



# ASLAN™ 100 SETTING THE BAR

---

## FIBERGLASS REBAR (FRP)

Long Lasting Structures | Electrical Isolation | TBM Soft-Eye Openings | Thermal Neutrality



# APPLICATIONS USING ASLAN™ 100 SOLUTIONS



Dry dock – Marine structures



Channel Tunnel TBM – Tunneling



Miami Metro Rail –  
Deck Bars for electrical isolation  
in Segmental Precast



Taipei metro soft-eye



Rudland Castle



Texas DOT –  
High Speed Tolling Tie Bars



Floodway Bridge –  
Winnipeg, Manitoba



Missouri DOT –  
Boone Co Bridge



Utah DOT – Emma Park Bridge  
Precast Deck Panels

---

## **ASLAN™ 100 SOLUTIONS**

<b>Where Concrete is Susceptible to Corrosion .....</b>	<b>4</b>
<b>ASLAN™ 100 Physical and Mechanical Properties.....</b>	<b>6</b>
<b>Design Guides.....</b>	<b>12</b>
<b>Handling and Placement.....</b>	<b>14</b>



## WHERE CONCRETE IS SUSCEPTIBLE TO CORROSION

Corrosion of internal reinforcing steel is one of the chief causes of failure of concrete structures. Inevitably concrete will crack, creating a direct avenue for chlorides to begin oxidizing the steel rebar. Fiber Reinforced Polymers (FRP's) are a proven and successful alternative reinforcement that will give structures a longer service life. A complete spectrum of authoritative consensus design guides, test methods, material and construction standards, product procurement specifications and qualification procedures are available to the designer and owner to safely and commercially implement FRP's in many different types of structures.

Since 1993, we have been at the forefront of worldwide academic and industry efforts to define consensus standards and methods. Thousands of structures incorporating Aslan™ 100 Fiberglass Rebar, also referred to as “GFRP”, remain in service and are performing well.



---

### Concrete Exposed to De-Icing Chlorides

- Bridge Decks & Railings
- Median Barriers
- Approach Slabs
- Salt Storage Facilities
- Continuously Reinforced Concrete Paving
- Precast Elements : Manhole Covers, Culverts, Rail
- Grade & Crossings, Full Depth Deck Panels, etc.



---

### Concrete Exposed to Marine Chlorides

- Sea Walls, Wharfs, Quays & Dry Docks
- Coastal Construction exposed to Salt Fog
- Desalinization intakes
- Port Aprons



---

### Concrete Exposed to High Voltage and Electromagnetic Fields

- Light & Heavy Rail 3rd Rail Isolation
- Hospital MRI Areas
- High Voltage Substations
- Cable Ducts & Banks
- Aluminum Smelters & Steel Mills
- Radio Frequency Sensitive Areas
- High Speed Highway Tolling Zones



---

### Concrete Susceptible to Corrosion

- Waste Water Treatment
- Inadequate Concrete Cover
- Architectural Concrete Elements
- Historic Preservation

---

### Tunneling and Mining

- Tunnel Boring Machine “Soft-eye” Openings for Launch and Reception
- Sequential Excavation or NATM Tunneling
- Soil Nails & Earth Retention

---

### Masonry Strengthening and Historic Preservation

- Strengthening for “Event Loading” of Clay & Concrete Masonry
- Historic Preservation – Restoration and Pinning of Stone Elements



## ASLAN™ 100 PHYSICAL AND MECHANICAL PROPERTIES

---

### Benefits

- Impervious to Chloride Ion and low pH chemical attack
- Tensile strengths greater than steel
- 1/4 the weight of steel rebar
- Transparent to magnetic fields and radio frequencies
- Electrically non-conductive
- Thermally non-conductive

