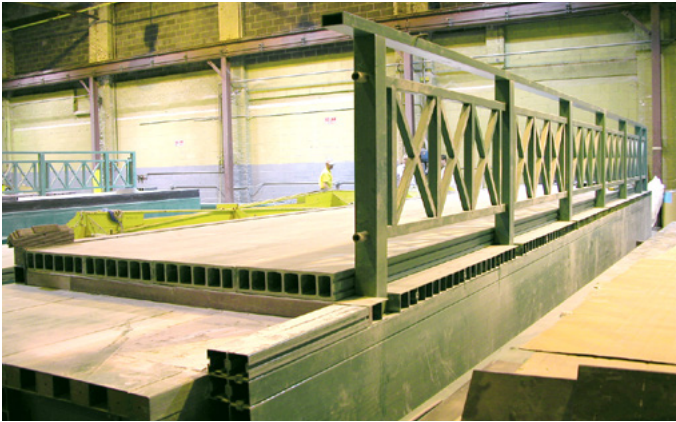
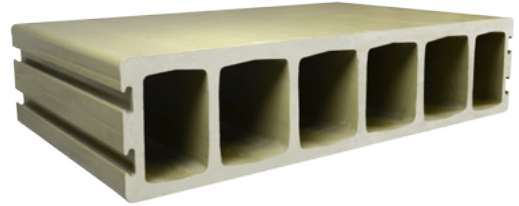
STRONGDEK™ fiberglass decking is an attractive, low-maintenance architectural decking system that offers an alternative to traditional decking materials. STRONGDEK™ panels are designed to connect to form a continuous solid surface utilizing an innovative interlocking design. The 12" wide deck sections are easily installed with screw-like fasteners that are not visible, creating a smooth, attractive surface.



## COMPOSOLITE® & COMPOSOLITE HD™

COMPOSOLITE® is a patented advanced composite building panel system suitable for major load bearing structural applications. The modular construction system consists of a small number of interlocking fiber reinforced polymer (FRP) structural components produced by the pultrusion process. The main building panels are 3.15" (80mm) thick and either 23.68" or 13.70" (601.5mm or 348.0mm) wide and feature a cellular construction. Through the use of toggles and/or hangers, panels can be connected to one another, to 3-way connectors, or to 45° connectors.

COMPOSOLITE HD™ is a heavy duty version of the COMPOSOLITE® building panel which measures 4-1/2" thick by 19-5/8" wide. COMPOSOLITE HD™ can be used when additional strength is required.

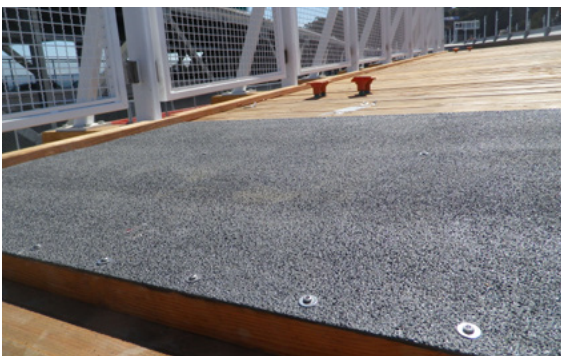


**Above Left / Left:** An all-composite bascule bridge in Bridgetown, Barbados, was built using Strongwell's COMPOSOLITE®, COMPOSOLITE HD™, and EXTREN® structural shapes. The drawbridge is mainly used by pedestrians in this tourist destination.

**Above:** Jenkins Bridge in Maine was installed with the COMPOSOLITE® building system to create a corrosion resistant soil retention headwall system.

## EXTREN® Plate

EXTREN® plate is a pultruded composite made from fiberglass continuous strand mat, fiberglass rovings, a synthetic surfacing veil and a thermoset resin system, and may also contain stitched mat. EXTREN® plate is available in thicknesses from 1/8" to 1" and in all standard EXTREN® resin systems.

