TS03 Guideline **Repointing of masonry**

Intent

State Heritage Places are an important part of South Australia's legacy. The following Guideline provides specific maintenance and repair advice for owners of State Heritage Places. Advice is based on the best-practice approach of the Australia ICOMOS Burra Charter (2013) and current heritage industry knowledge.

Development Approval is required for repointing of State heritage listed buildings. Use of the correct materials and finishing techniques is vital for the retention of historic fabric. This Guideline can be used by building owners, contractors and architects to assist in the development approval process and conservation work.

It covers:

- Lime mortars
- Additives
- Mixing
- Masonry repair
- Raking out
- Re-pointing

A stone wall being repointed using lime mortar.

Source

This Guideline provides recommendations for materials and work practices expected for the masonry repointing of a State Heritage Place – <u>in addition to</u> Australian Standards and Building Certifier approved documentation.

What is the right type of repointing?

Before conservation works are undertaken, it is advised that you contact the SA DEW State Heritage Unit to determine the best approach to repointing your building.

Selection of the best conservation approach for your building will depend on:

- heritage values of a particular property,
- Surrounding environmental factors causing deterioration of existing pointing or masonry,
- Identification of early pointing methods/ colours for the place,
- Advice of the Heritage Professional.

Why do I need Development Approval?

<u>Any work</u> to a State Heritage Place – inside and outside - may be considered 'development' under the SA Development Act, 1993/PDI Act 2016. Always contact your local council planner to determine if intended work is considered 'development' and if a Development Approval is required before commencing work.

Pointing test samples may be requested as a Condition of Development Approval. The applicant should advise Council when samples are ready for inspection.

Scope of Guideline

Masonry repointing: the repair/ replacement of pointing mortar to stonework or brickwork.

Work may include removal of hard cement mortar and rejuvenation of pointing joints prior to repointing.

Depending on the nature of the work, this Guideline should be read in conjunction with the Guidelines: **TS01 Rising Damp and Salt Attack** and **TS06 Undersetting.**

This Guideline does not cover stone replacement, brick washes or crack repairs.

Heritage Considerations

Heritage conservation work should be guided by the Australian best practice approach of the Aust ICOMOS Burra Charter. In particular, Article 3.1

"Conservation is based on a respect for the existing fabric, use, associations and meanings. It requires a cautious approach of ***changing as much as necessary but as little as possible.****"*

Changes to building fabric of heritage value should only be necessary if the fabric is beyond repair. This means all measures should be taken to retain or match original, significant façade pointing whenever possible.

Standard and Quality of Work

All masonry work to State Heritage Places should be carried out by a specialist contractor with demonstrated experience in this type of work and/or has relevant accreditation through a professionally recognised heritage skills training programme. The contractor is to provide a list of past projects on request, with a particular reference to other heritage listed places.

Masonry repointing work should be undertaken in accordance with Australian Standards, the requirements of the Australian National Construction Code and any relevant Building Certifier approved documentation. This Guideline provides recommendations for repointing work <u>in addition to</u> these statutory requirements.

Materials

Preferred mortar mix

Non-hydraulic lime– used in traditional mortar for conservation of heritage buildings

Option 1 - Slaked Lime Putty mortar (mixing quicklime and sand): 1:3 – slaked lime putty mixed with concrete sand – well graded - fine to course, without clay. Slaked lime putty should be allowed to stand for several days prior to mixing. Then the lime water and very thin putty should be poured off the top and only the stiffer putty used to make the mortar. Use a stainless steel trough to mix the mortar using a larry (mason's hoe) so that considerable pressure can be applied to the mix thus forcing the lime and sand grains together. Ensure the sand is dry and kept dry prior to mixing. Do not add water to the mix, there is sufficient in the putty. Thoroughly mix the components together so that the batch is uniform and store it in sealed pails ready for use. Maturing improves workability and performance. On opening each pail the mix should be turned out onto a mortar board and thoroughly mixed again before use, but without adding water. Normal barrel cement mixers will not produce satisfactory mixing. Mixers with wide blades and flint balls (from a ball mill) will help with thorough mixing but the initial mix must be done by hand Pozzolans may need to be added prior to pointing, to create 'dirty' lime mortar and to provide a degree of strengthening (typically 5% of total mix (one-fifth part) trass).

