FIBERMESH® 650

PRODUCT DATA SHEET

FIBERMESH® 650 SYNTHETIC FIBER

Fibermesh 650 is an engineered high tensile, graded macro-synthetic fiber used for secondary reinforcement for concrete - an alloy polymer macro-synthetic fiber featuring e3® patented* technology manufactured to an optimum gradation and highly oriented to allow greater surface area contact within the concrete resulting in increased interfacial bonding and flexural toughness efficiency. Fibermesh 650 is specifically engineered and manufactured in an ISO 9001:2000 certified facility for use as concrete secondary reinforcement at a minimum addition rate of 3.0 lbs per cubic yard (1.8 kg per cubic meter). Complies with ASTM C 1116 Type III 4.1.3.
* Covered by US Patent numbers: 5628822, 5456752

ADVANTAGES

Requires no minimum amount of concrete cover • Is always uniformly positioned in the concrete and in compliance with codes • Safe and easier to use than traditional reinforcement • Saves time and hassle

FEATURES & BENEFITS

- High tensile, graded macro-synthetic fiber for concrete secondary reinforcement used as an alternate to traditional steel
- Inhibits the formation of plastic shrinkage and plastic settlement cracking
- Provides impact, abrasion and shatter resistance
- Greater surface area provides increased flexural toughness (residual strength)
- Provides improved durability
- Control of drying shrinkage and temperature cracking
- Good finishing characteristics
- Pumpable reinforcement

PRIMARY APPLICATIONS

- Slabs-on-ground
- Sidewalks/Driveways
- Parking areas
- Overlays & toppings
- Exterior pavements
- Non-magnetic applications
- Shotcrete
- Composite metal decks

DO SPECIFY FIBERMESH 650 FIBERS:

- Reduced plastic shrinkage cracking
- Alternate to traditional steel for temperature/shrinkage reinforcement
- Improved impact, shatter and abrasion resistance
- Increased levels of residual strength/flexural toughness
- Improved durability

DO NOT SPECIFY FIBERMESH 650 FIBERS:

- Decreasing the thickness of slabs
- Replacing structural levels of steel reinforcement

CHEMICAL AND PHYSICAL PROPERTIES

Absorption	Nil	Acid & Salt Resistance	High
Specific Gravity	0.91	Tensile Strength	89,000 psi
Fiber Length	Graded	Aspect Ratio	96.5
Electrical Conductivity	Low		
Melt Point	324 F (162 C)		

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CONCRETE SYSTEMS

FIBERMESH® 650

PRODUCT USE

MIXING DESIGNS AND PROCEDURES: Fibermesh 650 reinforcing is a mechanical, not a chemical process. Due to fiber efficiency, minor mix design modifications may be required depending on the application. Consult your Propex Concrete Systems representative for recommendations. Fibermesh 650 macro-synthetic fiber is added to the mixer before, during or after batching the other concrete materials. Mixing time of at least 5 minutes at mixing speed is required as specified in ASTM C 94.

FINISHING: Fibermesh 650 reinforced concrete can be finished with normal finishing techniques in accordance with ACI 304, Section C.3.

APPLICATION RATE: The minimum application rate for Fibermesh 650 macro-synthetic fiber is 3.0 lbs per cubic yard (1.8 kg per cubic meter) of concrete. For Shotcrete or specialty concrete performance consult your Propex Concrete Systems representative for specific dosage recommendations.

GUIDELINES

Fibermesh 650 macro-synthetic fibers should not be used to replace structural reinforcement. Fibermesh 650 fibers should not be used as a means of using thinner concrete sections than original design. For joint spacing, follow industry standard guidelines suggested by PCA and ACI.

COMPATIBILITY

Fibermesh 650 is compatible with all commonly used concrete admixtures and performance enhancing chemicals.

PACKAGING

Fibermesh 650 macro-synthetic fibers are available in 1.5 lb and 3 lb degradable bags. Bags are packed into cartons, shrink wrapped and palletized for protection during shipping.

TECHNICAL SERVICES

Trained Propex Concrete Systems specialists are available worldwide to assist and advise in specifications and field service. Propex Concrete Systems representatives do not engage in the practice of engineering or supervision of projects and are available solely for service and support of our customers.

REFERENCES

- ASTM C 94 Standard Specification for Ready-Mixed Concrete Uniformity Requirements.
- ASTM C 1399 Average Residual Strength of Fiber Reinforced Concrete.
- ASTM C 1436 Standard Specification for Materials for Shotcrete.
- ASTM C 1609/C 1609M Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading). Replaces ASTM C 1018.
- ASTM C 1116 Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
- ASTM C 1550 Standard Test Method for Flexural Toughness of Fiber Reinforced Concrete (Using Centrally Loaded Round Panel).
- JCI-SF4 Method of Test for Flexural Strength and Flexural Toughness of Fiber Reinforced Concrete.
- ACI 304 Guide for Measuring, Mixing, Transporting and Placing Concrete.
- ACI 506 Guide for Shotcrete.

