HPCS Historic Plaster Conservation Services
Applied Science

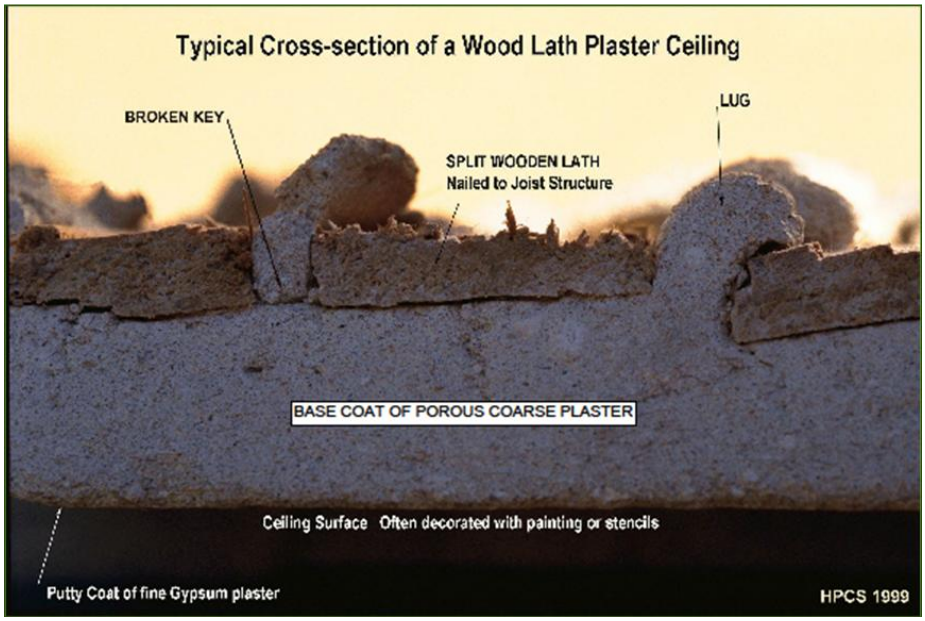
FAQ on Consolidating Plaster on Wood Lath

Q. What is plaster consolidation?

A. HPCS consolidates plaster by introducing a specially formulated acrylic material into its base coats, which are typically quite porous and brittle. This treatment not only strengthens the decaying plaster but also bonds it to the wood lath substrate, effectively converting the plaster ceiling from a loosely suspended system into a unified adhered system. HPCS coined the term “consolidation” because the acrylic material effectively consolidates the entire wood lath and plaster system.

Q. What do mean when you say that a plaster ceiling is a “loosely suspended system”?

A. A wood lath & plaster ceiling is an ingenious piece of mechanical engineering: the tradesman pushes the wet plaster up through narrow gaps between the strips of wood lath, causing the plaster to slump over onto the back of the lath to form keys & lugs. These keys & lugs (act) like “hooks” to hold the ceiling in place. The strips of wood lath are either green (young) or wet (soaked in water) so that they will dry and shrink away from the plaster, thus allowing the plaster, which is inherently brittle, some movement to withstand the building’s vibrations. A plaster on wood lath ceiling is therefore a “suspended” system, not - as it is often misconceived - an “adhered” system.



See how the plaster lug hooks on to the back of the wood lath to hold the ceiling in place. Also, note that the plaster is not adhered to the wood lath.

Q. How and why does plaster deteriorate?

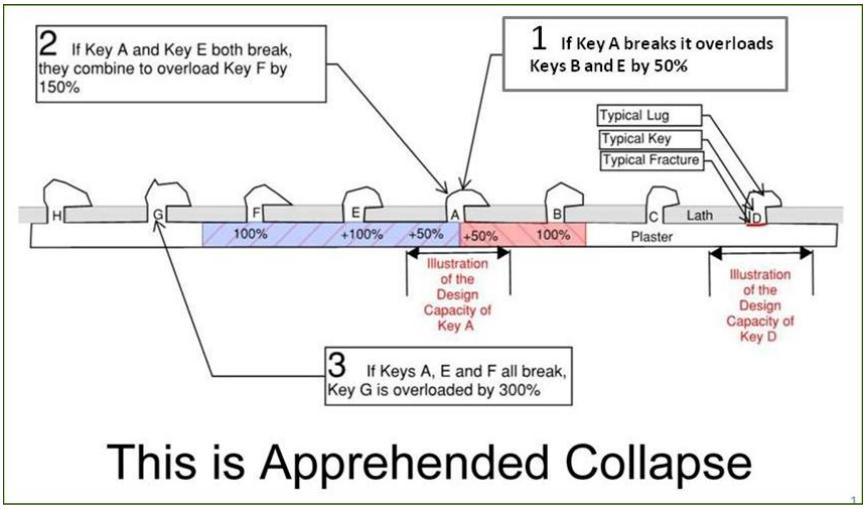
A. Plaster deterioration in old buildings is part of an ongoing and unrelenting process that is accelerated by:

