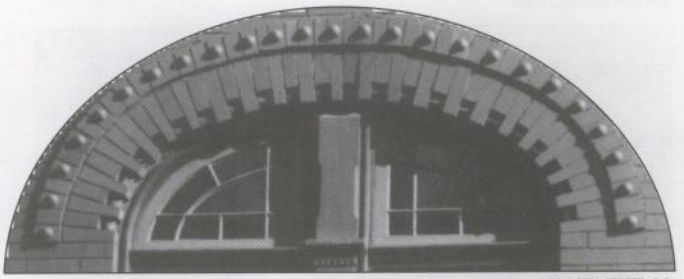
CAPITOL HILL
HISTORIC DISTRICT

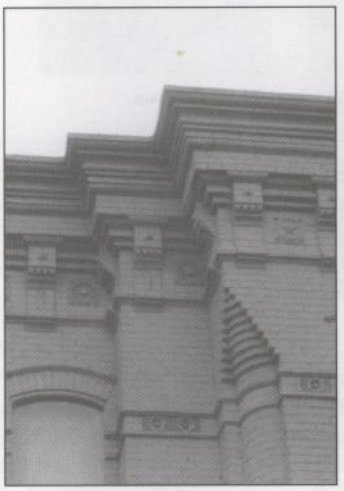
Guidelines

RED BRICK, BROWN BRICK, PRESSED BRICK, AND COMMON: CAPITOL HILL BRICK



110 12TH STREET, S.E.

Since humanity began building, brick has been there with a story to tell. Because brick is such a character-defining element of the Capitol Hill Historic District, this Guideline will discuss the history of its use here and will make recommendations for the maintenance and repair of historic brick, and use of brick in new construction.



(BOTTOM LEFT) THIS CORBELLED CORNICE AT 10TH AND PENNSYLVANIA AVENUE, S.E. ACHIEVES EXTRAORDINARY VISUAL RICHNESS USING SPECIAL SHAPES, TERRA-COTTA PANELS, AND VARIED PLANES.

(BOTTOM RIGHT) SPECIAL PRESSED BRICK SHAPES AT 650 EAST CAPITOL STREET INCLUDE: BRICK "BEADS" ON THE CORNER OF THE BAY, IN THE ARCHES, AT THE HORIZONTAL BELT COURSE INTERSECTING THE WINDOW; THE EGG AND DART BRICK AND HORIZONTALLY REEDED BRICK IN THE DOOR SURROUND (IN THE UPPER LEFT OF PICTURE); AND THE TERRA-COTTA PANELS, SHOWN LARGER ABOVE.

ANCIENT BRICK

The Temple of Athena's 2,400 year old marble columns influence architecture to this day; the people's brick dwellings are long gone. The necropoli of the Egyptian Pharaohs remain while the mud brick dwellings of the people who built them, including the Israelites whose nascent monotheism got a jump start in a dispute over brick, are gone. We admire the glory of Palladian villas, momentarily forgetting their material expression, stone, is a fraud. Cost cutting dictated stucco scored to look like stone, over brick.

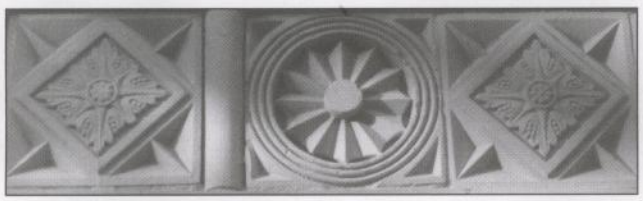
The diversity of exterior materials found on Capitol Hill's historic buildings (stone, wood siding, pressed and cast metal, metal, clay tile, and slate roofs each with specific recommendations for maintenance and repair) is too great to include a single Guideline, so exterior materials will be individually treated in a series of Guidelines.

Unfired brick, hand made with straw added to prevent cracking during drying, has housed humanity in the globe's arid belt since people began to build. Brick making may have been one of the earliest industries of humanity, second only to agriculture. The earliest known unfired brick dates from 6,800 B.C.E., in the world's oldest city, Jericho. Fired or unfired brick appears at every early center of civilization, Peru to the Indus River Valley and the Near East, with civilizations like the Babylonians, Egyptians, and Romans elevating the use of brick to art. Burned brick is mentioned 2in the eleventh chapter of Genesis, with bitumen mortar. Brick has repeatedly been the most elegant solution to the confluence of resources and shelter during human history. The huge evolutionary leap from the Stone Age to the Bronze Age is exemplified by the advance from *using* available stone to *creating* a building material, brick. Fired, this ancient unit of earth and water provides weather resistant enclosure in wetter climes, arriving in force on Capitol Hill in the 19th century.

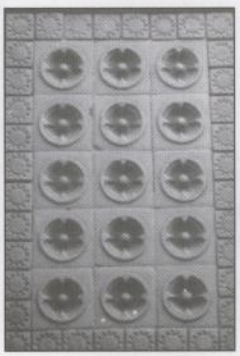
BRICK IN AMERICA AND THE 19TH-CENTURY

Brick was made and used in all the American colonies, employing simple processes of hand or machine pressing relatively wet clay into wooden molds, sometimes lined with sand, then firing the bricks in easily constructed kilns. Because shipping bulky, heavy brick on Colonial

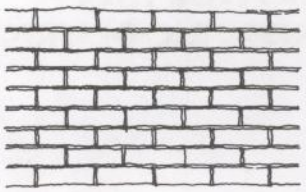
BY JUDITH M. CAPEN, AIA



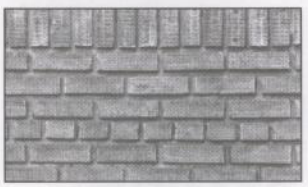
650 EAST CAPITOL STREET.

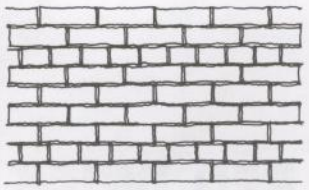


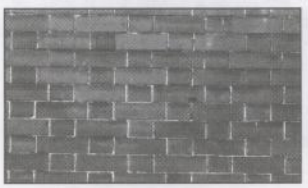
TERRA COTTA PANELS ARE FOUND ALL OVER CAPITOL HILL ON HISTORIC BRICK BUILDINGS.



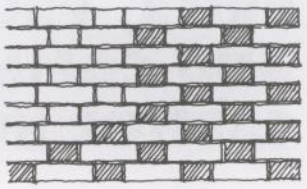
A TAPESTRY BRICK WALL, WITH RAKED MORTAR JOINTS IN COMMON BOND WITH A SOLDIER COURSE OF BRICK ABOVE THE TOP ROW OF STRETCHERS.







A FLEMISH BOND BRICK WALL. COLOR DIFFERENCES BETWEEN THE HEADER AND STRETCHER BRICKS DON'T SHOW UP WELL IN BLACK AND WHITE.



(TOP) 1/2 RUNNING BOND
(CENTER) COMMON BOND
(BOTTOM) FLEMISH BOND

era roads was difficult and clay suitable for brick widely available, early American brick was usually local, often made at building sites. Brick making was so straightforward, many farmers made an annual batch of bricks in free moments.

Mid-19th-century industrialization brought the second revolution to brick making. The first revolution, millennia before, was firing previously sun-baked bricks. By the 1870's and 1880's, boom years of Capitol Hill construction, most bricks were machine made. Machine-made "common" brick was soft by modern standards and often rather irregular, but pressed brick was introduced in the late 19th-century. Pressed bricks were made of very fine, rather dry, clay pressed into molds under great pressure by hydraulic or screw presses. Pressed brick were fired almost immediately without an intermediate drying phase with minimal shrinkage. They were dense; hard compared to common brick; extremely regular, allowing the use of fine mortar joints, known as "butter" joints; and could be pressed into highly decorative molds for a variety of textures and patterns. Baltimore and Philadelphia were well-known centers for the manufacture of pressed bricks. By the 1870's the Peerless Brick Company of Philadelphia made and shipped so many bricks all over the country that "Philadelphia pressed brick" became a generic term for pressed brick. The Hydraulic Press Brick Company had offices in Philadelphia, New York, St. Louis, and in Washington's Kellog Building. Colors available in 1894 included buff, grey, brown, red, granite, and mottled.

