

Description

- This seminar provides a comprehensive explanation of the 2018 International Residential Code® (IRC®) simplified wall bracing requirements. It guides the participant through an in-depth review and analysis of the bracing requirements for wood-framed residential structures.



2018 IRC Simplified Wall Bracing Provisions



Objectives

Upon completion, participants will be better able to:

1. Identify the forces that act on a house.
2. Determine bracing materials available with simplified wall bracing.
3. Apply simplified wall bracing provisions.
4. Review connections required at floor and roof.

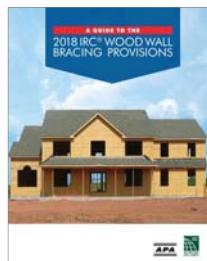


2018 IRC Simplified Wall Bracing Provisions



Resources

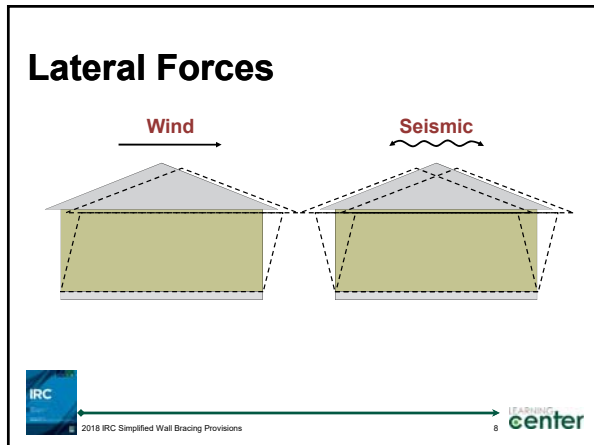
www.iccsafe.org
Item # 7102S18

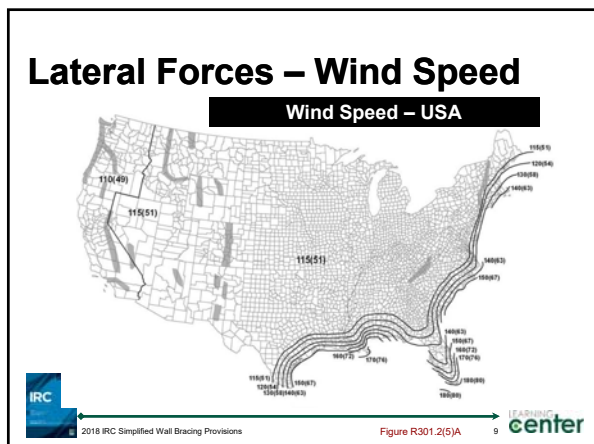


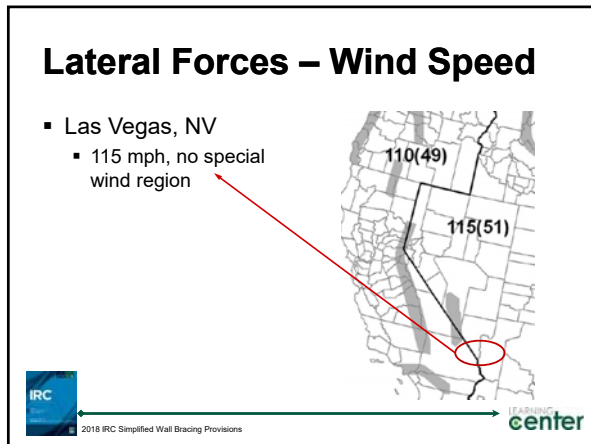
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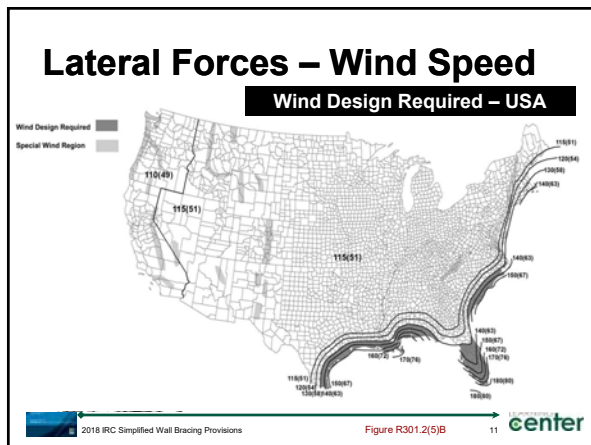


