

A PRIMER ON CLAY TILE ROOF INSPECTION AND MATERIAL SELECTION

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INTRODUCTION

Clay roofing materials are commonly used on both steep-sloped commercial and residential roofing projects. However, if the project involves restoration of an "historic building," the needs and requirements are typically much different. In this article we examine two key elements that

are necessary for the successful historic preservation or restoration re-roofing project. These elements are the evaluation of the current roofing system and establishment of a standard for selection of clay tile roofing material.

Evaluation Standards

A complete and thorough evaluation of the existing roofing system is the first step in a successful re-roofing project. What needs to be done to the roofing system and what will be the subsequent impact on the over-all building? In order to answer these basic questions, the design professional must first establish the degree of preservation mandated by the owner and or governing authority and determine the standard of treatment or care required on this project. Is the building designated and protected by landmark status and therefore subject to its state's Interior Department standards for historic properties?

Before beginning an extensive roof investigation program, the standard of treatment or care required should be defined. Is the goal preservation of the roof system? Is it restoration of the roof system? Or is it the reconstruction of the roof system? The Secretary of the Interior Standards are very specific and detailed with respect to these standards of treatment. Excerpts follow:

Preservation Standard requires retention of the greatest amount of historic fabric, along with the building's historic form, features, and detailing as they have evolved over time.

Restoration Standard acknowledges the need to alter or add to the historic building to meet continuing new uses while retaining the building's historic character.

Reconstruction Standards establish a limited framework for re-creating a vanished to non-surviving building with new materials, primarily for interpretive purposes.¹

These standards create the framework within which the roof designer will formulate a plan of action to address the scope of work for the project.

Evaluation of the other building components that are impacted by the roof covering is also necessary. To focus only upon the roof covering and disregard its related parts is professionally irresponsible and may adversely affect the performance of the over-all roof system. Other components or elements that should be reviewed include, but are not limited to:

- Adjacent metal flashing
- Condition of the parapet walls
- Condition of the supporting deck
- Drainage issues
- Current code requirements

Understanding the interaction of all these components as part of the overall roofing system will provide a clearer picture of how this area of the building envelope functions. Developing a thorough and complete evaluation protocol is necessary to be certain that all parts of the building related to or affected by the roofing system are examined and documented.

Evaluation Protocol

An interior condition survey is necessary to obtain an overview of potentially deficient conditions within the roofing system. The inspection of accessible interior spaces is carefully documented and then superimposed over a plan of the exterior roof to identify and locate the relative position of the leaks and

other deleterious conditions. Locations of stained ceiling tile, falling plaster, and other damage to interior finishes should be closely examined for possible leak locations.

Do not limit the inspection to just the point of interior damage. Leaks on tile roofs have the ability and often the tendency to travel beyond the source location. With these types of roofing systems, water penetrating the building envelope will typically follow the contour of the roof deck and rafters for several feet before entering the interior and damaging the space. The detection of interior damage is only a general indicator of where to help focus attention on possible problem roof areas.

After recording the locations of leaks and potential problem areas, the evaluation and inspection moves to the exterior building envelope. It is important to note that the exterior building survey is not just a visual survey but also a comprehensive, hands-on look at the entire roof system and its related parts. When actually on the field of the roof, one can observe the conditions of the tile and its components. How is the existing installation holding up? Are there missing or broken tiles in random areas of the roof, or are the missing and broken tiles in critical transition areas, such as hip, ridge, valley, or eave lines? Close, visual observation and hands-on examination of the roof area will help identify obvious leak and problem areas. However, in many instances, actual samples of the roofing system will have to be taken.

These probes or inspection openings into the roofing system will help the roof designer gain the greatest amount of information about the as-built construction and condition of the existing roof system. The number and extent of probes or inspection openings should be dictated by the condition of the roof, size of the area to be re-roofed, and number of levels to be re-roofed.

It is also recommended that, at the time of the roof probe, representative sample of the components of the roof system be obtained for laboratory analysis. In many cases, the laboratory analysis will allow a reasonable assessment to be made regarding the expected service life remaining in the part and, by extrapolation, the rest of the roof system. These results are helpful in determining the scope of work required and the types of materials needed to successfully complete the project.

