


APA

From Outsider to Insider:

An Engineer's Perspective of APA Services



By Aleeta Dene, P.E.

APA – The Engineered Wood Association



Agenda

- **APA Testing & Product Standards**
- **Design Options**
 - Free Calculator
 - Portal Frames
 - Advanced Framing
- **Constructability**
 - Moisture Issues
 - Field Notching
- **How to Educate Yourself**



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Product Standards

with ANSI:

- SIP
- Wood Siding
- Glulam
- CLT
- Rim Board®

with NIST:

- Sheathing



Quality Services

▪ **For certification, all mills must:**

- Develop an internal quality control program
- Be subject to ongoing audits of their quality system
- Send product samples to APA for qualification



Quality Services

Inspections

Internal & External

Scheduled & Unannounced



APA Testing

▪ **Sheathing**

- Tested on a regular basis both in the mill and at APA
- Impact Loads
- Concentrated Loads
- Fastener Test
- Linear Expansion Tests
- Moisture Cycle Tests



APA Testing

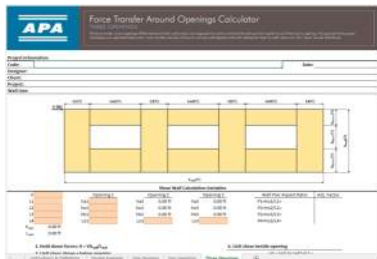


Lab expansion completed 2019
 Research & Development



FTAO Calculator: Three Openings

www.apawood.org/FTAO



FTAO Calculator: Design Output

Design output:

- Required sheathing capacity
- Required strap force above and below openings
- Required hold-down force
- Maximum deflection

Design Summary			
Req. Sheathing Capacity	388 ipf	4-Term Deflection	0.334 in.
Req. Strap Force	863 lbf	4-Term Story Drift %	0.013 %
Req. HD Force (lbf)	1328 lbf		

See Page 2



FTAO Calculator

Shear Wall Deflection Calculation Variables		Wood End-Floor Values		Nail Type: (8d common, (empty weight))	
OSB	Sheathing Material	Species	Mem 2 of Mem 2	Row 1	Row 2
7/16"	Performance Category	A-1	2x10		
APA Related Sheathing	Grade	OSB	Wall Size	Nail Spacing	s
		Dimensions	2' x 8'	2'	2'
		A	18.5	HD Capacity	2345
		B Overlap	10a7	HD Deflection	0.128
		B Overlap	10a7		

Para. 10.10.1 Shear Wall Deflection Check

$$\Delta = \frac{W_{eff}}{2.543} \left(\frac{W_{eff}}{C_{90}} + 0.75 W_{eff} \cdot a \cdot \frac{D}{W_{eff}} \right) \quad (\text{Equation 23-2})$$

	Shear 1.1	Shear 2.1	Shear 2.4	Shear 2.1	Shear 2.3
Sheathing	3718	3720	3718	3718	3718
Nail	8d	8d	8d	8d	8d
W _{eff}	481	481	554	554	549
C ₉₀	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
a	8.00	4.00	4.00	4.00	8.00
D	18.5	18.5	18.5	18.5	18.5
W _{eff}	89,308	89,308	89,308	89,308	89,308
Nail Spacing	s	s	s	s	s
W _{eff}	160	160	205	180	150
W _{eff}	0.017	0.013	0.004	0.004	0.004
W _{eff}	4.90	4.90	4.90	4.90	4.90
HD Capacity	2345	2345	2345	2345	2345
HD Defl	0.128	0.128	0.128	0.128	0.128

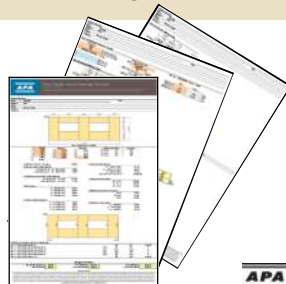
The calculator does not check the sheathing selection for the required capacity calculated above.



