

APA and IRC Simplified Bracing Methods

Presented By: Jacquelyn Miller



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What is APA – The Engineered Wood Association?



1933: Douglas Fir Plywood Association
1994: APA – The Engineered Wood Association



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Quality
Services

Technical
Services

APA

Market Access
and Development

Marketing
Communications

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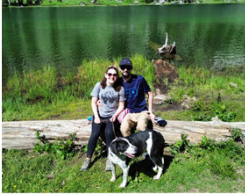
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Webinar Attendee Survey



<https://www.apawood.org/presentation-survey>

Today's Presenter



Jacquelyn Miller, PE
Engineered Wood Specialist
Midwest Region



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Learning Objectives

1. Identify situations where APA simplified or IRC simplified methods would be appropriate for a home.
2. Outline the steps required to implement the APA or IRC simplified methods.
3. Detail appropriate braced wall panel locations and spacings.
4. Describe the purpose of braced wall panels and the structural failures they prevent.

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Lateral Loads

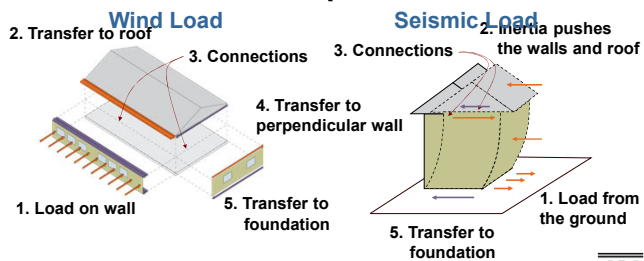


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Wind and Earthquake Load Path

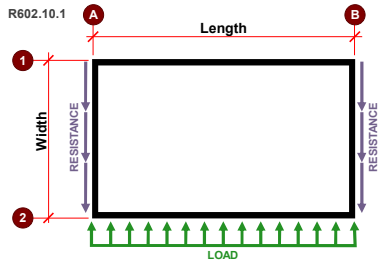


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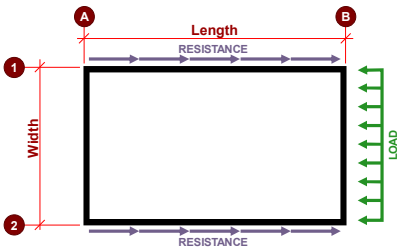
Loaded Wall Versus Resisting Walls



10

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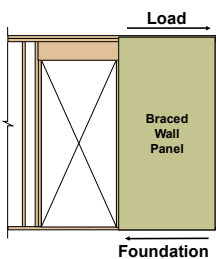
Loaded Wall Versus Resisting Walls



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Load Path: Wall Bracing Requirements



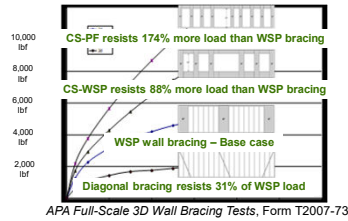
R301.1 Application

The construction of buildings... shall result in a... complete load path... for the transfer of all loads... to the foundation.

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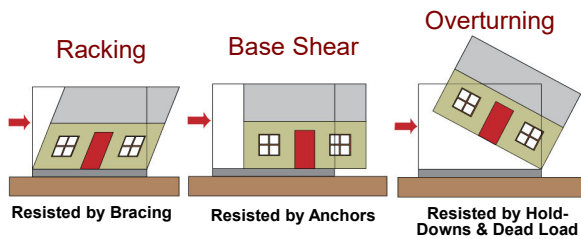
What Does APA Testing Tell Us?