Conversion of cities to nonflammable masonry materials often correlated with disastrous city-wide fires or fear of them. The great fire of 1666 transformed London from a wooden to a brick town. Conflagrations in Chicago, 1871, Boston, 1872, and Baltimore, 1904 stimulated implementation of comprehensive building regulations directed at protecting city-dwellers from fires especially, transforming both those cities to masonry cities.

BRICK IN WASHINGTON AND CAPITOL HILL

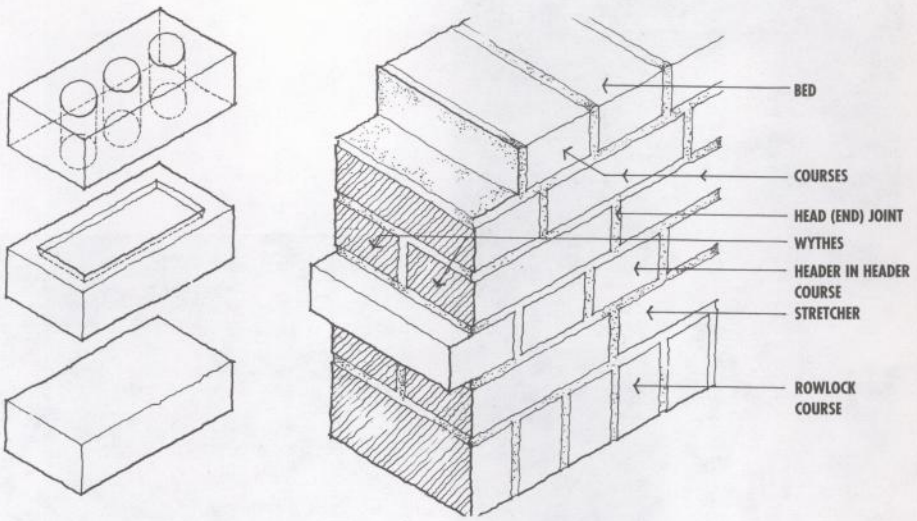
President George Washington, issued building regulations for the District of Columbia on October 17, 1791 requiring house walls in the new city to be brick or stone. That provision was suspended very soon in 1796 as onerous from fear masonry construction was beyond the means of the new city's working people.

However, brick was indispensable for public buildings, used as back-up behind Aquia Creek sandstone on the White House, the Capitol, and, later, the Patent Office, a Post Office at Seventh and E, NW, and the Treasury Building (although granite replaced the sandstone on Treasury in 1908, and on part of the Patent Office). Many early federal buildings, built quickly under the press of events, were entirely brick, including the "Old Brick Capitol" constructed to house Congress after the British burned the Capitol. In the extensive post-1814 rebuilding, brick vaulting was widely used to fire-proof many public buildings.

Brick has continued to be an important building material in Washington, whether exposed and prominent in Federal buildings like the Pension Building of 1883 with its 15 million brick, or as back up to stone, or in residential and commercial construction, making Washington the largest market for brick today in the country.

The historic masonry construction requirement resurfaced in Washington nearly a hundred years after George Washington's 1791 regulations. During its brief existence, 1870 to 1873, Washington's Board of Public Works passed building regulations severely limiting construction of wooden structures within the original L'Enfant planned city and parts of Georgetown. Sheds and privies could be wood, but not closer than fifty feet to stone or brick buildings. Washington's future as a red brick city was assured.

By 1900, approximately 100 brickyards dotted the city. Washington's last surviving brickyard, though no longer functioning, is on the



(TOP) EXTRUDED WIRE-CUT, CORED BRICK (MODERN)
(CENTER) SOLID BRICK W/RECESSED "FROG" (HISTORIC)
(BOTTOM) SOLID BRICK

grounds of the National Arboretum, just off New York Avenue, adjacent to a high quality clay deposit. The kilns there are still clearly visible. Undoubtedly, bricks from this yard found their way to nearby Capitol Hill.

The building styles popular during Capitol Hill's major development in the late 19th-century emphasized pattern, texture, polychromy —use of multiple colors— and varied materials. In Washington and Capitol Hill, the Queen Anne style, elsewhere executed in a variety of wood siding and shingles, was translated to variously patterned and textured bricks. Even complex brickwork was less expensive than cut and carved stone, allowing builders for the middle class to achieve great decorative effect at modest expense. A look around Capitol Hill reveals an extraordinary variety of pressed brick patterns: rusticated surfaces, a pebbled finish weirdly resembling jelly beans, reeding, egg and dart bricks, and a range of shapes in window and door arches.

The Richardsonian Romanesque style emphasized massive masonry, contributing rock-faced stone bases, lintels, and string courses to many Capitol Hill brick buildings.

Thus, late 19th-century industrialization and building regulations promulgated to restrict fires assured the use of brick, with later regulations gradually limiting the use of wood even on cornices. The popular styles of the day shaped the expressive use of the brick. While Washington was long known as a red brick city, the popularity of Classically inspired styles after the 1893 World's Columbian Exposition introduced buff and tan brick to Capitol Hill.

USE OF BRICK ON CAPITOL HILL

As a Primary Exterior Material. Since Capitol Hill's major development dates from the late 19th-century, most of its buildings were required to be brick under early 1870's fire control regulations.

Capitol Hill's brick is of several distinctively different types and looks. Grander houses have fine-textured, deep red-orange smooth-surfaced pressed brick with butter joints on their street facades. The sides and backs of the fancy houses as well as fronts of more modest houses are simple common brick with conventional joints, about 3/8 inch compared to half that for butter joints. Early 20th-century porch-front houses with mansard roofs often have tan- or buff-colored vertically striated brick (called "tapestry brick") and raked mortar joints on their facades.

We have few, if any, historic salmon-colored brick buildings with grapevine joints, brick

TERMINOLOGY

"masonry" *includes brick, stone, hollow clay tile, and concrete block. "Mason" originally referred to a stone worker. As stone was superseded in importance by brick, brick layers came to be called "brick masons."*

bond: *the pattern in which brick is laid. See illustration for 1/2 running bond, common bond, and Felemish bond.*

types of brick:
common brick: *a broad term referring to solid brick made by hand or simple industrial processes. Common bricks were typically local and relatively soft and irregular. 19th century brick were usually categorized as "common" and "stock," common brick being of lesser quality, used behind better quality facing bricks and on side and rear walls.*

stock brick: *good quality, regular, dense finish brick. Later called face brick.*

