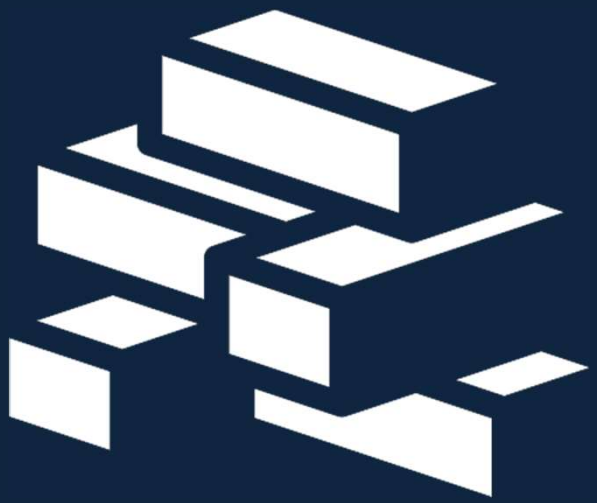


MASONRY Association of Florida

TMS 402/602 REVIEW

COMPONENT 3

Don Beers, PE , GC

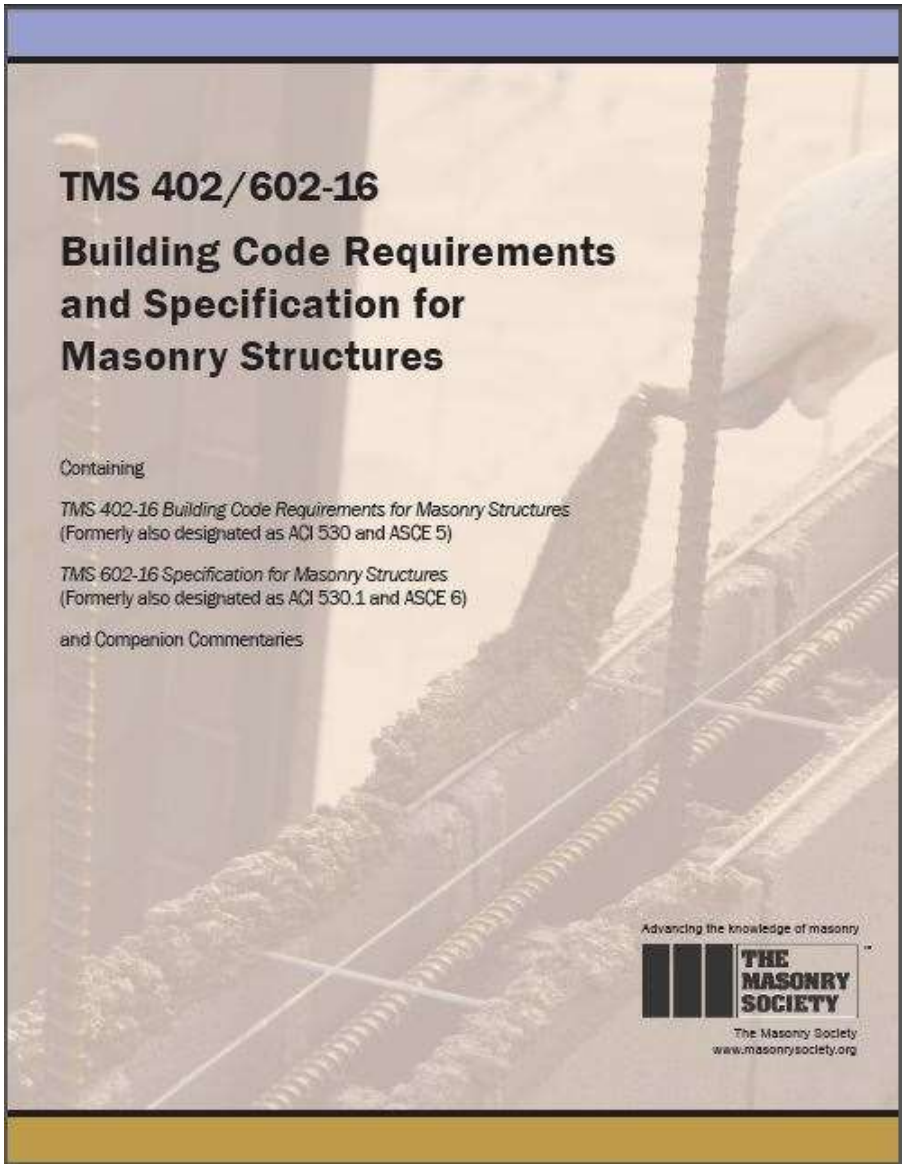
Don Beers, PE, GC is currently the staff engineer for the Masonry Association of Florida (since 2009) and President of Adrian Engineering, Inc. Previous to 2009 Don acted as Engineering Services Manager with Rinker Materials for 29 years. He is a graduate of the University of South Florida in Civil and Structural Engineering and is a licensed engineer and general contractor in Florida. Has served as Chairman of the National Concrete Masonry Association's Codes Committee, the Florida Concrete & Products Association's Block Committee and a board member for The Masonry Society (TMS).

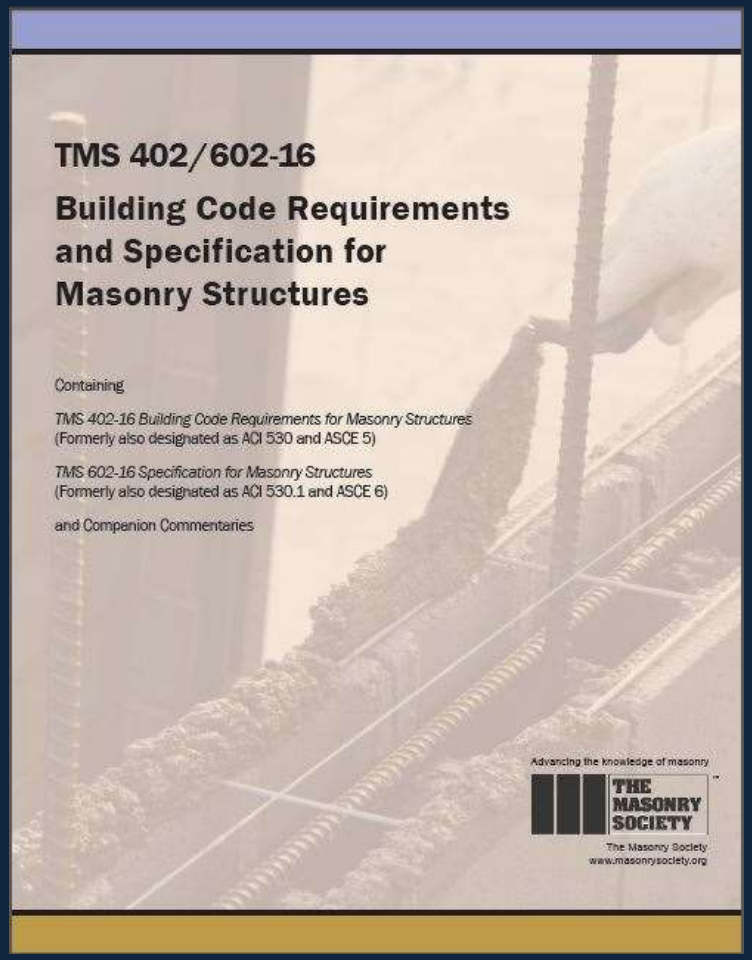
561-310-9902
don@floridamasonry.com

TMS 402-16

Building Code Requirements for Masonry Structures

TMS 402-16 (Formerly also designated as ACI 530 and ASCE 6)





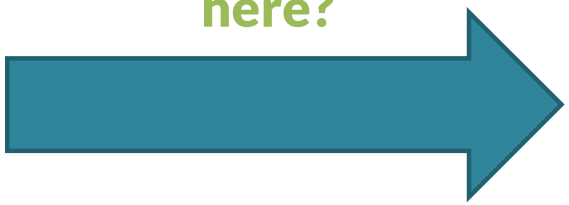
TMS 402

Part 1 – General
Chapter 1 - General Requirements - Pg. C-1

THE MSJC CODE

PG. C-2 SECT 1.2.1(H)

Who do you think is responsible here?



(f) Details of reinforcement, including the size, grade, type, lap splice length, and location of reinforcement.

(g) Reinforcing bars to be welded and welding requirements.

(h) Provision for dimensional changes resulting from elastic deformation, creep, shrinkage, temperature, and moisture.

(i) Size and permitted location of conduits, pipes, and sleeves.

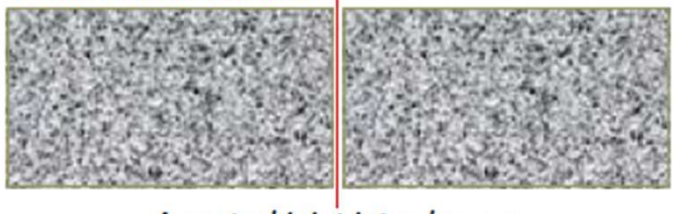
...THE ENGINEER

CONTROL JOINTS

Definitions:

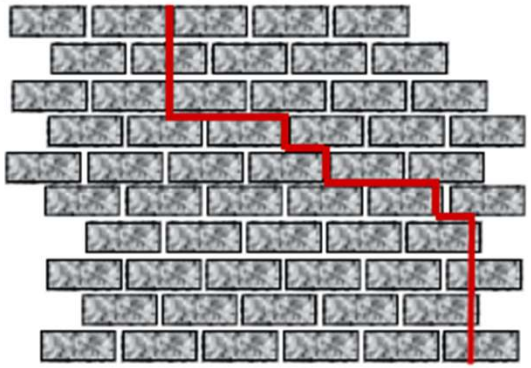
Control Joint:
A continuous un-bonded masonry joint to regulate the location and amount of separation resulting from the dimensional change of different parts of a structure as to avoid the development of excessively high stresses.

With Control Joint:



A control joint introduces a "CONTROLLED" Crack.

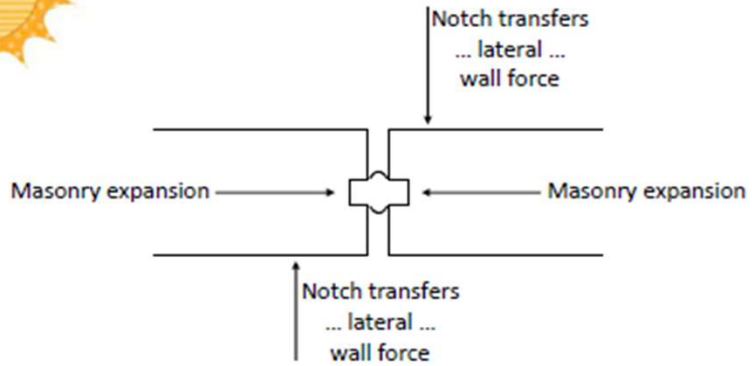
Without Control Joint:



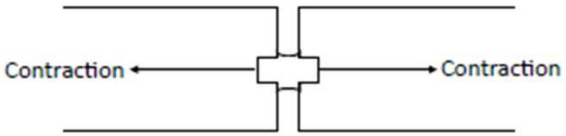
No control joint results in "UN-CONTROLLED" cracking.

Expansion Joint:
A separation between adjoining parts of a masonry structure which is provided to allow small relative movements such as those caused by thermal changes, to occur without one part affecting an adjacent part.

Heat of Day Expands Masonry

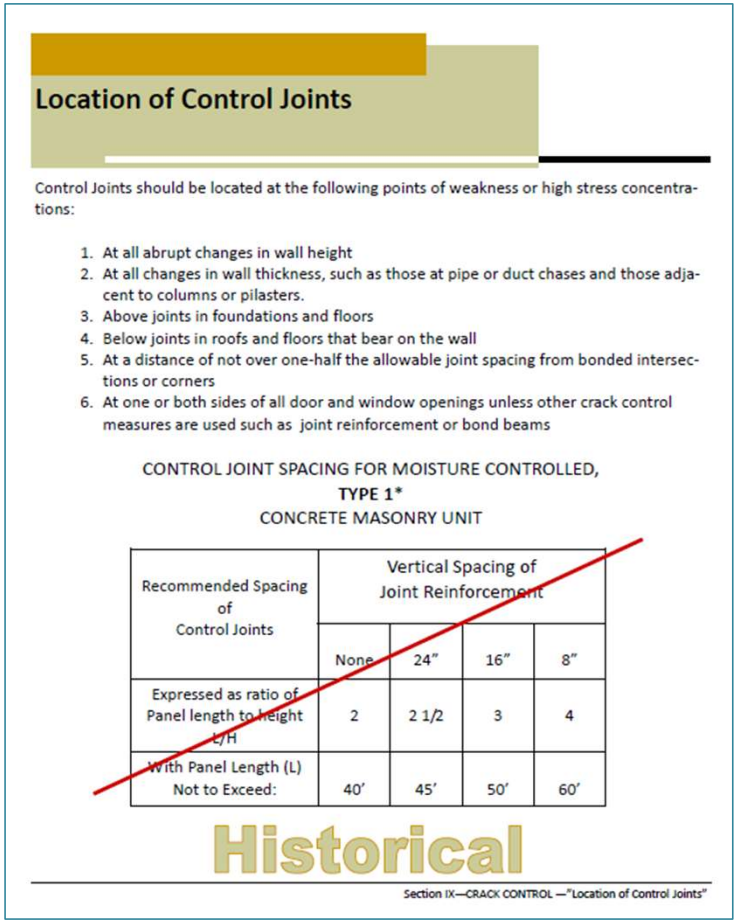


Cool of Night Makes Masonry Contract



LOCATION OF CONTROL JOINTS

1) Abrupt changes in wall height
2) Changes in wall thickness
3) Above joints in foundations and floors
4) Below joints in roofs and floors
5) **<u>½ the allowable joint spacing from wall corners</u>**
6) One or both sides of doors and windows.



Location of Control Joints

Control Joints should be located at the following points of weakness or high stress concentrations:

1. At all abrupt changes in wall height
2. At all changes in wall thickness, such as those at pipe or duct chases and those adjacent to columns or pilasters.
3. Above joints in foundations and floors
4. Below joints in roofs and floors that bear on the wall
5. At a distance of not over one-half the allowable joint spacing from bonded intersections or corners
6. At one or both sides of all door and window openings unless other crack control measures are used such as joint reinforcement or bond beams

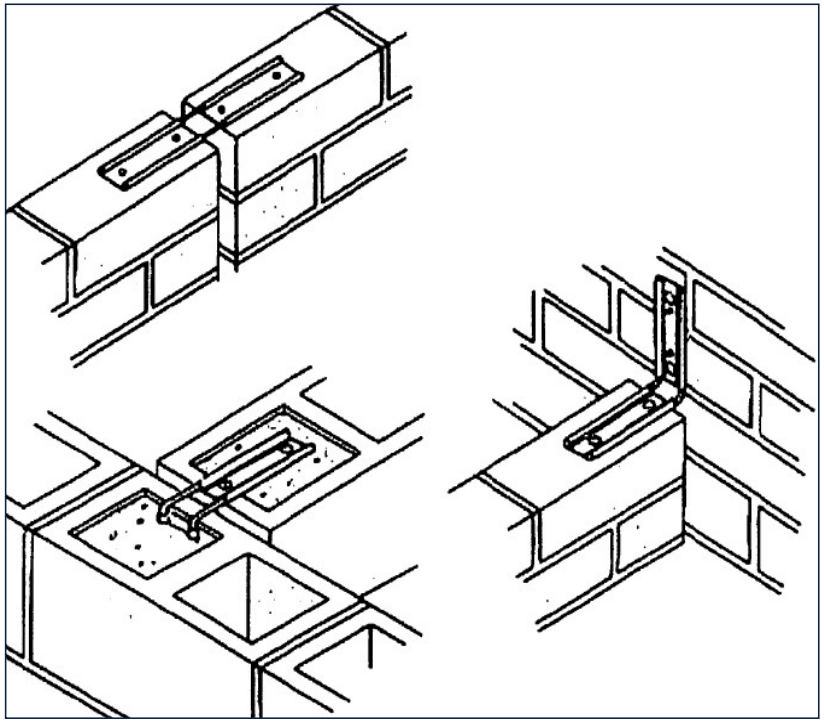
CONTROL JOINT SPACING FOR MOISTURE CONTROLLED,
TYPE 1*
CONCRETE MASONRY UNIT

Recommended Spacing of Control Joints	Vertical Spacing of Joint Reinforcement			
	None	24"	16"	8"
Expressed as ratio of Panel length to height L/H	2	2 1/2	3	4
With Panel Length (L) Not to Exceed:	40'	45'	50'	60'

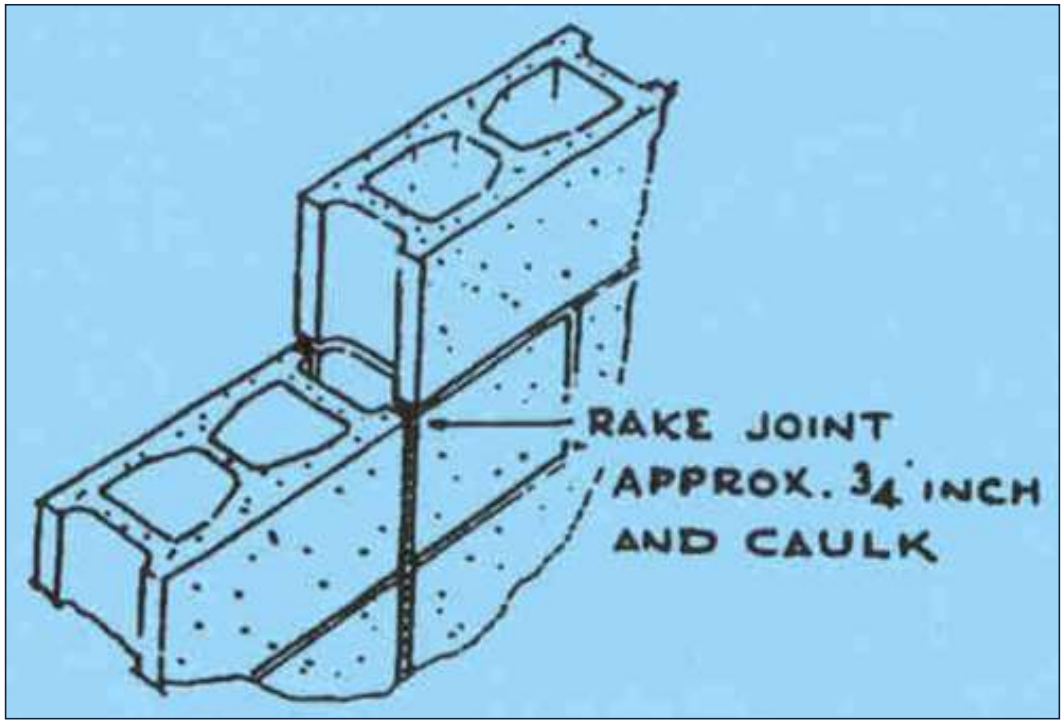
Historical

Section IX—CRACK CONTROL —"Location of Control Joints"

THE 4 MOST COMMON CONTROL JOINTS

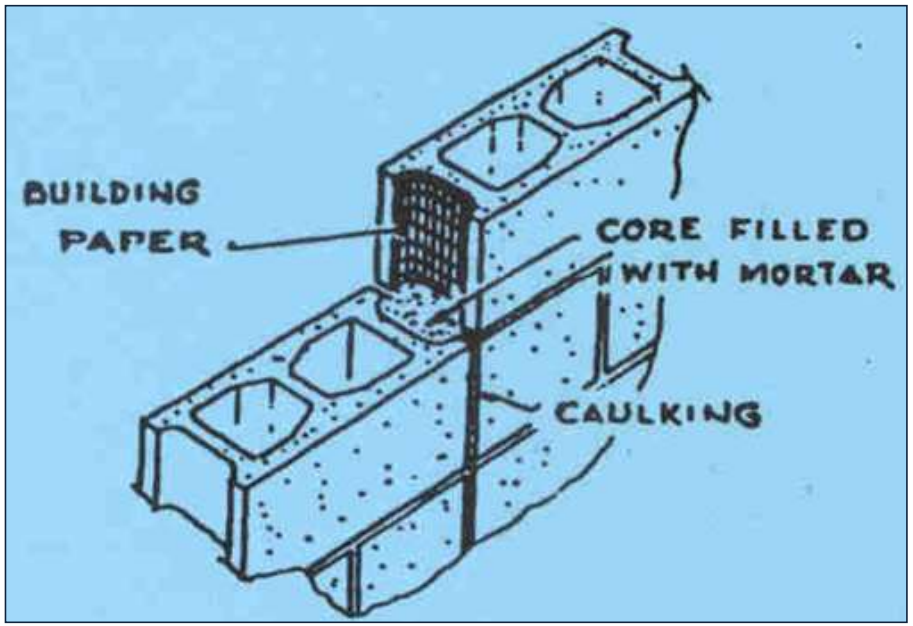


MECHANICAL SLIP CONNECTORS

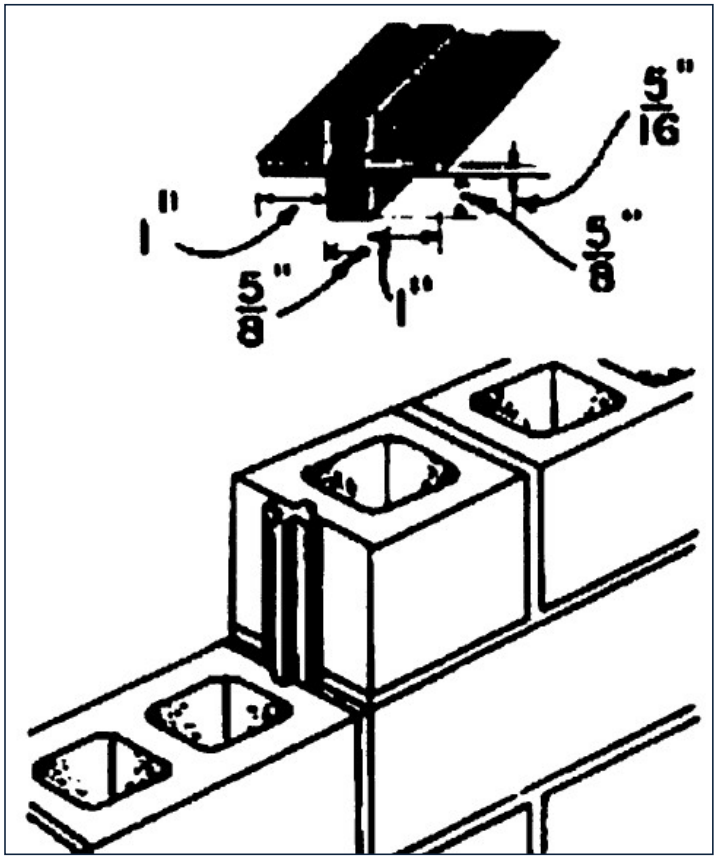


STANDARD RAKED JOINT (NO KEYWAY)

THE 4 MOST COMMON CONTROL JOINTS



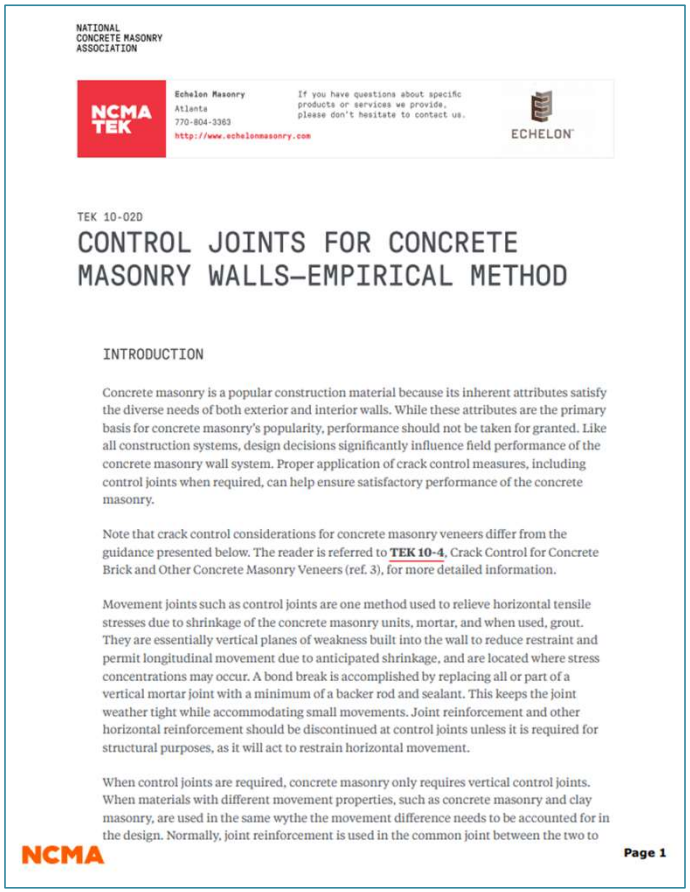
MICHIGAN KEYED JOINT



SASH BLOCK WITH PREFORMED GASKET

NATIONAL
NCMA
CONCRETE MASONRY
ASSOCIATION

CONTROL JOINTS FOR CONCRETE MASONRY WALLS—EMPIRICAL METHOD



NATIONAL
CONCRETE MASONRY
ASSOCIATION

NCMA TEK

Echelon Masonry
Atlanta
770-804-3363
http://www.echelonmasonry.com

If you have questions about specific products or services we provide, please don't hesitate to contact us.