## Physical and Mechanical Properties

NOMINAL DIAMETER			NOMINAL AREA		f* <sub>FU</sub> GUARANTEED TENSILE STRENGTH		ULTIMATE TENSILE LOAD		E <sub>F</sub> TENSILE MODULUS OF ELASTICITY		ULTIMATE STRAIN
Size	mm	in	mm <sup>2</sup>	in <sup>2</sup>	MPa	ksi	kN	kips	GPa	psi 10 <sup>6</sup>	%
2	6	1/4	31.67	0.049	896	130	28.34	6.37	46	6.7	1.94%
3	10	3/8	71.26	0.110	827	120	58.72	13.20	46	6.7	1.79%
4	13	1/2	126.7	0.196	758	110	95.90	21.56	46	6.7	1.64%
5	16	5/8	197.9	0.307	724	105	143.41	32.24	46	6.7	1.57%
6	19	3/4	285.0	0.442	690	100	196.60	44.20	46	6.7	1.49%
7	22	7/8	387.9	0.601	655	95	254.00	57.10	46	6.7	1.42%
8	25	1	506.7	0.785	620	90	314.27	70.65	46	6.7	1.34%
9	29	1-1/8	641.3	0.994	586	85	375.83	84.49	46	6.7	1.27%
10	32	1-1/4	791.7	1.227	551	80	436.60	98.16	46	6.7	1.19%
11*	35	1-3/8	958.1	1.485	482	70	462.40	104*	46	6.7	1.04%
12*	38	1-1/2	1160	1.800	448	65	520.40	117*	46	6.7	0.97%
13*	41	1-5/8	1338	2.074	413	60	553.50	124*	46	6.7	0.90%

\*Tensile properties of #11, #12 & #13 bar are NOT guaranteed due to the inability to achieve a valid bar break per ASTM D7205.

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 D7205.

## Design Tensile Properties

Tensile strength and E-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 ASTM D7957 as the mean tensile strength of a given production lot, minus three times the standard deviation or  $f_{fu}^* = f_{u,ave} - 3\sigma$ . The "Design or Guaranteed Modulus of Elasticity is as defined by ASTM D7957 as the mean modulus of a production lot or  $E_f = E_{f,ave}$ .

## Quality Assurance Tests

Quality Control Tests are performed on each production lot and are indicative measures to short and long term performance of the FRP bar.

**Void Content** Each production run of Aslan™ 100 product is sampled to screen for longitudinal thermal or mechanical cracks as well as continuous hollow fibers. No continuous voids are permitted after 15 minutes of capillary action. Testing performed per ASTM D5117

- **Fiber Content** Fiber content or fiber volume fraction is a key variable in the overall mechanical properties of the FRP bar. Fiber Content by weight > 70% by weight per ASTM D2584
- **Moisture Absorption Susceptibility** to moisture absorption is a key indicator of successful long-term durability. Testing per ASTM D570. 24 hour absorption at 122°F (50°C) ≤ 0.25% / At saturation ≤ 1%
- **Transition Temperature of Resin (Tg)** Known as the "glass transition temperature" or the temperature at which the resin changes from a "glassy state" and begins to soften. Tg = 230°F (110°C)
- **Transverse Shear Strength** Frequently measured from random production runs. The testing is performed per ASTM D7617. The property is consistent across bar diameters. Transverse Shear Strength = 22,000 psi (150MPa)

# CHARACTERISTIC PROPERTIES

Characteristic Properties are those that are inherent to the FRP bar and not necessarily measured or quantified from production lot to production lot.

---

## Bond

Bond to concrete is achieved in the Aslan™ 100 series by means of a slight surface undulation created by an external helical wrap along with a sand coating. There are many different methods for measuring the bond characteristics of a bar with each test method providing a different value depending on the influences of the testing apparatus and method.

As a means of determining "characteristic" bond strength, block pullout tests are often used as a relative gage of bond performance. However, to accurately define the bond strength it is necessary to perform full -scale beam or beam lap splice tests on a bar. In consensus design guidelines such as ACI, CSA and AASHTO, perfect bond is assumed for flexural design.

