

CONCRETE MASONRY MANUAL

2008



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FOREWORD

We hope you will find this concrete masonry manual useful in your work.

The full membership of the Carolinas Concrete Masonry Association, its Board of Directors, and the Manual Revision Task Force have undertaken in the development and compilation of this manual a prime objective:

To place at the disposal of the architect, engineer, contractor, and qualified technician, authoritative reference and source material, which will prove beneficial in the design, selection, and construction of structures with concrete masonry.

Detailed information as to shapes, properties, standard details of assembly and construction, augmented by reference tables for design computation are the basic ingredients of the publication.

The Carolinas Concrete Masonry Association, a non-profit trade association, assumes no liability for any consequences which may follow the use of any information contained in this manual, and expressly disclaims any implied or expressed warranties with regard to said information.

This manual was originally published in 1982 and based on previous publications by the N.C. Concrete Masonry Association and the S.C. Concrete Masonry Association in 1959, 1969, 1971, and 1977. It was updated and re-printed in 1987, 1993, 1997 and again in 2000. It was copyrighted in 1987 by the Carolinas Concrete Masonry Association. No portion of this manual may be reproduced in whole or in part without the express written permission of CCMA.

A registration card has been completed in your name. This card will be retained in our files so you may receive future changes or other information we feel may be of interest and help to you. If you have a change of address, please let us know.

Users of this manual are encouraged to contact the office of the Carolinas Concrete Masonry Association for any information relating to concrete masonry. When answers are not readily available to your questions, we will investigate and research an answer, or refer you to the source you need.

TABLE OF CONTENTS

GENERAL INFORMATION

CCMA Producer Members
CCMA Associate Members
CCMA Professional and Affiliate Members
Selected Definitions & Terminology
Area & Volume of Concrete Masonry Units
Dimensions of Concrete Masonry Units
Texture of Concrete Masonry Units
Bibliography, References, Acknowledgments

SECTION I SPECIFICATIONS

Suggested Specifications for Concrete Masonry Walls

SECTION II CODES

Structural Requirements for Masonry Walls Not Designed With ACI 530
Fire Resistance Ratings of Concrete Masonry (1994 Standard Building Code, NC Amendments)
 Chapter 7 - Calculated Fire Resistance
Fire Walls
1999 Standard Building Code Section 709 Calculated Fire Resistance & ACI 216.1-97/TMS 0216.1-97
 Chapter 3 - Concrete Masonry
Underwriters' Laboratories, Inc. Requirements
Structural Requirements for Use of Surface Bonding Cement
ASTM C 887 Standard Specification for Packaged, Dry, Combined Materials for Surface Bonding Mortar
ASTM C 946 Standard Practice for Construction of Dry Stacked, Surface-Bonded Walls

SECTION III STRUCTURAL DATA

Load Tests of Patterned Concrete Masonry Walls
Concrete Masonry Lintels - NCMA TEK 17-1A (Formerly TEK 25A(16A))
Precast Lintels for Concrete Masonry Construction - NCMA TEK 17-2 (Formerly TEK 165)
Control of Wall Movement
Specification Revision Type I & Type II Concrete Masonry Units (CMU)
Control Joints and Spacing Tables
Bond Beams
Joint Reinforcement
Wall Capacity / Masonry Prisms

SECTION IV MISCELLANEOUS TECHNICAL DATA

Sound Control
Sound Absorptive Blocks
Construction Details Foundation Walls
Construction Details Intersecting Shearwalls

SECTION V ENERGY CONSERVATION

R-Values of Multi-Wythe Concrete Masonry Walls, NCMA TEK 6-1A
R-Values of Single Wythe Concrete Masonry Walls, NCMA TEK 6-2A
Shifting Peak Loads with Concrete Masonry Walls, NCMA TEK 6-3
Compliance with ASHRAE/IES Standard 90.1-1989 Requirements, NCMA TEK 6-4
Passive Solar Construction With Concrete Masonry and Selected Details
Passive Solar Bibliography

SECTION VI SIZES AND SHAPES

Concrete Masonry Units Manufactured by CCMA members.

