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Resilient Construction with Engineered Wood: Sustainable, Code-Compliant Solutions

RW1

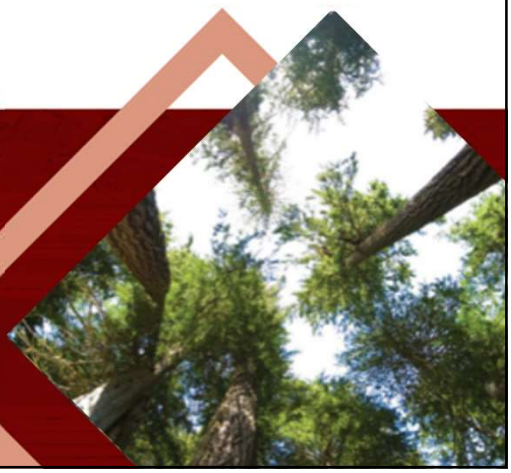
Presented by:

Matt Brown

Director of Energy Policy and Code

Stephanie Thomas-Rees

Engineered Wood Specialist/Territory Lead



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Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

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

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Attendee Survey

Matt Brown

Stephanie Thomas-Rees

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

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Course Description

Today's building codes and standards address many of society's top concerns regarding the built environment—from public health and safety to the environmental impacts of construction materials. As natural disasters become more frequent, severe and costly, the need for more resilient buildings is paramount.

This webinar explores the essential role of resilient construction methods in today's built environment and explains the various APA resources that can support resilient design. Learn how to meet and exceed code requirements using engineered wood products (EWPs) to build strong, sustainable and energy - efficient structures.

This session will cover key programs and standards that quantify resiliency, provide detailed construction drawings, and discuss installation best practices and which to avoid. Participants will also learn how to showcase the value of EWPs to their clients. Ideal for designers, engineers, builders and other industry professionals, this webinar will empower you to enhance building performance and occupant safety while promoting environmental stewardship.

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Objectives

- Define and explain the importance and advantages of resilient construction methods promoting health and wellness in communities.
- Outline APA's resiliency focus and the resources available to enhance health and wellness of building occupants through resilient building practices in the built environment.
- Discuss code requirements, standards and certification programs that ensure resiliency.
- Identify design and construction techniques using engineered wood products that contribute to resilient and safe buildings.

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Agenda

1. **Why?**
2. Definition
3. Pillars – Structural, Hazards, Sustainability, Energy
4. How? APA Resources MM0
5. Examples – Bad & Good
6. APA Moving Forward AD1

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Why?

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- Survive progressive changing climate and intensifying natural disasters.
- Promote sustainability and safeguard occupants using innovative solutions.
- Reduces risk assessment in investment evaluations.
- Codes are increasing energy efficiency and sustainability mandates.

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Why?

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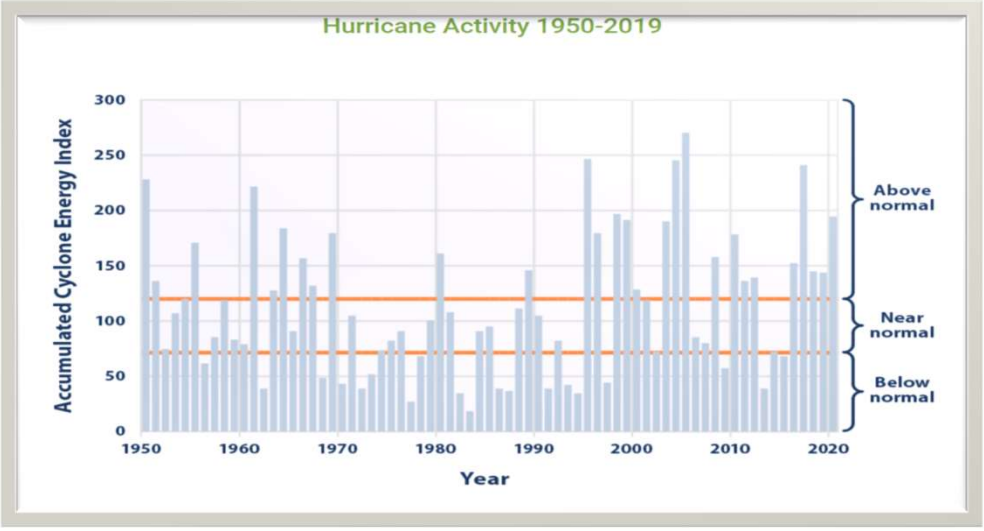

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Agenda

1. Why?
2. **Definition**
3. Pillars – Structural, Hazards, Sustainability, Energy
4. How? APA Resources
5. Examples – Bad & Good
6. APA Moving Forward

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Definition

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The ability to design and construct buildings that can withstand and recover from severe wind events, seismic activities, fire, and floods while promoting sustainability, and energy efficiency, utilizing engineered wood products. This is achieved through APA's four resiliency pillars: Structural Resilience, Hazard Mitigation, Sustainability/Stewardship, and Energy Efficiency.

re·sil·iency

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Agenda

1. Why?
2. Definition
3. **Pillars – Structural, Hazards, Sustainability, Energy**
4. How? APA Resources
5. Examples – Bad & Good
6. APA Moving Forward

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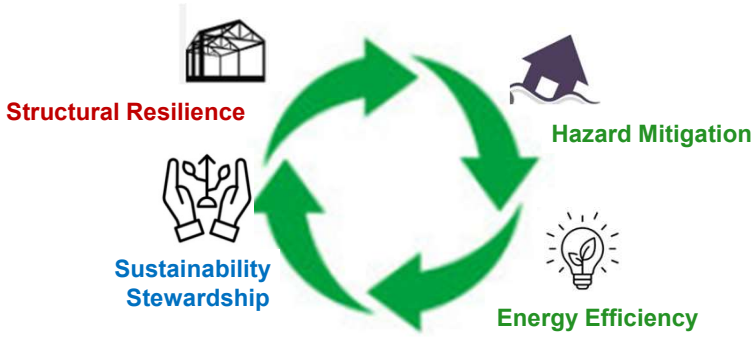
Resiliency Pillars a person or thing regarded as reliably providing essential support for something.



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Structural Resilience

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Structural Resilience

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- Promoting resilient, high-performing buildings capable of withstanding severe wind events.
- Seismic Resilience: Advocating for high-performance seismic design and construction.



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Structural Resilience

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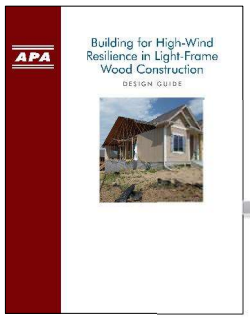
Wind/High Wind

- Brace for high-wind events
- Maximize wall bracing using WSP

Seismic

- Wall bracing or seismic
- FTAO
- Weight of materials



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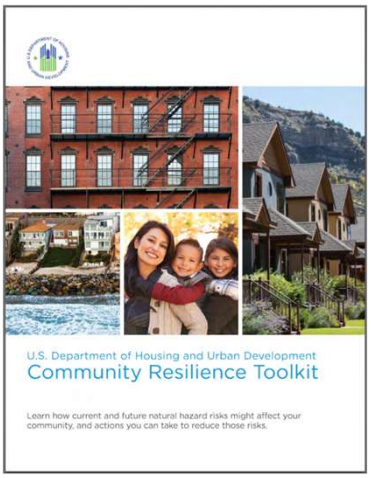
Structural Resiliency- Programs



HUD Resiliency Guide for Wind

- Cites APA details and recommendations
- HUD – "A complete wrap of OSB or plywood on exterior"

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Hazard Mitigation

Structural Fire

- AWC's fire resources
- Wildland Urban Interface (WUI)

Flood

- Raised wood floors resource

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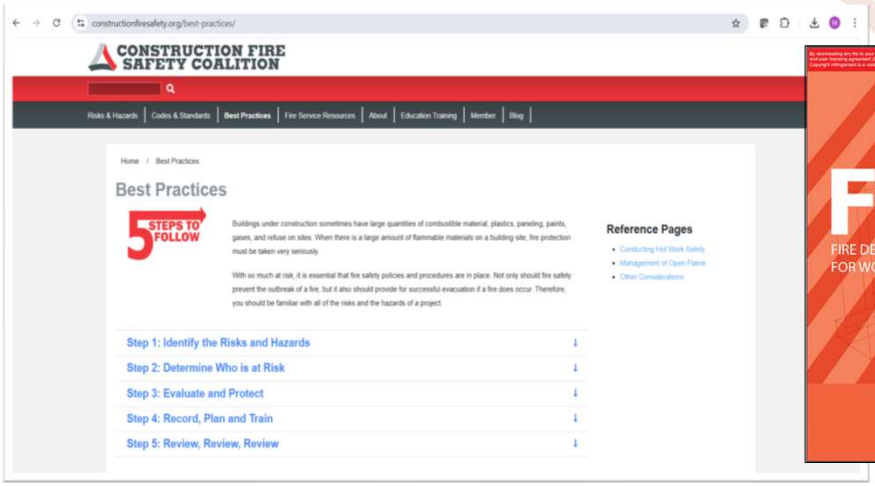
Structural Fire



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Flood

Raised Wood Floor Case Study: Cooper Homes

John Cooper, Cooper Homes, Roswell, Georgia

Raised front porches provide historic character to John Cooper's homes. "The main thing is selling houses, and I've found that raised floors sell quicker."

