



## Historic Bricks, Repair or Replace

*Are damaged bricks repairable, or should they be replaced? Missing bricks do have to be replaced, but with what? Opinions differ on the merits of the options.*

by Loretta Hall

**"Solid as a brick wall" is a nice metaphor**, but historic buildings are often peppered with spalled, broken, or missing brick. Restoration experts must make a few important choices. Are damaged bricks repairable, or should they be replaced? Missing bricks do have to be replaced, but with what — vintage, salvaged brick or new, custom-made replicas? Not surprisingly, opinions differ on the relative merits of each option.

### Found treasure

"The best situation is to find the original brick," says John Speweik, a historic masonry specialist with U.S. Heritage Group. When consulting on a restoration project, his first strategy is to look around the property for opportunities to harvest brick from the original construction. "I can compare it to skin transplants on burn victims, where they're taking skin from other parts of the same person and transplanting it into another area of the body," he explains. He might find usable brick in a less visible part of the building, such as a foundation or attic wall, or he might discover surplus brick that has been tossed aside.

In a recent instance, Speweik noticed brick walkways and a patio at a house built in 1874. On a closer look, he realized they had been added when an original outbuilding had been dismantled. He immediately told the contractor to stop driving his heavy equipment over the brick. "Let's get them up, get them aired out, clean them off," he said. "This is like a gold mine here."

If the original brick is not available, the next option is to search for similar brick that has been salvaged from demolition projects. Color, size, and texture are the important matching criteria. "Our process starts with a client e-mailing us a digital image of the brick they're trying to match, with the dimensions," says Mike Gavin, whose Iowa company, Gavin Historical Bricks, reclaims and stockpiles brick. If they find an apparent match, they send the client a sample brick to compare to the existing structure.

When clients are concerned about the salvaged brick being from the right region or time period, they can ask for background information. "We know where we get the brick, and we usually know the general history and age of the brick that we reclaim," Gavin says.

While color and texture are very important, Speweik lists size as the most important element to match. "The size of the mortar joints in the construction will dictate that the same size be used," he says. "The height of the brick is very important in matching, even as opposed to the length."

Some caution is in order when using salvaged brick on exterior restoration projects. For instance, old manufacturing methods produced brick with a range of hardness characteristics (see sidebar). Experienced builders sorted the brick, using the softer ones inside the building and the harder ones on the



exterior. But when a building is demolished, the interior and exterior brick are usually intermingled in the rubble. The visual clues used for the initial sorting will have faded, leaving the less durable bricks looking just like the more durable ones. Inadvertently using softer brick on an exterior restoration can result in early failure. "In the same wall, you may have two or three brick that are falling apart for no apparent reason and all the other brick around them are fine," Speweik says.

top: Deteriorating brick due to portland cement repointing. center: Under-fired brick circa 1820. bottom: Historic brick that has lost its fire skin. The fire skin is like the crust on a loaf of bread: When it is lost, the inside disintegrates at a much more rapid pace.



top: Installation of brick patching material (not finished yet). Three different colors of mortar were used. bottom: Next day close-up. The brick repairs are very hard to find.

When Speweik harvests bricks from an interior wall for exterior repairs, he tests them by clinking two bricks against each other. If the sound is a high-pitched ring, the bricks are probably fully fired and hard enough for exterior use. A dull, clunking sound indicates softer, less durable brick. However, he cautions that this test is not completely reliable. "There really aren't many things you can do to absolutely ensure that it's not an interior [quality] brick," he says. "That's a risk you take."

Another potential problem is that mortar may not adhere as well to secondhand brick. Before being approved for use, reclaimed brick should be tested for water permeability. Water beading up on the surface indicates the presence of a waterproofing treatment, which would prevent mortar adhesion. "Waterproofing naturally deteriorates over a period of years, but if it's present, I don't know how you'd get rid of it," says Dennis Rude, president of Maryland-based Cathedral Stone Products." In addition, it is essential that salvaged brick be thoroughly cleaned to remove all the old mortar before applying fresh mortar.

