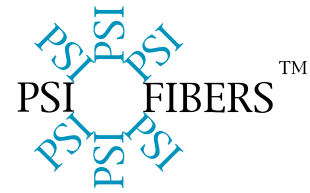


MaxTen™ 150



High Performance Synthetic Fibers A Replacement For Steel Reinforcement In Slab-on-Grade Applications

The use of MaxTen™ Synthetic Structural Fiber Reinforcement as a replacement for Welded Wire Fabric and Light Rebar in Slab-on-Grade (SOG) applications is increasing rapidly throughout the Construction Industry.

MaxTen™ Synthetic Fibers are specifically engineered and manufactured to be used for the reduction of plastic shrinkage cracking, to improve impact, shatter and abrasion resistance, to increase fatigue resistance, to increase toughness and provide long term durability for any concrete project. In addition, they are safe and easy to use. MaxTen™ Synthetic Fibers save construction time and money by eliminating the purchase, storage, handling, cutting, placing and waste associated with welded wire fabric. They are chemically inert, non-magnetic and will not rust, rot or corrode.

The information presented in this document has been provided to determine the minimum volume of synthetic fiber reinforcement required to replace the welded wire fabric and light rebar typically used in Slab-on-Grade applications.

The design criteria used to determine the minimum volume of fibers needed to replace the steel reinforcement requires both the steel and the fiber reinforced concrete (FRC) sections have the same performance characteristics and post-cracking strength. Post-cracking strength or toughness is defined as the ability of the FRC to provide additional load carrying capacity after the concrete cracks. The ultimate post-cracking strength of the PSI MaxTen™ reinforced concrete sections were determined by utilizing ASTM C 1399, ASTM C 1018 and the JSCE, SF-4 test methods

Table 1

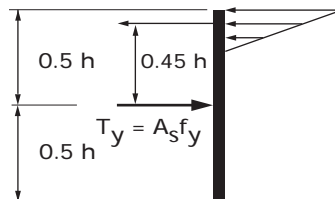
Equivalent Flexural Strength, f'_{eq} , for Different Dosage Rates and Concrete Strengths					
MaxTen 150	Compressive Strength (MPa)				
kg/m ³	20	25	30	35	40
1.8	0.68	0.77	0.85	0.93	1.02
2.0	0.74	0.82	0.90	0.99	1.07
2.5	0.87	0.96	1.04	1.12	1.21
3.0	1.01	1.09	1.17	1.26	1.34
3.5	1.14	1.23	1.31	1.39	1.48
4.0	1.28	1.36	1.44	1.53	1.61
4.5	1.41	1.50	1.58	1.66	1.75
5.0	1.55	1.63	1.71	1.80	1.88
5.5	1.68	1.77	1.85	1.93	2.02

Based on extensive independent testing, engineering analysis and calculations, a conversion table was developed to determine the performance of Synthetic Fibers as a replacement for welded wire fabric and light rebar while maintaining the same ultimate post-cracking performance.

Table 1 shows the equivalent flexural strength of MaxTen™ 150 reinforced concrete at different fiber dosages and different concrete compressive strengths.

Utilizing the strain-compatibility method, the Ultimate Post-Cracking Flexural Capacity of the concrete with welded wire fabric located at Mid-Depth, M_u , is calculated as follows:

$$M_u = A_s f_y (0.45bh)$$

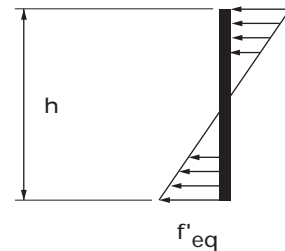


Where:

- A_s = Area of steel per unit length
- f_y = yield stress of steel
- b = unit width
- h = thickness of section

The Ultimate Post-Cracking Flexural Capacity, M_u , of the Fiber Reinforced Concrete is calculated as follows:

$$M_u = f'_{eq} \frac{bh^2}{6}$$



Where:

- f'_{eq} = The Equivalent Ultimate Flexural Capacity of the Fiber Reinforced Concrete when tested as per ASTM C 1018-98
- b = unit length
- h = thickness of section

To replace the steel reinforcement with fibers, the fibers must be added such that the moment capacities for the steel reinforced and fiber reinforced concrete are equal as follows:

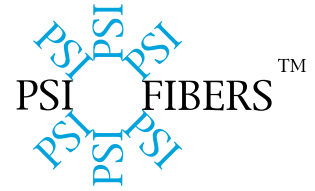
$$M_u = A_s f_y (0.45bh) = f'_{eq} \frac{bh^2}{6}$$

Some examples with calculations and recommended dosage rates are included on the next page.

