Electronic Supplementary Material for:

RILEM TC 247-DTA Round Robin Test: Sulfate resistance, alkali-silica reaction and freeze-thaw resistance of alkali-activated concretes

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In the following Tables S1–S12, the data reported by the laboratories that participated in the sulfate, alkali-silica reaction, and freeze-thaw testing of RILEM TC 247-DTA are summarised. The data shown in the tables are either the mean values and standard deviations (SD) of the experimental results of each laboratory, or the individual specimen-by-specimen data where appropriate. The means and standard deviations were either reported by the laboratories, or computed from the single-specimen data reported by the respective laboratories. When no standard deviation is given after a mean value, either only one specimen was tested, or no standard deviation and no single-specimen values were reported.

Table S1. Mortar mix designs used in the sulfate resistance testing (ASTM C1012 and SVA test).

Mortar	Laboratory	Precursor g	Sodium silicate dose [a]	Sodium hydroxide dose [b]	water/binder mass ratio [c]	Aggregate g
S3a	A	BFS, 475.1	2.69	4	0.382	EN 196-1 sand, 1350
S1b	A	BFS, 460.7	1.34	3	0.420	EN 196-1 sand, 1350
S3a	F	BFS, 681.0	2.69	4	0.382	EN 196-1 sand, 1350
S1b	F	BFS, 644.9	1.34	3	0.420	EN 196-1 sand, 1350
S3a	H	BFS, 571.4	2.69	4	0.382	EN 196-1 sand, 1350
S1b	H	BFS, 557.4	1.34	3	0.420	EN 196-1 sand, 1350
FA2	E, H	FA, 478.0	16.5	5.9	0.223	EN 196-1 sand, 1350
FA8	E, H	FA, 455.9	16.5	5.9	0.253	EN 196-1 sand, 1350
MK1	H	MK, 450.0	32.3	2.7	0.393	EN 196-1 sand, 1350

[a] Represented as g $Na_2Si_2O_5$ / 100 g precursor, where the solid component of sodium silicate solution of modulus 2.0 is given as $Na_2Si_2O_5$. Where a different modulus of sodium silicate solution was used in some labs, the total activator dose was held constant but the division between silicate and hydroxide constituents was changed.

[b] Represented as g NaOH / 100 g precursor

[c] Including water added within the aqueous activator solution, or separately from the activator, and with "binder" defined as the sum of precursor and solid activator components.

Table S2. Strength development of mortars used in the ASTM C1012 sulfate resistance testing.

	Sample age d	**Lab E MPa**		**Lab F MPa**		**Lab H MPa** [a]	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
S3a	1	22.7	0.1				
	3					22.3	0.6
	3					18.9 [b]	2.0
S1b	1	16.1	0.0			12.5	0.1
	2	22.0	0.2			12.5	0.1
	3					15.2	0.1
	6					21.4	1.4
	6					22.6 [b]	0.4
FA2	2	10.3					
	3	13.4					
	6	17.8					
	7	21.1	1.5			8.5	-
	13					17.2	0.5
	14					18.1	
	15					20.1	0.1
	16					20.7	1.0
	16					23.2 [b]	
	24					23.8	5.7
FA8	1	2.9					
	3	9.5					
	4	12.0					
	7	15.7				11.5	0.1
	8	18.8					
	9	21.0	0.3				
	11					17.6	0.4
	12					17.7	0.5
	13					20.2	0.8
	13					18.9 [b]	0.5

Table S2. Strength development of mortars used in the ASTM C1012 sulfate resistance testing **(continued)**.

	Sample age d	**Lab E MPa**		**Lab F MPa** [a]		**Lab H MPa**	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
MK	2					50.6	1.1
	2					57.6 [b]	

[a] Pre-curing first 48 h at 20°C and >90% RH (instead of 24 h in the mould at 35°C in a container with water), Afterwards according to the standard in saturated lime water at 23°C

[b] values obtained from cubes 5 cm x 5 cm x 5 cm

Table S3. Results of the ASTM C1012 test results reported by Laboratories E, F and H.