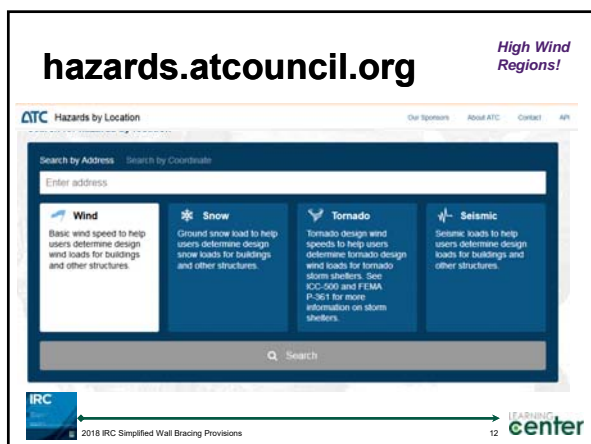












**hazards.
atcouncil
.org**

ATC Hazards by Location

Search by Address: Search by Coordinate

New Orleans, LA, USA

Coordinates: 29.95106739999999, -90.0713323

Wind Snow Tornado Sleet

Print these results Save these results

ASCE 7-16 Select a dataset to view contours

MRI 10-Year 81 mph

MRI 25-Year 96 mph

MRI 50-Year 108 mph

MRI 100-Year 119 mph

Risk Category I 134 mph

You are in a wind-borne debris region if you are also within 1 mile of the coastal mean high water line.

Risk Category II 144 mph

You are in a wind-borne debris region.

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Lateral Forces - Earthquakes

IRC 2018 IRC Simplified Wall Bracing Provisions

Lateral Forces - Earthquakes

ATC Hazards by Location

Search by Address: Search by Coordinate

Memphis, TN, USA

Coordinates: 35.1495343, -90.0489591

Wind Snow Tornado Sleet

Print these results Save these results

Reference Document ASCE7-16

Risk Category II

Site Class D - Stiff Soil

Print these results Save these results

Basic Parameters

Name	Value	Description
S ₀	1.023	MCE _g ground motion (period=0.2s)
S ₁	0.347	MCE _g ground motion (period=1.0s)
S _{MS}	1.116	Site-modified spectral acceleration value
S _{M1}	* null	Site-modified spectral acceleration value
S _{0.744}	0.744	Numeric seismic design value at 0.2s SA

S_{0.744} value
0.744g = SDC D₁
per Table R301.2.2.1.1

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Lateral Forces - Earthquakes

ATC Hazards by Location

Search by Address: 3700 W Flamingo Rd, Las Vegas, NV 89103, USA

Coordinates: 36.1175635, -115.16646130000003

Reference Document: ASCE7-16

Risk Category: I

Site Class: D - Default

Basic Parameters

Name	Value	Description
S_g	0.49	MCEq ground motion (period=0.2s)
S_1	0.171	MCEq ground motion (period=1.0s)
S_{ag}	0.69	Site-modified spectral acceleration value
S_{a1}	0.385	Site-modified spectral acceleration value
S_{ds}	0.46	Numeric seismic design value at 0.2s SA
S_{d1}	0.257	Numeric seismic design value at 1.0s SA

S_{ds} value
0.46g = SDC C
per Table R301.2.2.1.1

2018 IRC Simplified Wall Bracing Provisions

Lateral Forces

Effects of Forces

Racking **Base Shear** **Overtuning**

Resisted by Bracing Resisted by Anchors Resisted by hold-downs & Dead Load

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Lateral Forces – Effects of Forces

Racking

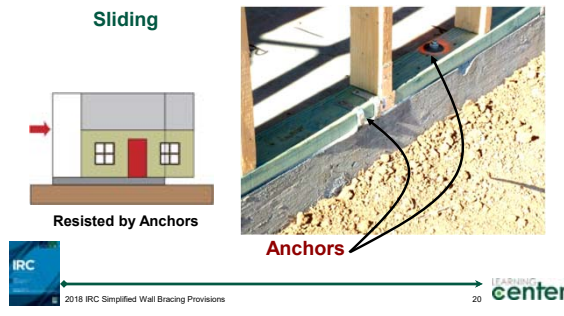
Resisted by Bracing

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Lateral Forces – Effects of Forces



Lateral Forces – Effects of Forces





Lateral Forces – Effects of Forces



Lateral Forces – Effects of Forces

Overturning





Resisted by hold-downs
& Dead Load

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Lateral Forces – Effects of Forces

Overturning



IRC 2018 IRC Simplified Wall Bracing Provisions NWS BMX



Simplified Wall Bracing

Simplified Wall Bracing

Prescriptive Limits

SDC A or B, C for dwellings

Exposure Category B or C

Max. Wind Speed = 130 mph

1, 2 or 3 story

Braced Wall Panel Material

WSP

SFB

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Simplified Wall Bracing

Prescriptive Limits

Max. Wall Height = 10 ft

Max. Eave to Ridge Height = 15 ft

Building Length ≤ 60 ft

Max. Cantilever = 24 in.

