

APA

Sheathe for Success

Simple techniques to make buildings stronger and more energy efficient

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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Webinar Attendee Survey




Cory McCambridge
<https://www.apawood.org/sheathe-for-success-survey>

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Learning Objectives

- Identify easy solutions for common building challenges using wood structural panel wall sheathing
- Identify the functions of a building's structural shell and energy envelope
- Describe how to balance structural integrity, energy efficiency and cost effectiveness in building design
- Identify methods to simplify the support of common cladding materials

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Today's Agenda

- Strength and Resiliency
- Energy Codes and Building Envelopes
- Cladding Support
- Advanced Framing
- Sustainability

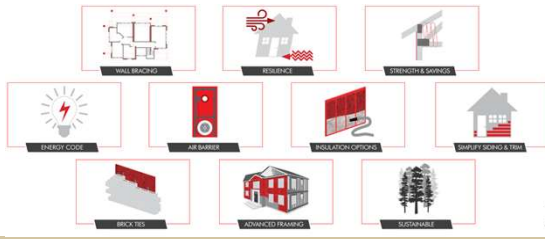
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DID YOU KNOW?

10 Benefits of Wood Structural Panel Wall Sheathing

Fully Sheathed Wood Walls




6

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Fully Sheathed Wood Walls



WALL BRACING



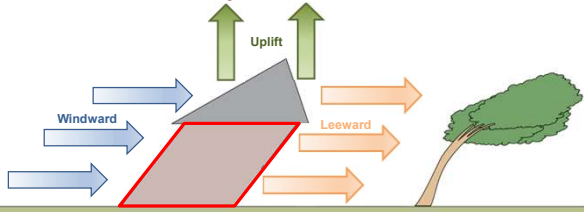
RESILIENCE

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Load Path

Lateral load path is not intuitive...



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Enhanced Fujita Scale

EF-Scale	Tornado description	Wind Speed (3-sec gust)	Description of Expected Damage
EF-0	Gale tornado	65-85 mph 90-130 kph	Minor or no damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF-1	Moderate tornado	86-110 mph 135-175 kph	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors, windows and other glass broken.
EF-2	Significant tornado	111-135 mph 180-220 kph	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF-3	Severe tornado	136-165 mph 225-265 kph	Severe damage. Entire stories of well-constructed houses destroyed; trains overturned; trees debarked; heavy cars lifted off the ground and thrown.
EF-4	Devastating tornado	166-200 mph 270-310 kph	Extreme damage. Well-constructed and whole frame houses completely leveled; cars and other large objects thrown, and small missiles generated.
EF-5	Incredible tornado	>200 mph >315 kph	Total Destruction. Strong framed, well-built houses leveled off foundations and swept away;

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Lateral and Uplift Load Path Failures



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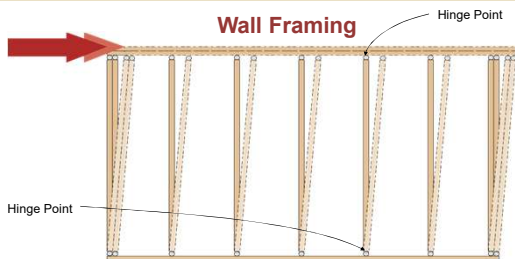
Lateral and Uplift Load Path Failures



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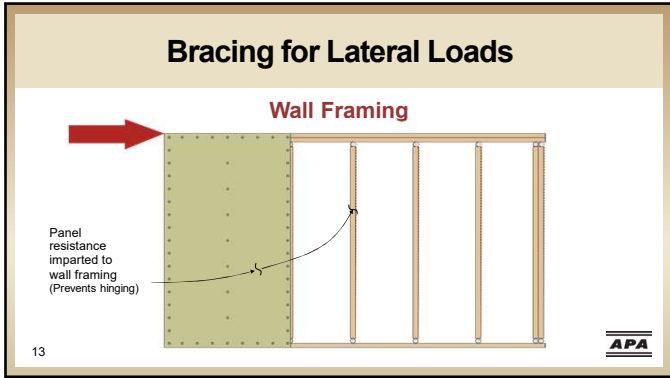
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Bracing for Lateral Loads