ECHELON

TEK 10-02D

CONTROL JOINTS FOR CONCRETE MASONRY WALLS—EMPIRICAL METHOD

INTRODUCTION

Concrete masonry is a popular construction material because its inherent attributes satisfy the diverse needs of both exterior and interior walls. While these attributes are the primary basis for concrete masonry's popularity, performance should not be taken for granted. Like all construction systems, design decisions significantly influence field performance of the concrete masonry wall system. Proper application of crack control measures, including control joints when required, can help ensure satisfactory performance of the concrete masonry.

Note that crack control considerations for concrete masonry veneers differ from the guidance presented below. The reader is referred to **TEK 10-4**, Crack Control for Concrete Brick and Other Concrete Masonry Veneers (ref. 3), for more detailed information.

Movement joints such as control joints are one method used to relieve horizontal tensile stresses due to shrinkage of the concrete masonry units, mortar, and when used, grout. They are essentially vertical planes of weakness built into the wall to reduce restraint and permit longitudinal movement due to anticipated shrinkage, and are located where stress concentrations may occur. A bond break is accomplished by replacing all or part of a vertical mortar joint with a minimum of a backer rod and sealant. This keeps the joint weather tight while accommodating small movements. Joint reinforcement and other horizontal reinforcement should be discontinued at control joints unless it is required for structural purposes, as it will act to restrain horizontal movement.

When control joints are required, concrete masonry only requires vertical control joints. When materials with different movement properties, such as concrete masonry and clay masonry, are used in the same wythe the movement difference needs to be accounted for in the design. Normally, joint reinforcement is used in the common joint between the two to

NCMA

Page 1

NATIONAL NCMA CONCRETE MASONRY ASSOCIATION

CONTROL JOINTS FOR CONCRETE MASONRY WALLS—EMPIRICAL METHOD

TABLE 1
[1] #5 BAR FOR 12' HEIGHT OF WALL

Table 1—Recommended Control Joint Spacing for Above Grade Exposed Concrete Masonry Walls[A]

Distance between joints not to exceed the lesser of: Length to height ratio	or ft (m)
1½ : 1	25 (7.62)

[A] Notes:

1. Table values are based on the use of horizontal reinforcement having an equivalent area of not less than 0.025 in.^{2}/ft (52.9 mm^2/m) of height to keep unplanned cracks closed (see Table 2).
2. Criteria applies to all concrete masonry units.

BURY THE MYTH

Note for Engineers:
It is recommended that the project should be designed to take into account the shrinkage requirements of ACI 530 which calls for designing for 1/2 of the potential linear shrinkage or 3/16" in 100 lf.

Page C-40 Ref 4.2.5.1 (TMS 402-13) CONCRETE MASONRY	Section 4.2.5 Notation (TMS 402-13
$K_m = 0.5\ S_L$	K_m : coefficient of shrinkage of concrete masonry (The value that should be considered in the design of the structure) S_L = total linear drying shrinkage of concrete masonry units determined in accordance with ASTM C 426

What is a good value for "S_L" in Florida?

You may want to check with your concrete producer; however, a good general value for S (for normal weight units—125 pounds per cubic foot or more, oven dry weight for concrete), is 0.032%

Example Coefficient of shrinkage for Type II masonry units:

$K_m = 0.5\ S_L$
$= 0.5\ (0.32\%)$
$= 0.16\%$

How much shrinkage in 100 feet? ≃ 3/16"!

Potential linear shrinkage for typical florida masonry units for 100 inear feet of wall:

$= 0.016\%\ (100')\ (12')$
$= 0.016\% \times 1200$
$= 0.192"$ = about 3/16" (3/16" = 0.1875)

REFERENCE STANDARDS

PG. C-3 SECT 1.4

1.4 — Standards cited in this Code

Standards of the American Concrete Institute, the American Society of Civil Engineers, ASTM International, the American Welding Society, and The Masonry Society cited in this Code are listed below with their serial designations, including year of adoption or revision, and are declared to be part of this Code as if fully set forth in this document.

TMS 602-13/ACI 530.1-13/ASCE 6-13 — Specification for Masonry Structures

PLUS
MANY MORE
STANDARDS

TMS 402

Part 1 – General

CHAPTER 2 – NOTATION AND DEFINITIONS

Pg. C-5

TMS 402 CHAPTER 2

NOTATIONS & DEFINITIONS

Pages C-5 through C-22

TMS 402 CODE

2.2 — Definitions

Anchor — Metal rod, wire, or strap that secures masonry to its structural support.

Anchor pullout — Anchor failure defined by the anchor sliding out of the material in which it is embedded without breaking out a substantial portion of the surrounding material.

Area, gross cross-sectional — The area delineated by the out-to-out dimensions of masonry in the plane under consideration.

Area, net cross-sectional — The area of masonry units, grout, and mortar crossed by the plane under consideration based on out-to-out dimensions.

Area, net shear — The net area that is effective in resisting shear.

Autoclaved aerated concrete — Low-density cementitious product of calcium silicate hydrates, whose material specifications are defined in ASTM C1693.

Autoclaved aerated concrete (AAC) masonry — Autoclaved aerated concrete units manufactured without reinforcement, set on a mortar leveling bed, bonded with thin-bed mortar, placed with or without grout, and placed with or without reinforcement.

Backing — Wall or surface to which veneer is attached.

Bed joint — The horizontal layer of mortar on which a masonry unit is laid.

COMMENTARY

2.2 — Definitions

For consistent application of this Code, terms are defined that have particular meanings in this Code. The definitions given are for use in application of this Code only and do not always correspond to ordinary usage. Other terms are defined in referenced documents and those definitions are applicable. If any term is defined in both this Code and in a referenced document, the definition in this Code applies. Referenced documents are listed in Section 1.4 and include ASTM standards. Terminology standards include ASTM C1232 Standard Terminology of Masonry and ASTM C1180 Standard Terminology of Mortar and Grout for Unit Masonry. Glossaries of masonry terminology are available from several sources within the industry (BIA TN 2 (1999); NCMA TEK 1-4 (2004); and IMI (1981)).

Area, net shear — The net shear area for a partially grouted flanged shear wall is shown in Figure CC-2.2-1. For members without flanges, the net shear area is the net cross-sectional area.

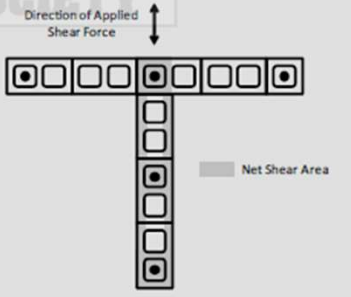


Figure CC-2.2-1 — Net shear area

THE MASONRY SOCIETY

TMS 402

Part 1 – General

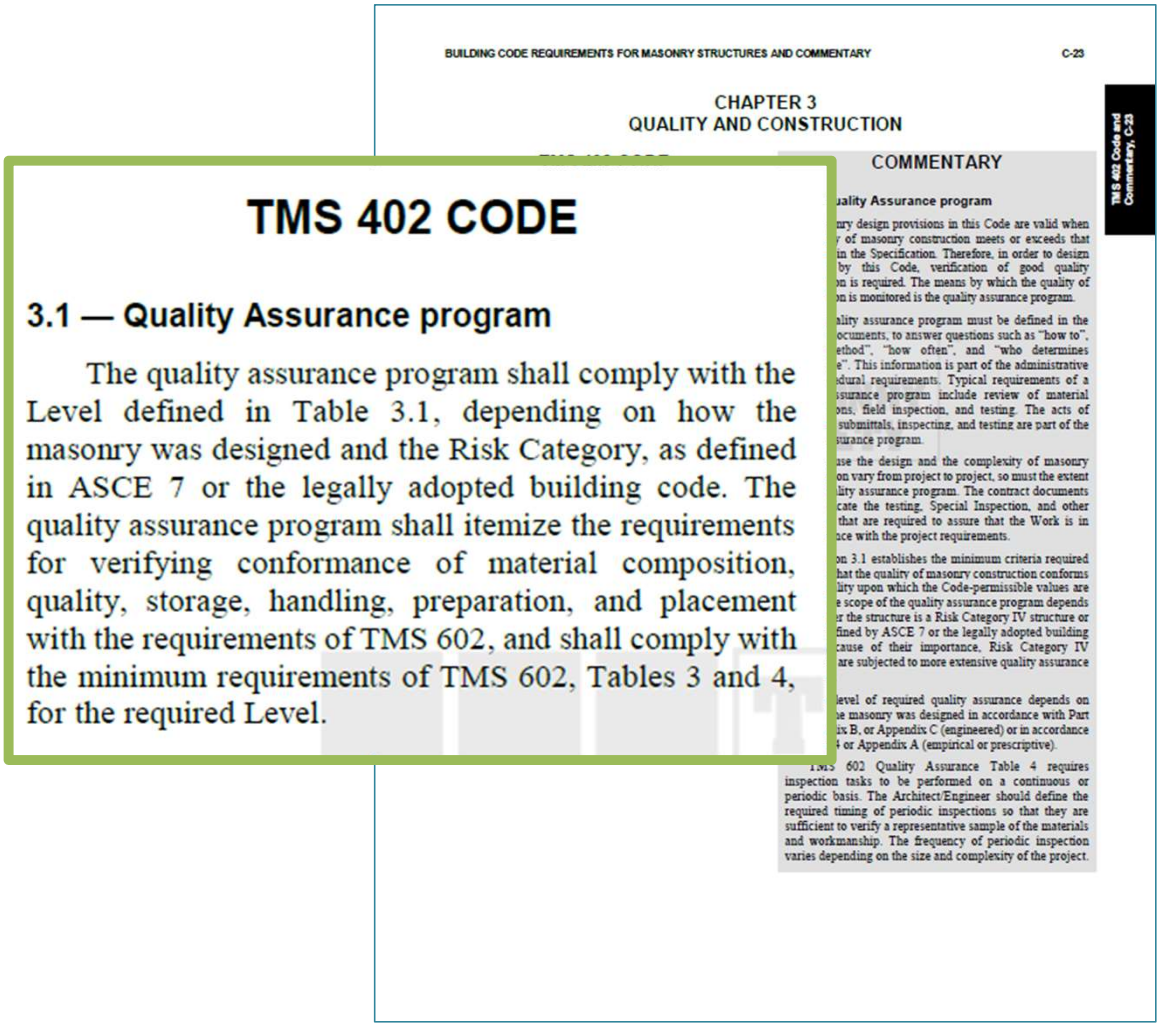
CHAPTER 3 – QUALITY AND CONSTRUCTION - PG. C-23

3.1 – QUALITY ASSURANCE PROGRAM

pg. C-23 Sect 3.1

Exempted by Florida Building Code

(Responsibility of Arch/Eng/Building Official)



BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES AND COMMENTARY C-23

CHAPTER 3
QUALITY AND CONSTRUCTION

TMS 402 Code and Commentary, C-23

COMMENTARY

TMS 402 CODE

3.1 — Quality Assurance program

The quality assurance program shall comply with the Level defined in Table 3.1, depending on how the masonry was designed and the Risk Category, as defined in ASCE 7 or the legally adopted building code. The quality assurance program shall itemize the requirements for verifying conformance of material composition, quality, storage, handling, preparation, and placement with the requirements of TMS 602, and shall comply with the minimum requirements of TMS 602, Tables 3 and 4, for the required Level.

uality Assurance program

ury design provisions in this Code are valid when of masonry construction meets or exceeds that in the Specification. Therefore, in order to design by this Code, verification of good quality on is required. The means by which the quality of on is monitored is the quality assurance program.

ality assurance program must be defined in the ocuments, to answer questions such as "how to", ethod", "how often", and "who determines e". This information is part of the administrative dural requirements. Typical requirements of a ssurance program include review of material ons, field inspection, and testing. The acts of submittals, inspecting, and testing are part of the surance program.

se the design and the complexity of masonry on vary from project to project, so must the extent lity assurance program. The contract documents cate the testing, Special Inspection, and other that are required to assure that the Work is in ce with the project requirements.

on 3.1 establishes the minimum criteria required hat the quality of masonry construction conforms lity upon which the Code-permissible values are e scope of the quality assurance program depends r the structure is a Risk Category IV structure or fined by ASCE 7 or the legally adopted building cause of their importance, Risk Category IV are subjected to more extensive quality assurance

evel of required quality assurance depends on e masonry was designed in accordance with Part ix B, or Appendix C (engineered) or in accordance or Appendix A (empirical or prescriptive).

602 Quality Assurance Table 4 requires inspection tasks to be performed on a continuous or periodic basis. The Architect/Engineer should define the required timing of periodic inspections so that they are sufficient to verify a representative sample of the materials and workmanship. The frequency of periodic inspection varies depending on the size and complexity of the project.

FBC | QUALITY ASSURANCE

Section 2107 Allowable Stress Design

2107.1 General

The design of masonry structures using *allowable stress design* shall comply with Section 2106 and the requirements of Chapters 1 through 8 of TMS 402/ACI 530/ASCE 5 except as modified by Sections 2107.2 through 2107.5.

Exception: Where plan review and inspections are performed by a local building department in accordance with Sections 107 and 110, the provisions of TMS 402/ACI 530/ASCE 5, Chapter 3 Section 3.1 and TMS 602/ACI 530.1/ASCE 6 Sections 1.5 and 1.6 shall not apply unless specified by the architect or engineer, or the building official.

PIPES AND CONDUITS IN THE WALL

PG. C-27 SECT 3.2.2.2 & 3.2.2.3

3.2.2.2 Conduits, pipes, and sleeves in masonry shall be no closer than 3 diameters on center. Minimum spacing of conduits, pipes or sleeves of different diameters shall be determined using the larger diameter.

3.2.2.3 Vertical conduits, pipes, or sleeves placed in masonry columns or pilasters shall not displace more than 2 percent of the net cross section.

GROUT SPACE REQUIREMENTS

PG. C-28 TABLE 3.2.1

ALSO APPEARS IN SPECIFICATIONS

TMS 402 Code and Commentary, C-28

Table 3.2.1 — Grout space requirements

Grout type[1]	Maximum grout pour height, ft (m)	Minimum clear width of grout space,[2,3] in. (mm)	Minimum clear grout space dimensions for grouting cells of hollow units,[3,4] in. x in. (mm x mm)
Fine	1 (0.30)	3/4 (19.1)	1 1/2 x 2 (38.1 x 50.8)
Fine	5.33 (1.63)	2 (50.8)	2 x 3 (50.8 x 76.2)
Fine	12.67 (3.86)	2 1/2 (63.5)	2 1/2 x 3 (63.5 x 76.2)
Fine	24 (7.32)	3 (76.2)	3 x 3 (76.2 x 76.2)
Coarse	1 (0.30)	1 1/2 (38.1)	1 1/2 x 3 (38.1 x 76.2)
Coarse	5.33 (1.63)	2 (50.8)	2 1/2 x 3 (63.5 x 76.2)
Coarse	12.67 (3.86)	2 1/2 (63.5)	3 x 3 (76.2 x 76.2)
Coarse	24 (7.32)	3 (76.2)	3 x 4 (76.2 x 102)

[1] Fine and coarse grouts are defined in ASTM C476.

[2] For grouting between masonry wythes.

[3] Minimum clear width of grout space and minimum clear grout space dimension are the net dimension of the space determined by subtracting masonry protrusions and the diameters of horizontal bars from the as-designed cross section of the grout space. Grout type and maximum grout pour height shall be specified based on the minimum clear space.

[4] Minimum grout space dimension for AAC masonry units shall be 3 in. (76.2 mm) x 3 in. (76.2 mm) or a 3-in. (76.2 mm) diameter cell.

THE MASONRY SOCIETY

TMS 402

Part 2 – Design Requirements

CHAPTER 4 – GENERAL ANALYSIS & DESIGN CONSIDERATIONS PG. C-29

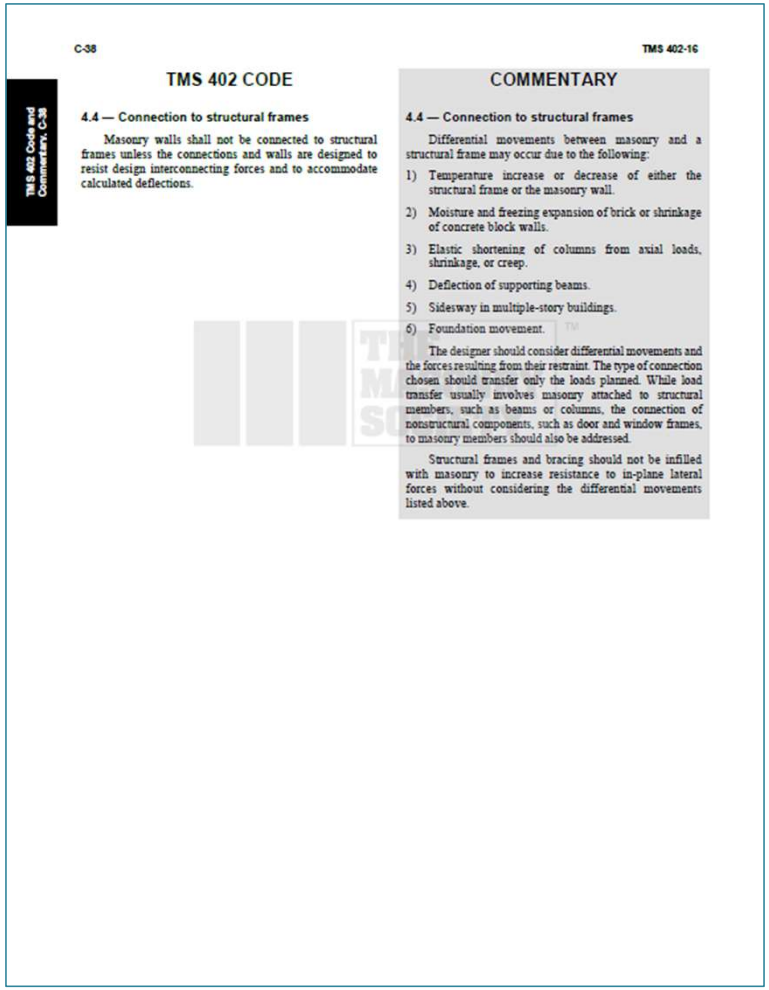
CONNECTION TO STRUCTURAL FRAMES

PG. C-38 SECT 4.4

TMS 402 CODE

4.4 — Connection to structural frames

Masonry walls shall not be connected to structural frames unless the connections and walls are designed to resist design interconnecting forces and to accommodate calculated deflections.



C-38 TMS 402-16

TMS 402 Code and Commentary, C-38

TMS 402 CODE

4.4 — Connection to structural frames

Masonry walls shall not be connected to structural frames unless the connections and walls are designed to resist design interconnecting forces and to accommodate calculated deflections.

COMMENTARY

4.4 — Connection to structural frames

Differential movements between masonry and a structural frame may occur due to the following:

1) Temperature increase or decrease of either the structural frame or the masonry wall.
2) Moisture and freezing expansion of brick or shrinkage of concrete block walls.
3) Elastic shortening of columns from axial loads, shrinkage, or creep.
4) Deflection of supporting beams.
5) Sidesway in multiple-story buildings.
6) Foundation movement.

The designer should consider differential movements and the forces resulting from their restraint. The type of connection chosen should transfer only the loads planned. While load transfer usually involves masonry attached to structural members, such as beams or columns, the connection of nonstructural components, such as door and window frames, to masonry members should also be addressed.

Structural frames and bracing should not be infilled with masonry to increase resistance to in-plane lateral forces without considering the differential movements listed above.

STACKED BOND VS RUNNING BOND

PG. C-39 FIG CC-4.5-1 RUNNING BOND MASONRY

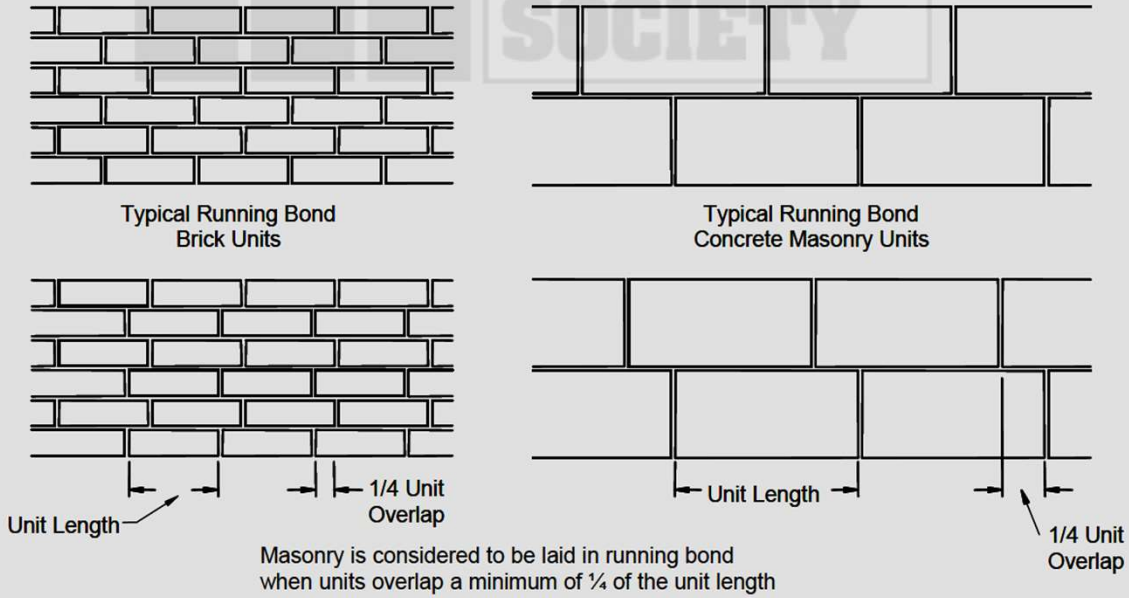


Figure CC-4.5-1 — Running bond masonry

STACKED BOND

PG. C-39 SECT 4.5

TMS 402 CODE

4.5 — Masonry not laid in running bond

For masonry not laid in running bond, the minimum area of horizontal reinforcement shall be 0.00028 multiplied by the gross vertical cross-sectional area of the wall using specified dimensions. Horizontal reinforcement shall be placed at a maximum spacing of 48 in. (1219 mm) on center in horizontal mortar joints or in bond beams.

STANDARD 9 GA. JOINT REINFORCEMENT EVERY OTHER COURSE

TMS 402

Part 2 – Design Requirements

CHAPTER 5 – STRUCTURAL ELEMENTS PG. C-41

INTERSECTING WALLS

PG. C-41 SECT 5.1.1

OR

TMS 402 CODE

5.1 — Masonry assemblies

5.1.1 *Intersecting walls*

5.1.1.1 Wall intersections shall meet one of the following requirements:

(a) Design shall conform to the provisions of Section 5.1.1.2.

(b) Transfer of shear between walls shall be prevented.

TIE THEM TOGETHER OR ALLOW THEM TO ACT SEPARATELY

INTERSECTING WALLS

PG. C-42 SECT 5.1.1.2.5 (A) & (B)

TMS 402 CODE

5.1.1.2.5 The connection of intersecting walls shall conform to one of the following requirements:

(a) At least fifty percent of the masonry units at the interface shall interlock.

(b) Walls shall be anchored by steel connectors grouted into the wall and meeting the following requirements:

(1) Minimum size: $^{1}/_{4}$ in. x $1^{1}/_{2}$ in. x 28 in. (6.4 mm x 38.1 mm x 711 mm) including 2-in. (50.8-mm) long, 90-degree bend at each end to form a U or Z shape.

(2) Maximum spacing: 48 in. (1219 mm).

INTERSECTING WALLS

PG. C-42 SECT 5.1.1.2.5 (C)

(c) Intersecting reinforced bond beams shall be provided at a maximum spacing of 48 in. (1219 mm) on center. The area of reinforcement in each bond beam shall not be less than 0.1 $in.^2$ per ft (211 mm^2/m) multiplied by the vertical spacing of the bond beams in feet (meters). Reinforcement shall be developed on each side of the intersection.

