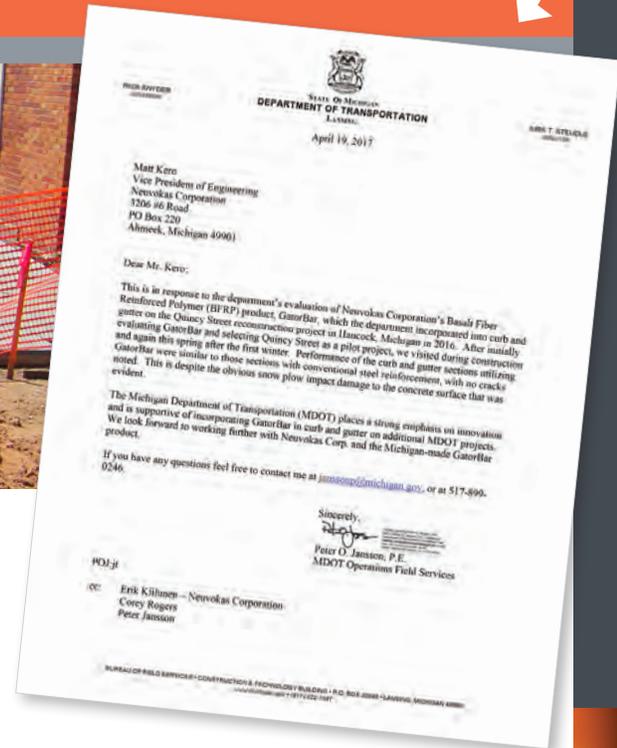


GATORBAR™

FRP REBAR: MDOT APPROVED

MDOT SPECIAL SPEC 12DS802(K075) ALLOWS BASALT FRP

RUST-FREE REBAR THAT EXTENDS THE LIFESPAN OF CONCRETE.



QUINCY STREET, HANCOCK, MI

GATORBAR PILOT PROJECT = SUCCESS

#3 GatorBar FRP rebar was successfully used in place of #4 epoxy-coated steel in a summer 2016 curb and gutter project.

GET THE GATORBAR ADVANTAGE:

- 2X more durable than steel rebar
- 86% lower transport costs & reduced structure costs
- Electrically & thermally non-conductive
- Equivalent tensile strength at smaller diameter
- Made in Michigan, USA

SAVE TIME WITH GATORBAR

Just feed it into the slip form machine—no pre-bending required!

THE GATORBAR SOLUTION

FRP (fiber reinforced polymer) rebar is corrosion resistant and has been documented in multiple studies to provide superior crack control when used in pavements.

APPLICATIONS:

- Sidewalks & driveways
- Slope paving
- Curbs & gutters



NEUVOKAS CORP. (906) 934-2661

INFO@NEUVOKASCORP.COM
NEUVOKASCORP.COM





STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
LANSING

RICK SNYDER
GOVERNOR

KIRK T. STEUDLE
DIRECTOR

April 19, 2017

Matt Kero
Vice President of Engineering
Neuvokas Corporation
3206 #6 Road
PO Box 220
Ahmeek, Michigan 49901

Dear Mr. Kero:

This is in response to the department's evaluation of Neuvokas Corporation's Basalt Fiber Reinforced Polymer (BFRP) product, GatorBar, which the department incorporated into curb and gutter on the Quincy Street reconstruction project in Hancock, Michigan in 2016. After initially evaluating GatorBar and selecting Quincy Street as a pilot project, we visited during construction and again this spring after the first winter. Performance of the curb and gutter sections utilizing GatorBar were similar to those sections with conventional steel reinforcement, with no cracks noted. This is despite the obvious snow plow impact damage to the concrete surface that was evident.

The Michigan Department of Transportation (MDOT) places a strong emphasis on innovation and is supportive of incorporating GatorBar in curb and gutter on additional MDOT projects. We look forward to working further with Neuvokas Corp. and the Michigan-made GatorBar product.

If you have any questions feel free to contact me at janssonp@michigan.gov, or at 517-899-0246.