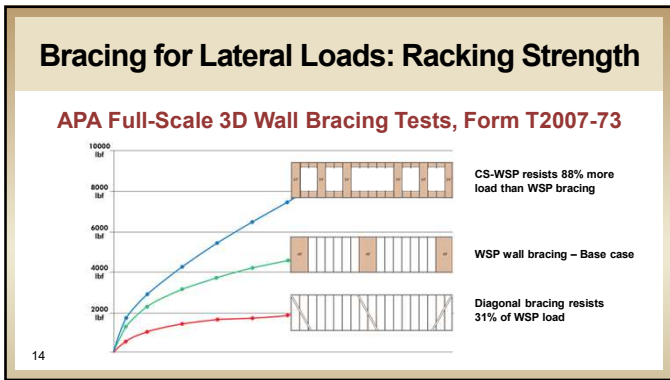


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Bracing for Lateral Loads

Braced Wall Panels (Prescriptive)	VS.	Shear Walls (Engineered)
<ul style="list-style-type: none"> ▪ Limitations ▪ 3-Story Maximum ▪ Wind Speed and SDC Limitations ▪ Others (see IRC Chap. 3) ▪ Typically without hold-downs 		<ul style="list-style-type: none"> ▪ Applications ▪ Any building size/shape ▪ Wind - no limit ▪ SDC - no limit ▪ Calculations required ▪ Typically with hold-downs

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APA Wall Bracing Calculator

www.apawood.org/wall-bracing-calculator

Download the APA Wall Bracing Calculator Quick Start Guide for a tutorial.

This video walks new users through the basics of the APA Wall Bracing Calculator, a free tool that creates printable reports showing 2009, 2012, 2015, or 2018 IRC wall bracing compliance. The reports are accepted by most local jurisdictions. Running time: 1:43.

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APA Wall Bracing Resources

www.iccsafe.org
Item no. 7102S12

www.apawood.org
Form F430

www.apawood.org
On-demand webinar

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Resilient Construction

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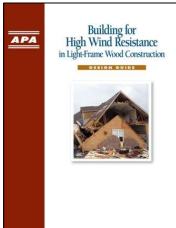
Resilient Construction



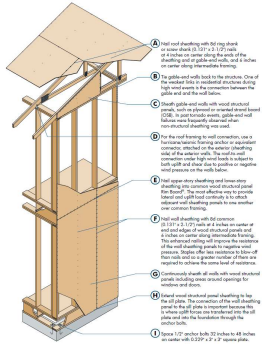
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Building for High Wind Resistance



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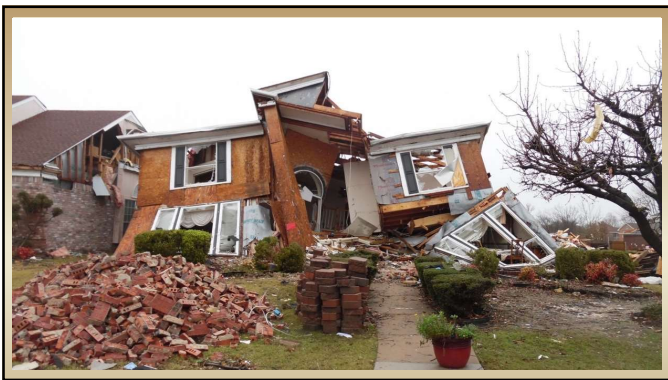
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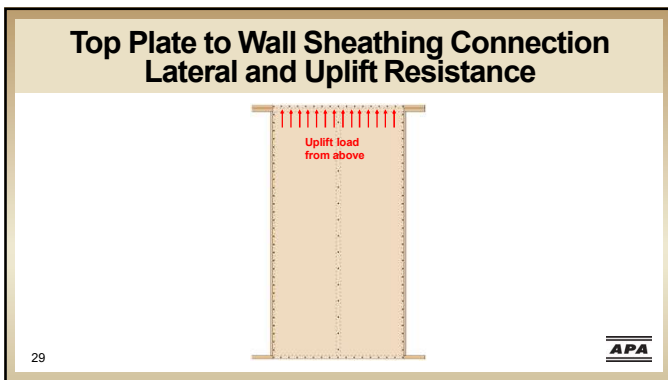
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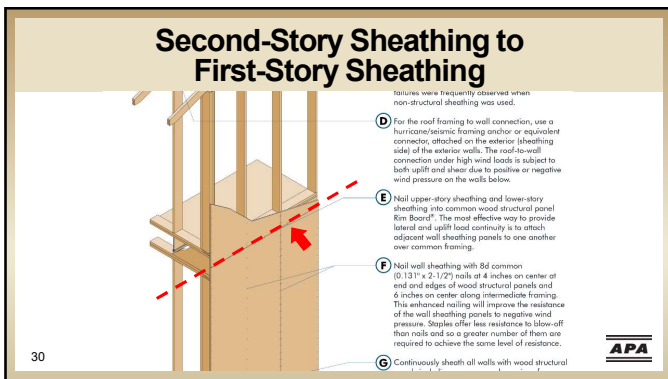
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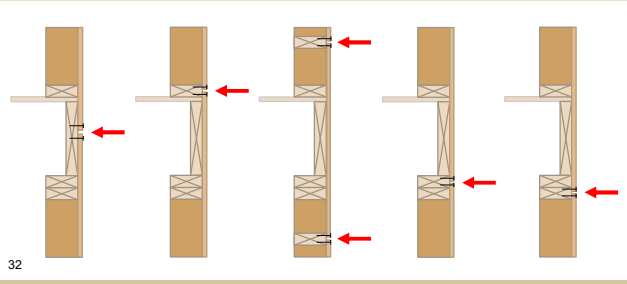
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Second-Story Sheathing to First-Story Sheathing



