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RESEARCH & TECHNOLOGY

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BAS report:	2016-1065-001
Subject:	Metalic fibered concrete, flexural tensile strength NEN-EN 14651 *Premix mortar; Betec 860 0/4 mm*
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Contractor:	Deys Betontechniek Nederland B.V.
Adress contractor:	Gelreweg 5 3840 AH Harderwijk

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Author:	P.L.M. Bisschop
Theme:	Metalic fibered concrete, flexural tensile strength
Keywords:	Tensile strength, LOP

1 General

On behalf of Deys Betontechniek Nederland B.V. B|A|S has executed tests on the flexural tensile strength of premix mortar Betec 860 0/4 mm including metallic fibres. This report presents a description of the test and the results.

2 Research

The tensile behaviour of metalic fibre concrete is tested by applying a centre-point load. Before testing a notch is made by wet sawing (depth 25 mm and width ± 5 mm).

At the notch, the following dimensions are measured:

- b: width of the specimens (mm),
- hsp: the distance between the tip of the notch and the top of the specimen (mm),
- x: the width of the notch

The test is deformation controlled, and driven by the deflection (δ) of the specimens. Until a deflection of 0,13 mm, the deflection rate is 0,0013 mm/s. After that the speed is increased to 0,0035 mm/s. The test is terminated at a deflection of 3,50 mm. The test showes the relationship between force and deflection of the speciment. The span length of the specimens is 500 mm.

From each specimend the following properties are determined:

- *LOP*: limit of proportionality (δ = 0,08 mm)
- $f_{R.1}$: residual flexural tensile strength (δ = 0,47 mm)
- $f_{R.2}$: residual flexural tensile strength (δ = 1,32 mm)
- $f_{R.3}$: residual flexural tensile strength (δ = 2,17 mm)
- $f_{R.4}$: residual flexural tensile strength (δ = 3,02 mm)

3 Standard

The test is carried out in accordance to EN 14651 + A1 (Q).

The specimens have been produced and conditioned at B|A|S, these items are outside the scope of accreditation.

4 Samples

The serie of prismatic beams consists of 6 pieces and have been produced in the laboratory of B|A|S. After production the samples have been stored with a temperature of 20 ± 2 °C and a relative humidity of ≥ 95%.

The notch has been made three days before the testing. After sawing the notch up to three hours before the start of the test the specimens were stored under water. The moisture condition of the samples at the time of reseach is "surface dry". The table below shows the data of the prisms.

sample code	type fibre	dates			age	nominal sizes		
		production	notching	research		length	width	height
					days	mm	mm	mm
1	-	21-10-2016	15-11-2016	18-11-2016	28	600	150	150
2	-	21-10-2016	15-11-2016	18-11-2016	28	600	150	150
3	-	21-10-2016	15-11-2016	18-11-2016	28	600	150	150
4	-	21-10-2016	15-11-2016	18-11-2016	28	600	150	150
5	-	21-10-2016	15-11-2016	18-11-2016	28	600	150	150
6	-	21-10-2016	15-11-2016	18-11-2016	28	600	150	150

5 Results

5.1 Flexural tensile strength (Q)

sample code	dimensions at the location of notch			flexural tensile strength				
	b	h_{sp}	x	LOP	$f_{R.1}$	$f_{R.2}$	$f_{R.3}$	$f_{R.4}$
	mm	mm	mm	N/mm²	N/mm²	N/mm²	N/mm²	N/mm²
1	150,0	125,2	5	7,86	8,94	6,65	5,39	4,26
2	150,0	124,8	5	7,65	8,91	7,00	5,75	4,78
3	150,0	124,9	5	6,01	5,01	4,38	3,72	2,84
4	150,0	124,8	5	7,90	8,84	6,97	5,86	4,77
5	150,0	124,8	5	7,49	9,78	6,40	5,42	4,61
6	150,0	124,8	5	8,64	11,95	10,50	8,79	7,14
average				7,59	8,91	6,98	5,82	4,73

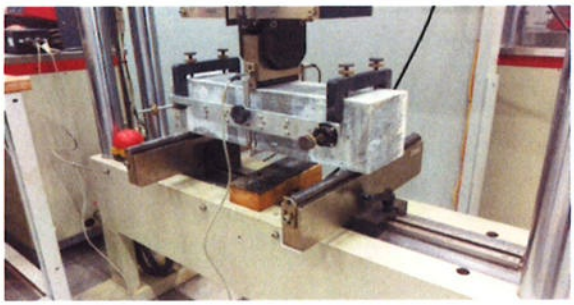
The force-deflection curves of the specimens are reported in Appendix 1.

