MASONRY Association of Florida

MASONRY CODE CHANGES

COMPONENT 3

Don Beers, PE , GC

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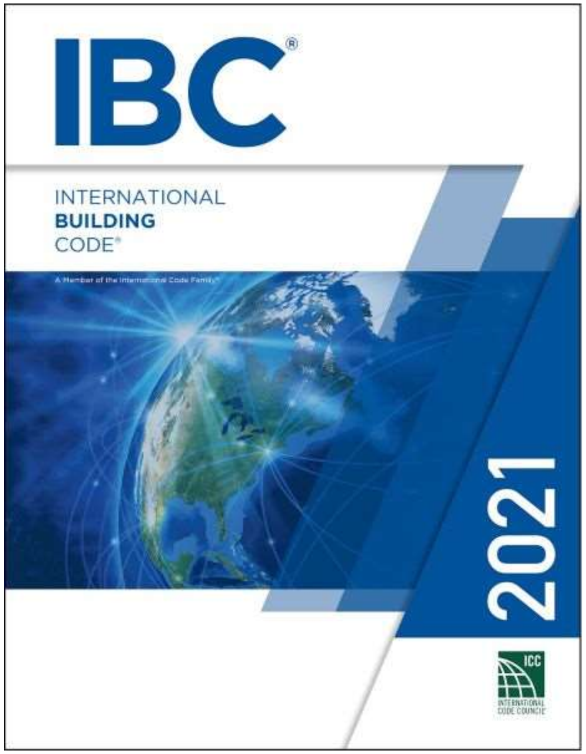
Codes and Standards

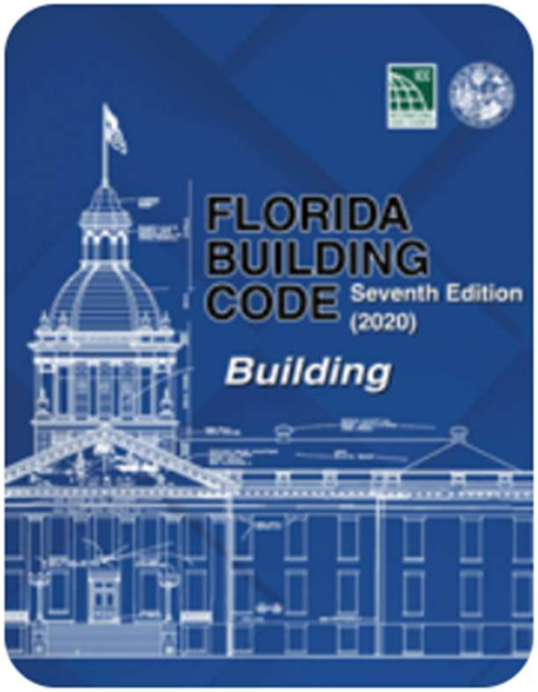
CODES – the top level. You work "under" a legally adopted code.

- **JOB SPECIFICATIONS** – Are created under a particular legally adopted Code, like the IBC or FBC
  - **STANDARDS** are either referenced by the Building Code or included in the Job Specification and are product specific.

Codes and Standards

- IBC
  - Chapter 21 - Masonry
- Florida Building Code
  - Chapter 21 - Masonry





CODES AND STANDARDS

STANDARDS

- **NATIONAL MASONRY STANDARD**
  - TMS 402/602 2016 – currently referenced by 7TH ED. FLORIDA BLDG CODE
- ASTM STANDARDS
  - The number after the dash is the year
  - The newest standard year may NOT be the standard referenced by the local (State) building code or by the specifications
  - Masonry standards are contained in ASTM Volume 4.05 (free when you become a member)
- MCAA BRACING STANDARD
  - Plan on Site? Why?

Determination of ASTM Standards to be used in 2021 MCW

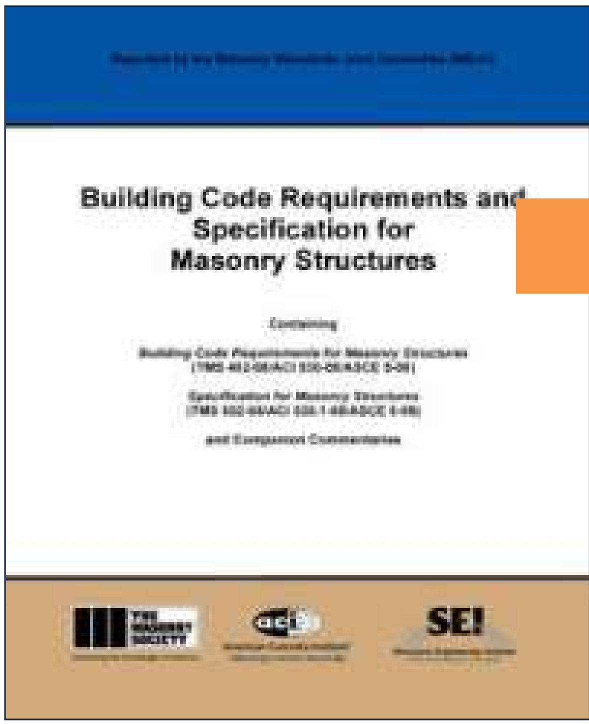
ASTM Standard	Legal Std in Florida 1/1/21 (use in 2021 MCW)	Year used in the 2018 MCW	Latest ASTM Year (as of Oct 2020) 4th	TMS 602-16 Ref Yr 2nd	7th Ed. FBC Ref Yr (effective 1/1/21) 1st	2018 IBC Ref Yr 3rd
ASTM C 216	15	13	19	15	15	15
ASTM C 652	15	13	19b	15	15	15
ASTM C 90	14	14	16a	14	14	14
ASTM C 140	15	13	20a	$15e^1$	15	15
ASTM C 426	$15e^1$	$15e^1$	16	$15e^1$	No Ref	No Ref
ASTM C 1314	14	14	18	14	~~07 Glitch~~	No Ref
ASTM C 270	14a	12a	$19ae^1$	14a	14a	14a
ASTM C 144	11	11	18	11	No Ref	No Ref
ASTM C 780	20	17	20	No Ref	No Ref	No Ref
ASTM C 1586	20	05(2011)	20	No Ref	No Ref	No Ref
ASTM C 476	19	10	20	10	19	No Ref
ASTM C 1019	16	16	19	16	No Ref	No Ref