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Second-Story Sheathing to First-Story Sheathing



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Rim Board® Connections



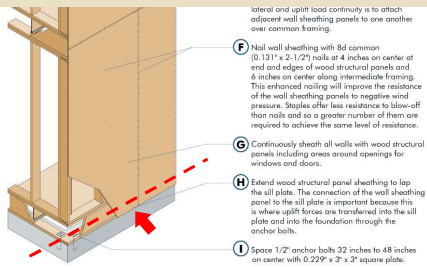
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Rim Board Connections



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First-Story Sheathing to Sill Plate



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First-Story Sheathing to Sill Plate

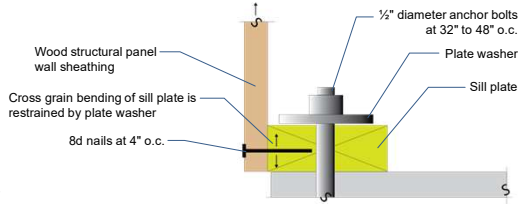


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First-Story Sheathing to Sill Plate

Large plate washers (3"x3"x0.229") prevent cross-grain splitting of sill plate

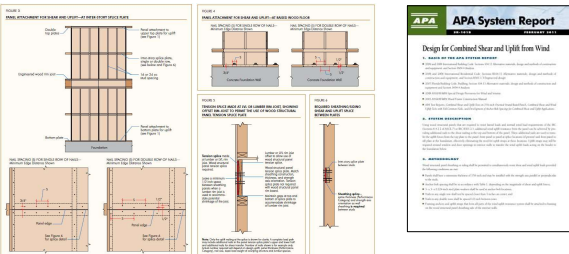


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Wall Sheathing to Rim Board and Sill Plate



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DID YOU KNOW?

10 Benefits of Wood Structural Panel Wall Sheathing

Fully Sheathed Wood Walls



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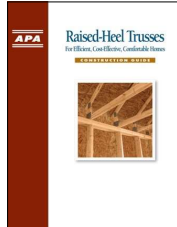


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Raised-Heel Truss to Wall Sheathing Connection Lateral and Uplift Resistance

APA Construction Guide

- Form R330
 - Reduce hurricane straps
 - For heel heights between 9-1/4" and 15-1/4" in depth
 - Free download at www.apawood.org



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Raised-Heel Truss to Wall Sheathing Connection Lateral and Uplift Resistance

APA System Report

- Form SR-103
 - Reduce hurricane straps
 - For heel heights between 15-1/4" and 24" in depth
 - Free download at www.apawood.org



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Raised-Heel Truss to Wall Sheathing Connection Lateral and Uplift Resistance




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ENERGY CODE

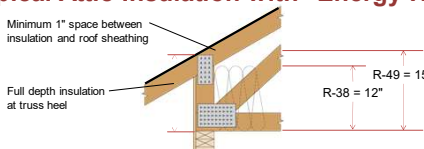
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Energy Efficiency: Raised-Heel Trusses

Typical Attic Insulation with “Energy Heel”




2021 IECC, R402.2.1: Where Section R402.1.3 requires R-49 insulation in the ceiling or attic, installing R-38 over 100 percent of the ceiling of attic area requiring insulation shall satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. Where Section R402.1.3 requires R-60 insulation in the ceiling, installing R-49 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the wall top plate at the eaves.

