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Materials

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By Tom Inglesby

Mortar has been used for thousands of years. Over the centuries, the formulas have changed, and we aren't done yet as the proliferation of new masonry products provide new challenges.

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"Masonry contractors, along with architects and engineers, have embraced the whole concept of admixtures in mortar and performance mortars based on all the work that's been done with the architectural community," says Brian Carney, VP and general manager of Spec Mix in Minneapolis. "We see over a thousand architects a year, and they all want to learn more about performance mortars. They're realizing mortar is not the least important component of the wall. It's probably the most important."

And, if mortar is the critical element in the wall, then for many masons, the critical element in mortar has become the way it is done on the jobsite. According to Jeff Leonard, VP of bulk materials for Quikrete in Milwaukee, "From our perspective and commercial masonry's perspective, the influx of silo delivery systems, such as those from Spec Mix, has lent itself to the use of pre-blended mortars. In the past, we were able to add pigments in just the exact amounts that were necessary, but today we get many more requests than just for color. More and more, we're seeing the need for accelerators or retarders. We do integral water repellent mortars. Those require dosages that are very small compared to the 3,000-pound bag that we make them in — as little as 1.75 pounds on some of these materials per 3,000 pounds."

Pre-mix companies such as Quikrete are able to be precise with some of these items to meet certain situations that the masons, owner or architect may desire. An example of that is a job in New York where the brick that was specified is a king-sized, hard brick, with very low absorption. Leonard recalled, "It was specified that we put an accelerant in the mortar so after the mason laid his bed of mortar and put a course of brick on, that the brick did not swim or start moving around before he got to the next course. So we added a dosage of accelerant — just a couple of pounds per 3,000-pound super sack of mortar — to provide just enough of a kick to the mortar so that when they put on their course the brick didn't swim."

Bonsal American, makers of the ProSpec and Sakrete brands, sees similar requirements from their customers. Shawn King, director of marketing for Bonsal American in Charlotte, N.C., said, "We are seeing a significant amount of interest in the pre-blended products from a couple of different standpoints: One, it takes the guess work out of what's actually going into the mortar mix. Did they count the number of sand shovels and cement shovels, whatever the ratio is for that particular application? Was it done correctly? Also, from the standpoint that it's a labor savings. All they have to do here is rip open an 80-pound bag and pour it into the mixer, or take a bulk bag and silo system onto the site, and the job goes a lot faster."

All contractors are looking for ways they can decrease labor costs, given that the material costs are going up. King continued, "We get a lot of requests for pre-blended pigmented mortars. The thing with pre-blended mortars — particularly with pigmented mortars — is that you'll see more consistency in colors, which you don't always get from field mix. I was recently on a jobsite where they didn't use pre-blended pigmented mortars; they field-mixed all their pigments. Three sections of the wall were a nice, dark gray color, the next section was a much lighter gray, and the following section was back to dark gray. You could tell there was a color variation between

the segments that were done.”

Nick Blohowiack, central regional manager for Spec Mix in Green Bay, Wis., agrees. “What’s been happening over the last 10 to 15 years is that mortars have been shifting from what once worked for portion-based mortars, typically proportioned in the field, for example, a cubic foot of Portland cement to a half cubic foot of hydrated lime and four and one-half cubic feet of sand. That’s a type S proportioned mortar. With the advent of factory pre-blending facilities, we can now take that a step further and go into prescriptive mortars where we can design mortars to physically match masonry units and/or applications. So, they work better with the masonry units, and that’s important, since the masonry units have been changing over the years.”

Various standards are in place to determine which formula is right for the job based on environmental, strength, stress and other factors. Picking the right pre-blend can be a challenge as new masonry units and standards are released. Quikrete’s Leonard explains, “At the beginning of every job, we will read the specs, supply the submittal package that would include what mortar is to be used that best matches that specification, and then we do a pre-construction panel, and some of them lately are pretty sizable. Some test panels require that even the window units be inside, so the architect can get a full feel for what the wall is going to look like with some of the other variables.”

Products such as manufactured stone veneers and concrete brick add to the challenges. Bill Kjollien, masonry technical sales manager for Lafarge North America in Atlanta, said, “The ASTM committee for manufactured stone is finalizing their installation instructions and, generally, it’s a type S masonry cement that they’re recommending. The mortars that are available have proven to be applicable.”

Mortar cement is becoming more visible. It is produced as a way to satisfy the requirements that came out of the uniform building code. Those requirements also were written into the International Building Code (IBC). Mortar cement is a product that has the strength that you typically get from cement lime mortar, but it has the majority of hydrated lime removed, so it is more user-friendly for the mason.

“That having been said,” Kjollien says, “while more and more specifications are calling for mortar cement, it is presently only available in grey, and it’s required to be used in a higher seismic design category — D or greater. It’s generally used for structural purpose only in reinforced CMU construction, not so much for veneers.

“We’re seeing mortar cement become more prevalent in some parts of the country, so it might be something for masonry contractors to become acquainted with,” he added. “In my personal education work with LaFarge, I’m doing a program on what mortar cement is, why it exists, how it is the same and how it is different from what we have now. If there’s anything new in mortar, the movement in the direction of mortar cement would be it.”

