EASYSLAB

The fast, economic slab system for ***domestic*** *and* ***light commercial*** *applications that incorporates Scancem Steel Fibres*

INTRODUCTION

The "Easyslab" concept has been developed as an alternative to the conventional method of reinforcing concrete slabs on grade.

By replacing conventional steel wire mesh with Scancem high tensile steel wire fibres, slabs on grade can be produced quicker and easier and to a higher quality than has previously been possible.

THE FIBRE ADVANTAGE

The addition of high quality steel wire fibres to concrete turns a brittle (easily broken/damaged) material into a tough composite that is more resistant to cracking and localised damage, especially impact related damage.

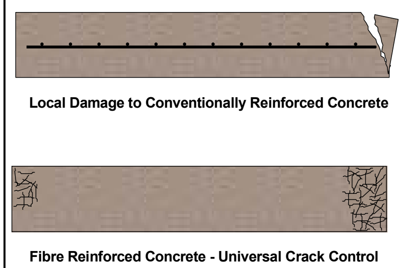
The steel wire fibres are distributed right through the concrete matrix and effectively lock off developing cracks, slowing down their propagation through the concrete. This can be likened to the action of "rip-stop" fabrics when used in parachute canopies.

In the event of there being sufficient tension in the slab to overcome the resistance offered by the fibres a fully visible crack will develop within the concrete. The fibres, by continuing to bridge the crack, will continue to offer resistance to the crack becoming wider, effectively pulling the concrete on either side of the crack back together. This is the exact mechanism relied on with conventional mesh reinforcement to control crack widths.

Conventional mesh reinforcement is present at one discreet location within the concrete and can only act to limit crack widths after they have formed. Prior to the concrete cracking mesh is dormant and offers no resistance at the initial crack forming stage the way fibres do. In the event of a crack missing the reinforcement, it will remain ineffective.

This disadvantage of mesh is highlighted in regards to localised damage as shown in Figure 1.

Fig 1 - Fibres are distributed throughout the concrete, offering full section resistance to cracking.



Although fibres do offer resistance to crack initiation and propagation it is essential that in the event of a crack forming they offer the same control of crack widths that a conventional mesh does. Refer to **Dosage Rates** below.

DOSAGE RATES

The dosage rate of steel fibres is determined for two criteria:-

1. **Fibre Spacing** If fibres are to effectively control crack development they cannot be too far apart. If they are too far apart a crack can simply pass between them as shown in Figure 2.

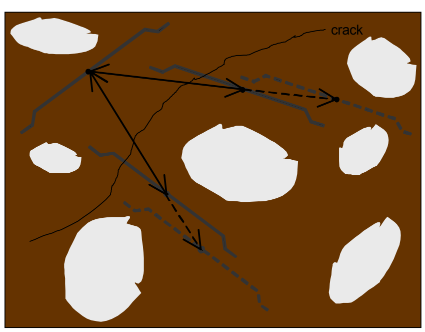


Figure 2. Fibre Spacing

With a recommended maximum average fibre spacing of 0.45 times the fibre length, it is possible, using the spacing theory formula of McKee, to determine a minimum fibre dosage as follows:-

$$\text{Vol. Fraction} = \frac{\text{Vol. of 1 fibre}}{(\text{Min. Ave. Spacing})^3}$$

Example: Using the Scanfibre CHO80/60NB steel wire fibres with a length of 60mm and a diameter of 0.75mm.

$$\text{Vol. Fraction} = \frac{60 \times \pi \times 0.75^2/4}{(0.45 \times 60)^3} = .00135 m^3/m^3$$

Taking steel as having a density of $78{,}500 kg/m^3$ gives the <u>minimum</u> dosage of Scanfibre CHO80/60NB fibres as:-

.00135 x 78,500 = <u>$10.6 kg/m^3$.</u>

2. **Tensile Capacity** The tensile capacity of cracked fibre reinforced concrete needs to be the same as mesh reinforced concrete. Table 1 shows the fibre dosages required for high quality Scanfibre CHO80/60NB steel wire fibres to meet the mesh requirements in accordance with Australian Standard AS 2870 –1996 *Residential Slabs and Footings – Construction*

Using the two criteria of minimum fibre dosage and tensile capacity of a cracked section leads to the concept of fibre performance and an understanding of the variation in available performance from different fibre types. The important parameters in determining fibre performance can be summarised as:-

Geometry – Specifically the fibre length, diameter and anchorage shape.