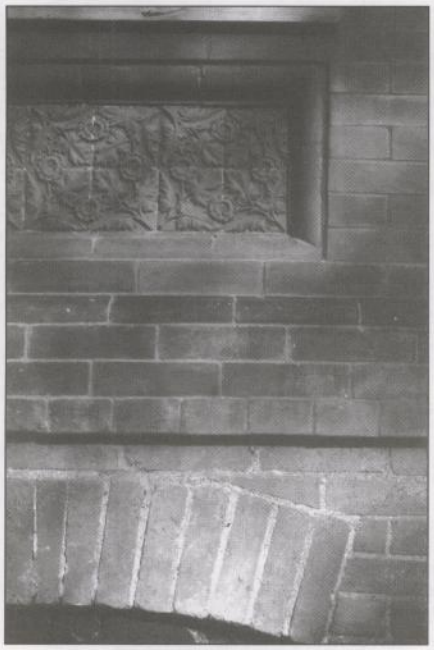
cored brick: *modern brick is available solid or with cores. Solid bricks are used to cap walls or in other applications where holes would be inappropriate. Holes through cored bricks improve the mechanical key between mortar and brick, lighten the brick, and improve brick firing by providing more surface area. The appearance of cored brick coincides with the introduction of extrusion manufacturing techniques for brick around the turn of this century.*

pressed brick: *19th-century solid brick made by forcing extremely low-moisture clay into molds under great pressure with hydraulic, steam powered, or screw presses. These brick, manufactured in a few major centers, were harder, smoother faced, and more uniform in size and color than common brick.*

tapestry brick: *describes vertically striated brick, manufactured by Fiske and Company of Boston. Usually tan- or buff-colored, found on many early 20th-century Washington porch-front row houses.*

terra-cotta: *(literally, "baked earth") refers to elaborate and intricate masonry units, glazed or unglazed, formed in molds with fine clay mixtures. The unglazed decorative panels found on many Capitol Hill houses may be called terra-cotta, although it is likely they were manufactured by the same plants making pressed brick, using identical processes.*

concrete (cinder or cement) block: *(included because today brick and block go together like horse and carriage.) Many people call ubiquitous concrete block "cinder block." To be precise, you should call it "concrete" block. One type of concrete block is lightweight, units that weigh less because they contain lightweight aggregate, although not necessarily cinders. Likewise, it is not precise to call it "cement block." Cement, usually Portland cement, is one of the ingredients of concrete. When cement is combined with aggregate in the form of gravel and sand, you have concrete. Concrete block is a relatively recent material, from about 1925. The first concrete blocks were molded with rock faces, often for use on foundations and ancillary buildings such as garages as an economical alternative to brick or stone. You occasionally see an entire building from this period in rock faced block. After the Second World War, concrete block came into its own, being widely substituted for brick and clay tile. Today, concrete block is available in a wide range of integral colors, sizes, finishes, and textures that can cost as much as brick. But, even the fancier blocks, save labor, since one concrete block takes the place of nine bricks. Today's contractor is likely to refer to concrete block as "CMU" for "concrete masonry unit."*



VICTORIAN-ERA FRUGALITY IN ACTION: THE FOUNDATION OF COMMON BRICK ALLOWS THE UPPER STORIES OF PRESSED BRICK COMPLETE PRE-EMINENCE. THIS FACE BRICK WAS RECENTLY REPOINTED.

THE SEPARATION OF PRESSED BRICK FACE FROM THE COMMON BRICK SIDE WALLS VISIBLE IN THIS PICTURE CAN BE THE RESULT OF PRESSED BRICK LAID IN A RUNNING BOND WITH NO TIES TO THE BRICK BEHIND IT

THIS CORNICE AT 616 A STREET, S.E. INCORPORATES A FORM OF BASKETWEAVE BRICK WITH AN EGG AND DART BRICK COURSE BELOW AND OTHER SPECIAL SHAPES.

and joints commonly associated with the Georgian style of architecture predating Capitol Hill by a century.

Unlike much modern brick construction where brick is just a veneer over cheaper materials, Capitol Hill houses have solid brick walls of two, three, or more layers called "wythes." The interior of the brick wall had plaster applied directly to the brick. Craftsmanship on interior faces of walls covered by plaster is much cruder than on exposed exterior brick, possibly to save money or, as suggested by tradition, because less skilled, and presumably lower paid masons laid the common brick back-up and interior brick. Should you wish to expose interior brick in your house, you may find rougher brick-work than you want.

Exterior walls of various bricks look very different. Pressed brick walls with butter joints of black or charcoal-colored mortar have a smooth, monolithic appearance. That flatness allows the complex patterned and projecting parts of the wall prominence. Mortar analysis on several pressed brick buildings identified materials like lampblack used for coloring, a difficult material to replicate today. Some 19th-century builders or homeowners further reinforced the monolithic appearance of these walls by applying iron oxide in linseed oil as a brick-colored coating to de-emphasize mortar joints even more. Interestingly, pressed brick walls are nearly always running bond. This aesthetic decision sometimes creates practical problems since that bond does not effectively tie the outer wythe of brick to the layers behind. Look for outwardly bowed walls, corners where it is apparent the pressed brick face of a house is pulling away, or reinforcing stars as signs of weakness in the bond.

Larger and lighter mortar joints provide visual interest on modest houses with common brick wall surfaces.

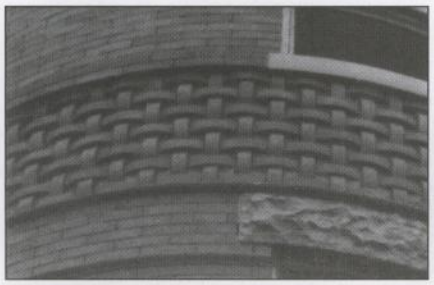
The walls of porch-front houses are generally plain except for the ornamental interest of the textured brick itself and the shadow line around each brick created by the raked joint typically used with tapestry brick.

Flemish bond provides an interesting pattern on some late 19th and early 20th-century Hill houses. These Flemish bond walls are often further enlivened by the contrast in color or sheen of the alternating header bricks. These consciously patterned walls contrast with deliberately un-patterned earlier walls of pressed brick.

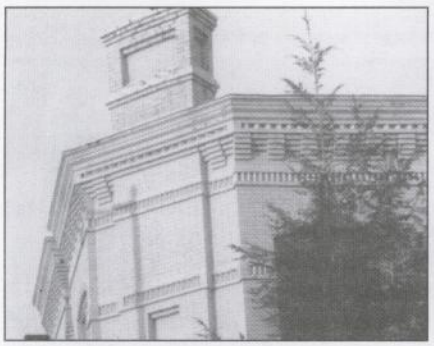
Trim. A number of factors including fire laws, the increased pace of late 19th-century industrialization, preferences for highly articulated architectural styles, and themodest means of many Capitol Hill residents, shaped both the whats and hows of trim on our buildings. Gradually wood trim, on cornices, at windows, and at doors, was replaced by mass produced cast iron, pressed metal, and pressed ornamental brick. Many of Capitol Hill's pressed brick buildings have wonderfully elaborate pressed brick trim. Special shapes include floral and geometric panels, basket-weave brick, elaborate shapes in arches, bull-nose, reeded, and egg-and-dart belt courses. Even modest common brick buildings are articulated with simple belt courses and brick surrounds at doors and windows.

Sides and Rears. Virtually all Capitol Hill brick buildings have common brick on their narrow rear, dogleg, sections and rear walls. Tract house builders of the 20th-century did not invent the subterfuge of restricting expensive materials to the street face, using cheaper materials on sides and rear. On Capitol Hill one often sees semi-detached or corner houses, with facades in pressed brick, switching to common brick at the corner for the exposed side of the house. The apparent misconception that houses exist only as viewed head-on has not been corrected in a hundred years, visible from pre-Historic District designation houses with brick on the fronts and concrete block sides.

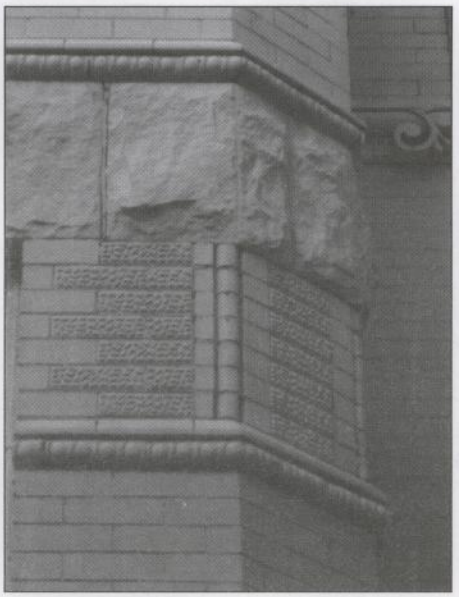
The practice of using grander materials on the front for company, with less expensive, more utilitarian materials on sides and rears prevails for Capitol Hill's stone houses, porch-front, tapestry brick houses, iron spot, tan, brown, and Flemish Bond brick houses.



