

Masonry Overview

Common brick is produced with a lower firing temperature making it softer, less tolerant to stress, and more permeable to water than either historic higher quality or modern brick.

Mortar is designed to be an expansion joint and vapor membrane around masonry blocks or brick. The mortar must be weaker and more permeable than brick.

Repointing is the process of filling and finishing joints with mortar.

Tooling is the final process of smoothing and shaping a mortar joint. "Tuck pointing" is one example of tooling.

Recipe for Mortar:

(expect to experiment with proportions)

- ✓ 1 cup white Portland cement (Lehigh, type 1 white Portland cement, 94 lb, \$25-45)
- ✓ 3 cups type S Lime (Chemstar, 30-50lb, \$7-10)
- ✓ 6 cups sand (mortar or “brick” sand, 200lb, \$2-5)
- ✓ 2 level teaspoons dark brown coloring agent (\$2/lb)

Mixing:

For the above recipe, thoroughly mix all ingredients before slowly adding 2-3 cups cold water until a semi-dry consistency is attained. Keep mixture in a bucket to reduce drying.

Trial batches of mortar should be made in order to match the color, texture, and strength of existing mortar on a building. Different coloring agents are available from masonry supply stores. Keep clear notes of the different mixtures and carefully follow the recipe for each batch once a proper mixture is determined. Mixture will generally dry within 1 to 1 ½ hours.



Intricate masonry work adorns the First Presbyterian Church in Butte.

Further Information

NPS Preservation Briefs:

(www.nps.gov)

- ✓ Brief 2: Repointing Mortar Joints in Historic Masonry Buildings
- ✓ Brief 6: Dangers of Abrasive Cleaning to Historic Buildings
- ✓ Brief 15: Preservation of Historic Concrete: Problems and General Approaches
- ✓ Brief 38: Removing Graffiti from Historic Masonry
- ✓ Brief 42: Maintenance, Repair, and Replacement of Historic Cast Stone

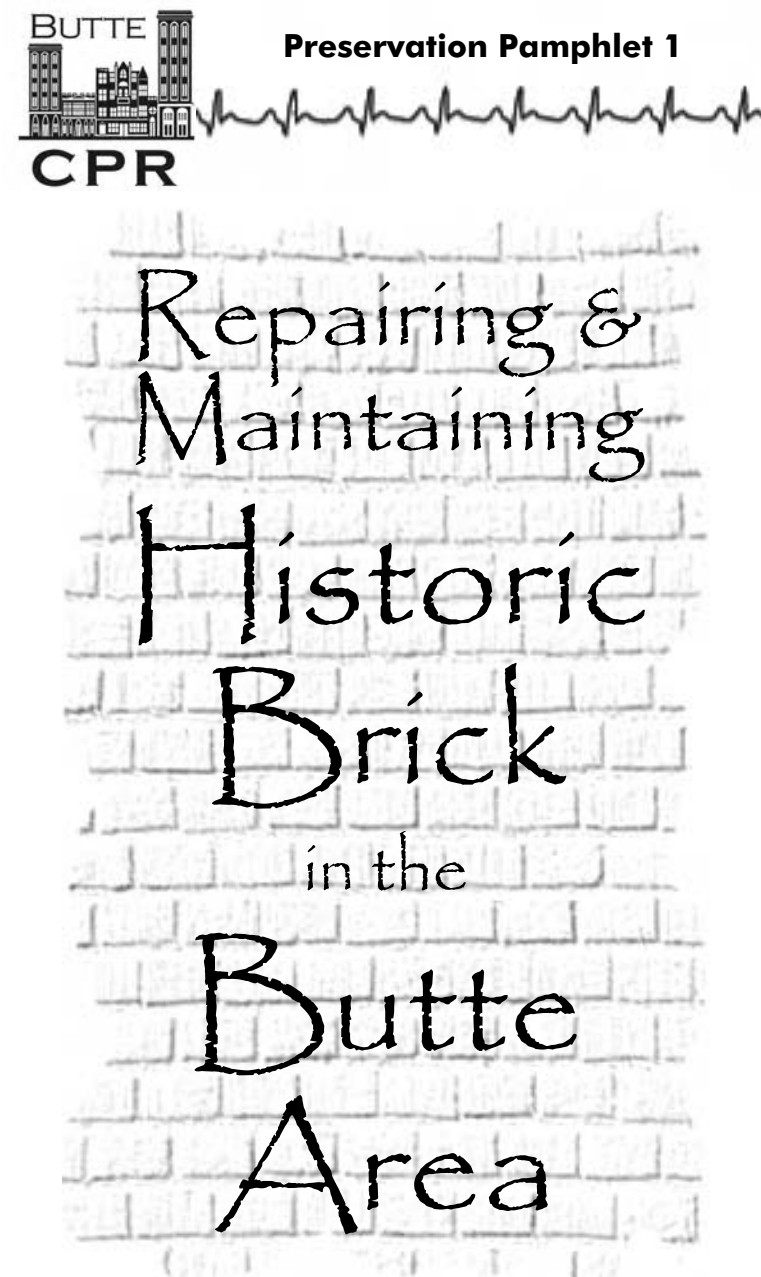
Sources of Information & Supplies:

- ✓ U.S. Heritage (involved with historic masonry preservation)
www.usheritage.com
3516 North Kostner Ave.
Chicago, IL 60641
(800) 286-2100
- ✓ Chemrex Inc. (produces cleaners and water sealers)
www.chemrex.com
889 Valley Park Drive
Shakopee, MN 55379
(800) 433-9517
- ✓ Prosoco Inc. (produces cleaners and water sealers)
www.prosoco.com
3741 Greenway Circle
Lawrence, KS 66046
(800) 255-4255



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Brochure created by Montana Tech Students Alex Brown & Kelly Speer



Introduction

The use of brick in the construction of homes and commercial buildings in Butte began in earnest around 1880. Brick was preferred for its resistance to fire and for its signified permanence as Butte grew from a mining camp to a city. Most brick used in Butte is called “common brick,” a somewhat soft, reddish-orange brick that is easily damaged by water, abrasion, and impact. Common brick was made by several small local firms in the Butte area. Higher-quality brick, commonly with a yellowish color, was often used on the more visible areas of stately homes and buildings. This higher quality brick was brought in from outside Butte; some from the Kessler facility in Helena, but also from out of state.

Components of Mortar

Sand: The largest single ingredient in mortar. Sand is generally mixed with the binder (cement and/or lime) in a 1:3 binder to sand ratio. Sand composition greatly affects color and texture. Most sand in the Butte area comes from the weathered granite surrounding the valley.

Lime: Calcium oxide, or lime, is the dominant binder in historic mortar. Historical mortar functioned as a bedding material and provided an expansion joint between bricks. Lime was a much more prominent ingredient in early mortar than it is today. High-lime mortars are more permeable to water vapor and weaker than cement mortars. Lime mortar is soft, porous, and resistant to temperature fluctuations, making it easy to work with when wet. Type S or SA hydrated lime is best for masonry purposes.

Portland Cement: A fast-curing, strong additive that accelerates mortar set time and strength. By the 1930s, most masons used a mix of equal parts Portland cement and lime. Portland cement is a silica- and lime-based material that hardens even when wet. Portland cement wasn’t commonly used until the early 20th century.

Pigments: Some historic mortars contained pigments to match the brick or stone. Red, brown, and black pigments were commonly used but weren’t always stable, resulting in fading over time. Modern counterparts are readily available, colorfast, and generally accepted as good substitutes.



The Charles Walker Clark Mansion (currently the Arts Chateau Museum) is an excellent example of well-maintained brick.

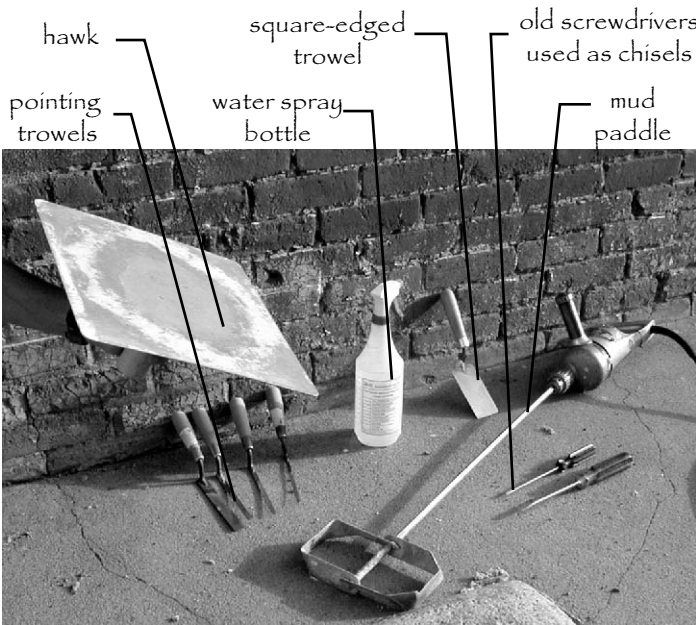
Tools

Required:

- ✓ Pointing trowel(s) of appropriate size
- ✓ A hawk (a square, flat metal pan used for holding mortar)
- ✓ Chisels (screwdrivers also work well)
- ✓ Gloves
- ✓ Water spray bottle
- ✓ Square edged trowel
- ✓ Bucket (2-5 gallon with a wire handle)
- ✓ Old rug scraps
- ✓ Natural bristle brush (for clean up)