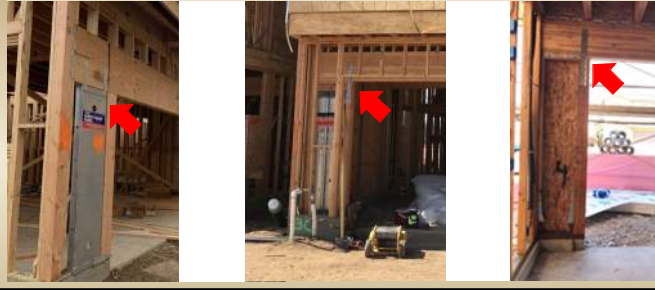
FTAO Calculator: Final Output

Final Design Output

- Summary of input parameters
- FTAO shear wall analysis
- Summary of final design requirements
- Total calculated deflection
- Three-page shear wall design to include in calculation package
 - Print directly from Excel
 - Save as PDF



Portal Frames



Portal Frames – Site Built

Method CS-PF

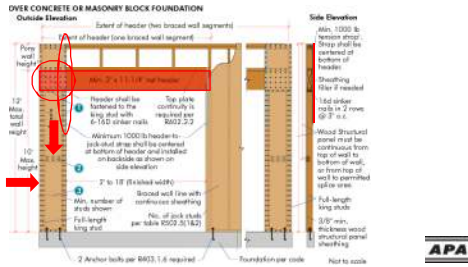


Figure R602.10.6.4



Portal Frames – Site Built

If you're not using the Residential Code...



APA Technical Topic TT-100F



Advanced Framing

- **What do you mean advanced?**
 - Maximizes material efficiency
 - Minimizes thermal bridging
 - Increases cavity insulation volume to provide maximum energy efficiency

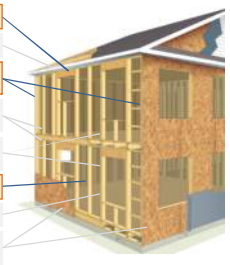


Advanced Framing Construction Guide - Form M400



Advanced Framing

- Single or double-ply headers, leaving room for insulation.
- Raised heel / Energy heel trusses spaced 24" on center
- Insulated three-stud corners or two-stud corner with ladder blocking.
- Interleaved or stacked framing when single top plates are used.
- Stacked loading whenever possible, eliminate point loads on headers.
- 2x6 wood studs spaced 24" on center.
- Efficient use of framing around openings.
- Walls continuously sheathed with plywood or oriented strand board (OSB).



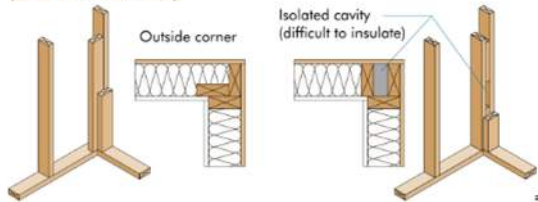
- Insulated Headers
- Larger Insulated Wall Cavities
- Insulated Corners
- Ladder Framing

ALL OR NOTHING

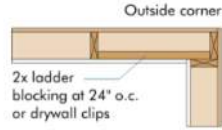


Advanced Framing

INSULATED THREE-STUD CORNER (CALIFORNIA CORNER) **CONVENTIONAL CORNER**



Advanced Framing



Moisture During Construction



Moisture Content upon arrival
v.
Moisture Content upon installation
v.
Moisture Content in service



Panel Buckling



APA-rated panels are manufactured well below 16% moisture content



Panel Buckling



Your design makes a difference!

The contractors' challenges are also your challenges.



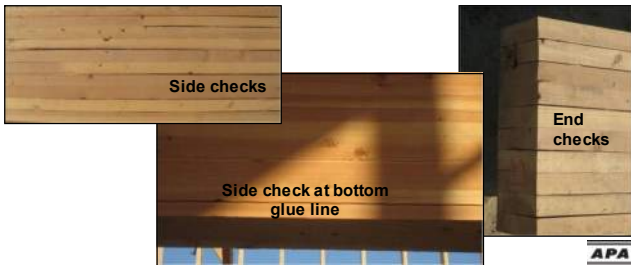
Panel Buckling



There is A LOT of information on this topic.

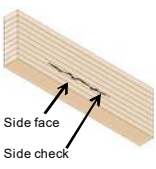


Checking




Checking

Seasoning Checks



Side face
Side check



* Owner's Guide to Understanding Checks in Glued Laminated Timber, Form F450

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Evaluation of Checks

- Guidelines established for what size checks are OK without an engineering analysis
- Published in an Owner's Guide to Understanding Checks in Glued Laminated Timber

IS MY GULNAM OK?

Is the span of the glulam greater than 18 times the depth?
Example: Depth is 12" span is greater than 18"

Where do the checks appear?

BOTTOM FACE
Is the check parallel to the grain of wood?

SEW FACE
Is the depth of the check less than one third the width of the face. And is the length less than one third the depth of the beam?

END FACE
Is the length of the check or split less than one third the depth of the span?

NO STRUCTURAL CONCERN

If the checks on your building's glulam are not structural or address, engineering analysis is not necessary. These checks can occur because wood naturally splits along its growth rings.