Green – Standard was updated for 2021

Yellow – Standard unchanged in 2021

Flow of Codes TMS 402/602 into IBC into FBC

2008 TMS 402/602

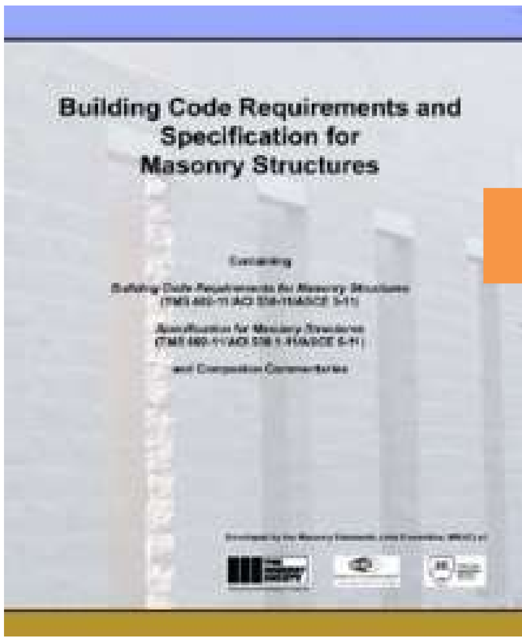


2009 IBC

2010 FBC

Flow of Codes TMS 402/602 into IBC into FBC

2011 TMS 402/602

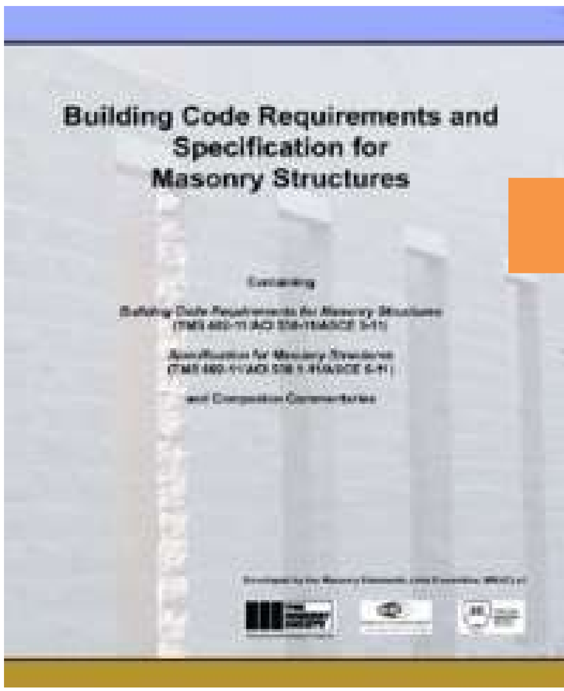


2012 IBC

5th Edition FBC

Flow of Codes TMS 402/602 into IBC into FBC

2013 TMS 402/602

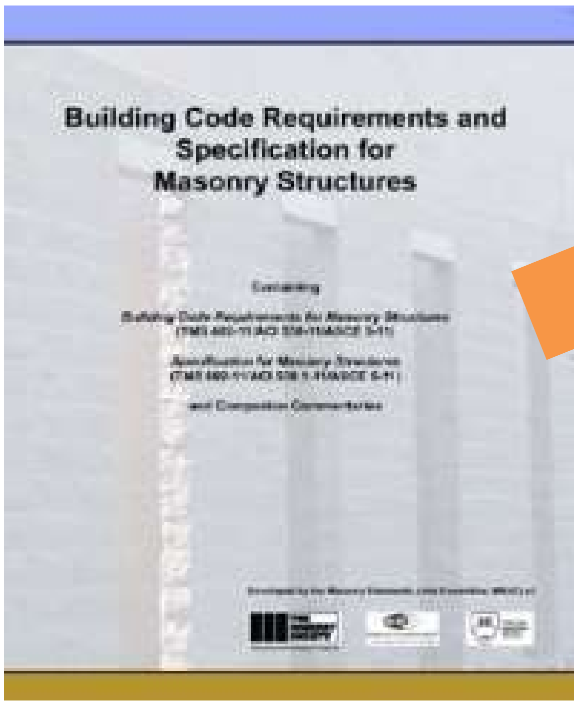


2015 IBC

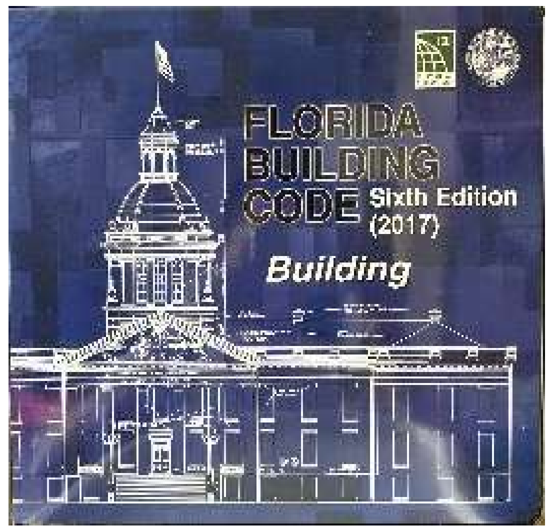
6th Edition FBC

Flow of Codes TMS 402/602 into IBC into FBC

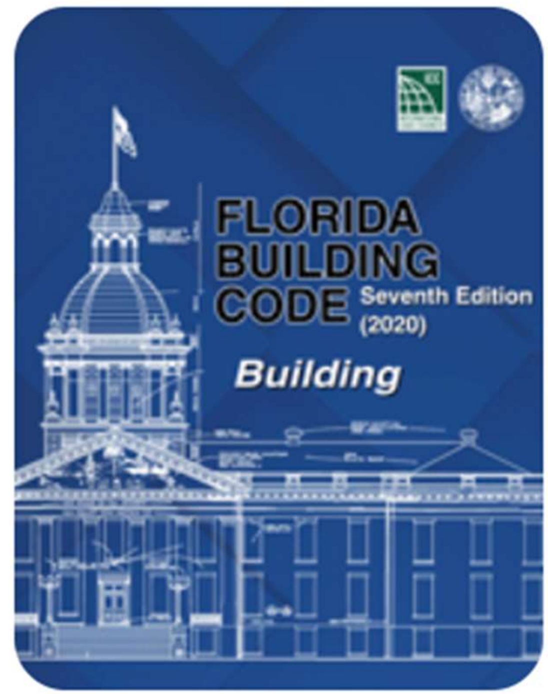
2016 TMS 402/602

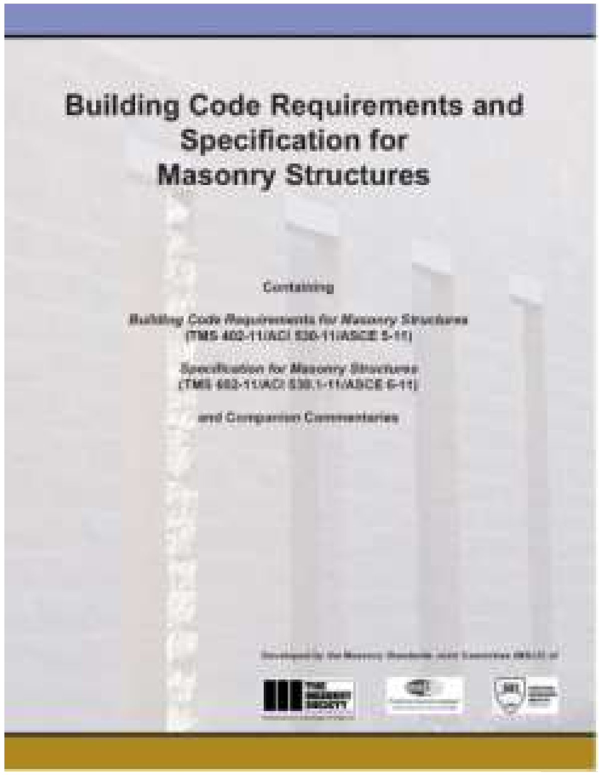


6th Edition FBC



7th Edition FBC





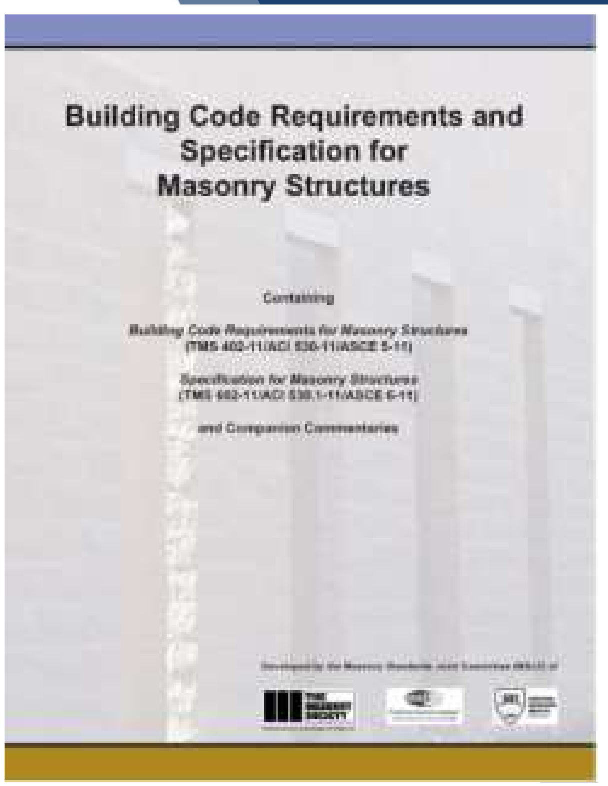
HISTORICALLY THE MSJC COMMITTEE

MSJC – MASONRY STANDARDS JOINT COMMITTEE

Joint Committee with:

- The Masonry Society (TMS)
- American Concrete Institute (ACI)
- Structural Engineering Institute of the American Society of Civil Engineers (ASCE-SEI)

HISTORICALLY THE MSJC COMMITTEE

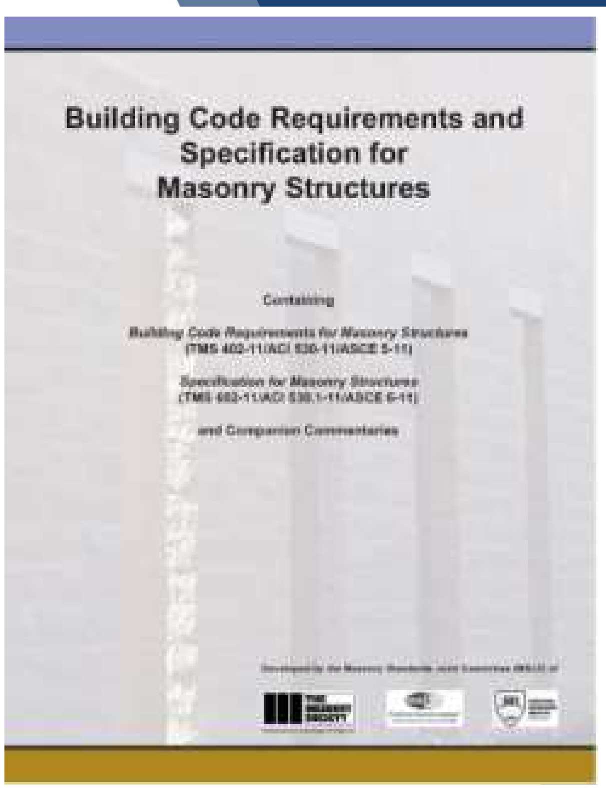


- TMS 402/ACI 530/ASCE 5
  Building Code Requirements for Masonry Structures

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

- Commentary for each *Non-mandatory*

Presently (Beginning with the 2016 Edition)



THE MSJC COMMITTEE - TMS

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

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

2008-2011 SUMMARY OF CHANGES

2011 MSJC REFERENCES 2010 ASCE 7

6.2.2.11 *Requirements in areas of high winds* — The following requirements apply in areas where the basic wind speed exceeds 110 mph (177 km/hr) but does not exceed 130 mph (209 km/hr) and the building's mean roof height is less than or equal to 60 ft (18.3 m):

2008

2011

6.2.2.11 *Requirements in areas of high winds* — The following requirements apply in areas where the velocity pressure, q_z, exceeds 40 psf (1.92 kPa) but does not exceed 55 psf (2.63 kPa) and the building's mean roof height is less than or equal to 60 ft (18.3 m):

2008-2011 SUMMARY OF CHANGES

RECALIBRATION OF ALLOWABLE STRESS DESIGN

Historically masonry design permitted allowable design stresses to be increased by one-third when subjected to wind or seismic loads.

2.1.2.3 Unless prohibited by the legally adopted building code, allowable stresses and allowable loads in Chapters 2 and 4 shall be permitted to be increased by one-third when considering Load Combination (c), (d), or (e) of Section 2.1.2.1.