THIS BAY AT 329 EAST CAPITOL STREET HAS SEVERAL SPECIAL PRESSED BRICK SHAPES INCLUDING STUNNING BASKETWEAVE BRICK.



THE CORNICE AT 600 CONSTITUTION AVENUE, N.E. ABOVE USES CORBELLING, RECESSED PANELS, AND BRICK TURNED DIAGONALLY TO ACHIEVE TEXTURAL VARIETY.



SOME NOVEL 19TH CENTURY PRESSED BRICK PATTERNS APPEAR HERE: THE TEXTURE RESEMBLES JELLY BEANS. OTHER PRESSED BRICK SHAPES ARE COMBINED WITH ROCK-FACED STONE. (616 A STREET, S.E.)

Alley Buildings/Carriage Houses. Almost all of Capitol Hill's historic brick carriage houses and garages are of common brick, with simple details befitting their functional use.

MOISTURE IN MASONRY

Background. Brick, concrete, and mortar are all hygroscopic materials--able to absorb moisture from the air. As such, they allow moisture movement in walls, whether the source is wind driven rain on the exterior, damp earth at its base, or high interior humidity. Thus, moisture problems are common in old brick buildings with their solid brick walls: moisture has travelled through our walls from the day they were built. The builders of our houses knew this and took steps to ameliorate moisture problems.

Early iron oxide and linseed oil "paints" were often applied to pressed brick to protect against wind-driven rain. They can be seen today as powdery red coatings. Some 19th-century builders built a damp course, visible as a horizontal course of slate laid in mortar just below the floor line. These damp courses retarded rising damp or upward wicking of moisture in foundation walls. Such a slate damp course is described in the **Historic Mortar** specification. Also, recent archeology in the old downtown section of Washington discovered slate lining the outside walls of foundations, presumably a water barrier. Unfortunately, there is little that can be done today about rising damp in historic walls, short of some very expensive, invasive, and not always successful efforts.

Efflorescence, visible as white powder on exterior masonry surfaces, is evidence of moisture. As water travels through masonry, it picks up salts and minerals from the brick and mortar in addition to whatever is already in the water, leaving them behind on the surface as it evaporates. Many masons wash down new masonry to remove efflorescence, but that may exacerbate the problem more than solve it. In small areas of efflorescence, once the underlying cause of the moisture is solved, brushing the efflorescence off with a stiff brush is usually the recommended solution. Efflorescence is not a new problem: discussions of it and remedies are found in 19th century builder's magazines.

Contributing Factors. While moisture has always migrated through brick masonry, aging of the building stock contributes to the problem. As the constituents of old lime and sand mortar break down with time, masonry walls become more vulnerable to water penetration. Building settlement, foundation and masonry movement, and slipping arches all cause cracks. A nearly microscopic crack from any cause can draw in extraordinary amounts of water through capillary action.

Another contributing factor to moisture problems in masonry walls ironically can ironically be attempts to solve those problems. When exteriors of walls are parged and sealed moisture is trapped in the wall or forced to the interior surface. Sealing exterior or interior wall surfaces can cause damp to rise significantly higher than when there were two surfaces from which to evaporate. Also, nonpermeable paints on interiors can trap moisture causing the paint to lift and blister.

Sources of Moisture in Masonry Walls: Brick and stone walls can become wet from above when water enters tops of walls at open flashing joints; from their exterior surface by wind driven rain or broken gutters; or from below: rising damp, rain splashing onto the wall from adjacent hard surfaces, contact with ground saturated with water from broken subsurface drainage pipes, clogged yard drains, or broken downspouts. Rotted wood, cracked masonry sills, or open joints between wall and sills at windows provide more moisture entry points. Moisture entering at window sills is often visible as bubbling interior plaster below windows.

Dealing with Moisture in brick and masonry walls begins with maintenance. Roofs and flashings must be periodically inspected and repaired or replaced as necessary. As mortar deteriorates, walls need to be repointed. Joints of window sills to walls must be caulked and broken or deteriorating sills repaired, always providing a good slope away from the window.

Rain Splash Back on walls from adjacent hard surfaces can be alleviated by sloping surfaces away from the wall and maintaining the wall. Ideally, exterior paving should not run right up to walls.

Wet Basements. If you have water in your basement, you must try to stop it at the source. Once basement walls become saturated, moisture may rise and cause staining and damage in first-floor space. You may wonder if water pouring or seeping into your basement is city water from a broken pipe. The city will check it, if occurrences don't correlate with rain falls. If you're not satisfied with their answer, you can have the water tested for fluoride, whose presence is a strong indication of city water. Another source of water in basements is over-zealous landscape watering, especially of foundation plants, saturating the earth at the foundation where cracks or joints can allow the water into the basement. Because we do not have a high water table, basement wetness is rarely caused by ground water.

To discover the source of water in your moist or wet basement, follow a logical series of

SECRETARY OF THE INTERIOR STANDARDS FOR REHABILITATION

Standards for Rehabilitation are the Ten Commandments of preservation. Standards particularly applicable to brick maintenance and repair include:

"2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

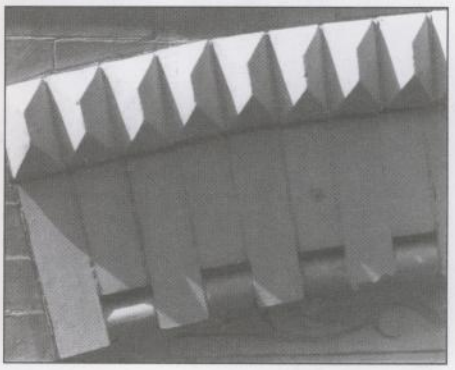
"3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

"5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a property shall be preserved.

"6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration required replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

"7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible."

PRESSED BRICK SHAPES IN A SEGMENTAL ARCH.



HISTORIC MORTAR

*"Mortar to be composed of good down river sand, sharp & clean— and fresh lime in proper proportions so as to make a good building mortar. Use good quality cement mortar for foundation walls and embed a sound course of wall slate in cement over all walls two courses above grade."**

Modern masons generally use pre-mixed mortars that vary in strengths and recommended applications. These mortars are composed of sand, lime, and portland cement. While 19th-century masons knew of and used portland cement, they generally reserved its use for foundations. Mortar in walls was typically a simple mix of lime and sand, in a proportion of about 3 parts sand and 1 part lime hydrated by adding water to readily available slaked lime or crushed limestone, to add hydrogen. This mixture does not "set up" nearly as rapidly as a portland mix does, so such walls need to be protected from rain and weather longer than does a wall with a portland mix. However, as these historic mortars are exposed to air, a chemical reaction occurs creating calcium carbonate that can provide self-sealing properties.

*from historic specification for a pair of houses on Ninth Street, SE.

investigations to try to eliminate common causes. Look for blocked yard drains and water ponding in your own and your neighbor's yards during rain storms, slopes directing water toward your house, broken or blocked roof gutters and downspouts. Repair such problems. If you eliminate surface water possibilities and still have water problems, you may have to do some digging outside your building wall at the location of the inside moisture to see if you can discover a broken or leaking drainage pipe or other causes of moisture.