CONSULT DESIGN PROFESSIONAL


If checks on glulam exceed these limits and structures, a qualified design professional should be consulted for advice on the quality of the glulam. The design professional can refer to the Timber Engineering Guide to Understanding Checks in Glued Laminated Timber, Form R475.

Evaluation of Checks

APA Technical Note R475

- Discussion of checking with a flowchart and equations for determining allowable check size.

EVALUATION OF CHECKS SIZE IN GLUED LAMINATED TIMBER BEAMS



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Field Notching and Drilling

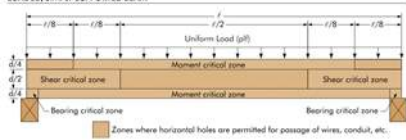


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Field Notching and Drilling of GLB

Horizontal Hole Drilling (S560)

FIGURE 3
ZONES WHERE SMALL HORIZONTAL HOLES ARE PERMITTED IN A UNIFORMLY LOADED, SIMPLY SUPPORTED BEAM



TECHNICAL NOTE
Field Notching and Drilling of Glued Laminated Timber Beams

Author: [Name]

Revised: [Date]

Introduction: [Text]

Notching: [Text]

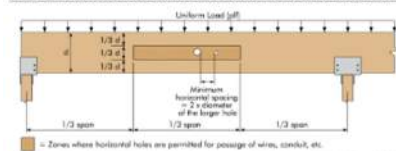
Drilling: [Text]

References: [List]

Field Notching and Drilling of LVL

Horizontal Hole Drilling (G535)

FIGURE 2
PERMISSIBLE HORIZONTAL ROUND HOLE LOCATIONS FOR LVL BEAMS UNDER UNIFORM LOADS



For beam depths of 3-1/2, 5-1/2, and 7-1/4 inches, the maximum hole diameter is 3/4, 1-1/8, and 1-1/2 inches, respectively. For deeper beams, the maximum hole diameter is 2 inches. The maximum number of holes for each span is limited to three. Holes should not be cut in conditions.

TECHNICAL NOTE
Field Notching and Drilling of Laminated Veneer Lumber

Author: [Name]

Revised: [Date]

Introduction: [Text]

Notching: [Text]

Drilling: [Text]

References: [List]

Effects of Vertical Holes



Strength reduction
= 1.5 x hole diameter/beam width

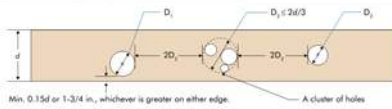
Example:
▪ 6-3/4" beam width
▪ 1" diameter vertical hole
Reduction = (1.5 x 1.0/6.75)
Reduction = 0.22
Beam has 78% of original strength



Engineered Notching and Drilling of GLB

Horizontal Hole Drilling (V700)

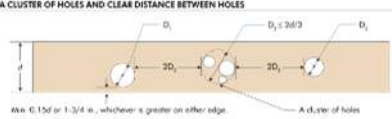
A CLUSTER OF HOLES AND CLEAR DISTANCE BETWEEN HOLES



Engineered Notching and Drilling of LVL

Horizontal Hole Drilling (V900)

FIGURE 1 A CLUSTER OF HOLES AND CLEAR DISTANCE BETWEEN HOLES



FREE RESOURCES!

- Literature
- Training Videos
- Calculators
- Technical Updates
- Help



www.apawood.org/webinars

www.apawood.org/FTAO

www.apawood.org/wall-bracing-calculator



APA Update Newsletter

Sign up @ www.apawood.org

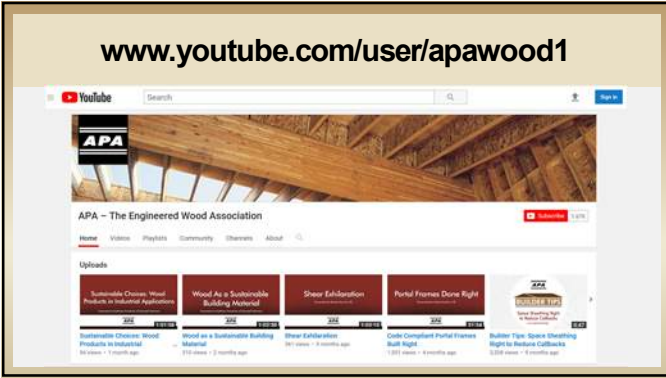


Designers Circle Newsletter

Connecting building and design professionals with timely technical information and recommendations. JOIN TODAY.



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Get Help!



From Outsider to Insider: An Engineer's Perspective of APA Services