SECTION VII ARCHITECTURAL CONCRETE MASONRY UNITS SPECIFICATIONS AND DETAILS

CCMA Producer Members Manufacturing Special Architectural Concrete Masonry Units
Recommendations
Definition
Informational Guideline
Design Information for Architectural Concrete Masonry Walls
Guideline Specification Architectural Block
Suggested Construction Details

SECTION VIII CONCRETE PAVERS

CCMA Producer Members Manufacturing Interlocking and Concrete Grid Pavers
and Additional Technical References
CPI SPECDATA Paving & Surfacing Interlocking Concrete Pavers
CPI MANUSPEC Interlocking Concrete Pavers
ASTM C 936 Standard Specification for Solid Concrete Interlocking Paving Units
NCMA TEK 11-3 Concrete Grid Pavements
CPI MANUSPEC Concrete Grid Pavers
ASTM C1319 Concrete Grid Paving Units

SECTION IX SEGMENTAL BLOCK RETAINING WALLS

CCMA Producer Members Manufacturing Segmental Retaining Block Units
and Additional Technical References
NCMA TEK 2-4B Specification for Segmental Retaining Wall Units



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Rev.
10/08



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SELECTED DEFINITIONS & TERMINOLOGY



ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures

ACI 530.1/ASCE 6/TMS 602 - Specifications for Masonry Structures

This is a joint effort of the American Concrete Institute, American Society of Civil Engineers and The Masonry Society. The Code covers the design and construction of masonry structures while the Specifications is concerned with the quality, inspection, testing, and placement of materials.

A.S.T.M. - Means American Society for Testing and Materials.

ATRIUM - An open patio or court, with or without a roof or ceiling around which a building is built.

BRICK - A solid masonry unit having a shape approximately a rectangular prism, usually not larger than 12 by 4 by 4 inches. A brick may be made of burned clay or shale, of fire clay or mixtures thereof, of lime and sand, of cement and suitable aggregates, or of other approved materials.

BONDER (header) - A masonry unit which overlaps two or more adjacent wythes of masonry to bind or tie them together.

BUILDING OFFICIAL - The officer or other designated authority charged with the administration and enforcement of the applicable code, or his duly authorized representative.

BUTTRESS - A bonded column of masonry built as an integral part of the wall, projecting from either or both surfaces, and decreasing in area from base to top.

COLLAR JOINT - The vertical longitudinal joint between wythes of masonry.

COLUMN - A vertical compression member whose horizontal dimension measured at right angles to the thickness does not exceed three times its thickness. A bearing wall not bonded at the sides into associated masonry shall be considered a column when its horizontal dimension measured at right angles to the thickness does not exceed three times its thickness.

CONCRETE BRICK - A solid masonry unit having a shape approximately a rectangular prism and composed of inert aggregate particles embedded in a hardened cementitious matrix.

CONCRETE MASONRY - Construction consisting of concrete masonry units set in mortar or grout.

CONCRETE MASONRY UNIT - A masonry unit composed principally of inert aggregate particles embedded in a hardened cementitious matrix.

COURSE - A horizontal layer of concrete masonry units.

CROSS-SECTIONAL AREA - Net cross-sectional area of a masonry unit shall be taken as the gross cross-sectional area minus the area of cores or cells.

ECCENTRICITY - The normal distance between the centroidal axis of a member and the parallel resultant load.

EFFECTIVE AREA OF REINFORCEMENT - The area obtained by multiplying the right cross-sectional area of the metal reinforcement by the cosine of the angle between its direction and the direction for which the effectiveness of the reinforcement is to be determined.

Rev.
1/97

DEFINITIONS—2

EFFECTIVE HEIGHT - The height of a member to be assumed for calculating the slenderness ratio.

EFFECTIVE THICKNESS - The thickness of a member to be assumed for calculating the slenderness ratio.

f ' m - Specified compressive strength of masonry, psi.

FIRE-RESISTANCE RATING - The time in hours that the material or construction will withstand the standard fire exposure as determined by a fire test made in conformity with the “Methods of Fire Tests of Building Construction and Materials, ASTM E119.”

FIRE WALL - A fire resistive wall, having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, Bearing or Non-bearing, and have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

GROUT - Mixture of cementitious material and aggregate which is proportioned to produce pouring or pumping consistency without segregation of the constituents.

GROUTED MASONRY - Concrete masonry construction composed of hollow units where hollow cells are filled with grout, or multi-wythe construction in which space between wythes is solidly filled with grout.

