

RN 21228888

Zagreb, 2008-12-22

## TESTING REPORT No. 2122-02-PS/003/08

Client: **BENING d.o.o.**  
Pavlovec Zabočki 121, Zabok

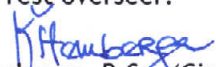
Contract/order: Order No. 01/2008-EB dated 2008-01-03

Construction product: Product **VETROFLUID**


Tested properties: Depth of penetration according to HRN EN 1504-2, Table 3  
Determination of water absorption coefficient by partial immersion according to HRN EN ISO 15148  
Bond strength by pull-off according to HRN EN 1542  
Measurement of abrasion resistance according to HRN EN 1339, annex G and annex H  
Chemical resistance according to HRN EN 13529  
Depth of penetration of water under pressure according to HRN EN 12390-8  
Compatibility on wet concrete according to HRN EN 13578  
Determination of permeability to gases according to EN 993-4

Testing purpose: Testing of product **VETROFLUID** according to IGH offer No. 2122-0-0641/07

Test overseer:

  
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## ANNEXES:

Testing report No. 2752-397/08 (abrasion, annex H)

Testing report No. 2752-398/08 (abrasion, annex H)

Testing report No. 2122-01-V 006/08 (depth of penetration of water under pressure)

Testing report No. 2122-03-PP 001/08 (permeability to gases)

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## 1 GENERAL INFORMATION

Client: BENING d.o.o., Pavlovec Zabočki 121, Zabok  
Produced by: ECOBETON, Vicenza, Italija  
Contract/order: Order No. 01/2008-EB dated 2008-01-03  
Testing purpose: Testing of product *VETROFLUID* according to IGH offer No. 2122-0-0641/07  
Construction product: *VETROFLUID*  
Sample description: Product for achieving watertightness of concrete and for concrete protection  
Sample delivered by: Client representative  
Date of receipt: 2008-01-16

## 2 TESTING PROGRAM

By requirement dated 2007-11-24 it was requested testing of product *VETROFLUID*, product for achieving watertightness of concrete and for concrete protection, producer's *ECOBETON* iz Vicenze, Italija.

Although the product is not closely covered by existing standard specification, the testing programme comprise of tests specified in Tables ZA.1b and ZA.1c (for product for surface protection - impregnation, with intended use for ingress protection and physical resistance) of standard HRN EN 1504-2, *Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems for concrete*.

In addition testing of producer's declared properties are involved.

Testing involves tests for intended use according to HRN EN 1504-2 (No. 1 to 4) and in addition tests of declared characteristics (No. 5 to 8). The testing programme is shown in Table 1.









Following the client request the treatment of specimens with *VETROFLUID* was carried out on concrete of 24 hours age. Product was applied by brush in two layers. After that the specimens were cured in laboratory climate ((20±2)°C i (60±10) % r.h.) for 36 days until full crystallization of product.

After having got first test results, in agreement with client, it was decided that treatment would be carried out also on hardened concrete (age > 28 days) cured according to requirement of standard HRN EN 1766 and that additional tests would be carried out.



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Table 1 Testing program

No.	PROPERTY	TESTING METHOD	CONCRETE TYPE	ACCREDITED METHOD
1.	Penetration depth	HRN EN 1504-2:2004, <i>Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems for concrete, table 3</i>	no saturated aged concrete C(0,70)	
			saturated aged concrete C(0,70)	
2.	Water absorption coefficient	HRN EN ISO 15148:2004, <i>Hygrothermal performance of building materials and products - Determination of water absorption coefficient by partial immersion</i>	saturated aged concrete C(0,70)	
3.	Bond strength	HRN EN 1452:2001, <i>Products and systems for the protection and repair of concrete structures - Test methods - Measurement of bond strength by pull-off</i>	young concrete MC(0,40)	
			saturated aged concrete MC(0,40)	
4.	Abrasion resistance	HRN EN 1339:2004, <i>Concrete paving flags - Requirements and test methods, annex G</i>	young concrete C(0,70)	
			saturated aged concrete C(0,70)	
		HRN EN 1339:2004, <i>Concrete paving flags - Requirements and test methods, annex H (wet and dry abrasion)</i>	saturated aged concrete C(0,70)	
5.	Chemical resistance	HRN EN 13529:2004, <i>Products and systems for the protection and repair of concrete structures - Test method - Resistance to severe chemical attack</i>	saturated aged concrete C(0,45)	NO
6.	Depth of penetration of water under pressure	HRN EN 12390-8:2001, <i>Testing hardened concrete - Part 8: Depth of penetration of water under pressure</i>	saturated aged concrete C(0,70)	
7.	Compatibility on wet concrete	HRN EN 13578:2004, <i>Products and systems for the protection and repair of concrete structures - Test method - Compatibility on wet concrete</i>	young concrete MC(0,40)	
8.	Permeability to gases	EN 993-4:1995, <i>Methods of test for dense shaped refractory products. Determination of permeability to gases</i>	young concrete C(0,70)	
			saturated aged concrete C(0,70)	

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### 3 TEST RESULTS REVIEW

Table 2 Overview of all testing result and comparison with criteria in standard HRN EN 1504-2, table 3

TESTED PROPERTY		TESTING RESULT	CRITERIA	TESTING METHOD
1.	Penetration depth	Substrate: concrete C(0,70)	HRN EN 1504-2, table 4	HRN EN 1504-2 (table 4) i modified method prEN 14630
		Product consumption (no saturated aged concrete): <b>342,3 g/m<sup>2</sup></b>	penetration depth ≥ 5 mm	
		Product consumption (saturated aged concrete): <b>210,6 g/m<sup>2</sup></b>		
		• no saturated aged concrete (>28 days): <b>9,0 mm</b>	Satisfactory	
		• saturated aged concrete (>28 days): <b>10,0 mm</b>	Satisfactory	
2.	Water absorption coefficient	Substrate: concrete C(0,70) Product consumption (saturated aged concrete): <b>550,0 g/m<sup>2</sup></b>	--	HRN EN ISO 15148
		• referent specimen: <b>1,71 kg/m<sup>2</sup> h<sup>-1/2</sup></b> • saturated aged concrete (>28 days): <b>1,31 kg/m<sup>2</sup> h<sup>-1/2</sup></b>	- treated specimens have 23,4% lower water absorption specific coefficient in regard to referent specimens	
3.	Bond strength	Substrate: concrete MC(0,40)	HRN EN 1504-2, table 4	HRN EN 1542
		Product consumption (young concrete): <b>435,2 g/m<sup>2</sup></b>	bond strength: vertical ≥ 0,8 (0,5) N/mm <sup>2</sup> horizontal without trafficking ≥ 1,0 (0,7) N/mm <sup>2</sup> horizontal with trafficking ≥ 1,5 (1,0) N/mm <sup>2</sup>	
		Product consumption (saturated aged concrete): <b>431,1 g/m<sup>2</sup></b>		
		• referent specimen: <b>4,0 N/mm<sup>2</sup></b>	Satisfy all requirements	
		• young concrete (age 24 h): <b>3,5 N/mm<sup>2</sup></b>	Satisfy all requirements	
		• saturated aged concrete (>28 days): <b>3,6 N/mm<sup>2</sup></b>	Satisfy all requirements	

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Continue of table 2.