Option 2 - 'Course stuff' – pre-mixed, non-hydraulic lime mortar (with sand), in bucket form, for use in repointing work.

Alternative mortar mix

Hydraulic lime – used for new work and in limited instances, conservation work:

The majority of South Australian limestone burnt to create quicklime for building purposes was not naturally hydraulic and therefore hydraulic lime (NHL) should be used with caution in conservation work, as it will change the permeability of the wall.

Hydraulic lime types include:

NHL2 (Feebly hydraulic). Recommended for conservation work, as is the least hydraulic and hence it takes longer to set. This is perhaps the closest to the strength and workability of traditional 'dirty' non-hydraulic limes

NHL3.5 (Moderately hydraulic) for exposed situation such as for parapets, copings and chimneys.

NHL5 (Eminently hydraulic) for strong tough substrates in very exposed situations or where permanently wet, it sets quite quickly and is harder to work – it is close in strength to the Portland Cements in use in around c1900.

Discuss the use of hydraulic lime in conservation work with a Prescribed Heritage Professional before selection. Incorrect use may cause irreversible damage to walling of a State Heritage Place. Lime mortar should be selected to match the existing lime type of the existing

building, to maintain the degree of permeability and balance of moisture movement through a masonry wall.

Dry Hydrated Lime

This is the type of lime available from hardware stores. Do not use this lime, as this is not Quicklime, or Hydraulic Lime and use will cause damage to wall masonry.

Sand

Washed, well graded, dry, sharp, angular concrete sand with no clay content, free from efflorescing salts and selected for colour and grading. Do not use standard bricklayers or plasterers sand as these are either not well graded or contain too much clay.

It is important that the sand be graded so as to have a similar distribution of particles to match the sand in the existing mortar, as differences in the grading can impact the porosity of the mortar. Grading also impacts on the amount of lime required in the mix, so finer sands will require a higher proportion of lime than a coarser sand. Curing problems can also occur where there is inadequate grading.

Generally, historic pointing used a fine-medium well graded sand containing a well distributed range of sizes based on approximately 80-85% of grains passing through a 600 micron sieve.

The colour of the sand should be selected for the colour matching properties of the existing original pointing. A mix of other pit sands (without clay) may be needed. Colour is to be achieved through aggregate selection only unless noted under Additives.

Pozzolans

Pozzolans: Natural volcanic ash in the form of Trass. Artificial binders and cement are not recommended, as these affect the natural porosity of the mortar and will adversely affect the movement of moisture through masonry.

Water

Clean, potable and free from any deleterious matter – generally no additional water should be added with that contained in the putty being sufficient for the mix.

Additives

Should pointing be dark in colour, grey natural mineral oxides, such as red iron oxide or black oxide powder, coal dust, carbon dust, charcoal can be considered. Material must be free of organic material. If oxide is added, mortar mix proportions are to be determined on site based upon colour and lime mix. Oxides perform in a similar manner to clay and cause mortar mixes to be less porous and reduce lime performance. Do not use cement in the mix to darken colour. The porosity of the mix will be reduced and the mix will be too hard, causing damage to surrounding stones.

Line work

White or black external grade acrylic paint, colour dependant on stone type being ruler lined. Apply with appropriate chisel brush.

Stonework

Replacement natural stone is to be second hand salvaged stone matching the existing. Salt impregnated stone from salt impacted portions of walls is not to be reused in repairs.

Where salvaged stone is unavailable, new stone is to be sourced to match the existing stone type and colour.

Brickwork

Bricks to be used for replacing deteriorated existing bricks are to be undamaged external grade salvaged bricks of the same size, profile, colour and texture to match the existing. Do not use existing, salt affected bricks in repair works.

If the bricks are the incorrect size to match the existing, these are to be carefully cut down to match the size required.

