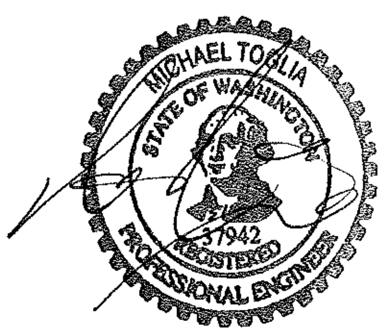
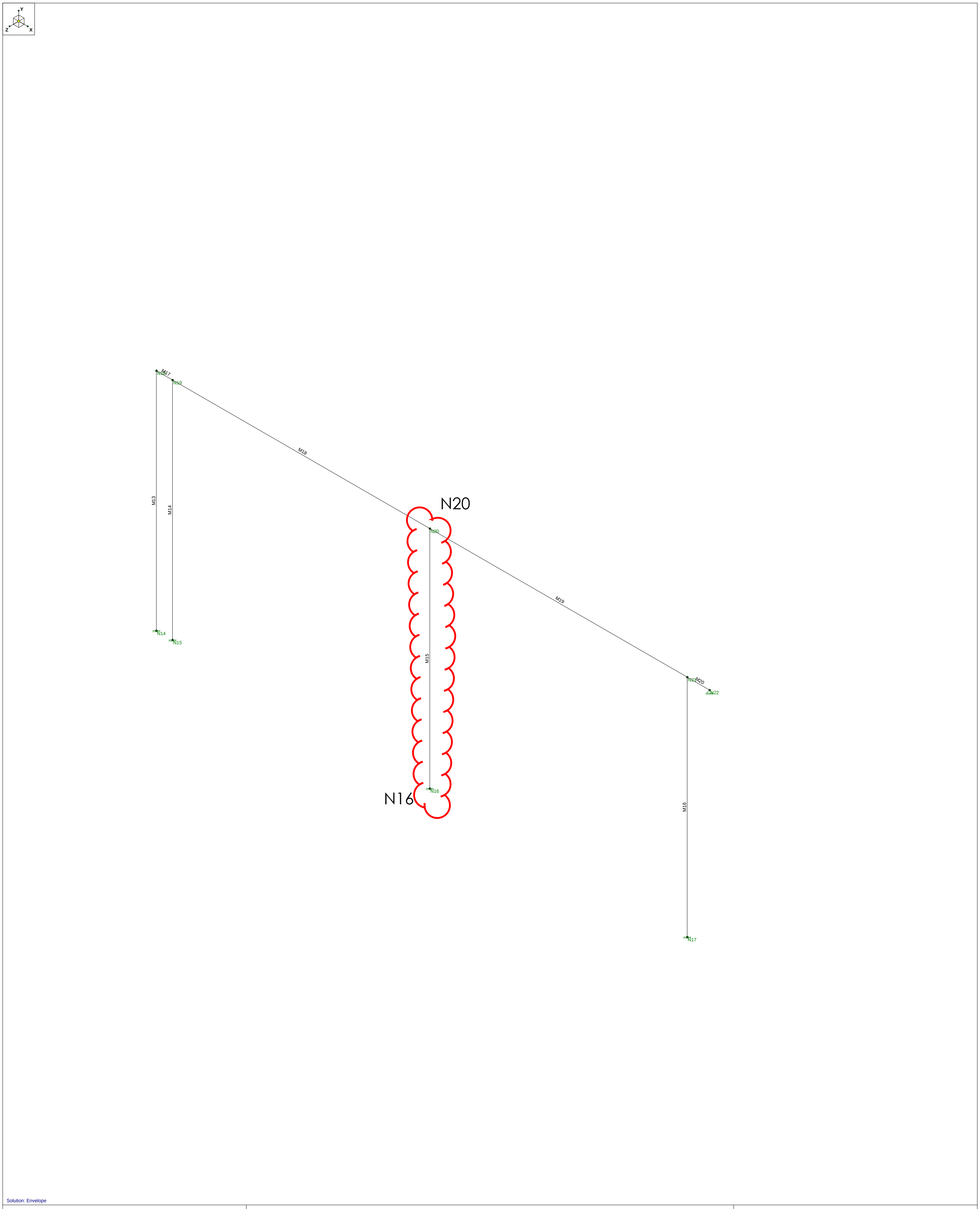
Structural Calculations
for

The Clearview® Railing System

AGS STAINLESS, Inc.
7873 NE Day Road
Bainbridge Island, WA 98110

Designed by





Feb 8, 2011 at 9:40 AM

2009 IBC 42F.r3d

Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation	Yes
Include Warping	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Vertical Axis	Y

Hot Rolled Steel Code	AISC : ASD 13th
Cold Formed Steel Code	AISI 99: ASD
Wood Code	NDS 91/97: ASD
Wood Temperature	< 100F
Concrete Code	ACI 2002
Masonry Code	MSJC 05/IBC 06 ASD

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	PCA Load Contour
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections	Yes
Bad Framing Warnings	No
Unused Force Warnings	Yes

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E5 F)	Density[k/ft^3]	Yield[ksi]
1	A304 SS	28000	11154	.3	.65	.49	45

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rul...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Post	SS TUBE 1.5x1.5x.075	Column	Wide Flange	A304 SS	Typical	.427	.145	.145	.217
2	Top Rail	SS TUBE .5x2x.062	Beam	Wide Flange	A304 SS	Typical	.295	.013	.126	.038
3	End Post	SS TUBE 1.5x1.5x.105	Beam	Wide Flange	A304 SS	Typical	.584	.191	.191	.284

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N14	0	-5	0	0	
2	N15	.25	-5	0	0	
3	N16	4.25	-5	0	0	
4	N17	8.25	-5	0	0	
5	N18	0	-1.5	0	0	
6	N19	.25	-1.5	0	0	
7	N20	4.25	-1.5	0	0	
8	N21	8.25	-1.5	0	0	
9	N22	8.6	-1.5	0	0	

