

Tech Note

This month the RMMI Technical Director investigated a building to see what might be causing the inconsistent color of the mortar joints between the cast stone panels and to evaluate what might be contributing to the variation (Photo 1 is an example of the issue).

The cast stone used on this project was manufactured by Continental Cast Stone Company and the Spec Mix mortar used between the cast stone panels was produced by Quikrete of Colorado and supplied by Threewit-Cooper Cement Company. The mortar used was a pre-blended, cement-lime based, Type N mortar - packaged in 80 pound bags.



Photo 1

The reasons for an inconsistent mortar joint color are often difficult to determine because there are many contributing factors to its final appearance. Some of these factors include: atmospheric and weather conditions, tooling (striking) of the mortar joints, pre-wetting of stones for proper mortar adherence, cleaning techniques and proper cleaning solutions, and the type of masonry unit selected. Type N mortar will cure differently with each type of masonry unit. Cast stone has unique properties because of its high cement content and porosity. Common masonry units such as clay brick and concrete masonry units absorb moisture from the same type of mortar used on this project in much different ways than does cast stone. The unique properties of cast stone dictate a different installation technique than many other masonry material types.

It is unusual for a pre-blended, standard gray mortar to be as inconsistent as is evident on this project; especially given that, in this case, the color of the joint often varies within a single joint or piece of cast stone. There is no indication of an iron oxide pigment present within the mortar itself, in the unlikely event that there could have been bags of mortar of different colors on the same pallet. It also seems unlikely that the mason tenders mixing the mortar would not have noticed different colors of dry mortar as they cut the bags open. This would suggest that the issue is not a result of the mortar itself, but is likely due to other contributing factors.

The degree to which the masons followed recommended practices when installing the cast stone panels probably had a greater impact on the final appearance of the veneer than the mortar alone. Both the Cast Stone Institute and Continental Cast Stone Company have Technical Bulletins for best practices and procedures when using cast stone. Technical Bulletin No. 39 "Cleaning", Technical Bulletin No. 42 "Mortars", Technical Bulletin No. 44 "Pointing", and Technical Bulletin No. 48 "Hot Weather Setting Practices" are the most relevant bulletins about how to avoid mortar and cleaning related issues.

Technical Bulletins 42, 44, and 48 recommend using a post-setting pointing system when installing cast stone to allow for natural shrinkage of the mortar as it settles and cures. This is accomplished by setting the stone in fresh mortar, then raking the mortar back to a depth of $\frac{3}{4}$ inch. Once the setting mortar has been allowed to cure for a minimum of 24 hours, pointing of the finished mortar joint is usually done in 1 or 2 stages to allow maximum sealing of shrinkage cracking in the mortar. Hot weather conditions (above 90 degrees) require special precautions be taken to assure the installation does not suffer from high temperatures. The primary concern is the evaporation of the water from the mortar. If sufficient water is not present, the bond between the stone and mortar will be compromised. Technical Bulletin No. 48 recommends thoroughly drenching the cast stone prior to setting, limiting the spread of mortar beds to 4 feet, placing the cast stone within 1 minute of spreading the mortar, fogging the mortar with a water mist periodically throughout the day, and covering the units at the end of the day with plastic sheeting to control evaporation.

Timing is critical when it comes to tooling the mortar joints for both performance and final appearance. Mortar too stiff will contribute to an overall darker appearance, mortar too wet will contribute to a lighter color. When stones are set without using the post-setting pointing system, it is much more difficult to control the moisture content in the mortar because the cast stone absorbs the moisture from it so rapidly the masons cannot control the consistency.

Technical Bulletin No. 39 states cleaning during construction to prevent staining is mandatory and becomes the best solution for a clean finished project. This bulletin also recommends that every effort should be taken to protect the cast stone during storage, setting, and after installation. Commercial cleaners can be used for the final wash-down. However, extreme care should be taken when applying commercial cleaners to assure the cast stone is completely saturated with fresh water prior to application of the cleaner and then thoroughly rinsed to assure there is not an acidic residue. Cleaning solutions should be applied by hand with a stiff fiber brush. Power washing should be avoided. Photo 2 is an example of an uncleaned area showing a white residue on many of the cast stone panels.

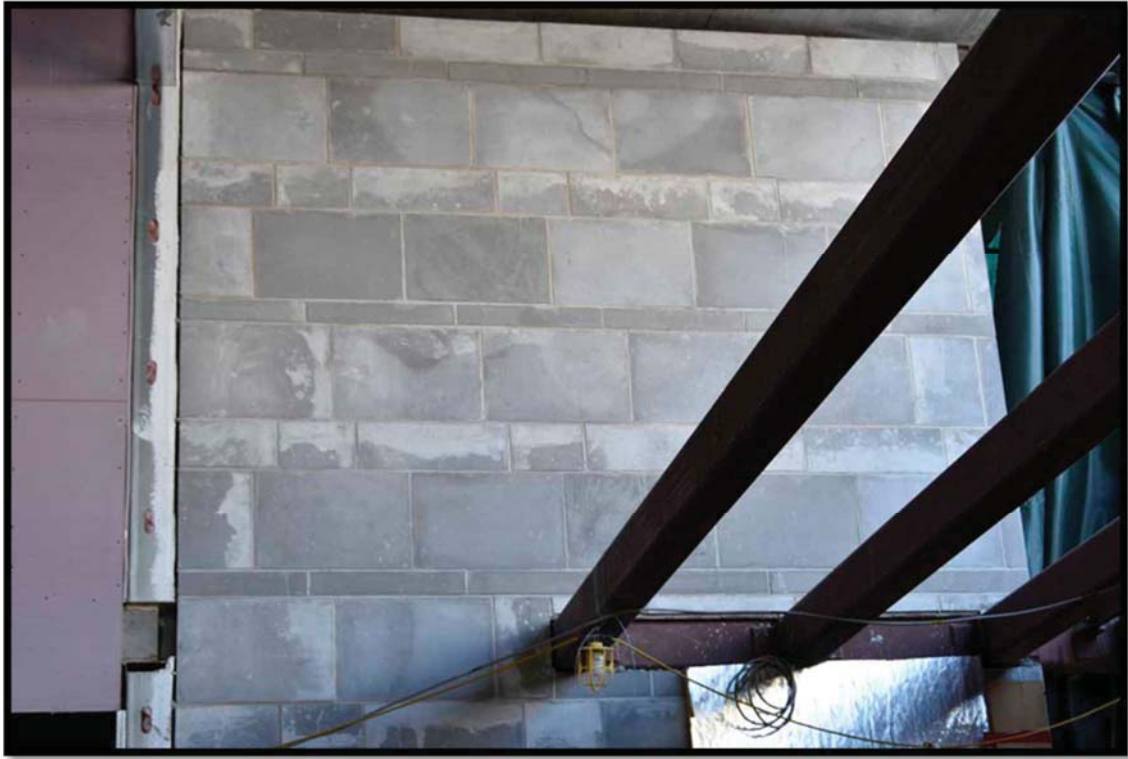


Photo 2

As explained above, there are many reasons for inconsistent mortar color. Because of the patterns of color inconsistency on this project, it is unlikely the mortar itself is the primary contributing factor. Rather, it appears that other outlying factors, such as weather, installation, and cleaning practices may have combined to provide an inconsistent finished product in this case.