TEST REPORT

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Testing of Sikagard-705L and Sikagard-777 in combination on concrete

(1 appendix)

1 Assignment

Testing of Sikagard-705L hydrophobic impregnation and Sikagard-777 anti-graffiti coating on concrete in accordance with the instructions in VVAMA Anläggning 09 rev. 1, Publication 2009:147, Swedish National Road Administration (SNRA).

2 Test schedule

Test objects and the scope of the tests are shown in table 1. The tests were carried out between March and September 2010.

Table.1 Test schedule for treated and untreated concrete samples

	Properties	**Method in accordance with SS-EN 1504-2**	**Test object** Size (mm)	No. of units
1	Effect on the frost resistance of concrete	SS-EN 13 581	100x100x100	4 treated units 4 untreated units
2	Effect on the drying of concrete	SS-EN 13 579	100x100x100	3 treated units 3 untreated units

The concrete and test specimens were produced and stored at CBI Swedish Cement and Concrete Research Institute in Borås in accordance with the instructions in SS-EN 1766. Test 1 was carried out on “Type C (0.70)” concrete, and test 2 on “Type C (0.45)” concrete.

Sikagard-705L batch no. 090714-9565 and Sikagard-777 batch no. 1469, which arrived at CBI on 10 March 2010, were applied by CBI in accordance with the manufacturer’s instructions. A quantity of Sikagard-705L equivalent to approximately 100 g/m^2 was applied to each test specimen. When the Sikagard-705L had been left to dry for 24 hours, a quantity of Sikagard-777 equivalent to approx. 200 g/m^2 was applied in two layers. The amount applied was checked through weighing. CBI has no other information on the preparation and selection of product samples.

3 Test methodology and results

3.1 Effect on the frost resistance of concrete

The effect on the frost resistance of concrete has been verified in accordance with SS-EN 13 581. The test specimens were submerged in water for at least 28 days, and then conditioned at a temperature of 21 ±2°C and a relative humidity of 60 ±10% for 60 days. The surfaces of four test specimens were treated and conditioned for a further 14 days under the same conditions. The test specimens, both treated and untreated, were weighed before and after exposure to a 3% NaCl solution for 24 hours. The frost test then commenced, and continued for 50 cycles in 3% NaCl solution. The test specimens were weighed every five days.

The results were reported as the average of four partial results. The changes in weight of the test specimens as a result of spalling caused by frost during the test are shown in diagram 3.1. The testing of untreated test specimens was abandoned after 20 freezing cycles, due to excessive spalling. The test methods for both treated and untreated test specimens, as well as the measured data, are described in Appendix 1.

