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The Difference Between Cast Stone and Adhered Manufactured Stone Masonry Veneer

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On many construction documents today, there is confusion in both terminology and physical properties when a material is called out as cast stone or adhered stone veneer. This article attempts to clarify the differences in the two products.

DEFINITIONS

Cast Stone is defined as “a refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.” Cast Stone is a masonry product, used as an architectural feature, trim, ornament or facing for buildings or other structures. It is created to simulate all types of natural cut stone and is referenced in the International Building Code under Chapter 14, Anchored Masonry Veneer.

The earliest known use dates to about the year 1138 and can still be seen at Carcassonne, France, a city that contains some of the finest remains of early architecture in Europe. Cast stone was first used extensively in London beginning around 1900 and has gained widespread acceptance in America since the 1920s. According to Gary Fry, President of Board of Directors of the Cast Stone Institute, “Many lessons have been learned throughout this history and they can be used to improve the mason contractor’s experience with cast stone at the current state of the art.” The requirements for Cast Stone are referenced in the current ASTM International C1364 Standard for Architectural Cast Stone which was originally approved in 1997 and most recently updated in 2007, although various trade groups had published specifications as early as 1927.

Cast stone is generally **built into a load bearing masonry wall system**, and used as an architectural feature, trim, ornament or veneer in traditional commercial and residential buildings and other structures. It is most often specified as a replacement for full bed-depth natural dressed dimensional limestone.

Adhered Manufactured Stone Masonry Veneer (AMSMV) – is a lightweight man made concrete masonry product which is usually cast into random sizes, in a variety of colors with a natural undressed quarried or cleft stone finish. It is sometimes referred to as Simulated Stone or adhered veneer. AMSMV is generally **applied as a residential or lightweight commercial masonry veneer adhered to exterior and interior walls, structures, columns, landscape structures, and other structures suitable to receive lightweight adhered units**. It is known by a variety of different product names with a variety of proprietary specifications. Several

companies manufacture stone-like products that are used primarily as veneers on other substrate materials such as concrete masonry units. These simulated stone products are manufactured to meet Construction Specifications Institute (CSI) Division 047300 classification for simulated stone while cast stone is manufactured to meet Division 047200 requirements. There are currently no ASTM standard specifications for AMSMV.

PHYSICAL PROPERTIES

There are substantial differences between cast stone and adhered veneer in regard to physical properties that should be considered when specifying. Adhered veneer is a lightweight product that is applied to a structural wall with an adhesive. Therefore, it cannot be used to add to the load bearing capacity of the wall. Cast stone, however, can be used to add to the load bearing capacity of a masonry wall and is usually integrated into the brickwork, becoming part of a composite wall system rather than being adhered to it. It provides additional strength because it is anchored within the masonry structure, therefore will stand the test of time. In addition, while adhered stone products are made light in weight so they will work easily on the exterior of other wall material, cast stone weighs approximately the same as natural cut limestone.

Test methods dictate how the materials are tested while the specification stipulates what the requirements of the test results must be, as well as the ingredients each product must contain.

	PSI	Absorption	Unit Density	Max Density
Cast Stone	6,500	6%	135pcf	40 psf
AMSMV	1,800 - 2,000	22% (UBC Standard 15-5)	75pcf	15 psf

For example, cast stone is required to have a minimum compressive strength of 6,500 psi, maximum moisture absorption of 6 percent, and unit density of approximately 135 pcf. The minimum compressive strength of adhered veneer is approximately 1,800 to 2,000 psi, absorption may reach 22% (UBC Standard 15-5), unit density is approximately 75 pcf, and much emphasis is put onto a shear bond test which is presently under development. Each product must pass a rigorous freeze-thaw test. Because AMSMV is an adhered unit, most building codes such as UBC/IBC require the maximum density to be 15 lbs per square foot, and allow the minimum thickness to be approximately ¼". Cast stone when used in conventional 3-5/8" thickness weighs approximately 40 psf.

APPEARANCE

The use of a high percentage of durable fine aggregate in any manmade stone creates a very smooth, consistent texture for the building elements being cast, resembling natural limestone, brownstone, sandstone, marble or granite. Applications that use cast stone can range from the simplest window sill to the most complicated classical architecture. Therefore, the number of profiles and sizes required for any given project can vary from a single shape shown on a sketch to hundreds (or more) shapes, perhaps not so clearly shown in a set of architectural contract documents.

AMSMV usually has a natural quarried stone appearance and can be used for many of the same applications, although it is primarily used as adhered veneer. Both products have many of the same properties inherent in a material which is primarily intended to simulate natural building stone, although cast stone is typically custom made to approved shop drawings and AMSMV is most often laid out and cut to suit field conditions.

INSTALLATION

Cast Stone is generally used as the veneer or trim component of a conventional masonry cavity wall system, similar to brick veneer. Therefore, concrete masonry units (CMU), steel frame, concrete or metal studs are typically built out from a backup wall with a 1" to 4" air space, which may include insulation. Sizes of cast stone are typically made to accommodate pallet lengths of 4' to 5' and are commercially available in sizes up to 24 sf in area. Larger sizes are still possible, subject to local availability, but may not be recommended for use in mortar set systems.

