DESIGN OF NAIL AND SCREW CONNECTIONS© also see the accompanying discussion

NAILSCREW©

Example Problem 1. Figure 3. Single shear. Side S4S 1x8, Main S4S 3x8
Job 14 - 12 gage by 3" screws
Notes lateral snow load No. 1 Doug Fir-Larch
other conditions normal

Fill in yellow cells below
Fill in turquoise cells if needed
Red cells are calculated
Light green cells are tables

Except for the yellow and turquoise cells, this spreadsheet is protected to prevent accidental loss of the formulas.

Specific Gravities (G) of Selected Wood Species (Ref. 3)

Doug Fir-Larch	.50	Doug Fir-South	.46
Eastern Hemlock	.41	Eastern Softwoods	.36
Hem-Fir	.43	Mountain Hemlock	.47
Red Oak	.67	Redwood close grain	.44
Red Maple	.58	Redwood open grain	.37
Sitka Spruce	.43	Southern Pine	.55
Spruce-Pine-Fir	.42	Western Cedar	.36
Western Hemlock	.47	White Oak	.73
Western Hemlock	.47	White Oak	.73

load: lateral (L), withdrawal (W), combined (C)		L	
load in side grain (s) or end grain (e)		s	
specific gravity (g) or dowel bearing (b)		g	
side member wood (w) or steel (s)		w	
screw (s) or nail (n)		s	
nail or screw diameter (inches) = D and D_{root}		0.216	0.171
nail or screw length (inches) =	L =	3.00	
if W or C in E22, effective penetration	t =		
if C in E22, total penetration in main			
dowel bending yield (psi)	F_{yb} =	80000	
side member thickness (inches)	L_s =	0.750	
main member thickness (inches)	L_m =	2.50	
side member specific gravity	G_s =	0.5	
main member specific gravity	G_m =	0.5	
load to wood surface º	á =	0	
of axis and wood surface º	â =	90	
for nails: not toenailed (n), toe-nailed (t)			
effective threaded length		2.00	
effective total penetration in main		2.25	
	R_e =	1	
	k_2 =	1.0491	
	k_3 =	1.406	
	K_d =	2.21	
Yield Mode I_s	Z =	270	pounds
Yield Mode $I\ I\ I_m$	Z =	N.A.	pounds
Yield Mode $I\ I\ I_s$	Z =	126	pounds
Yield Mode IV	Z =	147	pounds
BASIC LATERAL DESIGN VALUE		126	pounds

Nail and Spike Lengths and Diameters (D)

penny (d)	6	7	8	10	12	16	20	30	40	50	60
Length	2"	2 1/4"	2 1/2"	3"	3 1/4"	3 1/2"	4"	4 1/2"	5"	5 1/2"	6"
Commons	.113	.113	.131	.148	.148	.162	0.192	.207	.225	.244	.263
Box	.099	.099	.113	.128	.128	.135	0.148	.148	.162	none	
Sinker	.092	.099	.113	.12	.135	.148	0.177	.192	.207	none	.244
Spikes	none			0.192	.192	.207	0.225	.244	.263	.283	.283

Screw Numbers and Diameters

Number	6	7	8	9	10	12	14	16	18	20	24
Diameter	.138	.151	.164	.177	.19	.216	.242	.268	.294	.32	0.372
Root Diam	.113	.122	.131	.142	.152	.171	.196	.209	.232	.255	0.298

Fill in turquoise column with dowel bearing strengths if they are to be used instead of specific gravities

side member dowel bearing =	F_{es}	4650	psi
main member dowel bearing =	F_{em}	4650	psi

used F_{es} =	4650
used F_{em} =	4650
Penetration C_d =	1.00
Lateral C_{tn} =	N.A.
Withdrawal C_{tn} =	N.A.

Metal Gages and Thicknesses

Gage	20	18	16	14	12	11	10	7	3
Thickness	.036	.048	.060	.075	.105	.120	.134	.179	0.239

Number of Nails or Screws in Joint		14
Load Duration Factor,	C_D =	1.15
Lateral Moisture Factor,	C_M =	1.00
Temperature Factor,	C_t =	1.00
Diaphragm Factor,	C_{di} =	1.00
Withdrawal Moisture Factor,	C_M =	1.00

Load Duration Factors, C_D (Ref.3)

permanent	0.9
occupancy live	1
snow	1.15
construction	1.25
wind, quake	1.6

Moisture Conditions Factors, C_M

Fab'n	Use	Load	Screws	Nails
dry	dry	any	1.0	1.0
wet	dry	lateral	.4	.7
wet	dry	withdraw	1.0	.25
dry	wet	lateral	.7	.7
dry	wet	withdraw	1.0	.25
wet	wet	lateral	.7	.7
wet	wet	withdraw	.7	1.0

Lateral Design Value For One	145	pounds
Lateral Design Value For All	2036	pounds

Withdrawal Design Value For One	N.A.	pounds
Withdrawal Design Value For All	N.A.	pounds

ScrewsTensile Capacity	6427	pounds
Nail tensile stress =	N.A.	psi

FINAL DESIGN VALUE = 2036 pounds