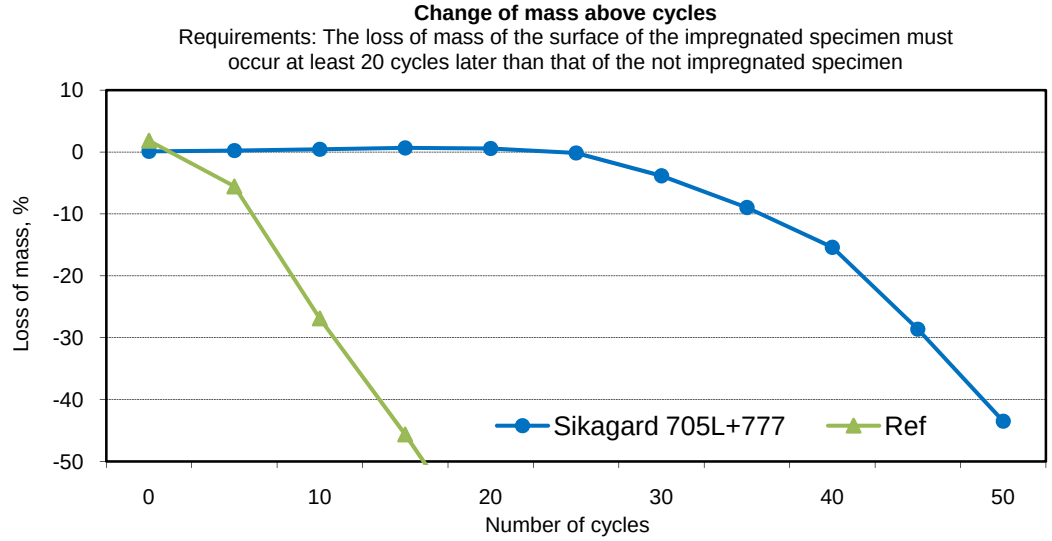

Diagram 3.1. Changes in weight

3.2 Effect on drying of concrete

The effect on the drying of concrete has been verified in accordance with SS-EN 13 579. After being submerged in water, the test specimens were conditioned at a temperature of 21 ±2°C and a relative humidity of 60 ±10% for 7 days. The surfaces of three of the test specimens were treated once they had reached a moisture level of 5.0±0.5 % in comparison with the test specimens which had been dried at 105 ±5°C. After a further 2 days, the drying process continued in a climate cabinet at a higher temperature and lower relative humidity, i.e. a temperature of 30 ±2°C and a relative humidity of 40 ±5%. The drying of the untreated test specimens was determined by weighing the test specimens between 6 and 24 hours and, for the treated test specimens, by weighing the test specimens between 24 and 48 hours. The drying coefficient specified in class I (> 30%) is the relationship between the treated and untreated test specimens.

The results are shown in diagram 3.2. The results are reported as the average value of three partial results. The test methods for both treated and untreated test specimens, as well as the measured data, are shown in Appendix 1.

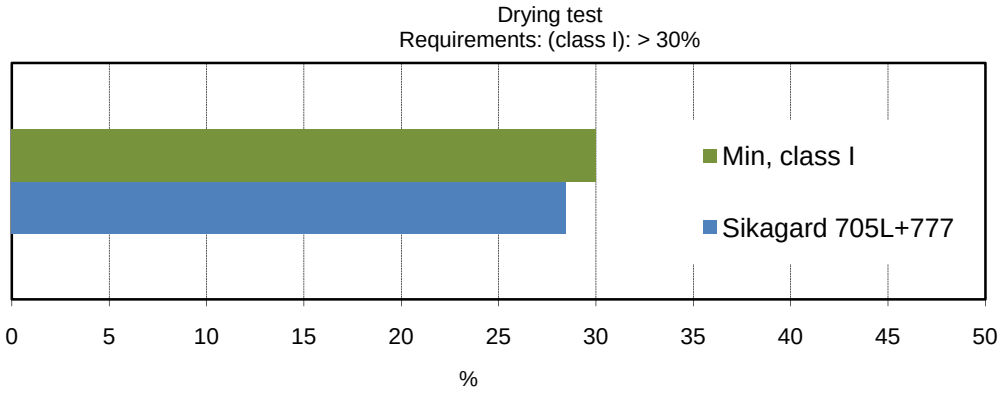

Diagram 3.2. Drying rate coefficient (DRC)

4 Opinion and interpretation of results

The tested combination of surface treatments, consisting of the hydrophobic impregnation, Sikagard-705L, and the anti-graffiti coating, Sikagard-777, with respect to their effect on the frost resistance and drying of concrete, meets the requirements of VVAMA Anläggning 09 rev. 1, Publication 2009:147.

Deviating values in the assessment (28.5%) with respect to the drying requirement (class I > 30%) are probably not due to the effects of the substances, but to the scatter in the partial results and measurement uncertainty in the method.

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Appendix
Test methodology, measured data and evaluation of results.

This is a translation from the Swedish original document. In the event of any dispute as to the content of the document, the Swedish text shall take precedence.

TEST REPORT

Date	Reference	Page
2010-09-17	FX000041 A	1 (4)

