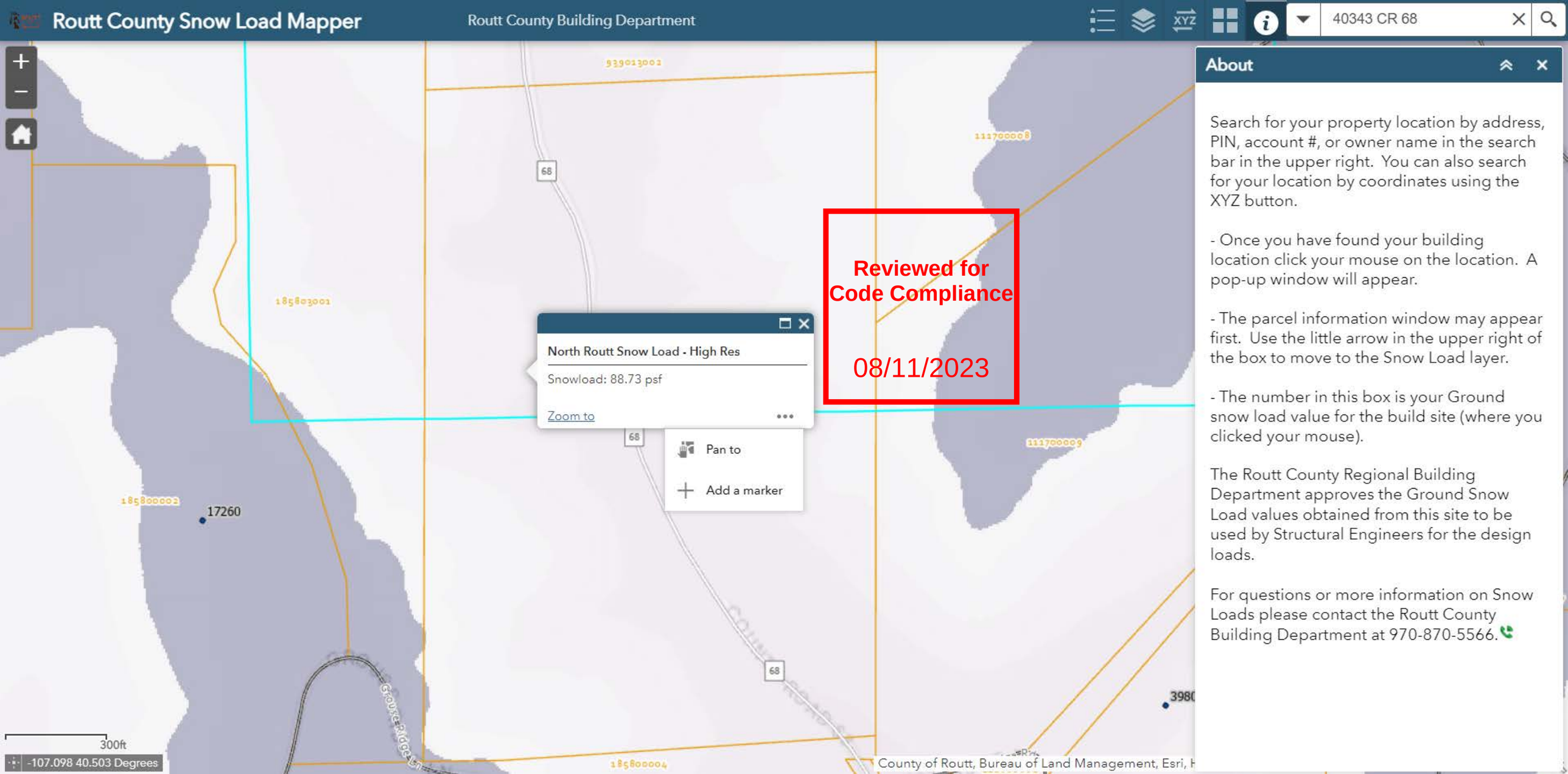
Routt County Snow Load Mapper
Routt County Building Department
40343 CR 68
About
Search for your property location by address, PIN, account #, or owner name in the search bar in the upper right. You can also search for your location by coordinates using the XYZ button.
- Once you have found your building location click your mouse on the location. A pop-up window will appear.
- The parcel information window may appear first. Use the little arrow in the upper right of the box to move to the Snow Load layer.
- The number in this box is your Ground snow load value for the build site (where you clicked your mouse).
The Routt County Regional Building Department approves the Ground Snow Load values obtained from this site to be used by Structural Engineers for the design loads.
For questions or more information on Snow Loads please contact the Routt County Building Department at 970-870-5566.
Reviewed for Code Compliance
08/11/2023
North Routt Snow Load - High Res
Snowload: 88.73 psf
Zoom to
Pan to
Add a marker
68
17260
300ft
-107.098 40.503 Degrees
County of Routt, Bureau of Land Management, Esri, H

Snow ASCE 7-10 Sec 7

Ground Snow Load		Drifts on Lower Roofs					Sliding Snow	
pg (psf)	88.73	γ (pcf)	25.5	$l_{u,leeward}$ (ft)	20.0	Okay	W (ft)	8.0
Ce	1	h_{upper} (ft)	19.6	$l_{u,windward}$ (ft)	20.0	Okay	$p_{sliding}$ (lb/ft)	218.6
Ct	1.1	h_{lower} (ft)	13.3	$h_{d,leeward}$ (ft)	2.2		d (ft)	11.0
Is	1	h (ft)	6.3	$h_{d,windward}$ (ft)	2.2		$p_{sliding}$ (psf)	19.9
pf (psf)	68.3	h_b (ft)	2.3	$h_{d,design}$ (ft)	2.2			
pm (psf)	20	h_c (ft)	3.9	w (ft)	8.7	Okay		
Cs	0.86	h_c/h_b	1.72	p_d (psf)	55.6			
ps (psf)	**58.8**	Check Drift?	**Yes**					

Wind ASCE 7-10 Chpt 27

Risk Category	II
V (mph)	115
Structure Type	MWFRS
Kd	0.85
Exposure Category	C
H (ft)	0
Lh (ft)	1
x (ft)	165000
z (ft)	15
H/Lh	0
x/Lh	165000
z/Lh	15
Topography	3
K1	1
K2	1
K3	1
Kzt	1.00
G	0.85
Enclosure Classification	Enclosed
GCpi	0.18
Mean Roof h (ft)	20
α	9.5
Zg (ft)	900
Kh	0.90
qh (lb/ft2)	20.3
qh(GCpi) (lb/ft2)	3.65
South & L (ft)	40
North B(ft)	40
East & L (ft)	40
West B(ft)	40
Windward Roof Pitch (x:12)	8
Leeward Roof Pitch (x:12)	8
Above Sea Level (ft):	6853
Ke:	0.78

Topographic Variables

Wind from North Transverse

Windward Wall

Height (ft)	Cp	Kz	qz (lb/ft2)	P (psf)		
0	0.80	0.85	19.06	16.61	or	9.32
15	0.80	0.85	19.06	16.61	or	9.32
20	0.80	0.90	20.25	17.42	or	10.13
25	0.80	0.95	21.23	18.08	or	10.79
30	0.80	0.98	22.06	18.64	or	11.35
35	0.80	1.01	22.78	19.14	or	11.85

Height (ft)	Total (lbs)		
0	0	or	0
15	10,450	or	6,076
20	3,616	or	2,158
25	3,729	or	2,271
0	0	or	0
Sum total (lbs)	17,795	or	10,504

Leeward Wall

Height (ft)	L/B	Cp	qh (lb/ft2)	P (psf)		P (psf)
20	1.00	-0.5	20.3	-4.96	or	-12.25
Sum total (lbs)				-3,969	or	-9,802

Side Wall

Height (ft)	L/B	Cp	qh (lb/ft2)	P (psf)		P (psf)
20	N/A	-0.7	20.3	-8.40	or	-15.70
Sum total (lbs)				-6,724	or	-12,556

Windward Roof

h/L	Θ	Cp	qh (lb/ft2)	P (psf)		P (psf)
0.50	35	-0.192	20.3	0.34	or	-6.95
Vertical - Sum total (lbs)				272	or	-5,560
Horizontal - Sum total (lbs)				181	or	-3,707

Leeward Roof

h/L	Θ	Cp	qh (lb/ft2)	P (psf)		P (psf)
0.50	35	-0.600	20.3	-6.68	or	-13.97
Vertical - Sum total (lbs)				-5,347	or	-11,179
Horizontal - Sum total (lbs)				-3,564	or	-7,453

Parallel to Ridgeline

h/L	Distance (ft)	Cp	qh (lb/ft2)	P (psf)		P (psf)
0.50	20	-0.900	20.3	-11.85	or	-19.14
0.50	40	-0.900	20.3	-11.85	or	-19.14
0.50	80	-0.500	20.3	-4.96	or	-12.25
0.50	>80	-0.300	20.3	-1.52	or	-8.81

$V_{u\_Fac\_wind}$ (lbs)			
	25,510	or	24,052

Wind from East Longitudinal

Windward Wall

Height (ft)	Cp	Kz	qz (lb/ft2)	P (psf)		
0	0.80	0.85	19.06	16.61	or	9.32
15	0.80	0.85	19.06	16.61	or	9.32
20	0.80	0.90	20.25	17.42	or	10.13
25	0.80	0.95	21.23	18.08	or	10.79
30	0.80	0.98	22.06	18.64	or	11.35
35	0.80	1.01	22.78	19.14	or	11.85

Height (ft)	Total (lbs)		
0	0	or	0
15	10,450	or	6,076
20	3,616	or	2,158
25	3,729	or	2,271
0	0	or	0
Sum total (lbs)	17,795	or	10,504

Leeward Wall

Height (ft)	L/B	Cp	qh (lb/ft2)	P (psf)		P (psf)
20	1.00	-0.5	20.3	-4.96	or	-12.25
Sum total (lbs)				-3,969	or	-9,802

Side Wall

Height (ft)	L/B	Cp	qh (lb/ft2)	P (psf)		P (psf)
20	N/A	-0.7	20.3	-8.40	or	-15.70
Sum total (lbs)				-6,724	or	-12,556

Windward Roof

h/L	Θ	Cp	qh (lb/ft2)	P (psf)		P (psf)
0.50	35	-0.192	20.3	0.34	or	-6.95
Vertical - Sum total (lbs)				272	or	-5,560
Horizontal - Sum total (lbs)				181	or	-3,707

Leeward Roof

h/L	Θ	Cp	qh (lb/ft2)	P (psf)		P (psf)
0.50	35	-0.600	20.3	-6.68	or	-13.97
Vertical - Sum total (lbs)				-5,347	or	-11,179
Horizontal - Sum total (lbs)				-3,564	or	-7,453

Parallel to Ridgeline

h/L	Distance (ft)	Cp	qh (lb/ft2)	P (psf)		P (psf)
0.50	20	-0.900	20.3	-11.85	or	-19.14
0.50	40	-0.900	20.3	-11.85	or	-19.14
0.50	80	-0.500	20.3	-4.96	or	-12.25
0.50	>80	-0.300	20.3	-1.52	or	-8.81

$V_{u\_Fac\_wind}$ (lbs)			
	25,510	or	24,052

CIMARRON ENGINEERING, LLC.

Case	File Name	Description
1	22-010_Uhl_Trans_Middle_C1	Original; Per the plans submitted
2	22-010_Uhl_Trans_Middle_C2	Made interior columns 12x12, updated loads with 14' tributary
3	22-010_Uhl_Trans_Middle_C3	Review sizing for middle external columns; Updated to 10x10
4	22-010_Uhl_Trans_Middle_C4	Review rafter sizing
5	22-010_Uhl_Long_Outer_C5	Outer longitudinal direction wind loads
6	22-010_Uhl_Long_Inner_C6	Inner longitudinal direction wind loads

NDS 2018 FRAME CALCULATIONS

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	1	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																						
C_M	C_t	C_i	C_F	C_{fu}	C_r	C_c	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	32.85

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-10,571	1,050	2,493	0
Load Case	3	3	4	1

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
10,571	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	29%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	36,076	Okay	Plate Req	322

		Shear				Shear Capacity Check		C_{perp1} Stress Variables								C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
1,050	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	8%	Occupancy	1	28	367	11.5	2	0.1	0.29	23	1	0	0	10,571	939	1,270	454	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
2,493	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	25%	Occupancy	1	Strong	1,700	114	208	5.27	30,377	1,695	9,933	425	0.37	0.13	Sufficient	Sufficient	0.25	0.25	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_{tu}, I_u)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity						Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
	5.50	2	9	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,223	No	0.000	Sufficient

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	2	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	8 x 8	8	8	7.5	7.5	70	70	56.25	19.5	No	No	No	No

Design Factors																						
C_M	C_t	C_i	C_F	C_{fu}	C_r	C_c	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.362574115	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	2	12.00	7.5	1	1	6.00	7.5	0.5	0	0.00	26.85

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-34,702	-6,581	13,842	2,024
Load Case	3	6A	6B	6B

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
34,702	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Insufficient	196%	Occupancy	0.8	1	234.0	31.2	733	1,814	0.8	658	17,663	Okay	No Plate	1,292

