Sun City Hilton Head
Bluffton, South Carolina

Uplift Capacity; Nail Connection
Valley Truss to Main Roof Truss

August 17, 2010

Length of nail	**3.25**	inches	
Nail diameter	**0.135**	inches	12d sinker
Top of nail height	**1.50**	inches	See diagram
Thickness valley truss	**1.50**	inches	
Main truss slope			
Vertical component	**5.50**		
Horizontal component	**12**		
Slope angle, main truss	24.6	degrees	
Tan slope angle	0.458		
Nail installation angle	**40**	degrees	
Tangent	0.839		
Cosine	0.766		
Sine	0.643		
Gap vertical	0.69	inches	
Nail in upper truss, A	1.96	inches	Ts
Wedge horizontal,B	1.26	inches	
C	1.70	inches	
G2	0.57	inches	
Nail in gap, X	0.16	inches	X
Nail penetration	1.14	inches	Tm
Angle; nail & main truss	15.4	degrees	

Load Duration Factor	**1.6**	
Wood species	**Southern Pine**	
Reference withdrawal unit strength	42	lbs/inch
Penetration for Lateral Strength		
Minimum penetration (6D)	0.81	inches

Combined Withdrawal and Lateral Load (per NDS-2005)

Alpha	50	degrees
Sine	0.766	
Cosine	0.643	
Adjusted withdrawal capacity, W'p	76	lbs
Reference lateral capacity	**89**	lbs
Adjusted lateral capacity, Z'	143	lbs
Allowable inclined force, Z' alpha	69	lbs

per Technical Report 12

Uplift Capacity As Toenail (Without Gap)

Nail penetration (without gap)	1.29	inches
Toenail withdrawal capacity	58	lbs
Toenail Factor	**0.67**	

Calculation as toenail intended only as indirect "check" for upper part of nail in valley truss, assuming main truss in level position.
However, there is no code basis for such "check".

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Shaded cells are required inputs

Nail Size: **12d**
Nail Type: **Sinker**

Top of nail height 1.50 inches
Nail installation angle 40 degrees

Gap **0.16** inches

Input thickness (side) & nail in gap into Nail Shear Strength program

Nail Diameter, D **0.135** inches

Bending yield strength of nail 100,000 psi

Nail Length **3.25** inches

	Side	Main
Thickness (inches)	**1.96**	**3.50**
Dowel Bearing Length	1.96	1.14
Theta (degrees)	**0**	**0**
Theta (radians)	0.000	0.000
Sine Theta	0.00	0.00
Cosine Theta	1.00	1.00
Species	**SP**	**SP**
Specific Gravity	**0.55**	**0.55**
Dowel Bearing Strength, parallel	5,526	5,526
Dowel Bearing Strength, perpendicular	5,526	5,526
Dowel Bearing Strength	5,526	5,526

Load is considered applied by side member to nail

Kd 2.2

Re 1.0000
Rt 0.58

Thetamax 0
Ktheta 1.00

Theta = Angle between direction of load and direction of grain (long axis), for any member of connection

k1 0.347
k2 1.124
k3 1.043

Total available length 5.61 inches

Penetration, p 1.14 inches ***OK***
Minimum penetration 0.81 inches
Based on nominal diameter, D

Penetration factor 1.00 Either 1 or 0

Load Duration Factor **1.00**
Wet Service Factor **1.00**
Temperature Factor **1.00**
Group Action Factor **1.00**
Geometry Factor **1.00**
End Grain Factor **1.00**
Diaphragm Factor **1.00**
Toenail Factor **1.00**

Unit withdrawal value 42 lbs per inch of penetration

Net Factor, Withdrawal 1.00

Adjusted Withdrawal Design Value 47 lbs

Tech Report 12

Bending yield strength of nail; Fb,5% **100,000** psi

A	B	C	Technical Report 12 Z (lbs)	Least Z Value
			385	
			664	385
0.000670	1.703	-956	215	215
0.001005	0.724	-282	127	127
0.001005	1.135	-756	214	127
0.001341	0.156	-82	89	89

Adjusted Lateral Design Value 89 lbs
With gap

NDS-2005

Yield Mode	Rd	Z (lbs)	Least Z Value	Ratio of Z Values
1m	2.20	385		1.00
1s	2.20	664	385	1.00
2	2.20	230	230	0.93
3m	2.20	144	144	0.88
3s	2.20	231	144	0.93
4	2.20	112	112	0.79

Reference Lateral Design Value 112 lbs
Net Factor, Lateral 1.00

Adjusted Lateral Design Value 112 lbs
For zero gap only

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