2008-2011 SUMMARY OF CHANGES

RECALIBRATION OF ALLOWABLE STRESS DESIGN

Beginning with 2011, the transient load increase was removed and the ASD design provisions recalibrated.

2008

2.3.3.2.2 The compressive stress in masonry due to flexure or due to flexure in combination with axial load shall not exceed $(^1/_3)\ f'_m$ provided the calculated compressive stress due to the axial load component, f_a, does not exceed the allowable stress, F_a, in Section 2.2.3.1.

2011

2.3.4.2.2 The compressive stress in masonry due to flexure or due to flexure in combination with axial load shall not exceed $0.45\ f'_m$ provided that the calculated compressive stress due to the axial load component, f_a, does not exceed the allowable stress, F_a, in Section 2.2.3.1.

2008-2011 SUMMARY OF CHANGES

Recalibration of Allowable Stress Design

This was *not* an across-the-board 1/3 stress increase. Each design value was independently considered.

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

(b) Grade 60 reinforcement ....24,000 psi (165.5 MPa)

2008

2011

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

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

2008-2011 SUMMARY OF CHANGES

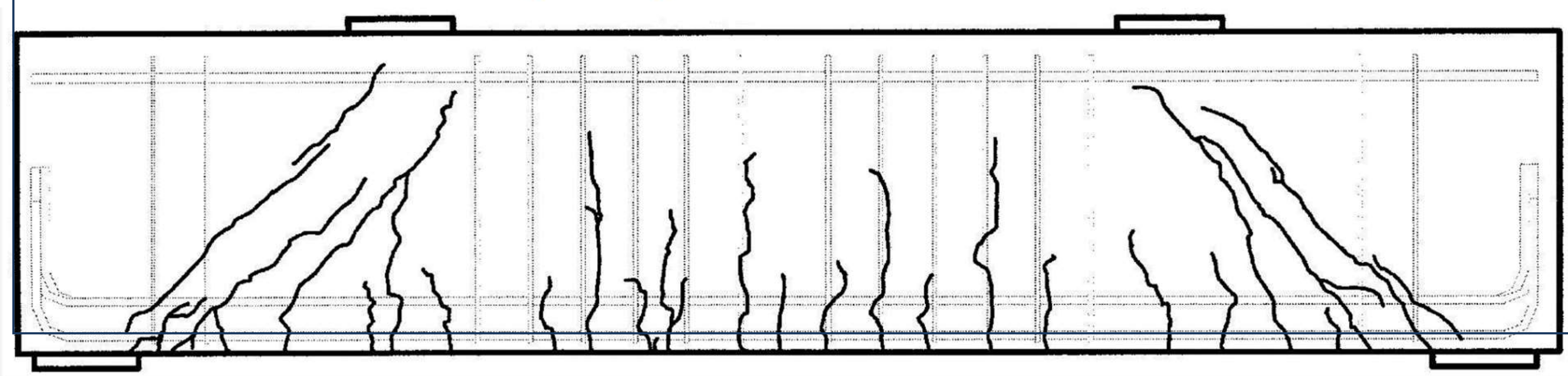
New masonry infill design provisions have been added.

Located in Appendix B.

2008-2011 SUMMARY OF CHANGES

Design provisions for deep beams have been added.

Deep beam — A beam that has an effective span-to-depth ratio, l_{eff}/d_v, less than 3 for a continuous span and less than 2 for a simple span.



Please Note 2011-2013: No significant revisions to the deep beam design provisions between 2011 and 2013 MSJC.

2008-2011 SUMMARY OF CHANGES

Lap Splices and Development Length 2011 MSJC Provisions… the addition of a confinement factor:

$$\xi = 1.0 - \frac{2.3A_{sc}}{d_b^{2.5}}$$

$$l_d = \left(\frac{0.13 d_b{}^2 f_y \gamma}{K\sqrt{f'_m}} \right) \xi$$

$$\text{Where : } \frac{2.3A_{sc}}{d_b^{2.5}} \le 1.0$$

A_{sc} is the area of the transervse bars at each end of the lap splice and shall not be taken greater than 0.35 in^2 (226 mm^2).

2008-2011 SUMMARY OF CHANGES

Lap Splices and Development

A_{sc} < 0.35 in.^{2}

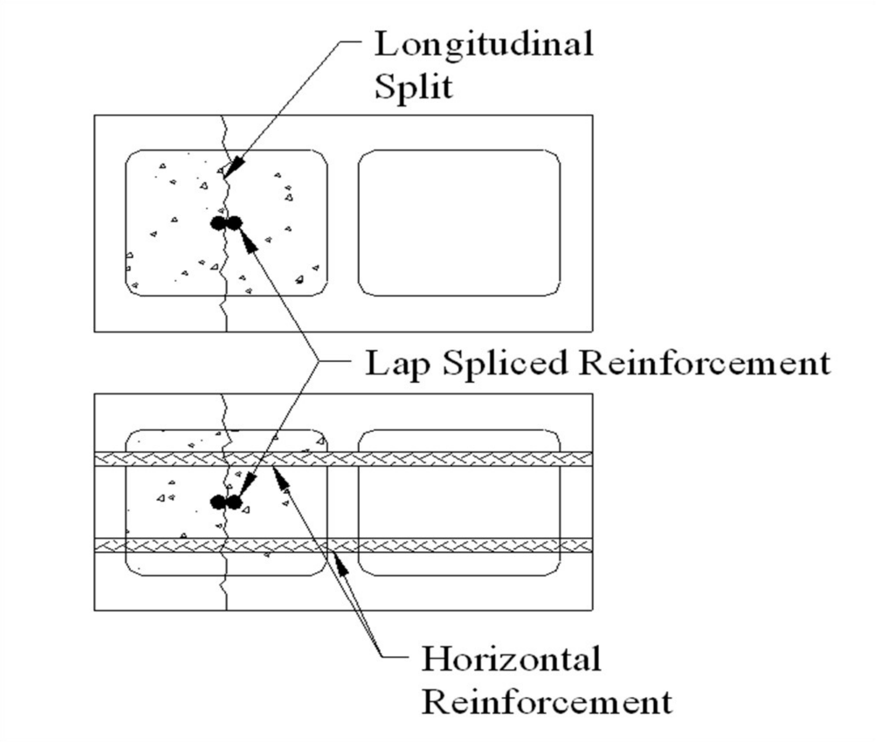
Transverse Offset $\leq$ 1.5 in.

Longitudinal Offset $\leq$ 8 in.

Lap Splice $\geq$ $36d_b$

2008-2011 SUMMARY OF CHANGES

Lap Splices and Development Length



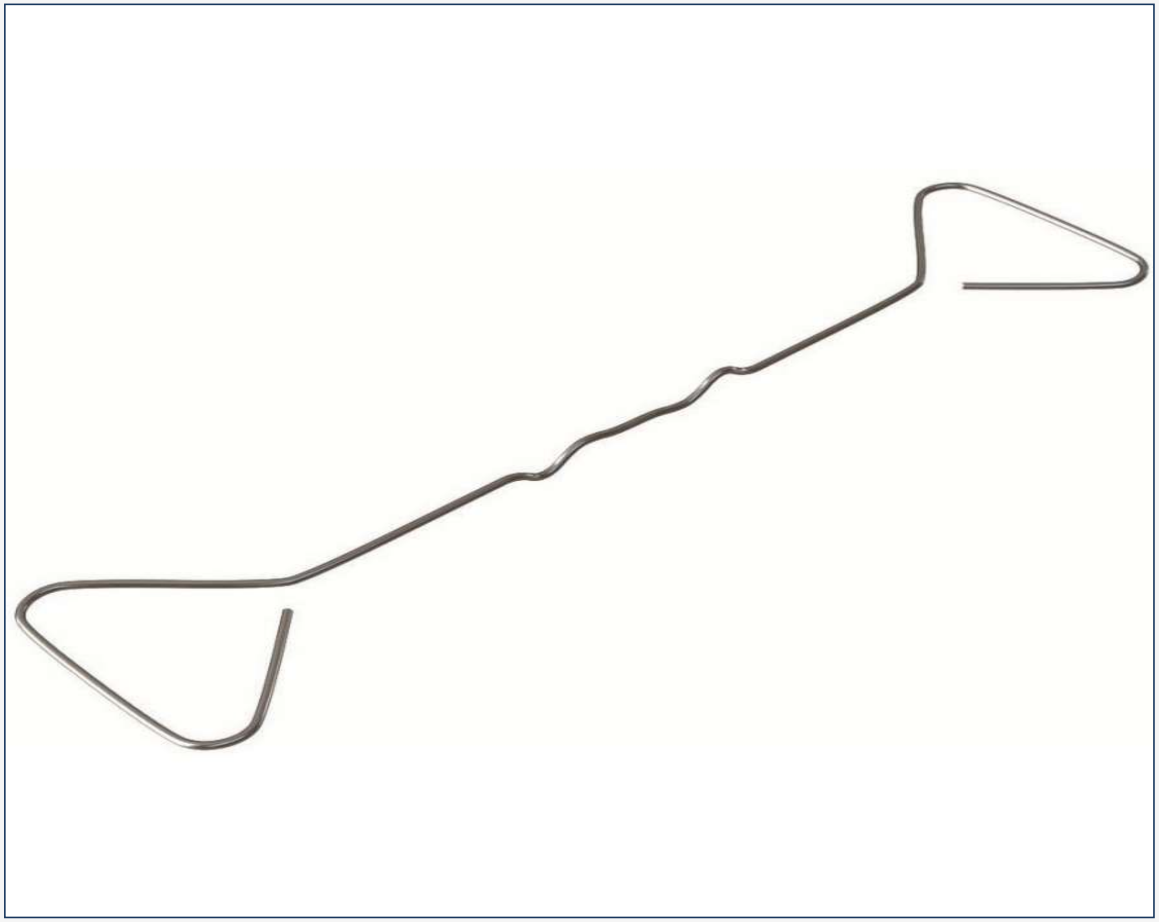
2008-2011 SUMMARY OF CHANGES

TYPICAL 8-INCH CONCRETE MASONRY UNIT LAP LENGTHS		
Bar Size	MSJC Lap Length, No Confinement (in.)	MSJC Lap Length, With No. 5 Confinement (in.)
No. 3	12.0	13.5
No. 4	14.1	18.0
No. 5	22.5	22.5
No. 6	42.8	27.0
No. 7	59.4	31.5
No. 8	91.2	36.0
No. 9	118.3*	55.5*

Please Note 2011-2013: *No significant revisions to the lap splice and development length design provisions between 2011 and 2013 MSJC.*

2008-2011 SUMMARY OF CHANGES

Veneer ties with drips no longer permitted.



