

GRACE FIBERS™ Synthetic fiber for concrete

ASTM C1116, ASTM C94

Product Description

Grace Fibers™ are synthetic fibers for concrete, manufactured from 100% virgin polypropylene in collated, fibrillated form. Designed specifically for use in concrete, they are alkali resistant, non-absorptive and completely noncorrosive. Their use protects concrete from stresses which cause cracking while it is most vulnerable during the first 24 hours after placement. Grace Fibers comply with ASTM Designation C1116, *Standard Specification for Fiber-Reinforced Concrete and Shotcrete*, Type III Synthetic Fiber-Reinforced Concrete or Shotcrete. They are available in ¾ in. (19 mm) length.

Uses

Grace Fibers may be used in any application where decreased plastic shrinkage cracking and improved durability are desired. Specifically, such applications include but are not limited to, slabs on grade, pavements, overlays, sloped walls, pools, shotcrete, stucco, precast and prestressed products. It is suggested that this product be used in conjunction with properly compacted base

materials and jointing in accordance with ACI guidelines and standards.

Grace Fibers may be used as an alternative to welded wire fabric, depending on the application. Grace Fibers may not be used as a replacement for structural or post-crack control steel reinforcement. For temperature or shrinkage post-crack control, please consult a Grace representative regarding our STRUX® synthetic macro fibers.

Advantages

Grace Fibers uniformly distribute multi-dimensionally throughout the concrete mixture. The small fibrillated fibers mechanically lock in the fresh concrete matrix providing reinforcement for the mixture while its tensile strength is the weakest. This reinforcement reduces the formation of plastic shrinkage cracking that may otherwise permanently weaken the resulting concrete. The concrete permeability is decreased, while the surface characteristics, impact and toughness properties are improved. Together these effects work synergistically to produce a long-term better quality, more durable and serviceable concrete.

Product Advantages

- Reduces plastic shrinkage cracking and improves durability
- Protects concrete from stresses that cause cracking
- Provides cost effective control of plastic shrinkage
- Provides overall higher quality of concrete



Typical Properties

Specific gravity	0.91
Absorption	None
Modulus of elasticity	500 ksi
Melt point	320°F (160°C)
Ignition point	1094°F (590°C)
Alkali, acid and salt resistance	High

Addition Rates

Grace Fibers may be added to concrete at any point during the batching or mixing process. Grace Fibers may be added to the aggregate during weighing or charging, or to the central mixer or truck before, during, or after charging. The load must be mixed at high speed for 5 minutes, or 70 revolutions, after the addition of the Grace Fibers to ensure uniform distribution. The standard range of addition for Grace Fibers is ¼ to 3 lbs/yd³ (450 to 1800 g/m³) of concrete. Typically, 1½ lbs/yd³ (900 g/m³) of Grace Fibers provides excellent results. Higher addition rates may be used to produce concrete when special properties are required.

Compatibility with Other Admixtures

Grace Fibers are compatible with all Grace admixtures. Their action in concrete is purely mechanical and will not affect the hydration process. Each admixture should be added separately.

Packaging & Handling

Grace Fibers are available in convenient Concrete-Ready™ Bags which are added, unopened, to the truck drum or central mixer. The specially designed cellulose fiber bag disintegrates and disperses its contents of Grace Fibers, throughout the mix.

Specifications

Fibers shall be ¾ in. (19 mm) collated, fibrillated polypropylene fibers as supplied by Grace Construction Products, Cambridge, MA 02140. Required dosage rate shall be as specified by the design engineer or architect. Grace Fibers shall be used in strict accordance with the supplier's recommendations and within time as specified in ASTM C94. The fibers shall comply with ASTM Designation C1116 Type III 4.1.3 and with applicable building codes. Certification of compliance shall be made available on request. Standard ACI 302 procedures for placing, finishing and curing shall be followed when using Grace Fibers.

References

Building Codes—
BOCA National Building Codes, SBCCI Standard Building Code, ICBO Uniform Building Code and all supplements as adopted by the Council of American Building Officials

Fire Classifications—
Underwriters Laboratories (UL) on Series D700 and D800 metal deck assemblies

American Concrete Institute (ACI)—
ACI 544 State of the Art Report of Fiber-Reinforced Concrete

ACI 302 Guide for Concrete Floor and Slab Construction

American Society of Testing and Materials (ASTM)—

ASTM C1116 Standard Specification for Fiber-Reinforced Concrete and Shotcrete

ASTM C1579 Standard Test Method for Evaluating Plastic Shrinkage Cracking of Restrained Fiber Reinforced Concrete (Using a Steel Form Insert)

ASTM C94 Standard Specification for Ready-Mixed Concrete

www.graceconstruction.com

North American Customer Service: 1-877-4AD-MIX1 (1-877-423-6491)

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This product may be covered by patents or patents pending.
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STRUX® 90/40