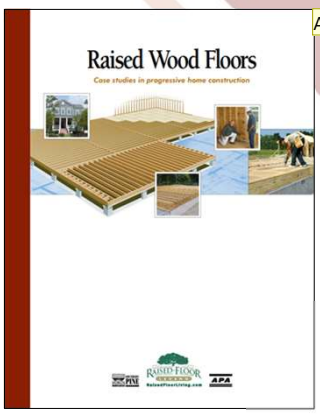
Since 1982, John Cooper of Cooper Homes has built homes and communities inspired by the architecture and style of Atlanta's historic neighborhoods. He prefers raised wood floors because they provide historic character to a house – a feature that is attractive to home buyers.

"The main thing for me is the aesthetics and streetscape," says Cooper. "When a home is raised, people come up to it – and they may not really figure out exactly what it is – but they just know it is a better looking house. And the streetscape – having a raised front porch and stairs in front – is just much more comfortable for a community. You can sit out front and say hello to your neighbors. If you are flat on the ground, it just doesn't have the same feel. People notice that. If they don't pay more for (the aesthetics) – which I think they do – the house will sell faster than a house that is on a slab."

Cooper's closed crawlspaces are semi-conditioned, keeping them dry and mildew-free, and can house mechanical equipment and ductwork for improved energy efficiency. Cooper says that finish siding over the foundation walls, such as brick or stone, is the kind of detailing that can have a significant visual impact. "That's a big dimension to cover the base, as opposed to a house that just comes down to the ground with siding. You can picture how much more pleasing it is to people who are looking for houses."

Cooper builds closed crawlspaces to better condition the main floor of the house and minimize moisture infiltration. He covers the dirt floor of the crawlspace with concrete for a more finished look. "You don't have to do a full 4-inch concrete floor," explains Cooper. "You can do 2 inches of concrete, which cuts your cost in half. You still get the same effect because you are not putting any weight on that floor. And that crawlspace is now dry and clean so it can be used for storage."

The finishing touches of a high-end raised floor home may cost a little more up front, but, according to Cooper, the builder will more than make up for it on the sale. "I've figured it out," Cooper says. "While it may cost me roughly $5,000 more to build it, in a normal market I will definitely get $10,000 to $15,000 more for a raised home."



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Sustainability

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Green Building Programs

- NGBS standards
- LEED H standards
- Integration of green practices and products

Sustainable

- Renewable/recyclable
- Carbon friendly
- Return of investment/affordability

CLF Carbon Leadership Forum

U.S. GREEN BUILDING COUNCIL LEED USGBC

NGBS GREEN Home Innovation Research Labs

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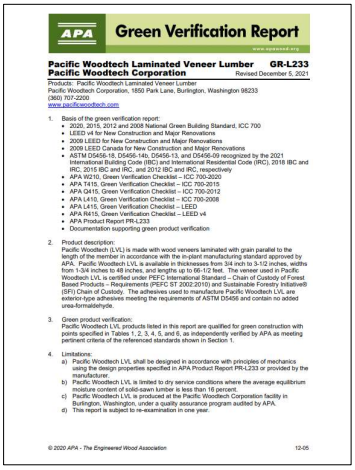
Green Verification Report



APA Green Verification Report

Pacific Woodtech Laminated Veneer Lumber **GR-L233**
Pacific Woodtech Corporation Revised December 5, 2021

Products: Pacific Woodtech Laminated Veneer Lumber
Pacific Woodtech Corporation, 1850 Park Lane, Burlington, Washington 98233
(360) 707-2200
www.pacificwoodtech.com

1. Basis of the green verification report:
   - 2020, 2015, 2012 and 2008 National Green Building Standard, ICC 700
   - LEED v4 for New Construction and Major Renovations
   - 2009 LEED for New Construction and Major Renovations
   - 2009 LEED Canada for New Construction and Major Renovations
   - ASTM D5456-18, D5456-14b, D5456-13, and D5456-09 recognized by the 2021 International Building Code (IBC) and International Residential Code (IRC), 2018 IBC and IRC, and 2012 IBC and IRC, respectively
   - APA W210, Green Verification Checklist – ICC 700-2020
   - APA T415, Green Verification Checklist – ICC 700-2015
   - APA Q415, Green Verification Checklist – ICC 700-2012
   - APA L410, Green Verification Checklist – ICC 700-2008
   - APA L415, Green Verification Checklist – LEED
   - APA R415, Green Verification Checklist – LEED v4
   - APA Product Report PR-L233
   - Documentation supporting green product verification
2. Product description:
   Pacific Woodtech (LVL) is made with wood veneers laminated with grain parallel to the length of the member in accordance with the in-plant manufacturing standard approved by APA. Pacific Woodtech LVL is available in thicknesses from 3/4 inch to 3-1/2 inches, widths from 1-3/4 inches to 48 inches, and lengths up to 66-1/2 feet. The veneer used in Pacific Woodtech LVL is certified under PEFC International Standard – Chain of Custody of Forest Based Products – Requirements (PEFC ST 2002:2010) and Sustainable Forestry Initiative® (SFI) Chain of Custody. The adhesives used to manufacture Pacific Woodtech LVL are exterior-type adhesives meeting the requirements of ASTM D5456 and contain no added urea-formaldehyde.
3. Green product verification:
   Pacific Woodtech LVL products listed in this report are qualified for green construction with points specified in Tables 1, 2, 3, 4, 5, and 6, as independently verified by APA as meeting pertinent criteria of the referenced standards shown in Section 1.
4. Limitations:
   a) Pacific Woodtech LVL shall be designed in accordance with principles of mechanics using the design properties specified in APA Product Report PR-L233 or provided by the manufacturer.
   b) Pacific Woodtech LVL is limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber is less than 16 percent.
   c) Pacific Woodtech LVL is produced at the Pacific Woodtech Corporation facility in Burlington, Washington, under a quality assurance program audited by APA.
   d) This report is subject to re-examination in one year.

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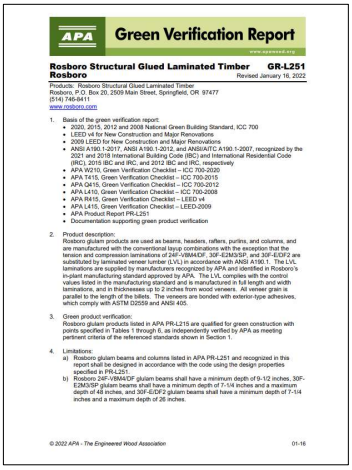

APA Green Verification Report

Rosboro Structural Glued Laminated Timber **GR-L251**
Rosboro Revised January 16, 2022

Products: Rosboro Structural Glued Laminated Timber
Rosboro, P.O. Box 20, 2509 Main Street, Springfield, OR 97477
(514) 746-8411
www.rosboro.com

