Water washing methods include soaking, pressure washing, pressure washing supplemented with detergents or surfactants, and steam cleaning. Most masonry can be cleaned with simple water washing without the need for more aggressive measures. The amount of soiling will determine the level at which testing should begin.

For light to moderate soiling, particularly on rough textured brick or stone, *water spray* at moderate pressure (200 to 600 psi) may be needed. Non-ionic detergents applied by bucket and brush, or added to the power spray, can hasten the cleaning process and reduce the amount of water that must be applied to the wall, but they must be thoroughly rinsed to remove any film or residue left on the surface.

*Water soaking* is effective for carbon or sulfate encrustations, which often build up in protected areas under cornices, eaves, and overhangs where rain cannot keep the wall clean. A fine mist sprayed on the wall for a prolonged period softens the crust by causing the dirt deposits to swell and loosen their grip on the masonry. The continuous application of water then rinses the deposits away, simulating the natural washing action of rain. A low to moderate pressure rinse may be needed as a final step. The volume of water required for cleaning can be enormous (9.8 million gal on Chicago's Field Museum). Precautions must be taken to prevent moisture damage to other parts of the building. Repair open mortar joints, replace deteriorated sealant joints, and check windows for glass that is loose before beginning work. In water soak applications, it is best to cover windows, doors, and lower courses of masonry to keep most of the water out.

*Steam cleaning* requires much less water, and is used almost exclusively for interior work. Steam is dangerous because it burns and because it obscures the visibility of the equipment operator. It can be very effective, though, on delicate, ornately carved stonework.

*Chemical compounds* are usually needed to remove heavy dirt buildup, wax coatings, water repellents, and paint. Acid-based cleaners are most effective for removing dirt, and alkaline cleaners for paint removal. The lime mortars used in historic masonry construction, however, are acid sensitive, and acid can also damage brick. To prevent the chemicals from penetrating beyond the layers of surface dirt, the walls must be thoroughly presoaked with water before application, and thoroughly rinsed with clean water afterward. Test patches must be used to determine the exact chemical concentrations and dwell times required for specific surfaces and specific soiling conditions.

Alkaline paint strippers are very effective in removing layers of paint from masonry buildings. It is important, however, to first determine whether the paint should be removed at all. Painted brick buildings were popular during several historic periods. Many were painted immediately after construction, sometimes to protect soft, inexpensive brick. If the underlying substrate is soft, low-fired brick, paint removal may be more damaging than beautifying in the long run.

### 16.4.3 Precautions

Because water is used in all masonry cleaning procedures, provisions must be made for adequate site drainage. The high volume of water also precludes cleaning during cold weather when there is any danger of the masonry freezing before it dries out. Effluent control and handling must also be provided when contaminants such as lead-based paints are involved, and chemical cleaning should not be performed under windy conditions when overspray or

drift could be a problem. Caution is essential to all phases of historic masonry cleaning, not only in the handling and treatment of the sometimes delicate building fabric itself.

## 16.5 REPAIR AND REPOINTING

The first priority in repairs to historic buildings should be identifying and treating the cause, rather than the effects, of deterioration and damage. Before stones cracked by settlement are repaired or replaced, the foundation itself must be stabilized, and roof leaks must be stopped before repairing moisture-damaged walls. If the symptoms rather than the disease are treated, the problems will recur.

### 16.5.1 Repairs

Begin with major structural work before undertaking minor repairs, and provide permanent weather protection as soon as possible. Be wary of methods that have not been extensively tested. Historic buildings should not be the testing grounds for new materials and procedures. Avoid the tendency to rush work, because shortcuts and poor craftsmanship compare poorly with the original work and result in jobs requiring additional repair. The most cost-effective approach is not necessarily the least expensive, but the one that will last longest, is technically best, and requires the least change to the historic property.

No matter how soiled the masonry itself is, or how much moisture it retains on the surface, much larger quantities of water will enter the wall through cracked or broken mortar joints, defective copings, and leaky roofs and gutters. Joint integrity must be maintained, not only for aesthetic reasons, but for structural soundness and weather protection as well. But repointing will not be effective if there are other sources of moisture that have not been identified and repaired. If the roof leaks, fix it. If the coping is ineffective in stopping water infiltration, repair it. Then repoint the mortar as needed. To finish the job, look carefully at caulking and sealant joints. There is a limit to the effective service life of these materials, even under optimum conditions. Periodic maintenance and repair are always necessary and should be scheduled regularly to avoid more costly long-term damage from water.

### 16.5.2 Joint Preparation

Deteriorated mortar joints in existing masonry can be cleaned out and repointed with fresh mortar. Mortar joints deteriorate for many reasons:

- Water, wind, and pollution erode the mortar.
- Historic mortars made with little or no portland cement are soft, and often more susceptible to weathering.
- Uneven settlement can cause cracks to form in the mortar joints.
- Mortar joints are only partially filled during construction, or mortar inadequately bonds to the units, allowing excessive moisture to penetrate the wall.
- Walls saturated by moisture can freeze and thaw again, eventually spalling both the mortar and the masonry.

*Raking* refers to the process of removing or cutting out the old mortar. Mortar joints should be raked out to a depth of $^1/_2$ to $^3/_4$ in. (*see Fig. 16-6*). If