Sincerely,

Digitally signed by Peter O. Jansson, P.E.
DN: cn=Peter O. Jansson, P.E., ou=Michigan
Department of Transportation, ou=MDOT Field
Services, email=janssonp@michigan.gov, c=US
Date: 2017.04.20 14:40:45 -0400
Adobe Acrobat DC version: 2015.009 (2015)

Peter O. Jansson, P.E.
MDOT Operations Field Services

POJ:jt

cc: Erik Kiiilunen – Neuvokas Corporation
Corey Rogers
Peter Jansson

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
**CURB AND GUTTER, CONCRETE WITH BASALT FIBER REINFORCED POLYMER,
DETAIL ___, MODIFIED**

OFS:SCK

1 of 4

APPR:JFS:POJ:11-30-15

a. Description. This work consists of providing all labor, equipment, and materials to construct a concrete curb and gutter using basalt fiber reinforced polymer (BFRP) reinforcement in accordance with section 802 of the Standard Specifications for Construction, Standard Plan R-30 Series, and as modified by the details on the plans and this special provision.

b. Materials. Provide materials in accordance with subsection 802.02 of the Standard Specifications for Construction except as modified by this special provision. Furnish BFRP reinforcement that meet the following material specifications and requirements. Fabricate BFRP reinforcement in accordance with the details shown on the plans. Ensure the size of BFRP bars is consistent with typical standard sizes of steel reinforcing bars.

1. **Fibers.** Use fibers in the form of unidirectional rovings of given size and weight with fiber sizing and coupling agents that are compatible with the resin system used to impregnate them. The BFRP reinforcement must contain 70 percent minimum, by weight of basalt fiber.

2. **Resin Matrix.** Use commercial grades of epoxy resin or vinyl ester resin. Ensure the base polymer in the resin system does not contain any polyester. Blending of vinyl ester and epoxy resins will be permitted. Polyester based resin will not be permitted in the manufacturing process of the bar. Ensure the glass transition temperature (T_g) of the resin is not less than 212 degrees Fahrenheit (F). The glass transition temperature of the resin does not represent a service level maximum temperature, but a quality assurance tool used by the manufacturer. Test the resin matrix in accordance with the Differential Scanning Calorimetry (DSC) method as described in *ASTM E 1356*.

3. **Fillers.** Inorganic fillers and secondary fibers may be used, but their quantity must not exceed 20 percent by weight of the base polymer resin specified. Commercial grade additives and process aids such as release agents, low profile shrink additives, initiators, promoters, hardeners, catalysts, pigments, fire-retardants, and ultra violet inhibitors are permitted and depend on the process method. If used, limit shrink additives to less than 20 percent by weight of the polymer resin.

4. **Mechanical Properties.** Furnish BFRP with the following minimum requirements:

A. **Tensile Strength.** This property varies with bar size. The minimum tensile strength of BFRP reinforcement is listed in Table 1. Test in accordance with *ASTM D 7205*.

Table 1. Minimum Tensile Strength Requirements

Bar Size	Minimum Tensile Strength (ksi)
3	140
4	135
5	130
6	125
7	120
8	110

B. Tensile Modulus. Ensure the nominal tensile modulus of elasticity averages 6,000 ksi in accordance with *ASTM D 7205*.

C. Transverse Shear. Test transverse shear in accordance with *ASTM D 7617*. Ensure the minimum transverse shear for all bars is 20 ksi.

D. Moisture Absorption. Test moisture absorption in accordance with *ASTM D 570*. The maximum value of this test must follow ACI recommendations and be less than 1.0 percent.

E. Bond Strength. The guaranteed bond strength for all bars must follow ACI recommendations of *ACI 440.6-08*, 1.4 ksi. The manufacturer must report the test method used for testing bond strength. A suggested test method is *ACI 440.3R test method B3*.

F. Ultimate Tensile Strain. Ensure the ultimate tensile strain is calculated by dividing the guaranteed tensile strength by the nominal tensile modulus of elasticity. The nominal values obtained by this procedure must be at least 1.4 percent.

Provide BFRP as manufactured by:

Neuvokas Corp., 3206 Number 6 Road, PO Box 220, Ahmeek, MI 49901, (906) 934-2661,

Raw Energy Materials Corp., 1190 South Dixie Hwy Southeast, Pompano Beach, FL 33060, Ph: 954-803-9206, Alt: 954-270-9000, or approved equal.

c. Submittals. Provide four 4 foot long quality assurance samples of each size BFRP bar at the beginning of each project or as determined by the Department.

