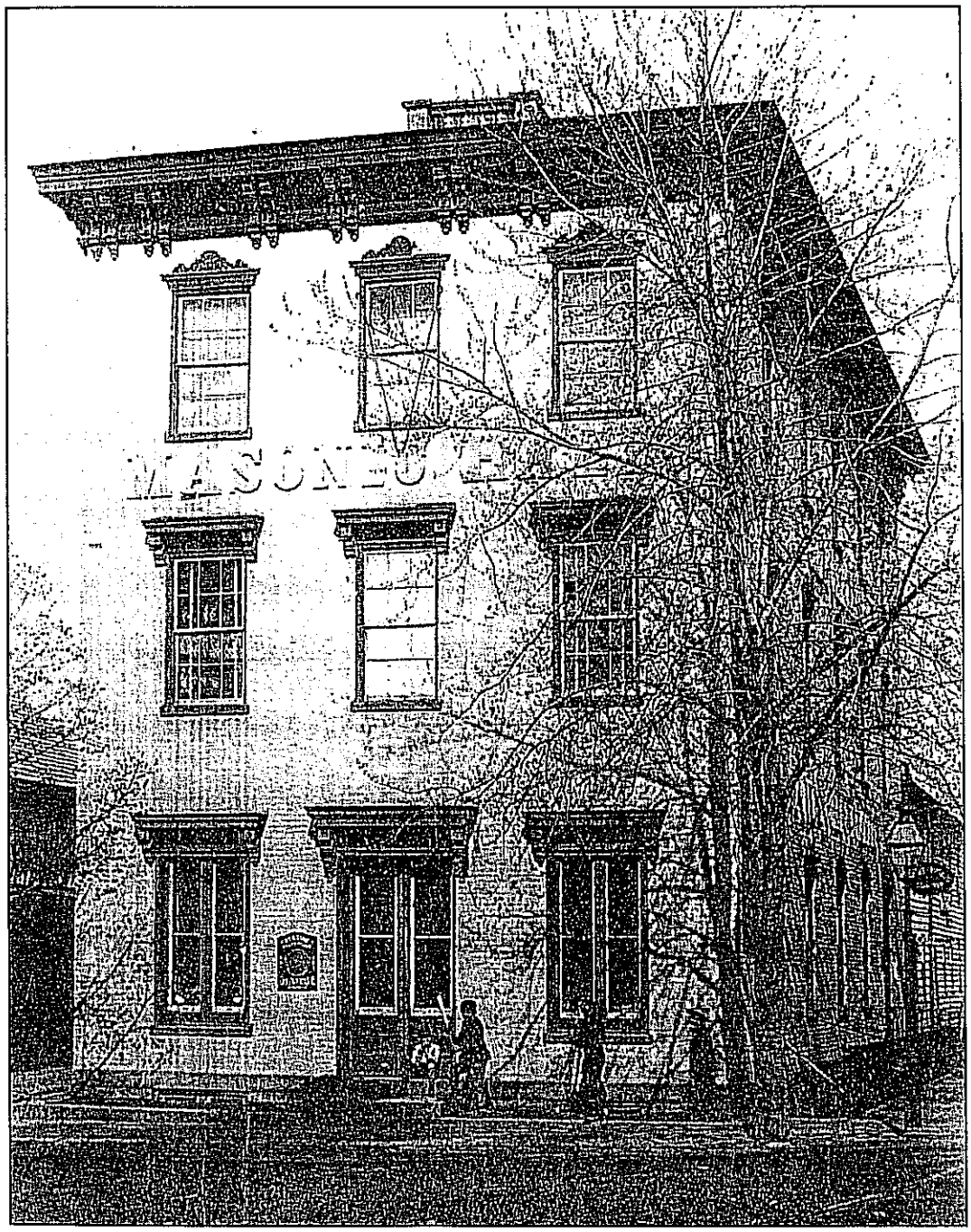
MASONRY WALLS



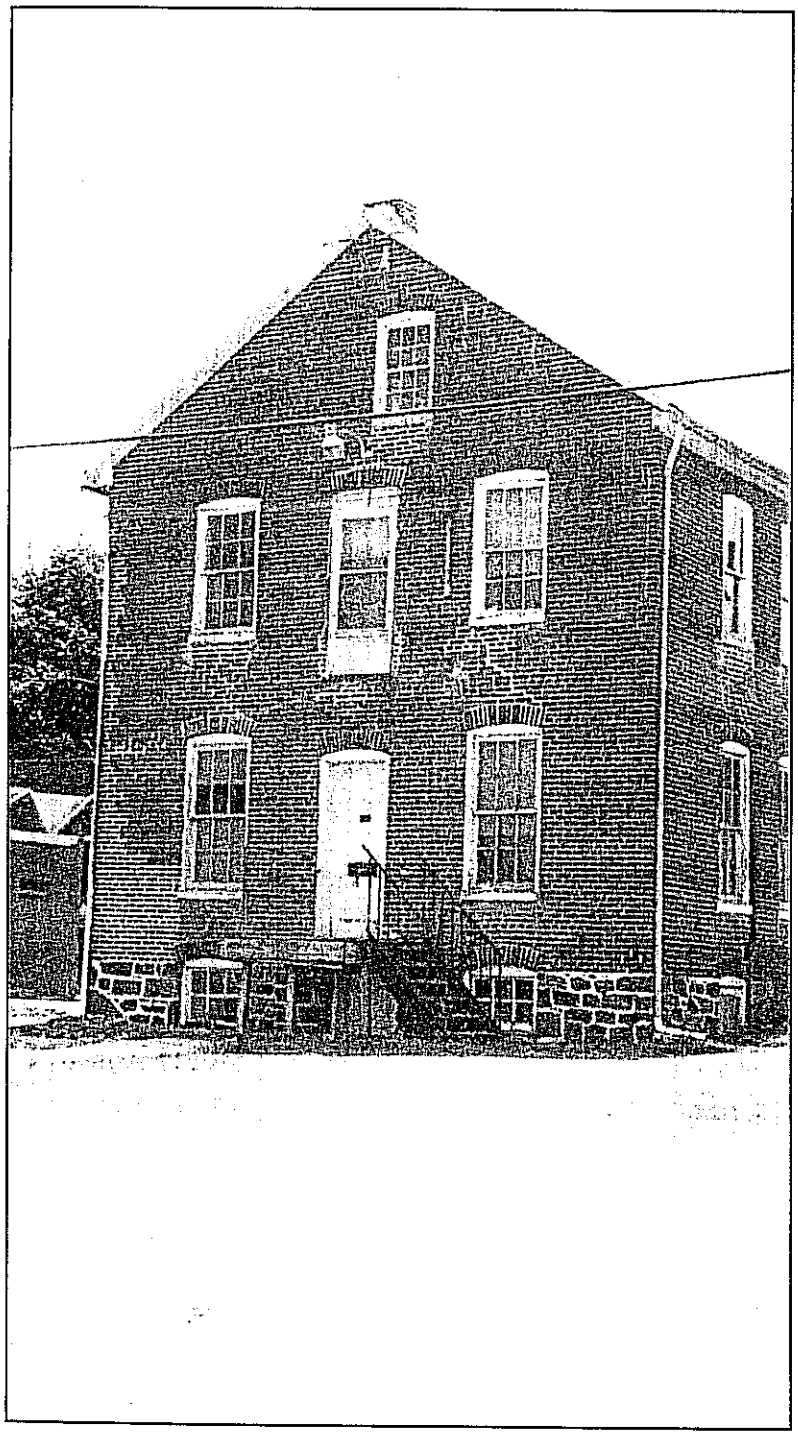
The Sheads & Buehler Building formerly at 101 Carlisle Street, built in 1859 (razed ca. 1965). Photo courtesy of the Adams County Historical Society.