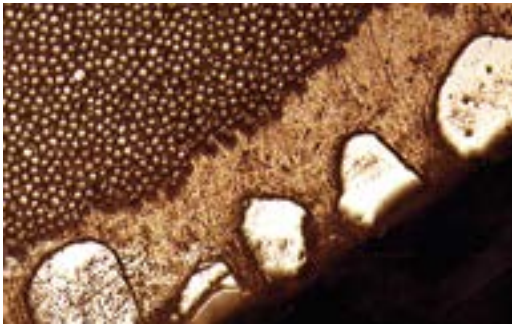
With any of the test methods for bond, caution is urged as a very wide scatter of statistical results is found depending on the strain in the bar in the test and inaccuracies involved in the measuring of crack widths.

The bond depended coefficient  $k_b$  is empirically derived from beam specimens where the dimensions of the beam, concrete strengths, bar properties and strain in the bars are carefully measured. After initial cracking has occurred, the crack widths are measured using LVDT's and the bond dependent coefficient for Aslan™ 100 Fiberglass Rebar is derived. The  $k_b$  bond dependent coefficient for Aslan™ 100 GFRP bars is  $k_b = 0.90$ , per ASTM draft test method. As used in ACI equation 8-9.

Aslan™ 100 bars have been used in all the basic fundamental research studies that appear in peer review papers establishing the consensus design equations for serviceability, flexural capacity, crack widths and development lengths for FRP bars. The designer is urged to follow consensus equations in authoritative publications.

---

## Durability/Alkali Resistance without Load



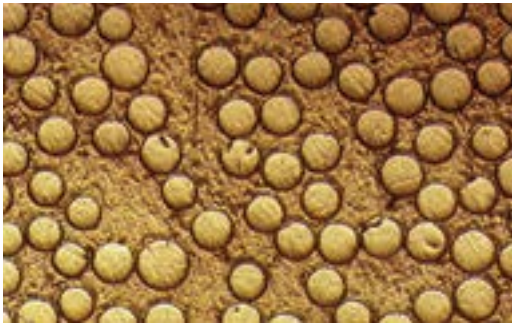
One of the main concerns about the use of Glass FRP's is the potential to be degraded in the long term by the high pH environment of the concrete itself. This phenomenon is analogous to an alkali silica reaction with certain types of aggregate. A great deal of research has been performed on this subject with the conclusion being that a properly designed and manufactured composite system of resin and glass can adequately protect the glass fibers from degradation.

Aslan™ 100 bar is made using a vinyl ester resin matrix with E-CR glass fibers. Selection of high caliber raw materials, which have appropriate "sizing chemistry" resulting in a good bond between the ECR fiber itself and the protective resin are a key to successful long term performance of the fiberglass bar. For this reason the designer needs to be aware of short term and long-term properties of the fiberglass bar.

To characterize the long term properties of the Aslan™ 100 bar, we frequently subject production lot samples to a 12.8pH alkaline solution, at 60°C (140°F) for 90 days and measures the residual tensile, modulus and strain properties of the sample.

Aslan™ 100 bars achieve residual tensile strength retention in excess of 80% making them a "D1" durability according to CSA Standard S-807. Tensile E-modulus properties are typically not affected by the alkaline bath at elevated temperatures.





Subjecting the fiberglass bars to an aqueous, high pH solution at elevated temperatures is not intended to be a perfectly accurate measure of the long term residual properties of the GFRP bar, rather its purpose is to differentiate high caliber fiberglass bars from lesser quality ones.

The unlimited supply of free ions in the purely aqueous elevated pH solution are much more harmful than actual field conditions. This conclusion is drawn from a series of tests performed on FRP bars extracted from service in several structures across Canada by the ISIS research network that reveals NO DEGRADATION of FRP bars after being in service for eight to ten years. At this time, there is no consensus as to what would be an accurate service life prediction model for the use of FRP bars. Links to the complete ISIS findings are available at the Aslan™ FRP web site.