SPECIFICATION CLAUSE

Fibermesh 650 high tensile, graded macro-synthetic fiber will be used for shrinkage and temperature reinforcement. Fibermesh 650 with e3 patented technology shall be specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. All fibrous concrete shall conform to ASTM C 1116 and produce an Average Residual Strength of 150 psi in accordance with ASTM C 1399 Test Method for Determining Average Residual Strength of Fiber Reinforced Concrete. Application rate shall be a minimum of 3.0 lbs per cubic yard (1.8 kg per cubic meter) of concrete. Fiber manufacturer must document evidence of satisfactory performance history and compliance with ASTM C 1116 Type III, 4.1.3. Fibrous concrete reinforcement shall be manufactured by Propex Concrete Systems, 6025 Lee Highway, Ste 425, PO Box 22788, Chattanooga, TN, USA, 37422. Phone: (423) 892-8080, Fax: (423) 892-0157, e-mail: Fibermesh@propexinc.com.

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CS-520

07/06

ANSI/SDI-C1.0 Standard for
COMPOSITE STEEL FLOOR DECK

Steel Deck Institute

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Attachment C5 of this specification or the SDI *Composite Deck Design Handbook*.

5. Suspended Loads: All suspended loads must be included in the analysis and calculations for strength and deflection.

   Commentary: The designer must take into account the sequence of loading. Suspended loads may include ceilings, light fixtures, ducts or other utilities. The designer must be informed of any loads applied after the composite slab has been installed.

   Care should be used during the placement of loads on all types of hanger tabs or other hanging devices for the support of ceilings so that an approximate uniform loading is maintained. The individual manufacturer should be consulted for allowable loading on single hanger tabs. Improper use of hanger tabs or other hanging devices could result in the overstressing of tabs and/or the overloading of the composite deck slab.

6. Reinforcement:
   a. Temperature and shrinkage reinforcement, consisting of welded wire fabric or reinforcing bars, shall have a minimum area of 0.00075 times the area of the concrete above the deck (per foot or meter of width), but shall not be less that the area provided by 6 x 6 – W1.4 x W1.4 welded wire fabric.

      Fibers shall be permitted as a suitable alternative to the welded wire fabric specified for temperature and shrinkage reinforcement. Cold-drawn steel fibers meeting the criteria of ASTM A820, at a minimum addition rate of 25 lb/cu yd (14.8 kg/cu meter), or macro synthetic fibers "Coarse fibers" (per ASTM Subcommittee C09.42), made from virgin polyolefin, shall have an equivalent diameter between 0.4 mm (0.016 in.) and 1.25 mm (0.05 in.), having a minimum aspect ratio (length/equivalent diameter) of 50, at a minimum addition rate of 4 lb./cu yd (2.4 kg/m^3 are suitable to be used as minimum temperature and shrinkage reinforcement.

      Commentary: Neither welded wire fabric or fibers will prevent cracking, however they have

been shown to do a good job of crack control. The welded wire fabric must be placed near the top of the slab [3/4 to 1 inch cover (20 to 25mm)] at supports and draped toward the center of the deck span. If a welded wire fabric is used with a steel area given by the above formula, it will not be sufficient as the total negative reinforcement. If the minimum quantity of steel fibers, or macro synthetic fibers are used for shrinkage and temperature reinforcement, they will not be sufficient as a total negative reinforcement.

b. Negative: When negative moment exists, the deck shall designed to act only as a permanent form.

Commentary: Composite steel deck does not function as compression reinforcing steel in areas of negative moment. If the designer wants a continuous slab, then negative bending reinforcing should be designed using conventional reinforced concrete design techniques in compliance with the ACI *Building Code Requirements for Reinforced Concrete*. The welded wire fabric, chosen for temperature reinforcing, may not supply enough area for continuity. The deck is not considered to be compression reinforcement. Typically negative reinforcement is required at all cantilevered slabs, or if a continuous slab is desired.

c. Distribution: When localized loads exceed the published uniform composite deck load tables, the designer shall proportion distribution reinforcement using conventional concrete design methods.

Commentary: Distribution steel may be required in addition to the welded wire fabric or steel fibers. Concentrated loads, either during construction or in-service, are the most common example of this requirement. Concentrated loads may be analyzed by the methods in the latest SDI *Composite Deck Design Handbook*.