Submit independent laboratory test reports including the following, for each size of BFRP used on the project.

1. Results of the tensile test of BFRP reinforcement, for each size of reinforcement used, including the following:

- A. Diameter(s);
- B. Breaking load;
- C. Tensile modulus, and
- D. Strain at ultimate tensile load

2. Results of the transverse shear test of BFRP reinforcement, including the following:
 - A. Diameter(s)
 - B. Breaking load, and;
 - C. Shear modulus
3. Provide the Engineer a certification from the BFRP reinforcement manufacturer stating the materials furnished meets the specifications as described herein. The certification must include:
 - A. The basalt fiber and percentage by weight in the reinforcement;
 - B. The resin matrix material, composition percentage of filler material, and resin glass transition temperature (T_g);
 - C. Guaranteed bond strength, including the test method used, and;
 - D. Results of moisture absorption testing

The BFRP reinforcement may not be incorporated into the work until the submittal is approved by the Engineer. Allow 10 working days for review of submittal.

d. Construction. Construct the concrete curb and gutter in accordance with subsection 802.03 of the Standard Specifications for Construction and Standard Plan R-30 Series, except as modified by the details on the plans and this special provision. Before ordering material, submit approved drawings and specifications to manufacturer for quotation. This should include: bar size, length, bent shape and radius of bends, and quantities in linear feet. BFRP reinforcement bars must be uniform in diameter/size and free of defects. Defects include: exposed fibers, cracks, kinks, and surface pitting. Slight discoloration over time is typical and is not cause for rejection.

1. **Field Fabrication.** Field fabrication, except for tying of BFRP reinforcing bars, is prohibited. Field cut BFRP reinforcement only when specifically permitted by the Engineer using high speed grinding cutter, fine blade saw, diamond blade, or masonry blade. Shear cutting of BFRP reinforcement is prohibited. All surface damage due to cutting must be inspected by the Engineer and repaired or replaced at the Contractor's expense.

2. **Handling.** BFRP bars can be handled similar to their steel counterparts. If lifting long sections, use two or three pickup points. Minor scratches and chipping are allowed and do not affect performance. More than 0.04 inch of chipping should be repaired or replaced. When more than 2 percent of the surface area of the bar is excessively chipped or cracked it must be replaced.

3. **Storage of BFRP Reinforcement.** Store reinforcement above the surface of the ground on platforms, skids, pallets, or other supports as close as possible to the point of placement. Cover the BFRP bars with a tarp or other protective cover if it is anticipated that the BFRP bars will be stored outdoors for more than two months. Protective cover must be at least opaque in color.

4. **Placing and Fastening.** Place all reinforcement within the tolerances recommended in the CRSI "Manual of Standard Practice" unless otherwise specified. Secure reinforcement firmly with mechanical fasteners during the placing and setting of the concrete. Suspend concrete placement and take corrective action if it is observed that the BFRP reinforcement is not adequately supported or tied to resist settlement, floating upward, or movement in any direction during concrete placement.

5. **Ties and Supports.** All accessories for use with the BFRP bars such as tie wires, bar chairs, supports or clips can be either plastic coated steel or plastic. Place all reinforcement in locations as shown on the plans and securely hold in position while placing and consolidating concrete. Fasten bars together with ties at all intersections for both top and bottom mats. Do not use pebbles, pieces of broken glass, stone or brick, metal pipe or wooden blocks as bar supports or to separate layers of bars.

6. **Lap Splices.** Lap splice is the only approved method to tie bars together to make a continuous bar. Mechanical splices are prohibited. Lap length and spacing must be as specified on the plans. Provide the same cover clearances for splices that is shown or specified for the reinforcement.

e. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract price using the following pay item:

Pay Item

Pay Unit

Curb and Gutter, Conc with Basalt Fiber Reinforced Polymer, Detail __, ModifiedFoot

Curb and Gutter, Conc with Basalt Fiber Reinforced Polymer, Detail __, Modified includes the provision of documentation certifications and quality assurance samples for submittal. Delays caused by the review and resubmittal process, or due to replacement of defective or damaged BFRP reinforcement, will not be paid for, and no extension of time will be given.