	Time weeks (w), months (m)	**Lab E (mm/m) Na_2SO_4**		**Lab F (mm/m) Na_2SO_4**		**Lab F (mm/m) $MgSO_4$**		**Lab H (mm/m) [a] Na_2SO_4**	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
S3a	0 w			0.000		0.000		0.000	
	1 w			0.000	n.a.	0.001	n.a.	-0.008	0.000
	2 w			0.000	n.a.	0.003	n.a.	-0.008	0.000
	3 w			0.001	n.a.	0.005	n.a.	-0.008	0.000
	4 w			-0.001	n.a.	0.009	n.a.	-0.006	0.003
	8 w			-0.002	n.a.	0.013	n.a.	0.002	0.002
	13 w			-0.002	n.a.			0.007	0.005
	15 w							0.009	0.003
	4 m							0.014	0.003
	6 m							0.017	0.003
	9 m							0.017	0.003
	12 m							0.019	0.003
	15 m								
S1b	0 w			0.000		0.000		0.000	
	1 w			0.000	n.a.	0.002	n.a.	-0.013	0.002
	2 w			0.001	n.a.	0.006	n.a.	-0.015	0.002
	3 w			0.002	n.a.	0.010	n.a.	-0.010	0.005
	4 w			0.001	n.a.	0.014	n.a.	-0.004	0.003
	8 w			0.000	n.a.	0.019	n.a.	-0.007	0.003
	13 w			0.001	n.a.			-0.007	0.003
	15 w							-0.006	0.002
	4 m							-0.003	0.002
	6 m							-0.001	0.002
	9 m							-0.001	0.002
	12 m							0.001	0.002
	15 m								

[a] Pre-curing first 48 h at 20°C and >90% RH (instead of 24 h in the mould at 35°C in a container with water), Afterwards according to the standard in saturated lime water at 23°C

n.a. = not available

Table S3. Results of the ASTM C1012 test results reported by Laboratories E, F and H **(continued)**.

	Time weeks (w), months (m)	**Lab E (mm/m) Na_2SO_4**		**Lab F (mm/m) Na_2SO_4**		**Lab F (mm/m) $MgSO_4$**		**Lab H (mm/m) [a] Na_2SO_4**	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
FA2	0 w	0.000						0.000	
	1 w	-0.010	0.003					-0.006	0.002
	2 w	-0.005	0.003					-0.010	0.002
	3 w	-0.007	0.003					-0.012	0.004
	4 w	-0.006	0.002					-0.012	0.004
	8 w	-0.010	0.002					-0.020	0.003
	13 w	-0.012	0.002					-0.021	0.005
	15 w	-0.013	0.002					-0.021	0.005
	4 m							-0.021	0.005
	6 m	-0.016	0.001					-0.019	0.003
	9 m	-0.015	0.002					-0.021	0.003
	12 m	-0.028	0.013					-0.020	0.002
	15 m	-0.027	0.016						
FA8	0 w	0.000						0.000	
	1 w	-0.002	0.003					-0.002	0.004
	2 w	-0.001	0.003					-0.005	0.003
	3 w	-0.002	0.003					-0.013	0.002
	4 w	-0.002	0.002					-0.017	0.002
	8 w	-0.002	0.002					-0.015	0.003
	13 w	-0.008	0.002					-0.015	0.002
	15 w	-0.006	0.002					-0.015	0.002
	4 m							-0.017	0.003
	6 m	-0.013	0.001					-0.019	0.003
	9 m	-0.012	0.002					-0.020	0.003
	12 m	-0.013	0.013					-0.020	0.003
	15 m	-0.011	0.016						

[a] Pre-curing first 48 h at 20°C and >90% RH (instead of 24 h in the mould at 35°C in a container with water), Afterwards according to the standard in saturated lime water at 23°C

Table S3. Results of the ASTM C1012 test results reported by Laboratories E, F and H **(continued)**.