		Shear				Shear Capacity Check		C_{perp1} Stress Variables								C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
6,581	L6 - 0.9D+1.0W	Sufficient	48%	Occupancy	1	175	367	11.5	2	0.1	0.29	23	1	0	0	34,702	939	1,814	1,490	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
13,842	L6 - 0.9D+1.0W	Sufficient	88%	Occupancy	1	Strong	2,720	234	404	7.34	19,333	2,698	15,811	2,362	2.71	1.78	Insufficient	Insufficient	0.91	0.85	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_{tu}, I_u)	R_d (III_s)
2,024	L6 - 0.9D+1.0W	Sufficient	4%	Occupancy	1	75	1,871	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity						Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
	5.50	2	9	225	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	3	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	8 x 8	8	8	7.5	7.5	70	70	56.25	19.5	No	No	No	No

Design Factors																						
C_M	C_t	C_i	C_F	C_{fu}	C_r	C_c	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.362574115	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	2	12.00	7.5	1	1	6.00	7.5	0.5	0	0.00	26.85

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-34,702	-11,412	21,740	3,507
Load Case	3	4	4	6B

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
34,702	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Insufficient	196%	Occupancy	0.8	1	234.0	31.2	733	1,814	0.8	658	17,663	Okay	No Plate	1,292

		Shear				Shear Capacity Check		C_{perp1} Stress Variables								C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
11,412	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	83%	Occupancy	1	304	367	11.5	2	0.1	0.29	23	1	0	0	34,702	939	1,814	1,490	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
21,740	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Insufficient	137%	Occupancy	1	Strong	2,720	234	404	7.34	19,333	2,698	15,811	3,710	2.06	1.80	Insufficient	Insufficient	1.43	1.33	Insufficient	Insufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_{tu}, I_u)	R_d (III_s)
3,507	L6 - 0.9D+1.0W	Sufficient	7%	Occupancy	1	131	1,871	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

NDS 2018 FRAME CALCULATIONS

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
5.50	2	9	390	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

				Member Properties															Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	4	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions			Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	32.85

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-10,571	774	1,839	267
	3	4	4	6B

Compression				Column Stability Calculations						Axial Buckling Cap.	Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
10,571	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	29%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	36,076	Okay	Plate Req	322

Shear					Shear Capacity Check		C_{perp} Stress Variables						C_{perp} Capacity						
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
774	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	6%	Occupancy	1	21	367	11.5	2	0.1	0.29	23	1	0	0	10,571	939	1,270	454	No	0.000	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b*}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
1,839	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	19%	Occupancy	1	Strong	1,700	114	208	5.27	30,377	1,695	9,933	314	0.30	0.13	Sufficient	Sufficient	0.20	0.18	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_m, I_s)	R_d (III_s)
267	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	8	646	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
5.50	2	9	30	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,223	No	0.000	Sufficient

				Member Properties															Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	5	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	7	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.935058119	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions			Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	56.25

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-6,596	0	0	0
	3	1	1	1

Compression				Column Stability Calculations						Axial Buckling Cap.	Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
6,596	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	10%	Occupancy	0.8	1	84.0	11.2	4,607	1,270	0.8	1,188	66,802	Okay	Plate Req	117

Shear					Shear Capacity Check		C_{perp} Stress Variables						C_{perp} Capacity						
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	220	7.5	7.5	0.1	0.29	57	1	0	0	6,596	939	1,270	117	Yes	0.124	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b*}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,020	84	159	4.61	39,694	1,019	5,969	0	0.01	0.03	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_m, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
5.50	2	9	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

				Member Properties															Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	6	DOUGLAS FIR-LARCH No1	Table4D_BeamsStringers	925	1,350	170	625	675	0.50	1,600,000	580,000	8 x 12	8	12	7.5	11.5	165	108	86.25	16	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1	1	1	1	0.768921983	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions			Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	1	2.63	4	1.5	1	6.00	11.5	1	1	10.00	11.5	0.5	0	0.00	67.63

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-8,823	7,800	19,811	15,178
	6A	4	4	4

Compression				Column Stability Calculations						Axial Buckling Cap.	Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
8,823	L6 - 0.9D+1.0W	Sufficient	8%	Occupancy	1	1	192.0	16.7	2,559	1,998	0.8	1,536	103,893	Okay	Plate Req	130

Shear					Shear Capacity Check		C_{perp} Stress Variables						C_{perp} Capacity						
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
7,800	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	37%	Occupancy	1	136	367	7.5	1.5	0.1	0.29	12	1	0	0	7,800	939	1,998	676	Yes	0.720	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b*}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2

NDS 2018 FRAME CALCULATIONS

19,811	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	50%	Occupancy	1	Strong	2,915	192	347	8.43	14,658	2,879	39,667	1,438	0.53	0.06	Sufficient	Sufficient	0.65	0.42	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{m}, I_s)	R_d (III_s)
15,178	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	15%	Occupancy	1	224	1,458	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
5.50	2	9	1,686	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	7	DOUGLAS FIR-LARCH No1	Table4D_BeamsStringers	925	1,350	170	625	675	0.50	1,600,000	580,000	8 x 10	8	10	7.5	9.5	113	89	71.25	16	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1	1	1	1	0.642710307	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	1	2.63	4	1.5	1	6.00	9.5	1	1	8.00	9.5	0.5	0	0.00	54.63

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-2,065	-3,400	10,098	10,041
	68	3	3	3

	Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
2,065	L6 - 0.9D+1.0W	Sufficient	3%	Occupancy	1	1	192.0	20.2	1,746	1,998	0.8	1,284	70,146	Okay	No Plate	38

	Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
3,400	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	19%	Occupancy	1	72	367	7.5	1	0.1	0.29	8	1	0	0	2,065	939	1,998	265	Yes	0.282	Sufficient

	Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10,098	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	37%	Occupancy	1	Strong	2,915	192	341	7.59	18,055	2,887	27,142	1,074	0.38	0.03	Sufficient	Sufficient	0.53	0.31	Sufficient	Sufficient

	Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{m}, I_s)	R_d (III_s)
10,041	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	16%	Occupancy	0.8	184	1,166	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
5.50	2	9	1,116	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,631	No	0.000	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	12	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.969279653	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-9,692	14	15	12,571
	2	1	1	6A

	Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
9,692	L2 - 1.2D+1.6L+0.5(Lr or S or R)	Sufficient	22%	Occupancy	0.8	1	54.0	7.4	12,856	1,814	0.8	1,759	44,626	Okay	Plate Req	382

	Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.75	1.5	4.31	7	3	3	45	6,853	1,040	1,322	988	Yes	0.950	Sufficient

	Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,632	54	110	8.06	16,027	1,623	4,147	6	0.05	0.03	Sufficient	Sufficient	0.27	-0.30	Sufficient	Sufficient

	Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{m}, I_s)	R_d (III_s)
12,571	L6 - 0.9D+1.0W	Sufficient	26%	Occupancy	1	495	1,871	1.5	2.25	1	1	7.8	0.50	90	71,793	27,026	27,026	22,494	253,159	2.66	1.217	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
6.00	2.5	13	1,006	Yes	Sufficient	21,538	24,323	21,109	10,095	10,095	1	1	1	1	3.32	0.65	21,785	Yes	0.577	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	13	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.960784207	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-21,276	14	-15	0
	4	1	1	1

	Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
21,276	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	38%	Occupancy	1	1	54.0	7.4	12,856	2,268	0.8	2,179	55,294	Okay	Plate Req	838

	Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								

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V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	3	2	5.75	16	3	3	45	15,044	1,040	1,426	926	Yes	0.890	Sufficient

		Bending					Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,632	54	110	8.06	16,027	1,623	4,147	6	0.15	0.07	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tor}, I_y)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	1,123	1.5	3.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.111	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes					Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
4.00	2	6	0	Yes	Sufficient	945	3,794	2,022	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

							Member Properties												Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	14	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.969279653	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-8,022	14	15	3,433
Load Case	3	1	1	6B

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
8,022	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	18%	Occupancy	0.8	1	54.0	7.4	12,856	1,814	0.8	1,759	44,626	Okay	Plate Req	316

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity							
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	3	2	4.31	7	3	3	45	5,672	1,040	1,322	818	Yes	0.786	Sufficient

		Bending					Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,632	54	110	8.06	16,027	1,623	4,147	6	0.04	0.02	Sufficient	Sufficient	0.08	-0.08	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tor}, I_y)	R_d (III_s)
3,433	L6 - 0.9D+1.0W	Sufficient	7%	Occupancy	1	135	1,871	1.5	3.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.111	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes					Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
4.00	1.5	5	763	Yes	Sufficient	945	3,794	2,022	945	945	1	1	1	1	3.32	0.65	2,038	Yes	1.684	Insufficient

							Member Properties												Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	15	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.960784207	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-8,382	14	-15	0
Load Case	4	1	1	1

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
8,382	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	15%	Occupancy	1	1	54.0	7.4	12,856	2,268	0.8	2,179	55,294	Okay	Plate Req	330

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity							
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	1.25	1.5	4.31	9	3	3	45	5,927	1,040	1,426	682	Yes	0.656	Sufficient

		Bending					Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,632	54	110	8.06	16,027	1,623	4,147	6	0.03	0.03	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tor}, I_y)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	1,123	1.5	3.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.111	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes					Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
4.00	1.5	5	0	Yes	Sufficient	945	3,794	2,022	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

NDS 2018 FRAME CALCULATIONS

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	1	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																						
C_M	C_t	C_i	C_F	C_{fu}	C_r	C_c	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	32.85

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-10,644	1,107	2,629	0
Load Case	3	4	4	1

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
10,644	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	30%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	36,076	Okay	Plate Req	324

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
1,107	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	8%	Occupancy	1	30	367	11.5	2	0.1	0.29	23	1	0	0	10,644	939	1,270	457	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
2,629	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	26%	Occupancy	1	Strong	1,700	114	208	5.27	30,377	1,695	9,933	449	0.39	0.13	Sufficient	Sufficient	0.26	0.26	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yr} (psi)	F_{yb} (psi)	R_e	k_3	k_0	R_d (I_m, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors					Dowel Capacity		
	L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
	7.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,223	No	0.000	Sufficient

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	2	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	12 x 12	12	12	11.5	11.5	253	253	132.25	19.5	No	No	No	No

Design Factors																						
C_M	C_t	C_i	C_F	C_{fu}	C_r	C_c	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1	1	1	1	0.689909321	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	2	12.00	11.5	1	1	10.00	11.5	0.5	0	0.00	98.85

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-35,600	7,096	14,046	1,977
Load Case	3	2	6B	6B

Tenon Length

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
35,600	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	30%	Occupancy	0.8	1	234.0	20.3	1,723	1,728	0.8	1,192	117,845	Okay	No Plate	360

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
7,096	L2 - 1.2D+1.6L+0.5(Lr or S or R)	Sufficient	27%	Occupancy	0.8	80	294	11.5	2	0.1	0.29	23	1	0	0	35,600	939	1,728	1,529	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
14,046	L6 - 0.9D+1.0W	Sufficient	26%	Occupancy	1	Strong	2,591	234	416	6.01	28,789	2,578	54,458	665	0.42	0.21	Sufficient	Sufficient	0.27	0.25	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yr} (psi)	F_{yb} (psi)	R_e	k_3	k_0	R_d (I_m, I_s)	R_d (III_s)
1,977	L6 - 0.9D+1.0W	Sufficient	1%	Occupancy	1	20	1,782	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors					Dowel Capacity		
	L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
	11.5	0.1	1	1,883	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	3	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	12 x 12	12	12	11.5	11.5	253	253	132.25	19.5	No	No	No	No

Design Factors																						
C_M	C_t	C_i	C_F	C_{fu}	C_r	C_c	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1	1	1	1	0.689909321	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	2	12.00	11.5	1	1	10.00	11.5	0.5	0	0.00	98.85

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-35,600	-12,340	25,364	3,232
Load Case	3	4	4	6B

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
35,600	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	30%	Occupancy	0.8	1	234.0	20.3	1,723	1,728	0.8	1,192	117,845	Okay	No Plate	360

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
12,340	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	38%	Occupancy	1	140	367	11.5	2	0.1	0.29	23	1	0	0	35,600	939	1,728	1,529	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
25,364	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	47%	Occupancy	1	Strong	2,591	234	416	6.01	28,789	2,578	54,458	1,201	0.68	0.21	Sufficient	Sufficient	0.48	0.45	Sufficient	Sufficient

						Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
						f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yr} (psi)	F_{yb} (psi)	R_e	k_3	k_0	R_d (I_m, I_s)	R_d (III_s)
						33	1,782	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

NDS 2018 FRAME CALCULATIONS

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
11.5	0.1	1	3,078	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	4	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	32.85

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-10,644	817	1,940	289
	3	4	4	6B

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{Allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
10,644	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	30%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	36,076	Okay	Plate Req	324

Shear					Shear Capacity Check		C_{perp} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
817	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	6%	Occupancy	1	22	367	11.5	2	0.1	0.29	23	1	0	0	10,644	939	1,270	457	No	0.000	Sufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
1,940	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	20%	Occupancy	1	Strong	1,700	114	208	5.27	30,377	1,695	9,933	331	0.31	0.13	Sufficient	Sufficient	0.20	0.19	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_m, I_s)	R_d (III$_s$)
289	L6 - 0.9D+1.0W	Sufficient	1%	Occupancy	1	9	1,077	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	0.1	1	445	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	5	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	7	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.935058119	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	56.25

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-5,201	0	0	0
	3	1	1	1

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{Allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
5,201	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	8%	Occupancy	0.8	1	84.0	11.2	4,607	1,270	0.8	1,188	66,802	Okay	Plate Req	92