TESTED PROPERTY		TESTING RESULT	CRITERIA	TESTING METHOD
4.	Abrasion resistance	Substrate: concrete C(0,45) Product consumption (young concrete): <b>383,5 g/m<sup>2</sup></b> Product consumption (saturated aged concrete): <b>398,9 g/m<sup>2</sup></b>	HRN EN 1339, table 6 Class I: testing is not performed Class II: ≤ 26 mm Class III: ≤ 23 mm Class IV: ≤ 20 mm	HRN EN 1339, annex G
		Groove width: • referent specimen: <b>19,9 mm</b> • young concrete (age 24 h): <b>16,7 mm</b> • saturated aged concrete (>28 days): <b>15,8 mm</b>	Class IV: ≤ 20 mm - improved abrasion resistance for 16,0% Class IV: ≤ 20 mm - improved abrasion resistance for 20,6%	
5.	Abrasion resistance	Loss during abrasion: • referent specimen: <b>12,4 cm<sup>3</sup> / 50 cm<sup>2</sup></b> • saturated aged concrete (>28 days): <b>12,3 cm<sup>3</sup> / 50 cm<sup>2</sup></b>	HRN 1128 Class XM1: ≤ 25 cm <sup>3</sup> / 50 cm <sup>2</sup> Class XM2: ≤ 21 cm <sup>3</sup> / 50 cm <sup>2</sup> Class XM3: ≤ 18 cm <sup>3</sup> / 50 cm <sup>2</sup> Class XM3: ≤ 18 cm <sup>3</sup> / 50 cm <sup>2</sup> - no difference between referent and treated specimens	HRN EN 1339, annex H
6.	Depth of penetration of water under pressure	Substrate: concrete C(0,70) Product consumption (saturated aged concrete): <b>398,9 g/m<sup>2</sup></b>	HRN 1128 Class V1: ≤ 50 mm Class V2: ≤ 30 mm Class V3: ≤ 20 mm	HRN EN 12390-8
		Depth of penetration of water under pressure: • referent specimen: <b>69,5 mm</b> • saturated aged concrete (>28 days): <b>55,0 mm</b>	- referent and treated specimens have higher water penetration depth than required for class V1 - treated specimens have 20,9% lower water penetration depth in regard to referent specimens	



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Continue of table 2.

TESTED PROPERTY		TESTING RESULT		CRITERIA	TESTING METHOD	
7.	Chemical resistance	Substrate: concrete C(0,45) Product consumption (saturated aged concrete): <b>398,9 g/m<sup>2</sup></b>		EN ISO 4628-2, EN ISO 4628-4, EN ISO 4628-5 + HRN EN 1542	HRN EN 13529	
				a) no blistering, cracking, flaking and change of colour/shine b) bond strength after chemical exposing: vertical ≥ 0,8 (0,5) N/mm <sup>2</sup> horizontal without traffic ≥ 1,0 (0,7) N/mm <sup>2</sup> horizontal with traffic ≥ 1,5 (1,0) N/mm <sup>2</sup>		
				Treated saturated aged concrete after chemical exposure during 3 days:		
		chemical type	visual assessment	bond strength after testing		
		Trichloroethylene	no changes	4,0 N/mm <sup>2</sup>		Satisfactory
		HCl (10%)	change of colour and low surface flaking	2,0 N/mm <sup>2</sup>		Unsatisfactory, because of surface flaking
		NaOH	no changes	4,4 N/mm <sup>2</sup>		Satisfactory
		Motor oil	no changes	3,8 N/mm <sup>2</sup>		Satisfactory
		Treated saturated aged concrete after chemical exposure during 28 days:				
		Trichloroethylene	no changes	2,7 N/mm <sup>2</sup>		Satisfactory
		HCl (10%)	change of colour and severe surface flaking	0,7 N/mm <sup>2</sup>		Unsatisfactory
		NaOH	small surface flaking	0,3 N/mm <sup>2</sup>		Unsatisfactory
		Motor oil	no changes	3,2 N/mm <sup>2</sup>		Satisfactory
		Referent saturated aged concrete after chemical exposure during 28 days:				
		Trichloroethylene	no changes	2,8 N/mm <sup>2</sup>		Satisfactory
		HCl (10%)	change of colour and severe surface flaking	0,6 N/mm <sup>2</sup>		Unsatisfactory
		NaOH	small surface flaking	0,3 N/mm <sup>2</sup>		Unsatisfactory
		Motor oil	no changes	3,1 N/mm <sup>2</sup>		Satisfactory

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Continue of table 2.

TESTED PROPERTY		TESTING RESULT	CRITERIA			TESTING METHOD
8.	Compatibility on wet concrete	Substrate: concrete MC(0,40) Product consumption (young concrete): <b>264,9 g/m<sup>2</sup></b>	HRN EN 1504-2, table 3			HRN EN 13578
		a) no blistering, no cracking, no flaking and no change of colour/shine b) bond strength after test $\geq 1,5$ N/mm <sup>2</sup> , fracture must be $> 50\%$ in concrete				
		a) no changes on concrete surface after testing b) treated referent specimens bond strength <b>4,1 N/mm<sup>2</sup></b> treated tested specimens bond strength <b>4,0 N/mm<sup>2</sup></b>	Satisfactory  Satisfactory  Satisfactory			
9.	Permeability to gases	Substrate: concrete C(0,70) Product consumption (young concrete): <b>601,2 g/m<sup>2</sup></b>	From literature (Ukrainczyk, Bjęgović)			EN 993-4
			Permeability (cm <sup>2</sup> )	Concrete permeability	Concrete quality	
			$< 10^{-14}$	low	good	
			$10^{-14} - 10^{-12}$	moderate	moderate	
			$> 10^{-12}$	high	bad	
		Permeability specific coefficient: • referent specimen: <b>0,946×10<sup>-12</sup> cm<sup>2</sup></b> • saturated aged concrete (>28 days): <b>0,535×10<sup>-12</sup> cm<sup>2</sup></b>	- referent and treated specimens have moderate permeability in regard to permeability specific coefficient - treated specimens have <b>43,4%</b> lower permeability specific coefficient in regard to referent specimens			