7. Cantilever Loads: When cantilevered slabs are encountered, the deck acts only as a permanent form; top reinforcing steel shall be proportioned by the designer. For construction loads, the deck shall be designed for the more severe of (a) deck plus slab weight plus 20 psf (1 kPa) construction load on both cantilever

(Project #10-Redone)

ASTM C1399 Tests on Concrete Reinforced with Fibermesh 650 Fiber at 4lb/yd^3

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Abstract

Flexural toughness tests (ASTM C1399) were performed on concrete reinforced with the Fibermesh 650 fiber produced by Propex Corporation. The Fibermesh 650 fiber is straight, undeformed fiber 38.1 mm in length. A fiber dosage rate of 4 lb/yd^3 was investigated. Five specimens were tested which yielded an Average Residual Strength (ARS) value for the FRC of 1.24 MPa.

Experimental Program and Results

Toughness Tests:

The mix proportions of the concrete used are given in Table 1. The fibers investigated are shown in Figure 1. Five beams (100 mm x 100 mm x 350 mm) were cast in Plexiglas moulds at a fiber dosage rate of 4lb/yd^3. The specimens were demolded 24 h later and cured in lime-saturated water until an approx. compressive strength of 35 MPa was obtained.

Table 1. Concrete Matrix Mix Proportions

Materials	kg/m^3
CSA Type 10 (ASTM Type I) Portland cement	400
Sand	560
Gravel 3/8"	1110
Water	180
W/C	0.45

Figure 1. The Fibermesh 650 Fiber

Beams (100 mm x 100 mm x 350 mm) were tested for flexural toughness as per ASTM C1399 [1, 2]. In this technique the specimen is loaded in two stages as described below.

In the first stage, beams are pre-cracked under third-point flexural loading as in the ASTM C 78 method, but in series with a 12 mm thick steel plate (Figure 2). The steel plate provides the support and absorbs the energy that is released from the machine at the occurrence of the peak load when the compliance of the specimen changes suddenly. After cracking the beam is unloaded and the steel plate is removed. The beam is then reloaded in four-point bending to obtain the residual load-deflection curve. The loads supported by this beam at 0.5, 0.75, 1.0, and 1.25 mm are averaged and normalized to obtain residual strength (*RS*) values by using an elastic analysis. In other words [1,2],

$$RS = \frac{L}{bd^2}\left[\frac{P_{0.5} + P_{0.75} + P_{1.0} + P_{1.25}}{4}\right] \quad (1)$$

where $P_{0.5}$, $P_{0.75}$, $P_{1.0}$, $P_{1.25}$ correspond to the load values at 0.5, 0.75, 1.0, and 1.25 mm beam deflection, respectively, L is the test span, b is width of the beam, and d is depth of the beam. Notice that the residual strength, *RS*, is the resulting stress and has the units of MPa. *RS* values from multiple specimens are averaged to obtain and *Average Residual Strength* (*ARS*) value.

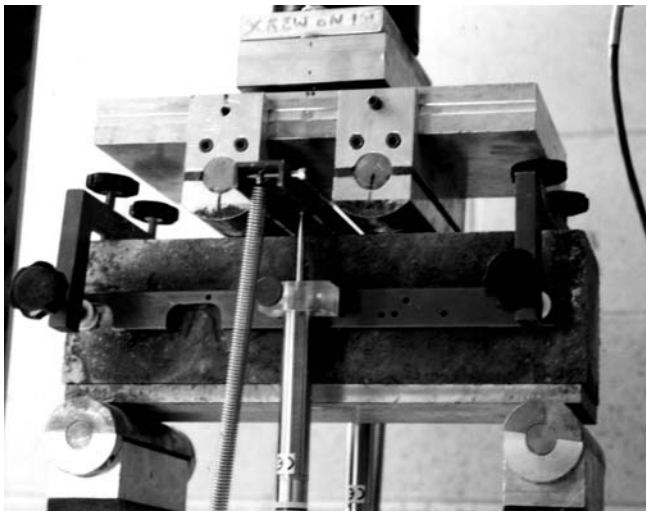

Figure 2. A Fiber-Reinforced Concrete Beam in Series with a Steel Plate as per ASTM C 1399

Results

The flexural toughness curves are given in Figure 3. The averaged load-deflection curve was analyzed as per the ASTM C1399 procedure (Eqn. 1) and an Average Residual Strength (*ARS*) value of 1.24 MPa was obtained.