	Time weeks (w), months (m)	**Lab E (mm/m) Na_2SO_4**		**Lab F (mm/m) Na_2SO_4**		**Lab F (mm/m) $MgSO_4$**		**Lab H (mm/m) [a] Na_2SO_4**	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
MK1	0 w							0.000	
	1 w							0.063	0.003
	2 w							0.064	0.003
	3 w							0.064	0.003
	4 w							0.062	0.002
	8 w							0.063	0.002
	13 w							0.061	0.003
	15 w							0.061	0.004
	4 m							0.063	0.003
	6 m							0.062	0.004
	9 m							0.064	0.004
	12 m							0.065	0.004
	15 m								

[a] Pre-curing first 48 h at 20°C and >90% RH (instead of 24 h in the mould at 35°C in a container with water), Afterwards storage according to the standard in saturated lime water at 23°C

Table S4. Results of the SVA test at 20 °C – results reported by Laboratory A.

	Time (d)	**Length change $Ca(OH)_2$ sln. (mm/m)**		**Length change Na_2SO_4 sln. (mm/m)**		**Mass change $Ca(OH)_2$ sln. (%)**		**Mass change Na_2SO_4 sln. (%)**	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
S3a	0	0.000		0.000		0.00		0.00	
	7	−0.004	0.008	−0.019	0.010	0.03	0.01	−0.04	0.01
	14	−0.005	0.008	−0.022	0.010	0.04	0.03	−0.06	0.02
	28	−0.003	0.013	−0.019	0.009	0.05	0.03	−0.06	0.02
	56	−0.001	0.011	−0.023	0.008	0.15	0.04	−0.01	0.03
	91	−0.005	0.010	−0.025	0.010	0.16	0.03	−0.04	0.04
S1b	0	0.000		0.000		0.00		0.00	
	7	0.004	0.004	−0.018	0.005	−0.02	0.02	−0.08	0.01
	14	0.002	0.008	−0.023	0.004	−0.01	0.02	−0.08	0.01
	28	−0.001	0.008	−0.034	0.004	0.04	0.01	−0.08	0.02
	56	0.002	0.009	−0.032	0.005	0.05	0.01	−0.14	0.01
	91	0.008	0.012	−0.029	0.007	0.13	0.03	−0.21	0.01

Table S5. Results of the accelerated sulfate resistance test (modified SIA 262/1 Appendix D method) and the continuous immersion method (modified ASTM C1012 method) using concrete prisms and 5% $MgSO_4$ – results reported by Laboratory G.

	Time weeks (w), months (m)	**Lab G $MgSO_4$ accelerated**				**Lab G $MgSO_4$ continuous**			
		Length change (mm/m)		*Mass change (%)*		*Length change (mm/m)*		*Mass change (%)*	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
S3a	1st cycle	0.005	0.003	0.249	0.023				
	2nd cycle	0.012	0.003	0.372	0.027				
	3rd cycle	0.021	0.005	0.405	0.029				
	4th cycle	0.029	0.005	0.525	0.039				
	1 w	0.039	0.002	0.679	0.006	0.010	0.001	0.235	0.021
	2 w	0.044	0.002	0.787	0.007	0.019	0.001	0.357	0.024
	3 w					0.013	0.002	0.333	0.034
	4 w	0.051	0.001	0.900	0.007				
	5 w					0.014	0.001	0.337	0.030
	6 w	0.053	0.001	0.950	0.017				
	8 w	0.054	0.001	0.964	0.003	0.017	0.002	0.471	0.010
	13 w	0.059	0.001	1.034	0.015	0.023	0.001	0.507	0.021
	15 w					0.023	0.002	0.346	0.064
	4 m					0.024	0.002	0.164	0.061
	6 m	0.063	0.001	1.279	0.037	0.024	0.002	0.297	0.146
	9 m	0.069	0.003	1.416	0.057	0.028	0.002	0.674	0.223
	12 m	0.068	0.002	1.665	0.070	0.028	0.002	0.171	0.060
S1b	1st cycle	0.007	0.001	0.258	0.025				
	2nd cycle	0.012	0.001	0.355	0.031				
	3rd cycle	0.017	0.001	0.393	0.032				
	4th cycle	0.021	0.002	0.580	0.030				
	1 w	0.033	0.002	0.694	0.084	0.005	0.001	0.148	0.007
	2 w	0.037	0.002	0.825	0.049	0.012	0.001	0.286	0.015
	3 w					0.005	0.001	0.291	0.011
	4 w	0.043	0.002	0.892	0.024				
	5 w					0.007	0.001	0.306	0.016
	6 w	0.045	0.003	0.936	0.036				
	8 w	0.047	0.003	0.960	0.044	0.010	0.001	0.753	0.042
	13 w	0.051	0.004	1.012	0.049	0.014	0.001	0.948	0.055
	15 w					0.016	0.001	0.950	0.081
	4 m					0.015	0.001	0.689	0.104
	6 m	0.055	0.003	1.211	0.049	0.015	0.001	1.143	0.166
	9 m	0.061	0.002	1.211	0.074	0.020	0.001	-0.209	1.122
	12 m	0.061	0.003	1.415	n.a.	0.018	0.001	-3.920	0.214