Translation
2010-09-17

Appendix 1

Drying test, SS-EN 13 579

Tillverkning/vattenlagring	Datum		REF		Behandlade		REF i 105±5 C	
	2010-03-08							
Vägning/kond	2010-04-05	W_{ssd}	D45-R1	2408,6	D45-S1	2423,0	D45-RT1	2382,7
Placering i 21±2C, 60±10 RF	12:30		D45-R2	2406,3	D45-S2	2390,5	D45-RT2	2419,5
Placering i 105±5 C			D45-R3	2400,0	D45-S3	2387,2	D45-RT3	2413,8
				2405,0		2400,2		2405,3
Vägning	2010-04-12	W_{od}					D45-RT1	2243,9
efter torkning i 105±5 C							D45-RT2	2279,0
							D45-RT3	2275,2
		M_{ssd}	(%)					6,1
Vägning	2010-04-09	W_5	D45-R1	2402,1	D45-S1	2417,2		
21±2C, 60±10 RF			D45-R2	2399,6	D45-S2	2384,9		
			D45-R3	2394,0	D45-S3	2381,6		
				2398,5		**2394,6**		
Vägning	2010-04-10	W_6	D45-R1	2401,1	D45-S1	2416,2		
21±2C, 60±10 RF			D45-R2	2398,6	D45-S2	2383,8		
			D45-R3	2393,1	D45-S3	2380,7		
				2397,6		**2393,6**		
Vägning	2010-04-12	W_7	D45-R1	2399,6	D45-S1	2414,7		
21±2C, 60±10 RF			D45-R2	2397,1	D45-S2	2382,3		
			D45-R3	2391,6	D45-S3	2379,2		
				2396,1		**2392,0**		
Fuktkvot (5,0±0,5)		M	%	**5,7**		**5,6**		
Utttorkning - obehandlade								
Vägning	2010-04-12	d_o	D45-R1	2399,6				
placering i 30±2C, 40±5 RF	Kl: 08:30		D45-R2	2397,1				
			D45-R3	2391,6				
				2396,1				
Vägning	2010-04-12	d_1	D45-R1	2396,5				
efter 6±0,1 h	Kl: 14:30		D45-R2	2393,9				
			D45-R3	2388,5				
				2392,9				
Vägning	2010-04-13	d_2	D45-R1	2393,0				
efter 24±0,1 h	Kl: 08:30		D45-R2	2390,5				
			D45-R3	2385,0				
				2389,5				
Drying rate		D_u	(g/m^2h)	**3,2**				
Applicering						*ca 6 g*		
Impregnering	2010-04-12	W_{t1}			D45-S1	2414,7		
ca 1,0 liter/m2	Kl: 09:40	W_{t2}				2420,6		
120 sek						**5,9**		
					D45-S2	2382,3		
						2388,0		
						5,7		
					D45-S3	2379,2		
						2385,9		
						6,8		
Klotterskydd	2010-04-13	W_{t1}			D45-S1	2415,6		
1,0 liter/m2	Kl: 08:40	W_{t2}				2422,1		
						6,5		
					D45-S2	2383,2		
						2389,8		
						6,6		
					D45-S3	2380,2		
						2386,2		
						6,0		
Klotterskydd	2010-04-13	W_{t1}			D45-S1	2416,2		
1,0 liter/m2	Kl: 13:30	W_{t2}				2420,7		
						4,5		
					D45-S2	2383,6		
						2388,2		
						4,6		

				D45-S3	2380,8
					2385,7
					4,9
Utttorkning - behandlade					
Vägning	2010-04-14	d_o		*D45-S1*	2416,8
placering i 30±2C, 40±5 RF	Kl:08:50			*D45-S2*	2384,2
				D45-S3	2381,5
					2394,2
Vägning	2010-04-15	d_1		*D45-S1*	2413,2
efter 24±0,1h	$d_1 < W_7$			*D45-S2*	2380,5
	Kl:08:52			*D45-S3*	2377,9
					2390,6
Vägning	2010-04-16	d_2		*D45-S1*	2411,9
efter 48±0,1h,	Kl:08:55			*D45-S2*	2379,2
				D45-S3	2376,7
					2389,3
Drying rate		D_t	*(g/m²h)*		***0,90***
(Class I: > 30 %)		**DRC**	%		**28,5**