INTERSECTING WALLS

PG. C-42 FIG CC-5.1-1

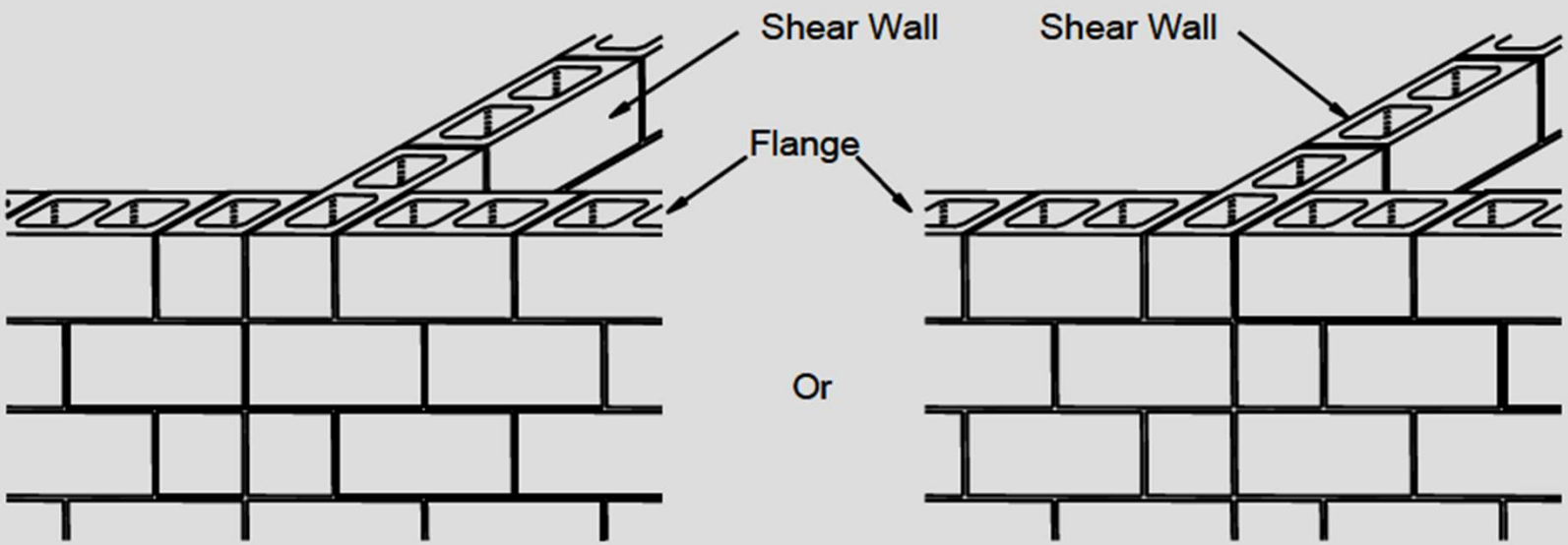


Figure CC-5.1-1 — Running bond lap at intersection

INTERSECTING WALLS

PG. C-43 FIG CC-5.1-2

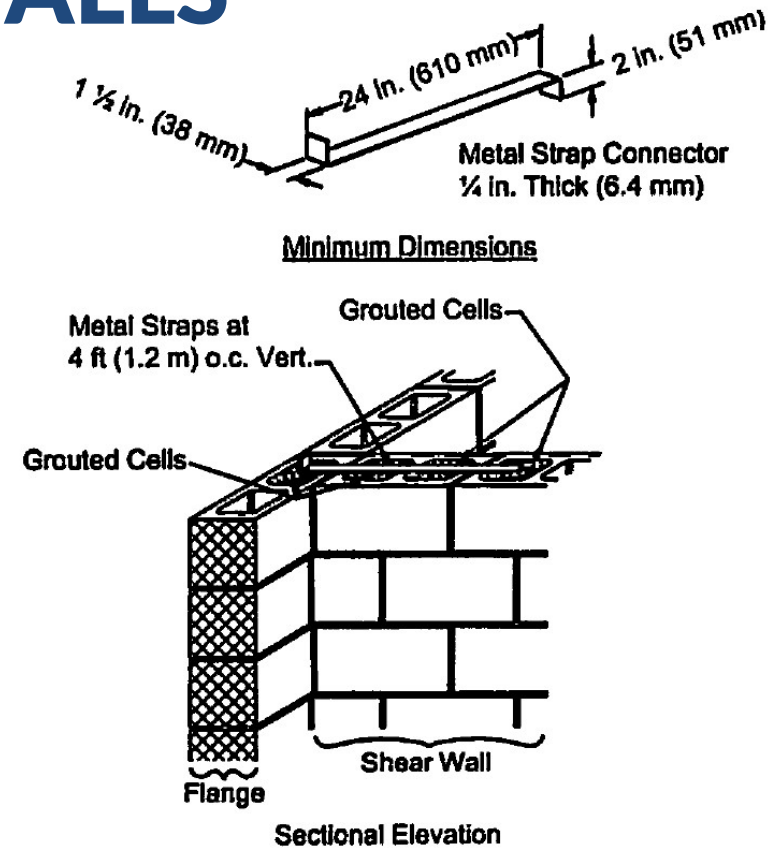


Figure CC-5.1-2 — Metal straps and grouting at wall intersections

INTERSECTING WALLS

PG. C-43 FIG CC-5.1-3

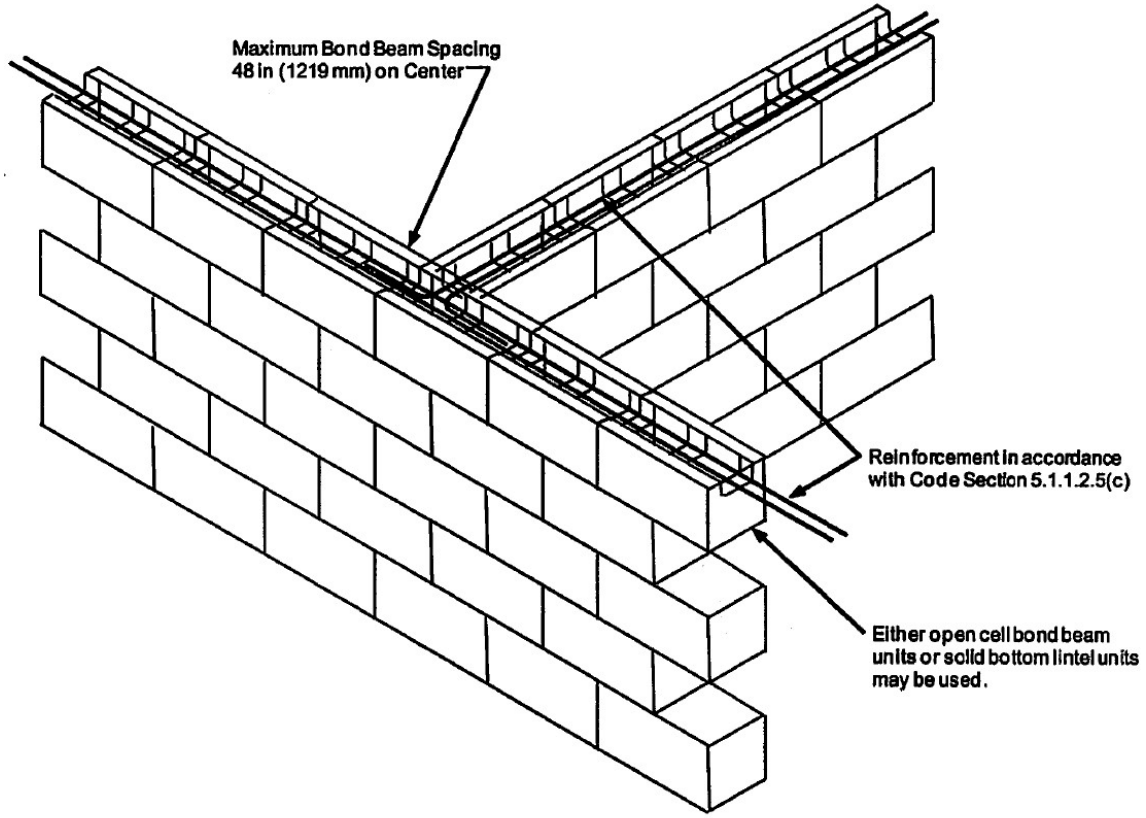


Figure CC-5.1-3 — Bond beam at wall intersection

LENGTH OF BEAM BEARING

PG. C-52 SECT 5.2.1.3

5.2.1.3 *Bearing length* — Length of bearing of beams on their supports shall be a minimum of 4 in. (102 mm) in the direction of span.

4 inch minimum -- not 8!

DEFLECTION

PG. C-52 SECT 5.2.1.4.1

5.2.1.4.1 The calculated deflection of beams providing vertical support to masonry designed in accordance with Section 8.2, Section 9.2, Section 11.2, Chapter 14, or Appendix A shall not exceed *l*/600 under allowable stress level dead plus live loads.

DEFINITION OF A COLUMN

PG. C-56 SECT 5.3

5.3 — Columns

Columns are defined in Section 2.2. They are isolated members usually under axial compressive loads and flexure. If damaged, columns may cause the collapse of other members; sometimes of an entire structure. These critical structural members warrant the special requirements of this section.

DEFINITION OF A COLUMN

PG. C-15 SECT 2.2

Column — A structural member, not built integrally into a wall, designed primarily to resist compressive loads parallel to its longitudinal axis and subject to dimensional limitations.

DEFINITION OF A COLUMN

PG. C-56 Sect CC 5.3

COMMENTARY

5.3 — Columns

Columns are defined in Section 2.2. They are isolated members usually under axial compressive loads and flexure. If damaged, columns may cause the collapse of other members; sometimes of an entire structure. These critical structural members warrant the special requirements of this section.

COLUMNS NEED TIES

COLUMNS NEED TIES

COLUMNS

PG. C-56 SECT 5.3.1

5.3.1 *General column design*

5.3.1.1 *Dimensional limits* — Dimensions shall be in accordance with the following:

(a) The distance between lateral supports of a column shall not exceed 99 multiplied by the least radius of gyration, r.

(b) Minimum side dimension shall be 8 in. (203 mm) nominal.

5.3.1.2 *Construction* — Columns shall be fully grouted.

5.3.1.3 *Vertical reinforcement* — Vertical reinforcement in columns shall not be less than $0.0025A_n$ nor exceed $0.04A_n$. The minimum number of bars shall be four.

COLUMN LATERAL TIES

PG. C-57 SECT 5.3.1.4 (A) (B)

5.3.1.4 *Lateral ties* — Lateral ties shall conform to the following:

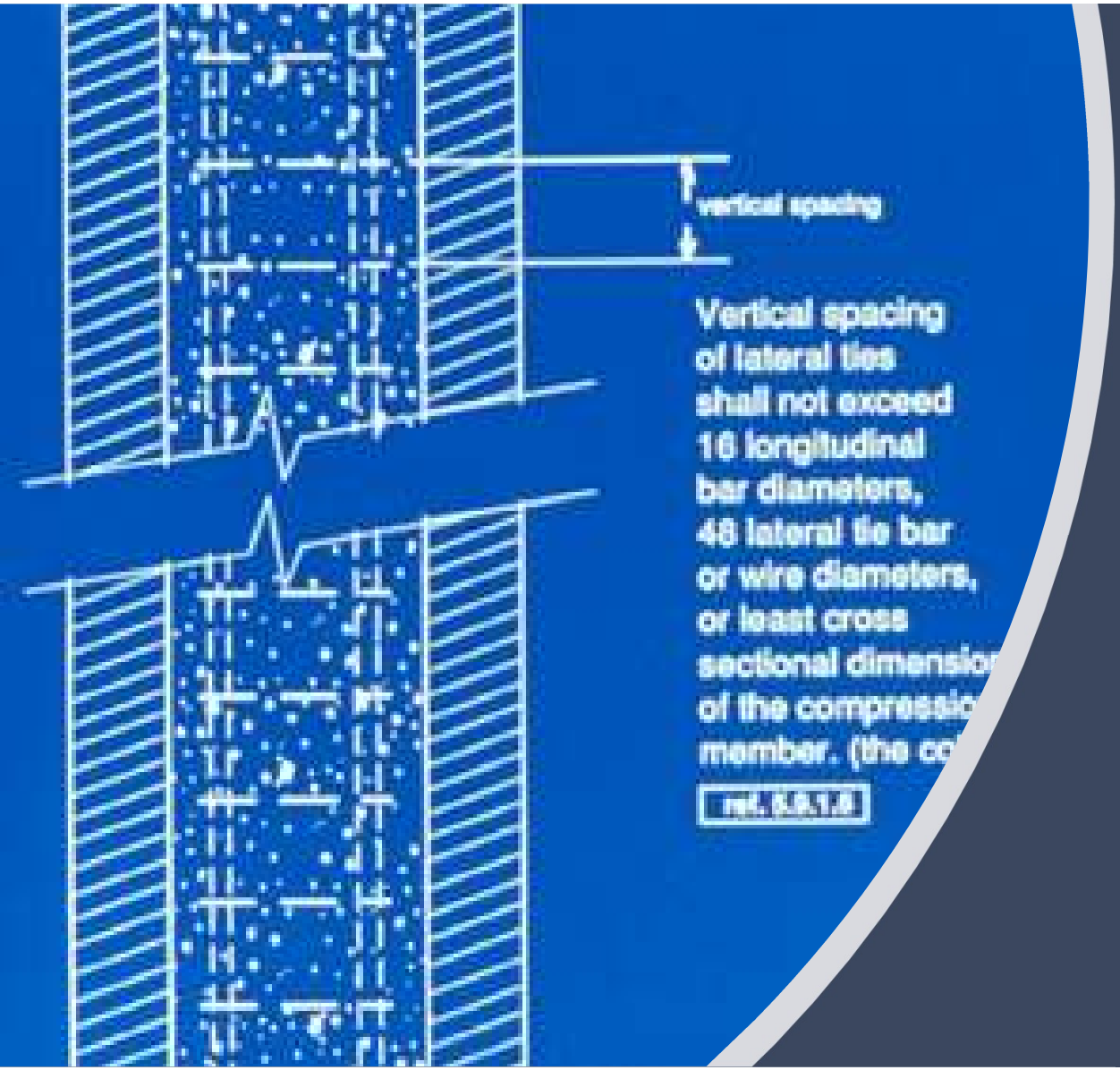
(a) Vertical reinforcement shall be enclosed by lateral ties at least $^1/_4$ in. (6.4 mm) in diameter.

(b) Vertical spacing of lateral ties shall not exceed 16 longitudinal bar diameters, 48 lateral tie bar or wire diameters, or least cross-sectional dimension of the member.

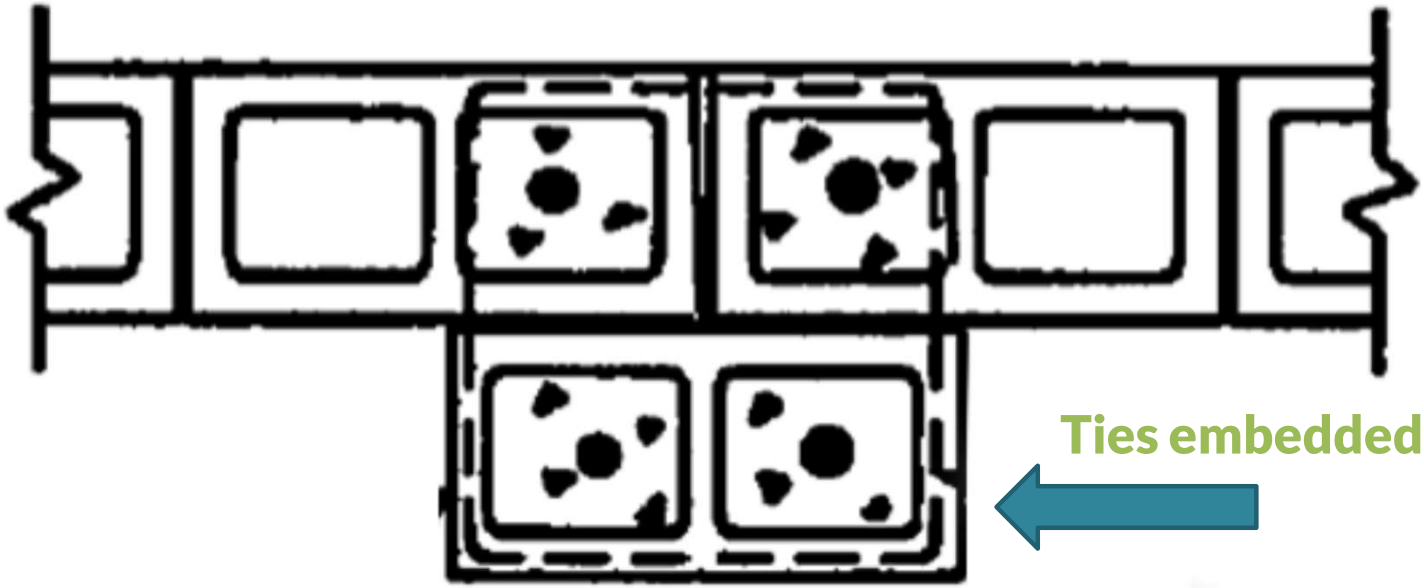
COLUMN LATERAL TIES

PG. C-57 SECT 5.3.1.4 (D)

(d) Lateral ties shall be located vertically not more than one-half lateral tie spacing above the top of footing or slab in any story, and shall be spaced not more than one-half a lateral tie spacing below the lowest horizontal reinforcement in beam, girder, slab, or drop panel above.



LATERAL TIES



Ties embedded in mortar joints.

LATERAL TIES

- Difficult to Embed a ¼” Lateral Tie in a 3/8” Mortar Joint

DEFINITION OF A PILASTER

PG. C-18 SECT 2.2

Pilaster - A vertical member, built integrally with a wall, with a portion of its cross section typically projecting from one or both faces of the wall.

DEFINITION OF A PILASTER

PG. C-18 COMMENTARY

Pilaster - A pilaster may support axial loads parallel to its longitudinal axis, as well as transverse loads applied perpendicular to its longitudinal axis. A projecting pilaster may or may not have longitudinal reinforcement, but non-projecting pilasters must be reinforced. Longitudinal reinforcement in a pilaster only needs to be laterally tied if the design relies upon that reinforcement to resist axial and/or flexural compression, although lateral ties (stirrups) may also be required if shear stresses are high.

PILASTERS

7TH EDITION FLORIDA BUILDING CODE CHAPTER 21

2107.5 TMS 402/ACI 530/ASCE 5, Section 5.4 Pilasters.
Modify Section 5.4 as follows:

5.4 — Pilasters

5.4.3 Where vertical pilaster reinforcement is not provided to resist axial compressive stress, lateral ties are not required.

A PILASTER BUILT INTEGRALLY WITH NO SPECIFIC VERTICAL LOAD IS NOT A COLUMN

A MASONRY POST

PG. C-57 SECT 5.3.2

5.3.2 *Lightly loaded columns*

Masonry columns used only to support light frame roofs of carports, porches, sheds or similar structures assigned to Seismic Design Category A, B, or C, which are subject to allowable stress level gravity loads not exceeding 2,000 lbs (8,900 N) acting within the cross-sectional dimensions of the column are permitted to be constructed as follows:

(a) Minimum side dimension shall be 8 in. (203 mm) nominal.

(b) Height shall not exceed 12 ft (3.66 m).

(c) Cross-sectional area of longitudinal reinforcement shall not be less than 0.2 $in.^2$ (129 mm^2) centered in the column.

(d) Columns shall be fully grouted.

THE MASONRY SOCIETY

TMS 402

Part 2 – Design Requirements

CHAPTER 6 – REINFORCEMENT, METAL ACCESSORIES & ANCHOR BOLTS PG. C-63

SIZE OF REINFORCEMENT

pg. C-63 Sect 6.1.2

Maximum is #9 For Strength Design

6.1.1 *Embedment*

Reinforcing bars shall be embedded in grout.

6.1.2 *Size of reinforcement*

6.1.2.1 The maximum size of reinforcement used in masonry shall be No. 11 (M #36).

DIAMETER OF REBAR

PG. C-63 SECT 6.1.2.2

6.1.2.2 The diameter of reinforcement shall not exceed one-half the least clear dimension of the cell, bond beam, or collar joint in which it is placed.

PG. C-63 SECT 6.1.2.5

6.1.2.5 The nominal bar diameter shall not exceed one-eighth of the least nominal member dimension.

JOINT REINFORCEMENT

PG. C-63 SECT 6.1.2.3

11 GA

6.1.2.3 Longitudinal and cross wires of joint reinforcement shall have a minimum wire size of W1.1 (MW7) and a maximum wire size of one-half the joint thickness.

3/16" DIA

CLEAR DISTANCE BETWEEN BARS

PG. C-63 SECT 6.1.3

6.1.3 *Placement of reinforcement*

6.1.3.1 The clear distance between parallel bars shall not be less than the nominal diameter of the bars, nor less than 1 in. (25.4 mm).

6.1.3.2 In columns and pilasters, the clear distance between vertical bars shall not be less than one and one-half multiplied by the nominal bar diameter, nor less than $1^1/_2$ in. (38.1 mm).

ADJACENT LAP SLICES

PG. C-64 SECT 6.1.3.3

> **6.1.3.3** The clear distance limitations between bars required in Sections 6.1.3.1 and 6.1.3.2 shall also apply to the clear distance between a contact lap splice and adjacent splices or bars.

CLEAR DISTANCE BETWEEN BARS APPLIES TO CONTACT LAP SPLICES

BUNDLED BARS

Applies to Allowable Design Only. Bundling not allowed in Strength Design

PG. C-64 SECT 6.1.3.4

6.1.3.4 Groups of parallel reinforcing bars bundled in contact to act as a unit shall be limited to two in any one bundle. Individual bars in a bundle cut off within the span of a member shall terminate at points at least 40 bar diameters apart.

Most common bundle:
2 each no.5 bars = .62 sq. inches
1 no. 7 bar = 0.60 sq. inches

CLEARANCE BETWEEN BAR & MASONRY GROUT

PG. C-64 SECT 6.1.3.5

6.1.3.5 Reinforcement embedded in grout shall have a thickness of grout between the reinforcement and masonry units not less than $^1/_4$ in. (6.4 mm) for fine grout or $^1/_2$ in. (12.7 mm) for coarse grout.

COVER REQUIREMENTS

PG. C-64 SECT 6.1.4

1 ½ INCH COVER

6.1.4 *Protection of reinforcement*

6.1.4.1 Reinforcing bars shall have a masonry cover not less than the following:

(a) Masonry face exposed to earth or weather: 2 in. (50.8 mm) for bars larger than No. 5 (M #16); $1^1/_2$ in. (38.1 mm) for No. 5 (M #16) bars or smaller.

(b) Masonry not exposed to earth or weather: $1^1/_2$ in. (38.1 mm).

JOINT REINFORCEMENT – WIRE REQUIREMENTS

PG. C-65 SECT 6.1.4.2

6.1.4.2 Longitudinal wires of joint reinforcement shall be fully embedded in mortar or grout with a minimum cover of $^{5}/_{8}$ in. (15.9 mm) when exposed to earth or weather and $^{1}/_{2}$ in. (12.7 mm) when not exposed to earth or weather. Joint reinforcement shall be stainless steel or protected from corrosion by hot-dipped galvanized coating or epoxy coating when used in masonry exposed to earth or weather and in interior walls exposed to a mean relative humidity exceeding 75 percent. All other joint reinforcement shall be mill galvanized, hot-dip galvanized, or stainless steel.

JOINT REINFORCEMENT – WIRE REQUIREMENTS

FBC 7TH ED. SECT 2103.4

2103.4 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602. Where provided in exterior walls, joint reinforcement shall be a minimum No. 9-gauge ladder-type stainless steel, hot dipped galvanized, or epoxy coated in accordance

DEVELOPMENT OF REINFORCING

PG. C-65 SECT 6.1.5.1.1

6.1.5.1.1 *Development length of bars grouted in clay masonry and concrete masonry* — The required development length of reinforcing bars shall be determined by Equation 6-1, but shall not be less than 12 in. (305 mm).

$$l_d = \frac{0.13 d_b^2 f_y \gamma}{K\sqrt{f_m'}} \qquad \text{(Equation 6-1)}$$

DEVELOPMENT OF REINFORCING

PG. C-66 SECT 6.1.6.1.1

6.1.6.1.1 *Lap splices of bar reinforcement*

6.1.6.1.1.1 The minimum length of lap for bars in tension or compression shall be determined by Section 6.1.5.1.1 for clay masonry and concrete masonry and by Section 6.1.5.1.2 for AAC masonry, but not less than 12 in. (305 mm).