n.a.: not available

Table S5. Results of the accelerated sulfate resistance test (modified SIA 262/1 Appendix D method) and the continuous immersion method (modified ASTM C1012 method) using concrete prisms and 5% $MgSO_4$ – results reported by Laboratory G **(continued)**.

	Time weeks (w), months (m)	**Lab G $MgSO_4$ accelerated**				**Lab G $MgSO_4$ continuous**			
		Length change (mm/m)		*Mass change (%)*		*Length change (mm/m)*		*Mass change (%)*	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
FA2	1st cycle	-0.017	0.002	0.149	0.016				
	2nd cycle	-0.012	0.001	0.014	0.277				
	3rd cycle	-0.009	0.001	0.221	0.020				
	4th cycle	-0.006	0.001	0.282	0.015				
	1 w	-0.002	0.001	0.335	0.013	0.003	0.002	0.549	0.035
	2 w	-0.001	0.001	0.316	0.022	0.004	0.001	0.609	0.068
	3 w					0.005	0.001	0.722	0.035
	4 w	0.001	0.001	0.334	0.012				
	5 w					0.006	0.001	0.716	0.034
	6 w	0.002	0.001	0.328	0.019				
	8 w	0.005	0.001	0.331	0.027	0.006	0.001	0.692	0.035
	13 w	0.004	0.001	0.372	0.017	0.008	0.000	0.546	0.036
	15 w					0.006	0.001	0.522	0.045
	4 m					0.006	0.001	0.505	0.042
	6 m	0.006	0.001	0.398	0.025	0.006	0.001	0.482	0.032
	9 m	0.005	0.003	0.420	0.012	0.004	0.001	0.496	0.067
	12 m	0.006	0.001	0.475	0.016	0.009	0.002	0.545	0.072
FA8	1st cycle	-0.013	0.003	0.020	0.009				
	2nd cycle	-0.009	0.002	0.034	0.010				
	3rd cycle	-0.006	0.002	0.114	0.017				
	4th cycle	-0.003	0.002	0.146	0.019				
	1 w	0.001	0.001	0.172	0.014	0.002	0.001	0.460	0.068
	2 w	0.003	0.001	0.344	0.280	0.003	0.001	0.491	0.084
	3 w					0.005	0.001	0.508	0.048
	4 w	0.004	0.001	0.161	0.009				
	5 w					0.006	0.001	0.449	0.060
	6 w	0.005	0.001	0.162	0.008				
	8 w	0.007	0.001	0.176	0.006	0.004	0.001	0.236	0.046
	13 w	0.009	0.001	0.225	0.007	0.007	0.001	0.095	0.049
	15 w					0.004	0.001	0.051	0.065
	4 m					0.005	0.001	0.065	0.066
	6 m	0.009	0.000	0.241	0.005	0.005	0.001	0.065	0.070
	9 m	0.009	0.002	0.289	0.006	0.001	0.001	0.171	0.100
	12 m	0.009	0.001	0.350	0.014	0.015	0.003	0.338	0.049

