A P A

The Engineered Wood Association

Background on Development of Shear Wall Tables

In the experience of APA technical staff, the development of the shear wall tables is greatly misunderstood. The purpose of this paper is to provide a brief history of the development of the code shear wall tables. The following text is excerpted out of Williamson[1]:

Tissell provides guidance in the principles of mechanics calculations, published in APA Research Report 154. Tissell's approach is based on single fastener design values adjusted by various empirically determined factors that account for such things as nail spacing, panel grade, framing size, stud spacing and the potential for panel buckling. APA originally derived [the code shear wall tables] based on this type of approach. Through the years, the load duration factor, diaphragm factor and nail design values have changed. Therefore, following Tissell's approach will not provide perfect agreement with [the code shear wall tables]. However, in most cases the agreement is reasonable. When the individual fastener design values changed, APA chose not to change the shear walls tables accordingly because, through testing, the design values have been demonstrated to be appropriate.

The original diaphragm table covers both horizontal diaphragms and shear walls. These tables were "derived" based on fastener values circa 1952 as published in the UBC (which differed from the NDS). The tables were then "verified" by full size diaphragm tests. In 1960, the shear wall table was split from the diaphragm table. The diaphragm table remained virtually unchanged, and the shear wall table was "adjusted" to fit the fastener values in the 1960 NDS.

According to the NDS commentary, the diaphragm factor was introduced in the NDS in 1960 (as 1.3), which also corresponds to the time the shear wall table was "adjusted". The diaphragm factor was introduced to provide reasonable parity with the existing diaphragm table. The product of the load duration factor and the diaphragm factor thus was 1-1/3 * 1.3 = 1.73. In 1991, the load duration factor for seismic was increased to 1.6. Since there was no interest in raising the design values, the diaphragm factor was then changed to 1.1 so that the product of the load duration factor and the diaphragm factor would be approximately equal to the pre-1991 level (1.1 * 1.6 = 1.76). Also in 1991, the nail design values changed. At this time, it was felt that the shear wall (and diaphragm table) had a long history of reasonable performance, and based on testing, the shear wall load factors averaged approximately 3.0 for all cells in the table so, the shear wall tables were not changed to match the 1991 NDS.

[1] Williamson, T.G. 2002. *APA Engineered Wood Handbook*. McGraw-Hill. New York, NY.

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The following table “back solves" for a load per fastener based on the current code tables (allowable stress design). This back solving technique is very simple: if boundary nail spacing is 6" oc, then there are 2 nails per foot. For nails, the load per fastener is very uniform at nail spacings of 6", 4" and 3". At 2", based on the potential for splitting framing, there is an additional reduction factor of approximately 10% - 15%.

Load per nail in pounds, backsolved from the allowable stress design building code shear wall tables.

Panel Grade	Minimum Nominal Panel Thickness (in.)	Minimum Penetration in Framing (in.)	Nail Size (Common or Hot-Dipped Galvanized Box)	Panels Applied Direct to Framing, Nail Spacing at Panel Edges (in.)			
				6	4	3	2
APA STRUCTURAL I grades	5/16	1 1/4	6d	100	100	98	85
	3/8	1 3/8	8d	115	120	115	102
	7/16			128	132	126	112
	15/32			140	143	138	122
	15/32	1 1/2	10d	170	170	166	145
APA Rated Sheathing; APA Rated Siding and other APA grades except species Group 5	3/8	1 1/4	6d	100	100	98	85
	3/8	1 3/8	8d	110	107	103	88
	7/16			120	117	113	98
	15/32			130	127	123	107
	15/32	1 1/2	10d	155	153	150	128
	19/32			170	170	166	145

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