EMBEDMENT & LAPS

Required Lap Length in Florida
-Reinforcing Steel-

Along with the IBC lap calculation method (Section 2107.2) the 7th Edition of the Florida Building Code allows the use of the TMS 402 method of lap calculation with Florida modified Y (gamma) factors to remove the Seismic influence. This is true for both Working Stress Design and Strength Design.

7th EDITION CHAPTER 21 MASONRY Section 2107.2.1 (IBC Lap Method)

2107.2.1 Lap splices. The minimum length of lap splices for reinforcing bars in tension or compression, l_d, shall be

$l_d = 0.002 d_b f_s$ **(Equation 21-1)**

For SI: $l_d = 0.29 d_b f_s$

but not less than 12 inches (305 mm). In no case shall the length of the lapped splice be less than 40 bar diameters.

where:

d_b = Diameter of reinforcement, inches (mm).

f_s = Computed stress in reinforcement due to design loads, psi (MPa).

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of the allowable steel tension stress, F_s, the lap length of splices shall be increased not less than 50 percent of the minimum required length, but need not be greater than 72 d_b. Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

TMS 402 LAP METHOD

$$l_d = \frac{0.13 d_b^2 f_y \gamma}{K\sqrt{f'_m}}$$

Eq 6-1
TMS 402-16
pp C-65

γ **=1.0 for #3 through #5 bar**
=1.04 for #6 and #7 bars
=1.2 for #8 and #9 bars

Modified factors for Y (gamma) approved in the 7th Edition Florida Building Code

EMBEDMENTS & LAPS

Development Lengths (l_d)

Assumptions
-f_y=60,000 psi
-f'm=2,000 psi
-Bar spacing > $9d_b$
-Bars centered in cell

$$l_d = \frac{0.13 d_b^2 f_y \gamma}{K\sqrt{f'_m}}$$

Eq 6-1
TMS 402-16
pp C-65

γ
=1.0 for #3 through #5 bar
=1.04 for #6 and #7 bars
=1.2 for #8 and #9 bars

	Min/Max Laps		8" Masonry		12" Masonry	
Bar Size	40db (Min per FBC)	72db (Max Req per FBC)	Lap Per TMS 402-16	Lap Per TMS 402-16 w/FBC Y Factors	Lap Per TMS 402-16	Lap Per TMS 402-16 w/FBC Y Factors
3	15.0	27.0	12.0	12.0	12.0	12.0
4	20.0	36.0	12.2	12.2	12.0	12.0
5	25.0	45.0	19.5	19.5	12.4	12.4
6	30.0	54.0	37.1	29.7	23.4	18.8
7	35.0	63.0	51.4	41.1	32.3	25.8
8	40.0	72.0	79.0	63.2	49.3	39.4
9	45.0	81.0	101.9	81.5	63.1	50.5

K Chart					
Bar Size	9 x db	Cover for 8" Masonry	K for 8" Masonry	Cover for 12" Masonry	K for 12" Masonry
3	3.38	3.63	3.38	5.63	3.38
4	4.50	3.56	3.56	5.56	4.50
5	5.63	3.50	3.50	5.50	5.50
6	6.75	3.44	3.44	5.44	5.44
7	7.88	3.38	3.38	5.38	5.38
8	9.00	3.31	3.31	5.31	5.31
9	10.13	3.25	3.25	5.25	5.25

HOOK EMBEDMENT

PG. C-66 SECT 6.1.5.1.3

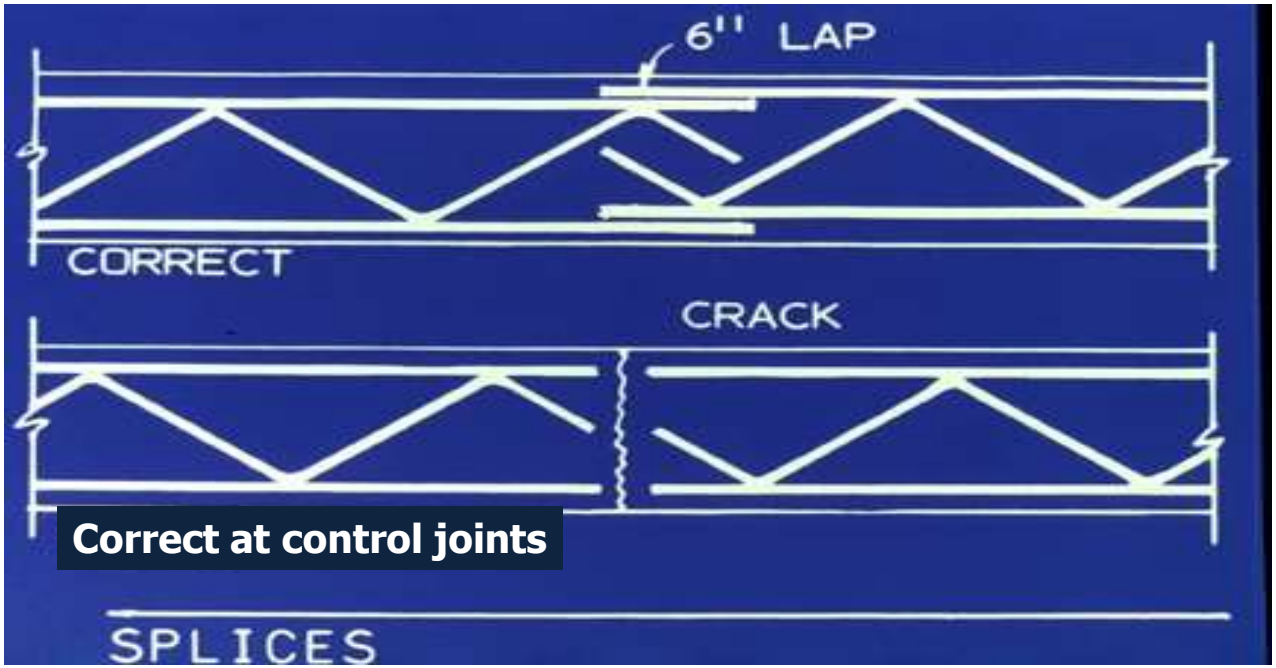
6.1.5.1.3 *Standard hooks* — Standard hooks in tension shall be considered to develop an equivalent embedment length, l_e, as determined by Equation 6-2. Hooks shall not be used to develop bars in compression.

$$l_e = 13\, d_b \qquad \text{(Equation 6-2)}$$

USED TO BE 11.25

LAP ON JOINT REINFORCEMENT

PG. C-66 SECT 6.1.5.2



6.1.5.2 *Development of wires in tension* — The development length of wire shall be determined by Equation 6-3, but shall not be less than 6 in. (152 mm).

$$l_d = 48\, d_b \qquad \text{(Equation 6-3)}$$

LAP CONFINEMENT

PG. C-67 SECT 6.1.6.1.1.2

6.1.6.1.1.2 For clay masonry and concrete masonry, where reinforcement consisting of No. 3 (M#10) or larger bars is placed transversely within the lap, with at least one bar 8 in. (203 mm) or less from each end of the lap, the minimum length of lap for bars in tension or compression determined by Equation 6-1 shall be permitted to be reduced by multiplying by the confinement factor, ξ, determined in accordance with Equation 6-4. The clear

PG. C-67 EQUATION 6-4

$$\xi = 1.0 - \frac{2.3 A_{sc}}{d_b^{2.5}} \quad \text{(Equation 6-4)}$$

NON-CONTACT LAP SPLICES

PG. C-67 SECT 6.1.6.1.1.3

6.1.6.1.1.3 Reinforcement spliced by noncontact lap splices shall not be spaced transversely farther apart than one-fifth the required length of lap nor more than 8 in. (203 mm). Noncontact splices are not permitted in AAC masonry.

EMBEDMENT & LAPS

WELDED SPLICES- MECHANICAL CONNECTION

PG. C-67 SECT 6.1.6.1.2

6.1.6.1.2 *Welded splices of bar reinforcement* — Welded splices shall have the bars butted and welded to develop at least 125 percent of the specified yield strength, f_y,

PG. C-69 SECT 6.1.6.2.3

6.1.6.2.3 *Mechanical splices of wires* — Mechanical splices shall have the wires connected to develop at least 125 percent of the specified yield strength of the wire in tension.

HOT DIPPED GALVANIZED

PG. C-76 SECT 6.2.1 PROTECTION OF METAL ACCESSORIES

6.2 — Metal accessories

6.2.1 *Protection of metal accessories*

Wall ties, sheet-metal anchors, steel plates and bars, and inserts exposed to earth or weather, or exposed to a mean relative humidity exceeding 75 percent shall be stainless steel or protected from corrosion by hot-dip galvanized coating or epoxy coating. Wall ties, anchors, and inserts shall be mill galvanized, hot-dip galvanized, or stainless steel for all other cases. Anchor bolts, and steel plates and bars, not exposed to earth, weather, nor exposed to a mean relative humidity exceeding 75 percent, need not be coated.

TMS 402

Part 2 – Design Requirements

CHAPTER 7 – SEISMIC DESIGN REQUIREMENTS PG. C-85

NOT COVERED IN THIS COURSE

TMS 402

Part 2 – Design Requirements

CHAPTER 8 – ALLOWABLE STRESS DESIGN OF MASONRY PG. C-101

FLEXURAL TENSION OF MORTARS

PG. C-110 TABLE 8.2.4.2

TMS 402 Code and Commentary, C-110

Table 8.2.4.2 — Allowable flexural tensile stresses for clay and concrete masonry, psi (kPa)

Direction of flexural tensile stress and masonry type	Mortar types			
	Portland cement/lime or mortar cement		Masonry cement or air entrained portland cement/lime	
	M or S	N	M or S	N
Normal to bed joints				
Solid units	53 (366)	40 (276)	32 (221)	20 (138)
Hollow units[1]				
Ungrouted	33 (228)	25 (172)	20 (138)	12 (83)
Fully grouted	65 (448)	63 (434)	61 (420)	58 (400)
Parallel to bed joints in running bond				
Solid units	106 (731)	80 (552)	64 (441)	40 (276)
Hollow units				
Ungrouted and partially grouted	66 (455)	50 (345)	40 (276)	25 (172)
Fully grouted	106 (731)	80 (552)	64 (441)	40 (276)
Parallel to bed joints in masonry not laid in running bond				
Continuous grout section parallel to bed joints	133 (917)	133 (917)	133 (917)	133 (917)
Other	0 (0)	0 (0)	0 (0)	0 (0)

[1] For partially grouted masonry, allowable stresses shall be determined on the basis of linear interpolation between fully grouted hollow units and ungrouted hollow units based on amount (percentage) of grouting.

ALLOWABLE WORKING STRESS IN REINFORCEMENT

PG. C-114 SECT 8.3.3

UNCHANGED

8.3.3 *Steel reinforcement — Allowable stresses*

8.3.3.1 Tensile stress in bar reinforcement shall not exceed the following:

(a) Grade 40 or Grade 50 reinforcement: 20,000 psi (137.9 MPa)

(b) Grade 60 reinforcement: 32,000 psi (220.7 MPa)

8.3.3.2 Tensile stress in wire joint reinforcement shall not exceed 30,000 psi (206.9 MPa).

33% INCREASE FROM 2008 CODE (24,000 PSI)

ALLOWABLE WORKING STRESS IN MASONRY

PG. C-115 SECT 8.3.4.2.2

8.3.4.2.2 The compressive stress in masonry due to flexure or due to flexure in combination with axial load shall not exceed $0.45\ f'_m$

.33 F'M IN 2008 CODE

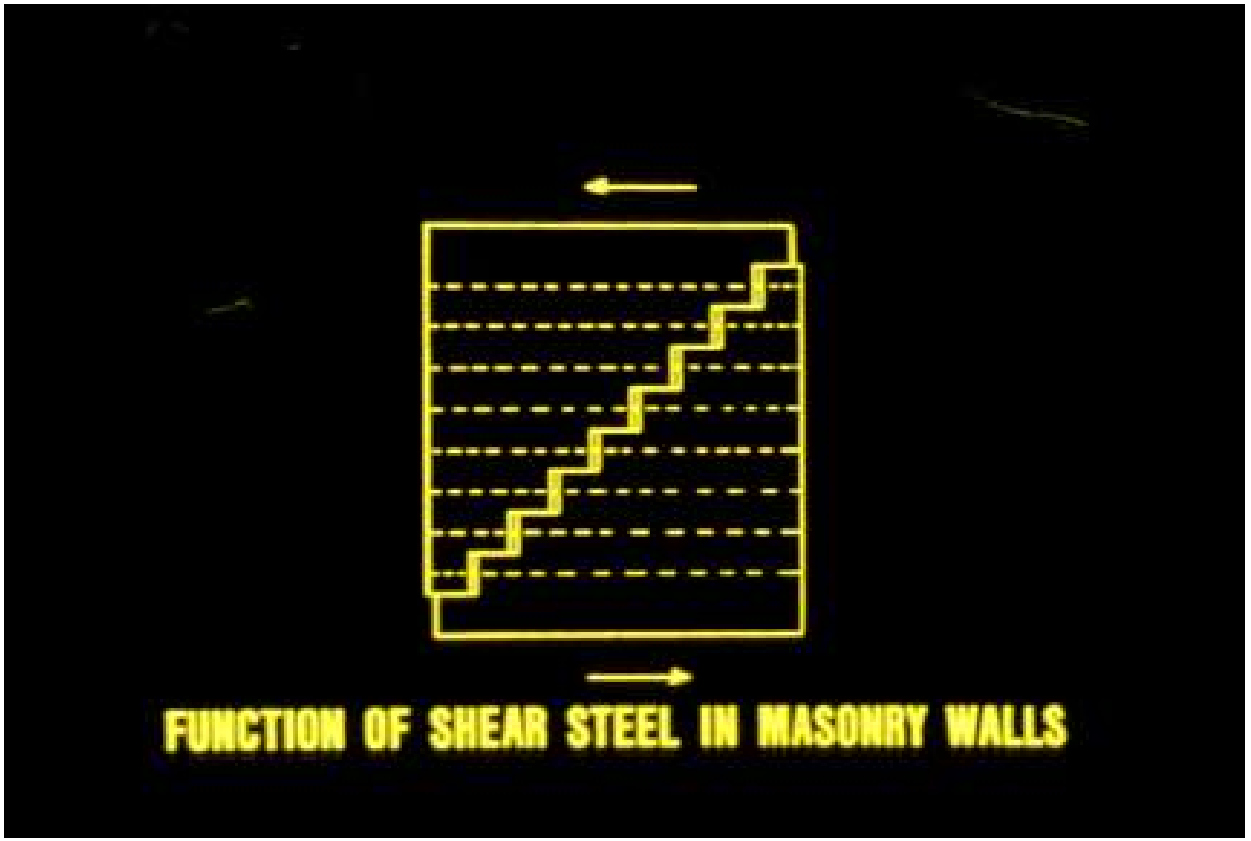
SHEAR REINFORCEMENT

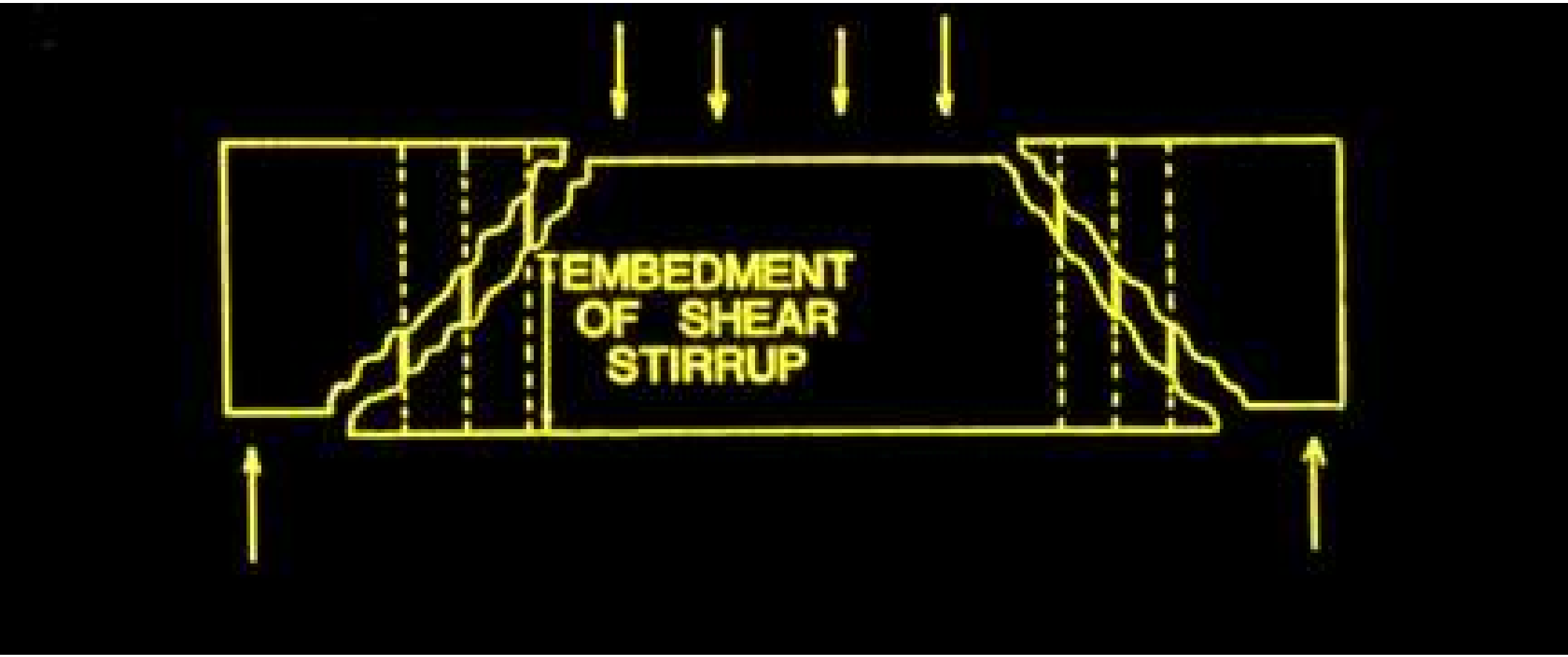
PG. C-119 SECT 8.3.5.2.1

8.3.5.2.1 Shear reinforcement shall be provided parallel to the direction of applied shear force. Spacing of shear reinforcement shall not exceed the lesser of $d/2$ or 48 in. (1219 mm).

..... PARALLEL TO THE APPLIED FORCE

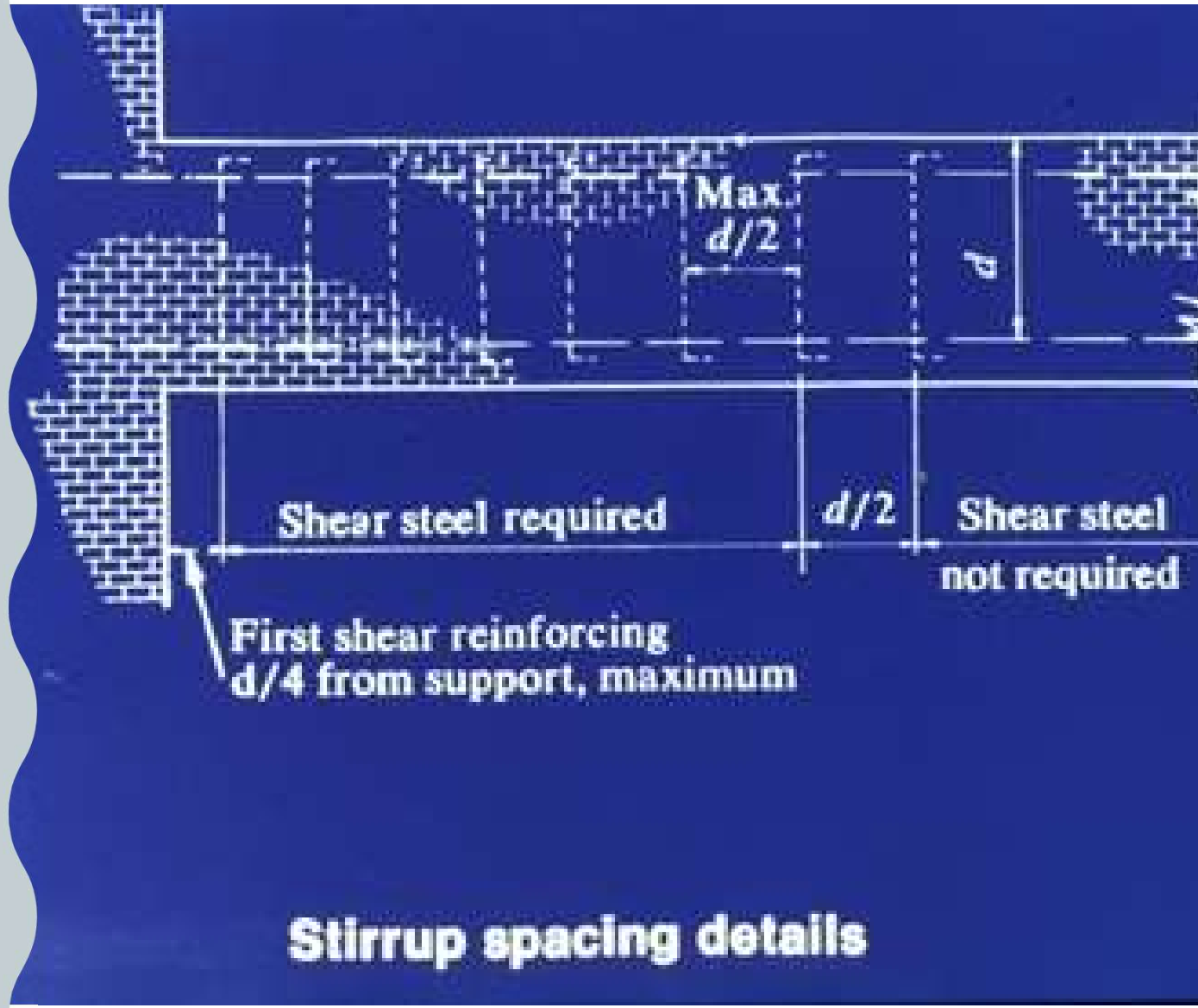
FUNCTION OF SHEAR STEEL IN WALLS



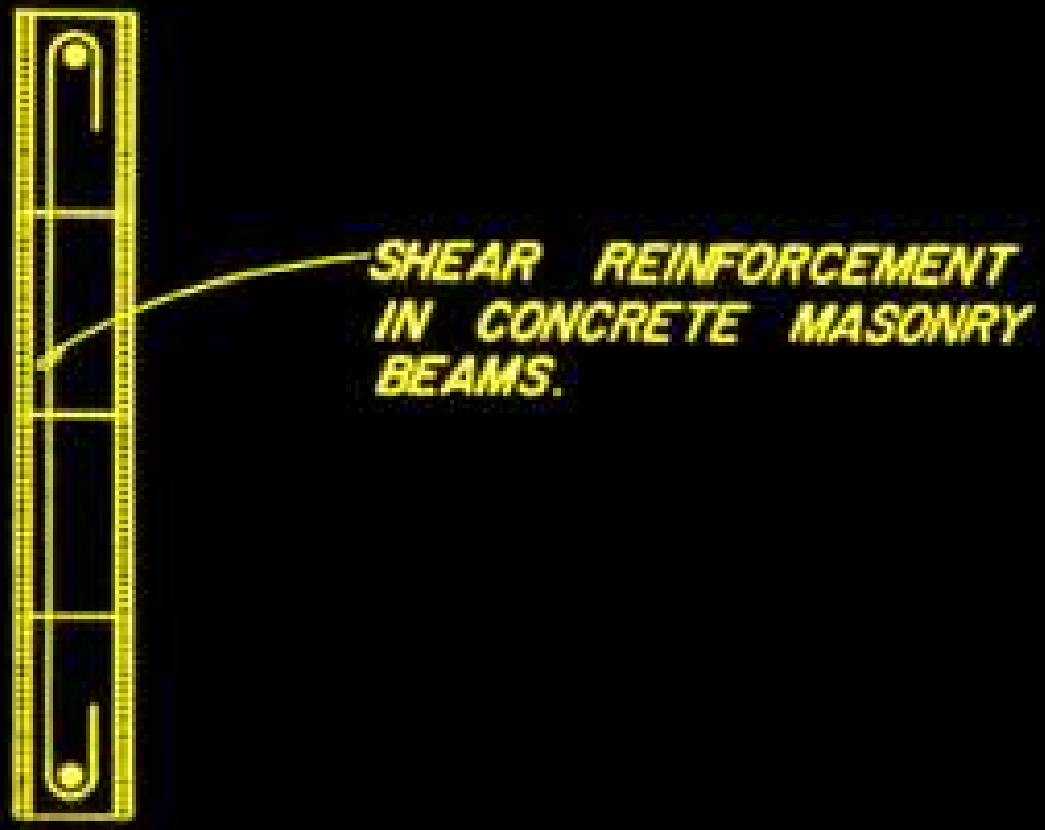


Function of Shear Steel in Beams

SHEAR STEEL IN BEAMS



SHEAR REINFORCEMENT IN DEEP BEAM



EFFECTIVENESS STIRRUPS IN MASONRY & PRECAST

THE MASONRY SOCIETY

TMS 402

Part 3 – Engineered Design Methods

CHAPTER 9 – STRENGTH DESIGN OF MASONRY PG C-123

MAX BAR SIZE

PG. C-135 - SECT 9.3.3.1

REMEMBER – WE ARE IN STRENGTH DESIGN

9.3.3 *Reinforcement requirements and details*

9.3.3.1 *Reinforcement size limitations*

(a) Reinforcing bars used in masonry shall not be larger than No. 9 (M#29). The nominal bar diameter shall not exceed one-quarter of the least clear dimension of the cell, course, or collar joint in which the bar is placed.

