The Catalonia Institute of Construction Technology

Wellington 19
ES-08018 Barcelona
Tel. +34 93 309 34 04
qualprod@itec.cat
itec.cat

Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA

www.eota.eu

European Technical Assessment

ETA 23/0933
of 18.03.2024

General part

Technical Assessment Body issuing the ETA: ITeC

ITeC has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment).

Trade name of the construction product	**FLEXOFIBER® FX-20** **FLEXOFIBER® FX-25**
Product family to which the construction product belongs	26 – PRODUCTS RELATED TO CONCRETE, MORTAR AND GROUT. Steel fibres recovered from end-of-life tyres
Manufacturer	**FLEXOFIBERS EUROPA SL** C/ Artesanos, 29 ES28660 Boadilla del Monte (Madrid) Spain
Manufacturing plant(s)	**FLEXOFIBERS SPAIN SL** Av. Monte Boyal,131 (Polígono industrial Monte Boyal) ES45950 Casarrubios del Monte (Toledo) Spain
This European Technical Assessment contains	8 pages.
This European Technical Assessment is issued in accordance with Regulation (EU) 305/2011, on the basis of	European Assessment Document - EAD 260010-00-0301 *Fibres for concrete - Steel fibres recovered from end-of-life tyres.* Edition January 2019.

General comments

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full.

Specific parts of the European Technical Assessment

1 Technical description of the product

The products assessed in this European Technical Assessment are FLEXOFIBERS® FX-20 and FLEXOFIBERS® FX-25 steel fibres recovered from recycling of end-of-life tyres (Reused Tyre Steel Fibres - RTSF). The basic material is cold drawn wire with high tensile strength used in the manufacturing of tyre steel cords.

The products RTSF are not fully covered by EN 14889-1:2006, as this standard does not comprise provisions for a recycled steel fibre group.

Given the specific production process, the RTSF are described by their geometrical characteristics (developed lengths and diameters) in the form of a statistical distribution, as described in this ETA, see clauses 3.4.1.1 and 3.4.1.2.

The product may contain traces of vulcanised rubber (see this ETA, clause 3.4.1.3).

The products RTSF are produced in two types, FX-20 has a mean value of length of 22,75 (± 5,37) mm and FX-25 has mean value of length of 26,45 (± 4,92) mm.

2 Specification of the intended use(s) in accordance with the applicable EAD

2.1 Intended use

The steel fibres recovered from end-of-life tyres are intended for structural use in concrete, mortar and grout as defined in EN 14889-1.

2.2 Working life / Durability

The provisions stated in this European Technical Assessment have been written based on the manufacturer's request to take into account a working life of concrete incorporating the steel fibres recovered from end-of life tyres for the intended use of 50 years when installed in the works provided that the concrete incorporating the steel fibres recovered from end-of-life tyres is subject to appropriate installation. These provisions are based upon the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[1].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by the Technical Assessment Body issuing this ETA, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

[1] The real working life of the RSTF built into specific works depends on the environmental conditions of the design, execution, use and maintenance of that works. Therefore, if cannot be executed that in certain cases of the real working life of the RSTF may also be shorter than 50 years referred above.

3 Performance of the product and reference to the methods used for its assessment

3.1 Performance of the product

The assessment of FLEXOFIBERS® FX-20 and FLEXOFIBERS® FX-25 has been performed in accordance with EAD 260010-00-0301 *Fibres for concrete - Steel fibres recovered from end-of-life tyres.*

Table 3.1: Performance of the product.

Basic requirement	Essential characteristic	Performance
BWR 1 Mechanical resistance and stability	Tensile strength of fibres	See 3.2.1
	Effect on consistence (workability) of concrete	See 3.2.2
	Effect on strength of concrete	See 3.2.3
BWR 3 Hygiene, health and the environment	Content, emission and/or release of dangerous substances	NPA[2]

3.2 Mechanical resistance and stability (BWR 1)

3.2.1 Tensile strength

The tensile strength is determined in accordance with EN ISO 6892-1:2016, with the following exceptions:

Test pieces with a minimum length of 20 mm are mounted on snubbing grips (e.g. countersunk snubbing grips, see EAD 260010-00-0301) with at least 1 mm radius, to increase the probability of failure occurring at the free length of the specimen and produce valid test results. The results from specimens failing at the grip are ignored. The cross-sectional area is calculated from the arithmetic mean of two measurements carried out in two perpendicular directions to an accuracy of 0,01 mm.

