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33106 Paderborn

Client: TERRAMARK GmbH
Kreuzstr. 2
33602 Bielefeld

Test Report

Subject: Examinations on screed and concrete specimens
treated with Metasiel-Protection System

Client: TERRAMARK GmbH
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33602 Bielefeld

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Purchase Order: B/H_S from 15.07.2013

Sample: Production in the laboratory of MIG mbH, Salzkotten

1. General

The company

TERRAMARK GmbH

Kreuzstr. 2

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- a) production of three sample plates from cement screed (strength class ZE 20 to ZE 30) according to DIN 18560 Part 1 and determining the time of occurrence of an inherent moisture of 2-4% by mass in the surface-treated sample plates.
- b) Preparation of test cubes with 150 mm side length from concrete (strength class B 25, grading curve A/B 0/16 mm) and determining the maximum water penetration depth in accordance with DIN 1048 Part 5. The samples should be stored, deviating from DIN 1048, in the laboratory and standard climate (20 °C/95% relative humidity) until the test period of 33 days is reached.

The client processed the screed surfaces and test areas of the sample cube themselves.

2. Preparation of test samples

2.1 Screed plates

Three screed plates (plates No. I, II and III) made of cement screed were prepared in the laboratory 24. July 2013. Their composition is as follows:

Cement: 300 kg/m³ CEM I 32.5 R

Additive: 50 kg/m³ coal fly ash

Aggregate: gravelly sand 0/8 mm

Admixture: 0.5 M-% v. ZG. air entraining agent LP

0.33 M-% v. ZG. concrete plasticizer BV.

Fresh mortar data: gross density $P_{\text{fresh}} = 2.2 \text{ kg/dm}^3$

air void content = 5.8 volumes -%

flow spread = 145 mm (according to DIN 18555, Part 2, Paragraph 3.2.1)

The dimensions of the plates were:

Plate No. I: 600 x 600 x 50 mm

Plate No. II: 600 x 600 x 50 mm

Plate No. III: 1000 x 1000 x 50 mm.

2.1.1 Treatment of the plate surfaces

While the surface of plate No. I was left untreated, representatives from Metasiel treated the surfaces of plates No. II and III - Age of the screed = 1 day - with the liquid Metasiel protection system on 25.07.2013.

2.1.2 Storage of the plates

To determine the inherent moisture of the screed, plate No. I was dried at the age of 5 days in a drying oven at 105° C until constant weight was reached. Plate No. II, whose surface was treated, was put upright and stored dry at laboratory temperature and weighed daily. Plate No. III, whose surface was treated, was stored dry on the sheathing membrane used for the preparation of samples at laboratory temperature.

2.1.3 Mortar prisms

To determine the screed's hardened mortar properties, three mortar prisms were produced in accordance with DIN 18555, Part 3 and stored according to standard.

2.2 Concrete test cubes

Ten test cubes (No. 1 to 10) with 150 mm side length according to DIN 1048 Part 5 were produced in the laboratory of ICT on 24 July 2013 using the following recipe:

Strength class:	B 25
Cement:	300 kg/m ³ CEM I 32.5 R
Aggregates:	50 mass-% sand 0/4 mm
	20 mass-% gravel 4/8 mm
	30 mass-% gravel 8/16 mm
	Water 180 kg/m ³
w/z value:	0.6

Fresh mortar data in conformity with DIN 1048 Part 1:

Gross density $P_{\text{fresh}} = 2.38 \text{ kg/dm}^3$

Air void content = 1.2 volumes-%

Flow spread = 480 mm.

2.2.1 Treatment of test cube surfaces

The surfaces of the freshly demoulded test cubes Nos. 3, 4 and 5 - age of the sample = 1 day - were treated by representatives from TerraMark with their liquid Metasiel protection system on 25.07.2013. The surfaces of the remaining cubes were left untreated.

2.2.2 Storage of test cubes

Cubes No. 1, 2 and 6 (untreated), intended for the water resistant test:

in laboratory climate until the age of 14 days. In a climate chamber at 20° C and 65% relative humidity until the start of the water resistant test.