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M13	N14	N18			Post	Column	Wide Flange	A304 SS	Typical
2	M14	N15	N19			Post	Column	Wide Flange	A304 SS	Typical
3	M15	N16	N20			Post	Column	Wide Flange	A304 SS	Typical
4	M16	N17	N21			Post	Column	Wide Flange	A304 SS	Typical
5	M17	N18	N19		90	Top Rail	Beam	Wide Flange	A304 SS	Typical
6	M18	N19	N20		90	Top Rail	Beam	Wide Flange	A304 SS	Typical
7	M19	N20	N21		90	Top Rail	Beam	Wide Flange	A304 SS	Typical
8	M20	N21	N22		90	Top Rail	Beam	Wide Flange	A304 SS	Typical

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	N14	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	
2	N15	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	
3	N16	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	
4	N17	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	
5	N22	Reaction	Reaction	Reaction				

Joint Loads and Enforced Displacements (BLC 1 : End Post Conc. Load)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/f...
1	N18	L	Z	-.2
2	N21	L	Z	-.2

Joint Loads and Enforced Displacements (BLC 2 : Intermed. Post Conc. Load)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/f...
1	N20	L	Z	-.2

Member Point Loads (BLC 3 : Top Rail Conc. Load-hor.)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M18	Z	-.2	%50

Member Point Loads (BLC 4 : Top Rail Conc. Load-vert.)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M18	Y	-.2	%50

Member Distributed Loads

Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,d...	Start Location[ft,%]	End Location[ft,%]
No Data to Print ...					

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area (Me...	Surface (...
1	End Post Conc. Load	None				2				
2	Intermed. Post Conc. Load	None				1				
3	Top Rail Conc. Load-hor.	None					1			
4	Top Rail Conc. Load-vert.	None					1			

Load Combinations

	Description	Sol...	PDelta	SR...	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	ASD	Yes	Y		1	1														
2	ASD	Yes	Y		2	1														
3	ASD	Yes	Y		3	1														
4	ASD	Yes	Y		4	1														
5	LRFD		Y		1	1.6														
6	LRFD		Y		2	1.6														
7	LRFD		Y		3	1.6														
8	LRFD		Y		4	1.6														

Envelope AISC 13th ASD Steel Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear ...	Loc[ft]	Dir	LC	Pnc/om [k]	Pnt/om [k]	Mnyy/o...	Mnzz/o...	Cb	Eqn
1	M13	SS TUBE 1....	.618	0	1	.111	0	z	1	8.075	11.506	.514	.514	1	H1-1b
2	M14	SS TUBE 1....	.594	0	1	.112	0	z	2	8.075	11.506	.514	.514	1	H1-1b
3	M15	SS TUBE 1....	.574	0	2	.110	0	z	3	8.075	11.506	.514	.514	1	H1-1b
4	M16	SS TUBE 1....	.045	0	2	.164	0	z	2	8.075	11.506	.514	.514	1	H1-1b
5	M17	SS TUBE .5...	.272	.25	4	.206	0	z	4	7.825	7.939	.128	.38	1	H1-1b

Envelope AISC 13th ASD Steel Code Checks (Continued)

	Member	Shape	Code Check	Loc[ft]	LC	Shear ...	Loc[ft]	Dir	LC	Pnc/om [k]	Pnt/om [k]	Mnyy/o...	Mnzz/o...	Cb	Eqn
6	M18	SS TUBE .5...	.821	2	4	.160	0	z	4	.789	7.939	.128	.38	1	H1-1b
7	M19	SS TUBE .5...	.453	0	2	.123	0	z	2	.789	7.939	.128	.38	1....	H1-1b
8	M20	SS TUBE .5...	.168	0	1	.050	0	y	1	7.718	7.939	.128	.38	1....	H1-1b

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N14	max	.001	4	0	1	.093	1	.318	1	.028	1	0	1
2		min	0	1	-.129	4	0	4	0	4	-.034	2	-.001	4
3	N15	max	.027	4	.23	4	.088	1	.305	1	.029	1	0	1
4		min	0	1	0	1	0	4	0	4	-.035	2	-.031	4
5	N16	max	0	1	.102	4	.09	2	.295	2	.031	3	.044	4
6		min	-.038	4	0	1	0	4	0	4	0	4	0	1
7	N17	max	0	4	0	1	.004	2	.023	2	.057	2	0	1
8		min	0	1	-.006	4	0	4	0	4	0	4	-.001	4
9	N22	max	.009	4	.003	4	.182	1	0	1	0	1	0	1
10		min	0	1	0	1	0	4	0	1	0	1	0	1
11	Totals:	max	0	4	.2	4	.4	1						
12		min	0	1	0	1	0	4						

Envelope Member Section Forces

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Mome...	LC	z-z Mome...	LC
1	M13	1	max	0	1	0	1	.093	1	.028	1	0	4	0	1
2			min	-.129	4	-.001	4	0	4	-.034	2	-.318	1	-.001	4
3		2	max	0	1	0	1	.093	1	.028	1	0	4	0	1
4			min	-.129	4	-.001	4	0	4	-.034	2	-.237	1	0	4
5		3	max	0	1	0	1	.093	1	.028	1	0	4	0	4
6			min	-.129	4	-.001	4	0	4	-.034	2	-.156	1	0	1
7		4	max	0	1	0	1	.093	1	.028	1	0	4	.002	4
8			min	-.129	4	-.001	4	0	4	-.034	2	-.075	1	0	1
9		5	max	0	1	0	1	.093	1	.028	1	.006	1	.002	4
10			min	-.129	4	-.001	4	0	4	-.034	2	-.007	2	0	1
11	M14	1	max	.23	4	0	1	.088	1	.029	1	0	4	0	1
12			min	0	1	-.027	4	0	4	-.035	2	-.305	1	-.031	4
13		2	max	.23	4	0	1	.088	1	.029	1	0	4	0	1
14			min	0	1	-.027	4	0	4	-.035	2	-.229	1	-.008	4
15		3	max	.23	4	0	1	.088	1	.029	1	0	4	.016	4
16			min	0	1	-.027	4	0	4	-.035	2	-.152	1	0	1
17		4	max	.23	4	0	1	.088	1	.029	1	0	4	.04	4
18			min	0	1	-.027	4	0	4	-.035	2	-.075	1	0	1
19		5	max	.23	4	0	1	.088	1	.029	1	.004	3	.064	4
20			min	0	1	-.027	4	0	4	-.035	2	0	2	0	1
21	M15	1	max	.102	4	.038	4	.09	2	.031	3	0	4	.044	4
22			min	0	1	0	1	0	4	0	4	-.295	2	0	1
23		2	max	.102	4	.038	4	.09	2	.031	3	0	4	.011	4
24			min	0	1	0	1	0	4	0	4	-.217	2	0	1
25		3	max	.102	4	.038	4	.09	2	.031	3	0	4	0	1
26			min	0	1	0	1	0	4	0	4	-.138	2	-.022	4
27		4	max	.102	4	.038	4	.09	2	.031	3	0	4	0	1
28			min	0	1	0	1	0	4	0	4	-.06	2	-.056	4
29		5	max	.102	4	.038	4	.09	2	.031	3	.018	2	0	1
30			min	0	1	0	1	0	4	0	4	-.003	1	-.089	4
31	M16	1	max	0	1	0	1	.004	2	.057	2	0	4	0	1
32			min	-.006	4	0	4	0	4	0	4	-.023	2	-.001	4
33		2	max	0	1	0	1	.004	2	.057	2	0	4	0	1
34			min	-.006	4	0	4	0	4	0	4	-.02	2	0	4
35		3	max	0	1	0	1	.004	2	.057	2	0	4	0	4
36			min	-.006	4	0	4	0	4	0	4	-.017	2	0	1
37		4	max	0	1	0	1	.004	2	.057	2	0	4	.001	4
38			min	-.006	4	0	4	0	4	0	4	-.014	2	0	1
39		5	max	0	1	0	1	.004	2	.057	2	0	4	.002	4