1. Basis of the green verification report:
   - 2020, 2015, 2012 and 2008 National Green Building Standard, ICC 700
   - LEED v4 for New Construction and Major Renovations
   - 2009 LEED for New Construction and Major Renovations
   - ANSI A190.1-2017, ANSI A190.1-2012, and ANSI/AITC A190.1-2007, recognized by the 2021 and 2018 International Building Code (IBC) and International Residential Code (IRC), 2015 IBC and IRC, and 2012 IBC and IRC, respectively
   - APA W210, Green Verification Checklist – ICC 700-2020
   - APA T415, Green Verification Checklist – ICC 700-2015
   - APA Q415, Green Verification Checklist – ICC 700-2012
   - APA L410, Green Verification Checklist – ICC 700-2008
   - APA R415, Green Verification Checklist – LEED v4
   - APA L415, Green Verification Checklist – LEED-2009
   - APA Product Report PR-L251
   - Documentation supporting green product verification
2. Product description:
   Rosboro glulam products are used as beams, headers, rafters, purlins, and columns, and are manufactured with the conventional layup combinations with the exception that the tension and compression laminations of 24F-V8M4/DF, 30F-E2M3/SP, and 30F-E/DF2 are substituted by laminated veneer lumber (LVL) in accordance with ANSI A190.1. The LVL laminations are supplied by manufacturers recognized by APA and identified in Rosboro's in-plant manufacturing standard approved by APA. The LVL complies with the control values listed in the manufacturing standard and is manufactured in full length and width laminations, and in thicknesses up to 2 inches from wood veneers. All veneer grain is parallel to the length of the billets. The veneers are bonded with exterior-type adhesives, which comply with ASTM D2559 and ANSI 405.
3. Green product verification:
   Rosboro glulam products listed in APA PR-L215 are qualified for green construction with points specified in Tables 1 through 6, as independently verified by APA as meeting pertinent criteria of the referenced standards shown in Section 1.
4. Limitations:
   a) Rosboro glulam beams and columns listed in APA PR-L251 and recognized in this report shall be designed in accordance with the code using the design properties specified in PR-L251.
   b) Rosboro 24F-V8M4/DF glulam beams shall have a minimum depth of 9-1/2 inches. 30F-E2M3/SP glulam beams shall have a minimum depth of 7-1/4 inches and a maximum depth of 48 inches, and 30F-E/DF2 glulam beams shall have a minimum depth of 7-1/4 inches and a maximum depth of 26 inches.

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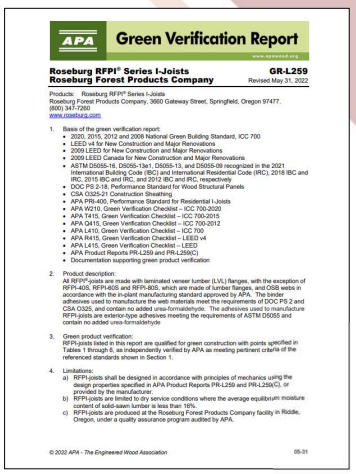

APA Green Verification Report

Roseburg RFPI® Series I-Joists **GR-L259**
Roseburg Forest Products Company Revised May 31, 2022

Products: Roseburg RFPI® Series I-Joists
Roseburg Forest Products Company, 3660 Gateway Street, Springfield, Oregon 97477.
(800) 347-7260
www.roseburg.com

1. Basis of the green verification report:
   - 2020, 2015, 2012 and 2008 National Green Building Standard, ICC 700
   - LEED v4 for New Construction and Major Renovations
   - 2009 LEED for New Construction and Major Renovations
   - 2009 LEED Canada for New Construction and Major Renovations
   - ASTM D5055-16, D5055-13a1, D5055-13, and D5055-09 recognized in the 2021 International Building Code (IBC) and International Residential Code (IRC), 2018 IBC and IRC, 2015 IBC and IRC, and 2012 IBC and IRC, respectively
   - DOC PS 2-18, Performance Standard for Wood Structural Panels
   - CSA O325-21 Construction Sheathing
   - APA PRI-400, Performance Standard for Residential I-Joists
   - APA W210, Green Verification Checklist – ICC 700-2020
   - APA T415, Green Verification Checklist – ICC 700-2015
   - APA Q415, Green Verification Checklist – ICC 700-2012
   - APA L410, Green Verification Checklist – ICC 700
   - APA R415, Green Verification Checklist – LEED v4
   - APA L415, Green Verification Checklist – LEED
   - APA Product Reports PR-L259 and PR-L259(C)
   - Documentation supporting green product verification
2. Product description:
   All RFPI®-joists are made with laminated veneer lumber (LVL) flanges, with the exception of RFPI-40S, RFPI-60S and RFPI-80S, which are made of lumber flanges, and OSB webs in accordance with the in-plant manufacturing standard approved by APA. The binder adhesives used to manufacture the web materials meet the requirements of DOC PS 2 and CSA O325, and contain no added urea-formaldehyde. The adhesives used to manufacture RFPI-joists are exterior-type adhesives meeting the requirements of ASTM D5055 and contain no added urea-formaldehyde
3. Green product verification:
   RFPI-joists listed in this report are qualified for green construction with points specified in Tables 1 through 6, as independently verified by APA as meeting pertinent criteria of the referenced standards shown in Section 1.
4. Limitations:
   a) RFPI-joists shall be designed in accordance with principles of mechanics using the design properties specified in APA Product Reports PR-L259 and PR-L259(C), or provided by the manufacturer.
   b) RFPI-joists are limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber is less than 16%.
   c) RFPI-joists are produced at the Roseburg Forest Products Company facility in Riddle, Oregon, under a quality assurance program audited by APA.

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Forest Certification and APA Members

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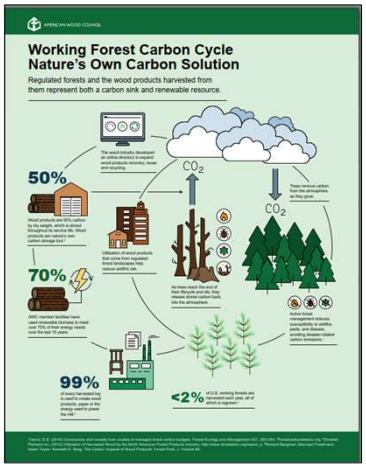
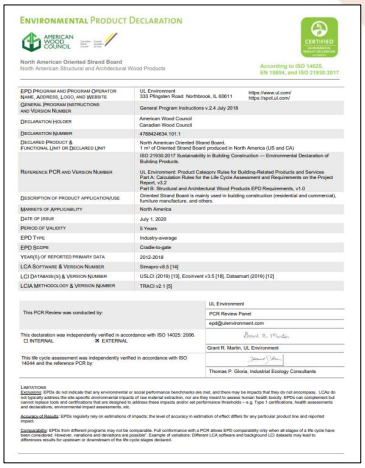
Life Cycle Analysis (LCA) and Environmental Product Declaration (EPD)





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Energy Efficiency

Codes

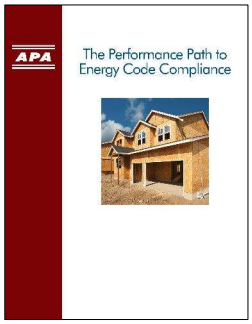
- Supporting cost-effective updates to energy codes and policies.

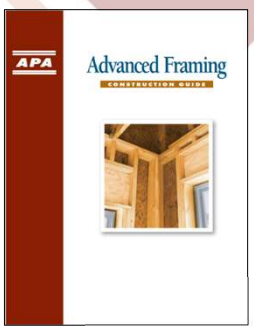
Survivability

- Maintain livable temperatures.

High-Energy Performance

- Maintain livable conditions without power or generation.





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Performance Energy Code Publication

- Intended to be a guide to generate conversations between raters and builders
- All assemblies must be modeled by an energy rater

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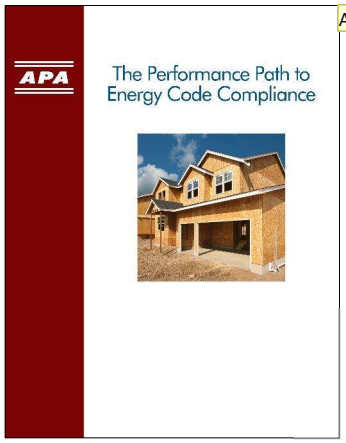

