USE OF REINFORCEMENT [1 of 2]

One of the advantages of Cast Stone over natural stone is its ability to contain integral reinforcement for added strength. This gives the material a distinct advantage by combining the high compressive strength of the stone materials with the tensile strength of billet steel reinforcing bars, to provide safety and control of cracking. Cast Stone is an architectural element, and should not be used to support the building structure or load bearing elements (such as hand rails or windows) which require structural support. A structural engineer should design reinforcement for structural or unusual situations.

The preferred type of steel reinforcement is that which meets the requirements of ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Reinforced Concrete, unless otherwise specified by the purchaser, according to ASTM C 1364 – Standard Specification for Architectural Cast Stone. Other types of reinforcement include wire reinforcement meeting the requirements of ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement, however, welded wire fabric reinforcing shall not be used in Vibrant Dry Tamp (VDT) products. All types of reinforcement should be shown on the shop drawings that are submitted by the manufacturer for approval.

The size of reinforcing bars is classified by a number that corresponds to its diameter in eighths of an inch. The typical sizes used to reinforce Cast Stone are #3 and #4 which are nominally 3/8” or ½” diameter. Deformed bars, with their deformations, are slightly larger than plain bars and do a better job of bonding with the concrete and resisting tension.

Some manufacturers use fiber reinforcement to control plastic shrinkage and thermal cracking. This secondary reinforcement in the form of fibrous nylon meeting the requirements of ASTM C 1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete may be used, but is not a substitute for conventional steel reinforcement.

It is important to understand that Cast Stone units do not always need integral reinforcement included in their design. Many typical applications such as where the material is used as a replacement for natural stone, masonry units or other non-structural applications do not benefit from steel to control cracking. In general, steel should be added to the design only when necessary for safe handling, setting and structural stress.

Typical minimum reinforcement for all other units shall be not less than 0.25% of the cross section area. Units less than 24” in their transverse direction are typically reinforced only in the longitudinal direction. Non-structural units less than 24” in both directions can generally be manufactured as non-reinforced units. Panels, soffits and similar stones measuring greater than 12” high and 24” long, which span openings or carry their own weight should contain reinforcing. Lintels, units supported by suspension connections and other structural applications should have reinforcing requirements reviewed by a professional engineer.

The minimum concrete cover for all reinforced units is twice the diameter of the reinforcing bars and should be non-corrosive when covered with less than 1-1/2” of material. Non-corrosive bars should be touched up with zinc or epoxy paint wherever they have been cut through to plain steel during the reinforcement fabrication process.

The tying together of reinforcing sections prior to unit fabrication is not usually required with the Vibrant Dry Tamp (VDT) units because the reinforcement is embedded into a layer of consolidated fresh concrete material during the manufacturing process. Some structural applications however may require flat bar mats to be used. The use of three-dimensional reinforcing cage assemblies with stirrups is not appropriate for Vibrant Dry Tamp (VDT) units because of the non-fluid nature of this consolidation process.

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USE OF REINFORCEMENT [2 of 2]

Units manufactured from wet cast slumpable concrete must have their reinforcement materials sufficiently rigid to prevent dislocation during the pouring process and to maintain the required cover over the reinforcement. The reinforcement must be accurately and carefully located and secured within the mold. Rebar chairs, which support the reinforcing away from the face of the mold, are not recommended with Cast Stone. Special procedures must be followed to prevent reinforcing from creating shadow lines on the face of the units when this production method is used.

Reinforcing bar sizes in panels should be kept small even where this will decrease the spacing of the bars, to resist cracking and improve temperature stress distribution. Reinforcement should be placed symmetrically to prevent warping of longer units. Typical spacing of transverse reinforcement, when required, is 12” on-center and should not exceed 18” between the bars.

One important misconception about reinforcement in concrete is that it will prevent cracking from occurring and this is simply not true. Reinforcing steel will only serve to control cracking from extending and limiting its width. No amount of conventional reinforcing will reduce the likelihood of cracking when units are designed excessively long and thin. To prevent cracking the Institute suggests that designers should consult with their manufacturers before drawing units that exceed fifteen (15) times their average effective thickness.

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.

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