#11 BAR FOR ALLOWABLE STRESS DESIGN

NO BUNDLING OF BARS IN STRENGTH DESIGN

PG. C137 - SECT 9.3.3.3

> **9.3.3.3** *Bundling of reinforcing bars* — Reinforcing bars shall not be bundled.

Strength Design Requires Minor Changes However, Lap Lengths Remain the Same as Allowable Stress Design

TMS 402

Part 3 – Engineered Design Methods

CHAPTER 10– PRESTRESSED MASONRY PG C-151

NOT COVERED IN THIS COURSE

Rarely used in Florida – Eliminates Grouting

Figure 13

Figure 14

CHAPTER 10
PRESTRESSED MASONRY

The primary use of Prestressed Masonry has been for homes in the Phoenix area.

It offers the possibility of saving $ through:

- 1. No need for grout in down cells.
- 2. Greater strengths at less cost

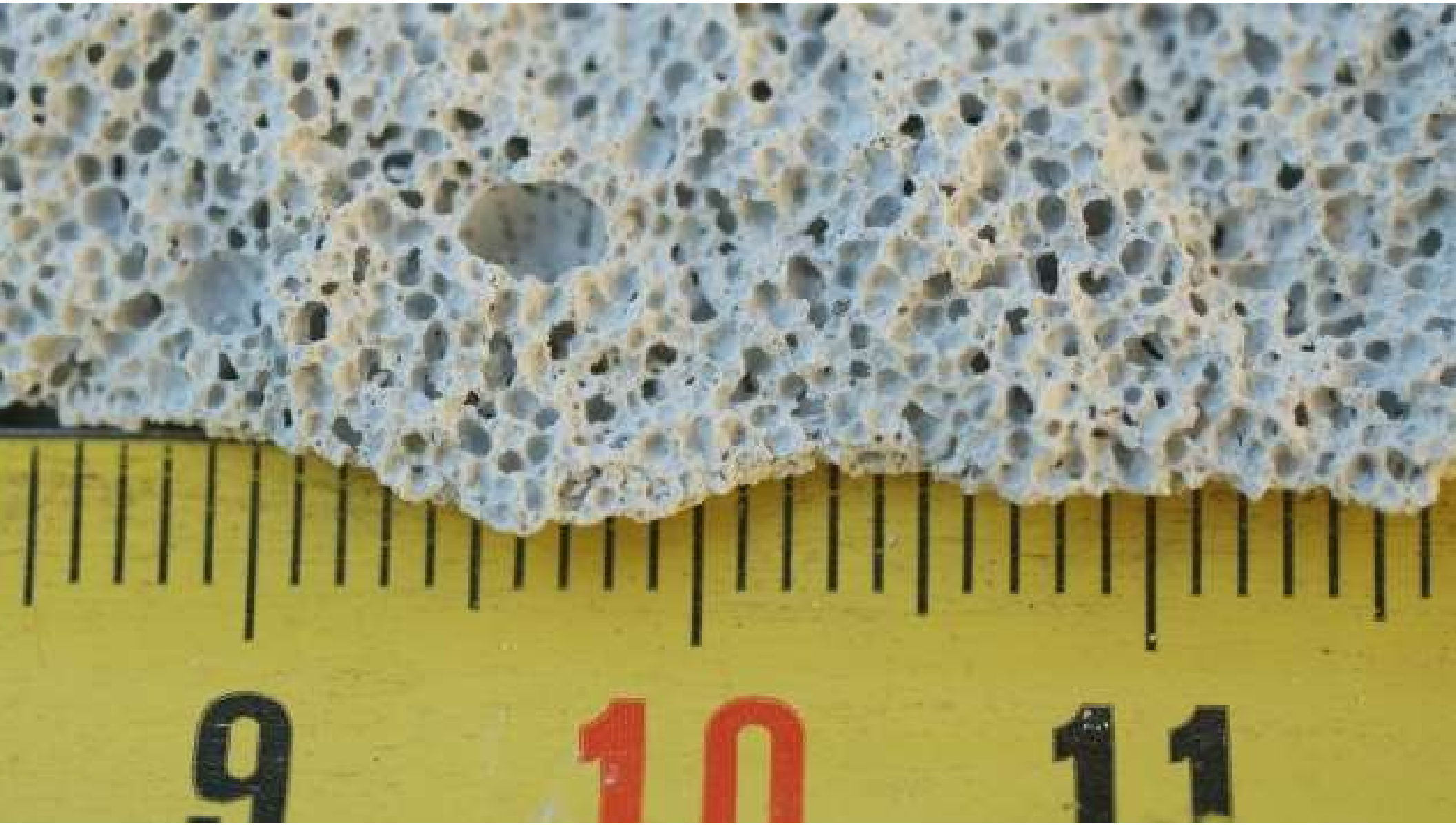
NOT COVERED IN THIS COURSE

TMS 402

Part 3 – Engineered Design Methods

CHAPTER 11 - STRENGTH DESIGN OF AUTOCLAVED AERATED CONCRETE (AAC) MASONRY PG. C-161

NOT COVERED IN THIS COURSE

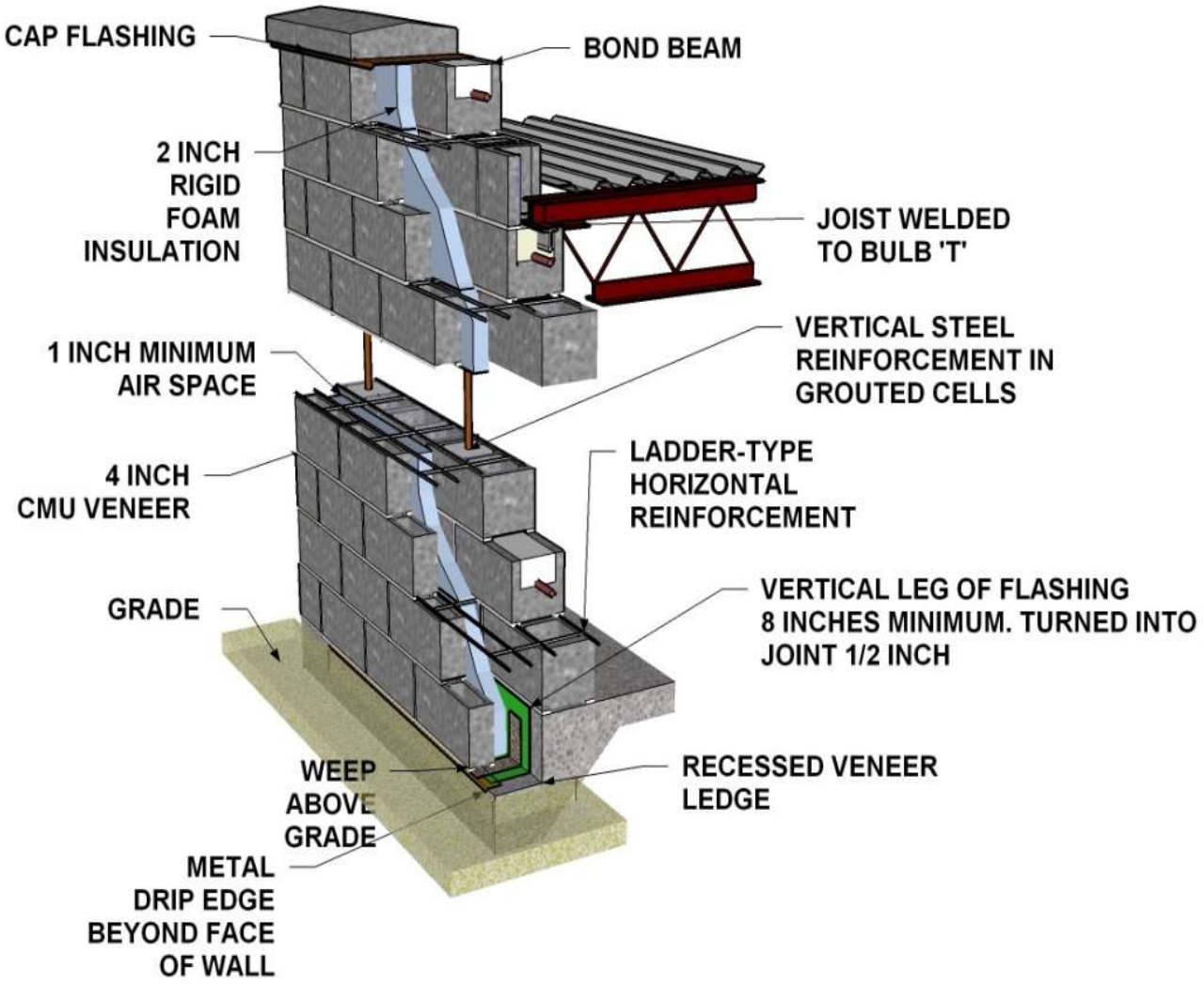

9
10
11

TMS 402

Part 4 – Prescriptive Design Methods

CHAPTER 12 – VENEER PG. C-179

COVERED IN C1 - BRICK WITH LISA PELHAM



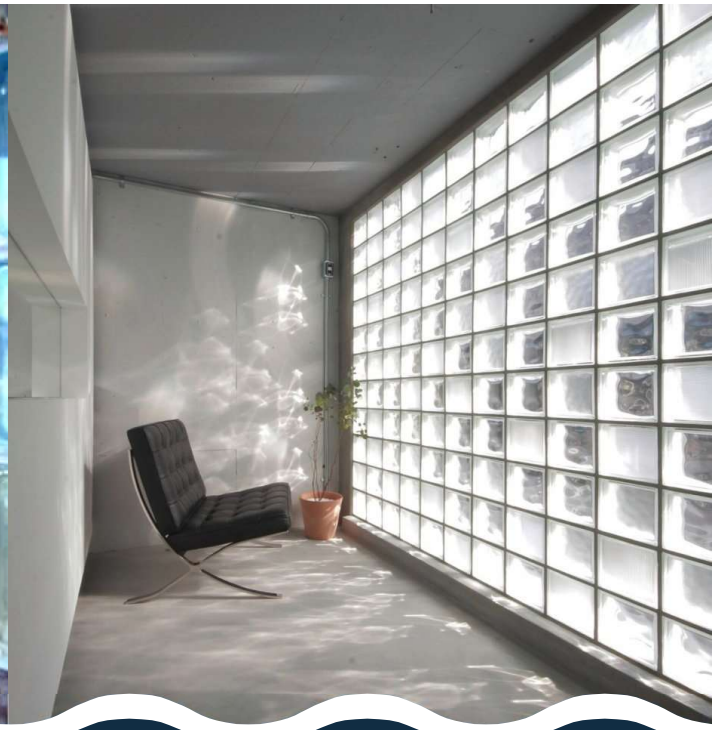
TMS 402

Part 4 – Prescriptive Design Methods

CHAPTER 13 – GLASS UNIT MASONRY PG. C-191

NOT COVERED IN THIS COURSE





GLASS UNIT MASONRY

TMS 402

Part 4 – Prescriptive Design Methods

CHAPTER 14 – MASONRY PARTITION WALLS PG C-197

NOT COVERED IN THIS COURSE

TMS 402

Part 5 – Appendices

APPENDIX A – EMPIRICAL DESIGN OF MASONRY PG. C-203

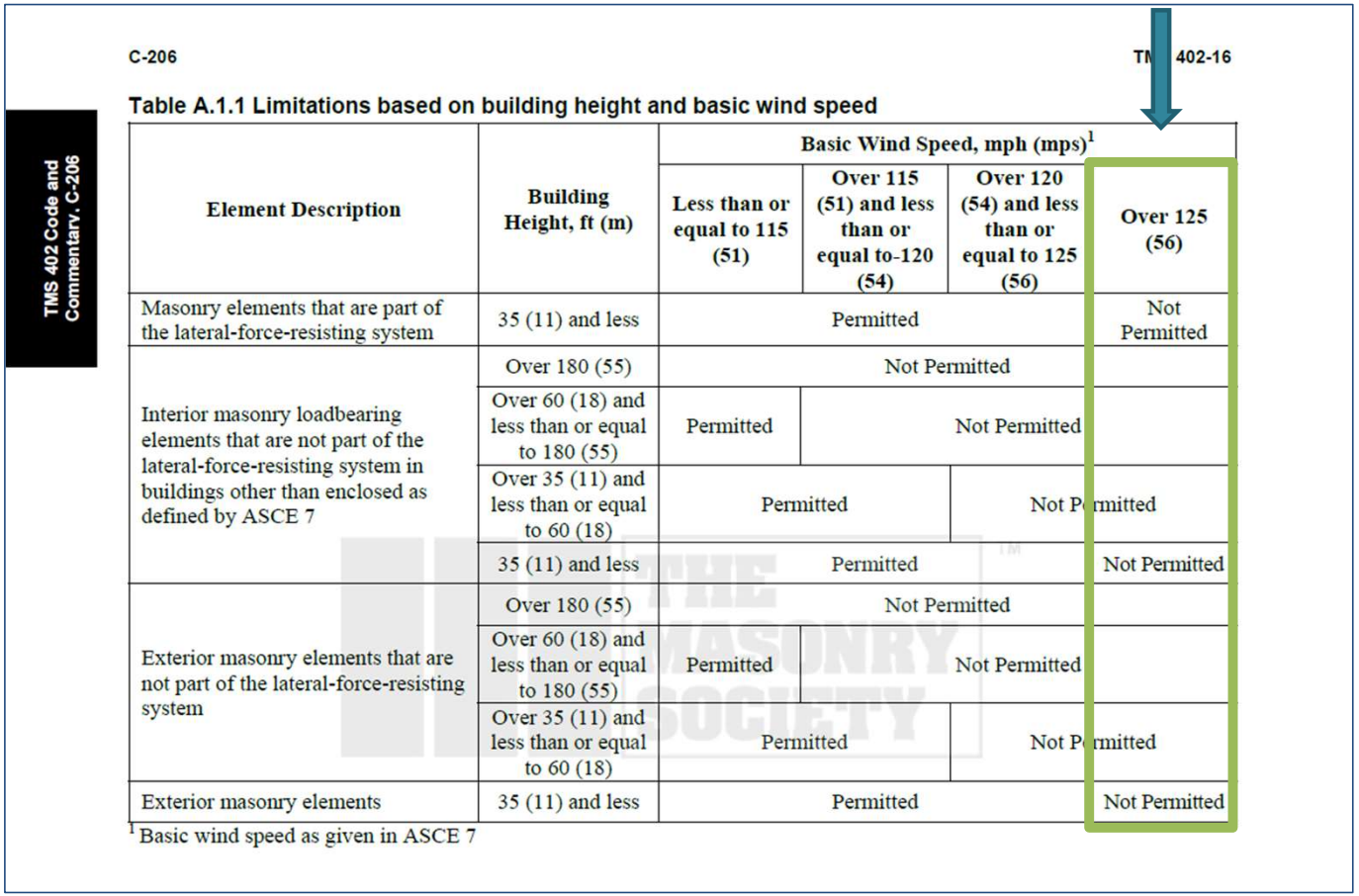
NOT COVERED IN THIS COURSE


Not Applicable in HVHZ

EMPIRICAL DESIGN LIMITATIONS

PG. C-206 - TABLE A.1.1

NOT PERMITTED



C-206

TMS 402-16

TMS 402 Code and Commentary, C-206

Table A.1.1 Limitations based on building height and basic wind speed

Element Description	Building Height, ft (m)	Basic Wind Speed, mph (mps)[1]			
		Less than or equal to 115 (51)	Over 115 (51) and less than or equal to-120 (54)	Over 120 (54) and less than or equal to 125 (56)	Over 125 (56)
Masonry elements that are part of the lateral-force-resisting system	35 (11) and less	Permitted			Not Permitted
Interior masonry loadbearing elements that are not part of the lateral-force-resisting system in buildings other than enclosed as defined by ASCE 7	Over 180 (55)	Not Permitted			
	Over 60 (18) and less than or equal to 180 (55)	Permitted	Not Permitted		
	Over 35 (11) and less than or equal to 60 (18)	Permitted		Not Permitted	
	35 (11) and less	Permitted			Not Permitted
Exterior masonry elements that are not part of the lateral-force-resisting system	Over 180 (55)	Not Permitted			
	Over 60 (18) and less than or equal to 180 (55)	Permitted	Not Permitted		
	Over 35 (11) and less than or equal to 60 (18)	Permitted		Not Permitted	
Exterior masonry elements	35 (11) and less	Permitted			Not Permitted

[1] Basic wind speed as given in ASCE 7

EMPIRICAL DESIGN LIMITATIONS

ASCE 7-10 Wind Speed Map

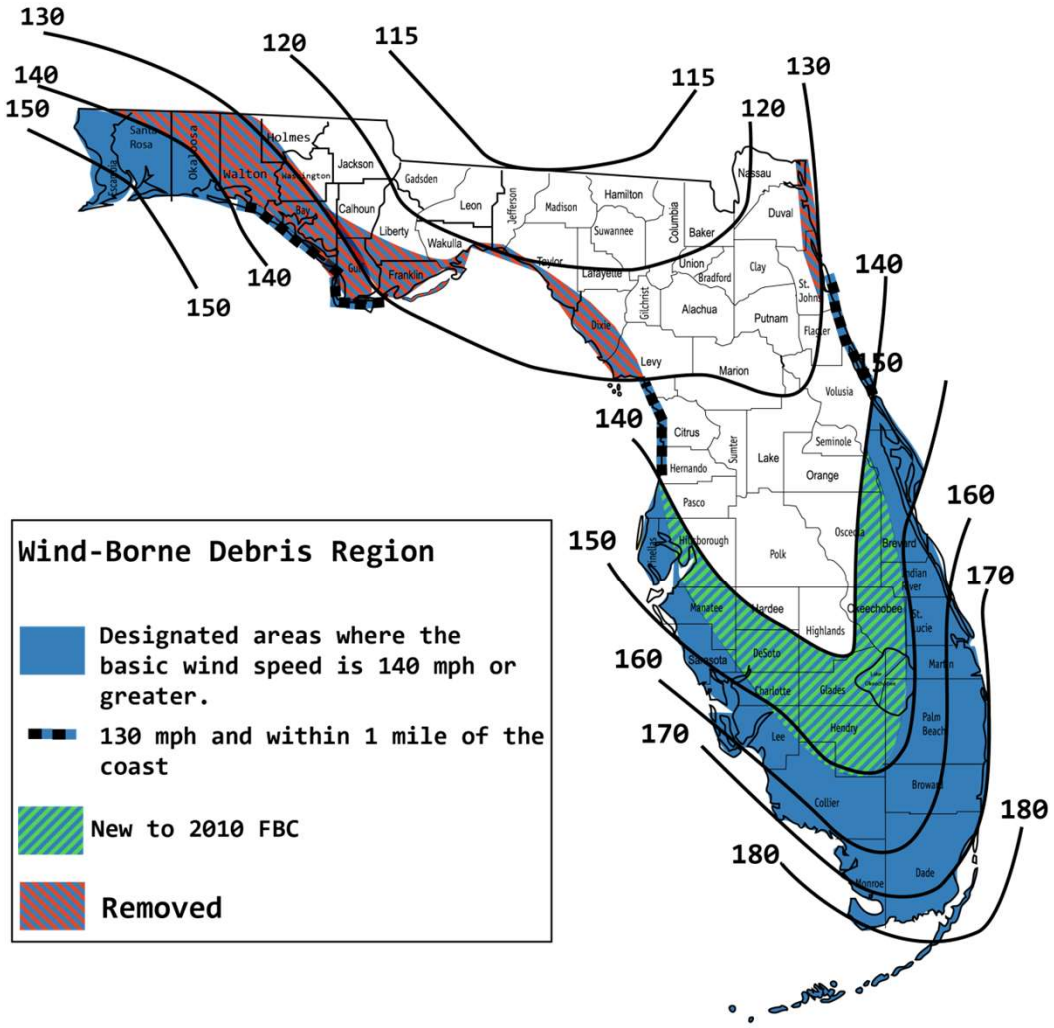


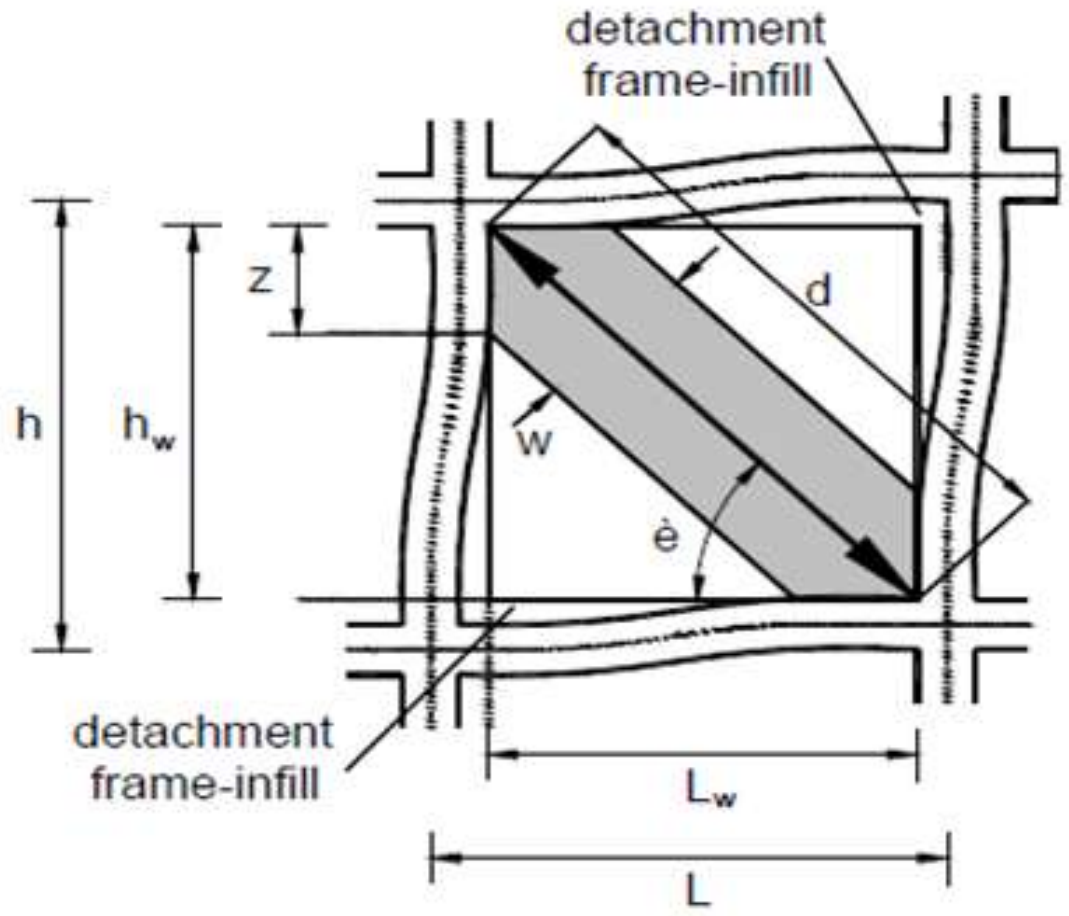
Figure 1609A Wind-Borne Debris Region, Category II and III Buildings and Structures except health care facilities

TMS 402

Part 5 – Appendices

APPENDIX B – DESIGN OF MASONRY INFILL PG. C-221

NOT COVERED IN THIS COURSE


detachment
frame-infill
z
d
h
h_w
w
è
detachment
frame-infill
L_w
L

TMS 402

Part 5 – Appendices

APPENDIX C – LIMIT DESIGN METHODS PG. C-229*

NOT COVERED IN THIS COURSE

*Applies to Perforated Shear Walls Subjected to In-Plane Seismic Loading

THE MASONRY SOCIETY

TMS 602

Specification for Masonry Structures

TMS 602-16 (FORMERLY ACI 530.1 AND ASCE 7)

CSI ORGANIZATIONAL FORMAT

THE MASONRY SOCIETY

TMS 602

Part 1 – General

TMS 602 SPECIFICATION PG S3

MSJC JOINT COMMITTEE

REFERENCE STANDARDS

PG. S-9 SECT 1.3

TMS 602 SPECIFICATION

1.3 — Reference standards

Standards referred to in this Specification are listed below with their serial designations, including year of adoption or revision, and are declared to be part of this Specification as if fully set forth in this document except as modified here.