2008-2011 SUMMARY OF CHANGES

Grout lift heights are now modular.

Grout type[1]	Maximum grout pour height, ft (m)
Fine	1 (0.30)
Fine	5.33 (1.63)
Fine	12.67 (3.86)
Fine	24 (7.32)
Coarse	1 (0.30)
Coarse	5.33 (1.63)
Coarse	12.67 (3.86)
Coarse	24 (7.32)

2008-2011 SUMMARY OF CHANGES

Quality Assurance provisions reorganized and clarified.

Inspection Task	Frequency [a]	
	Continuous	Periodic
1. Verify compliance with the approved submittals		X
2. As masonry construction begins, verify that the following are in compliance:		
a. Proportions of site-prepared mortar		X
b. Construction of mortar joints		X
c. Grade and size of prestressing tendons and anchorages		X
d. Location of reinforcement, connectors, and prestressing tendons and anchorages		X
e. Prestressing technique		X

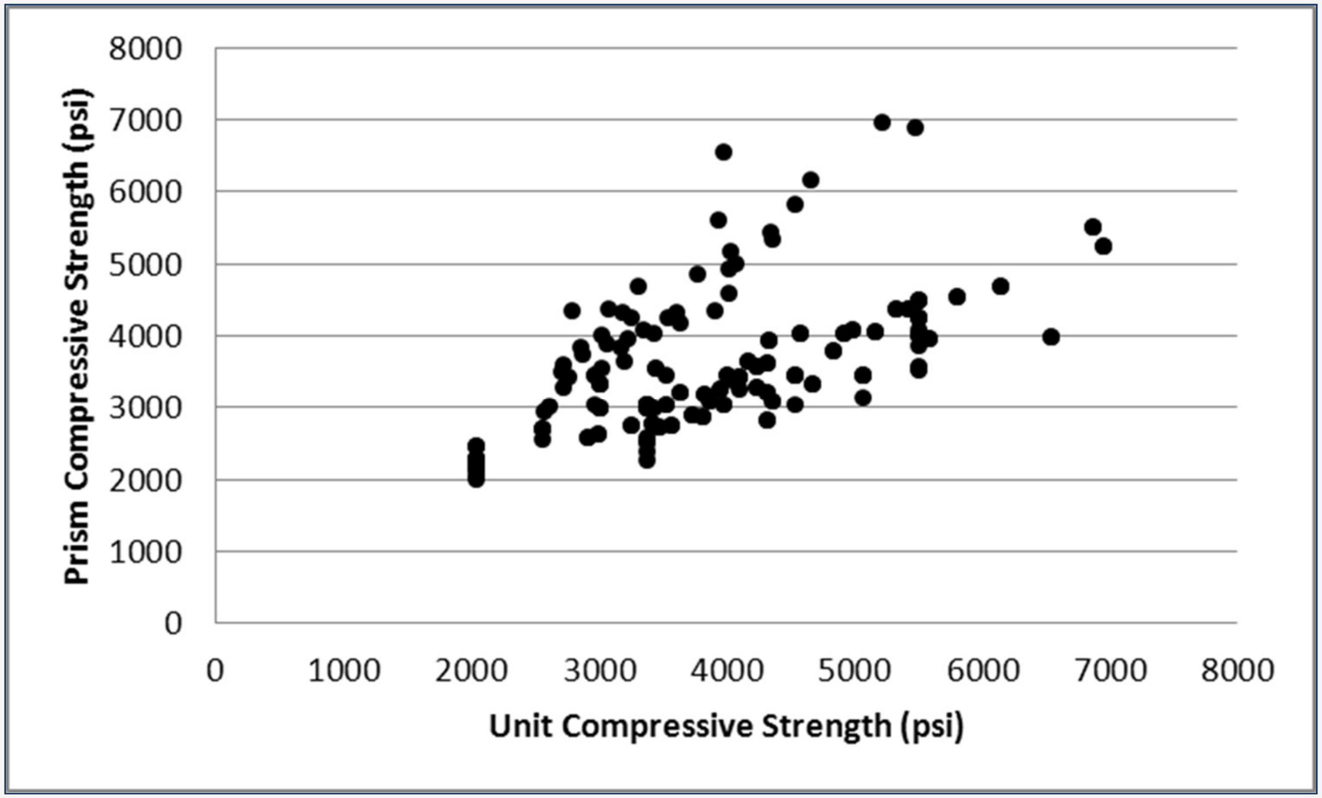
QUALITY ASSURANCE

- 7th Ed FBC - 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……………….

- 7th Ed FBC 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.

ASSEMBLY COMPRESSIVE STRENGTH (f'_m)

In 2010, a new research project was initiated to recalibrate the unit strength method.



ASSEMBLY COMPRESSIVE STRENGTH (f'_m)

For decades the unit strength table provided a quick/easy means of verifying f'_m.

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 units, psi (MPa)		Net area compressive strength of masonry, psi[1] (MPa)
Type M or S mortar	Type N mortar	
—	1,900 (13.10)	1,350 (9.31)
1,900 (13.10)	2,150 (14.82)	1,500 (10.34)
2,800 (19.31)	3,050 (21.03)	2,000 (13.79)
3,750 (25.86)	4,050 (27.92)	2,500 (17.24)
4,800 (33.10)	5,250 (36.20)	3,000 (20.69)

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

Individual Unit Strength

Resulting Allowable f'm Design Strength

CONC MASONRY UNIT SPECS

- Minimum Required Strength is 2000 psi From ASTM C90-14 (Historically 1900 psi)
- Net area strength of individual block vs f'm

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)[1]	Net area compressive strength of ASTM C90 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.

Resulting Allowable f'm Design Strength

Individual Unit Strength

Table 2 from TMS 602-16

ASSEMBLY COMPRESSIVE STRENGTH (f'_m)

At lower unit compressive strength values, Type M or S mortars produce an assembly compressive strength equal to the unit compressive strength.

1,900 psi unit → 1,900 psi f'_m

2,000 psi unit → 2,000 psi f'_m

Picked as the New
ASTM C-90
Minimum Strength

Table for Regular Strength Block							
	Block Strength	f'm - Compressive Strength of Masonry	Allowable Load Factor	Allowable Design Strength	Transient Factor (Increase Due to Wind)	Useable Design Strength for Wind Loading	% Increase from Current
2008 TMS 402/602	1900	1500	0.33	500	0.33	665	
2011 TMS 402/602	1900	1500	0.45	675	0	675	1.5
2016 TMS 402/602	2000	2000	0.45	900	0	900	35

Table for High-Strength Block							
	Block Strength	f'm - Compressive Strength of Masonry	Allowable Load Factor	Allowable Design Strength	Transient Factor (Increase Due to Wind)	Useable Design Strength for Wind Loading	% Increase from Current
2008 TMS 402/602	2800	2000	0.33	660	0.33	878	
2011 TMS 402/602	2800	2000	0.45	900	0	900	3
2016 TMS 402/602	3250	2500	0.45	1125	0	1125	28

		Table for Ultra High-Strength Block					
	Block Strength	f'm - Compressive Strength of Masonry	Allowable Load Factor	Allowable Design Strength	Transient Factor (Increase Due to Wind)	Useable Design Strength for Wind Loading	% Increase from Current
2008 TMS 402/602	3750	2500	0.33	825	0.33	1097	
2011 TMS 402/602	3750	2500	0.45	1125	0	1125	3
2016 TMS 402/602	3900	2750	0.45	1237	0	1237	13

INCREASED DESIGN STRENGTH FOR MASONRY IN THE 2013 CODE

Date: January 3rd, 2018
To: All Interested Parties in Masonry Production, Design and Installation
From: The Masonry Association of Florida
RE: Code Update on Increased Design Strength of Masonry Provided in the *2016 Building Code Requirements and Specification for Masonry Structures* (TMS 402/602-16)

The Building Code Requirements and Specification for Masonry Structures contains two standards and their commentaries: *Building Code Requirements for Masonry Structures* designated as TMS 402-16 (and formerly designated as TMS 402, ACI 530, ASCE 5) and *Specification for Masonry Structures* designated as TMS 602-16 (and formerly designated as TMS 602, ACI 530.1, ASCE 6). These standards are produced by The Masonry Society's Committee TMS 402/602 and were formerly developed through the joint sponsorship of The Masonry Society (TMS), the American Concrete Institute (ACI), and the Structural Engineering Institute of the American Society of Civil Engineers (SEI/ASCE) through the Masonry Standards Joint Committee (MSJC). In late 2013, ACI and ASCE relinquished their rights to these standards to TMS who has served as the lead sponsor of the Standard for a number of years. [1]

Available on www.floridamasonry.com/resources.html

2008-2011 SUMMARY OF CHANGES

ASTM C90 Revisions:
Beginning in 2011, ASTM C90 (specification for loadbearing concrete masonry units) was substantially revised to permit alternative unit configurations.