Table S6. Results of ASR testing according to ASTM C1293 (expansion, and corresponding mass change measurements) reported by Laboratory G. Data are presented as the mean and standard deviation (S.D.) of 4-6 replicate prisms for each mix. Control samples have fine and coarse aggregates of normal reactivity, Spratt samples use the reactive Spratt limestone as coarse aggregates.

Expansion								
Control	**S1b**		**S3a**		**FA2**		**FA8**	
Exposure duration	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*
7 days	0.002	0.001	-0.007	0.002	0.014	0.001	0.012	0.001
28 days	0.002	0.001	-0.004	0.002	0.016	0.001	0.013	0.001
56 days	0.005	0.003	-0.001	0.002	0.015	0.001	0.015	0.001
3 mo.	0.006	0.001	-0.003	0.002	0.019	0.002	0.016	0.001
6 mo.	0.009	0.002	0.003	0.002	0.019	0.001	0.015	0.002
9 mo.	0.009	0.002	0.005	0.002	0.025	0.002	0.020	0.002
12 mo.	0.013	0.002	0.011	0.003	0.024	0.001	0.019	0.001
18 mo.	0.018	0.003	0.016	0.002	0.024	0.002	0.021	0.002
24 mo.	0.020	0.002	0.018	0.002	0.024	0.000	0.021	0.002
Spratt	**S1b**		**S3a**		**FA2**		**FA8**	
	Mean (%)	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*
7 days	-0.010	0.001	-0.013	0.002	0.007	0.002	0.009	0.003
28 days	-0.011	0.002	-0.013	0.001	0.008	0.001	0.010	0.003
56 days	-0.010	0.002	-0.003	0.001	0.010	0.002	0.011	0.003
3 mo.	-0.006	0.003	0.007	0.002	0.014	0.002	0.014	0.003
6 mo.	0.004	0.002	0.028	0.002	0.017	0.003	0.018	0.002
9 mo.	0.016	0.004	0.043	0.002	0.019	0.002	0.020	0.001
12 mo.	0.025	0.005	0.057	0.002	0.022	0.002	0.022	0.003
18 mo.	0.034	0.004	0.069	0.001	0.029	0.002	0.025	0.003
24 mo.	0.041	0.005	0.073	0.003	0.030	0.002	0.026	0.003

Table S6. Results of ASR testing according to ASTM C1293 (expansion, and corresponding mass change measurements) reported by Laboratory G. Data are presented as the mean and standard deviation (S.D.) of 4-6 replicate prisms for each mix. Control samples have fine and coarse aggregates of normal reactivity, Spratt samples use the reactive Spratt limestone as coarse aggregates **(continued)**.

Mass change								
Control	**S1b**		**S3a**		**FA2**		**FA8**	
	Mean (%)	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*
7 days	0.147	0.010	0.178	0.018	0.281	0.027	0.175	0.025
28 days	0.171	0.017	0.220	0.012	0.502	0.036	0.341	0.029
56 days	0.207	0.016	0.319	0.116	0.709	0.046	0.471	0.038
3 mo.	0.212	0.076	0.317	0.010	0.804	0.160	0.491	0.100
6 mo.	0.309	0.023	0.387	0.018	0.990	0.194	0.627	0.061
9 mo.	0.314	0.012	0.417	0.010	0.960	0.308	0.580	0.155
12 mo.	0.318	0.017	0.432	0.020	0.840	0.311	0.316	0.066
18 mo.	0.338	0.015	0.447	0.011	0.872	0.203	0.246	0.151
24 mo.	0.343	0.006	0.462	0.015	0.879	0.145	0.269	0.151
Spratt	**S1b**		**S3a**		**FA2**		**FA8**	
	Mean (%)	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*
7 days	0.039	0.014	0.074	0.016	0.163	0.021	0.095	0.018
28 days	0.087	0.014	0.107	0.028	0.347	0.023	0.223	0.016
56 days	0.126	0.010	0.135	0.028	0.497	0.038	0.347	0.030
3 mo.	0.145	0.016	0.177	0.024	0.606	0.032	0.392	0.043
6 mo.	0.203	0.014	0.240	0.026	0.808	0.050	0.485	0.082
9 mo.	0.223	0.010	0.284	0.023	0.649	0.144	0.337	0.173
12 mo.	0.247	0.010	0.323	0.023	0.735	0.132	0.417	0.127
18 mo.	0.285	0.010	0.362	0.026	0.594	0.174	0.100	0.062
24 mo.	0.295	0.015	0.409	0.012	0.692	0.119	0.299	0.097