### Tensile Strength at Cold Temperature

As compared to properties at ambient conditions, temperatures at low as -40°F (-40°C) have less than 5% effect on the tensile strength of the bar

### Coefficient of Thermal Expansion

The Coefficient of Thermal Expansion or CTE of the FRP bars is an inherent characteristic property and if sufficient concrete cover of two bar diameters is used, it is not an important design consideration. This is because there is not enough radial force to cause reflective concrete cracking if adequate concrete confinement is present. These findings are elaborated in the work of Aiello, Focacci & Nanni in ACI Materials Journal, Vol. 98 No. 4, July-Aug 2001, pp. 332-339 "Effects of Thermal Loads on Concrete Cover of FRP Reinforced Elements: Theoretical and Experiential Analysis." Further, the transverse CTE is a non-linear property and affected by the helical wrap on the Aslan™ 100 bar. Differing labs achieve a wide scatter in measured CTE results depending on the test method and set-up.

### Creep Rupture/Sustained Loads

FRP bars subjected to a constant load over time can suddenly fail after a time period called the endurance time. The endurance time is greatly affected by the environmental conditions such as high temperature, alkalinity, wet and dry cycles, freezing and thawing cycles. As the percentage of sustained tensile stress to short-term strength of the bar increases, the endurance time decreases. For this reason, the design limits on FRP bars in consensus standards limit sustained loads on FRP bars to very low levels of utilization. The design professional should use the appropriate consensus guideline for creep rupture stress limits.

### Density

GFRP bars are approximately one fourth the weight of steel rebar.

NOMINAL DIAMETER			UNIT WEIGHT/LENGTH	
Size	mm	in	kg/m	lbs/ft
2	6	1/4	0.0774	0.052
3	10	3/8	0.1590	0.107
4	13	1/2	0.2813	0.189
5	16	5/8	0.4271	0.287
6	19	3/4	0.6072	0.408
7	22	7/8	0.8096	0.544
8	25	1	1.0462	0.730
9	29	1-1/8	1.4137	0.950
10	32	1-1/4	1.7114	1.15
11*	35	1-3/8	1.9346	1.30
12*	38	1-1/2	2.4554	1.65
13*	41	1-5/8	2.8721	1.93

# BENT BARS AND STIRRUPS DETAILING GUIDE

Most industry standard bent shapes are available in Aslan™ 100 Fiberglass Rebar with some exceptions as noted in the detailing guide. Standard steel shape codes are referenced along with those for FRP bar.

All bends must be made at the factory. Field bending of FRP bars is not possible. This is because the bent bars must be formed in the factory while the thermo-set resin is uncured. Once the resin is cured, the process cannot be reversed. We advise that you work closely with the factory to implement the most economical detailing of bent bars and stirrups.

## Strength of the Bent Portion of the Bar

All FRP bars exhibit a strength reduction through the bent portion of the bar, which is recognized by all the consensus design guidelines.

Testing per ASTM D7914, "Test method for strength of FRP bent bars and stirrups at bend locations" show that Aslan™ 100 bar are nearly twice the strength of the design levels in the guidelines. While most standard steel rebar shapes are available, there are a handful of limitations that influence the economics of the detailing. Closed square shapes are not available. They must be furnished as either pairs of Ubars or a continuous spiral. Generally, pairs of U-shaped bars are more economical. Z-shapes or gull-wing type configurations are not very economical.

A 90-degree bend with 12db, bar diameter, pigtail used to shorten development length is just as effective as a J-shape as per ACI 440.1R. The maximum leg length on any bend is 5 ft (1.5 m). The radius on all bends is fixed as per the following table. Accordingly, some U-shaped stirrups that fall in between the range of these two bend radii are not possible.