Shear					Shear Capacity Check		C_{perp} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	220	7.5	7.5	0.1	0.29	57	1	0	0	5,201	939	1,270	92	Yes	0.098	Sufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,020	84	159	4.61	39,694	1,019	5,969	0	0.01	0.02	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_m, I_s)	R_d (III$_s$)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	6	DOUGLAS FIR-LARCH No1	Table4D_BeamsStringers	925	1,350	170	625	675	0.50	1,600,000	580,000	8 x 12	8	12	7.5	11.5	165	108	86.25	16	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1	1	1	1	0.768921983	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	1	2.63	4	1.5	1	6.00	11.5	1	1	10.00	11.5	0.5	0	0.00	67.63

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-8,441	-7,921	-22,121	16,068
	6A	4	4	4

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{Allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
8,441	L6 - 0.9D+1.0W	Sufficient	8%	Occupancy	1	1	192.0	16.7	2,559	1,998	0.8	1,536	103,893	Okay	Plate Req	125

Shear					Shear Capacity Check		C_{perp} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
				Occupancy	1	138	367	7.5	1	0.1	0.29	8	1	0	0	7,921	939	1,998	1,017	Yes	1.083	Insufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2

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22,121	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	56%	Occupancy	1	Strong	2,915	192	347	8.43	14,658	2,879	39,667	1,606	0.59	0.06	Sufficient	Sufficient	0.71	0.48	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{m}, I_s)	R_d (III_s)
16,068	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	16%	Occupancy	1	238	1,458	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{ss} (lb)	Z_{sc} (lb)	Z_{ds} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_a	K_y	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
11.5	0.1	1	15,303	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

						Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	7	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	8 x 10	8	10	7.5	9.5	113	89	71.25	16	No	No	No	No

Design Factors																					
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	$ϕ_c$	$ϕ_{c,perp}$	$ϕ_b$	$ϕ_v$	$ϕ_t$	$ϕ_{tmin}$	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1	1	1	1	0.720449785	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_n (in^2)
0.75	3.5	1	2.63	5	1.5	1	7.50	9.5	1	2	16.00	9.5	0.5	0	0.00	45.13

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-2,846	3,349	-10,138	10,617
	68	4	4	3

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_n (lbf)	Load Case	$P_n < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
2,846	L6 - 0.9D+1.0W	Sufficient	7%	Occupancy	1	1	192.0	20.2	1,415	1,296	0.8	934	42,133	Okay	No Plate	63

		Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{n,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{c,perp} < F'_{c,perp,min}$
3,349	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	19%	Occupancy	1	71	367	7.5	1	0.1	0.29	8	1	0	0	2,846	939	1,296	365	Yes	0.389	Sufficient

		Bending				Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10,138	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	58%	Occupancy	1	Strong	1,889	192	341	7.59	14,631	1,875	17,630	1,078	0.61	0.05	Sufficient	Sufficient	0.89	0.45	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{m}, I_s)	R_d (III_s)
10,617	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	32%	Occupancy	0.8	235	734	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{ss} (lb)	Z_{sc} (lb)	Z_{ds} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_a	K_y	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
9.5	0.1	1	12,491	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,631	No	0.000	Sufficient

						Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	12	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	6 x 8	6	8	5.5	7.5	52	38	41.25	4.5	No	No	No	No

Design Factors																					
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	$ϕ_c$	$ϕ_{c,perp}$	$ϕ_b$	$ϕ_v$	$ϕ_t$	$ϕ_{tmin}$	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.975602949	1	1.068181818	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_n (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	41.25

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-13,065	14	15	11,787
	2	1	1	6A

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_n (lbf)	Load Case	$P_n < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
13,065	L2 - 1.2D+1.6L+0.5(Lr or S or R)	Sufficient	26%	Occupancy	0.8	1	54.0	7.2	11,149	1,270	0.8	1,239	51,113	Okay	Plate Req	317

		Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{n,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{c,perp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	5.5	1.5	2	5.75	14	3	3	45	9,238	1,003	1,121	660	Yes	0.658	Sufficient

		Bending				Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,020	54	111	5.23	30,792	1,018	4,376	3	0.07	0.03	Sufficient	Sufficient	0.27	-0.28	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{m}, I_s)	R_d (III_s)
11,787	L6 - 0.9D+1.0W	Sufficient	27%	Occupancy	1	286	1,077	2	3.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.111	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{ss} (lb)	Z_{sc} (lb)	Z_{ds} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_a	K_y	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	2	13	907	Yes	Sufficient	1,259	3,794	2,022	945	945	1	1	1	1	3.32	0.65	2,039	Yes	5.781	Insufficient

						Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	13	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	6 x 8	6	8	5.5	7.5	52	38	41.25	4.5	No	No	No	No

Design Factors																					
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	$ϕ_c$	$ϕ_{c,perp}$	$ϕ_b$	$ϕ_v$	$ϕ_t$	$ϕ_{tmin}$	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.968979609	1	1.068181818	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_n (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	41.25

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-23,442	14	-15	0
	4	1	1	1

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
				L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
				Occupancy	1	1	54.0	7.2	11,149	1,588	0.8	1,538	63,457	Okay	Plate Req	568

		Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								

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V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	5.5	1.5	2	5.75	14	3	3	45	16,576	1,003	1,230	1,184	Yes	1.180	Insufficient

		Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,020	54	111	5.23	30,792	1,018	4,376	3	0.14	0.05	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	2	3.75	1	1	7.8	0.50	90	71,793	27,026	27,026	22,494	253,159	2.66	0.879	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$F_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.5	2	13	0	Yes	Sufficient	28,717	40,538	25,416	10,095	10,095	1	1	1	1	3.32	0.65	13,071	Yes	0.000	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in³)	S_{Weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	14	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area		Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)	Loads	-6,591	14	15	4,739
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38	Load Case	3	1	1	6B

		Compression				Column Stability Calculations					Axial Buckling Cap.	Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
6,591	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	21%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	260

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity							
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	4,661	1,040	1,144	769	Yes	0.739	Sufficient

		Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.05	0.02	Sufficient	Sufficient	0.18	-0.18	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
4,739	L6 - 0.9D+1.0W	Sufficient	17%	Occupancy	1	187	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$F_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.25	1.5	9	505	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	2.325	Insufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in³)	S_{Weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	15	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area		Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)	Loads	-8,833	14	-15	0
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38	Load Case	4	1	1	1

		Compression				Column Stability Calculations					Axial Buckling Cap.	Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
8,833	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	23%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	348

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity							
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	6,246	1,040	1,257	1,030	Yes	0.991	Sufficient

		Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.06	0.03	Sufficient	Sufficient	0.01	0.01	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$F_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

NDS 2018 FRAME CALCULATIONS

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	1	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	32.85

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-5,610	851	-1,407	0
Load Case	3	4	4	1

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
5,610	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	16%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	36,076	Okay	Plate Req	171

Shear					Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
851	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	6%	Occupancy	1	23	367	11.5	2	0.1	0.29	23	1	0	0	5,610	939	1,270	241	No	0.000	Sufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
1,407	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	14%	Occupancy	1	Strong	1,700	114	208	5.27	30,377	1,695	9,933	240	0.18	0.07	Sufficient	Sufficient	0.14	0.14	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths				Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{tu}, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity					Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,223	No	0.000	Sufficient

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	2	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	10 x 10	10	10	9.5	9.5	143	143	90.25	19.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1	1	1	1	0.547677399	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
1.25	7.6	2	19.00	4	1.5	2	12.00	9.5	1	2	16.00	9.5	0.5	0	0.00	43.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-19,073	-3,664	8,077	0
Load Case	3	6A	6B	1

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
19,073	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	47%	Occupancy	0.8	1	234.0	24.6	1,176	1,728	0.8	946	40,931	Okay	No Plate	441

Shear					Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
3,664	L6 - 0.9D+1.0W	Sufficient	17%	Occupancy	1	61	367	11.5	2	0.1	0.29	23	1	0	0	19,073	939	1,728	819	No	0.000	Sufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
8,077	L6 - 0.9D+1.0W	Sufficient	26%	Occupancy	1	Strong	2,591	234	410	6.57	24,130	2,575	30,668	678	0.64	0.38	Sufficient	Sufficient	0.26	0.26	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths				Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{tu}, I_s)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,782	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity					Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
9.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

		Member Properties																		Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	3	DOUGLAS FIR-LARCH No1	Table4D_PostTimbers	1,000	1,200	170	625	825	0.50	1,600,000	580,000	10 x 10	10	10	9.5	9.5	143	143	90.25	19.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1	1	1	1	0.547677399	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
1.25	7.6	2	19.00	4	1.5	2	12.00	9.5	1	2	16.00	9.5	0.5	0	0.00	43.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-19,073	-6,046	12,957	1,577
Load Case	3	4	4	6B

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
19,073	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	47%	Occupancy	0.8	1	234.0	24.6	1,176	1,728	0.8	946	40,931	Okay	No Plate	441

Shear					Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
6,046	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	27%	Occupancy	1	100	367	11.5	2	0.1	0.29	23	1	0	0	19,073	939	1,728	819	No	0.000	Sufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
12,957	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	42%	Occupancy	1	Strong	2,591	234	410	6.57	24,130	2,575	30,668	1,088	0.89	0.38	Sufficient	Sufficient	0.44	0.41	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths				Yield Mode Constants				
			L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{tu}, I_s)	R_d (III_s)
			Occupancy	1	36	1,782	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

NDS 2018 FRAME CALCULATIONS

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
9.5	0.1	1	1,855	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	4	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	$K_{Ft,v}$	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	32.85

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-5,610	-690	1,036	0
Load Case	3	2	2	1

Compression				Column Stability Calculations						Axial Buckling Cap.	Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{Allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
5,610	L3 - 1.2D+1.6L+0.5(Lr or S or R)+(L or 0.5W)	Sufficient	16%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	36,076	Okay	Plate Req	171

Shear					Shear Capacity Check		C_{perp} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
690	L2 - 1.2D+1.6L+0.5(Lr or S or R)	Sufficient	6%	Occupancy	0.8	18	294	11.5	2	0.1	0.29	23	1	0	0	5,610	939	1,270	241	No	0.000	Sufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
1,036	L2 - 1.2D+1.6L+0.5(Lr or S or R)	Sufficient	13%	Occupancy	0.8	Strong	1,360	114	208	5.27	30,377	1,357	7,951	177	0.16	0.07	Sufficient	Sufficient	0.13	0.13	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_{lm}, I_t)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,223	No	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	5	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	7	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	$K_{Ft,v}$	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.935058119	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	56.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-2,917	0	0	0
Load Case	3	1	1	1

Compression				Column Stability Calculations						Axial Buckling Cap.	Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{Allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
2,917	L3 - 1.2D+1.6L(Lr or S or R)+(L or 0.5W)	Sufficient	4%	Occupancy	0.8	1	84.0	11.2	4,607	1,270	0.8	1,188	66,802	Okay	Plate Req	52

Shear					Shear Capacity Check		C_{perp} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	220	7.5	7.5	2	5.75	62	1	0	0	2,917	939	1,270	47	Yes	0.050	Sufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	Strong	1,020	84	159	4.61	39,694	1,019	5,969	0	0.00	0.01	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_{lm}, I_t)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	2	2.75	1	2	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	2	11	0	Yes	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,447	Yes	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	6	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	8 x 12	8	12	7.5	11.5	165	108	86.25	16	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	$K_{Ft,v}$	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1	1	1	1	0.824594084	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	1	2.63	4	1.5	1	6.00	11.5	1	1	10.00	11.5	0.5	0	0.00	67.63

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-3,916	-3,888	-9,920	7,380
Load Case	6A	4	4	4

Compression				Column Stability Calculations						Axial Buckling Cap.	Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{Allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
3,916	L6 - 0.9D+1.0W	Sufficient	5%	Occupancy	1	1	192.0	16.7	2,073	1,296	0.8	1,069	72,269	Okay	Plate Req	58

Shear					Shear Capacity Check		C_{perp} Stress Variables							C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
				Occupancy	1	68	367	7.5	1	0.001	0.00	8	1	0	0	3,888	939	1,296	518	Yes	0.552	Sufficient

Beam Stability Factor Calculations									Stress	Bending and Axial Compression				Bending and Axial Tension			
L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2

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9,920	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	38%	Occupancy	1	Strong	1,889	192	347	8.43	11,878	1,872	25,784	720	0.40	0.03	Sufficient	Sufficient	0.50	0.33	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{ey} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{m}, I_s)	R_d (III_s)
7,380	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	12%	Occupancy	1	109	918	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ds} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_d	K_y	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
11.5	0.001	0	702,857	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	7	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	8 x 10	8	10	7.5	9.5	113	89	71.25	16	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1	1	1	1	0.720449785	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	1	2.63	4	1.5	1	6.00	9.5	1	1	8.00	9.5	0.5	0	0.00	54.63

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	68	3	3	3

	Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
596	L6 - 0.9D+1.0W	Sufficient	1%	Occupancy	1	1	192.0	20.2	1,415	1,296	0.8	934	51,004	Okay	No Plate	11

	Shear				Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity										
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{c,perp} < F'_{c,perp,min}$
1,560	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	11%	Occupancy	0.8	33	294	7.5	1	0.1	0.29	8	1	0	0	596	939	1,296	77	Yes	0.081	Sufficient

	Bending					Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
4,386	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	31%	Occupancy	0.8	Strong	1,511	192	341	7.59	14,631	1,503	467	0.31	0.01	Sufficient	Sufficient	0.45	0.24	Sufficient	Sufficient

	Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{ey} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{m}, I_s)	R_d (III_s)
5,775	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	14%	Occupancy	0.8	106	734	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ds} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_d	K_y	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
9.5	0.1	1	6,794	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,631	No	0.000	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	12	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-6,322	14	15	5,340
	2	1	1	6A

	Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
6,322	L2 - 1.2D+1.6L+0.5(Lr or S or R)	Sufficient	20%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	249

	Shear				Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity										
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{c,perp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	1	1.5	4.31	8	3	3	45	4,470	1,040	1,144	572	Yes	0.550	Sufficient

	Bending					Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	6	0.05	0.02	Sufficient	Sufficient	0.20	-0.20	Sufficient	Sufficient

	Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{ey} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{m}, I_s)	R_d (III_s)
5,340	L6 - 0.9D+1.0W	Sufficient	20%	Occupancy	1	210	1,077	1.5	3.63	1	1	7.8	0.50	90	71,793	27,026	27,026	22,494	253,159	2.66	0.894	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ds} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_d	K_y	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	570	Yes	Sufficient	21,538	39,187	24,973	10,095	10,095	1	1	1	1	3.32	0.65	21,785	Yes	0.245	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	13	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-11,125	14	-15	0
	4	1	1	1

	Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
				L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
				Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	438

		Shear Capacity Check		C_{perp1} Stress Variables		C_{perp} Capacity

NDS 2018 FRAME CALCULATIONS

V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	1	1.5	4.31	8	3	3	45	7,867	1,040	1,257	1,007	Yes	0.968	Sufficient

		Bending					Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_e (in)	I_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.09	0.04	Sufficient	Sufficient	0.01	0.01	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	1.5	3.63	1	1	7.8	0.50	90	71,793	27,026	27,026	22,494	253,159	2.66	0.894	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	Z_{lm} (lb)	Z_{lt} (lb)	Z_{lbs} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.25	1.5	9	0	Yes	Sufficient	21,538	39,187	24,973	10,095	10,095	1	1	1	1	3.32	0.65	13,071	Yes	0.000	Sufficient

						Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in³)	S_{Weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	14	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area		Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)	Loads	-3,777	14	15	1,429
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38	Load Case	3	1	1	6B

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
3,777	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	12%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	149

		Shear				Shear Capacity Check		C_{perp1} Stress Variables											C_{perp} Capacity				
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	2,671	1,040	1,144	441	Yes	0.424	Sufficient

		Bending					Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_e (in)	I_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.02	0.01	Sufficient	Sufficient	0.06	-0.05	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
1,429	L6 - 0.9D+1.0W	Sufficient	5%	Occupancy	1	56	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	Z_{lm} (lb)	Z_{lt} (lb)	Z_{lbs} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.25	1.5	9	152	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.701	Sufficient

						Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in³)	S_{Weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	15	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area		Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)	Loads	-3,777	14	-15	0
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38	Load Case	3	1	1	1

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
3,777	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	12%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	149

		Shear				Shear Capacity Check		C_{perp1} Stress Variables											C_{perp} Capacity				
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	2,671	1,040	1,144	441	Yes	0.424	Sufficient

		Bending					Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_e (in)	I_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.02	0.01	Sufficient	Sufficient	0.01	0.01	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	Z_{lm} (lb)	Z_{lt} (lb)	Z_{lbs} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

CIMARRON ENGINEERING, LLC.

NDS 2018 FRAME CALCULATIONS

Member Properties																				Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	8	DOUGLAS FIR-LARCH No1	Table4D_BeamsStringers	925	1,350	170	625	675	0.50	1,600,000	580,000	6 x 8	6	8	5.5	7.5	52	38	41.25	12	No	No	No	Yes

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1.15	0.737741769	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	41.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-787	-3,044	8,100	880
Load Case	3	3	3	3

Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'$_c$ (psi)	P_{allow} (lbf)	F'$_c$ < F_{c^*}	F'$_c$ > (0.75)(F_{c^*})	f_c (psi)
787	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	2%	Occupancy	0.8	1	144.0	19.2	1,935	1,678	0.8	1,238	51,074	Okay	No Plate	19

Shear					Shear Capacity Check		C_{perp} Stress Variables						C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
3,044	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	38%	Occupancy	0.8	111	294	7.5	0.75	0.1	0.29	6	1	0	787	939	1,678	133	Yes	0.142	Sufficient	

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_b$* (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
8,100	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	68%	Occupancy	0.8	Strong	2,816	144	257	7.99	16,327	2,787	11,975	1,885	0.68	0.02	Sufficient	Sufficient	0.69	0.67	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{em} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{tu}, I_s)	R_d (III_s)
880	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	2%	Occupancy	0.8	21	1,225	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.5	0.1	1	1,354	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,631	No	0.000	Sufficient

Member Properties																				Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	9	DOUGLAS FIR-LARCH No1	Table4D_BeamsStringers	925	1,350	170	625	675	0.50	1,600,000	580,000	6 x 8	6	8	5.5	7.5	52	38	41.25	12	No	No	No	Yes

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1.15	0.737741769	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,600,000	867,680	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	41.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-787	3,044	8,100	880
Load Case	3	3	3	3

Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'$_c$ (psi)	P_{allow} (lbf)	F'$_c$ < F_{c^*}	F'$_c$ > (0.75)(F_{c^*})	f_c (psi)
787	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	2%	Occupancy	0.8	1	144.0	19.2	1,935	1,678	0.8	1,238	51,074	Okay	No Plate	19

Shear					Shear Capacity Check		C_{perp} Stress Variables						C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
3,044	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	38%	Occupancy	0.8	111	294	7.5	0.75	0.1	0.29	6	1	0	787	939	1,678	133	Yes	0.142	Sufficient	

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_b$* (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
8,100	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	68%	Occupancy	0.8	Strong	2,816	144	257	7.99	16,327	2,787	11,975	1,885	0.68	0.02	Sufficient	Sufficient	0.69	0.67	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{em} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{tu}, I_s)	R_d (III_s)
880	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	2%	Occupancy	0.8	21	1,225	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.5	0.1	1	1,354	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,631	No	0.000	Sufficient

Member Properties																				Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	10	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	6 x 8	6	8	5.5	7.5	52	38	41.25	9.5	No	No	No	Yes

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1.15	0.888106136	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	41.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-3,192	1,476	3,583	0
Load Case	3	3	3	1

Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'$_c$ (psi)	P_{allow} (lbf)	F'$_c$ < F_{c^*}	F'$_c$ > (0.75)(F_{c^*})	f_c (psi)
3,192	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	8%	Occupancy	0.8	1	114.0	15.2	2,502	1,089	0.8	967	39,882	Okay	Plate Req	77

Shear					Shear Capacity Check		C_{perp} Stress Variables						C_{perp} Capacity					
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
1,476	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	18%	Occupancy	0.8	54	294	7.5	0.75	0.1	0.29	6	1	0	0	3,192	939	1,089	540	Yes	0.575	Sufficient	

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_b$* (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
3,583	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	46%	Occupancy	0.8	Strong	1,825	114	208	7.19	16,336	1,814	7,793	834	0.48	0.03	Sufficient	Sufficient	0.46	0.46	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
					L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{em} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{tu}, I_s)	R_d (III_s)
					Occupancy	0.8	0	771	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

NDS 2018 FRAME CALCULATIONS

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,631	No	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	$F_{c,perp}$ (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	11	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	6 x 8	6	8	5.5	7.5	52	38	41.25	9.5	No	No	No	Yes

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1.15	0.888106136	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.5	1	0	0.00	7.5	0.5	0	0.00	41.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-3,192	1,476	3,583	0
Load Case	3	3	3	1

Compression					Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
3,192	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	8%	Occupancy	0.8	1	114.0	15.2	2,502	1,089	0.8	967	39,882	Okay	Plate Req	77

Shear					Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hans}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
1,476	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	18%	Occupancy	0.8	54	294	7.5	1	0.1	0.29	8	1	0	0	3,192	939	1,089	410	Yes	0.436	Sufficient

Bending						Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
3,583	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	46%	Occupancy	0.8	Strong	1,825	114	208	7.19	16,336	1,814	7,793	834	0.48	0.03	Sufficient	Sufficient	0.46	0.46	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_{mr}, I_s)	R_d (III_s)
0	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	0%	Occupancy	0.8	0	771	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	1,631	No	0.000	Sufficient

NDS 2018 FRAME CALCULATIONS

Member Properties																				Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	$F_{c,perp}$ (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Long	1	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	1	5.70	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	38.55

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-4,092	1,365	-4,095	137
Load Case	3	3	3	6

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u<P_{Allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_{c^*}	F'$_c$ > (0.75)(F_{c^*})	f_c (psi)
4,092	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	10%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	42,336	Okay	Plate Req	106

Shear					Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity				
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
1,365	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	12%	Occupancy	0.8	36	294	11.5	0.75	0.1	0.29	9	1	0	0	4,092	939	1,270	459	No	0.000	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b^*}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{Allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
4,095	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	52%	Occupancy	0.8	Strong	1,360	114	208	5.27	30,377	1,357	7,951	699	0.55	0.04	Sufficient	Sufficient	0.52	0.51	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_m, I_s)	R_d (III_s)
137	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	4	1,077	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.5	0.1	1	211	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

Member Properties																				Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	$F_{c,perp}$ (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Long	2	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	3.5	1.5	2	10.50	7.5	1	2	12.00	7.5	0.5	0	0.00	22.35

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-10,107	-751	2,253	99
Load Case	3	4	4	6

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u<P_{Allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_{c^*}	F'$_c$ > (0.75)(F_{c^*})	f_c (psi)
10,107	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	41%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	24,545	Okay	Plate Req	452

Shear					Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity				
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
751	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	5%	Occupancy	1	20	367	11.5	2	0.1	0.29	23	1	0	0	10,107	939	1,270	434	No	0.000	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b^*}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{Allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
2,253	L4 - 1.2D+1.0W+L+0.5(Lr or S or R)	Sufficient	23%	Occupancy	1	Strong	1,700	114	208	5.27	30,377	1,695	9,933	385	0.45	0.18	Sufficient	Sufficient	0.23	0.22	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_m, I_s)	R_d (III_s)
99	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	4	1,077	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.5	0.1	1	152	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

Member Properties																				Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	$F_{c,perp}$ (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	3	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	2	11.40	3.5	1.5	2	10.50	7.5	1	2	12.00	7.5	0.5	0	0.00	22.35

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-10,107	-616	1,849	28
Load Case	3	6	6	6

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u<P_{Allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_{c^*}	F'$_c$ > (0.75)(F_{c^*})	f_c (psi)
10,107	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	41%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	24,545	Okay	Plate Req	452

Shear					Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity				
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
616	L6 - 0.9D+1.0W	Sufficient	4%	Occupancy	1	16	367	11.5	2	0.1	0.29	23	1	0	0	10,107	939	1,270	434	No	0.000	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b^*}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{Allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
1,849	L6 - 0.9D+1.0W	Sufficient	19%	Occupancy	1	Strong	1,700	114	208	5.27	30,377	1,695	9,933	316	0.40	0.18	Sufficient	Sufficient	0.19	0.19	Sufficient	Sufficient

Tension					Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
					L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_m, I_s)	R_d (III_s)
					Occupancy	1	1	1,077	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

NDS 2018 FRAME CALCULATIONS

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	0.1	1	43	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Long	4	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 8	8	8	7.5	7.5	70	70	56.25	9.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.864671508	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions			Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	1	5.70	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	38.55

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-4,092	-1,365	4,095	258
Load Case	3	3	3	6

Compression					Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
4,092	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	10%	Occupancy	0.8	1	114.0	15.2	2,502	1,270	0.8	1,098	42,336	Okay	Plate Req	106

Shear					Shear Capacity Check		C_{perp} Stress Variables								C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
1,365	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	12%	Occupancy	0.8	36	294	11.5	2	0.1	0.29	23	1	0	0	4,092	939	1,270	176	No	0.000	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
4,095	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	52%	Occupancy	0.8	Strong	1,360	114	208	5.27	30,377	1,357	7,951	699	0.55	0.04	Sufficient	Sufficient	0.52	0.51	Sufficient	Sufficient

Tension				Tension Calcs			Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{gv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_{str}, I_s)	R_d (III_s)
258	L6 - 0.9D+1.0W	Sufficient	1%	Occupancy	1	7	1,077	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	0.1	1	397	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	5	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	8 x 10	8	10	7.5	9.5	113	89	71.25	40	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1	1	1	1	0.144826488	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions			Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	7.6	0	0.00	4	1.5	0	0.00	9.5	1	0	0.00	9.5	0.5	0	0.00	71.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-688	-3,405	3,699	4,459
Load Case	6	3	3	3

Compression					Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
688	L6 - 0.9D+1.0W	Sufficient	4%	Occupancy	1	1	480.0	50.5	226	1,512	0.8	219	15,602	Okay	No Plate	10

Shear					Shear Capacity Check		C_{perp} Stress Variables								C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
3,405	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	24%	Occupancy	0.8	72	294	7.5	0.5	1.5	4.31	8	1	0	0	688	939	1,512	85	Yes	0.091	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
3,699	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	30%	Occupancy	0.8	Strong	1,295	156	283	6.91	17,667	1,290	12,130	393	0.32	0.04	Sufficient	Sufficient	0.38	0.26	Sufficient	Sufficient

Tension				Tension Calcs			Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{gv} (psi)	F_{yb} (psi)	R_e	k_3	k_θ	R_d (I_{str}, I_s)	R_d (III_s)
4,459	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	8%	Occupancy	0.8	63	821	2	2.75	1	2	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
9.5	1.5	11	396	Yes	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	3,262	No	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	6	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions			Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-2,833	14	15	488
Load Case	3	1	1	6