ASTM C90 CHANGES

For 70 years, the configuration of concrete masonry units has been standardized to fit a specific configuration.

TABLE 1 Minimum Thickness of Face Shells and Webs[A]

Nominal Width (W) of Units, in. (mm)	Face Shell Thickness (t_{fs}), min, in. (mm)[B,C]	Web Thickness (t_w)	
		Webs[B,D,C] min, in. (mm)	Equivalent Web Thickness, min, in./linear ft[E] (mm/linear m)
3 (76.2) and 4 (102)	¾ (19)	¾ (19)	1⅝ (136)
6 (152)	1 (25)	1 (25)	2¼ (188)
8 (203)	1¼ (32)	1 (25)	2¼ (188)
10 (254) and greater	1¼ (32)	1⅛ (29)	2½ (209)

ASTM C90 CHANGES

1930s Building Solution

2010s Building Solution

ASTM C90 CHANGES

The marketplace, however, has evolved well beyond ASTM C90.

ASTM C90 CHANGES

ASTM C90 now permits different unit configurations using alternative web configurations.

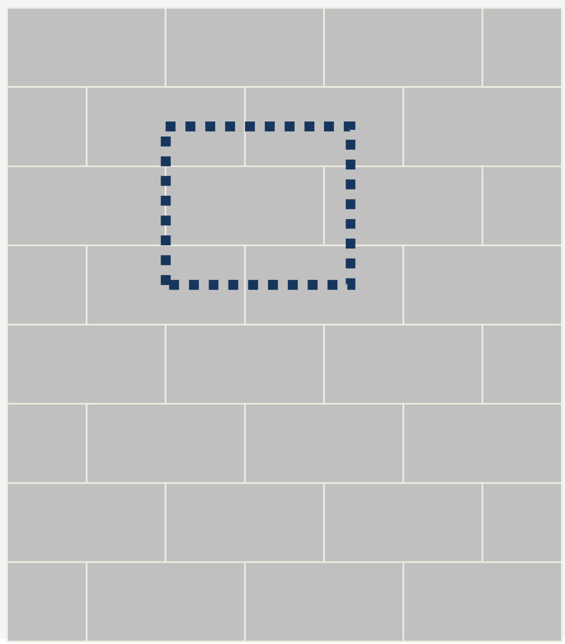
ells and Web Requirements[A]

Webs	
Web Thickness[C] (t_w), min, in. (mm)	Normalized Web Area (A_{nw}), min, in.^{2}/ft^2 (mm^2/m^2)[D]
¾ (19)	6.5 (45, 140)
¾ (19)	6.5 (45, 140)
¾ (19)	6.5 (45, 140)

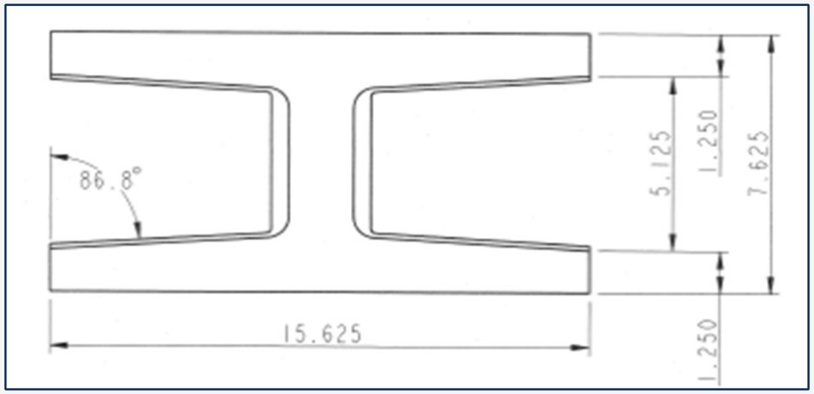
ed in Test Methods C140.
of the split surface is permitted to have thickness less than those shown, but not less
ot apply and Footnote C establishes a thickness requirement for the entire faceshell.
shall be not less than ⅝ in. (16 mm).
ed with grout. The length of that portion shall be deducted from the overall length of

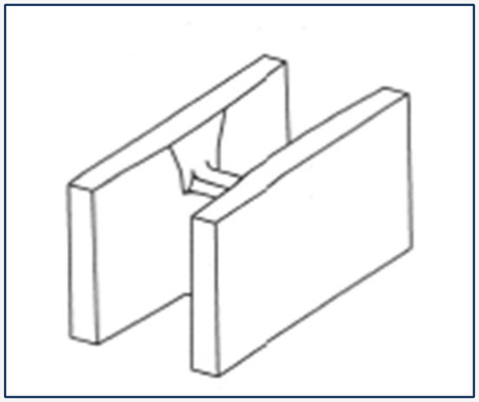
ASTM C90 CHANGES

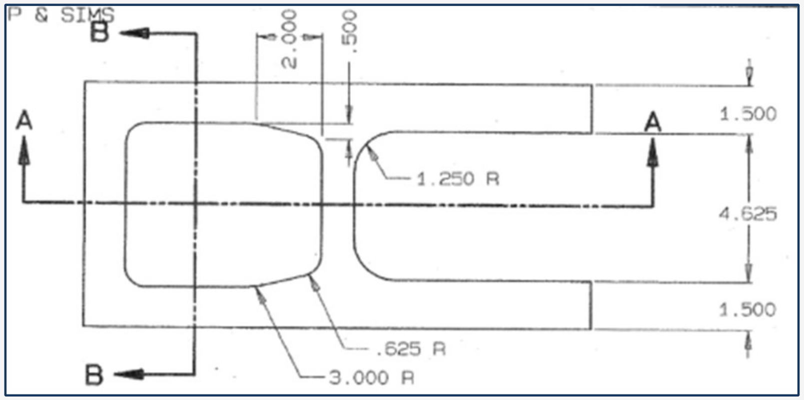
Literally, this new requirement means that for every square foot of wall surface, no less than 6.5 in.^{2} of web must connect the front and back face shells, with no web measuring less than 0.75 in. in thickness.