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Simplified Wall Bracing

Procedure:



1. Draw a rectangle around the perimeter of the building

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Simplified Wall Bracing

Procedure cont.:

2. Determine type of bracing to use.

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Simplified Wall Bracing



Bracing Methods for Simplified Wall Bracing

Material	Stud Spacing & Fastener Criteria	Fastener Spacing Criteria	Bracing Unit Method	Minimum Bracing Unit Length (feet)
Wood Structural Panel	Table R602.3(3)	6" edge 12" field	Continuous	3
			Intermittent	4
Structural Fiberboard Sheathing	Max 16" spacing Table R602.3(1)	3" edge 6" field	Continuous	3
			Intermittent	4

a. Mixing of wood structural panel and structural fiberboard sheathing in one building is not permitted.

b. Continuous and intermittent bracing units may be mixed from one story to another.

c. Continuous and intermittent bracing unit methods may not be mixed within one story.

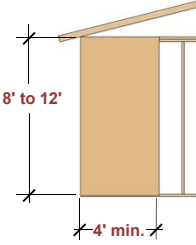





2018 IRC Simplified Wall Bracing Provisions R602.12.2, R602.12.3 29

Panel Material - Intermittent

Method WSP – Wood Structural Panel

- 3/8" min. thickness
- Nailing per Table R602.3(3) for exterior, per Table R602.3(1) or (2) for interior walls
- Nail spacing 6:12

2018 IRC Simplified Wall Bracing Provisions Table R602.10.4 30

Panel Material - Intermittent



Panel Material - Continuous

Method CS-WSP

Full-height sheathed wall segments having a length equal or greater than Table R602.10.5 are counted toward the total bracing length.

Wall minimum length is based on wall height and height of the adjacent clear opening.



Simplified Wall Bracing

Procedure cont.:

3. Identify the number of bracing units required on each side of the rectangle.



Simplified Wall Bracing

Minimum Number of Bracing Units on Each Side of the Circumscribed Rectangle

Ultimate Design Wind Speed (mph)	Story level	Eave to ridge height (ft)	Minimum number of bracing units on each long side					Minimum number of bracing units on each short side						
			Length of short side (ft)					Length of long side (ft)						
			10	20	30	40	50	60	10	20	30	40	50	60
115	1	10	1	2	2	2	3	3	1	2	2	2	3	3
			2	3	3	4	5	6	2	3	3	4	5	6
			2	3	4	6	7	8	2	3	4	6	7	8
	2	15	1	2	3	3	4	4	1	2	3	3	4	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	6	7	9	2	4	5	6	7	9

2018 IRC Simplified Wall Bracing Provisions Table R602.12.4

Simplified Wall Bracing

Minimum Number of Bracing Units on Each Side of the Circumscribed Rectangle

Ultimate Design Wind Speed (mph)	Story level	Eave to ridge height (ft)	Minimum number of bracing units on each long side					Minimum number of bracing units on each short side						
			Length of short side (ft)					Length of long side (ft)						
			10	20	30	40	50	60	10	20	30	40	50	60
130	1	10	1	2	2	3	3	4	1	2	2	3	3	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	7	8	10	2	4	5	7	8	10
	2	15	2	3	3	4	4	6	2	3	3	4	4	6
			3	4	6	7	8	10	3	4	6	7	8	10
			3	6	7	10	11	13	3	6	7	10	11	13

2018 IRC Simplified Wall Bracing Provisions Table R602.12.4

- ### Simplified Wall Bracing
- Minimum Number of Bracing Units on Each Side of the Circumscribed Rectangle - footnotes**
- a. Interpolation shall not be permitted.
 - b. Cripple walls and wood-framed basement walls = first story, stories above redesignated.
 - c. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10.
 - d. For Exposure Category C, multiply bracing units by:
 - 1.20 for a one-story building
 - 1.30 for a two-story building
 - 1.40 for a three-story building
- 2018 IRC Simplified Wall Bracing Provisions Table R602.12.4

Simplified Wall Bracing

Procedure cont.:

4. Check that maximum distances between units and ends of the wall are not exceeded.

Distribution of Bracing Units

- Bracing unit within 12 feet of the ends of a wall.
- Bracing units edges within 20 feet of each other.
- Walls > 8 feet in length must have at least one bracing unit.

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Simplified Wall Bracing

Distribution of Bracing Units

2018 IRC Simplified Wall Bracing Provisions R602.12.5 38

Simplified Wall Bracing

Procedure cont.:

5. Select additional narrow bracing options if needed.

Narrow Bracing Method	Equivalent Bracing Units
CS-G	0.5
CS-PF	0.75
PFH	1
PFG	0.75
ABW	1

Each narrow bracing method is worth one-half to one full 3 ft. or 4 ft. bracing unit.