EXTERIOR WALLS of MASONRY

Brick is the most common type of masonry in Gettysburg. Stone has also been used, and it is primarily found in foundations. The color and texture of individual bricks and stones, the pattern in which the units are laid, and the consistency, color, size, and shape of the mortar joints between the units all give character to masonry in the Borough. Masonry is also used ornamentally on buildings in Gettysburg. Ornament and detailing in masonry contribute greatly to the character of a building.

Although masonry is typically viewed as a very strong building material, excess water can literally turn it to dust. Other major causes of masonry deterioration include general neglect, improper maintenance, inappropriate repair, and harsh cleaning methods.

The most common problems with masonry in Gettysburg include the crumbling and flaking of individual bricks and the loss or loosening of individual bricks. This type of deterioration is typically caused by excess moisture penetrating the masonry wall — a problem that has been made worse because many buildings were sandblasted 20 to 30 years ago. This removed the protective coating on the brick, exposing the softer interior and leading to more rapid deterioration.



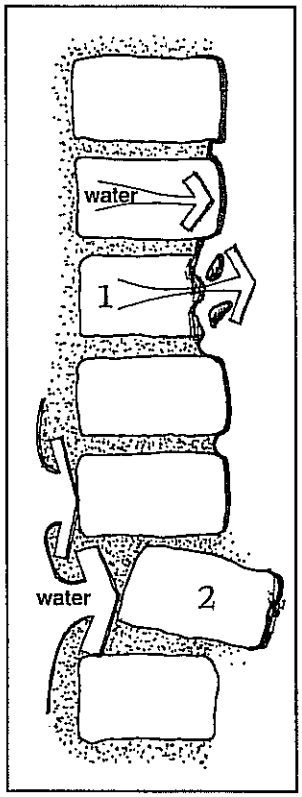
The Old Sewing Factory on North Fourth Street, a brick structure on a stone foundation.

MASONRY WALLS

Crumbling and Flaking Masonry

If the following conditions exist, identify and fix the source of the problem, then replace your bricks or stones.

Spalling can have two effects on masonry, both caused by excess moisture. First, water with its dissolved impurities is absorbed into a wall, and collects *inside* individual bricks and stones, or *behind* them. When caught *inside*, the impurities crystallize, then create pressure that causes the outside layer of the masonry to fall off (1).



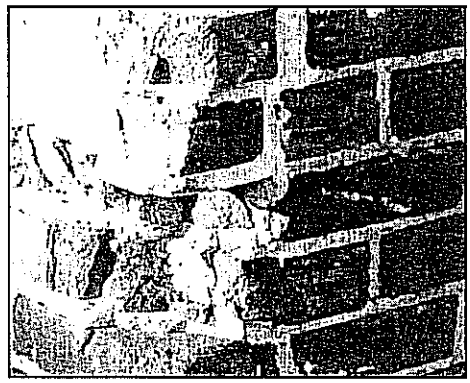
When water collects *behind* the bricks or stones, freezing and thawing of the wall causes them to contract and expand. They actually move, and this can break the bond between the unit and the surrounding mortar. When this happens, individual bricks or stones actually separate from the wall (2).

Dusting is a condition that occurs after the surface of the masonry has fallen off, and the softer, inner core of the masonry is being rubbed away. Dusting occurs after sandblasting or extensive spalling, or because of the use of soft bricks that were never intended for the exterior of a building.

MASONRY DETERIORATION: What to do about loose or missing masonry units.

ALWAYS

Remedy the cause of excess moisture in the wall before proceeding with repair or replacement of individual masonry units. See the information on spalling and dusting in the sidebar on this page.



A crumbling brick wall in Gettysburg.

OPTIONS

1 **1ST CHOICE**: If original masonry units that have become loose are sound, repair the damaged wall by securing the loose units and reattaching the separated units. (See the information on mortar later in this chapter.)