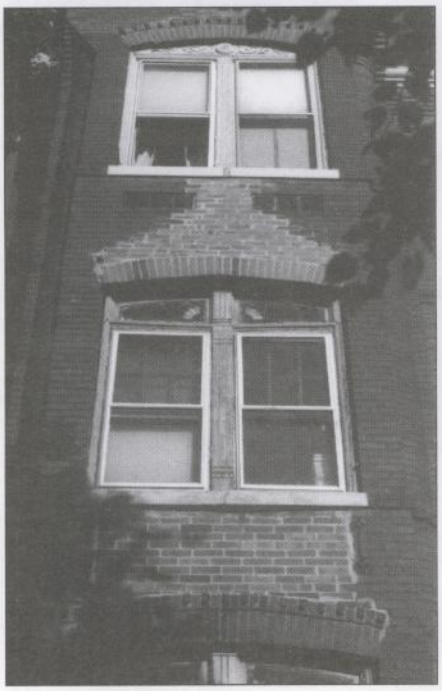
"Water proofing" interiors of basement walls is rarely a solution to wet basements. Water pushes against the outside of the foundation wall through hydrostatic pressure . While you may close off one avenue of entry, the pressure of the water will eventually force it in elsewhere. An inside coating on the wall will only divert the water or slow it for a while. Eventually water pressure will force water between the coating and the wall surface, popping the coating off. The only lasting solution to basement water problems is to find the source of the water and correct it. In some cases, this may require expensive excavation of the earth at the foundation wall to expose the exterior of the wall completely to allow parging and waterproofing, and possibly the installation of footing drains.

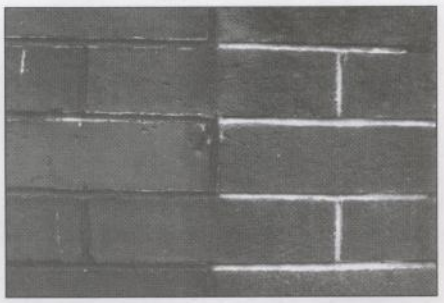
Once you think you have corrected a water problem, observe the results for a while. Walls can take months or even years to dry out entirely. So, after fixing the gutter, wait before re-plastering and repainting.

Finally, because our buildings are old, with solid masonry walls, a certain amount of moisture and rising damp is virtually inevitable, necessitating an accepting philosophy about old house living. One approach to unavoidable moisture at some locations is to use finishes that are indifferent to moisture such as exposed brick, ceramic tile, and cement-based plaster. Brick is not damaged by moderate levels of moisture. Only saturation with water and repeated exposure to freeze/thaw conditions threaten it seriously. Another approach to living with some moisture in walls is to keep an eye on the evidence of moisture to make sure it is not getting worse, then accept the result as a part of a routine maintenance process. You can consider re-plastering a particular location on a wall every ten years as just part of the longer-term maintenance cycle.

Sealants: **Preservation Brief #1** discusses water-proof and water-repellent coatings. After some disastrous experiences with various miracle coatings, professional preservationists have taken a very cautious stance on the use of coatings for historic masonry. The first question is, if some hundred-year-old

ON THE RIGHT, PRESSED BRICK WAS SANDBLASTED AND BADLY, PARTIALLY, REPOINTED. THE BRICK ON THE LEFT WAS WELL REPOINTED ALTHOUGH IT HAS SOME EFFLORESCENCE ALONG THE JOINT BETWEEN MORTAR AND BRICK FROM AN UNCORRECTED WATER PROBLEM.





(ABOVE) A BADLY EXECUTED PATCH ON A COMMON BRICK CARRIAGE HOUSE WALL. NEITHER THE BRICK NOR THE MORTAR JOINTS MATCH THE HISTORIC MATERIAL, WHICH IS SHOWING ITS DISMAY BY TRYING TO SEPARATE ITSELF FROM THIS DEBASED WORK.

(LEFT) A LESS THAN SUCCESSFUL EXAMPLE OF MASONRY REPAIRS. NOTE THE POORLY INSTALLED COMMON BRICK USED FOR REPAIR RATHER THAN RE-USING THE PRESSED BRICK; HOW TERRA-COTTA PANELS HAVE BEEN REMOVED; AND THE CRUDENESS OF THE MIDDLE, REPLACED ARCH.

masonry never had coatings, why apply now? Moisture problems are nearly always remediable through repointing and repair of gutters, flashing, downspouts, and surface drainage. When addressed, the majority of these moisture problems can be solved.

A second way of looking at sealant questions is to balance costs and benefits. The potential for "waterproof" coatings to accelerate or create deterioration has turned out to be great. The cost to reverse coatings that are not working or to repair damage is inordinate. The property owner should seriously consider how necessary the coating is in the face of the risks. Sometimes, people slap a coat of paint on previously unpainted brick to cover up mortar joints that should be repointed, to "brighten" up what they see as a somber Victorian house, or to respond to perceived market pressures. Given the great difficulty in removing paint from brick, the historical inaccuracy of painted pressed brick, and the fact that significant money spent painting a building will still not fix mortar that needs to be repointed, painting of unpainted brick is almost always discouraged.

RECOMMENDATIONS: Maintenance.

National Park Service **Preservation Brief #8** says, "Routine maintenance generally involves the least amount of work needed to preserve the materials and features of the building." It is better to perform routine maintenance at regular intervals, using conservative methods than to wait until some building component begins to fail and you have to make major repairs or replacements. **All** materials require routine maintenance and repair. The longer maintenance is deferred, the more extensive and expensive it ultimately will be.

Likewise, it is better not to experiment with untried methods on irreplaceable building fabric. Preservation and materials conservation literature is full of tales of new techniques tried on historic buildings that not only did not slow or stop deterioration, but actually contributed to disastrous, sometimes irreversible, damage.

The major maintenance required by brick is repointing and/or cleaning and stripping paint. Because brick is the primary component of Capitol Hill houses, its repair and maintenance can be very expensive. Property owners should familiarize themselves with the recommendations and processes involved before proceeding with work. This Guideline cannot cover all the technical issues involved, so several excellent and accessible references are listed at the end.

How Much to Repoint. The rate and extent of mortar deterioration varies on walls.

WHAT IS "POINTING?"

The terms "pointing," "repointing," and "tuck pointing" have been used more or less interchangeably for some time. To reduce confusion the Brick Institute of America (BIA) and the American Society for Testing Materials (ASTM) are promulgating the following standardized definitions:

Point: to place plastic mortar into joints to correct defects or to fill completely joints in newly laid masonry.

Repoint: to place plastic mortar into cut or raked joints to correct defective mortar joints in masonry.

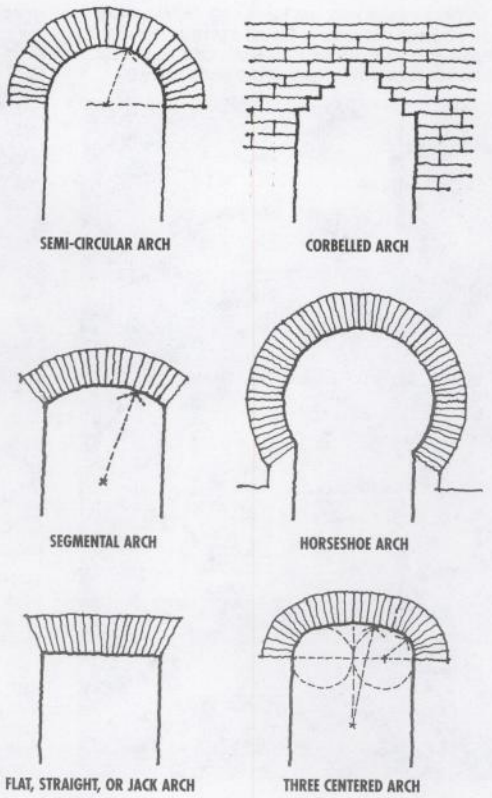
Tuckpoint: (1) to point masonry with a flush mortar joint that approximates the color of the masonry units and a mortar of contrasting color that is shaped into a thin strip. (2) see repoint.