Recommended:

- ✓ Low speed (300-500 rpm) ½" drill (for mixing mortar)
- ✓ “Mud paddle” (mixer attachment for drill)
- ✓ 4" to 5" electric hand grinder (for cutting horizontal joints)
- ✓ Diamond blade for grinder
- ✓ Safety equipment (face shield, dust mask, ear protection)
- ✓ Compressor and air hose (for cleaning out mortar)
- ✓ Circular saw with masonry blade and jig (to cut bricks)
- ✓ Line blocks and string



Some of the basic masonry repair tools

Repairing Joints & Replacing Brick

Brick & Mortar Assessment:

Generally, repointing is recommended if mortar can be easily scraped from brick joints with a screwdriver. Spalling and rounded bricks are good candidates for replacement, but don’t get carried away. Assess the general condition of the brickwork and replace only those that are severely damaged. Pay particular attention to areas subjected to running or standing water.

Practice makes perfect. Begin work on an area of the building that isn’t highly visible. This way, you’ll become comfortable with the process before moving to a more prominent area.

Joint Preparation:

Remove loose mortar to a minimum depth of 2 to 2 ½ times the width of the joint (approx ½" to 1"). Stone masonry may require removal of up to several inches. Use hand tools or a small power grinder with a thin masonry or diamond blade to grind a slot down the center of the horizontal joints. Then use a hammer and a chisel to break away mortar on either side of the slot. Work towards the joint’s center until the correct depth is reached. Wearing a particle filter mask, use compressed air to clean the surface of dust and any loose particles.

Brick Repointing:

If possible, avoid working in direct sunlight because mortar will dry too quickly. Freezing temperatures should also be avoided. Before beginning the repointing process, wet adjoining masonry to prevent adjacent bricks from absorbing water from the drying mortar.

Place somewhat dry mortar on the hawk and flatten into a sheet a little thinner than the joint. Using the trowel, cut pieces of mortar from the sheet and scrape them into the joint. Using a pointing trowel, pack the joints with mortar. Apply mortar to the deepest joints first using layers not exceeding ¼" thickness. Packing each layer into the joint with a repointing trowel ensures a strong joint. The mortar should come within 1/8" to ¼" of the brick surface. Joints may have to be recessed on weathered bricks in order to maintain an even appearance of joint width.

Finishing joints is usually done with a rounded “striking tool” or the flat part of a pointing trowel. You may choose your own joint profile if one is not apparent on the building.

Brick Replacement:

Bricks should be removed and either replaced or rebedded when either the mortar has deteriorated to the point of loosening the brick from its neighbors, or the brick has deteriorated. If the brick is removed, some adjoining bricks might also need to be rebedded.

Individual bricks can be difficult to remove without disturbing nearby bricks. Use an angle grinder or reciprocating saw, rather than a hammer and chisel, to cut mortar joints. This will reduce jarring forces to neighboring bricks.

Thoroughly coat the mating surfaces of the replacement brick (a process called “buttering”). Place the new brick into the gap and tightly fill the joints with mortar. Using a string, level, and straight-edge, make certain that the newly bedded bricks are in line with the existing wall. Tool the seams to blend in the repair.



An example of brick in need of repair



Removal of old mortar



Packing new mortar into joint



Replacing deteriorated brick

Useful Information

Cleaning Up:

To prevent staining, remove any excess mortar from brick faces before it hardens. Once joints are sufficiently dry, the faces of bricks may be scrubbed and rinsed with clean water using a rough rag. Be careful not to disturb the newly finished joints. Muriatic acid may be used to carefully dissolve dried and hardened mortar. With practice and skill, the need for brick cleaning is minimal.

Finding Used Brick:

Unfortunately, common brick is no longer produced in our region, but used (recycled) brick is sometimes available from local sources. Look for bricks that have remained relatively dry and stable.

Brickyards in neighboring states produce “new used brick”. These bricks are durable and attractive but generally don’t have the deep orange color of actual used brick.

Local Sources for More Information:

- ✓ Archie Bray Foundation
www.archiebray.org
(406) 443-3502
2915 Country Club Ave.
Helena, MT 59602
- ✓ Smitty’s Fireplace Shop
(406) 442-2242
4373 N. Montana
Helena, MT 59601

Water Repellents:

Silane water repellants contain chemicals that penetrate into porous masonry, bonding weakened surfaces and forming semi-permeable coatings that help to repel water. The repellants are water- or solvent-based, and made specifically for masonry. The use of these products can reduce deterioration of partially damaged brickwork.

Hiring a Contractor:

Get recommendations from other building owners when selecting a contractor to repair brickwork. After selecting possible contractors, inspect their previous work, compare bids, and make sure that they have experience in proper repointing of historic brick.