HEADER - A masonry unit laid across a wall with the end surface exposed. Headers are usually used as bonders.

HOLLOW CONCRETE MASONRY UNITS - A masonry unit whose net cross-sectional area in any plane parallel to the bearing surface is less than 75 percent of its gross cross-sectional area measured in the same plane.

LATERAL SUPPORT - Members such as cross walls, columns, pilasters, buttresses, floors, roofs, or spandrel beams which have sufficient strength and stability to resist the horizontal forces transmitted to them may be considered as lateral support.

LINTEL - A beam located over an opening in a wall to carry superimposed load.

LOAD, DEAD - The weight of all permanent construction including walls, floors, roofs, partitions, stairways and of fixed service equipment.

LOAD, LIVE - The weight superimposed by the use and occupancy of the building not including the wind load, earthquake load, or dead load.

MASONRY - A built-up construction or combination of masonry units set in mortar or grout.

MORTAR - A plastic mixture of cementitious material, fine aggregate, and water.

PARTIALLY-REINFORCED MASONRY WALLS - Walls designed as plain masonry except that reinforcement is provided in some portions to resist flexural tensile stresses.

PARTITION - An interior non-loadbearing wall one story or less in height, supporting no vertical load other than its own weight.

Rev.
1/97

DEFINITIONS—3

PILASTER - That portion of a wall which may serve as either a vertical beam or a column or both. In reinforced masonry the pilaster may or may not project beyond either face of the wall.

PRISM - Is a representative wall sample constructed in stack bond, one unit long and thick with a full mortar bed, and having a height to thickness ratio from 1.33 to 5.0, according to ACI 530.

REINFORCED CONCRETE MASONRY - Masonry construction made with hollow concrete masonry units in which certain cells are continuously filled with grout and in which reinforcement is embedded, or multi-wythe construction in which space between wythes is solidly filled with grout and in which reinforcement is embedded.

REINFORCED MASONRY - Unit masonry in which reinforcement is embedded as required in these regulations and in such a manner that the two materials act together in resisting forces.

REINFORCEMENT - Structural steel shapes, steel bars, rods, wire fabric, or expanded metal embedded or encased in masonry in such a manner that it works with the masonry in resisting forces.

SEGMENTAL RETAINING WALL UNITS - Concrete block units factory manufactured to quality standards and installed as a mortarless wall system.

SHEAR WALL - A wall which resists horizontal forces applied in the plane of the wall.

SINGLE-WYTHER WALL - A wall containing only one masonry unit in wall thickness.

SLENDerness RATIO - Ratio of the effective height of a member to its effective thickness.

SOLID MASONRY UNIT - A masonry unit whose net cross-sectional area in every plane parallel to the bearing surface is 75 percent or more of its gross cross-sectional area measured in the same plane.

WALL (bearing) - A wall supporting any vertical load in addition to its own weight.

WALL (non-bearing) - A wall which supports no vertical load other than its own weight.

WALL, CAVITY - A wall built of masonry units or of plain concrete or a combination of these materials, so arranged as to provide an air space within the wall, and in which the inner and outer parts of the wall are tied together with metal ties.

WALL, CURTAIN - A non-bearing wall between columns or piers and which is not supported by girders or beams, but is supported on the ground.

WALL, FACED - A wall in which the masonry facing and backing are so bonded as to exert common action under load.

WALL, EXTERIOR - A wall, bearing or non-bearing, which is used as an enclosing wall for a building, but which is not necessarily suitable for use as a Party Wall or Fire Wall.

WALL, FOUNDATION - A wall below the first floor extending below the adjacent ground level and serving as support for a wall, pier, column, or other structural part of a building.

DEFINITIONS—4

WALL OF MASONRY, HOLLOW - A wall built of masonry units so arranged as to provide an air space within the wall, and in which the inner and outer parts of the walls are bonded together with masonry units or steel.

WALL OF MASONRY, SOLID - A wall built of solid masonry units laid contiguously, with joints between units filled with mortar or grout.

WALL, PANEL - A non-bearing wall in skeleton or framed construction, built between columns or piers and wholly supported at each story.

WALL, PARAPET - That part of any wall entirely above the roof line.

WALL, PARTY - A wall on an interior lot line used or adapted for joint service between two (2) buildings.