Repointing: Mortar Analysis. If you have substantial and extensive areas of deteriorated mortar you should have those joints repointed. Your first question is the composition of your historic mortar. The references at the end of this piece include general guidelines for a relatively "soft" mix appropriate for use with old, soft brick. However, the best replacement mortar for an old wall is mortar that matches what is there. If you are planning visible exterior work, matching the color and texture of historic mortar is essential to preserving the character of a historic brick structure. To find out what you have, look in the Yellow Pages under "Laboratories—Testing" to find labs that do mortar analysis. You should be able to find a reputable lab to analyze your mortar chemically and microscopically for $125 to $175 per sample. Ask for an analysis by weight of the components in your mortar sample and a recommendation for a modern repointing mortar mix. Also, if your mortar is colored, ask for an analysis of the coloring agent. You will need to gather a sample of mortar to send to the lab. Look for a weathered location where the old mortar is soft enough to scrape out a sample. Then using a tool like a tuck pointer, dig as deeply into the joint as possible, to get mortar that has not been directly subject to weathering, which changes the apparent composition of the mortar. Collect about a half a cup of mortar, or the amount directed by your testing lab. If you have brick with butter joints as well as common brick, strongly consider having two analyses done, one for each kind of brick. Label your samples for location and send them off to your lab.

ARCH TYPES:

Louis Kahn, famous 20th-century modernist architect, was noted for his exquisite use of materials and poetic way of speaking. He related a conversation he had with brick, "I asked the brick what it wanted to be. It said it wanted to be an arch." Kahn was saying the arch is the elegant solution to the problem of how to get a small modular unit to span horizontally. Kahn was not the first to discover this. The earliest arches were actually corbels where each successive course of brick hung a little over the one below. Eventually, corbels from both sides of an opening meet and a solid wall could continue above. The Greeks knew this type of arch, using it in the beehive structures at Mycenae. But preferred a post and beam, or trabeated, form of building. The Romans embraced the arch, using the semicircular form in varied and impressive ways. The late 19th-century builders of our houses used the corbel extensively in cornices and a broad range of arches including semi-circular, segmental (because it is a segment of a circle), flat or jack. We also see occasional instances of exotic arches like the horseshoe, three-centered, and depressed three-centered.

Historic masonry is sometimes damaged by gas explosions, fires, automobiles jumping curbs and crashing through historic iron fences into buildings, and other accidents. In such cases, intact masonry materials should be reinstalled. If the wall is stone or pressed brick, this is especially important as the material may be difficult, time consuming, expensive, or impossible to replace in kind. Special care must also be taken to match adjacent joints in profile and color.



Foundations and tops of walls are particularly vulnerable to deterioration from rising damp, splash back, and leaks at flashings and roofs. If you repoint only obviously deteriorated portions of a wall, as recommended by the Secretary of the Interior's Standards, great care must be taken to match new work to existing exactly.

How not to repoint. Avoid less skilled workers who merely slather a bit of mortar over the top of old mortar. This is worse than useless besides looking awful. The thin layer will not adhere well to the powdery substrate and will spall off when moisture gets behind and loosens it during freeze/thaw cycles. Some companies today advertise an economical repointing technique that involves trowelling mortar over the surfaces of joints, sometimes called scrub coating or face grouting. The resulting appearance does not match that of historic masonry and is unacceptable on Capitol Hill buildings. Basically, there are no shortcuts to good repointing.

Preparing Joints for Repointing. After getting your mortar analysis results, and selecting your new mortar mix, the next step in repointing is to remove the powdery, sandy weathered mortar on the surface of the joints. The joints should be raked until you hit solid mortar or reach a depth of two to two and a half times the height of the joint. Although tedious, you can do this yourself with a tool called a joint raker available from hardware stores. Joint rakers are a pair of metal wheels on a handle with a masonry nail between. You roll the wheels along the brick with the nail set to the depth of mortar removal, scraping away old mortar with each pass. Don't neglect to rake out the vertical as well as the horizontal joints.

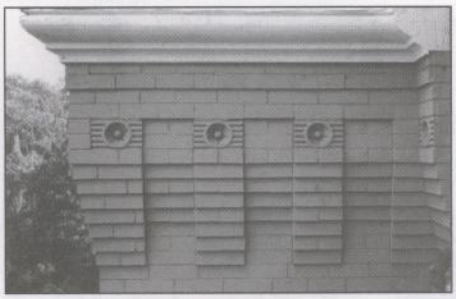
If you hire someone to do your repointing, pay special attention to how they propose to remove old mortar. Be sure to specify the depth of removal of old mortar in your contract. If they propose to use mechanical means (a carbide blade in a hand held power tool) have the technician demonstrate results on an inconspicuous section of your wall to be repointed. Establish a standard of quality, making it clear that score or gouge marks on adjacent brick will not be tolerated. Then be prepared to monitor the work since after a few hours of mortar removal, technicians get tired and make mistakes. Mistakes, especially on a decorative front facade, can't be fixed. A good compromise may be to require hand raking on front facades and allow power tools, properly supervised, on sides and rears.

Application of Mortar. The patient property owner with a great deal of time or determination can do his or her own repointing. It is a simple skill, well described in Mark London's book **Masonry: How to Care for Old and Historic Brick and Stone.**

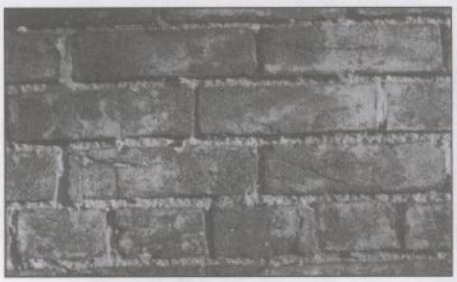
If you contract for repointing, be sure to check your contractor's references and look at actual jobs. Just as you established a standard of quality for mortar removal, you will want your contractor to establish a standard of quality for repointing. If you have butter joints, it is both feasible and necessary to repoint them as neatly as they were originally with no mortar lapping onto the pressed brick. A finer sand may be required for butter joints than those on common brick. Common brick should be repointed with a tooled joint that is smooth, neat, continuous, and that matches the profile of the original. If your original mortar was colored, samples of the work are essential to establish color match. As mortar sets up, the color changes, so sample repointing should cure a week in dry weather before you decide if the color is good. Modern mortar is colored with premixed pigments, available in hundreds of shades. The color of the sand, white or yellow, also affects the final mortar color. Sometimes it may take a number of samples to get a precise color match, but some time and careful planning is a modest investment for expensive work that will last a hundred years.

Once brick repointing is complete, the mason will wash down the wall with a mild acid solution and a bristle brush to remove mortar that has slopped over onto the brick. Prior to and after the acid wash, the wall must be well rinsed with clean water.

Paint removal from and cleaning historic brick is a painstaking process that is a very



A CORBELLED PRESSED BRICK CORNICE WITH SPECIAL BRICK SHAPES.



THE AFTERMATH OF SANDBLASTING IS ILLUSTRATED HERE. MANY BRICKS HAVE LOST CORNERS AND EDGES, MUCH OLD MORTAR HAS BEEN BLASTED OUT, AND SOME CRUDE REPOINTING HAS BEEN DONE.

THE IRON PIECE FOR A SECURITY GRILLE IS CORRODING IN THE MORTAR JOINT INTO WHICH IT WAS INSTALLED. THE EXPANSIVE FORCE OF THE CORROSION IS LITERALLY BREAKING THE ADJACENT BRICK APART.