Figure 3.1 and 3.2 shows the histogram including the range of mean values results of the tested samples.

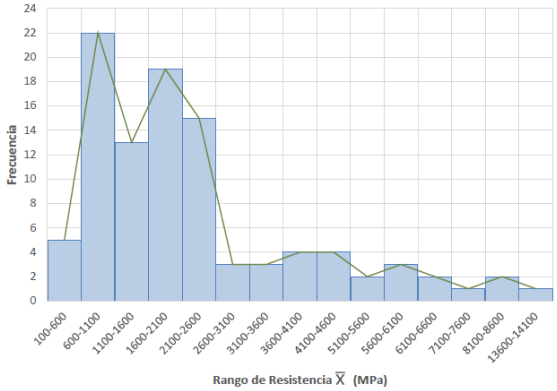


Figure 3.1: Histogram of mean values of tensile strength results of FX-20.

[2] NPA: No Performance Assessed.

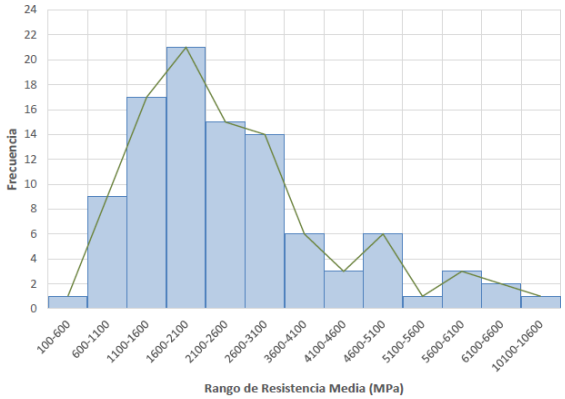


Figure 3.2: Histogram of mean values of tensile strength results of FX-25.

Based on the test results, the tensile strength of RTSF FX-20 is 694,44 MPa and the tensile strength of the RTSF FX-25 is 1183,27 MPa.

3.2.2 Effect on consistence (workability) of concrete

The effect of RTSF on the consistence of concrete is determined according to EN 14889-1:2006, clause 5.7. The reference concrete composition is specified as C25/30, w/c: 0.55, maximum aggregate size: 16 mm, cement content: 300 kg/m³.

The average values of VeBe consistence of the concrete incorporating the RTSF XF-20 and XF-25 are given in Table 3.2. The reference concrete has a VeBe consistence of 3 seconds.

A plasticizer and a superplasticizer have been used in these samples: Master fluid 60 is used in a proportion of 1,3% by cement weight and Dynamon SX-24 in 1,2 % by cement weight.

Table 3.2: Determination of consistency of fresh concrete.

RYSF	Fresh concrete	Height of cone (mm)	Time VeBe (s)
FX-20	Reference concrete without fibres	180	2,67
	Concrete with FX-20 fibres	50	5,53
FX-25	Reference concrete without fibres	170	3,03
	Concrete with FX-25 fibres	10	10,67

3.2.3 Effect on strength of concrete

The effect of RTSF on strength of concrete is determined according to EN 14889-1:2006, clause 5.8. The reference concrete is identical to the concrete described in this ETA, clause 3.2.2.

The unit volume of RTSF FX-20 and FX-25 that leads to a residual flexural strength of concrete of 1,5 MPa at 0,5 mm CMOD (equivalent to 0,47 mm central deflection) and a residual flexural strength of 1 MPa at 3,5 mm CMOD (equivalent to 3,02 mm central deflection) is 25 kg/m³.

3.3 Hygiene, health and the environment (BWR 3)

3.3.1 Content, emission and/or release of dangerous substances

No performance assessed.

3.4 Characterisation of the products

3.4.1 Fibre geometry

In order to allow the manufacturer to show in the factory production control that the assessed essential characteristics remain valid, the RTSF is characterised by its distribution of geometrical aspects, such as developed length and diameter of the fibres.

3.4.1.1 Distribution of developed lengths

According to EAD 260010-00-0301, clause 3.4.1.1, the population of developed lengths of the RTSF is best described by a lognormal probability distribution.