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## 4 SINGLE TEST RESULTS

### 4.1 PENETRATION DEPTH TEST RESULTS

Tested property: Measurement of depth of penetration  
Testing carried out according to: HRN EN 1504-2, table 3  
Substrate type/test specimens: Referent concrete C (0,70), label LB-39/07, dated 2007-11-15  
2 cubes, dimension 100×100×100 mm - 1 day old concrete  
2 cubes, dimension 100×100×100 mm - >28 days aged no saturated concrete  
2 cubes, dimension 100×100×100 mm - >28 days aged saturated concrete  
Substrate preparation: --  
Treatment procedure: The treatment was carried out according to the standard requirement. Each surface was immersed in impregnation during 120 sec (60 ml of impregnation in Petri dish ø150 mm). Consumption during treatment was not reached, so the treatment was carried out in two layers. Producer recommendation for product consumption is 345-460 g/m<sup>2</sup>. Product consumption for depth of penetration test is given in Table 3.  
Treatment date: 2008-02-21 to 22, 2008-02-28 to 29  
Conditioning after treatment: In laboratory conditions (20±2)°C and (60±10) % r.h.  
Test date: 2008-04-09  
Equipment used: Mettler Toledo balance (apparatus code 1977); Vernier claipe, (a.c. 2281)  
Test location: Laboratory for concrete, mortar and repair materials 2 2122  
Note: None  
Deviation from standard method of testing: None

Table 3 Product consumption during treatment

SPECIMEN	LAYER	SURFACE (g)						Mean value (g)	C <sub>mi</sub> (g/m <sup>2</sup> )	Total consumption of 1. and 2. layer (g/m <sup>2</sup> )	C <sub>m</sub> (g/m <sup>2</sup> )
		1	2	3	4	5	6				
YOUNG CONCRETE											
PS 003-1/1T	I	2,84	1,40	1,79	2,00	2,10	1,93	2,01	201,0	415,5	411,4
	II	2,29	1,96	2,34	1,84	2,13	2,31	2,15	214,5		
PS 003-1/2T	I	2,86	1,09	1,77	1,86	2,03	2,03	1,94	194,0	407,2	
	II	2,35	1,94	2,35	1,70	2,04	2,41	2,13	213,2		
SATURATED AGED CONCRETE											
PS 003-1/3T	I	4,04	2,07	2,74	2,65	2,46	2,07	2,67	267,2	362,3	342,3
	II	0,95	0,69	0,64	1,35	0,97	1,11	0,95	95,2		
PS 003-1/4T	I	3,45	1,63	2,40	1,90	2,40	2,44	2,37	237,0	322,2	
	II	0,77	0,54	0,95	0,87	1,01	0,97	0,85	85,2		
NO SATURATED AGED CONCRETE											
PS 003-1/5T	I	1,37	0,81	1,13	1,26	1,69	1,12	1,23	123,0	225,7	210,6
	II	0,91	0,76	1,39	0,86	1,60	0,64	1,03	102,7		
PS 003-1/6T	I	1,08	0,68	1,07	1,05	1,77	0,97	1,10	110,3	195,5	
	II	0,83	0,66	0,71	0,82	1,57	0,52	0,85	85,2		

Test results refer only to the tested specimens.  
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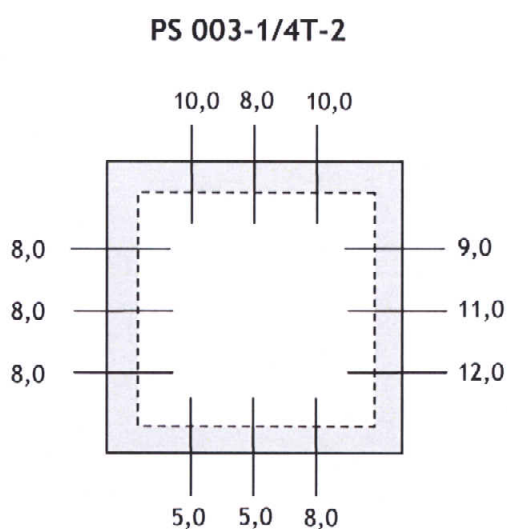
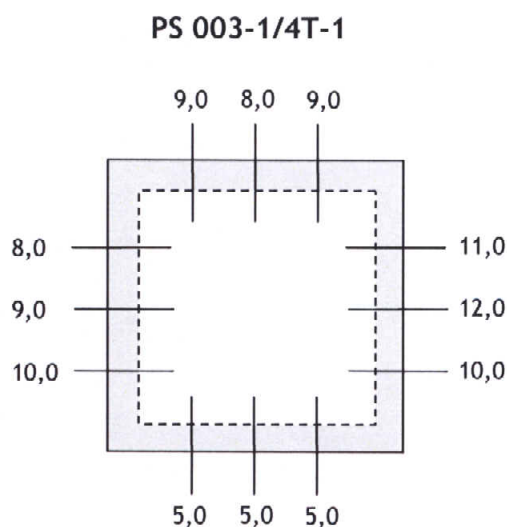
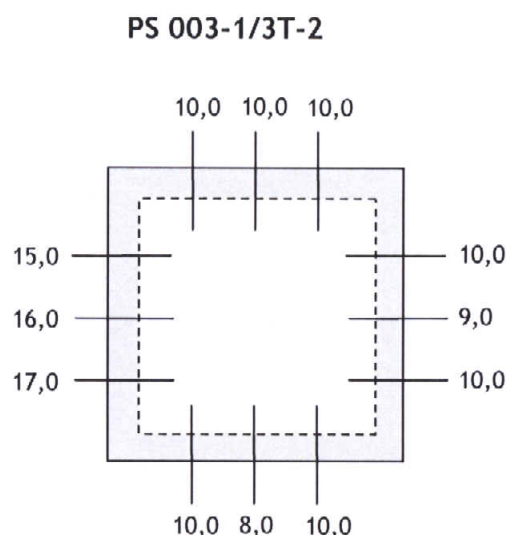
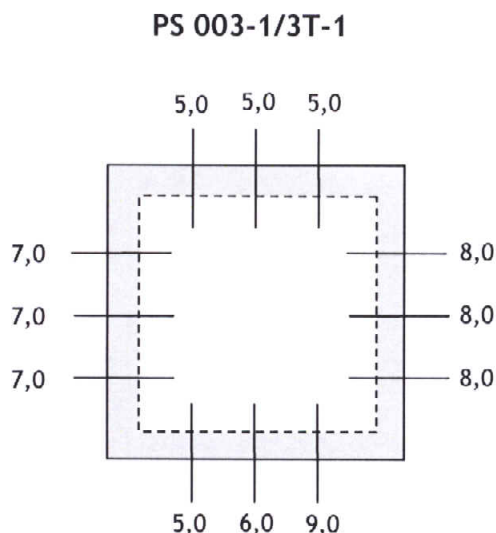
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Table 4 Depth of penetration test result