Envelope Member Section Forces (Continued)

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Mome...	LC	z-z Mome...	LC
40			min	-.006	4	0	4	0	4	0	4	-.011	2	0	1
41	M17	1	max	.001	4	.053	3	.129	4	.007	2	.002	4	.034	2
42			min	0	1	-.107	1	0	1	-.006	1	0	1	-.028	1
43		2	max	.001	4	.053	3	.129	4	.007	2	.011	4	.032	2
44			min	0	1	-.107	1	0	1	-.006	1	0	1	-.022	1
45		3	max	.001	4	.053	3	.129	4	.007	2	.019	4	.031	2
46			min	0	1	-.107	1	0	1	-.006	1	0	1	-.015	1
47		4	max	.001	4	.053	3	.129	4	.007	2	.027	4	.029	2
48			min	0	1	-.107	1	0	1	-.006	1	0	1	-.008	1
49		5	max	.001	4	.053	3	.129	4	.007	2	.035	4	.028	2
50			min	0	1	-.107	1	0	1	-.006	1	0	1	-.001	1
51	M18	1	max	.028	4	.114	3	0	1	.007	2	.098	4	.063	2
52			min	0	1	-.02	1	-.101	4	-.008	1	0	1	-.03	1
53		2	max	.028	4	.114	3	0	1	.007	2	0	1	.006	2
54			min	0	1	-.02	1	-.101	4	-.008	1	-.002	4	-.066	3
55		3	max	.028	4	.058	2	.099	4	.007	2	0	1	.009	1
56			min	0	1	-.086	3	0	1	-.008	1	-.103	4	-.179	3
57		4	max	.028	4	.058	2	.099	4	.007	2	0	1	.029	1
58			min	0	1	-.086	3	0	1	-.008	1	-.004	4	-.109	2
59		5	max	.028	4	.058	2	.099	4	.007	2	.096	4	.048	1
60			min	0	1	-.086	3	0	1	-.008	1	0	1	-.167	2
61	M19	1	max	0	1	.016	1	0	1	0	4	.007	4	.026	1
62			min	-.01	4	-.053	2	-.002	4	-.011	2	0	1	-.172	2
63		2	max	0	1	.016	1	0	1	0	4	.004	4	.01	1
64			min	-.01	4	-.053	2	-.002	4	-.011	2	0	1	-.119	2
65		3	max	0	1	.016	1	0	1	0	4	.002	4	0	4
66			min	-.01	4	-.053	2	-.002	4	-.011	2	0	1	-.066	2
67		4	max	0	1	.016	1	0	1	0	4	0	1	.012	3
68			min	-.01	4	-.053	2	-.002	4	-.011	2	0	4	-.021	1
69		5	max	0	1	.016	1	0	1	0	4	0	1	.04	2
70			min	-.01	4	-.053	2	-.002	4	-.011	2	-.003	4	-.037	1
71	M20	1	max	0	1	0	4	.003	4	0	1	0	1	0	4
72			min	-.009	4	-.182	1	0	1	0	1	-.001	4	-.064	1
73		2	max	0	1	0	4	.003	4	0	1	0	1	0	4
74			min	-.009	4	-.182	1	0	1	0	1	0	4	-.048	1
75		3	max	0	1	0	4	.003	4	0	1	0	1	0	4
76			min	-.009	4	-.182	1	0	1	0	1	0	4	-.032	1
77		4	max	0	1	0	4	.003	4	0	1	0	1	0	4
78			min	-.009	4	-.182	1	0	1	0	1	0	4	-.016	1
79		5	max	0	1	0	4	.003	4	0	1	0	1	0	1
80			min	-.009	4	-.182	1	0	1	0	1	0	1	0	1

Envelope Joint Displacements

	Joint		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation ...	LC	Y Rotation ...	LC	Z Rotation ...	LC
1	N14	max	0	1	0	4	0	4	0	4	0	2	0	4
2		min	0	4	0	1	0	1	0	1	0	1	0	1
3	N15	max	0	1	0	1	0	4	0	4	0	2	0	4
4		min	0	4	0	4	0	1	0	1	0	1	0	1
5	N16	max	0	4	0	1	0	4	0	4	0	4	0	1
6		min	0	1	0	4	0	2	0	2	0	3	0	4
7	N17	max	0	1	0	4	0	4	0	4	0	4	0	4
8		min	0	4	0	1	0	2	0	2	0	2	0	1
9	N18	max	0	4	0	4	0	4	0	4	7.077e-3	2	0	1
10		min	0	1	0	1	-.549	1	-1.936e-2	1	-5.887e-3	1	-8.127e-5	4
11	N19	max	0	4	0	1	0	4	0	4	7.39e-3	2	0	1
12		min	0	1	0	4	-.531	1	-1.884e-2	1	-6.038e-3	1	-1.997e-3	4
13	N20	max	0	1	0	1	0	4	0	4	0	4	2.79e-3	4
14		min	0	4	0	4	-.499	2	-1.718e-2	2	-6.388e-3	3	0	1
15	N21	max	0	1	0	4	0	4	0	4	0	4	0	1
16		min	0	4	0	1	-.05	2	-2.129e-3	2	-1.184e-2	2	-6.535e-5	4
17	N22	max	0	1	0	1	0	4	0	4	0	4	1.33e-5	4

