Glass Fiber Reinforced Polymer (GFRP)

DOWEL BAR

Aslan 600

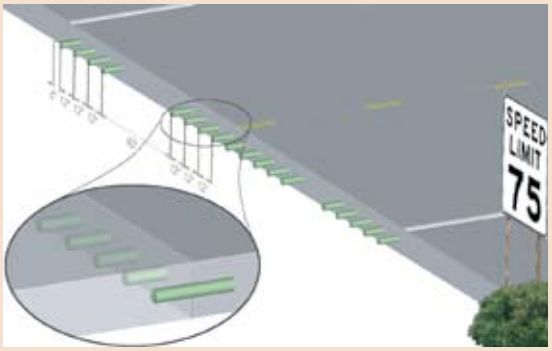
by Hughes Brothers

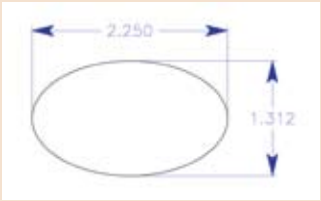
Glass Fiber Reinforced Polymer (GFRP) Dowel Bars have a number of advantages when used as load transfer devices for extended life pavement. The Achilles Heel of concrete pavement is the joint. Joint failure is often the result of corrosion of the steel dowel bar. Aslan 600 Dowels will not rust or corrode, locking a concrete joint together or causing spalling of the surrounding concrete. In addition, while providing the necessary shear capacity at the joint, the lower stiffness of the GFRP Dowel bars may reduce fatigue stresses in the concrete surrounding the dowel.

GFRP Dowel Bars are also electromagnetically transparent and frequently used in toll collection areas near inductance loops embedded in paving. Typically Aslan 100 GFRP Tie Bars are also used in conjunction with Aslan 600 Dowels.

Benefits of Aslan 600 GFRP Dowel Bars

- Impervious to Chloride Ion and Chemical attack
- Transparent to magnetic fields
- 1/4th the weight of traditional steel dowels means:
  Easier Handling and Fewer Injuries
- Faster Installation
- Modulus of Elasticity closer to concrete than steel
  – Less stress in concrete around the dowel
  – Allows for lower strength concrete
- No Need to Grease Dowels





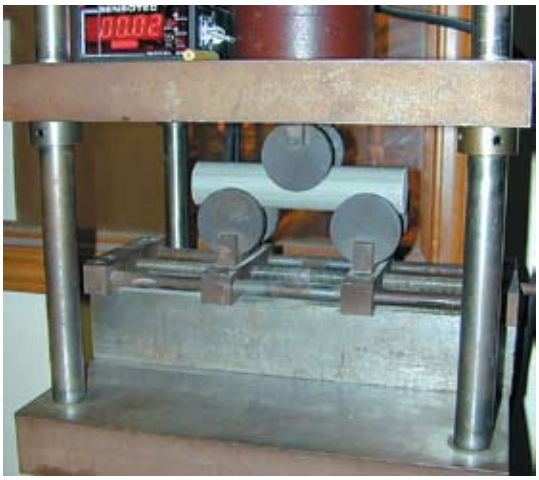
Aslan 600 Dowel Bars are smooth and round. An Elliptical Dowel bar is available in a diameter that would be equivalent to a 1.71" round rod. Many benefits in concrete joint performance are anticipated with the greater bearing area under the dowel offered by the elliptical shape. elliptical dowels are to be used with the wider plane horizontal.

Physical Properties

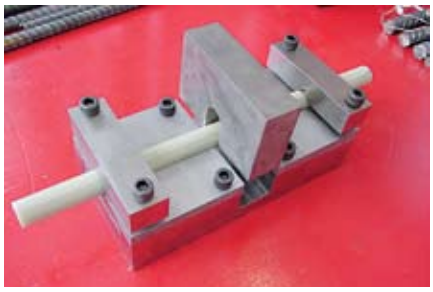
Dowel Diameter	Cross Sectional Area (in^2)	Nominal Metric Diameter (in)	Shear in Bending ASTMD4475-96 lbs	Shear Stress (psi) ACI440.3R-04-B.4	Shear Strength (lbs)	Modulus of Elasticity (psi x 10^6)
5/8"	0.3068	0.625	2,800	22,000	6750	5.92
3/4"	0.4418	0.750	5,000	22,000	9720	5.92
1"	0.7854	1.000	8,500	22,000	17,279	5.92
1-1/4"	1.2272	1.25	15,060	22,000	26,998	5.92
1-1/2"	1.7671	1.500	21,500	22,000	38,876	5.92
2.25 x 1.31*	2.289	1.71**	–	22,000	50,358	5.92

*Elliptical ** Nominal Diameter is equated to a round rod.

