ARCH 614: Practice Quiz 7

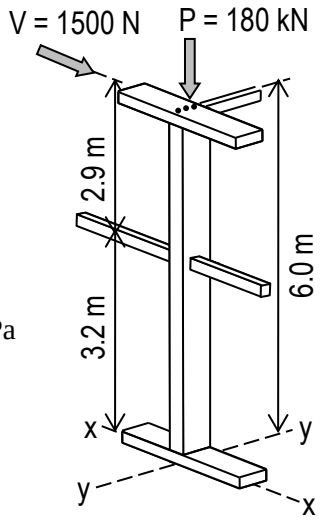
*Note: No aids are allowed for part 1. One side of a letter sized paper with notes is allowed during part 2, along with a silent, **non-programmable** calculator. There are reference charts on pages 2-3 for part 2.*

Clearly show your work and answer.

Part 1) Worth 5 points (conceptual questions)

*Part 2) Worth 45 point*s

(NOTE: The loads, bracing and end support conditions can and will be changed for the quiz! The unit system will not change.)



A 6 m tall, 125 mm x 200 mm (metric) glu-lam column is braced in the weak axis (y-y) at 3.2 m from the base. The ends can be considered to be pinned. The cross section and timber have the following properties:

$A = 25 \times 10^3$ mm^2 $F_c = 13.8$ MPa $E = 12{,}400$ MPa $E'_{min} = 6300$ MPa

a) If the column is to support 180 kN, is it adequate for Allowable Stress Design assuming permanent dead load duration?

b) If a lateral load of 1500 N is applied as shown to the 20 mm thick top bracing connected to the column, what size and how many nails would be needed (economically) using the capacity chart provided on the reference pages?

Answers – Not provided on actual quiz!

a) $P_{allowable} = 133$ kN $\therefore$ No Good ($P_{weak} = 176$ kN)
b) 2-40d nails *(by total length and capacity)*

Disclaimer: Answers have NOT been painstakingly researched.

REFERENCE CHARTS FOR QUIZ 7

Table 14 *Column Stability Factor* C_p.

"C_p" $F_c' = C_p \cdot F_c^*$ $F_{CE} = \frac{.30\,E}{(l/d)^2}$ for sawed posts $F_{CE} = \frac{.418\,E}{(l/d)^2}$ for glu-lam posts

