



Rowan County Building Code Enforcement

Braced Wall Framing, the Sequel

***Mandatory Sept. 1, 2013
Available to be used NOW.***

The new R602.10

Entire section replaced.

Five available bracing methods:

- 1) Isolated Panels – R602.10.3 (replaced “intermittent”)
- 2) Continuous Sheathing – R602.10.3
- 3) Engineered design per R602.10.4
- 4) 2012 IRC
- 5) SR-102, APA

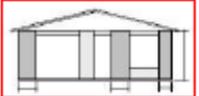
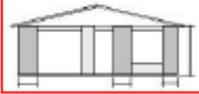
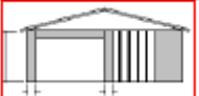
A **Panel** is an area along the BWL designated to resist lateral forces. Minimum width must be established before a surface can be called a “panel” – different widths for different installations.

Table **R602.10.1** shows all

- 1) Bracing Methods,
- 2) Brace Material thickness/size
- 3) Minimum BWP lengths
- 4) Fasteners & Spacing

All bracing is based on WIND.

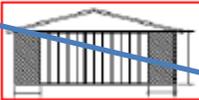
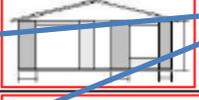
Table R602.10.1
BRACING METHODS^{1,2}

Method	Minimum Brace Material Thickness or Size	Minimum Brace Panel Length or Brace Angle	Connection Criteria		Illustration of Bracing Method (illustrates method only, not location)
			Fasteners	Spacing	
LIB <u>Let-in Bracing</u>	1x4 wood brace (or approved metal brace installed per manufacturer instructions)	45° angle for maximum 16" oc stud spacing ³	2-8d common nails or 3-8d (2-1/2" long x 0.113" dia.) nails	Per stud and top and bottom plates	
DWB <u>Diagonal wood boards</u>	3/4" (1" nominal)	48"	2-8d (2-1/2" long x 0.113" diameter) or 2 - 1-3/4" long staples	Per stud and top and bottom plates	
WSP <u>Wood structural panel</u>	3/8"	48" ⁴	6d common nail or 8d (2-1/2" long x 0.113" diameter) nail <i>See Table R602.3(3)</i>	6" edges 12" field	
SFB <u>Structural Fiberboard Sheathing</u>	3/4"	48" ⁴	1-1/2" long x 0.120" dia. Galvanized roofing nails	3" edges 6" field	
GB <u>Gypsum Board</u> Installed on both sides of wall	3/2"	96" for use with R602.10.2 48" for use with R602.10.3	Min. 5d cooler nails or #6 screws	7" edges 7" field	
PCP <u>Portland cement plaster</u>	3/4" (maximum 16" oc stud spacing)	48"	1-1/2" long, 11 gage, 7/16" diameter head nails or 7/8" long, 16 gage staples	6" o.c. on all framing members	
CS-WSP⁵ <u>Continuously sheathed WSP</u>	3/8"	24" adjacent to window not more than 67% of wall height; 30" adjacent to door or window greater than 67% and less than 85% of wall height; 48" for taller openings.	Same as WSP	Same as WSP	
CS-SFB⁵ <u>Continuously sheathed SFB</u>	3/4"	Same as CS-WSP	Same as SFB	Same as SFB	
PF <u>Portal Frame⁶</u>	7/16"	See Figure R602.10.1	See Figure R602.10.1	See Figure R602.10.1	

Isolated Panels

CS

Table R602.10.1
BRACING METHODS^{1,2}

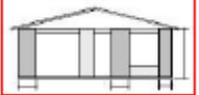
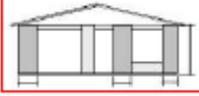
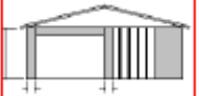
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PF <u>Portal Frame⁶</u>	7/16"	See Figure R602.10.1	See Figure R602.10.1	See Figure R602.10.1	

Footnotes:

- 1) Alt. methods...
- 2) All panel edges attached to framing or blocking (GB exception)
- 3) Two LIB at 60° = 1 LIB at 45°
- 4) Min. panel widths: 8' wall = 36", 9' wall = 42" (where not beside a door), 2,800# hold down at each end of panel = 32". Single story garage min. 24" panel permitted on one wall with one or more doors.
- 5) CS shall be sheathed on all surfaces.
- 6) PF (isolated) 2 PF panels per Figure R602.10.1 = 1 BWP.

CS Isolated Panels

**Table R602.10.1
BRACING METHODS^{1,2}**

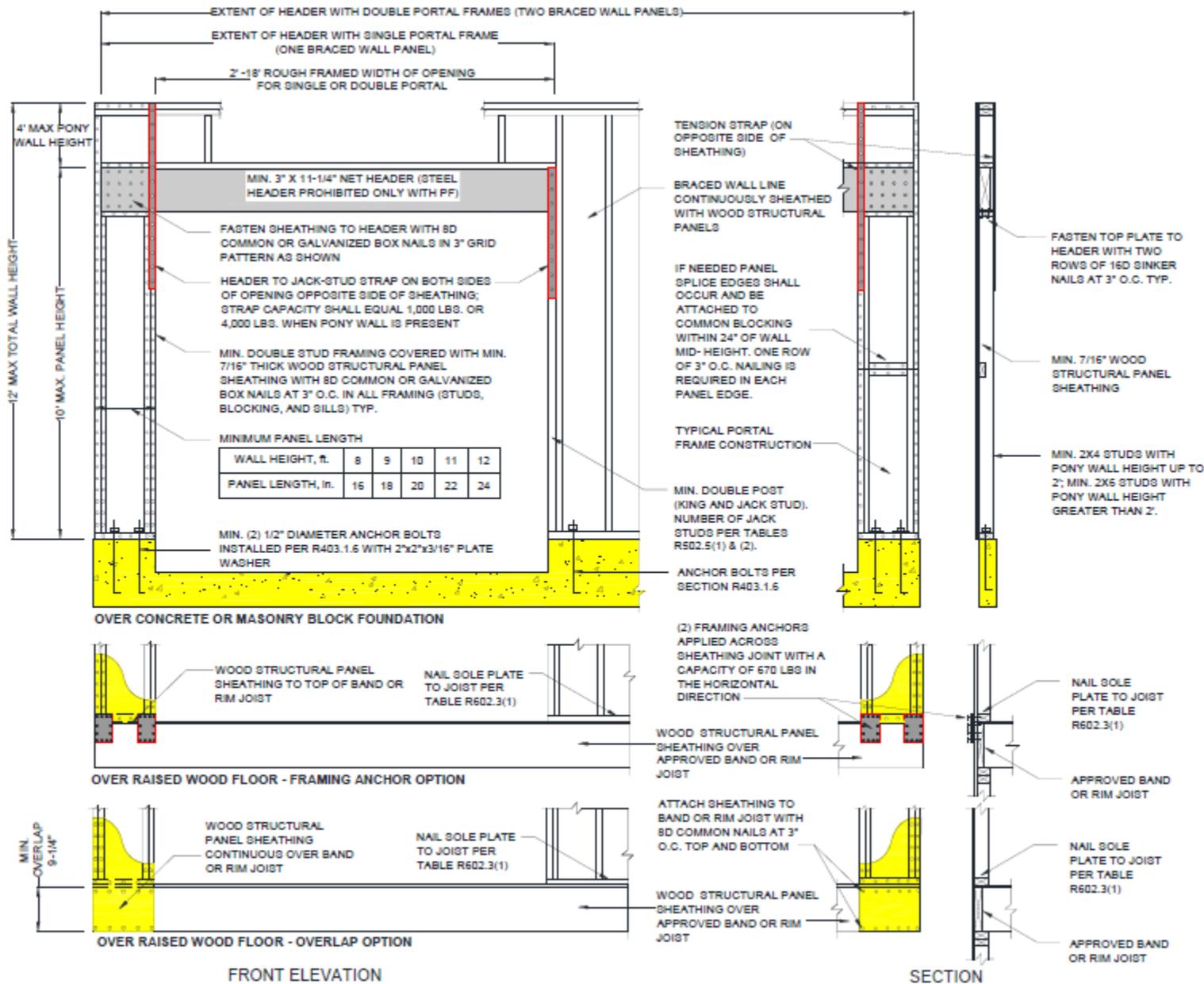
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PF Portal Frame ⁶	7/16"	See Figure R602.10.1	See Figure R602.10.1	See Figure R602.10.1	

Isolated Panels

CS

P

The ONLY portal frame detail now.



For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lb = 4.45 N

Figure R602.10.1

Method PF – Portal Frame Construction

R602.10.2: Isolated Panels

Replaces “Intermittent Bracing”

Limitations:

- 1) Winds less/equal to 100 mph & Exposure Category B (Rowan fits)
- 2) 75' max length of dwelling (length is longest plan dimension)
- 3) 3:1 max ratio of length to width (if L=75', minimum W=25')
- 4) 10' max wall height
- 5) 10' max ridge to eave height unless roof counts as additional story
- 6) All interior side of exterior walls and both sides of interior walls require ½" drywall continuously sheathed (or product of equal lateral bracing strength)
- 7) 24" maximum floor cantilever.
- 8) Townhouses...