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Panel Material - Continuous

Method CS-G

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Panel Material - Continuous

Method CS-G Wood structural panel adjacent to garage opening

- Full-height sheathed wall segments to either side of garage openings
- Where walls support only roof load or gable end wall
- Dead load ≤ 3 psf in high seismic regions
- Applied to one wall line of garage only
- Panel length = bracing length
- 4:1 aspect ratio

2018 IRC Simplified Wall Bracing Provisions Tables R602.10.4, R602.10.5 41

Panel Material - Continuous

Method CS-PF

FULLY SHEATHED

2018 IRC Simplified Wall Bracing Provisions R602.10.6.4, Table R602.10.5 42

Panel Material - Continuous

Method CS-PF Continuous portal frame

- No hold-downs required
- OK on raised floor
- Top of header at 10' max
- Top of wall at 12' max
- Panel length = 1.5 x bracing length (SDC A-C)

IRC FARMING center

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Panel Material - Continuous

Method CS-PF

Figure R602.10.6.4

IRC FARMING center

2018 IRC Simplified Wall Bracing Provisions R602.10.6.4 43

Panel Material - Continuous

Panel Material - Intermittent

Method PFH – Intermittent Portal Frame with hold-downs

- 16" min panel length for 1-story, 24" min for 2-story
- Each vertical panel replaces a 48" braced wall panel

2018 IRC Simplified Wall Bracing Provisions R602.10.6.2, Table R602.10.5 46

Panel Material - Intermittent

Method PFH – Intermittent Portal Frame with hold-downs

2018 IRC Simplified Wall Bracing Provisions Figure R602.10.6.2 47

Panel Material - Intermittent

Method PFG – Intermittent Portal Frame at Garage

- For use in SDC A-C only
- Bracing length = 1.5 x length of panel
- Minimum 24" length
- Single row of nails on studs

2018 IRC Simplified Wall Bracing Provisions R602.10.6.3, Table R602.10.5 48

Panel Material - Intermittent

Method PFG – Intermittent Portal Frame at Garage

Extended header

3" o.c. nailing

1,000 lb strap capacity (opposite side)

Min. 7/16" thick wood structural panel

No hold-downs required

Single sole plate allowed

(2) 1/2" anchor bolts and min. 2" x 2" x 3/16" plate washers

2018 IRC Simplified Wall Bracing Provisions **Figure R602.10.6.3** 49

Panel Material - Intermittent

Method ABW - Alternate Braced Wall

Wind 8' to 12'

SDC D₀, D₁ and D₂ 8' to 10'

Min. 3/8" thick wood structural panel sheathing

Anchor bolts 1/2" (2)

Hold-down capacity per Table R602.10.6.1

12" x 12" min. footing #4 bars top and bottom

2018 IRC Simplified Wall Bracing Provisions **Figure R602.10.6.1** 50

Panel Material - Intermittent

Method ABW - Alternate Braced Wall

Minimum Hold-down Forces For Method ABW Braced Wall Panels – Table R602.10.6.1




Seismic Design Category and Wind Speed	Supporting/Story	Hold Down Force (lbs)				
		Height of Braced Wall Panel				
		8 ft.	9 ft.	10 ft.	11 ft.	12 ft.
SDC A, B and C Ultimate design wind speed < 140 mph	One story	1,800	1,800	1,800	2,000	2,200
	First of two stories	3,000	3,000	3,000	3,300	3,600
SDC D ₀ , D ₁ and D ₂ Ultimate design wind speed ≥ 140 mph	One story	1,800	1,800	1,800	NP	NP
	First of two stories	3,000	3,000	3,000	NP	NP

2018 IRC Simplified Wall Bracing Provisions **Table R602.10.6.1** 51

Simplified Wall Bracing

Procedure cont.:

6. Check connection to roof.








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Connections

BWP Connection Requirements to Roof Framing

SDC Wind Speed	Distance (bottom of roof sheathing to top of plate)	Blocking
SDC A, B, C	9.25" or less	Not required, attach per R602.3(1)
	9.25" to 15.25"	Per R602.10.8.2.2 Item 1 and Figure R602.10.8.2(1)
SDC D ₀ , D ₁ , D ₂	15.25" or less	Per R602.10.8.2 Item 2 and Figure R602.10.8.2(1)
All SDCs	15.25" to 48"	Per R602.10.8.2 Item 3 and Figure R602.10.8.2(2) or R602.10.8.2(3) or engineered design

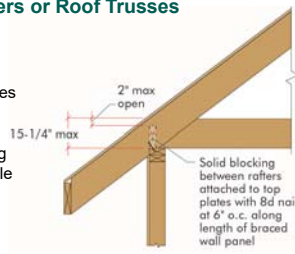
2018 IRC Simplified Wall Bracing Provisions R602.10.8.2 53




Connections

BWP Perpendicular to Rafters or Roof Trusses

For SDC A, B and C,

- Where distance from top of the rafters to perpendicular top plates is > 9.25" and ≤ 15.25".
- Connect rafters to top plates of braced wall panels with blocking [Figure R602.10.8.2(1) and Table R602.3(1)].