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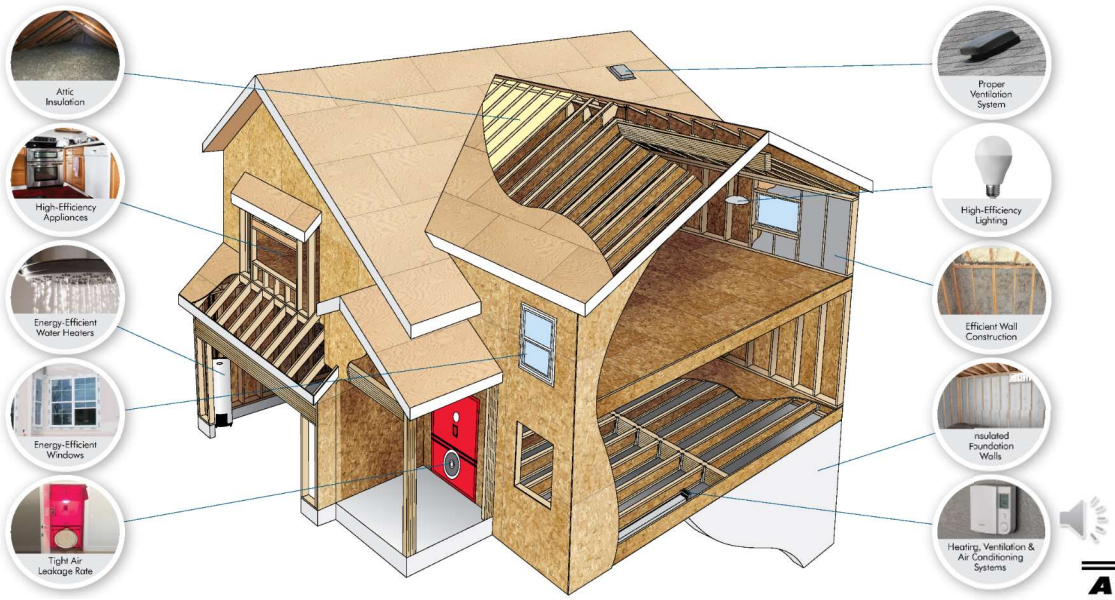

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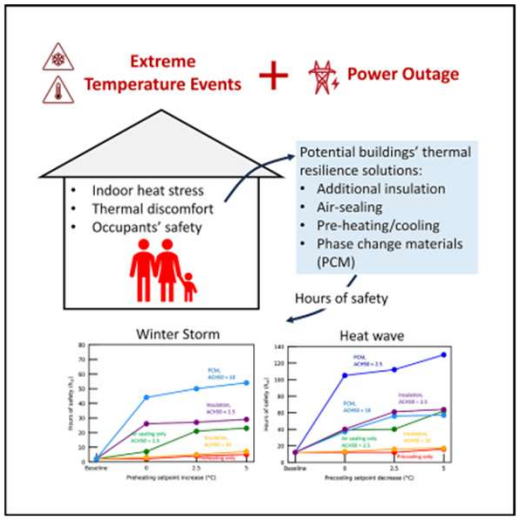
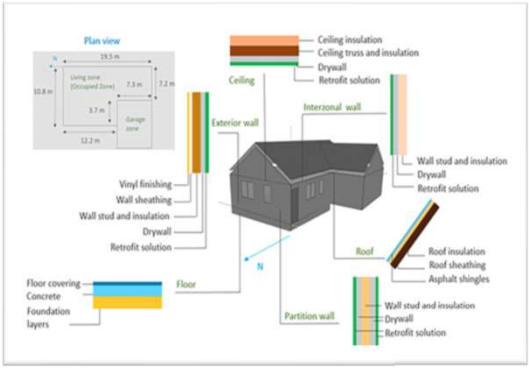
Survivability





Source: US DOE

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Incentives - Builder

- Federal Tax Credits
  - $2500 per home for Energy Star Version 3.2
  - $5000 per home for DOE Net Zero Energy Ready
- Utility Incentives:
  - Multiple state programs with rebates from $200 to $2800 per home, some incentivize continuous insulation.

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Incentives - Homeowner

- **Federal Tax Credits**
  - Energy Efficient Home Improvement Tax Credit
  - Residential Clean Energy Credit
- **Utility Incentives:**
  - Multiple State Programs with Rebates
- **State and Local Energy Code Adoptions**
  - Home Efficiency Rebates and Home Electrification and Appliance Rebates
- **Other Codes and Standards**
  - Pace Programs, Local Utility Rebates

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Agenda

1. Why?
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6. APA Moving Forward

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FTAO

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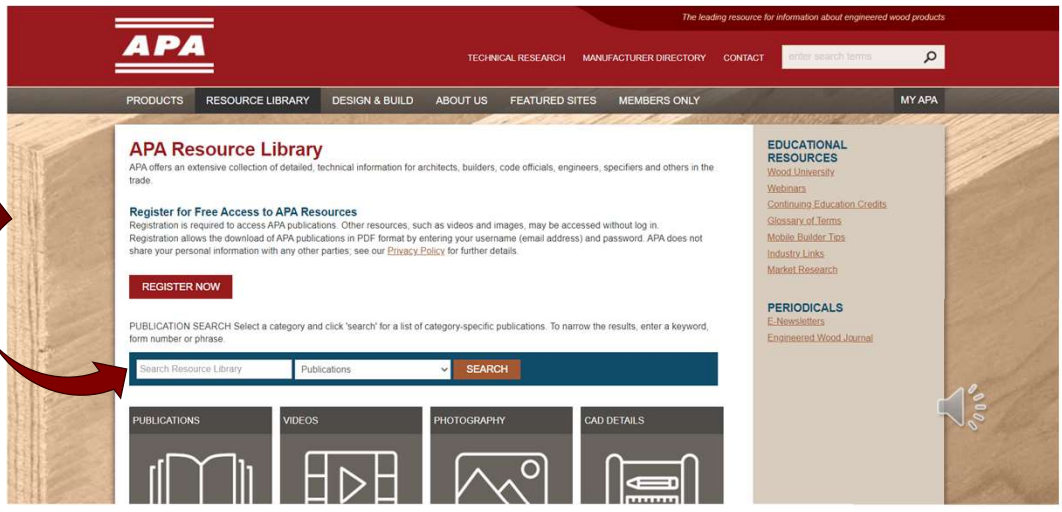

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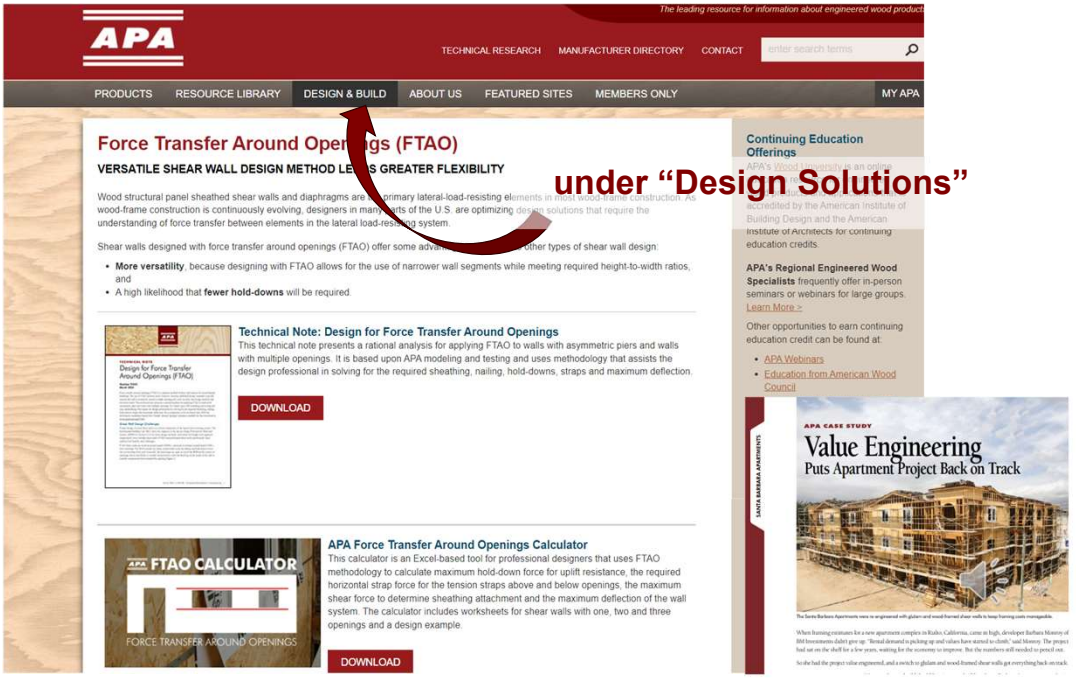