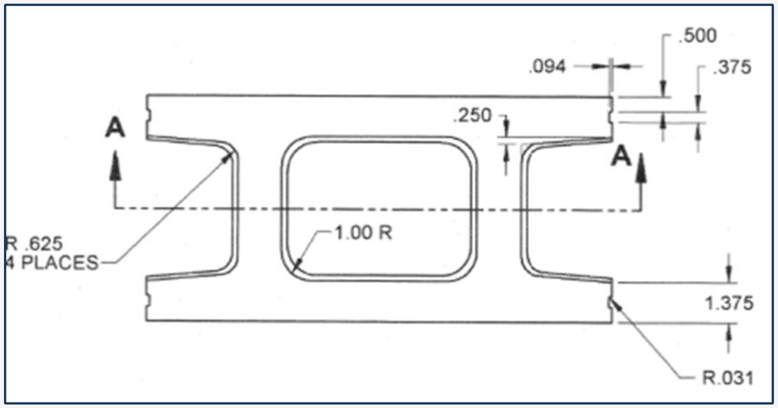


ASTM C90 CHANGES



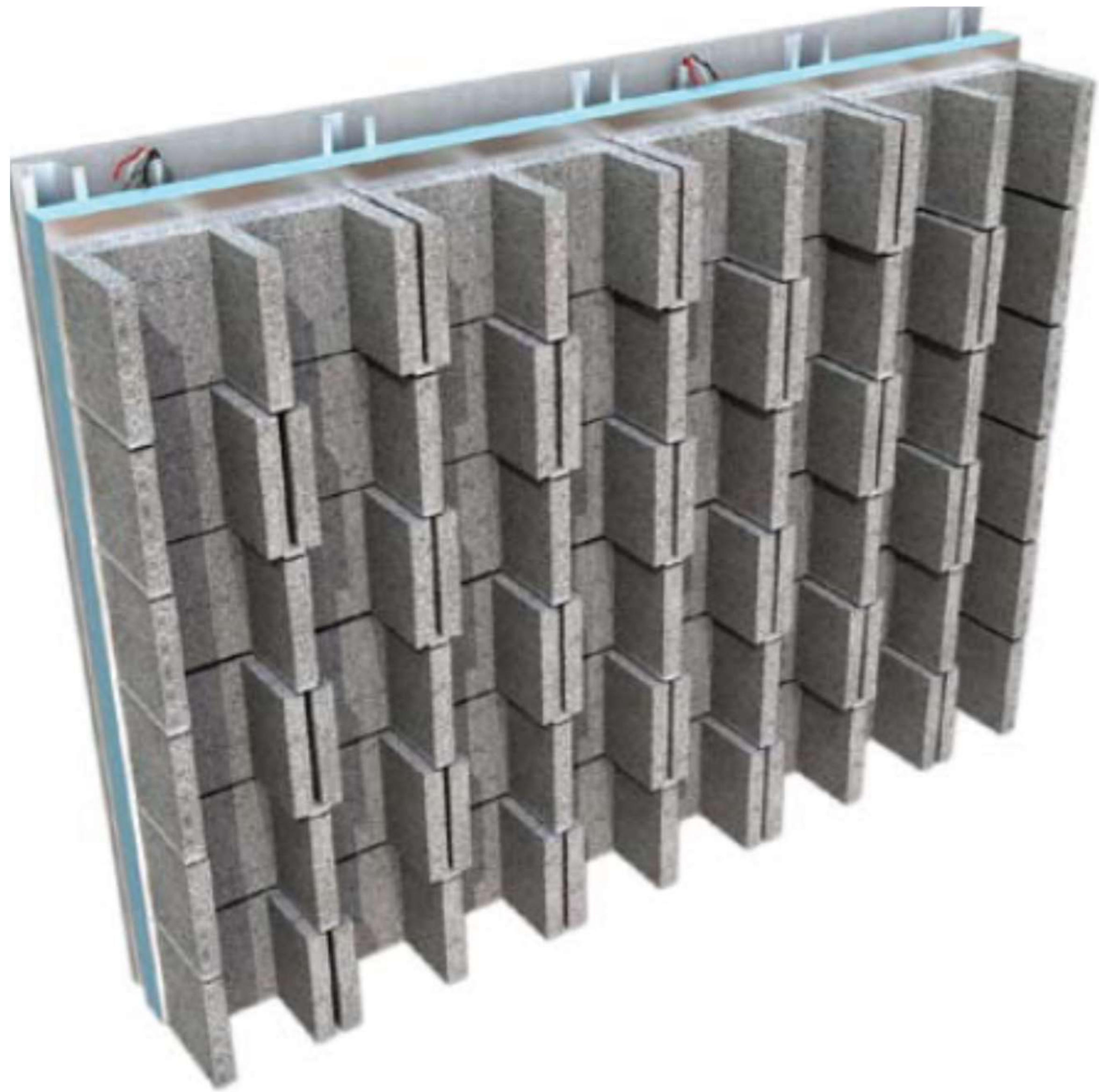


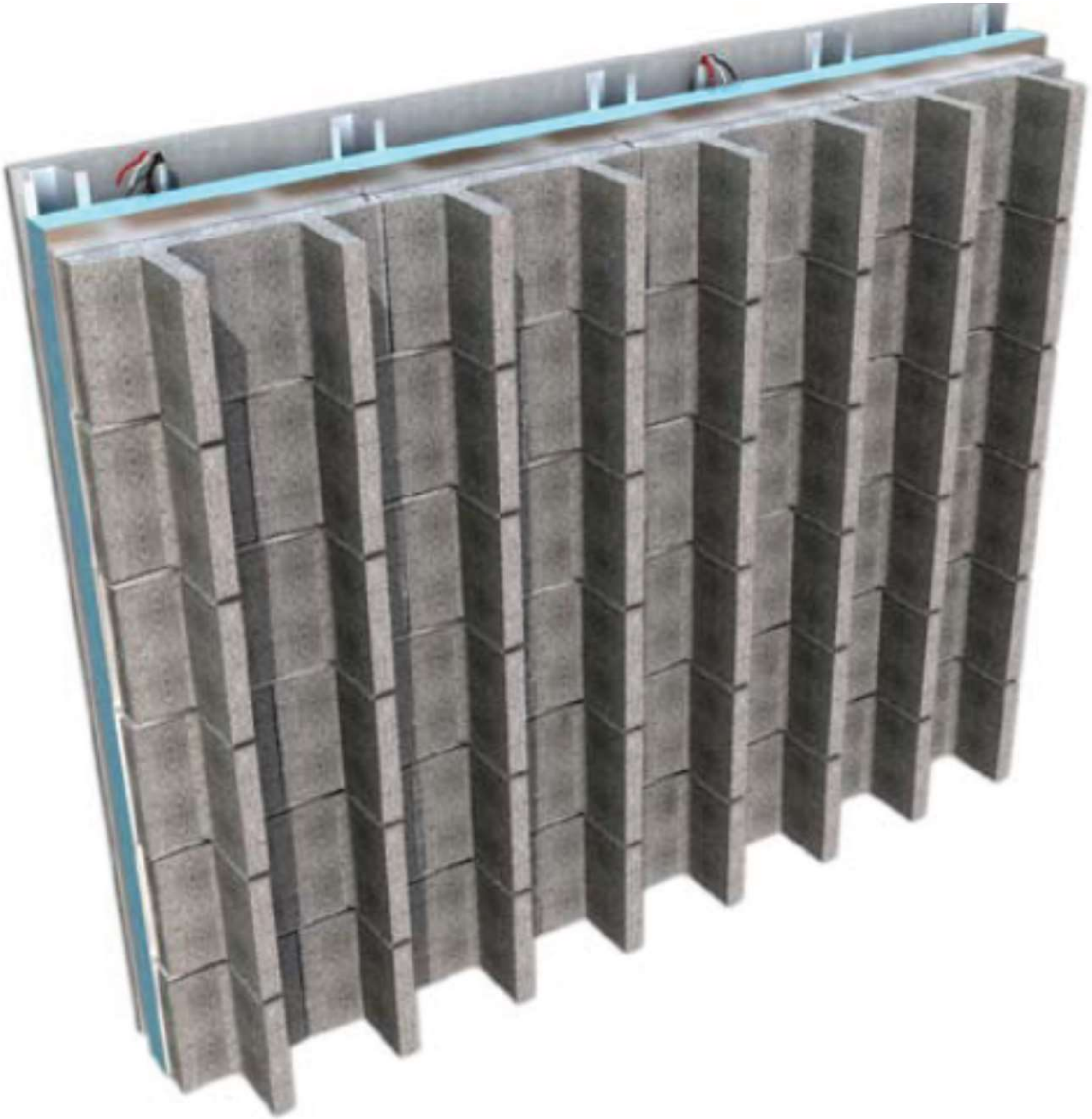




ASTM C90 CHANGES

3-Web Unit Configuration



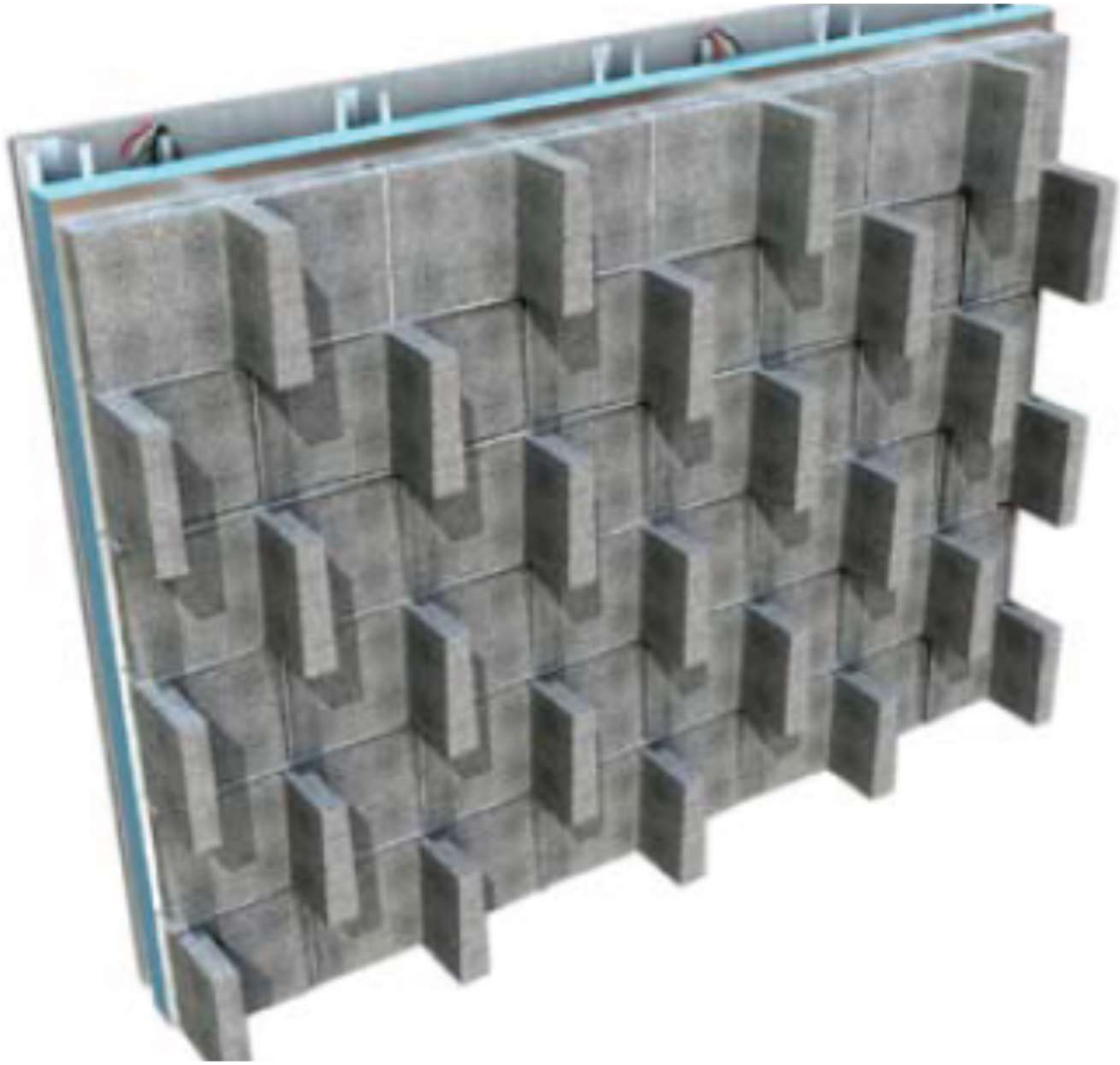


ASTM C90 CHANGES

- 2-Web Unit Configuration

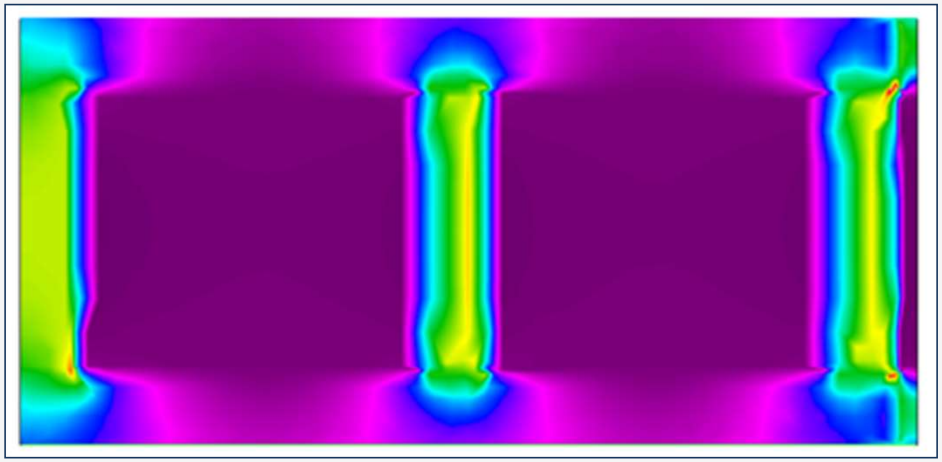
ASTM C90 CHANGES

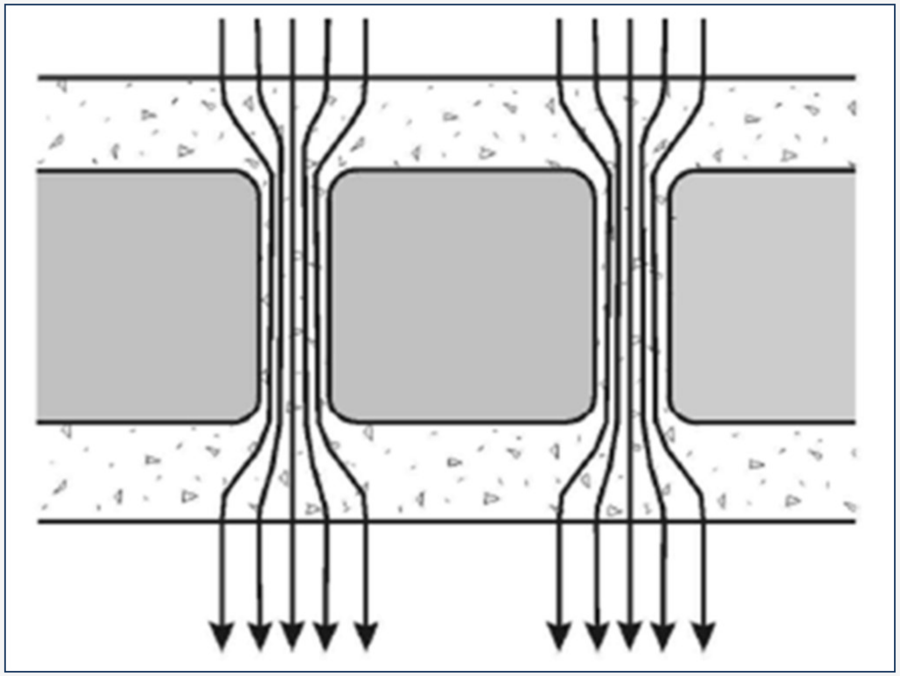
1-Web Unit Configuration



ASTM C90 CHANGES

- While there are several advantages, the primary reason for the change was energy efficiency.
- The basic premise = heat flows through the webs.





ASTM C90 CHANGES

R-Value Examples – 8 in. CMU with foam-in-place Insulation at non-grouted cells

Lightly Reinforced Walls (Grout at 48 in.)			
Density (lb/ft^3)	3 Web Units	2 Web Units	Minimum Webs
105	4.18	5.76	7.99
		38% increase	91% increase
115	3.70	5.27	7.42
		42% increase	100% increase
125	3.27	4.81	6.89
		47% increase	111% increase

DESIGN IMPLICATIONS

Design of alternative web configurations is exactly the same, except if designing unreinforced masonry – which requires a supplemental check of the web shear stresses.

$$f_v = \frac{VQ}{I_n b} \leq 1.5\sqrt{f'_m}$$

DESIGN IMPLICATIONS

Section properties vary slightly, but within the range of 'conventional' units.

		Three-Web Corner Unit	Three-Web Stretcher Unit	A-Block	H-Block
Face Shell Bedding Only	Net Area (An)	30.0	30.0	30.0	30.0
	Net MOI (In)	308.7	308.7	308.7	308.7
Full Mortar Bedding	Net Area (An)	38.6	38.6	35.8	32.9
	Net MOI (In)	327.6	327.6	321.4	315.1
Solid Grouted	Net Area (An)	90.1	84.3	91.5	91.5
	Net MOI (In)	440.2	427.5	443.3	443.3
Grout @ 16 in.	Net Area (An)	61.5	58.6	65.8	NA
	Net MOI (In)	383.9	371.3	387.0	NA
Grout @ 120 in.	Net Area (An)	34.2	33.8	34.8	NA
	Net MOI (In)	317.9	317.0	319.0	NA

7th Edition Florida Building Code

2010 FBC, EC

TABLE 402.1.1
COMPONENT EFFCIENCIES REQUIRED[a, l]

% Glazing[c]	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b]	CEILING *R*-VALUE	ROOF REFLECTANCE TESTED PER SECTION 405.6.2	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE/ SLAB *R*-VALUE[d]	DOOR *U*-FACTOR	DUCTS: *R*-VALUE/ LOCATION[k]	AIR HANDLER LOCATION[k]	AIR LEAKAGE TESTED PER SECTION 403.2.2.1
20%	0.65[j]	0.75	0.30	30	0.25	13	6/7.8	13/0	0.65	R-6/ Conditioned	Conditioned	Qn= 0.03

7th Ed FBC, EC

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, j]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0

The 2010 Code Compared Masonry to Wood and Did Not Properly Factor in Thermal Mass (i.e., wood had an unfair advantage in the FSEC EnergyGauge software).

Since the 5 Ed. the Code (and software) Compares Masonry to Masonry making it more accurate.

Table 2 - Energy Differences Between R4 CMU and R13 Wood Walls

Total Energy $ Savings per Year Over Standard CMU w/R4 Added Insulation					
Wall#	Wall Disc	Overall R Value	Miami	Orlando	Jax
11	CMU R4	5.8	0	0	0
12	Wood R13	10.9	$46	$15	$18

FBC 6th Ed. – Chapter 4