SPECIMEN	SINGLE VALUE OF PENETRATION DEPTH AND MEAN VALUE DUBINE OF PENETRATION DEPTH BY SURFACE (mm)												PENETRATION DEPTH (mm)			
	SURFACE 1 (upper surface)			SURFACE 2 (side surface)			SURFACE 3 (bottom surface)			SURFACE 4 (side surface)			average	min.	max.	
YOUNG CONCRETE																
PS 003-1/1T	Not possible to measure penetration depth of product in concrete.												0,0	0,0	0,0	
PS 003-1/2T	Not possible to measure penetration depth of product in concrete.												0,0	0,0	0,0	
SATURATED AGED CONCRETE																
PS 003-1/3T	1	5,0	5,0	5,0	8,0	8,0	8,0	9,0	6,0	5,0	7,0	7,0	7,0	6,7	5,0	9,0
		5,0			8,0			6,7			7,0					
	2	10,0	10,0	10,0	10,0	9,0	10,0	10,0	8,0	10,0	17,0	16,0	15,0	11,3	8,0	17,0
		10,0			9,7			9,3			16,0					
PS 003-1/4T	1	9,0	8,0	9,0	11,0	12,0	10,0	5,0	5,0	5,0	10,0	9,0	8,0	8,4	5,0	12,0
		8,7			11,0			5,0			9,0					
	2	10,0	8,0	10,0	9,0	11,0	12,0	8,0	5,0	5,0	8,0	8,0	8,0	8,5	5,0	12,0
		9,3			10,7			6,0			8,0					
NO SATURATED AGED CONCRETE																
PS 003-1/5T	1	8,0	7,0	10,0	12,0	12,0	9,0	14,0	10,0	11,0	16,0	16,0	15,0	11,7	7,0	16,0
		8,3			11,0			11,7			15,7					
	2	11,0	9,0	12,0	10,0	9,0	13,0	5,0	5,0	5,0	8,0	9,0	11,0	8,9	5,0	13,0
		5,0			10,7			10,7			9,3					
PS 003-1/6T	1	14,0	13,0	9,0	9,0	9,0	9,0	10,0	9,0	9,0	8,0	7,0	8,0	9,5	7,0	14,0
		12,0			9,0			9,3			7,7					
	2	15,0	11,0	11,0	11,0	11,0	11,0	7,0	8,0	7,0	11,0	11,0	11,0	10,4	7,0	15,0
		12,3			11,0			7,3			11,0					

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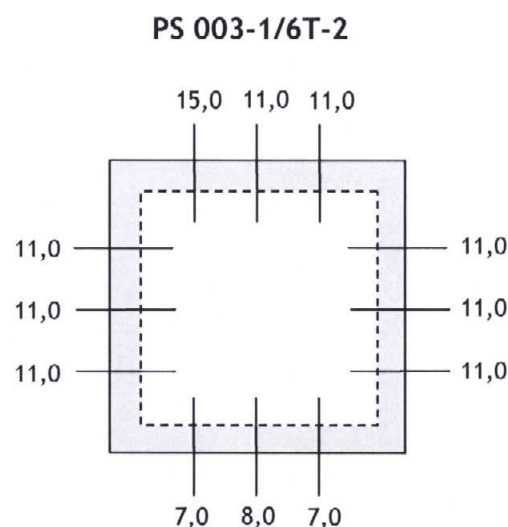
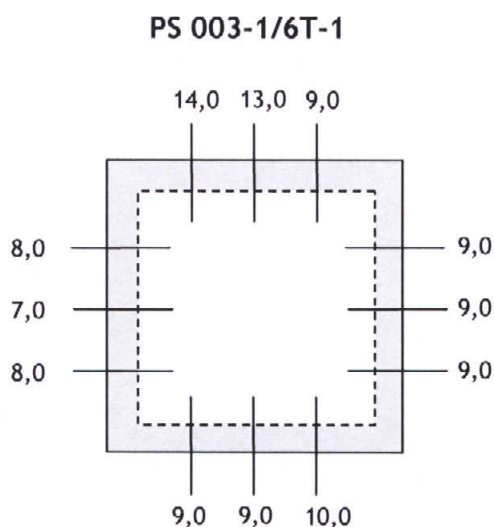
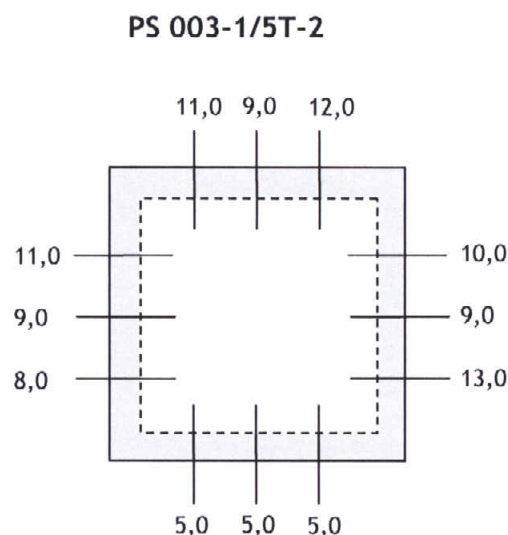
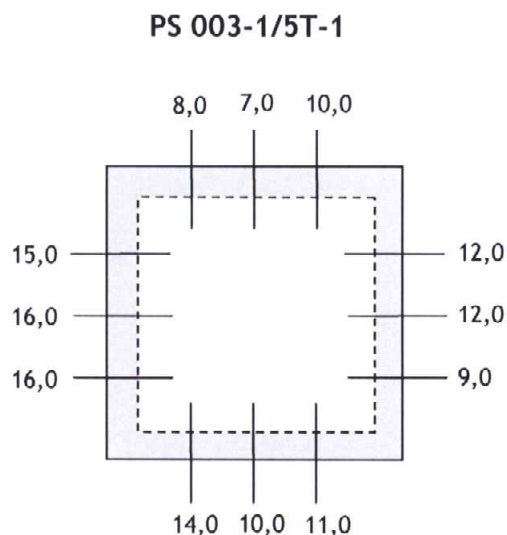
Figure 1 Schematic view of measured penetration depth on fractured surface of saturated aged concrete (measures u mm):





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Figure 2 Schematic view of measured penetration depth on fractured surface of saturated aged concrete (measures u mm):



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PS 003-1/1T-1

PS 003-1/1T-2

PS 003-1/2T-1

PS 003-1/2T-2

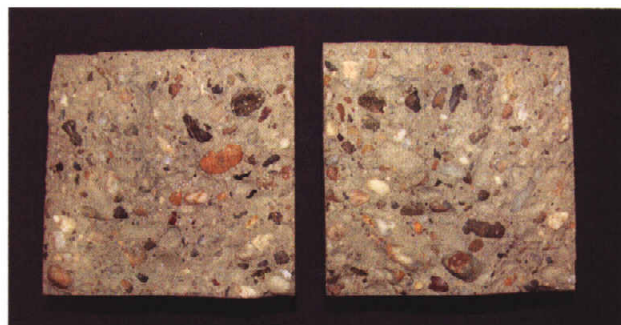


Figure 3 Pictures of fracture surface of young concrete on witch is not possible to measure penetration depths