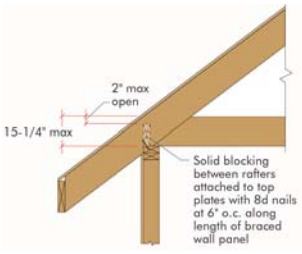
2018 IRC Simplified Wall Bracing Provisions Figure R602.10.8.2(1) 54

Connections

BWP Perpendicular to Rafters or Roof Trusses

For SDC D₀, D₁ and D₂,

- Where distance from top of rafters or roof trusses to perpendicular top plates is < 15.25"
- Connect rafters to the top plates of braced wall panels with blocking [Figure R602.10.8.2(1) and Table R602.3(1)]



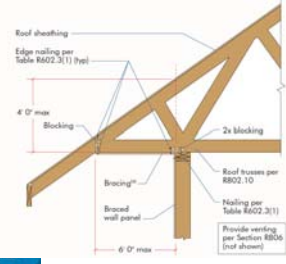
2018 IRC Simplified Wall Bracing Provisions Figure R602.10.8.2(1) 55

Connections

BWP Perpendicular to Rafters or Roof Trusses

For all Seismic Design Categories,

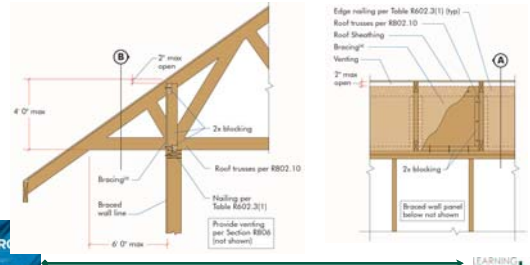
- Where distance from top of rafters or roof trusses to perpendicular top plates is > 15.25"
- Connect rafters to the top plates of braced wall panels [Figure R602.10.8.2(2) or Figure R602.10.8.2(3)]



2018 IRC Simplified Wall Bracing Provisions Figure R602.10.8.2(2) 56

Connections

BWP Perpendicular to Rafters or Roof Trusses



2018 IRC Simplified Wall Bracing Provisions Figure R602.10.8.2(3) 57



Example 1: 115 mph, Exp B



Example

- SDC B
- Wind 115 mph, Wind Exposure B
- Method CS-WSP
- 1 Story
- Walls - 9 ft.
- Eave to ridge height - 12 ft.

One Story	115 mph	SDC B
		NA

Example Highlights:

- Strategic placement of bracing units






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Step 1: Draw a Rectangle

1. Draw rectangle around the entire building
2. Check the length of the N-S and E-W sides the of rectangle

Less than 60 ft.?
OK

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Step 2: Determine bracing material

- Intermittent
 - 4 ft segments
 - WSP
- Continuous sheathing
 - 3 ft segments
 - WSP



Step 3: Determine bracing required

Table R602.12.4 Minimum Number of Bracing Units

Ultimate Design Wind Speed (mph)	Story level	Eave to ridge height (ft)	Minimum number of bracing units on each long side						Minimum number of bracing units on each short side					
			Length of short side (ft)						Length of long side (ft)					
			10	20	30	40	50	60	10	20	30	40	50	60
115		15	1	2	3	3	4	4	1	2	3	3	4	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	6	7	9	2	4	5	6	7	9