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Lateral Load Failures



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Racking Failures



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Base Shear Failures



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Overturning Failures



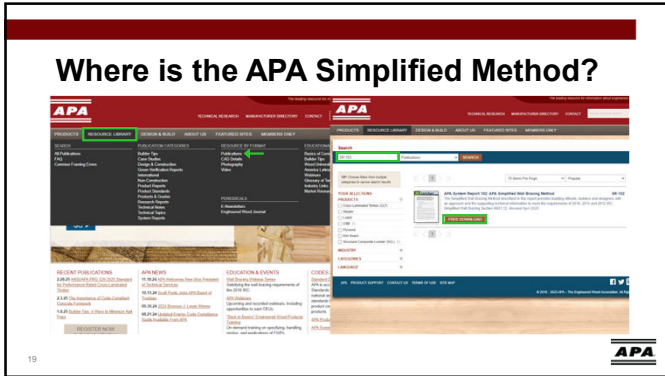
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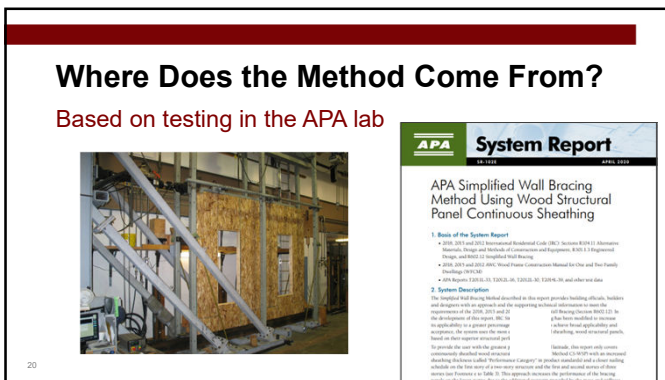
IRC Simplified Method
R602.12



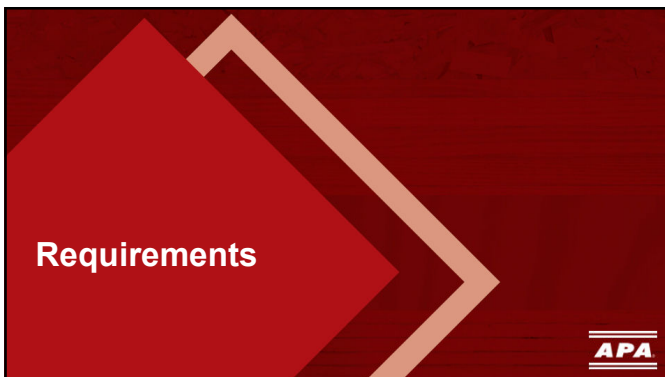
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Can I Use the IRC or APA Simplified Method?

Less than 3 stories

Floors cantilever less than 24"

Eave-to-ridge height less than 15'

Wall height less than 12'

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Requirements to Use Either Method

Seismic design category

Single family: A, B or C
Townhouse: A or B

Ultimate wind design speed
130 mph or less and exposure B or C

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Requirements to Use Either Method

No cripple walls in a 3-story building

No permanent wood foundations

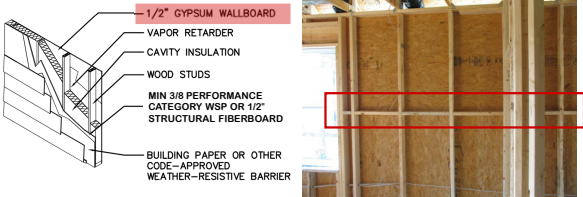
APA

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IRC Simplified Specific Requirements

Exterior walls have 1/2" gyp board on the interior face

Joint blocking is required



1/2" GYPSUM WALLBOARD
VAPOR RETARDER
CAVITY INSULATION
WOOD STUDS
MIN 3/8 PERFORMANCE CATEGORY WSP OR 1/2" STRUCTURAL FIBERBOARD
BUILDING PAPER OR OTHER CODE-APPROVED WEATHER-RESISTIVE BARRIER

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APA Method Specific Requirements



The panel edge nailing is 8d common nails @ 4" o.c. on lower stories

Home must be continuously sheathed with 7/16 performance category wood structural panels

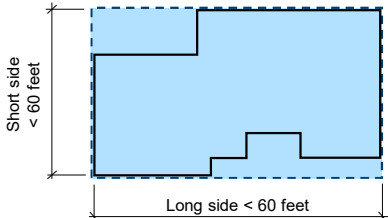
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Step 1 in Either Method

Circumscribe Rectangle



Short side < 60 feet

Long side < 60 feet

Max ratio of 3:1

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Check Table Entries

Wind Speed **Story Level** **Eave-to-Ridge Height**

Select Appropriate Story

Either 10 feet or 15 feet

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IRC Simplified APA Simplified