PS 003-1/3T-1

PS 003-1/3T-2

PS 003-1/4T-1

PS 003-1/4T-2

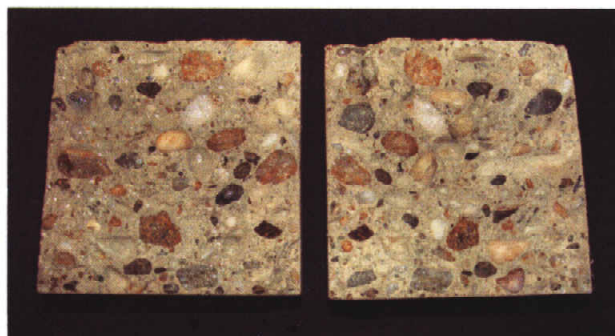


Figure 4 Pictures of fracture surface of no saturated aged concrete on witch are measured penetration depths

PS 003-1/5T-1

PS 003-1/5T-2

PS 003-1/6T-1

PS 003-1/6T-2

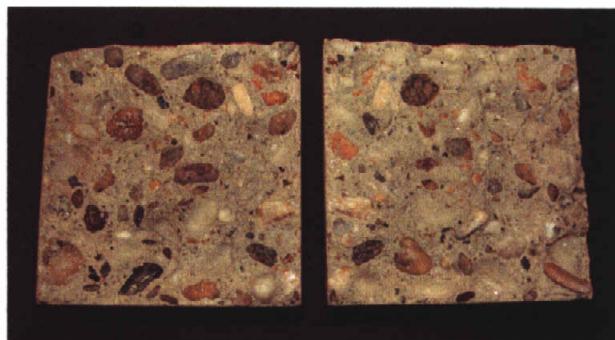


Figure 5 Pictures of fracture surface of saturated aged concrete on witch are measured penetration depths

Statement: Testing was carried out in according with standard, except as detailed from given in „Deviation from standard method of testing“.

Test results refer only to the tested specimens.  
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## 4.2 WATER ABSORPTION COEFFICIENT TEST RESULTS

Tested property:	Determination of water absorption coefficient by partial immersion
Testing carried out according to:	HRN EN 15148
Treatment procedure:	The treatment was carried out according to client recommendation. Product is applied in two layers with brush. Producer recommendation for product consumption is 345-460 g/m <sup>2</sup> . Product consumption for testing is given in Table 7.
Treatment date:	2008-04-21 i 2008-04-22
Curing:	24 h in laboratory conditions (21 ± 2) °C and (60 ± 10) % r.h. 27 days in wet chamber on (21 ± 2) °C i > 95 % r.h.
Conditioning:	Until testing in laboratory conditions on (21 ± 2) °C and (60 ± 10) % r.h.
Sample production:	Cores (Ø100 mm) are drilled from concrete slabs (dimension 300/300/100 mm) and saw on height of 50 mm
Test date:	2008-07-15 until 2008-07-16
Test location:	Laboratory for concrete, mortar and repair materials 2 2122
Equipment used:	Grinding equipment (a.c. 1138); Vernier claiper, (a.c. 2281), Mettler Toledo balance (apparatus code 2930); Stopwatch (a.c. 269)
Deviation from standard method of testing:	None
Note:	None

Table 5 Product consumption during treatment

SAMPLE	LAYER	C <sub>mi</sub> (g/m <sup>2</sup> )	Total consumption of 1 <sup>st</sup> and 2 <sup>nd</sup> layer (g/m <sup>2</sup> )
<b>SATURATED AGED CONCRETE</b>			
CONCRETE SLAB 300/300/100 mm	I	264,44	550,0
	II	285,56	



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Table 6 Results of testing water absorption coefficient on treated specimens

SAMPLE		PS 003-2/1T			PS 003-2/2T			PS 003-2/3T		
$\phi$ (mm)		98,5			98,7			98,6		
h (mm)		49,6			49,7			50,0		
P (mm <sup>2</sup> )		7621			7653			7635		
$\rho_{dry}$ (kg/dm <sup>3</sup> )		2,21			2,22			2,21		
time		m	m <sub>v</sub>	A	m	m <sub>v</sub>	A	m	m <sub>v</sub>	A
h	h <sup>1/2</sup>	g	kg/m <sup>2</sup>	kg/m <sup>2</sup> h <sup>1/2</sup>	g	kg/m <sup>2</sup>	kg/m <sup>2</sup> h <sup>1/2</sup>	g	kg/m <sup>2</sup>	kg/m <sup>2</sup> h <sup>1/2</sup>
0,00	0,00	835,41	0,00		842,78	0,00		843,57	0,00	
0,02	0,13	836,17	0,10	0,77	844,03	0,16	1,27	844,75	0,15	1,20
0,08	0,29	836,94	0,20	0,70	845,15	0,31	1,07	846,02	0,32	1,11
0,25	0,50	838,10	0,35	0,71	846,73	0,52	1,03	847,72	0,54	1,09
0,50	0,71	839,25	0,50	0,71	848,14	0,70	0,99	849,17	0,73	1,04
1,00	1,00	841,01	0,73	0,73	850,55	1,02	1,02	851,76	1,07	1,07
2,00	1,41	844,10	1,14	0,81	854,80	1,57	1,11	856,20	1,65	1,17
4,00	2,00	849,30	1,82	0,91	861,90	2,50	1,25	863,41	2,60	1,30
9,00	3,00	860,27	3,26	1,09	874,83	4,19	1,40	876,82	4,36	1,45
25,00	5,00	880,01	5,85	1,17	888,43	5,96	1,19	891,65	6,30	1,26
A by linear regression		0-24 h			0-24 h			0-24 h		
		1,18			1,25			1,32		

Table 7 Results of testing water absorption coefficient on referent specimens

SAMPLE		PS 003-2/4R			PS 003-2/5R			PS 003-2/6R		
$\phi$ (mm)		98,7			99,0			98,7		
h (mm)		49,8			49,6			50,1		
P (mm <sup>2</sup> )		7647			7697			7652		
$\rho_{dry}$ (kg/dm <sup>3</sup> )		2,19			2,18			2,20		
time		m	m <sub>v</sub>	A	m	m <sub>v</sub>	A	m	m <sub>v</sub>	A
h	h <sup>1/2</sup>	g	kg/m <sup>2</sup>	kg/m <sup>2</sup> h <sup>1/2</sup>	g	kg/m <sup>2</sup>	kg/m <sup>2</sup> h <sup>1/2</sup>	g	kg/m <sup>2</sup>	kg/m <sup>2</sup> h <sup>1/2</sup>
0,00	0,00	835,02	0,00		832,14	0,00		842,94	0,00	
0,02	0,13	837,00	0,26	2,01	834,26	0,28	2,13	844,85	0,25	1,93
0,08	0,29	838,45	0,45	1,55	835,94	0,49	1,71	846,35	0,45	1,54
0,25	0,50	840,53	0,72	1,44	838,17	0,78	1,57	848,40	0,71	1,43
0,50	0,71	842,63	1,00	1,41	840,41	1,07	1,52	850,58	1,00	1,41
1,00	1,00	846,10	1,45	1,45	844,01	1,54	1,54	854,21	1,47	1,47
2,00	1,41	852,10	2,23	1,58	850,00	2,32	1,64	860,30	2,27	1,60
4,00	2,00	860,25	3,30	1,65	858,61	3,44	1,72	869,09	3,42	1,71
9,00	3,00	873,93	5,09	1,70	871,50	5,11	1,70	882,82	5,21	1,74
25,00	5,00	883,31	6,31	1,26	879,39	6,14	1,23	891,28	6,32	1,26
A by linear regression		0-24 h			0-24 h			0-24 h		
		1,69			1,71			1,74		

