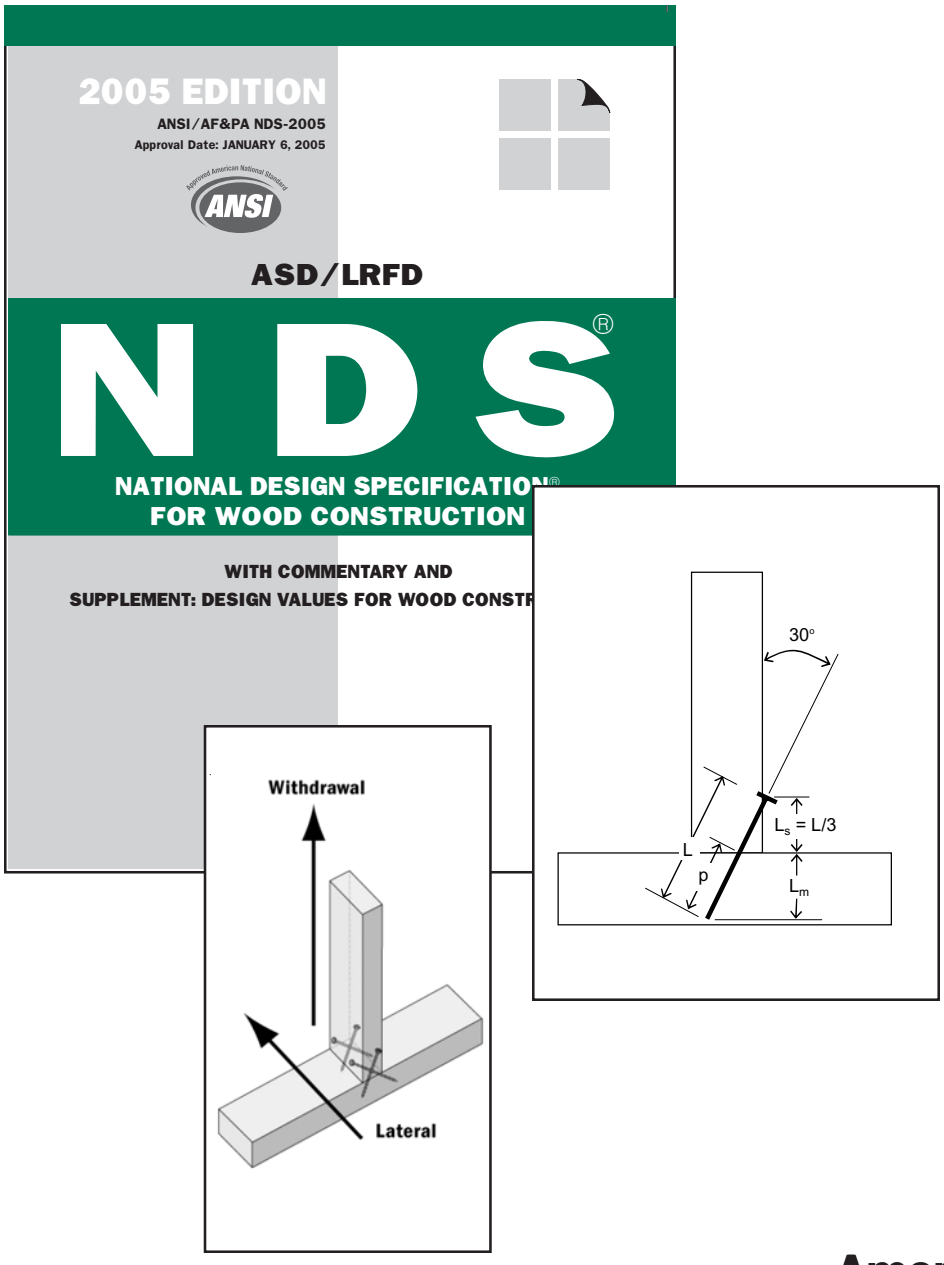
TOENAIL CONNECTIONS



American Wood Council

DESIGN AID No. 2

American Forest & Paper Association

DESIGN AID FOR TOENAIL CONNECTIONS

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Introduction

This Design Aid was developed as supplemental information for the *National Design Specification® (NDS®) for Wood Construction* to facilitate the design of connections. These tables are based on provisions of the 2001 and later editions of the *NDS* which are integral to the use and understanding of the tables.

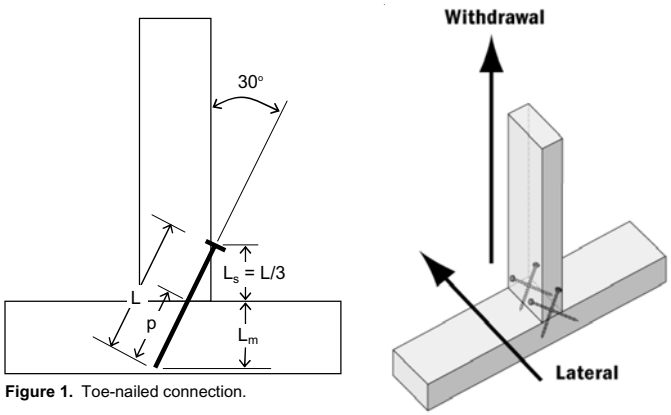

Figure 1. Toe-nailed connection.