Synthetic macro fiber reinforcement

ASTM C1116

Product Description

STRUX® 90/40 synthetic macro fiber reinforcement is a unique form of high strength, high modulus synthetic macro reinforcement that is evenly distributed throughout the concrete matrix. STRUX 90/40 adds toughness, impact and fatigue resistance to concrete. Unlike traditional microfiber reinforcement, STRUX 90/40 is specifically engineered to provide high, post-crack control performance. Reinforced concrete with STRUX 90/40 has been shown to reliably achieve average residual strength values in excess of 150 psi (1.0 MPa) at dosages that can easily be batched and finished. It consists of synthetic macro fibers 1.55 in. (40 mm) in length with an aspect ratio of 90 that have specifically been designed to replace welded wire fabric, steel fibers, light rebar and other secondary reinforcement in slab-on-ground flooring, thin-walled precast applications and composite steel floor deck. STRUX 90/40 is a user-friendly fiber reinforcement which is easier and safer to use, compared to these other types of reinforcement.

Uses

Slab-on-Ground

STRUX 90/40 is specially designed for ease of use, rapid dispersion, good finishability and improved pumpability in slab-on-ground flooring

Product Advantages

- Savings from lower labor costs and fewer construction days
- Enhances safety by eliminating handling of steel fibers, welded wire fabrics or light rebar
- Eliminates concerns of proper positioning of reinforcement
- Provides superior crack control due to the geometry and elastic modulus
- Abrasion resistance and will not corrode
- Controls plastic and drying shrinkage cracks

and many precast applications. STRUX 90/40 may be used in commercial floors, industrial floors, residential floors, other flat work applications and form work applications. The addition rate of STRUX 90/40 can be easily calculated using Grace's SDS Software, using several factors such as compressive strength of concrete, modulus of sub-grade reaction, thickness of concrete and applied load. Please consult your Grace sales representative for proper addition rate of STRUX 90/40 for your application. Always consult local building codes (refer to Engineering Bulletin 1).

Composite Steel Floor Deck for Normal and Lightweight Concrete

STRUX 90/40 can be used as a suitable alternative to WWF specified for temperature and shrinkage reinforcement for composite steel floor decks. STRUX 90/40 complies with *American National Standards Institute/Steel Deck Institute* (ANSI/SDI C-1.0) design code provision for minimum reinforcing at minimum addition rate of 4 lbs/yd³ (2.4 kg/m³). STRUX 90/40 is UL (U.S.) and ULC (Canada) classified with fire ratings up to 2 hours for D700, F700, D800, F800, D900 and F900 except 909 at a maximum addition rate of 5 lbs/yd³ (3.0 kg/m³).

Addition Rates

STRUX 90/40 addition rates are dependent on the specific application and desired properties and will vary between 3.0 to 12.0 lbs/yd³ (1.8 to 7.0 kg/m³).

Mix Design

The utilization of STRUX 90/40 may require the use of a superplasticizer such as ADVA® to restore the required workability. In addition, slight increases in fine aggregate contents may be needed. STRUX 90/40 may be added to concrete at any point during the batching or mixing process. After fiber addition, the concrete must be mixed at the minimum of 70 revolutions to ensure adequate dispersion.

Please contact your Grace representative with any questions. For more detailed instructions refer to Technical Bulletin TB-1200.



STRUX® 90/40 fiber as marketed by W. R. Grace & Co.-Conn. is classified by Underwriters Laboratories Inc. for use as an alternative, or in addition to, the welded wire fabric in 1, 1½ and 2 hr floor-ceiling D700, F700, D800, F800, D900 and F900 (except 909) Series Designs. Fibers to be added to the concrete mix at maximum addition rate of 5 lbs/yd³ (3.0 kg/m³).

Compatibility with Other Admixtures and Batch Sequencing

STRUX 90/40 is compatible with all Grace admixtures. Their action in concrete is mechanical and will not affect the hydration process of the cement or compressive strength. Each liquid admixture should be added separately to the concrete mix.

Packaging

STRUX 90/40 is available in 1.0 lb or 5.0 lb (.5 kg or 2.3 kg) Concrete-Ready™ bags.