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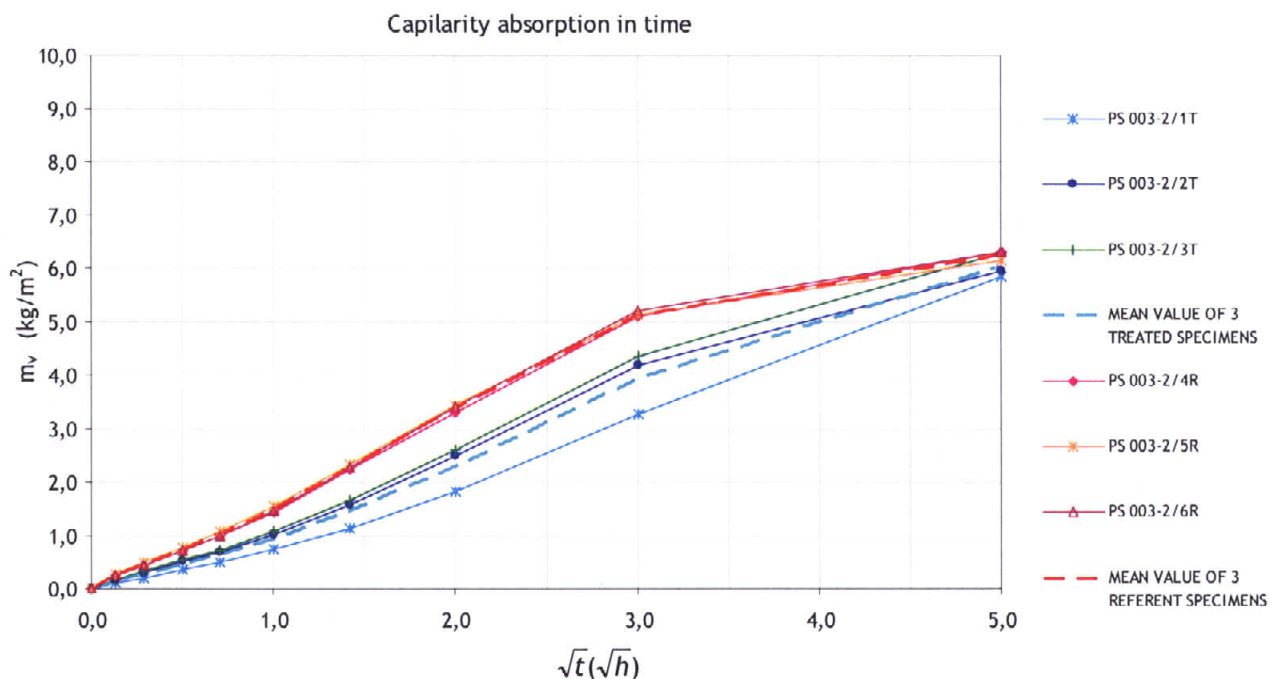


Figure 6 Diagram of testing water absorption coefficient on treated and referent specimens

Statement: Testing was carried out in according with standard, except as detailed from given in „Deviation from standard method of testing“.

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### 4.3 BOND STRENGTH TEST RESULTS

Tested property: Measuring of bond strength by pull-off method  
Testing carried out according to: HRN EN 1542  
Substrate: Concrete slab (300x300x100) mm, grit-blasted surface. Concrete type MC(0,40) according to HRN EN 1766, label LB-14/08  
Treatment procedure: The treatment was carried out according to client recommendation. Product is applied in two layers with brush. Producer recommendation for product consumption is 345-460 g/m<sup>2</sup>. Product consumption for testing is given in Table 8.  
Treatment date: Young concrete 2008-02-21 i 2008-02-22  
Saturated aged concrete 2008-04-21 i 2008-04-22  
Curing: 24 h in laboratory conditions (21 ± 2) °C i (60 ± 10) % r.h. covered in film  
27 day in wet chamber (21 ± 2) °C i > 95 % r.h.  
Conditioning: In laboratory conditions (21 ± 2) °C i (60 ± 10) % r.h.  
Test date: Young concrete 2008-06-06  
Saturated aged concrete 2008-06-17  
Test location: Laboratory for concrete, mortar and repair materials 2 2122  
Equipment used: Grinding equipment (a.c. 1138); Pull-off apparatus (a.c. 1987); Vernier claiper, (a.c. 2281)  
Type of adhesive: MG Spezialkleber  
Deviation from standard method of testing: None  
Note: None  
Type of failure marks: A - substrate (concrete), Y - adhesive  
Testing scheme:

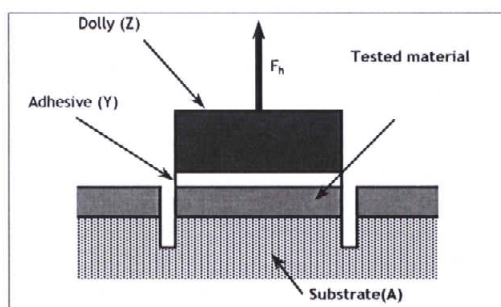


Table 8 Product consumption during treatment

SAMPLE	LAYER	C <sub>mi</sub> (g/m <sup>2</sup> )	Total consumption of 1 <sup>st</sup> and 2 <sup>nd</sup> layer (g/m <sup>2</sup> )
YOUNG CONCRETE			
CONCRETE SLAB 300/300/100 mm	I	226,33	435,22
	II	208,89	
SATURATED AGED CONCRETE			
CONCRETE SLAB 300/300/100 mm	I	216,67	431,11
	II	214,44	

Test results refer only to the tested specimens.  
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Table 9 Testing result of bond strength

SAMPLE	FAILURE LOAD (kN)	MEAN DIAMETER TESTED SPECIMEN (mm)	BOND STRENGTH (MPa)			TYPE OF FAILURE
			single	minimal value	mean value	
REFERENT CONCRETE						
PS 003-3/1-1	8,87	50,2	4,5	3,7	4,0	100 % A
PS 003-3/1-2	7,60	50,3	3,8			100 % A
PS 003-3/1-3	7,26	50,3	3,7			100 % A
PS 003-3/1-4	7,52	50,3	3,8			100 % A
PS 003-3/1-5	8,70	50,4	4,4			100 % A
YOUNG CONCRETE						
PS 003-3/2-1	6,93	50,4	3,5	3,4	3,5	100 % A
PS 003-3/2-2	7,07	50,3	3,6			100 % A
PS 003-3/2-3	6,68	50,4	3,4			100 % A
PS 003-3/2-4	7,23	50,3	3,6			100 % A
PS 003-3/2-5	6,72	50,4	3,4			100 % A
SATURATED AGED CONCRETE						
PS 003-3/3-1	6,42	50,3	3,2	3,1	3,6	100 % A
PS 003-3/3-2	6,05	50,2	3,1			100 % A
PS 003-3/3-3	8,99	50,3	4,5			100 % A
PS 003-3/3-4	7,81	50,3	3,9			100 % A
PS 003-3/3-5	6,58	50,4	3,3			100 % A

Statement: Testing was carried out in according with standard, except as detailed from given in „Deviation from standard method of testing“.