Compression					Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$	f_c (psi)
2,833	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	9%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	112

Shear					Shear Capacity Check		C_{perp} Stress Variables								C_{perp} Capacity					
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
				Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	2,003	1,040	1,144	330	Yes	0.318	Sufficient

Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension		
				L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2

NDS 2018 FRAME CALCULATIONS

15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.01	0.01	Sufficient	Sufficient	0.02	-0.01	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{mr}, I_s)	R_d (III_s)
488	L6 - 0.9D+1.0W	Sufficient	2%	Occupancy	1	19	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ib} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	$C_Δ$	K_Y	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	52	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.239	Sufficient

		Member Properties																			Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	7	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																				
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Etmin}	$Φ_c$	$Φ_{c,perp}$	$Φ_b$	$Φ_v$	$Φ_t$	$Φ_{tmin}$	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-7,209	14	-15	0
	3	1	1	#N/A

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
7,209	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	23%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	284

		Shear				Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,shank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	5,098	1,040	1,144	841	Yes	0.808	Sufficient

		Bending				Beam Stability Factor Calculations					Stress	Bending and Axial Compression					Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.06	0.03	Sufficient	Sufficient	0.01	0.01	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{mr}, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ib} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	$C_Δ$	K_Y	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

		Member Properties																			Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	8	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																				
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Etmin}	$Φ_c$	$Φ_{c,perp}$	$Φ_b$	$Φ_v$	$Φ_t$	$Φ_{tmin}$	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-6,085	14	15	760
	3	1	1	6

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
6,085	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	19%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	240

		Shear				Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,shank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	4,303	1,040	1,144	710	Yes	0.682	Sufficient

		Bending				Beam Stability Factor Calculations					Stress	Bending and Axial Compression					Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.04	0.02	Sufficient	Sufficient	0.03	-0.02	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_{mr}, I_s)	R_d (III_s)
760	L6 - 0.9D+1.0W	Sufficient	3%	Occupancy	1	30	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes							Dowel Design Factors					Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ib} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	$C_Δ$	K_Y	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	81	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.373	Sufficient

		Member Properties																			Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	9	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																				
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Etmin}	$Φ_c$	$Φ_{c,perp}$	$Φ_b$	$Φ_v$	$Φ_t$	$Φ_{tmin}$	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-6,085	14	-15	0
	3	1	1	#N/A

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
				Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	240

		Shear				Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,shank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$

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V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	4,303	1,040	1,144	710	Yes	0.682	Sufficient

		Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.04	0.02	Sufficient	Sufficient	0.01	0.01	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

						Member Properties												Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in³)	S_{Weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	10	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area		Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)	Loads	-7,209	14	15	668
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38	Load Case	3	1	1	6

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
7,209	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	23%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	284

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity							
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	5,098	1,040	1,144	841	Yes	0.808	Sufficient

		Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.06	0.03	Sufficient	Sufficient	0.03	-0.02	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
668	L6 - 0.9D+1.0W	Sufficient	2%	Occupancy	1	26	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	71	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.328	Sufficient

						Member Properties												Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in³)	S_{Weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	11	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	1.00	1.05	1	1	1	0.973766096	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area		Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)	Loads	-2,833	14	-15	0
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38	Load Case	3	1	1	#N/A

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
2,833	L3 - 1.2D+1.6(Lr or S or R)+(L or 0.5W)	Sufficient	9%	Occupancy	0.8	1	54.0	7.4	10,418	1,270	0.8	1,237	31,383	Okay	Plate Req	112

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity							
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
14	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	1	220	3.5	0.5	1.5	4.31	6	3	3	45	2,003	1,040	1,144	330	Yes	0.318	Sufficient

		Bending					Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
15	L1 - 1.4D	Sufficient	1%	Occupancy	0.6	Strong	1,020	54	110	8.06	12,987	1,016	2,596	6	0.01	0.01	Sufficient	Sufficient	0.01	0.01	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{tw}, I_s)	R_d (III_s)
0	L1 - 1.4D	Sufficient	0%	Occupancy	0.6	0	646	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	1,223	Yes	0.000	Sufficient

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								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	$F_{c,perp}$ (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Long	1	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	10 x 10	10	10	9.5	9.5	143	143	90.25	19.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1	1	1	1	0.518419875	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
1.25	7.6	2	19.00	4	1.5	2	12.00	9.5	1	2	16.00	9.5	0.5	0	0.00	43.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-2,158	-3,226	6,424	0
Load Case	6	6	6	#N/A

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
2,158	L6 - 0.9D+1.0W	Sufficient	6%	Occupancy	1	1	234.0	24.6	953	1,512	0.8	784	33,902	Okay	No Plate	50

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity				
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
3,226	L6 - 0.9D+1.0W	Sufficient	15%	Occupancy	1	54	367	11.5	0.75	0.1	0.29	9	1	0	0	2,158	939	1,512	242	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{Allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
6,424	L6 - 0.9D+1.0W	Sufficient	33%	Occupancy	1	Strong	1,619	234	410	6.57	19,554	1,612	19,196	539	0.36	0.05	Sufficient	Sufficient	0.33	0.33	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_m, I_s)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,026	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

		Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity		
		L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	φ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
		9.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	$F_{c,perp}$ (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Long	2	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	12 x 12	12	12	11.5	11.5	253	253	132.25	19.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1	1	1	1	0.662752205	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
1.25	7.6	2	19.00	4	1.5	2	12.00	11.5	1	2	20.00	11.5	0.5	0	0.00	81.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-3,000	-4,077	13,271	0
Load Case	6	6	6	#N/A

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
3,000	L6 - 0.9D+1.0W	Sufficient	4%	Occupancy	1	1	234.0	20.3	1,396	1,512	0.8	1,002	81,419	Okay	No Plate	37

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity				
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
4,077	L6 - 0.9D+1.0W	Sufficient	13%	Occupancy	1	46	367	11.5	2	0.1	0.29	23	1	0	0	3,000	939	1,512	129	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{Allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
13,271	L6 - 0.9D+1.0W	Sufficient	39%	Occupancy	1	Strong	1,619	234	416	6.01	23,329	1,613	34,077	628	0.40	0.03	Sufficient	Sufficient	0.39	0.39	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'$_t$	PR	L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_m, I_s)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,026	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

		Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity		
		L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'$_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	φ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
		11.5	0.1	1	0	No	Sufficient	1,259	2,782	1,705	945	945	1	1	1	1	3.32	0.65	2,039	No	0.000	Sufficient

								Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	$F_{c,perp}$ (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	3	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	12 x 12	12	12	11.5	11.5	253	253	132.25	19.5	No	No	No	No

Design Factors																							
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1	1	1	1	0.662752205	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
1.25	7.6	2	19.00	4	1.5	2	12.00	11.5	1	2	20.00	11.5	0.5	0	0.00	81.25

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-3,958	-4,098	12,983	0
Load Case	6	6	6	#N/A

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	P_u<P_{Allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_c* (psi)	c	F'$_c$ (psi)	P_{Allow} (lbf)	F'$_c$ < F_c*	F'$_c$ > (0.75)(F_c*)	f_c (psi)
3,958	L6 - 0.9D+1.0W	Sufficient	5%	Occupancy	1	1	234.0	20.3	1,396	1,512	0.8	1,002	81,419	Okay	No Plate	49

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity				
V_u (lbf)	Load Case	f_v < F'$_v$	PR	L from? for λ	λ	f_v (psi)	F'$_v$ (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	F'$_{c,perp}$ (psi)	F'$_{c,bank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / F'$_{c,perp,min}$	f_{cperp} < F'$_{c,perp,min}$
4,098	L6 - 0.9D+1.0W	Sufficient	13%	Occupancy	1	46	367	11.5	2	0.1	0.29	23	1	0	0	3,958	939	1,512	170	No	0.000	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'$_{b'}$ (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'$_b$ (psi)	M_{Allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
12,983	L6 - 0.9D+1.0W	Sufficient	38%	Occupancy	1	Strong	1,619	234	416	6.01	23,329	1,613	34,077	615	0.40	0.04	Sufficient	Sufficient	0.38	0.38	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
				L from? for λ	λ	f_t (psi)	F'$_t$ (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_Θ	R_d (I_m, I_s)	R_d (III_s)
				Occupancy	1	0	1,026	2	2.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.278	1.25	5.0	4.0

NDS 2018 FRAME CALCULATIONS

Tenon Tension Capacity

L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$
11.5	0.1	1	0	No	Sufficient

Yield Modes

Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)
1,259	2,782	1,705	945	945

Dowel Design Factors

C_M	C_t	C_g	C_Δ	K_θ	ϕ
1	1	1	1	3.32	0.65

Dowel Capacity

T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
2,039	No	0.000	Sufficient

Member Properties

Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)
Long	4	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	10 x 10	10	10	9.5	9.5	143	143	90.25	19.5

Design Factor References

Flat Bending	Moist > 19%	Incise	Rep Member
No	No	No	No

Design Factors

C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	1.00	1	1	1	1	0.518419875	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions

Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)
1.25	7.6	2	19.00

Mortise Dimensions

Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)
4	1.5	2	12.00

Peg Dimensions

Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)
9.5	1	2	16.00

Bolt Dimensions

Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)
9.5	0.5	0	0.00

Design Area

A_g (in^2)
43.25

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-3,715	-2,766	6,753	351
	6	6	6	6

Compression

P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ
3,715	L6 - 0.9D+1.0W	Sufficient	11%	Occupancy	1

Column Stability Calculations

K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c
1	234.0	24.6	953	1,512	0.8

Axial Buckling Cap.

F'_c (psi)	P_{allow} (lbf)
784	33,902

Bearing Capacity

$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$
Okay	No Plate

C Stress

f_c (psi)
86

Shear

V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ
2,766	L6 - 0.9D+1.0W	Sufficient	13%	Occupancy	1

Shear Capacity Check

f_v (psi)	F'_v (psi)
46	367

C_{perp} Stress Variables

L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)
11.5	2	0.1	0.29	23

C_{perp} Capacity

Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{cperp} / F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
1	0	0	3,715	939	1,512	160	No	0.000	Sufficient

Bending

M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ
6,753	L6 - 0.9D+1.0W	Sufficient	35%	Occupancy	1

Beam Stability Factor Calculations

Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)
Strong	1,619	234	410	6.57	19,554	1,612	19,196

Stress

f_b (psi)
567

Bending and Axial Compression

Calc 1	Calc 2	Check 1	Check 2
0.40	0.09	Sufficient	Sufficient

Bending and Axial Tension

Calc 1	Calc 2	Check 1	Check 2
0.36	0.35	Sufficient	Sufficient

Tension

T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ
351	L6 - 0.9D+1.0W	Sufficient	1%	Occupancy	1

Tension Calcs

f_t (psi)	F'_t (psi)
8	1,026

Mortise and Tenon Connection Variables

$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ
2	2.75	1	1	0.73	0.50	90

Dowel and Peg Strengths

F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{gv} (psi)	F_{yb} (psi)
3,149	2,529	2,529	2,105	17,413

Yield Mode Constants

R_e	k_3	k_θ	R_d (I_{lm}, I_s)	R_d (III_s)
1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity

L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$
9.5	0.1	1	413	No	Sufficient

Yield Modes

Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)
1,259	2,782	1,705	945	945

Dowel Design Factors

C_M	C_t	C_g	C_Δ	K_θ	ϕ
1	1	1	1	3.32	0.65

Dowel Capacity

T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
2,039	No	0.000	Sufficient

Member Properties

Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)
Trans	5	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	6 x 8	6	8	5.5	7.5	52	38	41.25	14

Design Factor References

Flat Bending	Moist > 19%	Incise	Rep Member
No	No	No	No

Design Factors

C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.630851575	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions

Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)
1	3.5	1	3.50

Mortise Dimensions

Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)
4	1.5	1	6.00

Peg Dimensions

Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)
7.5	1	1	6.00

Bolt Dimensions

Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)
7.5	0.5	0	0.00

Design Area

A_g (in^2)
25.75

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-5,043	1,715	-5,186	926
	6	6	6	6

Compression

P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ
5,043	L6 - 0.9D+1.0W	Sufficient	23%	Occupancy	1

Column Stability Calculations

K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c
1	168.0	22.4	1,152	1,361	0.8

Axial Buckling Cap.