R602.10.2: Isolated Panels

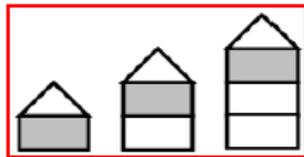
Number of Braced Wall Panels (BWPs) comply with Table R602.10.2

- 1) for each Side
- 2) for each Story
- 3) Minimum 2 BWPs along each plan elevation.
 - a. *“Plan Elevation” means an entire side of a dwelling – not each individual exterior wall.*
- 4) A BWP must be within 12' of both ends of each Plan Elevation
- 5) Edge to edge maximum dimension between any two BWPs is 21'.
- 6) 50% max BWP can be located along interior walls parallel to Plan Elevation
 - a. Must be less than half other plan distance back from Plan Elevation
- 7) Multiple bracing methods are permitted.
- 8) Detached garaged and storage buildings are considered separate buildings even when connected with a breezeway.
- 9) Houses with skewed wings may not use Isolated Panel Method.
- 10) Garage door openings supporting a floor load above shall be braced with Portal Frames unless Plan Elevation/Story containing garage opening complies with bracing requirements of this section.

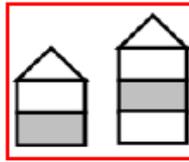
TABLE R602.10.2
Number of Braced Wall Panels Required
for Each House Elevation (Building Side) at Each Story Level¹

<u>Wind Velocity</u>	<u>Story Level Supporting:</u>	<u>Longest Overall Dimension of Floor Plan for a Given Story Level</u>		
		<u>25'</u>	<u>50'</u>	<u>75'</u>
<u>90 mph</u>	<u>Roof Only</u>	<u>1</u>	<u>2</u>	<u>3</u>
	<u>Roof + 1 Story</u>	<u>2</u>	<u>4</u>	<u>6</u>
	<u>Roof + 2 Stories</u>	<u>3</u>	<u>6</u>	<u>9</u>
<u>100 mph</u>	<u>Roof Only</u>	<u>2</u>	<u>3</u>	<u>4</u>
	<u>Roof + 1 Story</u>	<u>3</u>	<u>5</u>	<u>8</u>
	<u>Roof + 2 Stories</u>	<u>4</u>	<u>8</u>	<u>11</u>

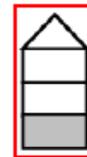
1. Interpolation between dimensions is permitted. Extrapolation is prohibited. Fractions of panels shall be rounded to the nearest whole panel.



Roof Only



Roof + 1 Story



Roof + 2 Stories

Interpolate to closest overall dimension & round to nearest whole panel.

- Overall plan dimension = 40'
- Roof only, 40' closer to 50' = 2 panels
- Roof +1 story, 40' is closer to 37.5' (half step) = 3 panels
- Roof +2 story, 40' is closer to 41.6' (1/3 step) = 5 panels

TABLE R602.10.2

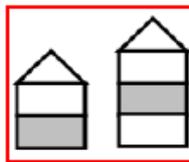
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	<u>Roof + 2 Stories</u>	<u>3</u>	<u>6</u>	<u>9</u>
<u>100 mph</u>	<u>Roof Only</u>	1/2 step: 37.5' (3) ... 62.5' (5)		
	<u>Roof + 1 St</u>	1/3 step: 33.3' (4), 41.6' (5) ... 58.3' (7), 66.6' (8)		
	<u>Roof + 2 St</u>			

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Roof Only



Roof + 1 Story

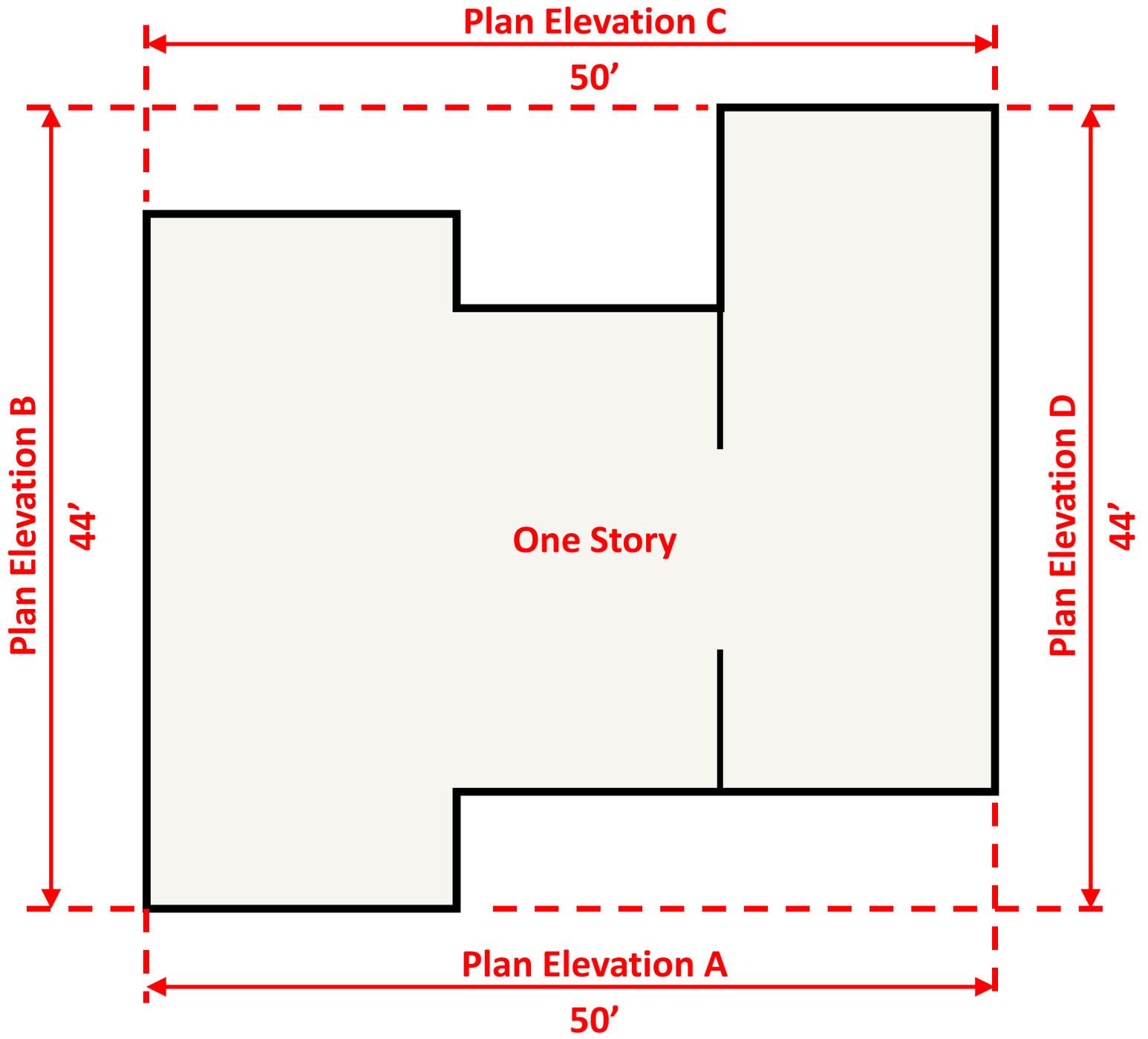


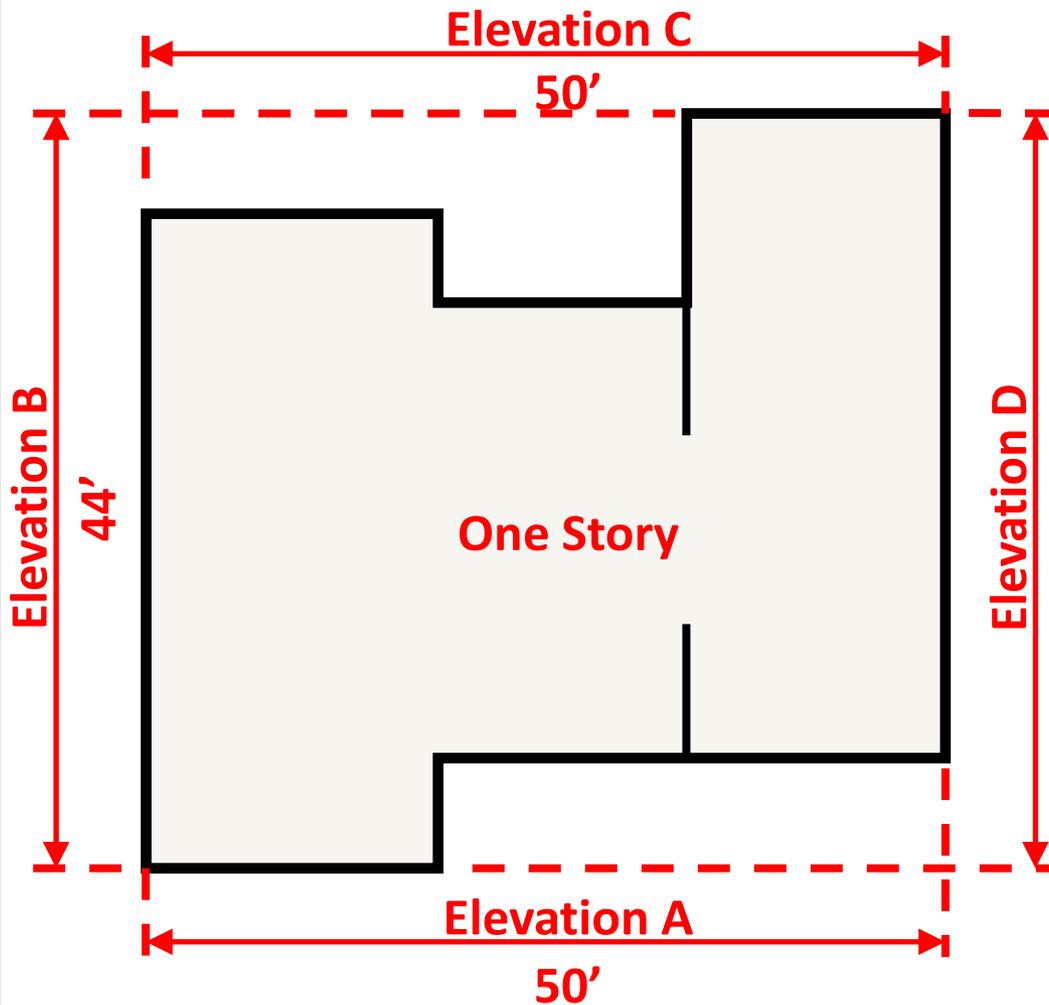
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Isolated Panels