$\frac{F_{CE}}{F_c^*}$	Sawed C_p	Glu-Lam C_p	$\frac{F_{CE}}{F_c^*}$	Sawed C_p	Glu-Lam C_p	$\frac{F_{CE}}{F_c^*}$	Sawed C_p	Glu-Lam C_p	$\frac{F_{CE}}{F_c^*}$	Sawed C_p	Glu-Lam C_p	$\frac{F_{CE}}{F_c^*}$	Sawed C_p	Glu-Lam C_p	$\frac{F_{CE}}{F_c^*}$	Sawed C_p	Glu-Lam C_p
0.00	0.000	0.000	0.40	0.360	0.377	0.80	0.610	0.667	1.20	0.750	0.822	2.00	0.867	0.921	3.40	0.930	0.962
0.01	0.010	0.010	0.41	0.367	0.386	0.81	0.614	0.672	1.22	0.755	0.826	2.02	0.869	0.922	3.45	0.931	0.963
0.02	0.020	0.020	0.42	0.375	0.394	0.82	0.619	0.678	1.24	0.760	0.831	2.04	0.870	0.924	3.50	0.932	0.963
0.03	0.030	0.030	0.43	0.383	0.403	0.83	0.623	0.683	1.26	0.764	0.836	2.06	0.872	0.925	3.55	0.933	0.964
0.04	0.040	0.040	0.44	0.390	0.411	0.84	0.628	0.688	1.28	0.769	0.840	2.08	0.874	0.926	3.60	0.934	0.965
0.05	0.049	0.050	0.45	0.398	0.420	0.85	0.632	0.693	1.30	0.773	0.844	2.10	0.875	0.927	3.65	0.936	0.965
0.06	0.059	0.060	0.46	0.405	0.428	0.86	0.637	0.698	1.32	0.777	0.848	2.12	0.876	0.928	3.70	0.937	0.966
0.07	0.069	0.069	0.47	0.412	0.436	0.87	0.641	0.703	1.34	0.781	0.852	2.14	0.878	0.929	3.75	0.938	0.966
0.08	0.079	0.079	0.48	0.419	0.444	0.88	0.645	0.708	1.36	0.785	0.855	2.16	0.879	0.930	3.80	0.938	0.967
0.09	0.088	0.089	0.49	0.427	0.453	0.89	0.649	0.713	1.38	0.789	0.859	2.18	0.881	0.931	3.85	0.939	0.968
0.10	0.098	0.099	0.50	0.434	0.461	0.90	0.653	0.718	1.40	0.793	0.862	2.20	0.882	0.932	3.90	0.940	0.968
0.11	0.107	0.109	0.51	0.441	0.469	0.91	0.658	0.722	1.42	0.796	0.865	2.22	0.883	0.932	3.95	0.941	0.969
0.12	0.117	0.118	0.52	0.448	0.477	0.92	0.661	0.727	1.44	0.800	0.868	2.24	0.885	0.933	4.00	0.942	0.969
0.13	0.126	0.128	0.53	0.454	0.484	0.93	0.665	0.731	1.46	0.803	0.871	2.26	0.886	0.934	4.05	0.943	0.969
0.14	0.136	0.138	0.54	0.461	0.492	0.94	0.669	0.735	1.48	0.807	0.874	2.28	0.887	0.935	4.10	0.944	0.970
0.15	0.145	0.147	0.55	0.468	0.500	0.95	0.673	0.740	1.50	0.810	0.877	2.30	0.888	0.936	4.15	0.944	0.970
0.16	0.154	0.157	0.56	0.474	0.508	0.96	0.677	0.744	1.52	0.813	0.879	2.32	0.889	0.937	4.20	0.945	0.971
0.17	0.164	0.167	0.57	0.481	0.515	0.97	0.680	0.748	1.54	0.816	0.882	2.34	0.891	0.937	4.25	0.946	0.971
0.18	0.173	0.176	0.58	0.487	0.523	0.98	0.684	0.752	1.56	0.819	0.884	2.36	0.892	0.938	4.30	0.947	0.972
0.19	0.182	0.186	0.59	0.494	0.530	0.99	0.688	0.756	1.58	0.822	0.887	2.38	0.893	0.939	4.35	0.947	0.972
0.20	0.191	0.195	0.60	0.500	0.538	1.00	0.691	0.760	1.60	0.825	0.889	2.40	0.894	0.940	4.40	0.948	0.972
0.21	0.200	0.205	0.61	0.506	0.545	1.01	0.694	0.764	1.62	0.827	0.891	2.45	0.897	0.941	4.45	0.949	0.973
0.22	0.209	0.214	0.62	0.512	0.552	1.02	0.698	0.767	1.64	0.830	0.893	2.50	0.899	0.943	4.50	0.949	0.973
0.23	0.218	0.224	0.63	0.518	0.559	1.03	0.701	0.771	1.66	0.832	0.895	2.55	0.901	0.944	4.55	0.950	0.974
0.24	0.227	0.233	0.64	0.524	0.566	1.04	0.704	0.774	1.68	0.835	0.897	2.60	0.904	0.946	4.60	0.950	0.974
0.25	0.235	0.242	0.65	0.530	0.573	1.05	0.708	0.778	1.70	0.837	0.899	2.65	0.906	0.947	4.65	0.951	0.974
0.26	0.244	0.252	0.66	0.536	0.580	1.06	0.711	0.781	1.72	0.840	0.901	2.70	0.908	0.949	4.70	0.952	0.975
0.27	0.253	0.261	0.67	0.542	0.587	1.07	0.714	0.784	1.74	0.842	0.903	2.75	0.910	0.950	4.75	0.952	0.975
0.28	0.261	0.270	0.68	0.548	0.593	1.08	0.717	0.788	1.76	0.844	0.904	2.80	0.912	0.951	4.80	0.953	0.975
0.29	0.270	0.279	0.69	0.553	0.600	1.09	0.720	0.791	1.78	0.846	0.906	2.85	0.914	0.952	4.85	0.953	0.975
0.30	0.278	0.288	0.70	0.559	0.607	1.10	0.723	0.794	1.80	0.849	0.908	2.90	0.916	0.953	4.90	0.954	0.976
0.31	0.287	0.297	0.71	0.564	0.613	1.11	0.726	0.797	1.82	0.851	0.909	2.95	0.917	0.954	5.00	0.955	0.976
0.32	0.295	0.306	0.72	0.569	0.619	1.12	0.729	0.800	1.84	0.853	0.911	3.00	0.919	0.955	6.00	0.963	0.981
0.33	0.304	0.315	0.73	0.575	0.626	1.13	0.731	0.803	1.86	0.855	0.912	3.05	0.920	0.956	8.00	0.973	0.986
0.34	0.312	0.324	0.74	0.580	0.632	1.14	0.734	0.806	1.88	0.857	0.914	3.10	0.922	0.957	10.0	0.979	0.989
0.35	0.320	0.333	0.75	0.585	0.638	1.15	0.737	0.809	1.90	0.858	0.915	3.15	0.923	0.958	20.0	0.990	0.995
0.36	0.328	0.342	0.76	0.590	0.644	1.16	0.740	0.811	1.92	0.860	0.916	3.20	0.925	0.959	40.0	0.995	0.997
0.37	0.336	0.351	0.77	0.595	0.650	1.17	0.742	0.814	1.94	0.862	0.918	3.25	0.926	0.960	60.0	0.997	0.998
0.38	0.344	0.360	0.78	0.600	0.655	1.18	0.745	0.817	1.96	0.864	0.919	3.30	0.927	0.961	100.0	0.998	0.999
0.39	0.352	0.368	0.79	0.605	0.661	1.19	0.747	0.819	1.98	0.868	0.920	3.35	0.929	0.961	200.0	0.999	0.999

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REFERENCE CHARTS FOR QUIZ 7

TABLE 5.2 Modification Factors for Design Values for Structural Lumber for Load Duration[a]

Load Duration	Multiply Design Values by:	Typical Design Loads
Permanent	0.9	Dead load
Ten years	1.0	Occupancy live load
Two months	1.15	Snow load
Seven days	1.25	Construction load
Ten minutes	1.6	Wind or earthquake load
Impact[b]	2.00	Impact load

Source: Adapted from the *National Design Specification for Wood Construction*, 2001 edition (Ref. 3), with permission of the publishers, American Forest & Paper Association.

[a] Load duration factors shall not apply to modulus of elasticity, E, nor to compression perpendicular to grain design values, $F_{c\perp}$, based on a deformation limit.

[b] Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with water-borne preservatives, or fire retardant chemicals. The impact load duration factor shall not apply to connections.

Lateral Load Capacity of common Wire Nails (N/nail)			
Side Member Thickness (mm)	Nail Length (mm)	Pennyweight	Load per Nail (N)
Solid-Sawn Lumber Side Members			
20	65	8d	400
	75	10d	467
	90	16d	538
	100	20d	614
	115	30d	743
	125	40d	787
	140	50d	805
	150	60d	885
40	75	10d	525
	90	16d	627
	100	20d	756
	115	30d	827
	125	40d	912
	140	50d	938
	150	60d	1067