2 **2ND CHOICE**: Use as much original material as possible to repair the damaged wall. For units that cannot be reused, replace with new units of the same material, color, size and texture, using the same bonding pattern.

3 **3RD CHOICE**: For significant stonework, consider hiring a professional experienced in the repair of historic masonry to pursue mechanical repair or composite patching.

CONSIDER

- Consider using recycled brick, but use only hard brick intended for the exterior of a building, ensuring that the face of the brick intended for the exterior will face the outside.
- If work is also being done in a less visible area of the building, consider relocating masonry from the less visible area to the more prominent area.

NEVER

- Avoid removing masonry units without installing replacements.
- Avoid installing replacements that don't match the original in size, shape, color, profile, and bond.

HOW TO CLEAN MASONRY

Masonry walls can become dirty or stained for many reasons. Metals or industrial products, moisture-related problems, and unwanted paint commonly affect brick and stone walls. Dirt accumulates on buildings over time, and dirty areas remain wet longer, which invites deterioration. Cleaning can improve a building by restoring the crispness to detail and by reducing the amount of moisture absorbed into the building materials. But, the normal aging and weathering of a building can form a natural coating on the building surface. **This coating need not be removed if it is not contributing to, or concealing, deterioration.**

STEPS TO CLEANING A BUILDING

1. Determine if the building really needs to be cleaned. See below.
2. Identify the type of masonry, the source and type of the stain, and the possible cleaning methods. (See the Masonry Cleaning Methods Table on the next 2 pages.)
3. Determine and evaluate the effect of each possible method on the masonry by conducting test patches. Water cleaning methods are the safest, cheapest, and simplest methods for cleaning masonry.
4. Prepare the masonry surface. Complete all necessary repointing **before** cleaning to discourage excessive water infiltration. (Cleaning may disturb some mortar, requiring additional repointing after cleaning. See the information on mortar on the last three pages of this chapter.)
5. For all methods, perform test patches to determine the effects of the method over time. Be aware that some effects may not be visible until several months have passed and all weathering possibilities have occurred.
6. Proceed with the gentlest cleaning method. If the desired cleanliness cannot be achieved, test the next strongest option that provides the desired result without damaging the masonry.

DOES YOUR BUILDING NEED TO BE CLEANED?

These Conditions Mean That Your Building **May** Need to Be Cleaned:

- Graffiti marks your building.
- Significant detailing is obscured by heavy soiling.
- A spotty white haze appears in a horizontal pattern on the brick. (This may be efflorescence.)
- Biological growth is present.
- Heavy soiling is contributing to the deterioration and decay of the building.

MASONRY WALLS

Clean Part or All of the Building?

Although each stain should be treated individually, and although cleaning an entire building just to clean it is not recommended, be aware that spot cleaning of stains may result in a wall that looks spotty.

GUIDELINES FOR CLEANING:

1. Clean only to halt deterioration or remove heavy soiling.
2. Aim to reduce water infiltration into the building.
3. Treat stains individually.
4. **NEVER** proceed with a wet cleaning operation in cold weather. Chemicals will work differently, and frost can severely damage a thoroughly wet building.

For more information see these sections in this guide:
- Water and Your Building in the Maintenance Chapter
- Exterior Color and Paint

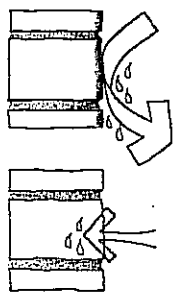
MASONRY WALLS

The Dangers of Abrasive Cleaning

Abrasive cleaning methods, tools, and equipment are **never** an option for cleaning historic buildings. This includes all:

- Sandblasting
- Wire and metal brushes
- Rotary wheels
- Power sanding disks
- Belt sanders
- Similar tools

These methods are very difficult to control and typically do irreversible damage to historic building materials.