…Are all part of the specifications

American Concrete Institute

A. ACI 117-10 Standard Specifications for Tolerances for Concrete Construction and Materials

American National Standards Institute

B. ANSI A 137.1-12 Standard Specification for Ceramic Tile

+ all of the ASTMs Listed

COMPRESSIVE STRENGTH

PG. S-15 - SECT 1.4B

1.4 B. *Compressive strength determination*

1. *Methods for determination of compressive strength* — Determine the compressive strength for each wythe by the unit strength method or by the prism test method as specified here.

UNIT STRENGTH METHOD IS PREFERRED

COMPRESSIVE STRENGTH

PG. S-18 - SECT 1.4 B.2.

1.4 B.2. *Unit strength method* (Continued)

b. *Concrete masonry* — Use Table 2 to determine the compressive strength of concrete masonry based on the strength of the unit and type of mortar specified. The following Articles must be met:

1) Units are sampled and tested to verify conformance with ASTM C90.

2) Thickness of bed joints does not exceed $^{5}/_{8}$ in. (15.9 mm).

3) For grouted masonry, the grout conforms to Article 2.2.(ASTM C476)

COMPRESSIVE STRENGTH

PG. S-18 TABLE 2

Table 2 — Compressive strength of masonry based on the compressive strength of concrete masonry units and type of mortar used in construction

Net area compressive strength of concrete masonry, psi (MPa)	Net area compressive strength of concrete masonry units, psi (MPa)	
	Type M or S mortar	Type N mortar
1,700 (11.72)	---	1,900 (13.10)
1,900 (13.10)	1,900 (13.10)	2,350 (14.82)
2,000 (13.79)	2,000 (13.79)	2,650 (18.27)
2,250 (15.51)	2,600 (17.93)	3,400 (23.44)
2,500 (17.24)	3,250 (22.41)	4,350 (28.96)
2,750 (18.96)	3,900 (26.89)	-----
3,000 (20.69)	4,500 (31.03)	-----

[1]For units of less than 4 in. (102 mm) nominal height, use 85 percent of the values listed.

QUALITY ASSURANCE

SECTIONS 1.5 AND 1.6

EXEMPTED BY FLORIDA BUILDING CODE

Section 2107
Allowable Stress Design
2107.1 General. The design of masonry structures using *allowable stress design* shall comply with Section 2106 and the requirements of Chapters 1 through 8 of TMS 402……..

Exception: Where plan review and inspections are performed by a local building department……provisions of TMS 402……Chapter 3, Section 3.1……and TMS 602……..Section 1.5 and 1.6 shall not apply unless specified by the architect or engineer, or the building official.

COLD WEATHER

PG. S-30 SECT 1.8 C.

40 degrees & falling

1.8 C. *Cold weather construction* — When ambient air temperature is below 40°F (4.4°C), implement cold weather procedures and comply with the following:

1. Do not lay glass unit masonry.
2. *Preparation* — Comply with the following requirements prior to conducting masonry work:
   a. Do not lay masonry units having either a temperature below 20°F (-6.7°C) or containing frozen moisture, visible ice, or snow on their surface.
   b. Remove visible ice and snow from the top surface of existing foundations and masonry to receive new construction. Heat these surfaces above freezing, using methods that do not result in damage.

COLD WEATHER

PG. S-31 SECT 1.8 C.3

40 degrees & falling

3. *Construction* — These requirements apply to work in progress and are based on ambient air temperature. Do not heat water or aggregates used in mortar or grout above 140°F (60°C). Comply with the following requirements when the following ambient air temperatures exist:

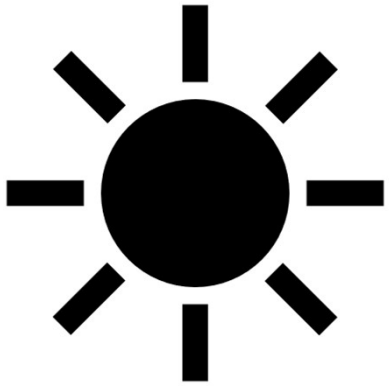
   a. 40°F to 32°F (4.4°C to 0°C):

      1) Heat sand or mixing water to produce mortar temperature between 40°F (4.4°C) and 120°F (48.9°C) at the time of mixing.

      2) Heat grout materials when the temperature of the materials is below 32°F (0°C).

HOT WEATHER CONSTRUCTION

PG. S-33 SECT 1.8 D.



1.8 D. *Hot weather construction* — Implement approved hot weather procedures and comply with the following provisions:

1. *Preparation* — Prior to conducting masonry work:

   a. When the ambient air temperature exceeds 100°F (37.8°C), or exceeds 90°F (32.2°C) with a wind velocity greater than 8 mph (12.9 km/hr):

      1) Maintain sand piles in a damp, loose condition.

      2) Provide necessary conditions and equipment to produce mortar having a temperature below 120°F (48.9°C).

   b. When the ambient temperature exceeds 115°F (46.1°C), or exceeds 105°F (40.6°C) with a wind velocity greater than 8 mph (12.9 km/hr), implement the requirements of Article 1.8 D.1.a and shade materials and mixing equipment from direct sunlight.

NOT LATELY

COOL WATER & RETEMPERING

PG. S-33 SECT 1.8 D. 2. A.

2. *Construction* — While masonry work is in progress:

a. When the ambient air temperature exceeds 100°F (37.8°C), or exceeds 90°F (32.2°C) with a wind velocity greater than 8 mph (12.9 km/hr):

1) Maintain temperature of mortar and grout below 120°F (48.9°C).

2) Flush mixer, mortar transport container, and mortar boards with cool water before they come into contact with mortar ingredients or mortar.

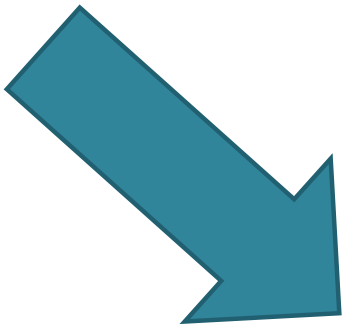
COOL WATER & RETEMPERING

PG. S-33 SECT 1.8 D 2. A.

3) Maintain mortar consistency by retempering with cool water.

4) Use mortar within 2 hr of initial mixing.

5) Spread thin-bed mortar no more than four feet ahead of AAC masonry units.



THIS IS A COMMAND STATEMENT IT IS NOT A CHOICE

FOG SPRAY

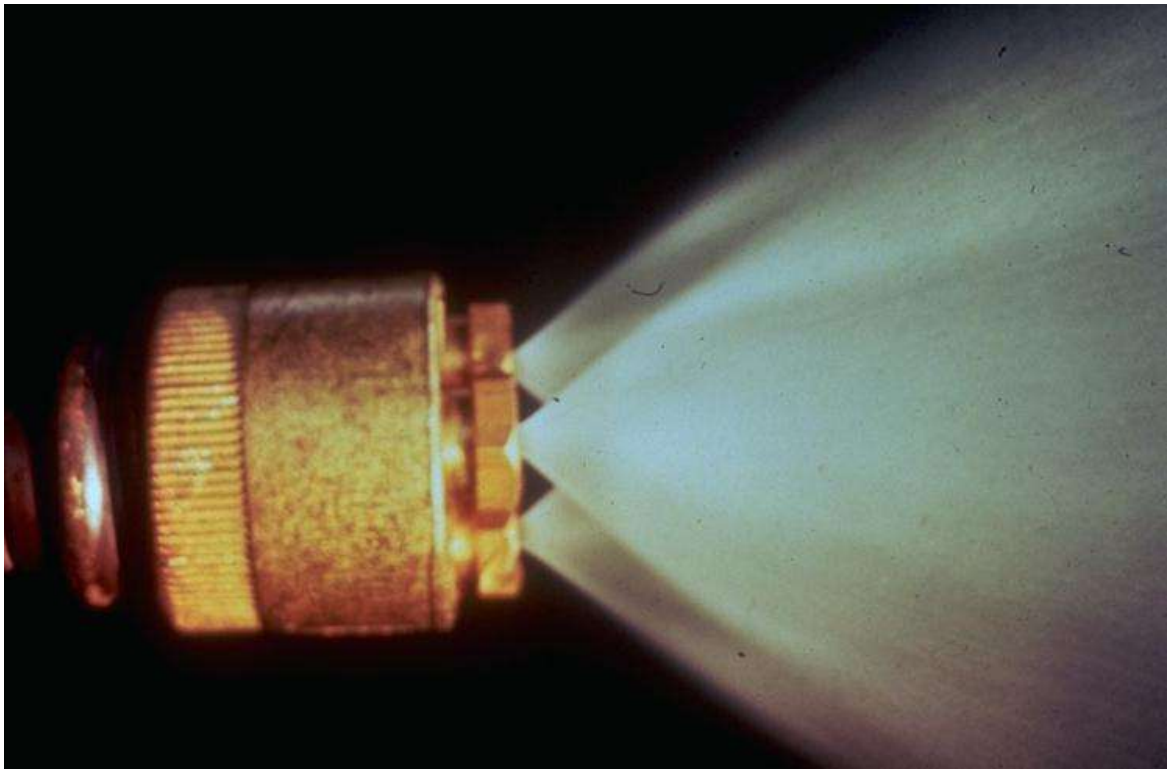
PG. S-33 SECT 1.8 D. 3.

3. *Protection* — When the mean daily temperature exceeds 100°F (37.8°C) or exceeds 90°F (32.2°C) with a wind velocity greater than 8 mph (12.9 km/hr), fog spray newly constructed masonry until damp, at least three times a day until the masonry is three days old.

BRASS FOG NOZZLE

THIS BRASS “FOG” NOZZLE IS GENERALLY AVAILABLE FROM A GARDEN OR NURSERY.

IT PRODUCES A “FINE MIST”.



THE MASONRY SOCIETY

TMS 602

Part 2 – Products

PG S-35

MORTAR & GROUT

PG. S-35 SECT 2.1

2.1 — Mortar materials

2.1 A. Provide mortar of the type and color specified, and conforming with ASTM C270.

MORTAR & GROUT

PG. S-37 SECT 2.2

2.2 — Grout materials

2.2 A. Unless otherwise required, provide grout that conforms to the requirements of ASTM C476.

2.2 B. When f'_m exceeds 2,000 psi (13.79 MPa), provide grout compressive strength that equals or exceeds f'_m. Determine compressive strength of grout in accordance with ASTM C1019.

2.2 C. Do not use admixtures unless acceptable. Field addition of admixtures is not permitted in self-consolidating grout.

JOINT REINFORCING

PG. S-42 SECT 2.4 C.

LADDER TYPE IS THE BEST

2.4 C. *Joint reinforcement*

1. Provide joint reinforcement that conforms to ASTM A951. Maximum spacing of cross wires in ladder-type joint reinforcement and of points of connection of cross wires to longitudinal wires of truss-type joint reinforcement shall be 16 in. (400 mm).

JOINT REINFORCING

PG. S-43 SECT 2.4 F. 1. B.

b. Hot-dip galvanized coatings:

1) Joint reinforcement, wire ties, and wire anchors .....

ASTM A153/A153M (1.50 oz/ft^2) (458 g/m^2)

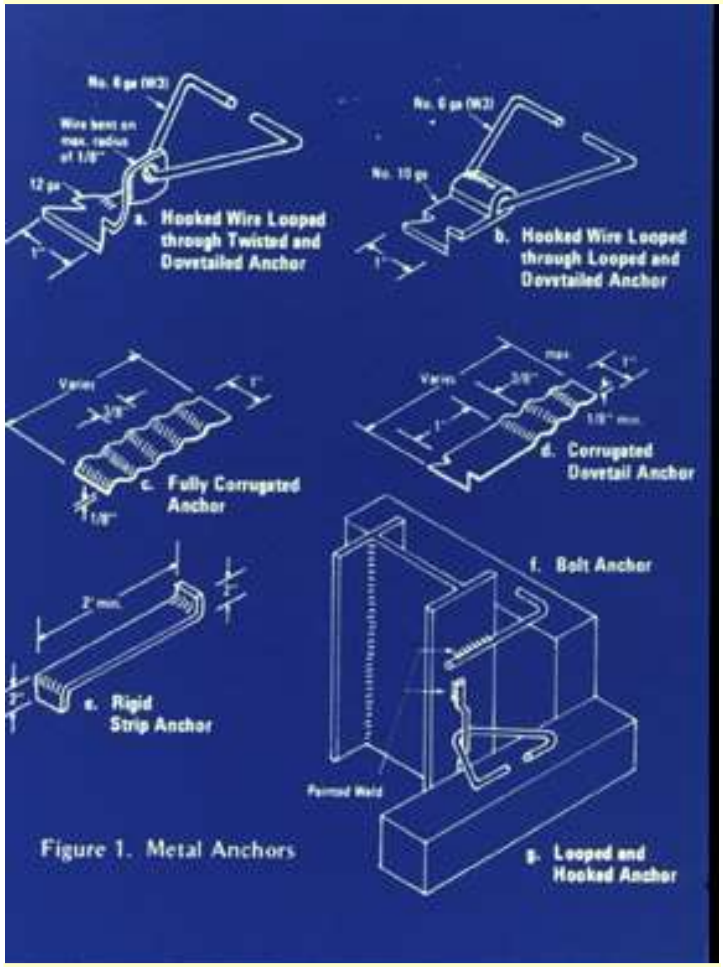
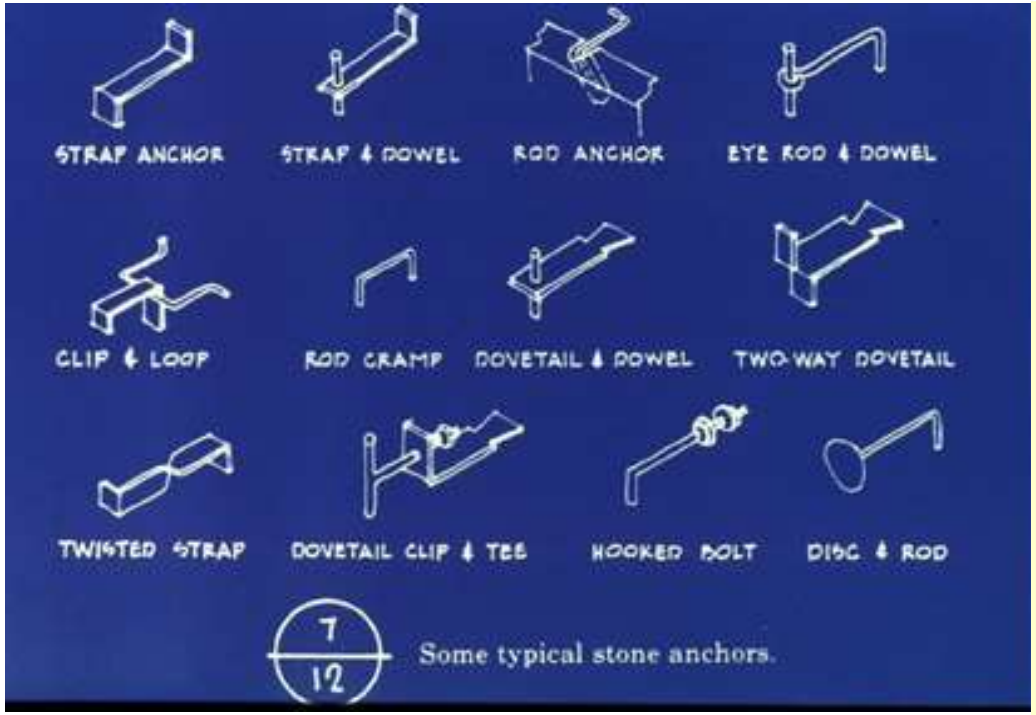


Figure 1. Metal Anchors

ACCESSORY CATALOGS

TIES & CONNECTORS

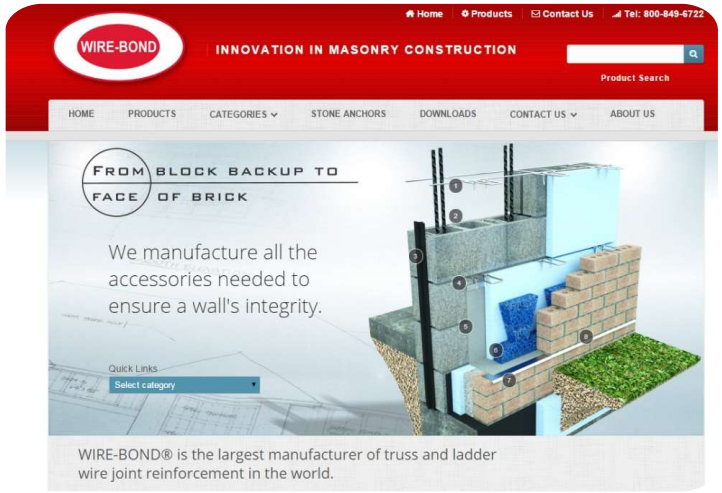
ACCESSORY CATALOGS



TIES & CONNECTORS

ACCESSORY CATALOGS

These documents are web-based only. The link is in your Documents section.



MIXING MORTAR

PG. S-52 SECT 2.6 A.

2.6 — Mixing

2.6 A. *Mortar*

1. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Unless acceptable, do not hand mix mortar. Maintain workability of mortar by remixing or retempering. Discard mortar which has begun to stiffen or is not used within $2^{1}/_{2}$ hr after initial mixing.

MIXING GROUT

PG. S-53 SECT 2.6 B.

2.6 B. *Grout*

1. Except for self-consolidating grout, mix grout in accordance with the requirements of ASTM C476.
2. Unless otherwise required, mix grout other than self-consolidating grout to a consistency that has a slump between 8 and 11 in. (203 and 279 mm).
3. Proportioning of self-consolidating grout at the project site is not permitted. Do not add water at the project site except in accordance with the self-consolidating grout manufacturer's recommendations.

THE MASONRY SOCIETY

TMS 602

Part 3 – Execution

PG. S-57

FOUNDATION TOLERANCE FROM ACI 117

PG. S-57 SECT 3.1 A.

3.1 — Inspection

3.1 A. Prior to the start of masonry construction, the Contractor shall verify:

1. That foundations are constructed within a level alignment tolerance of $\pm 1/2$ in. (12.7 mm).
2. That reinforcing dowels are positioned in accordance with the Project Drawings.

3.1 B. If stated conditions are not met, notify the Architect/Engineer.

FOUNDATION TOLERANCE FROM ACI 117

PG. S-57 FIG. SC-8

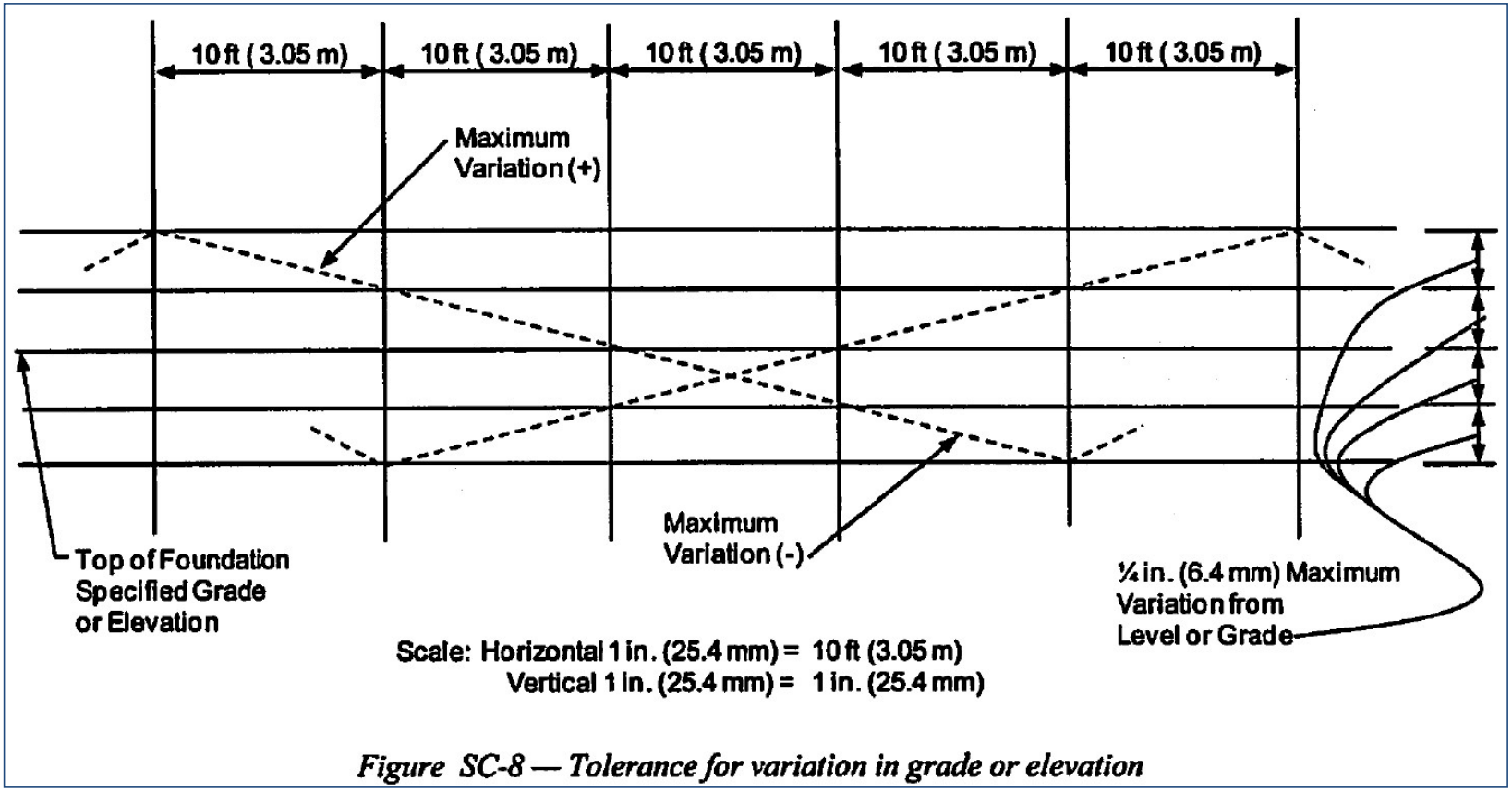


Figure SC-8 — Tolerance for variation in grade or elevation

CLEANOUTS

PG. S-58 SECT 3.2 F.

3.2 F. *Cleanouts* — Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds 5 ft 4 in. (1.63 m).

1. Construct cleanouts so that the space to be grouted can be cleaned and inspected. In solid grouted masonry, space cleanouts horizontally a maximum of 32 in. (813 mm) on center.

2. Construct cleanouts with an opening of sufficient size to permit removal of debris. The minimum opening dimension shall be 3 in. (76.2 mm).

CLEANOUT

BED JOINTS AT FOUNDATIONS

PG. S-59 SECT 3.3 B.

1. *Bed joints at foundations* — In the starting course on foundations and other supporting members, construct bed joints so that the bed joint thickness is at least ¼ in. (6.4 mm) and not more than:

   a. ¾ in. (19.1 mm) when the masonry is ungrouted or partially grouted.

   b. 1¼ in. (31.8 mm) when the first course of masonry is solid grouted and supported by a concrete foundation.

