Sands for NHL Mortars

Choosing the correct sand when making a mortar is of extreme importance.

Sands should be clean and uncontaminated by clay/silt or other elements such as pyrite, iron, etc. These occur in the range from #300 (0.04mm) and below and the most effective method to establish their presence is the wet sieve analysis.

Normal dry sieve analysis does not accurately reveal the presence of clay or silt (particles passing #200 (0.075) sieve). This is due to the fact that when the sand is dried before sieving, clay or silt particles can coat some particles and these will not pass the #200 (0.075) sieve. In contact with water, however, these particles will return to colloidal state, retaining moisture and general instability. The result is a much longer drying period, which if winter is approaching, would not allow the mortar to be sufficiently dried to withstand frost.

The fines in a sand will demand more water. This is due to much higher surface area to be wetted. A high proportion of fines in sand and the consequent high water content in the mortar will have negative effects in compressive and flexural strength. High moisture will promote shrinkage and could lead to de-bonding especially in mortars applied to low suction areas.

There is a tendency to choose sands because of their color. The fact is that the color of a mortar will be given by the fines contained in the sand and therefore fine sands are chosen for a number of jobs where they are not appropriate.

In plasters, for example, a good, well graded, coarse sharp sand is needed for the backing coats. A finer sand can be chosen for the finishing coat based on its color. If, however, the color of the sand is due to clay (earth) presence, as clay is a binder, the quantity of lime will be reduced to avoid producing a binder rich mortar. Fine sands require more water. A high proportion of these sands lead to longer setting time, possibility of shrinkage, lime leaching and more sensitivity to adverse weather conditions.

Sands are mostly responsible for the void structure of a mortar and, therefore, for its vapour permeability, so vital for the performance against accumulation of condensation. It is for this reason that well graded sands are recommended. If sharp, the void structure will be even more efficient.

Monogranular sands (particle size mainly between 1 or 2 grades) will not allow good vapour exchange, they will also diminish workability and therefore increase the danger of too much water addition in order to achieve it. In making NHL mortars with good sand, workability should not be achieved by adding more water but by allowing a little more time for mixing. It is also advantageous, if time permits, to let the mortar rest for a while. The water will settle between the particles and allow better hydration of the free lime content resulting in a fatter, more homogeneous and workable mortar.

A practical guide to choosing sands:

<table>
<tr><th>General Building</th><th colspan="2">Plastering</th></tr>
<tr><td>Maximum particle size approximately 1/3 of the height of the joint</td><td colspan="2">Dubbing out: same sand as per base coat</td></tr>
<tr><td>Depending on the size of the joint, sands from 1/4” (6mm) down to #200 (0.075) can be used, with a proportion from 0.150 to 0.075 (about 20% of the mass).</td><td>Stipple coats, base coats and rough finishing coats:

#7 (3mm) down to #200 (0.075mm)
Particles between #100 (0.150)
and #200 (0.075) not above 15%</td><td>Smooth finishing coats

#8 (2.36mm) (or less) down to #200 (0.075mm).
Particles between #100 (0.150) and #200 (0.075) not above 20%</td></tr>
<tr><td>Example (% retained):

#4 (5mm) 2
#6 (3.35mm) 3
#8 (2.36 mm) 6
#16 (1.18 mm) 15
#30(0.600 mm) 23
#50(0.300 mm) 32
#100(0.150 mm) 15
#200(0.075 mm) 4</td><td>Example (% retained)

#4 (5mm) 0
#6 (3.35mm) 0
#8 (2.36 mm) 4
#16 (1.18 mm) 10
#30(0.600 mm) 20
#50(0.300 mm) 35
#100(0.150 mm) 20
#200(0.075 mm) 11</td><td>Example (%retained)

#4 (5mm) 0
#6 (3.35mm) 0
#8 (2.36 mm) 0
#16 (1.18 mm) 6
#30(0.600 mm) 12
#50(0.300 mm) 34
#100(0.150 mm) 30
#200(0.075 mm) 18</td></tr>
<tr><td colspan="3">There are a vast number of sands, differing in gradings and qualities. To be sure that a well-graded sand is being used it is necessary that at least 4 grades form a substantial part of the proposed sand.</td></tr>
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In plastering, sharp and well-graded sands should be used for all coats. For smooth finishes finer sand can be used, in which case this should still be well graded. The structural soundness of a plaster depends on the bonding with the background and between coats. Bonding is partly dependant on the capillary suction of the background or the previous coat. A percentage of finer particles (10-15% between #100 (0.150) and #200 (0.075mm) with 0 below #200 (0.075)) will promote bonding without affecting vapour permeability and capillary suction. Indoor smooth plastering will require fine sands. Particular attention should be given to curing. Fine sands will also be used in ashlar work.

In all cases NHL binder quantities should be carefully considered and this should be done in relation to the performance required and the quality of the sand.