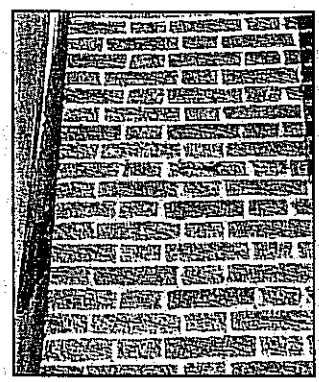


Abrasive cleaning allows too much water penetration.

Abrasive cleaning methods:

- Remove the outer surface of the masonry
- Damage detailing
- Allow increased water penetration and increased deterioration

If your building was previously cleaned by an abrasive method, it may require painting for protection. Call the Historic Preservation Officer for more information at 334-1160.



The rough, pock-marked surface of this brick in Gettysburg is a sign that it has been sandblasted.

MASONRY CLEANING METHODS

Always begin with the gentlest cleaning method available.

1st CHOICE METHODS: WATER WASHING

Water washing is the gentlest, easiest, most economical cleaning method. Begin with option #1. If the desired cleanliness cannot be achieved, move to option #2, then option #3, then #4, as necessary.

Option 1: Hand Scrubbing

For Which Stains	For Which Materials	Watch for these Hazards	Consider This
Dirt, grime, metallic stains, biological growth & related stains, soot, efflorescence.	Calcium-based masonry, like limestone, marble, and brick	Be careful not to use too much water. Excess water increases the drying time required and can lead to deterioration.	Use a garden hose, a bucket, possibly a non-ionic detergent (like dishwashing liquid), and a bristle (never metal) brush.

Option 2: Spraying

For Which Stains	For Which Materials	Watch for these Hazards	Consider This
Heavy dirt & grime, soot, metallic stains, biological growth & related stains, efflorescence.	Brick and calcium-based masonry, including limestone and marble.	Be careful not to use too much water. Excess water increases the drying time required and can lead to deterioration.	Involves the use of a hose with regular pressure applying a fine mist of water to the masonry surface for a number of hours. May be combined with hand scrubbing.

Option 3: Low Pressure Washing

For Which Stains	For Which Materials	Watch for these Hazards	Consider This
Heavy dirt & grime, soot, metallic stains, biological growth & related stains, efflorescence.	Brick and calcium-based masonry, including limestone and marble.	High pressure can damage brick, so perform test patches. Start with very low pressure, increase gradually until reaching desired cleanliness.	Involves the use of a low-pressure mechanical water jet with less than 500 psi. Can be combined with chemicals.

Option 4: Steaming

For Which Stains	For Which Materials	Watch for these Hazards	Consider This
Heavy dirt & grime, soot, metallic stains, biological growth & related stains, efflorescence.	Brick and calcium-based masonry, including limestone and marble.	See notes on chemicals on the next page.	Involves steam generated at the masonry surface at low pressure, possibly in combination w/ detergents or chemicals.

MASONRY CLEANING METHODS

2nd CHOICE METHODS: CHEMICAL CLEANING

If water washing cannot produce the desired result, proceed with Chemical Washing under the guidance of an experienced professional. Choose chemicals based on the nature of the building materials and the nature of the stain. Use the weakest possible solution and neutralize afterwards. Be sure to follow manufacturer's directions, particularly regarding the range of appropriate temperatures for working with chemicals, and the potential hazards.

Option 5a: Alkaline Chemicals

For Which Stains	For Which Materials	Watch for these Hazards	Consider This
Paint, metallic stains	Masonry that is sensitive to acids, like limestone, marble, calcium-based sandstone, polished granite, glazed brick and terra cotta.	Chemicals are potentially dangerous to people, the environment, and the building if not used cautiously.	Consult a professional experienced with historic buildings before beginning a chemical cleaning project.