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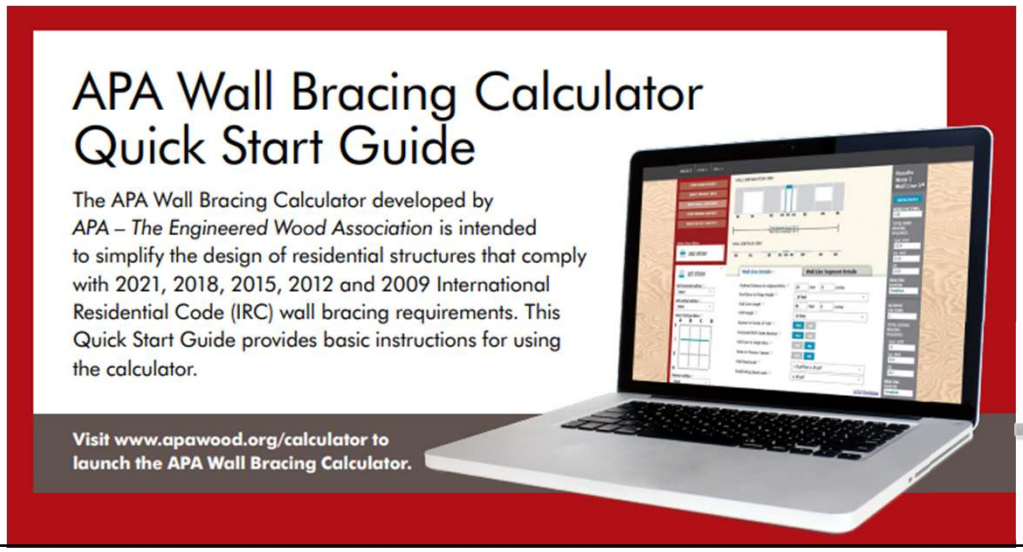
Wall Bracing Calculator



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Advanced Framing

On-Demand Webinar
Converting to Advanced Framing: Learn from Experience

As energy codes become stricter, builders and designers are seeking options for energy-efficient construction that maintain strength, durability, sustainability and cost-effectiveness. One effective solution is advanced framing, a system of construction framing techniques that optimize material use and increase energy efficiency. Join APA's Warren Hamrick as he discusses common advanced framing techniques, the benefits of the system and typical challenges that builders encounter during the conversion from traditional framing to advanced framing. **This course is approved by AIA (1 HSW/LU) and ICC (0.10 CEU).**

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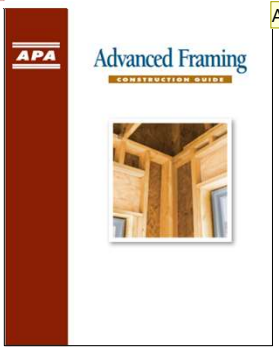

APA Publication: M400

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APA Publication: T110

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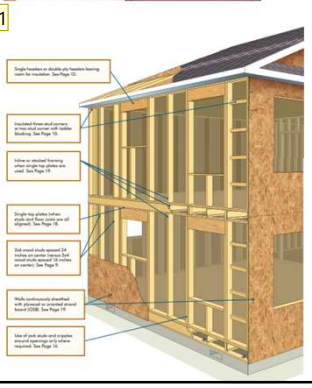

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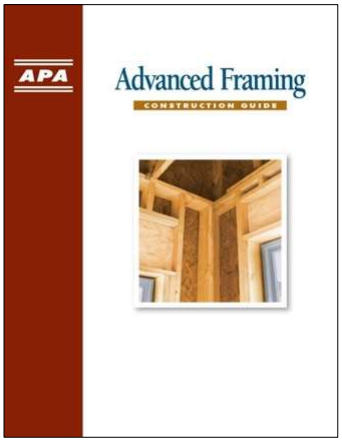
2x6 Advanced Framing



APA Publication: M400

AD0

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Advanced Framed Walls

IECC Climate Zones	2	3	4	5	6	7
2x6 Advanced Framing R-18	-4	-1	+2	+2	+2	+3
2x6 Advanced Framing R-20	-4	-1	+1	+2	+1	+2
2x6 Advanced Framing R-23	-4	-2	+1	+1	0	+1

Assumes 18% framing factor, double top plates and R-12 insulated headers

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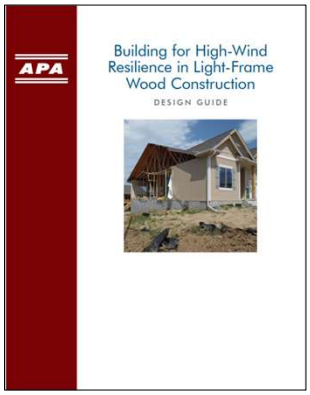
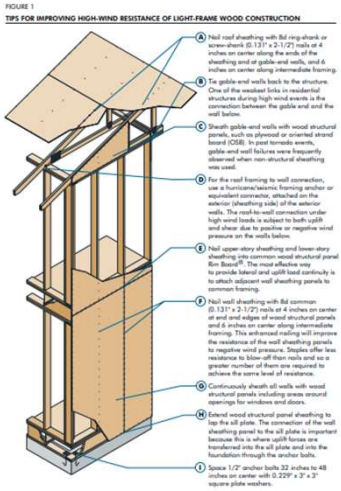
Storm Assessment Publications



Wind Resistance M310



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Best Practices for Sustainability

Less is more

- Use light-frame EWPs when you can
- Use mass timber EWPs instead of steel and concrete construction
- Use biophilic design
- Expose your structure
- Utilize advanced framing techniques

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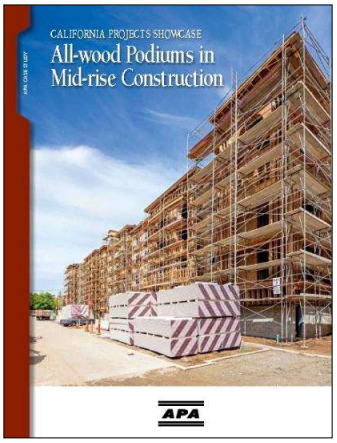
All-wood Podiums in Mid-Rise Construction



APA Case Study, Form No. N110

AD2

AD1

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Mass Timber

- **Renewable resource**
- **Lower embodied energy**
- **2021 IBC allows 18-story construction**
- **Cost benefits**
- **Recent projects:**
  - 18-story student housing, Brock Commons (Vancouver, BC)
  - 25- story (19 = mass timber) apartment building, Ascent Tower (Milwaukee, WI)

Photo Credit: Thornton Thomasetti, Ascent Tower, Milwaukee, WI

Photo Credit: The University of British Columbia

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Use Biophilic Design

APA Publication J140

AD0

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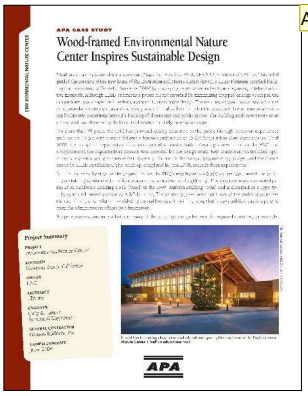
Case Study: Environmental Nature Center

- LEED Platinum building
- Exposed structure



AD2

APA Publication: K115

AD1

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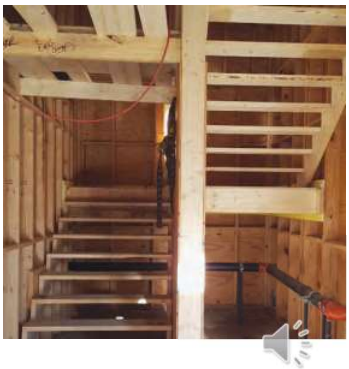
Wood Shaft Walls

- Substitute Concrete/CMU shaft walls with wood



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Wall Framing

- OSL top plate & frame @ opening
- I-joist & LVL studs
- Can use LSL/LVL studs 12’ high
- Straight and bending strength

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Fire Protection

SR-405
APA System Report 405: Fire Protection of Floors Constructed with Prefabricated Wood I-Joists...

Form 305
Fire Protective Options for I-Joist Floor

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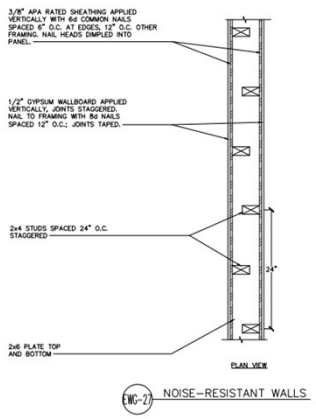
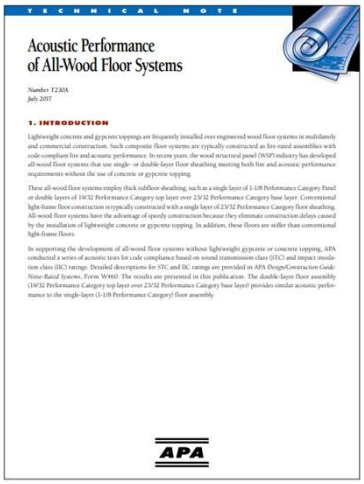
Examples-Details

Noise-Resistant Wall




TECHNICAL NOTE

Acoustic Performance of All-Wood Floor Systems

Number T230A
July 2017

1. INTRODUCTION

Lightweight concrete and gypcrete toppings are frequently installed over engineered wood floor systems in multifamily and commercial construction. Such composite floor systems are typically constructed as fire-rated assemblies with code-compliant fire and acoustic performance. In recent years, the wood structural panel (WSP) industry has developed all-wood floor systems that use single- or double-layer floor sheathing meeting both fire and acoustic performance requirements without the use of concrete or gypcrete topping.