A typical masonry cavity wall has five essential elements.

- Exterior wythe of masonry
- A clear cavity, or air space, of at least 1 inch
- An interior wythe of masonry or other backing material
- Flashing at all interruptions in the drainage cavity
- Weep holes at all flashing locations. Recommended spacing of 24 in. o.c.

The exterior wythe provides first resistance against moisture penetration. Cast Stone should be laid with full joints in mortar meeting the requirements of ASTM C 270, Type N mortar. Care should be taken when laying the stone to ensure the cavity behind this wythe stays clear. A tapered bed joint can help minimize mortar droppings and protrusions into the drainage cavity. Stainless steel building stone anchors are used to tie the cast stone to the backup wall. They are designed to be stiff enough to resist tension and compression, and flexible enough to permit in-plane differential movements. Non-corrosive type anchors should be used for all anchoring. Stainless steel Type 302 or 304 are the standard type used in this class of work.

Typical stone anchor sizes are 1/8" x 1" straps, 1/4" rods and 1/2" dowels. Dowel holes for 1/2" or 3/4" dowels are usually 1" diameter filled completely with mortar during setting. Anchor slots are typically 3/4" wide and similarly are filled with mortar.

The anchors for attaching cast stone may be required to penetrate flashing and building paper to allow a secure connection to the structure. Where this occurs, proper steps must be taken to ensure a watertight connection at the interface so that the anchor does not compromise the integrity of the flashing.

Alternative Cast Stone Thin Veneer Installation Methods

Over the past twenty years alternative thin veneer methods have been successfully installed and accepted within the masonry industry and most recently have been designed for thin veneer cast stone. These new methods of installation using corrosive protective steel as a support panel to anchor the steel panels in place have incorporated specially designed tabs to assist in holding the weight of each masonry unit without the use of hung lintels or relieving angles, some even offer a mortar locking feature to mechanically lock the mortar & thin veneer onto the steel support panel. These systems are designed to match the different types of expansion and contraction between the veneer, panel, and substrate. They offer greater fastener pull through resistance than cement board, polystyrene, plywood, OSB and asphalt board. Some of these systems even offer a true moisture control system, which allows the water to drain. Depending on the type of system used, structural steel support panel systems will successfully hold thin masonry cast stone veneer up to 150 MPH wind-loads at 400' high, per exposure D (ASTM-E-72).

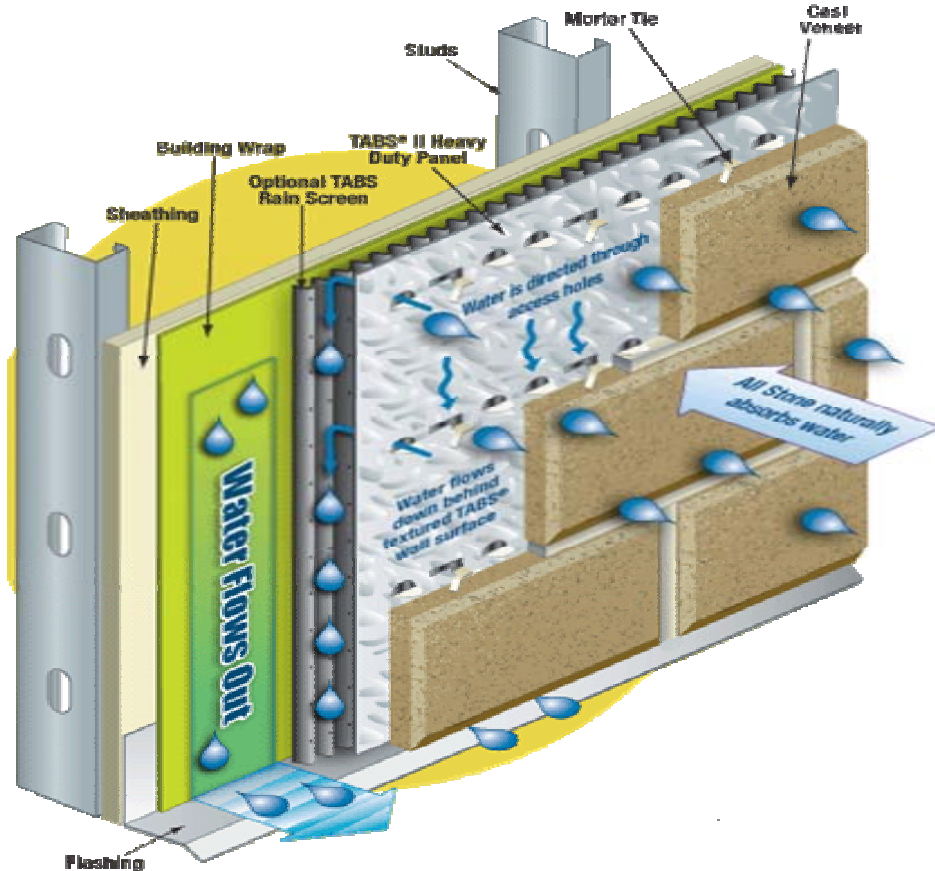


Figure 5 (Courtesy TABS Wall Systems)