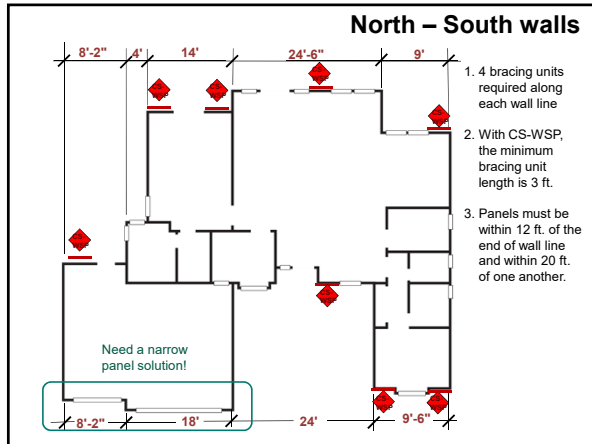


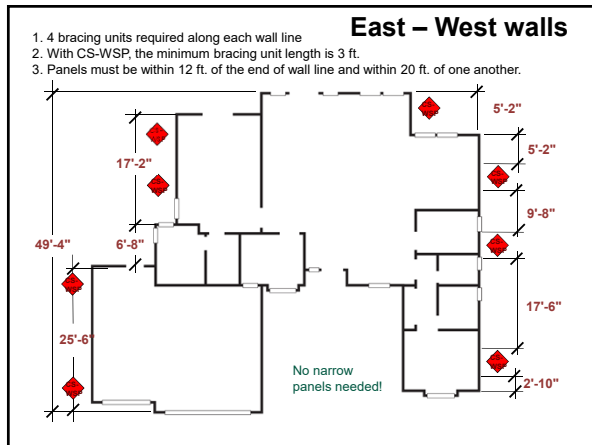
Step 4: Check panel spacing

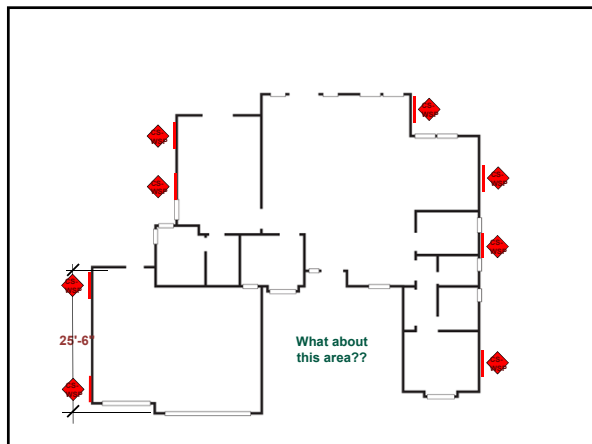
Distribution of Bracing Units

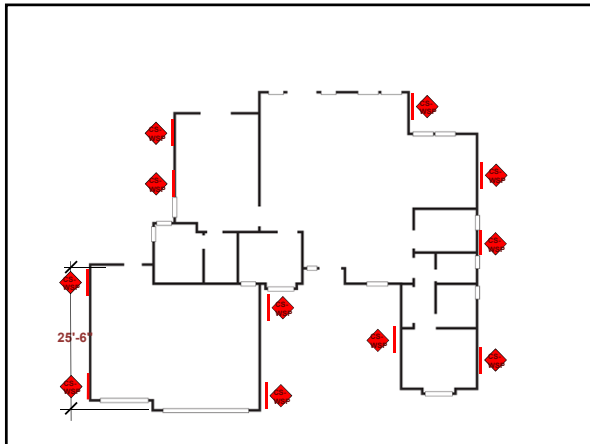
- Bracing unit within 12 feet of the ends of a wall.
- Bracing units edges within 20 feet of each other.
- Walls > 8 feet in length must have at least one bracing unit.





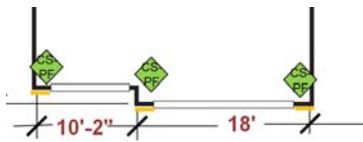






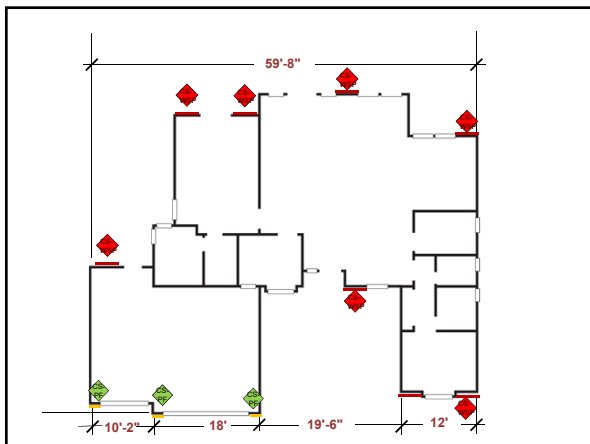
Step 5: Check for areas needing narrow panels

- Add narrow panels to garage – preferably a portal frame without hold-downs



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Step 6: Check roof connections

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Example 2: 115 mph, Exp C

Example

- SDC B
- Wind 115 mph, Wind Exposure C
- Method CS-WSP
- 1 Story
- Walls - 9 ft.
- Eave to ridge height - 12 ft.

One Story	115 mph	SDC B
		NA

Example Highlights:

- Exposure Category C requirements

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59'-8"


49'-4"

1. Draw rectangle around the entire building
2. Check the length of the N-S and E-W sides of the rectangle

Less than 60 ft.?
OK

Bracing: Simplified Wall Bracing

Table R602.12.4 Minimum Number of Bracing Units

Ultimate Design Wind Speed (mph)	Story level	Eave to ridge height (ft)	Minimum number of bracing units on each long side					Minimum number of bracing units on each short side						
			Length of short side (ft)					Length of long side (ft)						
			10	20	30	40	50	60	10	20	30	40	50	60
115		15	1	2	3	3	4	4	1	2	3	3	4	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	6	7	9	2	4	5	6	7	9