F'_c (psi)	P_{allow} (lbf)
858	22,105

Bearing Capacity

$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$
Okay	No Plate

C Stress

f_c (psi)
196

Shear

V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ
1,715	L6 - 0.9D+1.0W	Sufficient	17%	Occupancy	1

Shear Capacity Check

f_v (psi)	F'_v (psi)
62	367

C_{perp} Stress Variables

L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)
7.5	0.5	1.5	4.31	8

C_{perp} Capacity

Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{cperp} / F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
1	0	0	5,043	939	1,361	625	Yes	0.666	Sufficient

Bending

M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ
5,186	L6 - 0.9D+1.0W	Sufficient	61%	Occupancy	1

Beam Stability Factor Calculations

Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)
Strong	1,984	168	296	8.57	11,484	1,963	8,436

Stress

f_b (psi)
1,207

Bending and Axial Compression

Calc 1	Calc 2	Check 1	Check 2
0.79	0.18	Sufficient	Sufficient

Bending and Axial Tension

Calc 1	Calc 2	Check 1	Check 2
0.65	0.60	Sufficient	Sufficient

Tension

T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ
926	L6 - 0.9D+1.0W	Sufficient	4%	Occupancy	1

Tension Calcs

f_t (psi)	F'_t (psi)
36	964

Mortise and Tenon Connection Variables

$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ
2	2.75	1	2	0.73	0.50	90

Dowel and Peg Strengths

F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{gv} (psi)	F_{yb} (psi)
3,149	2,529	2,529	2,105	17,413

Yield Mode Constants

R_e	k_3	k_θ	R_d (I_{lm}, I_s)	R_d (III_s)
1.24	1.278	1.25	5.0	4.0

Tenon Tension Capacity

L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$
7.5	1.5	8	112	Yes	Sufficient

Yield Modes

Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)
1,259	2,782	1,705	945	945

Dowel Design Factors

C_M	C_t	C_g	C_Δ	K_θ	ϕ
1	1	1	1	3.32	0.65

Dowel Capacity

T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
4,078	No	0.000	Sufficient

Member Properties

Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)
Trans	6	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	6 x 8	6	8	5.5	7.5	52	38	41.25	14

Design Factor References

Flat Bending	Moist > 19%	Incise	Rep Member
No	No	No	No

Design Factors

C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.630851575	1	1.068181818	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions

Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)
1	3.5	1	3.50

Mortise Dimensions

Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)
4	1.5	1	6.00

Peg Dimensions

Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)
7.5	1	1	6.00

Bolt Dimensions

Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)
7.5	0.5	0	0.00

Design Area

A_g (in^2)
25.75

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-3,773	1,833	-5,541	2,817
	6	6	6	6

Compression

P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ
3,773	L6 - 0.9D+1.0W	Sufficient	17%	Occupancy	1

Column Stability Calculations

K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c
1	168.0	22.4	1,152	1,361	0.8

Axial Buckling Cap.

F'_c (psi)	P_{allow} (lbf)
858	22,105

Bearing Capacity

$F'_c < F_{c^*}$	$F'_c > (0.75)(F_{c^*})$
Okay	No Plate

C Stress

f_c (psi)
147

Shear

V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ
				Occupancy	1

Shear Capacity Check

f_v (psi)	F'_v (psi)
67	367

C_{perp} Stress Variables

L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)
5.5	0.5	1.5	4.31	7

C_{perp} Capacity

Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{cperp} / F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
3	3	45	2,668	1,003	1,155	378	Yes	0.376	Sufficient

Beam Stability Factor Calculations

L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)
Occupancy	1								

Stress

f_b (psi)

Bending and Axial Compression

Calc 1	Calc 2	Check 1	Check 2

Bending and Axial Tension

Calc 1	Calc 2	Check 1	Check 2

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5,541	L6 - 0.9D+1.0W	Sufficient	66%	Occupancy	1	Strong	1,984	168	296	8.57	11,484	1,963	8,436	1,290	0.78	0.14	Sufficient	Sufficient	0.76	0.60	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_m, I_s)	R_d (III_s)
2,817	L6 - 0.9D+1.0W	Sufficient	11%	Occupancy	1	109	964	1.5	3.75	1	2	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.111	1.25	5.0	4.0

	Tenon Tension Capacity						Yield Modes							Dowel Design Factors				Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ib} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_d	C_g	$K_θ$	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	1.5	8	341	Yes	Sufficient	945	3,794	2,022	945	945	1	1	1	1	3.32	0.65	4,077	Yes	0.691	Sufficient

							Member Properties												Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	7	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	6 x 8	6	8	5.5	7.5	52	38	41.25	14	No	No	No	No

Design Factors																					
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Etmin}	$ϕ_c$	$ϕ_{c,perp}$	$ϕ_b$	$ϕ_v$	$ϕ_t$	$ϕ_{tmin}$	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.630851575	1	1.068181818	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
1	3.5	1	3.50	4	1.5	1	6.00	7.5	1	1	6.00	7.5	0.5	0	0.00	25.75

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-2,064	1,702	5,066	3,835
Load Case	6	6	6	6

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
2,064	L6 - 0.9D+1.0W	Sufficient	9%	Occupancy	1	1	168.0	22.4	1,152	1,361	0.8	858	22,105	Okay	No Plate	80

		Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{c,perp} < F'_{c,perp,min}$
1,702	L6 - 0.9D+1.0W	Sufficient	17%	Occupancy	1	62	367	5.5	0.5	1.5	4.31	7	3	3	45	1,459	1,003	1,155	207	Yes	0.206	Sufficient

		Bending				Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
5,066	L6 - 0.9D+1.0W	Sufficient	60%	Occupancy	1	Strong	1,984	168	296	8.57	11,484	1,963	8,436	1,179	0.65	0.08	Sufficient	Sufficient	0.75	0.52	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_m, I_s)	R_d (III_s)
3,835	L6 - 0.9D+1.0W	Sufficient	15%	Occupancy	1	149	964	1.5	3.75	1	2	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.111	1.25	5.0	4.0

	Tenon Tension Capacity						Yield Modes							Dowel Design Factors				Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ib} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_d	C_g	$K_θ$	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.5	1.5	8	465	Yes	Sufficient	945	3,794	2,022	945	945	1	1	1	1	3.32	0.65	4,077	Yes	0.941	Sufficient

							Member Properties												Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	8	DOUGLAS FIR-LARCH No2	Table4D_BeamsStringers	600	875	170	625	425	0.50	1,300,000	470,000	8 x 10	8	10	7.5	9.5	113	89	71.25	40	No	No	No	No

Design Factors																					
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Etmin}	$ϕ_c$	$ϕ_{c,perp}$	$ϕ_b$	$ϕ_v$	$ϕ_t$	$ϕ_{tmin}$	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.98	1	1	1	1	0.167910507	1	1	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
1	3.5	1	3.50	4	1.5	1	6.00	9.5	1	1	8.00	9.5	0.5	0	0.00	53.75

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-2,410	1,078	3,040	1,219
Load Case	6	6	6	6

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
2,410	L6 - 0.9D+1.0W	Sufficient	21%	Occupancy	1	1	480.0	50.5	226	1,296	0.8	218	11,697	Okay	No Plate	45

		Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{c,perp}$ / $F'_{c,perp,min}$	$f_{c,perp} < F'_{c,perp,min}$
1,078	L6 - 0.9D+1.0W	Sufficient	6%	Occupancy	1	23	367	7.5	0.5	1.5	4.31	8	3	3	45	1,704	939	1,089	211	Yes	0.225	Sufficient

		Bending				Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension		
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	l_e (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
3,040	L6 - 0.9D+1.0W	Sufficient	17%	Occupancy	1	Strong	1,889	480	811	11.70	6,161	1,849	17,387	323	0.26	0.20	Sufficient	Sufficient	0.20	0.16	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths						Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_m (psi)	F_{yb} (psi)	F_{yb} (psi)	R_e	k_3	$k_θ$	R_d (I_m, I_s)	R_d (III_s)
1,219	L6 - 0.9D+1.0W	Sufficient	2%	Occupancy	1	23	918	1.5	4.75	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.034	1.25	5.0	4.0

	Tenon Tension Capacity						Yield Modes							Dowel Design Factors				Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{im} (lb)	Z_{is} (lb)	Z_{ib} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_d	C_g	$K_θ$	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
9.5	1.5	13	96	Yes	Sufficient	945	4,806	2,383	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.598	Sufficient

							Member Properties												Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	9	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																					
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Etmin}	$ϕ_c$	$ϕ_{c,perp}$	$ϕ_b$	$ϕ_v$	$ϕ_t$	$ϕ_{tmin}$	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_v (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	4,090	9	10	4,108
Load Case	6	6	6	6

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
				L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
				Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	161

						Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								

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V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	2,892	1,040	1,257	477	Yes	0.459	Sufficient

		Bending				Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.01	0.02	Sufficient	Sufficient	0.15	-0.09	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (l_{tw}, l_s)	R_d (III_s)
4,108	L6 - 0.9D+1.0W	Sufficient	15%	Occupancy	1	162	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	438	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	2.015	Insufficient

						Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{strong} (in³)	S_{weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	10	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{FB}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-4,352	9	-10	0
Load Case	6	6	6	#N/A

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
4,352	L6 - 0.9D+1.0W	Sufficient	11%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	172

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity							
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	3,077	1,040	1,257	508	Yes	0.488	Sufficient

		Bending				Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.01	0.02	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (l_{tw}, l_s)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.000	Sufficient

						Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{strong} (in³)	S_{weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	11	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{FB}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	4,542	9	10	4,560
Load Case	6	6	6	6

		Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity	C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F_{c*}$	$F'_c > (0.75)(F_{c*})$	f_c (psi)
4,542	L6 - 0.9D+1.0W	Sufficient	12%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	179

		Shear				Shear Capacity Check		C_{perp1} Stress Variables							C_{perp} Capacity							
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in²)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	3,212	1,040	1,257	530	Yes	0.509	Sufficient

		Bending				Beam Stability Factor Calculations							Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b*} (psi)	I_x (in)	I_y (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.02	0.02	Sufficient	Sufficient	0.17	-0.10	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants			
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (l_{tw}, l_s)	R_d (III_s)
4,560	L6 - 0.9D+1.0W	Sufficient	17%	Occupancy	1	180	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in²)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lim} (lb)	Z_{ll} (lb)	Z_{lll} (lb)	Z_{lv} (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_F	φ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
7.25	1.5	9	486	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	2.237	Insufficient

						Member Properties													Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{strong} (in³)	S_{weak} (in³)	A_{member} (in²)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	12	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{FB}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in²)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in²)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in²)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in²)	A_g (in²)
				4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-4,779	9	-10	0
Load Case	6	6	6	#N/A

NDS 2018 FRAME CALCULATIONS

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F'_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F'_{c^*}$	$F'_c > (0.75)(F'_{c^*})$	f_c (psi)
4,779	L6 - 0.9D+1.0W	Sufficient	12%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	188

		Shear				Shear Capacity Check		C_{perp1} Stress Variables								C_{perp} Capacity						
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{cperp} / F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	3,379	1,040	1,257	557	Yes	0.536	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.02	0.02	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yt} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{tm}, I_t)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.000	Sufficient

				Member Properties														Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	13	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_n (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	4,077	9	10	4,095
Load Case	6	6	6	6

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F'_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F'_{c^*}$	$F'_c > (0.75)(F'_{c^*})$	f_c (psi)
4,077	L6 - 0.9D+1.0W	Sufficient	10%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	161

		Shear				Shear Capacity Check		C_{perp1} Stress Variables								C_{perp} Capacity						
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{cperp} / F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	2,883	1,040	1,257	476	Yes	0.457	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.01	0.02	Sufficient	Sufficient	0.15	-0.09	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yt} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{tm}, I_t)	R_d (III_s)
4,095	L6 - 0.9D+1.0W	Sufficient	15%	Occupancy	1	161	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.25	1.5	9	437	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	2.009	Insufficient

				Member Properties														Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	14	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_n (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-4,266	9	-10	0
Load Case	6	6	6	#N/A

		Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity		C Stress
P_u (lbf)	Load Case	$P_u < P_{allow}$	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F'_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	$F'_c < F'_{c^*}$	$F'_c > (0.75)(F'_{c^*})$	f_c (psi)
4,266	L6 - 0.9D+1.0W	Sufficient	11%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	168

		Shear				Shear Capacity Check		C_{perp1} Stress Variables								C_{perp} Capacity						
V_u (lbf)	Load Case	$f_v < F'_v$	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	$f_{cperp} / F'_{c,perp,min}$	$f_{cperp} < F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	3,017	1,040	1,257	498	Yes	0.478	Sufficient

		Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	$M_u < M_{allow}$	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.01	0.02	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

		Tension				Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	$f_t < F'_t$	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yt} (psi)	F_{yb} (psi)	R_e	k_3	k_6	R_d (I_{tm}, I_t)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

	Tenon Tension Capacity					Yield Modes						Dowel Design Factors						Dowel Capacity			
	L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon} < F'_t$	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lb} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	$T_u < T_n$
	7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.000	Sufficient

				Member Properties														Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	15	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

				C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
				1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

NDS 2018 FRAME CALCULATIONS

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	1,585	9	10	1,603
	6	6	6	6

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	F'_c < F_{c^*}	F'_c > (0.75)(F_{c^*})	f_c (psi)
1,585	L6 - 0.9D+1.0W	Sufficient	4%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	62

Shear				Shear Capacity Check			C_{perp1} Stress Variables					C_{perp} Capacity								
V_u (lbf)	Load Case	f_v < F'_v	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	f_{cperp} < $F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	1,121	1,040	1,257	185	Yes	0.178	Sufficient

Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.00	0.01	Sufficient	Sufficient	0.06	-0.04	Sufficient	Sufficient

Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'_t	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_4	R_d (I_{mr}, I_s)	R_d (III_s)
1,603	L6 - 0.9D+1.0W	Sufficient	6%	Occupancy	1	63	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes							Dowel Design Factors				Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'_t	Z_{im} (lb)	Z_{it} (lb)	Z_{is} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_d	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.25	1.5	9	171	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.786	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	16	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	-609	9	-10	0
	6	6	6	#N/A

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	F'_c < F_{c^*}	F'_c > (0.75)(F_{c^*})	f_c (psi)
609	L6 - 0.9D+1.0W	Sufficient	2%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	24

Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								
V_u (lbf)	Load Case	f_v < F'_v	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	f_{cperp} < $F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	431	1,040	1,257	71	Yes	0.068	Sufficient

Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.00	0.00	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'_t	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_4	R_d (I_{mr}, I_s)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes							Dowel Design Factors				Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'_t	Z_{im} (lb)	Z_{it} (lb)	Z_{is} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_d	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.000	Sufficient