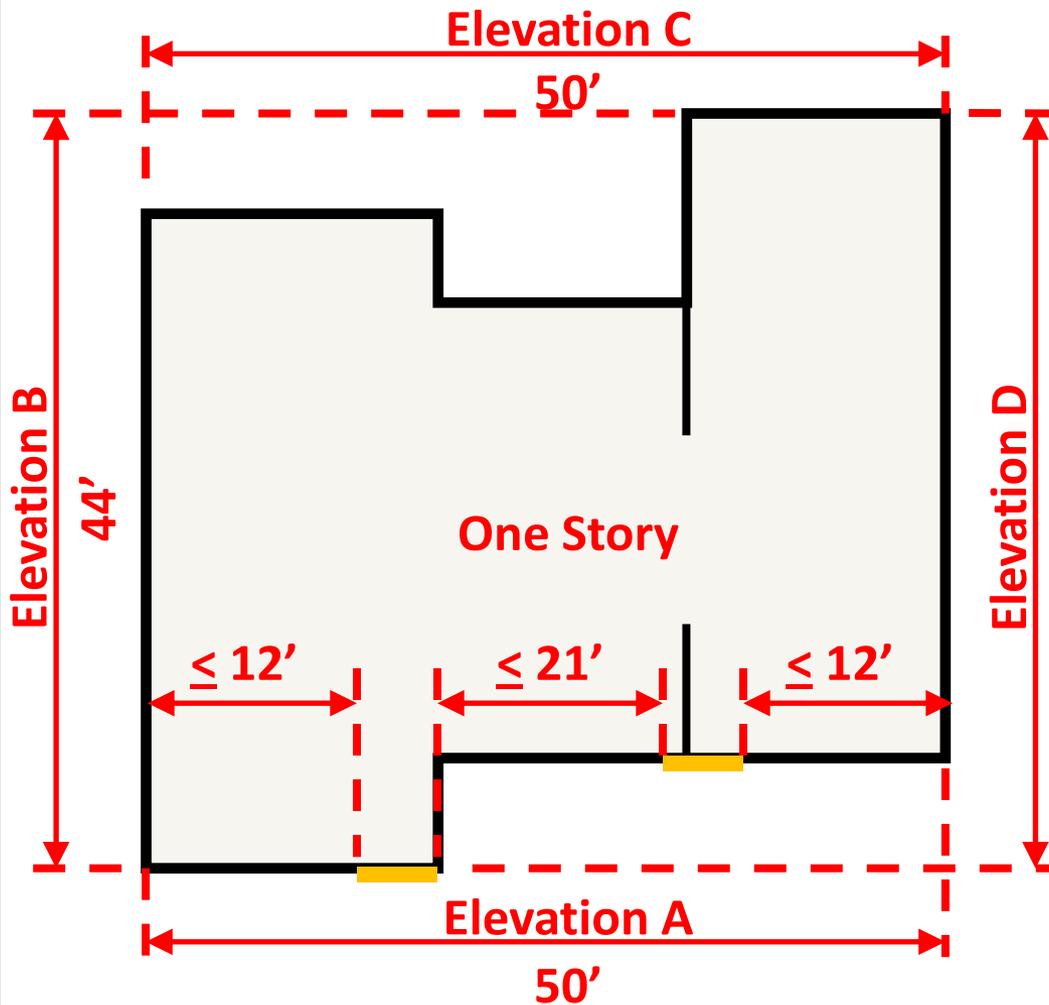




- 1 Story, 8' tall walls
- WSP method
- Minimum Panel Width = 36"
- 50' sides = 2 panels (A&C)
- 44' sides = 2 panels (B&D)
- 12' from edge, 21' apart
- $50 - 12 - 12 - 3 - 3 = 20 \Rightarrow 2$ panels could work if windows, doors, offsets, etc. work out.

<u>Wind Velocity</u>	<u>Story Level Supporting:</u>	<u>Longest Overall Dimension of Floor Plan for a Given Story Level</u>		
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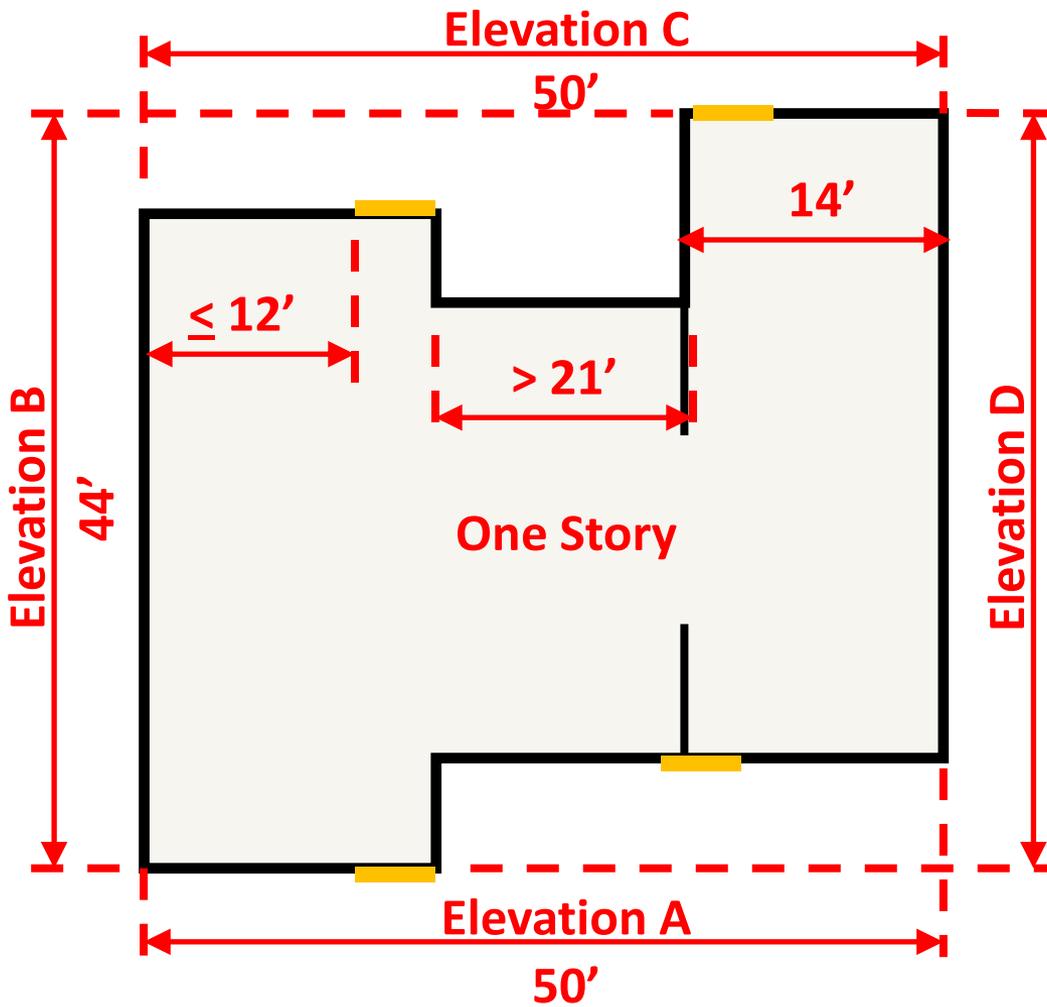
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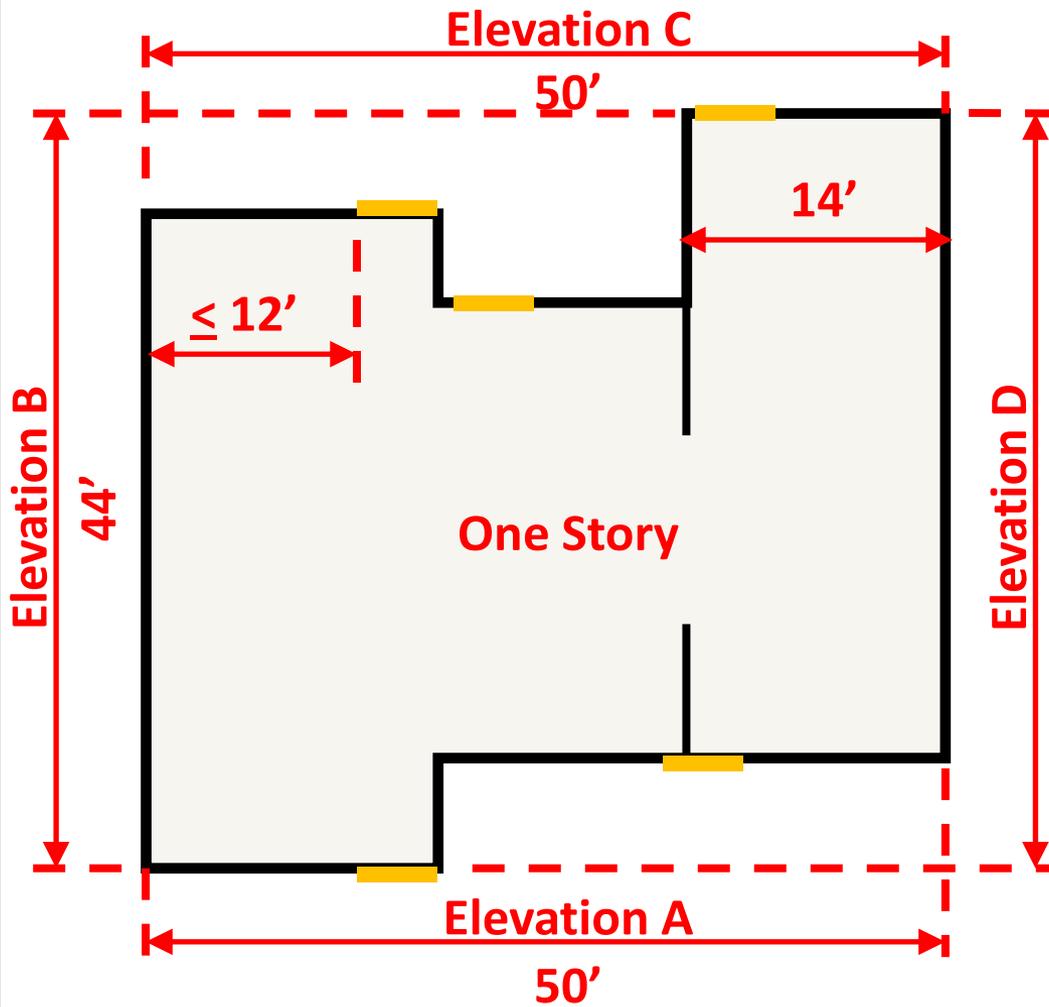
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Isolated Panels