TABLE R602.12.4 MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE

TABLE 3 MINIMUM REQUIRED BRACING LENGTH ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE FOR WIND EXPOSURE B=1.0

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IRC Simplified Bracing Unit Table

TABLE R602.12.4 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 (b=1.0)					MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE (b=1.0)				
			10	20	30	40	50	10	20	30	40	50
115	10	10	1	2	2	3	3	1	2	2	3	3
			2	3	3	4	5	2	3	3	4	5
			2	3	4	5	7	4	5	7	8	
	15	10	1	2	2	3	3	1	2	2	3	3
			2	3	4	5	7	2	3	4	5	7
			2	4	5	7	9	2	4	5	7	9

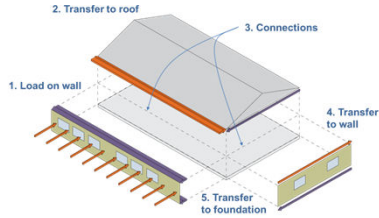
No Interpolation

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Why Does the Perpendicular Side Determine the Number of Bracing Units?



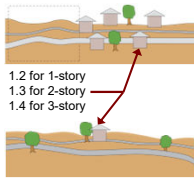
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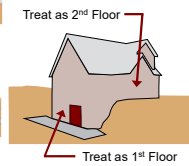
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Step 2 APA & IRC Adjustment Factors

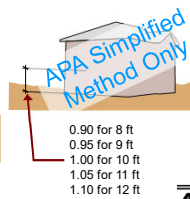
Exposure Category



Cripple Walls & Walk-Out Basement



Wall Height



APA Simplified Method Only

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APA Specific Exceptions

Horizontal Blocking Omitted



Interior Gypsum Wall Omitted



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Step 3 – Lay Out Panels

- Minimum Panel Width
- Maximum Spacing Between Panels
- Maximum Location from the Corner

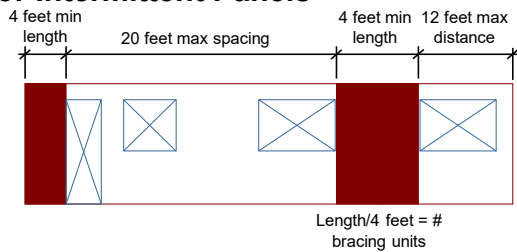
$$\frac{\text{Sum of Bracing Units/Length of Panel}}{\geq} \text{Adjusted IRC/APA Simplified Requirements}$$

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IRC Simplified Layout Requirements for Intermittent Panels

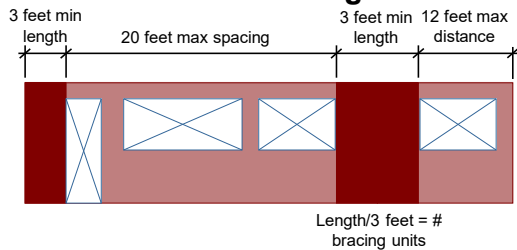


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IRC Simplified Layout Requirements for Continuous Sheathing

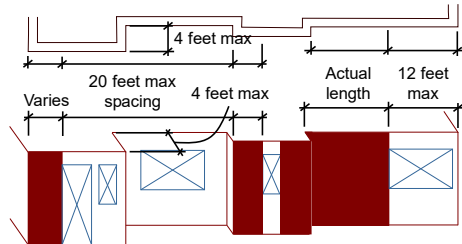


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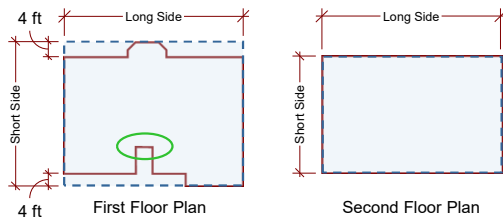
APA Simplified Layout Requirements



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Wall Offset Requirements



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Minimum Length in the APA Simplified

TABLE 1
MINIMUM LENGTH OF BRACED WALL PANELS
(Excerpt from the 2018, 2015 and 2012 IRC Table R602.10.5, modified in accordance with R602.12.3, Item 1)