- Micro-movements in the structure that eventually weaken the keys & lugs to the point where they ultimately break.
- Transmission of moisture and therefore salts back and forth through the plaster, causing it to slowly decay.
- Water infiltration that accelerates the plaster decay.
- Impact damage resulting from the installation and maintenance of mechanical & electrical systems over the years.

Q. What happens when a plaster key & lug breaks?

A. A plaster on wood lath ceiling is a single connected system and behaves as such: when one key & lug breaks, the support work it was performing is passed on to the adjacent keys & lugs on either side. This represents a 50% increase in the load they are taking up. If the next key breaks, the load on its neighbor increases to 150%. As more keys break, the load on other keys increases exponentially and the deterioration process is hastened. The situation can only get worse; it cannot get better. While it is true that some areas of the ceiling are in better condition than others, it is certain that all areas of the ceiling have deteriorated to some extent and that this process of deterioration is unrelenting.

How the System Breaks Down
(Exponential Deterioration)



As a system, plaster in a historic structure is always losing ground in terms of its present condition relative to its original designed condition. Unless consolidated, plaster in these buildings inevitably fails.

Q. What is the HPCS method of plaster assessment?

A. HPCS has developed a quantifiable, scientific method of assessing the condition of plaster from the attic side of the ceiling. We begin by selecting and delineating 10 – 20 small areas of plaster (the number of areas selected depends on the total square footage of the ceiling), which constitute a good representation of the ceiling as a whole. For example, if we are in a church with arches and deep groins, we make sure to include these in sample testing areas along with flat sections.

We then inspect and hand-test the keys & lugs in each sample test area, using a technique that we have developed and refined over the past 30 years. If, for example, a sample test area has 40 keys & lugs, and 10 of those keys and lugs are broken or missing, we would conclude that 75 per cent of that sample area is intact with good keys & lugs. After testing and assigning a percentage to each selected sample test area, we then tabulate and extrapolate the results to give us a pretty accurate sense of the ceiling's overall condition.

One of the attributes of the HPCS method of plaster assessment is that it generates a numeric result, which can be independently verified. In short, it is scientific and repeatable.

Q. How do you decide whether or not a plaster ceiling needs to be consolidated?

A. As a general rule, and through many years of experience, HPCS considers a plaster ceiling that has less than 75% of its keys intact to be in dire need of consolidation treatment, which means the entire ceiling requires treatment – not just the worst areas.

Q. Why treat the whole ceiling? Why not just isolate and treat the worst areas?

A. Having assessed hundreds of historic wood lath & plaster ceilings, we have found that general deterioration is an inevitable process that affects the entire ceiling system. In cases where there is severe deterioration (i.e. >25%), attempting to treat only the worst sections of plaster is, in our view, irresponsible and can only be entertained by people who do not understand the unrelenting mechanisms of deterioration at play in old wood lath & plaster ceilings. The fact is that the ongoing and increasingly serious problem of deterioration will have to be addressed at some point in time.

Why wait for the ceiling to collapse? The bottom line is that plaster consolidation, in addition to eliminating immediate structural dangers, is a preventive maintenance procedure that will take plaster problems and safety issues off the table for the foreseeable future. And from an economic perspective, it will save a great of money in the long run.

Q. Does HPCS ever NOT recommend consolidation?

A. When we are asked by a client to inspect a ceiling, we are usually given a clue as to what prompted the request. If a section of ceiling has failed and we discover it is because of a roof leak in that immediate area, we address the leak issue, double-check that other areas are not also subject to leaks that have not yet expressed themselves, and get on with recommendations for the repair in the immediate area. Therefore, in instances where acute trauma has damaged a particular section of plaster, we may recommend repair to only that section of plaster and leave the rest of the ceiling alone.

Under these or similar circumstances, HPCS would not recommend consolidation of the entire ceiling. However, unexplained collapses, which we encounter at an increasing level of frequency, are a different matter. In these cases, we try to determine the cause. In so doing, we often assess the plaster either informally or formally. The outcome of such an assessment guides our thinking and informs our recommendations. Forecasting the future of a ceiling that we know has a measurable 25+% degree of deterioration is not some nebulous exercise in guesswork. It is the essential practice of contemporary state-of-the-art risk assessment.