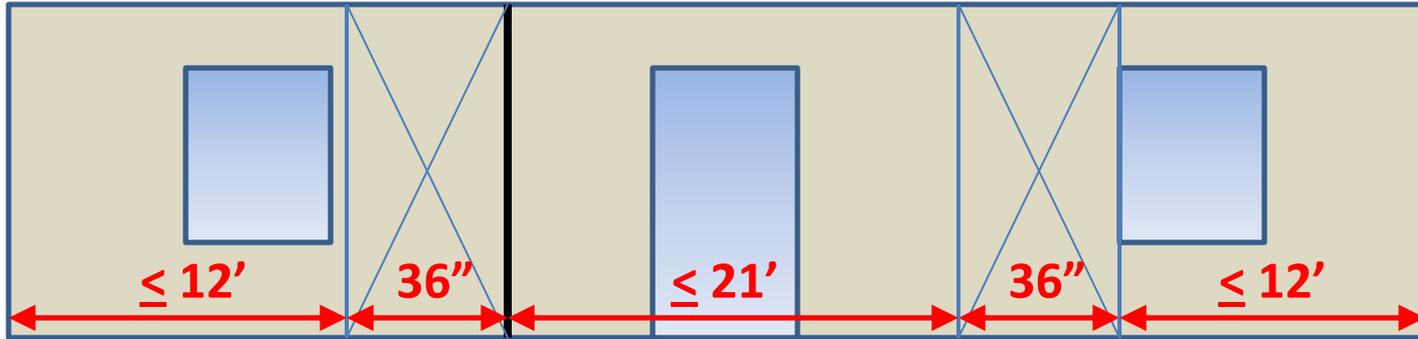
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Elevation A:

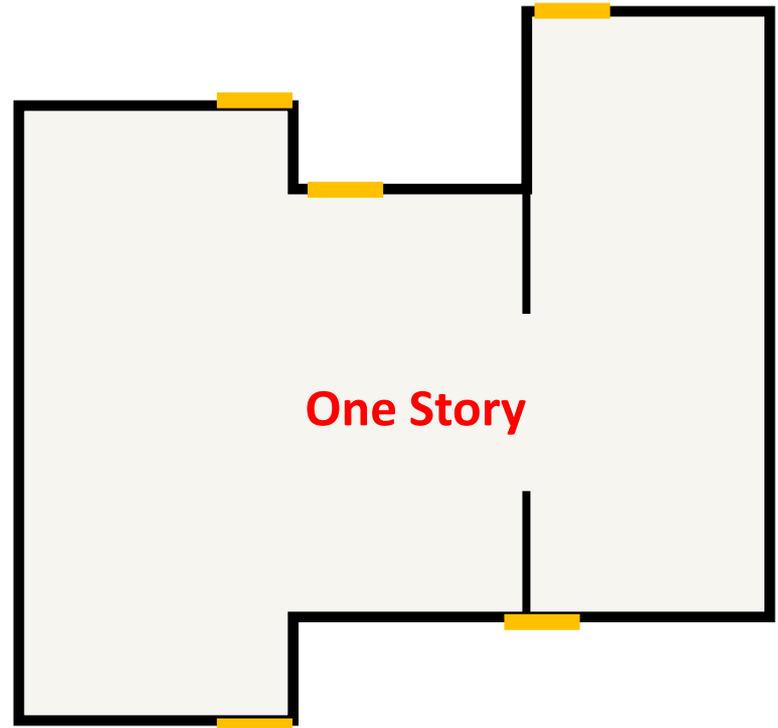
Total Length = 50'

Minimum two 36" panels

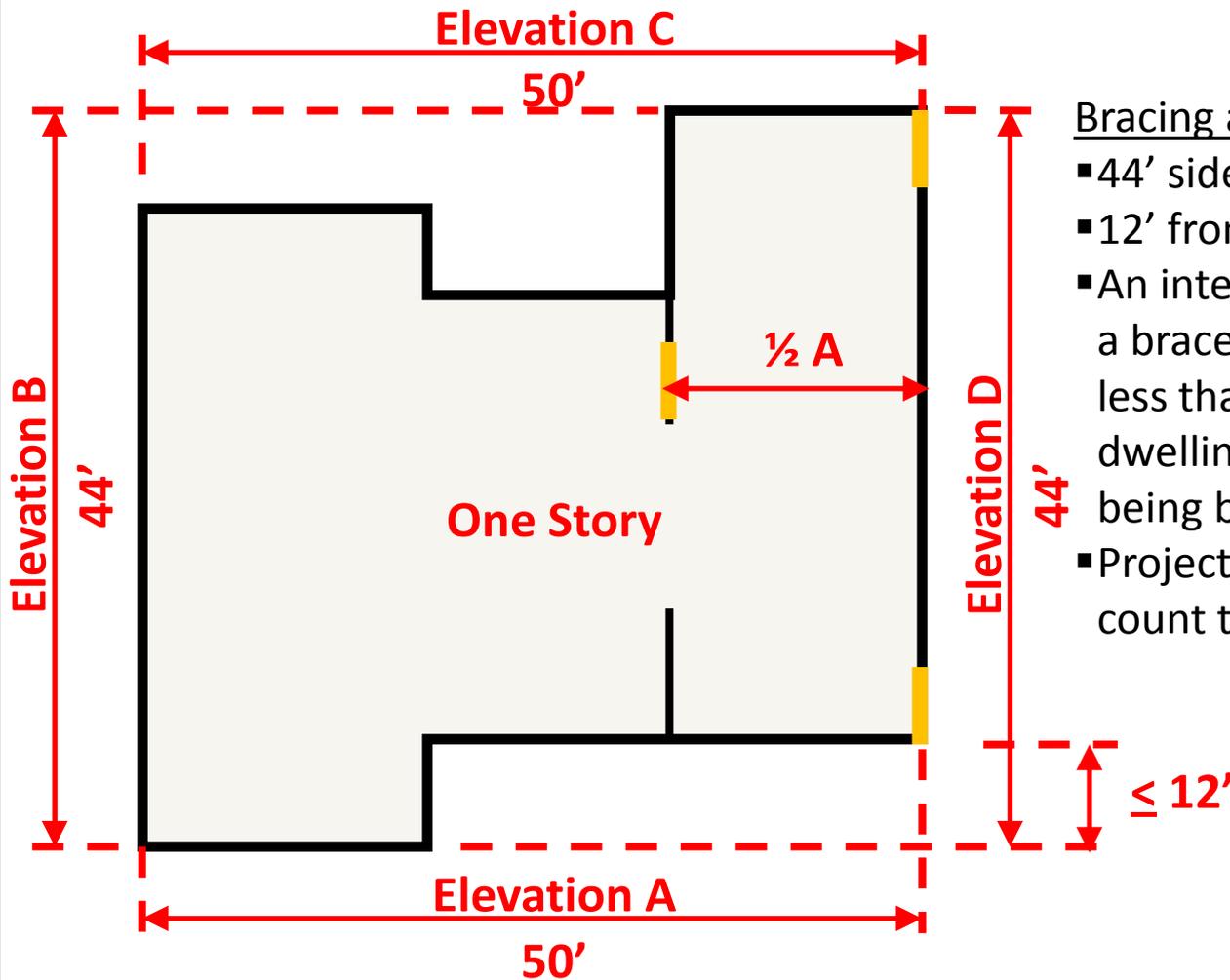


BWP Locations:

- 1) Less than 12' from corner
- 2) Less than 21' edge to edge
- 3) 48" min panel width can be reduced
 - a) If 8' tall wall = 36"
 - b) If 9' tall wall = 42"
 - c) If panel is not located beside door



Isolated Panels

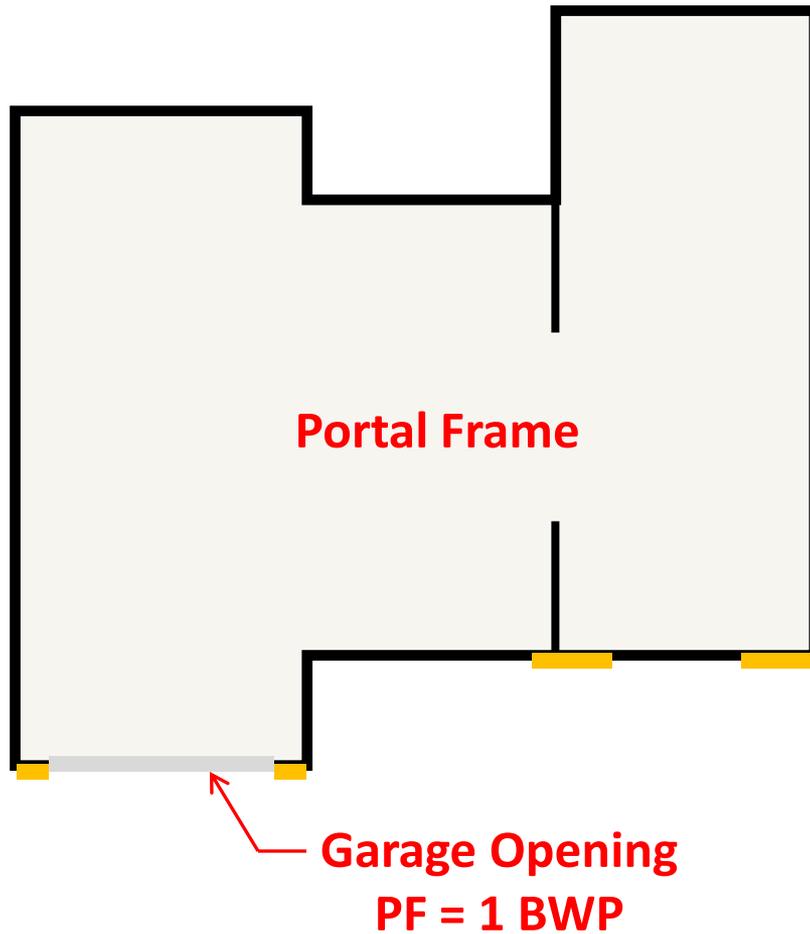


Bracing along Elevation D

- 44' sides = 2 panels (B&D)
- 12' from edge, 21' apart
- An interior wall can be used for a braced wall panel if located less than half the depth of the dwelling from the elevation being braced.
- Projections of wings beyond count toward overall elevation.

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Portal Frame



- Only required when NEEDED to meet minimum panel requirements.
 - If wall has 48" braced wall panel on each side of garage door and panels are within 12' of end of wall and less than 21' apart, then portal frame detailing is not required.
- Pair of portal frame panels (one at each side of opening) counts as one braced wall panel.

R602.10.3: Continuous Sheathing

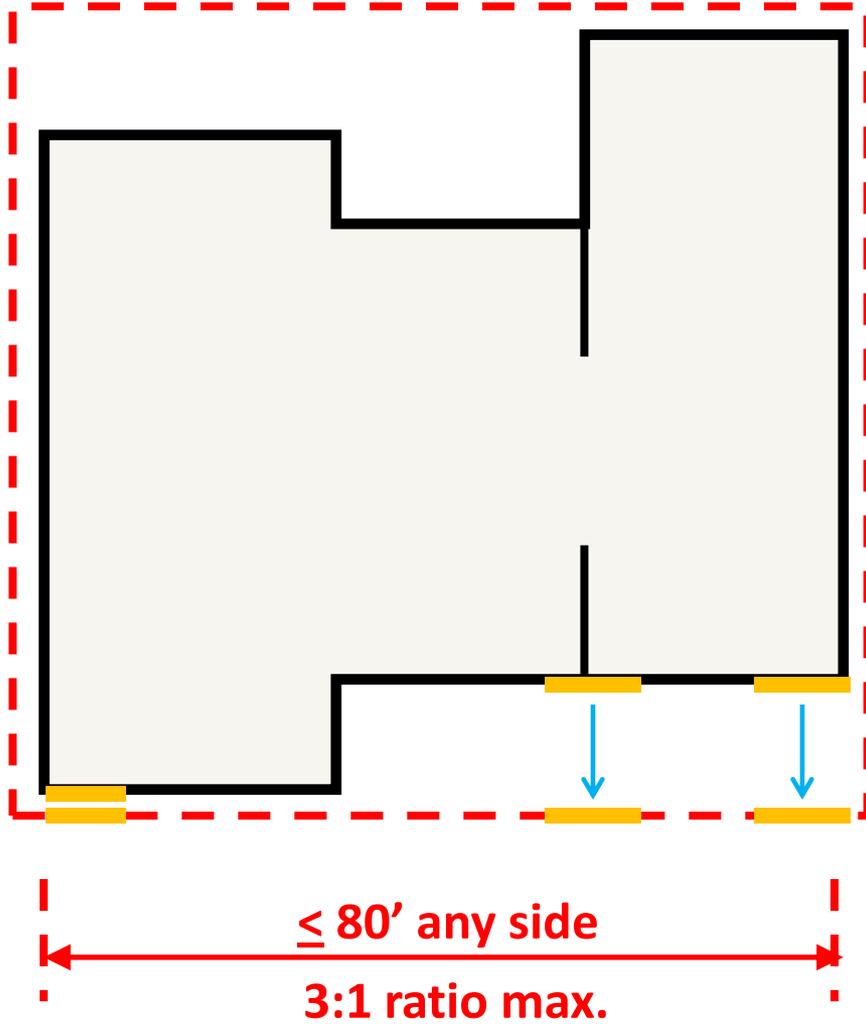
Limitations:

- 1) Winds less/equal to 110 mph & Exposure Category B (Rowan fits)
- 2) 12' max wall height
- 3) 20' max ridge to eave height unless roof counts as additional story
- 4) Exterior walls shall be sheathed on all sheathable surfaces...
- 5) All interior side of exterior walls and both sides of interior walls require ½" drywall continuously sheathed (or product of equal lateral bracing strength)
 - a) ...can be omitted if BWP min x 1.40.
- 6) 24" maximum floor cantilever.
- 7) Townhouses...

