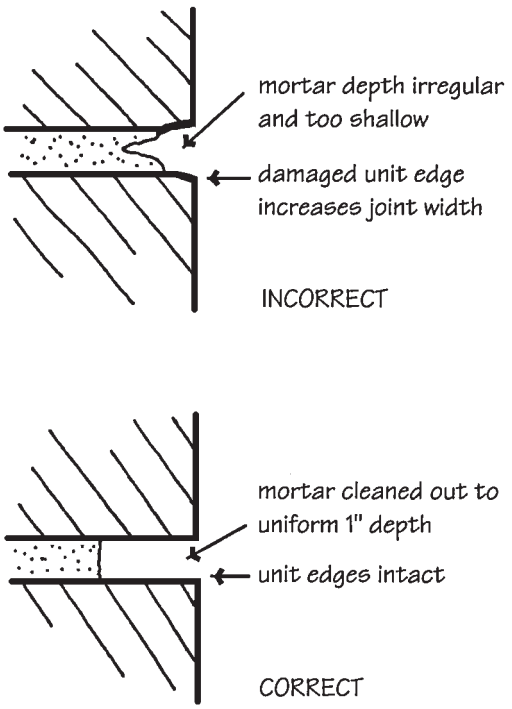

Figure 16-6 Raking out defective mortar joints. (*From U.S. National Park Service,* Preservation Brief No. 2.)

the mortar is still unsound, cut the joint deeper. Mortar can be removed with a hand-held grinder, a small mason's chisel, or with a special raking tool. If a grinder is used to rake vertical head joints, be careful not to cut into the brick courses above or below. Before repointing, brush all loose fragments and dust from the joint or flush them out with a stream of water or pressurized air. ASTM E2260, *Guide for Repointing (Tuckpointing) Historic Masonry* addresses mortar evaluation, mortar removal techniques, mortar selection, and procedures for joint preparation, mortar placement, and curing.

16.5.3 Mortar

Repointing mortar should match the existing material as closely as possible in strength, hardness, color, and texture. Historic mortars were generally soft and may have been mixed from clay, gypsum, lime, natural cement, and some later ones with portland cement. ASTM C1324, *Method for Examination and Analysis of Hardened Masonry Mortar* can be used to determine the ingredients and proportions by petrographic and chemical analysis. Mortars containing portland cement are much harder than these older mixes, and in some cases, harder than the brick or stone itself. The new mortar should have a similar or lower compressive strength and higher vapor permeability than the stones or bricks in the wall. A hard mortar used with soft brick or stone can cause deterioration of the masonry because the two components do not respond to temperature and moisture changes at the same rate, or to the same degree. The softer material will absorb more movement stress and more moisture, and hard mortar can act as a wedge, breaking the edges off the units (*see Fig. 16-7*). Many buildings have been irrepara-

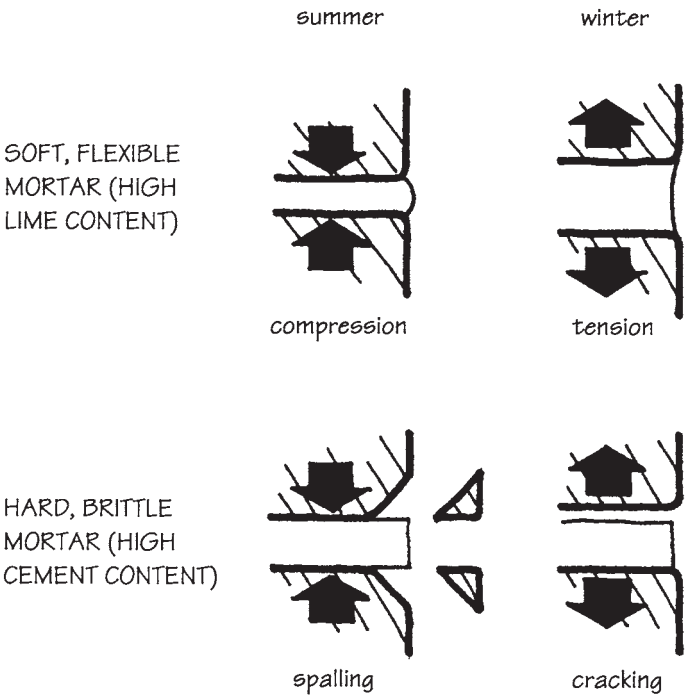

Figure 16-7 Hard mortar can damage soft historic brick or stone. (*From U.S. National Park Service,* Preservation Brief No. 2.)

bly damaged in this manner. Strong portland cement mortars may also shrink, leaving minute cracks at the mortar-to-unit interface.

Recommendations for repointing mortar vary with almost every source consulted. The Preservation Assistance Division of the U.S. National Park Service recommends lime-sand mortars with the optional addition of portland cement not to exceed 20% of the total volume of cement and lime. For brick masonry restoration in which the ingredients of the original mortar are unknown, BIA recommends an ASTM C270 Type N or Type O mortar mixed proportionally with portland cement, lime, and sand. The appendix to ASTM C270 recommends Type N, O, or K, depending on conditions of exposure. The recommendations in *Fig. 16-8* from the Ontario Ministry of Citizenship and Culture are based both on expected weather exposure and the type of masonry involved.

To compensate for shrinkage in mortars containing portland cement, prehydrate the mortar by first mixing the dry ingredients with only enough water to produce a damp, unworkable mix (one that will retain its form when pressed into a ball). Keep the mortar in this damp condition for 1 to 2 hours and then add enough water to bring it to a working consistency somewhat drier than conventional mortar. The drier mix is easier to place, and doesn't flow to the bottom of the joints as easily. To see if the color of the new mortar matches the color of the old, test a sample area in an inconspicuous location, using a garden hose to soak a portion of the wall. The color of the new mix should match the darker, wet color of the existing. Minor adjustments can be made by adding or subtracting sand or cement, but records should be kept of exact proportions so that the selected color can be reproduced consistently throughout the job.