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# Fibre Reinforcement for Concrete

New Zealand Selection and  
Specification Guide for:



**FORTA FERRO**  
STRONG AS STEEL

**FORTA**<sup>®</sup>  
CONCRETE FIBER



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## Why Synthetic Fibre Reinforcement?

Synthetic fibre reinforcement includes Forta micro fibres and FORTA FERRO® macro fibres. Both systems employ 100,000's or millions of fibres per cubic metre of concrete to reinforce the concrete on a small scale. Each individual fibre works to intersect cracks in the concrete as they form. Synthetic fibre reinforcement helps to create concrete with the fewest cracks and better overall performance. In comparison, wire mesh reinforcement which is a large scale reinforcing method, can only hold cracks together once the concrete has cracked. Furthermore, if wire mesh is properly placed in the top section of the slab, then all the concrete around it is essentially unreinforced and if it cracks, it will crack until it meets the wire mesh. This cracking weakens the concrete, is unsightly and causes customer complaints.

Synthetic fibre systems are safe to use and handle and any fibres that happen to be at the surface of the concrete are soft and can't damage tyres or cut feet. They cannot rust or corrode, are easily placed and have the lowest labour and placement costs.

The choice of the fibre system that you use depends on the application, the expected loads, joint spacing, concrete strength, concrete thickness, etc.

Use a **FORTA micro fibre system** for plastic shrinkage crack control in concrete that would typically be unreinforced or reinforced with light gauge wire mesh (non-structural) but not required to be reinforced by NZ standards, such as foot paths, driveways, etc.

Use **FORTA FERRO® macro fibre reinforcement** for applications where much higher crack control strength is required such as heavy-duty floors, driveways, parking areas, etc. and/or where non-structural wire mesh is required by NZ standards (for example, slab on grade for house floors). In the latter case, a producer statement and engineering calculations for FORTA FERRO® are available.

## Which Fibre for my Application?

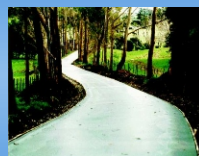
**FORTA MIGHTY-MONO®**: Paths, pavements, driveways, exposed aggregate, sprayed concrete, slab on ground (when used with steel reinforcement). A fine mixed length fibre providing the highest level of plastic shrinkage crack reduction and is virtually invisible in the finished concrete. Low level of post crack strength compared to other fibres.

**FORTA SUPER-NET®**: Paths, pavements, driveways, exposed aggregate, sprayed concrete, tanks, slab on ground (when used with steel reinforcement), thin concrete overlays, etc. A fibrillated mixed length fibre providing a higher level of post crack strength compared to FORTA MIGHTY-MONO® to hold cracks together should they form. Can be used in conjunction with steel reinforcing.

**FORTA ECONO-CAST®**: Precast concrete products. May be used as an alternative to non-structural steel reinforcement or in conjunction with steel.

**FORTA FERRO®**: A heavy-duty, high-performance blended macro fibre. Use for manufacturing facilities, commercial and industrial floors, residential slabs and driveways. Concrete overlays, parking areas and pavements. Precast applications. Provides the highest level of post crack strength – "strong as steel". FORTA FERRO® can be used as an alternative to steel fibres at approximately 1/10<sup>th</sup> the dosage by weight.

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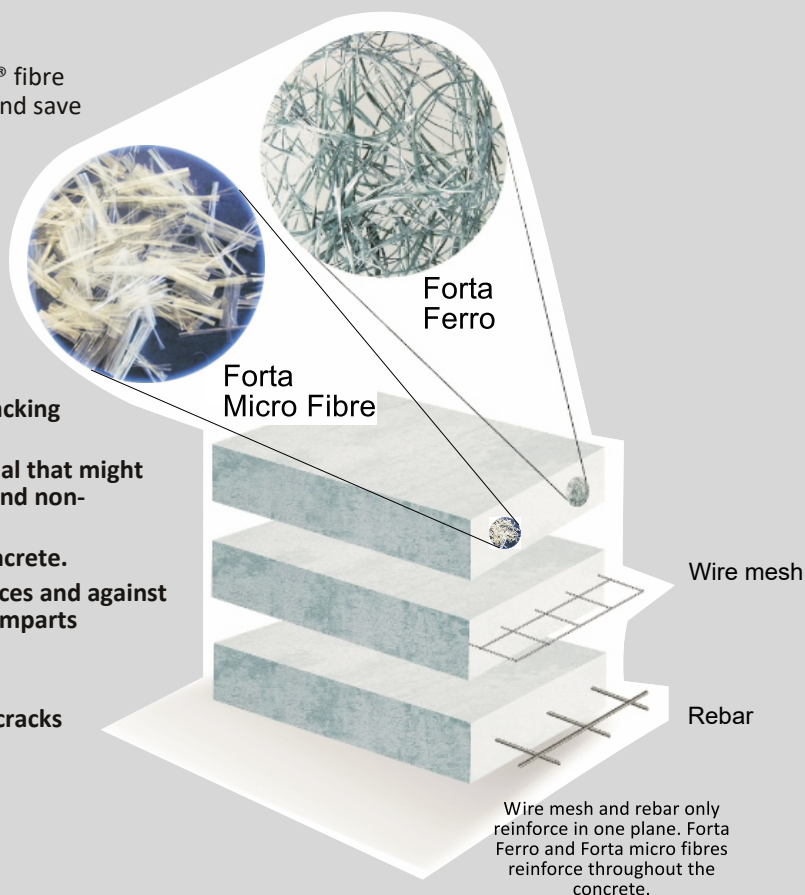
## What are the Features and Benefits?