R602.10.3: Continuous Sheathing

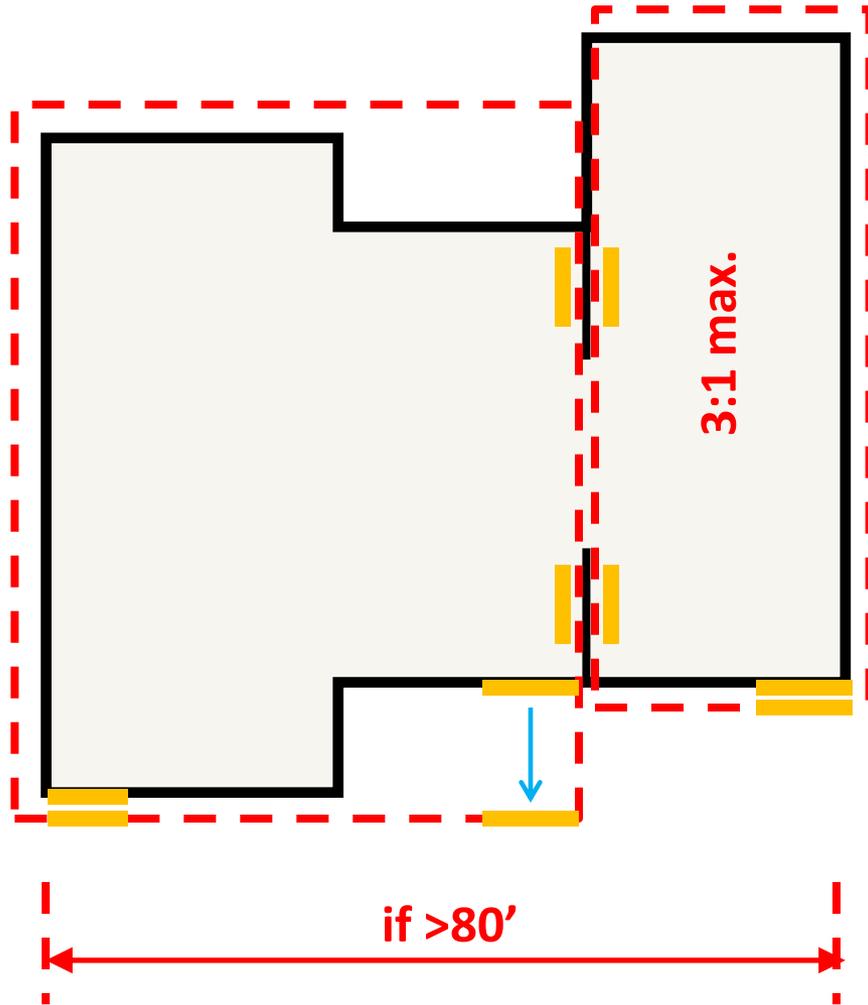
- 1) Number of BWPs comply with Table R602.10.3 – length of PERPENDICULAR side
- 2) Circumscribed Rectangle around plan or portion of plan at each story
 - a) Maximum Rectangle dimension = 80'
 - b) 3:1 maximum Rectangle width/depth ratio
 - c) Rectangles may be turned for skewed wings/walls
- 3) Table R602.10.3 to determine minimum width of BWPs.
- 4) BWP on exterior or interior wall assigned to nearest side of Rectangle
- 5) A BWP must be within 12' of every corner of the Circumscribed Rectangle
- 6) Edge to edge maximum dimension between any two BWPs is 21'.
- 7) Exterior walls greater than 12' long must have one BWP minimum.
- 8) Exterior walls less than 12' long, no BWP required.
- 9) Minimum of 50% of the required bracing shall be located on Exterior Walls within 8 feet of the Circumscribed Rectangle.
- 10) Interior BWPs may use Method GB at 0.5x actual BWP width (min. 48")
- 11) Where multiple Circumscribed Rectangles are used, minimum BWPs along the common wall between rectangles shall be the sum of the two.
- 12) Bracing provided on upper floors is calculated separately or if same or greater BWP is provided on upper floor than is required on lower floor, no analysis is required.
- 13) Portal Frames contribute 1.5x their actual length
- 14) End Condition requirements...

Circumscribed Rectangle(s)



- Rectangle allowed around entire structure if all dimensions are less than 80' and max. ratio width to length is 3:1.

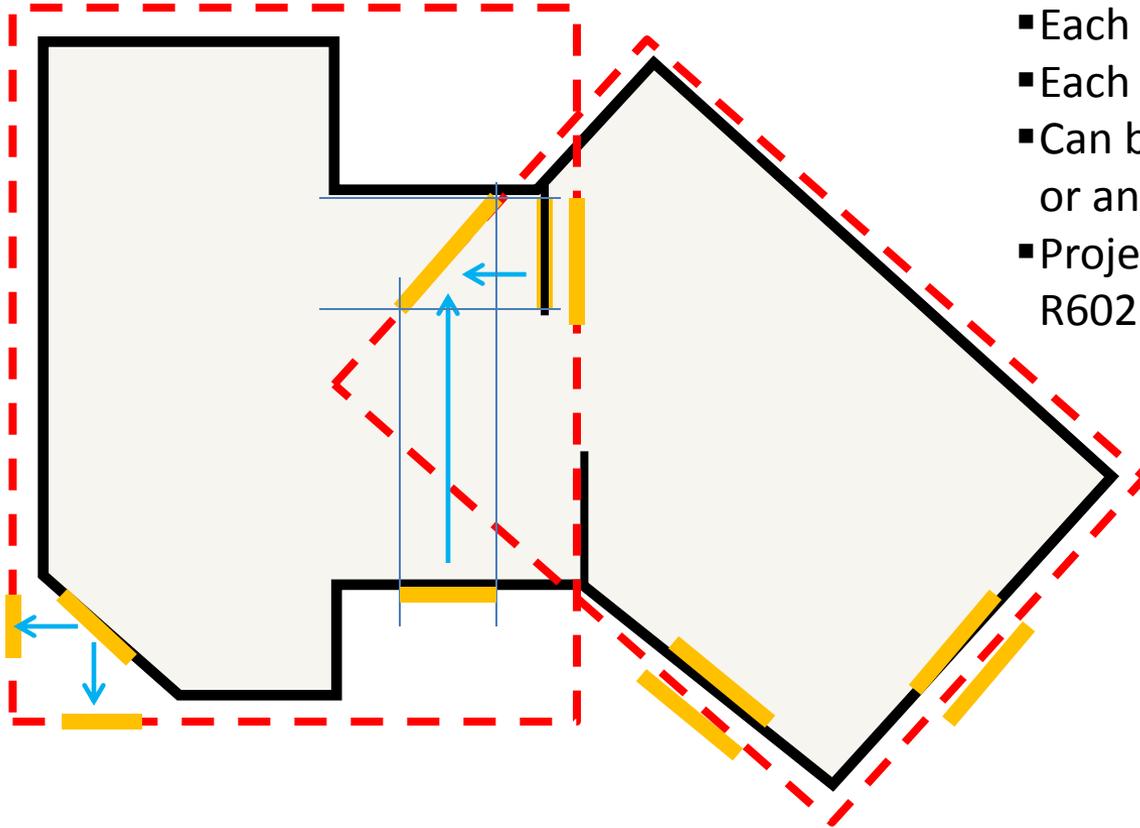
Circumscribed Rectangle(s)



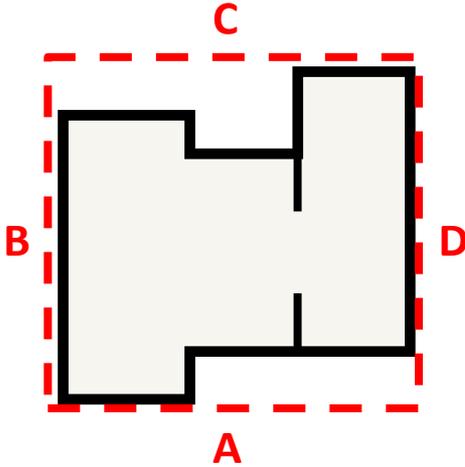
- Multiple Rectangles allowed
 - Each less than 80'
 - Each 3:1 ratio max.
- BWPs on adjacent lines = sum of both lines.

Circumscribed Rectangle(s)

- Multiple Rectangles allowed
 - Each less than 80'
 - Each 3:1 ratio max.
 - Can be used on skewed wings or angled corners
 - Project BWPs per Fig. R602.10.3(2)



Circumscribed Rectangle(s)



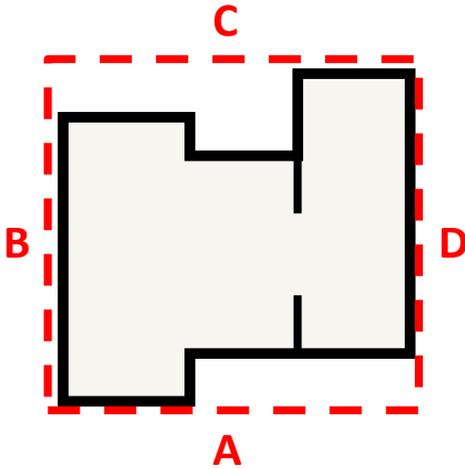
- Establishing number of BWPs for each side of Rectangle:
 - Eave to ridge height of roof?
 - Which story of how many stories?
 - Length of **perpendicular** Rectangle side?
 - Height of walls?
 - 8'=x0.9, 9'=x0.95, 10'=x1.0, 11'=x1.05, 12'=x1.10

TABLE R602.10.3

REQUIRED LENGTH OF BRACING ALONG EACH SIDE OF A CIRCUMSCRIBED RECTANGLE ^{a, b, c, d}

WIND SPEED	EAVE-TO RIDGE HEIGHT (FEET)	STORY LEVEL SUPPORTING: ^e	REQUIRED LENGTH OF BRACING ON ANY SIDE							
			Length of perpendicular side (ft) ^f							
			10	20	30	40	50	60	70	80
90	10	Roof Only	2.0	3.5	5.0	6.0	7.5	9.0	10.5	12.0
		Roof + 1 Story	3.5	6.5	9.0	12.0	14.5	17.0	19.8	22.6
		Roof + 2 Stories	5.0	9.5	13.5	17.5	21.5	25.0	29.2	33.4
	15	Roof Only	2.6	4.6	6.5	7.8	9.8	11.7	13.7	15.7
		Roof + 1 Story	4.0	7.5	10.4	13.8	16.7	19.6	22.9	26.2
		Roof + 2 Stories	5.5	10.5	14.9	19.3	23.7	27.5	32.1	36.7
	20	Roof Only	2.9	5.2	7.3	8.8	11.1	13.2	15.4	17.6
		Roof + 1 Story	4.5	8.5	11.8	15.6	18.9	22.1	25.8	29.5
		Roof + 2 Stories	6.2	11.9	16.8	21.8	27.3	31.1	36.3	41.5