Method	Adjacent Clear Opening Height (in.)	Minimum Length (in.)			Contributing Length (in.)
		8 ft	9 ft	10 ft	
CS-G	—	24	27	30	Actual Length ^a
CS-W	—	16	18 ^b	20 ^c	1.5 x Actual Length ^a
CS-WSP	≤ 60	24	27	30	Actual Length ^a
	64	24	27	30	
	68	24	27	30	
	72	27	27	30	
	76	30	29	30	
	80	32	30	30	
	84	35	32	32	
	88	36	32	32	
	92	36	36	35	
	96	36	36	36	
	100	36	36	36	
	104	36	36	36	
	108	36	36	36	
	112	36	36	36	
	116	36	36	36	
	120	36	36	36	

a. Use the actual length when it is greater than or equal to the minimum length.
 b. The wall height for CS-W is based on the height of the panel frame, as documented in APA Report 120146-05. The height of the panel frame shall be measured from the bottom of the bottom plate to the top of the panel frame header.
 c. See IRC Figure R602.10.4.6.

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Partial Credit in the APA Simplified Method

TABLE 2
PARTIAL CREDIT FOR CS-WSP LESS THAN FULL LENGTH WITH 8- AND 9-FOOT TALL WALLS*

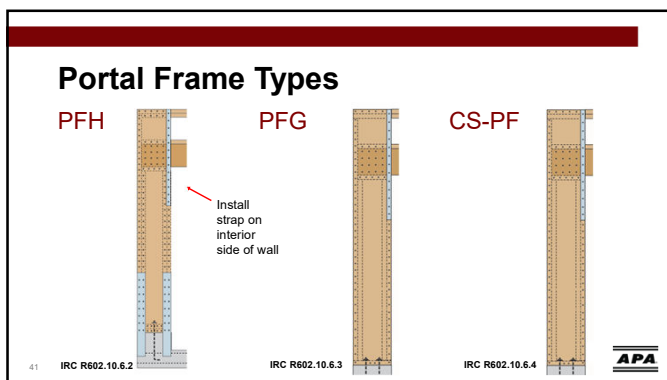
Wall Height (ft)	Length of Full Height Method CS-WSP Panel (in.)	Adjacent to a Clear Opening Height (in.) or Less	Contributing Length of Braced Wall Panel (in.)
24	24	≤50	24
		54	22
		66	20
		72	18
		76	16
		80	14
8 or 9	20	≤50	20
		54	18
		66	16
		72	15
		76	13
		80	11

* Linear interpolation shall be permitted.

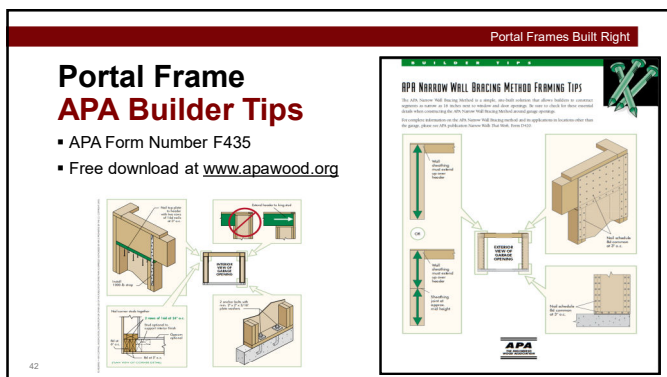
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IRC Simplified Portal Frames

CS-PF = 0.75 Bracing Units

- No more than 4 in a line

PFH = 1 Bracing Unit

PFG = 0.75 Bracing Units

- Intermittent bracing methods can be used with continuous sheathing



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APA Simplified Narrow Wall Bracing

CS-PF = 1.5 x Actual Length

- No more than 4 in a line

CS-G = Actual Length

- Can only be used when supporting a gable end or roof load only
- Shall only be used on one wall of the garage

