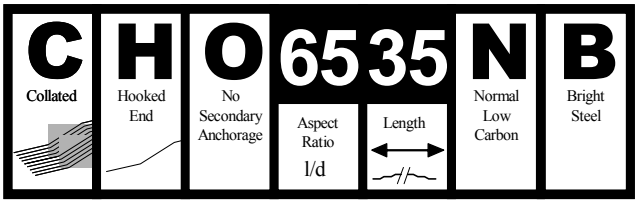
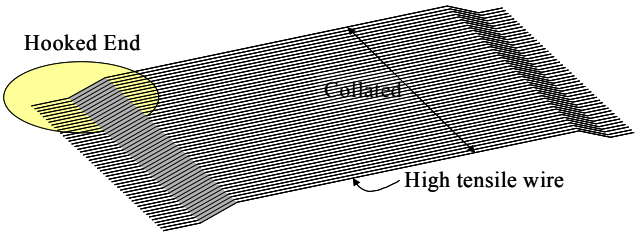
Scanfibre CHO65/35NB

Shotcrete fibre for use where performance is important and dosing equipment is not available





DESCRIPTION

The properties of Scanfibre CHO65/35NB are described below. Also refer to Scancem data sheet ***"Scanfibre for Slabs on Grade, Shotcrete and Precast".***

C – Collated

Wire from forty spools is fed to a glue line where a water dissolvable glue is applied.

H - Hooked End

The hooked end is designed to provide anchorage in a non-rigid way. The fibre cross section remains unchanged so it can pull through the concrete at high loads to prevent brittle failure due to fibre breakage and to promote high energy absorption. Also refer to Scancem data sheet ***"Fibre Geometry".***

O - No Secondary Anchorage

Although there is no secondary anchorage the hooks are specifically designed to maximize performance across the full range of concrete strengths.

65 - Aspect Ratio

Aspect ratio (length/diameter) is a key characteristic in determining performance. High aspect ratios lead to high performance (toughness) but without collation fibres tend to ball at aspect ratios over 50.

35 - Length

Length of 35mm is the ideal for shotcrete. It is long enough to ensure aggregate overlap and short enough not to block equipment.

N - Normal

Normal low carbon steel is pulled through a series of dyes to give wire strength of over 1200MPa

B - Bright

Bright steel is the norm for steel fibres in concrete. Corrosion is generally not an issue. The fibres are not interconnected so there can be no corrosion current, hence galvanizing is normally not necessary.

QUALITY

ISO 9001 - Quality Plan

The fibre is manufactured in an ISO9001 qualified plant.

QC - Production Testing

Samples of the fibre are tested for:

- Dimensional accuracy
- Tensile strength
- Bending

Conforms to ASTM A820 Type 1

PACKING

Paper Bags

Bags are in 20kg. They are degradable and can be added directly to the mix without being opened. In each 20kg bag there are approximately 350,000 fibres or at 50kg/m^3 there are approximately 0.9million fibres in each cubic meter of concrete.

HANDLIING

Manual

Paper bags are loaded into the mixer after addition of all other ingredient.

Automated

Automated systems that can be wired to the batching computer are available.

Also refer to the Scancem data sheets on ***"Readymix Production of Scanfibre Concrete"***

PERFORMANCE

The performance of fibre reinforced concrete is dependent on the fibre type and dosage. Hence specifiers should use an appropriate performance specification. See also Scancem data sheet ***"Equivalent Dosage Charts For Different Fibre Types"***

Round Determinate & EFNARC Panel

The round determinate panel has replaced the EFNARC panel test as the internationally favoured performance measure for steel fibre shotcrete. It mimics the behaviour of shotcrete rings. Although no strength parameter is determinable the values are a measure of the energy absorbed. The fibre dosage is related to the ground condition using the Scancem modified Barton Rock Mass chart. Also refer to Scancem data sheet on ***"SFRC Linings in Mining and Tunneling"***