Envelope Joint Displacements (Continued)

Joint			X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation ...	LC	Y Rotation ...	LC	Z Rotation ...	LC
18		min	0	4	0	4	0	1	-2.129e-3	2	-1.196e-2	2	0	1

Envelope Member Section Deflections

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y Ratio	LC	(n) L/z Ratio	LC
1	M13	1	max	0	1	0	1	0	1	0	1	NC	1	NC	1
2			min	0	1	0	1	0	1	0	1	NC	1	NC	1
3		2	max	0	4	0	4	0	4	1.769e-3	2	NC	4	NC	4
4			min	0	1	0	1	-.048	1	-1.472e-3	1	NC	1	878.154	1
5		3	max	0	4	0	4	0	4	3.539e-3	2	NC	4	NC	4
6			min	0	1	0	1	-.173	1	-2.944e-3	1	NC	1	242.987	1
7		4	max	0	4	0	4	0	4	5.308e-3	2	NC	4	NC	4
8			min	0	1	0	1	-.349	1	-4.416e-3	1	NC	1	120.454	1
9		5	max	0	4	0	1	0	4	7.077e-3	2	NC	1	NC	4
10			min	0	1	0	4	-.549	1	-5.887e-3	1	NC	4	76.511	1
11	M14	1	max	0	1	0	1	0	1	0	1	NC	1	NC	1
12			min	0	1	0	1	0	1	0	1	NC	1	NC	1
13		2	max	0	1	.004	4	0	4	1.848e-3	2	NC	4	NC	4
14			min	0	4	0	1	-.046	1	-1.51e-3	1	NC	1	912.92	1
15		3	max	0	1	.01	4	0	4	3.695e-3	2	4005.526	4	NC	4
16			min	0	4	0	1	-.167	1	-3.019e-3	1	NC	1	252.241	1
17		4	max	0	1	.012	4	0	4	5.543e-3	2	3577.984	4	NC	4
18			min	0	4	0	1	-.336	1	-4.529e-3	1	NC	1	124.825	1
19		5	max	0	1	0	1	0	4	7.39e-3	2	NC	1	NC	4
20			min	0	4	0	4	-.531	1	-6.038e-3	1	NC	4	79.117	1
21	M15	1	max	0	1	0	1	0	1	0	1	NC	1	NC	1
22			min	0	1	0	1	0	1	0	1	NC	1	NC	1
23		2	max	0	1	0	1	0	4	0	4	NC	1	NC	4
24			min	0	4	-.006	4	-.044	2	-1.597e-3	3	7544.863	4	949.183	2
25		3	max	0	1	0	1	0	4	0	4	NC	1	NC	4
26			min	0	4	-.015	4	-.159	2	-3.194e-3	3	2866.977	4	263.946	2
27		4	max	0	1	0	1	0	4	0	4	NC	1	NC	4
28			min	0	4	-.016	4	-.319	2	-4.791e-3	3	2559.78	4	131.625	2
29		5	max	0	1	0	4	0	4	0	4	NC	4	NC	4
30			min	0	4	0	1	-.499	2	-6.388e-3	3	NC	1	84.235	2
31	M16	1	max	0	1	0	1	0	1	0	1	NC	1	NC	1
32			min	0	1	0	1	0	1	0	1	NC	1	NC	1
33		2	max	0	4	0	4	0	4	0	4	NC	4	NC	4
34			min	0	1	0	1	-.004	2	-2.96e-3	2	NC	1	NC	2
35		3	max	0	4	0	4	0	4	0	4	NC	4	NC	4
36			min	0	1	0	1	-.014	2	-5.921e-3	2	NC	1	3021.125	2
37		4	max	0	4	0	4	0	4	0	4	NC	4	NC	4
38			min	0	1	0	1	-.03	2	-8.881e-3	2	NC	1	1412.193	2
39		5	max	0	4	0	4	0	4	0	4	NC	4	NC	4
40			min	0	1	0	1	-.05	2	-1.184e-2	2	NC	1	837.327	2
41	M17	1	max	0	4	0	4	0	1	0	4	NC	4	NC	1
42			min	0	1	-.549	1	0	4	-1.936e-2	1	NC	1	NC	4
43		2	max	0	4	0	4	0	1	0	4	NC	4	NC	1
44			min	0	1	-.544	1	0	4	-1.923e-2	1	NC	1	6507.889	4
45		3	max	0	4	0	4	0	1	0	4	NC	4	NC	1
46			min	0	1	-.54	1	0	4	-1.91e-2	1	NC	1	4175.426	4
47		4	max	0	4	0	4	0	1	0	4	NC	4	NC	1
48			min	0	1	-.535	1	0	4	-1.897e-2	1	NC	1	4864.166	4
49		5	max	0	4	0	4	0	4	0	4	NC	4	NC	4
50			min	0	1	-.531	1	0	1	-1.884e-2	1	NC	1	NC	1
51	M18	1	max	0	4	0	4	0	4	0	4	NC	4	NC	4
52			min	0	1	-.531	1	0	1	-1.884e-2	1	156.633	1	NC	1
53		2	max	0	4	0	4	.185	4	0	4	NC	4	260.758	4
54			min	0	1	-.452	1	0	1	-1.615e-2	1	210.451	1	NC	1
55		3	max	0	4	0	4	.358	4	0	4	NC	4	134.355	4
56			min	0	1	-.488	3	0	1	-1.346e-2	1	436.063	3	NC	1
57		4	max	0	1	0	4	.188	4	0	4	NC	4	255.936	4

Envelope Member Section Deflections (Continued)