BED JOINTS AT FOUNDATIONS

PG. S-59 FIG. SC-9

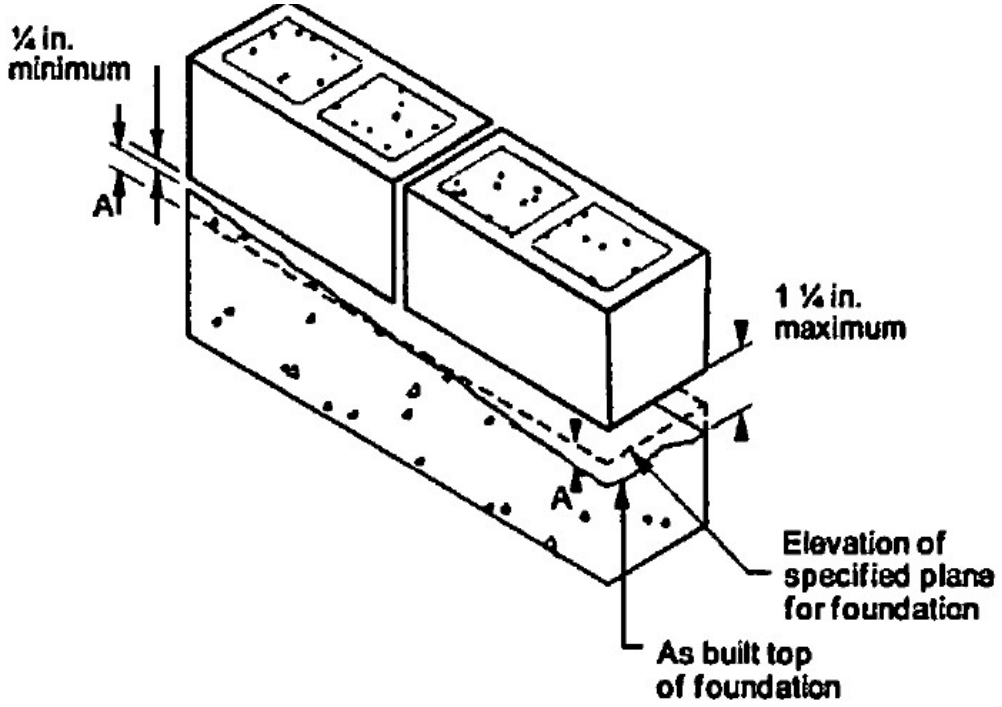


Figure SC-9 Mortar bed joint thickness for solid grouted walls on a foundation

LAYING BLOCK

PG. S-60 SECT 3.3 B. 2.

TOOL JOINT WHEN THUMB PRINT HARD

3.3 B. *Placing mortar and units* (Continued)

2. *Bed and head joints* — Unless otherwise required, construct $^{3}/_{8}$-in. (9.5-mm) thick bed and head joints, except at foundation or with glass unit masonry. Provide glass unit masonry bed and head joint thicknesses in accordance with Article 3.3 B.7.c. Provide AAC masonry bed and head joint thicknesses in accordance with Article 3.3 B.9.b. Construct joints that also conform to the following:

   a. Fill holes not specified in exposed and below grade masonry with mortar.

   b. Unless otherwise required, tool joint with a round jointer when the mortar is thumbprint hard.

   c. Remove masonry protrusions extending $^{1}/_{2}$ in. (12.7 mm) or more into cells or cavities to be grouted.

LAYING BLOCK

PG. S-60 SECT 3.3 B. 4.

ALIGN VERTICAL CELLS

4. *Hollow units* — Place hollow units so:

   a. Face shells of bed joints are fully mortared.

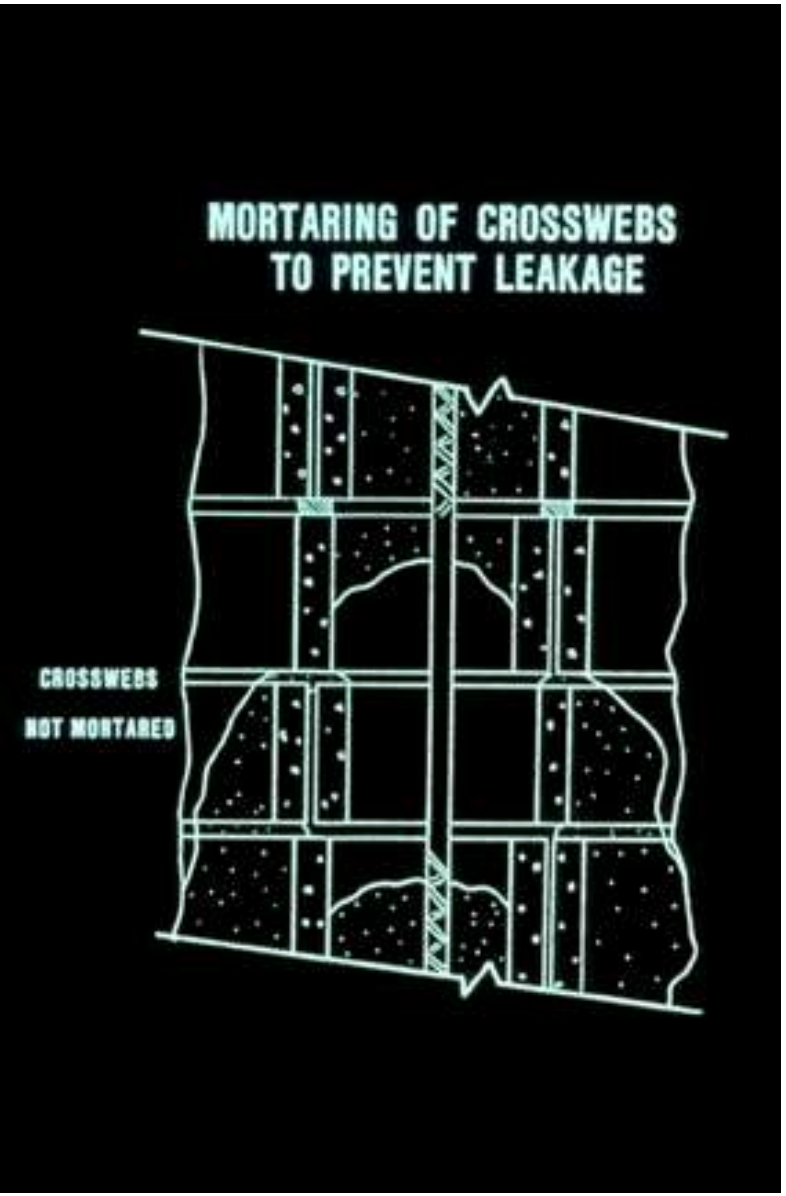
   b. Webs are fully mortared in:

      1) all courses of columns and pilasters;

      2) when necessary to confine grout or insulation.

   c. Head joints are mortared, a minimum distance from each face equal to the face shell thickness of the unit.

   d. Vertical cells to be grouted are aligned and unobstructed openings for grout are provided in accordance with the Project Drawings.



MORTAR ON CROSS WEBS

CONFINE THE GROUT

LAYING BLOCK

PG. S-61 SECT 3.3 B. 5.

NO "BUTTERING" OF HEAD JOINTS

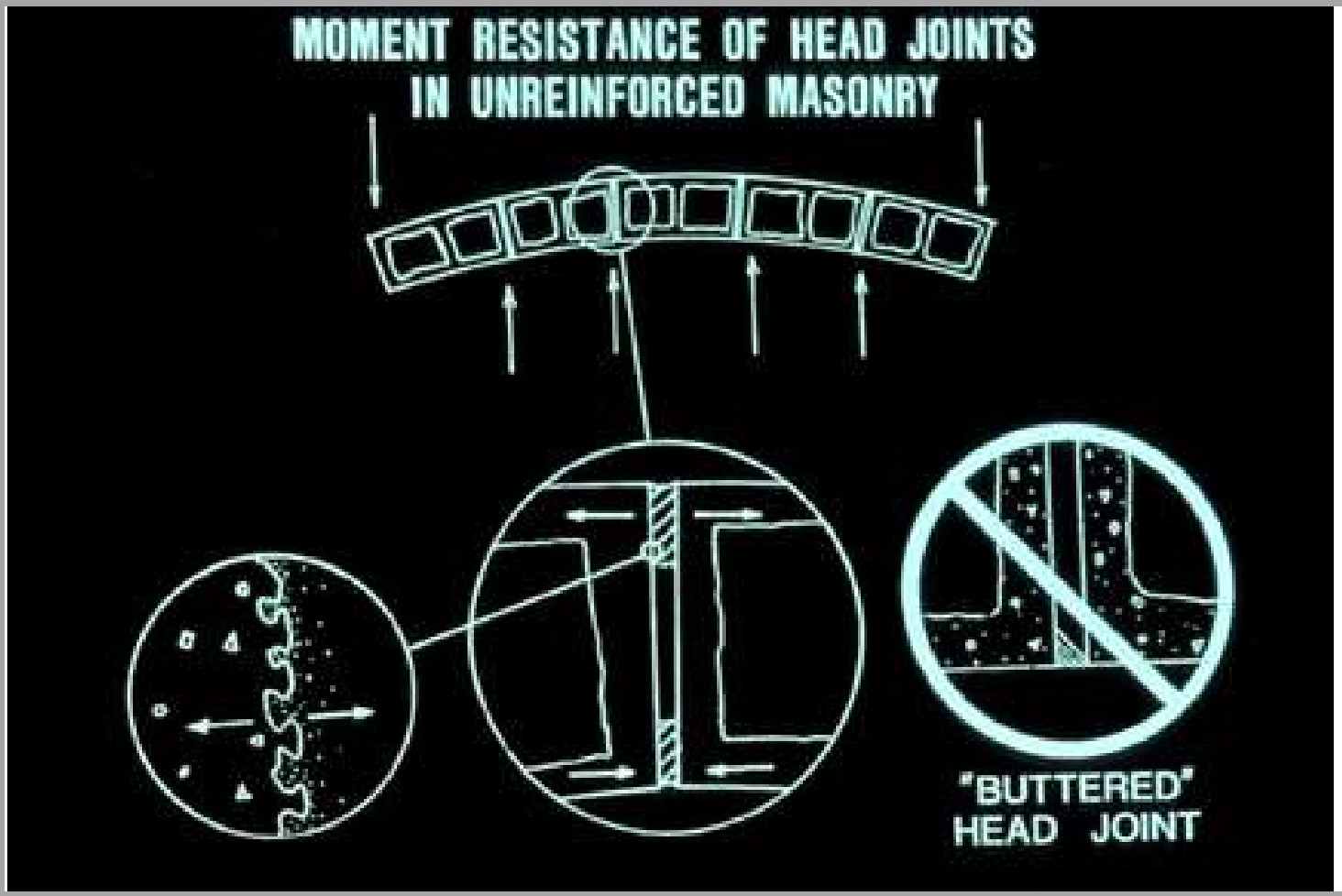
3.3 B. *Placing mortar and units* (Continued)

5. *Solid units* — Unless otherwise required, place mortar so that bed and head joints are fully mortared and:

   a. Do not fill head joints by slushing with mortar.

   b. Construct head joints by shoving mortar tight against the adjoining unit.

   c. Do not deeply furrow bed joints.



MOMENT AND MOISTURE RESISTANCE


BLOCK LAYING

BLOCK LAYING


WORKMANSHIP

HEAD JOINTS

HEAD JOINTS

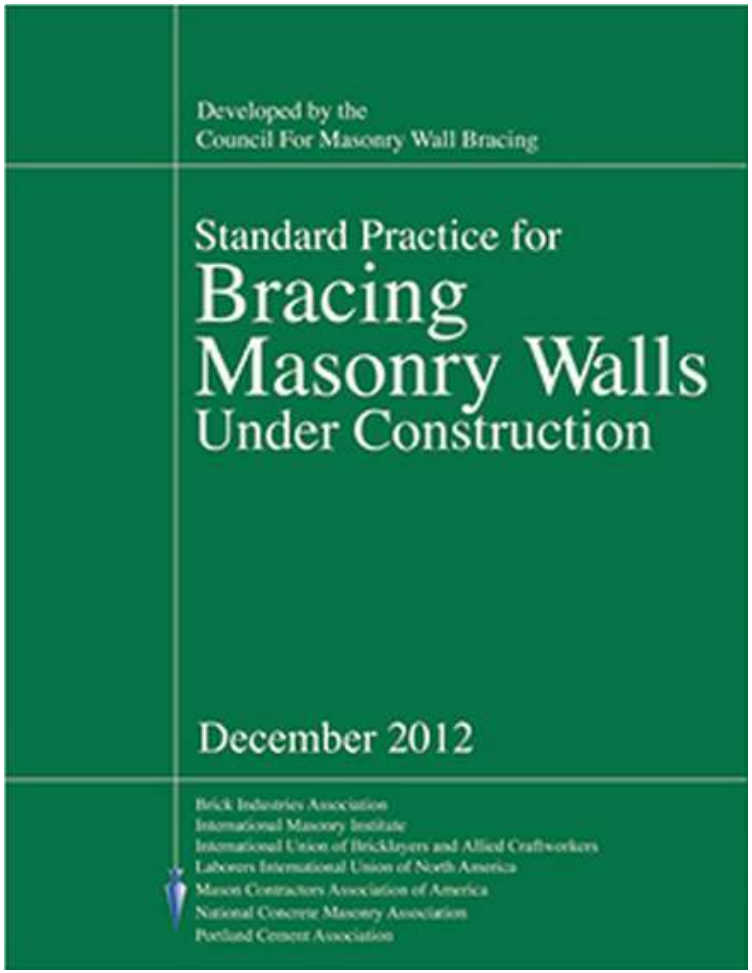
BRACING OF MASONRY

PG. S-64 SECT 3.3 E.

3.3 E. *Bracing of masonry* — Design, provide, and install bracing that will assure stability of masonry during construction.

IS BRACING A REQUIREMENT?

BRACING MASONRY WALLS DURING CONSTRUCTION



BRACING

An information series from the national authority on concrete masonry technology

CEMEX

NATIONAL CONCRETE MASONRY ASSOCIATION
Sustainable Concrete Products for Structures and Hardscapes

BRACING CONCRETE MASONRY WALLS UNDER CONSTRUCTION

TEK 3-4C
Construction (2014)

INTRODUCTION

Building codes typically place responsibility for providing a reasonable level of life safety for workers during construction on the erecting contractor. Various methods are employed to protect workers while newly constructed masonry walls are curing and/or until the roof or other structural supports are in place. This TEK provides guidelines for masonry wall stability to resist the lateral loading effects of wind during construction. It is based on principles set forth in the Council for Masonry Wall Bracing's *Standard Practice for Bracing Masonry Walls Under Construction* (ref. 1), but has been updated in accordance with the design provisions of the 2011 *Building Code Requirements for Masonry Structures* (MSJC, ref. 2). When other lateral loads such as impact, seismic, scaffolding, and lateral earth pressure are present, they need to be considered and evaluated separately. The *Walls Subject to Backfilling* section at the end of this TEK discusses bracing and support of basement walls during backfilling operations.

WALLS SUBJECT TO WIND LOADS

There are several strategies and considerations for protecting life safety on the jobsite. These include internal bracing, external bracing and evacuation zones. The combination of strategies appropriate for a particular job may depend on the type of masonry construction, masonry wall heights, the time elapsed since construction, and wind speeds at the site.

The industry term "internal bracing" is relatively new. Internal bracing refers to the stability of a masonry assembly

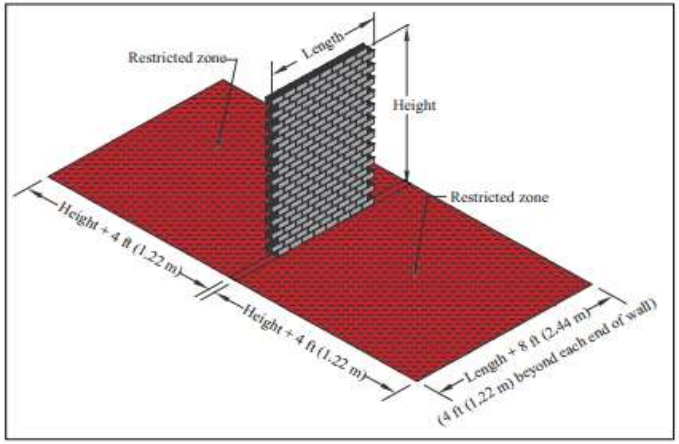


Figure 1—Restricted Zone for Masonry Walls

Related TEK:
14-4B, 14-7C

Keywords: backfilling, basement walls, bracing walls, construction loads, internal bracing, lateral loads, plain concrete masonry, restricted zone, unreinforced concrete masonry, wind loads

BRACING

Table 2—Intermediate Period Maximum Unbraced Heights, ft (m)[A, B] (based on ref. 2)
Type M or S Mortar Only[L]

Support Condition	Evacuation Wind Speed:					
	15 mph (6.7 m/s)		25 mph (11.2 m/s)		35 mph (15.6 m/s)	
	PCL & MRC[D]	MC[E]	PCL & MRC[D]	MC[E]	PCL & MRC[D]	MC[E]
Unreinforced 8 in. (203 mm) wall						
Unbonded[F]	10'-0" (3.05)		4'-8" (1.42)[G]		2'-8" (0.81)[G]	
Bonded[L]:						
Above grade or line of support	23'-0" (7.01)	23'-0" (7.01)	17'-4" (5.28)	14'-4" (4.36)	12'-4" (3.75)	10'-0" (3.05)
Vertical spacing between braces	21'-4" (6.50)	18'-0" (5.48)	21'-0" (6.40)	17'-4" (5.28)	15'-0" (4.57)	12'-4" (3.75)
Above top brace	10'-8" (3.25)	9'-0" (2.74)	10'-4" (3.14)	8'-8" (2.64)	7'-4" (2.23)	6'-0" (1.82)
Unreinforced 12 in. (305 mm) wall						
Unbonded[F]	20'-0" (6.09)		9'-4" (2.84)		5'-4" (1.62)[G]	
Bonded[L]						
Above grade or line of support	32'-0" (9.75)	32'-0" (9.75)	27'-0" (8.22)	21'-4" (6.50)	17'-4" (5.28)	14'-4" (4.36)
Vertical spacing between braces	32'-0" (9.75)	32'-0" 9.75)	30'-8" (9.34)	26'-0" (7.92)	21'-4" (6.50)	17'-4" (5.28)
Above top brace	16'-0" (4.87)	16'-0" (4.87)	15'-4" (4.67)	13'-0" (3.96)	10'-8" (3.25)	8'-8" (2.64)
Reinforced 8 in. (203 mm) wall[I, J]						
No. 5 at 10 ft o.c. (M#16 at 3.05 m)[M]						
Above grade or line of support	18'-0" (5.48)		18'-0" (5.48)		16'-0" (4.87)	
Vertical spacing between braces	21'-8" (6.60)		21'-8" (6.60)		19'-4" (5.89)	
Above top brace	10'-8" (3.25)		10'-8" (3.25)		9'-8" (2.94)	
No. 5 at 4 ft o.c. (M#16 at 1.22 m) [M]						
Above grade or line of support	23'-4" (7.11)		23'-4" (7.11)		23'-4" (7.11)	
Vertical spacing between braces	28'-0" (8.53)		28'-0" (8.53)		28'-0" (8.53)	
Above top brace	14'-0" (4.26)		14'-0" (4.26)		14'-0" (4.26)	

LAYING BLOCK TO A LINE

KEY INSPECTION POINTS

PG. S-64 SECT 3.3 F.

3.3 F. *Site tolerances* — Erect masonry within the following tolerances from the specified dimensions.

1. Dimensional tolerances

   a. In cross section or elevation
   .....-1/4 in. (6.4 mm), +1/2 in. (12.7 mm)

   b. Mortar joint thickness

   bed joints between masonry courses
   .....±1/8 in. (3.2 mm)

   bed joint between flashing and masonry
   ..... - ½ in. (12.7 mm), +1/8 in. (3.2 mm)

   head .....- 1/4 in. (6.4 mm), + 3/8 in. (9.5 mm)

   collar.....-1/4 in. (6.4 mm), + 3/8 in. (9.5 mm)

HEAD JOINTS 1/8" TO ¾"

TOLERANCE TABLE

PG. S-65 SECT 3.3 F.

¼" IN 10' – ½" MAX

3.3 F. *Site tolerances* (Continued)

2. Members

a. Variation from level:

bed joints

..... $\pm 1/4$ in. (6.4 mm) in 10 ft (3.05 m)
..... $\pm 1/2$ in. (12.7 mm) maximum

top surface of load-bearing walls

..... $\pm 1/4$ in. (6.4 mm) in 10 ft (3.05 m)
..... $\pm 1/2$ in. (12.7 mm) maximum

b. Variation from plumb

..... $\pm 1/4$ in. (6.4 mm) in 10 ft (3.05 m)
..... $\pm 3/8$ in. (9.5 mm) in 20 ft (6.10 m)
..... $\pm 1/2$ in. (12.7 mm) maximum

c. True to a line

..... $\pm 1/4$ in. (6.4 mm) in 10 ft (3.05 m)
..... $\pm 3/8$ in. (9.5 mm) in 20 ft (6.10 m)
..... $\pm 1/2$ in. (12.7 mm) maximum

d. Alignment of columns and walls (bottom versus top)

..... $\pm 1/2$ in. (12.7 mm) for load-bearing walls and columns
. $\pm 3/4$ in. (19.1 mm) for non-load-bearing walls

TOLERANCE TABLE

PG. S-65 SECT 3.3 F. 4.

4. If the above conditions cannot be met due to previous construction, notify the Architect/ Engineer.

CLEARANCE BETWEEN STEEL & INSIDE FACE OF MASONRY (AGAIN!)

PG. S-66 SECT 3.4 B.

Historical Values for Support 192 Bar Diameters

Fine grout ¼"
Coarse grout ½"

3.4 B. *Reinforcement*

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances.
2. Completely embed reinforcing bars in grout in accordance with Article 3.5.
3. Maintain clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $^1/_4$ in. (6.4 mm) for fine grout and $^1/_2$ in. (12.7 mm) for coarse grout, except where cross webs of hollow units are used as supports for horizontal reinforcement.

COVER REQUIREMENTS (AGAIN!)

PG. S-66 SECT 3.4 B. 4.

4. Place reinforcing bars maintaining the following minimum cover:

   a. Masonry face exposed to earth or weather: 2 in. (50.8 mm) for bars larger than No. 5 (M #16); 1½ in. (38.1 mm) for No. 5 (M #16) bars or smaller.

   b. Masonry not exposed to earth or weather: 1½ in. (38.1 mm).

PLACEMENT TOLERANCES

3.4 B. *Reinforcement* (Continued)

11. *Placement tolerances*

a. Place reinforcing bars in walls and flexural members within a tolerance of $\pm 1/2$ in. (12.7 mm) when the distance from the centerline of reinforcing bars to the opposite face of masonry, *d*, is equal to 8 in. (203 mm) or less, $\pm$ 1 in. (25.4 mm) for *d* equal to 24 in. (610 mm) or less but greater than 8 in. (203 mm), and $\pm 1\frac{1}{4}$ in. (31.8 mm) for *d* greater than 24 in. (610 mm).

