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REPAIRING HISTORIC MASONRY

The deterioration process of brick can be similar to that of stone, in which successive layers flake off. In cases where the brick is exposed to constant soaking moisture, it can disintegrate into powder. This process is accelerated when bricks have had their hard, outer surface destroyed through abrasion, such as sandblasting.

There is no real way of repairing brick short of replacement. The damaged brick must be chipped out, along with the surrounding mortar, and a new brick or bricks inserted and pointed. It is essential when replacing brick to use an exact match in size, color and texture. If the existing bricks are only damaged on their exterior face, it is sometimes possible in small areas, to remove the brick intact and re-install it in reverse with the rear face exposed. Besides solving the problems of matching, this method is desirable because it preserves the original materials of the building.

If the existing bricks cannot be used, then new bricks that match the original as closely as possible in terms of size, color and texture should be used. Care should be taken to match the size, tooling and color of the mortar joints, and the pattern of the brick bond as well.

SUMMARY OF RECOMMENDATIONS:

Identify the Problem Before Repointing:

The decision to repoint is most often related to some obvious sign of deterioration, such as disintegrating mortar, cracks in the mortar joints, loose bricks or stones, damp walls, or damaged plasterwork. The root cause of the deteriorations (leaking roofs or gutters, differential settlement of the building, capillary action causing rising damp, or extreme weather exposure) should always be dealt with prior to beginning work. Without appropriate repairs to eliminate the source of the problem, mortar deterioration will continue and any repointing will have been a waste of time and money.

Find an Appropriate Mortar Match

Analysis of unweathered portions of the historic mortar to which the new mortar will be matched can suggest appropriate mixes for the repointing mortar so that it will not damage the building because it is excessively strong or vapor impermeable. A simple, non-technical, evaluation of the masonry units and mortar can provide information concerning the relative strength and permeability of each, while a visual analysis of the historic mortar can provide the information necessary for the developing the new mortar mix and application techniques. Mortar analysis by qualified laboratory can be useful by providing detailed information on the original material ingredients.

In creating a repointing mortar that is compatible with the masonry units, the objective is to achieve one that matches the historic mortar as closely as possible, so that the new material can co-exist with the old in a sympathetic, supportive and, if necessary, sacrificial capacity. The exact physical and chemical properties of the historic mortar are not of major significance as long as the new mortar conforms to the following criteria:

- The new mortar must match the historic mortar in color, texture and tooling;
- The sand must match the sand in the historic mortar. The color and texture of the new mortar will usually fall into place if the sand is matched successfully;
- The new mortar must have greater vapor permeability and be softer (measured in compressive strength) than the masonry units;
- The new mortar must be as vapor permeable and as soft or softer (measured in compressive strength) than the historic mortar. (Softness or hardness is not necessarily an indication of permeability: old, hard lime mortars can still retain high permeability).

Properties of Mortar:

Mortars for repointing should be softer or more permeable than the masonry units and no harder or more impermeable than the historic mortar to prevent damage to the masonry units. It is a common error to assume that hardness or high strength is a measure of appropriateness, particularly for lime-based historic mortars. Stresses within a wall caused by expansion, contraction, moisture migration, or settlement must be accommodated in some manner. In a masonry wall these stresses should be relieved by the mortar rather than the masonry units. A mortar that is stronger in compressive strength than the masonry units, will not “give”, this causes the stresses to be relieved through the masonry units which results in permanent damage to the masonry, such as cracking and spalling.

Historically, mortar acted as a bedding material, not unlike an expansion joint, rather than a “glue” for the masonry units, and moisture was able to migrate through the mortar joints rather than the masonry units. When moisture evaporates from the masonry it deposits any soluble salts either on the surface as efflorescence or below the surface as subflorescence. While salts deposited on the surface of masonry units are usually relatively harmless, salt crystallization within a masonry unit creates pressure that can cause parts of the outer surface to spall off or delaminate. If the mortar does not permit moisture or moisture vapor to migrate out of the wall and evaporate, the result will be damage to the masonry units.

Mortar Type and Mix:

The actual specification of a particular mortar type should take into consideration all of the factors affecting the life of the building including: current site conditions, present condition of the masonry, function of the new mortar, degree of weather exposure, and skill of the mason. No two repointing projects are ever exactly the same.

Joint Preparation:

Old mortar should be removed to a minimum depth of 2 to 2-1/2 times the width of the joint to ensure an adequate bond and to prevent mortar “popouts”. For most brick joints, this will require removal of the mortar to a depth of approximately 1/2 to 1 inch; for stone masonry with wide joints, this will require removal of the mortar to a depth of several inches. Any loose or disintegrated mortar beyond this minimum depth also should be removed. Small pneumatically-powered chisels generally can be used safely and effectively to remove mortar on historic buildings as long as the masons maintain

appropriate control over the equipment. Although mechanical tools may be used safely in limited circumstances to cut out horizontal joints in preparation for repointing, they should never be used on vertical joints because of the danger of slipping and cutting into the brick above or below the vertical joint.

Mortar should be removed cleanly from the masonry units, leaving square corners at the back of the cut. Before filling, the joints should be rinsed with a jet of water to remove all loose particles and dust. At the time of filling, the joints should be damp, but with no standing water present. It is recommended that a continual mist of water be applied for a few hours before repointing begins on masonry walls (limestone, sandstone and common brick) that are extremely soft and absorbent.

Filling the Joints:

Where existing mortar has been removed to a depth of greater than 1 inch, these deeper areas should be filled first, compacting the new mortar in several layers. The back of the entire joint should be filled successively of applying approximately ¼ inch mortar, packing it into the back corners. This application may extend along the wall for several feet. Several layers will be needed to fill the joint flush with the outer surface of the masonry. It is important to allow each layer time to harden before the next layer is applied.

If the old bricks or stones have worn, rounded edges, it is best to recess the final mortar slightly from the face of the masonry, the treatment will help avoid a joint which is visually wider than the actual joint; it also will avoid creation of large, thin feathered edge which is easily damaged, thus admitting water. After tooling, excess mortar can be removed from the edge of the joint by brushing with a natural nylon brush. Metal bristle brushes should never be used on historic masonry.

During Restoration or Construction:

- Use traditional brick laying and masonry pointing techniques that reduce mortar smears during construction;
- Use construction practices that prevent debris from splashing onto brickwork and minimize water penetration into unfinished masonry.

For more information, see the National Park Service's Preservation Brief No. 1, "Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings," Chapter 2 "Repointing Mortar Joints in Historic Masonry Buildings", Robert C. Mack, FAIA and John P. Speweik, The Preservation of Historic Architecture (Department of the Interior: The Lyons Press, 2004), and the Brick Industry's "Technical Notes on Brick Construction," no. 20, 1996.