Cubes No. 4 to 6 (surfaces treated), intended for the water resistant test:

in laboratory climate until the age of 14 days. In a climate chamber at 20° C and 65% relative humidity until the start of the water resistant test.

Cubes No. 7 to 10 (untreated), intended for compressive strength test:

storage according to DIN 1048 Part 5.

3. Test results

3.1 Screed samples

3.1.1 Mortar prisms

Test date: 21 Aug 2013

Duration of test: 28 days

Table 1: Results of the prism tests according to DIN 1855 Part 3

Prism No.	Dimensions			gross density	flexural strength	compressive strength	
	height mm	length mm	width mm	ρ kg/dm ³	f_{BZ} N/mm ²	f_{Bd} N/mm ² N/mm ²	
1	2	3	4	5	6	7	8
1	39.9	159.3	40.0	2.17	7.1	40.4	39.8
2	39.9	159.2	40.0	2.18	6.3	38.6	40.3
3	39.8	159.4	39.9	2.19	6.6	39.1	40.5
mean values:				2.18	6.7	39.8	

The requirements for a screed ZE 30, as part of a quality audit in accordance with DIN 18560, Part 1 regarding compressive strength:

$$\text{Minimum value } f_{Bmin} \geq 30.0 \text{ N/mm}^2$$

$$\text{Mean value } \bar{f}_B \geq 35.0 \text{ N/mm}^2$$

and flexural strength:

$$\text{mean value } \bar{f}_{BZ} \geq 5.0 \text{ N/mm}^2$$

were met.

3.1.2 Screed plates

The daily weighing of Plate No. II (surface treated) gave rise to the following residual moisture (based on dry weight):

On 11 Aug 2013 on the 18th day: 4.0 mass-%

On 13 Aug 2013 on the 20th day: 3.8 mass-%

In a review of the moisture content of Plate No. III (dimensions 1000 x 1000 x 50 mm), the mean of 3 samples 3.8 mass -% (on a dry weight basis) was calculated

at the age of 28 days.

3.2 Test cubes

3.2.1 Compressive strength

Table 2: Test results according to DIN 1048 Part 5

cube No.	test date	time period days	Dimensions			gross density ρ kg/dm ³	compressive strength f_{c} N/mm ²
			height mm	length mm	width mm		
1	2	3	4	5	6	7	8
10	31.07.13	7	150	151	150	2.38	16.9
7	21.08.13	28	150	150	150	2.37	29.8
8		28	150	151	150	2.36	30.1
9		28	150	151	150	2.36	31.0
mean values after 28 days:						2.36	30.3

The requirements for the compressive strength of a B 25 according to DIN 1045, issue July 1988, Table 1 as part of a quality audit were met.

3.2.2 Water resistance in conformity with DIN 1048 Part 5

According to agreement, the samples were stored in the laboratory of ICT, deviating from DIN 1048 Part 5, not under water, but in laboratory climate at 20° C and 65% relative humidity until after 14 days and then subsequently in a climate chamber until testing started.

All tests were performed from 26.08.2013 to 29 .08.2013 under a test pressure of 0.5 N/mm² (5 bar), where the test pressure, according to agreement, is always applied to the filling direction of the samples.

Age of the samples at the start of test: 33 days

Table 3: Results of water resistant tests:

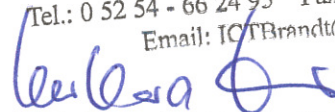
cube No.	treatment of the surfaces	maximum water penetration depth e _{max} mm
1	2	3
1	untreated	142
2		145
6		146
mean value of the untreated samples No. 1 -- 3		144
3 --5	treated with Metasiel	apart from the original inherent moisture of the concrete, no water penetration occurred. A typical water penetration cone was not detected.

Water leak:

While the lateral surfaces of cube 1, 2 and 6 were already exposed to water after 2 days of testing, the side surfaces of the treated samples No. 3-5 remained dry.

Paderborn, 31.08.2013

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