The developed lengths of individual fibres is determined using optical methods with an accuracy of 15%. In total 10 individual samples of minimum 1000 specimens each were measured for each fibre type.

The characteristics of developed lengths are given in the Tables 3.3 and 3.4.

Table 3.3: Lognormal probability distribution parameters for developed length of FX-20.

Parameter	Unit	Value
Mean length	mm	22,75
Standard deviation	mm	11,44
Coefficient of kurtosis	-	-0,22
Coefficient of skewness	-	0,07
Minimum range	mm	17,05
Maximum range	mm	57,41
80% lower limit	mm	13,36
80% upper limit	mm	30,33

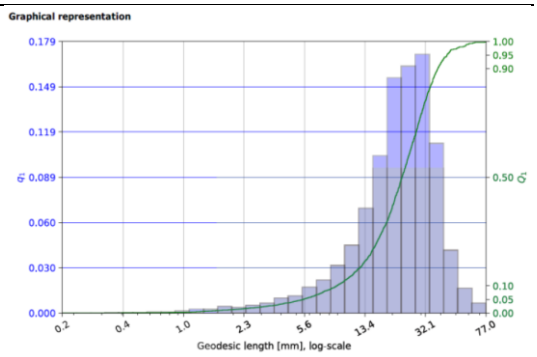
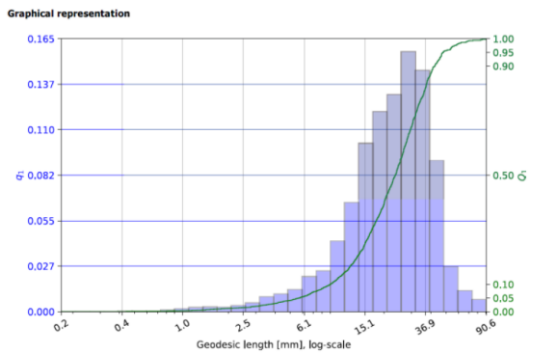


Table 3.4: Lognormal probability distribution parameters for developed length of FX-25.

Parameter	Units	Value
Mean length	mm	26,45
Standard deviation	mm	12,33
Coefficient of kurtosis	-	1,70
Coefficient of skewness	-	1,09
Minimum range	mm	16,93
Maximum range	mm	63,22
80% lower limit	mm	16,33
80% upper limit	mm	38,52



3.4.1.2 Distribution of diameters

According to EAD 260010-00-0301, clause 3.4.1.2, the population of diameters of the RTSF is best described by a statistical distribution.

The diameter of individual fibres is measured with a micrometre, in two directions, approximately at right angles, to an accuracy of 0,01 mm. In total 10 samples of 15 specimens each were measured for each fibre type.

The population characteristics of diameters are given in the Table 3.5.

Table 3.5: Distribution parameters for diameter.

Fibre	Diameter (mm)				
	Range	Mean	Standard deviation	Lower limit	Upper limit
FX-20	0,124	0,294	0,074	0,173	0,420
FX-25	0,147	0,282	0,044	0,144	0,437

3.4.1.3 Rubber content

The rubber content is determined through burn tests on 10 samples of approximately 300 g of RTSF (for each fibre type) at approximately 550°C, for 1 hour.

The measured rubber content is much lower than 10 % by mass with an average value of 0,52 % in FX-20 and 0,57% in FX-25.

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

According to the Decision 99/469/EC of the European Commission of 17/07/1999, as amended by Decision 2001/596/EC of 8th January 2001, the system of AVCP (see EC delegated Regulation (EU) No 568/2014 amending Annex V to Regulation (EU) 305/2011) given in the following table applies.

Table 4.1: AVCP system.

Product(s)	Intended use(s)	System
Fibres	For structural uses in concrete, mortar and grout	1

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

All the necessary technical details for the implementation of the AVCP system are laid down in the *Control Plan* deposited with the ITeC and agreed in accordance with EAD 260010-00-0301, section 3.

The *Control Plan* is a confidential part of the ETA and only handed over to the notified product certification body involved in the assessment and verification of constancy of performance.

The factory production control operated by the manufacturer shall be in accordance with the above-mentioned *Control Plan*.

Issued in Barcelona on 18h march 2024

by the Catalonia Institute of Construction Technology.

Ferran Bermejo Nualart

Technical Director, ITeC