WALL (retaining) - A wall designed to prevent the lateral displacement of soil or other material.

WALL, VENEERED - A wall having a facing of masonry units or other weather-resisting non-combustible materials securely attached to the backing, but not so bonded as to intentionally exert common action under load.

WYTHER (leaf) - Each continuous vertical section of a wall one masonry unit in thickness.

DEFINITIONS—5

COMPRESSIVE STRENGTH OF CONCRETE MASONRY UNITS

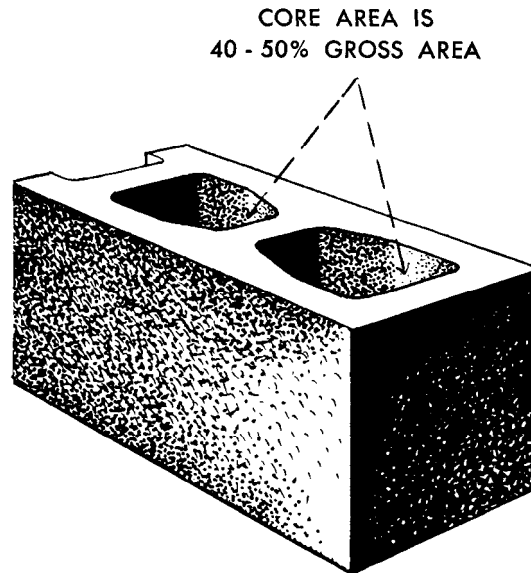
Compressive strength is the maximum load required to fracture an individual masonry unit by applying a compressive force to the upper and lower surface of the unit. The compressive strength can be expressed as either "gross compressive strength" or "net compressive strength". The compressive strength of concrete masonry units expressed in terms of "net cross sectional area" is a larger figure than for the same load expressed in terms of "gross cross sectional area".

ASTM Specifications ACI 530 express their requirements in terms of the "**average net area, psi**". Independent testing laboratories also express their results in terms of the "**average net area, psi**".

Confusion can be avoided if designers express their requirements for concrete masonry compressive strength in terms and figures for the "**average net area, psi**" of the units.

Definition

A hollow concrete masonry unit is a unit having a core area greater than 25 percent of its gross cross-sectional area. Generally, the core area of hollow units will be from 40 to 50 percent of the gross area. In this manual, the use of the terms “concrete block”, “concrete masonry unit”, and “hollow concrete masonry unit” are interchangeable and refer to load bearing units only.



