Masonry Material	Recommended Mortar Mix Proportions for Various Weathering Exposures		
	Sheltered	Moderate	Severe
Highly durable granite or hard brick	1 part cement 2 parts lime 8 to 9 parts sand	1 part cement 1½ parts lime 5 to 6 parts sand	1 part cement ½ part lime 4 to 4½ parts sand
Moderately durable stone or brick	1 part cement 3 parts lime 10 to 12 parts sand	1 part cement 2 parts lime 8 to 9 parts sand	1 part cement 1½ parts lime 5 to 6 parts sand
Poorly durable soft brick or friable stone	0 parts cement 2 parts hydraulic lime 5 parts sand	1 part cement 3 parts lime 10 to 12 parts sand	1 part cement 2 parts lime 8 to 9 parts sand

Figure 16-8 Recommended repointing mortars. (*Adapted from the Ontario Ministry of Citizenship and Culture,* Annotated Master Specifications for the Cleaning and Repointing of Historic Masonry Structures, *1985.*)

16.5.4 Pointing

To ensure good bond with brick and stone, dampen the cleaned joints with water just before beginning work. Mortar is placed using a small mortar board called a "hawk" and a tuckpointer's trowel, which looks like a jointer, but has a flat blade. Vertical joints are filled first, then horizontal joints, with the mortar applied in thin $^1/_4$-in. layers that are allowed to become "thumbprint hard" before placing the next layer. Joints should not be overfilled to the point where mortar hides the edges of the units. This makes the joint appear too wide, and the edges break off too easily, leaving voids through which moisture can penetrate. For brick or stone that has weathered to a rounded profile, the new mortar joint should be slightly recessed from the unit surface and tooled concave to avoid "feathered" edges (*see Fig. 16-9*). Wide, feathered joints also change the appearance of the masonry (*see Fig. 16-10*). Stippling joints with the bristles of a stiff, nonmetallic brush while the mortar is still soft will give it a worn appearance. Moist curing may be necessary in hot, dry weather to assure hydration of the cement and good mortar bond to the units.

16.6 COLOR MATCHING BRICK

Once the brick or stone in a wall begins to crumble, the deterioration will continue, often at an accelerated rate. The condition can be remedied only by replacement of the affected unit. Where damage or deterioration is extensive, replacement of entire sections of masonry may be required. The brick, stone, terra cotta, or clay tile used for such repairs should match the original material characteristics as closely as possible. Where damage has been caused by excessive moisture penetration from groundwater migration, the installation of a waterproof membrane as a dampproof course may be possible as sections of the original masonry are removed.

Whenever replacement of brick masonry is required, or when additions to existing buildings are necessary, consideration must be given to color matching. Matching the brick on an existing building involves more than just picking a unit color. To achieve an acceptable result, the mortar mix, the joint tooling, and the moisture content of the brick must also be controlled.

The first consideration is whether to match the brick as is (dirt and all) or to clean the masonry and then match the original color. The question may

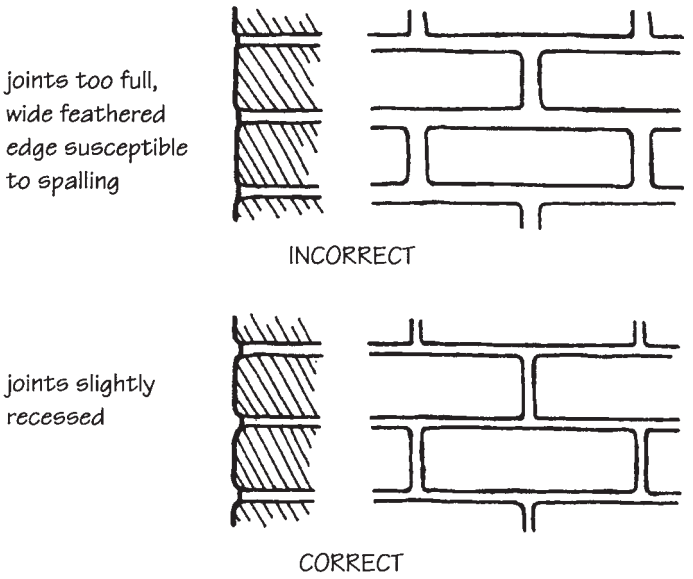

Figure 16-9 Correctly and incorrectly repointed mortar joints. (*From U.S. National Park Service* Preservation Brief No. 2.)

Figure 16-10 Original (left) and repointed (right) halves of building have very different appearance.

be at least partially answered by the age of the building itself. If constructed in the last 10 to 20 years, it is likely that the original brick is still available. Cleaning the existing walls may prove to be less expensive than a custom clay blend to match the soiled brick. Older brick may be unavailable, documentation may not exist to identify the original units, or cleaning may be unwarranted or undesirable from a historic perspective. In such cases, some