Option 5b: Acidic Chemicals

For Which Stains	For Which Materials	Watch for these Hazards	Consider This
Paint, metallic stains	These chemicals are typically used on slate, granite, unglazed bricks, concrete, and other non-calcium based stones.	Chemicals are potentially dangerous to people, the environment, and the building if not used cautiously.	Consult a professional experienced with historic buildings before beginning a chemical cleaning project.

Option 5c: Poultices

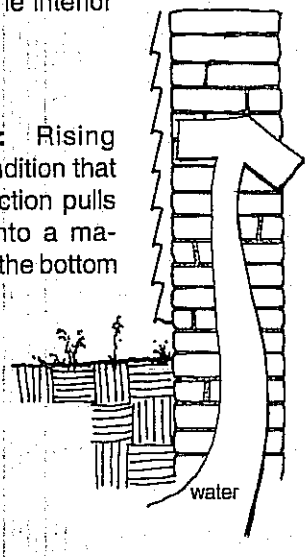
For Which Stains	For Which Materials	Watch for these Hazards	Consider This
Industrial products, graffiti, metallic stains	Poultices can be created for most types of building materials.	Chemicals are potentially dangerous to people, the environment, and the building if not used cautiously.	Consult a professional experienced with historic buildings before beginning a chemical cleaning project.

MASONRY WALLS

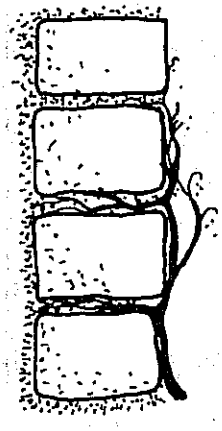
Other Damaging Conditions for Masonry

Efflorescence: Efflorescence is a spotty, white haze appearing in a horizontal pattern in brick. It is created by salts that are deposited after water evaporates inside the wall, and means there is excess moisture present. The moisture enters through a defect, or by rising damp, and then evaporates at the interior or exterior.

Rising Damp: Rising damp is the condition that exists when suction pulls groundwater into a masonry wall from the bottom up. Rising damp can result in spalling, efflorescence, and other deterioration.



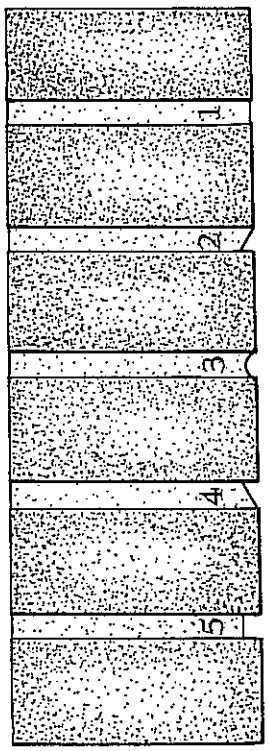
Biological Growth: Mold, algae, fungus, and vegetation can grow on a masonry wall when excess moisture is present. The moisture may be a result of faulty caulking or mortar; cracks created by building settlement; faulty gutters, downspouts, and flashing; improperly ventilated interior spaces; or excessive shade. This growth encourages moisture to remain in the masonry, thus making it more susceptible to deterioration.



MASONRY WALLS

Priorities for Masonry in Gettysburg:

- Always determine the appropriate mortar formula for historic masonry. Always test the existing mortar to determine its composition, then base the new mortar composition on the old.
- Keep historically painted masonry surfaces painted; avoid painting surfaces that weren't painted historically.
- Avoid using abrasive methods to clean masonry surfaces.



JOINT PROFILES:
1 Flush
2 Struck
3 Concave
4 Weathered
5 Raked

DO THIS: Check the credentials of any contractor you may consider for working on the masonry and mortar of your historic building. Choose a contractor who is experienced in properly repointing historic masonry walls. **If your contractor insists on widening the mortar joints, choose someone else.**

MORTAR

Mortar is composed of sand, water, and lime or Portland cement. Historic mortar may also contain ash, horse hair, oyster shells, or other additives. The process of using mortar to bond masonry units — brick or stone — to form a wall is called POINTING. REPOINTING is the process of removing deteriorated mortar and applying new mortar to restore the strength and appearance of the wall.