Circumscribed Rectangle(s)



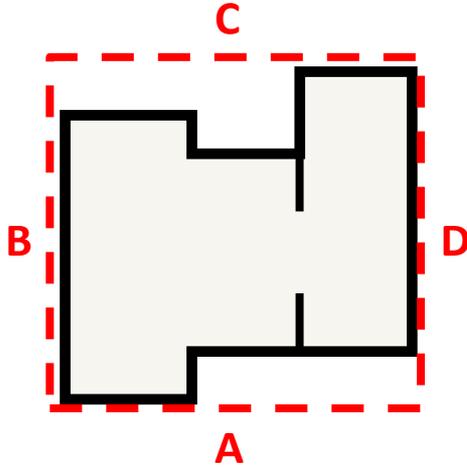
- Establishing number of BWPs for each side of Rectangle:
 - Eave to ridge height of roof? = **10'**
 - Which story of how many stories? = **1st of 1 story**
 - Length of perpendicular Rectangle side? = **44'**
 - Height of walls? = **8'**
- **44' = 6.6' x 0.9 = 5.94' total BWP on A & C**

TABLE R602.10.3

REQUIRED LENGTH OF BRACING ALONG EACH SIDE OF A CIRCUMSCRIBED RECTANGLE ^{a, b, c, d}

WIND SPEED	EAVE-TO RIDGE HEIGHT (FEET)	STORY LEVEL SUPPORTING: ^e	REQUIRED LENGTH OF BRACING ON ANY SIDE							
			Length of perpendicular side (ft) ^f							
			10	20	30	40	50	60	70	80
90	10	Roof Only	2.0	3.5	5.0	6.0	7.5	9.0	10.5	12.0
		Roof + 1 Story	3.5	6.5	9.0	12.0	14.5	17.0	19.8	22.6
		Roof + 2 Stories	5.0	9.5	13.5	17.5	21.5	25.0	29.2	33.4
	15	Roof Only	2.6	4.6	6.5	7.8	9.8	11.7	13.7	15.7
		Roof + 1 Story	4.0	7.5	10.4	13.8	16.7	19.6	22.9	26.2
		Roof + 2 Stories	5.5	10.5	14.9	19.3	23.7	27.5	32.1	36.7
	20	Roof Only	2.9	5.2	7.3	8.8	11.1	13.2	15.4	17.6
		Roof + 1 Story	4.5	8.5	11.8	15.6	18.9	22.1	25.8	29.5
		Roof + 2 Stories	6.2	11.9	16.8	21.8	27.3	31.1	36.3	41.5

Circumscribed Rectangle(s)



- Establishing number of BWPs for each side of Rectangle:
 - Eave to ridge height of roof? = **10'**
 - Which story of how many stories? = **1st of 1 story**
 - Length of perpendicular Rectangle side? = **44'**
 - Height of walls? = **8'**

▪ **44' = 6.6' x 0.9 = 5.94' total BWP on A & C**

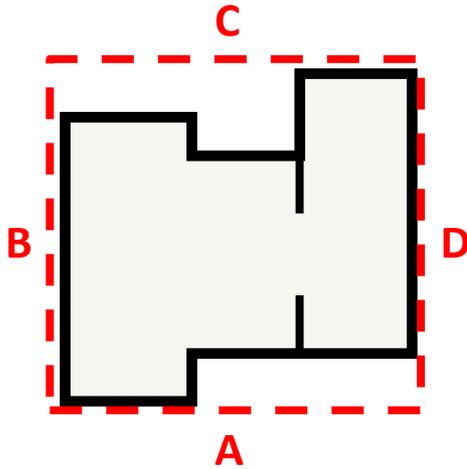
▪ Compare to Isolated Panels = **6'-0"** (same)

ANGLE ^{a, b, c, d}
ANY SIDE

REQUIRED LENGTH OF BRACING

WIND SPEED	EAVE-TO RIDGE HEIGHT (FEET)	STORY LEVEL SUPPORTING: ^e	Length of perpendicular side (ft) ^f							
			10	20	30	40	50	60	70	80
			90	10	Roof Only	2.0	3.5	5.0	6.0	7.5
		Roof + 1 Story	3.5	6.5	9.0	12.0	14.5	17.0	19.8	22.6
		Roof + 2 Stories	5.0	9.5	13.5	17.5	21.5	25.0	29.2	33.4
	15	Roof Only	2.6	4.6	6.5	7.8	9.8	11.7	13.7	15.7
		Roof + 1 Story	4.0	7.5	10.4	13.8	16.7	19.6	22.9	26.2
		Roof + 2 Stories	5.5	10.5	14.9	19.3	23.7	27.5	32.1	36.7
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		Roof + 1 Story	4.5	8.5	11.8	15.6	18.9	22.1	25.8	29.5
		Roof + 2 Stories	6.2	11.9	16.8	21.8	27.3	31.1	36.3	41.5

Circumscribed Rectangle(s)



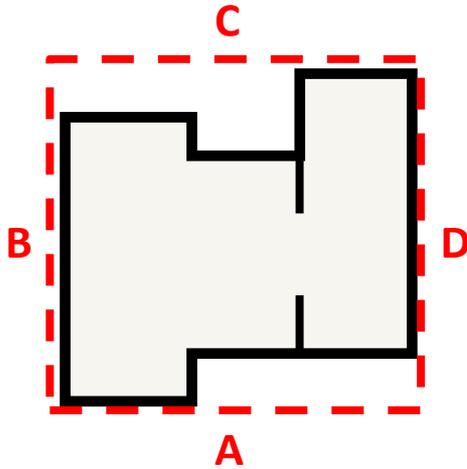
- Establishing number of BWPs for each side of Rectangle:
 - Eave to ridge height of roof? = **15'**
 - Which story of how many stories? = **1st of 1 story**
 - Length of perpendicular Rectangle side? = **44'**
 - Height of walls? = **12'**
- **44' = 8.2' x 1.1 = 9.02' total BWP on A & C**

TABLE R602.10.3

REQUIRED LENGTH OF BRACING ALONG EACH SIDE OF A CIRCUMSCRIBED RECTANGLE ^{a, b, c, d}

WIND SPEED	EAVE-TO RIDGE HEIGHT (FEET)	STORY LEVEL SUPPORTING: ^e	REQUIRED LENGTH OF BRACING ON ANY SIDE							
			Length of perpendicular side (ft) ^f							
			10	20	30	40	50	60	70	80
90	10	Roof Only	2.0	3.5	5.0	6.0	7.5	9.0	10.5	12.0
		Roof + 1 Story	3.5	6.5	9.0	12.0	14.5	17.0	19.8	22.6
		Roof + 2 Stories	5.0	9.5	13.5	17.5	21.5	25.0	29.2	33.4
	15	Roof Only	2.6	4.6	6.5	7.8	9.8	11.7	13.7	15.7
		Roof + 1 Story	4.0	7.5	10.4	13.8	16.7	19.6	22.9	26.2
		Roof + 2 Stories	5.5	10.5	14.9	19.3	23.7	27.5	32.1	36.7
	20	Roof Only	2.9	5.2	7.3	8.8	11.1	13.2	15.4	17.6
		Roof + 1 Story	4.5	8.5	11.8	15.6	18.9	22.1	25.8	29.5
		Roof + 2 Stories	6.2	11.9	16.8	21.8	27.3	31.1	36.3	41.5

Circumscribed Rectangle(s)



- Establishing number of BWPs for each side of Rectangle:
 - Eave to ridge height of roof? = **15'**
 - Which story of how many stories? = **1st of 1 story**
 - Length of perpendicular Rectangle side? = **44'**
 - Height of walls? = **12'**
- **44' = 8.2' x 1.1 = 9.02' total BWP on A & C**

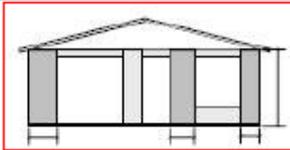
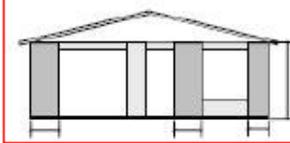
▪ Not allowed Isolated (15' Roof, 12' Walls)

REQUIRED LENGTH OF BRACING

ANGLE ^{a, b, c, d}
ANY SIDE

WIND SPEED	EAVE-TO RIDGE HEIGHT (FEET)	STORY LEVEL SUPPORTING: ^e	Length of perpendicular side (ft) ^f							
			10	20	30	40	50	60	70	80
			90	10	Roof Only	2.0	3.5	5.0	6.0	7.5
		Roof + 1 Story	3.5	6.5	9.0	12.0	14.5	17.0	19.8	22.6
		Roof + 2 Stories	5.0	9.5	13.5	17.5	21.5	25.0	29.2	33.4
	15	Roof Only	2.6	4.6	6.5	7.8	9.8	11.7	13.7	15.7
		Roof + 1 Story	4.0	7.5	10.4	13.8	16.7	19.6	22.9	26.2
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		Roof + 1 Story	4.5	8.5	11.8	15.6	18.9	22.1	25.8	29.5
		Roof + 2 Stories	6.2	11.9	16.8	21.8	27.3	31.1	36.3	41.5