Q. Why would one want to put plastic in an historic ceiling?

A. The acrylic formulations in the products developed by HPCS break down the surface tension on the plaster and encourage deep penetration of the acrylic into the plaster matrix. The word "plastic" actually means flexible and pliant. The term is meant to indicate that when cured, our products remain flexible within the matrix of the plaster and allow the plaster, which is not inherently flexible, to withstand the building's micro-movements without cracking.

"Plastic" is a nebulous word and its negative use in reference to our products is always a sign of naivety and or unwarranted contempt based on antiquated ideas such as repairing "like-with-like", to which some conservationists in Europe continue to cling. In our view, the "repair like-with-like" fixation is a sentimental and unscientific approach to conservation treatments, especially with regard to plaster.

Some have criticized the HPCS method of plaster consolidation because "the way this system responds to vibration or thermal movement is not entirely understood."

Q. What is your response?

A. It is true that there is still work to be done in understanding how a consolidated system responds to vibration and thermal movement, but the 100+ plaster consolidation projects HPCS has completed over almost 30 years are a testament to the very observable fact that it responds brilliantly. We have never had a warranty claim or deficiency of any kind. All projects are standing up exceptionally well and all the contact information for owners/representatives is available should anyone wish to verify.

Q. Are there other companies that do plaster consolidation the way HPCS does?

A. The simple answer is no. The term “consolidation” has caught on and many people have borrowed it, claiming that they consolidate plaster ceilings but we’re not really sure what they do. We’ve seen some ceilings that people claim to have consolidated that have collapsed. We’ve been to a few sites where, what they call plaster consolidation was performed. In those instances, the treatment method they used was clearly not consolidation – they just made some points of contact, which ultimately failed.

There are a couple of reputable heritage conservation firms who claim to use acrylic polymer resins for plaster consolidation as part of their “tool kit” for plaster treatment. However, we believe these firms use the word “consolidation” very loosely. For example, have any of them successfully consolidated an entire wood lath and plaster ceiling system? If they say yes, they should provide explicit details on the condition of that ceiling and on the treatment method and products used. Regardless of their response, we can say with a very high degree of certainty that whatever “consolidation” techniques they claim to use, they bear no resemblance to the HPCS proprietary methods.

If one looks at the long list of services and claims of expertise by some of the firms who include plaster conservation in their offerings, one would have to conclude that plaster conservation is a sideline to their decorating business. That is not how HPCS operates. We’ve been at this a very long time. Our sole area of expertise and focus is plaster conservation. We understand old plaster, how it was made and why it deteriorates, and we have developed **the** state-of-the-art methods and products to preserve it.

Q. How did HPCS develop its products?

A. In the early 1980s, we began experimenting with the formulas of Morgan Phillips, who pioneered the idea of treating plaster with acrylic resin. Since then, we have worked with chemists and engineers to make significant changes to those formulas. As a result, we have dramatically improved the ability of these resins to break down surface tension and increase penetration into the plaster. These products, along with our treatment methodologies, are strictly proprietary.

Q. How many plaster ceilings has HPCS consolidated?

A. To date, HPCS has consolidated plaster ceilings in more than 100 important buildings in the United States and Canada. There has not been one single post-consolidation problem in any of these projects: no ongoing deterioration, no additional cracking, no failures, no warranties exercised, no insurance claims filed, and no additional maintenance costs incurred. All projects are standing up exceptionally well and all the contact information for owners/representatives is available should anyone wish to confirm.

Here's a list of a few of those buildings:

- Old St. Patrick's Cathedral, New York City
- Felician College, Iviswold Castle, Rutherford, New Jersey
- Alexander Hamilton House, New York City
- Grace Church, New York City
- Colonial Building, St. John's, Newfoundland
- Lower East Side Tenement Museum, New York City
- St. Mary on the Mount Parish Church, Pittsburgh, Pennsylvania
- 24 Sussex Drive, Prime Minister's Residence, Ottawa
- Old City Hall, Toronto, Ontario
- Gould Memorial Library, Bronx, New York
- New Brunswick Legislature, Fredericton, New Brunswick
- The Library of Parliament, Ottawa, Ontario
- Dundurn Castle, Hamilton, Ontario
- Notre Dame Cathedral Basilica, Ottawa, Ontario
- St. Michael's Cathedral, Toronto, Ontario

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