WHAT YOU SEE: Crumbling, loose, and/or missing mortar.

THE PROBLEM: Building movement, extreme weathering, or excess moisture.

OPTIONS:

1 **1ST CHOICE**: If the pointing is firm, intact, and not eroded more than 1/3 inch, do not repoint. Inspect the mortar and the entire building regularly for further deterioration.

2 **2ND CHOICE**: If the joints have eroded more than 1/3 inch; or if mortar has fallen out; or if cracks have formed in the mortar; or if mortar has separated from the masonry units; or if mortar sits loosely in the joint; proceed with repointing only the damaged area, following the guidelines in this manual.

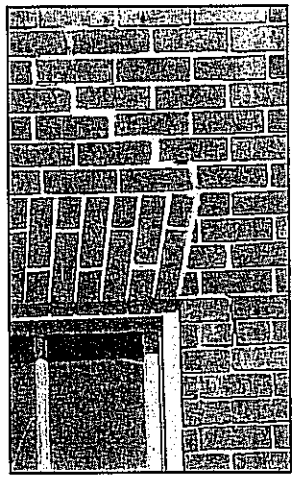
3 **3RD CHOICE**: If you think the entire wall needs repointing, seek professional assistance.

ALWAYS
- Repair the cause of the problem before treating the symptoms. If building movement is ongoing, contact a professional engineer.
- Seek professional assistance for determining appropriate mortar consistency.

NEVER
- Never use a synthetic caulking compound.
- Never use a mortar mixture with a Portland cement content higher than 20% of the total volume of lime and cement combined.
- Never use a mortar that is harder than the surrounding masonry.

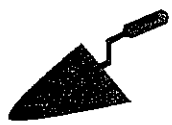
GUIDELINES FOR REPOINTING

1. New mortar must match the strength of the historic mortar, and must be softer than the surrounding masonry.
2. Mortar to be used for repointing should match the original mortar in color, texture, and composition.
3. Sand color is critical to determining mortar color.
4. Although it will be time and labor intensive, use only hand tools for removing old mortar. Using power tools will damage the edges of the stone or brick. Remove mortar to a depth of 3/4 inch or deeper to reach sound mortar.
5. When flushing the joints after removing mortar, use as little water as possible in a gentle stream.
6. Copy the tooling method and detailing of the historic joints. Be aware that these details may change on different portions of the building. Check for joint profile on protected areas of the building, like under eaves, because weathering may alter the profile.
7. Avoid removing sound mortar to achieve a uniform appearance. Achieve a uniform appearance by properly analyzing the existing mortar and matching it to the original recipe in only the damaged area. New mortar of the historic recipe should weather to the color of the original.



A variety of mortar joints. Note the missing mortar and the poorly repointed joints that are too wide.

WHY FUSS OVER LIME OR PORTLAND CEMENT?