NOMINAL DIAMETER			INSIDE BEND RADIUS	
Size	mm	in	mm	in
2	6	1/4	38	1.5
3	10	3/8	54	2.125
4	13	1/2	54	2.125
5	16	5/8	57	2.25
6	19	3/4	57	2.25
7	22	7/8	76	3.0
8	25	1	76	3.0

## Field Forming of Large Radius Curves

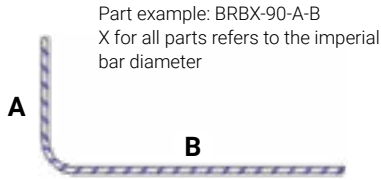
Due to the low modulus of the Aslan™ 100 bar, it is possible to field form the bar into large radius curves. This induces a bending stress in the bar which must be lower/smaller than the creep rupture limit/allowable stresses. A radius smaller than those in the following table would exceed the allowable long term sustained stresses. The table gives the minimum allowable radius for induced bending stresses without any consideration for additional sustained structural loads.

NOMINAL DIAMETER			INSIDE BEND RADIUS		EXTERIOR USE C=0.7MIN RADIUS	
Size	mm	in	mm	in	cm	in
2	6	1/4	107	42	122	48
3	10	3/8	170	67	196	77
4	13	1/2	246	97	282	111
5	16	5/8	323	127	368	145
6	19	3/4	404	159	462	182
7	22	7/8	495	195	566	223
8	25	1	597	235	678	267
9	29	1 1/8	597	280	813	320
10	32	1 1/4	711	343	996	392
11*	35	1 3/8	871	414	1204	474
12*	38	1 1/2	1052	487	1412	556
13*	41	1 5/8	1237	570	1656	652



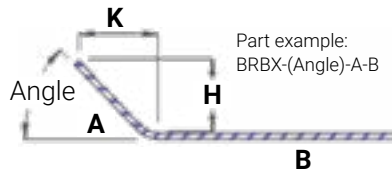
# STANDARD BAR BENDS

## G1 90° Bent (Steel 2, 17)



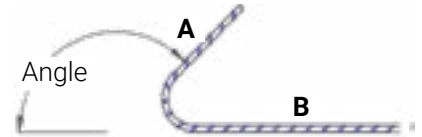
Max Legs: **A ≤ 80"**, B may be **up to 80"**  
 If **A ≤ 50"**, B may be **up to 95"**  
 If **A ≤ 30"**, B may be **up to 105"**

## G2 <90° Bent (Steel 3)



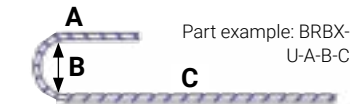
Max Total Linear Length:  
 Is typically **110"**

## G3 >90° Bent (Steel 13, 21, 30)



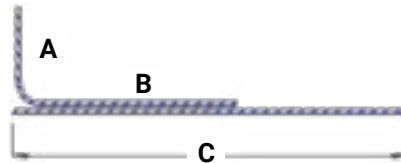
Max Total Linear Length:  
 Is typically **110"**

## G4 Hooked Bar (Steel 1)



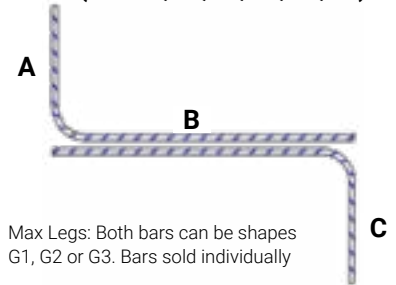
Max Legs: **A & C ≤ 80"**  
 B: 3" for #2 bar  
 4.5" for #3 through #6 bar  
 6" for #7 & #8 bar  
 Note: A 90° bend with a 12 bar diameter tail is equally effective and more economical

## G5 Long Leg Bent (Steel 2, 17)



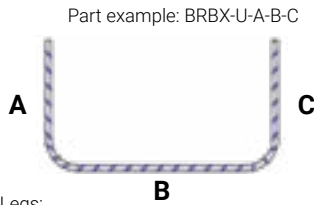
Max Legs: Bar comprised of sides A & B can be shapes G1, G2 or G3  
 Straight bar (C) can be produced up to 60 ft long. Bars sold individually