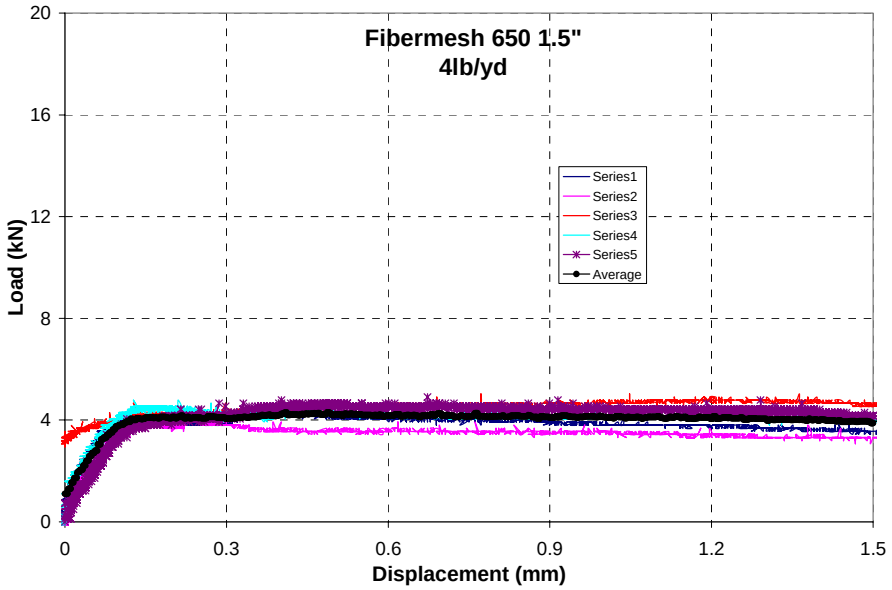

Figure 3. Average ASTM C1399 Curves for Fibermesh 650 Fiber at 4 lb/yd[3]

Conclusions

Flexural toughness tests (ASTM C1399) performed on concrete reinforced with 4 lb/yd^3 of Fibermesh 650 fiber yielded an Average Residual Strength (ARS) of 1.24 MPa.

References

1. ASTM C-1399, "Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete", 2003 Annual Book of ASTM Standards, V. 04.02, American Society of Testing and Materials, Philadelphia, pp. 1-5.
2. BANTHIA, N. and DUBEY, A., Measurement of Flexural Toughness of Fiber Reinforced Concrete using a Novel Technique, Part 1: Assessment and Calibration, ACI Materials Journal, 96(6), Nov-December 1999, pp. 651-656, and Part 2: Performance of Various Composites, ACI Materials Journal, 97(1), January-February 2000, pp. 3-11

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CBXQ.R14701
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Fiber Reinforcement

See General Information for Fiber Reinforcement

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Type Novocon XR Steel Fibers for use as an alternate or in addition to the welded wire fabric used in Floor-Ceiling D700, D800, D900 Series Designs. Fibers may also be used in Design Nos. G256, G514. Fibers added to concrete mix at a rate of 10 to 50 lb of fiber for each cu yard of concrete.

Type Fibermesh 300 fiber. For use as an alternate or in addition to the welded wire fabric used in Floor-Ceiling D700, D800, D900 Series Designs. Fiber may also be used in Floor-Ceiling Design Nos. G229, G243, G256, G514. Fibers added to concrete mix at a rate of 1.5 lb of fiber for each cu yard of concrete.

Type Fibermesh 150. For use as an alternate or in addition to the welded wire fabric used in Floor-Ceiling D700, D800, D900 Series Designs. Fibers may also be used in Floor-Ceiling Design Nos. G229, G243, G256, G514. Fiber added to concrete mix at a rate of 1.0 lb of fiber for each cu yard of concrete.

Type Novomesh 850. For use as an alternate or in addition to the welded wire fabric used in Floor-Ceiling D700, D800, D900 Series Designs . Fibers may also be used in Floor-Ceiling Design Nos. G256, G514. Fiber added to concrete mix at a rate of one 24 lb bag of fiber for each cu yard of concrete.

Type Novocon Steel Fibers for use as an alternate or in addition to the welded wire fabric used in Floor-Ceiling D700, D800, D900 Series Designs. Fibers may also be used in Design Nos. G256, G514. Fibers added to concrete mix at a rate of 10 to 50 lb of fiber for each cu yard of concrete.

Type Fibermesh 650. For use as an alternate or in addition to the welded wire fabric used in Floor-Ceiling D700, D800, D900 Series Designs. Use shall be limited to assemblies having 1, 1-1/2, 2, 2-1/2 and 3-hour fire resistance rating. Fiber added to concrete mix at a maximum rate of 5.0 lb of fiber for each cu yard of concrete.

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