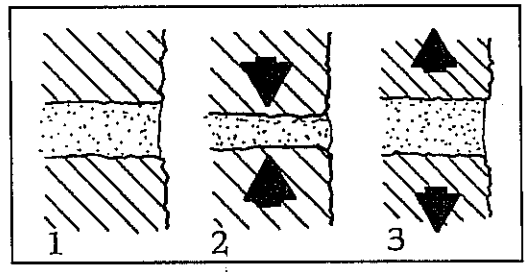


- Lime mortar and Portland cement mortar are significantly different.
- Although it may at first seem that a harder mortar is better, this is rarely true for historic brick. Bricks made today are considerably harder than the bricks used in Gettysburg's older buildings. Although the hardness of Portland cement mortars work well with today's modern bricks, they will destroy Gettysburg's older masonry in a relatively short period of time.
- Lime mortar is relatively soft and porous. Portland cement mortar is hard and nonporous.
- Lime mortar is softer than the surrounding historic brick, which allows the brick to expand and contract as it should. Hot bricks expand, forcing the mortar joint to contract. Cold bricks contract, requiring the mortar to expand.
- In masonry walls with joints of lime mortar, water can drain and escape through the mortar joints. In masonry walls with joints of Portland cement mortar, water stays in the brick or in the old lime mortar that lies behind the new Portland cement mortar. This causes the brick to expand. Because the Portland cement is too strong to move, the brick moves instead, resulting in the cracking, spalling, dusting, and loss of the brick, as well as the deterioration of the remaining lime mortar.

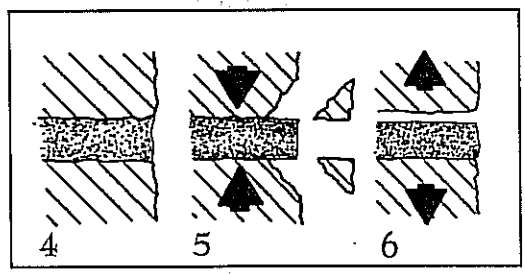
MASONRY WALLS

Is There Lime or Portland Cement in Your Mortar?

Remove a loose piece of mortar from an inconspicuous location. Soak the mortar in water. If it softens and crumbles under pressure, it has a lime base. If it softens but won't crack, it has Portland cement. Keep in mind that your building may have been repointed a number of times, and possibly with the wrong type of mortar, so you should carefully inspect your building and you may need to collect and test a number of samples.



Soft Historic Mortar and Historic Brick (1). The solidity of the wall is maintained throughout contraction (2) and expansion (3).



Hard Modern Mortar and Historic Brick (4). The forces of contraction (5) and expansion (6) break the bond between the bricks and the mortar and the wall deteriorates.

MASONRY WALLS

Historic Mortar Recipes

The following recipe is a starting point for a mortar suitable to historic masonry.

1 part hydrated lime
+
2 parts by volume sand of historic color
+
enough water for a workable mix

This recipe can be modified with some white Portland cement to improve workability and drying, but Portland content should never exceed 20% of the total volume of lime and cement combined. Portland cement should be white - never gray or light gray. You could begin by testing one of these recipes that include Portland cement:

1 part white Portland cement
+
2 or 3 parts hydrated lime
+
6 parts sand of historic color

OR

1 part white Portland cement
+
4 parts hydrated lime
+
10 parts sand of historic color

WHAT ARE THE EXACT COMPONENTS OF YOUR MORTAR?

A trained professional can determine the exact components of your mortar in a laboratory, but you can conduct a relatively simple experiment yourself. Follow these steps:

1. Collect three or four mortar samples from different locations on your building. Don't take the samples from the surface, because surface mortar has weathered and will be darker than the original color. Multiple samples are required because your building may have been repointed several times. Set one sample aside for comparison.

2. Keeping each sample separate, break the samples apart with a wooden mallet or dissolve them in muriatic acid (available from masonry suppliers).

3. When the sample has completely broken down, remove it from the liquid, wash the remaining components in water, and allow the sample to dry. Blow away any powdery material, which is lime or cement.

4. Inspect the remaining material with a magnifying glass to determine the size and color of the components of the mortar. For your new mortar, be sure to choose sand that matches the color of the sand in your sample. *Sand color is critical to determining final mortar color.* Sands of different colors are available from masonry suppliers. Use a pigment to obtain the correct color as a last resort.

5. Other materials in your sample — like shells, hair, or ash — may be harder to obtain. Consult your masonry supplier or Gettysburg's Historic Preservation Officer for suggestions.

6. Once you have assembled the appropriate components, try varying recipes (see information in the sidebar at the left). Allow them to dry in an oven, and then compare them to the historic sample you set aside in Step 1.