Freeze-thaw salt stress, EN 13 581

	Datum		REF		Behandlade	
Tillverkning/vattenlagring	2009-11-03					
Konditionering 21±2C, 60±10 RF	2010-04-30					
						ca 6 g
Applicering 21±2C, 60±10 RF Impregnering ca 1,0 liter/m2 120 sek	2010-06-28 Kl:10	C_n			*F70-S1* *F70-S2* *F70-S3* *F70-S4*	2311,8 2318,5 ***6,7*** 2329,3 2335,8 ***6,5*** 2342,7 2349,4 ***6,7*** 2324,5 2330,9 ***6,4***
Klotteskydd 1,0 liter/m2	2010-06-29 Kl:8:00	C_n			*F70-S1* *F70-S2* *F70-S3* *F70-S4*	2315,6 2322,1 ***6,5*** 2333,4 2339,5 ***6,1*** 2347,2 2353,3 ***6,1*** 2329,2 2335,2 ***6,0***
Klotteskydd 1,0 liter/m2	2010-06-29 Kl:12:20	C_n			*F70-S1* *F70-S2* *F70-S3* *F70-S4*	2316,6 2320,6 ***4,0*** 2334,6 2338,7 ***4,1*** 2348,3 2352,6 ***4,3*** 2330,4 2334,6 ***4,2***
Vägning kl: placeras i 3% NaCl	2010-07-11 Kl 11:00	W_o	*F70-R1* *F70-R2* *F70-R3* *F70-R4* ***2329,9***	2298,9 2307,2 2345,4 2368,1	*F70-S1* *F70-S2* *F70-S3* *F70-S4* ***2328,4***	2312,8 2330,6 2344,0 2326,0
Vägning, kl: efter 24 h	2010-07-12	W_e	*F70-R1* *F70-R2* *F70-R3* *F70-R4* ***2373,1***	2341,8 2350,1 2389,5 2411,1	*F70-S1* *F70-S2* *F70-S3* *F70-S4* ***2330,8***	2315,1 2333,0 2346,4 2328,5
		C_{abs}	***1,8***		***0,1***	
Vägning, 5 c	2010-07-17	W_5	*F70-R1* *F70-R2* *F70-R3* *F70-R4* ***2200,3***	2182,8 2168,3 2198,1 2252,0	*F70-S1* *F70-S2* *F70-S3* *F70-S4* ***2333,9***	2317,9 2336,2 2350,1 2331,3
		ΔW_5, %	***-5,6***		***0,2***	
Vägning, 10 c	2010-07-22	W_{10}	*F70-R1* *F70-R2* *F70-R3*	1692,1 1677,4 1713,9	*F70-S1* *F70-S2* *F70-S3*	2321,5 2341,5 2355,9

			F70-R4	1730,1	F70-S4	2336,3
				1703,4		***2338,8***
		ΔW_{10}, %		***-26,9***		***0,4***
Vägning, 15 c	2010-07-27	W_{15}	F70-R1	1254,1	F70-S1	2325,1
			F70-R2	1208,9	F70-S2	2347,1
			F70-R3	1366,4	F70-S3	2360,7
			F70-R4	1236,9	F70-S4	2342,7
				1266,6		***2343,9***
		ΔW_{15}, %		***-45,6***		***0,7***
Vägning, 20 c	2010-08-01	W_{20}	F70-R1	905,9	F70-S1	2327,1
			F70-R2	702,1	F70-S2	2334,6
			F70-R3	793,0	F70-S3	2360,9
			F70-R4	780,6	F70-S4	2344,9
				795,4		**2341,9**
		ΔW_{20}, %		***-65,9***		***0,6***
Vägning, 25 c	2010-08-06	W_{25}	F70-R1		F70-S1	2326,3
			F70-R2		F70-S2	2309,6
			F70-R3		F70-S3	2330,8
			F70-R4		F70-S4	2332,9
						2324,9
		ΔW_{25}, %				***-0,1***
Vägning, 30 c	2010-08-11	W_{30}	F70-R1		F70-S1	2312,4
			F70-R2		F70-S2	2213,4
			F70-R3		F70-S3	2175,5
			F70-R4		F70-S4	2254,7
						2239,0
		ΔW_{30}, %				***-3,8***
Vägning, 35 c	2010-08-16	W_{35}	F70-R1		F70-S1	2296,0
			F70-R2		F70-S2	2103,0
			F70-R3		F70-S3	1935,9
			F70-R4		F70-S4	2144,2
						2119,8
		ΔW_{35}, %				***-9,0***
Vägning, 40 c	2010-08-21	W_{40}	F70-R1		F70-S1	2236,7
			F70-R2		F70-S2	1923,9
			F70-R3		F70-S3	1717,8
			F70-R4		F70-S4	2001,0
						1969,9
		ΔW_{40}, %				***-15,4***
Vägning, 45 c	2010-08-26	W_{45}	F70-R1		F70-S1	2037,8
			F70-R2		F70-S2	1639,9
			F70-R3		F70-S3	1351,4
			F70-R4		F70-S4	1617,8
						1661,7
		ΔW_{45}, %				***-28,6***
Vägning, 50 c	2010-08-31	W_{50}	F70-R1		F70-S1	1609,3
			F70-R2		F70-S2	1387,1
			F70-R3		F70-S3	981,3
			F70-R4		F70-S4	1284,0
						1315,4
		ΔW_{50}, %				***-43,5***