APA

Technical Topics

TT-100D SEPTEMBER 2010

A Portal Frame with Hold Downs for Engineered Applications

ENGINEERED DESIGN USE

While the APA portal-frame design, as shown in Figure 1, was envisioned primarily for use as bracing in conventional light-frame construction, it can also be used in engineered applications. The portal frame is not actually a narrow shear wall because it transfers shear by means of a semi-rigid, moment-resisting frame. The extended header is integral in the function of the portal frame, thus, the effective frame width is more than just the wall segment, but includes the header length that extends beyond the wall segment. For this shear transfer mechanism, the wall aspect ratio requirements of the code do not technically apply to the wall segment of the APA portal frame.

Monotonic and cyclic testing has been conducted on the APA portal-frame design (APA, 2002, 2003a and 2003b). Recommended design values for engineered use of the portal frames are provided in Table 1. Design values are derived from the cyclic test data using a rational procedure that considers both strength and stiffness. The design value derivation procedure ensures that the code (IBC) drift limit and an adequate safety factor are maintained. For seismic design, APA recommends using the design coefficients and factors for light-frame walls with shear panels – wood structural panels. See APA Report T2004-59 for more details on this justification.

Since design values are based on testing conducted with the portal frame attached to a rigid test frame using embedded strap-type hold downs, design values should be limited to portal frames constructed on similar rigid-base foundations, such as a concrete foundation, stem wall or slab, and which use a similar embedded strap-type hold down.

REFERENCES

APA, 2002, *Cyclic Evaluation of APA Sturd-I-Frame® for Engineered Design,* APA Report T2002-46, APA – The Engineered Wood Association, Tacoma, WA

APA, 2003a, *Cyclic Evaluation of APA Sturd-I-Frame® as Wall Bracing,* APA Report T2002-70, APA – The Engineered Wood Association, Tacoma, WA

APA, 2003b, *Cyclic Evaluation of APA Sturd-I-Frame® with 10-ft Height and Lumber Header,* APA Report T2003-11, APA – The Engineered Wood Association, Tacoma, WA

APA, 2004, *Confirmation of Seismic Design Coefficients for the APA Portal Frame,* APA Report T2004-59, APA – The Engineered Wood Association, Tacoma, WA

Table 1. Recommended allowable design values for APA portal frame used on a rigid-base foundation for wind or seismic loading[a,b,c,d]

Minimum Width (inches)	Maximum Height (feet)	Ultimate Load (pounds)	ASD Allowable Design Values per Frame Segment		Load Factor
			Shear[e] (pounds)	Deflection (inch)	
16	8	2,780	1,000	0.32	2.8
	10	2,180	600	0.40	3.6
24	8	4,720	1,700	0.32	2.8
	10	3,630	1,000	0.34	3.6

(a) Design values are based on use of Douglas-fir or southern pine framing. For other species of framing, use the specific gravity adjustment factor = [1 – (0.5 – SG)], where SG = specific gravity of the actual framing. This adjustment shall not be greater than 1.

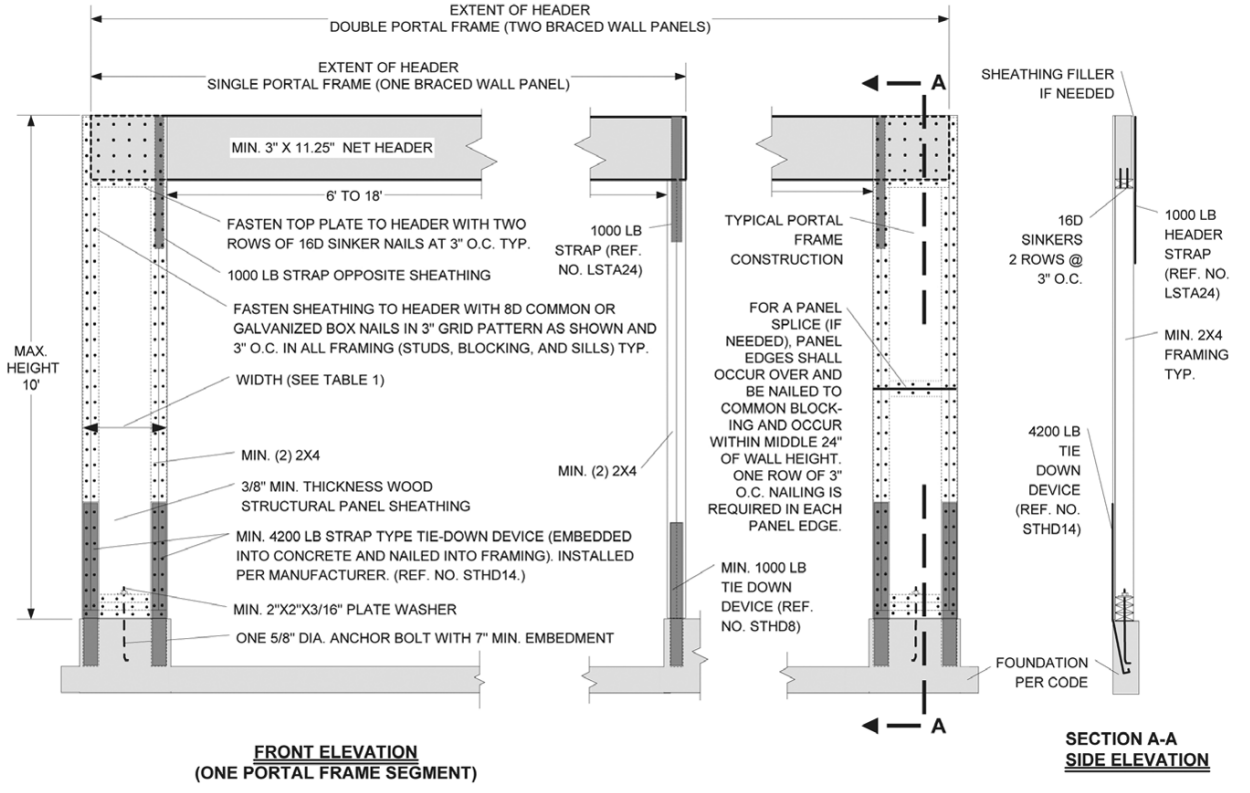
(b) For construction as shown in Figure 1.

(c) Values are for a single portal frame segment (one vertical leg and a portion of the header). For multiple portal frame segments, allowable design values can be multiplied by number of frame segments (e.g., two = 2x, three = 3x, etc.).

(d) Interpolation of design values for heights between 8 and 10 feet, and for portal widths between 16 and 24 inches, is permitted.

(e) The allowable shear value is permitted to be increased by 40 percent for wind design.

Figure 1. Construction details for APA portal-frame design with hold downs



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