		Member Properties																	Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	17	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors																						
C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	ϕ_c	$\phi_{c,perp}$	ϕ_b	ϕ_v	ϕ_t	ϕ_{tmin}	E' (psi)	E'_{min} (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

Loads	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Load Case	2,962	9	10	2,981
	6	6	6	6

Compression				Column Stability Calculations						Axial Buckling Cap.		Bearing Capacity	C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F_{c^*} (psi)	c	F'_c (psi)	P_{allow} (lbf)	F'_c < F_{c^*}	F'_c > (0.75)(F_{c^*})	f_c (psi)
2,962	L6 - 0.9D+1.0W	Sufficient	8%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	117

Shear				Shear Capacity Check		C_{perp1} Stress Variables						C_{perp} Capacity								
V_u (lbf)	Load Case	f_v < F'_v	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	f_{cperp} < $F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	2,094	1,040	1,257	345	Yes	0.332	Sufficient

Bending				Beam Stability Factor Calculations						Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'_{b^*} (psi)	l_u (in)	l_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.01	0.01	Sufficient	Sufficient	0.11	-0.07	Sufficient	Sufficient

Tension				Tension Calcs		Mortise and Tenon Connection Variables							Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'_t	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{t,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yv} (psi)	F_{yb} (psi)	R_e	k_3	k_4	R_d (I_{mr}, I_s)	R_d (III_s)
2,981	L6 - 0.9D+1.0W	Sufficient	11%	Occupancy	1	117	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes							Dowel Design Factors				Dowel Capacity			
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'_t	Z_{im} (lb)	Z_{it} (lb)	Z_{is} (lb)	Z_y (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_d	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.25	1.5	9	318	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	1.462	Insufficient

		Member Properties																	Design Factor References			
...tion				F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member

NDS 2018 FRAME CALCULATIONS

Trans	18	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors

C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	Φ_c	$\Phi_{c,perp}$	Φ_b	Φ_v	Φ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-1,676	9	-10	0
Load Case	6	6	6	#N/A

Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F'_c* (psi)	c	F'_c (psi)	P_{allow} (lbf)	F'_c < F'_c*	F'_c > (0.75)(F'_c*)	f_c (psi)
1,676	L6 - 0.9D+1.0W	Sufficient	4%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	66

Shear						Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity							
V_u (lbf)	Load Case	f_v < F'_v	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	f_{cperp} < $F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	1,185	1,040	1,257	195	Yes	0.188	Sufficient

Bending								Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'_b* (psi)	I_e (in)	I_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.00	0.01	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

Tension						Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'_t	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{im}, I_s)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'_t	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.25	1.5	9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.000	Sufficient

Member Properties																			Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	19	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors

C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	Φ_c	$\Phi_{c,perp}$	Φ_b	Φ_v	Φ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	2,528	9	10	2,546
Load Case	6	6	6	6

Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F'_c* (psi)	c	F'_c (psi)	P_{allow} (lbf)	F'_c < F'_c*	F'_c > (0.75)(F'_c*)	f_c (psi)
2,528	L6 - 0.9D+1.0W	Sufficient	6%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	100

Shear						Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity							
V_u (lbf)	Load Case	f_v < F'_v	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	f_{cperp} < $F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	1,788	1,040	1,257	295	Yes	0.284	Sufficient

Bending								Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'_b* (psi)	I_e (in)	I_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.01	0.01	Sufficient	Sufficient	0.10	-0.06	Sufficient	Sufficient

Tension						Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'_t	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{im}, I_s)	R_d (III_s)
2,546	L6 - 0.9D+1.0W	Sufficient	9%	Occupancy	1	100	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

Tenon Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity		
L_t (in)	W_{tenon} (in)	A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'_t	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
7.25	1.5	9	272	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	1.249	Insufficient

Member Properties																			Design Factor References			
Frame	Member	Species and Grade	Size Classification	F_c (psi)	F_b (psi)	F_v (psi)	F_{cperp} (psi)	F_t (psi)	SG	E (psi)	E_{min} (psi)	Nominal	b_{nom} (in)	d_{nom} (in)	b (in)	d (in)	S_{Strong} (in^3)	S_{Weak} (in^3)	A_{member} (in^2)	Length (ft)	Flat Bending	Moist > 19%	Incise	Rep Member
Trans	20	DOUGLAS FIR-LARCH No2	Table4D_PostTimbers	700	750	170	625	475	0.50	1,300,000	470,000	4 x 8	4	8	3.5	7.25	31	15	25.38	4.5	No	No	No	No

Design Factors

C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	C_P	C_T	C_b	K_{Fc}	$K_{Fc,perp}$	K_{Fb}	K_{Fv}	K_{Ft}	K_{Emin}	Φ_c	$\Phi_{c,perp}$	Φ_b	Φ_v	Φ_t	Φ_{Emin}	E' (psi)	E'$_{min}$ (psi)	# of Members
1	1	0.99	1.05	1	1	1	0.966604909	1	1.107142857	2.4	1.67	2.54	2.88	2.7	1.76	0.9	0.9	0.85	0.75	0.8	0.85	1,300,000	703,120	1

Housing Dimensions				Mortise Dimensions				Peg Dimensions				Bolt Dimensions				Design Area
Depth (in)	Width (in)	# Housings	$A_{housing}$ (in^2)	Depth (in)	Width (in)	# Tenons	$A_{mortise}$ (in^2)	Length (in)	Diameter (in)	# Pegs	A_{peg} (in^2)	Length (in)	Diameter (in)	# Bolts	A_{bolt} (in^2)	A_g (in^2)
0.75	3.5	0	0.00	4	1.5	0	0.00	7.25	1	0	0.00	7.25	0.5	0	0.00	25.38

	Compression (lb)	Shear (lb)	Bending (ft-lb)	Tension (lb)
Loads	-1,061	9	-10	0
Load Case	6	6	6	#N/A

Compression				Column Stability Calculations					Axial Buckling Cap.		Bearing Capacity		C Stress
P_c (lbf)	Load Case	P_c<P_{allow}	PR	L from? for λ	λ	K_e	l_e (in)	l_e/d	F_{cE} (psi)	F'_c* (psi)	c	F'_c (psi)	P_{allow} (lbf)	F'_c < F'_c*	F'_c > (0.75)(F'_c*)	f_c (psi)
1,061	L6 - 0.9D+1.0W	Sufficient	3%	Occupancy	1	1	54.0	7.4	10,418	1,588	0.8	1,535	38,940	Okay	Plate Req	42

Shear						Shear Capacity Check		C_{perp1} Stress Variables					C_{perp} Capacity							
V_u (lbf)	Load Case	f_v < F'_v	PR	L from? for λ	λ	f_v (psi)	F'_v (psi)	L_b (in)	W_b (in)	W_{tenon} (in)	$A_{additional}$	$A_{bearing}$ (in^2)	Vert (ft)	Horiz (ft)	Angle (deg)	$P_{u,angle}$ (lbf)	$F'_{c,perp}$ (psi)	$F'_{c,hank}$ (psi)	$f_{c,perp}$ (psi)	Check?	f_{cperp} / $F'_{c,perp,min}$	f_{cperp} < $F'_{c,perp,min}$
9	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	1	367	3.5	0.5	1.5	4.31	6	3	3	45	750	1,040	1,257	124	Yes	0.119	Sufficient

Bending								Beam Stability Factor Calculations					Stress	Bending and Axial Compression				Bending and Axial Tension			
M_u (ft-lbf)	Load Case	M_u < M_{allow}	PR	L from? for λ	λ	Bending Axis	F'_b* (psi)	I_e (in)	I_e (in)	R_B	F_{bE} (psi)	F'_b (psi)	M_{allow} (ft-lbf)	f_b (psi)	Calc 1	Calc 2	Check 1	Check 2	Calc 1	Calc 2	Check 1	Check 2
10	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	Strong	1,700	54	110	8.06	12,987	1,688	4,312	4	0.00	0.00	Sufficient	Sufficient	0.00	0.00	Sufficient	Sufficient

Tension						Tension Calcs		Mortise and Tenon Connection Variables						Dowel and Peg Strengths					Yield Mode Constants				
T_u (lbf)	Load Case	f_t < F'_t	PR	L from? for λ	λ	f_t (psi)	F'_t (psi)	$l_{m,Tenon}$ (in)	$l_{s,cheek}$ (in)	D_{peg} (in)	# Pegs	G_p	G_T	Θ	F_{em} $F_{e,para}$ (psi)	$F_{e,perp}$ (psi)	F_{es} (psi)	F_{yp} (psi)	F_{yb} (psi)	R_e	k_3	K_Θ	R_d (I_{im}, I_s)	R_d (III_s)
0	L6 - 0.9D+1.0W	Sufficient	0%	Occupancy	1	0	1,077	1.5	3.63	1	1	0.73	0.50	90	3,149	2,529	2,529	2,105	17,413	1.24	1.125	1.25	5.0	4.0

non Tension Capacity						Yield Modes					Dowel Design Factors						Dowel Capacity		
)		A_t (in^2)	$f_{t,tenon}$ (psi)	Check?	$f_{t,tenon}$ < F'_t	Z_{lm} (lb)	Z_{ls} (lb)	Z_{lm} (lb)	Z_v (lb)	Z_{min} (lb)	C_M	C_t	C_g	C_Δ	K_θ	ϕ	T_n (lbf)	Check?	T_u / T_n	T_u < T_n
		9	0	Yes	Sufficient	945	3,668	1,979	945	945	1	1	1	1	3.32	0.65	2,038	Yes	0.000	Sufficient

NDS 2018 FRAME CALCULATIONS

Isolated Footing Calculations

Column Properties														
$\phi_{Compression}$	α	$\rho_{g,\ assumed}$	$A_{g,\ min}$ (in^2)	Diameter (in)	b (in)	Type	A_g (in^2)	# of Long. Bars	Long. Bar Size (#)	A_s (in^2)	$A_s > A_{s,\ req'd}$	$A_{s,\ min}$ (in^2)	ρ_g	0.08 > A_s > 0.01	ϕP_n
0.65	0.8	0.02	0.00	16	16	Square	256	8	4	1.57	Sufficient	-9.96	0.0061	Insufficient	386,382

Loaded Area					Transverse Reinforcement						Check	Clear Bar Spacing			
b_{loaded} (in)	w_{loaded} (in)	A_{loaded} (in^2)	ϕB_n	$P_u < \phi B_n$	Tie Bar Size (#)	Bar Size Check	48 x Tie Bar (in)	16 x Long. Bar (in)	Least Col. Dim. (in)	Tie Bar Spacing (in)	# Long Bars	Conc. Cover (in)	# Long. Bars	Spacing (in)	Check
12	12	144	318,240	Sufficient	3	Sufficient	18	8	16	8	Sufficient	2.0	3	4.88	Sufficient

Center 12x12 Post - 16x16 Pedestal

Wall and Soil Properties										Soil Pressure Equivalent (q_e)					
b_{column} (in)	H_{Column} (ft)	Bottom of Footing (in)	γ_{soil} (pcf):	$\gamma_{concrete}$ (pcf)	q_a (psf)	f'$_c$ (psi)	f_y (psi)	ε_y	E_s (psi)	Soil above Footing (in)	$P_{D\ soil}$ (psf)	Seed $t_{footing}$ (in)	$P_{D,column}$ (psf)	$P_{D,footing}$ (psf)	q_e (psf)
16	3.1667	48	100	150	2,500	3,000	60,000	2.07E-03	2.90E+07	38	317	**10.00**	317	125	2,058

Footing Area					Design Bearing			
$Footing_{Area}$ (ft^2)	Use $b_{FootingWidth}$ (ft)	$b_{FootingWidth}$ (in)	$Footing_{Area}$ (ft^2)	Area Check	q_u (psf)	$Cover_{Steel}$ (in)	ϕ_{factor}	$Circular_{Eq}$ (in)
10.91	**3.50**	42.0	12.3	Sufficient	3,410	3.0	0.75	47.39

Moment Consideration								
Moment (ft-lb)	$P_{unfactored}$ (lbf)	I (ft^4)	c (in)	e (in)	a (in)	q_{min} (psf)	q_{max} (psf)	Check
13,386	16,498	13	21.0	7.0	14	526	224	Sufficient

Two-Way Shear

V_{u2} (lbs)	b_O (in)	Column Location	α_S	β_c	$d_{2,1}$ (in)	$d_{2,2}$ (in)	$d_{2,3}$ (in)	d_2 (in)	Thickness Check
29,245	92	Interior	40	2	1.93	0.00	0.00	1.93	Sufficient

One-Way Shear

Design Shear	Calculated Footing Thickness			Final Footing Thickness	
V_{u1} (lbs)	$d_{1,calc}$ (in)	Calc $t_{1,footing}$ (in)	Thickness Check	$t_{1,footing}$ (in)	d_1 (in)
5,967	1.73	4.73	Sufficient	10.00	7.00

Flexural Capacity

M_u (ft-kip)	Bending $\phi_{assumed}$	$M_{n,\ req'd}$ (ft-lbs)	$\rho_{req'd}$	$A_{s,req'd}$ (in^2)	A_s / $A_{s,\ req'd}$ > 1.33	# of Bars	Bar Spacing (in)	Bar Size (#)	Bar Space Check	A_s (in^2)	$A_s > A_{s,\ req'd}$	$A_{s,\ min}$ (in^2)	ACI Min Steel	β_1
2.00	0.9	2.22	0.000763079	0.06	Yes	5	7.20	4	Sufficient	0.33	Sufficient	0.28	Sufficient	0.85

a (in)	c (in)	Comp. (kip)	Tens. (kip)	Comp = Tens	ε_t	$\varepsilon_t > 0.005$ allowing $\phi = 0.9$	ACI Strain Limit ($\varepsilon_t > 0.004$)	M_n (ft-kip)	Bending ϕ	ϕM_n (ft-kip)	Capacity Check	Eff
0.64	0.75	19.63	19.63	Sufficient	0.024818247	Sufficient	Sufficient	11	0.90	10	Sufficient	20%