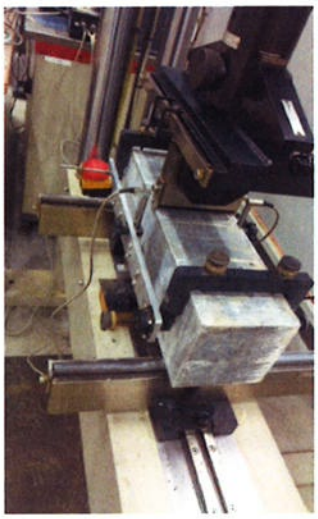
5.2 Compressive strength (NEN-EN 12390-3 (Q))

From each specimen one sample was cut for the determination of the compressive strength.

sample code	date of test	density	compressive strength
		kg/m³	N/mm²
1	18-11-2016	2400	103,0
2	18-11-2016	2380	103,0
3	18-11-2016	2370	98,5
4	18-11-2016	2390	97,5
5	18-11-2016	2370	97,5
6	18-11-2016	2400	104,5
average		2385	100,7

In the below pictures the test set-up of the flexural bending test is shown.





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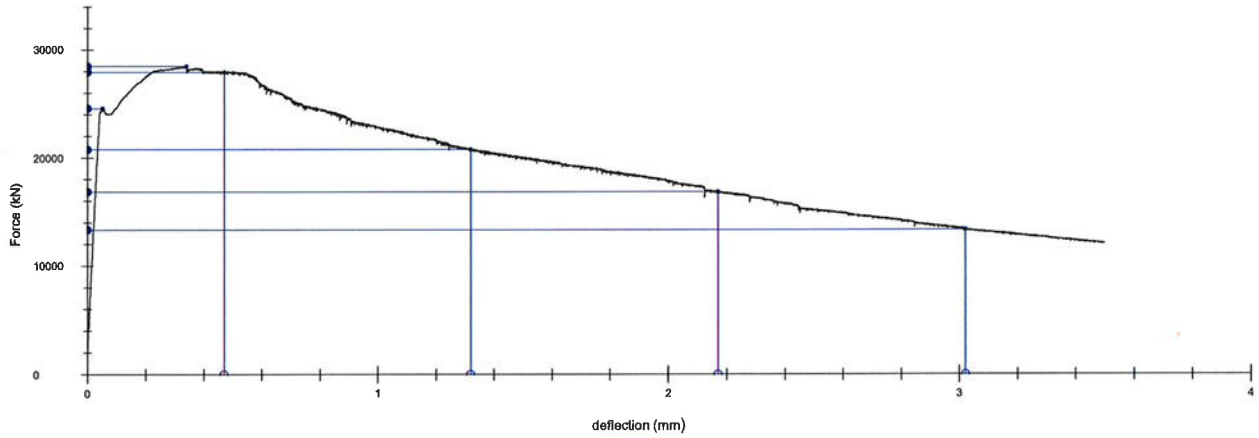
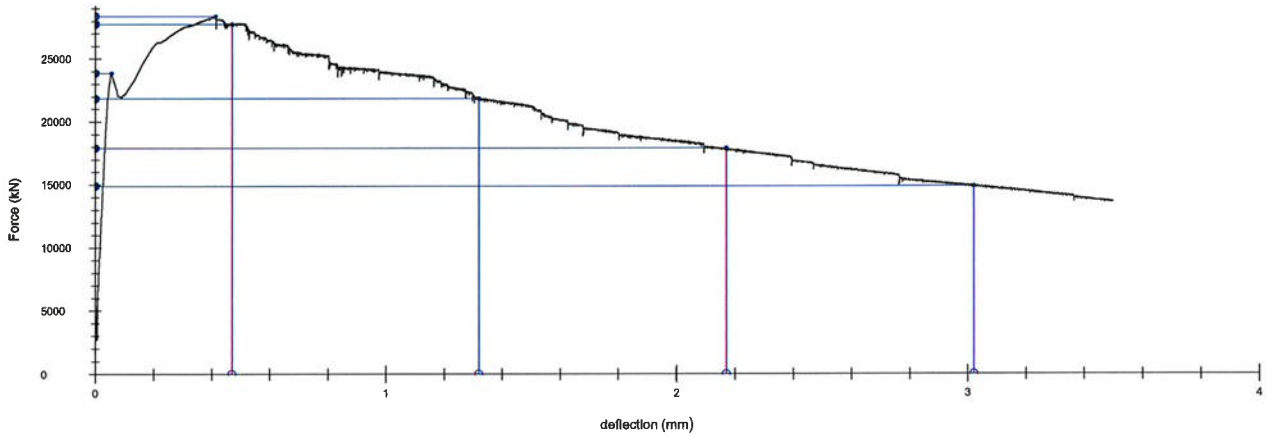
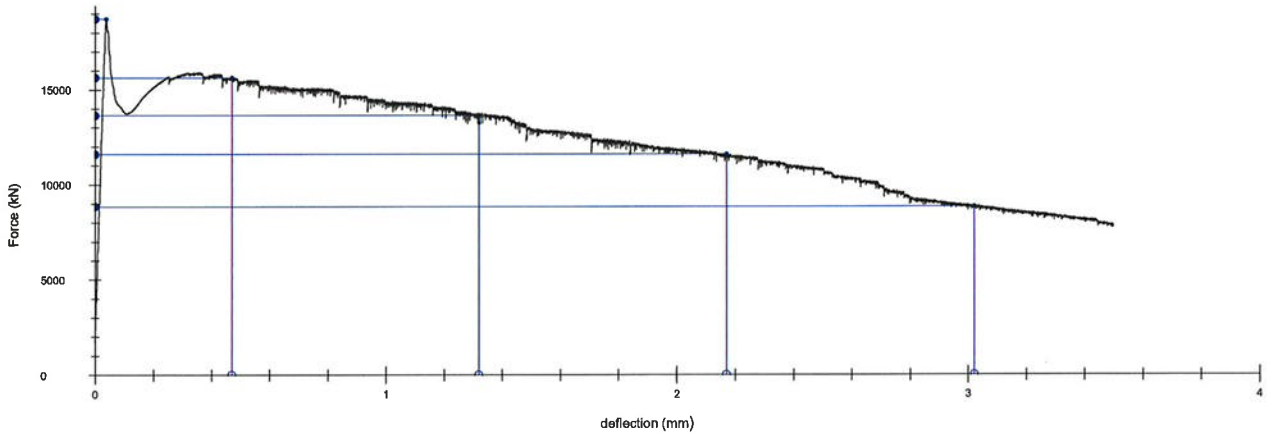