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Performance Path Options Energy Rating Programs

Performance paths look at the building components as a system

- Offers more flexibility in building design
- Credits low infiltration and tight ducts
- Credits high efficiency equipment
- Lower cost compared to prescriptive path



Advanced Framing details can be utilized in a performance-based approach

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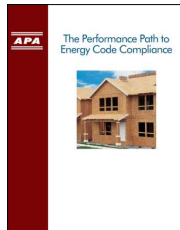
Energy Codes – Performance Path

APA Guide

- Form R505
- Free download at www.apawood.org

APA Webinar

- Meeting the Energy Code Using the Performance Path
- View at www.apawood.org/webinars



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TABLE 2
PERFORMANCE PATH TRADEOFF OPTIONS AND THEIR ESTIMATED ENERGY USE IMPACTS*

IECC Climate Zones	2	3	4	5	6	7
Wall Cavity Insulation Assumed Unless Noted	R-13	R-20	R-20	R-20	R-20	R-20
Wall Systems – Cavity Insulation Only						
2x6 Advanced Framing ¹ – R-18	-4	-1	-1	-1	+2	+3
2x6 Advanced Framing ¹ – R-20	-4	-1	-1	-2	+1	+2
2x6 Advanced Framing ¹ – R-23	-4	-2	-2	-3	0	1
R-13 2x4 Wall	0	+3	+4	NR	NA	NA
R-15 2x4 Wall	-1	+2	+3	+3	NA	NA
R-21 2x6 Wall	-3	-1	0	-1	+2	+3
Wall Systems – Continuous and Cavity Insulation						
R-3 Continuous Insulation ²	-2	-2	-2	-2	NR	NR
R-5 Continuous Insulation ²	-3	-2	-3	-3	0	0
Wall Systems – Windows³						
U-0.28 Windows	-3	-2	-2	-2	-2	-2
U-0.26 Windows	-3	-3	-3	-3	-2	-2
Roof Systems – Radiant Barrier and Burred Ducts⁴						
Radiant Barrier Roof Sheathing	-3	-3	-2	-1	See Footnote k	
Deeply Burred Ducts ⁴	-2	-2	-2	-1	-2	-2
Ducts Considered in Conditioned Space ⁴	-5	-6	-7	-8	-8	-9
Lighting and HVAC Systems						
100% CFL/LED Lighting	-6	-6	-6	-5	-5	-5
95% AFUE Furnace	-2	-3	-5	-6	-6	-8
18 SEER Air Conditioning ⁵	-5	-4	-3	-2	NA	NA

R-20 + 5 c.i.

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Energy Codes – Prescriptive Path



Prescriptive-Based Approach

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Prescriptive Path Options Effective R-Values and U-Factors

National Building Code of Canada 2015

- Ability to meet effective RSI or R-value targets ranging from:
 - RSI 2.78 (R 15.79) to RSI 3.85 (R 21.86)

International Energy Conservation Code

- Ability to meet U-factor targets ranging from:
 - U-Factor range: 0.084 to 0.045

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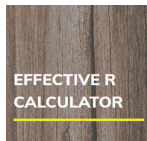


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Explore Assemblies with Free Online Resources

Canadian Wood Council

- Effective RSI/R-value Calculator



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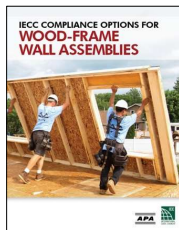
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Explore Assemblies with Free Online Resources

APA Form P320

Describes how energy performance is measured in exterior wood wall assemblies and how to improve wall thermal performance to meet energy code requirements

Free download at www.apawood.org




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DID YOU KNOW?

10 Benefits of Wood Structural Panel Wall Sheathing

Fully Sheathed Wood Walls



AIR BARRIER




INSULATION OPTIONS

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Wood Structural Panels in Air Barrier Systems

- Must be installed continuously
- Select durable materials
- Save on energy bills
- Airtightness is a key function of a building's overall energy performance



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Wood Structural Panels in Air Barrier Systems

Recognized as air barrier materials by:

- ASHRAE
- International Residential Code
- International Energy Conservation Code
- National Building Code of Canada



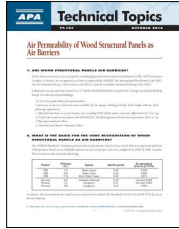
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Wood Structural Panels in Air Barrier Systems

APA Technical Topic

- Form TT-107
 - Answers questions regarding the performance of wood structural panels in air barrier systems
 - Free download at www.apawood.org



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Fully Sheathed Walls for Higher R-Values

Insulation Options

- Spray-in-place cellulose, fiberglass and mineral wool
- Spray foam
- Blanket batts and rolls



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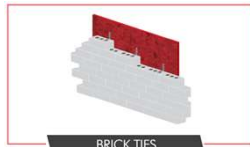
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DID YOU KNOW?