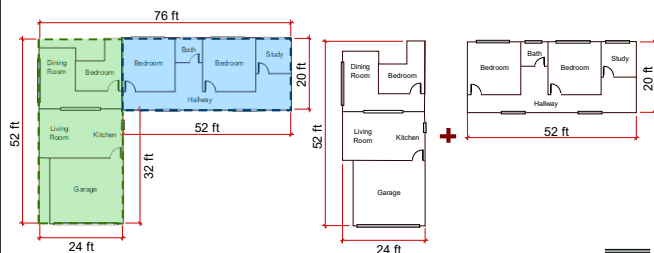


APA

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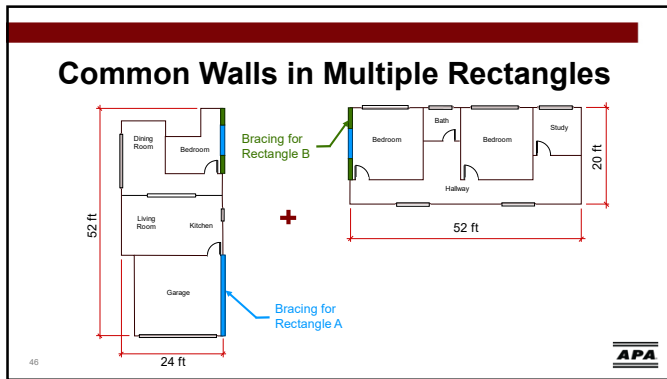
APA Simplified: Multiple Rectangles



APA

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Summary of APA and IRC Differences

APA	IRC
- Minimum 7/16" WSP Performance Cat. - Continuous sheathing only	- Minimum 3/8" WSP Performance Cat. or 1/2" structural fiberboard - Continuous or intermittent sheathing
- Min length varies with opening height 2-3 feet 4 feet offset max in each wall line	3 feet min length for continuous, 4 feet min length for intermittent - No offset max within a wall line

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APA

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Summary of APA and IRC Differences

APA	IRC
- Up to 12 feet wall height - Adj. factors for wall blocking and omitting gypsum - The 1st of 2-story or 1st and 2nd of 3-story homes require 8d common nails at 4" o.c. at the perimeter of sheathing	- Up to 10 feet wall height - Wall blocking and interior gypsum required - Code minimum nails required everywhere 6d or 8d common nails at 6" o.c. at the perimeter of sheathing

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APA

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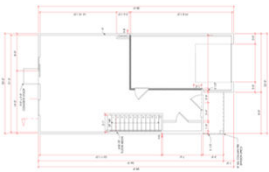
APA and IRC Simplified Example



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Example

- 2-story townhouse
- 22 ft x 38 ft



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Townhouse Background

Ultimate Wind Design
Speed

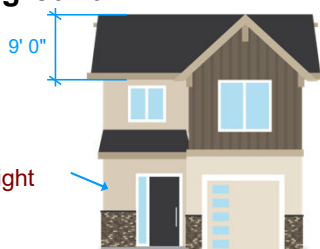
- $V=115$ mph

Story Height

- Roof + 1 Story

Roof Eave-to-Ridge Height

- 9 feet



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IRC Simplified – Step 1

The diagram shows a house with dimensions: 36'-0" wide, 24'-0" deep, and 10'-0" high. The table below provides the minimum number of bracing units required based on the ultimate design wind speed, story level, and eave-to-ridge height.

ULTIMATE DESIGN WIND SPEED (mph)	STORY LEVEL	EAVE-TO-RIDGE HEIGHT (ft)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE ¹⁻⁴					MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE ¹⁻⁴						
			Length of long side (ft)					Length of long side (ft)						
			10	20	30	40	50	60	10	20	30	40	50	60
15	1	10	1	2	3	4	5	6	1	2	3	4	5	6
		20	2	3	4	5	6	7	2	3	4	5	6	
		30	3	4	5	6	7	8	3	4	5	6	7	
20	1	10	1	2	3	4	5	6	1	2	3	4	5	
		20	2	3	4	5	6	7	2	3	4	5	6	
		30	3	4	5	6	7	8	3	4	5	6	7	
25	1	10	1	2	3	4	5	6	1	2	3	4	5	
		20	2	3	4	5	6	7	2	3	4	5	6	
		30	3	4	5	6	7	8	3	4	5	6	7	