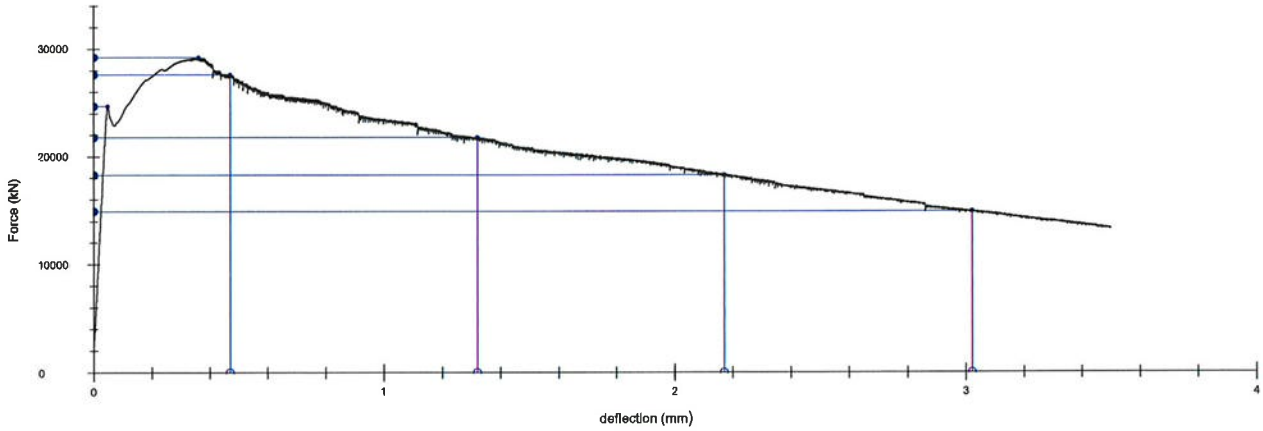
1) Force-deflection curve sample 1



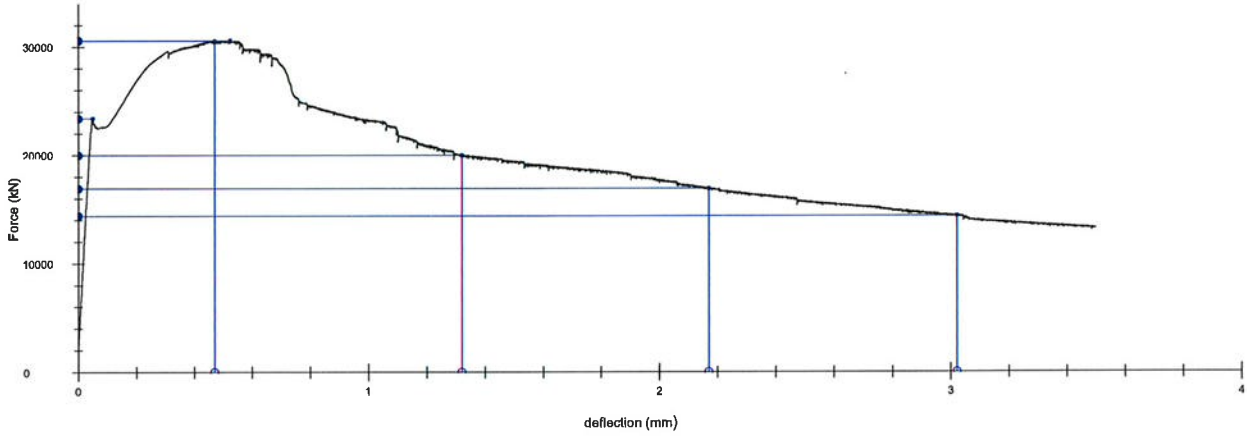
2) Force-deflection curve sample 2



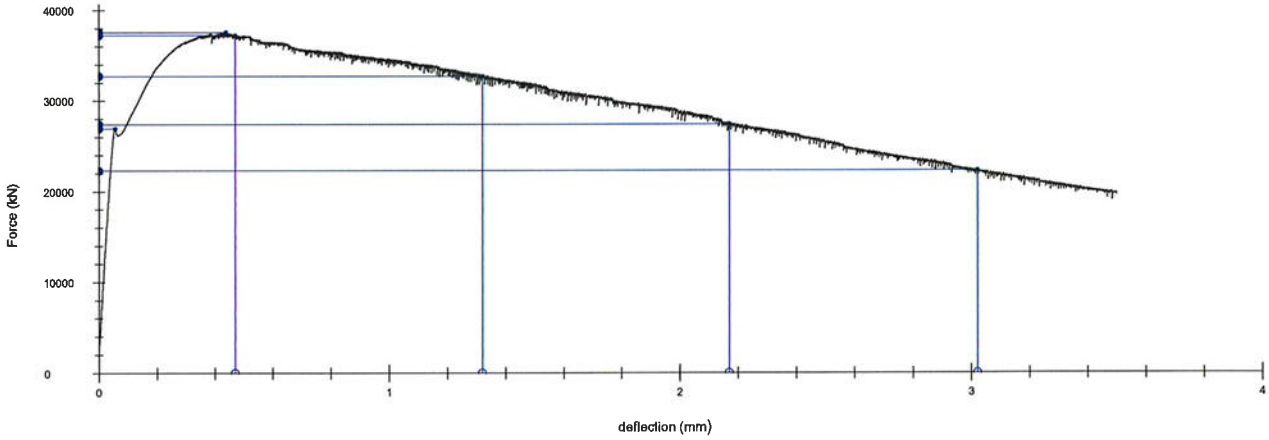
3) Force-deflection curve sample 3



4 Force-deflection curve sample 4



5 Force-deflection curve sample 5



6 Force-deflection curve sample 6