10 Benefits of Wood Structural Panel Wall Sheathing

Fully Sheathed Wood Walls



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Advantages of Nail-Base Sheathing

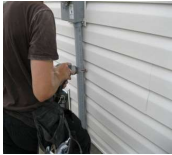
- Eliminates the need for precise fastener spacing.
- Allows for the use of shorter fasteners.
- Helps ensure that siding remains in place during high-wind events.
- Eliminates the need for blocking when siding ends don't fall on studs.

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Nail-Base Sheathing for Siding and Trim Attachment



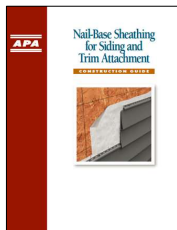
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Nail-Base Sheathing for Siding and Trim Attachment

APA Construction Guide

- **APA Form Q250**
 - Provides guidance regarding the use of wood structural panel wall sheathing as a nail base
 - Applicable for cladding materials with weights up to 3 psf
 - Free download at www.apawood.org



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Nail-Base Sheathing for Siding and Trim Attachment

TABLE 1
Fastener Substitution Schedule for Nail-Base Sheathing^{a,b}

Fastener Diameter	Fastener Type	Sheathing Performance Category	
		3/8	7/16
Use same diameter for all types of fastener as the smooth-shank nail diameter recommended by siding manufacturer	Smooth- or screw-shank nails	4:1 <small>(use 3 additional fasteners per specified fastener spacing)</small>	3:1 <small>(use 2 additional fasteners per specified fastener spacing)</small>
	Ring-shank nails ^d	1:1	1:1
	Wood screws ^d	1:1	1:1

Notes:
 a. The table above is based on the siding manufacturer's installation recommendations for 1.25-inch penetration into spruce-pine-fir lumber framing by smooth-shank nails.
 b. The table above is based on the use of a siding product with a weight of not more than 3 psf.
 c. Additional nails may be required if the siding manufacturer's installation recommendations are based on framing lumber with a specific gravity (SG) greater than 0.42.
 d. Use same number of fasteners and fastener spacing recommended by the siding manufacturer for fastening to studs.

61 Please note: See 2021 IRC Section R703.3.4

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Tested and Code Accepted



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Nail-Base Sheathing for Siding and Trim Attachment

APA Technical Topic

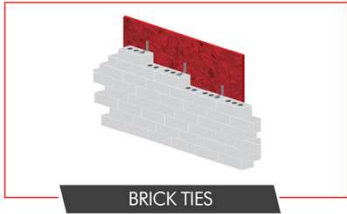
- **APA Form TT-109**
- **Applicable for cladding materials with weights up to 11 psf**
- **Free download at www.apawood.org**



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Nail-Base Sheathing for the Attachment of Brick Ties



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Nail-Base Sheathing for the Attachment of Brick Ties



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Nail-Base Sheathing for the Attachment of Brick Ties



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Nail-Base Sheathing for the Attachment of Brick Ties

IRC 2021

TABLE R703.8.4(2)
REQUIRED BRICK TIE SPACING FOR DIRECT APPLICATION TO WOOD STRUCTURAL PANEL SHEATHING^{1,2,3}

REQUIRED BRICK TIE SPACING (VERTICAL/TIE SPACING/HORIZONTAL/TIE SPACING) (INCHES/MILLIMETERS)