NOTE A MARGINALLY SUCCESSFUL ATTEMPT AT PAINT REMOVAL FROM AN 1888 PRESSED BRICK BUILDING. THIS OWNER DID A TEST SECTION THAT LOOKED VERY GOOD. IMAGINE HIS DISTRESS WHEN THE LARGE AREAS OF CEMENT STAINING APPEARED AS THE PAINT WAS REMOVED.

technical exercise of finding the gentlest means possible, generally using pressured water and/or chemicals. Even using gentle techniques, buildings from which paint has been removed frequently must be completely repointed, either because paint remains adhered to the mortar or because so much of the first layer of mortar has been lost. Sometimes, the overall appearance of a wall from which paint has been removed is un-satisfactory. Old, soft brick may have absorbed paint until it is not possible to remove the paint without damaging the brick. Sometimes buildings were painted to conceal masonry repairs, exposed when paint is removed. Sometimes, common brick buildings were painted because of moisture problems, which reappear when the paint is removed. People may remove paint from buildings to reduce painting maintenance, only to discover that they must apply and reapply clear moisture-proof coatings or paint. Also, because the processes of paint removal or cleaning involve a lot of water, efflorescence frequently appears after the cleaning or paint removal.

There is some disagreement in the preservation community about cleaning buildings. In some cases, a coat of dirt appears to protect against acid rain; in other cases the dirt itself is implicated in materials deterioration. For questions of methods, products, and even whether to clean or remove paint at all, the property owner can look around the neighborhood for successful examples and find out who did the work and with what products, or consult a preservation architect for advice.

Fortunately, many property owners are now aware of the well-publicized dangers of abrasive cleaning or sandblasting of old brick. The problem is so great, it merited a National Park Service **Preservation Brief**. Removing paint or cleaning brick by sandblasting can irreparably damage an old wall. Aggressive sandblasting substantially pits the face of brick, dramatically increasing its surface area, causing accelerated weathering. Sandblasting also removes old mortar, neccessitating repointing. Sometimes people exacerbate sandblasting damage by repointing with excessively hard mortar containing too much portland cement. Movement of mortar harder than old brick can cause bits of the brick face to spall, or flake, off, called "honeycombing." The seriousness of the damage caused by sandblasting cannot be overemphasized. It is permanent, irreversible, and unacceptable in the Historic District.

If you are considering removing paint from a building, first look carefully and do a test patch to verify your painted brick is old. Brick work of the last few decades that is inappropriately salmon colored or that has a large range of colors may appropriately be painted. A coat of paint can help tone down spottiness of excessive range or camouflage new brick to help it fit in with its historic

NEWS RELEASE!

Those of us writing and reviewing these **Guidelines** believed, from the information we had, all of Capitol Hill's buildings were originally unpainted brick, the pressed as well as the common brick. The fact that so many common brick side and rear walls are unpainted to this day suggests that the Victorians felt no technical need to paint common brick, unless for cosmetic reasons. Thus, we recommended brick remain unpainted or be painted brick-red if already painted buildings were repainted. Recently, though, we have had to re-evaluate.

Through the courtesy of a local realtor, we gained access to an original set of specifications for the construction of a pair of 19th century row houses on Ninth Street, SE, near Independence. It turns out that the builder of these houses specified their facades of common brick be prepared for paint and painted as part of the original construction. So, we now know that at least some historic Capitol Hill houses began their lives with a coat of paint.

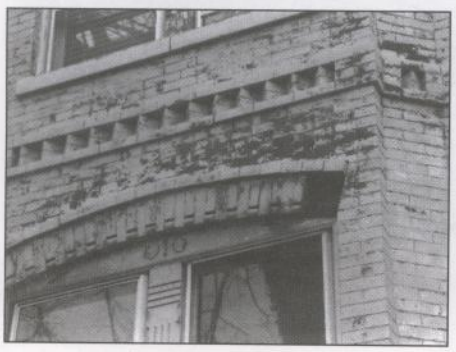
*"Lay these finet (sic) brick with even joints, well smoothed and all cleaned well ready for painting....As soon as brick work of fronts is dry they are to receive a priming coat of good oil paint and finished with 2 coats of blueish (sic) gray or such other color as the owner may prefer."**

*from historic specification for a pair of houses on Ninth Street, SE.

(RIGHT) THE NEW SEGMENTAL ARCH IN THE CENTER BAY IS CLUMSILY EXECUTED, ESPECIALLY DISAPPOINTING IN LIGHT OF SMOOTH CURVES OF ORIGINAL ARCHES TO RIGHT.

FALLING ARCHES:
(BELOW LEFT) SEVERAL BRICKS IN THIS ARCH HAVE FALLEN OUT ALTOGETHER.

(BELOW) IN THIS PHOTO, NOTE HOW THE OUTER WYTHE OF PRESSED BRICK IS FALLING OR BEING PUSHED FORWARD.



INAPPROPRIATE USE OF BRICK

neighbors. If so, paint the brick a color approximating one of Washington's historic brick colors, after assuring yourself the wall has no moisture problems. Paint or other moisture-resistant coatings can trap moisture in brick walls causing or accelerating moisture problems.

RECOMMENDATIONS: Repair

The best course of action on any repair is to avoid processes that cause damage: avoid using too-hard mortars that can make the face of brick spall off; avoid sandblasting and harsh cleaning methods that damage brick faces; avoid coatings that do not breathe and so trap deterioration causing moisture in walls.

Typical brick repairs include replacement of isolated, deteriorated bricks, resetting loose bricks, repairing falling arches and sections of walls damaged by accidents. The most common brick repair on old brick buildings is repointing, discussed above.

Occasionally, isolated bricks in a historic wall powder. This type of deterioration is usually from moisture in the brick expanding during freeze/thaw cycles as temperatures swing above and below 32 degrees Fahrenheit rapidly, not an infrequent occurance in our climate. While this problem sometimes appears on interior walls, it is more common on exterior brick that is subject to temperature extremes. A single brick may be removed and replaced with another old brick and compatible mortar. You can usually find an old brick or two in the yard, or ask a neighbor. Sometimes it is possible to scavenge bricks from inconspicuous locations to repair damaged brick in prominent places. Fancier bricks are sometimes available at local architectural salvage companies.

If you have minor cracks, you should repoint the crack to prevent water penetration and potential further deterioration. Whatever caused the crack in the first place may be continuing, whether foundation settlement caused by water washing away soil under the footing, poor construction technique (running oak flooring tight to walls has been known to cause exterior walls to bow outward when the flooring expanded lengthwise), differential movement, or some other cause. It is best to determine the cause of the cracking before taking action. However, some cracks are, themselves, historic: of long standing from causes no longer active. You can see if a crack is active and getting worse with a crack monitor, consisting of two pieces of clear plastic with bull's eyes mounted on either side of the crack.

When, as visible on many Capitol Hill buildings, the brick arches at window or door openings begin to fail, you may be able to slow the progress of the failure by repointing. At the least, repointing will prevent water penetration and accelerated deterioration. Some of our flat segmental and jack arches may have been over-ambitious in span when they were built a hundred years ago. Time has weakened the mortar, the arches have been subject to vibrations from heavy vehicular traffic on adjacent streets, our hundred-year-old buildings have moved around, resulting in the slipping or failing arches we see on many of our historic buildings. These failures are often seen in pressed brick where the face wythe of brick is not tied to the backup brick. When bricks actually begin to fall out or failure looks imminent, disassemble the arch carefully and reset the bricks in the plane of the wall with new mortar matching the old. A good repair may enable the arch to last another hundred years before it fails again.

RECOMMENDATIONS: New Work

Capitol Hill's abundant texture and ornament have important implications for new construction. Since there is virtually no unrelieved wall plane on the Hill's 19th-century buildings, new buildings with plain brick surfaces broken only by window openings look mean by comparison.

