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Replacement of Masonry - Important Selection Considerations

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1. Overview

Prior to locating a replacement source, important decisions must be made as to the extent of units needing replacement versus those that can be left in place for in situ repair. This will in large part be dependent upon the diagnosis of the failed unit. Expensive restoration or preservation activities will be useless, if the cause of deterioration or destruction is not identified and eliminated, or at least mitigated. Whether unit replacement is done may be also heavily influenced by the amount of financial resources available to the project and whether or not new replacement material can be found or produced in a timely manner. Too often this last consideration goes unexplored until the contract is let, the building is scaffolded, and the project is underway. It is not unusual that the location, manufacturing, and delivery of acceptable materials may take several months, if not the better part of a year. If an appropriate supplier is not located prior to the award of contract, delays of an unacceptable length may be expected.

The other major decision that needs to be made prior to approval of replacement units is whether the building's color will be matched clean or dirty. It is more common than not that masonry repair of a structure will be done without any cleaning of the units. If the units are to match the cleaned condition but the building is not being cleaned, the new units will stand out for several years unless some type of artificial staining or dirtying process is applied. An extreme example of this was done using kerosene lamps in order that the units had a smudged appearance at completion of the construction. If the units are matched to a dirty building, they will never look right should the building ever be cleaned. Additionally, there is no assurance that the units will weather in the same manner as the dirtied ones. It is for this reason that it is always recommended to match the cleaned condition, although this is often not done.

A situation unbeknownst to many who specify unit replacement is the amount of damage to adjacent units that may occur during extraction. This is especially true if only isolated units are removed. The nicking and chipping of nearby units is a common problem. Bricks pose the extra difficulty of the presence of header units being embedded in the second wythe. The situation with terra cotta is even more challenging given the elaborate set of pins, toggles, bars, and hangers that were often incorporated. With all masonry, but most often reported with terra cotta, the building has gone through irreversible movements either due to moisture expansion of the units, frame shrinkage, settlement, or a host of other factors. The result is an unknown and often delicate redistribution of stresses within the masonry, which may cause the sudden and unexpected cracking of nearby units when the stress in one portion of the wall is released during the removal of a unit or units. In such a situation, stress relief joints may need to be cut into the building along the mortar joints, at least temporarily.

Most bricks were originally made on site using locally available clay and sand often from the project's property. This highly localized approach resulted in a wide variety of sizes, colors, and finishes across the country that were extremely specific to a particular locale because of the local clay. By the late nineteenth century automation was revolutionizing brick making, mostly through the introduction of pug mills. This allowed larger scale operations, a better mixed and more consistent clay product, and greater uniformity in size and tolerances. The other important move towards automation came in the form of the tunnel kiln. Unlike in a stationary kiln, tunnel kiln bricks were exposed to basically the same heating and firing throughout the process. The result was much more uniformly fired individual bricks and more consistently fired batches. Visually, the end products had much more of a single color both across the batch and within a single unit.

Another major change in American brick making is the current move towards a smaller and modular sized brick. Because of this trend, non-modular brick is becoming increasingly difficult to find. If new brick is to be used for historic replacement, this leaves only a few options because of the size difference. Even with a custom run, many of the problems of matching remain unaddressed. One of the most common is color. Because of the change in production techniques, an entire brick firing will be largely the same color. Historic bricks possess a tremendous amount of color variation, even within a single unit, depending upon its orientation to the heat source during firing. Additionally, the clean edges of a new brick made in accordance to ASTM will have extremely sharp, crisp edges that will undoubtedly be easy to differentiate from bricks that have stood the test of time for many decades, if not centuries.

The final area to consider for matching is physical performance. Because historic bricks are relatively soft and porous by today's standards, it needs to be decided weather it is or is not advantageous to try to match these characteristics as well. For instance, a typical turn-of-the-century brick might have a crushing strength of 3,500 psi, whereas its modern equivalent could easily be three times this.

In some ways similar to the trends in the brick industry, terra cotta production has become more consistent and more uniform through advancements and sophistications in automation. This has generally produced a more durable and reliable product. Unfortunately, like brick, it has created a situation in which it is harder to match the wide variation of tones that appear on existing structures. Improved manufacturing processes have greatly minimized the range of colors produced during firing. The narrower range of tones has resulted in building appearing to be patchy where a large number of units are replaced from one section. Another problem in glaze matching. Many of the rich dark colors of blue, red, and green, and even some of the metallics are nearly impossible to match. The chemicals in current use are different from those in the early part of the century and few of the original formulas are even known. Given the additional factor of weathering, it is unclear whether this supplemental information would be useful. The exercise of color matching is even more complicated than this. Similar to the problem of matching weathered unit, much of today's terra cotta shows extensive crazing. Extensive crazing may substantially change the color of a piece. If the color of the new unit was selected to match exactly the color of an uncrazed portion of glaze, the contrast between new and old units may be startling. How these new pieces will then weather also becomes a major issue.

Stone, as a material that is used with little alteration or processing, differs in some significant ways from brick or terra cotta. Unlike these processed masonry units, the desired look and quality of the stone must be very close to what is taken from the ground. To date, stone cannot be dramatically enhanced or altered in a chemical or physical manner that would allow it to better match an existing unit or showed improved performance characteristics. The challenges this embodies are highly dependent upon the stone that is being replaced.

2. Conclusion

Finding suitable replacement material for masonry units is not an easy task. Locating appropriate sources for raw material and manufacturers with the proper equipment and a skilled labor force may take many months, in addition to the extensive amount of time that may be needed for quarrying or production. To successfully select replacement units important decisions must be taken prior to contracting regarding expectations for exact color matching, building cleaning, and variability tolerances within the units.