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#### 4.4 ABRASIVE RESISTANCE TEST RESULTS, annex G

Tested property: Testing of abrasive resistance  
Testing carried out according to: HRN EN 1339, annex G  
Substrate type/test specimens: Concrete slab (300x300x100) mm, grit-blasted surface. Concrete type C(0,45) according to HRN EN 1766, label LB-38/07  
Treatment procedure: The treatment was carried out according to client recommendation. Product is applied in two layers with brash. Producer recommendation for product consumption is 345-460 g/m<sup>2</sup>. Product consumption for testing is given in Table 10.  
Treatment date: Young concrete 2008-02-21 i 2008-02-22  
Saturated aged concrete 2008-04-21 i 2008-04-22  
Curing: 24 h in laboratory conditions (21 ± 2) °C i (60 ± 10) % r.h. covered in film  
27 day in wet chamber (21 ± 2) °C i > 95 % r.h.  
Conditioning: In laboratory conditions (21 ± 2) °C i (60 ± 10) % r.h.  
Test date: Young concrete 2008-06-06  
Saturated aged concrete 2008-06-17  
Test location: Laboratory for concrete, mortar and repair materials 2 2122  
Equipment used: Wearing machine (a.c. 2383); Vernier claiper, (a.c. 2281)  
Deviation from standard  
method of testing: None  
Note: None

Table 10 Product consumption during treatment

SAMPLE	LAYER	C <sub>mi</sub> (g/m <sup>2</sup> )	Total consumption of 1 <sup>st</sup> and 2 <sup>nd</sup> (g/m <sup>2</sup> )
YOUNG CONCRETE			
CONCRETE SLAB 300/300/100 mm	I	226,33	435,22
	II	208,89	
SATURATED AGED CONCRETE			
CONCRETE SLAB 300/300/100 mm	I	216,67	431,11
	II	214,44	

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Table 11 Testing results of abrasive resistance, annex G

SAMPLE	SINGLE GROOVE VALUES (mm)			MEAN GROOVE VALUE (mm)
	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	
REFERENT CONCRETE				
PS 003-4A/1	19,8	19,9	20,1	19,9
PS 003-4A/2	19,6	19,7	19,8	
PS 003-4A/3	20,2	19,9	19,8	
YOUNG CONCRETE				
PS 003-4A/4	16,9	16,5	16,1	16,7
PS 003-4A/5	16,3	17,0	17,8	
PS 003-4A/6	16,9	16,5	16,4	
SATURATED AGED CONCRETE				
PS 003-4A/7	16,7	16,6	16,6	15,8
PS 003-4A/8	15,0	15,1	15,1	
PS 003-4A/9	16,7	15,6	14,4	

Statement: Testing was carried out in according with standard, except as detailed from given in „Deviation from standard method of testing“.



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#### 4.5 CHEMICAL RESISTANCE TEST RESULTS

Tested property: Resistance to severe chemical attack  
Testing carried out according to: HRN EN 13529  
Treatment procedure: The treatment was carried out according to client recommendation. Product is applied in two layers with brash. Producer recommendation for product consumption is 345-460 g/m<sup>2</sup>. Product consumption for testing is given in Table 12.

Substrate type/test specimens: 2 concrete slabs (300×300×60 mm), grit-blasted surface. Concrete type C (0,45) according to HRN EN 1766, label LB-13/08

Type of testing liquid: trichloroethylene  
HCl (10%)  
NaOH  
Motor oil

Duration of exposure: 3 and 28 days  
Conditions during test: Laboratory conditions (21±2) °C and (60±10)% r.h.

Datum postavljanja kemikalija: 2008-04-09  
Date of testing pull off: 2008-05-13 i 2008-06-26  
Equipment used: Grinding equipment (a.c. 1138); Pull-off apparatus (a.c. 1987); Vernier claipe, (a.c. 2281)

Test location: Laboratory for concrete, mortar and repair materials 2 2122  
Type of adhesive: Sikadur 31 Rapid  
Deviation from standard  
method of testing: None  
Note: The standard predicts testing of hardness by Bucholz or Shore, or testing of bond strength. Testing of bond strength is carried out according to standard HRN EN 1542 on non exposed surface, and on surface after exposure of chemicals. The testing is carried out without pressure.

Scheme of testing bond strength:

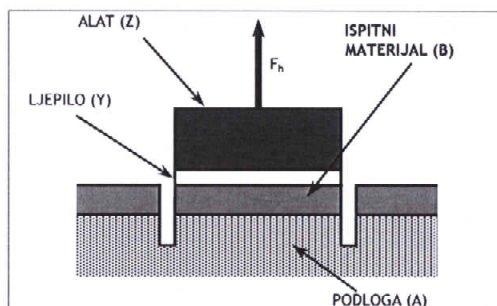


Table 12 Product consumption during treatment

SAMPLE	LAYER	C <sub>ml</sub> (g/m <sup>2</sup> )	Total consumption of 1 <sup>st</sup> and 2 <sup>nd</sup> layer (g/m <sup>2</sup> )
<b>SATURATED AGED CONCRETE</b>			
PS 003-6/1	I	214,44	405,33
	II	190,89	
PS 003-6/2	I	223,22	430,55
	II	207,33	

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Table 13 Visual assessment after chemical exposure

CHEMICAL TYPE	DAYS	ASSESSMENT OF DEGREE OF FLAKING ACCORDING TO HRN EN ISO 4628-5			ASSESSMENT OF DEFECTS AND OF INTENSITY OF CHANGES ACCORDING TO EN ISO 4628-1
		DESCRIPTION	QUANTITY	SIZE	
trichloroethylene	3	no changes	0	0	0
	28	no changes	0	0	0
	28 - ref	no changes	0	0	0
HCl (10%)	3	flaking up to 1 mm depth	5 (100% flaked area)	1	5
	28	flaking up to 6 mm depth	5 (100% flaked area)	3	5
	28 - ref	flaking up to 8 mm depth	5 (100% flaked area)	3	5
NaOH	3	no changes	0	0	0
	28	flaking up to 0,1 mm depth	4	1	3
	28 - ref	flaking up to 0,3 mm depth	5	1	3
motor oil	3	no changes	0	0	0
	28	no changes	0	0	0
	28 - ref	no changes	0	0	0
		Note:	0 - 0 % flaked area 1 - 0,1 % flaked area 2 - 0,3 % flaked area 3 - 1 % flaked area 4 - 3 % flaked area 5 - 15 % flaked area	0 - no visible under ×10 magnification 1 - up to 1 mm 2 - up to 3 mm 3 - up to 10 mm 4 - up to 30 mm 5 - larger than 30 mm	0 - no detectable defects 1 - barely significant number of defects 2 - small but significant number of defects 3 - moderate number of defects 4 - considerable number of defects 5 - dense pattern of defects