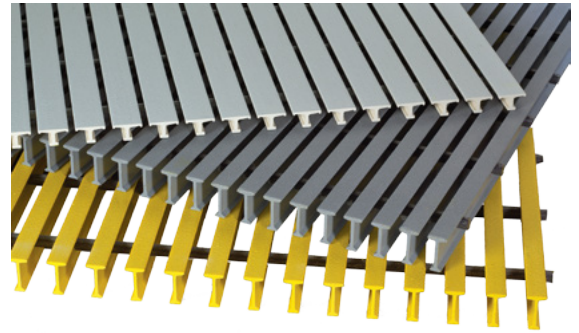


**Left / Above:** The San Francisco-Oakland Bay Bridge and Biking path in California utilized EXTREN® 1/8" thick plate for its walking/biking surface.



## DURADEK® & DURAGRID®

DURADEK® and DURAGRID® are high strength pultruded bar type gratings that can be designed and used like traditional metal grates but have the inherent benefits of fiberglass. The bearing bars use both longitudinal (glass roving) and multidirectional (glass mat) reinforcements as well as a synthetic surfacing veil to provide unequalled strength and corrosion resistance.



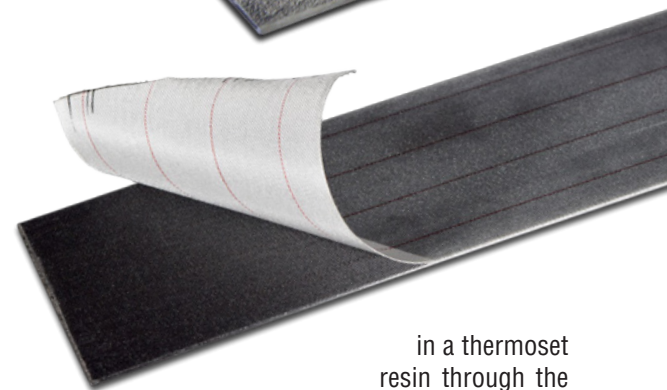
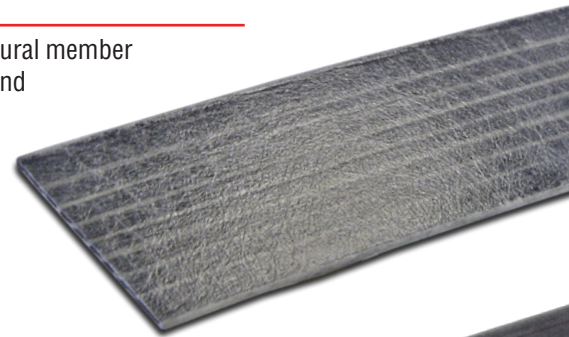
**Left / Below:** The Cleveland Lift Bridge in Cleveland, Ohio utilized DURADEK® T-5000 pultruded grating to replace metal pedestrian walking surface which had rusted away.



## SAFSTRIP® & SAFSTRIP® Carbon

SAFSTRIP® is a pultruded composite strip that improves the strength of an existing structural member when mechanically fastened to the structure. The reinforcing strip has high bearing and longitudinal properties and is designed to strengthen the flexural capacity on the tension face of concrete girders, slabs, and decks. Installation on bridges can occur without any interruption of service.

SAFSTRIP® Carbon is a unidirectional, carbon fiber reinforced polymer (CFRP) comprised of high tensile strength and high modulus carbon fibers encapsulated



**Above:** The posted load for this bridge that spans the Meramec River in Missouri was increased from 10 tons to 18 tons by installing SAFSTRIP® using the mechanically fastened FRP system.

in a thermoset resin through the pultrusion process. SAFSTRIP® Carbon is designed to be used as an externally applied reinforcement for strengthening concrete, timber, and masonry structures. A peelply fabric is adhered to the plate that, when removed, leaves a prepared bonding surface for adhesion to a prepared substrate.

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