

Annex 4a

St. Astier NHL mortars characteristics compared with Cement mortars and OPC/CL lime mortars
(Putties/hydrated lime)

Sand used: well-graded sharp sands #6-7(3mm) - #200 (0.075)

			Tests on pure NHL Mortars			Tests on cement/hydrated lime mixes		Notes
			NHL5	NHL3.5	NHL2	OPC/CL(hydrated)		
Volumetric mix (binder/sand)			1 : 2.5	1 : 2.5	1 : 2.5	1 : 1 : 6	1 : 2 : 9	
Set (beginning) / hours			2-4	4-6	6-9	1.0	1.0	A
Elasticity Moduli	28 days	Psi (10^3)	1595	1305	1421	2349	2261	B
	6 mnth	Psi (10^3)	2472	1958	1744	3191	2798	B
	12 mnth	Psi (10^3)	2506	1975	1744	3220	2856	
	24 mnth	Psi (10^3)	2613	1999	1740	3212	2849	
Compressive Strength	28 days	Psi	290	213	197	1116	808	C
	6 mnth	Psi	855	768	435	1174	834	C
	12 mnth	Psi	1224	855	420	1261	877	
	24 mnth	Psi	1277	870	435	1232	863	
Vapor Exchange (air gr/m²/h/mmHg)			0.55	0.65	0.71	0.23	0.25	D/E
Shrinkage 28 days %			0.013	0.044	0.06	0.063	0.042	

The water addition in the shrinkage test was regulated to obtain mortars with the same workability (flow table test 190 +/- 5mm)

NOTES

A - Mortars containing OPC start setting too quickly.

B - OPC mortars are not as flexible as lime mortars.

C - NHL/Putty mortars are considerably weaker than NHL mortars.

D - Cementitious mixes will retain moisture

E - At complete carbonation.

Annex 4b

St. Astier NHL mortars characteristics compared with Cement mortars and OPC/CL lime mortars
(Putties/hydrated lime)

Sand used: well-graded sharp sands #6-7(3mm) - #200 (0.075)

	Tests NHL/Putty(CL/Sand Mixes NHL 5/CL			Tests on cement/hydrated lime mixes		Notes		
	OPC/CL(hydrated)							
Volumetric mix (binder/sand)	0.9/0.1:3	0.7/0.5:3	0.5/0.5:3	1 : 1 : 6	1 : 2 : 9			
Set (beginning) / hours	3.5	5.25	9.5	1.0	1.0	A		
Elasticity Moduli	28 days	Psi (10 ³)	1595	1453	1160	2349	2261	B
	6 mnth	Psi (10 ³)	2320	2030	1744	3191	2798	B
	12 mnth	Psi (10 ³)	2394	2076	1744	3220	2856	
	24 mnth	Psi (10 ³)	2392	2023	1917	3212	2849	
Compressive Strength	28 days	Psi	203	159	87	1116	806	C
	6 mnth	Psi	696	573	431	1174	834	C
	12 mnth	Psi	768	594	406	1261	877	
	24 mnth	Psi	761	625	558	1232	863	
Vapor Exchange (air gr/m2/h/mmHg)	0.60	0.59	0.63	0.23	0.25	D/E		
Shrinkage 28 days %	0.025	0.060	0.084	0.063	0.042			

The water addition in the shrinkage test was regulated to obtain mortars with the same workability (flow table test 190 +/- 5mm)

NOTES

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B - OPC mortars are not as flexible as lime mortars.

C - NHL/Putty mortars are considerably weaker than NHL mortars.

D - Cementitious mixes will retain moisture

E - At complete carbonation.

Annex 4c

St. Astier NHL mortars characteristics compared with Cement mortars and OPC/CL lime mortars
(Putties/hydrated lime)

Sand used: well-graded sharp sands #6-7(3mm) - #200 (0.075)

			Tests on pure NHL Mortars NHL 3.5/CL			Tests on cement/hydrated lime mixes		Notes
						OPC/CL(hydrated)		
Volumetric mix (binder/sand)			0.9/0.1:3	0.7/0.3:3	0.5/0.5:3	1 : 1 : 6	1 : 2 : 9	
Set (beginning) / hours			6.5	8.5	10.0	1.0	1.0	A
Elasticity Moduli	28 days	Psi (10 ³)	1218	1167	1089	2349	2261	B
	6 mnth	Psi (10 ³)	1917	1827	1595	3191	2798	B
	12 mnth	Psi (10 ³)	1944	1870	1602	3220	2856	
	24 mnth	Psi (10 ³)	2066	1886	1573	3212	2849	
Compressive Strength	28 days	Psi	188	159	108	1116	808	C
	6 mnth	Psi	565	526	240	1174	834	C
	12 mnth	Psi	696	645	544	1261	877	
	24 mnth	Psi	689	660	384	1232	863	
Vapor Exchange (air gr/m²/h/mmHg)			0.69	0.71	0.68	0.23	0.25	D/E
Shrinkage 28 days %			0.035	0.067	0.089	0.063	0.042	

The water addition in the shrinkage test was regulated to obtain mortars with the same workability (flow table test 190 +/- 5mm)

NOTES

A - Mortars containing OPC start setting too quickly.

B - OPC mortars are not as flexible as lime mortars.

C - NHL/Putty mortars are considerably weaker than NHL mortars.

D - Cementitious mixes will retain moisture

E - At complete carbonation.