Table S7. Results of ASR testing according to RILEM AAR-3.1 (expansion, and corresponding mass change measurements) reported by Laboratory H. Data are presented as the mean and standard deviation (S.D.) of 2-3 replicate prisms for each mix.

Expansion								
	S1b		**FA2**		**FA8**		**MK1**	
Exposure time /d	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*
0	0	0	0	0	0	0	0	0
14	0.017	0.002	-0.008	0.018	-0.008	0.006	0.004	0.004
28	0.028	0.004	-0.029	0.026	-0.014	0.008	0.004	0.011
91	0.029	0.002	-0.019	0.018	-0.014	0.008	0.007	0.006
182	0.040	0.004	-0.027	0.020	-0.016	0.006	0.007	0.006
Mass change								
	S1b		**FA2**		**FA8**		**MK1**	
Exposure time /d	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*
0	0	0	0	0	0	0	0	0
14	-0.012	0.010	-0.001	0.103	-0.517	0.038	-0.552	0.054
28	-0.034	0.017	-0.123	0.099	-0.964	0.197	-0.745	0.065
91	0.124	0.016	-0.217	0.095	-0.741	0.289	-0.852	0.110
182	0.045	0.042	-0.267	0.053	-1.454	0.014	-1.559	0.223

Table S8. Results of ASR testing according to RILEM AAR-3.1 (expansion, and corresponding mass change measurements), and additional data recorded at 20°C, reported by Laboratory I. Data are presented as the mean and standard deviation (S.D.) of individual prisms. All samples are mix FA8, with partial replacement of either fine or coarse aggregates by suspected reactive aggregates as discussed in the main text.

FA8 with suspected reactive fine aggregate								
	38 °C				**20 °C**			
	Expansion		**Mass change**		**Expansion**		**Mass change**	
Exposure time / weeks	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*
0	0	0	0	0	0	0	0	0
1	0.016	0.004	3.84	0.14	0.020	0.001	3.89	0.02
2	0.020	0.006	4.03	0.15	0.024	0.001	4.03	0.07
4	0.015	0.005	4.18	0.17	0.023	0.002	4.16	0.01
13	0.010	0.006	4.29	0.14	0.014	0.003	4.35	0.01
26	0.012	0.005	4.44	0.14	0.019	0.003	4.52	0.02
52	0.016	0.005	4.72	0.12	0.019	0.002	4.76	0.09
FA8 with suspected reactive coarse aggregate								
	38 °C				**20 °C**			
	Expansion		**Mass change**		**Expansion**		**Mass change**	
Exposure time / weeks	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*	*Mean (%)*	*S.D.*
0	0	0	0	0	0	0	0	0
1	0.019	0.007	3.78	0.11	0.012	0.004	3.97	0.05
2	0.021	0.008	3.99	0.11	0.016	0.004	4.14	0.02
4	0.016	0.007	4.11	0.10	0.014	0.005	4.30	0.05
13	0.013	0.007	4.22	0.04	0.007	0.005	4.43	0.08
26	0.014	0.007	4.38	0.02	0.012	0.005	4.61	0.03
52	0.017	0.007	4.65	0.04	0.012	0.005	4.85	0.05

Table S9. Results of the CDF test: mass of scaled material (surface scaling) in g/m^2 – results reported by Laboratories A, B, C.