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y Ratio	LC	(n) L/z Ratio	LC
58			min	0	4	-.475	2	0	1	-1.463e-2	2	921.758	2	NC	1
59		5	max	0	1	0	4	0	4	0	4	NC	4	NC	4
60			min	0	4	-.499	2	0	1	-1.718e-2	2	NC	2	NC	1
61	M19	1	max	0	1	0	4	0	4	0	4	NC	4	NC	4
62			min	0	4	-.499	2	0	1	-1.718e-2	2	NC	2	NC	1
63		2	max	0	1	0	4	0	1	0	4	NC	4	NC	1
64			min	0	4	-.448	2	-.019	4	-1.341e-2	2	781.557	2	2537.313	4
65		3	max	0	1	0	4	0	1	0	4	NC	4	NC	1
66			min	0	4	-.339	2	-.017	4	-9.653e-3	2	742.229	2	2801.372	4
67		4	max	0	1	0	4	0	1	0	4	NC	4	NC	1
68			min	0	4	-.198	2	-.007	4	-5.891e-3	2	1348.72	2	7075.431	4
69		5	max	0	1	0	4	0	1	0	4	NC	4	NC	1
70			min	0	4	-.05	2	0	4	-2.129e-3	2	NC	2	NC	4
71	M20	1	max	0	1	0	4	0	1	0	4	NC	4	NC	1
72			min	0	4	-.05	2	0	4	-2.129e-3	2	NC	2	NC	4
73		2	max	0	1	0	4	0	4	0	4	NC	4	NC	4
74			min	0	4	-.038	2	0	1	-2.129e-3	2	NC	2	NC	1
75		3	max	0	1	0	4	0	4	0	4	NC	4	NC	4
76			min	0	4	-.025	2	0	1	-2.129e-3	2	NC	2	NC	1
77		4	max	0	1	0	4	0	4	0	4	NC	4	NC	4
78			min	0	4	-.013	2	0	1	-2.129e-3	2	NC	2	NC	1
79		5	max	0	1	0	1	0	1	0	4	NC	1	NC	1
80			min	0	1	0	1	0	1	-2.129e-3	2	NC	1	NC	1

42" Top-Mounted Posts with Flat Top Rail (TM36-F)

Base Plate Analysis

t = 0.25 in

l = 3.5 in

w = 3.5 in

F_y = 40 ksi

Determine M_a

Say d = 2.5 in

M = 295 ft -lb (see joint N16 from RISA 3D output).

T = C = 295 * 12/ 3 = 1416 lb

M_a = 1416 * .5 = 708 in-lb

Determine M_n

Z_{pl} = 3.5 * $(.25)^2/4$ = 0.05 in^3

M_n = 0.055 * 40,000 = 2188 in-lb

Check Design

Ω = 1.67

M_n/Ω = 2188 / 1.67 = 1310 **>** 708 **OK**

Post to Base Plate Weld Analysis

t_w = 2 16ths fillet

F_w = 87 ksi

Determine S_w

$b_w = d_w$ = 1.5 + 2*.062 = 1.62 in

S_w = $1.6^2 + 1.6^2/3$ = 3.43 in^3

M_n = .6*87,000*(2/16)*3.43*(√2/2) = 15,800 in-lb

Check Design

M = 295 ft -lb (see joint N16 from RISA 3D output).

M_a = 295 * 12 = 3540

Ω = 2

M_n/Ω = 15,800 / 2 = 7900 **>** 3540 **OK**

42" Top-Mounted Posts with Flat Top Rail (TM36-F) , cont.

Attachment to Supporting Structure

Note: AGS Stainless, Inc. is *not* the Engineer of Record (EOR). It is the responsibility of the EOR to determine the ability of the supporting structure to resist the governing code-prescribed loads imparted on it by the railing. The following calculations are based on the assumption that this requirement is met.

	4	fasteners per base plate
Use:	5/16	in dia. lag screws
Say d =	3	in

Lag Screw Analysis (for wood supporting structure)

Assume supporting structure is DF → G = 0.5

w =	266	lb / in
LDF =	1.6	

R_T = 295 *12 / 3 = 1180 lb

2 lag screws resisting tension (R_T)

$(T\text{-}E)_{req}$ = 1180 /(2*1.6* 266) = 1.4 in

Use 5/16 " dia. x 3 " lag screws

Appendix B (Non-mandatory) Load Duration (ASD Only)

B.1 Adjustment of Reference Design Values for Load Duration

B.1.1 Normal Load Duration. The reference design values in this Specification are for normal load duration. Normal load duration contemplates fully stressing a member to its allowable design value by the application of the full design load for a cumulative duration of approximately 10 years and/or the application of 90% of the full design load continuously throughout the remainder of the life of the structure, without encroaching on the factor of safety.

B.1.2 Other Load Durations. Since tests have shown that wood has the property of carrying substantially greater maximum loads for short durations than for long durations of loading, reference design values for normal load duration shall be multiplied by load duration factors, C_D, for other durations of load (see Figure B1). Load duration factors do not apply to reference modulus of elasticity design values, E, nor to reference compression design values perpendicular to grain, $F_{c\perp}$, based on a deformation limit.

(a) When the member is fully stressed to the adjusted design value by application of the full design load permanently, or for a cumulative total of more than 10 years, reference design values for normal load duration (except E and $F_{c\perp}$ based on a deformation limit) shall be multiplied by the load duration factor, $C_D = 0.90$.

(b) Likewise, when the duration of the full design load does not exceed the following durations, reference design values for normal load duration (except E and $F_{c\perp}$ based on a deformation limit) shall be multiplied by the following load duration factors:

C_D	Load Duration
1.15	two months duration
1.25	seven days duration
1.6	ten minutes duration
2.0	impact

(c) The 2 month load duration factor, $C_D = 1.15$, is applicable to design snow loads based on ANSI/ASCE. Other load duration factors shall be permitted to be used where such adjustments are referenced to the duration of the design snow load in the specific location being considered.

(d) The 10 minutes load duration factor, $C_D = 1.6$, is applicable to design earthquake loads and design wind loads based on ANSI/ASCE.

(e) Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with water-borne preservatives (see Reference 30), or fire retardant chemicals. The impact load duration factor shall not apply to connections.