These all-wood floor systems employ thick subfloor sheathing, such as a single layer of 1-1/8 Performance Category Panel or double layers of 10/32 Performance Category top layer over 23/32 Performance Category base layer. Conventional light-frame floor construction is typically constructed with a single layer of 23/32 Performance Category floor sheathing. All-wood floor systems have the advantage of speedy construction because they eliminate construction delays caused by the installation of lightweight concrete or gypcrete topping. In addition, these floors are stiffer than conventional light-frame floors.

In supporting the development of all-wood floor systems without lightweight gypcrete or concrete topping, APA conducted a series of acoustic tests for code compliance based on sound transmission class (STC) and impact insulation class (IIC) ratings. Detailed descriptions for STC and IIC ratings are provided in APA Design/Construction Guide: Nose-Rated Systems, Form W440. The results are presented in this publication. The double-layer floor assembly (10/32 Performance Category top layer over 23/32 Performance Category base layer) provides similar acoustic performance to the single-layer (1-1/8 Performance Category) floor assembly.

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Agenda

1. Why?
2. Definition
3. Pillars – Structural, Hazards, Sustainability, Energy
4. How? APA Resources
5. **Examples – Bad & Good**
6. APA Moving Forward

AD0

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Examples

AD0

Poor load path

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Examples

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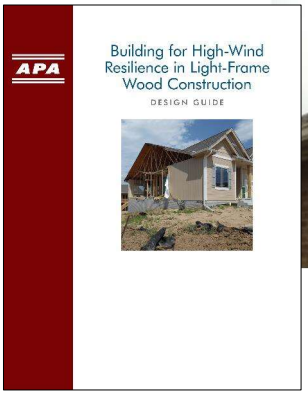
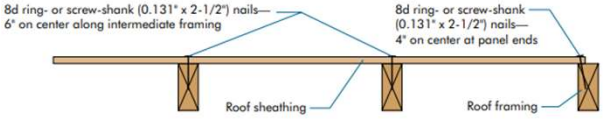
Examples – Roof Sheathing



Wind Resistance M310 AD1

NAIL ROOF SHEATHING WITH 8D RING-SHANK OR SCREW-SHANK (0.131" x 2-1/2") NAILS AT 4" ON CENTER AT PANEL ENDS AND EDGES AND AT GABLE-END WALL, AND 6" ON CENTER ALONG INTERMEDIATE FRAMING



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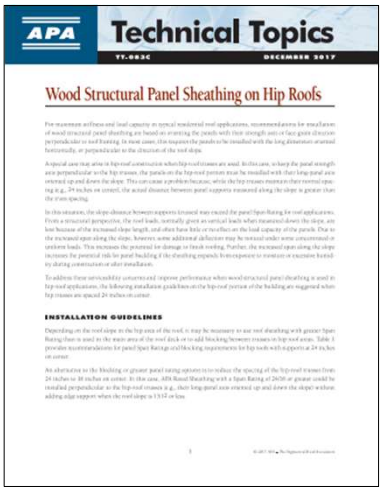
Examples – Roof Sheathing



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Examples –Sheath Gable-End Walls

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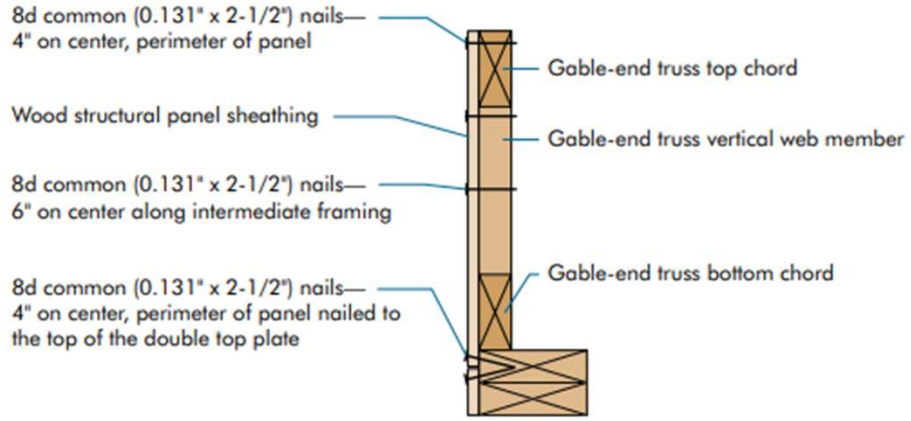
Examples –Sheath Gable-End Walls

SHEATH GABLE-END WALLS WITH WOOD STRUCTURAL PANELS, SUCH AS PLYWOOD OR ORIENTED STRAND BOARD (OSB)



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Examples –Sheath Gable-End Walls

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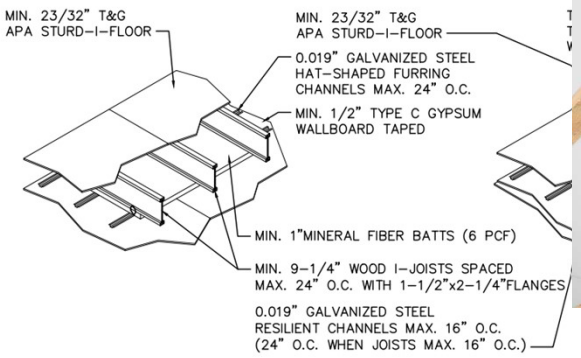
Examples - Fire



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Examples - WSP as an Air Barrier

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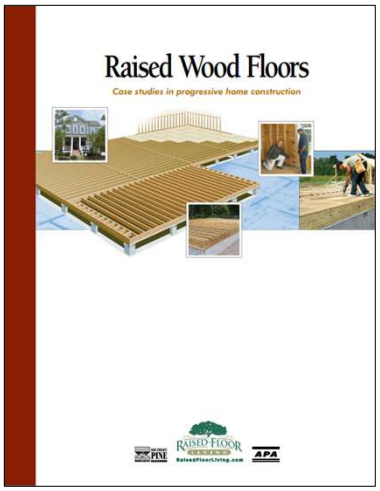
Examples – Flood



Form K110

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Examples - Flood

Solution – Raised Floor System

Owner/builder Scott Murray's desire for a home with height and curb appeal led to his decision to build a raised wood floor system that is "characteristic of the historic architecture that I like."

The continuous stem wall foundation, constructed from eight-inch CMU blocks over a poured-in-place footing, encloses the crawl space.

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Form L110 AD0

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Examples – Raised Foor

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Examples – Raised Foor

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Examples – Raised Floors

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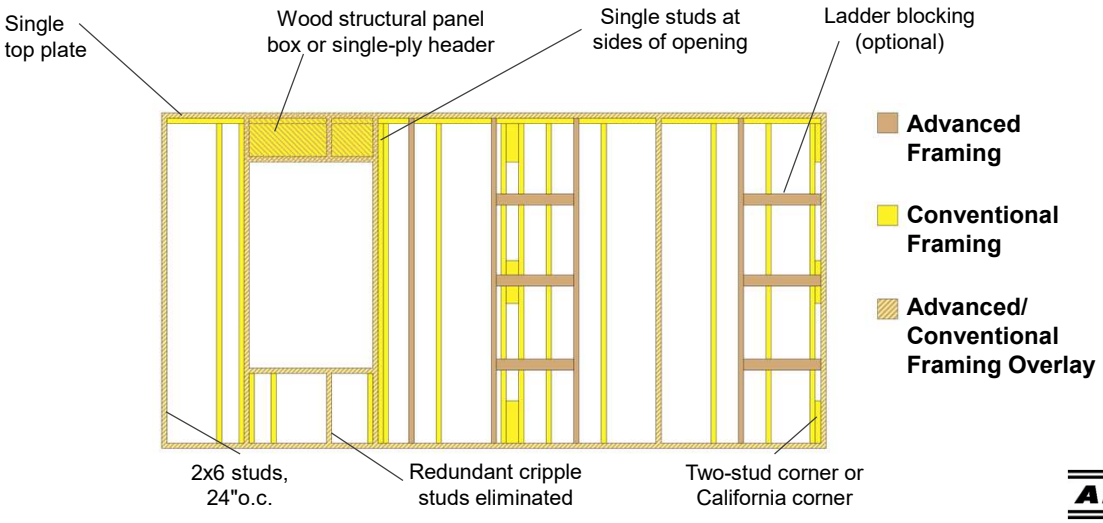
Examples – Advanced Framing



