

Strength development Smart Crusher sand and cement: tests carried out in November 2014

In November 2014 mortar tests have been carried out in cooperation with / at a concrete-products company regarding 0-2 mm material (sand and cement fractions, hereafter referred to as SB-02), obtained by using the *SlimBreken* (SmartCrushing) technique from concrete aggregates of concrete paving stones. This 0-2 mm material (in a way SmartCrusher sand) has been sieved from the material released from the Laboratory SmartCrusher (0-12mm). The test was primarily intended to point out the difference with traditional crusher sand. As traditional crusher sand proved unsuitable for the production of prisms it was decided not to use crusher sand and the comparison has been made between (pure) Norm sand 0-2 mm and the SmartCrusher fraction 0-2 mm (sand and cement fractions).

The SmartCrusher 2.0 machine provides a separation of the cement fractions in unhydrated cement (relatively coarse and heavy) and cement hydrates (approx. 10x finer and almost 2x lighter). In addition, the SmartCrusher 2.0 extracts the released moisture together with the hydrated cement, thus preventing the released, young, never hydrated cement reacting with water, which would have as a consequence that it could not be reused immediately.

As this SmartCrusher 2.0 (drying) feature is not available in the laboratory SmartCrusher (to which the test relates) and as we wanted to avoid the unhydrated cement reacting with the ever present water, the paving-stone concrete rubble (which had been exposed to the elements for an unknown period of time) was dried in advance at a temperature of 105°C for approx. 12 hours and was processed in the laboratory SmartCrusher when it had cooled down.

Norm sand 0-2 mm is (pre)packed in 1350 gram bags which, together with cement and any other additives, is sufficient to make 3 test prisms (dim. 40 x 40 x 160 mm).

At the concrete-products company the first tests were carried out using specimen codes 1 and 2 (Norm sand with 450 grams cement, specimen code 1 with CEM 111 Hoogoven cement and specimen code 2 with CEM 1 Portland cement). These were used as a reference for compressive strength.

Two other test specimens (codes 3 and 4, resp.) were based on SmartCrusher 0-2 mm fraction plus 300 gram cement (CEM 111 and CEM 1, resp.) and a small amount of dry super-plasticiser to maintain their workability.

This showed that one-third less cement is required to obtain the same strength!

In comparison the specimens codes 11 and 12 were made with Norm sand 0-2 and 300 gram cement, which shows that less cement typically means a significant loss of strength.

Specimen code	1	3	11	2	4	12
Date	Nov 2014					
Norm sand 0-2mm	1350		1350	1350		1350
SB 0-2mm		1350			1350	
CEM III B 42,5N Hoogoven cement	450	300	300			
CEM I 52,5N Portland cement				450	300	300
water	225	225	225	225	225	225
Superplast in powder form		4			4	
<i>Water cement factor</i>	0.5	0.75	0.75	0.5	0.75	0.75
Compressive str. after 2 days.	11	10.3	4.3	23.4	23	10.5
Compressive str. after 7 days.	30.6	32.1	13.6	36.3	39.6	18.1
Compressive str. after 14 days.	34.5	41.6	19.9	45.8	47.1	22.1
Compressive str. after 28 days.	45.5	44.8	26.3	52.6	53.3	28.3
% after 2 days:	100%	94%	39%	100%	98%	45%
% after 28 days	100%	98%	58%	100%	101%	54%

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