Loads

Tributary - Roof			Tributary - Floor			Individual Loads									
L (ft)	W (ft)	Area (ft^2)	L (ft)	W (ft)	Area (ft^2)	D_{roof} (psf)	D_{floor} (psf)	D_{point} (lbf)	L_{roof} (psf)	L_{floor} (psf)	$L_{storage}$ (psf)	L_{point} (lbf)	S (psf)	W (psf)	S_{point} (lbf)
13.0	21	273	15	20	300	0	0	7,055	0	0	0	8,880	0	0	14,844

Combined Dead and Live Loads				
$P_{DColumn}$ (lbf)	P_{WD} (lbf)	P_{WL} (lbf)	P_{Snow} (lbf)	P_{Wind} (lbf)
563	7,055	8,880	14,844	0

$D_{footing}$ (psf)
632

Load Case 1	Factored Loads			
	$1.2P_D$ (lbf)	$1.6P_L$ (lbf)	$0.5P_{Snow}$ (lbf)	P_u (lbf)
1.2D+1.6L+0.5(Lr or S or R)	9,142	14,208	7,422	30,772

Load Case 2	Factored Loads			
	$1.2P_D$ (lbf)	$1.6P_{Snow}$ (lbf)	L (lbf)	P_u (lbf)
1.2D+1.6(Lr or S or R)+(L or 0.5W)	9,142	23,750	8,880	41,772

P_u (lbf)
41,772

Column Properties														
$\phi_{Compression}$	α	$\rho_{g,\ assumed}$	$A_{g,\ min}$ (in^2)	Diameter (in)	b (in)	Type	A_g (in^2)	# of Long. Bars	Long. Bar Size (#)	A_s (in^2)	$A_s > A_{s,\ req'd}$	$A_{s,\ min}$ (in^2)	ρ_g	0.08 > A_s > 0.01	ϕP_n
0.65	0.8	0.02	0.00	12	12	Square	144	8	4	1.57	Sufficient	-5.66	0.0109	Sufficient	237,870

Loaded Area					Transverse Reinforcement						Check	Clear Bar Spacing			
b_{loaded} (in)	w_{loaded} (in)	A_{loaded} (in^2)	ϕB_n	$P_u < \phi B_n$	Tie Bar Size (#)	Bar Size Check	48 x Tie Bar (in)	16 x Long. Bar (in)	Least Col. Dim. (in)	Tie Bar Spacing (in)	# Long Bars	Conc. Cover (in)	# Long. Bars	Spacing (in)	Check
9.5	9.5	90	188,955	Sufficient	3	Sufficient	18	8	12	8	Sufficient	2.0	3	2.88	Sufficient

Center 10x10 Post - 12x12 Pedestal

Wall and Soil Properties										Soil Pressure Equivalent (q_e)					
b_{column} (in)	H_{Column} (ft)	Bottom of Footing (in)	γ_{soil} (pcf):	$\gamma_{concrete}$ (pcf)	q_a (psf)	f'$_c$ (psi)	f_y (psi)	ε_y	E_s (psi)	Soil above Footing (in)	$P_{D\ soil}$ (psf)	Seed $t_{footing}$ (in)	$P_{D,column}$ (psf)	$P_{D,footing}$ (psf)	q_e (psf)
12	3.1667	48	100	150	2,500	3,000	60,000	2.07E-03	2.90E+07	38	317	**10.00**	317	125	2,058

CIMARRON ENGINEERING, LLC.

Footing Area					Design Bearing			
$Footing_{Area}$ (ft^2)	Use $b_{FootingWidth}$ (ft)	$b_{FootingWidth}$ (in)	$Footing_{Area}$ (ft^2)	Area Check	q_u (psf)	$Cover_{Steel}$ (in)	ϕ_{factor}	$Circular_{Eq}$ (in)
5.70	**2.50**	30.0	6.3	Sufficient	3,476	3.0	0.75	33.85

Moment Consideration								
Moment (ft-lb)	$P_{unfactored}$ (lbf)	I (ft^4)	c (in)	e (in)	a (in)	q_{min} (psf)	q_{max} (psf)	Check
6,967	8,488	3	15.0	5.0	10	1,317	226	Sufficient

Two-Way Shear

V_{u2} (lbs)	b_O (in)	Column Location	α_S	β_c	$d_{2,1}$ (in)	$d_{2,2}$ (in)	$d_{2,3}$ (in)	d_2 (in)	Thickness Check
13,010	76	Interior	40	2	1.04	0.00	0.00	1.04	Sufficient

One-Way Shear

Design Shear	Calculated Footing Thickness			Final Footing Thickness	
V_{u1} (lbs)	$d_{1,calc}$ (in)	Calc $t_{1,footing}$ (in)	Thickness Check	$t_{1,footing}$ (in)	d_1 (in)
1,448	0.59	3.59	Sufficient	10.00	7.00

Flexural Capacity

M_u (ft-kip)	Bending $\phi_{assumed}$	$M_{n,\ req'd}$ (ft-lbs)	$\rho_{req'd}$	$A_{s,req'd}$ (in^2)	A_s / $A_{s,\ req'd}$ > 1.33	# of Bars	Bar Spacing (in)	Bar Size (#)	Bar Space Check	A_s (in^2)	$A_s > A_{s,\ req'd}$	$A_{s,\ min}$ (in^2)	ACI Min Steel	β_1
0.98	0.9	1.09	0.000371062	0.03	Yes	4	6.00	4	Sufficient	0.39	Sufficient	0.28	Sufficient	0.85

a (in)	c (in)	Comp. (kip)	Tens. (kip)	Comp = Tens	ε_t	ε_t > 0.005 allowing ϕ = 0.9	ACI Strain Limit (ε_t > 0.004)	M_n (ft-kip)	Bending ϕ	ϕM_n (ft-kip)	Capacity Check	Eff
0.77	0.91	23.56	23.56	Sufficient	0.020181872	Sufficient	Sufficient	13	0.90	12	Sufficient	8%

Loads

Tributary - Roof			Tributary - Floor			Individual Loads									
L (ft)	W (ft)	Area (ft^2)	L (ft)	W (ft)	Area (ft^2)	D_{roof} (psf)	D_{floor} (psf)	D_{point} (lbf)	L_{roof} (psf)	L_{floor} (psf)	$L_{storage}$ (psf)	L_{point} (lbf)	S (psf)	W (psf)	S_{point} (lbf)
13.0	21	273	15	20	300	0	0	3,629	0	0	0	4,542	0	0	7,779

Combined Dead and Live Loads				
$P_{DColumn}$ (lbf)	P_{WD} (lbf)	P_{WL} (lbf)	P_{Snow} (lbf)	P_{Wind} (lbf)
317	3,629	4,542	7,779	0

$D_{footing}$ (psf)
651

Load Case 1	Factored Loads			
1.2D+1.6L+0.5(Lr or S or R)	1.2P_D (lbf)	1.6P_L (lbf)	0.5P_{Snow} (lbf)	P_u (lbf)
	4,735	7,267	3,890	15,892

P_u (lbf)
21,723

Load Case 2	Factored Loads			
1.2D+1.6(Lr or S or R)+(L or 0.5W)	1.2P_D (lbf)	1.6P_{Snow} (lbf)	L (lbf)	P_u (lbf)
	4,735	12,446	4,542	21,723

Column Properties														
$\phi_{Compression}$	α	$\rho_{g,\ assumed}$	$A_{g,\ min}$ (in^2)	Diameter (in)	b (in)	Type	A_g (in^2)	# of Long. Bars	Long. Bar Size (#)	A_s (in^2)	$A_s > A_{s,\ req'd}$	$A_{s,\ min}$ (in^2)	ρ_g	0.08 > A_s > 0.01	ϕP_n
0.65	0.8	0.02	0.00	10	10	Square	100	4	4	0.79	Sufficient	-4.01	0.0079	Insufficient	156,063

Loaded Area					Transverse Reinforcement					Check	Clear Bar Spacing			
b_{loaded} (in)	w_{loaded} (in)	A_{loaded} (in^2)	ϕB_n	$P_u < \phi B_n$	Tie Bar Size (#)	Bar Size Check	48 x Tie Bar (in)	16 x Long. Bar (in)	Least Col. Dim. (in)	Tie Bar Spacing (in)	# Long Bars	Conc. Cover (in)	# Long. Bars	Spacing (in)	Check
7.5	7.5	56	124,313	Sufficient	3	Sufficient	18	8	10	8	Sufficient	2.0	2	4.25	Sufficient

Center 8x8 Post - 10x10 Pedestal

Wall and Soil Properties										Soil Pressure Equivalent (q_e)					
b_{column} (in)	H_{Column} (ft)	Bottom of Footing (in)	γ_{soil} (pcf):	$\gamma_{concrete}$ (pcf)	q_a (psf)	f'$_c$ (psi)	f_y (psi)	ε_y	E_s (psi)	Soil above Footing (in)	$P_{D\ soil}$ (psf)	Seed $t_{footing}$ (in)	$P_{D,column}$ (psf)	$P_{D,footing}$ (psf)	q_e (psf)
10	3.1667	48	100	150	2,500	3,000	60,000	2.07E-03	2.90E+07	38	317	**10.00**	317	125	2,058

Footing Area					Design Bearing			
$Footing_{Area}$ (ft^2)	Use $b_{FootingWidth}$ (ft)	$b_{FootingWidth}$ (in)	$Footing_{Area}$ (ft^2)	Area Check	q_u (psf)	$Cover_{Steel}$ (in)	ϕ_{factor}	$Circular_{Eq}$ (in)
3.65	**2.00**	24.0	4.0	Sufficient	3,228	3.0	0.75	27.08

Moment Consideration								
Moment (ft-lb)	$P_{unfactored}$ (lbf)	I (ft^4)	c (in)	e (in)	a (in)	q_{min} (psf)	q_{max} (psf)	Check
6,333	3,623	1	12.0	4.0	8	3,844	151	Sufficient

Two-Way Shear

V_{u2} (lbs)	b_O (in)	Column Location	α_S	β_c	$d_{2,1}$ (in)	$d_{2,2}$ (in)	$d_{2,3}$ (in)	d_2 (in)	Thickness Check
6,433	68	Interior	40	2	0.58	0.00	0.00	0.58	Sufficient

One-Way Shear

Design Shear	Calculated Footing Thickness	Final Footing Thickness

V_{u1} (lbs)	$d_{1,calc}$ (in)	Calc $t_{1,footing}$ (in)	Thickness Check	$t_{1,footing}$ (in)	d_1 (in)
0	0.00	3.00	Sufficient	10.00	7.00

Flexural Capacity

M_u (ft-kip)	Bending $\phi_{assumed}$	$M_{n,\ req'd}$ (ft-lbs)	$\rho_{req'd}$	$A_{s,req'd}$ (in^2)	A_s / $A_{s,\ req'd}$ > 1.33	# of Bars	Bar Spacing (in)	Bar Size (#)	Bar Space Check	A_s (in^2)	$A_s > A_{s,\ req'd}$	$A_{s,\ min}$ (in^2)	ACI Min Steel	β_1
0.55	0.9	0.61	0.000208066	0.02	Yes	4	4.50	4	Sufficient	0.52	Sufficient	0.28	Sufficient	0.85

a (in)	c (in)	Comp. (kip)	Tens. (kip)	Comp = Tens	ε_t	$\varepsilon_t > 0.005$ allowing $\phi = 0.9$	ACI Strain Limit ($\varepsilon_t > 0.004$)	M_n (ft-kip)	Bending ϕ	ϕM_n (ft-kip)	Capacity Check	Eff
1.03	1.21	31.42	31.42	Sufficient	0.014386404	Sufficient	Sufficient	17	0.90	15	Sufficient	4%

Loads

Tributary - Roof			Tributary - Floor			Individual Loads									
L (ft)	W (ft)	Area (ft^2)	L (ft)	W (ft)	Area (ft^2)	D_{roof} (psf)	D_{floor} (psf)	D_{point} (lbf)	L_{roof} (psf)	L_{floor} (psf)	$L_{storage}$ (psf)	L_{point} (lbf)	S (psf)	W (psf)	S_{point} (lbf)
13.0	21	273	15	20	300	0	0	1,720	0	0	0	1,683	0	0	5,563

Combined Dead and Live Loads				
$P_{DColumn}$ (lbf)	P_{WD} (lbf)	P_{WL} (lbf)	P_{Snow} (lbf)	P_{Wind} (lbf)
220	1,720	1,683	5,563	0

$D_{footing}$ (psf)
516

Load Case 1	Factored Loads			
	$1.2P_D$ (lbf)	$1.6P_L$ (lbf)	$0.5P_{Snow}$ (lbf)	P_u (lbf)
1.2D+1.6L+0.5(Lr or S or R)	2,328	2,693	2,782	7,802

P_u (lbf)
12,912

Load Case 2	Factored Loads			
	$1.2P_D$ (lbf)	$1.6P_{Snow}$ (lbf)	L (lbf)	P_u (lbf)
1.2D+1.6(Lr or S or R)+(L or 0.5W)	2,328	8,901	1,683	12,912