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Examples – Advanced Framing

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Advanced Framing - Example

Insulating Corners and Headers

AD1

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Advanced Framing - Example

Negated Effects

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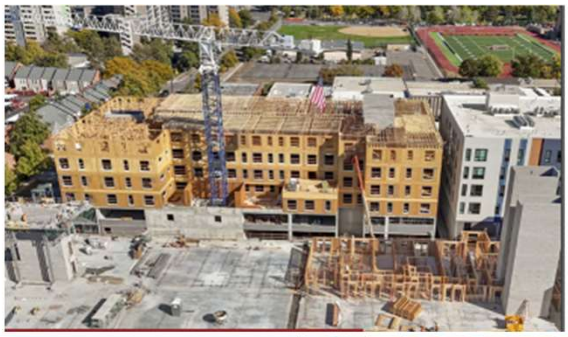
Examples – Modular/Panelized

- Flexible
- Adaptable
- Off-site solutions
- Controllable
- Scalable
- Less waste
  - On site & at plant



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Agenda

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APA Moving Forward

- Be at the forefront of Energy and Resiliency changes
- Address embodied carbon, LCA, and energy trends within the IECC framework.

Mass timber buildings are roughly 25% faster to construct than concrete buildings.

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APA Lab

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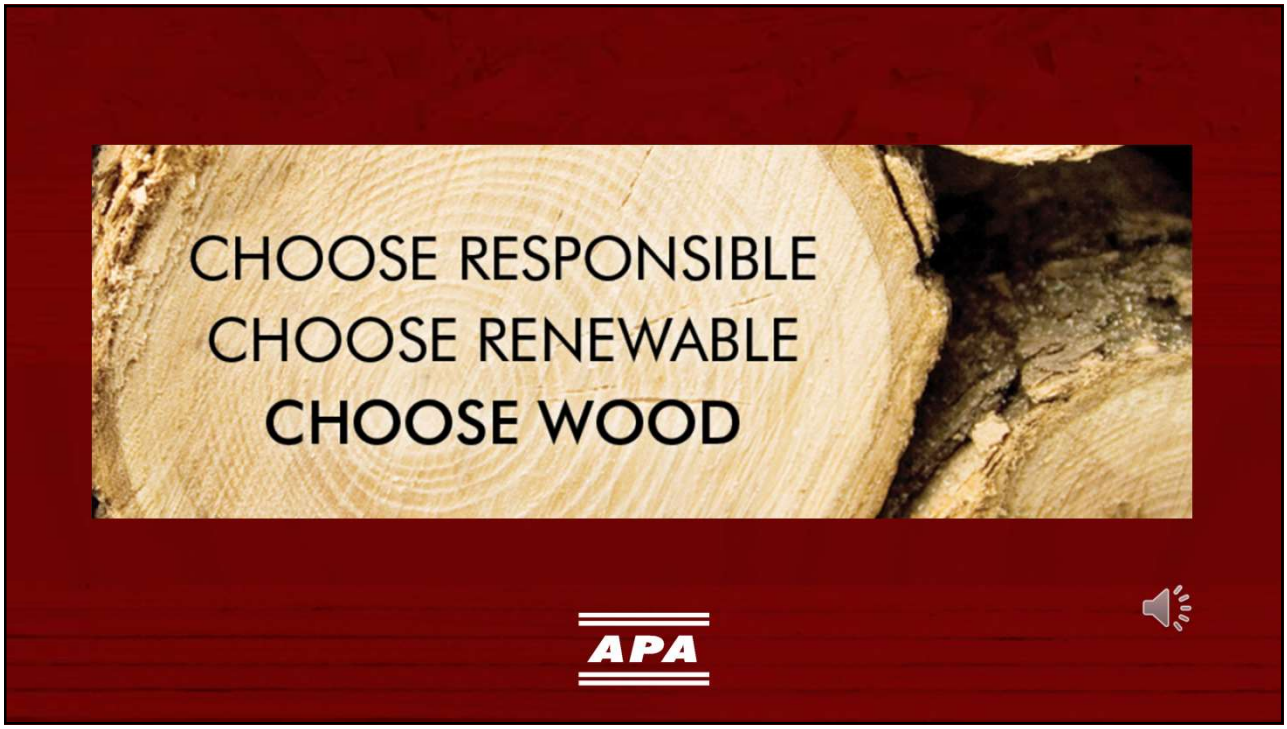
CHOOSE RESPONSIBLE
CHOOSE RENEWABLE
CHOOSE WOOD
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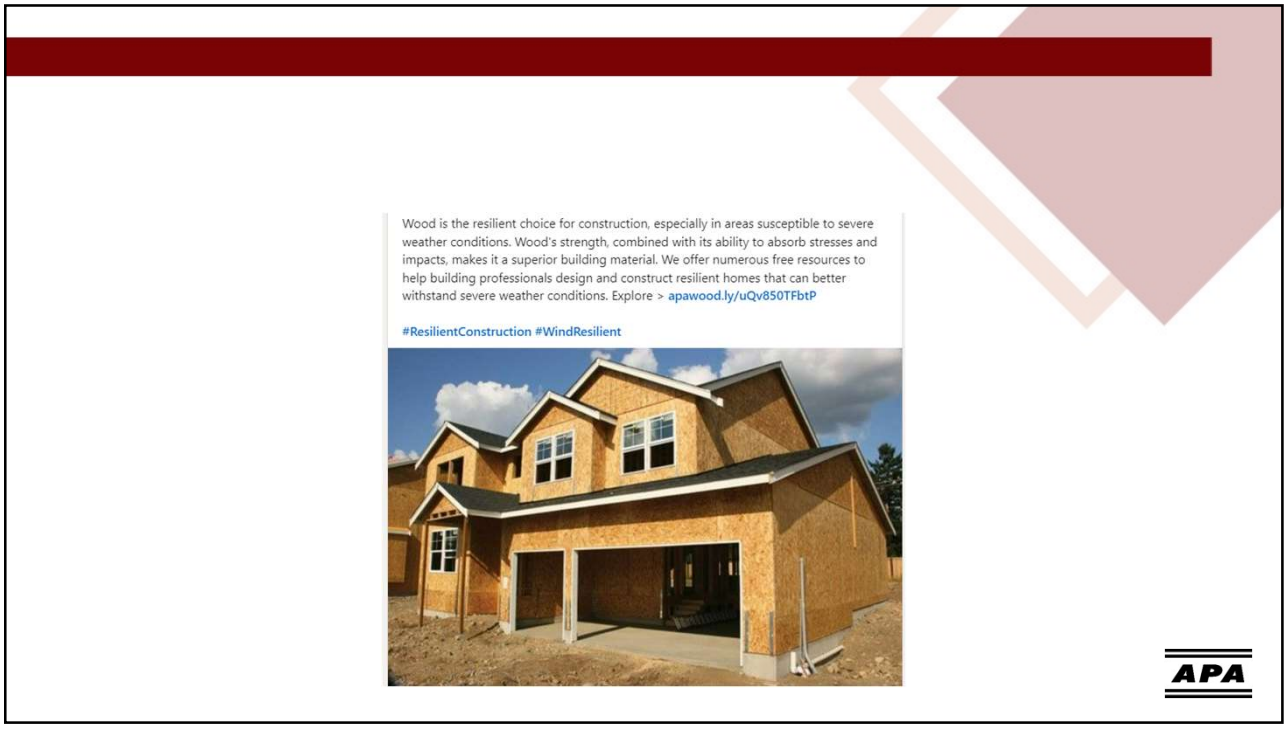
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#ResilientConstruction #WindResilient
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Questions?