Samples should be taken from several different locations to obtain a reasonable cross section of the conditions that are representative of the overall roof system. Water testing may be utilized in areas of suspected leaks to duplicate conditions and more definitively identify the source and cause(s) contributing to water leakage. During the water test, closely observe the suspect area. Is there clay tile missing or broken, resulting in underlayment deterioration? Is there metal flashing that is severely worn or weathered leading to underlayment damage and subsequent water infiltrations? Masonry detailing that is suspect could also lead to water infiltration. Recording detailed observations of the existing roof system while water testing will provide a solid foundation upon which to develop repair recommendations for the next generation of roofing on the building.²

Material Selection

After determining that replacement of the existing clay tile is needed, deciding the type required for the project is the next hurdle. The American Society of Testing and Materials (ASTM)

has developed a material specification for clay roof tile that establishes consensus standards for grading tiles having various degrees of resistance to weathering. There are three grades of clay roof tile established in ASTM C-1167. Grade 1 tile is resistant to severe frost action. This quality of tile is appropriate for use anywhere in the United States, including areas with cold, harsh climate. Grade 2 provides resistance to moderate frost action and is acceptable for use in more moderate temperate climate. Grade 3 provides negligible resistance to frost action, and is recommended only in very mild climates such as Southern Florida and Southern California.

The weathering index is one of the most significant features of this ASTM standard. It is established by the product of the average numbers of freezing cycle days during which the air temperature passes either above or below the freezing point and the average annual winter rainfall (a measure of the precipitation in inches, occurring between the first killing frost in the fall and the last killing frost in the spring).

A clay tile's moisture absorption rate is directly related to how well it resists weathering. Under cyclic freeze/thaw conditions, moisture within a tile unit expands and contracts. The resulting internal pressure within the pores of the tile can lead to deterioration. In areas of severe weathering, these repetitive freeze/thaw cycles cause tiles with a high moisture absorption rate to prematurely break apart. Once deterioration has been initiated, the rate of product deterioration increases rapidly, leading to material failure.³

Another important element of the ASTM standard is the establishment of the minimum transverse breaking strength values for different tile profiles. For Type 1 (high profile tiles with a rise-to-width ratio greater than 1:4), tiles must have a minimum allowable transverse breaking strength of 300 pounds. For Type 2 (low profile tiles with a rise-to-width ratio equal to or less than 1:4), the minimum allowable breaking strength is 225 pounds. With Type 3 tiles (which account for all other types, including flat), the minimum strength is also 225 pounds. Strength offers protection against the various elements a roof is subjected to: i.e., hail as well as damage during handling and installation.

The requirements of these ASTM standards set the minimum level of material quality standard that a tile must meet. Because it is a minimum level, this standard does not necessarily ensure that first quality materials will be provided for the project. Specifiers can and frequently do ask for additional performance requirements. Note 2 of ASTM Standard C-1192 states that:

"...The best indication of clay tile durability is the service record of experience with the specified product in the environment of its intended use."⁴

Roof designers should require a list of reference projects of similar size and scale to the project at hand for which the manufacturer has supplied material.

Go out and look at the referred projects. See how they have fared under actual field conditions. Be sure to look at projects that have several years of weathering behind them and not just recent installations. The roof designer should specify or require a higher level of quality or upgraded standards whenever he or she feels that the greater requirement will benefit the project. This would include manufacturers' warranties for long-term product performance. Some manufacturers warrant the performance of the material up to 75 years.

In checking the validity of the warranty, see how long the manufacturer has been making roof tile material. What is its track record in the climate zone of the project? If the manufacturer is offering a long-term product performance warranty, ask to see a reference list that would include projects that have performed for extended periods of time in similar types of climates. Do not accept a project reference list from a manufacturer who is primarily located in the southern climate if your project is in the north. Demand to see projects of similar size, scope, and location as your project. Finally, as always, read the fine print on the warranty to make sure it includes the required items prior to inclusion of the warranty in specifications. ■

Conclusion

When selecting materials for replacement components on an historic building, one must consider the material that was on the structure originally, the required regulations to maintain the building's historic designation, and material performance standards and characteristics. Establishing an evaluation protocol and adhering to at least a minimum standard of quality will help ensure proper stewardship of the historic property.

References

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