Reference **Lateral** Design Values (Z) for **Toe-Nailed** Connections[1,2]

for Sawn Lumber or SCL with both members of identical specific gravity

Nail Type	Nail Diameter	Nial Length			G=0.67 Red Oak	G=0.55 Mixed Maple Southern Pine	G=0.5 Douglas Fir-Larch	G=0.49 Douglas Fir-Larch (N)	G=0.46 Douglas Fir(S) Hem-Fir(N)	G=0.43 Hem-Fir	G=0.42 Spruce-Pine-Fir	G=0.37 Redwood (open grain)	G=0.36 Eastern Softwoods Spruce-Pine-Fir (S) Western Cedars Western Woods	G=0.35 Northern Species
	D	**L**	**L_s**	**L_m**										
	in.	in.	in.	in.	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
Box	0.099	2	0.67	1.07	60	50	46	45	42	38	36	30	29	28
	0.113	2.5	0.83	1.33	78	66	60	59	56	52	50	41	40	38
	0.128	3	1.00	1.60	101	84	77	75	71	67	65	55	53	51
	0.135	3.5	1.17	1.86	112	94	86	84	79	74	73	65	63	60
	0.148	4	1.33	2.13	128	107	98	95	91	85	83	74	72	70
	0.162	5	1.67	2.66	153	128	117	114	108	101	99	88	87	84
Common	0.113	2	0.67	1.07	78	65	57	55	50	46	44	37	36	35
	0.131	2.5	0.83	1.33	105	88	80	77	71	64	62	52	50	48
	0.148	3	1.00	1.60	128	107	98	95	91	82	80	66	64	61
	0.162	3.5	1.17	1.86	153	128	117	114	108	101	99	82	80	76
Sinker	0.099	2.125	0.71	1.13	60	50	46	45	43	39	38	31	30	29
	0.113	2.375	0.79	1.27	78	66	60	59	56	50	48	40	39	37
	0.120	2.875	0.96	1.53	88	74	68	66	63	59	57	49	47	45
	0.135	3.125	1.04	1.67	112	94	86	84	79	74	73	61	59	56
	0.148	3.250	1.08	1.73	128	107	98	95	91	85	83	69	67	64

1. Tabulated lateral design values (Z) shall be multiplied by all applicable adjustment factors (see NDS Table 10.3.1). Tabulated lateral design values (Z) have been multiplied by the toe-nail factor, C_{tn} = 0.83 as specified in NDS 11.5.4.2.
2. Tabulated lateral design values (Z) are for toe-nailed connections with common wire, box and sinker nails (see NDS Appendix L) installed in accordance with NDS; side and main member thickness sufficient to provide complete embedment of the nail into the wood members; and nail bending yield strengths (f_{yb}): F_{yb} = 100,000 psi for 0.099" ≤ D ≤ 0.142"; F_{yb} = 90,000 psi for 0.142" < D ≤ 0.177"

Reference **Withdrawal** Design Values (Wp) for **Toe-Nailed** Connections[1,2]

in Sawn Lumber or SCL

Nail Type	Nail Diameter	Nial Length			G=0.67 Red Oak	G=0.55 Mixed Maple Southern Pine	G=0.5 Douglas Fir-Larch	G=0.49 Douglas Fir-Larch (N)	G=0.46 Douglas Fir(S) Hem-Fir(N)	G=0.43 Hem-Fir	G=0.42 Spruce-Pine-Fir	G=0.37 Redwood (open grain)	G=0.36 Eastern Softwoods Spruce-Pine-Fir (S) Western Cedars Western Woods	G=0.35 Northern Species
	D	**L**	**L_s**	**L_m**										
	in.	in.	in.	in.	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
Box	0.099	2	0.67	1.07	41	25	20	19	16	14	13	9	9	8
	0.113	2.5	0.83	1.33	59	36	28	27	23	19	18	13	12	12
	0.128	3	1.00	1.60	80	49	39	37	31	26	25	18	17	16
	0.135	3.5	1.17	1.86	99	60	48	45	39	33	31	22	21	19
	0.148	4	1.33	2.13	124	76	60	57	48	41	38	28	26	24
	0.162	5	1.67	2.66	169	103	81	77	66	56	53	38	36	33
Common	0.113	2	0.67	1.07	47	29	23	22	18	16	15	11	10	9
	0.131	2.5	0.83	1.33	68	42	33	31	27	23	21	16	14	14
	0.148	3	1.00	1.60	93	57	45	42	36	31	29	21	20	18
	0.162	3.5	1.17	1.86	119	72	57	54	46	39	37	27	25	23
Sinker	0.099	2.125	0.71	1.13	44	27	21	20	17	15	14	10	9	9
	0.113	2.375	0.79	1.27	56	34	27	26	22	19	17	13	12	11
	0.120	2.875	0.96	1.53	72	44	35	33	28	24	22	16	15	14
	0.135	3.125	1.04	1.67	88	54	42	40	34	29	27	20	19	17
	0.148	3.250	1.08	1.73	101	61	48	46	39	33	31	23	21	20

1. Tabulated withdrawal design values (Wp) shall be multiplied by all applicable adjustment factors (see NDS Table 10.3.1). Tabulated withdrawal design values (Wp) have been multiplied by the toe-nail factor, C_{tn} = 0.67 as specified in NDS 11.5.4.1.
2. Tabulated withdrawal design values (Wp) are for toe-nailed connections with common wire, box and sinker nails (see NDS Appendix L) with side and main member thickness sufficient to provide complete embedment of the nail in the wood members

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