The primary reasons to use FORTA micro fibres and FORTA FERRO® fibre reinforcement systems are to create better performing concrete and save time and money. The fibres are delivered with the concrete - no lection, storage or handling costs. Synthetic fibre reinforcement is handle, unlike steel wire mesh and steel fibres which can cause during placing.

These fibres are in every centimetre of your concrete. Compare mesh and rebar which are only in one area of the concrete - the concrete is unreinforced.

### **FORTA micro fibres:**

- Reduce plastic shrinkage and settlement cracking – stop cracking before it starts and therefore make good concrete better.
- Made from 100% virgin polypropylene – no recycled material that might breakdown in the alkali concrete environment. Rustproof and non-magnetic. Unaffected by the highly alkaline concrete.
- Inhibit and control the formation of intrinsic cracking in concrete.
- Reinforce against impact forces, the effect of shattering forces and against material loss from abrasion. Provide improved durability - Imparts toughness to hardened concrete.
- Easy to mix, pump, place and finish.
- Provide a low level of residual strength (the ability to hold cracks together)



## **FORTA FERRO® macro fibres:**

- Consists of a 100% virgin blended copolymer/polypropylene fibre system incorporating both a high strength macro fibre & micro fibre.
- High-performance concrete reinforcement system. Rustproof and non-magnetic. Unaffected by the highly alkaline concrete.
- Used to reduce plastic and hardened concrete shrinkage.
- Improves fatigue resistance, concrete toughness and impact strength.
- Easy to place and finish. No safety issues if fibres are exposed.
- Used as a replacement for common (non-structural) wire mesh reinforcement for slab on ground and precast applications.

## **Dosage - How much do I need?**

### **FORTA micro fibres**

1 bag of the chosen fibre per cubic metre of concrete (typical). Additional bags may be added for extra performance (particularly for concrete overlays).

### **FORTA FERRO® fibres**

FORTA FERRO fibre dosage varies by application and slab design requirements. As a guide, the following dosages are typical for the applications listed. In all cases, it is recommended that a fibre dosage calculation be conducted to account for all parameters of the intended application.

#### **Unreinforced concrete**

For light-duty applications where the concrete is typically unreinforced, use FORTA FERRO® at 2 kg/m<sup>3</sup> to provide plastic shrinkage crack control and post crack control. Increase FORTA FERRO® fibre dosage for additional performance and benefits.

#### **Slab on Ground (mesh located in top third of concrete slab)**

*Wire mesh equivalents – 668, 665 & 500E*

Refer to the chart below for typical dosages of FORTA FERRO® versus wire mesh.

Note that concrete strength requirements are not determined by the reinforcement method chosen. Concrete strength determines the maximum loading point at which the concrete will crack; the reinforcement method chosen will hold the cracked concrete together. Slab thickness and concrete strength must be suitable for the application. Only alter slab thickness or strength after a fibre engineering analysis of the proposed application has been completed and the fibre dosage calculated accommodates changes to the design.

# Reinforcement in every centimetre of your concrete

# FORTA®

CONCRETE FIBER

## **Mesh type (all 150mm centres) standard wire sizes**

	<b>668</b>	<b>665</b>	<b>500E</b>	<b>663</b>
	Typical application Residential driveway or parking area, footpaths, etc.	Typical application Heavy duty residential driveway, residential slab on grade (single storey) or light commercial.	Typical application Residential slab on grade (compliance with code)	Typical application Commercial or industrial warehouse or loading area (external)
<b>Slab Thickness</b>	<b>FORTA FERRO® dosage (kg per cubic metre of concrete)</b>			
100mm	2.5 kg/m <sup>3</sup>	3.0 kg/m <sup>3</sup>	3.5 kg/m <sup>3</sup>	4.5 kg/m <sup>3</sup>
125mm	2.0 kg/m <sup>3</sup>	2.5 kg/m <sup>3</sup>	3.0 kg/m <sup>3</sup>	3.5 kg/m <sup>3</sup>
150mm	2.0 kg/m <sup>3</sup>	2.0 kg/m <sup>3</sup>	2.5 kg/m <sup>3</sup>	3.0 kg/m <sup>3</sup>

### **Notes:**

Dosages are the minimum recommended based on calculations comparing wire mesh to FORTA FERRO® fibre dosage.