FASTENER TYPE ¹	SIZE (DIA. OR SCREW #)	110 mph V _w				115 mph V _w				130 mph V _w				140 mph V _w			
		Zone 2		Zone 3		Zone 2		Zone 3		Zone 2		Zone 3		Zone 2		Zone 3	
		Exposure B	Exposure C	Exposure B	Exposure C	Exposure B	Exposure C	Exposure B	Exposure C	Exposure B	Exposure C	Exposure B	Exposure C	Exposure B	Exposure C	Exposure B	Exposure C
Ring Shank Nails	0.091	16/16, 16/12, 12/16, 12/12	16/12, 12/16, 12/12	12/12	16/16, 12/16, 12/12	16/12, 12/16, 12/12	12/12	12/12	16/12, 12/16, 12/12	16/12, 12/16, 12/12	12/12	12/12	—	12/12	—	—	—
	0.148	20/16, 16/24, 16/16, 16/12, 12/16, 12/12	16/16, 16/12, 12/16, 12/12	16/16, 16/12, 12/16, 12/12	24/16, 16/24, 16/16, 16/12, 12/16, 12/12	16/16, 16/12, 12/16, 12/12	16/16, 16/12, 12/16, 12/12	16/16, 16/12, 12/16, 12/12	16/16, 16/12, 12/16, 12/12	16/16, 16/12, 12/16, 12/12	16/12, 12/16, 12/12	16/12, 12/16, 12/12	16/12, 12/16, 12/12	16/16, 16/12, 12/16, 12/12	16/12, 12/16, 12/12	16/12, 12/16, 12/12	12/12

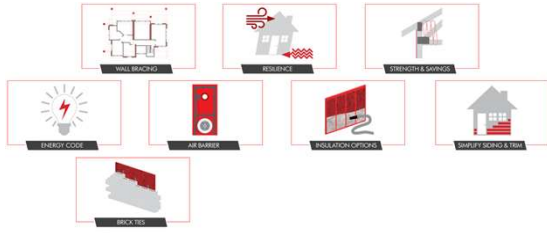


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DID YOU KNOW?

10 Benefits of Wood Structural Panel Wall Sheathing

Fully Sheathed Wood Walls



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DID YOU KNOW?

10 Benefits of Wood Structural Panel Wall Sheathing

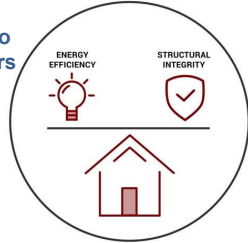
Fully Sheathed Wood Walls



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Advanced Framing Above Grade Wall Systems

- Optimize building material usage
- Increase cavity insulation volume to boost effective R-values or U-factors
- Withstand all design loads



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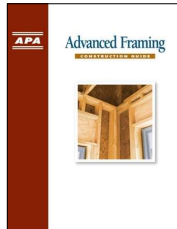
2x6 Advanced Framing Details

APA Construction Guide

- Form M400
- Free download at www.apawood.org

APA Webinar

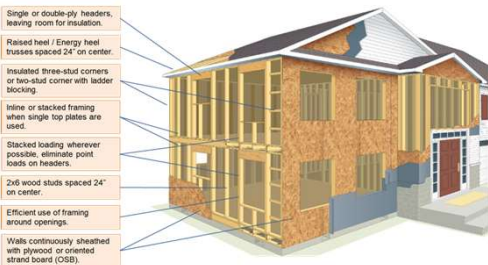
- View at www.apawood.org/webinars



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Components of Advanced Framing



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Meeting Energy Codes with Advanced Framing

Canada

- Required in 2015 NBC Table 9.36.2.4.(1)
 - Insulated or flush headers
 - Corners with two studs
 - Ladder blocking at intersections
 - Efficient use of framing around openings
 - Double Top Plates

United States

- Required in IECC Table R402.4.1.1
 - Insulated or flush headers
 - Cavities within corners
 - Cavities within wall intersections

Use with prescriptive or performance paths

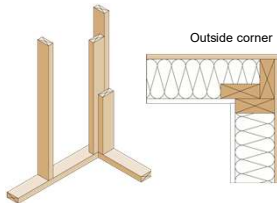


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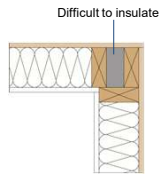
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Advanced Framing Details Corner Framing

Insulated Three-stud Corner



Traditional Corner



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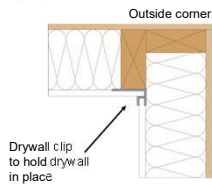
Please Note: Three-stud Corner for US only

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Advanced Framing Details Corner Framing

Two-stud Corner (with Drywall Clips)

- 2021 IRC, Figure R602.3(2) – Framing Details
 - Note: A third stud and/or partition backing stud shall be permitted to be omitted through the use of wood back-up cleats, metal drywall clips or other approved devices that will serve as adequate backing for facing materials.