*APPROXIMATE VOLUME IN STANDARD CONCRETE MASONRY UNITS

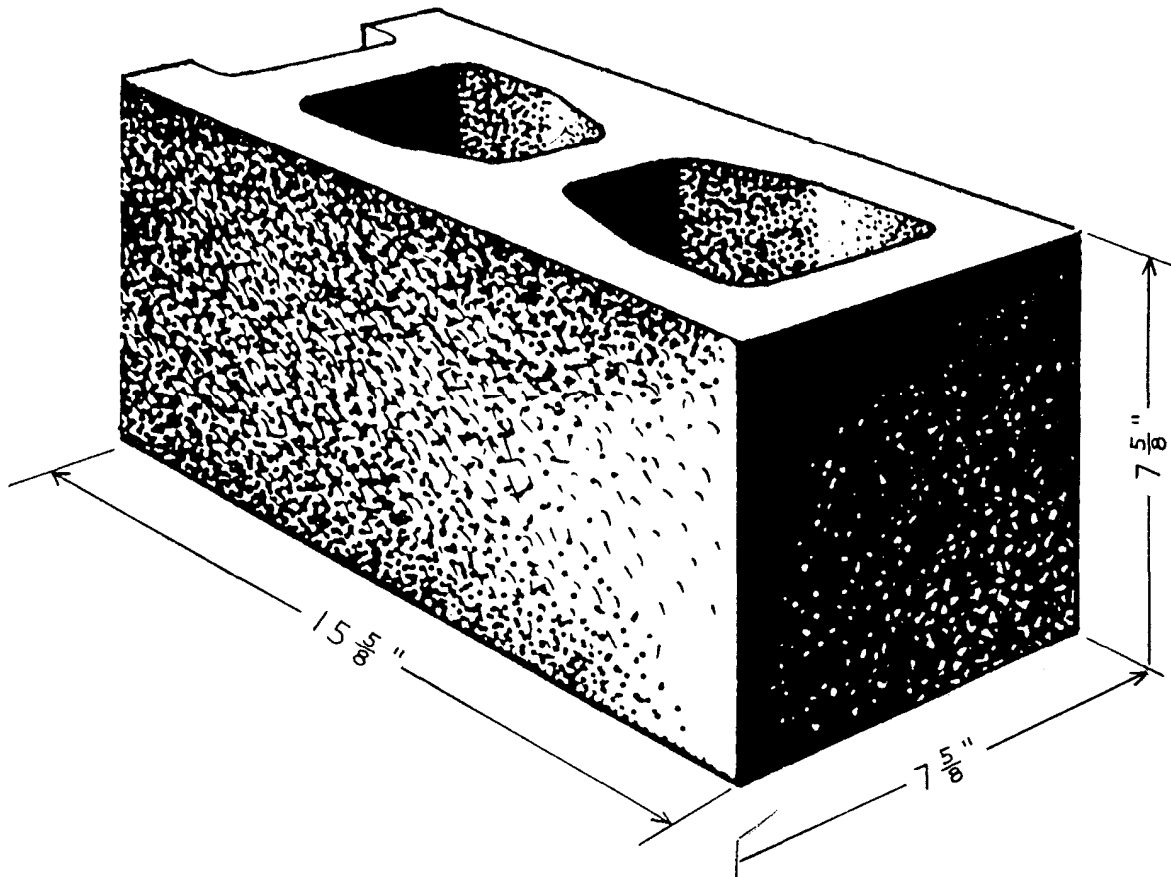
SIZE	CORES	CU. FT. TO FILL CORES	% SOLID VOLUME	EQUIVALENT THICKNESS INCHES
4 x 8 x 16	3	.06	73.6	2.66
4 x 8 x 16	2	.06	73.6	2.66
6 x 8 x 16	3	.15	57	3.21
6 x 8 x 16	2	.16	54	3.06
8 x 8 x 16	3	.22	53.83	4.10
8 x 8 x 16	2	.25	51.16	3.95
10 x 8 x 16	2	.34	49.27	4.70
12 x 8 x 16	3	.34	49.4	6.19
12 x 8 x 16	2	.40	44.54	5.62

*These Units may vary with each manufacturer depending on the style of the block, mold configuration, and wear, etc.

Dimensions of concrete masonry units

Common practice in specifying concrete block is to give the **wall width** first, the **course height**

This is known as a 8" x 8" x 16" block

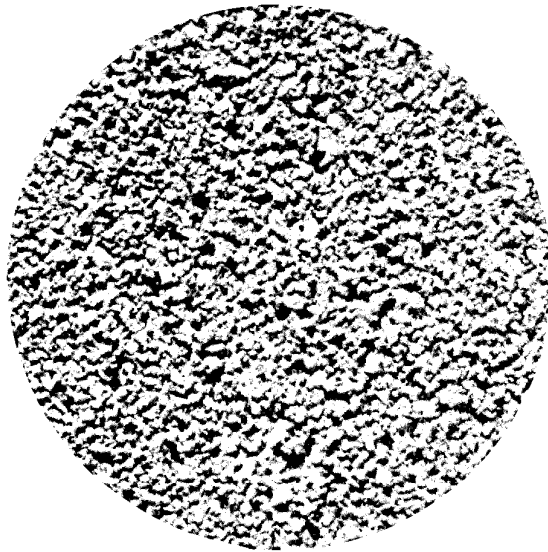


second, and the **block length** third, followed by the name of the unit. Dimensions given are nominal and modular with exact unit dimensions being $\frac{3}{8}$ " less. For example, a 8" x 8" x 16" Block is $7 \frac{5}{8}$ " wide, $7 \frac{5}{8}$ " high, and $15 \frac{5}{8}$ " long. All member companies of the CCMA produce modular dimensioned block.*