Example 1

Given Information:

Concrete Strength	= 25 MPa (3,625 psi)
Slab Thickness	= 152 mm (6 in)
Wire Mesh	= W 2 @ 150 mm x 150 mm (W 2 @ 6 in x 6 in)
Area of Steel, A_s	= 84.7 mm ² /m (0.040 in ² /ft)
Yield Stress of Steel, f_y	= 400 MPa (58,000 psi)



What is the Required Fiber Dosage Rate To Match This Size Welded Wire Mesh?

The Ultimate Post-Cracking Flexural Capacity of the Steel Reinforced Concrete, M_U , is Calculated as Follows:

$$M_U = A_s f_y (0.45bh) = 84.7 \times 400 \times 0.45 \times 1 \times 152 = 2,317,392 \text{ N} \cdot \text{mm}$$

$$M_U = 2.32 \text{ kN} \cdot \text{m}$$

The Ultimate Post-Cracking Flexural Capacity of the Fiber Reinforced Concrete, M_U , is Calculated as Follows:

$$M_U = f'_{eq} \frac{bh^2}{6}$$

$$f'_{eq} = 6 \times 2.32 \times 10^6 / (1,000 \times 152^2)$$

$$f'_{eq} = .60 \text{ MPa} = 87 \text{ psi}$$

For a concrete compressive strength of 25 MPa (3,625 psi), the equivalent flexural strength can be achieved by adding 2.0 kg/m² (3.4 lbs/yd²) of MaxTen 150 as interpolated from Table 1. This dosage rate is also presented in the Slab-on-Grade Floor Construction Conversion Table.

Example 2

Given Information:

Concrete Strength	= 30 MPa (4,350 psi)
Slab Thickness	= 152 mm (6 in)
Light Reinforcing Bar	= #3 (10M) @ 450 mm x 450 mm (#3 @ 18 in x 18 in)
Area of Steel, A_s	= 157 mm ² /m (0.074 in ² /ft)
Yield Stress of Steel, f_y	= 400 MPa (58,000 psi)

What is the Required Fiber Dosage Rate To Match This Size Light Reinforcing Bar?

The Ultimate Post-Cracking Flexural Capacity of the Steel Reinforced Concrete, M_U , is Calculated as Follows:

$$M_U = A_s f_y (0.45bh) = 157 \times 400 \times 0.45 \times 1 \times 152 = 4,295,520 \text{ N} \cdot \text{mm}$$

$$M_U = 4.295 \text{ kN} \cdot \text{m}$$

The Ultimate Post-Cracking Flexural Capacity of the Fiber Reinforced Concrete, M_U , is Calculated as Follows:

$$M_U = f'_{eq} \frac{bh^2}{6}$$

$$f'_{eq} = 6 \times 4.295 \times 10^6 / (1,000 \times 152^2)$$

$$f'_{eq} = 1.12 \text{ MPa} = 162 \text{ psi}$$

For a concrete compressive strength of 30 MPa (4,350 psi), the equivalent flexural strength can be achieved by adding 2.8 kg/m² (4.7 lbs/yd²) of MaxTen 150 as interpolated from Table 1. This dosage rate is also presented in the Slab-on-Grade Floor Construction Conversion Table.

Minimum Fiber Dosage:

In a reinforced concrete section, a minimum amount of reinforcement is typically specified even if the strength calculation indicates that reinforcement is not required. In the above example 1, the strength calculation is .60 MPa (87 psi). Therefore, a minimum dosage rate of 2.0 kg/m² (3.4 lbs/yd²) of MaxTen™ Fiber has been recommended in the included conversion Table 1 to control crackin. This dosage rate is also presented in the Slab-on-Grade Floor Construction Conversion Table.