## G6 Z Bar or Similar (Steel 8, 18, 19, 20, 24, 29)



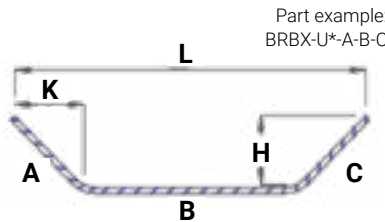
Max Legs: Both bars can be shapes G1, G2 or G3. Bars sold individually

## G7 U/C Shape Bar (Steel 2/17)



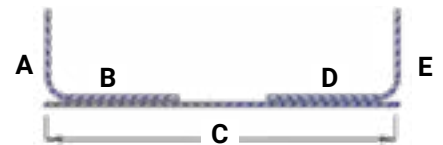
Max Legs:  
 For  $B < 40"$ , A & C can be up to 45" each  
 For  $40" < B < 80"$ , A & C can be up to 40" each  
 For  $80" < B < 90"$ , A & C can be up to 20" each

## G8 Open U (Steel 3d, 4c, 14ab, 22B)



Max Part Lengths: L can be up to 80"  
 H can be up to 45"

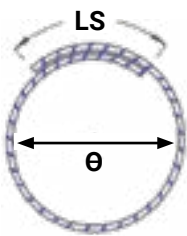
## G9 Long Leg U (Steel 2/17)



Max Legs: Bars comprised of sides A & B and D & E can be shapes G1, G2 or G3. Straight bar (C) can be produced to length. Bars sold individually

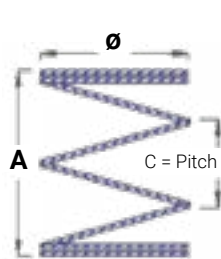
## G10 Hoop (Steel T3)

Part example: BRBX-H-(Int. Ø)-(LS)



Max Size:  
 $6 \leq \theta \leq 48"$

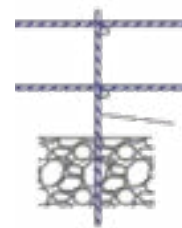
## G11 Spiral (Steel SP1)



Part example: BRBX-S-(Int. Ø)-(Turns)

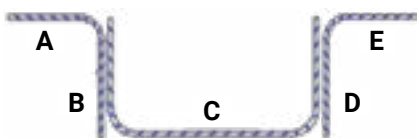
Max Size:  $\theta$  conforms to shape G13.  
 Number of turns can be up to 60

## G12 Stake (Steel 25, 26 alternative)



A GFRP stake is an alternative for a Standee shape. While a standee is possible, a GFRP stake is a much more economical solution and is preferred. Bar can be directly embedded into the ground and will not corrode

## G13 Gull Wing (Steel 3, 4, 7, 22, 23)

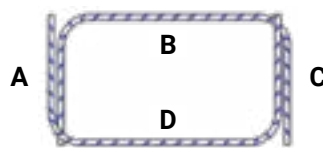


Max Legs: Bars comprised of sides A & B and D & E can be shapes G1, G2 or G3. Bar comprised of sides B, C & D can be shapes G7 or G8. Bars sold individually

### NOTE:

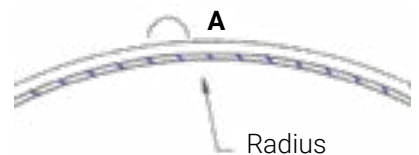
Bent bar is limited to sizes #2-#8  
 Bar dimensions larger than noted may be possible. Please contact Owens Corning if you need a shape larger than what is shown here.

## G14 Closed Stirrup (Steel S3, T1, T2)



Max Legs: Both individual bars conform to shape G7. Bars sold individually

## G15 Large Radius (Steel 9)



Max Legs: Straight bar can be produced to length. Refer to Field Forming section for Large Radius Curve allowances. Large Radius curves are field formed to shape.