Quality – Steel quality and tensile strength.

Practicality – Ability to achieve a uniform distribution of fibres and avoid balling (fibre clumps) within the concrete.

It is <u>not</u> adequate to determine steel fibre dosage on the basis of equivalent cross sectional area to conventional mesh reinforcement as this approach takes no account at all of the relative performance of different quality fibres and the fact that fibres work totally differently to mesh.

Table 1. Mesh requirements for footing slabs on Class A and Class S sites as detailed in Figures 3.2 and 3.3 of AS2870-1996 and the calculated fibre alternatives.

Site Classification	Concrete Grade (MPa)	Slab Thickness (mm)	Slab Length (m)	Mesh Type	CHO 80/60 NB Fibre Dosage (kg/m^3)
Class A	20	85	$\leq$ 12	F53	12
"	"	85	> 12 & < 18	F63	12
"	"	85	$\geq$ 18	F62	20
Class A	20	100	$\leq$ 12	F63	12
"	"	100	> 12 & < 18	F62	16
"	"	100	$\geq$ 18	F72	24
Class S	20	100	$\leq$ 18	F72	24
"	"	100	> 18	F82	32

* Fibre dosage determined from the ultimate tensile capacity of the fibre concrete *NOT FROM EQUIVALENT STEEL X-SECTIONAL AREAS.*

SPECIFICATION

The Steel

Scanfibre CHO 80/60NB steel wire fibres conform to ASTM A820.90 Type 1. They have a tensile strength in excess of $1100N/mm^2$ and are manufactured from hard drawn low carbon steel conforming to DIN 17 140-D9. Hard drawn steel wire combines a high and uniform tensile strength with a low elongation at rupture. Such steel wire is an optimal raw material for the manufacture of steel fibres and is a key element in the Scanfibre fibre concept.

ORDERING

Fibre concrete can be readily ordered from any supplier of premix concrete and is one of the main advantages of using fibre concrete i.e. the need to separately order, store, cut and place wire mesh is eliminated completely. Any ancillary steel, such as trimmer and re-entrant bars will, however, still be required.

PLACING

Fibre reinforced concrete can be placed direct from a transit truck chute or be pumped into position. If pumped the fibre length must not be greater than 70% of the line diameter and piston pumps are preferred to peristaltic (squeeze) pumps, having less tendency to block.

FINISHING

Finishing techniques for fibre reinforced concrete are exactly the same as for conventional concrete and no special tools are required.

Screeding should be carried out using a metal screed bar as timber may tend to catch and drag the fibres.

Bull floating will push down the fibres as well as the aggregates and will lead to a smooth fibre free surface that can be given a steel trowel finish using either a mechanical steel trowel or hand trowelling techniques. A light broom finish is also possible to achieve a textured finish although going too deep into the surface can catch and pull out fibres.

CORROSION RESISTANCE

It is normal practice to use low carbon, plain steel fibres. These steel fibres are less susceptible to corrosion than conventional reinforcing as they tend to be more effectively protected by the surrounding concrete. The only negative aspect of low carbon steel fibres is that when fibres are present at the concrete surface localised rust discolouration can result. It is possible to minimise, if not eliminate, this staining with proper attention to good finishing.

Steel fibres of $\leq$ 1mm in diameter, that are at or very near the surface and do corrode will <u>not</u> cause spalling of the concrete in the same way that conventional reinforcement does. This is because the mass of steel is simply insufficient to generate the pressures necessary to spall concrete.

SCANCEM MATERIALS

PRODUCTS FOR ENGINEERED CONCRETE

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