### Custom replicas

If it is not possible to find original or reclaimed brick that adequately matches a restoration project, using new replacements for missing bricks might be considered. Again, caution is in order. "If you take a new brick that is produced in a modern manufacturing company and place it into a historic wall,

it may match, but it may have different water absorption characteristics and performance characteristics that may not be compatible with the brick wall itself," Speweik says.

An acceptable alternative is to have custom-matched replica brick made using traditional techniques and antique kilns. "That's typically a costlier option, just because you set up for a small production of brick," Gavin says. "But we have had a lot of good luck, especially when it's a real unusual texture and that's what's most important to the client."

Colonial Brick Corp., located in Indiana, is another source of custom brick runs. They not only use antique beehive kilns, but they fire them with coal rather than more modern alternatives. Using this century-old technology allows very close matching of historic brick. The company produces more than 10 million brick each year.

### Rebuilt remnants

Damaged or deteriorated brick can be rebuilt using mortars formulated to match the original material in both appearance and physical properties. "Physical compatibility will give you a long-term, guaranteed repair that's not going to change in 10 or 20 years," says Rude of Cathedral Stone Products. He stresses the importance of matching the repair material to the original brick. "Not doing some testing before writing specifications and choosing mortars is the same as getting medicine from a doctor



### Brickmaking Techniques

Traditional brick manufacturing was a slow, labor-intensive effort.

without having a physical."

Cathedral Stone Products is heavily involved in the Gulf Coast region, where numerous historic structures were damaged by recent hurricanes. One example is Fort Gaines, a 150-year-old structure outside Mobile, Ala. Seawater 6 feet deep was trapped inside the fort for an extended period of time, and the salty water wicked up into the brick walls. "When the water evaporates, the salt is still there, and it recrystallizes," Rude explains. "When it turns back into crystals, it has an expansive pressure like rusting steel, and it just destroys everything. We engineer special mortars that will handle that salt, so the salt can come through the repairs rather than cause it to destruct again.

"To repair the brick is cheaper, and you probably can do a better job of matching what's there on historic buildings," Rude says. "It should last about as well, as long as they remove all the deterioration." However, he cautions that successful brick repair depends on skilled workmanship. His company's Jahn brand of repair material is sold only to installers who have completed a three-day, hands-on training class.

Bricks with relatively minor damage are obvious candidates for repair, but Rude says that a brick can be rebuilt even if more than half of the original material is missing. "It just has to be repaired with exactly the right material," he warns. "I wouldn't recommend repairing that with something off the shelf."

U.S. Heritage Group also manufactures brick repair products, but Speweik does not quite echo Rude's comments. He sees the repair option as the last choice, with his first preference being the harvesting of original brick and his second choice being replacement with salvaged or custom-made brick. "We wouldn't engage a client to send us a sample [for formulating a matching repair product] if they hadn't done their due diligence in doing the other things," he says.

Ground clay and/or shale was mixed with water until it reached the consistency of soft mud. Next, the brickmaker dampened a wooden or steel mold and coated the interior with sand as a lubricant. Then he packed the mud into the mold to form the brick shape. After removing the flexible, solid block from the mold, he set it aside to dry. Batches of a few thousand bricks were stacked, with room for air circulation, into beehive-shaped kilns, which were heated to 1,800-2,000 degrees F with coal fires. Firing took about a week, followed by several days of gradual cooling inside the sealed kiln.

Because heat was not evenly distributed throughout the kiln, some bricks were fired at a higher temperature than others. The under-heated ones were less dense, more porous, and less durable. Guided by a distinctive pink-orange color, the masons sorted out these "salmon" bricks for interior use.

The current generation of brick manufacturing technology uses extrusion rather than molding. A stiff clay mud is forced at high pressure through a die and is then sliced into blocks of the desired thickness. The raw bricks are oven-dried in computer-controlled conditions of temperature and humidity before being fired by passing slowly through a tunnel-shaped kiln usually heated by gas or oil. During the bricks' 36-hour journey through the kiln, they experience gradually increasing temperatures to a maximum of about 2,000 degrees F and then gradually decreasing temperatures. This process produces highly consistent, dense, hard bricks that have interior holes left by the extrusion die.