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Please note: Two-stud corners are an advanced framing requirement in Canada

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Advanced Framing Details Ladder Blocking

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Please note: Two-stud corners are an advanced framing requirement in Canada

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Advanced Framing Details Interior Wall Intersection Options

Ladder Junction

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Advanced Framing Details Interior Wall Intersection Options

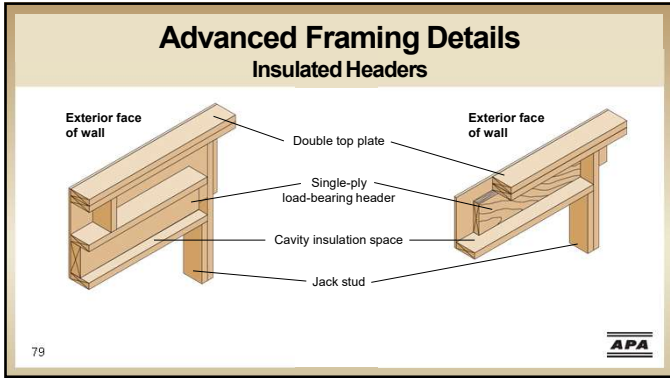
Junction for Continuous Drywall Application

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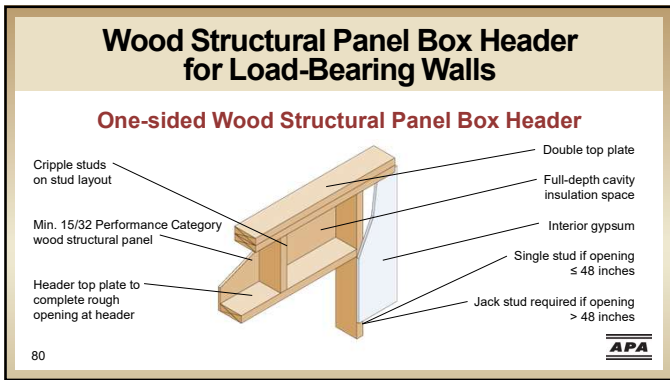
Detail courtesy of Home Innovations Research Laboratory

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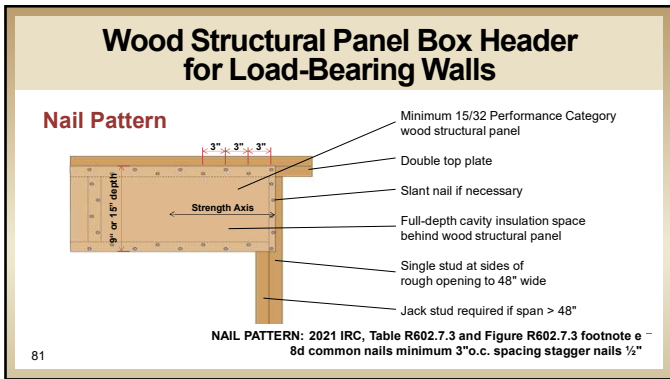
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Advanced Framing Details Flush Headers

Extend APA Rim Board and rim header a minimum of 12 inches (a) past the outer full-height studs

Joist hanger required (b) to ensure floor load is safely transferred to rim header

a. 6 inches for structural composite lumber; consult the proprietary rim board manufacturers recommendations.
b. Consult I-joist manufacturers recommendations.

Wood I-joist

2-Ply rim header or SCL / Glulam

Rim header splices are not permitted over the header span

Cripple studs, as required

Rim board hanger span - Max. 4'0"

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Single Top Plate Offsets

Member Placement for Single Top Plates

Canada	United States
50 mm or 2 inches max.	1 inch max.

Trusses or floor joists at 24" o.c.

Studs at 24" o.c.

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Double Top Plate Offsets (2x6 Framing)

Member Placement for Double Top Plates

Common floor or roof framing member

No Maximum Offset

Double 2x6 top plate no maximum offset

Studs up to 24 inches o.c.