APA

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IRC Simplified – Step 2

Exposure Category B
 Adj. = 1.0

Cripple Walls or Walkout Basement
 N/A

APA

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IRC Simplified – Step 3

Requirement = $4 \times 1 = 4$ Bracing Units

The diagram shows a wall section with a total length of 22'-0". It is divided into three panels: a central panel of 10'-0" and two side panels of 6'-0" each. The central panel is labeled "CS-PF 2' 0" Panel = 0.75 Bracing Unit". The side panels are labeled "3' 0" Panel = 1 Bracing Unit". The total bracing units are calculated as 0.75 + 1 + 1 = 2.75. The requirement is 4 bracing units, so the total does not comply.

Total = 2.75
 Total $\leq$ Requirement
DOES NOT COMPLY

APA

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APA Simplified – Step 1

TABLE 3
MINIMUM REQUIRED BRACING LENGTH ON EACH SIDE
OF THE CIRCUMSCRIBED RECTANGLE FOR WIND EXPOSURE B^{a,b,c,d}

Wind Speed	Story Level	Eave-to-Ridge Height (ft)	Minimum Required Bracing Length on Each Long Side					Minimum Required Bracing Length 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
90 mph nominal for the 2012 IRC	10		2.0	3.6	5.0	6.0	7.5	9.0	2.0	3.5	5.0	6.0	7.5	9.0
			2.9	5.4	7.4	9.9	12.0	14.0	2.9	5.4	7.4	9.9	12.0	14.0
115 mph ultimate for the 2018 and 2015 IRC	10		4.1	7.9	11.2	14.5	17.8	21.0	4.1	7.9	11.2	14.5	17.8	21.0
			2.6	4.6	6.5	7.8	9.8	11.7	2.6	4.6	6.5	7.8	9.8	11.7
			3.3	6.2	8.5	11.4	13.8	16.1	3.3	6.2	8.5	11.4	13.8	16.1
	15		4.5	8.7	12.3	16.0	19.6	23.1	4.5	8.7	12.3	16.0	19.6	23.1

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APA Simplified – Step 1.5

APA Simplified Method Allows Interpolation

$$9.9 \text{ ft} - \frac{9.9 \text{ ft} - 7.4 \text{ ft}}{40 \text{ ft} - 30 \text{ ft}} \times (40 \text{ ft} - 38 \text{ ft}) = 9.4 \text{ ft}$$

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APA Simplified – Step 2

Exposure Category B

▪ Adj. = 1.0

Wall Height

▪ Adj. = 0.95

Interior Gypsum

▪ Adj. = 1.0

Horizontal Joint Blocking

▪ Adj. = 1.0

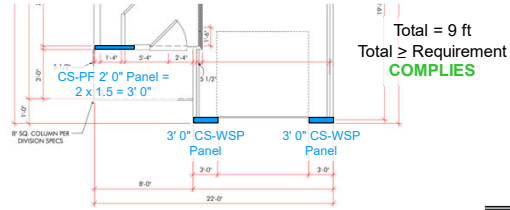
9' 1 1/8"



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APA Simplified – Step 3

Requirement = $9.4 \text{ ft} \times 1 \times 1 \times 0.95 \times 1 = 9$



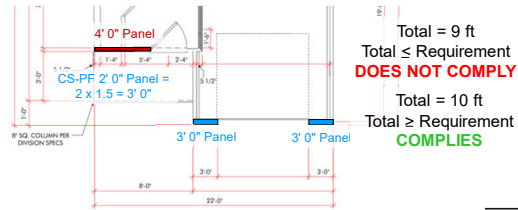
Total = 9 ft
Total $\geq$ Requirement
COMPLIES

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IRC Traditional Method – Step 3

Requirement = 10 ft



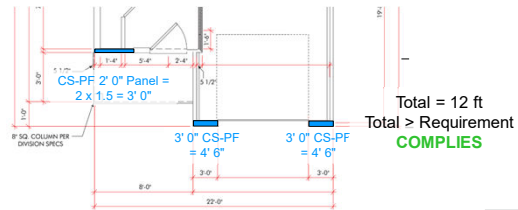
Total = 9 ft
Total $\leq$ Requirement
DOES NOT COMPLY
Total = 10 ft
Total $\geq$ Requirement
COMPLIES

