

## FREEZE/THAW DURABILITY

Architectural Cast Stone has been successfully used for decades in all climatic conditions. Cast stone has historically performed well when exposed to freezing and thawing environments, but like all building materials, cast stone can fail, too. Freeze/thaw damage occurs when the pore structure of the cast stone becomes fully saturated and cycles between freezing and thawing. Because water expands about 9% when it freezes, the concrete cannot withstand these expansive forces and the cast stone can fail over time. The problem is exacerbated when the cast stone is exposed to deicing salts.

In order to reasonably assure that the cast stone performs in-situ, the manufacturer must first produce a quality product. Second, the designer must use the cast stone in the manner that does not subject it to saturated conditions. Finally the contractor must install the cast stone according to plans.

There are three processes used to produce cast stone: vibrant dry tamp (dry cast), wet cast and machine made. Regardless of the process, all must comply with the requirements of ASTM C1364 Standard Specification of Architectural Cast Stone which references ASTM C 666, Procedure A - Test Method for Resistance of Concrete to Rapid Freezing and Thawing as the testing procedure as modified by ASTM C1364.

From a manufacturing standpoint, well performing cast stone starts with quality aggregates, cementitious materials and admixtures (see Technical Bulletin #50 for guidance on air entraining admixtures). Next these materials have to be properly proportioned, batched, placed or formed and cured. Finally, every 24 months or when changes to mixes or processes are made, the manufacturer must demonstrate through laboratory testing that their cast stone complies with specification.

The highest quality cast stone can still fail if it is not properly designed and installed. It is important that the designer locate flashing and weeps so as to allow for adequate drainage of water that may have breached the exterior. Additionally, care should be taken when using cast stone adjacent to areas where snow may accumulate and where deicing salts may be used. For mechanically set cast stone, the top kerf in the cast stone should be filled with sealant in order to mitigate breakage due to water infiltration and freeze/thaw. Finally, flashing and weeps that are not properly installed can restrict moisture drainage that can be detrimental to the cast stone.

In summary, cast stone enjoys a history of success. The options available and its versatility make cast stone a great alternative to natural stone. Using quality products that are properly designed and installed assures the end user of long term performance and satisfaction.

This Technical Bulletin addresses generally accepted practices, methods and general details for the use of Architectural Cast Stone. This document is designed **only as a guide** and is **not** intended for any specific application or project. It is the responsibility of design and construction professionals to determine the applicability and appropriate application of any detail to a specific project based on professional judgment, specific project conditions, manufacturer's recommendations and solid understanding of product characteristics. The Cast Stone Institute makes no express or implied warranty or guarantee of the techniques or construction methods identified herein. Technical references shall be made to the edition of the International Building Codes for the location of the structure, the latest edition of the TMS 402/406 Masonry Standards document and TMS 404, 504, 604 Standards for Design, Fabrication and Installation of Architectural Cast Stone.

The Cast Stone Institute (CSI) is a not-for-profit organization created to advance the design, manufacture and use of Architectural Cast Stone. To further this goal, the CSI continually disseminates information to targeted construction industry audiences through presentations, programs and technical publications.