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Conventional Framing

16" o.c. Member Spacing

CONVENTIONAL FRAMING: 2x4 studs at 16" o.c., double top plate, 3-stud corners, 2-stud 'T' junctions, double 2x12 header on jack studs, redundant cripples at ends of window

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2x6 Advanced Framing

24" o.c. Member Spacing

ADVANCED FRAMING: 2x6 studs at 24" o.c., single top plate (optional), 2-stud corners, ladder junctions, single ply or box headers, single studs at sides of openings, redundant cripples omitted

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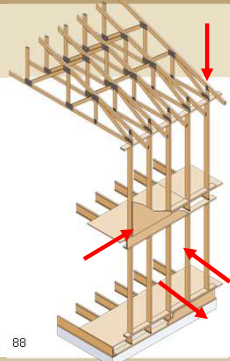
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Wall Frame Comparison

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Structural Integrity (2x6 @ 24" on center)



- **Studs**
 - 2.5 times stiffer
 - 1.4 times stronger in bending
 - 5% increase in compression perp
 - 2.05 increase in axial compression
- **Structural panel wall sheathing**
 - Out of plane wind loads
 - Comply with Table R602.3(3)
 - Fasten siding & trim to sheathing if needed
 - Comply with Table R703.3.3
 - Wall bracing – no impact
 - Shear walls – no major impact
 - Pay attention to footnotes in shear wall table

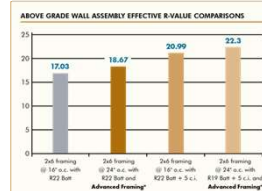
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Boosting Effective R-Values or U-Factors

Canada

ABOVE GRADE WALL ASSEMBLY EFFECTIVE R-VALUE COMPARISONS

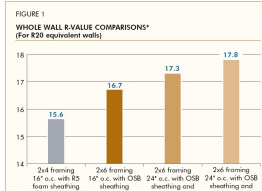


Assembly	Effective R-Value
2x6 framing @ 16" o.c. with K22 Stud	17.03
2x6 framing @ 24" o.c. with K22 Stud and Advanced Framing	18.67
2x6 framing @ 16" o.c. with K22 Stud + S.I.L. Advanced Framing	20.99
2x6 framing @ 24" o.c. with K22 Stud + S.I.L. and Advanced Framing	22.3

a. Advanced Framing as defined by NBC R-362.4. (1)
b. All wall assembly R-Values taken from the Canadian Wood Council thermal wall calculator.

United States

**FIGURE 1
WHOLE WALL R-VALUE COMPARISONS*
(For R20 equivalent walls)**



Assembly	Whole Wall R-Value
2x4 framing 16" o.c. with R5 foam sheathing + wall bracing	15.6
2x6 framing 16" o.c. with OSB sheathing + wall bracing	16.7
2x6 framing 24" o.c. with OSB sheathing and double top plates	17.3
2x6 framing 24" o.c. with OSB sheathing and single top plates	17.8

*Values based on unbraced studs and R21 core insulation in 2x6 walls.
**Values R2 from sheathing over wood structural panel wall bracing.

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DID YOU KNOW?

10 Benefits of Wood Structural Panel Wall Sheathing

Fully Sheathed Wood Walls

WALL BRACING

RESISTANCE

STRENGTH & SUPPORT

ENERGY CODE

AIR BARRIER

INSULATION OPTIONS

SIMPLIFY SCHEDULING

BRICK TIES

ADVANCED FRAMING

SUSTAINABLE

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Sustainability – Forest Facts

US and Canada

- A growing forest absorbs 1.4 tons of carbon dioxide for every 1 ton of wood produced.
- In the US, there are roughly 20% more trees than there were 50 years ago, totaling over 766 million acres.
- Canada has roughly 860 million acres of forest, of which almost half are certified to third-party standards of sustainable forest management.
- Global carbon dioxide emissions could be reduced by as much as 31% if builders used wood instead of steel and concrete.

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Sustainability – On-demand Webinars

WEBINAR
SUSTAINABLE CHOICES
Wood Products in Industrial Applications

WEBINAR
Wood as a Sustainable
Building Material

Available at www.apawood.org

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Sheathe for Success Balancing Cost, Structure and Energy



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Questions?



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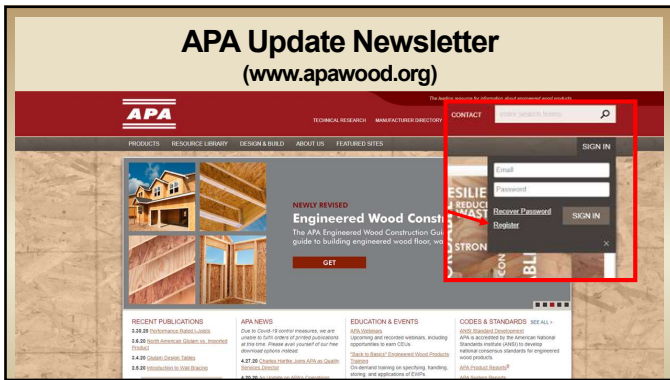


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