Example of the deterioration of stone as a result of hard cement pointing.

Source DEWNR

Undertaking the work – method and finish

Documentation

The following documentation should be submitted to the relevant Planning Authority when seeking Development Approval for repointing works.

- Site plan
- Floor plan showing proposed works
- This **TS03 Repointing** Guideline, initialled by the applicant to confirm acceptance of content as the guideline for the proposed works.
- Written confirmation that the intended works will not adversely affect the heritage values of the place, prepared by a Prescribed Person.
- A completed schedule outlining all proposed materials and details (link)

Preparation

All existing original pointing should be retained wherever possible.

Before deciding on the extent of repointing required, any existing sound pointing should be identified for the matching of the new pointing.

In the case where no original pointing exists, the colour and mortar mix used should reflect that used on surrounding buildings. A Heritage professional will advise the best mortar finish for repointing work.

Replace any stone/brick beyond reuse with the approved second hand or new units. Stones are to be laid on its natural bedding plane unless edge bedding is required to match the surrounding stones.

Where several stones/bricks require replacement in a single areas, evenly distribute to match the colour range of the adjoining wall surfaces to prevent colour concentrations and "banding".

Remove any residual surface salts before commencing works. Gently wash wall and remove any salt residue. If excessive salts remain, discuss with a heritage professional. Options may include application of a poultice (two applications minimum) to draw excessive salts out of the wall. Do not repoint wall until excessive wall salt has been removed from masonry (evident when salts remain in mortar/ stones after washing/ drying).

Raking out existing pointing mortar

Existing lime based, decayed pointing mortar – rake out existing mortar, to a depth of at least 25mm, or deeper where unconsolidated. Do not use power saws or cutting tools. Rake out using hand tools to avoid damage to brickwork or stone.

Cement based pointing – remove by hand methods with tools to suit where possible, avoiding damage to stonework and brickwork. If power tools are necessary:

- Carefully score one cut in each joint at the centre of the joint – this is to be no more than one half the width of the joint and to the full depth of the pointing. Ensure that adjacent masonry is not damaged during cutting-out operations.
- Stitch drilling along the centre line of the joint to break up the mortar.
- Final cutting-out of the joints is to be made by hand using sharp bolsters to detach the upper and lower fragments remaining.

Method – mortar work

***Pre-wetting*:** Thoroughly pre-wet the masonry until the stones/ bricks will absorb no more water. The purpose is to control the suction of the masonry so that water is not sucked out of the new mortar leading to premature drying and poor curing. Do an initial thorough pre-wet the night before and then again before repointing. Apply mortar when stones/bricks are still damp but not glistening with water on the surface.

Pre-wetting of wall to prevent suction.

Source DEWNR

***Mortar*:** Use a lime mortar made from slaked lime putty (not dry hydrated lime) and clean, sharp well graded concrete sand.

Mortar mix proportions to be approximately one part lime putty, three parts sand, with 5% of total mix (one-fifth part) trass if needed. Measure out components in containers, not a shovel.

***Placing*:** The mortar mix will be stiff and dry but still plastic enough to place for repointing. With a stiff dry mix any mortar spills that land on the face of the masonry can simply be brushed off without staining. Allow at least 25mm depth for pointing work.