Regardless of the material selected and the degree of care exercised during construction, a final wash down will be needed after installation and, normally, whatever is specified to clean the masonry will adequately clean the stone. A variety of commercial cleaners are available and most contain detergents combined with mild solutions of phosphoric and/or muriatic acids. Extreme care should be taken when applying acidic cleaners to areas where joints are left open or where sealant is used as jointing material. As with any cleaning solution, always consult with the stone manufacturer and try a test area first, before proceeding with the wash down. The window and sealant manufacturer should also be contacted to ascertain compatibility with cleaning materials.

AMSMV is an aesthetic wall covering, but it is the structural backup behind the adhered veneer that does all the work in resisting loads. The backup wall may be wood framing, sheet metal, steel framing, concrete block, or poured in place concrete. With adhered applications, the stone veneer will move with the backup wall as the structure responds to loads, temperature variations, and soil settlement. AMSMV veneer is relatively stiff, and is well-matched to a concrete block or poured in place concrete backup system. Wood and steel framing, on the other hand, are relatively flexible. Choosing a stiff backup structure ($L/600$ to $L/1,000$) is required to prevent future cracking of the adhered veneer. Wood framing is particularly susceptible to movement as the wood swells during damp periods, and shrinks when it dries.

AMSMV may be set using one of the following International Building Code methods, in lieu of another approved method, after properly installing a metal lathe to the substrate:

1. Back-butter and squeeze - Brush a paste of neat Portland cement on the backing and on the back of the veneer unit. Then apply Type S mortar to the backing and to the veneer unit. Sufficient mortar shall be used to create a slight excess to be forced out the edges of the units. The stones shall be tapped into place so as to completely fill the space between the stones and the backing. The resulting thickness of mortar in back of the units shall not be less than 1/2" or more than 1-1/4". Grout and finish joints as necessary.
2. Mortar setting bed - The setting bed of mortar shall be a minimum of 3/8" thick and a maximum of 3/4" thick. A paste of neat Portland cement or one half Portland cement and one half graded sand shall be applied to the back of the exterior veneer units and to the setting bed, and the veneer shall be pressed and tapped into place to provide complete coverage between the mortar bed and veneer stone. Grout and finish joints as necessary.
3. Use a combination of the two methods listed above.

Adhesion developed between adhered veneer units and backing shall have shear strength of at least 50 psi based on gross unit surface area. For veneer units weighing less than 3 pounds per square foot, there is no limit on its dimensions or area. Veneer units may not weigh more than 15 pounds per square foot. For veneer units between 3 and 15 pounds per square foot, the following dimension and area restrictions apply. No side of the veneer units can exceed 36 inches in length and the overall face area of the stone may not be greater than 5 square feet.

SPECIFICATION OF PRODUCTS

In November 2006, ASTM International Committee C15 on Manufactured Masonry Units created a new subcommittee, C15.11 on Adhered Manufactured Stone Masonry Veneer. The purpose of C15.11 is to develop and maintain product specifications and installation guidelines for adhered manufactured stone masonry veneer. The new standard was still under development at the time this article was written.

ASTM International (founded in 1898 as the American Chapter of the International Association for Testing and Materials and most recently known as the American Society for Testing and Materials) exceeds 30,000 technical experts from more than 100 countries who comprise a worldwide standards forum. The ASTM method of developing standards has been based on consensus of both users and producers of all kinds of materials. The ASTM process ensures that interested individuals and organizations representing industry, academia, consumers, and governments alike, all have an equal vote in determining a standard's content.

According to Brenda Harris, chair of the new subcommittee, adhered manufactured stone masonry veneer has recently been defined by Committee C15's executive subcommittee as "a light- weight architectural non-load bearing product. It is a wet cast blend of cementitious materials, lightweight and other aggregates, iron oxide pigments and admixtures."

Harris says that the subcommittee was formed because there are not currently any well-known standards for adhered manufactured stone masonry veneer. "The lack of a uniform and nationally recognized product standard and the lack of specific and appropriate installation procedures for this product have allowed untested and substandard products to find their way into both residential and commercial construction," says Harris. "The development of these standards

would create the critical definitions and procedures needed by project owners, as well as design and installation professionals.”

Considering the many advantages which man made stone has over natural building stone, it is surprising that wider use has not been made of this versatile and economical building material. Many architects are only now discovering Cast Stone. Although it has existed for more than centuries, the merits of it as a versatile ornamental building material are still far from universally recognized.

For thousands of years, architects and builders have chosen stone as an architectural medium - for its beauty -- for its permanence. So, what will man do when the last natural stone is quarried?

He will make his own.

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