2018 IRC Simplified Wall Bracing Provisions 73 **LEARNING center**

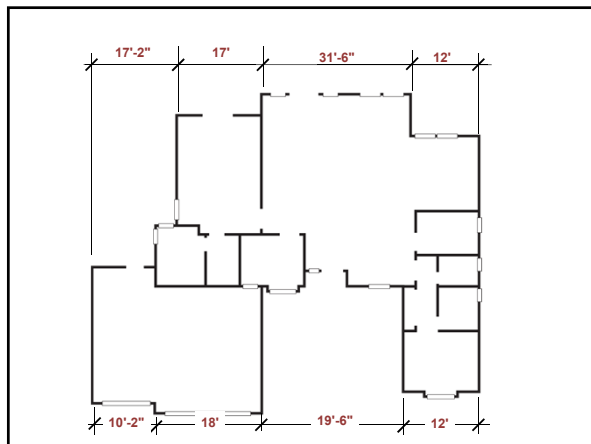
Bracing: Simplified Wall Bracing

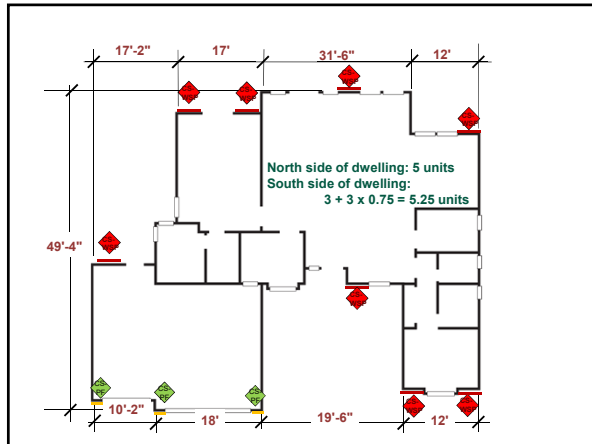
Table R602.12.4 footnotes

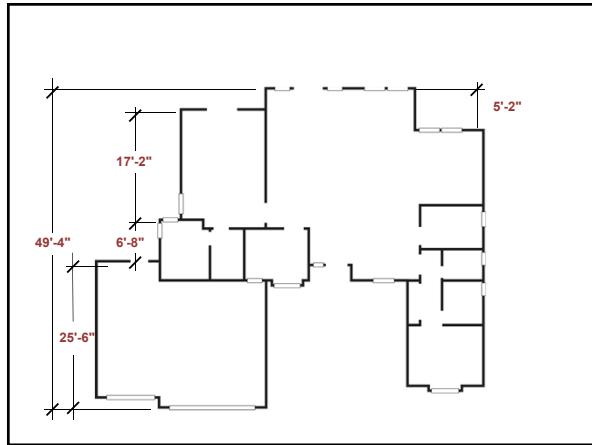
For Exposure Category C, multiply bracing units by a factor of 1.20 for a one-story building, 1.30 for a two-story building and 1.40 for a three-story building.

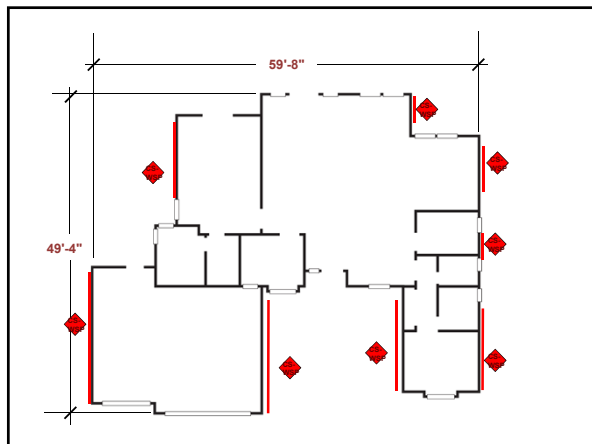
Minimum bracing units in each direction =
 4 units x 1.20 = 4.8 units **Call it 5 units**

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Example 3: 115 mph, Exp B

Example

- SDC B
- Wind 115 mph, Wind Exposure B
- Method CS-WSP
- 1 Story
- Walls - 9 ft.
- Eave to ridge height - 12 ft.

One Story	115 mph	SDC B
		NA

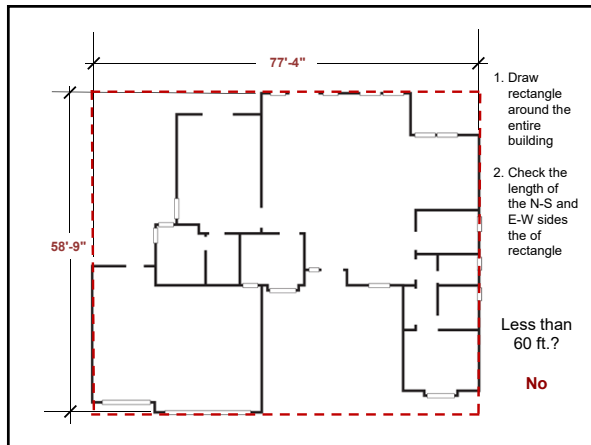
Example Highlights:

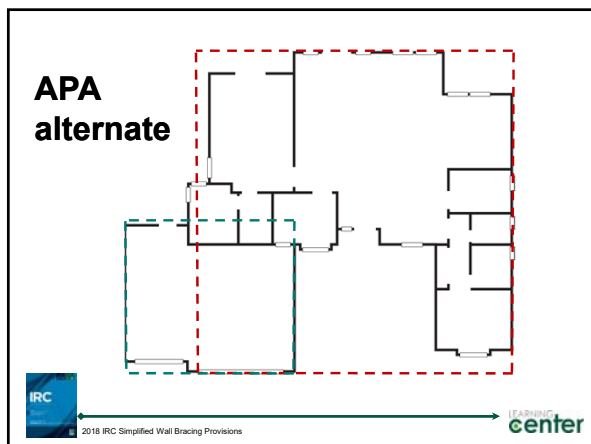
- Circumscribed rectangle longer than 60 ft

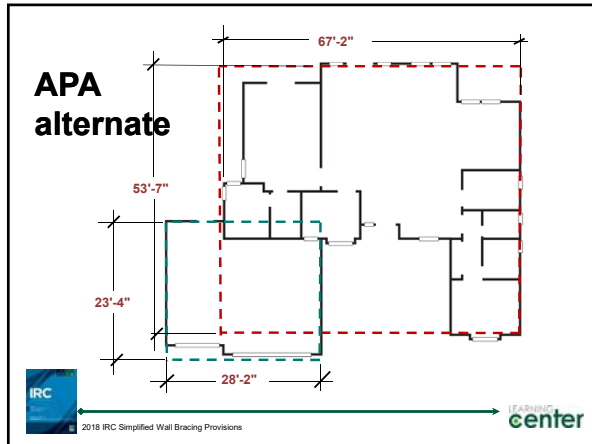


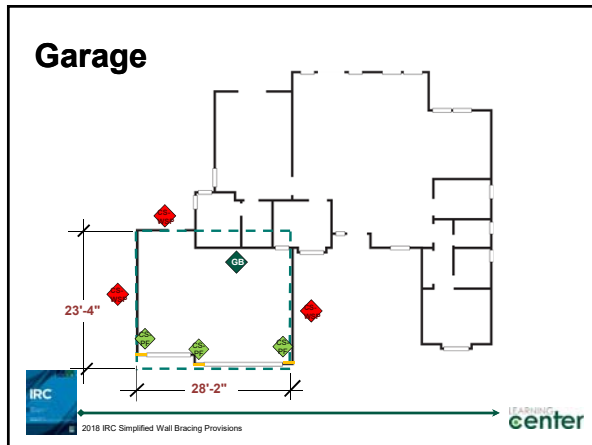
2018 IRC Simplified Wall Bracing Provisions

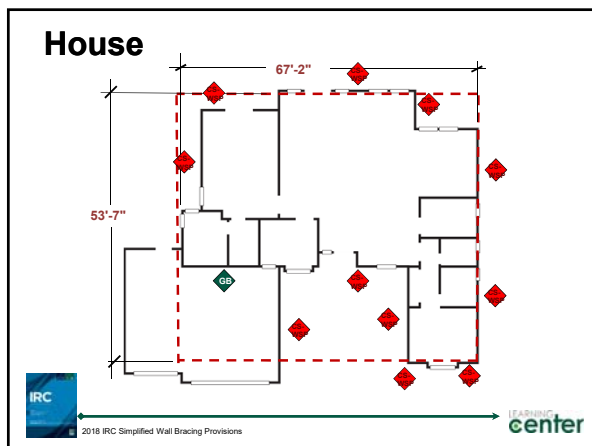


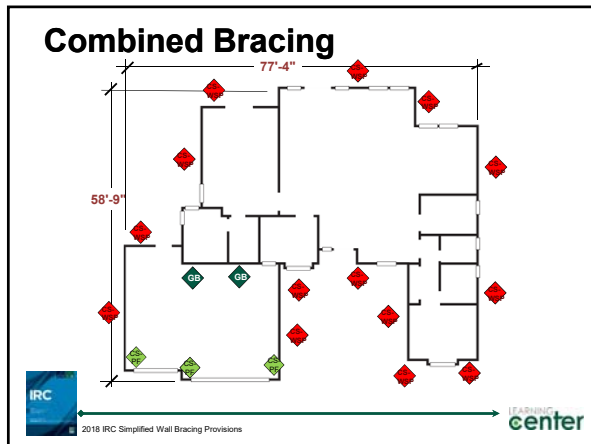












APA SR 102D

- Use Appendix A of this report when a circumscribed rectangle is greater than 60 ft long.
- apawood.org

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FINAL REFLECTION

Final Reflection

- **What?** What happened and what was observed in the training?
- **So what?** What did you learn? What difference did this training make?
- **Now what?** How will you do things differently back on the job as a result of this training?

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