ADFIL
Construction Fibres

Technical Note

How to interprete fibre dosage in standard EN 14889-2: 2006

Durus®

Every building product used in Europe needs to be CE certified. CE marking is set in place to facilitate free trade within the European market and to guarantee a certain level of safety. CE marking is NOT a quality brand like Benor, Asqual,...

The effect on the strength of concrete

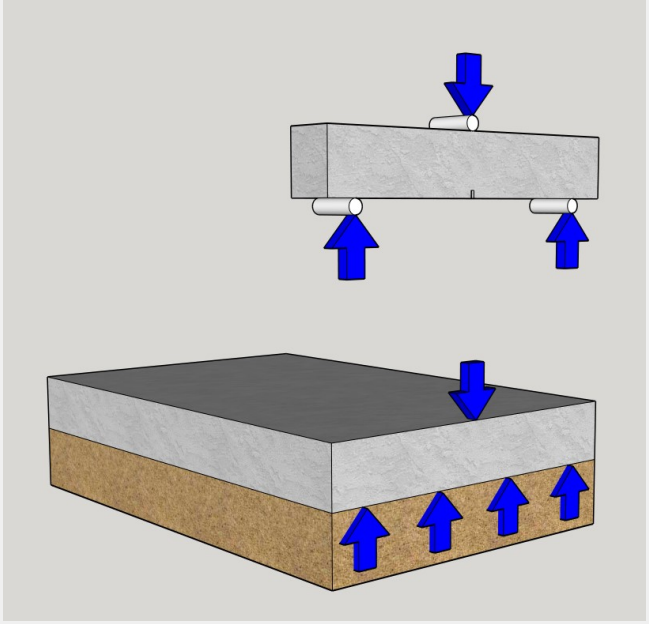
In the standard *EN 14889-2: 2006 'Polymer fibres—Definitions, specifications and conformity*, the technical committee has summarized all harmonized characteristics (mentioned in *Annex ZA*). A manufacturer needs to test and provide these characteristics in order to sell his fibres on the European market.

These tested harmonised characteristics are summarized on one official document called DOP (Declaration Of Performance).

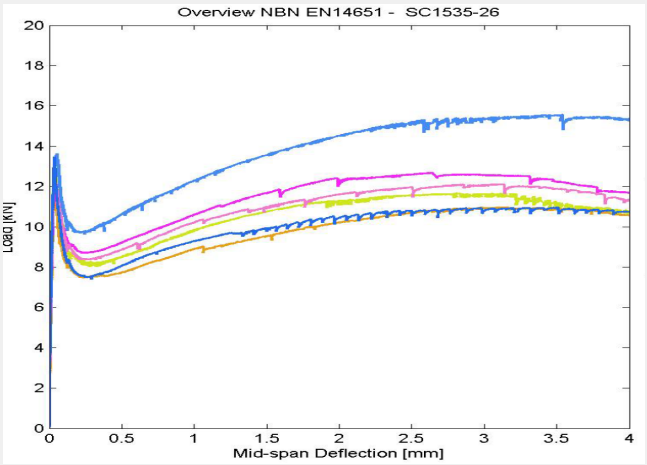
One of the harmonised characteristics is set in place to determine the effect of fibres on the strength of concrete. In this way a client is able to compare the performance in concrete of one fibre to another. The effect on the strength of concrete is described in chapter 5.8 and literally states the following: "*The effect on strength shall be determined*

according to EN 14845-2 using a reference concrete conforming to prEN 14845-1. The unit volume of fibres in kg/m³ shall be declared by the manufacturer that achieves a residual flexural strength of 1.5MPa at 0.5mm CMOD (equivalent to 0.47 central deflection) and a residual flexural strength of 1MPa at 3.5mm CMOD (equivalent to 3.02 mm central deflection)."

This is clearly to determine the effect of the fibres on the strength of the concrete at a given dosage. Nowhere in the standard a MINIMUM dosage has been defined. Beam suited for this test have a given bending moment and length, which is the same for all tests. If one changes the section of that beam, the results will be different so the residual flexural strength will be different.
Moreover a concrete slab cannot be assimilated to a two points supported beam. The subgrade has a certain bearing capacity and is therefor also considered in the design.



Designing with FRC (fibre reinforced concrete)
The section of the concrete is determined by the design and therefor the required bending moment is always calculated and depends on the thickness of the slab, the bearing capacity of the soil, the strength of the concrete, the amount of fibres, the loading, etc…. So the minimum amount of fibres valid for all applications can therefor not be set in the standard as this depends on to many parameters.



The beam tests are necessary to determine the residual flexural strength. In the past the $R_{e,3}$-value was used in the design. The $R_{e,3}$-value is the ratio between the equivalent flexural strength $f_{e,3}$ of FRC and the modulus of rupture (MOR) of plain concrete. The $f_{e,3}$ is proportional to the area under the load –deflection curve up to a central beam deflection of 3mm.
TR34 design guideline edition 3 use a yield-line analysis and $R_{e,3}$ to modify the ultimate moment capacity of plain concrete slabs. The increase in the flexural capacity of concrete slabs with fibres has also been linked to the beam $R_{e,3}$ value. The $R_{e,3}$ value depends on the fibre type, geometry, and volume fraction.

Conclusion
Our designs are written in a limit state format based on TR34 edition 4 and Model Code 2010. The residual flexural strengths of the beam tests at different dosages are used at 0,5mm CMOD for SLS design and at 3,5mm CMOD for ULS designs to calculate the moment capacity of FRC. The safety factors used in the design are in line with Eurocode 2.

The design model we use has a thirty year track record and we have not had an insurance claim to date.

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