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Cast Stone: Characteristics, Uses And Problems

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This standard includes general information on the characteristics and common uses of cast stone and identifies typical problems associated with this material along with common causes of its deterioration.

Introduction

Characteristics of Cast Stone:

- Made from Portland cement, sand, crushed stone, fine and coarse aggregates and water in varying proportions and formulas.
- Manufactured in custom molds - either by dry-tamping or wet casting.
- Dry-tamping is cast in two layers - an inner core and a facing; due to cost, only the facing material usually contains the coloring aggregates and pigments; numerous casts from the same mold can be made in the same day.
- Wet-casting is one integral mix containing enough water for it to flow easily into the mold; this method produces a cast with integral coloring; typically only one piece can be cast in a mold in one day due to the high water content.
- Typical aggregates used included granites, marbles and blast- furnace slag.
- Can be manufactured in just about any shape or size.
- The strongest cast stone consisted of varying sizes of aggregates; this allowed large and small pieces to fit closely together, while cement filled in the voids.
- Historically, paint was often applied to the surface for the purposes of waterproofing.
- The aggregate primarily determines the cast stone color.
- Veining was created by placing dye-soaked strings or thin strips of wood into the mold and then removing them before casting; the dye could then soak into the concrete mixture; veining could also be achieved by applying color or dye to the surface using a fine brush

- Typical finishes include
 - Surfaced cast stone,
 - Cut cast stone, and
 - Plain cast stone.
- Surfaced cast stone includes hand-rubbed, brushed and acid- washed finishes.
- Cut cast stone includes machine-rubbed, planar-rubbed, bush- hammered and machine- and hand-tooled finishes.

References: Cast Stone Institute (CSI), American Society for Testing and Materials, www.astm.org, see ASTM C1364, Standard Specifications for Architectural Cast Stone; for general information see: Wikipedia, "Cast Stone".

Typical Uses

Typical historical and current uses for cast stone include:

- Commonly used in the late 19th and early 20th centuries.
- Used in the form of a veneer, a block or as ornament.
- Used to simulate evenly veined and colored stones.
- Used to simulate natural stone by the late 1920s.
- Commonly used in the construction of houses, banks, churches, schools, libraries, and commercial buildings.
- Used for specific features such as window sill, steps, beltcourses, chimney caps, spandrel panels, sculpture and other ornament.
- Cast stone is installed like natural stone, laid in place with mortar, or fastened with metal anchors.
- Due to the high cost of manufacturing cast stone compared with lighter weight precast concrete, cast stone companies were almost non-existent by the early 1950s; many were absorbed into existing precast companies.
- The compressive strength of new cast stone is 6,500 pounds per square inch with an absorption rate not more than 6 percent; in the late 1920s, the standard compressive strength of cast stone was 5,000 pounds per square inch with an allowable absorption rate of 7 percent.

Natural or Inherent Problems:

- Facing Delamination: Common with dry-tamp cast stone; can result from flaws in manufacturing, or from differences in water absorption ratios combined with freeze/thaw cycles.
- Carbonation: Loss of alkalinity.
- Aggregate/Alkali Reaction.
- Freeze/Thaw: May result in surface scaling.
- Erosion: Visible as weathering of the aggregate and cement binder; surfaces look sandy, rough, with exposed aggregate and pockmarks; horizontal surfaces are especially vulnerable.
- Some types of cast stone (those containing calcareous sediments such as limestone) are sensitive to acidic environments.
- Cracking and Spalling: Typically caused by corrosion of metal reinforcement materials; visible as rust stains.

Vandalism or Human-Induced Problems:

- Cracking: Hairline cracks common especially with dry-tamp cast stone; a problem often caused by volume differences between the facing and backup material, or improper proportioning of the facing mix; visible by fine hairline cracks.
- When aggregates of uniform size are used, the cast stone tends to be more porous and less durable.

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