	Dosage (kg/m^3)				
	20	30	40	50	60
Round Determinate Panel (Joules)					
Actual*		430			800+
Curve Fit	304	444	576	700	816
EFNARC panel (Joules)*	760	1110	1440	1750	2040
Residual Strength 3mm (MPa)*	1.5	2.3	3.1	3.9	4.6
R_{e3}*	27%	43%	57%	70%	83%

Flex strength for round determinate panel 5.5Mpa
*Obtained by Bernard's conversion factors
**One result gave 812 Joules. Other result lower due to low strength concrete

$f'_{ct,fl}$

Characteristic flexural tensile strength is calculated from the characteristic cylinder compressive strength (f'_{cm}) by the formula:

$$f'_{ct,fl} = 0.4^{x}(1.25f_{cm})^{0.67}$$

$f_{e,3}$ & $R_{e,3}$

w	Dosage (kg/m^3)	20	30	40	50	60	70
$R_{10,30}$	(%)	46	61	73	83	91	98
$f_{10,30}$	Equiv. Flex. (MPa)	2.2	2.9	3.5	3.9	4.3	4.7
$R_{e,3}$	(%)	41	55	67	76	84	91
$f_{e,3}$	Equiv. Flex. (MPa)	1.9	2.6	3.2	3.6	4.0	4.3

Equivalent Flexural Ratio ($R_{e,3}$) is multiplied by the $f'_{ct,fl}$ to give equivalent flexural strength ($f_{e,3}$). This equates to the average flexural strength up to 3mm deflection in a standard JSCE beam test. IT is the basis of the TR34 floor design code. An estimate of $R_{e,3}$ can be calculated from the formula

$$R_{e,3} = \frac{180WLD^{1/3}}{(180C)+(WLD^{1/3})}$$

where
D = fibre diameter (mm)
W = fibre dosage (Kg/m^3)
L = fibre aspect ratio
C = Scancfibre CH0 constant = 19

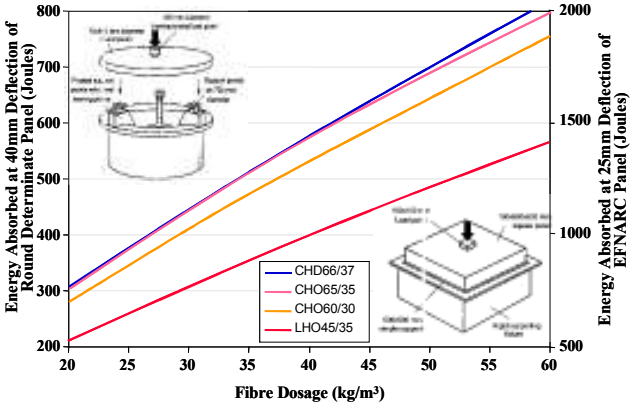
However, conversions from the round panel test are more reliable. Beam tests are unreliable and manufacturers use the best achieved of the highly variable results for publication and establishment of formulae.

F_{10-30} & $R_{10,30}$

Toughness ratio is multiplied by $f'_{ct,fl}$ to give equivalent flexural strength (f_{10-30}). This equates to the average flexural strength between I_{10} and I_{30} values (approx 0.25-0.75mm deflection) in a standard ASTM beam test. It is considered of little value today as deflections are too low to establish the important characteristic of the fibre. These criteria are generally used by poor performing fibres where brittle type failures result. An estimate of R_{10-30} can be calculated from the formula:

$$R_{10,30} = \frac{180\,WL}{(180xC)+(WxL)}$$

Spacing



It is important that the stress is transferred from one fibre to the next by the concrete forming compression struts i.e. there is a limit to the spacing of fibres. Spacing can be calculated using spacing theory of McKee using the following formula:-

$$S = \sqrt[3]{(\pi d^2 l/4\sigma)}$$

The maximum average spacing of fibres should be 0.45 times the typical fibre length. This recommendation comes from a technical committee of learned professors brought together to formulate a design guideline for SFRC for use with the European Code on concrete structures. For this fibre the minimum dosage to satisfy spacing factor is 16kg/m^3.

Minimum fibre Dosages to RTA QA Specification B82 for shotcrete is 30kg/m^3. See also Scancem data sheet ***"Minimum Performance Levels and Dosage Rates".***

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