B.2 Combinations of Loads of Different Durations

When loads of different durations are applied simultaneously to members which have full lateral support to prevent buckling, the design of structural members and connections shall be based on the critical load combination determined from the following procedures:

(a) Determine the magnitude of each load that will occur on a structural member and accumulate subtotals of combinations of these loads. Design loads established by applicable building codes and standards may include load combination factors to adjust for probability of simultaneous occurrence of various loads (see Appendix B.4). Such load combination factors should be included in the load combination subtotals.

(b) Divide each subtotal by the load duration factor, C_D, for the shortest duration load in the combination of loads under consideration.

Shortest Load Duration in the Combination of Loads	Load Duration Factor, C_D
Permanent	0.9
Normal	1.0
Two Months	1.15
Seven Days	1.25
Ten Minutes	1.6
Impact	2.0

(c) The largest value thus obtained indicates the critical load combination to be used in designing the structural member or connection.

EXAMPLE: Determine the critical load combination for a structural member subjected to the following loads:

DL = dead load established by applicable building code or standard

LL = live load established by applicable building code or standard
SL = snow load established by applicable building code or standard
WL = wind load established by applicable building code or standard

The actual stress due to any combination of the above loads shall be less than or equal to the adjusted design value modified by the load duration factor, C_D, for the shortest duration load in that combination of loads:

Actual stress due to	Design value
DL	≤ 0.9
DL+LL	≤ 1.0
DL+WL	≤ 1.6
DL+LL+SL	≤ 1.15
DL+LL+WL	≤ 1.6
DL+SL+WL	≤ 1.6
DL+LL+SL+WL	≤ 1.6)

The equations above may be specified by the applicable building code and shall be checked as required. Load combination factors specified by the applicable building code or standard should be included in the above equations, as specified in B.2(a).

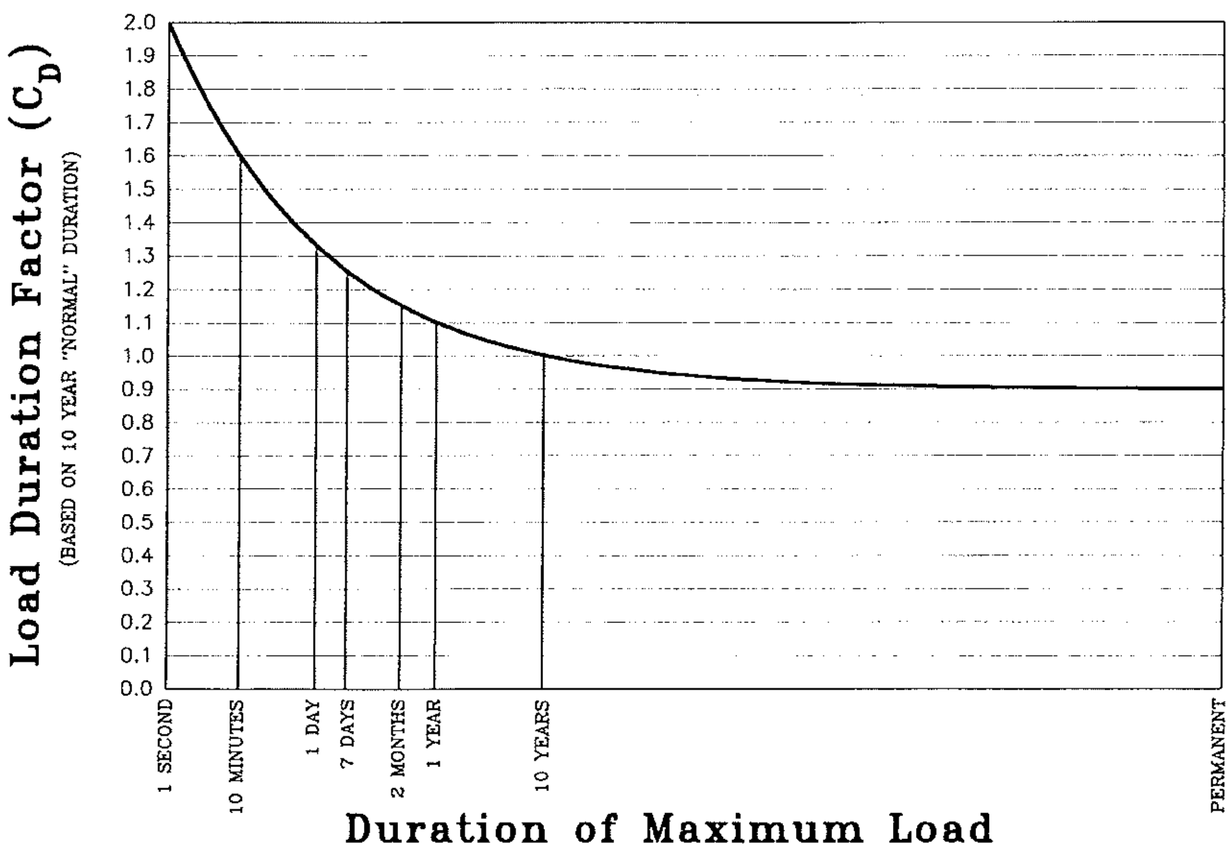
B.3 Mechanical Connections

Load duration factors, $C_D \leq 1.6$, apply to reference design values for connections, except when connection capacity is based on design of metal parts (see 10.2.3).

B.4 Load Combination Reduction Factors

Reductions in total design load for certain combinations of loads account for the reduced probability of simultaneous occurrence of the various design loads. Load duration factors, C_D, account for the relationship between wood strength and time under load. Load duration factors, C_D, are independent of load combination reduction factors, and both may be used in design calculations (see 1.4.4).

Figure B1 Load Duration Factors, C_D, for Various Load Durations



C1.4 Design Procedures

The Specification addresses both allowable stress design (ASD) and load and resistance factor design (LRFD) formats for design with wood structural members and their connections. In general, design of elements throughout a structure will utilize either the ASD or LRFD format; however, specific requirements to use a single design format for all elements within a structure are not included in this Specification. The suitability of mixing formats within a structure is the responsibility of the designer. Consideration should be given to building code limitations, where available. ASCE 7 – *Minimum Design Loads for Buildings and Other Structures* (3), referenced in building codes, limits mixing of design formats to cases where there are changes in materials.

C1.4.1 Loading Assumptions

The design provisions in the Specification assume adequacy of specified design loads.

