Heritage Council of New South Wales

Repointing Lime Mortar Joints — some important points

This is an outline of the important points that need to be considered for successful repointing of lime mortar joints in stone and brick masonry.

1. **Match previous mortars**
   - binder — if the original was lime, then use lime;
   - sand — seek to match colour, grain size, grain shape and grading;
   - match finished appearance of original joint — flush, struck, tuck pointed, etc;
   - match mix proportions — traditional mixes were commonly 1:2–3, quicklime:sand.
2. **But you may need to modify the mortar mix**
   - because of the nature of the available limes or sands; or
   - to make it weaker (sacrificial) to control salts; and
   - more porous to promote evaporation (breathing); or
   - to make it slightly stronger by adding pozzolanic, or hydraulic materials.
   - sacrificial mortars might be 1:3, 1:3.5 or 1:4 (lime: sand), depending on exposure;
   - adjust mix by adding lime putty (not water) to make poor sand more workable, or to allow for finer grained sand; e.g. 1:3 » 1:2.5 » 1:2» 1:1.5 as sands get progressively finer.
3. **Some mortars should not be matched**
   - hard cement repointing of original lime mortar may need to be replaced in lime;
   - where good breathing is needed, ‘mason’s putty’ may be too impermeable.
4. **Lime mortars are best made with slaked lime putty, or with quicklime**
   - slaked lime putty is more workable (buttery or creamy) than dry hydrated lime;
   - maturing of putty before use leads to finer particle size, faster curing and better working properties (these are even more important for plaster and limewash);
   - lime putty mortars can be stronger than those made with dry hydrated lime, and will be more elastic than those made with dry hydrated lime;
   - the workability of dry hydrated lime can be improved by running it to a putty in water 24 hours before use (this is not slaking, but soaking) (ensure that the lime is fresh);
   - excellent mortars can be made by the traditional practice of sand slaking quicklime.
5. **Sands should be washed clean, be sharp and well-graded**
   - washed clean to remove all clay, salt and organic material;
   - sharp (more angular in shape) to ensure good bond to adjacent masonry;
   - well-graded so that there is a range of coarse, medium and fine particle sizes;
   - sands of a uniform grainsize (whether coarse or fine) lead to higher void ratios and require more lime to fill the voids;
   - finer grained sands have greater surface areas requiring proportionally more lime;
   - dry sand makes for a better bond between lime putty and sand;
   - damp sand may produce too wet a mix for good repointing work;
   - a proportion of porous aggregates (including limestone) can be beneficial.

6. Mixing mortars

- lime putty mortars are best made by pounding and chopping the putty into the sand with a mason's hoe (larry), with the end of a mattock handle in a bucket, with a force action mixer, a paddle mixer, or a roller pan mixer;
- conventional rotary cement mixers can be used, but require longer mixing times; and
- adding heavy balls, such as used in milling, to force the lime and sand together;
- do not add water to the mix — there is enough in the lime putty;
- lime putty should be drained of any free water, and only stiff cheese-like material used;
- slaking quicklime with the sand (sand slaking) produces mixes with excellent workability and good strength and other characteristics;
- lime mortars can be mixed well ahead, kept sealed and then knocked up for use;
- the benefits of maturing the mix are greater than those of maturing putty separately;
- knock up with a mason's hoe, a mattock handle, by beating and chopping with a spade, or by using a force action, paddle, or roller pan mixer, but do not add water.

7. Raking out old mortar

- failure of much repointing is due to inadequate raking and cutting out of joints;
- thin feathered out pointing does not adhere well, fails rapidly, and traps water;
- rake out to a depth at least two and half times the width of the joints;
- rear of joints should be square, with clean sides;
- never widen original joints, no matter how narrow;
- use correct tools — quirks, plugging chisels, skates, hacksaw blades for fine joints;
- oscillating blade saws (multi-tools) can be very useful, but avoid angle grinders;
- clean out joints with compressed air.

8. Pre-wetting

- pre-wet masonry thoroughly, to control suction and prevent premature drying of mortar (premature drying leads to poor curing and low durability mortars);
- for many old (porous) walls it will be necessary to wet them the day before, and then several times on the day, the last immediately before placing the new mortar;
- walls should be thoroughly damp, but not glistening with water.

9. Pointing up joints

- a relatively stiff, dryish mortar mix is much better than one that is too wet;
- packing a joint requires compression of the mortar, not just placing with a trowel;
- use considerable force to compact mortar tightly into the joint;
- don't overwork by dragging the tool as this brings too much lime to the surface;
- always fill any deep voids, grouting if necessary, before final pointing;
- never use backing rods, as they prevent good adhesion and stop the joint breathing;
- use correct tools — caulking trowels (or finger trowels) that fit into the narrow joints, or plasterer's small tools for wide joints in rubble walls;
- for narrow joints use a stiff dry mix carefully, or use masking tape on either side.

10. Finishing the joint

- match known previous joint finish (struck, lined, etc), otherwise use a plain flush finish;
- dampen with a fine water spray as soon as possible after placing mortar;
- after initial stiffening lightly scrape off excess mortar with a trowel or small tool;
- tamp joint with a stiff bristle brush to prevent shrinkage, expose sand and increase the surface area — do this when just still possible to push a fingernail into mortar;
- tamping produces a weathered appearance — the amount of tamping will be determined by the need to match any existing mortar and by other factors such the need for good breathing characteristics (more tamping = better breathing);
- spray with fine water spray as soon as tamping is complete.

11. Curing

- good curing is an essential part of making durable lime mortars;
- water must be present for the curing reactions (carbonation and hydration) to occur which is why lime mortars should be kept wet during stiffening and curing;
- protect mortars from adverse weather conditions, e.g. too hot, too windy, too wet and too cold — ideally work only between 5º and 30ºC;
- stage work around a building to avoid hot sun on new work;
- keep new lime mortars quite wet for at least a week;
- spray with water several times a day, or use misting systems behind a tightly enclosed scaffold (covering with wet hessian may not be enough);
- improved results can be achieved by then allowing a week's drying (protected from rain) then wetting again thoroughly — periodic wetting and drying aids carbonation.

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For the Technical Advisory Group of the Heritage Council of NSW
November 2006. First revision April 2009.This revision July 2011