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IRC Traditional Method – Step 3

Requirement = 10 ft



Total = 12 ft
Total $\geq$ Requirement
COMPLIES

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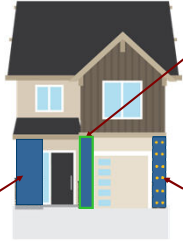
60

Comparison

Requirement:
 APA Simplified = 9 ft
 IRC Simplified = 4 Bracing Units
 IRC Traditional = 10 ft

Compliance:
 ■ Complies
 ■ Does not comply
 ■ Complies w/ 3 CS-PFs

Performance Category:
 ■ 7/16" Perf Cat
 ■ 3/8" Perf Cat
 ■ 3/8" Perf Cat



Perimeter Nailing:
 ■ 8d Common Nails
 (0.131 x 2 1/2") @ 4" o.c.
 ■ 6d or 8d Common Nails
 @ 6" o.c.
 ■ 6d or 8d Common Nails
 @ 6" o.c.

Nailing at Intermediate Supports (ALL METHODS):
 ■ 8d Common Nails
 (0.131 x 2 1/2") @ 12" o.c.
 ■ 6d or 8d Common Nails
 @ 12" o.c.
 ■ 6d or 8d Common Nails
 @ 12" o.c.

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APA

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Questions?

Please complete the survey!





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Referenced APA Publications





Form SR-102 **Form P310** **Guide to Wall Bracing**

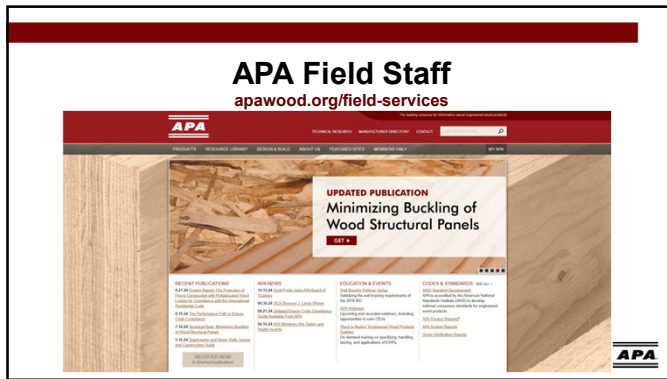




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APA

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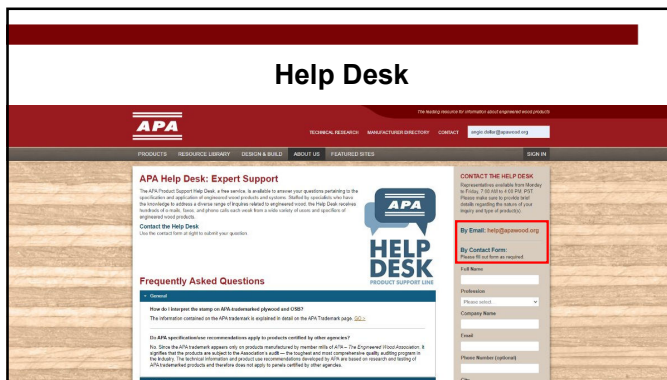
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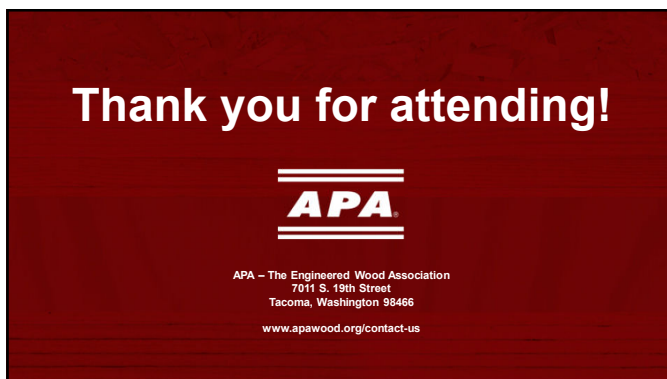
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