COMMERCIAL ENERGY EFFICIENCY

C402.1.4 *U*-factor Method. Building thermal envelope opaque assemblies………shall have a *U*-factor, *C*-factor, or *F*-factor not greater than that specified in Table C402.1.4.

5th Edition Florida Building Code

Conversion of R to U (U=1/R) (R=1/U)

Layers → $R_{TOTAL} = R_1 + R_2 + R_3 + ...$

Whole Wall
Includes Air Films → $U = 1/R_{TOTAL}$

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a] *(By Added Continous Insulation R Value)*

CLIMATE ZONE	1		2	
	All Other	Group R	All Other	Group R
Mass[c]	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20

TABLE C402.1.4 OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

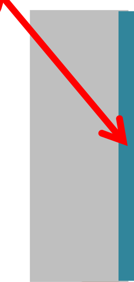
(By Through Wall U Value)

CLIMATE ZONE	1		2	
	All other	Group R	All other	Group R
Mass	U-0.151	U-0.151	U-0.151	U-0.123
Metal building	U-0.079	U-0.079	U-0.079	U-0.079
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064

Per 7th Ed. FBC Energy

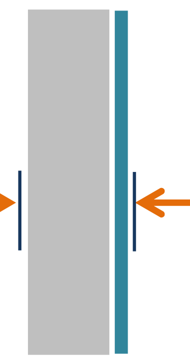
Commercial “R” Value Prescriptive Table C402.1.3

CLIMATE ZONE	1		2	
	All Other	Group R	All Other	Group R
Mass[c]	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20



U Value Table C402.1.4

CLIMATE ZONE	1		2	
	All Other	Group R	All Other	Group R
Mass	U-0.142	U-0.142	U-0.142	U-0.123
Metal building	U-0.079	U-0.079	U-0.079	U-0.079
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064
Wood framed and other	U-0.064	U-0.064	U-0.064	U-0.064



Exterior Air Film	R=.25
8” CMU	R=1.3
1 ½ ” Reflective Air Space	R=5.6
Int Gypboard	R=.45
Interior Air Film	R=.68
Tot R Value	**R=8.28**

U=1/R=1/8.28=.121<.123

Meets Code by Overall “U” Value

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		
	All Other	Group R	All Other	Group R	R Value
Mass	U=.151	U=.151	U=.151	U-0.123	R-8.13
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	R-12.66
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	R-15.62
Wood framed and other	U-0.064	U-0.064	U-0.064	U-0.064	R-15.62

All of these walls are considered by the code to be equivalent in their energy efficiency

The difference is MASS

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.

TMS 402 Lap Method

(TMS 402-16 Sect 6.1.5.1)

2107.6 TMS 402, Section 6.1.5.1.1 Development of bar reinforcement in tension or compression. Modify Section 6.1.5.1.1 as follows:

> 6.1.5.1.1 The required development length of reinforcing bars shall be determined by Equation (6-1), but shall not be less than 12 inches (305 mm) or 40 d_b and need not be greater than 72 d_b.
>
> Equation 6-1, including the notations from TMS 402, is unchanged. Gamma factors are changed as follows:

γ = 1.0 for No. 3 (M#10) through No. 5 (M#16) bars

~~1.3~~

γ = 1.04 for No. 6 (M#19) through No. 7 (M#22) bars

~~1.5~~

γ = 1.2 for No. 8 (M#25) through No. 11 (M#36) bars

Modified Factors

Minimum 48 bar diameters not in the FBC HVHZ since the 2010 Edition. Minimum is 40 bar dia.