Significant from the building code arena, the IBC now recognizes masonry cement in some applications that previously only permitted mortar cement or cement lime mortar. That could be good news for mason contractors. Most contractors and masons would prefer to work with masonry cement, because it doesn’t have the deleterious affects of lime, so it saves the hands and has better board life, requiring less tempering.

“We’ve seen the requests for mortar for stone veneers and manufactured stone,” King said, “but also for heavy natural stone that needs a little bit of a different formulation. We have come out with a new water-resistant mortar to be used with the water-resistant masonry units that are now becoming much more popular.”

Spec Mix’s Blohowiack discusses some of the new mortars for new masonry products: “Over the years, we’ve developed a standard stone veneer mortar and a polymer-modified stone veneer mortar, or a bond-enhanced stone veneer mortar. We’ve taken the materials and pre-designed them in our facilities with the help of laboratories to hit very specific specs or performance criteria. For example, for stone veneer mortar or a bond-enhanced or polymer-modified version of it, we’re meeting ANSI standards, ANSI 118.4. It drastically outperforms the standard masonry mortar in terms of bond strength.”

Stone has been used for thousands of years in masonry. Many different types of stone exist, and masonry mortars are being developed based on the densities of those various stones. “If I’ve got a porous stone, I don’t use a very low water-retention mortar that would be stronger than the stone, causing it to fail,” Blohowiack said. “The opposite would be true of a very dense stone. Brick masonry units that may or may not be sealed or have a texture to them — for instance, split-face masonry units — require the same approach. And, it’s not just a couple of mortars, we’re talking about different types of stone veneer mortars, straight-stone mortars,

accelerated mortars for use at lower temperatures, set-delayed mortars, etc. All of these things are being developed and used in the masonry industry.

Traditional masonry and masonry-mortared structures will continue to be solid architectural trends. But, as in all fields, there are constant changes of which to be aware. And, as Carney said, "mortar is not the least important component of the wall, it's probably the most important." So keep training your masons, learn to recognize and handle the new blends, know when and where to employ them, and "keep current." MD

Tom Inglesby is a San Diego-based writer and winner of the Construction Writers Association's 2002 Boger Award for Special Reports. Article reprinted from the October 2008 issue of Masonry magazine.

Rising to the Challenge
The Quikrete Companies were called upon to match 100-year-old mortar applied to a historic Frank Lloyd Wright-designed home.

By K.K. Snyder

As the third stage of a \$23-million restoration of the Darwin D. Martin House complex in Buffalo, N.Y., approached, The Quikrete Companies were called upon to match new mortar for the project with the historic mortar that had been applied more than 100 years ago — a considerable challenge.

The overall project focused on rebuilding masonry walls, restoring face brick and matching mortar for the interior "backup" brick on the 10,000-square-foot main house — Martin House — and a 100-foot covered pergola connecting the house to an interior garden in the complex's glass-roofed conservatory.

"The Quikrete Companies have responded to multiple requests for helping to match existing mortar on projects nationwide," said Chris Darner, bulk mortar/construction product sales manager for Quikrete. "As it relates to the restoration of mortar, this project was truly unique in its magnitude, especially given the significance of the home's designer and builder, Frank Lloyd Wright."

Darner says that during the original build between 1903 and 1905, aggregate and masonry sand were obtained from sources that were close and economical. There was little, if any, concern as to the effect the aggregate had on quality. Cement and lime also were found from a source that was readily available. Mix designs were contractor-specific, so what worked for one mason may not have worked for another.

Over the years, building owners/developers, architects, general contractors and masons have been educated about the importance of quality and consistency regarding mortar. The Quikrete Companies have been instrumental in this effort through leadership and support of organizations, such as the Masonry Contractors Association of America, which focus on promoting industry education, training, codes and standards composition.

Fortunately, ASTM specifications have been adopted and changed based on changes in the industry. In addition, pre-blended materials on construction sites are now specified, rather than an alternative.

So, the main challenge came in unlocking the mortar formula that exactly matched the historic mortar in texture, grit and color gradation, as well as preserved the home's historical accuracy and aesthetic beauty. Working with King Brothers Masonry Contractors and consultants from the Martin House Restoration Corp., Quikrete matched the formula, using the resulting local source of aggregate, with the masonry mortar on the historic home.

"The matching of mortar on a building that is more than 100 years old presents many challenges," Darner said. "At the time of initial construction of the multi-structure complex, there were no ASTM specifications or testing agencies to oversee the quality of the materials utilized."

So, inquiries were made to multiple contractors to determine the masonry practices used during the time of construction. Luckily, masonry contractors tend to pass the business along to their families, affording Quikrete some insight into past practices, Darner said.

"We also contacted aggregate and cement suppliers in an effort to identify the source of the materials utilized," Darner added. "The entire process was an investigation without any documented evidence."

Samples of various cement, lime, pigment and aggregate also were obtained and blended to achieve an exact match, and multiple samples were produced in an effort to duplicate the existing mortar.

Once Quikrete was able to achieve an exact match, a sample panel was constructed for review by all parties involved with the project. More than 60 different test panels were required throughout this evaluation process.

Because of their support of the restoration and material matching effort on the Darwin D. Martin House complex, Quikrete has received an increase in requests to match existing and historical mortars. In addition, the Bulk Products division of The Quikrete Companies continues to expand the product lines they can offer their customer base in the construction industry. MD