	Freeze-thaw cycles	**Lab A**		**Lab A 56 d curing**		**Lab B**		**Lab C**	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
S3a	4	1342	55	1320	77	93	10		
	6					200	11		
	8	1608	72	1570	125				
	10								
	14	1893	98	1821	148	631	19		
	18	2077	95	1969	158				
	22	2279	105	2107	171				
	28	2416	118	2270	186	1107	79		
S1b	4	3152	140	2192	139	221	22		
	6					438	54		
	8	3864	173	2820	181				
	10								
	14	4502	129	3411	242	1118	101		
	18			3809	313				
	22								
	28					2028	252		
FA2	4	531	82	279	85	1293	159		
	6					1748	222		
	8	2676	92	1051	161				
	10								
	14	4416	118	1763	164	4493	519		
	18			2164	159				
	22			2524	163				
	28			2997	201	6793	1148		

Table S9. Results of the CDF test: mass of scaled material (surface scaling) in g/m^2 – results reported by Laboratories A, B, C **(continued)**.

FA8	4	2509	111	1326	81	1973	337	3871	22
	6					2553	370		
	8	4797	118	2735	117				
	10							11051	38
	14	9579	806	4686	216	6125	548		
	18			5962	275				
	22								
	28					9455	1202		
MK1	4							10460	8
	6								
	8								
	10								
	14								
	18								
	22								
	28								

Table S10. Results of the scaling resistance test according to ASTM C672/C672M – 98 – results reported by Laboratory D for specimens exposed to **4 % $CaCl_2$ solution**.

	Freeze-thaw cycles	**Mass change[a]**		**Visual rating of surface[b]**	
		Mean	*SD*	*Mean*	*SD*
S3a	25	1.88 %		2	
	50	2.48 %		3	
	75	2.79 %		3	
	90	2.71 %		3	
S1b	25	2.83 %		3	
	50	3.32 %		4	
	75	3.45 %		4	
	90	3.43 %		4	

[a] Relative to initial mass

[b] Rating according to ASTM C672/C672M–98: 0, no scaling; 1, very slight scaling (3 mm depth max., no coarse aggregates visible); 2, slight to moderate scaling; 3, moderate scaling (some coarse aggregates visible); 4, moderate to severe scaling; 5, severe scaling (coarse aggregates visible over entire surface)

Table S11. Results of the scaling resistance test according to ASTM C672/C672M – 98 – results reported by Laboratory D for specimens exposed to **4 % NaCl solution.**

	Freeze-thaw cycles	**Mass change[a]**		**Visual rating of surface[b]**	
		Mean	*SD*	*Mean*	*SD*
S3a	25	5.02 %		4	
	50	6.74 %		4	
	75	8.95 %		4	
	90	9.38 %		4	
S1b	25	4.50 %		4	
	50	6.47 %		4	
	75	7.64 %		4	
	90	8.12 %		4	

[a] Relative to initial mass

[b] Rating according to ASTM C672/C672M–98: 0, no scaling; 1, very slight scaling (3 mm depth max., no coarse aggregates visible); 2, slight to moderate scaling; 3, moderate scaling (some coarse aggregates visible); 4, moderate to severe scaling; 5, severe scaling (coarse aggregates visible over entire surface)

Table S12. Results of the rapid freezing-thawing resistance test according to ASTM C666/C666M – 03 Procedure A – results reported by Laboratory D.

	Freezing-and-thawing cycles	**Dynamic modulus of elasticity (in GPa)**		**Relative dynamic modulus of elasticity**	
		Mean	*SD*	*Mean*	*SD*
S3a	0	40.3		100 %	
	100	38.4		96 %	
	200	38.3		96 %	
	300	38.4		96 %	
S1b	0	37.7		100 %	
	100	32.1		86 %	
	200	33.6		90 %	
	300	32.8		87 %	