PLACEMENT TOLERANCES

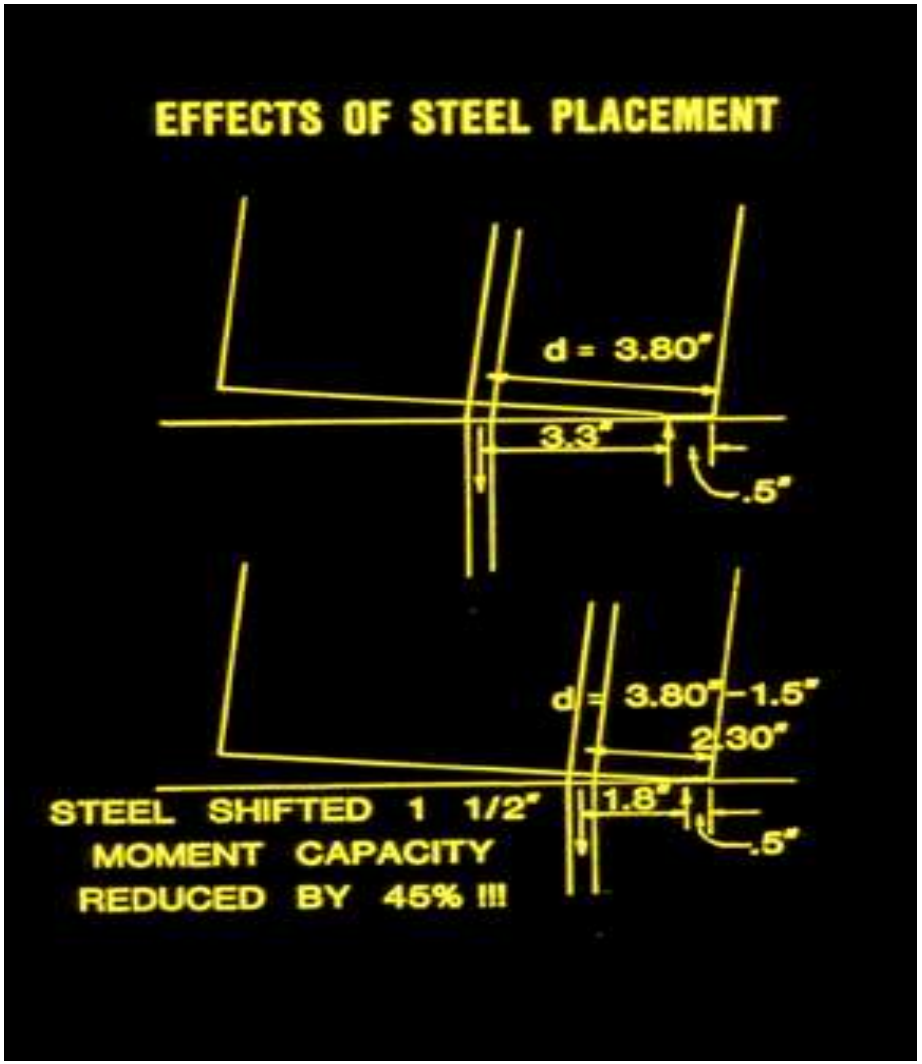
PG. S-69 SECT 3.4 B. 11. B.

b. Place vertical bars within:

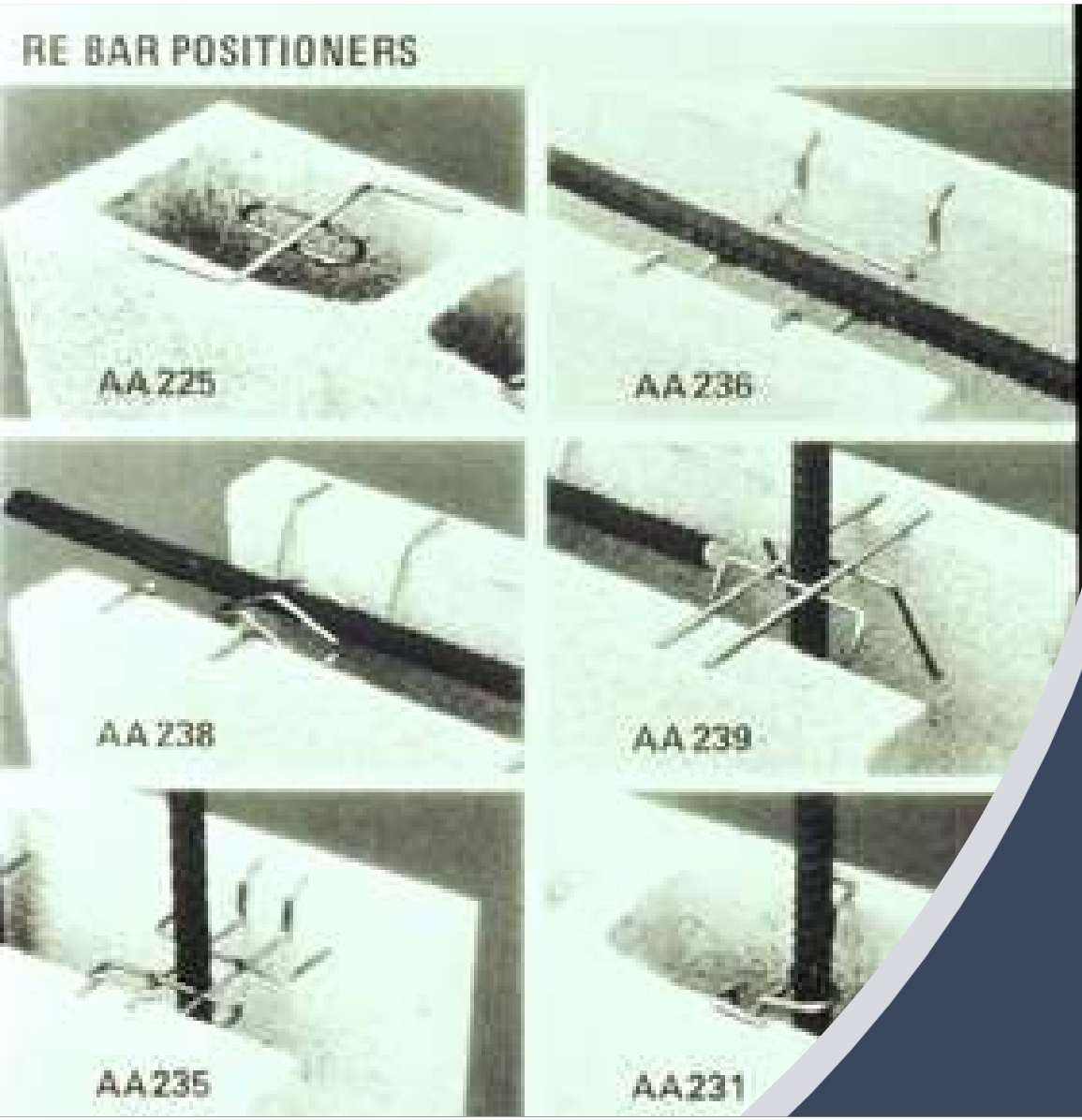
1) 2 in. (50.8 mm) of the required location along the length of the wall when the wall segment length exceeds 24 in. (610 mm).

2) 1 in. (25.4 mm) of the required location along the length of the wall when the wall segment length does not exceed 24 in. (610 mm)

2″ TOLERANCE WHEN WALL LENGTH EXCEEDS 24″



STEEL PLACEMENT



BAR POSITIONERS

DOWEL CORRECTIONS

PG. S-71 SECT 3.4 B. 11. D.

3.4 B.11. *Reinforcement, Placement tolerances*
(Continued)

d. Foundation dowels that interfere with unit webs are permitted to be bent to a maximum of 1 in. (25.4 mm) horizontally for every 6 in. (152 mm) of vertical height.

DOWEL CORRECTIONS

PG. S-71 FIG. SC-17

Max Bend
1:6

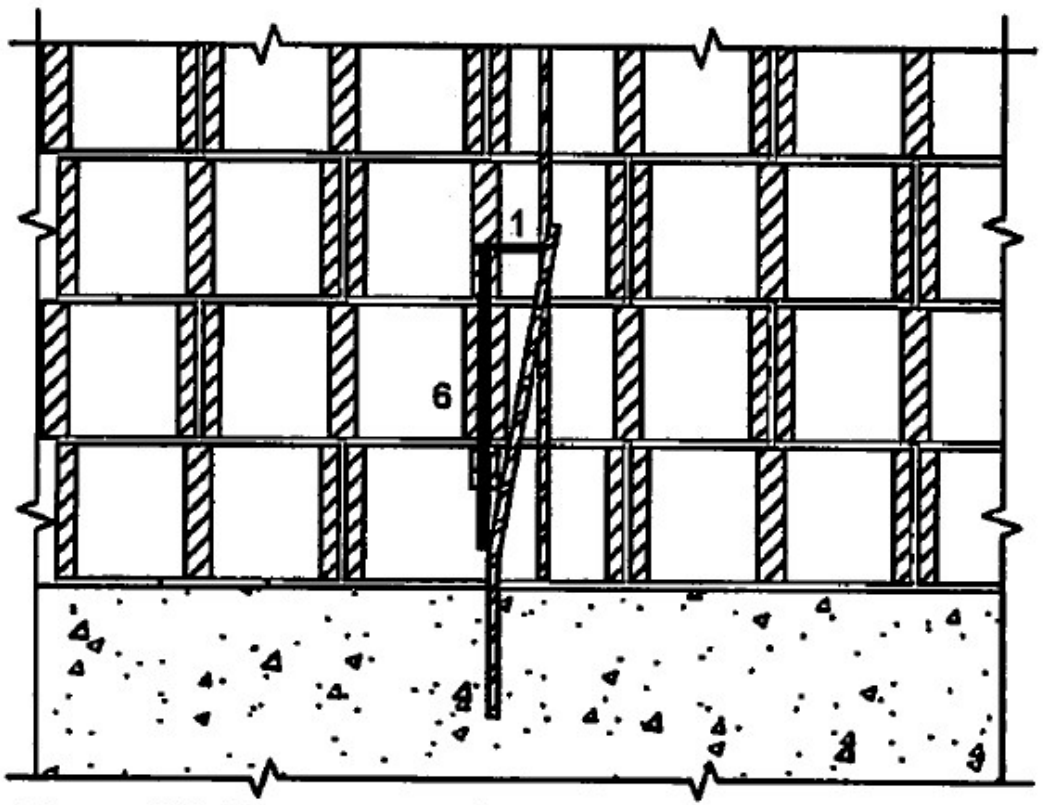
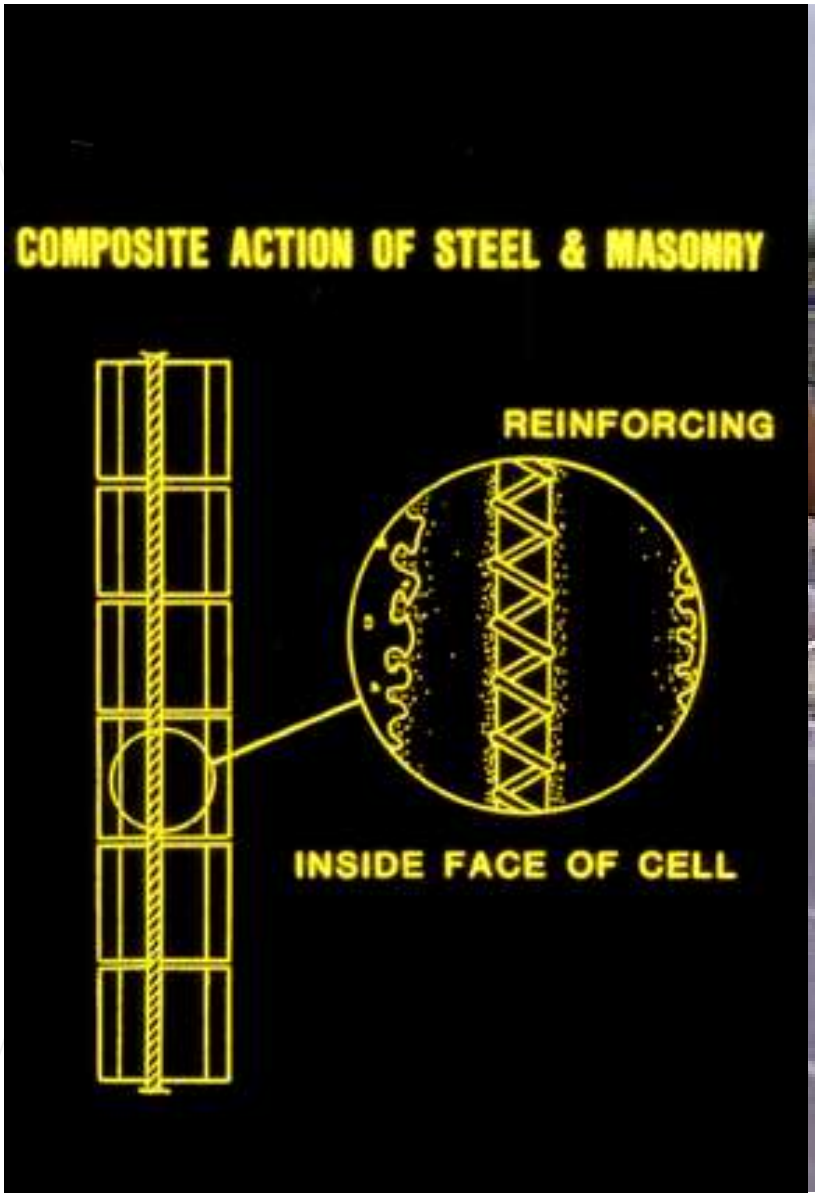


Figure SC-17 — Permitted Bending of Foundation Dowels

GROUTING THE WALL

BAR MUST BE EMBEDDED IN GROUT



GROUTING

PG. S-76 SECT 3.5 A.

CONFLICTS W/ FLB

3.5 A. *Placing time* — Place grout within 1½ hr from introducing water in the mixture and prior to initial set.

1. Discard site-mixed grout that does not meet the specified slump without adding water after initial mixing.

2. For ready-mixed grout:

   a. Addition of water is permitted at the time of discharge to adjust slump.

   b. Discard ready-mixed grout that does not meet the specified slump without adding water, other than the water that was added at the time of discharge.

The time limitation is waived as long as the ready-mixed grout meets the specified slump.

GROUTING

7TH ED. FBC SECT 2122.8.7

CONFLICT BETWEEN TMS 602-16 & FBC 7TH ED.

2122.8.7 Grout shall be placed before any initial set has occurred, but in no case more than $1^{1}/_{2}$ hours after the mix-designed water has been added.

SUGGEST WORKING THIS OUT BEFORE THE JOB STARTS IF IT IS PERCEIVED AS A POTENTIAL PROBLEM. TEMPERATURE MAY BE A BETTER GUAGE.

GROUTING

PG. S-76 SECT 3.5 B.

3.5 B. *Confinement* — Confine grout to the areas indicated on the Project Drawings. Use material to confine grout that permits bond between masonry units and mortar.

USE GROUT STOP --- SCREEN – *NO FELT* PAPER

DEFINITIONS - GROUT POUR & GROUT LIFT

PG. S-6 SECT 1.2

TMS 602 SPECIFICATION

1.2 — Definitions (Continued)

W. *Grout lift* — An increment of grout height within a total grout pour. A grout pour consists of one or more grout lifts.

X. *Grout pour* — The total height of masonry to be grouted prior to erection of additional masonry. A grout pour consists of one or more grout lifts.

GROUT SPACE REQUIREMENTS

PG. S-77 SECT 3.5 C.TABLE 6

3.5 C. *Grout pour height* — Do not exceed the maximum grout pour height given in Table 6.

Table 6 — Grout space requirements No Collar Joints

Grout type[1]	Maximum grout pour height, ft (m)	Minimum clear width of grout space,[2] in. (mm)	Minimum clear grout space dimensions for grouting cells of hollow units,[3,4] in. x in. (mm x mm)
Fine	1 (0.30)	¼ (19	1½ x 2 (38.1 x 50.8)
Fine	5.33 (1.63)		2 x 3 (50.8 x 76.2)
Fine	12.67 (3.86)	5)	2½ x 3 (63.5 x 76.2)
Fine	24 (7.32)		3 x 3 (76.2 x 76.2)
Coarse	1 (0.30)	½ (38	1½ x 3 (38.1 x 76.2)
Coarse	5.33 (1.63)	2 (50.8)	2½ x 3 (63.5 x 76.2)
Coarse	12.67 (3.86)	2½ (63.5)	3 x 3 (76.2 x 76.2)
Coarse	24 (7.32)	3 (76.2)	3 x 4 (76.2 x 102)

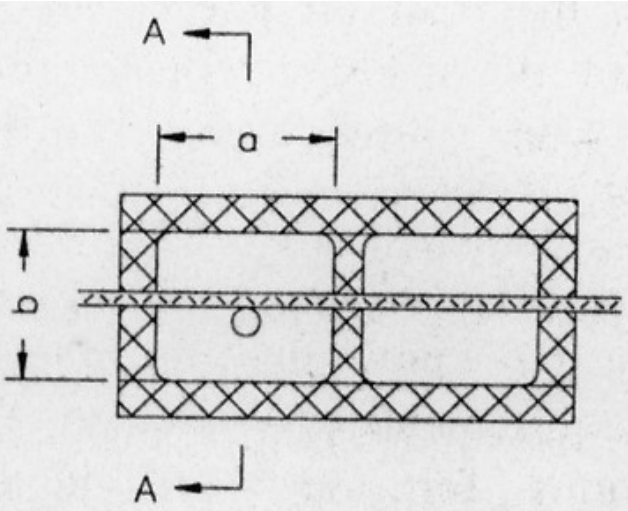
[1] Fine and coarse grouts are defined in ASTM C476.

[2] For grouting between masonry wythes.

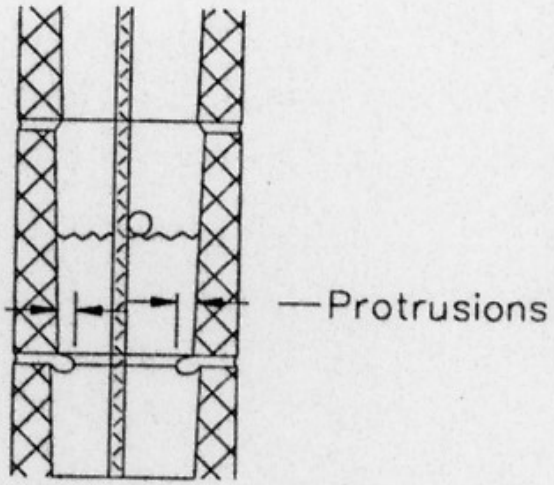
[3] Minimum clear width of grout space and minimum clear grout space dimension are the net dimension of the space determined by subtracting masonry protrusions and the diameters of horizontal bars from the as-built cross section of the grout space. Select the grout type and maximum grout pour height based on the minimum clear space.

[4] Minimum grout space dimension for AAC masonry units shall be 3 in. (76.2 mm) x 3 in. (76.2 mm) or a 3 in. (76.2 mm) diameter cell.

GROUT SPACE



a > Minimum Grout Space Dimension
b > Minimum Grout Space Dimension
Plus Horizontal Bar Diameter
Plus Horizontal Protrusions



Section A–A

GROUT POUR & GROUT LIFT

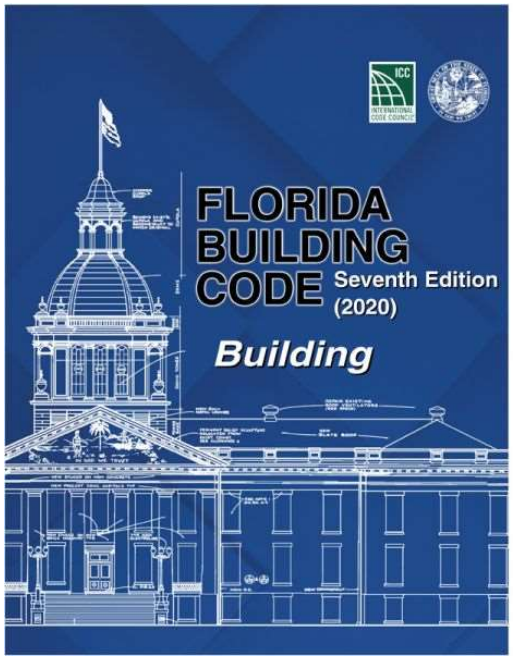
PG. S-78 SECT 3.5 D.

3.5 D. *Grout lift height*

1. For grout conforming to Article 2.2 A: (ASTM C-476)
   a. Where the following conditions are met, place grout in lifts not exceeding 12 ft 8 in. (3.86 m).
      i. The masonry has cured for at least 4 hours.
      ii. The grout slump is maintained between 10 and 11 in. (254 and 279 mm).
      iii. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.

CONSOLIDATION & RECONSOLIDATION

PG. S-78 SECT 3.5 E.



Florida Code HVHZ Allows Puddling

3.5 E. *Consolidation*

1. Consolidate grout at the time of placement.
   a. Consolidate grout pours 12 in. (305 mm) or less in height by mechanical vibration or by puddling.
   b. Consolidate pours exceeding 12 in. (305 mm) in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.
2. Consolidation or reconsolidation is not required for self-consolidating grout.

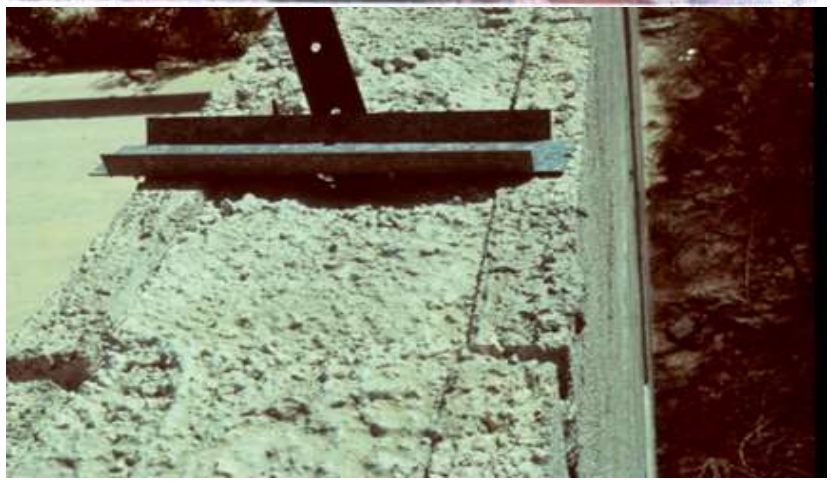
GROUT KEY

PG. S-79 SECT 3.5 F

3.5 F. *Grout key* — When grouting, form grout keys between grout pours. Form grout keys between grout lifts when the first lift is permitted to set prior to placement of the subsequent lift

1. Form a grout key by terminating the grout a minimum of 1½ in. (38.1 mm) below a mortar joint.
2. Do not form grout keys within beams.
3. At beams or lintels laid with closed bottom units, terminate the grout pour at the bottom of the beam or lintel without forming a grout key.

DISTRIBUTION OF LOAD ONTO BOND BEAM



TOPPING OFF:
MAKE A FINAL PASS WITH A BUCKET FULL OF GROUT

DISTRIBUTION OF LOAD ONTO BOND BEAM

Load Bears on Face Shells Only

THE MASONRY SOCIETY

TMS 602

Forward to Specification Checklists

PG. S-83

TMS 602 CHECKLISTS

PP S-83 - SECT F3.

F3. Checklists do not form a part of Specification TMS 602–16. Checklists are provided to assist the Architect/Engineer in selecting and specifying project requirements in the Project Specification. The checklists identify the Sections, Parts, and Articles of the reference Specification and the action required or available to the Architect/Engineer.

Mandatory Requirements Checklist pg. S-84

MANDATORY REQUIREMENTS CHECKLIST

Section/Part/Article	Notes to the Architect/Engineer
PART 1 — GENERAL	
PART 2 — PRODUCTS	
2.1 Mortar materials	Specify type, color, and cementitious materials to be used in
PART 3 — EXECUTION	S-25
3.3 E.2 Pipes and conduits	Specify sleeve sizes and spacing.
3.3 E.6 Accessories	Specify accessories not indicated on the project drawings.
3.3 E.7 Movement joints	Indicate type and location of movement joints on the project drawings.
2.4 C.3 Welded wire fabric	Specify when welded wire fabric is to be plain.
2.4 E Stainless steel	Specify when stainless steel joint reinforcement, anchors, ties, and/or accessories are required.
2.4 F Coating for corrosion protection	Specify which interior walls are governed by this provision.
2.4 G Corrosion protection for tendons	Specify the corrosion protection method.
2.4 H Prestressing anchorages, couplers, and end blocks	Specify the anchorages and couplers and their corrosion protection.
2.5 E Joint fillers	Specify size and shape of joint fillers.
2.7 B Prefabricated masonry	Specify prefabricated masonry and requirements in supplement of those of ASTM C 901.

Optional Requirements Checklists

pg. S-86

OPTIONAL REQUIREMENTS CHECKLIST

Section/Part/Article		Notes to the Architect/Engineer
PART 1 — GENERAL		
PART 2 — PRODUCTS		
PART 3 — EXECUTION		
3.2 C	Wetting masonry units	Specify when units are to be wetted.
3.3 A	Bond pattern	Specify bond pattern other than running bond.
3.3 B.1	Bed and head joints	Specify thickness and tooling differing from ACI 530.1/ASCE 6/TMS 602.
3.3 B.2	Collar joints	Specify the filling of collar joints less than $^3/_4$ in. (19.1 mm) thick differing from ACI 530.1/ASCE 6/TMS 602.
3.3 B.3	Hollow units	Specify when cross webs are to be mortar bedded.
3.3 B.4	Solid units	Specify mortar bedding at variance with ACI 530.1/ASCE 6/TMS 602.
3.3 B.5	Glass units	Specify mortar bedding at variance with ACI 530.1/ASCE 6/TMS 602.
3.3 E.2	Embedded items and accessories	Specify locations where sleeves are required for pipes or conduits.
3.4 C.2, 3, and 4		Specify requirements at variance with ACI 530.1/ASCE 6/TMS 602.

THE MASONRY SOCIETY

TMS 402/602

INDEX - PAGE I-1

INDEX

* AAC = Autoclaved Aerated Concrete, ASD = Allowable Stress Design, MSW = Masonry Shear Wall, SD = Strength Design

ST. PETERS CATHEDRAL - ROME

1443 - 1629

Are there any questions?