Joints are based on 4m spacing. Higher dosages will be required for extended joint spacing.

Fibre dosages should be increased where the slab will be subjected to higher loading than typical for the application.

Higher fibre dosages will provide greater fibre count therefore increased benefits and performance. For maximum performance, use 4.5 kg FORTA FERRO® per cubic metre of concrete.



# Saw Cuts - What do I need to do?

The timing of saw cut control joints and the depth of those joints are very important in any slab-on-ground project to minimize mid-panel cracking. If the timing is too late, the concrete will likely relieve shrink stresses at its convenience and at its weakest point by cracking. If the saw cut depth is not enough to create a sufficient plane of weakness within the joint, the shrinkage-related crack may not occur within the joint as planned. Best practice calls for cutting new slabs as soon as humanly possible, as long as the cuts do not ravel in the process. Ideally, panels should be roughly square with a ratio not exceeding 1: 1.5 unless a specific design has been provided.

**Depth:** FORTA micro fibres: Saw cut depth to be a minimum of 1/4 the slab thickness.

FORTA FERRO® fibres: Saw cut depth to be a minimum of 1/3 the slab thickness.

**Spacing:** Please refer to the Fibre Reinforcement Systems - Application and Fibre Selection Table below.

## Load Transfer

Maintaining sufficient load transfer from one slab panel to the next is very important in any concrete slab application, and naturally just as important in fibre projects. Even if conventional control joints are reduced dramatically by using high dosages of FORTA FERRO®, the remaining joints must preserve load transfer across the joint to prevent panel rocking and joint damage from traffic loads. High volumes of FORTA FERRO® fibre should not be considered as a replacement or alternative to adequate dowel or plate baskets for load transfer. Care should be taken that the load-transfer devices used will provide sufficient slab-to-slab loading capacity, without restricting lateral slab movement caused by shrinkage.

**Fibre Reinforcement Systems – Application and Fibre Selection Table**

Application	Wire Mesh	Features	FORTA Micro Fibres	FORTA FERRO®	Features and Benefits	Joint Spacing (based on dosage per m <sup>2</sup> )
Plain concrete	✓	Holds cracks together when the concrete cracks.	✓	✓	Reduces concrete permeability. Support and cohesiveness in the concrete on steep inclines.	Up to 30x concrete thickness. Typically, 3m between centres. FORTA FERRO® at low dosage up to 4m between centres.
Light duty concrete such as footpaths, patios, etc. No compliance requirements.	✓		✓	✓	Reduction of plastic and hardened concrete shrinkage cracking.	FORTA micro fibres 3 to 4m. FORTA FERRO® 4m for 2.5 kg and up to 6 m for 3.5 kg.
Light commercial applications (standard joint spacing)	✓		✓	✓	Improvement to concrete toughness and long-term durability. Improves impact and shatter resistance and enhances fatigue and residual strength.	FORTA micro fibres 3 to 4m. FORTA FERRO® 4m for 2.5 kg and up to 6m for 3.5 kg.
Light commercial applications (extended joint spacing)	✓	Cannot prevent concrete cracking.		✓	Considerable cost savings vs. conventional labour-intensive steel reinforcement.	FORTA FERRO® at 4.5 kg, 60 to 120 x concrete thickness.
Warehouse floors and single storey residential compliance requirements.	✓			✓	Non-corrosive and non-magnetic.	FORTA FERRO® at 3 to 4.5 kg, 60 to 120x concrete thickness.
Industrial applications (standard and extended joint spacing)	✓	Single-plane reinforcement: all concrete away from the wire mesh is unreinforced.		✓	Provides 3-Dimensional reinforcement coverage vs. one place reinforcement. Can be placed, cast, pumped or shot. Saves time vs. alternate reinforcing systems.	FORTA FERRO® at 4.5 kg up to 120x concrete thickness.

## Concrete Mix Considerations

Batch to NZ standard concrete design mix. The use of larger aggregates such as 19 mm and well-graded, reduces the risk of concrete shrinkage and curling. DO NOT add extra water. Batch as normal for FORTA micro fibres. For FORTA FERRO®, aim for water: cement ratio between 0.45 and 0.55 to best accommodate the surface area characteristic of macro synthetic fibres. Use PC-707 3rd generation polycarboxylate superplasticizer to adjust workability characteristics on site. DO NOT add extra water. FORTA fibres DO NOT absorb any water but do help to bind together the mix, reducing segregation but not workability.

## Placing and Finishing

For details on placing and finishing please refer to the Fibre Reinforcement Placing and Finishing guide from Stratmore Construction Solutions Limited.

## Fibre Specifications

Please contact Stratmore Construction Solutions or download fibre specifications from our dedicated fibre website, [www.frc.co.nz](http://www.frc.co.nz)

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