C1.4.2 Governed by Codes

Design loads shall be based on the building code or other recognized minimum design loads such as ASCE 7 – *Minimum Design Loads for Buildings and Other Structures* (3).

C1.4.3 Loads Included

This section identifies types of loads to consider in design but is not intended to provide a comprehensive list of required loading considerations.

C1.4.4 Load Combinations

The reduced probability of the simultaneous occurrence of combinations of various loads on a structure, such as dead, live, wind, snow, and earthquake, is recognized for both ASD and LRFD in the model building codes and ASCE 7 (3). Specific load reductions for ASD or load combinations for LRFD apply when multiple transient loads act simultaneously.

For ASD, some codes provide for a reduction in design load for wind or earthquake even when both are not considered to act simultaneously. This particular load reduction is accounted for in such codes by allowing all materials a 1/3 increase in allowable stress for these loading conditions. Because individual jurisdictions and code regions may account for load combinations differently, the building code governing the structural design should be consulted to determine the proper method.

All modifications for load combinations are entirely separate from adjustments for load duration, C_D, or time effect, λ, which are directly applicable to wood design values (see C2.3.2 and C2.3.7). It should be emphasized that reduction of design loads to account for the probability of simultaneous occurrence of loads and the adjustment of wood resistances to account for the effect of the duration of the applied loads are independent of each other and both adjustments are applicable in the design calculation.

C1.5 Specifications and Plans

C1.5.1 Sizes

To assure that the building is constructed of members with the capacity and stiffness intended by the designer, the basis of the sizes of wood products given in the plans and specifications should be clearly referenced in these documents. The use of nominal dimensions in the distribution and sale of lumber and panel products has been a source of confusion to some designers, particularly those unfamiliar with wood structural design practices. The standard nominal sizes and the standard net sizes for sawn lumber are established for each product in national product standards (152). For proprietary or made-to-order products, special sizes should be specified.

WINNER® WINNER STAINLESS STEEL TUBE CO.,LTD

EN ISO 9001 01 100 085159 | EN ISO 14001 01 104 043220 | PED 97/23/EC 01 202 ROC/Q-08 0167 | AD2000 W0/W2 01 202 ROC/AD-08 0167

ADDRESS: 3RD INDUSTRIAL PARK ,XIAOBU VILLAGE, HUASAN TOWN,HUADU DISTRICT,GUANGZHOU,P.R.C.
TEL: +86~20~86847851 FAX: +86~20~86941744

MILL TEST CERTIFICATE

Customer:

Order No.:

Issued Date:2008/11/08

Certificate No.:WIN-H0628

Article:Welding Stainless Steel Mechanical Tubing						Specification: ASTM A554-03						
Item No.	Size	Length	Qty,Pcs	Net Weight	Type	Heat No.	Annealed Temperature (°F)	Hold Time (minute)	Cooling	Surface Finish	Hydrostatic Test (psi)	ET
1#	38.1×38.1mm×2.11mm	5.8m			MT304	SF07193	—	—	—	180Grit	—	—
2#	41.3mm×1.65mm	5.8m			MT304	SF07193	—	—	—	180Grit	—	—
3#	10×50mm×1.65mm	5.8m			MT304	2W899	—	—	—	180Grit	—	—

	Chemical Composition (%)								Mechanical Test		
	C	Mn	P	S	Si	Ni	Cr	Mo	T. S. (Ksi)	Y. S.(Ksi)	Elongation(%)
MIN						8.00	18.00	—	≥75	≥30	≥35
MAX	0.080	2.00	0.040	0.030	1.00	11.00	20.00	—			
1#	0.024	1.61	0.031	0.006	0.44	8.15	18.23	—	95	48	51
2#	0.024	1.61	0.031	0.006	0.44	8.15	18.23	—	95	48	51
3#	0.023	1.37	0.029	0.004	0.37	8.02	18.31	—	98	50	55

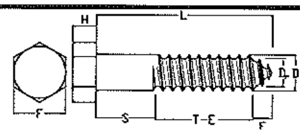
Remarks:
1. Corrosion test: as per ASTM-A262, Practice E :accepted.
2. Dimensions & Visual :good.
3. Materials are free from mercury contamination.

We, Winner Stainless Steel Tube Co., Ltd., hereby certify that the products described herein have been manufactured in accordance with the standards and specifications specified as above and meet the requirements as per order.

Q. C. Manager/Work Inspector: WINNER STAINLESS STEEL TUBE CO., LTD. QA DEPT

Appendix L (Cont.) (Non-mandatory) Typical Dimensions for Standard Hex Lag Screws[1]

D = diameter
D_r = root diameter
S = unthreaded shank length
T = minimum thread length[2]



E = length of tapered tip
N = number of threads/inch
F = width of head across flats
H = height of head