## DESIGN CONSIDERATIONS

There are a number of authoritative consensus design guidelines for the designer to follow. Generally the design methodology for FRP reinforced concrete members follows that of steel reinforcing but taking into account the linear elastic or non-ductile nature of the material with different safety factors. Care is taken to avoid the possibility of a balance failure mode where concrete crushing and rupture of the bar could occur simultaneously. The designer must choose between compression failure of concrete, which is the preferred mode, and rupture of the FRP bar with a higher factor of safety.

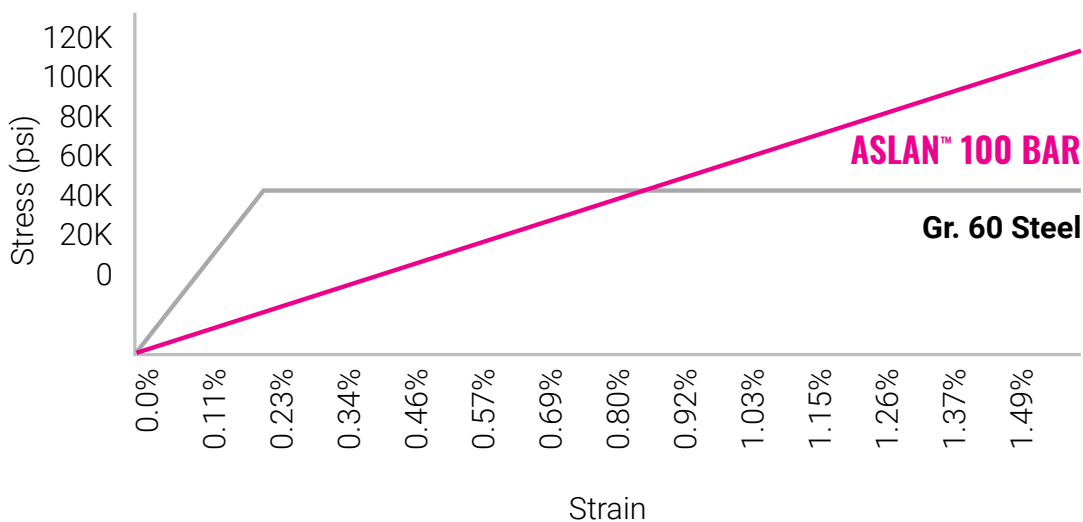
Due to the low modulus of elasticity of FRP bars, serviceability issues such as deflections and crack widths generally control design.

The compressive strength of FRP bars is disregarded in design calculations.

Although the FRP bars themselves are not ductile, an FRP reinforced concrete section is characterized by large deformability i.e. significant deflections and crack widths are a warning of pending failure of the section.

The designer should follow the recommendations in the appropriate consensus design guideline. To aid the designer who might not be familiar with these guides and standards, we maintain a staff of registered professional engineers to assist the engineer of record in safely implementing our products.

### Stress -Strain "Curve" for #6 Aslan™ 100 bar



## Design Guides



- **ACI 440.1R “Guide for the Design and Construction of Structural Concrete Reinforced with FRP Bars”** The American Concrete Institute 440 guide is a mature and living document that has undergone a number of revisions since its first publication in 2001. Companion documents to the 440.1R design guide include the ACI 440.3R “Guide Test Methods for FRP’s for Reinforcing or Strengthening Concrete Structures” which is intended as an interim document superseded by new ASTM test methods as they become available. The ACI 440.5 “Specification for Construction with Fiber Reinforced Polymer Reinforcing Bars” and a new material standard – ASTM D7957 Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement – give guidance in mandatory language for the use and specification of FRP bars. ACI also offers a number of professional educational materials and special publications and proceedings specifically addressing internal FRP reinforcing bars.
- **AASHTO LRFD Bridge Design Guide Specifications for GFRP Reinforced Concrete Bridge Decks and Traffic Railings** Published in November 2009, this document offers authoritative design guidance to the bridge design community in safely adopting FRP bars in bridge decks and railings.
- **CSA S-806** The Canadian designer has the luxury of utilizing the S806 document “Design and Construction of Building Components with Fibre-Reinforced Polymers”.
- **CSA S-6 Canadian Highway Bridge** Design Code Widespread adoption of GFRP bars in Canadian bridge structures is being made possible by this important document.
- **CSA S-807 Specification for Fibre-Reinforced Polymers** This specification offers guidance in terms of limits of constituent materials for FRP bars, criteria for qualification of FRP bar systems, manufacturers quality control reporting and owners acceptance criteria. The specification provides a framework for owners to use to pre-qualify FRP bar suppliers for bidding on major public works projects and for the manufacturers reporting of specific, traceable production lot properties and acceptance limits.
- **FIB Task Group 9.3 – bulletin 40 “FRP Reinforcement in RC Structures”** In Europe, the Federation Internationale du Beton FIB Task Group 9.3 has published a technical report «Bulletin 40», which is a «state of the art» of FRP reinforcement in RC structures. Work is under way on provisions for FRP bars in EuroCode 2 format. Norway and Italy have published internal design codes for the use of FRP bars.