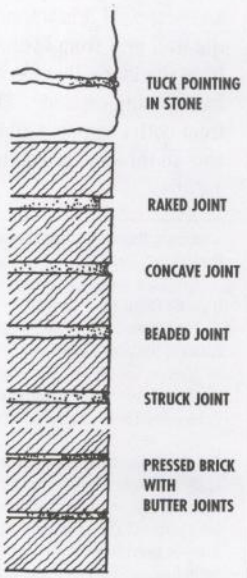
USE OF A GRAPEVINE MORTAR JOINT IN MORTAR SELECTED TO MATCH THE BRICK CLOSELY AND A SMOOTH FACED BRICK SUCH AS THIS ONE MANUFACTURED BY BELDEN CREATED A MODERN WALL OF A SIMILAR UNIFORM COLOR AND TEXTURE TO HISTORIC PRESSED BRICK WITH BUTTER JOINTS. IN THE ABSENCE OF MODERN PRESSED DECORATIVE SHAPES, THE ARCHITECT OF 303-305 SEVENTH STREET, S.E., AMY WEINSTEIN, USED A CHECKERBOARD OF RECESSED BRICK TO CREATE RICH AND LIVELY TEXTURES.

photo by Ken Wyner

Use this test for new construction: for modest, unassuming, secondary buildings like new garages and rear additions, since even the Hill's grander houses had common brick on sides and back, modern conventional red through body brick — where the color goes all the way through the brick — with tooled joints would be appropriate.

If a new house is on a prominent corner, has significant elevations, is grander, the design and construction should take its cues from the grander houses on the Hill, with their smooth-faced. highly articulated vertical facades. While pressed brick and the rich array of 19th century special patterns are not available today, modern smooth-faced dense brick is available as are limited special shapes. Beware of contractors and masons who bring up the difference in cost of $240 per thousand versus $260 per thousand brick as if saving a total of $400 on the brick, the single most important visual element of your $300,000 construction project, were an appropriate place to save some money. Don't be swayed by bogus economics.

Smooth-faced brick, combined with mortar colored to match it, and the smallest possible mortar joints can achieve a monolithic appearance for a modern wall. As important as the monolithic look to the wall planes, however, is articulation of the surface. Belt courses, projections, recesses, and polychromy can achieve the richness in articulation of the surrounding architecture.



One of the most important aspects of brick selection, whether a smooth-faced brick or a common brick grade, is color. The best method for selecting new brick is to match new to old. There is plenty of unpainted brick around the Hill for comparison. Avoid salmon-colored "Colonial" bricks, a brick color that predated our late 19th century building stock by a century, and avoid brick that incorporates a great range of different shades, also rare in 19th century Capitol Hill buildings.

New construction opportunities and challenges facing many Capitol Hill property owners include small construction projects such as retaining walls, walks, and paving. As important as knowing when to use brick is knowing when **not** to use it. Brick is a wonderful material, long lived, durable, warm, and textured, used for many things. However, there are some brick applications for which we have no documented examples from the 19th-century on Capitol Hill. Brick was not used for front steps and front walks from the public sidewalk to the front door and very probably not on public sidewalks either. The original material for public sidewalks appears to have been asphalt pavers with brick sidewalks not appearing until well into the 20th century. Brick was not used in conjunction with iron or alone for fences. And, brick was never applied over the top of cast iron steps. The sidewalks to our front doors were concrete or stone slabs, our front stairs and stoops were iron, wood, or stone, and our fences were iron. It is both inaccurate and detracts from the richness of our historic district to use brick indiscriminately in applications not originally brick.

Brick **was** used historically for retaining walls at window wells and at raised front yards. If you must repair or replace an existing retaining wall, or want to add a window well and new wall, first look for precedents in your immediate neighborhood, and match the brick in your foundation wall, which will be adjacent to the new work. Many Capitol Hill 19th-century developers were sparing in their use of more expensive pressed, colored, or striated bricks by building common brick foundation walls. If this is the case in your house, brick that looks like common brick with 3/8" mortar joints is appropriate for a new window well.

650 EAST CAPITOL STREET

If you must replace a failed brick retaining wall, the first question is to ask whether it is a historic wall of the same period as your house. If it is a modern addition, you have the opportunity to replace it with something historically appropriate. If it is a historic wall, you should replace it in kind: matching what was there. A tour of any residential neighborhood older than forty years in this metropolitan area will illustrate many cases of failing retaining walls. A well-built, modern, engineered retaining wall should last indefinitely. One without a foundation 30" below grade and appropriate reinforcing may last until you sell the house, if you do it fairly soon. Remember, masons are technicians, not professionals trained to design structurally sound walls. If you are installing or replacing a retaining wall, hire an architect or engineer. Designing a residential retaining wall is a modest effort for a professional and should not add much expense while helping insure a long life for your wall.

Weep holes will help make your new retaining wall last. They allow water behind the wall an escape. If it is trapped, water will push the wall over from hydrostatic pressure and from the incredible force exerted when it freezes and expands. The default weep hole, from both engineers and masons, is usually a two- to three-inch plastic pipe. While efficient, these are aesthetically obnoxious. You can solve the drainage problem just as well by embedding a perforated footing drain in gravel behind the wall and either draining it through the wall at a single location or to daylight elsewhere. This small but important detail can have a disproportionate visual effect on a new retaining wall.

Sometimes one has to brick in or reduce a window opening on a brick rear elevation. If so, try to match the surrounding brick, mortar, and joints, holding the new brick back from the plane of the original brick by about an inch. This allows all the original masonry window features such as arches and sills to "read," helping preserve the story of the building, including its evolution. Also, since the new and old masonry are not "toothed" together, the new brick can be cleanly removed in the future. It is unacceptable to block up or reduce a historic masonry window opening on a front or exposed side elevation, or to shrink masonry openings to install windows smaller than the original ones.

One of the many benefits and pleasures of life on Capitol Hill is our solid brick houses. Besides the security of living in brick houses, knowing we're safe from the huffing and puffing of the wolf at the door, we also know brick is a low maintenance material (who can argue with repointing every hundred years?) that will continue to provide shelter for our great-grandchildren as long as we take care of it responsibly now.

ADDITIONAL INFORMATION

London, Mark. *Masonry: How to Care for Old and Historic Brick and Stone*. Washington, D.C.: The Preservation Press, National Trust for Historic Preservation. 1988. *If you have only one brick reference book, this is the one to have. Also, Look carefully at the building on the cover and you will see it is a Capitol Hill Building! 420 10th Street, S.E.*

Smith, Baird M. *Moisture Problems in Historic Masonry Walls: Diagnosis and Treatment.* U.S. Department of the Interior, National Park Service Preservation Assistance Division, available from the Government Printing Office. *An excellent and detailed discussi on of causes and remedies.*

A Glossary of Historic Masonry Deterioration Problems and Preservation Treatments. Compiled by Anne E. Grimmer. U.S. Department of the Interior, National Park Service Preservation Assistance Division, available from the Government Printing Office. 1984. *This pamphlet is very comprehensive.*

The *Preservation Briefs,* available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., are excellent sources of additional material:

Mack, Robert C. "The Cleaning and Waterproof Coating of Masonry Buildings." *Brief #1.*

"Repointing Mortar Joints in Historic Brick Buildings." *Brief #2.*

Smith, Baird M. "Conserving Energy in Historic Buildings." *Brief #3.*

Grimmer, Anne E. "Dangers of Abrasive Cleaning to Historic Buildings." *Brief #6.*

Park, Sharon C. "The Use of Substitute Materials on Historic Building Exteriors." *Brief #16.*

Nelson, Lee H. "Architectural Character: Identifying the Visual Aspects of Historic Buildings as an Aid to Preserving Their Character." *Brief #17.*

The Brick Institute of America, billed as "the national authority on brick construction," with offices in Reston, Virginia, is a convenient source for personalized technical information. The people there can either answer questions or provide sources where you can find answers, including various BIA publications and standards in the industry. (703) 620-0010.

Consult the other *Design Guidelines* in this series, available from the Capitol Hill Restoration Society.

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