Matthew Brown, CGP

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214-930-7075

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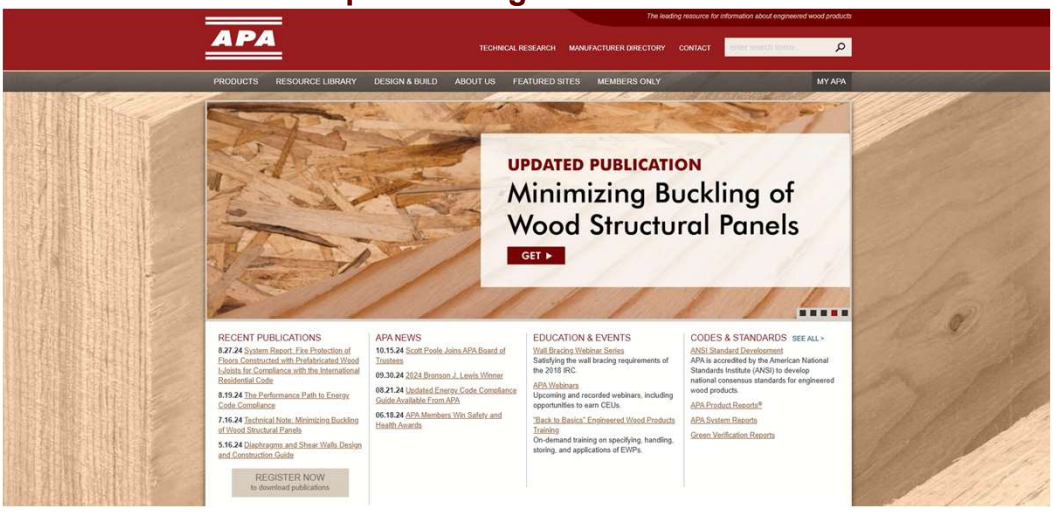
APA Field Staff

apawood.org/field-services



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(www.apawood.org)

APA UPDATE
PUBLICATIONS, VIDEOS, CAD DETAILS AND MORE

UPCOMING WEBINAR
Designing Engineered Wood Diaphragm Systems

Wednesday, May 22 | 10-11 a.m. PDT
Diaphragms play a vital role in a building's lateral load path. Whether that lateral load is from seismic activity or wind forces, the diaphragm is responsible for distributing that lateral load to the shear walls. This session provides guidance on the proper design of engineered wood diaphragm

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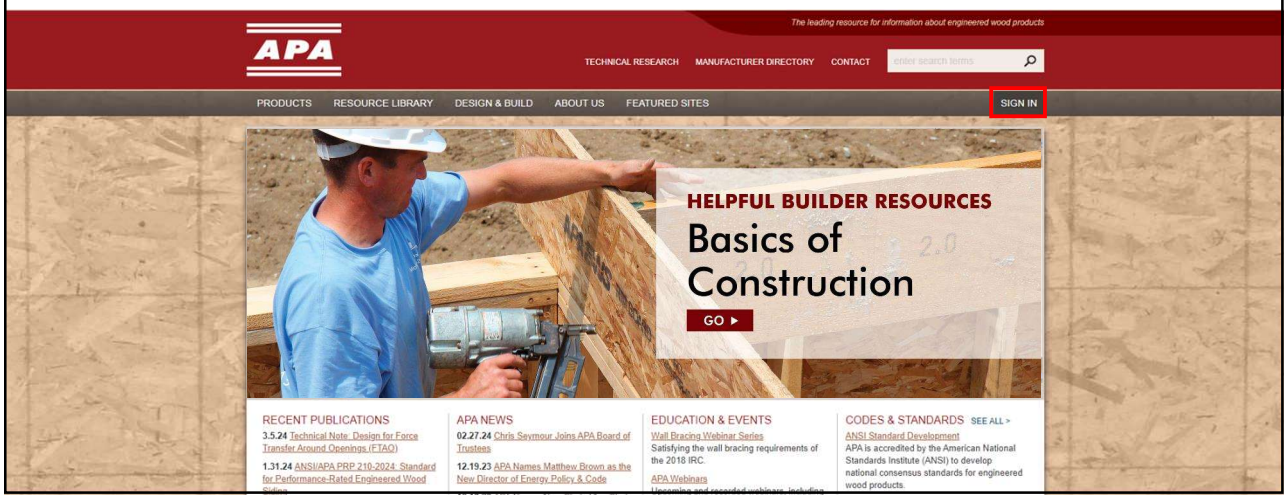

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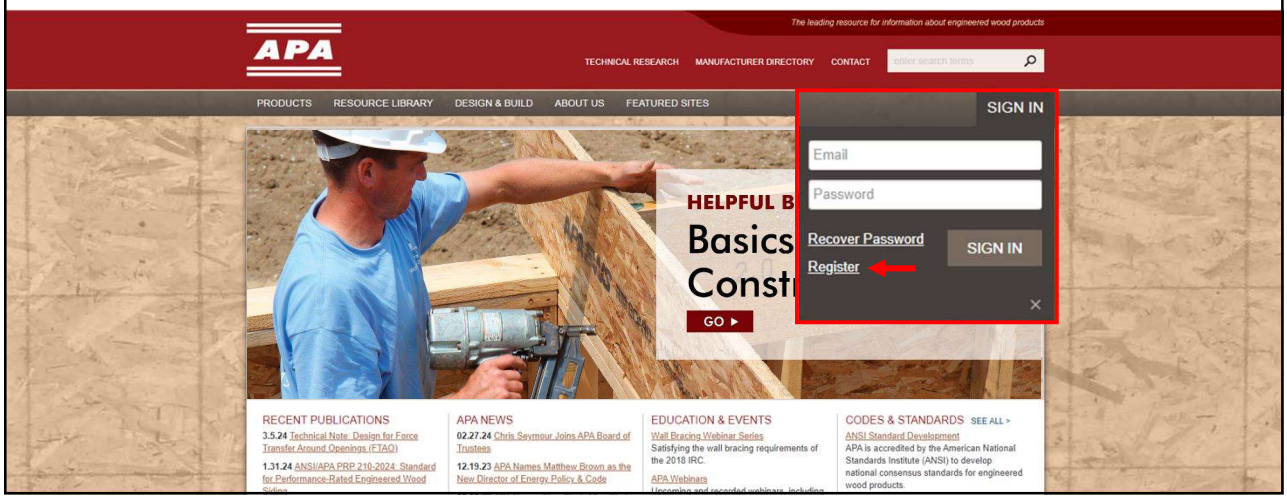
(www.apawood.org)



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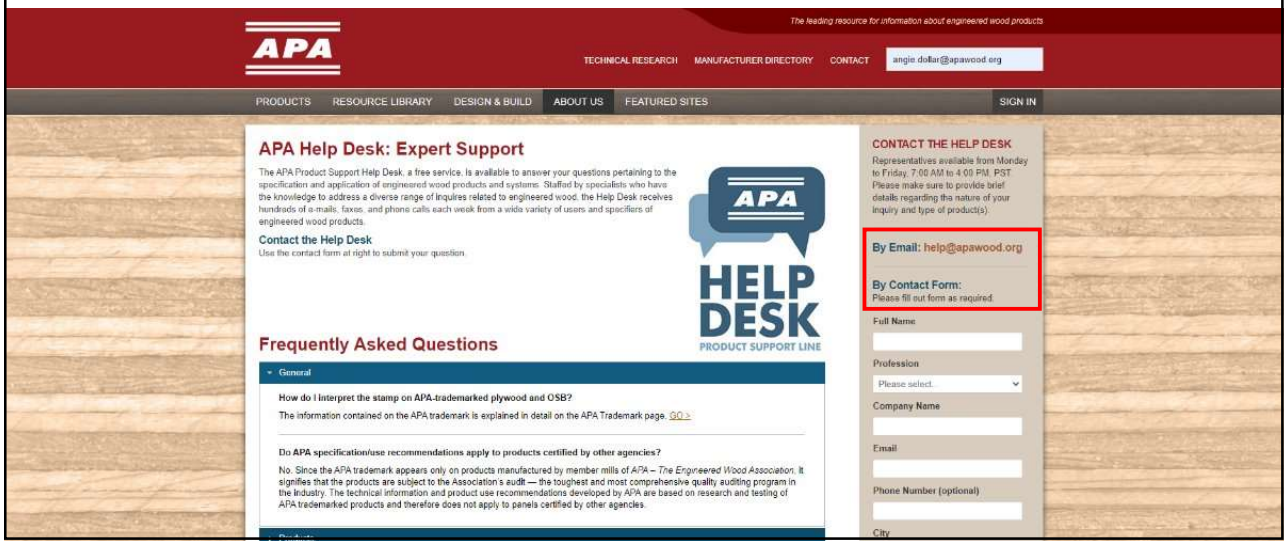
Help Desk



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Thank you!

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386-846-7188

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

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Thank you for attending.

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