Length L		Diameter, D										
		1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1"	1-1/8"	1-1/4"
	D_r	0.173"	0.227"	0.265"	0.328"	0.371"	0.471"	0.579"	0.683"	0.780"	0.887"	1.012"
	E	5/32"	3/16"	7/32"	9/32"	5/16"	13/32"	1/2"	13/32"	11/16"	25/32"	7/8"
	H	11/64"	7/32"	1/4"	19/64"	11/32"	27/64"	1/2"	37/64"	43/64"	3/4"	27/32"
	F	7/16"	1/2"	9/16"	5/8"	3/4"	15/16"	1-1/8"	1-5/16"	1-1/2"	1-11/16"	1-7/8"
	N	10	9	7	7	6	5	4 1/2	4	3 1/2	3 1/4	3 1/4
1"	S	1/4"	1/4"	1/4"	1/4"	1/4"						
	T	3/4"	3/4"	3/4"	3/4"	3/4"						
	T-E	19/32"	9/16"	17/32"	15/32"	7/16"						
1-1/2"	S	1/4"	1/4"	1/4"	1/4"	1/4"						
	T	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"						
	T-E	1-3/32"	1-1/16"	1-1/32"	31/32"	15/16"						
2"	S	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"					
	T	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"					
	T-E	1-11/32"	1-5/16"	1-9/32"	1-7/32"	1-3/16"	1-3/32"					
2-1/2"	S	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"					
	T	1-3/4"	1-3/4"	1-3/4"	1-3/4"	1-3/4"	1-3/4"					
	T-E	1-19/32"	1-9/16"	1-17/32"	1-15/32"	1-7/16"	1-11/32"					
3	S	1"	1"	1"	1"	1"	1"	1"	1"	1"		
	T	2"	2"	2"	2"	2"	2"	2"	2"	2"		
	T-E	1-27/32"	1-13/16"	1-25/32"	1-23/32"	1-11/16"	1-19/32"	1-1/2"	1-13/32"	1-5/16"		
4"	S	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"
	T	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"
	T-E	2-11/32"	2-5/16"	2-9/32"	2-7/32"	2-3/16"	2-3/32"	2"	1-29/32"	1-13/16"	1-23/32"	1-5/8"
5"	S	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
	T	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"
	T-E	2-27/32"	2-13/16"	2-25/32"	2-23/32"	2-11/16"	2-19/32"	2-1/2"	2-13/32"	2-5/16"	2-7/32"	2-1/8"
6"	S	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"
	T	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"
	T-E	3-11/32"	3-5/16"	3-9/32"	3-7/32"	3-3/16"	3-3/32"	3"	2-29/32"	2-13/16"	2-23/32"	2-5/8"
7"	S	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"
	T	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"
	T-E	3-27/32"	3-13/16"	3-25/32"	3-23/32"	3-11/16"	3-19/32"	3-1/2"	3-13/32"	3-5/16"	3-7/32"	3-1/8"
8"	S	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	3-1/2"
	T	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"
	T-E	4-11/32"	4-5/16"	4-9/32"	4-7/32"	4-3/16"	4-3/32"	4"	3-29/32"	3-13/16"	3-23/32"	3-5/8"
9"	S	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"
	T	5"	5"	5"	5"	5"	5"	5"	5"	5"	5"	5"
	T-E	4-27/32"	4-13/16"	4-25/32"	4-23/32"	4-11/16"	4-19/32"	4-1/2"	4-13/32"	4-5/16"	4-7/32"	4-1/8"
10"	S	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"	4-1/2"
	T	5-1/2"	5-1/2"	5-1/2"	5-1/2"	5-1/2"	5-1/2"	5-1/2"	5-1/2"	5-1/2"	5-1/2"	5-1/2"
	T-E	5-11/32"	5-5/16"	5-9/32"	5-7/32"	5-3/16"	5-3/32"	5"	4-29/32"	4-13/16"	4-23/32"	4-5/8"
11"	S	5"	5"	5"	5"	5"	5"	5"	5"	5"	5"	5"
	T	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"
	T-E	5-27/32"	5-13/16"	5-25/32"	5-23/32"	5-11/16"	5-19/32"	5-1/2"	5-13/32"	5-5/16"	5-7/32"	5-1/8"
12"	S	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"
	T	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"
	T-E	5-27/32"	5-13/16"	5-25/32"	5-23/32"	5-11/16"	5-19/32"	5-1/2"	5-13/32"	5-5/16"	5-7/32"	5-1/8"

1. Tolerances specified in ANSI B18.2.1. Full body diameter lag screw is shown. For reduced body diameter lag screws, the unthreaded shank diameter may be reduced to approximately the root diameter, D_r.
2. Minimum thread length (T) for lag screw lengths (L) is 6" or 1/2 the lag screw length plus 0.5", whichever is less. Thread lengths may exceed these minimums up to the full lag screw length (L).

11.2 Reference Withdrawal Design Values

11.2.1 Lag Screws

11.2.1.1 The reference withdrawal design values, in lb/in. of penetration, for a single lag screw inserted in side grain, with the lag screw axis perpendicular to the wood fibers, shall be determined from Table 11.2A or Eq. 11.2-1, within the range of specific gravities and screw diameters given in Table 11.2A. Reference withdrawal design values, W, shall be multiplied by all applicable adjustment factors (see Table 10.3.1) to obtain adjusted withdrawal design values, W'.

$$W = 1800\,G^{3/2}D^{3/4} \qquad (11.2\text{-}1)$$

11.2.1.2 When lag screws are loaded in withdrawal from end grain, reference withdrawal design values, W, shall be multiplied by the end grain factor, $C_{eg} = 0.75$.

11.2.1.3 When lag screws are loaded in withdrawal, the tensile strength of the lag screw at the net (root) section shall not be exceeded (see 10.2.3).

Table 11.2A Lag Screw Reference Withdrawal Design Values (W)[1]

Reference withdrawal design values (W) are in pounds per inch of thread penetration into side grain of main member. Length of thread penetration in main member shall not include the length of the tapered tip (see Appendix L).

Specific Gravity, G	Lag Screw Unthreaded Shank Diameter, D										
	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1"	1-1/8"	1-1/4"
0.73	397	469	538	604	668	789	905	1016	1123	1226	1327
0.71	381	450	516	579	640	757	868	974	1077	1176	1273
0.68	357	422	484	543	600	709	813	913	1009	1103	1193
0.67	349	413	473	531	587	694	796	893	987	1078	1167
0.58	281	332	381	428	473	559	641	719	795	869	940
0.55	260	307	352	395	437	516	592	664	734	802	868
0.51	232	274	314	353	390	461	528	593	656	716	775
0.50	225	266	305	342	378	447	513	576	636	695	752
0.49	218	258	296	332	367	434	498	559	617	674	730
0.47	205	242	278	312	345	408	467	525	580	634	686
0.46	199	235	269	302	334	395	453	508	562	613	664
0.44	186	220	252	283	312	369	423	475	525	574	621
0.43	179	212	243	273	302	357	409	459	508	554	600
0.42	173	205	235	264	291	344	395	443	490	535	579
0.41	167	198	226	254	281	332	381	428	473	516	559
0.40	161	190	218	245	271	320	367	412	455	497	538
0.39	155	183	210	236	261	308	353	397	438	479	518
0.38	149	176	202	227	251	296	340	381	422	461	498
0.37	143	169	194	218	241	285	326	367	405	443	479
0.36	137	163	186	209	231	273	313	352	389	425	460
0.35	132	156	179	200	222	262	300	337	373	407	441
0.31	110	130	149	167	185	218	250	281	311	339	367

1. Reference withdrawal design values (W) for lag screw connections shall be multiplied by all applicable adjustment factors (see Table 10.3.1).