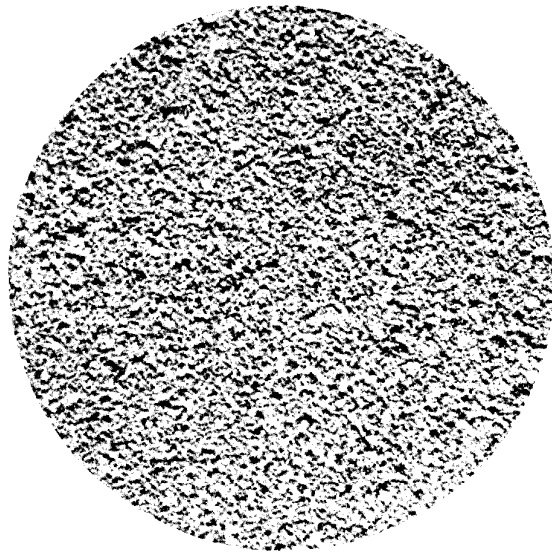
Modular dimension lines are from the center of a joint to the center of a joint. For this reason, the thickness of one mortar joint should be subtracted from the modular dimension to give the exact length. For opening dimensions the thickness of one mortar joint should be added to the modular dimensions to get exact opening dimensions. For simplicity it is usually advisable to use modular dimensioning for the floor plan and block layout plan as all fractions are eliminated. Exact dimensions can be used but they will be in fractions of an inch.

*See ASTM Specifications for permissible variations in dimensions.

Texture



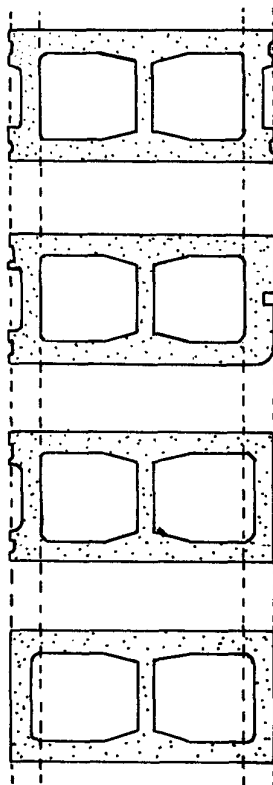
MEDIUM



FINE

Uniformity of Texture is the result of controlled aggregate production and block manufacturing methods. The standard texture supplied by the block manufacturer is designed to suit the needs of his customers in his area.

STANDARD BLOCK NOMENCLATURE



Machine Mfg.

Open both ends with mortar grooves

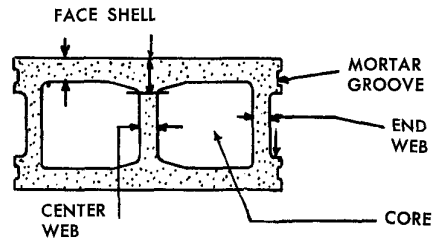
Open end with mortar grooves
 Steel sash other end with Bullnose corner

Open end with mortar grooves — Permanent Plain other end

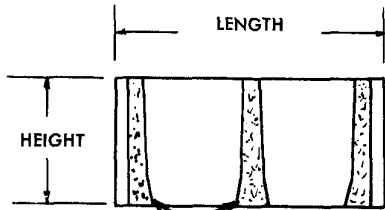
Permanent — plain Both ends

Specifier

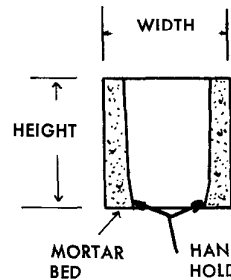
Stretcher (Regular)



Single corner with sash groove and round corner



Single Corner



Double Corner

Bibliography, Reference, Acknowledgments

1. A A Wire Products Company
2. American Concrete Institute (ACI - 530)(Copyrighted) by permission only
3. American Society for Testing Material (ASTM)
4. Besser Company
5. Bureau of Standards
6. Concrete Masonry Assoc. of Los Angeles, California
7. Interlocking Concrete Pavement Institute (ICPI)
8. Construction Specifications Institute (CSI)
9. Corps of Engineers (Control Joints)
10. Dur-O-wal Products
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12. National Concrete Masonry Assoc. (Copyrighted) by permission only
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14. Portland Cement Assoc. (Concrete Masonry Handbook)(Load Tests)
15. Martinsville Concrete Products (Lintels)
16. Southern Solar Energy Center, Atlanta, Passive Solar Construction Handbook
17. Standard Building Code & North Carolina Amendments
18. Zonolite, Division of W.R. Grace and Co.

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