---

## Material Certs and Traceability

Material test certificates are available for any production lot of Aslan™ 100 bar. The certs are traceable to the bar by means of a series of bar marks imprinted along the length of the bar in intervals showing the bar diameter, work order and production date. In addition to ASTM D7205 Tensile, Modulus and Strain values, the test cert includes a full accounting of various additional properties and lab tests performed on the production lot as per ASTM D7957.

---

## Cross Sectional Area

The design properties are determined using “Nominal” diameters. Surface undulations and sand coatings that facilitate bond are accounted for the “measured cross sectional area” in the tolerances in Table 3 of ASTM D7957, as determined by the Archimedes method of volume displacement in a fluid.

## HANDLING AND PLACEMENT

Authoritative guidance for the specifier, in mandatory language, is given in ACI 440.5-08 "Specification for Construction with FRP Bars", which details submittals, material delivery, storage, handling, permitted damage tolerances, bar supports, placement tolerances, concrete cover, tie-wire, field cutting and more. In general, the field handling and placement of FRP bars is similar to coated steel rebar (epoxy or galvanized), but with the benefit of weighing one fourth the weight of steel.

Do Not Shear FRP bars. When field cutting of FRP bars is necessary, use a fine blade saw, grinder, carborundum or diamond blade. Sealing the ends of FRP bars is not necessary. Support chairs are required at two-thirds the spacing of steel rebar.

Plastic coated tie wire is the preferred option for most projects. When completely non-ferrous reinforcing, i.e., no steel is required in the concrete, nylon zip ties (available from local building materials centers) or plastic bar clips are recommended. (Don't forget to use non-metallic form ties in formwork.) It is possible, especially in precast applications, for FRP bars to "float" during vibrating. Care should be exercised to adequately secure FRP in the formwork.







### **Owens Corning Infrastructure Solutions, LLC**

One Owens Corning Parkway

Toledo, OH 43659

+1 402 646 6262

This information and data contained herein is offered solely as a guide in the selection of product. We believe this information to be reliable, but do not guarantee its applicability to the user's process or assume any responsibility or liability arising out of its use or performance. The user agrees to be responsible for thoroughly testing any application of the product to determine its suitability. Because of numerous factors affecting results, we make no warranty of any kind, express or implied, including those of merchantability and fitness for a particular purpose. Statements in this publication shall not be construed as representations or warranties or as inducements to infringe any patent or violate any law, safety code or insurance regulation. We reserve the right to modify this document without prior notice.

THE PINK PANTHER & © 1964–2019 Metro-Goldwyn-Mayer Studios Inc. All Rights Reserved. © 2019 Owens Corning. All Rights Reserved.

Pub. 10022286-E. Aslan 100 Fiberglass Rebar rebars brochure\_ww\_10-2017\_Rev1\_EN. May 2019.

[www.owenscorning.com/rebar](http://www.owenscorning.com/rebar)  
[composites@owenscorning.com](mailto:composites@owenscorning.com)