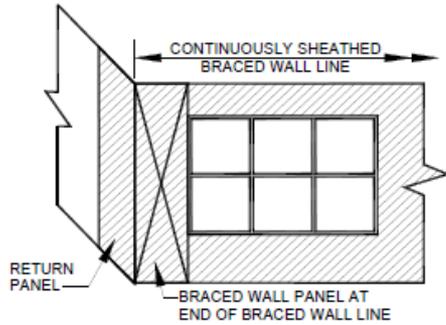
Cont. Sheathing – Minimum Panel Widths

			<u>staples</u>		
<u>CS-WSP³</u> <u>Continuously sheathed WSP</u>	<u>3/8"</u>	<u>24" adjacent to window not more than 67% of wall height. 30" adjacent to door or window greater than 67% and less than 85% of wall height. 48" for taller openings.</u>	<u>Same as WSP</u>	<u>Same as WSP</u>	
<u>CS-SFB³</u> <u>Continuously sheathed SFB</u>	<u>1/2"</u>	<u>24" adjacent to window not more than 67% of wall height. 30" adjacent to door or window greater than 67% and less than 85% of wall height. 48" for taller openings.</u>	<u>Same as SFB</u>	<u>Same as SFB</u>	

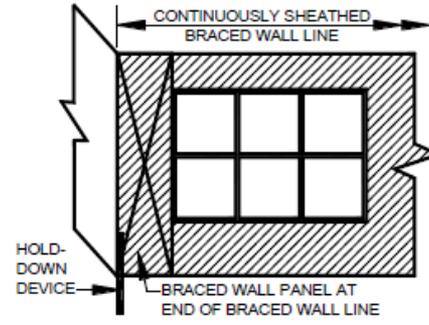
Minimum Panel Widths, Continuous Sheathing

- 24" beside window not more than 67% wall height
- 30" beside door or windows greater than 67% & less than 85% wall height
- 48" beside other openings
- Or use Portal Frame

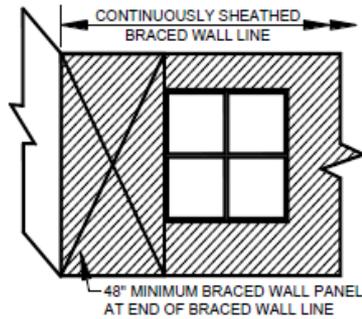
Cont. Sheathing – End Conditions



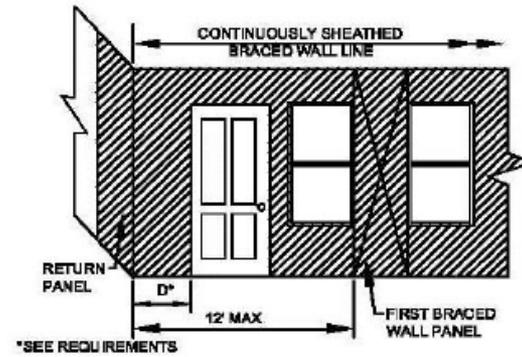
END CONDITION 1



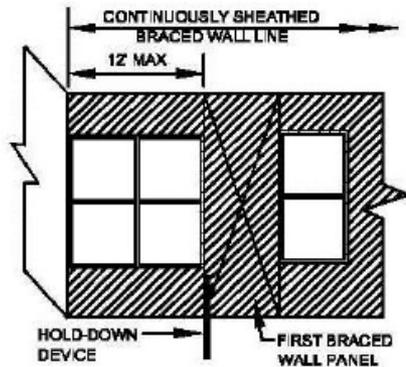
END CONDITION 2



END CONDITION 3



END CONDITION 4



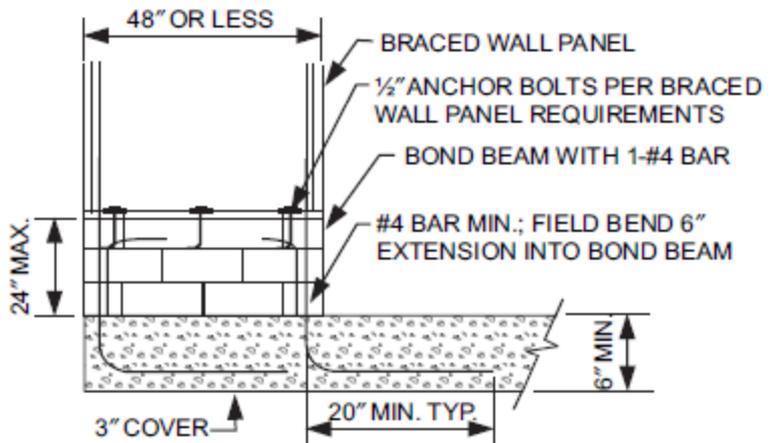
END CONDITION 5

REQUIREMENTS

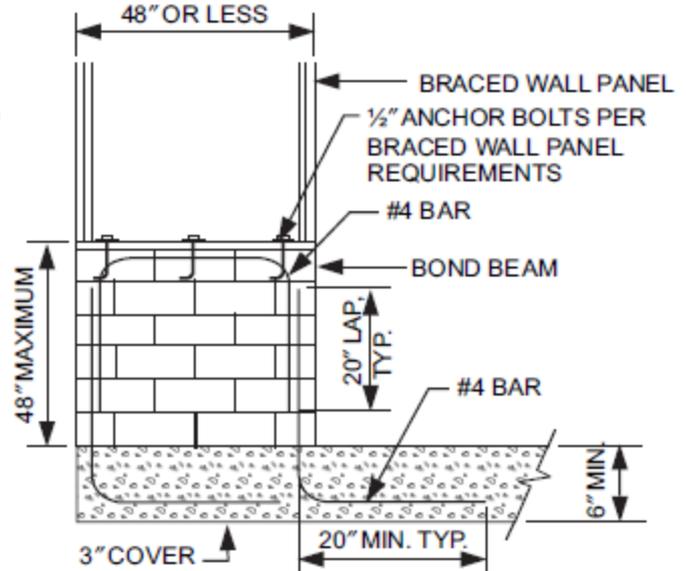
- Return panel:** 24" for braced wall lines sheathed with wood structural panels
32" for braced wall lines sheathed with structural fiberboard
- Distance D:** 24" for braced wall lines sheathed with wood structural panels
32" for braced wall lines sheathed with structural fiberboard
- Hold-down device:** 800 lbs capacity fastened to the edge of the braced wall panel closest to the corner and to the foundation or floor framing below

FIGURE CR602.10.3(4)a
END CONDITIONS FOR BRACED WALLS WITH CONTINUOUS SHEATHING

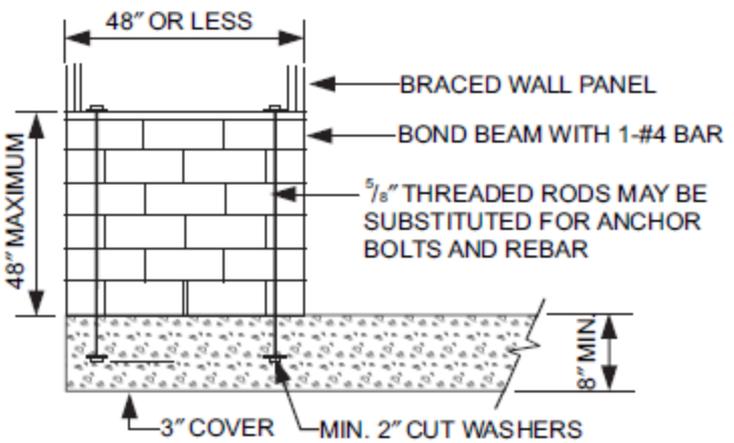
Stem Wall Details



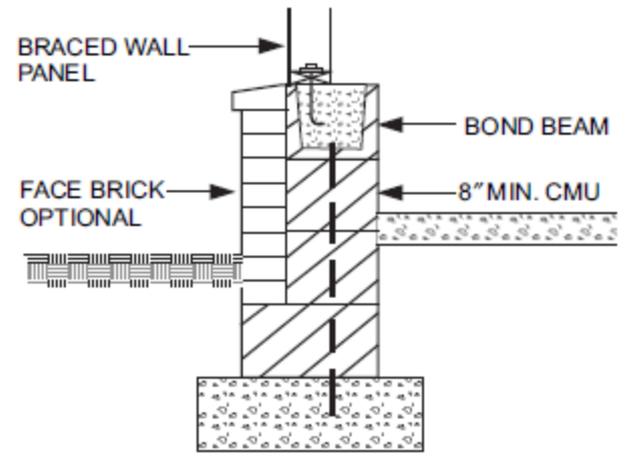
SHORT STEM WALL REINFORCEMENT



TALL STEM WALL REINFORCEMENT



OPTIONAL STEM WALL REINFORCEMENT



TYPICAL STEM WALL SECTION

For SI: 1 inch = 25.4 mm.

NOTE: GROUT BOND BEAMS AND ALL CELLS WHICH CONTAIN REBAR, THREADED RODS AND ANCHOR BOLTS.

**FIGURE R602.10.7
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS**



Rowan County Building Code Enforcement

Braced Wall Framing, the Sequel

***Mandatory Sept. 1, 2013
Available to be used NOW.***