6.1.5.1.1 The required development length of reinforcing bars shall be determined by Equation (6-1), but shall not be less than 12 inches (305 mm) or 40 d_b and need not be greater than 72 d_b.

Embedments & Laps

Assumptions

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

Development Lengths (l_d)

	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

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

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

Joint Reinforcement in Florida

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

Joint Reinforcement in South Florida

2122.2.3 Minimum No. 9 gauge ladder-type hot-dipped galvanized, stainless steel, or epoxy coating horizontal joint reinforcing at every alternate course [16-inch (406 mm) spacing], for reinforced masonry shall be provided.

SECTION 2122
HIGH-VELOCITY HURRICANE ZONES—REINFORCED UNIT MASONRY

2122.1 Standards. The provisions of TMS 402 and TMS 602 are hereby adopted as a minimum for the design and construction of reinforced unit masonry. In addition to TMS 402 and TMS 602, reinforced unit masonry structures shall comply with Sections 2122.2 through 2122.10.

> **Exception:** Unless otherwise specified by the designing architect or engineer, where plan review and inspections are performed by a local building department in accordance with Sections 107 and 110, the provisions of TMS 402, Chapter 3, Section 3.1 and TMS 602, Sections 1.5 and 1.6 shall not apply.

2122.2 General.

2122.2.1 Section 2121 shall not apply where design and construction are in accordance with the provisions of this section.

2122.2.2 The design of buildings and structures of reinforced unit masonry shall be by a professional engineer or registered architect.

2122.2.3 Minimum No. 9 gauge ladder-type hot-dipped galvanized, stainless steel, or epoxy coating horizontal joint reinforcing at every alternate course [16-inch (406 mm) spacing], for reinforced masonry shall be provided. This reinforcement shall be tied to structural columns with approved methods. In addition, horizontal joint reinforcement shall comply with TMS 602 Sections 2.4C through 2.4F and Section 3.4B.10.

2122.2.4 Special inspector. A Florida-registered architect or professional engineer shall furnish inspection of all reinforced unit masonry structures.

2122.3 Concrete masonry strength. Concrete masonry strength shall be determined by unit strength method from TMS 602 Section 1.4 or in accordance with ASTM C1314.

2122.4 Reinforcement. Reinforcement shall comply with TMS 402 and TMS 602 except as modified herein Sections 2107 and 2108.

2122.5 Concentrated loads. Bearing area and concentrated loads shall be in accordance with TMS 402 Sections 4.3.4 and 5.1.3.

2122.6 Reinforced masonry bearing walls. Reinforced masonry bearing walls shall have a nominal thickness of not less than 8 inches (203 mm).

2122.7.1 Reinforced masonry walls shall be securely anchored to adjacent structural members such as roofs, floors, columns, pilasters, buttresses and intersection walls.

2122.7.2 Masonry walls shall be anchored to all floors and roofs that provide lateral support to such walls.

2122.7.3 Such anchorage shall provide a positive direct connection capable of resisting the horizontal forces as required in Chapter 16 (High-Velocity Hurricane Zones), or a minimum force of 200 pounds per lineal foot (2919 N/m) of wall, whichever is greater.

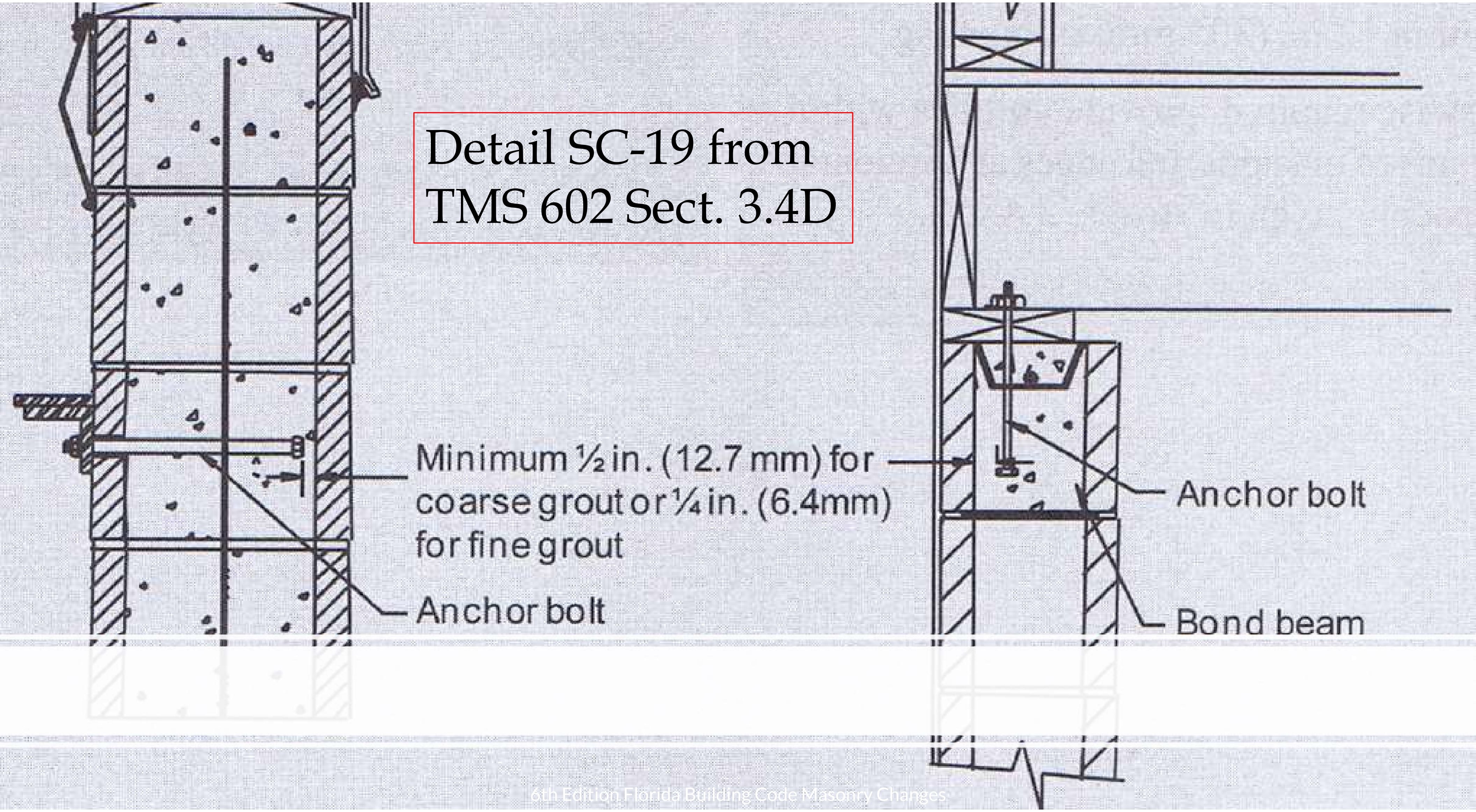

6th Edition Florida Building Code Masonry Changes

2122.7.4 Required anchors shall be embedded in reinforced grouted cells. Anchor bolts shall be installed in accordance with TMS 602 Section 3.4D.

2122.7.5 Wood framing connected by nails shall not be considered as acceptable anchorage.

Good Advice!!

Detail SC-19 from TMS 602 Sect. 3.4D



2122.8.2 Vertical alignment of cells to be grouted shall maintain clear, unobstructed, continuous, vertical cores measuring not less than $2^{1}/_{2}$ inches by 3 inches (51 mm by 76 mm) for fine aggregate grout and 3 inches by 3 inches (76 mm by 76 mm) for coarse aggregate grout as defined by ASTM C476. The architect or engineer may specify other grout space sizes which shall be permitted provided they comply with TMS 402 Section 1.203.2.1 and TMS 602 Section 3.5C.

pg. S-77 Sect 3.5 C.Table 6

Table 7 — 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,[3,4,5] 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-built cross-section of the grout space. Select the grout type and maximum grout pour height based on the minimum clear space.

[4] Area of vertical reinforcement shall not exceed 6 percent of the area of the grout space.

[5] 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.

2122.8.6 Unless otherwise required, mix grout other than self-consolidating grout to a consistency that has a slump between 8 and 11 inches (203 and 279 mm). Self-consolidating grout shall comply with TMS 602.

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.

2122.8.8 Grout placement shall comply with Section 3.5 of TMS 602. Grouting shall be a continuous operation with grout pour height in accordance with Section 3.5C of TMS 602 and with grout lift height in accordance with Section 3.5D of TMS 602.

3.5 A. *Placing time* — Place grout within $1^1/_2$ 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.

2122.8.9 Grouting shall be consolidated between lifts by puddling, rodding or mechanical vibration.

2122.8.10 Grout keys shall be formed between grout pours. Grout keys shall be formed 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 $1^1/_2$ inches (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.

2122.9 Bearing. Precast floor and roof units supported on masonry walls shall provide minimum bearing of 3 inches (76 mm) and anchorage in accordance with Section 2122.7.

2122.10 Intersecting walls. Intersecting walls shall comply with TMS 402/ ACI 530/ ASCE 5 Section 5.1.1.

From TMS 402 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.

Questions?