Table 14 Bond strength results after chemical exposure

SAMPLE	CHEMICAL TYPE	FAILURE LOAD (kN)	MEAN DIAMETER TESTED SPECIMEN (mm)	BOND STRENGTH (N/mm <sup>2</sup> )	TYPE OF FAILURE
<b>BOND STRENGTH OF REFERENCE SURFACE</b>					
PS 003-3/1	--	--	--	4,0	--
<b>BOND STRENGTH OF TREATED SURFACE (after 3 day exposure)</b>					
PS 003-6/1	trichloroethylene	8,03	50,4	4,0	100 % A
PS 003-6/2	HCl (10%)	4,06	50,6	2,0	100 % A
PS 003-6/3	NaOH	8,64	50,3	4,4	100 % A
PS 003-6/4	motor oil	7,50	50,4	3,8	100 % A
<b>BOND STRENGTH OF TREATED SURFACE (after 28 day exposure)</b>					
PS 003-6/5	trichloroethylene	5,30	50,3	2,7	100 % A
PS 003-6/6	HCl (10%)	1,37	50,5	0,7	100 % A
PS 003-6/7	NaOH	0,59	50,2	0,3	100 % A
PS 003-6/8	motor oil	6,28	50,3	3,2	100 % A
<b>BOND STRENGTH OF UNTREATED SURFACE (after 28 day exposure)</b>					
PS 003-6/9	trichloroethylene	5,50	50,3	2,8	100 % A
PS 003-6/10	HCl (10%)	1,18	50,4	0,6	100 % A
PS 003-6/11	NaOH	0,59	50,1	0,3	100 % A
PS 003-6/12	motor oil	6,09	50,1	3,1	100 % A

Statement: Testing was carried out in according with standard, except as detailed from given in „Deviation from standard method of testing“.

Test results refer only to the tested specimens.

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#### 4.6 TEST RESULTS OF COMPATIBILITY ON WET CONCRETE

Tested property:	Compatibility on wet concrete
Testing carried out according to:	HRN EN 13587
Substrate type/test specimens:	4 referent slabs (300 x 300 x 60) mm, concrete type MC(0,40) according to HRN EN 1766, label (LB14/08) Specimens marks: PS 003-8/1, PS 003-8/2 - treated stored in water PS 003-8/3, PS 003-8/4 - treated referent
Substrate preparation:	Grit-blasted surface
Roughness index:	Tested according to HRN EN 1766, subparagraph 7; roughness index: 0,31
Treatment procedure:	The treatment was carried out according to client recommendation. Product is applied in two layers with brush. Producer recommendation for product consumption is 345-460 g/m <sup>2</sup> . Product consumption for testing is given in Table 15.
Minimum permitted application temperature (MAT):	5 °C
Test date:	2008-04-10 until 2008-06-16
Date of treatment:	2008-04-17
Test location:	Laboratory for concrete, mortar and repair materials 2 2122
Equipment used:	Climatic chamber Hereaus (a.c. 315); Grinding equipment (a.c. 1138); Pull-off apparatus (a.c. 1987); Vernier claiper, (a.c. 2281)
Deviation from standard method of testing:	None
Note:	None

Table 15 Product consumption during treatment

SAMPLE	LAYER	C <sub>mi</sub> (g/m <sup>2</sup> )	Total consumption of 1 <sup>st</sup> and 2 <sup>nd</sup> layer (g/m <sup>2</sup> )
<b>YOUNG CONCRETE</b>			
PS 003-8/1	I	264,89	532,00
	II	267,11	
PS 003-8/2	I	274,78	530,67
	II	255,89	
PS 003-8/3	I	242,39	510,24
	II	267,85	
PS 003-8/4	I	259,11	521,40
	II	265,29	

Table 16 Visual assessment of surface (in cycles of 7 days)

Deviation of surface	Specimens stored in water on 5 °C	Referent specimens stored in condition 5 °C and (75 ± 10) % r.h.
Colour change according to HRN EN ISO 4628-1	no changes	no changes
Degree of blistering according to HRN EN ISO 4628-2	no changes	no changes
Degree of flaking according to HRN EN ISO 4628-5	no changes	no changes



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Table 17 Bond strength after conditioning according to HRN EN 1542

SPECIMEN	FAILURE LOAD (kN)	MEAN DIAMETER TESTED SPECIMEN (mm)	BOND STRENGTH (MPa)		TYPE OF FAILURE
			single	mean value	
SPECIMENS STORED IN WATER AND ON 5 °C					
PS003-8/1-1	7,40	50,2	3,75	3,8	100 % A
PS003-8/1-2	8,27	50,1	4,19		100 % A
PS003-8/1-3	6,81	50,2	3,44		100 % A
PS003-8/1-4	6,54	50,2	3,30		100 % A
PS003-8/1-5	8,11	50,2	4,10		100 % A
PS003-8/2-1	8,72	50,2	4,40	4,1	100 % A
PS003-8/2-2	8,50	50,2	4,30		100 % A
PS003-8/2-3	7,21	50,3	3,63		100 % A
PS003-8/2-4	7,26	50,3	3,66		100 % A
PS003-8/2-5	8,80	50,2	4,45		100 % A
REFERENT SPECIMENS STORED IN CONDITIONS 5 °C AND (75 ± 10) % r.h.					
PS003-8/3-1	7,76	50,2	3,92	4,1	100 % A
PS003-8/3-2	8,50	50,2	4,30		100 % A
PS003-8/3-3	8,93	50,3	4,50		100 % A
PS003-8/3-4	7,91	50,2	4,00		100 % A
PS003-8/3-5	7,80	50,2	3,94		100 % A
PS003-8/4-1	8,15	50,1	4,13	4,1	100 % A
PS003-8/4-2	8,89	50,2	4,49		100 % A
PS003-8/4-3	7,13	50,2	3,60		100 % A
PS003-8/4-4	8,52	50,2	4,31		100 % A
PS003-8/4-5	7,78	50,2	3,93		100 % A

Statement: Testing was carried out in according with standard, except as detailed from given in „Deviation from standard method of testing“.

#### ANNEXES:

Testing report No. 2752-397/08 (abrasion, annex H)

Testing report No. 2752-398/08 (abrasion, annex H)

Testing report No. 2122-01-V 006/08 (depth of penetration of water under pressure)

Testing report No. 2122-03-PP 001/08 (permeability to gases)