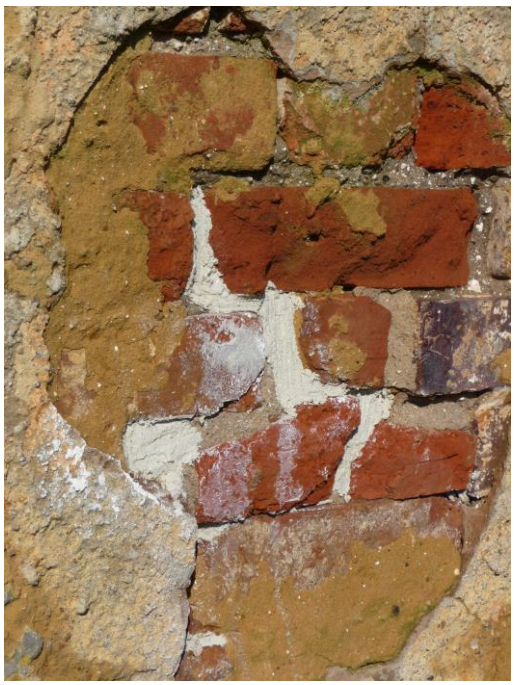
Repointing / Pointing work: Placement with trowels for pointing work is not acceptable. Use jointing irons (keys) that fit within the joints, with a range of iron sizes for different joint widths. Because of the need for deep packing of some joints, special tools may be needed. These may include a series of thin blocks of hardwood of different thicknesses for use in tamping mortar tightly into the joints. Using considerable force, tightly compact the mortar into the joints. Fill deep joints in stages, waiting at least a day and pre-wetting again, between stages. Initially finish the joints with a struck finish to match the existing masonry. Spray mortar with a fine mist as soon as it will take water. This can be quite soon after placement provided stiff dry mixes have been used. Keep the mortar damp.

Finishing: When pointing mortar is 'leather-hard' (when it is just still possible to push a fingernail into the mortar — often overnight) forcefully tamp joints with ends of stiff bristles from a brush or broom to compact mortar tightly, preventing shrinkage cracking, expose sand grains, and increase surface area of the joint. Spray with water as soon as tamping is complete.

Line work – stonework Apply ruled, struck, vertical and horizontal line work to mortar with a suitably sized iron while still setting. Apply lines to simulate ashlar work – mixing size of rectangles to provide variety and generally replicate typical stone block dimensions. Avoid excessively small blocks in line work application. Line work patterning to reflect remnant patterning if evident on building, or if not, typical to buildings of the era of the subject place.

Line work – brickwork Apply ruled, struck, vertical and horizontal line work to mortar with a suitably sized iron while still setting. Apply lines to simulate brickwork coursing and gauge lines.

Curing: Keep the curing pointing mortar damp with regular watering at least three times a day for ten days. Cover with wet hessian after each spraying and keep it wet. Then allow to dry for a week (longer if it rains) before once again thoroughly wetting the joints and surrounding stones for two days. Cool damp curing conditions are critical to successful repointing with lime mortars. Do not undertake repointing when the day temperature will exceed 30°C (preferable maximum of 25°C) or in windy weather as rapid drying must be avoided



Repointing of a brick wall using lime mortar

Source DEWNR

Cleaning

Clean progressively as the work proceeds to remove mortar dags, smears, stains and discolouration.

No acid will be permitted to clean masonry surfaces.

At the completion of the curing of the pointing and before the removal of the access equipment, wash down the entire wall from top to bottom.

Line work – painting

Where appropriate, apply painted line work, following struck line work, using

suitable brush and nominal 3mm thick straight painted lines.

Typically, white colouring is used for bluestone and black is used for sandstone and limestone walling. Brickwash finished brickwork is typically finished with black lining.

Original white lining on limestone wall.

Source DEWNR

Further reading

For more information about masonry conservation on heritage buildings visit:

https://www.environment.sa.gov.au/topics/heritage/conserving-our-heritage

Department of Environment and Natural Resources and David Young (1993, 2008); Booklet: Heritage Conservation Practice Notes- Stone Masonry in South Australia

Young, D. 2008. Salt Attack and Rising Damp- A Guide to salt damp in historic and older buildings. South Australia, Department for Environment and Heritage, Adelaide City Council ISBN 978-0-9805126-4-9.

Department of Environment and Natural Resources and City of Adelaide (1995, 1997) Rising Damp and Salt Attack.

Heritage Stone Restorations (2008). Booklet: Searching for the Perfect Mortar- ICOMOS World Heritage Day Workshop- Sacred Places.

Department for Environment and Heritage (2008) Maintenance and Repair of Older Buildings in South Australia- Technical Note 3.1. Government of South Australia and Adelaide City Council ISBN:1 921238 48 8

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