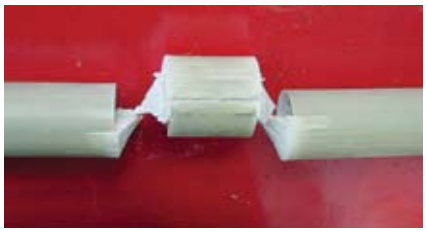
Hughes Brothers reserves the right to make improvements in the product and/or process which may result in benefits or changes to some physical-mechanical characteristics. Please refer to our web site at www.hughesbros.com for the most current values. The data contained herein is considered representative of current production and is believed to be reliable and to represent the best available characterization of the product as of May 2007.



The shear strength of the GFRP Dowels is measured in two ways, shear in bending and transverse shear. The bending shear test used is a standard ASTM test placing the dowel bar in a three-point loading fixture. Also known as a short beam shear test.



Shear Test Fixture



Tested 1 1/2" GFRP Dowel

In case of transverse shear, a special test fixture is used to shear the dowel in two planes. The shear strength is determined from the double shear test per ACI440.3R-04 test method B.4.

Field Trials

In 1983, the Ohio Department of Transportation (ODOT) installed several alternative dowel bars for long-term durability performance studies in sections of Interstate 77 in Guernsey County and Ohio State Route 7 in Bellmont County. These dowel bars were produced with the same constituent materials as in the Aslan 600 GFRP Dowels. In 1998, the Market Development Alliance (MDA) of the composites industry organized the extraction and testing of samples of these dowel bars to determine their durability performance after 15 years of in pavement service.

These results show that the GFRP Dowel Bars were virtually unaffected by approximately 15 years of field service and exposure.

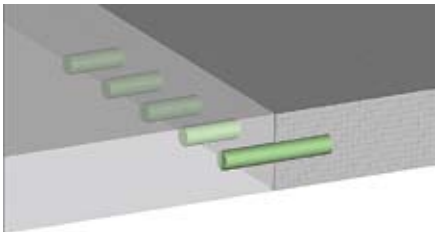
GFRP Dowel Bars have been installed in Illinois, Iowa, Kansas, Minnesota, Ohio, Wisconsin and Manitoba, Colorado, New York/ New Jersey, Illinois, Ohio, Texas, Florida, California, Arizona, Hawaii, Canada and many countries outside North America.

Hughes Brothers, Inc.
210 N. 13th Street
Seward, NE 68434

Phone: **800-869-0359**
402-643-2991
Fax: 402-643-2149
www.hughesbros.com
Email: **doug@hughesbros.com**

Performance of GFRP Dowels

The three design elements for dowels are spacing, length and diameter. Due to flexibility of the sub grade, the load is not transferred by a single dowel but by a group of dowels. Tests performed at the University of Manitoba in Winnipeg Canada show the joint effectiveness of GFRP Dowels to be in the range of 86% to 100% effectiveness using a weak sub grade and 90% to 97% using a stiff sub grade. An ACPA criterion for successful joint load transfer is 75%. The research concludes, "GFRP dowels are a viable, corrosion free alternative to steel dowels." *(ACI Structural Journal Vol. 98 No. 2, March-April 2001, Glass Fiber Reinforced Polymer Dowels for Concrete Pavements, D. Eddie, A. Shalaby and S. Rizkalla.)*



Loose or Baskets

Aslan 600 GFRP Dowels are generally furnished loose. When supplied loose they may be used by dowel bar insertion machines or as part of a dowel bar retrofit system. Use in construction joints or drilled and epoxied into existing cold joints using a structural epoxy, such as MBT 1420 or DeNeef Denepox, is also appropriate.

Aslan 600 Dowels may also be furnished in a 100% non-metallic basket assembly, the DBB1500 series. The completely metal free basket allows for free flow of concrete between the dowels which helps maintain alignment during the pour. The basket has been tested for a vertical load in excess of 1500 lbs.

The DBB1500 series is very light weight. Individual support chairs are snap fit onto #3 fiberglass runners and the 1-1/2" X 18" smooth round GFRP Dowel Bars snapped into place. The basket assemblies are generally field assembled.

With GFRP Dowel Bars, the there is no need to grease the dowels as the bond strength to the concrete is sufficiently low to allow longitudinal movement of the concrete.

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210 North 13th Street
Seward, Nebraska 68434
Phone 800.869.0359 or 402.643.2991 / Fax 402.643.2149
www.hughesbros.com