Winter working with lime mortars

As a brief background to the risk elements of carrying out this type of work at this time of year and the potential to be caught out by weather conditions, it is generally well recognised that a 1:1:6 cement : lime : sand mortar can, if conditions prevail, be susceptible to frost attack for up to about 10 weeks after placing, so the risk involved in a lime render should be considered more onerous as the curing times are longer for lime mortars than for cement mortars.

Typically a hydraulic lime mortar, properly cured in temperatures of around 18-20 degrees Celsius with adequate detailing and an ambient relative humidity of around 55- 80 % will achieve desired freeze thaw resistance at approximately 90 days.

A 5ºC drop in temperature will increase the time to achieve these performance values by about 25% a 10ºC average difference will result in a 50% extension of the curing time.

Freeze thaw cycles can only occur when materials become saturated to the extent that their pore structure is full of water or with less than 9% of the available pore structure available to handle the expansive forces of water as it freezes. Much of this can be alleviated by protection from wind driven rain by covering the outside face of the work and by providing good sound detailing and roof drainage.

The use of additions such as air entrainment, water reduction agents and water-proofers all contribute to faster freeze thaw resistance - 30 days in good curing conditions with the same caveat for temperature variations as illustrated earlier. This is achieved because the additions increase the air content of the mortar to around 14%, reduce the water required for workability in the mix, thereby increasing the early strength of the mortar and by providing a reduction in the capillarity.

Our remit is to recommend a regime whereby the best possible curing conditions can be sensibly employed to allow this work to proceed throughout this period.

To that end, the following list for recommendations is pertinent. Where background heating is discussed this should be propane gas heating as it provides a good level of humidity along with a higher level of carbon dioxide in conjunction with heat generated.

1. Provide well detailed protection from vertical and horizontally driven rain by overlapping the top most lift of the scaffolding with impervious sheeting, carried to the outside face of the scaffolding where it will ensure any rainfall or run off from the roofs can be safely discharged clear of the new work without causing incidental splash zones at the wall base or at abutting roof lines.

2. Provide well detailed wind and rain screening to the outside face of the scaffold such that warm air heating, if required can be introduced to combat temperature variations and maintain where possible 15 –20ºC conditions.

3. Record temperature and humidity levels throughout the curing period.

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4. Ensure that induced heating adequately circulates to avoid cold zones particularly at the base of the walls and that venting is available to regulate temperatures at the top of the walls to avoid overly rapid drying.

5. Provide close covering for the new works throughout the application and initial curing stages, preferably canvas or hessian sheeting hung within 100 mm of the wall face.

6. Keep new applications damp, not wet for at least 3-4 days to ensure adequate hydration of the mortar.

Violent damaging gusts can destroy even the best temporary protection but it is our experience that inadequate ties and poor detailing contribute most to failures.

Additional measures that should be put in place for all winter working are relatively standard practice, but for the absence of doubt, we have noted the most relevant:

1. Sand and aggregates should be stored on hard standing that are capable of free draining, sand stocks should be consistent, delivered where possible in a one operation for the entire works, particularly for render work and should be covered to maintain a consistent condition. Sand that is frozen should never be used until it has fully thawed out, the centre of the pile should be checked to ensure that it has reached a temperature of at least 3 degrees. (small amounts of clay in sands can stay frozen long after the sand appears to have thawed out).

2. Water for mixing should be clean potable, uncontaminated and free of ice. No additions should be used to keep water ice free, covers and insulation of water buts or water straight from a piped supply is best.

3. Binders should be kept in dry conditions, off the ground and away from walls.

4. Mixers should be clean and dry at the start of each batching process, water should not be left in mixers overnight.

5. In cold, not freezing conditions warm water could be considered advantageous. The mixing area may well be outwith the climate protected zone and this has to be taken into account.

N.B. This information is general guidance only and should not be treated as building or site specific.

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