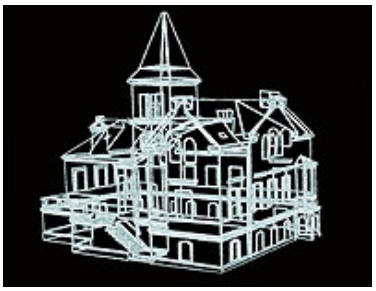
main story

High Tech for Old Houses

by Jerry Laiserin, FAIA



PhotoModeler Pro created accurate, high quality 3D models (above) and measurements from a photograph of this historic house (top).
New technologies can help in documenting and diagnosing building conditions.
Photos courtesy of PhotoModeler Pro

The cold glare of a computer screen seems incompatible with the warmth that most folks associate with a fine old house. Yet recent advances in computers and related technologies are providing savvy homeowners and their architects with many new options for documenting and investigating historic buildings.

With the help of these high-tech tools, you can identify existing dimensions, locate hidden problems, and assess material conditions faster, more economically, and with greater accuracy.

while the cost and complexity of most of these new gadgets and software makes them unsuitable for direct use by homeowners, knowing what's available is useful for deciding when to turn to specialists for help. there are two main categories of high tech for old houses: measurement and documentation, and inspection and testing. here's a quick guide to the primary options.

Measuring & Documenting

An accurate set of architectural drawings of the existing conditions is an essential tool for organizing any building project, but such drawings may not exist for older structures. Measuring and drawing by hand is timeconsuming and error prone for all but the smallest and simplest houses. Preservation architects, such as Michael J.Mills, FAIA, of Princeton-based Ford Farewell Mills and Gatsch Architects and Eric Rekdahl, AIA, with Architectural Resource Group of San Francisco, rely on computer-aided design and drafting (CADD) software. They find the accuracy ofCADD and its ability to superimpose different layers and levels in the computer ideal for working with older structures. Such professionals increasingly turn to photographic techniques or laser scanning as

fast and accurate ways to input building measurements into their CADD software.

In photographic measurement, or photogrammetry, a CADD operator applies a few known measurements as references or monument points to a series of multiple overlapping photographs taken from different angles. Special software, such as PhotoModeler Pro from Eos Systems, then derives accurate 3-D CADD models from the photos. The 3-D model can be further processed by most CADD software into conventional 2-D drawings of both interiors and exteriors.

Laser scanning, from companies like Quantapoint, uses safe, low-powered lasers to scan the outside or inside of any building in much the same way that medical CAT scanners analyze the human body. The resulting highly accurate data is fed from the laser to a computer as a "point cloud," or collection of dots in space, that can be converted into CADD models and drawings. Laser scanning is especially useful for capturing dimensionally accurate images of complex details as well as overall layout and dimensions. Because laser scanners are expensive and require specially trained operators, architects usually farm out the work to outfits like Quantapoint or one of its subcontractors.

Inspecting & Testing

Photos, lasers, and CADD can measure and depict everything you can see, but many of the thorniest problems in working with older buildings are due to things you can't see.What construction is behind that plaster? How solid is the mortar behind a brick façade? The key to these questions is to strike a balance between removing enough material, albeit of historic value, to be certain of the underlying conditions, versus disrupting the historic material as little as possible.

Preservation architects need to know more than just dimensions. "They need to see what's underneath, behind, and inside the surface materials,"says Kent Diebolt of Vertical Access in Ithaca, New York,who provides physical inspection services for many architects and building owners. New, computerized technologies for noninvasive testing can reveal this hidden information while minimizing damage to the building material that the architect or owner is attempting to save.

One such tool is impulse radar, which sends nondestructive electromagnetic waves through a wall, floor, or roof and measures varying reflections of those waves to create an image of the internal construction. Like the Doppler radar familiar from TV weather forecasts, the changing frequencies of the reflective waves as displayed on a computer screen reveal how many layers of construction are involved, which materials they consist of, and the thickness of those layers and any spaces between them.

For cavity walls-typically multiple layers or withes of masonry separated by air spaces-investigators sometimes turn to a borescope. The operator inserts this rigid bundle of fiber optics through inconspicuous holes drilled in mortar joints to allow direct visual inspection of the condition of internal layers. Hidden moisture conditions in older masonry and plasterwork can be detected by infrared thermography -which produces artificially colored images with "hot" reds and yellows corresponding to dry patches and "cool" blues and greens revealing damp spots. With homogeneous materials, such as metals in roofing applications,

ultrasound testing can determine the thickness of the material and identify weak spots. Metal detectors -high-tech versions of the devices that beachcombers use-can "see"metal items like reinforcing rods that are built in to an existing wall.

A Bird in Hand

Inspectors record their findings on the building drawings to correlate test results with the actual physical locations. However, wielding a roll of architectural drawings while clambering over a roof is not conducive to accuracy or safety. Technology comes to the rescue here too, with the latest handheld PocketPC computers, such as the Compaq iPaq, capable of displaying CADD drawings and accepting notations via stylus input or the iPaq's built-in voice recorder. This latest innovation helps close the loop of information from measurement to documentation to high-tech inspection.

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