STRUX 90/40 Properties

Specific gravity	0.92
Absorption	None
Modulus of elasticity	1,378 ksi (9.5 GPa)
Tensile strength	90 ksi (620 MPa)
Melting point	320°F (160°C)
Ignition point	1,094°F (590°C)
Alkali, acid & salt resistance	High

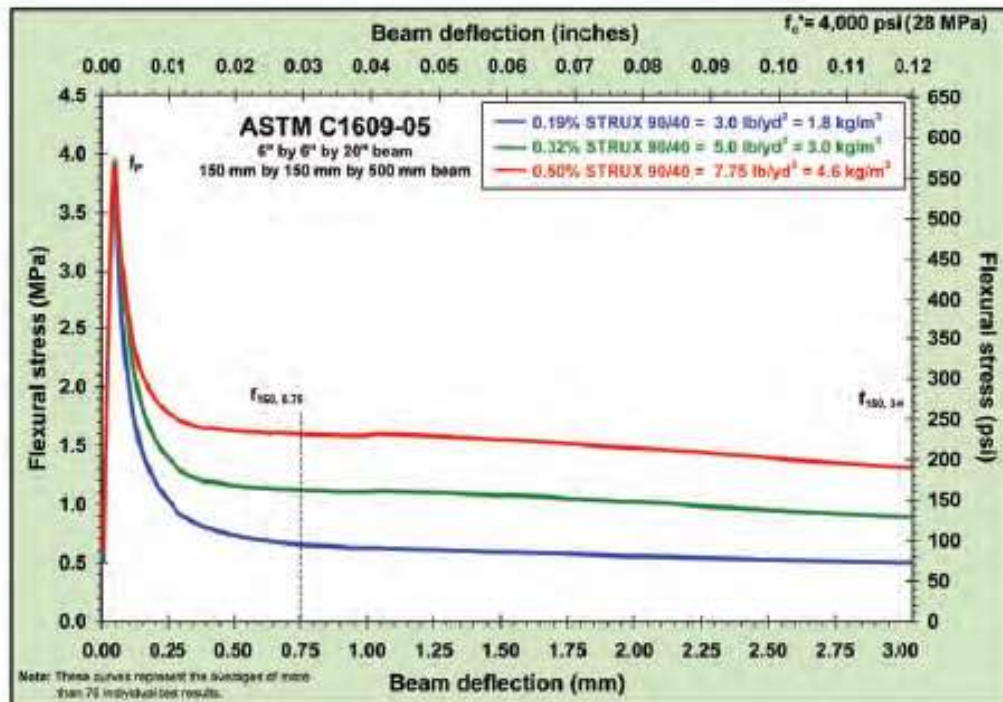
Flexural Strength and Toughness (Compressive Strength: 4,000 psi) according to ASTM C1609-05

STRUX 90/40 Dosage Rate	Specimen cross-section		Peak Load P_r (lbf)	Peak Strength f_r (psi)	Peak-load deflection Δ_p (in.)	Residual loads		Residual strengths		Toughness T_{res} (lbf-in.)	JCI-SF4 ¹ f_{res} (psi)	TR34 ² R_{res} (%)
	Width (in.)	Depth (in.)				$P_{res,0.75}$ (lbf)	$P_{res,3.0}$ (lbf)	$f_{res,0.75}$ (psi)	$f_{res,3.0}$ (psi)			
0.19% (3.0 lba/yd ³)	6.00	5.95	6,702	595	0.0079	1,299	952	110	80	160	115	20.0%
0.32% (5.0 lba/yd ³)	6.00	6.00	7,064	595	0.0020	1,905	1,558	160	130	240	165	28.5%
0.50% (7.75 lba/yd ³)	6.00	5.95	6,860	580	0.0020	2,770	2,251	230	190	330	230	40.5%

Flexural Strength and Toughness (Compressive Strength: 28 MPa) according to ASTM C1609-05

STRUX 90/40 Dosage Rate	Specimen cross-section		Peak Load P_r (N)	Peak Strength f_r (MPa)	Peak-load deflection Δ_p (mm)	Residual loads		Residual strengths		Toughness T_{res} (Joule)	JCI-SF4 ¹ f_{res} (MPa)	TR34 ² R_{res} (%)
	Width (mm)	Depth (mm)				$P_{res,0.75}$ (N)	$P_{res,3.0}$ (N)	$f_{res,0.75}$ (MPa)	$f_{res,3.0}$ (MPa)			
0.19% (1.8 kg/m ³)	152	151	29,813	3.90	0.048	5,776	4,236	0.75	0.55	18	0.80	20.0%
0.32% (3.0 kg/m ³)	152	152	31,422	4.10	0.050	8,472	6,932	1.10	0.90	27	1.15	28.5%
0.50% (4.6 kg/m ³)	152	151	30,513	4.00	0.050	12,323	10,012	1.80	1.30	37	1.60	40.5%

1) Japan Concrete Institute (JCI) Standard Test Method for Flexural Strength and Flexural Toughness of Fiber Reinforced Concrete, (Standard SF-4), JCI Standard for Test Methods of Fiber Reinforced Concrete, Japan Concrete Institute, 1993. 2) The Concrete Society Technical Report 34 Concrete industrial ground floors—A guide to their design and construction, The Society, Crawfords, 2003.



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STRUX and ADVA are registered trademarks and Concrete-Ready is a trademark of W. R. Grace & Co.—Conn.

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This product is covered by U.S. Patent Nos.: 6,569,525; 6,569,526; 6,758,897; 6,883,969.
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